2007 TRANSMISSION

AB60F Automatic Transaxle - Tundra

AUTOMATIC TRANSMISSION SYSTEM

PRECAUTION

NOTE:

- **When disconnecting the cable from the negative (-) battery terminal, initialize the following systems after the cable is reconnected (see INITIALIZATION).**
- **Perform the RESET MEMORY procedures (A/T initialization) after replacing the automatic transmission assembly, engine assembly or ECM (see INITIALIZATION).**

  HINT:

  RESET MEMORY cannot be completed by only reconnecting the cable to the negative (-) battery terminal.

CAUTION: When using compressed air, always aim away from yourself to prevent Automatic Transmission Fluid (ATF) or kerosene from spraying on your face.

NOTE:

- **The automatic transmission is composed of precision-made parts, necessitating careful inspection before reassembly because even a small nick could cause fluid leakage or affect performance.**
- **The procedures are organized so that you work on only one component group at a time. This will help avoid confusion with 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.**
- **Whenever possible, complete the inspection, repair and reassembly before proceeding to the next component group. 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 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.**
- **Use of Toyota Genuine ATF WS is recommended.**
- **All disassembled parts should be washed clean, and compressed air should be blown through any fluid passages and holes.**
- **Dry all parts with compressed air. Never use a cloth.**
- **The recommended ATF or kerosene should be used for cleaning.**
- **After cleaning, the parts should be arranged in the order they were**

removed for efficient inspection, repairs, and reassembly.

- **When disassembling a valve body, be sure to match each valve with its corresponding spring.**
- **New discs for the brakes and clutches that will be used for replacement must be soaked in ATF for at least 15 minutes before reassembly.**
- **All oil seal rings, clutch discs, clutch plates, rotating parts, and sliding surfaces should be coated with ATF prior to reassembly.**
- **All old gaskets and rubber O-rings must be replaced.**
- **Do not apply adhesive cement to gaskets and similar parts.**
- **Make sure that the ends of the snap rings are not aligned with any cutouts. Also make sure that snap rings are correctly installed into the grooves.**
- **If a worn bushing is to be replaced, the sub-assembly containing the bushing must also be replaced.**
- **Check the thrust bearings and races for wear or damage. Replace them if necessary.**
- **Use petroleum jelly to keep parts in place.**
- **When working with FIPG material, perform the following:**

  Using a razor blade and gasket scraper, remove all old FIPG material from the gasket surface.

  Clean all components thoroughly to remove all foreign matter.

  Clean both sealing surfaces with a non-residue solvent.

  Apply FIPG material in a continuous line approximately 1 mm (0.0394 in.) in diameter on the sealing surface.

  Reassemble parts within 10 minutes of applying FIPG material. Failing to do so will require the FIPG material to be removed and reapplied.

DEFINITION OF TERMS

TERMS DEFINITION

Term	Definition
Monitor description	Description of what the ECM monitors and how it detects malfunctions (monitoring purpose and its details).
Related DTCs	Group of diagnostic trouble codes that are output by the ECM based on same malfunction detection logic.
Typical enabling condition	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).
Sequence of operation	The priority order that is applied to monitoring if multiple sensors and components are used to detect the malfunction. While a sensor is being monitored, the next sensor or component will not be monitored until the previous monitoring has concluded.

Required sensor/components	The sensors and components that are used by the ECM to detect malfunctions.
Frequency of operation	The number of times that the ECM checks for malfunctions per driving cycle. "Once per driving cycle" means that the ECM detects the malfunction only one time during a single driving cycle. "Continuous" means that the ECM detects the malfunction every time when enabling condition is met.
Duration	The minimum time that the ECM must sense a continuous deviation in the monitored value (s) before setting a DTC. This timing begins after the "typical enabling conditions" are met.
Malfunction thresholds	Beyond this value, the ECM will conclude that there is a malfunction and set a DTC.
MIL operation	MIL illumination timing after a defect is detected. "Immediately" means that the ECM illuminates the MIL the instant the ECM determines that there is a malfunction. "2 driving cycle" means that the ECM illuminates the MIL if the same malfunction is detected again in the 2nd driving cycle.
Component operating range	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.

PARTS LOCATION

for Column Shift Type:

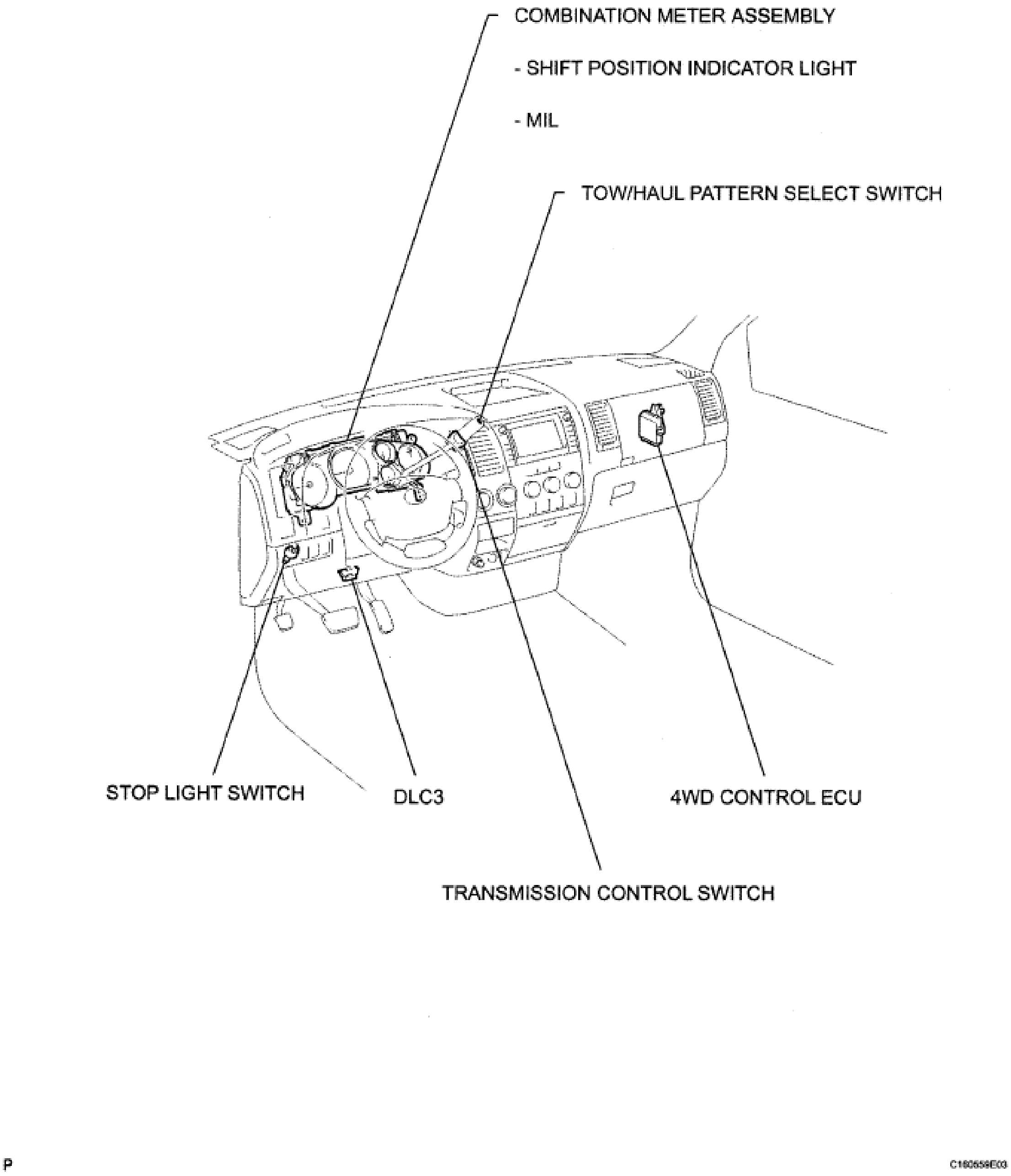

Fig. 1: Identifying Automatic Transmission Parts Location - For Column Shift Type
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

for Floor Shift Type:

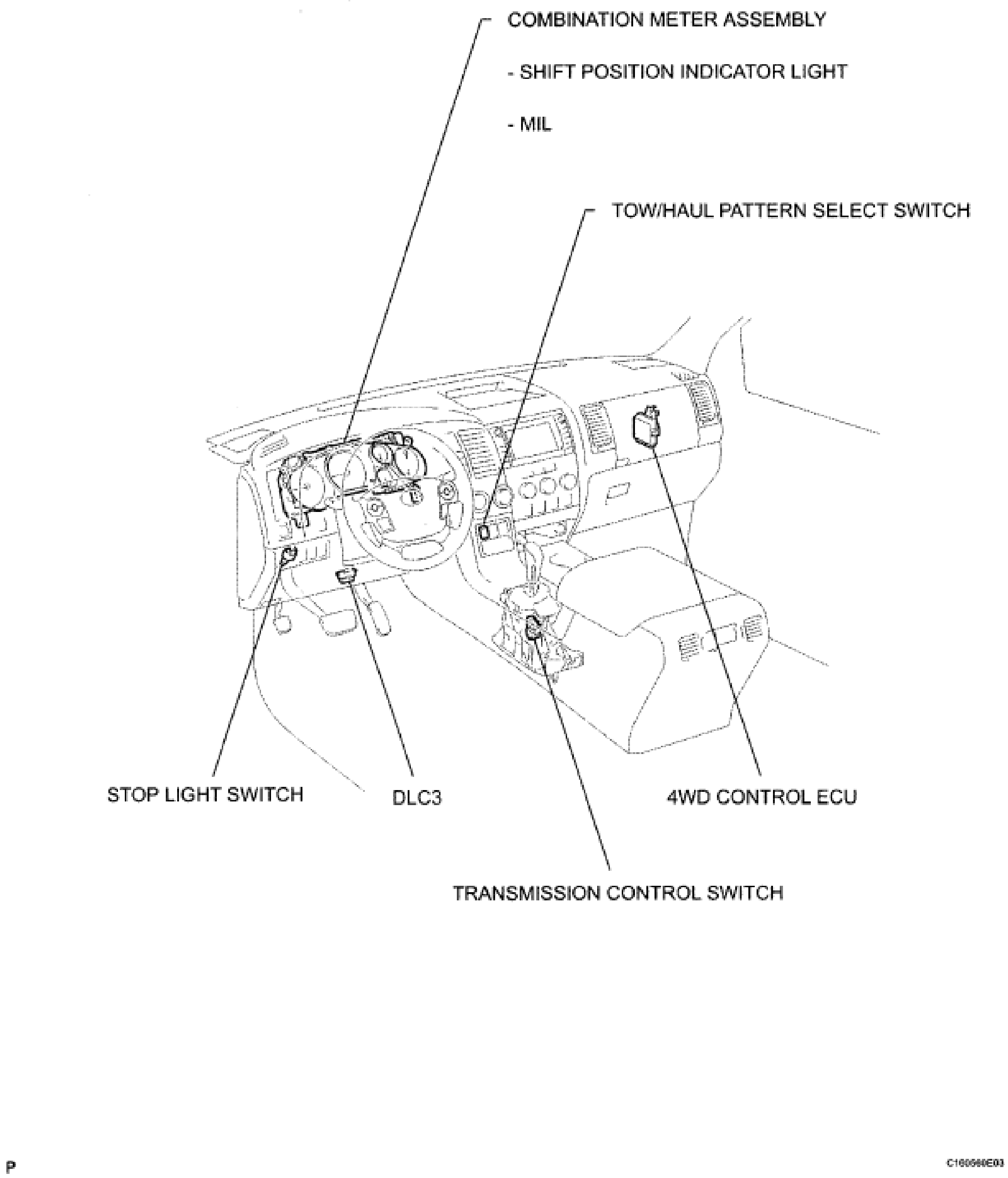

Fig. 2: Identifying Automatic Transmission Parts Location - For Floor Shift Type
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

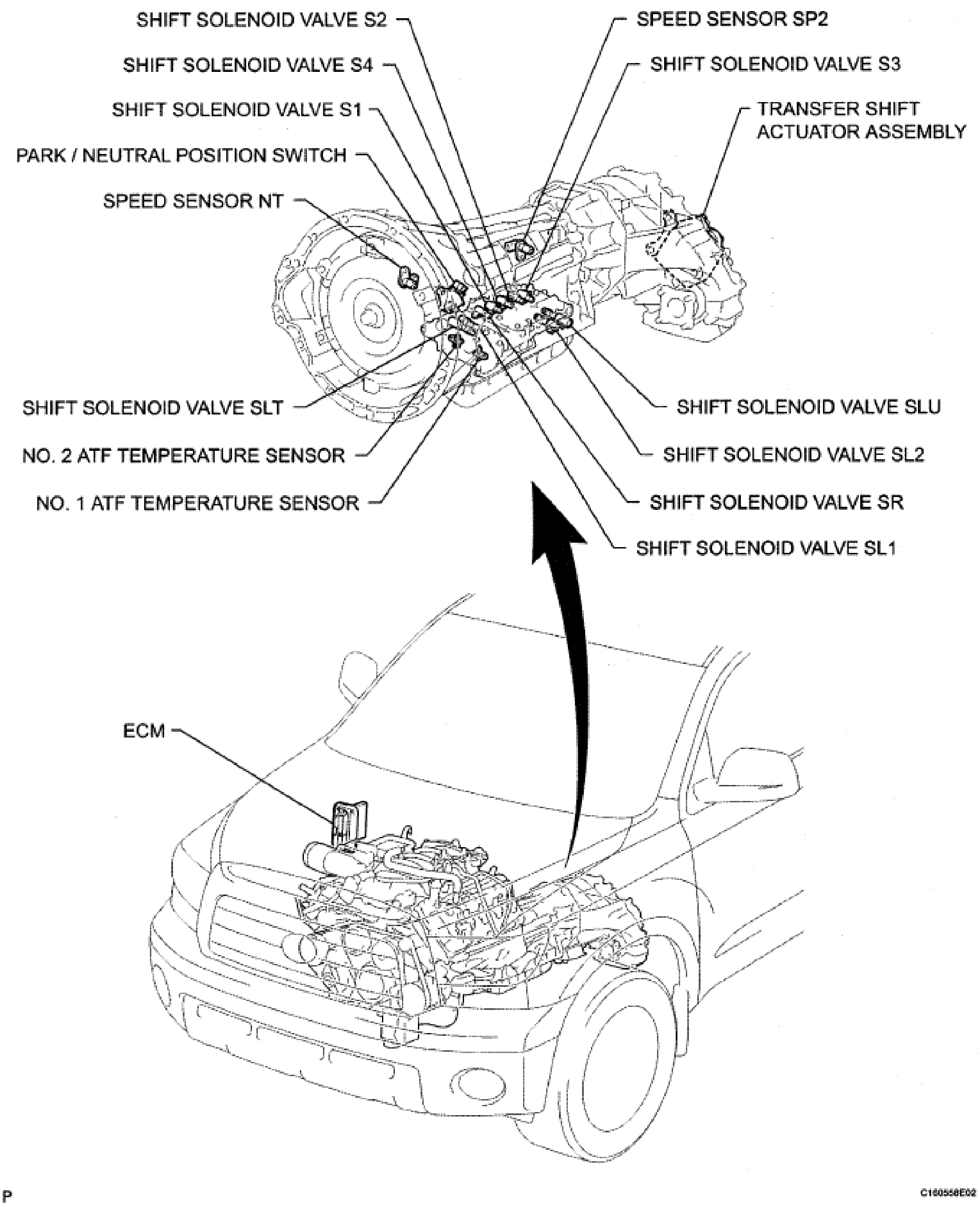

Fig. 3: Identifying Shift Solenoid Valve Locations
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

SYSTEM DIAGRAM

The configuration of the electronic control system in the AB60F automatic transmission is as shown in the following chart.

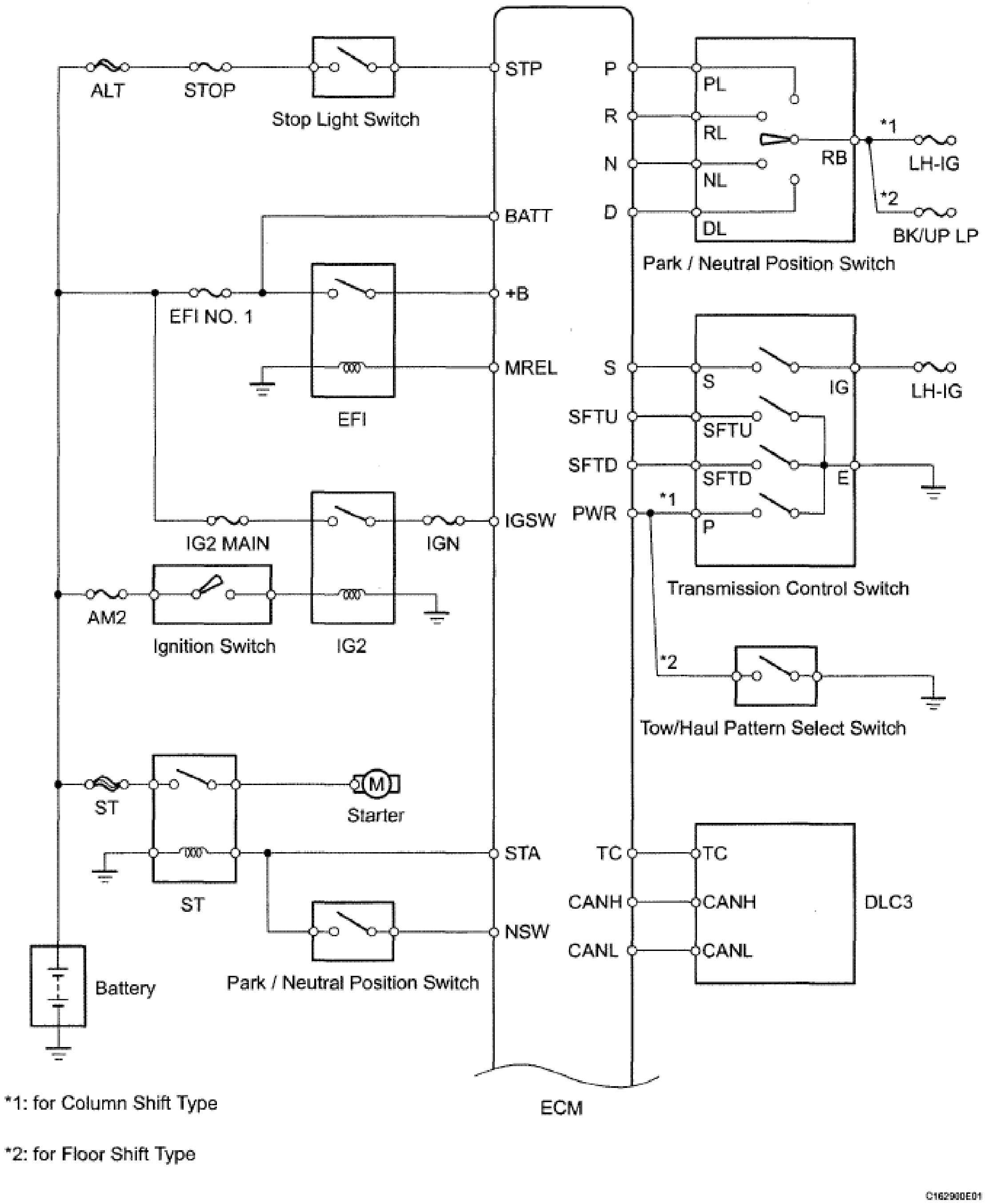

Fig. 4: AB60F Automatic Transmission - System Diagram (1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

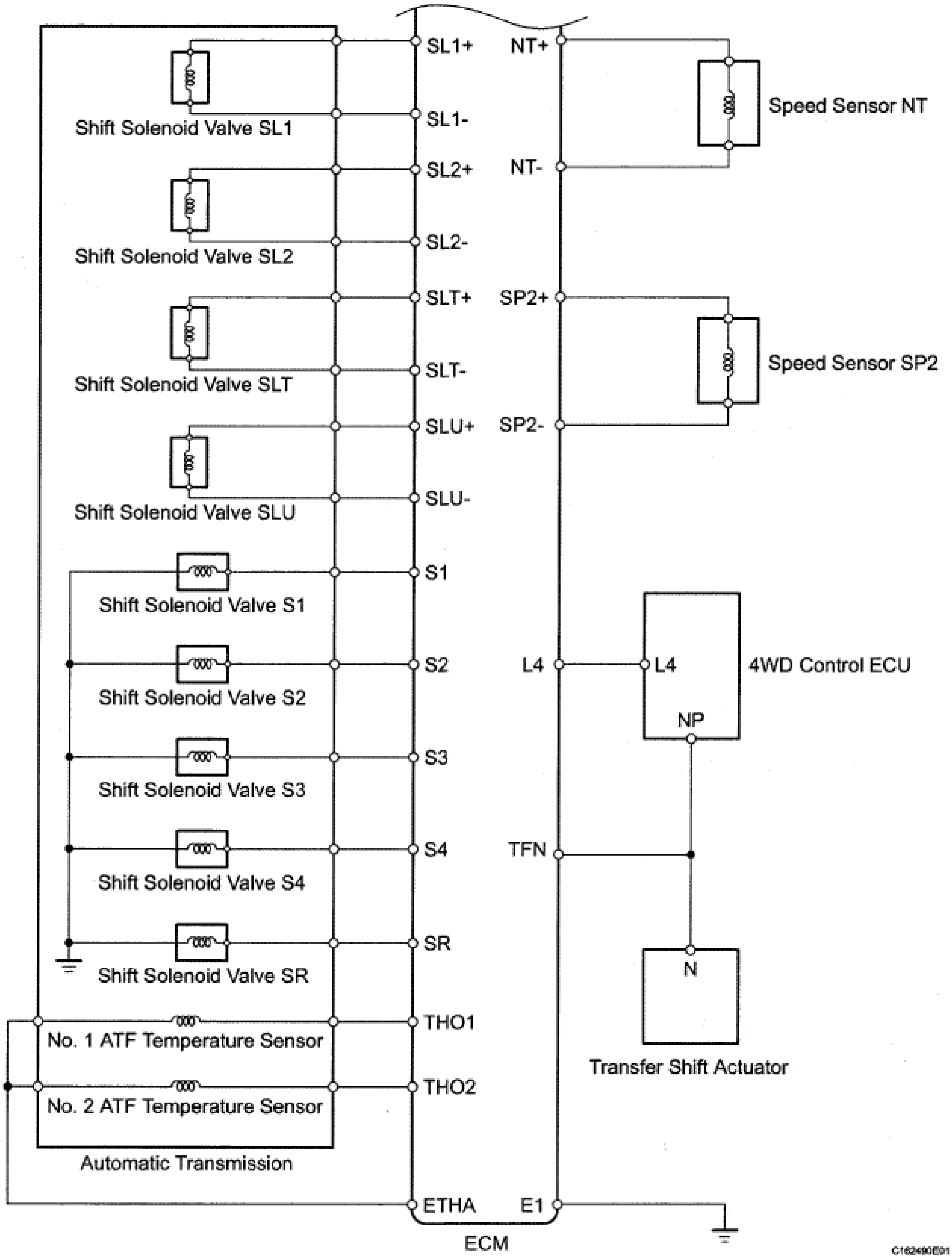

Fig. 5: AB60F Automatic Transmission - System Diagram (2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

SYSTEM DESCRIPTION

1. **SYSTEM DESCRIPTION**
   a. The Electronic Controlled Automatic Transmission (ECT) is an automatic transmission that electronically controls shift timing using the Engine Control Module (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 is reduced by controlling the engine and transmission simultaneously.

In addition, the ECT has the following features:

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

HOW TO PROCEED WITH TROUBLESHOOTING

HINT:

- The ECM is connected to the CAN communication system. Therefore, before starting troubleshooting, make sure to check that there is no trouble in the CAN communication system.
- *: Use the intelligent tester or Techstream.

1. **VEHICLE BROUGHT TO WORKSHOP**
2. **CUSTOMER PROBLEM ANALYSIS**
3. **INSPECT BATTERY VOLTAGE**

   Standard voltage:

   11 to 14 V

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

4. **CONNECT INTELLIGENT TESTER OR TECHSTREAM TO DLC3***
5. **CHECK AND CLEAR DTCS AND FREEZE FRAME DATA***
   a. Refer to the **DTC CHECK / CLEAR** .
6. **VISUAL INSPECTION**
7. **SETTING CHECK MODE DIAGNOSIS***
   a. Refer to the **CHECK MODE PROCEDURE** .
8. **PROBLEM SYMPTOM CONFIRMATION**
   a. Refer to the **ROAD TEST** .

   Result

   PROBLEM SYMPTOM RESULT CHART

Result	Proceed to
Symptom does not occur	A
Symptom occurs	B

B: Go TO STEP 10

A: Go to next step

9. **SYMPTOM SIMULATION**
    a. Refer to the **ELECTRONIC CIRCUIT INSPECTION PROCEDURE** .
10. **DTC CHECK***
    a. Refer to the **DTC CHECK / CLEAR** .

Result

DTC RESULT CHART

Result	Proceed to
DTC is not output	A
DTC is output	B

B: Go TO STEP 18

A: Go to next step

11. **BASIC INSPECTION**
    a. Refer to the **AUTOMATIC TRANSMISSION FLUID** .
    b. Refer to the **PARK/NEUTRAL POSITION SWITCH** .
    c. Refer to the **SHIFT LEVER ASSEMBLY**.
        - for Column Shift Type, refer to the following procedures (see **SHIFT LEVER ASSEMBLY (FOR COLUMN SHIFT TYPE)**)
        - for Floor Shift Type, refer to the following procedures (see **SHIFT LEVER ASSEMBLY (FOR FLOOR SHIFT TYPE)**)

NG: Go TO STEP 21

OK: Go to next step

12. **MECHANICAL SYSTEM TESTS**
    a. Refer to the **MECHANICAL SYSTEM TESTS** .

NG: Go TO STEP 17

OK: Go to next step

13. **HYDRAULIC TEST**
    a. Refer to the **HYDRAULIC TEST** .

NG: Go TO STEP 17

OK: Go to next step

14. **MANUAL SHIFTING TEST**
    a. Refer to the **MANUAL SHIFTING TEST** .

NG: Go TO STEP 16

OK: Go to next step

15. **PROBLEM SYMPTOMS TABLE CHAPTER 1**
    a. Refer to the **PROBLEM SYMPTOMS TABLE** .

NG: Go TO STEP 19

OK: Go to next step

16. **PROBLEM SYMPTOMS TABLE CHAPTER 2**
    a. Refer to the **PROBLEM SYMPTOMS TABLE** .
17. **PART INSPECTION**

NG: Go TO STEP 21

OK: Go to next step

18. **DTC CHART**
    a. Refer to the **DIAGNOSTIC TROUBLE CODE CHART** .
19. **CIRCUIT INSPECTION**
20. **IDENTIFICATION OF PROBLEM**
21. **REPAIR OR REPLACE**
22. **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 transmission 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 normal operating ATF temperature of 50 to 80°C (122 to 176°F).**

a. D position test

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

1. Check up-shift operation.

   Check that the 1 --> 2, 2 --> 3, 3 --> 4, 4 --> 5 and 5 --> 6 up-shifts take place at the shift point shown in the automatic shift schedule (see **AB60F AUTOMATIC TRANSMISSION**).

HINT:

6th Gear Up-shift Prohibition Control

- Engine coolant temperature is less than 60°C (140°F) and vehicle speed is at less than 55 km/h (34 mph).

5th Gear Up-shift Prohibition Control

- Engine coolant temperature is less than 55°C (131°F) and vehicle speed is at less than 51 km/h (32 mph).

4th Gear Up-shift Prohibition Control

- Engine coolant temperature is less than 47°C (117°F) and vehicle speed is at less than 49 km/h (30 mph).

Lock-up Prohibition Control

- Brake pedal is depressed.
- Accelerator pedal is released.
- Engine coolant temperature is less than 60°C (140°F).
- Lock-up in 5th or in 6th gear is not engaged when shift position is S4.
- Lock-up in 6th gear is not engaged when shift position is S5.
- Lock-up in 3rd or in 2nd gear is engaged when ATF temperature is more than 125°C (257°F).
- Lock-up control during accelerating is not engaged when shift position is S1, or in 1st gear.

2. Check for shift shock and slippage.

   Check for shock and slippage at the 1 --> 2, 2 --> 3, 3 --> 4, 4 --> 5 and 5 --> 6 up-shifts.

3. Check for abnormal noise and vibration.

   Check for abnormal noise and vibration when up-shifting from 1 --> 2, 2 --> 3, 3 --> 4, 4 --> 5 and 5 --> 6 while driving with the shift lever in the D position, and also check while driving in the lockup condition.

   HINT:

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

4. Check kick-down operation.

   Check vehicle speeds when the 2nd to 1st, 3rd to 2nd, 4th to 3rd, 5th to 4th and 6th to 5th kick-downs take place while driving with the shift lever in the D position. Confirm that each speed is within the applicable vehicle speed range indicated in the automatic shift schedule (see **AB60F AUTOMATIC TRANSMISSION**).

5. Check for abnormal shock and slippage at each kick-down.
6. Check the lock up mechanism.
   - Drive in the 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:

   If there is a sudden increase in engine speed, there is no lock up.

b. S position test
   1. Check shift operation.
      - While driving the vehicle in 6th gear with the shift lever on D, move the shift lever to S and return to D. Check that the gear change 6 --> 5 down-shift and 5 --> 6 up-shift can be performed.
      - With the shift lever on S (while the vehicle is stopped), shift into the "+" position to check that the shift position on the combination meter changes as follows: 1 --> 2, 2 --> 3, 3 --> 4,4 --> 5 and 5 --> 6.
      - While driving the vehicle in 5th gear with the shift lever on S5 (at a vehicle speed of approximately 55 to 65 km/h (34 to 40 mph)), shift into the "-" position and check if the 4th gear down-shift occurs and the engine brake operates properly.
      - While driving the vehicle in 4th gear with the shift lever on S4 (at a vehicle speed of approximately 30 to 40 km/h (19 to 25 mph)), shift into the "-" position and check if the 3rd gear down-shift occurs and the engine brake operates properly.
      - While driving the vehicle in 3rd gear with the shift lever on S3 (at a vehicle speed of approximately 20 to 30 km/h (12 to 19 mph)), shift into the "-" position and check if the 2nd gear down-shift occurs and the engine brake operates properly.
      - While driving the vehicle in 2nd gear with the shift lever on S2 (at a vehicle speed of approximately 10 to 20 km/h (6 to 12 mph)), shift into the "-" position and check if the 1st gear down-shift occurs and the engine brake operates properly.

   HINT:

   Manual shift (S position) is prohibited under either of the following conditions:

      - Down-shifting that causes engine overrun.
      - The driver continuously down-shifts (Downshifting to 1st gear may not be performed).

c. R position test

   Shift into the R position, lightly depress the accelerator pedal, and check that the vehicle moves backward without any abnormal noise or vibration.

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

d. P position test

Stop the vehicle on an incline (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.

MECHANICAL SYSTEM TESTS

1. **STALL SPEED TEST**

HINT:

This test is to check the overall performance of the engine and transmission.

CAUTION:

- **To ensure safety, perform this test in an open and level area that provides good traction.**
- **The stall speed test should always be performed with at least 2 people. One person should observe the condition of the wheels and wheel chocks while the other is performing the test.**

NOTE: Do not perform the stall speed test for longer than 5 seconds.

a. Connect the intelligent tester or Techstream to the DLC3.
b. Run the vehicle until the transmission fluid temperature has reached 50 to 80°C (122 to 176°F).
c. Allow the engine to idle with the air conditioning OFF.
d. Chock all 4 wheels.
e. Set the parking brake and keep the brake pedal depressed firmly with your left foot.
f. Move the shift lever to the D position.
g. Depress the accelerator pedal as much as possible with your right foot.
h. Read the engine rpm (stall speed) and release the accelerator pedal immediately.

Standard value:

2310 +/-200 rpm

Evaluation:

STALL SPEED TEST REFERENCE

Test Result	Possible Cause
Stall speed Is lower than standard value	• Stator one-way clutch is not operating properly • Torque converter is faulty (stall speed is less than standard value by 600 rpm or more) • Engine power may be insufficient
Stall speed is higher than standard value	• Line pressure is low • C1 clutch slipping • F3 one-way clutch is not operating properly • F4 one-way clutch is not operating properly

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

2. **SHIFT TIME LAG TEST**

HINT:

This test is to check the condition of the direct clutch, forward clutch, 1st brake and reverse brake.

a. Connect the intelligent tester or Techstream to the DLC3.
b. Run the vehicle until the transmission fluid temperature has reached 50 to 80°C (122 to 176°F).
c. Allow the engine to idle with the air conditioning OFF.
d. Set the parking brake and keep the brake pedal depressed firmly.
e. Check the D position time lag.
    1. Move the shift lever to N and wait for 1 minute.
    2. Move the shift lever to D and measure the time until the shock is felt.
    3. Repeat the 2 procedures above 3 times, and calculate the average time of the 3 tests.
f. Check the R position time lag.
    1. Move the shift lever to N and wait for 1 minute.
    2. Move the shift lever to R and measure the time until the shock is felt.
    3. Repeat the 2 procedures above 3 times, and calculate the average time of the 3 tests.

Standard value:

D position time lag is less than 1.2 seconds

R position time lag is less than 1.5 seconds

Evaluation:

SHIFT TIME LAG TEST REFERENCE

Test Result	Possible Cause
D position time lag exceeds standard value	• Line pressure is low • C1 clutch is worn • F3 one-way clutch is not operating properly • F4 one-way clutch is not operating properly
R position time lag exceeds standard value	• Line pressure is low • C3 clutch is worn • B4 brake is worn • F1 one-way clutch is not operating properly

HYDRAULIC TEST

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

CAUTION: The line pressure test should always be carried out in pairs. One technician should observe the conditions of the wheels and wheel chocks outside the vehicle while the other is performing the test.

NOTE:

- **Perform the test at the normal operating ATF (Automatic Transmission Fluid) temperature: 50to80°C (122to176°F).**
- **Be careful to prevent SST hose from interfering with the exhaust pipe.**
- **This check must be conducted after checking and adjusting the engine.**
- **Perform the test with the A/C OFF.**
- **When conducting stall test, do not continue for more than 5 seconds.**

1. Warm up the ATF (Automatic Transmission Fluid).
2. Turn the ignition switch OFF.
3. Lift the vehicle up.
4. Remove the test plug on the transmission case center right side and connect SST.

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

5. Lower the vehicle.
6. Fully apply the parking brake and chock the 4 wheels.
7. Start the engine and check the idling speed.
8. Keep your left foot pressed firmly on the brake pedal and shift into the D position.
9. Measure the line pressure when the engine is idling.
10. Fully depress the accelerator pedal with your right foot. Quickly read the highest line pressure when the engine speed reaches the stall speed.

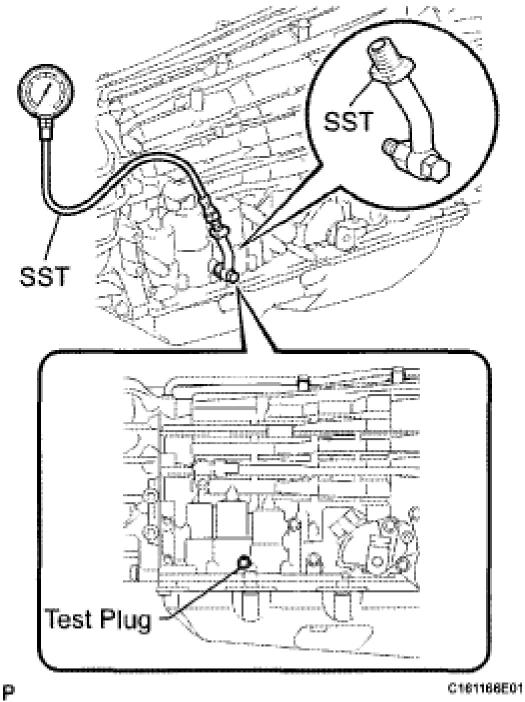

Fig. 6: Identifying Test Plug And SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. In the same manner, do the test in the R position.

Specified line pressure:

LINE PRESSURE SPECIFICATIONS

Condition	D position kPa (kgf/cm^2 , psi)	R position kPa (kgf/cm^2 , psi)
Idling	355 to 425 kPa (3.6 to 4.3 kgf/cm^2 , 52 to 62 psi)	541 to 641 kPa (5.5 to 6.5 kgf/cm^2 , 78 to 93 psi)
Stall speed	1198 to 1308 kPa (12.2 to 13.3 kgf/cm^2 , 174 to 190 psi)	1532 to 1740 kPa (15.6 to 17.7 kgf/cm^2 , 222 to 252 psi)

Evaluation:

HYDRAULIC TEST REFERENCE

Problem	Possible cause
Measured values at both positions are higher than specified pressure	• Shift solenoid valve SLT defective • Regulator valve defective
Measured values at both positions are lower than specified pressure	• Shift solenoid valve SLT defective • Regulator valve defective • Oil pump defective
Pressure is low in D position only	• D position circuit fluid leak

	• Clutch No. 1 (C1) defective
Pressure is low in R position only	• R position circuit fluid leak • Clutch No. 3 (C3) defective • Brake No. 4 (B4) defective

MANUAL SHIFTING TEST

1. **MANUAL SHIFTING TEST**

   HINT:

   - Through this test, it can be determined whether the trouble occurs in an electrical circuit or if it is a mechanical problem in the transmission.
   - If any abnormalities are found in the following test, the problem is in the transmission itself.

   a. Disconnect the connector of the No. 1 transmission wire and No. 2 transmission wire.

      HINT:

      It is possible to deactivate the electrical shift control by disconnecting the transmission wires. The gear positions can then be changed mechanically with the shift lever.

   b. Drive the vehicle with the transmission wires disconnected. Move the shift lever to each position to check whether the gear position changes as shown in the table below.

      GEAR POSITION REFERENCE

Shift Lever Position	Gear Position
P	P
R	R
D	3rd

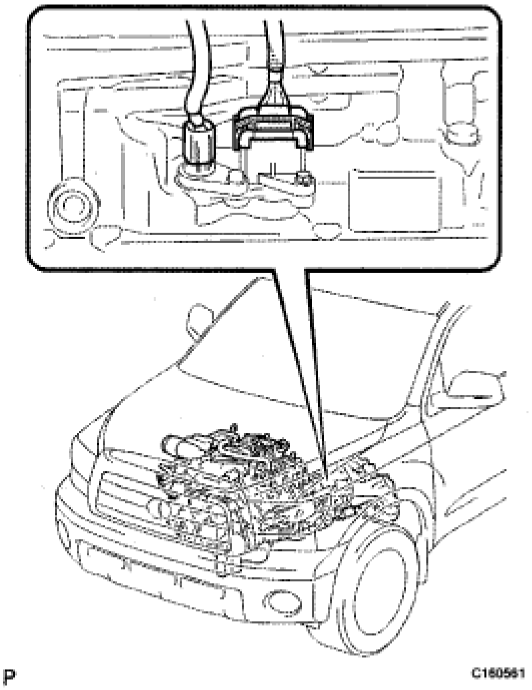

Fig. 7: Identifying Connector Of No. 1 And 2 Transmission Wire
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Connect the connector of the No. 1 transmission wire and No. 2 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 transmission assembly, engine assembly or ECM.**
- **The RESET MEMORY can be performed only with the intelligent tester or Techstream.**

HINT:

The ECM memorizes the control conditions of the automatic transmission assembly and engine assembly. Therefore, when the automatic transmission 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. Connect the intelligent tester or Techstream to the DLC3.
b. Turn the ignition switch ON and push the tester switch ON.
c. Enter the following menus:

NOTE: **After performing the RESET MEMORY, be sure to perform the ROAD TEST described earlier.**

HINT:

The ECM learns through the ROAD TEST.

1. Intelligent tester - Select: DIAGNOSIS / OBD/ MOBD / ENGINE AND ECT / RESET MEMORY.
2. Techstream - Select: Powertrain / Engine and ECT / Utility / Reset Memory.

MONITOR DRIVE PATTERN

1. **TEST MONITOR DRIVE PATTERN FOR ECT**

CAUTION: Perform this drive pattern on a level surface and strictly observe the posted speed limits and traffic laws while driving.

HINT:

Performing this drive pattern is one method to simulate the ECT's malfunction detection conditions. The DTCs may not be detected through ordinary, everyday driving. Also, DTCs may not be detected through this drive pattern.

a. Preparation for driving
   1. Warm up the engine sufficiently (engine coolant temperature is 60°C (140°F) or higher).
   2. Drive the vehicle when the atmospheric temperature is -10°C (14°F) or higher. Malfunctions are not detected when the atmospheric temperature is less than -10°C
b. Drive pattern
   1. Drive the vehicle through all the gears. Stop --> 1st --> 2nd --> 3rd --> 4th --> 5th --> 5th (lock up ON) --> 6th --> 6th (lock up ON).
   2. Repeat the above drive pattern 3 times or more.

NOTE:

- **When using the intelligent tester or Techstream, the monitor st be checked in the DATA LIST / ACTIVE TEST .**
- **In the event that the drive pattern must be interrupted (due to t conditions or other factors), the drive pattern can be resumed most cases, the monitor can be completed.**

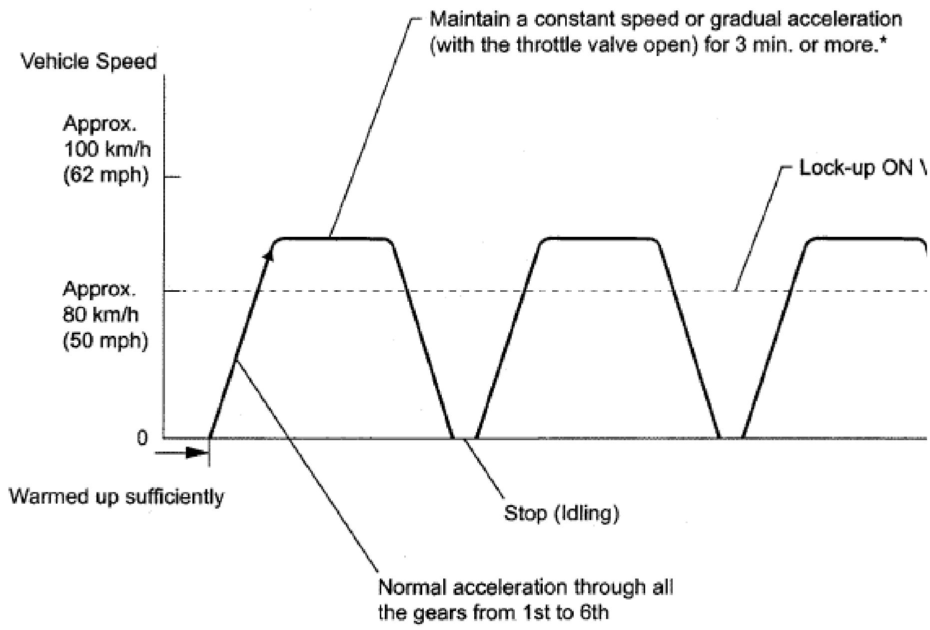

Fig. 8: Vehicle Driving Pattern
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

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

NOTE: **It is necessary to drive the vehicle for approximately 30 minutes to detect DTC P0711 (No. 1 ATF temperature sensor malfunction).**

PROBLEM SYMPTOMS TABLE

HINT:

- Use the table below to help determine the cause of the problem symptom. The potential causes of the symptoms are listed in order of probability in the "Suspected area" column of the table. Check each symptom by checking the suspected areas in the order they are listed. Replace parts as necessary.
- The Matrix Chart is divided into 2 chapters. When troubleshooting, check Chapter 1 first. If instructions are given in Chapter 1 to proceed to 2, proceed as instructed.
- If the instruction "Proceed to next circuit inspection shown in problem symptoms table" is given in the flowchart for each circuit, proceed to the next suspected area in the table.
- If the problem still occurs even though there are no malfunctions in any of the circuits, check the ECM and replace it if necessary.

1. **CHAPTER 1: ELECTRONIC CIRCUIT MATRIX CHART**

ELECTRONIC CIRCUIT MATRIX PROBLEM SYMPTOMS CHART

Symptom	Suspected Area	See
No up-shift (1st -> 2nd)	Shift solenoid valve S1 circuit*	DTC P0973 SHIFT SOLENOID "A" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE S1); DTC P0974 SHIFT SOLENOID "A" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE S1)
	ECM	ELECTRONIC CIRCUIT INSPECTION PROCEDURE
No up-shift (2nd -> 3rd)	Shift solenoid valve S2 circuit*	DTC P0976 SHIFT SOLENOID "B" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE S2); DTC P0977 SHIFT SOLENOID "B" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE S2)
	ECM	ELECTRONIC CIRCUIT INSPECTION PROCEDURE
No up-shift (3rd -> 4th)	Shift solenoid valve S3 circuit*	DTC P0979 SHIFT SOLENOID "C" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE S3); DTC P0980 SHIFT SOLENOID "C" CONTROL CIRCUIT HIGH (SHIFT

		SOLENOID VALVE S3)
	Engine coolant temperature sensor circuit*	**DIAGNOSTIC TROUBLE CODE CHART**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
No up-shift (4th -> 5th)	Shift solenoid valve S4 circuit*	**DTC P0982 SHIFT SOLENOID "D" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE S4); DTC P0983 SHIFT SOLENOID "D" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE S4)**
	Shift solenoid valve SR circuit*	**DTC P0985 SHIFT SOLENOID "E" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE SR); DTC P0986 SHIFT SOLENOID "E" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE SR)**
	Shift solenoid valve SL1 circuit*	**DTC P0748 PRESSURE CONTROL SOLENOID "A" ELECTRICAL (SHIFT SOLENOID VALVE SL1)**
	Shift solenoid valve SL2 circuit*	**DTC P0778 PRESSURE CONTROL SOLENOID "B" ELECTRICAL**

		(SHIFT SOLENOID VALVE SL2)
	ECM	ELECTRONIC CIRCUIT INSPECTION PROCEDURE
No up-shift (5th -> 6th)	Park/Neutral position switch circuit*	DTC P0705 TRANSMISSION RANGE SENSOR CIRCUIT MALFUNCTION (PRNDL INPUT)
	Engine coolant temperature sensor circuit*	DIAGNOSTIC TROUBLE CODE CHART
	Shift solenoid valve S2 circuit*	DTC P0976 SHIFT SOLENOID "B" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE S2); DTC P0977 SHIFT SOLENOID "B" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE S2)
	ECM	ELECTRONIC CIRCUIT INSPECTION PROCEDURE
No down-shift (6th -> 5th)	Park/Neutral position switch circuit*	DTC P0705 TRANSMISSION RANGE SENSOR CIRCUIT MALFUNCTION (PRNDL INPUT)
	Shift solenoid valve S2 circuit*	DTC P0976 SHIFT SOLENOID "B" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE S2); DTC P0977 SHIFT SOLENOID "B" CONTROL

		CIRCUIT HIGH (SHIFT SOLENOID VALVE S2)
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
No down-shift (5th -> 4th)	Shift solenoid valve S4 circuit*	**DTC P0982 SHIFT SOLENOID "D" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE S4); DTC P0983 SHIFT SOLENOID "D" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE S4)**
	Shift solenoid valve SR circuit*	**DTC P0985 SHIFT SOLENOID "E" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE SR); DTC P0986 SHIFT SOLENOID "E" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE SR)**
	Shift solenoid valve SL1 circuit*	**DTC P0748 PRESSURE CONTROL SOLENOID "A" ELECTRICAL (SHIFT SOLENOID VALVE SL1)**
	Shift solenoid valve SL2 circuit*	**DTC P0778 PRESSURE CONTROL SOLENOID "B" ELECTRICAL (SHIFT**

		SOLENOID VALVE SL2)
	ECM	ELECTRONIC CIRCUIT INSPECTION PROCEDURE
No down-shift (4th -> 3rd)	Shift solenoid valve S3 circuit*	DTC P0979 SHIFT SOLENOID "C" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE S3); DTC P0980 SHIFT SOLENOID "C" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE S3)
	ECM	ELECTRONIC CIRCUIT INSPECTION PROCEDURE
No down-shift (3rd -> 2nd)	Shift solenoid valve S2 circuit*	DTC P0976 SHIFT SOLENOID "B" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE S2); DTC P0977 SHIFT SOLENOID "B" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE S2)
	ECM	ELECTRONIC CIRCUIT INSPECTION PROCEDURE
	Shift solenoid valve S1 circuit*	DTC P0973 SHIFT SOLENOID "A" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE S1); DTC P0974 SHIFT

No down-shift (2nd-> 1st)		**SOLENOID "A" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE S1)**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
No lock up or no lock up off	Shift solenoid valve SLU circuit*	**DTC P2759 TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT ELECTRICAL (SHIFT SOLENOID VALVE SLU)**
	Stop light switch circuit*	**DTC P0724 BRAKE SWITCH "B" CIRCUIT HIGH**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
	No. 1 ATF temperature sensor circuit*	**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
No lock up	Shift solenoid valve SLU circuit*	**DTC P2759 TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT ELECTRICAL (SHIFT SOLENOID VALVE SLU)**
	Engine coolant temperature sensor circuit*	**DIAGNOSTIC TROUBLE CODE CHART**
	Stop light switch circuit*	**DTC P0724 BRAKE SWITCH "B" CIRCUIT HIGH**
	Speed sensor NT circuit*	**DTC P0717 TURBINE SPEED SENSOR CIRCUIT NO SIGNAL**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
No lock up off	Shift solenoid valve SLU circuit*	**DTC P2759 TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT ELECTRICAL (SHIFT SOLENOID VALVE SLU)**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
	Shift solenoid valve SLT circuit*	**DTC P2716 PRESSURE CONTROL**

		SOLENOID "D" ELECTRICAL (SHIFT SOLENOID VALVE SLT)
	Speed sensor NT circuit*	DTC P0717 TURBINE SPEED SENSOR CIRCUIT NO SIGNAL
	Speed sensor SP2 circuit*	DTC P0722 OUTPUT SPEED SENSOR CIRCUIT NO SIGNAL
	Throttle position sensor circuit*	DIAGNOSTIC TROUBLE CODE CHART
	Tow/haul pattern select switch circuit	PATTERN SELECT SWITCH CIRCUIT
Shift point too high or too low	No. 1 ATF temperature sensor circuit*	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
	ECM	ELECTRONIC CIRCUIT INSPECTION PROCEDURE
Up-shift to 4th from 3rd while engine is	Engine coolant temperature sensor circuit*	DIAGNOSTIC TROUBLE CODE CHART
	ECM	ELECTRONIC

cold		**CIRCUIT INSPECTION PROCEDURE**
Up-shift to 5th from 4th while engine is cold	Engine coolant temperature sensor circuit*	**DIAGNOSTIC TROUBLE CODE CHART**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
No gear change by shifting into "+" or "-" while shift lever on S	Transmission control switch circuit	**TRANSMISSION CONTROL SWITCH CIRCUIT**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
Harsh engagement (N -> D)	Shift solenoid valve SLT circuit*	**DTC P2716 PRESSURE CONTROL SOLENOID "D" ELECTRICAL (SHIFT SOLENOID VALVE SLT)**
	Speed sensor NT circuit*	**DTC P0717 TURBINE SPEED SENSOR CIRCUIT NO SIGNAL**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
Harsh engagement (lock up)	Speed sensor NT circuit*	**DTC P0717 TURBINE SPEED SENSOR CIRCUIT NO SIGNAL**
	Speed sensor SP2 circuit*	**DTC P0722 OUTPUT SPEED SENSOR CIRCUIT NO SIGNAL**
	Shift solenoid valve SLU circuit*	**DTC P2759 TORQUE CONVERTER CLUTCH**

		PRESSURE CONTROL SOLENOID CONTROL CIRCUIT ELECTRICAL (SHIFT SOLENOID VALVE SLU)
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
Harsh engagement (any driving position)	Throttle position sensor circuit*	**DIAGNOSTIC TROUBLE CODE CHART**
	Shift solenoid valve SL1 circuit*	**DTC P0748 PRESSURE CONTROL SOLENOID "A" ELECTRICAL (SHIFT SOLENOID VALVE SL1)**
	Shift solenoid valve SL2 circuit*	**DTC P0778 PRESSURE CONTROL SOLENOID "B" ELECTRICAL (SHIFT SOLENOID VALVE SL2)**
	Shift solenoid valve SLU circuit*	**DTC P2759 TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT ELECTRICAL (SHIFT SOLENOID VALVE SLU)**
	Shift solenoid valve SLT circuit*	**DTC P2716 PRESSURE CONTROL SOLENOID "D" ELECTRICAL**

		(SHIFT SOLENOID VALVE SLT)
	Speed sensor NT circuit*	**DTC P0717 TURBINE SPEED SENSOR CIRCUIT NO SIGNAL**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
Poor acceleration	No. 2 ATF temperature sensor circuit*	**DTC P2740 TRANSMISSION FLUID TEMPERATURE SENSOR "B" CIRCUIT; DTC P2742 TRANSMISSION FLUID TEMPERATURE SENSOR "B" CIRCUIT LOW INPUT; DTC P2743 TRANSMISSION FLUID TEMPERATURE SENSOR "B" CIRCUIT HIGH INPUT**
	Shift solenoid valve SLT circuit*	**DTC P2716 PRESSURE CONTROL SOLENOID "D" ELECTRICAL (SHIFT SOLENOID VALVE SLT)**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
No engine brake	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
No kick-down	ECM	**ELECTRONIC CIRCUIT**

		INSPECTION PROCEDURE
Engine stalls when starting off or stopping	Shift solenoid valve SLU circuit*	**DTC P2759 TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT ELECTRICAL (SHIFT SOLENOID VALVE SLU)**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
"A/T OIL TEMP" warning light remains on, lock up at 3rd gear and/or shift point too high	No. 2 ATF temperature sensor circuit*	**DTC P2740 TRANSMISSION FLUID TEMPERATURE SENSOR "B" CIRCUIT; DTC P2742 TRANSMISSION FLUID TEMPERATURE SENSOR "B" CIRCUIT LOW INPUT; DTC P2743 TRANSMISSION FLUID TEMPERATURE SENSOR "B" CIRCUIT HIGH INPUT**
	Engine coolant temperature sensor circuit*	**DIAGNOSTIC TROUBLE CODE CHART**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
	Park/Neutral position switch circuit*	**DTC P0705 TRANSMISSION RANGE SENSOR CIRCUIT**

Malfunction in shifting		**MALFUNCTION (PRNDL INPUT)**
	Transmission control switch circuit	**TRANSMISSION CONTROL SWITCH CIRCUIT**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
Harsh engagement (1st -> 2nd -> 3rd -> 4th -> 5th)	Shift solenoid valve SR circuit*	**DTC P0985 SHIFT SOLENOID "E" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE SR); DTC P0986 SHIFT SOLENOID "E" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE SR)**
Slip or shudder (5th -> 6th -> and 6th -> 5th)	Shift solenoid valve SR circuit*	**DTC P0985 SHIFT SOLENOID "E" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE SR); DTC P0986 SHIFT SOLENOID "E" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE SR)**
HINT: *: When the circuit is defective, a DTC may be output.		

2. **CHAPTER 2: ON-VEHICLE REPAIR AND OFF-VEHICLE REPAIR**

ON-VEHICLE REPAIR AND OFF-VEHICLE REPAIR PROBLEM SYMPTOMS CHART

Symptom	Suspected Area	See
	Transmission control cable (for Column Shift Type)	**TRANSMISSION CONTROL CABLE (FOR COLUMN SHIFT TYPE)**

Vehicle does not move when shift lever is in any forward position and reverse position	Transmission control cable (for Floor Shift Type)	**TRANSMISSION CONTROL CABLE (FOR FLOOR SHIFT TYPE)**
	Manual valve	**AUTOMATIC TRANSMISSION UNIT**
	Parking lock pawl	**AUTOMATIC TRANSMISSION UNIT**
	Rear planetary gear unit	**AUTOMATIC TRANSMISSION UNIT**
	Torque converter clutch	**TORQUE CONVERTER CLUTCH AND DRIVE PLATE**
Vehicle does not move with shift lever on R	Valve body assembly	**VALVE BODY ASSEMBLY**
	B4 brake	**AUTOMATIC TRANSMISSION UNIT**
No up-shift (1st->2nd)	Valve body assembly	**VALVE BODY ASSEMBLY**
	B3 brake	**AUTOMATIC TRANSMISSION UNIT**
	F1 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
	F2 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
No up-shift (2nd -> 3rd)	Valve body assembly	**VALVE BODY ASSEMBLY**
	C3 clutch	**AUTOMATIC TRANSMISSION UNIT**
No up-shift (3rd -> 4th)	Valve body assembly	**VALVE BODY ASSEMBLY**
	C2 clutch	**AUTOMATIC TRANSMISSION UNIT**
No up-shift (4th -> 5th)	Valve body assembly	**VALVE BODY ASSEMBLY**
	B1 brake	**AUTOMATIC TRANSMISSION**

		UNIT
No up-shift (5th -> 6th)	Valve body assembly	**VALVE BODY ASSEMBLY**
	B2 brake	**AUTOMATIC TRANSMISSION UNIT**
No down-shift (6th -> 5th)	Valve body assembly	**VALVE BODY ASSEMBLY**
No down-shift (5th -> 4th)	Valve body assembly	**VALVE BODY ASSEMBLY**
No down-shift (4th -> 3rd)	Valve body assembly	**VALVE BODY ASSEMBLY**
No down-shift (3rd -> 2nd)	Valve body assembly	**VALVE BODY ASSEMBLY**
No down-shift (2nd -> 1st)	Valve body assembly	**VALVE BODY ASSEMBLY**
No lock up or no lock up off	Valve body assembly	**VALVE BODY ASSEMBLY**
	Torque converter clutch	**TORQUE CONVERTER CLUTCH AND DRIVE PLATE**
Harsh engagement (N -> D)	Valve body assembly	**VALVE BODY ASSEMBLY**
	C1 accumulator	**AUTOMATIC TRANSMISSION UNIT**
	C1 clutch	**AUTOMATIC TRANSMISSION UNIT**
	F3 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
	F4 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
Harsh engagement (lock up)	Valve body assembly	**VALVE BODY ASSEMBLY**
	Torque converter clutch	**TORQUE CONVERTER CLUTCH AND DRIVE PLATE**
	Valve body assembly	**VALVE BODY ASSEMBLY**
	C3 accumulator	**AUTOMATIC TRANSMISSION UNIT**
	C3 clutch	**AUTOMATIC**

Harsh engagement (N -> R)		**TRANSMISSION UNIT**
	B4 brake	**AUTOMATIC TRANSMISSION UNIT**
	F1 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
Harsh engagement (1st -> 2nd -> 3rd -> 4th -> 5th -> 6th)	Valve body assembly	**VALVE BODY ASSEMBLY**
Harsh engagement (1st -> 2nd)	Valve body assembly	**VALVE BODY ASSEMBLY**
	B3 accumulator	**AUTOMATIC TRANSMISSION UNIT**
	B3 brake	**AUTOMATIC TRANSMISSION UNIT**
	F1 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
	F2 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
Harsh engagement (2nd -> 3rd)	Valve body assembly	**VALVE BODY ASSEMBLY**
	C3 accumulator	**AUTOMATIC TRANSMISSION UNIT**
	C3 clutch	**AUTOMATIC TRANSMISSION UNIT**
Harsh engagement (3rd -> 4th)	Valve body assembly	**VALVE BODY ASSEMBLY**
	C2 accumulator	**AUTOMATIC TRANSMISSION UNIT**
	C2 clutch	**AUTOMATIC TRANSMISSION UNIT**
Harsh engagement (4th -> 5th)	Valve body assembly	**VALVE BODY ASSEMBLY**
	B1 accumulator	**AUTOMATIC TRANSMISSION UNIT**
	B1 brake	**AUTOMATIC TRANSMISSION**

		UNIT
Harsh engagement (5th -> 6th)	Valve body assembly	**VALVE BODY ASSEMBLY**
	B2 accumulator	**AUTOMATIC TRANSMISSION UNIT**
	B2 brake	**AUTOMATIC TRANSMISSION UNIT**
Harsh engagement (6th -> 5th)	Valve body assembly	**VALVE BODY ASSEMBLY**
	C3 accumulator	**AUTOMATIC TRANSMISSION UNIT**
	C3 clutch	**AUTOMATIC TRANSMISSION UNIT**
Slip or shudder (forward and reverse, after warm-up)	Transmission control cable (for Column Shift Type)	**TRANSMISSION CONTROL CABLE (FOR COLUMN SHIFT TYPE)**
	Transmission control cable (for Floor Shift Type)	**TRANSMISSION CONTROL CABLE (FOR FLOOR SHIFT TYPE)**
	Valve body assembly	**VALVE BODY ASSEMBLY**
	Oil strainer	**VALVE BODY ASSEMBLY**
	F1 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
	C3 clutch	**AUTOMATIC TRANSMISSION UNIT**
	Torque converter clutch	**TORQUE CONVERTER CLUTCH AND DRIVE PLATE**
Slip or shudder (particular position, just after engine starts)	Torque converter clutch	**TORQUE CONVERTER CLUTCH AND DRIVE PLATE**
	B4 brake	**AUTOMATIC TRANSMISSION UNIT**

Slip or shudder (shift lever on R)	F1 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
	C3 clutch	**AUTOMATIC TRANSMISSION UNIT**
Slip or shudder (1st)	C1 clutch	**AUTOMATIC TRANSMISSION UNIT**
	F3 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
	F4 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
Slip or shudder (2nd)	C1 clutch	**AUTOMATIC TRANSMISSION UNIT**
	B3 brake	**AUTOMATIC TRANSMISSION UNIT**
	F1 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
	F2 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
	F4 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
Slip or shudder (3rd)	C1 clutch	**AUTOMATIC TRANSMISSION UNIT**
	C3 clutch	**AUTOMATIC TRANSMISSION UNIT**
	F1 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
	F4 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
Slip or shudder (4th)	C1 clutch	**AUTOMATIC TRANSMISSION UNIT**
	C2 clutch	**AUTOMATIC TRANSMISSION UNIT**

	F4 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
Slip or shudder (5th)	C2 clutch	**AUTOMATIC TRANSMISSION UNIT**
	C3 clutch	**AUTOMATIC TRANSMISSION UNIT**
	B1 brake	**AUTOMATIC TRANSMISSION UNIT**
Slip or shudder (6th)	C2 clutch	**AUTOMATIC TRANSMISSION UNIT**
	B2 brake	**AUTOMATIC TRANSMISSION UNIT**
No engine braking (1st to 4th, shift lever on S)	C4 clutch	**AUTOMATIC TRANSMISSION UNIT**
No engine braking (1st: shift lever on 1)	Valve body assembly	**VALVE BODY ASSEMBLY**
	B4 brake	**AUTOMATIC TRANSMISSION UNIT**
No engine braking (2nd: shift lever on 2)	Valve body assembly	**VALVE BODY ASSEMBLY**
	B2 brake	**AUTOMATIC TRANSMISSION UNIT**
No engine braking (3rd: shift lever on 3)	Valve body assembly	**VALVE BODY ASSEMBLY**
	B1 brake	**AUTOMATIC TRANSMISSION UNIT**
No engine braking (4th: shift lever on 4)	Valve body assembly	**VALVE BODY ASSEMBLY**
No kick-down	Valve body assembly	**VALVE BODY ASSEMBLY**
Shift point too high or too low	Valve body assembly	**VALVE BODY ASSEMBLY**
Poor acceleration (all positions)	Valve body assembly	**VALVE BODY ASSEMBLY**
	Torque converter clutch	**TORQUE CONVERTER CLUTCH AND**

		DRIVE PLATE
Poor acceleration (6th)	B2 brake	**AUTOMATIC TRANSMISSION UNIT**
	C2 clutch	**AUTOMATIC TRANSMISSION UNIT**
	Front planetary gear unit	**AUTOMATIC TRANSMISSION UNIT**
Engine stalls when starting off or stopping	Valve body assembly	**VALVE BODY ASSEMBLY**
	Torque converter clutch	**TORQUE CONVERTER CLUTCH AND DRIVE PLATE**

TERMINALS OF ECM

1. **CHECK ECM**

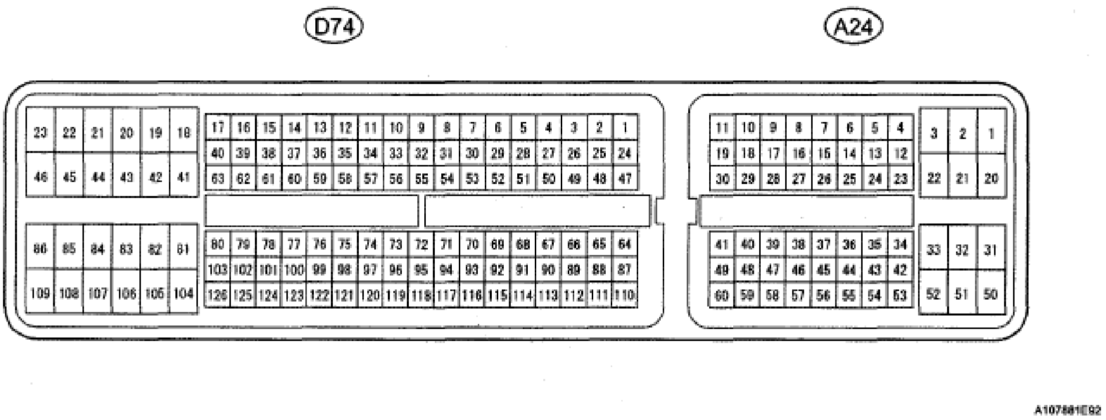

Fig. 9: Identifying ECM Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

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

In the table, first follow the information under "Condition". Look under "Terminal No. (Symbols)" for the terminals to be inspected. The standard voltage between the terminals is shown under "Specified Condition". Use the illustration above as a reference for the ECM terminals.

ECM CONNECTOR TERMINALS REFERENCE

Terminal No. (Symbols)	Wiring Color	Terminal Description	Condition	Specified Condition
A24-21 (L4) -		L4 shift position	• Ignition switch ON	

D74-81 (E1)	Y - BR	switch signal	• Transfer shift lever on L4	Below 1.5 V
A24-21 (L4) - D74-81 (E1)	Y - BR	L4 shift position switch signal	• Ignition switch ON • Transfer shift lever not on L4	11 to 14 V
A24-5 (TFN) - D74-81 (E1)	G - BR	N shift position switch signal	• Ignition switch ON • Transfer shift lever on N	Below 1.5 V
A24-5 (TFN) - D74-81 (E1)	G - BR	N shift position switch signal	• Ignition switch ON • Transfer shift lever not on N	11 to 14 V
D74-120 (NSW) - D74-81 (E1)	L - BR	PNP switch signal	• Ignition switch ON • Shift lever on P or N	Below 1 V
D74-120 (NSW) - D74-81 (E1)	L - BR	PNP switch signal	• Ignition switch ON • Shift lever not on P or N	11 to 14 V
D74-2 (P) - D74-81 (E1)	G-B - BR	P shift position switch signal	• Ignition switch ON • Shift lever on P	11 to 14 V
D74-2 (P) - D74-81 (E1)	G-B - BR	P shift position switch signal	• Ignition switch ON • Shift lever not on P	Below 1 V
D74-26 (R) - D74-81 (E1)	L-R - BR	R shift position switch signal	• Ignition switch ON • Shift lever on R	11 to 14 V
D74-26 (R) - D74-81 (E1)	L-R - BR	R shift position switch signal	• Ignition switch ON • Shift lever not on R	Below 1 V
D74-25 (N) - D74-81 (E1)	G-W - BR	N shift position switch signal	• Ignition switch ON • Shift lever on N	11 to 14 V
D74-25 (N) - D74-81 (E1)	G-W - BR	N shift position switch signal	• Ignition switch ON • Shift lever not on N	Below 1 V
D74-27 (D) - D74-81 (E1)	G - BR	D shift position switch signal	• Ignition switch ON • Shift lever on D	11 to 14 V
D74-27 (D) - D74-81 (E1)	G - BR	D shift position switch signal	• Ignition switch ON • Shift lever not on D	Below 1 V
A24-25 (S) - D74-81 (E1)	Y - BR	S shift position switch signal	• Ignition switch ON • Shift lever on S	11 to 14 V
A24-25 (S) - D74-81 (E1)	Y - BR	S shift position switch signal	• Ignition switch ON • Shift lever not on S	Below 1 V
A24-38 (SFTU) - D74-81 (E1)	G - BR	Up-shift shift position switch signal	• Ignition switch ON • Shift lever on S	11 to 14 V
			• Ignition switch ON	

A24-38 (SFTU) - D74-81 (E1)	G - BR	Up-shift shift position switch signal	• Shift lever "+" position (up-shift)	Below 1 V
A24-27 (SFTD) - D74-81 (E1)	O - BR	Down-shift position switch signal	• Ignition switch ON • Shift lever on S	11 to 14 V
A24-27 (SFTD) - D74-81 (E1)	O - BR	Down-shift position switch signal	• Ignition switch ON • Shift lever "-" position (down-shift)	Below 1 V
A24-36 (STP) - D74-81 (E1)	LG - BR	Stop light switch signal	Brake pedal is depressed	7.5 to 14 V
A24-36 (STP) - D74-81 (E1)	LG - BR	Stop light switch signal	Brake pedal is released	Below 1.5 V
D74-7 (S1) - D74-81 (E1)	R - BR	S1 solenoid signal	1st gear	Below 1 V
D74-7 (S1) - D74-81 (E1)	R - BR	S1 solenoid signal	Not on 1st gear	11 to 14 V
D74-6 (S2) - D74-81 (E1)	W - BR	S2 solenoid signal	1st, 2nd or 6th gear	11 to 14 V
D74-6 (S2) - D74-81 (E1)	W - BR	S2 solenoid signal	3rd, 4th or 5th gear	Below 1 V
D74-3 (S3) - D74-81 (E1)	G-W - BR	S3 solenoid signal	1st, 2nd or 3rd gear	11 to 14 V
D74-3 (S3) - D74-81 (E1)	G-W - BR	S3 solenoid signal	4th, 5th or 6th gear	Below 1 V
D74-5 (S4) - D74-81 (E1)	G-R - BR	S4 solenoid signal	5th or 6th gear	11 to 14 V
D74-5 (S4) - D74-81 (E1)	G-R - BR	S4 solenoid signal	1st, 2nd, 3rd or 4th gear	Below 1 V
D74-4 (SR) - D74-81 (E1)	G - BR	SR solenoid signal	1st, 2nd, 3rd or 4th gear	11 to 14 V
D74-4 (SR) - D74-81 (E1)	G - BR	SR solenoid signal	5th or 6th gear	Below 1 V
D74-14 (SL1+) - D74-15 (SL1-)	Y-L	SL1 solenoid signal	5th or 6th gear	Pulse generation (see awaveform 1)
D74-12 (SL2+) - D74-13 (SL2-)	G-R - L-W	SL2 solenoid signal	Engine is idling	Pulse generation (see bwaveform 2)
D74-9 (SLT+) - D74-8 (SLT-)	B - G-B	SLT solenoid signal	Engine is idling	Pulse generation (see cwaveform 3)
D74-10 (SLU+) - D74-11 (SLU-)	L-Y - L-R	SLU solenoid signal	5th (lock up) gear or 6th (lock up) gear	Pulse generation (see dwaveform 4)
D74-122 (THO1) - D74-98 (ETHA)	G-Y - BR	No. 1 ATF temperature sensor signal	No. 1 ATF temperature: 115°C (239°F) or more	Below 1.5 V
D74-99 (THO2) - D74-98 (ETHA)	L - BR	No. 2 ATF temperature sensor signal	No. 2 ATF temperature: 115°C (239°F) or more	Below 1.5 V

D74-101 (SP2+) - D74-100 (SP2-)	Y - B	Speed sensor SP2 signal	Vehicle speed 20 km/h (12 mph)	Pulse generation (see ewaveform 5)
D74-124 (NT+) - D74-123 (NT-)	Y-B	Speed sensor NT signal	Engine is idling (shift lever on P or N)	Pulse generation (see fwaveform 6)
A24-10 (CANH) - D74-81 (E1)	GR - BR	CAN communication line	Ignition switch ON	Pulse generation (see gwaveform 7)
A24-11 (CANL) - D74-81 (E1)	W - BR	CAN communication line	Ignition switch ON	Pulse generation (see hwaveform 8)
A24-51 (PWR) - D74-81 (E1)	L - BR	Tow/haul pattern select switch signal	• Ignition switch ON • Tow/haul pattern select switch ON	0 to 1.5 V
A24-51 (PWR) - D74-81 (E1)	L - BR	Tow/haul pattern select switch signal	• Ignition switch ON • Tow/haul pattern select switch OFF	Pulse generation*
HINT: *: Voltage is input intermittently as this is an intermittent circuit. (Voltage varies between a peak of 7.5 to 14 V and a low of 0 to 1.5 V.)				

a. Using an oscilloscope, check the waveform 1.

Reference:

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition
D74-14 (SL1+) - D74-15 (SL1-)	5 V/DIV, 1 msec./DIV.	Engine is idling

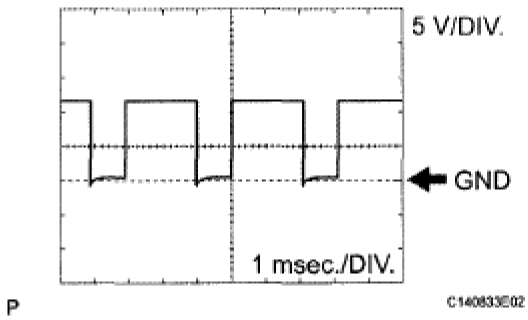

Fig. 10: Identifying Waveform 1
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Using an oscilloscope, check the waveform 2.

Reference:

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition
D74-12 (SL2+) - D74-13 (SL2-)	5 V/DIV, 1 msec./DIV.	Engine is idling

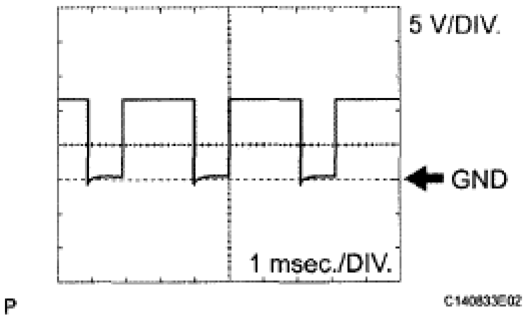

Fig. 11: Identifying Waveform 2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Using an oscilloscope, check the waveform 3.

Reference:

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition
D74-9 (SLT+) - D74-8 (SLT-)	5 V/DIV., 1 msec./DIV.	Engine is idling

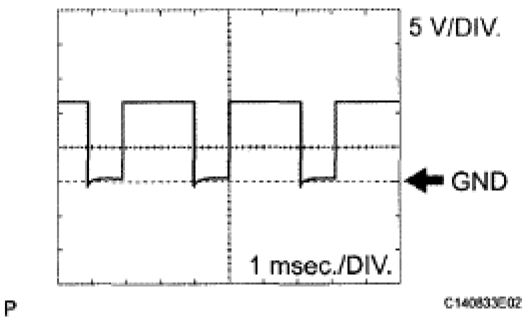

Fig. 12: Identifying Waveform 3
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Using an oscilloscope, check the waveform 4.

Reference:

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition
D74-10 (SLU+) - D74-11 (SLU-)	5 V/DIV., 1 msec./DIV.	5th (lock up)

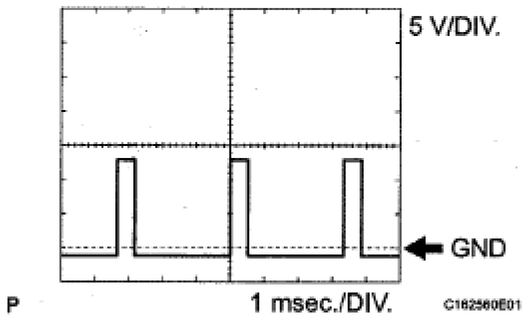

Fig. 13: Identifying Waveform 4
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

e. Using an oscilloscope, check the waveform 5.

Reference:

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition
D74-101 (SP2+) - D74-100 (SP2-)	2 V/DIV., 20 msec./DIV.	Vehicle speed 20 km/h (12mph)

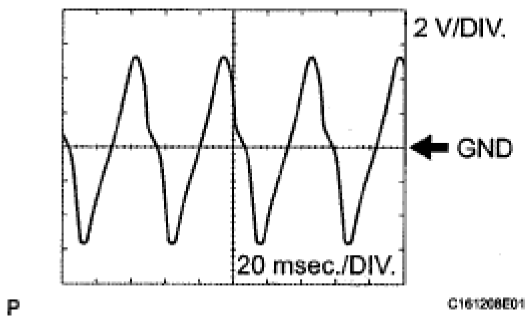

Fig. 14: Identifying Waveform 5
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

f. Using an oscilloscope, check the waveform 6.

Reference:

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition
D74-124 (NT+) - D74-123 (NT-)	1 V/DIV., 2 msec./DIV.	Engine is idling (P or N position)

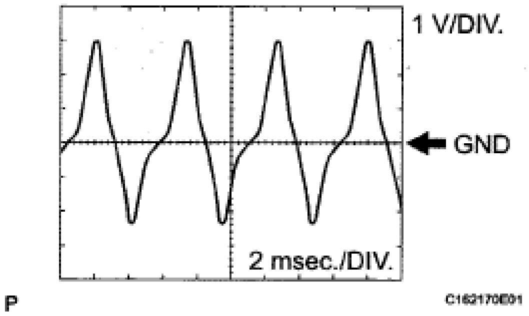

Fig. 15: Identifying Waveform 6
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

g. Using an oscilloscope, check the waveform 7.

Reference:

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition
A24-10 (CANH) - D74-81 (E1)	1 V/DIV., 10 ?sec./DIV.	Ignition switch ON

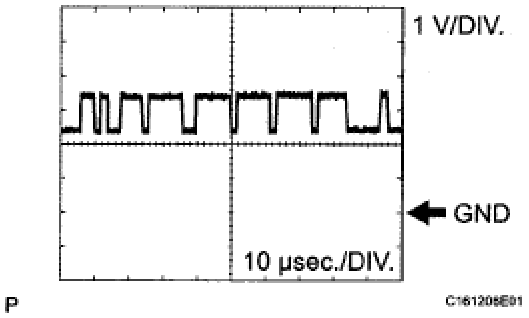

Fig. 16: Identifying Waveform 7
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

h. Using an oscilloscope, check the waveform 8.

Reference:

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition
A24-11 (CANL) - D74-81 (E1)	1 V/DIV., 10 ?sec./DIV.	Ignition switch ON

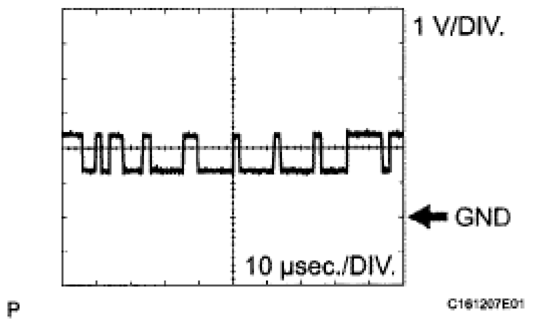

Fig. 17: Identifying Waveform 8
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DIAGNOSIS SYSTEM

1. **DESCRIPTION**
    a. When troubleshooting On-Board Diagnostic (OBD II) vehicles, the vehicle must be connected to the OBD II scan tool (complying with SAE J1987). Various data output from the vehicle's ECM can then be read.
    b. OBD II regulations require that the vehicle's on board computer illuminate the Malfunction Indicator Lamp (MIL) on the instrument panel when the computer detects a malfunction in:
        1. The emission control system/components
        2. The powertrain control components (which affect vehicle emissions)
        3. The computer

        In addition, the applicable Diagnostic Trouble Codes (DTCs) prescribed by SAE J2012 are recorded in the ECM memory.

        When the malfunction does not reoccur, the MIL stays illuminated until the ignition switch is turned OFF, and the MIL turns off when the engine is started. However, the DTCs remain recorded in the ECM memory.

    c. To check DTCs, connect the intelligent tester or Techstream to the Data Link Connector 3 (DLC3) of the vehicle. The tester displays DTCs, the freeze frame data and a variety of the engine data.

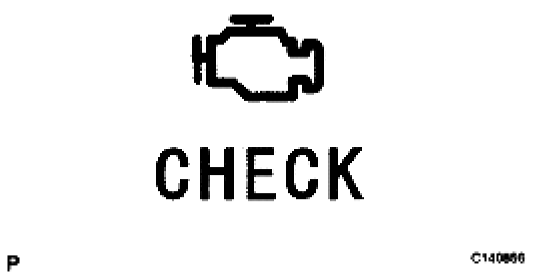

Fig. 18: Identifying Malfunction Indicator Lamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

The DTCs and freeze frame data can be erased with the tester (see **DTC CHECK / CLEAR**).

2. **NORMAL MODE AND CHECK MODE**
   a. The diagnosis system operates in "normal mode" during normal vehicle use. In normal mode, "2 trip detection logic" is used to ensure accurate detection of malfunctions. "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 malfunctions.
3. **TRIP DETECTION LOGIC**
   a. When a malfunction is first detected, the malfunction is temporarily stored in the ECM memory (1st trip). If the same malfunction is detected during the next drive cycle, the MIL is illuminated (2nd trip).
4. **FREEZE FRAME DATA**
   a. 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.
   b. The intelligent tester or Techstream records freeze frame data at 5 different times: 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 a temporary malfunction or not.

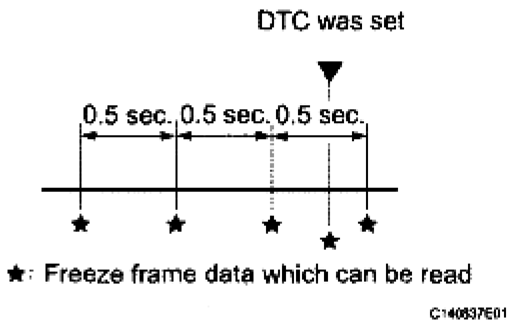

Fig. 19: Identifying Freeze Frame Data
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. **CHECK DATA LINK CONNECTOR 3 (DLC3)** (See **HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS**)
6. **CHECK MIL**
   a. Check that the MIL illuminates when turning the ignition switch ON.

      If the MIL does not illuminate, there is a problem in the MIL circuit (see **MIL CIRCUIT**).

   b. When the engine is started, the MIL should turn off.

DTC CHECK / CLEAR

1. **CHECK DTC**
   a. DTCs which are stored in the ECM can be displayed on the intelligent tester or Techstream.

The tester can display pending DTCs and current DTCs. Some DTCs are not stored unless a malfunction is detected in consecutive driving cycles. When a malfunction is detected in only one driving cycle, it is stored as a pending DTC.

1. Connect the intelligent tester or Techstream to the DLC3.
2. Turn the ignition switch ON and push the tester switch ON.
3. Enter the following menus:

   Intelligent tester

   Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / DTC INFO / CURRENT CODES.

   Techstream

   Select: Powertrain / Engine and ECT / Trouble Codes.

4. Confirm the DTCs and freeze frame data, and then write them down.
5. Confirm the details of the DTCs (see **DIAGNOSTIC TROUBLE CODE CHART**).

NOTE: **When simulating a symptom with the scan tool to check for DTCs, use normal mode. For codes on the DIAGNOSTIC TROUBLE CODE CHART subject to "2 trip detection logic", perform the following actions: Turn the ignition switch OFF after the symptom is simulated once. Then repeat the simulation process. When the symptom has been simulated twice, the MIL illuminates and the DTCs are recorded in the ECM.**

2. **CLEAR DTC (using the intelligent tester or Techstream)**
   a. Connect the intelligent tester or Techstream to the DLC3.
   b. Turn the ignition switch ON and push the tester switch ON.
   c. Enter the following menus:
      1. Intelligent tester - Select: DIAGNOSIS / OBD/ MOBD / ENGINE AND ECT / DTC INFO / CLEAR CODES.
      2. Techstream - Select: Powertrain / Engine and ECT / DTC / Clear.
3. **CLEAR DTC (without using the intelligent tester or Techstream)**
   a. Perform either of the following operations.
      1. Disconnect the negative battery cable for more than 1 minute.
      2. Remove the EFI NO. 1 fuse from the engine room relay block located inside the engine compartment for more than 1 minute.

CHECK MODE PROCEDURE

1. **DESCRIPTION**
   a. Check mode has a higher sensitivity to malfunctions and can detect malfunctions 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.

2. **CHECK MODE PROCEDURE**
   a. Make sure that the following conditions are met:
      1. Battery positive voltage 11 V or more.
      2. Throttle valve fully closed.
      3. Shift lever P or N position.
      4. A/C OFF.
   b. Connect the intelligent tester or Techstream to the DLC3.
   c. Turn the ignition switch ON and push the tester switch ON.
   d. Enter the following menus:
      1. Intelligent tester - Select: DIAGNOSIS / OBD/ MOBD / ENGINE AND ECT / CHECK MODE.
      2. Techstream - Select: Powertrain / Engine and ECT / Utility / Check Mode.
   e. Check that the MIL flashes as shown in the illustration.

NOTE:

- **All DTCs and freeze frame data will be erased if: 1) the intelligent tester or 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 ON to ACC or OFF.**
- **Before changing to check mode, make notes of the DTCs and freeze frame data.**

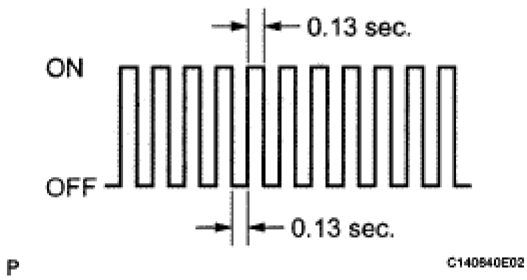

Fig. 20: Identifying MIL Flashing Pattern
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   f. Start the engine. The MIL should turn off after the engine starts.
   g. Perform "MONITOR DRIVE PATTERN" for the ECT test (see **INITIALIZATION**).

      (Or, simulate the conditions of the malfunction described by the customer.)

   h. After simulating the malfunction conditions, use the tester to check the DTC and freeze frame data.

FAIL-SAFE CHART

1. **Fail-safe**

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

2. **Fail-safe control list**

FAIL-SAFE CHART

Malfunctioning Part	Function
DTC P0717: Input Speed Sensor NT	During an input speed sensor malfunction, shift control is effected through the output speed sensor SP2 signal. During an input speed sensor malfunction, up-shift to the 5th and 6th, AI-SHIFT* and flex lock up clutch control are prohibited.
DTC P0722: Output Speed Sensor SP2	During an output speed sensor malfunction, shift control is effected through the input speed sensor NT signal. During an output speed sensor malfunction, up-shift to the 5th and 6th, AI-SHIFT* and flex lock up clutch control are prohibited.
DTC P0710, P0712, P0713: ATF Temperature Sensor	During an ATF temperature sensor malfunction, up-shift to the 5th and 6th and flex lock up clutch control are prohibited.
Shift Solenoid Valve S1, S2, S3, S4 and SR	The current to the failed solenoid valve is cut off and control is effected by operating the other solenoid valves. Shift control is effected depending on the failed solenoid as described in the table below.
DTC P0748, P0778: Shift Solenoid Valve SL1 and SL2	During a solenoid valve SL1 or SL2 malfunction, up-shift to the 5th and 6th and flex lock up clutch control are prohibited.
DTC P2714, P2716: Shift Solenoid Valve SLT	During a solenoid valve SLT malfunction, the current to the solenoid valve is stopped. This stops line pressure optimal control, and shift shock increases. However, shifting is effected through normal clutch pressure control.
DTC P2757, P2759: Shift Solenoid Valve SLU	During a solenoid valve SLU malfunction, the current to the solenoid valve is stopped. This stops lock up control and flex lock up control, and fuel economy decreases.
HINT: *: In addition to the switching of the shift pattern through the tow/haul pattern select switch, Artificial Intelligence Shift (AI-SHIFT) control enables the ECM to estimate the road conditions and the driver's intention in order to automatically select the optimal shift pattern.	

Shift solenoid valve normal operation chart:

SHIFT SOLENOID VALVE NORMAL OPERATION CHART

Shift lever position	Gear*	Shift solenoid S1	Shift solenoid S2	Shift solenoid S3	Shift solenoid S4	Shift solenoid SR	Shift solenoid SL1	Shift solenoid SL2
D, S6	1st	OFF	ON	ON	OFF	ON	OFF	ON
	2nd	ON	ON	ON	OFF	ON	OFF	ON
	3rd	ON	OFF	ON	OFF	ON	OFF	ON
	4th	ON	OFF	OFF	OFF	ON	OFF	ON
	5th	ON	OFF	OFF	ON	OFF	ON	OFF
	6th	ON	ON	OFF	ON	OFF	ON	OFF

S5	1st	OFF	ON	ON	OFF	ON	OFF	ON
	2nd	ON	ON	ON	OFF	ON	OFF	ON
	3rd	ON	OFF	ON	OFF	ON	OFF	ON
	4th	ON	OFF	OFF	OFF	ON	OFF	ON
	5th	ON	OFF	OFF	ON	OFF	ON	OFF
S4	1st	OFF	ON	ON	OFF	ON	OFF	ON
	2nd	ON	ON	ON	OFF	ON	OFF	ON
	3rd	ON	OFF	ON	OFF	ON	OFF	ON
	4th	ON	OFF	OFF	OFF	ON	OFF	ON
S3	1st	OFF	ON	ON	OFF	ON	OFF	ON
	2nd	ON	ON	ON	OFF	ON	OFF	ON
	3rd (E/B)	ON	OFF	ON	OFF	ON	OFF	OFF
S2	1st	OFF	ON	ON	OFF	ON	OFF	ON
	2nd (E/B)	ON	ON	ON	ON	ON	OFF	OFF
S1	1st (E/B)	OFF	ON	ON	OFF	ON	OFF	OFF

a. Fail-safe operation for electronically malfunctioning shift solenoid valve (S1, S2, S3, S4 and SR).

Fail-safe operation in the event of an electric system malfunction.

1. Fail-safe function

If any of the shift solenoid valve circuits has an open or short failure, the ECM turns the other shift solenoids "ON" and "OFF" in order to shift into the gear positions shown in the table below. Also, the ECM stops sending the current to the open or short circuit solenoid.

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

HINT:

- *: Actual gear shift (gear position) under fail-safe operation.
- X: OFF (the ECM stops sending current to the malfunctioning solenoid valve)
- -->: For an electrical malfunction, the ON/OFF condition is shown to the left of the "-->".
- --> For fail-safe mode, the ON/OFF condition is shown to the right of the "-->".
- E/B: Engine brake

Shift Solenoid Valve S1 Electrical Malfunction (P0973, P0974):

SHIFT SOLENOID VALVE S1 OPERATION CHART

Shift		Shift	Shift	Shift	Shift	Shift	Shift	Shift

lever position	Gear*	solenoid S1	solenoid S2	solenoid S3	solenoid S4	solenoid SR	solenoid SL1	solenoid SL2
D, S6	1st	X	ON	ON	OFF	ON	OFF	ON
	1st --> 4th	X	ON-->OFF	ON-->OFF	OFF	ON	OFF	ON
	3rd-->4th	X	OFF	ON-->OFF	OFF	ON	OFF	ON
	4th	X	OFF	OFF	OFF	ON	OFF	ON
	5th	X	OFF	OFF	ON	OFF	ON	OFF
	N-->5th	X	ON-->OFF	OFF	ON	OFF	ON	OFF
S5	1st	X	ON	ON	OFF	ON	OFF	ON
	1st-->4th	X	ON-->OFF	ON-->OFF	OFF	ON	OFF	ON
	3rd-->4th	X	OFF	ON-->OFF	OFF	ON	OFF	ON
	4th	X	OFF	OFF	OFF	ON	OFF	ON
	5th	X	OFF	OFF	ON	OFF	ON	OFF
S4	1st	X	ON	ON	OFF	ON	OFF	ON
	1st-->4th	X	ON-->OFF	ON-->OFF	OFF	ON	OFF	ON
	3rd-->4th	X	OFF	ON-->OFF	OFF	ON	OFF	ON
	4th	X	OFF	OFF	OFF	ON	OFF	ON
S3	1st	X	ON	ON	OFF	ON	OFF	ON
	1st-->4th	X	ON-->OFF	ON-->OFF	OFF	ON	OFF	ON
	3rd (E/B)-->4th	X	OFF	ON-->OFF	OFF	ON	OFF	OFF-->ON
S2	1st	X	ON	ON	OFF	ON	OFF	ON
	1st (E/B)-->4th	X	ON-->OFF	ON-->OFF	OFF	ON	OFF	OFF-->ON
S1	1st (E/B)	X	ON	ON	OFF	ON	OFF	OFF

Shift Solenoid Valve S2 Electrical Malfunction (P0976, P0977):

SHIFT SOLENOID VALVE S2 OPERATION CHART

Shift lever position	Gear*	Shift solenoid S1	Shift solenoid S2	Shift solenoid S3	Shift solenoid S4	Shift solenoid SR	Shift solenoid SL1	Shift solenoid SL2
D, S6	3rd	OFF-->ON	X	ON	OFF	ON	OFF	ON
	3rd	ON	X	ON	OFF	ON	OFF	ON
	3rd	ON	X	ON	OFF	ON	OFF	ON

	4th	ON	X	OFF	OFF	ON	OFF	ON
	5th	ON	X	OFF	ON	OFF	ON	OFF
	5th	ON	X	OFF	ON	OFF	ON	OFF
S5	3rd	OFF-->ON	X	ON	OFF	ON	OFF	ON
	3rd	ON	X	ON	OFF	ON	OFF	ON
	3rd	ON	X	ON	OFF	ON	OFF	ON
	4th	ON	X	OFF	OFF	ON	OFF	ON
	5th	ON	X	OFF	ON	OFF	ON	OFF
S4	3rd	OFF-->ON	X	ON	OFF	ON	OFF	ON
	3rd	ON	X	ON	OFF	ON	OFF	ON
	3rd	ON	X	ON	OFF	ON	OFF	ON
	4th	ON	X	OFF	OFF	ON	OFF	ON
S3	3rd-->3rd (E/B)	OFF-->ON	X	ON	OFF	ON	ON-->OFF	OFF
	3rd-->3rd (E/B)	ON	X	ON	OFF	ON	ON-->OFF	OFF
	3rd (E/B)	ON	X	ON	OFF	ON	OFF	OFF
S2	3rd-->3rd (E/B)	OFF-->ON	X	ON	OFF	ON	ON-->OFF	OFF
	3rd (E/B)	ON	X	ON	OFF	ON	OFF	OFF
S1	3rd (E/B)	OFF-->ON	X	ON	OFF	ON	OFF	OFF

Shift Solenoid Valve S3 Electrical Malfunction (P0979, P0980):

SHIFT SOLENOID VALVE S3 OPERATION CHART

Shift lever position	Gear*	Shift solenoid S1	Shift solenoid S2	Shift solenoid S3	Shift solenoid S4	Shift solenoid SR	Shift solenoid SL1	Shift solenoid SL2
D, S6	3rd-->4th	OFF-->ON	ON-->OFF	X	OFF	ON	OFF	ON
	4th	ON	ON-->OFF	X	OFF	ON	OFF	ON
	4th	ON	OFF	X	OFF	ON	OFF	ON
	4th	ON	OFF	X	OFF	ON	OFF	ON
	5th	ON	OFF	X	ON	OFF	ON	OFF
	6th	ON	ON	X	ON	OFF	ON	OFF
	3rd-->4th	OFF-->ON	ON-->OFF	X	OFF	ON	OFF	ON

S5	4th	ON	ON-->OFF	X	OFF	ON	OFF	ON
	4th	ON	OFF	X	OFF	ON	OFF	ON
	4th	ON	OFF	X	OFF	ON	OFF	ON
	5th	ON	OFF	X	ON	OFF	ON	OFF
S4	3rd-->4th	OFF-->ON	ON-->OFF	X	OFF	ON	OFF	ON
	4th	ON	ON-->OFF	X	OFF	ON	OFF	ON
	4th	ON	OFF	X	OFF	ON	OFF	ON
	4th	ON	OFF	X	OFF	ON	OFF	ON
S3	3rd-->4th	OFF-->ON	ON-->OFF	X	OFF	ON	OFF	ON
	4th	ON	ON-->OFF	X	OFF	ON	OFF	ON
	4th	ON	OFF	X	OFF	ON	OFF	OFF-->ON
S2	3rd-->4th	OFF-->ON	ON-->OFF	X	OFF	ON	OFF	ON
	6th-->4th	ON	ON-->OFF	X	OFF	ON	OFF	OFF-->ON
S1	1st (E/B)-->4th	OFF-->ON	ON-->OFF	X	OFF	ON	OFF	OFF-->ON

Shift Solenoid Valve S4 Electrical Malfunction (P0982, P0983):

SHIFT SOLENOID VALVE S4 OPERATION CHART

Shift lever position	Gear*	Shift solenoid S1	Shift solenoid S2	Shift solenoid S3	Shift solenoid S4	Shift solenoid SR	Shift solenoid SL1	Shift solenoid SL2
D, S6	1st	OFF	ON	ON	X	ON	OFF	ON
	2nd	ON	ON	ON	X	ON	OFF	ON
	3rd	ON	OFF	ON	X	ON	OFF	ON
	4th	ON	OFF	OFF	X	ON	OFF	ON
	4th	ON	OFF	OFF	X	OFF-->ON	ON-->OFF	OFF-->ON
	4th	ON	ON-->OFF	OFF	X	OFF-->ON	ON-->OFF	OFF-->ON
S5	1st	OFF	ON	ON	X	ON	OFF	ON
	2nd	ON	ON	ON	X	ON	OFF	ON
	3rd	ON	OFF	ON	X	ON	OFF	ON
	4th	ON	OFF	OFF	X	ON	OFF	ON
	4th	ON	OFF	OFF	X	OFF-->ON	ON-->OFF	OFF-->ON
	1st	OFF	ON	ON	X	ON	OFF	ON

S4	2nd	ON	ON	ON	X	ON	OFF	ON
	3rd	ON	OFF	ON	X	ON	OFF	ON
	4th	ON	OFF	OFF	X	ON	OFF	ON
S3	1st	OFF	ON	ON	X	ON	OFF	ON
	2nd	ON	ON	ON	X	ON	OFF	ON
	3rd (E/B)	ON	OFF	ON	X	ON	OFF	OFF
S2	1st	OFF	ON	ON	X	ON	OFF	ON
	2nd (E/B)	ON	ON	ON	X	ON	OFF	OFF
S1	1st (E/B)	OFF	ON	ON	X	ON	OFF	OFF

Shift Solenoid Valve SR Electrical Malfunction (P0985, P0986):

SHIFT SOLENOID VALVE SR OPERATION CHART

Shift lever position	Gear*	Shift solenoid S1	Shift solenoid S2	Shift solenoid S3	Shift solenoid S4	Shift solenoid SR	Shift solenoid SL1	Shift solenoid SL2
D, S6	1st	OFF	ON	ON	OFF	X	OFF	ON
	2nd	ON	ON	ON	OFF	X	OFF	ON
	3rd	ON	OFF	ON	OFF	X	OFF	ON
	4th	ON	OFF	OFF	OFF	X	OFF	ON
	5th	ON	OFF	OFF	ON	X	ON	OFF
	6th	ON	ON	OFF	ON	X	ON	OFF
S5	1st	OFF	ON	ON	OFF	X	OFF	ON
	2nd	ON	ON	ON	OFF	X	OFF	ON
	3rd	ON	OFF	ON	OFF	X	OFF	ON
	4th	ON	OFF	OFF	OFF	X	OFF	ON
	5th	ON	OFF	OFF	ON	X	ON	OFF
S4	1st	OFF	ON	ON	OFF	X	OFF	ON
	2nd	ON	ON	ON	OFF	X	OFF	ON
	3rd	ON	OFF	ON	OFF	X	OFF	ON
	4th	ON	OFF	OFF	OFF	X	OFF	ON
S3	1st	OFF	ON	ON	OFF	X	OFF	ON
	2nd	ON	ON	ON	OFF	X	OFF	ON
	3rd	ON	OFF	ON	OFF	X	OFF	OFF
S2	1st	OFF	ON	ON	OFF	X	OFF	ON
	2nd	ON	ON	ON	OFF	X	OFF	OFF
S1	1st	OFF	ON	ON	OFF	X	OFF	OFF

b. Fail-safe operation for mechanical malfunction. Fail-safe operation in the event of a mechanical system malfunction.

   1. Fail-safe function

The ECM controls the gear position as shown in the table below when malfunctions occur.

GEAR POSITION REFERENCE

DTC	Condition	Gear*1					
-	Normal	1st	2nd	3rd	4th	5th	6th
P0751	Shift solenoid valve S1: Stuck OFF malfunction	1st*2	1st*2	3rd	3rd	3rd	3rd
P0761	Shift solenoid valve S3: Stuck ON malfunction	1st	2nd	3rd	3rd	3rd	3rd
P0766	Shift solenoid valve S4, Shift solenoid valve SL2 or Valve body (brake control valve): Malfunction	1st	2nd	3rd	3rd	3rd	3rd
P0781	Valve body (1-2 shift valve): Malfunction	1st*2	1st*2	3rd	3rd	3rd	3rd
P0729	Valve body (sequence valve): Malfunction	1st	2nd	3rd	3rd	3rd	3rd

HINT:

- *1: Actual gear shift (gear position) under fail-safe operation.
- *2: Under engine braking, downshifting to 1st or 2nd gear is prohibited.

DATA LIST / ACTIVE TEST

1. **READ DATA LIST**

HINT:

Using the intelligent tester or 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 the intelligent tester or Techstream to the DLC3.
d. Turn the ignition switch ON and push the tester switch ON.
e. Enter the following menus:
    1. Intelligent tester - Select: DIAGNOSIS / OBD/ MOBD / ENGINE AND ECT / DATA LIST.
    2. Techstream - Select: Powertrain / Engine and ECT / Data List.
f. Follow the instructions on the tester and read the Data List.
    1. Intelligent tester

ECT:

INTELLIGENT TESTER ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
SPD (SP2)	Output shaft speed/ Min.: 0 km/h (0 mph) Max.: 255km/h (158mph)	Vehicle stopped: 0 km/h (0 mph) (output shaft speed is equal to vehicle speed)	-
SPD (NT)	Input shaft speed/ Min.: 0 rpm Max.: 12750 rpm	Lock-up is: • ON (after warming up engine): Input turbine speed (NT) is equal to engine speed • OFF (idling with shift lever on N): Input turbine speed (NT) is nearly equal to engine speed	Data is displayed in increments of 50 rpm
PNP SW [NSW]	PNP switch status/ ON or OFF	Shift lever is: • On P and N: ON • Not on P and N: OFF	When shift lever position displayed on intelligent tester differs from actual position, adjustment of PNP switch or shift cable may be incorrect HINT: When failure still occurs even after adjusting these parts, refer to **DTC P0705**
STOP LIGHT SW	Stop light switch status/ ON or OFF	Brake pedal is: • Depressed: ON • Released: OFF	-
SHIFT	ECM gear shift command/ 1st, 2nd, 3rd, 4th, 5th or 6th	Shift lever position is: • On D: 1st, 2nd, 3rd, 4th, 5th or 6th • On S: 1st, 2nd, 3rd, 4th, 5th or 6th	-
			When shift lever position displayed

REVERSE	PNP switch status/ ON or OFF	Shift lever is: • On R: ON • Not on R: OFF	on intelligent tester differs from actual position, adjustment of PNP switch or shift cable may be incorrect HINT: When failure still occurs even after adjusting these parts, refer to **DTC P0705**
PARKING	PNP switch status/ ON or OFF	Shift lever is: • On P: ON • Not on P: OFF	When shift lever position displayed on intelligent tester differs from actual position, adjustment of PNP switch or shift cable may be incorrect HINT: When failure still occurs even after adjusting these parts, refer to **DTC P0705**
NEUTRAL	PNP switch status/ ON or OFF	Shift lever is: • On N: ON • Not on N: OFF	When shift lever position displayed on intelligent tester differs from actual position, adjustment of PNP switch or shift cable may be incorrect HINT: When failure still occurs even after adjusting these parts, refer to **DTC P0705**
DRIVE	PNP switch status/	Shift lever is:	When shift lever position displayed on intelligent tester differs from actual position, adjustment of PNP switch or shift cable may be

	ON or OFF	• On D: ON • Not on D: OFF	incorrect HINT: When failure still occurs even after adjusting these parts, refer to **DTC P0705**
SPORTS UP SW	Sport shift up switch status/ ON or OFF	• ON: Continuously shift to "+" (up-shift) • OFF: Release "+" (up-shift)	-
SPORTS DOWN SW	Sport shift down switch status/ ON or OFF	• ON: Continuously shift to "-" (down-shift) • OFF: Release "-" (down-shift)	-
MODE SELECT SW	Sport mode select switch status/ ON or OFF	Shift lever position is: • ON: S, "+" and "-" • OFF: Not on S, "+" and "-"	-
A/TOIL TEMPI	No. 1 ATF temperature sensor value/ Min.: -40°C (-40°F) Max.:215°C (419°F)	• After stall test: Approximately 80°C (176°F) • Equal to ambient temperature while engine is cold	If value is -40°C (-40°F) or 215°C (419°F), No. 1 ATF temperature sensor circuit is open or shorted
A/TOILTEMP2	No. 2 ATF temperature sensor value/ Min.: -40°C (-40°F) Max.:215°C (419°F)	• After stall test: Approximately 80°C (176°F) • Equal to ambient temperature while engine is cold	If value is -40°C (-40°F) or 215°C (419°F), No. 2 ATF temperature sensor circuit is open or shorted
LOCK UP	Lock-up/ ON or OFF	Lock-up is: • Operating: ON • Not operating: OFF	-
LOCK UP SOL	Lock-up solenoid status/ ON or OFF	Lock-up solenoid is: • Operating: ON • Not operating: OFF	-
	Shift solenoid SLU	Shift solenoid SLU is:	

SOLENOID (SLU)	status/ ON or OFF	• Operating: ON • Not operating: OFF	-
SOLENOID (SLT)	Shift solenoid SLT status/ ON or OFF	• Accelerator pedal is depressed: OFF • Accelerator pedal is released: ON	-

2. Techstream

ECT:

TECHSTREAM ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
SPD (SP2)	Output shaft speed/ Min.: 0 km/h (0 mph) Max.: 255 km/h (158 mph)	Vehicle stopped: 0 km/h (0 mph) (output shaft speed is equal to vehicle speed)	-
SPD (NT)	Input shaft speed/ Min.: 0 rpm Max.: 12750 rpm	Lock-up is: • ON (after warming up engine): Input turbine speed (NT) is equal to engine speed • OFF (idling with shift lever on N): Input turbine speed (NT) is nearly equal to engine speed	Data is displayed in increments of 50 rpm
Neutral Position SW Signal	PNP switch status/ ON or OFF	Shift lever is: • On P and N: ON • Not on P and N: OFF	When shift lever position displayed on Techstream differs from actual position, adjustment of PNP switch or shift cable may be incorrect HINT: When failure still occurs even after adjusting these parts, refer to **DTC P0705**

Stop Light Switch	Stop light switch status/ ON or OFF	Brake pedal is: • Depressed: ON • Released: OFF	-
Shift Status	ECM gear shift command/ 1st, 2nd, 3rd, 4th, 5th or 6th	Shift lever position is: • On D: 1st, 2nd, 3rd, 4th, 5th or 6th • On S: 1st, 2nd, 3rd, 4th, 5th or 6th	-
Shift SW Status (R Range)	PNP switch status/ ON or OFF	Shift lever is: • On R: ON • Not on R: OFF	When shift lever position displayed on Techstream differs from actual position, adjustment of PNP switch or shift cable may be incorrect HINT: When failure still occurs even after adjusting these parts, refer to **DTC P0705**
Shift SW Status (P Range)	PNP switch status/ ON or OFF	Shift lever is: • On P: ON • Not on P: OFF	When shift lever position displayed on Techstream differs from actual position, adjustment of PNP switch or shift cable may be incorrect HINT: When failure still occurs even after adjusting these parts, refer to **DTC P0705**
Shift SW Status (N Range)	PNP switch status/ ON or OFF	Shift lever is: • On N: ON • Not on N: OFF	When shift lever position displayed on Techstream differs from actual position, adjustment of PNP switch or shift cable may be incorrect HINT:

			When failure still occurs even after adjusting these parts, refer to **DTC P0705**
Shift SW Status (D Range)	PNP switch status/ ON or OFF	Shift lever is: • On D: ON • Not on D: OFF	When shift lever position displayed on Techstream differs from actual position, adjustment of PNP switch or shift cable may be incorrect HINT: When failure still occurs even after adjusting these parts, refer to **DTC P0705**
Sports Shift Up SW	Sport shift up switch status/ ON or OFF	• ON: Continuously shift to "+" (up-shift) • OFF: Release "+" (up-shift)	-
Sports Shift Down SW	Sport shift down switch status/ ON or OFF	• ON: Continuously shift to "-" (down-shift) • OFF: Release "-" (down-shift)	-
Sports Mode Selection SW	Sport mode select switch status/ ON or OFF	• Shift lever position is: ON: S, "+" and "-" • OFF: Not on S, "+" and "-"	-
A/T Oil Temperature 1	No. 1 ATF temperature sensor value/ Min.: -40°C (-40°F) Max.:215°C (419°F)	• After stall test: Approximately 80°C (176°F) • Equal to ambient temperature while engine is cold	If value is -40°C (-40°F) or 215°C (419°F), No. 1 ATF temperature sensor circuit is open or shorted
A/T Oil Temperature 2	No. 2 ATF temperature sensor value/ Min.: -40°C (-40°F) Max.: 215°C (419°F)	• After stall test: Approximately 80°C (176°F) • Equal to ambient temperature, while engine is cold	If value is -40°C (-40°F) or 215°C (419°F), No. 2 ATF temperature sensor circuit is open or shorted

Lock Up	Lock-up/ ON or OFF	Lock-up is: • Operating: ON • Not operating: OFF	-
Lock Up Solenoid Status	Lock-up solenoid status/ ON or OFF	Lock-up solenoid is: • Operating: ON • Not operating: OFF	-
SLU Solenoid Status	Shift solenoid SLU status/ ON or OFF	Shift solenoid SLU is: • Operating: ON • Not operating: OFF	-
SLT Solenoid Status	Shift solenoid SLT status/ ON or OFF	• Accelerator pedal is depressed: OFF • Accelerator pedal is released: ON	-

2. **PERFORM ACTIVE TEST**

   HINT:

   Using the intelligent tester or Techstream to perform Active Tests 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 Tests early in troubleshooting is one way to save diagnostic time. Data List information can be displayed while performing Active Tests.

   a. Warm up the engine.
   b. Turn the ignition switch OFF.
   c. Connect the intelligent tester or Techstream to the DLC3.
   d. Turn the ignition switch ON and push the tester switch ON.
   e. Enter the following menus:
      1. Intelligent tester - Select: DIAGNOSIS / OBD/ MOBD / ENGINE AND ECT / ACTIVE TEST.
      2. Techstream - Select: Powertrain / Engine and ECT / Active Test.
   f. Follow the instructions on the tester and perform the Active Test.
      1. Intelligent tester

         ECT:

         INTELLIGENT TESTER ECT DATA ACTIVE TEST

Tester Display	Test Part	Control Range	Diagnostic Note
			[Vehicle Condition]

SOLENOID (SLU)	Operate the shift solenoid SLU	ON or OFF	• Engine stopped • Shift lever on P or N position
SOLENOID (SLT)*	Operate the shift solenoid SLT and raise line pressure	ON or OFF HINT: • OFF: Line pressure up (when Active Test "SOLENOID (SLT)" is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	[Vehicle Condition] • Vehicle stopped • Engine idling
SOLENOID (SI)	Operate the shift solenoid S1	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position
SOLENOID (S2)	Operate the shift solenoid S2	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position
SOLENOID (S3)	Operate the shift solenoid S3	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position
SOLENOID (S4)	Operate the shift solenoid S4	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position
	Control shift solenoid SLU to set		Possible to check shift solenoid valve SLU operation [Vehicle Condition]

LOCK UP	automatic transmission to lock up condition	ON or OFF	• Throttle valve opening angle: Less than 35% • Vehicle speed: 60 km/h (36 mph) or more
SHIFT	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less
SOLENOID (SR)	Operate the shift solenoid SR	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position
SOLENOID (SLI)	Operate the shift solenoid SL1	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position
SOLENOID (SL2)	Operate the shift solenoid SL2	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position
HINT: *: SOLENOID (SLT) in the Active Test is performed to check the line pressure changes by connecting SST to the automatic transmission, which is used in the HYDRAULIC TEST as well. Please note that the pressure values in the Active Test and HYDRAULIC TEST are different.			

2. Techstream

ECT:

TECHSTREAM ECT DATA ACTIVE TEST

Tester Display	Test Part	Control Range	Diagnostic Note
Activate the Solenoid (SLU)	Operate the shift solenoid SLU	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position
		ON or OFF	

Activate the Solenoid (SLT)*	Operate the shift solenoid SLT and raise line pressure	HINT: • OFF: Line pressure up (when Active Test "Activate the Solenoid (SLT)" is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	[Vehicle Condition] • Vehicle stopped • Engine idling
Activate the Solenoid (S1)	Operate the shift solenoid S1	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position
Activate the Solenoid (S2)	Operate the shift solenoid S2	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position
Activate the Solenoid (S3)	Operate the shift solenoid S3	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position
Activate the Solenoid (S4)	Operate the shift solenoid S4	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position
Activate the Lock Up	Control shift solenoid SLU to set automatic transmission to lock up condition	ON or OFF	Possible to check shift solenoid valve SLU operation [Vehicle Condition] • Throttle valve opening angle: Less than 35% • Vehicle speed: 60 km/h (36 mph) or more
	Operate shift	• Press "-->" button: Shift up	Possible to check operation of shift

Control the Shift Position	solenoid valve and set each shift position by yourself	• Press "<--" button: Shift down	solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less
Activate the Solenoid (SR)	Operate the shift solenoid SR	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position
Activate the Solenoid (SL1)	Operate the shift solenoid SL1	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position
Activate the Solenoid (SL2)	Operate the shift solenoid SL2	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position
HINT: *: Activate the Solenoid (SLT) in the Active Test is performed to check the line pressure changes by connecting SST to the automatic transmission, which is used in the **HYDRAULIC TEST** as well. Please note that the pressure values in the Active Test and HYDRAULIC TEST are different.			

DIAGNOSTIC TROUBLE CODE CHART

HINT:

- If a DTC is displayed during the DTC check, check the parts listed in the table below and proceed to the "See page" given.
- *1: "Comes on" means the Malfunction Indicator Lamp (MIL) illuminates.
- *2: "DTC stored" means the ECM memorizes the malfunction code if the ECM detects the DTC detection condition.
- These DTCs may be output when the clutch, brake, gear components, etc., inside the automatic transmission are damaged.

Automatic transmission system:

AUTOMATIC TRANSMISSION SYSTEM DTC CHART

DTC Code	Detection Item	Trouble Area	MIL*1	Memory*2
P0705	Transmission Range Sensor Circuit Malfunction (PRNDL Input)	○ Open or short in park/neutral position switch circuit ○ Park/neutral position switch ○ ECM	Comes on	DTC stored
P0710	Transmission Fluid	○ Open or short in No. 1 ATF	Comes on	DTC stored

	Temperature Sensor "A" Circuit	temperature sensor circuit o No. 1 transmission wire (No. 1 ATF temperature sensor) o ECM		
P0711	Transmission Fluid Temperature Sensor "A" Performance	No. 1 transmission wire (No. 1 ATF temperature sensor)	Comes on	DTC stored
P0712	Transmission Fluid Temperature Sensor "A" Circuit Low Input	o Short in No. 1 ATF temperature sensor circuit o No. 1 transmission wire (No. 1 ATF temperature sensor) o ECM	Comes on	DTC stored
P0713	Transmission Fluid Temperature Sensor "A" Circuit High Input	o Open in No. 1 ATF temperature sensor circuit o No. 1 transmission wire (No. 1 ATF temperature sensor) o ECM	Comes on	DTC stored
P0717	Turbine Speed Sensor Circuit No Signal	o Open or short in speed sensor NT circuit o Speed sensor NT o ECM o Automatic transmission (clutch, brake or gear, etc.)	Comes on	DTC stored
P0722	Output Speed Sensor Circuit No Signal	o Open or short in speed sensor SP2 circuit o Speed sensor SP2 o ECM o Automatic transmission (clutch, brake or gear, etc.)	Comes on	DTC stored
P0724	Brake Switch "B" Circuit High	o Short in stop light switch signal circuit o Stop light switch o ECM	Comes on	DTC stored
P0729	Gear 6 Incorrect Ratio	o Valve body is blocked up or stuck (sequence valve) o Shift solenoid valve SLT remains open or closed o Automatic transmission (clutch, brake or gear, etc.)	Comes on	DTC stored
P0748	Pressure Control Solenoid "A"	o Open or short in shift	Comes on	DTC stored

	Electrical (Shift Solenoid Valve SL1)	solenoid valve SL1 circuit ○ Shift solenoid valve SL1 ○ ECM		
P0751	Shift Solenoid "A" Performance (Shift Solenoid Valve S1)	○ Shift solenoid valve S1 remains open or closed ○ Shift solenoid valve SLT remains open or closed ○ Valve body is blocked ○ No. 2 brake malfunction (Driving is difficult.) ○ Automatic transmission (clutch, brake or gear, etc.)	Comes on	DTC stored
P0756	Shift Solenoid "B" Performance (Shift Solenoid Valve S2)	○ Shift solenoid valve S2 remains open or closed ○ Valve body is blocked ○ Automatic transmission (clutch, brake or gear, etc.)	Comes on	DTC stored
P0761	Shift Solenoid "C" Performance (Shift Solenoid Valve S3)	○ Shift solenoid valve S3 remains open or closed ○ Shift solenoid valve SLT remains open or closed ○ Valve body is blocked ○ Automatic transmission (clutch, brake or gear, etc.)	Comes on	DTC stored
P0766	Shift Solenoid "D" Performance (Shift Solenoid Valve S4)	○ Shift solenoid valve S4 remains closed ○ Shift solenoid valve SLT remains open or closed ○ Valve body is blocked (Brake control valve) ○ Automatic transmission (clutch, brake or gear, etc.)	Comes on	DTC stored
P0776	Pressure Control Solenoid "B" Performance (Shift Solenoid Valve SL2)	○ Shift solenoid valve SL2 remains open ○ Shift solenoid valve SLT remains open or closed ○ Valve body is blocked (Brake control valve) ○ Automatic transmission (clutch, brake or gear, etc.)	Comes on	DTC stored
P0778	Pressure Control Solenoid "B" Electrical (Shift Solenoid Valve	○ Open or short in shift solenoid valve SL2 circuit ○ Shift solenoid valve SL2	Comes on	DTC stored

	SL2)	ECM		
P0781	1-2 Shift (1-2 Shift Valve)	Valve body is blocked up or stuck (1-2 shift valve) Shift solenoid valve SLT remains open or closed Automatic transmission (clutch, brake or gear, etc.)	Comes on	DTC stored
P0818	Driveline Disconnect Switch Input Circuit	Short in transfer neutral position switch circuit Transfer neutral position switch ECM	Comes on	DTC stored
P0894	Transmission Component Slipping	Shift solenoid valve SLT remains open or closed Shift solenoid valve S1.S2, S3, S4or SL2 remains open or closed Gear 6 incorrect ratio (sequence valve) or 1-2 shift valve is stuck Valve body is blocked Automatic transmission (clutch, brake or gear, etc.)	Comes on	DTC stored
P0973	Shift Solenoid "A" Control Circuit Low (Shift Solenoid Valve S1)	Short in shift solenoid valve S1 circuit Shift solenoid valve S1 ECM	Comes on	DTC stored
P0974	Shift Solenoid "A" Control Circuit High (Shift Solenoid Valve S1)	Open in shift solenoid valve S1 circuit Shift solenoid valve S1 ECM	Comes on	DTC stored
P0976	Shift Solenoid "B" Control Circuit Low (Shift Solenoid Valve S2)	Short in shift solenoid valve S2 circuit Shift solenoid valve S2 ECM	Comes on	DTC stored
P0977	Shift Solenoid "B" Control Circuit High (Shift Solenoid Valve S2)	Open in shift solenoid valve S2 circuit Shift solenoid valve S2 ECM	Comes on	DTC stored
P0979	Shift Solenoid "C" Control Circuit Low (Shift Solenoid Valve S3)	Short in shift solenoid valve S3 circuit Shift solenoid valve S3	Comes on	DTC stored

		○ ECM		
P0980	Shift Solenoid "C" Control Circuit High (Shift Solenoid Valve S3)	○ Open in shift solenoid valve S3 circuit ○ Shift solenoid valve S3 ○ ECM	Comes on	DTC stored
P0982	Shift Solenoid "D" Control Circuit Low (Shift Solenoid Valve S4)	○ Short in shift solenoid valve S4 circuit ○ Shift solenoid valve S4 ○ ECM	Comes on	DTC stored
P0983	Shift Solenoid "D" Control Circuit High (Shift Solenoid Valve S4)	○ Open in shift solenoid valve S4 circuit ○ Shift solenoid valve S4 ○ ECM	Comes on	DTC stored
P0985	Shift Solenoid "E" Control Circuit Low (Shift Solenoid Valve SR)	○ Short in shift solenoid valve SR circuit ○ Shift solenoid valve SR ○ ECM	Comes on	DTC stored
P0986	Shift Solenoid "E" Control Circuit High (Shift Solenoid Valve SR)	○ Open in shift solenoid valve SR circuit ○ Shift solenoid valve SR ○ ECM	Comes on	DTC stored
P2714	Pressure Control Solenoid "D" Performance (Shift Solenoid Valve SLT)	○ Shift solenoid valve SLT remains open or closed ○ Shift solenoid valve S1.S2, S3, S4or SL2 remains open or closed ○ Gear 6 incorrect ratio (sequence valve) or 1-2 shift valve is stuck ○ Valve body is blocked ○ Automatic transmission (clutch, brake or gear, etc.)	Comes on	DTC stored
P2716	Pressure Control Solenoid "D" Electrical (Shift Solenoid Valve SLT)	○ Open or short in shift solenoid valve SLT circuit ○ Shift solenoid valve SLT ○ ECM	Comes on	DTC stored
P2740	Transmission Fluid Temperature Sensor "B" Circuit	○ Open or short in No. 2 ATF temperature sensor circuit ○ No. 1 transmission wire (No. 2 ATF temperature sensor) ○ ECM	Comes on	DTC stored

P2742	Transmission Fluid Temperature Sensor "B" Circuit Low Input	○ Short in No. 2 ATF temperature sensor circuit ○ No. 1 transmission wire (No. 2 ATF temperature sensor) ○ ECM	Comes on	DTC stored
P2743	Transmission Fluid Temperature Sensor "B" Circuit High Input	○ Open in No. 2 ATF temperature sensor circuit ○ No. 1 transmission wire (No. 2 ATF temperature sensor) ○ ECM	Comes on	DTC stored
P2757	Torque Converter Clutch Pressure Control Solenoid Performance (Shift Solenoid Valve SLU)	○ Shift solenoid valve SLU remains open or closed ○ Valve body is blocked ○ Torque converter clutch ○ Automatic transmission (clutch, brake or gear, etc.) ○ Line pressure is too low	Comes on	DTC stored
P2759	Torque Converter Clutch Pressure Control Solenoid Control Circuit Electrical (Shift Solenoid Valve SLU)	○ Open or short in shift solenoid valve SLU circuit ○ Shift solenoid valve SLU ○ ECM	Comes on	DTC stored
P2772	Four Wheel Drive (4WD) Low Switch Circuit Range / Performance	○ Short in transfer L4 position switch circuit ○ 4WD control ECU ○ ECM	Comes on	DTC stored

DTC P0705 TRANSMISSION RANGE SENSOR CIRCUIT MALFUNCTION (PRNDL INPUT)

DESCRIPTION

The Park/Neutral Position (PNP) switch detects the shift lever position and sends signals to the ECM.

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
	When one of following conditions is met: A. Any 2 or more of the following signals are ON simultaneously (2 trip detection logic) • P input signal	

P0705	• N input signal • R input signal • D input signal B. Any 2 or more of the following signals are ON simultaneously (2 trip detection logic) • NSW input signal • R input signal • D input signal C. Any of following signals are ON for 2.0 sec. or more in S position (2 trip detection logic) • NSW input signal • P input signal • N input signal • R input signal D. All signals are OFF simultaneously for P, R, N and D positions (2 trip detection logic)	• Open or short in part/neutral position switch circuit • Park/neutral position switch • ECM

MONITOR DESCRIPTION

This DTC indicates 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 the engine can be started only when the shift lever is on P or N.

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

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 illuminate the MIL and store the DTC.

MONITOR STRATEGY

MONITOR STRATEGY REFERENCE

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) and (C) 2 sec. Condition (D) 60 sec.
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

All

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None
Ignition switch	ON
Battery voltage	10.5 V or more

TYPICAL MALFUNCTION THRESHOLDS

One of the following conditions is met: Condition (A), (B), (C) or (D)

Condition (A)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Number of the following signal inputs at the same time	2 or more
P switch	ON
N switch	ON
R switch	ON
D switch	ON

Condition (B)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Number of the following signal inputs at the same time	2 or more
NSW switch	ON
R switch	ON
D switch	ON

Condition (C)

When the shift lever is in the S position, one of the following conditions is met:

TYPICAL MALFUNCTION THRESHOLDS CONDITION

NSW switch	ON
P switch	ON
N switch	ON
R switch	ON

Condition (D)

All of the following conditions are met:

TYPICAL MALFUNCTION THRESHOLDS CONDITION

P switch	OFF
NSW switch	OFF

N switch	OFF
R switch	OFF
D switch	OFF

COMPONENT OPERATING RANGE

COMPONENT OPERATING RANGE

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

WIRING DIAGRAM

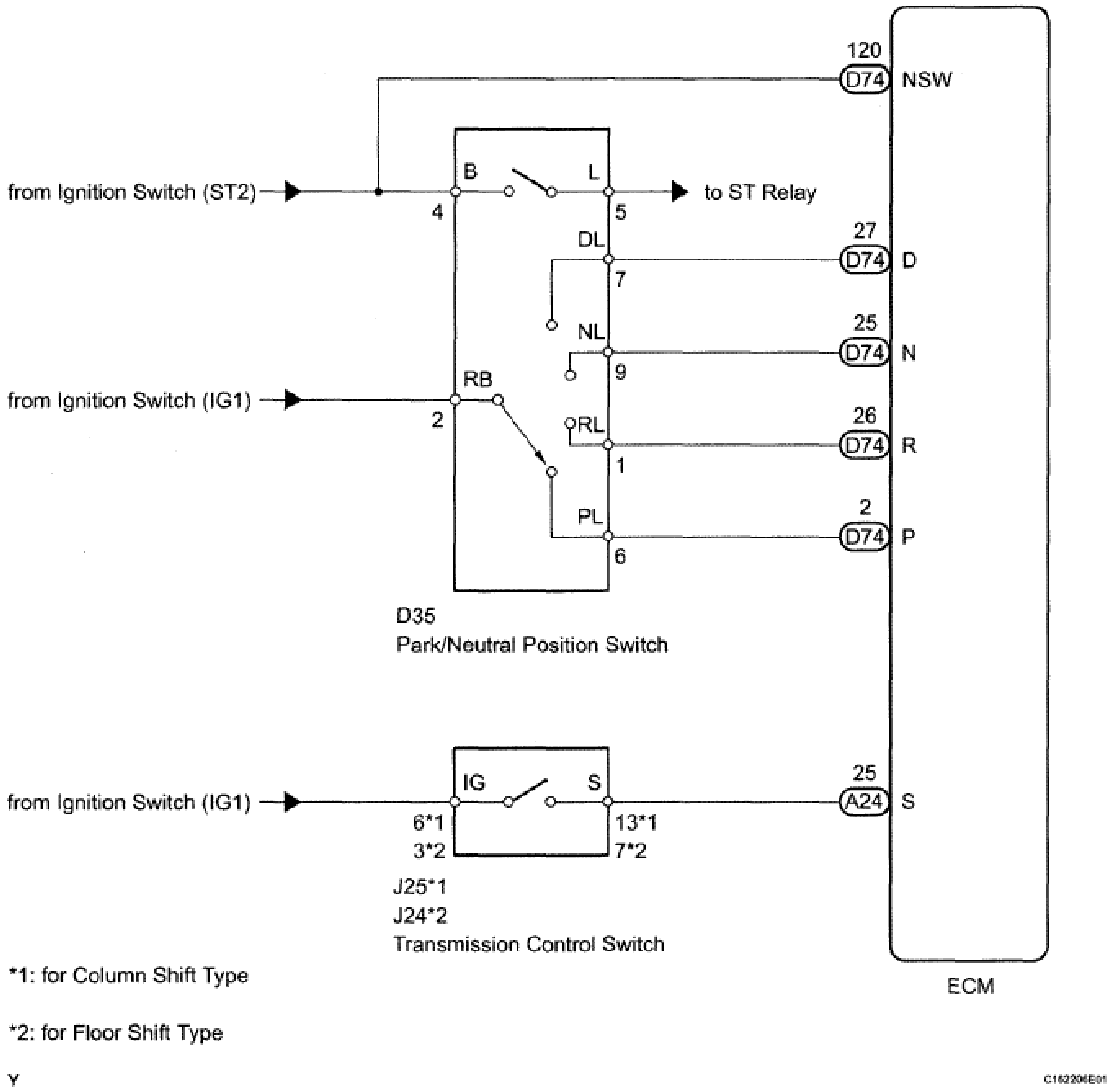

Fig. 21: Transmission Range Sensor - Wiring Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

1. **DATA LIST**

HINT:

Using the intelligent tester or 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 the intelligent tester or Techstream to the DLC3.
d. Turn the ignition switch ON and push the tester switch ON.
e. Enter the following menus:
    1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / DATA LIST.
    2. Techstream - Select: Powertrain / Engine and ECT / Data List.
f. Follow the instructions on the tester and read the Data List.
    1. Intelligent tester

ECT:

INTELLIGENT TESTER ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
PNP SW [NSW]	PNP switch status/ ON or OFF	Shift lever is: • On P and N: ON • Not on P and N: OFF	When shift lever position displayed on intelligent tester differs from actual position, adjustment of PNP switch or shift cable may be incorrect
REVERSE	PNP switch status/ ON or OFF	Shift lever is: • On R: ON • Not on R: OFF	When shift lever position displayed on intelligent tester differs from actual position, adjustment of PNP switch or shift cable may be incorrect
PARKING	PNP switch status/ ON or OFF	Shift lever is: • On P: ON • Not on P: OFF	When shift lever position displayed on intelligent tester differs from actual position, adjustment of PNP switch or shift cable may be incorrect
NEUTRAL	PNP switch status/ ON or OFF	Shift lever is: • On N: ON • Not on N: OFF	When shift lever position displayed on intelligent tester differs from actual position, adjustment of PNP switch or shift cable may be incorrect
		Shift lever is:	When shift lever position

DRIVE	PNP switch status/ ON or OFF	• On D: ON • Not on D: OFF	displayed on intelligent tester differs from actual position, adjustment of PNP switch or shift cable may be incorrect
SPORTS UP SW	Sport shift up switch status/ ON or OFF	• ON: Continuously shift to "+" (up-shift) • OFF: Release "+" (up-shift)	-
SPORTS DOWN SW	Sport shift down switch status/ ON or OFF	• ON: Continuously shift to "-" (down-shift) • OFF: Release "-" (down-shift)	-
MODE SELECT SW	Sport mode select switch status/ ON or OFF	Shift lever position is: • ON: S, "+" and "-" • OFF: Not on S, "+" and "-"	-

2. Techstream

ECT:

TECHSTREAM ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Neutral Position SW Signal	PNP switch status/ ON or OFF	Shift lever is: • On P and N: ON • Not on P and N: OFF	When shift lever position displayed on Techstream differs from actual position, adjustment of PNP switch or shift cable may be incorrect
Shift SW Status (R Range)	PNP switch status/ ON or OFF	Shift lever is: • On R: ON • Not on R: OFF	When shift lever position displayed on Techstream differs from actual position, adjustment of PNP switch or shift cable may be incorrect
Shift SW Status (P Range)	PNP switch status/ ON or OFF	Shift lever is: • On P: ON • Not on P: OFF	When shift lever position displayed on Techstream differs from actual position, adjustment of PNP switch or shift cable may be incorrect
Shift SW Status (N	PNP switch status/	Shift lever is:	When shift lever position displayed on Techstream differs from actual position,

Range)	ON or OFF	• On N: ON • Not on N: OFF	adjustment of PNP switch or shift cable may be incorrect
Shift SW Status (D Range)	PNP switch status/ ON or OFF	Shift lever is: • On D: ON • Not on D: OFF	When shift lever position displayed on Techstream differs from actual position, adjustment of PNP switch or shift cable may be incorrect
Sports Shift Up SW	Sport shift up switch status/ ON or OFF	• ON: Continuously shift to "+" (up-shift) • OFF: Release "+" (up-shift)	-
Sports Shift Down SW	Sport shift down switch status/ ON or OFF	• ON: Continuously shift to "-" (down-shift) • OFF: Release "-" (down-shift)	-
Sports Mode Selection SW	Sport mode select switch status/ ON or OFF	Shift lever position is: • ON: S, "+" and "-" • OFF: Not on S, "+" and "-"	-

1. **INSPECT PARK/NEUTRAL POSITION SWITCH ASSEMBLY**
    a. Disconnect the D35 park/neutral position switch connector.
    b. Measure the resistance according to the value (s) in the table below.

    Standard resistance

    PARK/NEUTRAL POSITION SWITCH ASSEMBLY RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
• 2 (RB) - 6 (PL) • 4 (B) - 5 (L)	Shift lever position on P	Below 1 ohms
2 (RB) - 1 (RL)	Shift lever position on R	Below 1 ohms
• 2 (RB) - 9 (NL) • 4 (B) - 5 (L)	Shift lever position on N	Below 1 ohms
2 (RB) - 7 (DL)	• Shift lever position on D • Shift lever position on S, "+" and "-"	Below 1 ohms
• 2 (RB) - 6 (PL) • 4 (B) - 5 (L)	Shift lever position not on P	10 kohms or higher

2 (RB) - 1 (RL)	Shift lever position not on R	10 kohms or higher
• 2 (RB) - 9 (NL) • 4 (B) - 5 (L)	Shift lever position not on N	10 kohms or higher
2 (RB) - 7 (DL)	• Shift lever position not on D • Shift lever position not on S, "+" and "-"	10 kohms or higher

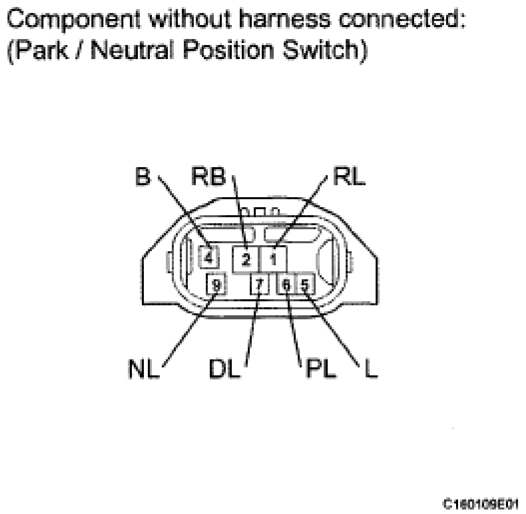

Fig. 22: Identifying D35 Park/Neutral Position Switch Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPLACE PARK/NEUTRAL POSITION SWITCH ASSEMBLY (see REMOVAL)

OK: Go to next step

2. **INSPECT TRANSMISSION CONTROL SWITCH**
   a. for Column Shift Type:
      1. Disconnect the J25 transmission control switch connector.
      2. Measure the resistance according to the value (s) in the table below.

         Standard resistance

         TRANSMISSION CONTROL SWITCH RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
6 (IG) - 13 (S)	Shift lever position on S, "+" and "-"	Below 1 ohms
6 (IG) - 13 (S)	Shift lever position not on S, "+" and "-"	10 kohms or higher

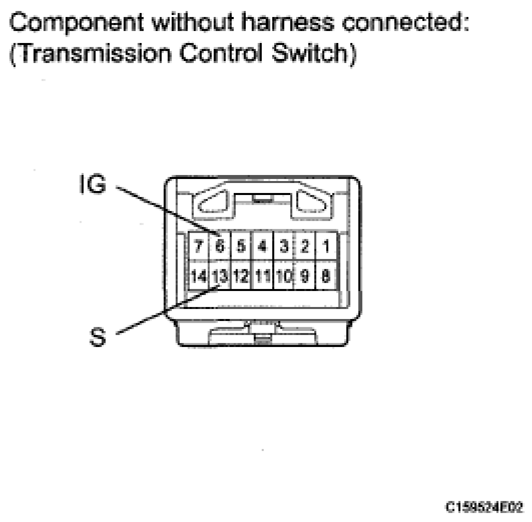

Fig. 23: Identifying J25 Transmission Control Switch Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. for Floor Shift Type:
   1. Disconnect the J24 transmission control switch connector.
   2. Measure the resistance according to the value (s) in the table below.

Standard resistance

TRANSMISSION CONTROL SWITCH RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
3 (IG) - 7 (S)	Shift lever position on S, M+" and "-"	Below 1 ohms
3 (IG) - 7 (S)	Shift lever position not on S, "+" and "-"	10 kohms or higher

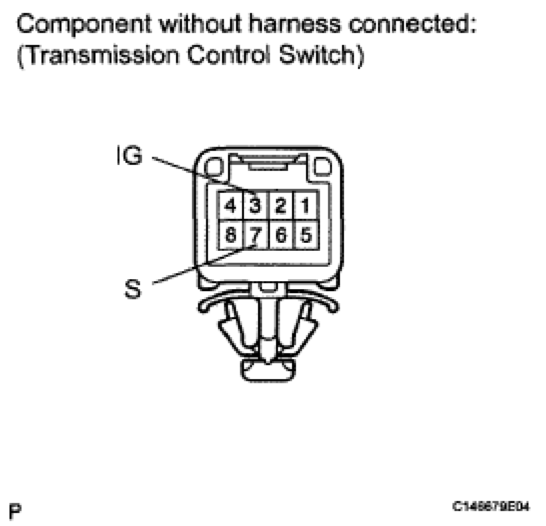

Fig. 24: Identifying J24 Transmission Control Switch Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Result

RESULT CHART

Result	Proceed to
OK	A
NG (for Column Shift Type)	B
NG (for Floor Shift Type)	C

B: REPLACE COLUMN SHIFT, SHIFT LEVER SUB-ASSEMBLY (TRANSMISSION CONTROL SWITCH) (see REMOVAL)

C: REPLACE TRANSMISSION FLOOR SHIFT ASSEMBLY (TRANSMISSION CONTROL SWITCH) (see SHIFT LEVER ASSEMBLY (FOR FLOOR SHIFT TYPE))

A: Go to next step

3. **CHECK PARK/NEUTRAL POSITION SWITCH ASSEMBLY (POWER SOURCE)**

V

a. Disconnect the D35 park/neutral position switch connector.
b. Measure the voltage according to the value (s) in the table below.

Standard voltage

PARK/NEUTRAL POSITION SWITCH ASSEMBLY (POWER SOURCE) VOLTAGE SPECIFIED CONDITION

Tester Connection	Switch Condition	Specified Condition
D35-2 (RB) - Body ground	Ignition switch ON	11 to 14 V
035-2 (RB) - Body ground	Ignition switch OFF	Below 1 V

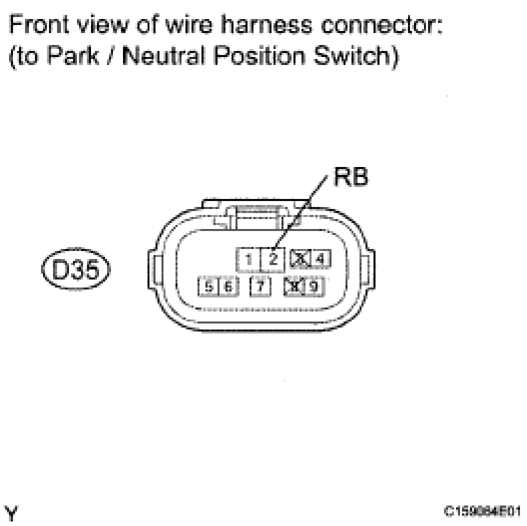

Fig. 25: Identifying Terminal RB Of D35 Park/Neutral Position Switch Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR (PARK/NEUTRAL POSITION SWITCH - IGNITION SWITCH)

OK: Go to next step

4. **CHECK TRANSMISSION CONTROL SWITCH (POWER SOURCE)**
   a. for Column Shift Type:
      1. Disconnect the J25 transmission control switch connector.
      2. Measure the voltage according to the value (s) in the table below.

      Standard voltage

      TRANSMISSION CONTROL SWITCH (POWER SOURCE) VOLTAGE SPECIFIED CONDITION

Tester Connection	Switch Condition	Specified Condition
J25-6 (IG) - Body ground	Ignition switch ON	11 to 14 V
J25-6 (IG) - Body ground	Ignition switch OFF	Below 1 V

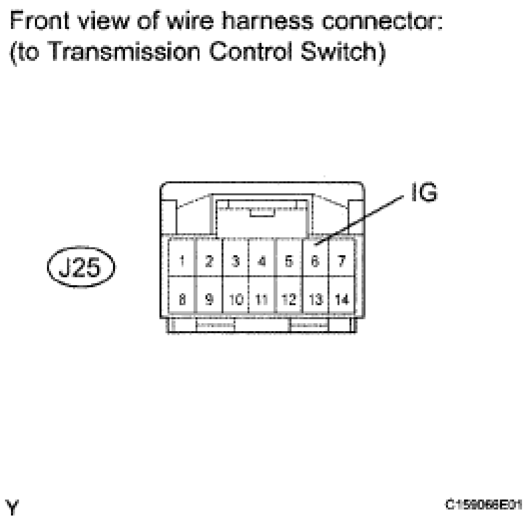

Fig. 26: Identifying Terminal IG Of J25 Transmission Control Switch Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. for Floor Shift Type:
      1. Disconnect the J24 transmission control switch connector.
      2. Measure the voltage according to the value (s) in the table below.

      Standard voltage

      VOLTAGE SPECIFIED CONDITION

Tester Connection	Switch Condition	Specified Condition
J24-3 (IG) - Body ground	Ignition switch ON	11 to 14 V
J24-3 (IG) - Body ground	Ignition switch OFF	Below 1 V

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR (TRANSMISSION CONTROL SWITCH - IGNITION SWITCH)

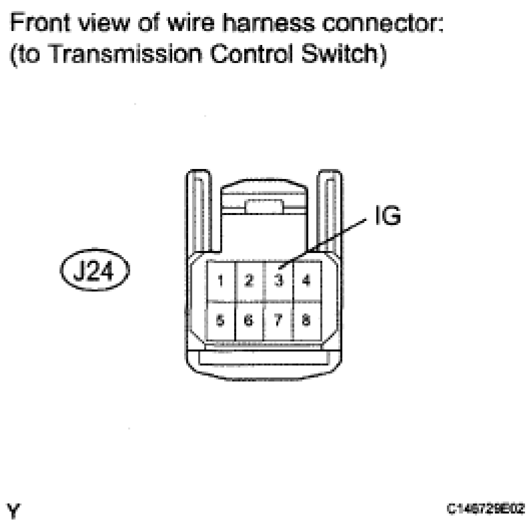

Fig. 27: Identifying Terminal IG Of J24 Transmission Control Switch Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

OK: Go to next step

5. **CHECK HARNESS AND CONNECTOR (PARK/NEUTRAL POSITION SWITCH - ECM)**
   a. Disconnect the D74 ECM connector.
   b. Measure the voltage according to the value (s) in the table below.

   Standard voltage

   VOLTAGE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
• D74-2 (P) - Body ground • D74-120 (NSW) - Body ground	• Ignition switch ON • Shift lever position on P	11 to 14 V
D74-26 (R) - Body ground	• Ignition switch ON • Shift lever position on R	11 to 14 V*
• D74-25 (N) - Body ground • D74-120 (NSW) - Body ground	• Ignition switch ON • Shift lever position on N	11 to 14 V
D74-27 (D) - Body ground	• Ignition switch ON • Shift lever position on D	11 to 14 V
• D74-2 (P) - Body ground • D74-120 (NSW) - Body ground	• Ignition switch ON • Shift lever position not on P	Below 1 V
D74-26 (R) - Body ground	• Ignition switch ON • Shift lever position not on R	Below 1 V
• D74-25 (N) - Body ground • D74-120 (NSW) - Body ground	• Ignition switch ON • Shift lever position not on N	Below 1 V
D74-27 (D) - Body ground	• Ignition switch ON • Shift lever position not on D	Below 1 V

HINT:
*: The voltage will drop slightly due to turning on the back up light.

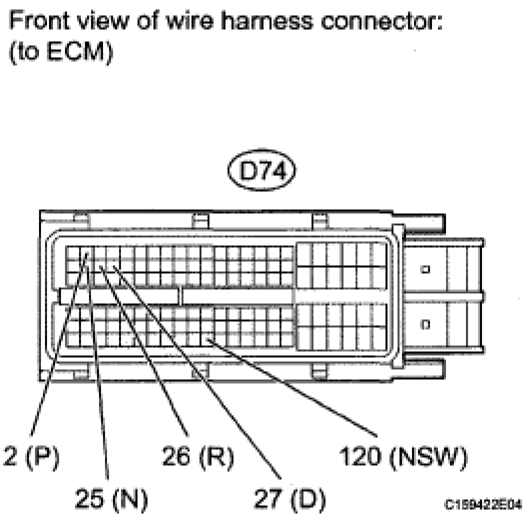

Fig. 28: Identifying D74 ECM Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: Go to next step

6. **CHECK HARNESS AND CONNECTOR (TRANSMISSION CONTROL SWITCH - ECM)**
   a. Disconnect the A24 ECM connector.
   b. Turn the ignition switch ON.
   c. Measure the voltage according to the value (s) in the table below.

   Standard voltage

   HARNESS AND CONNECTOR (TRANSMISSION CONTROL SWITCH - ECM) VOLTAGE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
A24-2S (S) - Body ground	Shift lever position on S, "+" and "-"	11 to 14 V
A24-25 (S) - Body ground	Shift lever position not on S, "+" and "-"	Below 1 V

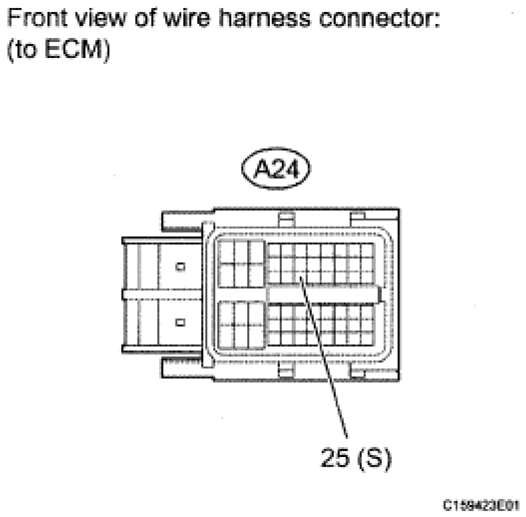

Fig. 29: Identifying A24 ECM Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE ECM (See **REMOVAL**)

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

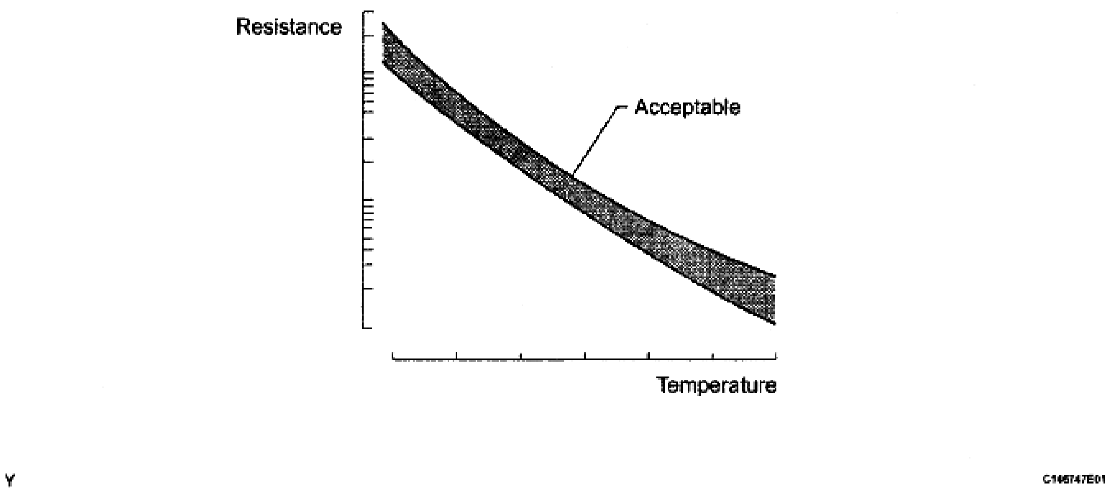

Fig. 30: Temperature And Resistance Characteristic Graph
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

The ECM applies voltage to the temperature sensor through the 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.

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0710	(a) and (b) are detected momentarily within 0.5 sec. when neither P0712 nor P0713 is detected (1-trip detection logic) a. No. 1 ATF temperature sensor resistance is less than 79 ohms. b. No. 1 ATF temperature sensor resistance is more than 156 kohms. HINT: Within 0.5 sec, the malfunction switches from (a) to (b) or from (b) to (a)	• Open or short in No. 1 ATF temperature sensor circuit • No. 1 transmission wire (No. 1 ATF temperature sensor) • ECM
P0712	No. 1 ATF temperature sensor resistance is less than 79 ohms for 0.5 sec. or more (1-trip detection logic)	• Short in No. 1 ATF temperature sensor circuit • No. 1 transmission wire (No. 1 ATF temperature sensor) • ECM
P0713	When 15 min. or more have elapsed after engine is started, No. 1 ATF temperature sensor resistance is more than 156 kohms for 0.5 sec. or more (1-trip detection logic)	• Open in No. 1 ATF temperature sensor circuit • No. 1 transmission wire (No. 1 ATF temperature sensor) • ECM

MONITOR DESCRIPTION

These DTCs indicate an open or short in the Automatic Transmission Fluid (ATF) temperature sensor circuit. The ATF temperature sensor converts the ATF temperature to an electrical resistance value. Based on the resistance, the ECM determines the ATF temperature, and the ECM detects an open or short 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.

HINT:

- The ATF temperature can be checked on the intelligent tester or Techstream display.
- *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.

MONITOR STRATEGY

MONITOR STRATEGY REFERENCE

Related DTCs	P0710: ATF temperature sensor/Range check (Chattering) 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	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

All

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None

P0710: Range check (Chattering)

TYPICAL ENABLING CONDITIONS

The typical enabling condition is not available	-

P0712: Range check (Low resistance)

TYPICAL ENABLING CONDITIONS

The typical enabling condition is not available	-

P0713: Range check (High resistance)

TYPICAL ENABLING CONDITIONS

Time after engine start	15 min. or more

TYPICAL MALFUNCTION THRESHOLDS

P0710: Range check (Chattering)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

ATF temperature sensor resistance	Less than 79 ohms or more than 156 kohms

P0712: Range check (Low resistance)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

ATF temperature sensor resistance	Less than 79 ohms

P0713: Range check (High resistance)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

ATF temperature sensor resistance	More than 156 kohms

COMPONENT OPERATING RANGE

COMPONENT OPERATING RANGE

ATF temperature sensor resistance	79 ohms to 156 kohms

WIRING DIAGRAM

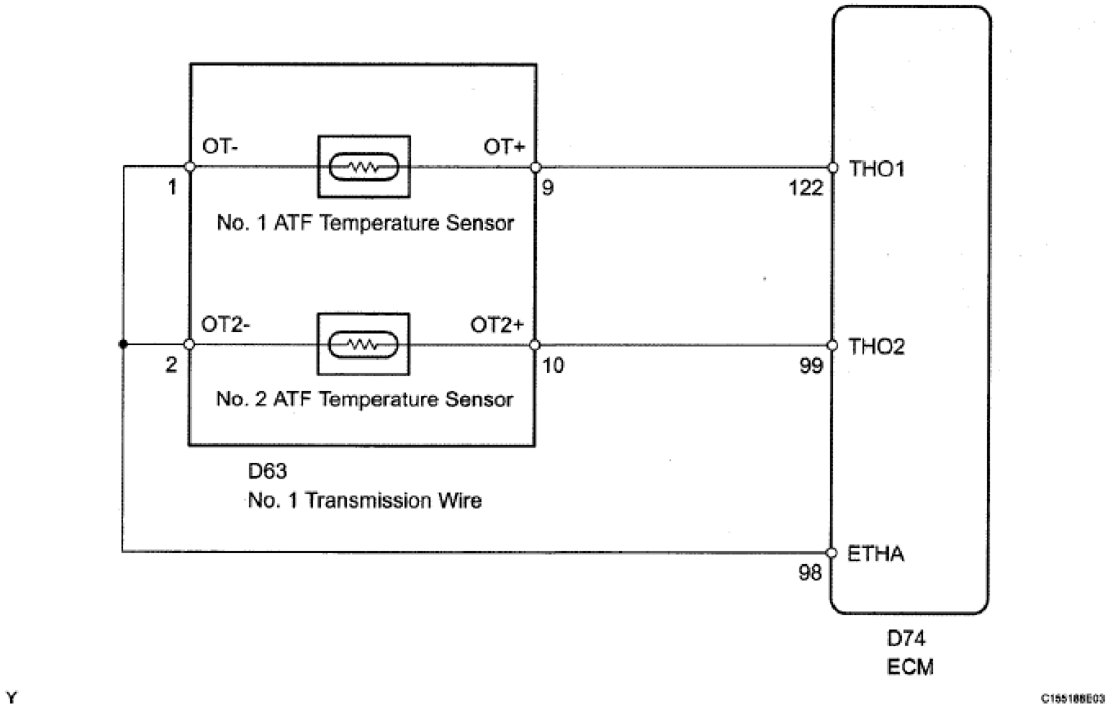

Fig. 31: Transmission Fluid Temperature Sensor - Wiring Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

1. **DATA LIST**

   HINT:

   Using the intelligent tester or 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 the intelligent tester or Techstream to the DLC3.
d. Turn the ignition switch ON and push the tester switch ON.
e. Enter the following menus:
   1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / DATA LIST.
   2. Techstream - Select: Powertrain / Engine and ECT / Data List.
f. Follow the instructions on the tester and read the Data List.
   1. Intelligent tester

      ECT:

      INTELLIGENT TESTER ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
A/TOIL TEMPI	No. 1 ATF temperature sensor value/ Min.: -40°C (-40°F) Max.:215°C (419°F)	• After stall test: Approximately 80°C (176°F) • Equal to ambient temperature while engine is cold	If value is -40°C (-40°F) or 215°C (419°F), No. 1 ATF temperature sensor circuit is open or shorted

   2. Techstream

      ECT:

      TECHSTREAM ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
A/T Oil Temperature 1	No. 1 ATF temperature sensor value/ Min.: -40°C (-40°F) Max.:215°C (419°F)	• After stall test: Approximately 80°C (176°F) • Equal to ambient temperature while engine is cold	If value is -40°C (-40°F) or 215°C (419°F), No. 1 ATF temperature sensor circuit is open or shorted

      HINT:

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

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

Measure the resistance between terminal TH01 and the body ground.

MALFUNCTION REFERENCE

Temperature Displayed	Malfunction
-40°C (-40°F)	Open circuit
150°C (302°F) or more	Short circuit

If a circuit related to the ATF temperature sensor becomes open, P0713 is immediately set (in 0.5 seconds). When P0713 is set, P0711 cannot be detected.

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

1. **INSPECT NO. 1 TRANSMISSION WIRE (NO. 1 ATF TEMPERATURE SENSOR)**
   a. Disconnect the D63 No. 1 transmission wire connector.
   b. Measure the resistance according to the value (s) in the table below.

Standard resistance

NO. 1 TRANSMISSION WIRE (NO. 1 ATF TEMPERATURE SENSOR) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 (OT-) - 9 (OT+)	Always	79 ohms to 156 kohms
1 (OT-) - Body ground	Always	10 kohms or higher
9 (OT+) - Body ground	Always	10 kohms or higher

HINT:

If the resistance is out of the specified range of one of the ATF temperatures shown in the table below, the driveability of the vehicle may decrease.

Standard resistance

NO. 1 TRANSMISSION WIRE (NO. 1 ATF TEMPERATURE SENSOR) RESISTANCE SPECIFIED CONDITION

ATF Temperature	Specified Condition
10°C (50°F)	5 to 8 kohms
25°C (77°F)	2.5 to 4.5 kohms
110°C (230°F)	0.22 to 0.28 kohms

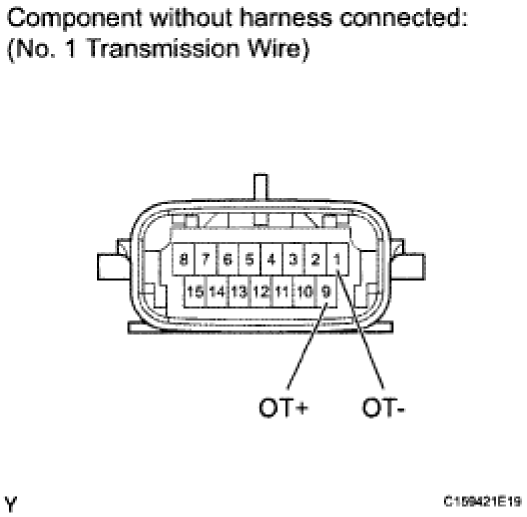

Fig. 32: Identifying D63 No. 1 Transmission Wire Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPAIR OR REPLACE NO. 1 TRANSMISSION WIRE (NO. 1 ATF TEMPERATURE SENSOR) (see **REMOVAL**)

OK: Go to next step

2. **CHECK HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE)**
   a. Disconnect the D74 ECM connector.
   b. Measure the resistance according to the value (s) in the table below.

   Standard resistance

   HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D74-122 (THO1) - D74-98 (ETHA)	Always	79 ohms to 156 kohms
D74-122 (THO1) - Body ground	Always	10 kohms or higher
D74-98 (ETHA) - Body ground	Always	10 kohms or higher

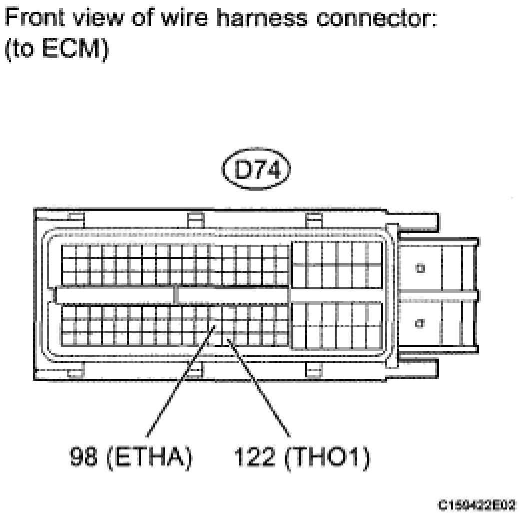

Fig. 33: Identifying D74 ECM Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE ECM (See **REMOVAL**)

DTC P0711 TRANSMISSION FLUID TEMPERATURE SENSOR "A" PERFORMANCE

DESCRIPTION

Refer to **DTC P0710** .

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0711	Both (a) and (b) are detected: (2-trip detection logic) a. Intake air and engine coolant temperature are more than -10°C (14°F) at engine start b. After normal driving for over 22 min. for 9 km (6 miles) or more, No. 1 ATF temperature is less than 20°C (68°F)	No. 1 transmission wire (No. 1 ATF temperature sensor)

MONITOR DESCRIPTION

This DTC indicates that there is a problem with the output from the Automatic Transmission Fluid (ATF) temperature sensor and that the sensor itself is defective. 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.

MONITOR STRATEGY

MONITOR STRATEGY REFERENCE

Related DTCs	P0711: ATF temperature sensor/Rationality check
Required sensors/Components	ATF temperature sensor
Frequency of operation	Continuous
Duration	3 sec.
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

All

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None

Condition (A)

TYPICAL ENABLING CONDITIONS

ATF temperature sensor "A" circuit	Not circuit malfunction
ECT (Engine coolant temperature) sensor circuit	Not circuit malfunction
IAT (Intake air temperature) sensor circuit	Not circuit malfunction
Duration time from engine start	8 min. and 20 sec. or more
Time after engine start	8 min. and 20 sec.
Driving distance after engine start	3.365 km (2.1 miles) or more
IAT (12 sec. after engine start)	-10°C (14°F) or more
ECT (12 sec. after engine start)	-10°C (14°F) or more

Condition (B)

TYPICAL ENABLING CONDITIONS

Duration time for ECT to reach 60°C (140°F)	10 sec. or more
ATF temperature (12 sec. after engine start)	105°C (221°F) or more
ECT (12 sec. after engine start)	Less than 35°C (95°F)

TYPICAL MALFUNCTION THRESHOLDS

Condition (A)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

ATF temperature	Less than 20°C (68°F) (ATF temperature = -10°C (14°F) at engine start) (Conditions vary with ATF temperature at engine start)

Condition (B)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

ATF temperature	105°C (221°F) or more

COMPONENT OPERATING RANGE

COMPONENT OPERATING RANGE

ATF temperature	20°C (68°F) or more (ATF temperature = -10°C (14°F) at engine start) (Conditions vary with ATF temperature at engine start)
ATF temperature	Less than 105°C (221°F)

WIRING DIAGRAM

Refer to **DTC P0710** .

INSPECTION PROCEDURE

1. **DATA LIST**

   HINT:

   Using the intelligent tester or 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 the intelligent tester or Techstream to the DLC3.
   d. Turn the ignition switch ON and push the tester switch ON.
   e. Enter the following menus:
      1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT /DATA LIST.
      2. Techstream - Select: Powertrain / Engine and ECT / Data List.
   f. Follow the instructions on the tester and read the Data List.
      1. Intelligent tester

         ECT:

         ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
	No. 1 ATF	• After stall test: Approximately 80°C	If value is -40°C (-40°F) or

A/T OIL TEMPI	temperature sensor value/ Min.: -40°C (-40°F) Max.:215°C (419°F)	(176°F) • Equal to ambient temperature while engine is cold	215°C (419°F), No. 1 ATF temperature sensor circuit is open or shorted

2. Techstream

ECT:

ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
A/T Oil Temperature 1	No. 1 ATF temperature sensor value/ Min.: -40°C (-40°F) Max.:215°C (419°F)	• After stall test: Approximately 80°C (176°F) • Equal to ambient temperature while engine is cold	If value is -40°C (-40°F) or 215°C (419°F), No. 1 ATF temperature sensor circuit is open or shorted

HINT:

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

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

Measure the resistance between terminal THO1 and the body ground.

MALFUNCTION REFERENCE

Temperature Displayed	Malfunction
-40°C (-40°F)	Open circuit
150°C (302°F) or more	Short circuit

If a circuit related to the ATF temperature sensor becomes open, P0713 is immediately set (in 0.5 seconds). When P0713 is set, P0711 cannot be detected.

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

1. **CHECK DTC OUTPUT (IN ADDITION TO DTC P0711)**
   a. Connect the intelligent tester or Techstream to the DLC3.
   b. Turn the ignition switch ON and push the tester switch ON.
   c. Enter the following menus:
      1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / DTC INFO / CURRENT CODES.
      2. Techstream - Select: Powertrain / Engine and ECT / Trouble Codes.
   d. Read the DTCs using the tester.

Result

DTC OUTPUT RESULT

Display (DTC output)	Proceed to
Only P0711 is output	A
P0711 and other DTCs are output	B

HINT:

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

B: Go TO DTC CHART (see **DIAGNOSTIC TROUBLE CODE CHART**)

A: Go to next step

2. **CHECK TRANSMISSION FLUID LEVEL**
    a. Check the transmission fluid level (see **AUTOMATIC TRANSMISSION FLUID**).

    OK: Automatic transmission fluid level is correct.

NG: ADD FLUID (see **AUTOMATIC TRANSMISSION FLUID**)

OK: REPAIR OR REPLACE NO. 1 TRANSMISSION WIRE (see **REMOVAL**)

DTC P0717 TURBINE SPEED SENSOR CIRCUIT NO SIGNAL

DESCRIPTION

This sensor detects the rotation speed of the turbine which shows the input revolution of the transmission. By comparing the input turbine speed signal NT with the counter gear speed sensor signal SP2, 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.

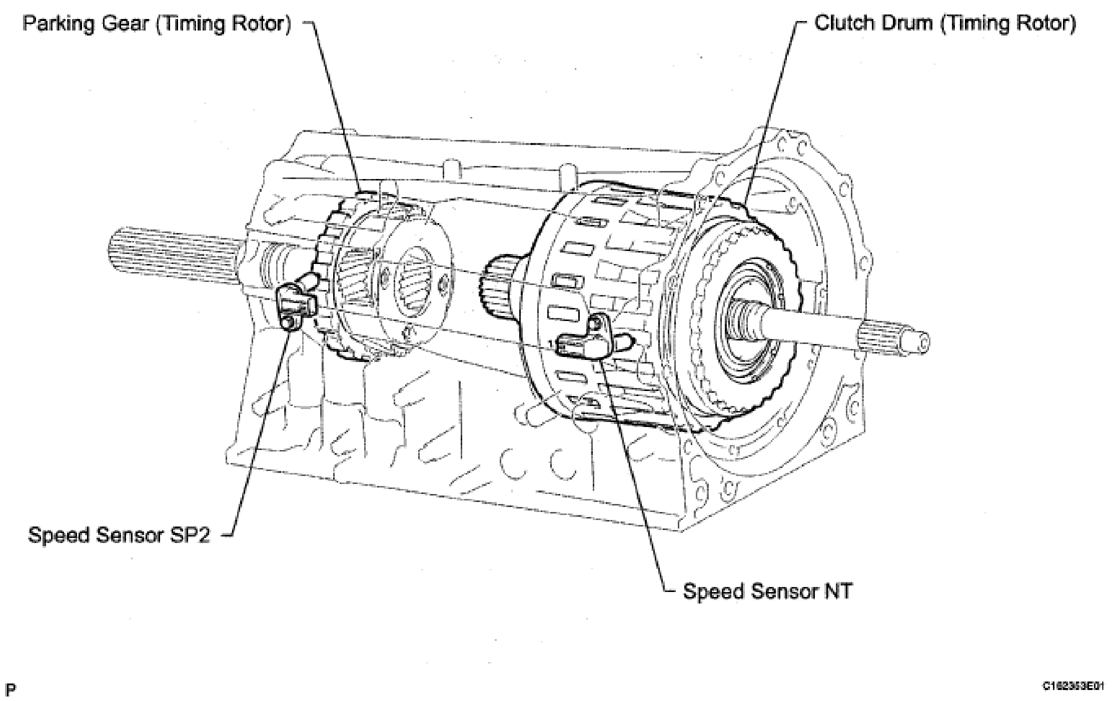

Fig. 34: Identifying Turbine Speed Sensor Locations
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0717	All conditions below are detected for 5 sec. or more (1 -trip detection logic) a. Gear change is not performed b. Gear position: 4th, 5th or 6th c. T/M input shaft rpm: 300 rpm or less d. T/M output shaft rpm: 1000 rpm or more e. Park/neutral position switch: • NSW input signal is OFF • R input signal is OFF f. Shift solenoid valves and park/neutral position switch are operating normally	• Open or short in speed sensor NT circuit • Speed sensor NT • ECM • Automatic transmission (clutch, brake or gear, etc.)

Reference: Inspect using an oscilloscope.

Check the waveform of the ECM connector.

Standard

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition	Specified Condition
D74-124 (NT+) -D74-123	1 V/DIV., 2 msec./	Engine is idling (P or N	Refer to the

(NT-)	DIV.	position)	illustration

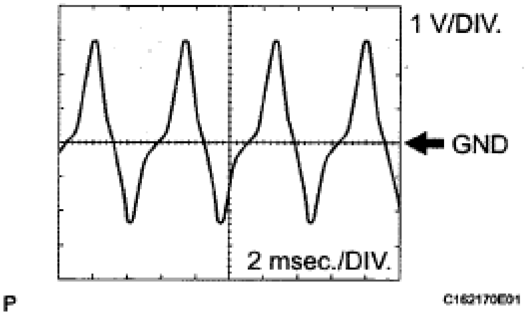

Fig. 35: Waveform Of ECM Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

MONITOR DESCRIPTION

This DTC indicates that a pulse is not output from the speed sensor NT (turbine (input) speed sensor) or is output only a little. The NT terminal of the ECM detects the revolving signal from the speed sensor NT (input RPM). The ECM outputs a gear shift signal comparing the input speed sensor NT with the output speed sensor SP2.

While the vehicle is operating in the 4th, 5th or 6th gear position 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 1000 rpm or more*2, the ECM detects the trouble, illuminates the MIL and stores the DTC.

HINT:

- *1: Pulse is not output or is irregularly output.
- *2: The vehicle speed is approximately 50 km/h (30 mph) or more.

MONITOR STRATEGY

MONITOR STRATEGY REFERENCE

Related DTCs	P0717: Speed sensor (NT)/Verify pulse input
Required sensors/Components (Main)	Speed sensor (NT)
Required sensors/Components (Related)	Speed sensor (NC)
Frequency of operation	Continuous
Duration	5 sec.
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	P0500 (VSS) P0748 (Trans solenoid (range))
Shift change	After shift change is completed and before starting next shift change operation

ECM selected gear	4th, 5th or 6th
Output shaft rpm	1000 rpm or more
NSW switch	OFF
R switch	OFF
Engine	Running
Transmission position switch failure	Not detected
Battery voltage	8 V or more
Ignition switch	ON
Starter	OFF

TYPICAL MALFUNCTION THRESHOLDS

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Speed sensor signal rpm	Less than 300 rpm

COMPONENT OPERATING RANGE

COMPONENT OPERATING RANGE

Speed sensor signal rpm	300 rpm or more

WIRING DIAGRAM

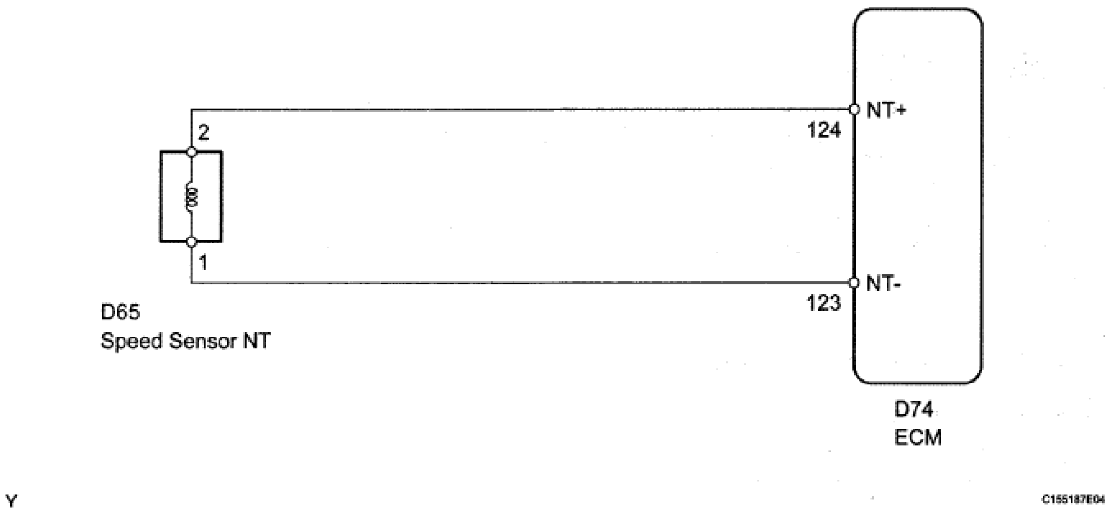

Fig. 36: Speed Sensor - Wiring Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

1. **DATA LIST**

   HINT:

   Using the intelligent tester or 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 the intelligent tester or Techstream to the DLC3.
d. Turn the ignition switch ON and push the tester switch ON.
e. Enter the following menus:
    1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / DATA LIST.
    2. Techstream - Select: Powertrain / Engine and ECT / Data List.
f. Follow the instructions on the tester and read the Data List.
    1. Intelligent tester

       ECT:

       INTELLIGENT TESTER ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
SPD (NT)	Input shaft speed/ Min.: 0 rpm Max.: 12750 rpm	Lock-up is: • ON (after warming up engine): Input turbine speed (NT) is equal to engine speed • OFF (idling with shift lever on N): Input turbine speed (NT) is nearly equal to engine speed	Data is displayed in increments of 50 rpm

    2. Techstream

       ECT:

       TECHSTREAM ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
SPD (NT)	Input shaft speed/ Min.: 0 rpm Max.: 12750 rpm	Lock-up is: • ON (after warming up engine): Input turbine speed (NT) is equal to engine speed • OFF (idling with shift lever on N): Input turbine speed (NT) is nearly equal to engine speed	Data is displayed in increments of 50 rpm

HINT:

- SPD (NT) is always 0 while driving:

  Open or short in the sensor or circuit.

- SPD (NT) is always more than 0 and less than 300 rpm while driving the vehicle at 50 km/ h (30 mph) or more:

  Sensor trouble, improper installation, or intermittent connection trouble of the circuit.

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

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

   NG: SECURELY INSTALL OR REPLACE SPEED SENSOR NT

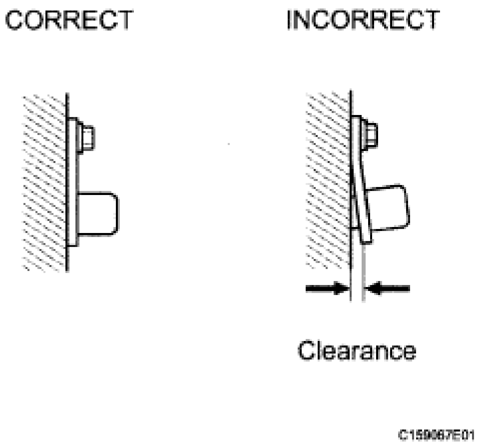

Fig. 37: Identifying Correct And Incorrect Method Of Speed Sensor NT Installation
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

OK: Go to next step

2. **INSPECT SPEED SENSOR NT**
   a. Disconnect the D65 speed sensor connector.
   b. Measure the resistance according to the value (s) in the table below.

      Standard resistance

      SPEED SENSOR NT RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°FJ	560 to 680 ohms

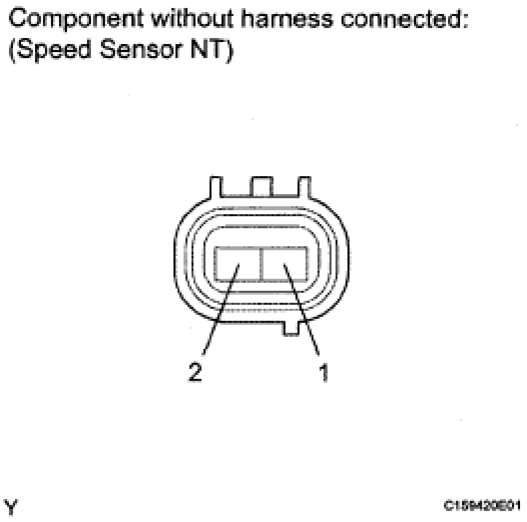

Fig. 38: Identifying Speed Sensor NT Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

OK: Go to next step

3. **CHECK HARNESS AND CONNECTOR (SPEED SENSOR NT - ECM)**
   a. Disconnect the D74 ECM connector.
   b. Measure the resistance according to the value (s) in the table below.

      Standard resistance

      HARNESS AND CONNECTOR (SPEED SENSOR NT - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D74-124 (NT+) - D74-123 (NT-)	20°C (68°F)	560 to 680 ohms
D74-124 (NT+) - Body ground	Always	10 kohms or higher
D74-123 (NT-) - Body ground	Always	10 kohms or higher

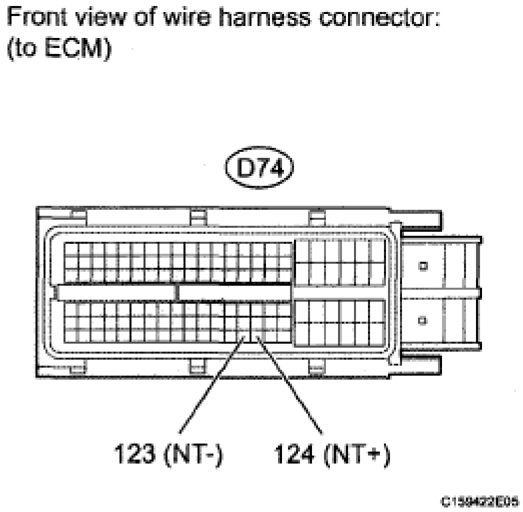

Fig. 39: Identifying D74 ECM Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE ECM (See **REMOVAL**)

DTC P0722 OUTPUT SPEED SENSOR CIRCUIT NO SIGNAL

DESCRIPTION

The speed sensor SP2 detects the rotation speed of the transmission output shaft and sends signals to the ECM. The ECM determines the vehicle speed based on these signals. An AC voltage is generated in the speed sensor SP2 coil as the parking gear mounted on the rear planetary gear assembly rotates, and this voltage is sent to the ECM. The parking gear on the rear planetary gear is used as the timing rotor for this sensor.

The gear shift point and lock up timing are controlled by the ECM based on the signals from this vehicle speed sensor and the throttle position sensor signal.

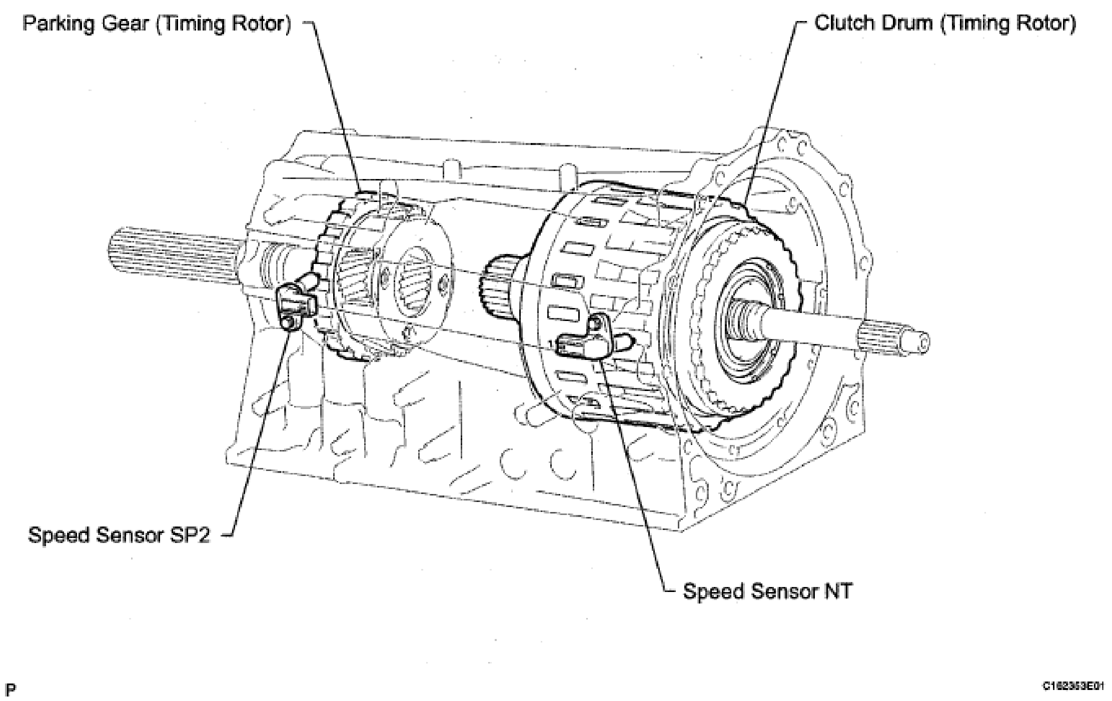

Fig. 40: Identifying Turbine Speed Sensor Locations
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0722	All conditions below are detected 500 times or more continuously (2-trip detection logic) a. No signal from speed sensor SP2 is input to ECM while 4 pulses of No. 1 vehicle speed sensor signal are sent b. Vehicle speed is 9 km/h (6 mph) or more for at least 5 sec. c. Park/neutral position switch is OFF d. Transfer position is in any position except neutral	• Open or short in speed sensor SP2 circuit • Speed sensor SP2 • ECM • Automatic transmission (clutch, brake or gear, etc.)

Reference: Inspect using an oscilloscope.

Check the waveform of the ECM connector.

Standard

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition	Specified Condition
D74-101 (SP2+) -D74-100 (SP2-)	2 V/DIV., 20 msec./DIV	Vehicle speed 20 km/h (12mph)	Refer to the illustration

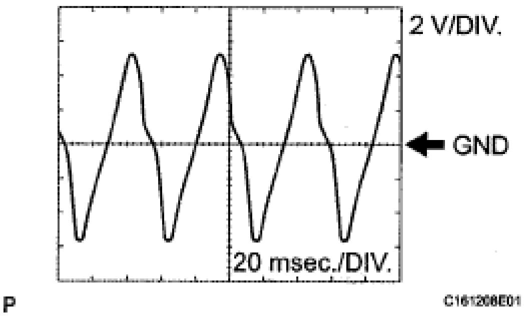

Fig. 41: Waveform Of ECM Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

MONITOR DESCRIPTION

The output speed sensor SP2 monitors the output shaft speed. The ECM controls the gear shift point and the lock up timing based on the signals from the output speed sensor SP2 and throttle position sensor. If the ECM detects no signal from the output shaft speed sensor SP2 even while the vehicle is moving, it will conclude that there is a malfunction of the output speed sensor SP2. The ECM will illuminate the MIL and set a DTC.

MONITOR STRATEGY

MONITOR STRATEGY REFERENCE

Related DTCs	P0722: Speed sensor SP2/Verify pulse input
Required	Sensors/Components Speed sensor SP2
Frequency of operation	Continuous
Duration	5 sec.
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	P0500 (VSS) P0748 (Trans solenoid (range))
Transfer neutral switch	Not "N" position
Vehicle speed at vehicle speed sensor	9 km/h (5.59 mph) or more
Battery voltage	8 V or more
Ignition switch	ON
Starter	OFF

TYPICAL MALFUNCTION THRESHOLDS

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Speed sensor signal	No signal

COMPONENT OPERATING RANGE

COMPONENT OPERATING RANGE

Vehicle speed at output speed sensor	9 km/h (5.59 mph) or more

WIRING DIAGRAM

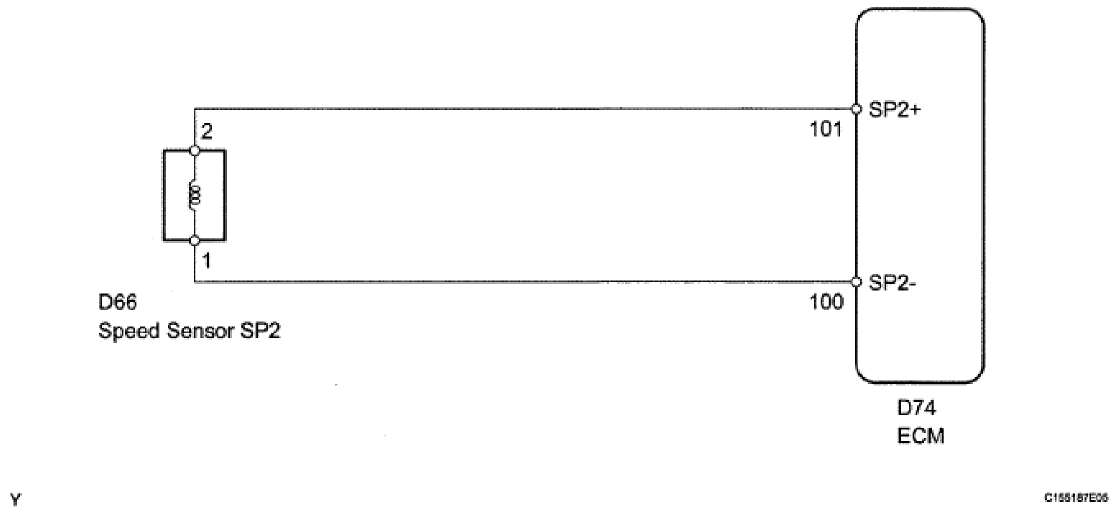

Fig. 42: Speed Sensor - Wiring Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

1. **DATA LIST**

   HINT:

   Using the intelligent tester or 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 the intelligent tester or Techstream to the DLC3.
   d. Turn the ignition switch ON and push the tester switch ON.
   e. Enter the following menus:
      1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / DATA LIST.
      2. Techstream - Select: Powertrain / Engine and ECT / Data List.
   f. Follow the instructions on the tester and read the Data List.

1. Intelligent tester

   ECT:

   INTELLIGENT TESTER ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
SPD (SP2)	Output shaft speed/ Min.: 0 km/h (0 mph) Max.:255km/h (158mph)	Vehicle stopped: 0 km/h (0 mph) (output shaft speed is equal to vehicle speed)	-

2. Techstream

   ECT:

   TECHSTREAM ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
SPD (SP2)	Output shaft speed/ Min.: 0 km/h (0 mph) Max.:255km/h (158mph)	Vehicle stopped: 0 km/h (0 mph) (output shaft speed is equal to vehicle speed)	-

HINT:

- SPD (SP2) is always 0 while driving:

  Open or short in the sensor or circuit.

- The SPD (SP2) value displayed on the tester is much lower than the actual vehicle speed: Sensor trouble, improper installation, or intermittent connection trouble of the circuit.

1. **INSPECT SPEED SENSOR SP2 INSTALLATION**
   a. Check the speed sensor SP2 installation.

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

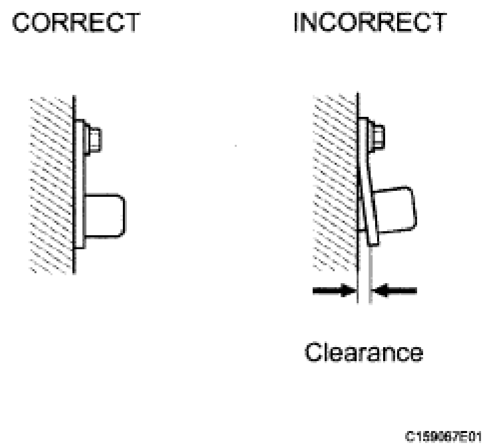

Fig. 43: Identifying Correct And Incorrect Method Of Speed Sensor NT Installation
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: SECURELY INSTALL OR REPLACE SPEED SENSOR SP2

OK: Go to next step

2. **INSPECT SPEED SENSOR SP2**

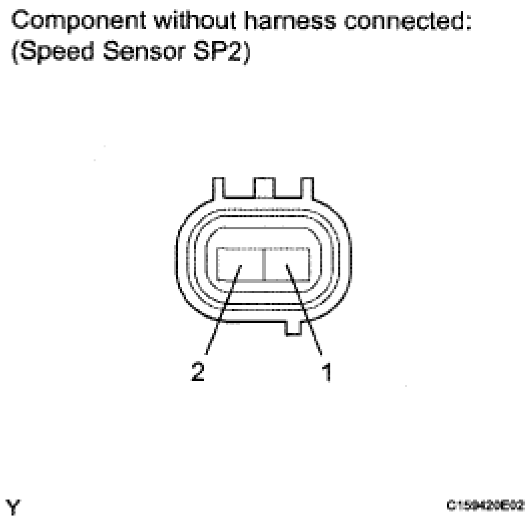

Fig. 44: Identifying Speed Sensor SP2 Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

a. Disconnect the D66 speed sensor connector.
b. Measure the resistance according to the value (s) in the table below.

Standard resistance

SPEED SENSOR SP2 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	560 to 680 ohms

NG: REPLACE SPEED SENSOR SP2 (see **REMOVAL**)

OK: Go to next step

3. **CHECK HARNESS AND CONNECTOR (SPEED SENSOR SP2 - ECM)**
   a. Disconnect the D74 ECM connector.
   b. Measure the resistance according to the value (s) in the table below.

Standard resistance

HARNESS AND CONNECTOR (SPEED SENSOR SP2 - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D74-101 (SP2+) - D74-100 (SP2-)	20°C (68°F)	560 to 680 ohms
D74-101 (SP2+) - Body ground	Always	10 kohms or higher
D74-100 (SP2-) - Body ground	Always	10 kohms or higher

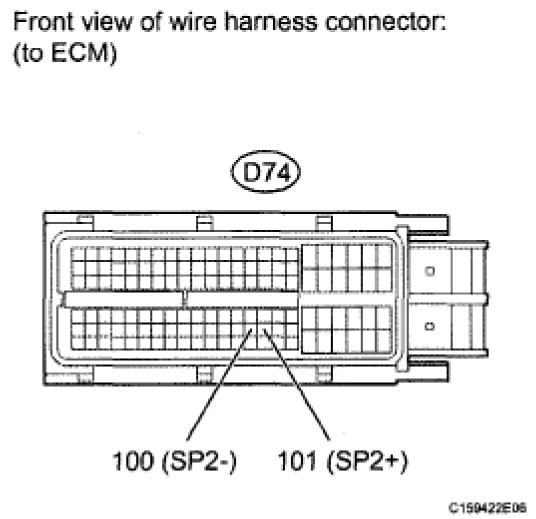

Fig. 45: Identifying D74 ECM Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE ECM (See **REMOVAL**)

DTC P0724 BRAKE SWITCH "B" CIRCUIT HIGH

DESCRIPTION

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

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

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
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) pattern 5 times. (2-trip detection logic)	• Short in stop light switch signal 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) five times for two driving cycles in order to detect a malfunction.

MONITOR STRATEGY

MONITOR STRATEGY REFERENCE

Related DTCs	P0724: Stop light switch/Range check/Rationality
Required sensors/Components	Stop light switch, Vehicle speed sensor
Frequency of operation	Continuous
Duration	GO and STOP 5 times
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The stop light switch remains ON during GO and STOP 5 times.

GO and STOP is defined as follows

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None
Battery voltage	8 V or more
Ignition switch	ON
Starter	OFF
GO: (Vehicle speed is 30 km/h (18.65 mph) or more)	Once
STOP: (Vehicle speed is less than 3 km/h (1.86 mph))	Once

TYPICAL MALFUNCTION THRESHOLDS

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Stop light switch status	ON stuck

WIRING DIAGRAM

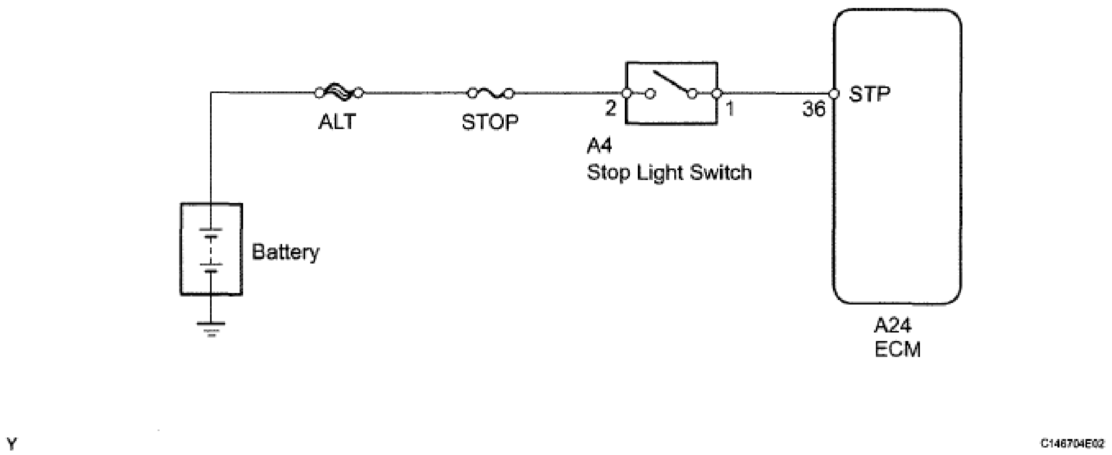

Fig. 46: Brake Switch - Wiring Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

1. **DATA LIST**

   HINT:

   Using the intelligent tester or 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 the intelligent tester or Techstream to the DLC3.
   d. Turn the ignition switch ON and push the tester switch ON.
   e. Enter the following menus:
      1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / DATA LIST.
      2. Techstream - Select: Powertrain / Engine and ECT / Data List.
   f. Follow the instructions on the tester and read the Data List.
      1. Intelligent tester

         ECT:

         INTELLIGENT TESTER ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note

STOP LIGHT SW	Stop light switch status/ ON or OFF	Brake pedal is: • Depressed: ON • Released: OFF	-

2. Techstream

ECT:

TECHSTREAM ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Stop Light Switch	Stop light switch status/ ON or OFF	Brake pedal is: • Depressed: ON • Released: OFF	-

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

   Standard resistance

   STOP LIGHT SWITCH RESISTANCE SPECIFIED CONDITION

Tester Connection	Switch Condition	Specified Condition
1 - 2	Pin not pushed	Below 1 ohms
3 - 4	Pin pushed	Below 1 ohms
1 - 2	Pin pushed	10 kohms or higher
3 - 4	Pin not pushed	10 kohms or higher

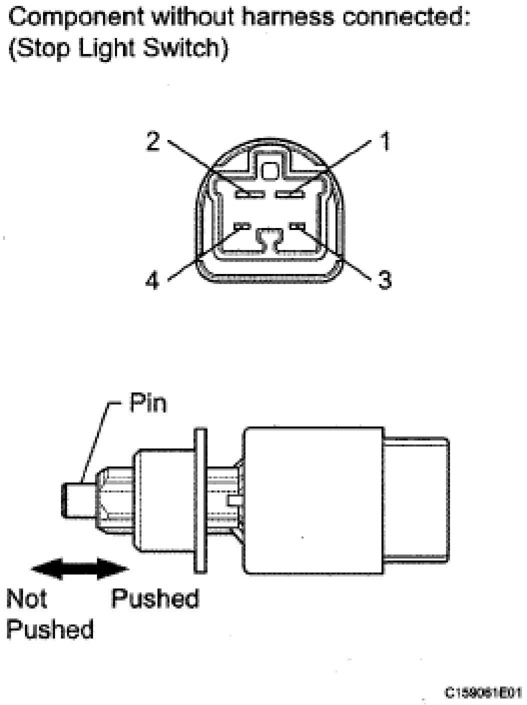

Fig. 47: Inspecting Stop Light Switch
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPLACE STOP LIGHT SWITCH (See **REMOVAL**)

OK: Go to next step

2. **CHECK HARNESS AND CONNECTOR (BATTERY - ECM)**
   a. Disconnect the A24 ECM connector.
   b. Measure the voltage according to the value (s) in the table below.

Standard voltage

HARNESS AND CONNECTOR (BATTERY - ECM) VOLTAGE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
A24-36 (STP) - Body ground	Brake pedal is depressed	11 to 14 V
A24-36 (STP) - Body ground	Brake pedal is released	Below 1 V

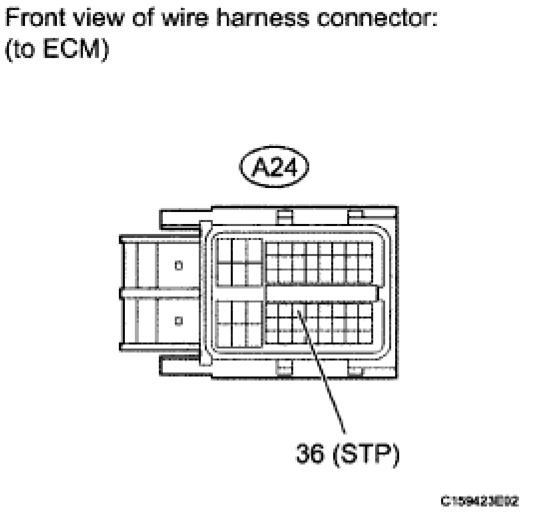

Fig. 48: Identifying A24 ECM Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE ECM (See **REMOVAL**)

DTC P0729 GEAR 6 INCORRECT RATIO

DESCRIPTION

The ECM uses signals from the output speed sensor SP2 and input speed sensor NT to detect the actual gear position (1st, 2nd, 3rd, 4th, 5th or 6th 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 transmission (clutch, brake or gear, etc.).

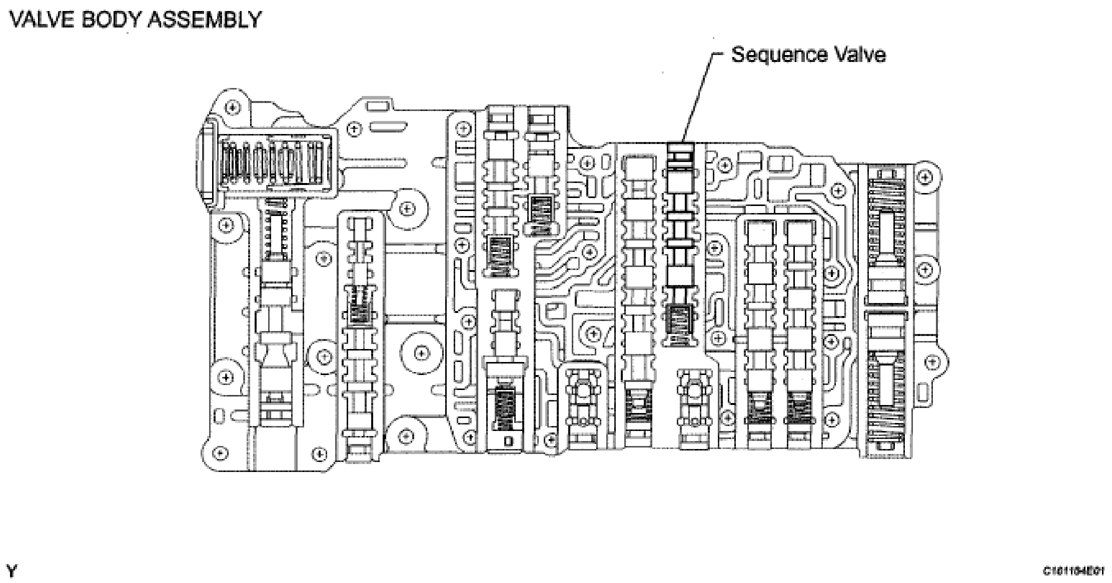

Fig. 49: Identifying Valve Body Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0729	6th gearshift malfunction: The ECM determines there is a malfunction when both of the following conditions are met. (2-trip detection logic) a. When the ECM directs the gearshift to switch to 5th gear, the actual gear is also shifted to 5th. b. When the ECM directs the gearshift to switch to 6th gear, the actual gear is shifted to 4th.	• Valve body is blocked up or stuck (sequence valve) • Shift solenoid valve SLT remains open or closed • Automatic transmission (clutch, brake or gear, etc.)

HINT:

- Gear positions in the event of a solenoid valve mechanical problem:

GEAR POSITION REFERENCE

ECM command gearshift	1st	2nd	3rd	4th	5th	6th
Actual gear position under malfunction	1st	2nd	3rd	4th	5th	4th

- Gear position during fail-safe operation:

  If any malfunction is detected, the ECM changes into the fail-safe mode to shift into the gear positions as shown in the table below.

GEAR POSITION REFERENCE

Gear position under normal conditions	1st	2nd	3rd	4th	5th	6th
Actual gear position under fail-safe mode	1st	2nd	3rd	3rd	3rd	3rd

MONITOR DESCRIPTION

The ECM commands gear shifts by turning the shift solenoid valves "ON/OFF" and switching oil pressure to the valves in the valve body.

The DTC indicates that the sequence valve is locked in the direction the spring stretches and that shifting to the 6th gear is impossible.

MONITOR STRATEGY

MONITOR STRATEGY REFERENCE

Related DTCs	P0729: Gear 6 incorrect ratio (Sequence valve) / Rationality check
Required sensors/Components	Sequence valve
Frequency of operation	Continuous
Duration	0.4 sec.
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

ALL

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	P0500 (VSS) P0748 (Trans solenoid (range))
Turbine speed sensor circuit	Not circuit malfunction
Output speed sensor circuit	Not circuit malfunction
Shift solenoid valve S1 circuit	Not circuit malfunction
Shift solenoid valve S2 circuit	Not circuit malfunction
Shift solenoid valve S3 circuit	Not circuit malfunction
Shift solenoid valve S4 circuit	Not circuit malfunction
Shift solenoid valve SR circuit	Not circuit malfunction
Shift solenoid valve SL1 circuit	Not circuit malfunction
Shift solenoid valve SL2 circuit	Not circuit malfunction
ECT (Engine coolant temperature) sensor circuit	Not circuit malfunction
KCS sensor circuit	Not circuit malfunction
ETCS (Electric Throttle Control System)	Not system down
Transmission position	"D"
Duration time from shifting "N" to "D"	4 sec. or more
ECT	40°C (104°F) or more
Spark advance from max. retard timing by KCS control	0° crankshaft angle or more
Engine	Starting

Transfer position is 4WD HIGH*

TYPICAL ENABLING CONDITIONS

Vehicle speed sensor circuit	Not circuit malfunction
Output shaft speed sensor circuit	Not circuit malfunction
Transfer output speed	143 rpm or more
NO/NOtf (Transfer input speed/Transfer output speed)	0.9 to 1.1

HINT:

*: This condition only applies to 4WD.

Condition (A)

TYPICAL ENABLING CONDITIONS

ECM selected gear	5th
Vehicle speed	2 km/h (1.2 mph) or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

Condition (B)

TYPICAL ENABLING CONDITIONS

ECM selected gear	6th

Vehicle speed	2 km/h (1.2 mph) or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

TYPICAL MALFUNCTION THRESHOLDS

Both of the following conditions are met: Condition (A) and (B)

Condition (A)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	0.66 or more, and 0.80 or less

Condition (B)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	0.93 or more, and 1.07 or less

INSPECTION PROCEDURE

1. **CHECK DTC OUTPUT (IN ADDITION TO DTC P0729)**
    a. Connect the intelligent tester or Techstream to the DLC3.
    b. Turn the ignition switch ON and push the tester switch ON.
    c. Enter the following menus:
        1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / DTC INFO / CURRENT CODES.
        2. Techstream - Select: Powertrain / Engine and ECT / Trouble Codes.
    d. Read the DTCs using the tester.

    Result

    DTC OUTPUT RESULT

Display (DTC output)	Proceed to
Only P0729 is output	A
P0729 and other DTCs are output	B

    HINT:

    If any other codes besides P0729 are output, perform troubleshooting for those DTCs first.

    B: Go TO DTC CHART (see **DIAGNOSTIC TROUBLE CODE CHART**)

    A: Go to next step

2. **PERFORM ACTIVE TEST BY INTELLIGENT TESTER OR TECHSTREAM (RUNNING TEST)**

    HINT:

Using the intelligent tester or Techstream to perform Active Tests 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 Tests early in troubleshooting is one way to save diagnostic time. Data List information can be displayed while performing Active Tests.

a. Warm up the engine.
b. Turn the ignition switch OFF.
c. Connect the intelligent tester or Techstream to the DLC3.
d. Turn the ignition switch ON and push the tester switch ON.
e. Enter the following menus:
    1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / ACTIVE TEST.
    2. Techstream - Select: Powertrain / Engine and ECT / Active Test.
f. Follow the instructions on the tester and perform the Active Test.

    HINT:

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

    Comparing the shift position commanded by the Active Test with the actual shift position enables you to confirm the problem (see **CHECK MODE PROCEDURE**).

    1. Intelligent tester

        ECT:

        INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
SHIFT	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less

    2. Techstream

        ECT:

        TECHSTREAM ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
	Operate shift solenoid	• Press "-->" button: Shift	Possible to check operation of shift

Control the Shift Position	valve and set each shift position by yourself	up • Press "<--" button: Shift down	solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less

HINT:

- This test can be conducted when the vehicle speed is 50 km/h (30 mph) or less.
- The 4th to 5th and 5th to 6th up-shift must be performed with the accelerator pedal released.
- The 6th to 5th and 5th to 4th down-shift must be performed with the accelerator pedal released.
- Do not operate the accelerator pedal for at least 2 seconds after shifting and do not shift successively.
- The shift position commanded by the ECM is shown in the Data List display on the tester.
- Gear positions in the event of a solenoid valve mechanical problem:

GEAR POSITIONS REFERENCE

Tester command gearshift	1st	2nd	3rd	4th	5th	6th
Actual gear position under malfunction	1st	2nd	3rd	4th	5th	4th

OK: Gear position changes in accordance with the tester command.

NG: REPAIR OR REPLACE TRANSMISSION VALVE BODY ASSEMBLY (see REMOVAL)

OK: Go to next step

3. **PERFORM ACTIVE TEST BY INTELLIGENT TESTER OR TECHSTREAM (SHIFT SOLENOID VALVE SLT)**

NOTE:

- **Perform the test at the normal operating ATF temperature: 50 to 80 C (122 to 176 F).**
- **Be careful to prevent SST's hose from interfering with the exhaust pipe.**
- **Perform the test with the A/C OFF.**

HINT:

Using the intelligent tester or Techstream to perform Active Tests 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 Tests early in troubleshooting is one way to save diagnostic time. Data List information can be displayed while performing Active Tests.

a. Remove the test plug on the transmission case center right side and connect SST.

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

b. Connect the intelligent tester or Techstream to the DLC3.
c. Start the engine and warm it up.
d. Measure the line pressure with SST.
e. Turn the tester ON.
f. Enter the following menus:
    1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / ACTIVE TEST.
    2. Techstream - Select: Powertrain / Engine and ECT / Active Test.
g. Follow the instructions on the tester and perform the Active Test.
h. Measure the line pressure.
    1. Intelligent tester

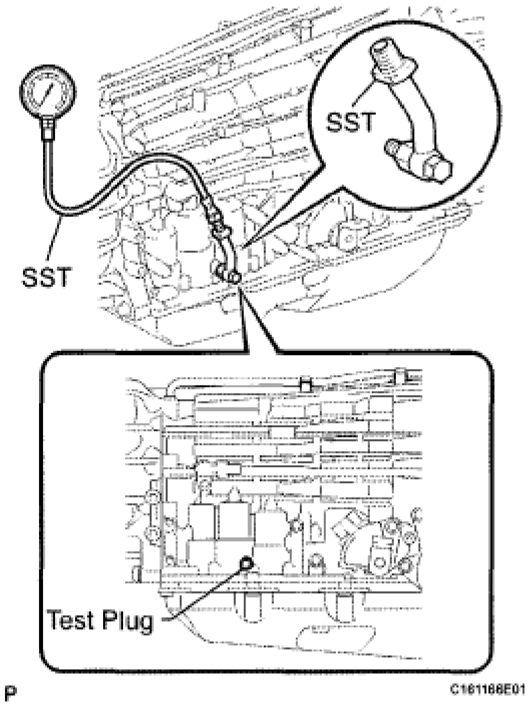

Fig. 50: Identifying Test Plug And SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ECT:

INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
SOLENOID (SLT)*	Operate the shift solenoid SLT and raise line	ON or OFF HINT: • OFF: Line pressure up (when Active Test "SOLENOID (SLT)"	[Vehicle Condition] • Vehicle

	pressure	is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	stopped • Engine idling
HINT: *: SOLENOID (SLT) in the Active Test is performed to check the line pressure changes by connecting SST to the automatic transmission, which is used in the Hydraulic Test (see **HYDRAULIC TEST**) as well. Please note that the pressure values in the Active Test and Hydraulic Test are different.			

2. Techstream

ECT:

ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
Activate the Solenoid (SLT)*	Operate the shift solenoid SLT and raise line pressure	ON or OFF HINT: • OFF: Line pressure up (when Active Test "Activate the Solenoid (SLT)" is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	[Vehicle Condition] • Vehicle stopped • Engine idling
HINT: *: Activate the Solenoid (SLT) in the Active Test is performed to check the line pressure changes by connecting SST to the automatic transmission, which is used in the Hydraulic Test (see **HYDRAULIC TEST**) as well. Please note that the pressure values in the Active Test and Hydraulic Test are different.			

OK: The line pressure changes as specified when performing the ACTIVE TEST.

NG: REPLACE SHIFT SOLENOID VALVE SLT (see **DISASSEMBLY**)

OK: Go to next step

4. **CLEAR DTC AND PERFORM RUNNING TEST**
   a. Clear the DTC (see **DTC CHECK / CLEAR**).
   b. Check the DTC again after conducting the MONITOR DRIVE PATTERN (see **INITIALIZATION**).

   OK: No DTC code

NG: REPAIR OR REPLACE TRANSMISSION VALVE BODY ASSEMBLY (see **REMOVAL**)

OK: END

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

DESCRIPTION

Shifting from 1st to 5th is performed in combination with the ON and OFF operation of the shift solenoid valves SL1, SL2, S1, S2, S3, S4and SR, which are controlled by the ECM. If an open or short circuit occurs in the shift solenoid valves, the ECM controls the remaining normal shift solenoid valves to allow the vehicle to be operated safely (see **CHECK MODE PROCEDURE**).

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0748	The ECM checks for an open or short in the shift solenoid valve SL1 circuit while driving and shifting between 4th and 5th gear (1 trip detection logic) Output signal duty equals to 100% HINT: SL1 output signal duty is less than 100% under normal condition	• Open or short in shift solenoid valve SL1 circuit • Shift solenoid valve SL1 • ECM

Reference: Inspect using an oscilloscope.

Check the waveform of the ECM connector.

Standard

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition	Specified Condition
D74-14 (SL1+) -D74-15 (SL1-)	5 V/DIV., 1 msec./ DIV.	Engine is idling	Refer to the Illustration

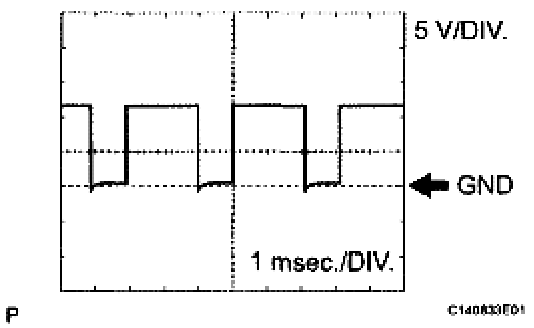

Fig. 51: Waveform Of ECM Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

MONITOR DESCRIPTION

This DTC indicates an open or short in the shift solenoid valve SL1 circuit. 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, illuminates the MIL and stores the DTC. Also, 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 the current to the open or short circuit solenoid. While driving and shifting between 4th and 5th gears, if the ECM detects an open or short in the shift solenoid valve SL1 circuit, the ECM determines that there is a malfunction (see **CHECK MODE PROCEDURE**).

MONITOR STRATEGY

MONITOR STRATEGY REFERENCE

Related DTCs	P0748: Shift solenoid valve SLI/Range check
Required sensors/Components	Shift solenoid valve SL1
Frequency of operation	Continuous
Duration	1 sec.
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

All

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None
Ignition switch	ON
Starter	OFF

All of the following conditions are met: Condition (A) and (B)

Condition (A)

TYPICAL ENABLING CONDITIONS

Solenoid current cut status	Not cut
Battery voltage	11 V or more
Target current	0.1 A or more

Condition (B)

TYPICAL ENABLING CONDITIONS

Battery voltage	8 V or more

TYPICAL MALFUNCTION THRESHOLDS

When either condition below is met: Condition (A) or (B)

Condition (A)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Solenoid status from Hybrid IC	Failure

Condition (B)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Hybrid IC status	Failure

COMPONENT OPERATING RANGE

COMPONENT OPERATING RANGE

Output signal duty	Less than 100%

WIRING DIAGRAM

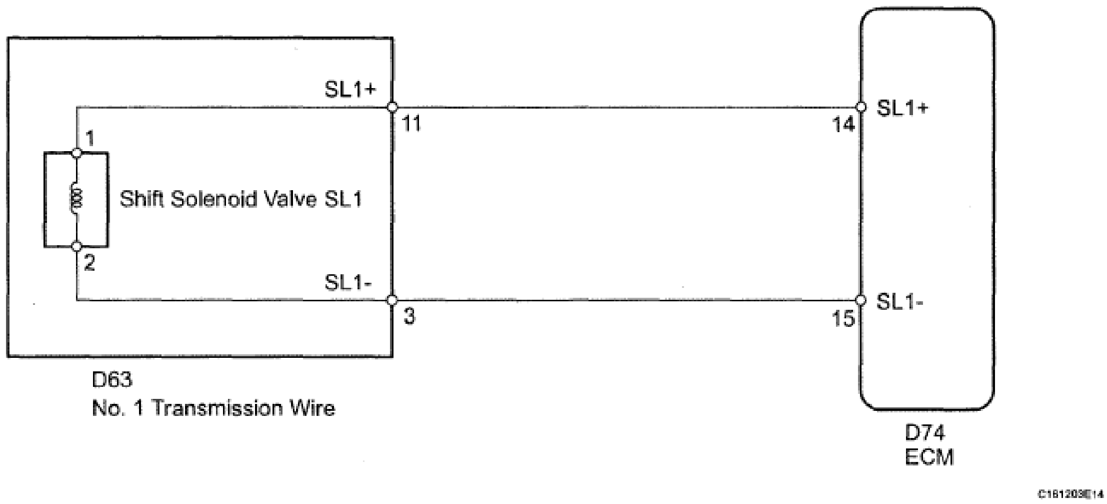

Fig. 52: Shift Solenoid Valve SL1 - Wiring Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

HINT:

The shift solenoid valve SL1 turns ON/OFF normally when the shift lever is on D:

SHIFT SOLENOID VALVE SL1 OPERATION CHART

ECM gear shift command	1st	2nd	3rd	4th	5th	6th
Shift solenoid valve SL1	OFF	OFF	OFF	OFF	ON	ON

1. **INSPECT NO. 1 TRANSMISSION WIRE (SHIFT SOLENOID VALVE SL1)**
   a. Disconnect the D63 No. 1 transmission wire connector.
   b. Measure the resistance according to the value (s) in the table below.

      Standard resistance

      NO. 1 TRANSMISSION WIRE (SHIFT SOLENOID VALVE SL1) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
11 (SL1+) - 3 (SL1-)	20°C (68°F)	5.0 to 5.6 ohms
11 (SL1+) - Body ground	Always	10 kohms or higher

3 (SL.1-) - Body ground	Always	10 kohms or higher

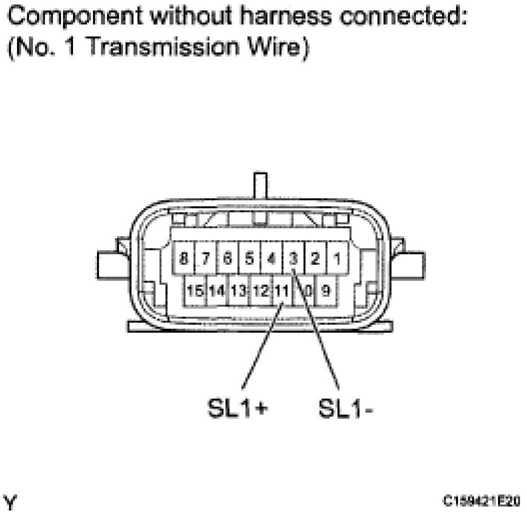

Fig. 53: Identifying D63 No. 1 Transmission Wire Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: Go to step 3

OK: Go to next step

2. **CHECK HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE - ECM)**
   a. Disconnect the D74 ECM connector.
   b. Measure the resistance according to the value (s) in the table below.

   Standard resistance

   HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D74-14 (SL1+) - D74-15 (SL1-)	20°C (68°F)	5.0 to 5.6 ohms
D74-14 (SL1+) - Body ground	Always	10 kohms or higher
D74-15 (SL1-) - Body ground	Always	10 kohms or higher

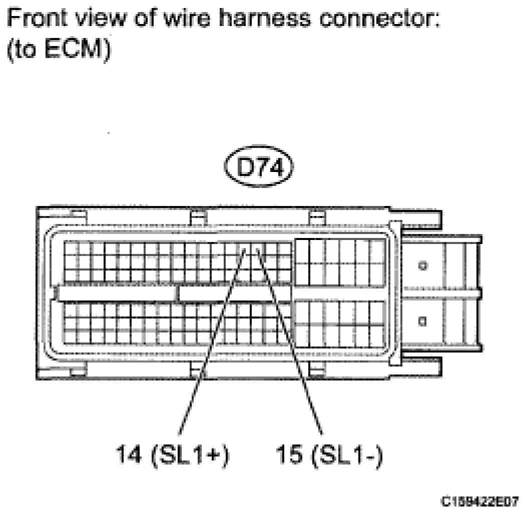

Fig. 54: Identifying D74 ECM Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE ECM (See REMOVAL)

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

   SHIFT SOLENOID VALVE SL1 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	5.0 to 5.6 ohms

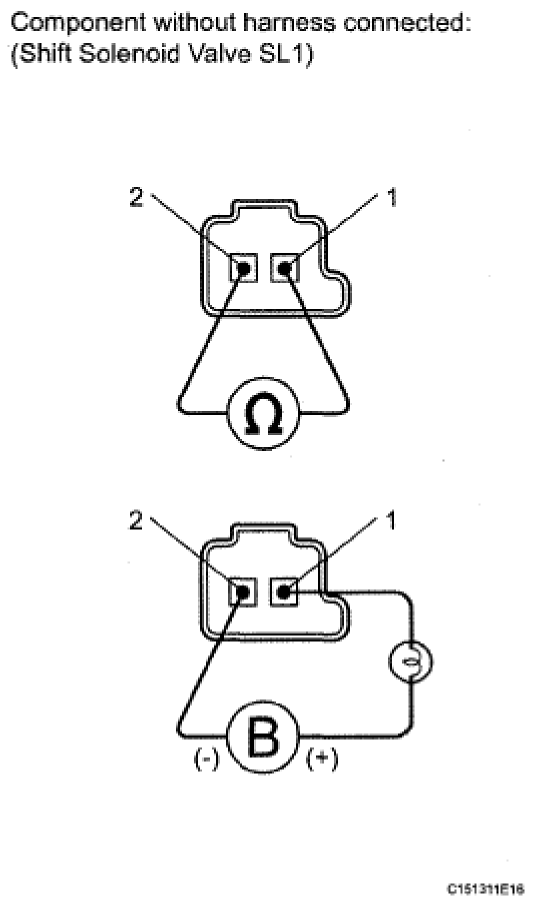

Fig. 55: Identifying Shift Solenoid Valve SL1
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Connect the battery's positive (+) lead with a 21 W bulb to terminal 1 and the negative (-) lead to terminal 2 of the solenoid valve connector. Then check that the valve moves and makes an operating noise.

OK: Valve moves and makes an operating noise.

NG: REPLACE SHIFT SOLENOID VALVE SL1 (see DISASSEMBLY)

OK: REPAIR OR REPLACE NO. 1 TRANSMISSION WIRE (see REMOVAL)

DTC P0751 SHIFT SOLENOID "A" PERFORMANCE (SHIFT SOLENOID VALVE S1)

DESCRIPTION

The ECM uses signals from the output shaft speed sensor and input speed sensor to detect the actual gear position (1st, 2nd, 3rd, 4th, 5th or 6th 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 transmission (clutch, brake or gear, etc.).

DTC TROUBLE DETECTION CHART

DTC		

No.	DTC Detection Condition	Trouble Area
P0751	S1stuck ON malfunctions*1: The ECM determines there is a malfunction when the following conditions are both met. (2-trip detection logic) a. When the ECM directs the gearshift to switch to 1st gear, the actual gear is shifted to 2nd. b. When the ECM directs the gearshift to switch to 5th gear, the actual gear is also shifted to 5th.	• Shift solenoid valve S1 remains open • Valve body is blocked • Automatic transmission (clutch, brake or gear, etc.)
P0751	S1stuck OFF malfunction*2: The ECM determines there is a malfunction when the following conditions are both met. (2-trip detection logic) a. When the ECM directs the gearshift to switch to 2nd gear, the actual gear is shifted to 1st. b. When the ECM directs the gearshift to switch to 5th gear, the actual gear is also shifted to 5th.	• Shift solenoid valve S1 remains closed • Shift solenoid valve SLT remains open or closed • Valve body is blocked • No. 2 brake malfunction (Driving is difficult.) • Automatic transmission (clutch, brake or gear, etc.)

HINT:

- Gear positions in the event of a solenoid valve mechanical problem:

GEAR POSITIONS REFERENCE

ECM command gearshift	1st	2nd	3rd	4th	5th	6th
*1: Actual gear position under S1stuck ON malfunction	2nd	2nd	3rd	4th	5th	6th
*2: Actual gear position under S1stuck OFF malfunction	1st	1st	3rd	4th	5th	N(1)
(1) Neutral						

- Gear position during fail-safe operation:

  If any malfunction is detected, the ECM changes into the fail-safe mode to shift into the gear positions as shown in the table below.

GEAR POSITIONS REFERENCE

Gear position under normal conditions	1st	2nd	3rd	4th	5th	6th
*1: Actual gear position under fail-safe mode when S1stuck ON malfunction	2nd	2nd	3rd	4th	5th	6th
*2: Actual gear position under fail-safe mode when S1stuck OFF malfunction	1st (1)	1st (1)	3rd	3rd	3rd	3rd
(1) Under engine braking, downshifting to 1st or 2nd gear is prohibited.						

MONITOR DESCRIPTION

This DTC indicates "stuck ON malfunction" or "stuck OFF malfunction" of the shift solenoid valve S1. The ECM commands gear shifts by turning the shift solenoid valves "ON/OFF". 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 REFERENCE

Related DTCs	P0751: Shift solenoid valve S1/OFF malfunction Shift solenoid valve S1/ON malfunction
Required sensors/Components	Shift solenoid valve S1, Speed sensor (NT), Speed sensor (NC), Crankshaft position sensor (NE), Throttle position sensor MAF
Frequency of operation	Continuous
Duration	OFF malfunction (A), (B) and ON malfunction (A), (B) 0.4 sec. OFF malfunction (C) 3 sec. OFF malfunction (D) 1 sec.
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

ALL

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	P0115-P0118 (ECT sensor) P0125 (Insufficient ECT for Closed Loop) P0500 (VSS) P0748 - P0798 (Trans solenoid (range))
Turbine speed sensor circuit	Not circuit malfunction
Output speed sensor circuit	Not circuit malfunction
Shift solenoid valve S1 circuit	Not circuit malfunction
Shift solenoid valve S2 circuit	Not circuit malfunction
Shift solenoid valve S3 circuit	Not circuit malfunction
Shift solenoid valve S4 circuit	Not circuit malfunction
Shift solenoid valve SR circuit	Not circuit malfunction
Shift solenoid valve SL1 circuit	Not circuit malfunction
Shift solenoid valve SL2 circuit	Not circuit malfunction
ECT (Engine coolant temperature) sensor circuit	Not circuit malfunction
KCS sensor circuit	Not circuit malfunction
ETCS (Electric Throttle Control System)	Not system down
Transmission position	"D"
Duration time from shifting "N" to "D"	4 sec. or more
ECT	40°C (104°F) or more
Spark advance from max. retard timing by KCS control	0° crankshaft angle or more
Engine	Starting

Transfer position is 4WD HIGH*

TYPICAL ENABLING CONDITIONS

Vehicle speed sensor circuit	Not circuit malfunction
Output shaft speed sensor circuit	Not circuit malfunction
Transfer output speed	143 rpm or more
NO/NOtf (Transfer input speed/Transfer output speed)	0.9 to 1.1

HINT:

*: This condition only applies to 4WD.

OFF malfunction (A)

TYPICAL ENABLING CONDITIONS

ECM selected gear	5th
Vehicle speed	2 km/h (1.2 mph) or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

OFF malfunction (B)

TYPICAL ENABLING CONDITIONS

ECM selected gear	2nd
Vehicle speed	2 km/h (1.2 mph) or more
Output speed	2nd --> 1st down-shift point or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

OFF malfunction (C)

TYPICAL ENABLING CONDITIONS

Current ECM selected gear	6th
Last ECM selected gear	5th
Vehicle speed (During transition from 5th to 6th gear)	Less than 100 km/h (62.2 mph)

OFF malfunction (D)

TYPICAL ENABLING CONDITIONS

ECM selected gear	6th
Engine speed-Turbine speed (NE-NT) (After transition from 5th to 6th gear)	150 rpm or less
Vehicle speed	Less than 100 km/h (62.2 mph)

ON malfunction (A)

TYPICAL ENABLING CONDITIONS

ECM selected gear	1st

Vehicle speed	2 km/h (1.2 mph) or more and less than 40 km/h (24.9 mph)
Engine speed-Turbine speed (NE-NT)	50 rpm or more

ON malfunction (B)

TYPICAL ENABLING CONDITIONS

ECM selected gear	5th
Vehicle speed	2 km/h (1.2 mph) or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

TYPICAL MALFUNCTION THRESHOLDS

[OFF malfunction]

Both of the following conditions are met: OFF malfunction (A) and OFF malfunction (B), (C) or (D)

OFF malfunction (A)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	0.66 or more, and 0.80 or less (This means actual gear is 5th)

OFF malfunction (B)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	3.11 or more, and 7.58 or less (This means actual gear is 1st)

OFF malfunction (C)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed-Output speed x 5th gear ratio (NT-NO x 5th gear ratio)	1000 rpm or more

OFF malfunction (D)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed-Output speed x 6th gear ratio (NT-NO x 6th gear ratio)	1000 rpm or more

[ON malfunction]

Both of the following conditions are met: ON malfunction (A) and (B)

2 detections are necessary per driving cycle:

1st detection: temporary flag ON

2nd detection: pending fault code ON

ON malfunction (A)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	1.83 or more, and 2.27 or less (This means actual gear is 2nd)

ON malfunction (B)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	0.66 or more, and 0.80 or less (This means actual gear is 5th)

INSPECTION PROCEDURE

1. **ACTIVE TEST**

   HINT:

   Using the intelligent tester or Techstream to perform Active Tests 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 Tests early in troubleshooting is one way to save diagnostic time. Data List information can be displayed while performing Active Tests.

   a. Warm up the engine.
   b. Turn the ignition switch OFF.
   c. Connect the intelligent tester or Techstream to the DLC3.
   d. Turn the ignition switch ON and push the tester switch ON.
   e. Enter the following menus:
      1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / ACTIVE TEST.
      2. Techstream - Select: Powertrain / Engine and ECT / Active Test.
   f. Follow the instructions on the tester and perform the Active Test.

      HINT:

      While driving, the shift position can be forcibly changed with the intelligent tester or Techstream. Comparing the shift position commanded by the Active Test with the actual shift position enables you to confirm the problem (see **CHECK MODE PROCEDURE**).

      1. Intelligent tester

         ECT:

         INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
SHIFT	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--"	Possible to check operation of shift solenoid valves [Vehicle Condition]

		button: Shift down	50 km/h (30 mph) or less

2. Techstream

ECT:

TECHSTREAM ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
Control the Shift Position	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less

HINT:

- This test can be conducted when the vehicle speed is 50 km/h (30 mph) or less.
- The 4th to 5th and 5th to 6th up-shift must be performed with the accelerator pedal released.
- The 6th to 5th and 5th to 4th down-shift must be performed with the accelerator pedal released.
- Do not operate the accelerator pedal for at least 2 seconds after shifting and do not shift successively.
- The shift position commanded by the ECM is shown in the Data List display on the tester.
- The shift solenoid valve S1 turns ON/OFF normally when the shift lever is in the D position.

SHIFT SOLENOID VALVE S1 OPERATION CHART

ECM command gearshift	1st	2nd	3rd	4th	5th	6th
Shift solenoid valve S1	OFF	ON	ON	ON	ON	ON

1. **CHECK DTC OUTPUT (IN ADDITION TO DTC P0751)**
   a. Connect the intelligent tester or Techstream to the DLC3.
   b. Turn the ignition switch ON and push the tester switch ON.
   c. Enter the following menus:
      1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / DTC INFO / CURRENT CODES.
      2. Techstream - Select: Powertrain / Engine and ECT / Trouble Codes.
   d. Read the DTCs using the tester.

   Result

DTC OUTPUT RESULT

Display (DTC output)	Proceed to
Only P0751 is output	A
P0751 and other DTCs are output	B

HINT:

If any other codes besides P0751 are output, perform troubleshooting for those DTCs first.

B: Go TO DTC CHART (see **DIAGNOSTIC TROUBLE CODE CHART**)

A: Go to next step

2. **PERFORM ACTIVE TEST BY INTELLIGENT TESTER OR TECHSTREAM (SHIFT SOLENOID VALVE SLT)**

NOTE:

- **Perform the test at the normal operating ATF temperature: 50 to 80 C (122 to 176 F).**
- **Be careful to prevent SST's hose from interfering with the exhaust pipe.**
- **Perform the test with the A/C OFF.**

HINT:

Using the intelligent tester or Techstream to perform Active Tests 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 Tests early in troubleshooting is one way to save diagnostic time. Data List information can be displayed while performing Active Tests.

a. Remove the test plug on the transmission case center right side and connect SST.

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

b. Connect the intelligent tester or Techstream to the DLC3.
c. Start the engine and warm it up.
d. Measure the line pressure with SST.
e. Turn the tester ON.
f. Enter the following menus:
   1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / ACTIVE TEST.
   2. Techstream - Select: Powertrain / Engine and ECT / Active Test.
g. Follow the instructions on the tester and perform the Active Test.
h. Measure the line pressure.
   1. Intelligent tester

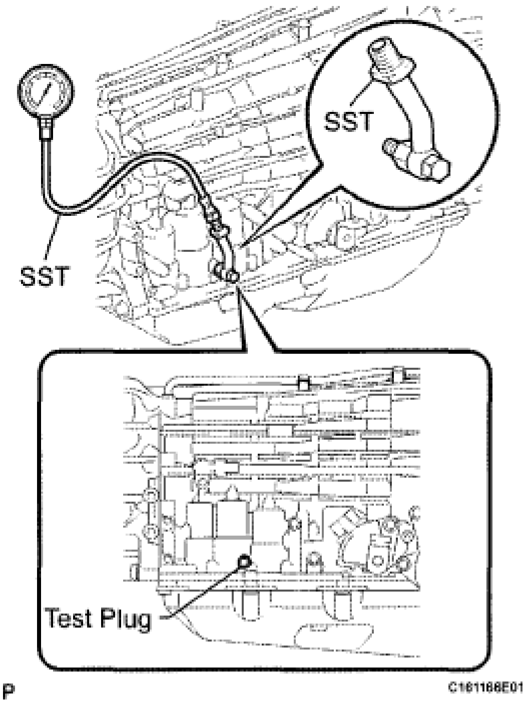

Fig. 56: Identifying Test Plug And SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ECT:

INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
SOLENOID (SLT)*	Operate the shift solenoid SLT and raise line pressure	ON or OFF HINT: • OFF: Line pressure up (when Active Test "SOLENOID (SLT)" is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	[Vehicle Condition] • Vehicle stopped • Engine idling
HINT: *: SOLENOID (SLT) in the Active Test is performed to check the line pressure changes by connecting SST to the automatic transmission, which is used in the Hydraulic Test (see **HYDRAULIC TEST**) as well. Please note that the pressure values in the Active Test and Hydraulic Test are different.			

2. Techstream

ECT:

TECHSTREAM ECT ACTIVE TEST REFERENCE

Tester	Test Part	Control Range	Diagnostic Note

Display			
Activate the Solenoid (SLT)*	Operate the shift solenoid SLT and raise line pressure	ON or OFF HINT: • OFF: Line pressure up (when Active Test "Activate the Solenoid (SLT)" is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	[Vehicle Condition] Vehicle stopped Engine idling
HINT: *: Activate the Solenoid (SLT) in the Active Test is performed to check the line pressure changes by connecting SST to the automatic transmission, which is used in the Hydraulic Test (see **HYDRAULIC TEST**) as well. Please note that the pressure values in the Active Test and Hydraulic Test are different.			

OK: The line pressure changes as specified when performing the Active Test.

NG: REPLACE SHIFT SOLENOID VALVE SLT (see **DISASSEMBLY**)

OK: Go to next step

3. **INSPECT SHIFT SOLENOID VALVE S1**
    a. Remove the shift solenoid valve S1.
    b. Measure the resistance according to the value (s) in the table below.

Standard resistance

SHIFT SOLENOID VALVE S1 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S1 connector terminal - Shift solenoid valve S1 body	20°C (68° F)	11 to 15 ohms

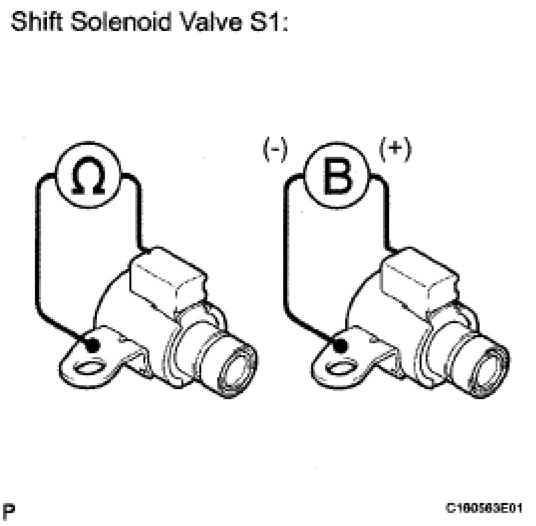

Fig. 57: Inspecting Shift Solenoid Valve S1
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Connect the battery's positive (+) lead to the terminal of the solenoid valve connector, and the negative (-) lead to the solenoid valve body. Then check that the valve moves and makes an operating noise.

OK: Valve moves and makes an operating noise.

NG: REPLACE SHIFT SOLENOID VALVE S1 (see **DISASSEMBLY**)

OK: Go to next step

4. **INSPECT TRANSMISSION VALVE BODY ASSEMBLY**
   a. Check the transmission valve body assembly (see **REMOVAL**).

   OK: There are no foreign objects on each valve.

NG: REPAIR OR REPLACE TRANSMISSION VALVE BODY ASSEMBLY (see **REMOVAL**)

OK: REPAIR OR REPLACE AUTOMATIC TRANSMISSION ASSEMBLY (see **REMOVAL**)

DTC P0756 SHIFT SOLENOID "B" PERFORMANCE (SHIFT SOLENOID VALVE S2)

DESCRIPTION

The ECM uses signals from the output shaft speed sensor and input speed sensor to detect the actual gear position (1st, 2nd, 3rd, 4th, 5th or 6th 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 transmission (clutch, brake, gear, etc.).

DTC TROUBLE DETECTION CHART

DTC		

No.	DTC Detection Condition	Trouble Area
P0756	S2 stuck ON malfunction* 1: Shifting to 3rd and 5th gears is impossible. The ECM determines there is a malfunction when the following conditions are both met. (2-trip detection logic) a. When the ECM directs the gear shift to switch to 5th gear, the actual gear is shifted to 6th. b. When the ECM directs the gear shift to switch to 6th gear, the actual gear is shifted to 6th.	• Shift solenoid valve S2 remains open • Valve body is blocked • Automatic transmission (clutch, brake, gear, etc.) • ECM
P0756	S2 stuck OFF malfunction*2: The vehicle starts in 3rd gear and shifting to 6th gear is impossible. The ECM determines there is a malfunction when the following conditions are both met. (2-trip detection logic) a. When the ECM directs the gear shift to switch to 1st gear, the actual gear is shifted to 3rd. b. When the ECM directs the gear shift to switch to 6th gear, the actual gear is shifted to 5th.	• Shift solenoid valve S2 remains closed • Valve body is blocked • Automatic transmission (clutch, brake, gear, etc.) • ECM

HINT:

Gear positions in the event of a solenoid valve mechanical problem:

GEAR POSITIONS REFERENCE

ECM gear shift command	1st	2nd	3rd	4th	5th	6th
*1: Actual gear position under S2 stuck ON malfunction	1st	2nd	2nd	4th	6th	6th
*2: Actual gear position under S2 stuck OFF malfunction	3rd	3rd	3rd	4th	5th	5th

MONITOR DESCRIPTION

This DTC indicates a stuck ON malfunction or stuck OFF malfunction of the shift solenoid valve S2. The ECM commands gear shifts by turning the shift solenoid valves ON/OFF. 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 REFERENCE

Related DTCs	P0756: Shift solenoid valve S2/OFF malfunction Shift solenoid valve S2/ON malfunction
Required sensors/Components	Shift solenoid valve S2
Frequency of operation	Continuous
Duration	0.4 sec.
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

All

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	P0115-P0118: ECT sensor P0125: Insufficient ECT for closed loop P0500: VSS P0748 - P0798: Trans solenoid (range)
Turbine speed sensor circuit	Not circuit malfunction
Output speed sensor circuit	Not circuit malfunction
Shift solenoid valve S1 circuit	Not circuit malfunction
Shift solenoid valve S2 circuit	Not circuit malfunction
Shift solenoid valve S3 circuit	Not circuit malfunction
Shift solenoid valve S4 circuit	Not circuit malfunction
Shift solenoid valve SR circuit	Not circuit malfunction
Shift solenoid valve SL1 circuit	Not circuit malfunction
Shift solenoid valve SL2 circuit	Not circuit malfunction
ECT (Engine coolant temperature) sensor circuit	Not circuit malfunction
KCS sensor circuit	Not circuit malfunction
ETCS (Electric Throttle Control System)	Not system down
Transmission position	"D"
Duration time from shifting "N" to "D"	4 sec. or more
ECT	40°C (104°F) or more
Spark advance from max. retard timing by KCS control	0° crankshaft angle or more
Engine	Starting

Transfer position is 4WD HIGH*

TYPICAL ENABLING CONDITIONS

Vehicle speed sensor circuit	Not circuit malfunction
Output shaft speed sensor circuit	Not circuit malfunction
Transfer output speed	143 rpm or more
NO/NOtf (Transfer input speed/Transfer output speed)	0.9 to 1.1

HINT:

*: This condition only applies to 4WD.

OFF malfunction (A)

TYPICAL ENABLING CONDITIONS

ECM selected gear	1st
Vehicle speed	2 km/h (1.2 mph) or more and less than 40 km/h (24.9 mph)

Engine speed - Turbine speed (NE - NT)	50 rpm or more

OFF malfunction (B)

TYPICAL ENABLING CONDITIONS

ECM selected gear	6th
Vehicle speed	2 km/h (1.2 mph) or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

ON malfunction (A)

TYPICAL ENABLING CONDITIONS

ECM selected gear	5th
Vehicle speed	2 km/h (1.2 mph) or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

ON malfunction (B)

TYPICAL ENABLING CONDITIONS

ECM selected gear	6th
Vehicle speed	2 km/h (1.2 mph) or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

TYPICAL MALFUNCTION THRESHOLDS

OFF malfunction is detected when OFF malfunction (A) and (B) are set.

OFF malfunction (A)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	1.24 to 1.49 (This means actual gear is 3rd)

OFF malfunction (B)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	0.66 to 0.80 (This means actual gear is 5th)

ON malfunction is detected when ON malfunction (A) and (B) are set.

ON malfunction (A)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	0.51 to 0.65 (This means actual gear is 6th)

ON malfunction (B)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	0.51 to 0.65 (This means actual gear is 6th)

INSPECTION PROCEDURE

1. **ACTIVE TEST**

   HINT:

   Using the intelligent tester or Techstream to perform Active Tests 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 Tests early in troubleshooting is one way to save diagnostic time. Data List information can be displayed while performing Active Tests.

   a. Warm up the engine.
   b. Turn the ignition switch OFF.
   c. Connect the intelligent tester or Techstream to the DLC3.
   d. Turn the ignition switch ON and push the tester switch ON.
   e. Enter the following menus:
      1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / ACTIVE TEST.
      2. Techstream - Select: Powertrain / Engine and ECT / Active Test.
   f. Follow the instructions on the tester and perform the Active Test.

      HINT:

      While driving, the shift position can be forcibly changed with the intelligent tester or Techstream. Comparing the shift position commanded by the Active Test with the actual shift position enables you to confirm the problem (see **CHECK MODE PROCEDURE**).

      1. Intelligent tester

         ECT:

         INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
SHIFT	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less

      2. Techstream

         ECT:

TECHSTREAM ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
Control the Shift Position	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less

HINT:

- This test can be conducted when the vehicle speed is 50 km/h (30 mph) or less.
- The 4th to 5th and 5th to 6th up-shift must be performed with the accelerator pedal released.
- The 6th to 5th and 5th to 4th down-shift must be performed with the accelerator pedal released.
- Do not operate the accelerator pedal for at least 2 seconds after shifting and do not shift successively.
- The shift position commanded by the ECM is shown in the Data List display on the tester.
- The shift solenoid valve S2 turns ON/OFF normally when the shift lever is in the D position.

SHIFT SOLENOID VALVE S2 OPERATION CHART

ECM gear shift command	1st	2nd	3rd	4th	5th	6th
Shift solenoid valve S2	ON	ON	OFF	OFF	OFF	ON

1. **CHECK DTC OUTPUT (IN ADDITION TO DTC P0756)**
    a. Connect the intelligent tester or Techstream to the DLC3.
    b. Turn the ignition switch ON and push the tester switch ON.
    c. Enter the following menus:
        1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / DTC INFO / CURRENT CODES.
        2. Techstream - Select: Powertrain / Engine and ECT / Trouble Codes.
    d. Read the DTCs using the tester.

Result

DTC OUTPUT RESULT

Display (DTC output)	Proceed to
Only P0756 is output	A
P0756 and other DTCs are output	B

HINT:

If any other codes besides P0756 are output, perform troubleshooting for those DTCs first.

B: Go TO DTC CHART (see **DIAGNOSTIC TROUBLE CODE CHART**)

A: Go to next step

2. **INSPECT SHIFT SOLENOID VALVE S2**
   a. Remove the shift solenoid valve S2.
   b. Measure the resistance according to the value (s) in the table below.

   Standard resistance

   SHIFT SOLENOID VALVE S2 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S2 connector terminal - Shift solenoid valve S2 body	20°C (68° F)	11 to 15 ohms

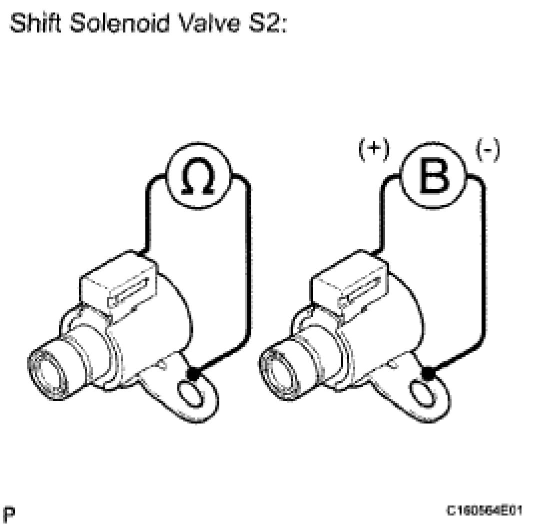

Fig. 58: Identifying Shift Solenoid Valve S2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   c. Connect the battery's positive (+) lead to the terminal of the solenoid valve connector, and the negative (-) lead to the solenoid valve body. Then check that the valve moves and makes an operating noise.

   OK: Valve moves and makes an operating noise.

NG: REPLACE SHIFT SOLENOID VALVE S2 (see **DISASSEMBLY**)

OK: Go to next step

3. **INSPECT TRANSMISSION VALVE BODY ASSEMBLY**
   a. Check the transmission valve body assembly (see **REMOVAL**).

OK: There are no foreign objects on each valve.

NG: REPAIR OR REPLACE TRANSMISSION VALVE BODY ASSEMBLY (see **REMOVAL**)

OK: REPAIR OR REPLACE AUTOMATIC TRANSMISSION ASSEMBLY (see **REMOVAL**)

DTC P0761 SHIFT SOLENOID "C" PERFORMANCE (SHIFT SOLENOID VALVE S3)

DESCRIPTION

The ECM uses signals from the output shaft speed sensor and input speed sensor to detect the actual gear position (1st, 2nd, 3rd, 4th, 5th or 6th 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 transmission (clutch, brake or gear, etc.).

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0761	S3 stuck ON malfunctions*1: When the ECM directs the gearshift to switch to 5th or 6th gear, the engine overruns (clutch slips). The ECM determines there is a malfunction when either of the following conditions is met. (2-trip detection logic) a. When the ECM directs the gearshift to switch to 4th gear, the actual gear is shifted to 3rd. b. When the ECM directs the gearshift to switch to 5th gear, the engine overruns (clutch slips).	• Shift solenoid valve S3 remains open • Shift solenoid valve SLT remains open or closed • Valve body is blocked • Automatic transmission (clutch, brake or gear, etc.)
P0761	S3 stuck OFF malfunction*2: Shifting to 1st, 2nd, and 3rd gears is impossible. The ECM determines there is a malfunction when the following conditions are both met. (2-trip detection logic) a. When the ECM directs the gearshift to switch to 2nd gear, the actual gear is shifted to 4th. b. When the ECM directs the gearshift to switch to 6th gear, the actual gear is shifted to 6th.	• Shift solenoid valve S3 remains closed • Valve body is blocked • Automatic transmission (clutch, brake or gear, etc.)

HINT:

- Gear positions in the event of a solenoid valve mechanical problem:

GEAR POSITIONS REFERENCE

ECM command gearshift	1st	2nd	3rd	4th	5th	6th
*1: Actual gear position under S3 stuck ON malfunction	1st	2nd	3rd	3rd	N(1)	N(1)
*2: Actual gear position under S3 stuck OFF malfunction	3rd	4th	4th	4th	5th	6th

(1) Neutral

- Gear position during fail-safe operation:

  If any malfunction is detected, the ECM changes into the fail-safe mode to shift into the gear positions as shown in the table below.

GEAR POSITIONS REFERENCE

Gear position under normal conditions	1st	2nd	3rd	4th	5th	6th
*1: Actual gear position under fail-safe mode when S3 stuck ON malfunction	1st	2nd	3rd	3rd	3rd	3rd
*2: Actual gear position under fail-safe mode when S3 stuck OFF malfunction	3rd	4th	4th	4th	5th	6th

MONITOR DESCRIPTION

This DTC indicates "stuck ON malfunction" or "stuck OFF malfunction" of the shift solenoid valve S3. The ECM commands gear shifts by turning the shift solenoid valves "ON/OFF". When the gear position commanded by the ECM and the actual gear position are not same, the ECM illuminates the MIL and stores the DTC.

MONITOR STRATEGY

MONITOR STRATEGY REFERENCE

Related DTCs	P0761: Shift solenoid valve S3/OFF malfunction Shift solenoid valve S3/ON malfunction
Required sensors/Components	Shift solenoid valve S3
Frequency of operation	Continuous
Duration	OFF malfunction (A), (B) and ON malfunction (A) 0.4 sec. ON malfunction (B) 3 sec. ON malfunction (C) 1 sec.
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

ALL

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	P0115-P0118 (ECT sensor) P0125 (Insufficient ECT for Closed Loop) P0500 (VSS) P0748 - P0798 (Trans solenoid (range))
Turbine speed sensor circuit	Not circuit malfunction
Output speed sensor circuit	Not circuit malfunction

Shift solenoid valve S1 circuit	Not circuit malfunction
Shift solenoid valve S2 circuit	Not circuit malfunction
Shift solenoid valve S3 circuit	Not circuit malfunction
Shift solenoid valve S4 circuit	Not circuit malfunction
Shift solenoid valve SR circuit	Not circuit malfunction
Shift solenoid valve SL1 circuit	Not circuit malfunction
Shift solenoid valve SL2 circuit	Not circuit malfunction
ECT (Engine coolant temperature) sensor circuit	Not circuit malfunction
KCS sensor circuit	Not circuit malfunction
ETCS (Electric Throttle Control System)	Not system down
Transmission position	"D"
Duration time from shifting "N" to "D"	4 sec. or more
ECT	40°C (104°F) or more
Spark advance from max. retard timing by KCS control	0° crankshaft angle or more
Engine	Starting

Transfer position is 4WD HIGH*

TYPICAL ENABLING CONDITIONS

Vehicle speed sensor circuit	Not circuit malfunction
Output shaft speed sensor circuit	Not circuit malfunction
Transfer output speed	143 rpm or more
NO/NOtf (Transfer input speed/Transfer output speed)	0.9 to 1.1

HINT:

*: This condition only applies to 4WD.

OFF malfunction (A)

TYPICAL ENABLING CONDITIONS

ECM selected gear	2nd
Vehicle speed	2 km/h (1.2 mph) or more
Output speed	2nd --> 1st down-shift point or more
Throttle valve opening angle	9% or more at 2000 rpm (Condition varies with engine speed)

OFF malfunction (B)

TYPICAL ENABLING CONDITIONS

ECM selected gear	6th
Vehicle speed	2 km/h (1.2 mph) or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

ON malfunction (A)

TYPICAL ENABLING CONDITIONS

ECM selected gear	4th
Vehicle speed	2 km/h (1.2 mph) or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

ON malfunction (B)

TYPICAL ENABLING CONDITIONS

Current ECM selected gear	5th
Last ECM selected gear	4th
Vehicle speed (During transition from 4th to 5th gear)	Less than 100 km/h (62.2 mph)

ON malfunction (C)

TYPICAL ENABLING CONDITIONS

ECM selected gear	5th
Engine speed - Turbine speed (NE - NT) (After transition to 5th gear)	150 rpm or less
Vehicle speed (After transition to 5th gear)	Less than 100 km/h (62.2 mph)

TYPICAL MALFUNCTION THRESHOLDS

[OFF malfunction]

Both of the following conditions are met: OFF malfunctions (A) and (B)

OFF malfunction (A)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	0.93 or more, and 1.07 or less (This means actual gear is 4th)

OFF malfunction (B)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	0.51 or more, and 0.65 or less (This means actual gear is 6th)

[ON malfunction]

One of the following conditions is met: ON malfunction (A), (B) or (C)

ON malfunctions (A)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	1.24 or more, and 1.49 or less (This means actual gear is 3rd)

ON malfunction (B)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed - Output speed x 4th gear ratio (NT - ratio) NO x 4th gear	1000 rpm or more

ON malfunction (C)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed - Output speed x 5th gear ratio (NT - NO x 5th gear ratio)	1000 rpm or more

INSPECTION PROCEDURE

1. **ACTIVE TEST**

   HINT:

   Using the intelligent tester or Techstream to perform Active Tests 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 Tests early in troubleshooting is one way to save diagnostic time. Data List information can be displayed while performing Active Tests.

   a. Warm up the engine.
   b. Turn the ignition switch OFF.
   c. Connect the intelligent tester or Techstream to the DLC3.
   d. Turn the ignition switch ON and push the tester switch ON.
   e. Enter the following menus:
      1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / ACTIVE TEST.
      2. Techstream - Select: Powertrain / Engine and ECT / Active Test.
   f. Follow the instructions on the tester and perform the Active Test.

      HINT:

      While driving, the shift position can be forcibly changed with the intelligent tester or Techstream. Comparing the shift position commanded by the Active Test with the actual shift position enables you to confirm the problem (see **CHECK MODE PROCEDURE**).

      1. Intelligent tester

         ECT:

         INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
SHIFT	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less

      2. Techstream

ECT:

TECHSTREAM ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
Control the Shift Position	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less

HINT:

- This test can be conducted when the vehicle speed is 50 km/h (30 mph) or less.
- The 4th to 5th and 5th to 6th up-shift must be performed with the accelerator pedal released.
- The 6th to 5th and 5th to 4th down-shift must be performed with the accelerator pedal released.
- Do not operate the accelerator pedal for at least 2 seconds after shifting and do not shift successively.
- The shift position commanded by the ECM is shown in the Data List display on the tester.
- The shift solenoid valve SL2 turns ON/OFF normally when the shift lever is in the D position.

SHIFT SOLENOID VALVE SL2 OPERATION CHART

ECM command gearshift	1st	2nd	3rd	4th	5th	6th
Shift solenoid valve S3	ON	ON	ON	OFF	OFF	OFF

1. **CHECK DTC OUTPUT (IN ADDITION TO DTC P0761)**
   a. Connect the intelligent tester or Techstream to the DLC3.
   b. Turn the ignition switch ON and push the tester switch ON.
   c. Enter the following menus:
      1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / DTC INFO / CURRENT CODES.
      2. Techstream - Select: Powertrain / Engine and ECT / Trouble Codes.
   d. Read the DTCs using the tester.

   Result

   DTC OUTPUT RESULT

Display (DTC output)	Proceed to
Only P0761 is output	A
P0761 and other DTCs are output	B

HINT:

If any other codes besides P0761 are output, perform troubleshooting for those DTCs first.

B: Go TO DTC CHART (see **DIAGNOSTIC TROUBLE CODE CHART**)

A: Go to next step

2. **PERFORM ACTIVE TEST BY INTELLIGENT TESTER OR TECHSTREAM (SHIFT SOLENOID VALVE SLT)**

NOTE:

- **Perform the test at the normal operating ATF temperature: 50 to 80°C (122 to 176°F).**
- **Be careful to prevent SST's hose from interfering with the exhaust pipe.**
- **Perform the test with the A/C OFF.**

HINT:

Using the intelligent tester or Techstream to perform Active Tests 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 Tests early in troubleshooting is one way to save diagnostic time. Data List information can be displayed while performing Active Tests.

a. Remove the test plug on the transmission case center right side and connect SST.

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

b. Connect the intelligent tester or Techstream to the DLC3.
c. Start the engine and warm it up.
d. Measure the line pressure with SST.
e. Turn the tester ON.
f. Enter the following menus:
   1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / ACTIVE TEST.
   2. Techstream - Select: Powertrain / Engine and ECT / Active Test.
g. Follow the instructions on the tester and perform the Active Test.
h. Measure the line pressure.
   1. Intelligent tester

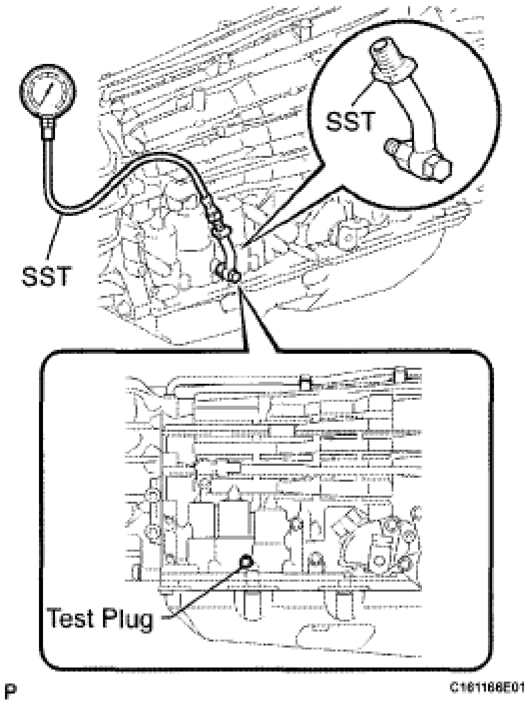

Fig. 59: Identifying Test Plug And SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ECT:

INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
SOLENOID (SLT)*	Operate the shift solenoid SLT and raise line pressure	ON or OFF HINT: • OFF: Line pressure up (when Active Test "SOLENOID (SLT)" is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	[Vehicle Condition] • Vehicle stopped • Engine idling
HINT: *: SOLENOID (SLT) in the Active Test is performed to check the line pressure changes by connecting SST to the automatic transmission, which is used in the Hydraulic Test (see **HYDRAULIC TEST**) as well. Please note that the pressure values in the Active Test and Hydraulic Test are different.			

2. Techstream

ECT:

TECHSTREAM ECT ACTIVE TEST REFERENCE

Tester	Test Part	Control Range	Diagnostic

Display			Note
Activate the Solenoid (SLT)*	Operate the shift solenoid SLT and raise line pressure	ON or OFF HINT: • OFF: Line pressure up (when Active Test "Activate the Solenoid (SLT)" is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	[Vehicle Condition] • Vehicle stopped • Engine idling
HINT: *: Activate the Solenoid (SLT) in the Active Test is performed to check the line pressure changes by connecting SST to the automatic transmission, which is used in the Hydraulic Test (see **HYDRAULIC TEST**) as well. Please note that the pressure values in the Active Test and Hydraulic Test are different.			

OK: The line pressure changes as specified when performing the ACTIVE TEST.

NG: REPLACE SHIFT SOLENOID VALVE SLT (see **DISASSEMBLY**)

OK: Go to next step

3. **INSPECT SHIFT SOLENOID VALVE S3**
   a. Remove the shift solenoid valve S3.
   b. Measure the resistance according to the value (s) in the table below.

   Standard resistance

   SHIFT SOLENOID VALVE S3 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S3 connector terminal - Shift solenoid valve S3 body	20°C (68° F)	11 to 15 ohms

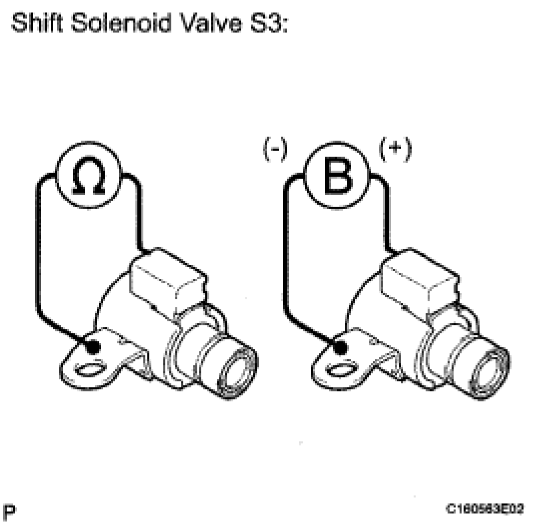

Fig. 60: Identifying Shift Solenoid Valve S3
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Connect the battery's positive (+) lead to the terminal of the solenoid valve connector, and the negative (-) lead to the solenoid valve body. Then check that the valve moves and makes an operating noise.

OK: Valve moves and makes an operating noise.

NG: REPLACE SHIFT SOLENOID VALVE S3 (see **DISASSEMBLY**)

OK: Go to next step

4. **INSPECT TRANSMISSION VALVE BODY ASSEMBLY**
   a. Check the transmission valve body assembly (see **REMOVAL**).

   OK: There are no foreign objects on each valve.

NG: REPAIR OR REPLACE TRANSMISSION VALVE BODY ASSEMBLY (see **REMOVAL**)

OK: REPAIR OR REPLACE AUTOMATIC TRANSMISSION ASSEMBLY (see **REMOVAL**)

DTC P0766 SHIFT SOLENOID "D" PERFORMANCE (SHIFT SOLENOID VALVE S4); DTC P0776 PRESSURE CONTROL SOLENOID "B" PERFORMANCE (SHIFT SOLENOID VALVE SL2)

DESCRIPTION

The ECM uses signals from the output shaft speed sensor and input speed sensor to detect the actual gear position (1st, 2nd, 3rd, 4th, 5th or 6th 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 transmission (clutch, brake or gear, etc.).

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0766	S4 stuck OFF malfunction or brake control valve malfunction*: Shifting to 5th and 6th gears is impossible. The ECM determines there is a malfunction when the following conditions are both met. (2-trip detection logic) a. When the ECM directs the gearshift to switch to 5th gear, the actual gear is shifted to 4th. b. When the ECM directs the gearshift to switch to 6th gear, the actual gear is shifted to 4th.	• Shift solenoid valve S4 remains closed • Shift solenoid valve SLT remains open or closed • Valve body is blocked (Brake control valve) • Automatic transmission (clutch, brake or gear, etc.)
	SL2 stuck ON malfunction or brake control valve malfunction*:	• Shift solenoid valve SL2

P0776	Shifting to 5th and 6th gears is impossible. The ECM determines there is a malfunction when the following conditions are both met. (2-trip detection logic) a. When the ECM directs the gearshift to switch to 5th gear, the actual gear is shifted to 4th. b. When the ECM directs the gearshift to switch to 6th gear, the actual gear is shifted to 4th.	remains open • Shift solenoid valve SLT remains open or closed • Valve body is blocked (Brake control valve) • Automatic transmission (clutch, brake or gear, etc.)

HINT:

- Gear positions in the event of a solenoid valve mechanical problem:

GEAR POSITIONS REFERENCE

ECM command gearshift	1st	2nd	3rd	4th	5th	6th
*: Actual gear position under malfunction	1st	2nd	3rd	4th	4th	4th

- Gear position during fail-safe operation:

  If any malfunction is detected, the ECM changes into the fail-safe mode to shift into the gear positions as shown in the table below.

GEAR POSITIONS REFERENCE

Gear position under normal conditions	1st	2nd	3rd	4th	5th	6th
*: Actual gear position under fail-safe mode	1st	2nd	3rd	3rd	3rd	3rd

MONITOR DESCRIPTION

This DTC indicates "stuck OFF malfunction" of the shift solenoid valve S4, "stuck ON malfunction" of the shift solenoid valve SL2, or brake control valve malfunction. The ECM commands gear shifts by turning the shift solenoid valves "ON/OFF". When the gear position commanded by the ECM and the actual gear position are not same, the ECM illuminates the MIL and stores the DTC.

MONITOR STRATEGY

MONITOR STRATEGY REFERENCE

Related DTCs	P0766: Shift solenoid valve S4/OFF malfunction P0776: Shift solenoid valve SL2/ON malfunction
Required sensors/Components	Shift solenoid valve S4, Speed sensor (NT), Speed sensor (NC), Crankshaft position sensor (NE)
Frequency of operation	Continuous
Duration	0.4 sec.
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

ALL

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	P0115-P0118 (ECT sensor) P0125 (Insufficient ECT for Closed Loop) P0500 (VSS) P0748 - P0798 (Trans solenoid (range))
Turbine speed sensor circuit	Not circuit malfunction
Output speed sensor circuit	Not circuit malfunction
Shift solenoid valve S1 circuit	Not circuit malfunction
Shift solenoid valve S2 circuit	Not circuit malfunction
Shift solenoid valve S3 circuit	Not circuit malfunction
Shift solenoid valve S4 circuit	Not circuit malfunction
Shift solenoid valve SR circuit	Not circuit malfunction
Shift solenoid valve SL1 circuit	Not circuit malfunction
Shift solenoid valve SL2 circuit	Not circuit malfunction
ECT (Engine coolant temperature) sensor circuit	Not circuit malfunction
KCS sensor circuit	Not circuit malfunction
ETCS (Electric Throttle Control System)	Not system down
Transmission position	"D"
Duration time from shifting "N" to "D"	4 sec. or more
ECT	40°C (104°F) or more
Spark advance from max. retard timing by KCS control	0° crankshaft angle or more
Engine	Starting

Transfer position is 4WD HIGH*

TYPICAL ENABLING CONDITIONS

Vehicle speed sensor circuit	Not circuit malfunction
Output shaft speed sensor circuit	Not circuit malfunction
Transfer output speed	143 rpm or more
NO/NOtf (Transfer input speed/Transfer output speed)	0.9 to 1.1

HINT:

*: This condition only applies to 4WD.

P0766 OFF malfunction (A) and P0776 ON malfunction (A)

TYPICAL ENABLING CONDITIONS

ECM selected gear	5th
Vehicle speed	2 km/h (1.2 mph) or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

P0766 OFF malfunction (B) and P0776 ON malfunction (B)

TYPICAL ENABLING CONDITIONS

ECM selected gear	6th
Vehicle speed	2 km/h (1.2 mph) or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

TYPICAL MALFUNCTION THRESHOLDS

[OFF malfunction]

Both of the following conditions are met: OFF malfunction (A) and (B)

P0766 OFF malfunction (A)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	0.93 or more, and 1.07 or less (This means actual gear is 4th)

P0766 OFF malfunction (B)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	0.93 or more, and 1.07 or less (This means actual gear is 4th)

[ON malfunction]

Both of the following conditions are met: ON malfunction (A) and (B)

P0776 ON malfunction (A)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	0.93 or more, and 1.07 or less (This means actual gear is 4th)

P0776 ON malfunction (B)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	0.93 or more, and 1.07 or less (This means actual gear is 4th)

INSPECTION PROCEDURE

1. **ACTIVE TEST**

   HINT:

   Using the intelligent tester or Techstream to perform Active Tests 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 Tests early in troubleshooting is one way to save diagnostic time. Data List information can be displayed while performing Active Tests.

   a. Warm up the engine.
   b. Turn the ignition switch OFF.

c. Connect the intelligent tester or Techstream to the DLC3.
d. Turn the ignition switch ON and push the tester switch ON.
e. Enter the following menus:
    1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / ACTIVE TEST.
    2. Techstream - Select: Powertrain / Engine and ECT / Active Test.
f. Follow the instructions on the tester and perform the Active Test.

HINT:

While driving, the shift position can be forcibly changed with the intelligent tester or Techstream. Comparing the shift position commanded by the Active Test with the actual shift position enables you to confirm the problem (see **CHECK MODE PROCEDURE**).

1. Intelligent tester

ECT:

INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
SHIFT	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less

2. Techstream

ECT:

TECHSTREAM ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
Control the Shift Position	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less

HINT:

- This test can be conducted when the vehicle speed is 50 km/h (30 mph) or less.
- The 4th to 5th and 5th to 6th up-shift must be performed with the accelerator pedal released.

- The 6th to 5th and 5th to 4th down-shift must be performed with the accelerator pedal released.
- Do not operate the accelerator pedal for at least 2 seconds after shifting and do not shift successively.
- The shift position commanded by the ECM is shown in the Data List display on the tester.
- The shift solenoid valve SL2 turns ON/OFF normally when the shift lever is in the D position.

SHIFT SOLENOID VALVE SL2 OPERATION CHART

ECM command gearshift	1st	2nd	3rd	4th	5th	6th
Shift solenoid valve S4	OFF	OFF	OFF	OFF	ON	ON
Shift solenoid valve SL2	ON	ON	ON	ON	OFF	OFF

1. **CHECK DTC OUTPUT (IN ADDITION TO DTCS P0766 AND P0776)**
   a. Connect the intelligent tester or Techstream to the DLC3.
   b. Turn the ignition switch ON and push the tester switch ON.
   c. Enter the following menus:
      1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / DTC INFO / CURRENT CODES.
      2. Techstream - Select: Powertrain / Engine and ECT / Trouble Codes.
   d. Read the DTCs using the tester.

   Result

   DTC OUTPUT RESULT

Display (DTC output)	Proceed to
Only P0766 and P0776 are output	A
P0766, P0776 and other DTCs are output	B

   HINT:

   If any other codes besides P0766 and P0776 are output, perform troubleshooting for those DTCs first.

   B: Go TO DTC CHART (see DIAGNOSTIC TROUBLE CODE CHART)

   A: Go to next step

2. **PERFORM ACTIVE TEST BY INTELLIGENT TESTER OR TECHSTREAM (SHIFT SOLENOID VALVE SLT)**

NOTE:

- **Perform the test at the normal operating ATF temperature: 50 to 80°C (122 to 176°F).**
- **Be careful to prevent SST's hose from interfering with the exhaust pipe.**

- **Perform the test with the A/C OFF.**

HINT:

Using the intelligent tester or Techstream to perform Active Tests 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 Tests early in troubleshooting is one way to save diagnostic time. Data List information can be displayed while performing Active Tests.

a. Remove the test plug on the transmission case center right side and connect SST.

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

b. Connect the intelligent tester or Techstream to the DLC3.
c. Start the engine and warm it up.
d. Measure the line pressure with SST.
e. Turn the tester ON.
f. Enter the following menus:
   1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / ACTIVE TEST.
   2. Techstream - Select: Powertrain / Engine and ECT / Active Test.
g. Follow the instructions on the tester and perform the Active Test.
h. Measure the line pressure.
   1. Intelligent tester

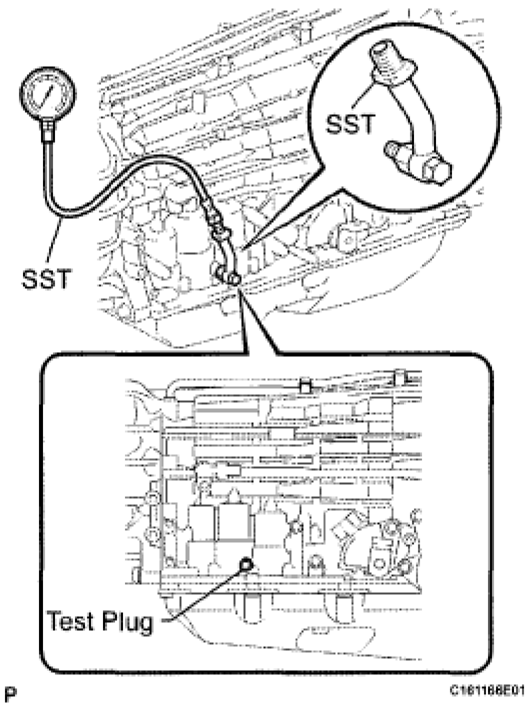

Fig. 61: Identifying Test Plug And SST

ECT:

INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
SOLENOID (SLT)*	Operate the shift solenoid SLT and raise line pressure	ON or OFF HINT: • OFF: Line pressure up (when Active Test "SOLENOID (SLT)" is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	[Vehicle Condition] • Vehicle stopped • Engine idling
HINT: *: SOLENOID (SLT) in the Active Test is performed to check the line pressure changes by connecting SST to the automatic transmission, which is used in the Hydraulic Test (see **HYDRAULIC TEST**) as well. Please note that the pressure values in the Active Test and Hydraulic Test are different.			

2. Techstream

ECT:

TECHSTREAM ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
Activate the Solenoid (SLT)*	Operate the shift solenoid SLT and raise line pressure	ON or OFF HINT: • OFF: Line pressure up (when Active Test "Activate the Solenoid (SLT)" is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	[Vehicle Condition] • Vehicle stopped • Engine idling
HINT: *: Activate the Solenoid (SLT) in the Active Test is performed to check the line pressure changes by connecting SST to the automatic transmission, which is used in the Hydraulic Test (see **HYDRAULIC TEST**) as well. Please note that the pressure values in the Active Test and Hydraulic Test are different.			

OK: The line pressure changes as specified when performing the Active Test.

NG: REPLACE SHIFT SOLENOID VALVE SLT (see **DISASSEMBLY**)

OK: Go to next step

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

   SHIFT SOLENOID VALVE S4 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S4 connector terminal - Shift solenoid valve S4 body	20°C (68° F)	11 to 15 ohms

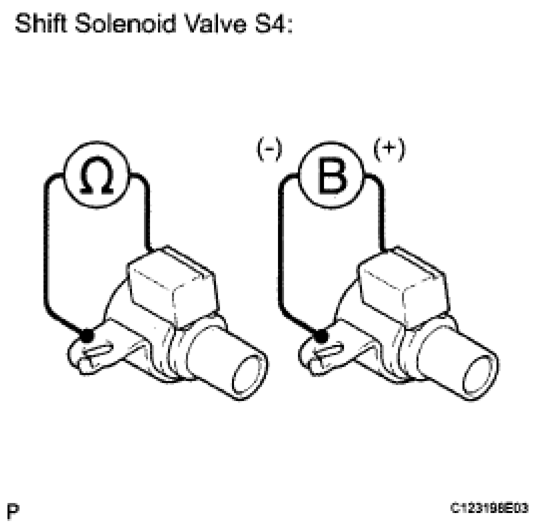

Fig. 62: Identifying Shift Solenoid Valve S4
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   c. Connect the battery's positive (+) lead to the terminal of the solenoid valve connector, and the negative (-) lead to the solenoid valve body. Then check that the valve moves and makes an operating noise.

   OK: Valve moves and makes an operating noise.

NG: REPLACE SHIFT SOLENOID VALVE S4 (see DISASSEMBLY)

OK: Go to next step

4. **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

   SHIFT SOLENOID VALVE SL2 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition

1 - 2	20°C (68°F)	5.0 to 5.6 ohms

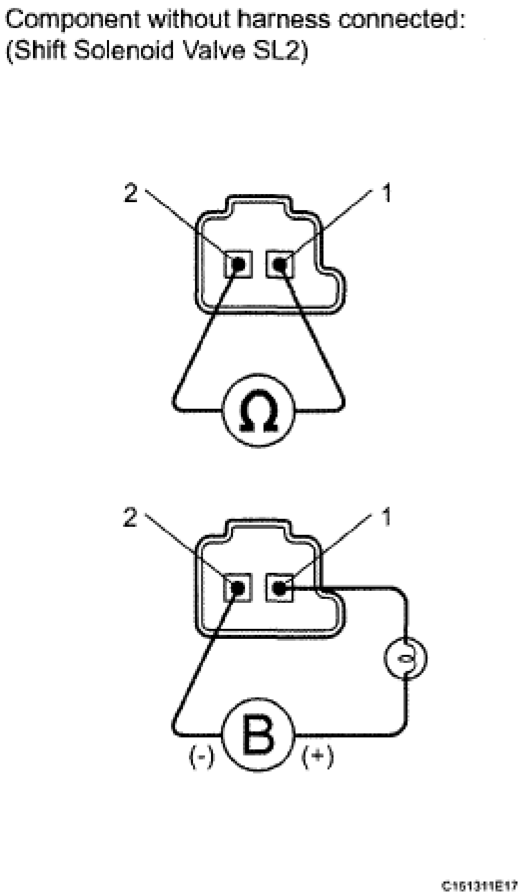

Fig. 63: Identifying Shift Solenoid Valve SL2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Connect the battery's positive (+) lead with a 21 W bulb to terminal 1 and the negative (-) lead to terminal 2 of the solenoid valve connector. Then check that the valve moves and makes an operating noise.

OK: Valve moves and makes an operating noise.

NG: REPLACE SHIFT SOLENOID VALVE SL2 (see **REMOVAL**)

OK: Go to next step

5. **INSPECT TRANSMISSION VALVE BODY ASSEMBLY**
   a. Check the transmission valve body assembly (see **REMOVAL**).

   OK: There are no foreign objects on each valve.

NG: REPAIR OR REPLACE TRANSMISSION VALVE BODY ASSEMBLY (see **REMOVAL**)

OK: REPAIR OR REPLACE AUTOMATIC TRANSMISSION ASSEMBLY (see **REMOVAL**)

DTC P0778 PRESSURE CONTROL SOLENOID "B" ELECTRICAL (SHIFT SOLENOID VALVE SL2)

DESCRIPTION

Shifting from 1st to 5th is performed in combination with the ON and OFF operation of the shift solenoid valves SL1, SL2, S1, S2, S3, S4 and SR, which are controlled by the ECM. If an open or short circuit occurs in the shift solenoid valves, the ECM controls the remaining normal shift solenoid valves to allow the vehicle to be operated safely (see **CHECK MODE PROCEDURE**).

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0778	The ECM checks for an open or short in the shift solenoid valve SL2 circuit while driving and shifting gears (1 trip detection logic) Output signal duty ratio equals to 100% (SL2 output signal duty ratio is less than 100% under normal condition)	• Open or short in shift solenoid valve SL2 circuit • Shift solenoid valve SL2 • ECM

Reference: Inspect using an oscilloscope.

Check the waveform of the ECM connector.

Standard

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition	Specified Condition
D74-12 (SL2+) - D74-13 (SL2-)	5 V/DIV., 1 msec./ DIV.	Engine is idling	Refer to the illustration

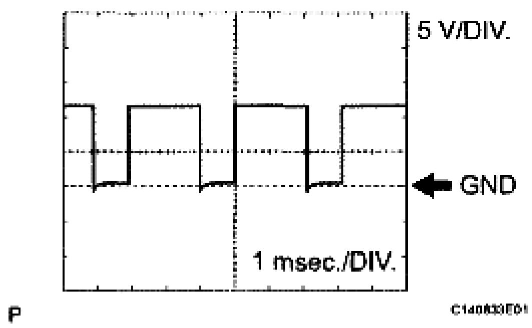

Fig. 64: Waveform Of ECM Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

MONITOR DESCRIPTION

This DTC indicates an open or short in the shift solenoid valve SL2 circuit. 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, illuminates the MIL and stores the DTC. Also, the ECM performs the fail-safe function and turns the other shift solenoid valves that are in good condition ON/OFF.

In case of an open or short circuit, the ECM stops sending the current to the open or short circuit solenoid.

While driving and shifting gears, if the ECM detects an open or short in the shift solenoid valve SL2 circuit, the ECM determines there is a malfunction (see **CHECK MODE PROCEDURE**).

MONITOR STRATEGY

MONITOR STRATEGY REFERENCE

Related DTCs	P0778: Shift solenoid valve SL2/Range check
Required sensors/Components	Shift solenoid valve SL2
Frequency of operation	Continuous
Duration	1 sec.
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

All

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	P0115 - P0118:ECT sensor P0125: Insufficient ECT for closed loop P0500: VSS P0748 - P0798: Trans solenoid (range)
Ignition switch	ON
Starter	OFF

All of the following conditions are met: Condition (A) and (B)

Condition (A)

TYPICAL ENABLING CONDITIONS

Solenoid current cut status	Not cut
Battery voltage	11 V or more
Target current	0.1 A or more

Condition (B)

TYPICAL ENABLING CONDITIONS

Battery voltage	8 V or more

TYPICAL MALFUNCTION THRESHOLDS

When either condition below is met: Condition (A) or (B)

Condition (A)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Solenoid status from Hybrid IC	Failure

Condition (B)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Hybrid IC status	Failure

COMPONENT OPERATING RANGE

COMPONENT OPERATING RANGE

Output signal duty	Less than 100%

WIRING DIAGRAM

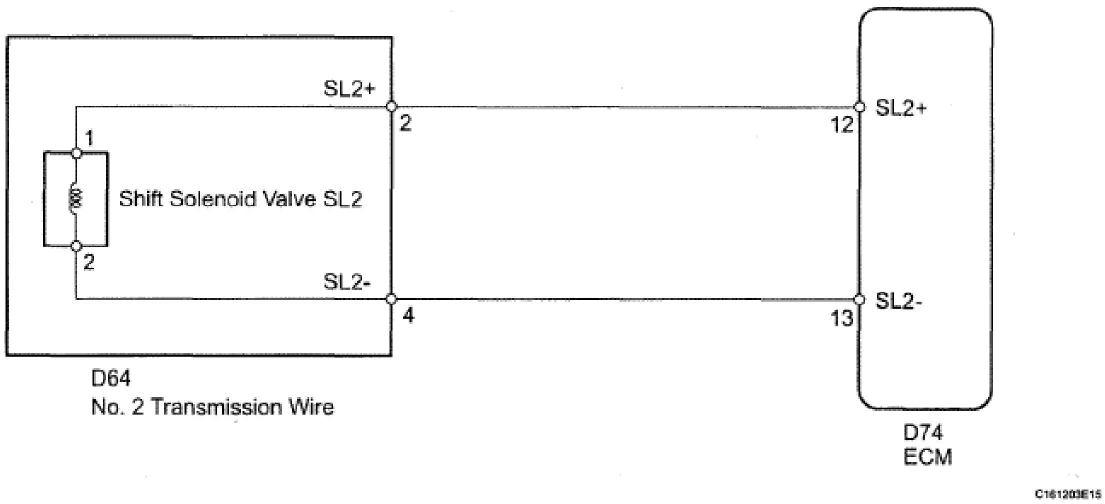

Fig. 65: Shift Solenoid Valve SL2 - Wiring Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

HINT:

The shift solenoid valve SL2 is turned ON/OFF normally when the shift lever is on D:

SHIFT SOLENOID VALVE SL2 OPERATION CHART

ECM gear shift command	1st	2nd	3rd	4th	5th	6th
Shift solenoid valve SL2	ON	ON	ON	ON	OFF	OFF

1. **INSPECT NO. 2 TRANSMISSION WIRE (SHIFT SOLENOID VALVE SL2)**
   a. Disconnect the D64 No. 2 transmission wire connector.
   b. Measure the resistance according to the value (s) in the table below.

   Standard resistance

NO. 2 TRANSMISSION WIRE (SHIFT SOLENOID VALVE SL2) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
2 (SL2+) - 4 (SL2-)	20°C (68°F)	5.0 to 5.6 ohms
2 (SL2+) - Body ground	Always	10 kohms or higher
4 (SL2-) - Body ground	Always	10 kohms or higher

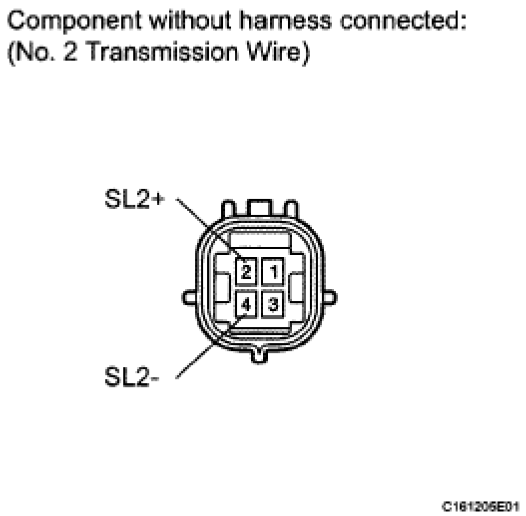

Fig. 66: Identifying D64 No. 2 Transmission Wire Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: Go to step 3

OK: Go to next step

2. **CHECK HARNESS AND CONNECTOR (NO. 2 TRANSMISSION WIRE - ECM)**
   a. Disconnect the D74 ECM connector.
   b. Measure the resistance according to the value (s) in the table below.

   Standard resistance

HARNESS AND CONNECTOR (NO. 2 TRANSMISSION WIRE - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D74-12 (SL2+) - D74-13 (SL2-)	20°C (68°F)	5.0 to 5.6 ohms
D74-12 (SL2+) - Body ground	Always	10 kohms or higher
D74-13 (SL2-) - Body ground	Always	10 kohms or higher

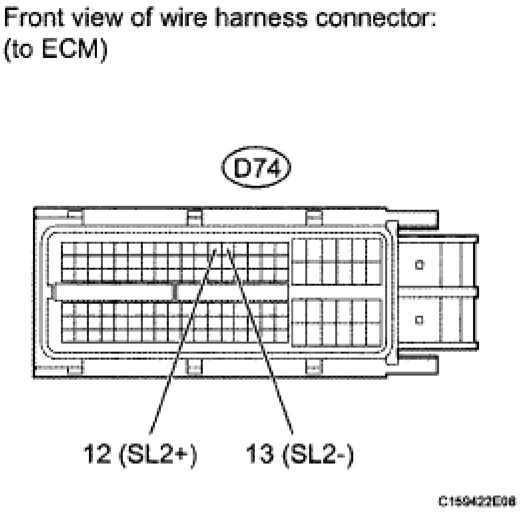

Fig. 67: Identifying D74 ECM Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE ECM (See **REMOVAL**)

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

   SHIFT SOLENOID VALVE SL2 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	5.0 to 5.6 ohms

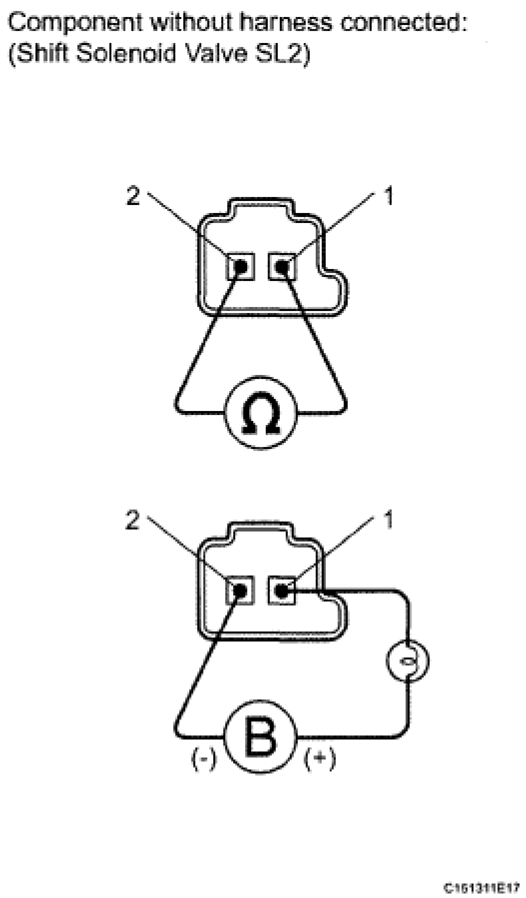

Fig. 68: Identifying Shift Solenoid Valve SL2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Connect the battery's positive (+) lead with a 21 W bulb to terminal 1 and the negative (-) lead to terminal 2 of the solenoid valve connector. Then check that the valve moves and makes an operating noise.

OK: Valve moves and makes an operating noise.

NG: REPLACE SHIFT SOLENOID VALVE SL2 (see **REMOVAL**)

OK: REPAIR OR REPLACE NO. 2 TRANSMISSION WIRE (see **REMOVAL**)

DTC P0781 1-2 SHIFT (1-2 SHIFT VALVE)

DESCRIPTION

The 1-2 shift valve performs shifting to 1st gear and other gears. When shifting to 2nd and 4th gears is impossible, or when the ECM directs the gearshift to switch to 5th and 6th gear and the engine overruns (clutch slips), this DTC is output.

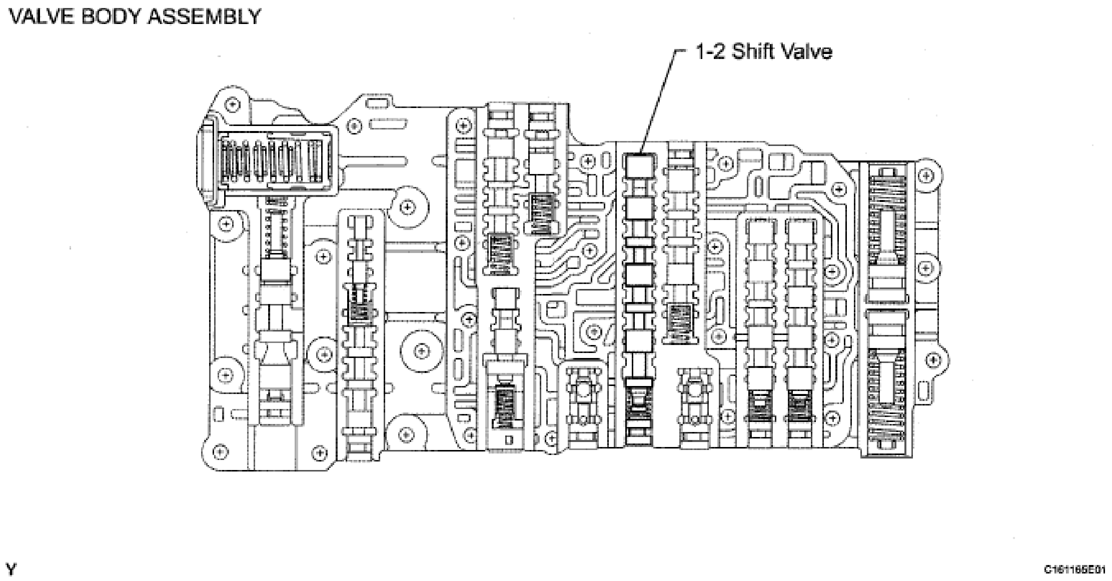

Fig. 69: Identifying 1-2 Shift Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0781	When conditions (a) and (b), or (a) and (c) are met. (2-trip detection logic) a. When the ECM directs the gearshift to switch to 2nd gear, the actual gear is shifted to 1st. b. When the ECM directs the gearshift to switch to 4th gear, the actual gear is shifted to 3rd. c. When the ECM directs the gearshift to switch to 5th gear, the engine overruns (clutch slips).	• Valve body is blocked up or stuck (1-2 shift valve) • Shift solenoid valve SLT remains open or closed • Automatic transmission (clutch, brake or gear, etc.)

HINT:

- Gear positions in the event of a solenoid valve mechanical problem:

GEAR POSITIONS REFERENCE

ECM command gearshift	1st	2nd	3rd	4th	5th	6th
Actual gear position under malfunction	1st	1st	3rd	3rd	N(1)	N(1)
(1) Neutral						

- Gear position during fail-safe operation:

  If any malfunction is detected, the ECM changes into the fail-safe mode to shift into the gear positions as shown in the table below.

GEAR POSITIONS REFERENCE

Gear position under normal conditions	1st	2nd	3rd	4th	5th	6th
Actual gear position under fail-safe mode	1st(1)	1st(1)	3rd	3rd	3rd	3rd
(1) Under engine braking, downshifting to 1st or 2nd gear is prohibited.						

MONITOR DESCRIPTION

This DTC indicates that the 1-2 shift valve in the valve body is locked in the direction the spring compresses.

The ECM commands gear shifts by turning the shift solenoid valves "ON/OFF" and switching oil pressure to the valves in the valve body.

The ECM calculates the "actual" transmission gear by comparing the signals from the input speed sensor (NT) and the output speed sensor (SP2). The ECM can detect many mechanical problems in the shift solenoids, valve body, transmission clutches, brakes, and gears. If the ECM detects that the actual gear position and the commanded gear position are different, it will illuminate the MIL and store the DTC.

MONITOR STRATEGY

MONITOR STRATEGY REFERENCE

Related DTCs	P0781: Valve body/Rationality check
Required sensors/Components	Valve body, Automatic transmission assembly
Frequency of operation	Continuous
Duration	Condition (A) and (B) 0.4 sec. Condition (C) 3 sec. Condition (D) 1 sec.
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

ALL

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	P0500 (VSS) P0748 - P0798 (Trans solenoid (range))
Turbine speed sensor circuit	Not circuit malfunction
Output speed sensor circuit	Not circuit malfunction
Shift solenoid valve S1 circuit	Not circuit malfunction
Shift solenoid valve S2 circuit	Not circuit malfunction
Shift solenoid valve S3 circuit	Not circuit malfunction
Shift solenoid valve S4 circuit	Not circuit malfunction
Shift solenoid valve SR circuit	Not circuit malfunction

Shift solenoid valve SL1 circuit	Not circuit malfunction
Shift solenoid valve SL2 circuit	Not circuit malfunction
ECT (Engine coolant temperature) sensor circuit	Not circuit malfunction
KCS sensor circuit	Not circuit malfunction
ETCS (Electric Throttle Control System)	Not system down
Transmission position	"D"
Duration time from shifting "N" to "D"	4 sec. or more
ECT	40°C (104°F) or more
Spark advance from max. retard timing by KCS control	0° crankshaft angle or more
Engine	Starting

Transfer position is 4WD HIGH*

TYPICAL ENABLING CONDITIONS

Vehicle speed sensor circuit	Not circuit malfunction
Output shaft speed sensor circuit	Not circuit malfunction
Transfer output speed	143 rpm or more
NO/NOtf (Transfer input speed/Transfer output speed)	0.9 to 1.1

HINT:

*: This condition only applies to 4WD.

Condition (A)

TYPICAL ENABLING CONDITIONS

ECM selected gear	2nd
Vehicle speed	2 km/h (1.2 mph) or more
Output speed	2nd --> 1st down-shift point or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

Condition (B)

TYPICAL ENABLING CONDITIONS

ECM selected gear	4th
Vehicle speed	2 km/h (1.2 mph) or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

Condition (C)

TYPICAL ENABLING CONDITIONS

Current ECM selected gear	5th
Last ECM selected gear	4th
Vehicle speed (During transition from 4th to 5th gear)	Less than 100 km/h (62.2 mph)

Condition (D)

TYPICAL ENABLING CONDITIONS

ECM selected gear	5th
Engine speed - Turbine speed (NE - NT) (After transition to 5th gear)	150 rpm or less
Vehicle speed (After transition to 5th gear)	Less than 100 km/h (62.2 mph)

TYPICAL MALFUNCTION THRESHOLDS

Both of the following conditions are met: Condition (A), and Condition (B), (C) or (D)

Condition (A)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	3.11 or more, and 7.58 or less (This means actual gear is 1st)

Condition (B)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	1.24 or more, and 1.49 or less (This means actual gear is 3rd)

Condition (C)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed - Output speed x 4th gear ratio (NT - NO x 4th gear ratio)	1000 rpm or more

Condition (D)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed - Output speed x 5th gear ratio (NT - NO x 5th gear ratio)	1000 rpm or more

INSPECTION PROCEDURE

1. **CHECK DTC OUTPUT (IN ADDITION TO DTC P0781)**
    a. Connect the intelligent tester or Techstream to the DLC3.
    b. Turn the ignition switch ON and push the tester switch ON.
    c. Enter the following menus:
        1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / DTC INFO / CURRENT CODES.
        2. Techstream - Select: Powertrain / Engine and ECT / Trouble Codes.
    d. Read the DTCs using the tester.

    Result

    DTC OUTPUT RESULT

Display (DTC output)	Proceed to
Only P0781 is output	A
P0781 and other DTCs are output	B

HINT:

If any other codes besides P0781 are output, perform troubleshooting for those DTCs first.

B: Go TO DTC CHART (see **DIAGNOSTIC TROUBLE CODE CHART**)

A: Go to next step

2. **PERFORM ACTIVE TEST BY INTELLIGENT TESTER OR TECHSTREAM (RUNNING TEST)**

HINT:

Using the intelligent tester or Techstream to perform Active Tests 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 Tests early in troubleshooting is one way to save diagnostic time. Data List information can be displayed while performing Active Tests.

a. Warm up the engine.
b. Turn the ignition switch OFF.
c. Connect the intelligent tester or Techstream to the DLC3.
d. Turn the ignition switch ON and push the tester switch ON.
e. Enter the following menus:
    1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / ACTIVE TEST.
    2. Techstream - Select: Powertrain / Engine and ECT / Active Test.
f. Follow the instructions on the tester and perform the Active Test.

HINT:

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

Comparing the shift position commanded by the Active Test with the actual shift position enables you to confirm the problem (see **CHECK MODE PROCEDURE**).

1. Intelligent tester

ECT:

INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
SHIFT	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--"	Possible to check operation of shift solenoid valves [Vehicle Condition]

		button: Shift down	50 km/h (30 mph) or less

2. Techstream

ECT:

TECHSTREAM ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
Control the Shift Position	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less

HINT:

- This test can be conducted when the vehicle speed is 50 km/h (30 mph) or less.
- The 4th to 5th and 5th to 6th up-shift must be performed with the accelerator pedal released.
- The 6th to 5th and 5th to 4th down-shift must be performed with the accelerator pedal released.
- Do not operate the accelerator pedal for at least 2 seconds after shifting and do not shift successively.
- The shift position commanded by the ECM is shown in the Data List display on the tester.
- Gear positions in the event of a solenoid valve mechanical problem:

GEAR POSITIONS REFERENCE

Tester command gearshift	1st	2nd	3rd	4th	5th	6th
Actual gear position under malfunction	1st	1st	1st	3rd	N(1)	N(1)
(1) Neutral						

OK: Gear position changes in accordance with the tester command.

NG: REPAIR OR REPLACE TRANSMISSION VALVE BODY ASSEMBLY (see **REMOVAL**)

OK: Go to next step

3. **PERFORM ACTIVE TEST BY INTELLIGENT TESTER OR TECHSTREAM (SHIFT SOLENOID VALVE SLT)**

NOTE:

- **Perform the test at the normal operating ATF temperature: 50 to**

80°C (122 to 176°F).

- **Be careful to prevent SSTs hose from interfering with the exhaust pipe.**
- **Perform the test with the A/C OFF.**

HINT:

Using the intelligent tester or Techstream to perform Active Tests 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 Tests early in troubleshooting is one way to save diagnostic time. Data List information can be displayed while performing Active Tests.

a. Remove the test plug on the transmission case center right side and connect SST.

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

b. Connect the intelligent tester or Techstream to the DLC3.
c. Start the engine and warm it up.
d. Measure the line pressure with SST.
e. Turn the tester ON.
f. Enter the following menus:
   1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / ACTIVE TEST.
   2. Techstream - Select: Powertrain / Engine and ECT / Active Test.
g. Follow the instructions on the tester and perform the Active Test.
h. Measure the line pressure.
   1. Intelligent tester

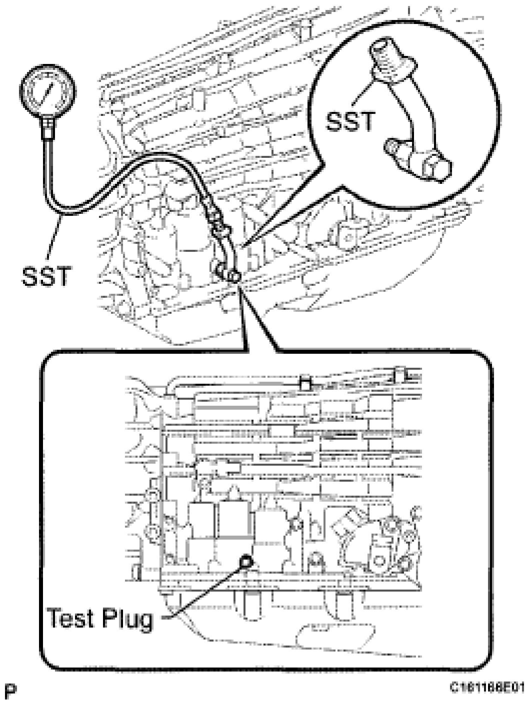

Fig. 70: Identifying Test Plug And SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ECT:

INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
SOLENOID (SLT)*	Operate the shift solenoid SLT and raise line pressure	ON or OFF HINT: • OFF: Line pressure up (when Active Test "SOLENOID (SLT)" is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	[Vehicle Condition] • Vehicle stopped • Engine idling
HINT: *: SOLENOID (SLT) in the Active Test is performed to check the line pressure changes by connecting SST to the automatic transmission, which is used in the Hydraulic Test (see **HYDRAULIC TEST**) as well. Please note that the pressure values in the Active Test and Hydraulic Test are different.			

2. Techstream

ECT:

TECHSTREAM ECT ACTIVE TEST REFERENCE

Tester	Test Part	Control Range	Diagnostic

Display			Note
Activate the Solenoid (SLT)*	Operate the shift solenoid SLT and raise line pressure	ON or OFF HINT: • OFF: Line pressure up (when Active Test "Activate the Solenoid (SLT)" is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	[Vehicle Condition] • Vehicle stopped • Engine idling
HINT: *: Activate the Solenoid (SLT) in the Active Test is performed to check the line pressure changes by connecting SST to the automatic transmission, which is used in the Hydraulic Test (see **HYDRAULIC TEST**) as well. Please note that the pressure values in the Active Test and Hydraulic Test are different.			

OK: The line pressure changes as specified when performing the Active Test.

NG: REPLACE SHIFT SOLENOID VALVE SLT (see **DISASSEMBLY**)

OK: Go to next step

4. **CLEAR DTC AND PERFORM RUNNING TEST**
   a. Clear the DTC (see **DTC CHECK / CLEAR**).
   b. Check the DTC again after conducting the MONITOR DRIVE PATTERN (see **INITIALIZATION**).

   OK: No DTC code

NG: REPAIR OR REPLACE TRANSMISSION VALVE BODY ASSEMBLY (see **REMOVAL**)

OK: END

DTC P0818 DRIVELINE DISCONNECT SWITCH INPUT CIRCUIT

DESCRIPTION

The ECM detects the signal from the transfer neutral position switch.

This DTC indicates that the transfer neutral position switch remains ON.

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0818	Transfer neutral position switch remains ON while vehicle is running under following conditions for 30 sec. (2 trip detection logic):	• Short in transfer neutral position switch circuit • Transfer neutral

	• Vehicle speed is 25 km/h (16 mph) or more • Transfer shift lever is on H	position switch • ECM

MONITOR DESCRIPTION

The ECM detects whether or not the transfer shift lever is in neutral by monitoring the signal from the transfer neutral position switch.

If the ECM detects that the transfer shift lever is in neutral under the following conditions, the ECM will conclude that there is a malfunction of the transfer neutral position switch, illuminate the MIL and store the DTC:

- Transfer neutral position switch indicates that the transfer shift lever is in neutral.
- Transfer shift lever is in the "H" position.
- The vehicle is being driven at 25 km/h (16 mph) or more.
- The transfer neutral position switch has been ON for more than 30 seconds.

MONITOR STRATEGY

MONITOR STRATEGY REFERENCE

Related DTCs	P0818: Transfer neutral position switch/Verify switch cycling
Required sensors/Components	Transfer neutral position switch, Vehicle speed sensor
Frequency of operation	Continuous
Duration	30 sec.
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None
Vehicle speed	25 km/h (15.54 mph) or more
Transfer position	High
Battery voltage	8 V or more
Ignition switch	ON
Starter	OFF

TYPICAL MALFUNCTION THRESHOLDS

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Transfer neutral switch signal	ON

WIRING DIAGRAM

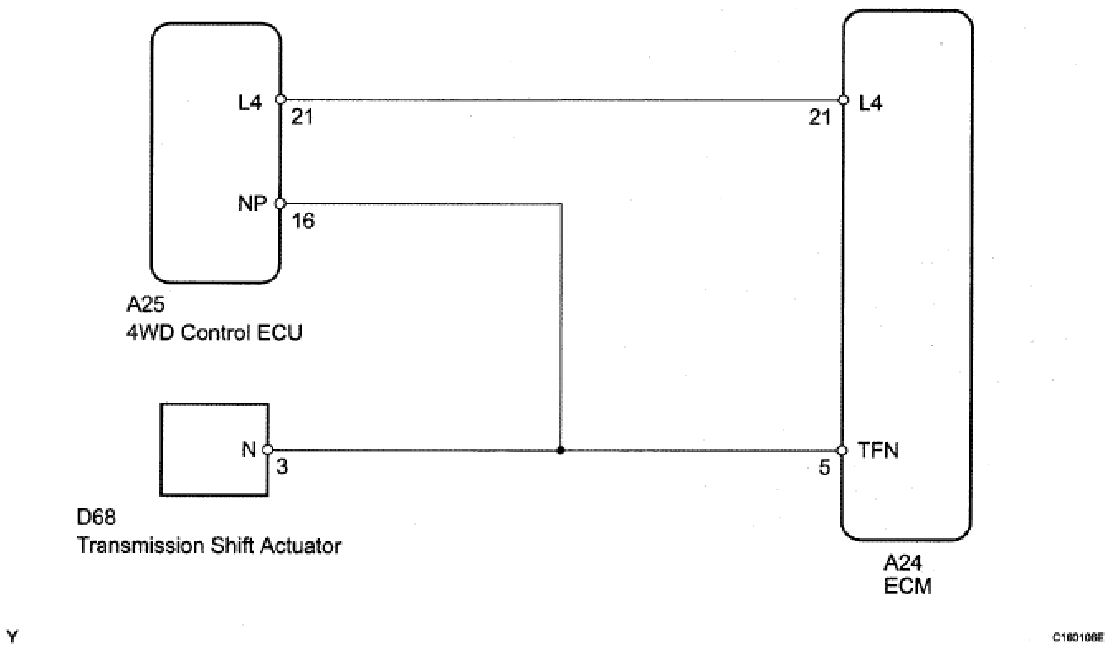

Fig. 71: Driveline Disconnect Switch - Wiring Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

1. **CHECK HARNESS AND CONNECTOR (TRANSFER SHIFT ACTUATOR - BODY GROUND)**
   a. Disconnect the D68 transfer shift actuator connector.
   b. Measure the resistance according to the value (s) in the table below.

Standard resistance

HARNESS AND CONNECTOR (TRANSFER SHIFT ACTUATOR - BODY GROUND) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D68-3 (N) - Body ground	Always	10 kohms or higher

Result

HARNESS AND CONNECTOR (TRANSFER SHIFT ACTUATOR - BODY GROUND) RESULT CHART

Result	Proceed to
NG	A
OK	B

B: Go TO TOUCH SELECT 2-4 AND HIGH-LOW SYSTEM (See ON-VEHICLE INSPECTION)

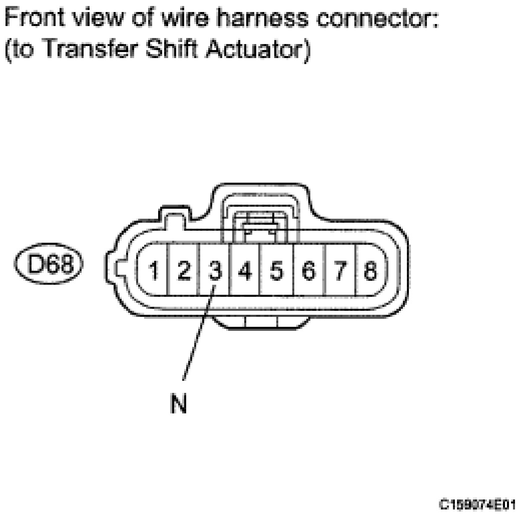

Fig. 72: Identifying Terminal N Of D68 Transfer Shift Actuator Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

A: Go to next step

2. **CHECK HARNESS AND CONNECTOR (4WD CONTROL ECU - BODY GROUND)**
   a. Disconnect the A25 4WD control ECU connector.
   b. Disconnect the D68 transfer shift actuator connector.
   c. Measure the resistance according to the value (s) in the table below.

   Standard resistance

   HARNESS AND CONNECTOR (4WD CONTROL ECU - BODY GROUND) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
A25-16 (NP) - Body ground	Always	10 kohms or higher

   Result

   HARNESS AND CONNECTOR (4WD CONTROL ECU - BODY GROUND) RESULT CHART

Result	Proceed to
NG	A
OK	B

B: Go TO TOUCH SELECT 2-4 AND HIGH-LOW SYSTEM (See **TERMINALS OF ECU**)

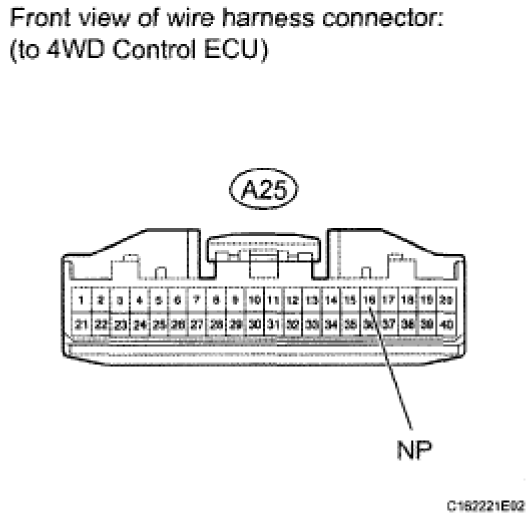

Fig. 73: Identifying Terminal NP Of A25 4WD Control ECU Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

A: Go to next step

3. **CHECK HARNESS AND CONNECTOR (TRANSFER SHIFT ACTUATOR, 4WD CONTROL ECU - ECM)**
   a. Disconnect the A24 ECM connector.
   b. Disconnect the D68 transfer shift actuator connector.
   c. Disconnect the A25 4WD control ECU connector.
   d. Measure the resistance according to the value (s) in the table below.

   Standard resistance

   HARNESS AND CONNECTOR (TRANSFER SHIFT ACTUATOR, 4WD CONTROL ECU - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
A24-5 (TFN) - Body ground	Always	10 kohms or higher

   Result

   HARNESS AND CONNECTOR (TRANSFER SHIFT ACTUATOR, 4WD CONTROL ECU - ECM) RESULT CHART

Result	Proceed to
OK	A
NG	B

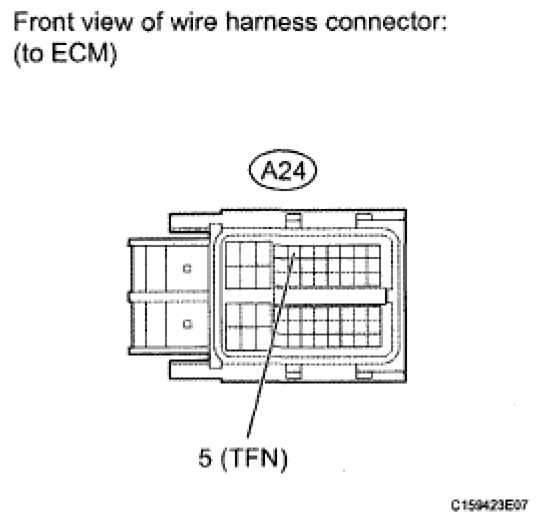

Fig. 74: Identifying Terminal 5 (TFN) Of A24 ECM Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

B: REPAIR OR REPLACE HARNESS OR CONNECTOR

A: REPLACE ECM (See REMOVAL)

DTC P0894 TRANSMISSION COMPONENT SLIPPING; DTC P2714 PRESSURE CONTROL SOLENOID "D" PERFORMANCE (SHIFT SOLENOID VALVE SLT)

DESCRIPTION

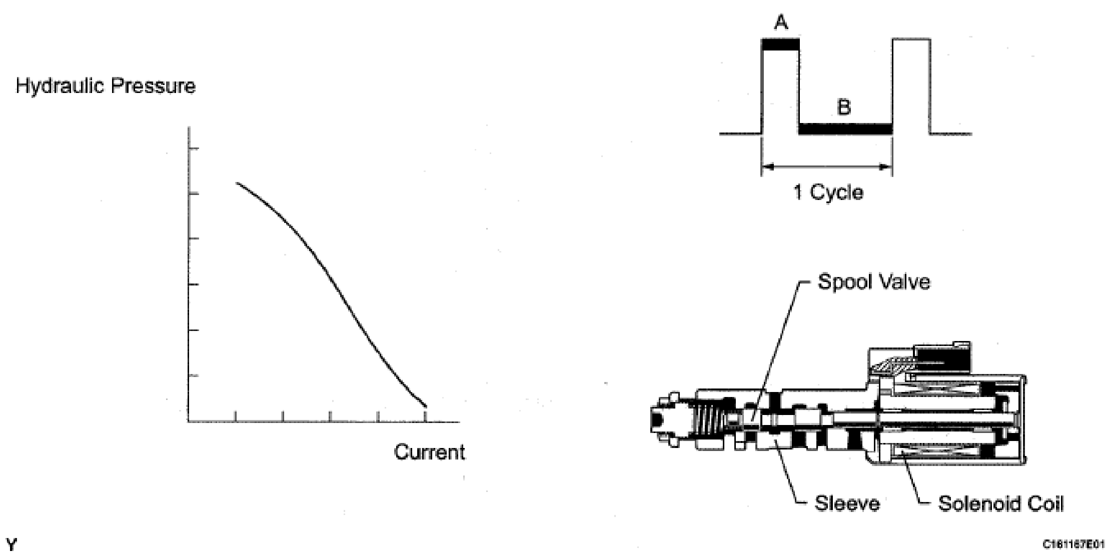

Fig. 75: Identifying Shift Solenoid Valve Components With Current Flow Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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 the hydraulic line pressure coming from the primary regulator valve. Appropriate line pressure assures smooth shifting with varying engine outputs.

HINT:

*: The duty ratio is the ratio of the current ON time (A) to the total of the current ON and OFF time (A + B).
Duty Ratio (%) = A / (A + B) x 100

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0894	The ECM detects a malfunction on SLT, S1, S2, S3, S4, SL2, gear 6 incorrect ratio (sequence valve) or 1-2 shift solenoid valve according to the revolution difference of the turbine and the output shaft, and also by the oil pressure. (2-trip detection logic)	• Shift solenoid valve SLT remains open or closed • Shift solenoid valve S1, S2, S3, S4 or SL2 remains open or closed • Gear 6 incorrect ratio (sequence valve) or 1-2 shift valve is stuck • Valve body is blocked • Automatic transmission (clutch, brake, gear, etc.)
P2714	The ECM detects a malfunction on SLT (ON side) according to the revolution difference of the turbine and the output shaft, and also by the oil pressure (2 trip detection logic)	• Shift solenoid valve SLT remains open or closed • Shift solenoid valve S1, S2, S3, S4 or SL2 remains open or closed • Gear 6 incorrect ratio (sequence valve) or 1-2 shift valve is stuck • Valve body is blocked • Automatic transmission (clutch, brake, gear, etc.)

MONITOR DESCRIPTION

The ECM calculates the amount of heat absorbed by the friction material based on the difference in revolution (clutch slippage) between the turbine and output shaft. The ECM illuminates the MIL and outputs this DTC when the amount of heat absorption exceeds the specified value.

There are two causes of revolution difference.

- When the shift solenoid valve SLT remains ON, oil pressure decreases, which causes the clutch engagement force to decrease.
- When the shift solenoid valve remains ON or OFF, the gear position commanded by the ECM and the actual gear position are not the same.

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

MONITOR STRATEGY

MONITOR STRATEGY REFERENCE

Related DTCs	P0894: Automatic transmission slip malfunction P2714: Shift solenoid valve SLT/ON malfunction
Required sensors/Components	Shift solenoid valve SLT
Frequency of operation	Continuous
Duration	P0894 ON malfunction (A): Immediately P0894 ON malfunction (B): 0.4 sec. P2714: Immediately
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

ALL

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None
Turbine speed sensor circuit	Not circuit malfunction
Output speed sensor circuit	Not circuit malfunction
ATF temperature sensor circuit	Not circuit malfunction
Shift solenoid valve S1 circuit	Not circuit malfunction
Shift solenoid valve S2 circuit	Not circuit malfunction
Shift solenoid valve S3 circuit	Not circuit malfunction
Shift solenoid valve S4 circuit	Not circuit malfunction
Shift solenoid valve SR circuit	Not circuit malfunction
Shift solenoid valve SL1 circuit	Not circuit malfunction
Shift solenoid valve SL2 circuit	Not circuit malfunction
Shift solenoid valve SLT circuit	Not circuit malfunction
ECT (Engine coolant temperature) sensor circuit	Not circuit malfunction
KCS sensor circuit	Not circuit malfunction
ETCS (Electric Throttle Control System)	Not system down
Transmission position	"D"
Duration time from shifting "N" to "D"	4 sec. or more
ECT	40°C (104°F) or more
Spark advance from max. retard timing by KCS control	0° crankshaft angle or more
Engine	Starting

Transfer position is 4WD HIGH*

TYPICAL ENABLING CONDITIONS

Vehicle speed sensor circuit	Not circuit malfunction

Output shaft speed sensor circuit	Not circuit malfunction
Transfer output speed	143 rpm or more
NO/NOtf (Transfer input speed/Transfer output speed)	0.9 to 1.1

HINT:

*: This condition only applies to 4WD.

TYPICAL MALFUNCTION THRESHOLDS

[P0894: ON malfunction]

When either condition below is met: OFF malfunction (A) or (B)

ON malfunction (A)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Summation of C1 clutch heat generations	Specified value

ON malfunction (B)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Summation of C2 clutch heat generations	Specified value
Actual gear for SLT failure judgment	Not determined

[P2714: ON malfunction]

One of the following conditions is met: ON malfunction (A), (B), (C), (D), (E), (F), (G) or (H)

ON malfunction (A)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Summation of C1 clutch heat generations	Specified value

ON malfunction (B)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve S1 OFF malfunction	Detected

ON malfunction (C)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve S2 OFF malfunction	Detected

ON malfunction (D)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve S3 ON malfunction	Detected

ON malfunction (E)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve S4 OFF malfunction	Detected

ON malfunction (F)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

1-2 shift valve malfunction	Detected

ON malfunction (G)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Sequence valve malfunction	Detected

ON malfunction (H)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve SL2 ON malfunction	Detected

INSPECTION PROCEDURE

1. **CHECK DTC OUTPUT (IN ADDITION TO DTCS P0894 AND P2714)**
   a. Connect the intelligent tester or Techstream to the DLC3.
   b. Turn the ignition switch ON and push the tester switch ON.
   c. Enter the following menus:
      1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / DTC INFO / CURRENT CODES.
      2. Techstream - Select: Powertrain / Engine and ECT / Trouble Codes.
   d. Read the DTCs using the tester.

   Result

   DTC OUTPUT RESULT

Display (DTC output)	Proceed to
• Only P0894 is output • Only P0894 and P2714 are output	A
P0894, P2714 and other DTCs are output	B

   HINT:

   If any other codes besides P0894 and P2714 are output, perform troubleshooting for those DTCs first.

B: Go TO DTC CHART (see **DIAGNOSTIC TROUBLE CODE CHART**)

A: Go to next step

2. **PERFORM ACTIVE TEST BY INTELLIGENT TESTER OR TECHSTREAM (SHIFT SOLENOID VALVE SLT)**

NOTE:

- **Perform the test at the normal operating ATF temperature: 50 to 80°C (122 to 176°F).**
- **Be careful to prevent SST's hose from interfering with the exhaust pipe.**
- **Perform the test with the A/C OFF.**

HINT:

Using the intelligent tester or Techstream to perform Active Tests 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 Tests early in troubleshooting is one way to save diagnostic time. Data List information can be displayed while performing Active Tests.

a. Remove the test plug on the transmission case center right side and connect SST.

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

b. Connect the intelligent tester or Techstream to the DLC3.
c. Start the engine and warm it up.
d. Measure the line pressure with SST.
e. Turn the tester ON.
f. Enter the following menus:
   1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / ACTIVE TEST.
   2. Techstream - Select: Powertrain / Engine and ECT / Active Test.
g. Follow the instructions on the tester and perform the Active Test.
h. Measure the line pressure.

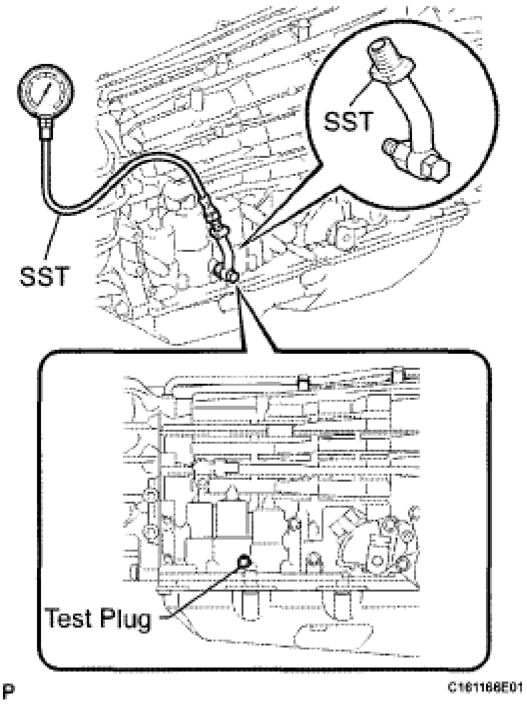

Fig. 76: Identifying Test Plug And SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Intelligent tester

   ECT:

   INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
SOLENOID (SLT)*	Operate the shift solenoid SLT and raise line pressure	ON or OFF HINT: • OFF: Line pressure up (when Active Test "SOLENOID (SLT)" is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	[Vehicle Condition] • Vehicle stopped • Engine idling
HINT: *: SOLENOID (SLT) in the Active Test is performed to check the line pressure changes by connecting SST to the automatic transmission, which is used in the Hydraulic Test (see **HYDRAULIC TEST**) as well. Please note that the pressure values in the Active Test and Hydraulic Test are different.			

2. Techstream

   ECT:

TECHSTREAM ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
Activate the Solenoid (SLT)*	Operate the shift solenoid SLT and raise line pressure	ON or OFF HINT: • OFF: Line pressure up (when Active Test "Activate the Solenoid (SLT)" is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	[Vehicle Condition] • Vehicle stopped • Engine idling
HINT: *: Activate the Solenoid (SLT) in the Active Test is performed to check the line pressure changes by connecting SST to the automatic transmission, which is used in the Hydraulic Test (see **HYDRAULIC TEST**) as well. Please note that the pressure values in the Active Test and Hydraulic Test are different.			

OK: The line pressure changes as specified when performing the Active Test.

NG: Go to step 9

OK: Go to next step

3. **PERFORM ACTIVE TEST BY INTELLIGENT TESTER OR TECHSTREAM (RUNNING TEST)**

CAUTION: This test should always be performed with at least 2 people.

a. Connect the intelligent tester or Techstream to the DLC3.
b. Clear the DTC (see **DTC CHECK / CLEAR**).
c. Enter the following menus:
    1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / ACTIVE TEST.
    2. Techstream - Select: Powertrain / Engine and ECT / Active Test.
d. Follow the instructions on the tester and perform the Active Test.

    HINT:

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

    1. Intelligent tester

    ECT:

    INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
SHIFT	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less

2. Techstream

ECT:

TECHSTREAM ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
Control the Shift Position	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less

HINT:

- This test can be conducted when the vehicle speed is 50 km/h (30 mph) or less.
- The 4th to 5th and 5th to 6th up-shift must be performed with the accelerator pedal released.
- The 6th to 5th and 5th to 4th down-shift must be performed with the accelerator pedal released.
- Do not operate the accelerator pedal for at least 2 seconds after shifting and do not shift successively.
- The shift position commanded by the ECM is shown in the Data List display on the tester.

e. Compare the ECM gear shift command and the actual gear position.

OK: Gear position changes in accordance with the tester command.

Result

RESULT CHART

ECM gear shift command			1st	2nd	3rd	4th	5th	6th	Proceed to
	Shift solenoid S1	Stuck ON*1	2nd	2nd	3rd	4th	5th	6th	A
		Stuck OFF	1st	1st	3rd	4th	5th	N*2	

Actual gear position under malfunction	Shift solenoid S2	Stuck ON	1st	2nd	2nd	4th	6th	6th	B
		Stuck OFF	3rd	3rd	3rd	4th	5th	5th	
	Shift solenoid S3	Stuck ON	1st	2nd	3rd	3rd	N*2	N*2	C
		Stuck OFF	3rd	4th	4th	4th	5th	6th	
	Shift solenoid S4	Stuck ON*3	1st	2nd	3rd	4th	5th	6th	D
		Stuck OFF	1st	2nd	3rd	4th	4th	4th	
Actual gear position when normal			1st	2nd	3rd	4th	5th	6th	E

HINT:

- *1: When shift solenoid S1 is stuck ON, the vehicle cannot drive in reverse.
- *2: Neutral
- *3: When shift solenoid S4 is stuck ON, gear shifting is normal.

B: Go to step 5

C: Go to step 6

D: Go to step 7

E: Go to step 9

A: Go to next step

4. **INSPECT SHIFT SOLENOID VALVE S1**
    a. Remove the shift solenoid valve S1.
    b. Measure the resistance according to the value (s) in the table below.

    Standard resistance

    SHIFT SOLENOID VALVE S1 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S1 connector terminal - Shift solenoid valve S1 body	20°C (68CF)	11 to 15 ohms

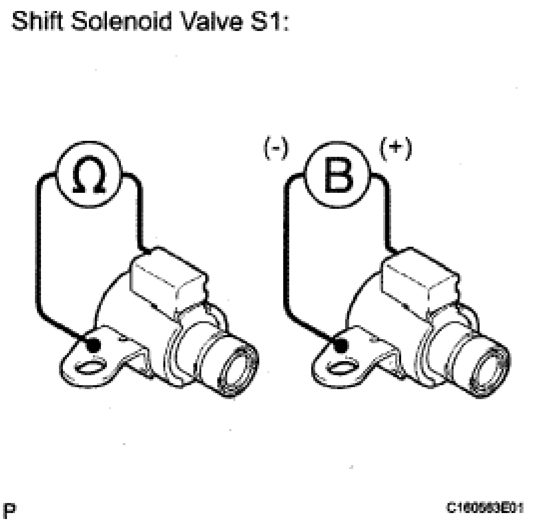

Fig. 77: Identifying Shift Solenoid Valve S1
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Connect the battery's positive (+) lead to the terminal of the solenoid valve connector, and the negative (-) lead to the solenoid valve body. Then check that the valve moves and makes an operating noise.

OK: Valve moves and makes an operating noise.

Result

SHIFT SOLENOID VALVE S1 RESULT CHART

Result	Proceed to
NG	A
OK	B

B: Go to step 10

A: REPLACE SHIFT SOLENOID VALVE S1 (see **DISASSEMBLY**)

5. **INSPECT SHIFT SOLENOID VALVE S2**
   a. Remove the shift solenoid valve S2.
   b. Measure the resistance according to the value (s) in the table below.

Standard resistance

SHIFT SOLENOID VALVE S2 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S2 connector terminal - Shift solenoid valve S2 body	20°C (68° F)	11 to 15 ohms

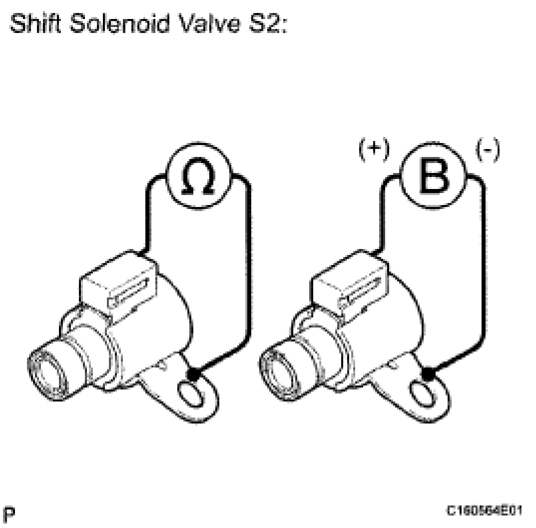

Fig. 78: Identifying Shift Solenoid Valve S2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Connect the battery's positive (+) lead to the terminal of the solenoid valve connector, and the negative (-) lead to the solenoid valve body. Then check that the valve moves and makes an operating noise.

OK: Valve moves and makes an operating noise.

Result

SHIFT SOLENOID VALVE S2 RESULT CHART

Result	Proceed to
NG	A
OK	B

B: Go to step 10

A: REPLACE SHIFT SOLENOID VALVE S2 (see **DISASSEMBLY**)

6. **INSPECT SHIFT SOLENOID VALVE S3**
   a. Remove the shift solenoid valve S3.
   b. Measure the resistance according to the value (s) in the table below.

Standard resistance

SHIFT SOLENOID VALVE S3 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S3 connector terminal - Shift solenoid valve S3 body	20°C (68° F)	11 to 15 ohms

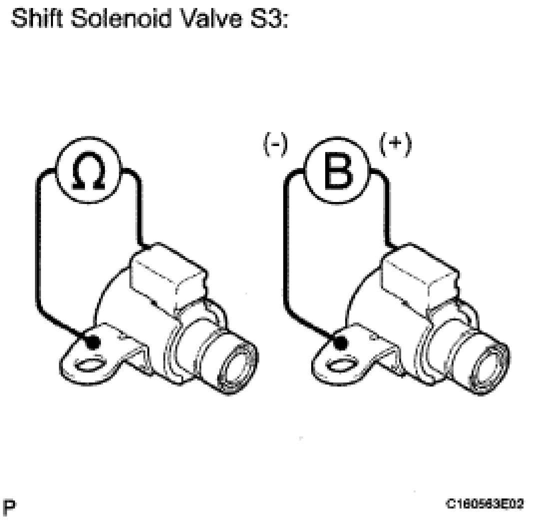

Fig. 79: Identifying Shift Solenoid Valve S3
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Connect the battery's positive (+) lead to the terminal of the solenoid valve connector, and the negative (-) lead to the solenoid valve body. Then check that the valve moves and makes an operating noise.

OK: Valve moves and makes an operating noise.

Result

SHIFT SOLENOID VALVE S3 RESULT CHART

Result	Proceed to
NG	A
OK	B

B: Go to step 10

A: REPLACE SHIFT SOLENOID VALVE S3 (see **DISASSEMBLY**)

7. **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

SHIFT SOLENOID VALVE S4 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S4 connector terminal - Shift solenoid valve S4 body	20°C (68° F)	11 to 15 ohms

c. Connect the battery's positive (+) lead to the terminal of the solenoid valve connector, and the negative (-) lead to the solenoid valve body. Then check that the valve moves and makes an operating noise.

OK: Valve moves and makes an operating noise.

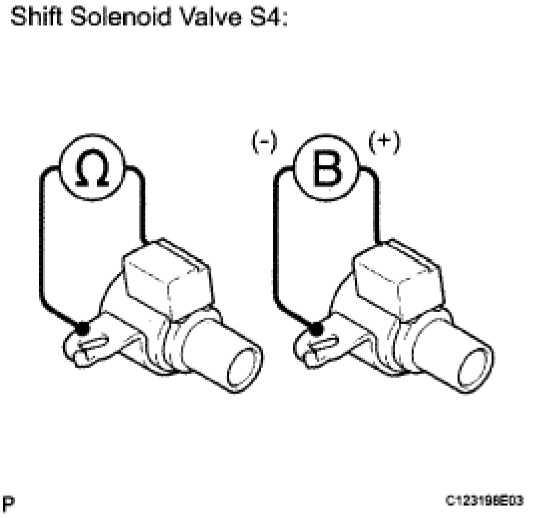

Fig. 80: Inspecting Shift Solenoid Valve S4
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPLACE SHIFT SOLENOID VALVE S4 (see **DISASSEMBLY**)

OK: Go to next step

8. **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

   SHIFT SOLENOID VALVE SL2 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	5.0 to 5.6 ohms

   c. Connect the battery's positive (+) lead with a 21 W bulb to terminal 1 and the negative (-) lead to terminal 2 of the solenoid valve connector. Then check that the valve moves and makes an operating noise.

   OK: Valve moves and makes an operating noise.

   Result

   SHIFT SOLENOID VALVE SL2 RESULT CHART

Result	Proceed to
NG	A
OK	B

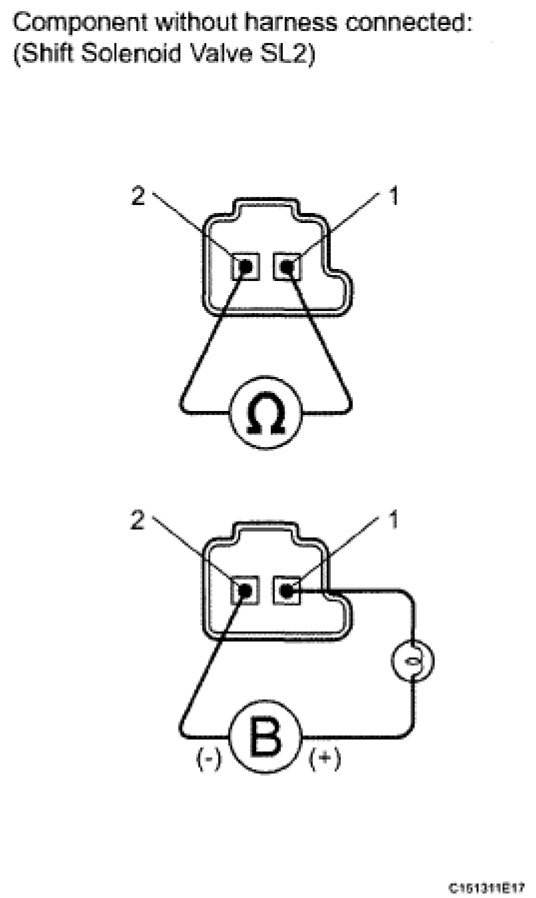

Fig. 81: Identifying Shift Solenoid Valve SL2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

B: Go to step 10

A: REPLACE SHIFT SOLENOID VALVE SL2 (see REMOVAL)

9. **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

   SHIFT SOLENOID VALVE SLT RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	5.0 to 5.6 ohms

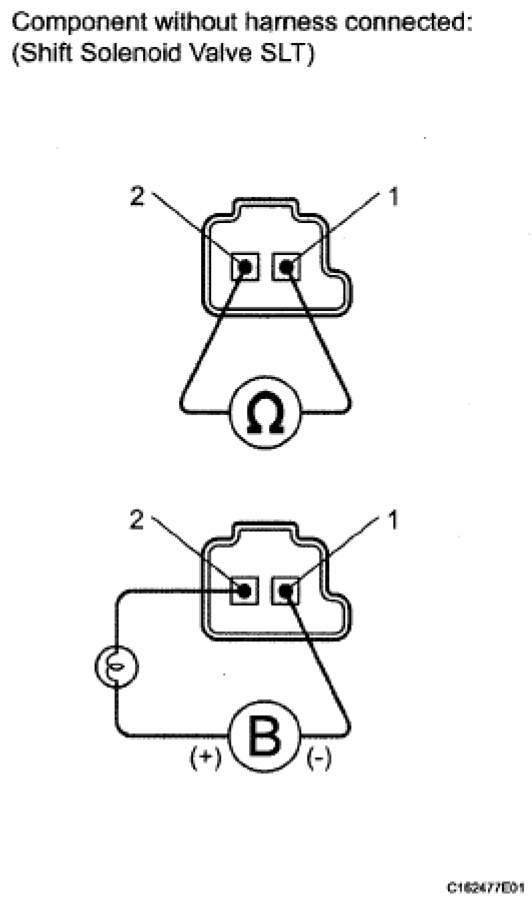

Fig. 82: Identifying Shift Solenoid Valve SLT
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Connect the battery's positive (+) lead with a 21 W bulb to terminal 2 and the negative (-) lead to terminal 1 of the solenoid valve connector. Then check that the valve moves and makes an operating noise.

OK: Valve moves and makes an operating noise.

NG: REPLACE SHIFT SOLENOID VALVE SLT (see **DISASSEMBLY**)

OK: Go to next step

10. **INSPECT TRANSMISSION VALVE BODY ASSEMBLY**
    a. Check the transmission valve body assembly (see **REMOVAL**).

    OK: There are no foreign objects on each valve.

NG: REPAIR OR REPLACE TRANSMISSION VALVE BODY ASSEMBLY (see **REMOVAL**)

OK: Go to next step

11. **INSPECT TORQUE CONVERTER CLUTCH ASSEMBLY**

a. Check the torque converter clutch assembly (see **TORQUE CONVERTER CLUTCH AND DRIVE PLATE**).

OK: The torque converter clutch operates normally.

NG: REPLACE TORQUE CONVERTER CLUTCH ASSEMBLY (see **REMOVAL**)

OK: REPAIR OR REPLACE AUTOMATIC TRANSMISSION ASSEMBLY (see **REMOVAL**)

DTC P0973 SHIFT SOLENOID "A" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE S1); DTC P0974 SHIFT SOLENOID "A" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE S1)

DESCRIPTION

Shifting from 1st to 6th is performed in combination with ON and OFF operation of the shift solenoid valves SL1, SL2, S1, S2, S3, S4 and SR, which are controlled by the ECM. If an open or short circuit occurs in any of the shift solenoid valves, the ECM controls the remaining normal shift solenoid valves to allow the vehicle to be operated safely. Also, the ECM stops sending the current to the open or short circuit solenoid (see **CHECK MODE PROCEDURE**).

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0973	ECM detects short in solenoid valve S1 circuit 2 times when solenoid valve S1 is operated (1 trip detection logic)	• Short in shift solenoid valve S1 circuit • Shift solenoid valve S1 • ECM
P0974	ECM detects open in solenoid valve S1 circuit 2 times when solenoid valve S1 is not operated (1 trip detection logic)	• Open in shift solenoid valve S1 circuit • Shift solenoid valve S1 • ECM

MONITOR DESCRIPTION

These DTCs indicate an open or short in the shift solenoid valve S1 circuit. When there is an open or short circuit in any shift solenoid valve circuit, the ECM detects the problem, illuminates the MIL and stores the DTC. When the shift solenoid valve S1 is ON, if its resistance is 8 ohms or less, the ECM determines there is a short in the shift solenoid valve S1 circuit.

When the shift solenoid valve S1 is OFF, if its resistance is 100 kohms or more, the ECM determines there is an open in the shift solenoid valve S1 circuit (see **CHECK MODE PROCEDURE**).

MONITOR STRATEGY

MONITOR STRATEGY REFERENCE

Related DTCs	P0973: Shift solenoid valve S1/Range check (Low resistance) P0974: Shift solenoid valve S1/Range check (High resistance)
Required sensors/Components	Shift solenoid valve S1

Frequency of operation	Continuous
Duration	0.128 sec. or more
MIL operation	1 driving cycle
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

All

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None

P0973: Range check (Low resistance)

TYPICAL ENABLING CONDITIONS

Shift solenoid valve S1	ON

P0974: Range check (High resistance)

TYPICAL ENABLING CONDITIONS

Shift solenoid valve S1	OFF

TYPICAL MALFUNCTION THRESHOLDS

P0973: Range check (Low resistance)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve S1 resistance	8 ohms or less

P0974: Range check (High resistance)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve S1 resistance	100 kohms or more

COMPONENT OPERATING RANGE

COMPONENT OPERATING RANGE

Shift solenoid valve S1 resistance	11 to15 ohms at 20°C (68°F)

WIRING DIAGRAM

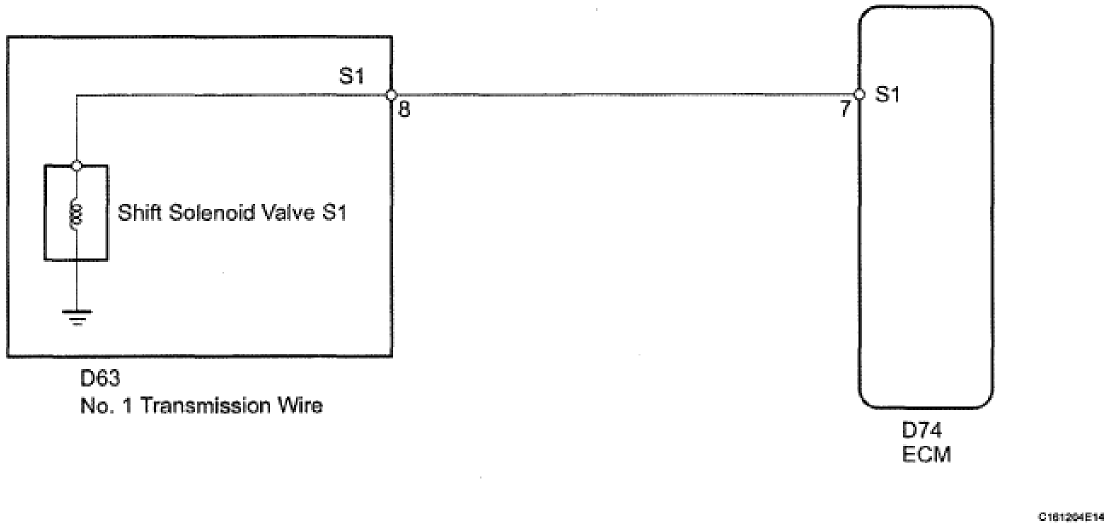

Fig. 83: Shift Solenoid Valve S1 - Wiring Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

HINT:

The shift solenoid valve S1 is turned ON/OFF normally when the shift lever is on D:

SHIFT SOLENOID VALVE S1 OPERATION CHART

ECM gear shift command	1st	2nd	3rd	4th	5th	6th
Shift solenoid valve S1	OFF	ON	ON	ON	ON	ON

1. **INSPECT NO. 1 TRANSMISSION WIRE (SHIFT SOLENOID VALVE S1)**
   a. Disconnect the D63 No. 1 transmission wire connector.
   b. Measure the resistance according to the value (s) in the table below.

      Standard resistance

      NO. 1 TRANSMISSION WIRE (SHIFT SOLENOID VALVE S1) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
8 (S1) - Body ground	20°C (68°F)	11 to 15 ohms

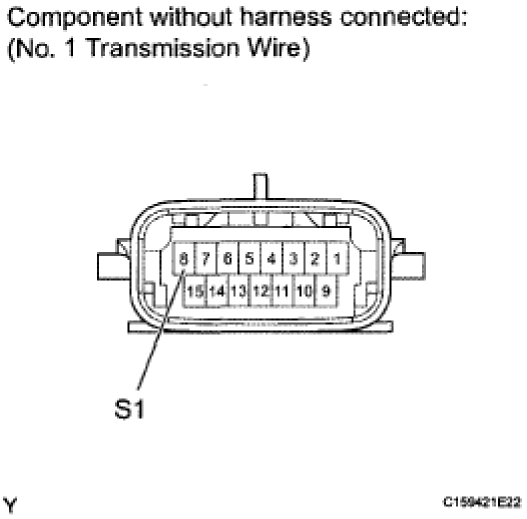

Fig. 84: Identifying Terminal S1 Of D63 No. 1 Transmission Wire Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: Go to step 3

OK: Go to next step

2. **CHECK HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE - ECM)**
   a. Disconnect the D74 ECM connector.
   b. Measure the resistance according to the value (s) in the table below.

   Standard resistance

   HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D74-7 (S1) - Body ground	20°C (68°F)	11 to 15 ohms

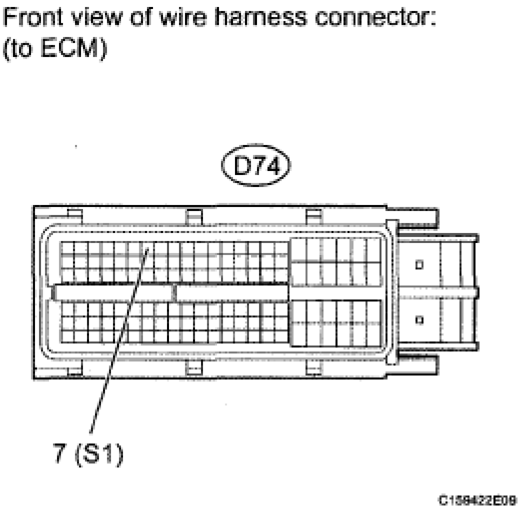

Fig. 85: Identifying Terminal 7 (S1) Of D74 ECM Connector

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

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE ECM (See REMOVAL)

3. **INSPECT SHIFT SOLENOID VALVE S1**
   a. Remove the shift solenoid valve S1.
   b. Measure the resistance according to the value (s) in the table below.

   Standard resistance

   SHIFT SOLENOID VALVE S1 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S1 connector terminal - Shift solenoid valve S1 body	20°C (68° F)	11 to 15 ohms

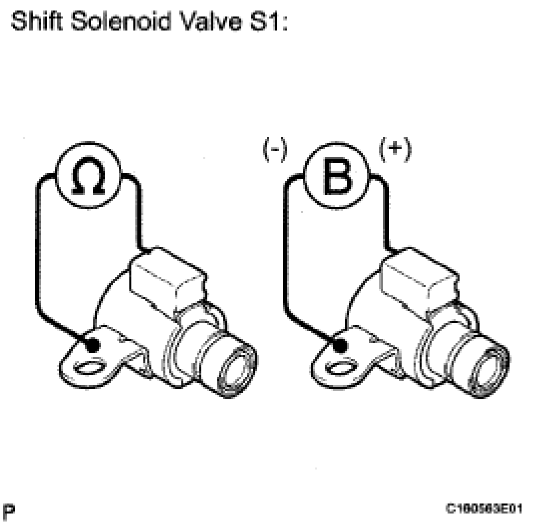

Fig. 86: Identifying Shift Solenoid Valve S1
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   c. Connect the battery's positive (+) lead to the terminal of the solenoid valve connector, and the negative (-) lead to the solenoid valve body. Then check that the valve moves and makes an operating noise.

   OK: Valve moves and makes an operating noise.

NG: REPLACE SHIFT SOLENOID VALVE S1 (see DISASSEMBLY)

OK: REPAIR OR REPLACE NO. 1 TRANSMISSION WIRE (see REMOVAL)

DTC P0976 SHIFT SOLENOID "B" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE S2); DTC P0977 SHIFT SOLENOID "B" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE S2)

DESCRIPTION

Shifting from 1st to 6th is performed in combination with ON and OFF operation of the shift solenoid valves SL1, SL2, S1, S2, S3, S4 and SR, which are controlled by the ECM. If an open or short circuit occurs in any of the shift solenoid valves, the ECM controls the remaining normal shift solenoid valves to allow the vehicle to be operated safely. Also, the ECM stops sending the current to the open or short circuit solenoid (see **CHECK MODE PROCEDURE**).

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0976	ECM detects short in solenoid valve S2 circuit 2 times when solenoid valve S2 is operated (1 trip detection logic)	• Short in shift solenoid valve S2 circuit • Shift solenoid valve S2 • ECM
P0977	ECM detects open in solenoid valve S2 circuit 2 times when solenoid valve S2 is not operated (1 trip detection logic)	• Open in shift solenoid valve S2 circuit • Shift solenoid valve S2 • ECM

MONITOR DESCRIPTION

These DTCs indicate an open or short in the shift solenoid valve S2 circuit. When there is an open or short circuit in any shift solenoid valve circuit, the ECM detects the problem, illuminates the MIL and stores the DTC. When the shift solenoid valve S2 is ON, if its resistance is 8 0 or less, the ECM determines there is a short in the shift solenoid valve S2 circuit.

When the shift solenoid valve S2 is OFF, if its resistance is 100 kohms or more, the ECM determines there is an open in the shift solenoid valve S2 circuit (see **CHECK MODE PROCEDURE**).

MONITOR STRATEGY

MONITOR STRATEGY REFERENCE

Related DTCs	P0976: Shift solenoid valve S2/Range check (Low resistance) P0977: Shift solenoid valve S2/Range check (High resistance)
Required sensors/Components	Shift solenoid valve S2
Frequency of operation	Continuous
Duration	0.128 sec. or more
MIL operation	1 driving cycle
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

All

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None

P0976: Range check (Low resistance)

TYPICAL ENABLING CONDITIONS

Shift solenoid valve S2	ON

P0977: Range check (High resistance)

TYPICAL ENABLING CONDITIONS

Shift solenoid valve S2	OFF

TYPICAL MALFUNCTION THRESHOLDS

P0976: Range check (Low resistance)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve S2 resistance	8 ohms or less

P0977: Range check (High resistance)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve S2 resistance	100 kohms or more

COMPONENT OPERATING RANGE

COMPONENT OPERATING RANGE

Shift solenoid valve S2 resistance	11 to 15 ohms at 20°C (68°F)

WIRING DIAGRAM

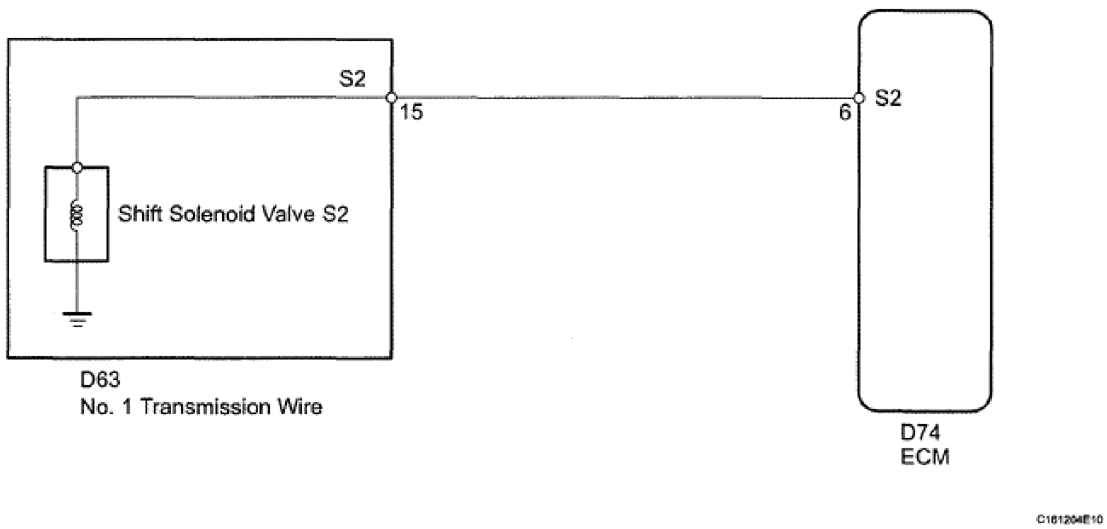

Fig. 87: Shift Solenoid Valve S2 - Wiring Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

HINT:

The shift solenoid valve S2 is turned ON/OFF normally when the shift lever is on D:

SHIFT SOLENOID VALVE S2 OPERATION CHART

ECM gear shift command	1st	2nd	3rd	4th	5th	6th
Shift solenoid valve S2	ON	ON	OFF	OFF	OFF	ON

1. **INSPECT NO. 1 TRANSMISSION WIRE (SHIFT SOLENOID VALVE S2)**
    a. Disconnect the D63 No. 1 transmission wire connector.
    b. Measure the resistance according to the value (s) in the table below.

    Standard resistance

    NO. 1 TRANSMISSION WIRE (SHIFT SOLENOID VALVE S2) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
15 (S2) - Body ground	20°C (68°F)	11 to 15 ohms

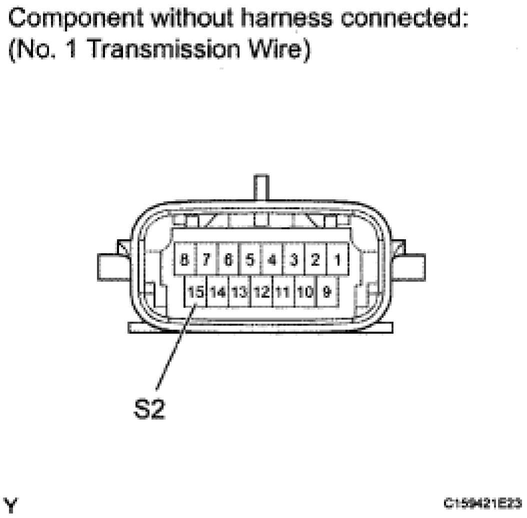

Fig. 88: Identifying Terminal S2 Of D63 No. 1 Transmission Wire Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: Go to step 3

OK: Go to next step

2. **CHECK HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE - ECM)**
    a. Disconnect the D74 ECM connector.
    b. Measure the resistance according to the value (s) in the table below.

    Standard resistance

    HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE - ECM) RESISTANCE

SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D74-6 (S2) - Body ground	20°C (68°F)	11 to 15 ohms

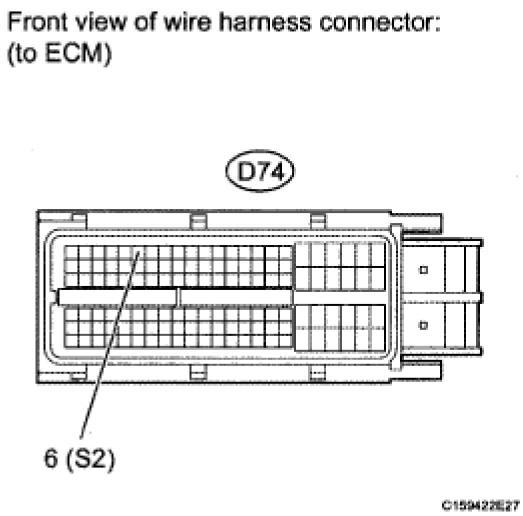

Fig. 89: Identifying Terminal 6 (S2) Of D74 ECM Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE ECM (See **REMOVAL**)

3. **INSPECT SHIFT SOLENOID VALVE S2**
   a. Remove the shift solenoid valve S2.
   b. Measure the resistance according to the value (s) in the table below.

Standard resistance

SHIFT SOLENOID VALVE S2 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S2 connector terminal - Shift solenoid valve S2 body	20°C (68°F)	11 to 15 ohms

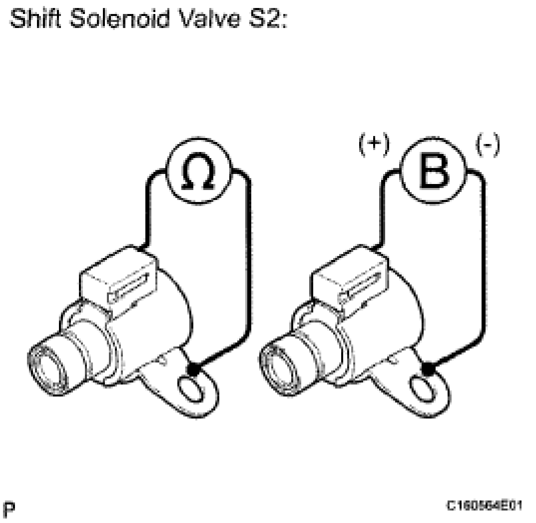

Fig. 90: Identifying Shift Solenoid Valve S2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Connect the battery's positive (+) lead to the terminal of the solenoid valve connector, and the negative (-) lead to the solenoid valve body. Then check that the valve moves and makes an operating noise.

OK: Valve moves and makes an operating noise.

NG: REPLACE SHIFT SOLENOID VALVE S2 (see **DISASSEMBLY**)

OK: REPAIR OR REPLACE NO. 1 TRANSMISSION WIRE (see **REMOVAL**)

DTC P0979 SHIFT SOLENOID "C" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE S3); DTC P0980 SHIFT SOLENOID "C" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE S3)

DESCRIPTION

Shifting from 1st to 6th is performed in combination with ON and OFF operation of the shift solenoid valves SL1, SL2, S1, S2, S3, S4 and SR, which are controlled by the ECM. If an open or short circuit occurs in any of the shift solenoid valves, the ECM controls the remaining normal shift solenoid valves to allow the vehicle to be operated safely. Also, the ECM stops sending the current to the open or short circuit solenoid (see **CHECK MODE PROCEDURE**).

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0979	ECM detects short in solenoid valve S3 circuit 2 times when solenoid valve S3 is operated (1 trip detection logic)	• Short in shift solenoid valve S3 circuit • Shift solenoid valve S3 • ECM
P0980	ECM detects open in solenoid valve S3 circuit 2 times when	• Open in shift solenoid valve S3 circuit

	solenoid valve S3 is not operated (1 trip detection logic)	• Shift solenoid valve S3 • ECM

MONITOR DESCRIPTION

These DTCs indicate an open or short in the shift solenoid valve S3 circuit. When there is an open or short circuit in any shift solenoid valve circuit, the ECM detects the problem, illuminates the MIL and stores the DTC. When the shift solenoid valve S3 is ON, if its resistance is 8 ohms or less, the ECM determines there is a short in the shift solenoid valve S3 circuit.

When the shift solenoid valve S3 is OFF, if its resistance is 100 kohms or more, the ECM determines there is an open in the shift solenoid valve S3 circuit (see **CHECK MODE PROCEDURE**).

MONITOR STRATEGY

MONITOR STRATEGY REFERENCE

Related DTCs	P0979: Shift solenoid valve S3/Range check (Low resistance) P0980: Shift solenoid valve S3/Range check (High resistance)
Required sensors/Components	Shift solenoid valve S3
Frequency of operation	Continuous
Duration	0.128 sec. or more
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

All

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None
Battery voltage	8 V or more
Ignition switch	ON
Starter	OFF

P0979: Range check (Low resistance)

TYPICAL ENABLING CONDITIONS

Shift solenoid valve S3	ON

P0980: Range check (High resistance)

TYPICAL ENABLING CONDITIONS

Shift solenoid valve S3	OFF

TYPICAL MALFUNCTION THRESHOLDS

P0979: Range check (Low resistance)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve S3 resistance	8 ohms or less

P0980: Range check (High resistance)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve S3 resistance	100 kohms or more

COMPONENT OPERATING RANGE

COMPONENT OPERATING RANGE

Shift solenoid valve S3 resistance	11 to 15 ohms at 20°C (68°F)

WIRING DIAGRAM

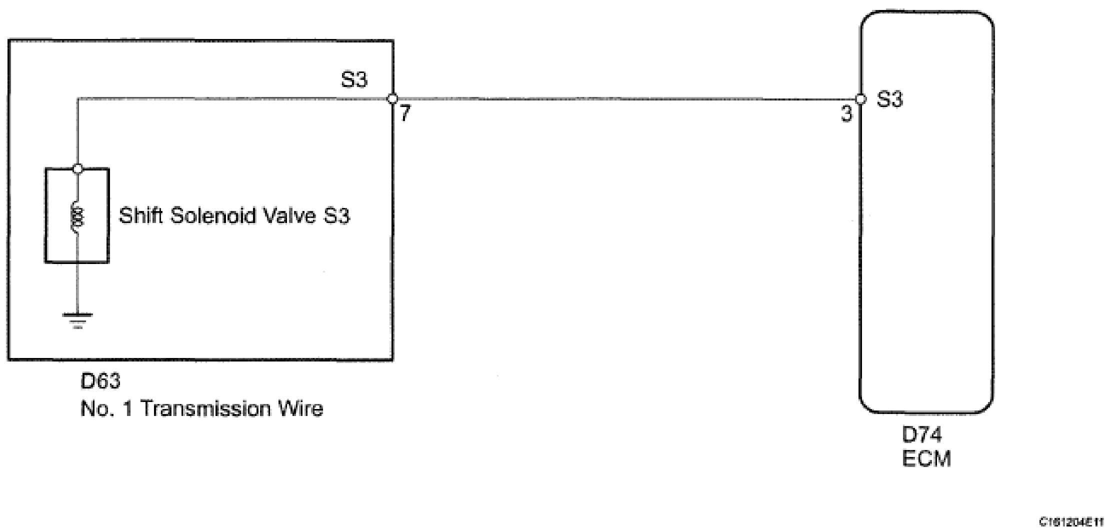

Fig. 91: Shift Solenoid Valve S3 - Wiring Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

HINT:

The shift solenoid valve S3 is turned ON/OFF normally when the shift lever is on D:

SHIFT SOLENOID VALVE S3 OPERATION CHART

ECM gear shift command	1st	2nd	3rd	4th	5th	6th
Shift solenoid valve S3	ON	ON	ON	OFF	OFF	OFF

1. **INSPECT NO. 1 TRANSMISSION WIRE (SHIFT SOLENOID VALVE S3)**
   a. Disconnect the D63 No. 1 transmission wire connector.
   b. Measure the resistance according to the value (s) in the table below.

   Standard resistance

NO. 1 TRANSMISSION WIRE (SHIFT SOLENOID VALVE S3) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
7 (S3) - Body ground	20°C (68°F)	11 to 15 ohms

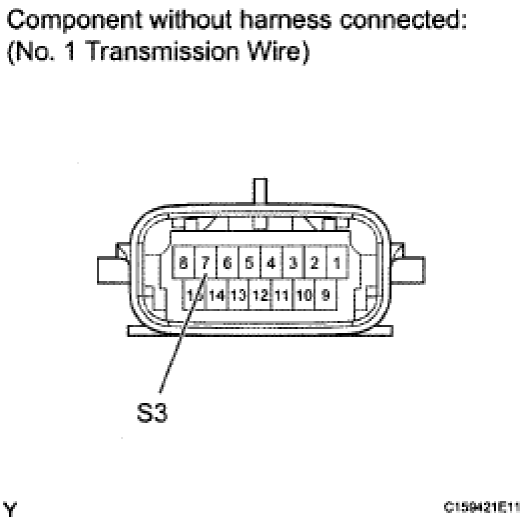

Fig. 92: Identifying Terminal S3 Of D63 No. 1 Transmission Wire Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: Go to step 3

OK: Go to next step

2. **CHECK HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE - ECM)**
   a. Disconnect the D74 ECM connector.
   b. Measure the resistance according to the value (s) in the table below.

   Standard resistance

   HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D74-3 (S3) - Body ground	20°C (68°F)	11 to15 ohms

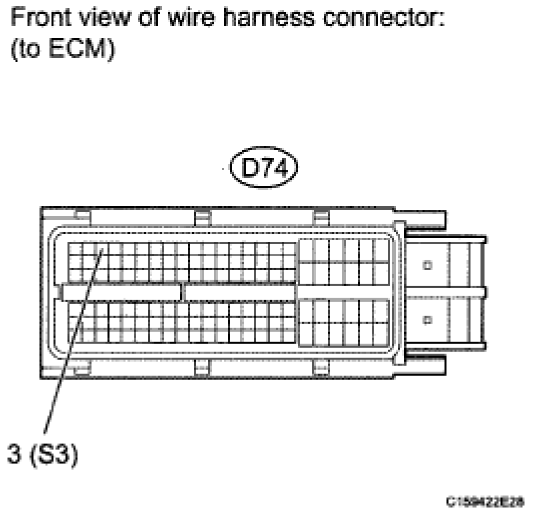

Fig. 93: Identifying Terminal 3 (S3) Of D74 ECM Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE ECM (See **REMOVAL**)

3. **INSPECT SHIFT SOLENOID VALVE S3**
   a. Remove the shift solenoid valve S3.
   b. Measure the resistance according to the value (s) in the table below.

Standard resistance

SHIFT SOLENOID VALVE S3 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S3 connector terminal - Shift solenoid valve S3 body	20°C (68° F)	11 to15 ohms

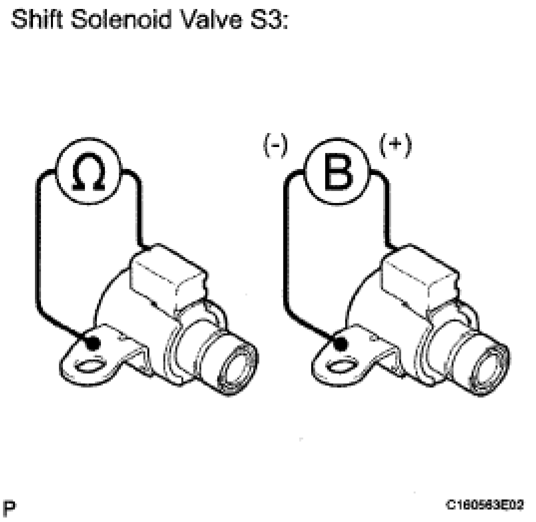

Fig. 94: Identifying Shift Solenoid Valve S3
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Connect the battery's positive (+) lead to the terminal of the solenoid valve connector, and the negative (-) lead to the solenoid valve body. Then check that the valve moves and makes an operating noise.

OK: Valve moves and makes an operating noise.

NG: REPLACE SHIFT SOLENOID VALVE S3 (see **DISASSEMBLY**)

OK: REPAIR OR REPLACE NO. 1 TRANSMISSION WIRE (see **REMOVAL**)

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 6th is performed in combination with ON and OFF operation of the shift solenoid valves SL1, SL2, S1, S2, S3, S4 and SR, which are controlled by the ECM. If an open or short circuit occurs in any of the shift solenoid valves, the ECM controls the remaining normal shift solenoid valves to allow the vehicle to be operated safely. Also, the ECM stops sending the current to the open or short circuit solenoid (see **CHECK MODE PROCEDURE**).

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0982	ECM detects short in solenoid valve S4 circuit 2 times when solenoid valve S4 is operated (1 trip detection logic)	• Short in shift solenoid valve S4 circuit • Shift solenoid valve S4 • ECM
P0983	ECM detects open in solenoid valve S4 circuit 2 times when solenoid valve S4 is not operated (1 trip detection logic)	• Open in shift solenoid valve S4 circuit • Shift solenoid valve S4 • ECM

MONITOR DESCRIPTION

These DTCs indicate an open or short in the shift solenoid valve S4 circuit. When there is an open or short circuit in any shift solenoid valve circuit, the ECM detects the problem, illuminates the MIL and stores the DTC. When the shift solenoid valve S4 is ON, if its resistance is 8 ohms or less, the ECM determines there is a short in the shift solenoid valve S4 circuit.

When the shift solenoid valve S4 is OFF, if its resistance is 100 kohms or more, the ECM determines there is an open in the shift solenoid valve S4 circuit (see **CHECK MODE PROCEDURE**).

MONITOR STRATEGY

MONITOR STRATEGY REFERENCE

Related DTCs	P0982: Shift solenoid valve S4/Range check (Low resistance) P0983: Shift solenoid valve S4/Range check (High resistance)
Required sensors/Components	Shift solenoid valve S4
Frequency of operation	Continuous
Duration	0.128 sec. or more
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

All

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None
Battery voltage	8 V or more
Ignition switch	ON
Starter	OFF

P0982: Range check (Low resistance)

TYPICAL ENABLING CONDITIONS

Shift solenoid valve S4	ON

P0983: Range check (High resistance)

TYPICAL ENABLING CONDITIONS

Shift solenoid valve S4	OFF

TYPICAL MALFUNCTION THRESHOLDS

P0982: Range check (Low resistance)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve S4 resistance	8 ohms or less

P0983: Range check (High resistance)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve S4 resistance	100 kohms or more

COMPONENT OPERATING RANGE

COMPONENT OPERATING RANGE

Shift solenoid valve S4 resistance	11 to 15 ohms at 20°C (68°F)

WIRING DIAGRAM

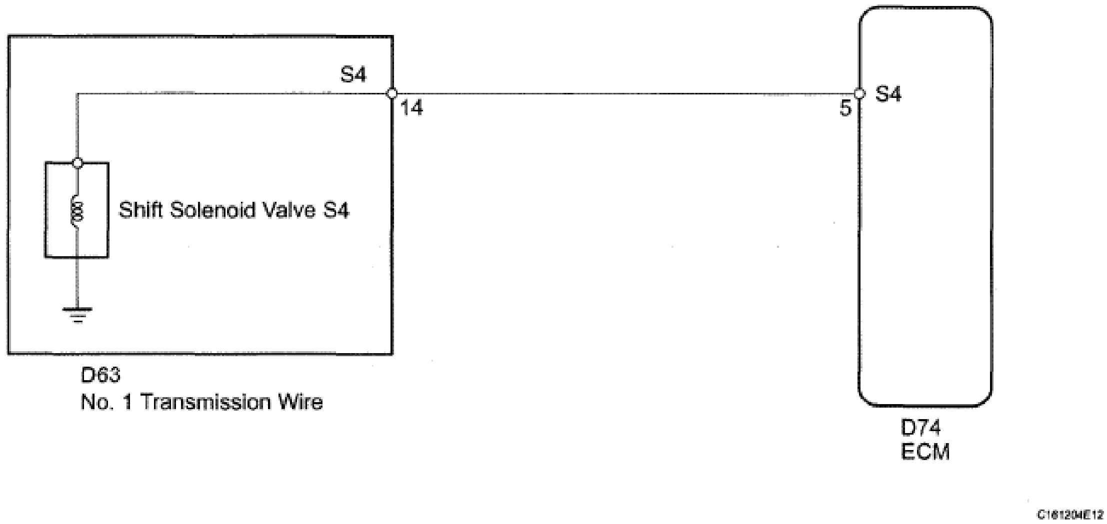

Fig. 95: Shift Solenoid Valve S4 - Wiring Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

HINT:

The shift solenoid valve S4 is turned ON/OFF normally when the shift lever is on D:

SHIFT SOLENOID VALVE S4 OPERATION CHART

ECM gear shift command	1st	2nd	3rd	4th	5th	6th
Shift solenoid valve S4	OFF	OFF	OFF	OFF	ON	ON

1. **INSPECT NO. 1 TRANSMISSION WIRE (SHIFT SOLENOID VALVE S4)**
    a. Disconnect the D63 No. 1 transmission wire connector.
    b. Measure the resistance according to the value (s) in the table below.

    Standard resistance

    NO. 1 TRANSMISSION WIRE (SHIFT SOLENOID VALVE S4) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
14 (S4) - Body ground	20°C (68°F)	11 to 15 ohms

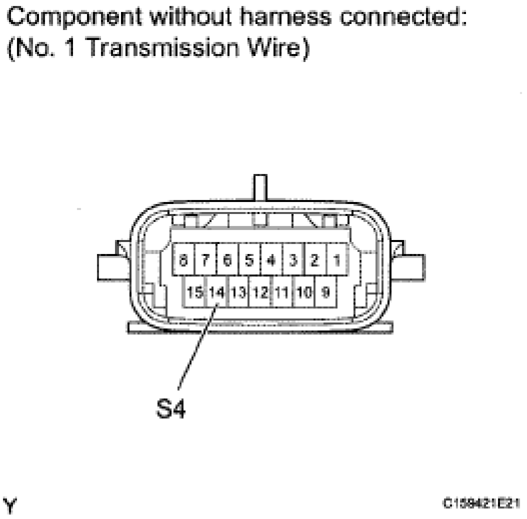

Fig. 96: Identifying Terminal S4 Of D63 No. 1 Transmission Wire Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: Go to step 3

OK: Go to next step

2. **CHECK HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE - ECM)**
   a. Disconnect the D74 ECM connector.
   b. Measure the resistance according to the value (s) in the table below.

   Standard resistance

   HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D74-5 (S4) - Body ground	20°C (68°F)	11 to15 ohms

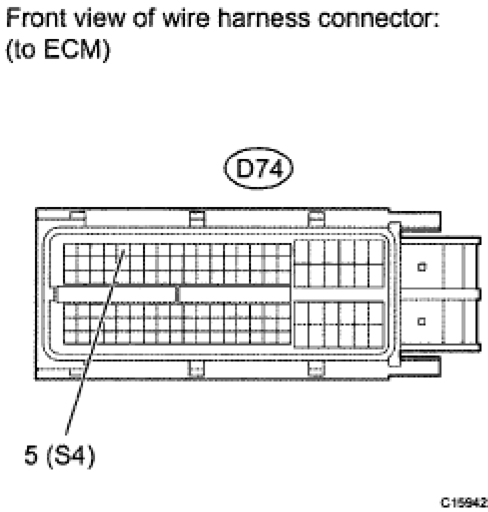

Fig. 97: Identifying Terminal 5 (S4) Of D74 ECM Connector

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

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE ECM (See REMOVAL)

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

   SHIFT SOLENOID VALVE S4 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S4 connector terminal - Shift solenoid valve S4 body	20°C (68° F)	11 to 15 ohms

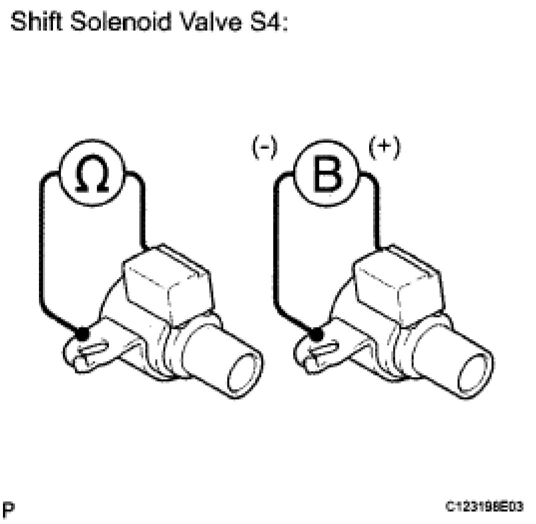

Fig. 98: Identifying Shift Solenoid Valve S4
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   c. Connect the battery's positive (+) lead to the terminal of the solenoid valve connector, and the negative (-) lead to the solenoid valve body. Then check that the valve moves and makes an operating noise.

   OK: Valve moves and makes an operating noise.

NG: REPLACE SHIFT SOLENOID VALVE S4 (see DISASSEMBLY)

OK: REPAIR OR REPLACE NO. 1 TRANSMISSION WIRE (see REMOVAL)

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 6th is performed in combination with ON and OFF operation of the shift solenoid valves SL1, SL2, S1, S2, S3, S4 and SR, which are controlled by the ECM. If an open or short circuit occurs in any of the shift solenoid valves, the ECM controls the remaining normal shift solenoid valves to allow the vehicle to be operated safely. Also, the ECM stops sending the current to the open or short circuit solenoid (see **CHECK MODE PROCEDURE**).

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
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

These DTCs indicate an open or short in the shift solenoid valve SR circuit. When there is an open or short circuit in any shift solenoid valve circuit, the ECM detects the problem, illuminates the MIL and stores the DTC. When the shift solenoid valve SR is ON, if its resistance is 8 ohms or less, the ECM determines there is a short in the shift solenoid valve SR circuit.

When the shift solenoid valve SR is OFF, if its resistance is 100 kohms or more, the ECM determines there is an open in the shift solenoid valve SR circuit (see **CHECK MODE PROCEDURE**).

MONITOR STRATEGY

MONITOR STRATEGY REFERENCE

Related DTCs	P0985: Shift solenoid valve SR/Range check (Low resistance) P0986: Shift solenoid valve SR/Range check (High resistance)
Required sensors/Components	Shift solenoid valve SR
Frequency of operation	Continuous
Duration	0.128 sec. or more
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

All

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None
Battery voltage	8 V or more
Ignition switch	ON
Starter	OFF

P0985: Range check (Low resistance)

TYPICAL ENABLING CONDITIONS

Shift solenoid valve SR	ON

P0986: Range check (High resistance)

TYPICAL ENABLING CONDITIONS

Shift solenoid valve SR	OFF

TYPICAL MALFUNCTION THRESHOLDS

P0985: Range check (Low resistance)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve SR resistance	8 ohms or less

P0986: Range check (High resistance)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve SR resistance	100 kohms or more

COMPONENT OPERATING RANGE

COMPONENT OPERATING RANGE

Shift solenoid valve SR resistance	11 to 15 ohms at 20°C (68°F)

WIRING DIAGRAM

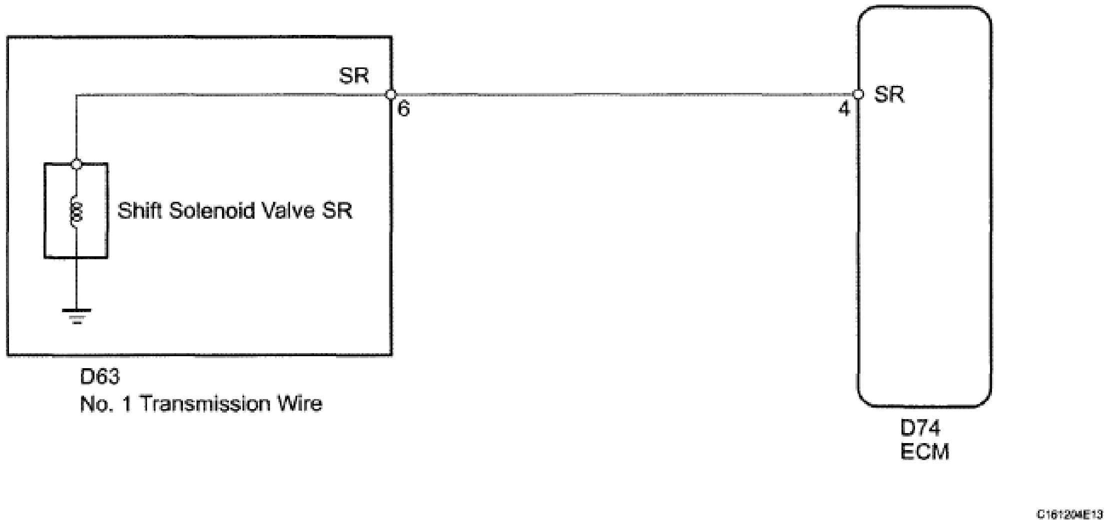

Fig. 99: Shift Solenoid Valve SR - Wiring Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

HINT:

The shift solenoid valve SR is turned ON/OFF normally when the shift lever is on D:

SHIFT SOLENOID VALVE SR OPERATION CONDITIONS

ECM gear shift command	1st	2nd	3rd	4th	5th	6th
Shift solenoid valve SR	ON	ON	ON	ON	OFF	OFF

1. **INSPECT NO. 1 TRANSMISSION WIRE (SHIFT SOLENOID VALVE SR)**
   a. Disconnect the D63 No. 1 transmission wire connector.
   b. Measure the resistance according to the value (s) in the table below.

   Standard resistance

   NO. 1 TRANSMISSION WIRE (SHIFT SOLENOID VALVE SR) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
6 (SR) - Body ground	20°C (68°F)	11 to 15 ohms

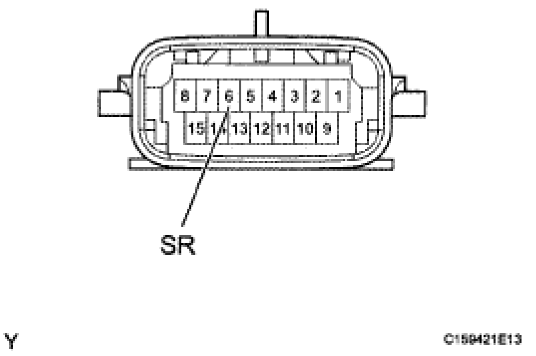

Fig. 100: Identifying Terminal SR Of D63 No. 1 Transmission Wire Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: Go to step 3

OK: Go to next step

2. **CHECK HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE - ECM)**
    a. Disconnect the D74 ECM connector.
    b. Measure the resistance according to the value (s) in the table below.

    Standard resistance

    HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D74-4 (SR) - Body ground	20°C (68°F)	11 to 15 ohms

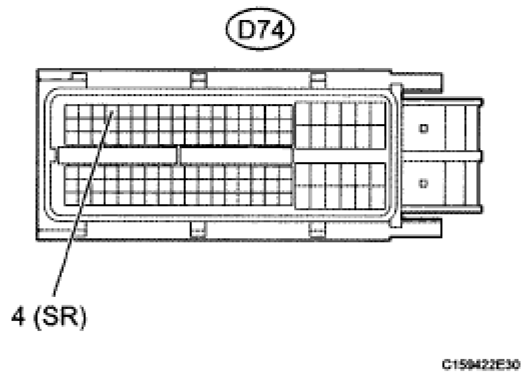

Fig. 101: Identifying Terminal 4 (SR) Of D74 ECM Connector

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

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE ECM (See REMOVAL)

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

   SHIFT SOLENOID VALVE SR RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve SR connector terminal - Shift solenoid valve SR body	20°C (68° F)	11 to 15 ohms

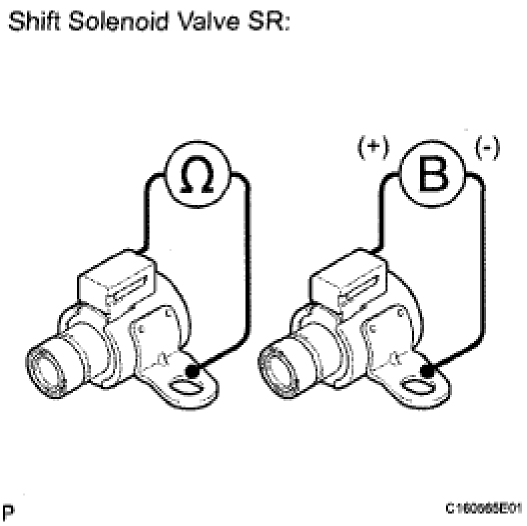

Fig. 102: Identifying Shift Solenoid Valve SR
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   c. Connect the battery's positive (+) lead to the terminal of the solenoid valve connector, and the negative (-) lead to the solenoid valve body. Then check that the valve moves and makes an operating noise.

   OK: Valve moves and makes an operating noise.

NG: REPLACE SHIFT SOLENOID VALVE SR (see DISASSEMBLY)

OK: REPAIR OR REPLACE NO. 1 TRANSMISSION WIRE (see REMOVAL)

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

DESCRIPTION

Refer to **DTC P0894** .

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P2716	Conditions (a) or (b) below are detected for 1 sec. or more. (1 trip detection logic) a. SLT - terminal: 0 V b. SLT-terminal: 12 V	• Open or short in shift solenoid valve SLT circuit • Shift solenoid valve SLT • ECM

Reference: Inspect using an oscilloscope.

Check the waveform of the ECM connector.

Standard

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition	Specified Condition
D74-9 (SLT+) -D74-8 (SLT-)	5 V/DIV., 1 msec./ DIV.	Engine is idling	Refer to the illustration

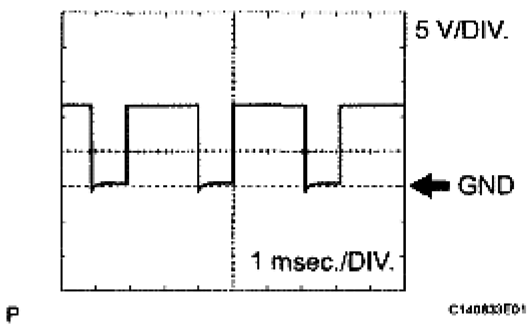

Fig. 103: Waveform Of ECM Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

MONITOR DESCRIPTION

When an open or short in the shift 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

MONITOR STRATEGY REFERENCE

Related DTCs	P2716: Shift solenoid valve SLT/Range check
Required sensors/Components	Shift solenoid valve SLT
Frequency of operation	Continuous
Duration	1 sec.
MIL operation	Immediately

Sequence of operation	None

TYPICAL ENABLING CONDITIONS

All

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None
Ignition switch	ON
Starter	OFF

All of the following conditions are met: Condition (A) and (B)

Condition (A)

TYPICAL ENABLING CONDITIONS

Solenoid current cut status	Not cut
Target current	0.1 A or more
Battery voltage	11 V or more

Condition (B)

TYPICAL ENABLING CONDITIONS

Battery voltage	8 V or more

TYPICAL MALFUNCTION THRESHOLDS

When either condition below is met: Condition (A) or (B)

Condition (A)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Solenoid status from Hybrid IC	Failure

Condition (B)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Hybrid IC status	Failure

COMPONENT OPERATING RANGE

COMPONENT OPERATING RANGE

Output signal duty	Less than 100%

WIRING DIAGRAM

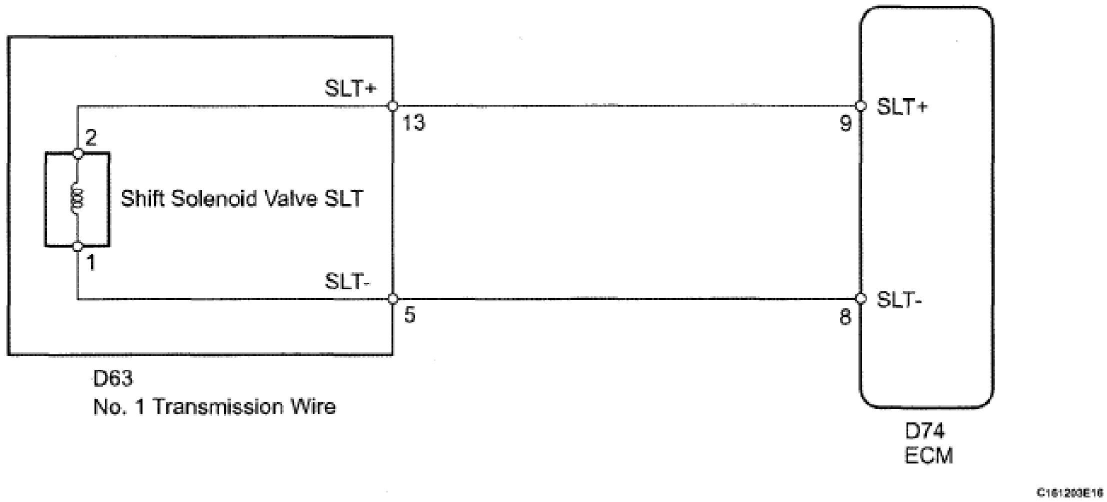

Fig. 104: Shift Solenoid Valve SLT - Wiring Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

1. **INSPECT NO. 1 TRANSMISSION WIRE (SHIFT SOLENOID VALVE SLT)**
   a. Disconnect the D63 No.1 transmission wire connector.
   b. Measure the resistance according to the value (s) in the table below.

   Standard resistance

   NO. 1 TRANSMISSION WIRE (SHIFT SOLENOID VALVE SLT RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
13 (SLT+) - 5 (SLT-)	20°C (68°F)	5.0 to 5,6 ohms
13 (SLT+) - Body ground	Always	10 kohms or higher
5 (SLT-) - Body ground	Always	10 kohms or higher

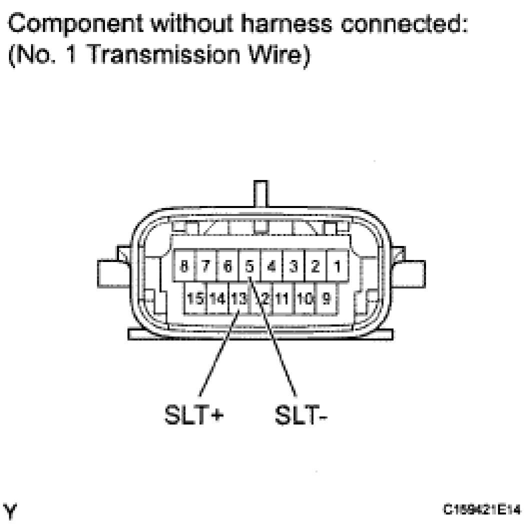

Fig. 105: Identifying D63 No.1 Transmission Wire Connector Terminals

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

NG: Go to step 3

OK: Go to next step

2. **CHECK HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE - ECM)**
   a. Disconnect the D74 ECM connector.

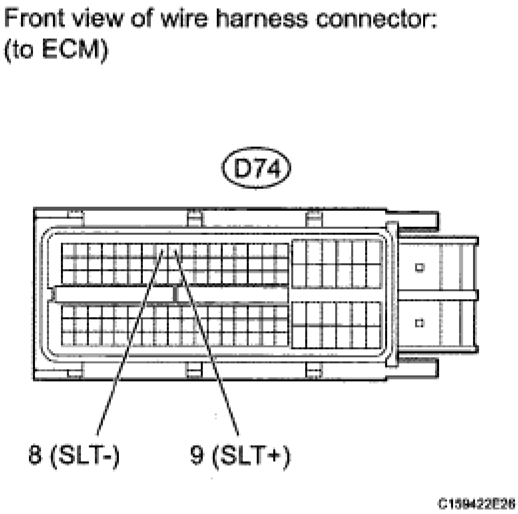

Fig. 106: Identifying D74 ECM Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Standard resistance

HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D74-9 (SLT+) - D74-8 (SLT-)	20°C (68°F)	5.0 to 5.6 ohms
D74-9 (SLT+) - Body ground	Always	10 kohms or higher
D74-8 (SLT-) - Body ground	Always	10 kohms or higher

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE ECM (See **REMOVAL**)

3. **INSPECT SHIFT SOLENOID VALVE SLT**

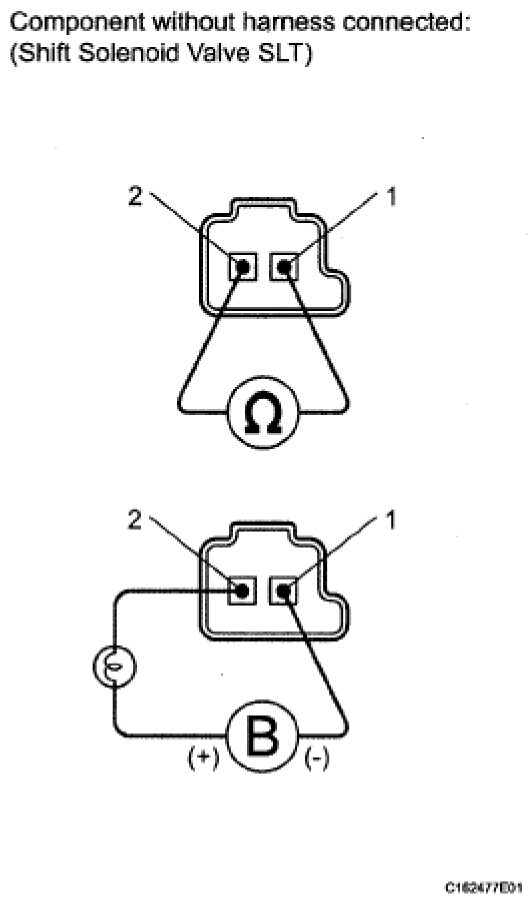

Fig. 107: Inspecting Shift Solenoid Valve SLT
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Standard resistance

SHIFT SOLENOID VALVE SLT RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	5.0 to 5.6 ohms

c. Connect the battery's positive (+) lead with a 21 W bulb to terminal 2 and the negative (-) lead to terminal 1 of the solenoid valve connector. Then check that the valve moves and makes an operating noise.

OK: Valve moves and makes an operating noise.

NG: REPLACE SHIFT SOLENOID VALVE SLT (see DISASSEMBLY)

OK: REPAIR OR REPLACE NO. 1 TRANSMISSION WIRE (see REMOVAL)

DTC P2740 TRANSMISSION FLUID TEMPERATURE SENSOR "B" CIRCUIT; DTC P2742 TRANSMISSION FLUID TEMPERATURE SENSOR "B" CIRCUIT LOW INPUT; DTC P2743

TRANSMISSION FLUID TEMPERATURE SENSOR "B" CIRCUIT HIGH INPUT

DESCRIPTION

The Automatic Transmission Fluid (ATF) temperature sensor is on the transmission, just in front of the oil cooler inlet pipeline.

If the ECM detects an abnormally high ATF temperature near this sensor, it illuminates the warning light.

HINT:

- The temperature of ATF easily rises when towing, climbing hills, in traffic, etc.
- If the ATF temperature sensor becomes short-circuited, the signal that indicates that the ATF temperature is 150°C (302°F) or higher is input into the ECM.

Vehicle conditions when the sensor is normal and when the sensor is short-circuited are indicated in the table below.

VEHICLE CONDITIONS CHART

No. 2 ATF Temperature Sensor State	Detection Condition	Symptom	Recovery Condition
Sensor is normal	ATF temperature more than 150°C (302°F)	"A/T OIL TEMP" warning light remains ON	ATF temperature less than 135°C (275°F)*1
	ATF temperature more than 130°C (266°F)	Shift point too high	ATF temperature less than 110°C (230°F)
	When the conditions (a) and (b) are satisfied. a. ATF temperature more than 130°C (266°F) b. Engine coolant temperature more than 95°C (203°F)	Lock-up at 3rd gear*2	ATF temperature less than 110cC (230°F)*1 and engine coolant temperature more than 95°C (203°F)
Sensor is short-circuited	Any conditions	• "A/T OIL TEMP" warning light remains ON • Shift point too high	Symptoms still occur
	Engine coolant temperature more than 95°C (203°F)	Lock-up at 3rd gear*2	Symptoms still occur

HINT:
*1: When ATF temperature is in the normal range, it decreases to less than 135°C (275°F) within 5 minutes with the shift lever in the P or N position in an idling state.
*2: When ATF temperature is normal, transmission lock up occurs in 5th or 6th gear with the shift

lever in the D position or S6 position, in 5th gear with the shift lever in the S5 position, and 4th gear with the shift lever in the S4 position.

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P2740	(a) and (b) are detected momentarily within 0.5 sec. when neither P2742 nor P2743 are detected. (1 -trip detection logic) a. No. 2 ATF temperature sensor resistance is less than 25 ohms (0.046 V). b. No. 2 ATF temperature sensor resistance is more than 156 kohms (4.915 V). HINT: Within 0.5 sec, the malfunction switches from (a) to (b) or from (b) to (a).	• Open or short in No. 2 ATF temperature sensor circuit • No. 1 transmission wire (No. 2 ATF temperature sensor) • ECM
P2742	No. 2 ATF temperature sensor resistance is less than 25 ohms (0.046 V) for 0.5 sec. or more. (1-trip detection logic)	• Short in No. 2 ATF temperature sensor circuit • No. 1 transmission wire (No. 2 ATF temperature sensor) • ECM
P2743	When 15 min. or more have elapsed after engine is started, No. 2 ATF temperature sensor resistance is more than 156 kohms (4.915 V) for 0.5 sec. or more (1-trip detection logic)	• Open in No. 2 ATF temperature sensor circuit • No. 1 transmission wire (No. 2 ATF temperature sensor) • ECM

MONITOR DESCRIPTION

The ATF temperature sensor converts the ATF temperature into an electrical resistance value. Based on the resistance, the ECM determines the ATF temperature, and the ECM detects an open or short in the ATF temperature circuit. If the resistance value of the ATF temperature is less than 25 ohms.*1 or more than 156 kohms*2, the ECM interprets this as a fault in the ATF sensor or wiring. The ECM will illuminate the MIL and store the DTC.

HINT:

- *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.
- The ATF temperature can be checked on the intelligent tester or Techstream display.

MONITOR STRATEGY

MONITOR STRATEGY REFERENCE

Related DTCs	P2740: ATF temperature sensor/Range check (Fluttering) P2742: ATF temperature sensor/Range check (Low resistance) P2743: ATF temperature sensor/Range check (High resistance)
Required sensors/Components	ATF temperature sensor
Frequency of operation	Continuous
Duration	0.5 sec.
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

All

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None

P2740: Range check (Chattering)

TYPICAL ENABLING CONDITIONS

The typical enabling condition is not available.	-

P2742: Range check (Low voltage)

TYPICAL ENABLING CONDITIONS

The typical enabling condition is not available.	-

P2743: Range check (High voltage)

TYPICAL ENABLING CONDITIONS

Time after engine start	15 min. or more

TYPICAL MALFUNCTION THRESHOLDS

P2740: Range check (Chattering)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

ATF temperature sensor voltage	Less than 0.046 V or more than 4.915 V

P2742: Range check (Low voltage)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

ATF temperature sensor voltage	Less than 0.046 V

P2743: Range check (High voltage)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

ATF temperature sensor voltage	More than 4.915 V

COMPONENT OPERATING RANGE

COMPONENT OPERATING RANGE

ATF temperature sensor voltage	0.046 to 4.915 V

WIRING DIAGRAM

Refer to **DTC P0710** .

INSPECTION PROCEDURE

1. **DATA LIST**

   HINT:

   Using the intelligent tester or 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 the intelligent tester or Techstream to the DLC3.
   d. Turn the ignition switch ON and push the tester switch ON.
   e. Enter the following menus:
      1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / DATA LIST.
      2. Techstream - Select: Powertrain / Engine and ECT / Data List.
   f. Follow the instructions on the tester and read the Data List.
      1. Intelligent tester

         ECT:

         INTELLIGENT TESTER ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
A/T OIL TEMP2	No. 2 ATF temperature sensor value/ Min.: -40°C (-40°F)	• After stall test: Approximately 80°C (176°F) • Equal to ambient	If value is -40°C (-40°F) or 215°C (419°F), No. 2 ATF temperature sensor circuit

	Max.:215°C (419°F)	temperature while engine is cold	is open or shorted

2. Techstream

ECT:

TECHSTREAM ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
A/T Oil Temperature 2	No. 2 ATF temperature sensor value/ Min.: -40°C (-40°F) Max.:215°C (419°F)	• After stall test: Approximately 80°C (176°F) • Equal to ambient temperature while engine is cold	If value is -40°C (-40°F) or 215°C (419°F), No. 2 ATF temperature sensor circuit is open or shorted

HINT:

- When DTC P2742 is output and the intelligent tester or Techstream output is 150°C (302°F) or more, there is a short circuit.
- When DTC P2743 is output and the intelligent tester or Techstream output is -40°C (- 40°F), there is an open circuit.

  Measure the resistance between terminal THO2 and the body ground.

  MALFUNCTION REFERENCE

Temperature Displayed	Malfunction
-40°C (-40°F)	Open circuit
150°C (302°F) or more	Short circuit

1. **INSPECT NO. 1 TRANSMISSION WIRE (NO. 2 ATF TEMPERATURE SENSOR)**
   a. Disconnect the D63 No. 1 transmission wire connector.
   b. Measure the resistance according to the value (s) in the table below.

   Standard resistance

   NO. 1 TRANSMISSION WIRE (NO. 2 ATF TEMPERATURE SENSOR) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
2 (OT2-) - 10 (OT2+)	Always	25 ohms to 156 kohms
2 (OT2-) - Body ground	Always	10 kohms or higher
10 (OT2+) - Body ground	Always	10 kohms or higher

   HINT:

   If the resistance is out of the specified range of one of the ATF temperatures shown in the table below, the driveability of the vehicle may decrease.

Standard resistance

NO. 1 TRANSMISSION WIRE (NO. 2 ATF TEMPERATURE SENSOR) RESISTANCE SPECIFIED CONDITION

ATF temperature	Specified Condition
10°C (50°F)	5 to 8 kohms
25°C (77°F)	2.5 to 4.5 kohms
110°C (230°F)	0.22 to 0.28 kohms

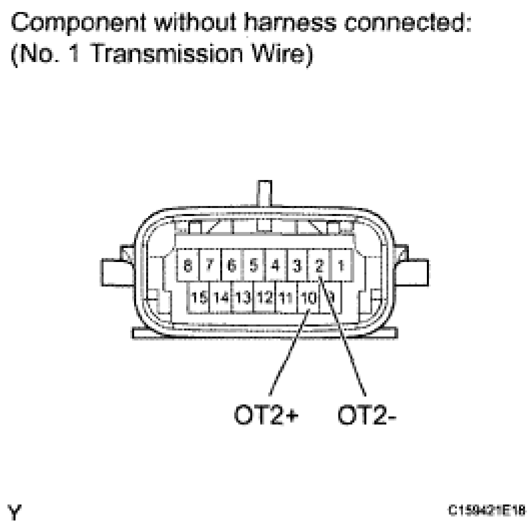

Fig. 108: Identifying D63 No. 1 Transmission Wire Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPAIR OR REPLACE NO. 1 TRANSMISSION WIRE (NO. 2 ATF TEMPERATURE SENSOR) (see **REMOVAL**)

OK: Go to next step

2. **CHECK HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE - ECM)**
   a. Disconnect the D74 ECM connector.
   b. Measure the resistance according to the value (s) in the table below.

Standard resistance

HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D74-99 (THO2) - D74-98 (ETHA)	Always	25 ohms to 156 kohms
D74-99 (THO2) - Body ground	Always	10 kohms or higher
D74-98 (ETHA) - Body ground	Always	10 kohms or higher

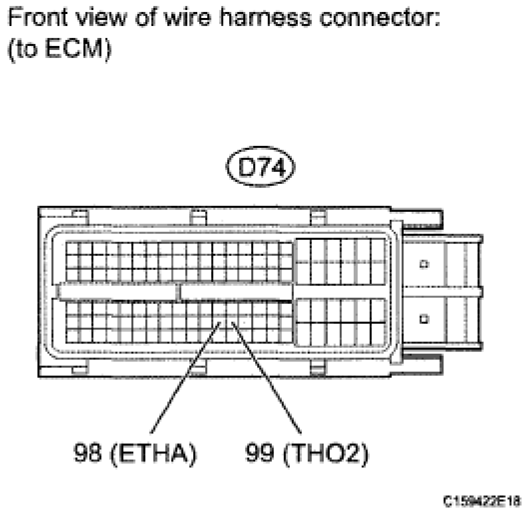

Fig. 109: Identifying D74 ECM Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE ECM (See **REMOVAL**)

DTC P2757 TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID PERFORMANCE (SHIFT SOLENOID VALVE SLU)

DESCRIPTION

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

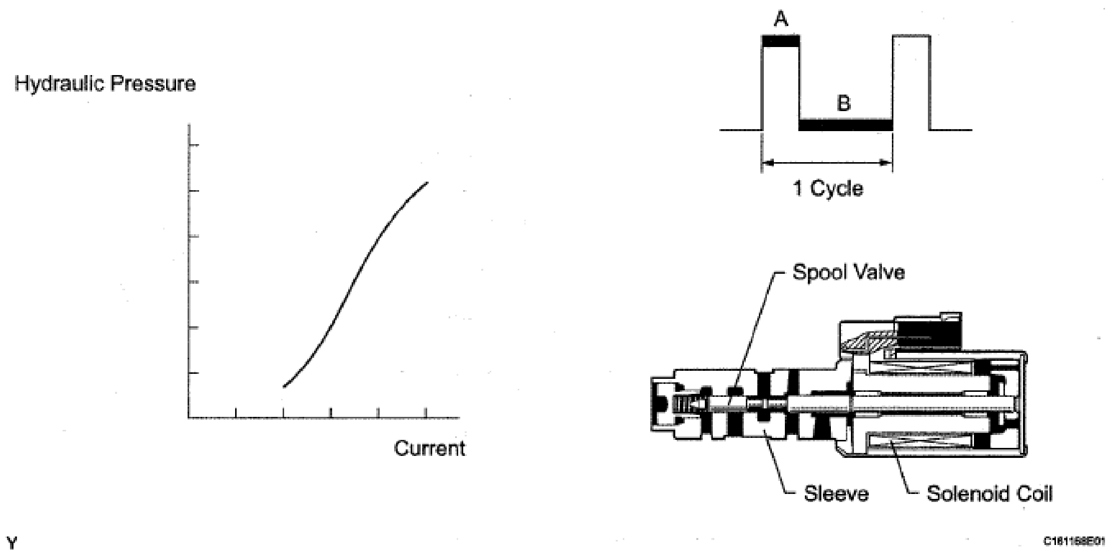

Fig. 110: Identifying Shift Solenoid Valve Components With Current Flow Graph
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Then the ECM compares the engagement condition of the lock up clutch with the lock up schedule in the ECM memory to detect mechanical problems of the shift solenoid valve SLU, valve body and torque converter clutch.

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P2757	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)	• Shift solenoid valve SLU remains open or closed • Valve body is blocked • Shift solenoid valve SLU • Torque converter clutch Automatic transmission (clutch, brake, gear, etc.) • Line pressure is too low • ECM

MONITOR DESCRIPTION

Torque converter lock up is controlled by the EGM based on the turbine (input) speed sensor NT, output speed sensor SP2, 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 output shaft rpm (SP2). When conditions are appropriate, the ECM requests lock up by applying control voltage to the shift solenoid SLU. When the SLU 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 SLU or lock up system performance.

The ECM will illuminate the MIL and store the DTC.

Example:

When one of the following conditions is met, the system determines that there is 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 ON.

  Engine speed is at least 75 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 REFERENCE

Related DTCs	P2757: Shift solenoid valve SLU/OFF malfunction Shift solenoid valve SLU/ON malfunction
Required sensors/Components	Shift solenoid valve SLU
Frequency of operation	Continuous
Duration	OFF malfunction (A) 2 sec. OFF malfunction (B) 0.4 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 the following DTCs are not present	None
Turbine speed sensor circuit	Not circuit malfunction
Output speed sensor circuit	Not circuit malfunction
Shift solenoid valve S1 circuit	Not circuit malfunction
Shift solenoid valve S2 circuit	Not circuit malfunction
Shift solenoid valve S3 circuit	Not circuit malfunction
Shift solenoid valve S4 circuit	Not circuit malfunction
Shift solenoid valve SR circuit	Not circuit malfunction
Shift solenoid valve SLU circuit	Not circuit malfunction
KCS sensor circuit	Not circuit malfunction
ETCS (Electric Throttle Control System)	Not system down
Transmission position	"D"
Duration time from shifting "N" to "D"	4 sec. or more
ECT (Engine coolant temperature)	40°C (104°F) or more
Spark advance from max. retard timing by KCS control	0° crankshaft angle or more
Engine	Starting
ECM selected gear	2nd, 3rd, 4th, 5th or 6th
Vehicle speed	25 km/h (15.5 mph) or more
Shift solenoid valve S1 circuit	Not circuit off malfunction
Shift solenoid valve S3 circuit	Not circuit on malfunction
Shift solenoid valve S4 circuit	Not circuit off malfunction
Shift solenoid valve SL2 circuit	Not circuit on malfunction
1 - 2 shift valve	Not malfunction
Sequence valve	Not malfunction

Transfer position is 4WD HIGH*

TYPICAL ENABLING CONDITIONS

Vehicle speed sensor circuit	Not circuit malfunction
Output shaft speed sensor circuit	Not circuit malfunction
Transfer output speed	143 rpm or more
NO/NOtf (Transfer input speed/Transfer output speed)	0.9 to 1.1

HINT:

*: This condition only applies to 4WD.

OFF malfunction (A)

TYPICAL ENABLING CONDITIONS

ECM lock up command	ON (SLU pressure: 513 kPa (5.2 kgf/cm^2 , 74 psi) or more)
Duration time from lock up on command	3 sec. or more
Vehicle speed	Less than 100 km/h (62.2 mph)

OFF malfunction (B)

TYPICAL ENABLING CONDITIONS

ECM selected gear	2nd
Vehicle speed	2 km/h (1.2 mph) or more
Output speed	2nd --> 1st down-shift point or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

ON malfunction

TYPICAL ENABLING CONDITIONS

ECM lock up command	OFF (SLU pressure: Less than 4 kPa (0.04 kgf/cm^2 , 0.6 psi))
Duration time from lock up off command	3 sec. or more
Throttle valve opening angle	9% or more
Vehicle speed	Less than 30km/h (18.6 mph) at 2nd gear (Varies with ECM selected gear)

TYPICAL MALFUNCTION THRESHOLDS

OFF malfunction is detected when OFF malfunction (A) and (B) are set.

OFF malfunction (A)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Engine speed - Turbine speed (NE - NT)	70 rpm or more

OFF malfunction (B)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	Less than 3.11 or more than 7.58

ON malfunction

2 detections are necessary per driving cycle:

1st detection: temporary flag ON

2nd detection: pending fault code ON

Vehicle speed must be under 10 km/h (6.2 mph) once before 2nd detection.

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Engine speed - Turbine speed (NE - NT)	Less than 35 rpm

COMPONENT OPERATING RANGE

COMPONENT OPERATING RANGE

Speed sensor (NT)	Input speed is equal to engine speed when lock up ON.

INSPECTION PROCEDURE

1. **ACTIVE TEST**

   HINT:

   Using the intelligent tester or Techstream to perform Active Tests 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 Tests early in troubleshooting is one way to save diagnostic time. Data List information can be displayed while performing Active Tests.

   a. Warm up the engine.
   b. Turn the ignition switch OFF.
   c. Connect the intelligent tester or Techstream to the DLC3.
   d. Turn the ignition switch ON and push the tester switch ON.
   e. Enter the following menus:
      1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / ACTIVE TEST.
      2. Techstream - Select: Powertrain / Engine and ECT / Active Test.
   f. Follow the instructions on the tester and perform the Active Test.
      1. Intelligent tester

         ECT:

         INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester	Test Part	Control	Diagnostic Note

Display		Range	
LOCK UP	Control shift solenoid SLU to set automatic transmission to lock up condition	ON or OFF	Possible to check shift solenoid valve SLU operation [Vehicle Condition] • Throttle valve opening angle: Less than 35% • Vehicle speed: 60 km/h (36 mph) or more

2. Techstream

ECT:

TECHSTREAM ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
Activate the Lock Up	Control shift solenoid SLU to set automatic transmission to lock up condition	ON or OFF	Possible to check shift solenoid valve SLU operation [Vehicle Condition] • Throttle valve opening angle: Less than 35% • Vehicle speed: 60 km/h (36 mph) or more

HINT:

- This test can be conducted when the vehicle speed is 60 km/h (36 mph) or more.
- Perform this test while driving in the 5th or 6th gear.

g. Lightly depress the accelerator pedal and check that the engine speed does not change abruptly.

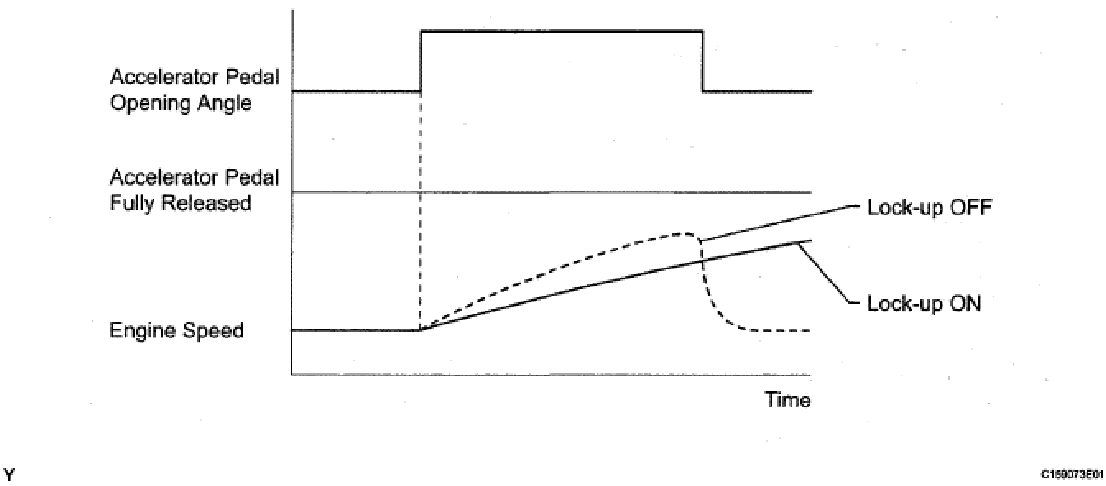

Fig. 111: Engine Speed Graph
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

- When changing the accelerator pedal opening angle while driving, if the engine speed does not change, lock up is on.
- Slowly release the accelerator pedal in order to decelerate, but do not fully release the pedal.

  (Fully releasing the pedal will close the throttle valve and lock up may be turned off automatically.)

1. **CHECK DTC OUTPUT (IN ADDITION TO DTC P2757)**
   a. Connect the intelligent tester or Techstream to the DLC3.
   b. Turn the ignition switch ON and push the tester switch ON.
   c. Enter the following menus:
      1. Intelligent tester - Select: DIAGNOSIS / OBD/MOBD / ENGINE AND ECT / DTC INFO / CURRENT CODES.
      2. Techstream - Select: Powertrain / Engine and ECT / Trouble Codes.
   d. Read the DTCs using the tester.

   Result

   DTC OUTPUT RESULT

Display (DTC output)	Proceed to
Only P2757 is output	A
P2757 and other DTCs are output	B

HINT:

If any other codes besides P2757 are output, perform troubleshooting for those DTCs first.

B: Go TO DTC CHART (see **DIAGNOSTIC TROUBLE CODE CHART**)

A: Go to next step

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

    Standard resistance

    SHIFT SOLENOID VALVE SLU RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	5.0 to 5.6 ohms

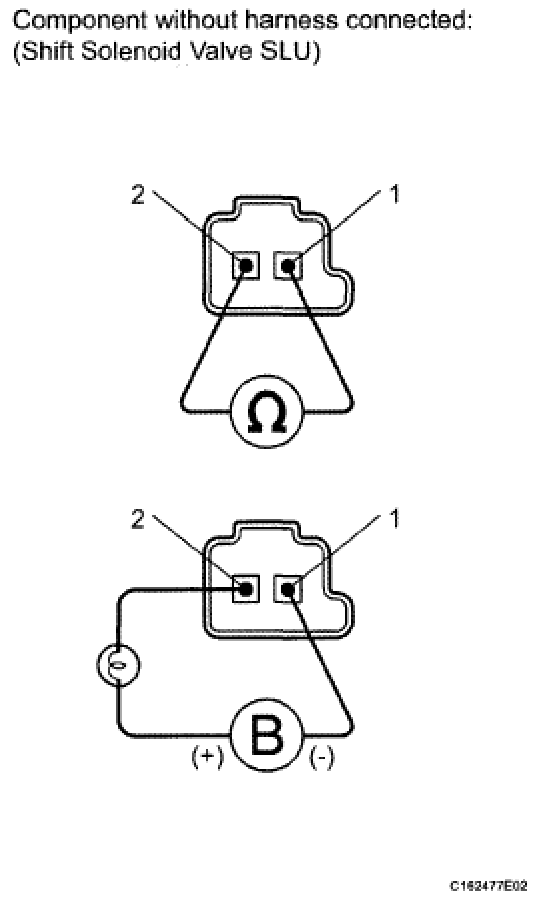

Fig. 112: Identifying Shift Solenoid Valve SLU
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    c. Connect the battery's positive (+) lead with a 21 W bulb to terminal 2 and the negative (-) lead to terminal 1 of the solenoid valve connector. Then check that the valve moves and makes an operating noise.

    OK: Valve moves and makes an operating noise.

NG: REPLACE SHIFT SOLENOID VALVE SLU (see **DISASSEMBLY**)

OK: Go to next step

3. **INSPECT TRANSMISSION VALVE BODY ASSEMBLY**
    a. Check the transmission valve body assembly (see **REMOVAL**).

    OK: There are no foreign objects on each valve.

NG: REPLACE TRANSMISSION VALVE BODY ASSEMBLY (see **REMOVAL**)

OK: Go to next step

4. **INSPECT TORQUE CONVERTER CLUTCH ASSEMBLY**
    a. Check the torque converter clutch assembly (see **TORQUE CONVERTER CLUTCH AND DRIVE PLATE**).

    OK: The torque converter clutch operates normally.

NG: REPLACE TORQUE CONVERTER CLUTCH ASSEMBLY (see **REMOVAL**)

OK: REPAIR OR REPLACE AUTOMATIC TRANSMISSION ASSEMBLY (see **REMOVAL**)

DTC P2759 TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT ELECTRICAL (SHIFT SOLENOID VALVE SLU)

DESCRIPTION

The amount of current flow to the solenoid is controlled by the duty ratio* of the ECM output signal. During the lock up operation, if the duty ratio increases, the lock up hydraulic pressure increases.

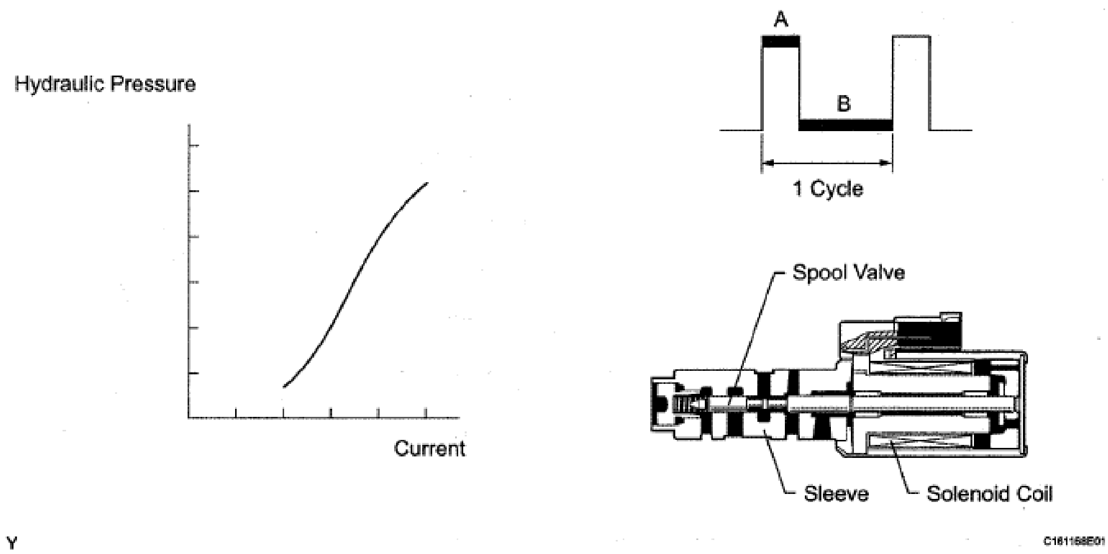

Fig. 113: Identifying Shift Solenoid Valve Components With Current Flow Graph
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

*: The duty ratio is the ratio of the current ON time (A) to the total of the current ON and OFF time (A + B).
Duty Ratio (%) = A / (A + B) x 100

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P2759	Open or short is detected in shift solenoid valve SLU circuit for 1 sec. or more while driving (1 trip detection logic)	• Open or short in shift solenoid valve SLU circuit • Shift solenoid valve SLU • ECM

Reference: Inspect using an oscilloscope.

Check the waveform of the ECM connector.

Standard

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition	Specified Condition
D74-10 (SLU+) - D74-11 (SLU-)	5 V/DIV., 1 msec./ DIV.	5th (lock up) or 6th (lock up) gear	Refer to the illustration

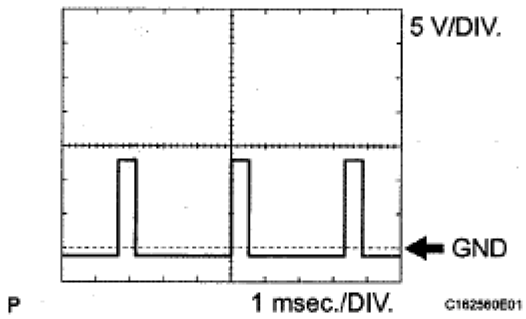

Fig. 114: Waveform Of ECM Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

MONITOR DESCRIPTION

When an open or short in a shift solenoid valve SLU circuit is detected, the ECM determines that there is a malfunction. The ECM will illuminate the MIL and store this DTC.

MONITOR STRATEGY

MONITOR STRATEGY REFERENCE

Related DTCs	P2759: Shift solenoid valve SLU/Range check
Required sensors/Components	Shift solenoid valve SLU
Frequency of operation	Continuous
Duration	1 sec.
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

All

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None
Ignition switch	ON
Starter	OFF

All of the following conditions are met: Condition (A) and (B)

Condition (A)

TYPICAL ENABLING CONDITIONS

Solenoid current cut status	Not cut
Battery voltage	11 V or more
Target current	0.1 A or more

Condition (B)

TYPICAL ENABLING CONDITIONS

Battery voltage	8 V or more

TYPICAL MALFUNCTION THRESHOLDS

When either condition below is met: Condition (A) or (B)

Condition (A)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Solenoid status from Hybrid IC	Failure

Condition (B)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Hybrid IC status	Failure

COMPONENT OPERATING RANGE

COMPONENT OPERATING RANGE

Output signal duty	Less than 100%

WIRING DIAGRAM

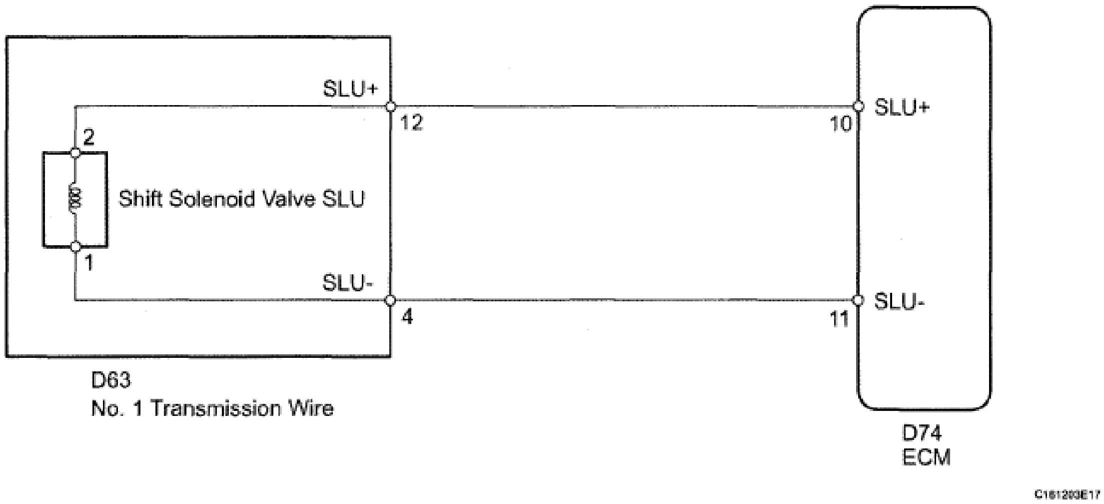

Fig. 115: Shift Solenoid Valve SLU - Wiring Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

1. **INSPECT NO. 1 TRANSMISSION WIRE (SHIFT SOLENOID VALVE SLU)**
    a. Disconnect the D63 No. 1 transmission wire connector.
    b. Measure the resistance according to the value (s) in the table below.

Standard resistance

NO. 1 TRANSMISSION WIRE (SHIFT SOLENOID VALVE SLU) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
12 (SLU+) - 4 (SLU-)	20°C (68°F)	5.0 to 5.6 ohms
12 (SLU+) - Body ground	Always	10 kohms or higher
4 (SLU-) - Body ground	Always	10 kohms or higher

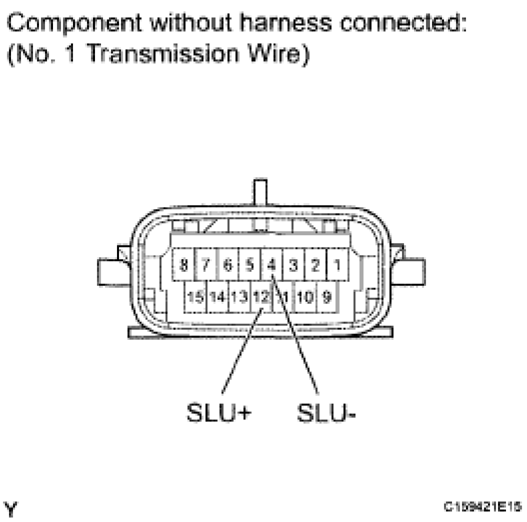

Fig. 116: Identifying D63 No. 1 Transmission Wire Connector Terminals

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

NG: Go to step 3

OK: Go to next step

2. **CHECK HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE - ECM)**
    a. Disconnect the D74 ECM connector.
    b. Measure the resistance according to the value (s) in the table below.

Standard resistance

HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D74-10 (SLU+) - D74-11 (SLU-)	20°C (68°F)	5.0 to 5.6 ohms
D74-10 (SLU+) - Body ground	Always	10 kohms or higher
D74-11 (SLU-) - Body ground	Always	10 kohms or higher

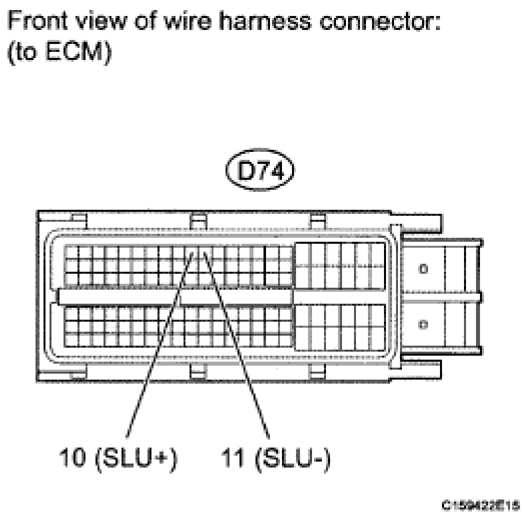

Fig. 117: Identifying D74 ECM Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: REPLACE ECM (See **REMOVAL**)

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

Standard resistance

SHIFT SOLENOID VALVE SLU RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	5.0 to 5.6 ohms

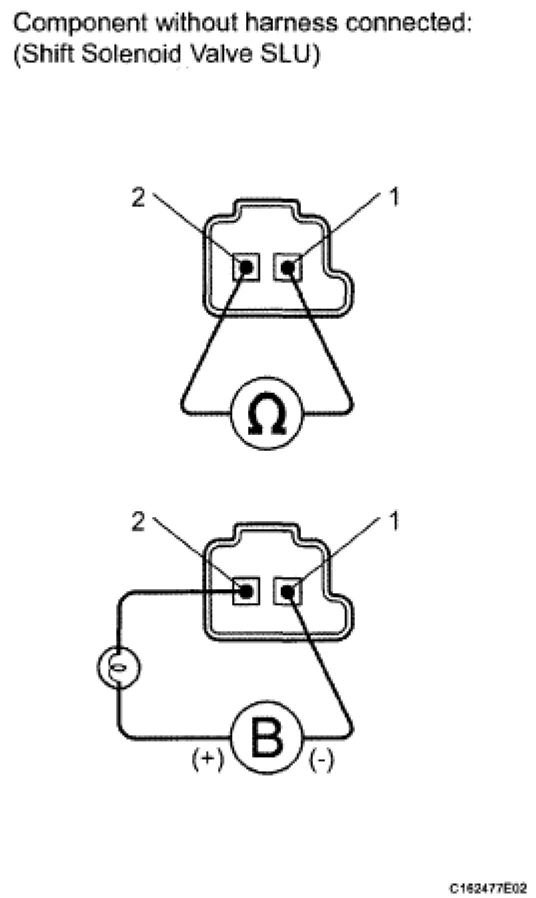

Fig. 118: Identifying Shift Solenoid Valve SLU
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Connect the battery's positive (+) lead with a 21 W bulb to terminal 2 and the negative (-) lead to terminal 1 of the solenoid valve connector. Then check that the valve moves and makes an operating noise.

OK: Valve moves and makes an operating noise.

NG: REPLACE SHIFT SOLENOID VALVE SLU (see **DISASSEMBLY**)

OK: REPAIR OR REPLACE NO. 1 TRANSMISSION WIRE (see **REMOVAL**)

DTC P2772 FOUR WHEEL DRIVE (4WD) LOW SWITCH CIRCUIT RANGE / PERFORMANCE

DESCRIPTION

The ECM detects the signal from the transfer L4 position switch.

This DTC indicates that the transfer L4 position switch remains on.

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P2772	Transfer L4 position switch remains ON while vehicle is running under following conditions for 1.8 sec. or more (1-trip detection logic) a. Output shaft speed between 1000 and 3000 rpm b. Transfer shift position is H	• Short in transfer L4 position switch circuit • 4WD control ECU • ECM

MONITOR DESCRIPTION

The ECM monitors the transfer-case L4 position switch to determine when the transfer-case L4 gear is engaged. If the transfer-case L4 gears remain engaged under the following conditions, the ECM will conclude that there is a malfunction of the L4 position switch, and illuminate the MIL and store the DTC:

- L4 switch indicates that the L4 transfer-case gears are engaged.
- Transfer-case shifter is in the "H" position.
- Transfer-case output shaft rpm is between 1000 and 3000 rpm.
- The specified time period has elapsed.

MONITOR STRATEGY

MONITOR STRATEGY REFERENCE

Related DTCs	P2772: Transfer L4 position switch/ON malfunction
Required sensors/Components	Transfer L4 position switch
Frequency of operation	Continuous
Duration	ON malfunction (A): 1.8 sec. ON malfunction (B): 0.5 sec.
MIL operation	1 driving cycle
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

All

TYPICAL ENABLING CONDITIONS

Output speed sensor circuit	Not circuit malfunction
Vehicle speed sensor circuit	Not circuit malfunction
Transfer neutral position switch	OFF

ON malfunction (A)

TYPICAL ENABLING CONDITIONS

Output speed (Transfer output speed)	1000 to 3000 rpm

ON malfunction (B)

TYPICAL ENABLING CONDITIONS

Output speed (Transfer output speed)	143 rpm or more

TYPICAL MALFUNCTION THRESHOLDS

Both of the following conditions are met: ON malfunction (A) and (B)

ON malfunction (A)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

L4 switch	ON

ON malfunction (B)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Actual transfer gear ratio Transfer input speed/Transfer output speed	0.9 to 1.1

WIRING DIAGRAM

Refer to **DTC P0818** .

INSPECTION PROCEDURE

1. **CHECK HARNESS AND CONNECTOR (4WD CONTROL ECU - BODY GROUND)**
   a. Disconnect the A25 4WD control ECU connector.
   b. Measure the resistance according to the value (s) in the table below.

   Standard resistance

   HARNESS AND CONNECTOR (4WD CONTROL ECU - BODY GROUND) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
A25-21 (L4) - Body ground	Always	10 kohms or higher

   Result

   HARNESS AND CONNECTOR (4WD CONTROL ECU - BODY GROUND) RESULT CHART

Result	Proceed to
NG	A
OK	B

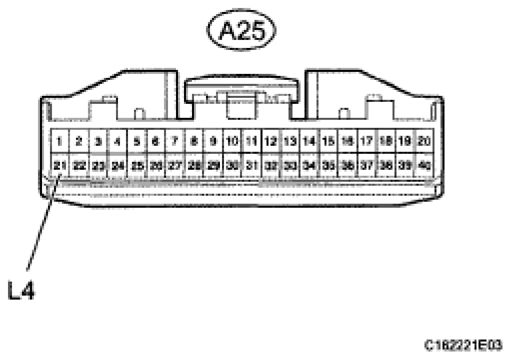

Fig. 119: Identifying Terminal L4 Of A25 4WD Control ECU Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

B: Go TO TOUCH SELECT 2-4 AND HIGH-LOW SYSTEM (See TERMINALS OF ECU)

A: Go to next step

2. **CHECK HARNESS AND CONNECTOR (4WD CONTROL ECU - ECM)**
   a. Disconnect the A24 ECM connector.
   b. Measure the resistance according to the value (s) in the table below.

   Standard resistance

   HARNESS AND CONNECTOR (4WD CONTROL ECU - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
A24-21 (L4) - Body ground	Always	10 kohms or higher

   Result

   HARNESS AND CONNECTOR (4WD CONTROL ECU - ECM) RESULT CHART

Result	Proceed to
OK	A
NG	B

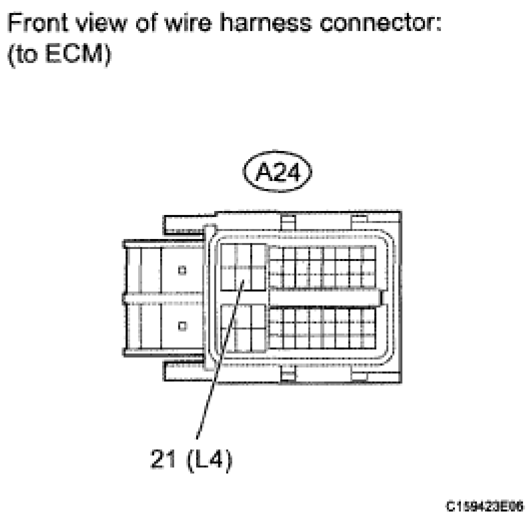

Fig. 120: Identifying 21 (L4) Terminal Of A24 ECM Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

B: REPAIR OR REPLACE HARNESS OR CONNECTOR

A: REPLACE ECM (See **REMOVAL**)

TRANSMISSION CONTROL SWITCH CIRCUIT

DESCRIPTION

When moving the shift lever into the S position using the transmission control switch, it is possible to switch the shift range position between "1" (1st range) and "6" (6th range).

Shifting to "+" once raises the shift range position by one, and shifting to "-" lowers the shift range position by one.

WIRING DIAGRAM

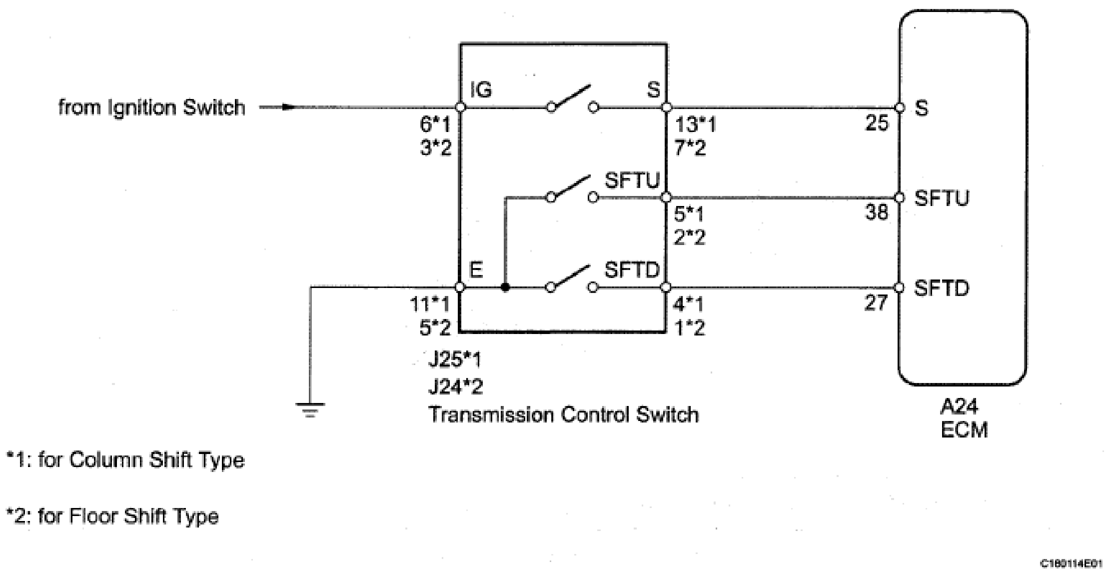

Fig. 121: Transmission Control Switch - Wiring Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

1. **INSPECT TRANSMISSION CONTROL SWITCH**
   a. for Column Shift Type:
      1. Disconnect the J25 transmission control switch connector.
      2. Measure the resistance according to the value (s) in the table below.

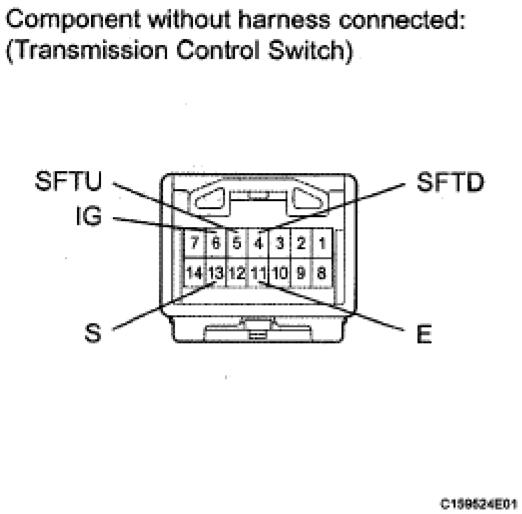

Fig. 122: Identifying J25 Transmission Control Switch Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard resistance

TRANSMISSION CONTROL SWITCH RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
6 (IG) - 13 (S)	Shift lever position on S, "+" and "-"	Below 1 ohms
5 (SFTU) - 11 (E)	Shift lever position continuously shifted to (Up-shift)	Below 1 ohms
4 (SFTD) - 11 (E)	Shift lever position continuously shifted to (Down-shift)	Below 1 ohms
6 (IG) - 13 (S)	Shift lever position not on S, "+" and "-"	10 kohms or higher
5 (SFTU) - 11 (E)	Shift lever position on S	10 kohms or higher
4 (SFTD) - 11 (E)	Shift lever position on S	10 kohms or higher

   b. for Floor Shift Type:
      1. Disconnect the J24 transmission control switch connector.
      2. Measure the resistance according to the value (s) in the table below.

Standard resistance

TRANSMISSION CONTROL SWITCH RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
3 (IG) - 7 (S)	Shift lever position on S, "+" and "-"	Below 1 ohms
2 (SFTU) - 5 (E)	Shift lever position continuously shifted to "+" (Up-shift)	Below 1 ohms
1 (SFTD) - 5 (E)	Shift lever position continuously shifted to "-" (Down-shift)	Below 1 ohms
3 (IG) - 7 (S)	Shift lever position not on S, "+" and "-"	10 kohms or higher
2 (SFTU) - 5 (E)	Shift lever position on S	10 kohms or higher
1 (SFTD) - 5 (E)	Shift lever position on S	10 kohms or higher

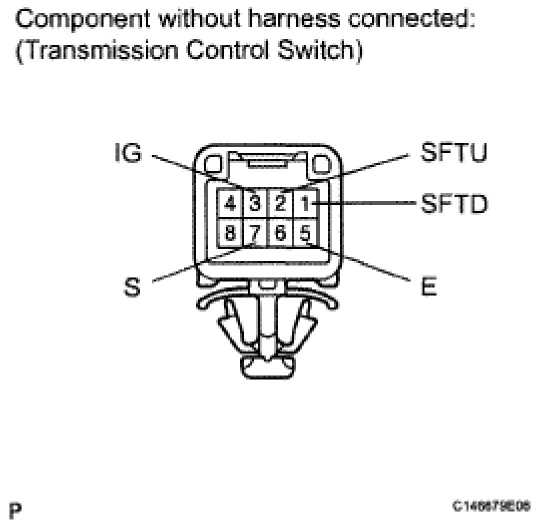

Fig. 123: Identifying J24 Transmission Control Switch Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Result

TRANSMISSION CONTROL SWITCH RESULT CHART

Result	Proceed to
OK	A
NG (for Column Shift Type)	B
NG (for Floor Shift Type)	C

B: REPLACE COLUMN SHIFT, SHIFT LEVER SUB-ASSEMBLY (TRANSMISSION CONTROL SWITCH) (see REMOVAL)

C: REPLACE TRANSMISSION FLOOR SHIFT ASSEMBLY (TRANSMISSION CONTROL SWITCH) (see SHIFT LEVER ASSEMBLY (FOR FLOOR SHIFT TYPE))

A: Go to next step

2. **CHECK HARNESS AND CONNECTOR (TRANSMISSION CONTROL SWITCH - BATTERY, BODY GROUND)**
   a. for Column Shift Type:
      1. Disconnect the J25 transmission control switch connector.
      2. Measure the voltage according to the value (s) in the table below.

         Standard voltage

         HARNESS AND CONNECTOR (TRANSMISSION CONTROL SWITCH - BATTERY, BODY GROUND) VOLTAGE SPECIFIED CONDITION

Tester Connection	Switch Condition	Specified Condition
J25-6 (IG) - Body ground	Ignition switch ON	11 to 14 V
J25-6 (IG) - Body ground	Ignition switch OFF	Below 1 V

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

         Standard resistance

         HARNESS AND CONNECTOR (TRANSMISSION CONTROL SWITCH - BATTERY, BODY GROUND) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
J25-11 (E) - Body ground	Always	Below 1 ohms

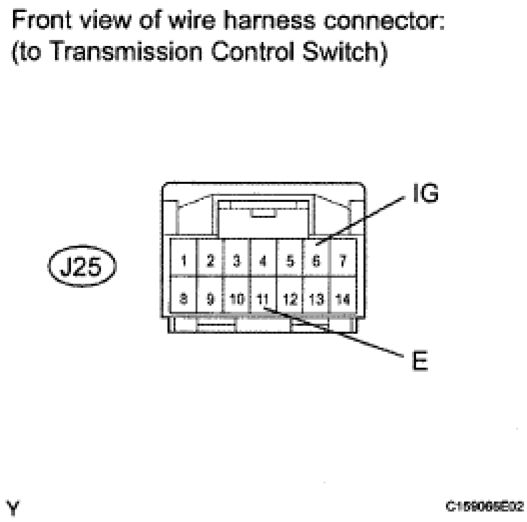

Fig. 124: Identifying J25 Transmission Control Switch Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. for Floor Shift Type:
      1. Disconnect the J24 transmission control switch connector.
      2. Measure the voltage according to the value (s) in the table below.

         Standard voltage

HARNESS AND CONNECTOR (TRANSMISSION CONTROL SWITCH - BATTERY, BODY GROUND) VOLTAGE SPECIFIED CONDITION

Tester Connection	Switch Condition	Specified Condition
J24-3 (IG) - Body ground	Ignition switch ON	11 to 14 V
J24-3 (IG) - Body ground	Ignition switch OFF	Below 1 V

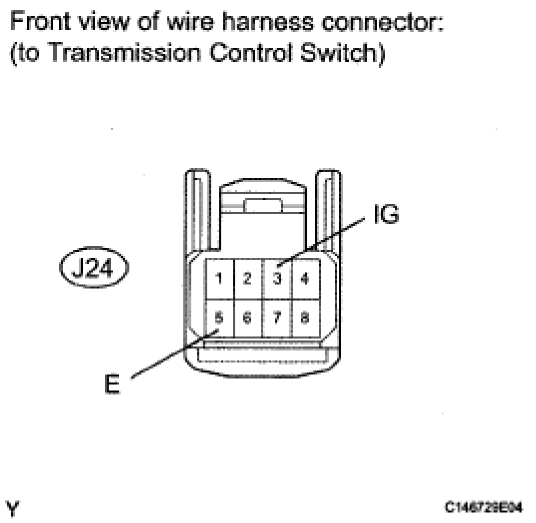

Fig. 125: Identifying J24 Transmission Control Switch Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Standard resistance

HARNESS AND CONNECTOR (TRANSMISSION CONTROL SWITCH - BATTERY, BODY GROUND) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
J24-5 (E) - Body ground	Always	Below 1 ohms

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: Go to next step

3. **CHECK HARNESS AND CONNECTOR (TRANSMISSION CONTROL SWITCH - ECM)**
   a. Disconnect the A24 ECM connector.
   b. Measure the voltage according to the value (s) in the table below.

   Standard voltage

   HARNESS AND CONNECTOR (TRANSMISSION CONTROL SWITCH - ECM) VOLTAGE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
A24-25 (S) - Body ground	• Ignition switch ON • Shift lever position on S, "+" and "-"	11 to 14 V

A24-25 (S) - Body ground	• Ignition switch ON • Shift lever position not on S, "+" and "-"	Below 1 V

c. Turn the ignition switch OFF.
d. Measure the resistance according to the value (s) in the table below.

Standard resistance

HARNESS AND CONNECTOR (TRANSMISSION CONTROL SWITCH - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
A24-38 (SFTU) - Body ground	Shift lever position continuously shifted to "+" (Up-shift)	Below 1 ohms
A24-27 (SFTD) - Body ground	Shift lever position continuously shifted to (Down-shift)	Below 1 ohms
A24-38 (SFTU) - Body ground	Shift lever position on S	10 kohms or higher
A24-27 (SFTD) - Body ground	Shift lever position on S	10 kohms or higher

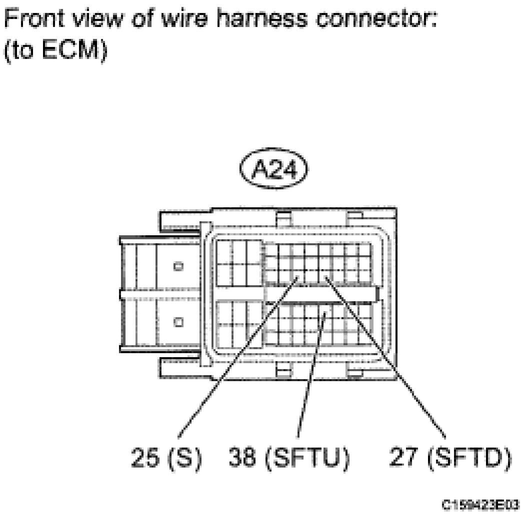

Fig. 126: Identifying A24 ECM Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE (see **PROBLEM SYMPTOMS TABLE**)

PATTERN SELECT SWITCH CIRCUIT

DESCRIPTION

The ECM receives tow/haul pattern select switch information and performs the tow/haul control.

While the tow/haul control is operating, in contrast to normal mode, low gears are used to increase engine braking and towing power, reduce frequent shifts, and improve driveability. The tow/haul control includes throttle control, shift schedule control, wide open throttle shift timing control and AI-SHIFT control. Tow/haul mode only operates when the shift lever is in the D position and the tow/haul pattern select switch is ON.

HINT:

- The tow/haul pattern select switch is a momentary-type switch.
- In order to cancel tow/haul mode, push the tow/haul pattern select switch again or turn the ignition switch OFF.

WIRING DIAGRAM

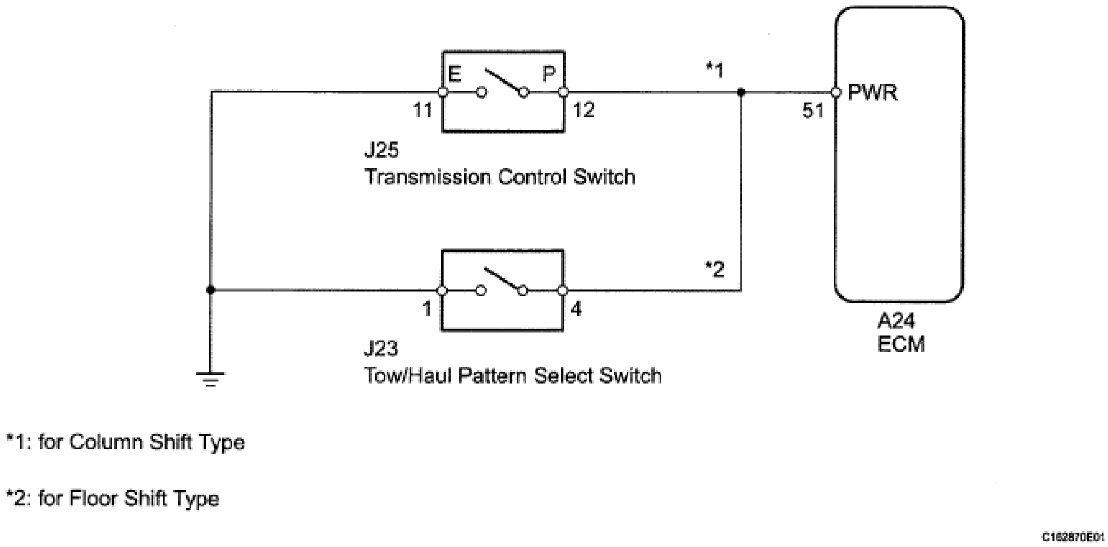

Fig. 127: Tow/Haul Pattern Select Switch - Wiring Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION PROCEDURE

1. **INSPECT TOW/HAUL PATTERN SELECT SWITCH ASSEMBLY**
    a. for Column Shift Type:
        1. Disconnect the J25 transmission control switch connector.
        2. Measure the resistance according to the value (s) in the table below.

Standard resistance

TOW/HAUL PATTERN SELECT SWITCH ASSEMBLY RESISTANCE SPECIFIED CONDITION

Tester Connection	Switch Condition	Specified Condition
12 (P) - 11 (E)	Tow/haul pattern select switch ON	Below 1 ohms
12 (P) - 11 (E)	Tow/haul pattern select switch OFF	10 kohms or higher

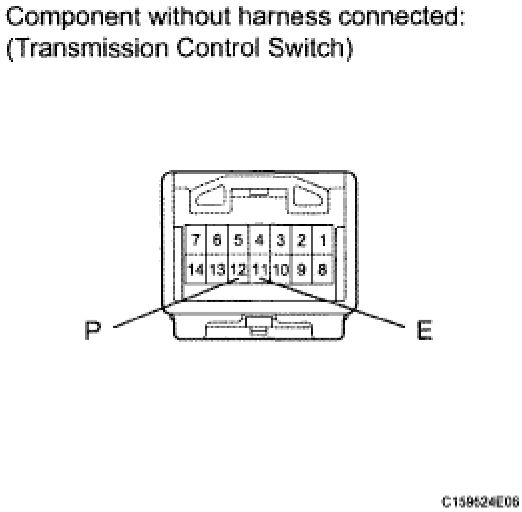

Fig. 128: Identifying J25 Transmission Control Switch Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. for Floor Shift Type:

1. Remove the rear upper console panel sub-assembly (see **SHIFT LEVER ASSEMBLY (FOR FLOOR SHIFT TYPE)**).
2. Disconnect the J23 tow/haul pattern select switch connector.
3. Measure the resistance according to the value (s) in the table below.

Standard resistance

TOW/HAUL PATTERN SELECT SWITCH ASSEMBLY RESISTANCE SPECIFIED CONDITION

Tester Connection	Switch Condition	Specified Condition
4- 1	Tow/haul pattern select switch ON	Below 1 ohms
4 - 1	Tow/haul pattern select switch OFF	10 kohms or higher

Result

TOW/HAUL PATTERN SELECT SWITCH ASSEMBLY RESULT CHART

Result	Proceed to
OK	A
NG (for Column Shift Type)	B
NG (for Floor Shift Type)	C

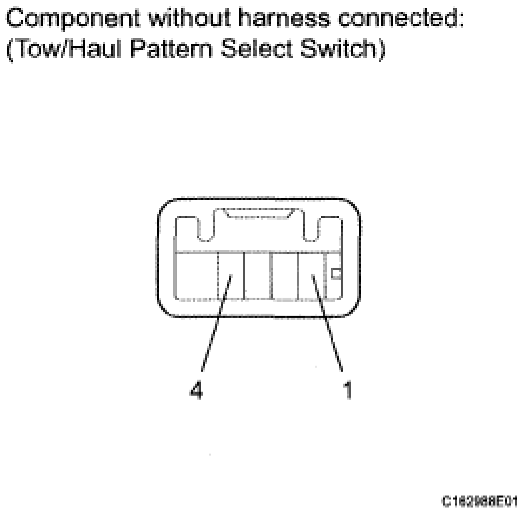

Fig. 129: Identifying J23 Tow/Haul Pattern Select Switch Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Install the rear upper console panel sub-assembly (see **INSTALLATION**).

B: REPLACE COLUMN SHIFT, SHIFT LEVER SUB-ASSEMBLY (TRANSMISSION CONTROL SWITCH) (see **REMOVAL**)

C: REPLACE TOW/HAUL PATTERN SELECT SWITCH ASSEMBLY

A: Go to next step

2. **CHECK HARNESS AND CONNECTOR (TOW/HAUL PATTERN SELECT SWITCH - BODY GROUND)**
   a. for Column Shift Type:
      1. Disconnect the J25 transmission control switch connector.
      2. Measure the resistance according to the value (s) in the table below.

Standard resistance

HARNESS AND CONNECTOR (TOW/HAUL PATTERN SELECT SWITCH - BODY GROUND) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
J25-11 (E) - Body ground	Always	Below 1 ohms

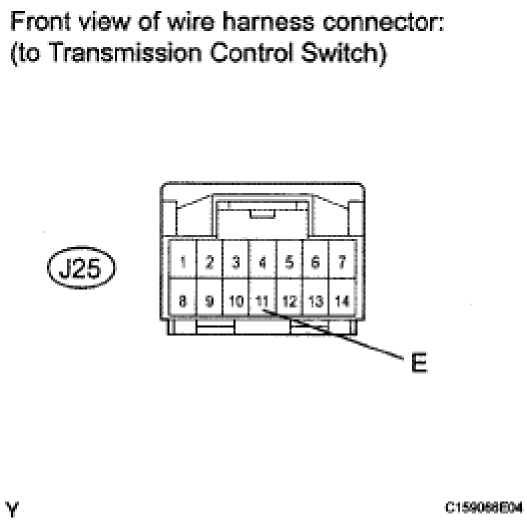

Fig. 130: Identifying Terminal E Of J25 Transmission Control Switch Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. for Floor Shift Type:
  1. Remove the rear upper console panel sub-assembly (see **SHIFT LEVER ASSEMBLY (FOR FLOOR SHIFT TYPE)**).
  2. Disconnect the J23 tow/haul pattern select switch connector.

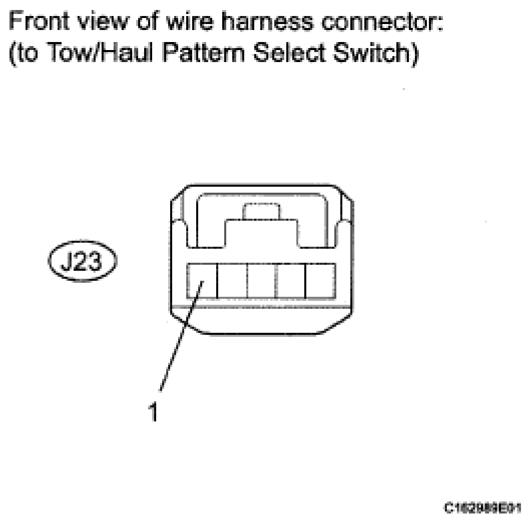

Fig. 131: Identifying Terminal 1 Of J23 Tow/Haul Pattern Select Switch Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Standard resistance

HARNESS AND CONNECTOR (TOW/HAUL PATTERN SELECT SWITCH - BODY GROUND) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
J23-1 - Body ground	Always	Below 1 ohms

4. Install the rear upper console panel sub-assembly (see **INSTALLATION**).

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: Go to next step

3. **CHECK HARNESS AND CONNECTOR (TOW/HAUL PATTERN SELECT SWITCH - ECM)**
   a. Disconnect the A24 ECM connector.
   b. Measure the resistance according to the value (s) in the table below.

   Standard resistance

   HARNESS AND CONNECTOR (TOW/HAUL PATTERN SELECT SWITCH - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Switch Condition	Specified Condition
A24-51 (PWR) - Body ground	Tow/haul pattern select switch ON	Below 1 ohms
A24-51 (PWR) - Body ground	Tow/haul pattern select switch OFF	10 kohms or higher

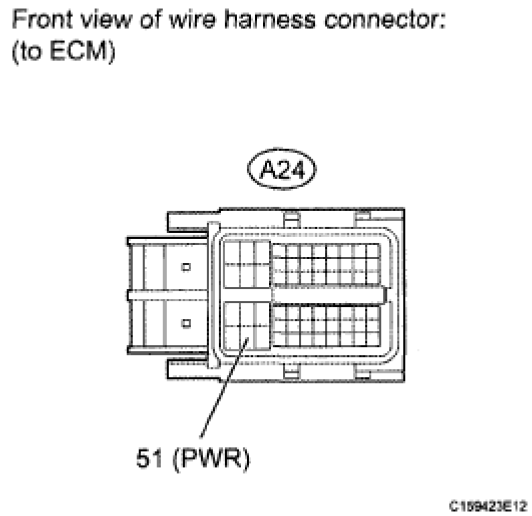

Fig. 132: Identifying 51 (PWR) Terminal Of A24 ECM Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NG: REPAIR OR REPLACE HARNESS OR CONNECTOR

OK: PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE (see **PROBLEM SYMPTOMS TABLE**)

AUTOMATIC TRANSMISSION FLUID

ADJUSTMENT

1. **BEFORE FILLING TRANSMISSION**
   - This transmission requires Toyota Genuine ATF WS transmission fluid.

- After servicing the transmission, you must refill the transmission with the correct amount of fluid.
- Maintain the vehicle in a horizontal position while adjusting the fluid level.
- Proceed to the 2"TRANSMISSION PAN FILL" procedures if you replaced the entire transmission, transmission pan, drain plug, valve body and/or torque converter.
- Proceed to the 3"TRANSMISSION FILL" procedures after removing the refill plug if you replaced the transmission hose and/or output shaft oil seal.

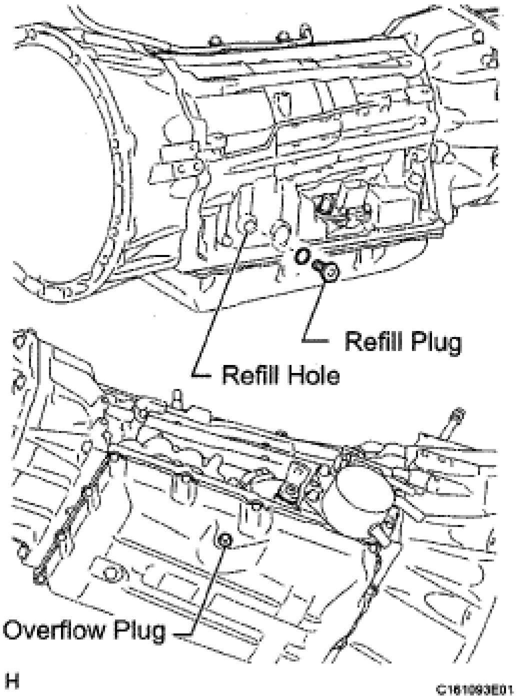

Fig. 133: Identifying Transmission Refill Plug, Hole With Overflow Plug
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **TRANSMISSION PAN FILL**
   a. Remove the refill plug and overflow plug.
   b. Fill the transmission through the refill hole until fluid begins to trickle out of the overflow tube.
   c. Reinstall the overflow plug.

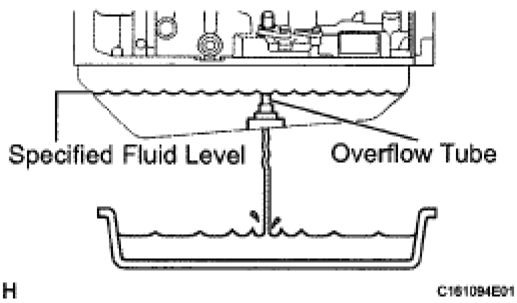

Fig. 134: Identifying Proper Position Of Filling Transmission
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **TRANSMISSION FILL**
   a. w/ Trailer Towing System (w/ Thermostat):

   Push the shaft of the thermostat and fix it in place.

   1. By using compressed air, etc., blow dust off of the thermostat's cap to clean it.

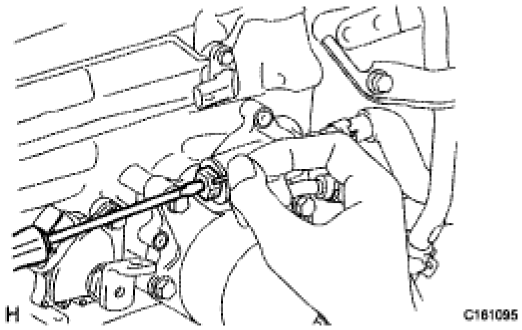

Fig. 135: Pushing Shaft Of Thermostat
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   2. Using a screwdriver, push the shaft of the thermostat.

   HINT:

   - Pushed amount: 5.5 to 7.0 mm (0.217 to 0.276 in.)
   - Push the shaft until the screwdriver contacts the inside the cap.

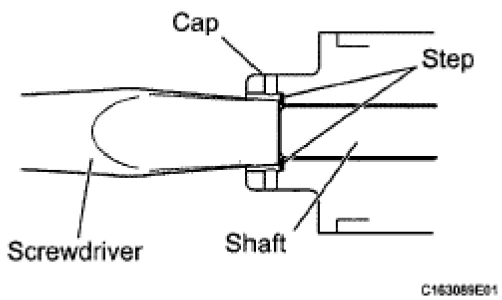

Fig. 136: Position Of Pushing Shaft Of Thermostat
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   3. With the shaft of the thermostat pressed, push a pin (diameter: 1.0 to 1.8 mm (0.0394 to 0.0709 in.)) into a hole on the side of the thermostat's cap. Insert the pin until it passes through the hole on the other side of the thermostat's cap to fix the shaft in place.

   b. Fill the transmission with the amount of fluid listed in the table below.

   Standard capacity

TRANSMISSION FLUID FILL CAPACITY

Repair	Fill Amount
Transmission pan and drain plug removal	2.1 liters (2.2 US qts, 1.9 lmp. qts)

Transmission valve body removal	4.7 liters (5.0 US qts, 4.1 lmp. qts)
Torque converter removal	5.4 liters (6.5 US qts, 5.4 lmp. qts)

c. Reinstall the refill plug to prevent the fluid from splashing.

HINT:

If you cannot add the listed amount of fluid, do the following:

1. Install the refill plug.
2. Allow the engine to idle with the air conditioning OFF.
3. Move the shift lever through the entire gear range to circulate fluid.
4. Wait for 30 seconds with the engine idling.
5. Stop the engine.
6. Remove the refill plug and add fluid.
7. Reinstall the refill plug.

4. **FLUID CIRCULATION**
    a. Allow the engine to idle with the air conditioning OFF.
    b. Move the shift lever through the entire gear range to circulate fluid.
5. **FLUID TEMPERATURE CHECK**
    a. When using the intelligent tester or Techstream:
        1. Connect the intelligent tester or Techstream to the DLC3.
        2. Enter the following menus:

FLUID TEMPERATURE CHECK MENU

Item	Select
Intelligent tester	DIAGNOSIS / ENHANCED OBD II / DATA LIST / A/T OIL TEMP 2
Techstream	Powertrain / Engine / Data List / A/T Oil Temperature 2

3. Check ATF temperature.
4. Allow the engine to idle until the fluid temperature reaches 46 to 56°C (115 to 133°F).

b. When not using the intelligent tester or Techstream (using indicator light):
1. Using SST, connect terminals 13 (TC) and 4 (CG) of the DLC3.

SST 09843-18040

2. Start the engine.
3. Slowly move the shift lever from P to S, then change the gears from 1st to 6th. Then return the shift lever to P.

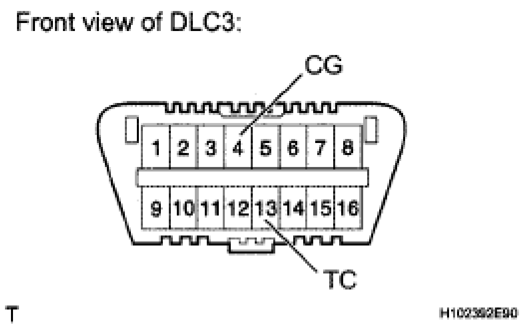

Fig. 137: Identifying Terminals 13 (TC) And 4 (CG) Of DLC3
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Move the shift lever to the D position, and quickly move back and forth between N and D (once within 1.5 seconds) for at least 6 seconds. This will activate the fluid temperature detection mode.

   Standard condition:

   Indicator light (D) remains illuminated for 2 seconds and then goes off.

5. Return the shift lever to the P position and disconnect terminals 13 (TC) and 4 (CG).
6. Allow the engine to idle until the fluid temperature reaches 46 to 56°C (115 to 133°F).

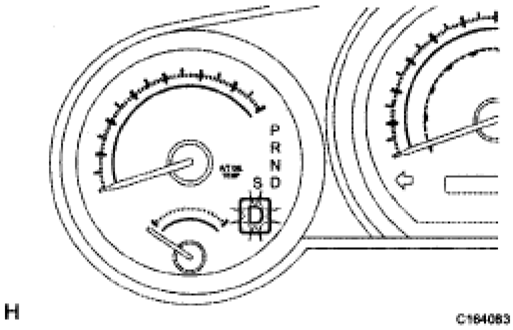

Fig. 138: Identifying Fluid Temperature Indicator
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. The indicator (D) will come on again when the fluid temperature reaches 46°C (115°F) and will blink when it exceeds 56°C (133°F).

   Indicator will indicate the ATF temperature

FLUID TEMPERATURE SENSOR INDICATIONS

Lower than proper temp.	Proper temp.	Higher than proper temp.
Turn off	Turn on	Blinking

NOTE: Perform the fluid level inspection while the indicator light is on.

6. **FLUID LEVEL CHECK**

NOTE: The fluid temperature must be between 46 and 56°C (115 and 133°F) to accurately check the fluid level.

a. Remove the overflow plug with the engine idling.
b. Check that the fluid comes out of the overflow tube. If fluid does not come out, proceed to the 7"TRANSMISSION REFILL" procedures.

   If fluid comes out, wait until the overflow slows to a trickle and proceed to the 8"COMPLETE" procedures.

7. **TRANSMISSION REFILL**
a. Remove the overflow plug and gasket.
b. Remove the refill plug and gasket.

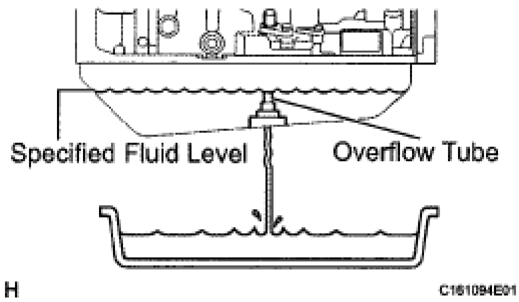

Fig. 139: Identifying Proper Position Of Filling Transmission
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Add ATF into the refill hole until ATF flows from the overflow tube.
d. Wait until the overflow slows to a trickle and proceed to the 8"COMPLETE" procedures.

8. **COMPLETE**
a. Install a new gasket and the overflow plug.
b. Stop the engine.
c. Install a new gasket and the refill plug.

   Torque: for overflow plug

   20 N*m (204 kgf*cm, 15 ft.*lbf)

   for refill plug

   39 N*m (400 kgf*cm, 29 ft.*lbf)

d. w/ Trailer Towing System (w/ Thermostat):
   1. Remove the pin.

NOTE: Make sure the shaft of the thermostat is protruding from the

hole of the cap.

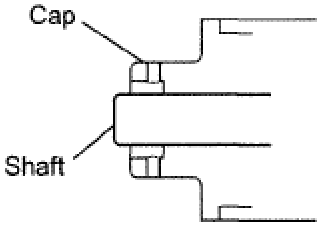

Fig. 140: Identifying Cap And Shaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

SPEED SENSOR

COMPONENTS

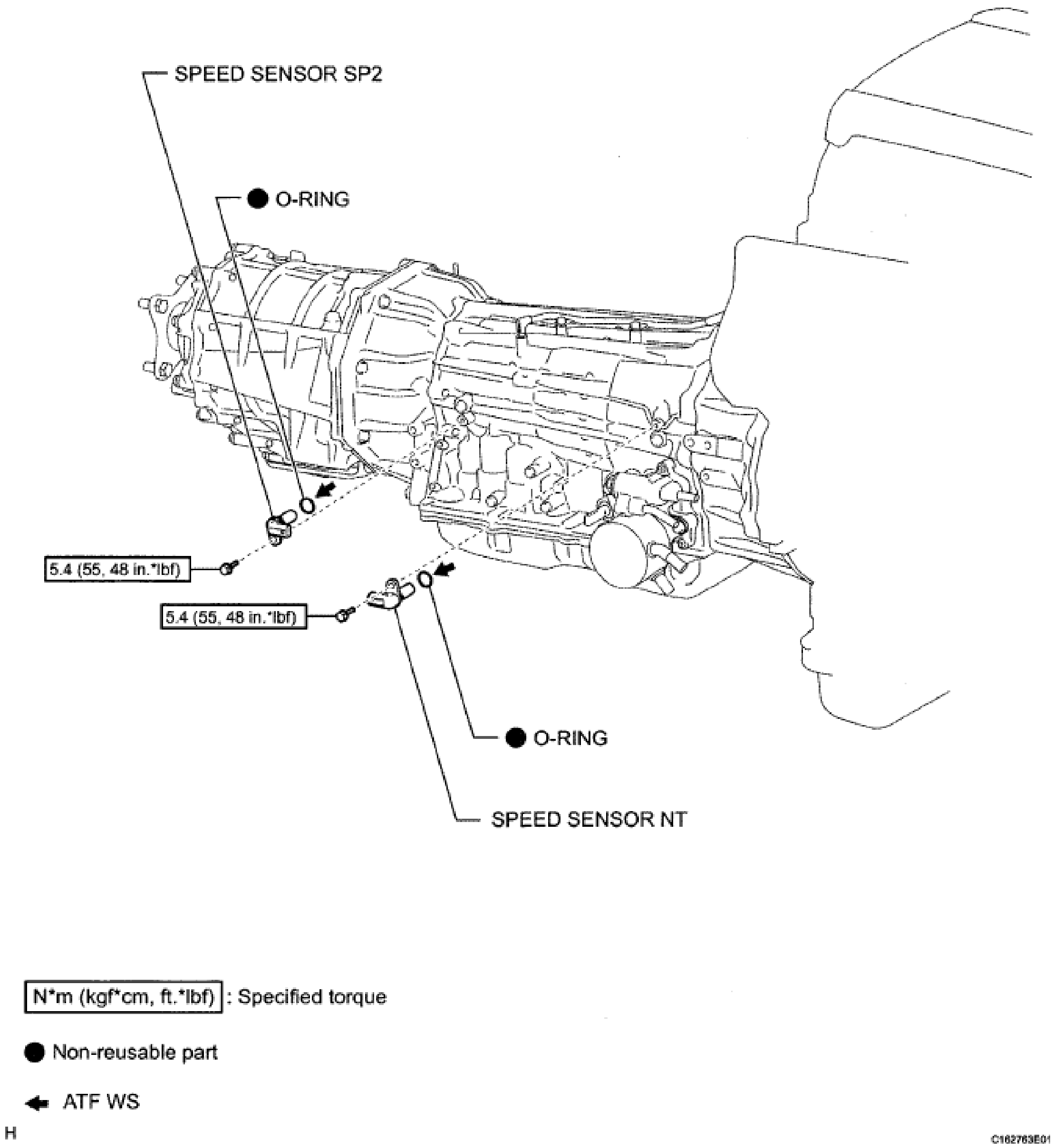

Fig. 141: Identifying Speed Sensor Components With Torque Specifications
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **REMOVE SPEED SENSOR NT**
    a. Disconnect the sensor connector.
    b. Remove the bolt and sensor.
    c. Remove the O-ring from the sensor.

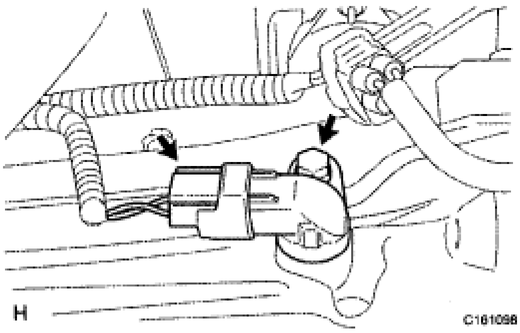

Fig. 142: Identifying Speed Sensor NT Connector With Mounting Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **REMOVE SPEED SENSOR SP2**
    a. Disconnect the sensor connector.
    b. Remove the bolt and sensor.
    c. Remove the O-ring from the sensor.

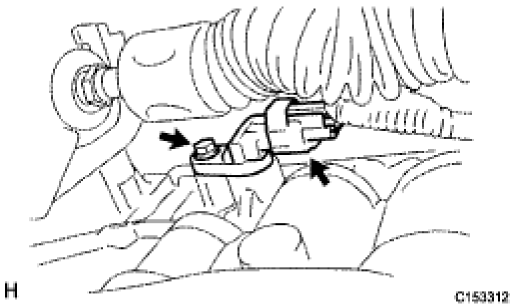

Fig. 143: Identifying Speed Sensor SP2 Connector With Mounting Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION

1. **INSPECT SPEED SENSOR NT**
    a. Measure the resistance according to the value (s) in the table below.

    Standard resistance

    SPEED SENSOR NT RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	560 to 680 ohms

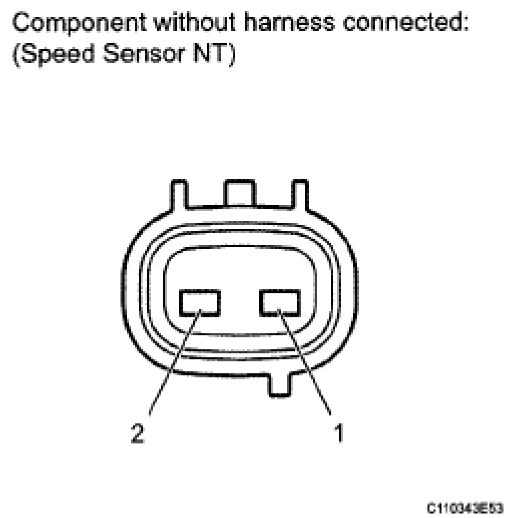

Fig. 144: Identifying Speed Sensor NT Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the result is not as specified, replace the sensor.

2. **INSPECT SPEED SENSOR SP2**
   a. Measure the resistance according to the value (s) in the table below.

Standard resistance

SPEED SENSOR SP2 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	560 to 680 ohms

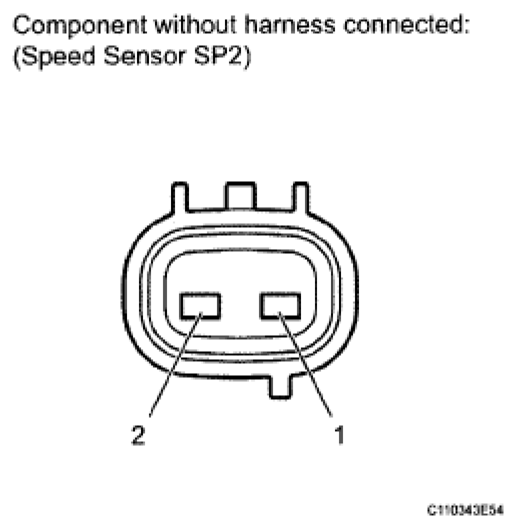

Fig. 145: Identifying Speed Sensor SP2 Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the result is not as specified, replace the sensor.

INSTALLATION

1. **INSTALL SPEED SENSOR SP2**
   a. Coat a new O-ring with ATF and install it to the sensor.
   b. Install the sensor with the bolt.

      Torque: 5.4 N*m (55 kgf*cm, 48 in.*lbf)

   c. Connect the sensor connector.

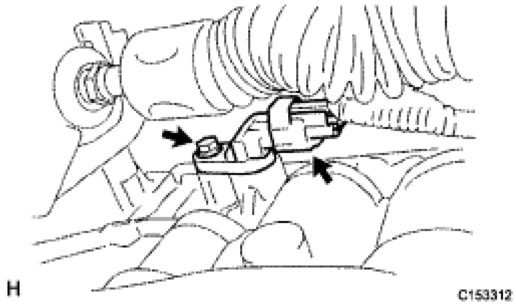

Fig. 146: Identifying Speed Sensor SP2 Connector With Mounting Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **INSTALL SPEED SENSOR NT**
   a. Coat a new O-ring with ATF and install it to the sensor.
   b. Install the sensor with the bolt.

      Torque: 5.4 N*m (55 kgf*cm, 48 in.*lbf)

   c. Connect the sensor connector.

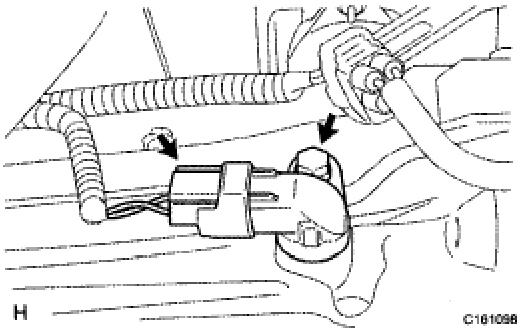

Fig. 147: Identifying Speed Sensor NT Connector With Mounting Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TRANSMISSION WIRE

COMPONENTS

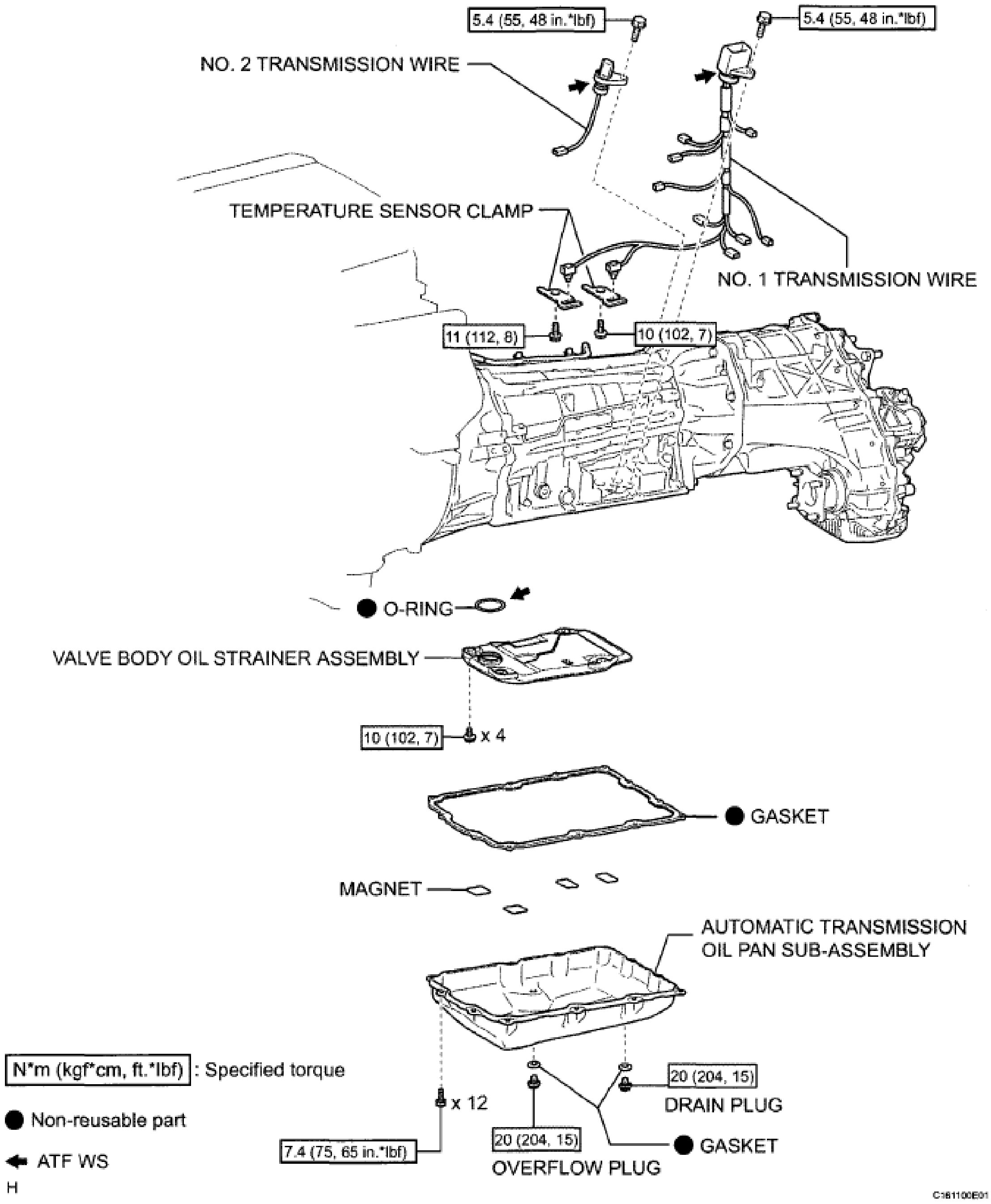

Fig. 148: Exploded View Of Transmission Wire With Torque Specifications
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**

   NOTE: Some systems need to be initialized after the cable is reconnected (see INITIALIZATION).

2. **DRAIN AUTOMATIC TRANSMISSION FLUID**
   a. Remove the drain plug and gasket, and drain the ATF.

b. Install a new gasket and the drain plug.

Torque: 20 N*m (204 kgf*cm, 15 ft.*lbf)

3. **REMOVE AUTOMATIC TRANSMISSION OIL PAN SUB-ASSEMBLY**
   a. Remove the 12 bolts, oil pan and gasket from the transmission.

NOTE: **Some fluid will remain in the oil pan. Remove all the bolts, and carefully remove the oil pan assembly.**

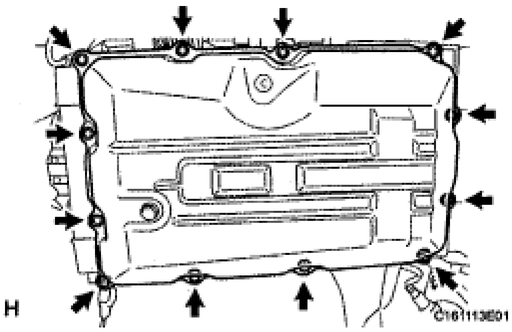

Fig. 149: Identifying Automatic Transmission Oil Pan Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Examine the particles in the pan.
      1. Remove the 4 magnets and use them to collect steel particles. Carefully inspect the foreign matter and particles in the pan and on the magnets to anticipate the type of wear you will find in the transmission.

         Steel (magnetic): bearing, gear and clutch plate wear

         Brass (non-magnetic): bush wear

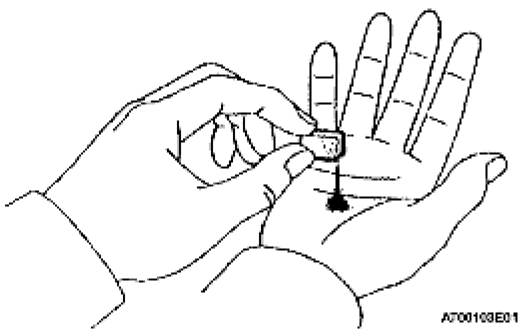

Fig. 150: Collecting Steel Particles From Magnet
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. **REMOVE VALVE BODY OIL STRAINER ASSEMBLY**
   a. Remove the 4 bolts and oil strainer.

NOTE: Be careful as some fluid may leak out of the oil strainer.

b. Remove the O-ring from the oil strainer.

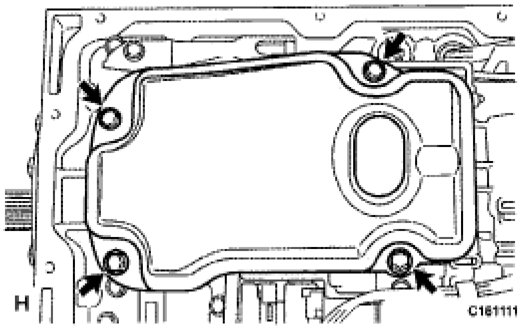

Fig. 151: Identifying Oil Strainer Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. **DISCONNECT TRANSMISSION WIRE**
   a. Remove the 2 bolts and 2 temperature sensor clamps.
   b. Disconnect the 2 ATF temperature sensors.
   c. Disconnect the 9 connectors from the solenoid valves.

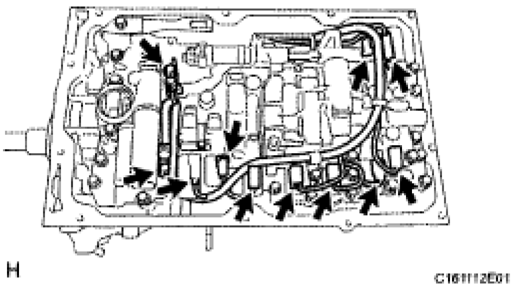

Fig. 152: Identifying Solenoid Valves Connectors And ATF Temperature Sensors
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. **REMOVE TRANSMISSION WIRE**
   a. Disconnect the 2 wire connectors.

   HINT:

   Detach the claw, press down the lever, and then disconnect the transmission wire connector.

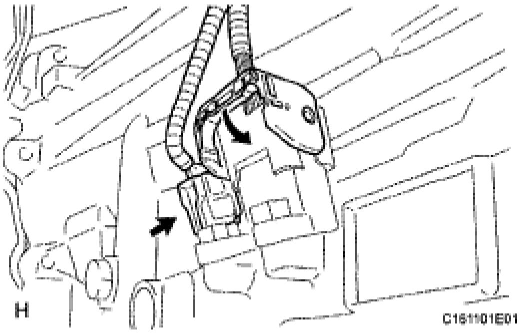

Fig. 153: Identifying Transmission Wire Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the 2 bolts and pull out the 2 transmission wires.

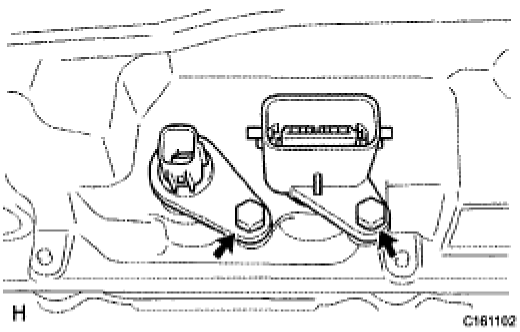

Fig. 154: Identifying Transmission Wire Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION

1. **INSPECT TRANSMISSION WIRE (ATF TEMPERATURE SENSOR)**
   a. Measure the resistance according to the value (s) in the table below.

      HINT:

      If the resistance is out of the specified range of any of the ATF temperatures shown in the table below, the driveability of the vehicle may decrease.

      Standard resistance

      TRANSMISSION WIRE (ATF TEMPERATURE SENSOR) RESISTANCE SPECIFIED CONDITION

Tester Connection	ATF Temperature	Specified Condition
1 (OT-) - 9 (OT+)	10°C (50°F)	5 to 8 kohms
1 (OT-) - 9 (OT+)	25°C (77°F)	2.5 to 4.5 kohms
1 (OT-) - 9 (OT+)	110°C (230°F)	0.22 to 0.28 kohms
2 (OT2-) - 10 (OT2+)	10°C (50°F)	5 to 8 kohms
2 (OT2-) - 10 (OT2+)	25°C (77°F)	2.5 to 4.5 kohms
2 (OT2-) - 10 (OT2+)	110°C (230°F)	0.22 to 0.28 kohms

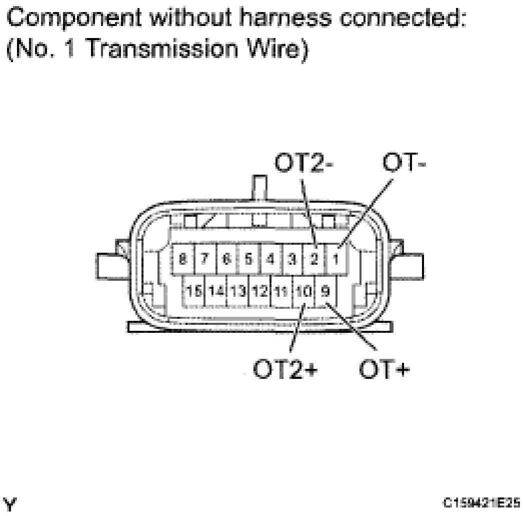

Fig. 155: Identifying No.1 Transmission Wire Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the result is not as specified, replace the transmission wire.

INSTALLATION

1. **INSTALL TRANSMISSION WIRE**
   a. Coat the O-ring of the transmission wire connector with ATF.
   b. Install the 2 transmission wires with the 2 bolts.

   Torque: 5.4 N*m (55 kgf*cm, 48 in.*lbf)

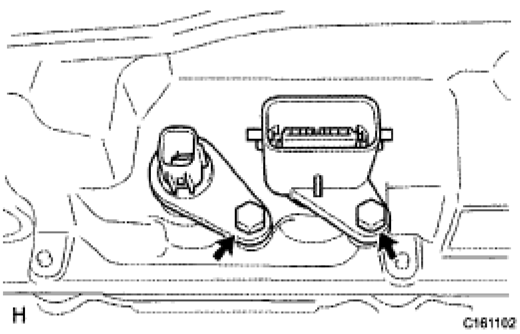

Fig. 156: Identifying Transmission Wires With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   c. Connect the 2 transmission wire connectors.

   HINT:

   Push up the lever until the claw of the transmission wire connector makes a connection sound.

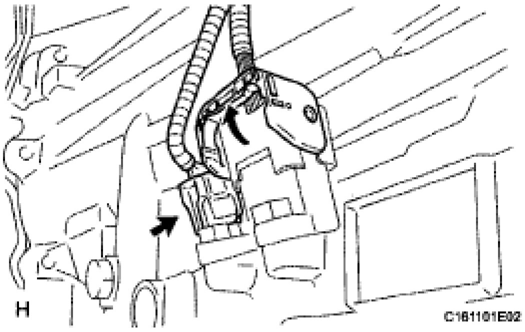

Fig. 157: Identifying Transmission Wire Connectors
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **CONNECT TRANSMISSION WIRE**
   a. Connect the 9 connectors to the solenoid valves.
   b. Connect the 2 ATF temperature sensors with the 2 clamps and 2 bolts.

   Torque: for bolt A

   10 N*m (102 kgf*cm, 7 ft.*lbf)

   for bolt B

   11 N*m (112 kgf*cm, 8 ft.*lbf)

   HINT:

   Each bolt length is indicated below.

   12 mm (0.472 in.) for bolt A

   36 mm (1.41 in.) for bolt B

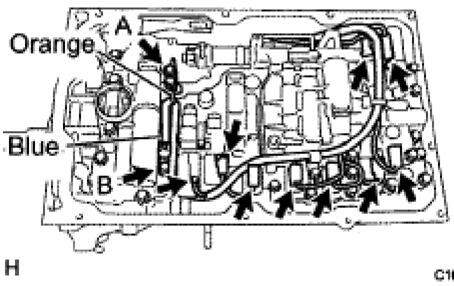

Fig. 158: Identifying Connectors To Solenoid Valves
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **INSTALL VALVE BODY OIL STRAINER ASSEMBLY**
   a. Coat a new O-ring with ATF and install it to the oil strainer.
   b. Install the oil strainer with the 4 bolts.

Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)

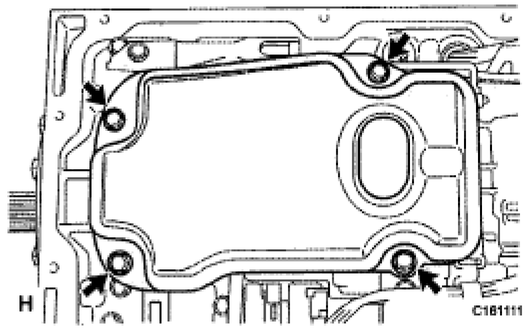

Fig. 159: Identifying Oil Strainer With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. **INSTALL AUTOMATIC TRANSMISSION OIL PAN SUB-ASSEMBLY**
   a. Install the 4 transmission oil cleaner magnets to the oil pan.

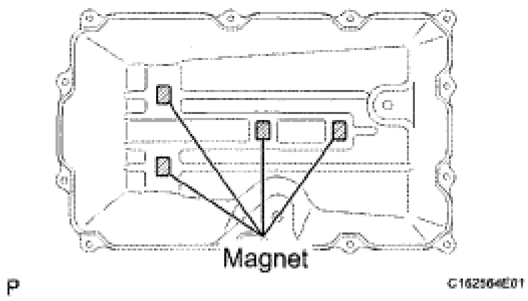

Fig. 160: Identifying Transmission Oil Cleaner Magnets To Oil Pan
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Install a new gasket and the oil pan with the 12 bolts.

Torque: 7.4 N*m (75 kgf*cm, 65 in.*lbf)

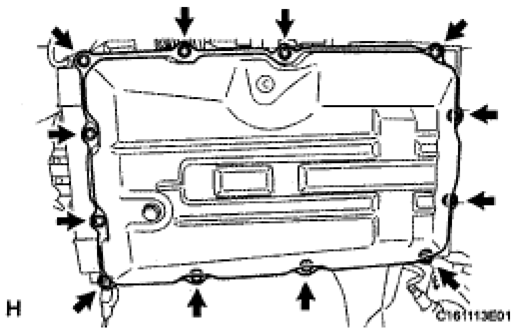

Fig. 161: Identifying Oil Pan With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:	• **Make sure that there is no oil or foreign matter on the gasket seal surface and oil pan contact surface.**

- **Install the gasket so that there is no slack in the gasket, and make sure the seal surface's entire circumference is level.**
- **Make sure that the 9 gasket drop prevention protrusions are set on the oil pan.**
- **When tightening the oil pan, make sure that the gasket is not pinched between the gasket tightening area's sleeve and the transmission's seal surface.**

5. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

NOTE: **Some systems need to be initialized after the cable is reconnected (see INITIALIZATION).**

6. **ADD AUTOMATIC TRANSMISSION FLUID**
   a. Add automatic transmission fluid (see **AUTOMATIC TRANSMISSION FLUID**).

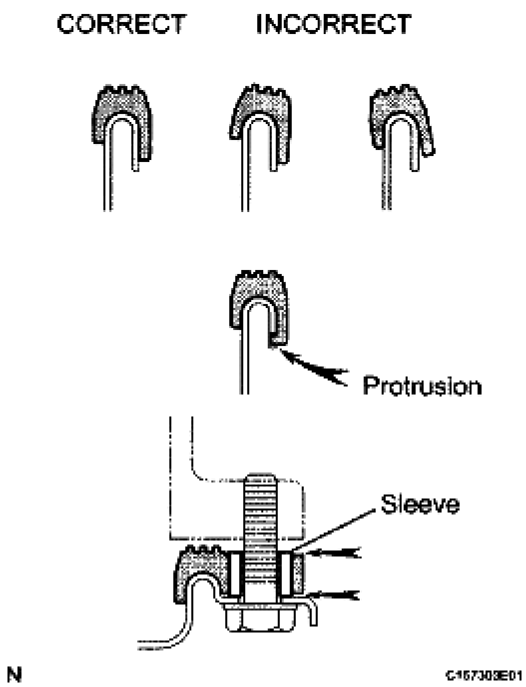

Fig. 162: Identifying Correct Position Of Protrusion
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

PARK/NEUTRAL POSITION SWITCH

COMPONENTS

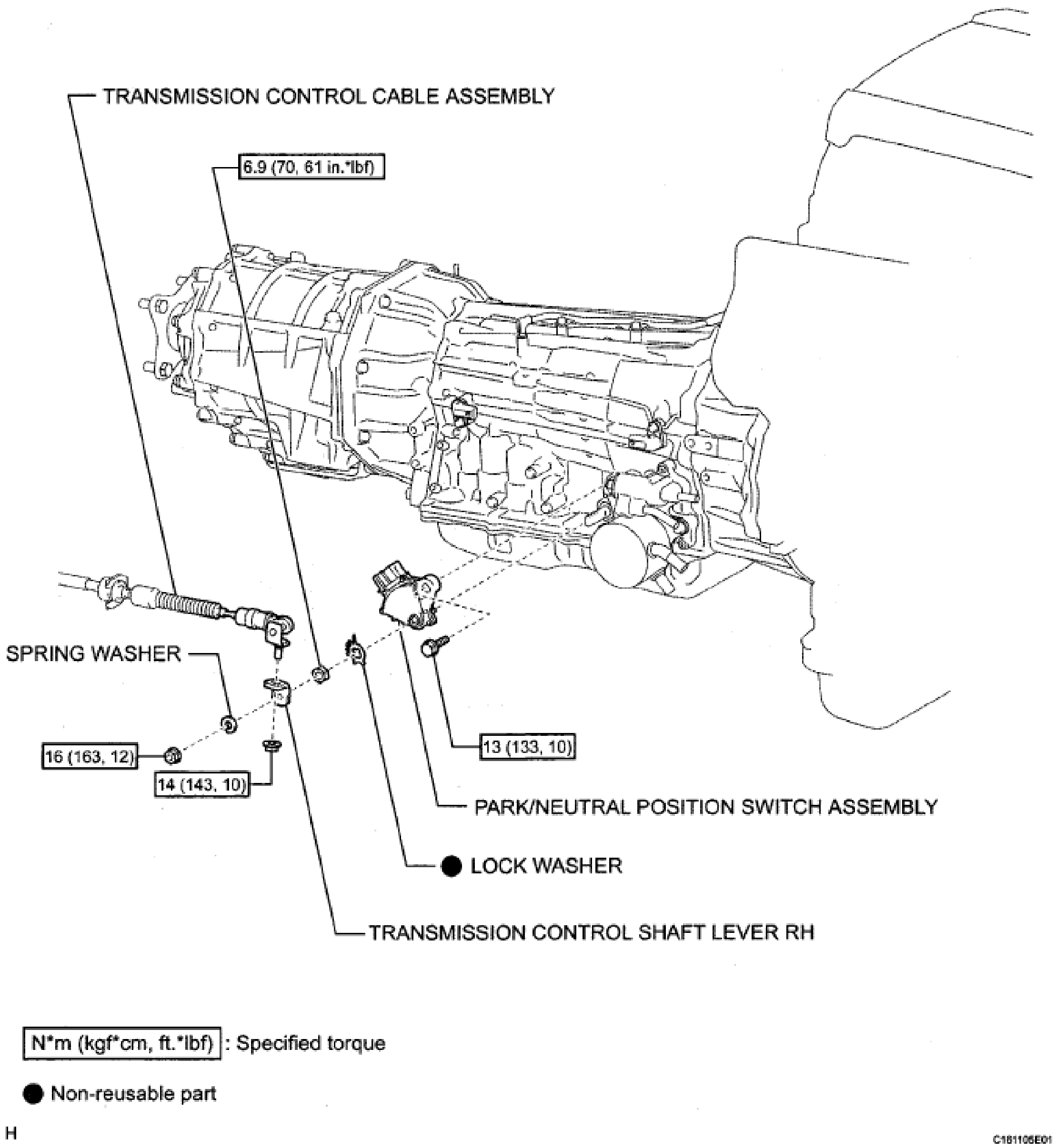

Fig. 163: Identifying Park/Neutral Position Switch Components With Torque Specifications
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ON-VEHICLE INSPECTION

1. **INSPECT PARK/NEUTRAL POSITION SWITCH ASSEMBLY**
   a. Apply the parking brake and turn the ignition switch ON.
   b. Depress the brake pedal and check that the engine starts when the shift lever is on N or P, but does not start in other positions.
   c. Check that the back-up light illuminates and the reverse warning buzzer sounds when the shift lever is on R, but do not function in other positions.

REMOVAL

1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**

NOTE: Some systems need to be initialized after the cable is reconnected (see INITIALIZATION).

2. **DISCONNECT TRANSMISSION CONTROL CABLE ASSEMBLY**
    a. Remove the nut and disconnect the cable.

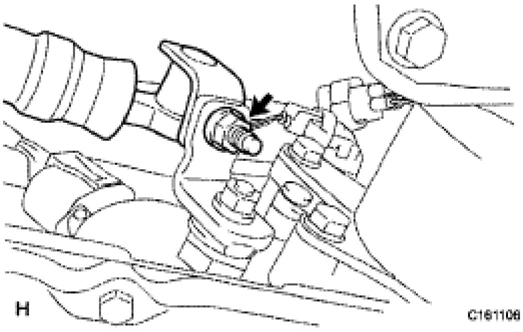

Fig. 164: Identifying Transmission Control Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **REMOVE PARK/NEUTRAL POSITION SWITCH ASSEMBLY**
    a. Disconnect the switch connector.
    b. Remove the nut, spring washer and transmission control shaft lever RH.

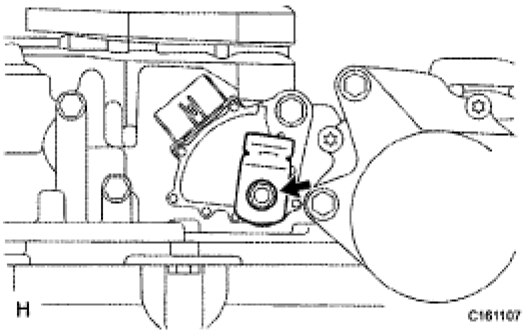

Fig. 165: Identifying Transmission Control Shaft Lever RH And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    c. Using a screwdriver, bend the tabs of the lock washer.

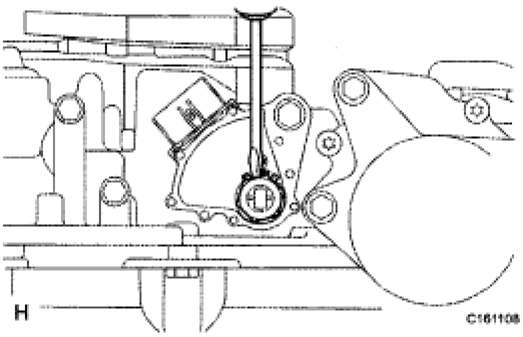

Fig. 166: Identifying Tabs Of Lock Washer

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

d. Remove the lock nut and lock washer.

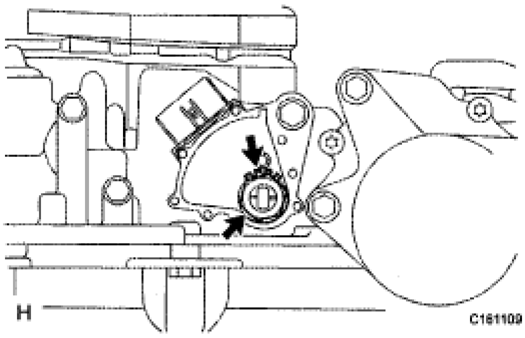

Fig. 167: Identifying Lock Washer And Lock Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

e. Remove the bolt and switch.

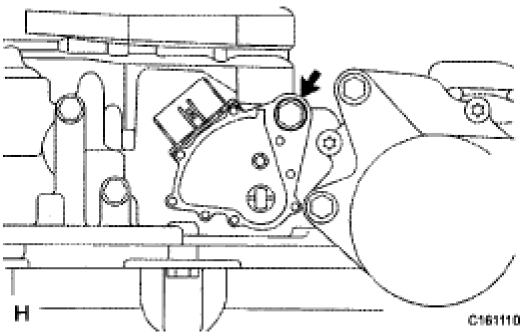

Fig. 168: Identifying Switch And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION

1. **INSPECT PARK/NEUTRAL POSITION SWITCH ASSEMBLY**
   a. Measure the resistance according to the value (s) in the table below.

Standard resistance

PARK/NEUTRAL POSITION SWITCH ASSEMBLY RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
2 (RB) - 5 (PL)	Shift Position P	Below 1 ohms
2 (RB) - 5 (PL)	Shift Position Not on P	10 kohms or higher
2 (RB) - 1 (RL)	Shift Position R	Below 1 ohms
2 (RB) - 1 (RL)	Shift Position Not on R	10 kohms or higher
2 (RB) - 7 (NL)	Shift Position N	Below 1 ohms
2 (RB) - 7 (NL)	Shift Position Not on N	10 kohms or higher

2 (RB) - 6 (DL)	Shift Position D and S	Below 1 ohms
2 (RB) - 6 (DL)	Shift Position Not on D and S	10 kohms or higher
3 (B) - 4 (L)	Shift Position P and N	Below 1 ohms
3 (B) - 4 (L)	Shift Position Not on P and N	10 kohms or higher

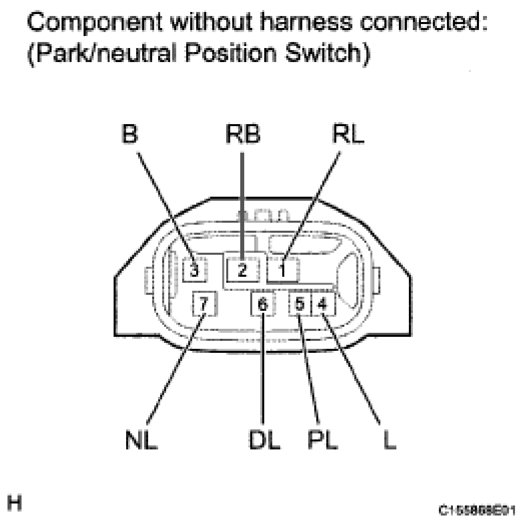

Fig. 169: Identifying Park/Neutral Position Switch Connector Terminal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the result is not as specified, replace the switch assembly.

ADJUSTMENT

1. **ADJUST PARK/NEUTRAL POSITION SWITCH ASSEMBLY**
   a. Loosen the bolt 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 the position described above and tighten the bolt.

   Torque: 13 N*m (130 kgf*cm, 10 ft.*lbf)

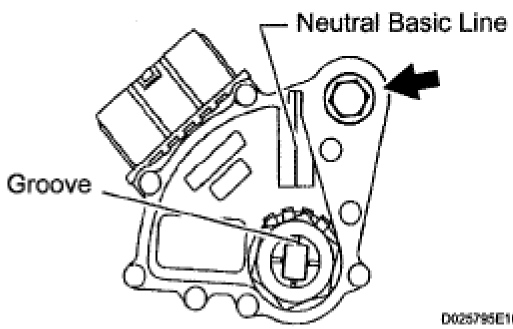

Fig. 170: Identifying Neutral Basic Line And Groove
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   d. After the adjustment, perform the on-vehicle inspection (see **REMOVAL**).

INSTALLATION

1. **INSTALL PARK/NEUTRAL POSITION SWITCH ASSEMBLY**
    a. Install the switch to the manual valve shaft.
    b. Temporarily install the bolt.

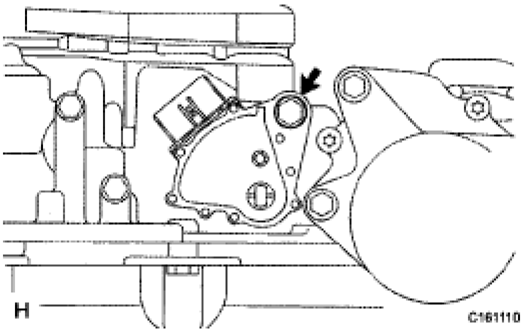

Fig. 171: Identifying Park/Neutral Position Switch Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    c. Install a new lock washer and the nut.

    Torque: 6.9 N*m (70 kgf*cm, 61 in.*lbf)

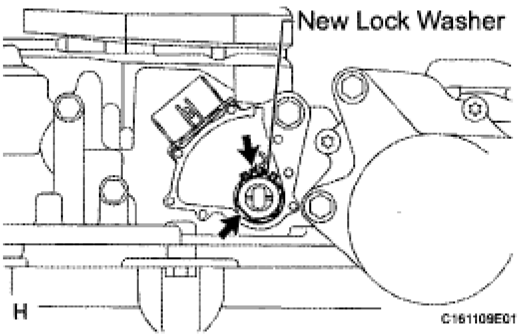

Fig. 172: Identifying Lock Washer And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    d. Temporarily install the control shaft lever RH.

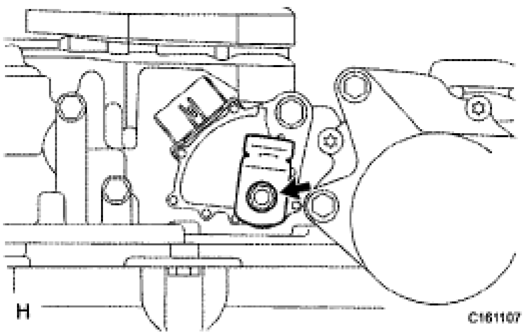

Fig. 173: Identifying Transmission Control Shaft Lever RH And Nut

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

e. Turn the control shaft lever RH counterclockwise until it stops, and then turn it clockwise 2 notches to set it to the N position.
f. Remove the control shaft lever RH.

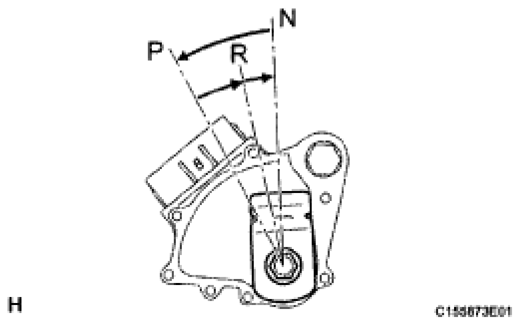

Fig. 174: Identifying Control Shaft Lever RH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

g. Align the groove with the neutral basic line.
h. Hold the switch in the position described above and tighten the bolt.

Torque: 13 N*m (133 kgf*cm, 10 ft.*lbf)

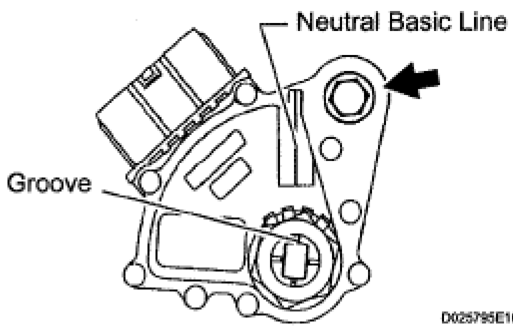

Fig. 175: Identifying Neutral Basic Line And Groove
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

i. Using a screwdriver, bend the tabs of the lock washer.

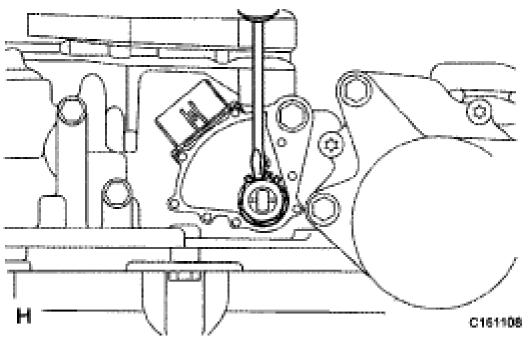

Fig. 176: Identifying Tabs Of Lock Washer

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

j. Install the transmission control shaft lever RH with the spring washer and nut.

Torque: 16 N*m (163 kgf*cm, 12 ft.*lbf)

k. Connect the switch connector.

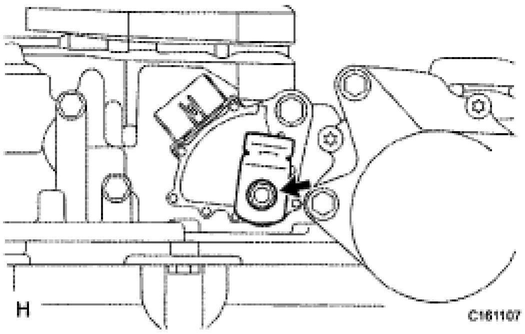

Fig. 177: Identifying Transmission Control Shaft Lever RH And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **CONNECT TRANSMISSION CONTROL CABLE ASSEMBLY**
   a. Connect the cable with the nut.

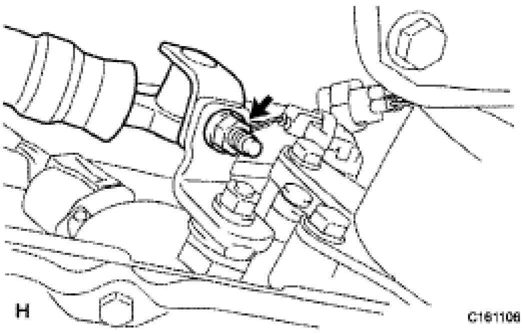

Fig. 178: Identifying Transmission Control Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Torque: 14 N*m (143 kgf*cm, 10 ft.*lbf)

NOTE:	**When connecting the cable to the transmission control shaft lever, make sure the cable's L bracket faces the outside of the vehicle.**

3. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

NOTE:	**Some systems need to be initialized after the cable is reconnected (see INITIALIZATION).**

4. **ADJUST SHIFT LEVER POSITION**
   a. Adjust the shift lever position (see **ADJUSTMENT**).

5. **INSPECT PARK/NEUTRAL POSITION SWITCH ASSEMBLY**
    a. Inspect the switch (see **REMOVAL**).

VALVE BODY ASSEMBLY

COMPONENTS

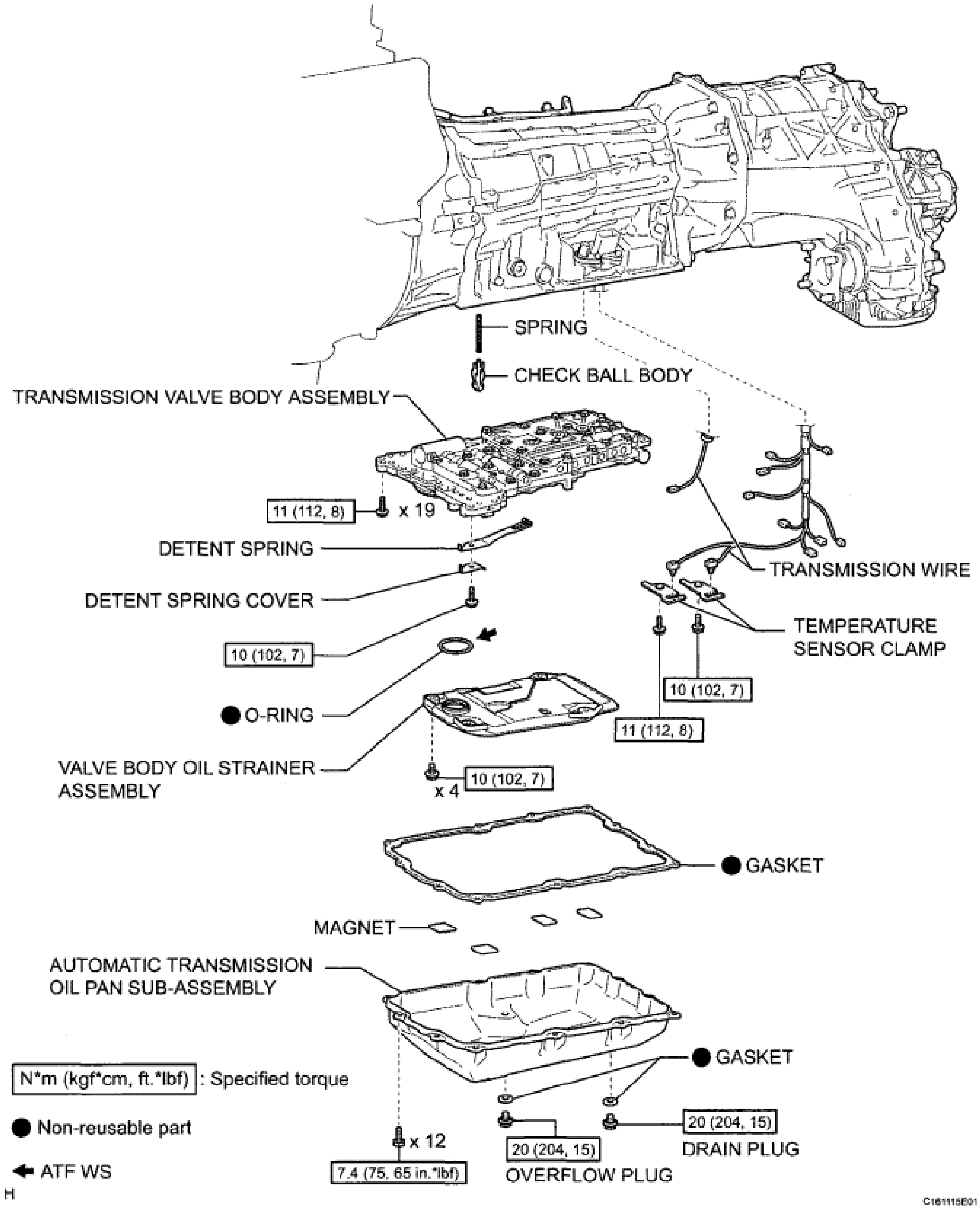

Fig. 179: Identifying Valve Body Components With Torque Specifications (1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

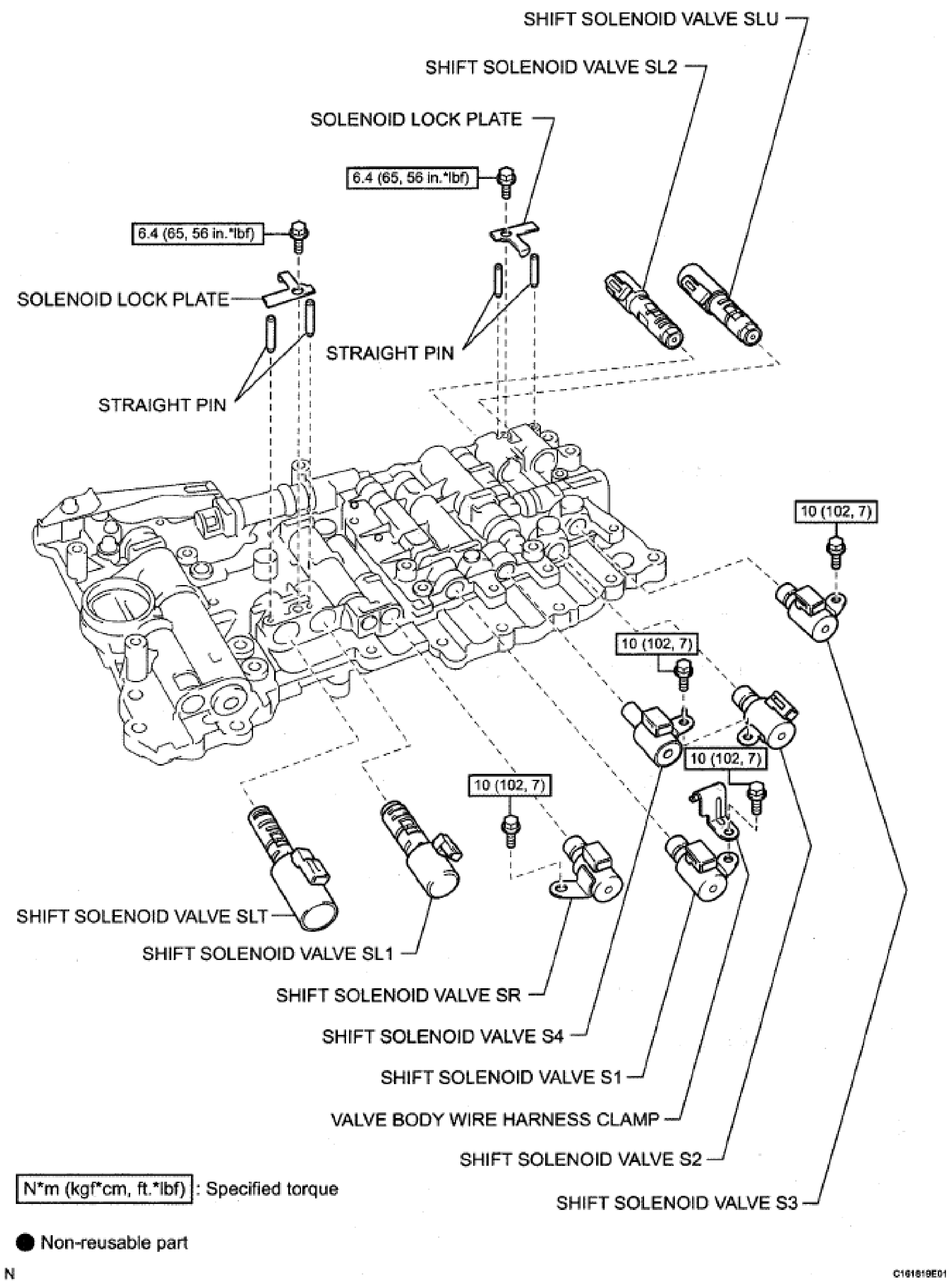

Fig. 180: Identifying Valve Body Components With Torque Specifications (2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**

NOTE: **Some systems need to be initialized after the cable is reconnected (see**

INITIALIZATION).

2. **DRAIN AUTOMATIC TRANSMISSION FLUID** (see **REMOVAL**)
3. **REMOVE AUTOMATIC TRANSMISSION OIL PAN SUB-ASSEMBLY** (see **REMOVAL**)
4. **REMOVE VALVE BODY OIL STRAINER ASSEMBLY** (see **REMOVAL**)
5. **DISCONNECT TRANSMISSION WIRE** (see **REMOVAL**)
6. **REMOVE TRANSMISSION VALVE BODY ASSEMBLY**
    a. Remove the bolt, detent spring cover and detent spring.
    b. Remove the 19 bolts and valve body.

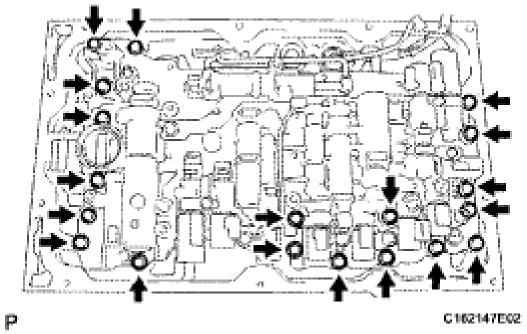

Fig. 181: Identifying Valve Body Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    c. Remove the check ball body and spring.

NOTE: **Do not drop the check ball body and spring.**

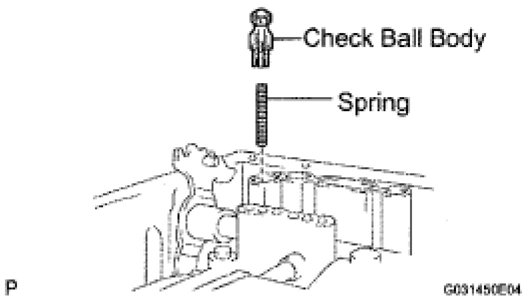

Fig. 182: Identifying Check Ball Body And Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DISASSEMBLY

1. **REMOVE SHIFT SOLENOID VALVE SL2**
    a. Remove the bolt, lock plate and 2 straight pins.
    b. Remove the shift solenoid valve.

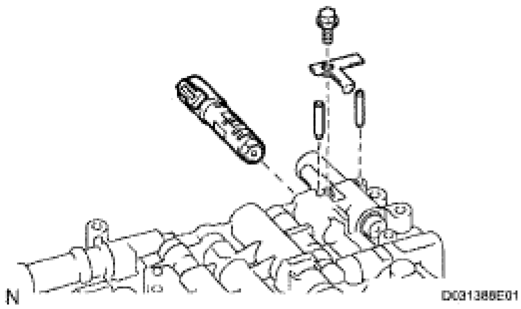

Fig. 183: Identifying Lock Plate And Straight Pins
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **REMOVE SHIFT SOLENOID VALVE SLU**

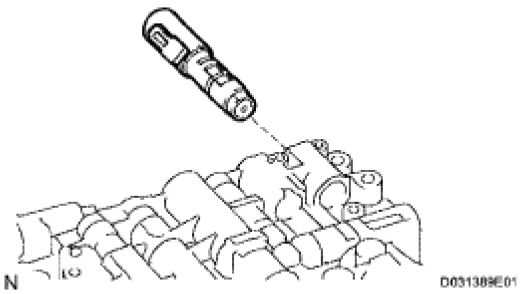

Fig. 184: Identifying Shift Solenoid Valve SLU
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **REMOVE SHIFT SOLENOID VALVE SLT**
    a. Remove the bolt, lock plate and 2 straight pins.
    b. Remove the shift solenoid valve.

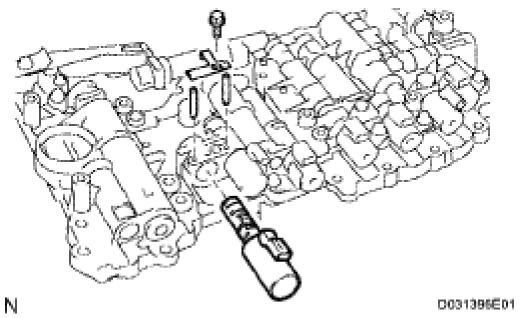

Fig. 185: Identifying Lock Plate, Straight Pins And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. **REMOVE SHIFT SOLENOID VALVE SL1**

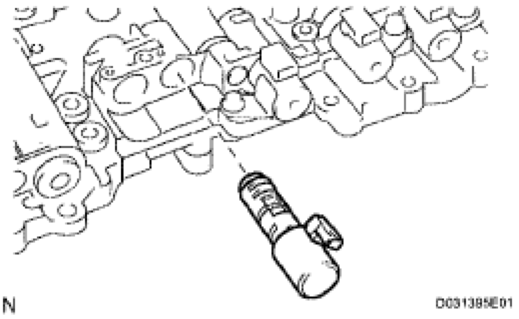

Fig. 186: Identifying Shift Solenoid Valve SL1
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. **REMOVE SHIFT SOLENOID VALVE SR**
    a. Remove the bolt and shift solenoid valve.

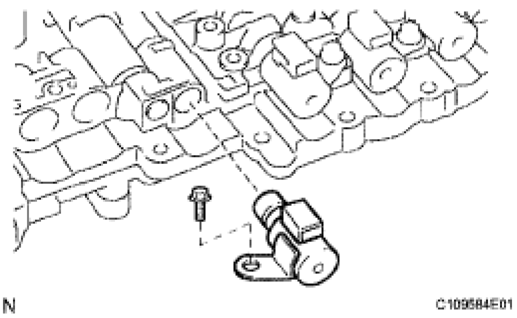

Fig. 187: Identifying Shift Solenoid Valve And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. **REMOVE SHIFT SOLENOID VALVE S1**
    a. Remove the bolt, valve body wire harness clamp and shift solenoid valve.

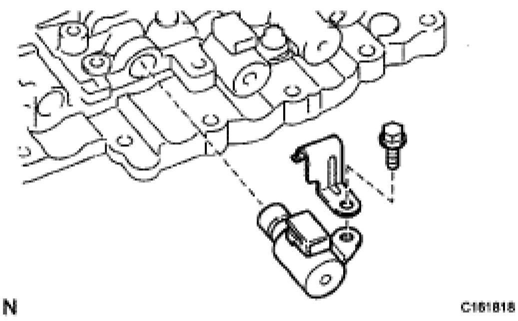

Fig. 188: Identifying Valve Body Wire Harness Clamp And Shift Solenoid Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. **REMOVE SHIFT SOLENOID VALVE S4**
    a. Remove the bolt and shift solenoid valve.

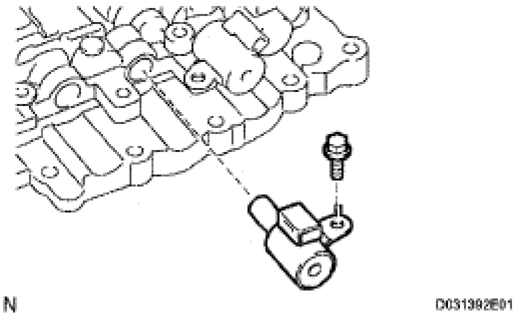

Fig. 189: Identifying Shift Solenoid Valve And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. **REMOVE SHIFT SOLENOID VALVE S2**

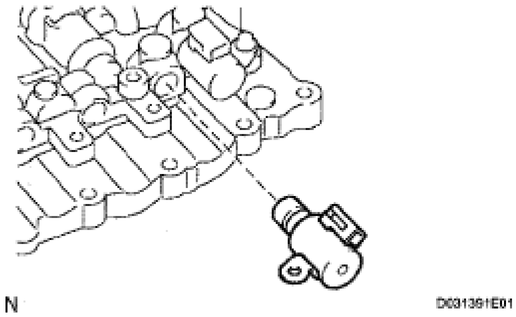

Fig. 190: Identifying Shift Solenoid Valve S2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. **REMOVE SHIFT SOLENOID VALVE S3**
   a. Remove the bolt and shift solenoid valve.

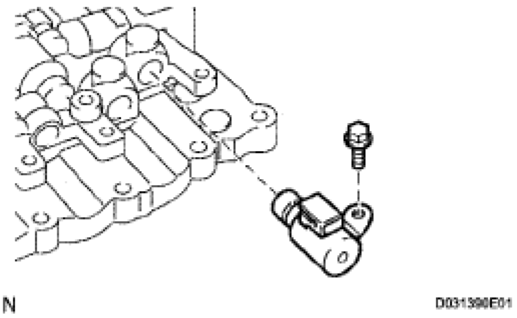

Fig. 191: Identifying Shift Solenoid Valve And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION

1. **INSPECT SHIFT SOLENOID VALVE SL1**
   a. Measure the resistance according to the value (s) in the table below.

   Standard resistance

SHIFT SOLENOID VALVE SL1 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	5.0 to 5.6 ohms

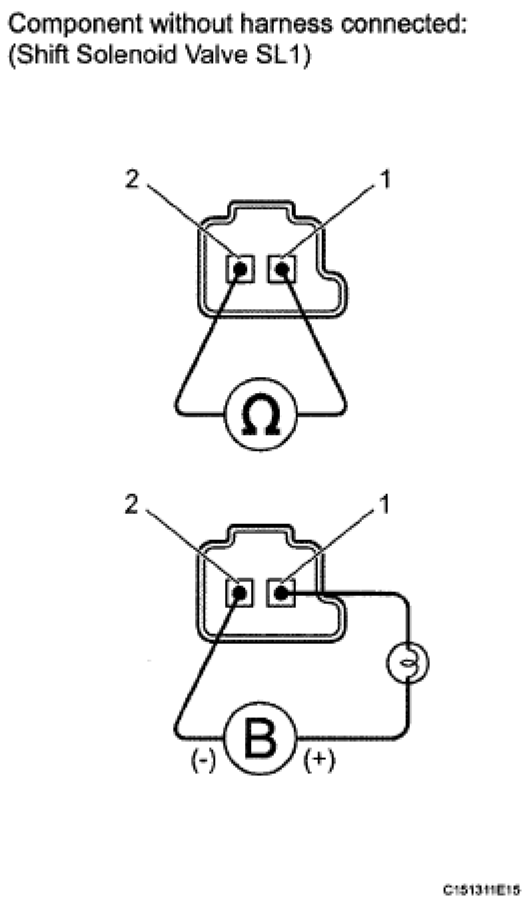

Fig. 192: Identifying Shift Solenoid Valve SL1
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Connect the battery's positive (+) lead with a 21 W bulb to terminal 1 and the negative (-) lead to terminal 2 of the solenoid valve connector. Then check that the valve moves and makes an operating noise.

OK: Valve moves and makes operating noise.

If the result is not as specified, replace the solenoid valve.

2. **INSPECT SHIFT SOLENOID VALVE S1**

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

Standard resistance

SHIFT SOLENOID VALVE S1 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S1 connector terminal - Shift solenoid	20°C (68°	

valve S1 body	F)	11 to 15 ohms

Shift Solenoid Valve S1:

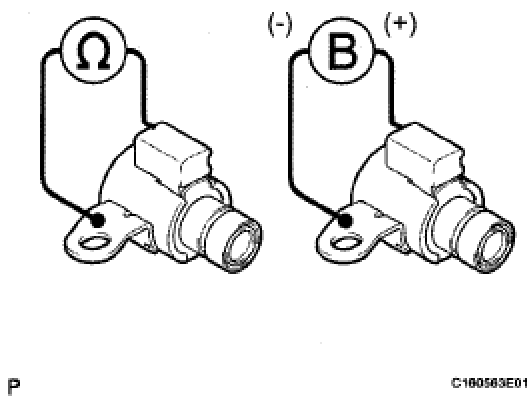

Fig. 193: Identifying Shift Solenoid Valve S1
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Connect the battery's positive (+) lead to the terminal of the solenoid valve connector, and the negative (-) lead to the solenoid valve body. Then check that the valve moves and makes an operating noise.

OK: Valve moves and makes operating noise.

If the result is not as specified, replace the solenoid valve.

3. **INSPECT SHIFT SOLENOID VALVE S2**

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

Standard resistance

SHIFT SOLENOID VALVE S2 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S2 connector terminal - Shift solenoid valve S2 body	20°C (68° F)	11 to 15 ohms

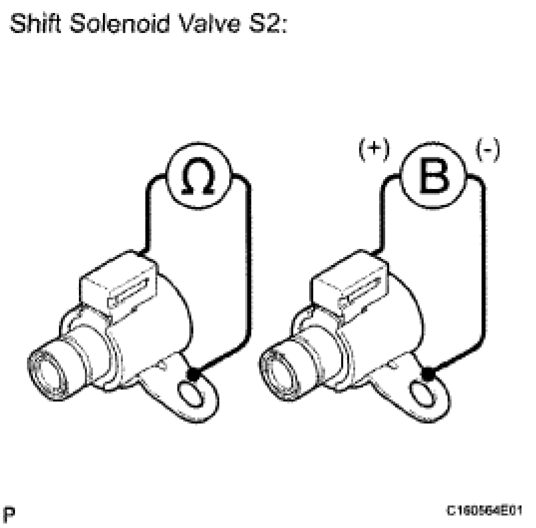

Fig. 194: Identifying Shift Solenoid Valve S2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Connect the battery's positive (+) lead to the terminal of the solenoid valve connector, and the negative (-) lead to the solenoid valve body. Then check that the valve moves and makes an operating noise.

OK: Valve moves and makes operating noise.

If the result is not as specified, replace the solenoid valve.

4. **INSPECT SHIFT SOLENOID VALVE S3**

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

Standard resistance

SHIFT SOLENOID VALVE S3 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S3 connector terminal - Shift solenoid valve S3 body	20°C (68°F)	11 to 15 ohms

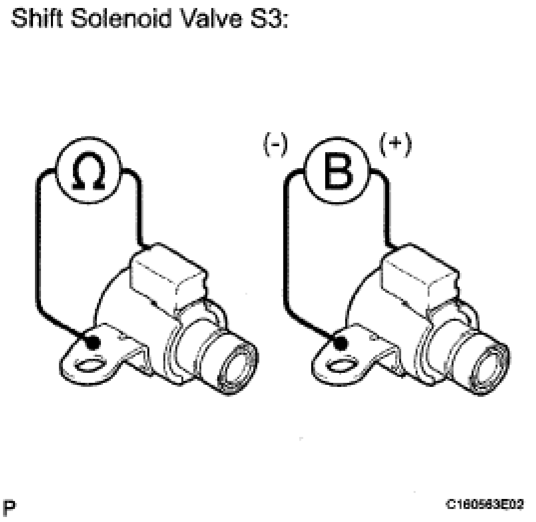

Fig. 195: Identifying Shift Solenoid Valve S3
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Connect the battery's positive (+) lead to the terminal of the solenoid valve connector, and the negative (-) lead to the solenoid valve body. Then check that the valve moves and makes an operating noise.

OK: Valve moves and makes an operating noise.

If the result is not as specified, replace the solenoid valve.

5. **INSPECT SHIFT SOLENOID VALVE S4**

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

Standard resistance

SHIFT SOLENOID VALVE S4 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S4 connector terminal - Shift solenoid valve S4 body	20°C (68° F)	11 to 15 ohms

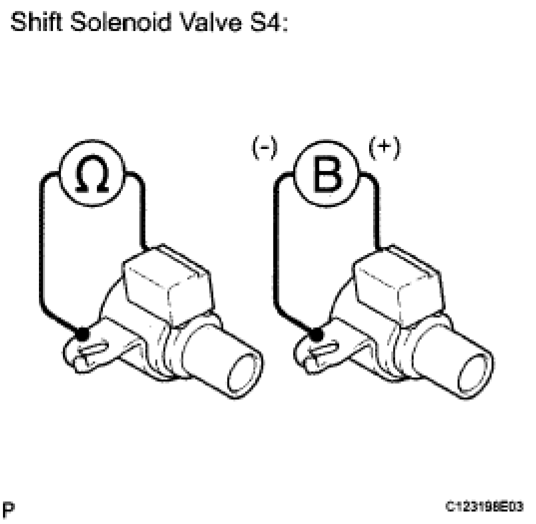

Fig. 196: Identifying Shift Solenoid Valve S4
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Connect the battery's positive (+) lead to the terminal of the solenoid valve connector, and the negative (-) lead to the solenoid valve body. Then check that the valve moves and makes an operating noise.

OK: Valve moves and makes an operating noise.

If the result is not as specified, replace the solenoid valve.

6. **INSPECT SHIFT SOLENOID VALVE SL2**

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

Standard resistance

SHIFT SOLENOID VALVE SL2 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	5.0 to 5.6 ohms

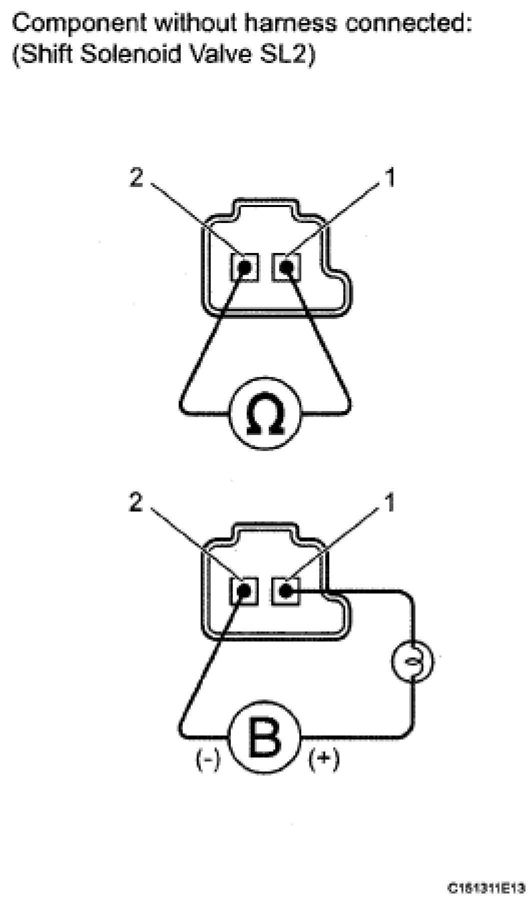

Fig. 197: Identifying Shift Solenoid Valve SL2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Connect the battery's positive (+) lead with a 21 W bulb to terminal 1 and the negative (-) lead to terminal 2 of the solenoid valve connector. Then check that the valve moves and makes an operating noise.

OK: Valve moves and makes an operating noise.

If the result is not as specified, replace the solenoid valve.

7. **INSPECT SHIFT SOLENOID VALVE SR**

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

Standard resistance

SHIFT SOLENOID VALVE SR RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve SR connector terminal - Shift solenoid valve SR body	20°C (68° F)	11 to 15 ohms

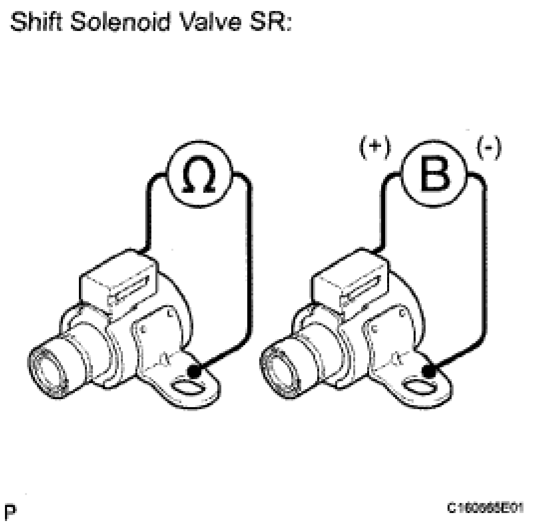

Fig. 198: Identifying Shift Solenoid Valve SR
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Connect the battery's positive (+) lead to the terminal of the solenoid valve connector, and the negative (-) lead to the solenoid valve body. Then check that the valve moves and makes an operating noise.

OK: Valve moves and makes an operating noise.

If the result is not as specified, replace the solenoid valve.

8. **INSPECT SHIFT SOLENOID VALVE SLT**
   a. Measure the resistance according to the value (s) in the table below.

Standard resistance

SHIFT SOLENOID VALVE SLT RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	5.0 to 5.6 ohms

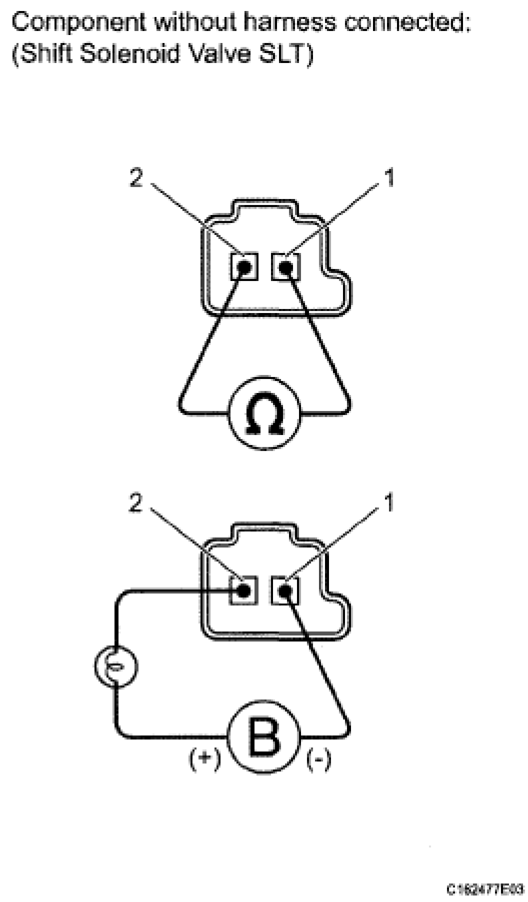

Fig. 199: Identifying Shift Solenoid Valve SLT
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Connect the battery's positive (+) lead with a 21 W bulb to terminal 2 and the negative (-) lead to terminal 1 of the solenoid valve connector. Then check that the valve moves and makes an operating noise.

OK: Valve moves and makes an operating noise.

If the result is not as specified, replace the solenoid valve.

9. **INSPECT SHIFT SOLENOID VALVE SLU**

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

Standard resistance

SHIFT SOLENOID VALVE SLU RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	5.0 to 5.6 ohms

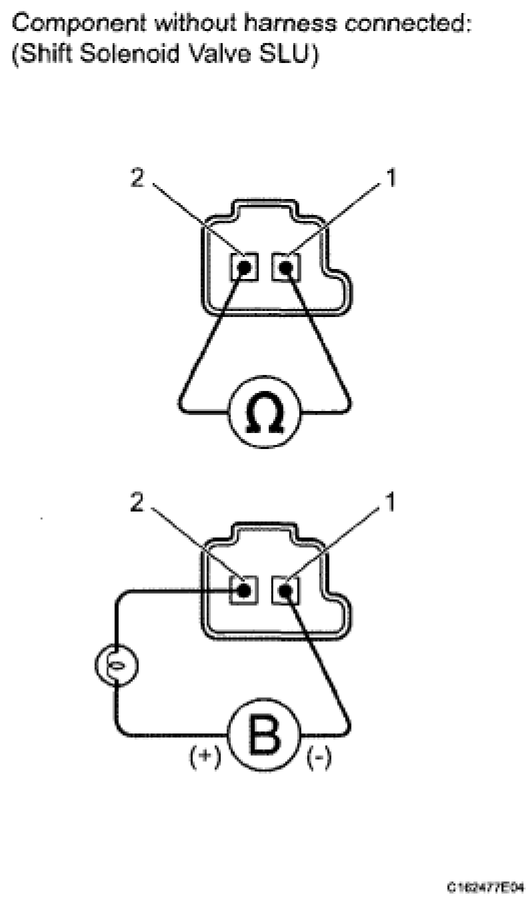

Fig. 200: Identifying Shift Solenoid Valve SLU
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Connect the battery's positive (+) lead with a 21 W bulb to terminal 2 and the negative (-) lead to terminal 1 of the solenoid valve connector. Then check that the valve moves and makes an operating noise.

OK: Valve moves and makes an operating noise.

If the result is not as specified, replace the solenoid valve.

REASSEMBLY

1. **INSTALL SHIFT SOLENOID VALVE S3**
   a. Install the shift solenoid valve with the bolt.

   Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)

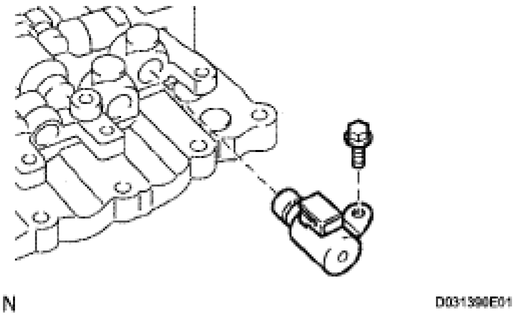

Fig. 201: Identifying Shift Solenoid Valve And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **INSTALL SHIFT SOLENOID VALVE S2**

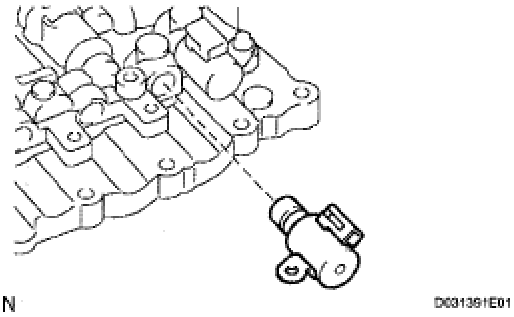

Fig. 202: Identifying Shift Solenoid Valve S2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **INSTALL SHIFT SOLENOID VALVE S4**
   a. Install the shift solenoid valve with the bolt.

      Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)

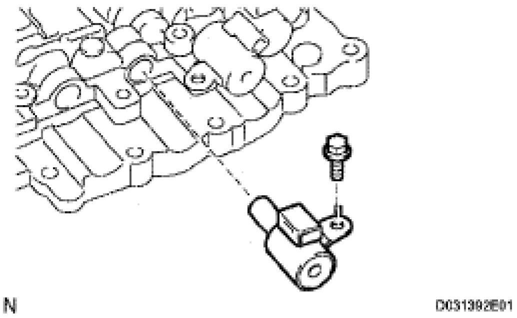

Fig. 203: Identifying Shift Solenoid Valve And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. **INSTALL SHIFT SOLENOID VALVE S1**
   a. Install the shift solenoid valve and valve body wire harness clamp with the bolt.

      Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)

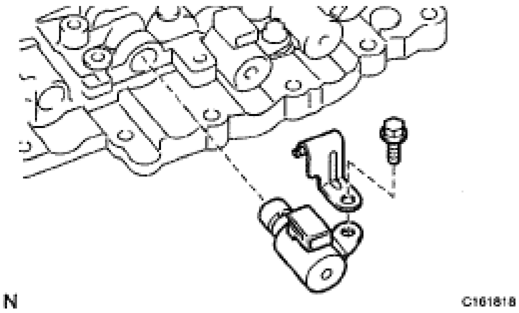

Fig. 204: Identifying Shift Solenoid Valve And Valve Body Wire Harness Clamp With Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. **INSTALL SHIFT SOLENOID VALVE SR**
   a. Install the shift solenoid valve with the bolt.

   Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)

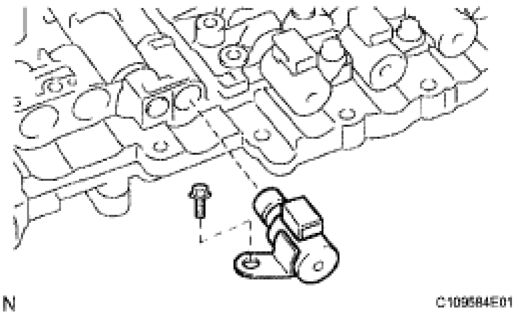

Fig. 205: Identifying Shift Solenoid Valve And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. **INSTALL SHIFT SOLENOID VALVE SL1**

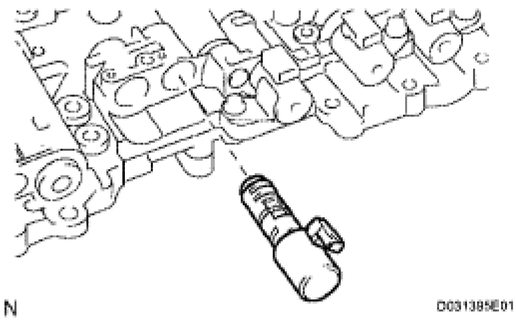

Fig. 206: Identifying Shift Solenoid Valve SL1
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. **INSTALL SHIFT SOLENOID VALVE SLT**
   a. Install the shift solenoid valve.
   b. Install the 2 straight pins and lock plate with the bolt.

Torque: 6.4 N*m (65 kgf*cm, 57 in.*lbf)

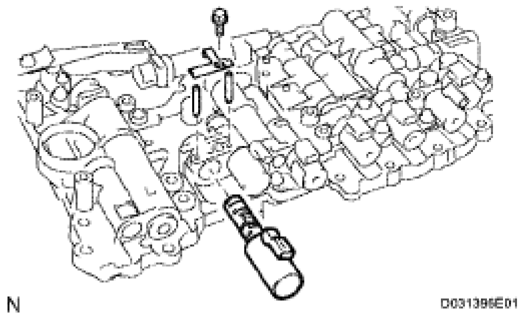

Fig. 207: Identifying Lock Plate, Straight Pins And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. **INSTALL SHIFT SOLENOID VALVE SLU**

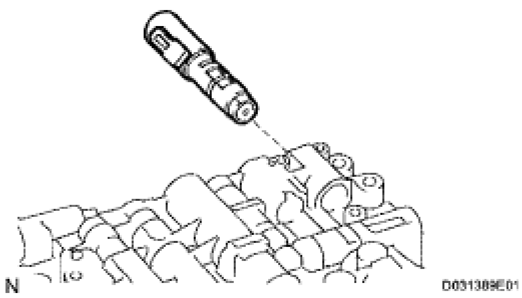

Fig. 208: Identifying Shift Solenoid Valve SLU
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. **INSTALL SHIFT SOLENOID VALVE SL2**
   a. Install the shift solenoid valve.
   b. Install the 2 straight pins and lock plate with the bolt.

   Torque: 6.4 N*m (65 kgf*cm, 57 in.*lbf)

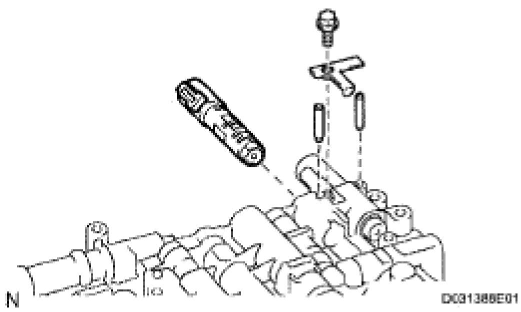

Fig. 209: Identifying Lock Plate And Straight Pins
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. **INSTALL TRANSMISSION VALVE BODY ASSEMBLY**

a. Install the spring and check ball body.

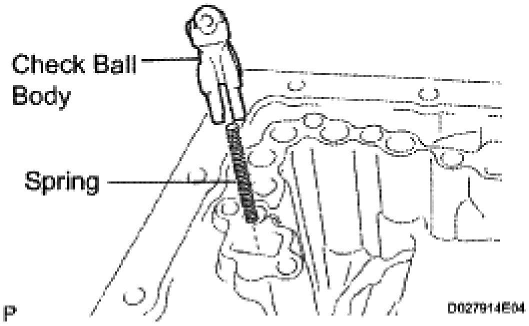

Fig. 210: Identifying Check Ball Body And Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Insert the pin of the manual valve into the hole of the manual valve lever.

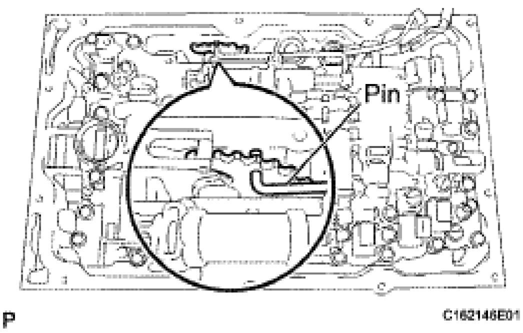

Fig. 211: Identifying Pin Of Manual Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Install the 19 bolts.

Torque: 11 N*m (112 kgf*cm, 8 ft.*lbf)

HINT:

Each bolt length is indicated below.

36 mm (1.42 in.) for bolt A

25 mm (0.984 in.) for bolt B

45 mm (1.77 in.) for bolt C

50 mm (1.97 in.) for bolt D

d. Install the detent spring and detent spring cover with the bolt.

Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)

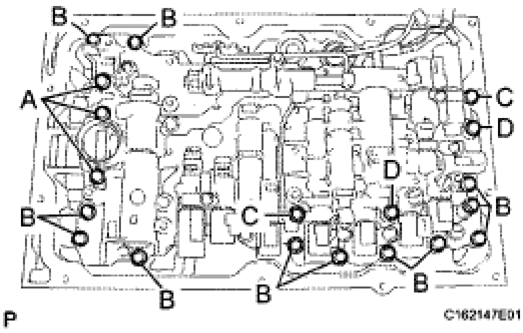

Fig. 212: Identifying Transmission Valve Body Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **CONNECT TRANSMISSION WIRE** (see **INSTALLATION**)
3. **INSTALL VALVE BODY OIL STRAINER ASSEMBLY** (see **INSTALLATION**)
4. **INSTALL AUTOMATIC TRANSMISSION OIL PAN SUB-ASSEMBLY** (see **INSTALLATION**)
5. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

NOTE: **Some systems need to be initialized after the cable is reconnected (see INITIALIZATION).**

6. **ADD AUTOMATIC TRANSMISSION FLUID**
   a. Add automatic transmission fluid (see **AUTOMATIC TRANSMISSION FLUID**).

SHIFT LOCK SYSTEM

ON-VEHICLE INSPECTION

1. **CHECK SHIFT LOCK OPERATION**
   a. Move the shift lever to P.
   b. Turn the ignition switch OFF.
   c. Check that the shift lever cannot be moved to any position other than P.
   d. Turn the ignition switch ON, depress the brake pedal and check that the shift lever can be moved to other positions.
2. **CHECK SHIFT LOCK RELEASE BUTTON OPERATION**
   a. 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 the operation cannot be performed as specified, check the shift lever assembly.
3. **CHECK KEY INTERLOCK OPERATION**
   a. Turn the ignition switch ON.
   b. Depress the brake pedal and move the shift lever to any position other than P.
   c. Check that the ignition switch cannot be turned OFF.
   d. Move the shift lever to P, turn the ignition switch OFF and check that the key can be removed.

If the results are not as specified, inspect the shift lock control ECU.

4. **CHECK SHIFT LOCK CONTROL ECU (for Column Shift Type)**
   a. Measure the voltage according to the value (s) in the table below.

      HINT:

      Measure the voltage of the connector.

      Standard voltage

      SHIFT LOCK CONTROL ECU (FOR COLUMN SHIFT TYPE) VOLTAGE SPECIFIED CONDITION

Tester Connection	Switch Condition	Specified Condition
J30-8 (KLS+) - J30-10 (E)	Ignition switch ACC and shift lever on P	Below 1 V
J30-8 (KLS+) - J30-10 (E)	Ignition switch ACC and shift lever not on P	7.5 to 11 V
J30-8 (KLS+) - J30-10 (E)	Ignition switch ACC and shift lever not on P (after approx. 1 second)	6to9V
J30-3 (ACC) - J30-10 (E)	Ignition switch ON	10 to 14 V
J30-3 (ACC) - J30-10 (E)	Ignition switch ACC	10 to 14 V
J30-3 (ACC) - J30-10 (E)	Ignition switch OFF	Below 1 V
J30-13 (STP) - J30-10 (E)	Brake pedal depressed	10 to 14 V
J30-13 (STP) - J30-10 (E)	Brake pedal released	Below 1 V
J30-4 (IG) - J30-10 (E)	Ignition switch ON	10 to 14 V
J30-4 (IG) - J30-10 (E)	Ignition switch OFF	Below 1 V

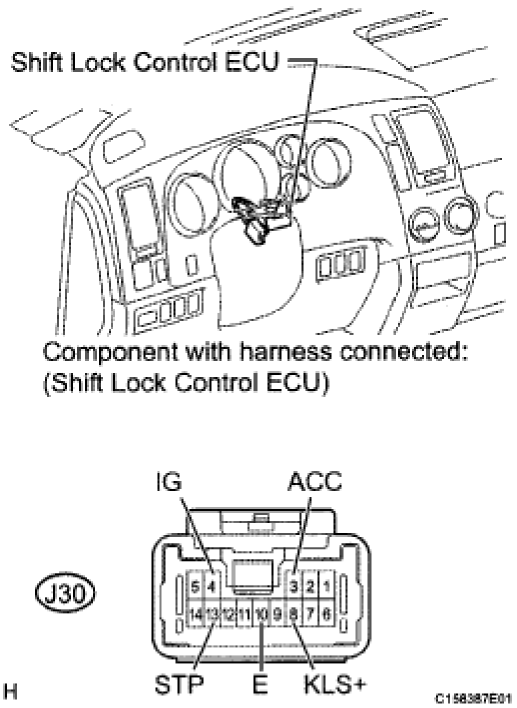

Fig. 213: Identifying Shift Lock Control ECU
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the result is not as specified, replace the shift lock control ECU.

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

NOTE: Do not disconnect the shift lock control ECU connector.

Standard resistance

RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
J30-10 (E) - Body ground	Always	Below 1 ohms

If the result is not as specified, replace the shift lock control ECU.

5. **CHECK SHIFT LOCK CONTROL ECU (for Floor Shift Type)**

a. Measure the voltage according to the value (s) in the table below.

HINT:

Measure the voltage of the connector.

Standard voltage

SHIFT LOCK CONTROL ECU (FOR FLOOR SHIFT TYPE) VOLTAGE SPECIFIED CONDITION

		Specified

Tester Connection	Switch Condition	Condition
J27-5 (KLS+) - J27-1 (E)	Ignition switch ACC and shift lever on P	Below 1 V
J27-5 (KLS+) - J27-1 (E)	Ignition switch ACC and shift lever not on P	7.5 to 11 V
J27-5 (KLS+) - J27-1 (E)	Ignition switch ACC and shift lever not on P (after approx. 1 second)	6to9V
J27-6 (ACC) - J27-1 (E)	Ignition switch ON	10 to 14 V
J27-6 (ACC) - J27-1 (E)	Ignition switch ACC	10 to 14 V
J27-6 (ACC) - J27-1 (E)	Ignition switch OFF	Below 1 V
J27-4 (STP) - J27-1 (E)	Brake pedal depressed	10 to 14 V
J27-4 (STP) - J27-1 (E)	Brake pedal released	Below 1 V
J27-8 (IG) - J27-1 (E)	Ignition switch ON	10 to 14 V
J27-8 (IG) - J27-1 (E)	Ignition switch OFF	Below 1 V

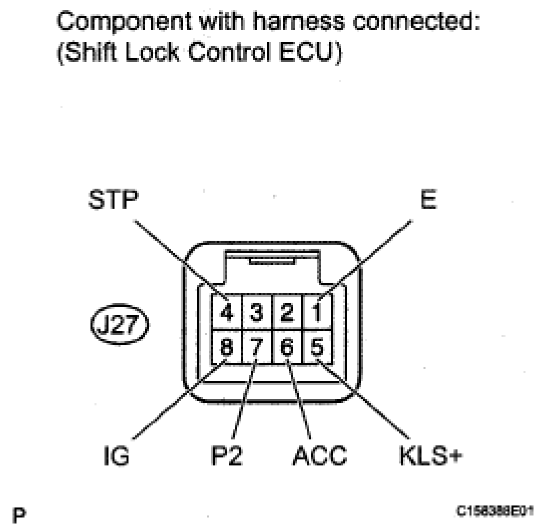

Fig. 214: Identifying Shift Lock Control ECU Connector Terminal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the result is not as specified, replace the shift lock control ECU.

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

NOTE: Do not disconnect the shift lock control ECU connector.

Standard resistance

RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition

1 (E) - Body ground	Always	Below 1 ohms

If the result is not as specified, replace the shift lock control ECU.

6. **CHECK SHIFT LOCK SOLENOID (for Column Shift Type)**
   a. Disconnect the transmission control switch connector.
   b. Measure the resistance according to the value (s) in the table below.

Standard resistance

SHIFT LOCK SOLENOID (FOR COLUMN SHIFT TYPE) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 (SLS+) - 8 (E)	Always	24 to 26 ohms

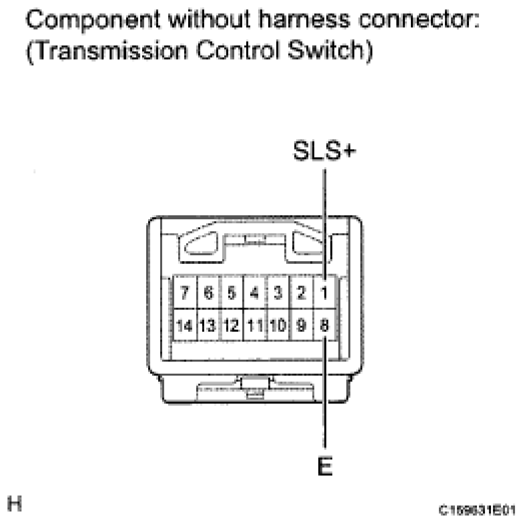

Fig. 215: Identifying Transmission Control Switch Connector Terminal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the result is not as specified, replace the shift lock solenoid.

7. **CHECK SHIFT LOCK SOLENOID (for Floor Shift Type)**
   a. Disconnect the shift lock solenoid connector from the shift lock control ECU.
   b. Measure the resistance according to the value (s) in the table below.

Standard resistance

SHIFT LOCK SOLENOID (FOR FLOOR SHIFT TYPE) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
4 (SLS+) - 3 (SLS-)	Always	101 to 123 ohms

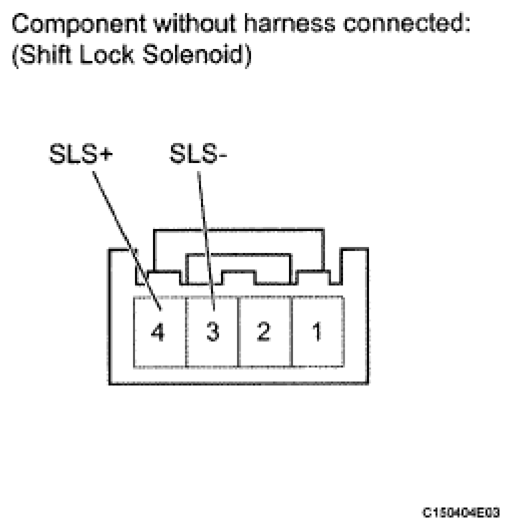

Fig. 216: Identifying Shift Lock Solenoid Connector Terminal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the result is not as specified, replace the floor shift assembly.

8. **CHECK KEY INTERLOCK SOLENOID**
   a. Disconnect the solenoid connector.
   b. Measure the resistance according to the value (s) in the table below.

Standard resistance

KEY INTERLOCK SOLENOID RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 (SOL+) - 2 (SOL-)	20°C (68°F)	14.4 ohms

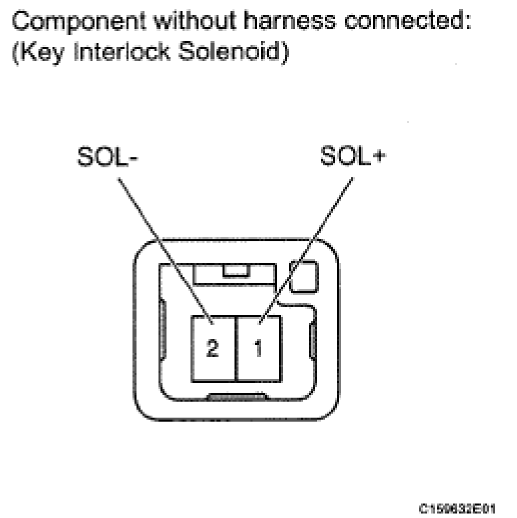

Fig. 217: Identifying Key Interlock Solenoid Connector Terminal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the result is not as specified, replace the solenoid.

c. Connect the battery's positive (+) lead to terminal 1 (SOL+) and the battery's negative (-) lead to terminal 2 (SOL-).

Check that the operating noise of the solenoid can be heard.

If the result is not as specified, replace the solenoid.

OIL COOLER (W/ TRAILER TOWING SYSTEM)

COMPONENTS

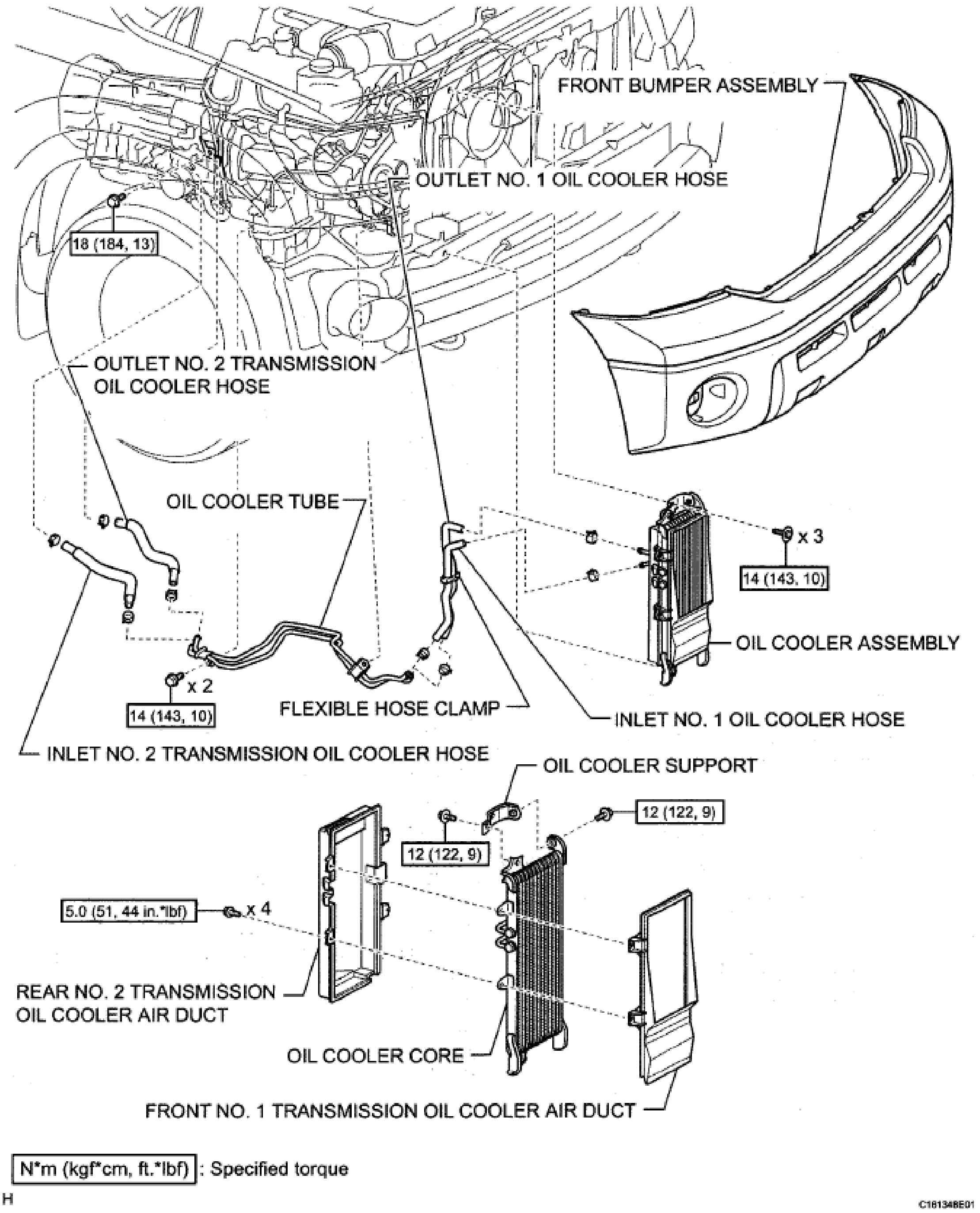

Fig. 218: Identifying Oil Cooler (w/ Trailer Towing System) Components With Torque Specifications
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **REMOVE FRONT BUMPER ASSEMBLY**
    a. for Steel Type:

    Remove the front bumper (see **REMOVAL**).

    b. for Resin Type:

    Remove the front bumper (see **REMOVAL**).

2. **DISCONNECT TRANSMISSION OIL COOLER HOSE**
    a. Remove the bolt and move the water bypass pipe so that the 2 transmission oil cooler hoses can be disconnected.
    b. Disconnect the inlet No. 2 transmission oil cooler hose and outlet No. 2 transmission oil cooler hose.

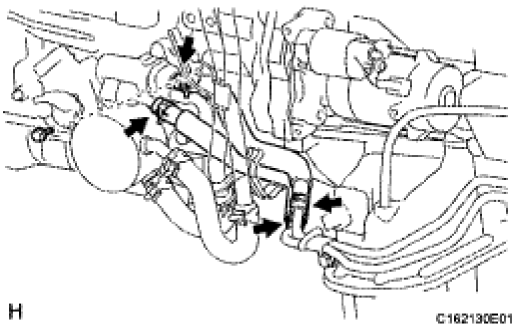

Fig. 219: Identifying Transmission Oil Cooler Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    c. Detach the claw to open the flexible hose clamp.
    d. Disconnect the inlet No. 1 oil cooler hose and outlet No. 1 oil cooler hose.

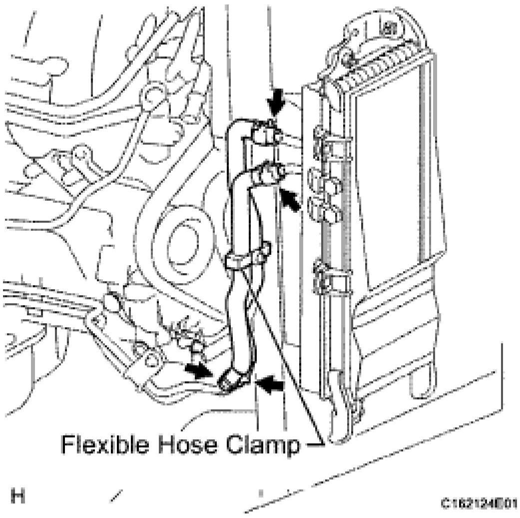

Fig. 220: Identifying Flexible Hose Clamp And Claw
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **REMOVE OIL COOLER TUBE**
   a. Remove 2 bolts and oil cooler tube.

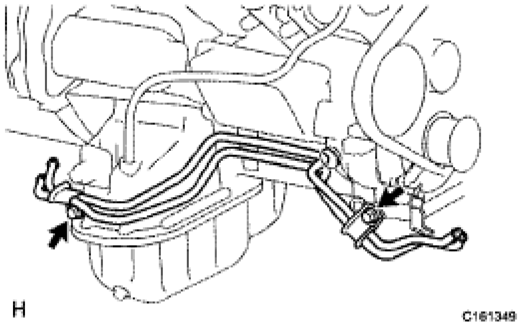

Fig. 221: Identifying Oil Cooler Tube And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. **REMOVE OIL COOLER ASSEMBLY**
   a. Remove the 3 bolts and oil cooler.

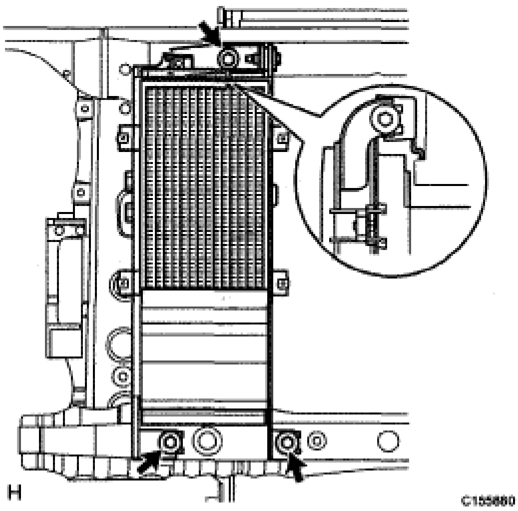

Fig. 222: Identifying Oil Cooler And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the 2 bolts and oil cooler support.
c. Remove the 4 bolts and separate the No. 1 and No. 2 oil cooler air ducts.

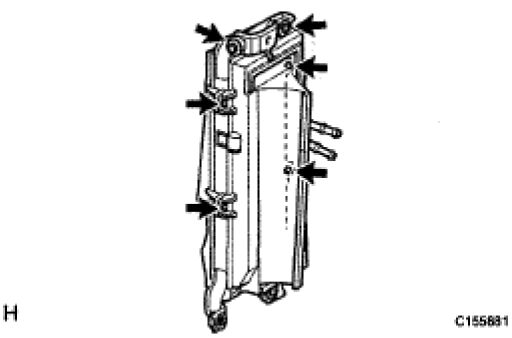

Fig. 223: Identifying Oil Cooler Support And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. **INSTALL OIL COOLER ASSEMBLY**
   a. Install the No. 1 and No. 2 oil cooler air ducts with the 4 bolts.

   Torque: 5.0 N*m (51 kgf*cm, 44 in.*lbf)

   b. Install the oil cooler support with the 2 bolts.

   Torque: 12 N*m (122 kgf*cm, 9 ft.*lbf)

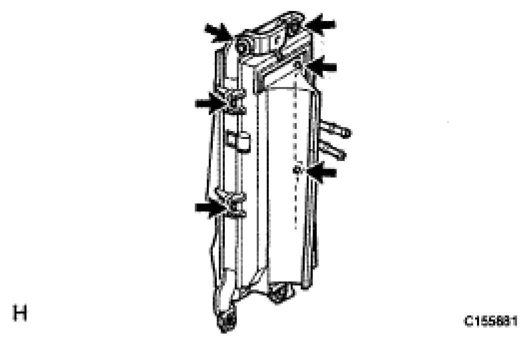

Fig. 224: Identifying Oil Cooler Air Ducts With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Temporarily put the oil cooler on the radiator support.

NOTE: Securely attach the claw of the oil cooler into the hole of the radiator support.

d. Install the 3 bolts.

Torque: 14 N*m (143 kgf*cm, 10 ft.*lbf)

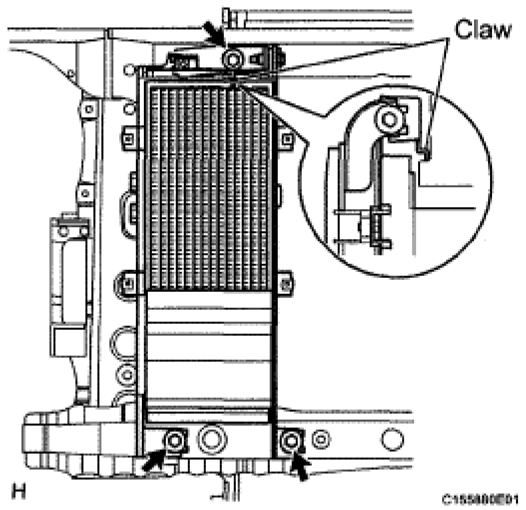

Fig. 225: Identifying Oil Cooler Claw And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **INSTALL OIL COOLER TUBE**
   a. Install the oil cooler tube with the 2 bolts.

   Torque: 14 N*m (143 kgf*cm, 10 ft.*lbf)

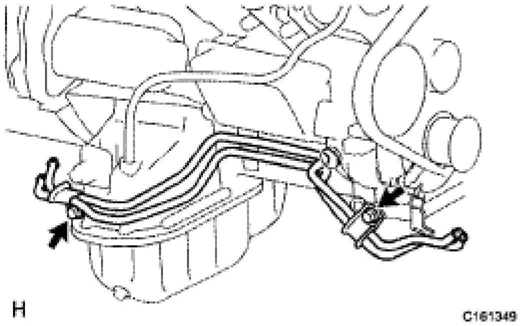

Fig. 226: Identifying Oil Cooler Tube With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **CONNECT TRANSMISSION OIL COOLER HOSE**
   a. Connect the inlet No. 1 oil cooler hose and outlet No. 1 oil cooler hose as shown in the illustration.

   NOTE: Make sure the pinching portion of each clip is facing the direction shown in the illustration.

   b. Pass the 2 hoses through the flexible hose clamp and close the clamp as shown in the illustration.

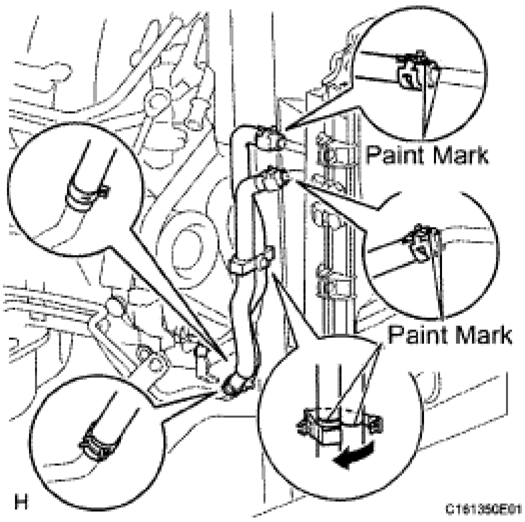

Fig. 227: Identifying Transmission Oil Cooler Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   c. Connect the inlet No. 2 transmission oil cooler hose and outlet No. 2 transmission oil cooler hose.

   NOTE:
   - **Make sure the pinching portion of each clip is facing the direction shown in the illustration.**
   - **Make sure the paint portion of each hose is facing outward.**

   d. Install the bolt to fix the water bypass pipe in place.

Torque: 18 N*m (184 kgf*cm, 13 ft.*lbf)

4. **ADD AUTOMATIC TRANSMISSION FLUID**
   a. Add automatic transmission fluid (see **AUTOMATIC TRANSMISSION FLUID**).
5. **INSTALL FRONT BUMPER ASSEMBLY**
   a. for Steel Type:

      Install the front bumper (see **REASSEMBLY**).

   b. for Resin Type:

      Install the front bumper (see **INSTALLATION**).

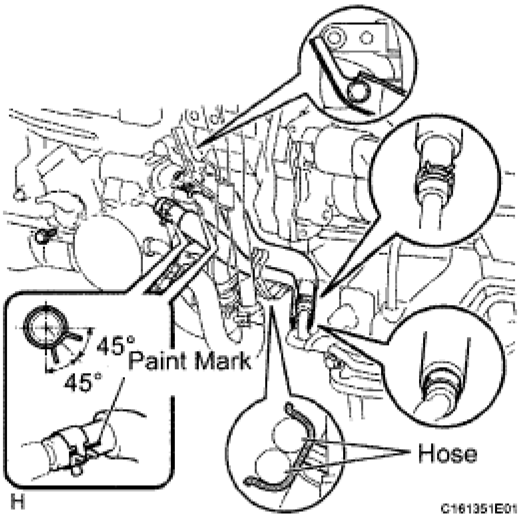

Fig. 228: Identifying Transmission Oil Cooler Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

SHIFT LEVER ASSEMBLY (FOR COLUMN SHIFT TYPE)

COMPONENTS

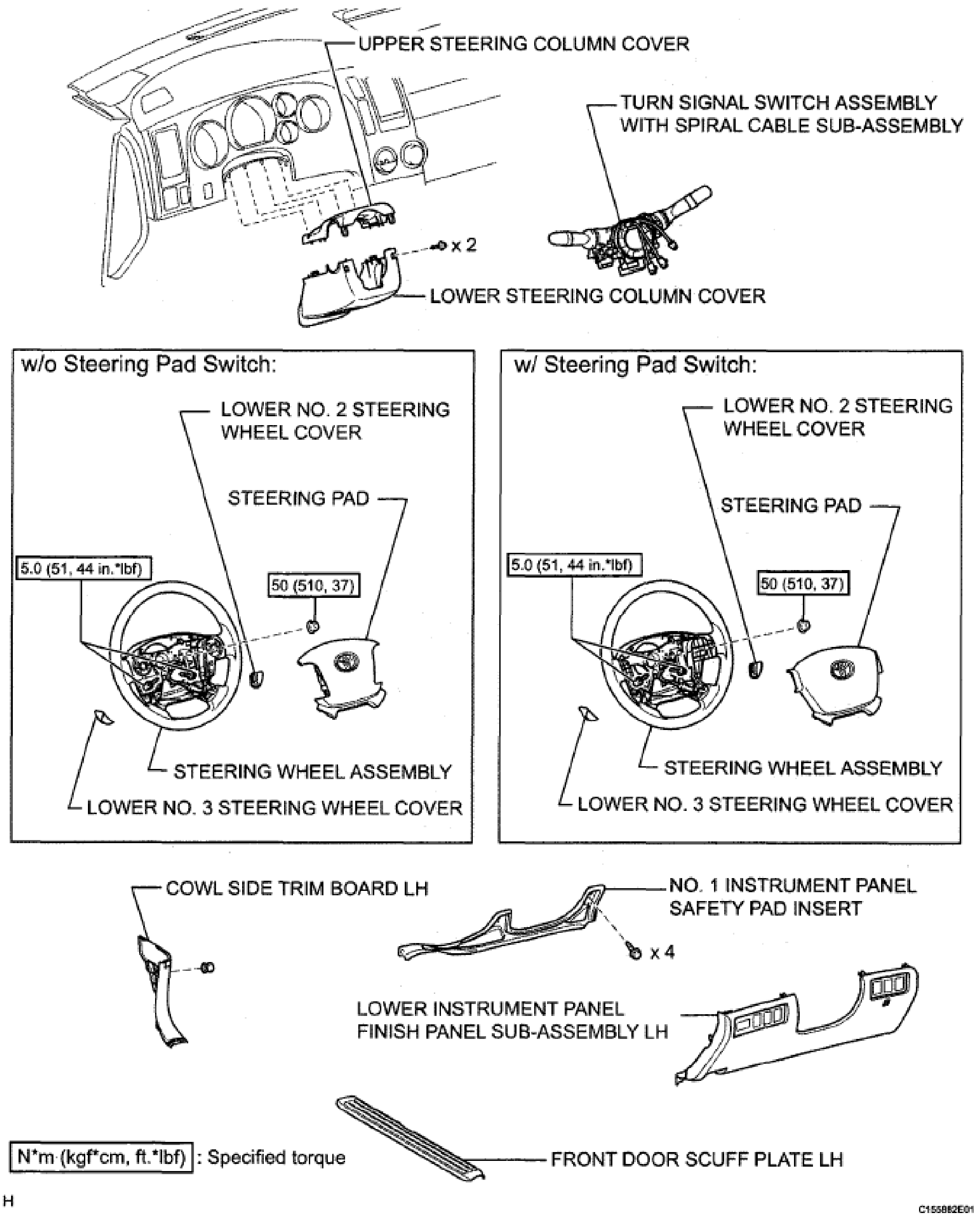

Fig. 229: Identifying Shift Lever Assembly (For Column Shift Type) Components With Torque Specifications (1 Of 3)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

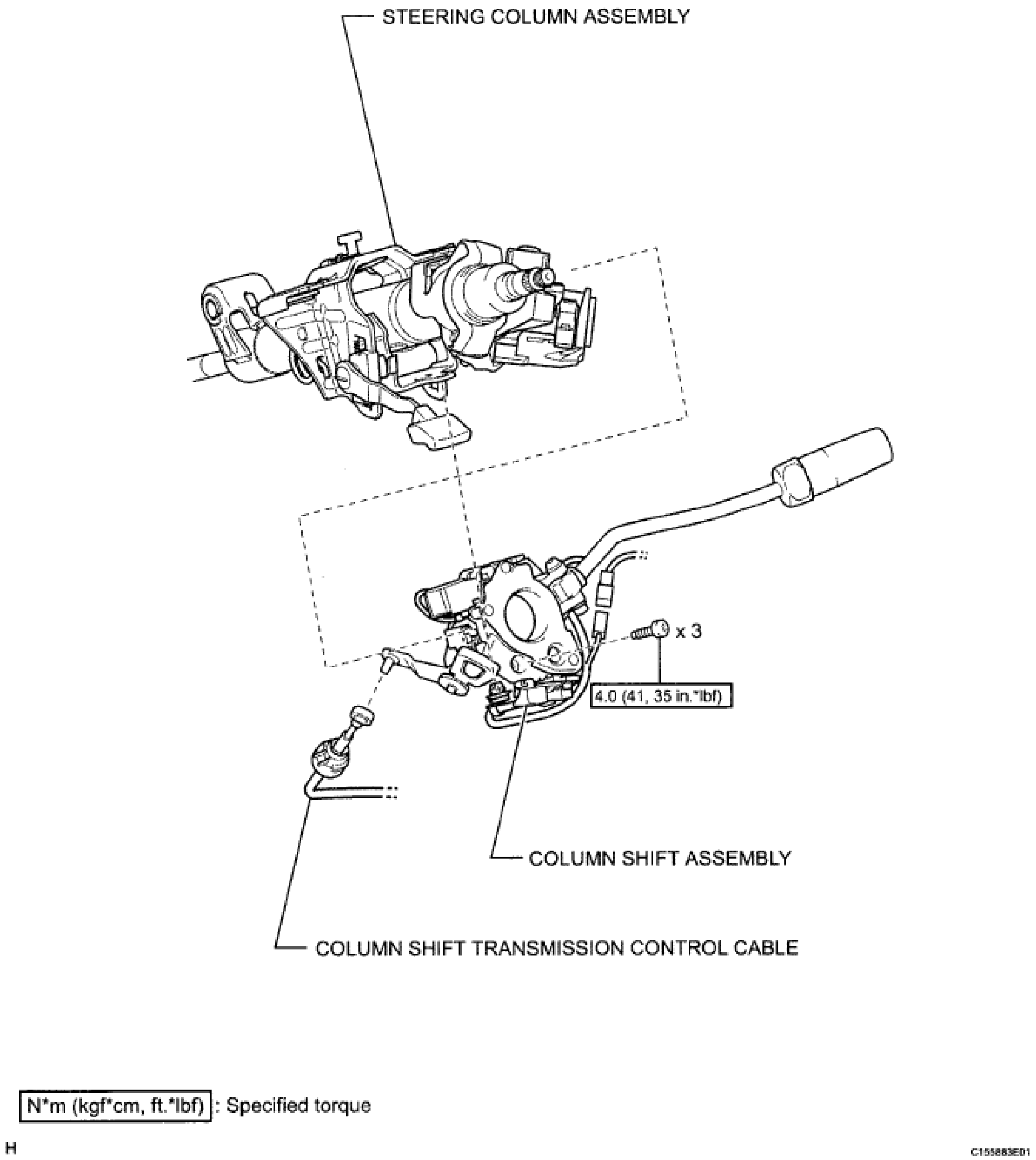

Fig. 230: Identifying Shift Lever Assembly (For Column Shift Type) Components With Torque Specification (2 Of 3)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

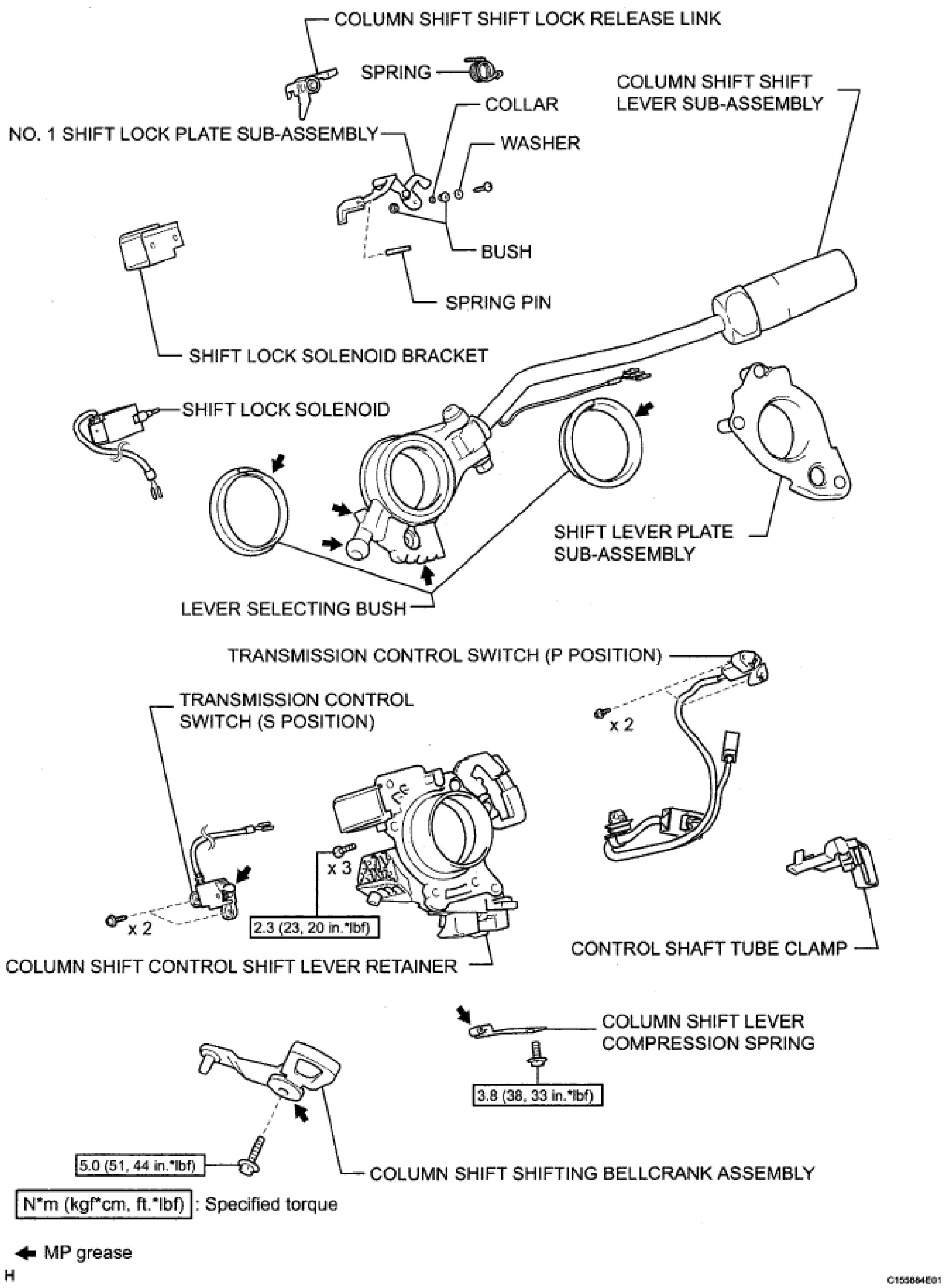

Fig. 231: Identifying Shift Lever Assembly (For Column Shift Type) Components With Torque Specifications (3 Of 3)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ON-VEHICLE INSPECTION

1. **INSPECT SHIFT LEVER POSITION**
    a. When moving the shift lever from the P to R position with the ignition switch ON and brake

pedal depressed, make sure that it moves smoothly and correctly into position.

b. Start the engine and make sure that the vehicle moves forward after moving the shift lever from the N to D position, and moves rearward after moving the shift lever to the R position.

If the operation cannot be performed as specified, inspect the park/neutral position switch assembly and check the shift lever assembly installation condition.

REMOVAL

1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**

CAUTION: Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.

NOTE:

- **Some systems need to be initialized after the cable is reconnected (see INITIALIZATION).**
- **After the ignition switch is turned OFF, the navigation system requires approximately 90 seconds to record various types of memory and settings. As a result, after turning the ignition switch OFF, wait 90 seconds or more before disconnecting the cable from the negative (-) battery terminal.**

2. **REMOVE FRONT DOOR SCUFF PLATE LH (for Regular Cab)** (See REMOVAL)
3. **REMOVE FRONT DOOR SCUFF PLATE LH (for Double Cab, CrewMax)** (See REMOVAL)
4. **REMOVE COWL SIDE TRIM BOARD LH** (See REMOVAL)
5. **REMOVE LOWER INSTRUMENT PANEL FINISH PANEL SUB-ASSEMBLY LH** (See REMOVAL)
6. **REMOVE NO. 1 INSTRUMENT PANEL SAFETY PAD INSERT** (See REMOVAL)
7. **REMOVE STEERING PAD (w/o Steering Pad Switch)** (See REMOVAL)
8. **REMOVE STEERING PAD (w/ Steering Pad Switch)** (See REMOVAL)
9. **REMOVE STEERING WHEEL ASSEMBLY** (See REMOVAL)
10. **REMOVE LOWER STEERING COLUMN COVER** (See REMOVAL)
11. **REMOVE UPPER STEERING COLUMN COVER** (See REMOVAL)
12. **REMOVE TURN SIGNAL SWITCH ASSEMBLY WITH SPIRAL CABLE SUB-ASSEMBLY** (See REMOVAL)
13. **REMOVE COLUMN SHIFT ASSEMBLY**
    a. Move the shift lever to the N position.
    b. Disconnect the column shift transmission control cable end from the column shift.

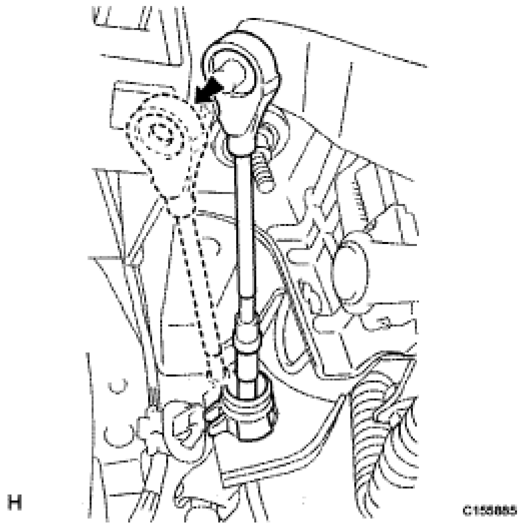

Fig. 232: Identifying Column Shift Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Disconnect the connector and detach the harness clamp.
d. Using a T30 "TORX" wrench, remove the 3 bolts and column shift.

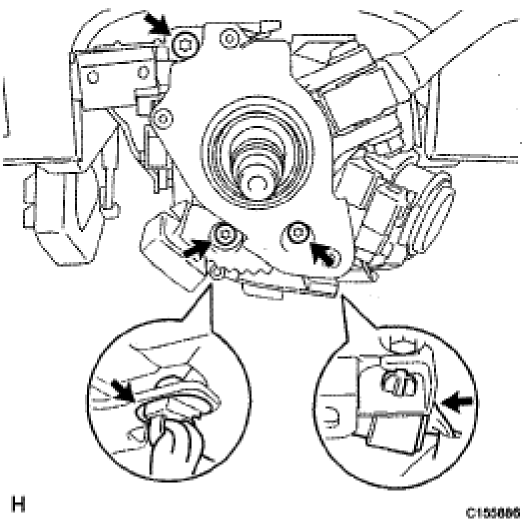

Fig. 233: Identifying Connector And Harness Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DISASSEMBLY

1. **REMOVE COLUMN SHIFT SHIFTING BELLCRANK ASSEMBLY**
    a. Remove the bolt and shifting bellcrank from the column shift control shift lever retainer.

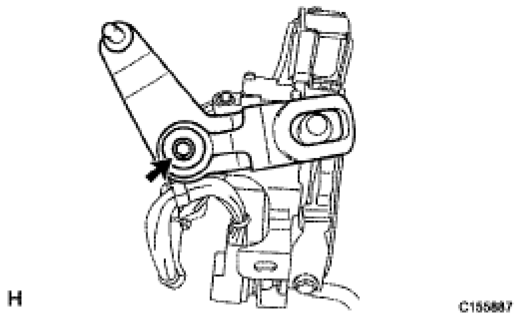

Fig. 234: Identifying Column Shift Shifting Bellcrank And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **REMOVE COLUMN SHIFT LEVER COMPRESSION SPRING**
   a. Remove the bolt and spring from the column shift control shift lever retainer.

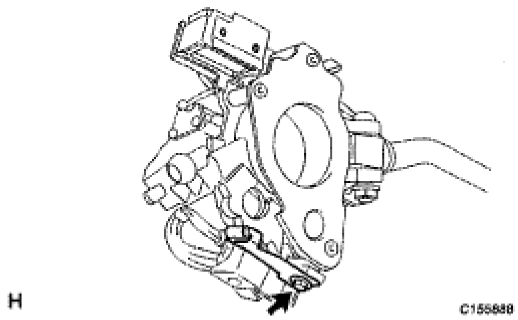

Fig. 235: Identifying Column Shift Lever Compression Spring And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **REMOVE SHIFT LEVER PLATE SUB-ASSEMBLY**
   a. Disconnect the transmission control switch connector clamp from the column shift.
   b. Detach the wire harness clamp and cut the 4 wire guides.

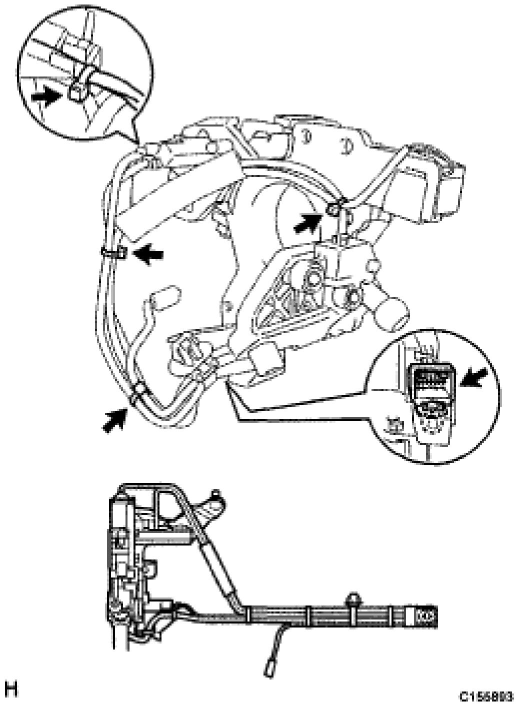

Fig. 236: Identifying Shift Lever Plate Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Remove the 3 bolts.

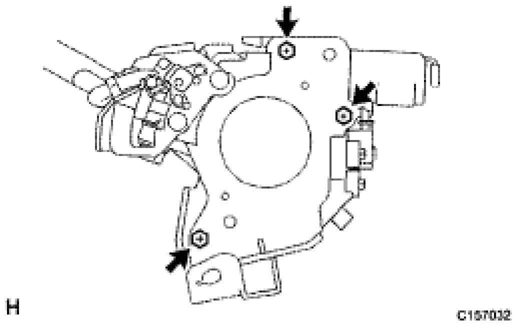

Fig. 237: Identifying Shift Lever Plate Sub-Assembly And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Separate the shift lever plate from the column shift control shift lever retainer.

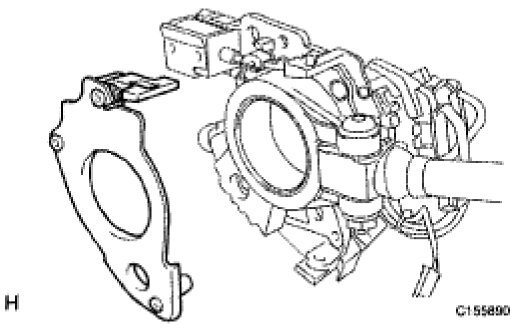

Fig. 238: Identifying Column Shift Control Shift Lever Retainer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. **REMOVE COLUMN SHIFT, SHIFT LOCK RELEASE LINK**
   a. Remove the shift lock release link and spring from the shift lever plate.

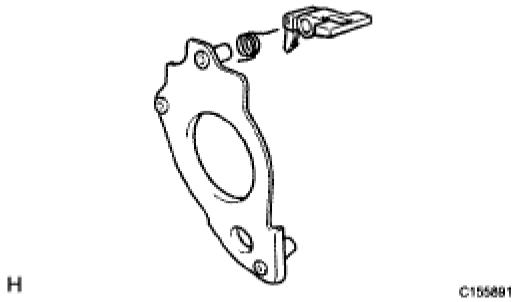

Fig. 239: Identifying Shift Lock Release Link And Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. **REMOVE COLUMN SHIFT, SHIFT LEVER SUB-ASSEMBLY**
   a. Remove the shift lever and 2 lever selecting bushes from the column shift control shift lever retainer.

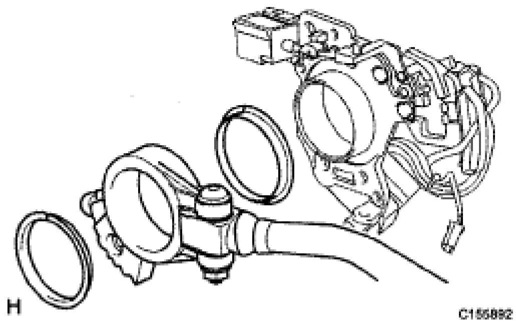

Fig. 240: Identifying Column Shift, Shift Lever Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Using a thin-bladed screwdriver, release the connector housing retainer.
   c. w/o Trailer Towing System:

      Insert a thin-bladed screwdriver, release the locking lug of terminal 4 (SFTD-), 5 (SFTD+) and 11 (E), and pull the terminals out from the rear.

   d. w/ Trailer Towing System:

      Insert a thin-bladed screwdriver, release the locking lug of terminal 4 (SFTD-), 5 (SFTD+), 12 (P), 9 (P) and 11 (E), and pull the terminals out from the rear.

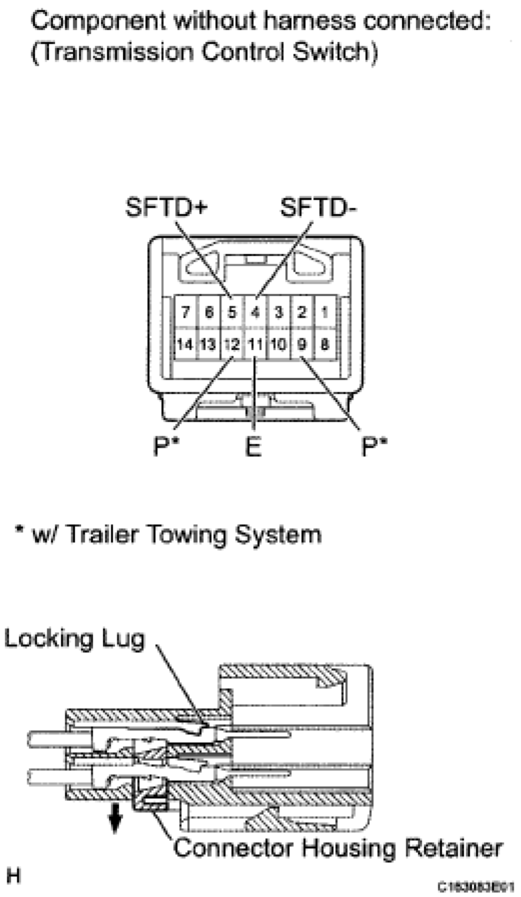

Fig. 241: Identifying Transmission Control Switch Connector Terminal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

e. Detach the 2 claws and remove the control shaft tube clamp from the column shift control shift lever retainer.

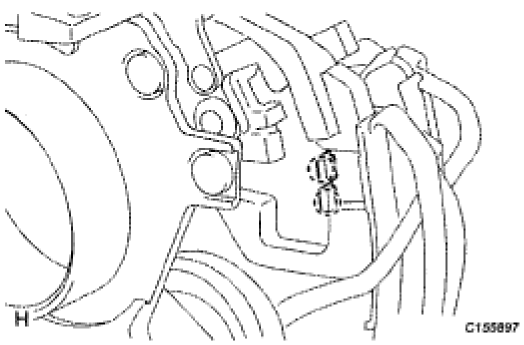

Fig. 242: Identifying Control Shaft Tube Clamp And Claws
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. **REMOVE SHIFT LOCK SOLENOID**
   a. Detach the 2 claws and remove the shift lock solenoid bracket.

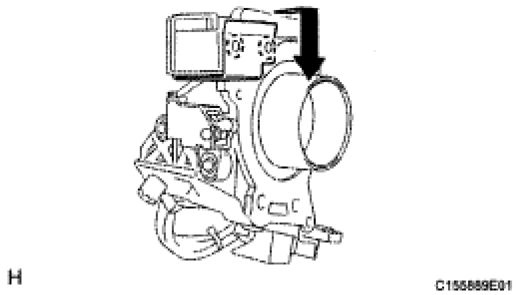

Fig. 243: Removing Shift Lock Solenoid
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the screw, collar, 2 bushes and shift lock solenoid with No. 1 shift lock plate sub-assembly from the column shift control shift lever retainer.

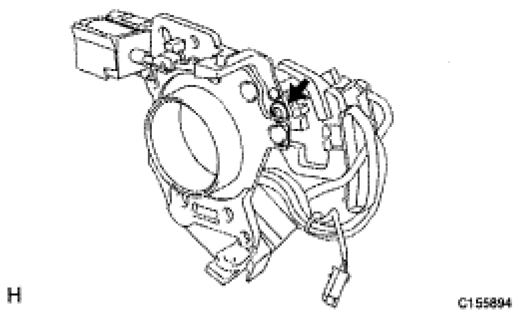

Fig. 244: Identifying Shift Lock Solenoid, Collar And Screw
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Insert a thin-bladed screwdriver, release the locking lug of terminal 1 (SLS+) and 8 (E), and pull the terminals out from the rear.

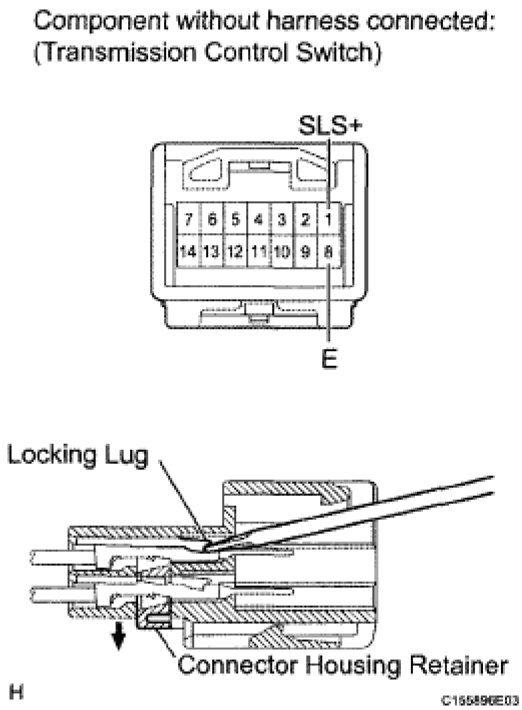

Fig. 245: Identifying Transmission Control Switch Connector Terminal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. **DISCONNECT NO. 1 SHIFT LOCK PLATE SUB-ASSEMBLY**
   a. Using a pin-punch and hammer, tap out the spring pin and disconnect the shift lock plate from the shift lock solenoid.

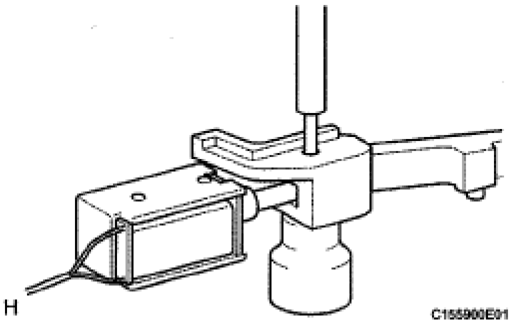

Fig. 246: Identifying No. 1 Shift Lock Plate Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. **REMOVE TRANSMISSION CONTROL SWITCH (S POSITION)**
   a. Remove the 2 screws and switch from the column shift control shift lever retainer.

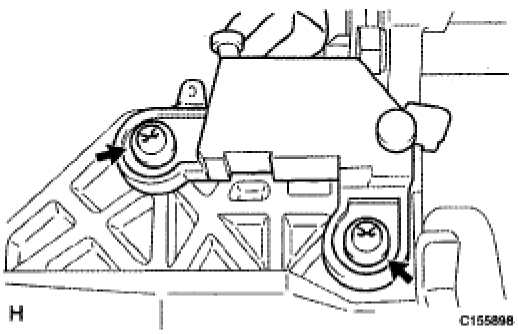

Fig. 247: Identifying Column Shift Control Shift Lever Retainer And Screw
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Insert a thin-bladed screwdriver, release the locking lug of terminal 6 (IG) and 13 (S), and pull the terminals out from the rear.

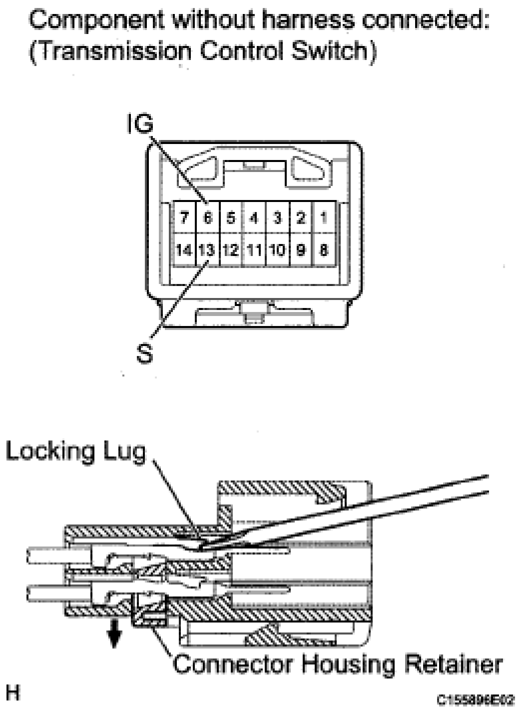

Fig. 248: Identifying Locking Lug Of Terminal 6 (IG) And 13 (S)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. **REMOVE TRANSMISSION CONTROL SWITCH (P POSITION)**
   a. Remove the 2 screws and switch from the column shift control shift lever retainer.

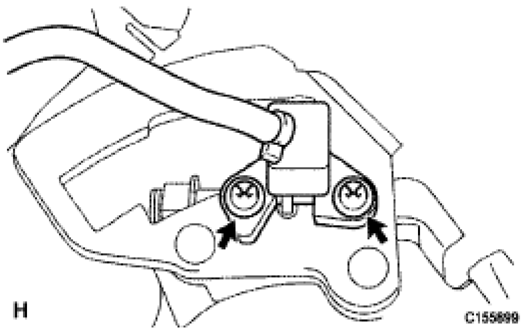

Fig. 249: Identifying Column Shift Control Shift Lever Retainer And Screw
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION

1. **INSPECT COLUMN SHIFT, SHIFT LEVER SUB-ASSEMBLY**
   a. Disconnect the transmission control switch connector.
   b. Measure the resistance according to the value (s) in the table below.

   Standard resistance

   COLUMN SHIFT, SHIFT LEVER SUB-ASSEMBLY RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
6 (IG) - 13 (S)	Shift lever position S, "+" and "-"	Below 1 ohms
5 (SFTU) - 11 (E)	Shift lever position continuously shifted to "+" (Up-shift)	
4 (SFTD) - 11 (E)	Shift lever position continuously shifted to "-" (Down-shift)	
6 (IG) - 13 (S)	Shift lever position not on S, "+" and "-"	10 kohms or higher
5 (SFTU) - 11 (E)	Shift lever position S	
4 (SFTD) - 11 (E)		

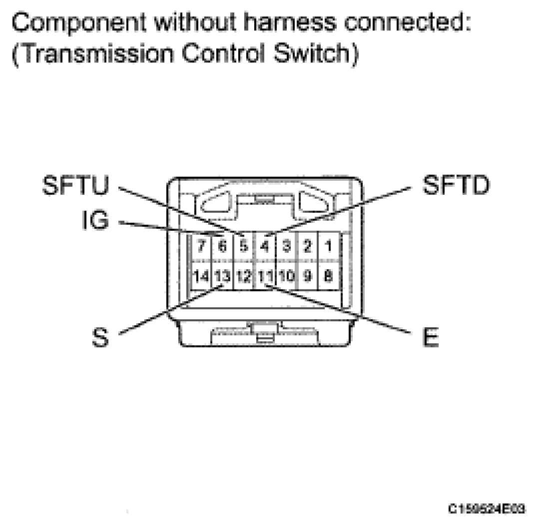

Fig. 250: Identifying Transmission Control Switch Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the result is not as specified, replace the column shift, shift lever sub-assembly.

ADJUSTMENT

1. **INSPECT SHIFT LEVER POSITION**
   a. When moving the shift lever from the N position to other positions, check that the lever can be shifted smoothly and accurately to each position and that the position indicator comes on in accordance with the shift lever position.

   If the indicator and shift lever position do not match, carry out the following adjustment procedures.

2. **ADJUST SHIFT LEVER POSITION**
   a. Move the shift lever to the N position.
   b. Fold back the transmission control cable adjust case cover. Then while sliding the slider toward the cable end side, press the lock piece from the back side to release the lock.

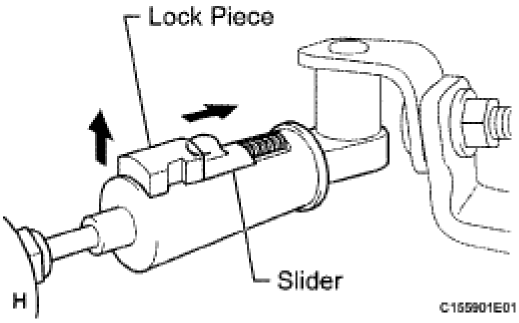

Fig. 251: Adjusting Shift Lever Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Check that the adjust case's spring is applying enough tension to the shift control cable. Then press the lock piece to set the lock.

NOTE:
- **Use your hand to push the lock piece. Do not use any tools.**
- **Securely push the lock piece so that the slider's protrusion is above the lock piece.**

d. Return the cover of the adjust case to its original position.
e. Inspect the operation after the adjustment.

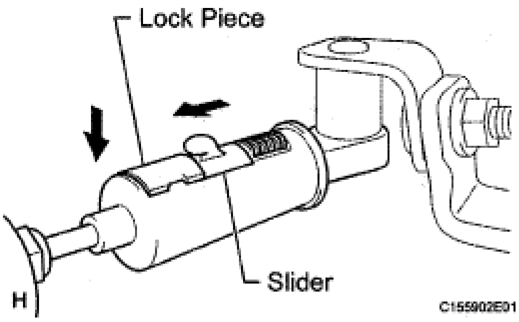

Fig. 252: Pushing Lock Piece
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REASSEMBLY

1. **INSTALL TRANSMISSION CONTROL SWITCH (P POSITION)**
   a. Install the switch to the column shift control shift lever retainer with the 2 screws.

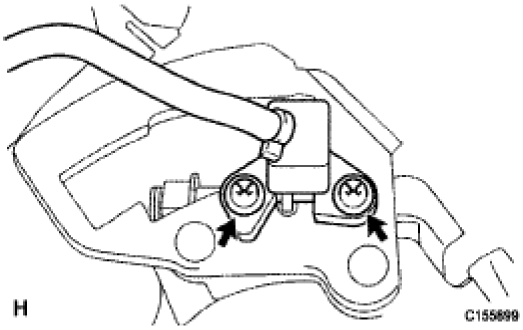

Fig. 253: Identifying Column Shift Control Shift Lever Retainer And Screw
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **INSTALL TRANSMISSION CONTROL SWITCH (S POSITION)**
   a. Apply MP grease to the switch shown in the illustration.
   b. Install the switch to the column shift control shift lever retainer with the 2 screws.

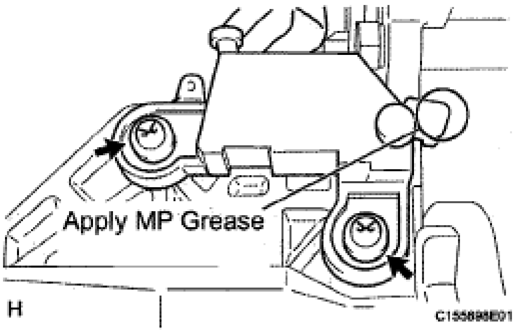

Fig. 254: Identifying MP Grease To Switch
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   c. Securely connect the 2 wire terminals to terminal 6 (IG) and 13 (S) of the transmission control switch connector.

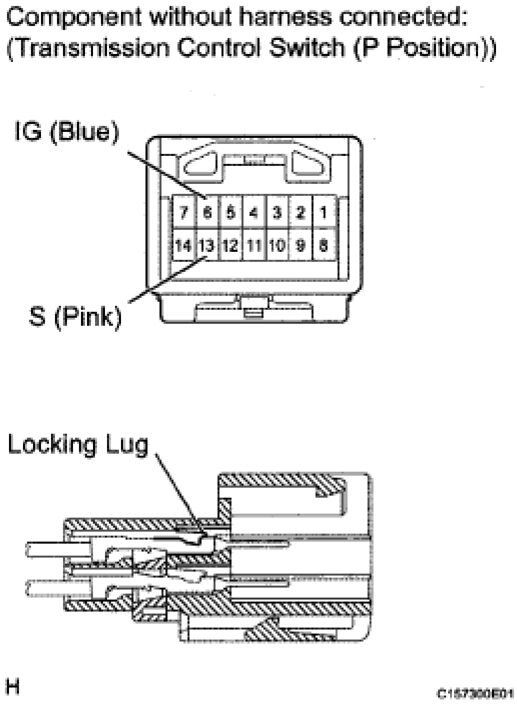

Fig. 255: Identifying Transmission Control Switch (P Position)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **CONNECT NO. 1 SHIFT LOCK PLATE SUB-ASSEMBLY**
    a. Using a hammer, tap in the spring pin to connect the shift lock plate and shift lock solenoid.

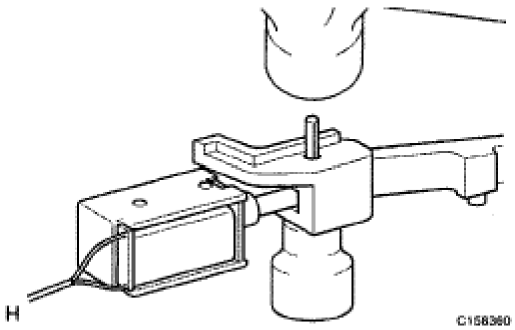

Fig. 256: Tapping Spring Pin To Shift Lock Plate And Shift Lock Solenoid
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. **INSTALL SHIFT LOCK SOLENOID**
    a. Install the shift lock solenoid with No. 1 shift lock plate sub-assembly, 2 bushes and collar to the column shift control shift lever retainer with the screw.

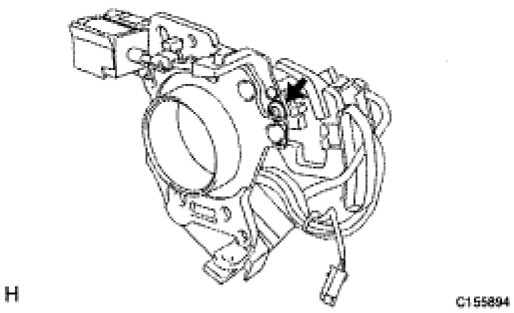

Fig. 257: Identifying Shift Lock Solenoid, Collar And Screw
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Attach the 2 claws to install the shift lock solenoid bracket.

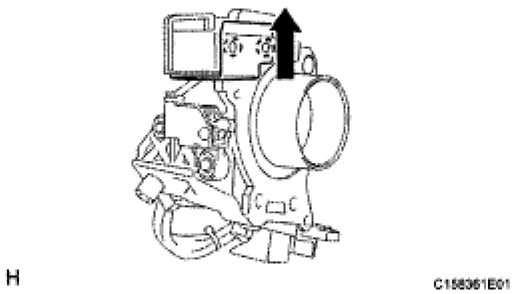

Fig. 258: Identifying Shift Lock Solenoid Bracket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Securely connect the 2 wire terminals to terminal 1 (SLS+) and 8 (E) of the transmission control switch connector.

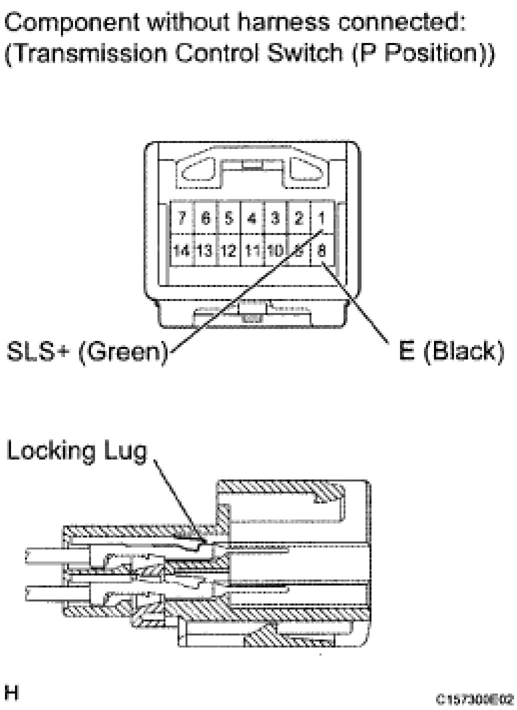

Fig. 259: Identifying Transmission Control Switch (P Position)

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

5. **INSTALL COLUMN SHIFT, SHIFT LEVER SUB-ASSEMBLY**
    a. Apply MP grease to the 2 lever selecting bushes and shift lever shown in the illustration.
    b. Install the 2 lever selecting bushes and shift lever to the column shift control shift lever retainer.
    c. Pass the wire harness of the shift lever through the control shaft tube clamp.

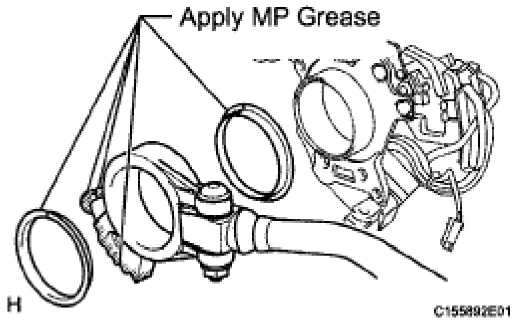

Fig. 260: Identifying MP Grease To 2 Lever Selecting Bushes And Shift Lever
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    d. Attach the 2 claws to install the control shaft tube clamp to the column shift control shift lever retainer.

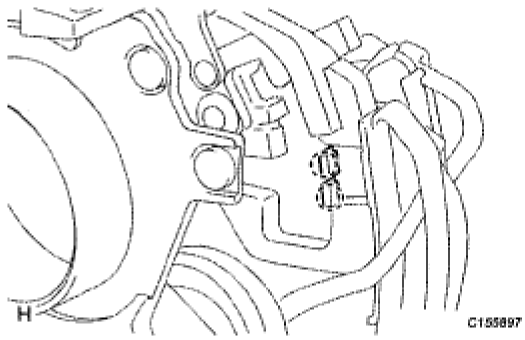

Fig. 261: Identifying Claw To Control Shaft Tube Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    e. w/o Trailer Towing System:

    Securely connect the 3 wire terminals to terminal 4 (SFTD-), 5 (SFTU+) and 11 (E) of the transmission control switch connector. Then push the connector housing retainer to lock it.

    f. w/ Trailer Towing System:

    Securely connect the 4 wire terminals to terminal 4 (SFTD-), 5 (SFTU+), 12 (P), 9 (P) and 11 (E) of the transmission control switch connector. Then push the connector housing retainer to lock it.

    g. Fix the connector housing retainer of the connector in place.

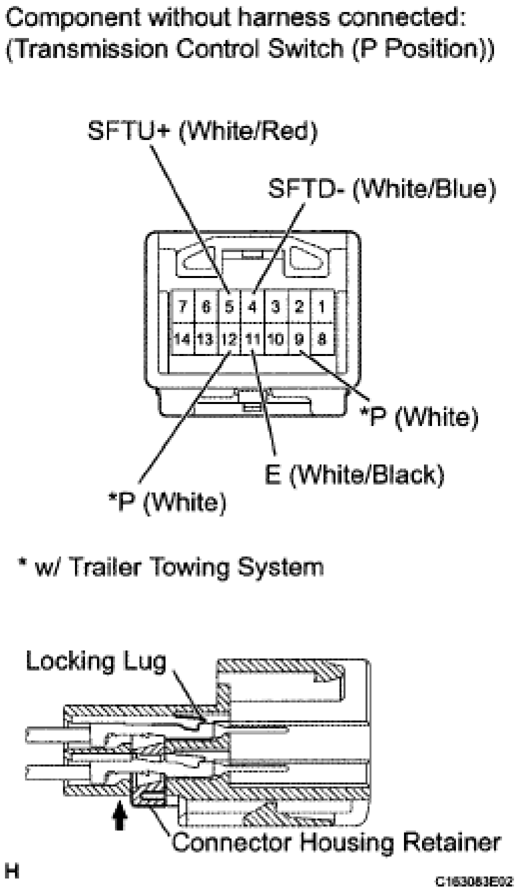

Fig. 262: Identifying Transmission Control Switch (P Position)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. **INSTALL COLUMN SHIFT, SHIFT LOCK RELEASE LINK**
    a. Install the spring and shift lock release link to the shift lever plate.

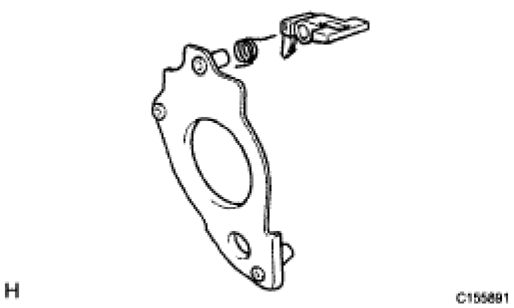

Fig. 263: Identifying Shift Lock Release Link To Shift Lever Plate
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. **INSTALL SHIFT LEVER PLATE SUB-ASSEMBLY**
    a. Install the shift lever plate to the column shift control shift lever retainer with the 3 bolts.

    Torque: 2.3 N*m (23 kgf*cm, 20 in.*lbf)

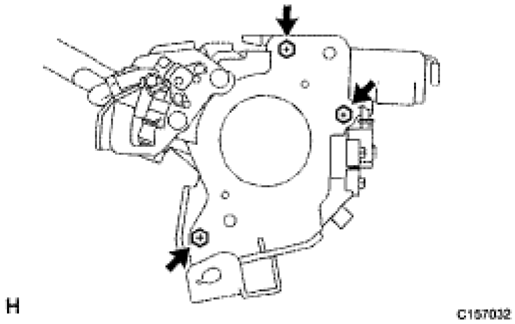

Fig. 264: Identifying Shift Lever Plate Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Clamp the harness with the 4 wire guides and wire harness clamp as shown in the illustration.

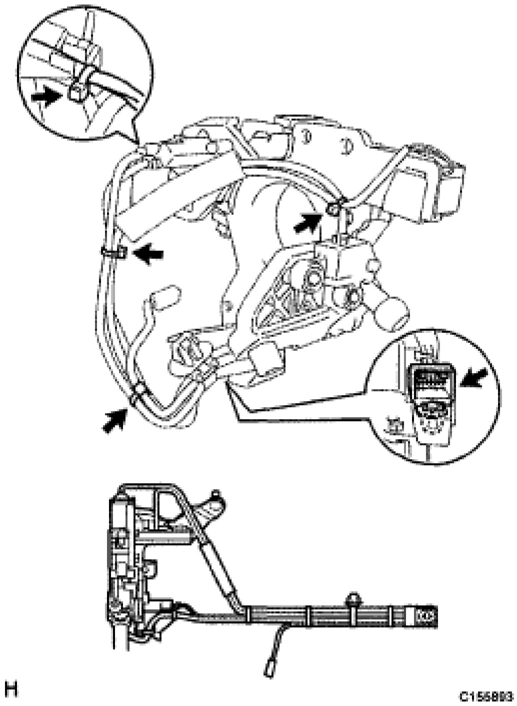

Fig. 265: Identifying Clamp Harness With Wire Guides And Wire Harness Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. **INSTALL COLUMN SHIFT LEVER COMPRESSION SPRING**
    a. Apply MP grease to the spring shown in the illustration.
    b. Temporarily install the spring to the column shift control shift lever retainer with the bolt.

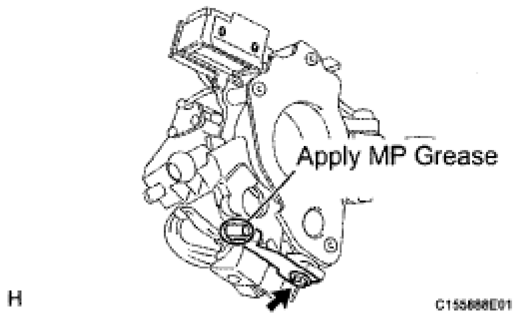

Fig. 266: Applying MP Grease To Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. With the shift lever's protrusion pushed towards the column shift control shift lever retainer's N position wall, align the spring's roller to the groove as shown in the illustration. Then tighten the bolt.

Torque: 3.8 N*m (38 kgf*cm, 33 in.*lbf)

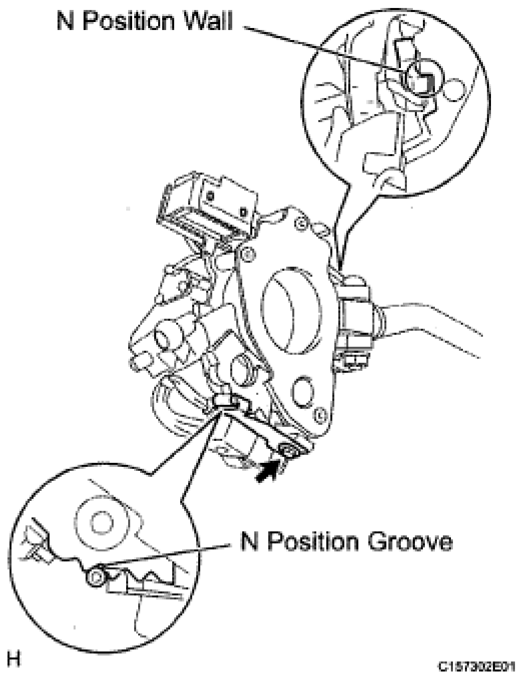

Fig. 267: Identifying N Position Wall And N Position Groove
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. **INSTALL COLUMN SHIFT SHIFTING BELLCRANK ASSEMBLY**
   a. Apply MP grease to the shifting bellcrank shown in the illustration.
   b. Install the shifting bellcrank with the bolt.

   Torque: 5.0 N*m (51 kgf*cm, 44 in.*lbf)

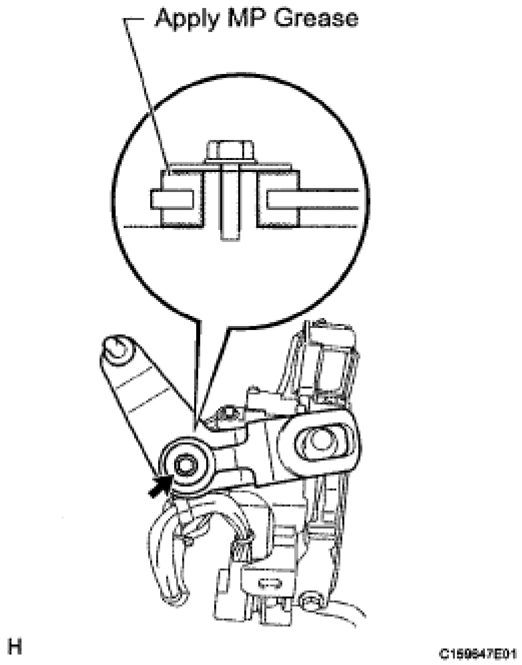

Fig. 268: Applying MP Grease To Shifting Bellcrank
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. **INSTALL COLUMN SHIFT ASSEMBLY**
   a. Using a T30 "TORX" wrench, install the column shift with the 3 bolts.

      Torque: 4.0 N*m (41 kgf*cm, 35 in.*lbf)

   b. Connect the connector and attach the harness clamp.

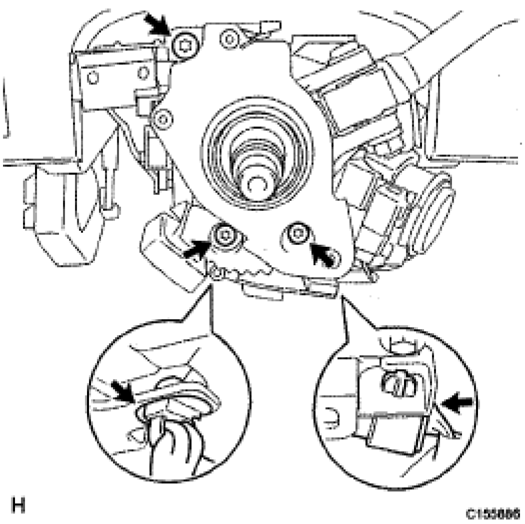

Fig. 269: Identifying Column Shift With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   c. Connect the column shift transmission control cable end to the column shift.

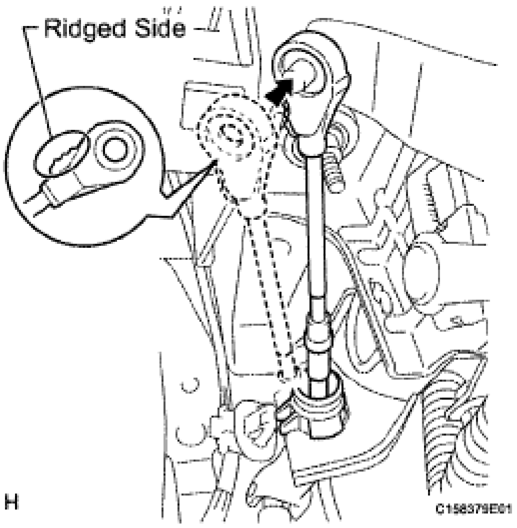

Fig. 270: Identifying Column Shift Transmission Control Cable End To Column Shift
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: **Make sure to install the cable end so that the inner cable is not twisted. Confirm that the cable end's ridged side is facing upward.**

2. **INSTALL TURN SIGNAL SWITCH ASSEMBLY WITH SPIRAL CABLE SUB-ASSEMBLY** (See INSTALLATION)
3. **INSTALL UPPER STEERING COLUMN COVER** (See INSTALLATION)
4. **INSTALL LOWER STEERING COLUMN COVER** (See INSTALLATION)
5. **INSTALL STEERING WHEEL ASSEMBLY** (See INSTALLATION)
6. **INSTALL STEERING PAD (w/ Steering Pad Switch)** (See INSTALLATION)
7. **INSTALL STEERING PAD (w/o Steering Pad Switch)** (See INSTALLATION)
8. **INSTALL NO. 1 INSTRUMENT PANEL SAFETY PAD INSERT** (See INSTALLATION)
9. **INSTALL LOWER INSTRUMENT PANEL FINISH PANEL SUB-ASSEMBLY LH** (See INSTALLATION)
10. **INSTALL COWL SIDE TRIM BOARD LH** (See INSTALLATION)
11. **INSTALL FRONT DOOR SCUFF PLATE LH (for Double Cab, CrewMax)** (See INSTALLATION)
12. **INSTALL FRONT DOOR SCUFF PLATE LH (for Regular Cab)** (See INSTALLATION)
13. **ADJUST SHIFT LEVER POSITION** (see ADJUSTMENT)
14. **INSPECT SHIFT LEVER POSITION** (see ADJUSTMENT)
15. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

NOTE: **Some systems need to be initialized after the cable is reconnected (see INITIALIZATION).**

SHIFT LEVER ASSEMBLY (FOR FLOOR SHIFT TYPE)

COMPONENTS

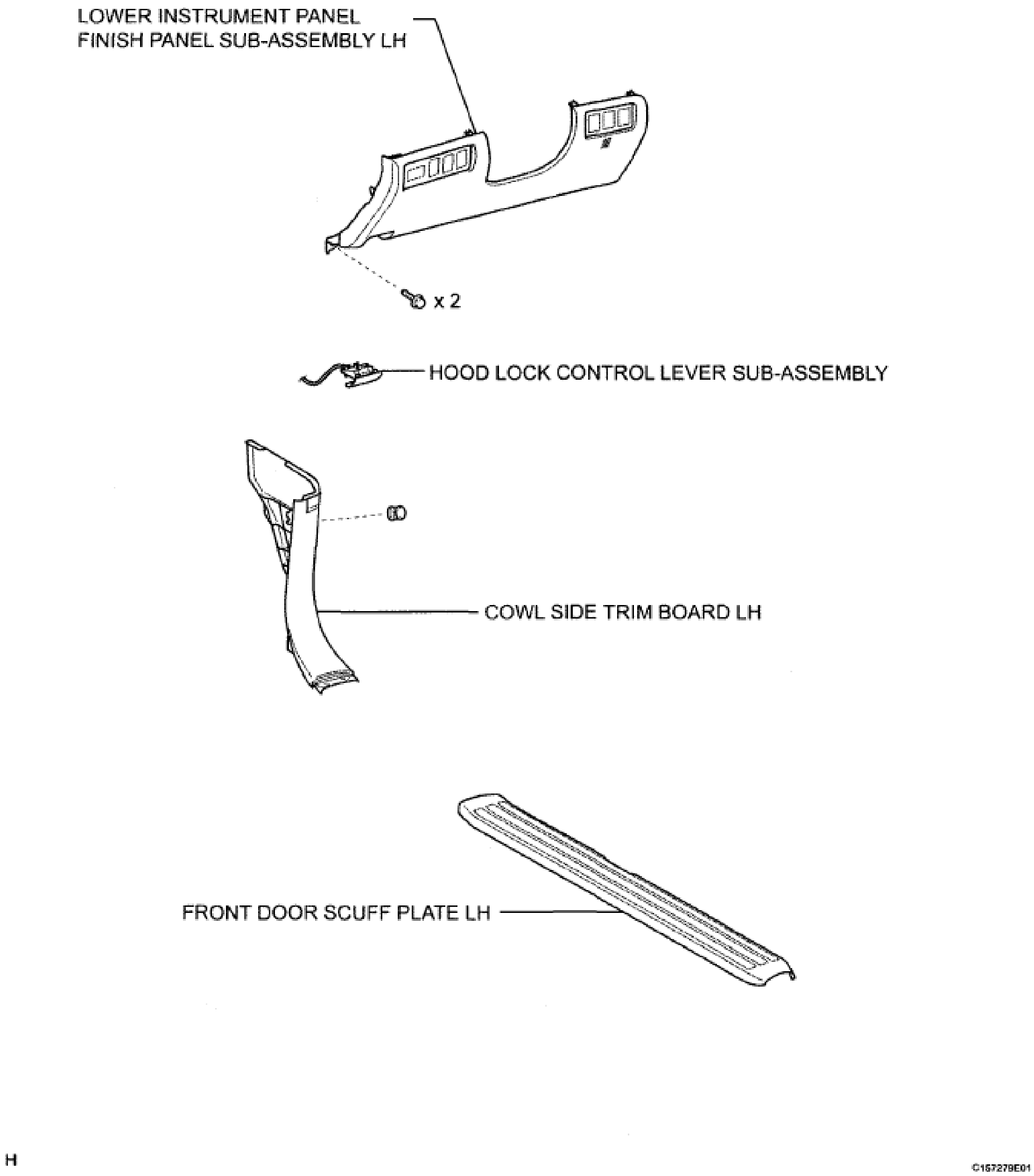

Fig. 271: Identifying Shift Lever Assembly Components - For Floor Shift Type (1 Of 3)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

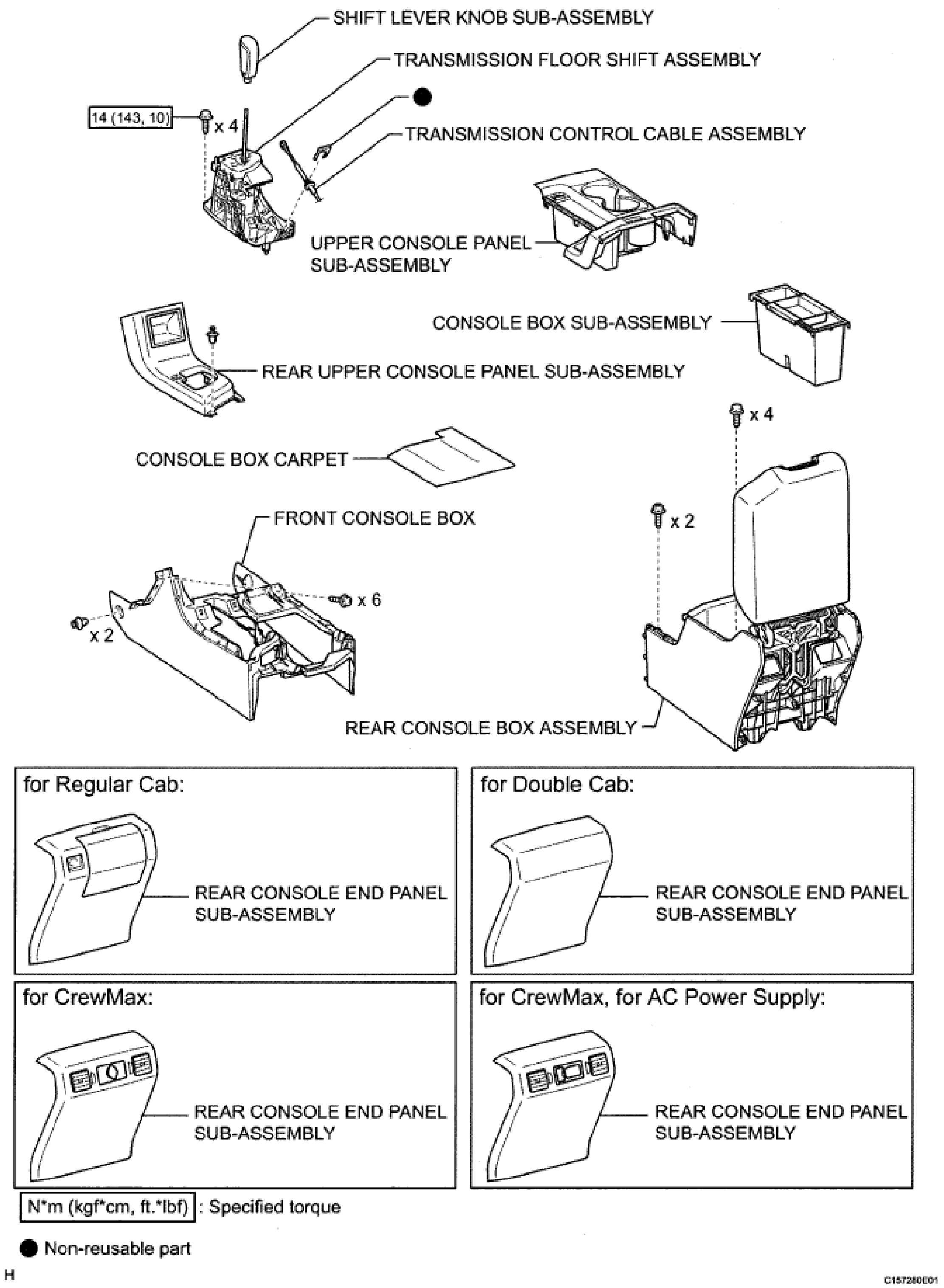

Fig. 272: Identifying Shift Lever Assembly Components With Torque Specification - For Floor Shift Type (2 Of 3)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

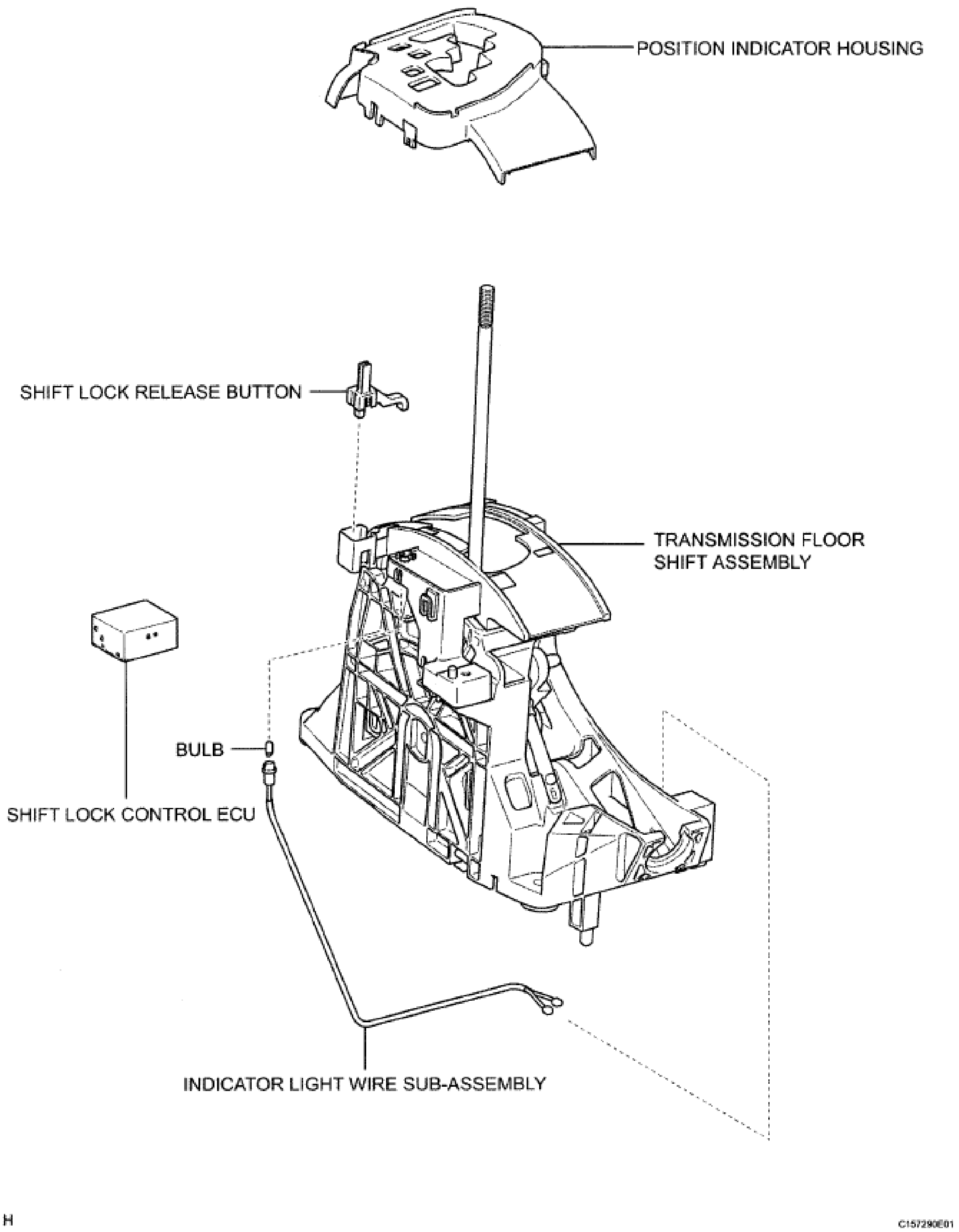

Fig. 273: Identifying Shift Lever Assembly Components - For Floor Shift Type (3 Of 3)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ON-VEHICLE INSPECTION

1. **INSPECT SHIFT LEVER POSITION**
   a. When moving the shift lever from the P to R position with the ignition switch ON and brake pedal depressed, make sure that it moves smoothly and correctly into position.
   b. Start the engine and make sure that the vehicle moves forward after moving the shift lever from the N to D position and moves rearward after moving the shift lever to the R position.

If the operation cannot be performed as specified, inspect the park/neutral position switch assembly and check the shift lever assembly installation condition.

REMOVAL

1. **REMOVE FRONT DOOR SCUFF PLATE LH (for Regular Cab)** (See REMOVAL)
2. **REMOVE FRONT DOOR SCUFF PLATE LH (for Double Cab, CrewMax)** (See REMOVAL)
3. **REMOVE COWL SIDE TRIM BOARD LH** (See REMOVAL)
4. **REMOVE LOWER INSTRUMENT PANEL FINISH PANEL SUB-ASSEMBLY LH** (See REMOVAL)
5. **REMOVE SHIFT LEVER KNOB SUB-ASSEMBLY** (See REMOVAL)
6. **REMOVE UPPER CONSOLE PANEL SUB-ASSEMBLY** (See REMOVAL)
7. **REMOVE REAR UPPER CONSOLE PANEL SUB-ASSEMBLY** (See REMOVAL)
8. **REMOVE REAR CONSOLE END PANEL SUB-ASSEMBLY** (See REMOVAL)
9. **REMOVE CONSOLE BOX CARPET**
10. **REMOVE REAR CONSOLE BOX ASSEMBLY** (See REMOVAL)
11. **REMOVE FRONT CONSOLE BOX** (See REMOVAL)
12. **REMOVE TRANSMISSION FLOOR SHIFT ASSEMBLY**
    a. Move the shift lever to the N position.
    b. Disconnect the transmission control cable end from the shift lever.

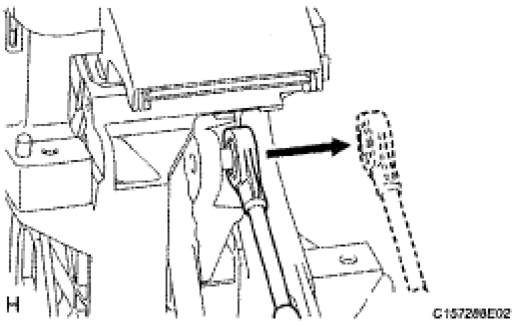

Fig. 274: Identifying Transmission Control Cable End From Shift Lever
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    c. Remove the clip and disconnect the transmission control cable from the shift lever retainer.

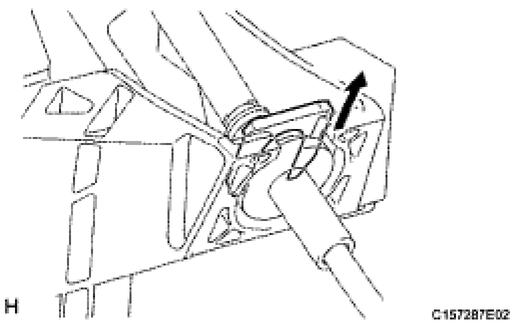

Fig. 275: Identifying Transmission Control Cable From Shift Lever Retainer

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

d. Disconnect the 2 connectors.
e. Remove the 4 bolts and floor shift.

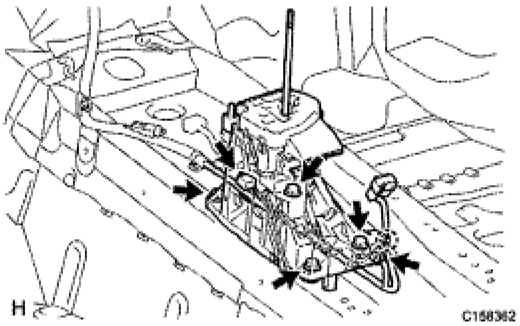

Fig. 276: Identifying Floor Shift And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DISASSEMBLY

1. **REMOVE INDICATOR LIGHT WIRE SUB-ASSEMBLY**
   a. Using a thin-bladed screwdriver, release the connector housing retainer.
   b. Pull the 4 (ILL+) and 8 (ILL-) terminals out from the rear.

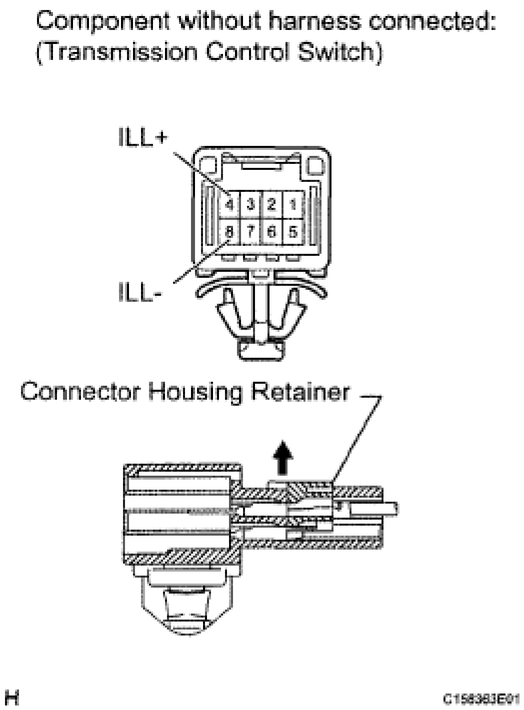

Fig. 277: Identifying Indicator Light Wire Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Rotate the indicator light wire counterclockwise to align the key part and remove the wire.

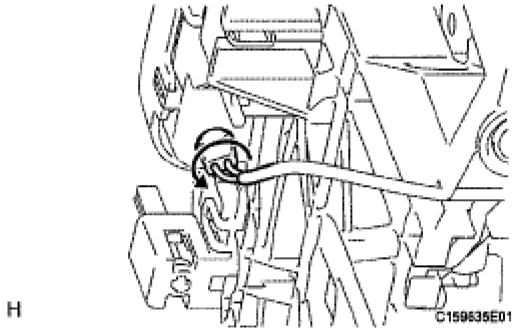

Fig. 278: Identifying Indicator Light
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **REMOVE SHIFT LOCK RELEASE BUTTON**
    a. Detach the 4 claws and remove the position indicator housing from the floor shift.

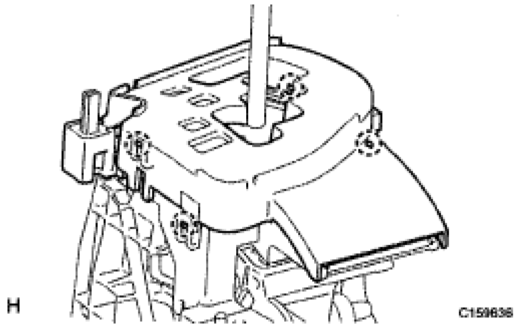

Fig. 279: Identifying Position Indicator Housing To Floor Shift
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    b. Detach the 2 claws and remove the button.

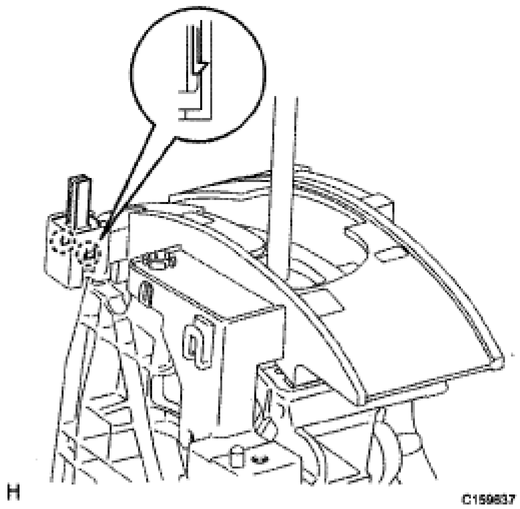

Fig. 280: Identifying Claws
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **REMOVE SHIFT LOCK CONTROL ECU**

a. Disconnect the shift lock solenoid connector from the ECU.
b. Detach the 3 claws and remove the ECU.

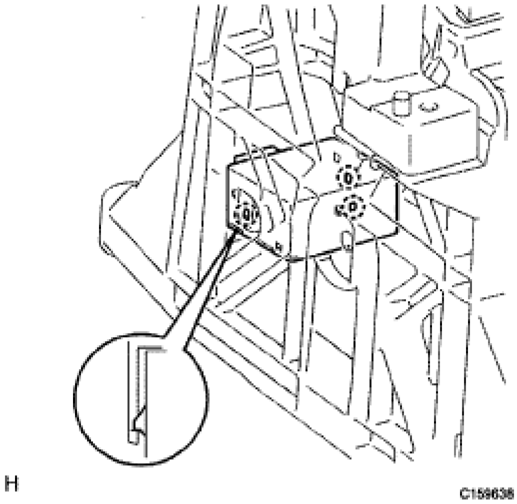

Fig. 281: Identifying ECU And Claws
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION

1. **INSPECT TRANSMISSION CONTROL SWITCH**
   a. Disconnect the transmission control switch connector.
   b. Measure the resistance according to the value (s) in the table below.

Standard resistance

TRANSMISSION CONTROL SWITCH RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
3 (IG) - 7 (S)	Shift lever position S, "+" and "-"	Below 1 ohms
2 (SFTU) - 5 (E)	Shift lever position continuously shifted to "+" (Up-shift)	
1 (SFTD) - 5 (E)	Shift lever position continuously shifted to "-" (Down-shift)	
3 (IG) - 7 (S)	Shift lever position not on S, "+" and "-"	10 kohms or higher
2 (SFTU) - 5 (E)	Shift lever position S	
1 (SFTD) - 5 (E)		

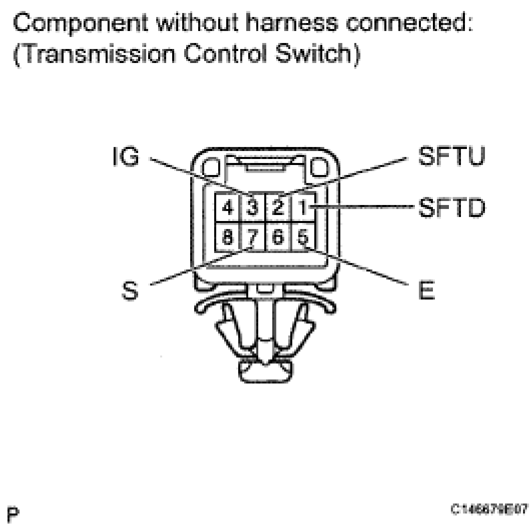

Fig. 282: Identifying Transmission Control Switch Connector Terminal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the result is not as specified, replace the transmission floor shift assembly.

ADJUSTMENT

1. **INSPECT SHIFT LEVER POSITION**
   a. When moving the shift lever from the N position to other positions, check that the lever can be shifted smoothly and accurately to each position and that the position indicator comes on in accordance with the shift lever position.

      If the indicator and shift lever position do not match, carry out the following adjustment procedures.

2. **ADJUST SHIFT LEVER POSITION**
   a. Move the shift lever to the N position.
   b. Fold back the transmission control cable adjust case cover. Then while sliding the slider toward the cable end side, press the lock piece from the back side to release the lock.

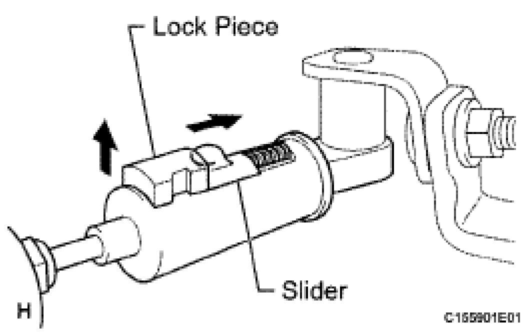

Fig. 283: Adjusting Shift Lever Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   c. Check that the adjust case's spring is applying enough tension to the shift control cable. Then press the lock piece to set the lock.

NOTE:

- **Use your hand to push the lock piece. Do not use any tools.**
- **Securely push the lock piece so that the slider's protrusion is above the lock piece.**

d. Return the cover of the adjust case to its original position.
e. Inspect the operation after the adjustment.

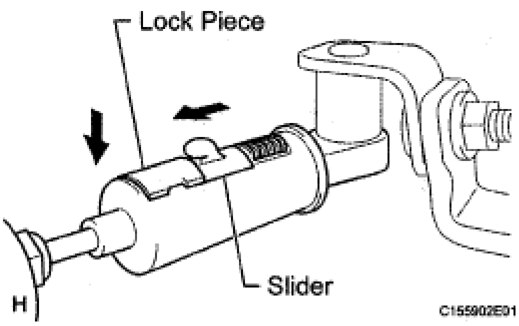

Fig. 284: Pushing Lock Piece
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REASSEMBLY

1. **INSTALL SHIFT LOCK CONTROL ECU**
   a. Attach the 3 claws to install the ECU to the floor shift.
   b. Connect the shift lock solenoid connector to the ECU.

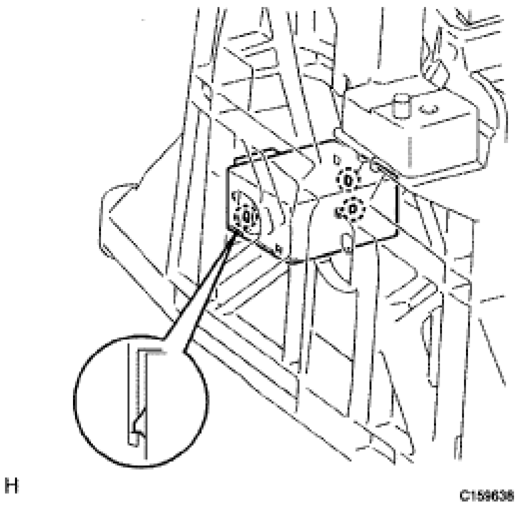

Fig. 285: Identifying ECU And Claws
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **INSTALL SHIFT LOCK RELEASE BUTTON**
   a. Attach the 2 claws to install the button.

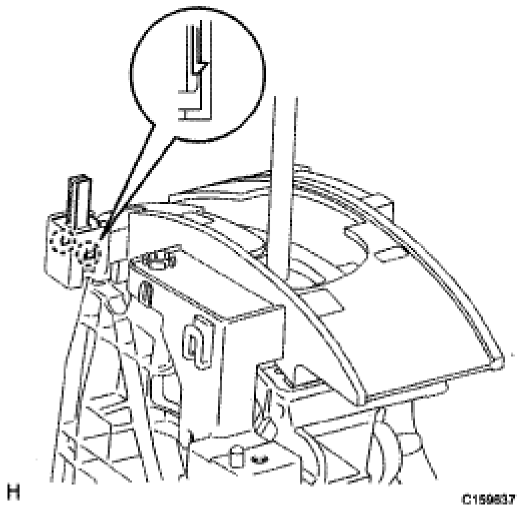

Fig. 286: Identifying Claws
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Attach the 4 claws to install the position indicator housing.

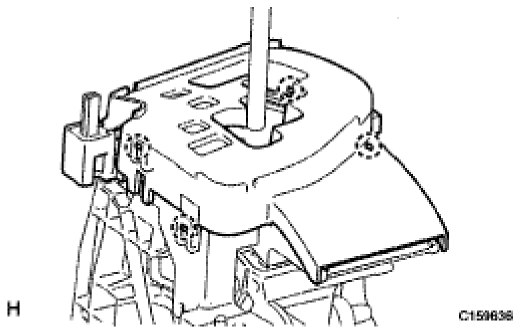

Fig. 287: Identifying Position Indicator Housing To Floor Shift
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **INSTALL INDICATOR LIGHT WIRE SUB-ASSEMBLY**
   a. Align the wire with the key part of the position indicator housing lower, and install the wire. Then rotate the wire clockwise until it locks.

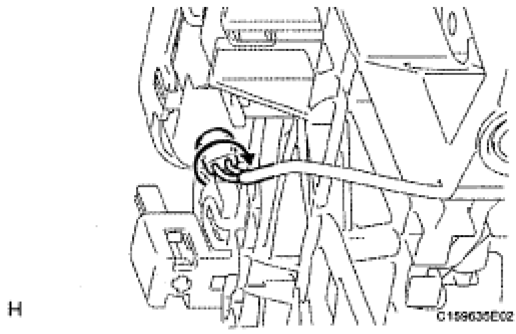

Fig. 288: Identifying Wire Clockwise Locks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Securely connect the 2 wire terminals to terminal 4 (ILL+) and 8 (ILL-) of the transmission control switch connector. Then push the connector housing retainer to lock it.

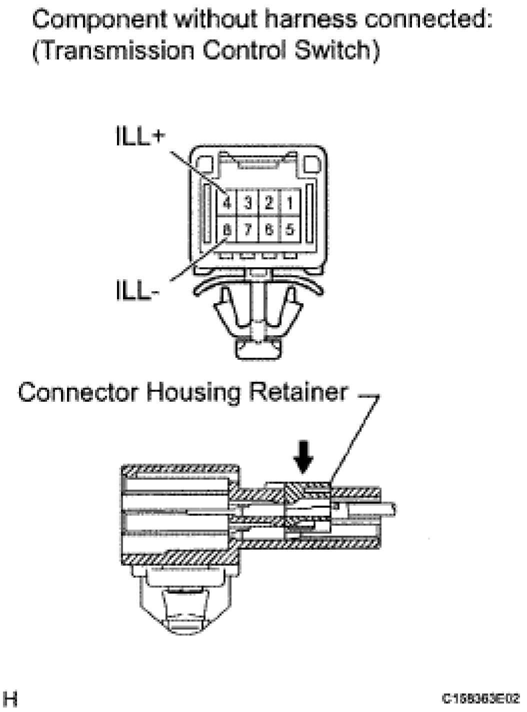

Fig. 289: Identifying Transmission Control Switch Connector Terminal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. **INSTALL TRANSMISSION FLOOR SHIFT ASSEMBLY**
   a. Install the floor shift with the 4 bolts. Tighten the bolts in the order shown in the illustration.

   Torque: 14 N*m (143 kgf*cm, 10 ft.*lbf)

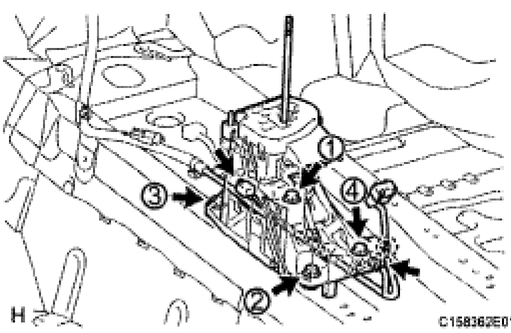

Fig. 290: Identifying Floor Shift With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Install the cable outer of the transmission control cable to the shift lever retainer, and install a new clip.

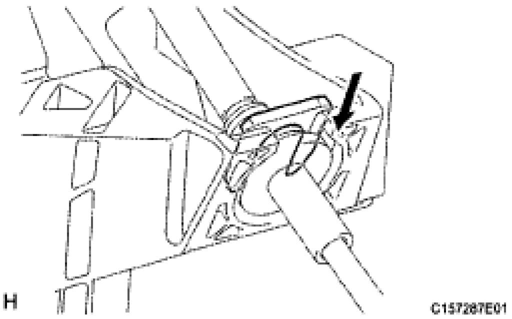

Fig. 291: Identifying Cable Outer Of Transmission Control Cable
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Connect the control cable end to the shift lever.

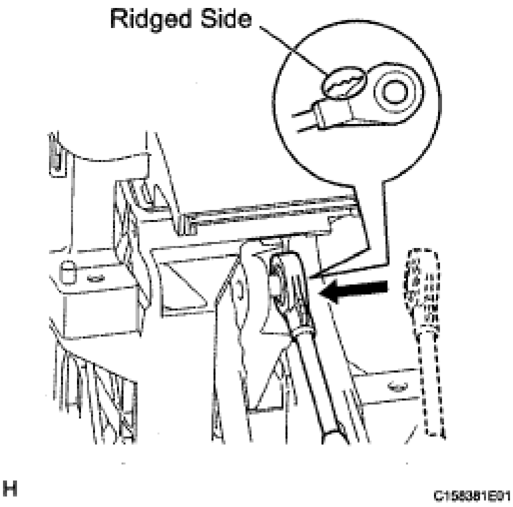

Fig. 292: Connecting Control Cable End To Shift Lever
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:	**Make sure to install the cable end so that the inner cable is not twisted. Confirm that the cable end's ridged side is facing upward.**

d. Connect the 2 connectors.

2. **INSTALL FRONT CONSOLE BOX** (See INSTALLATION)
3. **INSTALL REAR CONSOLE BOX ASSEMBLY** (See INSTALLATION)
4. **INSTALL CONSOLE BOX CARPET**
5. **INSTALL REAR CONSOLE END PANEL SUB-ASSEMBLY** (See INSTALLATION)
6. **INSTALL REAR UPPER CONSOLE PANEL SUB-ASSEMBLY** (See INSTALLATION)
7. **INSTALL UPPER CONSOLE PANEL SUB-ASSEMBLY** (See INSTALLATION)
8. **INSTALL SHIFT LEVER KNOB SUB-ASSEMBLY** (See INSTALLATION)
9. **INSTALL LOWER INSTRUMENT PANEL FINISH PANEL SUB-ASSEMBLY LH** (See INSTALLATION)
10. **INSTALL COWL SIDE TRIM BOARD LH** (See INSTALLATION)
11. **INSTALL FRONT DOOR SCUFF PLATE LH (for Double Cab, CrewMax)** (See

INSTALLATION)

12. **INSTALL FRONT DOOR SCUFF PLATE LH (for Regular Cab)** (See INSTALLATION)
13. **ADJUST SHIFT LEVER POSITION** (see ADJUSTMENT)
14. **INSPECT SHIFT LEVER POSITION** (see SHIFT LEVER ASSEMBLY (FOR FLOOR SHIFT TYPE))

AUTOMATIC TRANSMISSION ASSEMBLY

COMPONENTS

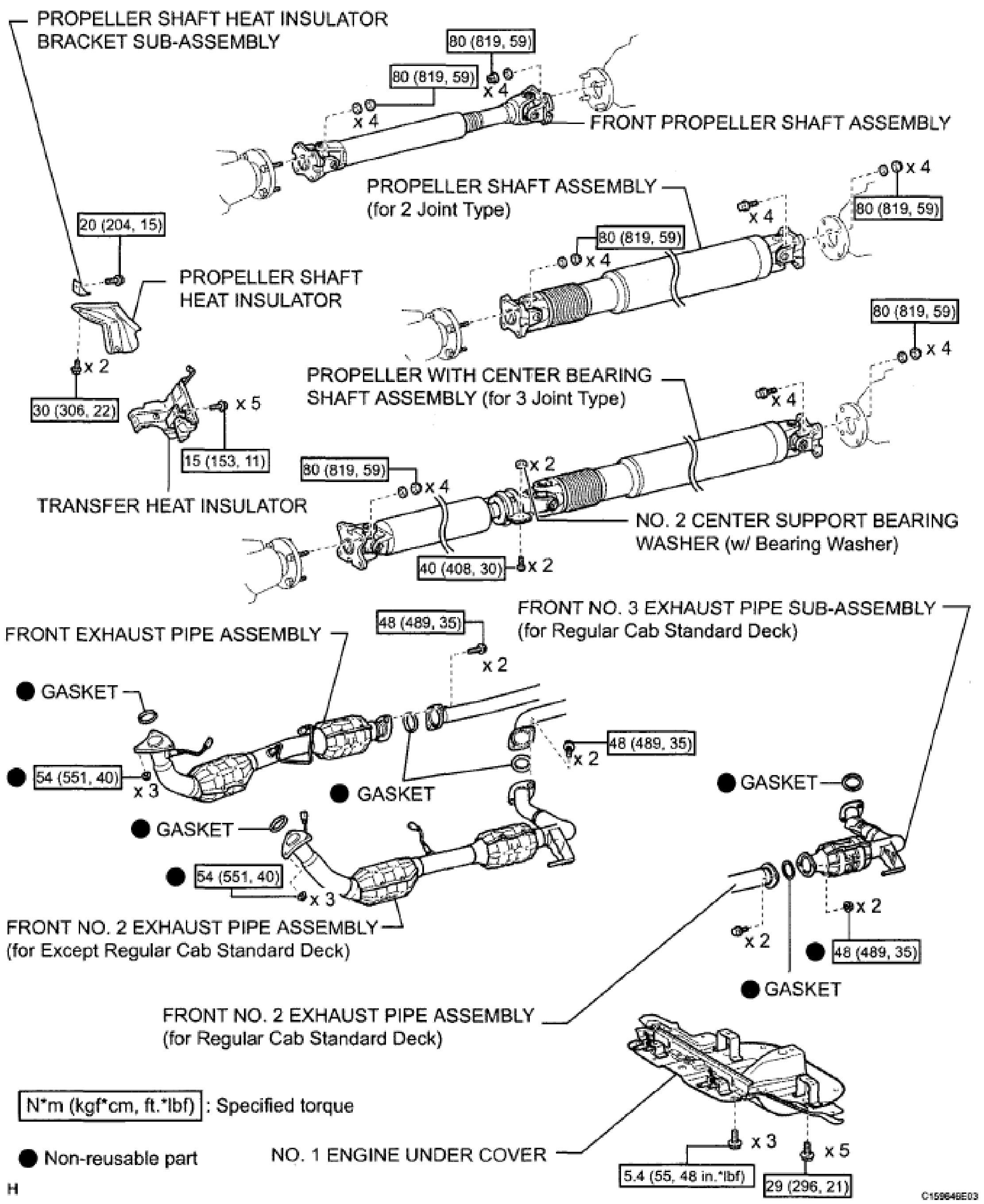

Fig. 293: Identifying Automatic Transmission Components With Torque Specifications (1 Of 5)

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

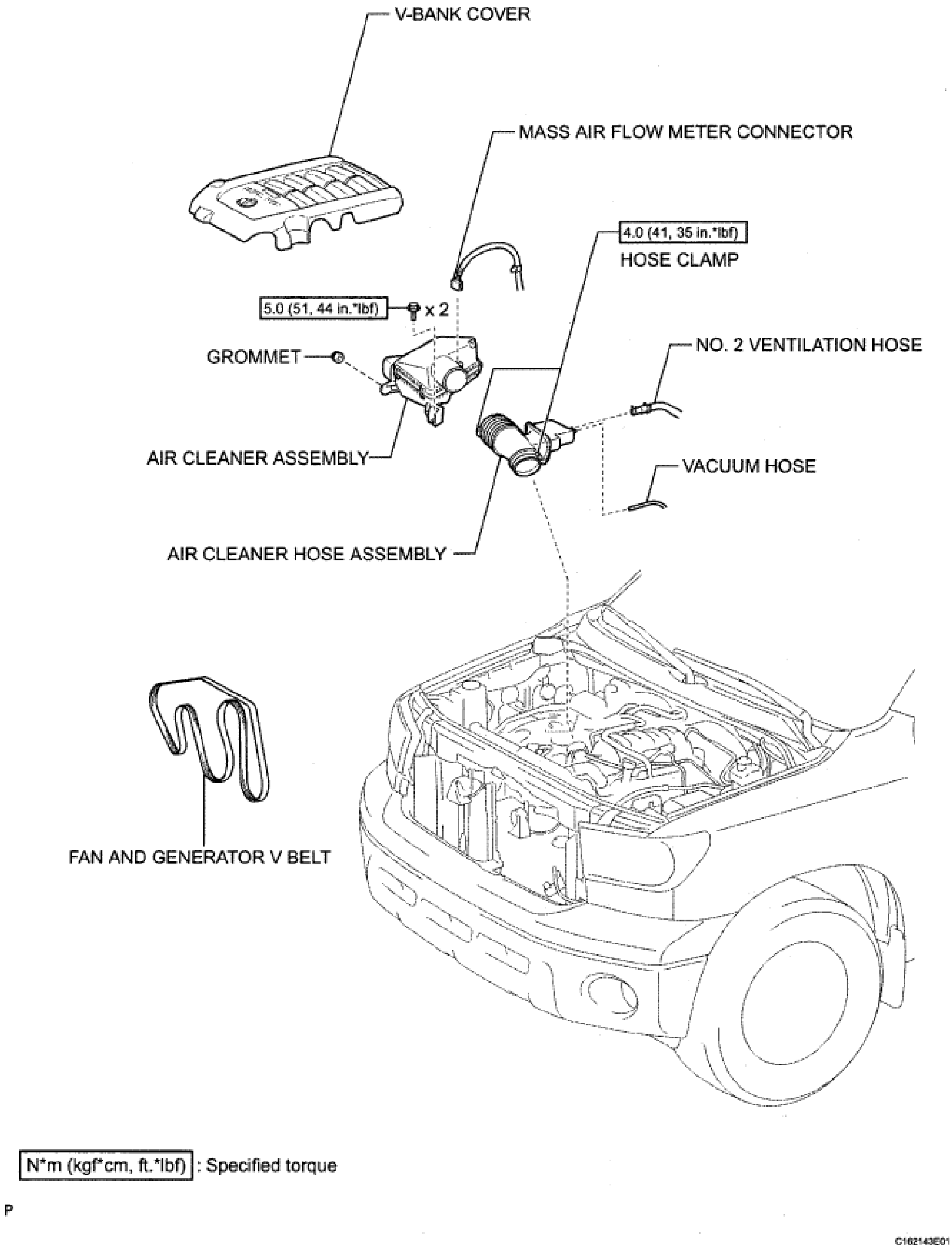

Fig. 294: Identifying Automatic Transmission Components With Torque Specifications (2 Of 5)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

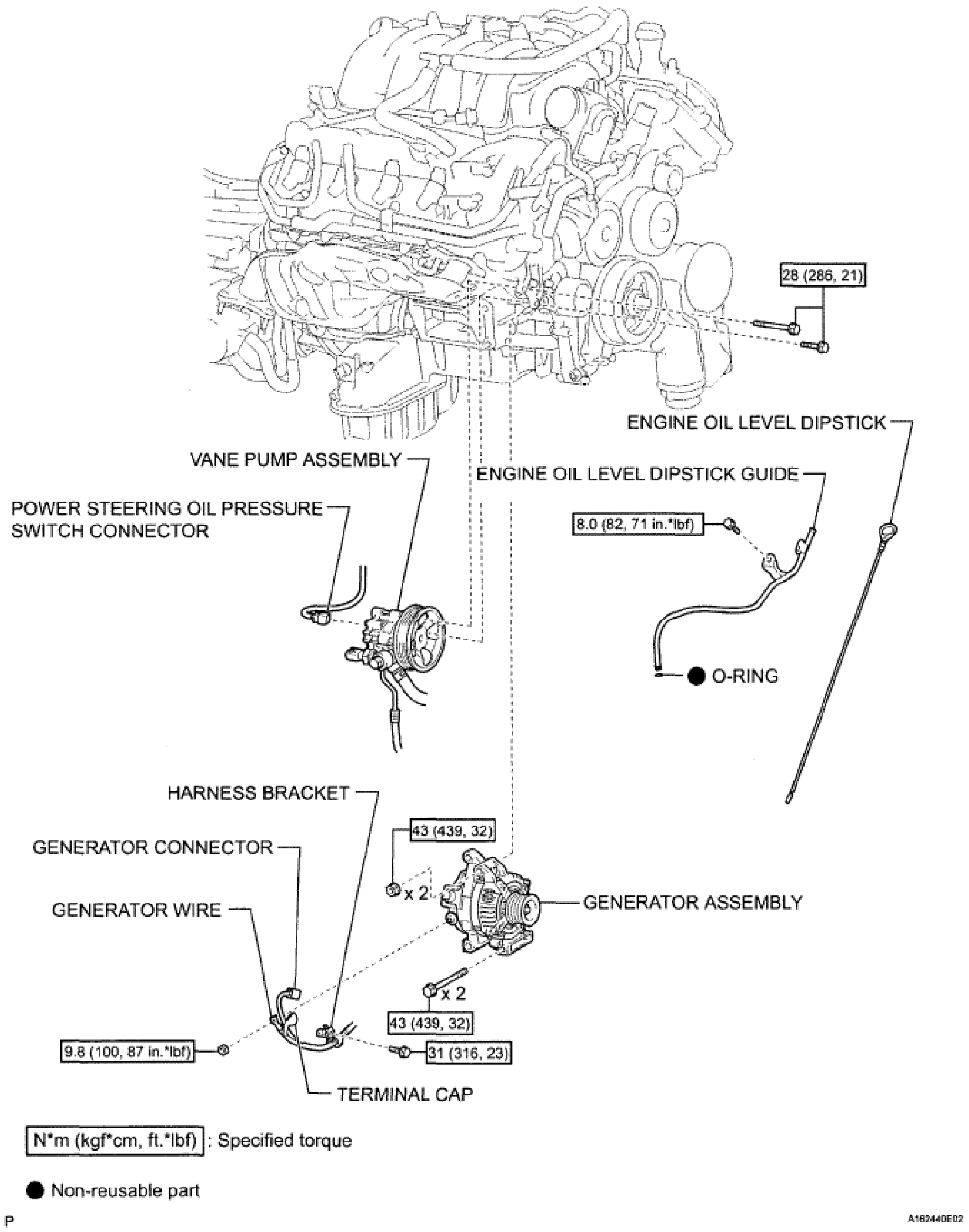

Fig. 295: Identifying Automatic Transmission Components With Torque Specifications (3 Of 5)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

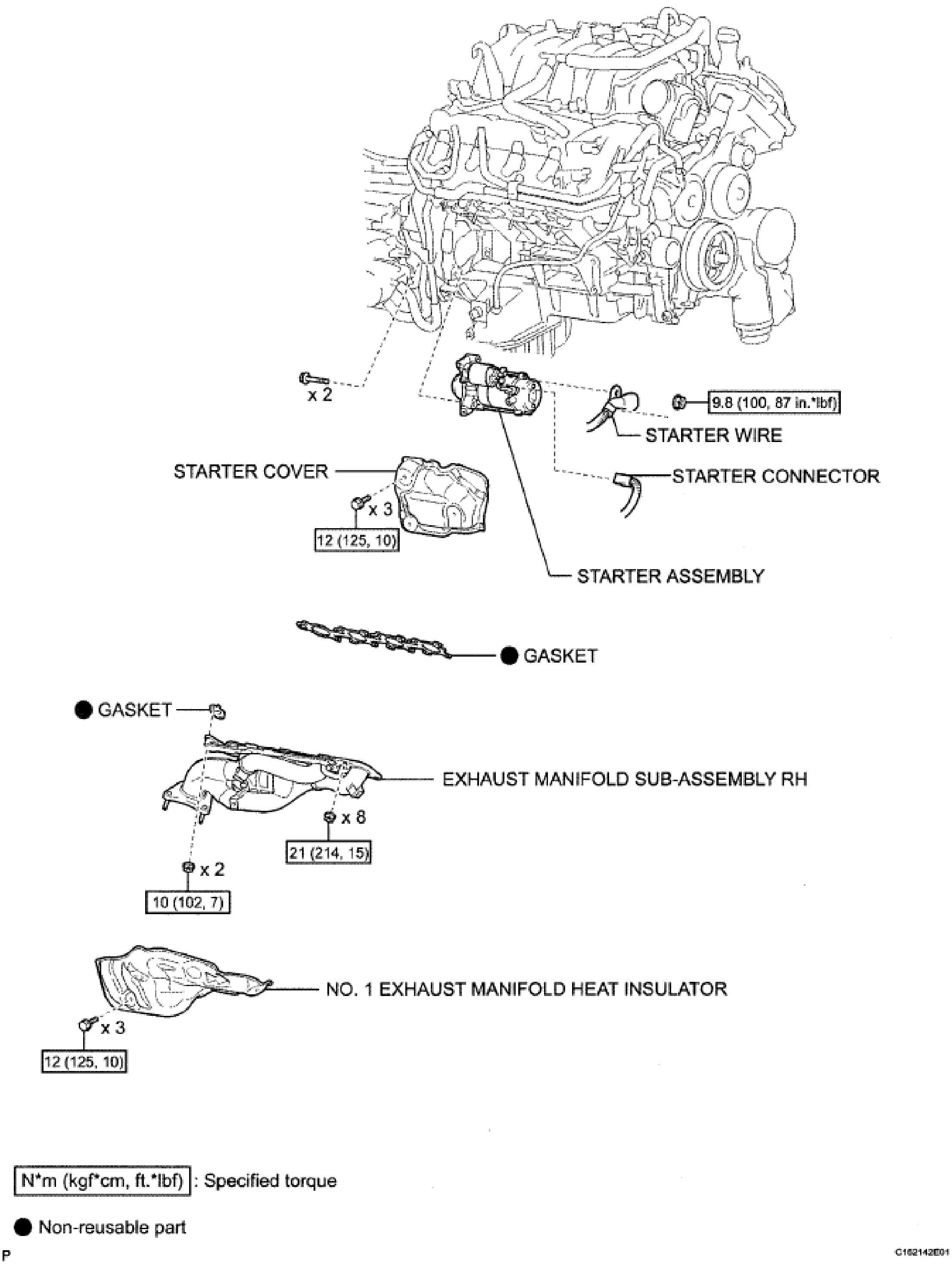

Fig. 296: Identifying Automatic Transmission Components With Torque Specifications (4 Of 5)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

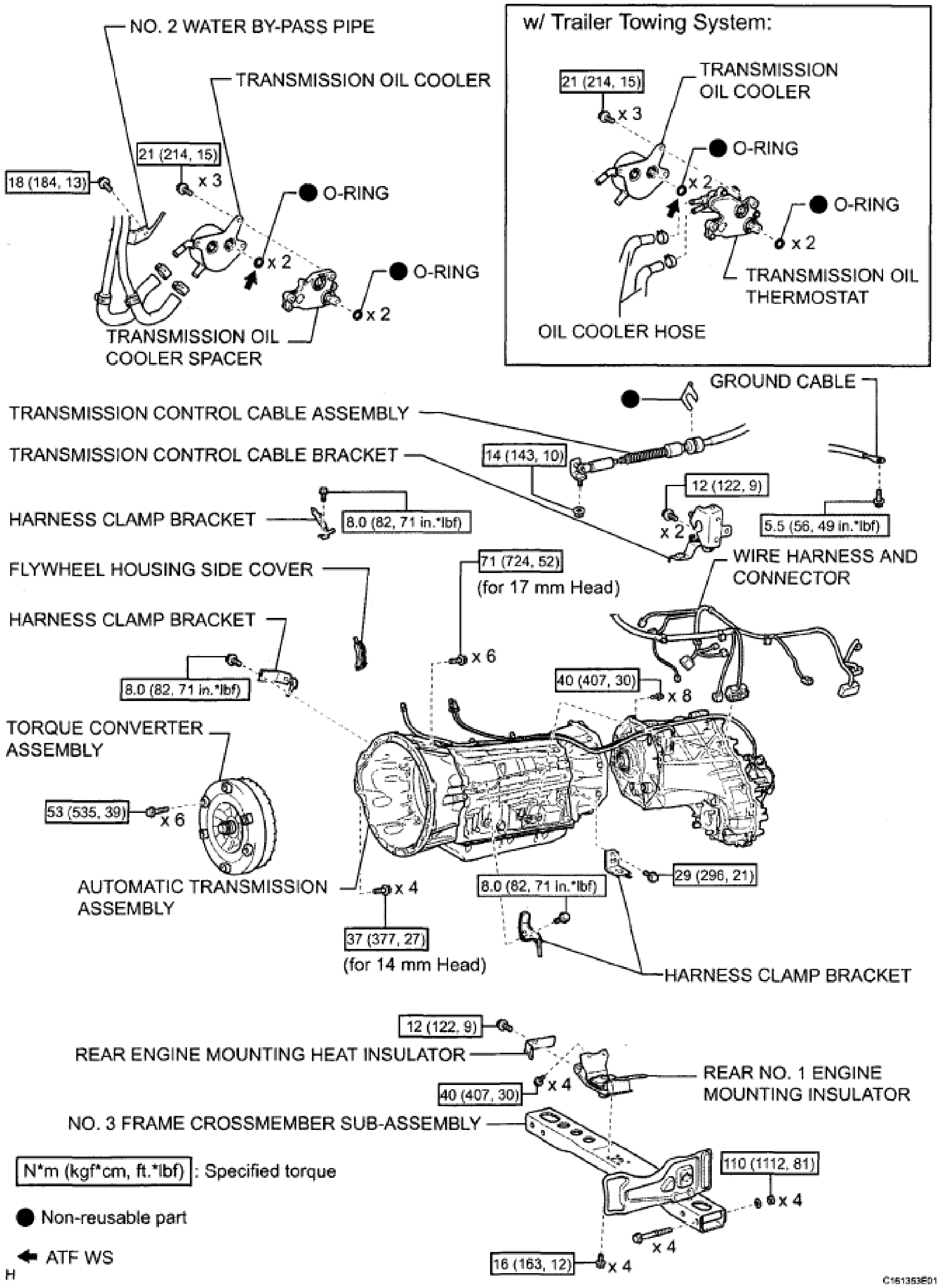

Fig. 297: Identifying Automatic Transmission Components With Torque Specifications (5 Of 5)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**

NOTE: **Some systems need to be initialized after the cable is reconnected (see INITIALIZATION).**

2. **REMOVE NO. 1 ENGINE UNDER COVER**
3. **DRAIN AUTOMATIC TRANSMISSION FLUID** (see **REMOVAL**)
4. **DRAIN ENGINE COOLANT** (See **REPLACEMENT**)
5. **REMOVE FRONT PROPELLER SHAFT ASSEMBLY**
   a. Remove the front propeller shaft (see **REMOVAL**).
6. **REMOVE PROPELLER SHAFT ASSEMBLY**
   a. Remove the propeller shaft (see **REMOVAL**).
7. **REMOVE FRONT EXHAUST PIPE ASSEMBLY**
   a. for Regular Cab Standard Deck:

      Remove the front exhaust pipe (See **REMOVAL**).

   b. except Regular Cab Standard Deck:

      Remove the front exhaust pipe (See **REMOVAL**).

8. **DISCONNECT TRANSMISSION CONTROL CABLE ASSEMBLY**
   a. Remove the nut and clip, and disconnect the shift control cable.

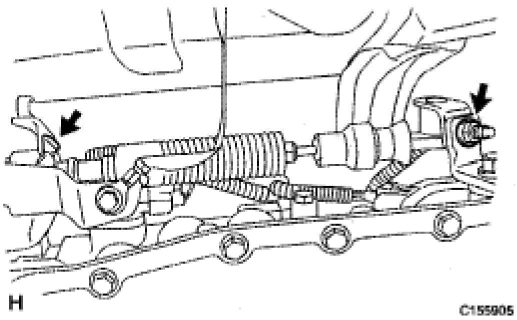

Fig. 298: Identifying Shift Control Cable Clip And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. **REMOVE STARTER ASSEMBLY**
   a. Remove the starter (see **REMOVAL**).
10. **REMOVE DRIVE PLATE AND TORQUE CONVERTER CLUTCH SETTING BOLT**
   a. Remove the flywheel housing side cover.

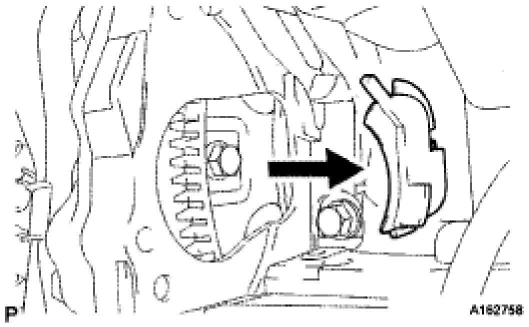

Fig. 299: Identifying Flywheel Housing Side Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Turn the crankshaft to gain access to the 6 bolts and remove the bolts while holding the crankshaft pulley setting bolt with a wrench.

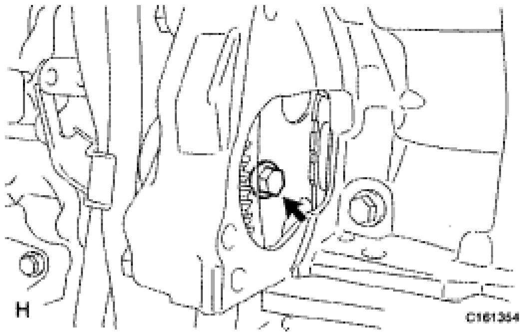

Fig. 300: Identifying Crankshaft Pulley Setting Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. **SUPPORT AUTOMATIC TRANSMISSION ASSEMBLY**
    a. Support the transmission with a transmission jack. Lift the transmission slightly from the crossmember.

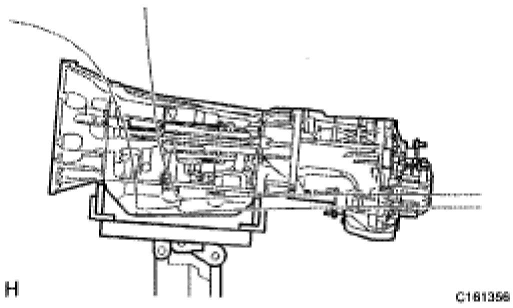

Fig. 301: Identifying Support Automatic Transmission Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. **REMOVE NO. 3 FRAME CROSSMEMBER SUB-ASSEMBLY**
    a. Remove the 4 bolts of the rear engine mounting insulator.

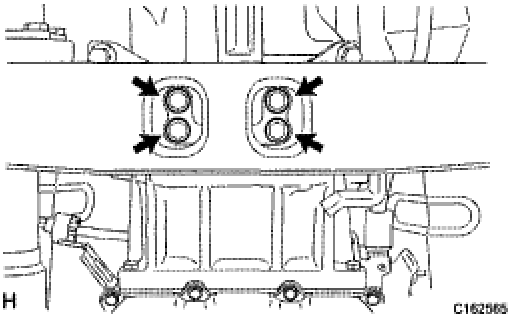

Fig. 302: Identifying Rear Engine Mounting Insulator And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the 4 nuts, 4 washers, 4 bolts and frame crossmember.

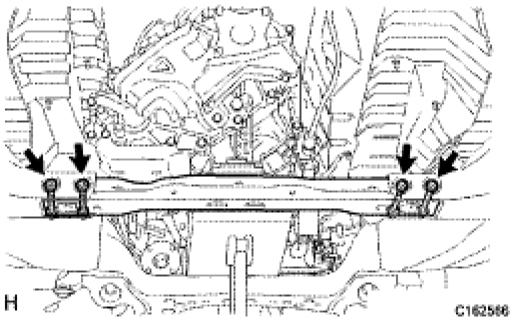

Fig. 303: Identifying Frame Crossmember Washer, Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. **REMOVE REAR NO. 1 ENGINE MOUNTING INSULATOR**
    a. Remove the 4 bolts and rear engine mounting insulator from the transmission.

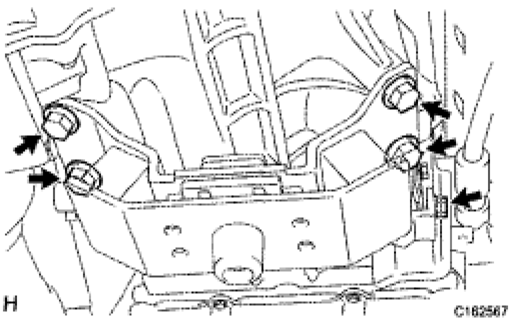

Fig. 304: Identifying Rear Engine Mounting Insulator Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. **DISCONNECT WIRE HARNESS AND CONNECTOR**
    a. Remove the bolt and disconnect the ground cable.

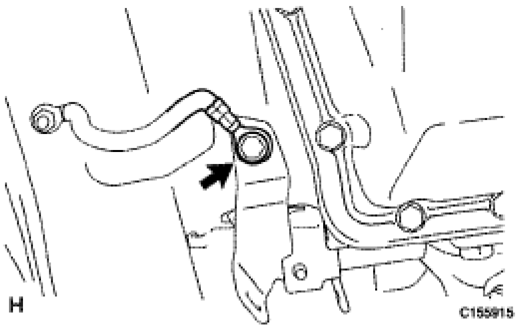

Fig. 305: Identifying Ground Cable Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Tilt the transmission downward.

NOTE: Make sure the cooling fan does not contact the fan shroud.

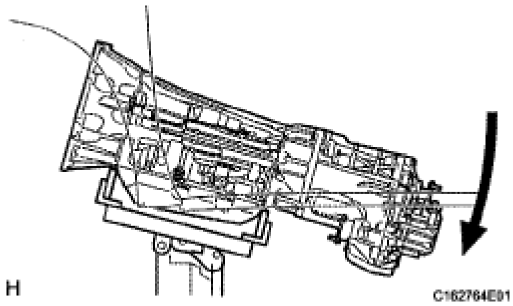

Fig. 306: Tilting Transmission Downward
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Disconnect the park/neutral position switch connector, 2 transmission wire connectors, 2 speed sensor connectors and 3 transfer control side connectors.

   HINT:

   Detach the claw, press down the lever, and then disconnect the transmission wire connector.

d. Disconnect the 3 connector clamps and 7 harness clamps.
e. Remove the 2 bolts and disconnect the harness clamps and wire harness.

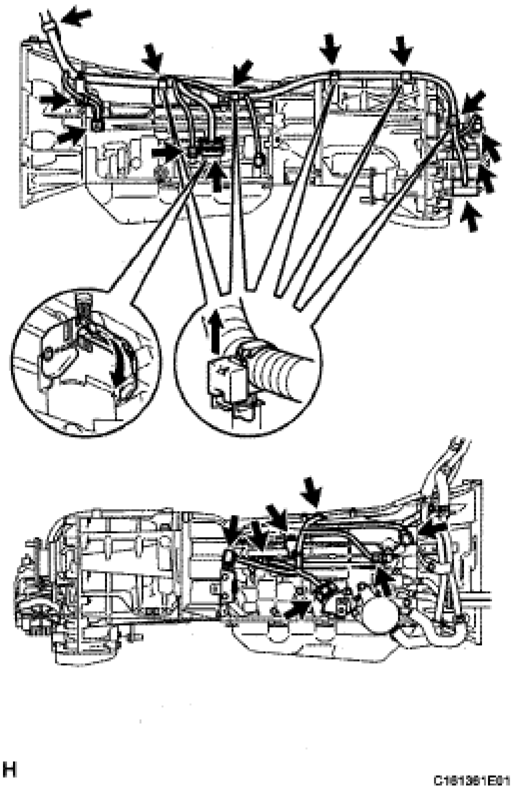

Fig. 307: Identifying Speed Sensor Connectors And Transfer Control Side Connectors
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. **DISCONNECT BREATHER PLUG HOSE**
    a. Disconnect the 3 breather plug hoses from the harness clamp bracket.

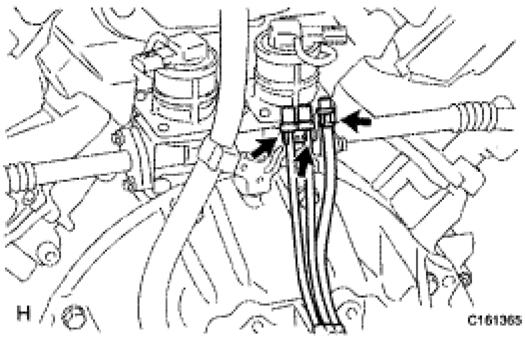

Fig. 308: Identifying Breather Plug Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. **DISCONNECT NO. 2 WATER BYPASS PIPE (w/ Trailer Towing System)**
    a. Remove the bolt and disconnect the 2 water bypass hoses from the transmission oil cooler. Then separate the bypass pipe from the automatic transmission.

NOTE:	**Use a container to catch any coolant which flows out of the water bypass hoses.**

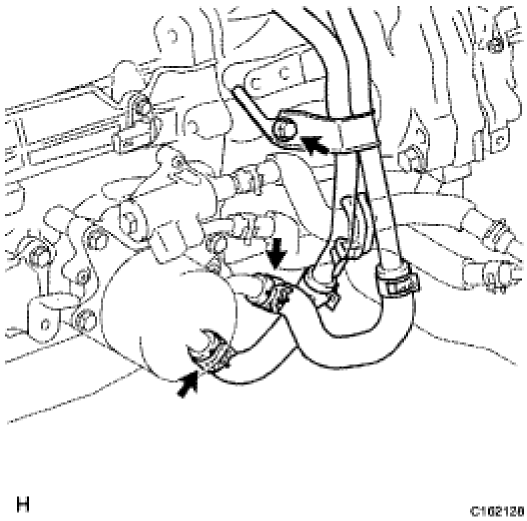

Fig. 309: Identifying No. 2 Water Bypass Pipe (w/ Trailer Towing System)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Disconnect the 2 transmission oil cooler hoses from the transmission oil thermostat.

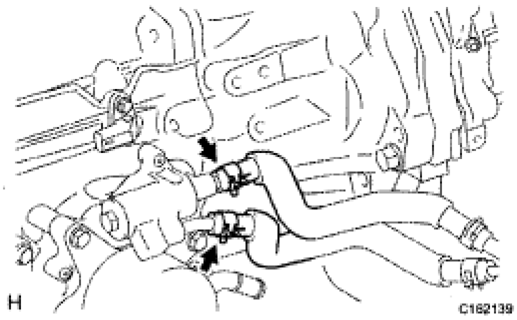

Fig. 310: Identifying Transmission Oil Cooler Hoses And Transmission Oil Thermostat
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. **DISCONNECT NO. 2 WATER BYPASS PIPE (w/o Trailer Towing System)**
    a. Remove the bolt and disconnect the 2 water bypass hoses from the transmission oil cooler. Then separate the bypass pipe from the automatic transmission.

    NOTE: Use a container to catch any coolant which flows out of the water bypass hoses.

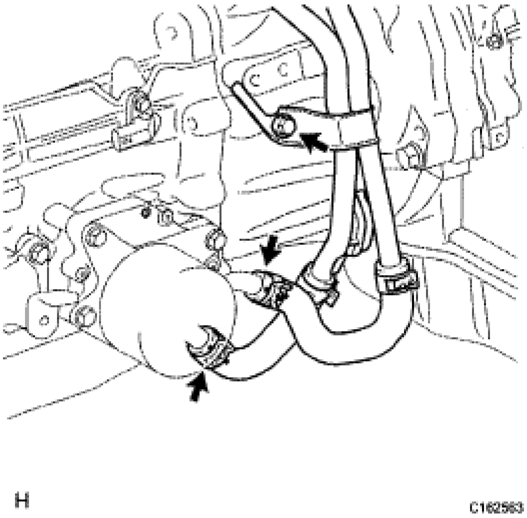

Fig. 311: Identifying Bypass Pipe To Automatic Transmission
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

18. **REMOVE AUTOMATIC TRANSMISSION ASSEMBLY**
    a. Remove the 10 bolts and transmission.

NOTE: Do not use excess force to pry off the transmission assembly.

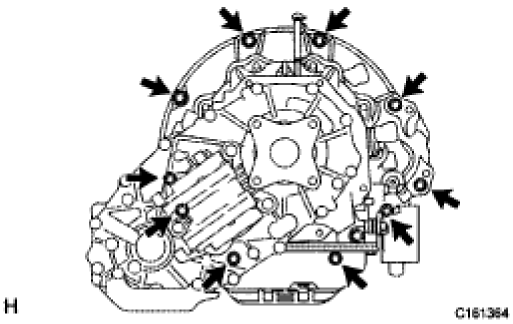

Fig. 312: Identifying Transmission Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. **REMOVE TRANSMISSION OIL COOLER ASSEMBLY (w/ Trailer Towing System)**
    a. Remove the 3 bolts and transmission oil cooler with transmission oil thermostat.
    b. Separate the transmission oil cooler from the transmission oil thermostat.
    c. Remove the 4 O-rings.

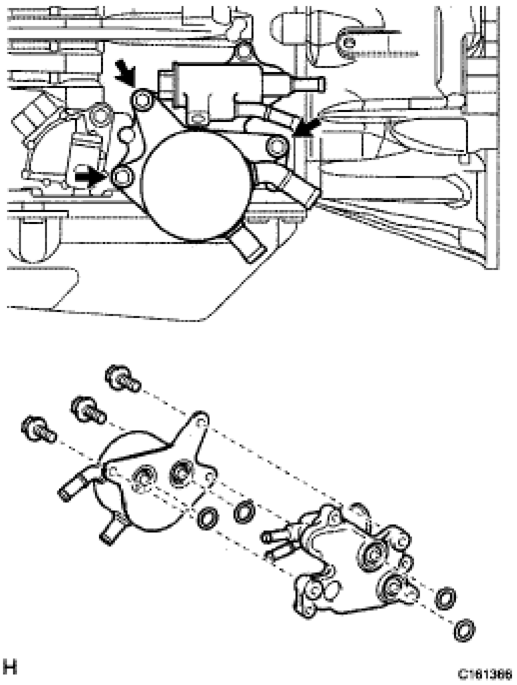

Fig. 313: Identifying Transmission Oil Cooler Assembly (w/ Trailer Towing System)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. **REMOVE TRANSMISSION OIL COOLER ASSEMBLY (w/o Trailer Towing System)**
    a. Remove the 3 bolts and transmission oil cooler with transmission oil cooler spacer.

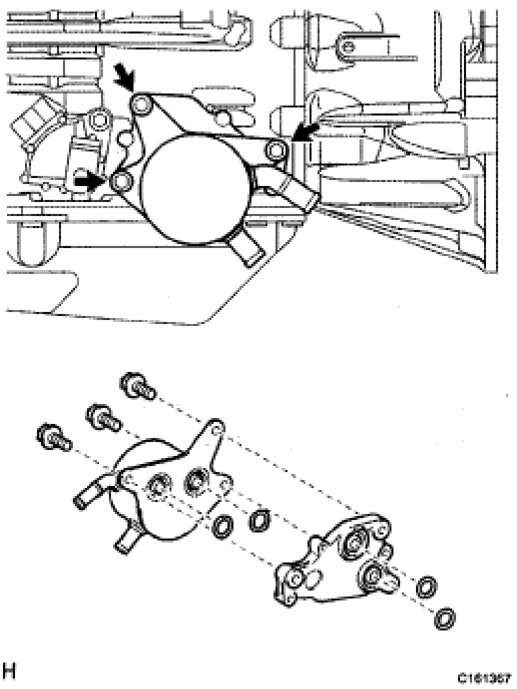

Fig. 314: Identifying Transmission Oil Cooler With Transmission Oil Cooler Spacer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    b. Separate the transmission oil cooler from the transmission oil cooler spacer.

c. Remove the 4 O-rings.

21. **REMOVE PROPELLER SHAFT HEAT INSULATOR BRACKET SUB-ASSEMBLY**

a. Remove the bolt and bracket

22. **REMOVE HARNESS CLAMP BRACKET**

a. Remove the 3 bolts and 3 brackets.

23. **REMOVE TRANSMISSION CONTROL CABLE BRACKET**

a. Remove the 2 bolts and bracket.

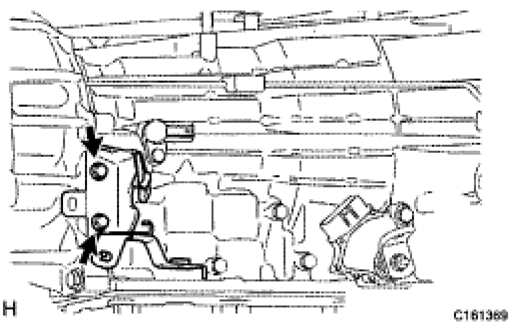

Fig. 315: Identifying Bracket Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

24. **REMOVE TORQUE CONVERTER ASSEMBLY**

25. **INSPECT TORQUE CONVERTER ASSEMBLY**

a. Inspect the torque converter clutch (see **TORQUE CONVERTER CLUTCH AND DRIVE PLATE**).

INSTALLATION

1. **INSTALL TORQUE CONVERTER CLUTCH ASSEMBLY**

a. Using a vernier caliper and a straightedge, measure dimension A between the transmission and the end surface of the drive plate.

Standard distance A:

9.3 mm (0.366 in.)

b. Install the torque converter to the transmission housing.

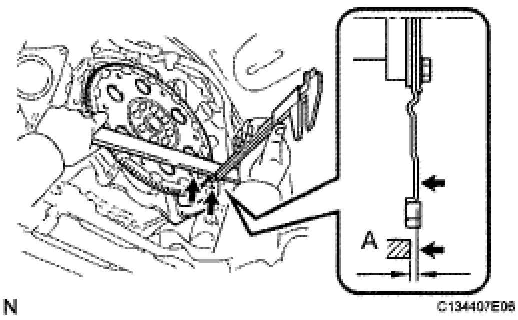

Fig. 316: Identifying Torque Converter Clutch Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Using a vernier caliper and a straightedge, measure dimension B shown in the illustration and check that B is greater than A measured in the first step.

Standard distance B:

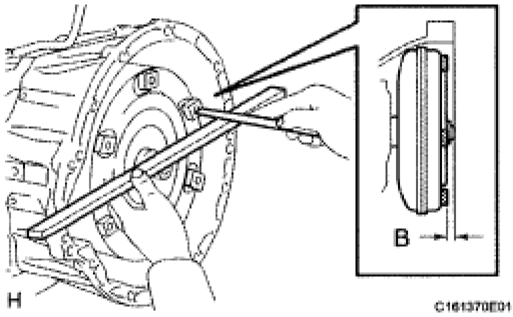

Fig. 317: Measuring Torque Converter Clutch Dimension
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **INSTALL TRANSMISSION CONTROL CABLE BRACKET**
   a. Install the bracket with the 2 bolts.

   Torque: 12 N*m (122 kgf*cm, 9 ft.*lbf)

3. **INSTALL WIRE HARNESS CLAMP BRACKET**
   a. Install the front bracket LH with the bolt.

   Torque: 8.0 N*m (82 kgf*cm, 71 in.*lbf)

   b. Install the rear bracket LH with the bolt.

   Torque: 29 N*m (296 kgf*cm, 21 ft.*lbf)

   c. Install the rear engine bracket with the bolt.

   Torque: 8.0 N*m (82 kgf*cm, 71 in.*lbf)

4. **INSTALL PROPELLER SHAFT HEAT INSULATOR BRACKET SUB-ASSEMBLY**
   a. Install the bracket with the bolt.

   Torque: 20 N*m (204 kgf*cm, 15 ft.*lbf)

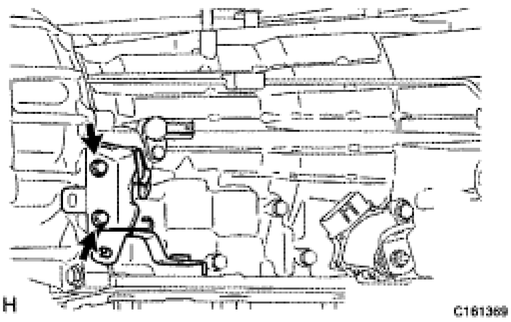

Fig. 318: Identifying Bracket With Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. **INSTALL TRANSMISSION OIL COOLER ASSEMBLY (w/o Trailer Towing System)**
    a. Coat 4 new O-rings with ATF.
    b. Install the 4 O-rings, transmission oil cooler spacer and transmission oil cooler to the automatic transmission assembly with the 3 bolts.

    Torque: 21 N*m (214 kgf*cm, 25 ft.*lbf)

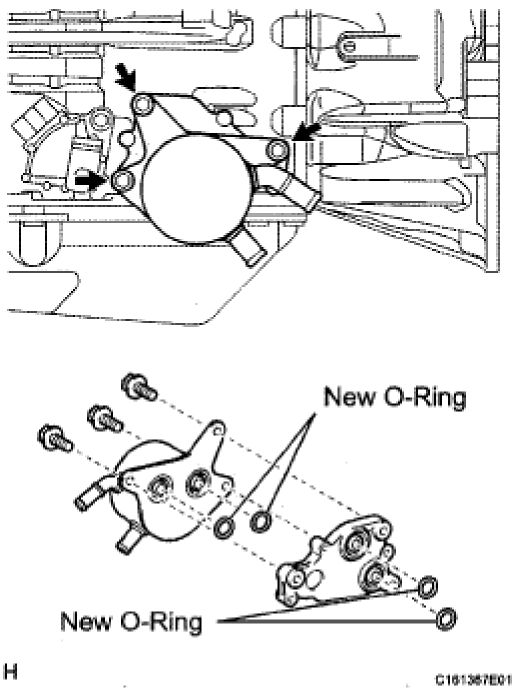

Fig. 319: Identifying O-Rings With ATF
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. **INSTALL TRANSMISSION OIL COOLER ASSEMBLY (w/ Trailer Towing System)**
    a. Coat 4 new O-rings with ATF.
    b. Install the 4 O-rings, transmission oil thermostat and transmission oil cooler to the automatic transmission assembly with the 3 bolts.

    Torque: 21 N*m (214 kgf*cm, 25 ft.*lbf)

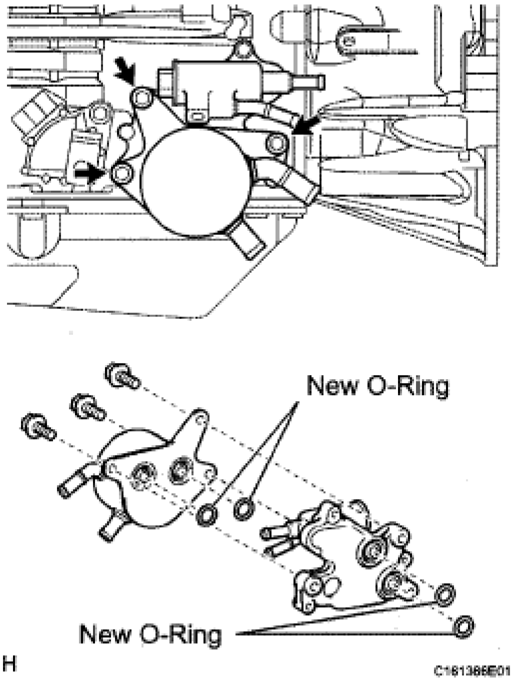

Fig. 320: Identifying Transmission Oil Cooler Assembly (w/ Trailer Towing System)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. **INSTALL AUTOMATIC TRANSMISSION ASSEMBLY**
   a. Install the transmission with the 10 bolts.

      Torque: for 17 mm head bolt A

      71 N*m (724 kgf*cm, 52 ft.*lbf)

      for 14 mm head bolt B

      37 N*m (377 kgf*cm, 27 ft.*lbf)

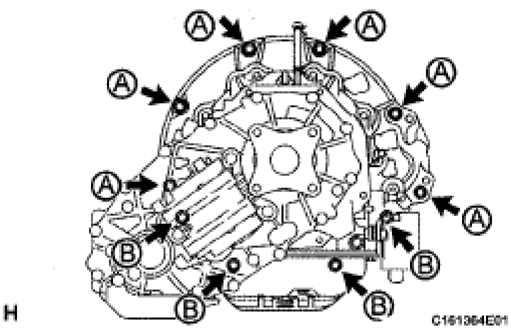

Fig. 321: Identifying Transmission With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. **CONNECT NO. 2 WATER BYPASS PIPE (w/o Towing Hitch)**
   a. Connect the 2 water bypass hoses with the 2 clips and install the water bypass pipe with the bolt.

Torque: 18 N*m (184 kgf*cm, 13 ft.*lbf)

NOTE: **Make sure the pinching portion of each clip is facing the direction shown in the illustration.**

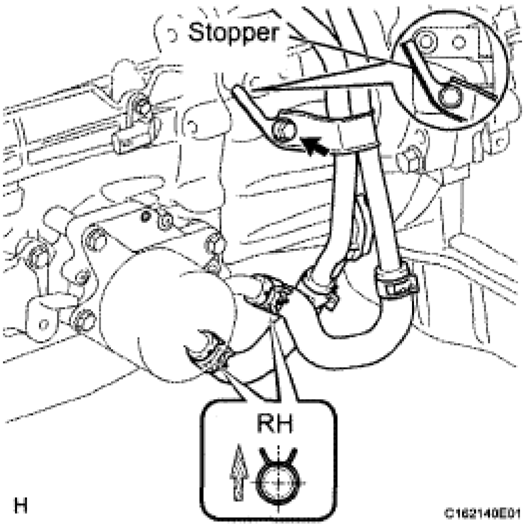

Fig. 322: Identifying Water Bypass Hoses With Clips
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. **CONNECT NO. 2 WATER BYPASS PIPE (w/ Towing Hitch)**
   a. Connect the 2 oil cooler hoses to the transmission oil cooler.

NOTE:

- **Make sure the pinching portion of each clip is facing the direction shown in the illustration.**
- **Make sure the paint portion of each hose is facing outward.**

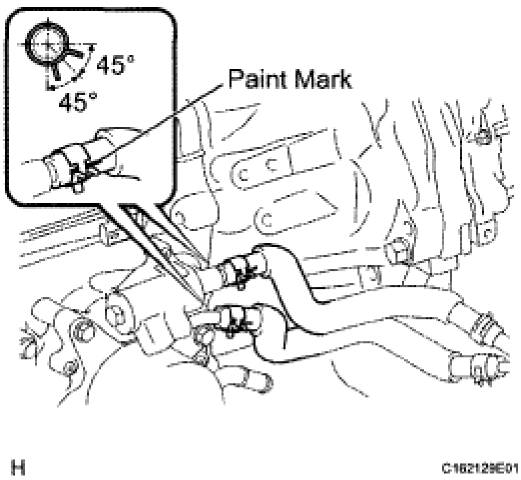

Fig. 323: Identifying NO. 2 Water Bypass Pipe (w/ Towing Hitch) Paint Mark Location
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Connect the 2 water bypass hoses with the 2 clips and install the water bypass pipe with the bolt.

Torque: 18 N*m (184 kgf*cm, 13 ft.*lbf)

NOTE: Pinching portion of clip shall be directed as shown in the illustration.

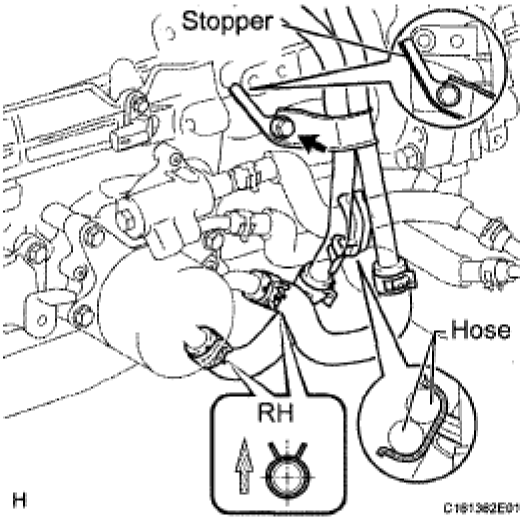

Fig. 324: Identifying Water Bypass Hoses With Clips
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. **CONNECT BREATHER PLUG HOSE**
    a. Connect the 3 breather plug hoses to the harness clamp bracket.

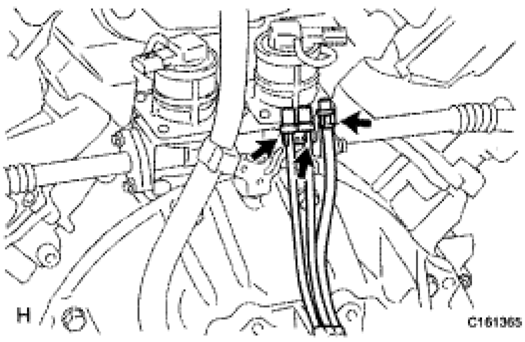

Fig. 325: Identifying Breather Plug Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. **CONNECT WIRE HARNESS AND CONNECTOR**
    a. Connect the park/neutral start switch connector, 2 transmission wire connectors and 2 speed sensor connectors.

    HINT:

    Push up the lever until the claw of the transmission wire connector makes a connection sound.

b. Connect the harness clamp with the bolt.

Torque: 8.2 N*m (84 kgf*cm, 73 in.*lbf)

c. Connect the 3 connector clamps and 7 harness clamps.
d. Tilt up the automatic transmission.

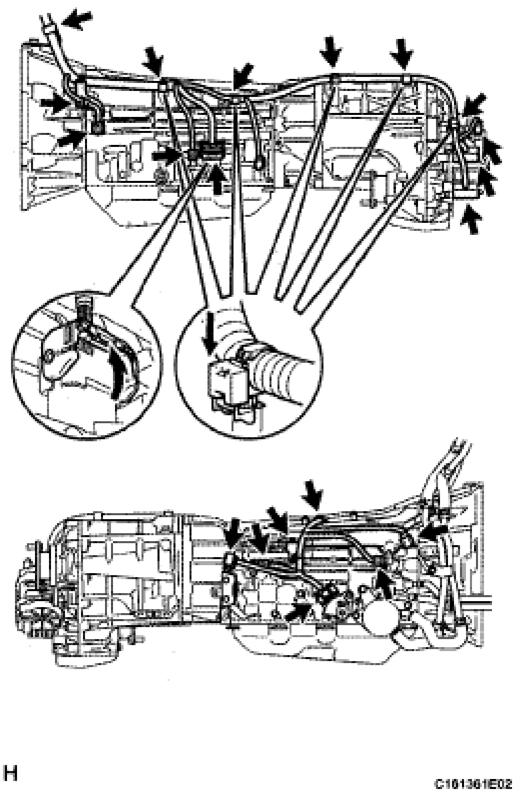

Fig. 326: Identifying Harness Clamp With Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

e. Connect the ground cable with the bolt.

Torque: 5.5 N*m (56 kgf*cm, 49 in.*lbf)

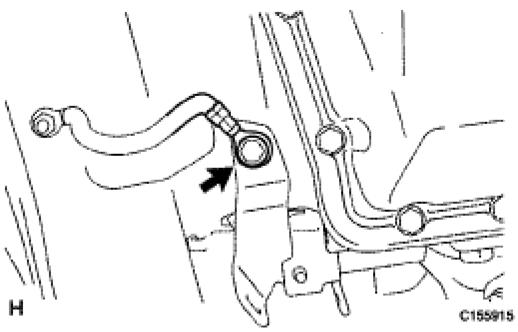

Fig. 327: Identifying Ground Cable Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. **INSTALL REAR NO. 1 ENGINE MOUNTING INSULATOR**

a. Install the rear engine mounting insulator to the transmission with the 4 bolts.

Torque: 40 N*m (407 kgf*cm, 30 ft.*lbf)

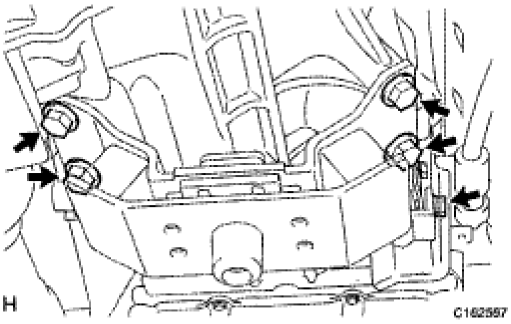

Fig. 328: Identifying Rear Engine Mounting Insulator To Transmission
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. **INSTALL NO. 3 FRAME CROSSMEMBER SUB-ASSEMBLY**

a. Install the frame crossmember to the rear engine mounting insulator with the 4 bolts.

Torque: 16 N*m (163 kgf*cm, 12 ft.*lbf)

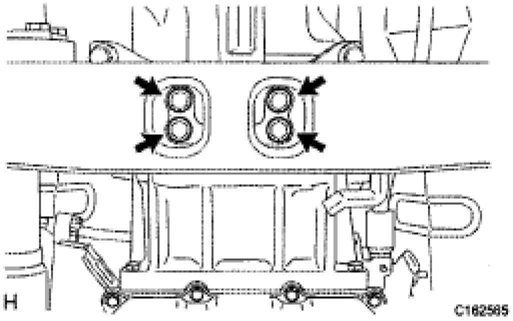

Fig. 329: Identifying Rear Engine Mounting Insulator With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Install the frame crossmember with the 4 bolts, 4 washers and 4 nuts.

Torque: 110 N*m (1122 kgf*cm, 81 ft.*lbf)

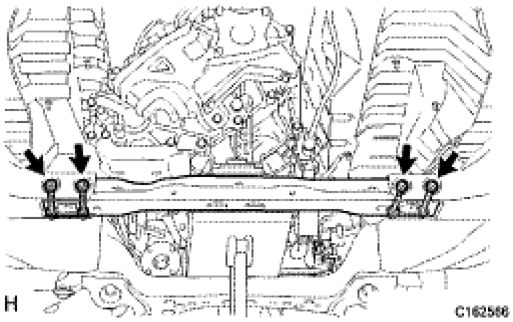

Fig. 330: Identifying Frame Crossmember Washer, Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. **INSTALL DRIVE PLATE AND TORQUE CONVERTER CLUTCH SETTING BOLT**
    a. Turn the crankshaft to gain access to the 6 bolts and install the bolts while holding the crankshaft pulley set bolt with a wrench.

    Torque: 53 N*m (535 kgf*cm, 39 ft.*lbf)

    NOTE: First install the black colored bolt and then the remaining 5 bolts.

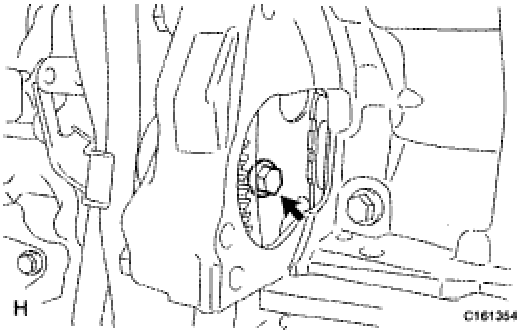

Fig. 331: Identifying Crankshaft Pulley Setting Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    b. Install the flywheel housing side cover.
15. **INSTALL STARTER ASSEMBLY**
    a. Install the starter (see **INSTALLATION**).

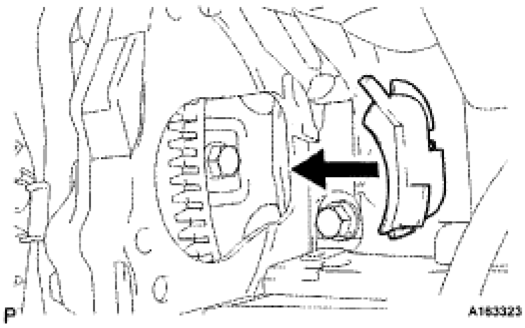

Fig. 332: Identifying Starter Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. **CONNECT TRANSMISSION CONTROL CABLE ASSEMBLY**
    a. Connect the control cable with a new clip and the nut.

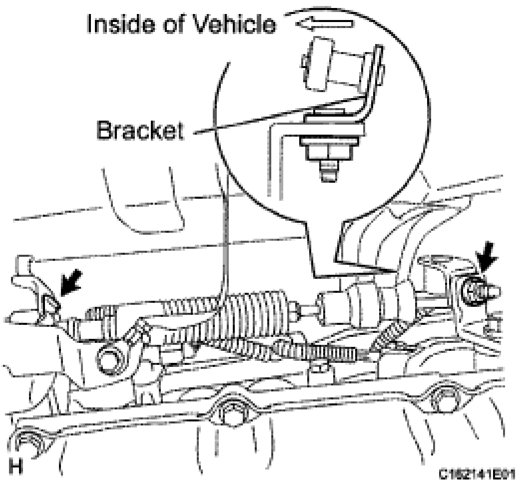

Fig. 333: Identifying Control Cable With Clip And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Torque: 14 N*m (143 kgf*cm, 10 ft.*lbf)

NOTE: **When connecting the cable to the transmission control shaft lever, make sure the cable's L bracket faces the outside of the vehicle.**

17. **INSTALL PROPELLER SHAFT ASSEMBLY**
    a. Install the propeller shaft (see **INSTALLATION**).
18. **INSTALL FRONT PROPELLER SHAFT ASSEMBLY**
    a. Install the front propeller shaft (see **INSTALLATION**).
19. **INSTALL FRONT EXHAUST PIPE ASSEMBLY**
    a. for Regular Cab Standard Deck:

       Install the front exhaust pipe (see **INSTALLATION**).

    b. except Regular Cab Standard Deck:

       Install the front exhaust pipe (see **INSTALLATION**).

20. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

    NOTE: **Some systems need to be initialized after the cable is reconnected (see INITIALIZATION).**

21. **ADD AUTOMATIC TRANSMISSION FLUID**
    a. Add automatic transmission fluid (see **AUTOMATIC TRANSMISSION FLUID**).
22. **ADD ENGINE COOLANT** (See **REPLACEMENT**)
23. **CHECK FOR ENGINE COOLANT LEAK** (See **ON-VEHICLE INSPECTION**)
24. **ADJUST SHIFT LEVER POSITION** (see **ADJUSTMENT**)
25. **INSPECT SHIFT LEVER POSITION** (see **ADJUSTMENT**)
26. **CHECK FOR EXHAUST GAS LEAK** (See **INSTALLATION**)

27. **INSTALL NO. 1 ENGINE UNDER COVER**
28. **RESET MEMORY**
    a. Perform the RESET MEMORY procedures (A/T initialization) (see **WIRING DIAGRAM**).

TORQUE CONVERTER CLUTCH AND DRIVE PLATE

INSPECTION

1. **INSPECT TORQUE CONVERTER CLUTCH ASSEMBLY**
    a. Inspect the 1-way clutch.
        1. Press on the serrations of the starter with a finger and rotate it. Check that it rotates smoothly when turned clockwise and locks when turned counterclockwise.

           If necessary, clean the converter and recheck the 1-way clutch.

           Replace the converter if the 1-way clutch still fails the check.

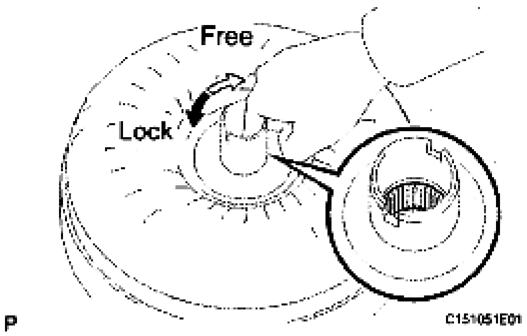

Fig. 334: Identifying Torque Converter Clutch Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    b. Determine the condition of the torque converter clutch.
        1. Check that the following conditions are met:
            - During the stall test or when the shift lever is on N, metallic sounds are not emitted from the torque converter clutch.
            - The 1-way clutch turns in one direction and locks in the other direction.
            - The amount of powder in the ATF is not greater than the sample shown in the illustration.

           If the results are not as specified, replace the torque converter clutch assembly.

           HINT:

           The sample illustration shows approximately 0.25 liters (0.26 US qts, 0.22 lmp. qts) of the ATF taken from a removed torque converter clutch.

    c. Replace the ATF in the torque converter clutch.
        1. If the ATF is discolored and/or has a foul odor, stir the ATF in the torque converter clutch

thoroughly and drain the ATF with the torque converter facing upward.

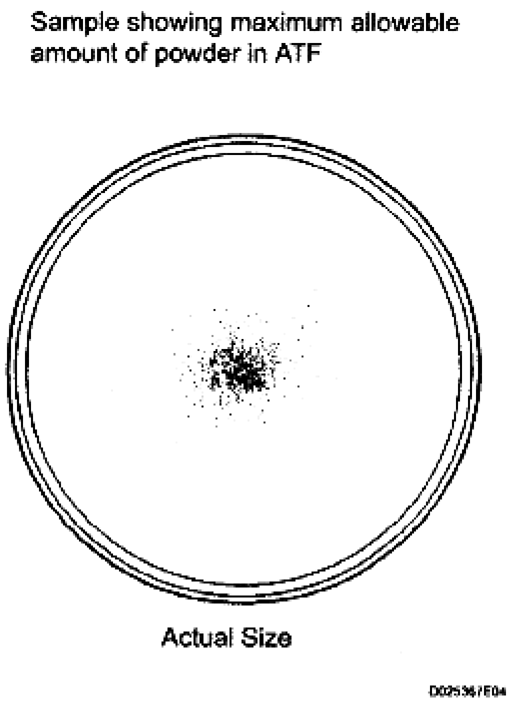

Fig. 335: Identifying ATF (Actual Size)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Prevent deformation of the torque converter clutch and damage to the oil pump gear.
   1. When any marks due to interference are found on the end of the bolt for the torque converter clutch and on the bottom of the bolt hole, replace the bolt and torque converter clutch.
   2. All of the bolts should be the same length.
   3. Make sure no spring washers are missing.

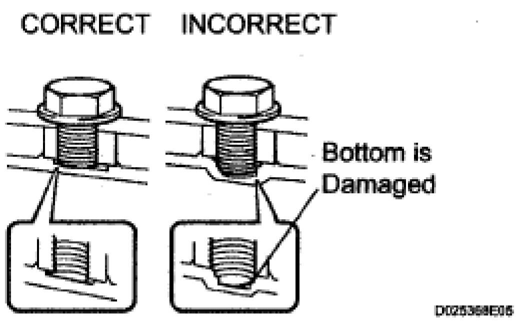

Fig. 336: Identifying Torque Converter Clutch Bolt Correct And Incorrect Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **INSPECT RUNOUT OF DRIVE PLATE AND RING GEAR**
   a. Set up a dial indicator and measure the drive plate runout.

   Maximum runout:

0.20 mm (0.00787 in.)

If the runout is greater than the maximum or if the ring gear is damaged, replace the drive plate (see **REMOVAL**).

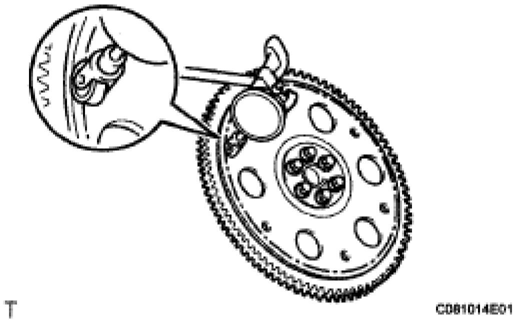

Fig. 337: Measuring Drive Plate Runout
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **INSPECT RUNOUT OF TORQUE CONVERTER CLUTCH ASSEMBLY**
   a. Temporarily mount the torque converter clutch to the drive plate. Set up a dial indicator and measure the torque converter clutch runout.

   Maximum runout:

   0.30 mm (0.0118 in.)

   If the runout is greater than the maximum, try to correct it by changing the installation direction of the torque converter clutch. If the runout cannot be corrected, replace the torque converter clutch.

   HINT:

   Mark the position of the torque converter clutch so that it can be installed correctly later.

   b. Remove the torque converter clutch.

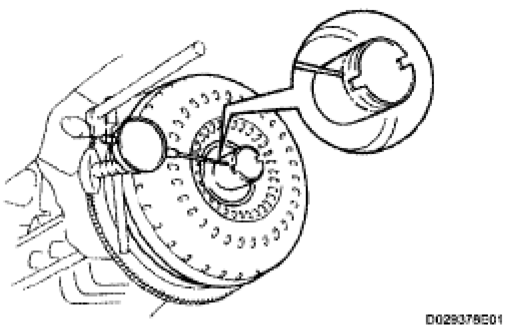

Fig. 338: Identifying Runout Of Torque Converter Clutch Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TRANSMISSION CONTROL CABLE (FOR COLUMN SHIFT TYPE)

COMPONENTS

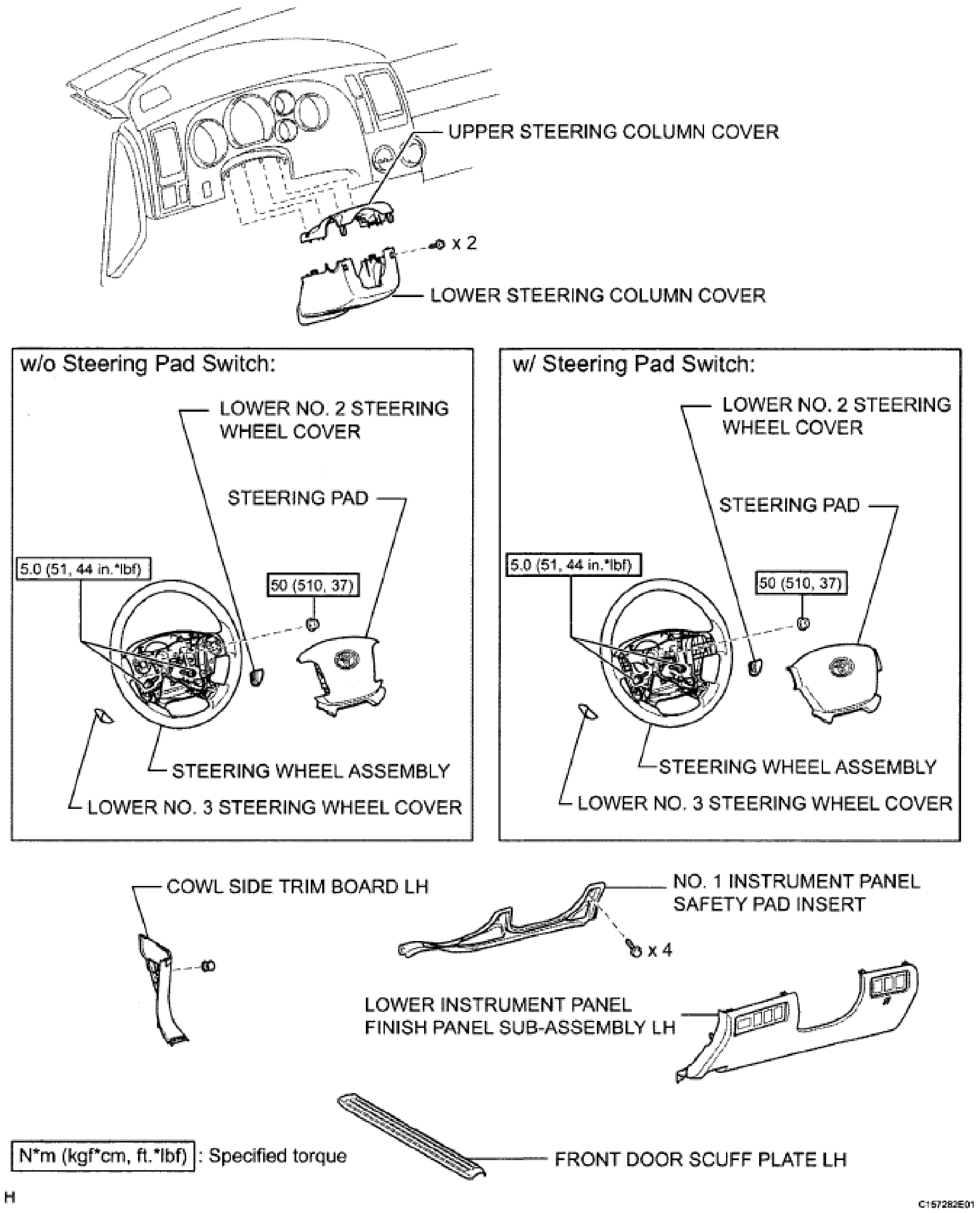

Fig. 339: Identifying Transmission Control Cable (For Column Shift Type) Components With Torque Specifications (1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

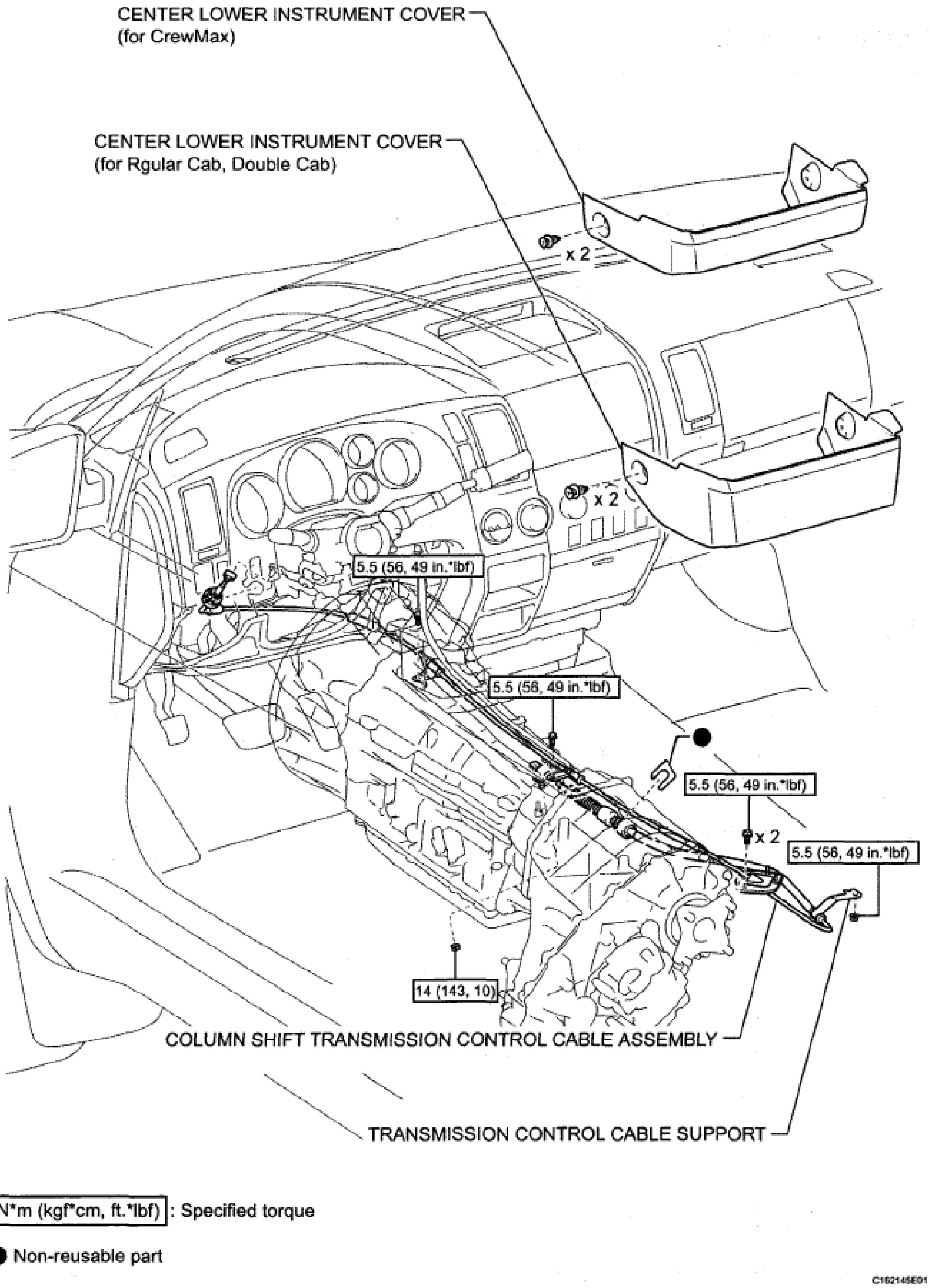

Fig. 340: Identifying Transmission Control Cable (For Column Shift Type) Components With Torque Specifications (2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**

CAUTION: Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.

NOTE: Some systems need to be initialized after the cable is reconnected (see INITIALIZATION).

2. **REMOVE FRONT DOOR SCUFF PLATE LH (for Regular Cab)** (See **REMOVAL**)
3. **REMOVE FRONT DOOR SCUFF PLATE LH (for Double Cab, CrewMax)** (See **REMOVAL**)
4. **REMOVE COWL SIDE TRIM BOARD LH** (See **REMOVAL**)
5. **REMOVE LOWER INSTRUMENT PANEL FINISH PANEL SUB-ASSEMBLY LH** (See **REMOVAL**)
6. **REMOVE NO. 1 INSTRUMENT PANEL SAFETY PAD INSERT** (See **REMOVAL**)
7. **REMOVE CENTER LOWER INSTRUMENT COVER** (See **REMOVAL**)
8. **REMOVE STEERING PAD (w/o Steering Pad Switch)** (See **REMOVAL**)
9. **REMOVE STEERING PAD (w/ Steering Pad Switch)** (See **REMOVAL**)
10. **REMOVE STEERING WHEEL ASSEMBLY** (See **REMOVAL**)
11. **REMOVE LOWER STEERING COLUMN COVER** (See **REMOVAL**)
12. **REMOVE UPPER STEERING COLUMN COVER** (See **REMOVAL**)
13. **REMOVE FRONT SEAT ASSEMBLY LH**
    a. for Manual Seat Type:

       Remove the front seat LH (see **REMOVAL**).

    b. for Power Seat Type:

       Remove the front seat LH (see **REMOVAL**).

14. **REMOVE COLUMN SHIFT TRANSMISSION CONTROL CABLE ASSEMBLY**
    a. Move the shift lever to the N position.
    b. Fold back the floor carpet front LH side.
    c. Disconnect the column shift transmission control cable end from the column shift.

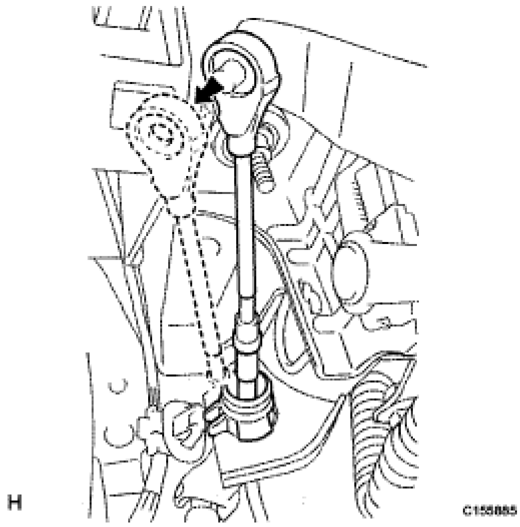

Fig. 341: Identifying Column Shift Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Press the outer cable socket's claws and disconnect the cable from the steering column shaft bracket.

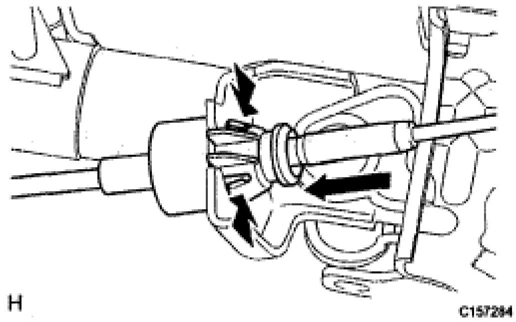

Fig. 342: Identifying Outer Cable Socket's Claws
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

e. Remove the 2 bolts and disconnect the 2 cable clamps.

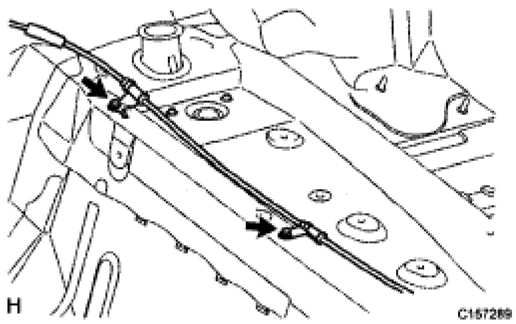

Fig. 343: Identifying Cable Clamps And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

f. Remove the nut and clip, and disconnect the transmission control cable from the automatic transmission.

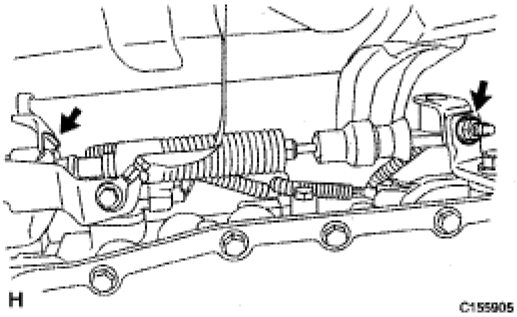

Fig. 344: Identifying Automatic Transmission Nut And Clip
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

g. Remove the nut and disconnect the transmission control cable support.

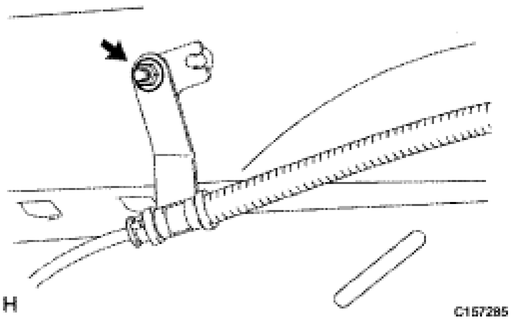

Fig. 345: Identifying Transmission Control Cable Support Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

h. Remove the 2 bolts and remove the column shift transmission control cable toward the vehicle interior.

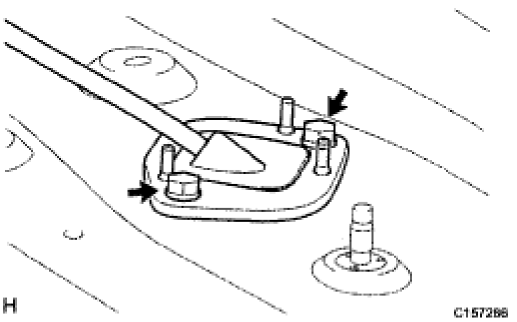

Fig. 346: Identifying Column Shift Transmission Control Cable Vehicle Interior
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. **INSTALL COLUMN SHIFT TRANSMISSION CONTROL CABLE ASSEMBLY**
   a. Insert the column shift transmission control cable from the vehicle interior, and install the cable retainer with the 2 bolts.

Torque: 5.5 N*m (56 kgf*cm, 49 in.*lbf)

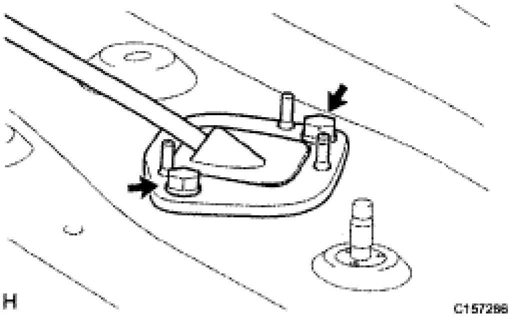

Fig. 347: Identifying Column Shift Transmission Control Cable Vehicle Interior
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Connect the cable to the steering column shaft bracket so that the outer cable socket's claws attach securely.

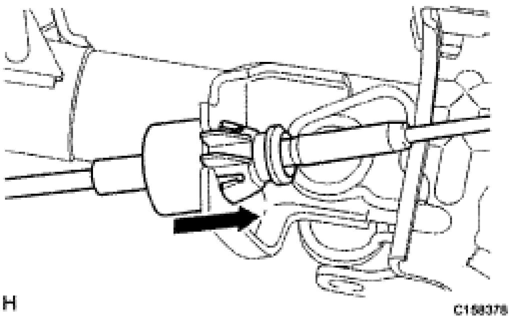

Fig. 348: Identifying Steering Column Shaft Bracket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Connect the column shift transmission control cable end to the column shift.

NOTE: **Make sure to install the cable end so that the inner cable is not twisted. Confirm that the cable end's ridged side is facing upward.**

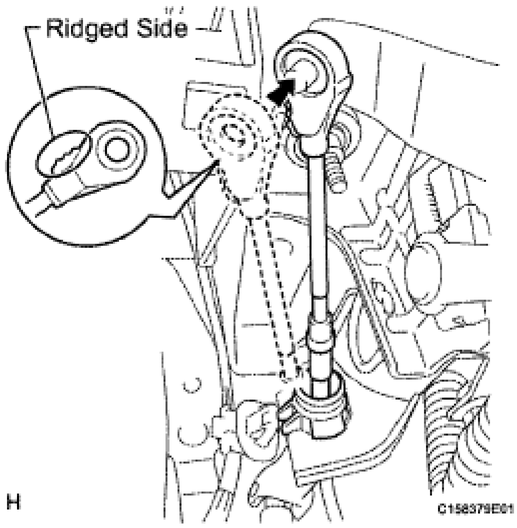

Fig. 349: Identifying Column Shift Transmission Control Cable End To Column Shift
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Connect the 2 cable clamps with the 2 bolts.

Torque: 5.5 N*m (56 kgf*cm, 49 in.*lbf)

e. Return the floor carpet front LH side to its original position.
f. Move the shift lever to the N position.

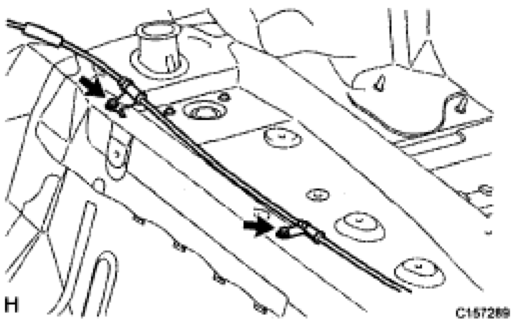

Fig. 350: Identifying Cable Clamps And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

g. Turn the control shaft lever counterclockwise until it stops, and then turn it clockwise 2 notches to set it to the N position.

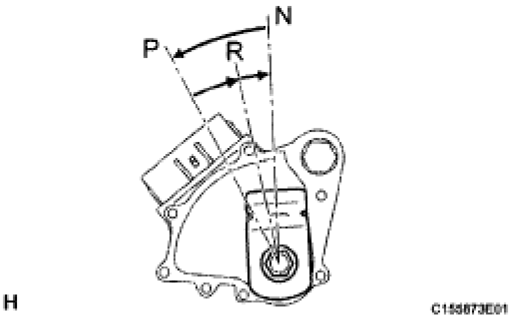

Fig. 351: Identifying Control Shaft Lever RH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

h. Connect the control cable with a new clip and the nut.

Torque: 14 N*m (143 kgf*cm, 10 ft.*lbf)

NOTE: **When connecting the cable to the transmission control shaft lever, make sure the cable's L bracket faces the inside of the vehicle.**

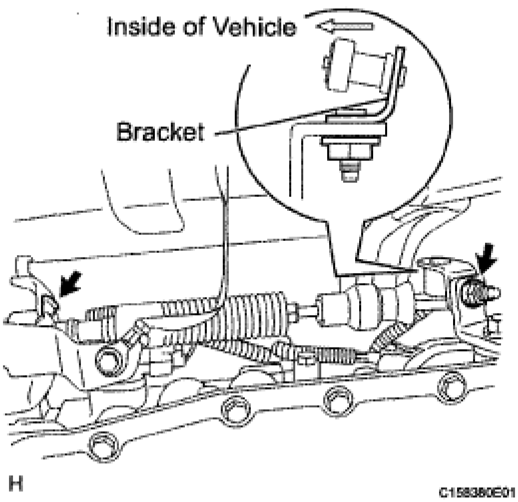

Fig. 352: Identifying Control Cable With Clip And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

i. Connect the transmission control cable support with the nut.

Torque: 5.5 N*m (56 kgf*cm, 49 in.*lbf)

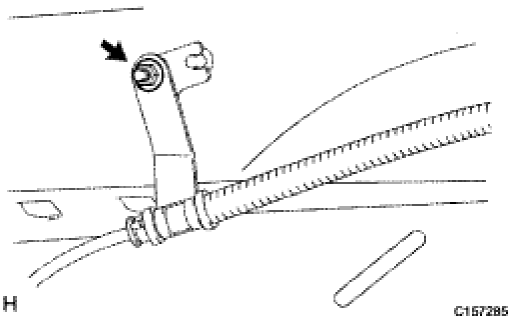

Fig. 353: Identifying Transmission Control Cable Support Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **INSTALL FRONT SEAT ASSEMBLY LH**
   a. for Power Seat Type:

      Install the front seat LH (see **INSTALLATION**).

   b. for Manual Seat Type:

      Install the front seat LH (see **INSTALLATION**).

3. **ADJUST SHIFT LEVER POSITION** (see **ADJUSTMENT**)
4. **INSPECT SHIFT LEVER POSITION** (see **ADJUSTMENT**)
5. **INSTALL UPPER STEERING COLUMN COVER** (See **INSTALLATION**)
6. **INSTALL LOWER STEERING COLUMN COVER** (See **INSTALLATION**)
7. **INSTALL STEERING WHEEL ASSEMBLY** (See **INSTALLATION**)
8. **INSTALL STEERING PAD (w/ Steering Pad Switch)** (See **INSTALLATION**)
9. **INSTALL STEERING PAD (w/o Steering Pad Switch)** (See **INSTALLATION**)
10. **INSTALL CENTER LOWER INSTRUMENT COVER** (See **INSTALLATION**)
11. **INSTALL NO. 1 INSTRUMENT PANEL SAFETY PAD INSERT** (See **INSTALLATION**)
12. **INSTALL LOWER INSTRUMENT PANEL FINISH PANEL SUB-ASSEMBLY LH** (See **INSTALLATION**)
13. **INSTALL COWL SIDE TRIM BOARD LH** (See **INSTALLATION**)
14. **INSTALL FRONT DOOR SCUFF PLATE LH (for Double Cab, CrewMax)** (See **INSTALLATION**)
15. **INSTALL FRONT DOOR SCUFF PLATE LH (for Regular Cab)** (See **INSTALLATION**)
16. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

NOTE: **Some systems need to be initialized after the cable is reconnected (see INITIALIZATION).**

TRANSMISSION CONTROL CABLE (FOR FLOOR SHIFT TYPE)

COMPONENTS

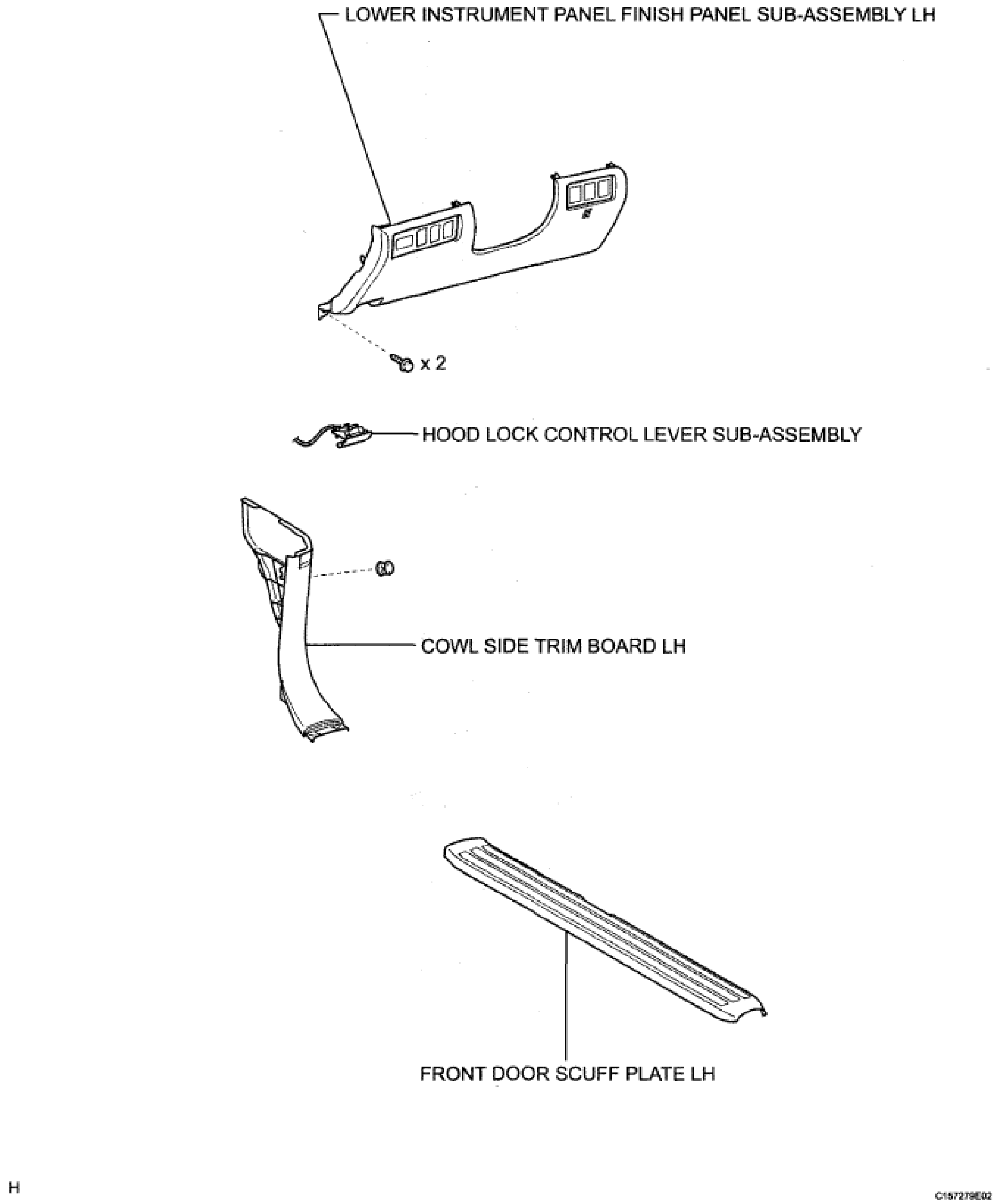

Fig. 354: Identifying Transmission Control Cable Components - For Floor Shift Type (1 Of 3)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

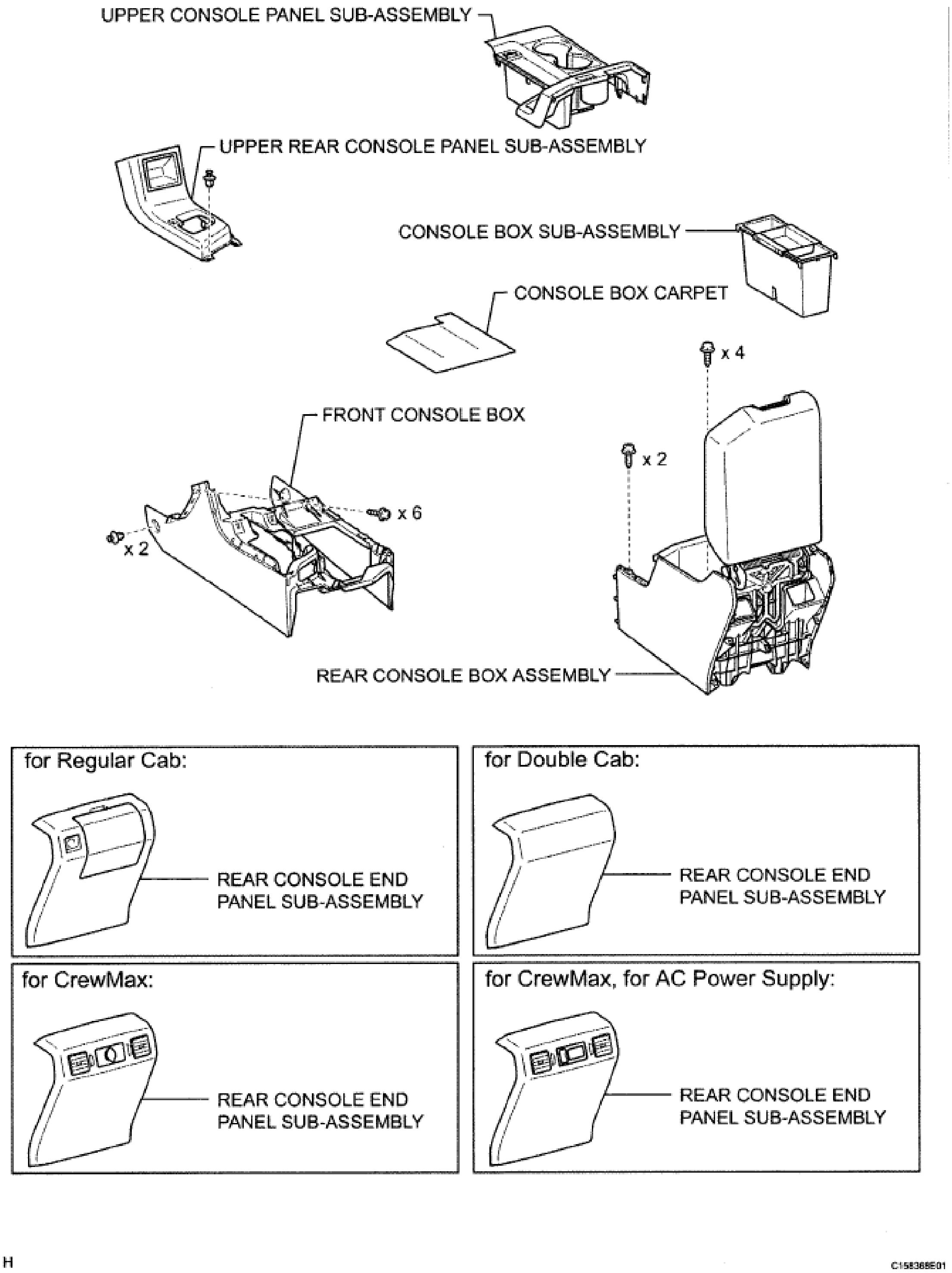

Fig. 355: Identifying Transmission Control Cable Components - For Floor Shift Type (2 Of 3)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

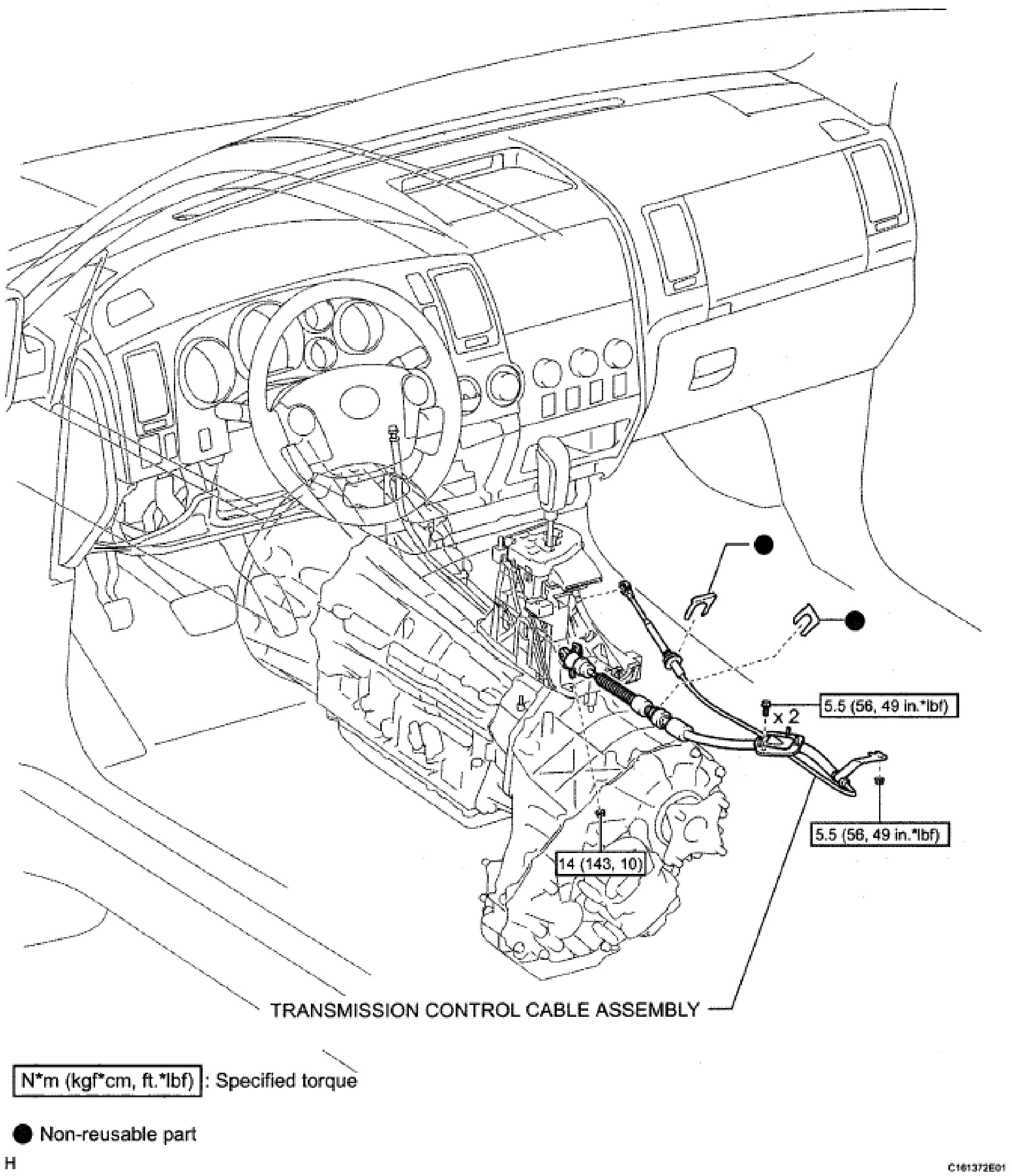

Fig. 356: Identifying Transmission Control Cable Components With torque Specifications - For Floor Shift Type (3 Of 3)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **REMOVE FRONT DOOR SCUFF PLATE LH (for Regular Cab)** (See REMOVAL)
2. **REMOVE FRONT DOOR SCUFF PLATE LH (for Double Cab, CrewMax)** (See REMOVAL)
3. **REMOVE COWL SIDE TRIM BOARD LH** (See REMOVAL)
4. **REMOVE LOWER INSTRUMENT PANEL FINISH PANEL SUB-ASSEMBLY LH** (See REMOVAL)
5. **REMOVE SHIFT LEVER KNOB SUB-ASSEMBLY** (See REMOVAL)
6. **REMOVE UPPER CONSOLE PANEL SUB-ASSEMBLY** (See REMOVAL)

7. **REMOVE UPPER REAR CONSOLE PANEL SUB-ASSEMBLY** (See **REMOVAL**)
8. **REMOVE CONSOLE REAR END PANEL SUB-ASSEMBLY** (See **REMOVAL**)
9. **REMOVE CONSOLE BOX CARPET**
10. **REMOVE REAR CONSOLE BOX ASSEMBLY** (See **REMOVAL**)
11. **REMOVE FRONT CONSOLE BOX** (See **REMOVAL**)
12. **REMOVE TRANSMISSION CONTROL CABLE ASSEMBLY**
    a. Move the shift lever to the N position.
    b. Disconnect transmission control cable end from the shift lever.

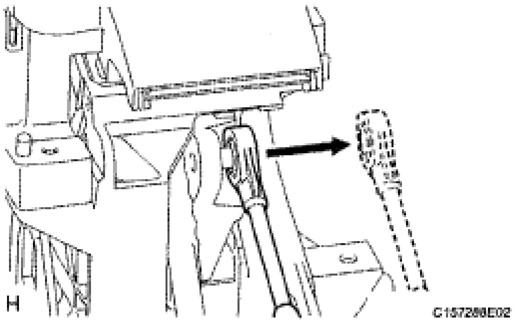

Fig. 357: Disconnecting Transmission Control Cable End From Shift Lever
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    c. Remove the clip and disconnect the transmission control cable from the shift lever retainer.

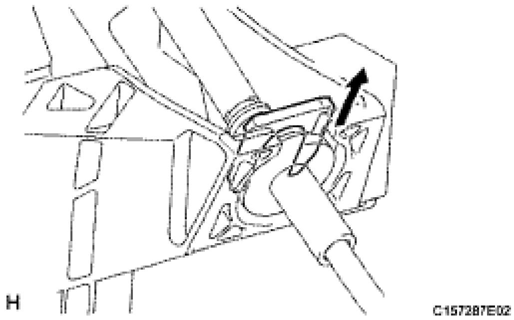

Fig. 358: Identifying Transmission Control Cable From Shift Lever Retainer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    d. Remove the nut and clip, and disconnect the transmission control cable from the automatic transmission.

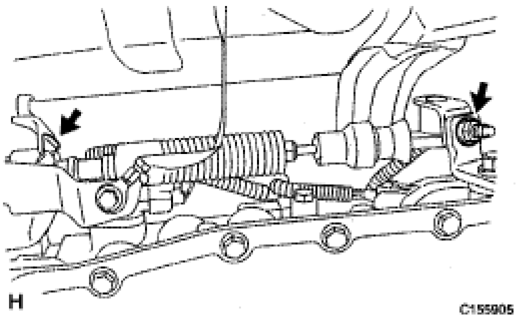

Fig. 359: Identifying Shift Control Cable Clip And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

e. Remove the nut and disconnect the transmission control cable support.

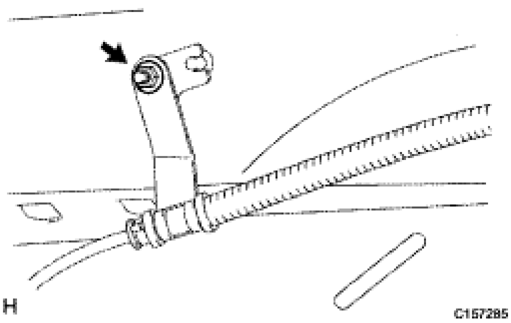

Fig. 360: Identifying Transmission Control Cable Support Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

f. Remove the 2 bolts and remove the column shift transmission control cable toward the vehicle interior.

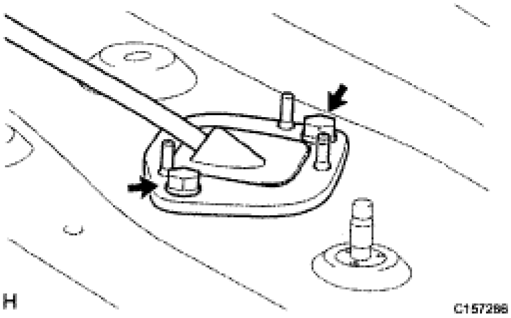

Fig. 361: Identifying Column Shift Transmission Control Cable Vehicle Interior
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. **INSTALL TRANSMISSION CONTROL CABLE ASSEMBLY**
   a. Insert the floor shift transmission control cable from the vehicle interior, and install the cable retainer with the 2 bolts.

   Torque: 5.5 N*m (56 kgf*cm, 49 in.*lbf)

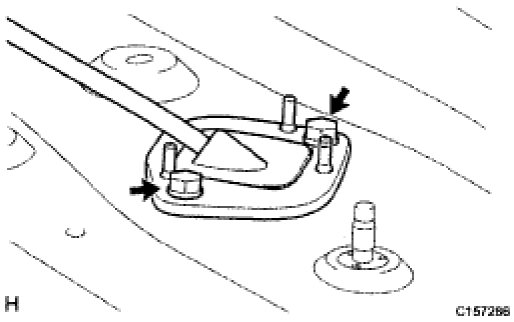

Fig. 362: Identifying Column Shift Transmission Control Cable Vehicle Interior
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Install the cable outer of the transmission control cable to the shift lever retainer, and install a new clip.

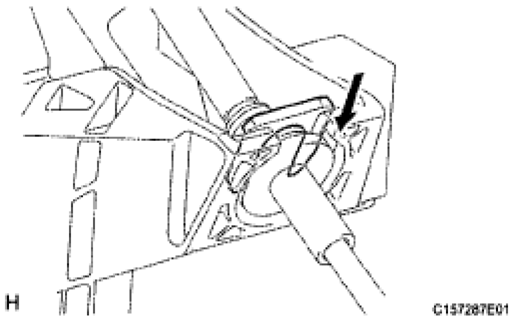

Fig. 363: Identifying Cable Outer Of Transmission Control Cable
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Connect the control cable end to the shift lever.

NOTE:	**Make sure to install the cable end so that the inner cable is not twisted. Confirm that the cable end's ridged side is facing upward.**

d. Move the shift lever to the N position.

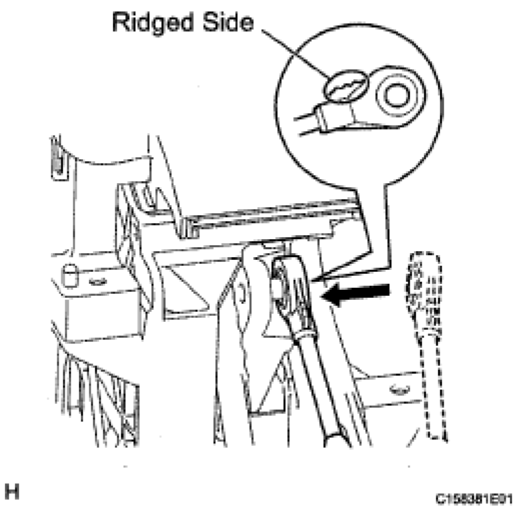

Fig. 364: Connecting Control Cable End To Shift Lever
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

e. Turn the control shaft lever counterclockwise until it stops, and then turn it clockwise 2 notches to set it to the N position.

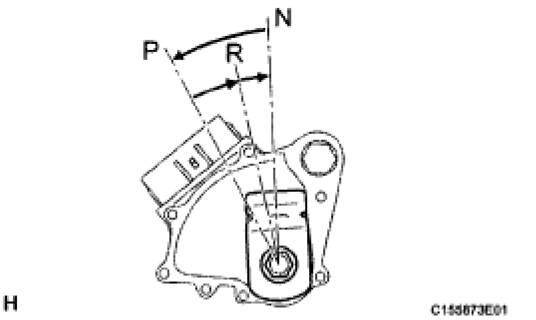

Fig. 365: Identifying Control Shaft Lever RH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

f. Connect the control cable with a new clip and the nut.

NOTE: **When connecting the cable to the transmission control shaft lever, make sure the cable's L bracket faces the inside of the vehicle.**

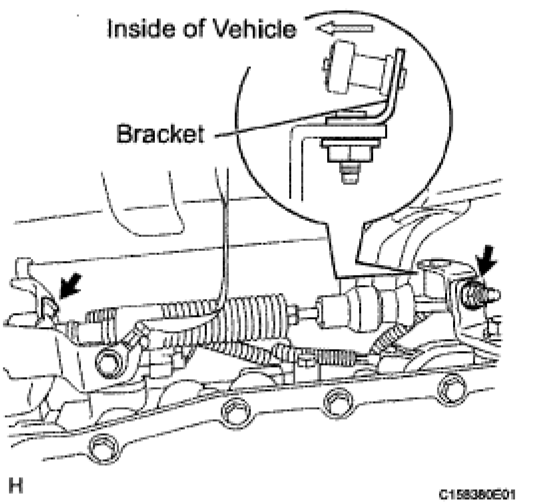

Fig. 366: Identifying Control Cable With Clip And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

g. Connect the transmission control cable support with the nut.

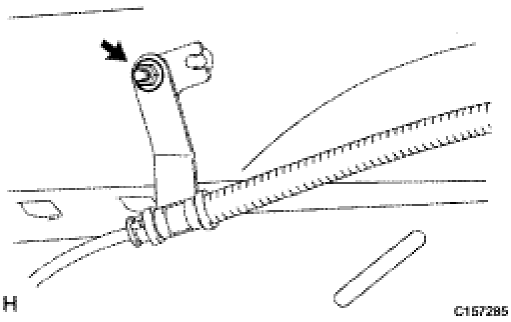

Fig. 367: Identifying Transmission Control Cable Support Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Torque: 5.5 N*m (56 kgf*cm, 49 in.*lbf)

2. **ADJUST SHIFT LEVER POSITION** (see ADJUSTMENT)
3. **INSPECT SHIFT LEVER POSITION** (see ADJUSTMENT)
4. **INSTALL FRONT CONSOLE BOX** (See INSTALLATION)
5. **INSTALL REAR CONSOLE BOX ASSEMBLY** (See INSTALLATION)
6. **INSTALL CONSOLE BOX CARPET**
7. **INSTALL REAR CONSOLE END PANEL SUB-ASSEMBLY** (See INSTALLATION)
8. **INSTALL REAR UPPER CONSOLE PANEL SUB-ASSEMBLY** (See INSTALLATION)
9. **INSTALL UPPER CONSOLE PANEL SUB-ASSEMBLY** (See INSTALLATION)
10. **INSTALL SHIFT LEVER KNOB SUB-ASSEMBLY** (See INSTALLATION)
11. **INSTALL LOWER INSTRUMENT PANEL FINISH PANEL SUB-ASSEMBLY LH** (See INSTALLATION)
12. **INSTALL COWL SIDE TRIM BOARD LH** (See INSTALLATION)
13. **INSTALL FRONT DOOR SCUFF PLATE LH (for Double Cab, CrewMax)** (See INSTALLATION)
14. **INSTALL FRONT DOOR SCUFF PLATE LH (for Regular Cab)** (See INSTALLATION)

AUTOMATIC TRANSMISSION UNIT

COMPONENTS

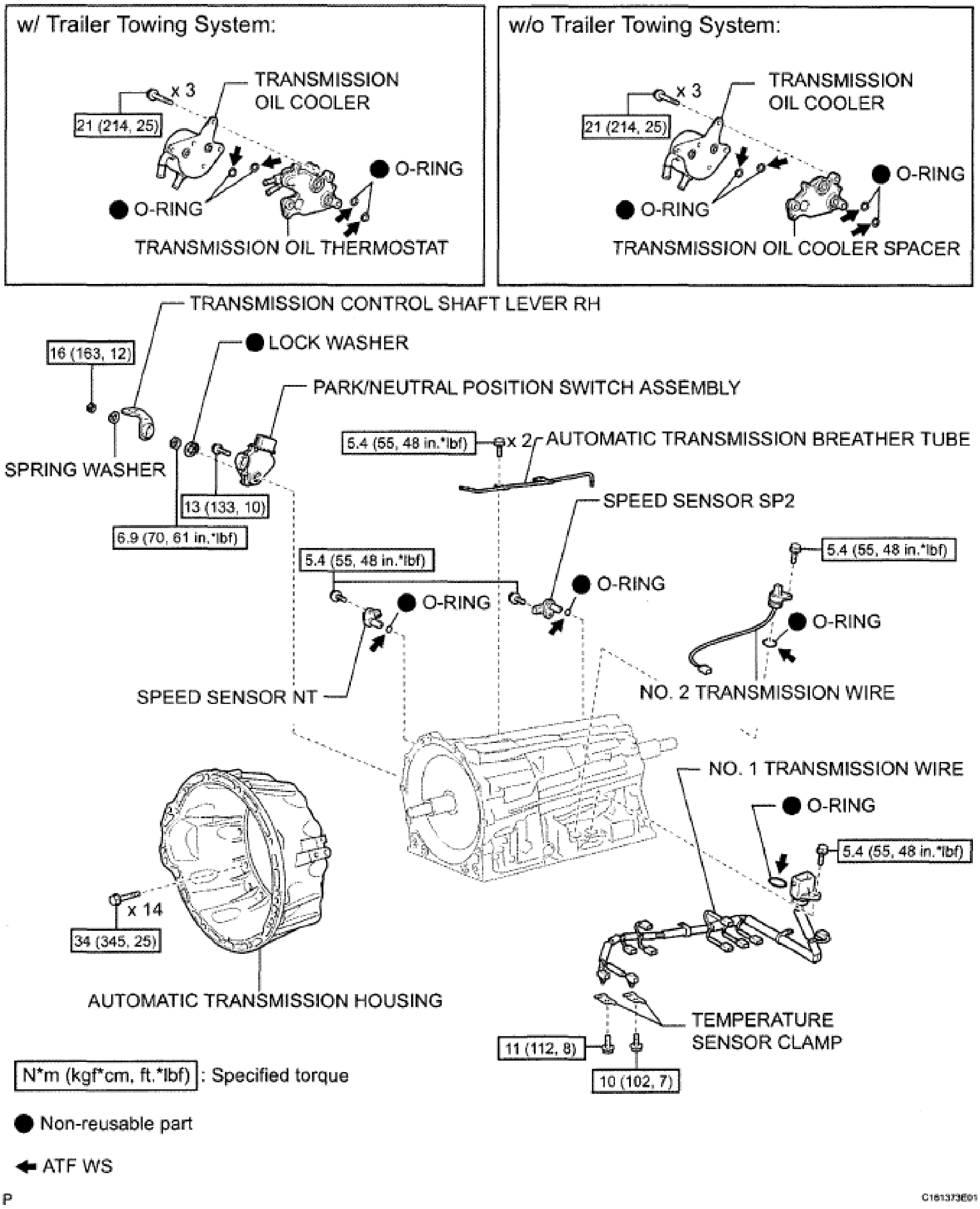

Fig. 368: Identifying Automatic Transmission Unit Components With Torque Specifications (1 Of 10)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

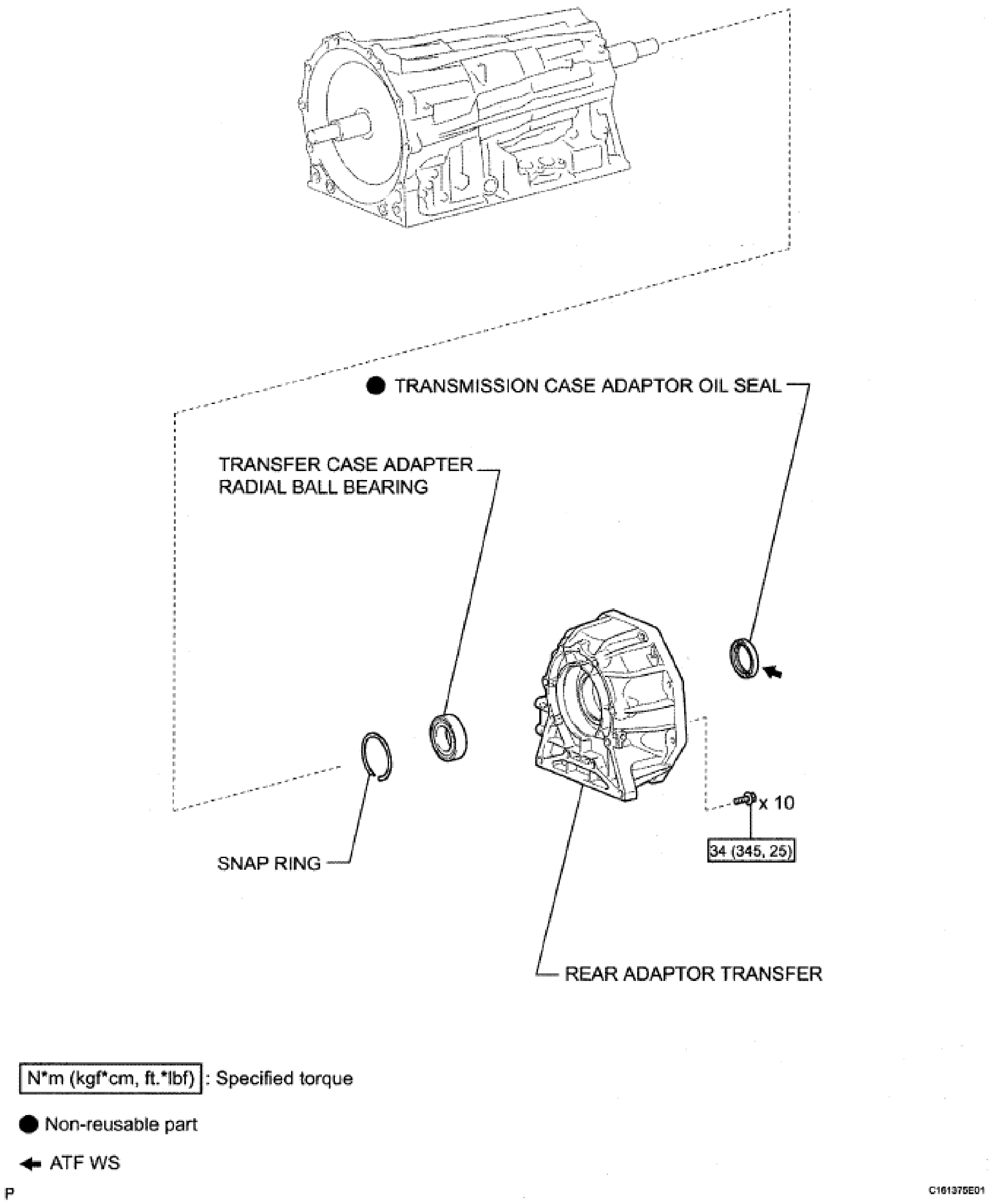

Fig. 369: Identifying Automatic Transmission Unit Components With Torque Specification (2 Of 10)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

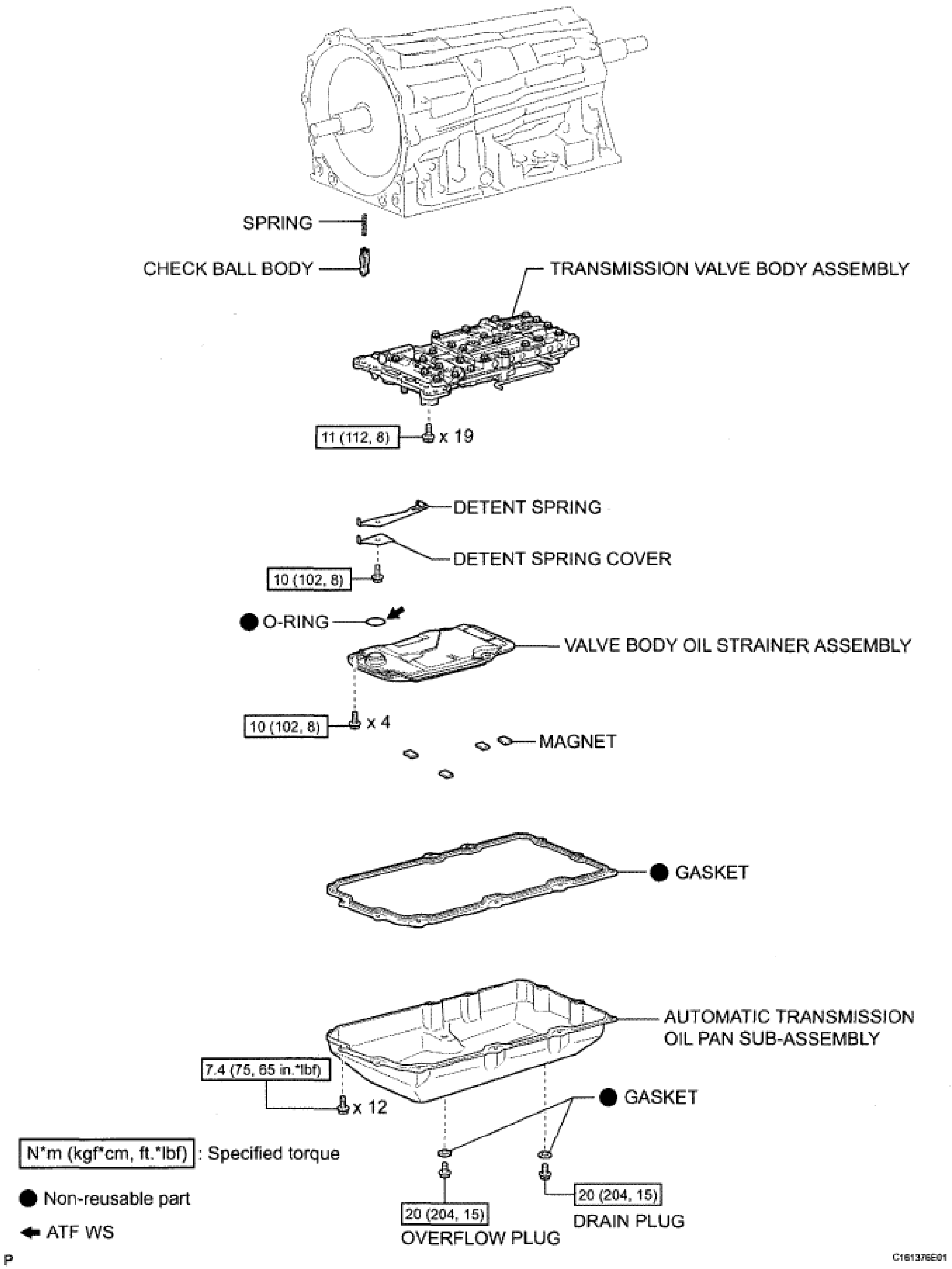

Fig. 370: Identifying Automatic Transmission Unit Components With Torque Specifications (3 Of 10)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

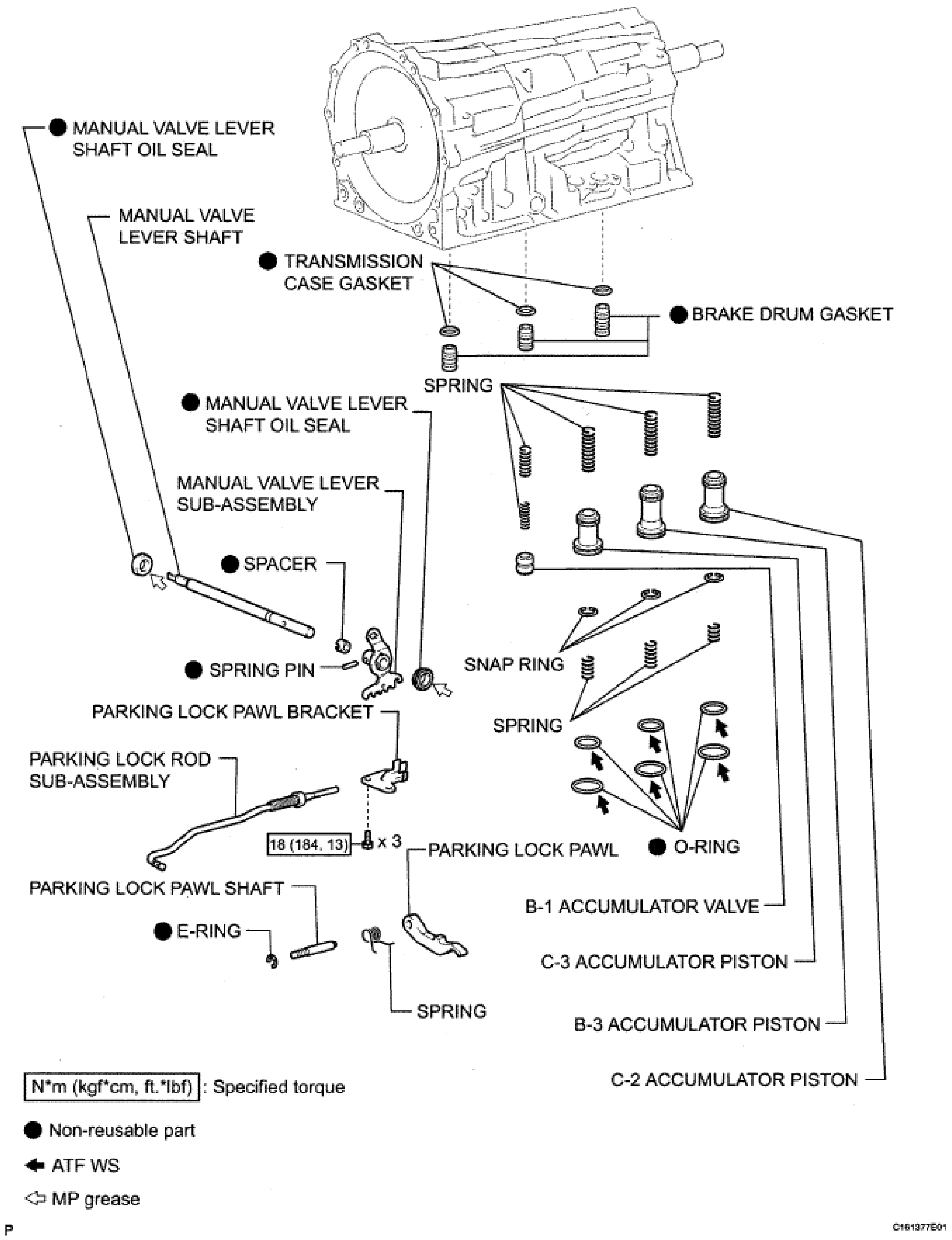

Fig. 371: Identifying Automatic Transmission Unit Components With Torque Specification (4 Of 10)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

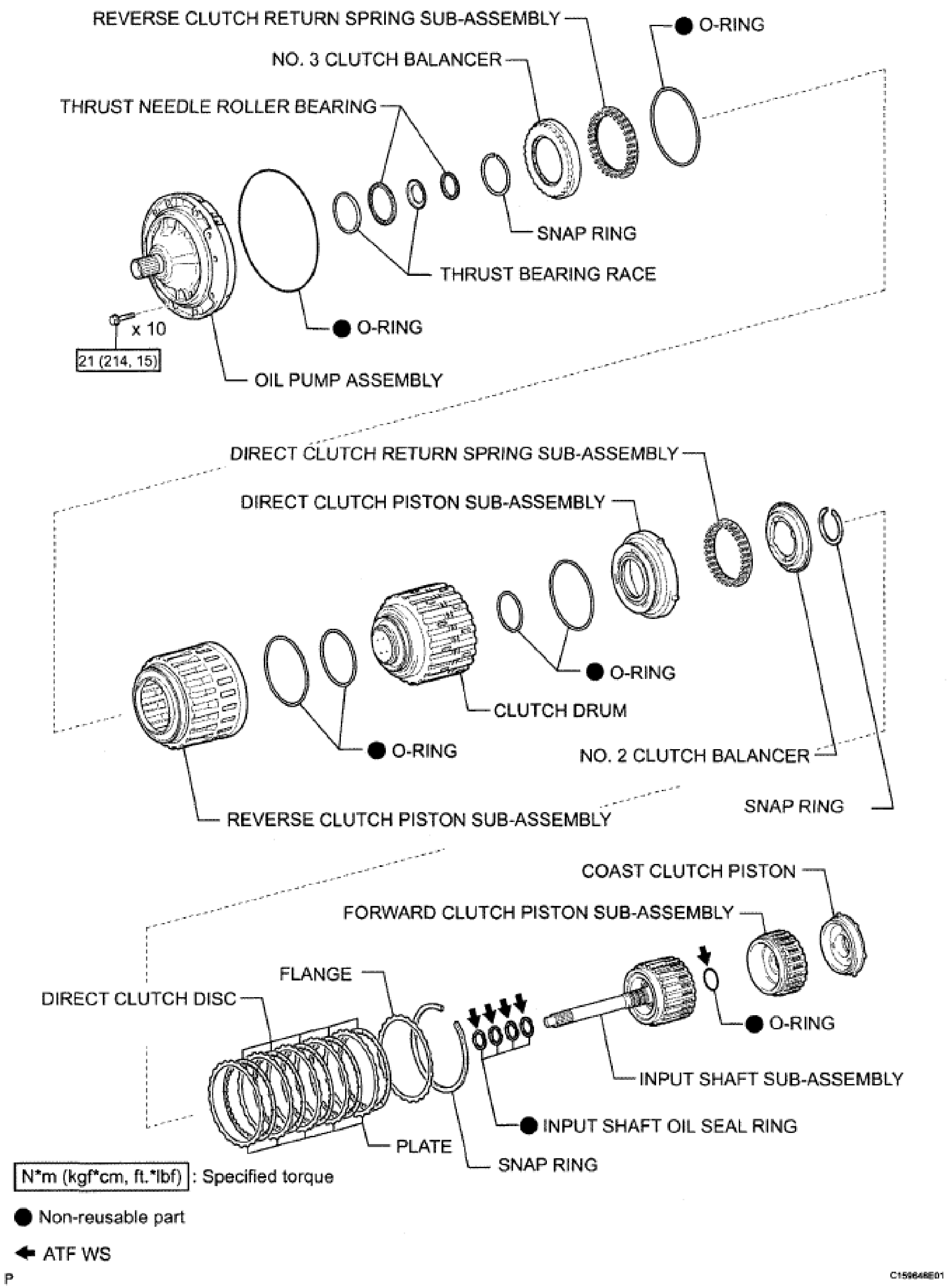

Fig. 372: Identifying Automatic Transmission Unit Components With Torque Specification (5 Of 10)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

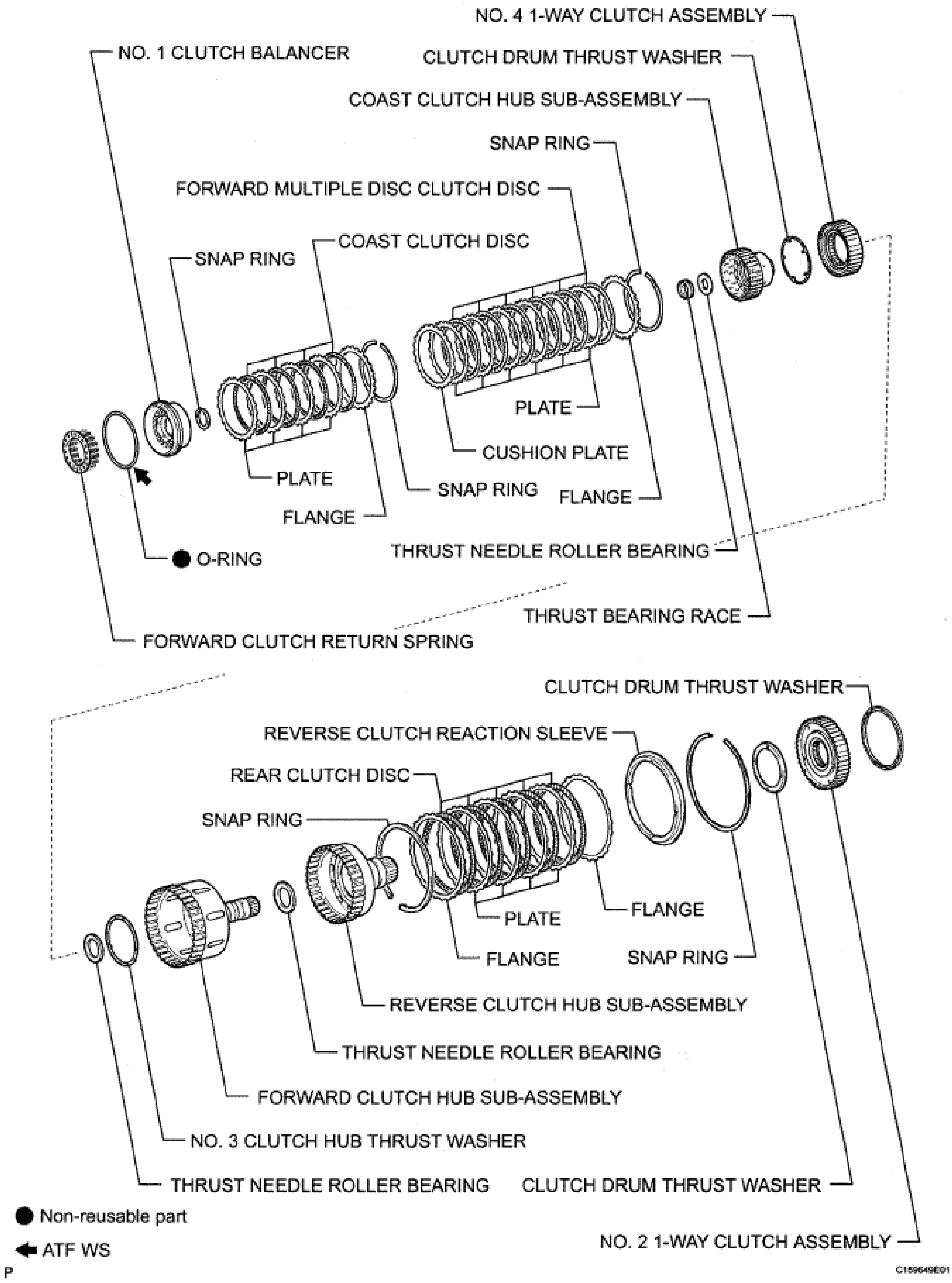

Fig. 373: Identifying Automatic Transmission Unit Components (6 Of 10)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

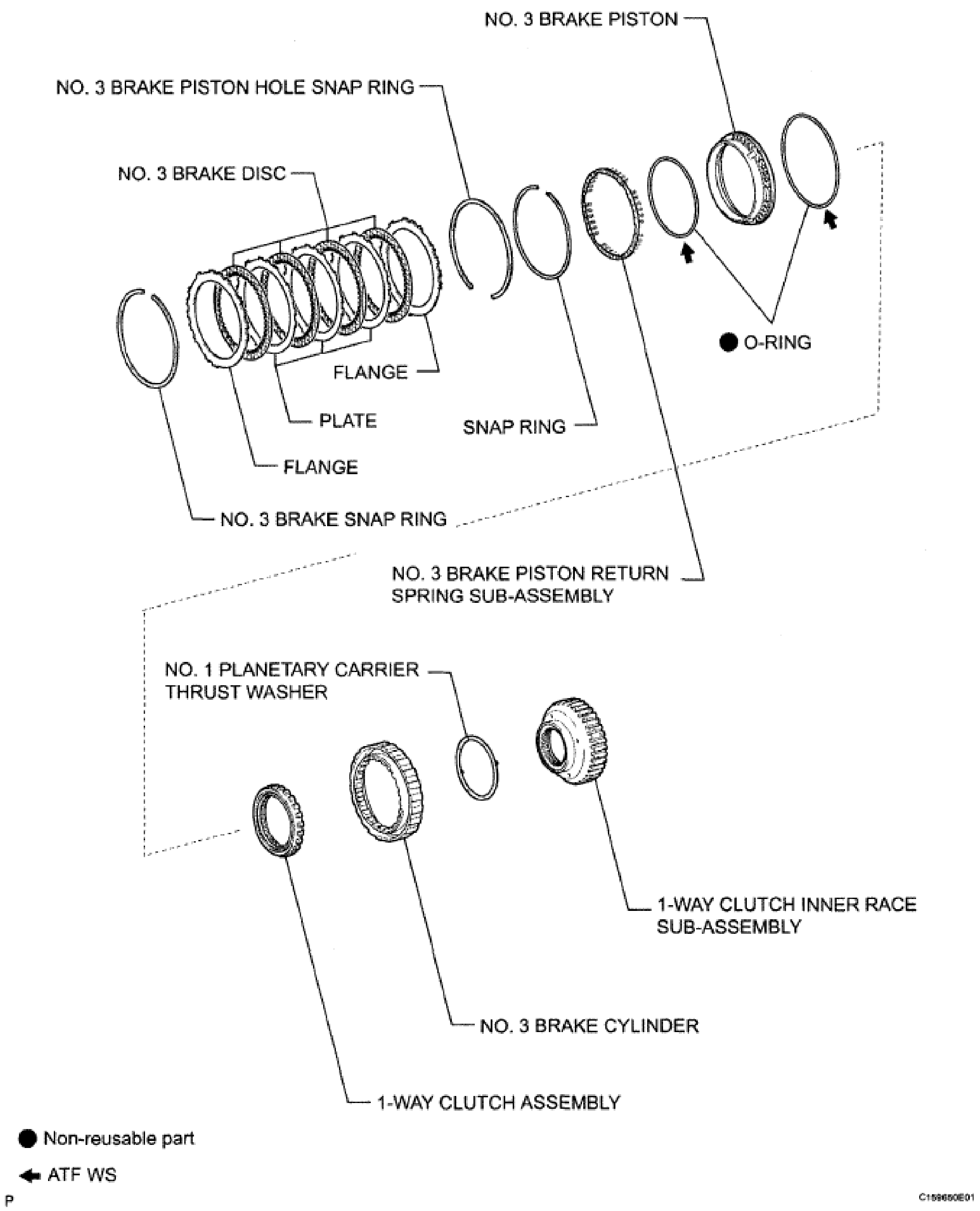

Fig. 374: Identifying Automatic Transmission Unit Components (7 Of 10)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

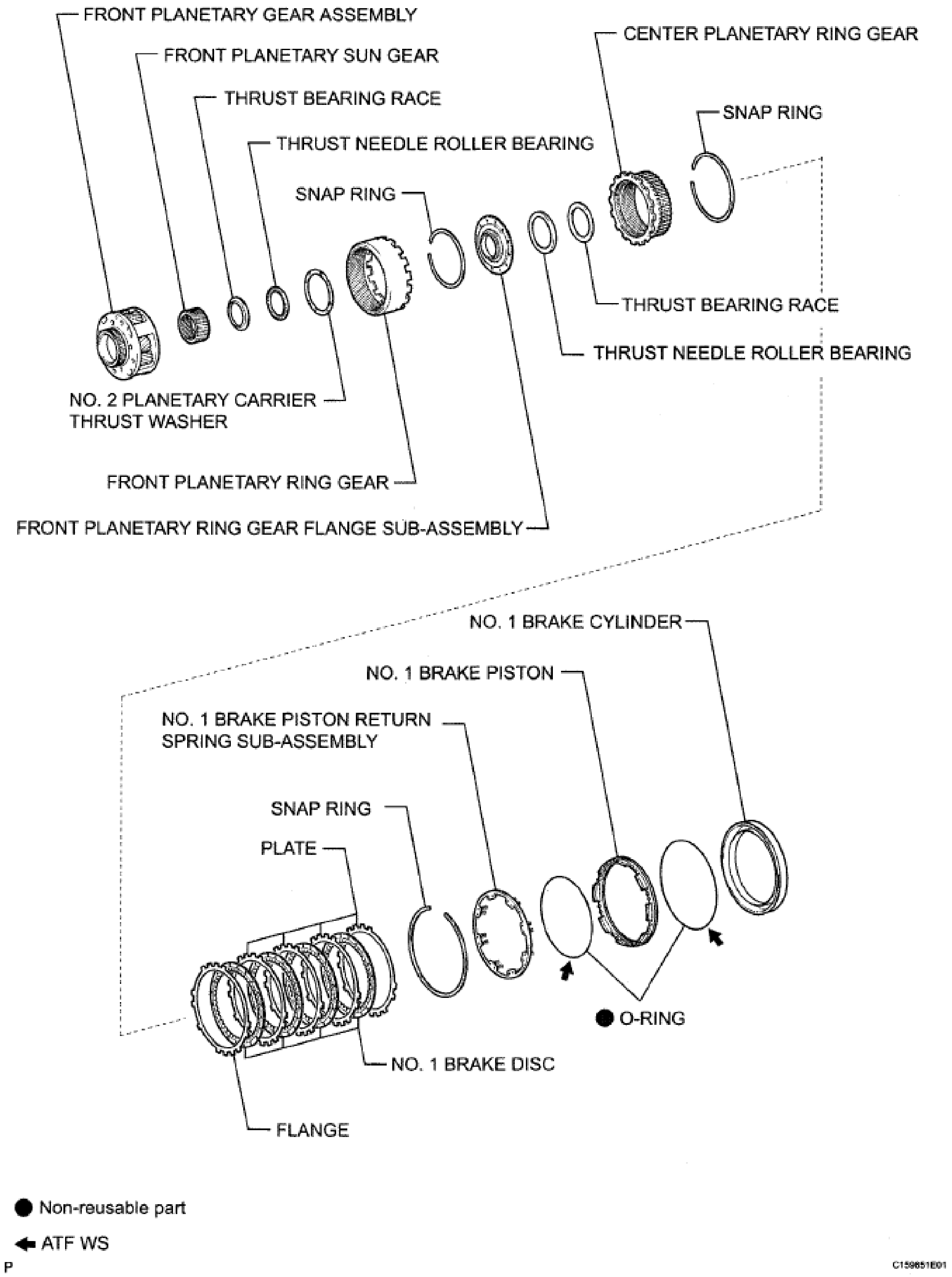

Fig. 375: Identifying Automatic Transmission Unit Components (8 Of 10)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

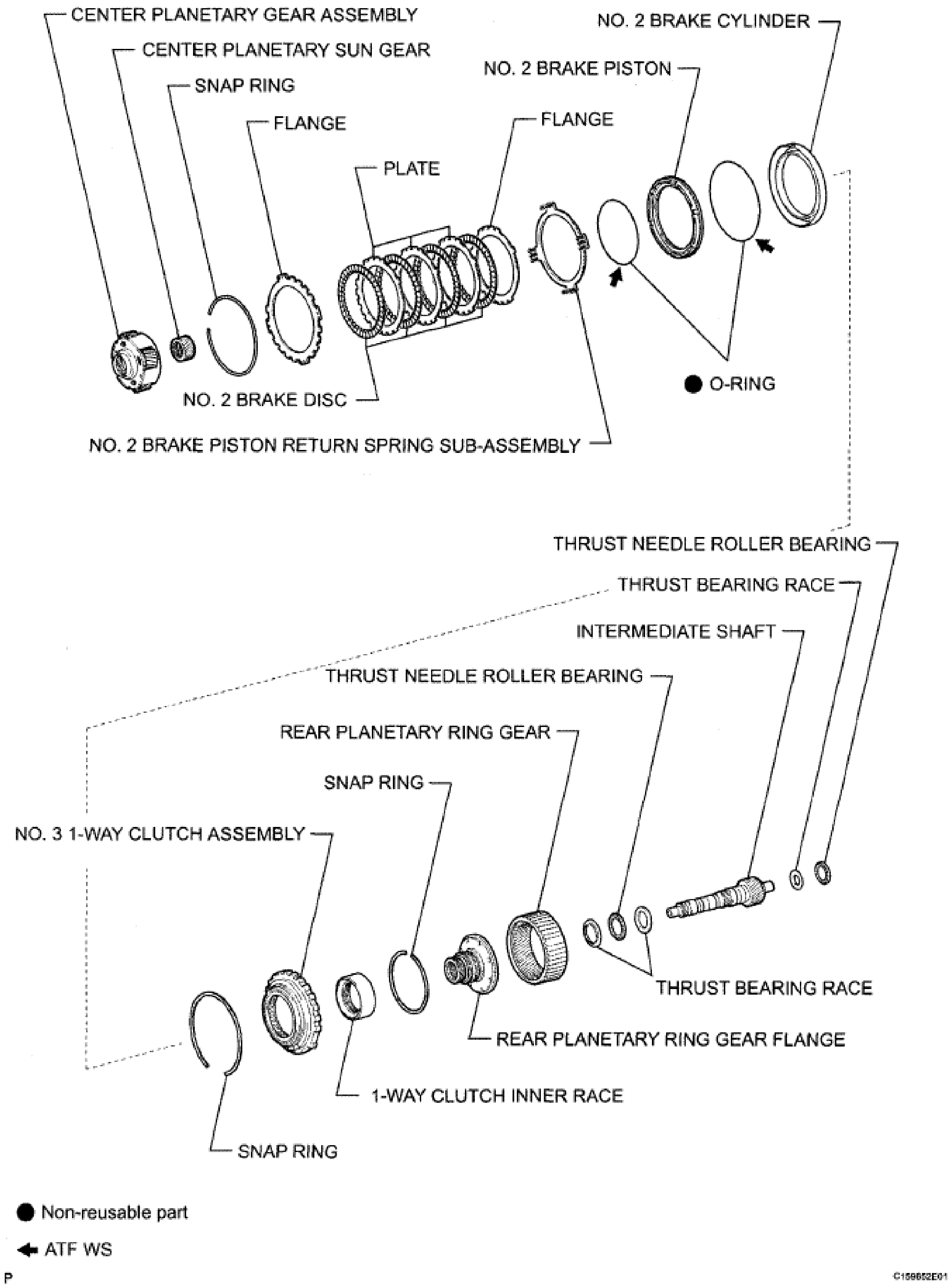

Fig. 376: Identifying Automatic Transmission Unit Components (9 Of 10)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

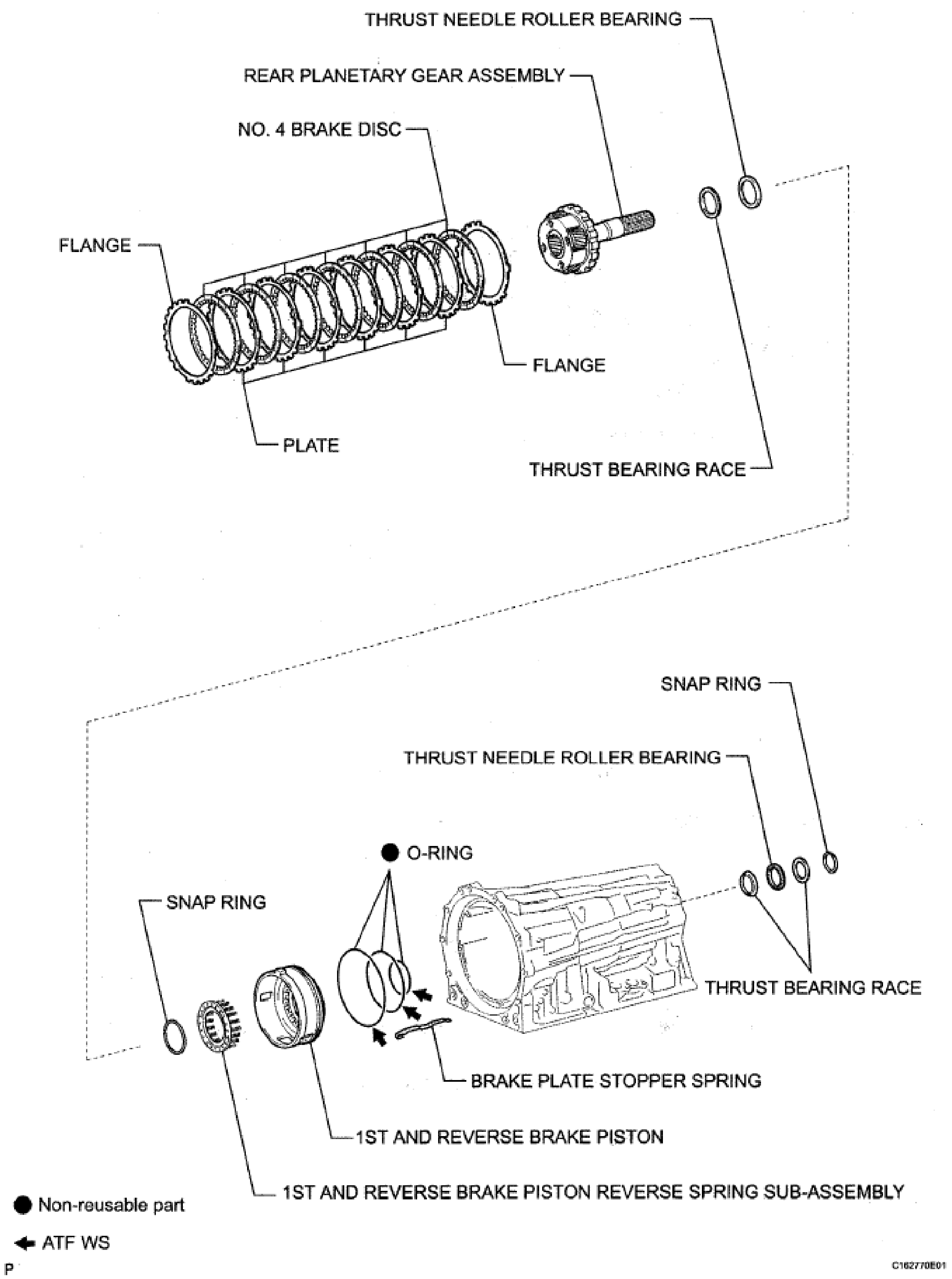

Fig. 377: Identifying Automatic Transmission Unit Components (10 Of 10)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DISASSEMBLY

1. **REMOVE TRANSMISSION CONTROL SHAFT LEVER RH**
   a. Remove the nut, spring washer and control shaft lever.

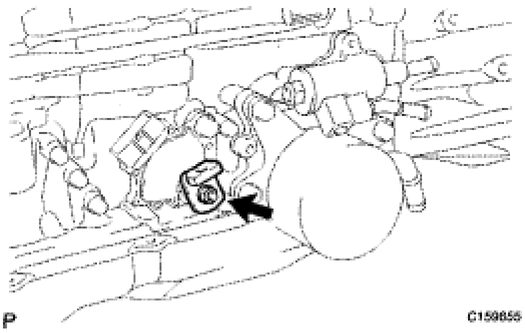

Fig. 378: Identifying Spring Washer, Control Shaft Lever And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **REMOVE PARK/NEUTRAL POSITION SWITCH ASSEMBLY**
    a. Using a screwdriver, bend the tabs of the lock washer.
    b. Remove the nut, lock washer and bolt.
    c. Remove the park/neutral position switch.

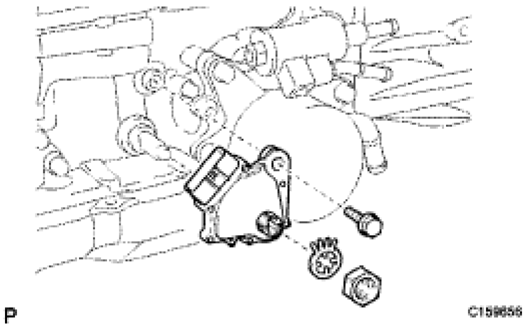

Fig. 379: Identifying Park/Neutral Position Switch Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **REMOVE SPEED SENSOR**
    a. Remove the 2 bolts and 2 speed sensors.
    b. Remove the 2 O-rings from sensors.

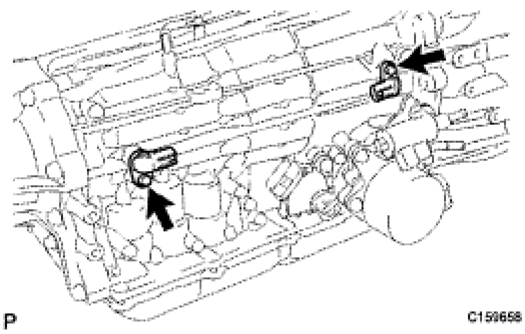

Fig. 380: Identifying Speed Sensors And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. **REMOVE TRANSMISSION OIL COOLER ASSEMBLY**

a. w/ Trailer Towing System:
    1. Remove the 3 bolts and transmission oil cooler with transmission oil thermostat.
    2. Separate the transmission oil cooler from the transmission oil thermostat.
    3. Remove the 4 O-rings.

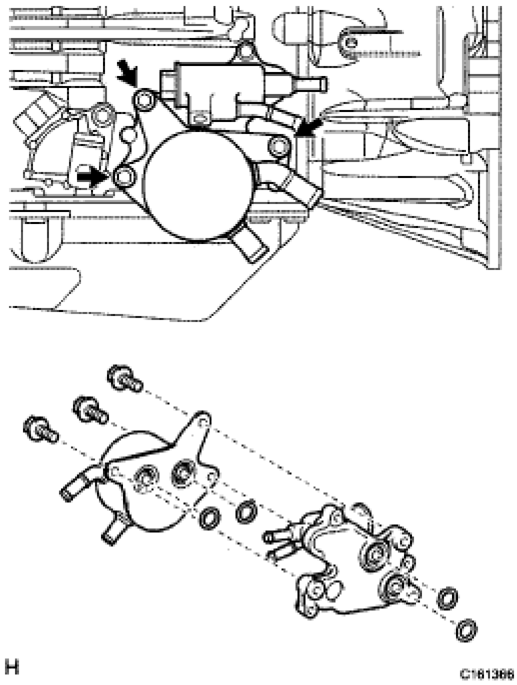

Fig. 381: Identifying Transmission Oil Cooler Assembly (w/ Trailer Towing System)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. w/o Trailer Towing System:
    1. Remove the 3 bolts and transmission oil cooler with transmission oil cooler spacer.
    2. Separate the transmission oil cooler from the transmission oil cooler spacer.
    3. Remove the 4 O-rings.

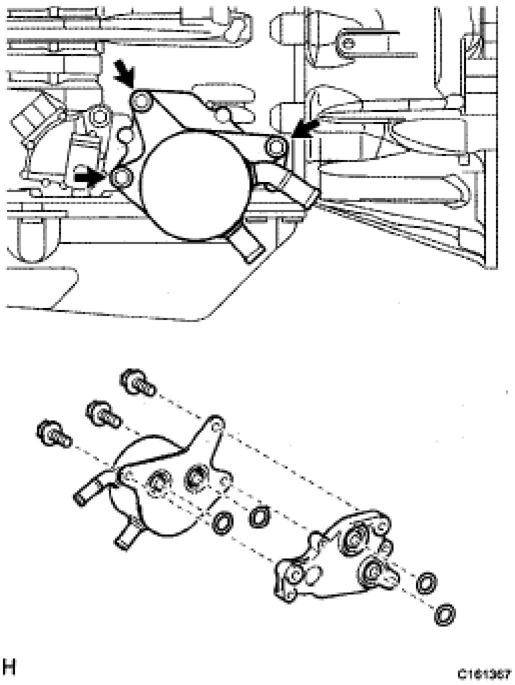

Fig. 382: Identifying Transmission Oil Cooler With Transmission Oil Cooler Spacer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. **REMOVE AUTOMATIC TRANSMISSION BREATHER TUBE**
   a. Remove the 2 bolts.
   b. Remove the breather tube.
   c. Remove the O-ring from the tube.

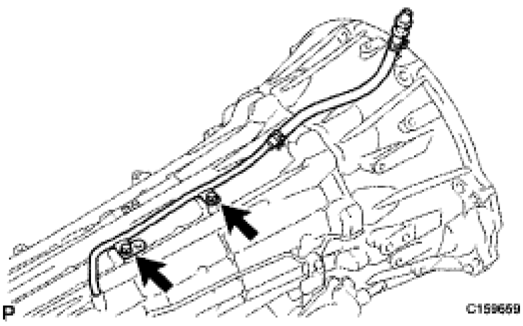

Fig. 383: Identifying Automatic Transmission Breather Tube And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. **REMOVE AUTOMATIC TRANSMISSION HOUSING**
   a. Remove the 14 bolts.
   b. Remove the transmission housing.

Fig. 384: Identifying Automatic Transmission Housing And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. **REMOVE REAR ADAPTOR TRANSFER**
    a. Remove the 10 bolts.
    b. Remove the rear adaptor transfer.

       HINT:

       Tap on the circumference of the extension housing with a plastic-faced hammer to remove the rear adaptor transfer.

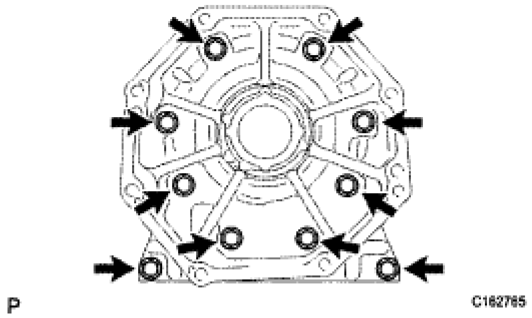

Fig. 385: Identifying Rear Adaptor Transfer And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. **REMOVE TRANSMISSION CASE ADAPTOR OIL SEAL**
    a. Using a screwdriver, pry out the oil seal.

NOTE:	Be careful not to damage the rear adaptor transfer. Wrap the tip of the screwdriver with tape.

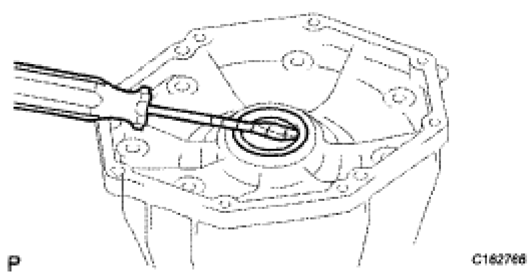

Fig. 386: Removing Transmission Case Adaptor Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. **REMOVE TRANSFER CASE ADAPTER RADIAL BALL BEARING**
    a. Using a screwdriver, remove the snap ring.
    b. Using SST and a press, press out the bearing.

    SST 09950-60010 (09951-00650), 09950-70010 (09951-07150)

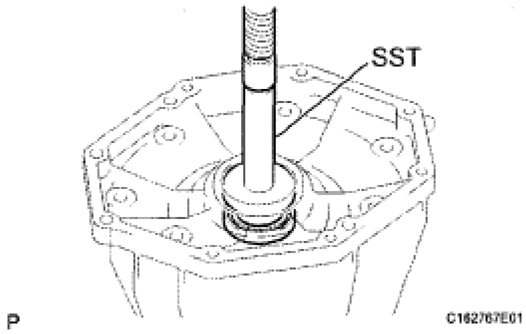

Fig. 387: Removing Transfer Case Adapter Radial Ball Bearing Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. **FIX AUTOMATIC TRANSMISSION CASE SUB-ASSEMBLY**
    a. Install the transmission case on the overhaul attachment.

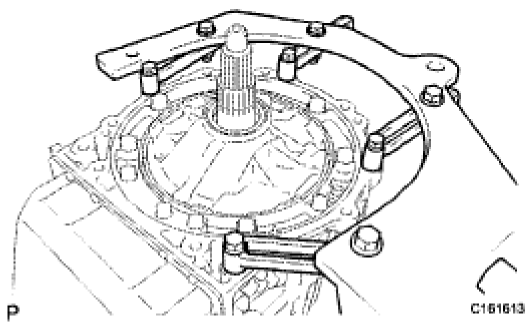

Fig. 388: Identifying Transmission Case On Overhaul Attachment
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. **REMOVE AUTOMATIC TRANSMISSION OIL PAN SUB-ASSEMBLY**

NOTE: Do not turn the transmission over as this will contaminate the valve body with foreign matter on the bottom of the pan.

    a. Remove the drain plug, 12 bolts, oil pan and gasket.

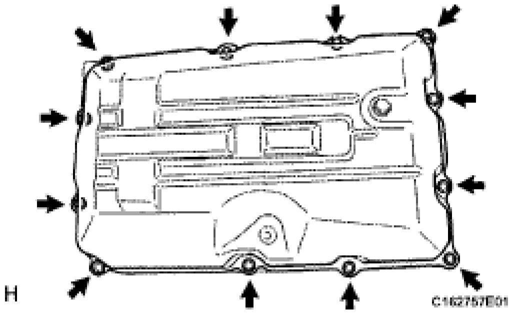

Fig. 389: Identifying Automatic Transmission Oil Pan Sub-Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. **INSPECT AUTOMATIC TRANSMISSION OIL PAN SUB-ASSEMBLY** (see INSPECTION)
13. **REMOVE VALVE BODY OIL STRAINER ASSEMBLY**
    a. Turn over the transmission.
    b. Remove the 4 bolts and oil strainer from the valve body.
    c. Remove the O-ring from the oil strainer.

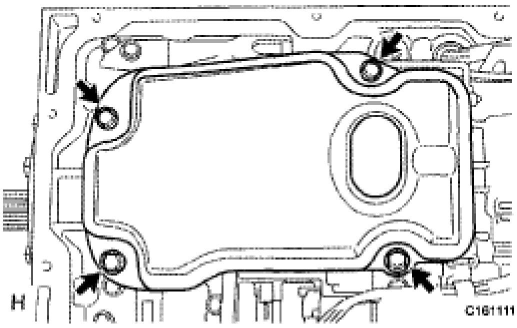

Fig. 390: Identifying Valve Body Oil Strainer Assembly And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. **REMOVE TRANSMISSION WIRE**
    a. Remove the 2 bolts and 2 temperature sensor clamps.
    b. Disconnect the 2 ATF temperature sensors.
    c. Disconnect the 9 connectors from the solenoid valves.

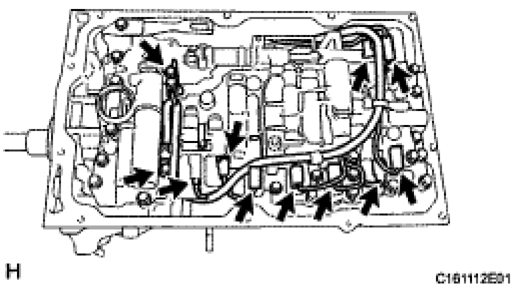

Fig. 391: Identifying Temperature Sensor Clamps And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Remove the 2 bolts and pull out the No. 1 and No. 2 transmission wires.
e. Pull the transmission wires out of the transmission case.

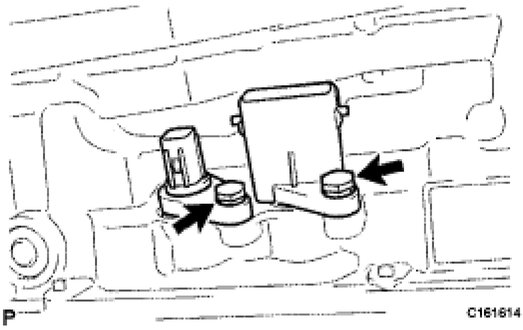

Fig. 392: Identifying Transmission Wires Out Of Transmission Case
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

f. Remove the 2 O-rings from the transmission wires.

15. **REMOVE TRANSMISSION VALVE BODY ASSEMBLY**

a. Remove the bolt, detent spring cover and detent spring.

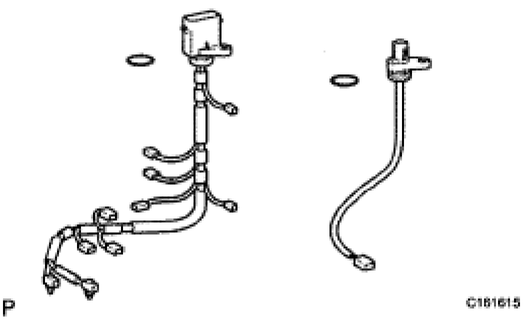

Fig. 393: Identifying O-Rings And Transmission Wires
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the 19 bolts.
c. Remove the valve body assembly.

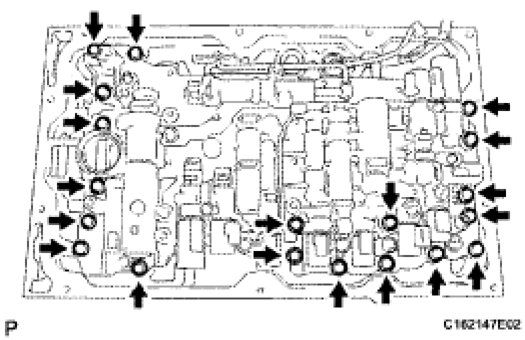

Fig. 394: Identifying Valve Body Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. **REMOVE TRANSMISSION CASE GASKET**
    a. Remove the 3 gaskets.

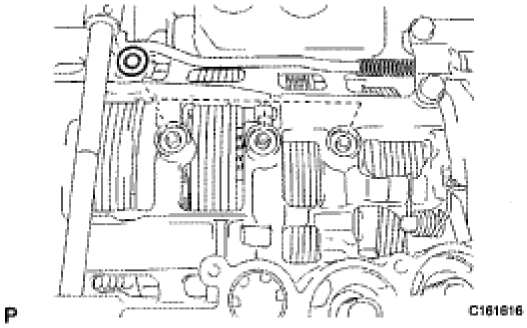

Fig. 395: Identifying Transmission Case Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. **REMOVE BRAKE DRUM GASKET**
    a. Remove the 3 gaskets.

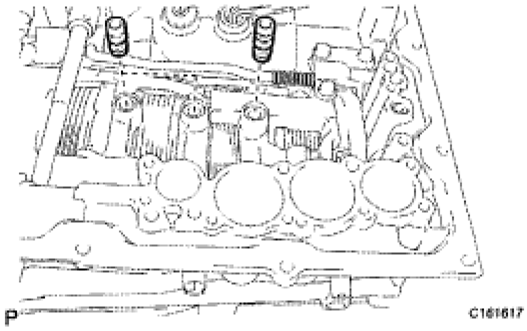

Fig. 396: Identifying Brake Drum Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

18. **REMOVE CHECK BALL BODY**
    a. Remove the check ball body and spring.

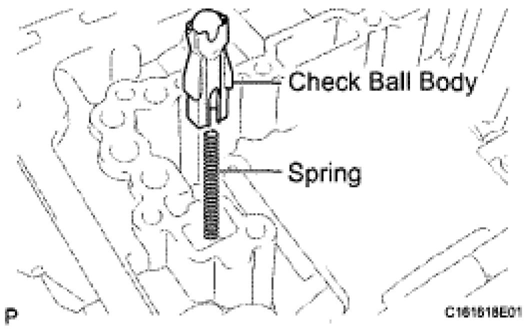

Fig. 397: Identifying Check Ball Body And Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. **REMOVE C-2 ACCUMULATOR PISTON**

a. While applying compressed air to the oil hole, remove the C-2 accumulator piston and spring.
b. Remove the 2 O-rings from the piston.

NOTE: Be careful as the C-3 and B-3 accumulator pistons may jump out.

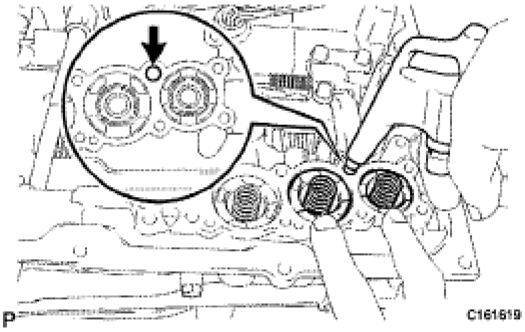

Fig. 398: Identifying C-2 Accumulator Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. **REMOVE B-3 ACCUMULATOR PISTON**
   a. While applying compressed air to the oil hole, remove the B-3 accumulator piston and spring.
   b. Remove the 2 O-rings from the piston.

NOTE: Be careful as the C-3 accumulator piston may jump out.

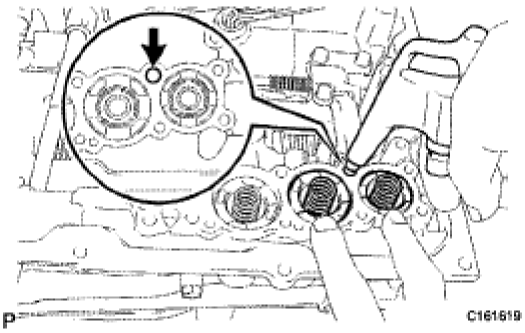

Fig. 399: Identifying B-3 Accumulator Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

21. **REMOVE C-3 ACCUMULATOR PISTON**
   a. While applying compressed air to the oil hole, remove the C-3 accumulator piston and spring.
   b. Remove the 2 O-rings from the piston.

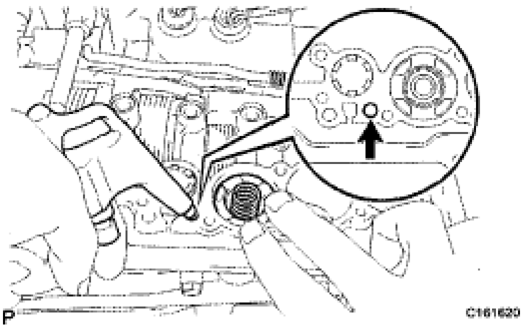

Fig. 400: Identifying C-3 Accumulator Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

22. **REMOVE B-1 ACCUMULATOR VALVE**
    a. Remove the B-1 accumulator valve and 2 springs.

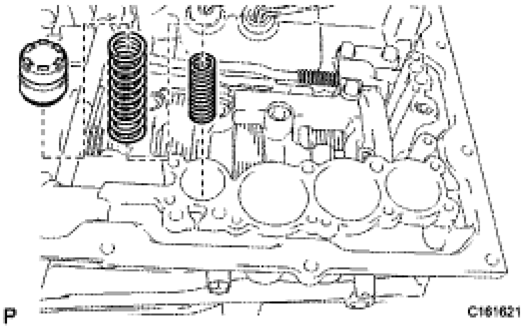

Fig. 401: Identifying B-1 Accumulator Valve And Springs
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

23. **REMOVE PARKING LOCK PAWL BRACKET**
    a. Remove the 3 bolts and bracket.

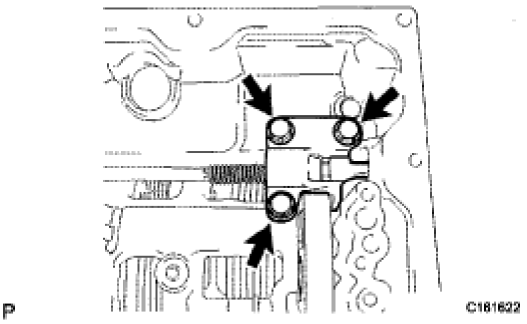

Fig. 402: Identifying Bolts And Bracket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

24. **REMOVE PARKING LOCK ROD SUB-ASSEMBLY**
    a. Disconnect the parking lock rod from the manual valve lever.

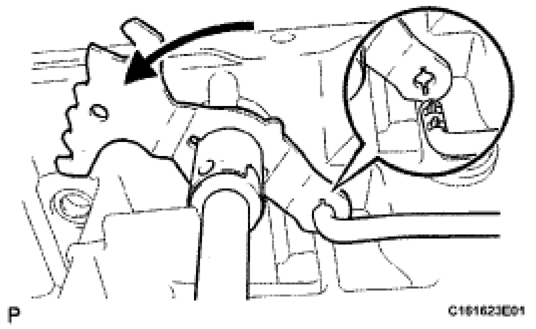

Fig. 403: Identifying Parking Lock Rod Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

25. **REMOVE PARKING LOCK PAWL**
    a. Pull out the parking lock pawl shaft from the front side, and then remove the lock pawl and spring.
    b. Remove the E-ring from the shaft.

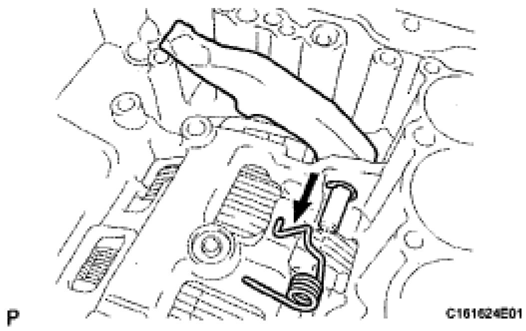

Fig. 404: Identifying Parking Lock Pawl
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

26. **REMOVE MANUAL VALVE LEVER SUB-ASSEMBLY**
    a. Using a screwdriver and hammer, cut off the spacer and remove it from the shaft.

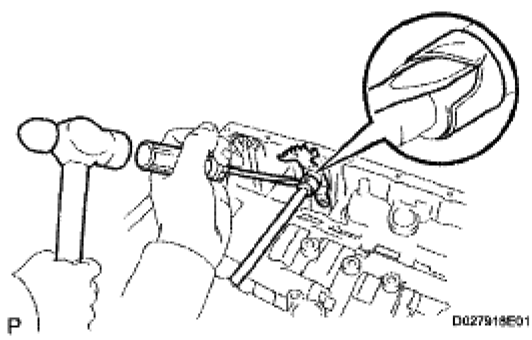

Fig. 405: Removing Manual Valve Lever
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    b. Using a pin punch and hammer, tap out the spring pin.

HINT:

Slowly tap out the spring pin so that it does not fall into the transmission case.

c. Pull the manual valve lever shaft out through the transmission case, and remove the manual valve lever.

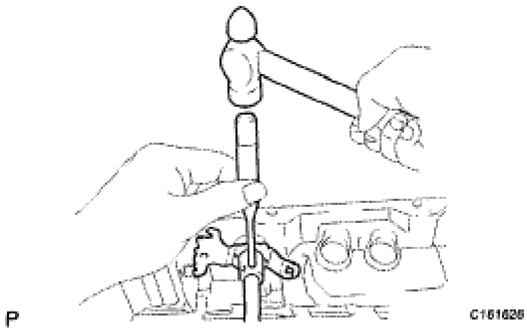

Fig. 406: Tapping Spring Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

27. **REMOVE MANUAL VALVE LEVER SHAFT OIL SEAL**
   a. Using a screwdriver, pry out the 2 oil seals.

NOTE: Be careful not to damage the transmission case.

HINT:

Wrap the tip of the screwdriver with tape before use.

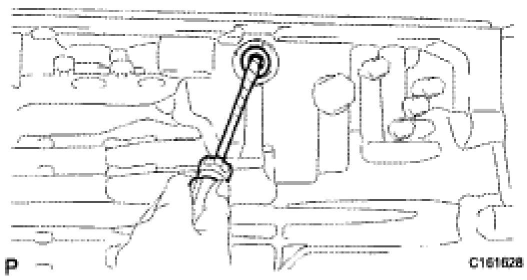

Fig. 407: Removing Manual Valve Lever Shaft Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

28. **REMOVE OIL PUMP ASSEMBLY**
   a. Remove the 10 bolts.

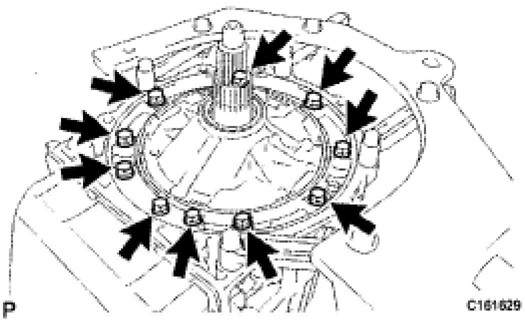

Fig. 408: Identifying Oil Pump Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Using SST, pull out the oil pump.

SST 09950-40011 (09951-04010,09953-04020, 09958-04011, 09952-04010, 09954-04010, 09955-04031, 09955-04031)

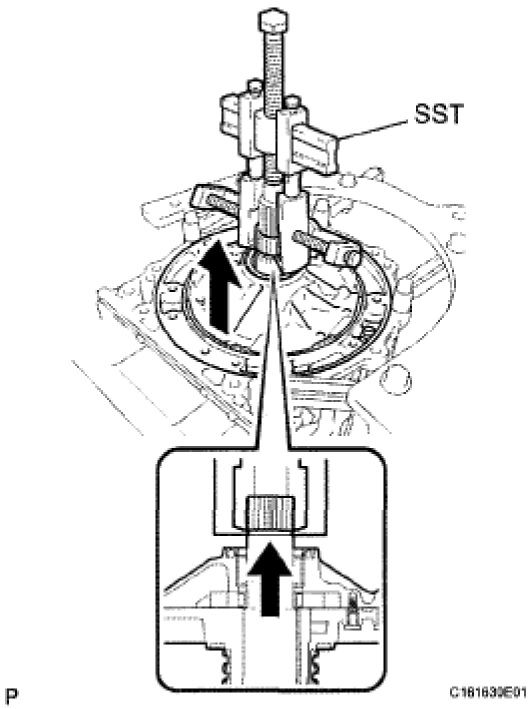

Fig. 409: Pulling Oil Pump With SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Remove the O-ring and 2 thrust bearing races from the oil pump.

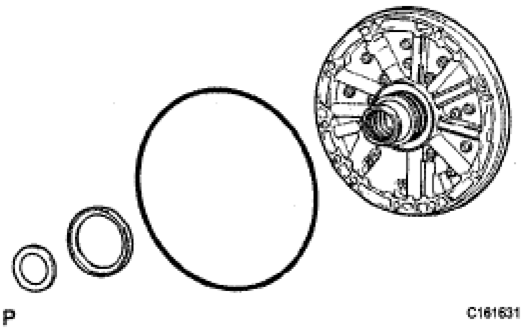

Fig. 410: Identifying O-Ring And Thrust Bearing Races
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

29. **REMOVE CLUTCH DRUM AND INPUT SHAFT ASSEMBLY**
    a. Remove the clutch drum and input shaft drum assembly from the transmission case.

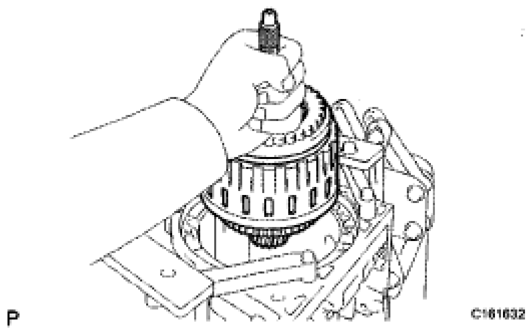

Fig. 411: Removing Clutch Drum And Input Shaft Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    b. Remove the clutch drum thrust washer and 2 thrust needle roller bearings.

30. **INSPECT NO. 2 1-WAY CLUTCH ASSEMBLY** (see INSPECTION)

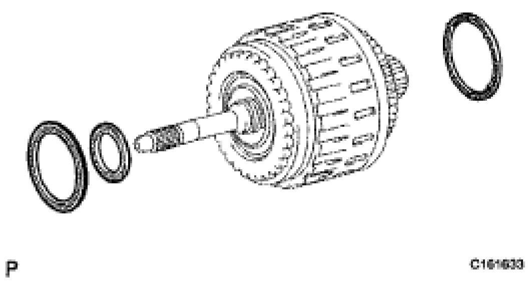

Fig. 412: Identifying Clutch Drum Thrust Washer And Thrust Needle Roller Bearings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

31. **REMOVE NO. 2 1-WAY CLUTCH ASSEMBLY**
    a. Remove the No. 2 1-way clutch and clutch drum thrust washer from the clutch drum and input shaft assembly.

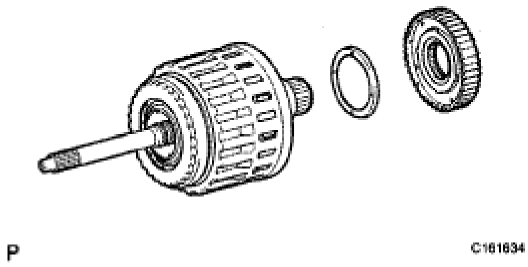

Fig. 413: Identifying No. 2 1-Way Clutch Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

32. **FIX CLUTCH DRUM AND INPUT SHAFT ASSEMBLY**
    a. Place the oil pump onto the torque converter clutch, and then place the clutch drum and input shaft assembly onto the oil pump.

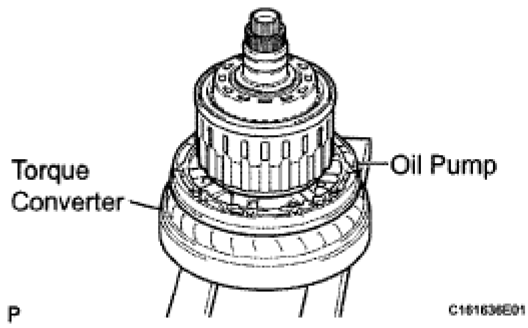

Fig. 414: Identifying Torque Converter And Oil Pump
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

33. **REMOVE REVERSE CLUTCH HUB SUB-ASSEMBLY**
    a. Using a screwdriver, remove the snap ring.

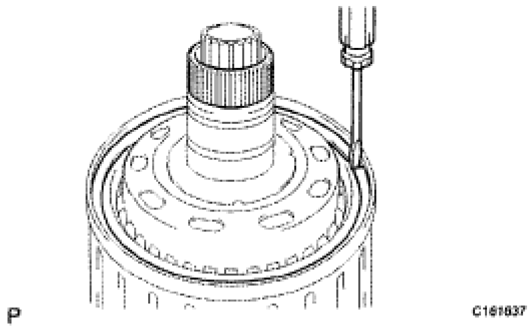

Fig. 415: Removing Snap Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    b. Remove the reverse clutch reaction sleeve and reverse clutch hub sub-assembly with the rear clutch disc set from the clutch drum.

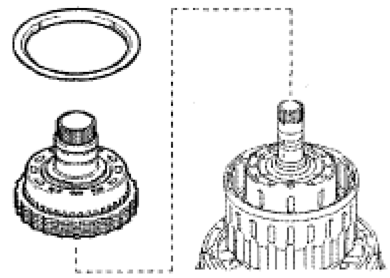

Fig. 416: Identifying Clutch Hub Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

34. **REMOVE REAR CLUTCH DISC SET**
    a. Remove the selective reverse clutch flange, 5 discs and 4 plates from the reverse clutch hub.

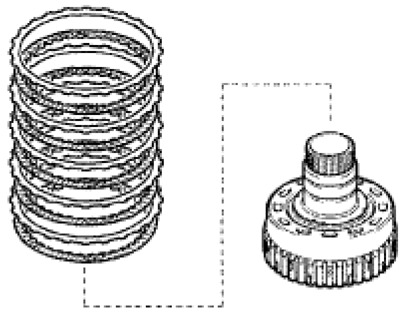

Fig. 417: Identifying Rear Clutch Disc Set
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    b. Remove the reverse clutch flange from the clutch drum.
35. **INSPECT REAR CLUTCH DISC** (see INSPECTION)
36. **INSPECT REVERSE CLUTCH HUB SUB-ASSEMBLY** (see INSPECTION)

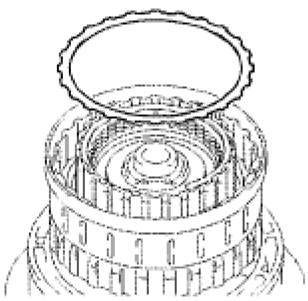

Fig. 418: Identifying Reverse Clutch Flange From Clutch Drum
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

37. **REMOVE FORWARD CLUTCH HUB SUB-ASSEMBLY**
    a. Remove the thrust needle roller bearing, forward clutch hub and No. 3 clutch hub thrust washer from the clutch drum.

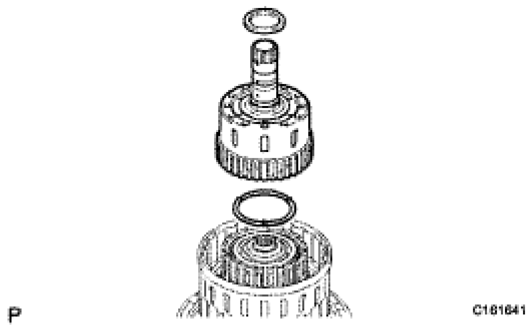

Fig. 419: Identifying Forward Clutch Hub Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

38. **INSPECT FORWARD CLUTCH HUB SUB-ASSEMBLY** (see **INSPECTION**)
39. **REMOVE COAST CLUTCH HUB SUB-ASSEMBLY WITH NO. 4 1-WAY CLUTCH ASSEMBLY**
    a. Remove the 2 thrust needle roller bearings, coast clutch hub with the No. 4 1-way clutch and thrust bearing race from the clutch drum.

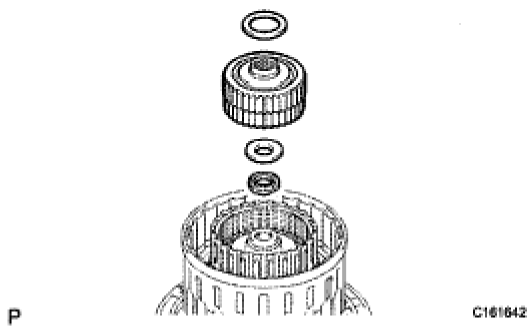

Fig. 420: Identifying Thrust Needle Roller Bearings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

40. **INSPECT NO. 4 1-WAY CLUTCH ASSEMBLY** (see **INSPECTION**)
41. **REMOVE NO. 4 1-WAY CLUTCH ASSEMBLY**
    a. Separate the No. 4 1-way clutch from the coast clutch hub.
    b. Remove the No. 2 clutch hub thrust washer from the coast clutch hub.

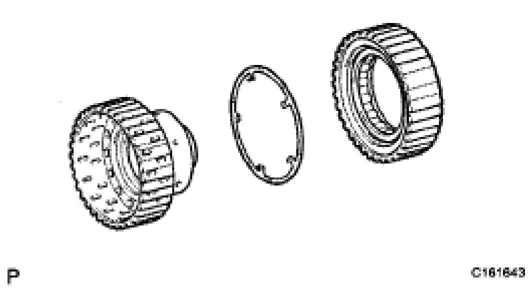

Fig. 421: Identifying 4 1-Way Clutch Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

42. **REMOVE FORWARD MULTIPLE DISC CLUTCH, CLUTCH DISC SET**

a. Using a screwdriver, remove the hole snap ring.

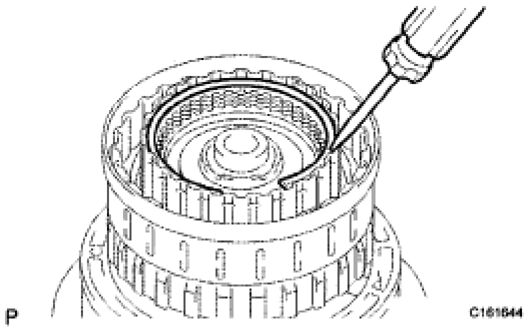

Fig. 422: Removing Hole Snap Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the flange, 6 discs, 6 plates and cushion plate from the input shaft.

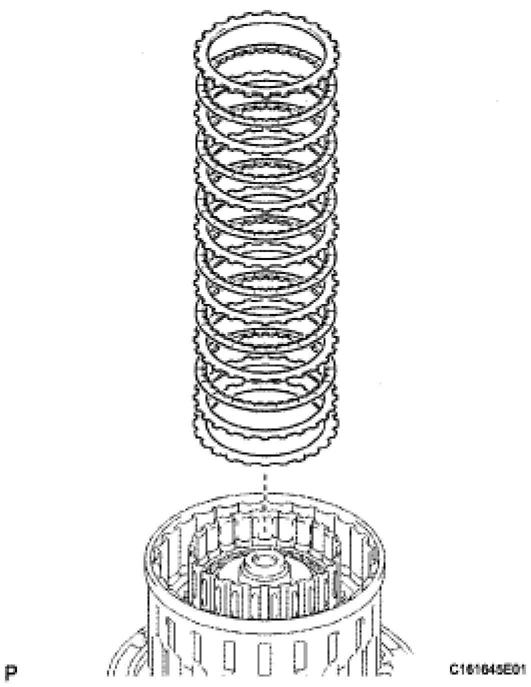

Fig. 423: Identifying Discs, Plates And Cushion Plate
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

43. **INSPECT FORWARD MULTIPLE DISC CLUTCH, CLUTCH DISC** (see INSPECTION)
44. **REMOVE COAST CLUTCH DISC SET**
    a. Using a screwdriver, remove the hole snap ring.

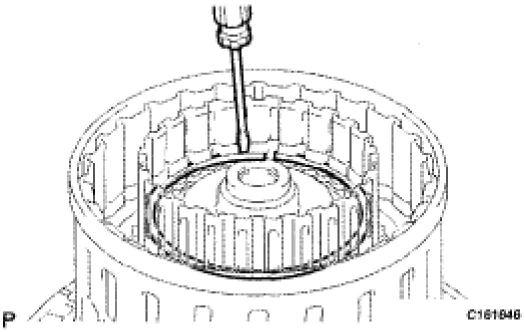

Fig. 424: Removing Hole Snap Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the flange, 4 discs and 4 plates from the input shaft.

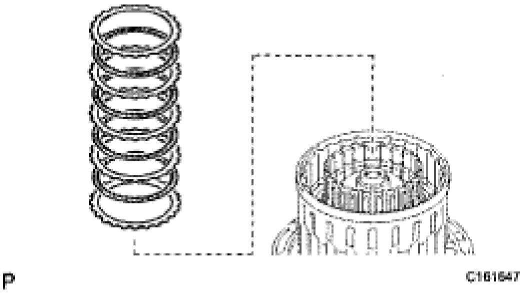

Fig. 425: Identifying Input Shaft, Discs And Plates
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

45. **INSPECT COAST CLUTCH DISC** (see INSPECTION)
46. **REMOVE INPUT SHAFT SUB-ASSEMBLY**
    a. Remove the input shaft from the clutch drum.

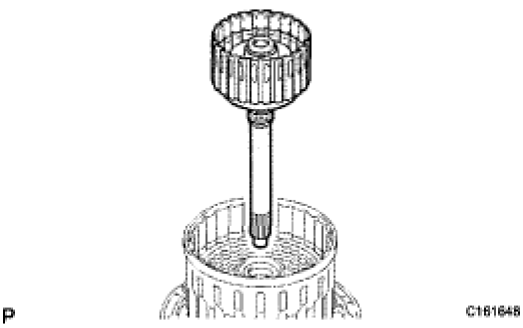

Fig. 426: Identifying Input Shaft To Clutch Drum
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

47. **REMOVE INPUT SHAFT OIL SEAL RING**
    a. Remove the 4 oil seal rings from the input shaft.

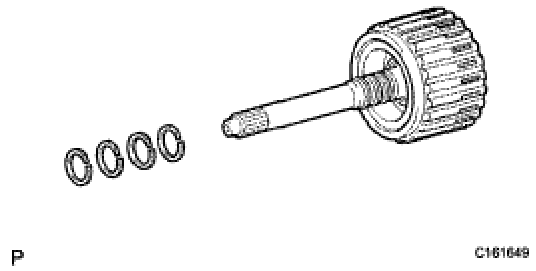

Fig. 427: Identifying Oil Seal Rings To Input Shaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

48. **REMOVE COAST CLUTCH PISTON**
    a. Place SST on the No. 1 clutch balancer, and compress the return spring with a press.

    SST 09350-30020 (09350-07040)

    b. Using SST, remove the snap ring.

    SST 09350-30020 (09350-07070)

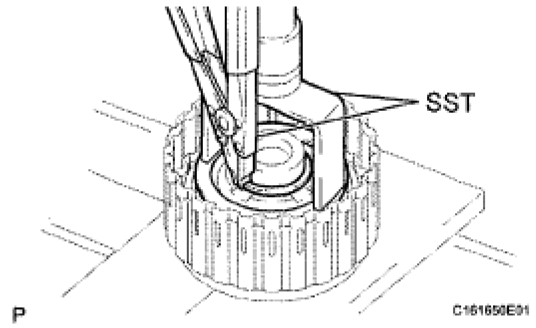

Fig. 428: Removing Coast Clutch Piston Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    c. Remove the No. 1 clutch balancer and forward clutch return spring from the input shaft.

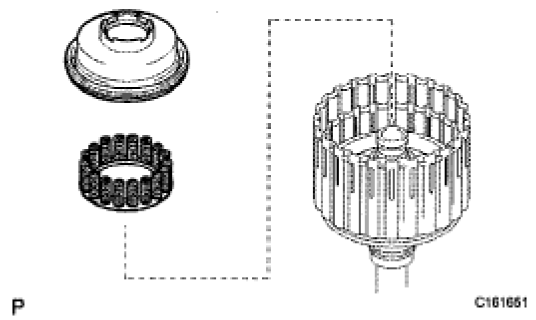

Fig. 429: Identifying Clutch Balancer And Forward Clutch Return Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    d. Remove the O-ring from the No. 1 clutch balancer.

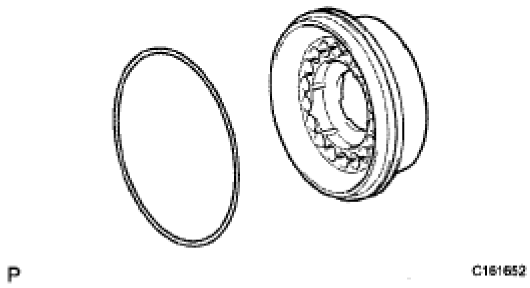

Fig. 430: Identifying No. 1 Clutch Balancer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

e. Hold the coast clutch piston by hand and apply compressed air to the input shaft to remove the coast clutch piston.

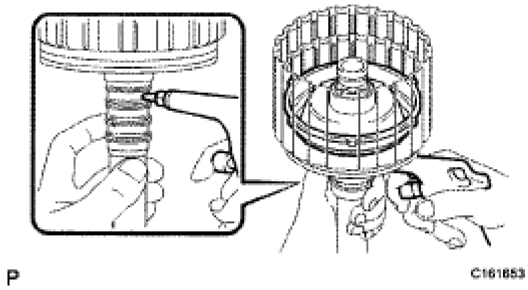

Fig. 431: Applying Compressed Air To Input Shaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

49. **INSPECT FORWARD CLUTCH RETURN SPRING SUB-ASSEMBLY** (see **INSPECTION**)
50. **REMOVE FORWARD CLUTCH PISTON SUB-ASSEMBLY**
    a. Hold the forward clutch piston by hand and apply compressed air to the input shaft to remove the forward clutch piston.

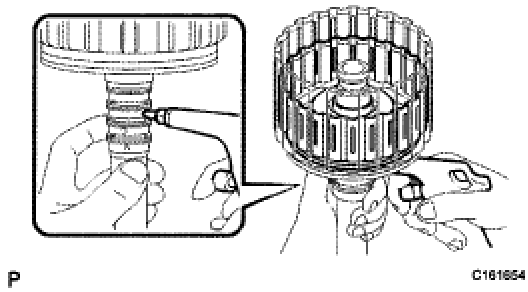

Fig. 432: Applying Compressed Air To Input Shaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the O-ring from the input shaft.

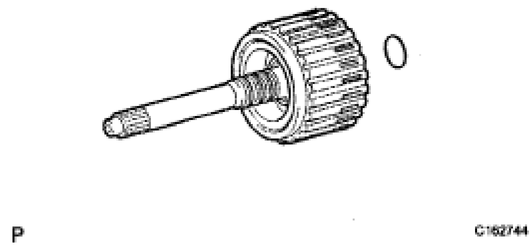

Fig. 433: Identifying O-Ring And Input Shaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

51. **INSPECT FORWARD CLUTCH RETURN SPRING SUB-ASSEMBLY** (see **INSPECTION**)
52. **REMOVE DIRECT CLUTCH DISC SET**
    a. Using a screwdriver, remove the 2 hole snap rings from the clutch drum.

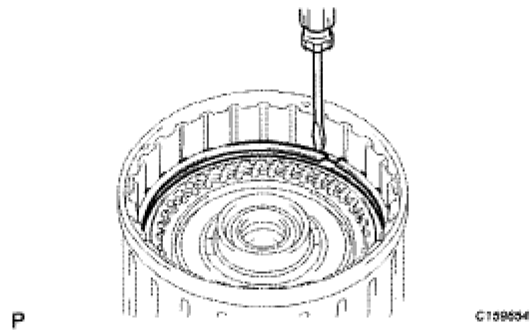

Fig. 434: Removing Hole Snap Rings To Clutch Drum
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    b. Remove the direct clutch flange, 5 discs and 5 plates from the clutch drum.

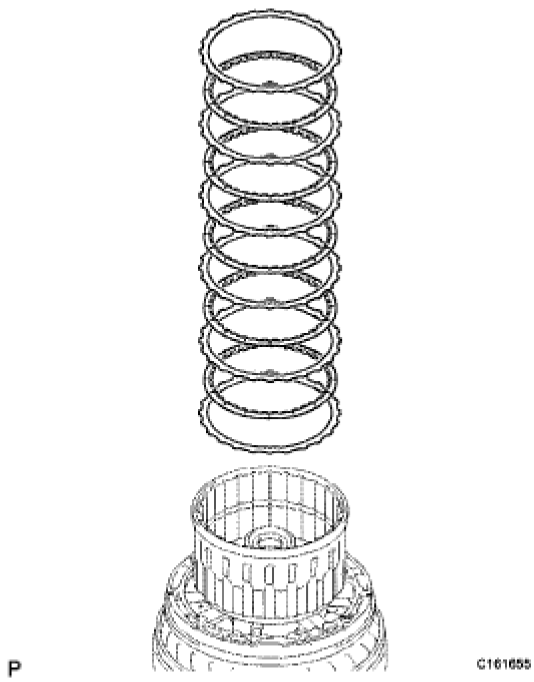

Fig. 435: Identifying Discs And Plates Clutch Drum
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

53. **INSPECT DIRECT CLUTCH DISC** (see **INSPECTION**)
54. **REMOVE NO. 3 CLUTCH BALANCER**
    a. Place SST on the No. 3 clutch balancer, and compress the return spring with a press.

       SST 09380-60010 (09381-06020, 09381 -06030, 09381-06040, 09381-06050, 09381-06080)

    b. Using SST, remove the snap ring.

       SST 09350-30020 (09350-07070)

    c. Remove the No. 3 clutch balancer.

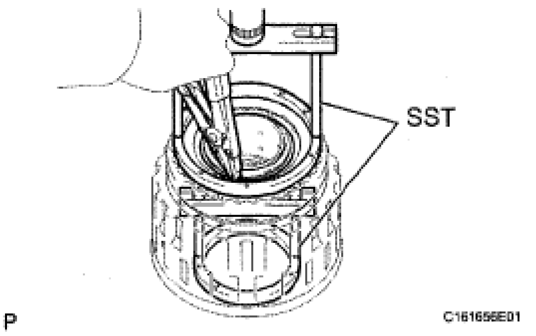

Fig. 436: Identifying No. 3 Clutch Balancer Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    d. Remove the reverse clutch return spring and O-ring from the reverse clutch piston sub-assembly.

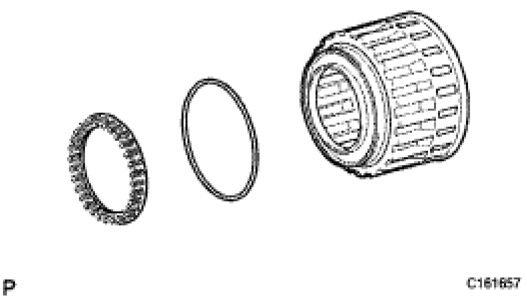

Fig. 437: Identifying Clutch Piston Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

55. **INSPECT REVERSE CLUTCH RETURN SPRING SUB-ASSEMBLY** (see **INSPECTION**)
56. **REMOVE REVERSE CLUTCH PISTON SUB-ASSEMBLY**
    a. Remove the reverse clutch piston from the clutch drum.

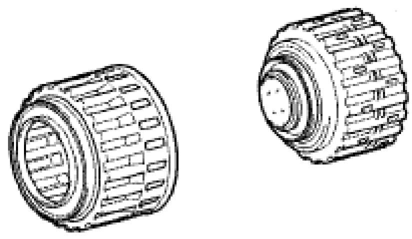

Fig. 438: Identifying Reverse Clutch Piston To Clutch Drum
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the O-ring from the reverse clutch piston.

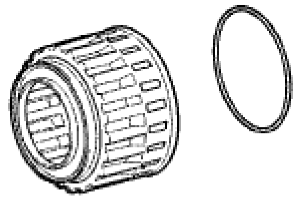

Fig. 439: Identifying O-Ring And Reverse Clutch Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Remove the O-ring from the clutch drum.

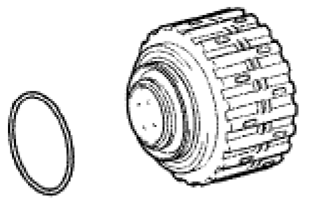

Fig. 440: Identifying O-Ring And Clutch Drum
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

57. **REMOVE DIRECT CLUTCH PISTON SUB-ASSEMBLY**

a. Place SST on the direct clutch piston, and compress the return spring with a press.

SST 09380-60010 (09381-06030,09381-06040, 09381-06080)

b. Using SST, remove the snap ring.

SST 09350-30020 (09350-07070)

c. Place the oil pump onto the torque converter clutch, and then place the clutch drum onto the oil pump.

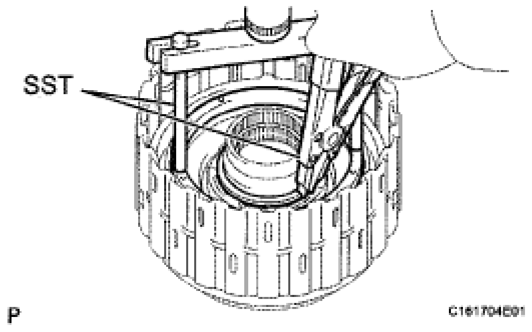

Fig. 441: Removing Direct Clutch Piston Sub-Assembly Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Hold the direct clutch piston by hand and apply compressed air to the oil hole of the oil pump as shown in the illustration to remove the direct clutch piston with the No. 2 clutch balancer and direct clutch return spring sub-assembly.

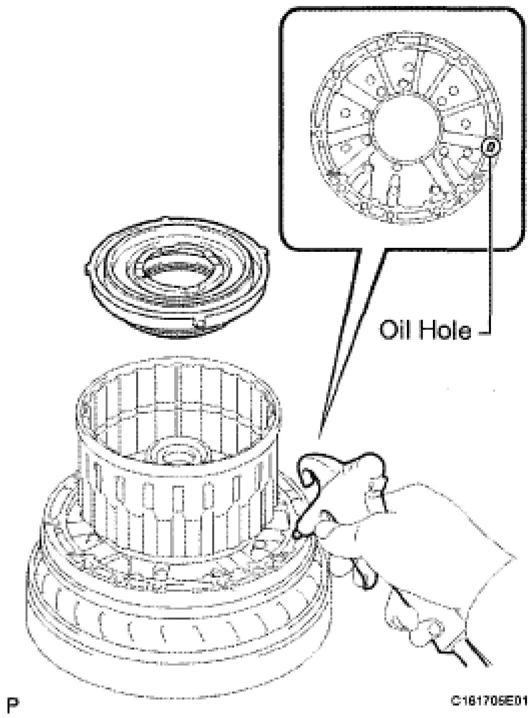

Fig. 442: Applying Compressed Air To Oil Hole Of Oil Pump
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

e. Remove the No. 2 clutch balancer and direct clutch return spring sub-assembly from the direct clutch piston.

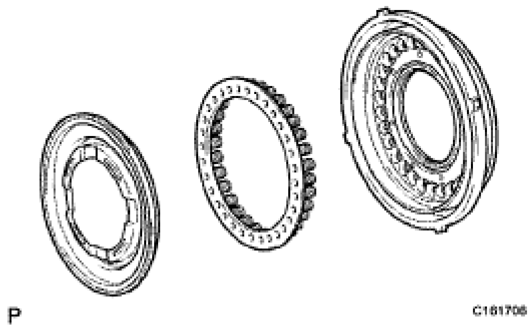

Fig. 443: Identifying No. 2 Clutch Balancer And Direct Clutch Return Spring Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

f. Remove the 2 O-rings from the direct clutch piston.

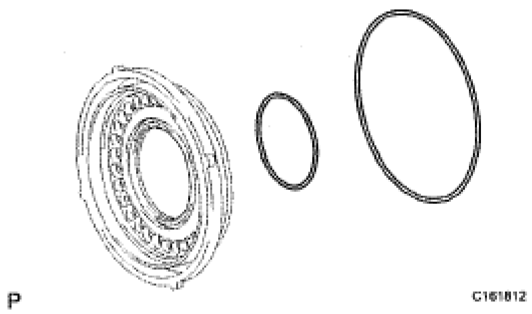

Fig. 444: Identifying O-Rings To Direct Clutch Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

58. **INSPECT DIRECT CLUTCH RETURN SPRING SUB-ASSEMBLY** (see INSPECTION)
59. **REMOVE NO. 3 BRAKE SNAP RING**
    a. Using a screwdriver, remove the No. 3 brake snap ring from the transmission case.

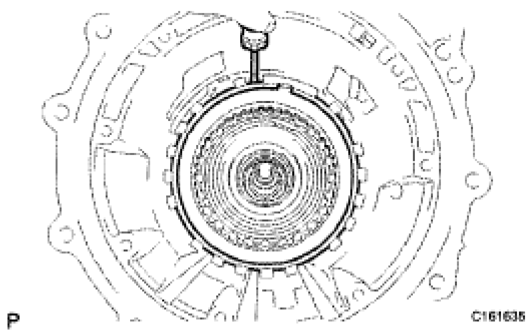

Fig. 445: Removing No. 3 Brake Snap Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

60. **REMOVE NO. 3 BRAKE DISC SET**
    a. Remove the 2 flanges, 4 discs and 3 plates from the transmission case.

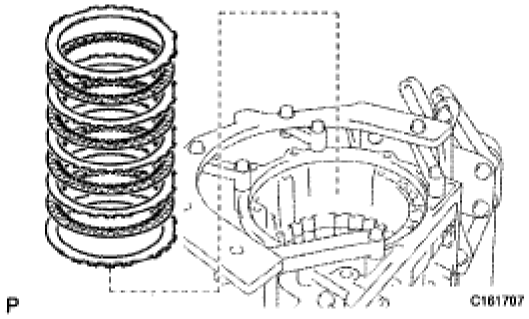

Fig. 446: Identifying Flanges, Discs And Plates
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

61. **INSPECT NO. 3 BRAKE DISC** (see **INSPECTION**)
62. **REMOVE NO. 3 BRAKE PISTON HOLE SNAP RING**
    a. Using SST, remove the snap ring.

    SST 09350-30020 (09350-07060)

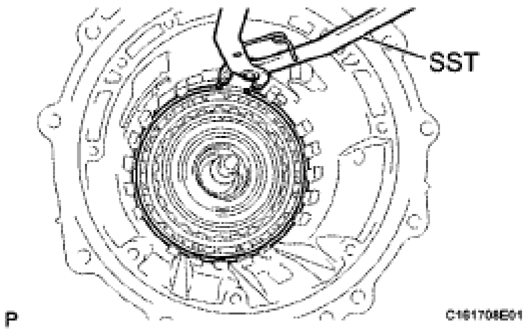

Fig. 447: Removing No. 3 Brake Piston Hole Snap Ring Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

63. **REMOVE NO. 3 BRAKE CYLINDER WITH NO. 3 BRAKE PISTON AND NO. 3 BRAKE PISTON RETURN SPRING SUB-ASSEMBLY**
    a. Remove the No. 3 brake cylinder with the No. 3 brake piston and No. 3 brake piston return spring from the transmission case.

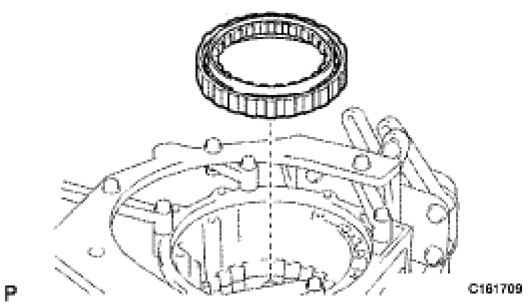

Fig. 448: Identifying No. 3 Brake Piston Return Spring And Transmission Case
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

64. **REMOVE NO. 3 BRAKE PISTON**

a. Using SST and a press, compress the return spring and remove the snap ring and No. 3 brake piston return spring with a screwdriver.

SST 09380-60010 (09381-06020, 09381-06040, 09381-06060, 09381-06100, 09381-06110)

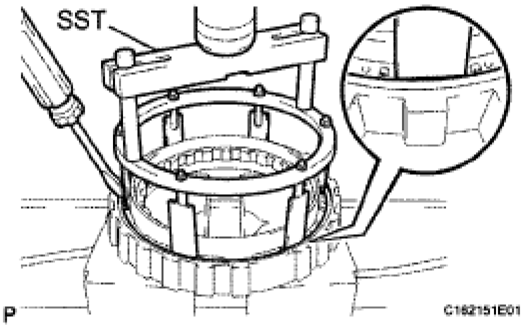

Fig. 449: Removing No. 3 Brake Piston Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Hold the No. 3 brake piston and apply compressed air (392 kPa, 4.0 kgf/cm^2 , 57 psi) to the No. 3 brake cylinder to remove the No. 3 brake piston.

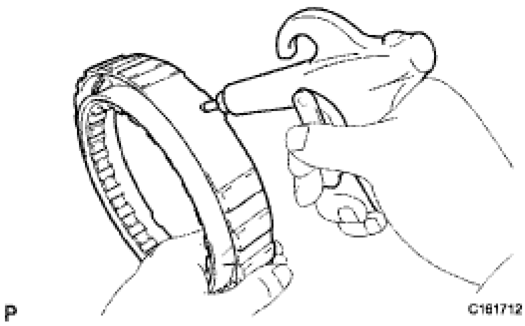

Fig. 450: Holding No. 3 Brake Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Remove the 2 O-rings from the No. 3 brake piston.

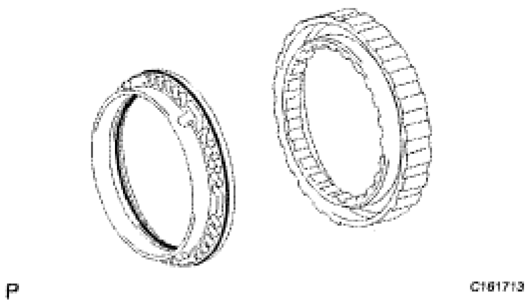

Fig. 451: Identifying O-Rings And No. 3 Brake Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

65. **INSPECT NO. 3 BRAKE PISTON RETURN SPRING SUB-ASSEMBLY** (see **INSPECTION**)

66. **REMOVE 1-WAY CLUTCH ASSEMBLY WITH 1-WAY CLUTCH INNER RACE SUB-ASSEMBLY**
    a. Remove the 1-way clutch with 1-way clutch inner race from the transmission case.

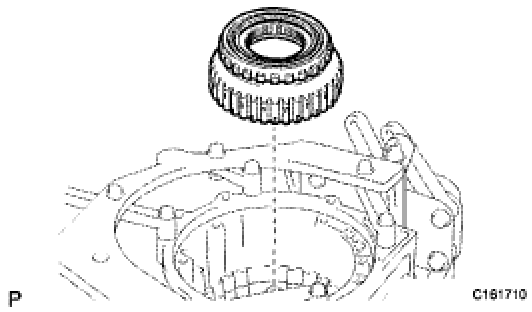

Fig. 452: Identifying 1-Way Clutch With 1-Way Clutch Inner Race
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

67. **INSPECT 1-WAY CLUTCH ASSEMBLY** (see **INSPECTION**)
68. **REMOVE 1-WAY CLUTCH INNER RACE SUB-ASSEMBLY**
    a. Separate the 1-way clutch inner race from the 1-way clutch and remove the No. 1 planetary carrier thrust washer.

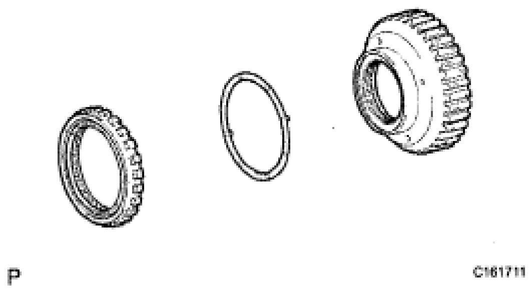

Fig. 453: Identifying 1-Way Clutch Inner Race Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

69. **REMOVE FRONT PLANETARY GEAR ASSEMBLY**
    a. Remove the front planetary gear and thrust needle roller bearing from the transmission case.

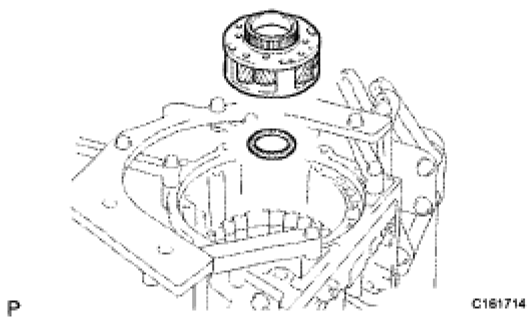

Fig. 454: Identifying Front Planetary Gear And Thrust Needle Roller Bearing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the No. 2 planetary carrier thrust washer, thrust bearing race and front planetary sun gear from the front planetary gear.

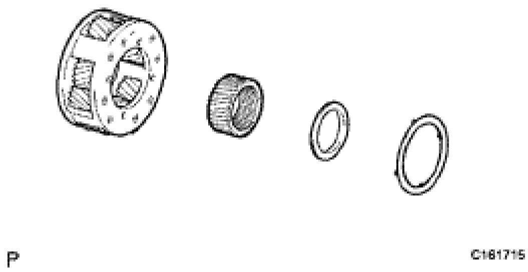

Fig. 455: Identifying No. 2 Planetary Carrier Thrust Washer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

70. **INSPECT FRONT PLANETARY GEAR ASSEMBLY** (see **INSPECTION**)
71. **REMOVE FRONT PLANETARY RING GEAR WITH FRONT PLANETARY RING GEAR FLANGE SUB-ASSEMBLY AND CENTER PLANETARY RING GEAR**
    a. Remove the front planetary ring gear with the front planetary ring gear flange and center planetary ring gear from the transmission case.
    b. Remove the thrust needle roller bearing and thrust bearing race.

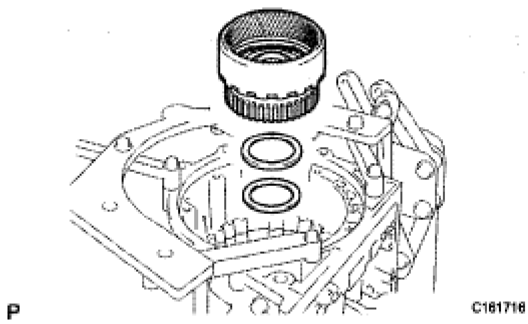

Fig. 456: Identifying Thrust Needle Roller Bearing And Thrust Bearing Race
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

72. **REMOVE FRONT PLANETARY RING GEAR**
    a. Using a screwdriver, remove the snap ring.

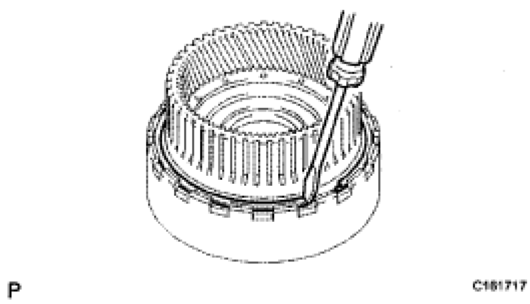

Fig. 457: Removing Front Planetary Ring Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the front planetary ring gear from the center planetary ring gear.

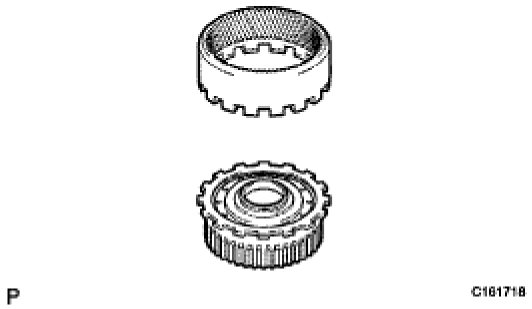

Fig. 458: Identifying Front Planetary Ring Gear And Center Planetary Ring Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

73. **REMOVE CENTER PLANETARY RING GEAR**

a. Using a screwdriver, remove the snap ring.

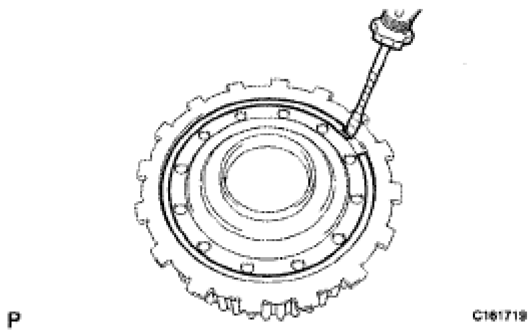

Fig. 459: Removing Snap Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the center planetary ring gear from the front planetary ring gear flange.

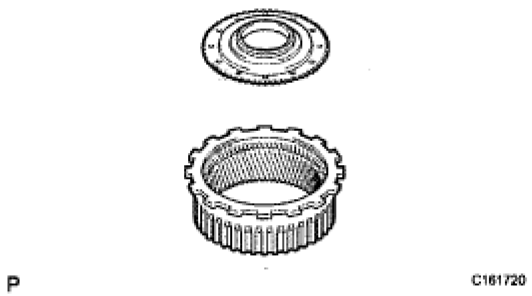

Fig. 460: Identifying Center Planetary Ring Gear And Front Planetary Ring Gear Flange
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

74. **REMOVE NO. 1 BRAKE DISC SET**

a. Remove the flange, 4 discs and 4 plates from the transmission case.

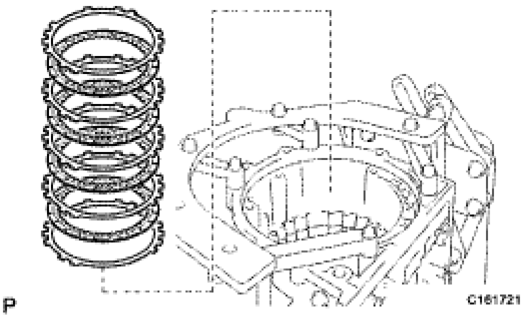

Fig. 461: Identifying Flange, Discs And Plates Transmission Case
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

75. **INSPECT NO. 1 BRAKE DISC** (see **INSPECTION**)
76. **REMOVE NO. 1 BRAKE CYLINDER WITH NO. 1 BRAKE PISTON**
    a. Place SST on the No. 1 brake piston return spring, and compress the return spring.

       SST 09380-60010 (09381-06010, 09381-06020, 09381-06050, 09381-06060, 09381-06090, 09381-06100, 09381-06110, 09381-06120)

    b. Using a screwdriver, remove the snap ring from the transmission case.

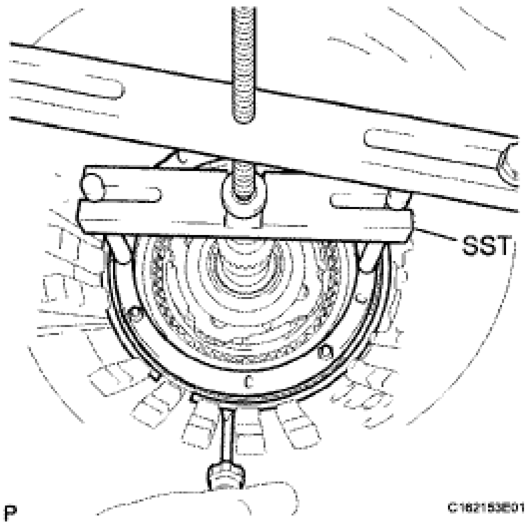

Fig. 462: Identifying No. 1 Brake Piston Return Spring, And Compress Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    c. Remove the brake piston return spring and No. 1 brake piston with No. 1 brake cylinder from the transmission case.

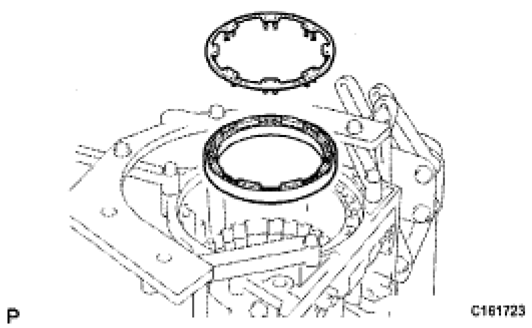

Fig. 463: Identifying Brake Piston Return Spring And No. 1 Brake Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

77. **INSPECT BRAKE PISTON RETURN SPRING SUB-ASSEMBLY** (see **INSPECTION**)
78. **REMOVE NO. 1 BRAKE PISTON**
    a. Hold the No. 1 brake piston and apply compressed air to the No. 1 brake cylinder to remove the No. 1 brake piston.

       HINT:

       If the piston does not pop out with compressed air, lift the piston out with needle-nose pliers.

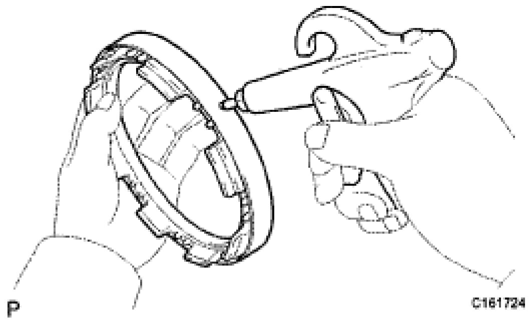

Fig. 464: Applying Compressed Air To No. 1 Brake Cylinder
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    b. Remove the 2 O-rings from the No. 1 brake piston.

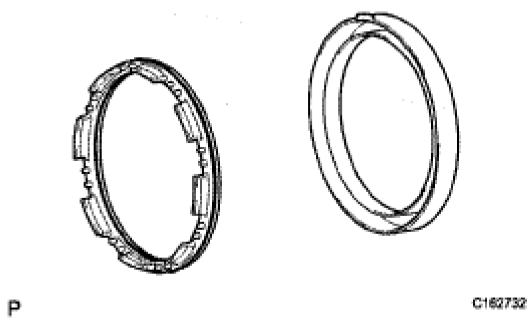

Fig. 465: Identifying O-rings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

79. **REMOVE NO. 2 BRAKE DISC SET**

a. Place SST on the No. 2 brake flange, and compress the return spring.

SST 09380-60010 (09381-06010, 09381-06020, 09381-06050, 09381-06070, 09381-06090, 09381-06120)

b. Using a screwdriver, remove the snap ring from the transmission case.

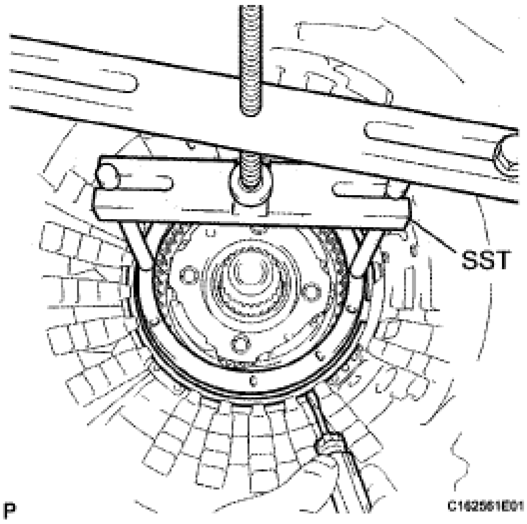

Fig. 466: Removing No. 2 Brake Disc Set Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Remove the 2 flanges, 4 discs, 3 plates and brake piston return spring from the transmission case.

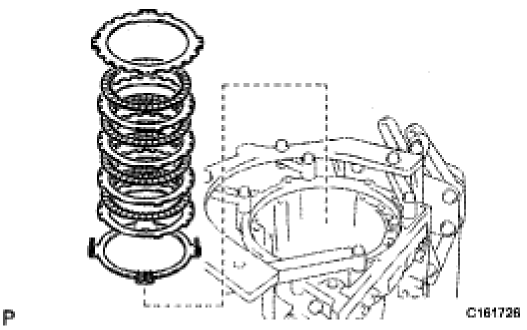

Fig. 467: Identifying Brake Piston Return Spring And Transmission Case
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

80. **INSPECT NO. 2 BRAKE DISC** (see INSPECTION)
81. **INSPECT NO. 2 BRAKE PISTON RETURN SPRING SUB-ASSEMBLY** (see INSPECTION)
82. **REMOVE CENTER PLANETARY GEAR ASSEMBLY**
    a. Remove the center planetary gear and planetary sun gear from the transmission case.

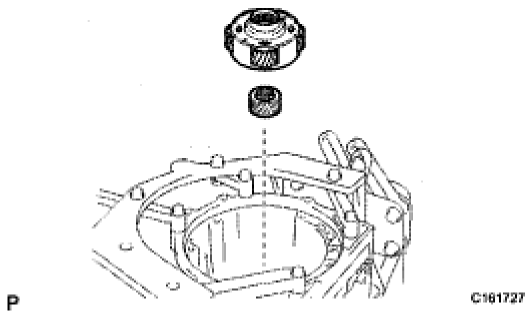

Fig. 468: Identifying Center Planetary Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

83. **INSPECT CENTER PLANETARY GEAR ASSEMBLY** (see **INSPECTION**)
84. **REMOVE NO. 2 BRAKE CYLINDER WITH NO. 2 BRAKE PISTON**
    a. Remove the No. 2 brake cylinder with the No. 2 brake piston from the transmission case.

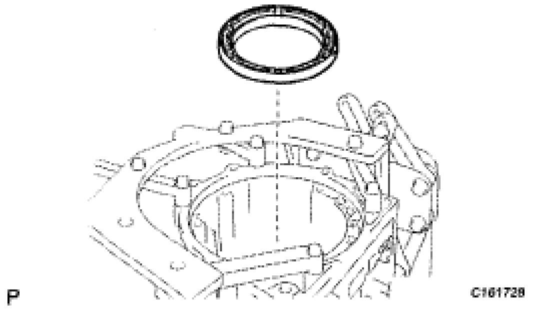

Fig. 469: Identifying No. 2 Brake Cylinder With No. 2 Brake Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

85. **REMOVE NO. 2 BRAKE PISTON**
    a. Hold the No. 2 brake piston and apply compressed air to the No. 2 brake cylinder to remove the No. 2 brake piston.

       HINT:

       If the piston does not pop out with compressed air, lift the piston out with needle-nose pliers.

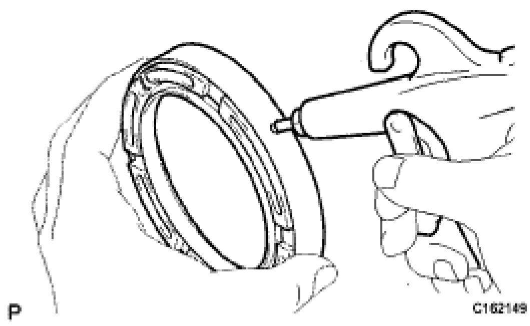

Fig. 470: Applying Compressed Air To No. 2 Brake Cylinder
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the 2 O-rings from the No. 2 brake piston.

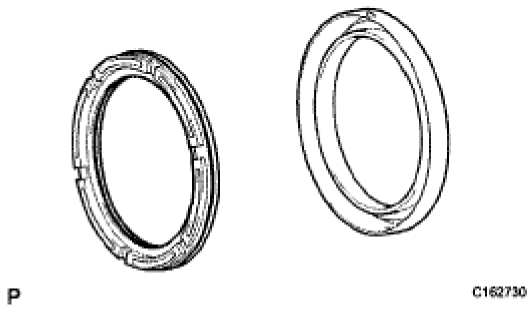

Fig. 471: Identifying O-Rings And No. 2 Brake Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

86. **REMOVE INTERMEDIATE SHAFT WITH NO. 3 1-WAY CLUTCH ASSEMBLY, REAR PLANETARY RING GEAR FLANGE AND REAR PLANETARY RING GEAR**

a. Using SST, remove the snap ring from the transmission case.

SST 09350-30020 (09350-07060)

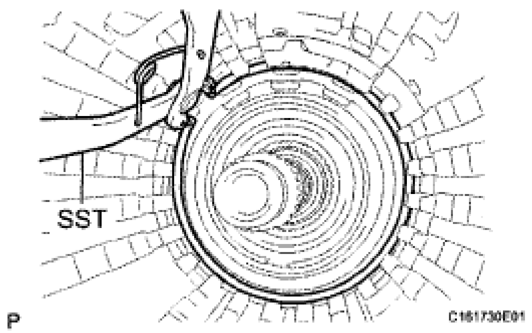

Fig. 472: Removing Snap Ring To Transmission Case
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the intermediate shaft with No. 3 1-way clutch, rear planetary ring gear flange and rear planetary ring gear from the transmission case.

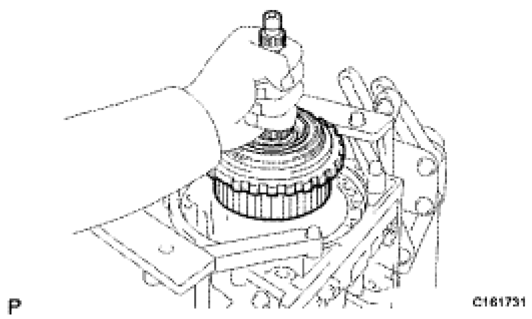

Fig. 473: Removing Intermediate Shaft With No. 3 1-Way Clutch
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

87. **INSPECT NO. 3 1-WAY CLUTCH ASSEMBLY** (see **INSPECTION**)

88. **REMOVE NO. 3 1-WAY CLUTCH ASSEMBLY**
   a. Remove the No. 3 1-way clutch and 1-way clutch inner race from the intermediate shaft.

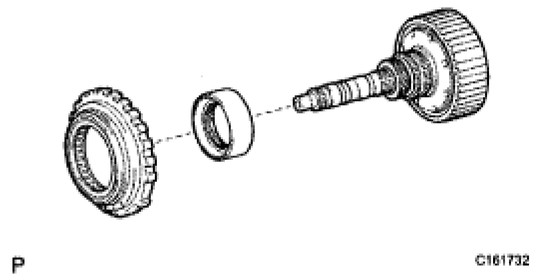

Fig. 474: Identifying No. 3 1-Way Clutch Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

89. **REMOVE REAR PLANETARY RING GEAR**
   a. Remove the rear planetary ring gear with rear planetary ring gear flange, 3 thrust bearing races and thrust needle roller bearing from the intermediate shaft.

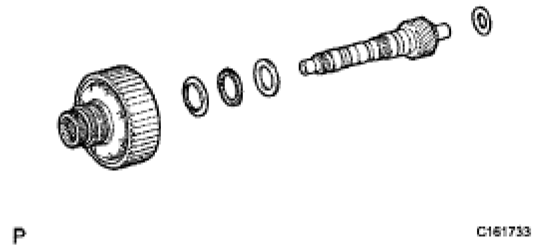

Fig. 475: Identifying Rear Planetary Ring Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Using a screwdriver, remove the snap ring.
   c. Remove the rear planetary ring gear flange from the rear planetary ring gear.

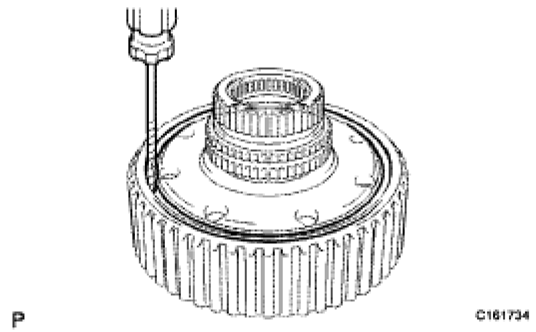

Fig. 476: Removing Rear Planetary Ring Gear Flange
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

90. **INSPECT INTERMEDIATE SHAFT** (see INSPECTION)
91. **REMOVE NO. 4 BRAKE DISC SET**
   a. Remove the 2 flanges, 7 discs and 6 plates from the transmission case.

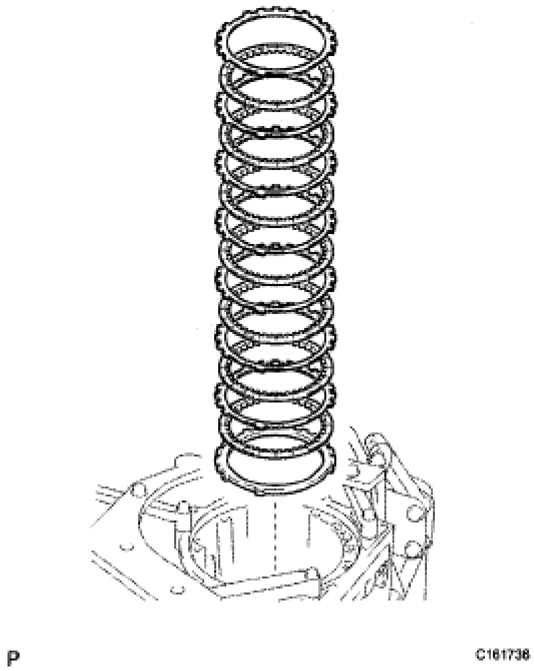

Fig. 477: Identifying Discs And Plates
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

92. **INSPECT NO. 4 BRAKE DISC** (see INSPECTION)
93. **REMOVE BRAKE PLATE STOPPER SPRING**

NOTE:	**When removing the stopper spring, do not apply excessive force and do not deform it.**

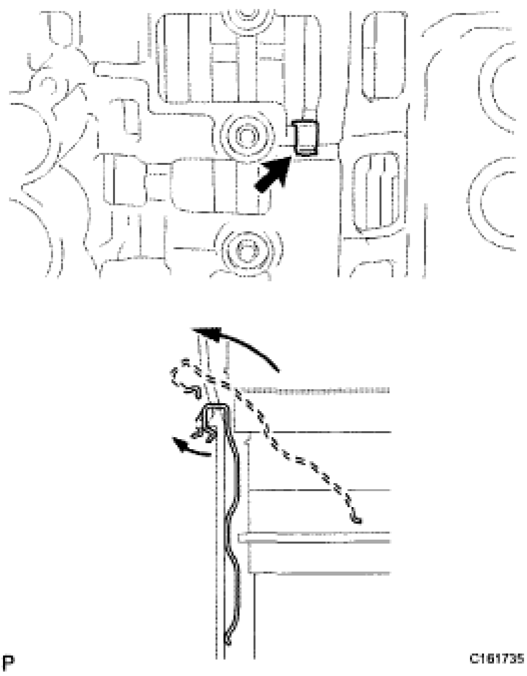

Fig. 478: Identifying Brake Plate Stopper Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

94. **REMOVE REAR PLANETARY GEAR ASSEMBLY**

a. Remove the rear planetary gear from the transmission case.

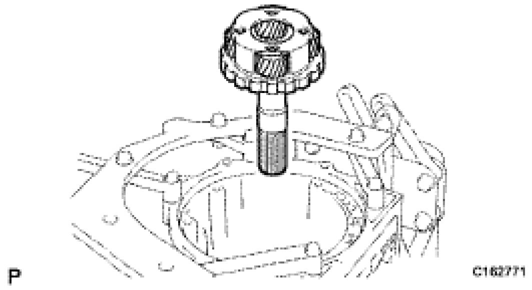

Fig. 479: Identifying Rear Planetary Gear To Transmission Case
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the 2 thrust needle roller bearings from the rear planetary gear.

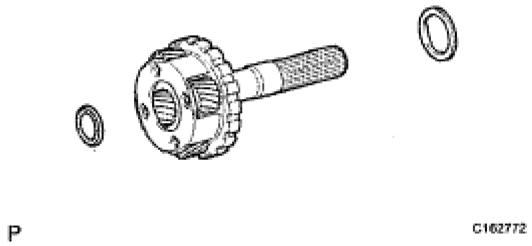

Fig. 480: Identifying Thrust Needle Roller Bearings To Rear Planetary Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Remove the thrust bearing race from the transmission case.

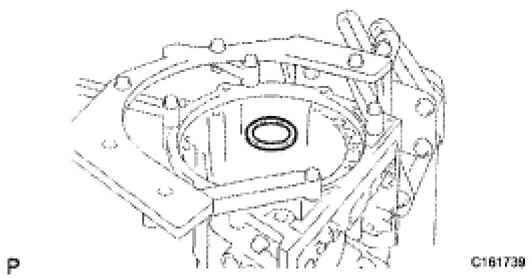

Fig. 481: Identifying Thrust Bearing Race To Transmission Case
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

95. **INSPECT REAR PLANETARY GEAR ASSEMBLY** (see INSPECTION)

96. **REMOVE 1ST AND REVERSE BRAKE PISTON**

a. Place SST on the spring retainer and compress the brake return spring.

SST 09380-60010 (09381 -06030, 09381 -06040, 09381-06080, 09381-06120, 09381-06130, 09381-05040, 09381-05050)

b. Using SST, remove the snap ring and brake return spring.

SST 09350-30020 (09350-07070)

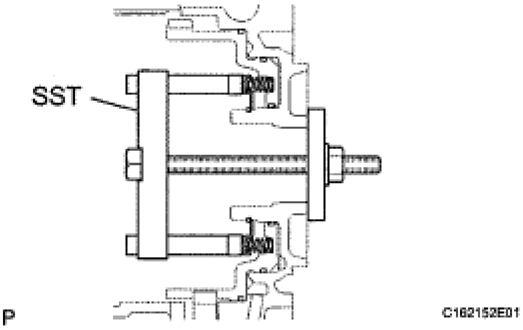

Fig. 482: Identifying Spring Retainer And Brake Return Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Hold the 1st and reverse brake piston and apply compressed air (392 kPa, 4.0 kgf/cm^2 , 57 psi) to the transmission case to remove the 1st and reverse brake piston.

HINT:

If the piston does not pop out with compressed air, lift the piston out with needle-nose pliers.

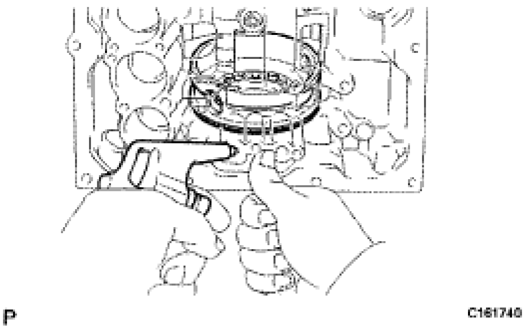

Fig. 483: Holding Reverse Brake Piston And Apply Compressed Air
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Remove the 3 O-rings from the 1st and reverse brake piston.

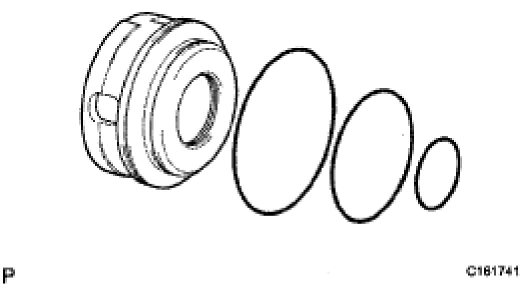

Fig. 484: Identifying Reverse Brake Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

97. **INSPECT 1ST AND REVERSE BRAKE RETURN SPRING SUB-ASSEMBLY** (see

INSPECTION)

INSPECTION

1. **INSPECT AUTOMATIC TRANSMISSION OIL PAN SUB-ASSEMBLY**
    a. Remove the magnets, and use them to collect steel particles.
    b. Carefully look at the foreign matter and particles in the pan and on the magnets to anticipate the type of wear you will find in the transmission.
        - Steel (magnetic): bearing, gear and clutch plate wear
        - Brass (non-magnetic): bush wear

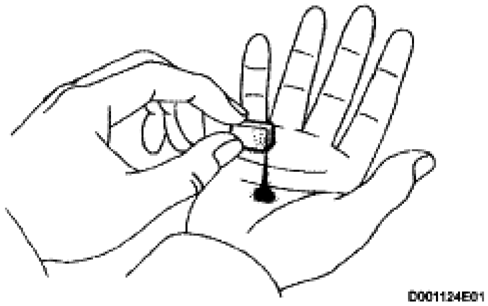

Fig. 485: Removing Magnets
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **INSPECT NO. 2 1 -WAY CLUTCH ASSEMBLY**
    a. Hold the reverse clutch hub and turn the 1-way clutch assembly. Check that the 1-way clutch turns freely clockwise and locks when turned counterclockwise.

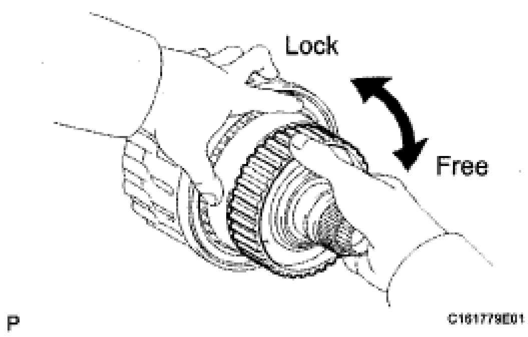

Fig. 486: Turning 1-Way Clutch Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **INSPECT REAR CLUTCH DISC**
    a. Replace all discs if one of the following problems is present: 1) a disc, plate or flange is worn or burnt, 2) the lining of a disc is peeled off or discolored, or 3) grooves have even a little bit of damage.

NOTE:	**Before assembling new discs, soak them in ATF for at least 2 hours.**

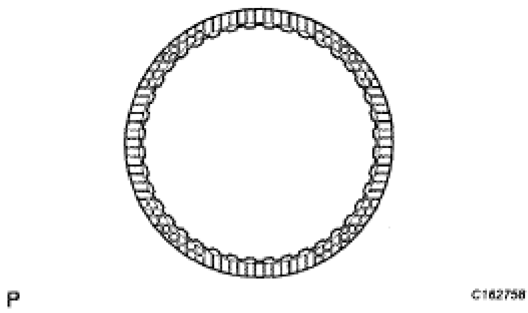

Fig. 487: Identifying Rear Clutch Disc
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. **INSPECT REVERSE CLUTCH HUB SUB-ASSEMBLY**
   a. Using a dial indicator, measure the inside diameter of the reverse clutch hub bush.

      Standard inside diameter:

      41.912 to 41.937 mm (1.410 to 1.411 in.)

      If the inside diameter is greater than the standard inside diameter, replace the reverse clutch hub.

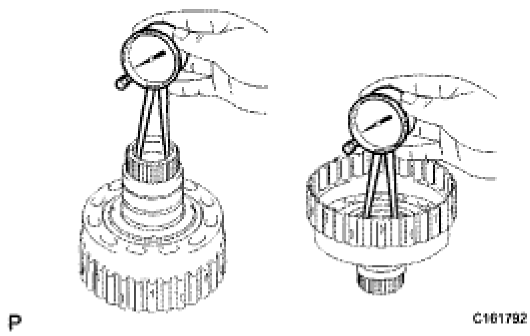

Fig. 488: Measuring Inside Diameter Of Reverse Clutch Hub Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. **INSPECT FORWARD CLUTCH HUB SUB-ASSEMBLY**
   a. Using a dial indicator, measure the inside diameter of the forward clutch hub bush.

      Standard inside diameter:

      30.200 to 30.225 mm (1.189 to 1.190 in.)

      If the inside diameter is greater than the standard, replace the forward clutch hub.

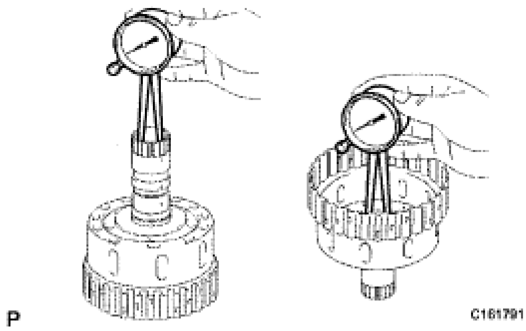

Fig. 489: Measuring Inside Diameter Of Forward Clutch Hub Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. **INSPECT NO. 4 1-WAY CLUTCH ASSEMBLY**
   a. Hold the coast clutch hub and turn the 1-way clutch assembly. Check that the 1 -way clutch turns freely clockwise and locks when turned counterclockwise.

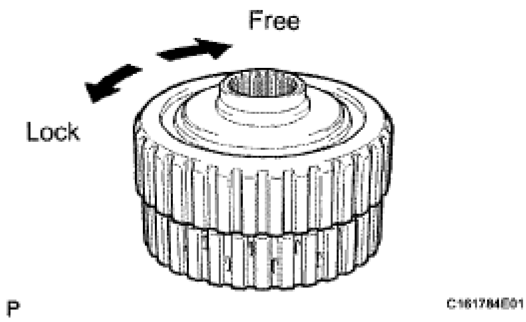

Fig. 490: Identifying No. 4 1-Way Clutch Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. **INSPECT FORWARD MULTIPLE DISC CLUTCH DISC**
   a. Replace all discs if one of the following problems is present: 1) a disc, plate or flange is worn or burnt, 2) the lining of a disc is peeled off or discolored, or 3) grooves or printed numbers have even a little bit of damage.

NOTE: **Before assembling new discs, soak them in ATF for at least 2 hours.**

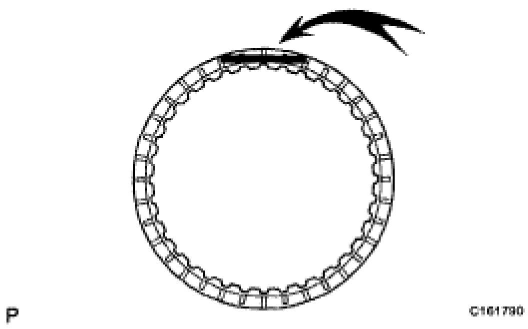

Fig. 491: Identifying Forward Multiple Disc Clutch Disc
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. **INSPECT COAST CLUTCH DISC**
    a. Replace all discs if one of the following problems is present: 1) a disc, plate or flange is worn or burnt, 2) the lining of a disc is peeled off or discolored, or 3) grooves or printed numbers have even a little bit of damage.

    NOTE: Before assembling new discs, soak them in ATF for at least 2 hours.

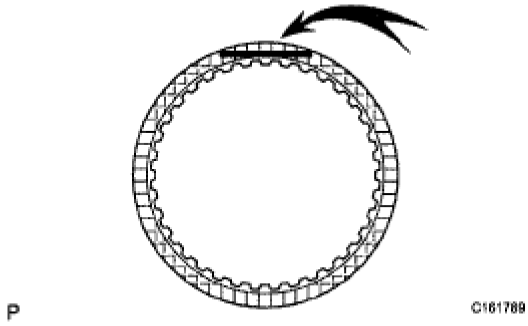

Fig. 492: Identifying Coast Clutch Disc
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. **INSPECT FORWARD CLUTCH RETURN SPRING SUB-ASSEMBLY**
    a. Using a vernier caliper, measure the free length of the spring together with the spring seat.

    Standard free length:

    29.65 mm (1.17 in.)

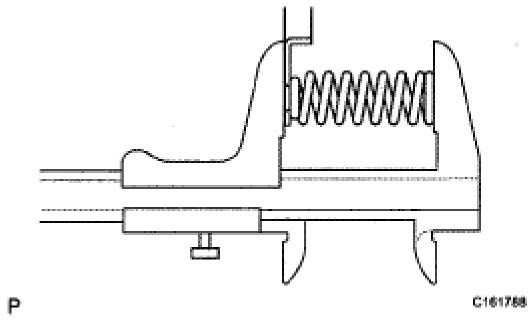

Fig. 493: Measuring Free Length Of Spring With Spring Seat
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. **INSPECT DIRECT CLUTCH DISC**
    a. Replace all discs if one of the following problems is present: 1) a disc, plate or flange is worn or burnt, 2) the lining of a disc is peeled off or discolored, or 3) grooves or printed numbers have even a little bit of damage.

    NOTE: Before assembling new discs, soak them in ATF for at least 2 hours.

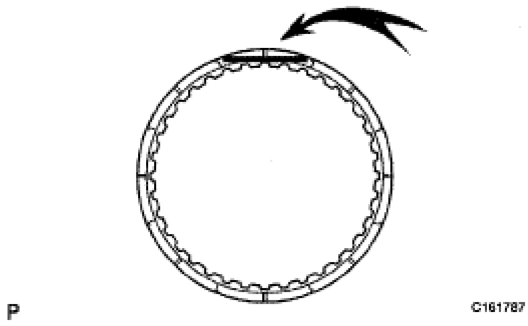

Fig. 494: Identifying Direct Clutch Disc
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. **INSPECT REVERSE CLUTCH RETURN SPRING SUB-ASSEMBLY**
    a. Using a vernier caliper, measure the free length of the spring together with the spring seat.

    Standard free length:

    21.24 mm (0.836 in.)

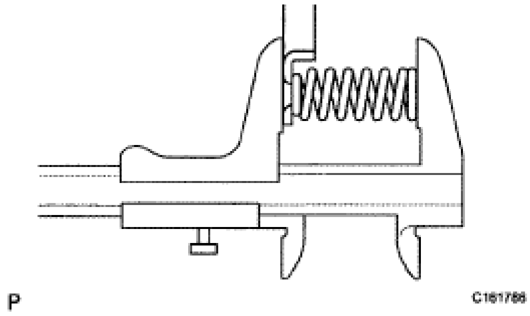

Fig. 495: Measuring Free Length Of Spring With Spring Seat
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. **INSPECT DIRECT CLUTCH RETURN SPRING SUB-ASSEMBLY**
    a. Using a vernier caliper, measure the free length of the spring together with the spring seat.

    Standard free length:

    19.46 mm (0.766 in.)

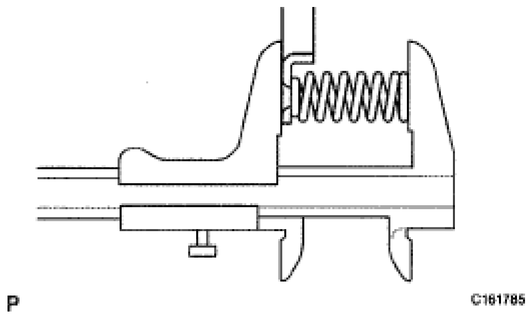

Fig. 496: Measuring Free Length Of Spring With Spring Seat

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

13. **INSPECT NO. 3 BRAKE DISC**
    a. Replace all discs if one of the following problems is present: 1) a disc, plate or flange is worn or burnt, 2) the lining of a disc is peeled off or discolored, or 3) grooves or printed numbers have even a little bit of damage.

NOTE: Before assembling new discs, soak them in ATF for at least 2 hours.

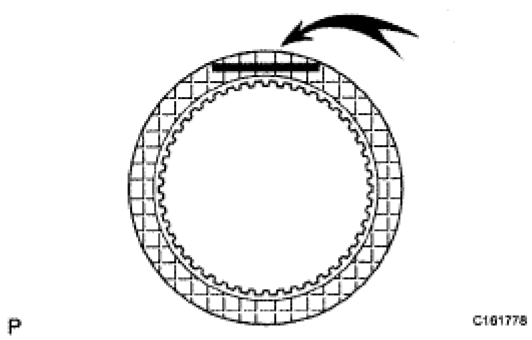

Fig. 497: Identifying No. 3 Brake Disc
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. **INSPECT NO. 3 BRAKE PISTON RETURN SPRING SUB-ASSEMBLY**
    a. Using a vernier caliper, measure the free length of the spring together with the spring seat.

Standard free length:

15.72 mm (0.619 in.)

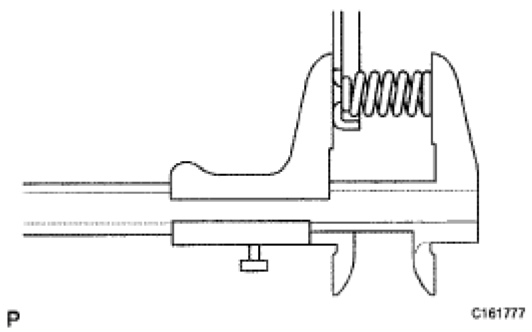

Fig. 498: Measuring Free Length Of Spring With Spring Seat
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. **INSPECT FRONT PLANETARY GEAR ASSEMBLY**
    a. Using a feeler gauge, measure the front planetary pinion gear thrust clearance.

Standard clearance:

0.2 to 0.6 mm (0.00787 to 0.0236 in.)

If the clearance is greater than the standard, replace the front planetary gear assembly.

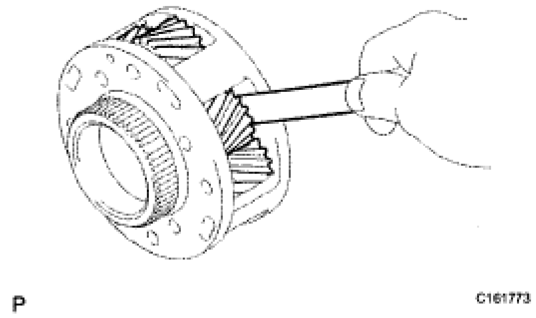

Fig. 499: Measuring Front Planetary Pinion Gear Thrust Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Using a cylinder gauge, measure the inside diameter of the front planetary gear bush.

Standard inside diameter:

61.005 to 61.030 mm (2.402 to 2.403 in.)

If the inside diameter is greater than the standard, replace the front planetary gear.

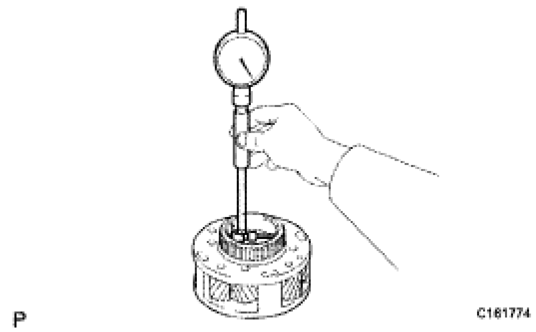

Fig. 500: Measuring Inside Diameter Of Front Planetary Gear Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. **INSPECT 1-WAY CLUTCH ASSEMBLY**
    a. Install the 1-way clutch to the 1-way clutch inner race.
    b. Hold the 1-way clutch inner race and turn the 1-way clutch. Check that the 1-way clutch turns freely counterclockwise and locks when turned clockwise.
    c. Remove the 1-way clutch from the 1-way clutch inner race.

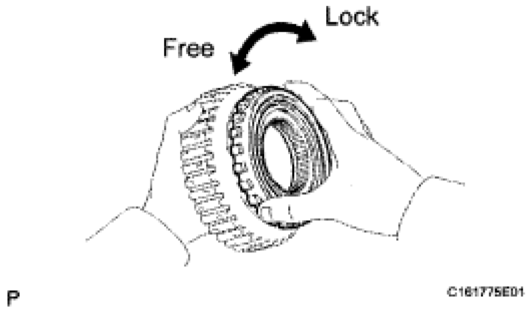

Fig. 501: Identifying 1-Way Clutch Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. **INSPECT NO. 1 BRAKE DISC**
    a. Replace all discs if one of the following problems is present: 1) a disc, plate or flange is worn or burnt, 2) the lining of a disc is peeled off or discolored, or 3) grooves or printed numbers have even a little bit of damage.

NOTE: **Before assembling new discs, soak them in ATF for at least 2 hours.**

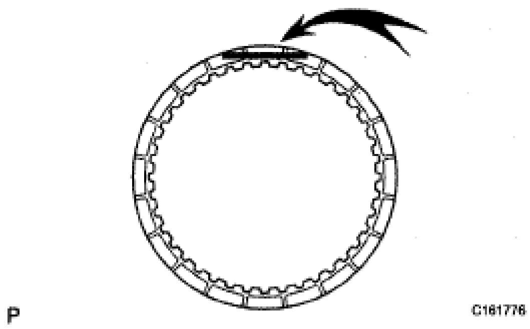

Fig. 502: Identifying No. 1 Brake Disc
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

18. **INSPECT BRAKE PISTON RETURN SPRING SUB-ASSEMBLY**
    a. Using a vernier caliper, measure the free length of the spring together with the spring seat.

Standard free length:

17.05 mm (0.671 in.)

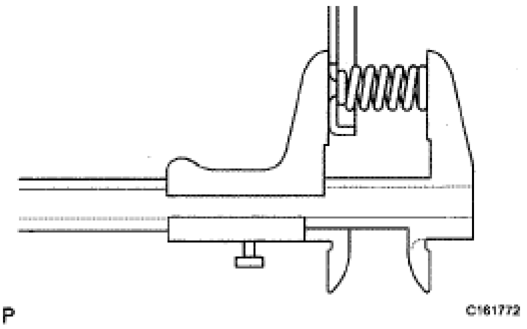

Fig. 503: Measuring Free Length Of Spring With Spring Seat
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. **INSPECT NO. 2 BRAKE DISC**
    a. Replace all discs if one of the following problems is present: 1) a disc, plate or flange is worn or burnt, 2) the lining of a disc is peeled off or discolored, or 3) grooves or printed numbers have even a little bit of damage.

NOTE: Before assembling new discs, soak them in ATF for at least 2 hours.

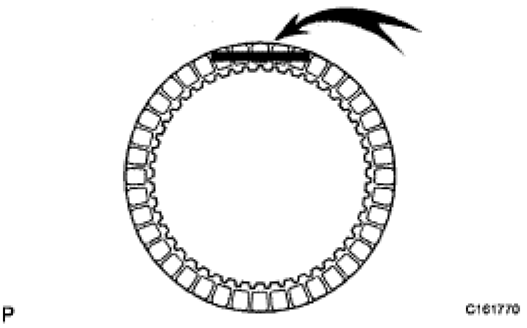

Fig. 504: Identifying No. 2 Brake Disc
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. **INSPECT NO. 2 BRAKE PISTON RETURN SPRING SUB-ASSEMBLY**
    a. Using a vernier caliper, measure the free length of the spring together with the spring seat.

    Standard free length:

    22.66 mm (0.892 in.)

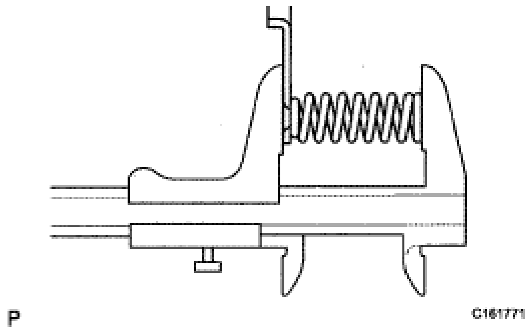

Fig. 505: Identifying No. 2 Brake Piston Return Spring Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

21. **INSPECT CENTER PLANETARY GEAR ASSEMBLY**
    a. Using a feeler gauge, measure the center planetary gear pinion thrust clearance.

       Standard clearance:

       0.20 to 0.60 mm (0.00787 to 0.0236 in.)

       If the clearance is greater than the standard, replace the center planetary gear assembly.

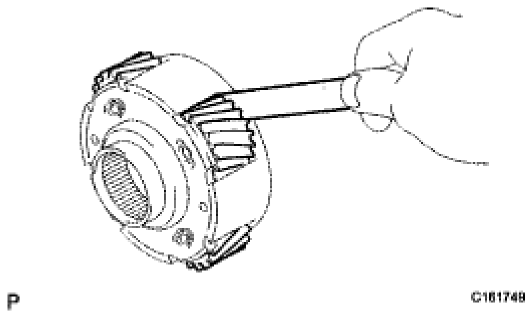

Fig. 506: Measuring Center Planetary Gear Pinion Thrust Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

22. **INSPECT NO. 3 1-WAY CLUTCH ASSEMBLY**
    a. Hold the rear planetary ring gear flange and turn the 1-way clutch. Check that the 1-way clutch turns freely counterclockwise and locks when turned clockwise.

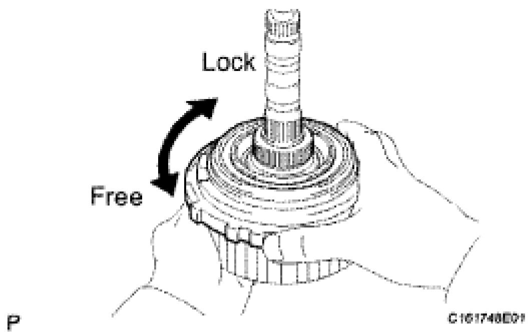

Fig. 507: Holding Rear Planetary Ring Gear Flange And Turn 1-Way Clutch

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

23. **INSPECT INTERMEDIATE SHAFT**
   a. Using a dial indicator, check the intermediate shaft runout.

   Standard runout:

   0.03 mm (0.00118 in.)

   If the runout is greater than the standard, replace the intermediate shaft with a new one.

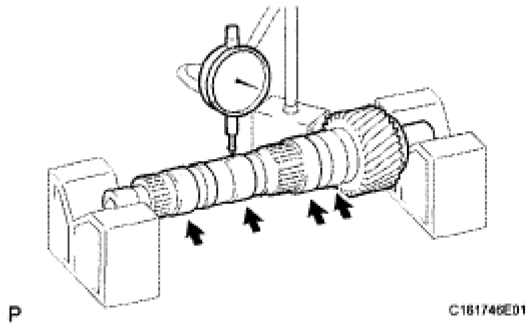

Fig. 508: Identifying Intermediate Shaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Using a micrometer, check the outer diameter of the intermediate shaft at the positions shown in the diagram.

   Standard diameter:

   A:

   19.963 to 19.976 mm (0.7859 to 0.7865 in.)

   B, C:

   30.150 to 30.163 mm (1.187 to 1.188 in.)

   D, E:

   36.404 to 36.420 mm (1.433 to 1.434 in.)

   If the diameter is less than the standard, replace the intermediate shaft with a new one.

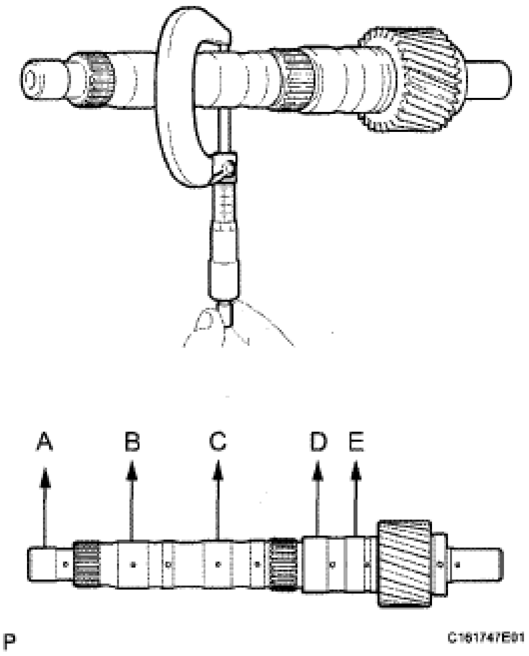

Fig. 509: Checking Outer Diameter Of Intermediate Shaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

24. **INSPECT NO. 4 BRAKE DISC**
    a. Replace all discs if one of the following problems is present: 1) a disc, plate or flange is worn or burnt, 2) the lining of a disc is peeled off or discolored, or 3) grooves or printed numbers have even a little bit of damage.

    NOTE: Before assembling new discs, soak them in ATF for at least 2 hours.

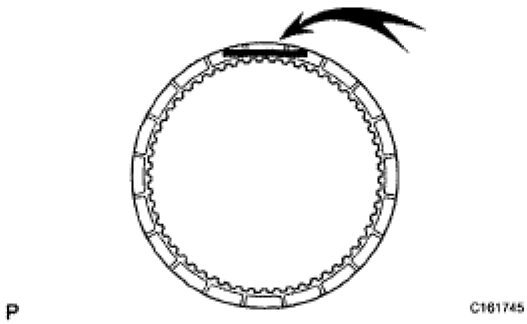

Fig. 510: Identifying No. 4 Brake Disc
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

25. **INSPECT REAR PLANETARY GEAR ASSEMBLY**
    a. Using a feeler gauge, measure the rear planetary gear pinion thrust clearance.

    Standard clearance:

    0.2 to 0.6 mm (0.00787 to 0.0236 in.)

If the clearance is greater than the standard, replace the planetary gear assembly.

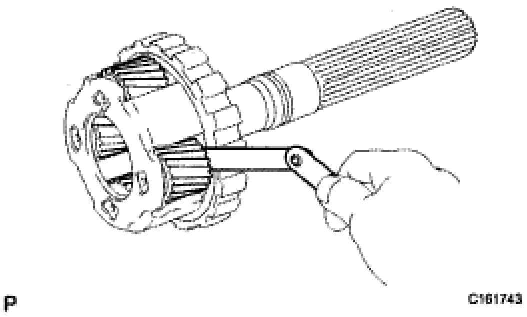

Fig. 511: Measuring Rear Planetary Gear Pinion Thrust Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Using a dial indicator, measure the inside diameter of the rear planetary gear bush.

Standard inside diameter:

20.0 to 20.025 mm (0.787 to 0.788 in.)

If the inside diameter is greater than the standard, replace the rear planetary gear assembly.

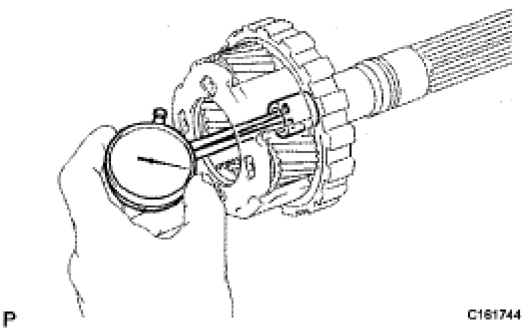

Fig. 512: Measuring Inside Diameter Of Rear Planetary Gear Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

26. **INSPECT 1ST AND REVERSE BRAKE RETURN SPRING SUB-ASSEMBLY**

a. Using a vernier caliper, measure the free length of the spring together with the spring seat.

Standard free length:

23.54 to 23.94 mm (0.927 to 0.943 in.)

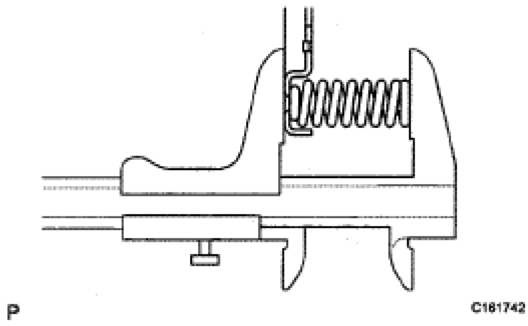

Fig. 513: Measuring Free Length Of Spring With Spring Seat
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

27. **INSPECT INDIVIDUAL PISTON OPERATION**
    a. Check the operating sound while applying compressed air into the oil holes indicated in the illustration.

    HINT:

    When inspecting the direct clutch, check with the C3 accumulator piston holes indicated in the illustration. If there is no sound, disassemble and check the installation condition of the parts.

    1. No. 2 clutch (C2)
    2. No. 3 clutch (C3)
    3. No. 4 clutch (C4)
    4. No. 1 clutch (C1)
    5. No. 3 brake (B3)
    6. No. 1 brake (B1)
    7. No. 2 brake (B2)
    8. No. 4 brake (B4)

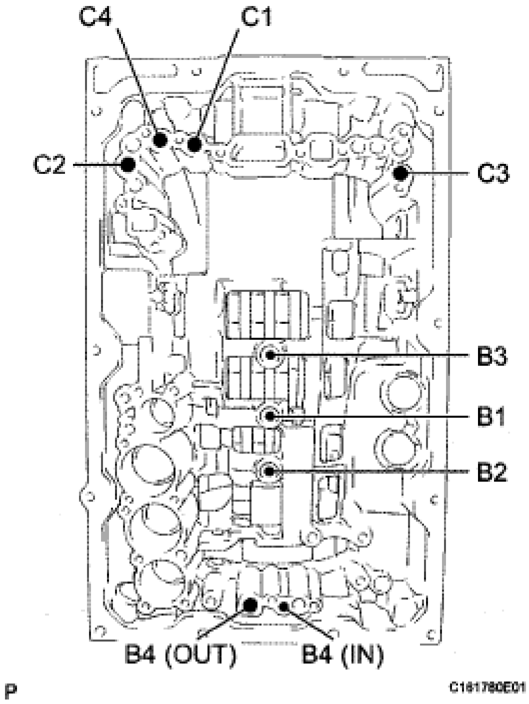

Fig. 514: Identifying Individual Piston Operation
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REASSEMBLY

1. **BEARING POSITION**

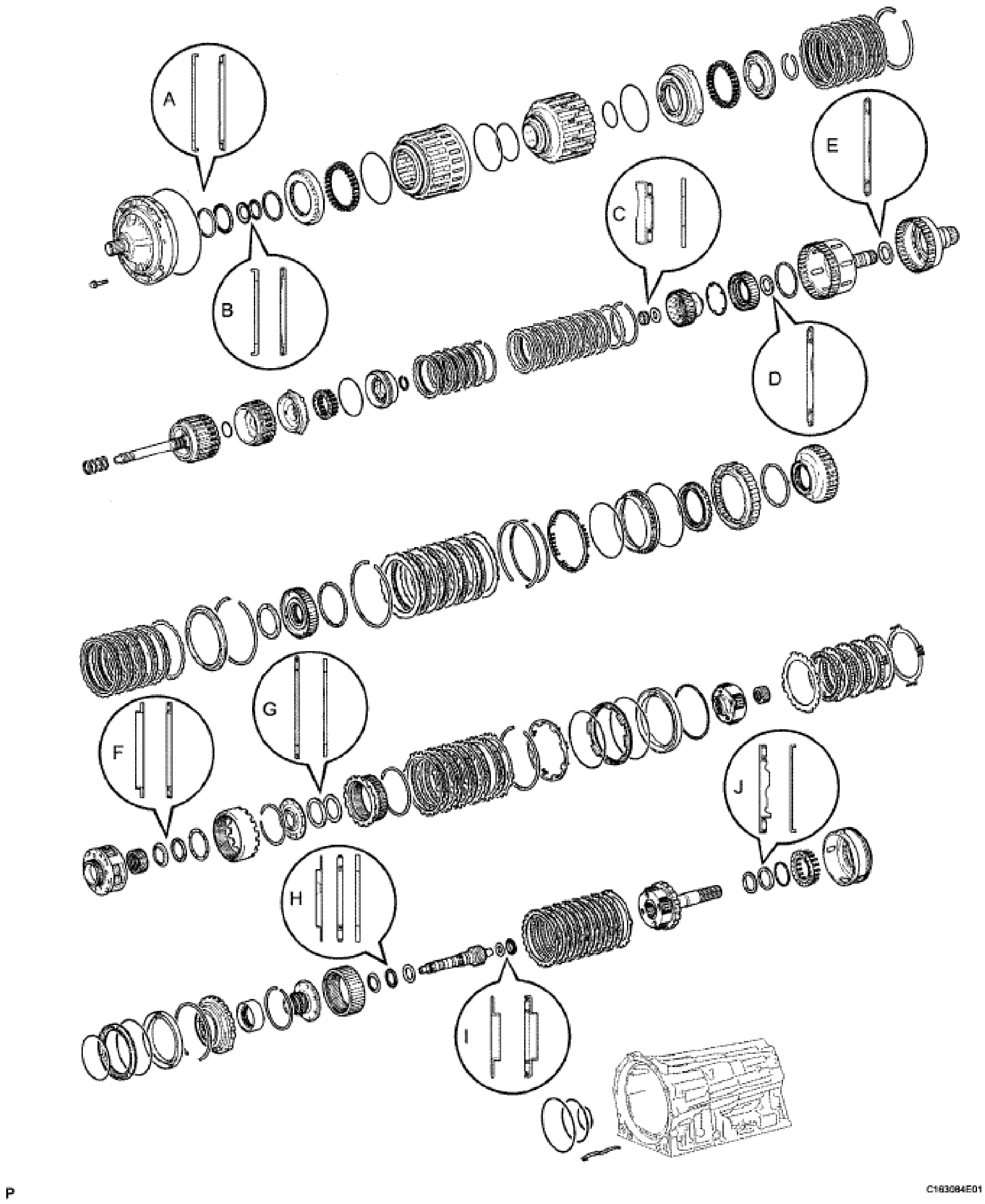

Fig. 515: Exploded View Of Bearing Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Bearing and race diameter

BEARING AND RACE DIAMETER SPECIFICATIONS

Mark	Front Race Diameter Inside / Outside	Thrust Bearing Diameter Inside / Outside	Rear Race Diameter Inside / Outside
A	74.3 to 74.6 mm (2.93 to 2.94 in.) / 87.4 to 87.7 mm (3.44 to 3.45 in.)	72.0 to 72.3 mm (2.83 to 2.85 in.) / 85.3 to 85.6 mm (3.36 to 3.37 in.)	-
	38.0 to 38.3 mm (1.50 to 1.51	36.5 to 36.7 mm (1.437 to	

B	in.) / 53.9 to 54.1 mm (2.12 to 2.13 in.)	1.445 in.) / 52.9 to 53.2 mm (2.08 to 2.09 in.)	-
C	-	21.1 to 21.3 mm (0.83 to 0.84 in.) / 39.5 to 39.8 mm (1.56 to 1.57 in.)	22.8 to 23.1 mm (0.898 to 0.909 in.) / 44.5 to 44.8 mm (1.75 to 1.76 in.)
D	-	39.5 to 39.7 mm (1.555 to 1.563 in.) / 60.5 to 60.8 mm (2.38 to 2.39 in.)	-
E	-	46.5 to 46.7 mm (1.83 to 1.84 in.) / 64.4 to 64.6 mm (2.535 to 2.543 in.)	-
F	55.0 to 55.2 mm (2.165 to 2.173 in.) / 68.8 to 69.3 mm (2.71 to 2.73 in.)	54.6 to 54.8 mm (2.15 to 2.16 In.) / 70.0 to 70.5 mm (2.76 to 2.78 in.)	-
G	-	65.4 to 65.6 mm (2.57 to 2.58 in.) / 85.6 to 86.0 mm (3.37 to 3.39 in.)	62.9 to 63.1 mm (2.476 to 2.484 in.) / 82.3 to 82.6 mm (3.24 to 3.25 in.)
H	39.5 to 39.8 mm (1.56 to 1.57 in.) / 56.9 to 57.2 mm (2.24 to 2.25 in.)	36.5 to 36.6 mm (1.437 to 1.441 in.) / 56.8 to 57.1 mm (2.24 to 2.25 in.)	36.5 to 36.7 mm (1.437 to 1.445 in.) / 56.7 to 57.2 mm (2.23 to 2.25 in.)
1	21.1 to 21.3 mm (0.831 to 0.839 in.) / 39.9 to 40.1 mm (1.57 to 1.58 in.)	23.0 to 23.3 mm (0.906 to 0.917 in.) / 44.0 to 44.2 mm (1.73 to 1.74 in.)	-
J	-	43.6 to 43.9 mm (1.72 to 1.73 in.)/63.0 to 63.2 mm (248 to 2.49 in.)	47.2 to 47.4 mm (1.86 to 1.87 in.) / 67.1 to 67.4 mm (2.64 to 2.65 in.)

2. **INSTALL 1ST AND REVERSE BRAKE PISTON**
   a. Coat 3 new O-rings with ATF, and install them to the 1st and reverse brake piston.

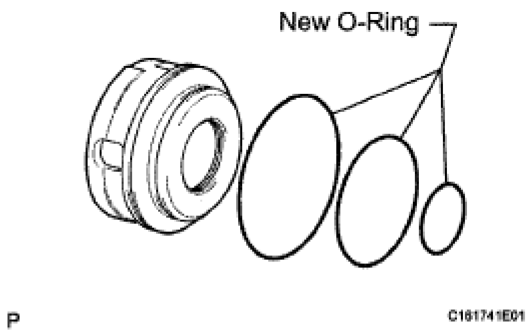

Fig. 516: Identifying O-Rings With ATF
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Install the 1st and reverse brake piston to the transmission case.

NOTE:

- **Be careful not to damage the O-ring.**
- **Make sure that the parking hole of the brake piston is on the bottom side by engaging the brake piston's protrusion to the**

transmission case's spline grooves.

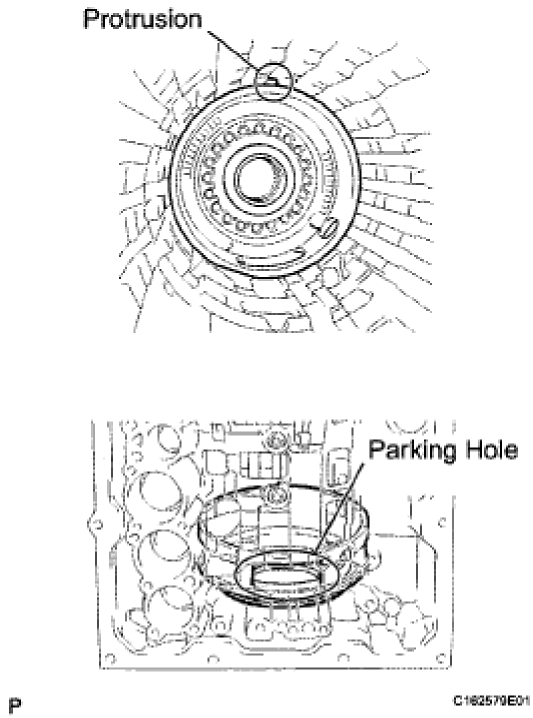

Fig. 517: Identifying Piston Protrusion And Parking Hole Of Brake Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **INSTALL 1ST AND REVERSE BRAKE RETURN SPRING SUB-ASSEMBLY**
   a. Place the brake return spring onto the 1st and reverse brake piston.

   SST 09380-60010 (09381-06030, 09381-06040, 09381-06080, 09381-06120, 09381-06130, 09381-05040, 09381-05050)

   b. Place SST on the spring retainer, and compress the return spring.
   c. Using SST, install the snap ring.

   SST 09350-30020 (09350-07070)

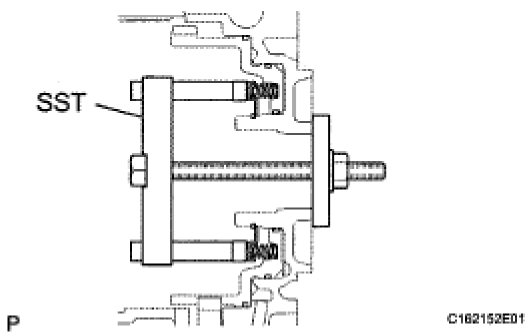

Fig. 518: Identifying SST On Spring Retainer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. **SELECT NO. 4 BRAKE FLANGE**
   a. Measure distance A (from the tip of the 1st and reverse brake piston to the step in the transmission case) in the illustration. *1

      HINT:

      Standard distance A: 27.82 to 28.42 mm (1.09 to 1.12 in.)

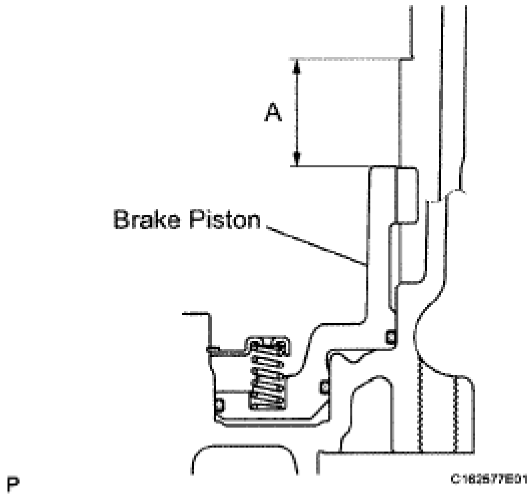

Fig. 519: Identifying Distance A
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Assemble the No. 4 brake flange, 7 No. 4 brake discs and 6 No. 4 brake plates, and measure distance B in the illustration. *2

      HINT:

      Standard distance B: 25.98 to 27.01 mm (1.02 to 1.06 in.)

   c. Measure length H of the No. 4 brake selective flange in the illustration.
   d. Apply the A and B measurements taken in *1 and *2 to the graph below. Use A for the X axis and B for the Y axis, and then choose the flange indicated by the graph point.

      HINT:

      Make sure that when the B measurement and selected flange's H dimension are subtracted from the A measurement, the value is 0.961 to 1.261 mm (0.0378 to 0.0495 in.).

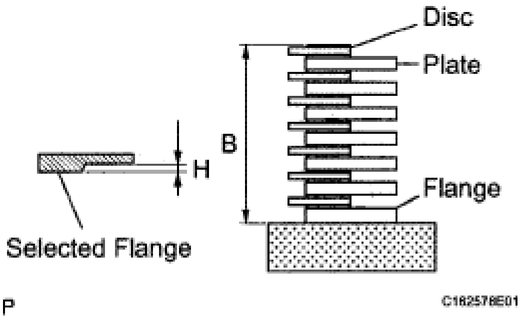

Fig. 520: Identifying Distance B
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

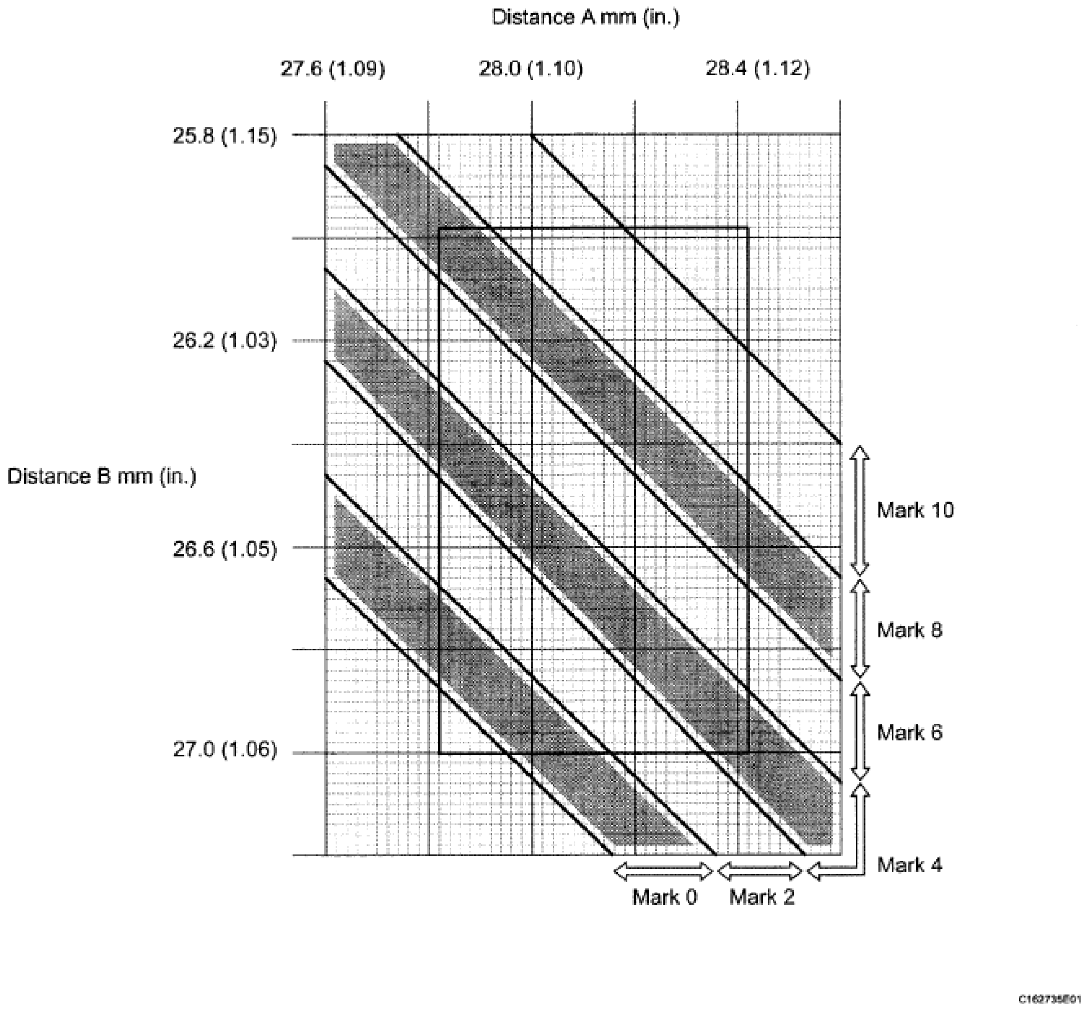

Fig. 521: A And B Measurement Graph
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

No. 4 brake selective flange length H

THICKNESS SPECIFICATIONS

Mark	Thickness
0	0 mm (0 in.)

2	0.15 to 0.25 mm (0.00590 to 0.00984 in.)
4	0.35 to 0.45 mm (0.0138 to 0.0177 in.)
6	0.55 to 0.65 mm (0.0217 to 0.0256 in.)
8	0.75 to 0.85 mm (0.0295 to 0.0335 in.)
10	0.95 to 1.05 mm (0.0374 to 0.0413 in.)

5. **INSTALL REAR PLANETARY GEAR ASSEMBLY**
    a. Install the thrust bearing race.

    HINT:

    Use a small amount of MP grease to make the thrust bearing race stay securely in place.

    Bearing race diameter

    BEARING RACE DIAMETER SPECIFICATIONS

Item	Inside	Outside
Race J	47.2 to 47.4 mm (1.86 to 1.87 in.)	67.1 to 67.4 mm (2.64 to 2.65 in.)

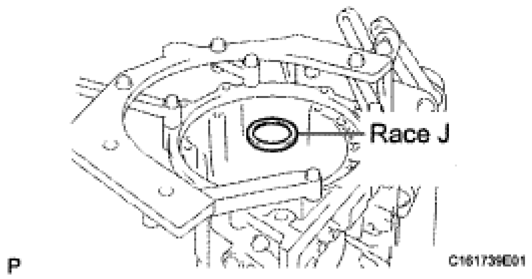

Fig. 522: Identifying Race J
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    b. Install the 2 thrust needle roller bearings to the rear planetary gear.

    Bearing diameter

    BEARING DIAMETER SPECIFICATIONS

Item	Inside	Outside
Bearing	23.0 to 23.3 mm (0.906 to 0.917 in.)	44.0 to 44.2 mm (1.73 to 1.74 in.)
Bearing J	43.6 to 43.9 mm (1.72 to 1.73 in.)	63.0 to 63.2 mm (2.48 to 2.49 in.)

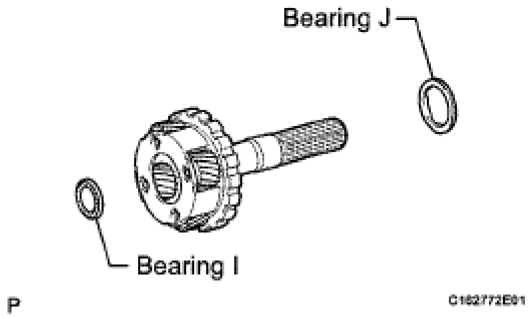

Fig. 523: Identifying Bearing I And J
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

Use a small amount of MP grease to make the thrust bearing stay securely in place.

c. Install the rear planetary gear assembly.

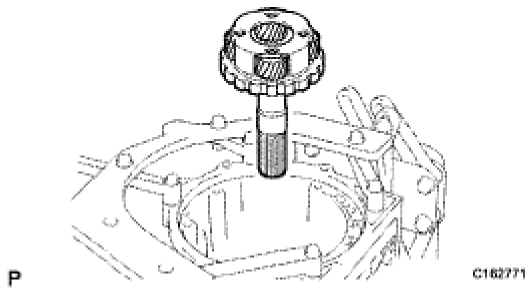

Fig. 524: Identifying Rear Planetary Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. **INSTALL BRAKE PLATE STOPPER SPRING**

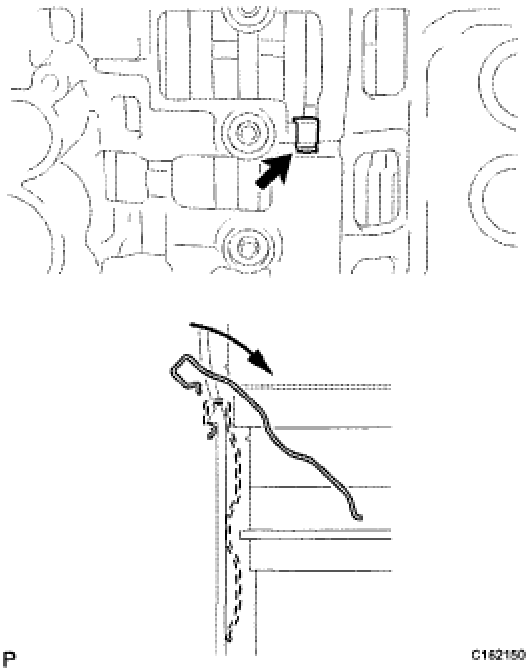

Fig. 525: Identifying Brake Plate Stopper Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. **INSTALL REAR PLANETARY RING GEAR**
   a. Install the rear planetary ring gear flange on the rear planetary ring gear.
   b. Using a screwdriver, install the snap ring.

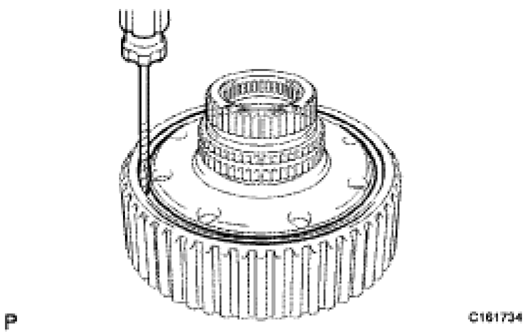

Fig. 526: Installing Snap Ring Using Screwdriver
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   c. Install the 3 thrust bearing races, thrust needle roller bearing and planetary ring gear with the rear planetary ring gear flange to the intermediate shaft.

   HINT:

   Use a small amount of MP grease to make the thrust bearing and race stay securely in place.

   Bearing and race diameter

   BEARING AND RACE DIAMETER SPECIFICATIONS

Item	Inside	Outside
Front race H	39.5 to 39.8 mm (1.56 to 1.57 in.)	56.9 to 57.2 mm (2.24 to 2.25 in.)
Bearing H	36.5 to 36.6 mm (1.437 to 1.441 in.)	56.8 to 57.1 mm (2.24 to 2.25 in.)
Rear race H	36.5 to 36.7 mm (1.437 to 1.445 in.)	56.7 to 57.2 mm (2.23 to 2.25 in.)
Race I	21.1 to 21.3 mm (0.831 to 0.839 in.)	39.9 to 40.1 mm (1.57 to 1.58 in.)

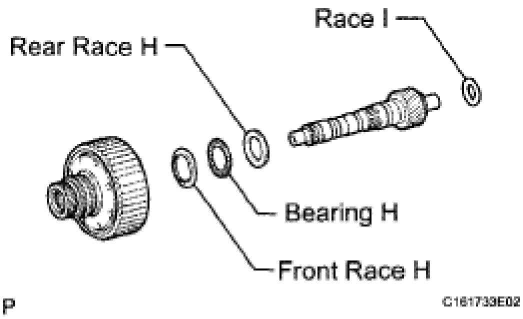

Fig. 527: Identifying Thrust Bearing Races
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. **INSTALL INTERMEDIATE SHAFT WITH REAR PLANETARY RING GEAR FLANGE AND REAR PLANETARY RING GEAR**
   a. Install the intermediate shaft with rear planetary ring gear flange and rear planetary ring gear to the transmission case.

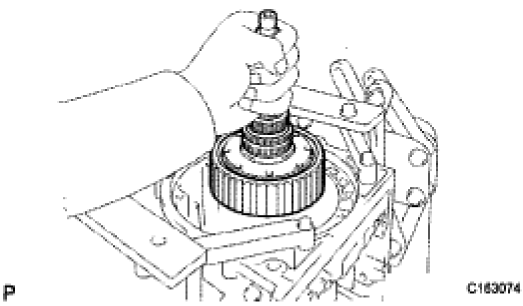

Fig. 528: Installing Intermediate Shaft With Rear Planetary Ring Gear Flange And Rear Planetary Ring Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. **INSTALL NO. 4 BRAKE DISC**
   a. Install the flange, 7 discs, 6 plates and selected flange.

   Install in order:

   F - D - P - D - P - D - P - D - P - D - P - D - P - D - S/F

   HINT:

   F = Flange

   D = Disc

P = Plate

S/F = Selected flange

NOTE: **Before assembling new discs, soak them in ATF for at least 2 hours.**

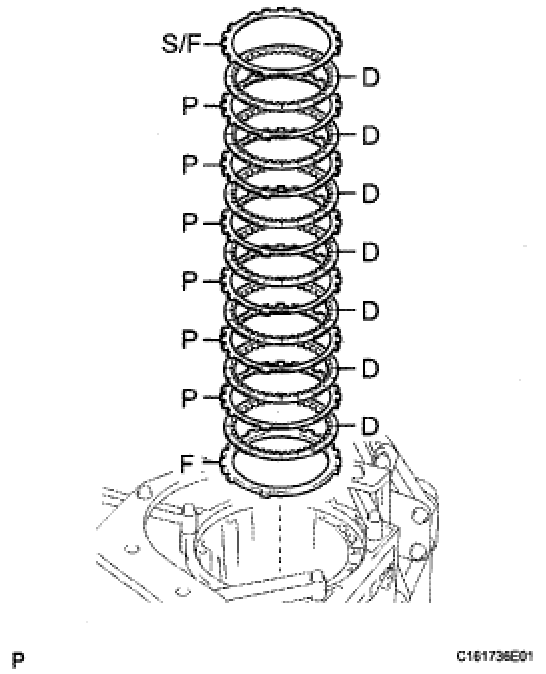

Fig. 529: Identifying Flange, Discs And Plates
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. **INSTALL NO. 3 1-WAY CLUTCH INNER RACE**
    a. Install the 1 -way clutch inner race to the No. 3 1 -way clutch assembly.

NOTE: **Do not mistake the direction of the 1-way clutch inner race.**

11. **INSPECT NO. 3 1-WAY CLUTCH ASSEMBLY** (see INSPECTION)

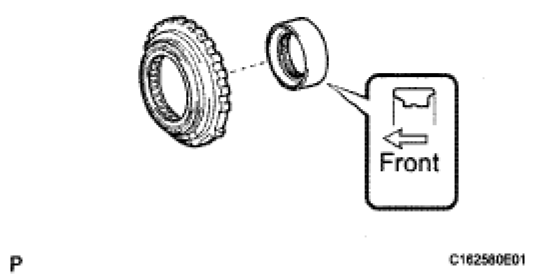

Fig. 530: Position Of Installing No. 3 1-Way Clutch Inner Race
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. **INSTALL NO. 3 1-WAY CLUTCH ASSEMBLY**

a. Install the 1 -way clutch assembly to the transmission case.

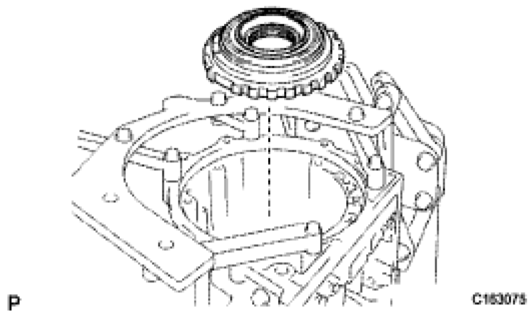

Fig. 531: Identifying No. 3 1-Way Clutch Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Using SST, install the snap ring.

SST 09350-30020 (09350-07060)

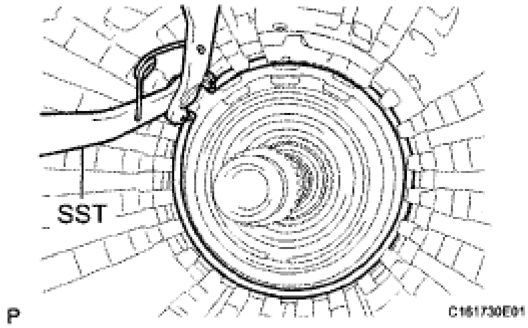

Fig. 532: Identifying SST For Installing Snap Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. **INSTALL NO. 2 BRAKE PISTON**

a. Coat 2 new O-rings with ATF, and install them to the brake piston.
b. Press the brake piston into the brake cylinder with both hands.

NOTE: Be careful not to damage the O-rings.

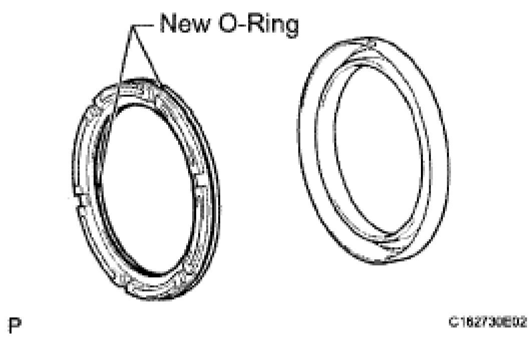

Fig. 533: Identifying O-Rings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. **INSTALL NO. 2 BRAKE CYLINDER WITH NO. 2 BRAKE PISTON**
    a. Install the No. 2 brake cylinder with piston to the transmission case.

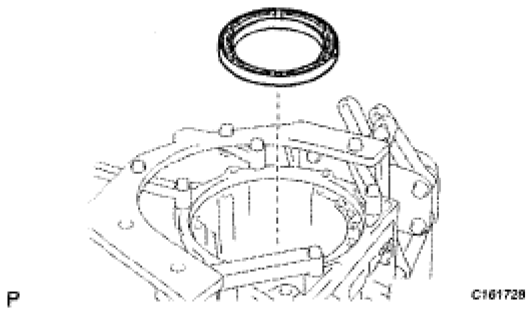

Fig. 534: Identifying No. 2 Brake Cylinder With No. 2 Brake Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:

- **When installing the No. 2 brake cylinder with piston to the transmission case, align and install the cylinder's claw to the case's top groove.**
- **Make sure the No. 2 brake cylinder with piston is securely inserted into the transmission case.**

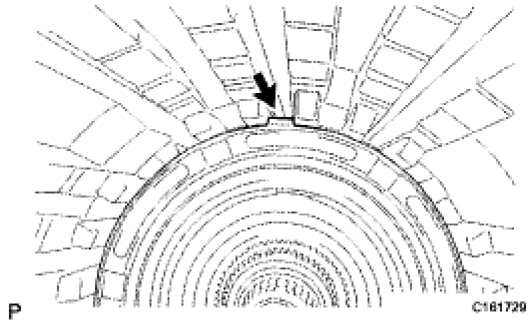

Fig. 535: Identifying Claw Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. **SELECT NO. 2 BRAKE FLANGE**
    a. Install the No. 2 brake piston return spring and flange on the No. 2 brake piston.
    b. Place SST on the brake flange and compress the brake return spring.

    SST 09380-60010 (09381-06010, 09381-06020, 09381-06050, 09381-06070, 09381-06090, 09381-06120)

    c. Using a screwdriver, install the snap ring to the transmission case.

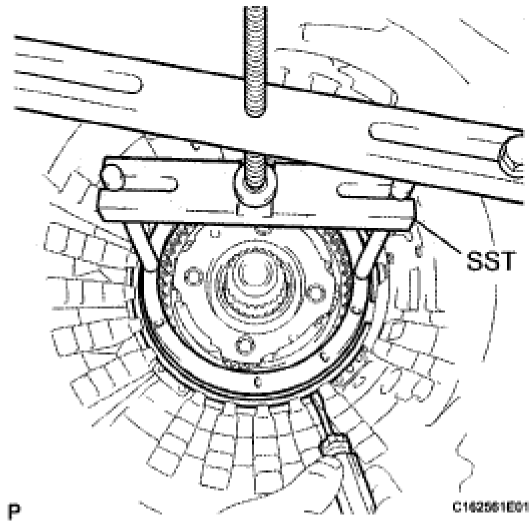

Fig. 536: Placing SST On Brake Flange
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Measure distance A (from the top surface of the snap ring to the bottom surface of the brake piston return spring retainer) in the illustration. *1

HINT:

Standard distance A: 21.00 to 21.76 mm (0.834 to 0.857 in.)

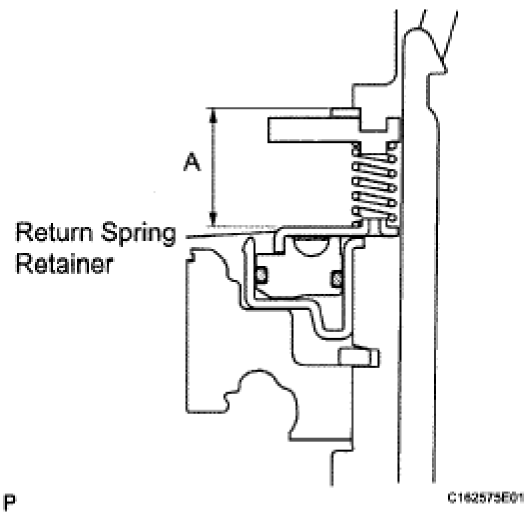

Fig. 537: Identifying Distance A
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

e. Assemble the 4 discs, 3 plates and flange as shown in the illustration. Then with a fixture of 165.2 mm (6.50 in.) or less placed on the flange, measure distance B. *2

HINT:

Standard distance B: 16.54 to 17.15 mm (0.651 to 0.675 in.)

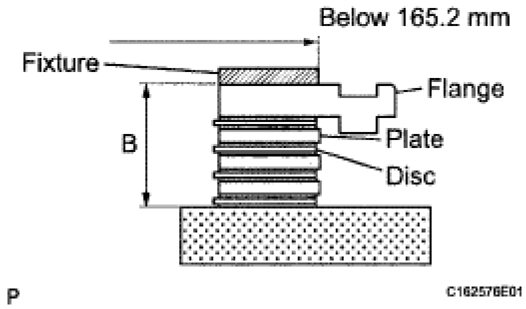

Fig. 538: Identifying Distance B
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

f. Apply the A and B measurements taken in *1 and *2 to the graph below. Use A for the X axis and B for the Y axis, and then choose the flange indicated by the graph point.

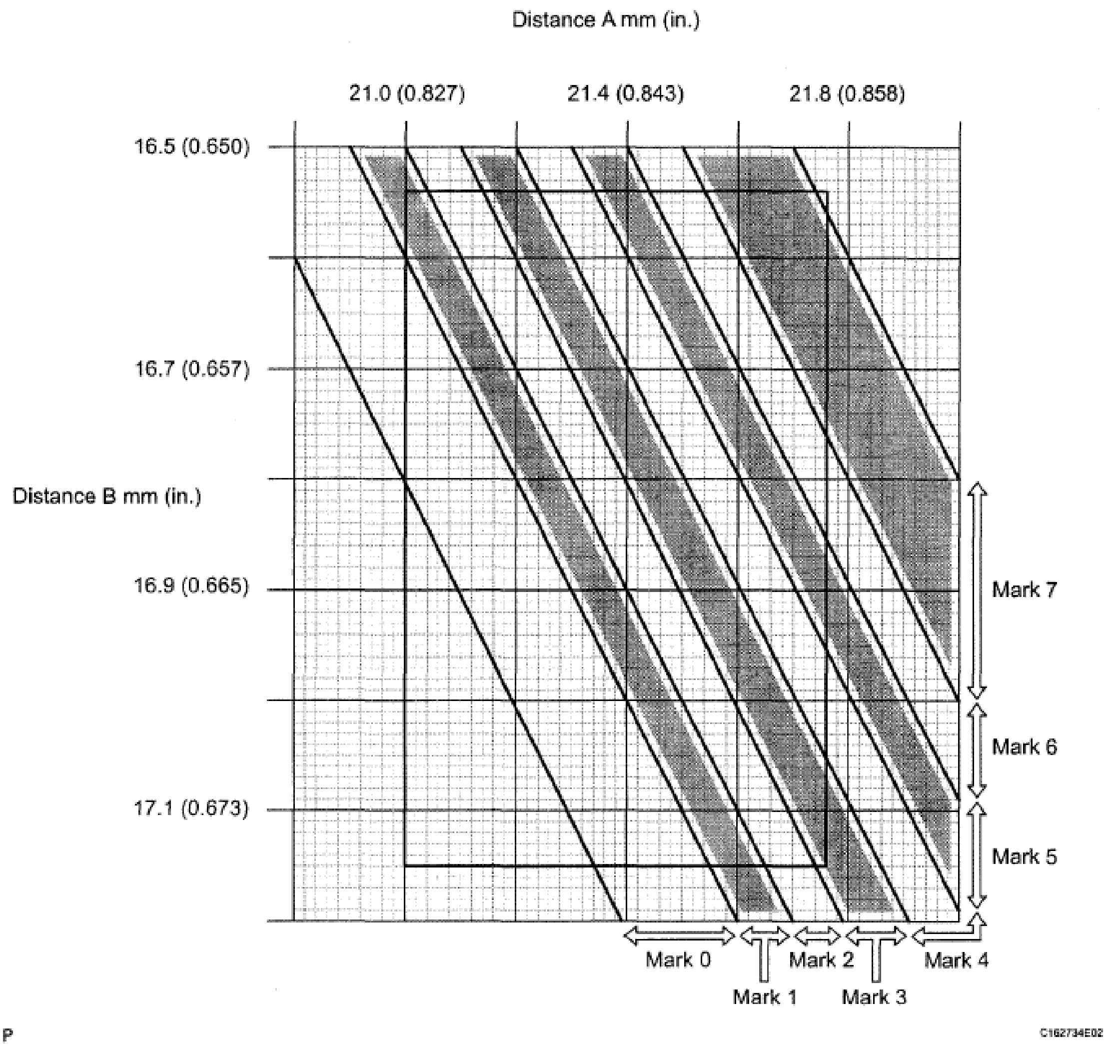

Fig. 539: A And B Measurement Graph
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

Make sure that when the B measurement and selected flange's thickness are subtracted from the A measurement, the value is 2.20 to 2.50 mm (0.0866 to 0.0984 in.).

Flange thickness

FLANGE THICKNESS SPECIFICATIONS

Mark	Thickness
0	1.95 to 2.05 mm (0.0768 to 0.0807 in.)
1	2.05 to 2.15 mm (0.0807 to 0.0846 in.)
2	2.15 to 2.25 mm (0.0846 to 0.0886 in.)
3	2.25 to 2.35 mm (0.0886 to 0.0925 in.)
4	2.35 to 2.45 mm (0.0925 to 0.0965 in.)
5	2.45 to 2.55 mm (0.0965 to 0.100 in.)
6	2.55 to 2.65 mm (0.100 to 0.104 in.)
7	2.65 to 2.75 mm (0.104 to 0.108 in.)

g. Remove the snap ring, flange and No. 2 brake piston return spring from the transmission case.

16. **INSTALL NO. 2 BRAKE DISC SET**

a. Install the brake piston return spring, selective flange, 4 discs, 3 plates, and flange.

Install in order:

S/F - D - P - D - P - D - P - D - F

HINT:

S/F = Selective flange

D = Disc

P = Plate

F = Flange

NOTE: **Before assembling new discs, soak them in ATF for at least 2 hours.**

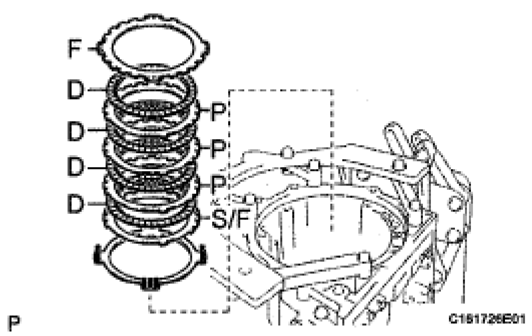

Fig. 540: Identifying Discs, Plates And Flange

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

b. Place SST on the brake flange and compress the brake return spring.

SST 09380-60010 (09381-06010, 09381-06020, 09381-06050, 09381-06070, 09381-06090, 09381-06120)

c. Using a screwdriver, install the snap ring to the transmission case.

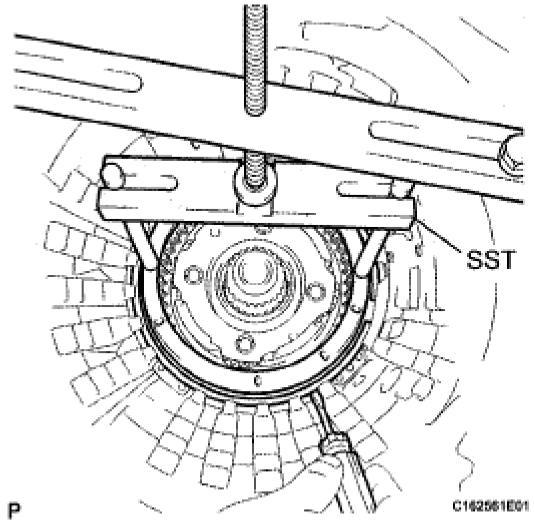

Fig. 541: Placing SST On Brake Flange
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. **INSTALL CENTER PLANETARY GEAR ASSEMBLY**

a. Install the center planetary sun gear and center planetary gear to the transmission case.

NOTE: **Make sure to install the center planetary sun gear with the groove facing the transmission case.**

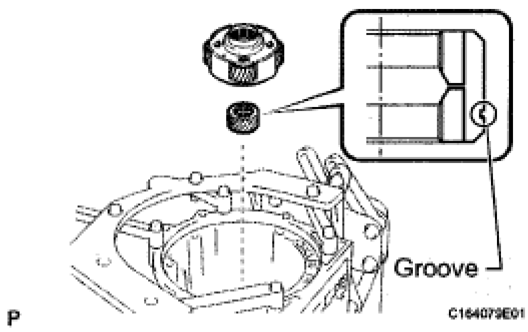

Fig. 542: Positions For Installing Center Planetary Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

18. **INSTALL NO. 1 BRAKE PISTON**

a. Coat 2 new O-rings with ATF, and install them on the brake piston.
b. Press the brake piston into the brake cylinder with both hands.

NOTE: **Be careful not to damage the O-rings.**

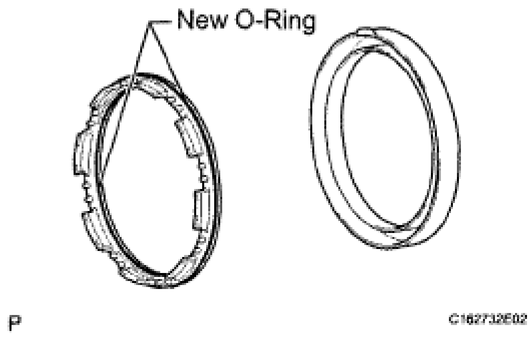

Fig. 543: Identifying O-Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. **INSTALL NO. 1 BRAKE CYLINDER WITH NO. 1 BRAKE PISTON**
    a. Install the No. 1 brake cylinder with piston and brake piston return spring to the transmission case.

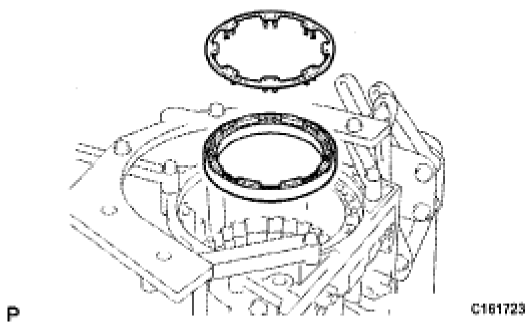

Fig. 544: Identifying No. 1 Brake Cylinder With Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:
- **When installing the No. 1 brake cylinder with piston to the transmission case, align and install the cylinder's claw to the case's top groove.**
- **Make sure the No. 1 brake cylinder with piston is securely inserted into the transmission case.**

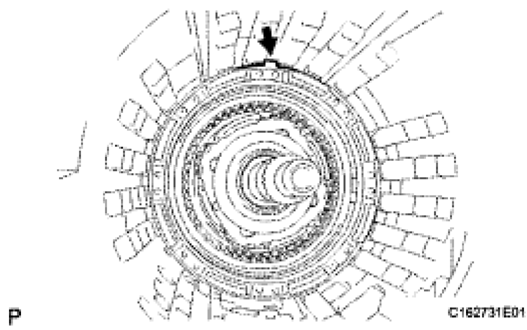

Fig. 545: Identifying Claw

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

b. Place SST on the brake return spring and compress the brake return spring.

SST 09380-60010 (09381-06010, 09381-06020, 09381-06050, 09381-06060, 09381-06090, 09381-06100, 09381-06110, 09381-06120)

c. Using a screwdriver, install the snap ring to the transmission case.

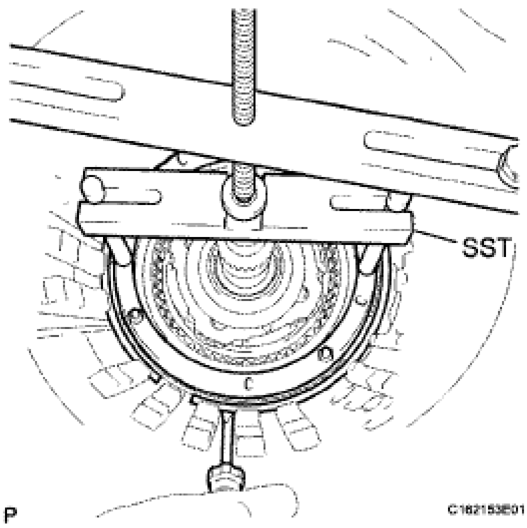

Fig. 546: Placing SST On Brake Return Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. **SELECT NO. 1 BRAKE FLANGE**

a. Measure distance A (from the step in the transmission case to the tip of the No. 1 brake piston) in the illustration. *1

HINT:

Standard distance A: 19.74 to 20.22 mm (0.777 to 0.796 in.)

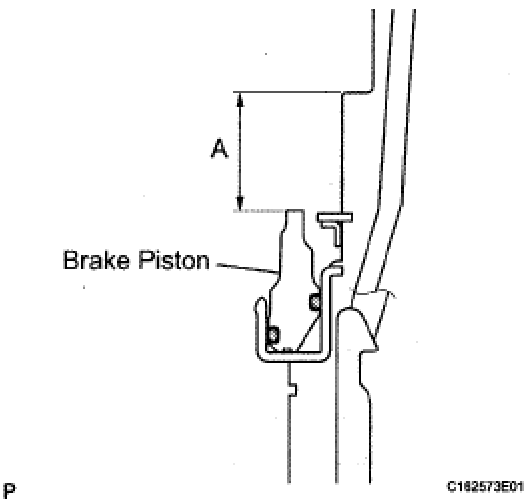

Fig. 547: Identifying Distance A
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Assemble the 4 plates and 4 discs and measure distance B in the illustration. *2

HINT:

Standard distance B: 16.72 to 17.19 mm (0.658 to 0.677 in.)

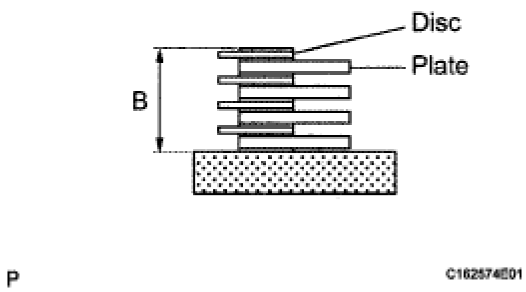

Fig. 548: Identifying Distance B
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Apply the A and B measurements taken in *1 and *2 to the graph below. Use A for the X axis and B for the Y axis, and then choose the flange indicated by the graph point.

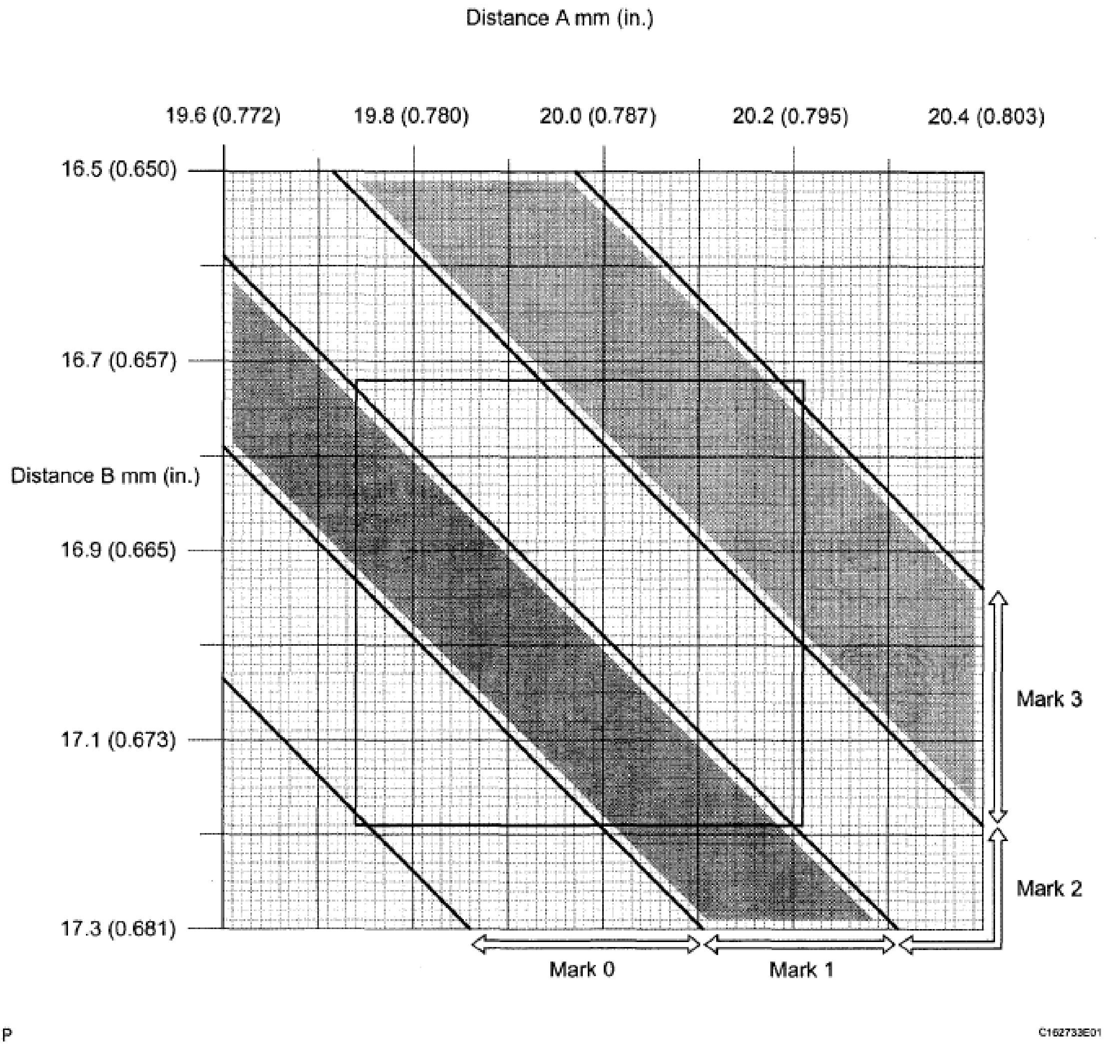

Fig. 549: Identifying A And B Measurement Graph
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

Make sure that when the B measurement and selected flange's thickness are subtracted from the A measurement, the value is 0.56 to 0.86 mm (0.0220 to 0.0339 in.).

Flange thickness

FLANGE THICKNESS SPECIFICATIONS

Mark	Thickness
0	1.95 to 2.05 mm (0.0768 to 0.0807 in.)
1	2.15 to 2.25 mm (0.0846 to 0.0886 in.)
2	2.35 to 2.45 mm (0.0925 to 0.0965 in.)
3	2.55 to 2.65 mm (0.100 to 0.104 in.)

21. **INSTALL CENTER PLANETARY RING GEAR**
    a. Install the front planetary ring gear flange to the center planetary ring gear.

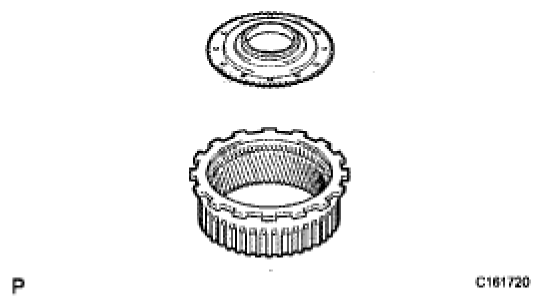

Fig. 550: Identifying Planetary Ring Gear Flange And Center Planetary Ring Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Using a screwdriver, install the snap ring.

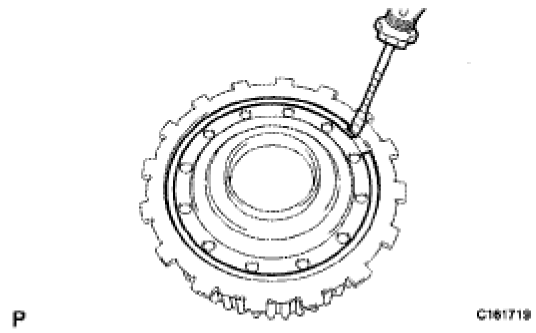

Fig. 551: Installing Snap Ring Using Screwdriver
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

22. **INSTALL FRONT PLANETARY RING GEAR**
    a. Install the front planetary ring gear to the center planetary ring gear.

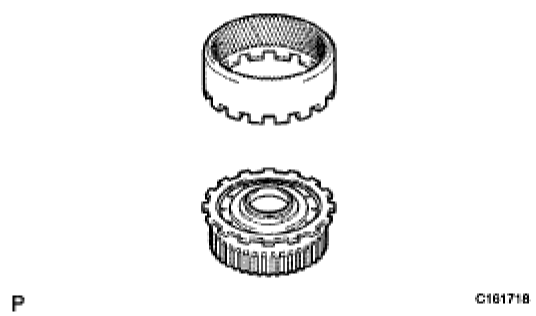

Fig. 552: Identifying Front Planetary Ring Gear And Center Planetary Ring Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

23. **INSTALL FRONT PLANETARY RING GEAR WITH FRONT PLANETARY RING GEAR FLANGE SUB-ASSEMBLY AND CENTER PLANETARY RING GEAR**
    a. Install the thrust bearing race and thrust needle roller bearing.

    HINT:

    Use a small amount of MP grease to make the thrust bearing and race stay securely in place.

Bearing and race diameter

BEARING AND RACE DIAMETER SPECIFICATIONS

Item	Inside	Outside
Race	65.4 to 65.6 mm (2.57 to 2.58 in.)	85.6 to 86.0 mm (3.37 to 3.39 in.)
Bearing	62.9 to 63.1 mm (2.476 to 2.484 in.)	82.3 to 82.6 mm (3.24 to 3.25 in.)

b. Install the front planetary ring gear with the front planetary ring gear flange and center planetary ring gear to the transmission case.

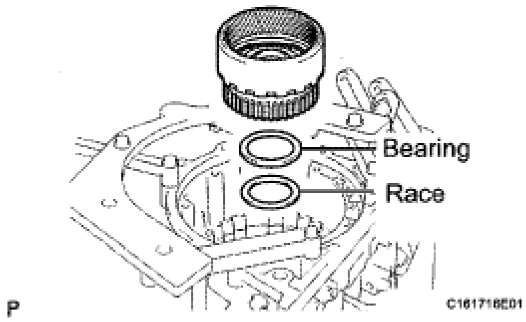

Fig. 553: Identifying Thrust Bearing Race And Thrust Needle Roller Bearing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

24. **INSTALL FRONT PLANETARY GEAR ASSEMBLY**

a. Install the No. 2 planetary carrier thrust washer to the front planetary gear.

HINT:

Use a small amount of MP grease to make the thrust washer stay securely in place.

Bearing race diameter

BEARING AND RACE DIAMETER SPECIFICATIONS

Item	Inside	Outside
Race	55.0 to 55.2 mm (2.165 to 2.173 in.)	68.8 to 69.3 mm (2.71 to 2.73 in.)

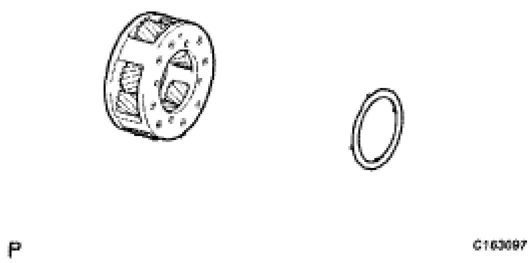

Fig. 554: Identifying No. 2 Planetary Carrier Thrust Washer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Install the thrust needle roller bearing, thrust bearing race, front planetary sun gear and front planetary gear.

HINT:

Use a small amount of MP grease to make the thrust bearing and race stay securely in place.

Bearing diameter

BEARING DIAMETER SPECIFICATIONS

Item	Inside	Outside
Bearing	54.6 to 54.8 mm (2.15 to 2.16 in.)	70.0 to 70.5 mm (2.76 to 2.78 in.)
Race	55.0 to 55.2 mm (2.165 to 2.173 in.)	68.8 to 69.3 mm (2.71 to 2.73 in.)

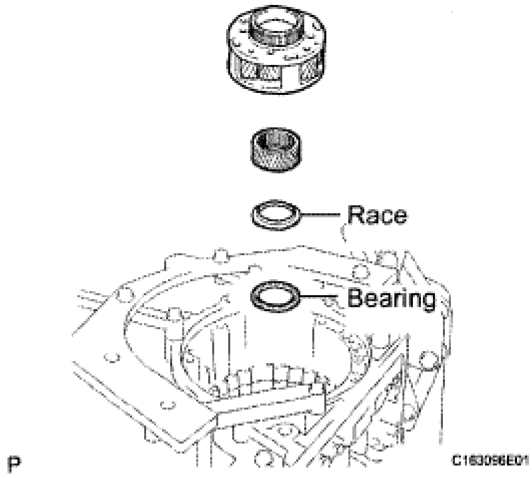

Fig. 555: Identifying Thrust Needle Roller Bearing And Thrust Bearing Race
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

25. **INSTALL 1-WAY CLUTCH INNER RACE SUB-ASSEMBLY**
    a. Apply the No. 1 planetary carrier thrust washer to the 1-way clutch inner race, and then install them to the 1-way clutch.

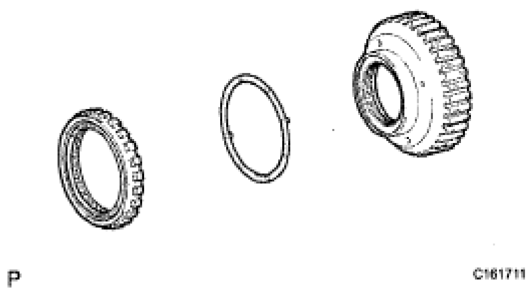

Fig. 556: Identifying No. 1 Planetary Carrier Thrust Washer And 1-Way Clutch Inner Race
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

Use a small amount of MP grease to make the thrust washer stay securely in place.

26. **INSPECT 1-WAY CLUTCH ASSEMBLY** (see **INSPECTION**)
27. **INSTALL 1-WAY CLUTCH ASSEMBLY WITH 1-WAY CLUTCH INNER RACE SUB-ASSEMBLY**
    a. Install the 1-way clutch with 1-way clutch inner race to the transmission case.

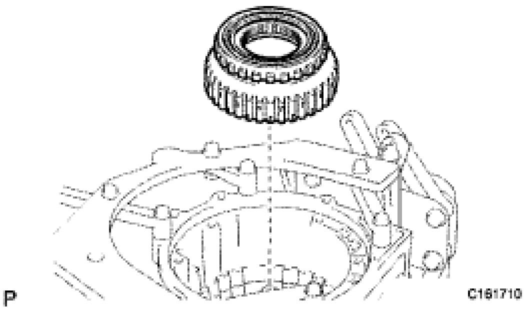

Fig. 557: Identifying 1-Way Clutch Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

28. **INSTALL NO. 1 BRAKE DISC SET**
    a. Install the 4 plates, 4 discs and flange.

    Install in order:

    P - D - P - D - P - D - P - D - F

    HINT:

    P = Plate

    D = Disc

    F = Flange

NOTE: **Before assembling new discs, soak them in ATF for at least 2 hours.**

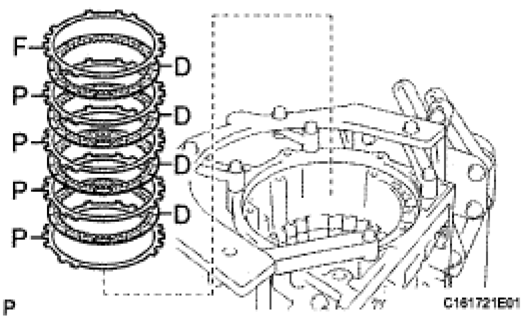

Fig. 558: Identifying Plates, Discs And Flange
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

29. **INSTALL NO. 3 BRAKE PISTON**

a. Coat 2 new O-rings with ATF, and install them to the brake piston.
b. Press the brake piston into the brake cylinder with both hands.

NOTE: Be careful not to damage the O-rings.

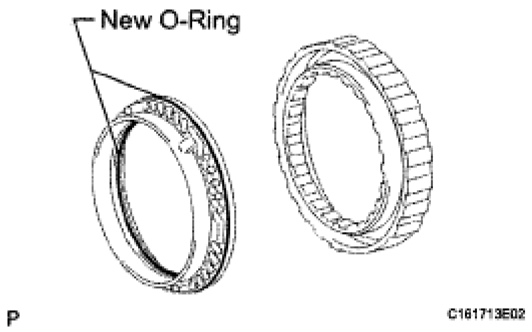

Fig. 559: Identifying O-Rings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Using SST and a press, compress the return spring and install the snap ring with a screwdriver.

SST 09380-60010 (09381-06020, 09381-06040, 09381-06060, 09381-06100, 09381-06110)

NOTE: Be sure the end gap of the snap ring is not aligned with the spring retainer claw.

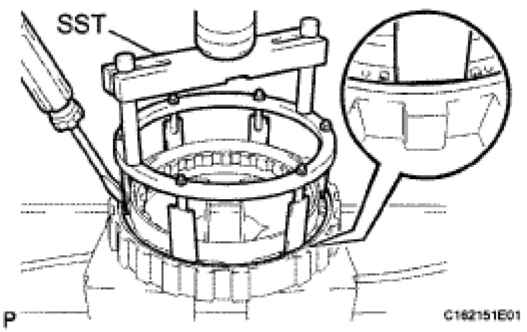

Fig. 560: Removing No. 3 Brake Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

30. **INSTALL NO. 3 BRAKE CYLINDER WITH NO. 3 BRAKE PISTON AND NO. 3 BRAKE PISTON RETURN SPRING SUB-ASSEMBLY**

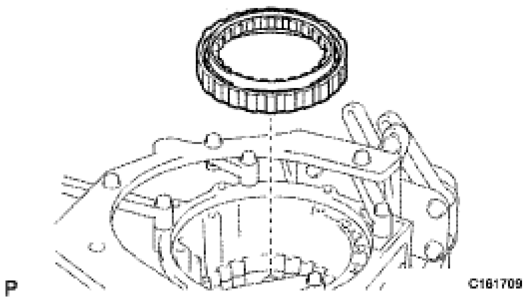

Fig. 561: Identifying No. 3 Brake Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

a. Install the No. 3 brake cylinder with the No. 3 brake piston and No. 3 brake piston return spring to the transmission case.

NOTE:

- **Align the oil holes of the No. 3 brake cylinder and transmission case as shown in the illustration.**
- **Make sure the No. 3 brake piston and cylinder are securely inserted into the transmission case.**

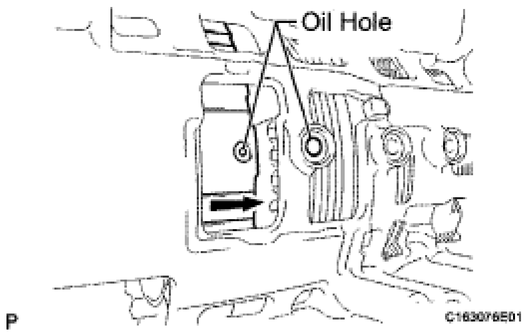

Fig. 562: Identifying Oil Holes Of No. 3 Brake Cylinder And Transmission Case
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

31. **INSTALL NO. 3 BRAKE PISTON HOLE SNAP RING**

a. Using SST, install the snap ring.

SST 09350-30020 (09350-07060)

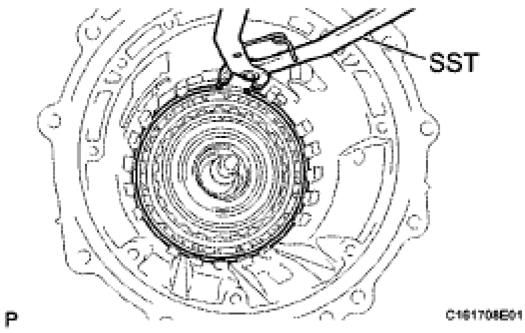

Fig. 563: Installing Snap Ring Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

32. **INSTALL NO. 3 BRAKE DISC SET**
    a. Install the "O" mark flange, 4 discs, 3 plates and "A" mark flange to the transmission case.

    Install in order:

    OF - D - P - D - P - D - P - D - AF

    HINT:

    OF = "O" mark flange

    P = Plate

    D = Disc

    AF = "A" mark flange

NOTE:	**Before assembling new discs, soak them in ATF for at least 2 hours.**

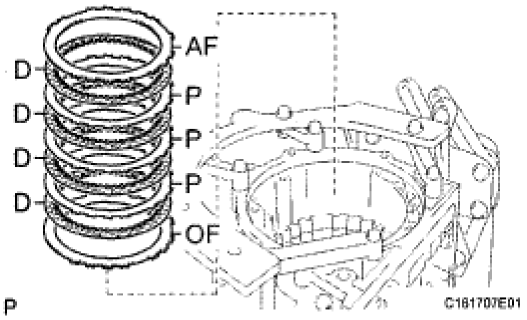

Fig. 564: Identifying Flange, Discs And Plates
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

33. **INSTALL NO. 3 BRAKE SNAP RING**
    a. Using a screwdriver, install the snap ring.

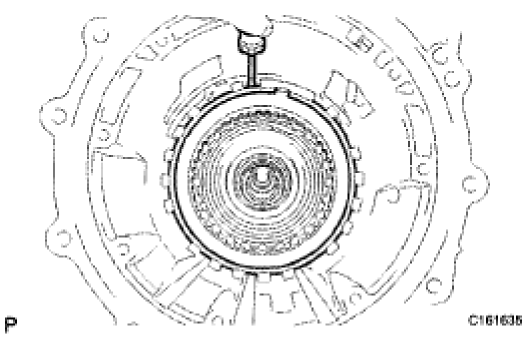

Fig. 565: Installing Snap Ring Using Screwdriver

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

34. **INSTALL DIRECT CLUTCH PISTON SUB-ASSEMBLY**

a. Coat 2 new O-rings with ATF, and install them to the direct clutch piston.

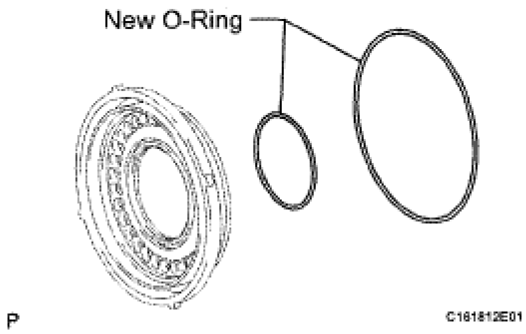

Fig. 566: Identifying O-Rings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Install the direct clutch return spring and No. 2 clutch balancer to the direct clutch piston.

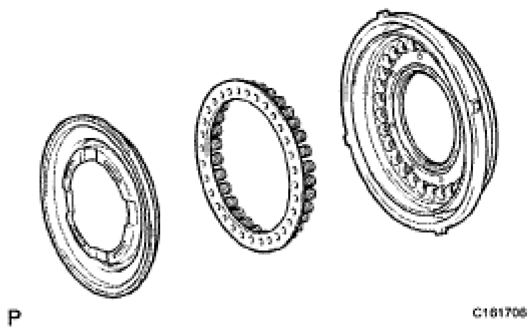

Fig. 567: Identifying No. 2 Clutch Balancer And Direct Clutch Return Spring Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Press the direct clutch piston with clutch return spring and clutch balancer into the reverse clutch piston with both hands.

NOTE: Be careful not to damage the O-ring.

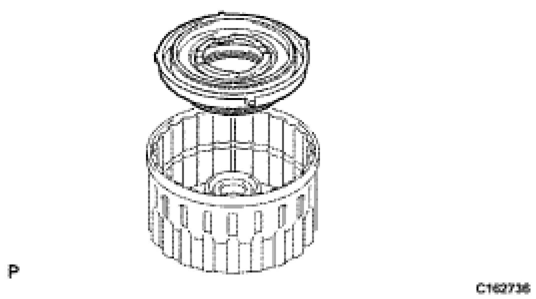

Fig. 568: Identifying Direct Clutch Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Place SST on the direct clutch balancer, and compress the return spring with a press.

SST 09380-60010 (09381-06030, 09381-06040, 09381-06080)

NOTE: **Stop pressing when the spring sheet is lowered to a position 1 to 2 mm (0.0394 to 0.0787 in.) from the snap ring groove to prevent the spring sheet from being deformed.**

e. Using SST, install the snap ring.

SST 09350-30020 (09350-07070)

NOTE: **Do not expand the snap ring excessively.**

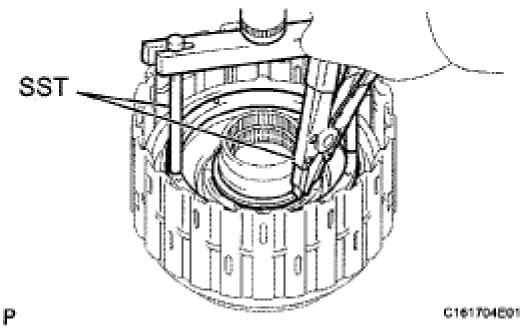

Fig. 569: Placing SST On Direct Clutch Balancer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

f. Set the end gap of the snap ring in the balancer as shown in the illustration.

NOTE: **Be sure the end gap of the snap ring is not aligned with the spring retainer claw.**

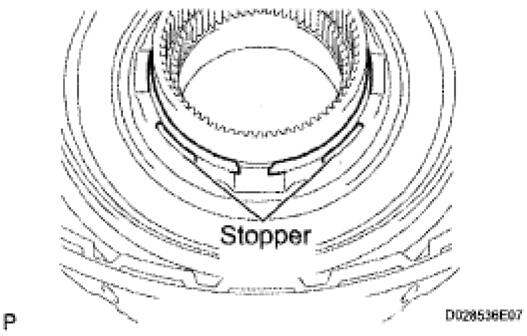

Fig. 570: Identifying Stopper
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

35. **INSTALL REVERSE CLUTCH PISTON SUB-ASSEMBLY**

a. Coat a new O-ring with ATF, and install it to the clutch drum.

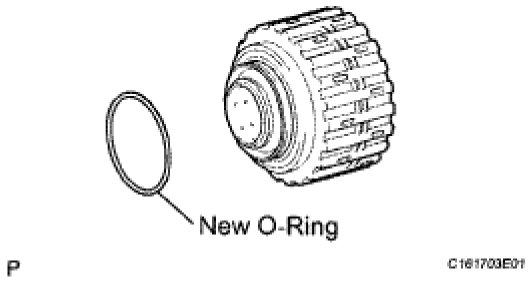

Fig. 571: Identifying O-Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Coat a new O-ring with ATF, and install it on the reverse clutch piston.

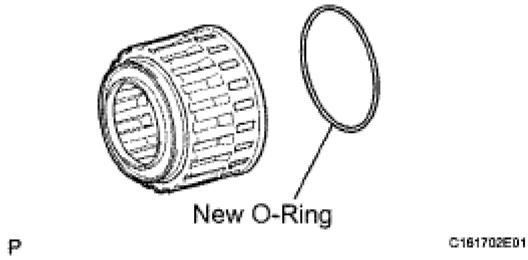

Fig. 572: Identifying O-Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Pass the clutch drum into the reverse clutch piston with both hands.

NOTE:

- **Be careful not to damage the O-ring.**
- **Make sure to align the holes of the reverse clutch piston and clutch drum as shown in the illustration.**
- **Make sure to align the protrusions of the reverse clutch pistons and the cutout of the clutch drum.**

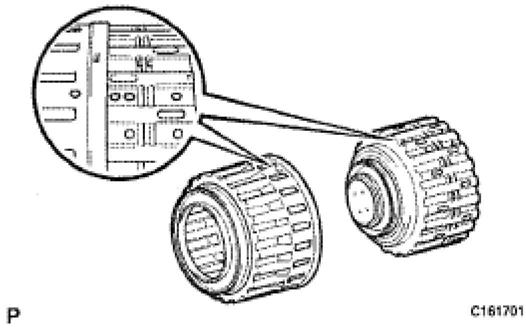

Fig. 573: Identifying Holes Of Reverse Clutch Piston And Clutch Drum
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

36. **INSTALL NO. 3 CLUTCH BALANCER**

a. Coat a new O-ring with ATF, and install it to the reverse clutch piston.

b. Install the reverse clutch return spring and balancer onto the reverse clutch piston.

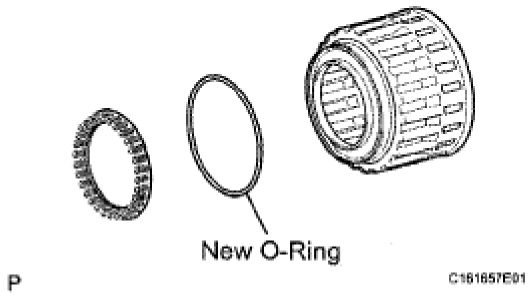

Fig. 574: Identifying O-Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Place SST on the clutch balancer, and compress the clutch balancer with a press.

SST 09380-60010 (09381-06020, 09381-06030, 09381-06040, 09381-06050, 09381-06070, 09381-06080)

NOTE: **Stop pressing when the spring sheet is lowered to a position 1 to 2 mm (0.0394 to 0.0787 in.) from the snap ring groove to prevent the spring sheet from being deformed.**

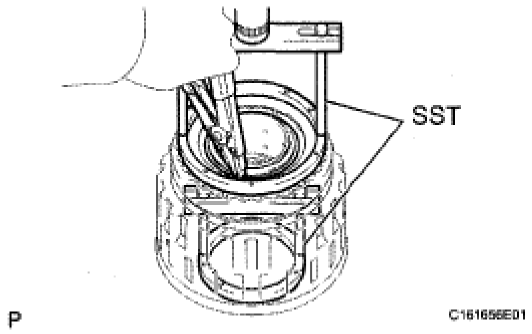

Fig. 575: Placing SST On Clutch Balancer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Using SST, install the snap ring.

SST 09350-30020 (09350-07070)

NOTE: **Do not expand the snap ring excessively.**

e. Set the end gap of the snap ring in the piston as shown in the illustration.

NOTE: **Be sure the end gap of the snap ring is not aligned with the spring retainer claw.**

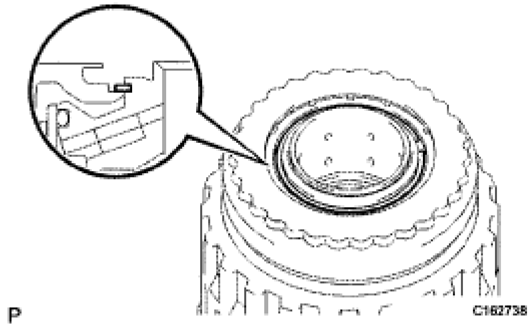

Fig. 576: Identifying End Gap Of Snap Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

37. **INSTALL DIRECT CLUTCH DISC**
    a. Place the oil pump onto the torque converter clutch, and then place the clutch drum.
    b. Install the 5 plates, 5 discs and reverse clutch flange on the clutch drum.

    Install in order:

    P - D - P - D - P - D - P - D - P - D - F

    HINT:

    P = Plate

    D = Disc

    F = Flange

NOTE:	**Before assembling new discs, soak them in ATF for at least 2 hours.**

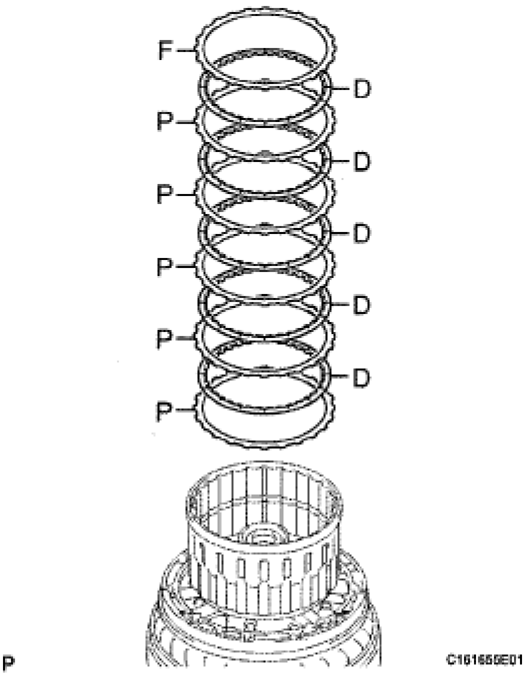

Fig. 577: Identifying Plates, Discs And Reverse Clutch Flange
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Using a screwdriver, install the snap ring to the clutch drum.
d. Using a dial indicator, measure the moving distance (A) of the clutch flange at both ends across the diameter while blowing compressed air (392 kPa, 2.0 kgf/cm^2 , 57 psi) from the oil hole as shown in the illustration. Then choose from the 9 flange thicknesses in the table so that the measured value is within the standard value.

Standard moving distance (A):

0.58 to 0.88 mm (0.0228 to 0.0346 in.)

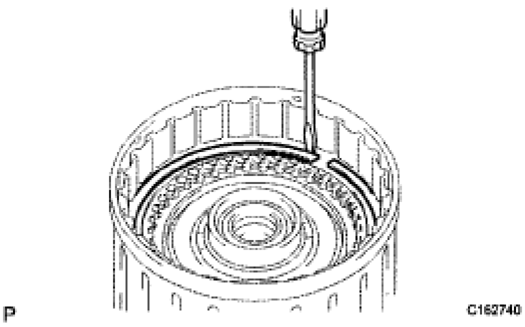

Fig. 578: Installing Snap Ring To Clutch Drum Using Screwdriver
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

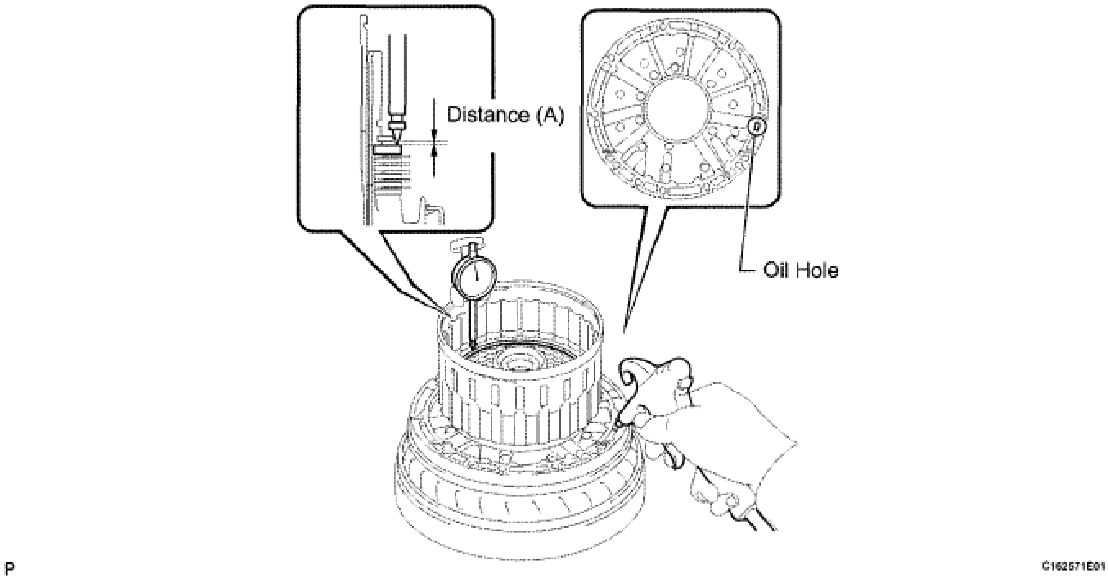

Fig. 579: Measuring Moving Distance (A) Of Clutch Flange
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Flange thickness

FLANGE THICKNESS SPECIFICATIONS

Mark	Thickness
0	3.45 to 3.55 mm (0.136 to 0.140 in.)
1	3.55 to 3.65 mm (0.140 to 0.144 in.)
2	3.65 to 3.75 mm (0.144 to 0.148 in.)
3	3.75 to 3.85 mm (0.148 to 0.152 in.)
4	3.85 to 3.95 mm (0.152 to 0.156 in.)
5	3.95 to 4.05 mm (0.156 to 0.159 in.)
6	4.05 to 4.15 mm (0.159 to 0.163 in.)
7	4.15 to 4.25 mm (0.163 to 0.167 in.)
8	4.25 to 4.35 mm (0.167 to 0.171 in.)

e. Temporarily remove the snap ring, attach the selected flange and reinstall the snap ring.

38. **SELECT REVERSE CLUTCH FLANGE**

a. Using a screwdriver, install the snap ring to the clutch drum.

NOTE: Make sure to install the direct clutch and reverse clutch snap rings so that their openings face opposite directions.

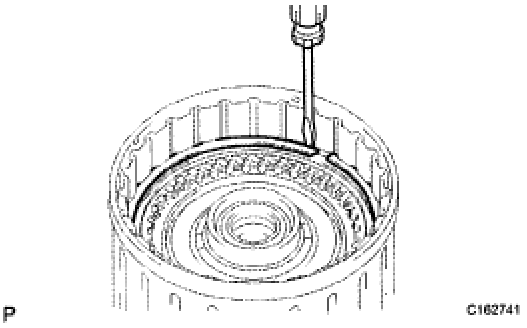

Fig. 580: Installing Snap Ring To Clutch Drum Using Screwdriver
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Install the flange, 5 discs, 4 plates, selective flange and reverse clutch reaction sleeve to the clutch drum.

Install in order:

F - D - P - D - P - D - P - D - P - D - S/F

HINT:

F = Flange

D = Disc

P = Plate

S/F = Selective flange

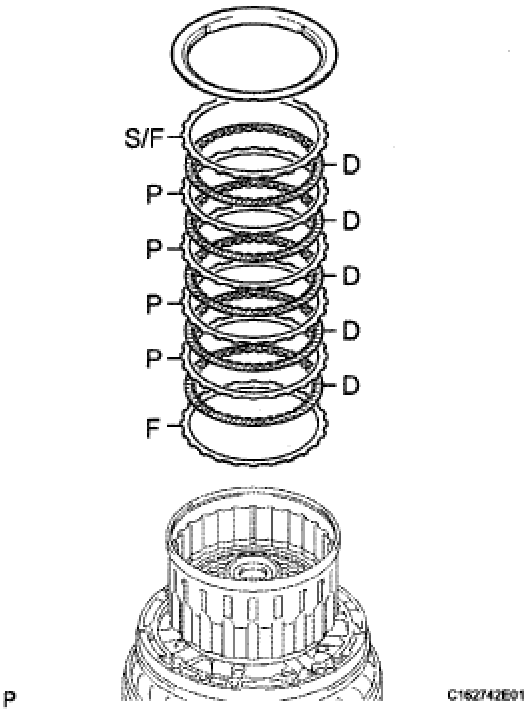

Fig. 581: Identifying Flange, Discs And Plates
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Using a screwdriver, install the hole snap ring.
d. Using a dial indicator, measure the moving distance (A minus B) of the tip of the reverse clutch piston (A) and clutch flange at both ends across the diameter (B) while blowing compressed air (392 kPa, 2.0 kgf/cm^2 , 57 psi) from the oil hole as shown in the illustration. Then choose from the 12 flange thicknesses in the table so that the measured value is within the standard value.

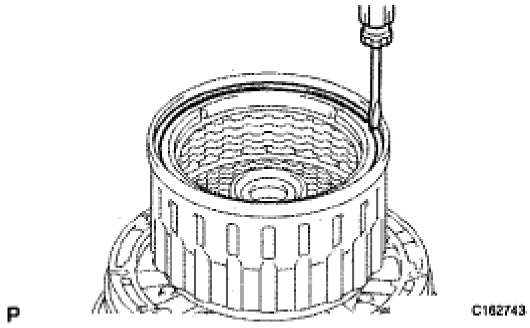

Fig. 582: Installing Hole Snap Ring Using Screwdriver
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

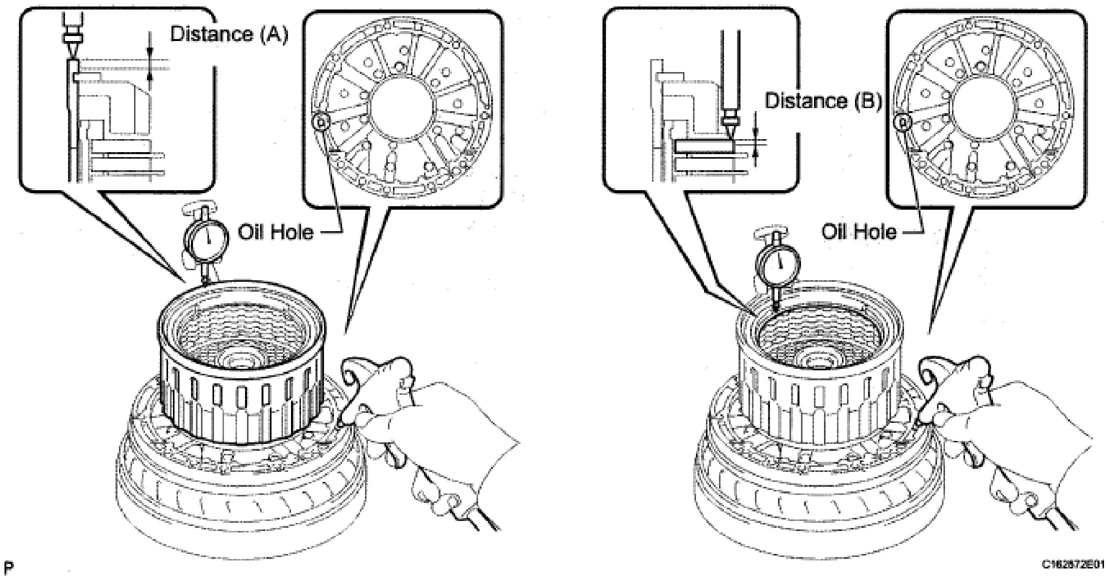

Fig. 583: Measuring Moving Distance Using Dial Indicator
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard moving distance (A minus B): 0.79 to 1.09 mm (0.0311 to 0.0429 in.)

Flange thickness

FLANGE THICKNESS SPECIFICATIONS

Mark	Thickness
0	2.35 to 2.45 mm (0.0925 to 0.0965 in.)
1	2.45 to 2.55 mm (0.0965 to 0.100 in.)

2	2.55 to 2.65 mm (0.100 to 0.104 in.)
3	2.65 to 2.75 mm (0.104 to 0.108 in.)
4	2.75 to 2.85 mm (0.108 to 0.112 in.)
5	2.85 to 2.95 mm (0.112 to 0.116 in.)
6	2.95 to 3.05 mm (0.116 to 0.120 in.)
7	3.05 to 3.15 mm (0.120 to 0.124 in.)
8	3.15 to 3.25 mm (0.124 to 0.128 in.)
A	3.25 to 3.35 mm (0.128 to 0.132 in.)
B	3.35 to 3.45 mm (0.132 to 0.136 in.)
C	3.45 to 3.55 mm (0.136 to 0.140 in.)

e. Remove the snap ring, reverse clutch reaction sleeve and rear clutch disc set from the clutch drum.

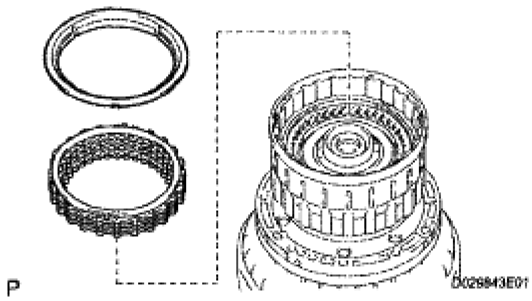

Fig. 584: Identifying Reverse Clutch Reaction Sleeve And Clutch Cushion Plate
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

39. **INSTALL FORWARD CLUTCH PISTON SUB-ASSEMBLY AND COAST CLUTCH PISTON**

a. Coat a new O-ring with ATF, and install it to the input shaft.

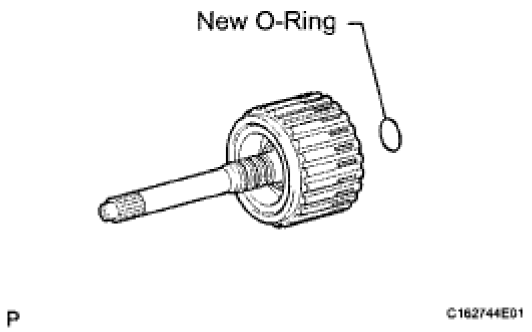

Fig. 585: Identifying O-Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Install the forward clutch piston and coast clutch piston to the input shaft.

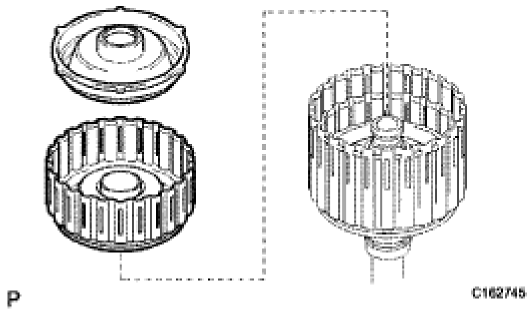

Fig. 586: Identifying Forward Clutch Piston And Coast Clutch Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Coat a new O-ring with ATF, and install it to the No. 1 clutch balancer.

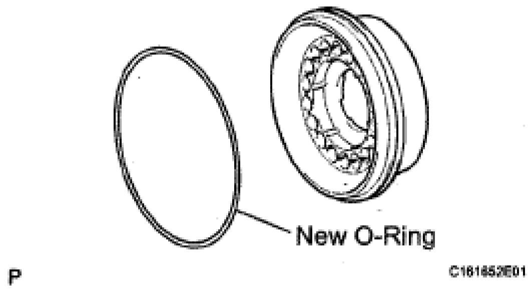

Fig. 587: Identifying O-Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Install the forward clutch return spring and No. 1 clutch balancer to the input shaft.

NOTE: Be careful not to damage the O-rings.

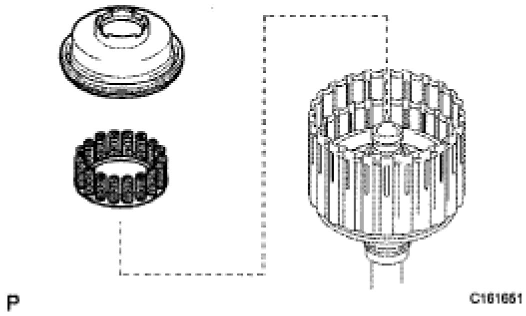

Fig. 588: Identifying Clutch Balancer And Forward Clutch Return Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

e. Place SST on the No. 1 clutch balancer, and compress the return spring with a press.

SST 09350-30020 (09350-07040)

NOTE: Stop pressing when the spring sheet is lowered to a position 1 to 2 mm (0.0394 to 0.0787 in.) from the snap ring groove to prevent the spring sheet from being deformed.

f. Using SST, install the snap ring.

SST 09350-30020 (09350-07070)

NOTE: Do not expand the snap ring excessively.

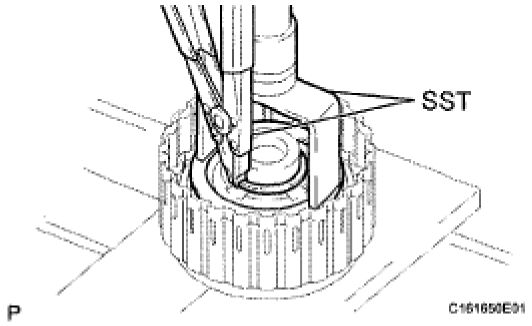

Fig. 589: Placing SST On No. 1 Clutch Balancer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

g. Set the end gap of the snap ring in the balancer as shown in the illustration.

NOTE: Be sure the end gap of the snap ring is not aligned with the spring retainer claw.

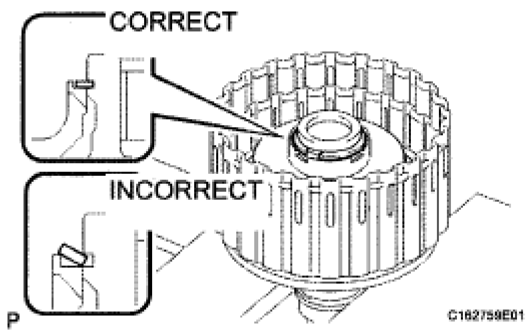

Fig. 590: Identifying Correct And Incorrect Gap Of Snap Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

40. **INSTALL COAST CLUTCH DISC SET**

a. Install the 4 plates, 4 discs and flange.

Install in order:

P - D - P - D - P - D - P - D - F

HINT:

P = Plate

D = Disc

F = Flange

NOTE: **Before assembling new discs, soak them in ATF for at least 2 hours.**

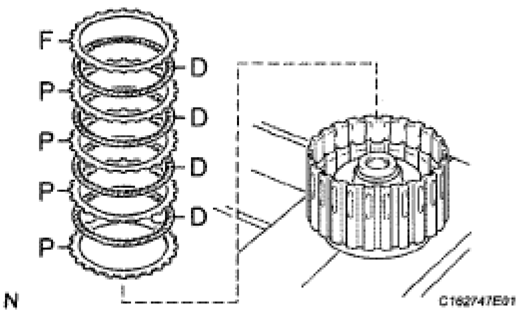

Fig. 591: Identifying Plates, Discs And Flange
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Temporarily install the snap ring.

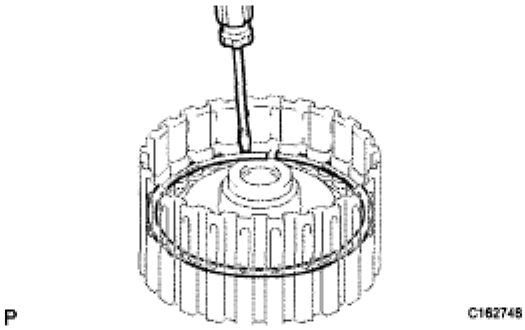

Fig. 592: Installing Snap Ring Using Screwdriver
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Using a dial indicator, measure the moving distance (A) of the clutch flange at both ends across the diameter while blowing compressed air (196 kPa, 2.0 kgf/cm^2 , 28 psi) from the oil hole as shown in the illustration. Then choose from the 11 flange thicknesses in the table so that the measured value is within the standard value.

Standard moving distance (A):

0.41 to 0.71 mm (0.0161 to 0.0280 in.)

Flange thickness

FLANGE THICKNESS SPECIFICATIONS

Mark	Thickness
0	2.95 to 3.05 mm (0.116 to 0.120 in.)
1	3.05 to 3.15 mm (0.120 to 0.124 in.)
2	3.15 to 3.25 mm (0.124 to 0.128 in.)

3	3.25 to 3.35 mm (0.128 to 0.132 in.)
4	3.35 to 3.45 mm (0.132 to 0.136 in.)
5	3.45 to 3.55 mm (0.136 to 0.140 in.)
6	3.55 to 3.65 mm (0.140 to 0.144 in.)
7	3.65 to 3.75 mm (0.144 to 0.148 in.)
8	3.75 to 3.85 mm (0.148 to 0.152 in.)
A	3.85 to 3.95 mm (0.152 to 0.156 in.)
B	3.95 to 4.05 mm (0.156 to 0.159 in.)

d. Temporarily remove the snap ring, attach the selected flange and reinstall the snap ring.

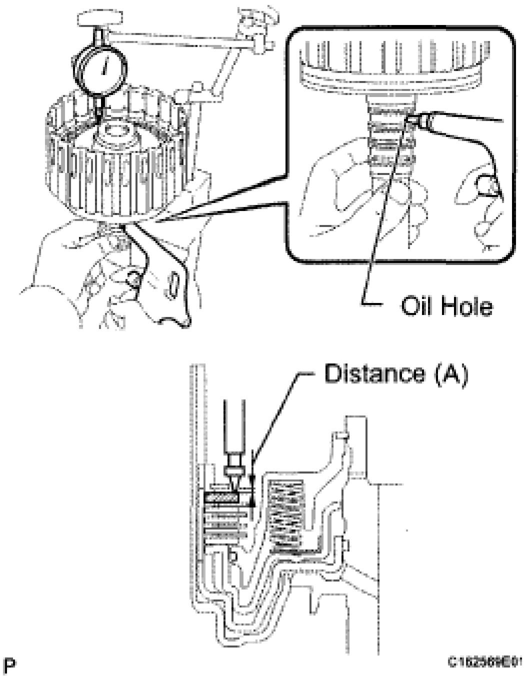

Fig. 593: Measuring Moving Distance Using Dial Indicator
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

41. **INSTALL NO. 4 1-WAY CLUTCH ASSEMBLY**
    a. Install the No. 2 clutch hub thrust washer to the coast clutch hub.

    HINT:

    Use a small amount of MP grease to make the thrust washer stay securely in place.

    b. Install the 1-way clutch to the coast clutch hub.
42. **INSPECT NO. 4 1-WAY CLUTCH ASSEMBLY** (see **INSPECTION**)

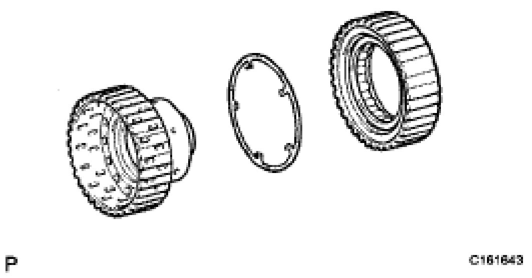

Fig. 594: Identifying 1-Way Clutch
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

43. **INSTALL COAST CLUTCH HUB SUB-ASSEMBLY WITH NO. 4 1-WAY CLUTCH ASSEMBLY**
    a. Install the 2 thrust needle roller bearings, thrust bearing race and coast clutch hub with the No. 4 1-way clutch to the clutch drum.

       HINT:

       Use a small amount of MP grease to make the thrust bearing and race stay securely in place.

       Bearing and race diameter

       BEARING AND RACE DIAMETER SPECIFICATIONS

Item	Inside	Outside
Bearing C	21.1 to 21.3 mm (0.831 to 0.839 in.)	39.5 to 39.8 mm (1.56 to 1.57 in.)
Race	22.8 to 23.1 mm (0.898 to 0.909 in.)	44.5 to 44.8 mm (1.75 to 1.76 in.)
Bearing D	39.5 to 39.7 mm (1.555 to 1.563 In.)	60.5 to 60.8 mm (2.38 to 2.39 in.)

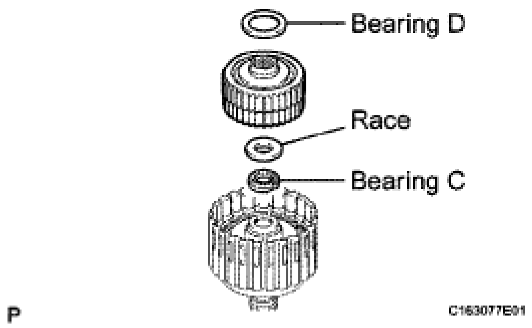

Fig. 595: Identifying Thrust Needle Roller Bearings And Thrust Bearing Race
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

44. **INSTALL FORWARD MULTIPLE DISC CLUTCH DISC SET**
    a. Install the cushion, 6 plates, 6 discs and flange to the input shaft.

       Install in order:

       C - P - D - P - D - P - D - P - D - P - D - P - D - F

       HINT:

C = Cushion

P = Plate

D = Disc

F = Flange

NOTE: Before assembling new discs, soak them in ATF for at least 2 hours.

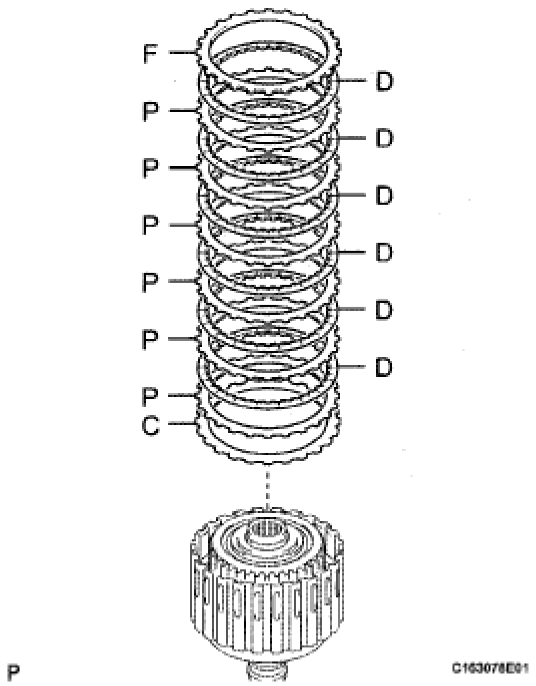

Fig. 596: Identifying Cushion, Plates, Discs And Flange
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Temporarily install the snap ring.

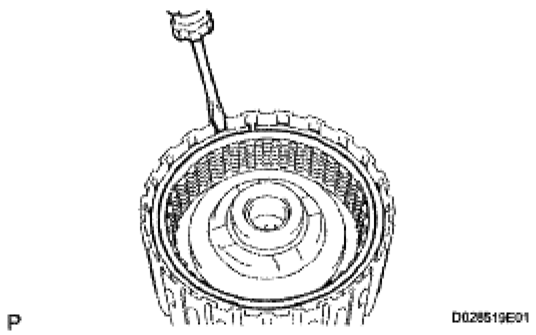

Fig. 597: Installing Snap Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Using a dial indicator, measure the moving distance (A) of the clutch flange at both ends across the diameter while blowing compressed air (196 kPa, 2.0 kgf/cm^2 , 28 psi) from the oil hole as shown in the illustration. Then choose from the 12 flange thicknesses in the table so that the measured value is within the standard value.

Standard moving distance (A):

0.85 to 1.15 mm (0.0335 to 0.0453 in.)

Flange thickness

FLANGE THICKNESS SPECIFICATIONS

Mark	Thickness
0	2.95 to 3.0S mm (0.116 to 0.120 in.)
1	3.05 to 3.15 mm (0.120 to 0.124 in.)
2	3.15 to 3.25 mm (0.124 to 0.128 in.)
3	3.25 to 3.35 mm (0.128 to 0.132 in.)
4	3.35 to 3.45 mm (0.132 to 0.136 in.
S	3.45 to 3.55 mm (0.136 to 0.140 in.
6	3.55 to 3.65 mm (0.140 to 0.144 in.
7	3.65 to 3.75 mm (0.144 to 0.148 in.
8	3.75 to 3.85 mm (0.148 to 0.152 in.
A	3.85 to 3.95 mm (0.152 to 0.156 in.
B	3.95 to 4.05 mm (0.156 to 0.159 in.
C	4.05 to 4.15 mm (0.159 to 0.163 in.)

d. Temporarily remove the snap ring, attach the selected flange and reinstall the snap ring.

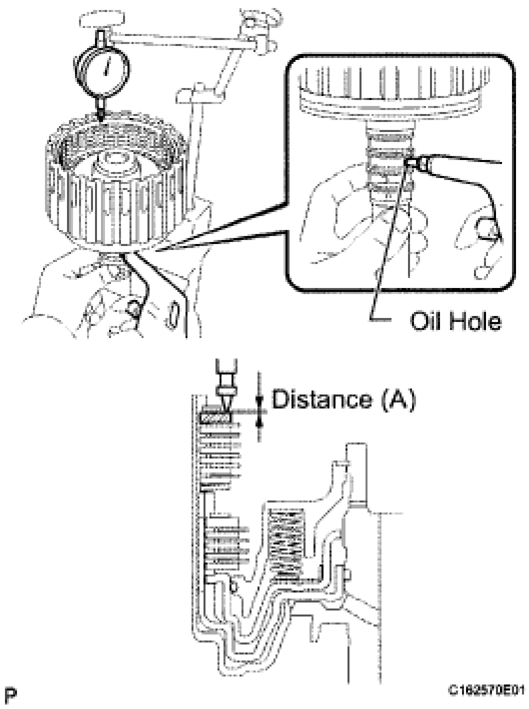

Fig. 598: Measuring Moving Distance Using Dial Indicator

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

45. **INSTALL INPUT SHAFT OIL SEAL RING**
    a. Overlap the seal ring edges in the axial direction.

NOTE:
- **Overlapping the seal ring edges in the axial direction prevents damage to the seal ring.**
- **Do not overlap the seal ring edges in the radial direction, as this may damage the seal ring.**

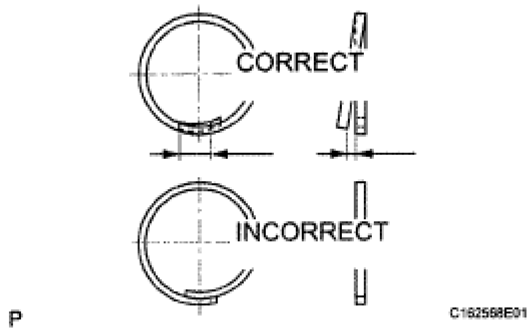

Fig. 599: Identifying Correct And Incorrect Method Of Overlapping Seal Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Coat 4 new oil seal rings with ATF.
c. Squeeze the ends of the 4 oil seal rings together, and then install them to the input shaft groove.

NOTE: Do not excessively widen the rings.

HINT:

After installing the oil seal rings, check that they rotate smoothly.

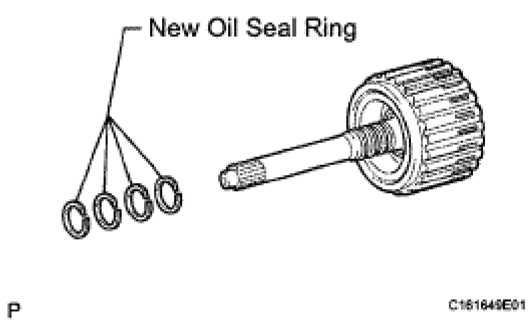

Fig. 600: Identifying Oil Seal Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

46. **INSTALL INPUT SHAFT ASSEMBLY**
    a. Install the input shaft to the clutch drum.

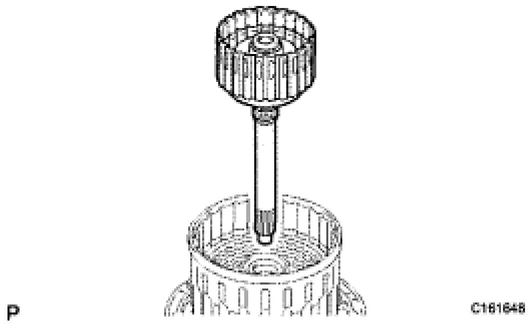

Fig. 601: Identifying Input Shaft Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

47. **INSTALL FORWARD CLUTCH HUB SUB-ASSEMBLY**
   a. Install the No. 3 clutch hub thrust washer, forward clutch hub and thrust needle roller bearing to the clutch drum.

NOTE: Before installing the forward clutch hub, apply ATF to the forward clutch hub bush's sliding surfaces. After the installation, check that the forward clutch hub rotates smoothly.

HINT:

Use a small amount of MP grease to make the thrust bearing and thrust washer stay securely in place.

Bearing diameter

BEARING DIAMETER SPECIFICATIONS

Item	Inside	Outside
Bearing	46.5 to 46.7 mm (1.83 to 1.84 in.)	64.4 to 64.6 mm (2.535 to 2.543 in.)

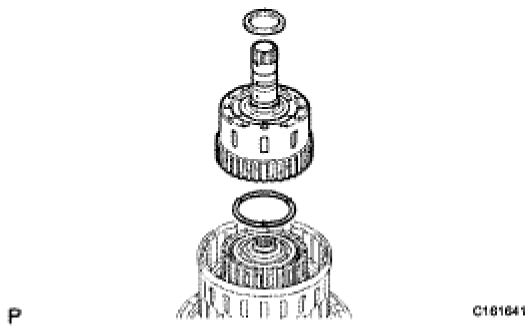

Fig. 602: Identifying Forward Clutch Hub Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

48. **INSTALL REVERSE CLUTCH HUB SUB-ASSEMBLY**
   a. Install the reverse clutch hub to the clutch drum.

NOTE: Before installing the reverse clutch hub, apply ATF to the reverse

clutch hub bush's sliding surfaces. After the installation, check that the reverse clutch rotates smoothly.

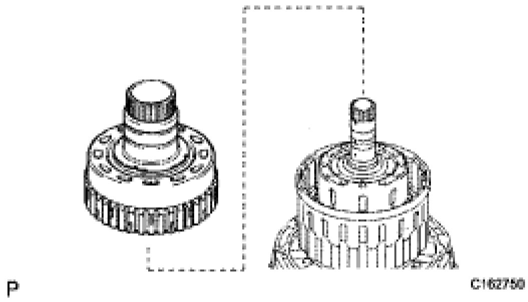

Fig. 603: Identifying Reverse Clutch Hub Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

49. **INSTALL REAR CLUTCH DISC SET**
   a. Install the flange, 5 discs, 4 plates, selected flange and reverse clutch reaction sleeve to the clutch drum.

      Install in order:

      F - D - P - D - P - D - P - D - P - D - S/F

      HINT:

      F = Flange

      D = Disc

      P = Plate

      S/F = Selected flange

   b. Using a screwdriver, install the snap ring to the clutch drum.

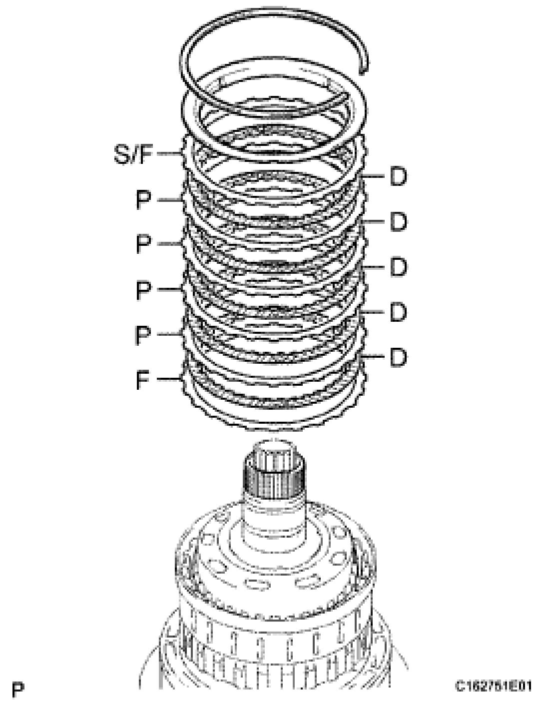

Fig. 604: Identifying Flange, Discs And Plates
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

50. **INSTALL NO. 2 1-WAY CLUTCH ASSEMBLY**
    a. Install the clutch drum thrust washer to the clutch drum.

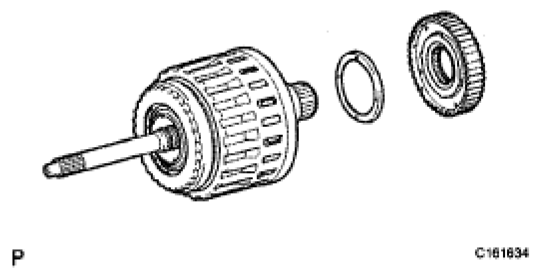

Fig. 605: Identifying Clutch Drum Thrust Washer And Clutch Drum
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

Use a small amount of MP grease to make the thrust washer stay securely in place.

    b. Install the 1-way clutch to the clutch drum.
51. **INSPECT NO. 2 1-WAY CLUTCH ASSEMBLY** (see INSPECTION)
52. **INSTALL CLUTCH DRUM AND INPUT SHAFT ASSEMBLY**
    a. Install the 2 thrust needle roller bearings.

HINT:

Use a small amount of MP grease to make the thrust bearing stay securely in place.

Bearing diameter

BEARING DIAMETER SPECIFICATIONS

Item	Inside	Outside
Bearing A	72.0 to 72.3 mm (2.83 to 2.85 in.)	85.3 to 85.6 mm (3.36 to 3.37 in.)
Bearing B	36.5 to 36.7 mm (1.437 to 1.445 in.)	52.9 to 53.2 mm (2.08 to 2.09 in.)

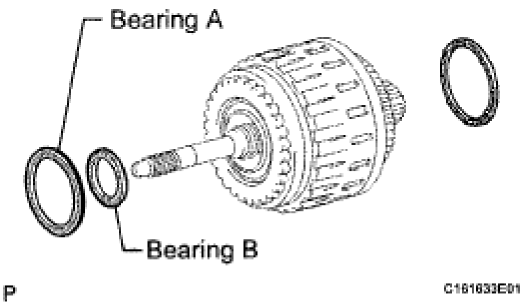

Fig. 606: Identifying Thrust Needle Roller Bearings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Coat the clutch drum thrust washer with petroleum jelly and install it onto the clutch drum and input shaft assembly.
c. Install the clutch drum and input shaft drum assembly onto the transmission case.

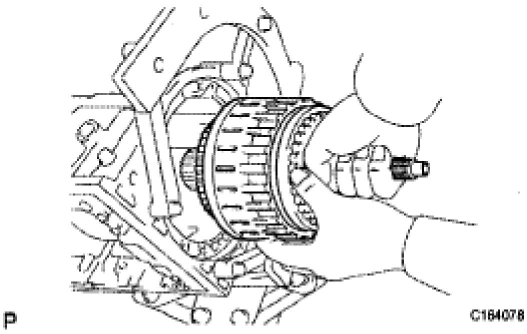

Fig. 607: Installing Clutch Drum And Input Shaft Drum Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

53. **INSTALL OIL PUMP ASSEMBLY**
    a. Coat a new O-ring with ATF, and install it to the oil pump.
    b. Install the 2 thrust bearing races to the front oil pump.

Thrust bearing race diameter

THRUST BEARING RACE DIAMETER SPECIFICATIONS

Item	Inside	Outside
Race A	74.3 to 74.6 mm (2.93 to 2.94 in.)	87.4 to 87.7 mm (3.44 to 3.45 in.)
Race B	38.0 to 38.3 mm (1.50 to 1.51 in.)	53.9 to 54.1 mm (2.12 to 2.13 in.)

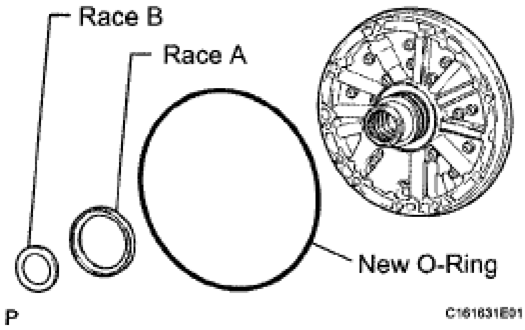

Fig. 608: Identifying O-Ring And Thrust Bearing Race
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Pass the input shaft through the center hole of the oil pump, and align the bolt holes of the oil pump assembly with the transmission case.
d. Hold the input shaft, and lightly press the oil pump body to slide the oil seal rings into the overdrive direct clutch drum.
e. Apply seal packing to the flanges of the bolts.

Seal packing:

Toyota Genuine Seal Packing 1281, Three Bond 1281 or equivalent

NOTE: Do not allow seal packing to contact the bolts' threads.

f. Install the 10 bolts.

Torque: 21 N*m (214 kgf*cm, 15 ft.*lbf)

NOTE: During installation, do not allow oil to contact the bolts or the surface of the oil pump body.

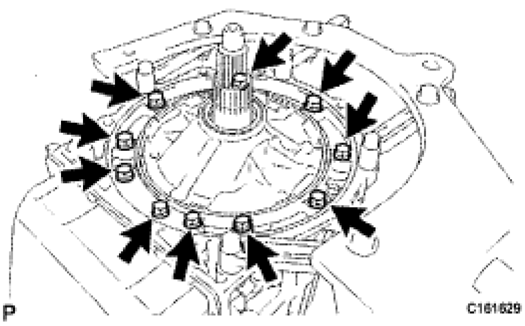

Fig. 609: Identifying Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

54. **INSPECT INDIVIDUAL PISTON OPERATION** (see INSPECTION)
55. **INSTALL MANUAL VALVE LEVER SHAFT OIL SEAL**
    a. Using SST, tap in 2 new oil seals.

SST 09350-30020 (09350-07110)

b. Coat the lips of the oil seals with MP grease.

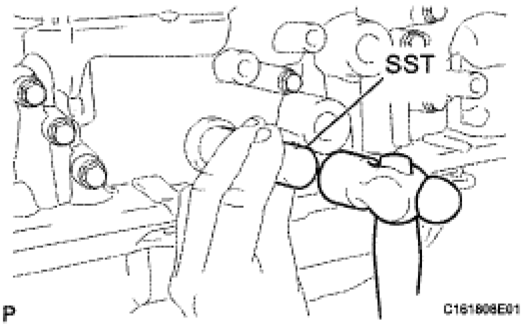

Fig. 610: Tapping Oil Seal Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

56. **INSTALL MANUAL VALVE LEVER SUB-ASSEMBLY**
   a. Install a new spacer to the manual valve lever.
   b. Push the manual valve lever shaft through the transmission case, and install the manual valve lever to the shaft.

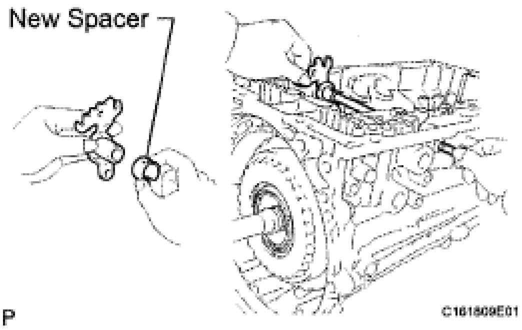

Fig. 611: Identifying Manual Valve Lever Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   c. Using a hammer, tap in a new spring pin.

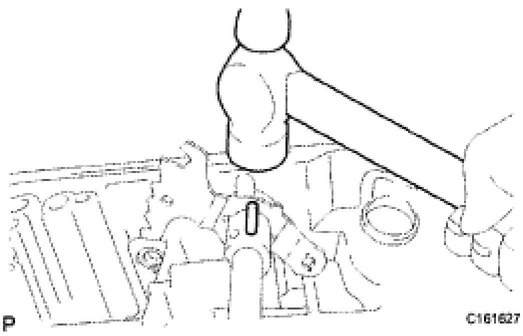

Fig. 612: Tapping Spring Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Align the manual valve lever indentation with the spacer hole, and stake them together with the punch.
e. Check that the shaft rotates smoothly.

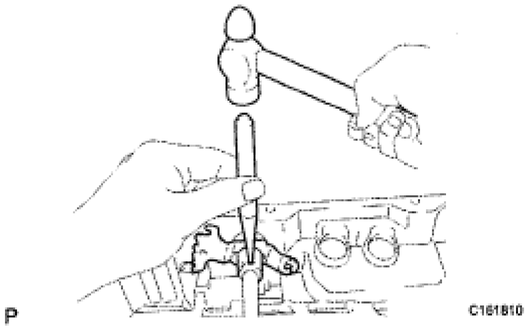

Fig. 613: Staking Manual Valve Lever Indentation
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

57. **INSTALL PARKING LOCK PAWL**
    a. Install a new E-ring to the shaft.
    b. Install the parking lock pawl, shaft and spring.

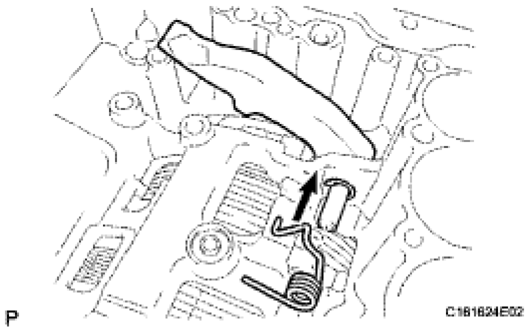

Fig. 614: Identifying Parking Lock Pawl
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

58. **INSTALL PARKING LOCK ROD SUB-ASSEMBLY**
    a. Connect the parking lock rod to the manual valve lever.

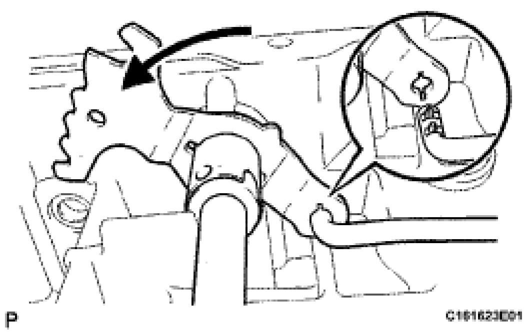

Fig. 615: Installing Parking Lock Rod Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

59. **INSTALL PARKING LOCK PAWL BRACKET**

a. Place the parking lock pawl bracket onto the transmission case and install the 3 bolts.

Torque: 18 N*m (184 kgf*cm, 13 in.*lbf)

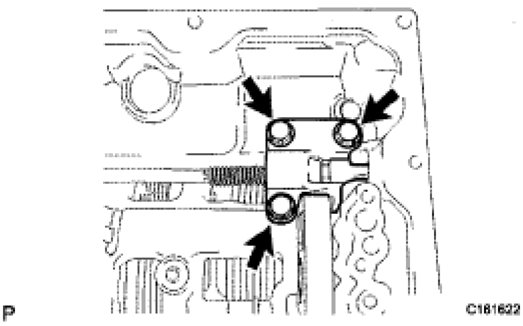

Fig. 616: Identifying Parking Lock Pawl Bracket Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Move the manual valve lever to the P position, and confirm that the planetary ring gear is correctly locked by the lock pawl.

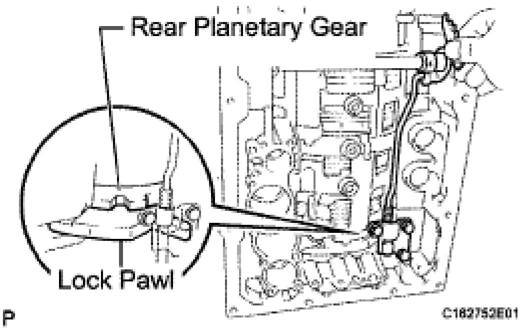

Fig. 617: Identifying Rear Planetary Gear And Lock Pawl
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

60. **INSTALL B-1 ACCUMULATOR VALVE**

a. Install the 2 springs and accumulator valve to the hole.

Spring diameter

SPRING DIAMETER SPECIFICATIONS

Spring	Free length Outer diameter	Color
B-1 Inner	44.98 mm (1.77 in.) 11.30 mm (0.445 in.)	Natural
B-1 Outer	46.36 mm (1.83 in.) 17.10 mm (0.673 in.)	Natural

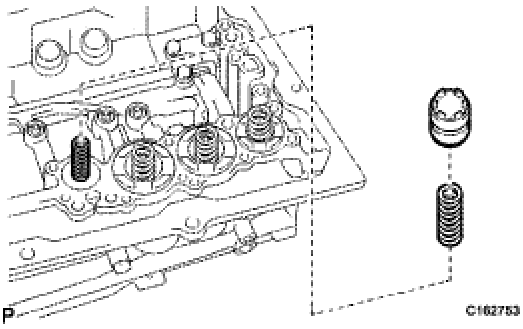

Fig. 618: Identifying Springs And Accumulator Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

61. **INSTALL C-3 ACCUMULATOR PISTON**
    a. Coat 2 new O-rings with ATF, and install them to the piston.
    b. Install the spring and accumulator piston to the hole.

Spring diameter

SPRING DIAMETER SPECIFICATIONS

Spring	Free length Outer diameter	Color
C-3	73.35 mm (2.89 in.) 19.9 mm (0.783 in.)	Red

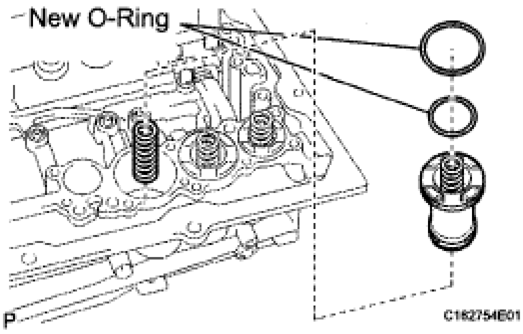

Fig. 619: Identifying O-Rings And C-3 Accumulator Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

62. **INSTALL B-3 ACCUMULATOR PISTON**
    a. Coat 2 new O-rings with ATF, and install them to the piston.
    b. Install the spring and accumulator piston to the hole.

Spring diameter

SPRING DIAMETER SPECIFICATIONS

Spring	Free length Outer diameter	Color
B-3	64.50 mm (2.54 in.) 19.5 mm (0.768 in.)	Orange

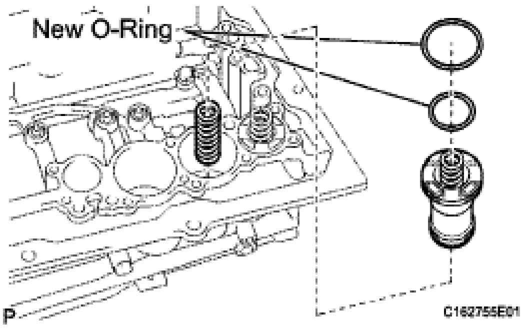

Fig. 620: Identifying O-Rings And B-3 Accumulator Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

63. **INSTALL C-2 ACCUMULATOR PISTON**
    a. Coat 2 new O-rings with ATF, and install them to the piston.
    b. Install the spring and accumulator piston to the hole.

Spring diameter

SPRING DIAMETER SPECIFICATIONS

Spring	Free length Outer diameter	Color
C-2	68.0 mm (2.68 in.) 16.1 mm (0.634 in.)	Light green

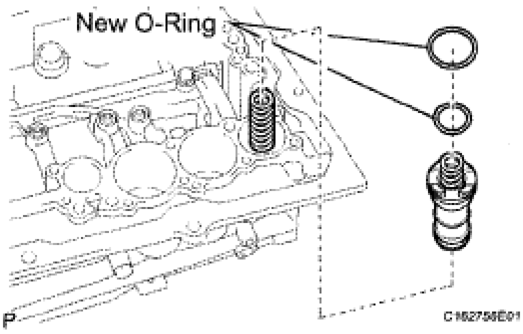

Fig. 621: Identifying O-Ring And C-2 Accumulator Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

64. **INSTALL CHECK BALL BODY**
    a. Install the spring and check ball body.

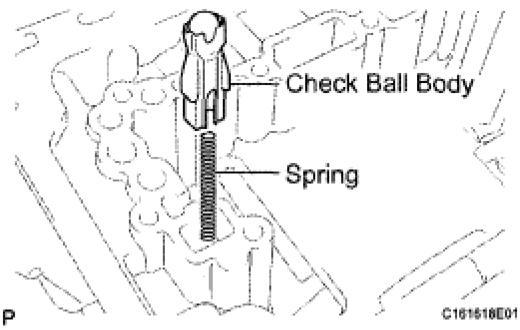

Fig. 622: Identifying Spring And Check Ball Body
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

65. **INSTALL BRAKE DRUM GASKET**
    a. Install 3 new brake drum gaskets.

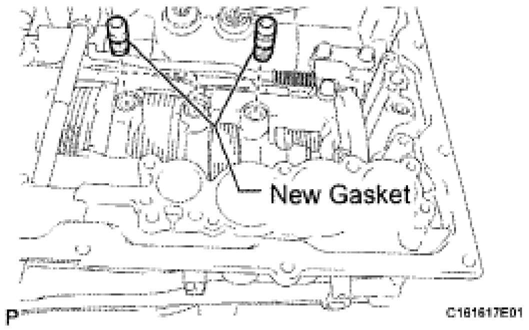

Fig. 623: Identifying Brake Drum Gaskets
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

66. **INSTALL TRANSMISSION CASE GASKET**
    a. Install 3 new transmission case gaskets.

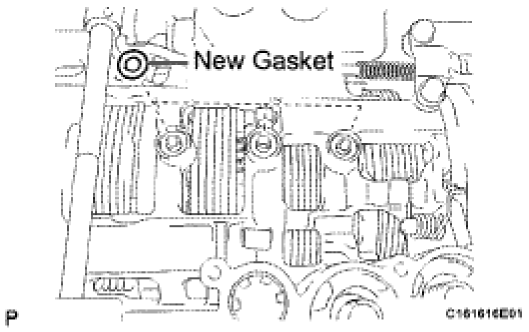

Fig. 624: Identifying Transmission Case Gaskets
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

67. **INSTALL TRANSMISSION VALVE BODY ASSEMBLY**
    a. Align the hole of the manual valve with the pin of the lever.

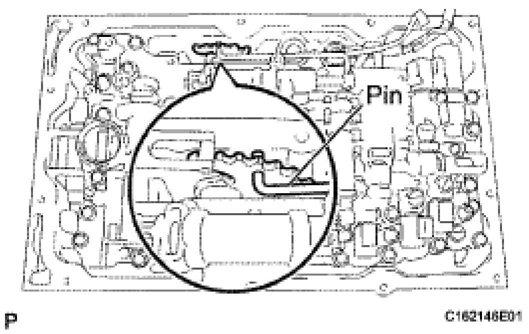

Fig. 625: Identifying Hole Of Manual Valve With Pin Of Lever
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Install the 19 bolts.

Torque: 11 N*m (110 kgf*cm, 8 ft.*lbf)

HINT:

Each bolt length is indicated below.

36 mm (1.42 in.) for bolt A

25 mm (0.984 in.) for bolt B

45 mm (1.77 in.) for bolt C

50 mm (1.97 in.) for bolt D

c. Install the detent spring and detent spring cover with the bolt.

Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)

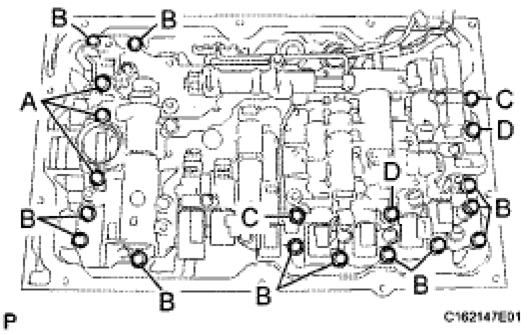

Fig. 626: Identifying Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

68. **INSTALL TRANSMISSION WIRE**

a. Install 2 new O-rings to the transmission wires.

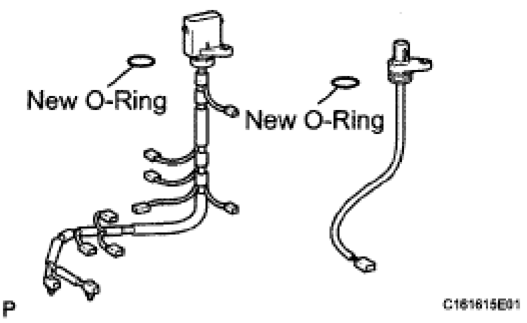

Fig. 627: Identifying O-Rings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Install the transmission wire harnesses.

c. Install the bolts.

Torque: 5.4 N*m (55 kgf*cm, 48 in.*lbf)

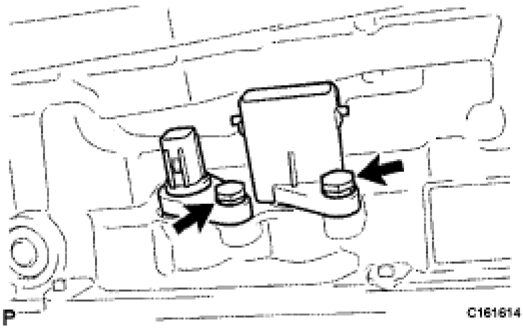

Fig. 628: Identifying Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Connect the 9 connectors to the solenoid valves.
e. Connect the 2 ATF temperature sensors with the 2 clamps and 2 bolts.

Torque: for bolt A

10 N*m (102 kgf*cm, 7 ft.*lbf)

for bolt B

11 N*m (112 kgf*cm, 8 ft.*lbf)

HINT:

Each bolt length is indicated below.

12 mm (0.472 in.) for bolt A

36 mm (1.42 in.) for bolt B

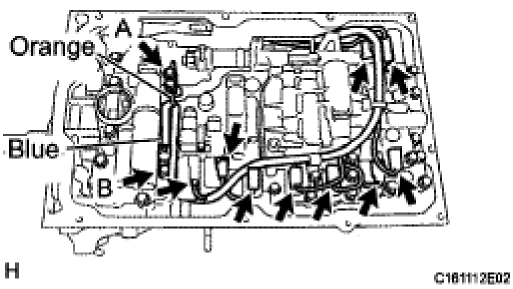

Fig. 629: Identifying Solenoid Valves Connector With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

69. **INSTALL VALVE BODY OIL STRAINER ASSEMBLY**

a. Coat a new O-ring with ATF, and install it to the oil strainer.

b. Install the oil strainer with the 4 bolts.

Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)

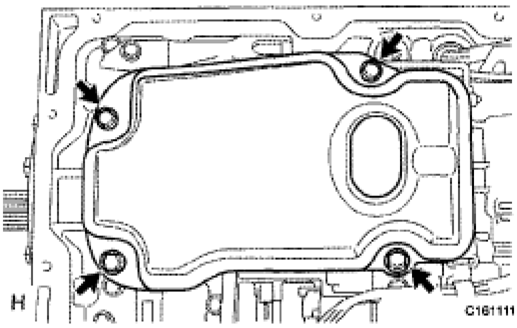

Fig. 630: Identifying Oil Strainer Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

70. **INSTALL AUTOMATIC TRANSMISSION OIL PAN SUB-ASSEMBLY**

a. Install the 4 magnets.
b. Install a new gasket on the oil pan.
c. Install the 12 bolts.

Torque: 7.4 N*m (75 kgf*cm, 65 in.*lbf)

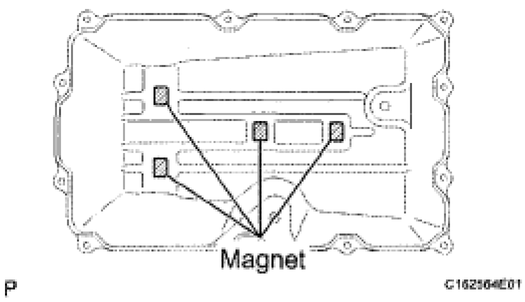

Fig. 631: Identifying Magnets
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:

- **Make sure that there is no oil or foreign matter on the gasket seal surface and oil pan contact surface.**
- **Install the gasket so that there is no slack in the gasket, and make sure the seal surface's entire circumference is level.**
- **Make sure that the 9 gasket drop prevention protrusions are set on the oil pan.**
- **When tightening the oil pan, make sure that the gasket is not pinched between the gasket tightening area's sleeve and the transmission's seal surface.**

d. Install the drain plug.

Torque: 20 N*m (204 kgf*cm, 15 ft.*lbf)

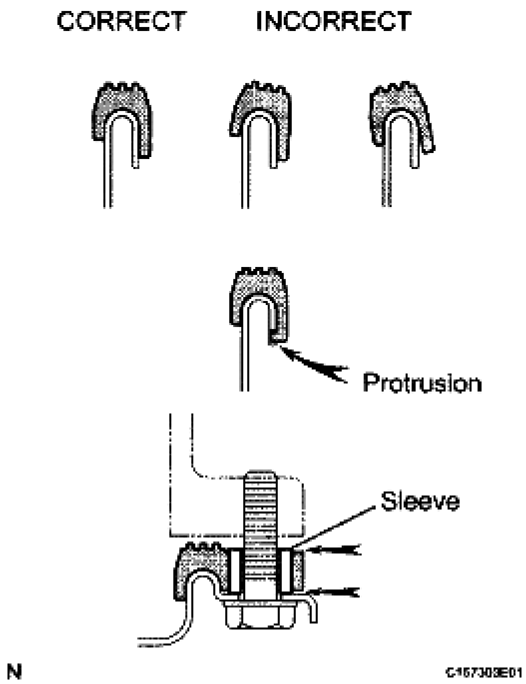

Fig. 632: Identifying Correct And Incorrect Position Of Protrusion
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

71. **INSTALL TRANSFER CASE ADAPTER RADIAL BALL BEARING**
    a. Using SST and a press, press in the bearing.

    SST 09950-60010 (09951-00650), 09950-70010 (09951-07150)

    b. Using a screwdriver, install the snap ring.

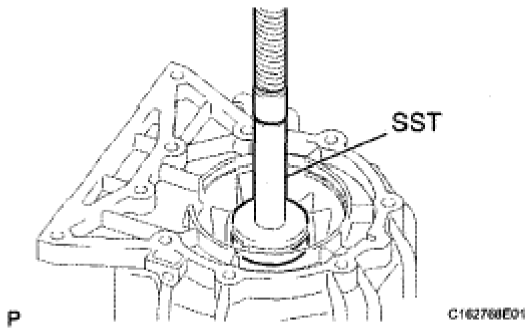

Fig. 633: Identifying SST For Pressing Bearing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

72. **INSTALL TRANSMISSION CASE ADAPTOR OIL SEAL**
    a. Coat the lip of a new oil seal with ATF.
    b. Using SST and a hammer, tap in the oil seal.

    Standard depth:

0 to 0.1 mm (0 to 0.00394 in.)

SST 09950-60010 (09951-00650), 09950-70010 (09951-07150)

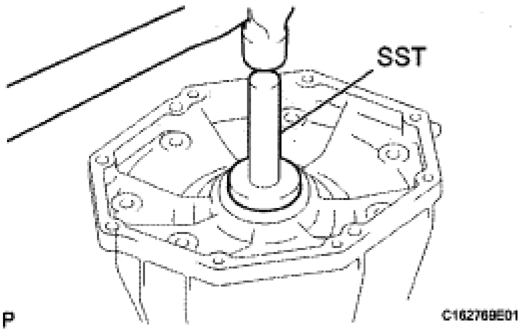

Fig. 634: Identifying Transmission Case Adaptor Oil Seal Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

73. **INSTALL REAR ADAPTOR TRANSFER**

a. Clean the threads of the bolts and case with non-residue solvent.
b. Apply seal packing to the rear adaptor transfer.

Seal packing:

Toyota Genuine Seal Packing 1281, Three Bond 1281 or equivalent

Seal diameter:

1.0 to 1.5 mm (0.0394 to 0.0591 in.)

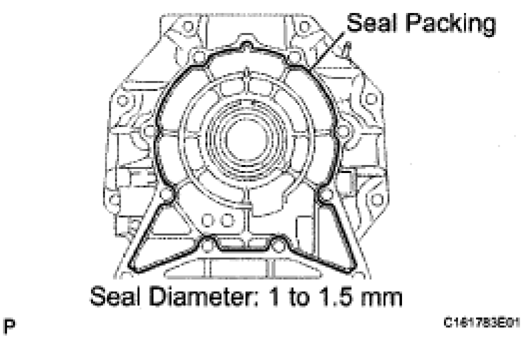

Fig. 635: Identifying Seal Packing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Install the rear adaptor transfer with the 10 bolts.

Torque: 34 N*m (345 kgf*cm, 25 ft.*lbf)

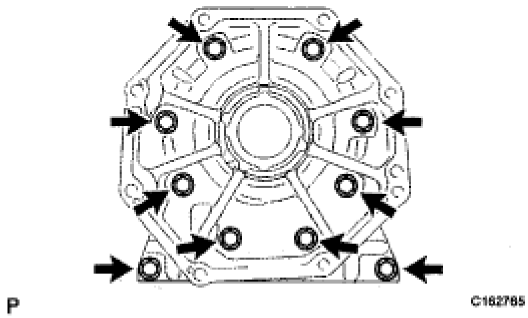

Fig. 636: Identifying Rear Adaptor Transfer Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

74. **INSTALL AUTOMATIC TRANSMISSION HOUSING**
    a. Clean the threads of the bolts and case with non-residue solvent.
    b. Install the transmission housing with the 14 bolts.

    Torque: 34 N*m (345 kgf*cm, 25 ft.*lbf)

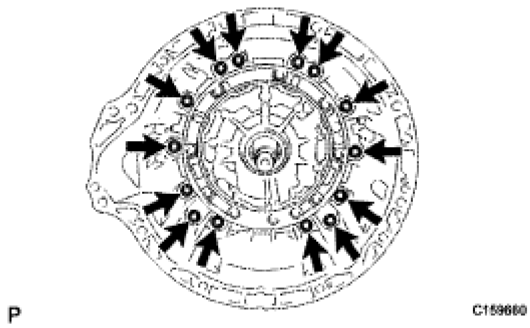

Fig. 637: Identifying Transmission Housing Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

75. **INSTALL AUTOMATIC TRANSMISSION BREATHER TUBE**
    a. Coat a new O-ring with ATF and install it to the breather tube.
    b. Install the breather tube with the 2 bolts.

    Torque: 5.4 N*m (55 kgf*cm, 48 in.*lbf)

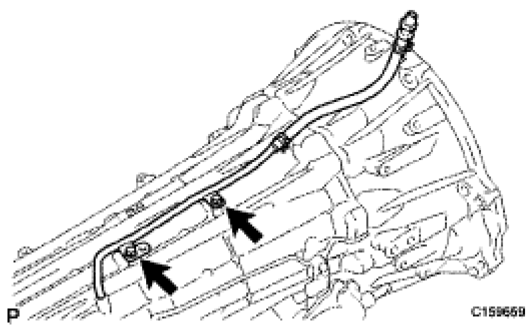

Fig. 638: Identifying Bolts On Breather Tube
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

76. **INSTALL TRANSMISSION OIL COOLER ASSEMBLY**

a. w/ Trailer Towing System:

1. Coat 4 new O-rings with ATF.
2. Install the 4 O-rings, transmission oil cooler and transmission oil thermostat to the automatic transmission assembly with the 3 bolts.

Torque: 21 N*m (214 kgf*cm, 25 ft.*lbf)

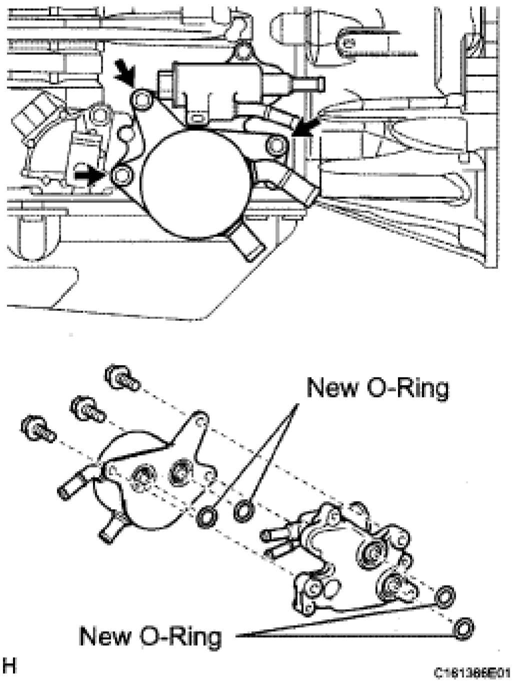

Fig. 639: Identifying Automatic Transmission Assembly Bolts And O-Ring (W/ Trailer Towing System)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. w/o Trailer Towing System:

1. Coat 4 new O-rings with ATF.
2. Install the 4 O-rings, transmission oil cooler and transmission oil cooler spacer to the automatic transmission assembly with the 3 bolts.

Torque: 21 N*m (214 kgf*cm, 25 ft.*lbf)

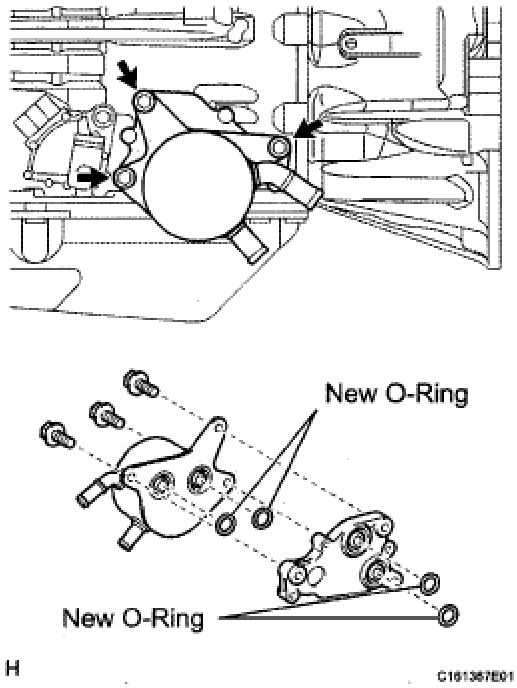

Fig. 640: Identifying Automatic Transmission Assembly Bolts And O-Ring (W/O Trailer Towing System)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

77. **INSTALL SPEED SENSOR**
    a. Coat 2 new O-rings with ATF, and install them to the speed sensors.
    b. Install the 2 speed sensors.
    c. Install the 2 bolts.

    Torque: 5.4 N*m (55 kgf*cm, 48 in.*lbf)

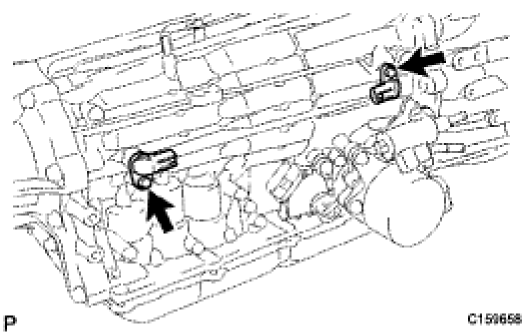

Fig. 641: Identifying Speed Sensors
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

78. **INSTALL PARK/NEUTRAL POSITION SWITCH ASSEMBLY**
    a. Install the park/neutral position switch to the manual valve lever shaft, and temporarily install the adjusting bolt.
    b. Install a new lock washer and the nut.

Torque: 6.9 N*m (70 kgf*cm, 61 in.*lbf)

c. Temporarily install the control shaft lever RH.

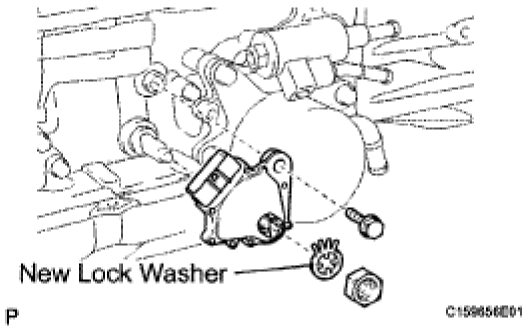

Fig. 642: Identifying Lock Washer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Turn the control shaft lever RH counterclockwise until it stops, and then turn it clockwise 2 notches to set it to the N position.
e. Remove the control shaft lever RH.

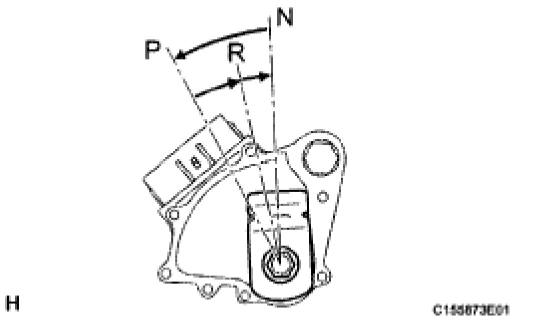

Fig. 643: Identifying Control Shaft Lever RH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

f. Align the groove with the neutral basic line.
g. Hold the switch in position and tighten the bolt.

Torque: 13 N*m (133 kgf*cm, 10 ft.*lbf)

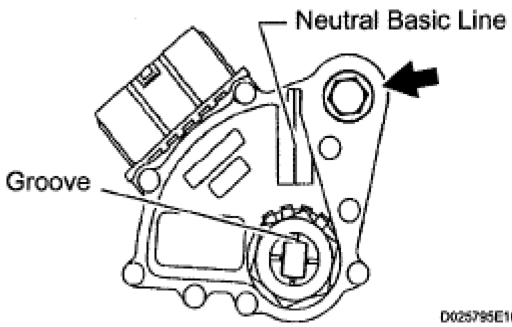

Fig. 644: Identifying Neutral Basic Line And Groove

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

h. Using a screwdriver, bend the tabs of the lock washer.

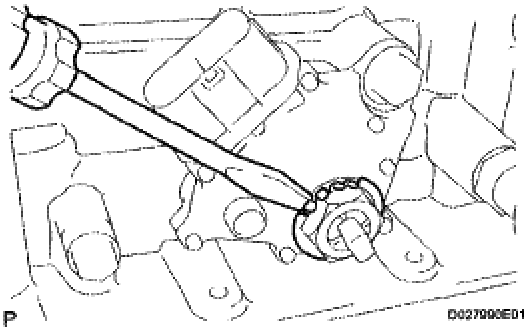

Fig. 645: Bending Tabs Of Lock Washer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

79. **INSTALL TRANSMISSION CONTROL SHAFT LEVER RH**
    a. Install the control shaft lever RH with the washer and nut.

    Torque: 16 N*m (163 kgf*cm, 12 ft.*lbf)

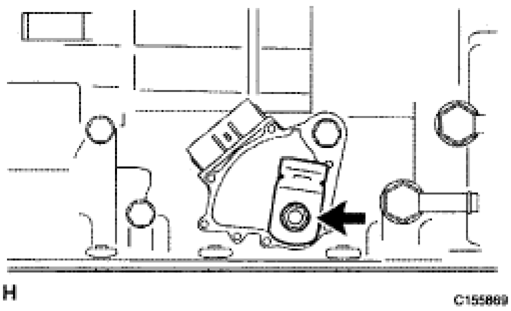

Fig. 646: Identifying Transmission Control Shaft Lever RH Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

OIL PUMP

COMPONENTS

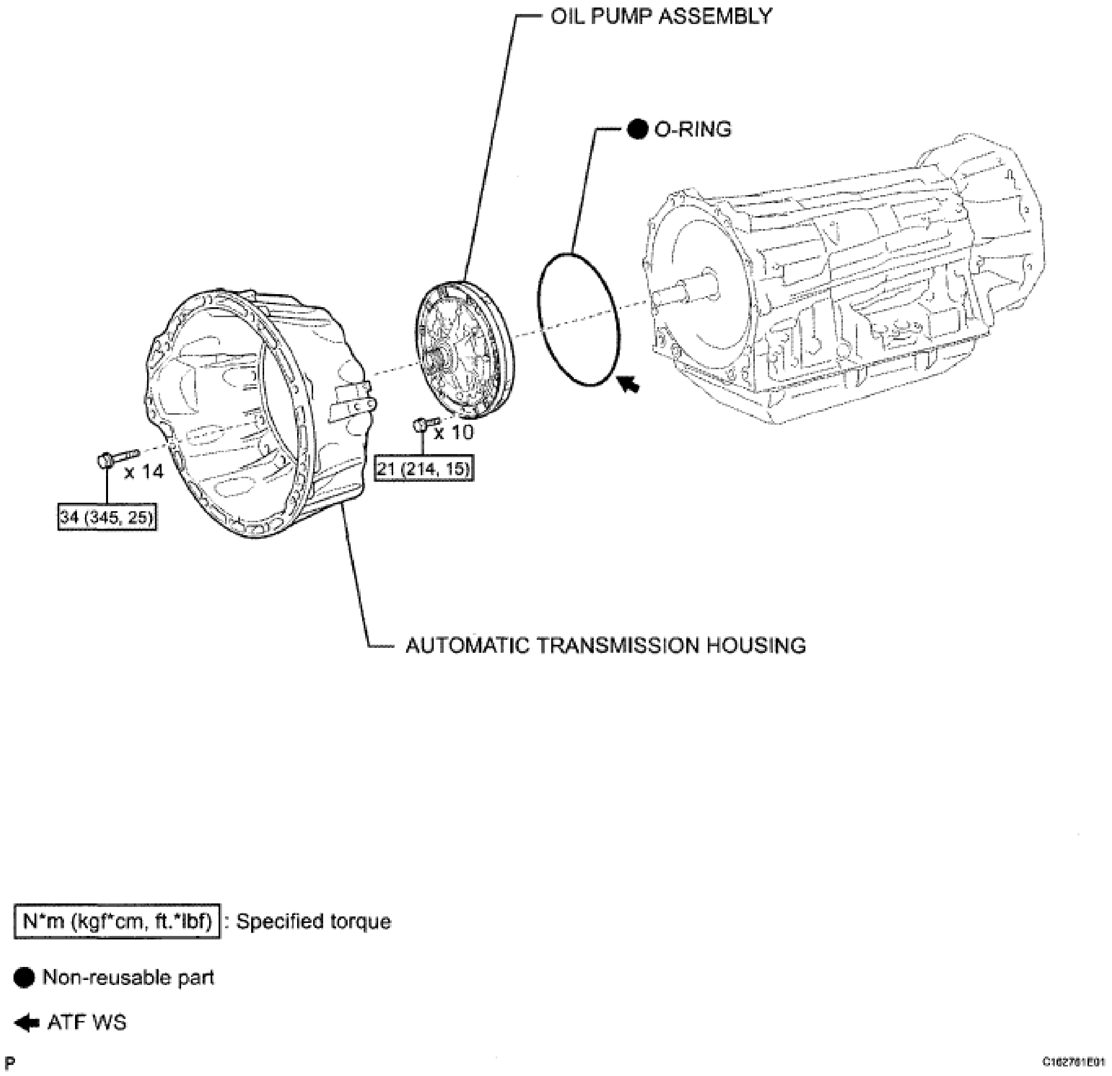

Fig. 647: Exploded View Of Oil Pump Assembly With Torque Specifications With Torque Specifications (1 Of 2)

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

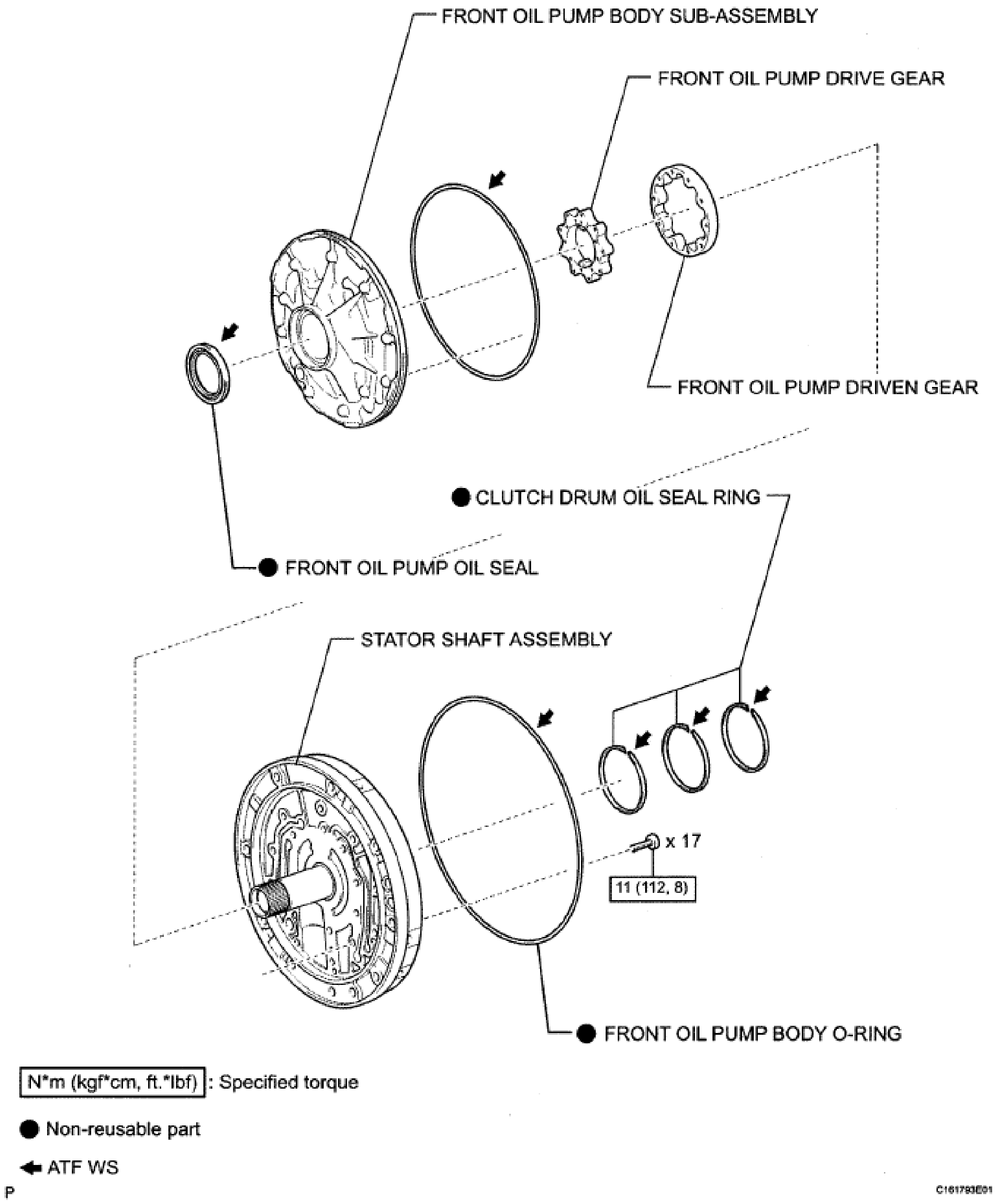

Fig. 648: Exploded View Of Oil Pump Assembly With Torque Specifications With Torque Specification (2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **REMOVE AUTOMATIC TRANSMISSION HOUSING** (see DISASSEMBLY)
2. **FIX AUTOMATIC TRANSMISSION CASE SUB-ASSEMBLY** (see DISASSEMBLY)
3. **REMOVE OIL PUMP ASSEMBLY** (see DISASSEMBLY)

DISASSEMBLY

1. **REMOVE FRONT OIL PUMP BODY O-RING**
   a. Remove the O-ring from the oil pump.

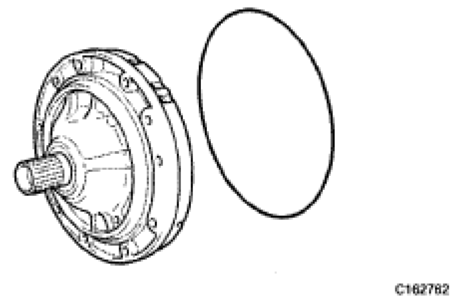

Fig. 649: Identifying O-Ring And Oil Pump
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **FIX OIL PUMP ASSEMBLY**
   a. Place the oil pump body on the torque converter.

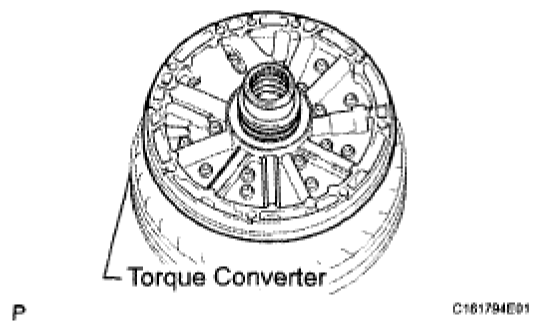

Fig. 650: Identifying Torque Converter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **REMOVE CLUTCH DRUM OIL SEAL RING**
   a. Remove the 3 oil seal rings.

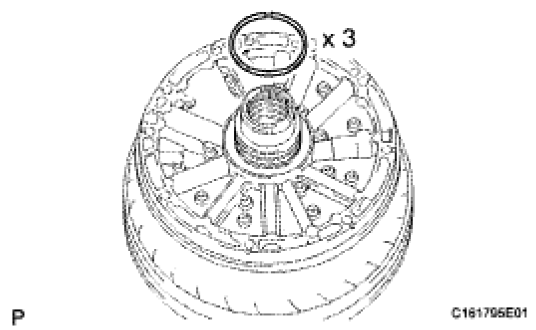

Fig. 651: Identifying Oil Seal Rings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. **REMOVE STATOR SHAFT ASSEMBLY**
   a. Remove the 17 bolts, and then remove the stator shaft from the oil pump body.

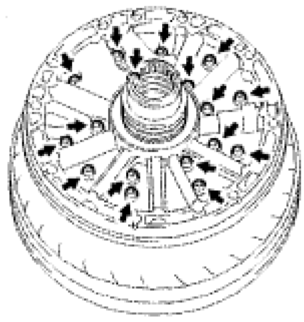

Fig. 652: Identifying Stator Shaft Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. **REMOVE FRONT OIL PUMP BODY O-RING**
   a. Remove the O-ring from the oil pump body.

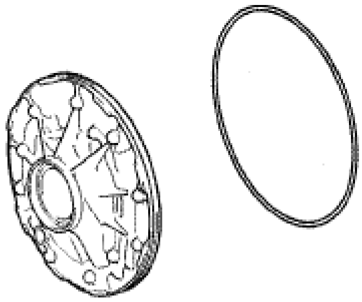

Fig. 653: Identifying O-Ring And Oil Pump Body
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Remove the oil pump body from the torque converter clutch.
6. **INSPECT FRONT OIL PUMP BODY SUB-ASSEMBLY** (see INSPECTION)
7. **INSPECT STATOR SHAFT ASSEMBLY** (see INSPECTION)
8. **INSPECT CLEARANCE OF OIL PUMP ASSEMBLY** (see INSPECTION)
9. **REMOVE FRONT OIL PUMP DRIVE GEAR**

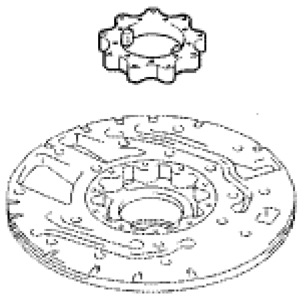

Fig. 654: Identifying Front Oil Pump Drive Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. **REMOVE FRONT OIL PUMP DRIVEN GEAR**

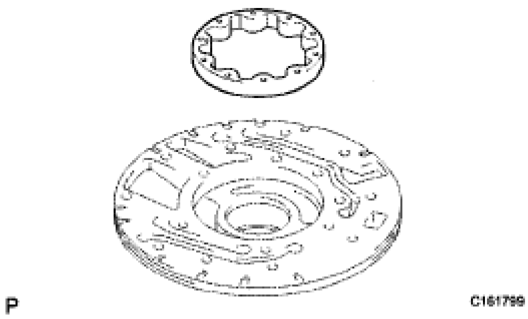

Fig. 655: Identifying Front Oil Pump Driven Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. **REMOVE FRONT OIL PUMP OIL SEAL**
    a. Using a screwdriver, pry out the oil seal.

    NOTE: Be careful not to damage the transmission case. Wrap the tip of the screwdriver with tape.

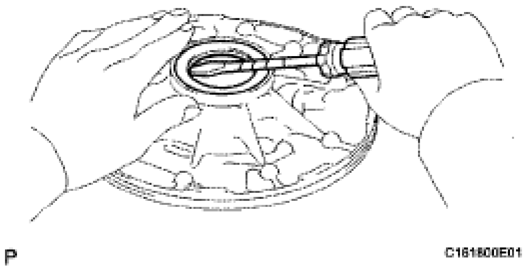

Fig. 656: Prying Out Oil Pump Oil Seal Using Screwdriver
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION

1. **INSPECT FRONT OIL PUMP BODY SUB-ASSEMBLY**
    a. Using a dial indicator, measure the inside diameter of the oil pump body bush.

    Standard inside diameter:

    45.064 to 45.078 mm (1.774 to 1.775 in.)

    If the inside diameter is greater than the standard, replace the oil pump body sub-assembly.

Fig. 657: Measuring Inside Diameter Of Oil Pump Body Bush Using Dial Indicator
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **INSPECT STATOR SHAFT ASSEMBLY**
   a. Using a dial indicator, measure the inside diameter of the stator shaft bush.

      Standard inside diameter:

      25.900 to 25.921 mm (1.020 to 1.021 in.)

      If the inside diameter is greater than the standard, replace the stator shaft assembly.

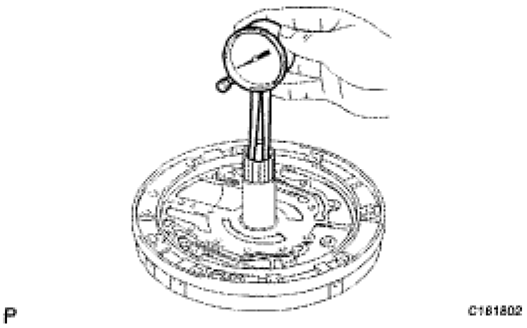

Fig. 658: Measuring Inside Diameter Of Stator Shaft Bush Using Dial Indicator
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **INSPECT CLEARANCE OF OIL PUMP ASSEMBLY**
   a. Push the driven gear to one side of the body.
   b. Using a feeler gauge, measure the body clearance.

      Standard body clearance:

      0.10 to 0.17 mm (0.00394 to 0.00669 in.)

      Maximum body clearance:

      0.17 mm (0.00669 in.)

      If the body clearance is greater than the maximum, replace the drive gear, driven gear or pump body assembly.

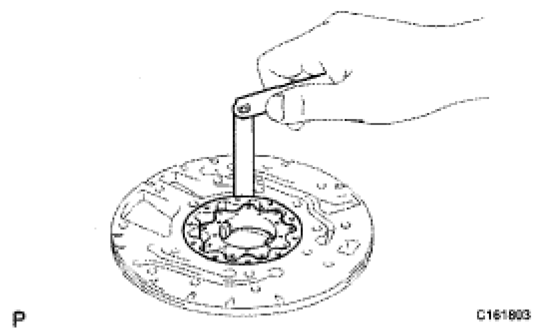

Fig. 659: Measuring Body Clearance Using Feeler Gauge
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Using a feeler gauge, measure the tip clearance between the driven gear teeth and drive gear teeth.

Standard tip clearance:

0.070 to 0.150 mm (0.00276 to 0.00591 in.)

Maximum tip clearance:

0.150 mm (0.00591 in.)

If the tip clearance is greater than the maximum, replace the drive gear, driven gear or pump body assembly.

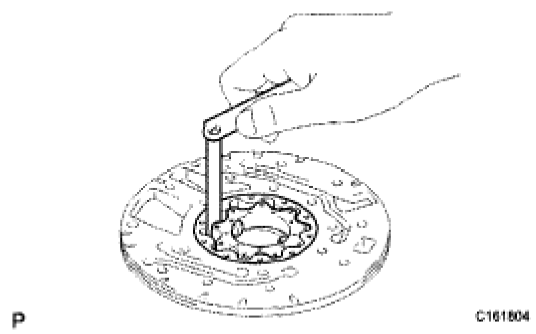

Fig. 660: Measuring Tip Clearance Between Driven Gear Teeth And Drive Gear Teeth Using Feeler Gauge
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Using a steel straightedge and feeler gauge, measure the side clearance of both gears.

Standard side clearance:

0.03 to 0.05 mm (0.00118 to 0.00197 in.)

Maximum side clearance:

0.05 mm (0.00197 in.)

If the side clearance of both gears is greater than the maximum, replace the drive gear, driven gear or pump body assembly.

HINT:

There are 7 different thicknesses for the drive and driven gears.

Standard drive and driven gears thickness

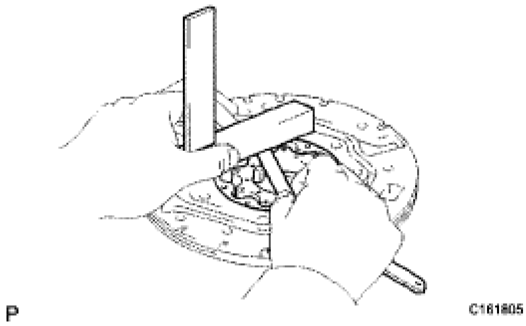

Fig. 661: Measuring Side Clearance Of Both Gears Using Steel Straightedge And Feeler Gauge
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

STANDARD DRIVE AND DRIVEN GEARS THICKNESS SPECIFICATIONS

Mark	Thickness
0	11.636 to 11.642 mm (0.4581 to 0.4583 in.)
1	11.643 to 11.649 mm (0.4584 to 0.4586 in.)
2	11.650 to 11.656 mm (0.4587 to 0.4589 in.)
3	11.657 to 11.663 mm (0.4589 to 0.4592 in.)
4	11.664 to 11.670 mm (0.4592 to 0.4594 in.)
5	11.671 to 11.677 mm (0.4595 to 0.4597 in.)
6	11.678 to 11.684 mm (0.4598 to 0.4600 in.)

4. **INSPECT FRONT OIL PUMP DRIVE GEAR ROTATION**
   a. Place the oil pump body on the torque converter clutch.
   b. Check that the drive gear rotates smoothly.
   c. Remove the oil pump assembly from the torque converter.

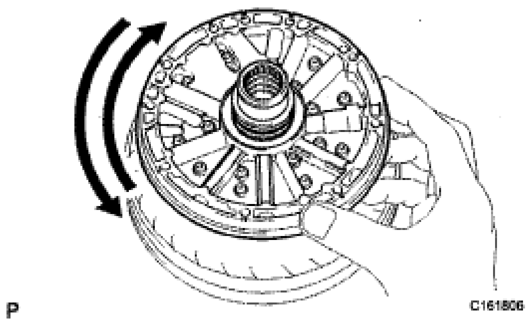

Fig. 662: Checking Drive Gear Rotation

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

REASSEMBLY

1. **INSTALL FRONT OIL PUMP OIL SEAL**
    a. Using SST and a hammer, tap in a new oil seal.

    SST 09950-60010 (09951-00650), 09950-70010 (09951-07100)

    HINT:

    The oil seal end should be flush with the outer edge of the pump body.

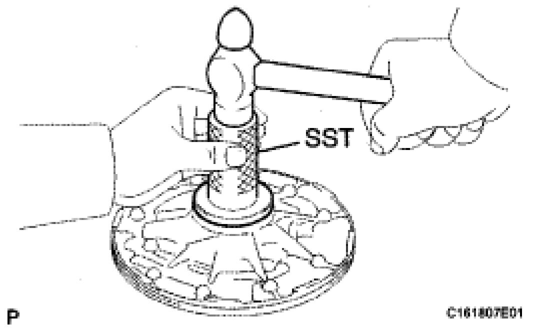

Fig. 663: Tapping Front Oil Pump Oil Seal Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    b. Coat the lip of the oil seal with MP grease.
2. **FIX FRONT OIL PUMP BODY SUB-ASSEMBLY**
    a. Place the oil pump body on the torque converter clutch.
3. **INSTALL FRONT OIL PUMP DRIVEN GEAR**
    a. Coat the driven gear with ATF.
    b. Install the driven gear to the oil pump body.

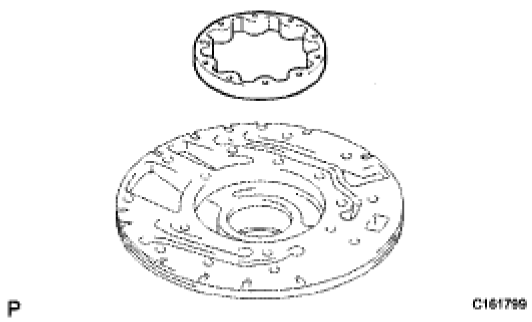

Fig. 664: Identifying Front Oil Pump Driven Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. **INSTALL FRONT OIL PUMP DRIVE GEAR**
    a. Coat the drive gear with ATF.
    b. Install the drive gear to the oil pump body.

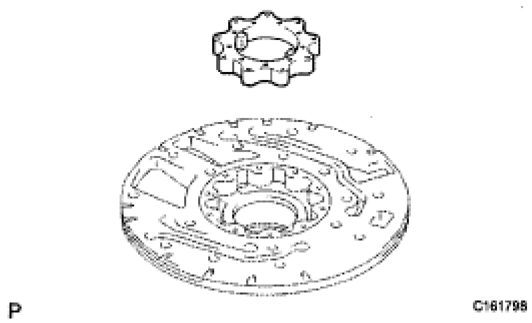

Fig. 665: Identifying Front Oil Pump Drive Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. **INSTALL FRONT OIL PUMP BODY O-RING**
    a. Coat a new O-ring with ATF and install it to the oil pump body.

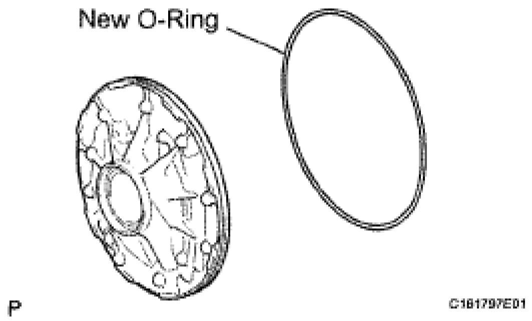

Fig. 666: Identifying O-Ring And Oil Pump Body
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. **INSTALL STATOR SHAFT ASSEMBLY**
    a. Align the stator shaft with the bolt holes.
    b. Install the 17 bolts.

    Torque: 11 N*m (112 kgf*cm, 8 ft.*lbf)

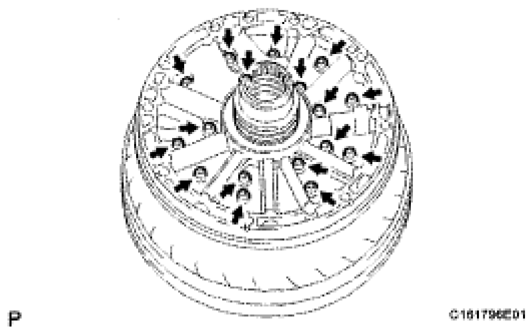

Fig. 667: Identifying Stator Shaft Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. **INSTALL CLUTCH DRUM OIL SEAL RING**
    a. Coat 3 new oil seal rings with ATF.

b. Squeeze the ends of the 3 oil seal rings together so that the overlap distance is 8 mm (0.314 in.) or less, and then install them to the starter shaft groove.

NOTE: Do not excessively widen the rings.

HINT:

After installing the oil seal rings, check that they rotate smoothly.

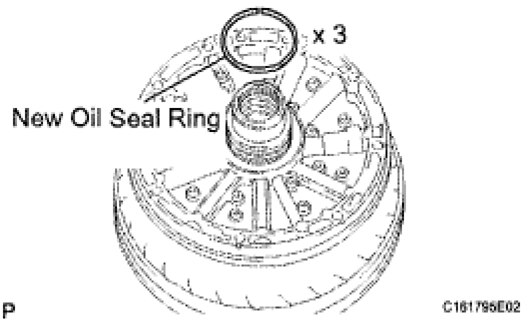

Fig. 668: Identifying Oil Seal Rings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. **INSPECT OIL PUMP DRIVE GEAR ROTATION** (see **INSPECTION**)
9. **INSTALL FRONT OIL PUMP BODY O-RING**
   a. Coat a new O-ring with ATF and install it to the oil pump.

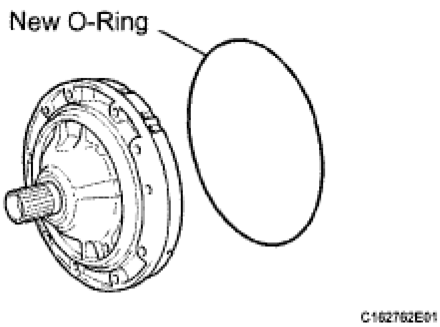

Fig. 669: Identifying O-Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. **INSTALL OIL PUMP ASSEMBLY** (see **REASSEMBLY**)
2. **INSTALL AUTOMATIC TRANSMISSION HOUSING** (see **REASSEMBLY**)

TERMS DEFINITION

Term	Definition
Monitor description	Description of what the ECM monitors and how it detects malfunctions (monitoring purpose and its details).
	Group of diagnostic trouble codes that are output by the ECM based on same

Related DTCs	malfunction detection logic.
Typical enabling condition	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).
Sequence of operation	The priority order that is applied to monitoring if multiple sensors and components are used to detect the malfunction. While a sensor is being monitored, the next sensor or component will not be monitored until the previous monitoring has concluded.
Required sensor/components	The sensors and components that are used by the ECM to detect malfunctions.
Frequency of operation	The number of times that the ECM checks for malfunctions per driving cycle. "Once per driving cycle" means that the ECM detects the malfunction only one time during a single driving cycle. "Continuous" means that the ECM detects the malfunction every time when enabling condition is met.
Duration	The minimum time that the ECM must sense a continuous deviation in the monitored value (s) before setting a DTC. This timing begins after the "typical enabling conditions" are met.
Malfunction thresholds	Beyond this value, the ECM will conclude that there is a malfunction and set a DTC.
MIL operation	MIL illumination timing after a defect is detected. "Immediately" means that the ECM illuminates the MIL the instant the ECM determines that there is a malfunction. "2 driving cycle" means that the ECM illuminates the MIL if the same malfunction is detected again in the 2nd driving cycle.
Component operating range	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.

PROBLEM SYMPTOM RESULT CHART

Result	Proceed to
Symptom does not occur	A
Symptom occurs	B

DTC RESULT CHART

Result	Proceed to
DTC is not output	A
DTC is output	B

STALL SPEED TEST REFERENCE

Test Result	Possible Cause
Stall speed Is lower than standard value	• Stator one-way clutch is not operating properly • Torque converter is faulty (stall speed is less than standard value by 600 rpm or more) • Engine power may be insufficient

Stall speed is higher than standard value	• Line pressure is low • C1 clutch slipping • F3 one-way clutch is not operating properly • F4 one-way clutch is not operating properly

SHIFT TIME LAG TEST REFERENCE

Test Result	Possible Cause
D position time lag exceeds standard value	• Line pressure is low • C1 clutch is worn • F3 one-way clutch is not operating properly • F4 one-way clutch is not operating properly
R position time lag exceeds standard value	• Line pressure is low • C3 clutch is worn • B4 brake is worn • F1 one-way clutch is not operating properly

LINE PRESSURE SPECIFICATIONS

Condition	D position kPa (kgf/cm^2 , psi)	R position kPa (kgf/cm^2 , psi)
Idling	355 to 425 kPa (3.6 to 4.3 kgf/cm^2 , 52 to 62 psi)	541 to 641 kPa (5.5 to 6.5 kgf/cm^2 , 78 to 93 psi)
Stall speed	1198 to 1308 kPa (12.2 to 13.3 kgf/cm^2 , 174 to 190 psi)	1532 to 1740 kPa (15.6 to 17.7 kgf/cm^2 , 222 to 252 psi)

HYDRAULIC TEST REFERENCE

Problem	Possible cause
Measured values at both positions are higher than specified pressure	• Shift solenoid valve SLT defective • Regulator valve defective
Measured values at both positions are lower than specified pressure	• Shift solenoid valve SLT defective • Regulator valve defective • Oil pump defective
Pressure is low in D position only	• D position circuit fluid leak • Clutch No. 1 (C1) defective
Pressure is low in R position only	• R position circuit fluid leak • Clutch No. 3 (C3) defective • Brake No. 4 (B4) defective

GEAR POSITION REFERENCE

Shift Lever Position	Gear Position
P	P

R	R
D	3rd

ELECTRONIC CIRCUIT MATRIX PROBLEM SYMPTOMS CHART

Symptom	Suspected Area	See
No up-shift (1st -> 2nd)	Shift solenoid valve S1 circuit*	**DTC P0973 SHIFT SOLENOID "A" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE S1); DTC P0974 SHIFT SOLENOID "A" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE S1)**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
No up-shift (2nd -> 3rd)	Shift solenoid valve S2 circuit*	**DTC P0976 SHIFT SOLENOID "B" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE S2); DTC P0977 SHIFT SOLENOID "B" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE S2)**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
	Shift solenoid valve S3 circuit*	**DTC P0979 SHIFT SOLENOID "C" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE S3); DTC P0980 SHIFT SOLENOID "C"**

		CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE S3)
No up-shift (3rd -> 4th)	Engine coolant temperature sensor circuit*	**DIAGNOSTIC TROUBLE CODE CHART**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
No up-shift (4th -> 5th)	Shift solenoid valve S4 circuit*	**DTC P0982 SHIFT SOLENOID "D" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE S4); DTC P0983 SHIFT SOLENOID "D" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE S4)**
	Shift solenoid valve SR circuit*	**DTC P0985 SHIFT SOLENOID "E" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE SR); DTC P0986 SHIFT SOLENOID "E" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE SR)**
	Shift solenoid valve SL1 circuit*	**DTC P0748 PRESSURE CONTROL SOLENOID "A" ELECTRICAL (SHIFT SOLENOID VALVE SL1)**
	Shift solenoid valve SL2 circuit*	**DTC P0778 PRESSURE**

		CONTROL SOLENOID "B" ELECTRICAL (SHIFT SOLENOID VALVE SL2)
	ECM	ELECTRONIC CIRCUIT INSPECTION PROCEDURE
No up-shift (5th -> 6th)	Park/Neutral position switch circuit*	DTC P0705 TRANSMISSION RANGE SENSOR CIRCUIT MALFUNCTION (PRNDL INPUT)
	Engine coolant temperature sensor circuit*	DIAGNOSTIC TROUBLE CODE CHART
	Shift solenoid valve S2 circuit*	DTC P0976 SHIFT SOLENOID "B" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE S2); DTC P0977 SHIFT SOLENOID "B" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE S2)
	ECM	ELECTRONIC CIRCUIT INSPECTION PROCEDURE
No down-shift (6th -> 5th)	Park/Neutral position switch circuit*	DTC P0705 TRANSMISSION RANGE SENSOR CIRCUIT MALFUNCTION (PRNDL INPUT)
	Shift solenoid valve S2 circuit*	DTC P0976 SHIFT SOLENOID "B" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE S2); DTC

		P0977 SHIFT SOLENOID "B" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE S2)
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
No down-shift (5th -> 4th)	Shift solenoid valve S4 circuit*	**DTC P0982 SHIFT SOLENOID "D" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE S4); DTC P0983 SHIFT SOLENOID "D" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE S4)**
	Shift solenoid valve SR circuit*	**DTC P0985 SHIFT SOLENOID "E" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE SR); DTC P0986 SHIFT SOLENOID "E" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE SR)**
	Shift solenoid valve SL1 circuit*	**DTC P0748 PRESSURE CONTROL SOLENOID "A" ELECTRICAL (SHIFT SOLENOID VALVE SL1)**
	Shift solenoid valve SL2 circuit*	**DTC P0778 PRESSURE CONTROL**

		SOLENOID "B" ELECTRICAL (SHIFT SOLENOID VALVE SL2)
	ECM	ELECTRONIC CIRCUIT INSPECTION PROCEDURE
No down-shift (4th -> 3rd)	Shift solenoid valve S3 circuit*	DTC P0979 SHIFT SOLENOID "C" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE S3); DTC P0980 SHIFT SOLENOID "C" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE S3)
	ECM	ELECTRONIC CIRCUIT INSPECTION PROCEDURE
No down-shift (3rd -> 2nd)	Shift solenoid valve S2 circuit*	DTC P0976 SHIFT SOLENOID "B" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE S2); DTC P0977 SHIFT SOLENOID "B" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE S2)
	ECM	ELECTRONIC CIRCUIT INSPECTION PROCEDURE
	Shift solenoid valve S1 circuit*	DTC P0973 SHIFT SOLENOID "A" CONTROL CIRCUIT LOW (SHIFT

No down-shift (2nd-> 1st)		SOLENOID VALVE S1); DTC P0974 SHIFT SOLENOID "A" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE S1)
	ECM	ELECTRONIC CIRCUIT INSPECTION PROCEDURE
No lock up or no lock up off	Shift solenoid valve SLU circuit*	DTC P2759 TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT ELECTRICAL (SHIFT SOLENOID VALVE SLU)
	Stop light switch circuit*	DTC P0724 BRAKE SWITCH "B" CIRCUIT HIGH
	ECM	ELECTRONIC CIRCUIT INSPECTION PROCEDURE
	No. 1 ATF temperature sensor circuit*	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
No lock up	Shift solenoid valve SLU circuit*	**DTC P2759 TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT ELECTRICAL (SHIFT SOLENOID VALVE SLU)**
	Engine coolant temperature sensor circuit*	**DIAGNOSTIC TROUBLE CODE CHART**
	Stop light switch circuit*	**DTC P0724 BRAKE SWITCH "B" CIRCUIT HIGH**
	Speed sensor NT circuit*	**DTC P0717 TURBINE SPEED SENSOR CIRCUIT NO SIGNAL**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
No lock up off	Shift solenoid valve SLU circuit*	**DTC P2759 TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT ELECTRICAL (SHIFT SOLENOID VALVE SLU)**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**

	Shift solenoid valve SLT circuit*	**DTC P2716 PRESSURE CONTROL SOLENOID "D" ELECTRICAL (SHIFT SOLENOID VALVE SLT)**
	Speed sensor NT circuit*	**DTC P0717 TURBINE SPEED SENSOR CIRCUIT NO SIGNAL**
	Speed sensor SP2 circuit*	**DTC P0722 OUTPUT SPEED SENSOR CIRCUIT NO SIGNAL**
	Throttle position sensor circuit*	**DIAGNOSTIC TROUBLE CODE CHART**
Shift point too high or too low	Tow/haul pattern select switch circuit	**PATTERN SELECT SWITCH CIRCUIT**
	No. 1 ATF temperature sensor circuit*	**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**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
	Engine coolant	**DIAGNOSTIC**

Up-shift to 4th from 3rd while engine is cold	temperature sensor circuit*	**TROUBLE CODE CHART**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
Up-shift to 5th from 4th while engine is cold	Engine coolant temperature sensor circuit*	**DIAGNOSTIC TROUBLE CODE CHART**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
No gear change by shifting into "+" or "-" while shift lever on S	Transmission control switch circuit	**TRANSMISSION CONTROL SWITCH CIRCUIT**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
Harsh engagement (N -> D)	Shift solenoid valve SLT circuit*	**DTC P2716 PRESSURE CONTROL SOLENOID "D" ELECTRICAL (SHIFT SOLENOID VALVE SLT)**
	Speed sensor NT circuit*	**DTC P0717 TURBINE SPEED SENSOR CIRCUIT NO SIGNAL**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
	Speed sensor NT circuit*	**DTC P0717 TURBINE SPEED SENSOR CIRCUIT NO SIGNAL**
	Speed sensor SP2 circuit*	**DTC P0722 OUTPUT SPEED SENSOR CIRCUIT NO SIGNAL**
	Shift solenoid valve	**DTC P2759**

Harsh engagement (lock up)	SLU circuit*	**TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT ELECTRICAL (SHIFT SOLENOID VALVE SLU)**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
Harsh engagement (any driving position)	Throttle position sensor circuit*	**DIAGNOSTIC TROUBLE CODE CHART**
	Shift solenoid valve SL1 circuit*	**DTC P0748 PRESSURE CONTROL SOLENOID "A" ELECTRICAL (SHIFT SOLENOID VALVE SL1)**
	Shift solenoid valve SL2 circuit*	**DTC P0778 PRESSURE CONTROL SOLENOID "B" ELECTRICAL (SHIFT SOLENOID VALVE SL2)**
	Shift solenoid valve SLU circuit*	**DTC P2759 TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT ELECTRICAL (SHIFT SOLENOID VALVE SLU)**
	Shift solenoid valve SLT circuit*	**DTC P2716 PRESSURE**

		CONTROL SOLENOID "D" ELECTRICAL (SHIFT SOLENOID VALVE SLT)
	Speed sensor NT circuit*	**DTC P0717 TURBINE SPEED SENSOR CIRCUIT NO SIGNAL**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
Poor acceleration	No. 2 ATF temperature sensor circuit*	**DTC P2740 TRANSMISSION FLUID TEMPERATURE SENSOR "B" CIRCUIT; DTC P2742 TRANSMISSION FLUID TEMPERATURE SENSOR "B" CIRCUIT LOW INPUT; DTC P2743 TRANSMISSION FLUID TEMPERATURE SENSOR "B" CIRCUIT HIGH INPUT**
	Shift solenoid valve SLT circuit*	**DTC P2716 PRESSURE CONTROL SOLENOID "D" ELECTRICAL (SHIFT SOLENOID VALVE SLT)**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
No engine brake	ECM	**ELECTRONIC CIRCUIT INSPECTION**

		PROCEDURE
No kick-down	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
Engine stalls when starting off or stopping	Shift solenoid valve SLU circuit*	**DTC P2759 TORQUE CONVERTER CLUTCH PRESSURE CONTROL SOLENOID CONTROL CIRCUIT ELECTRICAL (SHIFT SOLENOID VALVE SLU)**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
"A/T OIL TEMP" warning light remains on, lock up at 3rd gear and/or shift point too high	No. 2 ATF temperature sensor circuit*	**DTC P2740 TRANSMISSION FLUID TEMPERATURE SENSOR "B" CIRCUIT; DTC P2742 TRANSMISSION FLUID TEMPERATURE SENSOR "B" CIRCUIT LOW INPUT; DTC P2743 TRANSMISSION FLUID TEMPERATURE SENSOR "B" CIRCUIT HIGH INPUT**
	Engine coolant temperature sensor circuit*	**DIAGNOSTIC TROUBLE CODE CHART**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
	Park/Neutral	**DTC P0705**

	position switch circuit*	**TRANSMISSION RANGE SENSOR CIRCUIT MALFUNCTION (PRNDL INPUT)**
Malfunction in shifting	Transmission control switch circuit	**TRANSMISSION CONTROL SWITCH CIRCUIT**
	ECM	**ELECTRONIC CIRCUIT INSPECTION PROCEDURE**
Harsh engagement (1st -> 2nd -> 3rd -> 4th -> 5th)	Shift solenoid valve SR circuit*	**DTC P0985 SHIFT SOLENOID "E" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE SR); DTC P0986 SHIFT SOLENOID "E" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE SR)**
Slip or shudder (5th -> 6th -> and 6th -> 5th)	Shift solenoid valve SR circuit*	**DTC P0985 SHIFT SOLENOID "E" CONTROL CIRCUIT LOW (SHIFT SOLENOID VALVE SR); DTC P0986 SHIFT SOLENOID "E" CONTROL CIRCUIT HIGH (SHIFT SOLENOID VALVE SR)**
HINT: *: When the circuit is defective, a DTC may be output.		

ON-VEHICLE REPAIR AND OFF-VEHICLE REPAIR PROBLEM SYMPTOMS CHART

Symptom	Suspected Area	See
	Transmission control cable (for Column Shift Type)	**TRANSMISSION CONTROL CABLE (FOR COLUMN SHIFT**

		TYPE)
	Transmission control cable (for Floor Shift Type)	**TRANSMISSION CONTROL CABLE (FOR FLOOR SHIFT TYPE)**
Vehicle does not move when shift lever is in any forward position and reverse position	Manual valve	**AUTOMATIC TRANSMISSION UNIT**
	Parking lock pawl	**AUTOMATIC TRANSMISSION UNIT**
	Rear planetary gear unit	**AUTOMATIC TRANSMISSION UNIT**
	Torque converter clutch	**TORQUE CONVERTER CLUTCH AND DRIVE PLATE**
Vehicle does not move with shift lever on R	Valve body assembly	**VALVE BODY ASSEMBLY**
	B4 brake	**AUTOMATIC TRANSMISSION UNIT**
No up-shift (1st->2nd)	Valve body assembly	**VALVE BODY ASSEMBLY**
	B3 brake	**AUTOMATIC TRANSMISSION UNIT**
	F1 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
	F2 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
No up-shift (2nd -> 3rd)	Valve body assembly	**VALVE BODY ASSEMBLY**
	C3 clutch	**AUTOMATIC TRANSMISSION UNIT**
No up-shift (3rd -> 4th)	Valve body assembly	**VALVE BODY ASSEMBLY**
	C2 clutch	**AUTOMATIC TRANSMISSION UNIT**
No up-shift (4th -> 5th)	Valve body assembly	**VALVE BODY ASSEMBLY**
	B1 brake	**AUTOMATIC**

		TRANSMISSION UNIT
No up-shift (5th -> 6th)	Valve body assembly	**VALVE BODY ASSEMBLY**
	B2 brake	**AUTOMATIC TRANSMISSION UNIT**
No down-shift (6th -> 5th)	Valve body assembly	**VALVE BODY ASSEMBLY**
No down-shift (5th -> 4th)	Valve body assembly	**VALVE BODY ASSEMBLY**
No down-shift (4th -> 3rd)	Valve body assembly	**VALVE BODY ASSEMBLY**
No down-shift (3rd -> 2nd)	Valve body assembly	**VALVE BODY ASSEMBLY**
No down-shift (2nd -> 1st)	Valve body assembly	**VALVE BODY ASSEMBLY**
No lock up or no lock up off	Valve body assembly	**VALVE BODY ASSEMBLY**
	Torque converter clutch	**TORQUE CONVERTER CLUTCH AND DRIVE PLATE**
Harsh engagement (N -> D)	Valve body assembly	**VALVE BODY ASSEMBLY**
	C1 accumulator	**AUTOMATIC TRANSMISSION UNIT**
	C1 clutch	**AUTOMATIC TRANSMISSION UNIT**
	F3 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
	F4 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
Harsh engagement (lock up)	Valve body assembly	**VALVE BODY ASSEMBLY**
	Torque converter clutch	**TORQUE CONVERTER CLUTCH AND DRIVE PLATE**
	Valve body assembly	**VALVE BODY ASSEMBLY**
	C3 accumulator	**AUTOMATIC TRANSMISSION UNIT**

Harsh engagement (N -> R)	C3 clutch	**AUTOMATIC TRANSMISSION UNIT**
	B4 brake	**AUTOMATIC TRANSMISSION UNIT**
	F1 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
Harsh engagement (1st -> 2nd -> 3rd -> 4th -> 5th -> 6th)	Valve body assembly	**VALVE BODY ASSEMBLY**
Harsh engagement (1st -> 2nd)	Valve body assembly	**VALVE BODY ASSEMBLY**
	B3 accumulator	**AUTOMATIC TRANSMISSION UNIT**
	B3 brake	**AUTOMATIC TRANSMISSION UNIT**
	F1 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
	F2 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
Harsh engagement (2nd -> 3rd)	Valve body assembly	**VALVE BODY ASSEMBLY**
	C3 accumulator	**AUTOMATIC TRANSMISSION UNIT**
	C3 clutch	**AUTOMATIC TRANSMISSION UNIT**
Harsh engagement (3rd -> 4th)	Valve body assembly	**VALVE BODY ASSEMBLY**
	C2 accumulator	**AUTOMATIC TRANSMISSION UNIT**
	C2 clutch	**AUTOMATIC TRANSMISSION UNIT**
Harsh engagement (4th -> 5th)	Valve body assembly	**VALVE BODY ASSEMBLY**
	B1 accumulator	**AUTOMATIC TRANSMISSION UNIT**
	B1 brake	**AUTOMATIC**

		TRANSMISSION UNIT
Harsh engagement (5th -> 6th)	Valve body assembly	**VALVE BODY ASSEMBLY**
	B2 accumulator	**AUTOMATIC TRANSMISSION UNIT**
	B2 brake	**AUTOMATIC TRANSMISSION UNIT**
Harsh engagement (6th -> 5th)	Valve body assembly	**VALVE BODY ASSEMBLY**
	C3 accumulator	**AUTOMATIC TRANSMISSION UNIT**
	C3 clutch	**AUTOMATIC TRANSMISSION UNIT**
Slip or shudder (forward and reverse, after warm-up)	Transmission control cable (for Column Shift Type)	**TRANSMISSION CONTROL CABLE (FOR COLUMN SHIFT TYPE)**
	Transmission control cable (for Floor Shift Type)	**TRANSMISSION CONTROL CABLE (FOR FLOOR SHIFT TYPE)**
	Valve body assembly	**VALVE BODY ASSEMBLY**
	Oil strainer	**VALVE BODY ASSEMBLY**
	F1 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
	C3 clutch	**AUTOMATIC TRANSMISSION UNIT**
	Torque converter clutch	**TORQUE CONVERTER CLUTCH AND DRIVE PLATE**
Slip or shudder (particular position, just after engine starts)	Torque converter clutch	**TORQUE CONVERTER CLUTCH AND DRIVE PLATE**
	B4 brake	**AUTOMATIC TRANSMISSION UNIT**

Slip or shudder (shift lever on R)	F1 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
	C3 clutch	**AUTOMATIC TRANSMISSION UNIT**
Slip or shudder (1st)	C1 clutch	**AUTOMATIC TRANSMISSION UNIT**
	F3 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
	F4 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
Slip or shudder (2nd)	C1 clutch	**AUTOMATIC TRANSMISSION UNIT**
	B3 brake	**AUTOMATIC TRANSMISSION UNIT**
	F1 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
	F2 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
	F4 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
Slip or shudder (3rd)	C1 clutch	**AUTOMATIC TRANSMISSION UNIT**
	C3 clutch	**AUTOMATIC TRANSMISSION UNIT**
	F1 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
	F4 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
Slip or shudder (4th)	C1 clutch	**AUTOMATIC TRANSMISSION UNIT**
	C2 clutch	**AUTOMATIC TRANSMISSION UNIT**

	F4 one-way clutch	**AUTOMATIC TRANSMISSION UNIT**
Slip or shudder (5th)	C2 clutch	**AUTOMATIC TRANSMISSION UNIT**
	C3 clutch	**AUTOMATIC TRANSMISSION UNIT**
	B1 brake	**AUTOMATIC TRANSMISSION UNIT**
Slip or shudder (6th)	C2 clutch	**AUTOMATIC TRANSMISSION UNIT**
	B2 brake	**AUTOMATIC TRANSMISSION UNIT**
No engine braking (1st to 4th, shift lever on S)	C4 clutch	**AUTOMATIC TRANSMISSION UNIT**
No engine braking (1st: shift lever on 1)	Valve body assembly	**VALVE BODY ASSEMBLY**
	B4 brake	**AUTOMATIC TRANSMISSION UNIT**
No engine braking (2nd: shift lever on 2)	Valve body assembly	**VALVE BODY ASSEMBLY**
	B2 brake	**AUTOMATIC TRANSMISSION UNIT**
No engine braking (3rd: shift lever on 3)	Valve body assembly	**VALVE BODY ASSEMBLY**
	B1 brake	**AUTOMATIC TRANSMISSION UNIT**
No engine braking (4th: shift lever on 4)	Valve body assembly	**VALVE BODY ASSEMBLY**
No kick-down	Valve body assembly	**VALVE BODY ASSEMBLY**
Shift point too high or too low	Valve body assembly	**VALVE BODY ASSEMBLY**
Poor acceleration (all positions)	Valve body assembly	**VALVE BODY ASSEMBLY**
	Torque converter clutch	**TORQUE CONVERTER CLUTCH AND**

		DRIVE PLATE
Poor acceleration (6th)	B2 brake	**AUTOMATIC TRANSMISSION UNIT**
	C2 clutch	**AUTOMATIC TRANSMISSION UNIT**
	Front planetary gear unit	**AUTOMATIC TRANSMISSION UNIT**
Engine stalls when starting off or stopping	Valve body assembly	**VALVE BODY ASSEMBLY**
	Torque converter clutch	**TORQUE CONVERTER CLUTCH AND DRIVE PLATE**

ECM CONNECTOR TERMINALS REFERENCE

Terminal No. (Symbols)	Wiring Color	Terminal Description	Condition	Specified Condition
A24-21 (L4) - D74-81 (E1)	Y - BR	L4 shift position switch signal	• Ignition switch ON • Transfer shift lever on L4	Below 1.5 V
A24-21 (L4) - D74-81 (E1)	Y - BR	L4 shift position switch signal	• Ignition switch ON • Transfer shift lever not on L4	11 to 14 V
A24-5 (TFN) - D74-81 (E1)	G - BR	N shift position switch signal	• Ignition switch ON • Transfer shift lever on N	Below 1.5 V
A24-5 (TFN) - D74-81 (E1)	G - BR	N shift position switch signal	• Ignition switch ON • Transfer shift lever not on N	11 to 14 V
D74-120 (NSW) - D74-81 (E1)	L - BR	PNP switch signal	• Ignition switch ON • Shift lever on P or N	Below 1 V
D74-120 (NSW) - D74-81 (E1)	L - BR	PNP switch signal	• Ignition switch ON • Shift lever not on P or N	11 to 14 V
D74-2 (P) - D74-81 (E1)	G-B - BR	P shift position switch signal	• Ignition switch ON • Shift lever on P	11 to 14 V
D74-2 (P) - D74-81 (E1)	G-B - BR	P shift position switch signal	• Ignition switch ON • Shift lever not on P	Below 1 V
D74-26 (R) - D74-81 (E1)	L-R - BR	R shift position switch signal	• Ignition switch ON • Shift lever on R	11 to 14 V

D74-26 (R) - D74-81 (E1)	L-R - BR	R shift position switch signal	• Ignition switch ON • Shift lever not on R	Below 1 V
D74-25 (N) - D74-81 (E1)	G-W - BR	N shift position switch signal	• Ignition switch ON • Shift lever on N	11 to 14 V
D74-25 (N) - D74-81 (E1)	G-W - BR	N shift position switch signal	• Ignition switch ON • Shift lever not on N	Below 1 V
D74-27 (D) - D74-81 (E1)	G - BR	D shift position switch signal	• Ignition switch ON • Shift lever on D	11 to 14 V
D74-27 (D) - D74-81 (E1)	G - BR	D shift position switch signal	• Ignition switch ON • Shift lever not on D	Below 1 V
A24-25 (S) - D74-81 (E1)	Y - BR	S shift position switch signal	• Ignition switch ON • Shift lever on S	11 to 14 V
A24-25 (S) - D74-81 (E1)	Y - BR	S shift position switch signal	• Ignition switch ON • Shift lever not on S	Below 1 V
A24-38 (SFTU) - D74-81 (E1)	G - BR	Up-shift shift position switch signal	• Ignition switch ON • Shift lever on S	11 to 14 V
A24-38 (SFTU) - D74-81 (E1)	G - BR	Up-shift shift position switch signal	• Ignition switch ON • Shift lever "+" position (up-shift)	Below 1 V
A24-27 (SFTD) - D74-81 (E1)	O - BR	Down-shift position switch signal	• Ignition switch ON • Shift lever on S	11 to 14 V
A24-27 (SFTD) - D74-81 (E1)	O - BR	Down-shift position switch signal	• Ignition switch ON • Shift lever "-" position (down-shift)	Below 1 V
A24-36 (STP) - D74-81 (E1)	LG - BR	Stop light switch signal	Brake pedal is depressed	7.5 to 14 V
A24-36 (STP) - D74-81 (E1)	LG - BR	Stop light switch signal	Brake pedal is released	Below 1.5 V
D74-7 (S1) - D74-81 (E1)	R - BR	S1 solenoid signal	1st gear	Below 1 V
D74-7 (S1) - D74-81 (E1)	R - BR	S1 solenoid signal	Not on 1st gear	11 to 14 V
D74-6 (S2) - D74-81 (E1)	W - BR	S2 solenoid signal	1st, 2nd or 6th gear	11 to 14 V
D74-6 (S2) - D74-81 (E1)	W - BR	S2 solenoid signal	3rd, 4th or 5th gear	Below 1 V
D74-3 (S3) - D74-81 (E1)	G-W - BR	S3 solenoid signal	1st, 2nd or 3rd gear	11 to 14 V
D74-3 (S3) - D74-81 (E1)	G-W - BR	S3 solenoid signal	4th, 5th or 6th gear	Below 1 V
D74-5 (S4) - D74-81 (E1)	G-R - BR	S4 solenoid signal	5th or 6th gear	11 to 14 V

D74-5 (S4) - D74-81 (E1)	G-R - BR	S4 solenoid signal	1st, 2nd, 3rd or 4th gear	Below 1 V
D74-4 (SR) - D74-81 (E1)	G - BR	SR solenoid signal	1st, 2nd, 3rd or 4th gear	11 to 14 V
D74-4 (SR) - D74-81 (E1)	G - BR	SR solenoid signal	5th or 6th gear	Below 1 V
D74-14 (SL1+) - D74-15 (SL1-)	Y-L	SL1 solenoid signal	5th or 6th gear	Pulse generation (see awaveform 1)
D74-12 (SL2+) - D74-13 (SL2-)	G-R - L-W	SL2 solenoid signal	Engine is idling	Pulse generation (see bwaveform 2)
D74-9 (SLT+) - D74-8 (SLT-)	B - G-B	SLT solenoid signal	Engine is idling	Pulse generation (see cwaveform 3)
D74-10 (SLU+) - D74-11 (SLU-)	L-Y - L-R	SLU solenoid signal	5th (lock up) gear or 6th (lock up) gear	Pulse generation (see dwaveform 4)
D74-122 (THO1) - D74-98 (ETHA)	G-Y - BR	No. 1 ATF temperature sensor signal	No. 1 ATF temperature: 115°C (239°F) or more	Below 1.5 V
D74-99 (THO2) - D74-98 (ETHA)	L - BR	No. 2 ATF temperature sensor signal	No. 2 ATF temperature: 115°C (239°F) or more	Below 1.5 V
D74-101 (SP2+) - D74-100 (SP2-)	Y - B	Speed sensor SP2 signal	Vehicle speed 20 km/h (12 mph)	Pulse generation (see ewaveform 5)
D74-124 (NT+) - D74-123 (NT-)	Y-B	Speed sensor NT signal	Engine is idling (shift lever on P or N)	Pulse generation (see fwaveform 6)
A24-10 (CANH) - D74-81 (E1)	GR - BR	CAN communication line	Ignition switch ON	Pulse generation (see gwaveform 7)
A24-11 (CANL) - D74-81 (E1)	W - BR	CAN communication line	Ignition switch ON	Pulse generation (see hwaveform 8)
A24-51 (PWR) - D74-81 (E1)	L - BR	Tow/haul pattern select switch signal	• Ignition switch ON • Tow/haul pattern select switch ON	0 to 1.5 V
A24-51 (PWR) - D74-81 (E1)	L - BR	Tow/haul pattern select switch signal	• Ignition switch ON • Tow/haul pattern select switch OFF	Pulse generation*
HINT: *: Voltage is input intermittently as this is an intermittent circuit. (Voltage varies between a peak of 7.5 to 14 V and a low of 0 to 1.5 V.)				

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition
D74-14 (SL1+) - D74-15 (SL1-)	5 V/DIV, 1 msec./DIV.	Engine is idling

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition
D74-12 (SL2+) - D74-13 (SL2-)	5 V/DIV, 1 msec./DIV.	Engine is idling

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition

D74-9 (SLT+) - D74-8 (SLT-)	5 V/DIV., 1 msec./DIV.	Engine is idling

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition
D74-10 (SLU+) - D74-11 (SLU-)	5 V/DIV., 1 msec./DIV.	5th (lock up)

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition
D74-101 (SP2+) - D74-100 (SP2-)	2 V/DIV., 20 msec./DIV.	Vehicle speed 20 km/h (12mph)

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition
D74-124 (NT+) - D74-123 (NT-)	1 V/DIV., 2 msec./DIV.	Engine is idling (P or N position)

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition
A24-10 (CANH) - D74-81 (E1)	1 V/DIV., 10 ?sec./DIV.	Ignition switch ON

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition
A24-11 (CANL) - D74-81 (E1)	1 V/DIV., 10 ?sec./DIV.	Ignition switch ON

FAIL-SAFE CHART

Malfunctioning Part	Function
DTC P0717: Input Speed Sensor NT	During an input speed sensor malfunction, shift control is effected through the output speed sensor SP2 signal. During an input speed sensor malfunction, up-shift to the 5th and 6th, AI-SHIFT* and flex lock up clutch control are prohibited.
DTC P0722: Output Speed Sensor SP2	During an output speed sensor malfunction, shift control is effected through the input speed sensor NT signal. During an output speed sensor malfunction, up-shift to the 5th and 6th, AI-SHIFT* and flex lock up clutch control are prohibited.
DTC P0710, P0712, P0713: ATF Temperature Sensor	During an ATF temperature sensor malfunction, up-shift to the 5th and 6th and flex lock up clutch control are prohibited.
Shift Solenoid Valve S1, S2, S3, S4 and SR	The current to the failed solenoid valve is cut off and control is effected by operating the other solenoid valves. Shift control is effected depending on the failed solenoid as described in the table below.
DTC P0748, P0778: Shift Solenoid Valve SL1 and SL2	During a solenoid valve SL1 or SL2 malfunction, up-shift to the 5th and 6th and flex lock up clutch control are prohibited.
DTC P2714, P2716: Shift Solenoid Valve SLT	During a solenoid valve SLT malfunction, the current to the solenoid valve is stopped. This stops line pressure optimal control, and shift shock increases. However, shifting is effected through normal clutch pressure control.
DTC P2757, P2759: Shift Solenoid Valve SLU	During a solenoid valve SLU malfunction, the current to the solenoid valve is stopped. This stops lock up control and flex lock up control, and fuel economy decreases.

HINT:
*: In addition to the switching of the shift pattern through the tow/haul pattern select switch, Artificial Intelligence Shift (AI-SHIFT) control enables the ECM to estimate the road conditions and the driver's intention in order to automatically select the optimal shift pattern.

SHIFT SOLENOID VALVE NORMAL OPERATION CHART

Shift lever position	Gear*	Shift solenoid S1	Shift solenoid S2	Shift solenoid S3	Shift solenoid S4	Shift solenoid SR	Shift solenoid SL1	Shift solenoid SL2
D, S6	1st	OFF	ON	ON	OFF	ON	OFF	ON
	2nd	ON	ON	ON	OFF	ON	OFF	ON
	3rd	ON	OFF	ON	OFF	ON	OFF	ON
	4th	ON	OFF	OFF	OFF	ON	OFF	ON
	5th	ON	OFF	OFF	ON	OFF	ON	OFF
	6th	ON	ON	OFF	ON	OFF	ON	OFF
S5	1st	OFF	ON	ON	OFF	ON	OFF	ON
	2nd	ON	ON	ON	OFF	ON	OFF	ON
	3rd	ON	OFF	ON	OFF	ON	OFF	ON
	4th	ON	OFF	OFF	OFF	ON	OFF	ON
	5th	ON	OFF	OFF	ON	OFF	ON	OFF
S4	1st	OFF	ON	ON	OFF	ON	OFF	ON
	2nd	ON	ON	ON	OFF	ON	OFF	ON
	3rd	ON	OFF	ON	OFF	ON	OFF	ON
	4th	ON	OFF	OFF	OFF	ON	OFF	ON
S3	1st	OFF	ON	ON	OFF	ON	OFF	ON
	2nd	ON	ON	ON	OFF	ON	OFF	ON
	3rd (E/B)	ON	OFF	ON	OFF	ON	OFF	OFF
S2	1st	OFF	ON	ON	OFF	ON	OFF	ON
	2nd (E/B)	ON	ON	ON	ON	ON	OFF	OFF
S1	1st (E/B)	OFF	ON	ON	OFF	ON	OFF	OFF

SHIFT SOLENOID VALVE S1 OPERATION CHART

Shift lever position	Gear*	Shift solenoid S1	Shift solenoid S2	Shift solenoid S3	Shift solenoid S4	Shift solenoid SR	Shift solenoid SL1	Shift solenoid SL2
D, S6	1st	X	ON	ON	OFF	ON	OFF	ON
	1st --> 4th	X	ON-->OFF	ON-->OFF	OFF	ON	OFF	ON
	3rd-->4th	X	OFF	ON-->OFF	OFF	ON	OFF	ON
	4th	X	OFF	OFF	OFF	ON	OFF	ON
	5th	X	OFF	OFF	ON	OFF	ON	OFF
	N-->5th	X	ON-->OFF	OFF	ON	OFF	ON	OFF

S5	1st	X	ON	ON	OFF	ON	OFF	ON
	1st-->4th	X	ON-->OFF	ON-->OFF	OFF	ON	OFF	ON
	3rd-->4th	X	OFF	ON-->OFF	OFF	ON	OFF	ON
	4th	X	OFF	OFF	OFF	ON	OFF	ON
	5th	X	OFF	OFF	ON	OFF	ON	OFF
S4	1st	X	ON	ON	OFF	ON	OFF	ON
	1st-->4th	X	ON-->OFF	ON-->OFF	OFF	ON	OFF	ON
	3rd-->4th	X	OFF	ON-->OFF	OFF	ON	OFF	ON
	4th	X	OFF	OFF	OFF	ON	OFF	ON
S3	1st	X	ON	ON	OFF	ON	OFF	ON
	1st-->4th	X	ON-->OFF	ON-->OFF	OFF	ON	OFF	ON
	3rd (E/B)-->4th	X	OFF	ON-->OFF	OFF	ON	OFF	OFF-->ON
S2	1st	X	ON	ON	OFF	ON	OFF	ON
	1st (E/B)-->4th	X	ON-->OFF	ON-->OFF	OFF	ON	OFF	OFF-->ON
S1	1st (E/B)	X	ON	ON	OFF	ON	OFF	OFF

SHIFT SOLENOID VALVE S2 OPERATION CHART

Shift lever position	Gear*	Shift solenoid S1	Shift solenoid S2	Shift solenoid S3	Shift solenoid S4	Shift solenoid SR	Shift solenoid SL1	Shift solenoid SL2
D, S6	3rd	OFF-->ON	X	ON	OFF	ON	OFF	ON
	3rd	ON	X	ON	OFF	ON	OFF	ON
	3rd	ON	X	ON	OFF	ON	OFF	ON
	4th	ON	X	OFF	OFF	ON	OFF	ON
	5th	ON	X	OFF	ON	OFF	ON	OFF
	5th	ON	X	OFF	ON	OFF	ON	OFF
S5	3rd	OFF-->ON	X	ON	OFF	ON	OFF	ON
	3rd	ON	X	ON	OFF	ON	OFF	ON
	3rd	ON	X	ON	OFF	ON	OFF	ON
	4th	ON	X	OFF	OFF	ON	OFF	ON
	5th	ON	X	OFF	ON	OFF	ON	OFF
S4	3rd	OFF-->ON	X	ON	OFF	ON	OFF	ON
	3rd	ON	X	ON	OFF	ON	OFF	ON
	3rd	ON	X	ON	OFF	ON	OFF	ON
	4th	ON	X	OFF	OFF	ON	OFF	ON
S3	3rd-->3rd (E/B)	OFF-->ON	X	ON	OFF	ON	ON-->OFF	OFF
	3rd-->3rd	ON	X	ON	OFF	ON	ON-->OFF	OFF

	(E/B)							
	3rd (E/B)	ON	X	ON	OFF	ON	OFF	OFF
S2	3rd-->3rd (E/B)	OFF-->ON	X	ON	OFF	ON	ON-->OFF	OFF
	3rd (E/B)	ON	X	ON	OFF	ON	OFF	OFF
S1	3rd (E/B)	OFF-->ON	X	ON	OFF	ON	OFF	OFF

SHIFT SOLENOID VALVE S3 OPERATION CHART

Shift lever position	Gear*	Shift solenoid S1	Shift solenoid S2	Shift solenoid S3	Shift solenoid S4	Shift solenoid SR	Shift solenoid SL1	Shift solenoid SL2
D, S6	3rd-->4th	OFF-->ON	ON-->OFF	X	OFF	ON	OFF	ON
	4th	ON	ON-->OFF	X	OFF	ON	OFF	ON
	4th	ON	OFF	X	OFF	ON	OFF	ON
	4th	ON	OFF	X	OFF	ON	OFF	ON
	5th	ON	OFF	X	ON	OFF	ON	OFF
	6th	ON	ON	X	ON	OFF	ON	OFF
S5	3rd-->4th	OFF-->ON	ON-->OFF	X	OFF	ON	OFF	ON
	4th	ON	ON-->OFF	X	OFF	ON	OFF	ON
	4th	ON	OFF	X	OFF	ON	OFF	ON
	4th	ON	OFF	X	OFF	ON	OFF	ON
	5th	ON	OFF	X	ON	OFF	ON	OFF
S4	3rd-->4th	OFF-->ON	ON-->OFF	X	OFF	ON	OFF	ON
	4th	ON	ON-->OFF	X	OFF	ON	OFF	ON
	4th	ON	OFF	X	OFF	ON	OFF	ON
	4th	ON	OFF	X	OFF	ON	OFF	ON
S3	3rd-->4th	OFF-->ON	ON-->OFF	X	OFF	ON	OFF	ON
	4th	ON	ON-->OFF	X	OFF	ON	OFF	ON
	4th	ON	OFF	X	OFF	ON	OFF	OFF-->ON
S2	3rd-->4th	OFF-->ON	ON-->OFF	X	OFF	ON	OFF	ON
	6th-->4th	ON	ON-->OFF	X	OFF	ON	OFF	OFF-->ON
S1	1st (E/B)-->4th	OFF-->ON	ON-->OFF	X	OFF	ON	OFF	OFF-->ON

SHIFT SOLENOID VALVE S4 OPERATION CHART

Shift lever position	Gear*	Shift solenoid S1	Shift solenoid S2	Shift solenoid S3	Shift solenoid S4	Shift solenoid SR	Shift solenoid SL1	Shift solenoid SL2

D, S6	1st	OFF	ON	ON	X	ON	OFF	ON
	2nd	ON	ON	ON	X	ON	OFF	ON
	3rd	ON	OFF	ON	X	ON	OFF	ON
	4th	ON	OFF	OFF	X	ON	OFF	ON
	4th	ON	OFF	OFF	X	OFF-->ON	ON-->OFF	OFF-->ON
	4th	ON	ON-->OFF	OFF	X	OFF-->ON	ON-->OFF	OFF-->ON
S5	1st	OFF	ON	ON	X	ON	OFF	ON
	2nd	ON	ON	ON	X	ON	OFF	ON
	3rd	ON	OFF	ON	X	ON	OFF	ON
	4th	ON	OFF	OFF	X	ON	OFF	ON
	4th	ON	OFF	OFF	X	OFF-->ON	ON-->OFF	OFF-->ON
S4	1st	OFF	ON	ON	X	ON	OFF	ON
	2nd	ON	ON	ON	X	ON	OFF	ON
	3rd	ON	OFF	ON	X	ON	OFF	ON
	4th	ON	OFF	OFF	X	ON	OFF	ON
S3	1st	OFF	ON	ON	X	ON	OFF	ON
	2nd	ON	ON	ON	X	ON	OFF	ON
	3rd (E/B)	ON	OFF	ON	X	ON	OFF	OFF
S2	1st	OFF	ON	ON	X	ON	OFF	ON
	2nd (E/B)	ON	ON	ON	X	ON	OFF	OFF
S1	1st (E/B)	OFF	ON	ON	X	ON	OFF	OFF

SHIFT SOLENOID VALVE SR OPERATION CHART

Shift lever position	Gear*	Shift solenoid S1	Shift solenoid S2	Shift solenoid S3	Shift solenoid S4	Shift solenoid SR	Shift solenoid SL1	Shift solenoid SL2
D, S6	1st	OFF	ON	ON	OFF	X	OFF	ON
	2nd	ON	ON	ON	OFF	X	OFF	ON
	3rd	ON	OFF	ON	OFF	X	OFF	ON
	4th	ON	OFF	OFF	OFF	X	OFF	ON
	5th	ON	OFF	OFF	ON	X	ON	OFF
	6th	ON	ON	OFF	ON	X	ON	OFF
S5	1st	OFF	ON	ON	OFF	X	OFF	ON
	2nd	ON	ON	ON	OFF	X	OFF	ON
	3rd	ON	OFF	ON	OFF	X	OFF	ON
	4th	ON	OFF	OFF	OFF	X	OFF	ON
	5th	ON	OFF	OFF	ON	X	ON	OFF
S4	1st	OFF	ON	ON	OFF	X	OFF	ON
	2nd	ON	ON	ON	OFF	X	OFF	ON
	3rd	ON	OFF	ON	OFF	X	OFF	ON
	4th	ON	OFF	OFF	OFF	X	OFF	ON
	1st	OFF	ON	ON	OFF	X	OFF	ON

S3	2nd	ON	ON	ON	OFF	X	OFF	ON
	3rd	ON	OFF	ON	OFF	X	OFF	OFF
S2	1st	OFF	ON	ON	OFF	X	OFF	ON
	2nd	ON	ON	ON	OFF	X	OFF	OFF
S1	1st	OFF	ON	ON	OFF	X	OFF	OFF

GEAR POSITION REFERENCE

DTC	Condition	Gear*1					
-	Normal	1st	2nd	3rd	4th	5th	6th
P0751	Shift solenoid valve S1: Stuck OFF malfunction	1st*2	1st*2	3rd	3rd	3rd	3rd
P0761	Shift solenoid valve S3: Stuck ON malfunction	1st	2nd	3rd	3rd	3rd	3rd
P0766	Shift solenoid valve S4, Shift solenoid valve SL2 or Valve body (brake control valve): Malfunction	1st	2nd	3rd	3rd	3rd	3rd
P0781	Valve body (1-2 shift valve): Malfunction	1st*2	1st*2	3rd	3rd	3rd	3rd
P0729	Valve body (sequence valve): Malfunction	1st	2nd	3rd	3rd	3rd	3rd
HINT: • *1: Actual gear shift (gear position) under fail-safe operation. • *2: Under engine braking, downshifting to 1st or 2nd gear is prohibited.							

INTELLIGENT TESTER ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
SPD (SP2)	Output shaft speed/ Min.: 0 km/h (0 mph) Max.: 255km/h (158mph)	Vehicle stopped: 0 km/h (0 mph) (output shaft speed is equal to vehicle speed)	-
SPD (NT)	Input shaft speed/ Min.: 0 rpm Max.: 12750 rpm	Lock-up is: • ON (after warming up engine): Input turbine speed (NT) is equal to engine speed • OFF (idling with shift lever on N): Input turbine speed (NT) is nearly equal to engine speed	Data is displayed in increments of 50 rpm
PNP SW [NSW]	PNP switch status/ ON or OFF	Shift lever is: • On P and N: ON • Not on P and N: OFF	When shift lever position displayed on intelligent tester differs from actual position, adjustment of PNP switch or shift cable may be incorrect HINT: When failure still occurs even after adjusting

			these parts, refer to **DTC P0705**
STOP LIGHT SW	Stop light switch status/ ON or OFF	Brake pedal is: • Depressed: ON • Released: OFF	-
SHIFT	ECM gear shift command/ 1st, 2nd, 3rd, 4th, 5th or 6th	Shift lever position is: • On D: 1st, 2nd, 3rd, 4th, 5th or 6th • On S: 1st, 2nd, 3rd, 4th, 5th or 6th	-
REVERSE	PNP switch status/ ON or OFF	Shift lever is: • On R: ON • Not on R: OFF	When shift lever position displayed on intelligent tester differs from actual position, adjustment of PNP switch or shift cable may be incorrect HINT: When failure still occurs even after adjusting these parts, refer to **DTC P0705**
PARKING	PNP switch status/ ON or OFF	Shift lever is: • On P: ON • Not on P: OFF	When shift lever position displayed on intelligent tester differs from actual position, adjustment of PNP switch or shift cable may be incorrect HINT: When failure still occurs even after adjusting these parts, refer to **DTC P0705**
NEUTRAL	PNP switch status/ ON or OFF	Shift lever is: • On N: ON • Not on N: OFF	When shift lever position displayed on intelligent tester differs from actual position, adjustment of PNP switch or shift cable may be incorrect HINT: When failure still occurs even after adjusting these parts, refer to **DTC P0705**
			When shift lever

DRIVE	PNP switch status/ ON or OFF	Shift lever is: • On D: ON • Not on D: OFF	position displayed on intelligent tester differs from actual position, adjustment of PNP switch or shift cable may be incorrect HINT: When failure still occurs even after adjusting these parts, refer to **DTC P0705**
SPORTS UP SW	Sport shift up switch status/ ON or OFF	• ON: Continuously shift to "+" (up-shift) • OFF: Release "+" (up-shift)	-
SPORTS DOWN SW	Sport shift down switch status/ ON or OFF	• ON: Continuously shift to "-" (down-shift) • OFF: Release "-" (down-shift)	-
MODE SELECT SW	Sport mode select switch status/ ON or OFF	Shift lever position is: • ON: S, "+" and "-" • OFF: Not on S, "+" and "-"	-
A/TOIL TEMPI	No. 1 ATF temperature sensor value/ Min.: -40°C (-40°F) Max.:215°C (419°F)	• After stall test: Approximately 80°C (176°F) • Equal to ambient temperature while engine is cold	If value is -40°C (-40°F) or 215°C (419°F), No. 1 ATF temperature sensor circuit is open or shorted
A/TOILTEMP2	No. 2 ATF temperature sensor value/ Min.: -40°C (-40°F) Max.:215°C (419°F)	• After stall test: Approximately 80°C (176°F) • Equal to ambient temperature while engine is cold	If value is -40°C (-40°F) or 215°C (419°F), No. 2 ATF temperature sensor circuit is open or shorted
LOCK UP	Lock-up/ ON or OFF	Lock-up is: • Operating: ON • Not operating: OFF	-
LOCK UP SOL	Lock-up solenoid status/ ON or OFF	Lock-up solenoid is: • Operating: ON • Not operating: OFF	-
		Shift solenoid SLU is:	

SOLENOID (SLU)	Shift solenoid SLU status/ ON or OFF	• Operating: ON • Not operating: OFF	-
SOLENOID (SLT)	Shift solenoid SLT status/ ON or OFF	• Accelerator pedal is depressed: OFF • Accelerator pedal is released: ON	-

TECHSTREAM ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
SPD (SP2)	Output shaft speed/ Min.: 0 km/h (0 mph) Max.: 255 km/h (158 mph)	Vehicle stopped: 0 km/h (0 mph) (output shaft speed is equal to vehicle speed)	-
SPD (NT)	Input shaft speed/ Min.: 0 rpm Max.: 12750 rpm	Lock-up is: • ON (after warming up engine): Input turbine speed (NT) is equal to engine speed • OFF (idling with shift lever on N): Input turbine speed (NT) is nearly equal to engine speed	Data is displayed in increments of 50 rpm
Neutral Position SW Signal	PNP switch status/ ON or OFF	Shift lever is: • On P and N: ON • Not on P and N: OFF	When shift lever position displayed on Techstream differs from actual position, adjustment of PNP switch or shift cable may be incorrect HINT: When failure still occurs even after adjusting these parts, refer to **DTC P0705**
Stop Light Switch	Stop light switch status/ ON or OFF	Brake pedal is: • Depressed: ON • Released: OFF	-
Shift Status	ECM gear shift command/ 1st, 2nd, 3rd, 4th, 5th or 6th	Shift lever position is: • On D: 1st, 2nd, 3rd, 4th, 5th or 6th • On S: 1st, 2nd, 3rd, 4th, 5th or 6th	-
			When shift lever position

Shift SW Status (R Range)	PNP switch status/ ON or OFF	Shift lever is: • On R: ON • Not on R: OFF	displayed on Techstream differs from actual position, adjustment of PNP switch or shift cable may be incorrect HINT: When failure still occurs even after adjusting these parts, refer to **DTC P0705**
Shift SW Status (P Range)	PNP switch status/ ON or OFF	Shift lever is: • On P: ON • Not on P: OFF	When shift lever position displayed on Techstream differs from actual position, adjustment of PNP switch or shift cable may be incorrect HINT: When failure still occurs even after adjusting these parts, refer to **DTC P0705**
Shift SW Status (N Range)	PNP switch status/ ON or OFF	Shift lever is: • On N: ON • Not on N: OFF	When shift lever position displayed on Techstream differs from actual position, adjustment of PNP switch or shift cable may be incorrect HINT: When failure still occurs even after adjusting these parts, refer to **DTC P0705**
Shift SW Status (D Range)	PNP switch status/ ON or OFF	Shift lever is: • On D: ON • Not on D: OFF	When shift lever position displayed on Techstream differs from actual position, adjustment of PNP switch or shift cable may be incorrect HINT: When failure still occurs even after adjusting these parts, refer to **DTC P0705**
Sports Shift Up SW	Sport shift up switch status/ ON or OFF	• ON: Continuously shift to "+" (up-shift) • OFF: Release "+" (up-shift)	-
	Sport shift down switch	• ON: Continuously shift to "-" (down-	

Sports Shift Down SW	status/ ON or OFF	shift) • OFF: Release "-" (down-shift)	-
Sports Mode Selection SW	Sport mode select switch status/ ON or OFF	• Shift lever position is: ON: S, "+" and "-" • OFF: Not on S, "+" and "-"	-
A/T Oil Temperature 1	No. 1 ATF temperature sensor value/ Min.: -40°C (-40°F) Max.:215°C (419°F)	• After stall test: Approximately 80°C (176°F) • Equal to ambient temperature while engine is cold	If value is -40°C (-40°F) or 215°C (419°F), No. 1 ATF temperature sensor circuit is open or shorted
A/T Oil Temperature 2	No. 2 ATF temperature sensor value/ Min.: -40°C (-40°F) Max.: 215°C (419°F)	• After stall test: Approximately 80°C (176°F) • Equal to ambient temperature, while engine is cold	If value is -40°C (-40°F) or 215°C (419°F), No. 2 ATF temperature sensor circuit is open or shorted
Lock Up	Lock-up/ ON or OFF	Lock-up is: • Operating: ON • Not operating: OFF	-
Lock Up Solenoid Status	Lock-up solenoid status/ ON or OFF	Lock-up solenoid is: • Operating: ON • Not operating: OFF	-
SLU Solenoid Status	Shift solenoid SLU status/ ON or OFF	Shift solenoid SLU is: • Operating: ON • Not operating: OFF	-
SLT Solenoid Status	Shift solenoid SLT status/ ON or OFF	• Accelerator pedal is depressed: OFF • Accelerator pedal is released: ON	-

INTELLIGENT TESTER ECT DATA ACTIVE TEST

Tester Display	Test Part	Control Range	Diagnostic Note
SOLENOID (SLU)	Operate the shift solenoid SLU	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position
		ON or OFF HINT:	

SOLENOID (SLT)*	Operate the shift solenoid SLT and raise line pressure	• OFF: Line pressure up (when Active Test "SOLENOID (SLT)" is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	[Vehicle Condition] • Vehicle stopped • Engine idling
SOLENOID (SI)	Operate the shift solenoid S1	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position
SOLENOID (S2)	Operate the shift solenoid S2	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position
SOLENOID (S3)	Operate the shift solenoid S3	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position
SOLENOID (S4)	Operate the shift solenoid S4	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position
LOCK UP	Control shift solenoid SLU to set automatic transmission to lock up condition	ON or OFF	Possible to check shift solenoid valve SLU operation [Vehicle Condition] • Throttle valve opening angle: Less than 35% • Vehicle speed: 60 km/h (36 mph) or more
SHIFT	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less
SOLENOID (SR)	Operate the shift solenoid SR	ON or OFF	[Vehicle Condition] • Engine stopped

			• Shift lever on P or N position
SOLENOID (SLI)	Operate the shift solenoid SL1	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position
SOLENOID (SL2)	Operate the shift solenoid SL2	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position

HINT:
*: SOLENOID (SLT) in the Active Test is performed to check the line pressure changes by connecting SST to the automatic transmission, which is used in the **HYDRAULIC TEST** as well. Please note that the pressure values in the Active Test and HYDRAULIC TEST are different.

TECHSTREAM ECT DATA ACTIVE TEST

Tester Display	Test Part	Control Range	Diagnostic Note
Activate the Solenoid (SLU)	Operate the shift solenoid SLU	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position
Activate the Solenoid (SLT)*	Operate the shift solenoid SLT and raise line pressure	ON or OFF HINT: • OFF: Line pressure up (when Active Test "Activate the Solenoid (SLT)" is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	[Vehicle Condition] • Vehicle stopped • Engine idling
Activate the Solenoid (S1)	Operate the shift solenoid S1	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position
Activate the Solenoid (S2)	Operate the shift solenoid S2	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position

Activate the Solenoid (S3)	Operate the shift solenoid S3	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position
Activate the Solenoid (S4)	Operate the shift solenoid S4	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position
Activate the Lock Up	Control shift solenoid SLU to set automatic transmission to lock up condition	ON or OFF	Possible to check shift solenoid valve SLU operation [Vehicle Condition] • Throttle valve opening angle: Less than 35% • Vehicle speed: 60 km/h (36 mph) or more
Control the Shift Position	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less
Activate the Solenoid (SR)	Operate the shift solenoid SR	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position
Activate the Solenoid (SL1)	Operate the shift solenoid SL1	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position
Activate the Solenoid (SL2)	Operate the shift solenoid SL2	ON or OFF	[Vehicle Condition] • Engine stopped • Shift lever on P or N position

HINT:
*: Activate the Solenoid (SLT) in the Active Test is performed to check the line pressure changes by connecting SST to the automatic transmission, which is used in the **HYDRAULIC TEST** as well. Please note that the pressure values in the Active Test and HYDRAULIC TEST are different.

AUTOMATIC TRANSMISSION SYSTEM DTC CHART

DTC Code	Detection Item	Trouble Area	MIL*1	Memory*2

P0705	Transmission Range Sensor Circuit Malfunction (PRNDL Input)	o Open or short in park/neutral position switch circuit o Park/neutral position switch o ECM	Comes on	DTC stored
P0710	Transmission Fluid Temperature Sensor "A" Circuit	o Open or short in No. 1 ATF temperature sensor circuit o No. 1 transmission wire (No. 1 ATF temperature sensor) o ECM	Comes on	DTC stored
P0711	Transmission Fluid Temperature Sensor "A" Performance	No. 1 transmission wire (No. 1 ATF temperature sensor)	Comes on	DTC stored
P0712	Transmission Fluid Temperature Sensor "A" Circuit Low Input	o Short in No. 1 ATF temperature sensor circuit o No. 1 transmission wire (No. 1 ATF temperature sensor) o ECM	Comes on	DTC stored
P0713	Transmission Fluid Temperature Sensor "A" Circuit High Input	o Open in No. 1 ATF temperature sensor circuit o No. 1 transmission wire (No. 1 ATF temperature sensor) o ECM	Comes on	DTC stored
P0717	Turbine Speed Sensor Circuit No Signal	o Open or short in speed sensor NT circuit o Speed sensor NT o ECM o Automatic transmission (clutch, brake or gear, etc.)	Comes on	DTC stored
P0722	Output Speed Sensor Circuit No Signal	o Open or short in speed sensor SP2 circuit o Speed sensor SP2 o ECM o Automatic transmission (clutch, brake or gear, etc.)	Comes on	DTC stored
P0724	Brake Switch "B" Circuit High	o Short in stop light switch signal circuit o Stop light switch o ECM	Comes on	DTC stored
P0729	Gear 6 Incorrect	o Valve body is blocked up or	Comes on	DTC stored

	Ratio	stuck (sequence valve) ○ Shift solenoid valve SLT remains open or closed ○ Automatic transmission (clutch, brake or gear, etc.)		
P0748	Pressure Control Solenoid "A" Electrical (Shift Solenoid Valve SL1)	○ Open or short in shift solenoid valve SL1 circuit ○ Shift solenoid valve SL1 ○ ECM	Comes on	DTC stored
P0751	Shift Solenoid "A" Performance (Shift Solenoid Valve S1)	○ Shift solenoid valve S1 remains open or closed ○ Shift solenoid valve SLT remains open or closed ○ Valve body is blocked ○ No. 2 brake malfunction (Driving is difficult.) ○ Automatic transmission (clutch, brake or gear, etc.)	Comes on	DTC stored
P0756	Shift Solenoid "B" Performance (Shift Solenoid Valve S2)	○ Shift solenoid valve S2 remains open or closed ○ Valve body is blocked ○ Automatic transmission (clutch, brake or gear, etc.)	Comes on	DTC stored
P0761	Shift Solenoid "C" Performance (Shift Solenoid Valve S3)	○ Shift solenoid valve S3 remains open or closed ○ Shift solenoid valve SLT remains open or closed ○ Valve body is blocked ○ Automatic transmission (clutch, brake or gear, etc.)	Comes on	DTC stored
P0766	Shift Solenoid "D" Performance (Shift Solenoid Valve S4)	○ Shift solenoid valve S4 remains closed ○ Shift solenoid valve SLT remains open or closed ○ Valve body is blocked (Brake control valve) ○ Automatic transmission (clutch, brake or gear, etc.)	Comes on	DTC stored
P0776	Pressure Control Solenoid "B" Performance (Shift Solenoid Valve SL2)	○ Shift solenoid valve SL2 remains open ○ Shift solenoid valve SLT remains open or closed ○ Valve body is blocked	Comes on	DTC stored

		(Brake control valve) ○ Automatic transmission (clutch, brake or gear, etc.)		
P0778	Pressure Control Solenoid "B" Electrical (Shift Solenoid Valve SL2)	○ Open or short in shift solenoid valve SL2 circuit ○ Shift solenoid valve SL2 ○ ECM	Comes on	DTC stored
P0781	1-2 Shift (1-2 Shift Valve)	○ Valve body is blocked up or stuck (1-2 shift valve) ○ Shift solenoid valve SLT remains open or closed ○ Automatic transmission (clutch, brake or gear, etc.)	Comes on	DTC stored
P0818	Driveline Disconnect Switch Input Circuit	○ Short in transfer neutral position switch circuit ○ Transfer neutral position switch ○ ECM	Comes on	DTC stored
P0894	Transmission Component Slipping	○ Shift solenoid valve SLT remains open or closed ○ Shift solenoid valve S1.S2, S3, S4or SL2 remains open or closed ○ Gear 6 incorrect ratio (sequence valve) or 1-2 shift valve is stuck ○ Valve body is blocked ○ Automatic transmission (clutch, brake or gear, etc.)	Comes on	DTC stored
P0973	Shift Solenoid "A" Control Circuit Low (Shift Solenoid Valve S1)	○ Short in shift solenoid valve S1 circuit ○ Shift solenoid valve S1 ○ ECM	Comes on	DTC stored
P0974	Shift Solenoid "A" Control Circuit High (Shift Solenoid Valve S1)	○ Open in shift solenoid valve S1 circuit ○ Shift solenoid valve S1 ○ ECM	Comes on	DTC stored
P0976	Shift Solenoid "B" Control Circuit Low (Shift Solenoid Valve S2)	○ Short in shift solenoid valve S2 circuit ○ Shift solenoid valve S2 ○ ECM	Comes on	DTC stored
P0977	Shift Solenoid "B" Control Circuit	○ Open in shift solenoid valve S2 circuit	Comes on	DTC stored

	High (Shift Solenoid Valve S2)	- Shift solenoid valve S2 - ECM		
P0979	Shift Solenoid "C" Control Circuit Low (Shift Solenoid Valve S3)	- Short in shift solenoid valve S3 circuit - Shift solenoid valve S3 - ECM	Comes on	DTC stored
P0980	Shift Solenoid "C" Control Circuit High (Shift Solenoid Valve S3)	- Open in shift solenoid valve S3 circuit - Shift solenoid valve S3 - ECM	Comes on	DTC stored
P0982	Shift Solenoid "D" Control Circuit Low (Shift Solenoid Valve S4)	- Short in shift solenoid valve S4 circuit - Shift solenoid valve S4 - ECM	Comes on	DTC stored
P0983	Shift Solenoid "D" Control Circuit High (Shift Solenoid Valve S4)	- Open in shift solenoid valve S4 circuit - Shift solenoid valve S4 - ECM	Comes on	DTC stored
P0985	Shift Solenoid "E" Control Circuit Low (Shift Solenoid Valve SR)	- Short in shift solenoid valve SR circuit - Shift solenoid valve SR - ECM	Comes on	DTC stored
P0986	Shift Solenoid "E" Control Circuit High (Shift Solenoid Valve SR)	- Open in shift solenoid valve SR circuit - Shift solenoid valve SR - ECM	Comes on	DTC stored
P2714	Pressure Control Solenoid "D" Performance (Shift Solenoid Valve SLT)	- Shift solenoid valve SLT remains open or closed - Shift solenoid valve S1.S2, S3, S4or SL2 remains open or closed - Gear 6 incorrect ratio (sequence valve) or 1-2 shift valve is stuck - Valve body is blocked - Automatic transmission (clutch, brake or gear, etc.)	Comes on	DTC stored
P2716	Pressure Control Solenoid "D" Electrical (Shift Solenoid Valve SLT)	- Open or short in shift solenoid valve SLT circuit - Shift solenoid valve SLT - ECM	Comes on	DTC stored
P2740	Transmission Fluid		Comes on	DTC stored

	Temperature Sensor "B" Circuit	○ Open or short in No. 2 ATF temperature sensor circuit ○ No. 1 transmission wire (No. 2 ATF temperature sensor) ○ ECM		
P2742	Transmission Fluid Temperature Sensor "B" Circuit Low Input	○ Short in No. 2 ATF temperature sensor circuit ○ No. 1 transmission wire (No. 2 ATF temperature sensor) ○ ECM	Comes on	DTC stored
P2743	Transmission Fluid Temperature Sensor "B" Circuit High Input	○ Open in No. 2 ATF temperature sensor circuit ○ No. 1 transmission wire (No. 2 ATF temperature sensor) ○ ECM	Comes on	DTC stored
P2757	Torque Converter Clutch Pressure Control Solenoid Performance (Shift Solenoid Valve SLU)	○ Shift solenoid valve SLU remains open or closed ○ Valve body is blocked ○ Torque converter clutch ○ Automatic transmission (clutch, brake or gear, etc.) ○ Line pressure is too low	Comes on	DTC stored
P2759	Torque Converter Clutch Pressure Control Solenoid Control Circuit Electrical (Shift Solenoid Valve SLU)	○ Open or short in shift solenoid valve SLU circuit ○ Shift solenoid valve SLU ○ ECM	Comes on	DTC stored
P2772	Four Wheel Drive (4WD) Low Switch Circuit Range / Performance	○ Short in transfer L4 position switch circuit ○ 4WD control ECU ○ ECM	Comes on	DTC stored

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
	When one of following conditions is met: A. Any 2 or more of the following signals are ON simultaneously (2 trip detection logic) • P input signal	

P0705	• N input signal • R input signal • D input signal B. Any 2 or more of the following signals are ON simultaneously (2 trip detection logic) • NSW input signal • R input signal • D input signal C. Any of following signals are ON for 2.0 sec. or more in S position (2 trip detection logic) • NSW input signal • P input signal • N input signal • R input signal D. All signals are OFF simultaneously for P, R, N and D positions (2 trip detection logic)	• Open or short in part/neutral position switch circuit • Park/neutral position switch • ECM

MONITOR STRATEGY REFERENCE

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) and (C) 2 sec. Condition (D) 60 sec.
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None
Ignition switch	ON
Battery voltage	10.5 V or more

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Number of the following signal inputs at the same time	2 or more
P switch	ON
N switch	ON
R switch	ON
D switch	ON

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Number of the following signal inputs at the same time	2 or more
NSW switch	ON
R switch	ON

D switch	ON

TYPICAL MALFUNCTION THRESHOLDS CONDITION

NSW switch	ON
P switch	ON
N switch	ON
R switch	ON

TYPICAL MALFUNCTION THRESHOLDS CONDITION

P switch	OFF
NSW switch	OFF
N switch	OFF
R switch	OFF
D switch	OFF

COMPONENT OPERATING RANGE

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

INTELLIGENT TESTER ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
PNP SW [NSW]	PNP switch status/ ON or OFF	Shift lever is: • On P and N: ON • Not on P and N: OFF	When shift lever position displayed on intelligent tester differs from actual position, adjustment of PNP switch or shift cable may be incorrect
REVERSE	PNP switch status/ ON or OFF	Shift lever is: • On R: ON • Not on R: OFF	When shift lever position displayed on intelligent tester differs from actual position, adjustment of PNP switch or shift cable may be incorrect
PARKING	PNP switch status/ ON or OFF	Shift lever is: • On P: ON • Not on P: OFF	When shift lever position displayed on intelligent tester differs from actual position, adjustment of PNP switch or shift cable may be incorrect
NEUTRAL	PNP switch status/ ON or OFF	Shift lever is: • On N: ON • Not on N: OFF	When shift lever position displayed on intelligent tester differs from actual position, adjustment of PNP switch or shift cable may be incorrect
DRIVE	PNP switch status/ ON or OFF	Shift lever is: • On D: ON • Not on D: OFF	When shift lever position displayed on intelligent tester differs from actual position, adjustment of PNP switch or shift cable may be incorrect
SPORTS UP SW	Sport shift up switch status/ ON or OFF	• ON: Continuously shift to "+" (up-shift)	-

		• OFF: Release "+" (up-shift)	
SPORTS DOWN SW	Sport shift down switch status/ ON or OFF	• ON: Continuously shift to "-" (down-shift) • OFF: Release "-" (down-shift)	-
MODE SELECT SW	Sport mode select switch status/ ON or OFF	Shift lever position is: • ON: S, "+" and "-" • OFF: Not on S, "+" and "-"	-

TECHSTREAM ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Neutral Position SW Signal	PNP switch status/ ON or OFF	Shift lever is: • On P and N: ON • Not on P and N: OFF	When shift lever position displayed on Techstream differs from actual position, adjustment of PNP switch or shift cable may be incorrect
Shift SW Status (R Range)	PNP switch status/ ON or OFF	Shift lever is: • On R: ON • Not on R: OFF	When shift lever position displayed on Techstream differs from actual position, adjustment of PNP switch or shift cable may be incorrect
Shift SW Status (P Range)	PNP switch status/ ON or OFF	Shift lever is: • On P: ON • Not on P: OFF	When shift lever position displayed on Techstream differs from actual position, adjustment of PNP switch or shift cable may be incorrect
Shift SW Status (N Range)	PNP switch status/ ON or OFF	Shift lever is: • On N: ON • Not on N: OFF	When shift lever position displayed on Techstream differs from actual position, adjustment of PNP switch or shift cable may be incorrect
Shift SW Status (D Range)	PNP switch status/ ON or OFF	Shift lever is: • On D: ON • Not on D: OFF	When shift lever position displayed on Techstream differs from actual position, adjustment of PNP switch or shift cable may be incorrect
Sports Shift Up SW	Sport shift up switch status/ ON or OFF	• ON: Continuously shift to "+" (up-shift) • OFF: Release "+" (up-shift)	-
Sports Shift Down SW	Sport shift down switch status/ ON or OFF	• ON: Continuously shift to "-" (down-shift)	-

		• OFF: Release "-" (down-shift)	
Sports Mode Selection SW	Sport mode select switch status/ ON or OFF	Shift lever position is: • ON: S, "+" and "-" • OFF: Not on S, "+" and "-"	-

PARK/NEUTRAL POSITION SWITCH ASSEMBLY RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
• 2 (RB) - 6 (PL) • 4 (B) - 5 (L)	Shift lever position on P	Below 1 ohms
2 (RB) - 1 (RL)	Shift lever position on R	Below 1 ohms
• 2 (RB) - 9 (NL) • 4 (B) - 5 (L)	Shift lever position on N	Below 1 ohms
2 (RB) - 7 (DL)	• Shift lever position on D • Shift lever position on S, "+" and "-"	Below 1 ohms
• 2 (RB) - 6 (PL) • 4 (B) - 5 (L)	Shift lever position not on P	10 kohms or higher
2 (RB) - 1 (RL)	Shift lever position not on R	10 kohms or higher
• 2 (RB) - 9 (NL) • 4 (B) - 5 (L)	Shift lever position not on N	10 kohms or higher
2 (RB) - 7 (DL)	• Shift lever position not on D • Shift lever position not on S, "+" and "-"	10 kohms or higher

TRANSMISSION CONTROL SWITCH RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
6 (IG) - 13 (S)	Shift lever position on S, "+" and "-"	Below 1 ohms
6 (IG) - 13 (S)	Shift lever position not on S, "+" and "-"	10 kohms or higher

TRANSMISSION CONTROL SWITCH RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
3 (IG) - 7 (S)	Shift lever position on S, M+" and "-"	Below 1 ohms
3 (IG) - 7 (S)	Shift lever position not on S, "+" and "-"	10 kohms or higher

RESULT CHART

Result	Proceed to
OK	A
NG (for Column Shift Type)	B
NG (for Floor Shift Type)	C

PARK/NEUTRAL POSITION SWITCH ASSEMBLY (POWER SOURCE) VOLTAGE SPECIFIED CONDITION

Tester Connection	Switch Condition	Specified Condition
D35-2 (RB) - Body ground	Ignition switch ON	11 to 14 V
035-2 (RB) - Body ground	Ignition switch OFF	Below 1 V

TRANSMISSION CONTROL SWITCH (POWER SOURCE) VOLTAGE SPECIFIED CONDITION

Tester Connection	Switch Condition	Specified Condition
J25-6 (IG) - Body ground	Ignition switch ON	11 to 14 V
J25-6 (IG) - Body ground	Ignition switch OFF	Below 1 V

VOLTAGE SPECIFIED CONDITION

Tester Connection	Switch Condition	Specified Condition
J24-3 (IG) - Body ground	Ignition switch ON	11 to 14 V
J24-3 (IG) - Body ground	Ignition switch OFF	Below 1 V

VOLTAGE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
• D74-2 (P) - Body ground • D74-120 (NSW) - Body ground	• Ignition switch ON • Shift lever position on P	11 to 14 V
D74-26 (R) - Body ground	• Ignition switch ON • Shift lever position on R	11 to 14 V*
• D74-25 (N) - Body ground • D74-120 (NSW) - Body ground	• Ignition switch ON • Shift lever position on N	11 to 14 V
D74-27 (D) - Body ground	• Ignition switch ON • Shift lever position on D	11 to 14 V
• D74-2 (P) - Body ground • D74-120 (NSW) - Body ground	• Ignition switch ON • Shift lever position not on P	Below 1 V
D74-26 (R) - Body ground	• Ignition switch ON • Shift lever position not on R	Below 1 V
• D74-25 (N) - Body ground • D74-120 (NSW) - Body ground	• Ignition switch ON • Shift lever position not on N	Below 1 V
D74-27 (D) - Body ground	• Ignition switch ON • Shift lever position not on D	Below 1 V
HINT: *: The voltage will drop slightly due to turning on the back up light.		

HARNESS AND CONNECTOR (TRANSMISSION CONTROL SWITCH - ECM) VOLTAGE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
A24-2S (S) - Body ground	Shift lever position on S, "+" and "-"	11 to 14 V
A24-25 (S) - Body ground	Shift lever position not on S, "+" and "-"	Below 1 V

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0710	(a) and (b) are detected momentarily within 0.5 sec. when neither P0712 nor P0713 is detected (1-trip detection logic) a. No. 1 ATF temperature sensor resistance is less than 79 ohms. b. No. 1 ATF temperature sensor resistance is more than 156 kohms. HINT: Within 0.5 sec, the malfunction switches from (a) to (b) or from (b) to (a)	• Open or short in No. 1 ATF temperature sensor circuit • No. 1 transmission wire (No. 1 ATF temperature sensor) • ECM
P0712	No. 1 ATF temperature sensor resistance is less than 79 ohms for 0.5 sec. or more (1-trip detection logic)	• Short in No. 1 ATF temperature sensor circuit • No. 1 transmission wire (No. 1 ATF temperature sensor) • ECM
P0713	When 15 min. or more have elapsed after engine is started, No. 1 ATF temperature sensor resistance is more than 156 kohms for 0.5 sec. or more (1-trip detection logic)	• Open in No. 1 ATF temperature sensor circuit • No. 1 transmission wire (No. 1 ATF temperature sensor) • ECM

MONITOR STRATEGY REFERENCE

Related DTCs	P0710: ATF temperature sensor/Range check (Chattering) 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	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None

TYPICAL ENABLING CONDITIONS

The typical enabling condition is not available	-

TYPICAL ENABLING CONDITIONS

The typical enabling condition is not available	-

TYPICAL ENABLING CONDITIONS

Time after engine start	15 min. or more

TYPICAL MALFUNCTION THRESHOLDS CONDITION

ATF temperature sensor resistance	Less than 79 ohms or more than 156 kohms

TYPICAL MALFUNCTION THRESHOLDS CONDITION

ATF temperature sensor resistance	Less than 79 ohms

TYPICAL MALFUNCTION THRESHOLDS CONDITION

ATF temperature sensor resistance	More than 156 kohms

COMPONENT OPERATING RANGE

ATF temperature sensor resistance	79 ohms to 156 kohms

INTELLIGENT TESTER ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
A/TOIL TEMPI	No. 1 ATF temperature sensor value/ Min.: -40°C (-40°F) Max.:215°C (419°F)	• After stall test: Approximately 80°C (176°F) • Equal to ambient temperature while engine is cold	If value is -40°C (-40°F) or 215°C (419°F), No. 1 ATF temperature sensor circuit is open or shorted

TECHSTREAM ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
A/T Oil Temperature 1	No. 1 ATF temperature sensor value/ Min.: -40°C (-40°F) Max.:215°C (419°F)	• After stall test: Approximately 80°C (176°F) • Equal to ambient temperature while engine is cold	If value is -40°C (-40°F) or 215°C (419°F), No. 1 ATF temperature sensor circuit is open or shorted

MALFUNCTION REFERENCE

Temperature Displayed	Malfunction
-40°C (-40°F)	Open circuit
150°C (302°F) or more	Short circuit

NO. 1 TRANSMISSION WIRE (NO. 1 ATF TEMPERATURE SENSOR) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 (OT-) - 9 (OT+)	Always	79 ohms to 156 kohms

1 (OT-) - Body ground	Always	10 kohms or higher
9 (OT+) - Body ground	Always	10 kohms or higher

NO. 1 TRANSMISSION WIRE (NO. 1 ATF TEMPERATURE SENSOR) RESISTANCE SPECIFIED CONDITION

ATF Temperature	Specified Condition
10°C (50°F)	5 to 8 kohms
25°C (77°F)	2.5 to 4.5 kohms
110°C (230°F)	0.22 to 0.28 kohms

HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D74-122 (THO1) - D74-98 (ETHA)	Always	79 ohms to 156 kohms
D74-122 (THO1) - Body ground	Always	10 kohms or higher
D74-98 (ETHA) - Body ground	Always	10 kohms or higher

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0711	Both (a) and (b) are detected: (2-trip detection logic) a. Intake air and engine coolant temperature are more than -10°C (14°F) at engine start b. After normal driving for over 22 min. for 9 km (6 miles) or more, No. 1 ATF temperature is less than 20°C (68°F)	No. 1 transmission wire (No. 1 ATF temperature sensor)

MONITOR STRATEGY REFERENCE

Related DTCs	P0711: ATF temperature sensor/Rationality check
Required sensors/Components	ATF temperature sensor
Frequency of operation	Continuous
Duration	3 sec.
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None

TYPICAL ENABLING CONDITIONS

ATF temperature sensor "A" circuit	Not circuit malfunction
ECT (Engine coolant temperature) sensor circuit	Not circuit malfunction
IAT (Intake air temperature) sensor circuit	Not circuit malfunction
Duration time from engine start	8 min. and 20 sec. or more
Time after engine start	8 min. and 20 sec.

Driving distance after engine start	3.365 km (2.1 miles) or more
IAT (12 sec. after engine start)	-10°C (14°F) or more
ECT (12 sec. after engine start)	-10°C (14°F) or more

TYPICAL ENABLING CONDITIONS

Duration time for ECT to reach 60°C (140°F)	10 sec. or more
ATF temperature (12 sec. after engine start)	105°C (221°F) or more
ECT (12 sec. after engine start)	Less than 35°C (95°F)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

ATF temperature	Less than 20°C (68°F) (ATF temperature = -10°C (14°F) at engine start) (Conditions vary with ATF temperature at engine start)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

ATF temperature	105°C (221°F) or more

COMPONENT OPERATING RANGE

ATF temperature	20°C (68°F) or more (ATF temperature = -10°C (14°F) at engine start) (Conditions vary with ATF temperature at engine start)
ATF temperature	Less than 105°C (221°F)

ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
A/T OIL TEMPI	No. 1 ATF temperature sensor value/ Min.: -40°C (-40°F) Max.:215°C (419°F)	• After stall test: Approximately 80°C (176°F) • Equal to ambient temperature while engine is cold	If value is -40°C (-40°F) or 215°C (419°F), No. 1 ATF temperature sensor circuit is open or shorted

ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
A/T Oil Temperature 1	No. 1 ATF temperature sensor value/ Min.: -40°C (-40°F) Max.:215°C (419°F)	• After stall test: Approximately 80°C (176°F) • Equal to ambient temperature while engine is cold	If value is -40°C (-40°F) or 215°C (419°F), No. 1 ATF temperature sensor circuit is open or shorted

MALFUNCTION REFERENCE

Temperature Displayed	Malfunction
-40°C (-40°F)	Open circuit
150°C (302°F) or more	Short circuit

DTC OUTPUT RESULT

Display (DTC output)	Proceed to
Only P0711 is output	A
P0711 and other DTCs are output	B

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0717	All conditions below are detected for 5 sec. or more (1 -trip detection logic) a. Gear change is not performed b. Gear position: 4th, 5th or 6th c. T/M input shaft rpm: 300 rpm or less d. T/M output shaft rpm: 1000 rpm or more e. Park/neutral position switch: • NSW input signal is OFF • R input signal is OFF f. Shift solenoid valves and park/neutral position switch are operating normally	• Open or short in speed sensor NT circuit • Speed sensor NT • ECM • Automatic transmission (clutch, brake or gear, etc.)

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition	Specified Condition
D74-124 (NT+) -D74-123 (NT-)	1 V/DIV., 2 msec./ DIV.	Engine is idling (P or N position)	Refer to the illustration

MONITOR STRATEGY REFERENCE

Related DTCs	P0717: Speed sensor (NT)/Verify pulse input
Required sensors/Components (Main)	Speed sensor (NT)
Required sensors/Components (Related)	Speed sensor (NC)
Frequency of operation	Continuous
Duration	5 sec.
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	P0500 (VSS) P0748 (Trans solenoid (range))
Shift change	After shift change is completed and before starting next shift change operation
ECM selected gear	4th, 5th or 6th
Output shaft rpm	1000 rpm or more
NSW switch	OFF
R switch	OFF
Engine	Running

Transmission position switch failure	Not detected
Battery voltage	8 V or more
Ignition switch	ON
Starter	OFF

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Speed sensor signal rpm	Less than 300 rpm

COMPONENT OPERATING RANGE

Speed sensor signal rpm	300 rpm or more

INTELLIGENT TESTER ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
SPD (NT)	Input shaft speed/ Min.: 0 rpm Max.: 12750 rpm	Lock-up is: • ON (after warming up engine): Input turbine speed (NT) is equal to engine speed • OFF (idling with shift lever on N): Input turbine speed (NT) is nearly equal to engine speed	Data is displayed in increments of 50 rpm

TECHSTREAM ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
SPD (NT)	Input shaft speed/ Min.: 0 rpm Max.: 12750 rpm	Lock-up is: • ON (after warming up engine): Input turbine speed (NT) is equal to engine speed • OFF (idling with shift lever on N): Input turbine speed (NT) is nearly equal to engine speed	Data is displayed in increments of 50 rpm

SPEED SENSOR NT RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°FJ	560 to 680 ohms

HARNESS AND CONNECTOR (SPEED SENSOR NT - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D74-124 (NT+) - D74-123 (NT-)	20°C (68°F)	560 to 680 ohms
D74-124 (NT+) - Body ground	Always	10 kohms or higher
D74-123 (NT-) - Body ground	Always	10 kohms or higher

DTC TROUBLE DETECTION CHART

DTC	DTC Detection Condition	Trouble Area

No.		
P0722	All conditions below are detected 500 times or more continuously (2-trip detection logic) a. No signal from speed sensor SP2 is input to ECM while 4 pulses of No. 1 vehicle speed sensor signal are sent b. Vehicle speed is 9 km/h (6 mph) or more for at least 5 sec. c. Park/neutral position switch is OFF d. Transfer position is in any position except neutral	• Open or short in speed sensor SP2 circuit • Speed sensor SP2 • ECM • Automatic transmission (clutch, brake or gear, etc.)

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition	Specified Condition
D74-101 (SP2+) -D74-100 (SP2-)	2 V/DIV., 20 msec./DIV	Vehicle speed 20 km/h (12mph)	Refer to the illustration

MONITOR STRATEGY REFERENCE

Related DTCs	P0722: Speed sensor SP2/Verify pulse input
Required	Sensors/Components Speed sensor SP2
Frequency of operation	Continuous
Duration	5 sec.
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	P0500 (VSS) P0748 (Trans solenoid (range))
Transfer neutral switch	Not "N" position
Vehicle speed at vehicle speed sensor	9 km/h (5.59 mph) or more
Battery voltage	8 V or more
Ignition switch	ON
Starter	OFF

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Speed sensor signal	No signal

COMPONENT OPERATING RANGE

Vehicle speed at output speed sensor	9 km/h (5.59 mph) or more

INTELLIGENT TESTER ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
SPD (SP2)	Output shaft speed/ Min.: 0 km/h (0 mph)	Vehicle stopped: 0 km/h (0 mph) (output shaft	-

	Max.:255km/h (158mph)	speed is equal to vehicle speed)	

TECHSTREAM ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
SPD (SP2)	Output shaft speed/ Min.: 0 km/h (0 mph) Max.:255km/h (158mph)	Vehicle stopped: 0 km/h (0 mph) (output shaft speed is equal to vehicle speed)	-

SPEED SENSOR SP2 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	560 to 680 ohms

HARNESS AND CONNECTOR (SPEED SENSOR SP2 - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D74-101 (SP2+) - D74-100 (SP2-)	20°C (68°F)	560 to 680 ohms
D74-101 (SP2+) - Body ground	Always	10 kohms or higher
D74-100 (SP2-) - Body ground	Always	10 kohms or higher

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
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) pattern 5 times. (2-trip detection logic)	• Short in stop light switch signal circuit • Stop light switch • ECM

MONITOR STRATEGY REFERENCE

Related DTCs	P0724: Stop light switch/Range check/Rationality
Required sensors/Components	Stop light switch, Vehicle speed sensor
Frequency of operation	Continuous
Duration	GO and STOP 5 times
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None
Battery voltage	8 V or more
Ignition switch	ON
Starter	OFF
GO: (Vehicle speed is 30 km/h (18.65 mph) or more)	Once
STOP: (Vehicle speed is less than 3 km/h (1.86 mph))	Once

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Stop light switch status	ON stuck

INTELLIGENT TESTER ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
STOP LIGHT SW	Stop light switch status/ ON or OFF	Brake pedal is: • Depressed: ON • Released: OFF	-

TECHSTREAM ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Stop Light Switch	Stop light switch status/ ON or OFF	Brake pedal is: • Depressed: ON • Released: OFF	-

STOP LIGHT SWITCH RESISTANCE SPECIFIED CONDITION

Tester Connection	Switch Condition	Specified Condition
1 - 2	Pin not pushed	Below 1 ohms
3 - 4	Pin pushed	Below 1 ohms
1 - 2	Pin pushed	10 kohms or higher
3 - 4	Pin not pushed	10 kohms or higher

HARNESS AND CONNECTOR (BATTERY - ECM) VOLTAGE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
A24-36 (STP) - Body ground	Brake pedal is depressed	11 to 14 V
A24-36 (STP) - Body ground	Brake pedal is released	Below 1 V

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0729	6th gearshift malfunction: The ECM determines there is a malfunction when both of the following conditions are met. (2-trip detection logic) a. When the ECM directs the gearshift to switch to 5th gear, the actual gear is also shifted to 5th. b. When the ECM directs the gearshift to switch to 6th gear, the actual gear is shifted to 4th.	• Valve body is blocked up or stuck (sequence valve) • Shift solenoid valve SLT remains open or closed • Automatic transmission (clutch, brake or gear, etc.)

GEAR POSITION REFERENCE

ECM command gearshift	1st	2nd	3rd	4th	5th	6th
Actual gear position under malfunction	1st	2nd	3rd	4th	5th	4th

GEAR POSITION REFERENCE

Gear position under normal conditions	1st	2nd	3rd	4th	5th	6th
Actual gear position under fail-safe mode	1st	2nd	3rd	3rd	3rd	3rd

MONITOR STRATEGY REFERENCE

Related DTCs	P0729: Gear 6 incorrect ratio (Sequence valve) / Rationality check
Required sensors/Components	Sequence valve
Frequency of operation	Continuous
Duration	0.4 sec.
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	P0500 (VSS) P0748 (Trans solenoid (range))
Turbine speed sensor circuit	Not circuit malfunction
Output speed sensor circuit	Not circuit malfunction
Shift solenoid valve S1 circuit	Not circuit malfunction
Shift solenoid valve S2 circuit	Not circuit malfunction
Shift solenoid valve S3 circuit	Not circuit malfunction
Shift solenoid valve S4 circuit	Not circuit malfunction
Shift solenoid valve SR circuit	Not circuit malfunction
Shift solenoid valve SL1 circuit	Not circuit malfunction
Shift solenoid valve SL2 circuit	Not circuit malfunction
ECT (Engine coolant temperature) sensor circuit	Not circuit malfunction
KCS sensor circuit	Not circuit malfunction
ETCS (Electric Throttle Control System)	Not system down
Transmission position	"D"
Duration time from shifting "N" to "D"	4 sec. or more
ECT	40°C (104°F) or more
Spark advance from max. retard timing by KCS control	0° crankshaft angle or more
Engine	Starting

TYPICAL ENABLING CONDITIONS

Vehicle speed sensor circuit	Not circuit malfunction
Output shaft speed sensor circuit	Not circuit malfunction
Transfer output speed	143 rpm or more
NO/NOtf (Transfer input speed/Transfer output speed)	0.9 to 1.1

TYPICAL ENABLING CONDITIONS

ECM selected gear	5th
Vehicle speed	2 km/h (1.2 mph) or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

TYPICAL ENABLING CONDITIONS

ECM selected gear	6th
Vehicle speed	2 km/h (1.2 mph) or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	0.66 or more, and 0.80 or less

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	0.93 or more, and 1.07 or less

DTC OUTPUT RESULT

Display (DTC output)	Proceed to
Only P0729 is output	A
P0729 and other DTCs are output	B

INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
SHIFT	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less

TECHSTREAM ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
Control the Shift Position	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less

GEAR POSITIONS REFERENCE

Tester command gearshift	1st	2nd	3rd	4th	5th	6th
Actual gear position under malfunction	1st	2nd	3rd	4th	5th	4th

INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
SOLENOID (SLT)*	Operate the shift solenoid SLT and raise line pressure	ON or OFF HINT: • OFF: Line pressure up (when Active Test "SOLENOID (SLT)" is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	[Vehicle Condition] • Vehicle stopped • Engine idling

HINT:

*: SOLENOID (SLT) in the Active Test is performed to check the line pressure changes by connecting SST to the automatic transmission, which is used in the Hydraulic Test (see **HYDRAULIC TEST**) as well. Please note that the pressure values in the Active Test and Hydraulic Test are different.

ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
Activate the Solenoid (SLT)*	Operate the shift solenoid SLT and raise line pressure	ON or OFF HINT: • OFF: Line pressure up (when Active Test "Activate the Solenoid (SLT)" is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	[Vehicle Condition] • Vehicle stopped • Engine idling
HINT: *: Activate the Solenoid (SLT) in the Active Test is performed to check the line pressure changes by connecting SST to the automatic transmission, which is used in the Hydraulic Test (see **HYDRAULIC TEST**) as well. Please note that the pressure values in the Active Test and Hydraulic Test are different.			

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0748	The ECM checks for an open or short in the shift solenoid valve SL1 circuit while driving and shifting between 4th and 5th gear (1 trip detection logic) Output signal duty equals to 100% HINT: SL1 output signal duty is less than 100% under normal condition	• Open or short in shift solenoid valve SL1 circuit • Shift solenoid valve SL1 • ECM

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition	Specified Condition
D74-14 (SL1+) -D74-15 (SL1-)	5 V/DIV., 1 msec./ DIV.	Engine is idling	Refer to the Illustration

MONITOR STRATEGY REFERENCE

Related DTCs	P0748: Shift solenoid valve SLI/Range check
Required sensors/Components	Shift solenoid valve SL1
Frequency of operation	Continuous
Duration	1 sec.
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None
Ignition switch	ON
Starter	OFF

TYPICAL ENABLING CONDITIONS

Solenoid current cut status	Not cut
Battery voltage	11 V or more
Target current	0.1 A or more

TYPICAL ENABLING CONDITIONS

Battery voltage	8 V or more

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Solenoid status from Hybrid IC	Failure

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Hybrid IC status	Failure

COMPONENT OPERATING RANGE

Output signal duty	Less than 100%

SHIFT SOLENOID VALVE SL1 OPERATION CHART

ECM gear shift command	1st	2nd	3rd	4th	5th	6th
Shift solenoid valve SL1	OFF	OFF	OFF	OFF	ON	ON

NO. 1 TRANSMISSION WIRE (SHIFT SOLENOID VALVE SL1) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
11 (SL1+) - 3 (SL1-)	20°C (68°F)	5.0 to 5.6 ohms
11 (SL1+) - Body ground	Always	10 kohms or higher
3 (SL.1-) - Body ground	Always	10 kohms or higher

HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D74-14 (SL1+) - D74-15 (SL1-)	20°C (68°F)	5.0 to 5.6 ohms
D74-14 (SL1+) - Body ground	Always	10 kohms or higher
D74-15 (SL1-) - Body ground	Always	10 kohms or higher

SHIFT SOLENOID VALVE SL1 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	5.0 to 5.6 ohms

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
	S1stuck ON malfunctions*1: The ECM determines there is a malfunction when the following conditions are both met. (2-trip detection logic)	• Shift solenoid valve S1 remains open

P0751	a. When the ECM directs the gearshift to switch to 1st gear, the actual gear is shifted to 2nd. b. When the ECM directs the gearshift to switch to 5th gear, the actual gear is also shifted to 5th.	• Valve body is blocked • Automatic transmission (clutch, brake or gear, etc.)
P0751	S1stuck OFF malfunction*2: The ECM determines there is a malfunction when the following conditions are both met. (2-trip detection logic) a. When the ECM directs the gearshift to switch to 2nd gear, the actual gear is shifted to 1st. b. When the ECM directs the gearshift to switch to 5th gear, the actual gear is also shifted to 5th.	• Shift solenoid valve S1 remains closed • Shift solenoid valve SLT remains open or closed • Valve body is blocked • No. 2 brake malfunction (Driving is difficult.) • Automatic transmission (clutch, brake or gear, etc.)

GEAR POSITIONS REFERENCE

ECM command gearshift	1st	2nd	3rd	4th	5th	6th
*1: Actual gear position under S1stuck ON malfunction	2nd	2nd	3rd	4th	5th	6th
*2: Actual gear position under S1stuck OFF malfunction	1st	1st	3rd	4th	5th	N(1)
(1) Neutral						

GEAR POSITIONS REFERENCE

Gear position under normal conditions	1st	2nd	3rd	4th	5th	6th
*1: Actual gear position under fail-safe mode when S1stuck ON malfunction	2nd	2nd	3rd	4th	5th	6th
*2: Actual gear position under fail-safe mode when S1stuck OFF malfunction	1st (1)	1st (1)	3rd	3rd	3rd	3rd
(1) Under engine braking, downshifting to 1st or 2nd gear is prohibited.						

MONITOR STRATEGY REFERENCE

Related DTCs	P0751: Shift solenoid valve S1/OFF malfunction Shift solenoid valve S1/ON malfunction
Required sensors/Components	Shift solenoid valve S1, Speed sensor (NT), Speed sensor (NC), Crankshaft position sensor (NE), Throttle position sensor MAF
Frequency of operation	Continuous
Duration	OFF malfunction (A), (B) and ON malfunction (A), (B) 0.4 sec. OFF malfunction (C) 3 sec. OFF malfunction (D) 1 sec.
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	P0115-P0118 (ECT sensor) P0125 (Insufficient ECT for Closed Loop) P0500 (VSS) P0748 - P0798 (Trans solenoid (range))
Turbine speed sensor circuit	Not circuit malfunction
Output speed sensor circuit	Not circuit malfunction
Shift solenoid valve S1 circuit	Not circuit malfunction
Shift solenoid valve S2 circuit	Not circuit malfunction
Shift solenoid valve S3 circuit	Not circuit malfunction
Shift solenoid valve S4 circuit	Not circuit malfunction
Shift solenoid valve SR circuit	Not circuit malfunction
Shift solenoid valve SL1 circuit	Not circuit malfunction
Shift solenoid valve SL2 circuit	Not circuit malfunction
ECT (Engine coolant temperature) sensor circuit	Not circuit malfunction
KCS sensor circuit	Not circuit malfunction
ETCS (Electric Throttle Control System)	Not system down
Transmission position	"D"
Duration time from shifting "N" to "D"	4 sec. or more
ECT	40°C (104°F) or more
Spark advance from max. retard timing by KCS control	0° crankshaft angle or more
Engine	Starting

TYPICAL ENABLING CONDITIONS

Vehicle speed sensor circuit	Not circuit malfunction
Output shaft speed sensor circuit	Not circuit malfunction
Transfer output speed	143 rpm or more
NO/NOtf (Transfer input speed/Transfer output speed)	0.9 to 1.1

TYPICAL ENABLING CONDITIONS

ECM selected gear	5th
Vehicle speed	2 km/h (1.2 mph) or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

TYPICAL ENABLING CONDITIONS

ECM selected gear	2nd
Vehicle speed	2 km/h (1.2 mph) or more
Output speed	2nd --> 1st down-shift point or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

TYPICAL ENABLING CONDITIONS

Current ECM selected gear	6th
Last ECM selected gear	5th
Vehicle speed (During transition from 5th to 6th gear)	Less than 100 km/h (62.2 mph)

TYPICAL ENABLING CONDITIONS

ECM selected gear	6th
Engine speed-Turbine speed (NE-NT) (After transition from 5th to 6th gear)	150 rpm or less
Vehicle speed	Less than 100 km/h (62.2 mph)

TYPICAL ENABLING CONDITIONS

ECM selected gear	1st
Vehicle speed	2 km/h (1.2 mph) or more and less than 40 km/h (24.9 mph)
Engine speed-Turbine speed (NE-NT)	50 rpm or more

TYPICAL ENABLING CONDITIONS

ECM selected gear	5th
Vehicle speed	2 km/h (1.2 mph) or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	0.66 or more, and 0.80 or less (This means actual gear is 5th)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	3.11 or more, and 7.58 or less (This means actual gear is 1st)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed-Output speed x 5th gear ratio (NT-NO x 5th gear ratio)	1000 rpm or more

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed-Output speed x 6th gear ratio (NT-NO x 6th gear ratio)	1000 rpm or more

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	1.83 or more, and 2.27 or less (This means actual gear is 2nd)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	0.66 or more, and 0.80 or less (This means actual gear is 5th)

INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
SHIFT	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less

TECHSTREAM ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note

Control the Shift Position	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less

SHIFT SOLENOID VALVE S1 OPERATION CHART

ECM command gearshift	1st	2nd	3rd	4th	5th	6th
Shift solenoid valve S1	OFF	ON	ON	ON	ON	ON

DTC OUTPUT RESULT

Display (DTC output)	Proceed to
Only P0751 is output	A
P0751 and other DTCs are output	B

INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
SOLENOID (SLT)*	Operate the shift solenoid SLT and raise line pressure	ON or OFF HINT: • OFF: Line pressure up (when Active Test "SOLENOID (SLT)" is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	[Vehicle Condition] • Vehicle stopped • Engine idling
HINT: *: SOLENOID (SLT) in the Active Test is performed to check the line pressure changes by connecting SST to the automatic transmission, which is used in the Hydraulic Test (see **HYDRAULIC TEST**) as well. Please note that the pressure values in the Active Test and Hydraulic Test are different.			

TECHSTREAM ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
Activate the Solenoid (SLT)*	Operate the shift solenoid SLT and raise line pressure	ON or OFF HINT: • OFF: Line pressure up (when Active Test "Activate the Solenoid (SLT)" is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	[Vehicle Condition] Vehicle stopped Engine idling
HINT: *: Activate the Solenoid (SLT) in the Active Test is performed to check the line pressure changes by connecting SST to the automatic transmission, which is used in the Hydraulic Test (see **HYDRAULIC TEST**) as well. Please note that the pressure values in the Active Test and Hydraulic Test are different.			

SHIFT SOLENOID VALVE S1 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition

Shift solenoid valve S1 connector terminal - Shift solenoid valve S1 body	20°C (68°F)	11 to 15 ohms

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0756	S2 stuck ON malfunction* 1: Shifting to 3rd and 5th gears is impossible. The ECM determines there is a malfunction when the following conditions are both met. (2-trip detection logic) a. When the ECM directs the gear shift to switch to 5th gear, the actual gear is shifted to 6th. b. When the ECM directs the gear shift to switch to 6th gear, the actual gear is shifted to 6th.	• Shift solenoid valve S2 remains open • Valve body is blocked • Automatic transmission (clutch, brake, gear, etc.) • ECM
P0756	S2 stuck OFF malfunction*2: The vehicle starts in 3rd gear and shifting to 6th gear is impossible. The ECM determines there is a malfunction when the following conditions are both met. (2-trip detection logic) a. When the ECM directs the gear shift to switch to 1st gear, the actual gear is shifted to 3rd. b. When the ECM directs the gear shift to switch to 6th gear, the actual gear is shifted to 5th.	• Shift solenoid valve S2 remains closed • Valve body is blocked • Automatic transmission (clutch, brake, gear, etc.) • ECM

GEAR POSITIONS REFERENCE

ECM gear shift command	1st	2nd	3rd	4th	5th	6th
*1: Actual gear position under S2 stuck ON malfunction	1st	2nd	2nd	4th	6th	6th
*2: Actual gear position under S2 stuck OFF malfunction	3rd	3rd	3rd	4th	5th	5th

MONITOR STRATEGY REFERENCE

Related DTCs	P0756: Shift solenoid valve S2/OFF malfunction Shift solenoid valve S2/ON malfunction
Required sensors/Components	Shift solenoid valve S2
Frequency of operation	Continuous
Duration	0.4 sec.
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	P0115-P0118: ECT sensor P0125: Insufficient ECT for closed loop P0500: VSS P0748 - P0798: Trans solenoid (range)
Turbine speed sensor circuit	Not circuit malfunction

Output speed sensor circuit	Not circuit malfunction
Shift solenoid valve S1 circuit	Not circuit malfunction
Shift solenoid valve S2 circuit	Not circuit malfunction
Shift solenoid valve S3 circuit	Not circuit malfunction
Shift solenoid valve S4 circuit	Not circuit malfunction
Shift solenoid valve SR circuit	Not circuit malfunction
Shift solenoid valve SL1 circuit	Not circuit malfunction
Shift solenoid valve SL2 circuit	Not circuit malfunction
ECT (Engine coolant temperature) sensor circuit	Not circuit malfunction
KCS sensor circuit	Not circuit malfunction
ETCS (Electric Throttle Control System)	Not system down
Transmission position	"D"
Duration time from shifting "N" to "D"	4 sec. or more
ECT	40°C (104°F) or more
Spark advance from max. retard timing by KCS control	0° crankshaft angle or more
Engine	Starting

TYPICAL ENABLING CONDITIONS

Vehicle speed sensor circuit	Not circuit malfunction
Output shaft speed sensor circuit	Not circuit malfunction
Transfer output speed	143 rpm or more
NO/NOtf (Transfer input speed/Transfer output speed)	0.9 to 1.1

TYPICAL ENABLING CONDITIONS

ECM selected gear	1st
Vehicle speed	2 km/h (1.2 mph) or more and less than 40 km/h (24.9 mph)
Engine speed - Turbine speed (NE - NT)	50 rpm or more

TYPICAL ENABLING CONDITIONS

ECM selected gear	6th
Vehicle speed	2 km/h (1.2 mph) or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

TYPICAL ENABLING CONDITIONS

ECM selected gear	5th
Vehicle speed	2 km/h (1.2 mph) or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

TYPICAL ENABLING CONDITIONS

ECM selected gear	6th
Vehicle speed	2 km/h (1.2 mph) or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	1.24 to 1.49 (This means actual gear is 3rd)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	0.66 to 0.80 (This means actual gear is 5th)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	0.51 to 0.65 (This means actual gear is 6th)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	0.51 to 0.65 (This means actual gear is 6th)

INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
SHIFT	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less

TECHSTREAM ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
Control the Shift Position	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less

SHIFT SOLENOID VALVE S2 OPERATION CHART

ECM gear shift command	1st	2nd	3rd	4th	5th	6th
Shift solenoid valve S2	ON	ON	OFF	OFF	OFF	ON

DTC OUTPUT RESULT

Display (DTC output)	Proceed to
Only P0756 is output	A
P0756 and other DTCs are output	B

SHIFT SOLENOID VALVE S2 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S2 connector terminal - Shift solenoid valve S2 body	20°C (68°F)	11 to 15 ohms

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
	S3 stuck ON malfunctions*1: When the ECM directs the gearshift to switch to 5th or	• Shift solenoid valve S3

P0761	6th gear, the engine overruns (clutch slips). The ECM determines there is a malfunction when either of the following conditions is met. (2-trip detection logic) a. When the ECM directs the gearshift to switch to 4th gear, the actual gear is shifted to 3rd. b. When the ECM directs the gearshift to switch to 5th gear, the engine overruns (clutch slips).	remains open • Shift solenoid valve SLT remains open or closed • Valve body is blocked • Automatic transmission (clutch, brake or gear, etc.)
P0761	S3 stuck OFF malfunction*2: Shifting to 1st, 2nd, and 3rd gears is impossible. The ECM determines there is a malfunction when the following conditions are both met. (2-trip detection logic) a. When the ECM directs the gearshift to switch to 2nd gear, the actual gear is shifted to 4th. b. When the ECM directs the gearshift to switch to 6th gear, the actual gear is shifted to 6th.	• Shift solenoid valve S3 remains closed • Valve body is blocked • Automatic transmission (clutch, brake or gear, etc.)

GEAR POSITIONS REFERENCE

ECM command gearshift	1st	2nd	3rd	4th	5th	6th
*1: Actual gear position under S3 stuck ON malfunction	1st	2nd	3rd	3rd	N(1)	N(1)
*2: Actual gear position under S3 stuck OFF malfunction	3rd	4th	4th	4th	5th	6th
(1) Neutral						

GEAR POSITIONS REFERENCE

Gear position under normal conditions	1st	2nd	3rd	4th	5th	6th
*1: Actual gear position under fail-safe mode when S3 stuck ON malfunction	1st	2nd	3rd	3rd	3rd	3rd
*2: Actual gear position under fail-safe mode when S3 stuck OFF malfunction	3rd	4th	4th	4th	5th	6th

MONITOR STRATEGY REFERENCE

Related DTCs	P0761: Shift solenoid valve S3/OFF malfunction Shift solenoid valve S3/ON malfunction
Required sensors/Components	Shift solenoid valve S3
Frequency of operation	Continuous
Duration	OFF malfunction (A), (B) and ON malfunction (A) 0.4 sec. ON malfunction (B) 3 sec. ON malfunction (C) 1 sec.
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

	P0115-P0118 (ECT sensor)

The monitor will run whenever the following DTCs are not present	P0125 (Insufficient ECT for Closed Loop) P0500 (VSS) P0748 - P0798 (Trans solenoid (range))
Turbine speed sensor circuit	Not circuit malfunction
Output speed sensor circuit	Not circuit malfunction
Shift solenoid valve S1 circuit	Not circuit malfunction
Shift solenoid valve S2 circuit	Not circuit malfunction
Shift solenoid valve S3 circuit	Not circuit malfunction
Shift solenoid valve S4 circuit	Not circuit malfunction
Shift solenoid valve SR circuit	Not circuit malfunction
Shift solenoid valve SL1 circuit	Not circuit malfunction
Shift solenoid valve SL2 circuit	Not circuit malfunction
ECT (Engine coolant temperature) sensor circuit	Not circuit malfunction
KCS sensor circuit	Not circuit malfunction
ETCS (Electric Throttle Control System)	Not system down
Transmission position	"D"
Duration time from shifting "N" to "D"	4 sec. or more
ECT	40°C (104°F) or more
Spark advance from max. retard timing by KCS control	0° crankshaft angle or more
Engine	Starting

TYPICAL ENABLING CONDITIONS

Vehicle speed sensor circuit	Not circuit malfunction
Output shaft speed sensor circuit	Not circuit malfunction
Transfer output speed	143 rpm or more
NO/NOtf (Transfer input speed/Transfer output speed)	0.9 to 1.1

TYPICAL ENABLING CONDITIONS

ECM selected gear	2nd
Vehicle speed	2 km/h (1.2 mph) or more
Output speed	2nd --> 1st down-shift point or more
Throttle valve opening angle	9% or more at 2000 rpm (Condition varies with engine speed)

TYPICAL ENABLING CONDITIONS

ECM selected gear	6th
Vehicle speed	2 km/h (1.2 mph) or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

TYPICAL ENABLING CONDITIONS

ECM selected gear	4th
Vehicle speed	2 km/h (1.2 mph) or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

TYPICAL ENABLING CONDITIONS

Current ECM selected gear	5th
Last ECM selected gear	4th
Vehicle speed (During transition from 4th to 5th gear)	Less than 100 km/h (62.2 mph)

TYPICAL ENABLING CONDITIONS

ECM selected gear	5th
Engine speed - Turbine speed (NE - NT) (After transition to 5th gear)	150 rpm or less
Vehicle speed (After transition to 5th gear)	Less than 100 km/h (62.2 mph)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	0.93 or more, and 1.07 or less (This means actual gear is 4th)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	0.51 or more, and 0.65 or less (This means actual gear is 6th)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	1.24 or more, and 1.49 or less (This means actual gear is 3rd)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed - Output speed x 4th gear ratio (NT - ratio) NO x 4th gear	1000 rpm or more

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed - Output speed x 5th gear ratio (NT - NO x 5th gear ratio)	1000 rpm or more

INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
SHIFT	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less

TECHSTREAM ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
Control the Shift Position	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less

SHIFT SOLENOID VALVE SL2 OPERATION CHART

ECM command gearshift	1st	2nd	3rd	4th	5th	6th
Shift solenoid valve S3	ON	ON	ON	OFF	OFF	OFF

DTC OUTPUT RESULT

Display (DTC output)	Proceed to
Only P0761 is output	A
P0761 and other DTCs are output	B

INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
SOLENOID (SLT)*	Operate the shift solenoid SLT and raise line pressure	ON or OFF HINT: • OFF: Line pressure up (when Active Test "SOLENOID (SLT)" is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	[Vehicle Condition] • Vehicle stopped • Engine idling
HINT: *: SOLENOID (SLT) in the Active Test is performed to check the line pressure changes by connecting SST to the automatic transmission, which is used in the Hydraulic Test (see **HYDRAULIC TEST**) as well. Please note that the pressure values in the Active Test and Hydraulic Test are different.			

TECHSTREAM ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
Activate the Solenoid (SLT)*	Operate the shift solenoid SLT and raise line pressure	ON or OFF HINT: • OFF: Line pressure up (when Active Test "Activate the Solenoid (SLT)" is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	[Vehicle Condition] • Vehicle stopped • Engine idling
HINT: *: Activate the Solenoid (SLT) in the Active Test is performed to check the line pressure changes by connecting SST to the automatic transmission, which is used in the Hydraulic Test (see **HYDRAULIC TEST**) as well. Please note that the pressure values in the Active Test and Hydraulic Test are different.			

SHIFT SOLENOID VALVE S3 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S3 connector terminal - Shift solenoid valve S3 body	20°C (68°F)	11 to 15 ohms

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0766	S4 stuck OFF malfunction or brake control valve malfunction*: Shifting to 5th and 6th gears is impossible. The ECM determines there is a malfunction when the following conditions are both met. (2-trip detection logic) a. When the ECM directs the gearshift to switch to 5th	• Shift solenoid valve S4 remains closed • Shift solenoid valve SLT remains open or closed • Valve body is blocked (Brake control valve)

	gear, the actual gear is shifted to 4th. b. When the ECM directs the gearshift to switch to 6th gear, the actual gear is shifted to 4th.	• Automatic transmission (clutch, brake or gear, etc.)
P0776	SL2 stuck ON malfunction or brake control valve malfunction*: Shifting to 5th and 6th gears is impossible. The ECM determines there is a malfunction when the following conditions are both met. (2-trip detection logic) a. When the ECM directs the gearshift to switch to 5th gear, the actual gear is shifted to 4th. b. When the ECM directs the gearshift to switch to 6th gear, the actual gear is shifted to 4th.	• Shift solenoid valve SL2 remains open • Shift solenoid valve SLT remains open or closed • Valve body is blocked (Brake control valve) • Automatic transmission (clutch, brake or gear, etc.)

GEAR POSITIONS REFERENCE

ECM command gearshift	1st	2nd	3rd	4th	5th	6th
*: Actual gear position under malfunction	1st	2nd	3rd	4th	4th	4th

GEAR POSITIONS REFERENCE

Gear position under normal conditions	1st	2nd	3rd	4th	5th	6th
*: Actual gear position under fail-safe mode	1st	2nd	3rd	3rd	3rd	3rd

MONITOR STRATEGY REFERENCE

Related DTCs	P0766: Shift solenoid valve S4/OFF malfunction P0776: Shift solenoid valve SL2/ON malfunction
Required sensors/Components	Shift solenoid valve S4, Speed sensor (NT), Speed sensor (NC), Crankshaft position sensor (NE)
Frequency of operation	Continuous
Duration	0.4 sec.
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	P0115-P0118 (ECT sensor) P0125 (Insufficient ECT for Closed Loop) P0500 (VSS) P0748 - P0798 (Trans solenoid (range))
Turbine speed sensor circuit	Not circuit malfunction
Output speed sensor circuit	Not circuit malfunction
Shift solenoid valve S1 circuit	Not circuit malfunction
Shift solenoid valve S2 circuit	Not circuit malfunction
Shift solenoid valve S3 circuit	Not circuit malfunction
Shift solenoid valve S4 circuit	Not circuit malfunction
Shift solenoid valve SR circuit	Not circuit malfunction
Shift solenoid valve SL1 circuit	Not circuit malfunction

Shift solenoid valve SL2 circuit	Not circuit malfunction
ECT (Engine coolant temperature) sensor circuit	Not circuit malfunction
KCS sensor circuit	Not circuit malfunction
ETCS (Electric Throttle Control System)	Not system down
Transmission position	"D"
Duration time from shifting "N" to "D"	4 sec. or more
ECT	40°C (104°F) or more
Spark advance from max. retard timing by KCS control	0° crankshaft angle or more
Engine	Starting

TYPICAL ENABLING CONDITIONS

Vehicle speed sensor circuit	Not circuit malfunction
Output shaft speed sensor circuit	Not circuit malfunction
Transfer output speed	143 rpm or more
NO/NOtf (Transfer input speed/Transfer output speed)	0.9 to 1.1

TYPICAL ENABLING CONDITIONS

ECM selected gear	5th
Vehicle speed	2 km/h (1.2 mph) or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

TYPICAL ENABLING CONDITIONS

ECM selected gear	6th
Vehicle speed	2 km/h (1.2 mph) or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	0.93 or more, and 1.07 or less (This means actual gear is 4th)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	0.93 or more, and 1.07 or less (This means actual gear is 4th)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	0.93 or more, and 1.07 or less (This means actual gear is 4th)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	0.93 or more, and 1.07 or less (This means actual gear is 4th)

INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
SHIFT	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less

TECHSTREAM ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
Control the Shift Position	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less

SHIFT SOLENOID VALVE SL2 OPERATION CHART

ECM command gearshift	1st	2nd	3rd	4th	5th	6th
Shift solenoid valve S4	OFF	OFF	OFF	OFF	ON	ON
Shift solenoid valve SL2	ON	ON	ON	ON	OFF	OFF

DTC OUTPUT RESULT

Display (DTC output)	Proceed to
Only P0766 and P0776 are output	A
P0766, P0776 and other DTCs are output	B

INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
SOLENOID (SLT)*	Operate the shift solenoid SLT and raise line pressure	ON or OFF HINT: • OFF: Line pressure up (when Active Test "SOLENOID (SLT)" is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	[Vehicle Condition] • Vehicle stopped • Engine idling
HINT: *: SOLENOID (SLT) in the Active Test is performed to check the line pressure changes by connecting SST to the automatic transmission, which is used in the Hydraulic Test (see **HYDRAULIC TEST**) as well. Please note that the pressure values in the Active Test and Hydraulic Test are different.			

TECHSTREAM ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
Activate the Solenoid (SLT)*	Operate the shift solenoid SLT and raise line pressure	ON or OFF HINT: • OFF: Line pressure up (when Active Test "Activate the Solenoid (SLT)" is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	[Vehicle Condition] • Vehicle stopped • Engine idling
HINT: *: Activate the Solenoid (SLT) in the Active Test is performed to check the line pressure changes by connecting SST to the automatic transmission, which is used in the Hydraulic Test (see **HYDRAULIC TEST**) as well. Please note that the pressure values in the Active Test and Hydraulic Test are different.			

SHIFT SOLENOID VALVE S4 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S4 connector terminal - Shift solenoid valve S4 body	20°C (68°F)	11 to 15 ohms

SHIFT SOLENOID VALVE SL2 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	5.0 to 5.6 ohms

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0778	The ECM checks for an open or short in the shift solenoid valve SL2 circuit while driving and shifting gears (1 trip detection logic) Output signal duty ratio equals to 100% (SL2 output signal duty ratio is less than 100% under normal condition)	• Open or short in shift solenoid valve SL2 circuit • Shift solenoid valve SL2 • ECM

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition	Specified Condition
D74-12 (SL2+) - D74-13 (SL2-)	5 V/DIV., 1 msec./ DIV.	Engine is idling	Refer to the illustration

MONITOR STRATEGY REFERENCE

Related DTCs	P0778: Shift solenoid valve SL2/Range check
Required sensors/Components	Shift solenoid valve SL2
Frequency of operation	Continuous
Duration	1 sec.
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	P0115 - P0118:ECT sensor P0125: Insufficient ECT for closed loop P0500: VSS P0748 - P0798: Trans solenoid (range)
Ignition switch	ON
Starter	OFF

TYPICAL ENABLING CONDITIONS

Solenoid current cut status	Not cut
Battery voltage	11 V or more
Target current	0.1 A or more

TYPICAL ENABLING CONDITIONS

Battery voltage	8 V or more

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Solenoid status from Hybrid IC	Failure

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Hybrid IC status	Failure

COMPONENT OPERATING RANGE

Output signal duty	Less than 100%

SHIFT SOLENOID VALVE SL2 OPERATION CHART

ECM gear shift command	1st	2nd	3rd	4th	5th	6th
Shift solenoid valve SL2	ON	ON	ON	ON	OFF	OFF

NO. 2 TRANSMISSION WIRE (SHIFT SOLENOID VALVE SL2) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
2 (SL2+) - 4 (SL2-)	20°C (68°F)	5.0 to 5.6 ohms
2 (SL2+) - Body ground	Always	10 kohms or higher
4 (SL2-) - Body ground	Always	10 kohms or higher

HARNESS AND CONNECTOR (NO. 2 TRANSMISSION WIRE - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D74-12 (SL2+) - D74-13 (SL2-)	20°C (68°F)	5.0 to 5.6 ohms
D74-12 (SL2+) - Body ground	Always	10 kohms or higher
D74-13 (SL2-) - Body ground	Always	10 kohms or higher

SHIFT SOLENOID VALVE SL2 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	5.0 to 5.6 ohms

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0781	When conditions (a) and (b), or (a) and (c) are met. (2-trip detection logic) a. When the ECM directs the gearshift to switch to 2nd gear, the actual gear is shifted to 1st. b. When the ECM directs the gearshift to switch to 4th gear, the actual gear is shifted to 3rd. c. When the ECM directs the gearshift to switch to 5th gear, the engine overruns (clutch slips).	• Valve body is blocked up or stuck (1-2 shift valve) • Shift solenoid valve SLT remains open or closed • Automatic transmission (clutch, brake or gear, etc.)

GEAR POSITIONS REFERENCE

ECM command gearshift	1st	2nd	3rd	4th	5th	6th
Actual gear position under malfunction	1st	1st	3rd	3rd	N(1)	N(1)
(1) Neutral						

GEAR POSITIONS REFERENCE

Gear position under normal conditions	1st	2nd	3rd	4th	5th	6th
Actual gear position under fail-safe mode	1st(1)	1st(1)	3rd	3rd	3rd	3rd
(1) Under engine braking, downshifting to 1st or 2nd gear is prohibited.						

MONITOR STRATEGY REFERENCE

Related DTCs	P0781: Valve body/Rationality check
Required sensors/Components	Valve body, Automatic transmission assembly
Frequency of operation	Continuous
Duration	Condition (A) and (B) 0.4 sec. Condition (C) 3 sec. Condition (D) 1 sec.
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	P0500 (VSS) P0748 - P0798 (Trans solenoid (range))
Turbine speed sensor circuit	Not circuit malfunction
Output speed sensor circuit	Not circuit malfunction
Shift solenoid valve S1 circuit	Not circuit malfunction
Shift solenoid valve S2 circuit	Not circuit malfunction
Shift solenoid valve S3 circuit	Not circuit malfunction
Shift solenoid valve S4 circuit	Not circuit malfunction
Shift solenoid valve SR circuit	Not circuit malfunction
Shift solenoid valve SL1 circuit	Not circuit malfunction
Shift solenoid valve SL2 circuit	Not circuit malfunction
ECT (Engine coolant temperature) sensor circuit	Not circuit malfunction
KCS sensor circuit	Not circuit malfunction
ETCS (Electric Throttle Control System)	Not system down
Transmission position	"D"
Duration time from shifting "N" to "D"	4 sec. or more
ECT	40°C (104°F) or more
Spark advance from max. retard timing by KCS control	0° crankshaft angle or more
Engine	Starting

TYPICAL ENABLING CONDITIONS

Vehicle speed sensor circuit	Not circuit malfunction
Output shaft speed sensor circuit	Not circuit malfunction
Transfer output speed	143 rpm or more
NO/NOtf (Transfer input speed/Transfer output speed)	0.9 to 1.1

TYPICAL ENABLING CONDITIONS

ECM selected gear	2nd
Vehicle speed	2 km/h (1.2 mph) or more
Output speed	2nd --> 1st down-shift point or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

TYPICAL ENABLING CONDITIONS

ECM selected gear	4th
Vehicle speed	2 km/h (1.2 mph) or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

TYPICAL ENABLING CONDITIONS

Current ECM selected gear	5th
Last ECM selected gear	4th
Vehicle speed (During transition from 4th to 5th gear)	Less than 100 km/h (62.2 mph)

TYPICAL ENABLING CONDITIONS

ECM selected gear	5th
Engine speed - Turbine speed (NE - NT) (After transition to 5th gear)	150 rpm or less
Vehicle speed (After transition to 5th gear)	Less than 100 km/h (62.2 mph)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	3.11 or more, and 7.58 or less (This means actual gear is 1st)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	1.24 or more, and 1.49 or less (This means actual gear is 3rd)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed - Output speed x 4th gear ratio (NT - NO x 4th gear ratio)	1000 rpm or more

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed - Output speed x 5th gear ratio (NT - NO x 5th gear ratio)	1000 rpm or more

DTC OUTPUT RESULT

Display (DTC output)	Proceed to
Only P0781 is output	A
P0781 and other DTCs are output	B

INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
SHIFT	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less

TECHSTREAM ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
Control the Shift Position	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less

GEAR POSITIONS REFERENCE

Tester command gearshift	1st	2nd	3rd	4th	5th	6th
Actual gear position under malfunction	1st	1st	1st	3rd	N(1)	N(1)
(1) Neutral						

INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
SOLENOID (SLT)*	Operate the shift solenoid SLT and raise line pressure	ON or OFF HINT: • OFF: Line pressure up (when Active Test "SOLENOID (SLT)" is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	[Vehicle Condition] • Vehicle stopped • Engine idling
HINT: *: SOLENOID (SLT) in the Active Test is performed to check the line pressure changes by connecting SST to the automatic transmission, which is used in the Hydraulic Test (see **HYDRAULIC TEST**) as well. Please note that the pressure values in the Active Test and Hydraulic Test are different.			

TECHSTREAM ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
Activate the Solenoid (SLT)*	Operate the shift solenoid SLT and raise line pressure	ON or OFF HINT: • OFF: Line pressure up (when Active Test "Activate the Solenoid (SLT)" is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	[Vehicle Condition] • Vehicle stopped • Engine idling
HINT: *: Activate the Solenoid (SLT) in the Active Test is performed to check the line pressure changes by			

connecting SST to the automatic transmission, which is used in the Hydraulic Test (see **HYDRAULIC TEST**) as well. Please note that the pressure values in the Active Test and Hydraulic Test are different.

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0818	Transfer neutral position switch remains ON while vehicle is running under following conditions for 30 sec. (2 trip detection logic): • Vehicle speed is 25 km/h (16 mph) or more • Transfer shift lever is on H	• Short in transfer neutral position switch circuit • Transfer neutral position switch • ECM

MONITOR STRATEGY REFERENCE

Related DTCs	P0818: Transfer neutral position switch/Verify switch cycling
Required sensors/Components	Transfer neutral position switch, Vehicle speed sensor
Frequency of operation	Continuous
Duration	30 sec.
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None
Vehicle speed	25 km/h (15.54 mph) or more
Transfer position	High
Battery voltage	8 V or more
Ignition switch	ON
Starter	OFF

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Transfer neutral switch signal	ON

HARNESS AND CONNECTOR (TRANSFER SHIFT ACTUATOR - BODY GROUND) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D68-3 (N) - Body ground	Always	10 kohms or higher

HARNESS AND CONNECTOR (TRANSFER SHIFT ACTUATOR - BODY GROUND) RESULT CHART

Result	Proceed to
NG	A
OK	B

HARNESS AND CONNECTOR (4WD CONTROL ECU - BODY GROUND) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition

A25-16 (NP) - Body ground	Always	10 kohms or higher

HARNESS AND CONNECTOR (4WD CONTROL ECU - BODY GROUND) RESULT CHART

Result	Proceed to
NG	A
OK	B

HARNESS AND CONNECTOR (TRANSFER SHIFT ACTUATOR, 4WD CONTROL ECU - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
A24-5 (TFN) - Body ground	Always	10 kohms or higher

HARNESS AND CONNECTOR (TRANSFER SHIFT ACTUATOR, 4WD CONTROL ECU - ECM) RESULT CHART

Result	Proceed to
OK	A
NG	B

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0894	The ECM detects a malfunction on SLT, S1, S2, S3, S4, SL2, gear 6 incorrect ratio (sequence valve) or 1-2 shift solenoid valve according to the revolution difference of the turbine and the output shaft, and also by the oil pressure. (2-trip detection logic)	• Shift solenoid valve SLT remains open or closed • Shift solenoid valve S1, S2, S3, S4 or SL2 remains open or closed • Gear 6 incorrect ratio (sequence valve) or 1-2 shift valve is stuck • Valve body is blocked • Automatic transmission (clutch, brake, gear, etc.)
P2714	The ECM detects a malfunction on SLT (ON side) according to the revolution difference of the turbine and the output shaft, and also by the oil pressure (2 trip detection logic)	• Shift solenoid valve SLT remains open or closed • Shift solenoid valve S1, S2, S3, S4 or SL2 remains open or closed • Gear 6 incorrect ratio (sequence valve) or 1-2 shift valve is stuck • Valve body is blocked • Automatic transmission (clutch, brake, gear,

		etc.)

MONITOR STRATEGY REFERENCE

Related DTCs	P0894: Automatic transmission slip malfunction P2714: Shift solenoid valve SLT/ON malfunction
Required sensors/Components	Shift solenoid valve SLT
Frequency of operation	Continuous
Duration	P0894 ON malfunction (A): Immediately P0894 ON malfunction (B): 0.4 sec. P2714: Immediately
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None
Turbine speed sensor circuit	Not circuit malfunction
Output speed sensor circuit	Not circuit malfunction
ATF temperature sensor circuit	Not circuit malfunction
Shift solenoid valve S1 circuit	Not circuit malfunction
Shift solenoid valve S2 circuit	Not circuit malfunction
Shift solenoid valve S3 circuit	Not circuit malfunction
Shift solenoid valve S4 circuit	Not circuit malfunction
Shift solenoid valve SR circuit	Not circuit malfunction
Shift solenoid valve SL1 circuit	Not circuit malfunction
Shift solenoid valve SL2 circuit	Not circuit malfunction
Shift solenoid valve SLT circuit	Not circuit malfunction
ECT (Engine coolant temperature) sensor circuit	Not circuit malfunction
KCS sensor circuit	Not circuit malfunction
ETCS (Electric Throttle Control System)	Not system down
Transmission position	"D"
Duration time from shifting "N" to "D"	4 sec. or more
ECT	40°C (104°F) or more
Spark advance from max. retard timing by KCS control	0° crankshaft angle or more
Engine	Starting

TYPICAL ENABLING CONDITIONS

Vehicle speed sensor circuit	Not circuit malfunction
Output shaft speed sensor circuit	Not circuit malfunction
Transfer output speed	143 rpm or more
NO/NOtf (Transfer input speed/Transfer output speed)	0.9 to 1.1

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Summation of C1 clutch heat generations	Specified value

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Summation of C2 clutch heat generations	Specified value
Actual gear for SLT failure judgment	Not determined

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Summation of C1 clutch heat generations	Specified value

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve S1 OFF malfunction	Detected

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve S2 OFF malfunction	Detected

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve S3 ON malfunction	Detected

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve S4 OFF malfunction	Detected

TYPICAL MALFUNCTION THRESHOLDS CONDITION

1-2 shift valve malfunction	Detected

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Sequence valve malfunction	Detected

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve SL2 ON malfunction	Detected

DTC OUTPUT RESULT

Display (DTC output)	Proceed to
• Only P0894 is output • Only P0894 and P2714 are output	A
P0894, P2714 and other DTCs are output	B

INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
SOLENOID (SLT)*	Operate the shift solenoid SLT and raise line pressure	ON or OFF HINT: • OFF: Line pressure up (when Active Test "SOLENOID (SLT)" is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	[Vehicle Condition] • Vehicle stopped • Engine idling
HINT: *: SOLENOID (SLT) in the Active Test is performed to check the line pressure changes by connecting SST to the automatic transmission, which is used in the Hydraulic Test (see **HYDRAULIC TEST**) as well.			

Please note that the pressure values in the Active Test and Hydraulic Test are different.

TECHSTREAM ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
Activate the Solenoid (SLT)*	Operate the shift solenoid SLT and raise line pressure	ON or OFF HINT: • OFF: Line pressure up (when Active Test "Activate the Solenoid (SLT)" is performed, ECM commands SLT solenoid to turn OFF) • ON: No action (normal operation)	[Vehicle Condition] • Vehicle stopped • Engine idling
HINT: *: Activate the Solenoid (SLT) in the Active Test is performed to check the line pressure changes by connecting SST to the automatic transmission, which is used in the Hydraulic Test (see **HYDRAULIC TEST**) as well. Please note that the pressure values in the Active Test and Hydraulic Test are different.			

INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
SHIFT	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less

TECHSTREAM ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
Control the Shift Position	Operate shift solenoid valve and set each shift position by yourself	• Press "-->" button: Shift up • Press "<--" button: Shift down	Possible to check operation of shift solenoid valves [Vehicle Condition] 50 km/h (30 mph) or less

RESULT CHART

ECM gear shift command			1st	2nd	3rd	4th	5th	6th	Proceed to
Actual gear position under malfunction	Shift solenoid S1	Stuck ON*1	2nd	2nd	3rd	4th	5th	6th	A
		Stuck OFF	1st	1st	3rd	4th	5th	N*2	
	Shift solenoid S2	Stuck ON	1st	2nd	2nd	4th	6th	6th	B
		Stuck OFF	3rd	3rd	3rd	4th	5th	5th	
	Shift solenoid S3	Stuck ON	1st	2nd	3rd	3rd	N*2	N*2	C
		Stuck OFF	3rd	4th	4th	4th	5th	6th	
	Shift solenoid S4	Stuck ON*3	1st	2nd	3rd	4th	5th	6th	D
		Stuck OFF	1st	2nd	3rd	4th	4th	4th	
Actual gear position when normal			1st	2nd	3rd	4th	5th	6th	E

HINT:

- *1: When shift solenoid S1 is stuck ON, the vehicle cannot drive in reverse.
- *2: Neutral
- *3: When shift solenoid S4 is stuck ON, gear shifting is normal.

SHIFT SOLENOID VALVE S1 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S1 connector terminal - Shift solenoid valve S1 body	20°C (68CF)	11 to 15 ohms

SHIFT SOLENOID VALVE S1 RESULT CHART

Result	Proceed to
NG	A
OK	B

SHIFT SOLENOID VALVE S2 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S2 connector terminal - Shift solenoid valve S2 body	20°C (68°F)	11 to 15 ohms

SHIFT SOLENOID VALVE S2 RESULT CHART

Result	Proceed to
NG	A
OK	B

SHIFT SOLENOID VALVE S3 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S3 connector terminal - Shift solenoid valve S3 body	20°C (68°F)	11 to 15 ohms

SHIFT SOLENOID VALVE S3 RESULT CHART

Result	Proceed to
NG	A
OK	B

SHIFT SOLENOID VALVE S4 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S4 connector terminal - Shift solenoid valve S4 body	20°C (68°F)	11 to 15 ohms

SHIFT SOLENOID VALVE SL2 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	5.0 to 5.6 ohms

SHIFT SOLENOID VALVE SL2 RESULT CHART

Result	Proceed to
NG	A
OK	B

SHIFT SOLENOID VALVE SLT RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	5.0 to 5.6 ohms

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0973	ECM detects short in solenoid valve S1 circuit 2 times when solenoid valve S1 is operated (1 trip detection logic)	• Short in shift solenoid valve S1 circuit • Shift solenoid valve S1 • ECM
P0974	ECM detects open in solenoid valve S1 circuit 2 times when solenoid valve S1 is not operated (1 trip detection logic)	• Open in shift solenoid valve S1 circuit • Shift solenoid valve S1 • ECM

MONITOR STRATEGY REFERENCE

Related DTCs	P0973: Shift solenoid valve S1/Range check (Low resistance) P0974: Shift solenoid valve S1/Range check (High resistance)
Required sensors/Components	Shift solenoid valve S1
Frequency of operation	Continuous
Duration	0.128 sec. or more
MIL operation	1 driving cycle
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None

TYPICAL ENABLING CONDITIONS

Shift solenoid valve S1	ON

TYPICAL ENABLING CONDITIONS

Shift solenoid valve S1	OFF

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve S1 resistance	8 ohms or less

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve S1 resistance	100 kohms or more

COMPONENT OPERATING RANGE

Shift solenoid valve S1 resistance	11 to15 ohms at 20°C (68°F)

SHIFT SOLENOID VALVE S1 OPERATION CHART

ECM gear shift command	1st	2nd	3rd	4th	5th	6th

Shift solenoid valve S1	OFF	ON	ON	ON	ON	ON

NO. 1 TRANSMISSION WIRE (SHIFT SOLENOID VALVE S1) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
8 (S1) - Body ground	20°C (68°F)	11 to 15 ohms

HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D74-7 (S1) - Body ground	20°C (68°F)	11 to 15 ohms

SHIFT SOLENOID VALVE S1 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S1 connector terminal - Shift solenoid valve S1 body	20°C (68°F)	11 to 15 ohms

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0976	ECM detects short in solenoid valve S2 circuit 2 times when solenoid valve S2 is operated (1 trip detection logic)	• Short in shift solenoid valve S2 circuit • Shift solenoid valve S2 • ECM
P0977	ECM detects open in solenoid valve S2 circuit 2 times when solenoid valve S2 is not operated (1 trip detection logic)	• Open in shift solenoid valve S2 circuit • Shift solenoid valve S2 • ECM

MONITOR STRATEGY REFERENCE

Related DTCs	P0976: Shift solenoid valve S2/Range check (Low resistance) P0977: Shift solenoid valve S2/Range check (High resistance)
Required sensors/Components	Shift solenoid valve S2
Frequency of operation	Continuous
Duration	0.128 sec. or more
MIL operation	1 driving cycle
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None

TYPICAL ENABLING CONDITIONS

Shift solenoid valve S2	ON

TYPICAL ENABLING CONDITIONS

Shift solenoid valve S2	OFF

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve S2 resistance	8 ohms or less

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve S2 resistance	100 kohms or more

COMPONENT OPERATING RANGE

Shift solenoid valve S2 resistance	11 to 15 ohms at 20°C (68°F)

SHIFT SOLENOID VALVE S2 OPERATION CHART

ECM gear shift command	1st	2nd	3rd	4th	5th	6th
Shift solenoid valve S2	ON	ON	OFF	OFF	OFF	ON

NO. 1 TRANSMISSION WIRE (SHIFT SOLENOID VALVE S2) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
15 (S2) - Body ground	20°C (68°F)	11 to 15 ohms

HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D74-6 (S2) - Body ground	20°C (68°F)	11 to 15 ohms

SHIFT SOLENOID VALVE S2 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S2 connector terminal - Shift solenoid valve S2 body	20°C (68°F)	11 to 15 ohms

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P0979	ECM detects short in solenoid valve S3 circuit 2 times when solenoid valve S3 is operated (1 trip detection logic)	• Short in shift solenoid valve S3 circuit • Shift solenoid valve S3 • ECM
P0980	ECM detects open in solenoid valve S3 circuit 2 times when solenoid valve S3 is not operated (1 trip detection logic)	• Open in shift solenoid valve S3 circuit • Shift solenoid valve S3 • ECM

MONITOR STRATEGY REFERENCE

Related DTCs	P0979: Shift solenoid valve S3/Range check (Low resistance) P0980: Shift solenoid valve S3/Range check (High resistance)
Required sensors/Components	Shift solenoid valve S3
Frequency of operation	Continuous
Duration	0.128 sec. or more

MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None
Battery voltage	8 V or more
Ignition switch	ON
Starter	OFF

TYPICAL ENABLING CONDITIONS

Shift solenoid valve S3	ON

TYPICAL ENABLING CONDITIONS

Shift solenoid valve S3	OFF

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve S3 resistance	8 ohms or less

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve S3 resistance	100 kohms or more

COMPONENT OPERATING RANGE

Shift solenoid valve S3 resistance	11 to 15 ohms at 20°C (68°F)

SHIFT SOLENOID VALVE S3 OPERATION CHART

ECM gear shift command	1st	2nd	3rd	4th	5th	6th
Shift solenoid valve S3	ON	ON	ON	OFF	OFF	OFF

NO. 1 TRANSMISSION WIRE (SHIFT SOLENOID VALVE S3) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
7 (S3) - Body ground	20°C (68°F)	11 to 15 ohms

HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D74-3 (S3) - Body ground	20°C (68°F)	11 to15 ohms

SHIFT SOLENOID VALVE S3 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S3 connector terminal - Shift solenoid valve S3 body	20°C (68°F)	11 to15 ohms

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area

P0982	ECM detects short in solenoid valve S4 circuit 2 times when solenoid valve S4 is operated (1 trip detection logic)	• Short in shift solenoid valve S4 circuit • Shift solenoid valve S4 • ECM
P0983	ECM detects open in solenoid valve S4 circuit 2 times when solenoid valve S4 is not operated (1 trip detection logic)	• Open in shift solenoid valve S4 circuit • Shift solenoid valve S4 • ECM

MONITOR STRATEGY REFERENCE

Related DTCs	P0982: Shift solenoid valve S4/Range check (Low resistance) P0983: Shift solenoid valve S4/Range check (High resistance)
Required sensors/Components	Shift solenoid valve S4
Frequency of operation	Continuous
Duration	0.128 sec. or more
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None
Battery voltage	8 V or more
Ignition switch	ON
Starter	OFF

TYPICAL ENABLING CONDITIONS

Shift solenoid valve S4	ON

TYPICAL ENABLING CONDITIONS

Shift solenoid valve S4	OFF

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve S4 resistance	8 ohms or less

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve S4 resistance	100 kohms or more

COMPONENT OPERATING RANGE

Shift solenoid valve S4 resistance	11 to 15 ohms at 20°C (68°F)

SHIFT SOLENOID VALVE S4 OPERATION CHART

ECM gear shift command	1st	2nd	3rd	4th	5th	6th
Shift solenoid valve S4	OFF	OFF	OFF	OFF	ON	ON

NO. 1 TRANSMISSION WIRE (SHIFT SOLENOID VALVE S4) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
14 (S4) - Body ground	20°C (68°F)	11 to 15 ohms

HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D74-5 (S4) - Body ground	20°C (68°F)	11 to15 ohms

SHIFT SOLENOID VALVE S4 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S4 connector terminal - Shift solenoid valve S4 body	20°C (68°F)	11 to 15 ohms

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
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 STRATEGY REFERENCE

Related DTCs	P0985: Shift solenoid valve SR/Range check (Low resistance) P0986: Shift solenoid valve SR/Range check (High resistance)
Required sensors/Components	Shift solenoid valve SR
Frequency of operation	Continuous
Duration	0.128 sec. or more
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None
Battery voltage	8 V or more
Ignition switch	ON
Starter	OFF

TYPICAL ENABLING CONDITIONS

Shift solenoid valve SR	ON

TYPICAL ENABLING CONDITIONS

Shift solenoid valve SR	OFF

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve SR resistance	8 ohms or less

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Shift solenoid valve SR resistance	100 kohms or more

COMPONENT OPERATING RANGE

Shift solenoid valve SR resistance	11 to 15 ohms at 20°C (68°F)

SHIFT SOLENOID VALVE SR OPERATION CONDITIONS

ECM gear shift command	1st	2nd	3rd	4th	5th	6th
Shift solenoid valve SR	ON	ON	ON	ON	OFF	OFF

NO. 1 TRANSMISSION WIRE (SHIFT SOLENOID VALVE SR) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
6 (SR) - Body ground	20°C (68°F)	11 to 15 ohms

HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D74-4 (SR) - Body ground	20°C (68°F)	11 to 15 ohms

SHIFT SOLENOID VALVE SR RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve SR connector terminal - Shift solenoid valve SR body	20°C (68°F)	11 to 15 ohms

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P2716	Conditions (a) or (b) below are detected for 1 sec. or more. (1 trip detection logic) a. SLT - terminal: 0 V b. SLT-terminal: 12 V	• Open or short in shift solenoid valve SLT circuit • Shift solenoid valve SLT • ECM

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition	Specified Condition
D74-9 (SLT+) -D74-8 (SLT-)	5 V/DIV., 1 msec./ DIV.	Engine is idling	Refer to the illustration

MONITOR STRATEGY REFERENCE

Related DTCs	P2716: Shift solenoid valve SLT/Range check

Required sensors/Components	Shift solenoid valve SLT
Frequency of operation	Continuous
Duration	1 sec.
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None
Ignition switch	ON
Starter	OFF

TYPICAL ENABLING CONDITIONS

Solenoid current cut status	Not cut
Target current	0.1 A or more
Battery voltage	11 V or more

TYPICAL ENABLING CONDITIONS

Battery voltage	8 V or more

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Solenoid status from Hybrid IC	Failure

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Hybrid IC status	Failure

COMPONENT OPERATING RANGE

Output signal duty	Less than 100%

NO. 1 TRANSMISSION WIRE (SHIFT SOLENOID VALVE SLT RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
13 (SLT+) - 5 (SLT-)	20°C (68°F)	5.0 to 5,6 ohms
13 (SLT+) - Body ground	Always	10 kohms or higher
5 (SLT-) - Body ground	Always	10 kohms or higher

HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D74-9 (SLT+) - D74-8 (SLT-)	20°C (68°F)	5.0 to 5.6 ohms
D74-9 (SLT+) - Body ground	Always	10 kohms or higher
D74-8 (SLT-) - Body ground	Always	10 kohms or higher

SHIFT SOLENOID VALVE SLT RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	5.0 to 5.6 ohms

VEHICLE CONDITIONS CHART

No. 2 ATF Temperature Sensor State	Detection Condition	Symptom	Recovery Condition
Sensor is normal	ATF temperature more than 150°C (302°F)	"A/T OIL TEMP" warning light remains ON	ATF temperature less than 135°C (275°F)*1
	ATF temperature more than 130°C (266°F)	Shift point too high	ATF temperature less than 110°C (230°F)
	When the conditions (a) and (b) are satisfied. a. ATF temperature more than 130°C (266°F) b. Engine coolant temperature more than 95°C (203°F)	Lock-up at 3rd gear*2	ATF temperature less than 110cC (230°F)*1 and engine coolant temperature more than 95°C (203°F)
Sensor is short-circuited	Any conditions	• "A/T OIL TEMP" warning light remains ON • Shift point too high	Symptoms still occur
	Engine coolant temperature more than 95° C (203°F)	Lock-up at 3rd gear*2	Symptoms still occur
HINT: *1: When ATF temperature is in the normal range, it decreases to less than 135°C (275°F) within 5 minutes with the shift lever in the P or N position in an idling state. *2: When ATF temperature is normal, transmission lock up occurs in 5th or 6th gear with the shift lever in the D position or S6 position, in 5th gear with the shift lever in the S5 position, and 4th gear with the shift lever in the S4 position.			

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P2740	(a) and (b) are detected momentarily within 0.5 sec. when neither P2742 nor P2743 are detected. (1 -trip detection logic) a. No. 2 ATF temperature sensor resistance is less than 25 ohms (0.046 V). b. No. 2 ATF temperature sensor resistance is more than 156 kohms (4.915 V). HINT: Within 0.5 sec, the malfunction switches from (a) to (b) or	• Open or short in No. 2 ATF temperature sensor circuit • No. 1 transmission wire (No. 2 ATF temperature sensor) • ECM

	from (b) to (a).	
P2742	No. 2 ATF temperature sensor resistance is less than 25 ohms (0.046 V) for 0.5 sec. or more. (1-trip detection logic)	• Short in No. 2 ATF temperature sensor circuit • No. 1 transmission wire (No. 2 ATF temperature sensor) • ECM
P2743	When 15 min. or more have elapsed after engine is started, No. 2 ATF temperature sensor resistance is more than 156 kohms (4.915 V) for 0.5 sec. or more (1-trip detection logic)	• Open in No. 2 ATF temperature sensor circuit • No. 1 transmission wire (No. 2 ATF temperature sensor) • ECM

MONITOR STRATEGY REFERENCE

Related DTCs	P2740: ATF temperature sensor/Range check (Fluttering) P2742: ATF temperature sensor/Range check (Low resistance) P2743: ATF temperature sensor/Range check (High resistance)
Required sensors/Components	ATF temperature sensor
Frequency of operation	Continuous
Duration	0.5 sec.
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None

TYPICAL ENABLING CONDITIONS

The typical enabling condition is not available.	-

TYPICAL ENABLING CONDITIONS

The typical enabling condition is not available.	-

TYPICAL ENABLING CONDITIONS

Time after engine start	15 min. or more

TYPICAL MALFUNCTION THRESHOLDS CONDITION

ATF temperature sensor voltage	Less than 0.046 V or more than 4.915 V

TYPICAL MALFUNCTION THRESHOLDS CONDITION

ATF temperature sensor voltage	Less than 0.046 V

TYPICAL MALFUNCTION THRESHOLDS CONDITION

ATF temperature sensor voltage	More than 4.915 V

COMPONENT OPERATING RANGE

ATF temperature sensor voltage	0.046 to 4.915 V

INTELLIGENT TESTER ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
A/T OIL TEMP2	No. 2 ATF temperature sensor value/ Min.: -40°C (-40°F) Max.:215°C (419°F)	• After stall test: Approximately 80°C (176°F) • Equal to ambient temperature while engine is cold	If value is -40°C (-40°F) or 215°C (419°F), No. 2 ATF temperature sensor circuit is open or shorted

TECHSTREAM ECT DATA LIST

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
A/T Oil Temperature 2	No. 2 ATF temperature sensor value/ Min.: -40°C (-40°F) Max.:215°C (419°F)	• After stall test: Approximately 80°C (176°F) • Equal to ambient temperature while engine is cold	If value is -40°C (-40°F) or 215°C (419°F), No. 2 ATF temperature sensor circuit is open or shorted

MALFUNCTION REFERENCE

Temperature Displayed	Malfunction
-40°C (-40°F)	Open circuit
150°C (302°F) or more	Short circuit

NO. 1 TRANSMISSION WIRE (NO. 2 ATF TEMPERATURE SENSOR) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
2 (OT2-) - 10 (OT2+)	Always	25 ohms to 156 kohms
2 (OT2-) - Body ground	Always	10 kohms or higher
10 (OT2+) - Body ground	Always	10 kohms or higher

NO. 1 TRANSMISSION WIRE (NO. 2 ATF TEMPERATURE SENSOR) RESISTANCE SPECIFIED CONDITION

ATF temperature	Specified Condition
10°C (50°F)	5 to 8 kohms
25°C (77°F)	2.5 to 4.5 kohms
110°C (230°F)	0.22 to 0.28 kohms

HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D74-99 (THO2) - D74-98 (ETHA)	Always	25 ohms to 156 kohms
D74-99 (THO2) - Body ground	Always	10 kohms or higher
D74-98 (ETHA) - Body ground	Always	10 kohms or higher

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P2757	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)	• Shift solenoid valve SLU remains open or closed • Valve body is blocked • Shift solenoid valve SLU • Torque converter clutch Automatic transmission (clutch, brake, gear, etc.) • Line pressure is too low • ECM

MONITOR STRATEGY REFERENCE

Related DTCs	P2757: Shift solenoid valve SLU/OFF malfunction Shift solenoid valve SLU/ON malfunction
Required sensors/Components	Shift solenoid valve SLU
Frequency of operation	Continuous
Duration	OFF malfunction (A) 2 sec. OFF malfunction (B) 0.4 sec. ON malfunction 1.8 sec.
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None
Turbine speed sensor circuit	Not circuit malfunction
Output speed sensor circuit	Not circuit malfunction
Shift solenoid valve S1 circuit	Not circuit malfunction
Shift solenoid valve S2 circuit	Not circuit malfunction
Shift solenoid valve S3 circuit	Not circuit malfunction
Shift solenoid valve S4 circuit	Not circuit malfunction
Shift solenoid valve SR circuit	Not circuit malfunction
Shift solenoid valve SLU circuit	Not circuit malfunction
KCS sensor circuit	Not circuit malfunction
ETCS (Electric Throttle Control System)	Not system down

Transmission position	"D"
Duration time from shifting "N" to "D"	4 sec. or more
ECT (Engine coolant temperature)	40°C (104°F) or more
Spark advance from max. retard timing by KCS control	0° crankshaft angle or more
Engine	Starting
ECM selected gear	2nd, 3rd, 4th, 5th or 6th
Vehicle speed	25 km/h (15.5 mph) or more
Shift solenoid valve S1 circuit	Not circuit off malfunction
Shift solenoid valve S3 circuit	Not circuit on malfunction
Shift solenoid valve S4 circuit	Not circuit off malfunction
Shift solenoid valve SL2 circuit	Not circuit on malfunction
1 - 2 shift valve	Not malfunction
Sequence valve	Not malfunction

TYPICAL ENABLING CONDITIONS

Vehicle speed sensor circuit	Not circuit malfunction
Output shaft speed sensor circuit	Not circuit malfunction
Transfer output speed	143 rpm or more
NO/NOtf (Transfer input speed/Transfer output speed)	0.9 to 1.1

TYPICAL ENABLING CONDITIONS

ECM lock up command	ON (SLU pressure: 513 kPa (5.2 kgf/cm^2 , 74 psi) or more)
Duration time from lock up on command	3 sec. or more
Vehicle speed	Less than 100 km/h (62.2 mph)

TYPICAL ENABLING CONDITIONS

ECM selected gear	2nd
Vehicle speed	2 km/h (1.2 mph) or more
Output speed	2nd --> 1st down-shift point or more
Throttle valve opening angle	9% or more at 2000 rpm (Conditions vary with engine speed)

TYPICAL ENABLING CONDITIONS

ECM lock up command	OFF (SLU pressure: Less than 4 kPa (0.04 kgf/cm^2 , 0.6 psi))
Duration time from lock up off command	3 sec. or more
Throttle valve opening angle	9% or more
Vehicle speed	Less than 30km/h (18.6 mph) at 2nd gear (Varies with ECM selected gear)

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Engine speed - Turbine speed (NE - NT)	70 rpm or more

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Turbine speed/Output speed (NT/NO)	Less than 3.11 or more than 7.58

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Engine speed - Turbine speed (NE - NT)	Less than 35 rpm

COMPONENT OPERATING RANGE

Speed sensor (NT)	Input speed is equal to engine speed when lock up ON.

INTELLIGENT TESTER ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
LOCK UP	Control shift solenoid SLU to set automatic transmission to lock up condition	ON or OFF	Possible to check shift solenoid valve SLU operation [Vehicle Condition] • Throttle valve opening angle: Less than 35% • Vehicle speed: 60 km/h (36 mph) or more

TECHSTREAM ECT ACTIVE TEST REFERENCE

Tester Display	Test Part	Control Range	Diagnostic Note
Activate the Lock Up	Control shift solenoid SLU to set automatic transmission to lock up condition	ON or OFF	Possible to check shift solenoid valve SLU operation [Vehicle Condition] • Throttle valve opening angle: Less than 35% • Vehicle speed: 60 km/h (36 mph) or more

DTC OUTPUT RESULT

Display (DTC output)	Proceed to
Only P2757 is output	A
P2757 and other DTCs are output	B

SHIFT SOLENOID VALVE SLU RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	5.0 to 5.6 ohms

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P2759	Open or short is detected in shift solenoid valve SLU circuit for 1 sec. or more while driving (1 trip detection logic)	• Open or short in shift solenoid valve SLU circuit • Shift solenoid valve SLU • ECM

WAVEFORM REFERENCE

Terminal No. (Symbols)	Tool Setting	Condition	Specified Condition
D74-10 (SLU+) - D74-11 (SLU-)	5 V/DIV., 1 msec./ DIV.	5th (lock up) or 6th (lock up) gear	Refer to the illustration

MONITOR STRATEGY REFERENCE

Related DTCs	P2759: Shift solenoid valve SLU/Range check
Required sensors/Components	Shift solenoid valve SLU
Frequency of operation	Continuous
Duration	1 sec.
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	None
Ignition switch	ON
Starter	OFF

TYPICAL ENABLING CONDITIONS

Solenoid current cut status	Not cut
Battery voltage	11 V or more
Target current	0.1 A or more

TYPICAL ENABLING CONDITIONS

Battery voltage	8 V or more

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Solenoid status from Hybrid IC	Failure

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Hybrid IC status	Failure

COMPONENT OPERATING RANGE

Output signal duty	Less than 100%

NO. 1 TRANSMISSION WIRE (SHIFT SOLENOID VALVE SLU) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
12 (SLU+) - 4 (SLU-)	20°C (68°F)	5.0 to 5.6 ohms
12 (SLU+) - Body ground	Always	10 kohms or higher
4 (SLU-) - Body ground	Always	10 kohms or higher

HARNESS AND CONNECTOR (NO. 1 TRANSMISSION WIRE - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
D74-10 (SLU+) - D74-11 (SLU-)	20°C (68°F)	5.0 to 5.6 ohms
D74-10 (SLU+) - Body ground	Always	10 kohms or higher
D74-11 (SLU-) - Body ground	Always	10 kohms or higher

SHIFT SOLENOID VALVE SLU RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	5.0 to 5.6 ohms

DTC TROUBLE DETECTION CHART

DTC No.	DTC Detection Condition	Trouble Area
P2772	Transfer L4 position switch remains ON while vehicle is running under following conditions for 1.8 sec. or more (1-trip detection logic) a. Output shaft speed between 1000 and 3000 rpm b. Transfer shift position is H	• Short in transfer L4 position switch circuit • 4WD control ECU • ECM

MONITOR STRATEGY REFERENCE

Related DTCs	P2772: Transfer L4 position switch/ON malfunction
Required sensors/Components	Transfer L4 position switch
Frequency of operation	Continuous
Duration	ON malfunction (A): 1.8 sec. ON malfunction (B): 0.5 sec.
MIL operation	1 driving cycle
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Output speed sensor circuit	Not circuit malfunction
Vehicle speed sensor circuit	Not circuit malfunction
Transfer neutral position switch	OFF

TYPICAL ENABLING CONDITIONS

Output speed (Transfer output speed)	1000 to 3000 rpm

TYPICAL ENABLING CONDITIONS

Output speed (Transfer output speed)	143 rpm or more

TYPICAL MALFUNCTION THRESHOLDS CONDITION

L4 switch	ON

TYPICAL MALFUNCTION THRESHOLDS CONDITION

Actual transfer gear ratio Transfer input speed/Transfer output speed	0.9 to 1.1

HARNESS AND CONNECTOR (4WD CONTROL ECU - BODY GROUND) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
A25-21 (L4) - Body ground	Always	10 kohms or higher

HARNESS AND CONNECTOR (4WD CONTROL ECU - BODY GROUND) RESULT CHART

Result	Proceed to
NG	A
OK	B

HARNESS AND CONNECTOR (4WD CONTROL ECU - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
A24-21 (L4) - Body ground	Always	10 kohms or higher

HARNESS AND CONNECTOR (4WD CONTROL ECU - ECM) RESULT CHART

Result	Proceed to
OK	A
NG	B

TRANSMISSION CONTROL SWITCH RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
6 (IG) - 13 (S)	Shift lever position on S, "+" and "-"	Below 1 ohms
5 (SFTU) - 11 (E)	Shift lever position continuously shifted to (Up-shift)	Below 1 ohms
4 (SFTD) - 11 (E)	Shift lever position continuously shifted to (Down-shift)	Below 1 ohms
6 (IG) - 13 (S)	Shift lever position not on S, "+" and "-"	10 kohms or higher
5 (SFTU) - 11 (E)	Shift lever position on S	10 kohms or higher
4 (SFTD) - 11 (E)	Shift lever position on S	10 kohms or higher

TRANSMISSION CONTROL SWITCH RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
3 (IG) - 7 (S)	Shift lever position on S, "+" and "-"	Below 1 ohms
2 (SFTU) - 5 (E)	Shift lever position continuously shifted to "+" (Up-shift)	Below 1 ohms
1 (SFTD) - 5 (E)	Shift lever position continuously shifted to "-" (Down-shift)	Below 1 ohms
3 (IG) - 7 (S)	Shift lever position not on S, "+" and "-"	10 kohms or higher
2 (SFTU) - 5 (E)	Shift lever position on S	10 kohms or higher
1 (SFTD) - 5 (E)	Shift lever position on S	10 kohms or higher

TRANSMISSION CONTROL SWITCH RESULT CHART

Result	Proceed to
OK	A
NG (for Column Shift Type)	B
NG (for Floor Shift Type)	C

HARNESS AND CONNECTOR (TRANSMISSION CONTROL SWITCH - BATTERY, BODY

GROUND) VOLTAGE SPECIFIED CONDITION

Tester Connection	Switch Condition	Specified Condition
J25-6 (IG) - Body ground	Ignition switch ON	11 to 14 V
J25-6 (IG) - Body ground	Ignition switch OFF	Below 1 V

HARNESS AND CONNECTOR (TRANSMISSION CONTROL SWITCH - BATTERY, BODY GROUND) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
J25-11 (E) - Body ground	Always	Below 1 ohms

HARNESS AND CONNECTOR (TRANSMISSION CONTROL SWITCH - BATTERY, BODY GROUND) VOLTAGE SPECIFIED CONDITION

Tester Connection	Switch Condition	Specified Condition
J24-3 (IG) - Body ground	Ignition switch ON	11 to 14 V
J24-3 (IG) - Body ground	Ignition switch OFF	Below 1 V

HARNESS AND CONNECTOR (TRANSMISSION CONTROL SWITCH - BATTERY, BODY GROUND) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
J24-5 (E) - Body ground	Always	Below 1 ohms

HARNESS AND CONNECTOR (TRANSMISSION CONTROL SWITCH - ECM) VOLTAGE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
A24-25 (S) - Body ground	• Ignition switch ON • Shift lever position on S, "+" and "-"	11 to 14 V
A24-25 (S) - Body ground	• Ignition switch ON • Shift lever position not on S, "+" and "-"	Below 1 V

HARNESS AND CONNECTOR (TRANSMISSION CONTROL SWITCH - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
A24-38 (SFTU) - Body ground	Shift lever position continuously shifted to "+" (Up-shift)	Below 1 ohms
A24-27 (SFTD) - Body ground	Shift lever position continuously shifted to (Down-shift)	Below 1 ohms
A24-38 (SFTU) - Body ground	Shift lever position on S	10 kohms or higher
A24-27 (SFTD) - Body ground	Shift lever position on S	10 kohms or higher

TOW/HAUL PATTERN SELECT SWITCH ASSEMBLY RESISTANCE SPECIFIED CONDITION

Tester Connection	Switch Condition	Specified Condition
12 (P) - 11 (E)	Tow/haul pattern select switch ON	Below 1 ohms

12 (P) - 11 (E)	Tow/haul pattern select switch OFF	10 kohms or higher

TOW/HAUL PATTERN SELECT SWITCH ASSEMBLY RESISTANCE SPECIFIED CONDITION

Tester Connection	Switch Condition	Specified Condition
4- 1	Tow/haul pattern select switch ON	Below 1 ohms
4 - 1	Tow/haul pattern select switch OFF	10 kohms or higher

TOW/HAUL PATTERN SELECT SWITCH ASSEMBLY RESULT CHART

Result	Proceed to
OK	A
NG (for Column Shift Type)	B
NG (for Floor Shift Type)	C

HARNESS AND CONNECTOR (TOW/HAUL PATTERN SELECT SWITCH - BODY GROUND) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
J25-11 (E) - Body ground	Always	Below 1 ohms

HARNESS AND CONNECTOR (TOW/HAUL PATTERN SELECT SWITCH - BODY GROUND) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
J23-1 - Body ground	Always	Below 1 ohms

HARNESS AND CONNECTOR (TOW/HAUL PATTERN SELECT SWITCH - ECM) RESISTANCE SPECIFIED CONDITION

Tester Connection	Switch Condition	Specified Condition
A24-51 (PWR) - Body ground	Tow/haul pattern select switch ON	Below 1 ohms
A24-51 (PWR) - Body ground	Tow/haul pattern select switch OFF	10 kohms or higher

TRANSMISSION FLUID FILL CAPACITY

Repair	Fill Amount
Transmission pan and drain plug removal	2.1 liters (2.2 US qts, 1.9 lmp. qts)
Transmission valve body removal	4.7 liters (5.0 US qts, 4.1 lmp. qts)
Torque converter removal	5.4 liters (6.5 US qts, 5.4 lmp. qts)

FLUID TEMPERATURE CHECK MENU

Item	Select
Intelligent tester	DIAGNOSIS / ENHANCED OBD II / DATA LIST / A/T OIL TEMP 2
Techstream	Powertrain / Engine / Data List / A/T Oil Temperature 2

FLUID TEMPERATURE SENSOR INDICATIONS

Lower than proper temp.	Proper temp.	Higher than proper temp.
Turn off	Turn on	Blinking

SPEED SENSOR NT RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	560 to 680 ohms

SPEED SENSOR SP2 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	560 to 680 ohms

TRANSMISSION WIRE (ATF TEMPERATURE SENSOR) RESISTANCE SPECIFIED CONDITION

Tester Connection	ATF Temperature	Specified Condition
1 (OT-) - 9 (OT+)	10°C (50°F)	5 to 8 kohms
1 (OT-) - 9 (OT+)	25°C (77°F)	2.5 to 4.5 kohms
1 (OT-) - 9 (OT+)	110°C (230°F)	0.22 to 0.28 kohms
2 (OT2-) - 10 (OT2+)	10°C (50°F)	5 to 8 kohms
2 (OT2-) - 10 (OT2+)	25°C (77°F)	2.5 to 4.5 kohms
2 (OT2-) - 10 (OT2+)	110°C (230°F)	0.22 to 0.28 kohms

PARK/NEUTRAL POSITION SWITCH ASSEMBLY RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
2 (RB) - 5 (PL)	Shift Position P	Below 1 ohms
2 (RB) - 5 (PL)	Shift Position Not on P	10 kohms or higher
2 (RB) - 1 (RL)	Shift Position R	Below 1 ohms
2 (RB) - 1 (RL)	Shift Position Not on R	10 kohms or higher
2 (RB) - 7 (NL)	Shift Position N	Below 1 ohms
2 (RB) - 7 (NL)	Shift Position Not on N	10 kohms or higher
2 (RB) - 6 (DL)	Shift Position D and S	Below 1 ohms
2 (RB) - 6 (DL)	Shift Position Not on D and S	10 kohms or higher
3 (B) - 4 (L)	Shift Position P and N	Below 1 ohms
3 (B) - 4 (L)	Shift Position Not on P and N	10 kohms or higher

SHIFT SOLENOID VALVE SL1 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	5.0 to 5.6 ohms

SHIFT SOLENOID VALVE S1 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S1 connector terminal - Shift solenoid valve S1 body	20°C (68°F)	11 to 15 ohms

SHIFT SOLENOID VALVE S2 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S2 connector terminal - Shift solenoid valve S2 body	20°C (68°F)	11 to 15 ohms

SHIFT SOLENOID VALVE S3 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S3 connector terminal - Shift solenoid valve S3 body	20°C (68°F)	11 to 15 ohms

SHIFT SOLENOID VALVE S4 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve S4 connector terminal - Shift solenoid valve S4 body	20°C (68°F)	11 to 15 ohms

SHIFT SOLENOID VALVE SL2 RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	5.0 to 5.6 ohms

SHIFT SOLENOID VALVE SR RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
Shift solenoid valve SR connector terminal - Shift solenoid valve SR body	20°C (68°F)	11 to 15 ohms

SHIFT SOLENOID VALVE SLT RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	5.0 to 5.6 ohms

SHIFT SOLENOID VALVE SLU RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	5.0 to 5.6 ohms

SHIFT LOCK CONTROL ECU (FOR COLUMN SHIFT TYPE) VOLTAGE SPECIFIED CONDITION

Tester Connection	Switch Condition	Specified Condition
J30-8 (KLS+) - J30-10 (E)	Ignition switch ACC and shift lever on P	Below 1 V
J30-8 (KLS+) - J30-10 (E)	Ignition switch ACC and shift lever not on P	7.5 to 11 V
J30-8 (KLS+) - J30-10 (E)	Ignition switch ACC and shift lever not on P (after approx. 1 second)	6to9V
J30-3 (ACC) - J30-10 (E)	Ignition switch ON	10 to 14 V
J30-3 (ACC) - J30-10 (E)	Ignition switch ACC	10 to 14 V
J30-3 (ACC) - J30-10 (E)	Ignition switch OFF	Below 1 V
J30-13 (STP) - J30-10 (E)	Brake pedal depressed	10 to 14 V
J30-13 (STP) - J30-10 (E)	Brake pedal released	Below 1 V
J30-4 (IG) - J30-10 (E)	Ignition switch ON	10 to 14 V
J30-4 (IG) - J30-10 (E)	Ignition switch OFF	Below 1 V

RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
J30-10 (E) - Body ground	Always	Below 1 ohms

SHIFT LOCK CONTROL ECU (FOR FLOOR SHIFT TYPE) VOLTAGE SPECIFIED CONDITION

Tester Connection	Switch Condition	Specified Condition
J27-5 (KLS+) - J27-1 (E)	Ignition switch ACC and shift lever on P	Below 1 V
J27-5 (KLS+) - J27-1 (E)	Ignition switch ACC and shift lever not on P	7.5 to 11 V
J27-5 (KLS+) - J27-1 (E)	Ignition switch ACC and shift lever not on P (after approx. 1 second)	6to9V
J27-6 (ACC) - J27-1 (E)	Ignition switch ON	10 to 14 V
J27-6 (ACC) - J27-1 (E)	Ignition switch ACC	10 to 14 V
J27-6 (ACC) - J27-1 (E)	Ignition switch OFF	Below 1 V
J27-4 (STP) - J27-1 (E)	Brake pedal depressed	10 to 14 V
J27-4 (STP) - J27-1 (E)	Brake pedal released	Below 1 V
J27-8 (IG) - J27-1 (E)	Ignition switch ON	10 to 14 V
J27-8 (IG) - J27-1 (E)	Ignition switch OFF	Below 1 V

RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 (E) - Body ground	Always	Below 1 ohms

SHIFT LOCK SOLENOID (FOR COLUMN SHIFT TYPE) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 (SLS+) - 8 (E)	Always	24 to 26 ohms

SHIFT LOCK SOLENOID (FOR FLOOR SHIFT TYPE) RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
4 (SLS+) - 3 (SLS-)	Always	101 to 123 ohms

KEY INTERLOCK SOLENOID RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
1 (SOL+) - 2 (SOL-)	20°C (68°F)	14.4 ohms

COLUMN SHIFT, SHIFT LEVER SUB-ASSEMBLY RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
6 (IG) - 13 (S)	Shift lever position S, "+" and "-"	Below 1 ohms
5 (SFTU) - 11 (E)	Shift lever position continuously shifted to "+" (Up-shift)	

4 (SFTD) - 11 (E)	Shift lever position continuously shifted to "-" (Down-shift)	
6 (IG) - 13 (S)	Shift lever position not on S, "+" and "-"	10 kohms or higher
5 (SFTU) - 11 (E)	Shift lever position S	
4 (SFTD) - 11 (E)		

TRANSMISSION CONTROL SWITCH RESISTANCE SPECIFIED CONDITION

Tester Connection	Condition	Specified Condition
3 (IG) - 7 (S)	Shift lever position S, "+" and "-"	Below 1 ohms
2 (SFTU) - 5 (E)	Shift lever position continuously shifted to "+" (Up-shift)	
1 (SFTD) - 5 (E)	Shift lever position continuously shifted to "-" (Down-shift)	
3 (IG) - 7 (S)	Shift lever position not on S, "+" and "-"	10 kohms or higher
2 (SFTU) - 5 (E)	Shift lever position S	
1 (SFTD) - 5 (E)		

BEARING AND RACE DIAMETER SPECIFICATIONS

Mark	Front Race Diameter Inside / Outside	Thrust Bearing Diameter Inside / Outside	Rear Race Diameter Inside / Outside
A	74.3 to 74.6 mm (2.93 to 2.94 in.) / 87.4 to 87.7 mm (3.44 to 3.45 in.)	72.0 to 72.3 mm (2.83 to 2.85 in.) / 85.3 to 85.6 mm (3.36 to 3.37 in.)	-
B	38.0 to 38.3 mm (1.50 to 1.51 in.) / 53.9 to 54.1 mm (2.12 to 2.13 in.)	36.5 to 36.7 mm (1.437 to 1.445 in.) / 52.9 to 53.2 mm (2.08 to 2.09 in.)	-
C	-	21.1 to 21.3 mm (0.83 to 0.84 in.) / 39.5 to 39.8 mm (1.56 to 1.57 in.)	22.8 to 23.1 mm (0.898 to 0.909 in.) / 44.5 to 44.8 mm (1.75 to 1.76 in.)
D	-	39.5 to 39.7 mm (1.555 to 1.563 in.) / 60.5 to 60.8 mm (2.38 to 2.39 in.)	-
E	-	46.5 to 46.7 mm (1.83 to 1.84 in.) / 64.4 to 64.6 mm (2.535 to 2.543 in.)	-
F	55.0 to 55.2 mm (2.165 to 2.173 in.) / 68.8 to 69.3 mm (2.71 to 2.73 in.)	54.6 to 54.8 mm (2.15 to 2.16 In.) / 70.0 to 70.5 mm (2.76 to 2.78 in.)	-
G	-	65.4 to 65.6 mm (2.57 to 2.58 in.) / 85.6 to 86.0 mm (3.37 to 3.39 in.)	62.9 to 63.1 mm (2.476 to 2.484 in.) / 82.3 to 82.6 mm (3.24 to 3.25 in.)
H	39.5 to 39.8 mm (1.56 to 1.57 in.) / 56.9 to 57.2 mm (2.24 to 2.25 in.)	36.5 to 36.6 mm (1.437 to 1.441 in.) / 56.8 to 57.1 mm (2.24 to 2.25 in.)	36.5 to 36.7 mm (1.437 to 1.445 in.) / 56.7 to 57.2 mm (2.23 to 2.25 in.)
1	21.1 to 21.3 mm (0.831 to 0.839 in.) / 39.9 to 40.1 mm (1.57 to 1.58 in.)	23.0 to 23.3 mm (0.906 to 0.917 in.) / 44.0 to 44.2 mm (1.73 to 1.74 in.)	-
J	-	43.6 to 43.9 mm (1.72 to 1.73 in.)/63.0 to 63.2 mm (248 to 2.49	47.2 to 47.4 mm (1.86 to 1.87 in.) / 67.1 to 67.4 mm (2.64 to

		in.)	2.65 in.)

THICKNESS SPECIFICATIONS

Mark	Thickness
0	0 mm (0 in.)
2	0.15 to 0.25 mm (0.00590 to 0.00984 in.)
4	0.35 to 0.45 mm (0.0138 to 0.0177 in.)
6	0.55 to 0.65 mm (0.0217 to 0.0256 in.)
8	0.75 to 0.85 mm (0.0295 to 0.0335 in.)
10	0.95 to 1.05 mm (0.0374 to 0.0413 in.)

BEARING RACE DIAMETER SPECIFICATIONS

Item	Inside	Outside
Race J	47.2 to 47.4 mm (1.86 to 1.87 in.)	67.1 to 67.4 mm (2.64 to 2.65 in.)

BEARING DIAMETER SPECIFICATIONS

Item	Inside	Outside
Bearing	23.0 to 23.3 mm (0.906 to 0.917 in.)	44.0 to 44.2 mm (1.73 to 1.74 in.)
Bearing J	43.6 to 43.9 mm (1.72 to 1.73 in.)	63.0 to 63.2 mm (2.48 to 2.49 in.)

BEARING AND RACE DIAMETER SPECIFICATIONS

Item	Inside	Outside
Front race H	39.5 to 39.8 mm (1.56 to 1.57 in.)	56.9 to 57.2 mm (2.24 to 2.25 in.)
Bearing H	36.5 to 36.6 mm (1.437 to 1.441 in.)	56.8 to 57.1 mm (2.24 to 2.25 in.)
Rear race H	36.5 to 36.7 mm (1.437 to 1.445 in.)	56.7 to 57.2 mm (2.23 to 2.25 in.)
Race I	21.1 to 21.3 mm (0.831 to 0.839 in.)	39.9 to 40.1 mm (1.57 to 1.58 in.)

FLANGE THICKNESS SPECIFICATIONS

Mark	Thickness
0	1.95 to 2.05 mm (0.0768 to 0.0807 in.)
1	2.05 to 2.15 mm (0.0807 to 0.0846 in.)
2	2.15 to 2.25 mm (0.0846 to 0.0886 in.)
3	2.25 to 2.35 mm (0.0886 to 0.0925 in.)
4	2.35 to 2.45 mm (0.0925 to 0.0965 in.)
5	2.45 to 2.55 mm (0.0965 to 0.100 in.)
6	2.55 to 2.65 mm (0.100 to 0.104 in.)
7	2.65 to 2.75 mm (0.104 to 0.108 in.)

FLANGE THICKNESS SPECIFICATIONS

Mark	Thickness
0	1.95 to 2.05 mm (0.0768 to 0.0807 in.)
1	2.15 to 2.25 mm (0.0846 to 0.0886 in.)
2	2.35 to 2.45 mm (0.0925 to 0.0965 in.)
3	2.55 to 2.65 mm (0.100 to 0.104 in.)

BEARING AND RACE DIAMETER SPECIFICATIONS

Item	Inside	Outside
Race	65.4 to 65.6 mm (2.57 to 2.58 in.)	85.6 to 86.0 mm (3.37 to 3.39 in.)
Bearing	62.9 to 63.1 mm (2.476 to 2.484 in.)	82.3 to 82.6 mm (3.24 to 3.25 in.)

BEARING AND RACE DIAMETER SPECIFICATIONS

Item	Inside	Outside
Race	55.0 to 55.2 mm (2.165 to 2.173 in.)	68.8 to 69.3 mm (2.71 to 2.73 in.)

BEARING DIAMETER SPECIFICATIONS

Item	Inside	Outside
Bearing	54.6 to 54.8 mm (2.15 to 2.16 in.)	70.0 to 70.5 mm (2.76 to 2.78 in.)
Race	55.0 to 55.2 mm (2.165 to 2.173 in.)	68.8 to 69.3 mm (2.71 to 2.73 in.)

FLANGE THICKNESS SPECIFICATIONS

Mark	Thickness
0	3.45 to 3.55 mm (0.136 to 0.140 in.)
1	3.55 to 3.65 mm (0.140 to 0.144 in.)
2	3.65 to 3.75 mm (0.144 to 0.148 in.)
3	3.75 to 3.85 mm (0.148 to 0.152 in.)
4	3.85 to 3.95 mm (0.152 to 0.156 in.)
5	3.95 to 4.05 mm (0.156 to 0.159 in.)
6	4.05 to 4.15 mm (0.159 to 0.163 in.)
7	4.15 to 4.25 mm (0.163 to 0.167 in.)
8	4.25 to 4.35 mm (0.167 to 0.171 in.)

FLANGE THICKNESS SPECIFICATIONS

Mark	Thickness
0	2.35 to 2.45 mm (0.0925 to 0.0965 in.)
1	2.45 to 2.55 mm (0.0965 to 0.100 in.)
2	2.55 to 2.65 mm (0.100 to 0.104 in.)
3	2.65 to 2.75 mm (0.104 to 0.108 in.)
4	2.75 to 2.85 mm (0.108 to 0.112 in.)
5	2.85 to 2.95 mm (0.112 to 0.116 in.)
6	2.95 to 3.05 mm (0.116 to 0.120 in.)
7	3.05 to 3.15 mm (0.120 to 0.124 in.)
8	3.15 to 3.25 mm (0.124 to 0.128 in.)
A	3.25 to 3.35 mm (0.128 to 0.132 in.)
B	3.35 to 3.45 mm (0.132 to 0.136 in.)
C	3.45 to 3.55 mm (0.136 to 0.140 in.)

FLANGE THICKNESS SPECIFICATIONS

Mark	Thickness
0	2.95 to 3.05 mm (0.116 to 0.120 in.)

1	3.05 to 3.15 mm (0.120 to 0.124 in.)
2	3.15 to 3.25 mm (0.124 to 0.128 in.)
3	3.25 to 3.35 mm (0.128 to 0.132 in.)
4	3.35 to 3.45 mm (0.132 to 0.136 in.)
5	3.45 to 3.55 mm (0.136 to 0.140 in.)
6	3.55 to 3.65 mm (0.140 to 0.144 in.)
7	3.65 to 3.75 mm (0.144 to 0.148 in.)
8	3.75 to 3.85 mm (0.148 to 0.152 in.)
A	3.85 to 3.95 mm (0.152 to 0.156 in.)
B	3.95 to 4.05 mm (0.156 to 0.159 in.)

BEARING AND RACE DIAMETER SPECIFICATIONS

Item	Inside	Outside
Bearing C	21.1 to 21.3 mm (0.831 to 0.839 in.)	39.5 to 39.8 mm (1.56 to 1.57 in.)
Race	22.8 to 23.1 mm (0.898 to 0.909 in.)	44.5 to 44.8 mm (1.75 to 1.76 in.)
Bearing D	39.5 to 39.7 mm (1.555 to 1.563 In.)	60.5 to 60.8 mm (2.38 to 2.39 in.)

FLANGE THICKNESS SPECIFICATIONS

Mark	Thickness
0	2.95 to 3.0S mm (0.116 to 0.120 in.)
1	3.05 to 3.15 mm (0.120 to 0.124 in.)
2	3.15 to 3.25 mm (0.124 to 0.128 in.)
3	3.25 to 3.35 mm (0.128 to 0.132 in.)
4	3.35 to 3.45 mm (0.132 to 0.136 in.
S	3.45 to 3.55 mm (0.136 to 0.140 in.
6	3.55 to 3.65 mm (0.140 to 0.144 in.
7	3.65 to 3.75 mm (0.144 to 0.148 in.
8	3.75 to 3.85 mm (0.148 to 0.152 in.
A	3.85 to 3.95 mm (0.152 to 0.156 in.
B	3.95 to 4.05 mm (0.156 to 0.159 in.
C	4.05 to 4.15 mm (0.159 to 0.163 in.)

BEARING DIAMETER SPECIFICATIONS

Item	Inside	Outside
Bearing	46.5 to 46.7 mm (1.83 to 1.84 in.)	64.4 to 64.6 mm (2.535 to 2.543 in.)

BEARING DIAMETER SPECIFICATIONS

Item	Inside	Outside
Bearing A	72.0 to 72.3 mm (2.83 to 2.85 in.)	85.3 to 85.6 mm (3.36 to 3.37 in.)
Bearing B	36.5 to 36.7 mm (1.437 to 1.445 in.)	52.9 to 53.2 mm (2.08 to 2.09 in.)

THRUST BEARING RACE DIAMETER SPECIFICATIONS

Item	Inside	Outside
Race A	74.3 to 74.6 mm (2.93 to 2.94 in.)	87.4 to 87.7 mm (3.44 to 3.45 in.)

Race B	38.0 to 38.3 mm (1.50 to 1.51 in.)	53.9 to 54.1 mm (2.12 to 2.13 in.)

SPRING DIAMETER SPECIFICATIONS

Spring	Free length Outer diameter	Color
B-1 Inner	44.98 mm (1.77 in.) 11.30 mm (0.445 in.)	Natural
B-1 Outer	46.36 mm (1.83 in.) 17.10 mm (0.673 in.)	Natural

SPRING DIAMETER SPECIFICATIONS

Spring	Free length Outer diameter	Color
C-3	73.35 mm (2.89 in.) 19.9 mm (0.783 in.)	Red

SPRING DIAMETER SPECIFICATIONS

Spring	Free length Outer diameter	Color
B-3	64.50 mm (2.54 in.) 19.5 mm (0.768 in.)	Orange

SPRING DIAMETER SPECIFICATIONS

Spring	Free length Outer diameter	Color
C-2	68.0 mm (2.68 in.) 16.1 mm (0.634 in.)	Light green

STANDARD DRIVE AND DRIVEN GEARS THICKNESS SPECIFICATIONS

Mark	Thickness
0	11.636 to 11.642 mm (0.4581 to 0.4583 in.)
1	11.643 to 11.649 mm (0.4584 to 0.4586 in.)
2	11.650 to 11.656 mm (0.4587 to 0.4589 in.)
3	11.657 to 11.663 mm (0.4589 to 0.4592 in.)
4	11.664 to 11.670 mm (0.4592 to 0.4594 in.)
5	11.671 to 11.677 mm (0.4595 to 0.4597 in.)
6	11.678 to 11.684 mm (0.4598 to 0.4600 in.)

