

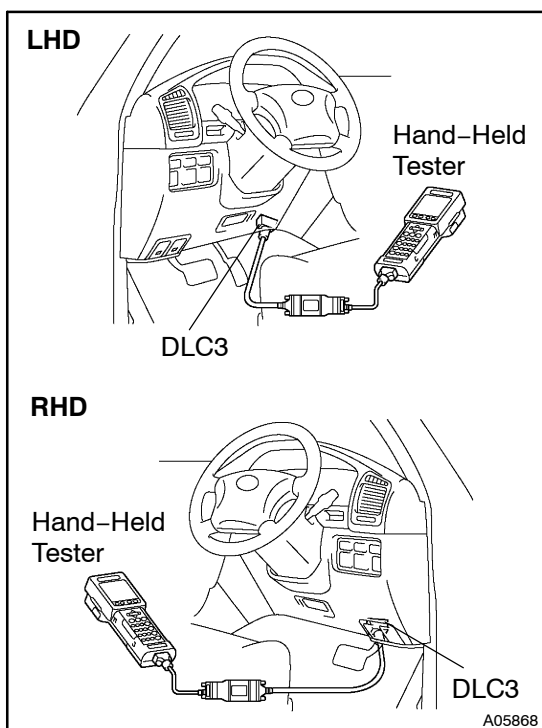
## PRE-CHECK

### 1. DIAGNOSIS SYSTEM

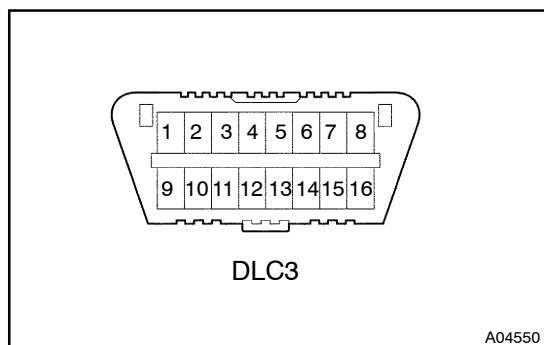
#### (a) Description for M-OBD

- When troubleshoot Multiplex OBD (M-OBD) vehicles, the only difference from the usual troubleshooting procedure is that you connect the vehicle to the hand-held tester, and read off various data output from the vehicle's Engine and ECT ECU.
- The vehicle's on-board computer indicates the check engine light (CHK ENG) on the instrument panel when the computer detects a malfunction in the computer itself or in drive system components. In addition to an indication of the CHK ENG when a malfunction is detected, the applicable Diagnostic Trouble Codes (DTCs) are recorded in the Engine and ECT ECU memory (See page DI-114).

If the malfunction code is not detected in 3 consecutive trips, CHK ENG (MIL) goes off automatically but the DTCs remain recorded in the Engine and ECT ECU memory.



- To check the DTCs, connect the hand-held tester to Data Link Connector 3 (DLC3) on the vehicle, or read the number of blinks of the check engine warning light when TC and CG terminals on the DLC3 are connected. The hand-held tester also enables you to erase the DTCs and activate the several actuators and check frozen frame data and various forms of engine data. (For operating instructions, see the hand-held tester instruction book.)
- The diagnosis system operates in the normal mode during normal vehicle use. It also has a check (test) mode for technicians to simulate malfunction symptoms and troubleshoot. Most DTCs use 2 trip detection logic\* to prevent erroneous detection, and ensure thorough malfunction detection. By switching the Engine and ECT ECU to the check (test) mode using hand-held tester when troubleshooting, the technician can cause the CHK ENG on the light up for a malfunction that is only detected once or momentarily (Hand-held tester only) (See step 2).
- \* 2 trip detection logic  
When a logic malfunction is first detected, the malfunction is temporally stored in the Engine and ECT ECU memory. If the same malfunction is detected again during the second drive test, this second detection causes the CHK ENG to light up. The 2 trip repeats the same mode for 2 times (However, the ignition switch must be turned OFF between the 1st trip and 2nd trip).



## (b) Check the DLC3.

The vehicle's Engine and ECT ECU uses the ISO 14230 (M–OBD) communication protocol. The terminal arrangement of DLC3 complies with ISO 15031–3 and matches the ISO 14230 format.

Terminal No.	Connection/Voltage or Resistance	Condition
7	Bus + Line/Pulse generation	During communication
4	Chassis Ground ⇔ Body Ground/1 Ω or less	Always
5	Signal Ground – Body Ground/1 Ω or less	Always
16	Battery Positive ⇔ Body Ground/9 – 14 V	Always

## HINT:

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

If communication is normal when the tool is connected to another vehicle, inspect the DLC3 on the original vehicle.

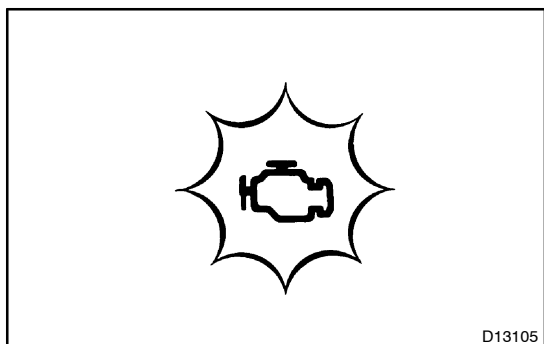
If communication is still not possible when the tool is connected to another vehicle, the problem is probably in the tool itself, so consult the Service Department listed in the tool's instruction manual.

**2. INSPECT DIAGNOSIS (Normal Mode)**

## (a) Check the DTC using hand-held tester.

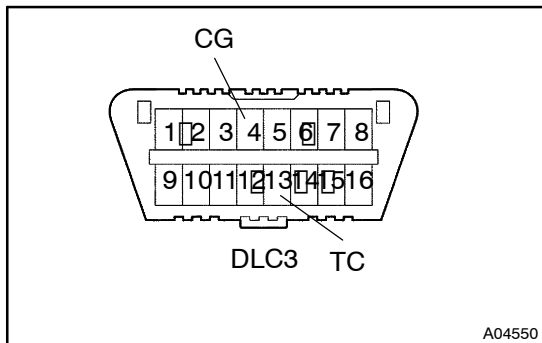
**NOTICE:****Hand-held tester only:**

**When the diagnosis system is switched from the normal mode to the check mode, it erases all DTCs and freezed frame data recorded in the normal mode. So before switching modes, always check the DTCs and freezed frame data, and note them down.**



- (1) The CHK ENG (MIL) comes on when the ignition switch is turned ON and the engine is not running.
- (2) Prepare the hand-held tester.
- (3) Connect the hand-held tester to the DLC3.
- (4) Turn the ignition switch ON and push the hand-held tester main switch ON.
- (5) Use the hand-held tester to check the DTCs and freezed frame data, note them down (For operating instructions, see the hand-held tester instruction book.).

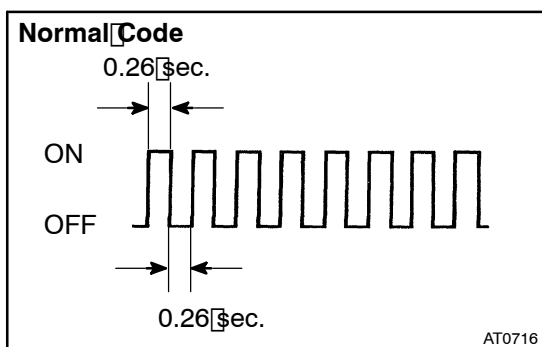
- (6) See page DI-114 to confirm the details of the DTCs.



- (b) Check the DTC when not using hand-held tester (M-OBD).

- (1) Turn the ignition switch ON, but do not start the engine.
- (2) Using SST, connect terminals 13 (TC) and 4 (CG) of DLC3.

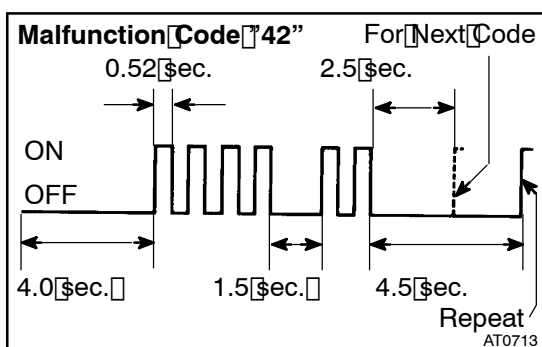
SST 09843-18040



- (3) Read the DTC indicated by the number of times the MIL blinks.

HINT:

If the system is operating normally, the light will blink 2 times per second.



- (4) The malfunction code is indicated, as shown in the chart on the left (DTC "42" is shown as an example).

HINT:

When 2 or more malfunction codes are stored in memory, the lower-numbered code is displayed first.

### 3. INSPECT DIAGNOSIS (Check (Test) Mode)

HINT:

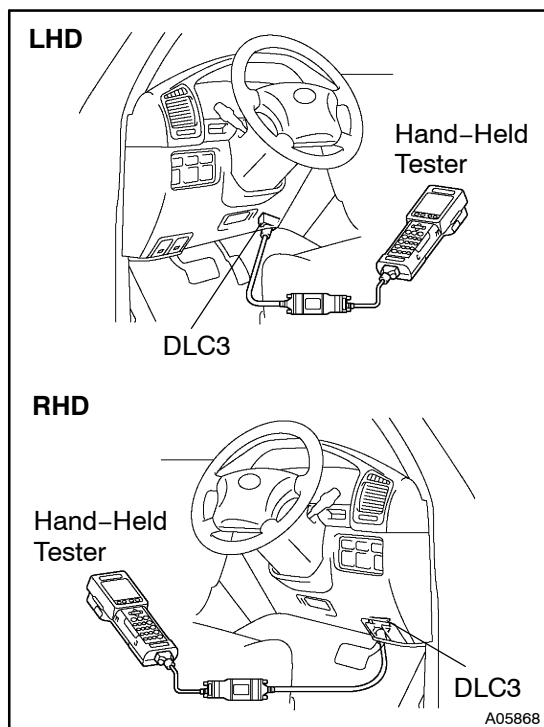
Hand-held tester only:

Compared to the normal mode, the check mode has an increased sensitivity to detect malfunctions.

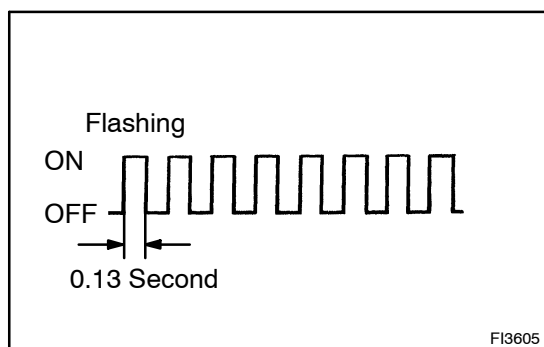
Furthermore, the same diagnostic items which are detected in the normal mode can also be detected in the check (test) mode.

- (a) Check the DTC.

- (1) Initial conditions
  - Battery voltage 11 V or more
  - Throttle valve fully closed
  - Transmission in P or N range
  - A/C switched OFF
- (2) Turn the ignition switch OFF.
- (3) Prepare the hand-held tester.



- (4) Connect the hand-held tester to the DLC3.
- (5) Turn the ignition switch ON and push the hand-held tester main switch ON.



- (6) Switch the hand-held tester from the normal mode to the check (test) mode.
- (7) Check if the CHK ENG (MIL) blinks.

**NOTICE:**

If the hand-held tester switches the Engine and ECT ECU from the normal mode to the check mode or vice-versa, or if the ignition switch is turned from ON to ACC or OFF during the check mode, the DTCs and freeze frame data will be erased.

- (8) Start the engine (MIL goes out after the engine starts).
- (9) Simulate the conditions of the malfunction described by the customer.

**NOTICE:**

Leave the ignition switch ON until you have checked the DTCs, etc.

- (10) After simulating the malfunction conditions, use the hand-held tester diagnosis selector to check the DTCs and freeze frame data, etc.

**HINT:**

Take care not to turn the ignition switch OFF. Turning the ignition switch OFF switches the diagnosis system from the check (test) mode to the normal mode. so all DTCs, etc. are erased.

- (11) After checking the DTC, inspect the applicable circuit.
- (b) Clear the DTC.  
The DTCs and freeze frame data will be erased by either actions.

- (1) Operating the hand-held tester to erase the codes. (See the hand-held tester's instruction book for operating instructions.)
- (2) Disconnecting the battery terminals or (EFI OR ECD No.1 fuse) and (EFI OR ECD No.2 fuse) fuse more than 60 second.

#### 4. PROBLEM SYMPTOM CONFIRMATION

Taking into consideration the results of the customer problem analysis, try to reproduce the symptoms of the trouble. If the problem is that the transmission does not up-shift, down-shift, or the shift point is too high or too low, conduct the following road test to confirm the automatic shift schedule and simulate the problem symptoms.

#### 5. ROAD TEST

##### NOTICE:

**Perform the test at normal operating ATF temperature 50 – 80 °C (122 – 176 °F).**

- (a) D range test (NORM and PWR pattern):

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

- (1) Check up-shift operation.

Check that 1 → 2, 2 → 3, 3 → 4 and 4 → 5th up-shifts take place, and that the shift points conform to the automatic shift schedule (See page SS-4).

##### HINT:

When the 2nd start switch is on, there is no 1 → 2 up-shift and 2 → 1 down-shift.

- (2) Check for shift shock and slip.

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

- (3) Check for abnormal noises and vibration.

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

##### HINT:

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

- (4) Check kick-down operation.

While running in the D range, 2nd, 3rd, 4th and 5th gears, check that the possible kick-down vehicle speed limits for 2 → 1, 3 → 2, 4 → 3 and 5th → 4 kick-downs conform to those indicated on the automatic shift schedule (See page SS-4).

- (5) Check abnormal shock and slip at kick-down.

- (6) Check the lock-up mechanism.

- Drive in D range 5th gear, at a steady speed (lock-up ON) of about 70 km/h (43 mph).
- Lightly depress the accelerator pedal and check that the engine speed does not change abruptly.

If there is a big jump in engine speed, there is no lock-up.

- (b) 4 range test:

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

- (1) Check up-shift operation.

Check that the 1 → 2, 2 → 3 and 3 → 4 up-shift takes place and that the shift point conforms to the automatic shift schedule (See page SS-4).

##### HINT:

- There is no 5th up-shift in the 4 range.
- 4th Gear Lock-up Prohibition Control (1. Brake pedal is depressed. 2. Coolant temp. is 60 °C (140 °F) or less.)
- (2) Check engine braking.  
While driving in the 4 range and 4th gear, release the accelerator pedal and check the engine braking effect.

- (3) Check for abnormal noises during acceleration and deceleration, and for shock at up-shift and down-shift.
- (4) Check the lock-up mechanism.
  - Drive in 4 range 4th gear, at a steady speed (lock-up ON) of about 61 km/h (38 mph).
  - Lightly depress the accelerator pedal and check that the engine speed does not change abruptly.

If there is a big jump in engine speed, there is no lock-up.

(c) 3 range test:

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

- (1) Check up-shift operation.  
Check that the 1 → 2 and 2 → 3 up-shift takes place and that the shift point conforms to the automatic shift schedule [\(See page SS-4\)](#).
- (2) Check engine braking.  
While running in the 3 range and 3rd gear, release the accelerator pedal and check the engine braking effect.
- (3) Check for abnormal noises during acceleration and deceleration, and for shock at up-shift and down-shift.

(d) 2 range test:

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

- (1) Check up-shift operation.  
Check that the 1 → 2 up-shift takes place and that the shift point conforms to the automatic shift schedule [\(See page SS-4\)](#).

HINT:

When the 2nd start switch is ON, there is no 1 → 2 up-shift and 2 → 1 down-shift.

- (2) Check engine braking.  
While running in the 2 range and 2nd gear, release the accelerator pedal and check the engine braking effect.
- (3) Check for abnormal noises during acceleration and deceleration, and for shock at up-shift and down-shift.

(e) L range test:

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

- (1) Check no up-shift.  
While running in the L range, check that there is no up-shift to 2nd gear.
- (2) Check engine braking.  
While running in the L range, release the accelerator pedal and check the engine braking effect.
- (3) Check for abnormal noises during acceleration and deceleration.

(f) R range test:

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

**CAUTION:**

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

(g) P range test:

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

**6. BASIC INSPECTION**

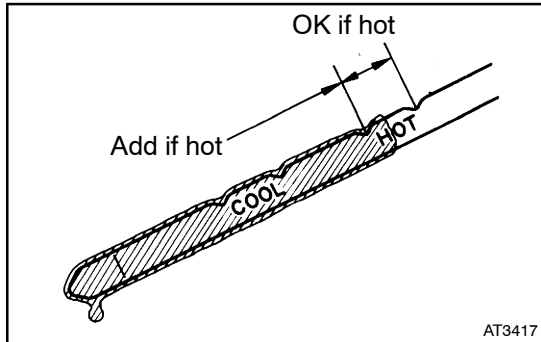
(a) Check the fluid level.

HINT:

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

**Fluid temp.: 70 – 80 °C (158 – 176 °F)**

- Only use the COOL range on the dipstick as a rough reference when the fluid is replaced or the engine does not run.



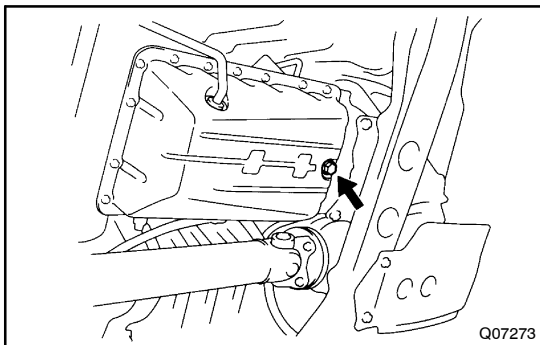
- (1) Park the vehicle on a level surface and set the parking brake.
- (2) With the engine idling and the brake pedal depressed, shift the shift lever into all ranges from P to L range and return to P range.
- (3) Pull out the dipstick and wipe it clean.
- (4) Push it back fully into the pipe.
- (5) Pull it out and check that the fluid level is in the HOT range.

If the level is at the low side, add new fluid.

**Fluid type: ATF Type T-IV****NOTICE:****Do not overfill.**

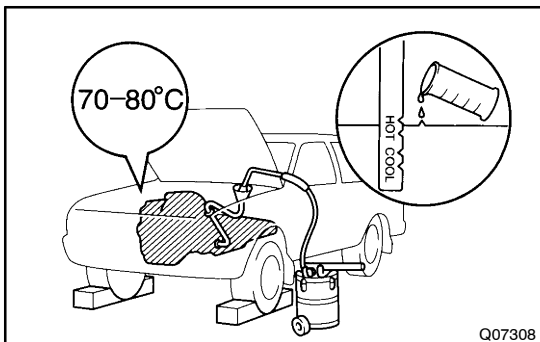
(b) Check the fluid condition.

If the fluid smells burnt or is black, replace it.



(c) Replace the ATF.

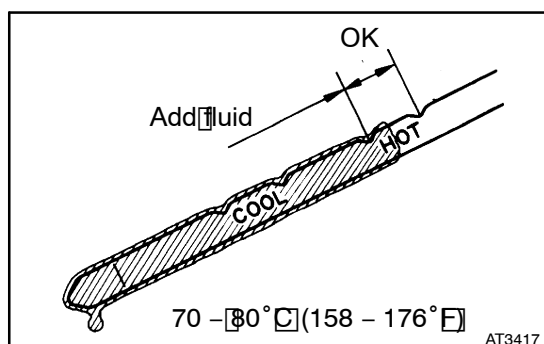
- (1) Remove the drain plug and drain the fluid.
- (2) Reinstall the drain plug securely.



- (3) With the engine OFF add new fluid through the oil filler pipe.

**Fluid type: ATF Type T-IV****Capacity: 3.0 liters (3.2 US qts, 2.6 Imp. qts)**

- (4) Start the engine and shift the shift lever into all ranges from P to L range and then shift into P range.
- (5) With the engine idling, check the fluid level. Add fluid up to the COOL level on the dipstick.



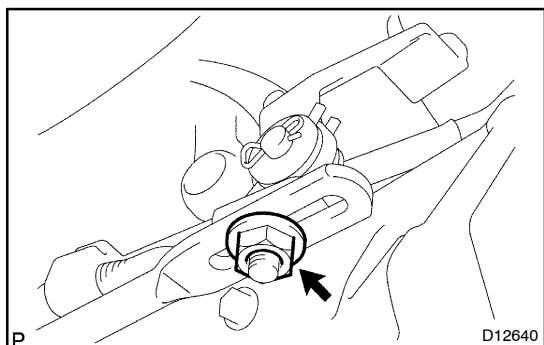
- (6) Check the fluid level at the normal operating temperature, 70 – 80°C (158 – 176°F), and add as necessary.

**NOTICE:****Do not overfill.**

- (d) Check the fluid leaks.

Check for leaks in the transmission.

If there are leaks, it is necessary to repair or replace O-rings, FIPGs, oil seals, plugs or other parts.

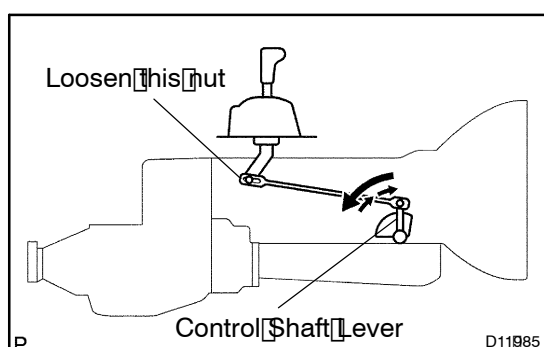


- (e) Inspect and adjust the shift lever range.

When shifting the shift lever from the N range to other ranges, check that the lever can be shifted smoothly and accurately to each range and that the range indicator is not aligned with the correct range.

If the indicator is not aligned with the correct range, carry out the following adjustment procedures.

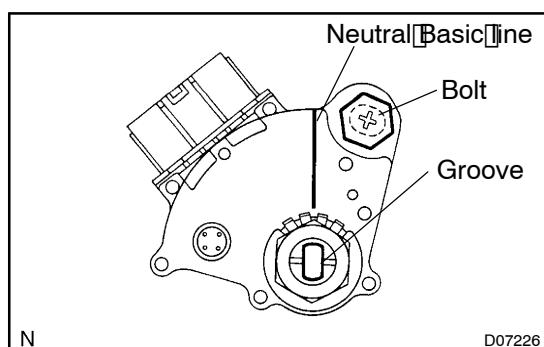
- (1) Loosen the nut on the shift lever.
- (2) Push the control shaft fully rearward.



- (3) Return the control shaft lever 2 notches to N range.
- (4) Set the shift lever to N range.
- (5) While holding the shift lever lightly toward the R range side, tighten the shift lever nut.

**Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)**

- (6) Start the engine and make sure that the vehicle moves forward when shifting the lever from the N to D range and reverses when shifting it to the R range.



- (f) Inspect and adjust the neutral start switch.

- Check that the engine can be started with the shift lever only in the N or P range, but not in other ranges.

If it is not as stated above, carry out the following adjustment procedures.

- Loosen the neutral start switch bolt and set the shift lever to the N range.
- Align the groove with neutral basic line.
- Hold in range and tighten the bolt.

**Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)**

- For continuity inspection of the neutral start switch, see [page DI-156](#).

- (g) Check the idle speed.

**Idle speed (In N range and air conditioner OFF):**

**700 ± 50 rpm**



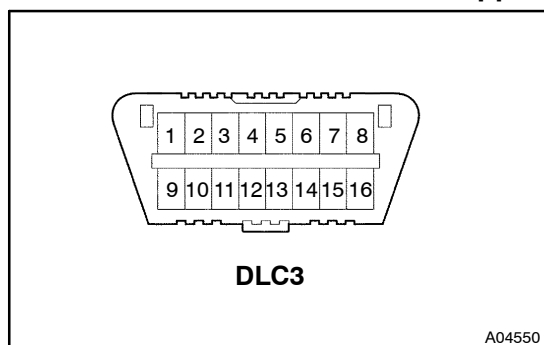
## 7. MECHANICAL SYSTEM TESTS

### (a) Measure the stall speed.

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

#### NOTICE:

- **Do the test at normal operating fluid temperature 70 – 80 °C (158 – 176 °F).**
- **Do not continuously run this test longer than 5 seconds.**
- **To ensure safety, conduct this test in a wide, clear level area which provides good traction.**
- **The stall test should always be carried out in pairs. One technician should observe the conditions of wheels or wheel stoppers outside the vehicle while the other is doing the test.**



- (1) Chock the 4 wheels.
- (2) Connect a hand-held tester to DLC3 or tachometer to terminal TAC (9) of DLC3 with SST.

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- (3) Fully apply the parking brake.
- (4) Keep your left foot pressing firmly on the brake pedal.
- (5) Start the engine.
- (6) Shift into the D range. Press all the way down on the accelerator pedal with your right foot. Quickly read the stall speed at this time.

**Stall speed: 2,400 ± 150 rpm**

- (7) Do the same test in R range.

**Stall speed: 2,400 ± 150 rpm**

#### Evaluation:

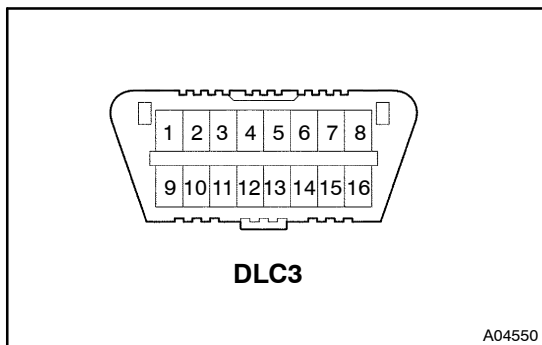
Problem	Possible cause
(a) Stall speed low in D and R ranges	<ul style="list-style-type: none"> <li>• Engine output may be insufficient</li> <li>• Stator one-way clutch is not operating properly</li> </ul> <p>HINT: If the value is larger or smaller than the specified value by 600 rpm or more, the torque converter could be faulty.</p>
(b) Stall speed high in D range	<ul style="list-style-type: none"> <li>• Line pressure too low</li> <li>• Clutch No. 1 (C<sub>1</sub>) slipping</li> <li>• One-way clutch No.3 (F<sub>3</sub>) not operating properly</li> </ul>
(c) Stall speed high in R range	<ul style="list-style-type: none"> <li>• Line pressure too low</li> <li>• Brake No. 4 (B<sub>4</sub>) slipping</li> <li>• Clutch No. 3 (C<sub>3</sub>) slipping</li> <li>• One-way clutch No.1 (F<sub>1</sub>) not operating properly</li> </ul>
(d) Stall speed high in D and R ranges	<ul style="list-style-type: none"> <li>• Line pressure too low</li> <li>• Improper fluid level</li> </ul>

## (b) Measure the time lag.

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

**NOTICE:**

- **Do the test at normal operating fluid temperature 70 – 80 °C (158 – 176 °F).**
- **Be sure to allow 1 minute interval between tests.**
- **Take 3 measurements and take the average value.**



- (1) Fully apply the parking brake.
- (2) Connect a hand-held tester to DLC3 or tachometer to terminal TAC (9) of DLC3 with SST.

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- (3) Start the engine and check idle speed.

**Idle speed (In N range and air conditioner OFF): 700 ± 50 rpm.**

- (4) Shift the shift lever from N to D range. Using a stop watch, measure the time from when the lever is shifted until the shock is felt.

**Time lag:**

**N → D Less than 1.2 seconds**

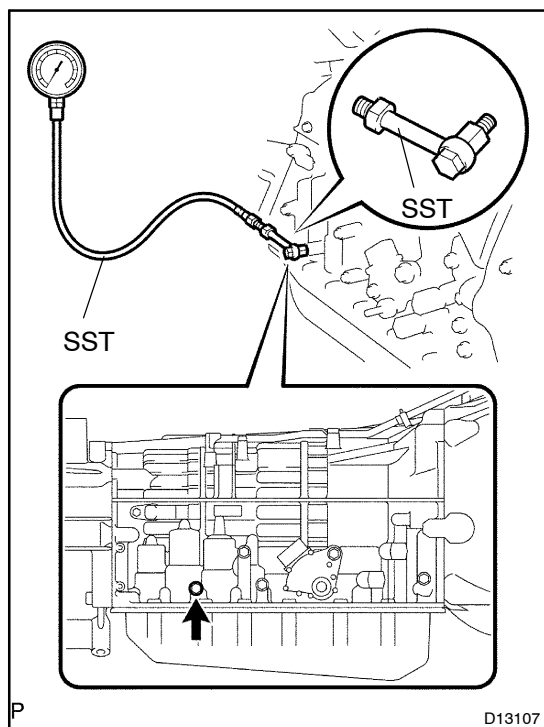
- (5) In the same manner, measure the time lag for N → R.

**Time lag:**

**N → R Less than 1.5 seconds**

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

Problem	Possible cause
N → D time lag is longer	<ul style="list-style-type: none"> <li>• Line pressure too low</li> <li>• Clutch No. 1 (C<sub>1</sub>) worn</li> <li>• One-way clutch No.3 (F<sub>3</sub>) not operating properly</li> </ul>
N → R time lag is longer	<ul style="list-style-type: none"> <li>• Line pressure too low</li> <li>• Clutch No. 3 (C<sub>3</sub>) worn</li> <li>• Brake No. 4 (B<sub>4</sub>) worn</li> <li>• One-way clutch No.1 (F<sub>1</sub>) not operating properly</li> </ul>



## 8. HYDRAULIC TEST

Measure the line pressure.

### NOTICE:

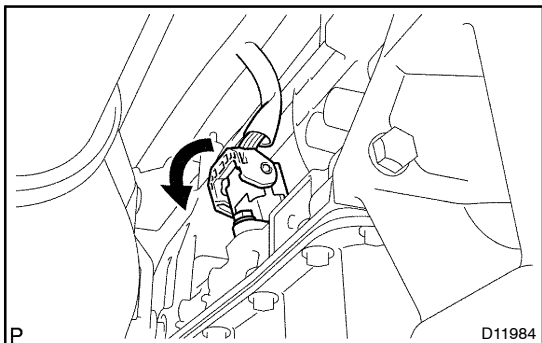
- Do the test at normal operation fluid temperature 70 – 80 °C (158 – 176 °F).
  - The line pressure test should always be carried out in pairs. One technician should observe the conditions of wheels or wheel stoppers outside the vehicle while the other is doing the test.
  - Be careful to prevent SST's hose from interfering with the exhaust pipe.
    - (1) Warm up the ATF.
    - (2) Remove the test plug on the transmission case center right side and connect SST.
- SST 09992-00095 (09992-00231, 09992-00271)
- (3) Fully apply the parking brake and chock the 4 wheels.
  - (4) Start the engine and check idling speed.
  - (5) Keep your left foot pressing firmly on the brake pedal and shift into D range.
  - (6) Measure the line pressure when the engine is idling.
  - (7) Depress the accelerator pedal all the way down. Quickly read the highest line pressure when engine speed reaches stall speed.
  - (8) In the same manner, do the test in R range.

### Specified line pressure:

Condition	D range kPa (kgf/cm <sup>2</sup> , psi)	R range kPa (kgf/cm <sup>2</sup> , psi)
Idling	362 – 420 (3.7 – 4.2, 53 – 59)	500 – 580 (5.1 – 5.9, 73 – 84)
Stall	1,360 – 1,460 (13.8 – 14.9, 196 – 212)	1,295 – 1,415 (13.2 – 14.4, 188 – 205)

### Evaluation

Problem	Possible cause
If the measured value at all ranges are higher	<ul style="list-style-type: none"> <li>• Shift solenoid valve SLT defective</li> <li>• Regulator valve defective</li> </ul>
If the measured value at all ranges are lower	<ul style="list-style-type: none"> <li>• Shift solenoid valve SLT defective</li> <li>• Regulator valve defective</li> <li>• Oil pump defective</li> </ul>
If pressure is low in the D range only	<ul style="list-style-type: none"> <li>• D range circuit fluid leakage</li> <li>• Clutch No. 1 (C<sub>1</sub>) defective</li> </ul>
If pressure is low in the R range only	<ul style="list-style-type: none"> <li>• R range circuit fluid leakage</li> <li>• Clutch No. 3 (C<sub>3</sub>) defective</li> <li>• Brake No. 4 (B<sub>4</sub>) defective</li> </ul>



## 9. MANUAL SHIFTING TEST

### HINT:

By this test, it can be determined whether the trouble is within the electrical circuit or is a mechanical problem in the transmission.

- (a) Disconnect the solenoid wire.
- (b) Inspect the manual driving operation.

Check that the shift and gear ranges correspond with the table below.

While driving, shift through the L, 2, 3, 4 and D ranges. Check that the gear change corresponds to the shift range.

Shift range	Gear range
D	4th
4	4th
3	3rd
2	1st
L	1st
R	Reverse
P	Pawl Lock

### HINT:

If the gear ranges of the L, 2, 3, 4 and D are difficult to distinguish, do the following road test.

If any abnormality is found in the above test, the problem is in the transmission itself.

- (c) Connect the solenoid wire.
- (d) Cancel out DTC.