

## PRE-CHECK

### 1. DIAGNOSIS SYSTEM

#### (a) Description

When troubleshooting OBD II vehicles, the only difference from the usual troubleshooting procedure is that you connect to the vehicle the OBD II scan tool complying with SAE J1987 or TOYOTA hand-held tester, and read off various data output from the vehicle's ECM.

OBD II regulations require that the vehicle's on-board computer lights up the Malfunction Indicator Lamp (MIL) on the instrument panel when the computer detects a malfunction in the computer itself or in drive system components which affect vehicle emissions. In addition to the MIL lighting up when a malfunction is detected, the applicable DTCs prescribed by SAE J2012 are recorded in the ECM memory (See page [DI-14](#)).

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

To check the DTCs, connect the OBD II scan tool or TOYOTA hand-held tester to DLC3 on the vehicle. The OBD II scan tool or TOYOTA hand-held tester also enables you to erase the DTCs and check freeze frame data and various forms of engine data (For operating instructions, see the OBD II scan tool's instruction book).

DTCs include SAE controlled codes and Manufacturer controlled codes.

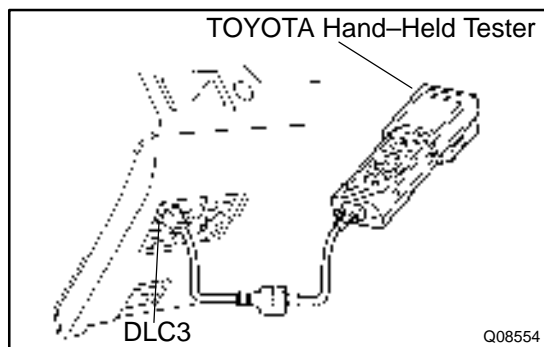
SAE controlled codes must be set as prescribed by the SAE, while Manufacturer controlled codes can be set freely by the manufacturer within the prescribed limits (See DTC chart on page [DI-137](#)).

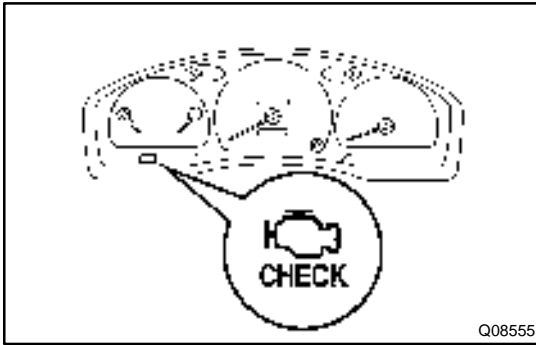
The diagnosis system operates in normal mode during normal vehicle use, and also has a check mode for technicians to simulate malfunction symptoms and perform troubleshooting. Most DTCs use 2 trip detection logic(\*) to prevent erroneous detection. By switching the ECM to check mode when troubleshooting, the technician can cause the MIL to light up to blink for a malfunction that is only detected once or momentarily.

(TOYOTA hand-held tester)

\*2 trip detection logic:

When a logic malfunction is first detected, the malfunction is temporarily stored in the ECM memory. If the same malfunction is detected again during the second test drive, this second detection causes the MIL to light up.





## 2. INSPECT DIAGNOSIS (NORMAL MODE)

### (a) Check the MIL.

- (1) The MIL lights up when the ignition switch is turned ON and the engine is not running.

#### HINT:

If the MIL does not light up, troubleshoot the combination meter (See page [BE-33](#)).

- (2) When the engine starts, the MIL should go off. If the lamp remains on, the diagnosis system has detected a malfunction or abnormality in the system.

### (b) Check the DTC.

#### NOTICE:

**(TOYOTA hand-held tester only):** When the diagnostic system is switched from normal mode to check mode, it erases all DTCs and freeze frame data recorded in normal mode. So before switching modes, always check the DTCs and freeze frame data, and note them down.

- (1) Prepare the OBD II scan tool (complying with SAE J1978) or TOYOTA hand-held tester.
- (2) Connect the OBD II scan tool or TOYOTA hand-held tester to DLC3 at the instrument panel junction block.
- (3) Turn the ignition switch ON and turn the OBD II scan tool or TOYOTA hand-held tester switch ON.
- (4) Use the OBD II scan tool or TOYOTA hand-held tester to check the DTCs and freeze frame data. Note them down (For operating instructions, see the OBD II scan tool's instruction book).
- (5) See page [DI-137](#) to confirm the details of the DTCs.

#### NOTICE:

**When simulating symptoms with an OBD II scan tool (excluding TOYOTA hand-held tester) to check the DTCs, use normal mode. For codes on the DTC chart subject to "2 trip detection logic", turn the ignition switch off after the symptoms have been simulated for the first time. Then repeat the simulation process again. When the program has been simulated twice, the MIL lights up and the DTCs are recorded in the ECM.**

### 3. INSPECT DIAGNOSIS (CHECK MODE)

TOYOTA hand-held tester only:

Compared to the normal mode, the check mode has high sensing ability to detect malfunctions. Furthermore, the same diagnostic items which are detected in the normal mode can also be detected in check mode.

(a) Check the DTC.

(1) Initial conditions.

- Battery positive voltage 11 V or more.
- Throttle valve fully closed.
- Transaxle in the PARK position.
- Air conditioning off.

(2) Turn the ignition switch OFF.

(3) Prepare the TOYOTA hand-held tester.

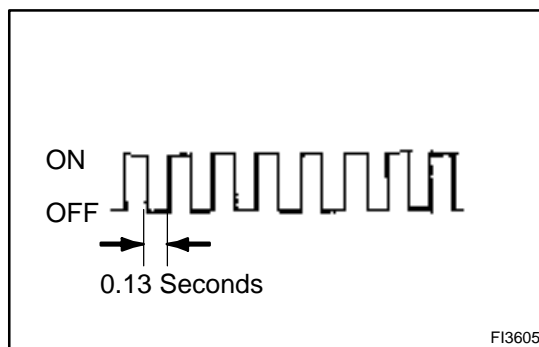
(4) Connect the TOYOTA hand-held tester to DLC3 at the instrument panel junction block.

(5) Turn the ignition switch ON and switch the TOYOTA hand-held tester ON.

(6) Switch the TOYOTA hand-held tester from normal mode to check mode (Check that the MIL flashes).

(7) Start the engine (The MIL goes off after the engine start).

(8) Simulate the conditions of the malfunction described by the customer.



#### NOTICE:

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

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

#### HINT:

Take care not to turn the ignition switch OFF, as turning it off switches the diagnosis system from check mode to normal mode, erasing all DTCs etc.

(10) After checking the DTC, inspect the applicable circuit.

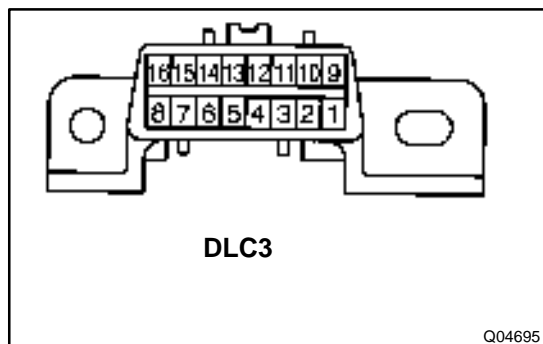
(b) Clear the DTC.

The following actions will erase the DTCs and freeze frame data.

Operating the OBD II scan tool (complying with SAE J1978) or TOYOTA hand-held tester to erase the codes. (See the OBD II scan tool's instruction book for operating instructions.)

#### NOTICE:

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



- (c) Check the DLC3.  
The vehicle's ECM uses the ISO 9141-2 communication protocol. The terminal arrangement of DLC3 complies with SAE J1962 and matches the ISO 9141-2 format.

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

**HINT:**

If your display shows "UNABLE TO CONNECT TO VEHICLE" when you have connected the cable of OBD II scan tool or TOYOTA hand-held tester to 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 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.

**4. CHECK FOR INTERMITTENT PROBLEMS**

TOYOTA hand-held tester only:

By putting the vehicle's ECM in check mode, 1 trip detection logic is possible instead of 2 trip detection logic and sensitivity to detect open circuits is increased. This makes it easier to detect intermittent problems.

- (1) Clear diagnostic trouble codes (See page [DI-126](#))
- (2) Set check mode (See page [DI-126](#))
- (3) Do a simulation test (See page [IN-17](#))
- (4) Connector connection and terminal inspection (See page [IN-27](#))
- (5) Visual check and contact pressure check (See page [IN-27](#))
- (6) Connector handling (See page [IN-27](#))

**5. 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 transaxle does not up-shift, does not down-shift, or the shift point is too high or too low, conduct the following road test the automatic shift schedule and simulate the problem symptoms.

## 6. ROAD TEST

### NOTICE:

**Do the test at normal ATF operating temperature 70 – 80°C (158 – 176°F).**

#### (a) D position test.

Shift into the D position and keep the accelerator pedal constant at the full throttle valve opening position, and check the following points:

##### (1) Check up – shift operation.

Check that 1 → 2, 2 → 3 and 3 → O/D up – shift takes place at the shift point shown in the automatic shift schedule (See page [SS-27](#))

### HINT:

#### (1) O/D Gear Up – shift Prohibition Control.

- Coolant temperature is 60°C (140°F) or less.
- If there is a 10 km/h (6 mph) difference between the set cruise control speed and vehicle speed.
- O/D main switch is pushed OFF. (During the O/D OFF indicator light lights up.)

#### (2) O/D Gear Lock-up Prohibition Control.

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

##### (2) Check for shift shock and slip.

Check for shock and slip at the 1 → 2, 2 → 3 and 3 → O/D up-shifts.

##### (3) Check for abnormal noise and vibration.

Run at the D position lock – up or O/D gear and check for abnormal noise and vibration.

### HINT:

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

#### (4) Check kick – down operation.

While running in the D position, 2nd, 3rd and O/D gears, check to see that the possible kick – down vehicle speed limits for 2 → 1, 3 → 2 and O/D → 3 kick – downs conform to those indicated on the automatic shift schedule (See page [SS-27](#)).

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

#### (6) Check the lock – up mechanism.

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

If there is a big jump in RPM, there is no lock – up.

#### (b) 2 position test

Shift into the 2 position and, while driving with the accelerator pedal held constantly at the full throttle valve opening position, check on the following points:

##### (1) Check up – shift operation.

Check to see that the 1 → 2 up – shift takes place and that the shift point conforms to the automatic shift schedule (See page [SS-27](#)).

### HINT:

There is no O/D up – shift and lock – up in the 2 position.

#### (2) Check engine braking.

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

#### (3) Check for abnormal noise during acceleration and deceleration, and for shock during up – shift and down – shift.

#### (c) L position test.

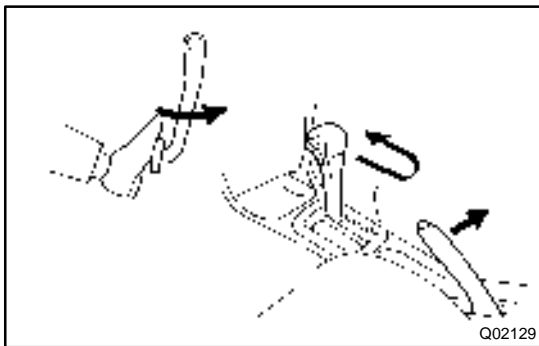
Shift into the L position and while driving with the accelerator pedal held constantly at the full throttle valve opening position, and check the following points:

- (1) Check no up-shift.  
While running in the L position, check that there is no up – shift to 2nd gear.
- (2) Check engine braking.  
While running in the L position, release the accelerator pedal and check the engine braking effect.
- (3) Check for abnormal noise during acceleration and deceleration.
- (d) R position test.  
Shift into the R position and while starting at full throttle, check for slipping.

**CAUTION:**

**Before conducting this test make sure that the test area is free from personnel and obstructor.**

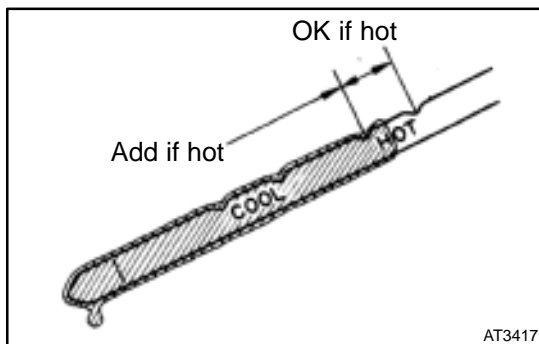
- (e) P position test.  
Stop the vehicle on a grade (more than 5°) and after shifting into the P position, release the parking brake.  
Then check the parking lock pawl holds the vehicle in place.

**7. BASIC INSPECTION**

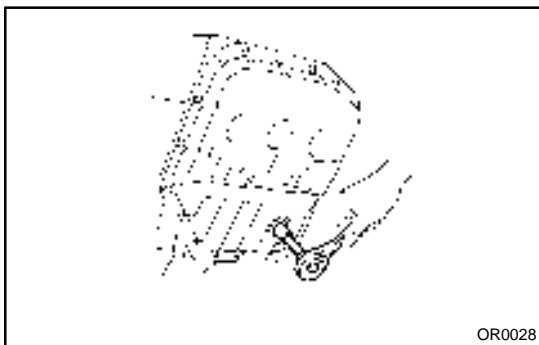
- (a) Check the fluid level.

**HINT:**

- Drive the vehicle so that the engine and transaxle are at normal operating temperature.  
**Fluid temperature: 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 positions from the P to L position and return to the P position.
- (3) Pull out the oil level gauge 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 D-II or DEXRON®III (DEXRON®II)**

**NOTICE:**

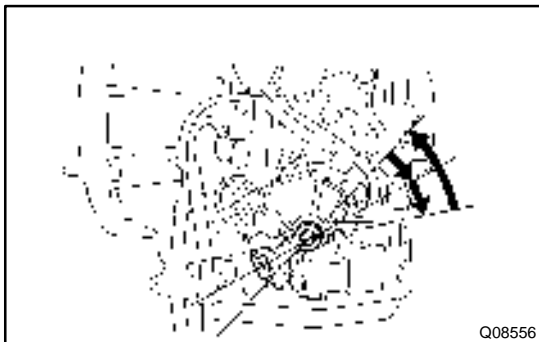
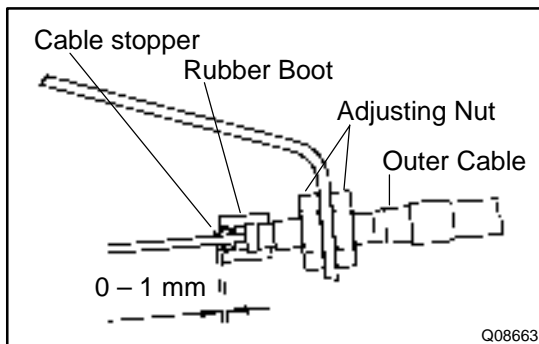
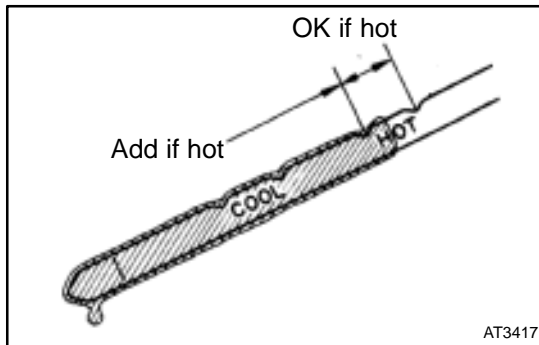
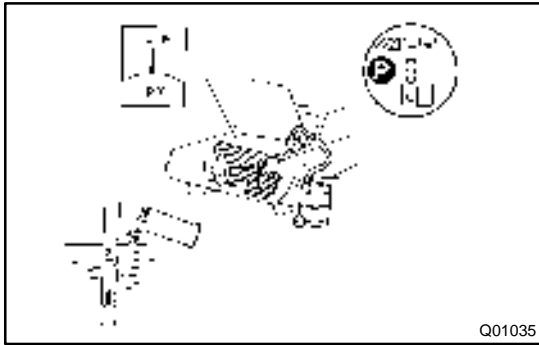
**Do not overfill.**

- (b) Check the fluid condition.

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

- (c) Replace transaxle fluid

- (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 D-II or DEXRON®III (DEXRON®II)**

**Capacity:**

**Drain and refill: 3.1 liters (3.3 US qts, 2.7 Imp. qts)**

- (4) Start the engine and shift the shift lever into all positions from P to L position and then shift into P position.
- (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 transaxle.

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

- (e) Inspect and adjust the throttle cable

- (1) Check that the throttle valve is fully closed.
- (2) Check that the inner cable is not slack.
- (3) Measure the distance between the outer cable end and stopper on the cable.

**Standard distance: 0 – 1 mm (0 – 0.04 in.)**

If the distance is not standard, adjust the cable by the adjusting nuts.

- (f) Inspect and adjust the shift lever position.

When shifting 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 correctly indicates the position.

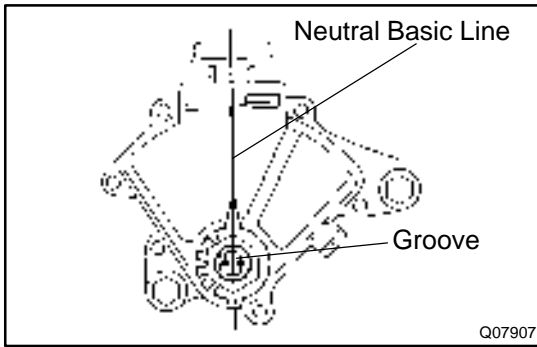
If the indicator is not aligned with the correct position, carry out the following adjustment procedures:

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

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

**Torque: 6.9 N·m (70 kgf·cm, 61 in.-lbf)**

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



- (g) Inspect and adjust the park/neutral position switch. Check that the engine can be started with the shift lever only in the N or P position, but not in other positions.

If not as stated above, carry out the following adjustment procedures:

- (1) Loosen the park/neutral position switch bolt and set the shift lever to the N position.
- (2) Align the groove and neutral basic line.
- (3) Hold in position and tighten the bolt.

**Torque: 5.4 N·m (55 kgf·cm, 48 in·lbf)**

For continuity inspection of the park/neutral position switch, see page [AX-4](#).

- (h) Check the idle speed.

**Idle speed:**

**750 ± 50 rpm (In N position and A/C OFF)**

## 8. MECHANICAL SYSTEM TESTS

- (a) Measure the stall speed.

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

### NOTICE:

- Do the test at normal ATF operation temperature 50 – 80°C (122 – 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 be always 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) Fully apply the parking brake.
  - (3) Connect OBD II scan tool or TOYOTA hand-held tester to DLC3.
  - (4) Start the engine and check idle speed.
  - (5) Keep you left foot pressed firmly on the brake pedal.
  - (6) Shift into the D position. Fully depress the accelerator pedal. Quickly read the stall speed at this time.

**Stall speed: 2,300 ± 200 rpm**

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

**Stall speed: 2,300 ± 200 rpm**



**Evaluation:**

Problem	Possible cause
(a) Stall speed low in D and R positions	<ul style="list-style-type: none"> <li>• Engine output may be insufficient</li> <li>• Stator one-way clutch is operating properly</li> </ul> HINT: If more than 600 rpm below the specified value, the torque converter clutch could be faulty.
(b) Stall speed high in D position	<ul style="list-style-type: none"> <li>• Line pressure too low</li> <li>• Forward clutch slipping</li> <li>• No.2 one-way clutch not operating properly</li> <li>• U/D one-way clutch not operating properly</li> </ul>
(c) Stall speed high in R position	<ul style="list-style-type: none"> <li>• Line pressure too low</li> <li>• Direct clutch slipping</li> <li>• 1st and reverse brake slipping</li> <li>• U/D brake slipping</li> </ul>
(d) Stall speed high in D and R positions	<ul style="list-style-type: none"> <li>• Line pressure too low</li> <li>• Improper fluid level</li> <li>• U/D one-way clutch not operating properly</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 U/D direct clutch, forward clutch, direct clutch, and 1st and reverse brake.

**NOTICE:**

- **Do the test at normal operating ATF temperature 50 – 80°C (122 – 176°F).**
- **Make sure to allow 1 minute interval between tests.**
- **Take 3 measurements and take the average value.**

(1) Fully apply the parking brake.

(2) Connect OBD II scan tool or TOYOTA hand-held tester to DLC3.

(3) Start the engine and check idle speed.

**Idle speed: 750 ± 50 rpm (In N position and A/C OFF)**

(4) Shift the shift lever from the N to D position. Using a stop watch, measure the time it takes from shifting the lever until the shock is felt.

**Time lag: N → D Less than 1.2 seconds**

In the same way, measure the time lag for N → R.

**Time lag: N → R Less than 1.5 seconds**

**Evaluation:**

Problem	Possible cause
N → D time lag is longer	<ul style="list-style-type: none"> <li>• Line pressure too low</li> <li>• Forward clutch worn</li> <li>• U/D one-way clutch not operating properly</li> </ul>
N → R time lag is longer	<ul style="list-style-type: none"> <li>• Line pressure too low</li> <li>• Direct clutch worn</li> <li>• 1st and reverse brake worn</li> <li>• U/D brake worn</li> </ul>

## 9. HYDRAULIC TEST

(a) Measure the line pressure.

### NOTICE:

- Do the test at normal operating ATF temperature 50 – 80°C (122 – 176°F).
- The line pressure test should be 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 transaxle case left side and connect SST.  
SST 09992-00094 (09992-00230, 09992-00270)  
(See page [AX-16](#) for the location to connect SST)
  - (3) Chock the 4 wheels.
  - (4) Fully apply the parking brake.
  - (5) Start the engine and check idling speed.
  - (6) Keep your left foot pressed firmly on the brake pedal and shift into D position.
  - (7) Measure the line pressure when the engine is idling.
  - (8) Fully depress the accelerator pedal. Quickly read the highest line pressure when engine speed reaches stall speed.

### NOTICE:

Release the accelerator pedal and stop test if the wheels begin to rotate before the engine speed reaches specified stall speed.

(9) In the same way, do the test in R position.

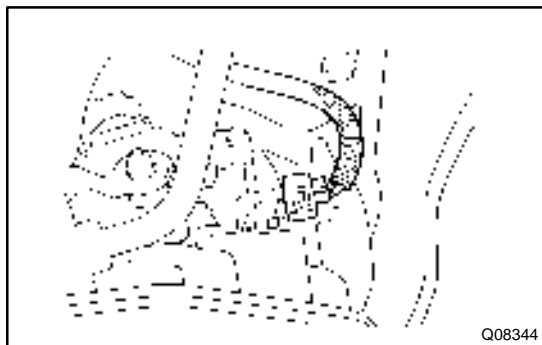
### Specified line pressure:

Condition	D position kPa (kgf/cm <sup>2</sup> , psi)	R position kPa (kgf/cm <sup>2</sup> , psi)
Idling	373 – 422 (3.8 – 4.3, 54 – 61)	637 – 794 (6.5 – 8.1, 92 – 115)
Stall	735 – 863 (7.5 – 8.8, 107 – 125)	1,334 – 1,579 (13.6 – 16.1, 193 – 229)

If the measured pressures are not up to specified values, recheck the throttle cable adjustment and do a retest.

### Evaluation

Problem	Possible cause
If the measured value in all position are higher	<ul style="list-style-type: none"> <li>• Throttle cable out of adjustment</li> <li>• Throttle valve defective</li> <li>• Regulator valve defective</li> </ul>
If the measured values at all position are lower	<ul style="list-style-type: none"> <li>• Throttle cable out of adjustment</li> <li>• Throttle valve defective</li> <li>• Regulator valve defective</li> <li>• Oil pump defective</li> <li>• U/D direct clutch defective</li> </ul>
If pressure is low in the D position only	<ul style="list-style-type: none"> <li>• D position circuit fluid leakage</li> <li>• Forward clutch defective</li> </ul>
If pressure is low in the R position only	<ul style="list-style-type: none"> <li>• R position circuit fluid leakage</li> <li>• Direct clutch defective</li> <li>• 1st and reverse brake defective</li> </ul>



## 10. MANUAL SHIFTING TEST

### HINT:

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

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

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

Shift Position	Gear Position
D	O/D
2	3rd
L	1st
R	Reverse
P	Pawl Lock

### HINT:

If the L, 2 and D position gear positions are difficult to distinguish, do the following road test.

- While driving, shift through the L, 2 and D positions. Check that the gear change corresponds to the shift position.

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

- (c) Connect the solenoid wire.
- (d) Cancel out DTC (See page [DI-126](#)).