



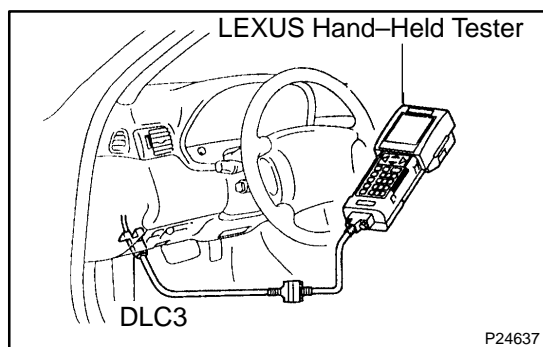
## PRE-CHECK

### 1. DIAGNOSIS SYSTEM

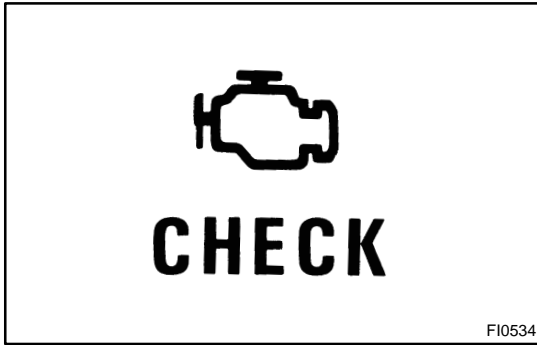
#### (a) Description

- When troubleshooting OBD II vehicles, the only difference from the usual troubleshooting procedure is that you connect the OBD II scan tool complying with SAE J1978 or LEXUS hand-held tester to the vehicle, 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 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-13](#)).

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 LEXUS hand-held tester to DLC3 on the vehicle. The OBD II scan tool or LEXUS 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-311](#)).
- 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 for a malfunction that is only detected once or momentarily (LEXUS hand-held tester) (See page [DI-300](#)).
- \*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-59](#)).

- (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:

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

- (1) Prepare the OBD II scan tool (complying with SAE J1978) or LEXUS hand-held tester.
- (2) Connect the OBD II scan tool or LEXUS hand-held tester to DLC3 at the lower left of the instrument panel.
- (3) Turn the ignition switch ON and turn the OBD II scan tool or LEXUS hand-held tester switch ON.
- (4) Use the OBD II scan tool or LEXUS hand-held tester to check the DTCs and frozen frame data. Note them down (For operating instructions, see the OBD II scan tool's instruction book.).
- (5) See page [DI-311](#) to confirm the details of the DTCs.

### NOTICE:

**When simulating symptoms with an OBD II scan tool (excluding LEXUS 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)

#### HINT:

LEXUS 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 the check mode.

#### (a) Check the DTC.

##### (1) Initial conditions.

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

##### (2) Turn the ignition switch OFF.

##### (3) Prepare the LEXUS hand-held tester.

##### (4) Connect the LEXUS hand-held tester to DLC3 at the lower left of the instrument panel.

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

##### (6) Switch the LEXUS 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 LEXUS 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 check mode to normal mode, so all DTCs, etc. are erased.

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

#### (b) Clear the DTC.

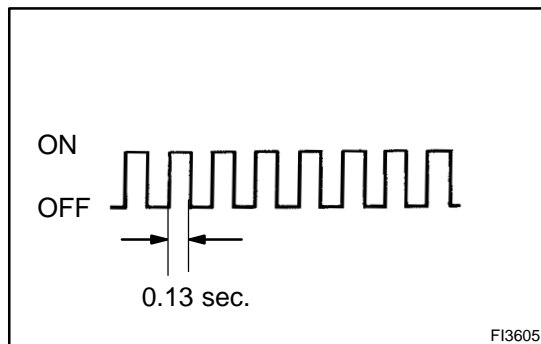
The following actions will erase the DTCs and freeze frame data.

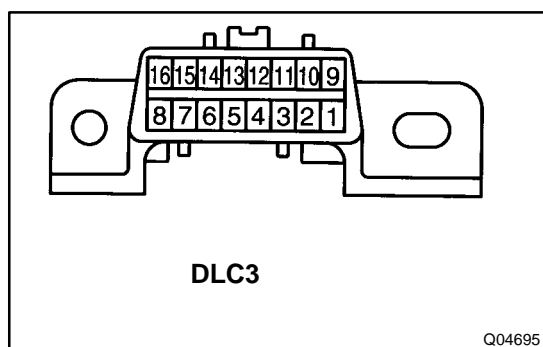
Operating the OBD II scan tool (complying with SAE J1978) or LEXUS hand-held tester to erase the codes.

(See the OBD II scan tool's instruction book for operating instructions.)

#### NOTICE:

**If the LEXUS 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) Inspect the DLC3.  
The vehicle's ECM uses V.P.W. (Variable Pulse Width) for communication to comply with SAE J1850. The terminal arrangement of DLC3 complies with SAE J1962 and matches the V.P.W. format.

Tester connection	Specified condition	Condition
2 (Bus ⊕ Line) ↔ 5 (Signal Ground)	Pulse generation	During transmission
4 (Chassis Ground) ↔ Body ground	1 Ω or less	Always
5 (Signal Ground) ↔ Body ground	1 Ω or less	Always
16 (B+) ↔ Body ground	1 Ω or less	Always
	9 – 14 V	

**HINT:**

If your display shows "UNABLE TO CONNECT TO VEHICLE" when you have connected the cable of the OBD II scan tool or LEXUS 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**

LEXUS 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 the DTCs (See step 3).
- (2) Set the check mode (See step 3).
- (3) Perform a simulation test (See page [IN-29](#)).
- (4) Check the connector and terminal (See page [IN-29](#)).
- (5) Visual check and contact pressure check (See page [IN-29](#)).
- (6) Handle the connector (See page [IN-29](#)).

**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 transmission does not up-shift, does not down-shift, 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.

## 6. ROAD TEST

### NOTICE:

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

(a) D position test (NORM and PWR pattern)

Shift into the D position and fully depress accelerator pedal 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-49](#)).

Conduct the test for both Normal and Power patterns.

### HINT:

O/D Gear Up-shift and Lock-up Prohibition Control:

- When the following 2 conditions occur at the same time, the ECM prohibits O/D gear up-shift and lock-up.

The engine coolant temperature is 60°C (140°F) or less.

The vehicle speed is 63km/h (39 mph) or less.

However, if the engine coolant temperature is below 60°C (140°F) but the vehicle speed exceed 63 km/h (39 mph), O/D gear and lock-up prohibition is canceled.

Cancellation continues until the IG SW is turned OFF.

- If there is a 10 km/h (6 mph) difference between the set cruise control speed and vehicle speed.

3rd Gear Up-shift Position Control:

When the following 2 conditions occur at the same time, the ECM prohibits up-shift to 3rd gear.

The engine coolant temperature is 35 °C (95 °F) or less.

The vehicle speed is 40 km/h (25 mph) or less.

However, if the engine coolant temperature is below 35°C (95°F) but the vehicle speed exceeds 40 km/h (25 mph), 3rd gear prohibition is canceled.

Cancellation continues until the IG SW is turned OFF.

(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 noises and vibration.

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

### HINT:

The check for the cause of abnormal noises and vibration must be performed very thoroughly as it could also be due to loss of balance in the propeller shaft, 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-49](#)).

(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 58 km/h (36 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 fully depress the accelerator pedal and check 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-49](#)).

## 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 noises during acceleration and deceleration, and for shock at up-shift and down-shift.

## (c) L position test

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

## (1) Check no up-shift

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

## (2) Check engine braking

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

## (3) Check for abnormal noises during acceleration and deceleration.

## (d) R position test

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

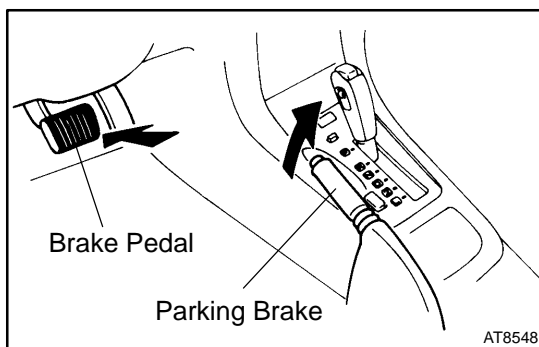
**CAUTION:**

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

## (e) P position test

Stop the vehicle on a gradient (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.

**7. BASIC INSPECTION**

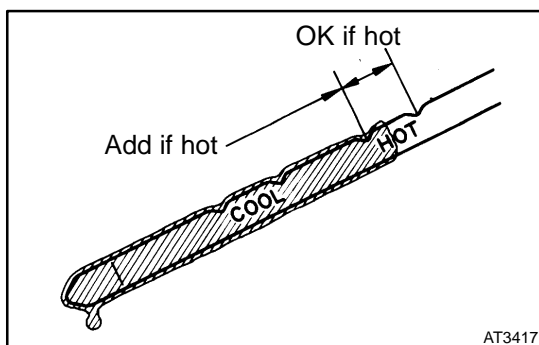
## (a) Check the fluid level.

## HINT:

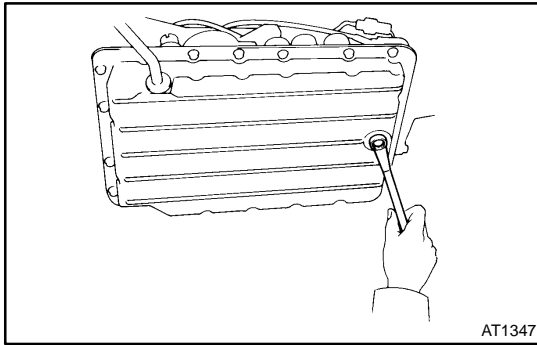
- Drive the vehicle so that the engine and transmission are at normal operating temperature.

**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 the L position and return to the P position.
- (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 D-II or DEXRON®III (DEXRON®II)**

**NOTICE:**

**Do not overfill.**

(b) Check the fluid condition.

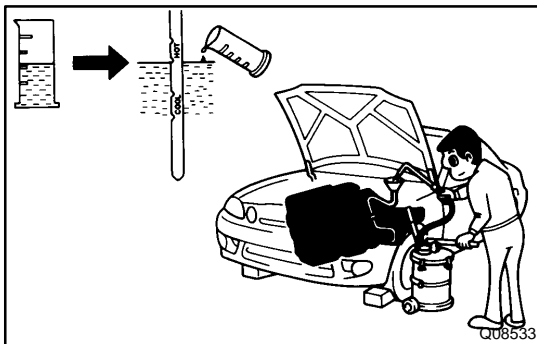
If the fluid smells burnt or is black, replace it.

(c) Replace 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 D-II or DEXRON®III (DEXRON®II)**

**Capacity:**

**Drain and refill: 1.6 liters (1.7 US qts, 1.4 Imp. qts)**

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

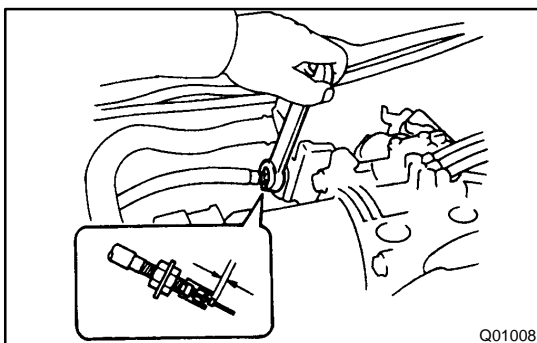
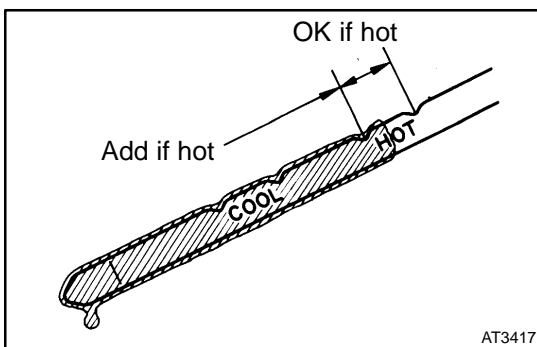
**NOTICE:**

**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, FIPG, oil seals, plugs or other parts.



(e) Inspect and adjust the throttle cable.

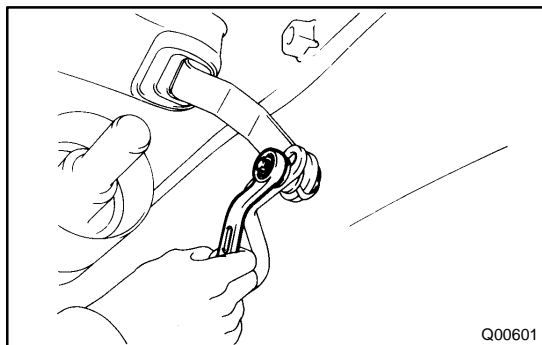
(1) Check that the throttle valve is fully closed.

(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.)**

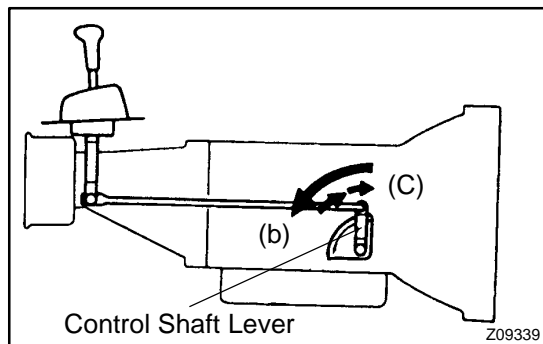
If the distance is not standard, adjust the cable by the adjusting nuts.



- (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:

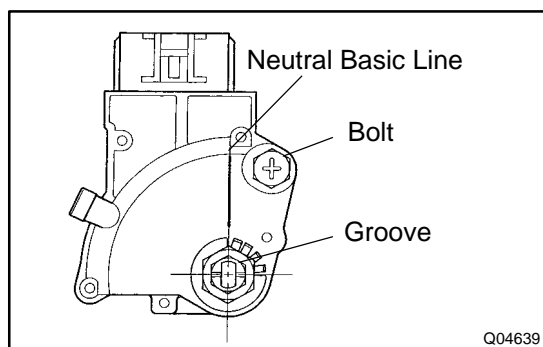
- (1) Loosen the nut on the shift lever subassembly.
- (2) Push the control shaft lever fully rearward.



- (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 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 position and reverses when shifting it to the R position.



- (g) Inspect and adjust the park/neutral position. 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 procedure:

- (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: 13 N·m (130 kgf-cm, 9 ft-lbf)**

For continuity inspect of the park/neutral position switch, see page [DI-335](#).

- (h) Check the idle speed.

**Idle speed: 650 ± 50 rpm**

**(In the 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 transmission and engine by measuring the stall speeds in the D and R positions.

#### NOTICE:

- **Do the test at normal operating fluid 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 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 OBD II scan tool or LEXUS hand-held tester to DLC3.
  - (3) Fully apply the parking brake.
  - (4) Keep your left foot pressed firmly on the brake pedal.
  - (5) Start the engine.
  - (6) Shift into the D position. Press all the way down on the accelerator pedal with your right foot. Quickly read the stall speed at this time.

**Stall speed: 2,450 ± 150 rpm**

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

**Stall speed: 2,450 ± 150 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 not operating properly</li> </ul> <p>HINT: If more than 600 rpm below the specifies value, the torque converter clutch could be faulty.</p>
(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>• O/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>• O/D one-way clutch not operating properly</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>• O/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 O/D direct clutch, forward clutch, direct clutch, and 1st and reverse brake.

**NOTICE:**

- **Do the test at normal operating fluid temperature 50 – 80°C (122 – 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) Start the engine and check idle speed.

**Idle speed: 650 ± 50 rpm (In the N position and A/C OFF)**

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

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

**Time lag:**

**N → D Less than 1.2 seconds**

**N → R Less than 1.5 seconds**

**EVALUATION (If N → D or N → R time lag are longer than specified:)**

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>• O/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>• O/D one-way clutch not operating properly</li> </ul>

**9. HYDRAULIC TEST**

Measure the line pressure.

**NOTICE:**

- **Do the test at normal operating fluid temperature 50 – 80°C (122 – 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 transmission fluid.

(2) Remove the test plug on the transmission case right side and connect SST (See page AT-20 for the location to connect SST).

SST 09992-00094 (09992-00150, 09992-00270)

(3) Fully apply the parking brake and chock the 4 wheels.

(4) Start the engine and check idling speed.

(5) Keep your left foot pressed firmly on the brake pedal and shift into the D position.

(6) Measure the line pressure when the engine is idling.

(7) Press the accelerator pedal all the way down. Quickly read the highest line pressure when engine speed reaches stall speed.

**NOTICE:**

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

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

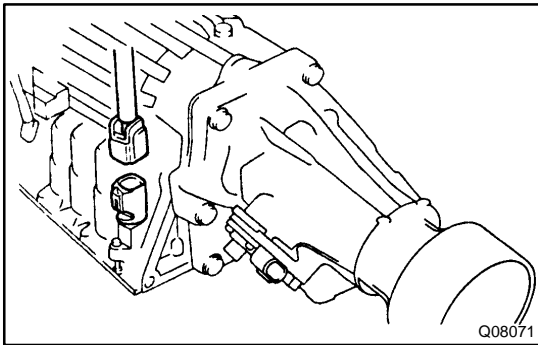
**SPECIFIED LINE PRESSURE:**

Condition	D position kPa (kgf/cm <sup>2</sup> , psi)	R position kPa (kgf/cm <sup>2</sup> , psi)
Idling	362 – 422 (3.7 – 4.3, 53 – 61)	500 – 598 (5.1 – 6.1, 73 – 87)
Stall	902 – 1,147 (9.2 – 11.7, 132 – 166)	1,236 – 1,589 (12.6 – 16.2, 179 – 230)

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

**EVALUATION:**

Problem	Possible cause
If the measured value at all positions 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 value at all positions 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>• O/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 transmission.

- Disconnect the solenoid wire.
- 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 gear positions (L, 2 and D position) 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 transmission itself.
- Connect the solenoid wire.
  - Clear the DTC (See page [DI-300](#)).