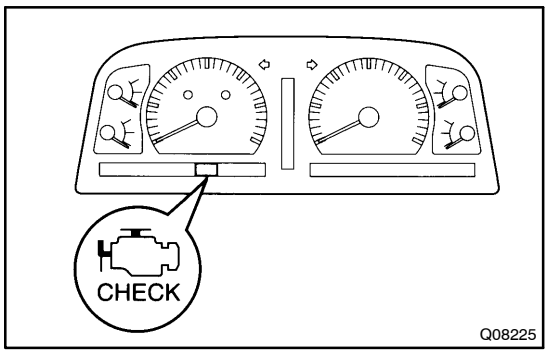
DI5K9–03

PRE–CHECK

1. DIAGNOSIS SYSTEM

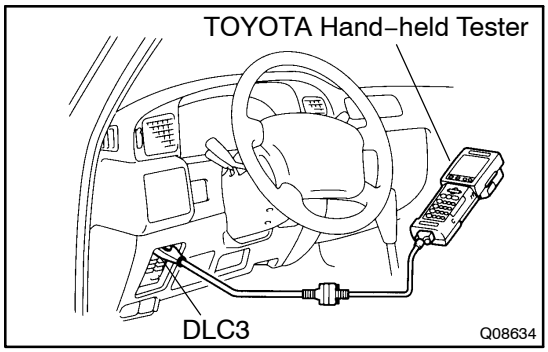
(a) Description

- 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 J1978 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–13).

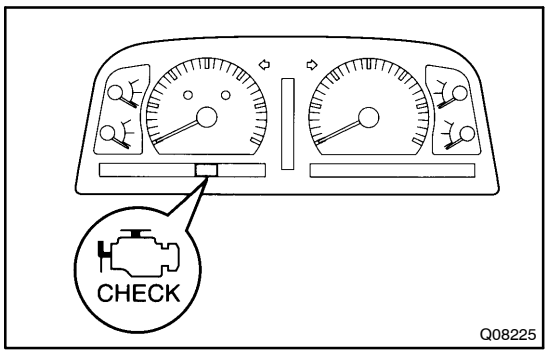
If the malfunction does not occurs in 3 trips, the MIL goes off but the DTCs remain recorded in the ECM memory.



- To check the DTCs, connect an OBD II scan tool or TOYOTA hand–held tester to the 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 OBDII 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 page DI–143).

- 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 (TOYOTA hand–held tester) (See step 3).
- *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 2nd test drive, this 2nd detection causes the MIL to light up.



2. Normal Mode:
INSPECT DIAGNOSIS

(a) Check the MIL.

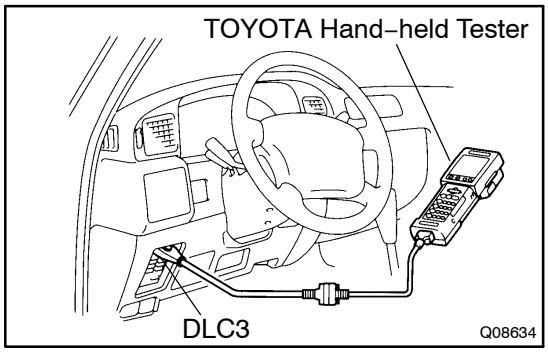
(1) The MIL lights up when the ignition switch is turned ON and the engine is not running.

HINT:
If the MIL does not light up, troubleshoot the combination meter (See page BE–2).

(2) When the engine is started, 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 the normal mode to the check mode, it erases all DTCs and freeze frame data recorded in the 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 the DLC3 in the fuse box at the lower left of the instrument panel.

(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–143 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 the 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 1st time. Them 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. Check Mode:

INSPECT DIAGNOSIS

HINT:

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) Check the initial conditions.

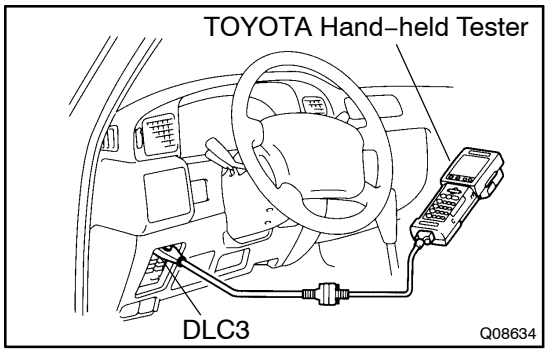
- Battery positive voltage 11 V or more.
- Throttle valve fully closed.
- Transmission in P position.
- Air conditioning switched off.

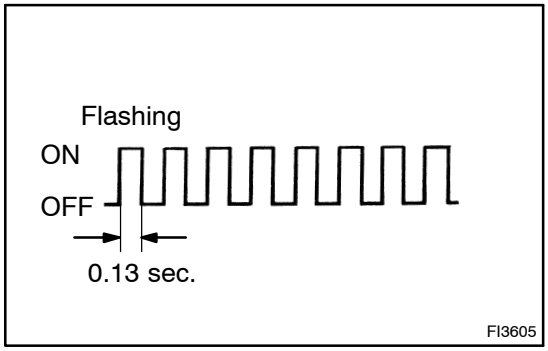
(2) Turn the ignition switch OFF.

(3) Prepare the TOYOTA hand–held tester.

(4) Connect the TOYOTA hand–held tester to the DLC3 in the fuse box at the lower left of the instrument panel.

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





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

(7) Start the engine (The MIL goes).

(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. 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.

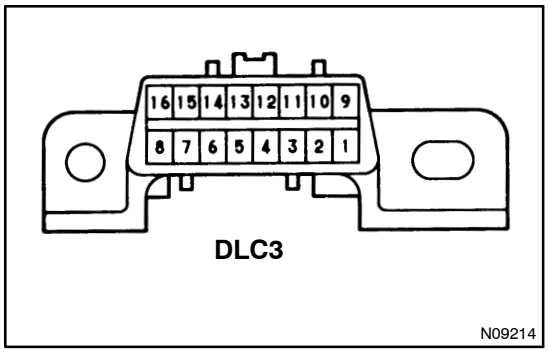
(b) Clear the DTC.

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

Operating the OBD II scan tool (complying with SAE J1978) or 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 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 freezed frame data will be erased.



DLC3

(c) Check 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.

Terminal No.	Connection/Voltage or Resistance	Condition
2	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/9 – 14 V or 1 Ω or less	Always

HINT:
If your display shows ”UNABLE TO CONNECT TO VEHICLE” when you have connected the cable of the OBD II scan tool or TOYOTA 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.

4. CHECK FOR INTERMITTENT PROBLEMS

TOYOTA hand–held tester only:
By putting the vehicle’s ECM in the 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 DTC (See step 3).
(2) Set the check mode (See step 3).
(3) Do a simulation test (See page IN–18).
(4) Check the cnnector connection and terminal (See page IN–28).
(5) Visual check and contact pressure (See page IN–28).
(6) Handle the connector (See page IN–28).

5. ROAD TEST

NOTICE:

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

(a) D position test in NORM and PWR pattern positions.
Shift into the D position and hold the accelerator pedal constant at the full throttle valve opening position and check the following:

HINT:
When the 2nd start switch in on, there is no 1 →2 up–shift and 2 →1 down–shift.

(1) 1 →2, 2 →3 and 3 →O/D up–shift takes place, and shift point should conform to those shown in the automatic shift schedule. Conduct a test under both Normal and Power patterns.

HINT:
There is no O/D up–shift or lock–up when the coolant temperature is below 55˚C (131˚F).

Evaluation:

- If there is no 1 →2 up–shift:
  Shift solenoid valve No. 2 is stuck.
  1–2 shift valve is stuck.
- If there is no 2 →3 up–shift:
  Shift solenoid valve No. 1 is stuck.
  2–3 shift valve is stuck.
- If there is no 3 →O/D up–shift:
  3–4 shift valve is stuck.
- If the shift point is defective:
  Throttle valve, 1–2 shift valve, 2–3 shift valve, 3–4 shift valve etc., are defective.

- If the lock–up is defective:
  Lock–up solenoid is stuck.
  Lock–up control valve is stuck.
  Lock–up signal value is stuck.

(2) In the same way, check the shock and slip at the 1 → 2, 2 → 3 and 3 → O/D up–shift.

Evaluation:

If the shock is excessive:
Line pressure is too high.
Accumulator is defective.
Check ball is defective.

(3) 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 noises and vibration must be made with extreme care as it could also be due to loss of balance in the propeller shaft, differential, torque converter clutch, etc.

(4) 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.

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

(6) Check for the lock–up mechanism.

- Drive in D position, O/D gear, at a steady speed (lock–up ON) of about 95 km/h (59 mph).
- Lightly depress the accelerator pedal and check that the engine RPM does not change abruptly.

If there is a big jump in engine 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, push in one of the pattern selectors and check the following points:

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

(1) Check to see that the 1 → 2 up–shift takes place and that the shift point conforms to the automatic shift schedule.

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

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

Evaluation:

If there is no engine braking effect:
2nd coast brake is defective.

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

(c) L position test.

(1) While running in the L position, check to see that there is no up–shift to 2nd gear.

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

Evaluation:

If there is no engine braking effect:
1stand reverse brake is defective.

(3) Check for abnormal noise during acceleration and deceleration.

(d) R position test.
Shift into the R position and fully depress the accelerator pedal and check for slipping.

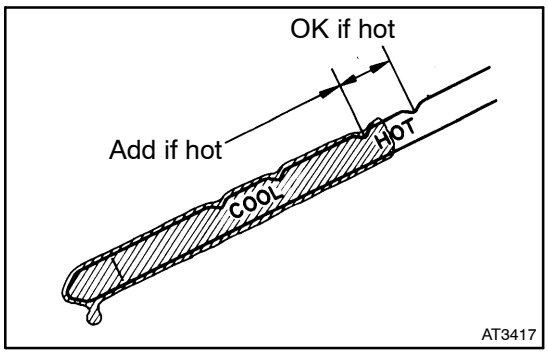
(e) P position test.
Stop the vehicle on a grade (more than 5°) and after shifting into the P position, release the parking brake. Then, check to see that the parking lock pawl holds the vehicle in place.

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 ATF 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 P to L position and return to 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.

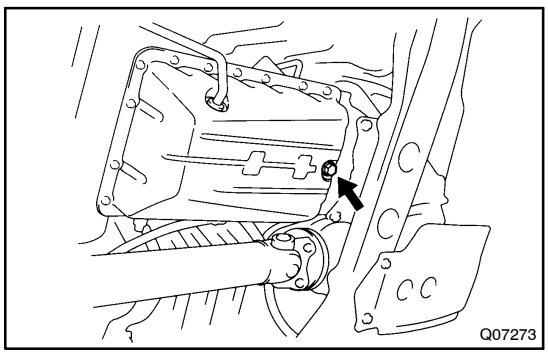
If the level is at the low side, add new fluid.

Fluid type: ATF DEXRON ®II

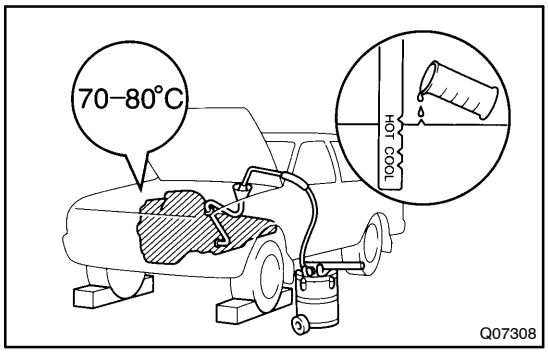
NOTICE:

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 ATF.
(2) Reinstall the drain plug securely.



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

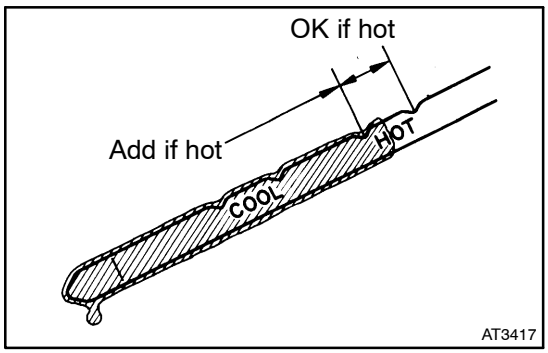
Fluid type: ATF DEXRON ®II

Capacity:

Dry fill: 11.0 liters (11.6 US qts, 9.7 Imp. qts)

Drain and refill: 1.9 liters (2.0 US qts, 1.7 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.

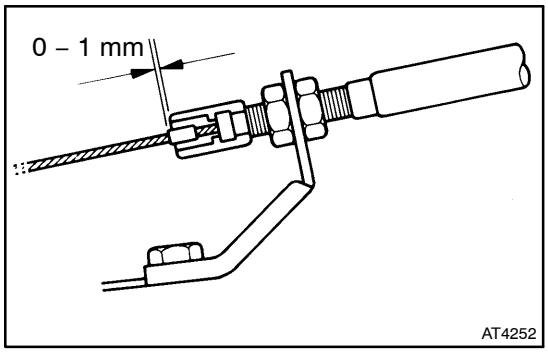
NOTICE:

Do not overfill.

(d) Check the fluid leaks.

Check for leaks in the transmission.

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



(e) Inspect and adjust the throttle cable.

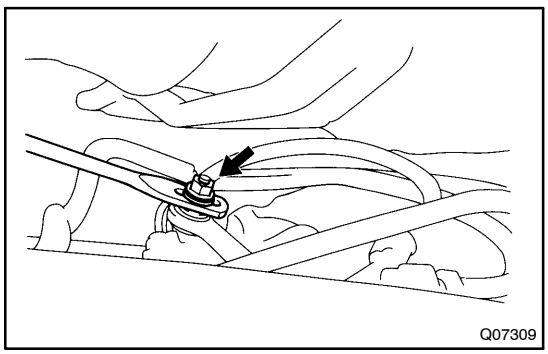
(1) Check that the throttle valve is fully closed.

(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.



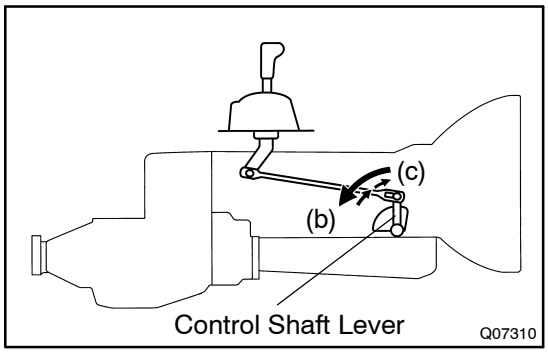
(f) Inspect and adjust the shift lever position.

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 rod.

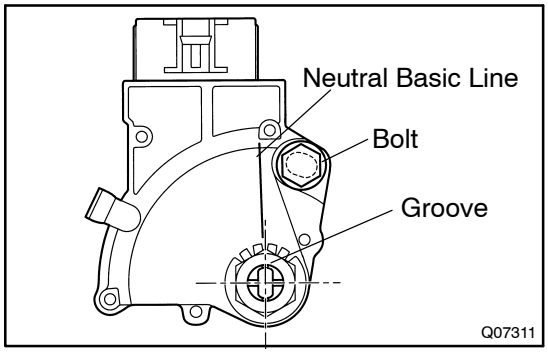
(2) Push the control rod fully rearward.



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

Torque: 13 N·m (130 kgf·cm, 9 ft·lbf)

(7) 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) Inspec and adjust park/neutral positoin 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 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–169.

(h) Check the idle speed.
Idle speed:
650 ± 50 rpm (In N position and air conditioner OFF)

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 positions.

NOTICE:

- **Do the that at normal operating ATF 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 an OBD II scan tool or TOYOTA hand–held tester to the DLC3.
(3) Fully apply the parking brake.
(4) Keep your left foot pressed firmly on the brake pedal.
(5) Start the engine.

(6) Shift into the D position. Press all the way down on the accelerator pedal with your right foot. Quickly read the stall speed at this time.

Stall speed: 1,950 ± 150 rpm

(7) Do the same test in R position.

Stall speed: 1,950 ± 150 rpm

Evaluation:

Problem	Possible cause
Stall speed low in D and R positions	• Engine output may be insufficient • Stator one–way clutch is operating properly HINT: If more than 600 rpm below the specified value, the torque converter clutch could be faulty.
Stall speed high in D position	• Line pressure too low • Forward clutch slipping • No. 2 one–way clutch not operating properly • O/D one–way clutch not operating properly
Stall speed high in R position	• Line pressure too low • Direct clutch slipping • 1st and reverse brake slipping • O/D clutch slipping
Stall speed high in D and R positions	• Line pressure too low • Improper fluid level • O/D one–way clutch not operating properly

(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 ATF 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 N position and air conditioner OFF)

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

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

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

If N → D time or N → R time lag is longer than specified:

Evaluation:

Problem	Possible cause
N → D time lag is longer	• Line pressure too low • Forward clutch worn • O/D one–way clutch not operating properly
N → R time lag is longer	• Line pressure too low • Direct clutch worn • 1st and reverse brake worn • O/D one–way clutch not operating properly

8. HYDRAULIC TEST

Measure the line pressure.

NOTICE:

- **Do the test at normal operation ATF 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 ATF.

(2) Remove the test plug on the transmission case right side and connect SST (See page AT–18 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 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 the specified stall speed.

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

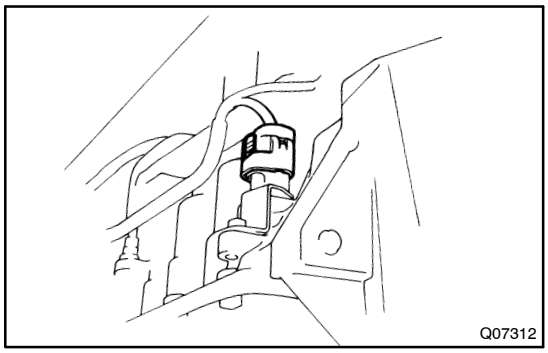
Specified line pressure:

Condition	D position kPa (kgf/cm^2, psi)	R position kPa (kgf/cm^2, psi)
Idling	422 – 481 (4.3 – 4.9, 61 – 70)	510 – 608 (5.2 – 6.2, 74 – 88)
Stall	1,285 – 1,530 (13.1 – 15.6, 128 – 153)	1,579 – 1,932 (16.1 – 19.7, 158 – 193)

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	• Throttle cable out of adjustment • Throttle valve defective • Regulator valve defective
If the measured value at all positions are lower	• Throttle cable out of adjustment • Throttle valve defective • Regulator valve defective • Oil pump defective • O/D direct clutch defective
If pressure is low in the D position only	• D position circuit fluid leakage • Forward clutch defective
If pressure is low in the R position only	• R position circuit fluid leakage • Direct clutch defective • 1st and reverse brake defective



9. MANUAL SHIFTING TEST

The purpose of this manual shifting test is to determine whether a problem is caused by either mechanical or electrical factors. Disconnecting the solenoid wire disables electrically–controlled automatic gear shifting. In this case, operating the shift lever is the only way to shift the transmission gear. If the gear is not changed by shift lever operation, it is assumed that there is a mechanical problem.

(a) Turn the ignition switch OFF.
(b) Disconnect the solenoid wire connector.
(c) Warm up the engine.
(d) Drive the vehicle.
(e) Check the transmission operation when the shift lever is moved into L, 2 and D positions.

Standard:

Shift Lever	Operation
L to 2	Shift up
2 to D	Shift up
D to 2	Shift down
2 to L	Shift down

(f) Turn the ignition switch OFF.
(g) Connect the solenoid wire connector.
(h) Clear DTCs.

HINT:

When the solenoid wire is disconnected, the transmission gear will be set as listed below:

Shift Lever	Gear
P	Parking
R	Reverse
N	Neutral
D	O/D (4th)
2	3rd
L	1st