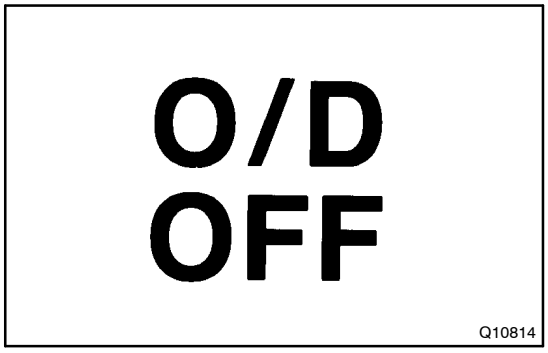
DI9TC–02

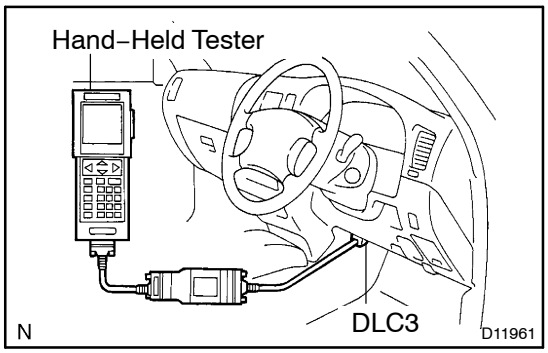


PRE–CHECK

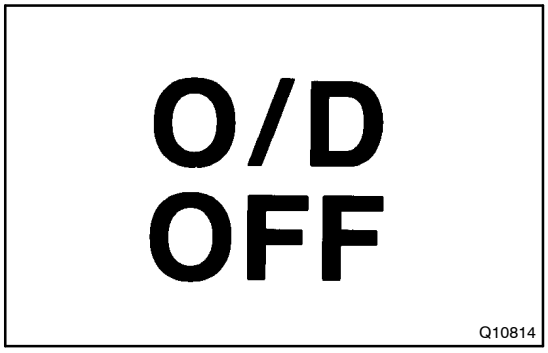
1. DIAGNOSIS SYSTEM

Description

- When troubleshooting Multiplex (M–OBD) vehicles, the only difference from the usual troubleshooting procedure is that you connect the hand–held tester to the vehicle, and read off various data output from the vehicle's Engine & ECT ECU.
  The vehicle's on–board computer lights up the O/D OFF indicator light blink the instrument panel when the computer detects a malfunction in the computer itself or in drive system components. In addition to the O/D OFF indicator light blinking when a malfunction is detected, the applicable DTCs are recorded in the Engine & ECT ECU memory (See page DI–16).
  If the malfunction not occurs in 3 trips, the O/D OFF indicator light goes off but the DTCs remain recorded in the Engine & ECT ECU memory.



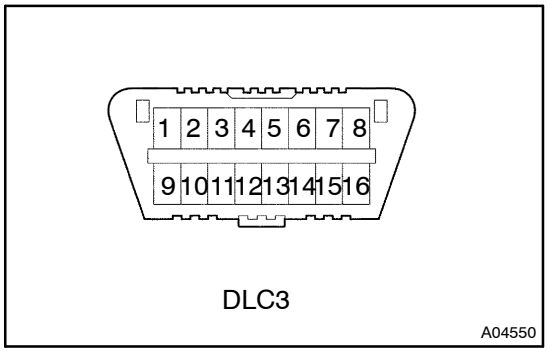
- To check the DTCs, connect a hand–held tester to DLC3 on the vehicle or read the number of blinks of the O/D OFF indicator light when TC and CG terminals on the DLC3 are connected. The hand–held tester also enables you to erase the DTCs and activate the several actuators and check freeze frame data and various forms of engine data (For instruction book).
- The diagnosis system operates in normal mode during normal vehicle use, and also has a check (test) mode for technicians to simulate malfunction symptoms and perform troubleshooting. Most DTCs use 2–trip detection logic (*) to prevent erroneous detection and ensure thorough malfunction detection. By switching the Engine & ECT ECU to check (test) mode using hand–held tester when troubleshooting, the technician can cause the O/D OFF indicator light blink for a malfunction that is only detected once or momentarily.
- *2 trip–detection logic:
  When a logic malfunction is first detected, the malfunction is temporarily stored in the Engine & ECT ECU memory.
  If the same malfunction is detected again during the 2nd test drive, this 2nd detection causes the O/D OFF indicator light blink.



2. INSPECT DIAGNOSIS (NORMAL MODE)

(a) Check the O/D OFF indicator light.
  (1) Turn the ignition switch to ON.
  (2) Check that the O/D OFF indicator light light up when the O/D main switch is pushed out to OFF and goes off when the O/D main switch is pushed in to ON.

HINT:
- If the O/D OFF indicator light does not light up or stays on all the time, carry out the check for "O/D OFF Indicator Light Circuit" on page DI–43.
- If the O/D OFF indicator light blinks, a malfunction code is stored in the ECU memory.



(b) Inspect the DLC3.
The vehicle's Engine & ECT ECU uses ISO 14230 for communication. The terminal arrangement of DLC3 complies with ISO 15031–3 and matches the ISO 14230 format.

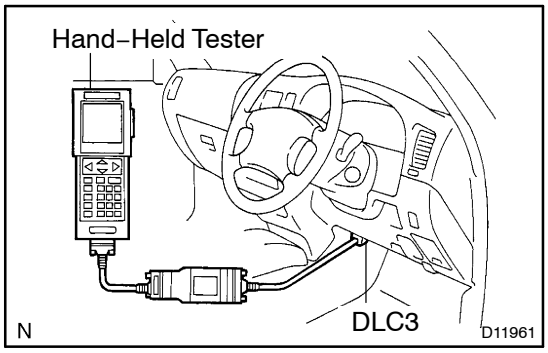
Terminal No.	Connection	Voltage or Resistance	Condition
7	Bus ⊕ Line	Pulse generation	During transmission
4	Chassis Ground	↔ Body Ground / 1 Ω or less	Always
16	Battery Positive	↔ Body Ground / 9 ~ 14 V	Always

HINT:
If your display shows "UNABLE TO CONNECT TO VEHICLE" when you have connected the cable of hand–held tester to DLC3, turned the ignition switch ON and operated the hand–held tester, 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.

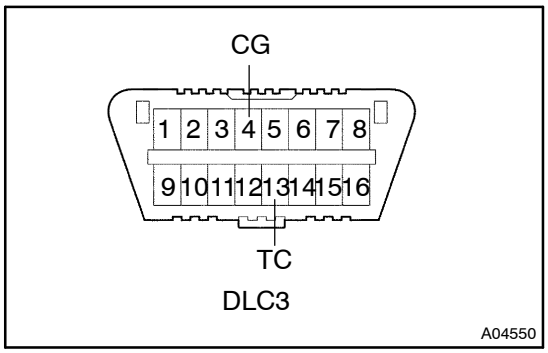
(c) Check the DTC (Using hand–held tester).

NOTICE:

When the diagnostic system is switched from normal mode to check (test) 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.



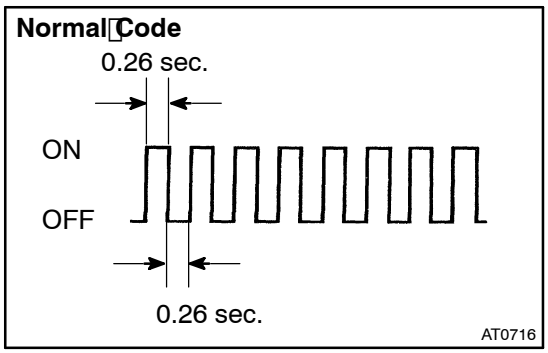
(1) Prepare hand–held tester.
(2) Connect the hand–held tester to DLC3 at the lower of the instrument panel.
(3) Turn the ignition switch ON and turn the hand–held tester switch ON.
(4) Use the hand–held tester to check the DTCs and instructions, see the hand–held tester instruction book.
(5) See page DI–16 to confirm the details of the DTCs.



(d) Check the DTC (Not using hand–held tester).
(1) Turn the ignition switch ON, but do not start the engine.
(2) Push in the O/D main switch to ON.

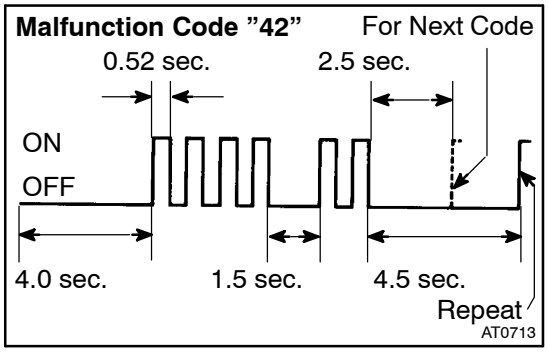
HINT:
Warning and DTCs can be read only when the O/D main switch is ON. If it is OFF, the O/D OFF indicator light will light up continuously and will not blink.

(3) Using SST, connect terminals 13 (TC) and 4 (CG) of DLC3.
SST 09843–18040



(4) Read the DTC indicated by the number of times the O/D OFF indicator light blinks.

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



(5) 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 MODE)

HINT:

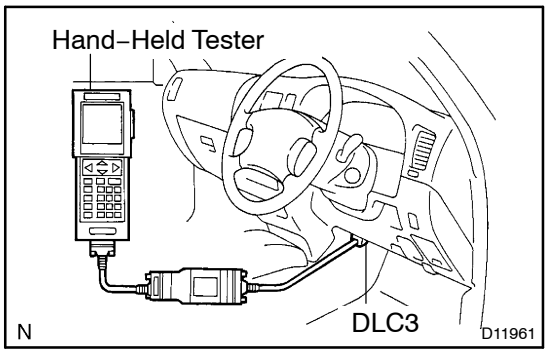
Hand–held tester only: Compared to the normal mode, the check mode has high sensing ability to detect malfunctions. Furthermore, the same diagnostic items which are detected in Normal mode can also be detected in check mode.

(a) Check DTC.

(1) Check the initial conditions.
- Battery positive voltage 11 V or more
- Throttle valve fully closed
- Transmission in P range
- Air conditioning switched off

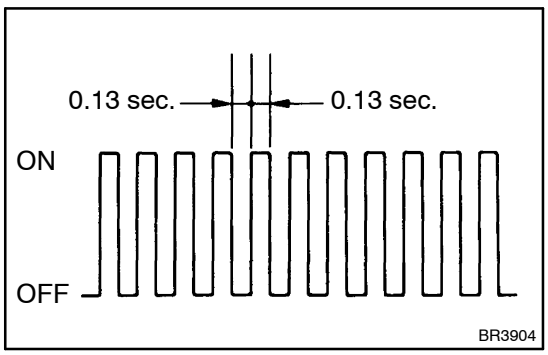
(2) Turn the ignition switch OFF.

(3) Prepare a hand–held tester.



(4) Connect the hand–held tester to DLC3 at the lower of the instrument panel.

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



(6) Switch the hand–held tester from Normal mode to Check mode (Check that the O/D OFF indicator light flashes).

(7) Start the engine (O/D OFF indicator light goes out after the engine starts).

(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 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, so all DTCs etc. are erased.

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

(b) When using hand–held tester:
Clearance DTC.
The following actions will erase the DTC and freeze frame data. Operate a hand–held tester to erase the codes.

(c) When not using hand–held tester:
Clearance DTC.
Remove the EFI fuse from engine room R/B for 10 seconds or more.

4. DATA LIST

HINT:

According to the DATA LIST displayed by the Hand–held tester, you can read the value of the switch, sensor, actuator and so on without parts removal. Reading the DATA LIST as a first step of troubleshooting is one of the method to shorten the labor time.

(a) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the Hand–held tester to the DLC3.
(d) Turn the ignition switch ON.
(e) According to the display on tester, read the ”DATA LIST”.

Item	Measurement Item/ Display (Range)	Normal Condition	Diagnostic Note
STOP LIGHT SW	Stop light SW Status/ ON or OFF	• Brake Pedal is depressed: ON • Brake Pedal is released: OFF	←
SHIFT	Actual Gear Range/ 1st, 2nd, 3rd, 4th (O/D)	Shift Lever Range is; • L: 1st • 2: 1st or 2nd • D(O/D OFF): 1st, 2nd or 3rd • D(O/D ON): 1st, 2nd, 3rd or 4th (O/D)	←
LOCK UP SOL	Lock Up Solenoid Status/ ON or OFF	• Lock Up: ON • Except Lock Up: OFF	←
OVERDRV CUT SW2	O/D SW Status/ ON or OFF	O/D SW is; Pushed in (O/D OFF): ON Pushed once again (O/D ON): OFF	←
ECT PWR SW	ECT PWR SW Status/ ON or OFF	ECT PWR SW is; Pushed in: ON Pushed once again: OFF	←
PNP SW [NSW]	PNP SW Status/ ON or OFF	Shift lever range is; P or N: ON Except P or N: OFF	The shift lever range and these values are different, there are failures of the PNP switch or shift cable adjustment.
REVERSE	PNP SW Status/ ON or OFF	Shift lever range is; R: ON Except R: OFF	
2ND	PNP SW Status/ ON or OFF	Shift lever range is; 2: ON Except 2: OFF	
LOW	PNP SW Status/ ON or OFF	Shift lever range is; L: ON Except L: OFF	

SPD (SP2)	Counter Gear Speed display/ min.: 0 km/h (0 mph) max.: 255 km/h (158 mph)	Vehicle stopped: 0 km/h (0 mph)	←
AT FLUID TEMP	ATF Temp. Sensor No. 1 Value/ min.: –40 °C (–40 °F) max.: 215 °C (419 °F)	80 °C (176 °F) (After Stall Test)	If the value is "–40 °C (–40 °F)" or "215 °C (419 °F)", ATF temp. sensor No. 1 circuit is opened or shorted.

5. ACTIVE TEST

HINT:

Performing the ACTIVE TEST using the Hand–held tester allows the relay, VSV, actuator and so on to operate without parts removal. Performing the ACTIVE TEST as a first step of troubleshooting is one of the method to shorten the labor time.

It is possible to display the DATA LIST during the ACTIVE TEST.

(a) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the Hand–held tester to the DLC3.
(d) Turn the ignition switch ON.
(e) According to the display on tester, perform the "ACTIVE TEST".

Item	Test Details	Diagnostic Note
LOCK UP	[Test Details] Control the shift solenoid SL to set the ATM to the lock–up condition. [Vehicle Condition] Vehicle Speed: 58 km/h (36 mph) or more	Possible to check the SL operation.
SHIFT	[Test Details] Operate the shift solenoid valve and set the each shift range by yourself. [Vehicle Condition] Less than 50 km/h (31 mph) [Others] • Press → button: Shift up • Press ← button: Shift down	Possible to check the operation of the shift solenoid values.

6. 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 shift up, shift down, or the shift point is too high or too low conduct the following road test referring to the automatic shift schedule and simulate the problem symptoms.

7. ROAD TEST

NOTICE:

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

(a) D range test

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

(1) Check up–shift operation.

1 → 2, 2 → 3 and 3 → O/D up–shift take place, at the shift point shown in the automatic shift schedule (See page SS–5).

HINT:

- O/D Gear Up–shift Prohibition Control (1. Water temp. is 60 °C (140 °F) or less. 2. If there is a 10 km/h (6 mph) difference between the set cruise control speed and vehicle speed.)
- O/D Gear Lock–up Prohibition Control (1. Brake pedal is depressed. 2.Water temp. is 60 °C (140 °F) or lower)

(2) Check for shift shock and slip.

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

(3) Check for abnormal noises and vibration.
Drive in D range 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 done very thoroughly as it could also be sure to loss of balance in the differential, torque converter, etc..

(4) Check kick–down operation.
While running in the D range, 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–5).

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

(6) Check the lock–up mechanism.
- Drive in D range 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 engine speed does not change abruptly.

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

(b) 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 to see that the 1 → 2 up–shift takes place and that the shift point conforms to the automatic shift schedule (See page SS–5).

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

(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.

(c) 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.

(d) 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.

(e) 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 to see that the parking lock pawl holds the vehicle in place.

8. BASIC INSPECTION

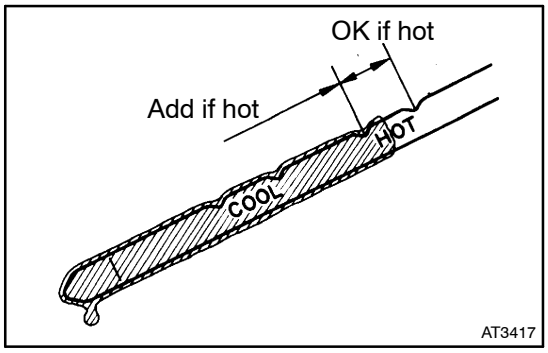
(a) Check the fluid level.

HINT:
Drive the vehicle so that the engine and transaxle are at normal operating temperature.

Fluid temperature: 70 – 80 °C (158 – 176 °F)

(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 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 not within the range, add new fluid.

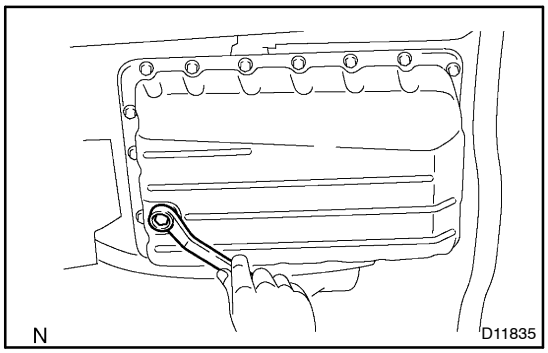
Fluid type: ATF T–IV

NOTICE:

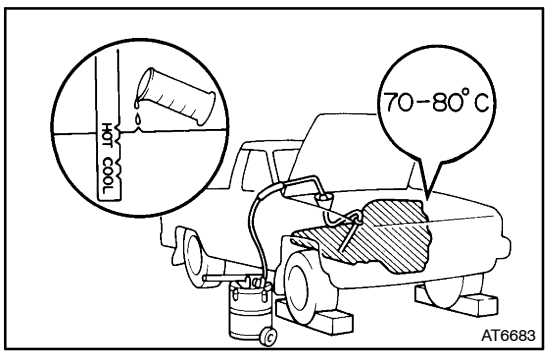
Do not overfill.

(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.

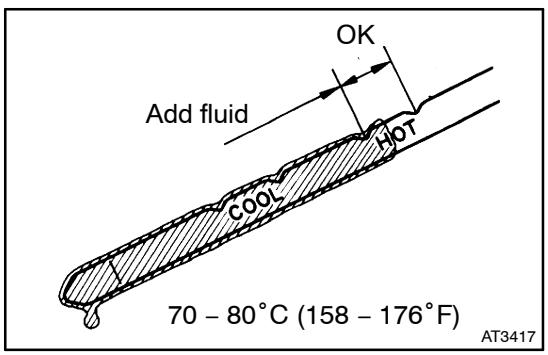


(3) With the engine OFF add new fluid through the oil filler pipe.

Fluid type: ATF T–IV

Capacity: 1.7 liters (1.8 US qts, 1.5 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.

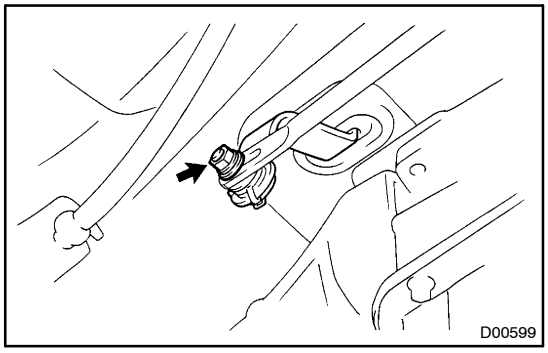
NOTICE:

Do not overfill.

(d) Check the fluid leaks.

Check for leaks in the transmission.

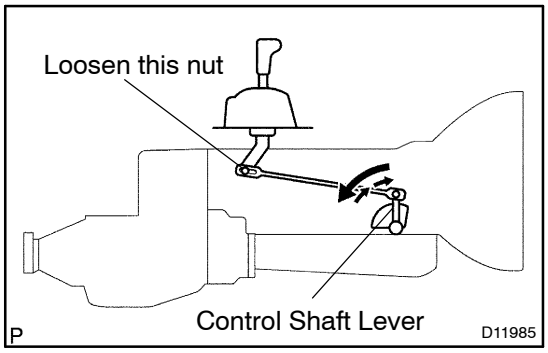
If there are leaks, it is necessary to repair or replace O–rings, FIPGs, oil seals, plugs or other parts.



(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 position indicator is not aligned with the correct position.

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

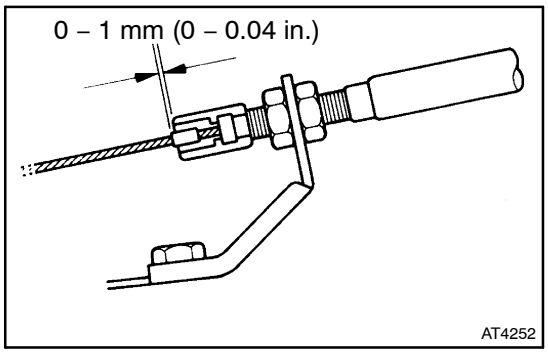
(1) Loosen the nut on the shift lever.
(2) Push the control shaft fully rearward.



(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.

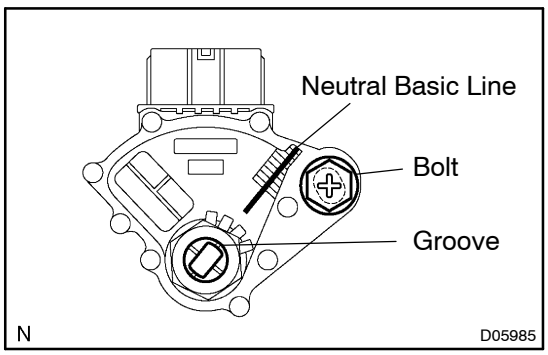


(f) Inspect and adjust the throttle cable.

(1) Check that the accelerator pedal is fully released.
(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 the standard, adjust the cable by the adjusting nuts.



(g) 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.

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

Torque: 13 N·m (130 kgf·cm, 10 ft·lbf)

HINT:
For continuity inspection of the neutral start switch, see page DI–39.

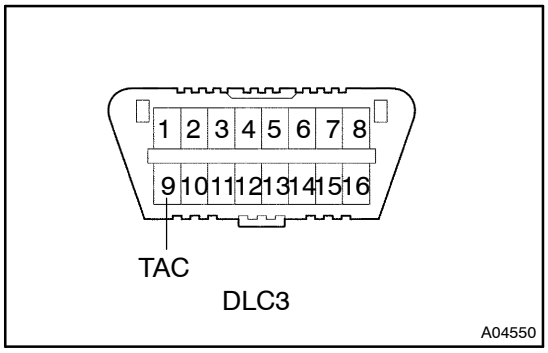
9. MECHANICAL SYSTEM TESTS

(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 ATF temperature 50 – 80 °C (122 – 176 °F).**
- **Do not continuously run this test for 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 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: 2,200 ± 150 rpm

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

Stall speed: 2,200 ± 150 rpm

Evaluation:

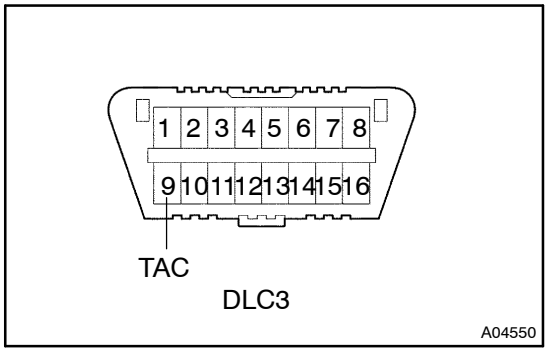
Problem	Possible cause
(a) Stall speed low in D and R ranges	• Engine output may be insufficient • Stator one–way clutch is operating properly HINT: If the value is larger or smaller than the specified value by 600 rpm or more, the torque converter could be faulty.
(b) Stall speed high in D range	• Line pressure too low • Forward clutch slipping • No. 2 one–way clutch not operating properly • O/D one–way clutch not operating properly
(c) Stall speed high in R range	• Line pressure too low • Direct clutch slipping • 1st & reverse brake slipping • O/D one–way clutch not operating properly
(d) Stall speed high in D and R ranges	• 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, and 1st & 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) Chock the 4 wheels.
(2) Connect a hand–held tester to DLC3 or tachometer to terminal TAC of DLC3 with SST.

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(3) Start engine and check idle speed.

Idle speed: 700 ± 50 rpm (In N range and A/C OFF)

(4) Shift the 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

In the same way, 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	• 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 & reverse brake worn • O/D one–way clutch not operating properly

10. HYDRAULIC TEST

(a) 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 stopper 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–13 for the location to connect SST)

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

(3) Fully apply the parking brake and chock the 4 wheels.
(4) Connect a hand–held tester to DLC3.
(5) Start the engine and check idling speed.
(6) Keep your left foot pressing firmly on the brake pedal and shift into D range.
(7) Measure the line pressure when the engine is idling.
(8) Depress the accelerator pedal all the way down. Quickly read the highest line pressure when engine speed reaches stall speed.
(9) In the same way, do the test in R range.

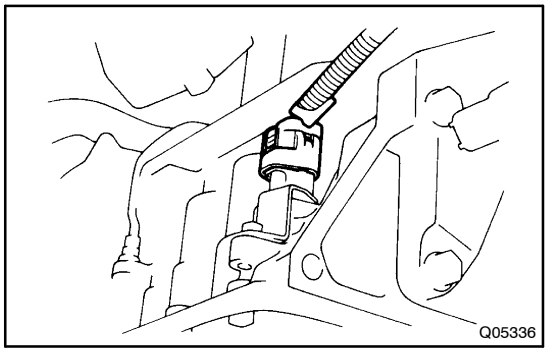
Specified line pressure:

Condition	D range kPa (kgf / cm², psi)	R range kPa (kgf / cm², psi)
Idling	376 – 436 (3.8 – 4.4, 54 – 63)	584 – 684 (6.0 – 7.0, 85 – 100)
Stall	1,032 – 1,177 (10.6 – 12.0, 151 – 171)	1,395 – 1,735 (14.2 – 17.7, 202 – 252)

If the measured pressure is not up to the specified value, recheck the throttle cable adjustment and retest.

Evaluation

Problem	Possible cause
If the measured values at all ranges are higher	•Throttle cable out of adjustment •Throttle valve defect •Regulator valve detective
If the measured values at all ranges are lower	•Throttle cable out of adjustment •Throttle valve defect •Regulator valve defect •Oil pump defect •O/D direct clutch defect
If pressure is low in the D range only	•D range circuit fluid leakage •Forward clutch defect
If pressure is low in the R range only	•R range circuit fluid leakage •Direct clutch defect •1st & reverse brake defect



11. 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 positions correspond to the table below.

While driving, shift through the L, 2 and D ranges.

Check that the gear change corresponds to the shift range.

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

HINT:

If the L, 2 and D range gear positions are difficult to distinguish, do the following read 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.