05A8R–03

PRE–CHECK

1. DIAGNOSIS SYSTEM

(a) Description for Euro–OBD

(1) When troubleshooting Euro–OBD vehicles, the only difference from the usual troubleshooting procedure is that you connect the vehicle to the OBD scan tool complying with ISO 15031–4 or hand–held tester, and read off various data output from the vehicle's ECM.

(2) Euro–OBD regulations require that the vehicle's on–board computer illuminate the Check Engine Warning Light (Malfunction Indicator Lamp)/CHK ENG (MIL) on the instrument panel when the computer detects a malfunction in the emission control system/components or in the driving system components which affect vehicle emissions, or a malfunction in the computer. In addition to CHK ENG (MIL) illuminating when a malfunction is detected, the applicable Diagnostic Trouble Codes (DTCs) prescribed by ISO15031–6 are recorded in the ECM memory.

If the malfunction does not occurs in 3–trip, the CHK ENG (MIL) goes off but the DTCs remain recorded in the ECM memory.

(3) To check the DTCs, connect the OBD scan tool or hand–held tester to the Data Link Connector 3 (DLC3) on the vehicle. The OBD scan tool or hand–held tester also enables you to erase the DTCs and check freezed frame data and various forms of engine data (For operating instructions, see the OBD scan tool's instruction book.).

(4) DTCs include ISO controlled codes and manufacturer controlled codes. ISO controlled codes must be set as prescribed by the ISO, while manufacturer controlled codes can be set freely by the manufacturer within the prescribed limits (See DTC chart on page 05–294).

(5) The diagnosis system operates in normal mode during normal vehicle use. It also has a check mode for technicians to simulate malfunction symptoms and troubleshoot. Most DTCs use 2 trip detection logic (*) to prevent erroneous detection, and ensure thorough malfunction detection. By switching the ECM to check mode when troubleshooting, the technician can cause the CHK ENG (MIL) to light up for a malfunction that is only detected once or momentarily (Hand–held tester only) (See step 2).

(6) *2 trip detection logic:
When a malfunction is first detected, the malfunction code is temporarily stored in the ECM memory (1st trip). If the same malfunction is detected again during the second drive test, this second detection causes the CHK ENG (MIL) to illumenate (2nd trip) (However, the ignition switch must be turned OFF between the 1st trip and the 2nd trip.).

(b) Description M–OBD

(1) 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 ECM.

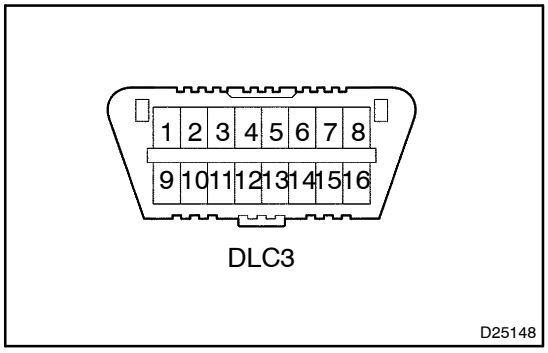
(2) The vehicle's on–board computer illuminate the MIL on the instrument panel when the computer detects a malfunction in the computer itself or in driving system components. In addition to the MIL illuminating when a malfunction is detected, the applicable DTCs are recorded in the ECM memory.

If the malfunction does not occurs in 3–trip, the CHK ENG (MIL) goes off but the DTCs remain recorded in the ECM memory.

(3) To check the DTCs, connect a hand–held tester to DLC3 on the vehicle or read the number of blinks of the MIL 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).

(4) 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 ECM to check (test) mode using hand–held tester when troubleshooting, the technician can cause the MIL to light up 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 ECM memory. If the same malfunction is detected again during the 2nd test drive, this 2nd detection causes the MIL to illuminate.



(c) Inspect the DLC3.

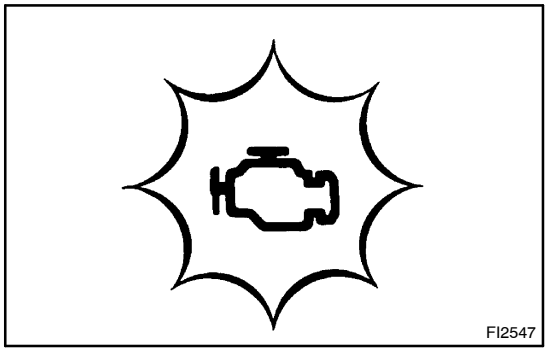
(1) The vehicle's ECM uses the ISO 9141–2 (Euro–OBD)/ISO 14230 (M–OBD) communication protocol. The terminal arrangement of DLC3 complies with ISO 15031–3 and matches the ISO 9141–2/ISO 14230 format.

Terminal No.	Connection	Voltage or Resistance	Condition
7	Bus ⊕ Line	Pulse generation	During communication
4	Chassis Ground	↔ Body Ground / 1 Ω or less	Always
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.



2. INSPECT DIAGNOSIS (NORMAL MODE)

(a) Check the MIL.

(1) The MIL comes on 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.

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

(b) Using hand–held tester:

Check the DTC.

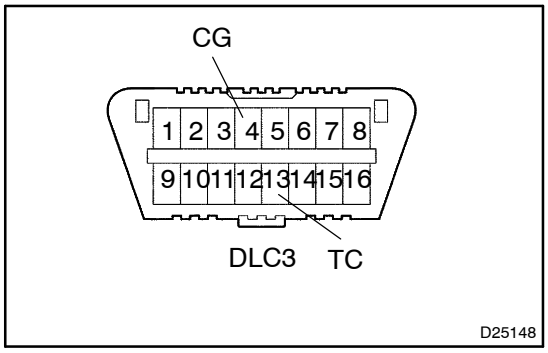
NOTICE:

Hand–held tester only:

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) Use the hand–held tester to check the DTCs and instructions, see the hand–held tester instruction book.

(2) See page 05–294 to confirm the details of the DTCs.

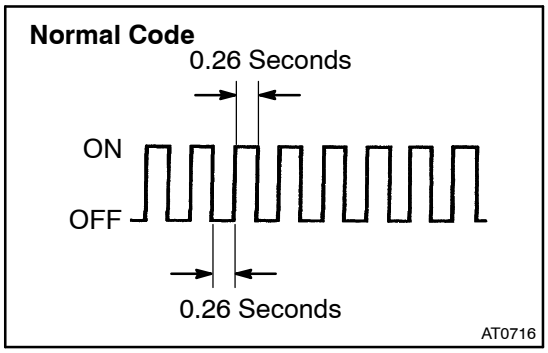


(c) Not using hand–held tester:
Check the DTC.

HINT:
General only:

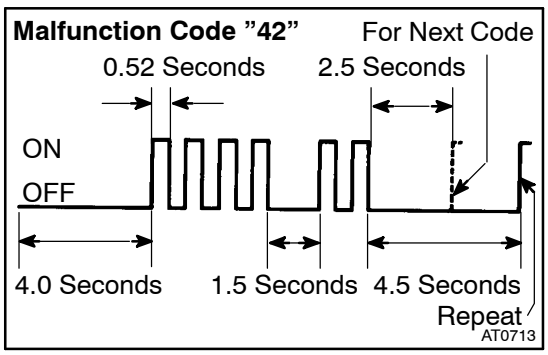
(1) Turn the ignition switch ON, but do not start the engine.

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



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

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



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

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

3. INSPECT DIAGNOSIS (CHECK 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 the DTC.

(1) Check the initial conditions.

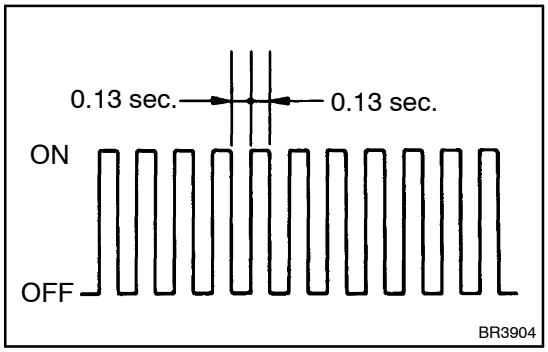
- Battery voltage 11 V or more
- Throttle valve fully closed
- Shift lever in P range
- Air conditioning switched OFF

(2) Turn the ignition switch OFF.

(3) Prepare a hand–held tester.

(4) Connect the hand–held tester to DLC3.

(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 MIL flashes).

(7) Start the engine (MIL 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, all DTCs etc. are erased.

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

(b) Clear the DTC.

(1) When using hand–held tester:

The following operation will erase the DTC and freeze frame data. Operate a hand–held tester to erase the codes.

(2) When not using hand–held tester:

Remove the EFI fuse from engine room J/B for 60 seconds or more.

4. DATA LIST (Except General only)

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 the 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 Position/ 1st, 2nd, 3rd, 4th (O/D)	Shift lever Range is; • L: 1st • 2: 1st or 2nd • 3: 1st, 2nd or 3rd • D: 1st, 2nd, 3rd or 4th (O/D)	←
LOCK UP SOL	Lock Up Solenoid Status/ ON or OFF	• Lock Up: ON • Except Lock Up: 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. HINT: When the failure still occurs even after adjusting these parts, (See page 05–327).
REVERSE	PNP SW Status/ ON or OFF	Shift lever range is; R: ON Except R: OFF	
DRIVE	PNP SW Status/ ON or OFF	Shift lever range is; D and 3: ON Except D and 3: OFF	
3RD	PNP SW Status/ ON or OFF	Shift lever range is; 3: ON Except 3: 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	
SOLENOID (SLT)	Shift Solenoid SLT Status/ ON or OFF	IG SW ON: ON	←
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)	←
SPD (NCO)	Input Speed display: 50 r/min	4th (O/D) gear and lock–up Position; Same as engine speed	←
SNOW SW	Pattern SW (2nd) Status/ ON or OFF	• IG SW ON: OFF ↓ • Pattern SW (2nd) Push: ON ↓ • Pattern SW (2nd) Push: OFF	←
AT FLUID TEMP	ATF Temp. Sensor 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 circuit is opened or shorted.

5. ACTIVE TEST (Except General only)

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 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
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 valves.
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.
LINE PRESS UP *	[Test Details] Operate the shift solenoid SLT and raise the line pressure. [Vehicle Condition] • Vehicle Stopped. • IDL: ON [Others] ON: No action (normal operation) OFF: Line pressure up.	–

*: ”LINE PRESS UP” in ACTIVE TEST is performed to check the line pressure changes by connecting the SST to the automatic transmission same as used in HYDRAULIC TEST.

HINT:

The pressure values in ACTIVE TEST and HYDRAULIC TEST are different from each other.

6. PROBLEM SYMPTOM CONFIRMATION

(a) 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 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.

Check that the 1 → 2, 2 → 3 and 3 → O/D up–shift take place, at the shift point shown in the automatic shift schedule (See page 03–26).

HINT:

- O/D Gear Up–shift Prohibition Control (1. Coolant temp. is 47 °C (117 °F) or less. 2. Vehicle speed is 70 km/h (43 mph) or less.)
- 3rd Gear Up–shift Prohibition Control (1. Coolant temp. is 40 °C (104 °F) or less. 2. Vehicle speed is 55 km/h (34 mph) or less.)
- O/D Gear Lock–up Prohibition Control (1. Brake pedal is depressed. 2. Accelerator pedal is released)
- When the 2nd start switch is on, there is no 1→2 up–shift and 2→1 down–shift.

(2) Check for shift shock and slip.

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

(3) Check for abnormal noise 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 noise 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 03–26).

(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 80 km/h (50 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 that the 1 → 2 up–shift take place and that the shift point conforms to the automatic shift schedule (See page 03–26).

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 noise 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 noise during acceleration and deceleration.

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

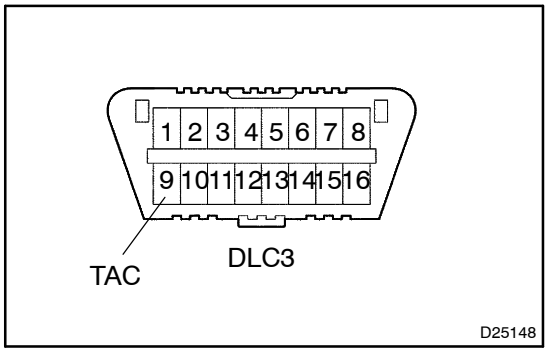
CAUTION:
Before conducting this test ensure that the test area is free from people and obstruction.

(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. 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, do 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.
SST 09843–18030
(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.
(7) Quickly read the stall speed at this time.
Stall speed: 2,350 ± 150 rpm
(8) Do the same test in the R range.
Stall speed: 2,350 ± 150 rpm

Evaluation:

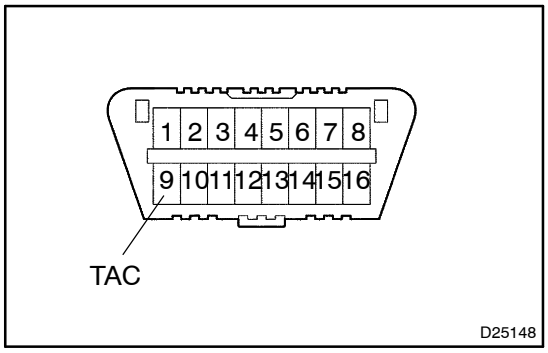
Problem	Possible cause
(a) Stall speed low in D and R ranges	• Engine output may be insufficient • Stator one–way clutch is operating properly HINT: If the value is larger or smaller than the specified value by 600 rpm or more, the torque converter could be faulty.
(b) Stall speed high in D range	• Line 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.

(1) 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 direct clutch, forward 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.**



(2) Chock the all wheels.

(3) Connect a hand–held tester to DLC3 or tachometer to terminal TAC of DLC3 with SST.

SST 09843–18030

(4) Start engine and check idle speed.

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

(5) 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

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

Time lag: N → R less than 1.5 seconds

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

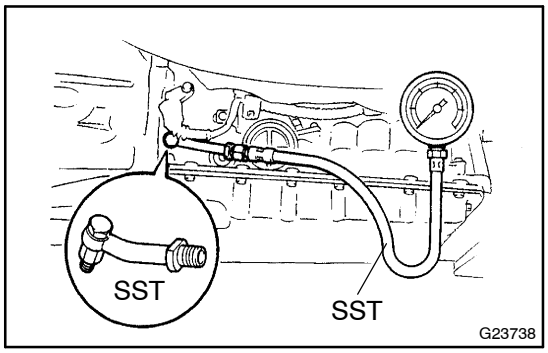
Problem	Possible cause
N → D time lag is longer	• Line pressure too low • Forward clutch worn • O/D one–way clutch not operating properly
N → R time lag is longer	• Line pressure too low • Direct clutch worn • 1st & reverse brake worn • O/D one–way clutch not operating properly

9. 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.**



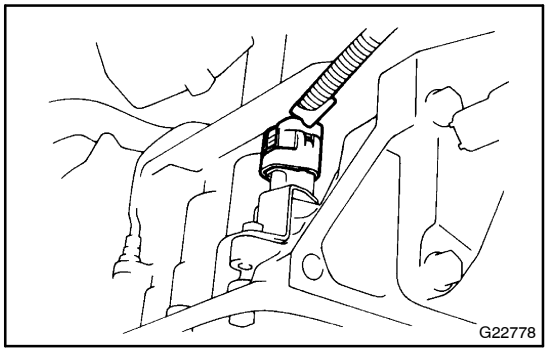
(1) Warm up the ATF.
(2) Remove the test plug on the front side of the transmission case and connect SST.
SST 09992–00095 (09992– 00231, 09992–00271)
(3) Fully apply the parking brake and chock the 4 wheels.
(4) Connect a hand–held tester to DLC3.
(5) Start the engine and check idling speed.
(6) Keep 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 / cm^2, psi)	R range kPa (kgf / cm^2, psi)
Idling	385 – 445 (3.9 – 4.5, 55 – 64)	596 – 696 (6.1 – 7.1, 87 – 101)
Stall	1,197 – 1,337 (12.2 – 13.6, 174 – 193)	1,600 – 1,940 (16.3 – 19.8, 232 – 282)

Evaluation:

Problem	Possible cause
If the measured values at all ranges are higher	• Shift solenoid valve (SLT) defective • Regulator valve detective
If the measured values at all ranges are lower	• Shift solenoid valve (SLT) defective • Regulator valve detective • Oil pump defective • O/D direct clutch defect
If pressure is low in the D range only	• D range circuit fluid leak • Forward clutch defective
If pressure is low in the R range only	• R range circuit fluid leak • Direct clutch defective • 1st & reverse brake defective



10. 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 transmission wire connector.

(b) Inspect the manual driving operation.

Check that the shift and gear ranges 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 positons are difficult to distinguish, do the above road test.

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

(c) Connect the transmission wire connector.

(d) Clear the DTC.