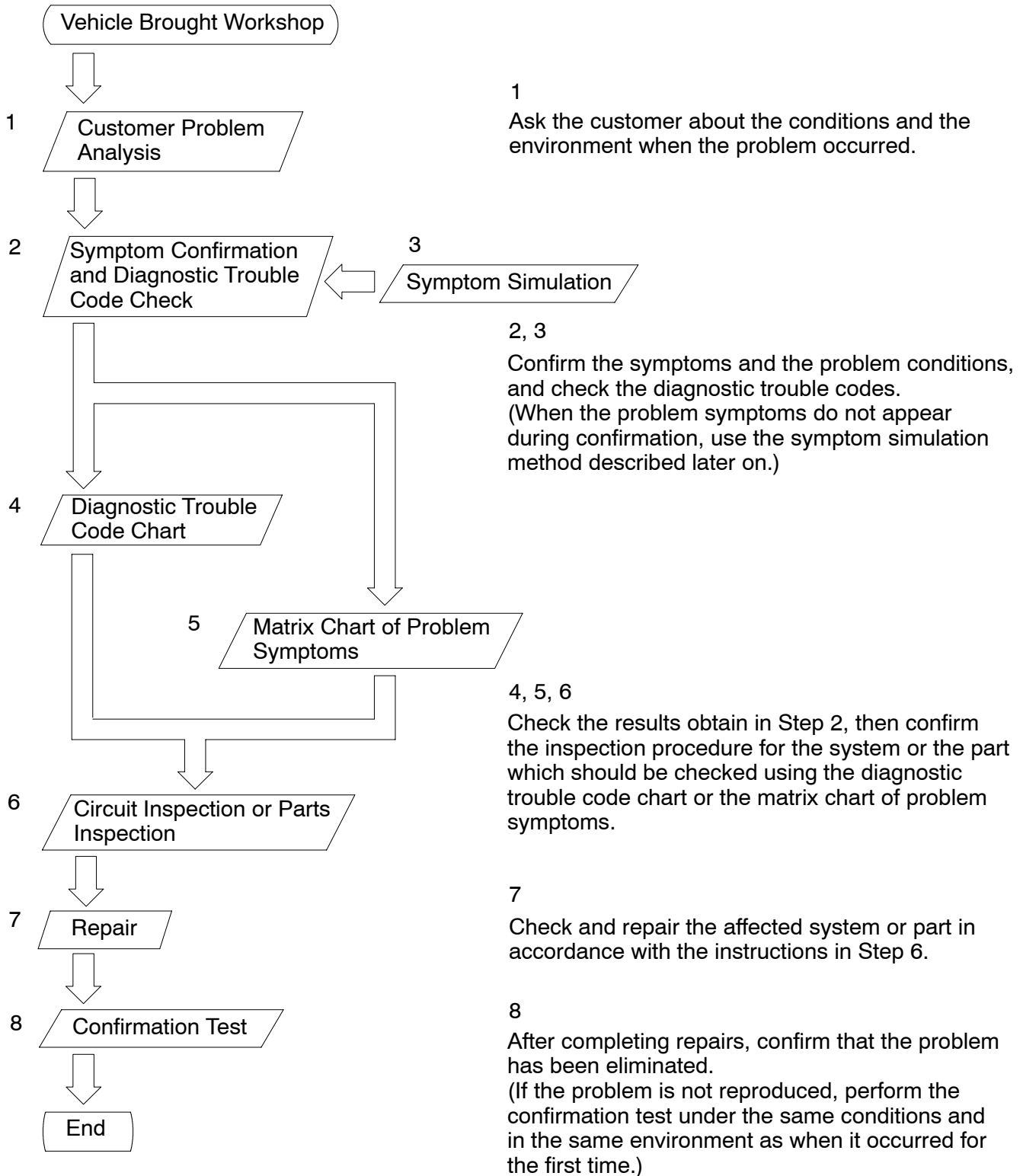


HOW TO PROCEED WITH TROUBLESHOOTING

Carry out troubleshooting in accordance with the procedure on the following page. Here, only the basic procedure is shown. Details are provided in each section, showing the most effective methods for each circuit. Confirm the troubleshooting procedures first for the relevant circuit before beginning troubleshooting of that circuit.



1. CUSTOMER PROBLEM ANALYSIS

In troubleshooting, the problem symptoms must be confirmed accurately and all preconceptions must be cleared away in order to give an accurate judgment. To ascertain just what the problem symptoms are, it is extremely important to ask the customer about the problem and the conditions at the time it occurred.

Important Point in the Problem Analysis:

The following 5 items are important points in the problem analysis. Past problems which are thought to be unrelated and the repair history, etc. may also help in some cases, so as much information as possible should be gathered and its relationship with the problem symptoms should be correctly ascertained for reference in troubleshooting. A customer problem analysis table is provided in the troubleshooting section for each system for your use.

Important Points in the Customer Problem Analysis

- What ----- Vehicle model, system name
- When ----- Date, time, occurrence frequency
- Where ----- Road conditions
- Under what conditions? ----- Running conditions, driving conditions, weather conditions
- How did it happen? ----- Problem symptoms

(Sample) Engine control system check sheet.

ENGINE CONTROL SYSTEM Check Sheet				Inspector's Name _____
Customer's Name		Model and Model Year		
Driver's Name		Frame No.		
Data Vehicle Brought in		Engine Model		
License No.		Odometer Reading	km miles	

Problem Symptoms	☐ Engine does not Start	☐ Engine does not crank ☐ No initial combustion ☐ No complete combustion			
	☐ Difficult to Start	☐ Engine cranks slowly ☐ Other _____			
	☐ Poor Idling	☐ Incorrect first idle ☐ Idling rpm is abnormal ☐ High (rpm) ☐ Low (rpm) ☐ Rough idling ☐ Other _____			
	☐ Poor Drive ability	☐ Hesitation ☐ Back fire ☐ Muffler explosion (after-fire) ☐ Surging ☐ Knocking ☐ Other _____			
	☐ Engine Stall	☐ Soon after starting ☐ After accelerator pedal depressed ☐ After accelerator pedal released ☐ During A/C operation ☐ Shifting from N to D ☐ Other _____			
	☐ Others				

☐ Constant ☐ Sometimes (times per day/month)

2. SYMPTOM CONFIRMATION AND DIAGNOSTIC TROUBLE CODE CHECK

The diagnostic system in the LAND CRUISER fulfills various functions. The first function is the Diagnostic Trouble Code Check in which a malfunction in the signal circuits to the ECU is stored in code in the ECU memory at the time of occurrence, to be output by the technician during troubleshooting. Another function is the Input Signal Check which checks if the signals from various switches are sent to the ECU correctly. By using these check functions, the problem areas can be narrowed down quickly and troubleshooting can be performed effectively. Diagnostic functions are incorporated in the following systems in the LAND CRUISER.

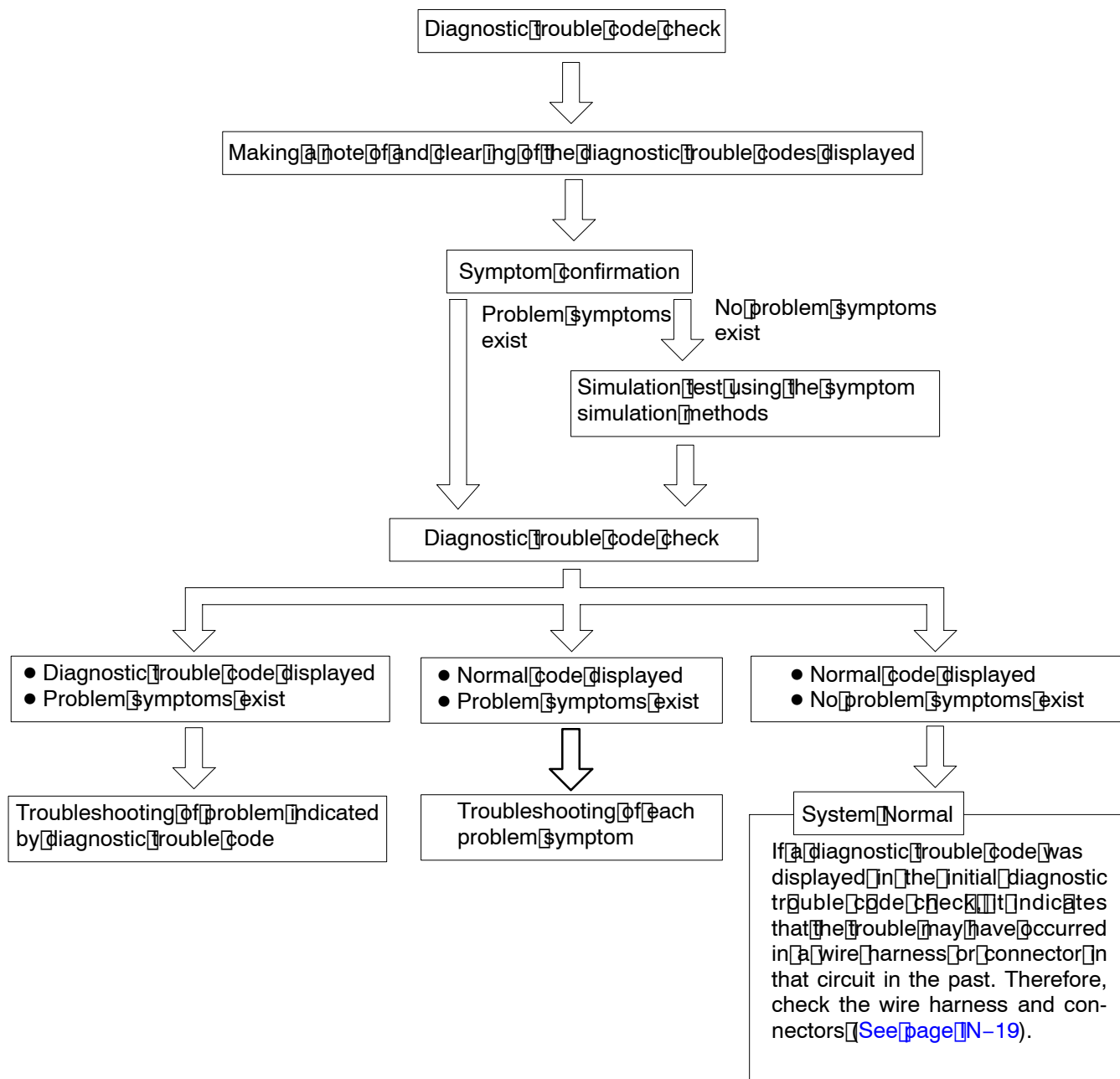
System	Diagnostic Trouble Code Check	Input Signal Check (Sensor Check)	Other Diagnosis Function
Engine	○ (with Check Mode)	○	Diagnostic Test Mode

In diagnostic trouble code check, it is very important to determine whether the problem indicated by the diagnostic trouble code is still occurring or occurred in the past but returned to normal at present. In addition, it must be checked in the problem symptom check whether the malfunction indicated by the diagnostic trouble code is directly related to the problem symptom or not. For this reason, the diagnostic trouble codes should be checked before and after the symptom confirmation to determine the current conditions, as shown in the table below. If this is not done, it may, depending on the case, result in unnecessary troubleshooting for normally operating systems, thus making it more difficult to locate the problem, or in repairs not pertinent to the problem. Therefore, always follow the procedure in correct order and perform the diagnostic trouble code check.

DIAGNOSTIC TROUBLE CODE CHECK PROCEDURE

Diagnostic Trouble Code Check (Make a note of and then clear)	Confirmation of Symptoms	Diagnostic Trouble Code Check	Problem Condition
Diagnostic Trouble Code Display	Problem symptoms exist	Same diagnostic trouble code is displayed	Problem is still occurring in the diagnostic circuit
	→	Normal code is displayed	The problem is still occurring in a place other than in the diagnostic circuit. (The diagnostic trouble code displayed first is either for a past problem or it is a secondary problem.)
	→ No problem symptoms exist		The problem occurred in the diagnostic circuit in the past.
Normal Code Display	→ Problem symptoms exist	Normal code is displayed	The problem is still occurring in a place other than in the diagnostic circuit.
	→ No problem symptoms exist	Normal code is displayed	The problem occurred in a place other than in the diagnostic circuit in the past.

Taking into account the above points, a flow chart showing how to proceed with troubleshooting using the diagnostic trouble code check is shown below. This flow chart shows how to utilize the diagnostic trouble code check effectively, then by carefully checking the results, indicates how to proceed either to diagnostic trouble code troubleshooting or to troubleshooting of problem symptoms.

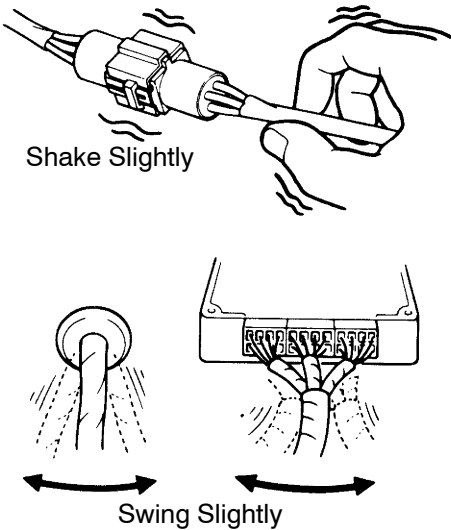
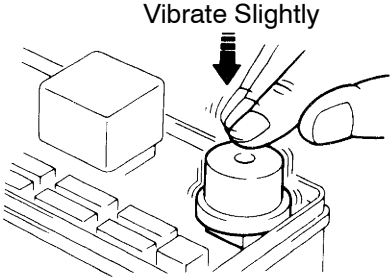


3. SYMPTOM SIMULATION

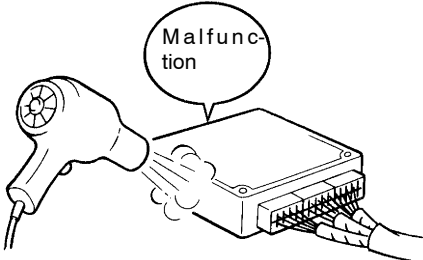
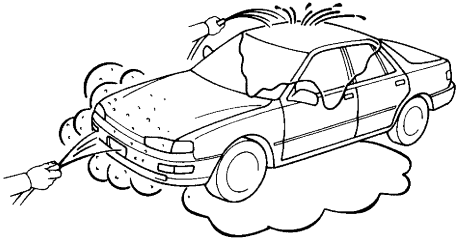
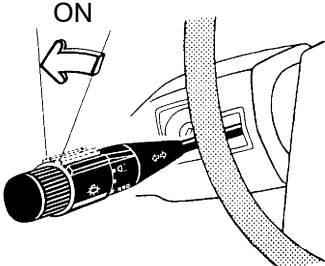
The most difficult case in troubleshooting is when there are no problem symptoms occurring. In such cases, a thorough customer problem analysis must be carried out, then simulate the same or similar conditions and environment in which the problem occurred in the customer's vehicle. No matter how much experience a technician has, or how skilled he may be, if he proceeds to troubleshoot without confirming the problem symptoms he will tend to overlook something important in the repair operation and make a wrong guess somewhere, which will only lead to a standstill. For example, for a problem which only occurs when the engine is cold, or for a problem which occurs due to vibration caused by the road during driving, etc., the problem can never be determined so long as the symptoms are confirmed with the engine hot condition or the vehicle at a standstill. Since vibration, heat or water penetration (moisture) are likely causes for problems which are difficult to reproduce, the symptom simulation tests introduced here are effective measures in that the external causes are applied to the vehicle in a stopped condition.

Important Points in the Symptom Simulation Test:

In the symptom simulation test, the problem symptoms should of course be confirmed, but the problem area or parts must also be found out. To do this, narrow down the possible problem circuits according to the symptoms before starting this test and connect a tester beforehand. After that, carry out the symptom simulation test, judging whether the circuit being tested is defective or normal and also confirming the problem symptoms at the same time. Refer to the matrix chart of problem symptoms for each system to narrow down the possible causes of the symptom.

1	VIBRATION METHOD: When vibration seems to be the major cause.	
CONNECTORS Slightly shake the connector vertically and horizontally. WIRE HARNESS Slightly shake the wire harness vertically and horizontally. The connector joint, fulcrum of the vibration, and body through portion are the major areas to be checked thoroughly.	 FI2331 FI2332	
PARTS AND SENSOR Apply slight vibration with a finger to the part of the sensor considered to be the problem cause and check if the malfunction occurs. HINT: Applying strong vibration to relays may result in open relays.	 FI2330	

V07268

2	HEAT METHOD: When the problem seems to occur when the suspect area is heated.
Heat the component that is the likely cause of the malfunction with a hair dryer or similar object. Check to see if the malfunction occurs. NOTICE: (1) Do not heat to more than 60 °C (140 °F). (Temperature limit that no damage is done to the component.) (2) Do not apply heat directly to parts in the ECU.	 F12334
3	WATER SPRINKLING METHOD: When the malfunction seems to occur on a rainy day or in a high-humidity condition.
Sprinkle water onto the vehicle and check to see if the malfunction occurs. NOTICE: (1) Never sprinkle water directly into the engine compartment, but indirectly change the temperature and humidity by applying water spray onto the radiator front surface. (2) Never apply water directly onto the electronic components. (Service hint) If a vehicle is subject to water leakage, the leaked water may contaminate the ECU. When testing a vehicle with a water leakage problem, special caution must be used.	 F16649
4	OTHER: When a malfunction seems to occur when electrical load is excessive.
Turn on all electrical loads including the heater blower, head lights, rear window defogger, etc. and check to see if the malfunction occurs.	 F12336

4. DIAGNOSTIC TROUBLE CODE CHART

The inspection procedure is shown in the table below. This table permits efficient and accurate troubleshooting using the diagnostic trouble codes displayed in the diagnostic trouble code check. Proceed with troubleshooting in accordance with the inspection procedure given in the diagnostic chart corresponding to the diagnostic trouble codes displayed. The engine diagnostic trouble code chart is shown below as an example.

- DTC No.

Indicates the diagnostic trouble code.

- Page or Instructions

Indicates the page where the inspection procedure for each circuit is to be found, or gives instructions for checking and repairs.

- Trouble Area

Indicates the suspect area of the problem.

- Detection Item

Indicates the system of the problem or contents of the problem.

DTC CHART (SAE Controlled)

HINT: Parameters listed in the chart may not be exactly the same as your reading due to the type of instrument or other factors.

If a malfunction code is displayed during the DTC check in check mode, check the circuit for that code listed in the table below. For details of each code, turn to the page referred to under the "See page" for the respective "DTC No." in the DTC chart.

DTC No. (See page)	Detection Item	Trouble Area	*1 Check Engine Warning Light Normal Mode/ Test Mode	*Memory
12 (DI-25)	Crankshaft Position Sensor Circuit Malfunction	● Open or short in crankshaft position sensor circuit ● Crankshaft position sensor ● Engine ECU	ON / N.A	○
1 ³ (DI-30)	Engine Speed Sensor Circuit Malfunction	● Open or short in engine speed sensor circuit ● Engine speed sensor ● Open or short in STA circuit ● Engine ECU	ON / ON	○
14 (DI-35)	Timing Control System Malfunction	● Open or short in timing control valve circuit ● Fuel filter (Clogging) ● Engine ECU	ON / N.A	○
17	Ignition IC Malfunction	● Engine ECU	ON / N.A	○

5. PROBLEM SYMPTOMS TABLE

The suspect circuits or parts for each problem symptom are shown in the table below. Use this table to troubleshooting the problem when a "Normal" code is displayed in the diagnostic trouble code check but the problem is still occurring. Numbers in the table indicate the inspection order in which the circuits or parts should be checked.

HINT:

When the problem is not detected by the diagnostic system even though the problem symptom is present, it is considered that the problem is occurring outside the detection range of the diagnostic system, or that the problem is occurring in a system other than the diagnostic system.

- Page

Indicates the page where the flow chart for each circuit is located.

- Circuit Inspection, Inspection Order

Indicates the circuit which needs to be checked for each problem symptom. Check in the order indicated by the numbers.

- Problem Symptom

- Circuit or Part Name

Indicates the circuit or part which needs to be checked.

PROBLEM SYMPTOMS TABLE		
Symptom	Suspect Area	See page
Engine not crank (Difficult to start)	1. Starter and starter relay	–
No initial combustion (Difficult start)	1. Engine ECU power source circuit 2. Pre-heating system 3. Compression 4. Engine ECU 5. Injection Pump	DI-124 DI-127 EM-30 DI-128 FU-2
Cold engine (Difficult to start)	1. pre-heating system 2. STA signal circuit 3. Water temperature sensor 4. Injection nozzle 5. Fuel filter 6. Diesel throttle body 7. Engine ECU 8. Injection pump	DI-121 DI-127 DI-85 FU-15 FU-16 ED-5 D-I75 FU-2
Hot engine (Difficult to start)	1. STA signal circuit 2. Injection pump 3. Fuel filter 4. Diesel throttle body 5. Engine ECU 6. Injection pump	AC-54 DL-124

6. CIRCUIT INSPECTION

How to read and use each page is shown below.

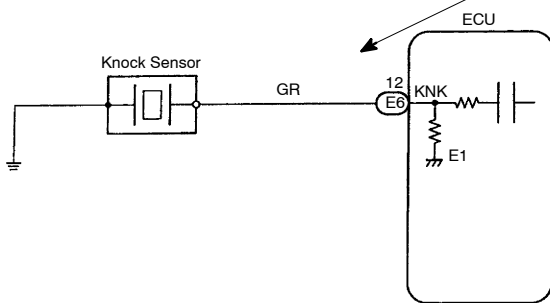
● Diagnostic Trouble Code No. and Detection Item

● Circuit Description
The major role and operation, etc. of the circuit and its component parts are explained.

DTC	14	Timing Control System Malfunction
CIRCUIT DESCRIPTION The engine ECU control the injection timing by actuating the timing control valve. The timing control valve is mounted on the injection pump and delay one by duty control of pump internal fuel pressure. The engine ECU detects the injection advance angle by TDC and NE signal.		
DTC No.	Detection Item	Trouble Area
14	After engine warm up and during, actual injection timing is different from target value of engine ECU calculated for several sec.	● Open or short in timing control valve circuit ● Fuel filter (Clogging) ● Fuel (Freezing Airin) ● Injection pump (Internal pressure and timing control valve) ● Engine ECU

● Indicates the diagnostic trouble code, diagnostic trouble code set parameter and suspect area of the problem.

WIRING DIAGRAM



● Wiring Diagram

This shows a wiring diagram of the circuit.

Use this diagram together with ELECTRICAL WIRING DIAGRAM to thoroughly understand the circuit.

Wire colors are indicated by an alphabetical code.

B = Black, L = Blue, R = Red, BR = Brown,

LG = Light Green, V = Violet, G = Green,

O = Orange, W = White, GR = Gray, P = Pink,

Y = Yellow

The first letter indicates the basic wire color and the second letter indicates the color of the stripe.

- Indicates the position of the ignition switch during the check.

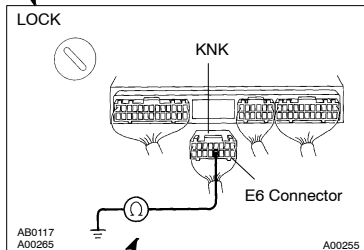


- Inspection Procedure

Use the inspection procedure to determine if the circuit is normal or abnormal, and, if it is abnormal, use it to determine whether the problem is located in the sensors, actuators, wire harness or ECU.

INSPECTION PROCEDURE

1 Check continuity between terminal KNK of ECM connector and body ground.



PREPARATION:

- Remove the glove compartment (See page FI-37).
- Disconnect the E6 connector of ECM.

CHECK:

Measure resistance between terminal KNK of ECU connector and body ground.

OK:

Resistance: 1 MΩ or higher

OK

Go to step 3.

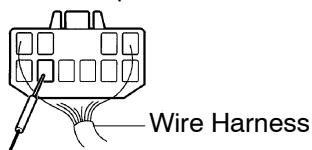
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2 Check knock sensor (See page FI-34).

OK

Replace knock sensor.

- Indicates the place to check the voltage or resistance.
- Indicates the connector position to checked, from the front or back side.

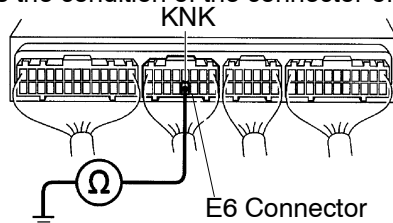


Check from the connector back side.
(with harness)

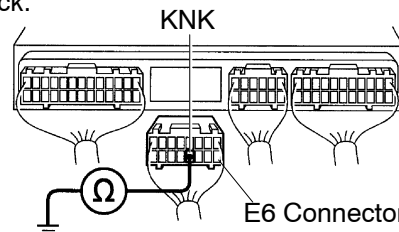


Check from the connector front side. (without harness)
In this case, care must be taken not to bend the terminals.

- Indicates the condition of the connector of ECU during the check.



Connector being checked is connected.



Connector being checked is disconnected.