WORKSHOP MANUAL

F-SERIES

EMISSION AND ELECTRICAL DIAGNOSIS (WITH TECH 2)

6HH1 EVT

(Euro 1)

SECTION 6E

ISUZU

ISUZU
International Service & Parts
Tokyo, Japan

NOTICE

Before using this Workshop Manual to assist you in performing vehicle service and maintenance operations, it is recommended that you carefully read and thoroughly understand the information contained in Section 0A under the headings "GENERAL REPAIR INSTRUCTIONS" and "HOW TO USE THIS MANUAL".

All material contained in this Manual is based on the latest product information available at the time of publication.
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Applicable Model : F-SERIES
6HH1 EVT (Euro 1)

This manual is applicable to 2000 year model and later vehicles.

THIS MANUAL INCLUDES THE FOLLOWING SECTIONS:

SECTION	CONTENTS
6E	EMISSION AND ELECTRICAL DIAGNOSIS

SECTION 6E
EMISSION AND ELECTRICAL DIAGNOSIS

⚠ CAUTION:

When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound, will be notified. The correct torque values must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

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GENERAL DESCRIPTION

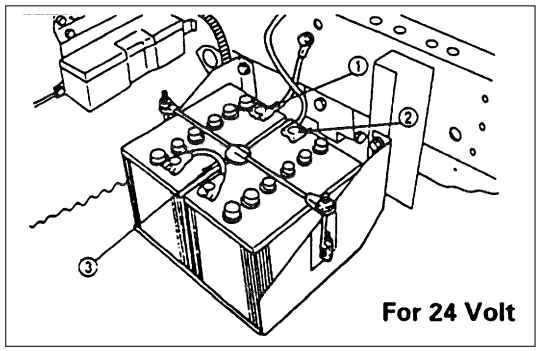
The emission and electrical control system operates on a twenty four volt power supply with negative ground polarity. Each wire in the vehicle is of a specific size and has an identifying colored insulation.
These colors are indicated in wiring diagrams and will help in tracing circuits and making proper connections. Wire size is determined by load capacity and circuit length. Some wires are grouped together and taped. Such a grouping of wires is called a harness.

The harness uses a split corrugated tube to protect the wires from the elements. Each circuit consists of the following:

- Power source — The battery and the alternator.
- Wires — To carry electrical current through the circuit.
- Fuses — To protect the circuit against current overload.
- Relays — To protect voltage drop between the battery and the circuit parts and to protect the switch points against burning.
- Switches — To open and close the circuit.
- Load — Any device, such as a light or a motor, which converts the electrical current into useful work.
- Ground — To allow the current to flow back to the power source.

In this manual, such electrical device is classified by system. For major parts shown on the circuit based on the circuit diagram for each system, inspection and removal and installation procedures are detailed.

NOTES FOR WORKING ON ELECTRICAL ITEMS



BATTERY CABLE

Disconnecting the Battery Cable

1) All switches should be in the "OFF" position.
2) Disconnect the battery ground cable.
3) Disconnect the battery positive cable
4) Disconnect the battery cable ③.

CAUTION:

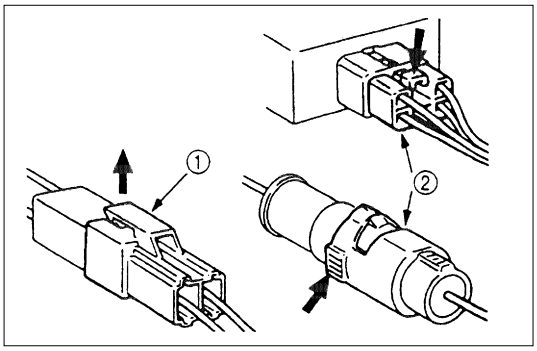
It is important that the battery ground cable be disconnected first.
Disconnecting the battery positive cable first can result in a short circuit.

Connecting the Battery Cable

Follow the disconnecting procedure in the reverse order.

CAUTION:

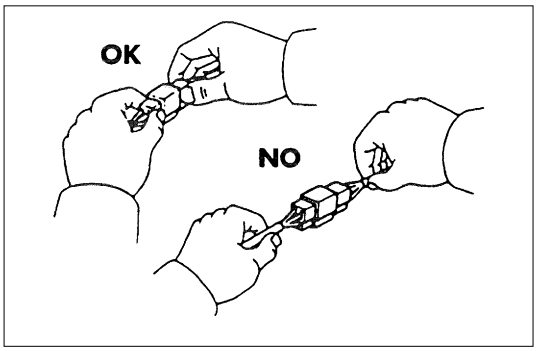
Clean the battery terminal and apply a light coat of grease to prevent terminal corrosion.



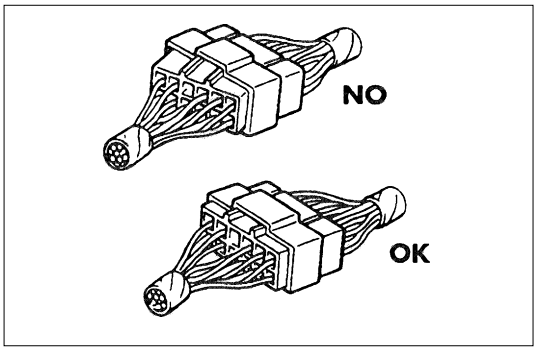
Connecting Handling

Disconnecting The Connectors

Some connectors have a tang lock to hold the connectors together during vehicle operation.
Some tang locks are released by pulling them towards you ①.
Other tang locks are released by pressing them forward ②.
Determine which type of tang lock is on the connector being handled.
Firmly grasp both sides (male and female) of the connector.
Release the tang lock and carefully pull the two halves of the connector apart.

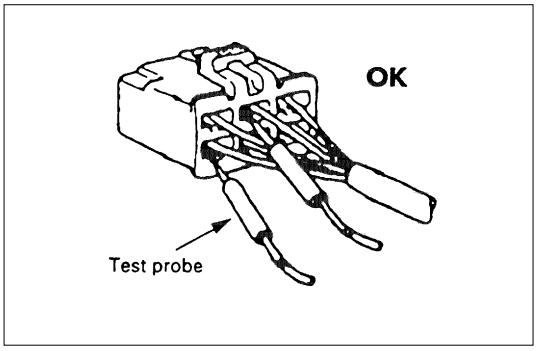


Never pull on the wires to separate the connectors.
This will result in wire breakage.



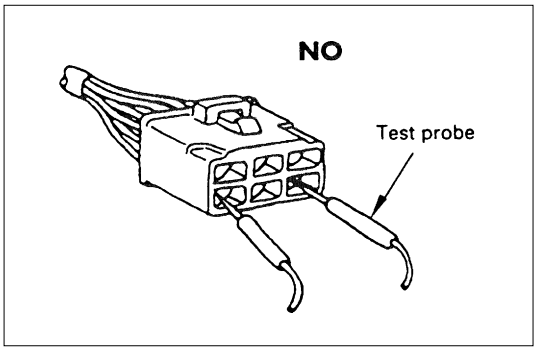
Connecting the Connector

Firmly grasp both sides (male and female) of the connector.
Be sure that the connector pins and pin holes match. Be sure that both sides of the connector are aligned with each other. Firmly but carefully push the two sides of the connector together until a distinct click is heard.

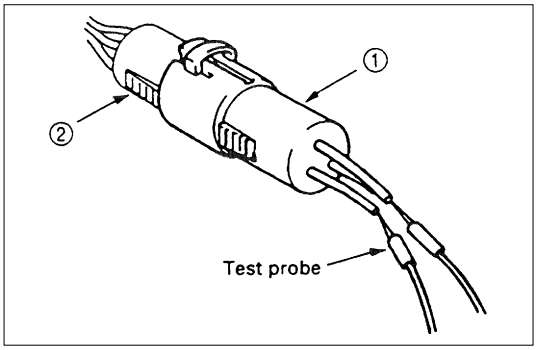


Connector Inspection

Use a circuit tester to check the connector for continuity.
Insert the test probes from the connector wire side.

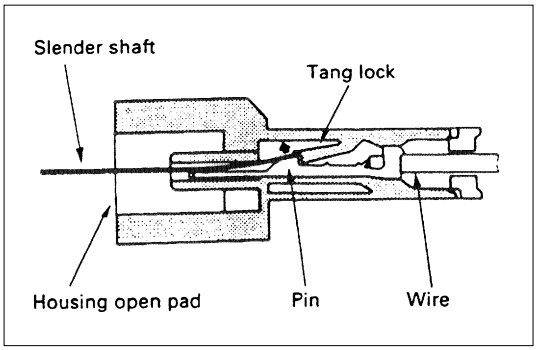


Never insert the circuit tester test probes into the connector open end to test the continuity. Broken or open connector terminals will result.



Waterproof Connector Inspection

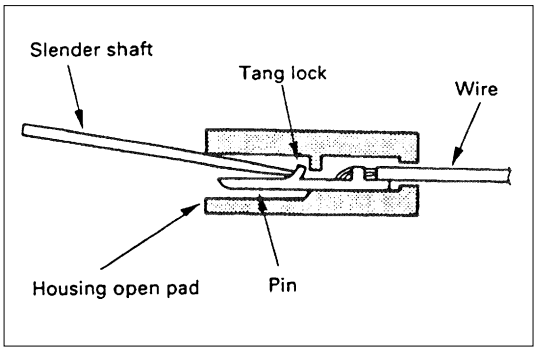
It is not possible to insert the test probes into the connector wire side of a waterproof connector. Use one side of a connector (1) with its wires cut to make the test. Connect the test connector (2) to the connector to be tested. Connect the test probes to the cut wires to check the connector continuity.



Connector Pin Removal

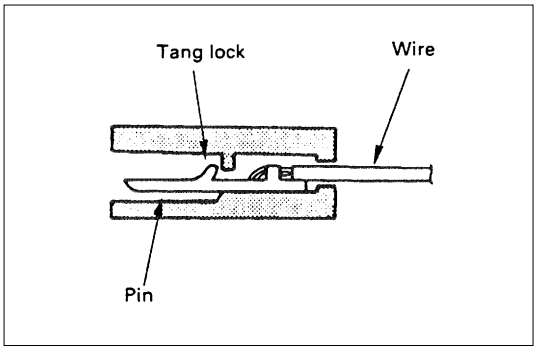
Connector Housing Tang Lock Type

1) Insert a slender shaft into the connector housing open end.
2) Push the tang lock up (in the direction of the arrow in the illustration). Pull the wire with pin free from the wire side of the connector.



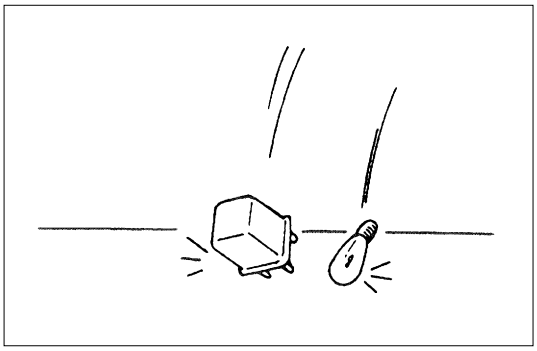
Pin Tang Lock Type

1) Insert a slender shaft into the connector housing open end.
2) Push the tang lock flat (toward the wire side of the connector). Pull the wire with pin free from the wire side of the connector.



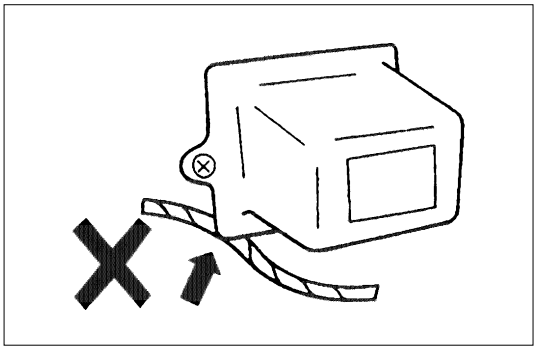
Connector Pin Insertion

1) Check that the tang lock is fully up.
2) Insert the pin from the connector wire side.
   Push the pin in until the tang lock closes firmly.
3) Gently pull on the wires to make sure that the connector pin is firmly set in place.



Parts Handling

Be careful when handling electrical parts. They should not be dropped or thrown, because short circuit or other damage may result.

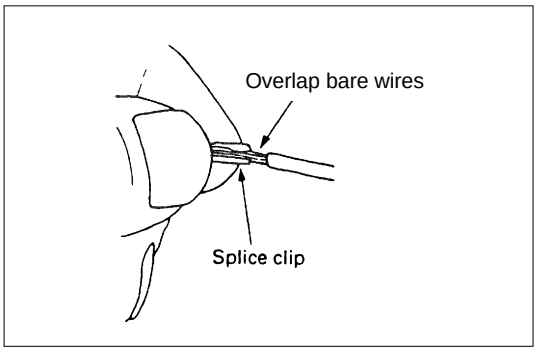


Cable Harness

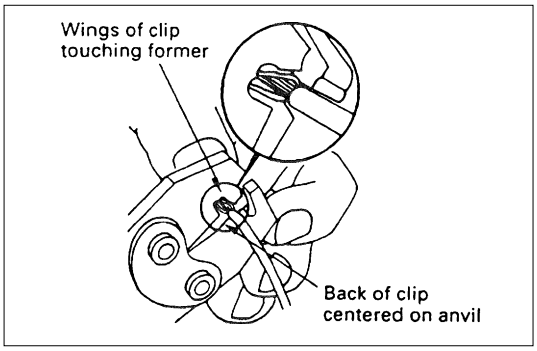
When installing the parts, be careful not to pinch or wedge the wiring harness.
All electrical connections must be kept clean and tight.

SPLICING WIRE

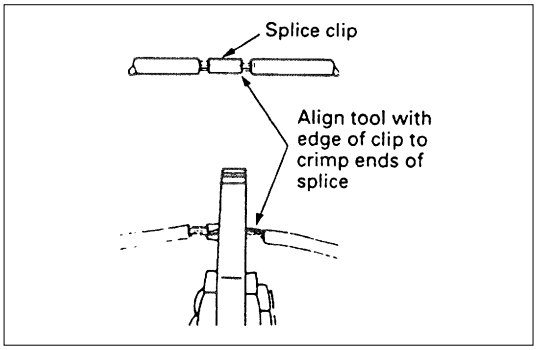
1. **Open the Harness**
   If the harness is taped, remove the tape. To avoid wire insulation damage, use a sewing "seam ripper" (available from sewing supply stores) to cut open the harness.
   If the harness has a block plastic conduit, simply pull out the desired wire.
2. **Cut the wire**
   Begin by cutting as little wire off the harness as possible. You may need the extra length of wire later if you decide to cut more wire off to change the location of a splice. You may have to adjust splice locations to make certain that each splice is at least 1-1/2in (40 mm) away from other splices, harness branches, or connectors.
3. **Strip the insulation**
   When replacing a wire, use a wire of the same size as the original wire. Check the stripped wire for nicks or cut strands. If the wire is damaged, repeat the procedure on a new section of wire. The two stripped wire ends should be equal in length.



4. **Crimp the Wires**
   Select the proper clip to secure the splice. To determine the proper clip size for the wire being spliced, follow the directions included with your clips. Select the correct anvil on the crimper. (On most crimpers your choice is limited to either a small or large anvil.) Overlap the two stripped wire ends and hold them between your thumb and forefinger. Then, center the splice clip under the stripped wires and hold it in place.

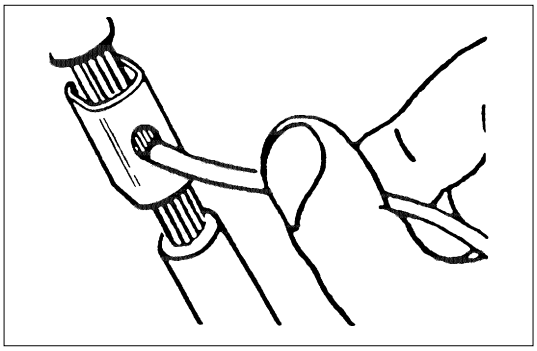


- Open the crimping tool to its full width and rest one handle on a firm flat surface.
- Center the back of the splice clip on the proper anvil and close the crimping tool to the point where the back of the splice clip touches the wings of the clip.
- Make sure that the clip and wires are still in the correct position. Then, apply steady pressure until the crimping tool closes.



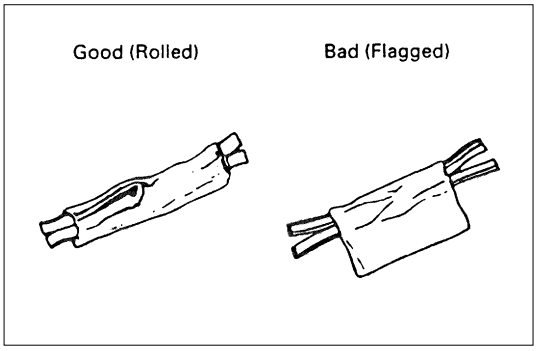
Before crimping the ends of the clip, be sure that:
- The wires extend beyond the clip in each direction.
- No strands of wire are cut loose, and
- No insulation is caught under the clip.

Crimp the splice again, once on each end. Do not let the crimping tool extend beyond the edge of the clip or you may damage or nick the wires.



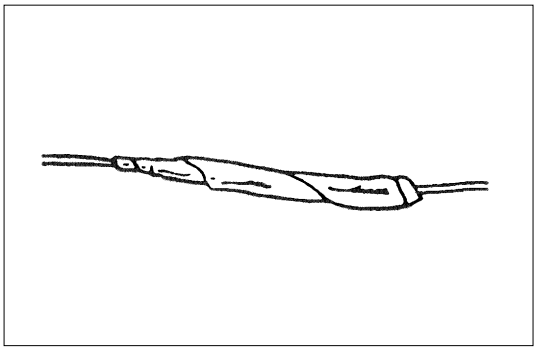
5. Solder

Apply 60/40 rosin core solder to the opening in the back of the clip. Follow the manufacturer's instructions for the solder equipment you are using.



6. Tape the Splice

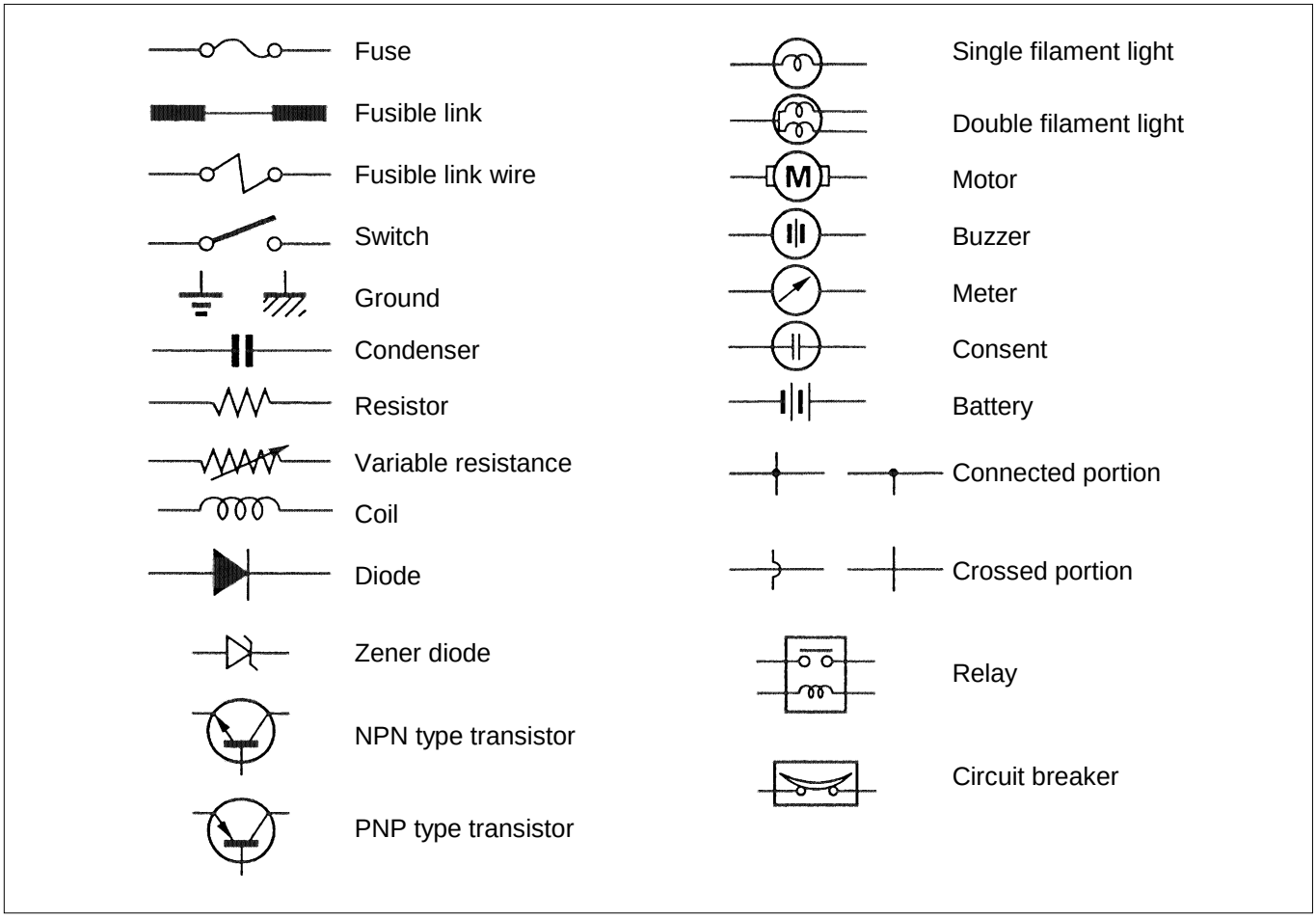
Center and roll the splicing tape. The tape should cover the entire splice. Roll on enough tape to duplicate the thickness of the insulation on the existing wires. Do not flag the tape. Flagged tape may not provide enough insulation, and the flagged ends will tangle with the other wires in the harness.



If the wire does not belong in a conduit or other harness covering, tape the wire again. Use a winding motion to cover the first piece of tape.

SYMBOLS AND ABBREVIATIONS

Symbols

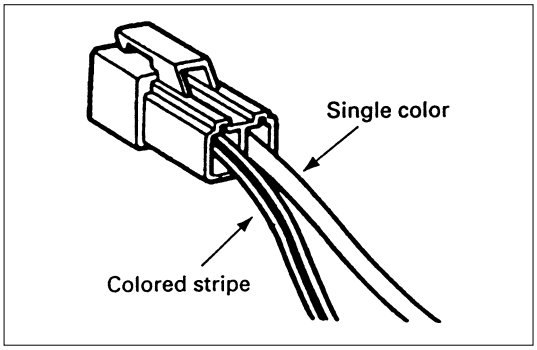


ABBREVIATIONS

The following abbreviations may appear in this manual.

ABBREVIATION	MEANING
A/C	AIR CONDITIONER
ACC	ACCESSORY
ACT	ACTUATOR
ASSIT	ASSISTANT
BATT	BATTERY
CAS	CAB AIR SUSPENSION
CAS C/U	CAB AIR SUSPENSION CONTROL UNIT
CONN	CONNECTOR
C/U	CONTROL UNIT
DC	DIRECT CURRENT
D/CONN	DIAGNOSIS CONNECTOR
DIAG	DIAGNOSIS
DMV	DIGITAL MULTI VOLTMETER
DTC	DIAGNOSTIC TROUBLE CODE
ECU	ELECTRICAL CONTROL UNIT
EEPROM	ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY
EMI	ELECTRO MAGNETIC INTERFERENCE
EXH	EXHAUST
FRT	FRONT
EVT	ELECTRONIC VARIABLE TIMER
GND	GROUND (BODY EARTH)
IN	INLET, INTAKE
I/PUMP	INJECTION PUMP
LH	LEFT HAND (SIDE)
LHD	LEFT HAND DRIVE
MAG	MAGNETIC
MEM, -CLR	MEMORY CLEAR
ME/CONN	MEMORY ERASER CONNECTOR
M/V	MAGNETIC VALVE
N	NEUTRAL (TRANSMISSION GEAR)
Ne	ENGINE REVOLUTION
OFF	TURN OFF (SWITCH/LAMP)
ON	TURN ON (SWITCH/LAMP)
OPT	OPTION
OSC	STANDARD WAVE FORM VOLTAGE
P/BRAKE	PARKING BRAKE
PGND	POWER GROUND (TO BODY EARTH)
PIN	PIN or TERMINAL
P/L	PILOT (WARNING) LAMP
PRESS	PRESSURE
PS	PRE-STROKE
P/T	POWER TRAIN
PWR	POWER SOURCE
RH	RIGHT HAND (SIDE)
RHD	RIGHT HAND DRIVE
R/L	RELAY
RR	REAR
S/ASB	SHOCK ABSORBER
SIG	SIGNAL
SLD	SHIELD
SS	SPEED SENSOR
SS C/U	SPEED SENSOR CONTROL UNIT
STD	STANDARD
SUSP	SUSPENSION
SW	SWITCH
TICS	TIMING AND INJECTION RATE CONTROL SYSTEM
TCV	TIMING CONTROL VALVE
W/L	WARNING LAMP

PARTS FOR ELECTRICAL CIRCUIT



Wiring

Wire Color

All wires have color-coded insulation.
Wires belonging to a system's main harness will have a single color. Wires belonging to a system's sub circuits will have a colored stripe. Striped wires use the following code to show wire size and colors.

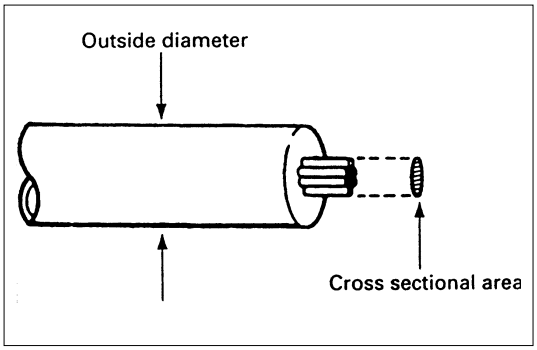
Example: 0.5 G R

- R — Red (Stripe color)
- G — Green (Base color)
- 0.5 — Wire size (0.5 mm)

Abbreviations are used to indicate wire color within a circuit diagram.
Refer to the following table.

Wire Color Coding

Color-coding	Meaning	Color-coding	Meaning
B	Black	Br	Brown
W	White	Lg	Light green
R	Red	Gr	Gray
G	Green	P	Pink
Y	Yellow	Sb	Sky blue
L	Blue	V	Violet
O	Orange		



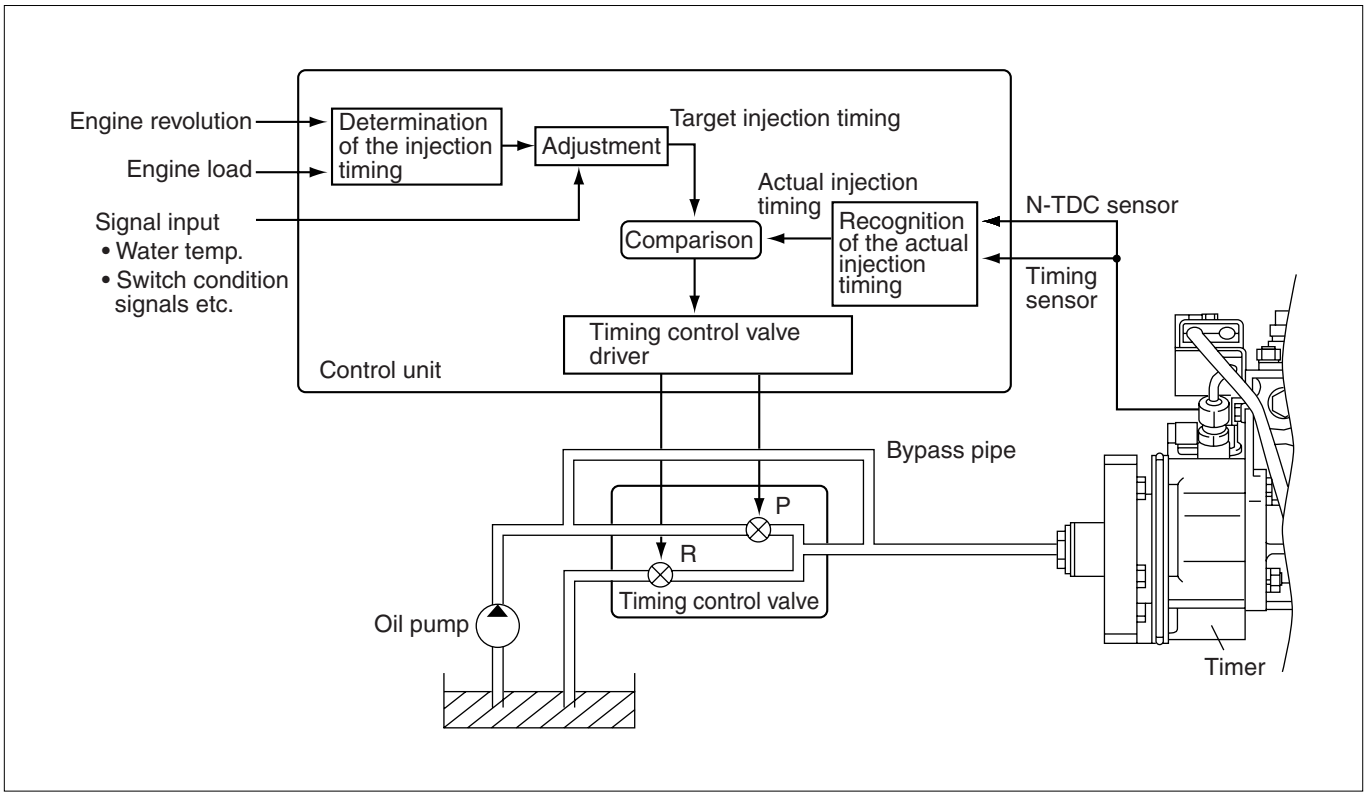
Wire size

The size of wire, used in a circuit is determined by the amount of current (amperage), the length of the circuit, and the voltage drop allowed. The following wire size and load capacity, shown below, are specified by JIS (Japanese Industrial Standard)
(Nominal size means approximate cross sectional area)

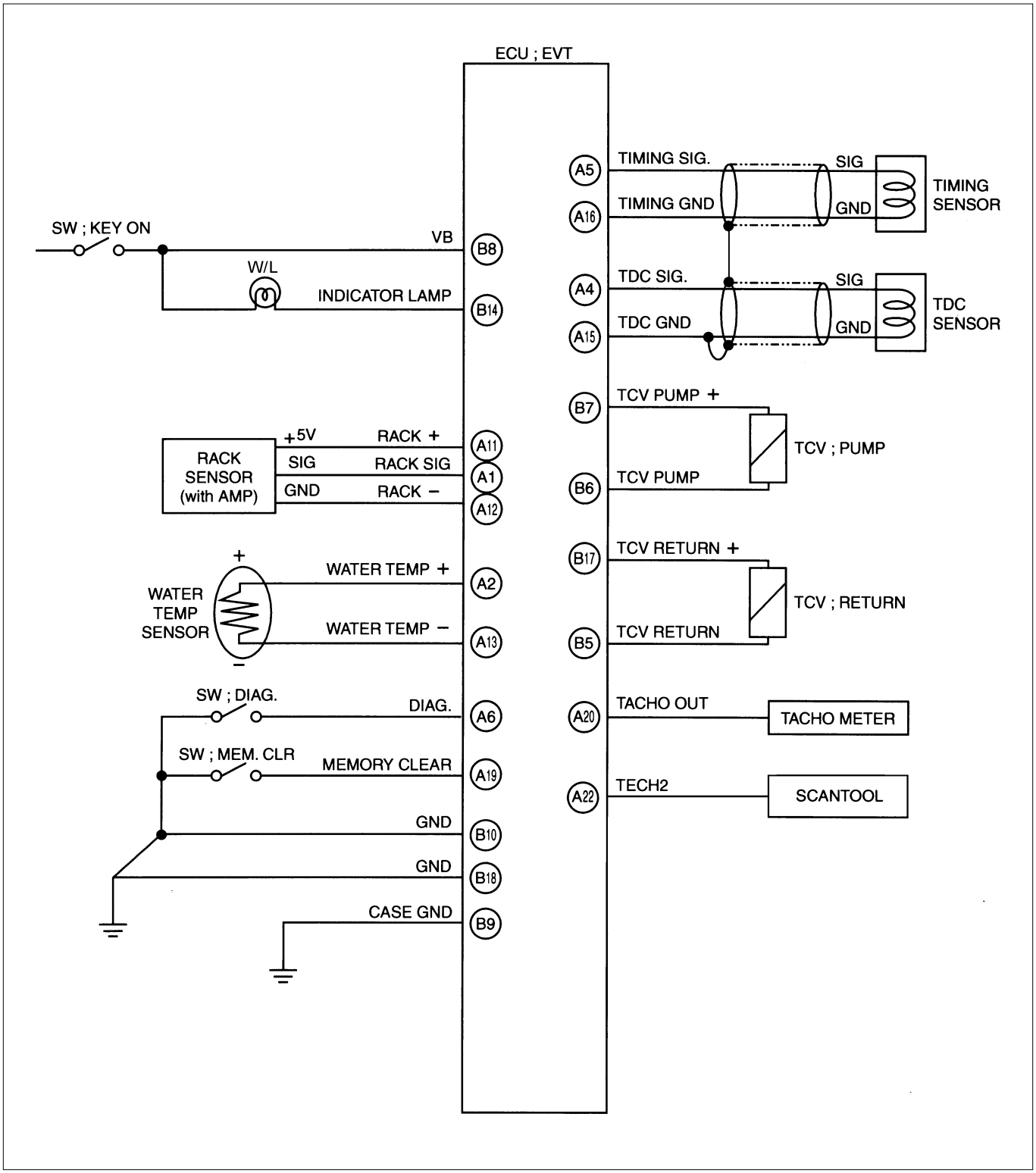
Nominal size	Cross sectional area (mm^2)	Outside diameter (mm)	Allowable current (A)
0.3	0.372	1.8	9
0.5	0.563	2.0	12
0.85	0.885	2.2	16
1.25	1.287	2.5	21
2	2.091	2.9	28
3	3.296	3.6	37.5
5	5.227	4.4	53
8	7.952	5.5	67
15	13.36	7.0	75
20	20.61	8.2	97

EVT (Electronic Variable Timer)

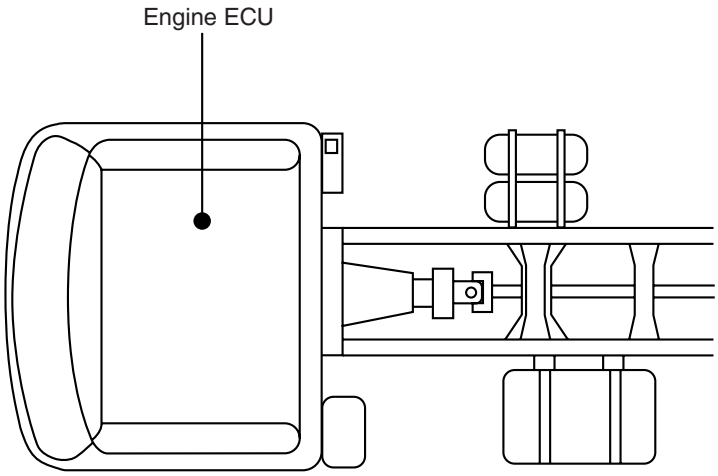
Electronic Variable Timer calculates the basic injection timing based on the engine load condition (rack position) and engine revolution, and determines the target injection timing by adjusting it using the information from each sensor.
It also detects the actual injection timing based on the phase difference between the N-TDC sensor and the timing sensor, activates the timing control in accordance with the target injection timing, and controls the injection timing by moving the timer hydraulically.



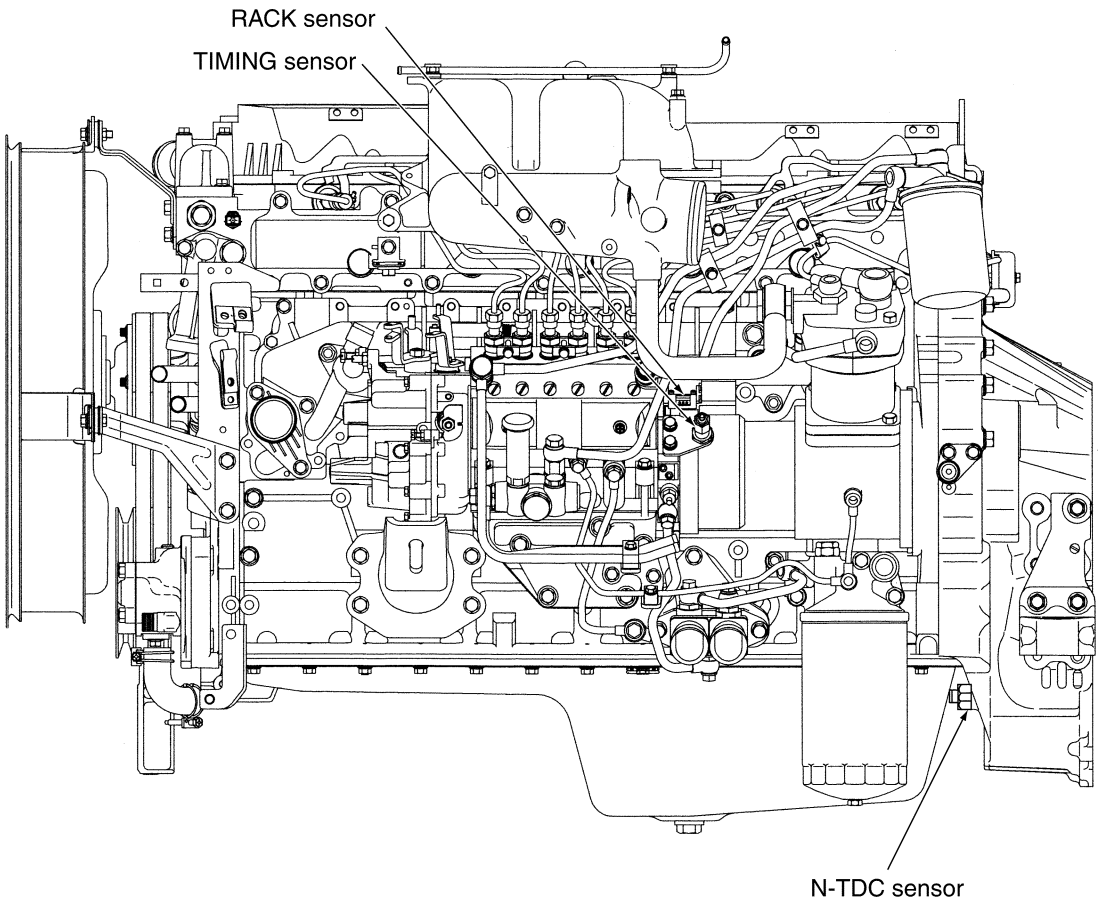
Engine ECU Wiring Diagram



Component location

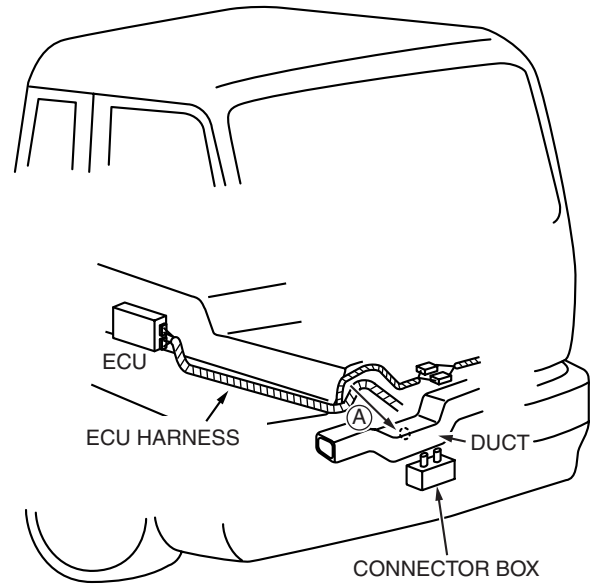


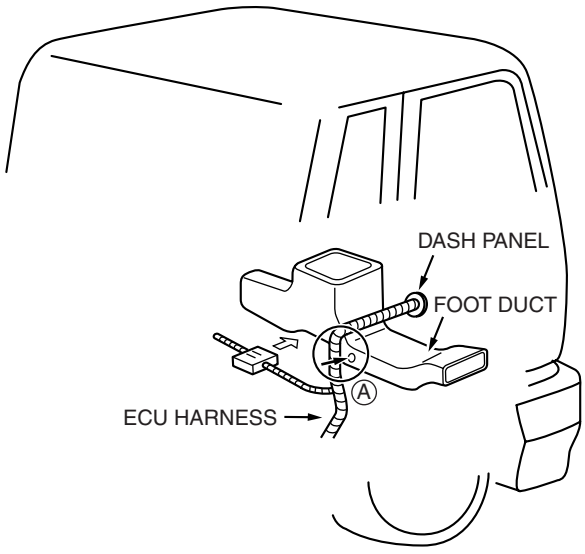
Engine



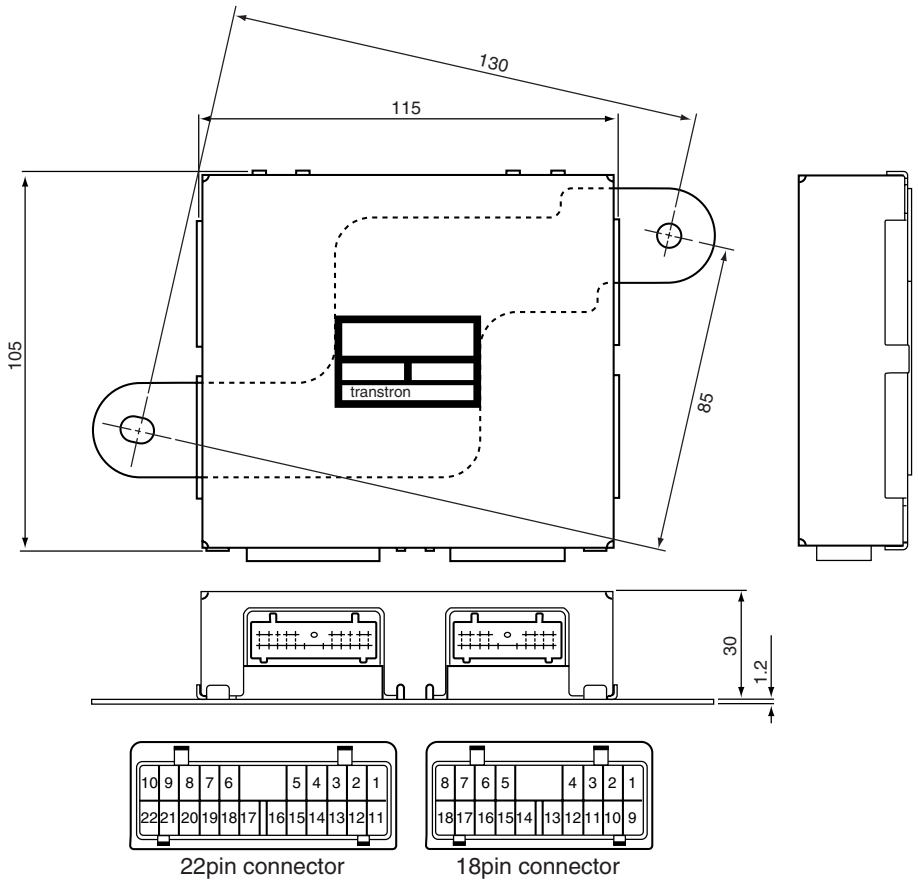
HARNESS LOCATION

Vehicle Harness





Engine ECU Terminal Assignment



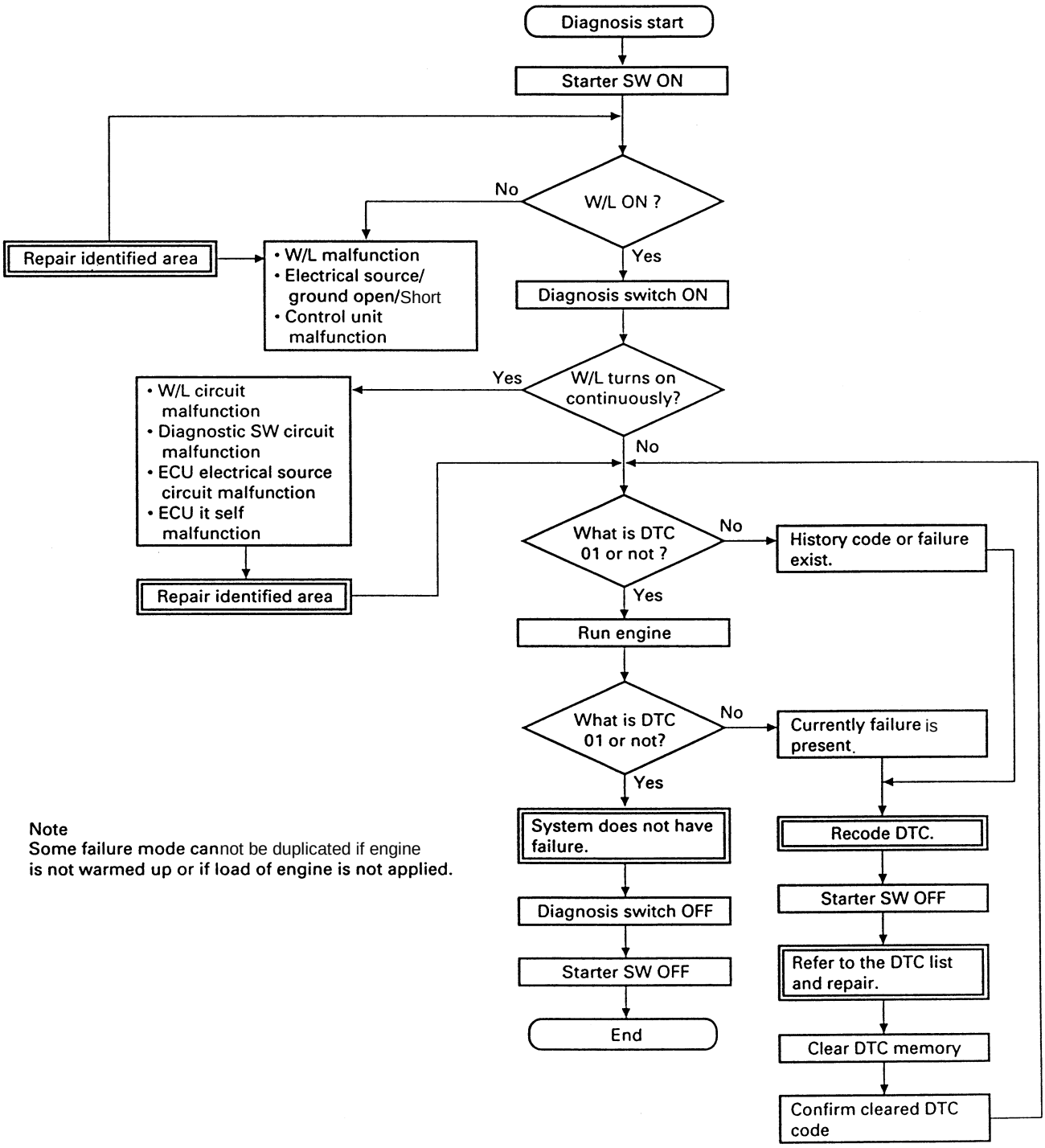
	No	Name		No	Name
Hybrid I/O connector 22&18P 22 side	A-1	RACK SIG.	Hybrid I/O connector 22&18P 18 side	B-1	NC
	A-2	WATER TEMP +		B-2	NC
	A-3	NC		B-3	NC
	A-4	TDC SIG.		B-4	NC
	A-5	TIMING SIG.		B-5	TCV RETURN
	A-6	DIAG.		B-6	TCV PUMP
	A-7	NC		B-7	TCV PUMP +
	A-8	NC		B-8	VB
	A-9	NC		B-9	CASE GND
	A-10	DDS-3		B-10	GND
	A-11	RACK +		B-11	NC
	A-12	RACK –		B-12	NC
	A-13	WATER TEMP –		B-13	NC
	A-14	NC		B-14	INDICATOR LAMP
	A-15	TDC GND		B-15	NC
	A-16	TIMING GND		B-16	NC
	A-17	NC		B-17	TCV RETURN +
	A-18	NC		B-18	GND
	A-19	MEMORY CLEAR			
	A-20	TACHO OUT			
	A-21	NC			
	A-22	TECH 2			

DIAGNOSTIC PROCEDURE

Diagnostic procedure

Note

Take notes of present Diagnostic trouble code (DTC) during diagnosis, especially when multiple DTC are present. Even though DTC can be cleared, diagnose related area in the system. Because DTC means there is or was some failure, the failure may happen later.



Note
Some failure mode cannot be duplicated if engine is not warmed up or if load of engine is not applied.

Self-diagnosis functions

Memorization of self-diagnosis code

The self-diagnosis code indicated will be memorized in EEPROM within ECU.
Accordingly even if the starter switch turns off or the ECU is removed from the vehicle, the memorized self-diagnosis code will not be eliminated.

Memory clear for EVT

The memory is not cleared, however, by removing the battery.
The DTC codes of the ECU on the EVT are not cleared but maintained in the memory when the power is turned off or the battery is removed off the body.

Confirm DTC code for dealer mode

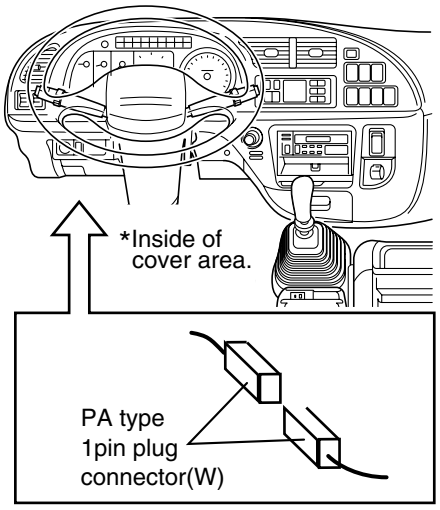
Diagnosis code is detected by flashing W/L.

* Unless an elimination procedure is taken the self-diagnosis code will remain in memory. (the memory will be eliminated only by a memory clear connector.)
Method to confirm the self-diagnosis code (dealer mode)
The self-diagnosis code can be read from the way the indicator lamp flashes.(service engine soon)
Reading self-diagnosis code from the flashing of the indicator lamp.

Detect DTC by Warning Lamp (W/L)

Operation

Connect Diagnosis connector, then W/L starts to flash. Flashing signal gives DTC code. Refer to the ‘how to read DTC’.



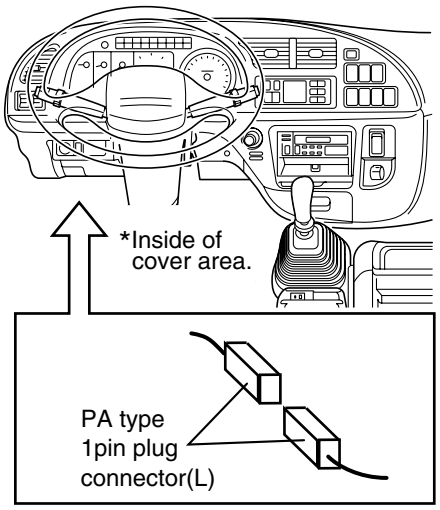
Display

Engine revolution=0 → displays present code and history code
Engine revolution≠0 → displays present code only
Note: If no failure occurs or no history code is stored, '001' code flashes.

DTC clear procedure

1. Check if the memory connector is off.
2. Turn starter switch off, and turn starter switch on.
3. Connect memory clear switch on for 1 sec.
4. Disconnect memory connector after step 3, then memory is cleared for 0.4 sec after disconnected.
5. Turn starter switch off, and on. Check DTC is cleared. If DTC still exists, repeat step 1 through step 4.
6. Turn starter switch off and finish this process.

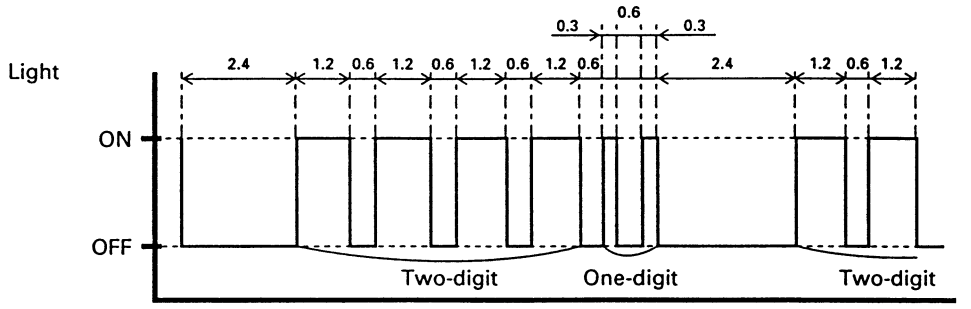
Memory clear switch position



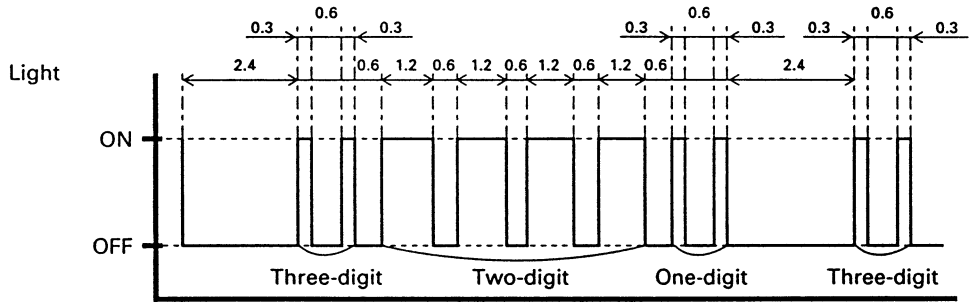
How to read DTC

Three different flashing digits indicate a number is started from three-digits number, two different flashing digits indicate a number is started from two-digit number in order. Identify DTC from the flashing number.
When multiple DTC are present, one DTC repeats three times and then turns to the next DTC.

[Example] Case of DTC 42 Unit ; sec



[Example] Case of 3 digits DTC 242 Unit ; sec



The check procedure of non DTC failure (user mode)

When diagnosis sw is OFF, W/L on indicates the system failure.
There are three different ways of W/L indication.

1. No warning light (W/L) on ……. '-' refer to DTC list
   DTC is recorded, but no W/L on.
2. Conditionally W/L on ……. '◯' refer to DTC list
   In addition to DTC triggers, condition lasts more than 20 sec at less than 600 rpm (Ne) engine revolution, then W/L lights ON.
3. Always W/L on …….'◎' refer to DTC list
   When DTC triggers, W/L always lights on.

   Note: W/L indicates the following in case of no failure.
   Ne=0 ……. light on
   Ne≠0 ……. light off

Cancellation of DTC

When DTC is triggered, perform back-up mode.
One type of DTCs is canceled even during back-up mode, if it is detected failure is no more. The other type of DTCs is not canceled until ECU is reset. First type of DTC means no damage to engine even for driving, second DTC means engine damage may occur by driving.

Diagnosis Trouble Code (DTC) list

6HH1 EVT

DTC	Items	Failure description	Detection time	Back-up		DTC cancellation
				DATA	TICS	
33	Memory(RAM)	Memory(RAM) error	None	None	Back up mode	No
543	Excessive high engine revolution	More than 3770 rpm	0.5sec	None	Regular mode	No
10	Rack sensor	Open or short eng. rpm less than 1200 rpm sensor voltage less than *2	30 sec	Rack position is calculated by eng. rpm	Regular mode	No
		Open or short sensor voltage more than *3	10sec			
15	TDC sensor	Starter SW ON then no pulse	1sec	None	Back up mode	No
14	Timing sensor	Starter SW ON then no pulse	1sec	None	Regular mode	No
18	Timing Control Valve	Open or short valve voltage less than 0.8V at the pump side	1sec	None	Regular mode	Yes
		Open or short valve voltage less than 0.8V at the return side	1sec			
12	Timer Feed Back	Difference of target and actual for pre-stroke angle is more than 3 deg CA See *4	30sec	None	Regular mode	Yes
23	Coolant temperature sensor	Open or short sensor voltage more than 4.8V or sensor voltage less than 0.1V	3sec	Coolant temp = 80 °C	Regular mode	Yes
01	Normal				Back up mode	Yes
					Regular mode	No back up mode

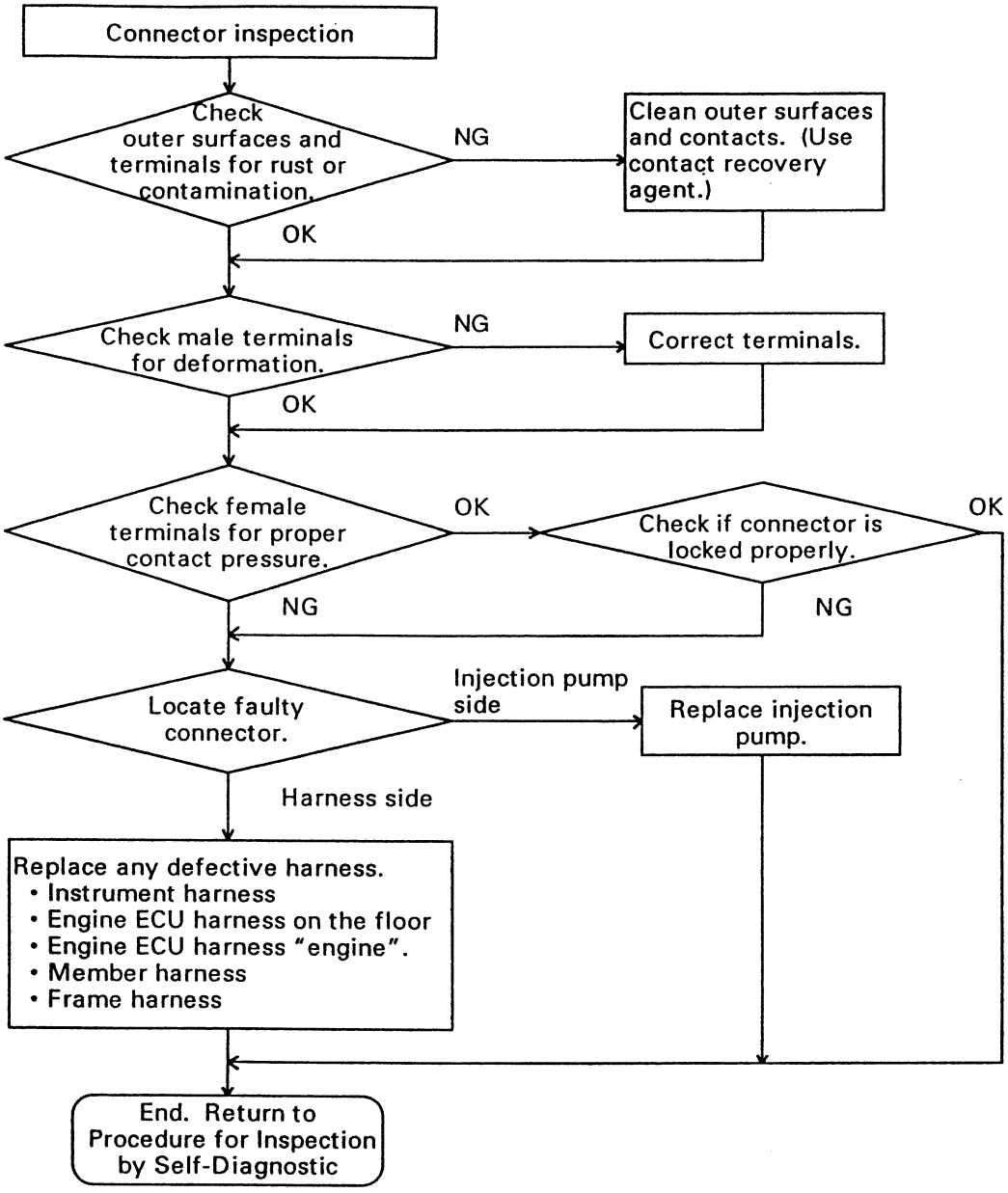
DTC	DTC cancel condition	Diagnosis lamp display		Remark	Engine model	Reference page
		Diag SW open (user)	Diag SW short (dealer)			
33	None	None	-	None	◯	48
543	None	None	5·4·3	DTC store only No back-up		49
10	Determine at the engine rpm failed sensor voltage become less than *2 detect at only the engine rpm failed at more than 1200 rpm	None	1·0	None	◯	50
15	TDC sensor on	◯	1·5	None No DTC store	◯	53
14	Timing sensor on	◯	1·4		◯	57
18	None	None	1·81	None	◯	61
12	None	◎	1·2	None	◯	64
23	Sensor (resistance input) voltage is less than 4.8V and more than 0.1V	None	2·3	None	◯	67
1	Normal	◯	0·1DTC	Diag lamp is on -	◯	-

Note

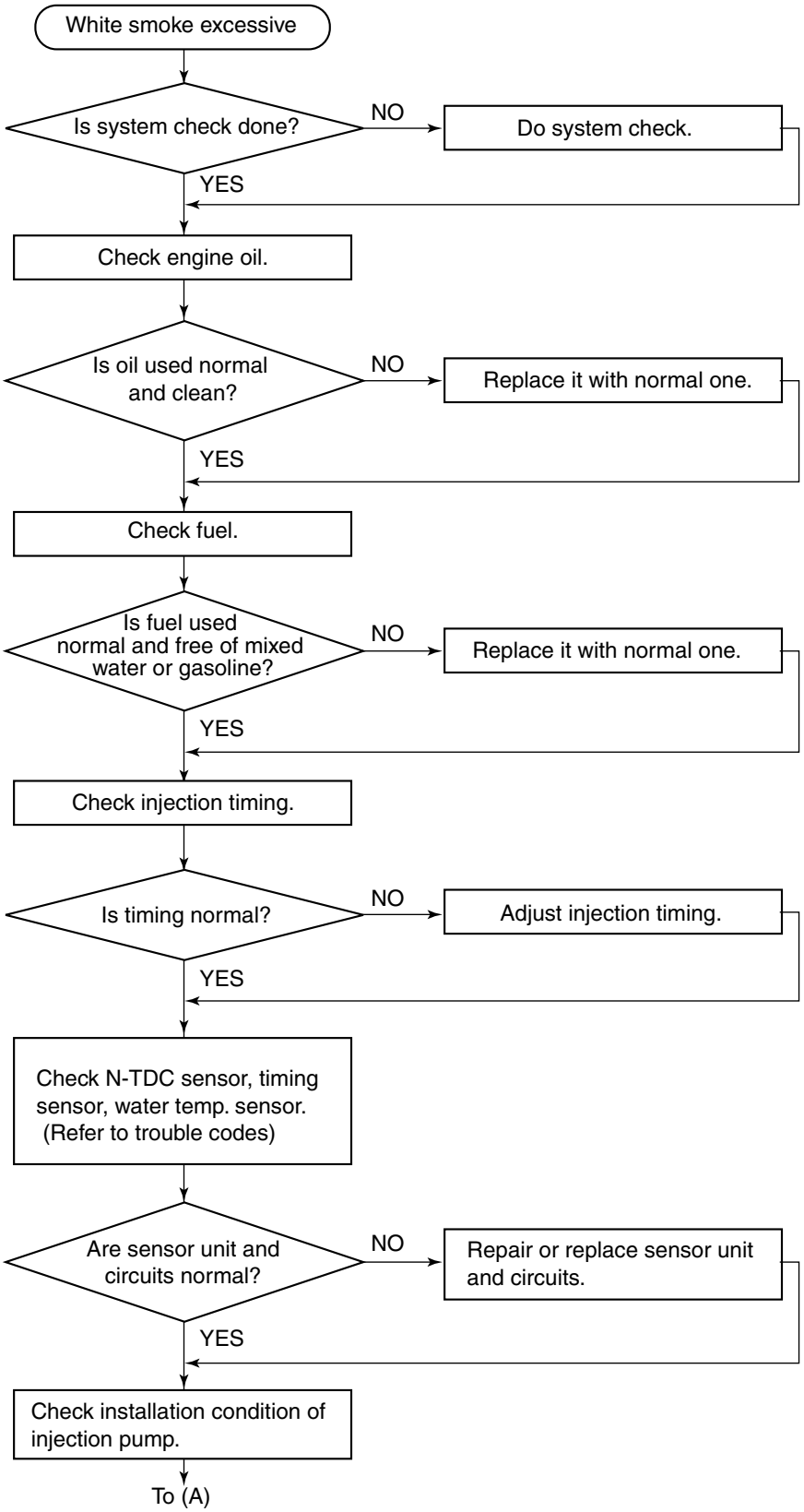
1. User mode display is as follows; ◯ : less than 600 rpm and last more than for 20 sec
   ◎ : light on continuously
   : no light on
2. Rack sensor output (high side) diagnosis voltages are different among engines; 6HH1 ..... 3.3V
3. Rack sensor output (low side) diagnosis voltage..... 0.7V
4. Pre-stroke angle (unit: deg) equivalent to ±3 deg CA is different 8.7deg
5. For +3 deg CA difference between target and actual angle, it turns on always.
   For -3 deg CA difference between target and actual angle, it does not turn on.
6. The following condition is not detected as failure.
   Pre-stroke sensor was failure already.
   Pre-stroke learning error is detected.
7. DTCs other than code 33 is not detected as less than 18 volts.
8. DTC code 543 is displayed by manual operation only.
   When Using Tech 2, DTC code 54 is displayed.

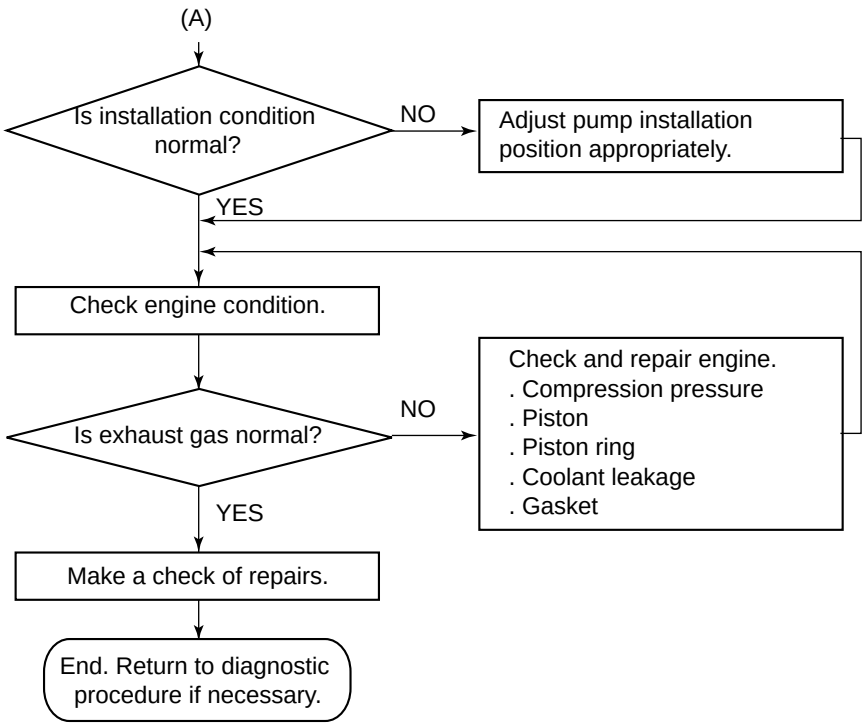
CONNECTOR INSPECTING PROCEDURE

Connector inspecting procedure



1. WHITE SMOKE (EXCESSIVE)

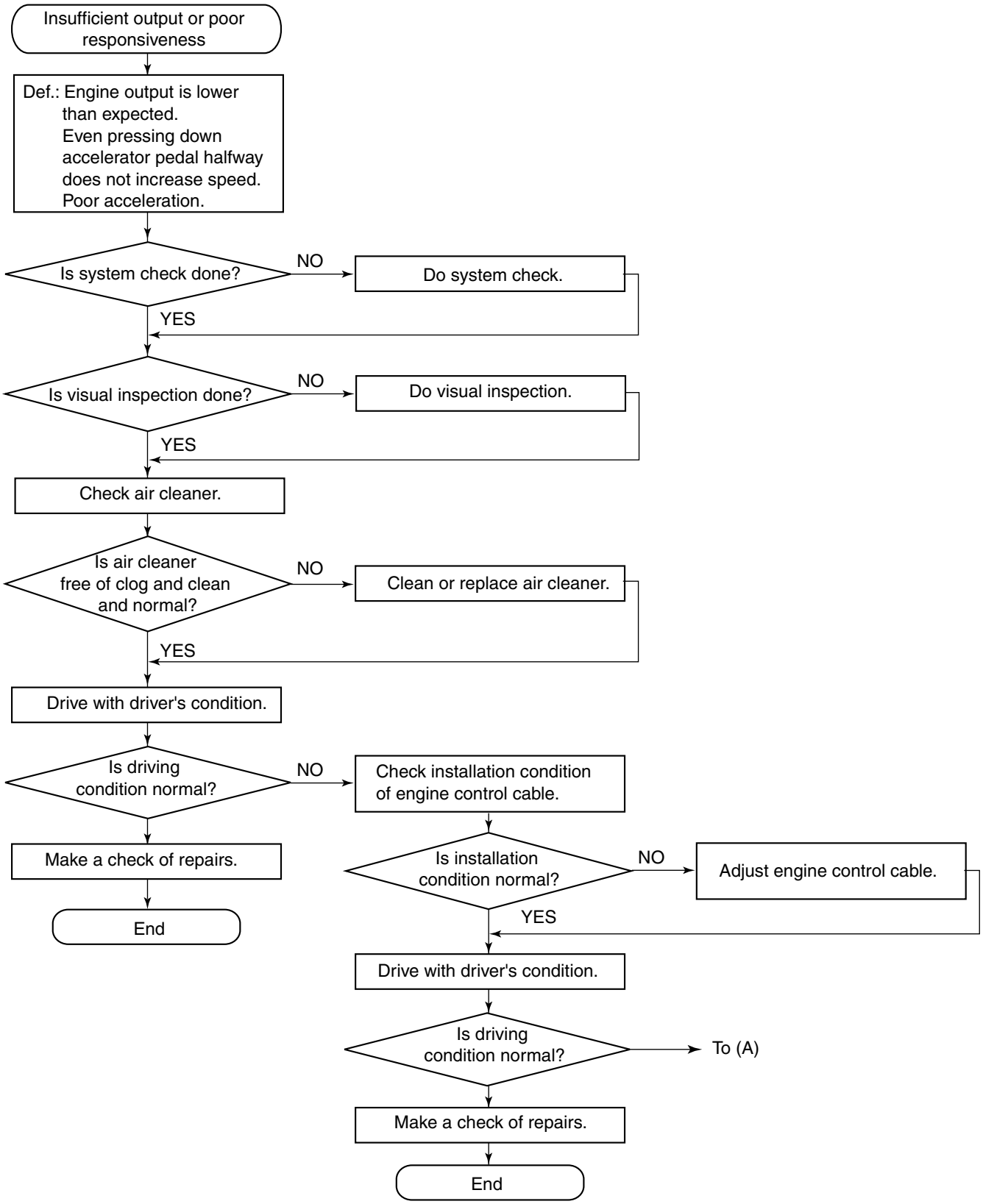


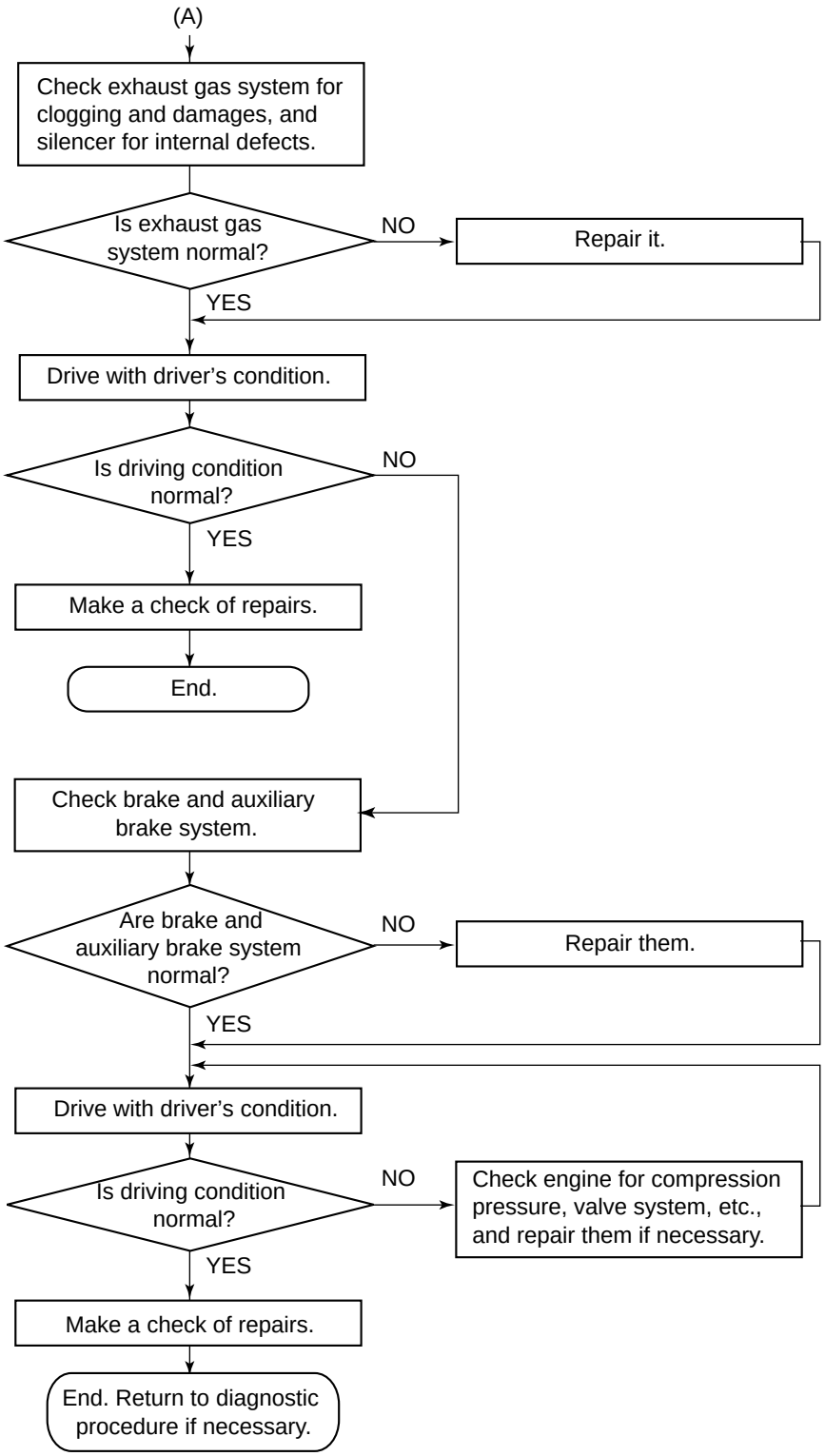


NOTE 1:

The condition of the system in which the malfunction has occurred should be checked by making comparisons between the vehicle ECU and the checking ECU.

2. LACK OF POWER

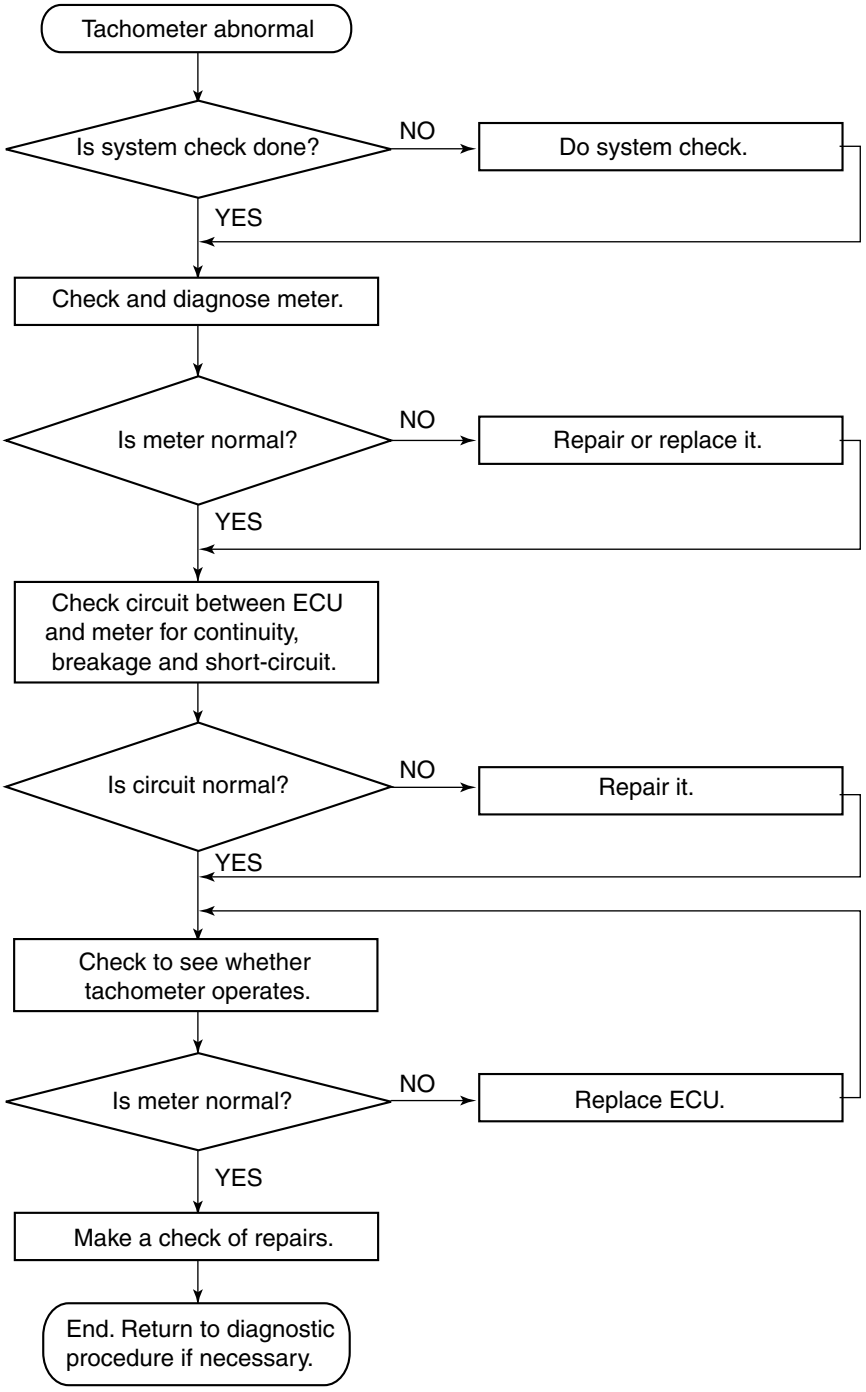




NOTE 1:

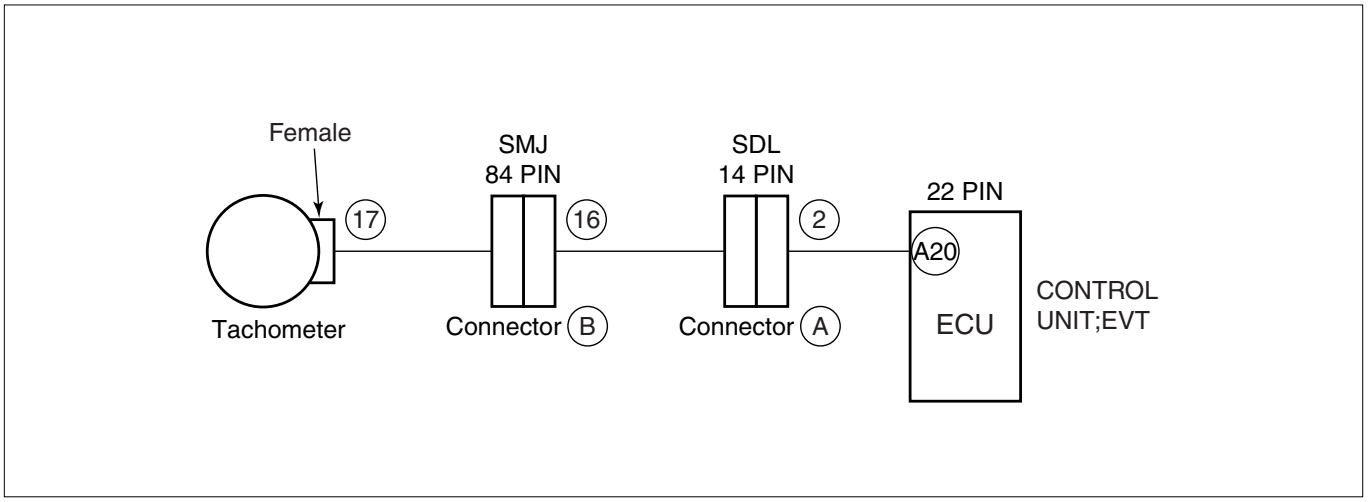
The condition of the system in which the malfunction has occurred should be checked by making comparisons between the vehicle ECU and the checking ECU.

3. TACHOMETER ABNORMALITY



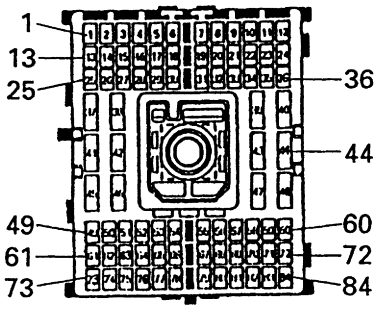
NOTE 1:

Check continuity among each terminal ⑰ - ⑯, ⑯ - ②, ② - Ⓐ-20. following circuit diagram on next page.



NOTE 2: The condition of the system in which the malfunction has occurred should be checked by making comparisons between the vehicle ECU and the checking ECU.

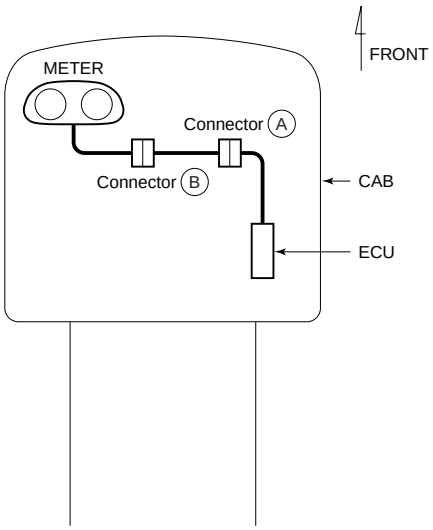
Inst. harness ~ Inst. harness Upper Connector



Female side

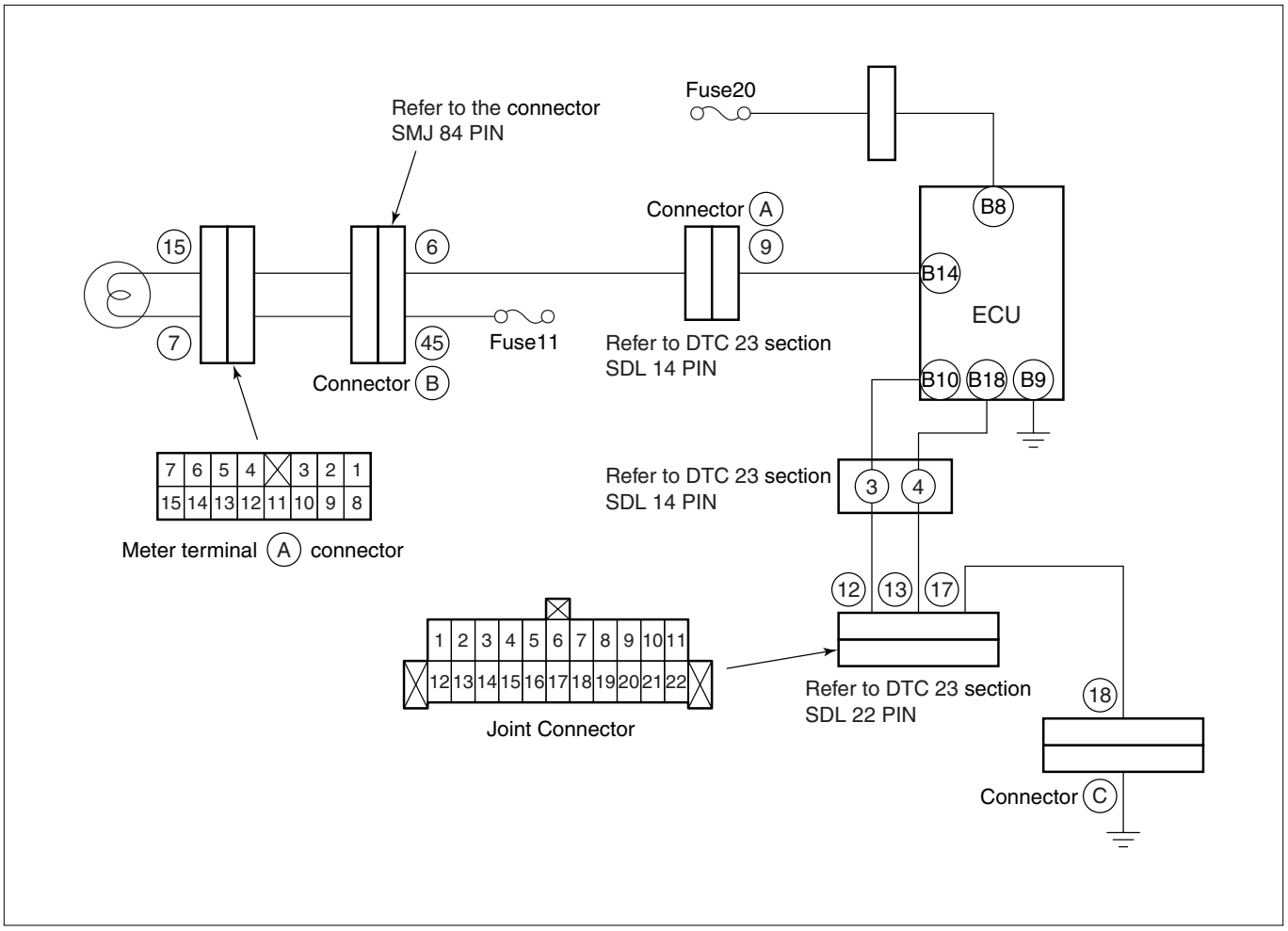
Meter C Connector

Female side

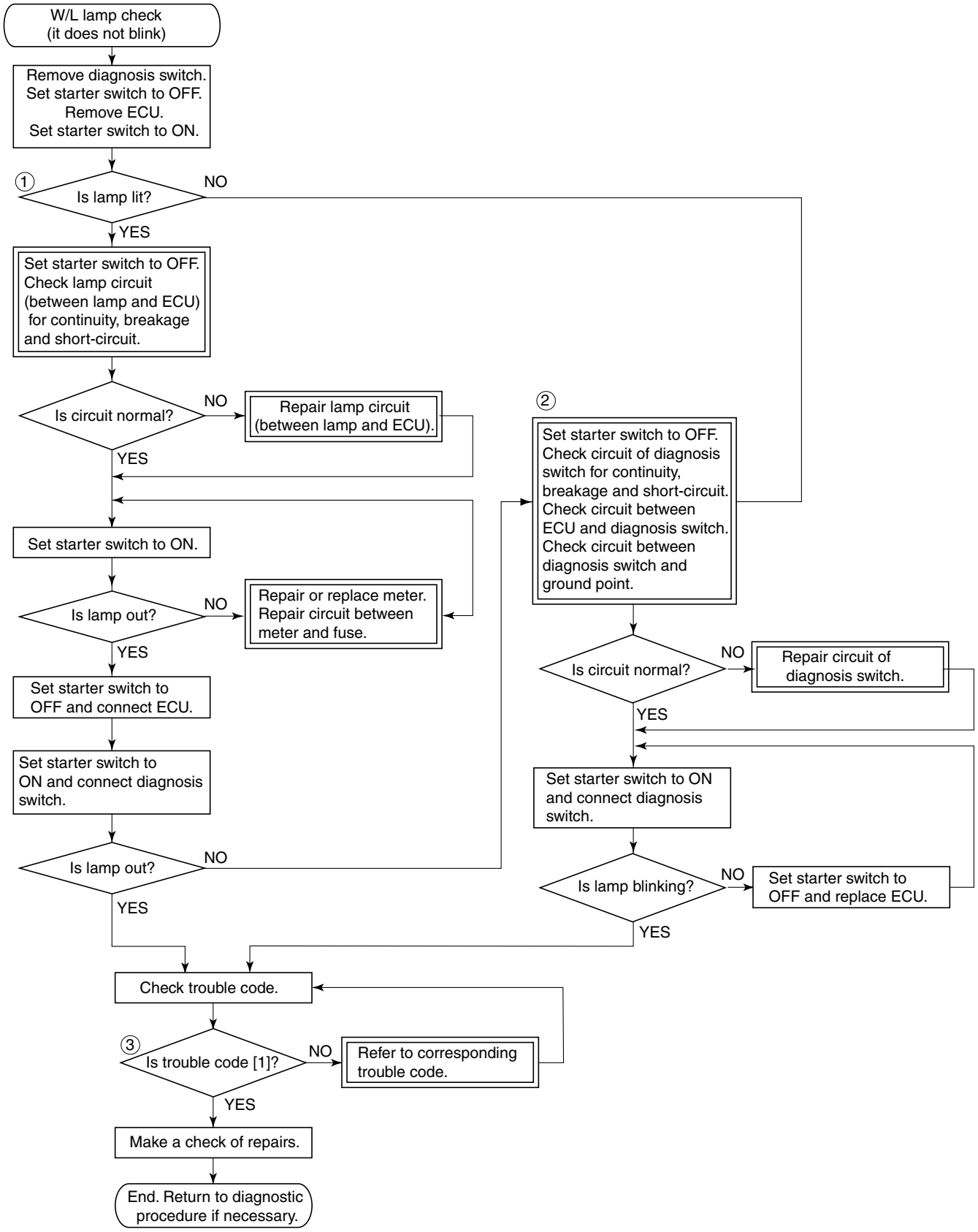


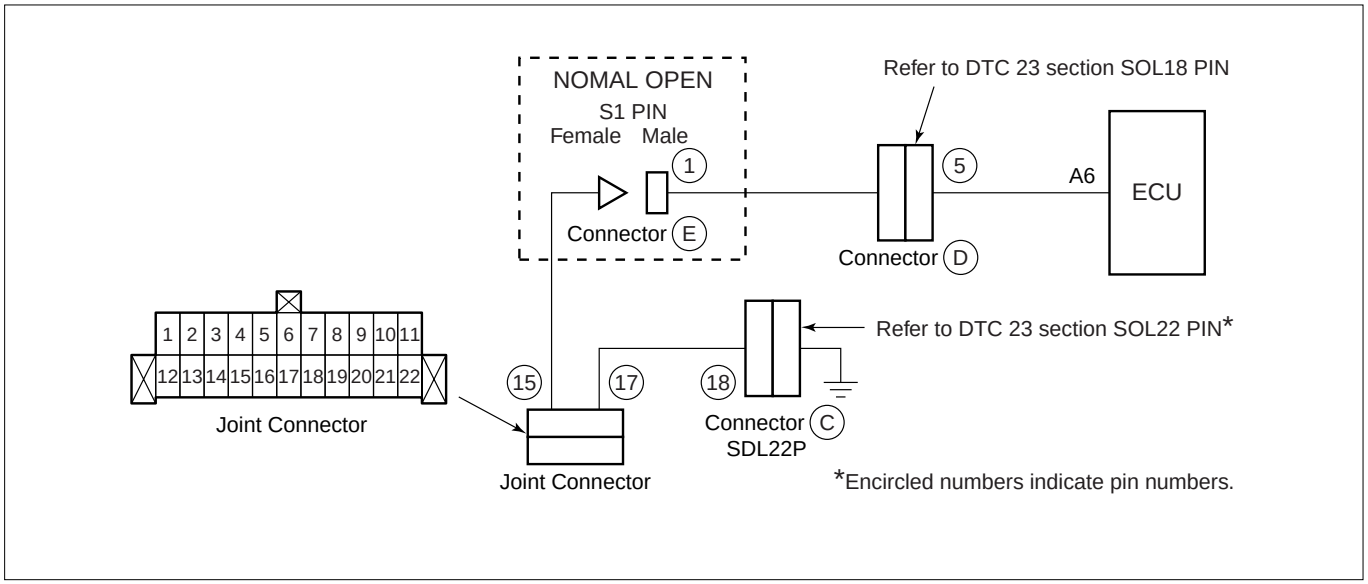
4. W/L LAMP (DIAG LAMP) MALFUNCTION

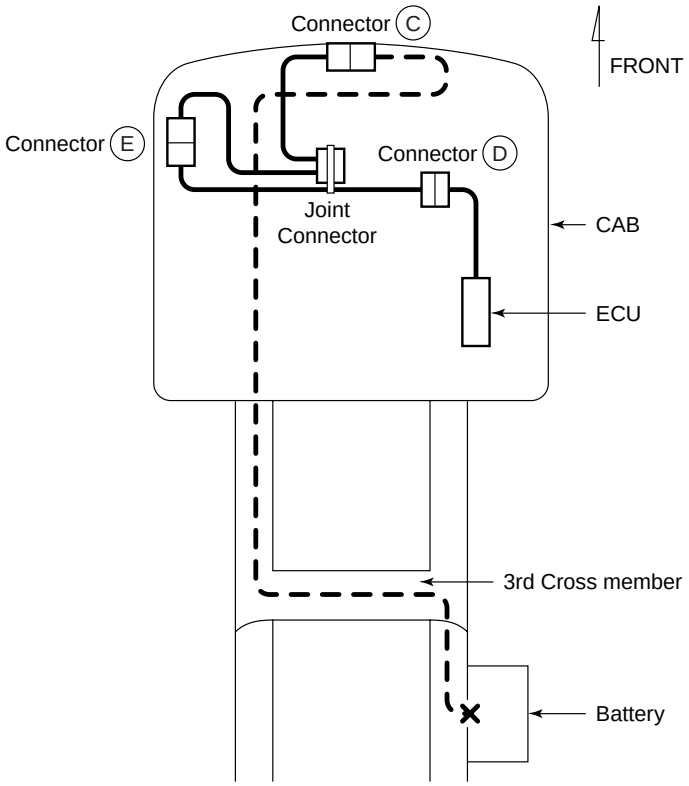
(1) The W/L lamp remains lit.



(2) The W/L lamp will not come on even when the starter SW is on.




NOMAL OPEN
S1 PIN
Female Male
1
Connector E
Refer to DTC 23 section SOL18 PIN
5
A6
ECU
Connector D
1 2 3 4 5 6 7 8 9 10 11
12 13 14 15 16 17 18 19 20 21 22
Joint Connector
15
17
18
Refer to DTC 23 section SOL22 PIN*
Connector C
SDL22P
Joint Connector
*Encircled numbers indicate pin numbers.


Connector C
FRONT
Connector E
Connector D
Joint
Connector
CAB
ECU
3rd Cross member
Battery

Tech 2 Overview and applicable model

This service manual is applicable to the model in the following table.

Vehicle Type	Model	Model Year
Medium Duty	6HH1 (F-Series)	'00 MY

Purpose:
This manual is prepared for engine diagnoses and system checks using Tech 2.

Tech 2 Operation Manual

Diagnosis Strategy-Based Diagnostics

Strategy-Based Diagnostics
The strategy-based diagnostic is a uniform approach to repair all Electrical/Electronic (E/E) systems. The diagnostic flow can always be used to resolve an E/E system problem and is a starting point when repairs are necessary. The following steps will instruct the technician how to proceed with a diagnosis:

1. Verify the customer complaint.
   To verify the customer complaint, the technician should know the normal operation of the system. = not present (History)

2. Perform preliminary checks.
- Conduct a thorough visual inspection.
- Review the service history.
- Detect unusual sounds or odors.
- Gather diagnostic trouble code information to achieve an effective repair. =Intermittent

3. Check bulletins and other service information. System checks contain information on a system that may not be supported by one or more DTCs. System checks verify proper operation of the system. This will lead the technician in an organized approach to diagnostics. = Preset

Reading Diagnostic Trouble Codes Using the Tech 2 Scan Tool

The procedure for reading diagnostic trouble code(s) is to use a diagnostic Scan Tool. When reading DTC(s), follow instructions supplied by the tool manufacturer.

Clearing Diagnostic Trouble Codes.
IMPORTANT: Do not clear DTCs unless directed to do so by the service information provided for each diagnostic procedure. When DTC(s) is cleared, the Failure Record data that may help diagnose and intermittent fault will also be erased from the memory.

To clear Diagnostic Trouble Codes (DTCs), use the diagnostic Scan Tool "clear information" or "Programming" function. When the DTC(s) is cleared the following instructions are supplied by the tool manufacturer.

Tech 2 Features

1. Tech 2 is a 12 volts system. Do not apply 24 volts.

NOTE: Install the Tech 2 Adapter and supply voltage is 12 volts for Tech 2.

2. After connecting and/or installing the Vehicle Communication Interface (VCI) module, PCMCIA card and DLC connector to the Tech 2, connect the tool to the vehicle DLC.
3. Make sure the Tech 2 is powered OFF when removing or installing the PCMCIA card.
4. The PCMCIA card has a capacity of 10 Megabytes.
5. The Tech 2 has two snapshots.
6. The PCMCIA card is sensitive to magnetism and static electricity, so care should be taken in the handling of the card.

7. The Tech 2 can plot a graph when replaying snapshot.
8. Always return to the Main Menu by pressing the EXIT key several times before shutting down.
9. To clear Diagnostic Trouble codes (DTCs), open Application Menu and press "F1: Clear DTC info".

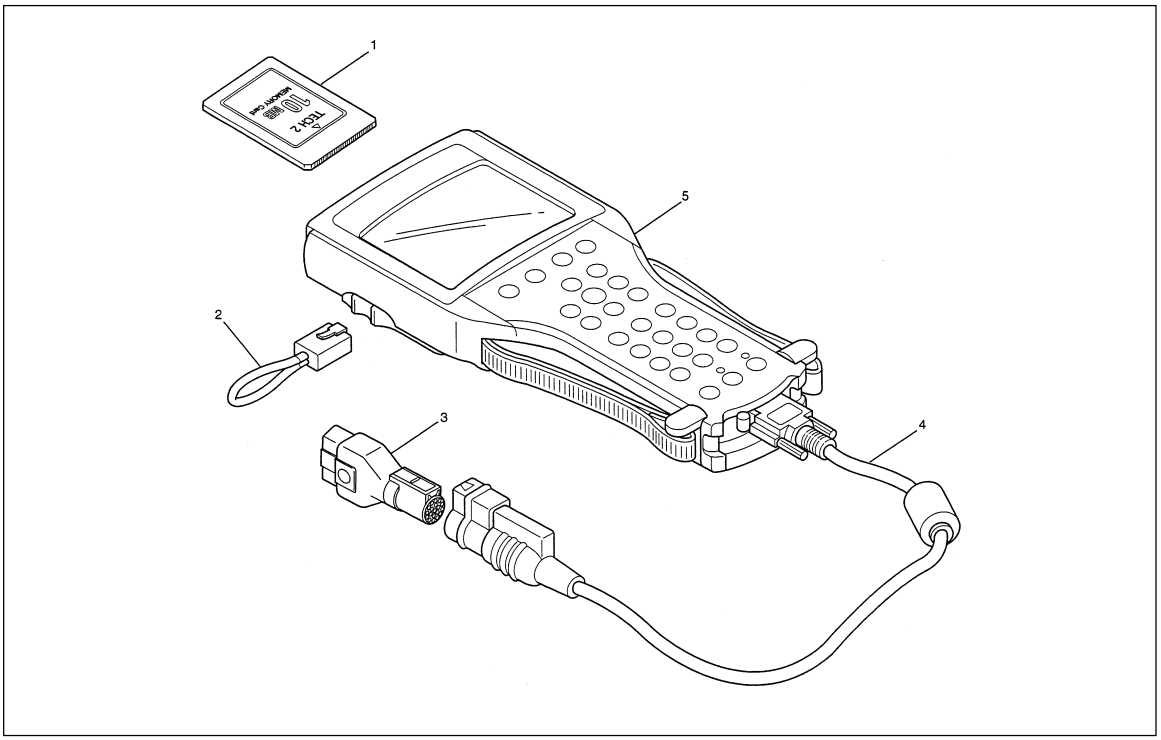
NOTE: The RS232 Loop back connector is only to be used for diagnosis of Tech 2.
Refer to users guide of the Tech 2.
To prevent system damage, the ignition key must be "OFF" when disconnecting or reconnecting battery power.

Overview

Tech 2 is useful for engine diagnoses and system checks. Although trouble diagnosis can be performed without Tech 2, using Tech 2 will increase efficiency.

Tech 2 is a portable, compact and light tester. Connected with the self-test connector of the vehicle, Tech 2 performs various diagnoses and tests by communicating with ECM.

Tech 2

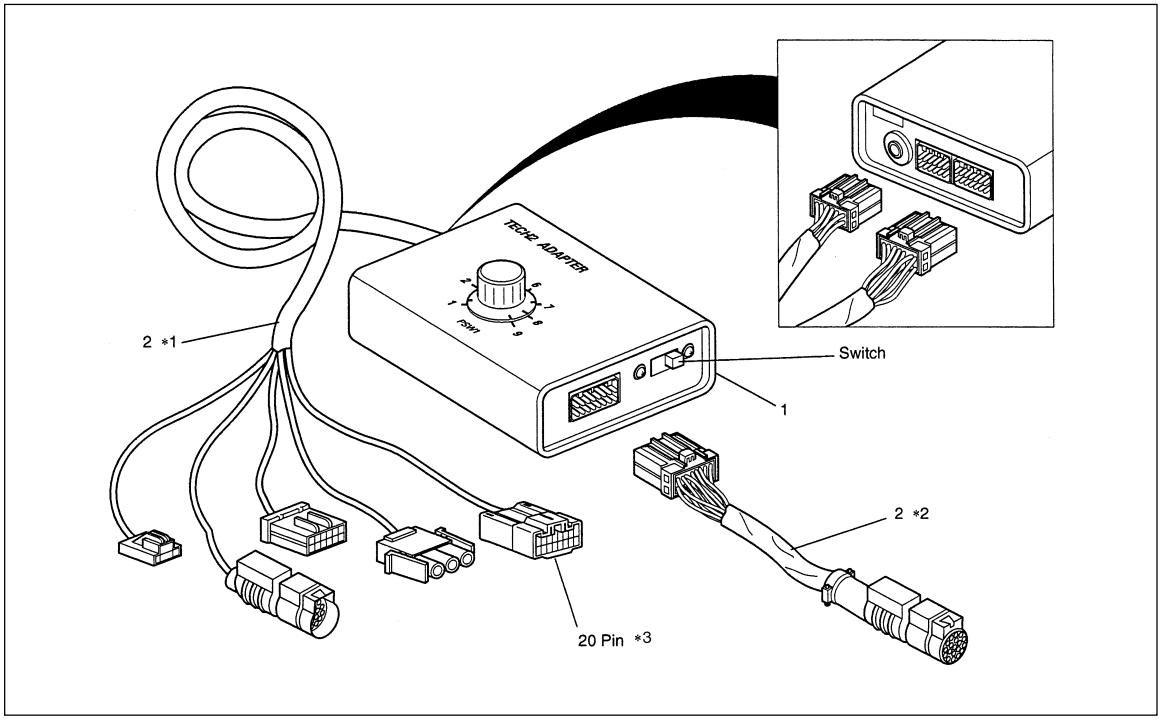


Names
(1) PCMCIA card
(2) DLC cable
(3) SAE 16/19 pin adapter
(4) Adapter cable
(5) Tech 2

Notes:

- Tech 2 requires power supply of 12 V.
- Be sure to use the adapter cable.
- ISB applicable vehicle model is equipped with a 24 V power supply.
- Be sure to turn the power OFF when removing and attaching PCMCIA card.
- Be sure to use a conversion adapter to comply with a 20-pin connector of DLC (vehicle equipment).
- Mount the adapter to DLC and connect Tech 2 to the adapter.
- Be sure to use the Tech 2 adapter.

Tech 2 adapter

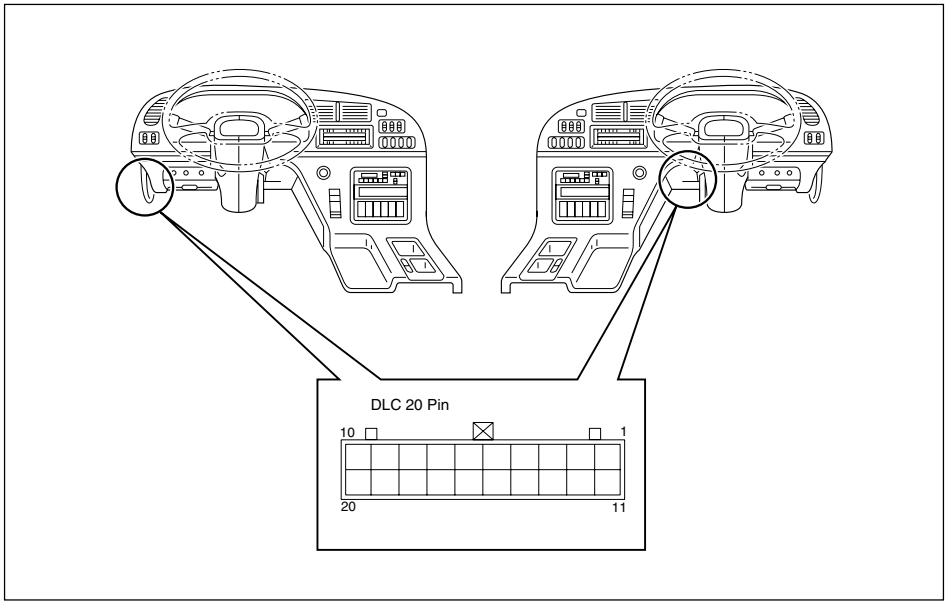


Legend
(1) Tech 2 adapter

Note: Be sure to set the TXD switch to the right side as illustrated and select the system selector switch to the #3 position.

(2) Adapter cable
*1. DLC cable
*2. Adapter cable
*3. Connector for I/E

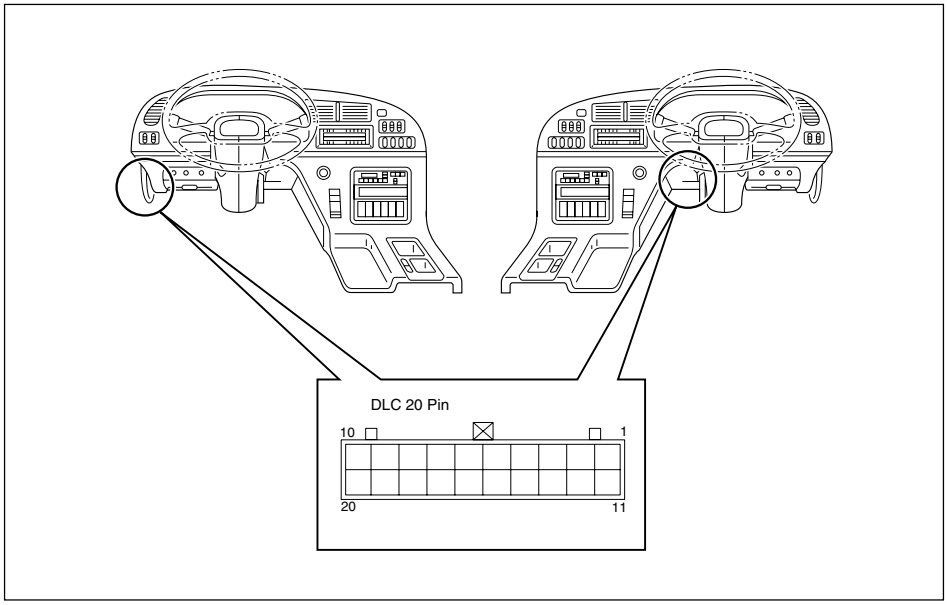
Location of DLC



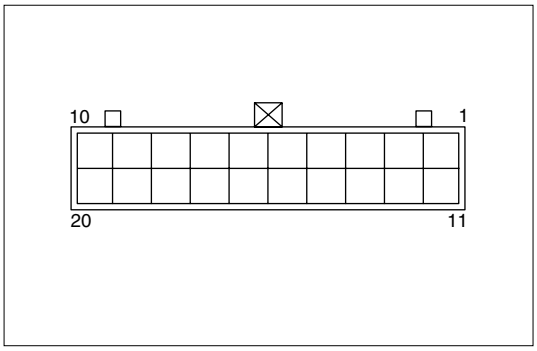
Attaching Tech 2

1 Insert the ISUZU 98 system PCMCIA card into the Tech 2 main body.
2 Connect the adapter to the DLC cable.
3 Attach the DLC cable to the Tech 2 main body.
4 Check that the ignition key is in the OFF position.
5 Connect the adapter of Tech 2 to the diagnosis connector (black) of the vehicle.
6 Turn the ignition key ON and push the "PWR" key of Tech 2.
7 Check the display of Tech 2.

DLC connection



Note:
Be sure to remove or attach the PCMCIA card when the power of Tech 2 is OFF.

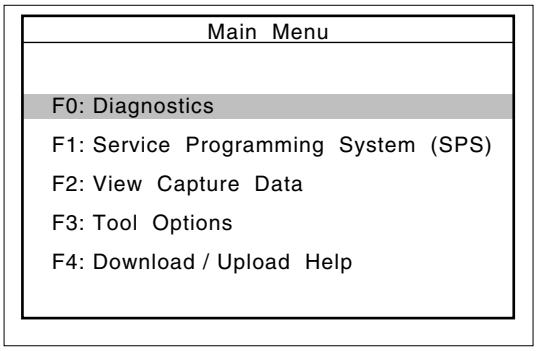


20 Pins Connector Pin assignment

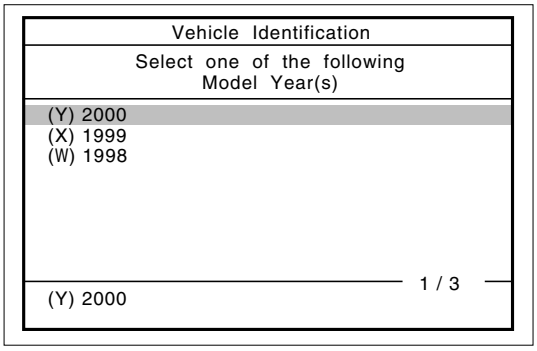
Pin No.3 = Power supply
Pin No.4 = Tech 2 signal (TXD)
Pin No.12 = Tech 2 signal (RXD)
Pin No.13 = Ground earth

Operation of Tech 2

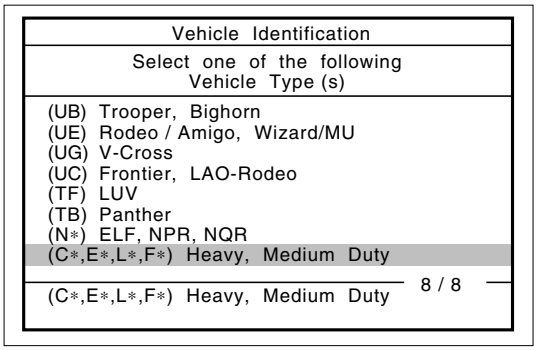
1. Check the initial display appears.



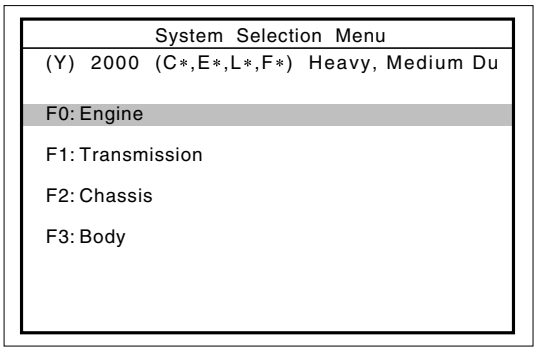
2. Press [ENTER].
   The Main menu appears.



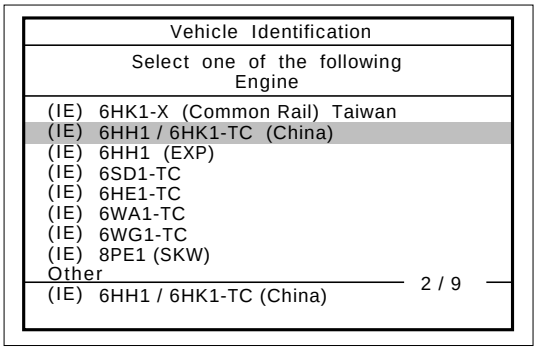
3. Select [F0] and press [ENTER].
   The Vehicle Identification display to select Model appears.



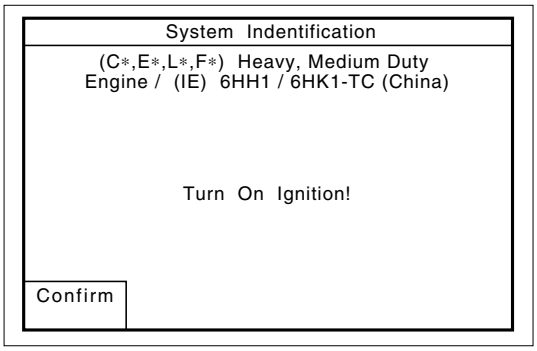
4. Select Applicable Model Year.
   For instance "2000" and press [ENTER].



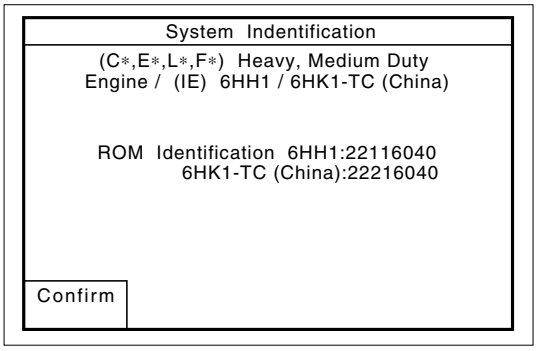
5. Select [Heavy, Medium Duty] and press [ENTER].
   The System Selection Menu appears.



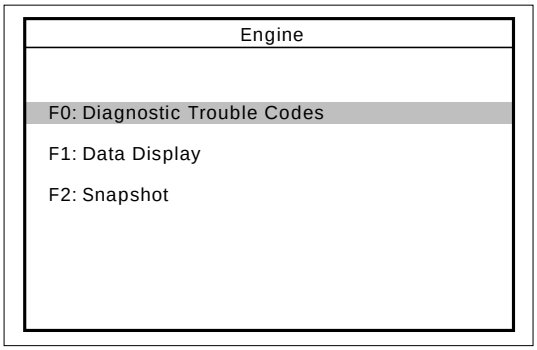
6. Select [F0] and press [ENTER].
   The Vehicle Identification display to select Engine appears.



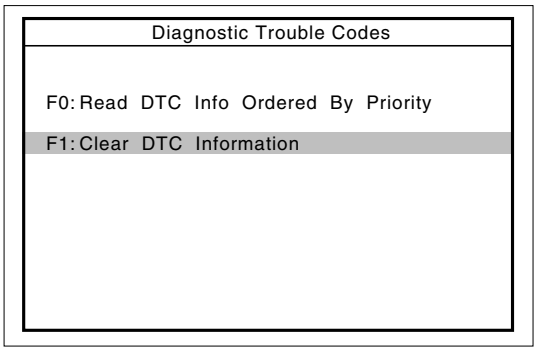
7. Select engine model (6HH1/6HK1-TC (China)) and press [ENTER].
   The System Identification display to turn on ignition appears.



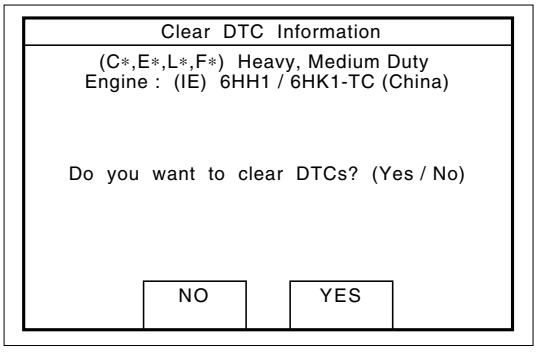
8. Turn on the ignition and press [Confirm].
   The System identification display to enter ROM ID. number appears.
   Enter the ROM Identification number then confirm it.



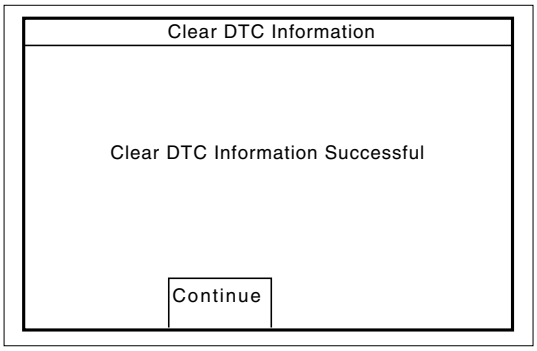
9. After engine display appears, select [F0] and press [ENTER].



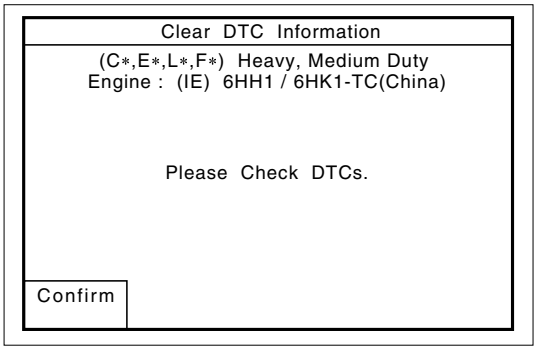
10. Select [F1] and press [ENTER].
    The Diagnostic Trouble Codes display appears.



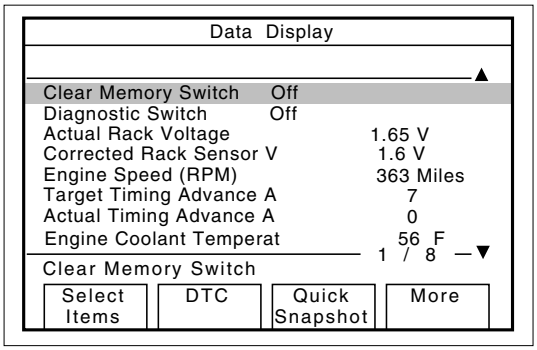
11. Select [F1] and press [ENTER].
    The Clear DTC Information display appears.
    Press [Yes] and the DTC number is cleared.



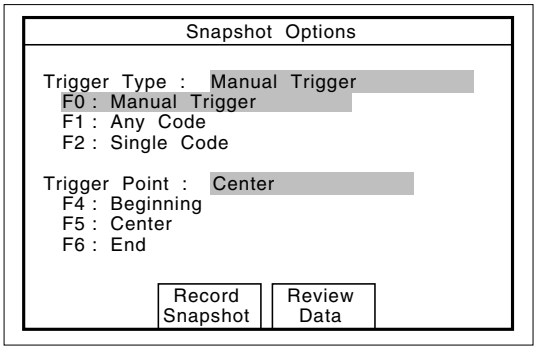
12. The Clear DTC Information display appears. Press [Continue] and then return to the Diagnostic Trouble Codes display.



13. After the DTC number is cleared, check and confirm the DTC number.

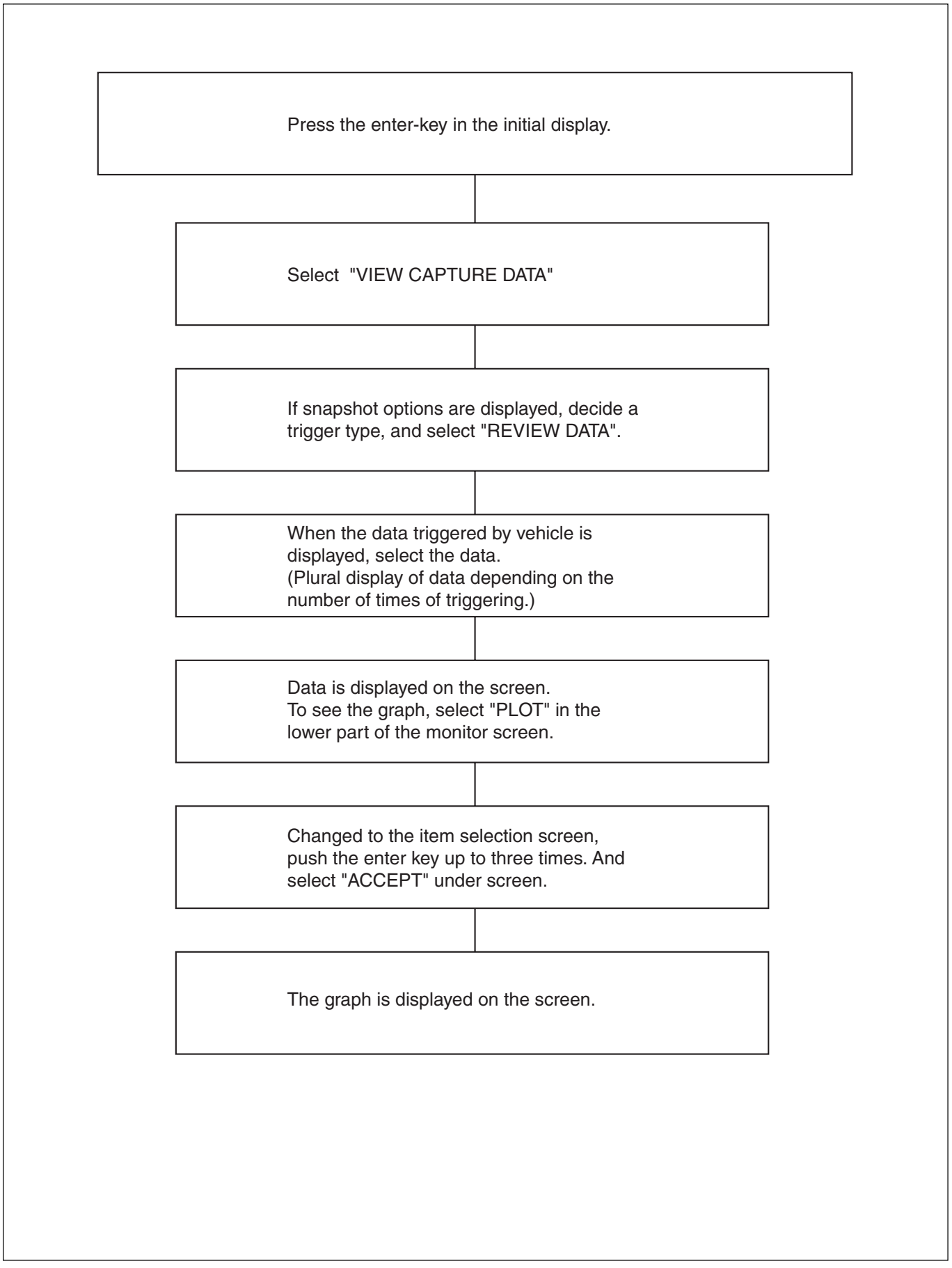


14. Select the Data Display.

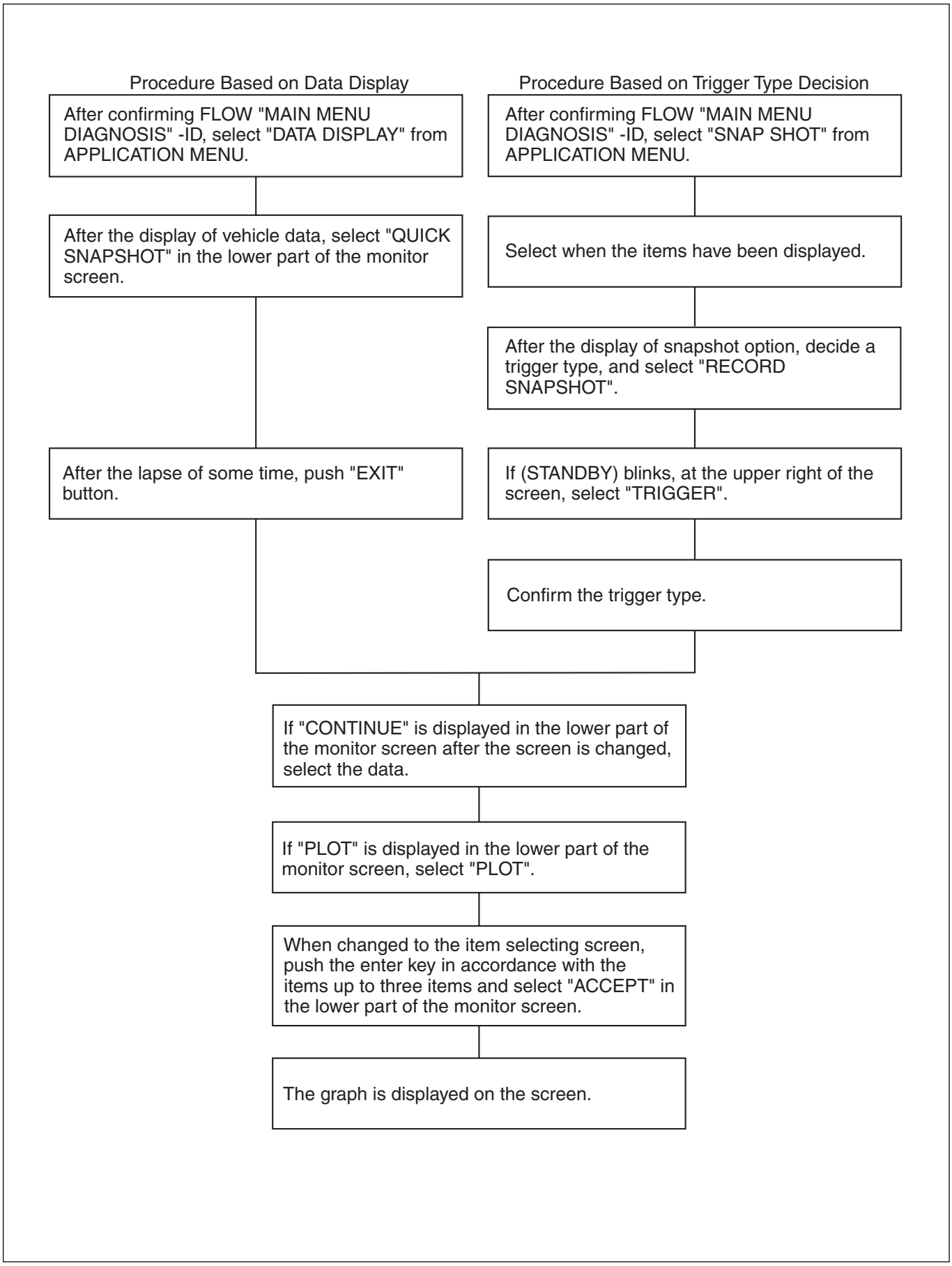


15. Select the Snapshot Options display.

Flow Chart for Snapshot relay (Plotting Graph)



Plotting Graph Flow Chart (Plotting graph after obtaining vehicle information)



Troubleshooting

System Diagnosis

System diagnosis
The system diagnosis is used to repair the electrical/electronic system. Troubles of the E/E system are different from general vehicle troubles and they can be classified as follows.

1. Initial state trouble
- This trouble occurs only once and persists for a short time. Therefore, customers are apt to overlook it. In this state, the customer's complaint is not clear and servicemen cannot re-produce the trouble. ECU, however, may memorize the trouble.

= Not-present state (past trouble)

2. Middle state trouble
- This trouble occurs intermittently but persists for a short time. Under a certain condition, this trouble occurs without exception. The trouble the customer complains is clear but the cause is not. Servicemen can re-produce the trouble if they can identify the condition.

=Intermittent state (intermittent trouble)

3. Advanced state trouble
- This trouble occurs constantly and persists. Customer's complaint is practical and clear. Servicemen can re-produce the trouble. There may be, however, two or more causes of the trouble.

=Present state (current trouble)

Use the diagnostic flow chart to repair the E/E system troubles. The flow chart is also used as a start point. The procedure of diagnosis is described below.

1. Examine the customer's complaint.
- Servicemen must be well acquainted with the normal operation of the system.
- It is required to examine the condition of the trouble

2. Perform a preliminary check.
- Perform a total visual inspection.
- Review the maintenance record.
- Detect abnormal sound or odor.
- Collect the diagnostic trouble code information for a more effective repair.

3. Examine reports and other service information.
- Videos and newsletters are included.

4. Refer to the service information (manual).
- The "System Check" includes information that is not supported by one or more DTC (Diagnostic Trouble Code). The System Check monitors the normal operation of the system, providing servicemen with a systematic diagnosis.

When DTC (Diagnostic Trouble Code) is memorized
Perform an effective repair according to the specified DTC chart.

When there is no DTC
Select a symptom from the diagnostic table classified by symptom. Perform a repair according to the diagnostic procedure. It is possible for servicemen to refer to constituent parts/system checks available with the System Check.

When there is no relevant symptom
1. Analyze the customer's complaint.
2. Develop a diagnostic strategy.
3. Make use of the wiring diagrams and operation principles.

Ask for technical supports when the trouble resembles a recorded case. Combine the technical knowledge of servicemen with available service information effectively.

In case of intermittent troubles
Troubles that do not occur necessarily at all times are referred to as intermittent troubles. To repair the intermittent trouble, perform the following procedure.

1. Examine the vehicle automatic records (frozen frame data) using the past DTC, DTC mode and scanning tool (Tech 2).
2. Evaluate the symptom and condition of the customer's complaint.
3. Examine the constituent parts of the circuits and electrical system using the check sheet or other means.
4. Follow the instructions of the intermittent trouble diagnosis described in the service document.

Most scanning tools such as Tech 2 are equipped with a data tracking ability useful in detection of the intermittent trouble.

When a trouble is not detected
This is when the vehicle is judged in the normal operation. Despite the customer's complaint, the vehicle can be in a normal condition. Compare the customer's complaint with the condition of a normal vehicle. The trouble may be one of the intermittent troubles. Before returning the vehicle to the customer, examine the complaint under the condition the customer specifies.

1. Examine the customer's complaint.
   If the trouble cannot be detected or identified, it is necessary to evaluate the trouble again. The complaint must be examined again. The vehicle may prove normal as well as the trouble may prove intermittent.

2. Repair and check
   After the cause is identified, it is necessary to repair the trouble. Check the trouble is repaired and demonstrate the normal operation of the vehicle. This procedure includes road tests or other checks to prove the trouble is repaired under the following conditions.

- Test and check the vehicle under the condition specified by the customer.
- When DTC has been issued, re-produce the condition where the DTC appeared using the scanning tool (Tech 2) according to the vehicle automatic record, and check the vehicle for the normal operation.

Checking the repairs
Checking the repairs is more comprehensive for vehicles using the IE system trouble diagnosis.

IMPORTANCE
Servicemen should perform the following procedure after the repair. Otherwise, unnecessary repairs may be undertaken.

1. Review the trouble record of the diagnosed DTC and record it.
2. Clear the DTC.
3. Run the vehicle under the condition specified in the trouble record.
4. Examine the status information of the diagnosed DTC until the diagnostic test related to the DTC is carried out.

NOTE
One of the necessary DTC status information is about the DTC setting condition. The time taken from the vehicle start up to the recognition of the DTC and the condition are important. As a guide, perform the DTC diagnostic test after warming up the vehicle sufficiently (water temperature; 70 °C or higher). If the vehicle is tested under a different condition with wrong time interval, the customer's complaint may occur again.

General Service Information

Problems of serviceability

Non-OEM parts
Every trouble diagnosis is designed to operate with OEM parts. If sensors or switches available on the market are attached, the IE lamp ("CHECK ENGINE" lamp) will light due to diagnostic errors. Electronic equipment, such as radio equipment, stereo system, theft-lock system, available on the market may radiate interference noises (EMI) to the control system, if they are installed inappropriately. This will lead to the occurrence of wrong sensor information and illumination of the IE lamp ("CHECK ENGINE" lamp).

Poor maintenance of the vehicle
The IE trouble diagnosis is so sensitive that the IE warning lamp ("CHECKING ENGINE" lamp) may light due to poor maintenance of the vehicle. Lack of oil replacement, clogging of the oil filter and fuel filter due to inappropriate viscosity of the oil, and the subsidence attached to the crankcase may cause vehicle malfunctions that were not detected before the IE system trouble diagnosis. Although a poor maintenance of the vehicle is not classified into the "Troubles not related to the vehicle", observe the maintenance schedule of the vehicle more strictly because the trouble diagnosis is very sensitive.

Troubles of the related system
Most system trouble diagnoses will stop functioning when ECU detects troubles of the related system or constituent parts.

Visual Inspection of the Engine
When performing the diagnosis procedure, inspect the engine visually with special care. The visual inspection may resolve the trouble without unnecessary procedure. Perform the visual Inspection according to the following guideline.

- Check every piping hose for punch holes, cuts, disconnection and appropriate piping.
- Check the hoses hidden by other constituent parts.
- Check every wire of the engine for appropriate connection, burns and abrasions. Check also that the wire is not pressed excessively, not touched with edges, or not connected to the hot exhaust manifold or pipes.

Basic knowledge about the required tools

CAUTION
The basic knowledge about the power train is necessary for the diagnostic procedure. Lack of this knowledge may cause diagnostic error and damages to the constituent parts of the power train. Servicemen without the knowledge must not attempt to diagnose the trouble related to the power train.

The basic understanding of Tech 2 is required for an effective use of this chapter in the service manual.

DTC Code:

DTC	DESCRIPTION	SERVICE ENGINE SOON	
33	Internal Control Module Random Access Memory(RAM)	-	
54	Engine Speed Too High	-	Note1
10	Rack Sensor Open Or Short Circuit	-	
15	TDC Sensor Error	◎	
14	Timing Sensor Error	◯	
18	TCV Open Or Short Circuit	-	
12	Timer Feedback Error	◎	
23	Engine Coolant Temperature Open Or Short Circuit	-	

Note: When diagnosis switch opens (user mode), trouble indication sign is shown as follows:
◯: Indicator turns on when less than 600 rpm last for 20 seconds.
◎: Indicator continuously turns on.
- : Indicator does not turn on.

Note1: DTC code number 543 is displayed with manual flashing operation.

DTC 33 Memory (RAM) error

STEP	ACTION	YES	NO
1	Replace ECU	Solved	

NOTE: Proper diagnosis can not be made due to malfunction of ECU. Check ECU again for malfunction after replacement.

DTC 54 Excessive high engine revolution error

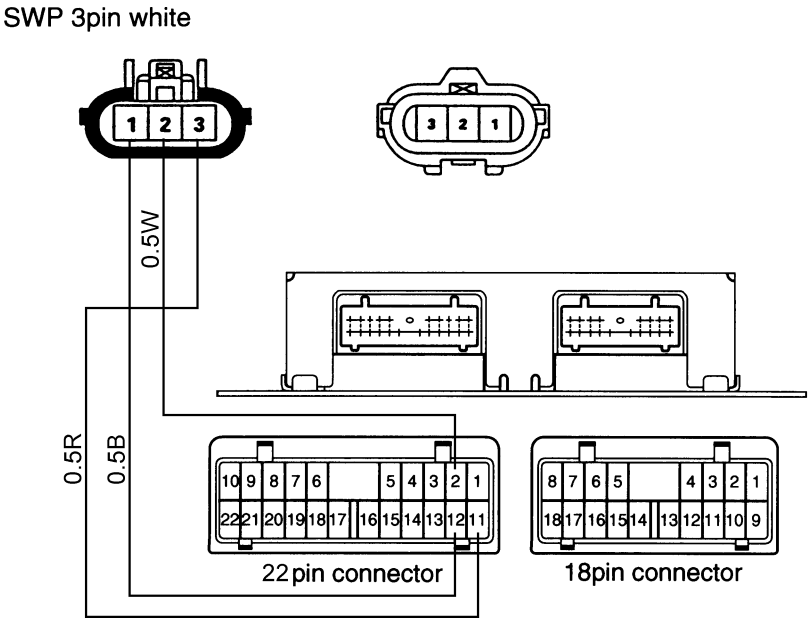
Tech 2 operation

STEP	ACTION	YES	NO
1	1. Check high engine revolution error. 2. Check diagnosis error?	Go to Step 2.	Check diagnostic error.
2	1. Set Tech 2 to IE and read W/L flashing. 2. Was DTC code 10 displayed?	Procedure DTC code 10	Go to Step 3.
3	1. Inspect engine unit, clutch and related parts for abnormality. 2. Starter SW on. 3. After holding down memory clear switch for at least one second, release it. 4. Once set Tech 2 to OFF and then set it to read DTC. 5. Confirm if DTC is cleared.	Go to Step 4.	Go back to Step 2.
4	End. Return to diagnostic procedure if necessary.	Solved.	Go back to Step 3.

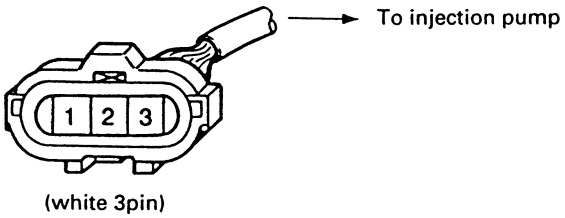
Note: DTC code number 543 is displayed with manual flashing operation.

DTC 10 Rack sensor

Rack Sensor Connector



Rack sensor connector terminal assignment



Injection pump side connector
(Location in connector box)

Terminal NO.	Signal Name	Color of wire
①	+5V	R
②	SIG	W
③	GND	B

DTC 10 Rack sensor error

Manual flashing operation

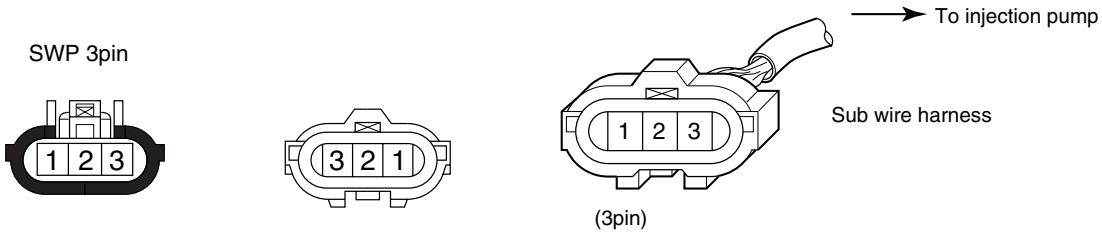
STEP	ACTION	YES	NO
1	1. Check rack sensor error. 2. Check diagnosis error?	Go to Step 2.	Check diagnostic error.
2	1. Starter SW off. 2. Open connector box. 3. Disconnect rack sensor connector and harness connector of cab. 4. Disconnect wire harness from engine ECU. 5. Inspect if rack sensor circuit (+5), (SIG) and (GND) have short circuit. 6. Check continuity, short circuit and snapping wire of rack sensor between connector box and engine ECU connector. 7. Was circuit correct?	Go to Step 3.	Repair circuit.
3	1. Connect wire harness to ECU. 2. Start SW on. 3. Measure output voltage at connector terminal at ECU harness. 4. Was voltage 4.75 to 5.25V?	Go to Step 4.	Replace ECU.
4	1. Replace rack sensor. 2. Replace injection pump. 3. Connect all harness to engine. 4. Clear DTC code. 5. Was DTC cleared?	Go to Step 5.	Go back to Step 3.
5	1. Make sure of repair procedure. 2. Connect Scan tool and refer to lack voltage of monitor. 3. Was resistance correct?	Go to Step 6.	Go back to Step 4.
6	1. Starter SW on. 2. Run engine. 3. Was DTC 10 displayed?	Go to Step 7.	Go back to Step 5.
7	End. Return to diagnostic procedure if necessary.	Solved	Go back to Step 1.

Tech 2 operation

STEP	ACTION	YES	NO
1	1. Check rack sensor error. 2. Check diagnosis error?	Go to Step 2.	Check diagnostic error.
2	1. Starter SW off. 2. Open connector box. 3. Disconnect rack sensor connector and harness connector of cab. 4. Disconnect wire harness from engine ECU. 5. Inspect if rack sensor circuit (+5), (SIG) and (GND) have short circuit. 6. Check continuity, short circuit and snapping wire of rack sensor between connector box and engine ECU connector. 7. Was circuit correct?	Go to Step 3.	Repair circuit.
3	1. Connect wire harness to ECU. 2. Starter SW on. 3. Measure output voltage at connector terminal at ECU harness. 4. Was voltage 4.75 to 5.25V?	Go to Step 4.	Replace ECU.
4	1. Replace rack sensor. 2. Replace injection pump. 3. Connect all harness to engine. 4. Run engine. 5. Set Tech 2 to read flickering condition of W/L.	Go to Step 5.	Go back to Step 3.
5	1. Stop engine run. 2. Starter SW on. 3. After holding down memory clear switch for at least one second, release it. 4. Once set Tech 2 to OFF and then set it to read DTC. 5. Confirm if DTC is cleared.	Go to Step 6.	Go back to Step 4.
6	End. Return to diagnostic procedure if necessary.	Solved	Go back to Step 1.

DTC 15 TDC sensor error

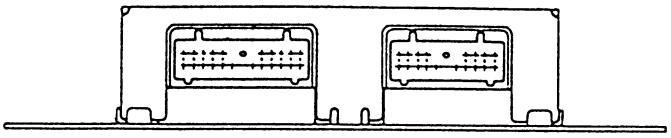
TDC Sensor Connector

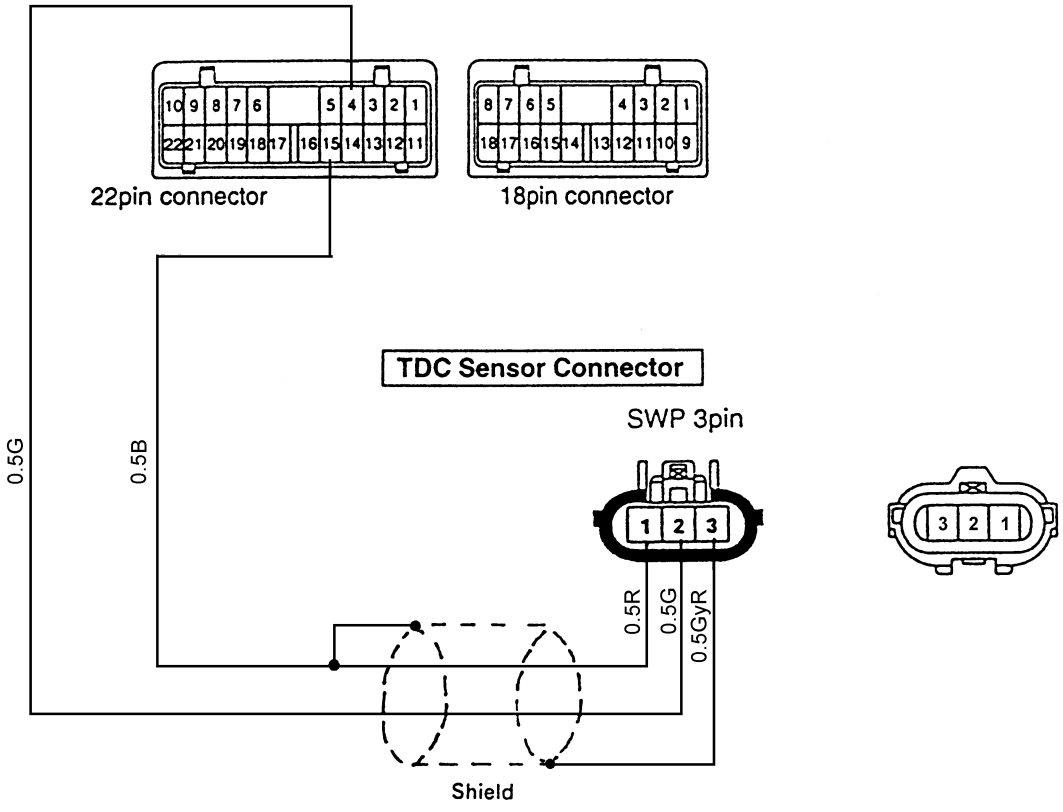


Injection pump side connector
(Location in connector box)

Terminal NO.	Signal Name	Color of wire
①	+5V	R
②	SIG	G
③	GND	B

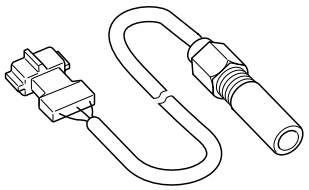
Engine ECU Connector



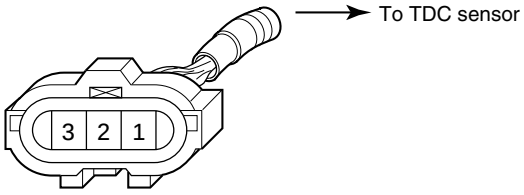


TDC sensor appearance, terminal assignment

TDC sensor appearance



(3pin)

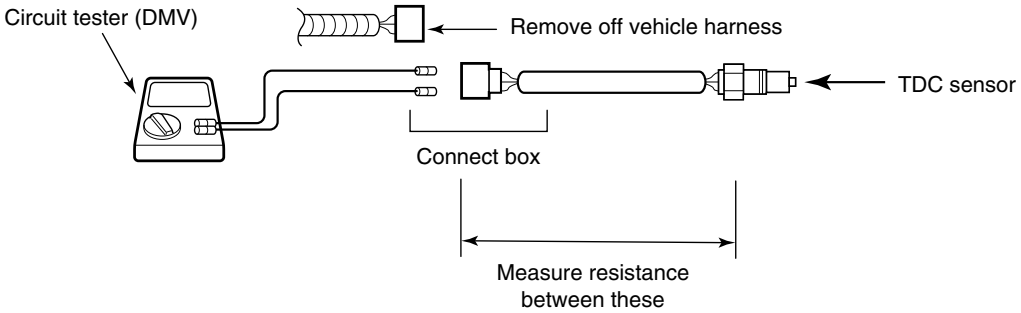


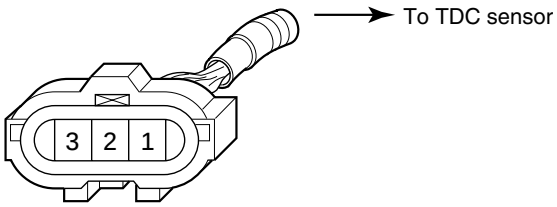
(3pin)

TDC sensor side connector
(Located in connector box)

Terminal NO.	Signal Name	Wire Color
①	GND	B
②	SIG	G
③	+5V	R

Measure TDC sensor resistance





(3pin)

TDC sensor side connector
(Located in connector box)

Resistance

Inspection area			Resistance	Remark		
Connector (3pin)	② terminal	↔ ① terminal	125.5 ± 17 [Ω]	SIG	↔	GND
	② terminal	↔ ③ terminal	∞	SIG	↔	Shield
	② terminal	↔ Body	∞	SIG	↔	Body
	① terminal	↔ ③ terminal	∞	GND	↔	Shield
	① terminal	↔ Body	∞	GND	↔	Body
	③ terminal	↔ Body	∞	Shield	↔	Body

DTC 15 TDC sensor error

Manual flashing operation

STEP	ACTION	YES	NO
1	1. Check TDC sensor error 2. Check diagnosis error?	Go to Step 2.	Check diagnostic error.
2	1. Starter sw off. 2. Disconnect TDC sensor connector and harness connector of cab. 3. Disconnect wire harness from engine ECU. 4. Inspect if TDC sensor circuit (+5), (SIG) and (GND) have short circuit. 5. Check continuity, short circuit and snapping wire of TDC sensor. 6. Was circuit correct?	Go to Step 3.	Repair circuit.
3	1. Connect wire harness to ECU. 2. Start SW on. 3. Measure resistance of TDC sensor. 4. Was resistance correct?	Go to Step 4.	Replace TDC sensor.
4	1. Check installation of TDC sensor. 2. Check TDC sensor for damage. 3. Is there any failure?	Go to Step 5.	Reinstall or inspect the TDC sensor.
5	1. Remove TDC sensor. 2. Make sure that there is magnetic force at the tip of TDC sensor. 3. Was magnetic force available?	Go to Step 6.	Replace TDC sensor .
6	1. Check installation of sensing plate for injection pump for TDC sensor. 2. Was sensing plate correct?	Go to Step 7.	Replace injection pump.
7	1. Replace ECU. 2. Clear DTC code.3. Make sure of repair procedure.	Go to Step 8.	Go back to Step 6.
8	End. Return to diagnostic procedure if necessary.	Solved	Go to Step 1.

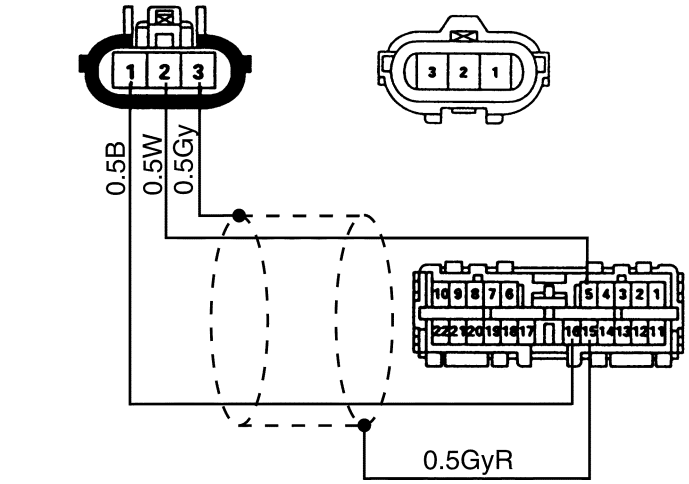
Tech 2 operation

STEP	ACTION	YES	NO
1	1. Check TDC sensor error 2. Check diagnosis error?	Go to Step 2.	Check diagnostic error.
2	1. Starter SW off. 2. Disconnect TDC sensor connector and harness connector of cab. 3. Disconnect wire harness from engine ECU. 4. Inspect if TDC sensor circuit (+5), (SIG) and (GND) have short circuit. 5. Check continuity, short circuit and snapping wire of TDC sensor. 6. Was circuit correct?	Go to Step 3.	Repair circuit.
3	1. Connect wire harness to ECU. 2. Start SW on. 3. Measure resistance of TDC sensor. 4. Was resistance correct?	Go to Step 4.	Replace TDC sensor.
4	1. Check installation of TDC sensor. 2. Check TDC sensor for damage. 3. Is there any failure?	Go to Step 5.	Reinstall or inspect the TDC sensor.
5	1. Remove TDC sensor. 2. Make sure that there is magnetic force at the tip of TDC sensor. 3. Was magnetic force available?	Go to Step 6.	Replace TDC sensor .
6	1. Replace TDC sensor. 2. Run engine. 3. Set Tech 2 to read flickering condition of W/L. 4. Was DTC 15 displayed?	Go to Step 7.	Replace injection pump.
7	1. Stop engine run. 2. Starter SW on. 3. After holding down memory clear switch for at least one second, release it. 4. Once set Tech 2 to OFF and then set it to read DTC. 5. Confirm if DTC is cleared.	Go to Step 8.	Go back to Step 6.
8	End. Return to diagnostic procedure if necessary.	Solved. Go to Step 1.	Go to Step 1.

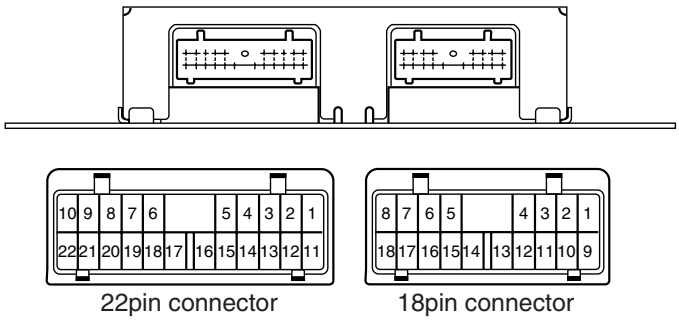
DTC 14 Timing sensor error

Timing Sensor Connector

SWP 3pin black



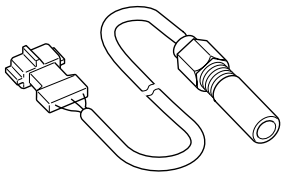
Engine ECU Connector



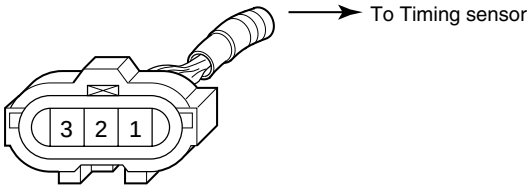
22pin connector 18pin connector

Timing sensor appearance, terminal assignment

Timing sensor appearance



(Black 3pin)

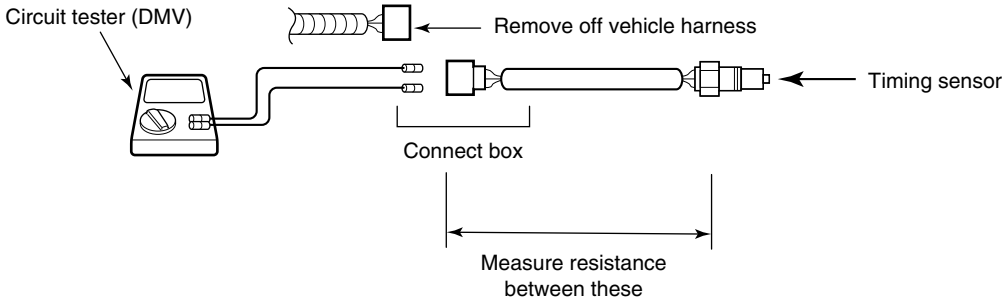


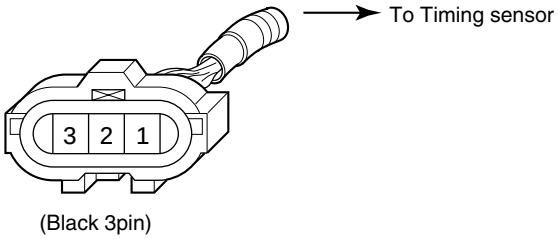
(Black 3pin)

Timing sensor side connector
(Located in connector box)

Terminal NO.	Signal Name	Wire Color
①	GND	B
②	SIG	Y
③	Shield	G

Measure Timing sensor resistance





(Black 3pin)

Timing sensor side connector
(Located in connector box)

Resistance

Inspection area			Resistance	Remark		
Connector (black 3pin)	② terminal	↔ ① terminal	2.1 ~ 2.5 [kΩ]	SIG	↔	GND
	② terminal	↔ ③ terminal	∞	SIG	↔	Shield
	② terminal	↔ Body	∞	SIG	↔	Body
	① terminal	↔ ③ terminal	∞	GND	↔	Shield
	① terminal	↔ Body	∞	GND	↔	Body
	③ terminal	↔ Body	∞	Shield	↔	Body

DTC 14 Timing sensor error

Manual flashing operation

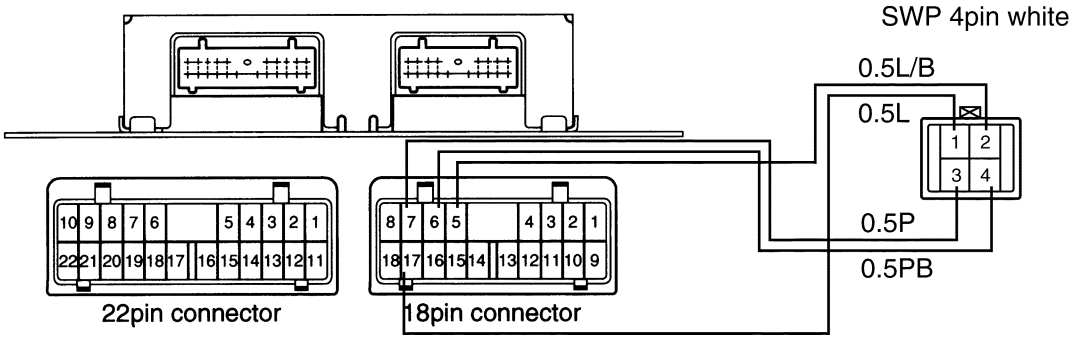
STEP	ACTION	YES	NO
1	1. Check Timing sensor error 2. Check diagnosis error?	Go to Step 2.	Check diagnostic error.
2	1. Starter SW off. 2. Disconnect Timing sensor connector and harness connector of cab. 3. Disconnect wire harness from engine ECU. 4. Inspect if Timing sensor circuit (+5), (SIG) and (GND) have short circuit. 5. Check continuity, short circuit and snapping wire of Timing sensor. 6. Was circuit correct?	Go to Step 3.	Repair circuit.
3	1. Connect wire harness to ECU. 2. Starter SW on. 3. Measure resistance of Timing sensor. 4. Was resistance correct?	Go to Step 4.	Replace Timing sensor sensor.
4	1. Check installation of Timing sensor. 2. Inspect Timing sensor gap. 3. Was gap value less than the following? less than 1mm.	Go to Step 5.	Adjust gap value.
5	1. Remove Timing sensor. 2. Make sure that there is magnetic force at the tip of TDC sensor. 3. Was magnetic force available?	Go to Step 6.	Replace Timing sensor.
6	1. Check installation of sensing plate for injection pump for Timing sensor. 2. Was sensing plate correct?	Go to Step 7.	Replace injection pump.
7	1. Replace ECU. 2. Clear DTC code. 3. Make sure of repair procedure.	Go to Step 8.	Go back to Step 6.
8	End. Return to diagnostic procedure if necessary.	Solved	Go to Step 1.

Tech 2 operation

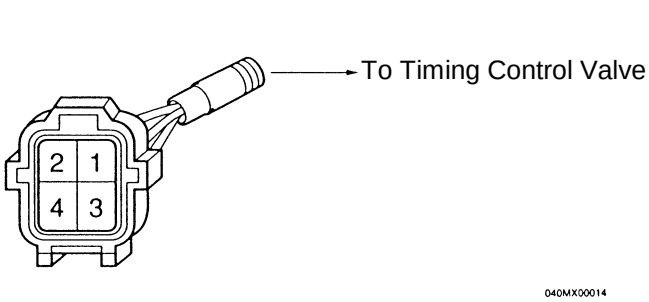
STEP	ACTION	YES	NO
1	1. Check Timing sensor error 2. Check diagnosis error?	Go to Step 2.	Check diagnostic error.
2	1. Starter SW off. 2. Disconnect Timing sensor connector and harness connector of cab. 3. Disconnect wire harness from engine ECU. 4. Inspect if Timing sensor circuit (+5), (SIG) and (GND) have short circuit. 5. Check continuity, short circuit and snapping wire of Timing sensor. 6. Was circuit correct?	Go to Step 3.	Repair circuit.
3	1. Connect wire harness to ECU. 2. Starter SW on. 3. Measure resistance of Timing sensor. 4. Was resistance correct?	Go to Step 4.	Replace Timing sensor sensor.
4	1. Check installation of Timing sensor. 2. Inspect Timing sensor gap. 3. Was gap value less than the following? less than 1mm.	Go to Step 5.	Adjust gap value.
5	1. Remove Timing sensor. 2. Make sure that there is magnetic force at the tip of TDC sensor. 3. Was magnetic force available?	Go to Step 6.	Replace Timing sensor.
6	1. Replace Timing sensor. 2. Replace injection pump. 3. Connect all harness to engine. 4. Run engine. 5. Set Tech 2 to read flickering condition of W/L.	Go to Step 7.	Replace injection pump.
7	1. Stop engine run. 2. Starter SW on. 3. After holding down memory clear switch for at least one second, release it. 4. Once set Tech 2 to OFF and then set it to read DTC. 5. Confirm if DTC is cleared.	Go to Step 8.	Go back to Step 6.
8	End. Return to diagnostic procedure if necessary.	Solved	Go to Step 1.

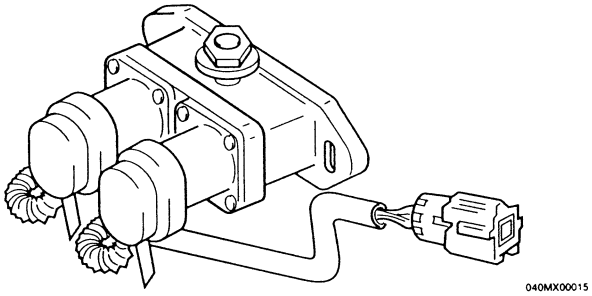
DTC 18 Timing Control Valve error

Engine ECU Connector



Timing Control Valve terminal assignment





Timing Control Valve side connector
(Located in connector box)

Terminal No	Signal Name
1	Return (+)
2	Return (-)
3	Pump (+)
4	Pump (-)

Measure resistance at Timing Control Valve

Resistance values

Inspection area	Resistance
①↔②	21 - 25kΩ
③↔④	21 - 25kΩ
Terminal ↔ body	∞

DTC 18 Timing Control Valve error

Manual flashing operation

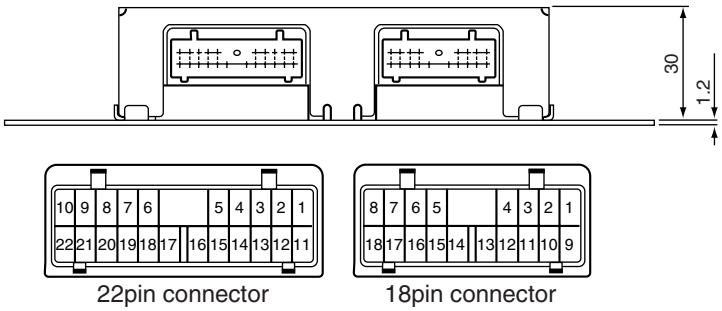
STEP	ACTION	YES	NO
1	1. Check TCV error 2. Check diagnosis error?	Go to Step 2.	Check diagnostic error.
2	1. Starter SW off. 2. Disconnect TCV and harness connector of cab. 3. Disconnect wire harness from engine ECU. 4. Inspect if TCV circuit (+5), (SIG) and (GND) have short circuit. 5. Check continuity, short circuit and snapping wire of TCV. 6. Was circuit correct?	Go to Step 3.	Repair circuit.
3	1. Connect wire harness to ECU. 2. Starter SW on. 3. Measure resistance of Timing sensor. 4. Was resistance correct?	Go to Step 4.	Replace TCV.
4	1. Replace ECU. 2. Clear DTC code. 3. Make sure of repair procedure.	Go to Step 5.	Go back to Step 3.
5	End. Return to diagnostic procedure if necessary.	Solved	Go to Step 1.

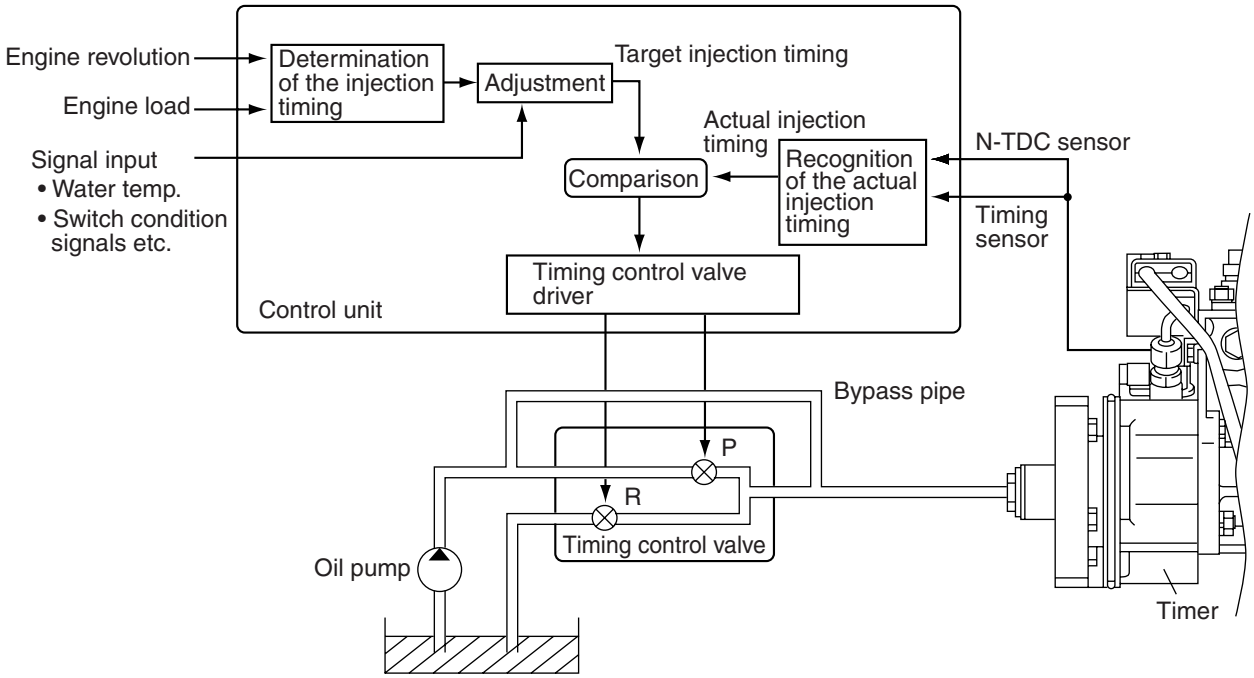
Tech 2 operation

STEP	ACTION	YES	NO
1	1. Check TCV error 2. Check diagnosis error?	Go to Step 2.	Check diagnostic error.
2	1. Starter SW off. 2. Disconnect TCV and harness connector of cab. 3. Disconnect wire harness from engine ECU. 4. Inspect if TCV circuit (+5), (SIG) and (GND) have short circuit. 5. Check continuity, short circuit and snapping wire of TCV. 6. Was circuit correct?	Go to Step 3.	Repair circuit.
3	1. Connect wire harness to ECU. 2. Starter SW on. 3. Measure resistance of Timing sensor. 4. Was resistance correct?	Go to Step 4.	Replace TCV.
4	1. Replace TCV. 2. Replace injection pump. 3. Connect all harness to engine. 4. Run engine. 5. Set Tech 2 to read flickering condition of W/L.	Go to Step 5.	Go back to Step 3.
5	1. Stop engine run. 2. Starter SW on. 3. After holding down memory clear switch for at least one second, release it. 4. Once set Tech 2 to OFF and then set it to read DTC. 5. Confirm if DTC is cleared.	Go to Step 6.	Go back to Step 4.
6	End. Return to diagnostic procedure if necessary.	Solved	Go to Step 1.

DTC 12 Timer feed back error

Engine ECU Connector





- Inspect oil pressure pipe for clogging and deformity.
- Inspect port of timing control valve for clogging or any other abnormality.

DTC 12 Timer feed back error

Manual flashing operation

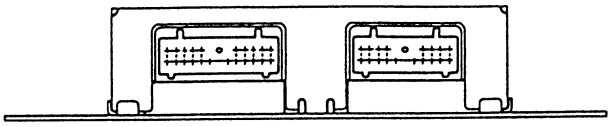
STEP	ACTION	YES	NO
1	1. Check Timer feed back error 2. Check diagnosis error?	Go to Step 2.	Check diagnostic error.
2	1. Starter SW off. 2. Check DTC code. 3. Was DTC code 14, 15 and 18?	Go to Step 3.	Go to DTC procedure of 14, 15 and 18.
3	1. Check injection timing. 2. Was injection timing correct?(Crank pulley damper)	Go to Step 4.	Adjust injection timing.
4	1. Check timing line of Injection pump. 2. Was timing line correct?	Go to Step 5.	Adjust timing line. Replace injection pump if it could not be adjusted.
5	1. Clear DTC code. 2. Starter SW on. 3. Check LED lamp for Scan tool. 4. Was LED lamp flashing? (Flashing time: less than 1 sec under regular interval)	Go to Step 6.	Make sure "degree CA" using scan tool. Replace ECU if " degree CA " was displayed.
6	1. Inspect oil pressure pipe. 2. Check abnormality on oil pressure pipe. 3. Was oil pressure pipe correct?	Go to Step 7.	Repair oil pipe.
7	1. Inspect TCV. 2. Inspect port of TCV and check abnormality. 3. Was port of TCV correct?	Go to Step 8.	Go back to Step 5.
8	1. Inspect engine unit. 2. Were oil pump, oil line and etc. correct?	Go to Step 9.	Repair engine unit.
9	1. Replace injection pump. 2. Clear DTC code. 3. Check value of " degree CA " using scan tool. 4. Was value correct?	Go to Step 10.	Replace ECU.
10	1. Make sure of repair procedure. End. 2. Return to diagnostic procedure if necessary.	Solved	Go to Step 1.

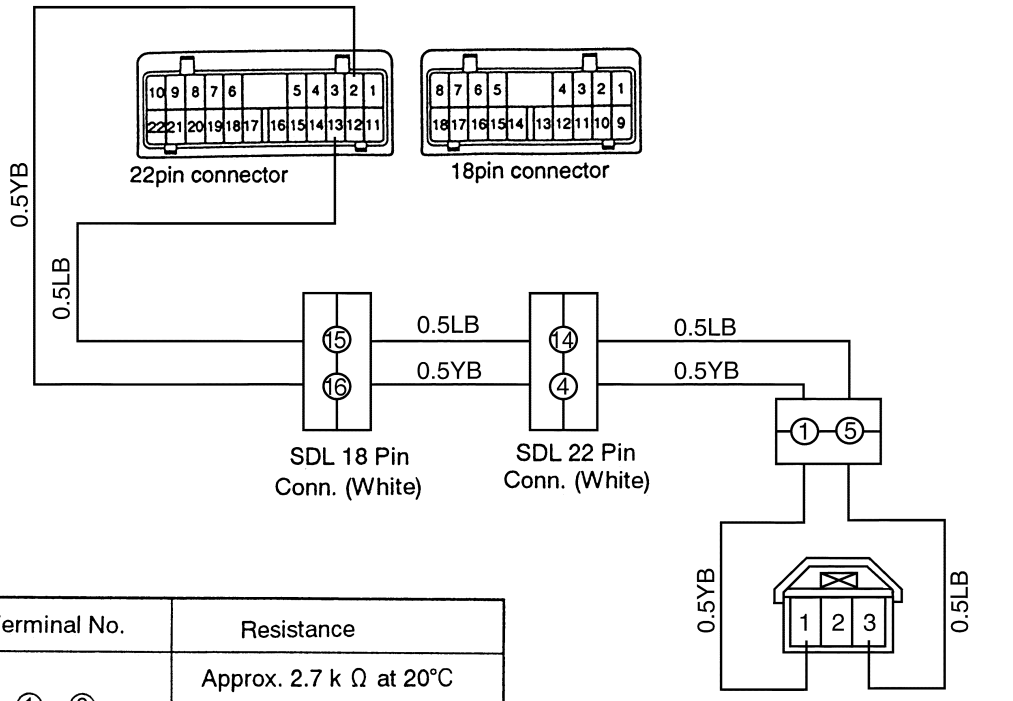
Tech 2 operation

STEP	ACTION	YES	NO
1	1. Check Timer feed back error 2. Check diagnosis error?	Go to Step 2.	Check diagnostic error.
2	1. Starter SW off. 2. Check DTC code. 3. Was DTC code 14, 15 and 18?	Go to Step 3.	Go to DTC procedure of 14, 15 and 18.
3	1. Check injection timing. 2. Was injection timing correct?(Crank pulley damper)	Go to Step 4.	Adjust injection timing.
4	1. Check timing line of Injection pump. 2. Was timing line correct?	Go to Step 5.	Adjust timing line. Replace injection pump if it could not be adjusted.
5	1. Clear DTC code. 2. Starter SW on. 3. Check LED lamp for Scan tool. 4. Was LED lamp flashing? (Flashing time: less than 1 sec under regular interval)	Go to Step 6.	Make sure "degree CA" using scan tool. Replace ECU if " degree CA " was displayed.
6	1. Inspect oil pressure pipe. 2. Check abnormality on oil pressure pipe. 3. Was oil pressure pipe correct?	Go to Step 7.	Repair oil pipe.
7	1. Inspect TCV. 2. Inspect port of TCV and check abnormality. 3. Was port of TCV correct?	Go to Step 8.	Go back to Step 5.
8	1. Inspect engine unit. 2. Were oil pump, oil line and etc. correct?	Go to Step 9.	Repair engine unit.
9	1. Replace injection pump 2. Connect all harness to engine. 3. Run engine. 4. Set Tech 2 to read flickering condition of W/L.	Go to Step 10.	Replace ECU.
10	1. Stop engine run. 2. Starter SW on. 3. After holding down memory clear switch for at least one second, release it. 4. Once set Tech 2 to OFF and then set it to read DTC. 5. Confirm if DTC is cleared.	Go to Step 11.	Go back to Step 9.
11	1. Make sure of repair procedure. End. Return to diagnostic procedure if necessary.	Solved	Go to Step 1.

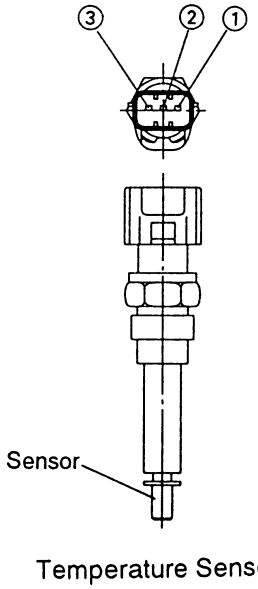
DTC 23 Coolant temperature sensor error

Engine ECU Connector



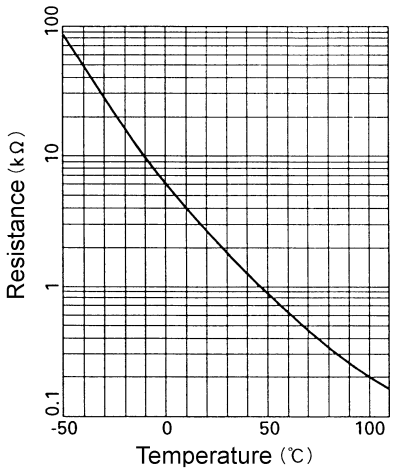


Terminal No.	Resistance
①−③	Approx. 2.7 k Ω at 20°C
	Approx. 400 Ω at 80°C
Terminal & Body	∞



Temperature Sensor

①	Sensor Signal
②	to Meter
③	Sensor Ground



DTC 23 Coolant temperature error

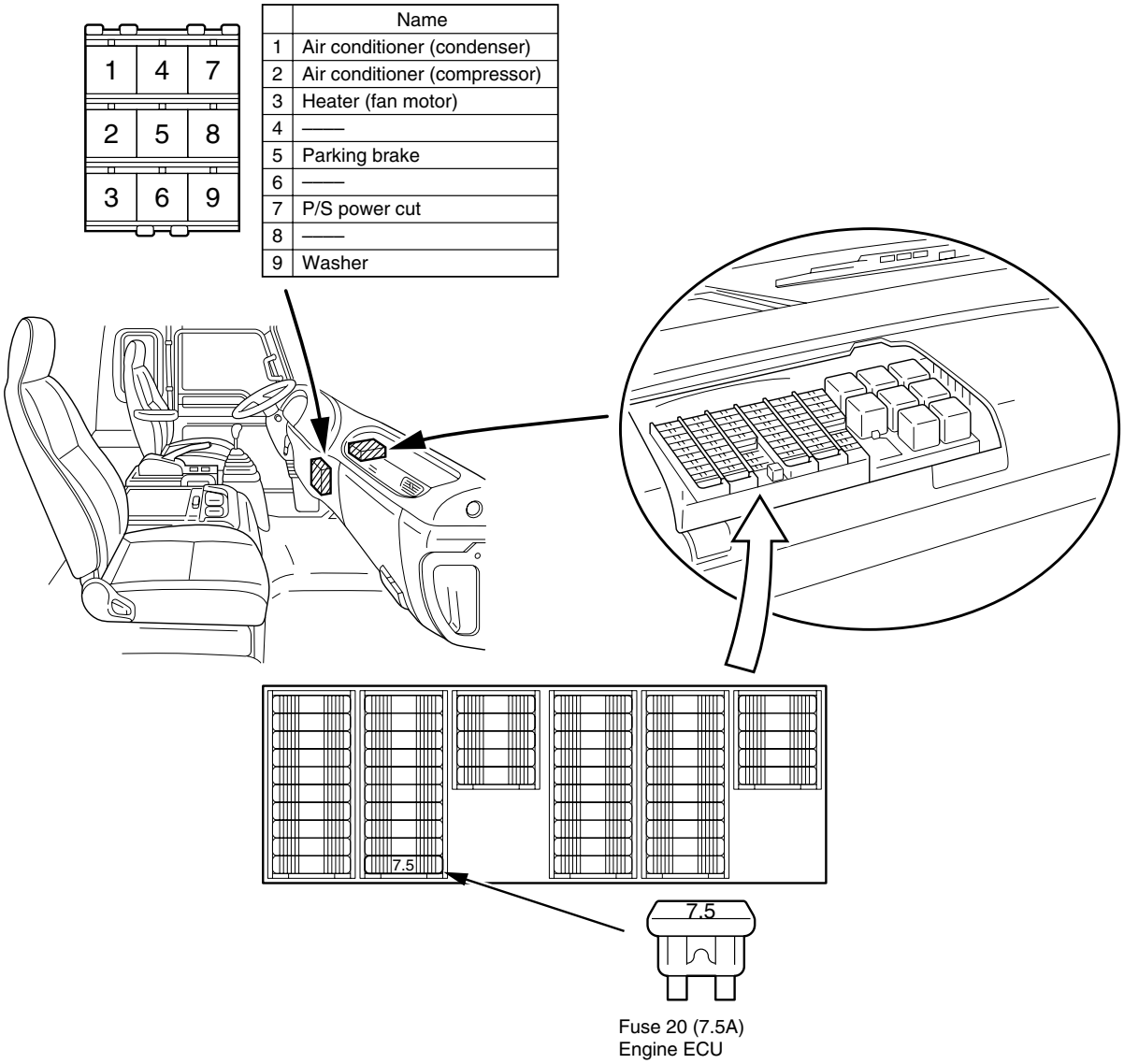
Manual flashing operation

STEP	ACTION	YES	NO
1	1. Check Coolant temperature sensor error 2. Check diagnosis error?	Go to Step 2.	Check diagnostic error.
2	1. Starter SW off. 2. Disconnect Coolant temperature sensor connector and harness connector of cab. 3. Starter SW on. 4. Measure resistance of coolant temperature circuit at ECU connector. 5. Was voltage 4.5 to 5.5V?	Go to Step 3.	Repair circuit.
3	1. Make sure of coolant temperature sensor. 2. Was resistance correct?	Go to Step 4.	Replace sensor.
4	1. Clear DTC code. 2. Starter SW on. 3. Was DTC 23 displayed?	Go to Step 5.	Replace ECU.
5	End. Return to diagnostic procedure if necessary.	Solved	Go to Step 1.

Tech 2 operation

STEP	ACTION	YES	NO
1	1. Check Coolant temperature sensor error 2. Check diagnosis error?	Go to Step 2.	Check diagnostic error.
2	1. Starter SW off. 2. Disconnect Coolant temperature sensor connector and harness connector of cab. 3. Starter SW on. 4. Measure resistance of coolant temperature circuit at ECU connector. 5. Was voltage 4.5 to 5.5V?	Go to Step 3.	Repair circuit.
3	1. Replace Coolant temperature sensor. 2. Replace injection pump. 3. Connect all harness to engine. 4. Run engine. 5. Set Tech 2 to read flickering condition of W/L.	Go to Step 4.	Replace sensor.
4	1. Stop engine run. 2. Starter SW on. 3. After holding down memory clear switch for at least one second, release it. 4. Once set Tech 2 to OFF and then set it to IE to read DTC. 5. Confirm if DTC is cleared.	Go to Step 5.	Replace ECU.
5	End. Return to diagnostic procedure if necessary.	Solved	Go to Step 1.

Relay and fuse location



	Name
1	Air conditioner (condenser)
2	Air conditioner (compressor)
3	Heater (fan motor)
4	——
5	Parking brake
6	——
7	P/S power cut
8	——
9	Washer

Fuse 20 (7.5A)
Engine ECU

Confirmation after repairs in the electronic control system.
It is required to attest the validity after the repairs in the control system are completed. Otherwise, warning light (check engine light) may light or malfunction in the driving system may occur on the way of delivery. In case of intermittent troubles it is especially required to re-create and check the situation before delivery.

Item No.	Item	Purpose	Description
1	Check of the trouble code (DTC).	To check the trouble code (DTC) after repair.	Delete the previous DTC. After the engine speed rotated to the proper rpm check the warning light does not blink. The No Diagnostic Trouble Codes Stored display appears if check the DTC.
2	Check of the idling speed after warming up the engine.	To check whether the idling control is normal or not.	Check the idling speed (Refer to the Technical data) after warming up the engine. If any trouble is detected, refer to the unstable idling of the diagnosis by each sympton.
3	Check of the scan tool data list	To check the engine control and communication condition mainly.	Monitor the scan tool data list and check using the normal value sheet. Check the normal values of the scan tool data list.
4	Check of the repeatability of start up.	To check whether the start up control is normal or not.	After warming up the engine, check the engine speed becomes stable within three seconds of re-start up.
5	Check of the high power transmitter	To check whether radio interference is caused or not after radio equipment such as a transceiver is attached.	Check the idling speed changes or not when you turn the power of radio equipment such as transceiver ON/OFF. If any trouble is detected, inform your client of the need to change the position of the radio equipment and to power down.

Tech 2 Data Display In Regards To The ECU Versions (6HH1)

Tech 2 Display Pos.	TECH 2 STRING	Unit	REF 1EVT	REF 1GOVTICS	REF 1GOVTICS	REF 1GOVTICS
	Emission Control		**Euro I**	**Euro II**	**Euro II**	**Euro II**
	Destination		**China**	**Thailand**	**Singapore**	**Hong Kong**
1	Engine Speed	RPM	575 ± 25	600-650	600-650	600-650
2	Rack Position	mm	1.5-1.8	1.5-1.8	1.5-1.8	1.5-1.8
3 ****	Prestroke	1st / (1st-Sol)	27.90	27.90	29.90	34.20
4 ****	Prestroke	°				
5	M/V Solenoid IVES (ISUZU Variable Electric and Economy Swirl)	Active/Inactive	-	-	-	-
6	M/V Solenoid CCS	Active/Inactive	-	-	-	-
7	Exhaust Brake Switch	Open 0V/Closed 24V				
8	M/V Solenoid Exhaust Switch	Active/Inactive				
9	Retarder Switch	Open 0V/Closed 24V				
10	M/V Retarder Solenoid	Active/Inactive				
11	Idle Control Set Value	%				
12	Accelerator Position Sensor signal	0.1-0.5V	←	←	←	←
13	Accelerator Position Sensor signal	0%	←	←	←	←
14	Accelerator Switch	Open 0V/Closed 24V	24V(Idling)	←	←	←
15	Vehicle Speed	Km/h / Miles/h	0Km/h	←	←	←
16	Engine Coolant Temperature	°C	80°C	←	←	←
17	Ambient Temperature	°C	-	-	-	-
18	Fuel Temperature	°C	-	-	-	-
19	Boost Pressure	mmHg	-	-	-	-
20	Barometric Pressure	760mmHg	-	-	-	-
21	Starter Switch	Open 0V/Closed 24V	0V	←	←	←
22	Heat Switch	Open 0V/Closed 24V	0V	←	←	←

23	PTO Switch	Open 0V/Closed 24V	0V	←	←	←
24	Parking Switch	Open 24V /Closed 0V	24V (Running)	←	←	←
25	Low Air Pressure Switch	Open 24V /Closed 0V	24V (Normal)	←	←	←
26	Idle Control Switch	Auto(Open)/ Manual(Short)	Manual	←	←	←
27	Idle Up Switch	Open 0V/Closed 24V	0V	←	←	←
28	Idle Down Switch	Open 0V/Closed 24V	0V	←	←	←
29	Brake Switch	Open 24V /Closed 0V	Not Used	←	←	←
30	Brake 2 Switch	Open 24V /Closed 0V	24V	←	←	←
31	Clutch Switch	Open 0V/Closed 24V	24V	←	←	←
32	Fuel Delivery Resistance Number1					
33	Fuel Delivery Resistance Number2					
34	Fuel Delivery Resistance Number3					
35	Memory clear Switch	OFF/ON	-	←	←	←
36	Diagnostic Switch	OFF/ON	OFF	←	←	←
37	Limp Home Switch	Open 0V/Closed 24V	0V	←	←	←
38	Auto Cruise Set Vehicle Speed	Km/h / Miles/h	Not Used	←	←	←

**** It is not possible to display these two strings in one Tech 2 display row.

Meaning of Control System Abbreviations:
GOV = EC Governor = Electrical Control Governor
TICS = Timing And Injection Control System

Note 1:
The measurement is taken on the assumption that the engine is running in a low idling state after sufficient warming up, at an altitude of sea level or thereabout, and the temperature is about 20°C. The barometric pressure of 760 mmHg or thereabout.
It should be noted that the engine speed changes due to the driver's idle up operation or the automatic idle up control activated by a low temperature of water.

The idling speed falls within the values specified in the control unit. Although each value does not deviate from the specifications, it should be noted that there are some variations depending on the type of the engine. (It is recommended to make an allowance of +/- 10 rpm.) However, it should be noted that the idling speed of the engine with the 6HH1 mechanical governor specification changes unlimitedly depending on the pump setting.
The rack position and prestroke position also changes due to the change in speed. Read a value near the center of the fluctuating area.

Caution taken in replacing engine control unit (ECU)

When the vehicle is shipped, the Quantity adjusting resistance No. is memorized in the ECU, so the adjusting resistor plugs are not fitted.
If the ECU is replaced, fit Quantity adjusting resistance which has the same No. as the quantity adjusting resistance No. memorized in the ECU.

The Quantity adjusting resistance No. is described in the seal attached to the vehicle. Please fit the Quantity adjusting resistance in accordance with the contents described in the seal. (Refer to the Workshop manual for Emission and Electrical Diagnosis of 6HH1)

When the ECU will be replaced with new one in the field the Quantity adjusting re-write procedure is not available. (It has already provided the manual procedure to adjust by using Q-Adjust resistors which are equipped on the vehicle.)

6HEED-WE-0001

You are requested to order this manual using the manual number that is shown above.

This manual is applicable for vehicles in all countries except the USA and Canada.

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