Introduction

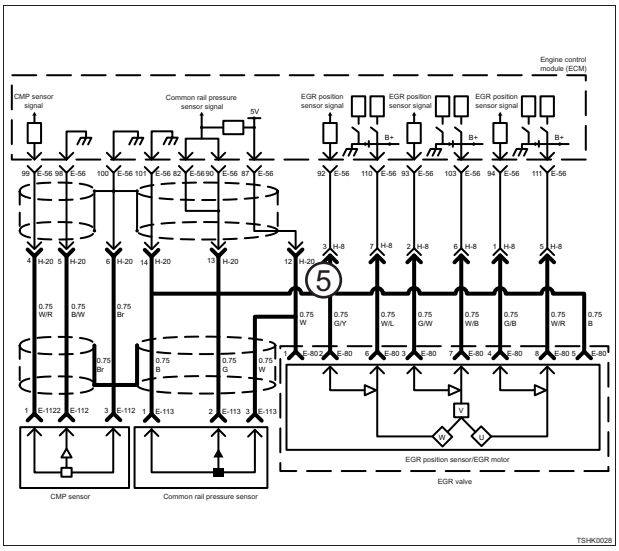
This Troubleshooting Manual describes the structure and the troubleshooting of electronic control fuel injection system (common rail type) in 4HK1 and 6HK1 industrial engines.
Use this manual sufficiently to perform service work properly and quickly.

Isuzu Motors Limited
Off-highway Powertrain Operation Dept.

How to read trouble diagnosis section

The following illustration is an example for trouble diagnosis section. See this illustration and description.

DTC: P0192 (Flash code 245) Common rail pressure sensor fault (low voltage fault, short circuit) (1) (2) (3) (4)



(5)

Description of circuit

The common rail pressure sensor detects the common rail internal pressure. The common rail pressure sensor is installed to the common rail. As the common rail internal pressure changes depending on engine condition, output voltage of the common rail pressure sensor will change (if the common rail internal fuel pressure is low, output voltage becomes low, if the pressure is high, the output voltage becomes high as well). The engine control module (ECM) reads this output voltage change, converting it into common rail internal pressure, to utilize for control. Dedicated communication circuits are used for the sensor power supply (5V), SIG, and ground in the common rail pressure sensor, which are connected to the ECM. Also, the sensor circuit is shielded to avoid electrical noise etc.

(6)

Main trouble symptom

Engine stall possible

Output lowering (7)

Preconditions when DTC is set

Key switch input voltage is 18V or more. (8)

DTC P1630 or P1635 is not detected.

DTC set condition

Common rail pressure sensor voltage becomes 0.7V or less. (9)

Action taken when DTC is set

Trouble is displayed on the monitor of the machine* or diagnosis lamp comes on. (* Nothing is displayed depending on the machine manufacturer) (10)

Back-up mode

Rail pressure feedback control stopped

Limited injection amount 2 (multi-injection stopped) (11)

EGR stopped

Switches the control to SCV compulsory drive

80 MPa target

Recovery from failure

Refer to 1E-310, List of Diagnostic Trouble Codes and About recovery from failure in this section for recovery from failure. (12)

The conditions to clear the MIL/DTC

The present trouble turns to history trouble when the condition is out of the range from DTC set condition (recovery from failure).

The diagnosis lamp will go off after the code turns to history trouble and the key switch is turned OFF then ON again.

Using the scan tool, or memory clear switch and diagnostic switch operation enables to clear DTCs.

Diagnostic aid

If the intermittent trouble is suspected, followings may be the cause. (13)

Improper connection of harness connector

Defective harness routing

Worn harness cladding

Wire disconnection inside harness cladding

Following inspections are necessary to detect these causes.

Improper connection of harness connector and ECM connector

Poor connection of terminal from connector

Unmatched terminals are fitted.

Damage of connector lock

Poor contact between terminal and wire

Damaged harness

Visually check the harness for damage.

Check the relevant items on the scan tool data display while moving the connector and the harness which are related to the sensor. The variation of the display indicates the faulty part.

Test description

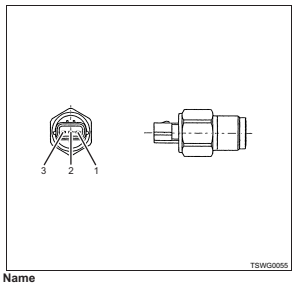
Numbers below indicate step numbers in the chart.

3. In case of present trouble, the Common rail pressure sensor displays more than the specified value. In this case, identify the cause by referring to Diagnostic aid .

5. If the Common rail pressure sensor displays more than the specified value when the common rail pressure sensor connector is removed, the circuit beyond the sensor is normal including ECM.

Step	Action	Value	YES	NO
1	Perform the OBD system check. Is the procedure completed?		Go to Step 2.	Perform the OBD system check and Go to Step 2.
2	...tion) available?		Go to Step 3.	Go to Step 14.
	...sor			
5	1. Turn the key switch to OFF . 2. Disconnect the common rail pressure sensor connector. 3. Turn the key switch to ON . 4. Check the value for Common rail pressure sensor using scan tool. Is the Common rail pressure sensor output voltage specified value?	0V	Go to Step 8.	Go to Step 6.
6	1. Check for followings in the power supply circuit between ECM and common rail pressure sensor using breaker box or DMM. Refer to 1E-427, Breaker box inspection procedure, DTC: P0192 (Flash code 245) Common rail pressure sensor fault (low voltage fault, short circuit), List of Diagnostic Trouble Codes . **Note:** If breaker box is not available, refer to 1E-428, On-board check procedure for sensors, DTC: P0192 (Flash code 245) Common rail pressure sensor fault (low voltage fault, short circuit), List of Diagnostic Trouble Codes . Open circuit High resistance 2. If the trouble is detected, repair or replace as required. Is the trouble detected?		Go to Step 12.	Go to Step 7.
	1. Check for followings in the signal circuit between ECM and common rail pressure sen... ...breaker box or DMM. ...box inspection pro... ...Com...			

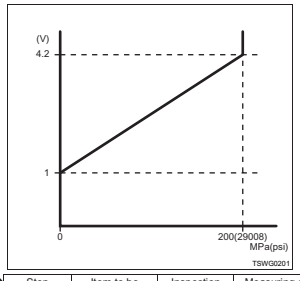
About common rail pressure sensor



Name

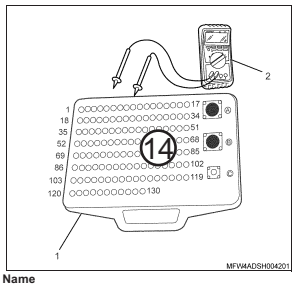
1. GND
2. Signal
3. Power supply

Characteristics of common rail pressure sensor



Breaker box inspection procedure

Perform the inspection in the following procedure if there is such an instruction to use breaker box in the step. After inspection, return to the diagnostic step.



Name

1. Breaker box
2. DMM

Step	Item to be checked	Inspection method	Measuring condition	Terminal No.	Normal value	Abnormal value
6	Open circuit/ high resistance	Resistance measurement	Disconnect the sensor connector. Key switch OFF	87 Sens or connector power supply terminal	100Ω or less	10 MΩ or more

TSWG0198

About DTC indicated by blinking of diagnosis lamp

While the engine stops, both the current and past DTCs are displayed.
While the engine is operated, the lamp illuminates only if the current DTC occurs.

How to read DTC by trouble display monitor

When a DTC occurs, it is displayed on trouble display monitor on the machine.

How to read DTC by a scan tool

DTC can be read using a scan tool.

Note:
Refer to 1E-37, “Diagnostic procedure, Tech2, How to Use Trouble Diagnosis–Related Tool” for work procedure.

If the DTC (diagnostic trouble code) is stored

Perform service correctly according to the specified DTC chart.

If there is no DTC

Select symptom from the diagnostic chart according to symptom. Complete the service following diagnostic procedure. You may also perform inspection by referring function diagnosis.

If there is no applicable symptom

1. Confirm the complaint in detail.
2. Create diagnostic plan.
3. Use wiring diagram and principle of operation.

Ask for technical support when repair history is available for similar case. Connect technician’s knowledge with the effective usage of available service information.

If there is intermittent (intermittent trouble)

The trouble situation not occurring constantly is called intermittent (intermittent trouble). Perform the following steps to solve the intermittent trouble.

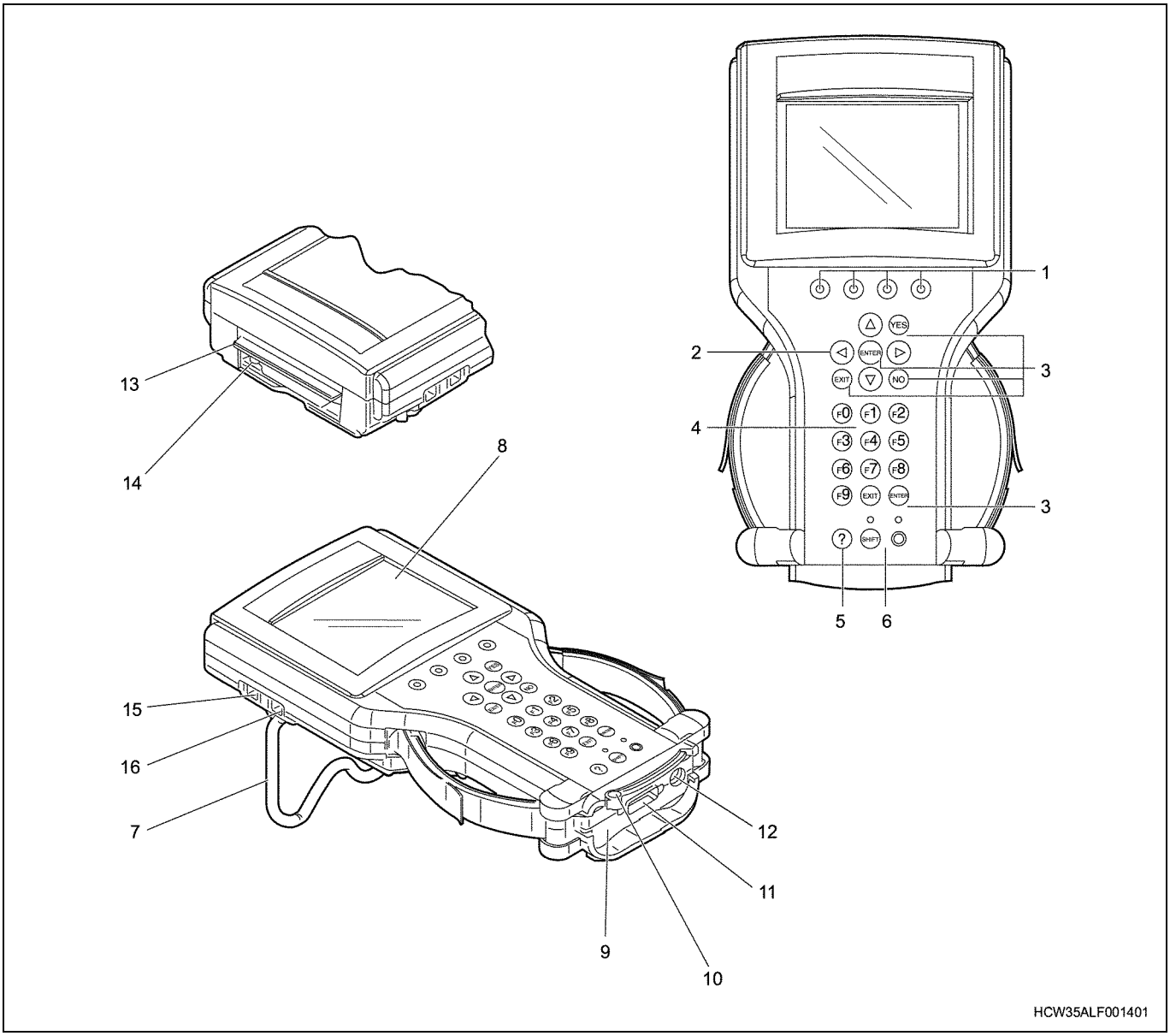
1. Check the DTC information and data display.
2. Evaluate symptom and situation explained by the customer.
3. Check the circuits or the electric system components using check sheet or other methods.

If the trouble is not detected

In this case, the machine is judged as it operates properly. The condition explained by the customer may be the normal condition. Confirm the customer’s complaint comparing with the condition of the machine to that of another machine. That condition may mean an intermittent trouble. Confirm the complaint in the situation the customer explains before returning the machine to the customer.

1. Confirm the complaint again.
   If the complaint can not be fully detected or identified, the machine must be diagnosed again. Confirm the complaint one more time. The complaint may be an intermittent trouble as defined in “If there is intermittent”, but it may also be possible that the machine is normal.
2. Repair and confirm.
   If the problem is confirmed, repair it. Confirm that the machine operates properly and the symptoms are corrected. This includes test on the machine or other procedures to confirm that the trouble is solved under following conditions:
   - Confirm by testing in the situation that the customer described.
   - If DTC is diagnosed, reproduce the situation found while the DTC is set, and confirm the repair by checking a scan tool data.

Each part of Tech2



Name

1. Softkeys
2. Selection keys (Arrow keys)
3. Action keys (YES, NO, ENTER, EXIT)
4. Function keys (F0 — F9)
5. Help key (?)
6. Control keys (PWR / SHIFT)
7. Wide stand
8. Display area (LCD)
9. Machine communication interface (VCI) module
10. Fastening bar of VCI module
11. Connector of DLC cable connection
12. Connector for AC adapter connection
13. PCMCIA card insertion slot with cover
14. PCMCIA card release button
15. Connector for external communication (RS-232 port)
16. Connector for external communication (RS-485 port)

Softkeys

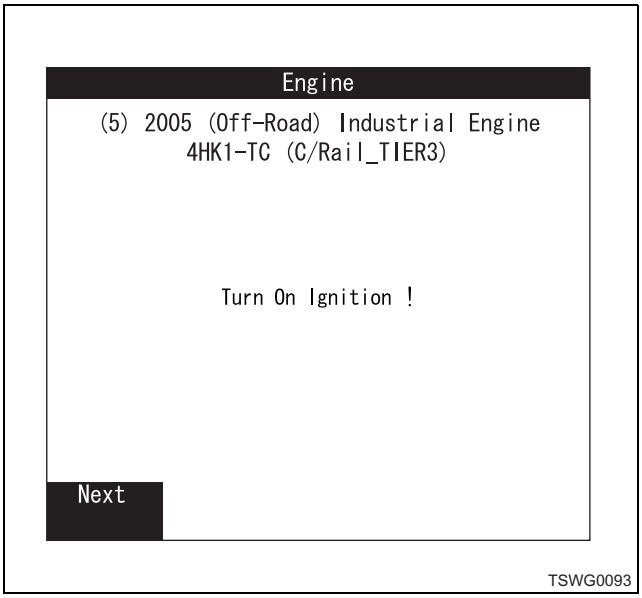
While operating the Tech2, selection boxes appear on the upper part of the screen. The softkeys correspond the selection boxes. They cannot be used unless the selection boxes are displayed.

Selection keys (Arrow keys)

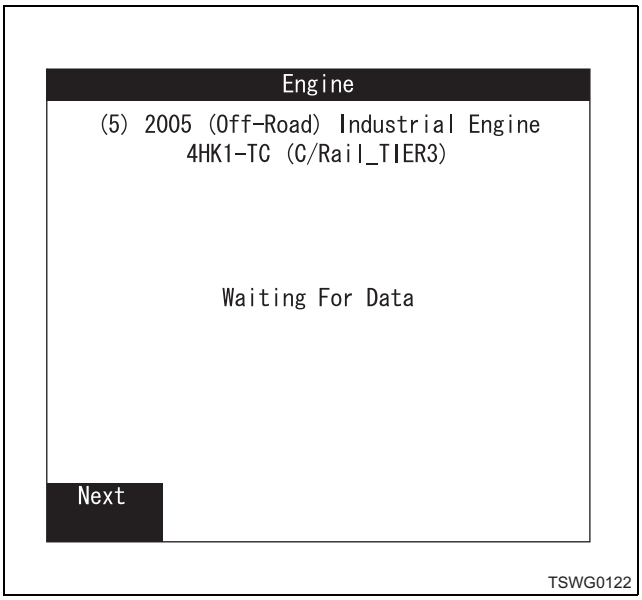
They are used to select the menu or switch the display on the screen of Tech2. Selected part is highlighted in the screen.

Action keys (YES, NO, ENTER, EXIT)

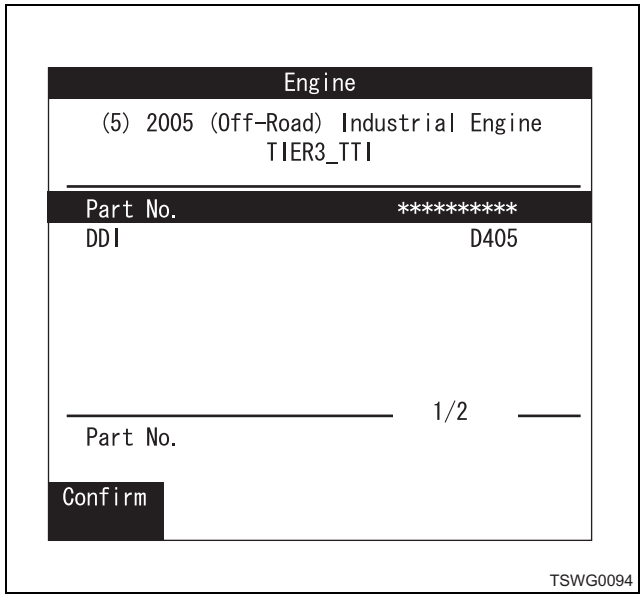
They are used to execute the operation of Tech2, respond to instruction/question, and switch/move to each menu screen.



8. The following illustration shows the state in which the Tech2 is waiting for communication with the machine controller. If the softkey “Next” is pressed with the ignition key in “OFF”, this display will stay forever. (State of communication disabled) However, turning the ignition key “ON” to “START” in this condition will place the unit in the waiting state for communication.



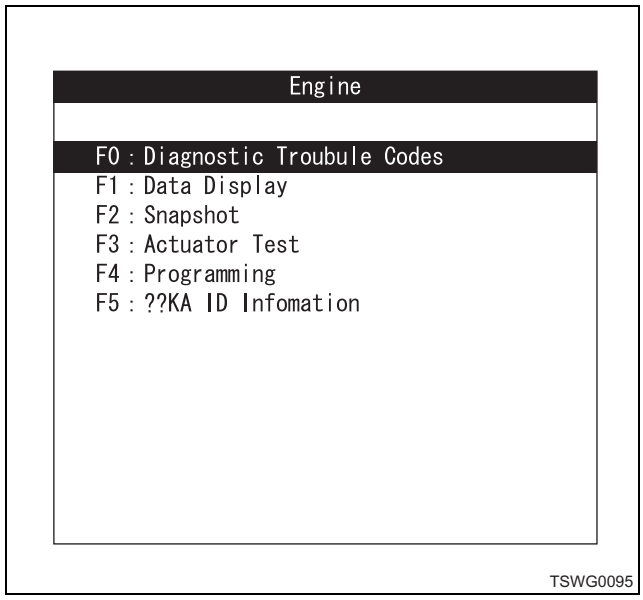
9. Once the communication is established, the unit will show the part No. and DDI (Diagnostic Data Identification) (which varies from a system to another). Press the softkey [Confirm] and go on to the application. If any mistake was made in the selection of the vehicle type, despite that the communication is enabled, a message to that effect will appear flashing. If that is the case, check the vehicle type again and redo the operation from step 1.



Pressing [EXIT] key in the steps 3 to 9 will return you to the “Main Menu” screen.

DTC check

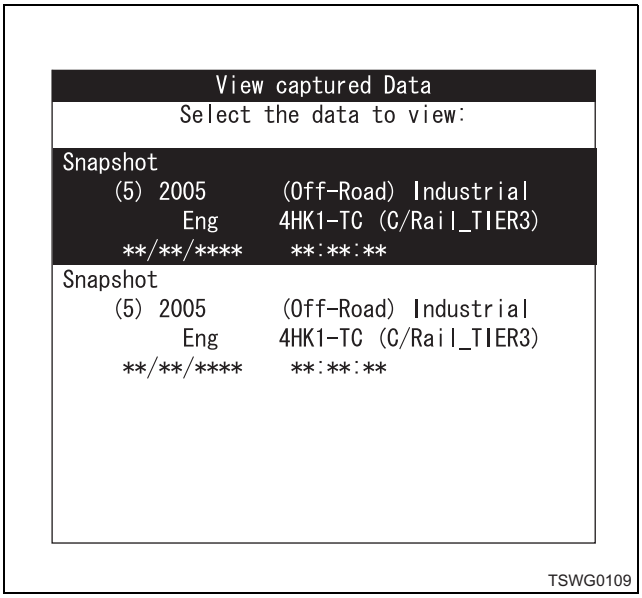
1. Select “F0: Diagnostic Trouble Codes” on the “Engine” screen.



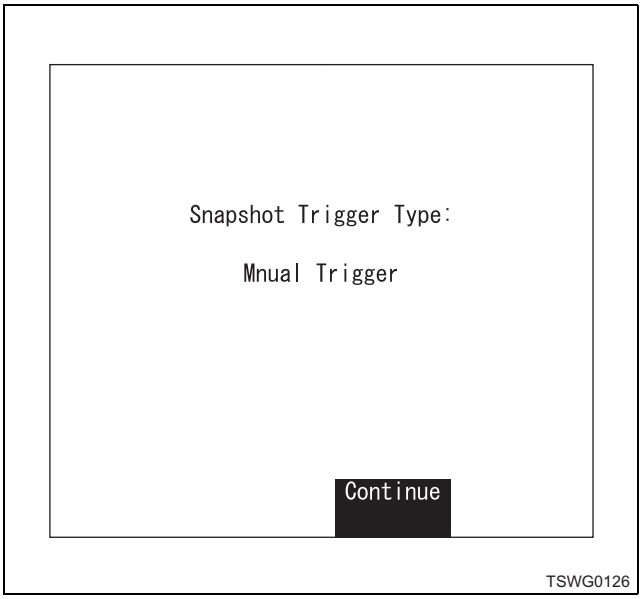
F0: Diagnostic Trouble Codes
This function allows the user to analyze the information on the Trouble Code related to the system currently under test.

2. Choosing “F0: Diagnostic Trouble Codes”, the following menu is displayed.
F0: DTC Display
F1: DTC Clear

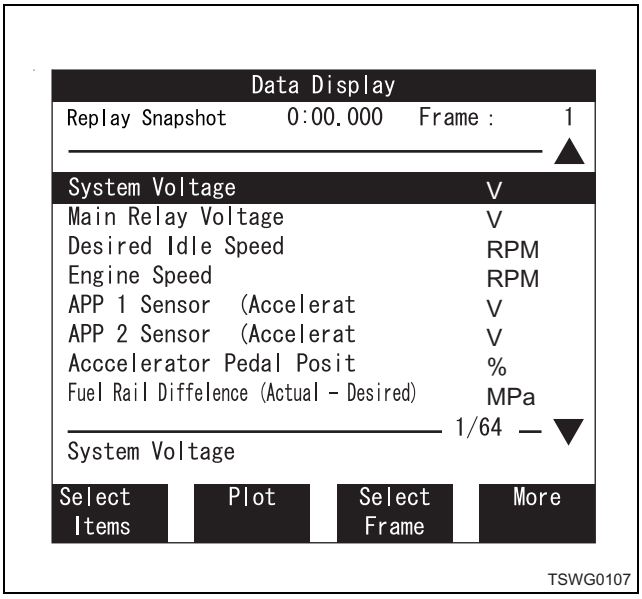
F0: DTC Display
Loads and displays the DTC information stored in the machine controller in a priority order.



5. Press the softkey [Continue] on the display screen.



6. Snapshot Replay Screen appears.



Softkey functions

1. Choose the softkey “More” on the Snapshot Replay screen
   - Select Items: Chosen to fix and display a parameter (up to 5 parameters).
   - Plot: Draws a graph (Up to 3 parameter items).
   - Select Frame: Allows to specify a frame No. and to move a parameter to the specified frame.
   - More: Switches the displayed softkeys.
2. Choose “More” out of the 4 softkeys on the display screen.
   - Auto Reverse: Allows to view changes of data of each frame.
   - Stop: Stops a frame in motion.
   - Auto Forward: Allows to view changes of data of each frame.
   - More: Switches the displayed softkeys.
3. Choose “More” out of the 4 softkeys on the display screen.
   - First Frame: Allows to view the top data frame.
   - Trigger Frame: Allows to view a triggered frame.
   - Last Frame: Allows to view the last data frame.
   - More: Switches the displayed softkeys.
4. Choose “More” out of the 4 softkeys on the display screen.
   - Units: Changes the unit (speed/temperature).
   - Previous Frame: Allows to view changes of data by reversing it, frame No. by frame No.
   - Next Frame: Allows to view changes of data by feeding it forward, frame No. by frame No.
   - More: Switches the displayed softkeys.
5. Choose “More” out of the 4 softkeys on the display screen.
   - DTC: Shows the frames in which a Trouble Code was issued, in the range from the top frame to the displayed frame.
   - Previous DTC-Chg: Shows the frames in which a Trouble Code was issued, in the range before the displayed frame.
   - Next DTC-Chg: Shows the frames in which a Trouble Code was issued, in the range after the displayed frame.
   - More: Switches the displayed softkeys.
6. Choose “More” out of the 4 softkeys on the display screen.
   The Snapshot Replay screen is restored.

Difference in operation of Snapshot Data Replay:

The operations of Snapshot Data Replay under “F2: View Captured Data” are somewhat different from those of Replay (softkey function “Review Data”) under “F2: Snapshot”. Be careful not to confuse them.

Data display item	Units	Reference value at Two Pump Relief (it varies depending on conditions of the machine.)
EGR Position Difference	%	—
EGR Motor Duty	%	0
EGR Position 1	ON/OFF	One of 1, 2, 3 is the reverse polarity. (e.g. 1=ON, 2=ON, 3=OFF)
EGR Position 2	ON/OFF	One of 1, 2, 3 is the reverse polarity. (e.g. 1=ON, 2=ON, 3=OFF)
EGR Position 3	ON/OFF	One of 1, 2, 3 is the reverse polarity. (e.g. 1=ON, 2=ON, 3=OFF)
Starter Switch (On)	ON/OFF	ON
Starter Switch (ST)	ON/OFF	OFF
Idle Manual Switch	ON/OFF	Auto
Idle Up Switch	ON/OFF	OFF
Idle Down Switch	ON/OFF	OFF (ON immediately after key switch ON.)
Glow Relay	ON/OFF	OFF (ON immediately after key switch ON.)
Glow Lamp	ON/OFF	OFF
Diagnostic Switch	ON/OFF	ON
Q Adjust Resistance Data 1		— Varies depending on the machine
Q Adjust Resistance Data 2		— Varies depending on the machine
Q Adjust Resistance Data 3		— Varies depending on the machine

Shindaiwa Kogyo Co., Ltd.
The data list is used to check the conditions of the machine and each equipment.
Each machine data is compared with standard value. The data list is used in trouble diagnosis to judge as out of reference value temporarily or all the time. (This Tech2 display menu is subject to change without notice.

6HK1 (1000 rpm)

Data display item	Units	Reference value at 1000 rpm (it varies depending on conditions of the machine.)
System Voltage	V	28.3
Main Relay Voltage	V	28.0
Desired Idle Speed	RPM	1000
Engine Speed	RPM	1000
Accelerator Sensor 1	V	0
Accelerator Sensor 2	V	0
Accelerator Pedal Position	%	0
Difference in Common Rail Pressure	MPa	−1 — 0
Common Rail Pressure Sensor	V	1.5
Common Rail Pressure F/B Mode		Feedback Mode
SCV Duty	%	25 — 43
SCV F/B	mA	972 — 1038
Engine Coolant Temperature Sensor	V	0.5
Engine Coolant Temperature	°C	79

Data display item	Units	Reference value at idling (it varies depending on conditions of the machine.)
Q Adjust Resistance Data 3		— Varies depending on the machine

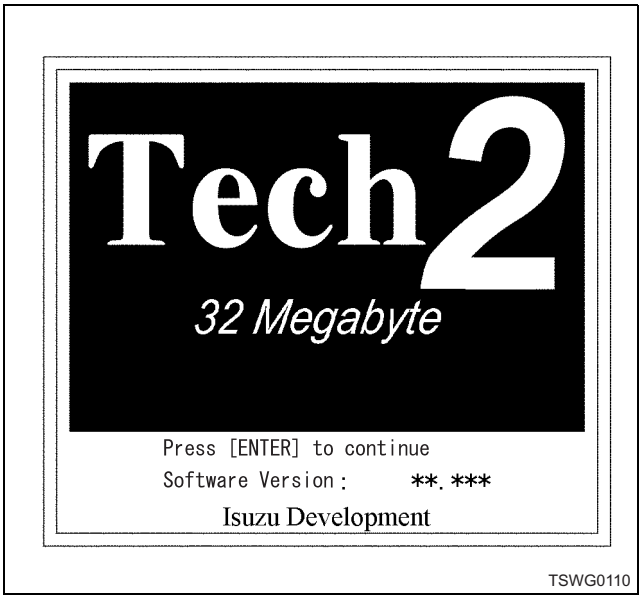
6HK1 (Two pump relief)

Data display item	Units	Reference value for Two pump relief (it varies depending on conditions of the machine.)
System Voltage	V	22 — 30
Main Relay Voltage	V	22 — 30
Desired Idle Speed	RPM	500
Engine Speed	RPM	1,945 — 1,950
Accelerator Sensor 1	V	0.0
Accelerator Sensor 2	V	0.0
Accelerator Pedal Position	%	0
Difference in Common Rail Pressure	MPa	0±5
Common Rail Pressure Sensor	V	1.5
Common Rail Pressure F/B Mode		Feedback Mode
SCV Duty	%	Approx. 15 — 50
SCV F/B	mA	Approx. 600 — 900
Engine Coolant Temperature Sensor	V	0.4 — 0.5
Engine Coolant Temperature	°C	80 — 85
Intake Air Temperature Sensor	V	2.2
Intake Air Temperature	°C	29
Fuel Temperature Sensor	V	1.0
Fuel Temperature	°C	53
Barometric Pressure Sensor	V	Approx. 2
Barometric Pressure	kPa	Approx. 100
Boost Temperature Sensor	V	4.3
Manifold Absolute Pressure	kPa	Approx. 180 — 200
No. 1 Cylinder Fuel Injection Correction Amount	mm3/st	± 3 or less
No. 2 Cylinder Fuel Injection Correction Amount	mm3/st	± 3 or less
No. 3 Cylinder Fuel Injection Correction Amount	mm3/st	± 3 or less
No. 4 Cylinder Fuel Injection Correction Amount	mm3/st	± 3 or less
No. 5 Cylinder Fuel Injection Correction Amount	mm3/st	± 3 or less
No. 6 Cylinder Fuel Injection Correction Amount	mm3/st	± 3 or less
Engine Mode		Fuel Mode
EGR Position Difference	%	−20 — 0
EGR Motor Duty	%	0 — 97

Refer to the following instruction for how to register Injector ID code.

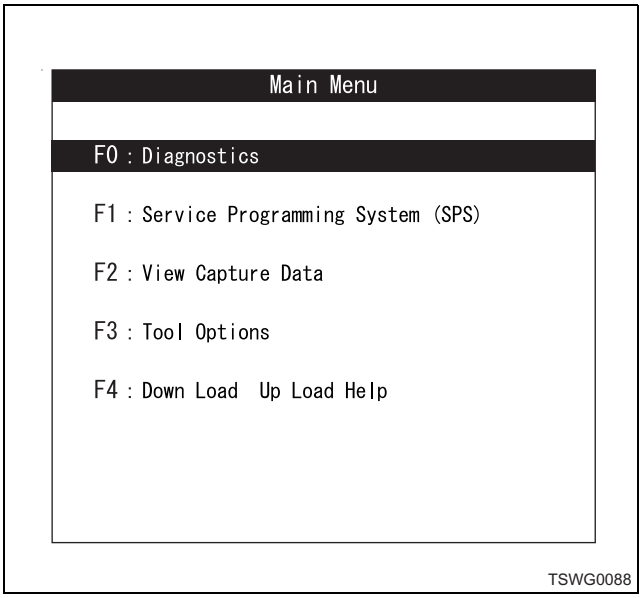
Step 1

- Press the [ENTER] key.



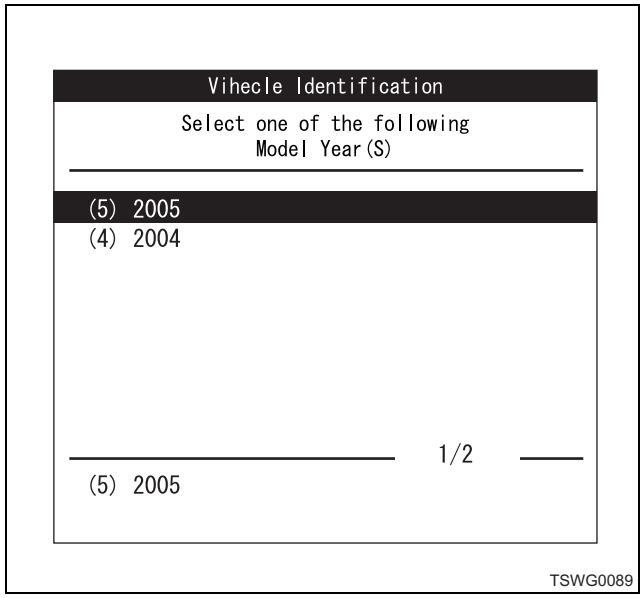
Step 2

- Choose the menu F0: Diagnostics with ▲, ▼ (up/down) keys or F0 (function) key, and press the [ENTER] key.



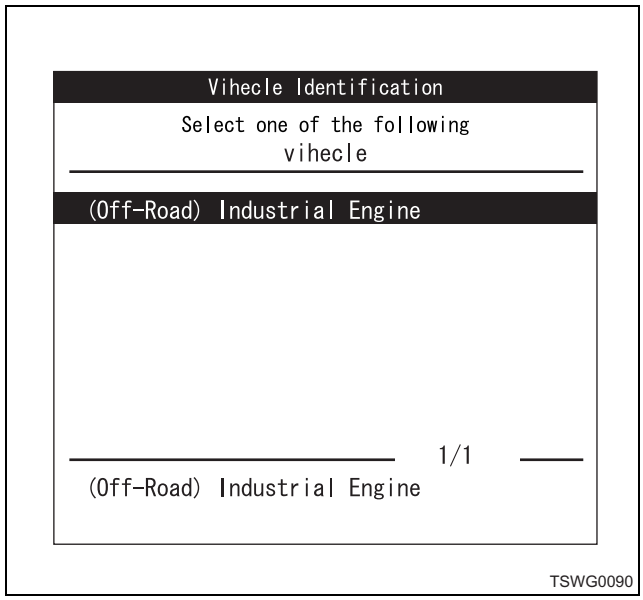
Step 3

- Choose the menu (5) 2005 with ▲, ▼ (up/down) keys, and press the [ENTER] key.



Step 4

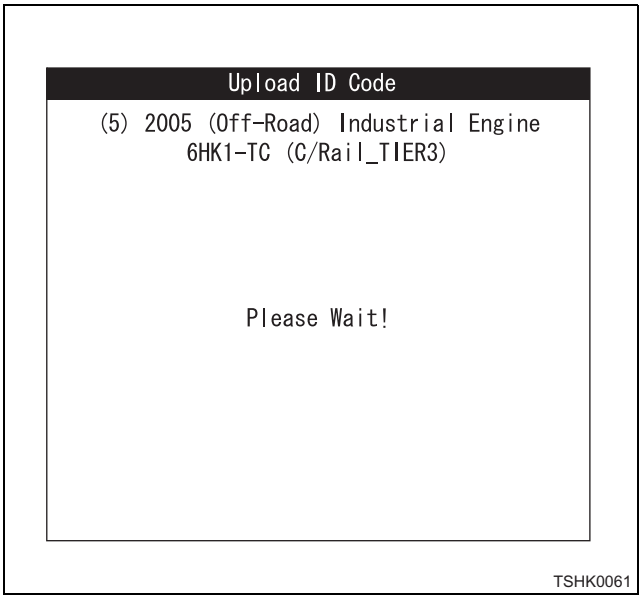
- Choose the menu (Off-Road) Industrial Engine with ▲, ▼ (up/down) keys, and press the [ENTER] key.



Step 5

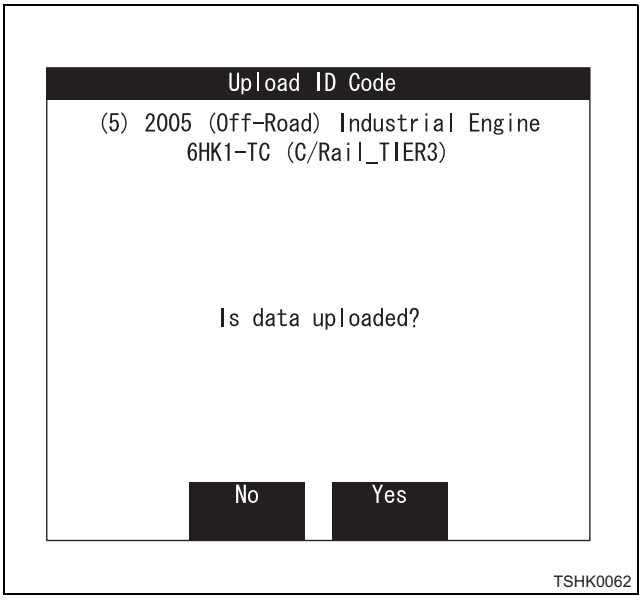
- Choose F0: Engine in Menu with ▲, ▼ (up/down) keys or F0 (function), and press the [ENTER] key.

Step 11-1

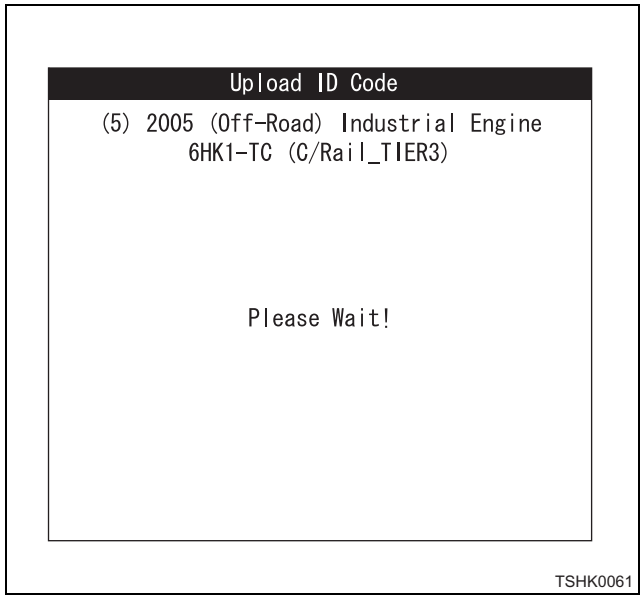


Step 12

- Pressing the softkey [Yes] updates the ID codes of No. 1 cylinder – No. 6 cylinder stored in the ECM, to the Tech2.
  Pressing the softkey [No] returns you to Step 11 without uploading the data.
- Upload is the function to transfer the registered ID code from ECM to Tech2 to store the data in it.

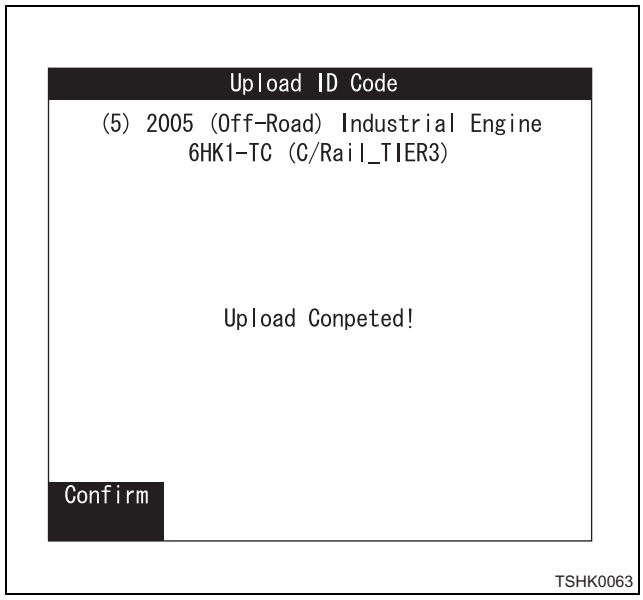


Step 12-1



Step 12-2

- When the ID code registered in the ECM corresponds to that uploaded to the Tech2, the following message will appear.
  Upload is completed.
  Pressing the softkey [Confirm] returns you to Step 11.



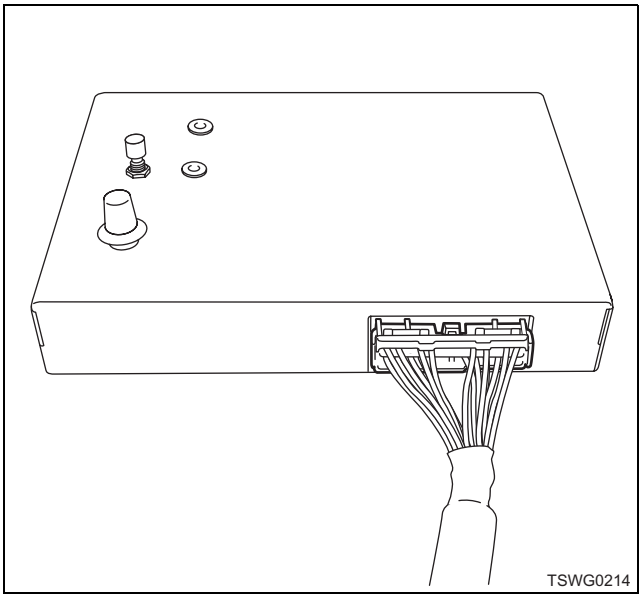
Step 12-3

- When the ID code registered in the ECM does not correspond to that uploaded to the Tech2, the following message will appear.
  Pressing the softkey [Confirm] returns you to Step 11.
- In this case, the uploaded ID code will be erased. Therefore, perform upload again. The message shown in Step 12-4 will appear.

Icons to be displayed

The following icons are used for data display.

	Transmits the snapshot from Tech to PC.
	Uploads the snapshot data from the floppy disk or hard disk.
	Saves the snapshot data on the floppy disk or hard disk.
	Displays the data parameters in one frame.
	Displays the data parameters in two frames.
	Changes the unit.
	Displays the data parameters in graph and list (up to 3 parameter items for graph display).
	Selects/cancels the parameter.
	Displays the data parameters in graph only (up to 6 parameter items).
	Prints (data parameter print out).



6. Start the engine.
7. If the machine has function to lower idle speed, lower the speed to clarify the engine reaction.
8. Set the selection switch to 1, and check the No. 1 cylinder.
9. Press the start button and check the engine vibration level and change in exhaust noise.
   - If it is difficult to recognize the change, touch the engine directly to check change in the vibration.

Note:
Do not operate the body and the machine while the operation lamp comes on.

10. Confirm that the lamp goes off and repeat check of the remaining cylinders as steps 8 and 9.
11. Replace the injector in the cylinder of which engine vibration level and exhaust noise did not change.

Note:
For work procedure, refer to “Engine section“ in the service manual.

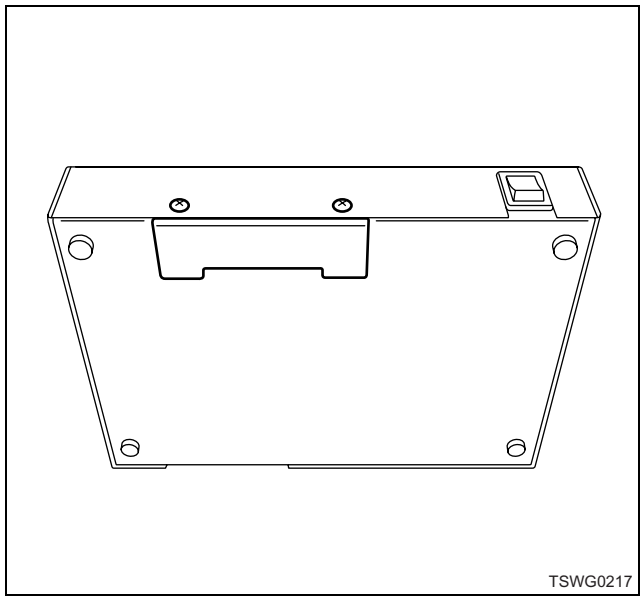
12. Turn the key switch to OFF, remove the test harness, and restore the injector harness.

Note:
DTC will be detected if disconnecting or connecting the harness with the key switch to ON. Turn it to OFF during work.

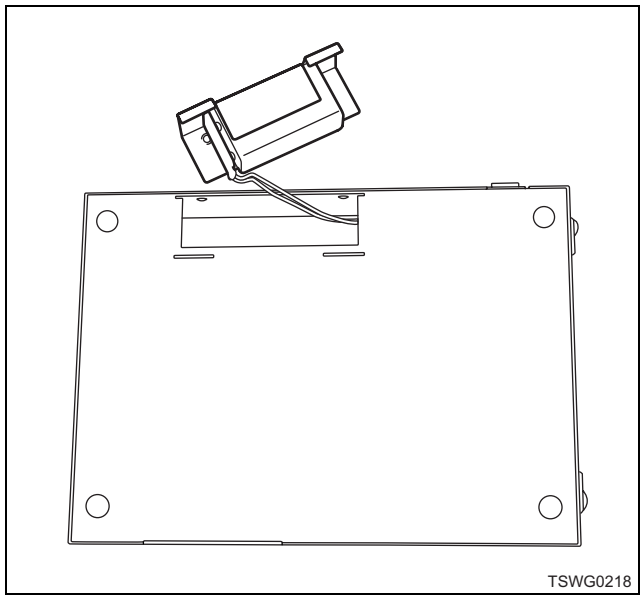
13. Start the engine and return the idle speed at specified one.
14. Clear the DTC.
15. Refer to the machines manual for how to clear DTCs.
16. Perform a test drive, and check that there are no faults.

Battery Replacement

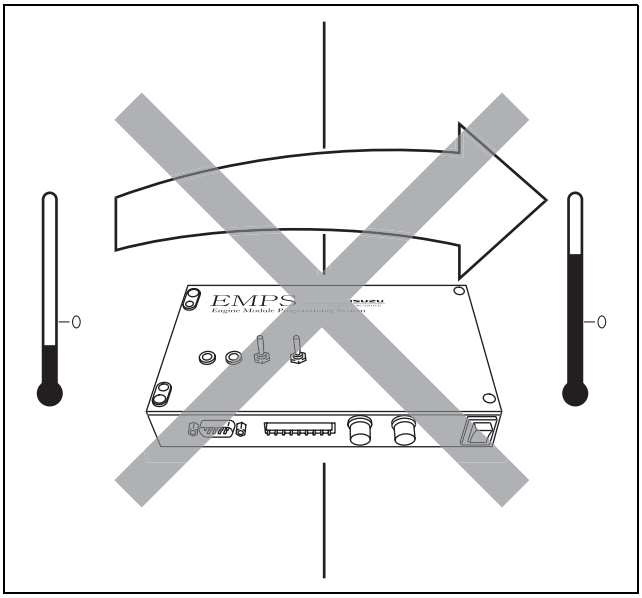
1. Remove the two screws on the side of the body.



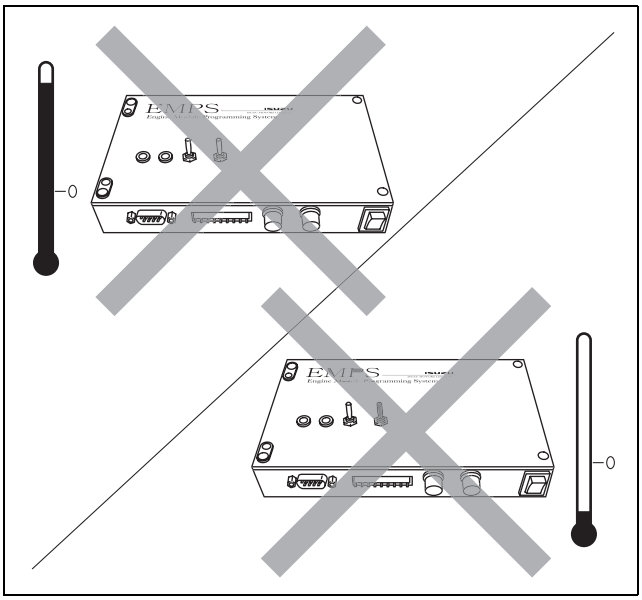
2. Pull out the battery holder.



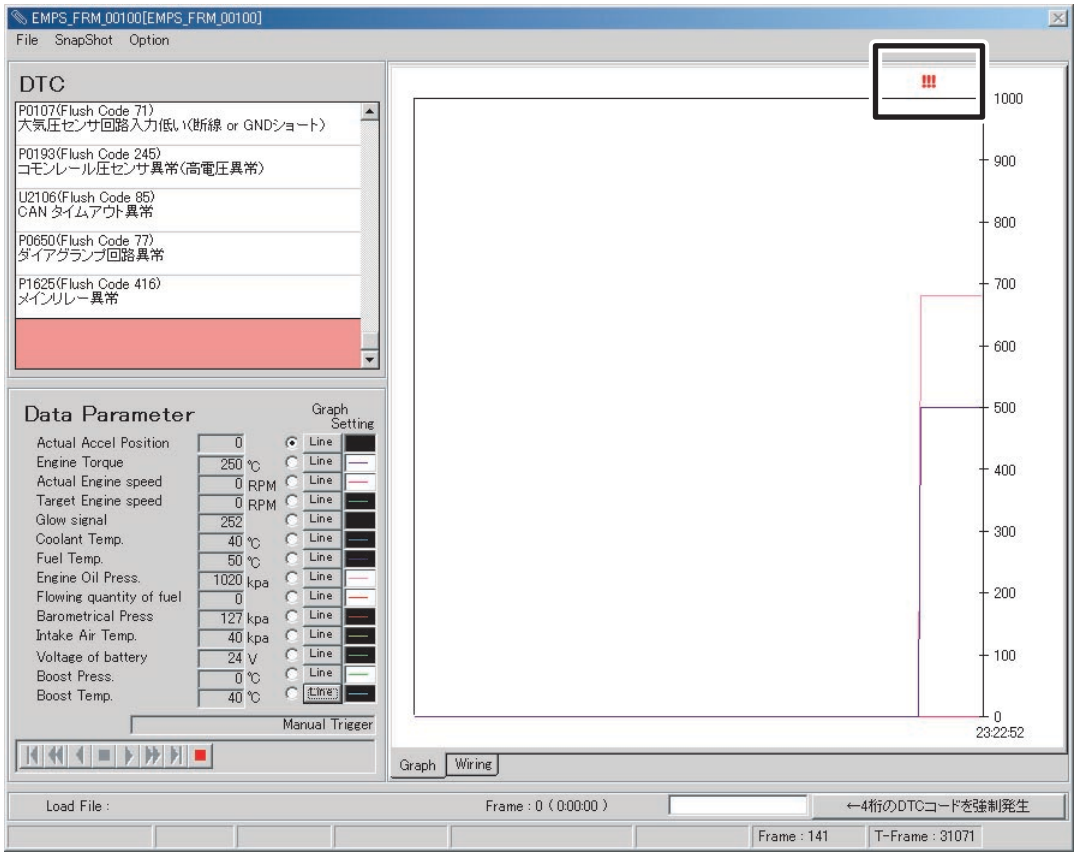
3. Remove the battery from the holder.



9. Avoid using and storing it in a place with extreme high or low temperature. Especially in summer, do not leave it in the machine exposed to direct sunlight.

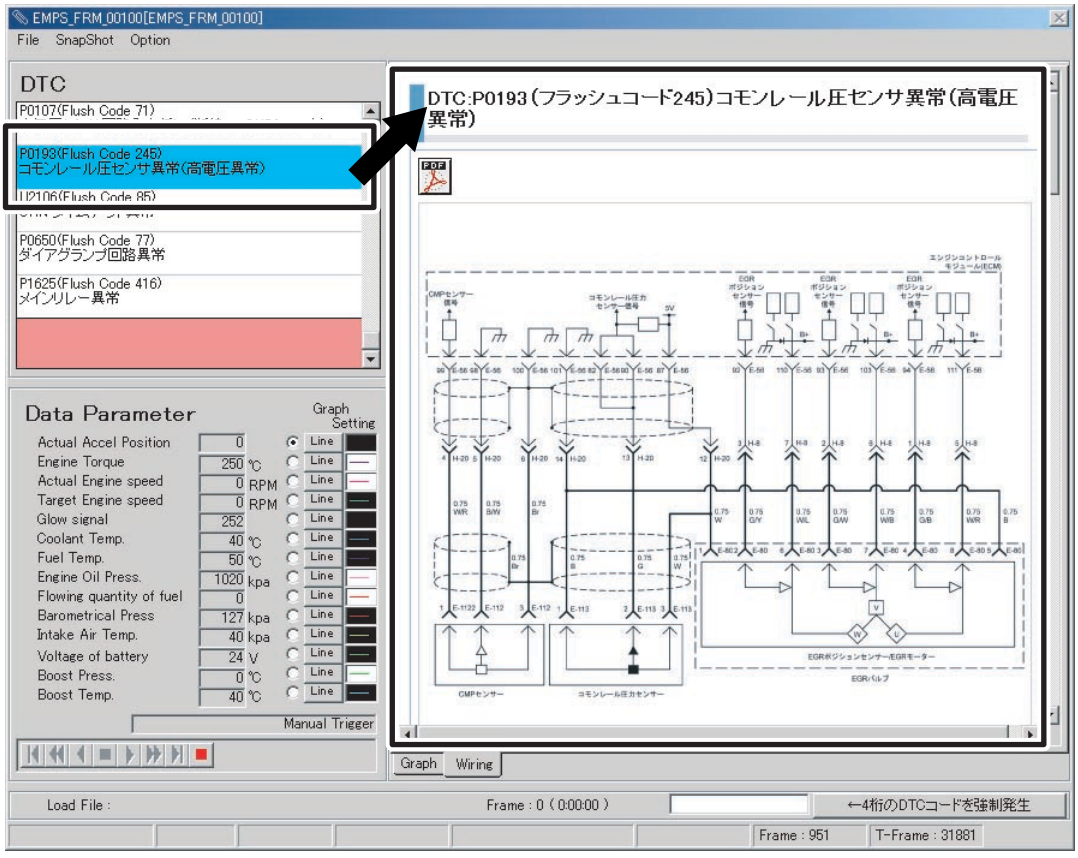


Snapshot screen (DTC code display)

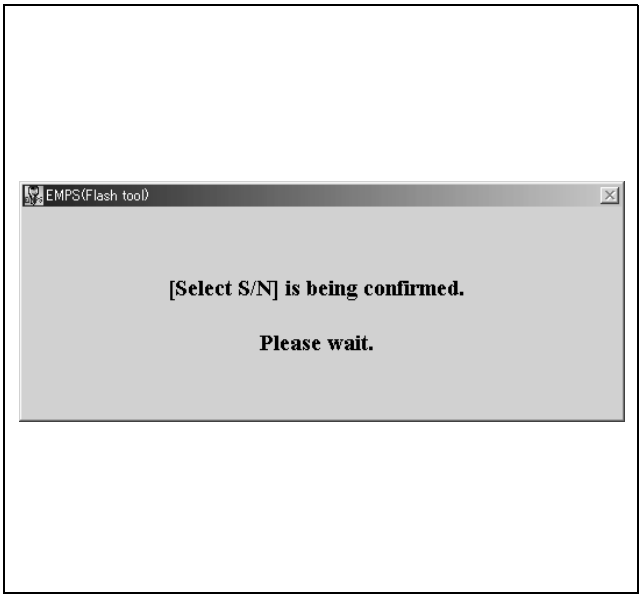


TSJJ0156

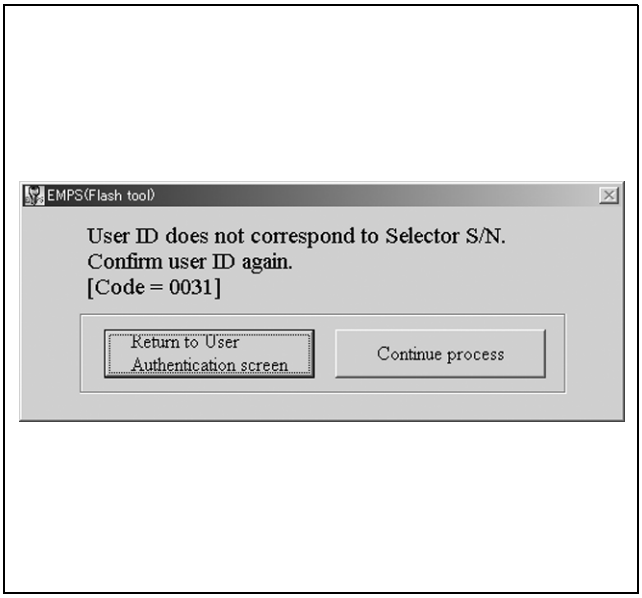
When the DTC code occurs, mark will appear above the graph.



TSJJ0157



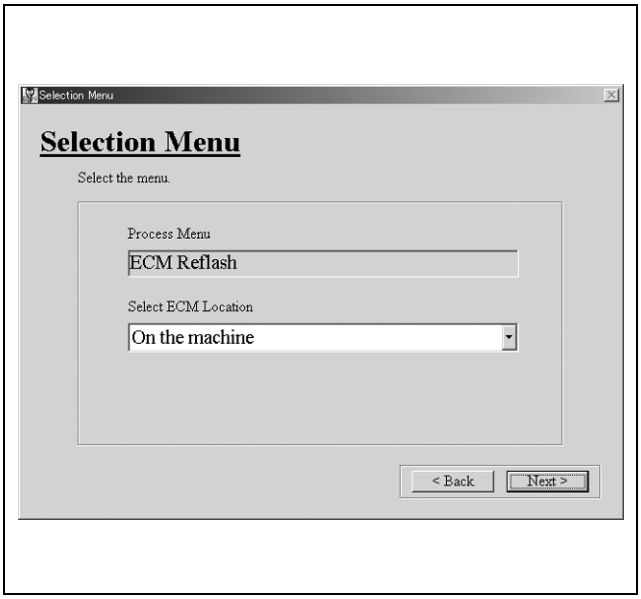
If response from the selector is normal, advance to "2.5 Selection Menu."
One of the following messages will appear if any abnormality is discovered. Click the [Return to User Authentication screen] button, and check the user ID. To continue the process as is, click the [Continue process] button.



If a communication error occurs, advance to the "6. Recover Point" screen.

2.5 Selection Menu

After selecting the [Select ECM Location], click the [Next] button.



Selection Item Descriptions

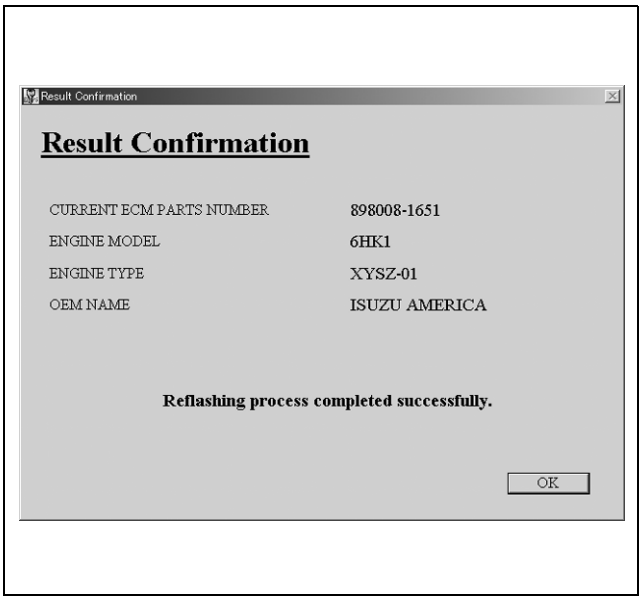
Items	Settings/Operation Performed
Process Menu	The process selected in "2.1 Startup" will appear.
Select ECM Location	on the machine off the machine
Back button	Returns to "2.3 Connection Confirmation Screen."
Next button	When [off the machine] is selected, advances to "2.5.1 External Power Confirmation Screen." When [on the machine] is selected, advances to "2.5.2 Voltage Confirmation Screen."

2.5.1 External Power Confirmation Screen

This screen prompts for confirmation of an external power supply.

2.22 Final Result Confirmation Screen

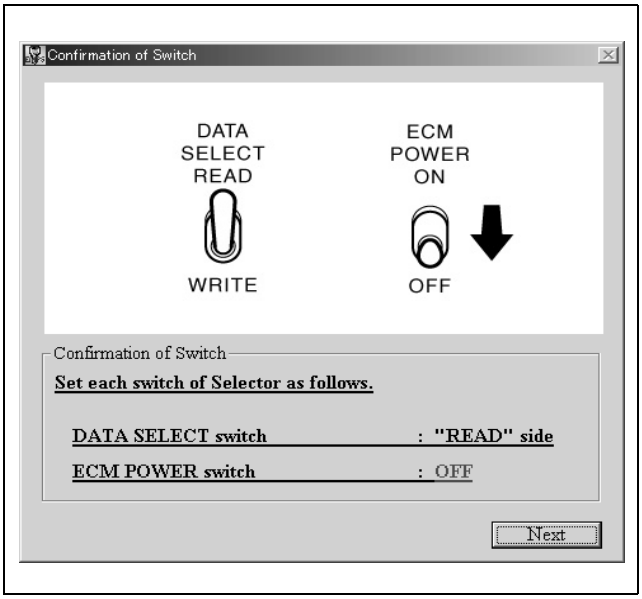
This screen displays the result of reflashing.



Clicking the [OK] button advances to “2.23 Switch Confirmation Screen 9.”

2.23 Switch Confirmation Screen 9

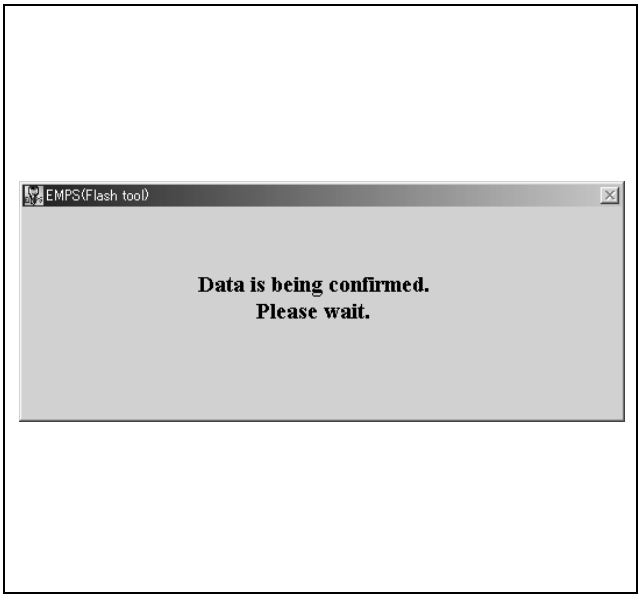
The switch confirmation screen is shown below.

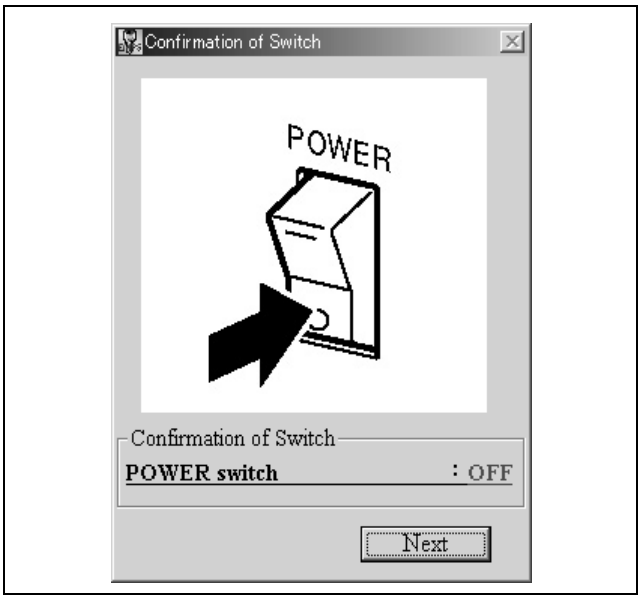


Configure the switch settings as shown below.

DATA SELECT switch: READ
ECM POWER switch: OFF

After configuring the switch settings, click the [Next] button.
The following message appears, then Switch Confirmation screen will be displayed.

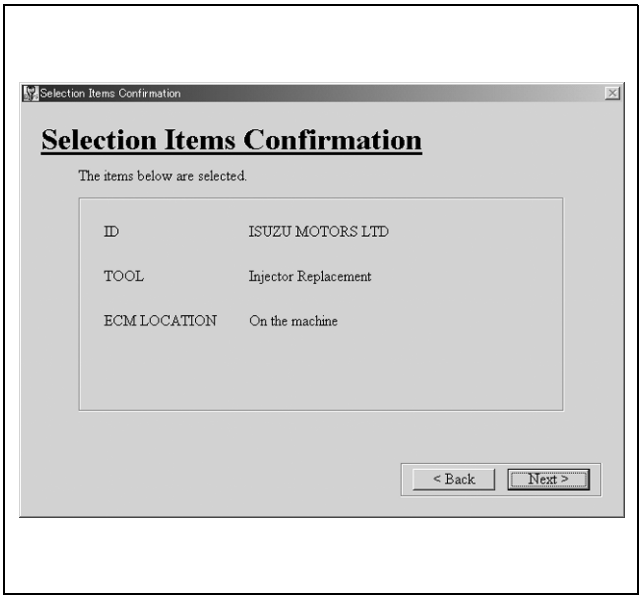




After configuring the power switch setting, click the [Next] button to advance to “2.24 Cable Removal Confirmation Screen.”

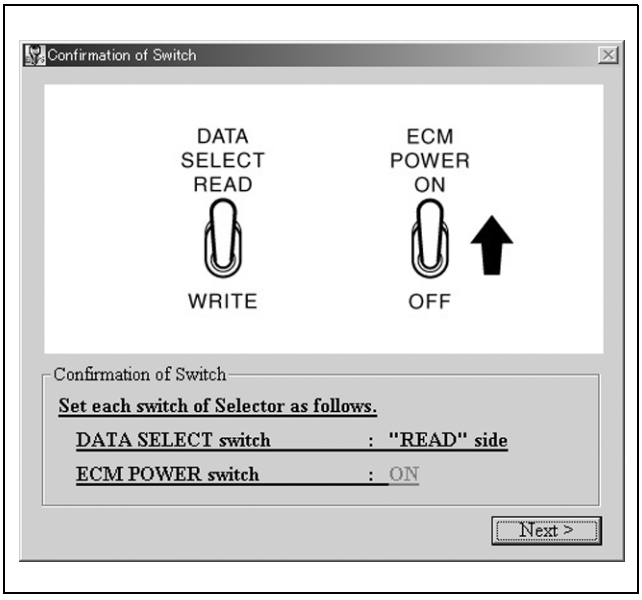
3.6 Selection Items Confirmation Screen

This screen shows the details of the settings configured up to this point.
If there is no problem with the displayed settings, click the [Next] button to advance to “3.7 Switch Confirmation Screen 2.”
To change the settings, click the [Back] to return to “3.5 Selection Menu.”



3.7 Switch Confirmation Screen 2

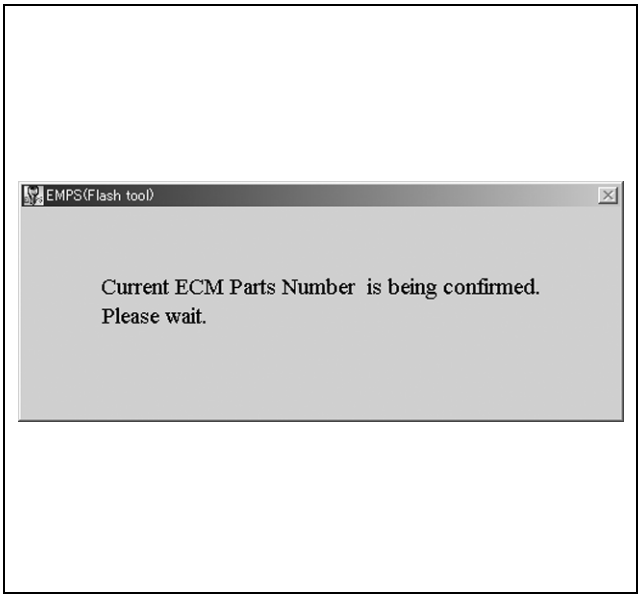
The switch confirmation screen is shown below.



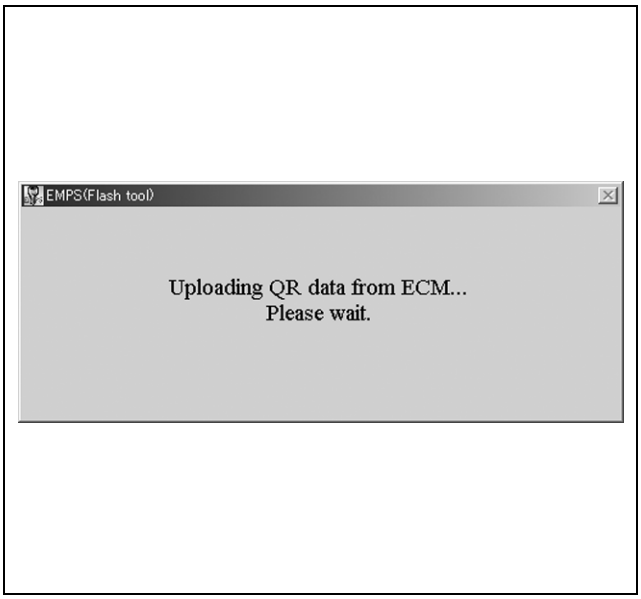
Configure the switch settings as shown below.

DATA SELECT switch: READ
ECM POWER switch: ON

After configuring the switch settings, click the [Next] button.
This starts selector confirmation, and displays the message shown below.



Then, QR data is uploaded from ECM.



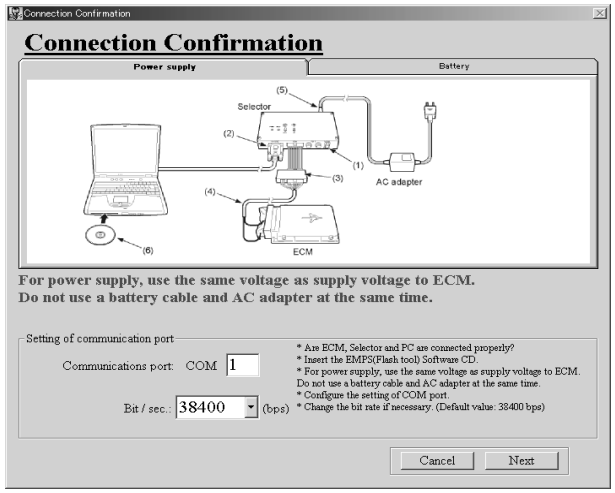
If the upload is successful, advance to “3.8 Change Injector QR Code.”
One of the messages will appear if any abnormality is discovered. Refer to “7. Error Messages.”

4.3 Connection Confirmation Screen

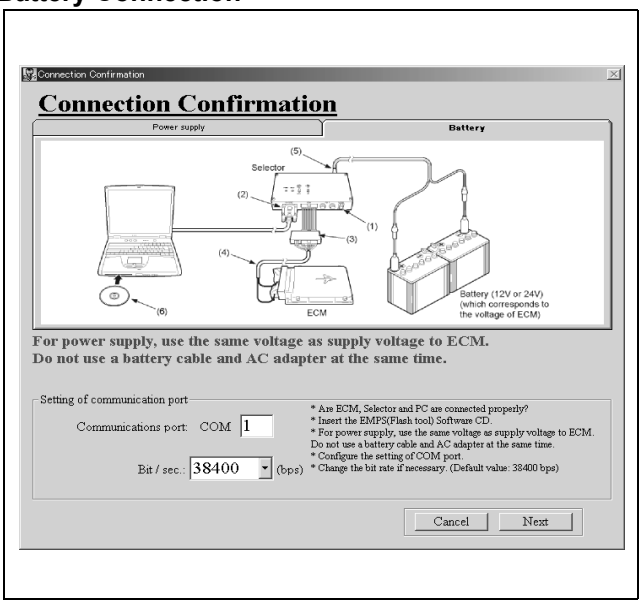
4.3.1 At the First Connection

This screen shows the connection status of the computer, selector, ECM, and power supply/battery.

Power Supply Connection



Battery Connection



After selecting the COM port (Communication port) and transmission bit rate (Bit/sec), click [Next] to advance to "4.4 Switch Confirmation Screen 1."

Selection Item Descriptions

Items	Description
COM port	Select the RS232C port to which the selector is connected.
Transmission bit rate	Select the data transmission bit rate.
Cancel button	Displays a confirmation message for exiting the tool.
Next button	Performs a check and then displays "4.4 Switch Confirmation Screen 1."

One of the error messages will appear if an error is discovered by the check that is performed when the [Next] button is clicked. Refer to "7. Error Messages."

4.3.2 At the Reconnection After ECM Replacement

If you repeat upload or download (when reconnecting after ECM replacement), you will start with this screen. But you cannot change COM port and bit rate (bps).

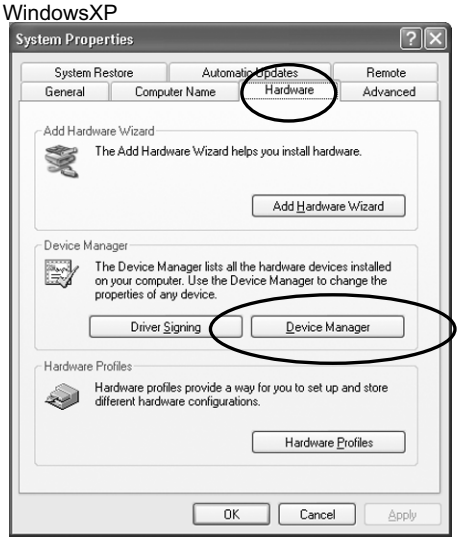
4.3.3 PC Setting

Normally select COM1 if RS232-C is used for connection.
In the case of a PC that is not equipped with an RS232-C port, connect using a commercially available USB conversion cable. For details about port settings, refer to the user documentation that comes with the USB conversion cable.

To check standard COM port settings

1. On the Windows [Start] menu, select [Control Panel].
2. On [Control Panel], open [System].
3. When system properties appear, select [Hardware].

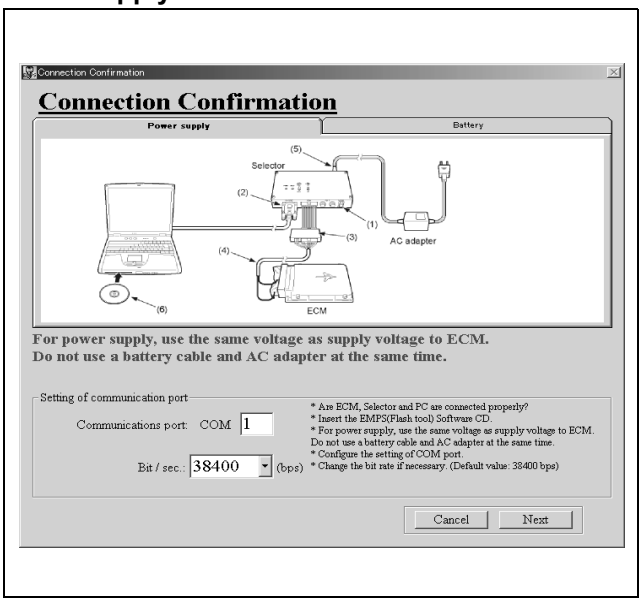
WindowsXP



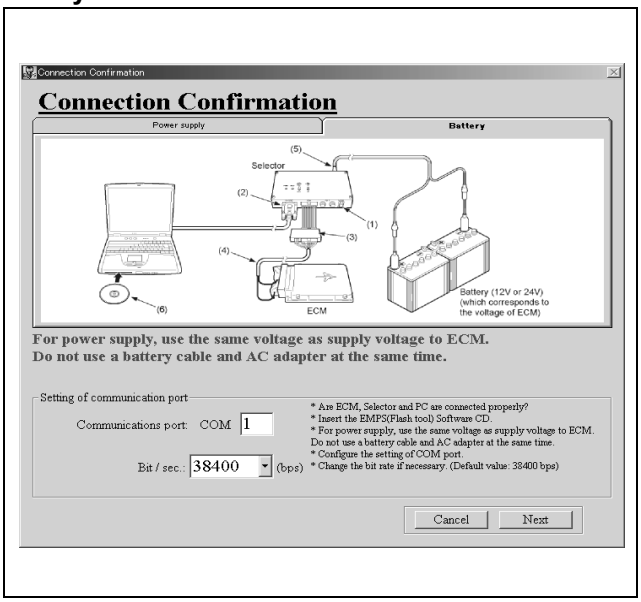
4.13 Connection Confirmation Screen

This screen shows the connection status of the computer, selector, ECM, and power supply/battery.

Power Supply Connection



Battery Connection



After selecting the COM port (Communication port) and transmission bit rate (Bit/sec), click the [Next] button to advance to “4.14 Switch Confirmation Screen 4.”

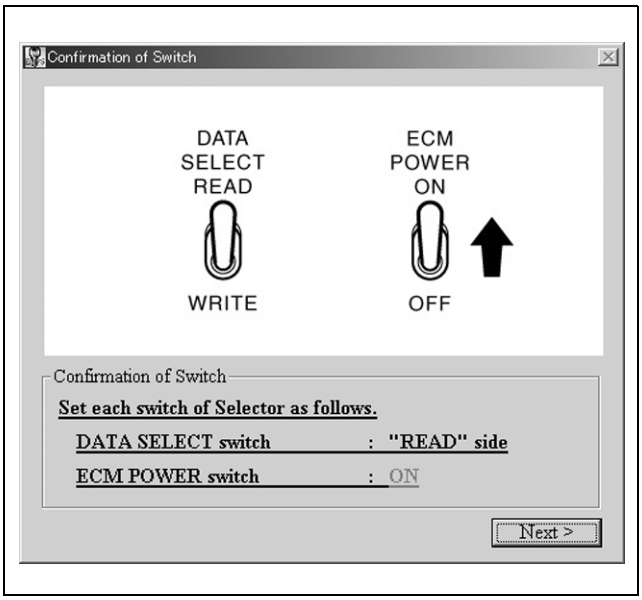
Selection Item Descriptions

Items	Description
COM port	Select the RS232C port to which the selector is connected.
Transmission bit rate	Select the data transmission bit rate.
Cancel button	Displays a confirmation message for exiting the tool.
Next button	Performs a check and then displays “4.14 Switch Confirmation Screen 4.”

One of the error messages will appear if an error is discovered by the check that is performed when the [Next] button is clicked. Refer to “7. Error Messages.”

4.29 Switch Confirmation Screen 11

The switch confirmation screen is shown below.



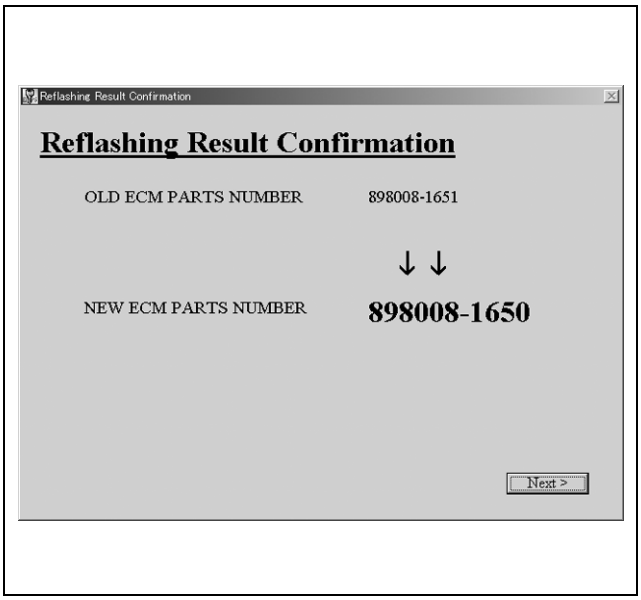
Configure the switch settings as shown below.

DATA SELECT switch: READ
ECM POWER switch: ON

After configuring the switch settings, click the [Next] button.
This starts data confirmation. After confirmation is complete, advance to “4.30 Reflashing Result Confirmation Screen.”
A message will appear if an error occurs during confirmation. Refer to “7. Error Messages.”
If a communication error occurs, advance to the “6. Recover Point” screen.

4.30 Reflashing Result Confirmation Screen

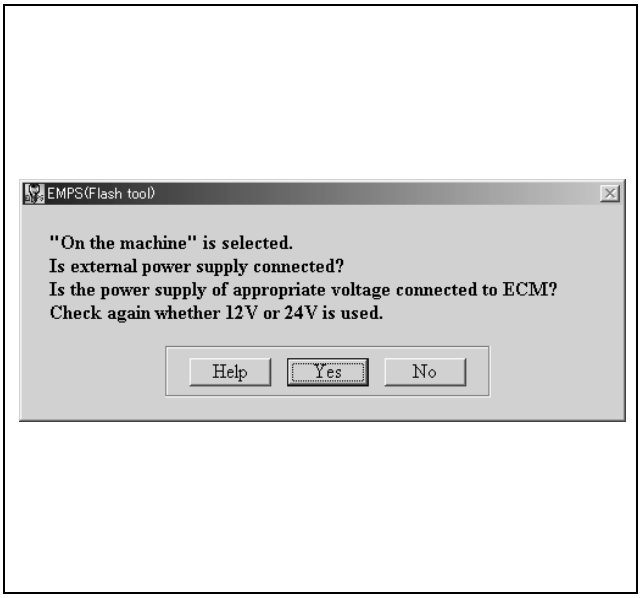
This screen displays the parts number reflash result.



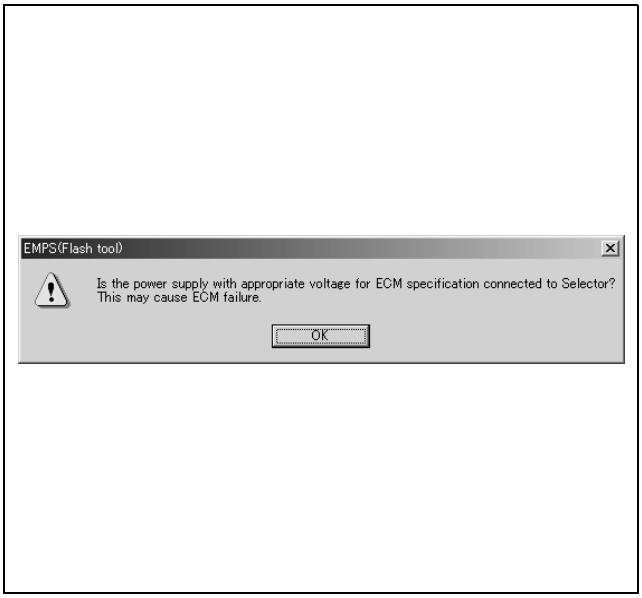
Clicking the [Next] button displays the message shown below.

Check the content and click the [OK] button.
This advances to “4.31 Engine Serial Number Confirm” screen.

Clicking the [Yes] button after checking the connection of external power supply advances to “5.6 Selection Items Confirmation Screen.”
If an external power supply cannot be connected, click the [No] button to return to “5.5 Selection Menu.”
Clicking the [Help] button will display the message shown below.



Clicking the [Yes] button after checking the voltage of power supply advances to “5.6 Selection Items Confirmation Screen.”
If power supply cannot be confirmed, click the [No] button to return to “5.5 Selection Menu.”
Clicking the [Help] button will display the message shown below.

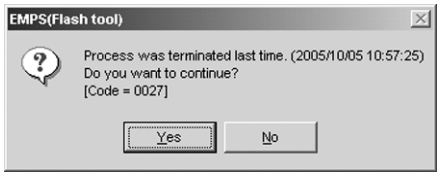
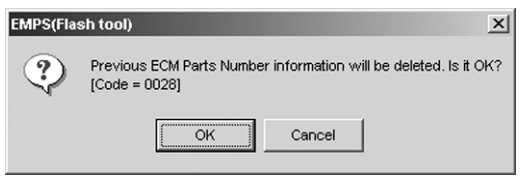


5.5.2 Voltage Confirmation Screen

This screen prompts for confirmation of proper voltage.

Error Type	Error Messages	Description	Response
Database read error		Service address is not found in the database.	Check the Data CD. Contact your administrator if there is no fault.

7.3 Connection Confirmation Errors (for Sections 2.3, 3.3, 4.3, 5.3)

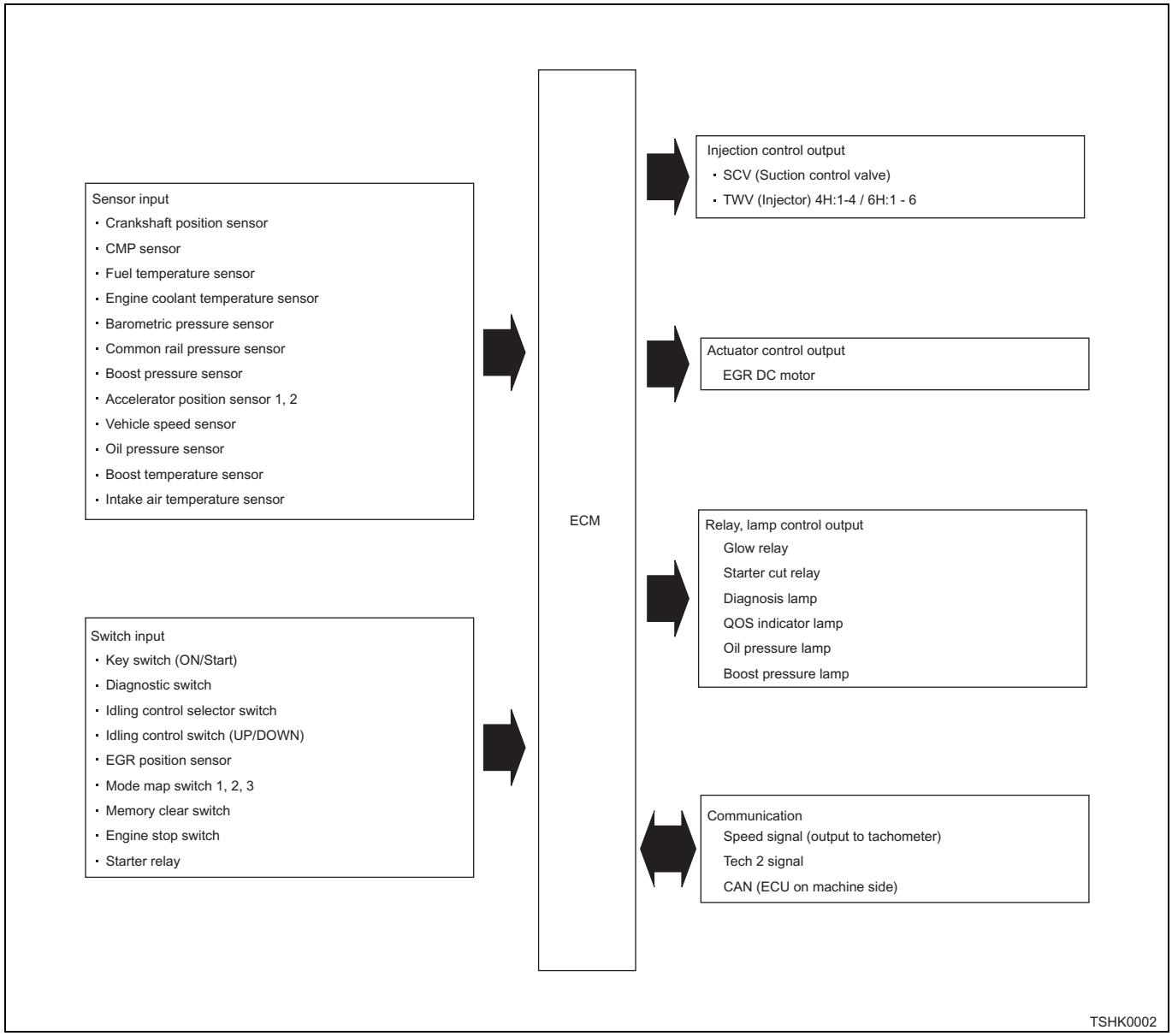
Error Type	Error Messages	Description	Response
COM port		COM port is not input.	Enter the COM port.
		COM port input value is not correct.	Enter the correct COM port.
	 	COM port communication error	Check if COM port operates properly.
Last process check		Last process continuation confirmation. Click the [Yes] button to advance to “2.8 Current ECM Parts Number Confirmation Screen.”	—
		This message appears to confirm deletion when the [No] button of the above message box is clicked.	—

Type	Code	Message	Description
	0106	Reflash error Do you want to try reflash again?	No data to be written to flash memory (at writing and verifying)
	0107	Reflash error Do you want to try reflash again?	Close (at writing and verifying)
	0108	Reflash error Do you want to try reflash again?	Port open error (all)
	0109	Reflash error Do you want to try reflash again?	Communication (all)
	0110	Reflash error Do you want to try reflash again?	Time out (all)
	0111	Reflash error Do you want to try reflash again?	Writing (at writing only)
	0112	Reflash error Do you want to try reflash again?	Unknown

Rewriting Verification Process

Type	Code	Message	Description
During execution			
	0113	Reflash error Do you want to try reflash again?	Being processed (all)
	0114	Reflash error Do you want to try reflash again?	Inconsistent execution state (at writing and verifying)
	0115	Reflash error Do you want to try reflash again?	Invalid startup parameter (all)
	0116	Reflash error Do you want to try reflash again?	Thread startup failure (all)
	0117	Reflash error Do you want to try reflash again?	Unknown
At CALL BACK			
	0118	Reflash error Do you want to try reflash again?	No response from rewriting module
	0119	Reflash error Do you want to try reflash again?	User program file cannot be found (at writing and verifying)
	0120	Reflash error Do you want to try reflash again?	Invalid user program file (at writing and verifying)
	0121	Reflash error Do you want to try reflash again?	No data to be written to flash memory (at writing and verifying)
	0122	Reflash error Do you want to try reflash again?	Close (at writing and verifying)
	0123	Reflash error Do you want to try reflash again?	Port open error (all)
	0124	Reflash error Do you want to try reflash again?	Communication (all)
	0125	Reflash error Do you want to try reflash again?	Time out (all)
	0126	Reflash error Do you want to try reflash again?	Verification (at verification only)
	0127	Reflash error Do you want to try reflash again?	Unknown

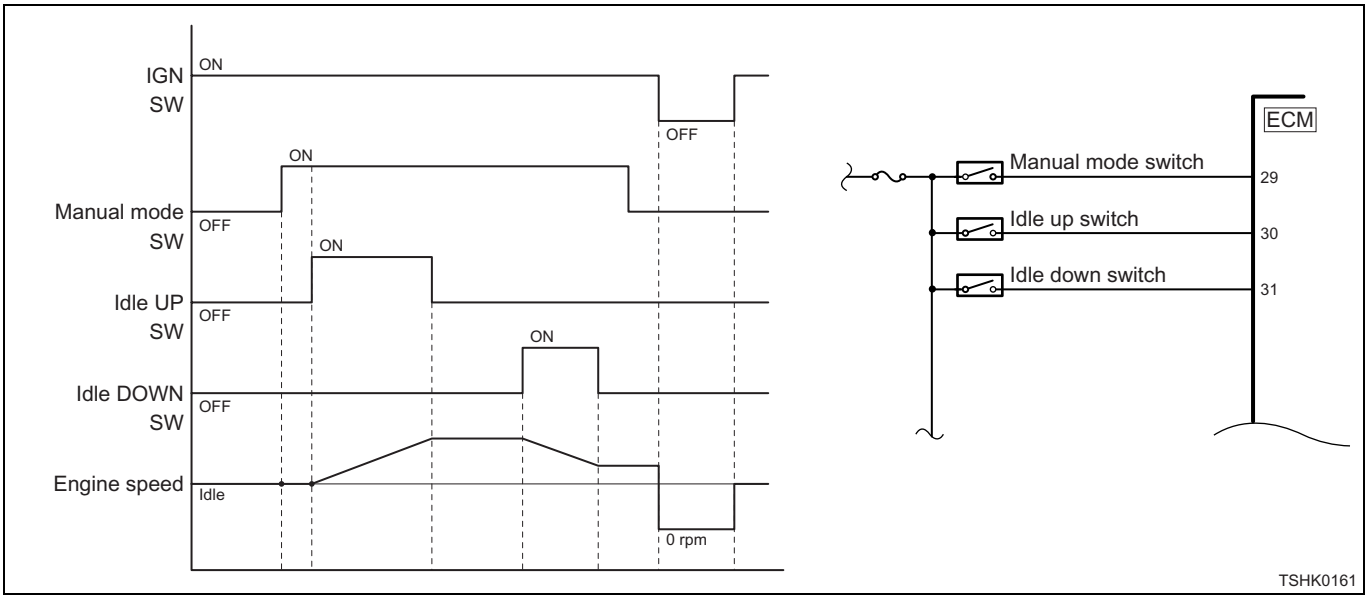
Table of Input/Output



Electronic control fuel injection system (Common rail type)

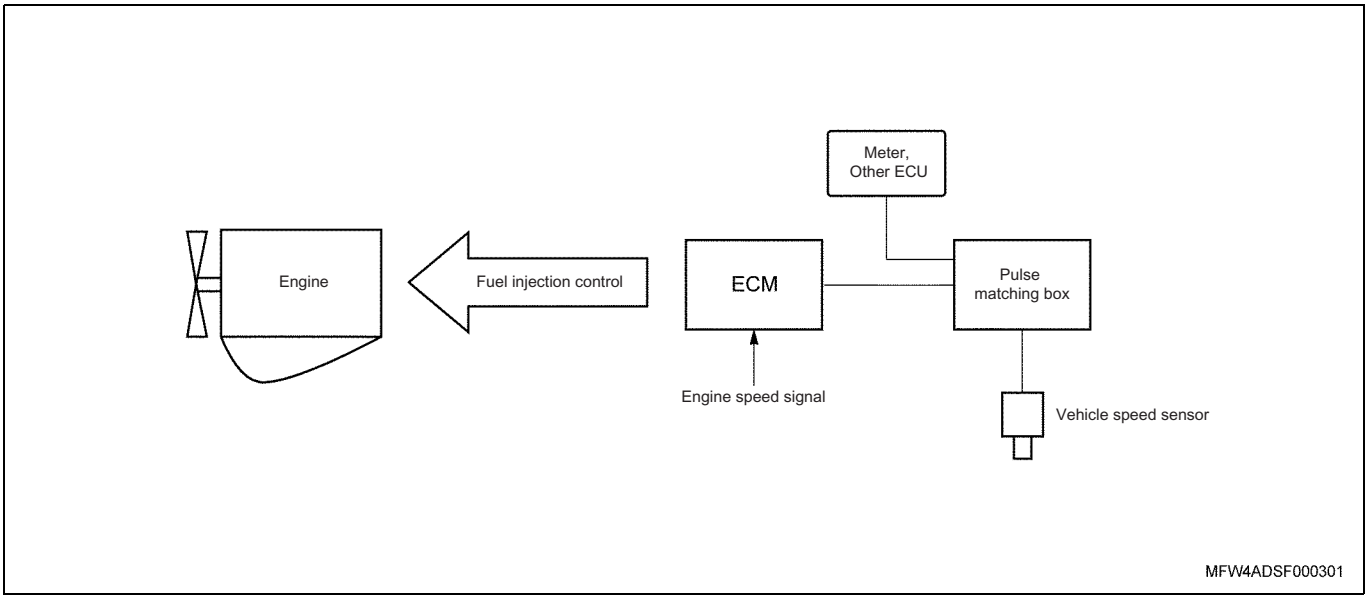
The engine control module (ECM) gets information, such as engine speed, engine load, etc. (signals from various sensors), and sends electrical signals, based on the information, to the supply pump, injector, etc. in order to properly control the fuel injection amount, injection timing, etc. in each cylinder.

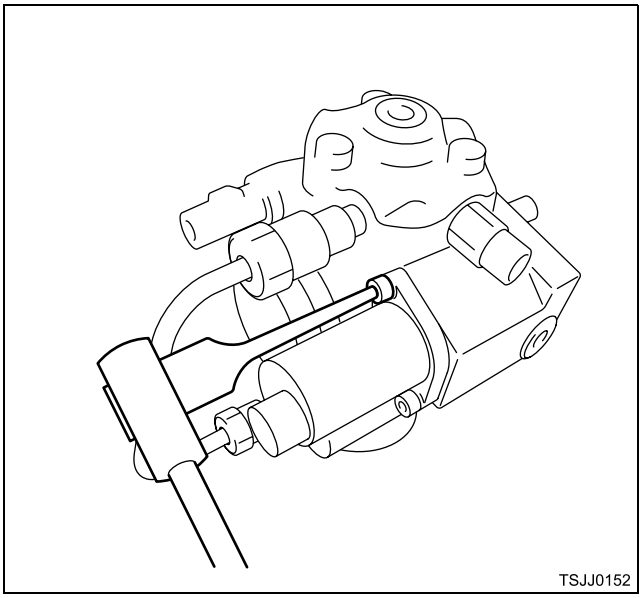
Idle manual control



Speed limit control

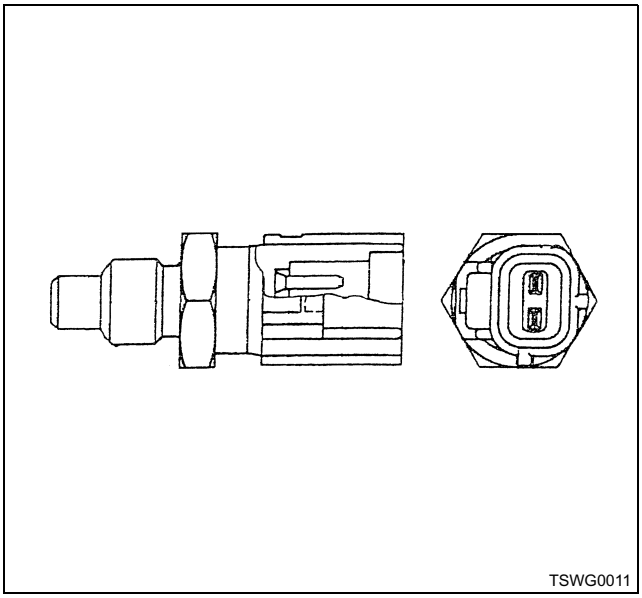
Speed limit control means that the engine control module (ECM) controls fuel injection amount, based on vehicle speed signal and engine speed, so that the machine speed does not exceed the setting value.
The vehicle speed signal is sent from vehicle speed sensor to pulse matching box. The pulse matching box corrects the signal to match with the machine, and sends it to ECM, meter, etc. The ECM recognizes the engine speed by the signal from crankshaft position (CKP) sensor.





12. Connect the SCV connector.
13. Wipe off the fuel which was leaked at replacement work.
14. Start the engine, and make sure there is no fuel leaked from the installation part of the SCV.

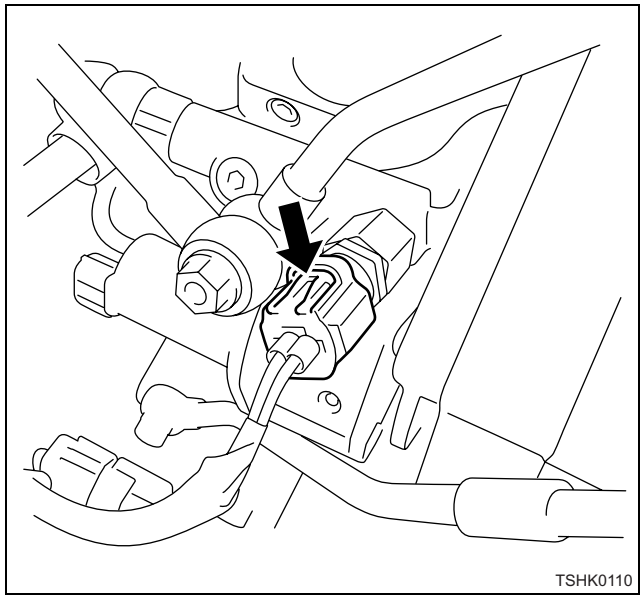
Fuel temperature (FT) sensor



The fuel temperature (FT) sensor is installed onto the supply pump, and the thermistor changes the resistance according to the temperature. The resistance is low when the fuel temperature is high, and is high when the temperature is low. The engine control module (ECM) energizes the voltage (5 V) to the FT sensor through pull up resistance, and calculates fuel temperature based on change of voltage to use for various controls such as supply pump control etc. If the resistance is low (temperature is high), the voltage becomes low; if the resistance is high (temperature is low), the voltage becomes high.

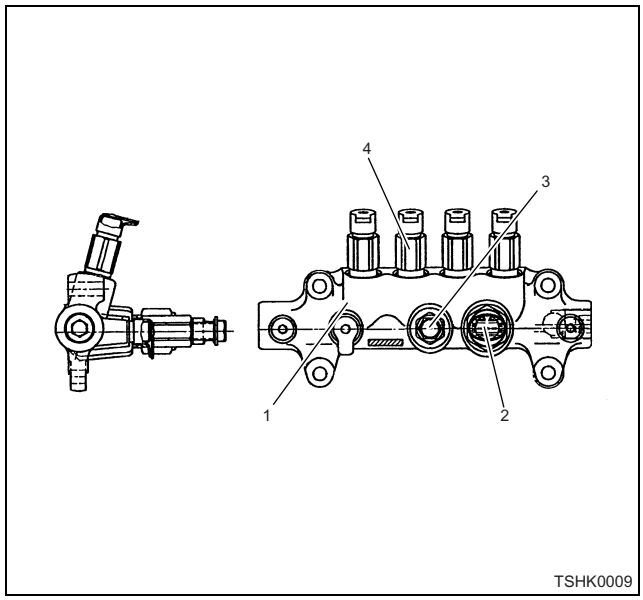
Removal

- Do not replace the FT sensor.
- If it is faulty, replace it as supply pump ASM.

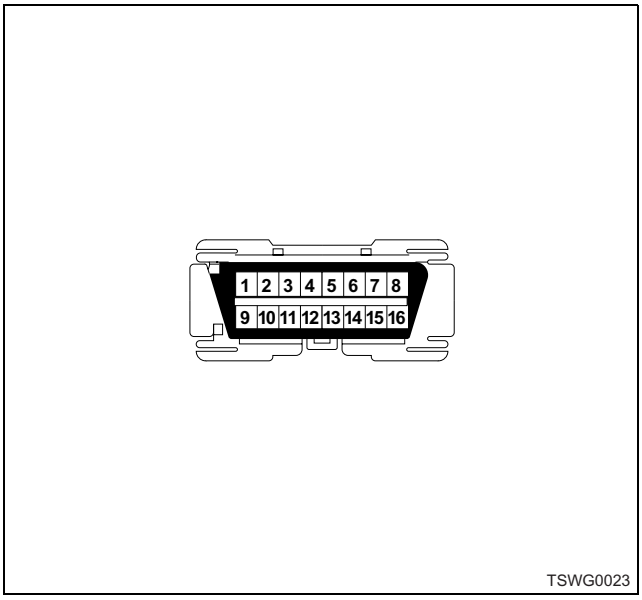


Common rail

4HK1



DLC (data link connector)



The DLC (data link connector) is a connector for communication and connection between the external diagnostic device (scan tool) and each controller.

Note:
Refer to the machines manual for the locations of DLC.

Diagnostic switch

The diagnosis switch shorts the DLC terminals No. 1 and No. 4 (or No. 5) to make the diagnosis lamp blink to indicate DTC.

Note:
Refer to the machines manual for the locations and form of diagnosis switch.

Memory clear switch

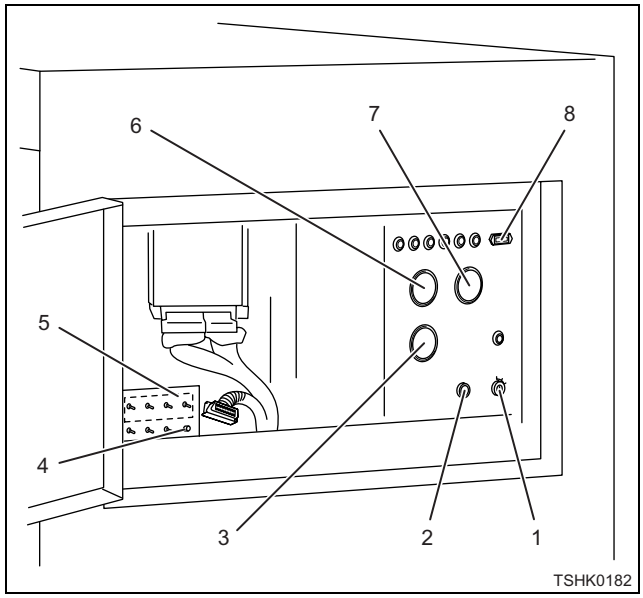
The diagnosis switch and memory clear switch are used to clear the DTC stored in ECM.

Note:
Refer to the machines manual for the locations of memory clear switch.

Mode selector switch (0, 1, 2)

The mode selector switch allows to operate at the engine speed set by each mode.

Note:
Refer to the machines manual for the locations of mode selector switch.



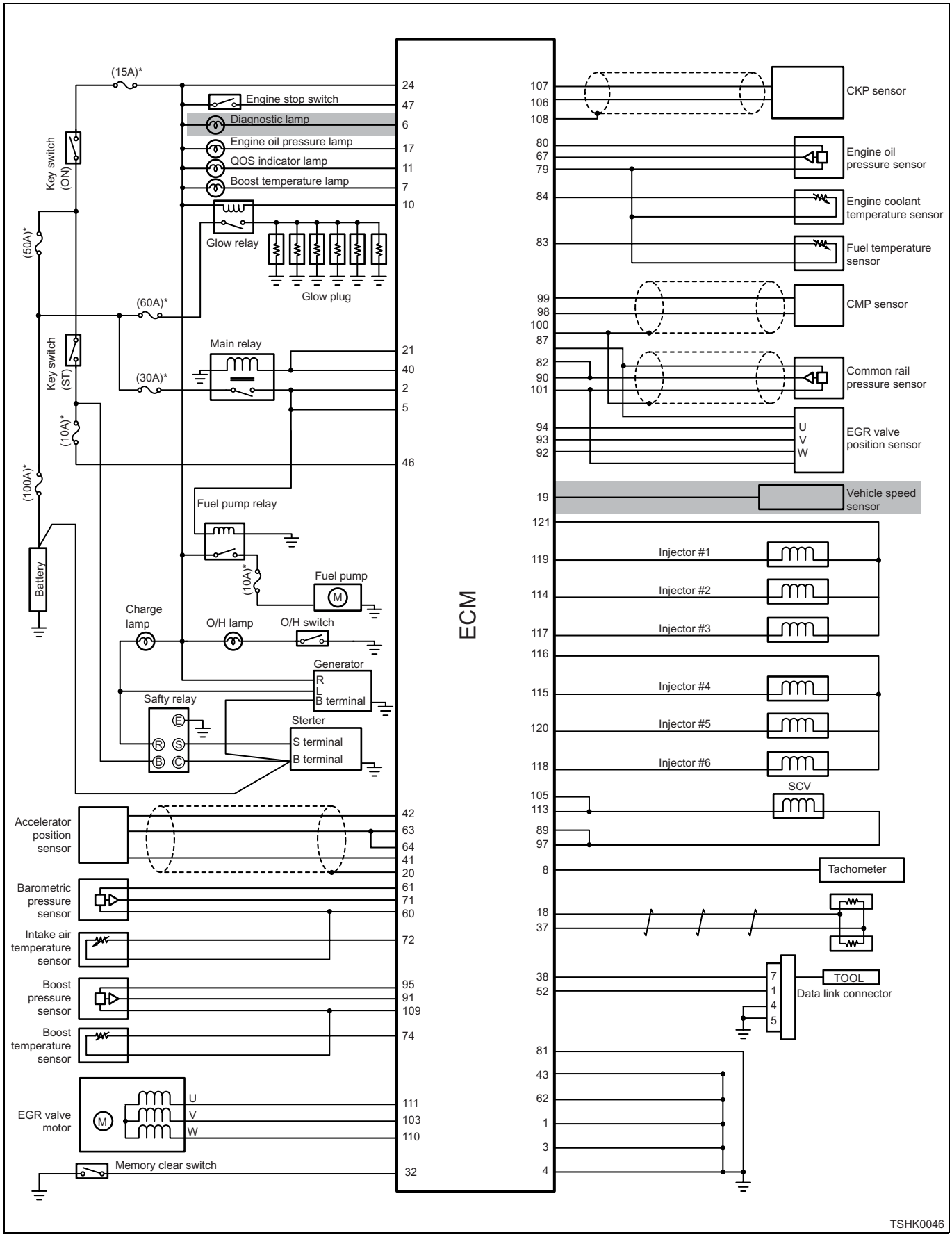
Name

1. Key switch
2. Engine stop switch
3. Fuel system
4. Memory clear switch
5. Mode switch
6. Engine coolant temperature gauge
7. Oil temperature thermometer
8. Hourmeter

TCM

- There are some sensors which are not connected to the ECM depending on the machine.

The areas with screening indicate that are not connected to the ECM.



Pin No.	Terminal name	Connection
8	OF-TACHO	
9	—	—
10	OS-GLOWR	Glow relay
11	OS-GLOWL	QOS indicator lamp
12	—	—
13	—	—
14	OS-STARTR	
15	OS-OVHL	
16	—	—
17	OS-OILPL	Engine oil pressure lamp
18	CC-CAN-H	CAN-HIGH
19	IF-SPD	Vehicle speed sensor signal
20	SG-SLD1	Accelerator position sensor 1 GND
21	OS-MAINR	ECM main relay
22	—	—
23	—	—
24	IS-IGKEY	Key switch ON signal
25	—	—
26	—	—
27	—	—
28	—	—
29	IS-IDLMNL	
30	IS-IDLUP	
31	IS-IDLDWN	
32	IS-MEMCL	Memory clear switch
33	IS-REG	
34	—	—
35	—	—
36	—	—
37	CC-CAN-L	CAN-LOW
38	CC-KW2000	Data link connector
39	—	—
40	OS-MAINR	ECM main relay
41	SG-5VRT1	Accelerator position (AP) sensor GND
42	SP-5V1	Accelerator position (AP) sensor power supply
43	PG-SIGN	GND
44	—	—
45	IS-LOAD	—
46	IS-START	Key switch start signal
47	IS-ENGSTP	Engine stop switch
48	—	—

ISZA

Pin No.	Terminal name	Connection
1	PG-POWER	GND
2	PS-+B	Power supply
3	PG-POWER	GND
4	PG-POWER	GND
5	PS-+B	Power supply
6	OS-DIAGL	Diagnosis lamp
7	OS-BOOSTL	Boost temperature sensor pilot lamp
8	OF-TACHO	
9	—	—
10	OS-GLOWR	Glow relay
11	OS-GLOWL	QOS indicator lamp
12	—	—
13	—	—
14	OS-STARTR	
15	OS-OVHL	
16	—	—
17	OS-OILPL	Engine oil pressure lamp
18	CC-CAN-H	CAN-HIGH
19	IF-SPD	Vehicle speed sensor signal
20	SG-SLD1	Accelerator position sensor 1 GND
21	OS-MAINR	ECM main relay
22	—	—
23	—	—
24	IS-IGKEY	Key switch ON signal
25	—	—
26	—	—
27	—	—
28	—	—
29	IS-IDLMNL	
30	IS-IDLUP	
31	IS-IDLDWN	
32	IS-MEMCL	Memory clear switch
33	IS-REG	
34	—	—
35	—	—
36	—	—
37	CC-CAN-L	CAN-LOW
38	CC-KW2000	Data link connector
39	—	—
40	OS-MAINR	ECM main relay

Pin No.	Terminal name	Connection
112	—	—
113	OS-SCVHI	SCVHI drive
114	OS-INJ5	Injector 2 (6H only)
115	OS-INJ6	Injector 4 (6H only)
116	OP-COM2	Injector power supply 2 (4H: No. 2, No. 3 cylinders/6H: No. 4, No. 5, No. 6 cylinders)
117	OS-INJ3	4H: Injector 4/6H: Injector 3
118	OS-INJ4	4H: Injector 2/6H: Injector 6
119	OS-INJ1	Injector 1
120	OS-INJ2	4H: Injector 3/6H: Injector 5
121	OP-COM1	Injector power supply 1 (4H: No. 1, No. 4 cylinders/6H: No. 1, No. 2, No. 3 cylinders)

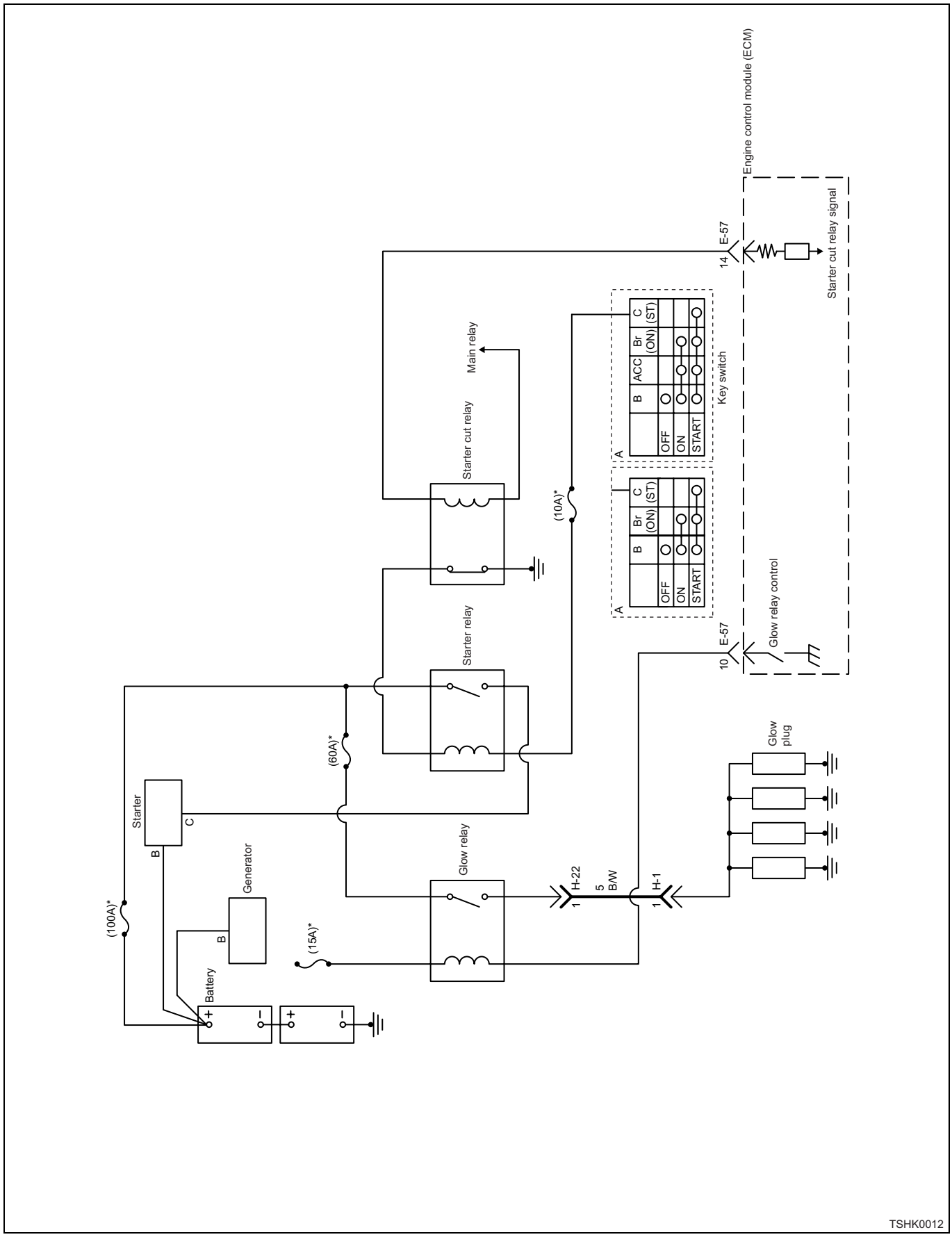
JCB

Pin No.	Terminal name	Connection
82	IA-PFUEL	Common rail pressure sensor signal
83	IA-THL	Fuel temperature sensor signal
84	IA-THW	Engine coolant temperature sensor signal
85	—	—
86	—	—
87	SP-5V5	Common rail pressure sensor power supply
88	—	—
89	IA-SCVLO	SCVLO drive
90	IA-PFUEL	Common rail pressure sensor signal
91	IA-BPRESS	Boost pressure sensor signal
92	IA-EBMPOS3	EGR valve EGR position sensor W
93	IA-EBMPOS2	EGR valve EGR position sensor V
94	IA-EBMPOS1	EGR valve EGR position sensor U
95	SP-5V4	Boost pressure sensor power supply
96	—	—
97	IA-SCVLO	SCVLO drive
98	IF-CAMHAL	Camshaft position (CMP) sensor signal
99	SP-CAMHAL	Camshaft position (CMP) sensor power supply
100	SG-SLD5	Camshaft position (CMP) sensor, common rail pressure sensor shield
101	SG-5VRT5	Common rail pressure sensor GND
102	—	—
103	OM-EBM2	EGR valve DC servomotor power supply input V
104	—	—
105	OS-SCVHI	SCVHI drive
106	IF-CRANK-	Crankshaft position (CKP) sensor (−)
107	IF-CRANK+	Crankshaft position (CKP) sensor (+)
108	SG-SLD4	Crankshaft position (CKP) sensor shield

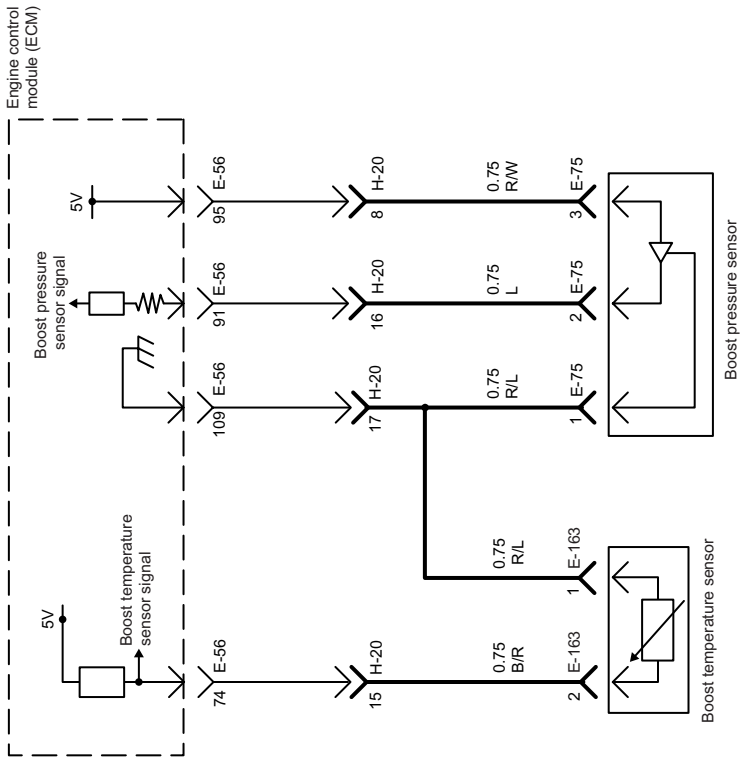
Starter for ECM control, glow circuit

(*: Specifications (fuse current value etc.) vary depending on each machine. Refer to the machine's manual.)

4HK1



Boost temperature sensor, boost pressure sensor circuit



TSWG0034

OBD system check

About OBD system check

OBD system check is systematic method to check the problems which caused by engine control system malfunction. It is the first procedure of all complaint diagnosis for operationality. Use of this diagnostic step properly enables to shorten the diagnosis period and to prevent unnecessary replacement of proper parts.

Test description

5. Communication disability with scan tool is caused by fault in the communication circuit between each ECU and scan tool.
8. If DTC is detected, proceed to the relevant DTC diagnosis by referring to 1E-375, “List of Diagnostic Trouble Codes”. If more than one DTC is detected, start with the one with smallest DTC number unless otherwise instructed in the diagnostic step.

Note for OBD system check

Important:

- **If there is no complaint for operationality, never perform this diagnostic step unless otherwise instructed in other items.**
- **Before the diagnosis, check the service information.**
- **Never erase DTCs unless otherwise instructed in the diagnostic step.**
- **If fault is found in the engine starting system, refer to “Electrical system” in the service manual “Engine section”.**
- **Ensure the battery is fully charged.**
- **Make sure the battery cable is normal and securely connected.**
- **Make sure the ground cable of ECM is connected to the proper position securely.**

Step	Action	Value	YES	NO
1	1. Turn the key switch to “ON”. 2. Check the diagnosis lamp (trouble display monitor on the machine). Does the diagnosis lamp (trouble display monitor on the machine) come on?	—	Go to Step 2.	Go to 1E-341, “Diagnosis lamp illumination circuit system check, List of Function Checks”.
2	1. Connect the diagnosis connector. • If the machine is not equipped with diagnosis lamp, Go to Step 3. 2. Check the diagnosis lamp. Does the diagnosis lamp blink?	—	Go to Step 3.	Go to 1E-343, “Diagnosis lamp blinking circuit system check, List of Function Checks”.
3	Is the scan tool (KW communication) available?	—	Go to Step 4.	Go to Step 6.
4	1. Connect the scan tool. 2. Turn the key switch to “ON”. 3. Turn the power switch of the scan tool to “ON”. Does the scan tool powered “ON”?	—	Go to Step 5.	Go to 1E-346, “Scan tool power supply circuit system check (Tech2), List of Function Checks”.
5	Communicate with ECM using a scan tool. Does it communicate with ECM properly?	—	Go to Step 6.	Go to 1E-350, “Scan tool communication circuit system check, List of Function Checks”.
6	Turn the key switch to “START”. Does the starter operate?	—	Go to Step 7.	Go to 1E-353, “Starting circuit system check, List of Function Checks”.
7	Turn the key switch to “START”. Does the engine start?	—	Go to Step 8.	Go to 1E-358, “Starting system check, List of Function Checks”.
8	Check if DTC is detected. Is DTC detected?	—	Go to the relevant DTC diagnosis.	Go to Step 9.

Step	Action	Value	YES	NO
5	1. Connect the scan tool to the machine. 2. Turn the power switch of the scan tool to “ON”. Does the scan tool powered “ON”?	—	Check the repair, and Go to 1E-339, “OBD system check, List of Function Checks”.	Go to Step 1.

– Damage of connector lock
– Poor contact between terminal and wire

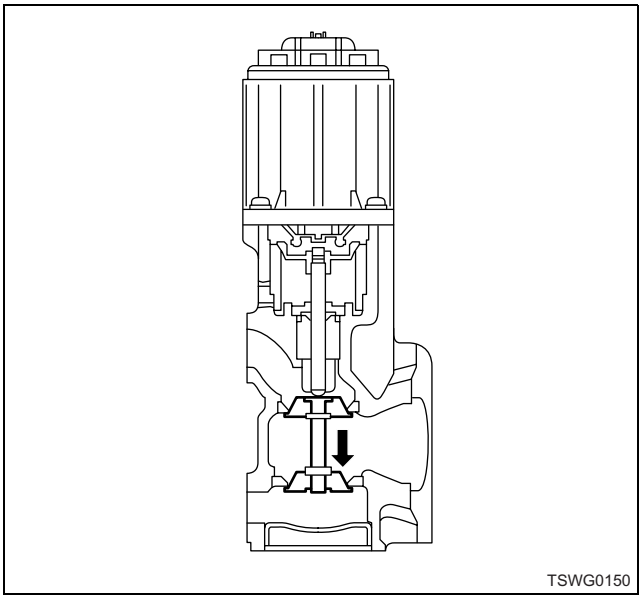
Test description

Numbers below indicate step numbers in the chart.

5. If the SCVLO drive circuit is shorted to ground, the SCV drive current will not be more than 900mA.
6. If the engine starts with the SCV connector disconnected, SCV system may be faulty. Also, if the engine does not start, the fuel system may be faulty.
7. Check the signal and operation of each sensor and injector.

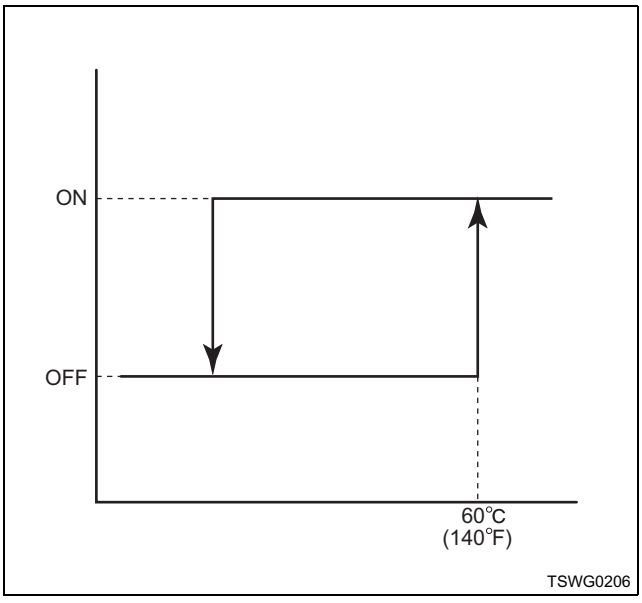
Step	Action	Value	YES	NO
1	Is the emergency stop switch equipped?	—	Turn the switch to OFF, then Go to Step 2.	Go to Step 2.
2	Check if the overheating switch is installed, and check the switch for faults. • Did the ECM stop the engine in an emergency due to faults in the harness or switches? If the trouble is detected, repair or replace. Is the procedure completed?	—	Go to Step 3.	—
3	1. Turn the key switch to “ON”. 2. Crank the engine for 15 seconds. 3. Check the DTC. Is DTC detected?	—	Go to the relevant diagnosis of DTC detected.	Go to Step 4.
4	Is the scan tool (KW communication) available?	—	Go to Step 5.	Go to Step 12.
5	While cranking the engine, check for “SCV F/B” on the data display using a scan tool. Is the “SCV F/B” the specified value or more?	900mA	Go to Step 6.	Go to Step 7.
6	1. Disconnect the SCV connector. 2. Crank the engine. Does the engine start?	—	Go to DTC P0090.	Go to 1E-361, “Fuel system check, List of Function Checks”.
7	Repair the SCVLO drive circuit between the ECM and the SCV. Is the procedure completed?	—	Go to Step 8.	—
8	1. Check the relevant items to the following using a scan tool to see if the values are normal. • Engine coolant temperature (ECT) sensor • Common rail pressure sensor • EGR position sensor • Injector 2. If the trouble is detected, replace the circuit or sensor as required. Is the fault detected?	—	Go to Step 10.	Go to Step 9.
9	1. Check for following faults. • Engine mechanical timing is off. • Improper installation position of flywheel • Excessive clogging in intake system • Excessive clogging in exhaust system 2. If the fault is detected, repair as required. Is the fault detected?	—	Go to Step 10.	—

EGR valve check



Push the EGR valve with finger to make sure it opens/ closes smoothly. Also, make sure that the valve closes completely when the finger is released.

EGR hysteresis

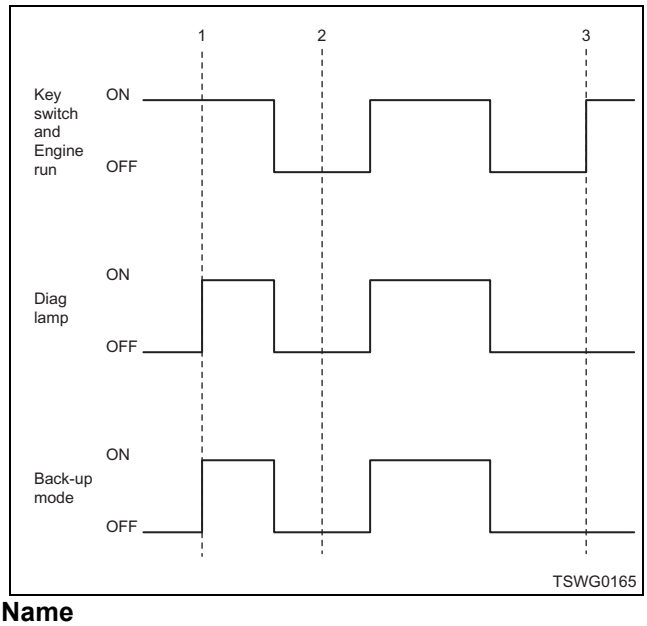


DTC	Flash code	DTC description	Item to be detected	Preconditions when DTC is set	DTC set condition	Fault judgment period	Behavior when trouble occurs	Diagnosis lamp	Recovery from failure
JCB									
P0219	543	Overrun	Engine speed abnormally high	• Key switch input voltage is 18V or more.	Engine speed becomes 200 rpm more than the speed under no-load. 2250 rpm or more	Approx. 1 sec.	Output lowering **Back-up:** **Limited injection amount 1** **Limitation is lifted if the speed decreases**	ON	*2
Kawasaki Heavy Industries, Ltd.									
P0219	543	Overrun	Engine speed abnormally high	• Key switch input voltage is 18V or more.	When engine speed is more than 2650 rpm.	Approx. 1 sec.	Output lowering **Back-up:** **Limited injection amount 1** **Limitation is lifted if the speed decreases**	ON	*2
Sumitomo (S.H.I.) Construction Machinery Manufacturing Co., Ltd.									
P0237	32	Boost pressure sensor fault (low voltage fault)	Open/short circuit/breakage of sensor or harness	• Key switch input voltage is 18V or more. • DTC P1630 or P1634 is not detected.	Boost pressure sensor voltage is less than 0.1V.	Approx. 3 sec.	Black smoke emitted **Back-up:** **Boost pressure default setting (150 kPa)** **Boost pressure correction/EGR stopped**	ON	*2
Hitachi Construction Machinery Co., Ltd.									
P0237	32	Boost pressure sensor fault (low voltage fault)	Open/short circuit/breakage of sensor or harness	• Key switch input voltage is 18V or more. • DTC P1630 or P1634 is not detected.	Boost pressure sensor voltage is less than 0.1V.	Approx. 3 sec.	Black smoke emitted **Back-up:** **Boost pressure default setting (160 kPa)** **Boost pressure correction/EGR stopped**	ON	*2
JCB									
P0237	32	Boost pressure sensor fault (low voltage fault)	Open/short circuit/breakage of sensor or harness	• Key switch input voltage is 18V or more. • DTC P1630 or P1634 is not detected.	Boost pressure sensor voltage is less than 0.1V.	Approx. 3 sec.	Black smoke emitted **Back-up:** **Boost pressure default setting (150 kPa)** **Boost pressure correction/EGR stopped**	ON	*2
Kawasaki Heavy Industries, Ltd.									
P0237	32	Boost pressure sensor fault (low voltage fault)	Open/short circuit/breakage of sensor or harness	• Key switch input voltage is 18V or more. • DTC P1630 or P1634 is not detected.	Boost pressure sensor voltage is less than 0.1V.	Approx. 3 sec.	Black smoke emitted **Back-up:** **Boost pressure default setting (150 kPa)** **Boost pressure correction/EGR stopped**	ON	*2
Sumitomo (S.H.I.) Construction Machinery Manufacturing Co., Ltd.									
P0238	32	Boost pressure sensor fault (high voltage fault)	Short circuit in sensor or harness	• Key switch input voltage is 18V or more. • DTC P1630 or P1634 is not detected.	Boost pressure sensor voltage is more than 4.9V.	Approx. 3 sec.	Black smoke emitted **Back-up:** **Boost pressure default setting (150 kPa)** **Boost pressure correction/EGR stopped**	ON	*2

DTC	Flash code	DTC description	Item to be detected	Preconditions when DTC is set	DTC set condition	Fault judgment period	Behavior when trouble occurs	Diagnosis lamp	Recovery from failure
Kawasaki Heavy Industries, Ltd.									
U2104	84	CAN Bus fault	CAN communication fault	• Key switch input voltage is 12 V or more.	Bus-off is detected.	At 3 sec. continuously	Set to idle speed. **Back-up: Switch to the accelerator sensor input operation**	ON	*3
Sumitomo (S.H.I.) Construction Machinery Manufacturing Co., Ltd.									
U2106	85	CAN timeout fault	CAN communication fault	• DTC U2104 is not detected. • Key switch input voltage is 12 V or more.	CAN data reception does not complete at a set time.	At 1 sec. continuously	Set to idle speed. **Back-up: Running at 1500 rpm.**	ON	*3
Hitachi Construction Machinery Co., Ltd.									
U2106	85	CAN timeout fault	CAN communication fault	• DTC U2104 is not detected. • Key switch input voltage is 12 V or more.	CAN data reception does not complete at a set time.	At 1 sec. continuously	Set to idle speed. **Back-up: Switches to the accelerator sensor input operation.**	ON	*3
JCB									
U2106	85	CAN timeout fault	CAN communication fault	• DTC U2104 is not detected. • Key switch input voltage is 12 V or more.	CAN data reception does not complete at a set time.	At 1 sec. continuously	Set to idle speed. **Back-up: Running at 1500 rpm.**	ON	*3
Kawasaki Heavy Industries, Ltd.									
U2106	85	CAN timeout fault	CAN communication fault	• DTC U2104 is not detected. • Key switch input voltage is 12 V or more.	CAN data reception does not complete at a set time.	At 1 sec. continuously	Set to idle speed. **Back-up: Switches to the accelerator sensor input operation.**	ON	*3

About recovery from failure

There are three modes for recovery from failure.
To clear the trouble displayed on the monitor of the machine, one more ignition cycle may be needed after the following ignition cycle.
*1
Even if the DTC has restored normally, the diagnosis lamp and back-up mode are not restored in the ignition cycle that the DTC is detected. After turning the key switch OFF, DTC diagnosis is performed when the vehicle starts again. If it is judged as normal, everything will be recovered to normal from the next ignition cycle.



Name

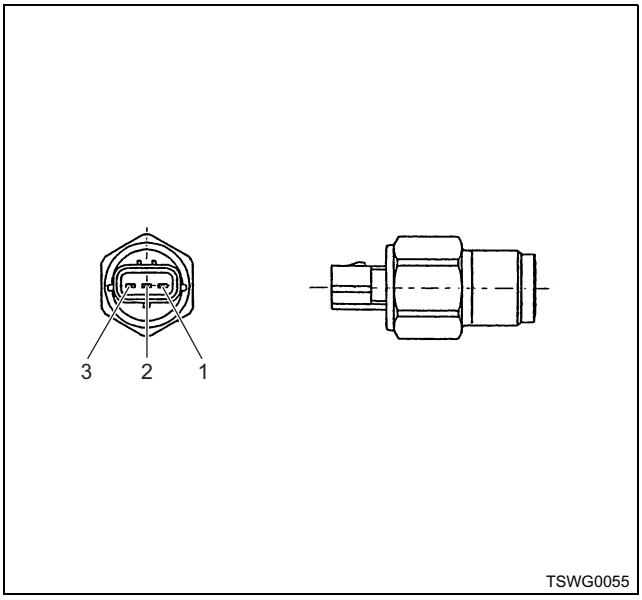
1. DTC is detected.
2. Repair and inspection
3. Returned to normal.

DTC	Flash code	DTC description	Item to be detected	Preconditions when DTC is set	DTC set condition	Fault judgment period	Behavior when trouble occurs	Diagnosis lamp	Recovery from failure
JCB									
P0488	45	EGR valve control fault	Trouble/open circuit or valve engage/stuck in drive motor side	• DTC P1630, P1635, P0487, P0488 or P1635 is not detected. • Main relay voltage is between 20 and 32 V.	Difference between target valve lift and actual position is more than 20%.	Approx. 10 sec.	Exhaust gas is affected. **Back-up:** **Instruction to fully close EGR valve**	ON	*1
TCM									
P0488	45	EGR valve control fault	Trouble/open circuit or valve engage/stuck in drive motor side	• DTC P1630, P1635, P0487, P0488 or P1635 is not detected. • Main relay voltage is between 20 and 32 V.	Difference between target valve lift and actual position is more than 20%.	Approx. 10 sec.	Exhaust gas is affected. **Back-up:** **Instruction to fully close EGR valve**	ON	*1
MADILL									
P0488	45	EGR valve control fault	Trouble/open circuit or valve engage/stuck in drive motor side	• DTC P1630, P1635, P0487, P0488 or P1635 is not detected. • Main relay voltage is between 20 and 32 V.	Difference between target valve lift and actual position is more than 20%.	Approx. 10 sec.	Exhaust gas is affected. **Back-up:** **Instruction to fully close EGR valve**	ON	*1
ISZA									
P0488	45	EGR valve control fault	Trouble/open circuit or valve engage/stuck in drive motor side	• DTC P1630, P1635, P0487, P0488 or P1635 is not detected. • Main relay voltage is between 20 and 32 V.	Difference between target valve lift and actual position is more than 20%.	Approx. 10 sec.	Exhaust gas is affected. **Back-up:** **Instruction to fully close EGR valve**	ON	*1
Hitachi Sumitomo Heavy Industries Construction Crane Co., Ltd.									
P0488	45	EGR valve control fault	Trouble/open circuit or valve engage/stuck in drive motor side	• DTC P1630, P1635, P0488 or P1635 is not detected. • Main relay voltage is between 20 and 32 V. • Difference between target EGR opening angle and actual one is 20% or less.	Difference between target valve lift and actual position is more than 20%.	Approx. 10 sec.	Exhaust gas is affected. **Back-up:** **Instruction to fully close EGR valve**	ON	*1
P0522	294	Engine oil pressure sensor fault (low voltage fault)	Open/short circuit/breakage of sensor or harness	• Key switch input voltage is 18V or more. • DTC P1633 is not detected.	Engine oil pressure sensor voltage is less than 0.098 V.	Approx. 4 sec.	Operationality is not affected. **Back-up:** **No back-up action**	ON	*2
P0523	294	Engine oil pressure sensor fault (high voltage fault)	Short circuit in sensor or harness	• Key switch input voltage is 18V or more. • DTC P1633 is not detected.	Engine oil pressure sensor voltage is more than 4.85 V.	Approx. 4 sec.	Operationality is not affected. **Back-up:** **No back-up action**	ON	*2
P0601	53	ROM fault	ROM fault	—	ROM is faulty. Reflash failure	—	Engine stopped **Back-up:** **Engine stopped**	ON	*2
P0603	54	EEPROM fault	EEPROM fault	—	EEPROM is faulty.	—	Operationality is not affected. **Back-up:** **No back-up action**	ON	*2

DTC	Flash code	DTC description	Item to be detected	Preconditions when DTC is set	DTC set condition	Fault judgment period	Behavior when trouble occurs	Diagnosis lamp	Recovery from failure
Shindaiwa Kogyo Co., Ltd.									
U2106	85	CAN timeout fault	CAN communication fault	• DTC U2104 is not detected. • Key switch input voltage is 20 V or more.	CAN data reception does not complete at a set time.	At 1 sec. continuously	Set to idle speed. **Back-up:** **Specified back-up value (depending on the machine manufacturer)**	ON	*3
Kobelco Construction Machinery Co., Ltd. (NHK)									
U2106	85	CAN timeout fault	CAN communication fault	• DTC U2104 is not detected. • Key switch input voltage is 20 V or more.	CAN data reception does not complete at a set time.	At 1 sec. continuously	Set to idle speed. **Back-up:** **Specified back-up value (depending on the machine manufacturer)**	ON	*3
JCB									
U2106	85	CAN timeout fault	CAN communication fault	• DTC U2104 is not detected. • Key switch input voltage is 20 V or more.	CAN data reception does not complete at a set time.	At 1 sec. continuously	Set to idle speed. **Back-up:** **29t: Running at 1350 rpm.** **33t: Running at 1350 (TBD) rpm.**	ON	*3
TCM									
U2106	85	CAN timeout fault	CAN communication fault	• DTC U2104 is not detected. • Key switch input voltage is 20 V or more.	CAN data reception does not complete at a set time.	At 1 sec. continuously	Set to idle speed. **Back-up:** **Switches to the accelerator sensor input operation.**	ON	*3
MADILL									
U2106	85	CAN timeout fault	CAN communication fault	• DTC U2104 is not detected. • Key switch input voltage is 20 V or more.	CAN data reception does not complete at a set time.	At 1 sec. continuously	Set to idle speed. **Back-up:** **Specified back-up value (depending on the machine manufacturer)**	ON	*3
ISZA									
U2106	85	CAN timeout fault	CAN communication fault	• DTC U2104 is not detected. • Key switch input voltage is 20 V or more.	CAN data reception does not complete at a set time.	At 1 sec. continuously	Set to idle speed. **Back-up:** **Specified back-up value (depending on the machine manufacturer)**	ON	*3
Hitachi Sumitomo Heavy Industries Construction Crane Co., Ltd.									
U2106	85	CAN timeout fault	CAN communication fault	• DTC U2104 is not detected. • Key switch input voltage is 20 V or more.	CAN data reception does not complete at a set time.	At 1 sec. continuously	Set to idle speed. **Back-up:** **Specified back-up value (depending on the machine manufacturer)**	ON	*3

Hitachi Sumitomo Heavy Industries Construction Crane Co., Ltd. E Code	ISUZU P Code	DTC description	Trouble display on monitor
E0107	P0107	Barometric pressure sensor circuit low input	❍
E0108	P0108	Barometric pressure sensor circuit high input	❍
E0112	P0112	Intake air temperature sensor circuit low input	❍
E0113	P0113	Intake air temperature sensor circuit high input	❍
E0117	P0117	Engine coolant temperature sensor low input	❍
E0118	P0118	Engine coolant temperature sensor input is high.	❍
E0182	P0182	Fuel temperature sensor circuit low input	—
E0183	P0183	Fuel temperature sensor circuit high input	—
E0192	P0192	Common rail pressure sensor circuit low input	❍
E0193	P0193	Common rail pressure sensor circuit high input	❍
E0201	P0201	No. 1 injector — injector circuit fault	❍
E0202	P0202	No. 2 injector — injector circuit fault	❍
E0203	P0203	No. 3 injector — injector circuit fault	❍
E0204	P0204	No. 4 injector — injector circuit fault	❍
E0205	P0205	No. 5 injector — injector circuit fault	❍
E0206	P0206	No. 6 injector — injector circuit fault	❍
E0219	P0219	Overrun	❍
E0237	P0237	Turbocharger boost sensor circuit low input	❍
E0238	P0238	Turbocharger boost sensor circuit high input	❍
E0335	P0335	Crankshaft position sensor circuit fault	❍
E0335	P0336	Crankshaft position sensor fault	❍
E0340	P0340	Camshaft position sensor circuit fault	❍
E0340	P0341	Camshaft position sensor fault	❍
E0380	P0380	Glow relay circuit fault	❍
E0487	P0487	EGR valve BLDC position circuit fault	❍
E0488	P0488	EGR valve fault	❍
E0522	P0522	Oil pressure circuit open circuit	❍
E0523	P0523	Oil pressure circuit short circuit	❍
E0601	P0601	ROM fault	❍
E0603	P0603	EEPROM fault	❍
E0606	P0606	ECM internal trouble (CPU fault)	❍
E0606	P0606	CPU monitoring IC fault	❍
E0611	P0611	EDU charge circuit 1 low voltage	❍
E0612	P0612	EDU charge circuit 2 low voltage	❍
E0650	P0650	Check engine control circuit fault	—
E1093	P1093	Fuel leakage (large amount)	❍
E1095	P1095	Pressure limiter is operated.	❍
E1112	P1112	Boost temperature sensor short circuit	—
E1113	P1113	Boost temperature sensor open circuit	—
E1173	P1173	Overheat	—
E1261	P1261	COMMON1 (Harness or injector harness)	❍
E1262	P1262	COMMON2 (Harness or injector harness) circuit fault	❍
E1271	P1271	Accelerator sensor 1 — 2 positional correlation fault	—
E1277	P1277	Accelerator sensor 1 low input	—
E1282	P1282	Accelerator sensor 2 low input	—
E1283	P1283	Accelerator sensor 2 high input	—

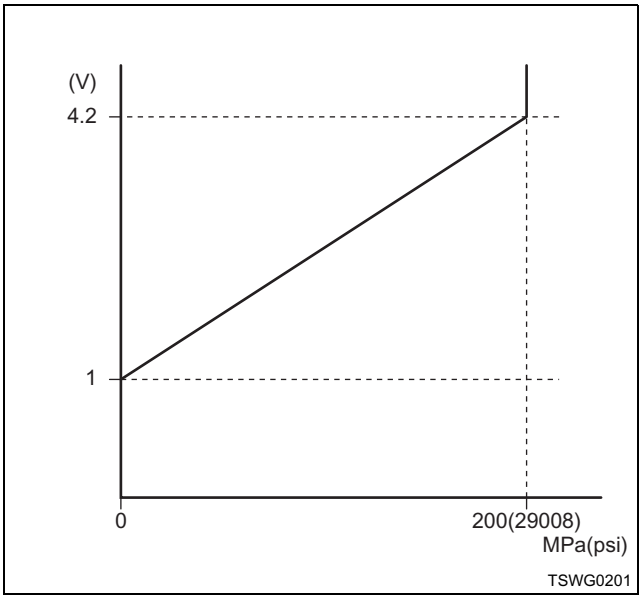
About common rail pressure sensor



Name

1. Sensor ground
2. Sensor signal
3. Sensor power supply

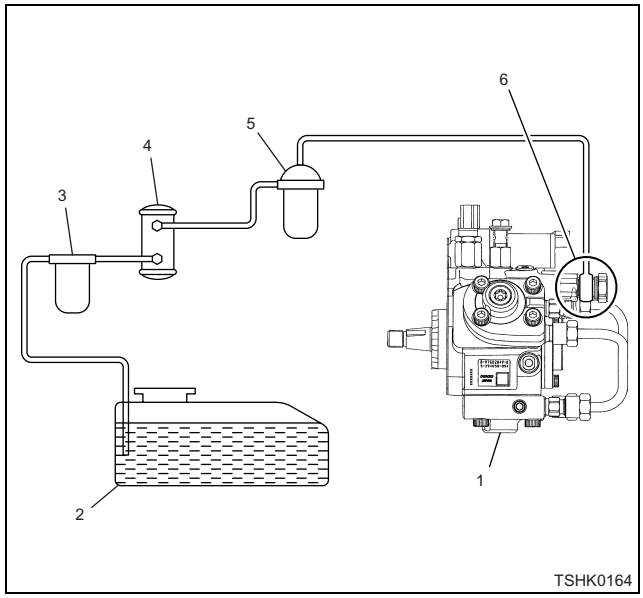
Characteristics of common rail pressure sensor



Fuel discharge inspection procedure

Perform the fuel discharging inspection of upstream side of the fuel system in the following procedure.

1. Disconnect the fuel pipe at the supply pump inlet.
2. Activate the electromagnetic pump.
3. Check if the fuel is discharging from the fuel pipe.
   - If the fuel is discharging, go to “4. Air mixture inspection”.
   - If no fuel is discharging, go to “5. Check the electromagnetic pump”.



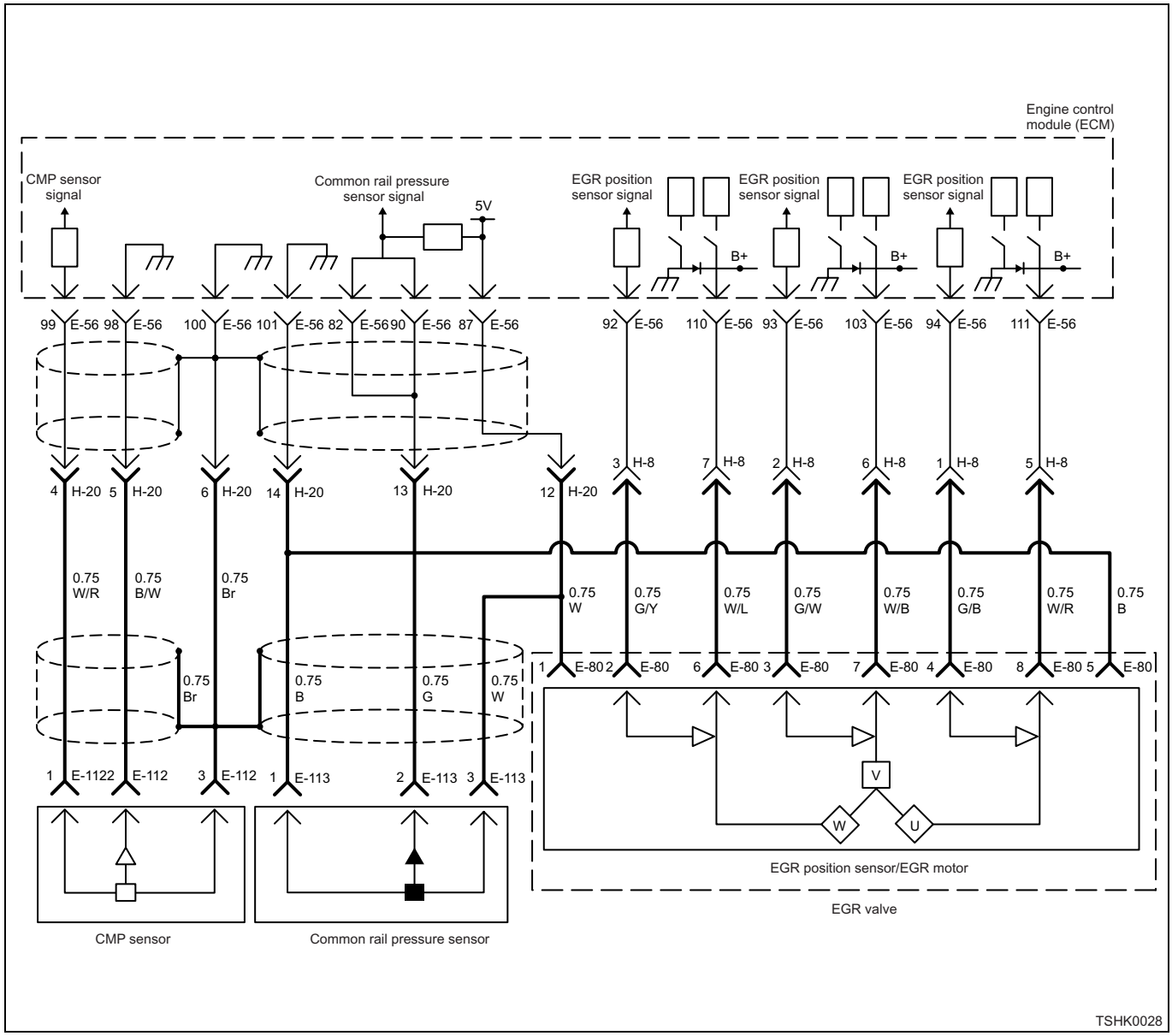
Name

1. Supply pump
2. Fuel tank
3. Pre-fuel filter
4. Electromagnetic Pump
5. Fuel filter
6. Supply pump inlet

4. Inspection of air mixture to fuel
   Connect a clear pipe to the fuel pipe and make sure that no air mixture in the discharging fuel.
   - If there is any air mixture in the fuel, identify the air mixed position upstream side of low pressure pipe and correct.
   - If no air mixture in the fuel, inside of the supply pump may be faulty. Replace the supply pump if the fault is not solved by replacing SCV alone after replacing the SCV.

Note:

- Refer to 1E-246, “SCV Replacement procedure, Engine component location diagram, Engine Control System” in this section for how to replace SVC.
- For how to replace supply pump, refer to “Engine section” in the service manual.



Description of circuit

The common rail pressure sensor detects the common rail internal pressure. The common rail pressure sensor is installed to the common rail. As the common rail internal pressure changes depending on engine condition, output voltage of the common rail pressure sensor will change (if the common rail internal fuel pressure is low, output voltage becomes low, if the pressure is high, the output voltage becomes high as well). The engine control module (ECM) reads this output voltage change, converting it into common rail internal pressure, to utilize for control. Dedicated communication circuits are used for the sensor power supply (5V), SIG, and ground in the common rail pressure sensor, which are connected to the ECM. Also, the sensor circuit is shielded to avoid electrical noise etc.

Main trouble symptom

- Intense engine vibration
- Rough idling
- Output lowering
- Engine blow up fault
- Black smoke emitted
- Excessive output possible

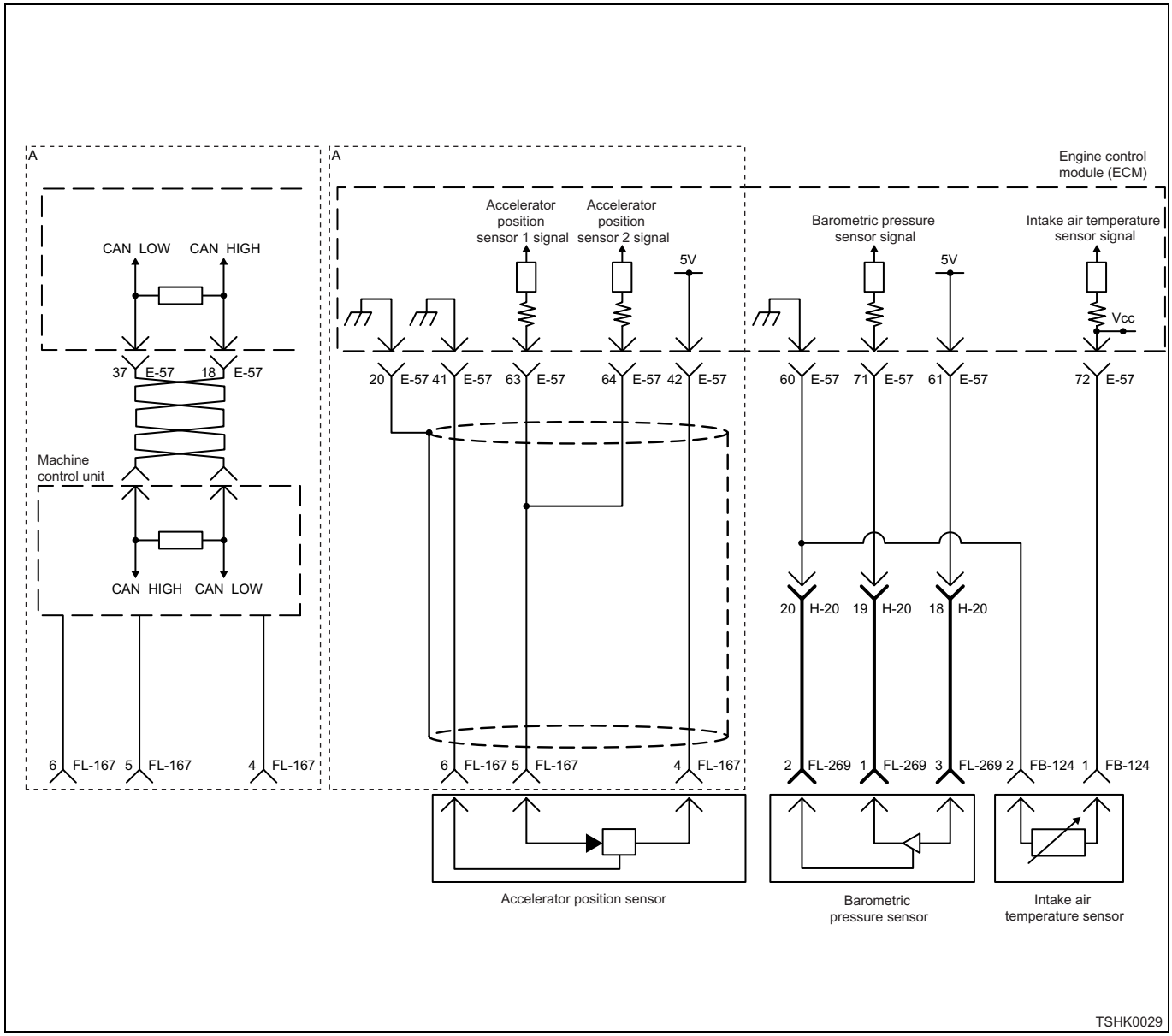
Preconditions when DTC is set

- Key switch input voltage is 18V or more.
- DTC P0089, P0192, P0193 or P1635 is not detected.
- Coolant temperature is 60°C (140°F) or more, and 375 rpm or more.
- Duty to SCV is 40% or less, or SCV target pressure feed is 90 mm^3/sec (0.0055 cu·in/sec) or less.

DTC set condition

- Actual rail pressure is 40 MPa (5802 psi) or more higher than target rail pressure for 5 seconds or more.

DTC: P0107 (Flash code 71) Barometric pressure sensor circuit input is low (open circuit or ground short)



Description of circuit

The barometric pressure sensor detects the barometric pressure. The barometric pressure sensor is installed to the machine. As the barometric pressure changes depending on altitude and weather condition, output voltage of the barometric pressure sensor will change (if the barometric pressure is low, output voltage becomes low, if the barometric pressure is high, the output voltage becomes high as well). The engine control module (ECM) reads this output voltage change, converting it into barometric pressure, to utilize for optimizing the fuel injection control and for calculating the relative boost pressure.

Main trouble symptom

Due to back-up equivalent to 2000 m (6562 ft)

- Black smoke emitted at high altitude
- Output shortage at low altitude

Preconditions when DTC is set

- Key switch input voltage is 18V or more.
- DTC P1630 or P1632 is not detected.

DTC set condition

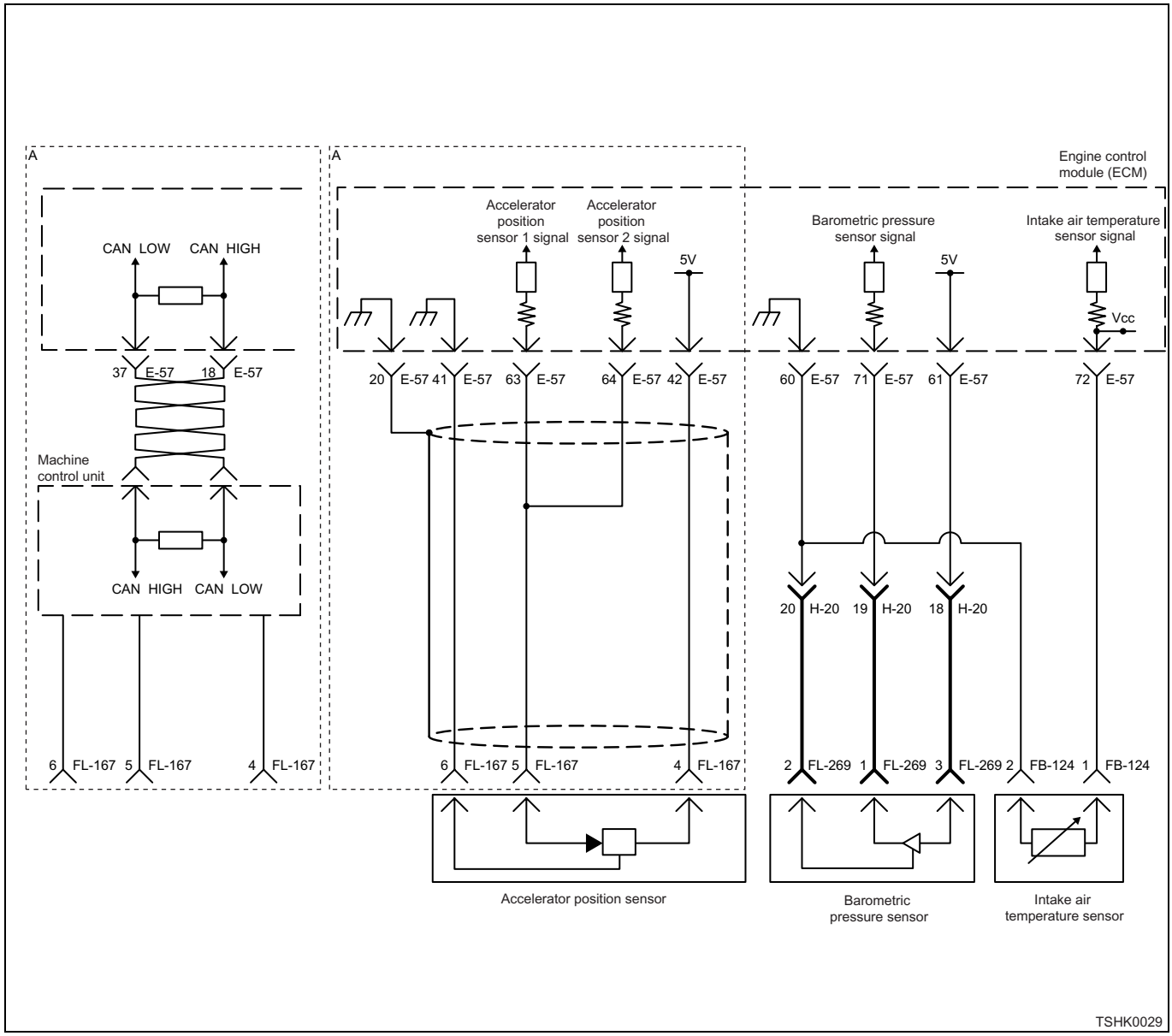
- Barometric pressure sensor voltage is 0.5V or less for 5 seconds or more.

Action taken when DTC is set

- Trouble is displayed on the monitor of the machine* or diagnosis lamp comes on. (* Nothing is displayed depending on the machine manufacturer)

Step	Action	Value	YES	NO
11	Replace the ECM. **Note:** EGR valve position learning is required after replacing or rewriting the ECM. Refer to 1E-242, “Installation of ECM, Engine control module (ECM), Engine Control System” in this section for learning of EGR. Is the procedure completed?	—	Go to Step 12.	—
12	Check the DTC again. 1. Connect all the harnesses. 2. Clear the DTC. Refer to 1E-21, “How to clear DTC, Procedure of Trouble Diagnosis” in this section for how to clear DTCs. 3. Turn the key switch to “OFF” for more than 10 seconds. 4. Test run with the “Preconditions when DTC is set”. 5. Check the DTC. Is DTC P0108 detected?	—	Go to Step 2.	Go to Step 13.
13	Check if other DTC is detected. Is other DTC detected?	—	Go to each DTC diagnosis.	Verify repair.
14	Is the scan tool or monitor (CAN communication) available?	—	Go to Step 15.	Go to Step 16.
15	Check the value for Barometric pressure using a scan tool or monitor. 1. Connect the scan tool or monitor. 2. Start the engine. 3. Check the value for “Barometric pressure” using a scan tool or monitor. Does the display of Barometric pressure show error value?	127 kPa (18.4 psi) (error value)	Go to Step 16.	Go to “Diagnostic aid”.
16	Check for installation condition of the barometric pressure sensor, ECM and coupling connector. (Check the barometric pressure sensor circuit for short to +5V line or battery power supply circuit.) 1. Check for play or looseness in the connection. 2. If the fault is detected, repair or replace as required. Is the fault detected?	—	Go to Step 12.	Go to Step 17.

DTC: P0113 (Flash code 22) Intake air temperature sensor fault (high voltage fault, open circuit or short to power supply circuit)



Description of circuit

The intake air temperature (IAT) sensor is the thermistor type and the value of resistance changes according to the temperature. The resistance is low when the intake air temperature is high, and is high when the temperature is low. The ECM energizes 5 V to the IAT sensor through the pull up resistance, and calculate the intake air temperature from the change in voltage, to utilize various control such as fuel injection control. If the resistance is low (temperature is high), the voltage becomes low; if the resistance is high (temperature is low), the voltage becomes high.

Main trouble symptom

- White smoke emission possible when starting at low temperatures

Preconditions when DTC is set

- Key switch input voltage is 18V or more.
- DTC P1630 or P1632 is not detected.
- 3 minutes or more has elapsed after starting engine.

DTC set condition

- IAT sensor voltage is 4.95V or more for 4 seconds or more.

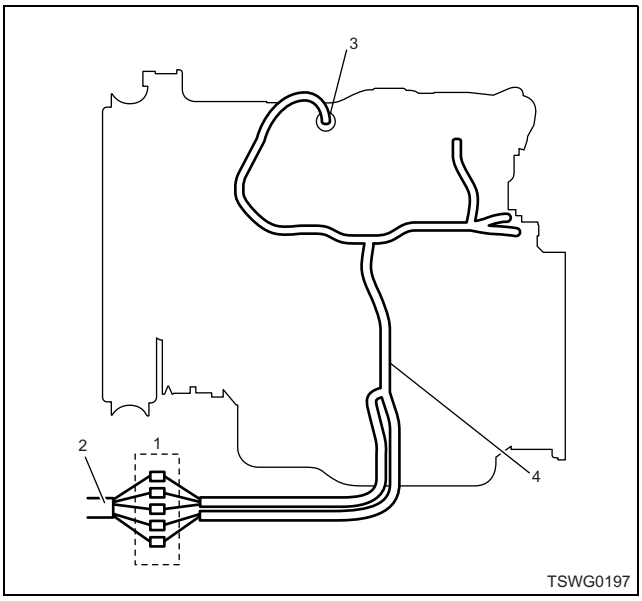
Action taken when DTC is set

- Trouble is displayed on the monitor of the machine* or diagnosis lamp comes on. (* Nothing is displayed depending on the machine manufacturer)

Step	Action	Value	YES	NO
11	Check the DTC again. 1. Connect all the harnesses. 2. Clear the DTC. Refer to 1E-21, “How to clear DTC, Procedure of Trouble Diagnosis” in this section for how to clear DTCs. 3. Turn the key switch to “OFF” for more than 10 seconds. 4. Test run with the “Preconditions when DTC is set”. 5. Check the DTC. Is DTC P0117 detected?	—	Go to Step 2.	Go to Step 12.
12	Check if other DTC is detected. Is other DTC detected?	—	Go to each DTC diagnosis.	Verify repair.
13	Is the scan tool or monitor (CAN communication) available?	—	Go to Step 14.	Go to Step 15.
14	Check the value for engine coolant temperature using a scan tool or monitor. 1. Connect the scan tool or monitor. 2. Start the engine. 3. Check the value for “Engine coolant temperature” using a scan tool or monitor. Display of engine coolant temperature is 214°C (419°F) due to back-up mode after fault judgment. Does the display of “Engine coolant temperature” show error value?	214°C (419°F) (error value)	Go to Step 15.	Go to Step 11.
15	Check for installation condition of the ECT sensor, ECM and coupling connector. 1. Check for play or looseness in the connection. 2. If the fault is detected, repair or replace as required. Is the procedure completed?	—	—	Go to Step 16.
16	1. Check for the followings in the signal circuit between ECM and ECT sensor using breaker box or DMM. Refer to 1E-480, “Breaker box inspection procedure, DTC: P0117 (Flash code 23) Engine coolant temperature sensor fault (low voltage fault, GND short, short circuit), List of Diagnostic Trouble Codes”. **Note:** If breaker box is not available, refer to 1E-481, “On-board check procedure for sensors, DTC: P0117 (Flash code 23) Engine coolant temperature sensor fault (low voltage fault, GND short, short circuit), List of Diagnostic Trouble Codes”. • Short circuit to ECT sensor ground circuit • Short circuit to ground 2. Measure the resistance of ECT sensor to check that the value is within normal range. 3. If the fault is detected, repair or replace as required. Is the procedure completed?	—	—	Go to Step 7.

Step	Item to be checked	Inspection method	Measuring condition	Terminal No.	Normal value	Abnormal value
6, 18	Short circuit to power supply circuit	Voltage measurement	• Disconnect the sensor connector. • Key switch “ON”	84 – GND	0 V	18 V or more
7, 19	Open circuit/ high resistance	Resistance measurement	• Disconnect the sensor connector. • Key switch “OFF”	84 – Sensor connector signal terminal	100Ω or less	10 MΩ or more
8, 20	Open circuit/ high resistance	Resistance measurement	• Disconnect the sensor connector. • Key switch “OFF”	79 – Sensor connector ground terminal	100Ω or less	10 MΩ or more

On-board check procedure for sensors



Name

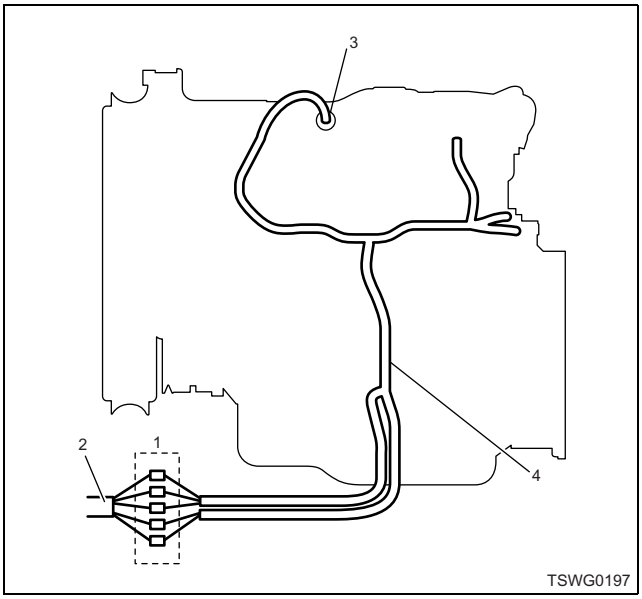
1. Coupling connector between engine — the machine
2. Machine harness
3. Sensor connector
4. Engine harness

1. Disconnect the coupling connector, and check the sensor from engine harness connector.
2. Disconnect the connector from sensor, and short the wiring of sensor connector.
3. Check the harness from coupling connector for open circuit.
   - If both steps 1 and 2 are faulty, repair the harness. Check from step 1 again.
   - If only step 1 is faulty, replace the sensor.

Step	Action	Value	YES	NO
8	1. Check for the followings in the ground circuit between ECM and FT sensor using breaker box or DMM. Refer to 1E-502, “Breaker box inspection procedure, DTC: P0183 (Flash code 211) Fuel temperature sensor fault (high voltage fault, open circuit or short to power supply circuit), List of Diagnostic Trouble Codes”. **Note:** If breaker box is not available, refer to 1E-503, “On-board check procedure for sensors, DTC: P0183 (Flash code 211) Fuel temperature sensor fault (high voltage fault, open circuit or short to power supply circuit), List of Diagnostic Trouble Codes”. • Open circuit • High resistance 2. If the fault is detected, repair or replace as required. Is the fault detected?	—	Go to Step 13.	Go to Step 10.
9	Replace the supply pump (FT sensor). Is the procedure completed?	—	Go to Step 13.	—
10	Is EMPS available?	—	Go to Step 11.	Go to Step 12.
11	1. Check the version of ECM software. Refer to 1E-117, “Trouble Diagnostic Tools (EMPS) for Industrial Engine” in this section for check and rewriting of ECM. 2. Rewrite the software if version upgraded is necessary. **Note:** EGR valve position learning is required after replacing or rewriting the ECM. Refer to 1E-242, “Installation of ECM, Engine control module (ECM), Engine Control System” in this section for learning of EGR. Is the procedure completed?	—	Go to Step 13.	Go to Step 12.
12	Replace the ECM. **Note:** EGR valve position learning is required after replacing or rewriting the ECM. Refer to 1E-242, “Installation of ECM, Engine control module (ECM), Engine Control System” in this section for learning of EGR. Is the procedure completed?	—	Go to Step 13.	—

Step	Item to be checked	Checking method	Measuring condition	Terminal No.	Normal value	Abnormal value
7	Short circuit to ground circuit/ ground	Resistance measurement	• Disconnect the sensor connector. • Key switch “OFF”	82 – 101 90 – 101 82 – GND 90 – GND	10 MΩ or more	100Ω or less
	Open circuit/ high resistance	Resistance measurement	• Disconnect the sensor connector. • Key switch “OFF”	82 – Sensor connector signal terminal 90 – Sensor connector signal terminal	100Ω or less	10 MΩ or more

On-board check procedure for sensors



Name

1. Coupling connector between engine — the machine
2. Machine harness
3. Sensor connector
4. Engine harness

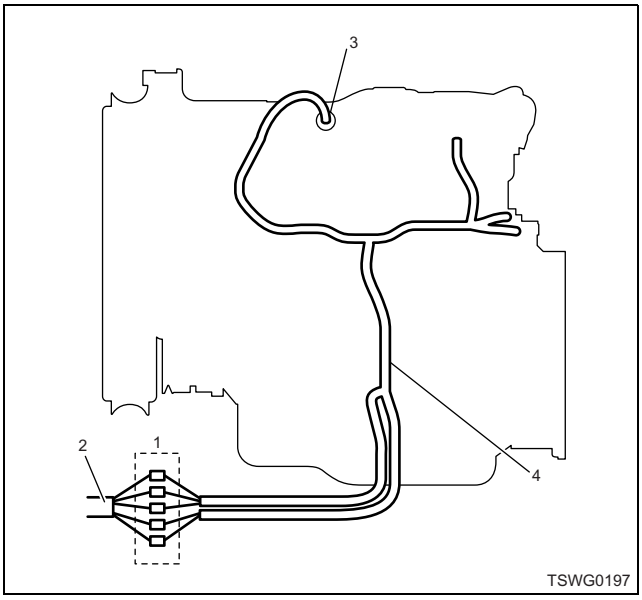
---

1. Disconnect the coupling connector, and check the sensor from engine harness connector.
2. Disconnect the connector from sensor, and short the wiring of sensor connector.
3. Check the harness from coupling connector for open circuit.
   - If both steps 1 and 2 are faulty, repair the harness. Check from step 1 again.
   - If only step 1 is faulty, replace the sensor.

- Improper connection of harness connector and ECM connector
  - Poor connection of terminal from connector
  - Unmatched terminals are fitted.
  - Damage of connector lock
  - Poor contact between terminal and wire
- Damaged harness
  - Visually check the harness for damage.
  - Check the relevant items on the scan tool data display while moving the connector and the harness which are related to the sensor. The variation of the display indicates the faulty part.

Step	Action	Value	YES	NO
1	Perform the OBD system check. Is the procedure completed?	—	Go to Step 2.	Perform the “OBD system check” and Go to Step 2.
2	Check the DTC. 1. Turn the key switch to “OFF” for more than 10 seconds. 2. Start the engine. 3. Check the DTC. Is DTC detected?	—	Go to Step 3.	Go to “Diagnostic aid”.
3	1. Turn the key switch to “OFF”. 2. Remove the coupling connector (H-94) from the cylinder head cover case. 3. Measure the resistance between the coupling connector terminals (power supply terminal – No. 1 cylinder injector drive signal terminal). Is the resistance the specified value or less?	0.45±0.1Ω (20°C {68°F})	Go to Step 4.	Go to Step 5.
4	1. Check for the followings in the circuit between ECM and coupling connector (H-94) using breaker box or DMM. Refer to 1E-521, “Breaker box inspection procedure, DTC: P0201 (Flash code 271) Open circuit in injection nozzle #1 drive system, List of Diagnostic Trouble Codes”. **Note:** If breaker box is not available, refer to 1E-522, “On-board check procedure for sensors, DTC: P0201 (Flash code 271) Open circuit in injection nozzle #1 drive system, List of Diagnostic Trouble Codes”. • Open circuit • High resistance 2. If the trouble is detected, repair as required. Is the trouble detected?	—	Go to Step 13.	Go to Step 8.
5	Check for installation condition of the injector terminal nut. 1. Remove the cylinder head cover. 2. Check the injector terminal nut for looseness etc. 3. If the trouble is detected, repair as required. Is the trouble detected?	—	Go to Step 13.	Go to Step 6.
6	Check for installation condition of the coupling connector. 1. Check for play or looseness in the connection. 2. If the trouble is detected, repair as required. Is the trouble detected?	—	Go to Step 13.	Go to Step 7.

On-board check procedure for sensors



Name

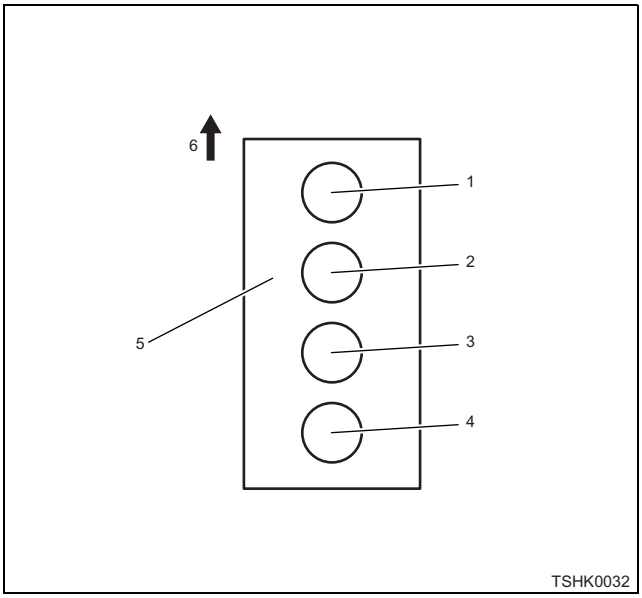
1. Coupling connector between engine — the machine
2. Machine harness
3. Sensor connector
4. Engine harness

---

1. Disconnect the coupling connector, and check the sensor from engine harness connector.
2. Disconnect the connector from sensor, and short the wiring of sensor connector.
3. Check the harness from coupling connector for open circuit.
   - If both steps 1 and 2 are faulty, repair the harness. Check from step 1 again.
   - If only step 1 is faulty, replace the sensor.

Cylinder No. and injection order

4HK1

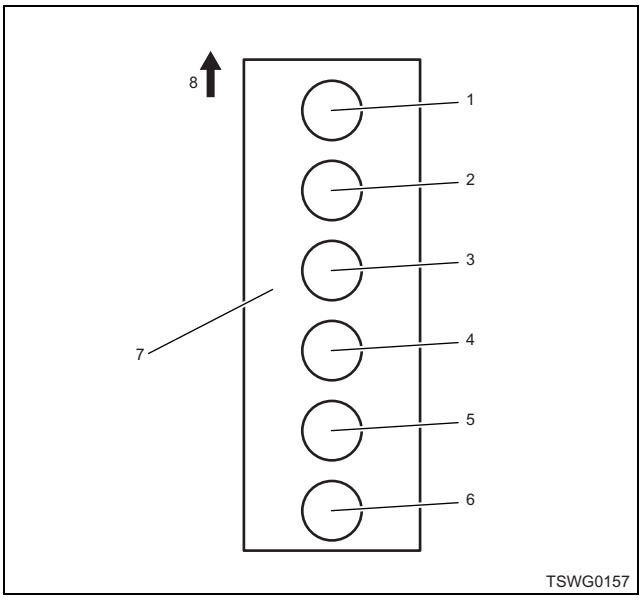


Name

1. Cylinder No. 1
2. Cylinder No. 2
3. Cylinder No. 3
4. Cylinder No. 4
5. Cylinder block
6. Engine front

Fuel injection order is 1 — 3 — 4 — 2.

6HK1



Name

1. Cylinder No. 1
2. Cylinder No. 2
3. Cylinder No. 3
4. Cylinder No. 4
5. Cylinder No. 5
6. Cylinder No. 6
7. Cylinder block
8. Engine front

Fuel injection is performed to each cylinder in the order of 1 — 5 — 3 — 6 — 2 — 4.

Main trouble symptom

- Intense engine vibration
- Rough idling
- Output lowering
- Engine blow up fault

Preconditions when DTC is set

- Main relay power supply voltage is 18V or more.
- 70 rpm or more
- DTC P0611, P1261 or P0204 is not detected (4HK1).
- DTC P0612, P1262 or P0204 is not detected (6HK1).

DTC set condition

- Open/short circuit is detected in No. 4 cylinder injector drive circuit.
- No. 4 cylinder injector monitor input signal does not exist for 2.4 seconds or more.

Action taken when DTC is set

- Trouble is displayed on the monitor of the machine* or diagnosis lamp comes on. (* Nothing is displayed depending on the machine manufacturer)

Back-up mode

- Injection for cylinder #4 stopped, EGR stopped

Recovery from failure

Refer to 1E-375, “List of Diagnostic Trouble Codes” and “About recovery from failure” in this section for recovery from failure.

The conditions to clear the MIL/DTC

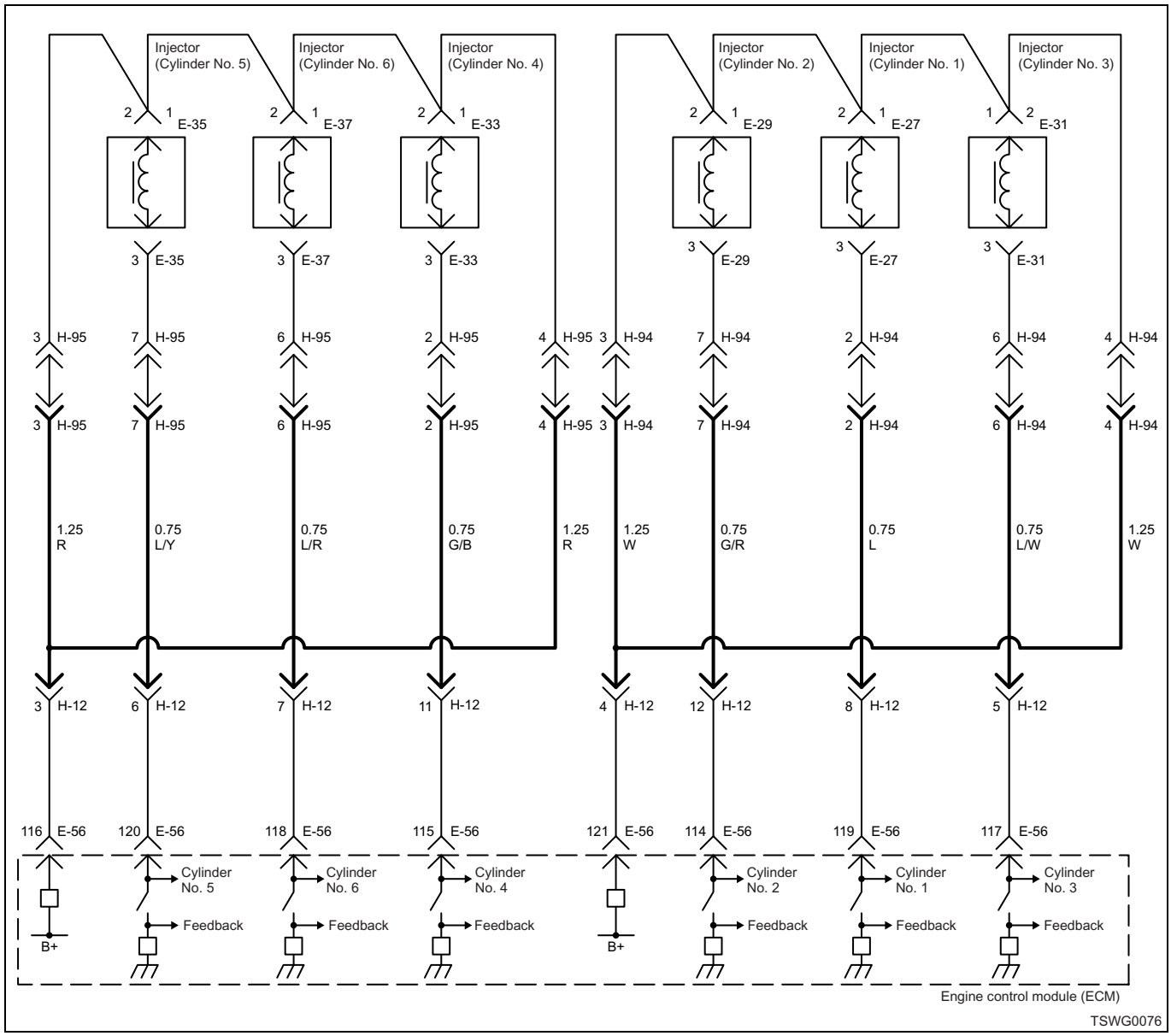
- The present trouble turns to history trouble when the condition is out of the range from DTC set condition (recovery from failure).
- The diagnosis lamp will go off after the code turns to history trouble and the key switch is turned “OFF” then “ON” again.
- Using the scan tool, or memory clear switch and diagnostic switch operation enables to clear DTCs.

Diagnostic aid

If the intermittent trouble is suspected, the followings may be the cause.

- Improper connection of harness connector
- Defective harness routing
- Worn harness cladding
- Wire disconnection inside harness cladding

DTC: P0206 (Flash code 276) Open circuit in injection nozzle #6 drive system



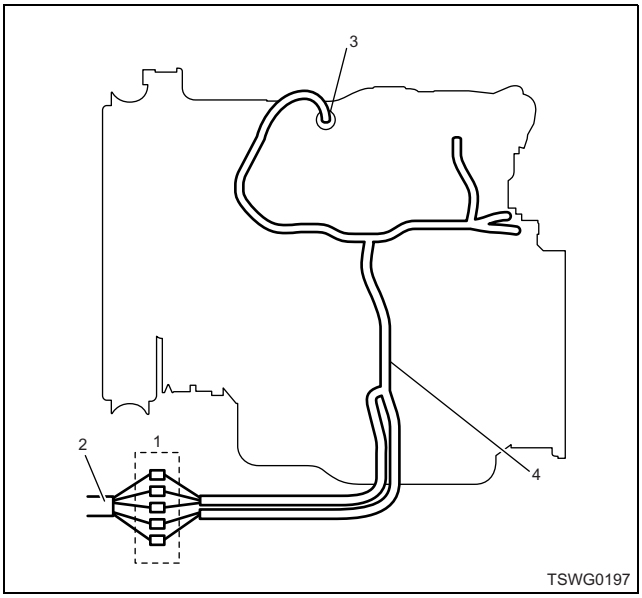
Description of circuit

The injector performs fuel injection. The injector is installed in the engine head. The engine control module (ECM) controls the fuel injection amount and timing by controlling the energizing time to the injector. Also, it generates the voltage for injector operation and energizes the pressurized voltage (more than 100 V) to the injector. For injector operation, the voltage applied to the injector will be sent back the to the ECM through injector as a signal, and the ECM controls this signal.

Step	Action	Value	YES	NO
10	1. Check the version of ECM software. Refer to 1E-117, “Trouble Diagnostic Tools (EMPS) for Industrial Engine” in this section for check and rewriting of ECM. 2. Rewrite the software if version upgraded is necessary. **Note:** EGR valve position learning is required after replacing or rewriting the ECM. Refer to 1E-242, “Installation of ECM, Engine control module (ECM), Engine Control System” in this section for learning of EGR. Is the procedure completed?	—	Go to Step 12.	Go to Step 11.
11	Replace the ECM. **Note:** EGR valve position learning is required after replacing or rewriting the ECM. Refer to 1E-242, “Installation of ECM, Engine control module (ECM), Engine Control System” in this section for learning of EGR. Is the procedure completed?	—	Go to Step 12.	—
12	Check the DTC again. 1. Connect all the harnesses. 2. Clear the DTC. Refer to 1E-21, “How to clear DTC, Procedure of Trouble Diagnosis” in this section for how to clear DTCs. 3. Turn the key switch to “OFF” for more than 10 seconds. 4. Test run with the “Preconditions when DTC is set”. 5. Check the DTC. Is DTC P0237 detected?	—	Go to Step 2.	Go to Step 13.
13	Check if other DTC is detected. Is other DTC detected?	—	Go to each DTC diagnosis.	Verify repair.
14	Is the scan tool or monitor (CAN communication) available?	—	Go to Step 15.	Go to Step 16.
15	Check the value for boost pressure sensor using a scan tool or monitor. 1. Connect the scan tool or monitor. 2. Start the engine. 3. Check the value for “Boost pressure sensor” using a scan tool or monitor. Does the display of “Boost pressure sensor” show error value?	508 kPa (73.7 psi) or 254 kPa (36.8 psi) (error value)	Go to Step 16.	Go to “Diagnostic aid”.
16	Check for installation condition of the boost pressure sensor connector, ECM connector and coupling connector. 1. Check for play or looseness in the connection. 2. If the fault is detected, repair as required. Is the fault detected?	—	Go to Step 13.	Go to Step 17.

Step	Item to be checked	Inspection method	Measuring condition	Terminal No.	Normal value	Abnormal value
6, 17	Short circuit to power supply circuit	Voltage measurement	• Disconnect the sensor connector. • Key switch “ON”	91 – GND	0 V	18 V or more
7, 18	Open circuit/ high resistance	Resistance measurement	• Disconnect the sensor connector. • Key switch “OFF”	109 – Sensor connector ground terminal	100Ω or less	10 MΩ or more

On-board check procedure for sensors



Name

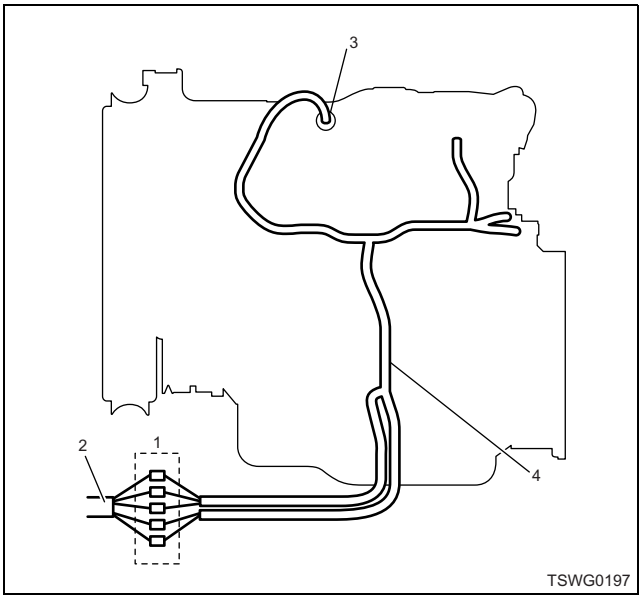
1. Coupling connector between engine — the machine
2. Machine harness
3. Sensor connector
4. Engine harness

---

1. Disconnect the coupling connector, and check the sensor from engine harness connector.
2. Disconnect the connector from sensor, and short the wiring of sensor connector.
3. Check the harness from coupling connector for open circuit.
   - If both steps 1 and 2 are faulty, repair the harness. Check from step 1 again.
   - If only step 1 is faulty, replace the sensor.

Step	Action	Value	YES	NO
4	Check the DTC again. 1. Clear the DTC. Refer to 1E-21, “How to clear DTC, Procedure of Trouble Diagnosis” in this section for how to clear DTCs. 2. Turn the key switch to “OFF” for more than 10 seconds. 3. Start the engine, and test drive with the “Preconditions when DTC is set”. 4. Check the DTC. Is DTC detected?	—	Go to Step 5.	Go to Step 12.
5	1. Check the CKP sensor circuit for short circuit to other signal circuit using breaker box or DMM. Refer to 1E-581, “Breaker box inspection procedure, DTC: P0336 (Flash code 15) Crank sensor fault (signal fault), List of Diagnostic Trouble Codes”. **Note:** If breaker box is not available, refer to 1E-582, “On-board check procedure for sensors, DTC: P0336 (Flash code 15) Crank sensor fault (signal fault), List of Diagnostic Trouble Codes”. 2. If the fault is detected, repair or replace as required. Is the fault detected?	—	Go to Step 12.	Go to Step 6.
6	Check the CKP sensor body. 1. Turn the key switch to “OFF”. 2. Remove the harness from the CKP sensor. 3. Measure the resistance between the sensor connector terminals. 4. Remove the CKP sensor, and check the sensor tip for scratch or damage. Is the CKP sensor normal?	Between terminals: 108.5 — 142.5 Ω; Each terminal — ground: ∞Ω (at normal temperature)	Go to Step 8.	Go to Step 7.
7	Replace the CKP sensor. Is the procedure completed?	—	Go to Step 12.	—
8	1. Visually check the flywheel for chipped tooth. 2. If the trouble is detected, replace it. Is the fault detected?	—	Go to Step 12.	Go to Step 9.
9	Is EMPS available?	—	Go to Step 10.	Go to Step 11.
10	1. Check the version of ECM software. Refer to 1E-117, “Trouble Diagnostic Tools (EMPS) for Industrial Engine” in this section for check and rewriting of ECM. 2. Rewrite the software if version upgraded is necessary. **Note:** EGR valve position learning is required after replacing or rewriting the ECM. Refer to 1E-242, “Installation of ECM, Engine control module (ECM), Engine Control System” in this section for learning of EGR. Is the procedure completed?	—	Go to Step 12.	Go to Step 11.

On-board check procedure for sensors



Name

1. Coupling connector between engine — the machine
2. Machine harness
3. Sensor connector
4. Engine harness

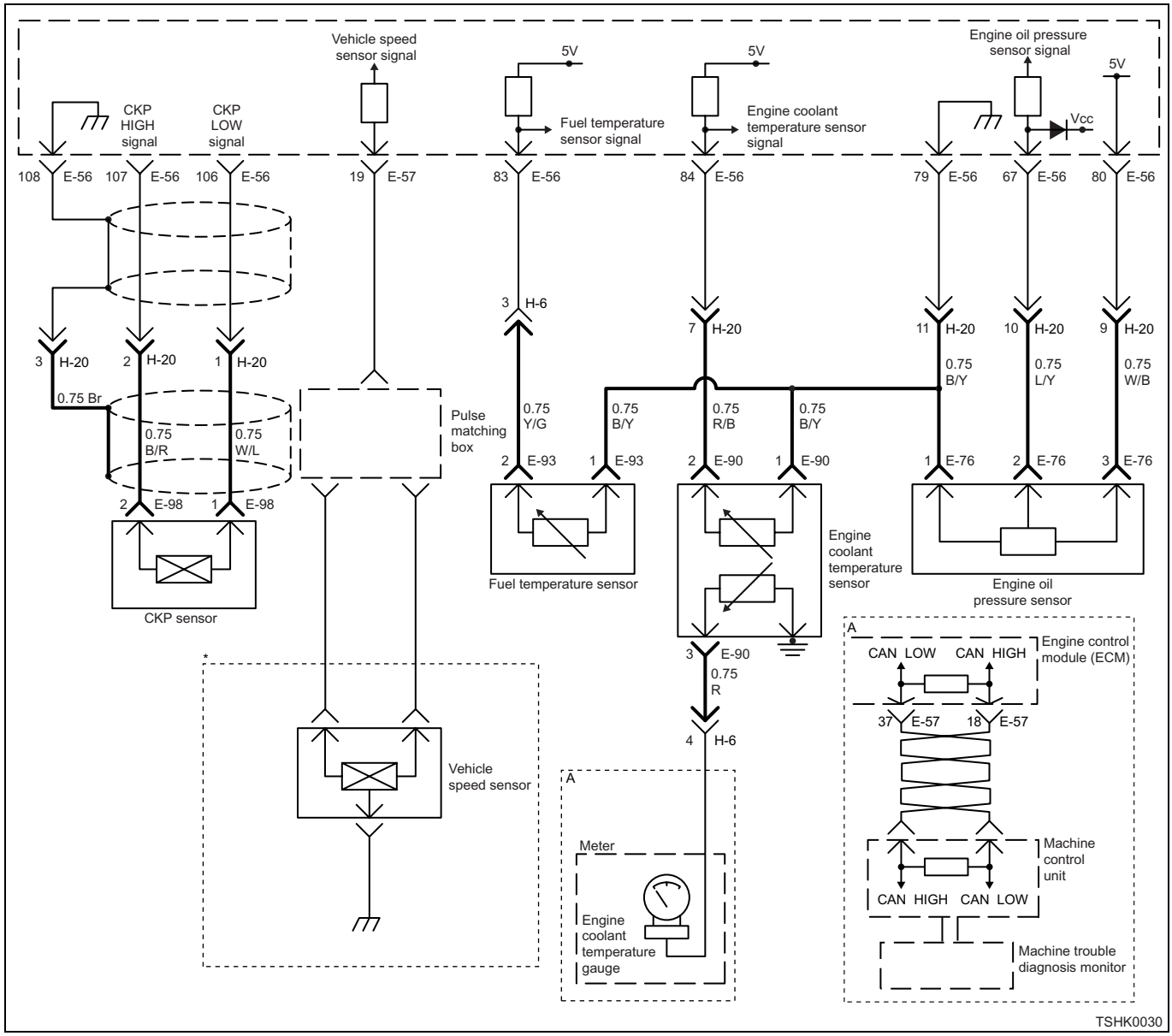
---

1. Disconnect the coupling connector, and check the sensor from engine harness connector.
2. Disconnect the connector from sensor, and short the wiring of sensor connector.
3. Check the harness from coupling connector for open circuit.
   - If both steps 1 and 2 are faulty, repair the harness. Check from step 1 again.
   - If only step 1 is faulty, replace the sensor.

Step	Action	Value	YES	NO
7	1. Check for the followings in the circuit between the fuse and the glow relay. • Open circuit • Short circuit to ground circuit • High resistance 2. If the fault is detected, repair as required. Is the fault detected?	—	Go to Step 12.	Go to Step 8.
8	1. Check for the followings in the circuit between glow relay and ECM using breaker box or DMM. Refer to 1E-600, “Breaker box inspection procedure, DTC: P0380 (Flash code 66) Glow relay circuit fault, List of Diagnostic Trouble Codes”. • Open circuit • Short circuit to ground circuit • High resistance 2. If the fault is detected, repair as required. Is the fault detected?	—	Go to Step 12.	Go to Step 9.
9	1. Turn the key switch to “OFF”. 2. Remove the glow relay. 3. Turn the key switch to “ON”. 4. Check the “Glow relay” on the data display using a scan tool. Does the “Glow relay” display “OFF”?	—	Go to Step 11.	Go to Step 10.
10	1. Check the circuit between glow relay and ECM for short circuit to the power supply circuit or ignition power supply circuit using breaker box or DMM. Refer to 1E-600, “Breaker box inspection procedure, DTC: P0380 (Flash code 66) Glow relay circuit fault, List of Diagnostic Trouble Codes”. 2. If the fault is detected, repair as required. Is the fault detected?	—	Go to Step 12.	Go to Step 11.
11	Replace the glow relay. Is the procedure completed?	—	Go to Step 12.	—
12	Is EMPS available?	—	Go to Step 13.	Go to Step 14.
13	1. Check the version of ECM software. Refer to 1E-117, “Trouble Diagnostic Tools (EMPS) for Industrial Engine” in this section for check and rewriting of ECM. 2. Rewrite the software if version upgraded is necessary. **Note:** EGR valve position learning is required after replacing or rewriting the ECM. Refer to 1E-242, “Installation of ECM, Engine control module (ECM), Engine Control System” in this section for learning of EGR. Is the procedure completed?	—	Go to Step 15.	Go to Step 14.

Step	Action	Value	YES	NO
3	1. Check for the followings in the circuit between ECM and EGR position sensor using breaker box or DMM. Refer to 1E-611, “Breaker box inspection procedure, DTC: P0487 (Flash code 44) EGR position sensor fault, List of Diagnostic Trouble Codes”. **Note:** If breaker box is not available, refer to 1E-612, “On-board check procedure for sensors, DTC: P0487 (Flash code 44) EGR position sensor fault, List of Diagnostic Trouble Codes”. • Short circuit to EGR position sensor ground circuit • Short circuit to ground • Open circuit • High resistance 2. If the fault is detected, repair as required. Is the fault detected?	—	Go to Step 10.	Go to Step 4.
4	Check the DTC again. 1. Connect all the harnesses. 2. Clear the DTC. Refer to 1E-21, “How to clear DTC, Procedure of Trouble Diagnosis” in this section for how to clear DTCs. 3. Turn the key switch to “OFF” for more than 10 seconds, and then start the engine. 4. Warm-up the engine until the engine coolant temperature exceeds 80°C (176°F). 5. Check the DTC. Is DTC P0487 detected?	—	Go to Step 5.	Go to “Diagnostic aid”.
5	Replace the EGR valve (EGR position sensor). **Note:** For work procedure, refer to “Engine section” in the service manual. Is the procedure completed?	—	Go to Step 6.	—
6	Check the DTC again. 1. Connect all the harnesses. 2. Clear the DTC. Refer to 1E-21, “How to clear DTC, Procedure of Trouble Diagnosis” in this section for how to clear DTCs. 3. Turn the key switch to “OFF” for more than 10 seconds, and then start the engine. 4. Warm-up the engine until the engine coolant temperature exceeds 80°C (176°F). 5. Check the DTC. Is DTC P0487 detected?	—	Go to Step 7.	Go to Step 11.
7	Is EMPS available?	—	Go to Step 8.	Go to Step 9.

DTC: P0522 (Flash code 294) Engine oil pressure sensor fault (low voltage fault, open circuit, ground short)



Description of circuit

The engine oil pressure sensor detects the engine oil pressure. The engine oil pressure sensor is installed near the starter motor of the cylinder block. The resistance value in the engine oil pressure sensor changes according to the pressure. If the pressure is high, the resistance becomes low; if the pressure is low, the resistance becomes high.

The engine control module (ECM) is connected to the engine pressure sensor via power supply circuit, signal circuit and ground circuit, and energizes +5 V power supply to the power supply circuit. The ECM detects the signal voltage change in response to the change in resistance according to the engine pressure sensor pressure (If the pressure is high, the voltage becomes high; if the pressure is low, the voltage becomes low) as a signal.

Main trouble symptom

Operationality is not affected.

Preconditions when DTC is set

- Key switch input voltage is 18V or more.
- DTC P1633 is not detected.

DTC set condition

- Engine oil pressure sensor voltage is 0.098V or less for 4 seconds or more.

Action taken when DTC is set

- Trouble is displayed on the monitor of the machine* or diagnosis lamp comes on. (* Nothing is displayed depending on the machine manufacturer)

Step	Action	Value	YES	NO
13	Check the DTC again. 1. Connect all the harnesses. 2. Clear the DTC. Refer to 1E-21, “How to clear DTC, Procedure of Trouble Diagnosis” in this section for how to clear DTCs. 3. Turn the key switch to “OFF” for more than 10 seconds. 4. Test run with the “Preconditions when DTC is set”. 5. Check the DTC. Is DTC P0523 detected?	—	Go to Step 2.	Go to Step 14.
14	Check if other DTC is detected. Is other DTC detected?	—	Go to each “DTC diagnosis”.	Verify repair.
15	Is the scan tool or monitor (CAN communication) available?	—	Go to Step 16.	Go to Step 17.
16	Check the value for engine oil pressure using a scan tool or monitor. 1. Connect the scan tool or monitor. 2. Start the engine. 3. Check the value for “Engine oil pressure” using a scan tool or monitor. Does the display of “Engine oil pressure” show error value?	1016 kPa (147.4 psi) (error value)	Go to Step 17.	Go to “Diagnostic aid”.
17	1. Check the signal circuit between ECM and engine oil pressure sensor for short circuit to the power supply circuit or ignition power supply circuit, using breaker box or DMM. Refer to 1E-631, “Breaker box inspection procedure, DTC: P0523 (Flash code 294) Engine oil pressure sensor fault (high voltage fault, short to power supply, ground short), List of Diagnostic Trouble Codes”. **Note:** If breaker box is not available, refer to 1E-632, “On-board check procedure for sensors, DTC: P0523 (Flash code 294) Engine oil pressure sensor fault (high voltage fault, short to power supply, ground short), List of Diagnostic Trouble Codes”. **Important:** **If the engine oil pressure sensor circuit is shorted to the power supply circuit, the sensor may be broken.** 2. If the fault is detected, repair as required. Is the fault detected?	—	Go to Step 13.	Go to Step 18.

DTC: P0606 (Flash code 52) CPU monitoring IC fault

Description of circuit

The internal part of the ECM consists of ROM, EEPROM, CPU, and Sub-CPU, which perform data storage, data clear and various controls.
The ECM sets the DTC when the CPU fault or Sub-CPU fault inside the ECM is detected.

Main trouble symptom

- Output lowering

Preconditions when DTC is set

- 480 msec or more has elapsed after key switch ON.
- Key switch input power supply voltage is higher than 16 V.

DTC set condition

- RUN-SUB pulse does not change for 20 msec or more.

Action taken when DTC is set

- Trouble is displayed on the monitor of the machine* or diagnosis lamp comes on. (* Nothing is displayed depending on the machine manufacturer)

Back-up mode

- Limited injection amount 1

Recovery from failure

Refer to 1E-375, “List of Diagnostic Trouble Codes” and “About recovery from failure” in this section for recovery from failure.

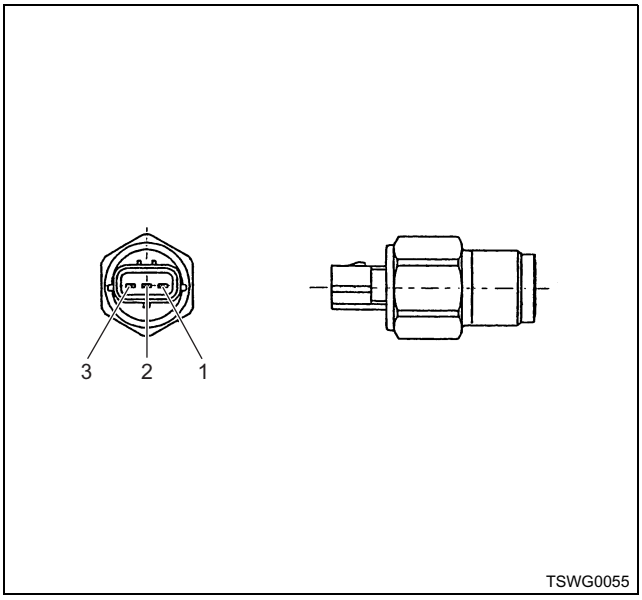
The conditions to clear the MIL/DTC

- The present trouble turns to history trouble when the condition is out of the range from DTC set condition (recovery from failure).
- The diagnosis lamp will go off after the code turns to history trouble and the key switch is turned “OFF” then “ON” again.
- Using the scan tool, or memory clear switch and diagnostic switch operation enables to clear DTCs.

Step	Action	Value	YES	NO
1	Perform the OBD system check. Is the procedure completed?	—	Go to Step 2.	Go to 1E-339, “OBD system check, List of Function Checks”.
2	Check the DTC again. 1. Clear the DTC. Refer to 1E-21, “How to clear DTC, Procedure of Trouble Diagnosis” in this section for how to clear DTCs. 2. Turn the key switch to “OFF” for more than 10 seconds. 3. Test run with the “Preconditions when DTC is set”. 4. Check the DTC. Is DTC P0606 detected?	—	Go to Step 3.	—
3	Is EMPS available?	—	Go to Step 4.	Go to Step 5.
4	1. Check the version of ECM software. Refer to 1E-117, “Trouble Diagnostic Tools (EMPS) for Industrial Engine” in this section for check and rewriting of ECM. 2. Rewrite the software if version upgraded is necessary. **Note:** EGR valve position learning is required after replacing or rewriting the ECM. Refer to 1E-242, “Installation of ECM, Engine control module (ECM), Engine Control System” in this section for learning of EGR. Is the procedure completed?	—	Go to Step 6.	Go to Step 5.

Step	Action	Value	YES	NO
7	1. Turn the key switch to “OFF”. 2. Disconnect the connector from the ECM. 3. Short between the diagnosis lamp control terminal of the ECM and the ground using breaker box or DMM. Refer to 1E-651, “Breaker box inspection procedure, DTC: P0650 (Flash code 77) Diagnosis lamp circuit fault, List of Diagnostic Trouble Codes”. 4. Turn the key switch to “ON”. 5. Check if the diagnosis lamp is ON. Does the diagnosis lamp come on?	—	Go to Step 13.	Go to Step 8.
8	Check the installation condition of the meter and ECM connector. 1. Check for play or looseness in the connection. 2. If the fault is detected, repair as required. Is the fault detected?	—	Go to Step 16.	Go to Step 9.
9	1. Check for the followings in the circuit between the fuse and the diagnosis lamp. • Open circuit • Short circuit to ground circuit • High resistance 2. If the fault is detected, repair as required. Is the fault detected?	—	Go to Step 16.	Go to Step 10.
10	1. Check for the followings in the circuit between diagnosis lamp and ECM using breaker box or DMM. Refer to 1E-651, “Breaker box inspection procedure, DTC: P0650 (Flash code 77) Diagnosis lamp circuit fault, List of Diagnostic Trouble Codes”. • Open circuit • High resistance 2. If the fault is detected, repair as required. Is the fault detected?	—	Go to Step 16.	Go to Step 12.
11	Replace the meter. Is the procedure completed?	—	Go to Step 16.	—
12	Replace the diagnosis lamp bulb. Is the procedure completed?	—	Go to Step 16.	—
13	Is EMPS available?	—	Go to Step 14.	Go to Step 15.

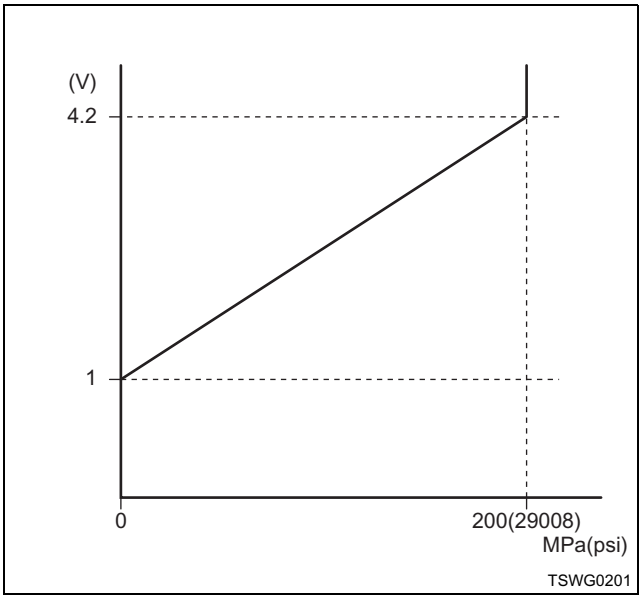
About common rail pressure sensor



Name

1. Sensor ground
2. Sensor signal
3. Sensor power supply

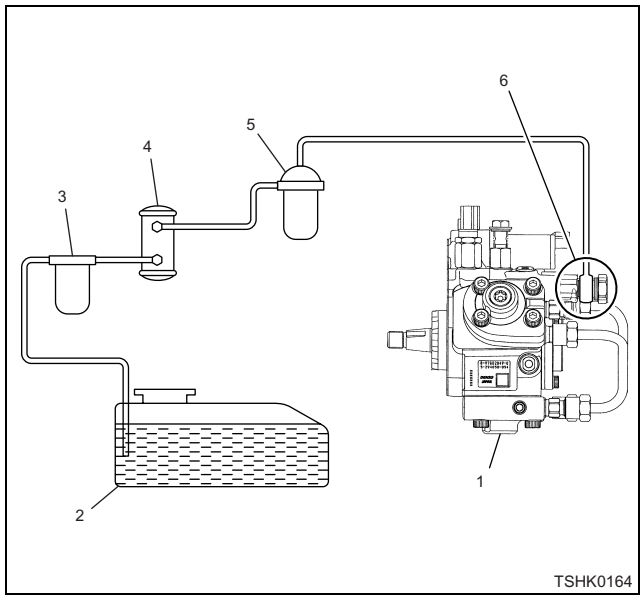
Characteristics of common rail pressure sensor



Fuel discharge inspection procedure

Check the fuel discharge on the fuel system upstream side in the following procedure.

1. Disconnect the fuel line from the inlet of the supply pump.
2. Activate the electromagnetic pump.
3. Check if fuel is discharged from the fuel line.
   - If fuel is discharging, go to “4. Air mixture inspection”.
   - If no fuel is discharging, go to “5. Check the electromagnetic pump”.



Name

1. Supply pump
2. Fuel tank
3. Pre-fuel filter
4. Electromagnetic Pump
5. Fuel filter
6. Supply pump inlet

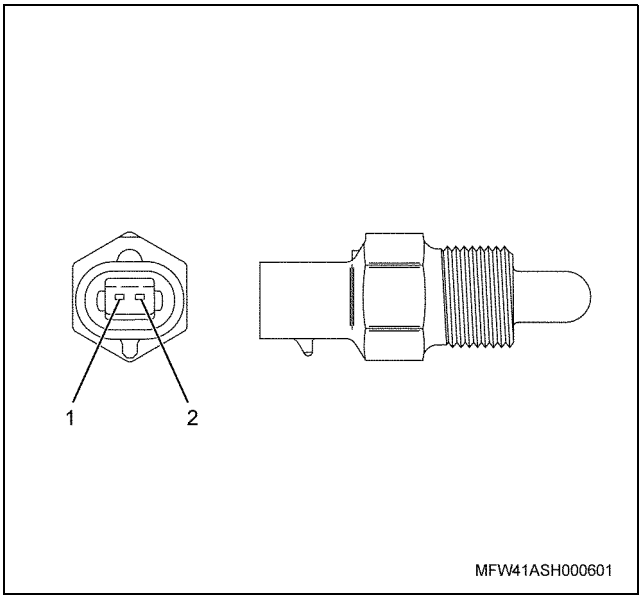
4. Check for air mixed in fuel
   Connect a clear pipe to fuel line, and check that no air is mixed in discharged fuel.
   - If air is mixed in fuel, determine and repair the point, where the air enters, on the upstream side of the low pressure line.
   - If no air is mixed in fuel, fault inside the supply pump may be suspected. Replace the supply pump if the fault is not solved by replacing SCV alone after replacing the SCV.

Note:

- Refer to 1E-246, “SCV Replacement procedure, Engine component location diagram, Engine Control System” in this section for the SCV replacement procedure.
- Refer to “Engine section” in the service manual for replacing the supply pump.

Step	Action	Value	YES	NO
14	Replace the supply pump. **Note:** • Bleed air completely after the parts are replaced. If air bleeding is not sufficient, P1095 may be detected due to overshoot of fuel pressure. • For work procedure, refer to “Engine section” in the service manual. Is the symptom improved?	—	Go to Step 29.	Go to Step 19.
15	1. Check the signal circuit between common rail pressure sensor and ECM for short circuit to signal circuits of other sensors using breaker box or DMM. Refer to 1E-672, “Breaker box inspection procedure, DTC: P1095 (Flash code 225) Pressure limiter open, List of Diagnostic Trouble Codes”. **Note:** If breaker box is not available, refer to 1E-673, “On-board check procedure for sensors, DTC: P1095 (Flash code 225) Pressure limiter open, List of Diagnostic Trouble Codes”. 2. If the fault is detected, repair as required. Is the fault detected?	—	Go to Step 28.	Go to Step 16.
16	Is EMPS available?	—	Go to Step 17.	Go to Step 18.
17	1. Check the version of ECM software. Refer to 1E-117, “Trouble Diagnostic Tools (EMPS) for Industrial Engine” in this section for check and rewriting of ECM. 2. Rewrite the software if version upgraded is necessary. **Note:** EGR valve position learning is required after replacing or rewriting the ECM. Refer to 1E-242, “Installation of ECM, Engine control module (ECM), Engine Control System” in this section for learning of EGR. Is the procedure completed?	—	Go to Step 19.	Go to Step 18.
18	Replace the ECM. **Note:** EGR valve position learning is required after replacing or rewriting the ECM. Refer to 1E-242, “Installation of ECM, Engine control module (ECM), Engine Control System” in this section for learning of EGR. Is the procedure completed?	—	Go to Step 19.	—
19	Replace the common rail (common rail pressure sensor). **Note:** For work procedure, refer to “Engine section” in the service manual. Is the procedure completed?	—	Go to Step 28.	—

About boost temperature sensor



Name

1. Signal
2. GND

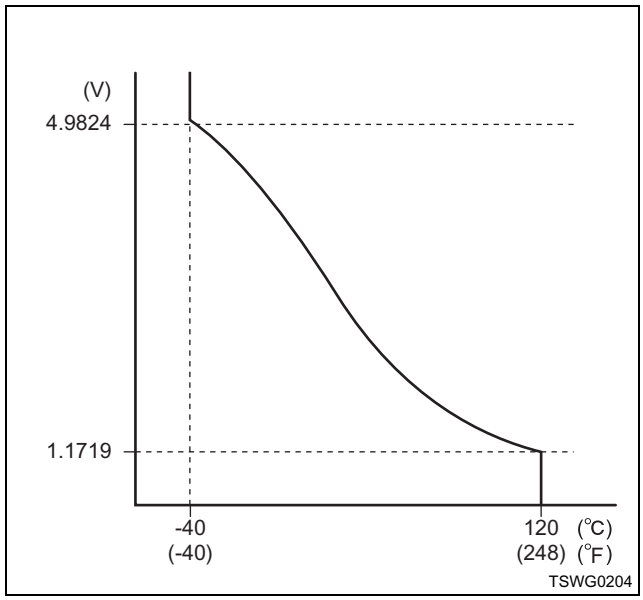
Characteristics of boost temperature sensor

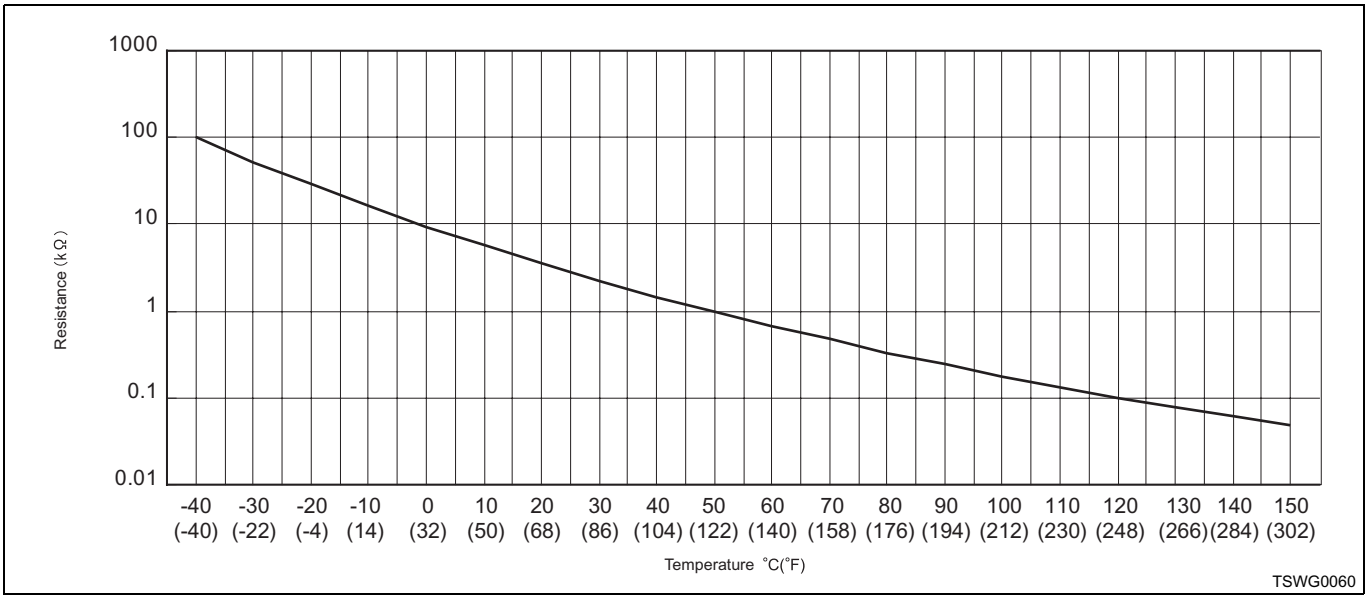
The output voltage of boost temperature sensor changes according to the boost temperature. The scan tool with CAN communication displays a fixed value when the value exceeds the threshold voltage. Therefore, judge as it is more than the threshold value if the value of –40°C (–40°F) or 120°C (248°F) is not changed.

When error occurs, error value (214°C {419°F}) is displayed.

The following illustration shows the correlation between physical value and voltage displayed in the scan tools with CAN communication.

Tech2, EMPSIII and scan tools with KW communication can display both physical value and voltage.





Preconditions when DTC is set

- Key switch input voltage is 18V or more.
- DTC P1630, P1633, P0117, or P0118 is not detected.
- Engine under operation

DTC set condition

- Engine coolant temperature is more than 110°C (230°F) for 5 seconds or more (4HK1).
- Engine coolant temperature is more than the threshold value for 5 seconds or more (depending on the machine manufacturer) (6HK1).

Action taken when DTC is set

- Trouble is displayed on the monitor of the machine* or diagnosis lamp comes on. (* Nothing is displayed depending on the machine manufacturer)

Back-up mode

- No back-up action

Recovery from failure

Refer to 1E-375, “List of Diagnostic Trouble Codes” and “About recovery from failure” in this section for recovery from failure.

The conditions to clear the MIL/DTC

- The present trouble turns to history trouble when the condition is out of the range from DTC set condition (recovery from failure).
- The diagnosis lamp will go off after the code turns to history trouble and the key switch is turned “OFF” then “ON” again.
- Using the scan tool, or memory clear switch and diagnostic switch operation enables to clear DTCs.

Diagnostic aid

If the intermittent trouble is suspected, the followings may be the cause.

- Improper connection of harness connector
- Defective harness routing
- Worn harness cladding
- Wire disconnection inside harness cladding

The following inspections are necessary to detect these causes.

- Improper connection of harness connector and ECM connector
  - Poor connection of terminal from connector
  - Unmatched terminals are fitted.
  - Damage of connector lock
  - Poor contact between terminal and wire
- Damaged harness
  - Visually check the harness for damage.
  - Check the relevant items on the scan tool data display while moving the connector and the harness which are related to the sensor. The variation of the display indicates the faulty part.

Test description

Numbers below indicate step numbers in the chart.
4. If the “Engine coolant temperature sensor” displays the specified value or less when the ECT sensor connector is removed, the sensor is faulty.
9. If no DTC is detected, intermittent trouble is suspected. Identify the cause by referring to Diagnostic aid.

Step	Action	Value	YES	NO
1	Perform the OBD system check. Is the procedure completed?	—	Go to Step 2.	Go to 1E-339, “OBD system check, List of Function Checks”.
2	1. Start the engine. 2. Check the DTC. Is DTC P0088, or P1093 detected?	—	Go to the relevant DTC detected.	Go to Step 3.
3	Is the scan tool available?	—	Go to Step 4.	Go to Step 14.
4	1. Turn the key switch to “OFF”. 2. Disconnect the ECT sensor connector. 3. Turn the key switch to “ON”. 4. Check the “Engine coolant temperature sensor” on the data display using a scan tool. Is the “Engine coolant temperature sensor” the specified value or more?	4.9V/–40°C (–40°F)	Go to Step 6.	Go to Step 5.

Back-up mode

Common 1 stop (#1, #4 cylinders stopped), EGR stopped (4HK1)
Common 1 stop (#1, #2, #3 cylinders stopped), EGR stopped (6HK1)

Recovery from failure

Refer to 1E-375, “List of Diagnostic Trouble Codes” and “About recovery from failure” in this section for recovery from failure.

The conditions to clear the MIL/DTC

- The present trouble turns to history trouble when the condition is out of the range from DTC set condition (recovery from failure).
- The diagnosis lamp will go off after the code turns to history trouble and the key switch is turned “OFF” then “ON” again.
- Using the scan tool, or memory clear switch and diagnostic switch operation enables to clear DTCs.

Diagnostic aid

If the intermittent trouble is suspected, the followings may be the cause.

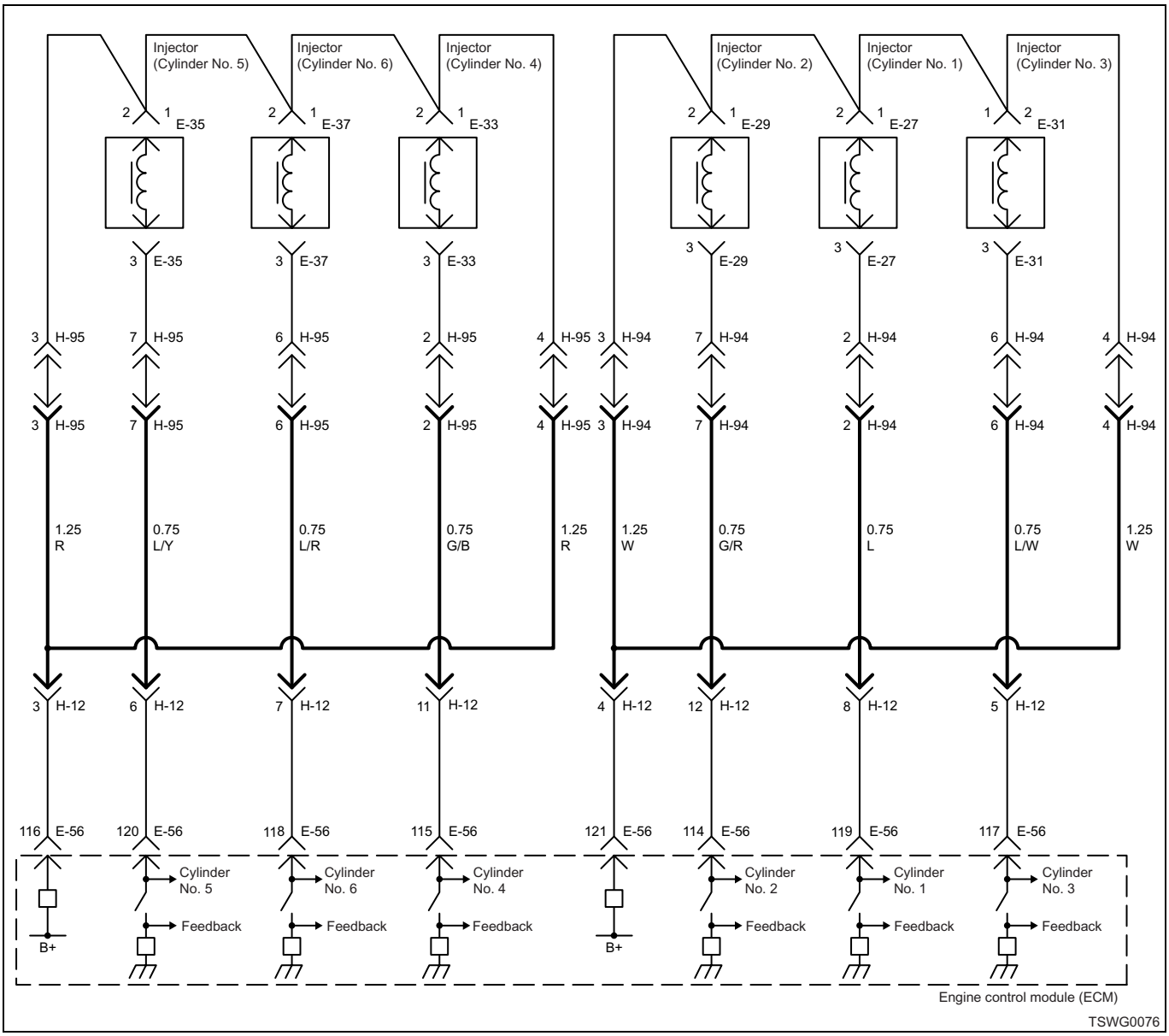
- Improper connection of harness connector
- Defective harness routing
- Worn harness cladding
- Wire disconnection inside harness cladding

The following inspections are necessary to detect these causes.

- Improper connection of harness connector and ECM connector
  - Poor connection of terminal from connector
  - Unmatched terminals are fitted.
  - Damage of connector lock
  - Poor contact between terminal and wire
- Damaged harness
  - Visually check the harness for damage.
  - Check the relevant items on the scan tool data display while moving the connector and the harness which are related to the sensor. The variation of the display indicates the faulty part.

Step	Action	Value	YES	NO
1	Perform the OBD system check. Is the procedure completed?	—	Go to Step 2.	Go to 1E-339, “OBD system check, List of Function Checks”.
2	1. Turn the key switch to “OFF”. 2. Remove the ECM-side harness connector from the coupling connector (H-94). 3. Connect the DMM between the injector power supply 1 circuit and the ground. 4. Turn the key switch to “ON”. 4H: H94 female-side No. 1 6H: H94 female-side No. 3 Is the DMM indication the specified value or more?	7.0 V	Go to Step 3.	Go to Step 4.
3	1. Turn the key switch to OFF. 2. Remove the ECM-side harness connector from the coupling connector (H-94). 3. Measure the resistance between the injector harness connector terminals. 4H: H94 male-side No. 1 and No. 4 6H: H94 male-side No. 3 and No. 4 Is the resistance the specified value or less?	1.0Ω	Go to Step 6.	Go to Step 22.
4	Check for installation condition of the injector harness connector, ECM connector and coupling connector. 1. Check for play or looseness in the connection. 2. If the fault is detected, repair as required. Is the fault detected?	—	Go to Step 27.	Go to Step 5.

6HK1



Description of circuit

The COMMON circuit is provided to supply the power supply voltage pressurized in the charge circuit inside the ECM to the injector, and is divided in to two systems (4H: 2 cylinders each, 6H: 3 cylinders each). The COMMON 2 circuit supplies the power supply voltage to the injectors (4H: No. 2, No. 3 cylinders, 6H: No. 4, No. 5, No. 6 cylinders). The ECM sets the DTC when faults are detected simultaneously for all the injector drive circuits of COMMON 2 system.

Main trouble symptom

- Intense engine vibration
- Rough idling
- Output lowering
- Engine blow up fault
- Engine stall possible

Preconditions when DTC is set

- Main relay power supply voltage is 18V or more.
- 70 rpm or more
- None of the following DTC sets are detected; DTC P0612, P1262 and P202; DTC P0612, P1262 and P0203. (4HK1)
- None of the following DTC sets are detected; DTC P0612, P1262 and P204; DTC P0612, P1262 and P0205; DTC P0612, P1262 and P0206. (6HK1)

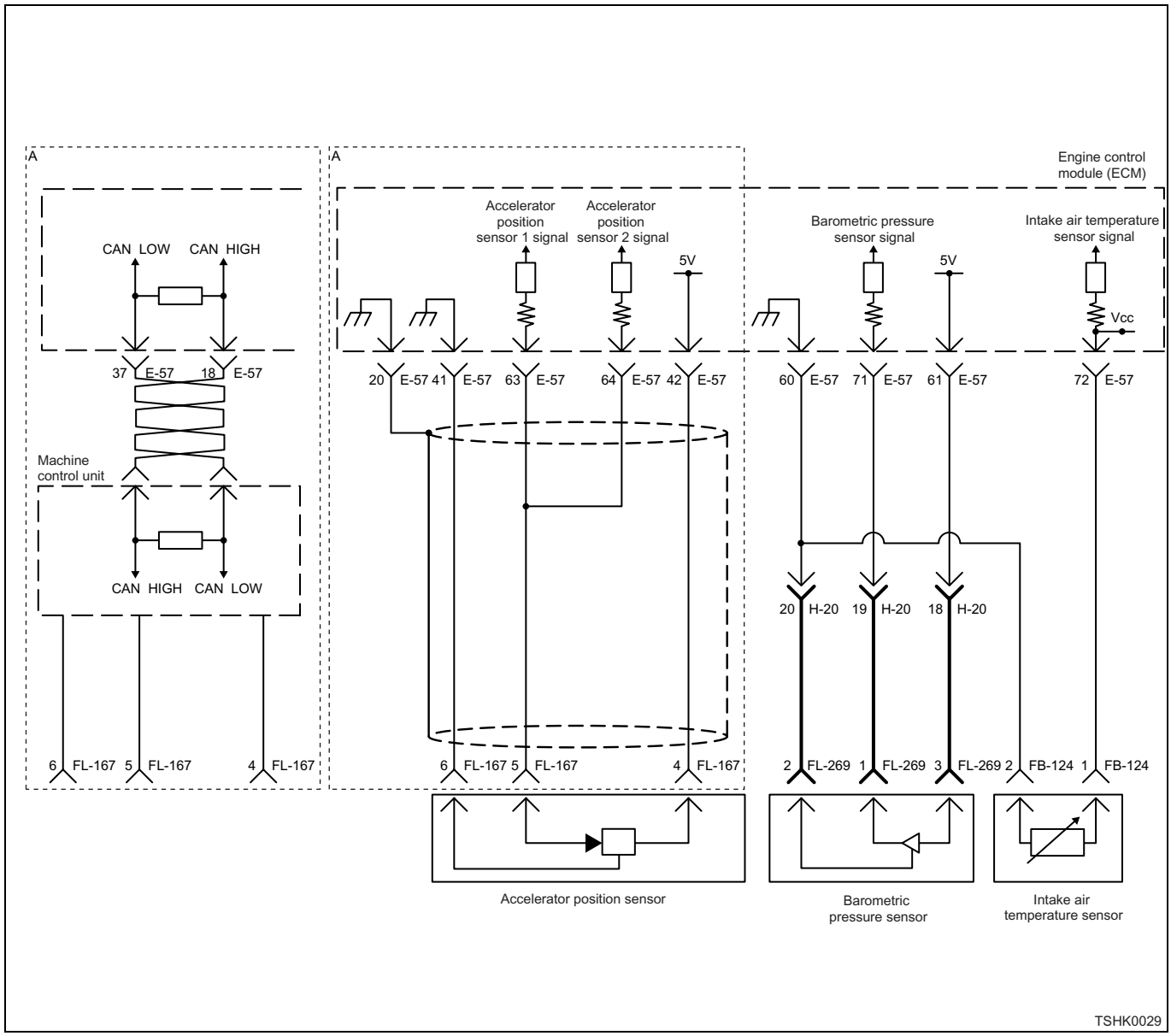
DTC set condition

- None of injector monitor input signal for COMMON 2 system exists for 3 seconds or more.

Action taken when DTC is set

- Trouble is displayed on the monitor of the machine* or diagnosis lamp comes on. (* Nothing is displayed depending on the machine manufacturer)

DTC: P1271 (Flash code 24) Accelerator sensor 1-2 comparison fault



Description of circuit

The accelerator position (AP) sensor is installed to the accelerator pedal. The AP sensor is the potentiometer-type sensor, and the value of output voltage changes according to the accelerator opening angle. Two AP sensors are installed, each of which includes following circuits.

- 5-V power supply circuit
- Ground circuit
- AP sensor signal circuit

The ECM provides 5 V to the AP sensor through 5-V power supply circuit, and grounds to the inside of the ECM through ground circuit. Also, the AP sensor outputs the signal voltage to the ECM through AP sensor signal circuit. When the accelerator opening angle is large, the AP sensor 1 outputs high voltage, whereas the AP sensor 2 outputs low voltage.

The ECM sets the DTC when the difference in the accelerator opening angle is large between which is detected based on the AP sensor 1 signal, and which is detected based on the AP sensor 2 signal.

Main trouble symptom

1 system fault: No backup
2 systems fault: Accelerator opening angle is controlled to 0%.

Preconditions when DTC is set

- Key switch input voltage is 18V or more.
- DTC P1630, P1631, P1271, P1277, P1278, P1282, or P1283 is not detected.

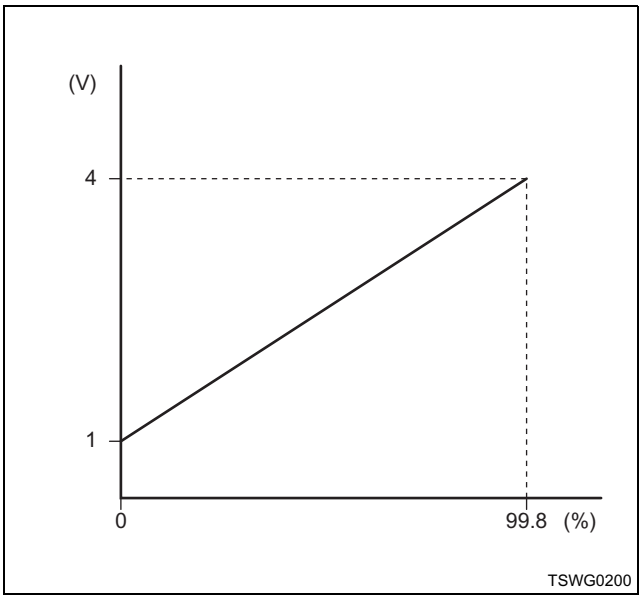
DTC set condition

Difference in opening angle between accelerator sensors 1 and 2 is 45% or more for 3 seconds or more.

About AP sensor

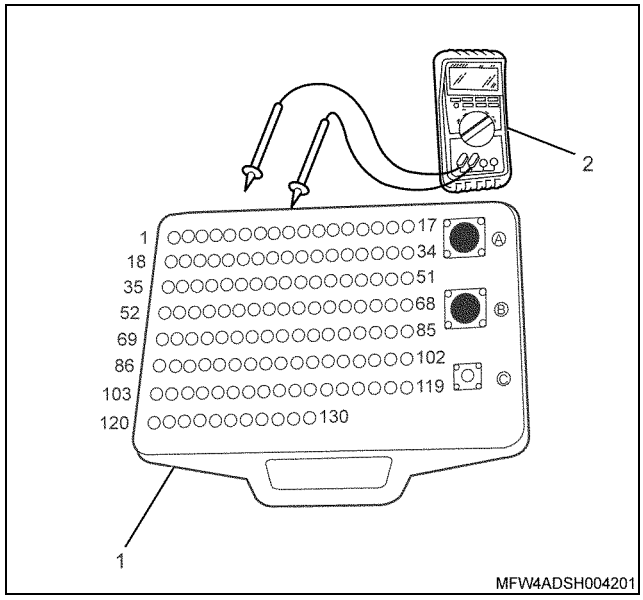
Refer to the machine's manual for installing position of the AP sensor.

Characteristics of AP sensor



Breaker box inspection procedure

Perform the inspection in the following procedure if there is such an instruction to use breaker box in the step. After inspection, return to the diagnostic step.
Ways to measure voltage and resistance are different when using a breaker box.
Refer to 1E-226, "Example of use for breaker box, Breaker box inspection procedure, How to Use Breaker Box".



Name

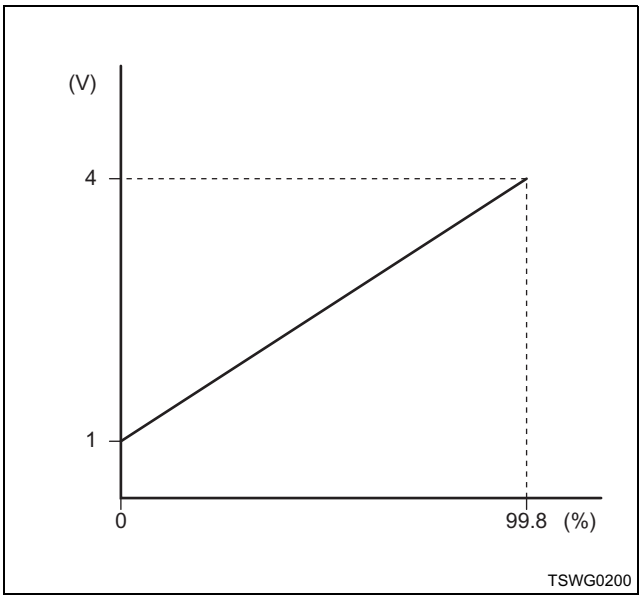
1. Breaker box
2. DMM

Step	Item to be checked	Checking method	Measuring condition	Terminal No.	Normal value	Abnormal value
6	Open circuit/ high resistance	Resistance measurement	• Disconnect the sensor connector. • Key switch "OFF"	42 – Sensor connector sensor 1 power supply terminal	100Ω or less	10 MΩ or more
7	Short circuit to ground circuit/ ground	Resistance measurement	• Disconnect the sensor connector. • Key switch "OFF"	63 – 41 63 – GND	10 MΩ or more	100Ω or less
	Open circuit/ high resistance	Resistance measurement	• Disconnect the sensor connector. • Key switch "OFF"	63 – Sensor connector sensor 1 signal terminal	100Ω or less	10 MΩ or more

About AP sensor

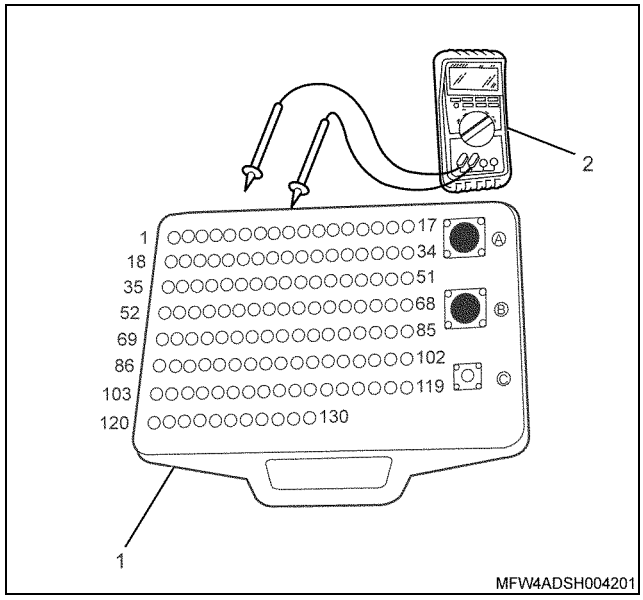
Refer to the machine's manual for installing position of the AP sensor.

Characteristics of AP sensor



Breaker box inspection procedure

Perform the inspection in the following procedure if there is such an instruction to use breaker box in the step. After inspection, return to the diagnostic step.
Ways to measure voltage and resistance are different when using a breaker box.
Refer to 1E-226, "Example of use for breaker box, Breaker box inspection procedure, How to Use Breaker Box".

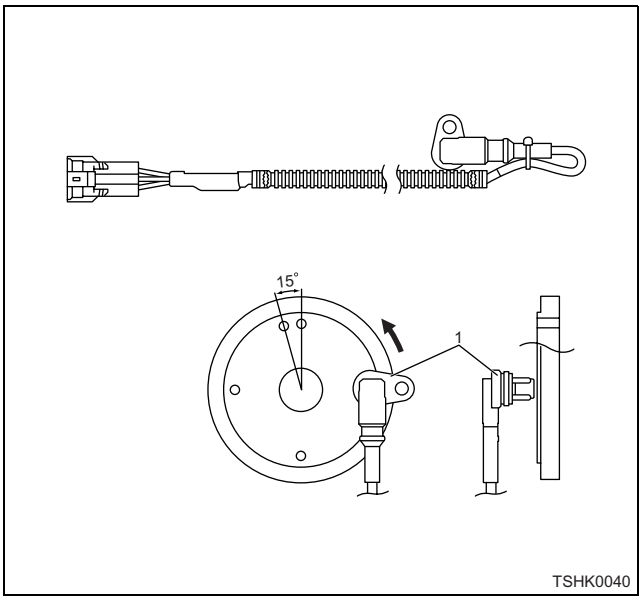


Name

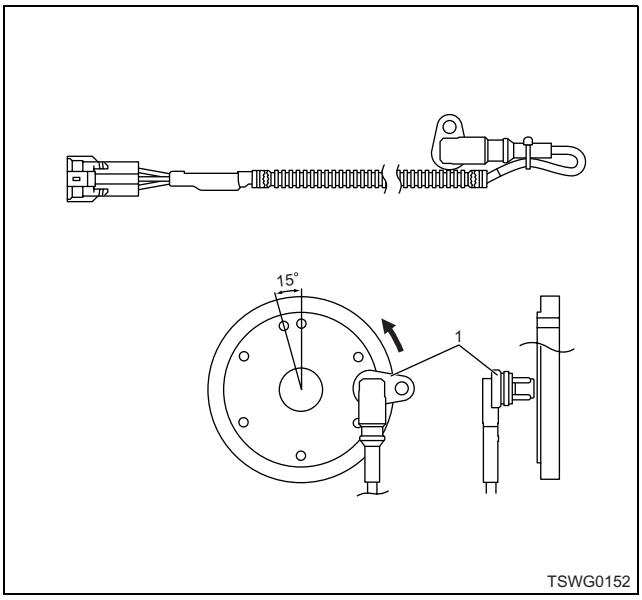
1. Breaker box
2. DMM

Step	Item to be checked	Checking method	Measuring condition	Terminal No.	Normal value	Abnormal value
6	Open circuit/ high resistance	Resistance measurement	• Disconnect the sensor connector. • Key switch "OFF"	61 – Sensor connector sensor 1 power supply terminal	100Ω or less	10 MΩ or more
7	Short circuit to ground circuit/ ground	Resistance measurement	• Disconnect the sensor connector. • Key switch "OFF"	64 – 61 64 – GND	10 MΩ or more	100Ω or less
	Open circuit/ high resistance	Resistance measurement	• Disconnect the sensor connector. • Key switch "OFF"	64 – Sensor connector sensor 1 signal terminal	100Ω or less	10 MΩ or more

4HK1



6HK1

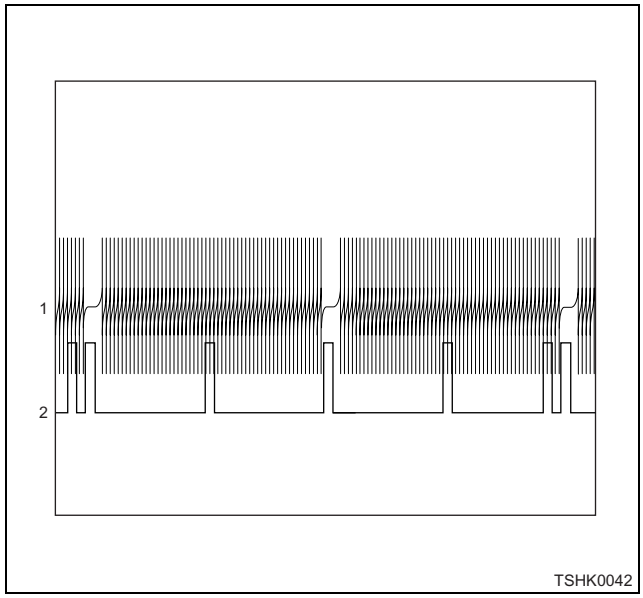


Name

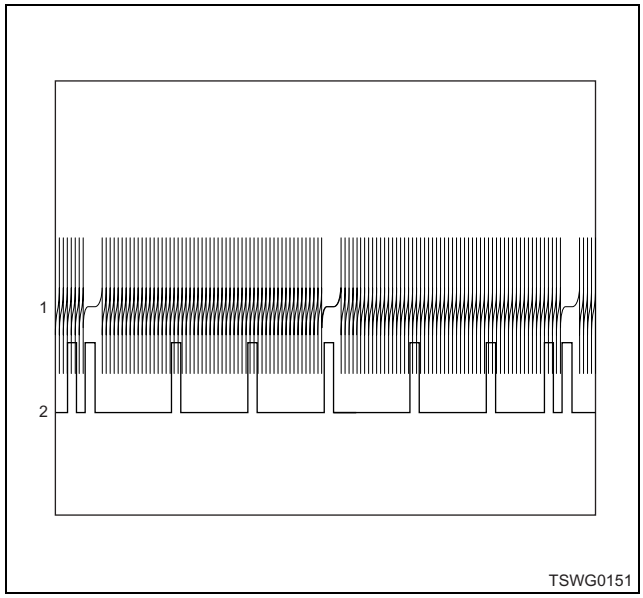
1. CMP sensor

About CKP sensor and CMP sensor signals

4HK1



6HK1



Name

1. CKP signal
2. CMP signal

The conditions to clear the MIL/DTC

- The present trouble turns to history trouble when the condition is out of the range from DTC set condition (recovery from failure).
- The diagnosis lamp will go off after the code turns to history trouble and the key switch is turned “OFF” then “ON” again.
- Using the scan tool, or memory clear switch and diagnostic switch operation enables to clear DTCs.

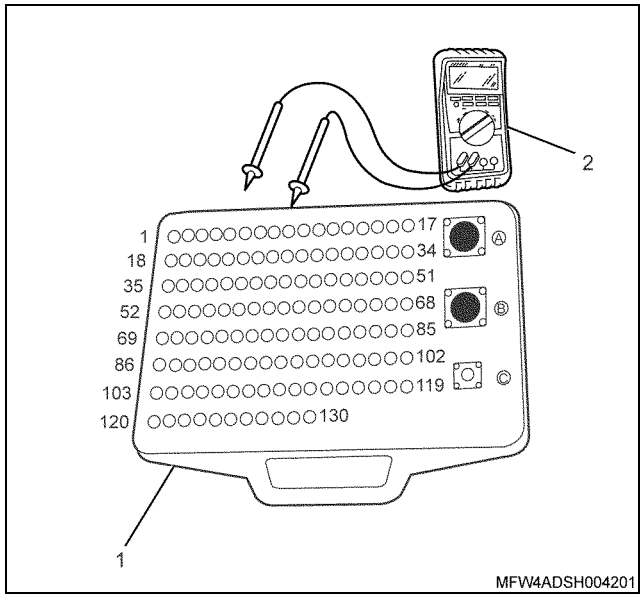
Test description

Numbers below indicate step numbers in the chart.
2. Measure at the harness connector-side.
3. Measure at the harness connector-side.

Step	Action	Value	YES	NO
1	Perform the OBD system check. Is the procedure completed?	—	Go to Step 2.	Go to 1E-339, “OBD system check, List of Function Checks”.
2	1. Turn the key switch to “OFF”. 2. Disconnect the AP sensor connector. 3. Connect the DMM between the AP sensor power supply terminal and the ground. 4. Turn the key switch to “ON”. Is the DMM indication the specified value or more?	5.5V	Go to Step 4.	Go to Step 3.
3	1. Turn the key switch to “OFF”. 2. Disconnect the AP sensor connector. 3. Connect the DMM between the AP sensor power supply terminal and the ground. 4. Turn the key switch to “ON”. Is the DMM indication the specified value or less?	4.5V	Go to Step 5.	Go to Step 9.
4	1. Check the power supply circuit between AP sensor 1 and ECM for short circuit to the battery power supply circuit or ignition power supply circuit using breaker box or DMM. Refer to 1E-761, “Breaker box inspection procedure, DTC: P1631 (Flash code 55) Voltage fault in 5-V power supply 1, List of Diagnostic Trouble Codes”. 2. If the fault is detected, repair as required. Is the fault detected?	—	Go to Step 9.	Go to Step 6.
5	1. Check the power supply circuit between AP sensor 1 and ECM for ground short circuit using breaker box or DMM. Refer to 1E-761, “Breaker box inspection procedure, DTC: P1631 (Flash code 55) Voltage fault in 5-V power supply 1, List of Diagnostic Trouble Codes”. 2. If the fault is detected, repair as required. Is the fault detected?	—	Go to Step 9.	Go to Step 6.
6	Is EMPS available?	—	Go to Step 7.	Go to Step 8.

Breaker box inspection procedure

Perform the inspection in the following procedure if there is such an instruction to use breaker box in the step. After inspection, return to the diagnostic step.
Ways to measure voltage and resistance are different when using a breaker box.
Refer to 1E-226, “Example of use for breaker box, Breaker box inspection procedure, How to Use Breaker Box”.

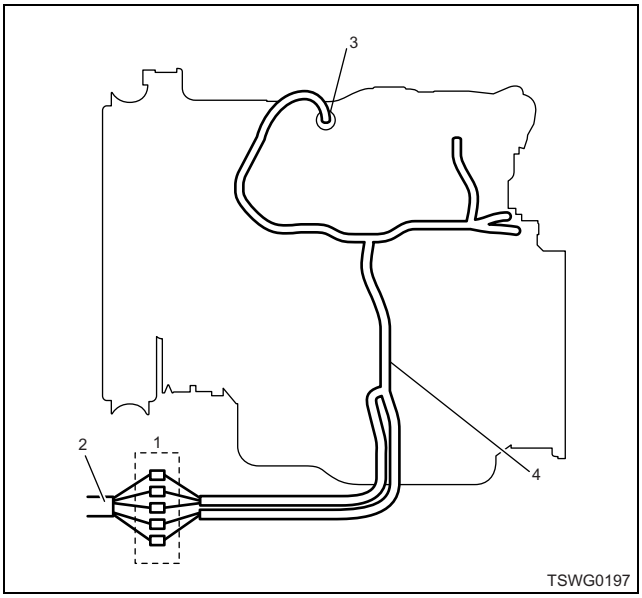


Name

1. Breaker box
2. DMM

Step	Item to be checked	Inspection method	Measuring condition	Terminal No.	Normal value	Abnormal value
4	Short circuit to power supply circuit	Voltage measurement	• Remove the ECM. • Key switch “ON”	80 – GND	0 V	1 V or more
5	Short circuit to ground circuit/ ground	Resistance measurement	• Remove the sensor. • Key switch “OFF”	80 – GND	10 MΩ or more	100Ω or less

On-board check procedure for sensors



Name

1. Coupling connector between engine — the machine
2. Machine harness
3. Sensor connector
4. Engine harness

1. Disconnect the coupling connector, and check the sensor from engine harness connector.
2. Disconnect the connector from sensor, and short the wiring of sensor connector.
3. Check the harness from coupling connector for open circuit.
   - If both steps 1 and 2 are faulty, repair the harness. Check from step 1 again.
   - If only step 1 is faulty, replace the sensor.

The conditions to clear the MIL/DTC

- The present trouble turns to history trouble when the condition is out of the range from DTC set condition (recovery from failure).
- Using the scan tool, or memory clear switch and diagnostic switch operation enables to clear DTCs.

Diagnostic aid

If the intermittent trouble is suspected, the followings may be the cause.

- Improper connection of harness connector
- Defective harness routing
- Worn harness cladding
- Wire disconnection inside harness cladding

The following inspections are necessary to detect these causes.

- Improper connection of harness connector and ECM connector
  - Poor connection of terminal from connector
  - Unmatched terminals are fitted.
  - Damage of connector lock
  - Poor contact between terminal and wire
- Damaged harness
  - Visually check the harness for damage.
  - Check the relevant items on the scan tool data display while moving the connector and the harness which are related to the sensor. The variation of the display indicates the faulty part.

Test description

Numbers below indicate step numbers in the chart.
2. If no DTC is detected, intermittent trouble is suspected. Identify the cause by referring to Diagnostic aid.
3. Measure at the harness connector-side.

Step	Action	Value	YES	NO
1	Perform the OBD check. Is the procedure completed?	—	Go to Step 2.	Go to 1E-339, “OBD system check, List of Function Checks”.
2	1. Turn the key switch to “OFF” for more than 10 seconds. 2. Start the engine. 3. Check the DTC. Is DTC U2104 detected?	—	Go to Step 3.	Go to “Diagnostic aid”.
3	1. If the DTC U2104 is detected, and the history and present troubles of DTC U2106 are alternately detected, check the circuit between ECM terminals (32) and (18) for the following conditions. • Short circuit 2. If the fault is detected, repair or replace as required. 3. Check if DTC is not detected again. Is the procedure completed?	—	—	Go to Step 4.
4	Is the breaker box available?	—	Go to Step 5.	Go to Step 15.
5	1. Turn the key switch to “OFF”. 2. Remove the ECM. 3. Connect the breaker box to the ECM. 4. Connect the breaker box with the ECM harness. 5. Measure the resistance between the CAN-High-side terminal and CAN-Low-side terminal using breaker box. Is the resistance within the specified value?	50 — 70Ω	Go to Step 13.	Go to Step 6.
6	1. Remove the ECM from the breaker box. 2. Measure the resistance between the CAN-High-side terminal and CAN-Low-side terminal using breaker box. Is the resistance specified value?	Approx. 120Ω	Go to Step 7.	Go to Step 8.

Engine start failure

Pre-inspection

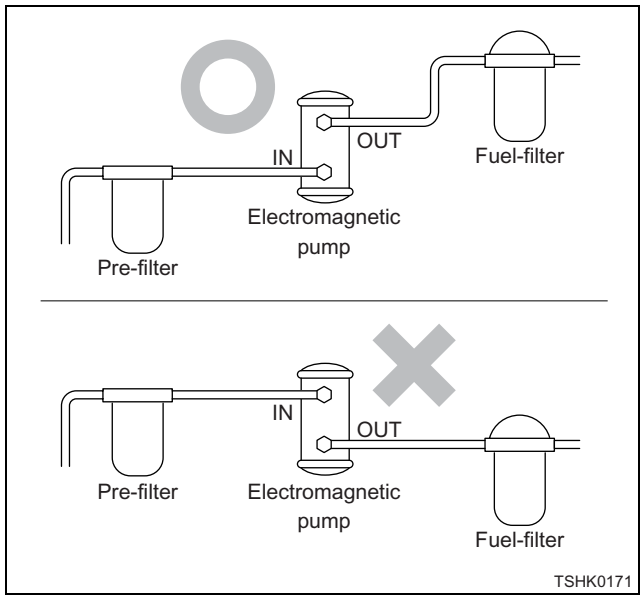
Before using this paragraph, perform the 1E-339, “OBD system check, List of Function Checks” and check all the following items.

- Check if excessive load is applied to the machine side.
- ECM and diagnosis lamp operate properly.
- Check the DTC.
- Scan tool data shows normal operating range.
- Check the condition of the machine to identify the applicable symptom from “List of trouble symptom”. Perform the procedure described in the symptom chart.
- Check with the customer if correct engine oil and fuel are used.

Visual check

Careful visual check is required for some symptom procedures. By this check, the problem can be corrected without performing further check, and time can be saved.
This check includes the following items.

- There is no dirt or clogging in fuel filter.
- There is no poor contact in connector (it must be connected with click sound). Especially for CKP sensor and CMP sensor.
- The terminal voltage of battery is not low.
- Wire is connected properly, tightened securely or not cut.
- Commercial accessory power supply is not bifurcated from ECM power supply.
- ECM ground is not contaminated and installed to the proper position securely.
- Pipes and hoses relevant to fuel, air and oil are free of crack or twist, and are properly connected. Thoroughly check for any oil leakage and clogging.
- The layout of the fuel filter, pre-filter and electromagnetic pump does not block air flow.



Check that Isuzu genuine pre-filter is arranged so that air flow is not blocked, since the air bleeding plug is not installed on it.
Also, check that the layout of inlet and outlet of the electromagnetic pump is proper. Correct the layout if the inlet of the electromagnetic pump faces upward or outlet of it faces in the direction that the machine moves to.

- Fuel system is free from oil leakage, and pipe is not damaged or dent.
- Intake system parts for fault.
- Exhaust system parts for fault.

Diagnostic aid

Important:

- **If the crank sensor is faulty, crank more than 60 rpm for 14 seconds or more since it is not judged on cranking for less than 14 revolutions.**
- **When the engine is running at low speed, the DTC of crank sensor fault may not be detected. If an intermittent trouble is found, raise the engine speed up to No Load Max, and check if DTC related to crank sensor is detected.**

- Fuel system fault (run out of fuel, frozen fuel, air mixed in fuel pipe, faulty filter [clog in main filter, gauze filter], pipe fault, fuel quality, fuel tank [foreign matter, fuel suction fault])
- Intake system fault (clogging in filter, intake pipe fault, etc.)
- Using low viscosity fuel such as kerosene promotes a wear of the supply pump plunger part, etc. to cause a faulty discharge, and may result in a faulty starting. In this case, the supply pump is needed to be replaced.

Step	Action	Value	YES	NO
3	Check the electrical system. 1. Check the DTC of crank sensor. **Important:** **Crank sensor fault is not judged on cranking for less than 14 revolutions. Crank the engine at 60 rpm or more for 14 seconds or more, or raise the engine speed up to No Load Max to perform the test drive.** 2. Check the connectors of the ECM, fuel pump, ACG and electronic governor for poor contact or play. **Note:** Poor contact in the connector, especially CKP sensor and CMP sensor, causes engine stall. It must be connected with click sound. 3. Check the harness for open or short circuit. 4. Repair or replace the faulty part. Is the procedure completed?	—	Go to Step 4.	—
4	Check the ACG. Check if the charge warning lamp turns on while engine is running. **Note:** Refer to the machine's manual for charge warning. Does the charge warning operate?	—	Go to Step 6.	Go to Step 5.
5	Replace the ACG. Also, check the charge warning system, and repair or replace if faulty. Is the procedure completed?	—	Go to Step 6.	—
6	Check the condition of commercial electrical equipment such as radio and lights. Does the engine stall when the commercial electrical equipment is powered OFF?	—	Go to Step 7.	Go to Step 8.
7	Correct the installation condition of the electrical equipment, or remove the electrical equipment. Is the procedure completed?	—	Go to Step 8.	—
8	Is the scan tool (KW communication) available?	—	Go to Step 9.	Go to Step 13.
9	1. Check if the common rail pressure shows unstable value using a scan tool. 2. If the trouble is detected, the SCV may need to be replaced. Remember this, and go to the next step. Is the procedure completed?	—	Go to Step 10.	—
10	1. Perform "Common rail pressure test" using a scan tool. 2. Check the common rail pressure follow-up. 3. If the trouble is detected, the SCV may need to be replaced. Remember this, and go to the next step. Is the procedure completed?	—	Go to Step 11.	—

Step	Action	Value	YES	NO
7	Check the fuel system. Is the procedure completed?	—	Go to Step 8.	Go to 1E-361, “Fuel system check, List of Function Checks”.
8	Check the intake system. Is the procedure completed?	—	Go to Step 9.	Go to 1E-365, “Intake system check, List of Function Checks”.
9	Check the exhaust system. Is the procedure completed?	—	Go to Step 10.	Go to 1E-366, “Exhaust system check, List of Function Checks”.
10	Check for the engine symptom again. Is the engine symptom corrected?	—	Go to Step 24.	Go to Step 11.
11	Check the condition of commercial electrical equipment such as radio and lights. Does the engine symptom change when the commercial electrical equipment is powered OFF?	—	Go to Step 12.	Go to Step 13.
12	Correct the installation condition of the electrical equipment, or remove the electrical equipment. Is the procedure completed?	—	Go to Step 13.	—
13	Check for the engine symptom again. Is the engine symptom corrected?	—	Go to Step 24.	Go to Step 14.
14	Is the scan tool (KW communication) available?	—	Go to Step 15.	Go to Step 16.
15	Check the injector. 1. Clear the DTC. Refer to 1E-21, “How to clear DTC, Procedure of Trouble Diagnosis” in this section for how to clear DTCs. 2. Start the engine. 3. Select the “Actuator test” from the scan tool menu. When the scan tool is not available, refer to 1E-106, “How to Inspect Injector” in this section. 4. Select the “Injection stop at each injector” in the “Common rail system”. 5. Press the “OFF” soft key to stop the fuel injection in the cylinder one by one, and check the change in engine sound. Is there any cylinder of which engine vibration and engine sound did not change when it is stopped?	—	Go to Step 17.	Go to Step 18.
16	Perform the injection balance test. Use EMPSIII, CAN scan tool or the injector checker to stop injection in the injector, and check the change in engine vibration and engine sound. Refer to 1E-106, “How to use injector checker, How to Inspect Injector” in this section for how to use injector checker. Is there any cylinder of which engine vibration and engine sound did not change when it is stopped?	—	Go to Step 17.	Go to Step 18.