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PROFESSIONAL PARTNER

TROUBLE SHOOTING MANUAL

6HK1 - 6WG1
TIER III ENGINES

87528730 NA

Issued 03-2006

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TROUBLESHOOTING MANUAL - Isuzu Common Rail Engines - 9

Error Code (6HK1)	Error Code description	Item to be detected	Preconditions when Error Code is set	Error Code set condition	Fault judgment period	Behavior when trouble occurs	Monitor Display	Recovery from failure
1173	Overheat	Overheat condition	<ul style="list-style-type: none"> • Key switch input voltage is 18V or more. • Error Code 1630, 1633, 0117, or 0118 is not detected. • Under operation 	<ul style="list-style-type: none"> • Coolant temperature is more than 120°C while engine is operated. 	Approx. 5 sec.	Operability is not affected. Back-up: Overheating is displayed with the temperature 105°C or more. Output controlling: temperature from 108°C or more. Pump output controlling: temperature from 108°C or more.	Does not come on.	*2
1261	Injection nozzle common 1 drive system fault	Open/short circuit in injector common 1-side electrical wiring, EDU output part fault	<ul style="list-style-type: none"> • Main relay power supply voltage is 18V or more. • 70 rpm or more • None of the following Error Code sets are detected; Error Code 0611, 1261, 0201, 0202 and 0203. 	No injector 1, 3, 5 monitor input signal exists.	Approx. 3 sec.	Intensive engine vibration, rough idling, output lowering, blow up fault Engine stall is possible. Back-up: Common 1 stop (#1, #2, #3 cylinders stopped), EGR stopped	ON	*1
1262	Injection nozzle common 2 drive system fault	Open/short circuit in injector common 2-side electrical wiring, EDU output part fault	<ul style="list-style-type: none"> • Main relay power supply voltage is 18V or more. • 70 rpm or more • None of the following Error Code sets are detected; Error Code 0612, 1262, 0204, 0205 and 0206. 	No injector 2, 4, 6 monitor input signal exists.	Approx. 3 sec.	Intensive engine vibration, rough idling, output lowering, blow up fault Engine stall is possible. Back-up: Common 2 stop (#4, #5, #6 cylinders stopped), EGR stopped	ON	*1
1345	Cam sensor out of phase	Camshaft gear/crankshaft gear installing angle is out of phase, or damage in gear.	<ul style="list-style-type: none"> • Key switch input voltage is 18V or more. • Error Code 0335, 0336, 0340, 0341, 1345, or 1635 is not detected. • CMP sensor pulse is normal. • Crank pulse is normal. 	Correct cam pulse does not exist in crank gap position.	When trouble occurs 7 out of 8 samples.	<ul style="list-style-type: none"> • Behavior does not change during engine running. • After engine stalls, engine will not start. Back-up: Engine running based on crank when it is normal After engine stops: unable to identify cylinder (unable to restart) Always L mode	ON	*1
1630	A/D conversion fault	A/D conversion fault	—	A/D conversion failure	Immediately	Output lowering, Black smoke emitted Back-up: Analog sensor system default processing Limited injection amount 3 Target RP upper limit (80MPa) Always L mode	ON	*2

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Error Code (6WG1)	Error Code description	Item to be detected	Preconditions when Error Code is set	Error Code set condition	Fault judgment period	Behavior when trouble occurs	Monitor Display	Recovery from failure
1631	Voltage fault in 5-V power supply 1	Power supply wiring short to sensor, or breakage in element/circuit for power supply regulation inside ECM.	<ul style="list-style-type: none"> • Error Code 1630 is not detected. • Key switch input power supply voltage is between 16 — 32 V. 	5-V 1 power supply voltage is 5.5 V or more, or 4.5 V or less.	Approx. 0.5 sec.	Accelerator opening angle is controlled to 0%.	—	*2
1632	Voltage fault in 5-V power supply 2		<ul style="list-style-type: none"> • Error Code 1630 is not detected. • Key switch input power supply voltage is between 16 — 32 V. 	5-V 2 power supply voltage is 5.5 V or more, or 4.5 V or less.	Approx. 0.5 sec.	Due to back-up equivalent to 2500m <ul style="list-style-type: none"> • Black smoke emitted at high altitude • Output lowers at low altitude Back-up: Same to barometric pressure and intake air temperature sensor fault	ON	*2
1633	Voltage fault in 5-V power supply 3		<ul style="list-style-type: none"> • Error Code 1630 is not detected. • Key switch input power supply voltage is between 16 — 32 V. 	5-V 3 power supply voltage is 5.5 V or more, or 4.5 V or less.	Approx. 0.5 sec.	Deterioration of startability, black smoke emission possible Operationality is affected. Back-up: Same to oil pressure, coolant temperature, and combustion temperature sensor fault	ON	*2
1634	Voltage fault in 5-V power supply 4		<ul style="list-style-type: none"> • Error Code 1630 is not detected. • Key switch input power supply voltage is between 16 — 32 V. 	5-V 4 power supply voltage is 5.5 V or more, or 4.5 V or less.	Approx. 0.5 sec.	Operationality is affected. Back-up: Same to boost pressure and boost temperature sensor fault	ON	*2
1635	Voltage fault in 5-V power supply 5		<ul style="list-style-type: none"> • Error Code 1630 is not detected. • Key switch input power supply voltage is between 16 — 32 V. 	5-V 5 power supply voltage is 5.5 V or more, or 4.5 V or less.	Approx. 0.5 sec.	Engine blow up, output lowering, black smoke emission, engine stall are possible. Back-up: Same to rail pressure sensor fault and EGR position sensor fault	ON	*2
2104	CAN Bus fault	CAN communication fault	<ul style="list-style-type: none"> • Key switch input voltage is 12V or more. 	Bus-off is detected.	At 3 sec. continuously	Back-up: Engine RPM goes down to 1350 rpm	ON	*2
2106	CAN timeout fault	CAN communication fault	<ul style="list-style-type: none"> • Error Code 2104 is not detected. • Key switch input voltage is 12V or more. 	CAN data reception does not complete at a set time.	At 1 sec. continuously	Back-up: Engine RPM goes down to 1350 rpm	ON	*2

Procedure of trouble diagnosis with an interview

Step 1 Confirm the user's complaint

- Organize the trouble conditions using a check list.

Step 2 Perform pre-inspection

- Perform an overall visual check.
- Confirm the service history in the past.
- Detect faulty such as noise, abnormal smell, etc.
- Collect the diagnostic trouble code (Error Code) information for effective repair.
- Check for faults by comparing with the specified value.

Step 3 Check service information

- Check service letters for the market.

Step 4 Check according to each Error Code

- Check the items indicated by the diagnostic trouble code (Error Code)

Step 5 Perform fault inspection for each symptom

- Check the items not indicated by the diagnostic trouble code (Error Code)

Information:

About types of system trouble diagnosis

System diagnostic method is a standardized method to repair all the electric/electronic (E/E) systems. The faults in E/E system often occur in the following stages, different from general machine fault.

1. Early stage of fault;
 - As the fault occurs for a short period and singly, a customer often does not notice and miss it. In this stage, customer's complaint is indefinite and it is impossible to reproduce the trouble. However, the engine control module (ECM) may store the fault.
=Past fault (past trouble)
2. Middle stage of fault;
 - The fault occurs for a short period and singly, but repeats intermittently and definitely occurs under a specific condition. A customer's complaint (contents of the fault) is clear but description of condition of the fault is not clear. Therefore, it is possible to reproduce the trouble if a mechanic could figure out the conditions.
=Intermittent trouble (intermittent)
3. Stage that fault is real;
 - The fault occurs on a steady basis and a customer's complaint is realistic and clear. Therefore, it is possible for a mechanic to reproduce the fault. However, sometimes there are multiple causes.
=Current fault (current trouble)

Interview

1. Comprehend the contents of a customer's complaint using "Check list (engine control system)".
Do not interview blindly. Interview about the trouble presumed by symptoms (cases).
2. Evaluate the trouble information correctly.
Figure out specifically based on 5W1H.
Example: The temperature is low, at the time of starting, constantly, in the vicinity of the engine portion, metallic noise, etc.

Measurement procedures

Start the measurements with the exhaust pipe temperature below 100°C.

- Measure the temperature of initial condition.
- Record the measured value.
- Start the engine. Maximum engine speed / 2 pump relief.
- Measure the temperature from cylinder No. 1 to No. 6, conduct the measurements at a constant pace of finishing once at around 30 seconds.
- Repeat the measurement six or seven times.
- Confirm that the temperature goes up to around 400 °C and temperature rise are slowed down.
- Finish the measurements and stop the engine after idling.
- From measured value distinguish the defected cylinder.

Note:

When five minutes are passed, it becomes difficult to distinguish.

For re-measuring, engine cooling down (below 100 °C) is required.

Criterion

Compare the temperature change between each cylinder and find relatively low cylinder.

Never determine the fault by the absolute value.

Placed below is an actual measurement value. Temperature fluctuates with changes depending on the conditions of measurement. Use this data as a reference to grasp a trend.

Placed three patterns of typical examples of the measurement.

- Data of normal status
- Data of imperfect combustion at endmost cylinder. (No.1 or No.6)
- Data of imperfect combustion at central part cylinder. (No.3)

Climate when the reference data were taken (Outside air temperature : 28°C/ Weather : fair)

Data of normal status

Characteristics of measurement result

- Temperature rose averagely. The temperature became stabilized after initiation of engine operation. (roughly 3min/400°C)
- At the normal state No.1 and No.6 cylinders are low in temperature with 50°C

Timing	No.1	No.2	No.3	No.4	No.5	No.6
0	105	110	140	156	137	109
40	145	208	213	261	267	242
1:10	255	299	290	355	310	288
1:40	310	297	324	367	320	288
2:20	332	360	335	414	350	338
2:40	301	369	378	407	384	364

Data of imperfect combustion at endmost cylinder. (No.1 or No.6)

Characteristics of measurement result

- When the defect is in No.1 or No.6 cylinder, temperature differs greatly with the center cylinder.
- Adjacent cylinders (No.2, No. 5) are affected and the temperature drops to lower value.

However, there is no failure in the adjacent cylinders.

Caution: Avoid accidental replacement of adjacent cylinders.

Timing	No.1	No.2	No.3	No.4	No.5	No.6
0	56	60	66	65	62	62
35	57	135	193	193	145	216
01:00	61	165	246	255	322	276
01:25	66	187	288	312	345	300
02:00	74	208	305	341	350	326
02:30	77	217	332	345	368	341
03:05	80	221	346	367	372	352

Data of imperfect combustion at central cylinder. (No.3)

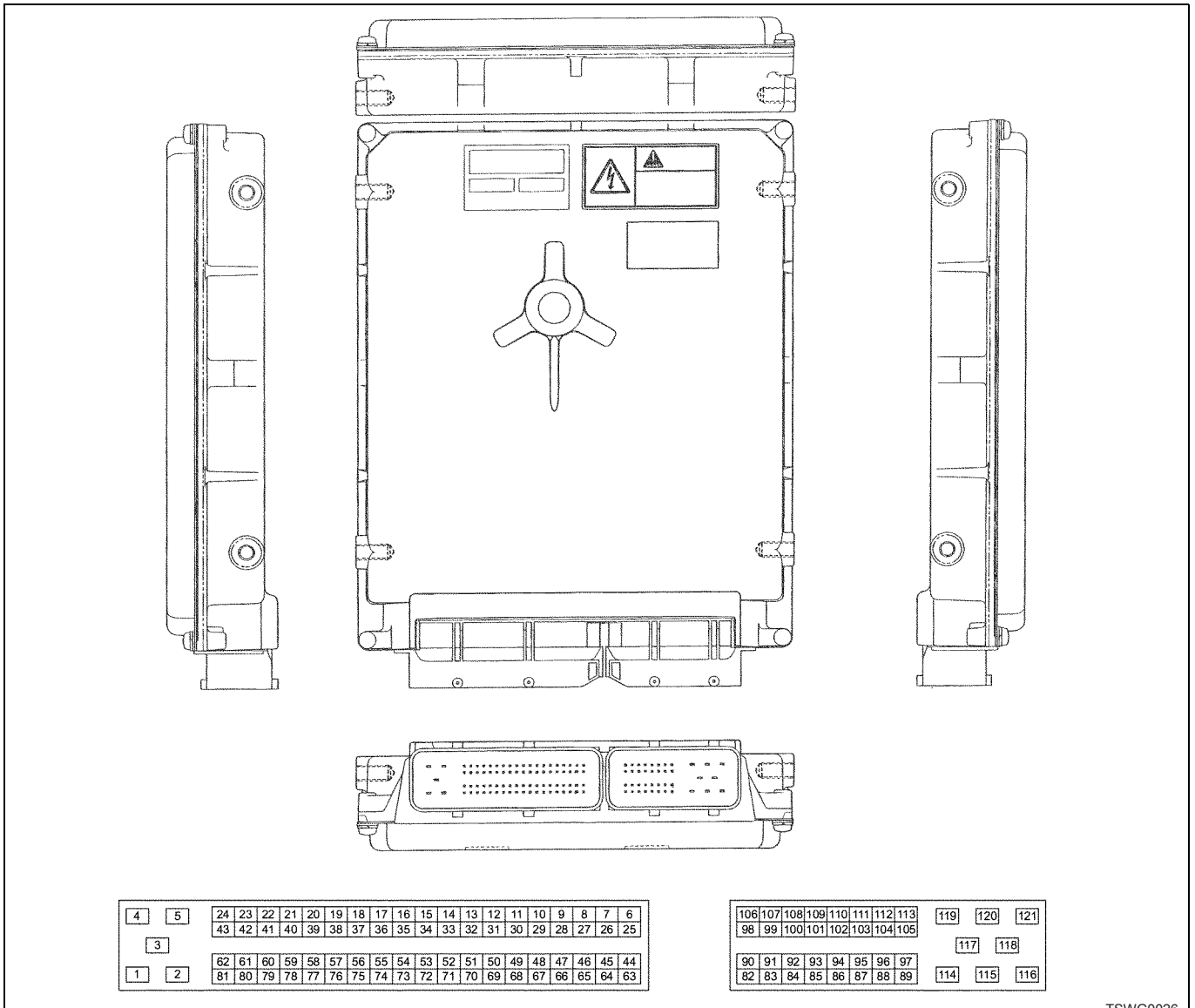
Characteristics of measurement result

- When the defect is in No.2, No.3, No.4 or No.5 cylinder, it is difficult to distinguish the defected cylinder, because of the small change in temperature.
- Temperature goes up but the transition is low compared to the other cylinders.
- Start the engine for 3 minutes and if the temperature difference was 100°C compared to other cylinders, evaluate the cylinder to be defected.

After a lapse of 3 minutes, it will gradually become difficult to distinguish.

	No.1	No.2	No.3	No.4	No.5	No.6
0	81	91	105	101	98	81
30	127	180	128	245	257	247
01:10	202	297	145	275	280	282
01:40	233	332	206	311	311	319
02:20	263	367	206	342	323	337
02:50	294	365	253	354	327	346
03:25	297	398	229	369	360	356

Pin arrangement of engine control module (ECM)



TSWG0026

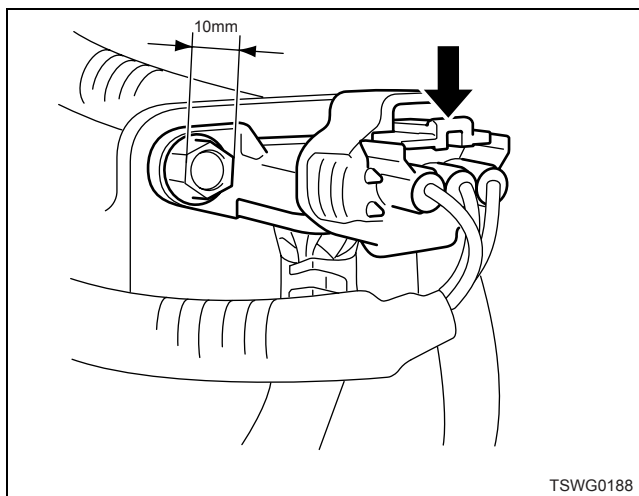
81-pin connector

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
6-9	—	—
10	OS-GLOWR	Glow relay
11-17	—	—
18	CC-CAN-H	CAN-HIGH
19,20	—	—
21	OS-MAINR	ECM main relay
22,23	—	—
24	IS-IGKEY	Key switch ON signal

The boost pressure sensor uses the pressure hose between the boost pressure sensor and intake pipe, detects boost (intake air pressure), converts the pressure into the voltage signal and sends it to engine control module (ECM). Voltage becomes higher as pressure becomes higher, and lower as one does lower. ECM calculates the boost (intake air pressure) based on the voltage signal sent from sensors and uses it for fuel injection control etc.

Removal

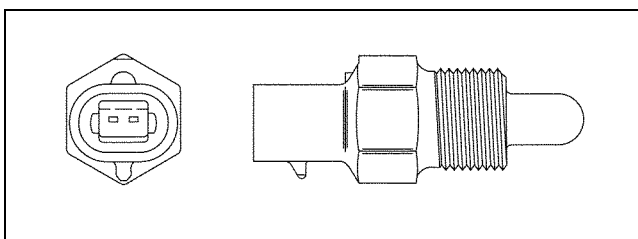
- Disconnect the connector, and remove the two 10mm-mounting bolts, hoses and sensor.



Installation

Tightening torque: 4 — 6 N·m {0.4 — 0.6 kgf·m}

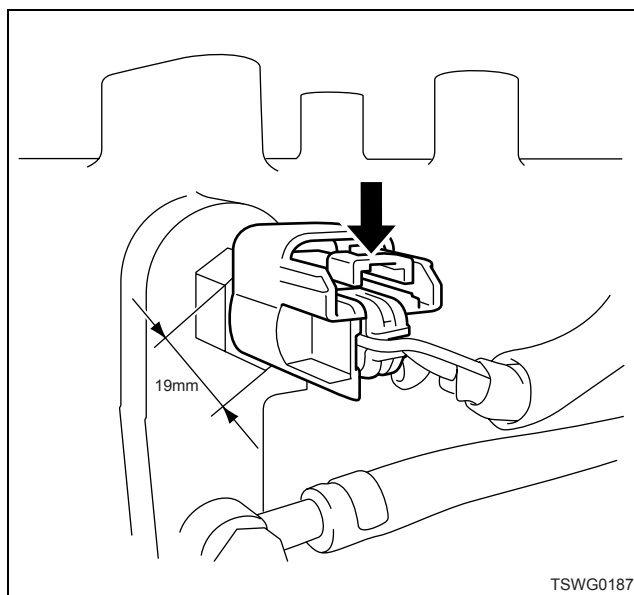
Boost temperature sensor (B51)



The boost temperature sensor is installed onto the EGR valve upstream side of intake manifold. The sensor is thermistor type. The resistance in the sensor changes as the temperature changes.

Removal

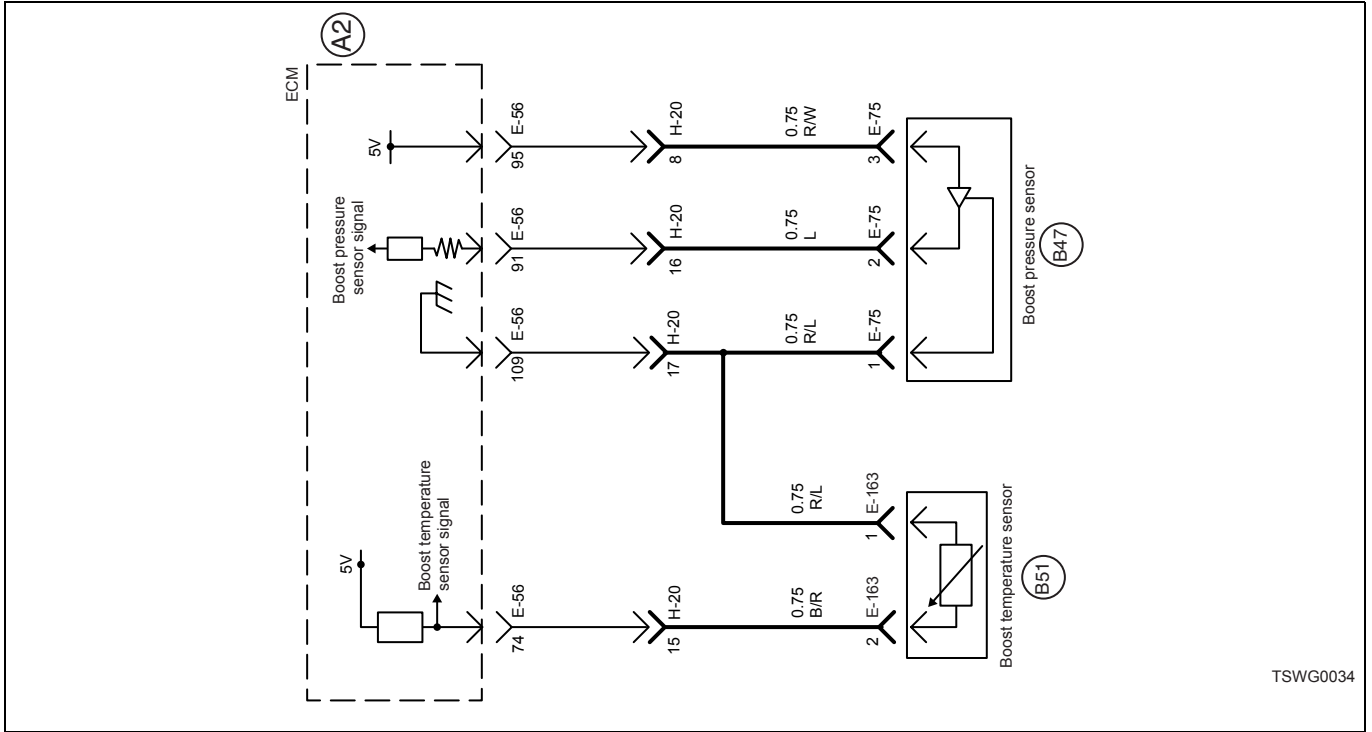
- Disconnect the connector and remove it with 19mm-wrench



Installation

Tightening torque: 10.8 — 16.3N·m {1.1 — 1.7 kgf·m}

Boost temperature sensor (B51), boost pressure sensor (B47) circuit

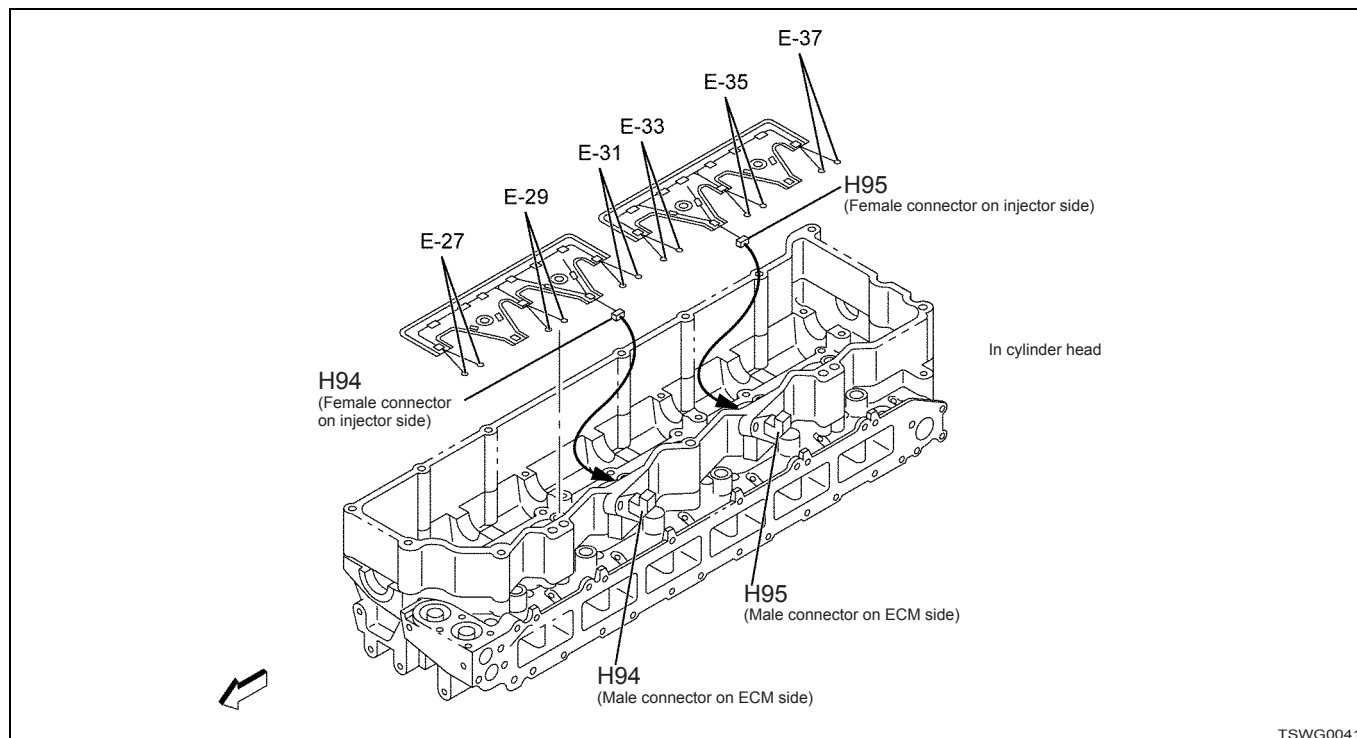


H95

Terminal Number	
1	—
2	OS — INJ6 signal
3	Injector power supply 2
4	Injector power supply 1

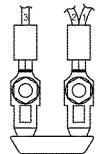
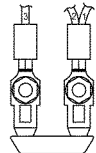
Terminal Number	
5	—
6	OS — INJ4 signal
7	OS — INJ2 signal
8	—

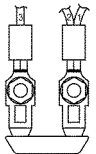
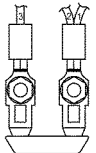
Cylinder head



TSWG0041

Connector list

No.	Connector Face
E-27	 <p>#1 injector (Silver)</p> <p>003-128</p>
E-29	 <p>#2 injector (Silver)</p> <p>003-128</p>

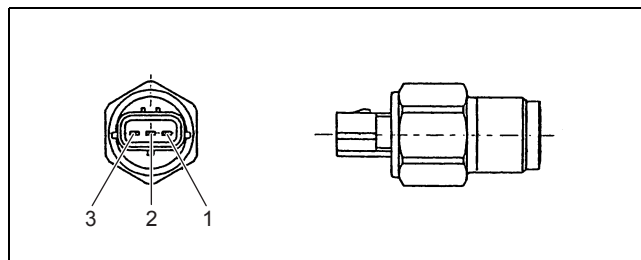
No.	Connector Face
E-31	 <p>#3 injector (Silver)</p> <p>003-128</p>
E-33	 <p>#4 injector (Silver)</p> <p>003-128</p>

Step	Action	Value	YES	NO
4	<p>Check for short circuit between the fuse, ECM and glow plug.</p> <ol style="list-style-type: none"> 1. Disconnect the harness from the fuse, glow relay, ECM and glow plug. 2. Measure the resistance between each glow relay terminal and the ground. <p>Is the resistance specified value?</p>	10 M Ω or more	Go to Step 6.	Go to Step 5.
5	<p>Repair the short circuit between the fuse, ECM and glow plug.</p> <p>Is the procedure completed?</p>	—	Go to Step 6.	—
6	<ol style="list-style-type: none"> 1. Replace the fuse. 2. Turn the key switch to "ON". 3. Make sure that the fuse is not blown. <p>Is the trouble detected?</p>	—	Go to Step 4.	Go to Step 7.
7	<ol style="list-style-type: none"> 1. Check the version of ECM software. 2. Rewrite the software if version upgraded is necessary. If rewriting is not necessary, go to step 3. 3. Replace the ECM. <p>Is the procedure completed?</p>	—	Go to Step 8.	—
8	<ol style="list-style-type: none"> 1. Perform "Glow plug relay" test. <p>Does the glow plug activated?</p>	—	Go to Step 9.	—
9	<ol style="list-style-type: none"> 1. Turn the key switch to "OFF". 2. Remove all the glow plugs. 3. Measure the resistance between each glow plug terminal and the ground. <p>Is the resistance specified value?</p>	6 Ω (Normal tempera ture)	Go to Step 10.	Go to Step12.
10	<ol style="list-style-type: none"> 1. Remove the glow relay and short-circuit between the terminal. 2. Measure the voltage between each cylinder glow plug harness terminal and the ground using circuit tester. <p>Are the voltages at all the cylinders more than specified value?</p>	18V	Go to Step 11.	Go to Step 12.
11	<ol style="list-style-type: none"> 1. Remove the glow relay. 2. Measure the voltage between each cylinder glow plug harness terminal and the ground using circuit tester. <p>Are the voltages at all the cylinders specified value?</p>	0V	Normal system	Go to Step 13.
12	<p>Repair the open circuit between the glow relay and the glow plug, or the short circuit to the ground circuit.</p> <p>Is the procedure completed?</p>	—	Go to Step 15.	—
13	<p>Repair the power supply circuit between the glow relay and the glow plug, or the short circuit to the ignition power supply circuit.</p> <p>Is the procedure completed?</p>	—	Go to Step 15.	—
14	<p>Replace the glow plug.</p> <p>Is the procedure completed?</p>	—	Go to Step 15.	—

Step	Action	Value	YES	NO
7	1. Connect the common rail pressure sensor connector. 2. Clear the Error Code. 3. Start the engine. 4. Enforce the injector inspection using thermo gun. Is there any cylinder of which engine temperature is low?	—	Go to Step 8.	Go to Step 9.
8	Replace the injector in the cylinder of which engine temperature was low in step 7. Note: For work procedure, refer to the Engine service manual. Is the procedure completed?	—	Go to Step 14.	—
9	Replace the supply pump. Note: For work procedure, refer to the Engine service manual. Is the procedure completed?	—	Go to Step 10.	—
10	Check the Error Code again. 1. Bleed air from the fuel system. 2. Clear the Error Code. 3. Turn the key switch to "OFF" for more than 10 seconds. 4. Test run with the "Preconditions when Error Code is set". 5. Check the Error Code. Is Error Code 0087 detected?	—	Go to Step 11.	Go to Step 15.
11	Is EMPS available?	—	Go to Step 12.	Go to Step 13.
12	1. Check the version of ECM software. 2. Rewrite the software if version upgraded is necessary. Note: EGR valve position learning is required after replacing or rewriting the ECM. Refer to "Engine Control System, Engine control module (ECM), Installation of ECM" in this section for learning of EGR. Is the procedure completed?	—	Go to Step 14.	Go to Step 13.
13	Replace the ECM. Note: EGR valve position learning is required after replacing or rewriting the ECM. Refer to "Engine Control System, Engine control module (ECM), Installation of ECM" in this section for learning of EGR. Is the procedure completed?	—	Go to Step 14.	—

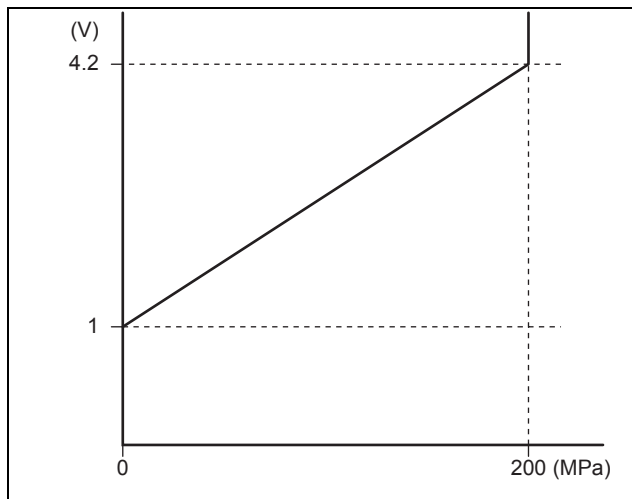
Step	Action	Value	YES	NO
6	Replace the supply pump. Note: For work procedure, refer to the Engine service manual. Is the procedure completed?	—	Go to Step 7.	—
7	Check the Error Code again. 1. Connect all the harnesses. 2. Clear the Error Code. Refer to “How to clear diagnosis trouble code (Error Code)” of “Procedure of trouble diagnosis” in this section for how to clear Error Codes. 3. Turn the key switch to “OFF” for more than 10 seconds. 4. Test run with the “Preconditions when Error Code is set”. 5. Check the Error Code. Is the Error Code 1093 detected?	—	Go to Step 2.	Go to Step 8.
8	Check if other Error Code is detected. Is other Error Code detected?	—	Go to each Error Code diagnosis.	Verify repair.
9	1. Visually check the harness between the ECM and the common rail pressure sensor for damage. 2. If the trouble is detected, repair as required. Is the procedure completed?	—	Go to Step 2.	Go to Step 2.

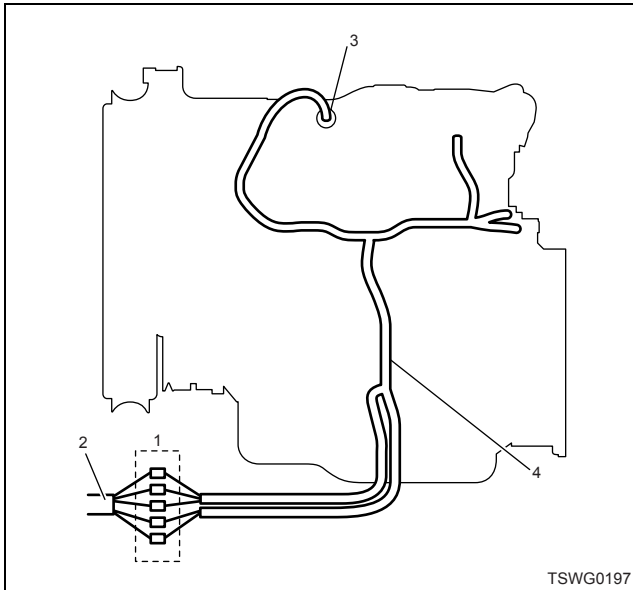
About common rail pressure sensor



- 1. Power supply
- 2. Signal
- 3. GND

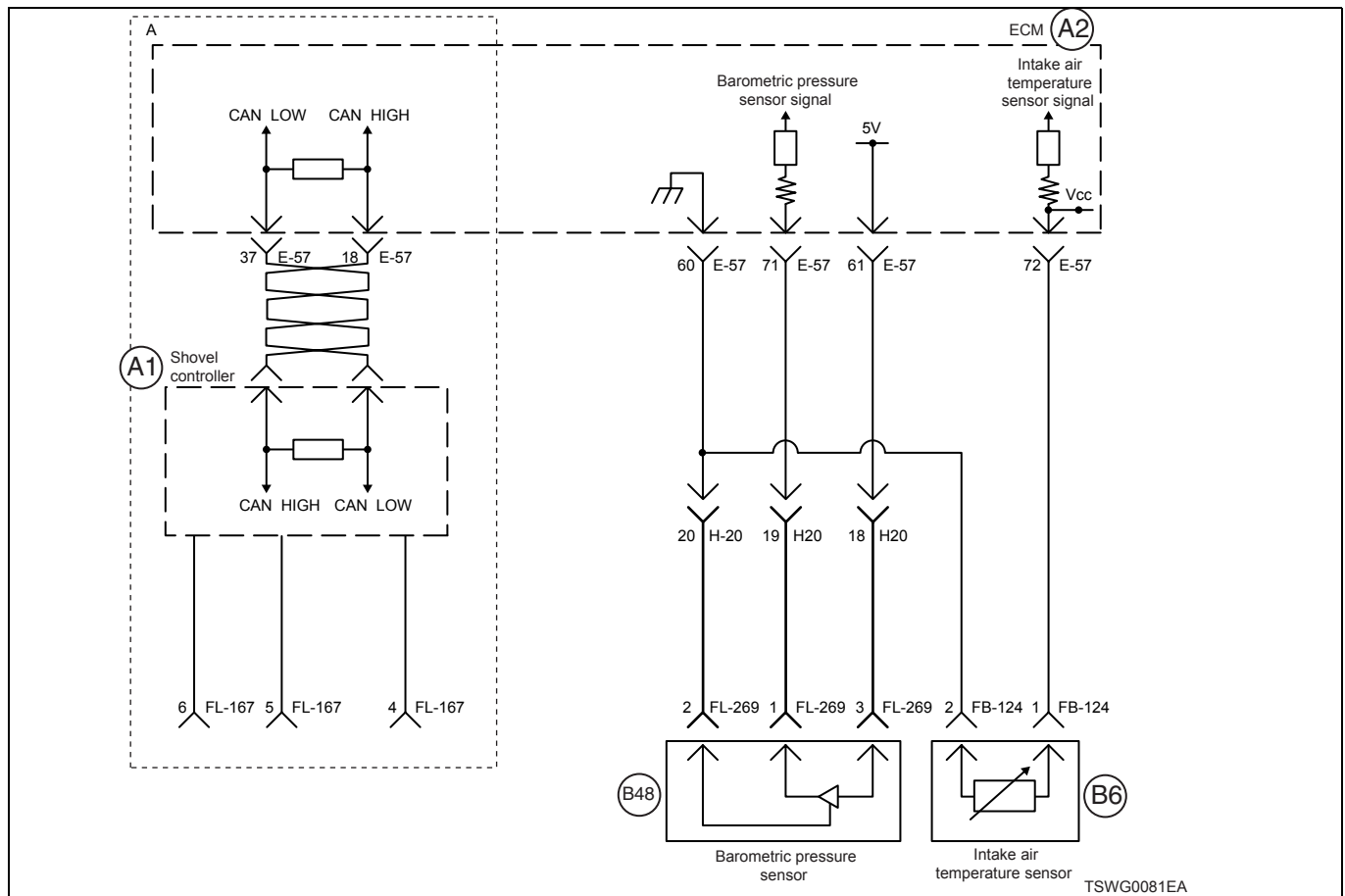
Characteristics of common rail pressure sensor



On-board check of sensors

1. Coupling connector between engine — the machine
2. Main 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.

Error Code: 0108**Barometric pressure sensor (B48) circuit input is high (+5V short circuit).****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 2500m

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

Preconditions when Error Code is set

- Key switch input voltage is 16V (18V for 6HK1) or more.
- Error Code 1630 or 1632 is not detected.

Error Code set condition

- Barometric pressure sensor voltage is 3.8 V or more for 4seconds or more.

Action taken when Error Code is set

- "ELEC. PROBLEM" is displayed.

Back-up mode

- Barometric pressure default setting (80kPa)
- EGR stopped.

Recovery from failure

- Recovery pattern 2.

Refer to "List of Error Code" and "About recovery from failure".

The conditions to clear the Error Code

- The error code is cleared from the current trouble when the condition is either repaired or disappeared.

Refer to "About recovery from failure"

Diagnostic aid

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

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

Following inspections are necessary to detect these causes.

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- Improper connection of harness connector
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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 EST 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	Check the error code 0113	—	Go to Step 2.	—
2	1. Start the engine. 2. Check the display of intake air temperature. Is the "Intake air temperature" more than the specified value?	-40°C	Go to Step 3.	Go to "Diagnostic aid".
3	Check for installation condition of the IAT sensor, ECM and coupling connector. 1. Check for play or looseness in the connection. 2. If the trouble is detected, repair or replace as required. Is the trouble detected?	—	Go to Step 11.	Go to Step 4.
4	1. Check the signal circuit between ECM and IAT sensor for short circuit to the power supply circuit or ignition power supply circuit using breaker box or circuit tester. Refer to "Breaker box inspection procedure". Important: If the IAT sensor circuit is shorted to the power supply circuit, the sensor may be broken. 2. If the trouble is detected, repair as required. Is the trouble detected?	—	Go to Step 11.	Go to Step 5.
5	1. Check for followings in the signal circuit between ECM and IAT sensor using breaker box or circuit tester. Refer to "Breaker box inspection procedure". • Open circuit • High resistance 2. If the trouble is detected, repair or replace as required. Is the trouble detected?	—	Go to Step 11.	Go to Step 6.
6	1. Check for followings in the ground circuit between ECM and IAT sensor using breaker box or circuit tester. Refer to "Breaker box inspection procedure". • Open circuit • High resistance 2. If the trouble is detected, repair or replace as required. Is the trouble detected?	—	Go to Step 11.	Go to Step 6.

- To make sure the correct performance of the ECT sensor, check with various temperatures using the reckoner table between temperature and resistance. If the sensor is faulty, operability may be affected.

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

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

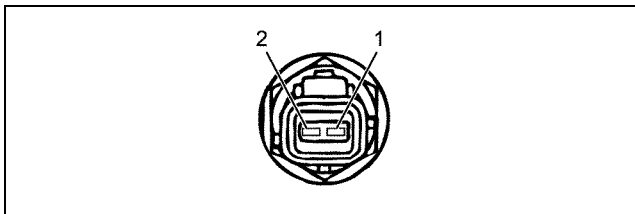
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 - Poor connection of terminal from connector
 - Unmatched terminals are fitted.
 - Damage of connector lock
 - Poor contact between terminal and wire
- Damaged harness
 - Visually check the harness for damage.
 - Check the relevant items on the EST 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	Check the error code 0118	—	Go to Step 2.	—
2	1. Start the engine. 2. Check the display of the “Engine coolant temperature”. Is the “Engine coolant temperature” more than the specified value?	–40°C	Go to Step 2.	Go to “Diagnostic aid”.
3	Check for installation condition of the ECT sensor, ECM and coupling connector. 1. Check for play or looseness in the connection. 2. If the trouble is detected, repair or replace as required. Is the trouble detected?	—	Go to Step 11.	Go to Step 4.
4	1. Check the signal circuit between ECM and ECT sensor for short circuit to the power supply circuit or ignition power supply circuit using breaker box or circuit tester. Refer to “Breaker box inspection procedure”. Important: If the ECT sensor circuit is shorted to the power supply circuit, the sensor may be broken. 2. If the trouble is detected, repair as required. Is the trouble detected?	—	Go to Step 11.	Go to Step 5.
5	1. Check for followings in the signal circuit between ECM and ECT sensor using breaker box or circuit tester. Refer to “Breaker box inspection procedure”. • Open circuit • High resistance 2. If the trouble is detected, repair or replace as required. Is the trouble detected?	—	Go to Step 11.	Go to Step 6.

Step	Action	Value	YES	NO
9	1. Check the version of ECM software. 2. Rewrite the software if version upgraded is necessary. Note: EGR valve position learning is required after replacing or rewriting the ECM. Refer to “Engine Control System, Engine control module (ECM), Installation of ECM” in this section for learning of EGR. Is the procedure completed?	—	Go to Step 11.	Go to Step 10.
10	Replace the ECM. Note: EGR valve position learning is required after replacing or rewriting the ECM. Refer to “Engine Control System, Engine control module (ECM), Installation of ECM” in this section for learning of EGR. Is the procedure completed?	—	Go to Step 11.	—
11	Check the Error Code again. 1. Connect all the harnesses. 2. Clear the Error Code. Refer to “How to clear diagnosis trouble code (Error Code)” of “Procedure of trouble diagnosis” in this section for how to clear Error Codes. 3. Turn the key switch to “OFF” for more than 10 seconds. 4. Test run with the “Preconditions when Error Code is set”. 5. Check the Error Code. Is Error Code 0183 detected?	—	Go to Step 2.	Go to Step 12.
12	Check if other Error Code is detected. Is other Error Code detected?	—	Go to each Error Code diagnosis.	Verify repair.

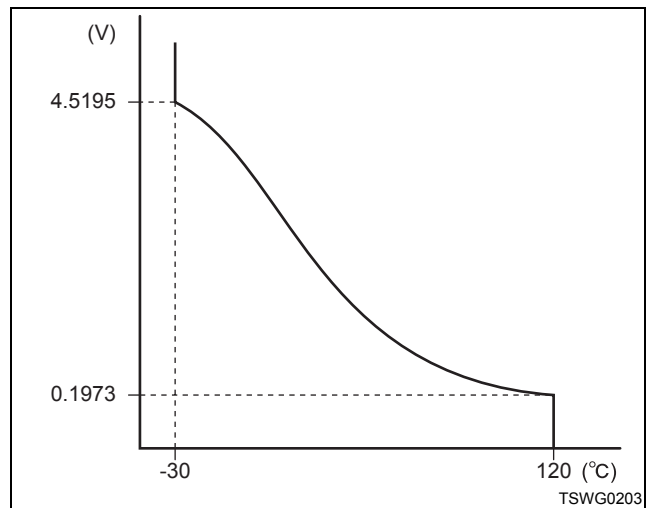
About FT sensor



- 1. GND
- 2. Signal

Characteristics of FT sensor

The output voltage of FT sensor changes according to the fuel temperature. It judges as it is more than the threshold value if the value of -30°C or 120°C is not changed.



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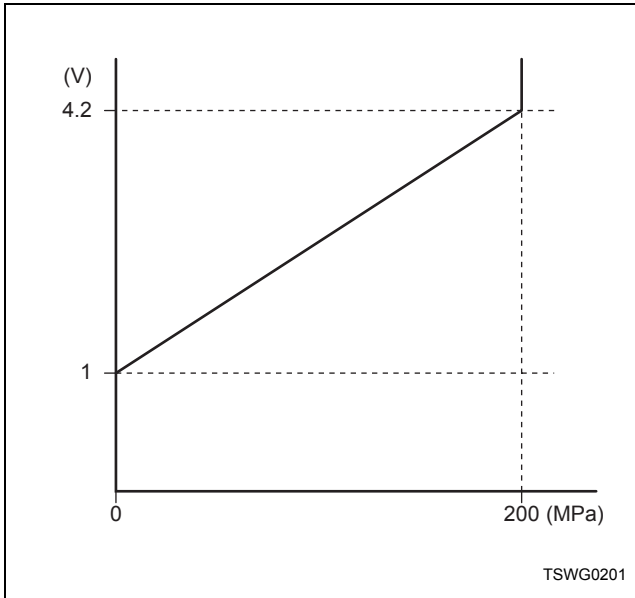
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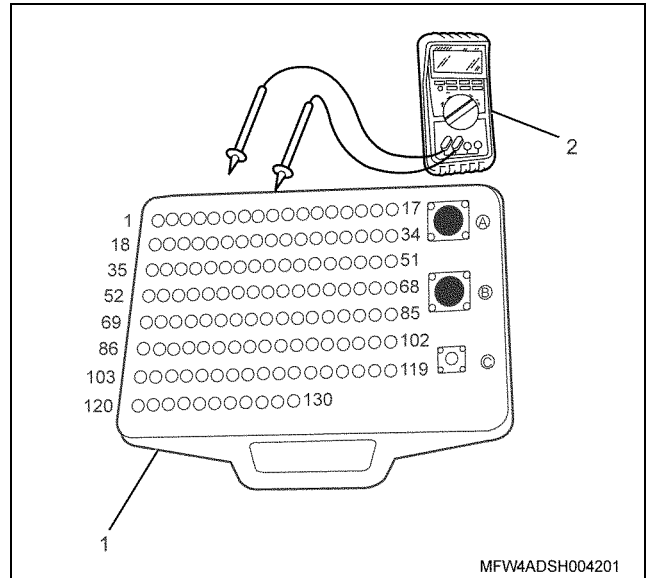
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Characteristics of common rail pressure sensor



Breaker box inspection procedure

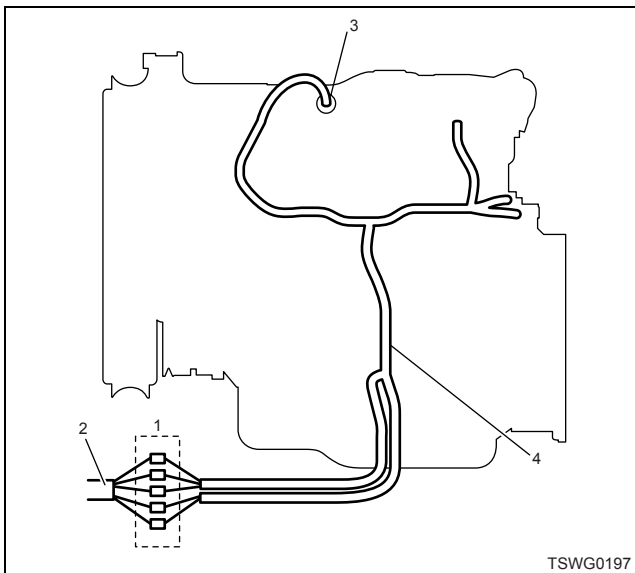
Perform the inspection in the following procedure if there is such an instruction to use breaker box in the step. After inspection, return to the diagnostic step.



1. Breaker box
2. Circuit tester

Step	Item to be checked	Inspection method	Measuring condition	Terminal No.	Normal value	Abnormal value
3	Short circuit to power supply circuit	Voltage measurement	Disconnect the sensor connector. Key switch "ON"	82 - Ground 90 - Ground	0V	18V or more
4	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	10MΩ or more
5	Open circuit/high resistance	Resistance measurement	Disconnect the sensor connector. Key switch "OFF"	101 - Sensor connector ground terminal	100Ω or less	10MΩ or more

On-board check of sensors



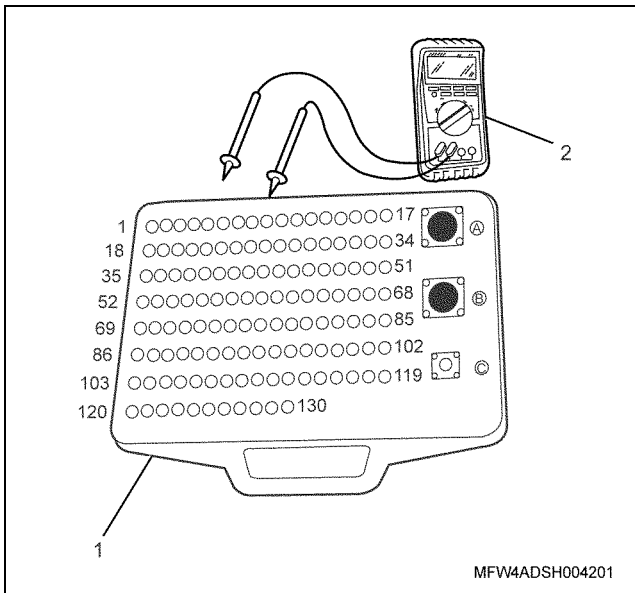
1. Coupling connector between engine — the machine
2. Main harness
3. Sensor connector

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.

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.

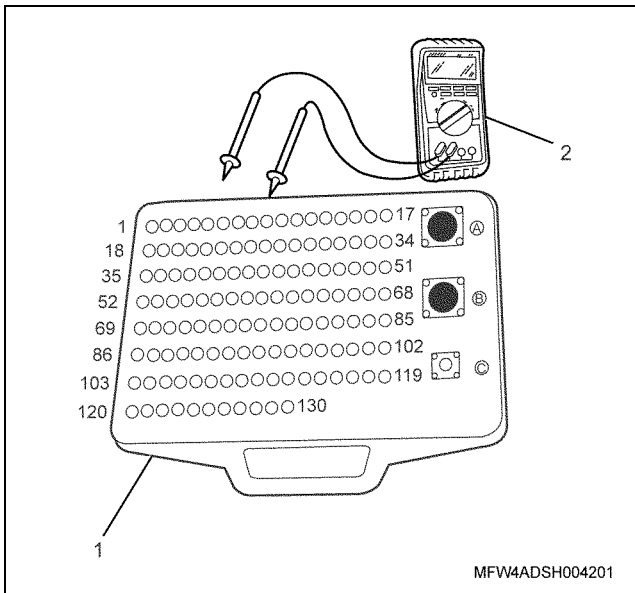


- 1. Breaker box
- 2. Circuit tester

Step	Item to be checked	Inspection method	Measuring condition	Terminal No.	Normal value	Abnormal value
4	Open circuit/high resistance	Resistance measurement	Remove the coupling connector. Key switch "OFF"	114 - Coupling connector (H-94) No. 7 terminal	100Ω or less	10MΩ or more

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.

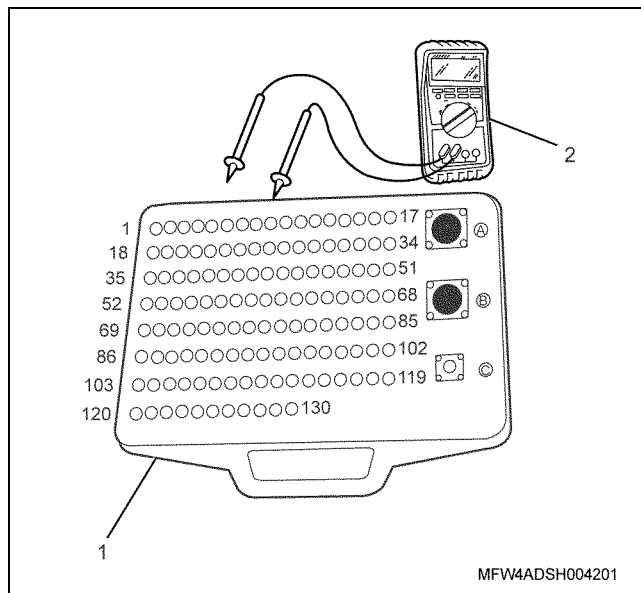


- 1. Breaker box
- 2. Circuit tester

Step	Item to be checked	Inspection method	Measuring condition	Terminal No.	Normal value	Abnormal value
4	Open circuit/high resistance	Resistance measurement	Remove the coupling connector. Key switch "OFF"	115 - Coupling connector (H-95) No. 2 terminal	100Ω or less	10MΩ or more

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.



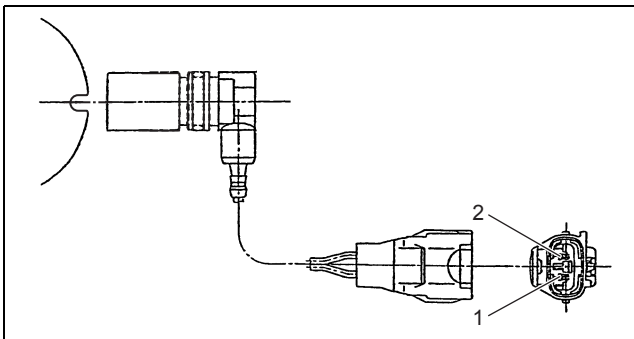
- 1. Breaker box
- 2. Circuit tester

Step	Item to be checked	Inspection method	Measuring condition	Terminal No.	Normal value	Abnormal value
4	Open circuit/high resistance	Resistance measurement	Remove the coupling connector. Key switch "OFF"	118 - Coupling connector (H-95) No. 6 terminal	100Ω or less	10MΩ or more

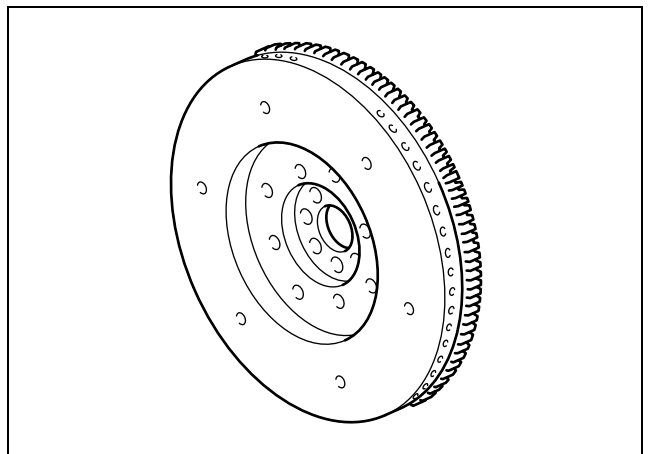
Step	Action	Value	YES	NO
8	<p>1. Check the version of ECM software. 2. Rewrite the software if version upgraded is necessary.</p> <p>Note: EGR valve position learning is required after replacing or rewriting the ECM. Refer to “Engine Control System, Engine control module (ECM), Installation of ECM” in this section for learning of EGR.</p> <p>Is the procedure completed?</p>	—	Go to Step 10.	Go to Step 9.
9	<p>Replace the ECM.</p> <p>Note: EGR valve position learning is required after replacing or rewriting the ECM. Refer to “Engine Control System, Engine control module (ECM), Installation of ECM” in this section for learning of EGR.</p> <p>Is the procedure completed?</p>	—	Go to Step 10.	—
10	<p>Check the Error Code again.</p> <p>1. Connect all the harnesses. 2. Clear the Error Code. Refer to “How to clear diagnosis trouble code (Error Code)” of “Procedure of trouble diagnosis” in this section for how to clear Error Codes.</p> <p>3. Turn the key switch to “OFF” for more than 10 seconds. 4. Test run with the “Preconditions when Error Code is set”. 5. Check the Error Code.</p> <p>Is Error Code 0238 detected?</p>	—	Go to Step 2.	Go to Step 11.
11	<p>Check if other Error Code is detected.</p> <p>Is other Error Code detected?</p>	—	Go to each Error Code diagnosis.	Verify repair.
12	<p>1. Start the engine. 2. Check the display of boost pressure sensor.</p> <p>Does the display of “Boost pressure sensor” show error value?</p>	508kPa (Displayed error value)	Go to Step 13.	Go to “Diagnostic aid”.
13	<p>Check for installation condition of the boost pressure sensor connector, ECM connector and coupling connector.</p> <p>1. Check for play or looseness in the connection. 2. If the trouble is detected, repair as required.</p> <p>Is the trouble detected?</p>	—	Go to Step 10.	Go to Step 14.

Step	Action	Value	YES	NO
9	Is EMPS available?	—	Go to Step 10.	Go to Step 11.
10	<ol style="list-style-type: none"> 1. Check the version of ECM software. 2. Rewrite the software if version upgraded is necessary. <p>Note: EGR valve position learning is required after replacing or rewriting the ECM. Refer to “Engine Control System, Engine control module (ECM), Installation of ECM” in this section for learning of EGR.</p> Is the procedure completed?	—	Go to Step 12.	Go to Step 11.
11	Replace the ECM. <p>Note: EGR valve position learning is required after replacing or rewriting the ECM. Refer to “Engine Control System, Engine control module (ECM), Installation of ECM” in this section for learning of EGR.</p> Is the procedure completed?	—	Go to Step 12.	—
12	Check the Error Code again. <ol style="list-style-type: none"> 1. Connect all the harnesses. 2. Clear the Error Code. Refer to “How to clear diagnosis trouble code (Error Code)” of “Procedure of trouble diagnosis” in this section for how to clear Error Codes. 3. Turn the key switch to “OFF” for more than 10 seconds. 4. Test run with the “Preconditions when Error Code is set”. 5. Check the Error Code. Is Error Code 0336 detected?	—	Go to Step 2.	Go to Step 13.
13	Check if other Error Code is detected. Is other Error Code detected?	—	Go to each Error Code diagnosis.	Verify repair.

About CKP sensor



1. GND
2. Power supply



About CKP sensor and CMP / G sensor signals

Step	Action	Value	YES	NO
7	<p>1. Check for followings in the signal circuit between ECM and G sensor using breaker box or circuit tester. Refer to "Breaker box inspection procedure".</p> <ul style="list-style-type: none"> • Open circuit • High resistance • Short circuit to power supply circuit or ignition power supply circuit <p>2. If the trouble is detected, repair or replace as required.</p> <p>Is the trouble detected?</p>	—	Go to Step 15.	Go to Step 8.
8	<p>1. Check for followings in the shield circuit between ECM and G sensor using breaker box or circuit tester. Refer to "Breaker box inspection procedure".</p> <ul style="list-style-type: none"> • Open circuit • High resistance • Short circuit to power supply circuit or ignition power supply circuit <p>2. If the trouble is detected, repair or replace as required.</p> <p>Is the trouble detected?</p>	—	Go to Step 15.	Go to Step 10.
9	<p>Replace the G sensor.</p> <p>Is the procedure completed?</p>	—	Go to Step 10.	—
10	<p>1. Visually check the camshaft gear for fault.</p> <p>2. Check the alignment mark in the timing gear.</p> <p>3. If the trouble is detected, repair or replace it.</p> <p>Is the trouble detected?</p>	—	Go to Step 15.	Go to Step 11.
11	<p>Replace the supply pump.</p> <p>Note: For work procedure, refer to the Engine service manual.</p> <p>Is the procedure completed?</p>	—	Go to Step 14.	—
12	<p>Is EMPS available?</p>	—	Go to Step 13.	Go to Step 14.
13	<p>1. Check the version of ECM software.</p> <p>2. Rewrite the software if version upgraded is necessary.</p> <p>Note: EGR valve position learning is required after replacing or rewriting the ECM. Refer to "Engine Control System, Engine control module (ECM), Installation of ECM" in this section for learning of EGR.</p> <p>Is the procedure completed?</p>	—	Go to Step 15.	Go to Step 14.

- 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 EST 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	Check for error code 0341	—	Go to Step 2.	—
2	Check for installation condition of the G sensor. 1. Turn the key switch to "OFF". 2. Visually check the sensor for installation condition such as play or looseness. 3. If the trouble is detected, repair as required. Is the procedure completed?	—	Go to Step 3.	—
3	Check for installation condition of the G sensor, ECM and coupling connector. 1. Check for play or looseness in the connection. 2. If the trouble is detected, repair or replace as required. Is the procedure completed?	—	Go to Step 4.	—
4	Check the Error Code again. 1. Clear the Error Code. Refer to "How to clear diagnosis trouble code (Error Code)" of "Procedure of trouble diagnosis" in this section for how to clear Error Codes. 2. Turn the key switch to "OFF" for more than 10 seconds. 3. Start the engine, and test run with the "Preconditions when Error Code is set". 4. Check the Error Code. Is Error Code detected?	—	Go to Step 5.	Go to Step 11.
5	Remove the G sensor, and check the sensor tip for scratch or damage. Is the G sensor normal?	—	Go to Step 6.	Go to Step 8.
6	1. Turn the key switch to "OFF". 2. Remove the harness from the G sensor. 3. Connect the breaker box or Circuit tester between the G sensor terminals. Refer to "Breaker box inspection procedure". 4. Turn the key switch to "ON". Is the Circuit tester indication specified value?	0V	Go to Step 8.	Go to Step 7.
7	1. Check the G sensor circuit for short circuit to other signal circuit using breaker box or circuit tester. Refer to "Breaker box inspection procedure". 2. If the trouble is detected, repair or replace as required. Is the trouble detected?	—	Go to Step 14.	Go to Step 9.
8	Replace the G sensor. Is the procedure completed?	—	Go to Step 14.	—
9	1. Visually check the camshaft gear for fault. 2. Check the alignment mark in the timing gear. 3. If the trouble is detected, repair or replace it. Is the trouble detected?	—	Go to Step 14.	Go to Step 10.

Step	Action	Value	YES	NO
6	<p>Check the Error Code again.</p> <ol style="list-style-type: none"> 1. Connect all the harnesses. 2. Clear the Error Code. Refer to "How to clear diagnosis trouble code (Error Code)" of "Procedure of trouble diagnosis" in this section for how to clear Error Codes. 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. 5. Check the Error Code. <p>Is Error Code 0487 detected?</p>	—	Go to Step 7.	Go to Step 11.
7	Is EMPS available?	—	Go to Step 8.	Go to Step 9.
8	<ol style="list-style-type: none"> 1. Check the version of ECM software. 2. Rewrite the software if version upgraded is necessary. <p>Note: EGR valve position learning is required after replacing or rewriting the ECM. Refer to "Engine Control System, Engine control module (ECM), Installation of ECM" in this section for learning of EGR.</p> <p>Is the procedure completed?</p>	—	Go to Step 10.	Go to Step 9.
9	<p>Replace the ECM.</p> <p>Note: EGR valve position learning is required after replacing or rewriting the ECM. Refer to "Engine Control System, Engine control module (ECM), Installation of ECM" in this section for learning of EGR.</p> <p>Is the procedure completed?</p>	—	Go to Step 10.	—
10	<p>Check the Error Code again.</p> <ol style="list-style-type: none"> 1. Connect all the harnesses. 2. Clear the Error Code. Refer to "How to clear diagnosis trouble code (Error Code)" of "Procedure of trouble diagnosis" in this section for how to clear Error Codes. 3. Turn the key switch to "OFF" for more than 10 seconds. 4. Warm-up the engine until the engine coolant temperature exceeds 80°C. 5. Check the Error Code. <p>Is Error Code 0487 detected?</p>	—	Go to Step 2.	Go to Step 11.
11	<p>Check if other Error Code is detected.</p> <p>Is other Error Code detected?</p>	—	Go to each Error Code diagnosis.	Verify repair.

Step	Action	Value	YES	NO
8	<p>Check the Error Code again.</p> <ol style="list-style-type: none"> 1. Connect all the harnesses. 2. Clear the Error Code. Refer to "How to clear diagnosis trouble code (Error Code)" of "Procedure of trouble diagnosis" in this section for how to clear Error Codes. 3. Turn the key switch to "OFF" for more than 10 seconds. 4. Test run with the "Preconditions when Error Code is set". 5. Check the Error Code. <p>Is the Error Code 0522 detected?</p>	—	Go to Step 2.	Go to Step 9.
9	<p>Check for installation condition of the engine oil pressure sensor, ECM and coupling connector.</p> <ol style="list-style-type: none"> 1. Check for play or looseness in the connection. 2. If the trouble is detected, repair or replace as required. <p>Is the trouble detected?</p>	—	Go to Step 8.	Go to Step 10.
10	<ol style="list-style-type: none"> 1. Check for followings in the signal circuit between ECM and engine oil pressure sensor using breaker box or circuit tester. Refer to "Breaker box inspection procedure". <ul style="list-style-type: none"> • Short circuit to engine oil pressure sensor ground circuit • Short circuit to ground 2. If the trouble is detected, repair or replace as required. <p>Is the trouble detected?</p>	—	Go to Step 8.	Go to Step 4.

Error Code: 0606**CPU 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 Error Code when the CPU fault or Sub-CPU fault inside the ECM is detected.

Main trouble symptom

Output lowering

Preconditions when Error Code is set

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

Error Code set condition

- Sub-CPU detects main CPU fault in 10 msec after key switch ON.
- RUN-SUB pulse does not change for 20 msec or more.

Action taken when Error Code is set

- "ELEC. PROBLEM" is displayed.

Back-up mode

- L mode fixed
- Specified back-up value (depending on the machine manufacturer)
- SUB-CPU stops control
- Limited injection amount 1

Recovery from failure

- Recovery pattern 2.

Refer to "List of Error Code" and "About recovery from failure".

The conditions to clear the Error Code

- The error code is cleared from the current trouble when the condition is either repaired or disappeared.

Refer to "About recovery from failure"

Step	Action	Value	YES	NO
1	Check for error code 0606	—	Go to Step 2.	—
2	Check the Error Code again. 1. Clear the Error Code. Refer to "How to clear diagnosis trouble code (Error Code)" of "Procedure of trouble diagnosis" in this section for how to clear Error Codes. 2. Turn the key switch to "OFF" for more than 10 seconds. 3. Test run with the "Preconditions when Error Code is set". 4. Check the Error Code. Is Error Code 0606 detected?	—	Go to Step 3.	Go to "Diagnostic aid".
3	Is EMPS available?	—	Go to Step 4.	Go to Step 5.
4	1. Check the version of ECM software. 2. Rewrite the software if version upgraded is necessary. Note: EGR valve position learning is required after replacing or rewriting the ECM. Refer to "Engine Control System, Engine control module (ECM), Installation of ECM" in this section for learning of EGR. Is the procedure completed?	—	Go to Step 6.	Go to Step 5.

Back-up mode

- Limited injection amount 3 (multi-injection stopped)
Target RP upper limit (80MPa)

Recovery from failure

- Recovery pattern 1.

Refer to “List of Error Code” and “About recovery from failure”.

The conditions to clear the Error Code

- The error code is cleared from the current trouble when the condition is either repaired or disappeared.

Refer to “About recovery from failure”

Diagnostic aid

Followings are suspected as the cause.

- Injector internal trouble
- Supply pump internal trouble

- Fuel system pipe fault (fuel leakage, clogging, crush, etc.)
- Fuel filter fault (clogging)
- Fuel tank fault (clogging)
- Pressure limiter trouble (operation under specified pressure, degradation of sealability)
- ECM trouble
- Common rail pressure sensor trouble

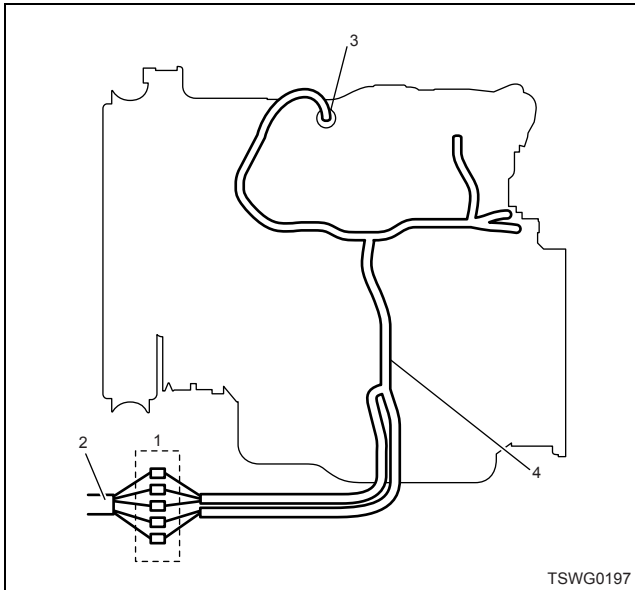
Test description

Numbers below indicate step numbers in the chart.

5. When rise of fuel level or diesel fuel odor is confirmed, fuel leakage in the injector portion may be the cause of the Error Code detection.

9. 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	Check for error code 1093	—	Go to Step 2.	—
2	Check the fuel system in the following procedure. 1. Check the high pressure pipe and low pressure pipe for looseness in the connection (fuel leakage), crush or clogging. Check the clogging in the following procedure. • Fuel filter (main fuel filter, pre-fuel filter, gauze filter) • Fuel tank (pump strainer) • Fuel system pipe 2. Check the fuel pipe, fuel filter, and inside of the fuel tank for freeze or waxing. (at cold temperature) 3. Check the feed pipe inside the fuel tank for clogging of foreign matter. Is the fuel system normal?	—	Go to Step 3.	Go to Step 5.
3	Check for rise of fuel level in the oil level gauge or light oil odor. Is the trouble detected?	—	Go to Step 4.	Go to Step 5.
4	Check the connection of the fuel pipe in each injector, and replace the injector if oil leakage is confirmed. Note: For work procedure, refer to the Engine service manual. Is the procedure completed?	—	Go to Step 13.	—
5	Check the injector. 1. Clear the Error Code. 2. Enforce the injector inspection using thermo gun. Is there any cylinder of which engine exhaust gas temperature was low?	—	Go to Step 6.	Go to Step 7.

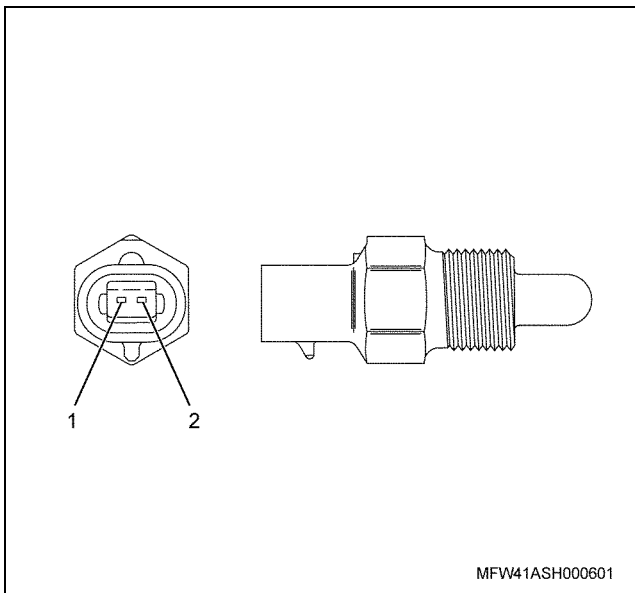
On-board check of sensors

1. Coupling connector between engine — the machine
2. Main 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
14	1. Check for followings in the ground circuit between ECM and boost temperature sensor, using breaker box or circuit tester. Refer to "Breaker box inspection procedure". <ul style="list-style-type: none"> • Open circuit • High resistance 2. If the trouble is detected, repair as required.	—	Go to Step 10.	Go to Step 6.
	Is the trouble detected?			

About boost temperature sensor



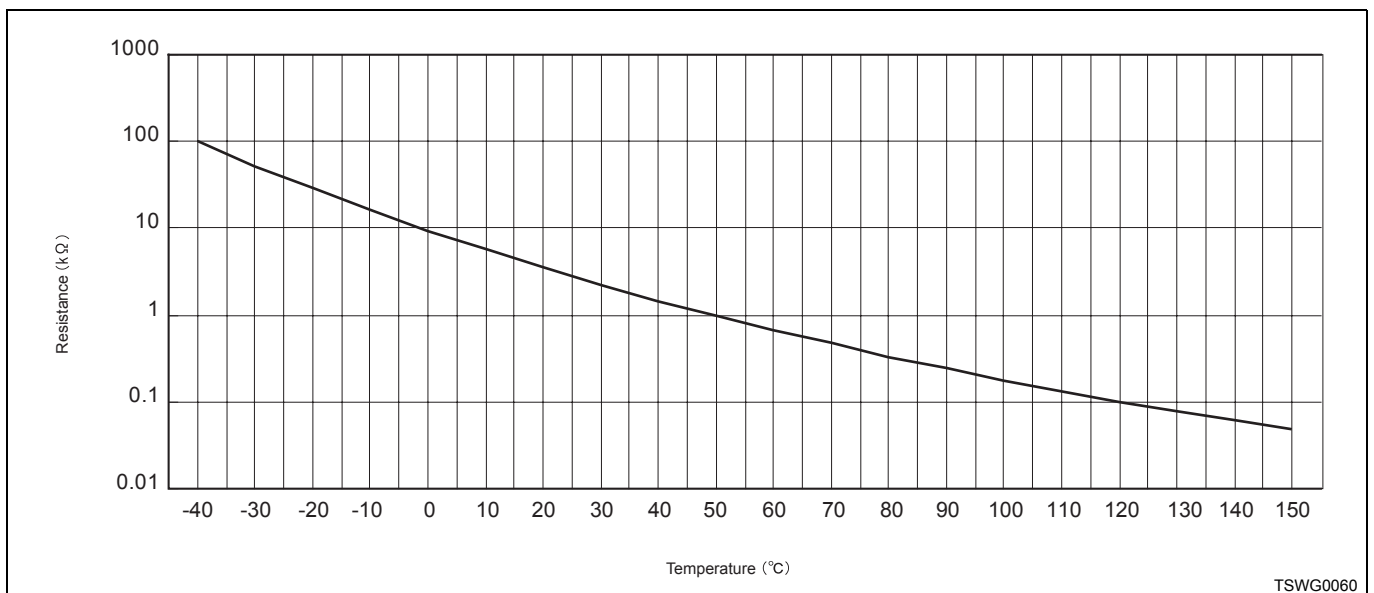
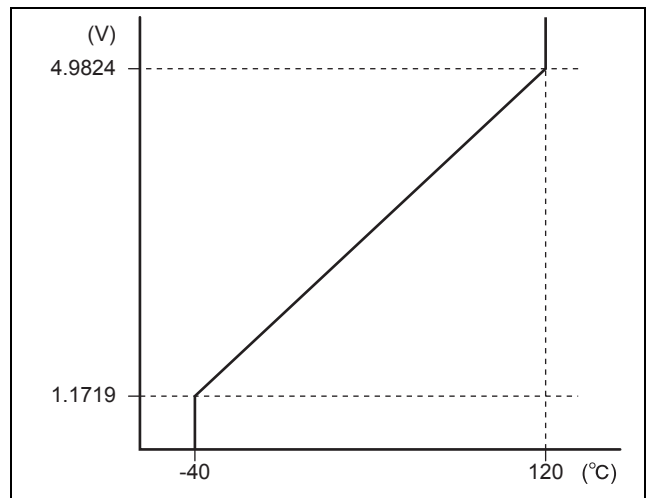
- 1. Signal
- 2. GND

MFW41ASH000601

Characteristics of boost temperature sensor

The output voltage of boost temperature sensor changes according to the boost temperature. The Service and support 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 or 120°C is not changed.

When error occurs, error value (214°C) is displayed.

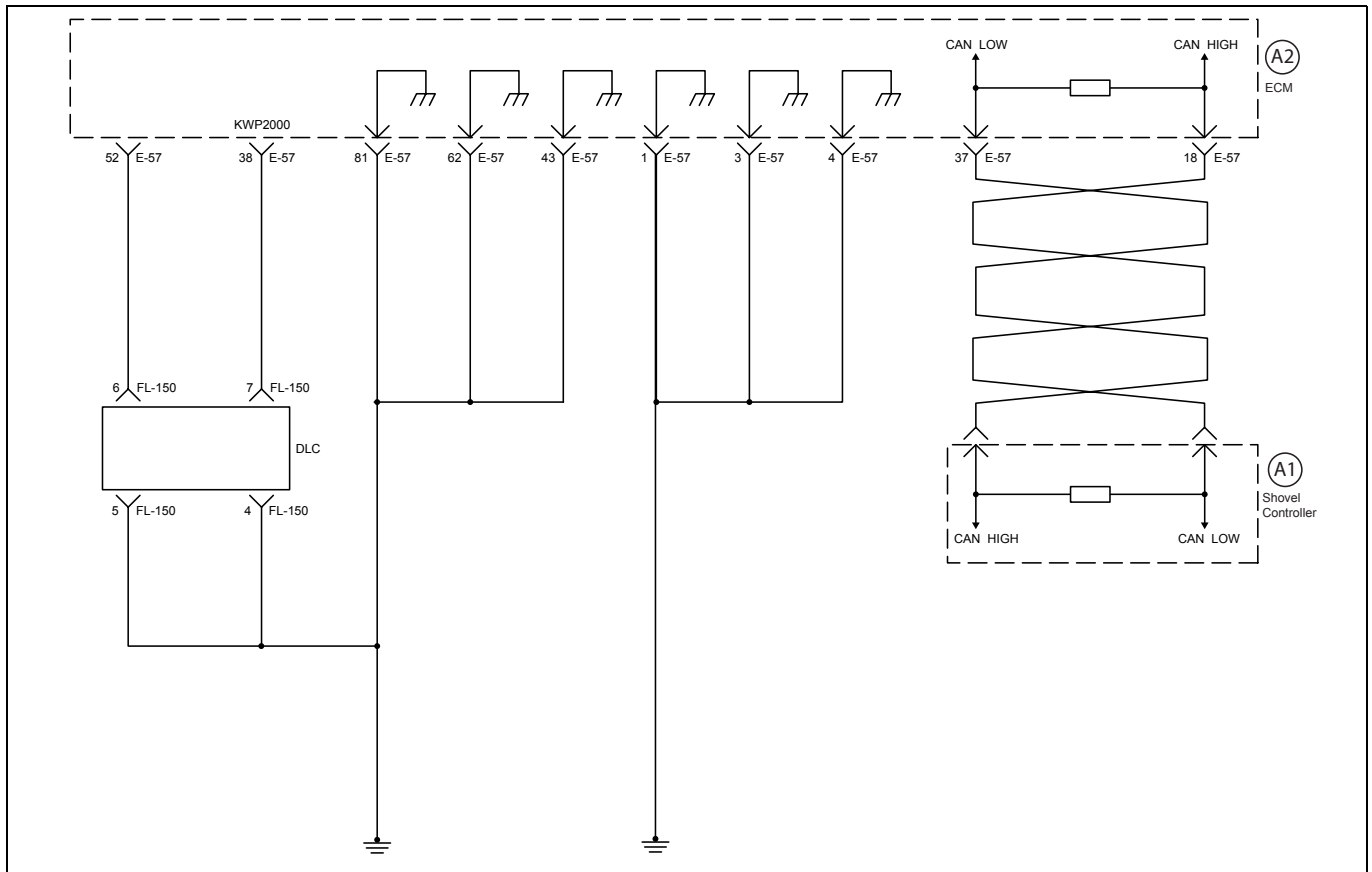


TSWG0060

Step	Action	Value	YES	NO
13	<ol style="list-style-type: none"> 1. Remove the injector harnesses from the injectors of No. 1 cylinder, No. 2 cylinder, and No. 3 cylinder. 2. Measure the resistance between each injector terminal and the ground. <p>Is the resistance more than the specified value?</p>	10MΩ	Go to Step 14.	Go to Step 23.
14	<ol style="list-style-type: none"> 1. Turn the key switch to "OFF". 2. Remove the injector-side harness connector from the coupling connector (H-94). 3. Connect the Circuit tester between the No. 1 cylinder injector drive circuit (H94 female-side No. 2) and the ground. 4. Turn the key switch to "ON". <p>Is the Circuit tester indication specified value?</p>	0V	Go to Step 18.	Go to Step 15.
15	<ol style="list-style-type: none"> 1. Turn the key switch to "OFF". 2. Remove the injector-side harness connector from the coupling connector (H-94). 3. Connect the Circuit tester between the No. 2 cylinder injector drive circuit (H94 female-side No.7) and the ground. 4. Turn the key switch to "ON". <p>Is the Circuit tester indication more than the specified value?</p>	0V	Go to Step 19.	Go to Step 16.
16	<ol style="list-style-type: none"> 1. Turn the key switch to "OFF". 2. Remove the injector-side harness connector from the coupling connector (H-94). 3. Connect the Circuit tester between the No. 3 cylinder injector drive circuit (H94 female-side No.6) and the ground. 4. Turn the key switch to "ON". <p>Is the Circuit tester indication more than the specified value?</p>	0V	Go to Step 20.	Go to Step 17.
17	<ol style="list-style-type: none"> 1. Turn the key switch to "OFF". 2. Remove the injector-side harness connector from the coupling connector (H-94). 3. Connect the Circuit tester between the injector power supply 1 circuit (H94 female-side No. 3) and the ground. 4. Turn the key switch to "ON". <p>Is the Circuit tester indication less than the specified value?</p>	7.0V	Go to Step 22.	Go to Step 21.
18	<ol style="list-style-type: none"> 1. Check the No. 1 cylinder injector drive circuit between ECM and coupling connector (H-94) for short circuit to the power supply circuit or ignition power supply circuit using breaker box or circuit tester. Refer to "Breaker box inspection procedure". 2. If the trouble is detected, repair as required. <p>Is the trouble detected?</p>	—	Go to Step 27.	Go to Step 24.

Step	Item to be checked	Inspection method	Measuring condition	Terminal No.	Normal value	Abnormal value
11	Short circuit to ground	Resistance measurement	Remove the ECM-side harness connector from the coupling connector. Key switch "OFF"	118 - Ground	10M Ω or more	100 Ω or less
18	Short circuit to power supply circuit	Voltage measurement	Remove the ECM-side harness connector from the coupling connector. Key switch "OFF"	115 - Ground	0V	18V or more
19	Short circuit to power supply circuit	Voltage measurement	Remove the ECM-side harness connector from the coupling connector. Key switch "OFF"	120 - Ground	0V	18V or more
20	Short circuit to power supply circuit	Voltage measurement	Remove the ECM-side harness connector from the coupling connector. Key switch "OFF"	118 - Ground	0V	18V or more
21	Short circuit to power supply circuit	Voltage measurement	Remove the ECM-side harness connector from the coupling connector. Key switch "OFF"	116 - Ground	0V	18V or more

Step	Action	Value	YES	NO
9	Check the Error Code again. 1. Connect all the harnesses. 2. Clear the Error Code. Refer to "How to clear diagnosis trouble code (Error Code)" of "Procedure of trouble diagnosis" in this section for how to clear Error Codes. 3. Turn the key switch to "OFF" for more than 10 seconds. 4. Test run with the "Preconditions when Error Code is set". 5. Check the Error Code. Is Error Code 1632 detected?	—	Go to Step 2.	Go to Step 10.
10	Check if other Error Code is detected. Is other Error Code detected?	—	Go to each Error Code diagnosis.	Verify repair.

Error Code: 2104**CAN Bus fault****Description of circuit**

The ECM communicates with the Shovel controller through CAN communication circuit. The ECM data outputs through the CAN-High circuit, and other ECU data inputs through the CAN-Low circuit. The CAN communication performs at a constant speed without interruption, and the number of data outputs and inputs must always be the same.

The ECM sets the Error Code when the fault is detected for the CAN communication.

Main trouble symptom

Vary depending on setting.

Error Code set condition

- Revolution command message of CAN communication is disrupted for 1 second or more.

Preconditions when Error Code is set

- Key switch input voltage is 12V (20V for 6HK1) or more.

Action taken when Error Code is set

- "ELEC. PROBLEM" is displayed.

Back-up mode

- Engine RPM goes down to 1350 rpm.

Recovery from failure

- Recovery pattern 2.

Refer to "List of Error Code" and "About recovery from failure".

The conditions to clear the Error Code

- The error code is cleared from the current trouble when the condition is either repaired or disappeared.

Refer to "About recovery from failure"

Test description

Numbers below indicate step numbers in the chart.

2. If no Error Code is detected, intermittent trouble is suspected. Identify the cause by referring to "Diagnostic aid".

5. Measure at the harness connector-side.

6. Measure at the TCM harness connector-side.

Step	Action	Value	YES	NO
1	Check for error code 2104	—	Go to Step 2.	—

Step	Action	Value	YES	NO
5	<p>Check the crank speed. Check if the crank speed is more than the necessary speed to start the engine (first combustion). Is the crank speed more than specified value?</p>	80 rpm	Go to Step 7.	Go to Step 6.
6	<p>Check the starting system. Is the procedure completed?</p>	—	Go to Step 7.	Go to "Starting system check".
7	<p>Check the fuel system in the following procedure.</p> <ol style="list-style-type: none"> Check the high pressure pipe and low pressure pipe for looseness in the connection (fuel leakage), crush or clogging. Check the clogging in the following procedure. <ul style="list-style-type: none"> Fuel filter (main fuel filter, pre-fuel filter, gauze filter) Fuel tank (pump strainer) Fuel system pipe Check the fuel pipe, fuel filter, and inside of the fuel tank for freeze or waxing. (at cold temperature) <ul style="list-style-type: none"> If opaque frosty object is found in the filter part of the main filter, waxing may occur. replace the fuel. Check the feed pipe inside the fuel tank for clogging of foreign matter. Repair or replace the faulty part. <p>Is the procedure completed?</p>	—	Go to Step 8.	—
8	<p>Check the injector.</p> <ol style="list-style-type: none"> Clear the Error Code. Refer to "How to clear diagnosis trouble code (Error Code)" of "Procedure of trouble diagnosis" in this section for how to clear Error Codes. Start the engine. Use the thermo gun to measure the temperature. Refer to "How to use thermo gun" <p>Is there any cylinder of which the temperature change was small?</p>	—	Go to Step 9.	Go to Step 10.
9	<p>Replace the injector in the cylinder of which the temperature change was small.</p> <p>Note: For work procedure, refer to the Engine service manual.</p> <p>Is the procedure completed?</p>	—	Go to Step 10.	—
10	<p>Check the ACG. Check if the charge warning lamp turns on while engine is running. Does the charge warning operate??</p>	—	Go to Step 17.	Go to Step 11.
11	<p>Replace the ACG. Also, check the charge warning system, and repair or replace if faulty. Is the procedure completed?</p>	—	Go to Step 12.	—

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