Control System

4JJ1 Electronic Control Fuel Injection System (Common Rail Type)

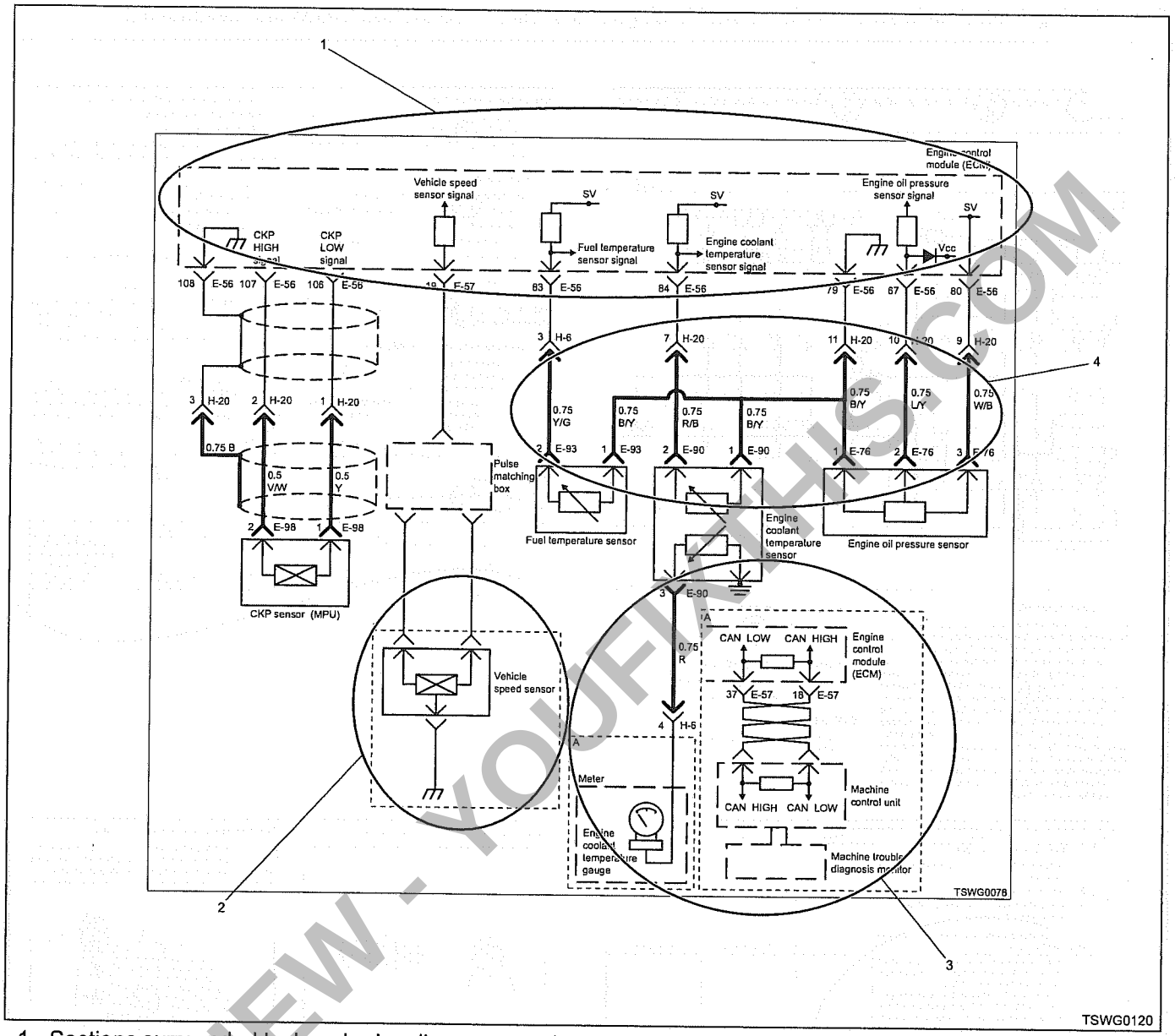
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About wiring diagrams



1. Sections surrounded by long broken lines are used to indicate the units, such as ECM.
2. Sections surrounded by dotted lines are used to classify or differentiate the specifications of machines. Confirmation of specifications is needed.
3. Sections surrounded by dotted lines and marked with a symbol ("A" in example) on the upper left are used to classify different wiring in the specifications of machines. Confirmation of specifications is needed.
4. Sections surrounded by heavy lines are used to differentiate engine harnesses from other harnesses. Heavy lines indicate engine harnesses, other lines indicate machine harnesses.

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Step	Action	Value	YES	NO
11	1. Check the following circuits for open circuit or high resistance. • Between key switch and starter cut relay • Between starter cut relay and starter relay • Between starter relay and ground • Between starter relay and starter 2. If the fault is detected, repair as required. Is the fault detected?	—	Go to Step 16.	Go to Step 12.
12	1. Inspect by referring to "Electrical system" in the service manual "Engine section". 2. If the trouble is detected, repair as required. Is the fault detected?	—	Go to Step 16.	Go to Step 13.
13	Is EMPS available?	—	Go to Step 14.	Go to Step 15.
14	1. Check the version of ECM software. Refer to the EMPS manual 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-54, "Installation of ECM, Engine control module (ECM), Engine Control System" in this section for learning of EGR. Is the procedure completed?	—	Go to Step 16.	Go to Step 15.
15	Replace the ECM. **Note:** EGR valve position learning is required after replacing or rewriting the ECM. Refer to 1E-54, "Installation of ECM, Engine control module (ECM), Engine Control System" in this section for learning of EGR. Is the procedure completed?	—	Go to Step 16.	—
16	Turn the key switch to "START". Does the starter operate?	—	Check the repair, and Go to 1E-96, "OBD system check, List of Function Checks".	Go to Step 1.
17	1. Check for the followings in the circuit between key switch and ECM using breaker box or DMM. Refer to 1E-114, "Breaker box inspection procedure, Starting circuit system check, List of Function Checks". • Open circuit • High resistance 2. If the fault is detected, repair as required. Is the fault detected?	—	Go to Step 13.	Go to Step 18.
18	1. Turn the key switch to "OFF". 2. Remove the starter cut relay. 3. Check for continuity between the starter cut relay switch-side terminals. Is the fault detected?	—	Go to Step 19.	Go to Step 20.

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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
P1631	55	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.	• DTC P1630 is not detected. • Battery voltage is between 16V — 32V	Key switch power supply voltage is 5.5V or more, or 4.5V or less.	Approx. 0.5 sec.	Accelerator opening angle is controlled to 0%. **Back-up:** **Same as accelerator sensor fault**	ON	*2
P1632	55	Voltage fault in 5-V power supply 2	Power supply wiring short to sensor, or breakage in element/circuit for power supply regulation inside ECM.	• DTC P1630 is not detected. • Battery voltage is between 16V — 32V	Key switch power supply voltage is 5.5V or more, or 4.5V or less.	Approx. 0.5 sec.	Due to back-up equivalent to 2,000 m (6,562 ft) • Black smoke emitted at high altitude **Back-up:** **Same as barometric pressure and intake air temperature sensor fault**	ON	*2
P1633	55	Voltage fault in 5-V power supply 3	Power supply wiring short to sensor, or breakage in element/circuit for power supply regulation inside ECM.	• DTC P1630 is not detected. • Battery voltage is between 16V — 32V	Key switch power supply voltage is 5.5V or more, or 4.5V or less.	Approx. 0.5 sec.	At normal temperature: Black smoke emission, greater engine combustion noise possible. During idling at low atmospheric temperatures: Rough idling, engine stall, white smoke emission possible. **Back-up:** **Same as coolant temperature, fuel temperature, and oil pressure sensor fault**	ON	*2
P1634	55	Voltage fault in 5-V power supply 4	Power supply wiring short to sensor, or breakage in element/circuit for power supply regulation inside ECM.	• DTC P1630 is not detected. • Battery voltage is between 16V — 32V	Key switch power supply voltage is 5.5V or more, or 4.5V or less.	Approx. 0.5 sec.	Black smoke emitted **Back-up:** **Same as boost pressure and boost temperature sensor fault**	ON	*2
P1635	55	Voltage fault in 5-V power supply 5	Power supply wiring short to sensor, or breakage in element/circuit for power supply regulation inside ECM.	• DTC P1630 is not detected. • Battery voltage is between 16V — 32V	Key switch power supply voltage is 5.5V or more, or 4.5V or less.	Approx. 0.5 sec.	Output weakening or engine stall is possible and exhaust gas is effected **Back-up:** **Same as rail pressure sensor fault and EGR position sensor fault**	ON	*2
U2104	84	CAN Bus fault	CAN communication fault	• Key switch input voltage is 20 V or more.	Bus-off is detected.	At 3 sec. continuously	• Operate at low idle speed. • CAN communication disconnects. **Back-up:** **Operate at low idle speed.**	ON	*3
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	• Operate at low idle speed. • CAN communication keeps on connectiong. **Back-up:** **Operate at low idle speed.**	ON	*3

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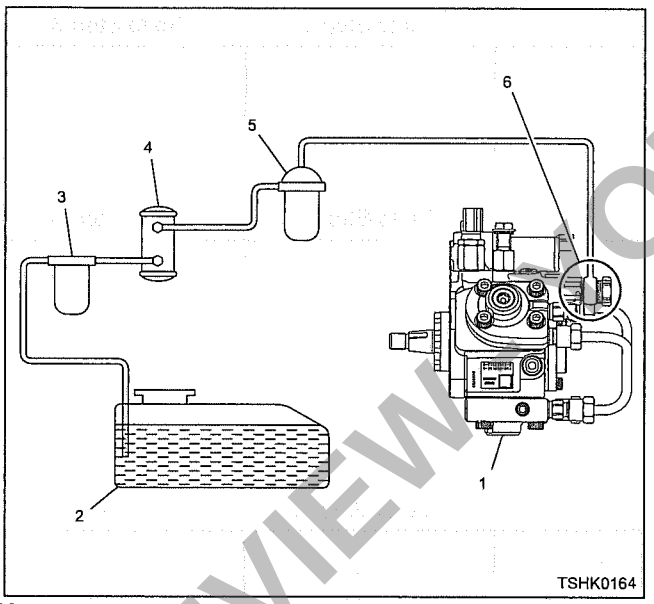
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Step	Action	Value	YES	NO
9	Let the air bleed from the fuel. **Note:** Refer to 1E-44, "Bleed air from fuel system, Description of function and operation for engine control (common rail) system, Engine Control System" for work procedure. Is the procedure completed?	—	Verify repair.	—

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 discharged, go to "4. Check for air mixed in fuel".
   - If no fuel is discharged, go to "5. Check the electromagnetic pump".



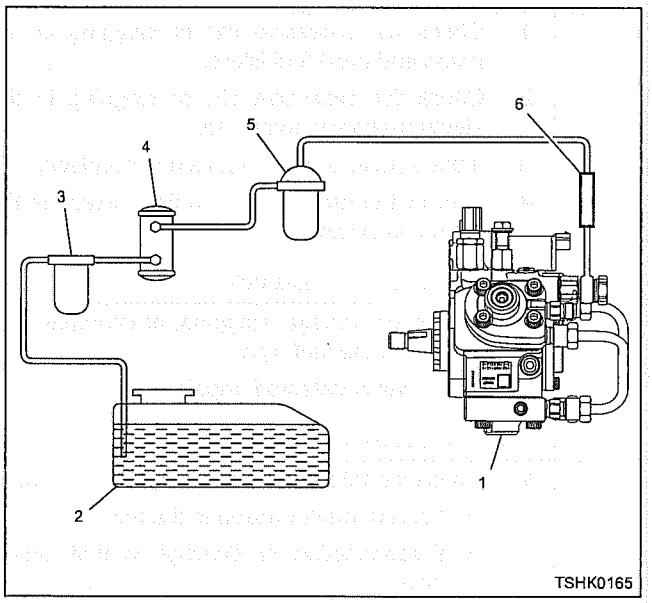
Name

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 SCV. If this does not correct the fault, replace the supply pump.

Note:

- Refer to 1E-56, "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.

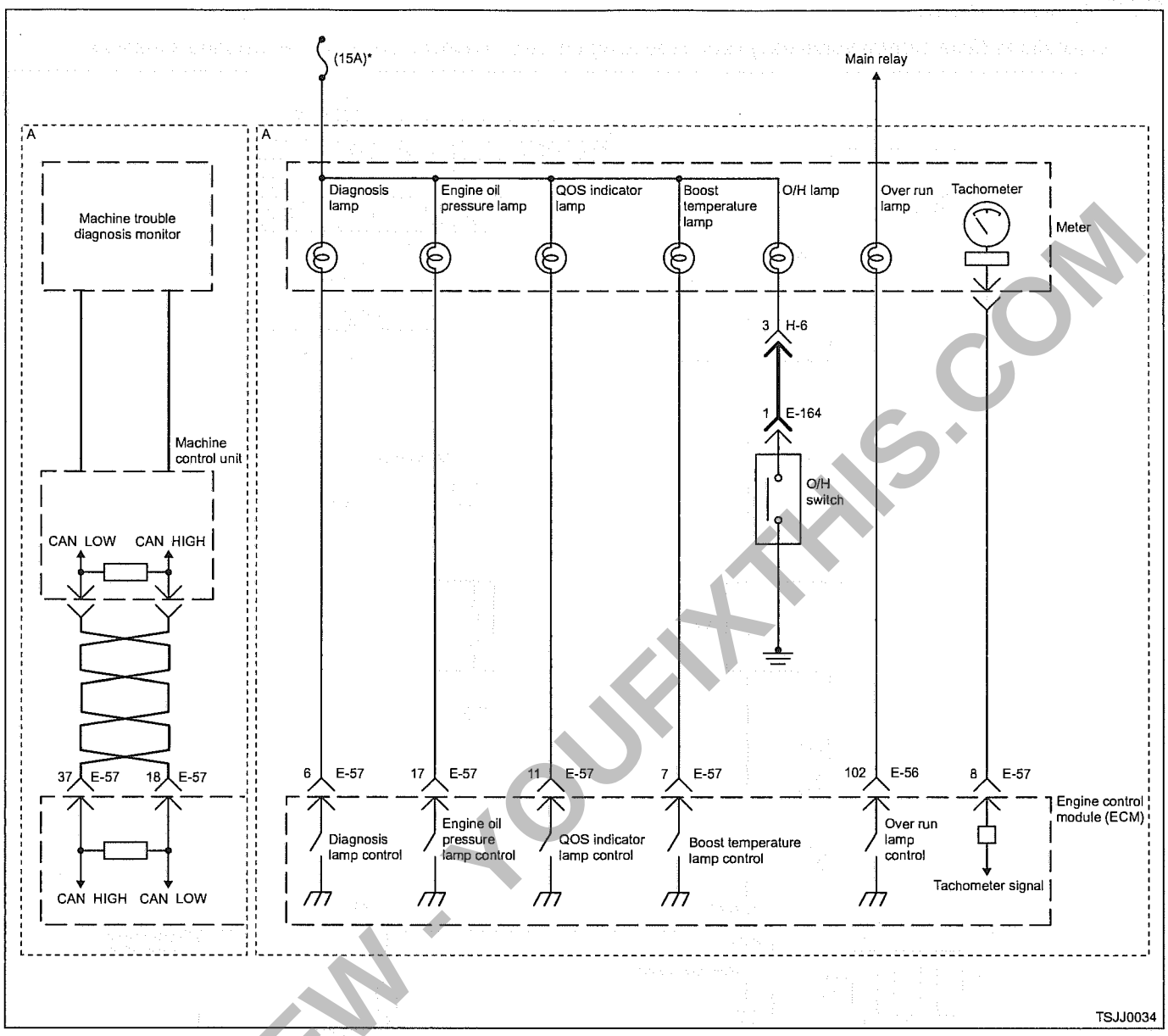


Name

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

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Note:
The QOS circuit is the same for both the starter ECM control specifications and the safety relay specifications.

Description of circuit

The QOS (Quick On Start) system consists of the ECM, glow relay, glow plug, and QOS indicator lamp. When the key switch is turned ON with low engine coolant temperatures, the ECM determines the glow time and operates the glow relay and QOS indicator lamp. After a certain time has elapsed, the ECM will turn the glow relay and QOS indicator lamp to "OFF".

Test description

Numbers below indicate step numbers in the chart.
7. The QOS indicator lamp turns on when the key switch is "ON" for lamp check, even if the QOS is not operating.
12. The QOS indicator lamp goes off within maximum 10 seconds.

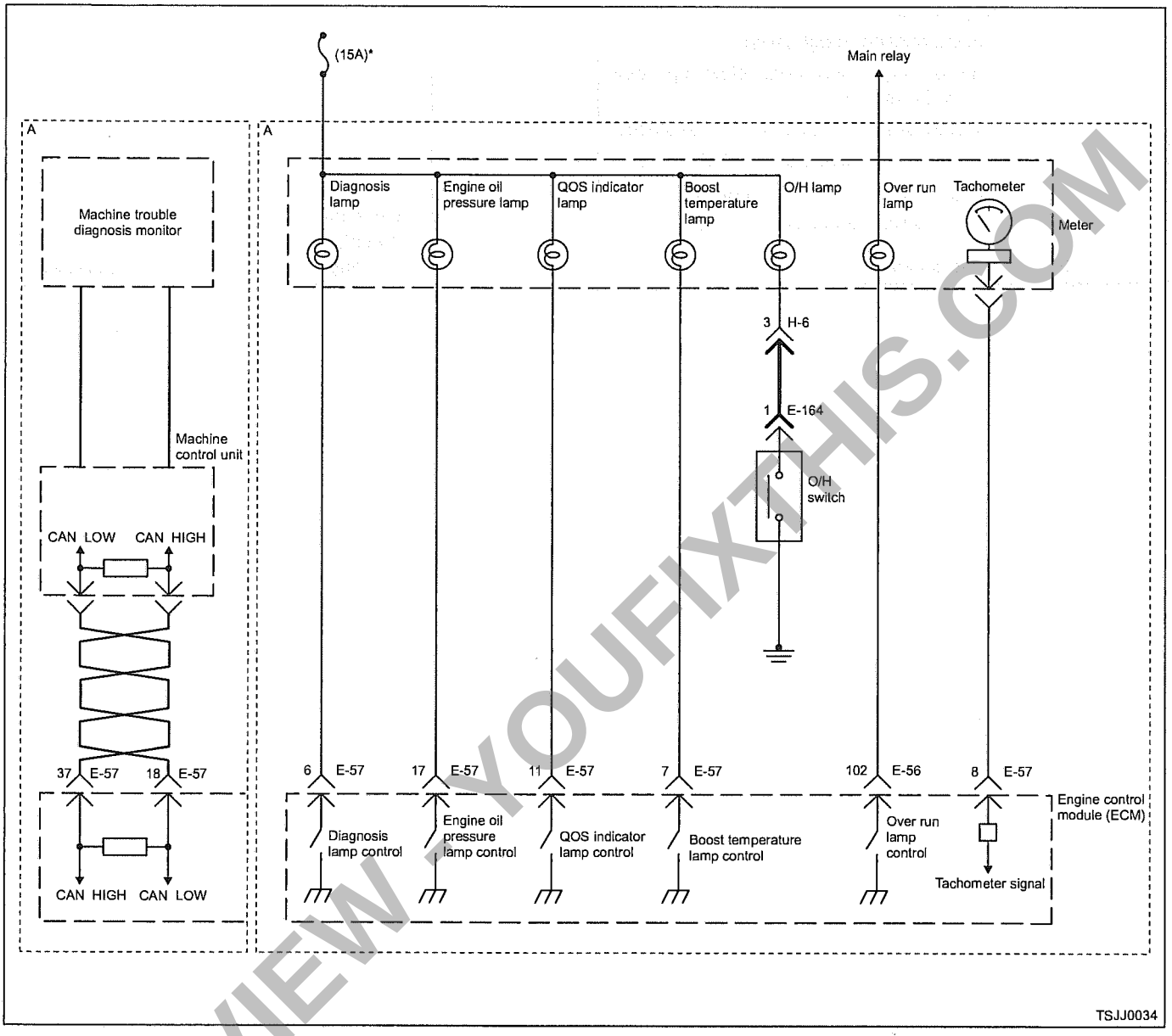
Step	Action	Value	YES	NO
1	Perform the OBD check. Is the procedure completed?	—	Go to Step 2.	Go to 1E-96, "OBD system check, List of Function Checks".

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Diagnosis lamp illumination circuit system check

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



Description of circuit

The power supply voltage is supplied to the diagnosis lamp via key switch, and the signal from ECM will turn the lamp on. The ECM turns the diagnosis lamp on during lamp check with the key switch "ON" and when DTC is detected. Also when the diagnosis connector is connected, it blinks the diagnosis lamp according to the DTC detected. A monitor circuit is provided inside the ECM to monitor the lamp operation.

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

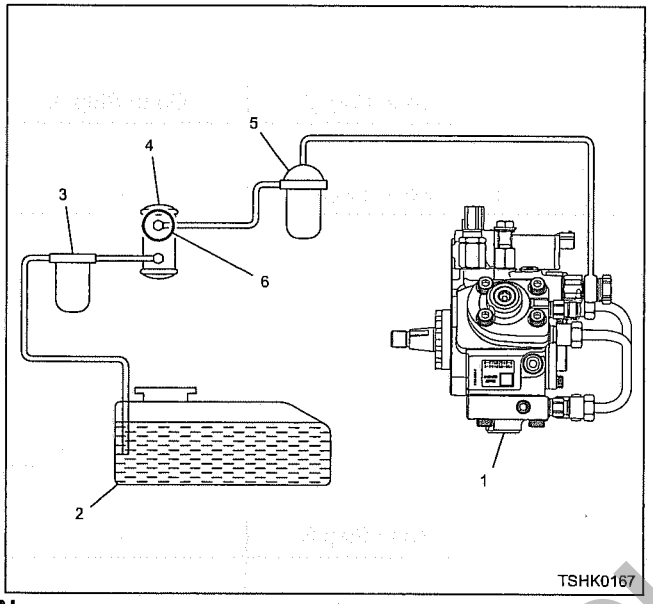
The following inspections are necessary to detect these causes.

- 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.

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5. Check the electromagnetic pump
   Disconnect the pipe from the outlet side of the electromagnetic pump, and activate the pump.
   - If fuel is discharged from the electromagnetic pump, check the lines of other than this pump for faults.
   - If no fuel is discharged from the electromagnetic pump, check the pump according to "Electromagnetic pump inspection procedure".

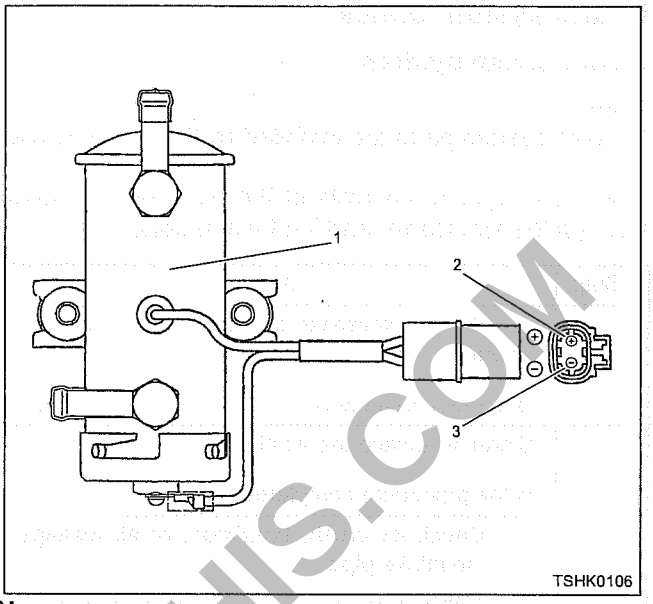


Name

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

Electromagnetic pump inspection procedure

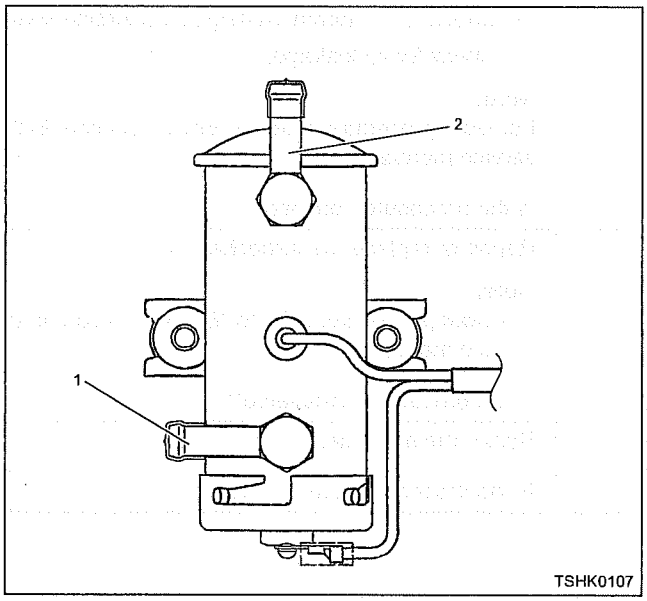
1. Turn the key switch to ON, and check for pulsation in the fuel hose.
   - It is normal if pulsation exists.
2. Disconnect the electromagnetic pump connector, and connect 24V power supply to the electromagnetic pump side to check if the pump operates.
   - If it operates properly, there may be open circuit, short circuit or poor contact in the machine-side harness. Repair the faulty part, and check again from Step 1.
   - If the electromagnetic pump does not operate, replace the pump.



Name

1. Electromagnetic pump
2. + terminal
3. - terminal

3. Blow air into the inlet of the electromagnetic pump with your mouth.
   - The internal seal may be stuck. Blow air to eliminate sticking.



Name

1. Fuel inlet port
2. Fuel outlet port

4. Install the removed parts, and check again from Step 1.

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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
P0201	271	Open circuit in injection nozzle #1 drive system	Open/short circuit in electrical wiring No. 1 cylinder injector	• Main relay power supply voltage is 18V or more. • 70 rpm or more • DTC P0611, P1261 or P0201 is not detected.	No injector 1 monitor input signal exists.	Approx. 2.5 sec.	Intensive engine vibration, rough idling, output lowering, blow up fault **Back-up:** **Injection for cylinder #1 stopped, EGR stopped**	ON	*1
P0202	272	Open circuit in injection nozzle #2 drive system	Open/short circuit in electrical wiring No. 2 cylinder injector	• Main relay power supply voltage is 18V or more. • 70 rpm or more • DTC P0612, P1262 or P0202 is not detected.	No injector 2 monitor input signal exists.	Approx. 2.5 sec.	Intensive engine vibration, rough idling, output lowering, blow up fault **Back-up:** **Injection for cylinder #2 stopped, EGR stopped**	ON	*1
P0203	273	Open circuit in injection nozzle #3 drive system	Open/short circuit in electrical wiring No. 3 cylinder injector	• Main relay power supply voltage is 18V or more. • 70 rpm or more • DTC P0612, P1262 or P0203 is not detected.	No injector 3 monitor input signal exists.	Approx. 2.5 sec.	Intensive engine vibration, rough idling, output lowering, blow up fault **Back-up:** **Injection for cylinder #3 stopped, EGR stopped**	ON	*1
P0204	274	Open circuit in injection nozzle #4 drive system	Open/short circuit in electrical wiring No. 4 cylinder injector	• Main relay power supply voltage is 18V or more. • 70 rpm or more • DTC P0611, P1261 or P0204 is not detected.	No injector 4 monitor input signal exists.	Approx. 2.5 sec.	Intensive engine vibration, rough idling, output lowering, blow up fault **Back-up:** **Injection for cylinder #4 stopped, EGR stopped**	ON	*1
P0219	543	Overrun	Engine speed abnormally high	• Key switch input voltage is 18V or more.	When engine speed exceeds the specified speed. 33t: 2,300 rpm 29t: 2,000 rpm	Approx. 0.5 sec.	Assuming a shovel will not blow more than 2,300 rpm. **Back-up:** **Limited injection amount 1** **Limitation is lifted if the speed decreases**	ON	*2
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. 2.5 sec.	Black smoke emitted **Back-up:** **Boost pressure default setting (200 kPa {29.0 psi})** **Boost pressure correction/EGR stopped**	ON	*2
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. 2.5 sec.	Black smoke emitted **Back-up:** **Boost pressure default setting (200 kPa {29.0 psi})** **Boost pressure correction/EGR stopped**	ON	*2

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Step	Action	Value	YES	NO
10	1. Clear the DTC. Refer to 1E-19, "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. Is the fault detected?	—	Go to Step 11.	Go to Step 4.
11	Check the DTC. Is DTC detected?	—	Go to the relevant diagnosis of DTC detected.	Check the repair, and Go to 1E-96, "OBD system check, List of Function Checks".
12	1. Check the SCVLO drive circuit between the ECM and the SCV. 2. If the trouble is detected, repair the circuit as required. Is the procedure completed?	—	Go to Step 13.	—
13	1. Check for following faults. • Engine mechanical timing is off. • Improper installation position of CKP sensor rotor • 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.	—

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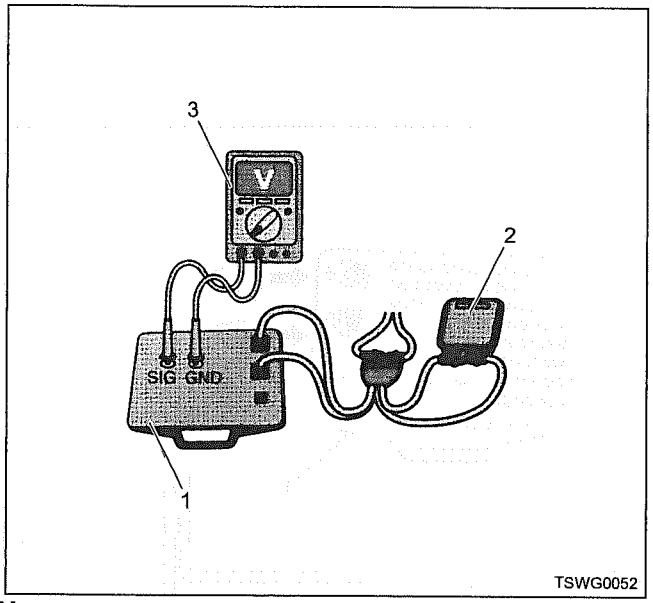
DTC: P0202 (Flash code 272) Open circuit in injection nozzle #2 drive system 1E-241
DTC: P0203 (Flash code 273) Open circuit in injection nozzle #3 drive system 1E-246
DTC: P0204 (Flash code 274) Open circuit in injection nozzle #4 drive system 1E-251
DTC: P0219 (Flash code 543) Overrun 1E-256
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DTC: P1278 (Flash code 24) Accelerator sensor 1 fault (high voltage fault)..... 1E-427
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Example of use for breaker box

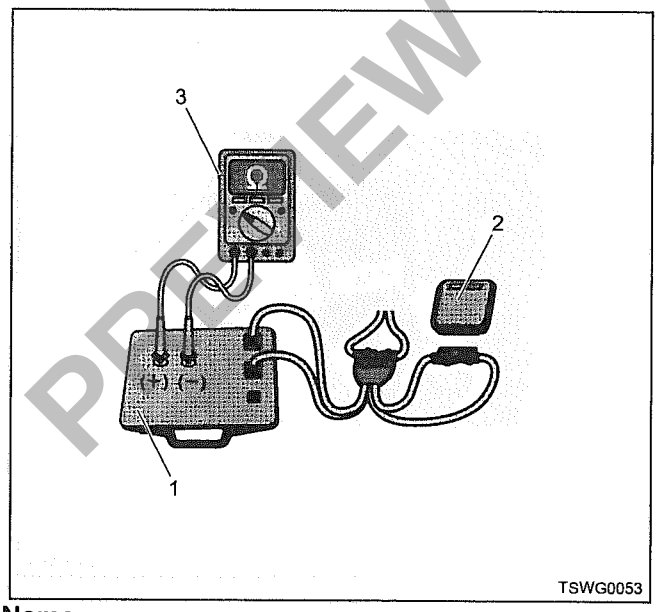
1. Inspection and measurement of voltage
   - Accelerator position sensor
   - Engine coolant temperature sensor
   - Intake air temperature sensor etc.



Name

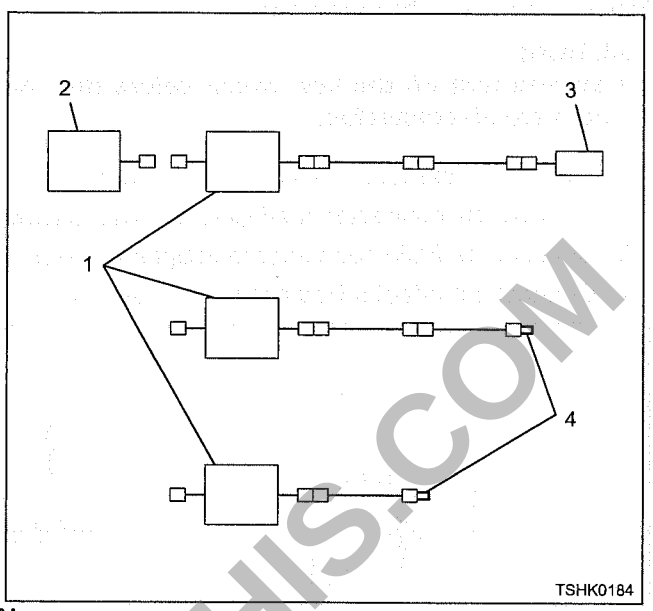
1. Breaker box
2. ECM
3. Digital multimeter

2. Inspection and measurement of resistance
   - Crankshaft position sensor
   - Camshaft position sensor
   - SCV etc.



Name

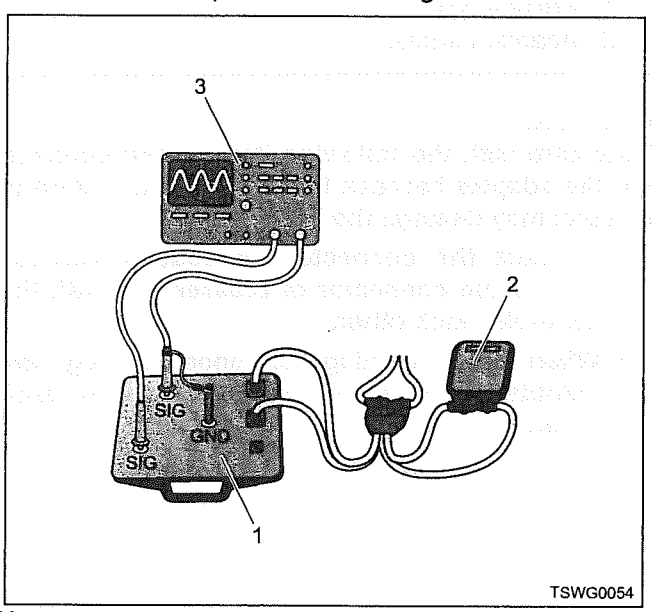
1. Breaker box
2. ECM
3. Digital multimeter



Name

1. Breaker box
2. ECM
3. Injector
4. Short to the terminal and measure two harnesses at the same time.

3. Inspection and measurement with oscilloscope
   - Vehicle speed sensor signal
   - Crankshaft position sensor signal
   - Camshaft position sensor signal etc.



Name

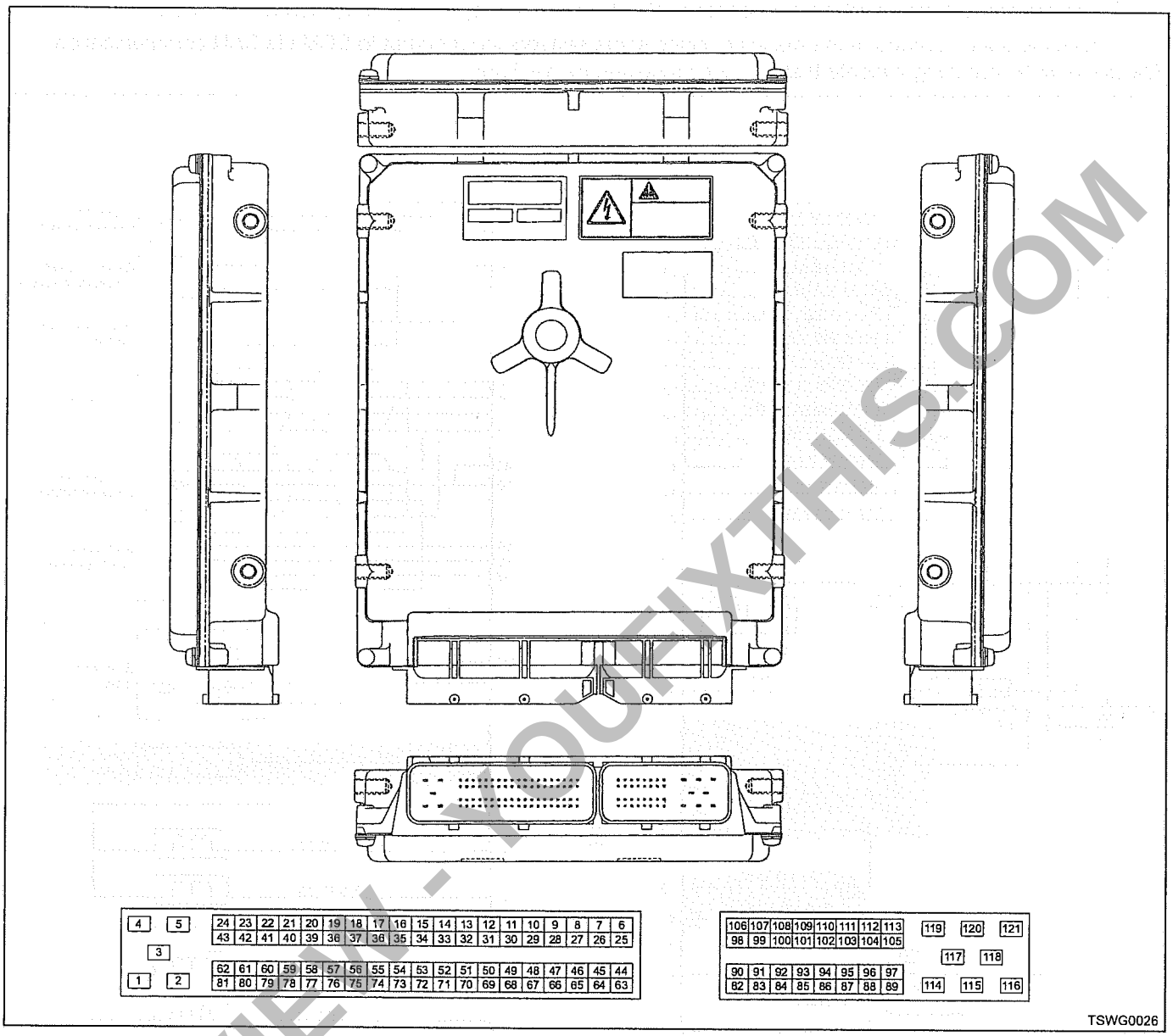
1. Breaker box
2. ECM
3. Oscilloscope

CAUTION:
During inspection and measurement, interference of measurement lead on breaker box or mistaking terminal to be measured may cause damage to ECM or sensors. Work with extreme care.

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Pin arrangement of engine control module (ECM)



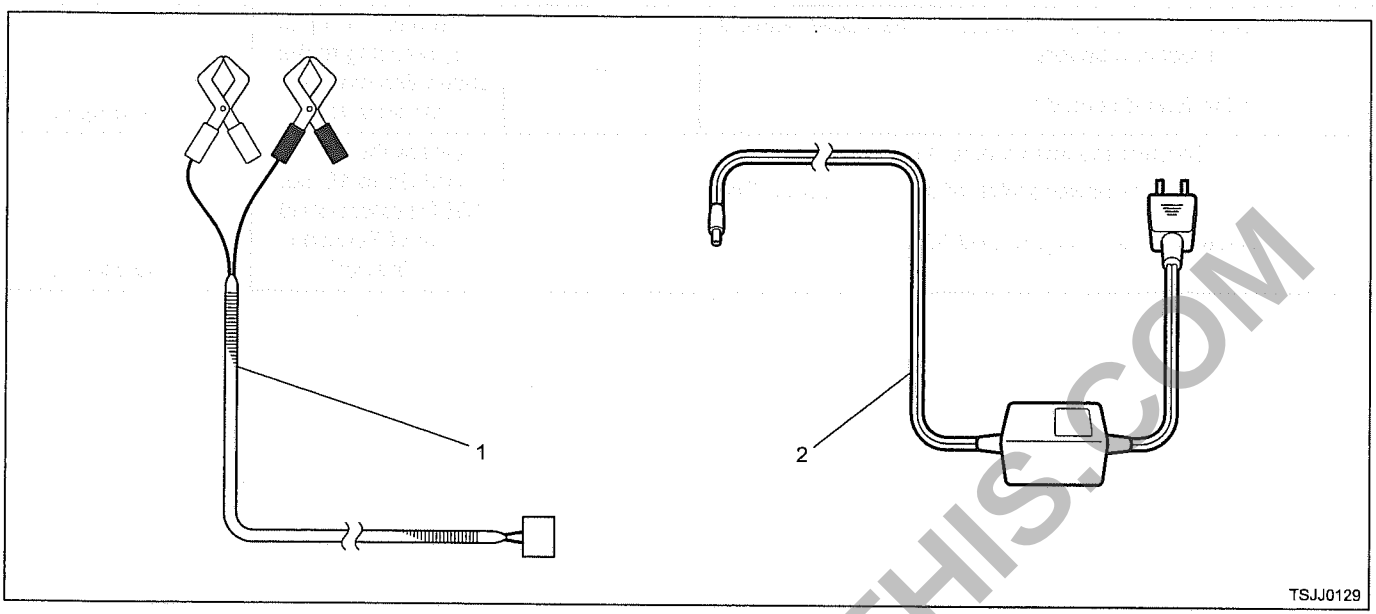
81-pin connector

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	—	—
7	OS-BOOSTL	Boost temperature sensor pilot lamp
8	—	—
9	—	—
10	OS-GLOWR	Glow relay
11	OS-GLOWL	QOS indicator lamp

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Scan tool power supply circuit system check (EMPSIII)



Name

1. Battery cable
2. Power socket cable (AC/DC adapter)

Description of circuit

The ECM and other ECUs communicate with the scan tool via data link connector (DLC). Power supply voltage for the scan tool is provided from the battery.

CAUTION:
Power supply voltage for the scan tool is the same as one for the machine's battery.

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

Important:
Before starting this diagnostic step, check if the scan tool operates properly on other machine.

Step	Action	Value	YES	NO
1	Check the voltage of battery on the machine using DMM. Is the voltage the specified value or more?	18V	Go to Step 2.	Charge or replace the battery.
2	Check for poor contact in the scan tool-side cable. Is the fault detected?	—	Go to Step 3.	Go to Step 4.
3	Correct the connection of the scan tool. Is the procedure completed?	—	Go to Step 4.	—

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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
P1261	158	Injection nozzle common 1 drive system fault	Open/short circuit in injector common 1-side electrical wiring, EDU output part fault	• Main relay power supply voltage is 18V or more. • 70 rpm or more • None of the following DTC sets are detected; DTC P0611, P1261 and P0201, P0204.	No injector 1 and 4 monitor input signal exists.	Approx. 2.5 sec.	Intensive engine vibration, rough idling, output lowering, blow up fault Engine stall is possible. **Back-up:** **Common 1 stop (#1, #4 cylinders stopped), EGR stopped**	ON	*1
P1262	159	Injection nozzle common 2 drive system fault	Open/short circuit in injector common 2-side electrical wiring, EDU output part fault	• 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 P0202, P0203.	No injector 2 and 3 monitor input signal exists.	Approx. 2.5 sec.	Intensive engine vibration, rough idling, output lowering, blow up fault Engine stall is possible. **Back-up:** **Common 2 stop (#2, #3 cylinders stopped), EGR stopped**	ON	*1
P1345	16	Cam sensor out of phase	Camshaft gear/ crankshaft gear installing angle is out of phase, or damage in gear.	• Key switch input voltage is 18V or more. • DTC P0335, P0336, P0340, P0341, P1345, or P1635 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.	• 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)**	ON	*1
P1625	416	Main relay system fault (Not enter)	Open/ground short circuit in harness, relay OFF anchoring	• Key switch input voltage is 18V or more. • DTC P1630 is not detected. • 3 seconds or more has elapsed after key switch ON. • Main relay drive indication ON	Main relay system voltage is 1V or less with main relay coil output ON.	Approx. 1.5 sec.	Engine does not start. **Back-up:** **Fail-safe process will not be carried out**	ON	*2
			Harness +B short, relay ON anchoring	• DTC P1625 or P0606 is not detected.	Relay does not cut off despite of main relay coil output OFF indication.	Approx. 5 sec.	Vehicle power supply cannot be shut off. **Back-up:** **Fail-safe process will not be carried out**	ON	*1
P1630	36	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 (multi-injection stopped)** **Target RP upper limit (80 MPa {11,603 psi})**	ON	*2

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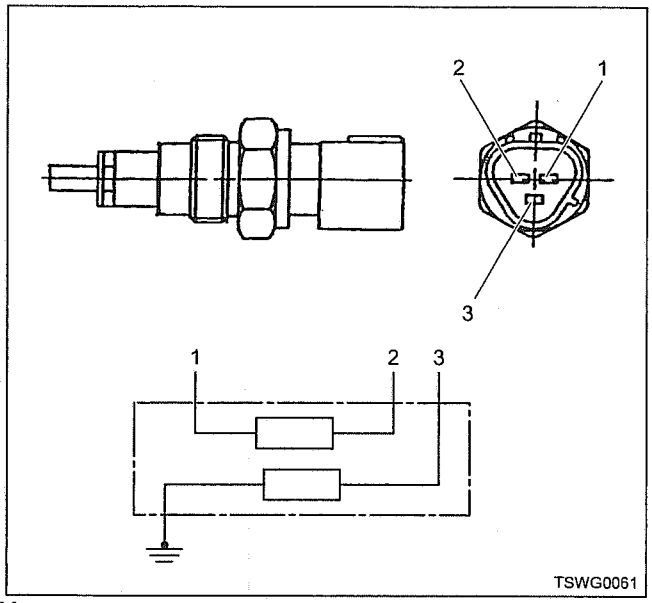
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Step	Action	Value	YES	NO
10	1. Check the version of ECM software. Refer to the EMPS manual for check and rewriting of ECM. 2. Rewrite the software if version upgraded is necessary. **Note:** EGR valve position learning is required after replacing or rewriting the ECM. Refer to 1E-54, "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-54, "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-19, "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 drive with the "Preconditions when DTC is set". 5. Check the DTC. Is DTC P0107 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 the installation condition of the barometric pressure sensor and ECM connector. (Check the barometric pressure sensor circuit for open circuit or ground short.) 1. Check for disconnection, play or looseness in the connection. 2. If the fault is detected, repair or replace as required. Is the fault detected?	—	Go to Step 9.	Go to Step 17.

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About ECT sensor

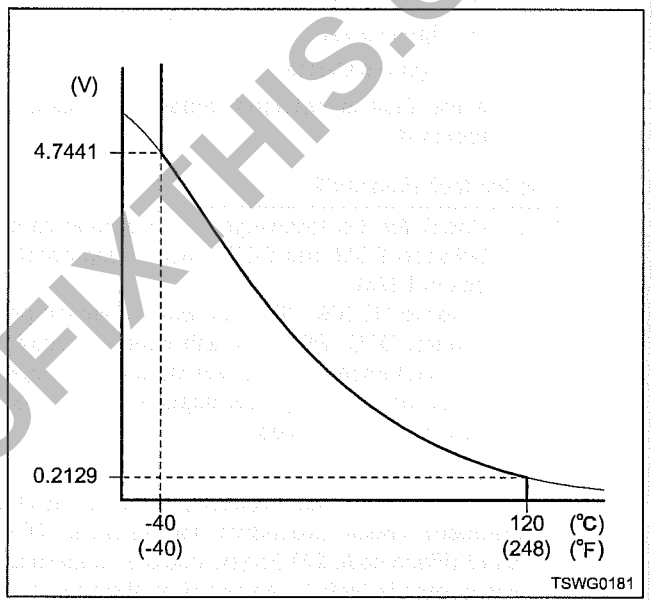


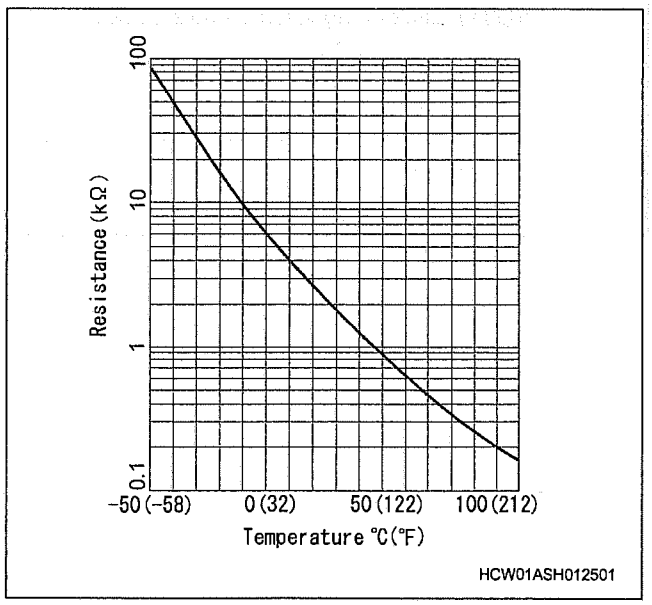
Name

1. Sensor ground (for engine control)
2. Sensor signal (for engine control)
3. Sensor signal (for meter)

Characteristics of ECT sensor

The output voltage of ECT sensor changes according to the engine coolant 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.

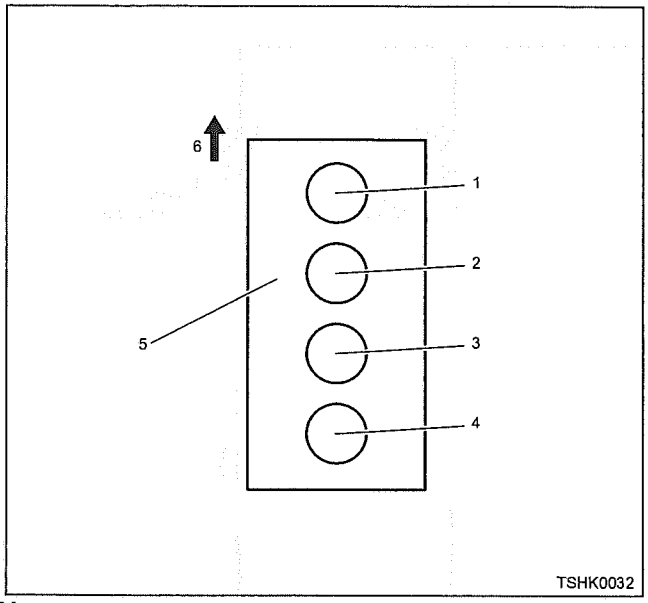




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Cylinder No. and injection order



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.

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 P0612, P1262 or P0202 is not detected.

DTC set condition

- Open/short circuit is detected in No. 2 cylinder injector drive circuit.
- No. 2 cylinder injector monitor input signal does not exist for 2.5 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.)

Back-up mode

- Injection for cylinder #2 stopped, EGR stopped

Recovery from failure

Refer to 1E-132, "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

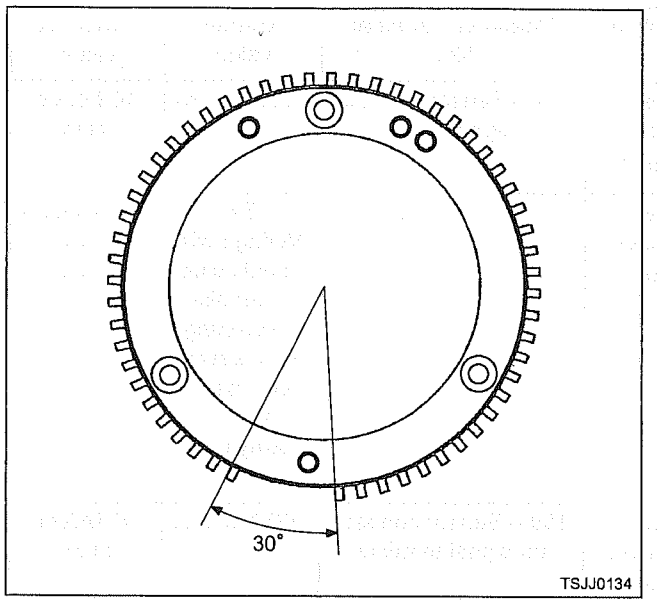
The following inspections are necessary to detect these causes.

- 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.

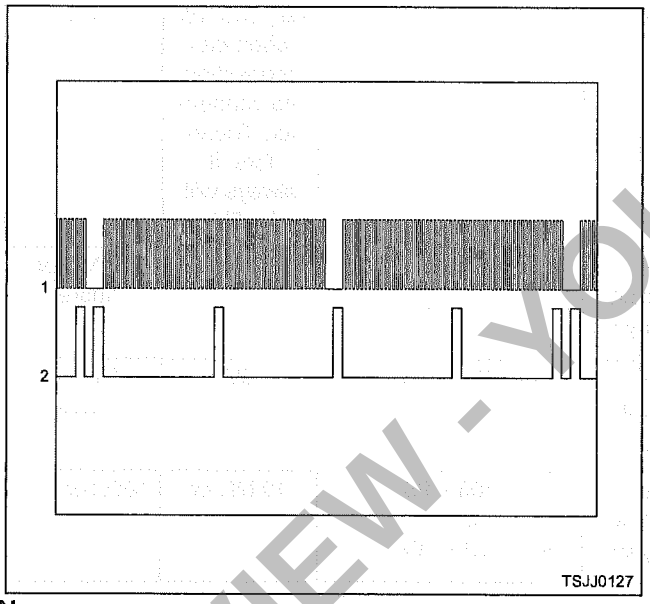
Step	Action	Value	YES	NO
1	Perform the OBD system check. Is the procedure completed?	—	Go to Step 2.	Perform the "OBD system check" and Go to Step 2.

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About CKP sensor and CMP sensor signals

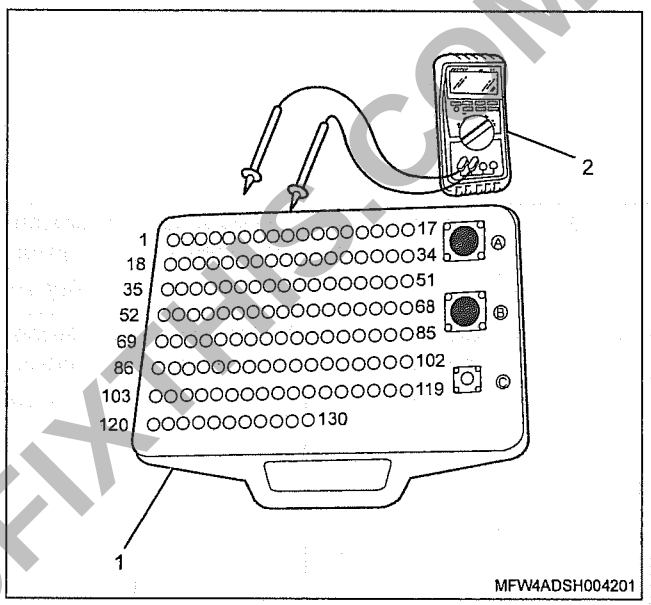


Name

1. CKP signal
2. CMP signal

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-36, "Example of use for breaker box, Breaker box inspection procedure, How to Use Breaker Box".



Name

1. Breaker box
2. DMM

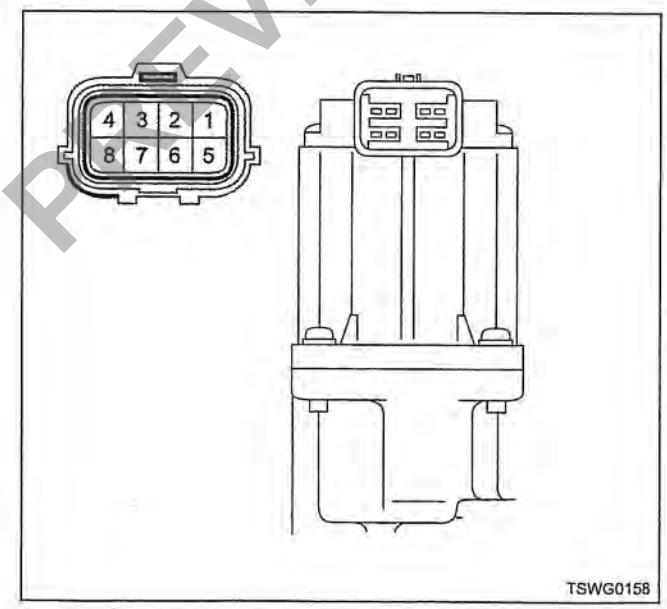
Step	Item to be checked	Checking method	Measuring condition	Measuring terminal No.	Normal value	Abnormal value
6	Open circuit/ high resistance	Resistance measurement	• Disconnect the sensor connector. • Key switch "OFF"	95 – Sensor connector power supply terminal	100Ω or less	10 MΩ or more
	Short circuit to ground	Resistance measurement	• Disconnect the sensor connector. • Key switch "OFF"	95 – GND	10 MΩ or more	100Ω or less

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Step	Action	Value	YES	NO
8	1. Check the version of ECM software. Refer to the EMPS manual 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-54, "Installation of ECM, Engine control module (ECM), Engine Control System" in this section for learning of EGR. Is the procedure completed?	—	Go to Step 10.	Go to Step 9.
9	Replace the ECM. **Note:** EGR valve position learning is required after replacing or rewriting the ECM. Refer to 1E-54, "Installation of ECM, Engine control module (ECM), Engine Control System" in this section for learning of EGR. Is the procedure completed?	—	Go to Step 10.	—
10	Check the DTC again. 1. Connect all the harnesses. 2. Clear the DTC. Refer to 1E-19, "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. 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 2.	Go to Step 11.
11	Check if other DTC is detected. Is other DTC detected?	—	Go to each DTC diagnosis.	Verify repair.

About EGR position sensor



Name

1. Position sensor power supply (5 V)
2. Position sensor signal W
3. Position sensor signal V
4. Position sensor signal U
5. Position sensor ground
6. Motor drive W
7. Motor drive V
8. Motor drive U

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Step	Action	Value	YES	NO
9	Replace the ECM. **Note:** EGR valve position learning is required after replacing or rewriting the ECM. Refer to 1E-54, "Installation of ECM, Engine control module (ECM), Engine Control System" in this section for learning of EGR. Is the procedure completed?	—	Go to Step 10.	—
10	Check the DTC again. 1. Connect all the harnesses. 2. Clear the DTC. Refer to 1E-19, "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 drive with the "Preconditions when DTC is set". 5. Check the DTC. Is DTC P0612 detected?	—	Go to Step 2.	Go to Step 11.
11	Check if other DTC is detected. Is other DTC detected?	—	Go to each DTC diagnosis.	Verify repair.
12	Is DTC P0612 detected?	—	Go to Step 4.	Go to Step 10.

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Recovery from failure

Refer to 1E-132, "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.
3. In case of present trouble, the "Boost temperature sensor" displays the specified value or less. If more than the specified value, identify the cause by referring to "Diagnostic aid".
5. If the "Boost temperature sensor" displays the specified value or more when terminals between the boost temperature sensor connector are shorted, 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.	Go to 1E-96, "OBD system check, List of Function Checks".
2	Is the scan tool (KW communication) available?	—	Go to Step 3.	Go to Step 14.
3	1. Turn the key switch to "ON". 2. Check the "Boost temperature sensor" on the data display using a scan tool. Is the "Boost temperature sensor" the specified value or less?	0.1V	Go to Step 4.	Go to "Diagnostic aid".
4	Check for installation condition of the boost temperature 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 12.	Go to Step 5.
5	1. Turn the key switch to "OFF". 2. Disconnect the boost temperature sensor connector. 3. Short between the boost temperature sensor connector ground terminal and the signal terminal using jump cable. 4. Turn the key switch to "ON". 5. Check the "Boost temperature" on the data display using a scan tool. Is the "Boost temperature" the specified value or more?	4.8V	Go to Step 8.	Go to Step 6.

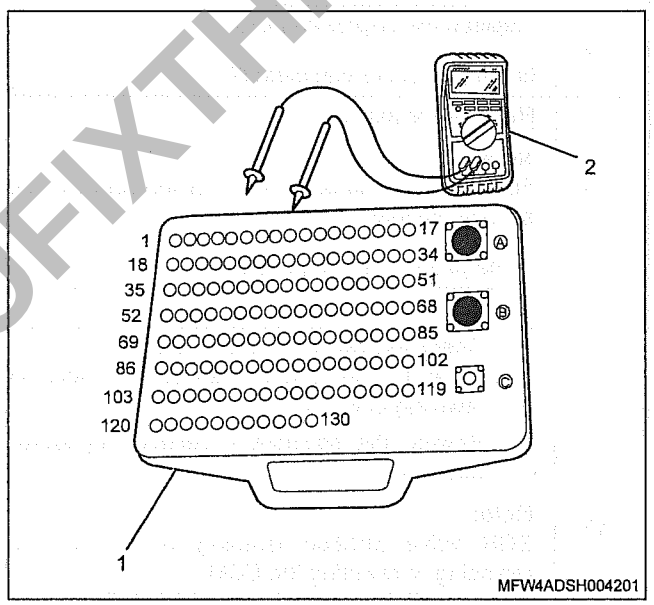
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Step	Action	Value	YES	NO
19	Check the DTC again. 1. Connect all the harnesses. 2. Clear the DTC. Refer to 1E-19, "How to clear DTC, Procedure of Trouble Diagnosis" in this section for how to clear DTCs. 3. Turn the key switch to "OFF" for more than 10 seconds. 4. Test drive with the "Preconditions when DTC is set". 5. Check the DTC. Is DTC P1262 detected?	—	Go to Step 2.	Go to Step 20.
20	Check if other DTC is detected. Is other DTC detected?	—	Go to each DTC diagnosis.	Verify repair.

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-36, "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	Measuring terminal No.	Normal value	Abnormal value
5	Open circuit/ high resistance	Resistance measurement	• Remove the ECM-side harness connector from the coupling connector. • Key switch "OFF"	116 – Female-side terminal (H12 No.3)	100Ω or less	10 MΩ or more
	Short circuit to ground	Resistance measurement	• Remove the ECM-side harness connector from the coupling connector. • Key switch "OFF"	116 – GND	10 MΩ or more	100Ω or less

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Step	Action	Value	YES	NO
6	1. Check the circuit (contact point side) between main relay and ECM for short circuit to the power supply circuit or ignition power supply circuit using breaker box or DMM. Refer to 1E-451, "Breaker box inspection procedure, DTC: P1625 (Flash code 416) Main relay 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 15.
7	Check the installation condition of the main relay 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 15.	Go to Step 8.
8	1. Turn the key switch to "OFF". 2. Remove the main relay. 3. Short between the terminals 1 – 2 and 3 – 5 in the main relay installing portion respectively using jump cable. 4. Turn the key switch to "ON". 5. Check the "Main relay voltage" on the data display using a scan tool. Is the "Main relay voltage" the specified value or more?	24V	Go to Step 11.	Go to Step 9.
9	1. Check for the followings in the circuit between slow-blow fuse and main 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 15.	Go to Step 10.
10	1. Check for the followings in the circuit between main relay and ECM using breaker box or DMM. Refer to 1E-451, "Breaker box inspection procedure, DTC: P1625 (Flash code 416) Main relay 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 15.	Go to Step 12.
11	Replace the main relay. Is the procedure completed?	—	Go to Step 15.	—
12	Is EMPS available?	—	Go to Step 13.	Go to Step 14.

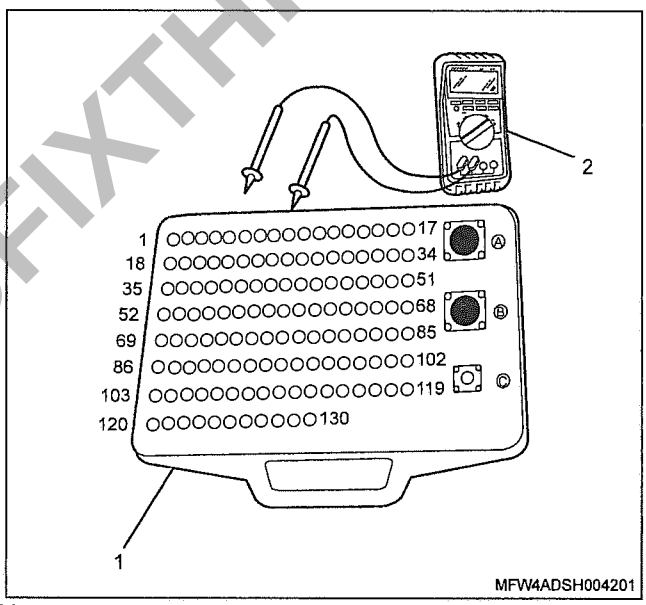
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Step	Action	Value	YES	NO
11	Check the DTC again. 1. Connect all the harnesses. 2. Clear the DTC. Refer to 1E-19, "How to clear DTC, Procedure of Trouble Diagnosis" in this section for how to clear DTCs. 3. Turn the key switch to "OFF" for more than 10 seconds. 4. Test drive with the "Preconditions when DTC is set". 5. Check the DTC. Is DTC U2106 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.

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-36, "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	Measuring terminal No.	Normal value	Abnormal value
4	Open circuit/ high resistance	Resistance measurement	• Remove the machine control unit (ECU) connector. • Key switch "OFF"	18 – Machine control unit (ECU) connector terminal 37 – Machine control unit (ECU) connector terminal	100Ω or less	10 MΩ or more

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