

2. Diagnostic Trouble Code (DTC) Detecting Criteria

A: DTC B1570 ANTENNA

1. OUTLINE OF DIAGNOSIS

DTC	Item	Outline of Diagnosis
B1570	Antenna	Faulty antenna
B1571	Reference Code Incompatibility	Reference code incompatibility between body integrated unit and ECM
B1572	IMM Circuit Failure (Except Antenna Circuit)	Communication failure between body integrated unit and ECM
B1574	Key Communication Failure	The body integrated unit to confirm the key (transponder) ID code has malfunction, of the transponder is faulty.
B1575	Incorrect Immobilizer Key	Incorrect immobilizer key (Use of unregistered key in body integrated unit)
B1576	EGI Control Module EEPROM	ECM malfunctioning
B1577	IMM Control Module EEPROM	Body integrated unit malfunctioning
B1578	Meter Failure	Reference code incompatibility between combination meter and body integrated unit

2. ENABLE CONDITIONS

When starting the engine.

3. GENERAL DRIVING CYCLE

Perform the diagnosis only after starting the engine.

4. DIAGNOSTIC METHOD

Judge as NG when the conditions for the outline of the diagnosis of the top are established.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

B: DTC B1571 REFERENCE CODE INCOMPATIBILITY

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC B1570. <Ref. to GD(H4DO HEV)-11, DTC B1570 ANTENNA, Diagnostic Trouble Code (DTC) Detecting Criteria.>

C: DTC B1572 IMM CIRCUIT FAILURE (EXCEPT ANTENNA CIRCUIT)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC B1570. <Ref. to GD(H4DO HEV)-11, DTC B1570 ANTENNA, Diagnostic Trouble Code (DTC) Detecting Criteria.>

D: DTC B1574 KEY COMMUNICATION FAILURE

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC B1570. <Ref. to GD(H4DO HEV)-11, DTC B1570 ANTENNA, Diagnostic Trouble Code (DTC) Detecting Criteria.>

E: DTC B1575 INCORRECT IMMOBILIZER KEY

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC B1570. <Ref. to GD(H4DO HEV)-11, DTC B1570 ANTENNA, Diagnostic Trouble Code (DTC) Detecting Criteria.>

F: DTC B1576 EGI CONTROL MODULE EEPROM

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC B1570. <Ref. to GD(H4DO HEV)-11, DTC B1570 ANTENNA, Diagnostic Trouble Code (DTC) Detecting Criteria.>

G: DTC B1577 IMM CONTROL MODULE EEPROM

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC B1570. <Ref. to GD(H4DO HEV)-11, DTC B1570 ANTENNA, Diagnostic Trouble Code (DTC) Detecting Criteria.>

H: DTC B1578 METER FAILURE

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC B1570. <Ref. to GD(H4DO HEV)-11, DTC B1570 ANTENNA, Diagnostic Trouble Code (DTC) Detecting Criteria.>

I: DTC P000A A CAMSHAFT POSITION SLOW RESPONSE (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the AVCS system malfunction.

Judge NG when the amount of AVCS actual timing advance does not approach to the amount of AVCS target timing advance.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Time of establishing all secondary parameter conditions	≥ 1000 ms
Battery voltage	≥ 10.9 V
Engine speed	≥ 500 rpm
Engine oil temperature	≥ -40 °C (-40 °F)
AVCS control	Operation
Target timing advance change amount (per 64 ms)	< 3.2 °CA

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when the engine speed increases and AVCS operates.

4. DIAGNOSTIC METHOD

When the differences of target timing advance amount and actual timing advance amount is calculated during AVCS control, and the difference per predetermined time is the specified value or larger.

Judge as NG when the following conditions are established within the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
$\Sigma(\text{Target position} - \text{Actual position})$	> 4000 °CA (Bank 1) > 4000 °CA (Bank 2)
or	
$\Sigma(\text{Target position} - \text{Actual position})$	< -4000 °CA (Bank 1) < -4000 °CA (Bank 2)

Time Needed for Diagnosis: 25000 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

J: DTC P000B B CAMSHAFT POSITION SLOW RESPONSE (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the exhaust AVCS system malfunction.

Judge NG when the amount of exhaust AVCS actual timing advance does not approach the amount of exhaust AVCS target timing advance.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Time of establishing all secondary parameter conditions	≥ 1000 ms
Battery voltage	≥ 10.9 V
Engine speed	≥ 500 rpm
Engine oil temperature	≥ -40 °C (-40 °F)
Exhaust AVCS control	Operation
Target timing advance change amount (per 64 ms)	< 3.2 °CA

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when the engine speed increases and exhaust AVCS operates.

4. DIAGNOSTIC METHOD

When the differences of target timing advance amount and actual timing advance amount is calculated during exhaust AVCS control, and the difference per predetermined time is the specified value or larger.

Judge as NG when the following conditions are established within the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
$\Sigma(\text{Target position} - \text{Actual position})$	> 4000 °CA (Bank 1) > 4000 °CA (Bank 2)
or	
$\Sigma(\text{Target position} - \text{Actual position})$	< -4000 °CA (Bank 1) < -4000 °CA (Bank 2)

Time Needed for Diagnosis: 25000 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

K: DTC P000C A CAMSHAFT POSITION SLOW RESPONSE (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to P000A. <Ref. to GD(H4DO HEV)-13, DTC P000A A CAMSHAFT POSITION SLOW RESPONSE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

L: DTC P000D B CAMSHAFT POSITION SLOW RESPONSE (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to P000B. <Ref. to GD(H4DO HEV)-14, DTC P000B B CAMSHAFT POSITION SLOW RESPONSE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

M: DTC P0010 "A" CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the oil control solenoid.

Judge as NG when the current is small even though the duty signal is large.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	$> 10.9 \text{ V}$
Oil control solenoid control duty	$\geq 99.61 \text{ \%}$

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Oil control solenoid control present current	$< 0.306 \text{ A}$

Time Needed for Diagnosis: 2000 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

N: DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the AVCS system malfunction.

Judge as NG when the conditions during which the differences of AVCS target timing advance amount and AVCS actual timing advance amount is large continues.

2. ENABLE CONDITION

- Normal

Secondary Parameters	Enable Conditions
Time of establishing all secondary parameter conditions	≥ 10000 ms
Battery voltage	≥ 10.9 V
Engine speed	≥ 500 rpm
Engine oil temperature	≥ -40 °C (-40 °F)
AVCS control	Operation

- Intermediate lock

Secondary Parameters	Enable Conditions
Time of establishing all secondary parameter conditions	≥ 2000 ms
Battery voltage	≥ 10.9 V
Engine speed	≥ 500 rpm
Engine oil temperature	≥ -40 °C (-40 °F)
AVCS control	Intermediate lock
Elapsed time after starting the engine	> 500 ms

3. GENERAL DRIVING CYCLE

- Normal

Perform the diagnosis continuously when the engine speed increases and AVCS operates.

- Intermediate lock

Perform the diagnosis when the AVCS is carrying out the intermediate lock control at the engine start.

4. DIAGNOSTIC METHOD

When the conditions during which the differences of AVCS target timing advance amount and AVCS actual timing advance amount is large continues for certain amount of time.

Judge as NG when the following conditions are established within the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
• Normal (Target position – Actual position)	> 10 °CA or < -10 °CA
• Intermediate lock (Target position – Actual position)	> 10 °CA or < -10 °CA

Time Needed for Diagnosis:

- Normal: 10000 ms
- Intermediate lock: 2000 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

O: DTC P0013 B CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the oil control solenoid.

Judge as NG when the current is small even though the duty signal is large.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	$> 10.9 \text{ V}$
Oil control solenoid control duty	$\geq 99.61 \text{ \%}$

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Oil control solenoid control present current	$< 0.306 \text{ A}$

Time Needed for Diagnosis: 2000 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

P: DTC P0014 EXHAUST AVCS SYSTEM 1 (RANGE/PERFORMANCE)

1. OUTLINE OF DIAGNOSIS

Detect the exhaust AVCS system malfunction.

Judge as NG when the conditions during which the differences of exhaust AVCS target timing advance amount and exhaust AVCS actual timing advance amount is large continues.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Time of establishing all secondary parameter conditions	≥ 10000 ms
Battery voltage	≥ 10.9 V
Engine speed	≥ 500 rpm
Engine oil temperature	≥ -40 °C (-40 °F)
Exhaust AVCS control	Operation

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when the engine speed increases and exhaust AVCS operates.

4. DIAGNOSTIC METHOD

When the conditions during which the differences of exhaust AVCS target timing advance amount and exhaust AVCS actual timing advance amount is large continues for certain amount of time.

Judge as NG when the following conditions are established within the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
(Target position – Actual position)	> 10 °CA or < -10 °CA

Time Needed for Diagnosis: 10000 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Q: DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1)

1. OUTLINE OF DIAGNOSIS

Detect the AVCS system malfunction.

Judge as NG when standard timing advance amount is far from learning angle.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Engine speed	≥ 1300 rpm and < 3000 rpm
Engine coolant temperature	≥ 50 °C (122 °F)
AVCS control	Not in operation
Target timing advance	0°CA

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting engine and while AVCS is not operating.

4. DIAGNOSTIC METHOD

Judge as NG when the absolute value of the difference between cam signal input position and learning value is out of specification.

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Crankshaft position when camshaft position sensor signal is input – Learning value	> 10 °CA

Time Needed for Diagnosis: 400 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

NOTE:

Initial standard learning value is the value of crank angle initially input at the production plant. And then it will be updated every time normal judgment has been completed. Learning value will not be updated if NG judgment occurs because timing belt or chain derails suddenly in process or because wrong assembly occurs during servicing.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

R: DTC P0017 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the exhaust AVCS system malfunction.

Judge as NG when standard timing advance amount is far from learning angle.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Engine speed	≥ 500 rpm and < 1200 rpm
Engine coolant temperature	≥ 50 °C (122 °F)
Exhaust AVCS control	Not in operation
Target timing advance	0°CA

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously while the exhaust AVCS is not operating after warming up.

4. DIAGNOSTIC METHOD

Judge as NG when the absolute value of the difference between cam signal input position and learning value is out of specification.

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Crankshaft position when camshaft position sensor signal is input – Learning value	> 10 °CA

Time Needed for Diagnosis: 400 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

NOTE:

Initial standard learning value is the value of crank angle initially input at the production plant. And then it will be updated every time normal judgment has been completed. Learning value will not be updated if NG judgment occurs because timing belt or chain derails suddenly in process or because wrong assembly occurs during servicing.

S: DTC P0018 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0016. <Ref. to GD(H4DO HEV)-19, DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

T: DTC P0019 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0017. <Ref. to GD(H4DO HEV)-20, DTC P0017 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

U: DTC P0020 "A" CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0010. <Ref. to GD(H4DO HEV)-15, DTC P0010 "A" CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

V: DTC P0021 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0011. <Ref. to GD(H4DO HEV)-16, DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

W: DTC P0023 B CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0013. <Ref. to GD(H4DO HEV)-17, DTC P0013 B CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

X: DTC P0024 EXHAUST AVCS SYSTEM 2 (RANGE/PERFORMANCE)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0014. <Ref. to GD(H4DO HEV)-18, DTC P0014 EXHAUST AVCS SYSTEM 1 (RANGE/PERFORMANCE), Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

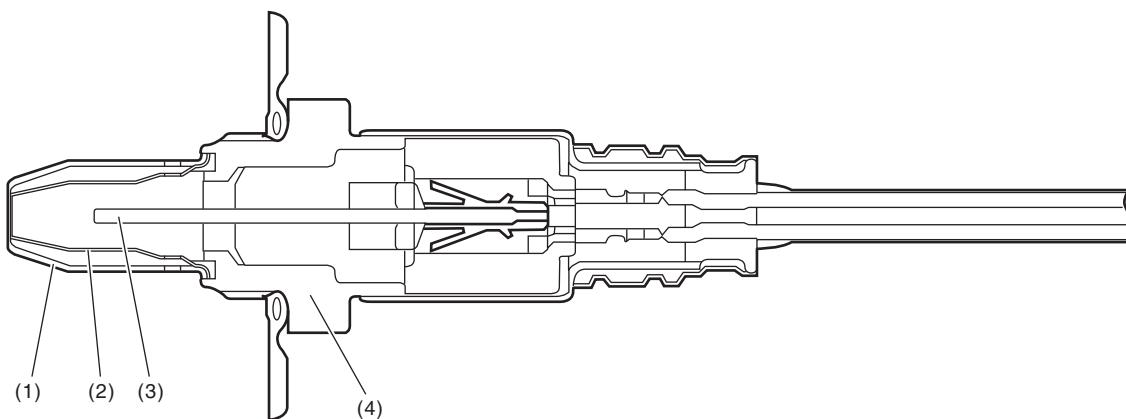
Y: DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect functional errors of the front oxygen (A/F) sensor heater.

Judge as NG when it is determined that the front oxygen (A/F) sensor impedance is large when looking at engine status such as deceleration fuel cut.

2. COMPONENT DESCRIPTION



EN-08982

(1) Element cover (outer)
(2) Element cover (inner)

(3) Sensor element

(4) Sensor housing

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Heater current	Permitted
A/F sensor heater final control	Main energization status
After fuel cut	≥ 20000 ms

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after 42000 ms or more have passed since the engine started.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Front oxygen (A/F) sensor impedance	$> 82 \Omega$

Time Needed for Diagnosis: 10000 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Z: DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1)

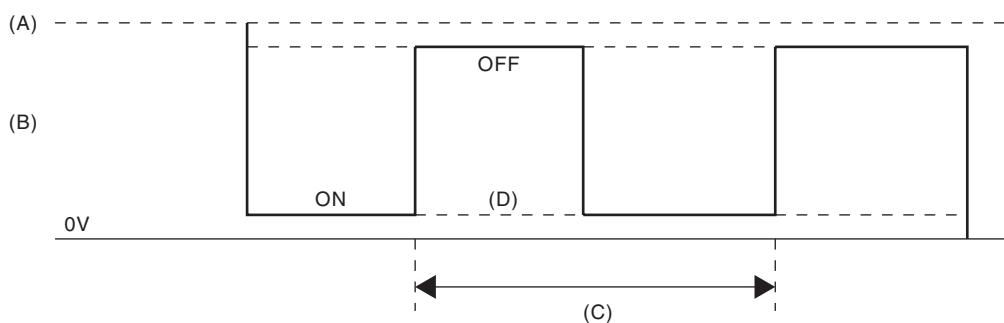
1. OUTLINE OF DIAGNOSIS

Detect front oxygen (A/F) sensor heater open or short circuit.

The front oxygen (A/F) sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.

Judge as NG when the terminal voltage remains Low.

2. COMPONENT DESCRIPTION



EN-01792

(A) Battery voltage
(D) Low error

(B) Front oxygen (A/F) sensor heater output voltage

(C) 128 ms

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Front oxygen (A/F) sensor heater control duty	< 87.5 %

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 1.9 V

Time Needed for Diagnosis: 1 second

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

AA:DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1)

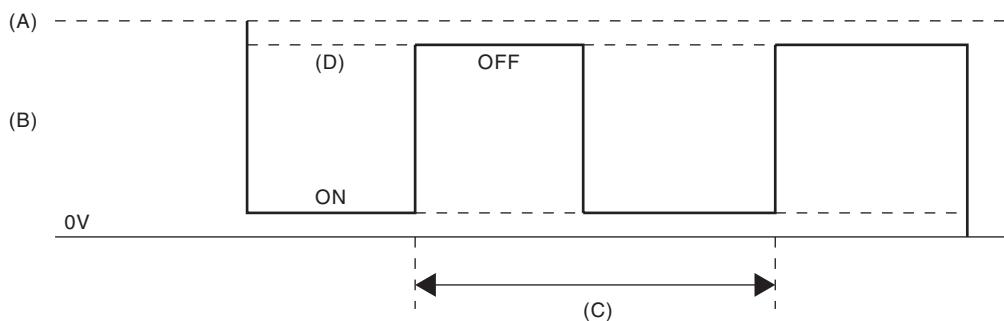
1. OUTLINE OF DIAGNOSIS

Detect front oxygen (A/F) sensor heater open or short circuit.

The front oxygen (A/F) sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.

Judge as NG when the terminal voltage remains High.

2. COMPONENT DESCRIPTION



EN-01793

(A) Battery voltage
(D) High error

(B) Front oxygen (A/F) sensor heater output voltage

(C) 128 ms

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Front oxygen (A/F) sensor heater control duty	> 12.5 %

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 1.9 V

Time Needed for Diagnosis: 2 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

AB:DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2)

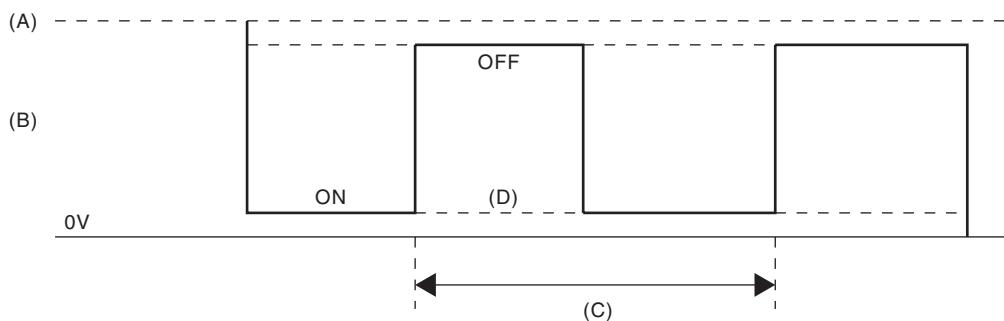
1. OUTLINE OF DIAGNOSIS

Detect the rear oxygen sensor heater open or short circuit.

The rear oxygen sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.

Judge as NG when the terminal voltage remains Low.

2. COMPONENT DESCRIPTION



EN-01792

(A) Battery voltage
(D) Low error

(B) Output voltage of the rear oxygen sensor heater

(C) 256 ms (cycle)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1 s
Rear oxygen sensor heater control duty	< 75 %

4. GENERAL DRIVING CYCLE

After starting the engine, perform the diagnosis continuously when engine is low speed.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$< \text{Battery voltage} \times 0.2$

Time Needed for Diagnosis: 10 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

AC:DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2)

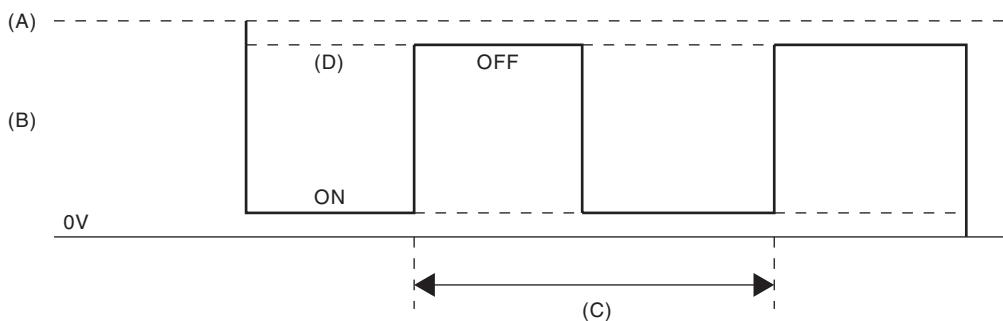
1. OUTLINE OF DIAGNOSIS

Detect the rear oxygen sensor heater open or short circuit.

The rear oxygen sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.

Judge as NG when the terminal voltage remains High.

2. COMPONENT DESCRIPTION



EN-01793

(A) Battery voltage
(D) High error

(B) Output voltage of the rear oxygen sensor heater

(C) 256 ms (cycle)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1 s
Rear oxygen sensor heater control duty	≥ 20 %

4. GENERAL DRIVING CYCLE

After starting the engine, perform the diagnosis continuously when engine is low speed.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$> \text{Battery voltage} \times 0.3$

Time Needed for Diagnosis: 2.56 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

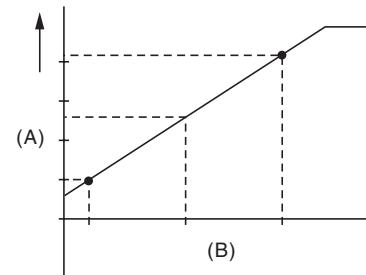
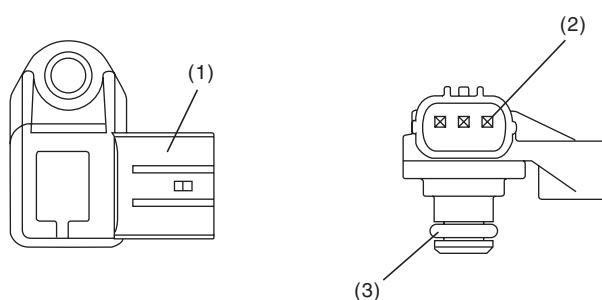
AD:DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION

1. OUTLINE OF DIAGNOSIS

Detect problems in the intake manifold pressure sensor output properties.

Judge as NG when the intake air pressure AD value is Low whereas it seemed to be High from the viewpoint of engine condition, or when it is High whereas it seemed to be Low from the engine condition.

2. COMPONENT DESCRIPTION



EN-08984

(B) Absolute pressure

(1) Connector

(2) Terminals

(3) O-ring

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	$\geq 60\text{ }^{\circ}\text{C}$ ($140\text{ }^{\circ}\text{F}$)

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after idling.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

Judge as NG when Low side or High side becomes NG.

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Low	
Engine speed	< 2900 rpm
Throttle position	≥ 3.4 °
Output voltage	< 0.95 V
Engine load	> 0.36 g/rev (0.01 oz/rev)
High	
Engine speed	500 rpm — 2000 rpm
Throttle position	< 9.6 °
Output voltage	≥ 3.61 V
Engine load	< 0.34 g/rev (0.01 oz/rev)

Time Needed for Diagnosis:

Low side: 5000 ms

High side: 5000 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

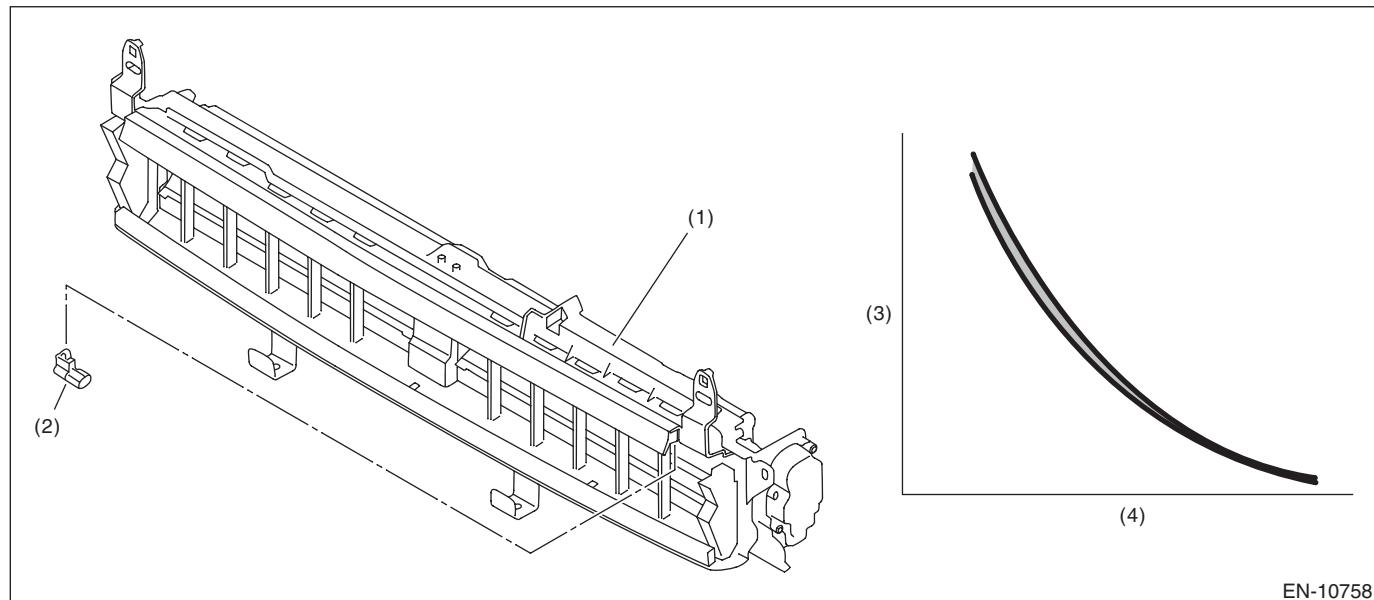
AE:DTC P0071 AMBIENT AIR TEMPERATURE SENSOR CIRCUIT "A" RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect the characteristic abnormality of the ambient air temperature sensor.

Perform diagnosis in reference to the ambient air temperature sensor value, intake air temperature sensor value and engine coolant temperature sensor value after engine start after predetermined time have passed in soak time. Judge as NG when the difference is more than the specific value in comparison respectively between ambient and intake air temperature, ambient and engine coolant temperature.

2. COMPONENT DESCRIPTION



EN-10758

(1) Active grille shutter

(3) Resistance value (kΩ)

(4) Ambient air temperature (°C (°F))

(2) Ambient air temperature sensor

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Soaking time	≥ 21600 s
Block heater judgment	Completed
Block heater activation	not activate

Block heater judgment

Parameter	Enable Conditions
Engine speed	> 500 rpm

Judge as "Block heater is not activate" when the following conditions are established.

Judgment Value

Judgment criteria	Threshold Value
Σ (Engine coolant temperature – Engine coolant temperature at engine start)	≥ -10 °C (-18°F)

Time Needed for Judgment: 1 s × 20 times

4. GENERAL DRIVING CYCLE

Perform diagnosis only once after engine start after constant soak time.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Ambient air temperature 30 s after engine start – Intake air temperature 30 s after engine start	> Value from Map
Ambient air temperature at engine start – Engine coolant temperature at engine start	> 25 °C (45°F)

Map

Ambient air temperature °C (°F)	-30 (-22)	30 (86)	45 (113)	60 (140)
Ambient air temperature 30 s after engine start – Intake air temperature 30 s after engine start °C (°F)	20 (36°F)	20 (36°F)	32 (57.6°F)	32 (57.6°F)

Time Needed for Diagnosis: 64 ms

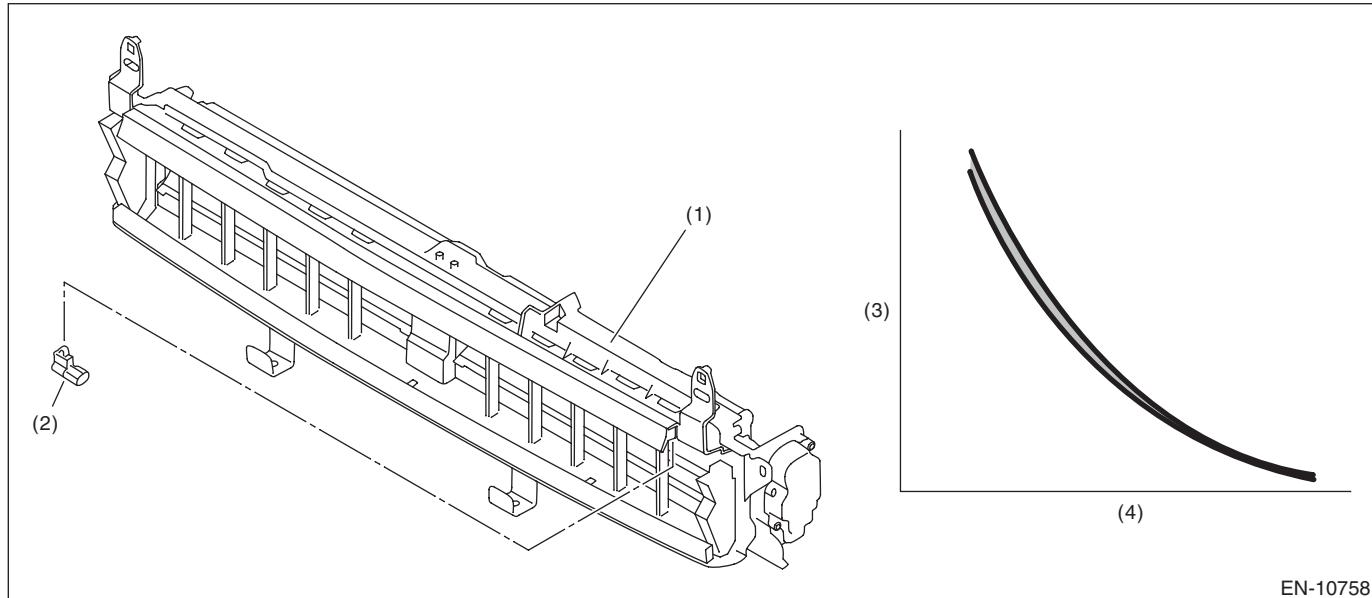
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

AF:DTC P0072 AMBIENT TEMPERATURE SENSOR CIRCUIT "A" LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of ambient air temperature sensor installed in active grille shutter. Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-10758

(1) Active grille shutter

(3) Resistance value (kΩ)

(4) Ambient air temperature (°C (°F))

(2) Ambient air temperature sensor

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.42 V

Time Needed for Diagnosis: 2500 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

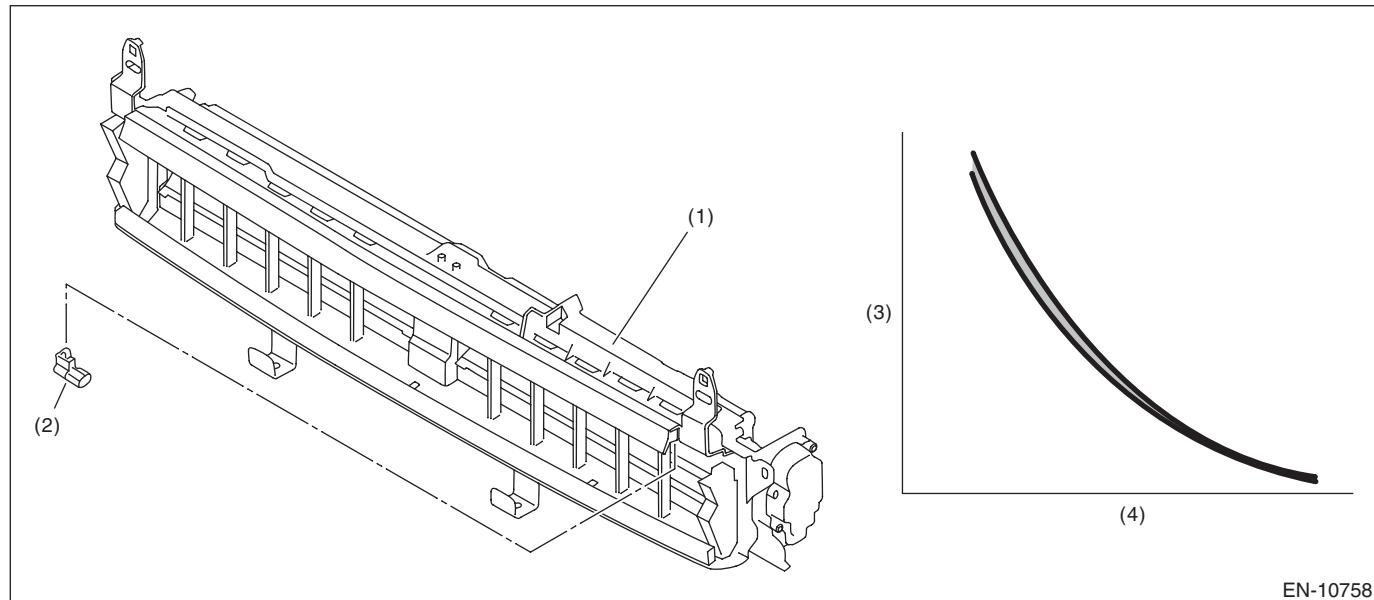
GENERAL DESCRIPTION

AG:DTC P0073 AMBIENT TEMPERATURE SENSOR CIRCUIT "A" HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of ambient air temperature sensor installed in active grille shutter. Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-10758

(1) Active grille shutter

(3) Resistance value (kΩ)

(4) Ambient air temperature (°C (°F))

(2) Ambient air temperature sensor

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	> 4.88 V

Time Needed for Diagnosis: 2500 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

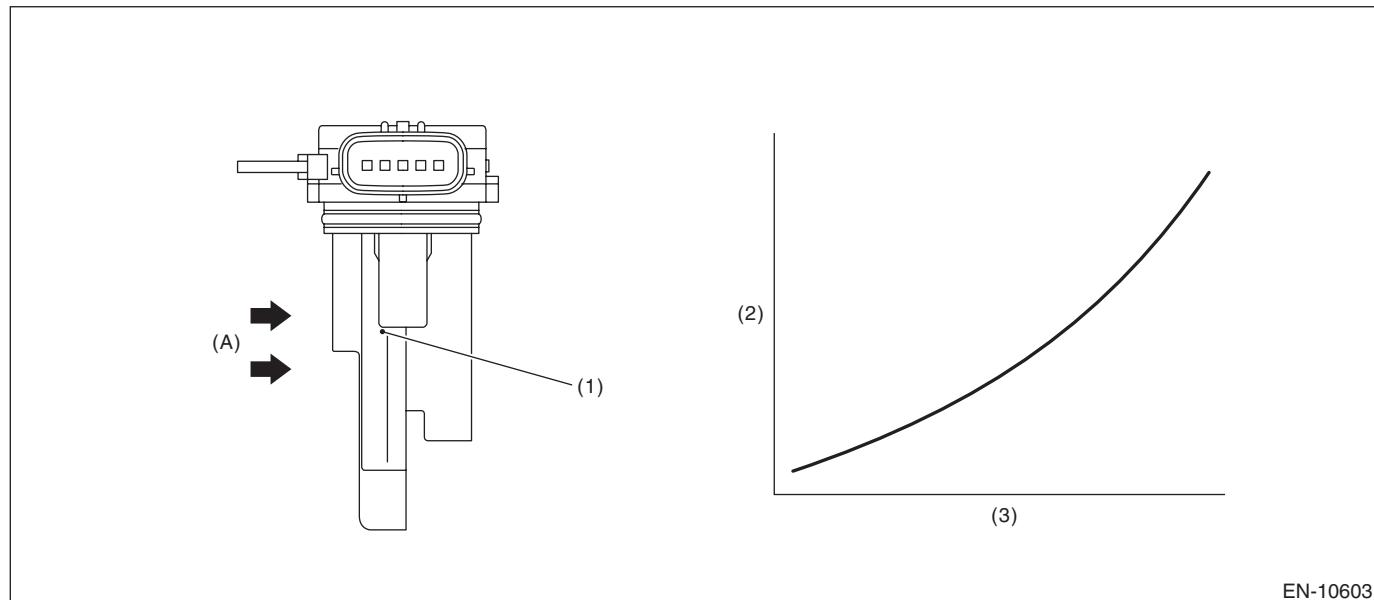
AH:DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of air flow sensor output properties.

Judge as a low side NG when the air flow voltage indicates a small value regardless of running in a state where the air flow voltage increases. Judge as a high side NG when the air flow voltage indicates a large value regardless of running in a state where the air flow voltage decreases. Judge air flow sensor property NG when the Low side or High side becomes NG.

2. COMPONENT DESCRIPTION



EN-10603

(A) Air

(1) Air flow sensor

(2) Voltage (V)

(3) Amount of intake air (kg (lb)/s)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	$\geq 60^{\circ}\text{C}$ (140°F)

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after idling.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

Judge as NG when Low side or High side becomes NG.

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Low	
Output voltage	< 1.27 V
Engine speed	≥ 1600 rpm
Throttle opening angle	≥ 5.6 °
Intake manifold pressure	≥ 66.7 kPa (500 mmHg, 19.7 inHg)
High (1)	
Output voltage	≥ 2.44 V
Engine speed	500 rpm — 2000 rpm
Throttle opening angle	< 9.3 °
Intake manifold pressure	≥ 44.8 kPa (336.3 mmHg, 13.2 inHg)
High (2)	
Output voltage	≥ 2.44 V
Engine speed	500 rpm — 2000 rpm
Throttle opening angle	< 9.3 °
Intake manifold pressure	≥ 44.8 kPa (336.3 mmHg, 13.2 inHg)
Fuel system diagnosis	Rich side malfunction

Time Needed for Diagnosis:

Low: 5000 ms

High: 5000 ms

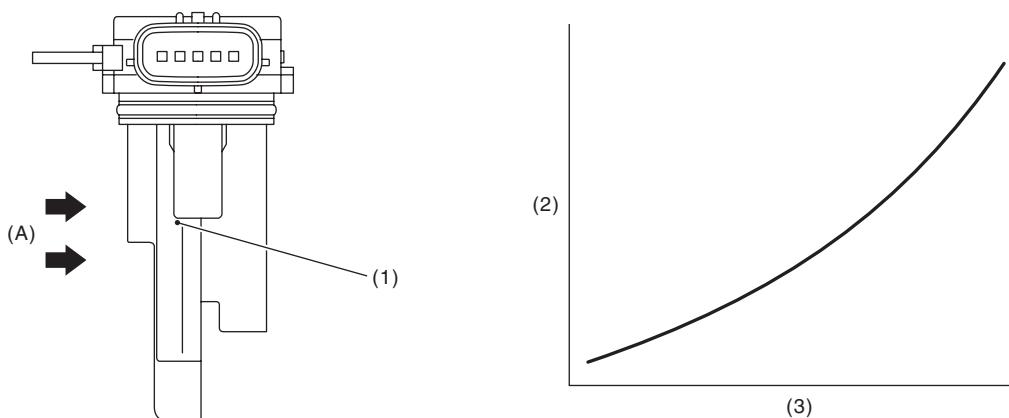
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

AI: DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT

1. OUTLINE OF DIAGNOSIS

Detect open or short circuits of the air flow sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-10603

(A) Air

(1) Air flow sensor

(2) Voltage (V)

(3) Amount of intake air (kg (lb)/s)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.127 V

Time Needed for Diagnosis: 500 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

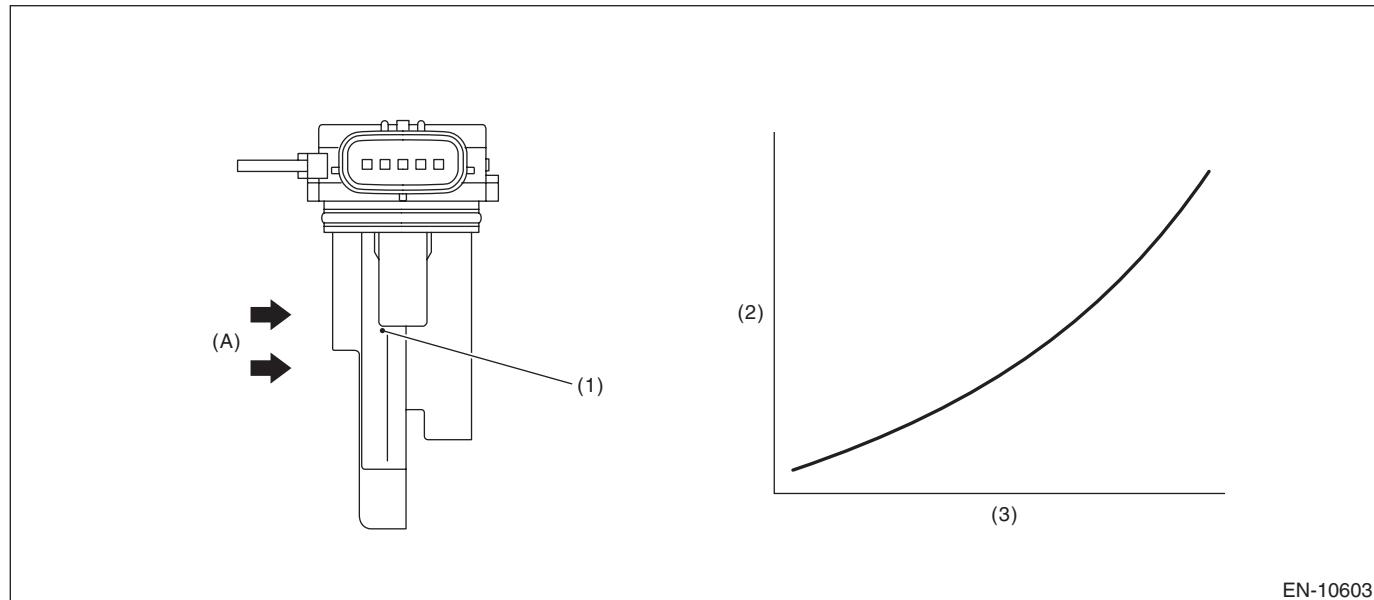
GENERAL DESCRIPTION

AJ:DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT

1. OUTLINE OF DIAGNOSIS

Detect open or short circuits of the air flow sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-10603

(A) Air

(1) Air flow sensor

(2) Voltage (V)

(3) Amount of intake air (kg (lb)/s)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.43 V

Time Needed for Diagnosis: 500 ms

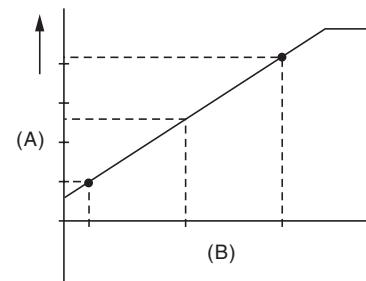
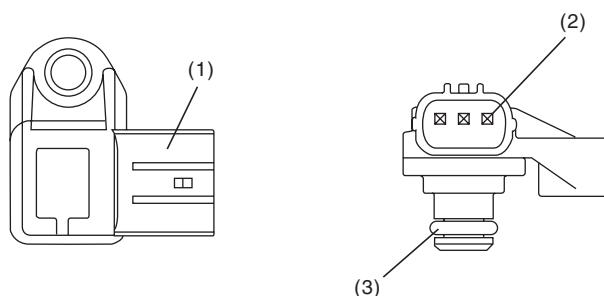
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

AK:DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of intake manifold pressure sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-08984

(A) Output voltage

(B) Absolute pressure

(1) Connector

(2) Terminals

(3) O-ring

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.608 V

Time Needed for Diagnosis: 2000 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

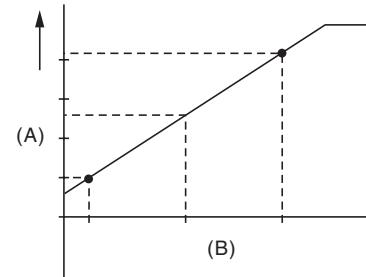
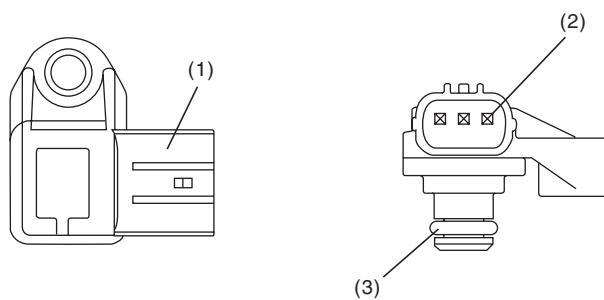
GENERAL DESCRIPTION

AL:DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of intake manifold pressure sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-08984

(A) Output voltage

(B) Absolute pressure

(1) Connector

(2) Terminals

(3) O-ring

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 3.906 V

Time Needed for Diagnosis: 2000 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

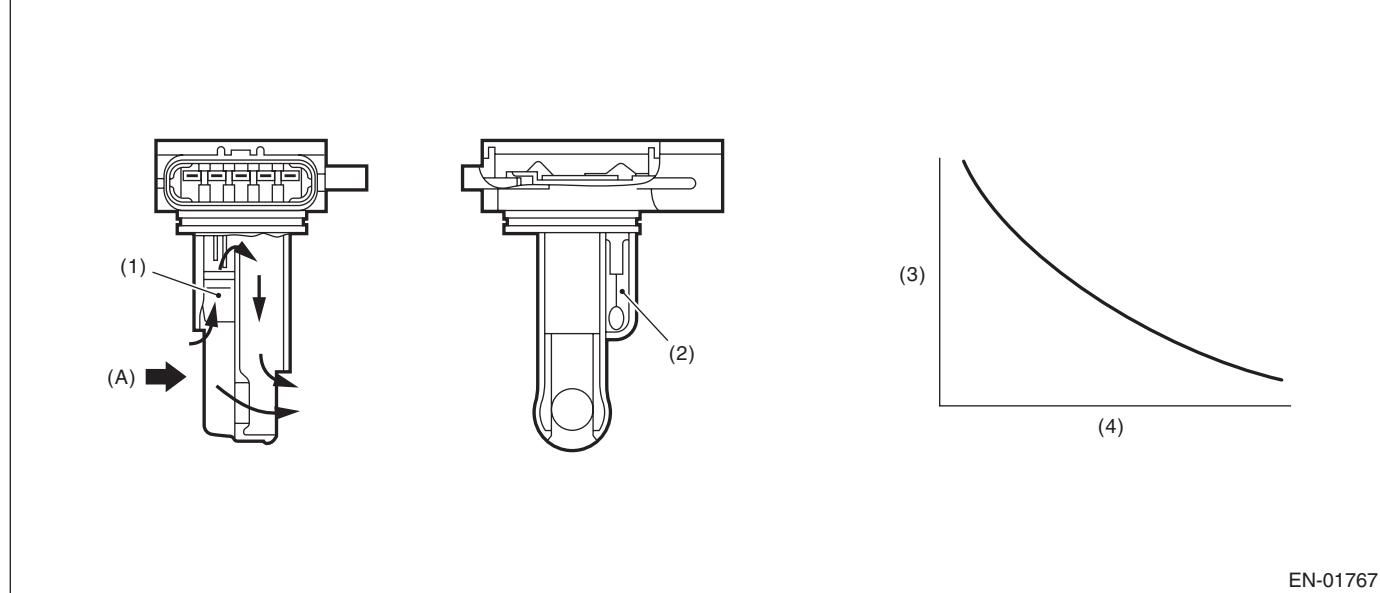
AM:DTC P0111 INTAKE AIR TEMPERATURE SENSOR RANGE/PERFORMANCE PROBLEM

1. OUTLINE OF DIAGNOSIS

Detect the abnormality of the intake air temperature sensor output characteristics. Perform the following two diagnosis, and judge as NG if either is NG.

- **Diagnosis 1 (relative diagnosis):** Perform diagnosis in reference to the intake air temperature sensor value, engine coolant temperature sensor value and ambient air temperature sensor value after engine start after predetermined time have passed in soak time. Judge as NG when the difference is more than the specific value in comparison respectively between intake air and engine coolant temperature, intake air and ambient air temperature.
- **Diagnosis 2 (stuck diagnosis):** Observe the engine condition, and if there is no variation in the driving condition under which the intake air temperature is considered to change, judge as NG.

2. COMPONENT DESCRIPTION



EN-01767

(A) Air

(1) Air flow sensor

(3) Resistance value (Ω)

(4) Intake air temperature °C (°F)

(2) Intake air temperature sensor

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITION

Diagnosis 1

Secondary Parameters	Enable Conditions
Soaking time	≥ 21600 s
Block heater judgment	Completed
Block heater activation	not activate

Diagnosis 2

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ 60 °C (140 °F)
Intake air amount sum value	\geq Value of Map 1
Number of experiences under conditions below	≥ 3 time(s)
• Continuous time when vehicle speed is less than 4 km/h (2.5 MPH)	\geq Value from Map 2
• Continuous time when vehicle speed is 40 km/h (24.9 MPH) or more and intake air amount is 10 g/s (0.35 oz/s) or more.	≥ 15 s

Map 1

Engine coolant temperature °C (°F)	-30 (-22)	-10 (14)	0 (32)	10 (50)	20 (68)
Intake air amount sum value (g (oz))	60000 (2116.2)	8500 (299.8)	7500 (264.53)	7000 (246.89)	5000 (176.35)

Map 2

Engine coolant temperature °C (°F)	-30 (-22)	-10 (14)	0 (32)	10 (50)
Continuous time (s) when vehicle speed is less than 4 km/h (2.5 MPH)	180	100	70	45

4. GENERAL DRIVING CYCLE

- **Diagnosis 1:** Perform diagnosis only once after engine start after constant soak time.
- **Diagnosis 2:** Perform the diagnosis when the vehicle speed condition is met after warming up from a cold condition.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

Judge as NG when diagnosis 1 or diagnosis 2 becomes NG.

Diagnosis 1

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Intake air temperature 30 s after engine start – engine coolant temperature at engine start	> Value of Map 3
Intake air temperature 30 s after engine start – Ambient air temperature 30 s after engine start	> Value of Map 4

Map 3

Ambient air temperature °C (°F)	-30 (-22)	30 (86)	45 (113)	60 (140)
Intake air temperature 30 s after engine start – engine coolant temperature at engine start °C (°F)	12 (21.6°F)	12 (21.6°F)	22 (39.6°F)	22 (39.6°F)

Map 4

Ambient air temperature °C (°F)	-30 (-22)	30 (86)	45 (113)	60 (140)
Intake air temperature 30 s after engine start – Ambient air temperature 30 s after engine start °C (°F)	20 (36°F)	20 (36°F)	32 (57.6°F)	32 (57.6°F)

Time Needed for Diagnosis: Less than 1 second

Diagnosis 2

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage difference between Max. and Min.	< 0.02 V (Equivalent to approximately 0.5°C (0.9°F) near 25°C (77°F)) (Equivalent to approximately 0.9°C (1.6°F) near -7°C (19.4°F))

Time Needed for Diagnosis: Less than 1 second

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

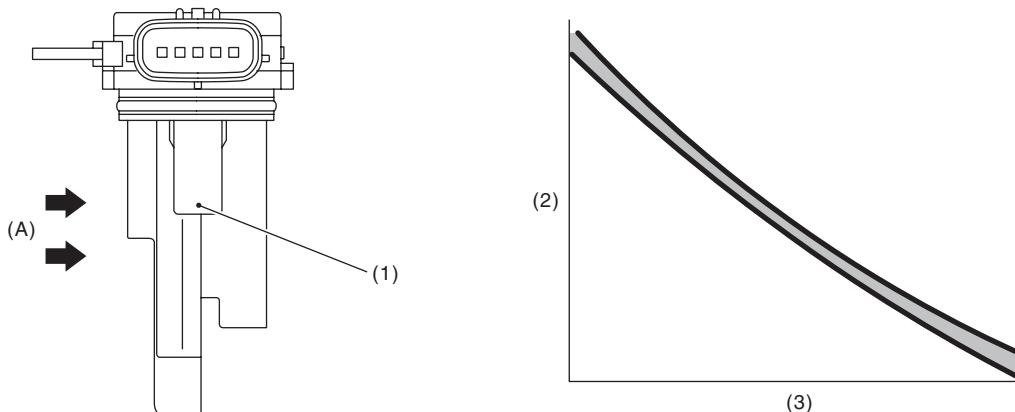
GENERAL DESCRIPTION

AN:DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the intake air temperature sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-10604

(A) Air

(1) Intake air temperature sensor

(2) Resistance value (Ω)

(3) Intake air temperature °C (°F)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.4 V

Time Needed for Diagnosis: 500 ms

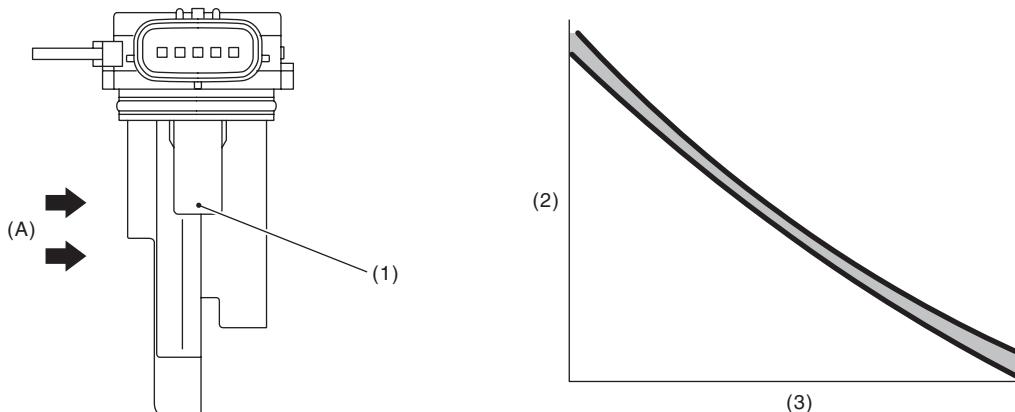
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

AO:DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the intake air temperature sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-10604

(A) Air

(1) Intake air temperature sensor

(2) Resistance value (Ω)

(3) Intake air temperature °C (°F)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.707 V

Time Needed for Diagnosis: 500 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

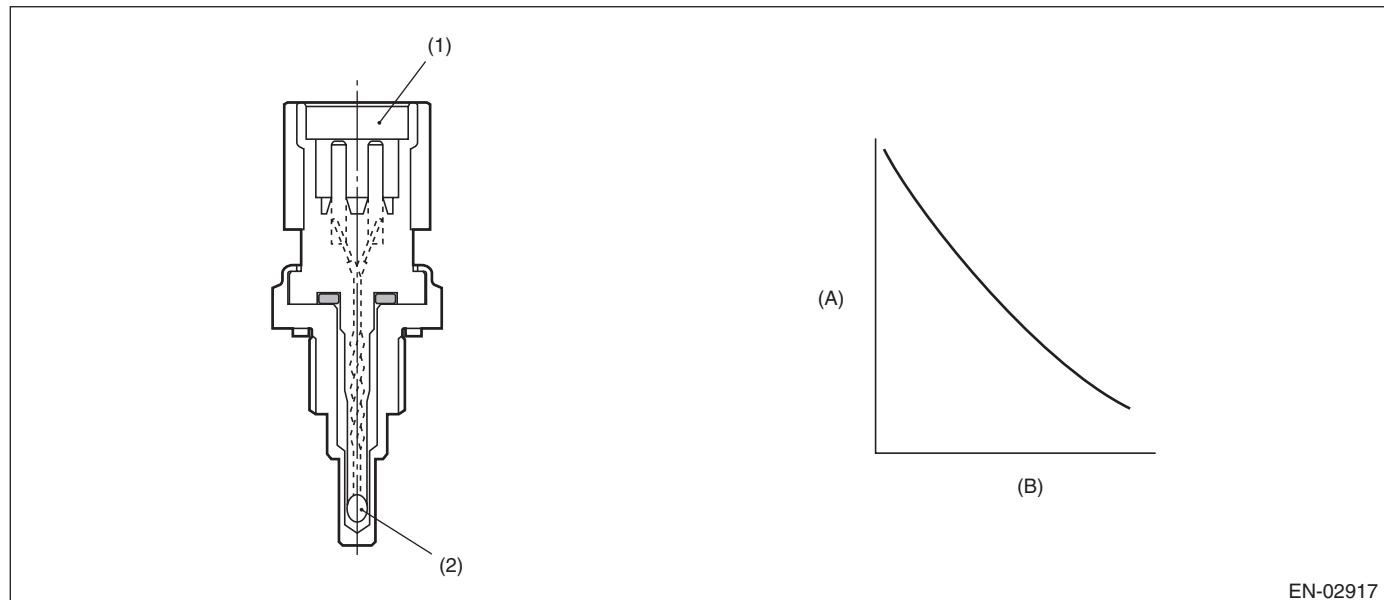
AP:DTC P0116 ENGINE COOLANT TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of the engine coolant temperature sensor characteristics.

Perform diagnosis in reference to the engine coolant temperature sensor value, intake air temperature sensor value and ambient air temperature sensor value after engine start after predetermined time have passed in soak time. Judge as NG when the difference is more than the specific value in comparison respectively between engine coolant and ambient air temperature, engine coolant and intake air temperature.

2. COMPONENT DESCRIPTION



EN-02917

(A) Resistance value (kΩ) (B) Temperature °C (°F)

(1) Connector (2) Thermistor element

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Soaking time	≥ 21600 s
Block heater judgment	Completed
Block heater activation	not activate

4. GENERAL DRIVING CYCLE

Perform diagnosis only once after engine start after constant soak time.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature at engine start – Intake air temperature 30 s after engine start	> Value from Map
Engine coolant temperature at engine start – ambient air temperature at engine start	> 25 °C (45°F)

Map

Ambient air temperature °C (°F)	-30 (-22)	30 (86)	45 (113)	60 (140)
Engine coolant temperature at engine start – Intake air temperature 30 s after engine start °C (°F)	12 (21.6°F)	12 (21.6°F)	22 (39.6°F)	22 (39.6°F)

Time Needed for Diagnosis: Less than 1 second

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

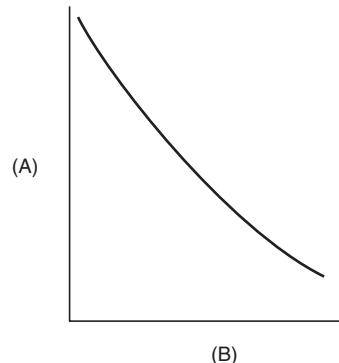
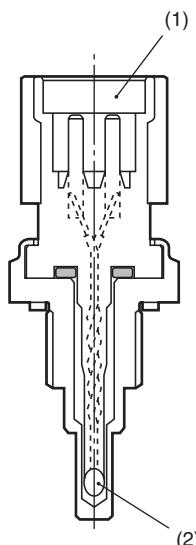
GENERAL DESCRIPTION

AQ:DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the engine coolant temperature sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-02917

(A) Resistance value (kΩ) (B) Temperature °C (°F)

(1) Connector (2) Thermistor element

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.349 V

Time Needed for Diagnosis: 500 ms

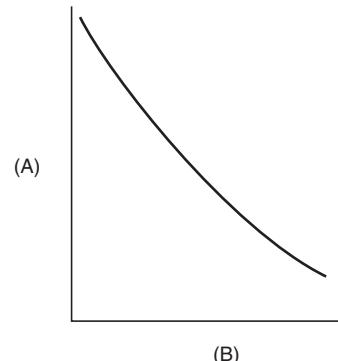
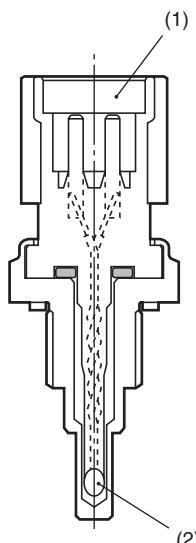
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

AR:DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the engine coolant temperature sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-02917

(A) Resistance value (kΩ) (B) Temperature °C (°F)

(1) Connector (2) Thermistor element

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.698 V

Time Needed for Diagnosis: 500 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

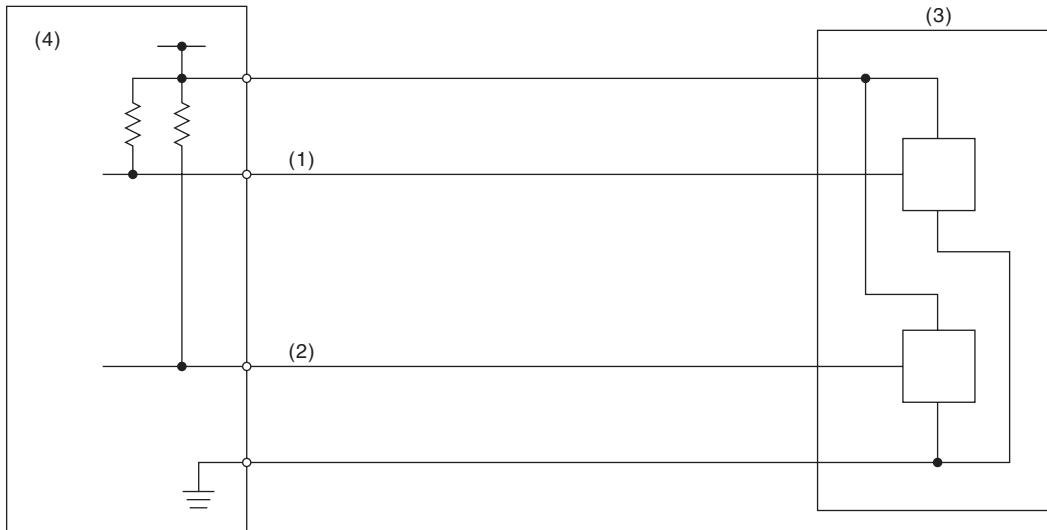
GENERAL DESCRIPTION

AS:DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 1.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-01859

(1) Throttle position sensor 1 signal
(2) Throttle position sensor 2 signal

(3) Throttle position sensor

(4) Engine control module (ECM)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

JUDGMENT VALUE

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	≤ 0.267 V

Time Needed for Diagnosis: 24 ms

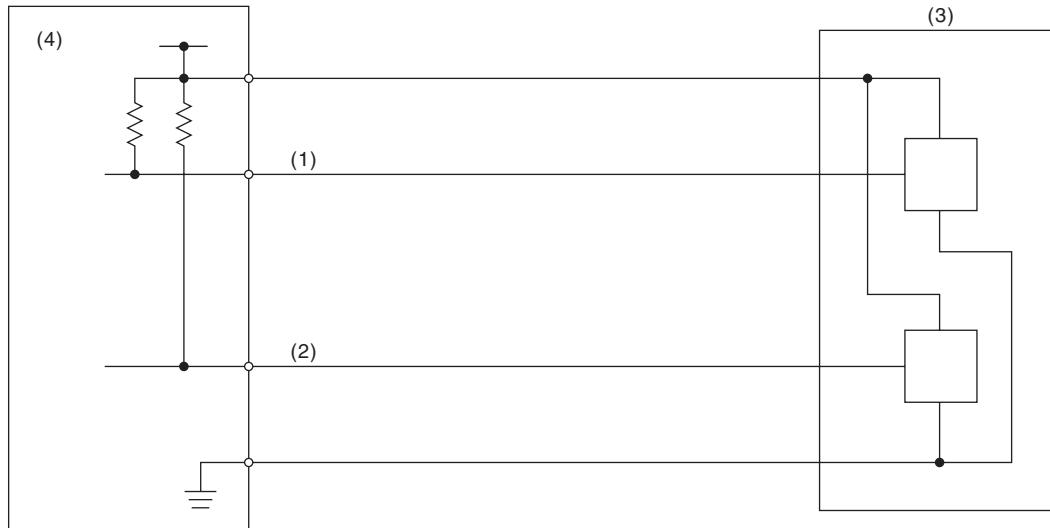
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

AT:DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 1.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-01859

(1) Throttle position sensor 1 signal
(2) Throttle position sensor 2 signal

(3) Throttle position sensor

(4) Engine control module (ECM)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	≥ 4.727 V

Time Needed for Diagnosis: 24 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

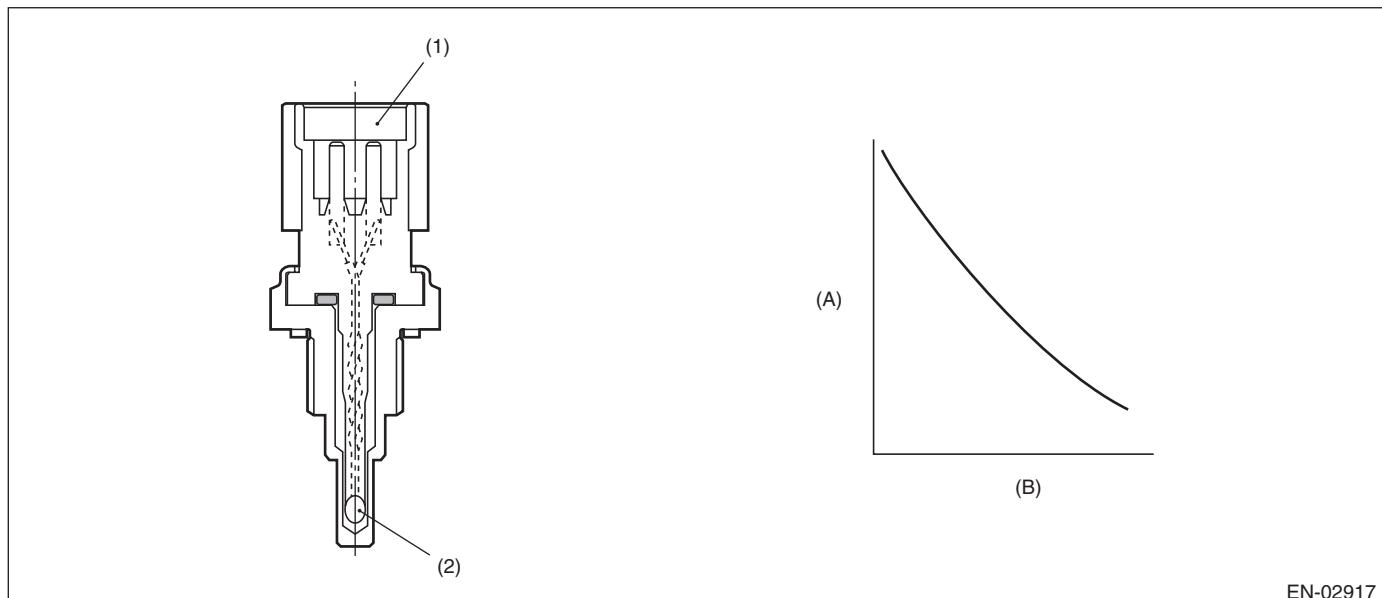
AU:DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of engine coolant temperature sensor output property.

Judge as NG when the engine coolant temperature has not risen to the specific value after the predetermined time has passed since engine start.

2. COMPONENT DESCRIPTION



EN-02917

(A) Resistance value (kΩ)

(B) Temperature °C (°F)

(1) Connector

(2) Thermistor element

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature at engine starting	$< -15^{\circ}\text{C}$ (5 °F)
Engine speed	> 500 rpm

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once after starting the engine in cold condition.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature	$< -15^{\circ}\text{C}$ (5 °F)
Elapsed time after starting the engine (At the time of (The smaller value of either Engine coolant temperature or Intake air temperature at engine start) $\geq -23.3^{\circ}\text{C}$ (-9.9°F))	≥ 120 s
or (At the time of (The smaller value of either Engine coolant temperature or Intake air temperature at engine start) $< -23.3^{\circ}\text{C}$ (-9.9°F))	≥ 300 s

Time Needed for Diagnosis: 120 s or 300 s

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

AV:DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE)

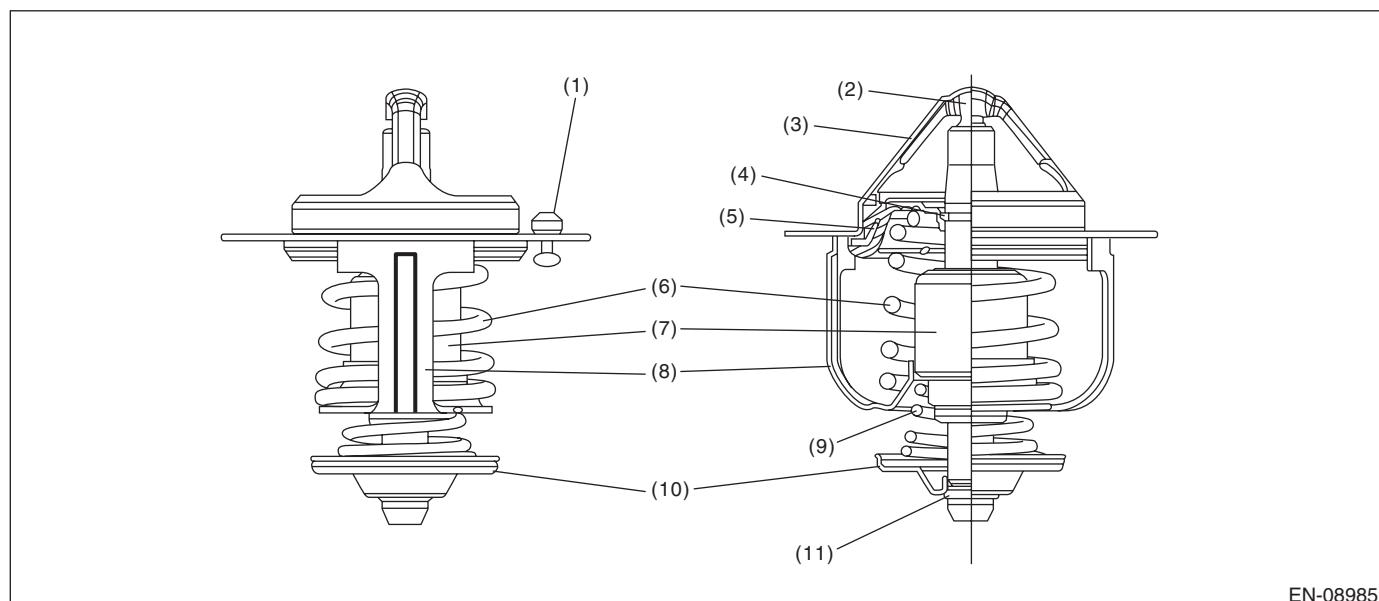
1. OUTLINE OF DIAGNOSIS

Detect malfunctions of the thermostat function.

Judge as NG when any one of the following conditions is established.

- When the actual engine coolant temperature does not reach the maximum temperature necessary to perform other OBDII diagnosis and Σ (Estimated engine coolant temperature – actual engine coolant temperature) exceeded the predetermined value. (Judgment 1)
- When the actual engine coolant temperature does not reach the range within -11°C (-19.8°F) from the regulated temperature and Σ (Estimated engine coolant temperature – actual engine coolant temperature) exceeded the predetermined value. (Judgment 2)
- When the difference between the estimated coolant temperature and the actual engine coolant temperature exceeds the predetermined value, and Σ (Estimated engine coolant temperature – actual engine coolant temperature) exceeded the predetermined value. (Judgment 3)

2. COMPONENT DESCRIPTION



(1) Jiggle valve	(5) Dust seal	(9) Bypass spring
(2) Piston	(6) Main spring	(10) Bypass valve
(3) Flange	(7) Wax element	(11) Stop ring
(4) Stop ring	(8) Frame	

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
<Judgment 1>	
Battery voltage	$\geq 10.9 \text{ V}$
Estimate ambient temperature	$\geq -7 \text{ }^{\circ}\text{C}$ (19.4 $^{\circ}\text{F}$)
Vehicle speed	$\geq 30 \text{ km/h}$ (18.6 MPH)
Estimated coolant temperature	\geq Value of Map 1
Engine coolant temperature at engine starting	$< 62 \text{ }^{\circ}\text{C}$ (143.6 $^{\circ}\text{F}$)
<Judgment 2>	
Battery voltage	$\geq 10.9 \text{ V}$
Estimate ambient temperature	$\geq -7 \text{ }^{\circ}\text{C}$ (19.4 $^{\circ}\text{F}$)
Vehicle speed	$\geq 30 \text{ km/h}$ (18.6 MPH)
Estimated coolant temperature	\geq Value from Map 2
Engine coolant temperature at engine starting	$< 62 \text{ }^{\circ}\text{C}$ (143.6 $^{\circ}\text{F}$)
<Judgment 3>	
Battery voltage	$\geq 10.9 \text{ V}$
Estimate ambient temperature	$\geq -7 \text{ }^{\circ}\text{C}$ (19.4 $^{\circ}\text{F}$)
Vehicle speed	$\geq 30 \text{ km/h}$ (18.6 MPH)
Estimated coolant temperature	\geq Value from Map 3
Engine coolant temperature at engine starting	$< 62 \text{ }^{\circ}\text{C}$ (143.6 $^{\circ}\text{F}$)

Map 1

Engine coolant temperature at engine starting °C (°F)	-7 (19.4)	8 (46.4)	10 (50)	25 (77)
Estimated coolant temperature °C (°F)	60 (140)	60 (140)	60 (140)	60 (140)

Map 2

Engine coolant temperature at engine starting °C (°F)	-7 (19.4)	8 (46.4)	10 (50)	25 (77)
Estimated coolant temperature °C (°F)	70.2 (158.4)	80.2 (176.4)	80.2 (176.4)	80.2 (176.4)

Map 3

Engine coolant temperature at engine starting °C (°F)	-7 (19.4)	10 (50)	25 (77)	29 (84.2)
Estimated coolant temperature °C (°F)	59 (138.2)	70 (158)	78 (172.4)	80.2 (176.4)

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once after starting the engine.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
When any one of the followings is established:	
<Judgment 1>	
Actual engine coolant temperature and Σ (Estimated engine coolant temperature – actual engine coolant temperature)	< Value of Map 4 > Value of Map 5
<Judgment 2>	
Actual engine coolant temperature and Σ (Estimated engine coolant temperature – actual engine coolant temperature)	< Regulated temperature – Value of Map 6 > Value of Map 7
<Judgment 3>	
Estimated engine coolant temperature – actual engine coolant temperature and Σ (Estimated engine coolant temperature – actual engine coolant temperature)	> Value of Map 8 > Value of Map 9

Map 4

Estimate ambient temperature °C (°F)	-7 (19.4)	8 (46.4)	10 (50)	25 (77)
Threshold Value °C (°F)	60 (140)	60 (140)	60 (140)	60 (140)

Map 5

Engine coolant temperature at engine starting °C (°F)	-7 (19.4)	0 (32)	8 (46.4)	10 (50)	25 (77)	35 (95)
Threshold Value °C (°F)	1731.6 (3116.9)	1731.6 (3116.9)	1731.6 (3116.9)	1731.6 (3116.9)	1731.6 (3116.9)	1200 (2160)

Map 6

Estimate ambient temperature °C (°F)	-7 (19.4)	8 (46.4)	10 (50)	25 (77)
Threshold Value °C (°F)	21.1 (30.1)	11.1 (20)	11.1 (20)	11.1 (20)

Map 7

Engine coolant temperature at engine starting °C (°F)	-7 (19.4)	0 (32)	8 (46.4)	10 (50)	30 (86)	35 (95)
Threshold Value °C (°F)	1731.6 (3116.9)	1731.6 (3116.9)	1731.6 (3116.9)	1731.6 (3116.9)	1731.6 (3116.9)	1500 (2700)

Map 8

Estimate ambient temperature °C (°F)	-7 (19.4)	8 (46.4)	10 (50)	25 (77)
Threshold Value °C (°F)	11.1 (20)	11.1 (20)	11.1 (20)	11.1 (20)

Map 9

Engine coolant temperature at engine starting °C (°F)	-7 (19.4)	8 (46.4)	10 (50)	25 (77)
Threshold Value °C (°F)	1731.6 (3116.9)	1731.6 (3116.9)	1731.6 (3116.9)	1731.6 (3116.9)

Time Needed for Diagnosis: 300 — 700 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

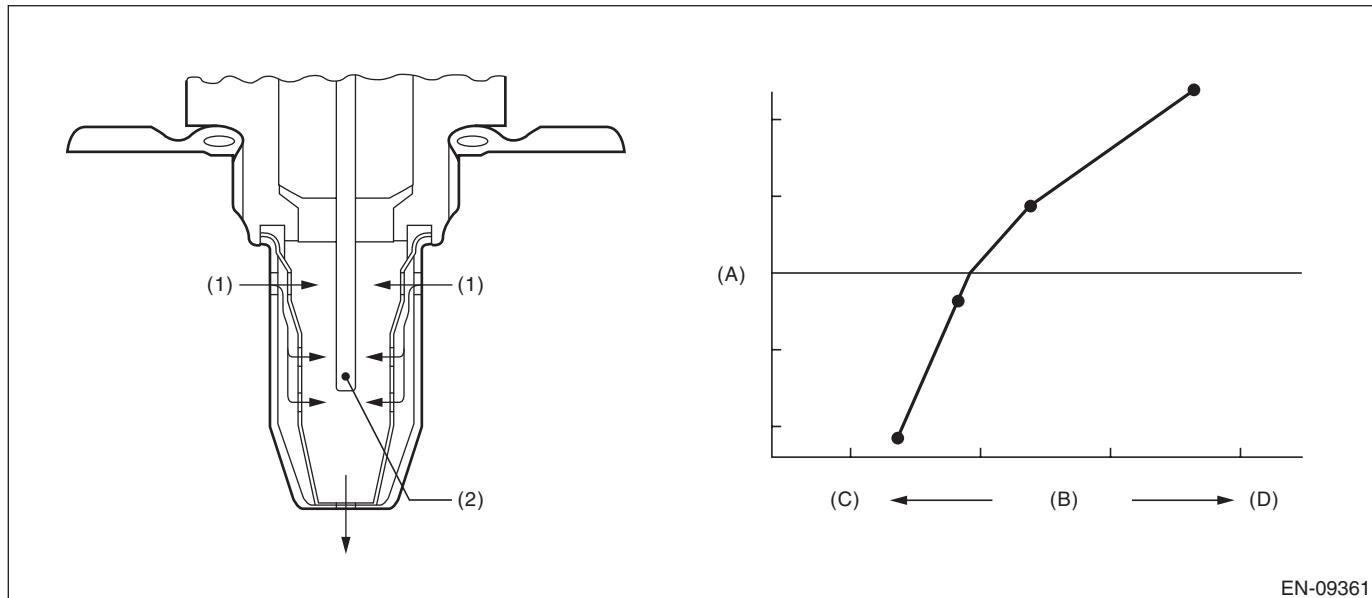
AW:DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of sensor.

Judge as NG, when the element voltage is out of the specified range.

2. COMPONENT DESCRIPTION



EN-09361

(A) Electromotive force
(D) Lean

(B) Air fuel ratio
(2) ZrO_2

(C) Rich

(1) Exhaust gas

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
(1) Input voltage (+)	< 0.4 V
or	
(2) Input voltage (-)	< 0.4 V
or	
(3) $ Input voltage (+) - Input voltage (-) $ and $3.8 V < Input voltage (-) < 4.7 V$	< 0.1 V

Time Needed for Diagnosis:

- (1): 1000 ms
- (2): 1000 ms
- (3): 1000 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

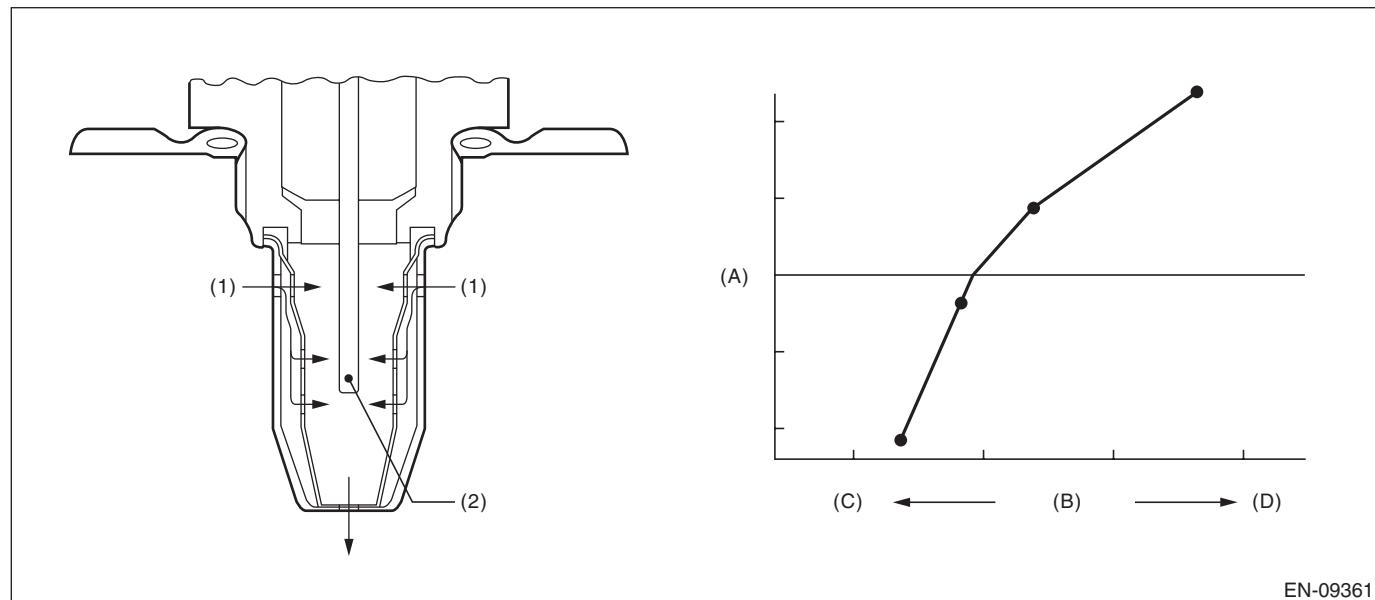
AX:DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of sensor.

Judge as NG, when the element voltage is out of the specified range.

2. COMPONENT DESCRIPTION



EN-09361

(A) Electromotive force
(D) Lean

(B) Air fuel ratio
(2) ZrO_2

(C) Rich

(1) Exhaust gas

(2) ZrO_2

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
(1) Input voltage (+)	> 4.7 V
or	
(2) Input voltage (-)	> 4.7 V

Time Needed for Diagnosis:

(1): 1000 ms

(2): 1000 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

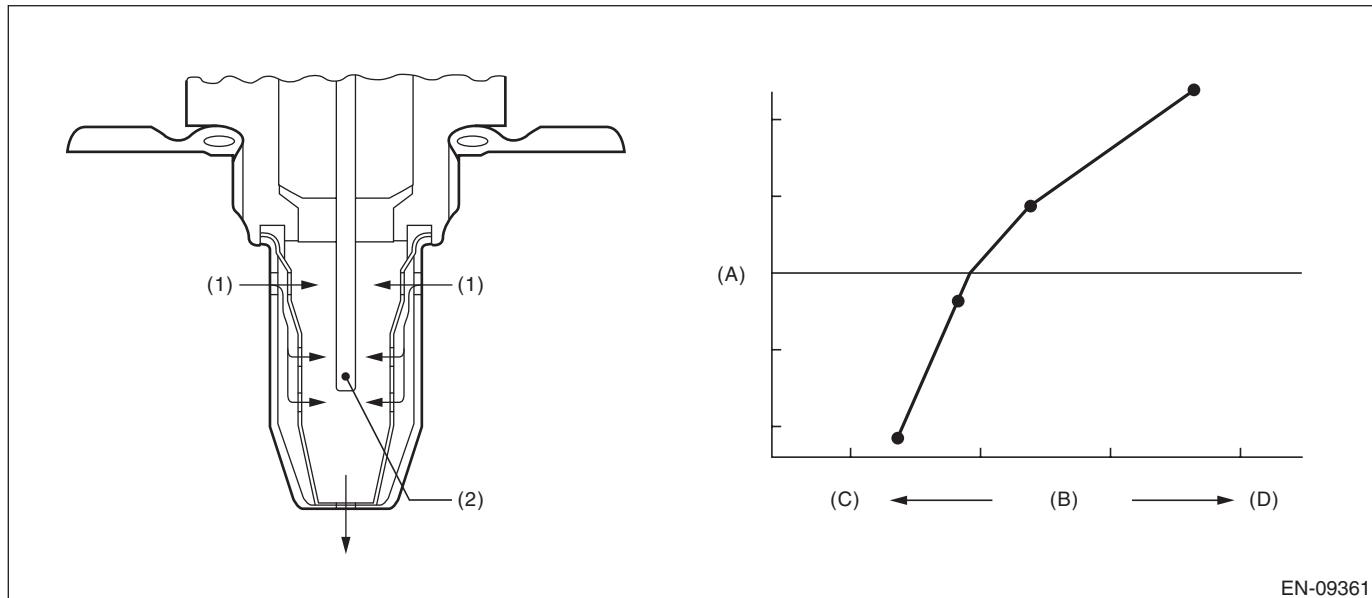
AY:DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect open circuits of the sensor.

Judge as NG when the impedance of the element is large.

2. COMPONENT DESCRIPTION



EN-09361

(A) Electromotive force
(D) Lean

(B) Air fuel ratio
(2) ZrO₂

(C) Rich

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Time of heater control duty at 70 % or more	≥ 36000 ms

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Front oxygen (A/F) sensor impedance	> 450 Ω

Time Needed for Diagnosis: 5000 ms

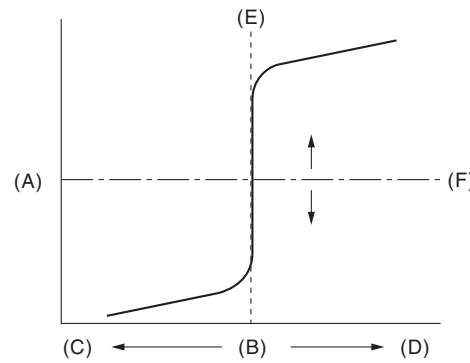
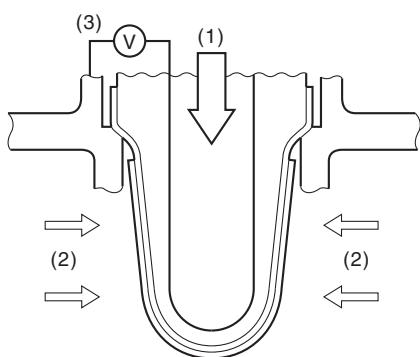
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

AZ:DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

Detect continuity NG of the oxygen sensor. If the oxygen sensor voltage reading is not within the probable range considering the operating conditions, judge as NG.

2. COMPONENT DESCRIPTION



EN-01696

(A) Electromotive force	(B) Air fuel ratio	(C) Lean
(D) Rich	(E) Theoretical air fuel ratio	(F) Comparative voltage
(1) Atmosphere	(2) Exhaust gas	(3) Electromotive force

3. ENABLE CONDITION

Used for judgment

Secondary Parameters	Enable Conditions
High	
Battery voltage	≥ 10.9 V
Low (1)	
Closed loop control at the oxygen sensor	In operation
Battery voltage	≥ 10.9 V
Amount of intake air	≥ 10 g/s (0.35 oz/s)
Low (2)	
Closed loop control at the oxygen sensor	In operation
Battery voltage	≥ 10.9 V
Amount of intake air	< 10 g/s (0.35 oz/s)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

4. GENERAL DRIVING CYCLE

After starting the engine, continuously perform the diagnosis with the same engine condition. If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

JUDGMENT VALUE

Malfunction Criteria	Threshold Value	DTC
High Sensor output voltage	> 1.2 V	P0138
Low Sensor output voltage	< 0.03 V	P0137

Time Needed for Diagnosis:

High: 2500 ms
Low (1): 20000 ms
Low (2): 40000 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

BA:DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0137. <Ref. to GD(H4DO HEV)-57, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

BB:DTC P013A O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 2)

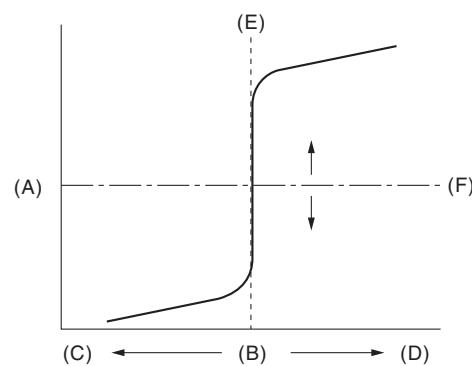
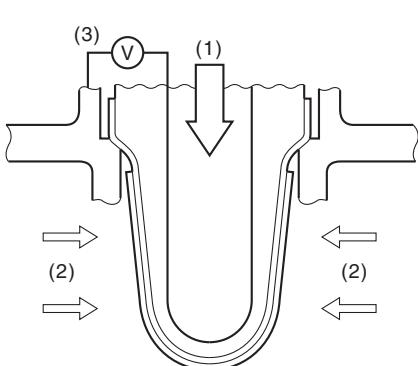
1. OUTLINE OF DIAGNOSIS

Detect the slow response of rich → lean for rear oxygen sensor output.

When the deceleration fuel cut has occurred, detect the trouble by calculating the time when the rear oxygen sensor output passes through the predetermined range of voltages.

Judge as NG when the response time is larger than the threshold value.

2. COMPONENT DESCRIPTION



EN-01696

(A) Electromotive force	(B) Air fuel ratio	(C) Lean
(D) Rich	(E) Theoretical air fuel ratio	(F) Comparative voltage
(1) Atmosphere	(2) Exhaust gas	(3) Electromotive force

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Current calculation time of the rear oxygen sensor heater after starting	≥ 180000 ms
Engine speed when fuel cut starts	≥ 1000 rpm
Rear oxygen sensor voltage when fuel cut starts	≥ 0.55 V
Fuel cut time	≥ 5000 ms
Engine coolant temperature when fuel cut starts	≥ -40 °C (-40 °F)
Estimated temperature of rear oxygen sensor element when fuel cut starts	≥ 500 °C (932 °F)

4. GENERAL DRIVING CYCLE

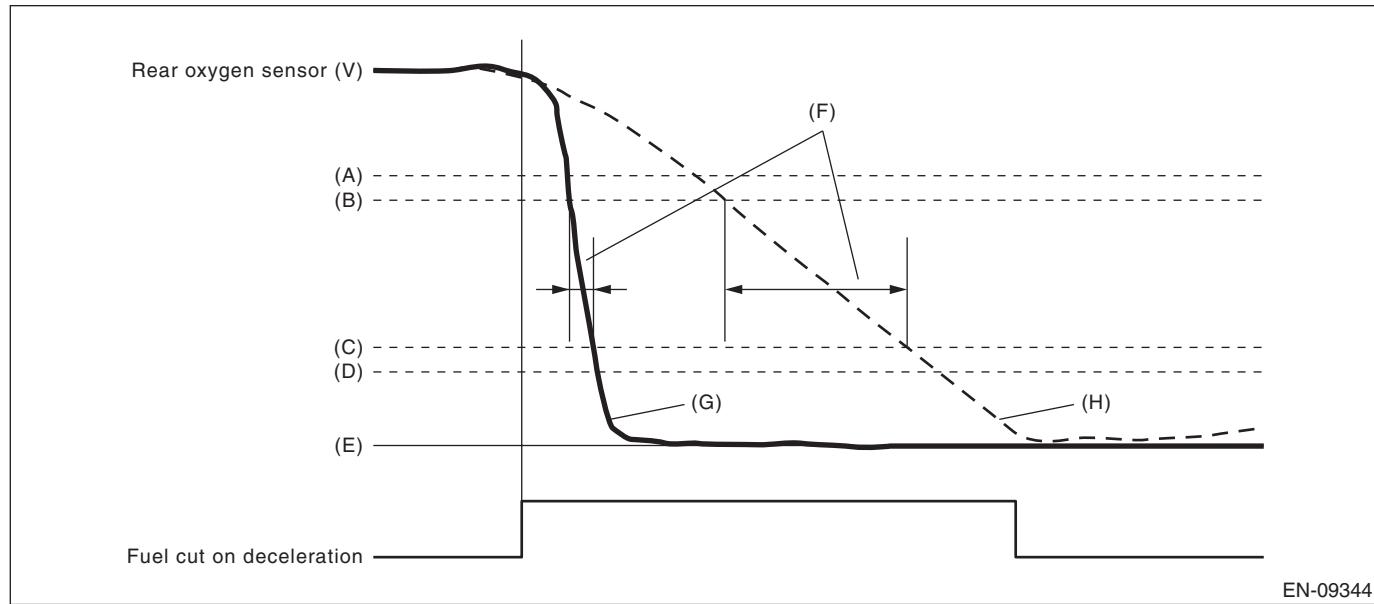
Perform diagnosis once during deceleration fuel cut from a constant and high speed driving, when rear oxygen sensor is warmed up sufficiently.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

Detect the trouble by calculating the response time of the rear oxygen sensor during fuel cut.



EN-09344

(A) 0.55 V	(B) 0.50 V	(C) 0.20 V
(D) 0.15 V	(E) 0 V	(F) Diagnostic parameter
(G) Normal	(H) Malfunction	

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Time when rear oxygen sensor voltage changed from 0.5 V to 0.2 V	> 491 ms

Time Needed for Diagnosis: 491 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

BC:DTC P013B O2 SENSOR SLOW RESPONSE - LEAN TO RICH (BANK 1 SENSOR 2)

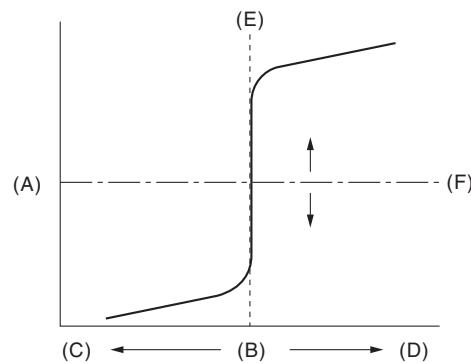
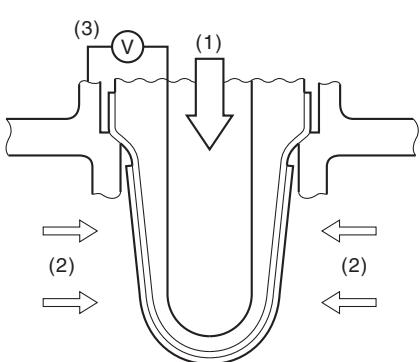
1. OUTLINE OF DIAGNOSIS

Detect the slow response of lean → rich for rear oxygen sensor output.

After the deceleration fuel cut has occurred, detect the trouble by calculating the time when the rear oxygen sensor output passes through the predetermined range of voltages.

Judge as NG when the response time is larger than the threshold value.

2. COMPONENT DESCRIPTION



EN-01696

(A) Electromotive force	(B) Air fuel ratio	(C) Lean
(D) Rich	(E) Theoretical air fuel ratio	(F) Comparative voltage
(1) Atmosphere	(2) Exhaust gas	(3) Electromotive force

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Front oxygen (A/F) sensor closed loop control	Operation
Fuel cut time	≥ 5000 ms

4. GENERAL DRIVING CYCLE

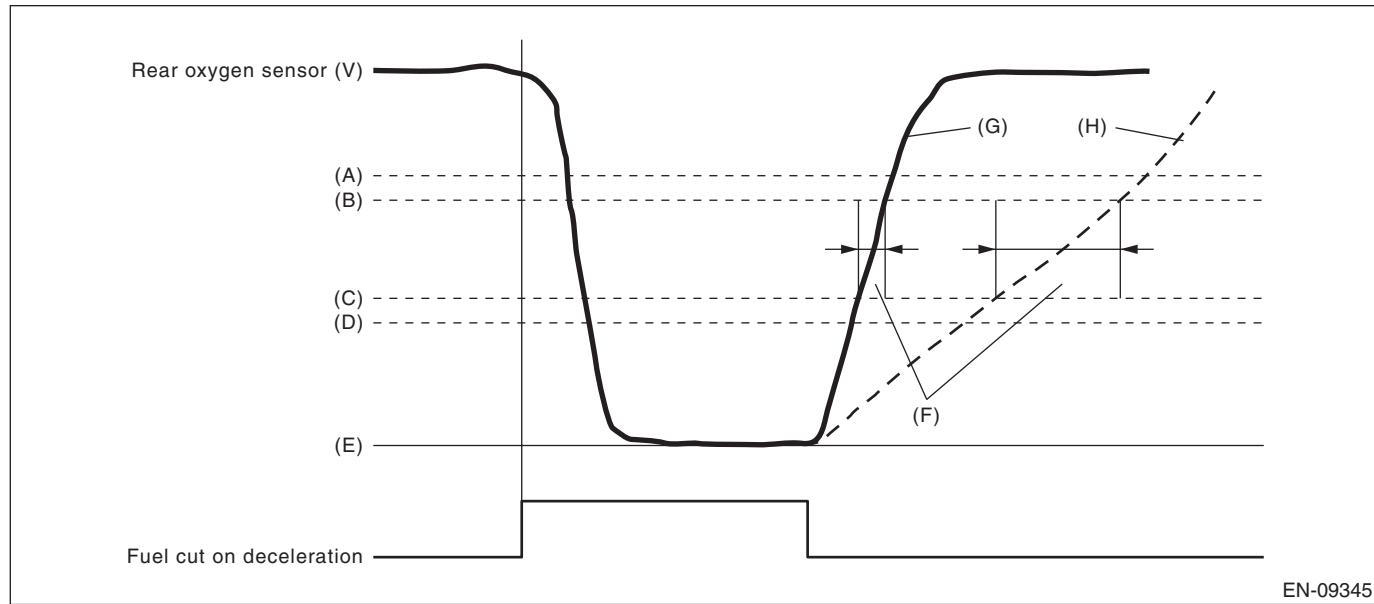
Perform diagnosis only once after recovering from a deceleration fuel cut continued for more than predetermined time.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

Detect the trouble by calculating the response time of the rear oxygen sensor after fuel cut.



EN-09345

(A) 0.55 V

(B) 0.50 V

(C) 0.30 V

(D) 0.25 V

(E) 0 V

(F) Diagnostic parameter

(G) Normal

(H) Malfunction

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Time when rear oxygen sensor voltage changed from 0.3 V to 0.5 V	> 4000 ms

Time Needed for Diagnosis: 4000 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

BD:DTC P013E O2 SENSOR DELAYED RESPONSE - RICH TO LEAN (BANK 1 SENSOR 2)

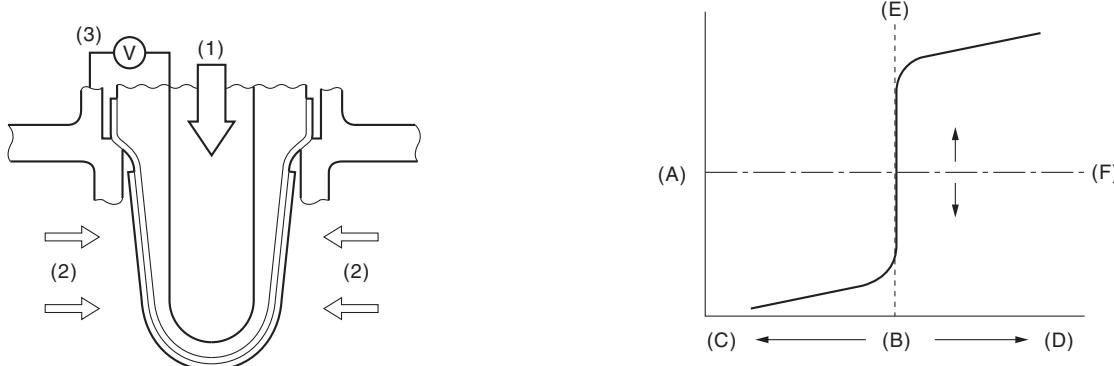
1. OUTLINE OF DIAGNOSIS

Detect the delayed response of rear oxygen sensor output for rich → lean.

After the deceleration fuel cut has started, detect the trouble by calculating the time when the rear oxygen sensor output decreases to the predetermined voltages.

Judge as NG when the response time is larger than the threshold value.

2. COMPONENT DESCRIPTION



EN-01696

(A) Electromotive force	(B) Air fuel ratio	(C) Lean
(D) Rich	(E) Theoretical air fuel ratio	(F) Comparative voltage
(1) Atmosphere	(2) Exhaust gas	(3) Electromotive force

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Engine speed when fuel cut starts	≥ 1000 rpm
Rear oxygen sensor voltage when fuel cut starts	≥ 0.55 V
Fuel cut time	≥ 5000 ms
Engine coolant temperature when fuel cut starts	≥ -40 °C (-40 °F)
Estimated temperature of rear oxygen sensor element when fuel cut starts	≥ 500 °C (932 °F)

4. GENERAL DRIVING CYCLE

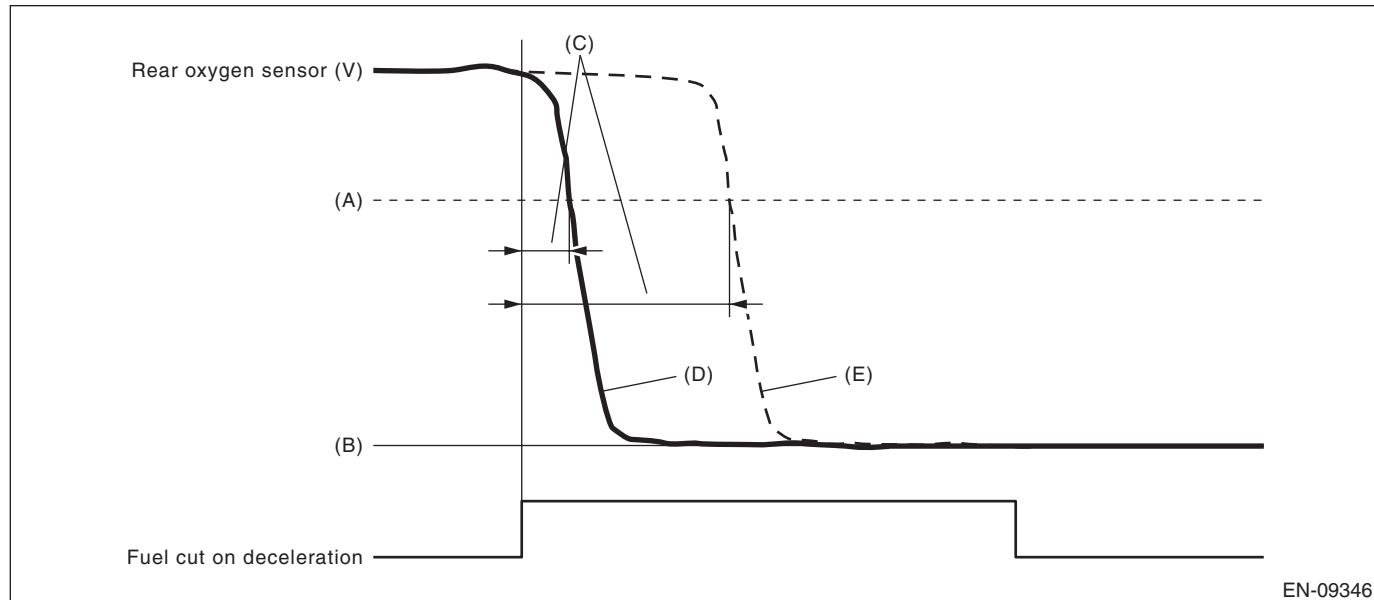
Perform diagnosis once during deceleration fuel cut from a constant and high speed driving, when rear oxygen sensor is warmed up sufficiently.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

Detect the trouble by calculating the time from the beginning of the fuel cut to the beginning of the rear oxygen sensor voltage starting to drop.



EN-09346

(A) 0.5 V

(D) Normal

(B) 0 V

(E) Malfunction

(C) Diagnostic parameter

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Time when rear oxygen sensor voltage changed to 0.5 V after the fuel cut started	> 4000 ms

Time Needed for Diagnosis: 4000 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

BE:DTC P013F O2 SENSOR DELAYED RESPONSE - LEAN TO RICH (BANK 1 SENSOR 2)

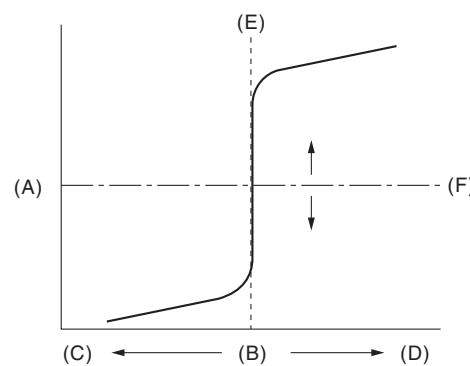
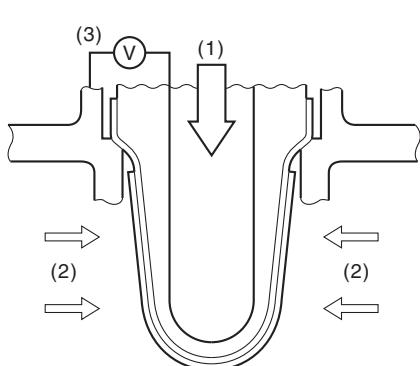
1. OUTLINE OF DIAGNOSIS

Detect the delayed response of rear oxygen sensor output for lean → rich.

After the deceleration fuel cut has completed, detect the trouble by calculating the time when the rear oxygen sensor output increases to the predetermined voltages.

Judge as NG when the response time is larger than the threshold value.

2. COMPONENT DESCRIPTION



EN-01696

(A) Electromotive force	(B) Air fuel ratio	(C) Lean
(D) Rich	(E) Theoretical air fuel ratio	(F) Comparative voltage
(1) Atmosphere	(2) Exhaust gas	(3) Electromotive force

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Front oxygen (A/F) sensor closed loop control	Operation
Engine speed	≥ 500 rpm
Rear oxygen sensor voltage when fuel cut has completed	< 0.15 V
Fuel cut time	≥ 5000 ms
Engine coolant temperature when fuel cut has completed	≥ -40 °C (-40 °F)
Estimated element temperature of rear oxygen sensor when fuel cut has completed	≥ 500 °C (932 °F)

4. GENERAL DRIVING CYCLE

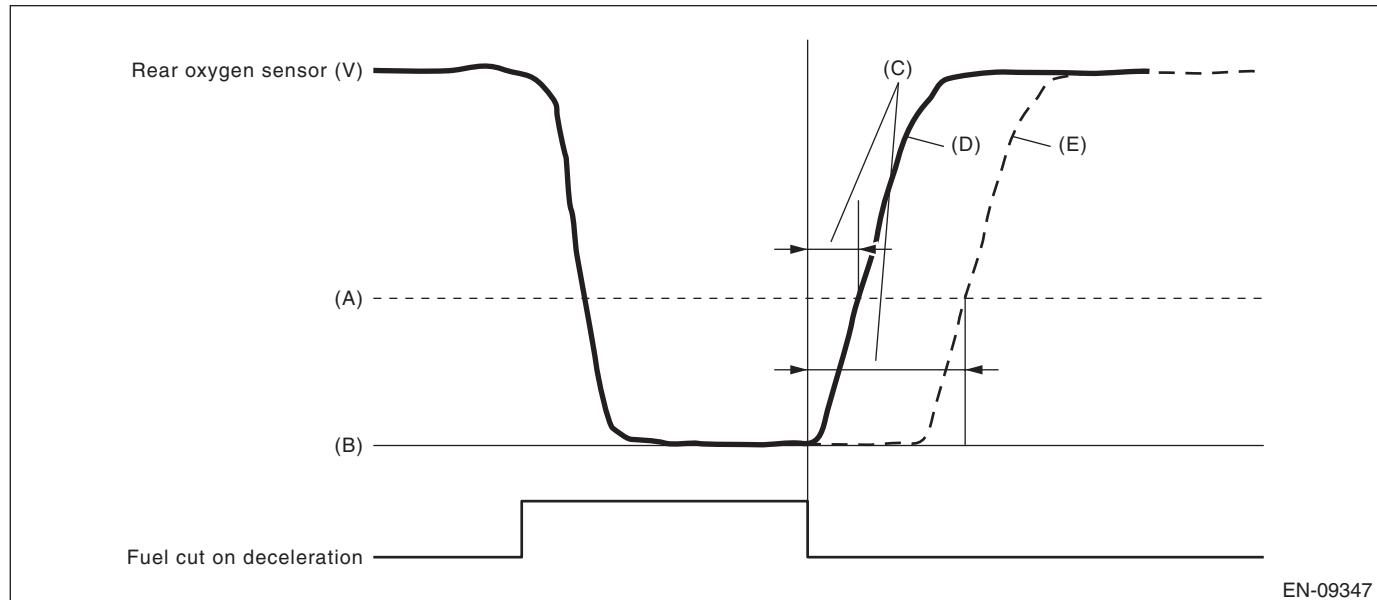
Perform diagnosis only once when recovering from the deceleration fuel cut continued for more than predetermined time with the rear oxygen sensor warmed up sufficiently.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

Detect the trouble by calculating the time from the completion of the fuel cut to the beginning of the rear oxygen sensor voltage starting to rise.



EN-09347

(A) 0.3 V

(D) Normal

(B) 0 V

(E) Malfunction

(C) Diagnostic parameter

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
The number of times that the rear oxygen sensor voltage changed to 0.3 V after the fuel cut has completed (time counter)	> 3750 time(s)

Time Needed for Diagnosis: 32 ms × 3750 time(s)

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

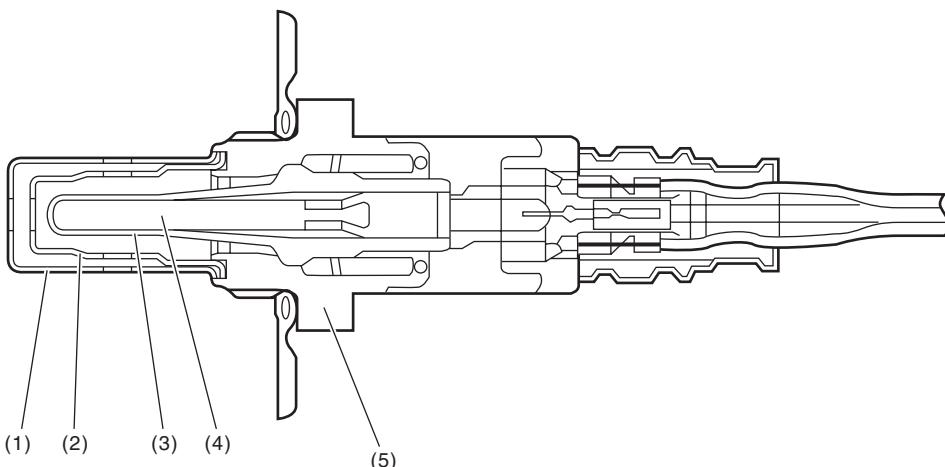
BF:DTC P0141 O2 SENSOR HEATER CIRCUIT (BANK1 SENSOR2)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of rear oxygen sensor heater.

While observing the engine condition, judge as NG if the rear oxygen sensor impedance is great.

2. COMPONENT DESCRIPTION



EN-08983

(1) Element cover (outer)	(3) Sensor element	(5) Sensor housing
(2) Element cover (inner)	(4) Ceramic heater	

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1000 ms
A/F sensor element impedance	≤ 82 Ω
A/F sensor heater control duty	≤ 75 %
Rear oxygen sensor heater control duty	< 70 %

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after 1000 ms or more have passed since the engine started.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$< \text{Battery voltage} \times 0.88$

Time Needed for Diagnosis: 4 ms \times 2500 time(s)

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

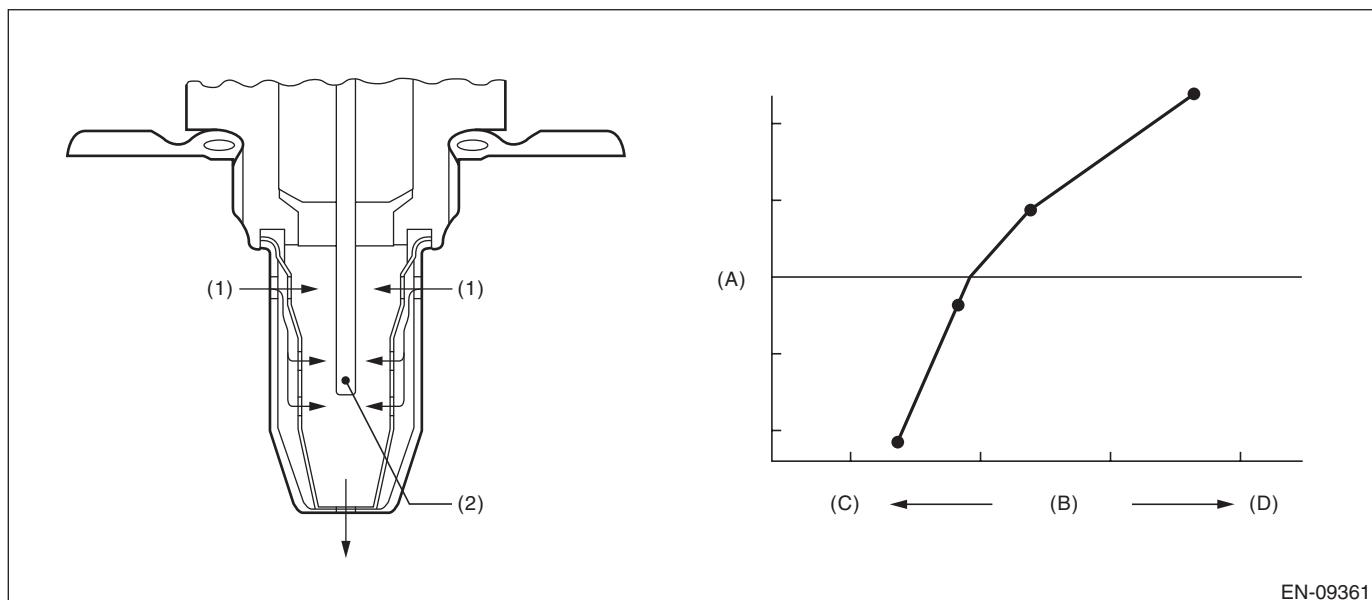
BG:DTC P014C O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect the slow response of front oxygen (A/F) sensor.

For diagnosis, detect the trouble by processing the λ waveform in normal driving without forcibly changing the target air fuel ratio.

2. COMPONENT DESCRIPTION



EN-09361

(A) Electromotive force

(B) Air fuel ratio

(C) Rich

(D) Lean

(1) Exhaust gas

(2) ZrO_2

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	$> 10.9 \text{ V}$
Closed loop control with main feedback	Operation
Engine speed	$\geq 1000 \text{ rpm}$
Amount of intake air	$\geq 10 \text{ g/s (0.35 oz/s)}$
Elapsed time after returning from the fuel cut	$\geq 3000 \text{ ms}$
Accelerator pedal position	$\neq 0\%$

4. GENERAL DRIVING CYCLE

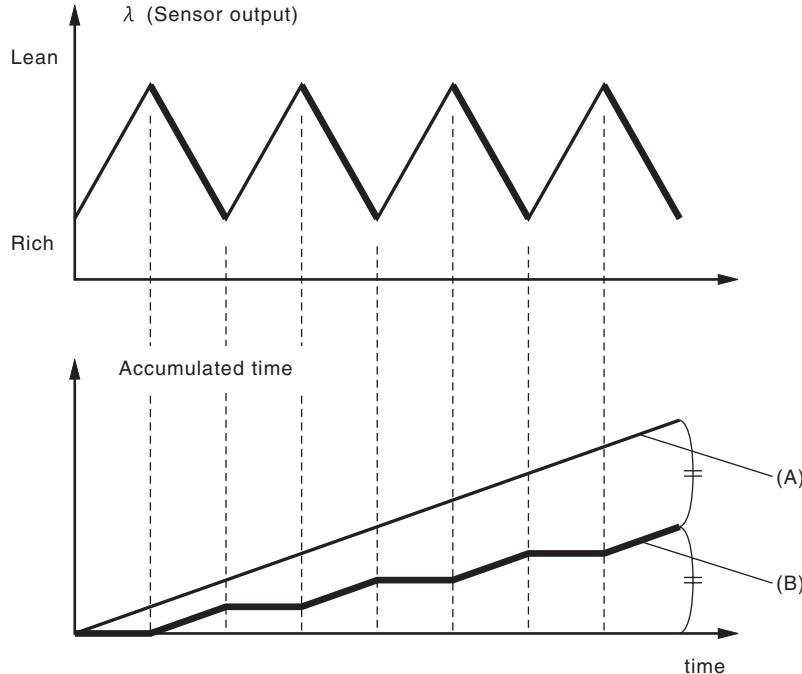
Perform diagnosis only once in a city driving including normal acceleration and deceleration.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD 1

Detect the malfunction by checking “Cumulative value of time when λ changes from lean → rich” in comparison to “Time during which diagnosis is in progress”.



EN-09340

(A) Time during which diagnosis is in progress (B) Cumulative value of time when λ changes from lean → rich

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
(Cumulative value of time when λ changes from lean → rich) / (Time during which diagnosis is in progress)	< 0.39	P014C
	> 0.61	P014D

Time Needed for Diagnosis: 90 seconds

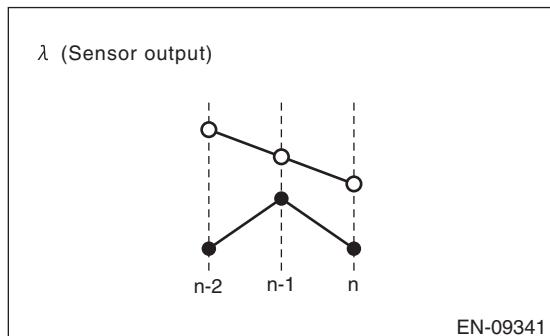
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

6. DIAGNOSTIC METHOD 2

Detect the malfunction by the cumulative value obtained from the amount of variation in λ change.



Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Cumulative value obtained from the amount of variation in λ change $\sum (\lambda(n) - \lambda(n-1)) - (\lambda(n-1) - \lambda(n-2)) $	< Value from Map	P014C and P014D

Map

Cumulative value obtained from the amount of variation in λ $\sum (\lambda(n) - \lambda(n-1)) $	0.00	3.50
Cumulative value obtained from the amount of variation in λ change $\sum (\lambda(n) - \lambda(n-1)) - (\lambda(n-1) - \lambda(n-2)) $	0.00	3.50

Time Needed for Diagnosis: 90 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

BH:DTC P014D O2 SENSOR SLOW RESPONSE - LEAN TO RICH (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P014C. <Ref. to GD(H4DO HEV)-68, DTC P014C O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

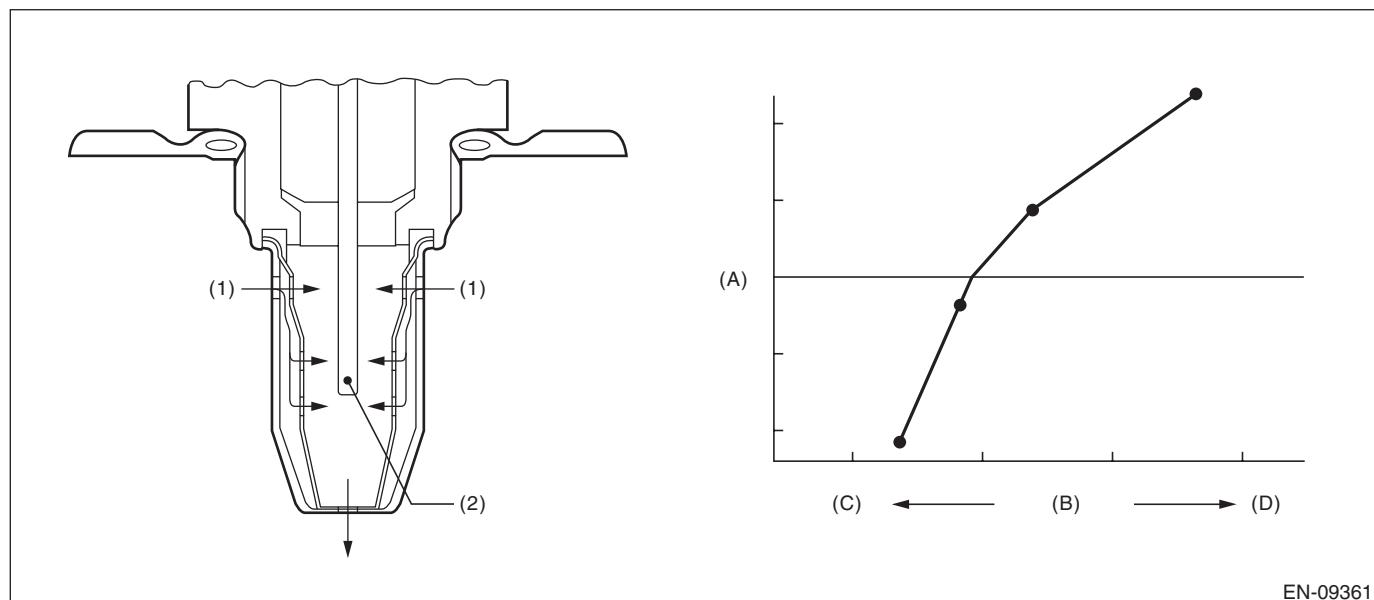
BI: DTC P015A O2 SENSOR DELAYED RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect the slow response of front oxygen (A/F) sensor.

For diagnosis, detect the trouble by processing the λ waveform in normal driving without forcibly changing the target air fuel ratio.

2. COMPONENT DESCRIPTION



EN-09361

(A) Electromotive force

(B) Air fuel ratio

(C) Rich

(D) Lean

(1) Exhaust gas

(2) ZrO_2

3. ENABLE CONDITIONS

Diagnostic method 1 and 2

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Closed loop control with main feedback	Operation
Engine speed	≥ 1000 rpm
Amount of intake air	≥ 10 g/s (0.35 oz/s)
Elapsed time after returning from the fuel cut	≥ 3000 ms
Accelerator pedal position	$\neq 0\%$

4. GENERAL DRIVING CYCLE

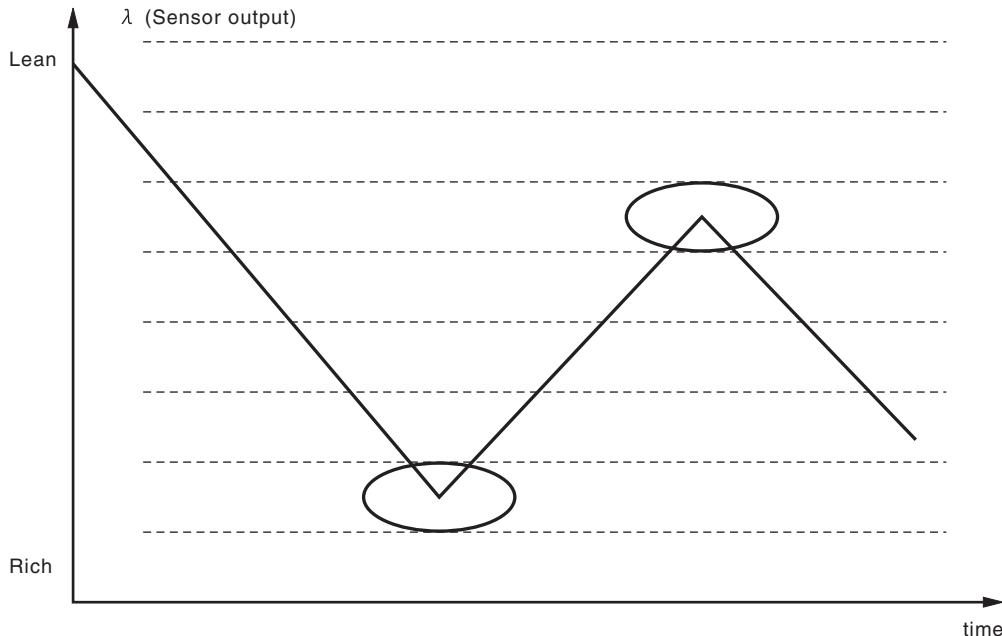
Perform diagnosis only once in a city driving including normal acceleration and deceleration.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD 1

Detect the malfunction depending on the average value of time necessary for λ to inverse the air fuel ratio from "Lean \rightarrow Rich \rightarrow Lean" to "Rich \rightarrow Lean \rightarrow Rich".



EN-09342

Judge as NG when the following conditions are established.

Judgment Value

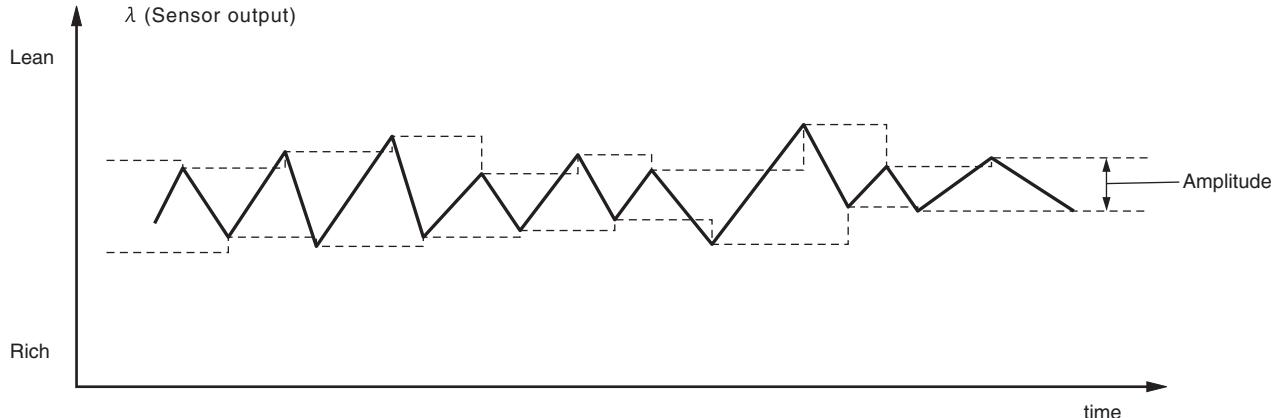
Malfunction Criteria	Threshold Value	DTC
Average value of time necessary for λ to inverse the air fuel ratio to Lean \rightarrow Rich \rightarrow Lean	> 150 ms	P015A
Average value of time necessary for λ to inverse the air fuel ratio to Rich \rightarrow Lean \rightarrow Rich	> 300 ms	P015B

Time Needed for Diagnosis: 50 times of inversion

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DIAGNOSTIC METHOD 2

Detect the malfunction by calculating the average amplitude of λ .



EN-09343

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Average value for λ amplitude	> 0.06	P015A and P015B

Time Needed for Diagnosis: 11250 time(s) \times 8 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

BJ:DTC P015B O2 SENSOR DELAYED RESPONSE - LEAN TO RICH (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P015A. <Ref. to GD(H4DO HEV)-71, DTC P015A O2 SENSOR DELAYED RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BK:DTC P0171 SYSTEM TOO LEAN (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect fuel system malfunction by the amount of main feedback control.

DIAGNOSTIC METHOD

Fuel system is diagnosed by comparing the target air fuel ratio calculated by ECM with the actual air fuel ratio measured by sensor.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
A/F main feedback function	In operation
Engine coolant temperature	$\geq -40^{\circ}\text{C} (-40^{\circ}\text{F})$
Engine load change	$< 1 \text{ g/rev (0.04 oz/rev)}$
Engine load	$\geq \text{Value of Map 1}$

Map 1

Engine speed (rpm)	Idling	600	1000	1500	2000	2500	3000	3500	4000	4500
Measured value (g (oz)/rev)	na	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling or at a constant speed after warming up the engine.

4. DIAGNOSTIC METHOD

Compare the diagnostic value (fsobd) with the threshold value, and if a condition meeting the malfunction criteria below continues for $10 \text{ s} \times 3$ time(s) or more, judge that there is a fault in the fuel system.

Judgment Value

Malfunction Criteria	Threshold Value
$\text{fsobd} = (\text{sglmd} - \text{tglmida}) + \text{faf} + \text{flaf}$ In this case: sglmd = measured lambda tglmida = target lambda faf = main feedback compensation coefficient (every 64 milliseconds) flaf = main feedback learning compensation coefficient	$\geq \text{Value from Map 2}$

Map 2

Amount of air (g (oz)/s)	0 (0)	3.2 (0.11)	6.4 (0.23)	9.6 (0.34)	12.8 (0.45)	16 (0.56)	19.2 (0.68)
fsobdL1 (%)	1.33	1.33	1.33	1.33	1.33	1.33	1.33

Time Needed for Diagnosis: $10 \text{ s} \times 3$ time(s)

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

BL:DTC P0172 SYSTEM TOO RICH (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect fuel system malfunction by the amount of main feedback control.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
A/F main learning system	In operation

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously during the closed loop.

4. DIAGNOSTIC METHOD

Compare the diagnostic value (fsobd) with the threshold value, and if a condition meeting the malfunction criteria listed below continues for $10\text{ s} \times 3$ time(s) or more, judge that there is a fault in the fuel system.

Judgment Value

Malfunction Criteria	Threshold Value
$fsobd = (sglmd - tglmda) + faf + flaf$ In this case: sglmd = measured lambda tglmda = target lambda faf = main feedback compensation coefficient (every 64 milliseconds) flaf = main feedback learning compensation coefficient	< Value from Map

Map

Compensation coefficient of warm-up increase amount	0	0.1	0.2	0.3
Threshold Value	0.67	0.576	0.502	0.436

Compensation coefficient of warm-up increase amount	0.4	0.5
Threshold Value	0.382	0.333

Time Needed for Diagnosis: $10\text{ s} \times 3$ time(s)

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

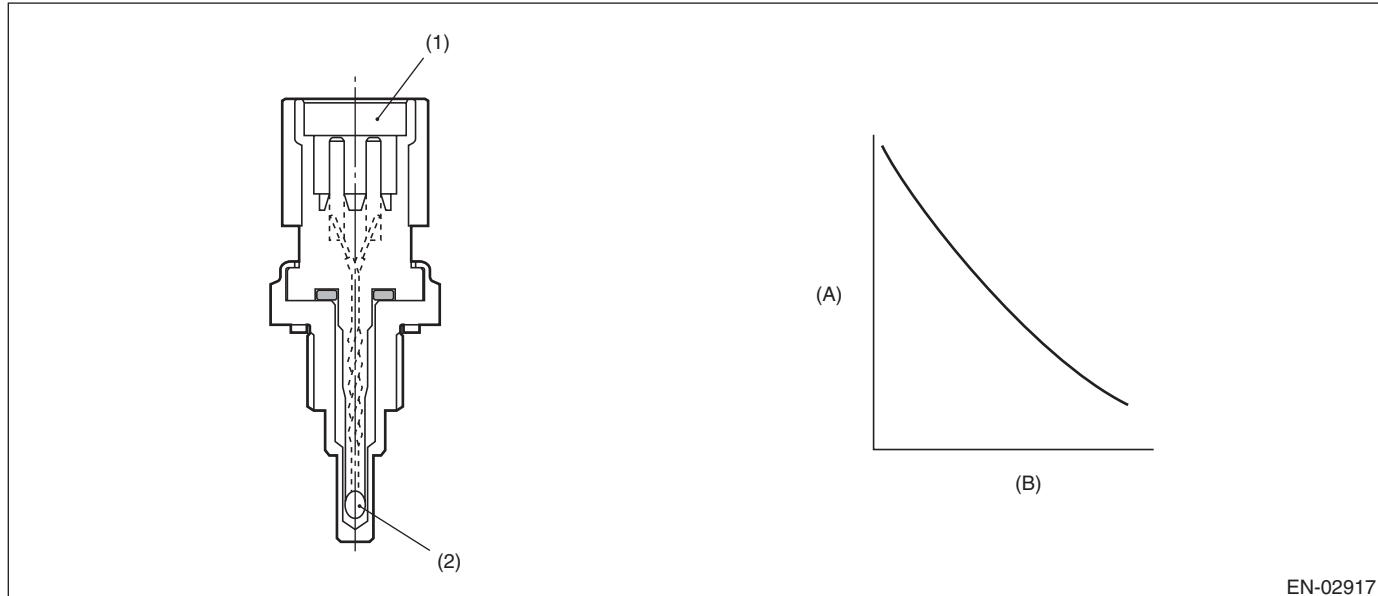
BM:DTC P0196 ENGINE OIL TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect the abnormality of the engine oil temperature sensor output characteristics. Perform the following two diagnosis, and judge as NG if either is NG.

- **Diagnosis 1 (relative diagnosis):** Perform diagnosis in reference to the engine oil temperature sensor value, engine coolant temperature sensor value and intake air temperature sensor value after engine start after predetermined time have passed in soak time. Judge as NG when the difference is more than the specific value in comparison respectively between engine oil and engine coolant temperature, engine oil and intake air temperature.
- **Diagnosis 2 (function diagnosis):** Judge as NG when the engine oil temperature does not rise to the specific value even if certain conditions are cleared at driving.

2. COMPONENT DESCRIPTION



EN-02917

(A) Resistance value (kΩ) (B) Temperature °C (°F)

(1) Connector (2) Thermistor element

3. ENABLE CONDITIONS

Diagnosis 1

Secondary Parameters	Enable Conditions
Soaking time	≥ 21600 s
Block heater judgment	Completed
Block heater activation	not activate

Diagnosis 2

Secondary Parameters	Enable Conditions
Engine oil temperature at engine starting	≤ 50 °C (122 °F)
Engine speed	> 500 rpm
Percentage of idling	$\leq 0.5 \times 100$

4. GENERAL DRIVING CYCLE

- **Diagnosis 1:** Perform diagnosis only once after engine start after constant soak time.
- **Diagnosis:** Perform the diagnosis only once after starting the engine in cold condition.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

Judge as NG when diagnosis 1 or diagnosis 2 becomes NG.

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Diagnosis 1

Judgment Value

Malfunction Criteria	Threshold Value
Engine oil temperature at engine start – Engine coolant temperature at engine start	> 10 °C (18°F)
Engine oil temperature at engine start – Intake air temperature 30 s after engine start	> Value of Map 1

Map 1

Ambient air temperature °C (°F)	-30 (-22)	30 (86)	45 (113)	60 (140)
Engine oil temperature at engine start – Intake air temperature 30 s after engine start °C (°F)	10 (18°F)	10 (18°F)	22 (39.6°F)	22 (39.6°F)

Time Needed for Diagnosis: Less than 1 second

Diagnosis 2

Judgment Value

Malfunction Criteria	Threshold Value
Engine oil temperature	< 50 °C (122 °F)
Elapsed time after starting the engine	≥ Value from Map 2

Map 2

		Intake air temperature at engine start °C (°F)							
		-30 (-22)	-20 (-4)	-10 (14)	0 (32)	10 (50)	20 (68)	30 (86)	40 (104)
Ratio of time at engine stop during elapsed time after engine start	0.0	2800000	2100000	1500000	1000000	750000	600000	500000	400000
	0.3	2800000	2100000	1500000	1000000	750000	600000	500000	400000
	0.6	2800000	2100000	1500000	1000000	750000	600000	500000	400000
	1.0	2800000	2100000	1500000	1000000	750000	600000	500000	400000

ms

Time Needed for Diagnosis: Value of Map 2

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

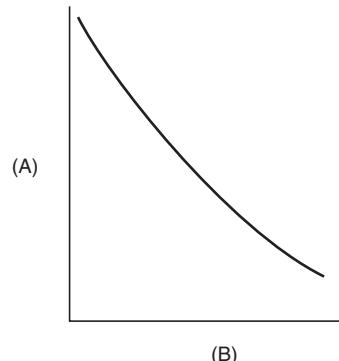
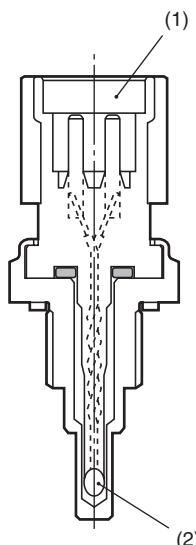
GENERAL DESCRIPTION

BN:DTC P0197 ENGINE OIL TEMPERATURE SENSOR LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the oil temperature sensor.
Judge as NG when outside of the judgment value.

2. COMPONENT DESCRIPTION



EN-02917

(A) Resistance value (kΩ) (B) Temperature °C (°F)

(1) Connector (2) Thermistor element

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.203 V

Time Needed for Diagnosis: 500 ms

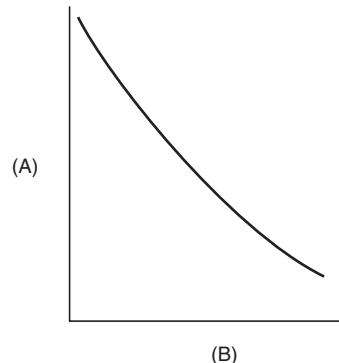
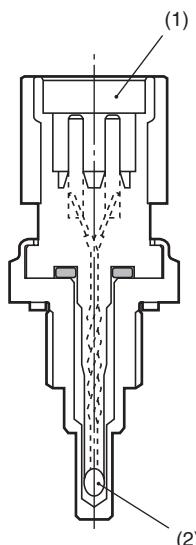
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

BO:DTC P0198 ENGINE OIL TEMPERATURE SENSOR HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the oil temperature sensor.
Judge as NG when outside of the judgment value.

2. COMPONENT DESCRIPTION



EN-02917

(A) Resistance value (kΩ) (B) Temperature °C (°F)

(1) Connector (2) Thermistor element

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.698 V

Time Needed for Diagnosis: 500 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BP:DTC P0201 INJECTOR #1

1. OUTLINE OF DIAGNOSIS

Based on the self-diagnostic result of the injector driving IC, judge the injector driving circuit as normal or abnormal.

Injector driving IC detects the status of “fuel remains injected” or “fuel is not injected” as a malfunction.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	> 1 s
Engine speed	> 500 rpm
Injection status	Not during fuel cut

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Injector driving IC information	Malfunction

Time Needed for Diagnosis: 2560 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

BQ:DTC P0202 INJECTOR #2

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0201. <Ref. to GD(H4DO HEV)-80, DTC P0201 INJECTOR #1, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BR:DTC P0203 INJECTOR #3

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0201. <Ref. to GD(H4DO HEV)-80, DTC P0201 INJECTOR #1, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BS:DTC P0204 INJECTOR #4

1. OUTLINE OF DIAGNOSIS

NOTE:

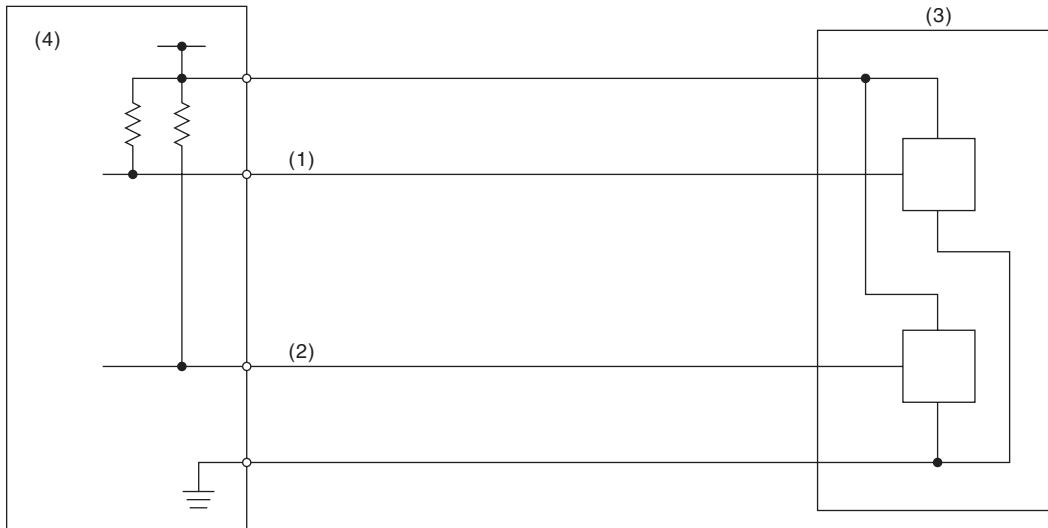
For the detection standard, refer to DTC P0201. <Ref. to GD(H4DO HEV)-80, DTC P0201 INJECTOR #1, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BT:DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 2.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-01859

(1) Throttle position sensor 1 signal
(2) Throttle position sensor 2 signal

(3) Throttle position sensor

(4) Engine control module (ECM)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	≤ 1.133 V

Time Needed for Diagnosis: 24 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

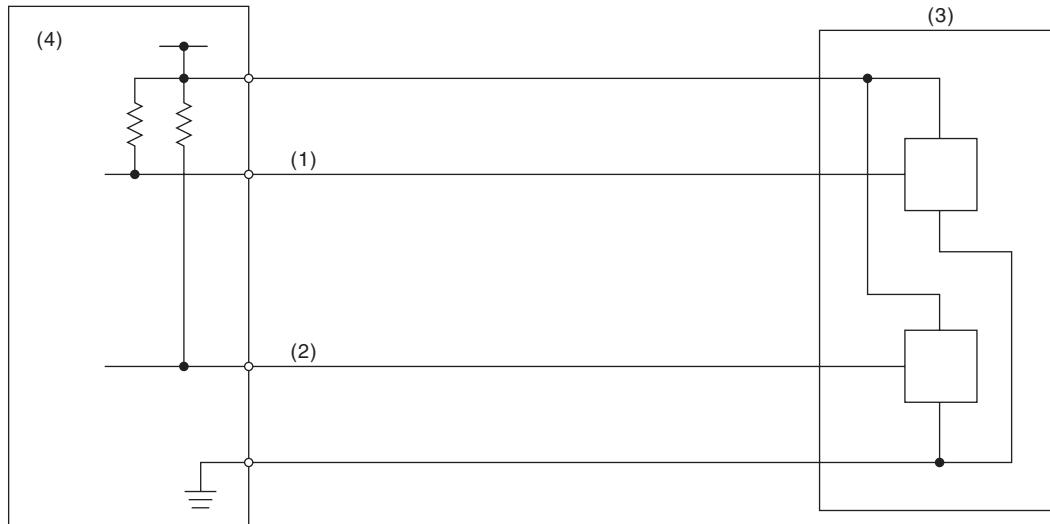
GENERAL DESCRIPTION

BU:DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 2.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-01859

- (1) Throttle position sensor 1 signal
- (2) Throttle position sensor 2 signal

(3) Throttle position sensor

(4) Engine control module (ECM)

.. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 6\text{ V}$

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	≥ 4.772 V

Time Needed for Diagnosis: 24 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

BV:DTC P0300 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

NOTE-

NOTE: For the detection standard, refer to DTC P0301. <Ref. to GD(H4DO HEV)-83, DTC P0301 CYLINDER 1 MISFIRE DETECTED. Diagnostic Trouble Code (DTC) Detecting Criteria.>

BW:DTC P0301 CYLINDER 1 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

Detect the presence of misfire occurrence. (Revolution fluctuation method)

Monitoring Misfire which influences exhaust deterioration (1.5 times of FTP) and catalyst damage is made obligatory by the law. Misfire affecting these two has two patterns below:

- Intermittent misfire (The same cylinder misfires in random, or different cylinders misfire in random.): FTP 1.5 times misfire
- Every time misfire (The same cylinder misfires every time.): FTP 1.5 times misfire, Catalyst damage misfire

The following detecting methods are adopted for these detection.

1) Intermittent misfire: FTP 1.5 times misfire

- 180° Interval Difference Method (MT: 1,800 rpm or less; AT: None)
- 360° Interval Difference Method (whole range)
- 720° Interval Difference Method (3,000 rpm or more)

2) Misfire every time: FTP 1.5 times misfire, Catalyst damage misfire

- 360° Interval Difference Method

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
All secondary parameters enable conditions	≥ 10000 ms
Intake manifold pressure change at 180°CA	$<$ Value of Map 1
Throttle position change during 16 milliseconds	< 100 °
Fuel shut-off function	Not in operation
Fuel level	≥ 7.8 l (2.06 US gal, 1.72 Imp gal)
Vehicle dynamic control or AT torque control	Not in operation
Evaporative system leak check	Not in operation
Engine speed	450 rpm — 6400 rpm
Intake manifold pressure	\geq Value from Map 2
Battery voltage	≥ 8 V
Fuel parameter determination	Not extremely low volatility
Engine speed change during 32 milliseconds	< 1000 rpm

Map 1

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6300
kPa (mmHg, inHg)	34 (255, 10)												

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Map 2

- Normal ignition

		Barometric pressure (kPa (mmHg, inHg))							
		66.4 (498 , 19.6)	72.5 (544 , 21.4)	75.7 (568 , 22.4)	79.5 (596 , 23.5)	82.3 (617 , 24.3)	84.9 (637 , 25.1)	91.6 (687 , 27)	100.5 (754, 29.7)
Engine speed (rpm)	700	17 (127.8 , 5)	17.7 (132.8 , 5.2)	18.1 (135.4 , 5.3)	18.5 (139.1 , 5.5)	19.2 (144.4 , 5.7)	20.3 (152.1 , 6)	21.2 (159.3 , 6.3)	26.3 (197.6 , 7.8)
	1000	17.8 (133.6 , 5.3)	18.5 (138.5 , 5.5)	19.2 (144.2 , 5.7)	19.8 (148.3 , 5.8)	20.3 (152.4 , 6)	20.6 (154.6 , 6.1)	21.7 (162.5 , 6.4)	23 (172.7 , 6.8)
	1200	17.7 (132.8 , 5.2)	18.1 (136.0 , 5.4)	19.2 (144.0 , 5.7)	19.9 (149.4 , 5.9)	20.2 (151.2 , 6)	20.8 (155.8 , 6.1)	21.9 (164.4 , 6.5)	22.7 (170.1 , 6.7)
	1600	17.7 (132.4 , 5.2)	18.2 (136.9 , 5.4)	19.2 (144.4 , 5.7)	19.6 (146.7 , 5.8)	20.3 (152.2 , 6)	20.5 (153.4 , 6)	21.6 (161.7 , 6.4)	22.8 (170.9 , 6.7)
	2000	18.1 (136.0 , 5.4)	19.5 (146.6 , 5.8)	20 (150.2 , 5.9)	20.3 (152.2 , 6)	21 (157.6 , 6.2)	21.5 (161.1 , 6.3)	22.3 (167.6 , 6.6)	23.9 (179.4 , 7.1)
	2400	18.2 (136.4 , 5.4)	20 (150.2 , 5.9)	20.6 (154.3 , 6.1)	21.6 (161.9 , 6.4)	21.8 (163.5 , 6.4)	22.8 (170.7 , 6.7)	23.5 (175.9 , 6.9)	24.8 (186.2 , 7.3)
	2800	18.9 (141.9 , 5.6)	20.5 (153.9 , 6.1)	21 (157.4 , 6.2)	21.6 (161.8 , 6.4)	22.4 (167.8 , 6.6)	22.7 (170.5 , 6.7)	23.7 (178.1 , 7)	25 (187.8 , 7.4)
	3000	19.4 (145.6 , 5.7)	20.1 (150.8 , 5.9)	20.7 (155.1 , 6.1)	21.4 (160.4 , 6.3)	22.4 (167.9 , 6.6)	22.4 (168.0 , 6.6)	23.4 (175.9 , 6.9)	25.2 (188.9 , 7.4)
	3200	21.8 (163.8 , 6.4)	22.7 (170.0 , 6.7)	22.9 (172.0 , 6.8)	23.5 (176.2 , 6.9)	24.4 (183.1 , 7.2)	24.5 (184.1 , 7.2)	25.4 (190.8 , 7.5)	25.1 (188.5 , 7.4)
	3600	23.7 (178.1 , 7)	24.8 (186.3 , 7.3)	25.5 (191.0 , 7.5)	26.2 (196.7 , 7.7)	27.4 (205.2 , 8.1)	27.5 (206.4 , 8.1)	28.1 (210.7 , 8.3)	27.8 (208.2 , 8.2)
	4000	25.4 (190.8 , 7.5)	26.7 (200.2 , 7.9)	27.4 (205.7 , 8.1)	28.7 (215.1 , 8.5)	29.7 (222.9 , 8.8)	29.8 (223.8 , 8.8)	30.1 (225.6 , 8.9)	29.1 (218.0 , 8.6)
	4400	27 (202.5 , 8)	28.3 (211.9 , 8.3)	29 (217.5 , 8.6)	30.2 (226.8 , 8.9)	31.3 (234.7 , 9.2)	31.4 (235.6 , 9.3)	31.6 (237.4 , 9.3)	30.6 (229.8 , 9)
	4800	28.6 (214.3 , 8.4)	29.8 (223.7 , 8.8)	30.6 (229.3 , 9)	31.8 (238.6 , 9.4)	32.9 (246.5 , 9.7)	33 (247.4 , 9.7)	33.2 (249.1 , 9.8)	32.2 (241.5 , 9.5)
	5200	30.1 (226.1 , 8.9)	31.4 (235.5 , 9.3)	32.1 (241.0 , 9.5)	33.4 (250.4 , 9.9)	34.4 (258.2 , 10.2)	34.5 (259.1 , 10.2)	34.8 (260.9 , 10.3)	33.8 (253.3 , 10)
	5600	31.7 (237.8 , 9.4)	33 (247.2 , 9.7)	33.7 (252.8 , 10)	34.9 (262.1 , 10.3)	36 (270.0 , 10.6)	36.1 (270.9 , 10.7)	36.4 (272.7 , 10.7)	35.3 (265.1 , 10.4)
	6000	33.3 (249.6 , 9.8)	34.5 (259.0 , 10.2)	35.3 (264.6 , 10.4)	36.5 (273.9 , 10.8)	37.6 (281.8 , 11.1)	37.7 (282.6 , 11.1)	37.9 (284.4 , 11.2)	36.9 (276.8 , 10.9)
	6400	34.8 (261.4 , 10.3)	36.1 (270.7 , 10.7)	36.8 (276.3 , 10.9)	38.1 (285.6 , 11.2)	39.1 (293.5 , 11.6)	39.3 (294.4 , 11.6)	39.5 (296.2 , 11.7)	38.5 (288.6 , 11.4)

kPa (mmHg, inHg)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

- Idling ignition

		Barometric pressure (kPa (mmHg, inHg))							
		66.4 (498 , 19.6)	72.5 (544 , 21.4)	75.7 (568 , 22.4)	79.5 (596 , 23.5)	82.3 (617 , 24.3)	84.9 (637 , 25.1)	91.6 (687 , 27)	100.5 (754, 29.7)
Engine speed (rpm)	700	17 (127.8 , 5)	17.7 (133.0 , 5.2)	18.1 (135.7 , 5.3)	18.7 (140.4 , 5.5)	19.2 (144.4 , 5.7)	20.3 (152.1 , 6)	21.2 (159.3 , 6.3)	26.3 (197.6 , 7.8)
	1000	18.6 (139.7 , 5.5)	19.5 (146.3 , 5.8)	19.9 (149.1 , 5.9)	20.9 (156.6 , 6.2)	20.9 (157.0 , 6.2)	22.1 (165.9 , 6.5)	23.4 (175.3 , 6.9)	24.4 (183.3 , 7.2)
	1200	18.5 (138.4 , 5.4)	19.3 (144.5 , 5.7)	20.2 (151.8 , 6)	20.7 (154.9 , 6.1)	21.1 (158.0 , 6.2)	23.4 (175.2 , 6.9)	25.8 (193.9 , 7.6)	24.6 (184.2 , 7.3)
	1600	18.3 (137.6 , 5.4)	19.3 (144.6 , 5.7)	19.9 (149.6 , 5.9)	20.4 (153.0 , 6)	20.9 (156.4 , 6.2)	21.9 (164.6 , 6.5)	23.7 (178.0 , 7)	23.8 (178.7 , 7)
	2000	18.4 (137.7 , 5.4)	20 (149.9 , 5.9)	20.4 (153.3 , 6)	20.9 (156.8 , 6.2)	21.4 (160.4 , 6.3)	22.7 (170.5 , 6.7)	24.1 (180.6 , 7.1)	25.4 (190.6 , 7.5)
	2400	18.2 (136.4 , 5.4)	20 (150.2 , 5.9)	20.6 (154.7 , 6.1)	21.6 (161.9 , 6.4)	22 (165.2 , 6.5)	23 (172.8 , 6.8)	24.7 (185.3 , 7.3)	26.2 (196.7 , 7.7)
	2800	18.9 (141.9 , 5.6)	20.5 (153.9 , 6.1)	21 (157.4 , 6.2)	22 (165.0 , 6.5)	22.4 (167.8 , 6.6)	22.7 (170.5 , 6.7)	24.3 (182.0 , 7.2)	25 (187.8 , 7.4)
	3000	19.4 (145.6 , 5.7)	20.1 (150.9 , 5.9)	20.7 (155.1 , 6.1)	21.5 (161.2 , 6.3)	22.4 (167.9 , 6.6)	22.4 (168.0 , 6.6)	23.7 (177.9 , 7)	25.2 (188.9 , 7.4)
	3200	21.8 (163.8 , 6.4)	22.7 (170.0 , 6.7)	22.9 (172.0 , 6.8)	23.5 (176.2 , 6.9)	24.4 (183.1 , 7.2)	24.5 (184.1 , 7.2)	25.7 (192.8 , 7.6)	25.1 (188.5 , 7.4)
	3600	24.4 (183.2 , 7.2)	25.5 (191.5 , 7.5)	25.8 (193.3 , 7.6)	26.9 (201.5 , 7.9)	28.1 (210.5 , 8.3)	28.4 (213.2 , 8.4)	29 (217.5 , 8.6)	28.6 (214.5 , 8.4)
	4000	25.8 (193.5 , 7.6)	27.1 (203.0 , 8)	27.4 (205.8 , 8.1)	28.9 (217.0 , 8.5)	30.1 (225.8 , 8.9)	30.1 (225.8 , 8.9)	30.1 (225.8 , 8.9)	29.4 (220.6 , 8.7)
	4400	27.4 (205.3 , 8.1)	28.6 (214.7 , 8.5)	29 (217.6 , 8.6)	30.5 (228.7 , 9)	31.7 (237.6 , 9.4)	31.7 (237.6 , 9.4)	31.7 (237.6 , 9.4)	31 (232.4 , 9.1)
	4800	28.9 (217.1 , 8.5)	30.2 (226.5 , 8.9)	30.6 (229.4 , 9)	32.1 (240.5 , 9.5)	33.2 (249.4 , 9.8)	33.2 (249.4 , 9.8)	33.2 (249.4 , 9.8)	32.5 (244.1 , 9.6)
	5200	30.5 (228.8 , 9)	31.8 (238.3 , 9.4)	32.1 (241.1 , 9.5)	33.6 (252.3 , 9.9)	34.8 (261.1 , 10.3)	34.8 (261.1 , 10.3)	34.8 (261.1 , 10.3)	34.1 (255.9 , 10.1)
	5600	32.1 (240.6 , 9.5)	33.3 (250.0 , 9.8)	33.7 (252.9 , 10)	35.2 (264.0 , 10.4)	36.4 (272.9 , 10.7)	36.4 (272.9 , 10.7)	36.4 (272.9 , 10.7)	35.7 (267.7 , 10.5)
	6000	33.6 (252.4 , 9.9)	34.9 (261.8 , 10.3)	35.3 (264.6 , 10.4)	36.8 (275.8 , 10.9)	38 (284.7 , 11.2)	38 (284.7 , 11.2)	38 (284.7 , 11.2)	37.3 (279.4 , 11)
	6400	35.2 (264.1 , 10.4)	36.5 (273.6 , 10.8)	36.9 (276.4 , 10.9)	38.3 (287.6 , 11.3)	39.5 (296.4 , 11.7)	39.5 (296.4 , 11.7)	39.5 (296.4 , 11.7)	38.8 (291.2 , 11.5)

kPa (mmHg, inHg)

3. GENERAL DRIVING CYCLE

- If conditions are met, it is possible to detect the misfires from idling to high engine speed. However, to avoid excessive load or harm to the engine, perform diagnosis at idle.
- Perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

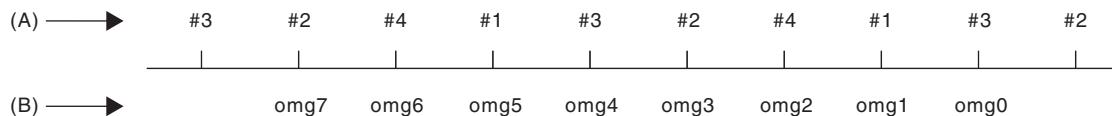
GENERAL DESCRIPTION

4. DIAGNOSTIC METHOD

When a misfire occurs, the engine speed will decrease and the crankshaft position speed will change. Calculate the interval difference value (diagnostic value) from crankshaft position speed by the following formula, and judge whether a misfire is occurring or not comparing the calculated result with judgment value. Count the number of misfires, if the misfire ratio is higher during 1000 revs. or 200 revs., judge corresponding cylinders as NG.

Diagnostic value calculation (Calculate from angle speed) →	Misfire detection every single ignition (Compare diagnostic value with judgment value) →	NG judgment (Misfire occurrence judgment required by the law) (Compare number of misfire with judgment value)
	<ul style="list-style-type: none">• 180° Interval Difference Method• 360° Interval Difference Method• 720° Interval Difference Method	<ul style="list-style-type: none">• FTP 1.5 times misfire NG judgment• Catalyst damage misfire NG judgment

As shown in the following figure, pick a cylinder as the standard and name it omg 0. And the former crankshaft position speed is named omg 1, the second former crankshaft position speed is named omg 2, the third is named omg 3, etc.



EN-01774

(A) Ignition order

(B) Crankshaft position speed

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

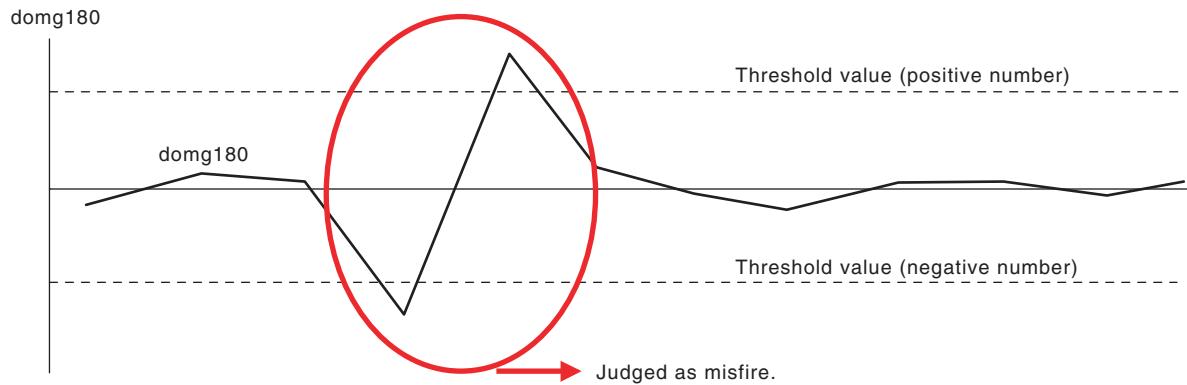
180° Interval Difference Method

Diagnostic value $domg\ 180 = (omg\ 1 - omg\ 0) - (omg\ 5 - omg\ 1)/4$

Judge as a misfire in the following cases.

- $domg\ 180 >$ judgment value of positive side
- $domg\ 180 \leq$ judgment value of negative side

(Diagnostic value before 180° CA)

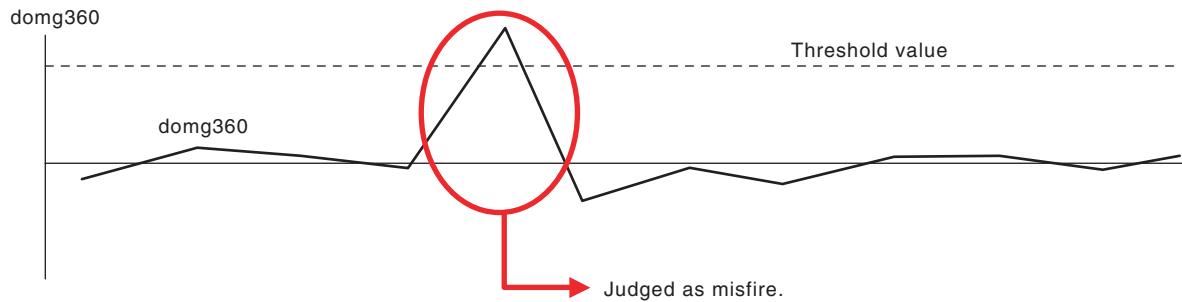


EN-02877

360° Interval Difference Method

Diagnostic value $domg\ 360 = (omg\ 1 - omg\ 0) - (omg\ 3 - omg\ 2)$

Misfire judgment $domg\ 360 >$ Judgment value \rightarrow Judge as misfire



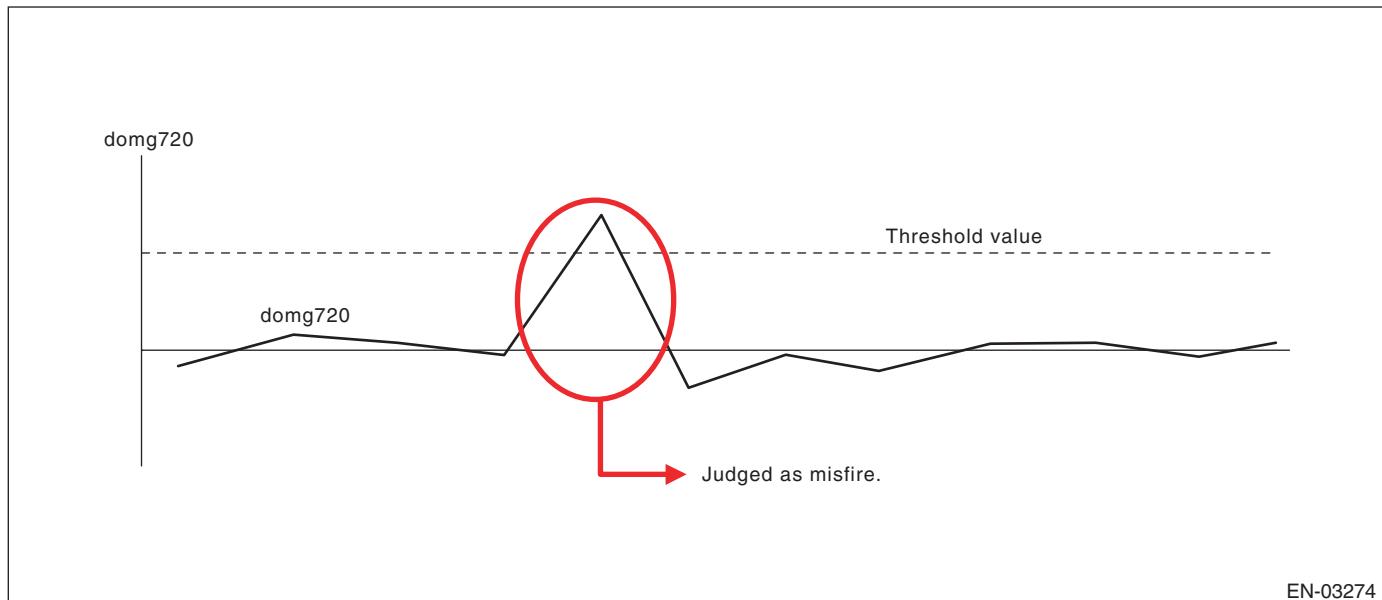
EN-03273

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

720° Interval Difference Method

Diagnostic value	$domg\ 720 = (omg\ 1 - omg\ 0) - (omg\ 5 - omg\ 4)$
Misfire judgment	$domg\ 720 > Judgment\ value \rightarrow \text{Judge as misfire}$



- **FTP 1.5 times misfire (Misfire occurrence level which influences exhaust gas)**

Judgment Value (Judge that malfunction occurs when the misfire ratio is high in 1000 engine revs.)

Malfunction Criteria	Threshold Value
FTP emission diagnostic value	$\geq 15 \times 100/2000\% \text{ in 1000 revs.}$

Time Needed for Diagnosis: 1000 engine revs.

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Catalyst damage misfire (Misfire occurrence level damaging catalyst)**

Judgment Value

Malfunction Criteria	Threshold Value
Catalyst damage misfire diagnostic value	$\geq \text{Value from Map 3}$

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Map 3

		Intake air (g(oz)/rev)									
		0.2 (0.01)	0.3 (0.01)	0.4 (0.01)	0.5 (0.02)	0.6 (0.02)	0.7 (0.02)	0.8 (0.03)	0.9 (0.03)	1 (0.04)	1.1 (0.04)
Engine speed (rpm)	700	100	100	100	100	80	80	80	80	80	80
	1000	100	100	100	100	80	80	57	44	80	80
	1200	100	100	100	100	100	80	67	57	57	57
	1600	100	100	80	80	80	57	44	36	44	44
	2000	100	80	80	80	57	44	27	44	44	44
	2400	100	80	80	80	57	31	36	36	36	36
	2800	80	80	80	80	57	44	36	36	36	36
	3200	80	80	57	57	44	36	36	36	36	36
	3600	57	57	57	44	44	44	44	44	44	44
	4000	57	57	57	36	36	36	44	44	44	44
	4400	44	44	44	44	44	44	44	44	44	44
	4800	44	44	44	36	36	36	36	36	36	36
	5200	36	36	36	36	36	36	44	44	44	44
	5600	27	27	27	31	36	36	44	44	44	44
	6000	44	44	44	44	44	44	44	36	36	36
	6400	24	24	24	21	21	21	25	31	31	31

Time Needed for Diagnosis: 200 engine revs.

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

BX:DTC P0302 CYLINDER 2 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H4DO HEV)-83, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BY:DTC P0303 CYLINDER 3 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H4DO HEV)-83, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BZ:DTC P0304 CYLINDER 4 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H4DO HEV)-83, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

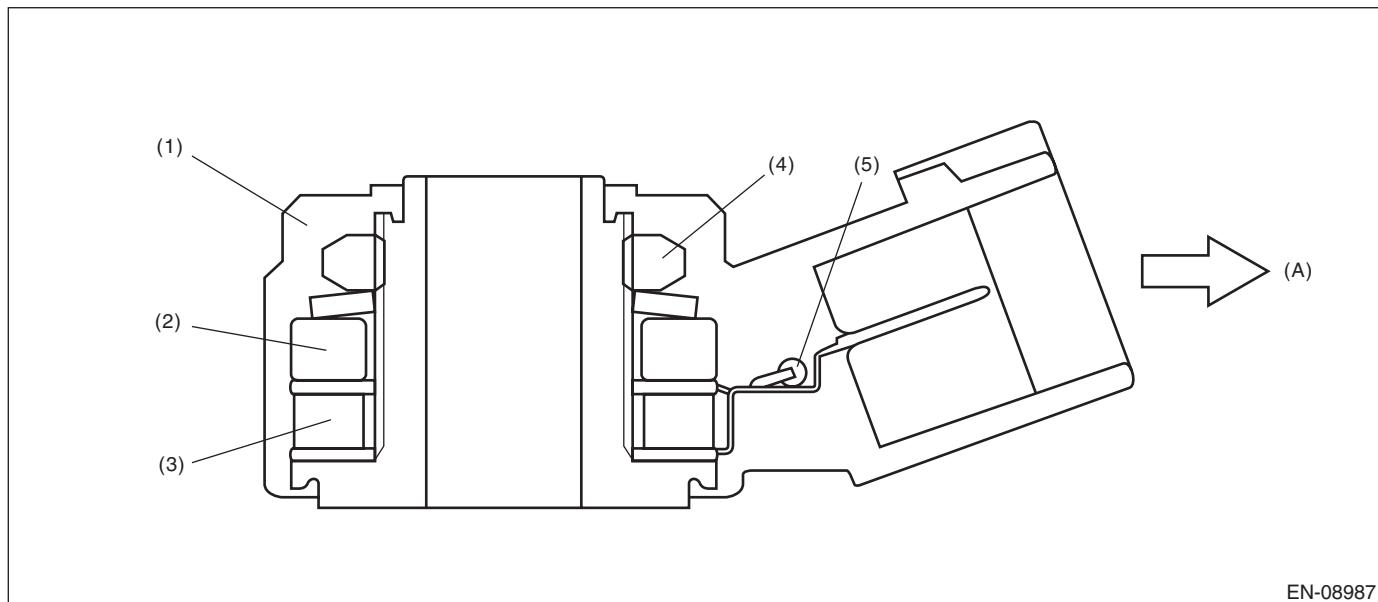
CA:DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of knock sensor.

Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) To knock sensor harness

(1) Case	(3) Piezoelectric element	(5) Resistance
(2) Weight	(4) Nut	

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.154 V

Time Needed for Diagnosis: 1000 ms

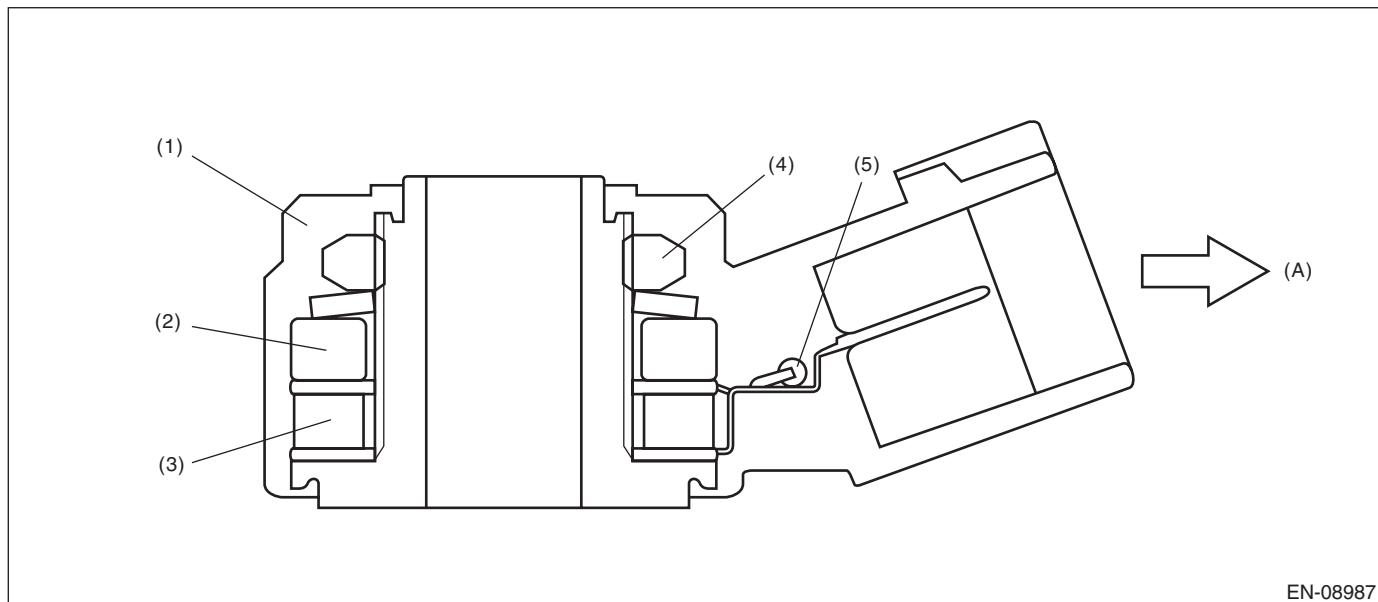
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

CB:DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of knock sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) To knock sensor harness

(1) Case	(3) Piezoelectric element	(5) Resistance
(2) Weight	(4) Nut	

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.838 V

Time Needed for Diagnosis: 1000 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

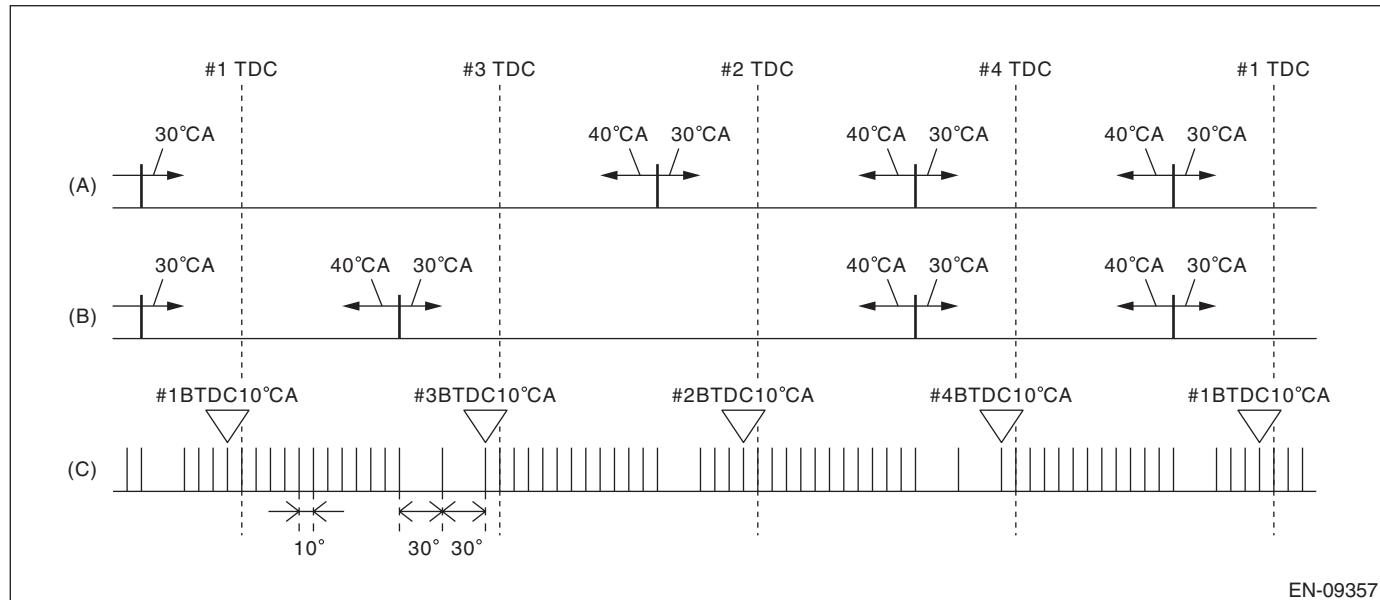
CC:DTC P0335 CRANKSHAFT POSITION SENSOR “A” CIRCUIT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the crankshaft position sensor.

Judge as NG when the crank signal is not input even though the starter was rotated.

2. COMPONENT DESCRIPTION

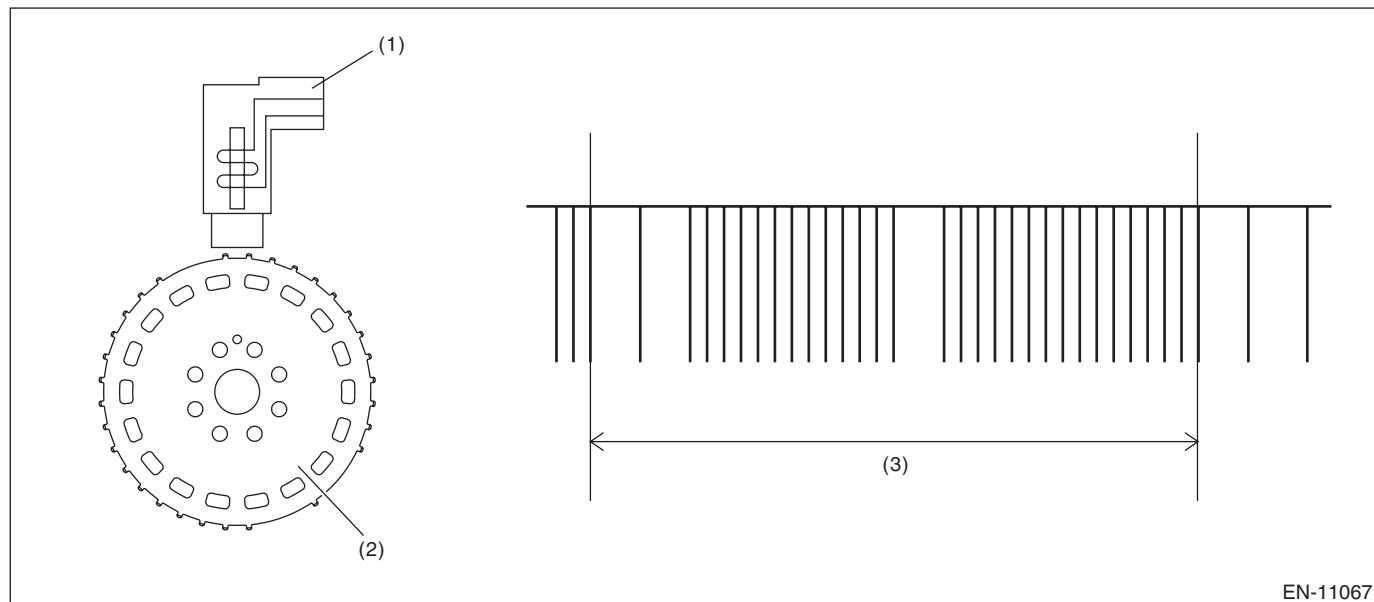


EN-09357

(A) Camshaft signal (RH)

(B) Camshaft signal (LH)

(C) Crankshaft signal



EN-11067

(1) Crankshaft position sensor

(2) Crankshaft position sensor plate

(3) Crankshaft one revolution

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Crankshaft position sensor signal	Not detected

Time Needed for Diagnosis: 3000 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

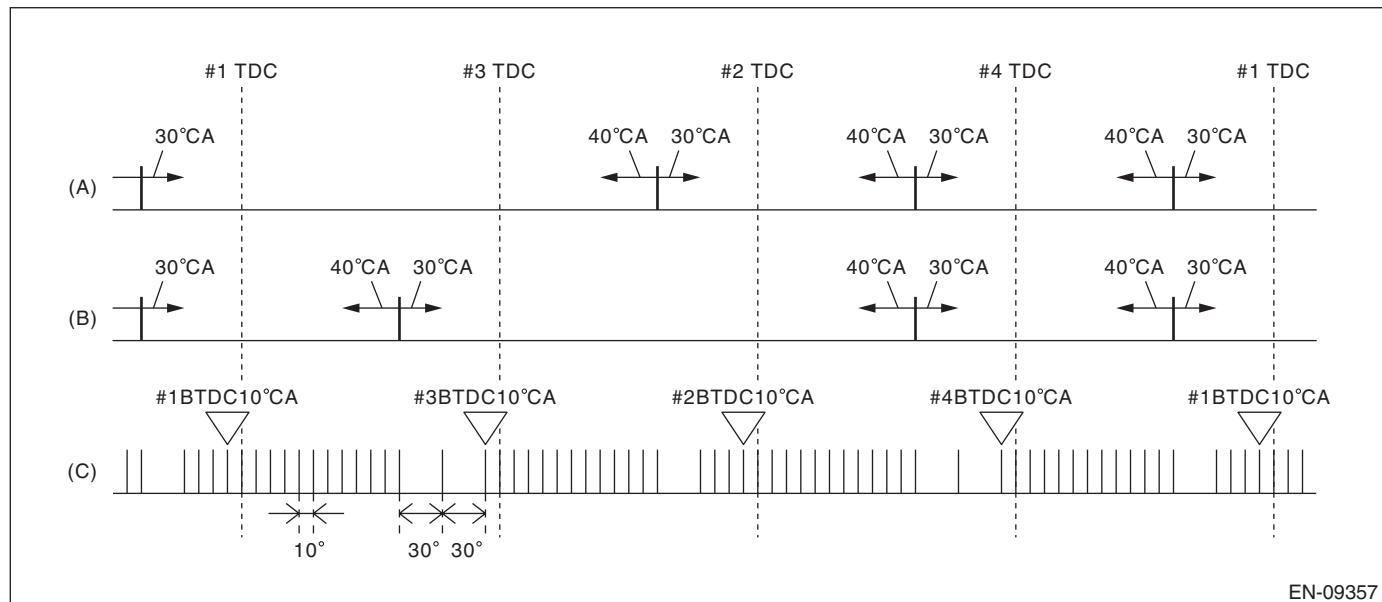
CD:DTC P0336 CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect for faults in crankshaft position sensor output properties.

Judge as NG when there is a problem in the number of crankshaft signals for every revolution of crankshaft.

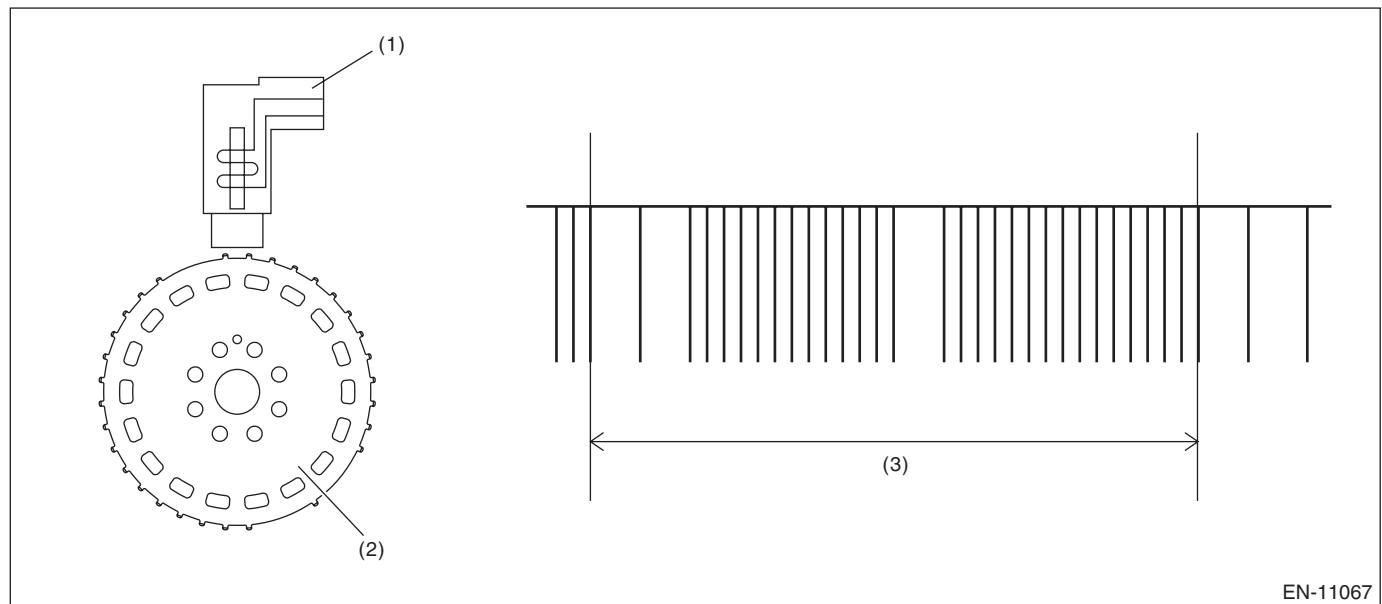
2. COMPONENT DESCRIPTION



(A) Camshaft signal (RH)

(B) Camshaft signal (LH)

(C) Crankshaft signal



(1) Crankshaft position sensor

(2) Crankshaft position sensor plate

(3) Crankshaft one revolution

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Amount of crank sensor signal during 1 rev of crankshaft	Not = 30

Time Needed for Diagnosis: Engine speed 10 engine revs.

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

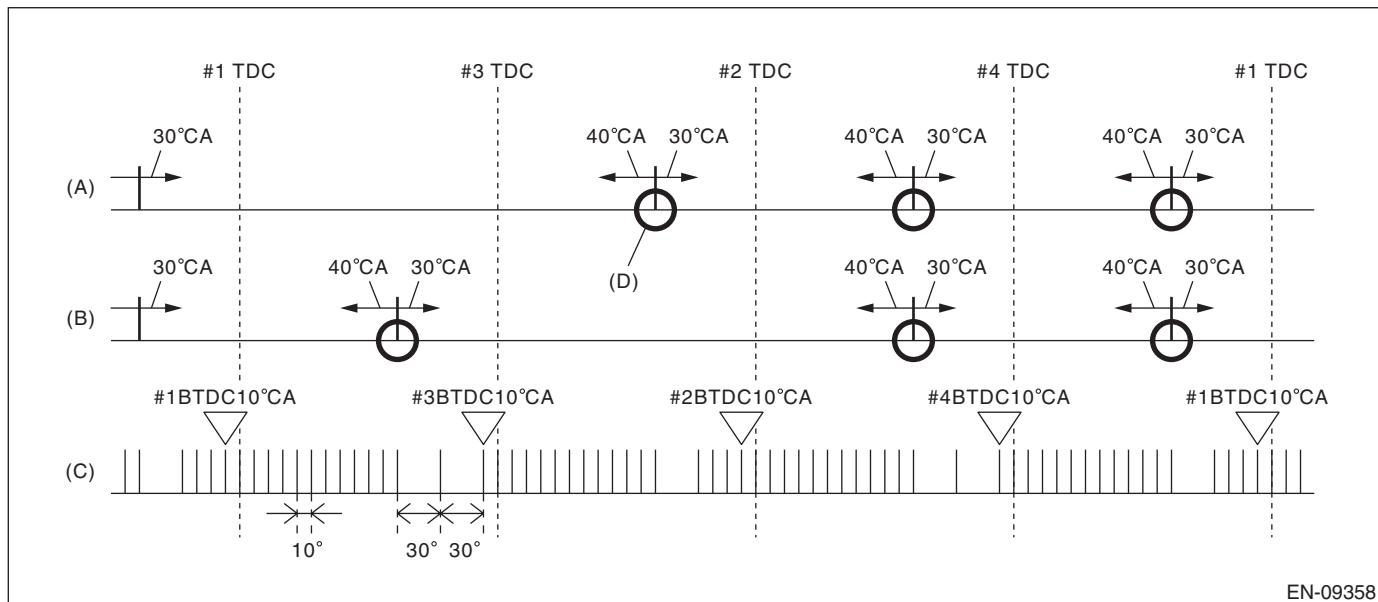
CE:DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the camshaft position sensor.

When there is no camshaft position signal input continuously, judge as NG.

2. COMPONENT DESCRIPTION



EN-09358

(A) Camshaft signal (RH)

(B) Camshaft signal (LH)

(C) Crankshaft signal

(D) Camshaft position signal: When normal, there will be 3 camshaft position signals for every 2 crankshaft revolutions.

3. ENABLE CONDITION

Diagnosis 1

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V

Diagnosis 2

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V
Elapsed time after starting the engine	≥ 200 ms

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Diagnosis 1

Judge as NG when no input of camshaft position sensor signal in TDC remains for (10 time(s)+2)/2 engine rev.

Judgment Value

Malfunction Criteria	Threshold Value
Number of camshaft position sensor signal input in TDC	= 0

Time Needed for Diagnosis: (10 time(s) +2)/2 engine revs.

Diagnosis 2

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Camshaft position sensor signal	No input

Time Needed for Diagnosis: 3000 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

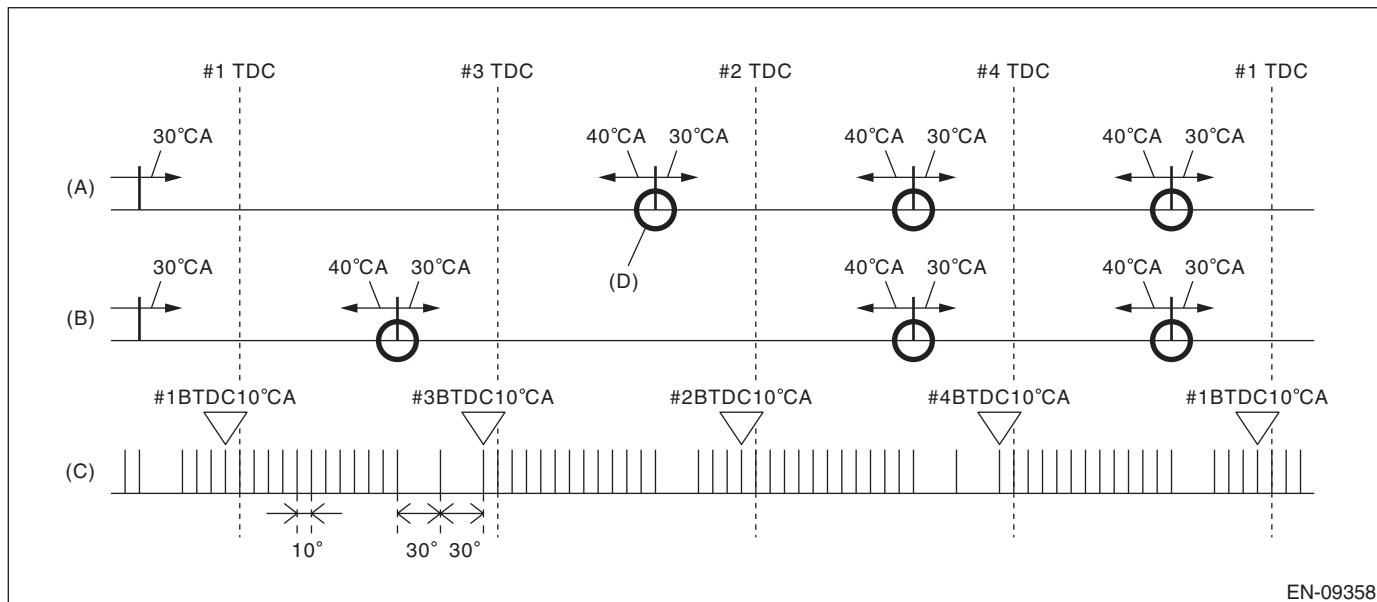
CF:DTC P0341 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of camshaft position sensor property.

Judge as NG when the number of camshaft signals remains abnormal.

2. COMPONENT DESCRIPTION



(A) Camshaft signal (RH)

(B) Camshaft signal (LH)

(C) Crankshaft signal

(D) Camshaft position signal: When normal, there will be 3 camshaft position signals for every 2 crankshaft revolutions.

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V
Elapsed time after starting the engine	≥ 200 ms

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge as NG when the status where the number of camshaft position sensor signals in two crankshaft revolutions is other than 3 time(s).

Judgment Value

Malfunction Criteria	Threshold Value
Amount of camshaft sensor signal during 2 revs of crankshaft	$\neq 3$ time(s)

Time Needed for Diagnosis: Two engine revs. \times 4 time(s)

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

CG:DTC P0345 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0340. <Ref. to GD(H4DO HEV)-96, DTC P0340 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CH:DTC P0346 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0341. <Ref. to GD(H4DO HEV)-98, DTC P0341 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CI: DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT

1. OUTLINE OF DIAGNOSIS

Based on the self-diagnostic result of the ignition coil driving IC, judge the ignition coil driving circuit as normal or abnormal.

The ignition coil driving IC detects “no ignition” status as a malfunction.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	> 1 s
Engine speed	> 500 rpm

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Ignition driving IC information	Malfunction

Time Needed for Diagnosis: 2560 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

CJ:DTC P0352 IGNITION COIL B PRIMARY/SECONDARY CIRCUIT

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0351. <Ref. to GD(H4DO HEV)-100, DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CK:DTC P0353 IGNITION COIL C PRIMARY/SECONDARY CIRCUIT

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0351. <Ref. to GD(H4DO HEV)-100, DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CL:DTC P0354 IGNITION COIL D PRIMARY/SECONDARY CIRCUIT

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0351. <Ref. to GD(H4DO HEV)-100, DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

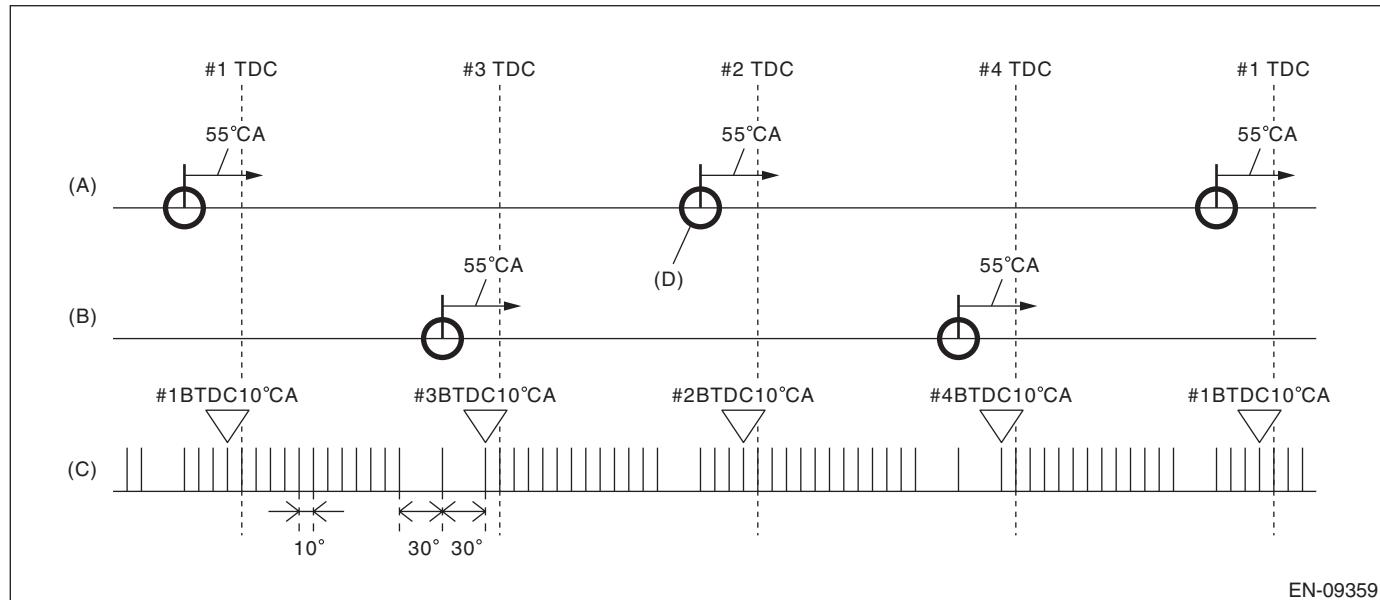
CM:DTC P0365 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the camshaft position sensor.

When there is no camshaft position signal input continuously, judge as NG.

2. COMPONENT DESCRIPTION



(A) Camshaft signal (RH)

(B) Camshaft signal (LH)

(C) Crankshaft signal

(D) Camshaft position signal: When normal, there will be 2 camshaft position signals for every 2 crankshaft revolutions.

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 200 ms

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge as NG when no input of camshaft position sensor signal in TDC remains for (10 time(s) +2)/2 engine rev.

Judgment Value

Malfunction Criteria	Threshold Value
Number of camshaft position sensor signal input in TDC	= 0

Time Needed for Diagnosis: (10 time(s) +2)/2 engine revs.

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

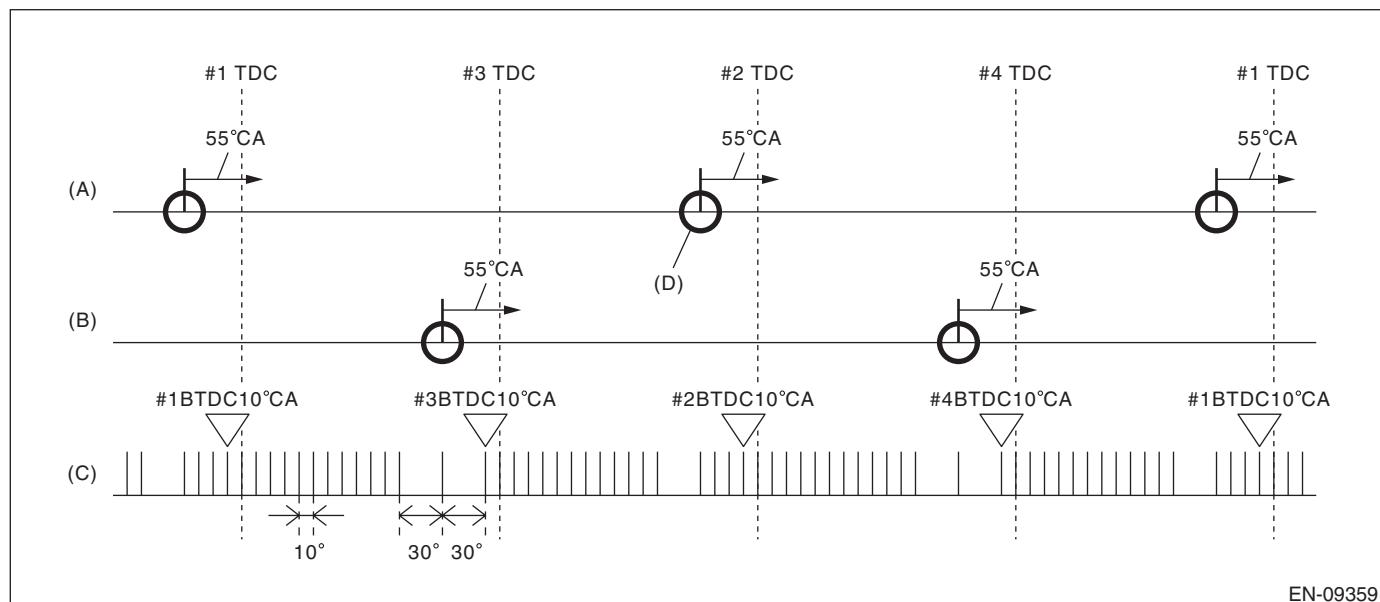
CN:DTC P0366 CAMSHAFT POSITION SENSOR B CIRCUIT RANGE/PERFORMANCE (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of camshaft position sensor property.

Judge as NG when the number of camshaft signals remains abnormal.

2. COMPONENT DESCRIPTION



EN-09359

(A) Camshaft signal (RH) (B) Camshaft signal (LH) (C) Crankshaft signal
(D) Camshaft position signal: When normal, there will be 2 camshaft position signals for every 2 crankshaft revolutions.

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 200 ms

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge as NG when the status where the number of camshaft position sensor signals in two crankshaft revolutions is other than 2 time(s).

Judgment Value

Malfunction Criteria	Threshold Value
Amount of camshaft sensor signal during 2 revs of crankshaft	$\neq 2$ time(s)

Time Needed for Diagnosis: Two engine revs. \times 4 time(s)

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

CO:DTC P0390 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0365. <Ref. to GD(H4DO HEV)-101, DTC P0365 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CP:DTC P0391 CAMSHAFT POSITION SENSOR B CIRCUIT RANGE/PERFORMANCE (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0366. <Ref. to GD(H4DO HEV)-102, DTC P0366 CAMSHAFT POSITION SENSOR B CIRCUIT RANGE/PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

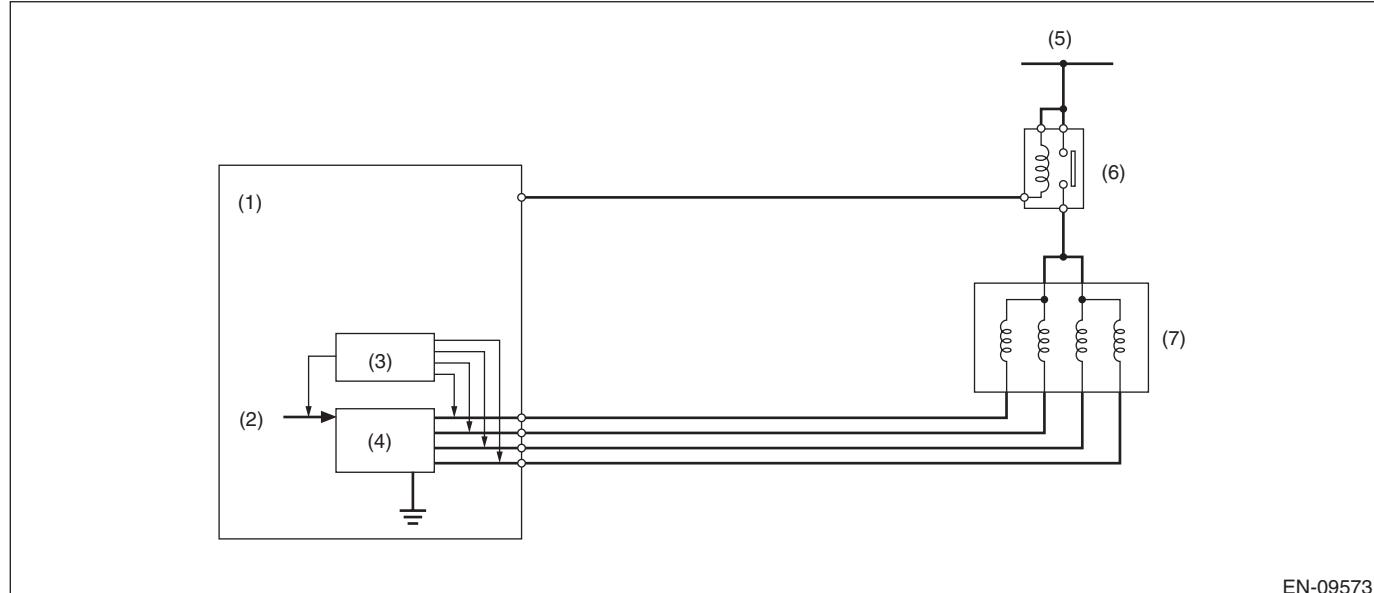
CQ:DTC P0400 EXHAUST GAS RECIRCULATION FLOW

1. OUTLINE OF DIAGNOSIS

Detect EGR system malfunction.

Intake manifold pressure (negative pressure) is constant because the throttle valve is fully closed during deceleration fuel cut. At this time, when the EGR control valve is opened/closed, the intake manifold pressure will change. EGR System OK/NG is judged by the range of this change.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)	(4) Switching circuit	(6) Main relay
(2) Computer unit (CPU)	(5) Battery voltage	(7) EGR control valve
(3) Detecting circuit		

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Engine speed	1100 rpm — 5000 rpm
Intake manifold pressure (absolute pressure)	< 133.3 kPa (1000 mmHg, 39.4 inHg)
Intake air temperature	≥ 0 °C(32 °F)
Throttle position	< 0.2442 °
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75.1 kPa (563 mmHg, 22.2 inHg)
Vehicle speed	≥ 40 km/h (24.9 MPH)
Fuel shut-off function	In operation
Neutral switch	OFF

4. GENERAL DRIVING CYCLE

During deceleration fuel cut from 53 km/h (approx. 33 MPH) or more, perform diagnosis once. Be careful of vehicle speed and engine speed. (Diagnosis will not be completed if the vehicle speed and engine speed conditions become out of specification due to deceleration.)

5. DIAGNOSTIC METHOD

Measure the pressure values when the enable conditions are established, and perform diagnosis by calculating those results.

1. Label the intake manifold pressure value as PMOF1, which is observed when enable conditions are established, and set the EGR target step to 45 step(s) (nearly full open).

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

2. Label the intake manifold pressure value as PMON, which is observed after 1000 ms has passed since EGR target step was set to 45 step(s) (when the enable conditions were established), and set the EGR target step to 0.

3. Label the intake manifold pressure as PMOF2, which is observed after 1000 ms has passed since EGR target step was set to 0 (after (1000 ms + 1000 ms) have passed since the enable conditions were established).

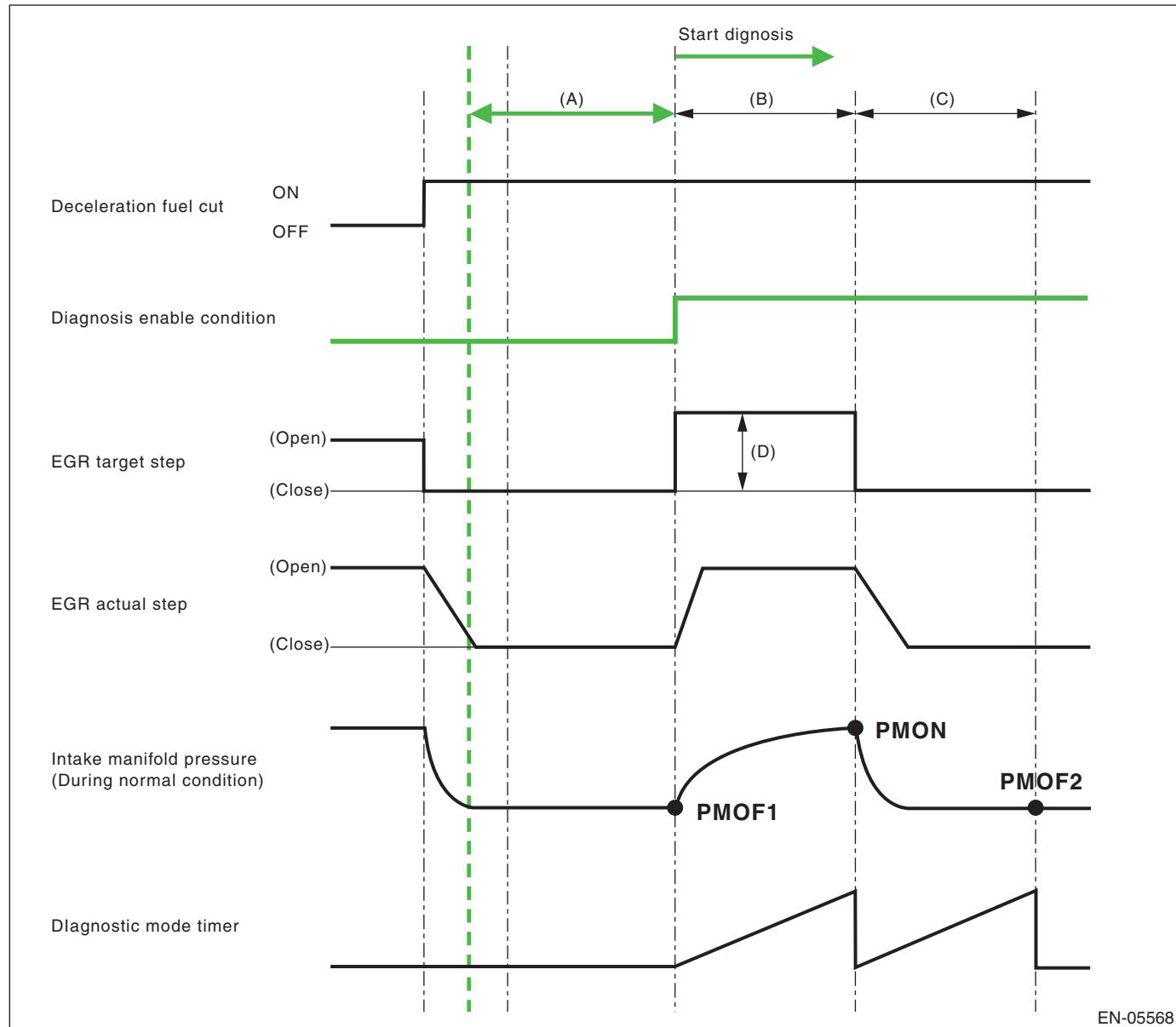
Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
PMON – (PMOF1 + PMOF2)/2	< 2.5 kPa (18.63 mmHg, 0.7 inHg)

Time Needed for Diagnosis: 1 time

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.



(A) 2000 ms

(B) 1000 ms

(C) 1000 ms

(D) 45 step(s)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CR:DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1)

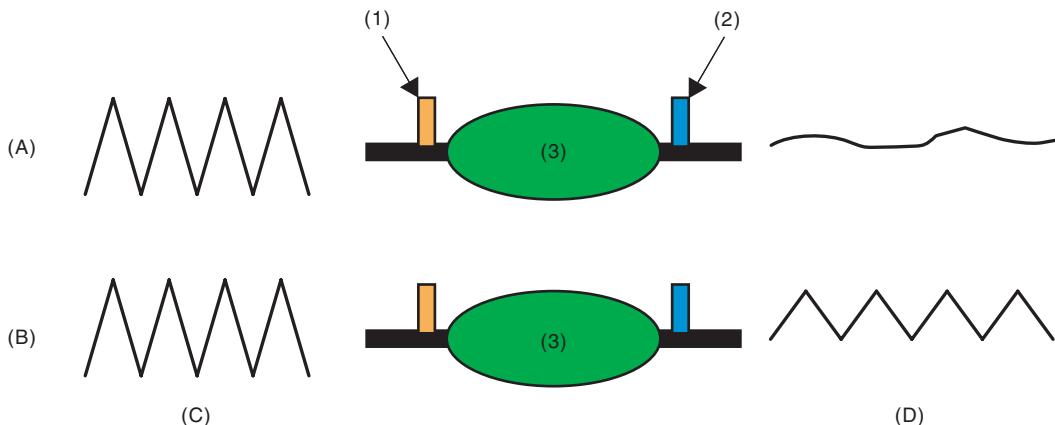
1. OUTLINE OF DIAGNOSIS

Detect the deterioration of the catalyst function.

Though the front oxygen sensor output would change slowly with a new catalyst, the sensor output with a deteriorated catalyst becomes high and the inversion time is shortened.

For this reason, the catalyst diagnosis is carried out by monitoring the front oxygen sensor output and comparing it with the front oxygen (A/F) sensor output.

2. COMPONENT DESCRIPTION



EN-01713

(A) Normal
(D) Output waveform from the front oxygen sensor

(B) Deterioration

(C) Output waveform from the front oxygen (A/F) sensor

(1) Front oxygen (A/F) sensor

(2) Front oxygen sensor

(3) Catalytic converter

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75.1 kPa (563 mmHg, 22.2 inHg)
Estimated catalyst temperature	≥ 480 °C (896 °F)
Misfire detection every 200 rotations	< 65535 time(s)
Sub feedback	In operation
Evaporative system diagnosis	Not in operation
Time of difference (< 0.10) between actual lambda and target lambda	≥ 0 ms
Vehicle speed	> 40 km/h (24.9 MPH)
Amount of intake air	≥ 5 g/s (0.18 oz/s) and < 40 g/s (1.41 oz/s)
Engine load change every 0.5 engine revs.	< 255 g/rev (8.99 oz/rev)
Rear oxygen output change from 660 mV or less to 660 mV or more	Experienced after fuel cut
Purge execution calculated time	≥ 0 s

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once at a constant 40 km/h (24.9 MPH) or higher.

5. DIAGNOSTIC METHOD

After the enable conditions have been established, calculate the front oxygen (A/F) sensor lambda value deviation sum value ($\sum |(sglmd_n - sglmd_{n-1})|$), and rear oxygen sensor output voltage deviation sum value ($\sum |(ro2sad_n - ro2sad_{n-1})|$) in every 32 ms \times 4 times. If the front oxygen (A/F) sensor lambda value deviation sum value ($\sum |(sglmd_n - sglmd_{n-1})|$) is the predetermined value or more, calculate the diagnostic value. If the duration of time while the following conditions are met is within the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
$\sum (ro2sad_n - ro2sad_{n-1}) / \sum (sglmd_n - sglmd_{n-1}) $	> 8

Time Needed for Diagnosis: 30 — 55 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

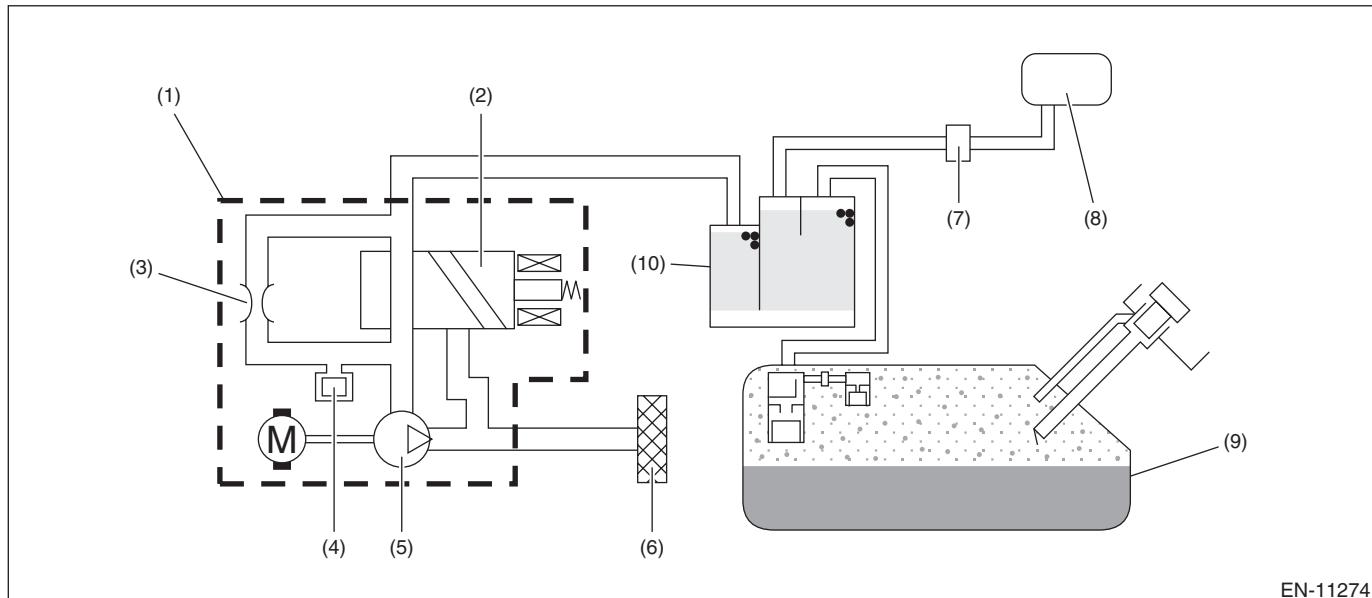
CS:DTC P0441 EVAPORATIVE EMISSION CONT. SYS. INCORRECT PURGE FLOW

1. OUTLINE OF DIAGNOSIS

This monitor intrusively performs a functional check to detect incorrect purge flow. The monitor seals the EVAP system (i.e. isolate from atmosphere) by closing the ELCM switching valve intrusively after recovering from a fuel cut event. In the case of normal condition, and the commanded purge control duty ratio is more than 0%, ELCM pressure (gauge) will decrease due to engine vacuum and reach to the threshold value. However, in the case of malfunction condition (e.g. fuel cap open, purge valve stuck closed, purge line disconnected or blocked), if the ELCM pressure (gauge) does not reach the threshold within a predetermined time, the monitor determines a malfunction and stores a fault code.

Malfunction Criteria

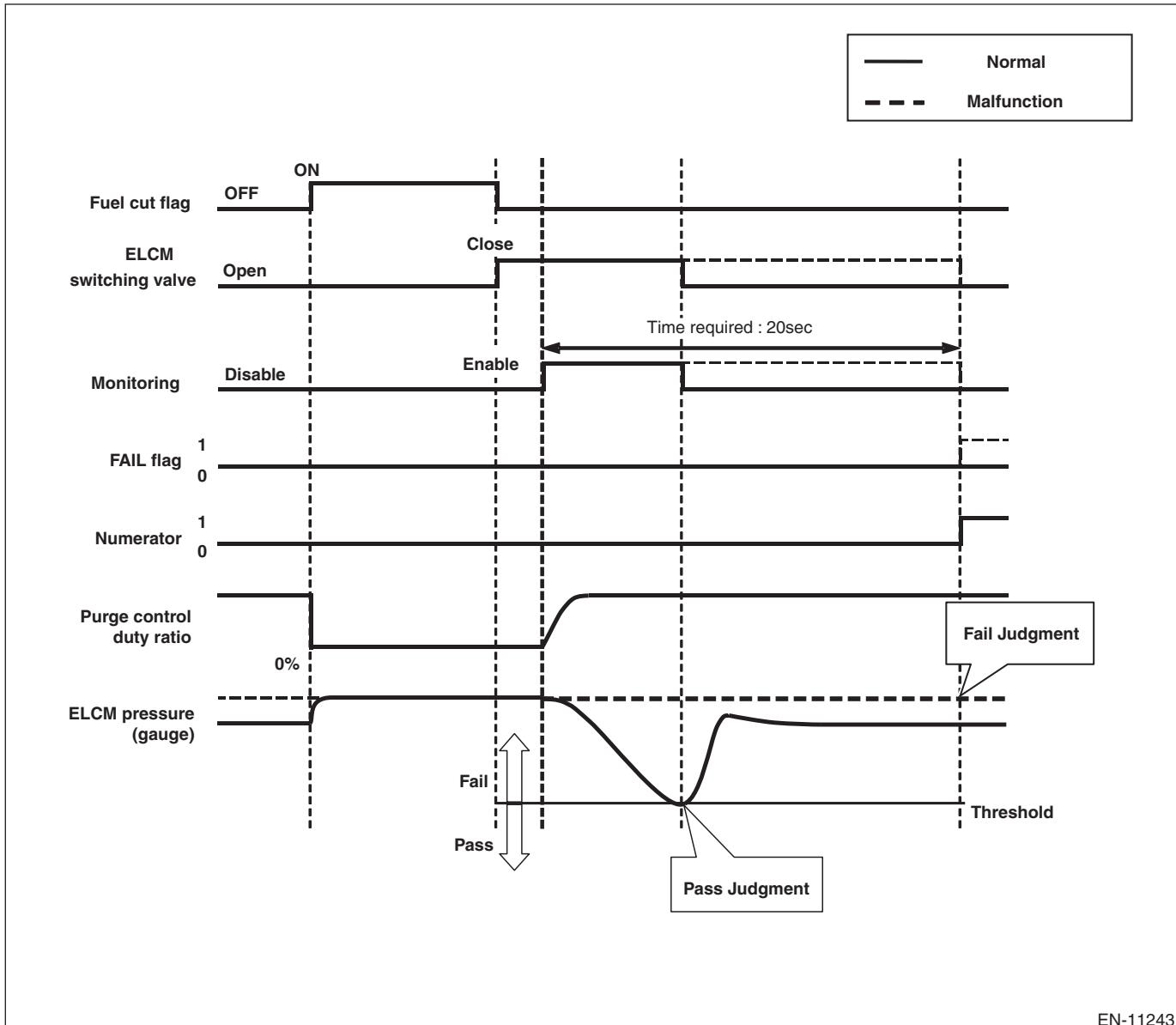
ELCM pressure (gauge) > Threshold



(1) ELCM	(5) Vacuum pump	(9) Fuel tank
(2) Switching valve (closed)	(6) Drain filter	(10) Canister
(3) Reference orifice (0.02 inch orifice)	(7) Purge control solenoid valve	
(4) Pressure sensor	(8) Intake manifold	

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION



EN-11243

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Time when ELCM switching valve is closed	< 120000 ms
Purge control solenoid valve control duty	> 0%
Precondition Conditions to close the switching valve of ELCM intrusively.	
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75.1 kPa (563 mmHg, 22.2 inHg)
Integrated value of calculated purge airflow since engine start	≥ Value from Map
Atmospheric pressure – Intake manifold absolute pressure	≥ 10 kPa (75 mmHg, 3 inHg)
Fuel cut time	≥ 1000 ms
Ambient air temperature	≥ -25 °C (-13 °F)

Map

Ambient air temperature °C (°F)	0 (32)	10 (50)	20 (68)	30 (86)	40 (104)	50 (122)
Integrated value of calculated purge airflow since engine start g (oz)	2250 (79.36)	2250 (79.36)	2250 (79.36)	2250 (79.36)	2250 (79.36)	2250 (79.36)

3. GENERAL DRIVING CYCLE

Perform the diagnosis only once during ordinary driving.

4. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
ELCM pressure	> 666.6 Pa × -1 (5 mmHg × -1, 0.2 inHg × -1)

Time Needed for Diagnosis: 30000 ms – 10000 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

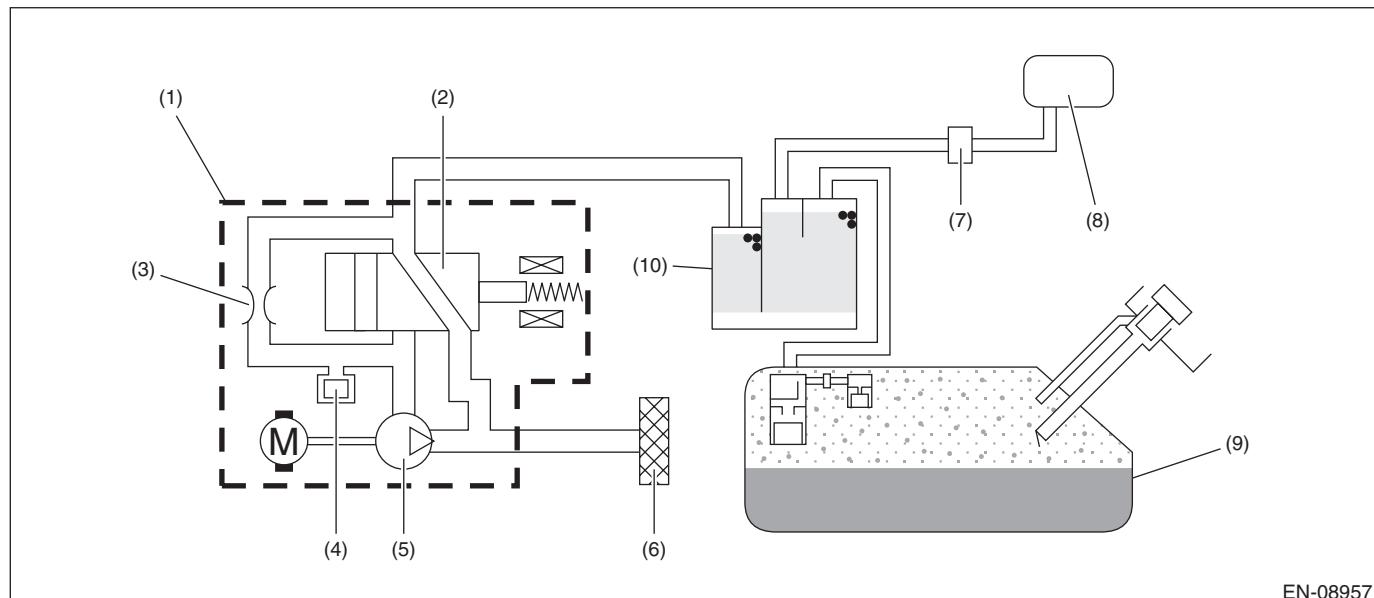
CT:DTC P0451 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/ SWITCH RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of ELCM pressure sensor output properties.

Judge as NG when the ELCM pressure sensor output value is largely different from the intake manifold pressure when the ignition switch is ON.

2. COMPONENT DESCRIPTION



EN-08957

(1) ELCM	(5) Vacuum pump	(9) Fuel tank
(2) Switching valve	(6) Drain filter	(10) Canister
(3) Reference orifice (0.02 inch orifice)	(7) Purge control solenoid valve	
(4) Pressure sensor	(8) Intake manifold	

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Elapsed time after ignition switch is turned to ON	≥ 500 ms and < 60000 ms
Vehicle speed	< 1 km/h (0.621 MPH)
Soaking time	≥ 60 s
ELCM vacuum pump	Not in operation
ELCM switching valve	Open
Purge control	Not in operation

4. GENERAL DRIVING CYCLE

Perform the diagnosis once at ignition ON.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
ELCM pressure sensor output value – intake manifold pressure (absolute pressure) when ignition switch is ON	> 4732.9 Pa (35.5 mmHg, 1.4 inHg)

Time Needed for Diagnosis: 328 ms

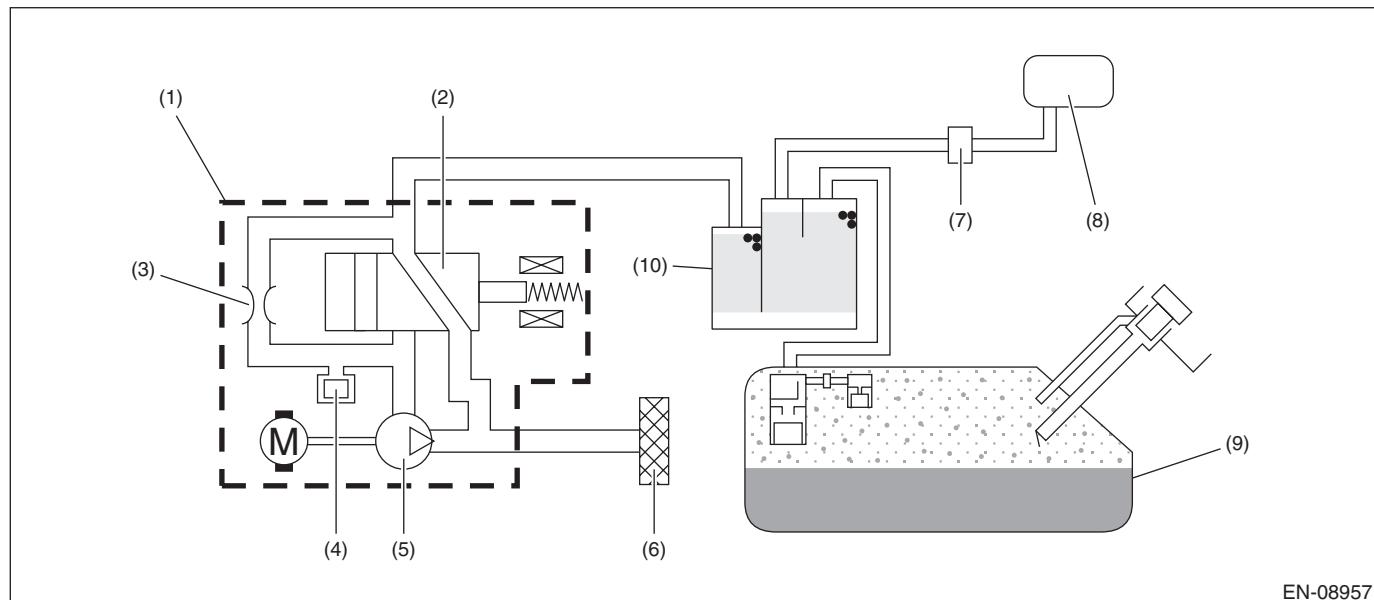
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

CU:DTC P0452 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/ SWITCH LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the ELCM pressure sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) ELCM	(5) Vacuum pump	(9) Fuel tank
(2) Switching valve	(6) Drain filter	(10) Canister
(3) Reference orifice (0.02 inch orifice)	(7) Purge control solenoid valve	
(4) Pressure sensor	(8) Intake manifold	

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.973 V

Time Needed for Diagnosis: 1000 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

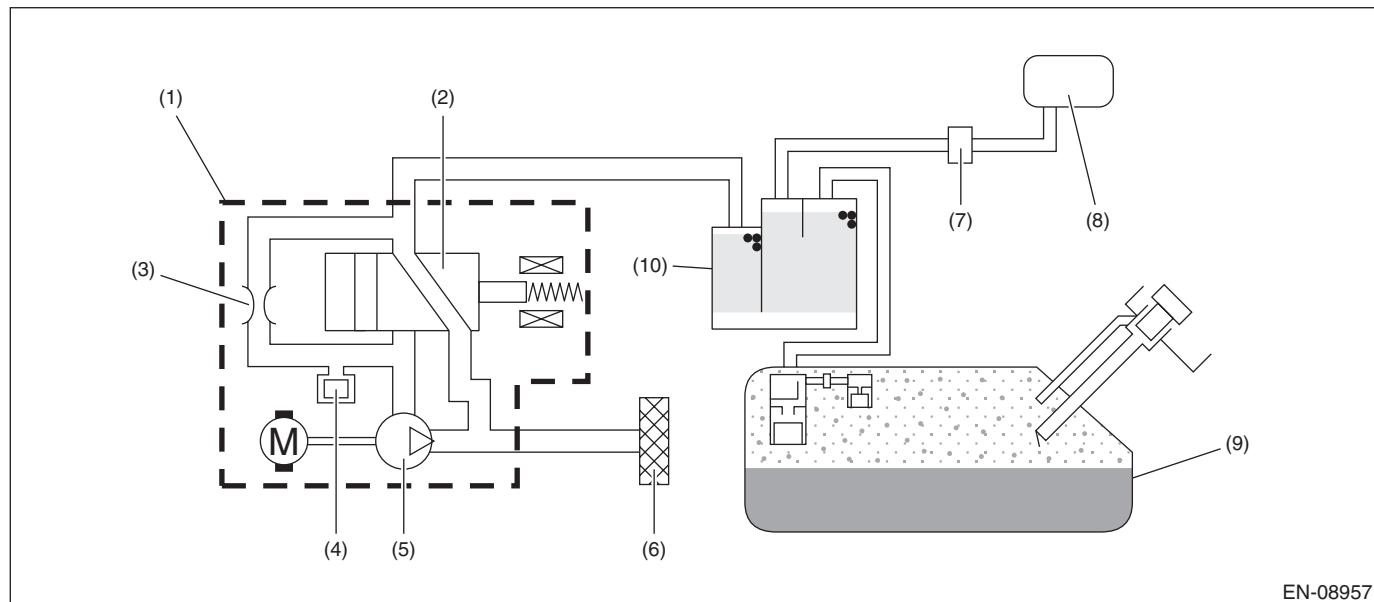
GENERAL DESCRIPTION

CV:DTC P0453 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/ SWITCH HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the ELCM pressure sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) ELCM	(5) Vacuum pump	(9) Fuel tank
(2) Switching valve	(6) Drain filter	(10) Canister
(3) Reference orifice (0.02 inch orifice)	(7) Purge control solenoid valve	
(4) Pressure sensor	(8) Intake manifold	

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.095 V

Time Needed for Diagnosis: 1000 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

CW:DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE LEAK)

1. OUTLINE OF DIAGNOSIS

This diagnosis judges whether the ELCM operation is normal or not, and whether the evaporative emission system has leak and clogging or not.

To purge the canister, after driving, perform the five hours soaking after ignition switch OFF in order to stabilize the evaporative gas status. * After 5, 7 or 9.5 hours passed, ECM is activated by soaking timer, and the leak check is started.

Judges whether the ELCM operation is normal or not, by measuring the reference pressure status via reference orifice (0.02 inch orifice). Judge as malfunction if the reference pressure is out of specified range. Then, judge whether there is a leak or not, by comparing the pressure (leak pressure) when the reference pressure and the evaporative emission system are in negative pressure condition. Judge as system leak in the evaporative emission system if the leak pressure is higher than reference pressure. Judge as clogging of pipe if the leak pressure becomes lower than the reference pressure within the specified amount of time.

0.02 inch leak and 0.04 inch leak can be distinguished by measuring the leak pressure.

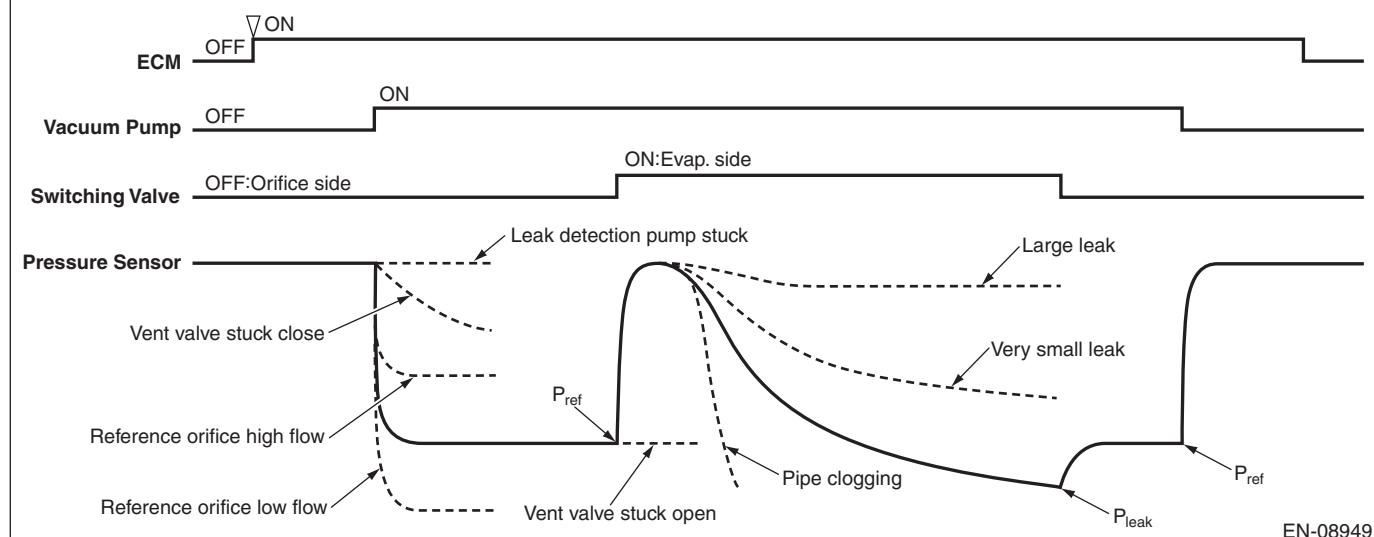
The diagnosis results are stored inside ECM until the engine is started again.

*: When the test conditions are not met in 5 hours, perform diagnosis at elapsed time of 7 hours. When the test conditions are not met in 7 hours, perform diagnosis at elapsed time of 9.5 hours.

Diagnostic item	
ELCM system (ELCM body)	Vacuum pump stuck Switching valve stuck to open Switching valve stuck to close Reference orifice flow large Reference orifice flow small
Leak check	Large leak • 0.04 inch leak • Fuel cap loose • Fuel cap off • System malfunction Very small leak • 0.02 inch leak
Clogging of pipe	—

OUTLINE OF DIAGNOSIS

5 hours after ignition switch turned off.



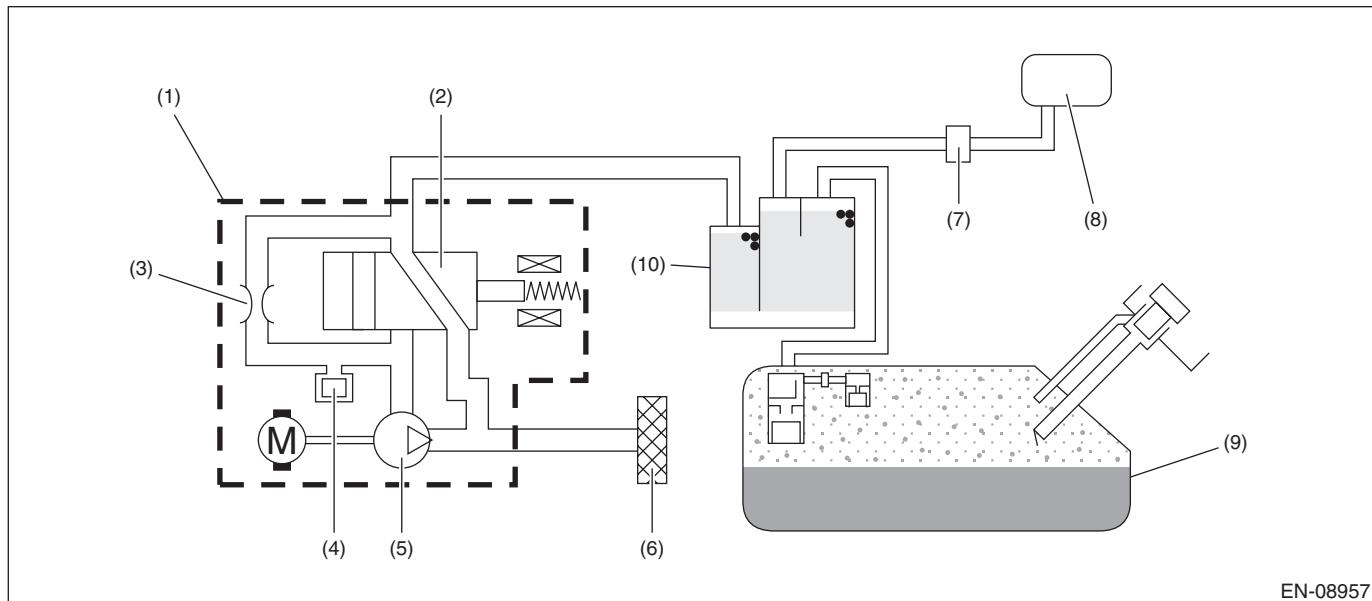
EN-08949

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

2. COMPONENT DESCRIPTION

ELCM consists of the pressure sensor, the reference orifice (diameter of 0.02 inch), the vacuum pump which introduces the negative pressure into evaporative emission system, and the switching valve which switches the passage to introduce the negative pressure.



(1)	ELCM	(5)	Vacuum pump	(9)	Fuel tank
(2)	Switching valve	(6)	Drain filter	(10)	Canister
(3)	Reference orifice (0.02 inch orifice)	(7)	Purge control solenoid valve		
(4)	Pressure sensor	(8)	Intake manifold		

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Activation of soaking timer	Completed
Battery voltage	≥ 10.9 V
Ignition switch	OFF
Engine coolant temperature	≥ 4.4 °C (39.9 °F) and < 45 °C (113 °F)
Atmospheric pressure	≥ 75.1 kPa (563 mmHg, 22.2 inHg) and < 110 kPa (825 mmHg, 32.5 inHg)
Accumulated purge amount during previous driving cycle	\geq Value of Map 1

Map 1

Engine coolant temperature °C (°F)	0 (32)	30 (86)	35 (95)	40 (104)	45 (113)
Accumulated purge amount during previous driving cycle g (oz)	1500 (52.91)	1500 (52.91)	15000 (529.05)	25000 (881.75)	35000 (1234.45)

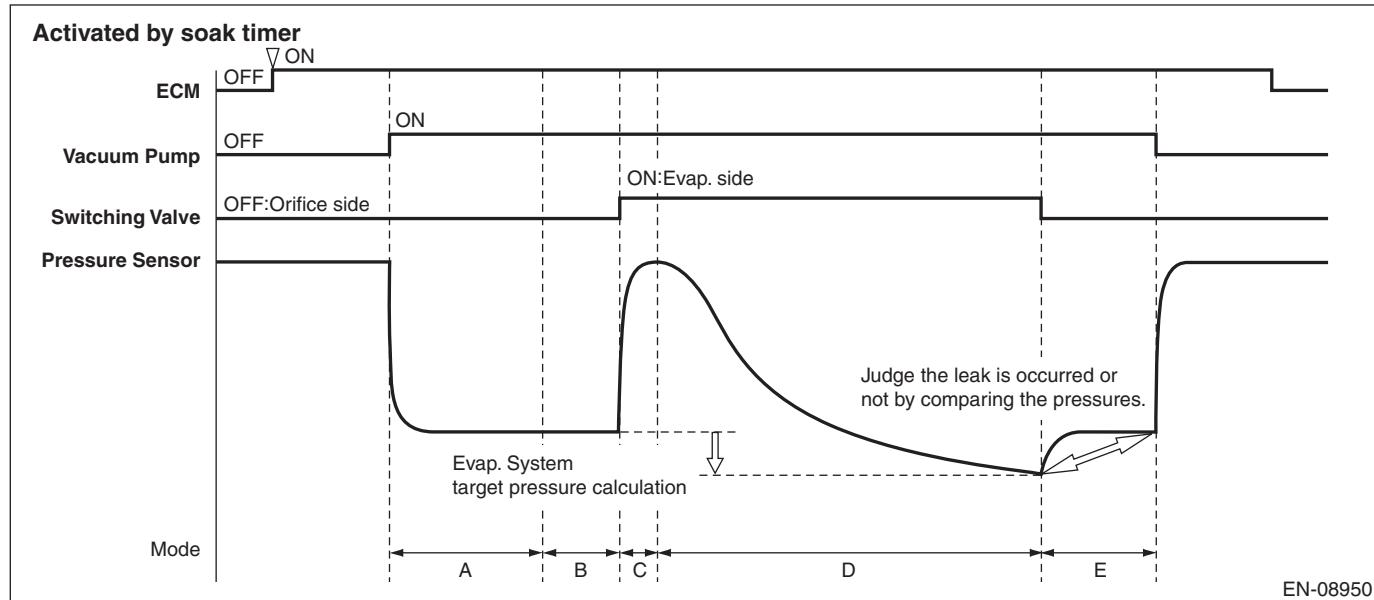
4. GENERAL DRIVING CYCLE

Perform the diagnosis only once when 5, 7 or 9.5 hours has passed after ignition switch is OFF. For more detail, refer to "OUTLINE OF DIAGNOSIS". <Ref. to GD(H4DO HEV)-115, OUTLINE OF DIAGNOSIS, DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

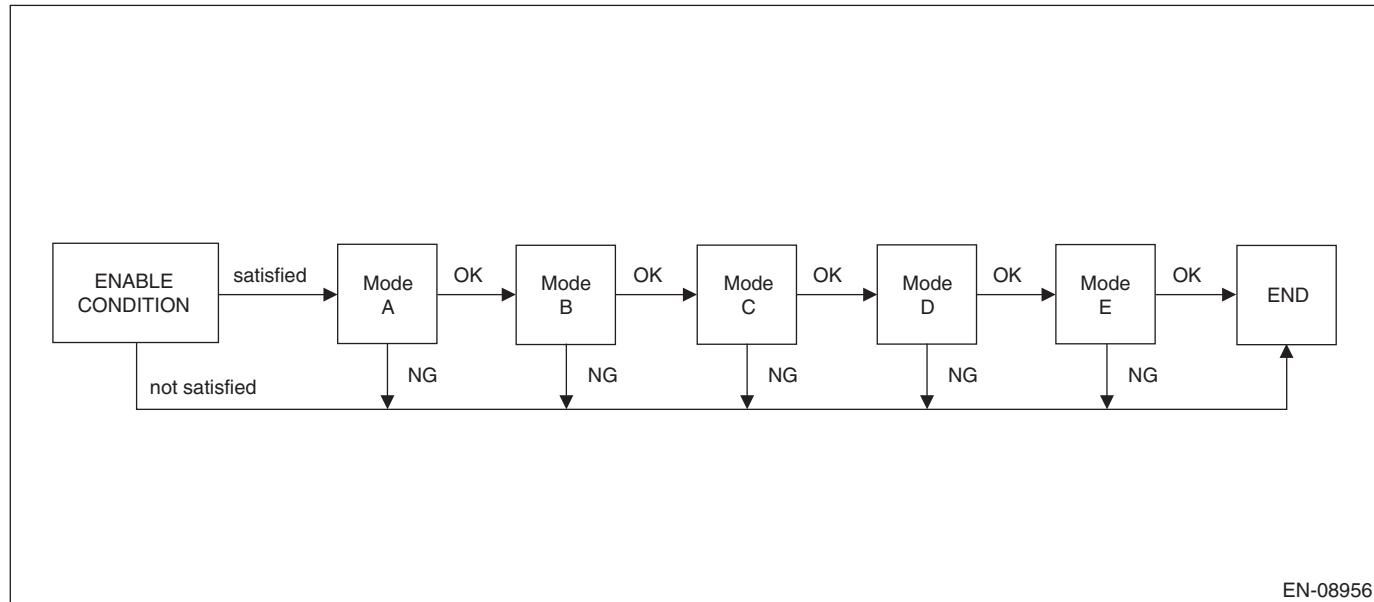
Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD



Mode	Explanation of Mode	Diagnosis Period
A	Vacuum pump operation confirmation and characteristics stability	7 s or less & 300 s
B	Measurement of reference pressure for setting the target negative pressure	40 s or less
C	Switching valve operation confirmation	12 s or less
D	Clogging of pipe diagnosis and leak pressure measurement	900 s or less
E	Reference pressure measurement for judgment	40 s or less



Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Mode A (Vacuum pump operation confirmation and characteristics stability)

Purpose: Detect the vacuum pump operation trouble.

Judge as NG when the following conditions are established.

Judge as OK if the following conditions are not established, and warm up for five minutes to stabilize the vacuum pump characteristics.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Pressure sensor output value	> -0.2 kPa (-1.68 mmHg, -0.1 inHg)	P2404

Mode B (Measurement of reference pressure for setting the target negative pressure)

1. Purpose: Judge the reference pressure stability.

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Pressure sensor maximum output value – Pressure sensor minimum output value	> 0.3 kPa (2.355 mmHg, 0.1 inHg)	P2404

2. Purpose: Judge whether the reference pressure is within the normal range, and detect the vacuum pump and orifice malfunctions.

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Reference pressure for setting the target negative pressure	< Value of Map 2 or > Value of Map 3	P2404

Map 2

Atmospheric pressure kPa (mmHg, inHg)	70 (525, 20.7)	80 (600, 23.6)	90 (675, 26.6)	100 (750, 29.5)
Reference pressure for setting the target negative pressure kPa (mmHg, inHg)	-4 (-29.790, -1.2)	-4.1 (-30.593, -1.2)	-4.2 (-31.395, -1.2)	-4.3 (-32.190, -1.3)

Map 3

Atmospheric pressure kPa (mmHg, inHg)	70 (525, 20.7)	80 (600, 23.6)	90 (675, 26.6)	100 (750, 29.5)
Reference pressure for setting the target negative pressure kPa (mmHg, inHg)	-0.9 (-7.065, -0.3)	-1 (-7.860, -0.3)	-1.2 (-8.663, -0.3)	-1.3 (-9.465, -0.4)

Mode C (Switching valve operation confirmation)

Purpose: Measure the pressure increase when switching valve is changed from open to close, and detect the stuck to open/close malfunctions of the switching valve.

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Pressure sensor output value – Reference pressure for setting the target negative pressure	< 0.2 kPa (1.68 mmHg, 0.1 inHg)	P2404

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Mode D (Clogging of pipe diagnosis and leak pressure measurement)

1. Clogging of pipe

Purpose: Measure the time required for the evaporative emission system to reach the target negative pressure by the vacuum pump, and detect the clogging of pipe trouble.

Judge as clogging of pipe malfunction if the evaporative emission system reaches to the target negative pressure within the specified time.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Time required to reach to the target negative pressure For target vacuum, use one of the followings. • Reference pressure for target vacuum setting – value of Map 4 • $-5 \text{ kPa} (-37.298 \text{ mmHg}, -1.5 \text{ inHg})$	$\leq 25000 \text{ ms}$	P1451

Map 4

Time of negative pressure introduction ms	0	100000	200000	300000	400000	500000	600000	700000	800000	900000	1000000	1100000	1200000
Reference pressure for setting the target negative pressure – Pressure sensor output value kPa (mmHg, inHg)	0.9 (7.058, 0.3)												

2. Leak pressure measurement

Purpose: Measure the pressure (leak pressure) when the evaporative emission system becomes the negative pressure by the vacuum pump.

Store the pressure as a leak pressure while the following conditions are met.

Judgment Value

Conditions for storing the leak pressure	Threshold Value
When any one of the followings is established: • Reference pressure for setting the target negative pressure – Pressure sensor output value • Pressure sensor output value • Time of negative pressure introduction	\geq Value of Map 4 $< -5 \text{ kPa} (-37.298 \text{ mmHg}, -1.5 \text{ inHg})$ $\geq 900000 \text{ ms}$

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Mode E (Measurement of reference pressure for judgment)

1. Purpose: Judge the reference pressure stability.

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Pressure sensor maximum output value – Pressure sensor minimum output value	> 0.3 kPa (2.355 mmHg, 0.1 inHg)	P2404

2. Purpose: Judge whether the reference pressure is within the normal range, and detect the vacuum pump and orifice malfunctions. Judge the vacuum pump performance stability.

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Reference pressure for judgment	< Value of Map 5 or > Value of Map 6	P2404

Map 5

Atmospheric pressure kPa (mmHg, inHg)	70 (525, 20.7)	80 (600, 23.6)	90 (675, 26.6)	100 (750, 29.5)
Reference pressure for judgment kPa (mmHg, inHg)	-4.5 (-34.020, -1.3)	-4.6 (-34.815, -1.4)	-4.7 (-35.618, -1.4)	-4.9 (-36.420, -1.4)

Map 6

Atmospheric pressure kPa (mmHg, inHg)	70 (525, 20.7)	80 (600, 23.6)	90 (675, 26.6)	100 (750, 29.5)
Reference pressure for judgment kPa (mmHg, inHg)	-0.8 (-6.180, -0.2)	-0.9 (-6.983, -0.3)	-1 (-7.785, -0.3)	-1.1 (-8.580, -0.3)

3. Purpose: Judge the presence of evaporative emission system leak.

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
<Large leak (0.04 inch)> Leak pressure	$\geq Ileakjdg$ (Pa)	P0455
$Ileakjdg = (\text{Reference pressure for judgment}) \times 0.377 - (-45.5 \text{ Pa})$		
<Very small leak (0.02 inch)> Leak pressure	$< Ileakjdg$ (Pa)	P0456

Time Needed for Diagnosis: Approx. 23 min

At next engine start, confirm whether the enable conditions are satisfied even though refueling has been done during soaking, and determine the malfunction.

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

CX:DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0455. <Ref. to GD(H4DO HEV)-115, DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

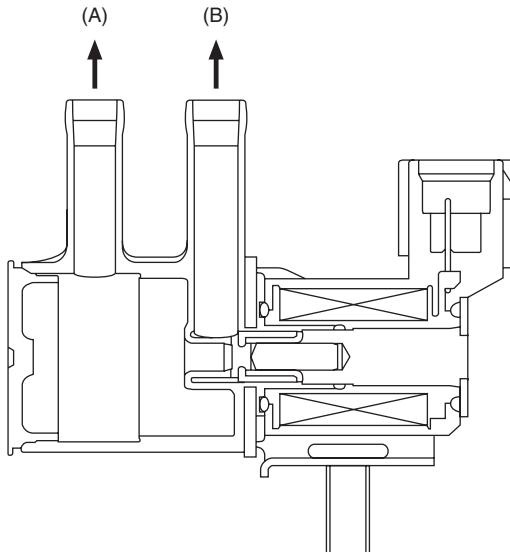
CY:DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the purge control solenoid valve.

Judge as NG when the ECM output level differs from the actual terminal level.

2. COMPONENT DESCRIPTION



EN-08988

(A) To canister

(B) To intake manifold

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Duty ratio of "ON"	< 0.75

4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal output voltage	$\leq \text{Battery voltage} \times 0.34$

Time Needed for Diagnosis: 2500 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

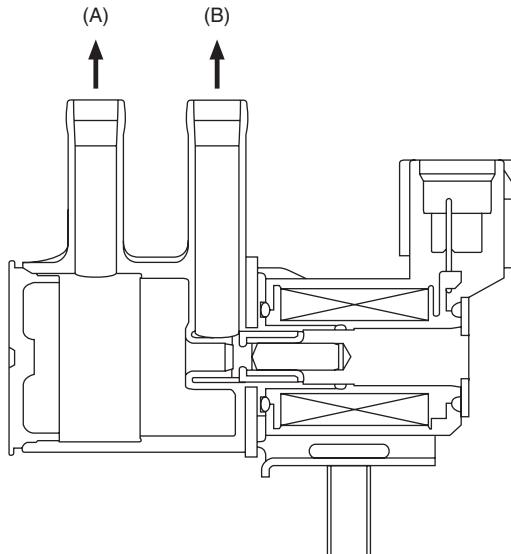
CZ:DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the purge control solenoid valve.

Judge as NG when the ECM output level differs from the actual terminal level.

2. COMPONENT DESCRIPTION



EN-08988

(A) To canister

(B) To intake manifold

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Duty ratio of "ON"	≥ 0.25

4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal output current	≥ 12 A

Time Needed for Diagnosis: 2500 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

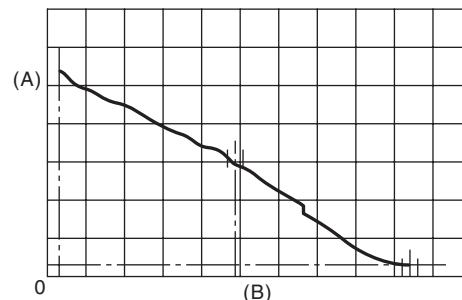
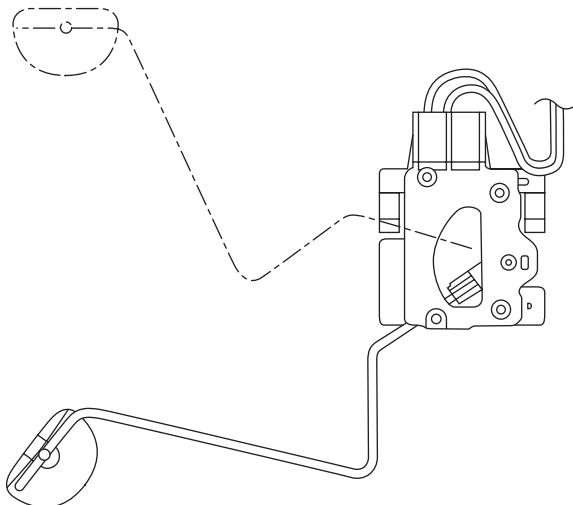
DA:DTC P0461 FUEL LEVEL SENSOR “A” CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect malfunctions of the fuel level sensor output property.

If the fuel level does not vary in a particular driving condition / engine condition where it should, judge as NG.

2. COMPONENT DESCRIPTION



EN-08989

(A) Fuel level

(B) Resistance

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Accumulated amount of intake air	$\geq 165375 \text{ g (5832.78 oz)}$
Max. – min. values of fuel level output	$< 2.6 \text{ l (0.69 US gal, 0.57 Imp gal)}$
Battery voltage	$\geq 10.9 \text{ V}$
Engine speed	$< 10000 \text{ rpm}$
Elapsed time after starting the engine	$\geq 5000 \text{ ms}$

Time Needed for Diagnosis: Less than 1 second

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

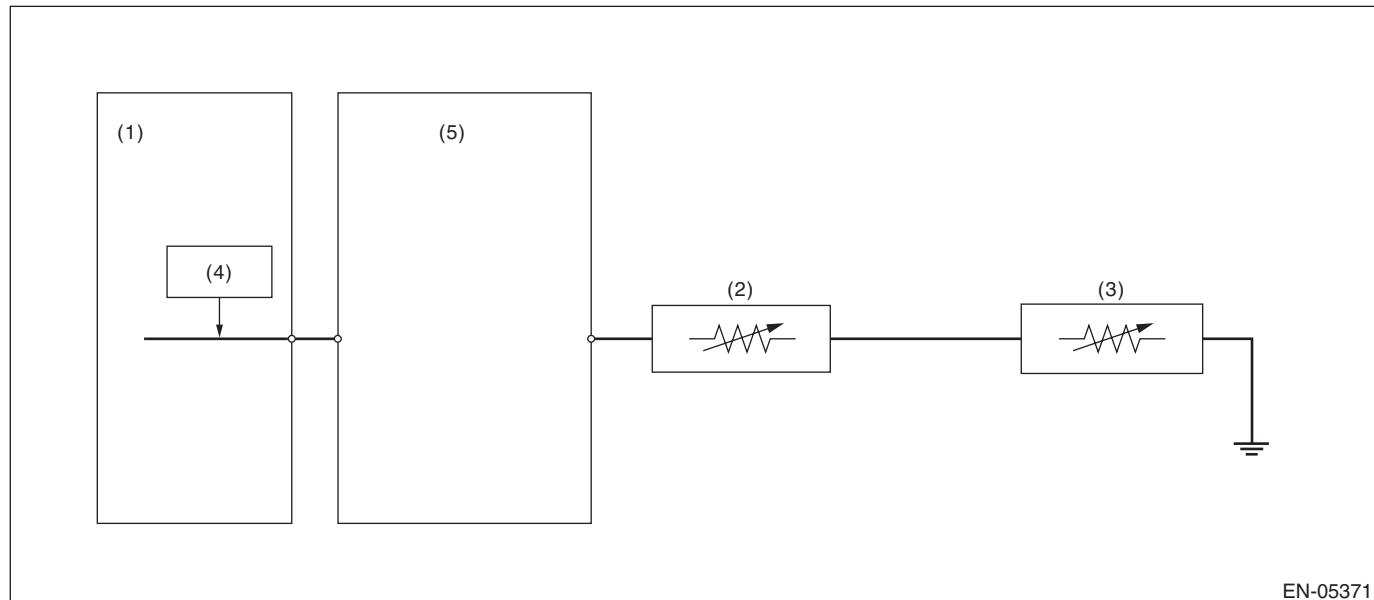
GENERAL DESCRIPTION

DB:DTC P0462 FUEL LEVEL SENSOR “A” CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel level sensor. Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)

(2) Fuel level sensor

(3) Fuel sub level sensor

(4) Detecting circuit

(5) Body integrated unit

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after ignition switch is turned to ON	≥ 3000 ms

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 2.211 V

Time Needed for Diagnosis: 2500 ms

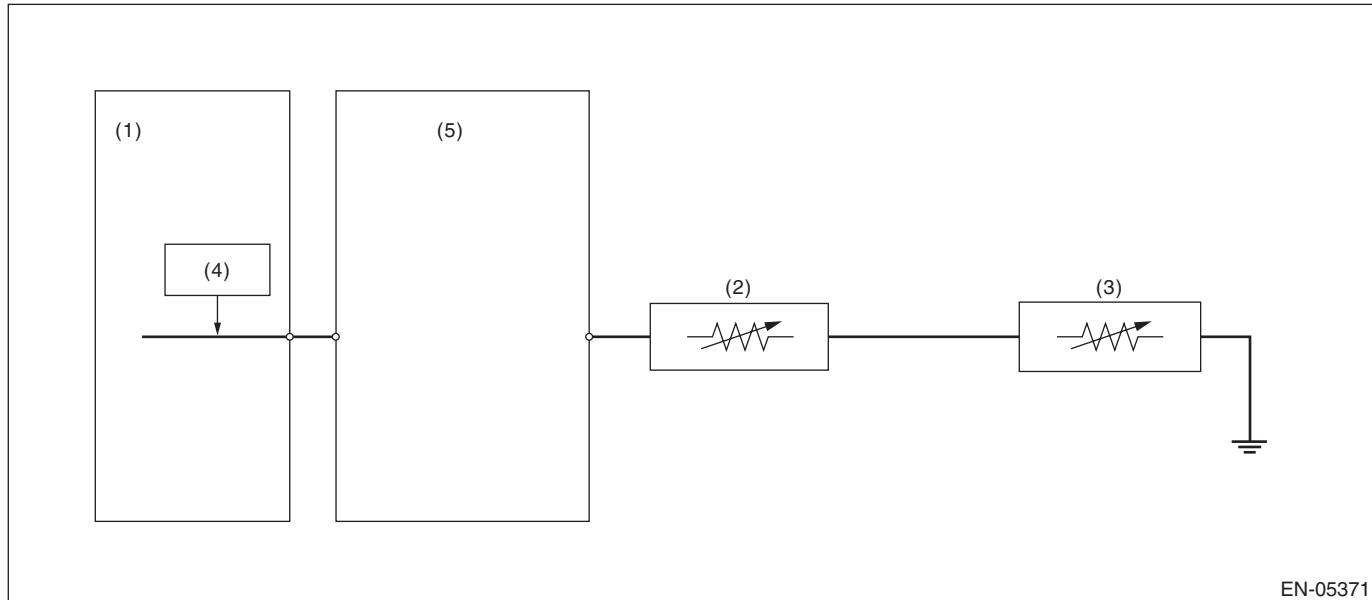
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

DC:DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel level sensor. Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)

(2) Fuel level sensor

(3) Fuel sub level sensor

(4) Detecting circuit

(5) Body integrated unit

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 12 V

Time Needed for Diagnosis: 1000 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

DD:DTC P0500 VEHICLE SPEED SENSOR “A”

1. OUTLINE OF DIAGNOSIS

Judge as NG when outside of the judgment value.

Judge NG when the received data from VDCCM&H/U is abnormal vehicle speed, and the vehicle speed data is impossible.

2. COMPONENT DESCRIPTION

Vehicle speed signals are taken in to the VDC control module and hydraulic control unit, and normal/erroneous data of the ABS wheel speed sensor is received by CAN communication from the VDC control module and hydraulic control unit.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Front ABS wheel speed sensor status	Malfunction
Either of the following is established	
Front left wheel speed	≥ 300 km/h (186.4 MPH)
Front right wheel speed	≥ 300 km/h (186.4 MPH)

Time Needed for Diagnosis: 2500 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

DE:DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED

1. OUTLINE OF DIAGNOSIS

Detect the malfunction that actual engine speed is not close to target engine speed during idling. Judge as NG when actual engine speed is not close to target engine speed during idling.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	$\geq 50^{\circ}\text{C}$ (122 °F)
Battery voltage	$\geq 10.9\text{ V}$
Atmospheric pressure	$\geq 75.1\text{ kPa}$ (563 mmHg, 22.2 inHg)
Fuel level	$\geq 7.8\text{ l}$ (2.06 US gal, 1.72 Imp gal)
Elapsed time after starting the engine	$\geq 10\text{ s}$
Accelerator pedal position	$= 0\%$
Lambda value (left and right)	≥ 0.85 and < 1.151
After intake manifold pressure changes by 133.3 kPa (1000 mmHg, 39.4 inHg) or more.	$> 0\text{ s}$
Elapsed time after switching neutral position switch to ON/OFF	$> 5\text{ s}$
Vehicle speed	0 km/h (0 MPH)

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling after warming up engine.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Actual engine speed – Targeted engine speed	$< -100\text{ rpm}$

Time Needed for Diagnosis: 15 s \times 1 time(s)

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

DF:DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED

1. OUTLINE OF DIAGNOSIS

Detect the malfunction that actual engine speed is not close to target engine speed during idling. Judge as NG when actual engine speed is not close to target engine speed during idling.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	$\geq 50^{\circ}\text{C}$ (122 $^{\circ}\text{F}$)
Battery voltage	$\geq 10.9 \text{ V}$
Atmospheric pressure	$\geq 75.1 \text{ kPa}$ (563 mmHg, 22.2 inHg)
Fuel level	$\geq 7.8 \text{ l}$ (2.06 US gal, 1.72 Imp gal)
Elapsed time after starting the engine	$\geq 10 \text{ s}$
Accelerator pedal position	$= 0\%$
Lambda value (left and right)	≥ 0.85 and < 1.151
After intake manifold pressure changes by 133.3 kPa (1000 mmHg, 39.4 inHg) or more.	$> 0 \text{ s}$
Elapsed time after switching neutral position switch to ON/OFF	$> 5 \text{ s}$
Vehicle speed	0 km/h (0 MPH)

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling after warming up engine.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Actual – Target engine speed	$\geq 200 \text{ rpm}$

Time Needed for Diagnosis: 15 s \times 1 time(s)

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

DG:DTC P050A COLD START IDLE AIR CONTROL SYSTEM PERFORMANCE**1. OUTLINE OF DIAGNOSIS**

- When cold, the abnormality in the control of target engine speed increase is detected. (P050A)

- Idle speed diagnosis

Judge as NG when actual engine speed is not close to target engine speed at cold start.

- Detect malfunctions of the catalyst advanced idling retard angle control. (P050B)

Judge as NG when ECM is not controlling the angle properly during catalyst advanced idling retard angle control.

- Final ignition timing diagnosis

Judge as NG when actual retard amount is under the specified value at cold start.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
<Idle speed diagnosis>	
Atmospheric pressure	≥ 75.1 kPa (563 mmHg, 22.2 inHg)
Battery voltage	> 10.9 V
Engine condition	In operation
Vehicle speed	≤ 2 km/h (1.2 MPH)
Engine coolant temperature	≤ 60 °C (140 °F)
Intake air amount sum value	≤ Value of Map 1
Elapsed time after gear position change (P ↔ D or N ↔ D)	≥ 3000 ms
Throttle opening angle	< 0.37 °
Fuel property	Not extremely low volatility
Elapsed time after starting the engine	≥ 2000 ms
<Final ignition timing diagnosis>	
Atmospheric pressure	≥ 75.1 kPa (563 mmHg, 22.2 inHg)
Battery voltage	> 10.9 V
Engine condition	In operation
Vehicle speed	≤ 2 km/h (1.2 MPH)
Engine coolant temperature	≤ 60 °C (140 °F)
Intake air amount sum value	≤ Value of Map 2
Elapsed time after gear position change (P ↔ D or N ↔ D)	≥ 3000 ms
Throttle opening angle	< 0.37 °
Fuel property	Not extremely low volatility
Target retard amount	≥ Value from Map 3

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Map 1

Engine coolant temperature at engine starting °C (°F)	-40 (-40)	-30 (-22)	-20 (-4)	-10 (14)	0 (32)	10 (50)	20 (68)	30 (86)
Intake air amount sum value g (oz)	770 (27.16)	690 (24.34)	620 (21.87)	560 (19.75)	510 (17.99)	450 (15.87)	390 (13.76)	320 (11.29)

Engine coolant temperature at engine starting °C (°F)	40 (104)	50 (122)	60 (140)	70 (158)	80 (176)	90 (194)	100 (212)	110 (230)
Intake air amount sum value g (oz)	260 (9.17)	210 (7.41)	180 (6.35)	180 (6.35)	180 (6.35)	180 (6.35)	180 (6.35)	180 (6.35)

Map 2

Engine coolant temperature at engine starting °C (°F)	-40 (-40)	-30 (-22)	-20 (-4)	-10 (14)	0 (32)	10 (50)	20 (68)	30 (86)
Intake air amount sum value g (oz)	770 (27.16)	690 (24.34)	620 (21.87)	560 (19.75)	510 (17.99)	450 (15.87)	390 (13.76)	320 (11.29)

Engine coolant temperature at engine starting °C (°F)	40 (104)	50 (122)	60 (140)	70 (158)	80 (176)	90 (194)	100 (212)	110 (230)
Intake air amount sum value g (oz)	260 (9.17)	210 (7.41)	180 (6.35)	180 (6.35)	180 (6.35)	180 (6.35)	180 (6.35)	180 (6.35)

Map 3

Engine coolant temperature	-40 °C (-40 °F)	-30 °C (-22 °F)	-20 °C (-4 °F)	-10 °C (14 °F)	0 °C (32 °F)	10 °C (50 °F)	20 °C (68 °F)	30 °C (86 °F)	40 °C (104 °F)	50 °C (122 °F)	60 °C (140 °F)
Target retard amount	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA

3. GENERAL DRIVING CYCLE

Perform the diagnosis at cold start.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

4. DIAGNOSTIC METHOD

• Idle speed diagnosis

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria		Threshold Value
Actual engine speed – Target engine speed		< Value of Map 4

Map 4

Engine coolant temperature	-40 °C (-40 °F)	-30 °C (-22 °F)	-20 °C (-4 °F)	-10 °C (14 °F)	0.00 °C (32 °F)	10.00 °C (50 °F)	20.00 °C (68 °F)	30.00 °C (86 °F)	40.00 °C (104 °F)	50.00 °C (122 °F)	60.00 °C (140 °F)
Threshold Value	-300 rpm	-300 rpm	-300 rpm	-300 rpm	-300 rpm	-300 rpm	-300 rpm	-300 rpm	-300 rpm	-300 rpm	-300 rpm

Time Needed for Diagnosis: 6000 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Final ignition timing diagnosis

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria		Threshold Value
Final ignition timing – ignition timing during CSERS*		> Value of Map 5

*: Ignition timing during CSERS (Cold Start Emission Reduction Strategy) = Base ignition timing – retard amount

Map 5

Engine coolant temperature	-40 °C (-40 °F)	-30 °C (-22 °F)	-20 °C (-4 °F)	-10 °C (14 °F)	0 °C (32 °F)	10 °C (50 °F)	20 °C (68 °F)	30 °C (86 °F)	40 °C (104 °F)	50 °C (122 °F)	60 °C (140 °F)
Threshold Value	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA

Time Needed for Diagnosis: 7000 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

DH:DTC P050B COLD START IGNITION TIMING PERFORMANCE

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P050A. <Ref. to GD(H4DO HEV)-129, DTC P050A COLD START IDLE AIR CONTROL SYSTEM PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

DI: DTC P0512 STARTER REQUEST CIRCUIT

1. OUTLINE OF DIAGNOSIS

Detect abnormal continuity in the starter SW1.

Judge as ON NG when the starter SW 1 signal remains ON.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	> 8 V
Engine revs (only at abnormality judgment)	> 500 rpm

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Starter SW1 voltage	\geq Battery voltage \times 0.85

Time Needed for Diagnosis: 30000 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

DJ:DTC P0560 SYSTEM VOLTAGE

1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of back-up power supply circuit.
Judge as NG when the backup power voltage is low.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	$> 10.9 \text{ V}$

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Voltage of back-up power supply	$\leq 3.5 \text{ V}$

Time Needed for Diagnosis: 2500 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

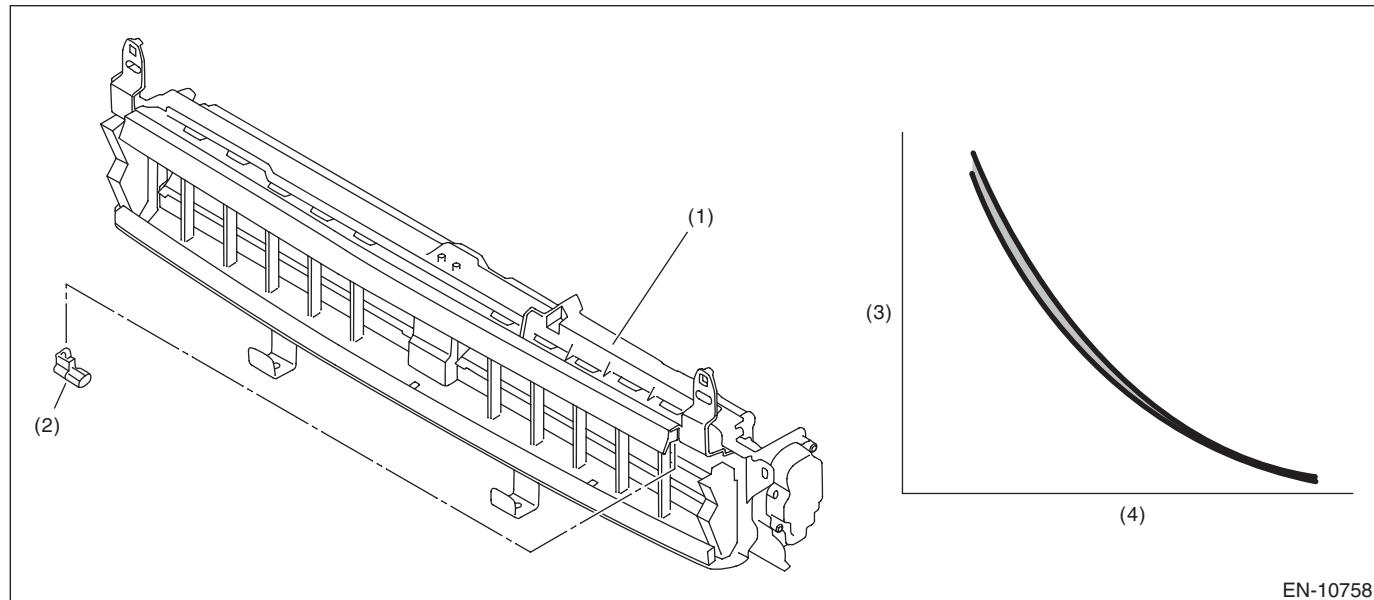
GENERAL DESCRIPTION

DK:DTC P059A ACTIVE GRILLE SHUTTER "A" POSITION SENSOR CIRCUIT

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of active grille shutter position sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-10758

(1) Active grille shutter

(3) Resistance value (kΩ)

(4) Ambient air temperature (°C (°F))

(2) Ambient air temperature sensor

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Command to active grille shutter	Open or close

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Input pulse of active grille shutter position sensor	= 0

Time Needed for Diagnosis: 2000 ms

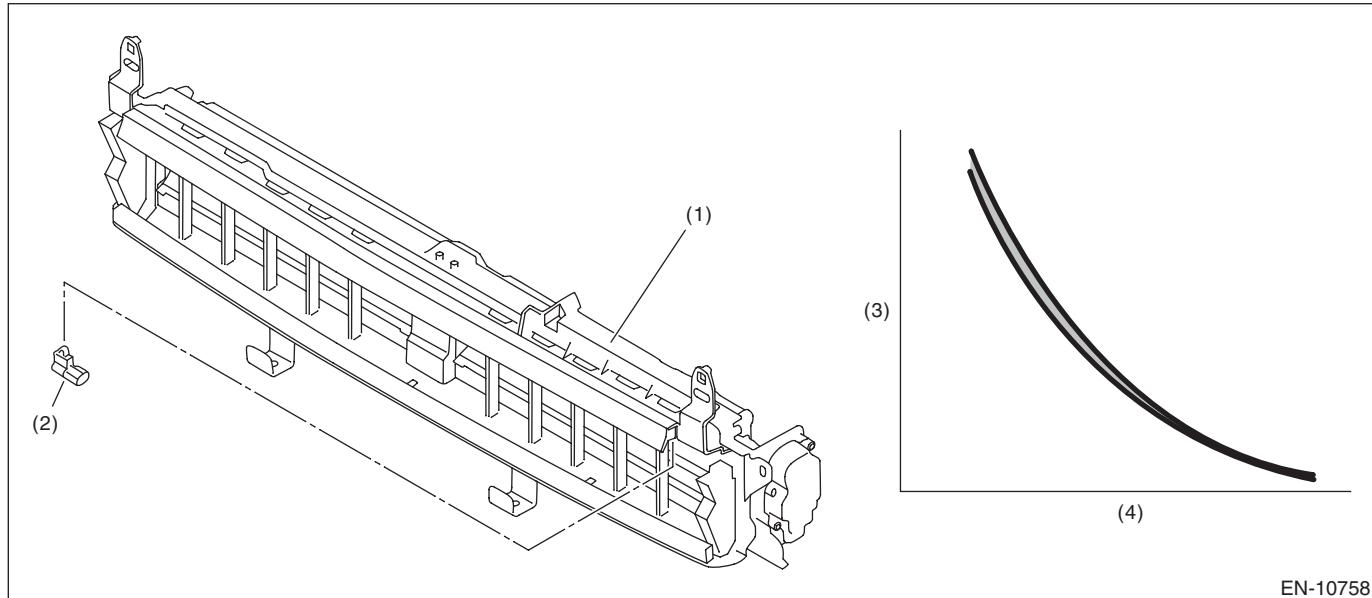
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

DL:DTC P059F ACTIVE GRILLE SHUTTER "A" PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of the response to active grille shutter open/close request.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-10758

(1) Active grille shutter

(3) Resistance value (kΩ)

(4) Ambient air temperature (°C (°F))

(2) Ambient air temperature sensor

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Active grille shutter drive	Yes

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Operation angle in 15000 ms of active grille shutter	< 88%

Time Needed for Diagnosis: 15000 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

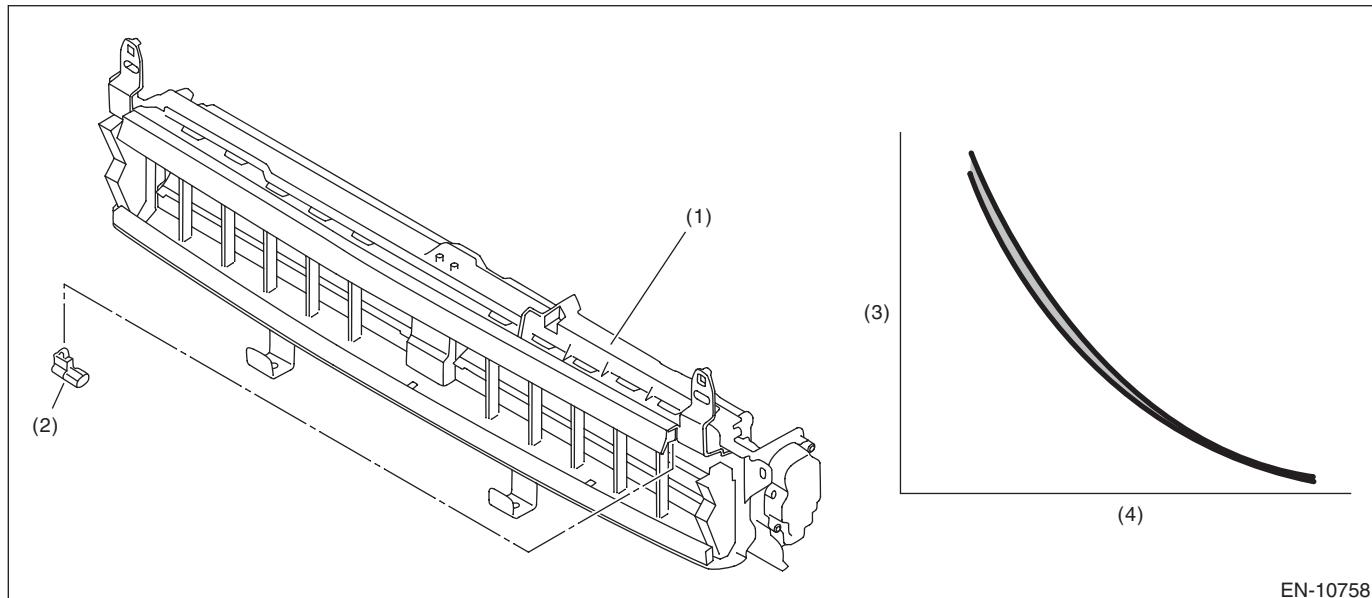
GENERAL DESCRIPTION

DM:DTC P05A0 ACTIVE GRILLE SHUTTER "A" STUCK

1. OUTLINE OF DIAGNOSIS

Detect that active grille shutter does not open/close with foreign matter jammed or a fault. Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-10758

(1) Active grille shutter

(3) Resistance value (kΩ)

(4) Ambient air temperature (°C (°F))

(2) Ambient air temperature sensor

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Command to active grille shutter	Open or close

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Maximum value of active grille shutter position sensor (when controlled at power supply ON)	< 70 deg
Operating angle of active grille shutter (when controlled at power supply ON)	< 88%

Time Needed for Diagnosis: 2500 ms

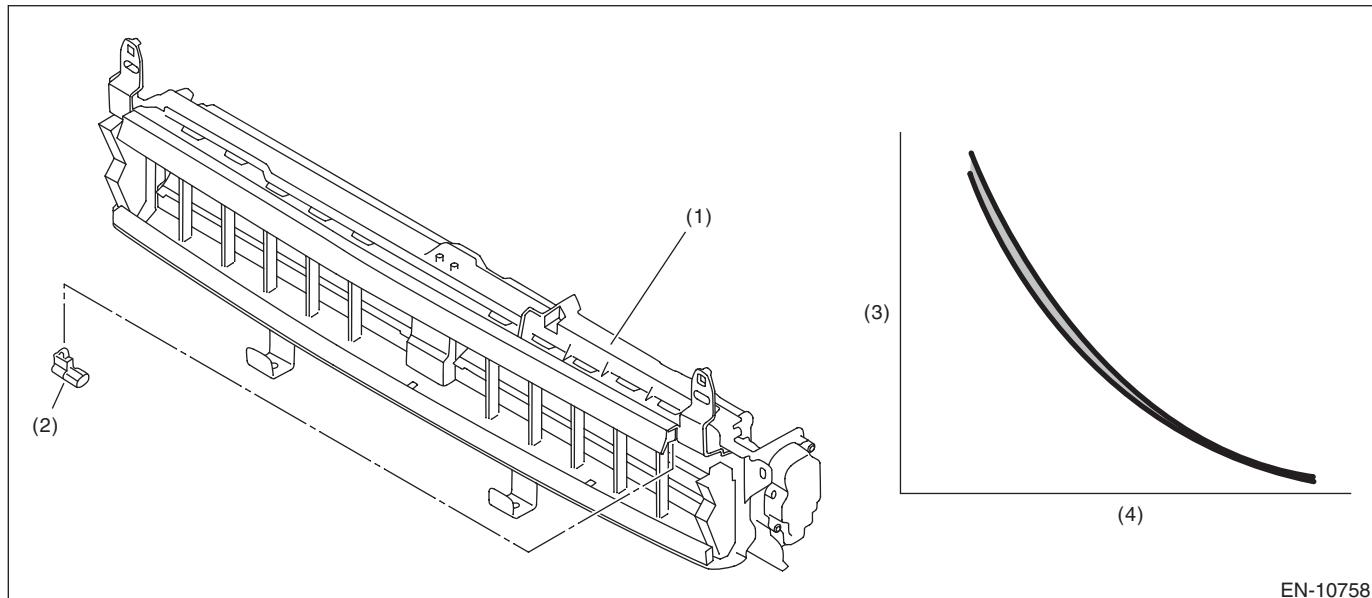
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

DN:DTC P05A1 ACTIVE GRILLE SHUTTER "A" RANGE OVER

1. OUTLINE OF DIAGNOSIS

Detect the excessive rotation beyond the specific angle with active grille shutter fault.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-10758

(1) Active grille shutter

(3) Resistance value (kΩ)

(4) Ambient air temperature (°C (°F))

(2) Ambient air temperature sensor

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Command to active grille shutter	Open or close

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Maximum value of active grille shutter position sensor (when controlled at power supply ON)	> 155 deg
Operating angle of active grille shutter (when controlled at power supply ON)	$> 112\%$

Time Needed for Diagnosis: 2500 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

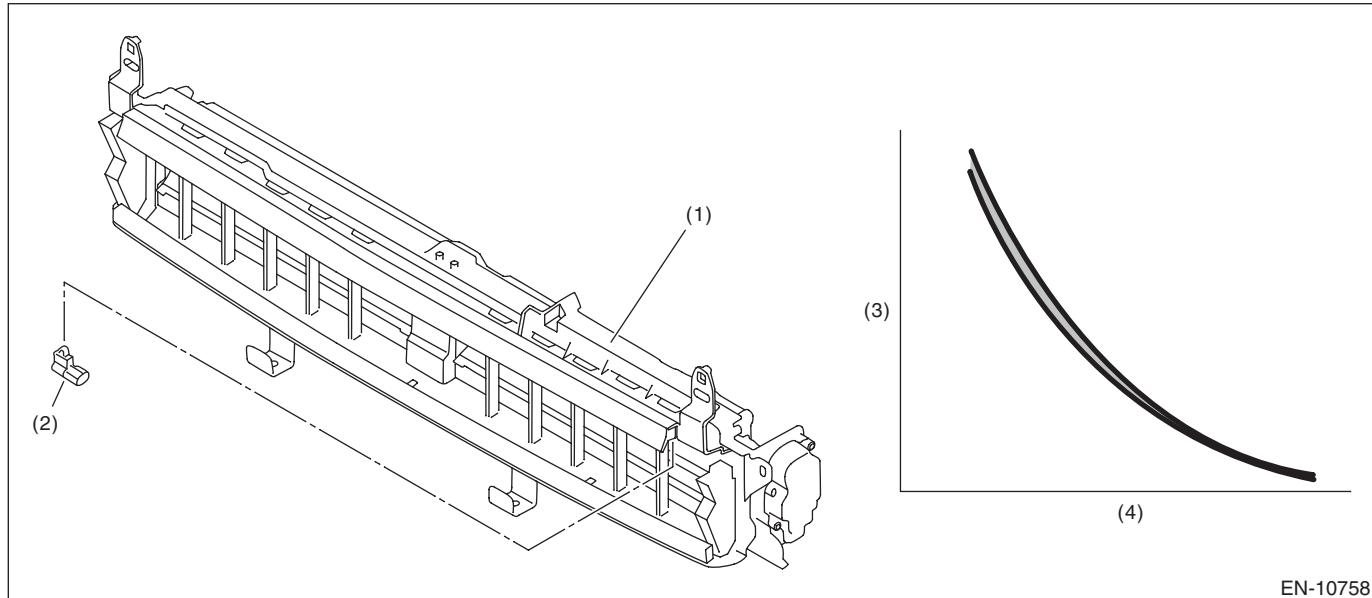
GENERAL DESCRIPTION

DO:DTC P05A2 ACTIVE GRILLE SHUTTER "A" CONTROL CIRCUIT

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of active grille shutter motor circuit.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-10758

(1) Active grille shutter

(3) Resistance value (kΩ)

(4) Ambient air temperature (°C (°F))

(2) Ambient air temperature sensor

3. ENABLE CONDITIONS

Diagnosis 1

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

Diagnosis 2

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Command to active grille shutter	Open or close

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Diagnosis 1

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Signal of malfunction from AGASCM	ON
Motor circuit current during open or close command to active grille shutter	< 10 mA or > 650 mA

Time Needed for Diagnosis: 2500 ms

Diagnosis 2

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Signal of malfunction from AGASCM	ON
Motor circuit current during open or close command to active grille shutter	< 10 mA or > 10 mA

Time Needed for Diagnosis: 2500 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

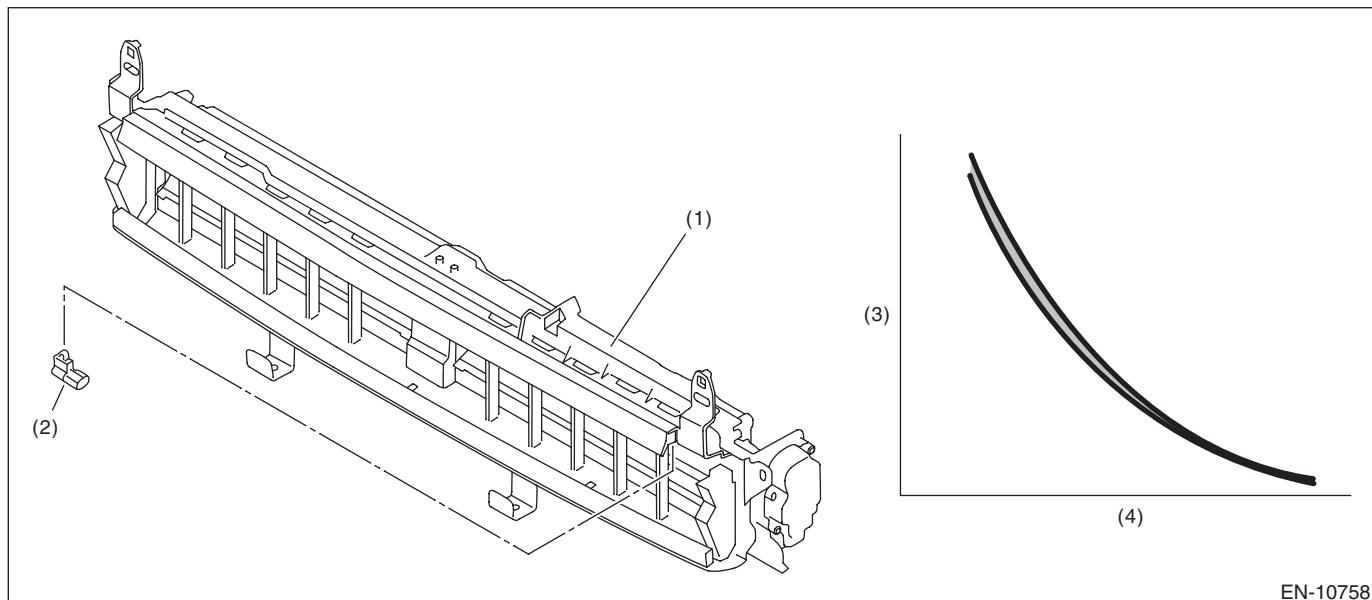
GENERAL DESCRIPTION

DP:DTC P05A6 ACTIVE GRILLE SHUTTER "A" SUPPLY VOLTAGE CIRCUIT/OPEN

1. OUTLINE OF DIAGNOSIS

Detect the abnormality of active grille shutter power supply voltage.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) Active grille shutter

(3) Resistance value (kΩ)

(4) Ambient air temperature (°C (°F))

(2) Ambient air temperature sensor

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Malfunction judgment flag	1

Time Needed for Diagnosis: 2500 ms

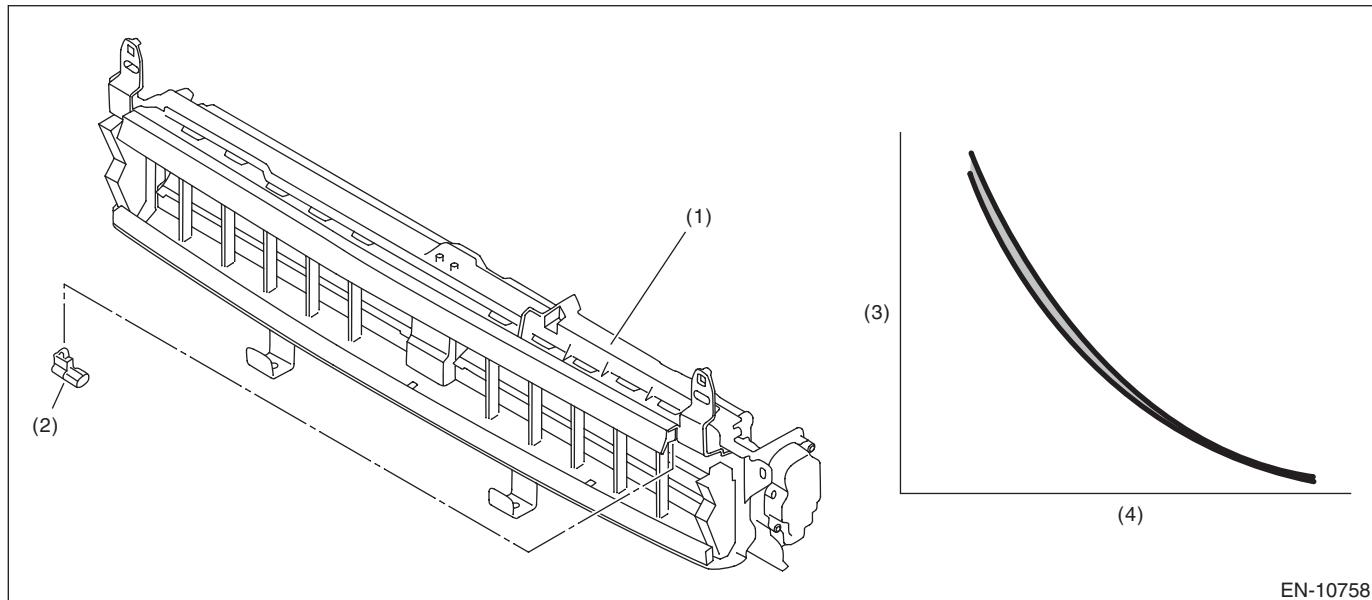
Malfunction Indicator Light Illumination: Malfunction indicator light does not illuminate.

DQ:DTC P05C0 ACTIVE GRILLE SHUTTER "A" OVER TEMPERATURE

1. OUTLINE OF DIAGNOSIS

Detect the abnormality of active grille shutter internal temperature.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-10758

(1) Active grille shutter

(3) Resistance value (kΩ)

(4) Ambient air temperature (°C (°F))

(2) Ambient air temperature sensor

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Malfunction judgment flag	1

Time Needed for Diagnosis: 2500 ms

Malfunction Indicator Light Illumination: Malfunction indicator light does not illuminate.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

DR:DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of microcomputer (RAM).

When there is a problem in the CPU normal RAM, judge as NG.

If it is possible to write data to the whole area of RAM in the initial routine, and is possible to read the same data, it is judged as OK, and if not, NG.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

Diagnosis with the initial routine.

3. GENERAL DRIVING CYCLE

Perform the diagnosis as soon as the ignition switch is turned to ON.

4. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Write the specified value into the RAM.	Unmatch to written value

Time Needed for Diagnosis: less than 512 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

DS:DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR

1. OUTLINE OF DIAGNOSIS

Judge as NG when SUM value of ROM is outside the standard value.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

Diagnosis with the initial routine.

3. GENERAL DRIVING CYCLE

Perform the diagnosis as soon as the ignition switch is turned to ON.

4. DIAGNOSTIC METHOD

Judge as NG if the criteria below are met.

Judgment Value

Malfunction Criteria	Threshold Value
SUM value of ROM	Standard

Time Needed for Diagnosis: 512 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

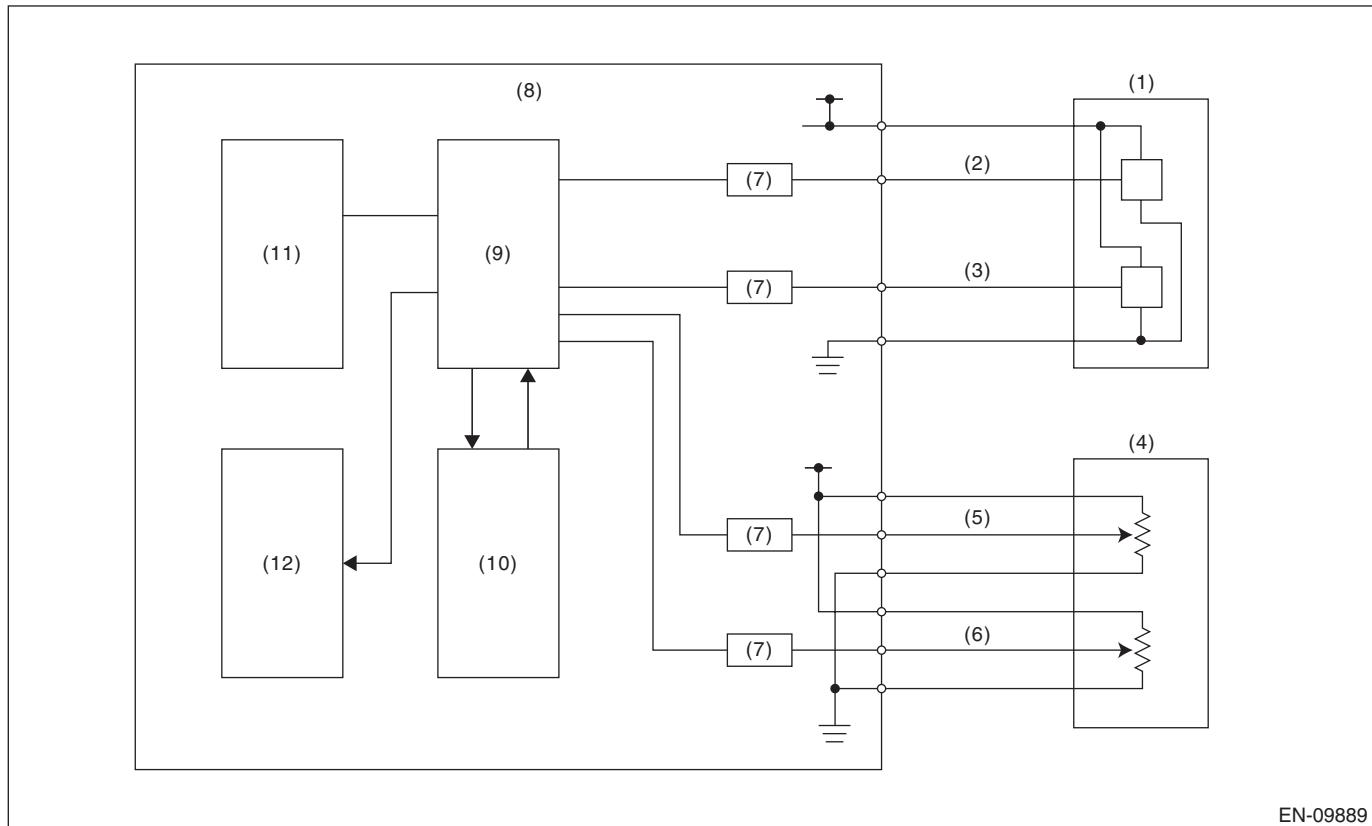
DT:DTC P0606 CONTROL MODULE PROCESSOR

1. OUTLINE OF DIAGNOSIS

Judge as NG when the CPU operation is abnormal.

- (1) Instruction check
- (2) Software flow check
- (3) Software monitor check
- (4) CAN register check
- (5) If the output IC operation is abnormal

2. COMPONENT DESCRIPTION



(1) Throttle position sensor	(5) Accelerator pedal position sensor 1	(9) CPU
(2) Throttle position sensor 1	(6) Accelerator pedal position sensor 2	(10) Monitoring IC
(3) Throttle position sensor 2	(7) I/F circuit	(11) EEPROM
(4) Accelerator pedal position sensor	(8) Engine control module (ECM)	(12) Output IC

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
(1) — 1 initial routine	
(1) — 2 ignition switch	ON
(1) — 2 Battery voltage	≥ 6.2 V
(1) — 2 Electronic throttle control relay	ON
(2) Ignition switch	ON
(3) Ignition switch	ON
(3) Battery voltage	≥ 6.2 V
(3) Electronic throttle control relay	ON
(4) Ignition switch	ON
(5) Initial routine	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
(1) — 1 instruction value	Unmatch to expected value
(1) — 2 calculation result of CPU and FPU	Unmatch to expected value
(2) Process flow result	The result and expected value do not match.
(3) High integrated IC motor continuity cut demand	Exist
(4) Communication between output driver ICs	Not possible to communicate
(5) Writing value to CAN register	≠ Read out value

Time Needed for Diagnosis:

- (1) — 1: 2 time(s)
- (1) — 2: 512 ms
- (2): 504 ms
- (3): 48 ms
- (4): 2500 ms
- (5): None

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

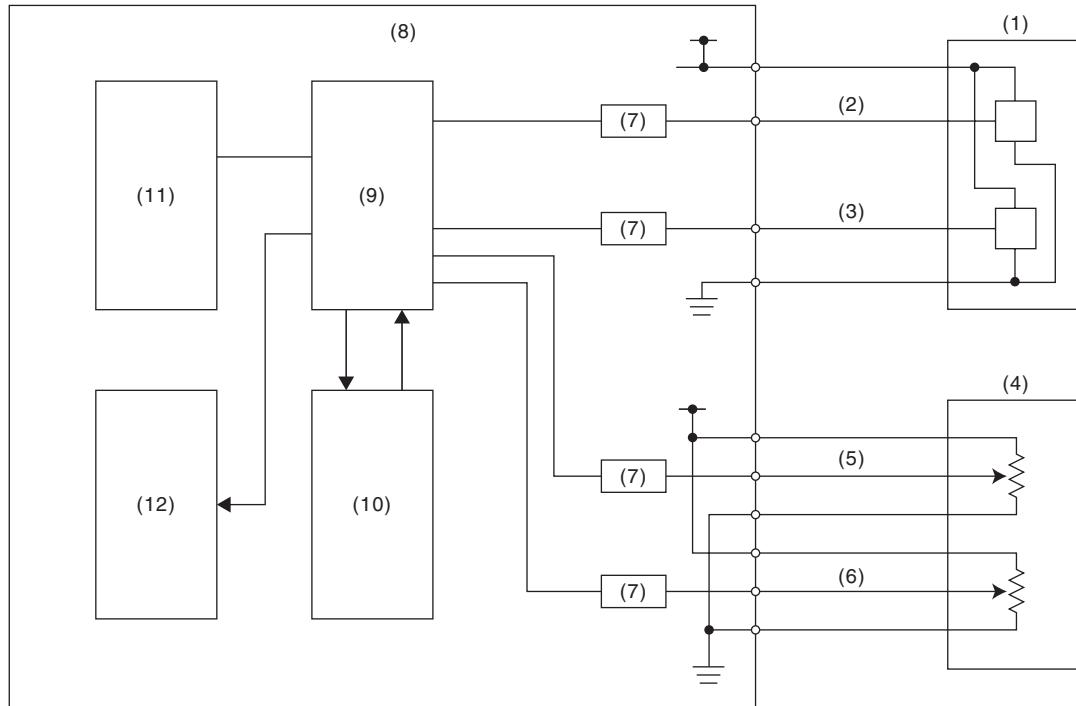
DU:DTC P060A INTERNAL CONTROL MODULE MONITORING PROCESSOR PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Judge as NG when the monitoring IC operation is abnormal.

- (1) Monitoring IC Disable (motor continuity cut demand) diagnosis
- (2) Monitoring IC function diagnosis
- (3) Monitoring IC register diagnosis

2. COMPONENT DESCRIPTION



EN-09889

(1) Throttle position sensor	(5) Accelerator pedal position sensor 1	(9) CPU
(2) Throttle position sensor 1	(6) Accelerator pedal position sensor 2	(10) Monitoring IC
(3) Throttle position sensor 2	(7) I/F circuit	(11) EEPROM
(4) Accelerator pedal position sensor	(8) Engine control module (ECM)	(12) Output IC

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
(1) Battery voltage	≥ 6 V
(1) When CPU transmits incorrect data intentionally	
(2) Battery voltage	≥ 6 V
(2) When CPU transmits incorrect data intentionally	
(3) Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge as NG when one of the following conditions is established.

Judgment Value

Malfunction Criteria	Threshold Value
(1) Main throttle opening angle – Main throttle opening angle at monitoring start	$\geq 2^\circ$
(2) Monitoring IC motor continuity cut demand	None
(3) Monitoring IC register writing value	\neq Reading value

Time Needed for Diagnosis:

- (1): 24 ms
- (2): $2984 \text{ ms} = (25 + 6) \times 0.008 + (4 \times 25 + 4) \times 0.008 + (5 \times 25 + 9) \times 0.008 + (2 \times 25) \times 0.008 + (25 + 2) \times 0.008 \times 2$
- (3): 200 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

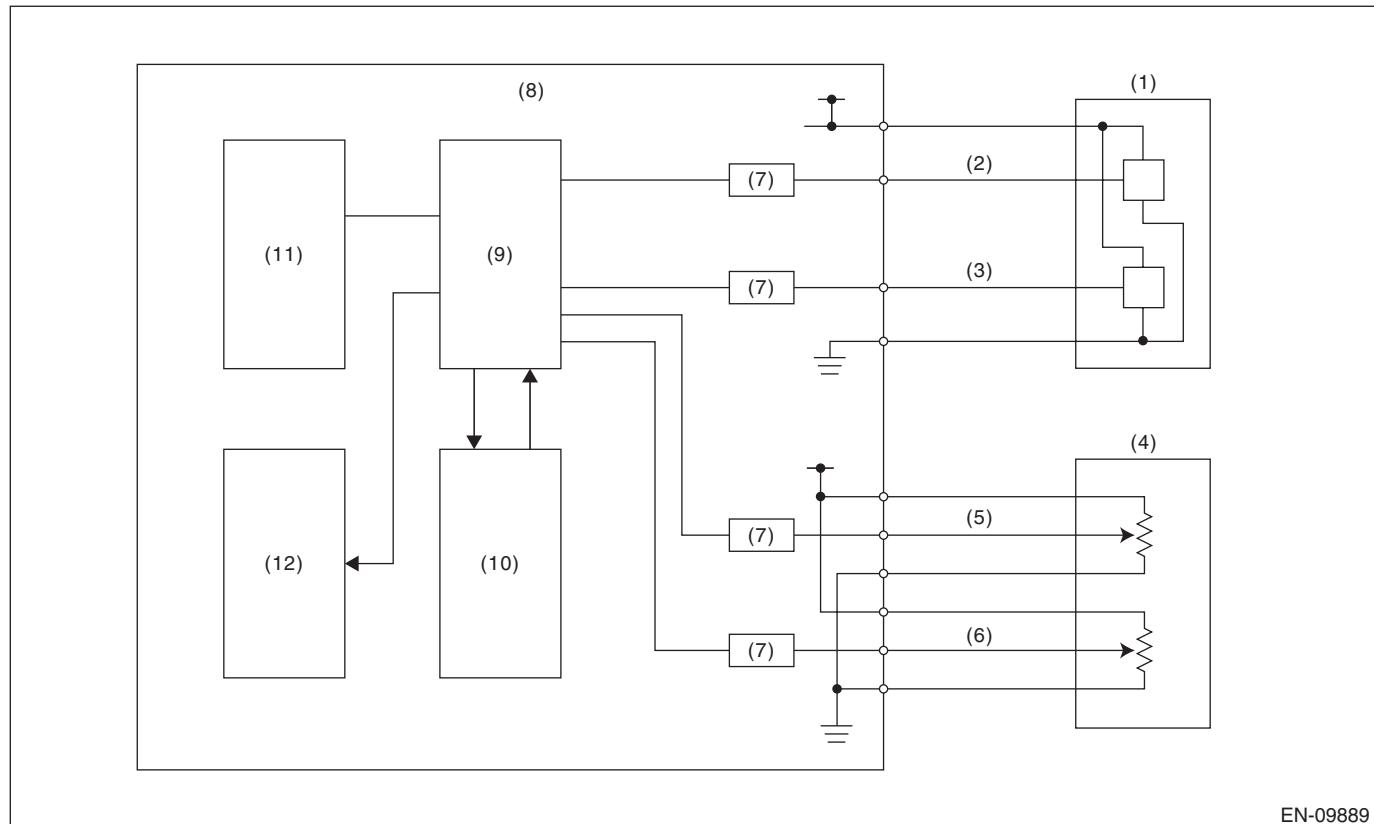
GENERAL DESCRIPTION

DV:DTC P060B INTERNAL CONTROL MODULE A/D PROCESSING PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Judge as NG when the AD converter operation is abnormal.

2. COMPONENT DESCRIPTION



(1) Throttle position sensor	(5) Accelerator pedal position sensor 1	(9) CPU
(2) Throttle position sensor 1	(6) Accelerator pedal position sensor 2	(10) Monitoring IC
(3) Throttle position sensor 2	(7) I/F circuit	(11) EEPROM
(4) Accelerator pedal position sensor	(8) Engine control module (ECM)	(12) Output IC

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V
Target voltage	$= 0$ V
Battery voltage	≥ 6 V
Target voltage	$= 5$ V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge as NG when one of the following conditions is established.

Judgment Value

Malfunction Criteria	Threshold Value
Actual voltage	> 0.01953125 V
Actual voltage	< 4.979248047 V

Time Needed for Diagnosis: 200 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

DW:DTC P0616 STARTER RELAY CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

- Model without push button start

Detect abnormal continuity in the starter SW1.

Judge as OFF NG when the starter SW 1 signal remains OFF.

- Model with push button start

Detect abnormal continuity in the starter SW 2.

Judge as OFF NG when the starter SW 2 signal remains OFF.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V
Vehicle speed	< 1 km/h (0.6 MPH)
Starter relay command	ON
Engine speed	Change from 0 rpm to 500 rpm or more

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

Judge as OFF NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Starter SW1 signal with battery voltage $\times 0.85$ or more (models without push button start)	Not detected
Starter SW2 signal with battery voltage $\times 0.85$ or more (models with push button start)	

Time Needed for Diagnosis: Less than 1 second

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

DX:DTC P0617 STARTER RELAY CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

- Model without push button start

Detect abnormal continuity in the starter SW1.

Judge as ON NG when the starter SW 1 signal remains ON.

- Model with push button start

Detect abnormal continuity in the starter SW 2.

Judge as ON NG when the starter SW 2 signal remains ON.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V
Engine speed	> 500 rpm
Starter relay command	OFF

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Starter SW 1 signal (model without push button start)	\geq Battery voltage $\times 0.85$
Starter SW 2 signal (model with push button start)	

Time Needed for Diagnosis: 30000 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

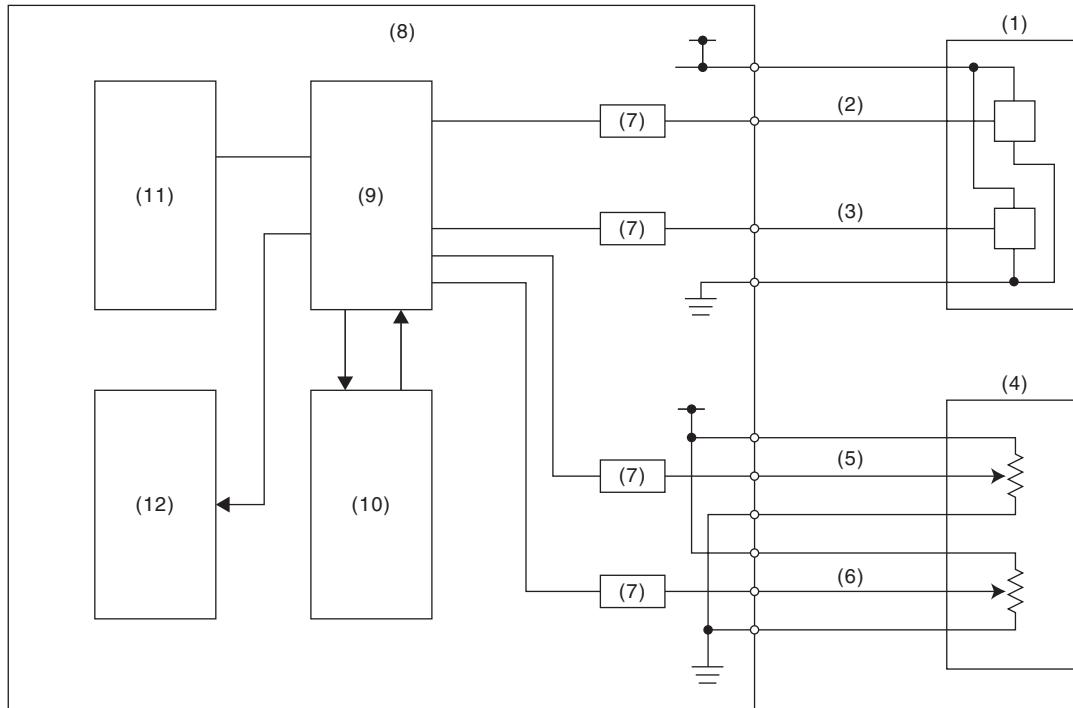
GENERAL DESCRIPTION

DY:DTC P062F INTERNAL CONTROL MODULE EEPROM ERROR

1. OUTLINE OF DIAGNOSIS

Judge as NG when the EEPROM operation is abnormal.

2. COMPONENT DESCRIPTION



EN-09889

(1) Throttle position sensor	(5) Accelerator pedal position sensor 1	(9) CPU
(2) Throttle position sensor 1	(6) Accelerator pedal position sensor 2	(10) Monitoring IC
(3) Throttle position sensor 2	(7) I/F circuit	(11) EEPROM
(4) Accelerator pedal position sensor	(8) Engine control module (ECM)	(12) Output IC

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Perform the diagnosis during self shut.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Writing result to EEPROM	Malfunction

Time Needed for Diagnosis: 2 times

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

DZ:DTC P0685 ECM/PCM POWER RELAY CONTROL CIRCUIT/OPEN

1. OUTLINE OF DIAGNOSIS

Detect the main relay stuck to ON.

Judge as NG when ECM keeps operating for more than predetermined time although the main relay does not turn to OFF after ignition switch is turned to OFF.

2. COMPONENT DESCRIPTION

The main relay controls current of coils by receiving instructions from the ignition switch and ELCM to switch ECM to ON/OFF.

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Main relay	OFF instruction

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once when the enable conditions are established with the ignition switch OFF → ON.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
ECM status	In operation

Time Needed for Diagnosis: 2500 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

EA:DTC P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST)

1. OUTLINE OF DIAGNOSIS

Judge as NG when there is CAN communication with the TCM and there is a MIL lighting request.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
MIL lighting request from TCM	Yes

Time Needed for Diagnosis: 128 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

EB:DTC P081A STARTER DISABLE CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect abnormal continuity in the starter cut relay.

Judge as NG when the starter cut relay output line is open.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	> 8 V
Engine speed	Change from 0 rpm to 500 rpm or more
Vehicle speed	< 1 km/h (0.6 MPH)
Starter cut relay command	OFF

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Starter cut relay terminal voltage	> Battery voltage \times 0.34 is not experienced

Time Needed for Diagnosis: Less than 1 second

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

EC:DTC P0851 PARK/NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of neutral SW.

Judge as NG when the ECM neutral terminal input differs from the reception data from TCM.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Starter relay feedback voltage	< Battery voltage × 0.35
“P” range/“N” range of TCM	OFF

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Neutral position switch signal voltage	≤ Battery voltage × 0.19

Time Needed for Diagnosis: 64 ms × 100 time(s)

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

ED:DTC P0852 PARK/NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of neutral SW.

Judge as NG when the ECM neutral terminal input differs from the reception data from TCM.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Starter relay feedback voltage	< Battery voltage × 0.35
“P” range/“N” range of TCM	ON

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Neutral position switch signal voltage	≥ Battery voltage × 0.6

Time Needed for Diagnosis: 64 ms × 100 time(s)

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

EE:DTC P0A7B BATTERY ENERGY CONTROL MODULE REQUEST MIL ILLUMINATION

1. OUTLINE OF DIAGNOSIS

Judge as NG when MIL lighting request comes from BECM.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
MIL lighting request from BECM	Yes

Time Needed for Diagnosis: 128 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

EF:DTC P0AC4 HYBRID POWERTRAIN CONTROL MODULE REQUEST MIL ILLUMINATION

1. OUTLINE OF DIAGNOSIS

Judge as NG when MIL lighting request comes from HPCM.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
MIL lighting request from HPCM	Yes

Time Needed for Diagnosis: 128 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

EG:DTC P0CA1 DRIVE MOTOR CONTROL MODULE REQUEST MIL ILLUMINATION

1. OUTLINE OF DIAGNOSIS

Judge as NG when MIL lighting request comes from DMCM.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
MIL lighting request from DMCM	Yes

Time Needed for Diagnosis: 128 ms

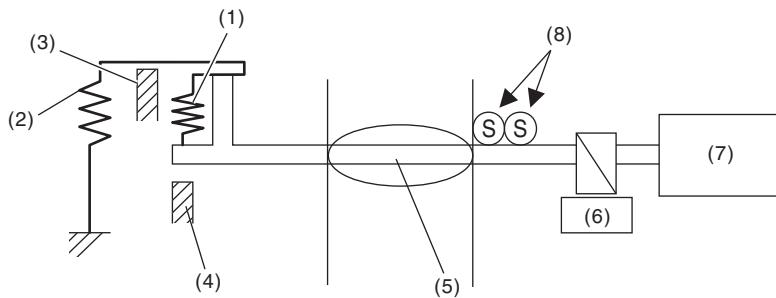
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

EH:DTC P1160 RETURN SPRING FAILURE

1. OUTLINE OF DIAGNOSIS

Judge as NG when the valve is opened more than the default opening angle, but does not move to the close direction with the motor power stopped.

2. COMPONENT DESCRIPTION



EN-04463

(1) Opener spring	(4) Full closed stopper	(7) DC motor
(2) Return spring	(5) Throttle valve	(8) Main and sub throttle position sensor
(3) Intermediate stopper	(6) Gear	

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V
Ignition switch	OFF
Elapsed time after motor continuity is set to OFF	= 1.6 s

4. GENERAL DRIVING CYCLE

- Ignition switch ON → OFF
- Ignition switch OFF → ON (Only after clearing memory)

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Opening variation after motor continuity is set to OFF	$< 2^\circ$

Time Needed for Diagnosis: Less than 1 second

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

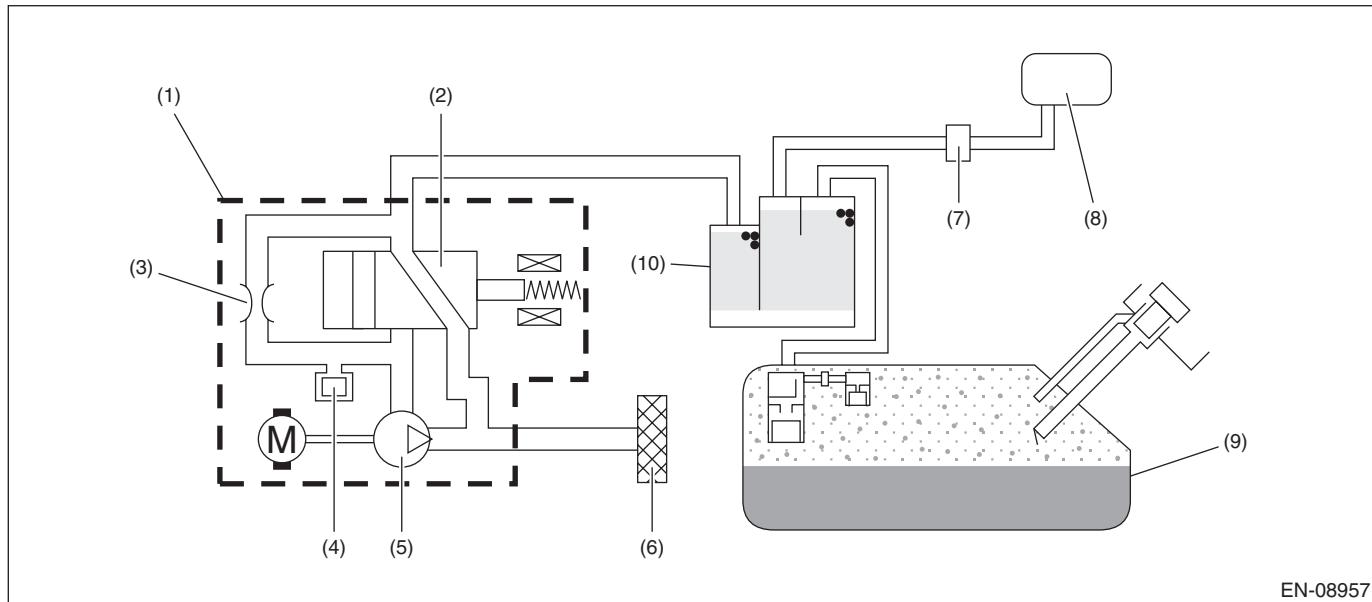
EI: DTC P1449 EVAPORATIVE EMISSION CONT. SYS. AIR FILTER CLOG

1. OUTLINE OF DIAGNOSIS

Detect the drain filter clogging by the pressure change during purge introduction.

Judge as drain filter clogging malfunction if the pressure in the evaporative emission system piping suddenly decreases by the purging.

2. COMPONENT DESCRIPTION



(1) ELCM	(5) Vacuum pump	(9) Fuel tank
(2) Switching valve	(6) Drain filter	(10) Canister
(3) Reference orifice (0.02 inch orifice)	(7) Purge control solenoid valve	
(4) Pressure sensor	(8) Intake manifold	

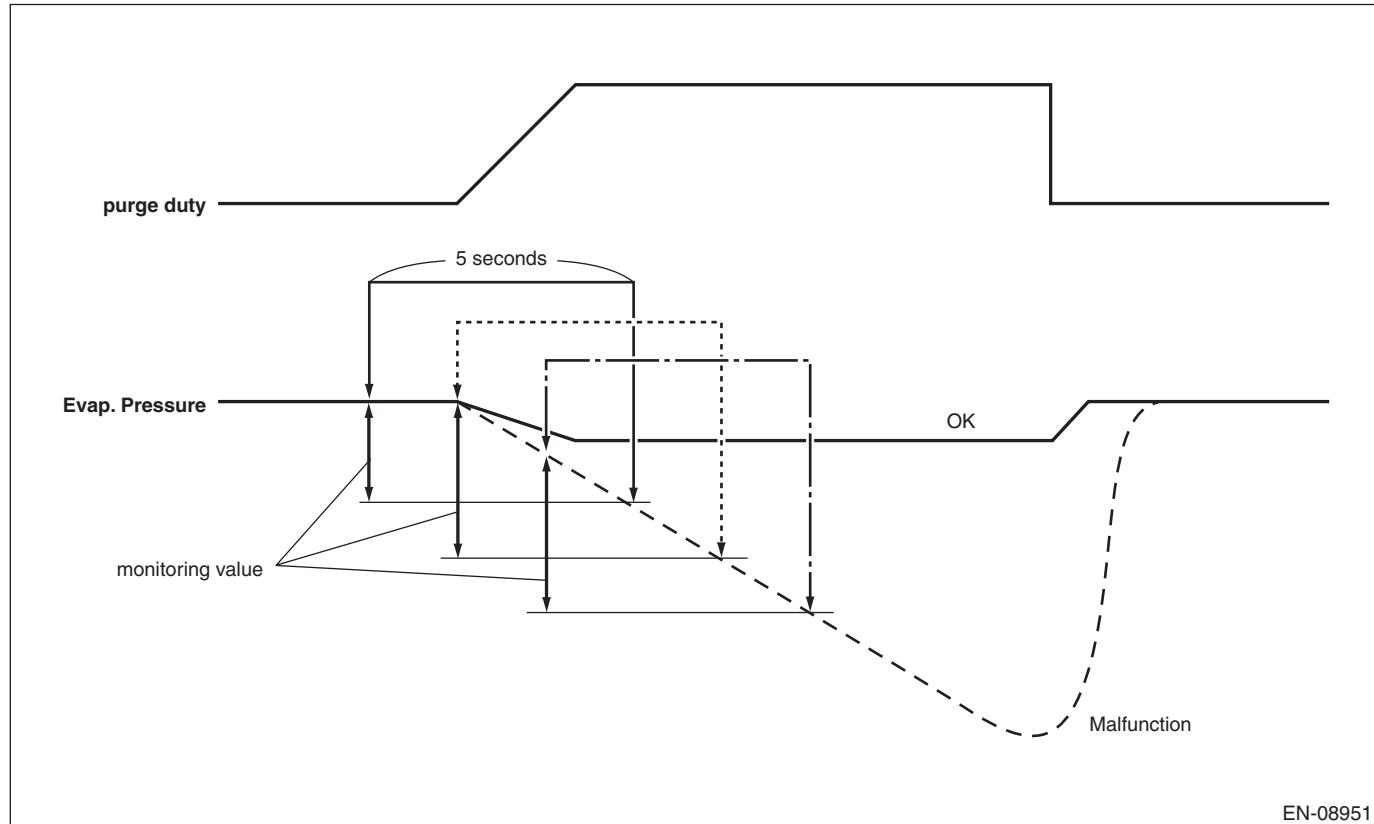
3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after ignition is turned to ON	≥ 20000 ms
ELCM vacuum pump	Not in operation
ELCM switching valve	Open

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when purging is performed after 20000 ms have passed since the engine started.

5. DIAGNOSTIC METHOD



Calculate the difference between the ELCM pressure sensor output value as of 5 seconds ago and the current one, and if the value is greater than judgment value, detect and judge as filter clogging trouble. Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
$ \text{Pressure sensor output value as of 5 seconds ago} - \text{Current pressure sensor output value} $	$> \text{Value from Map}$
Number of above conditions established	$> 2 \text{ time(s)}$

Map

Vehicle speed km/h (MPH)	0 (0)	20 (12.4)	40 (24.9)	60 (37.3)	80 (49.7)	100 (62.1)	120 (74.6)	300 (186.4)
$ \text{Pressure sensor output value as of 5 seconds ago} - \text{Current pressure sensor output value} $ kPa (mmHg, inHg)	1.1 (8.055, 0.3)	2.1 (15.99, 0.6)						

Time Needed for Diagnosis: Approx. 5 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

EJ:DTC P1451 EVAPORATIVE EMISSION CONT. SYS.

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0455. <Ref. to GD(H4DO HEV)-115, DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

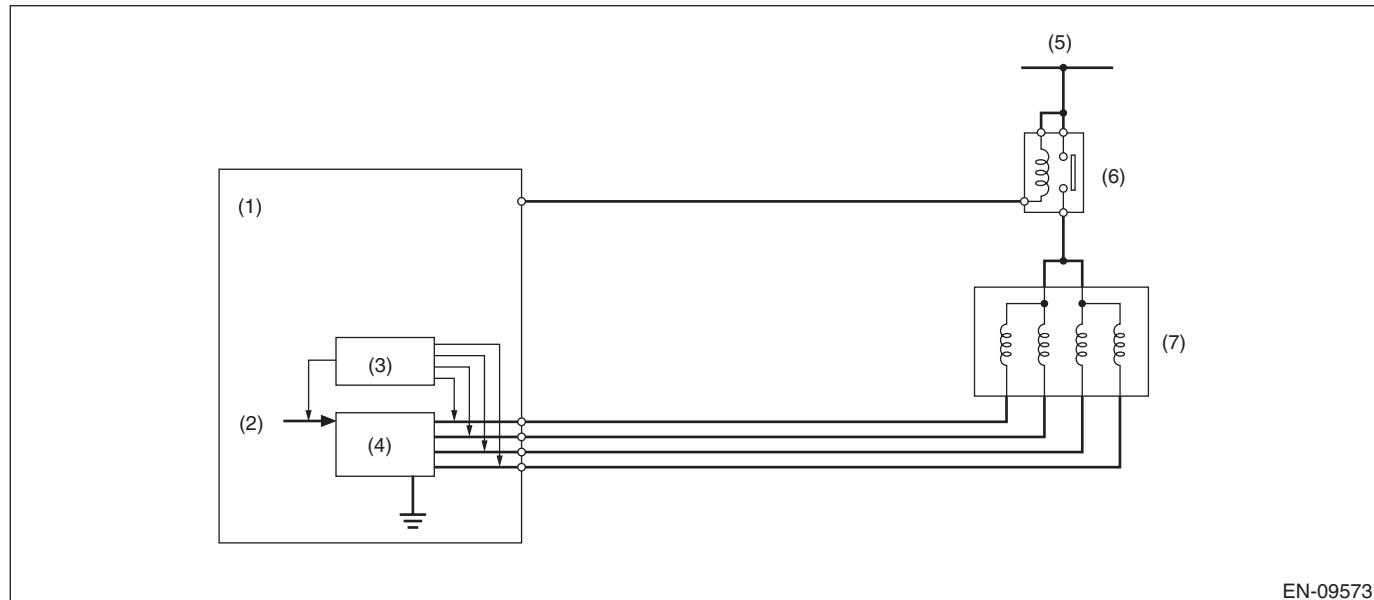
GENERAL DESCRIPTION

EK:DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT)

1. OUTLINE OF DIAGNOSIS

- Detects open or short circuit of EGR.
- Judge as NG when the ECM output level differs from the actual terminal level.

2. COMPONENT DESCRIPTION



EN-09573

(1) Engine control module (ECM)	(4) Switch circuit	(6) Main relay
(2) Computer unit (CPU)	(5) Battery voltage	(7) EGR control valve
(3) Detecting circuit		

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	≥ 1 s
Battery voltage	≥ 10.9 V
EGR drive signal	OFF

4. GENERAL DRIVING CYCLE

Perform diagnosis continuously during EGR operation.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
EGR terminal voltage	\leq Battery voltage $\times 0.34$

Time Needed for Diagnosis: 2500 ms

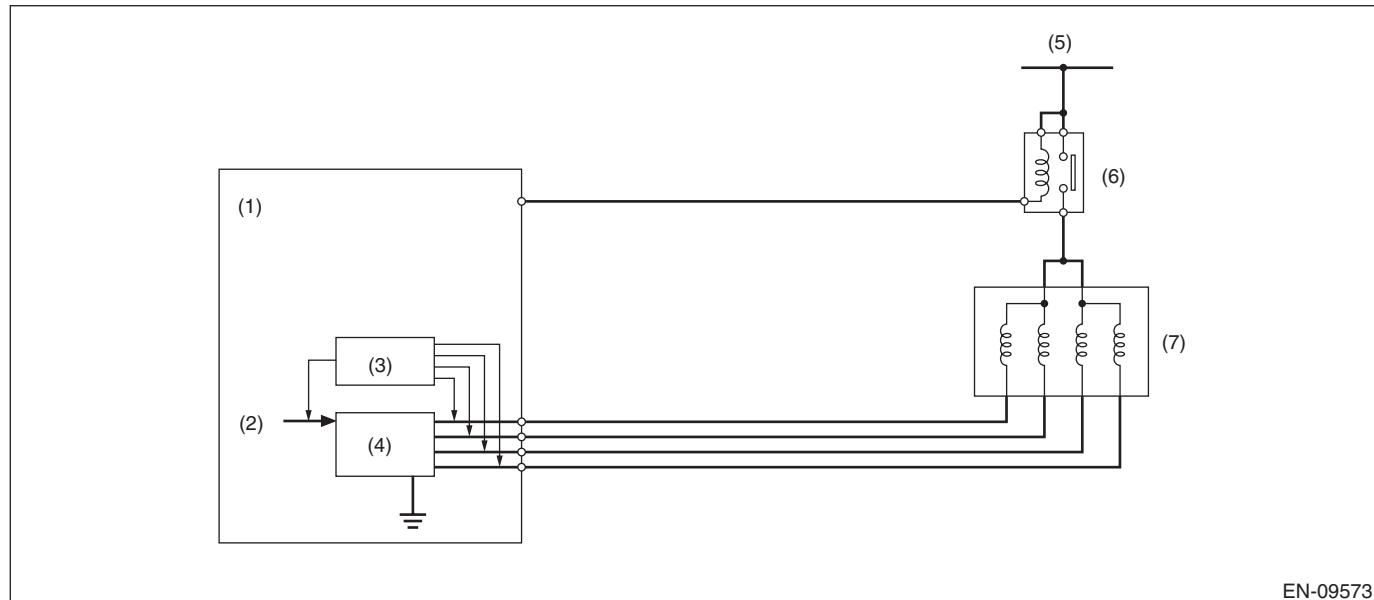
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

EL:DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT)

1. OUTLINE OF DIAGNOSIS

- Detects open or short circuit of EGR.
- Judge as NG when the ECM output level differs from the actual terminal level.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)	(4) Switch circuit	(6) Main relay
(2) Computer unit (CPU)	(5) Battery voltage	(7) EGR control valve
(3) Detecting circuit		

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	≥ 1 s
Battery voltage	≥ 10.9 V
EGR drive signal	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
EGR terminal current	≥ 6 A

Time Needed for Diagnosis: 2500 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

EM:DTC P1494 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P1492. <Ref. to GD(H4DO HEV)-164, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

EN:DTC P1495 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P1493. <Ref. to GD(H4DO HEV)-165, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

EO:DTC P1496 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P1492. <Ref. to GD(H4DO HEV)-164, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

EP:DTC P1497 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P1493. <Ref. to GD(H4DO HEV)-165, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

EQ:DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P1492. <Ref. to GD(H4DO HEV)-164, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

ER:DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P1493. <Ref. to GD(H4DO HEV)-165, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

ES:DTC P2004 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of tumble generator valve motor function.

Judge open fixing malfunction when the opening degree is large even after finishing the tumble generator valve closing driving.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Tumble generator valve "close" signal output time	≥ 1600 ms

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Tumble generator valve	Open

Time Needed for Diagnosis: 3000 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

ET:DTC P2005 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 2)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of tumble generator valve motor function.

Judge open fixing malfunction when the opening degree is large even after finishing the tumble generator valve closing driving.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Tumble generator valve "close" signal output time	≥ 1600 ms

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Tumble generator valve	Open

Time Needed for Diagnosis: 3000 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

EU:DTC P2006 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of tumble generator valve motor function.

Judge close fixing malfunction when the opening degree is small even after finishing the tumble generator valve open driving.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Tumble generator valve "open" signal output time	≥ 1600 ms

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Tumble generator valve	Close

Time Needed for Diagnosis: 3000 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

EV:DTC P2007 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 2)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of tumble generator valve motor function.

Judge close fixing malfunction when the opening degree is small even after finishing the tumble generator valve open driving.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Tumble generator valve "open" signal output time	≥ 1600 ms

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Tumble generator valve	Close

Time Needed for Diagnosis: 3000 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

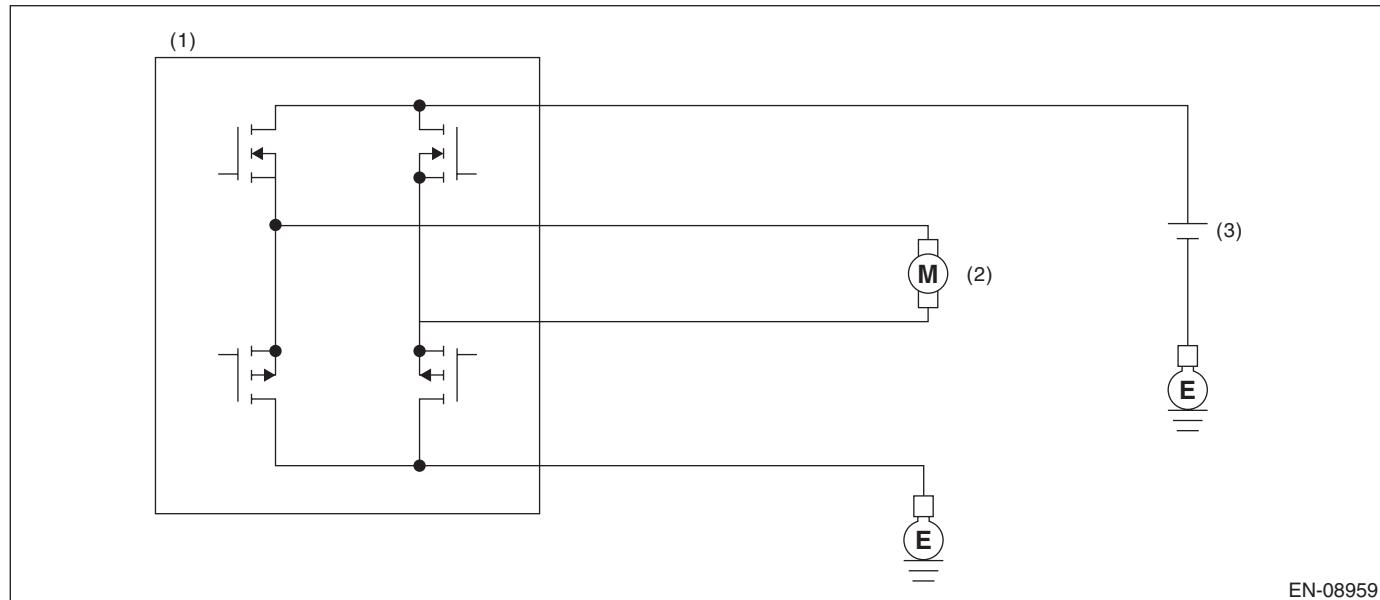
EW:DTC P2009 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of tumble generator valve motor.

Judge as NG when the overcurrent signal is sent from IC after tumble generator valve driving IC diagnosis.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)

(2) Tumble generator valve

(3) Battery

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$
Tumble generator valve command	Open or close

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Overcurrent signal from tumble generator valve drive IC	ON

Time Needed for Diagnosis: 1 second

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

EX:DTC P2012 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P2009. <Ref. to GD(H4DO w/o HEV)-172, DTC P2009 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

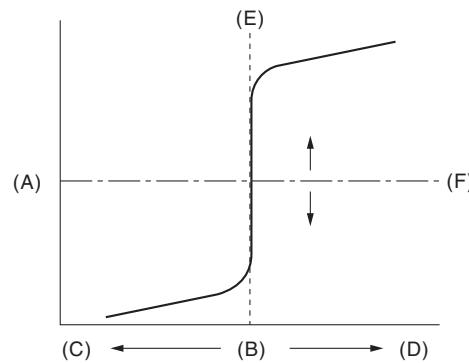
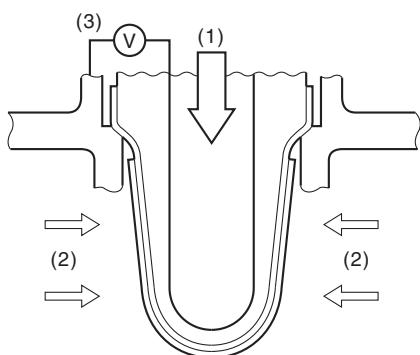
GENERAL DESCRIPTION

EY:DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel system from the size of the sub feedback learning value. Control the sub feedback learning and judge as NG when the learning value is in the lean zone.

2. COMPONENT DESCRIPTION



EN-01696

(A) Electromotive force	(B) Air fuel ratio	(C) Lean
(D) Rich	(E) Theoretical air fuel ratio	(F) Comparative voltage
(1) Atmosphere	(2) Exhaust gas	(3) Electromotive force

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Conditions for carrying out the sub feedback learning Continuous time when all conditions are established.	Completed ≥ 1 s

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when the vehicle is idling or running at a constant speed of 80 km/h (50 MPH) or more.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sub feedback learning value	< -0.0245

Time Needed for Diagnosis: 1 s \times 1 time(s)

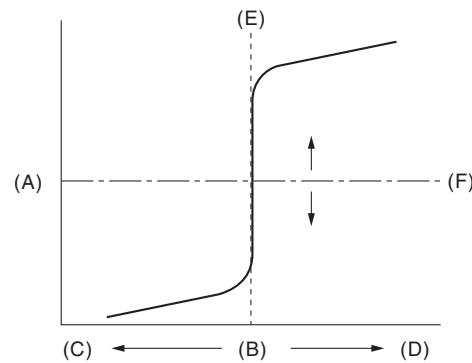
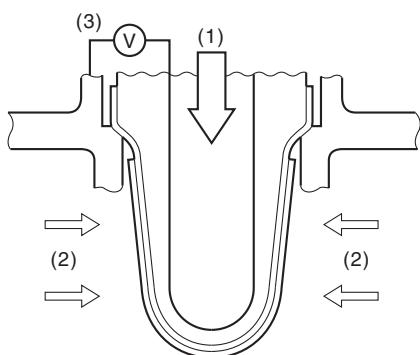
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

EZ:DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel system from the size of the sub feedback learning value. Sub feedback learning is being performed. When the learning value goes to the rich side, judge as NG.

2. COMPONENT DESCRIPTION



EN-01696

(A) Electromotive force	(B) Air fuel ratio	(C) Lean
(D) Rich	(E) Theoretical air fuel ratio	(F) Comparative voltage
(1) Atmosphere	(2) Exhaust gas	(3) Electromotive force

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Conditions for carrying out the sub feedback learning Continuous time when all conditions are established.	Completed ≥ 1 s

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when the vehicle is idling or running at a constant speed of 80 km/h (50 MPH) or more.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sub feedback learning value	≥ 0.0271

Time Needed for Diagnosis: 1 s \times 1 time(s)

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

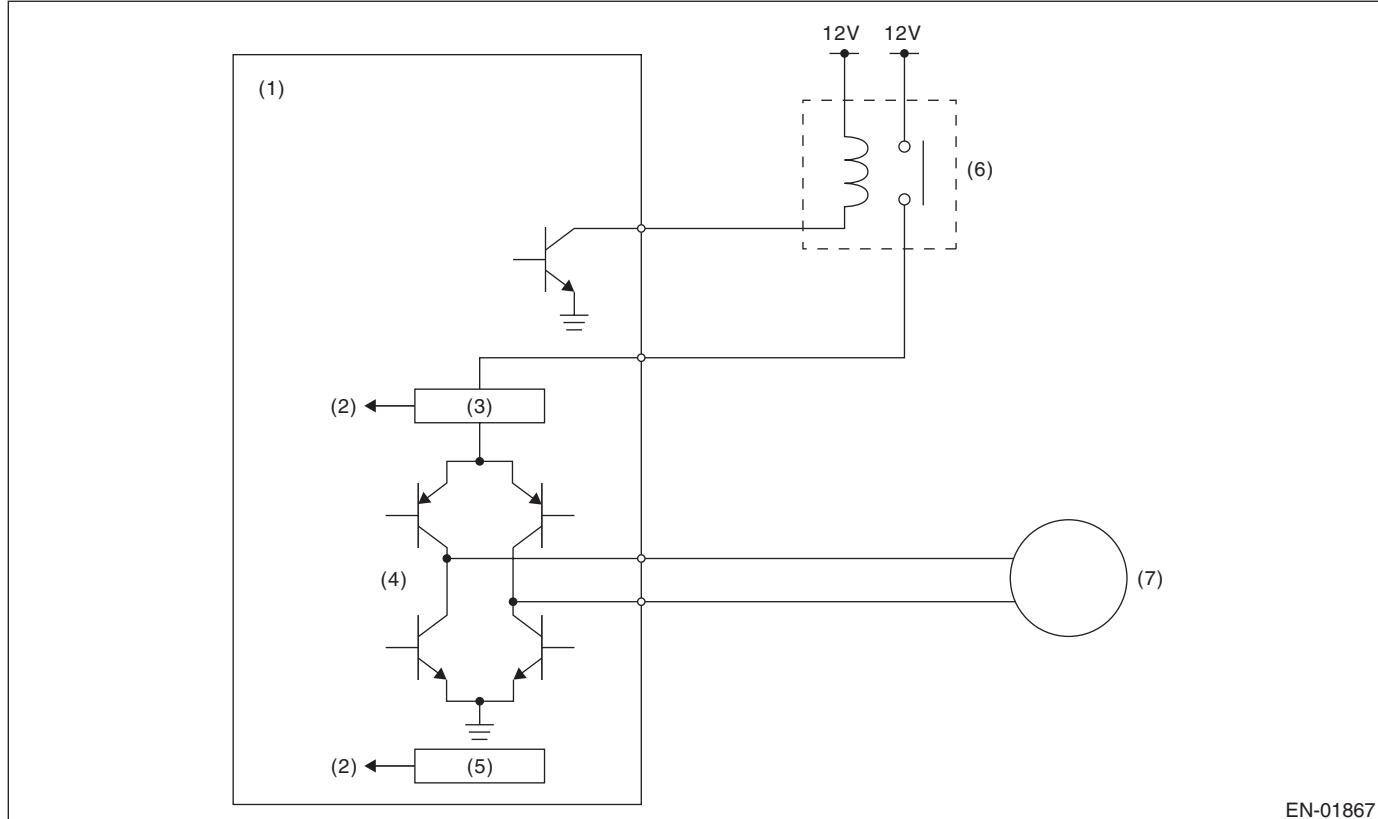
GENERAL DESCRIPTION

FA:DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/ PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Judge as NG when the motor current becomes large or drive circuit is heated.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)	(4) Drive circuit	(6) Electronic throttle control relay
(2) Detecting circuit	(5) Temperature detection circuit	(7) Motor
(3) Overcurrent detection circuit		

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Under control of electronic throttle control	ON
Battery voltage	≥ 6.2 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

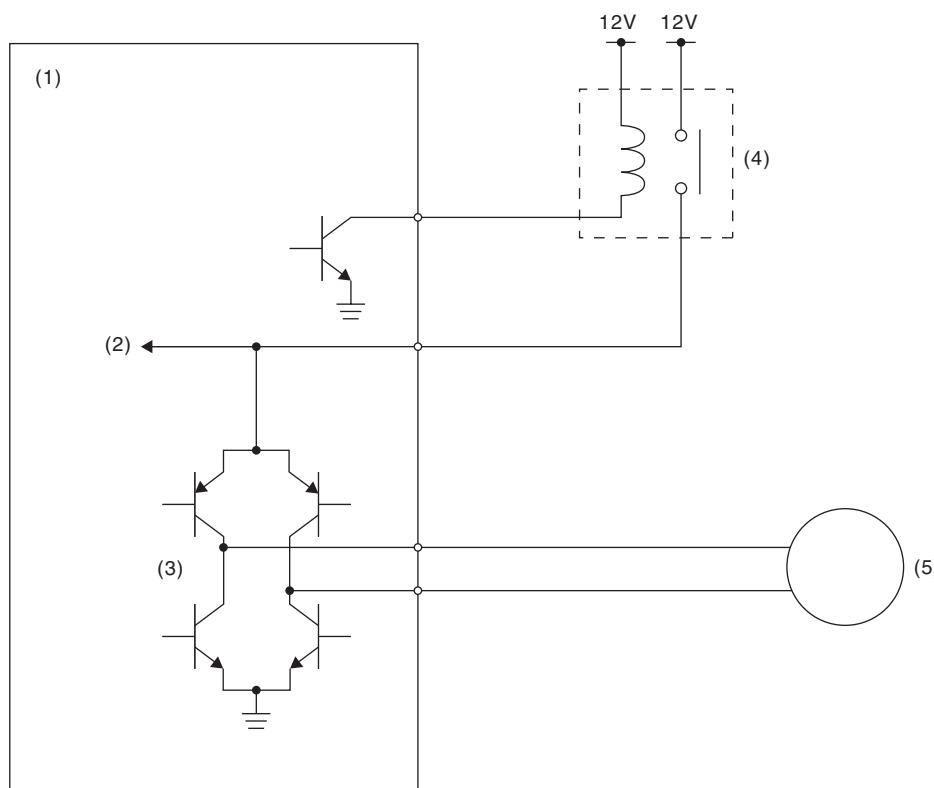
Malfunction Criteria	Threshold Value
Overcurrent signal from driver	ON

Time Needed for Diagnosis: 512 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

FB:DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW**1. OUTLINE OF DIAGNOSIS**

Judge as NG when the electronic throttle control power is not supplied even when ECM sets the electronic throttle control relay to ON.

2. COMPONENT DESCRIPTION

EN-01868

(1) Engine control module (ECM)
 (2) Voltage detection circuit

(3) Drive circuit
 (4) Electronic throttle control relay

(5) Motor

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 11 V
Electronic throttle control relay output	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Motor power voltage	≤ 5 V

Time Needed for Diagnosis: 352 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

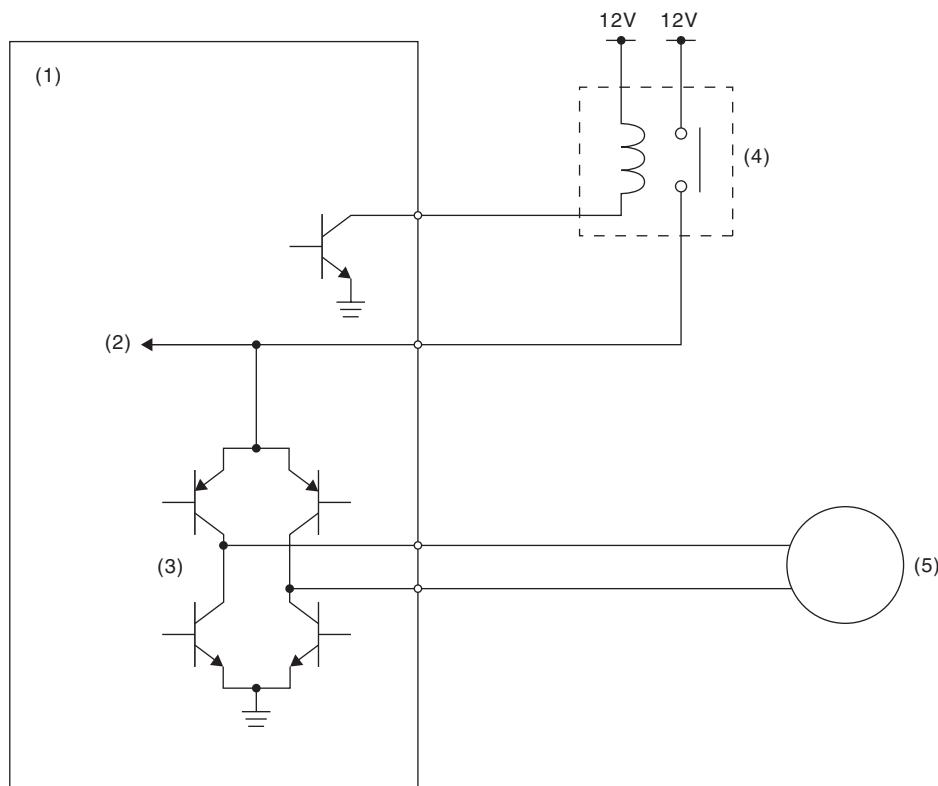
GENERAL DESCRIPTION

FC:DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Judge as NG when the electronic throttle control power is supplied even when ECM sets the electronic throttle control relay to OFF.

2. COMPONENT DESCRIPTION



EN-01868

(1) Engine control module (ECM)

(2) Voltage detection circuit

(3) Drive circuit

(4) Electronic throttle control relay

(5) Motor

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V
Electronic throttle control relay output	OFF

4. GENERAL DRIVING CYCLE

- When ignition switch ON → OFF
- Ignition switch OFF → ON (Only after clearing memory)

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Motor power voltage	≥ 5 V

Time Needed for Diagnosis: 600 ms

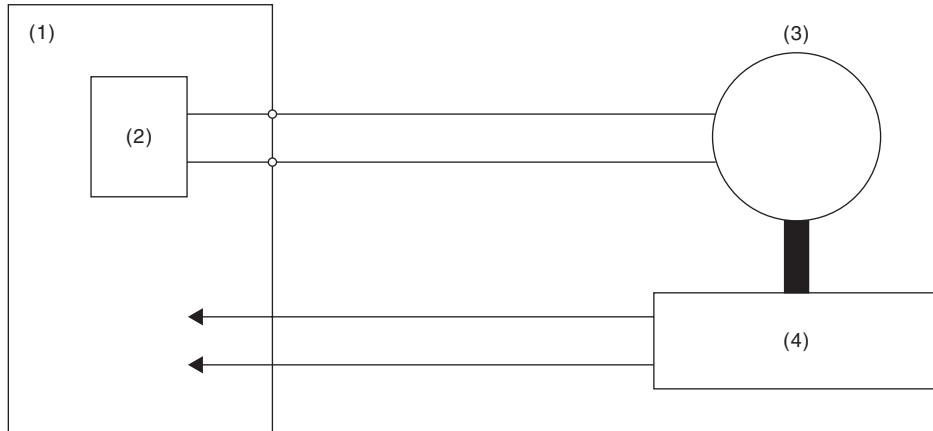
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

FD:DTC P2109 THROTTLE/PEDAL POSITION SENSOR “A” MINIMUM STOP PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Judge as NG when full close point learning cannot be conducted or abnormal value is detected.

2. COMPONENT DESCRIPTION



EN-01869

(1) Engine control module (ECM)
(2) Drive circuit

(3) Motor

(4) Throttle position sensor

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis at full closed point learning.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Throttle sensor opening angle at full close point learning	$< -4.02\%$ (0.4 V) or $> 4.02\%$ (0.8 V)
or Throttle opening angle when the ignition switch is ON – Throttle minimum stop position	1.162 °

Time Needed for Diagnosis: 8 ms — 80 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

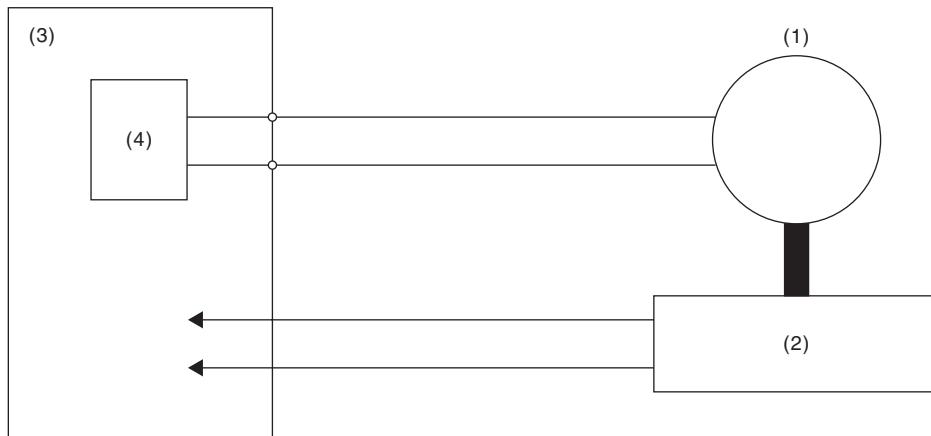
GENERAL DESCRIPTION

FE:DTC P2119 THROTTLE ACTUATOR CONTROL THROTTLE BODY RANGE/ PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Judge as NG when the target opening angle and actual opening angle is mismatched or the current to motor is the specified duty or more for specified time continuously.

2. COMPONENT DESCRIPTION



EN-01863

(1) Motor
(2) Throttle position sensor

(3) Engine control module (ECM)

(4) Drive circuit

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6.2 V
Normal operation of electronic throttle control	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously when the electronic throttle control is operating.

5. DIAGNOSTIC METHOD

Judge as OK and clear the NG when the malfunction criteria below are met.

Diagnosis 1

Judgment Value

Malfunction Criteria	Threshold Value
Output duty to drive circuit	< 95 %

Time Needed for Diagnosis:

- Engine speed ≥ 500 rpm: 2000 ms
- Engine speed < 500 rpm: 5000 ms

Diagnosis 2

Judgment Value

Malfunction Criteria	Threshold Value
Difference between target opening angle and actual opening angle	Within NG range of Details of Judgment value

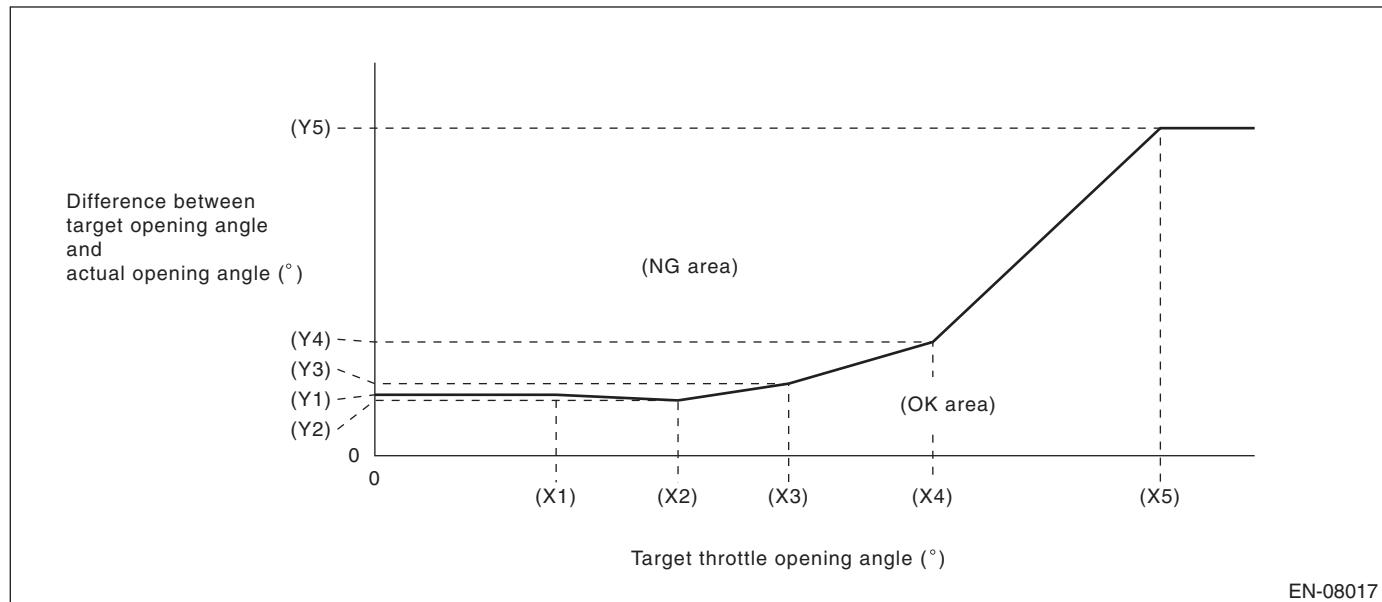
Time Needed for Diagnosis:

- Engine speed ≥ 500 rpm: Refer to **Details of Judgment time**.
- Engine speed < 500 rpm: 5000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Details of Judgment Value



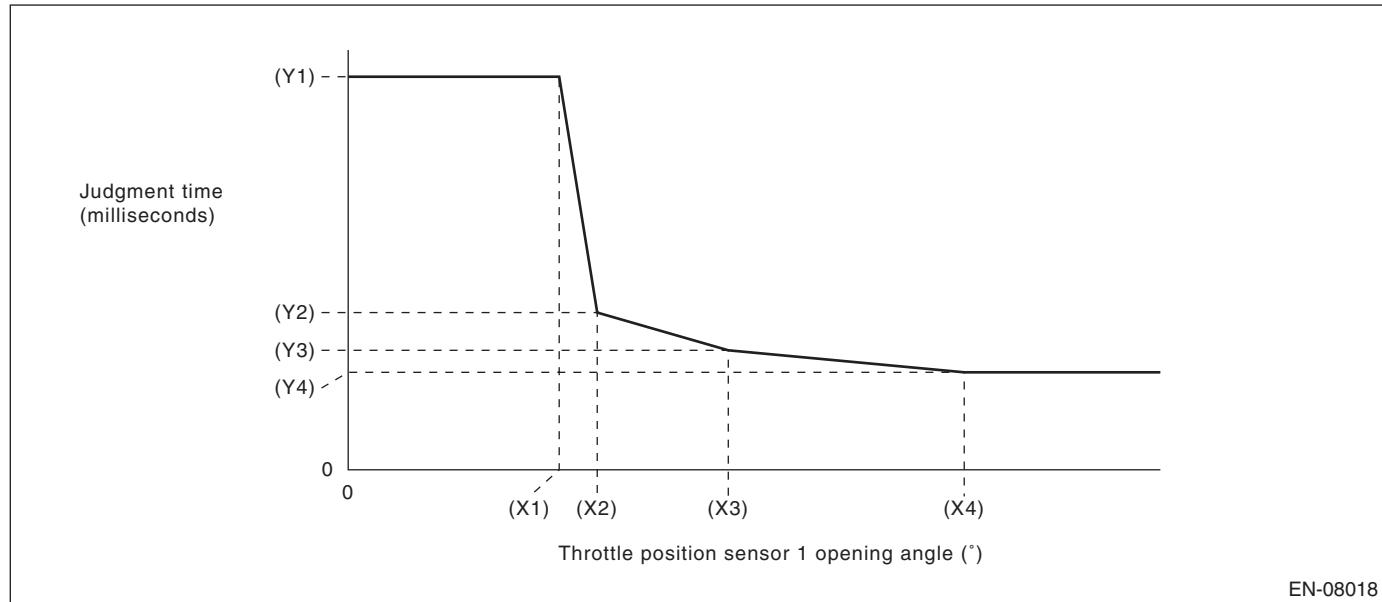
(X1) 6.915 ° (X2) 11.565 ° (X3) 15.785 °

(X4) 21.285 ° (X5) 29.965 °

(Y1) 4.65 ° (Y2) 4.22 ° (Y3) 5.5 °

(Y4) 8.68 ° (Y5) 25 °

Details of Judgment time



(X1) 8.049999237 ° (X2) 9.5 ° (X3) 14.5 °

(X4) 23.5 °

(Y1) 1000 ms (Y2) 400 ms (Y3) 304 ms

(Y4) 248 ms

NOTE:

Judgment time when actual opening angle \leq target opening angle is always 1000 milliseconds.

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

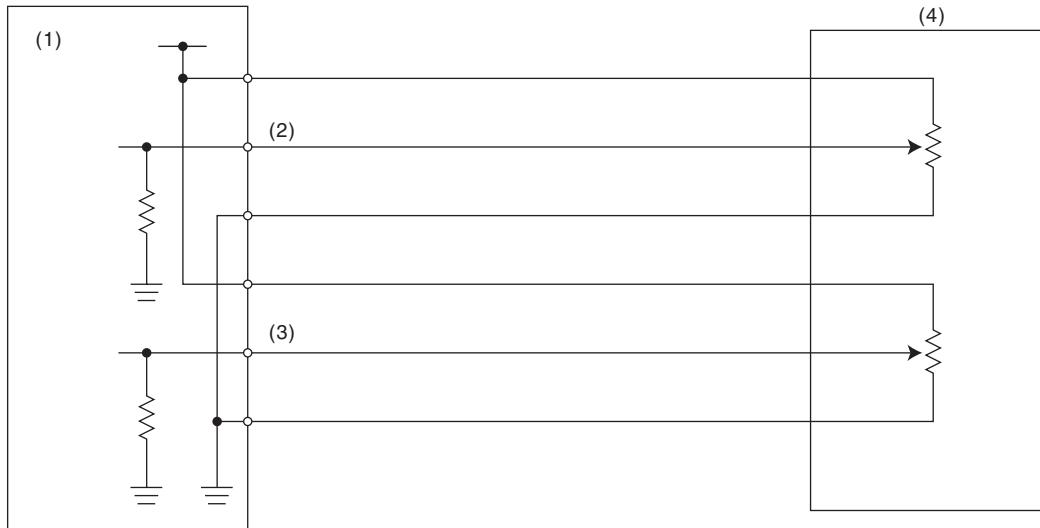
GENERAL DESCRIPTION

FF:DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT LOW INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 1.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-01861

(1) Engine control module (ECM)	(3) Accelerator pedal position sensor	(4) Accelerator pedal position sensor
(2) Accelerator pedal position sensor	2 signal	1 signal

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	< 0.298 V

Time Needed for Diagnosis: 100 ms

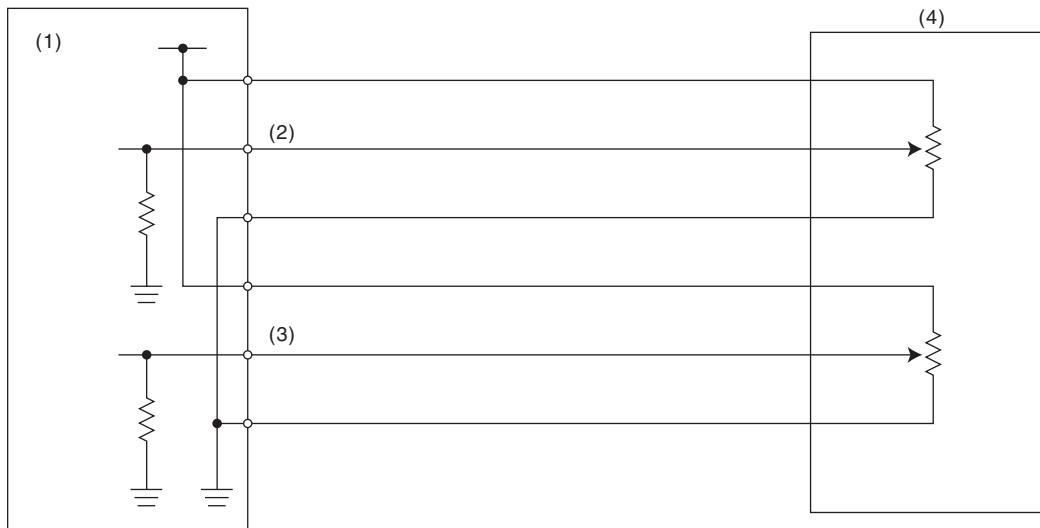
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

FG:DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT HIGH INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 1.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-01861

(1) Engine control module (ECM)	(3) Accelerator pedal position sensor 2 signal	(4) Accelerator pedal position sensor
(2) Accelerator pedal position sensor 1 signal		

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	≥ 4.737 V

Time Needed for Diagnosis: 32 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

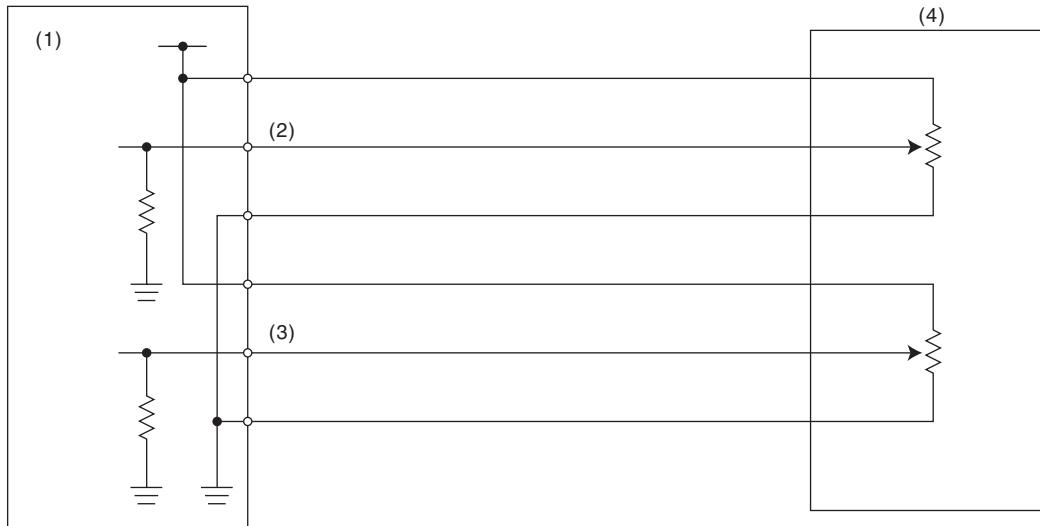
GENERAL DESCRIPTION

FH:DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT LOW INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 2.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-01861

(1) Engine control module (ECM)	(3) Accelerator pedal position sensor 2 signal	(4) Accelerator pedal position sensor 1 signal
(2) Accelerator pedal position sensor		

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	< 0.298 V

Time Needed for Diagnosis: 100 ms

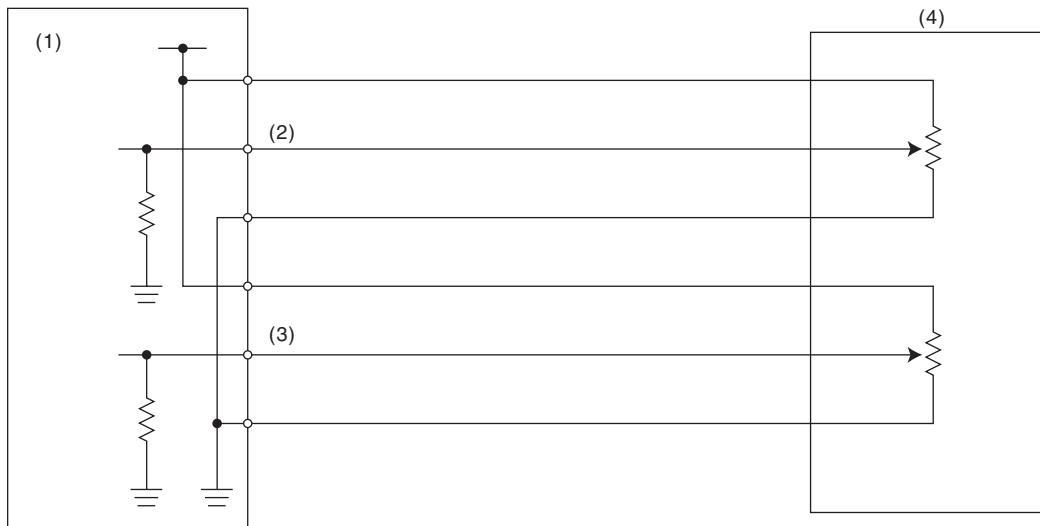
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

FI: DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT HIGH INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 2.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-01861

(1) Engine control module (ECM)	(3) Accelerator pedal position sensor 2 signal	(4) Accelerator pedal position sensor 1 signal
(2) Accelerator pedal position sensor		

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	≥ 4.737 V

Time Needed for Diagnosis: 100 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

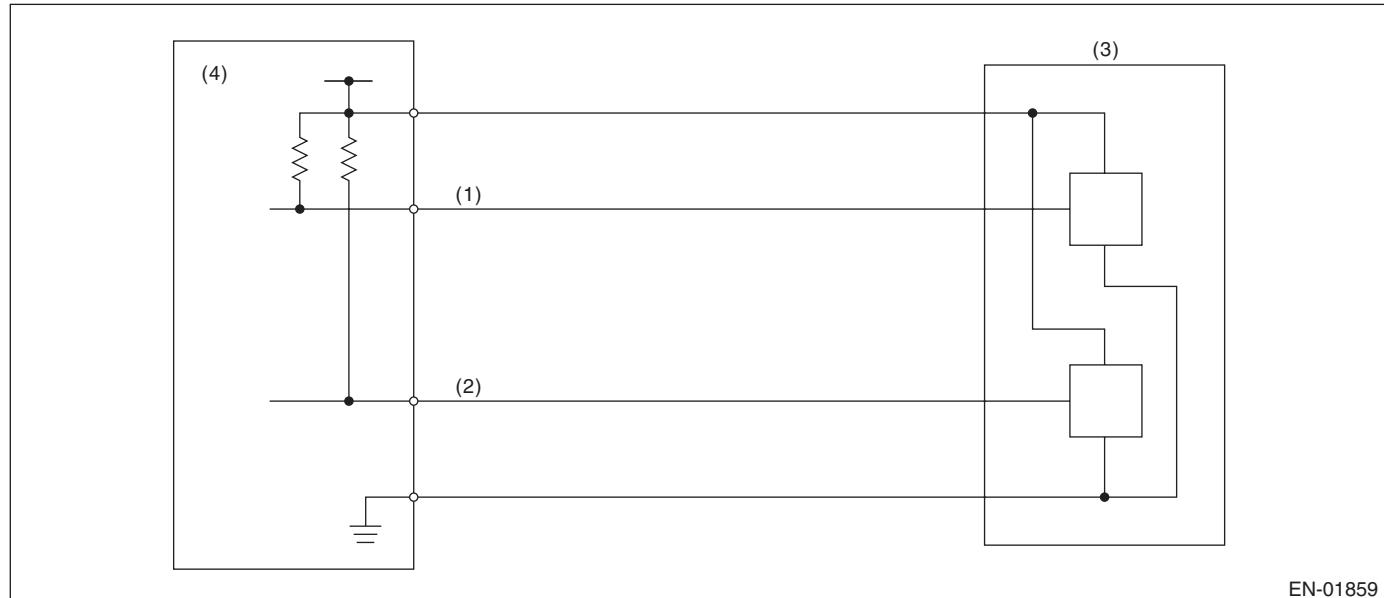
GENERAL DESCRIPTION

FJ: DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A"/"B" VOLTAGE CORRELATION

1. OUTLINE OF DIAGNOSIS

Judge as NG when the signal level of throttle position sensor 1 is different from the throttle position sensor 2.

2. COMPONENT DESCRIPTION



(1) Throttle position sensor 1 signal
(2) Throttle position sensor 2 signal

(3) Throttle position sensor

(4) Engine control module (ECM)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

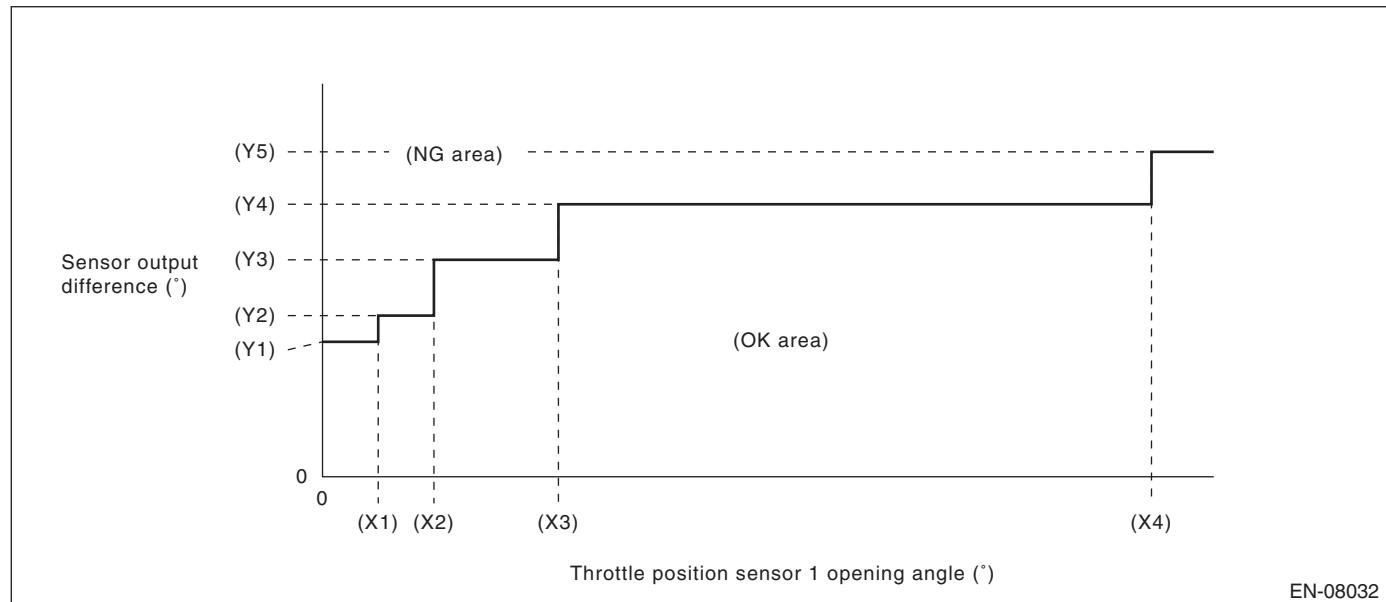
5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Signal difference between two sensors	Within NG range of Details of Judgment value

Details of Judgment Value



(X1) 2.125 °

(X2) 4.25 °

(X3) 9 °

(X4) 31.625 °

(Y1) 4.736 °

(Y2) 5.736 °

(Y3) 7.861 °

(Y4) 9.986 °

(Y5) 11.986 °

Time Needed for Diagnosis: 212 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

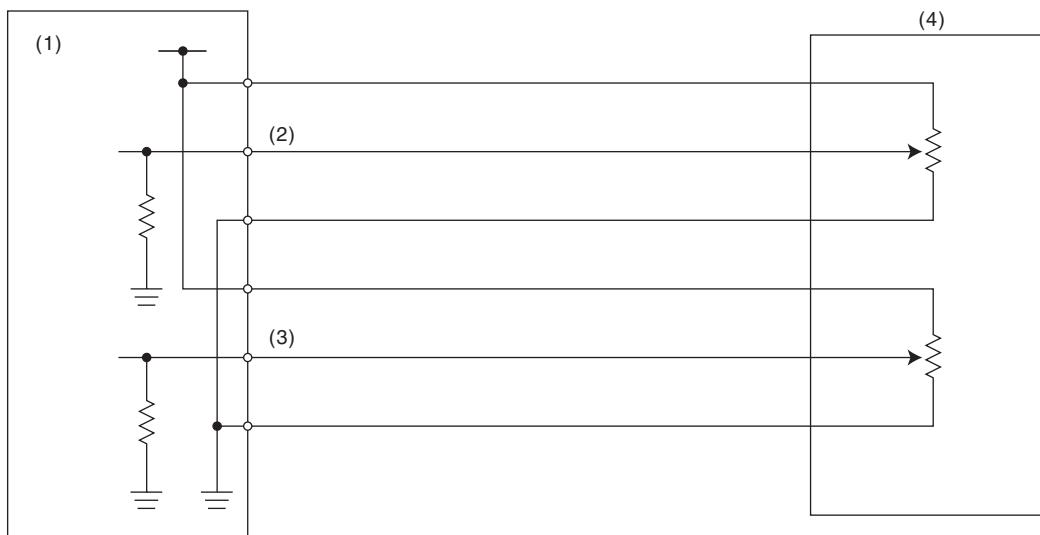
GENERAL DESCRIPTION

FK:DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION

1. OUTLINE OF DIAGNOSIS

Judge as NG when the signal level of throttle position sensor 1 is different from the throttle position sensor 2.

2. COMPONENT DESCRIPTION



EN-01861

(1) Engine control module (ECM) (3) Accelerator pedal position sensor
(2) Accelerator pedal position sensor
1 signal (4) Accelerator pedal position sensor
2 signal

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

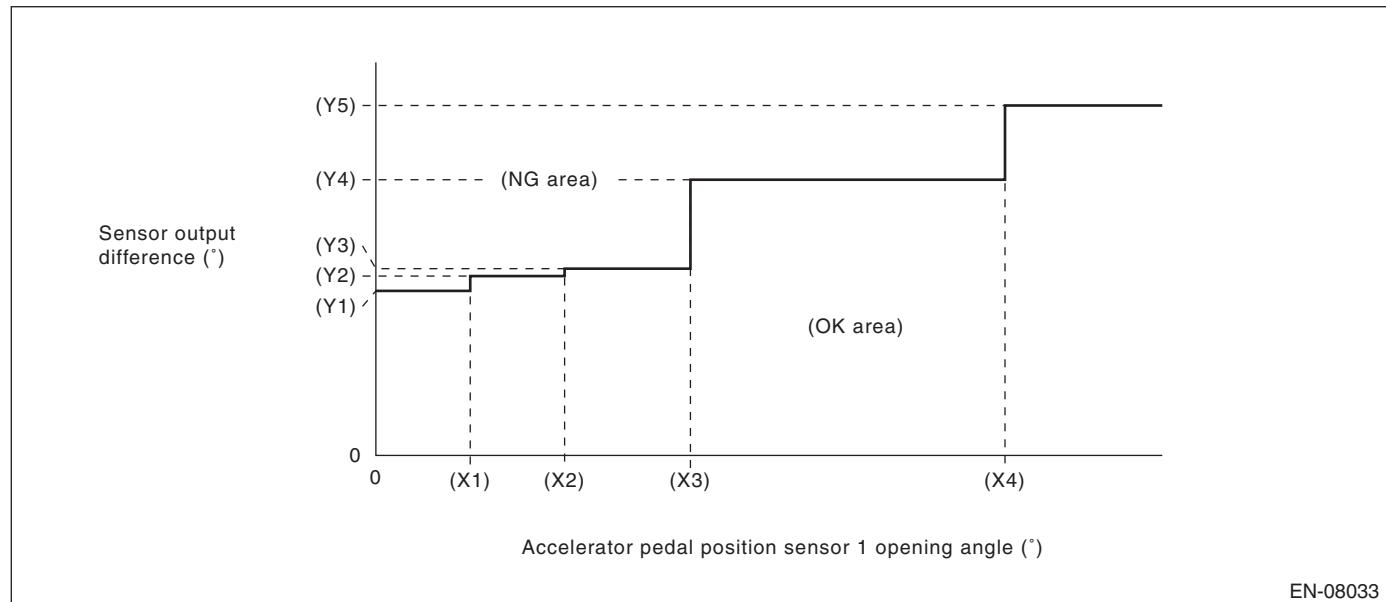
5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Signal difference between two sensors	Within NG range of Details of Judgment value

Details of Judgment Value



EN-08033

(X1) 0.6 °

(X2) 1.2 °

(X3) 2 °

(X4) 4 °

(Y1) 1.465 °

(Y2) 1.597 °

(Y3) 1.663 °

(Y4) 2.455 °

(Y5) 3.116 °

Time Needed for Diagnosis: 116 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

FL:DTC P2195 O2 SENSOR SIGNAL BIASED/STUCK LEAN (BANK 1 SENSOR 1)

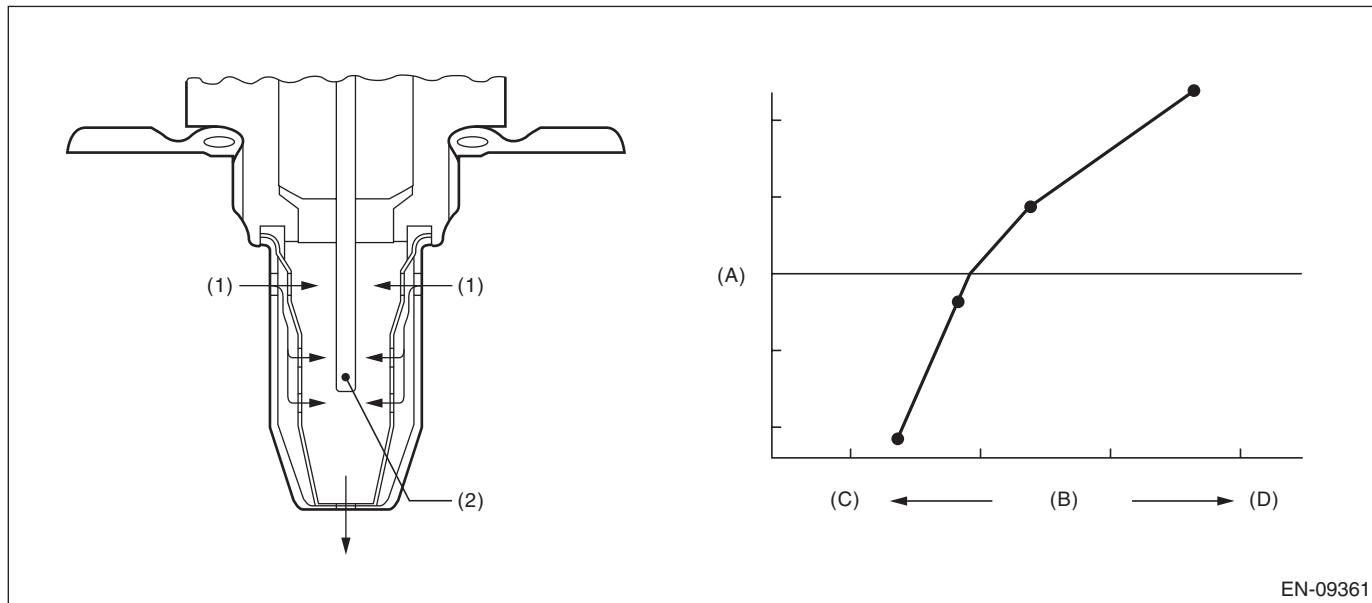
1. OUTLINE OF DIAGNOSIS

Detect that λ value remains low.

Judge as NG when lambda value is abnormal in accordance with λ value of front oxygen (A/F) sensor and running conditions such as vehicle speed, amount of intake air, engine coolant temperature, sub feedback control, etc.

λ value = Actual air fuel ratio/Theoretical air fuel ratio
 $\lambda > 1$: Lean
 $\lambda < 1$: Rich

2. COMPONENT DESCRIPTION



EN-09361

(A) Electromotive force

(D) Lean

(B) Air fuel ratio

(C) Rich

(1) Exhaust gas

(2) ZrO₂

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Time needed for all secondary parameters to be in enable conditions	≥ 4096 ms
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75.1 kPa (563 mmHg, 22.2 inHg)
Rear oxygen sensor sub feedback	Execution
Rear oxygen sensor output voltage – Feedback target voltage or rear oxygen sensor sub feedback compensation coefficient or rear oxygen sensor sub feedback compensation coefficient	-0.2 V — 0.1 V On Min. On Max.
Elapsed time after starting the engine	≥ 0 ms
Engine coolant temperature	≥ -40 °C (-40 °F)
Vehicle speed	≥ 0 km/h (0 MPH)
Amount of intake air	≥ 6 g/s (0.21 oz/s)
Targeted lambda value load compensation coefficient	-1 — 1.000

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

4. GENERAL DRIVING CYCLE

Perform diagnosis continuously at a constant speed of 0 km/h (0 MPH) or more after 0 ms have passed since the engine started.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
λ value	< 0.85

Time Needed for Diagnosis: 10000 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

FM:DTC P2196 O2 SENSOR SIGNAL BIASED/STUCK RICH (BANK 1 SENSOR 1)

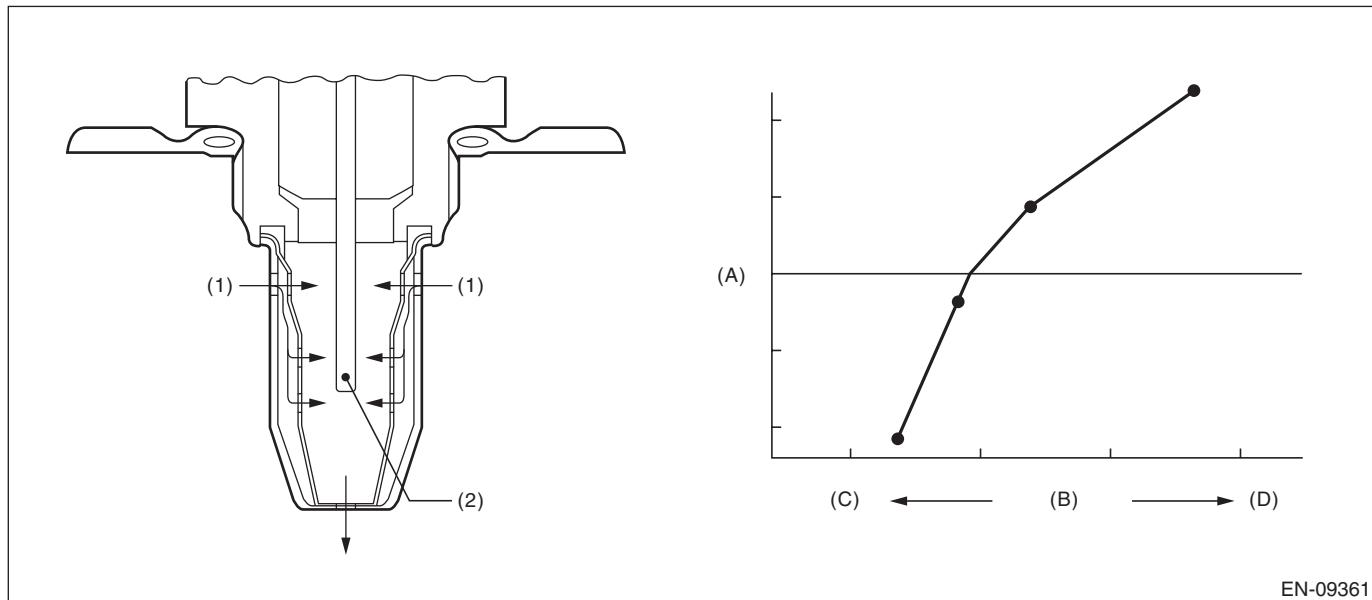
1. OUTLINE OF DIAGNOSIS

Detect that λ value remains high.

Judge as NG when lambda value is abnormal in accordance with λ value of front oxygen (A/F) sensor and running conditions such as vehicle speed, amount of intake air, engine coolant temperature, sub feedback control, etc.

λ value = Actual air fuel ratio/Theoretical air fuel ratio
 $\lambda > 1$: Lean
 $\lambda < 1$: Rich

2. COMPONENT DESCRIPTION



EN-09361

(A) Electromotive force

(D) Lean

(B) Air fuel ratio

(2) ZrO₂

(C) Rich

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Time needed for all secondary parameters to be in enable conditions	≥ 4096 ms
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75.1 kPa (563 mmHg, 22.2 inHg)
Rear oxygen sensor sub feedback	Execution
Rear oxygen sensor output voltage – Feedback target voltage	-0.2 V — 0.1 V
or rear oxygen sensor sub feedback compensation coefficient	On Min.
or rear oxygen sensor sub feedback compensation coefficient	On Max.
Elapsed time after starting the engine	≥ 0 ms
Engine coolant temperature	≥ -40 °C (-40 °F)
Vehicle speed	≥ 0 km/h (0 MPH)
Amount of intake air	≥ 6 g/s (0.21 oz/s)
Targeted lambda value load compensation coefficient	-1 — 1.000

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

4. GENERAL DRIVING CYCLE

Perform diagnosis continuously at a constant speed of 0 km/h (0 MPH) or more after 0 ms have passed since the engine started.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
λ value	> 1.15

Time Needed for Diagnosis: 10000 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

FN:DTC P219A BANK 1 AIR-FUEL RATIO IMBALANCE

1. OUTLINE OF DIAGNOSIS

This diagnostic monitor performs a functional check of the fuel system to determine an air-fuel ratio cylinder imbalance.

This diagnosis is composed of two monitors.

The outline of “monitor A1” is as follows. When an air-fuel ratio cylinder imbalance occurs, the primary oxygen sensor output signal will oscillate with increased amplitude. This monitor utilizes this behavior to make a diagnosis. The monitor integrates the difference between the amplification value and the mean value of the first oxygen sensor output signal and compares it to a threshold to make a judgment.

The outline of “monitor B1” is as follows. Similarly, when an imbalance occurs, the engine speed also fluctuates with increased amplitude. This monitor utilizes this behavior to make a diagnosis. For reference, it should be noted that this imbalance monitor method is actually similar to the current misfire diagnostic monitor, and the parameter “domg360” (units: degrees CA) is shared between the imbalance and misfire monitors. The imbalance monitor is performed during idle condition when the engine is warm. The monitor integrates the count of “domg360” which exceeds a threshold in 1,000 revolution.

When both the “monitor A1” value and the “monitor B1” value exceed a predetermined threshold, this monitor determines a malfunction and stores a fault code.

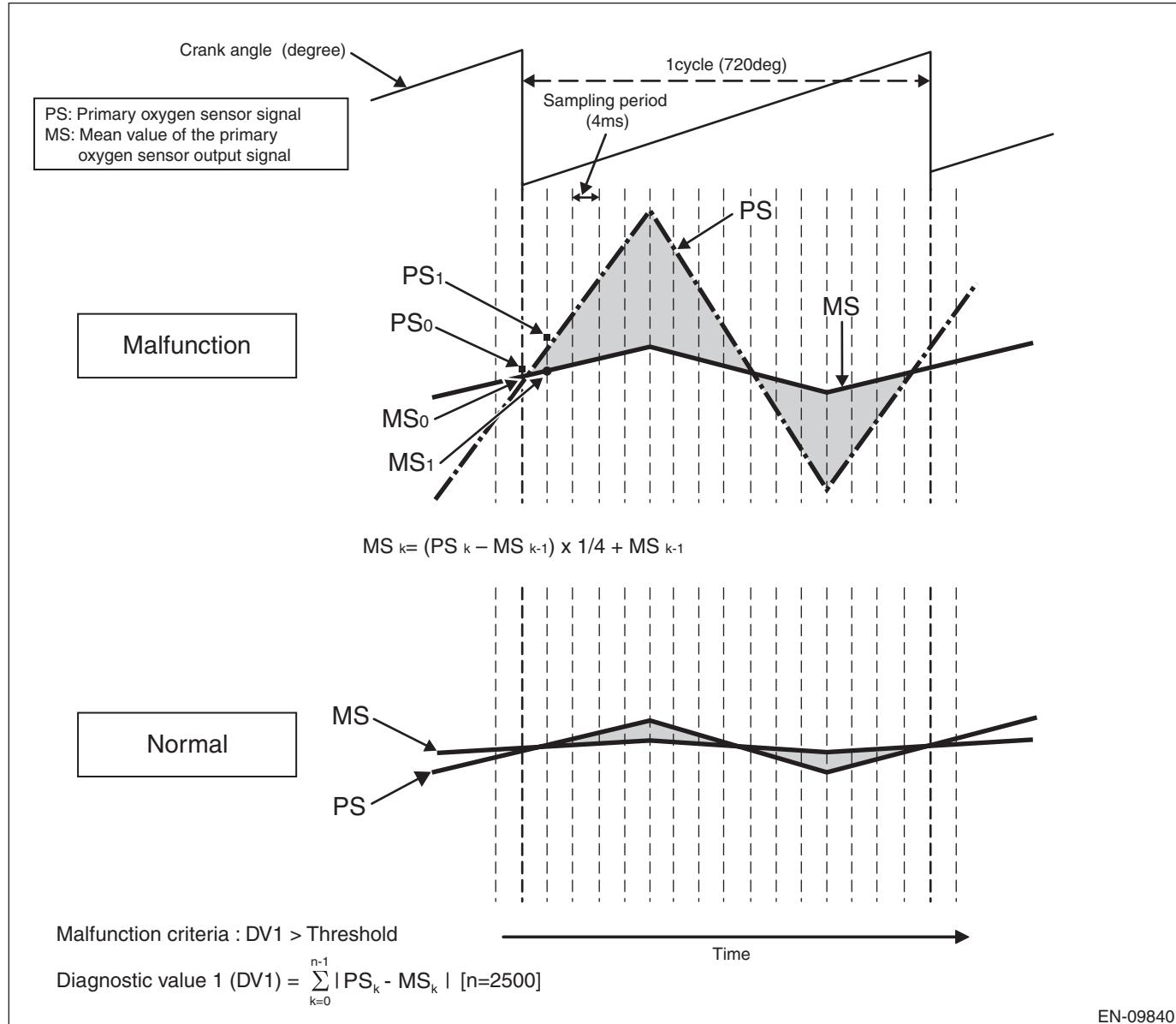
Monitor A1

When there is an air-fuel ratio cylinder imbalance malfunction, the primary oxygen sensor output fluctuates widely compared with a normal sensor, as shown by the chain line in Figure 1 below. This monitor makes a diagnosis based on this phenomenon. Each primary oxygen sensor signal (PS) and mean value of the primary oxygen sensor signal (MS) is calculated from the primary oxygen sensor signal. The absolute values of $(PS - MS)$ are sampled every 4 ms as shown in the figure. Diagnostic value 1 (DV1) is obtained by integrating the absolute value of $(PS - MS)$ for 2,500 times. A malfunction is determined when DV1 exceeds the threshold. The judgment values are determined experimentally.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Figure 1. Compare malfunctioned primary oxygen sensor output with a normal sensor



Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

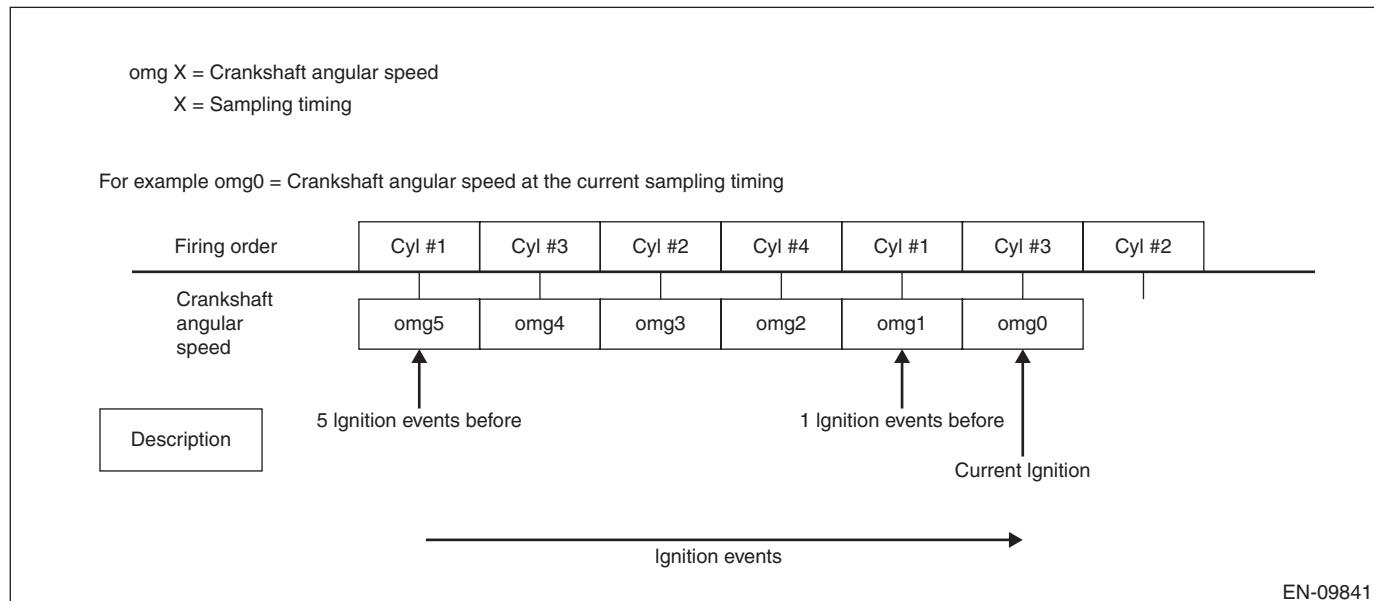
Monitor B1

Method used: Difference method of 360 degrees CA

Monitor value: domg360 = (omg 1 - omg 0) - (omg 3 - omg 2) = angular speed

Each crankshaft angular speed is defined as Figure 2 below.

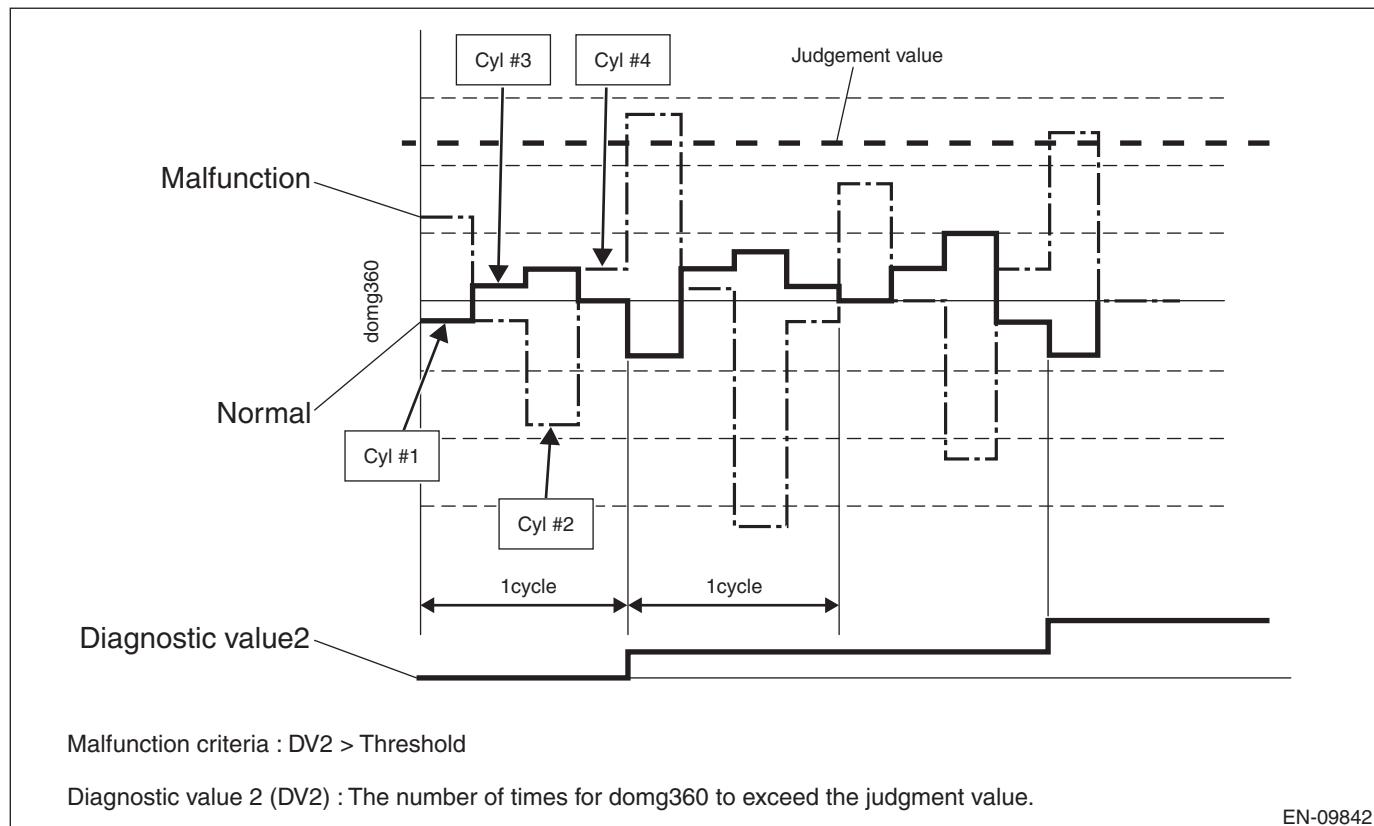
Figure 2. Description of domg360 output



This method uses the fact that the domg360 of lean conditioned cylinder caused by imbalance malfunction indicates big value, as shown by the chain line in Figure 3 below.

The number of times for domg360 to exceed the judgment value in 1,000 revolutions (500 cycles) is calculated as diagnostic value 2 (DV2). A malfunction is determined when DV2 exceeds the threshold.

Figure 3. Compare malfunctioned domg360 output with a normal output



2. ENABLE CONDITIONS

Monitor A1: Primary oxygen sensor fluctuation

Secondary Parameters	Enable Conditions
Closed loop control with primary oxygen sensor	Active
Engine speed	> 1400 rpm and < 3000 rpm
Engine coolant temperature	> -40 °C (-40 °F)
Intake air mass	≥ 0.70 g/rev (0.02 oz/rev)

Monitor B1: Crankshaft speed fluctuation

Secondary Parameters	Enable Conditions
Misfire diagnosis monitor	Active
Engine coolant temperature	> -40 °C (-40 °F)
Accelerator pedal position	= 0%
Engine speed	> 1400 rpm and < 3000 rpm
Intake air mass per revolution	> 0.7 g/rev (0.02 oz/rev)

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

4. DIAGNOSTIC METHOD

Judge as NG when Monitor A1 and Monitor B1 are both NG, and when either is OK, judge as OK.

Monitor A1

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Diagnostic value 1 (DV1)	> Threshold value 1 (TV1)

Threshold value 1 (TV1):

$$\sum_{k=0}^{n-1} \text{Map}_k \quad [n=2500]$$

EN-09888

Map

		Engine load (g/rev (oz/rev))				
		0.7 (0.02)	0.8 (0.03)	0.9 (0.03)	1 (0.04)	1.1 (0.04)
Engine speed (rpm)	1400	0.0076	0.0110	0.0153	0.0201	0.0201
	1600	0.0116	0.0144	0.0204	0.0269	0.0269
	1800	0.0130	0.0186	0.0247	0.0257	0.0257
	2000	0.0144	0.0197	0.0262	0.0303	0.0303
	2200	0.0134	0.0203	0.0289	0.0356	0.0356
	2400	0.0136	0.0199	0.0288	0.0343	0.0343
	2600	0.0149	0.0209	0.0304	0.0362	0.0362
	2800	0.0156	0.0218	0.0312	0.0373	0.0373
	3000	0.016	0.0198	0.0344	0.0388	0.0388

Time Needed for Diagnosis: 4 ms × 2500 time(s)

Monitor B1

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Diagnostic Value2 (DV2)	> 65535 time(s)

Time Needed for Diagnosis: 1000 engine revs.

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

FO:DTC P2270 O2 SENSOR SIGNAL BIASED/STUCK LEAN (BANK 1 SENSOR 2)

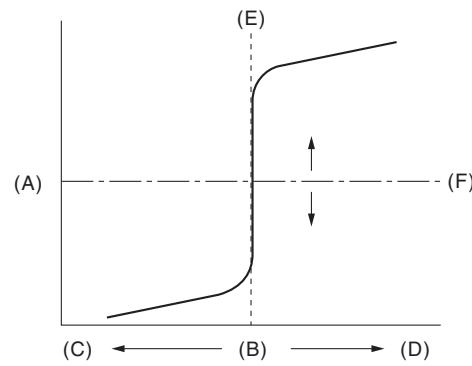
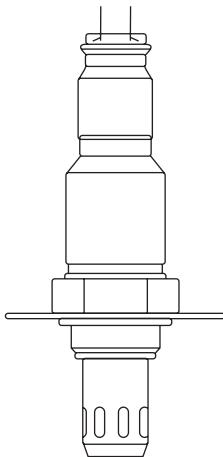
1. OUTLINE OF DIAGNOSIS

Detect the stuck of rear oxygen sensor voltage in lean state.

When rear oxygen sensor voltage remains below the threshold value for predetermined time, diagnosis interrupts target air fuel ratio for control and raises output voltage.

Judge as NG detecting the stuck in lean state when rear oxygen sensor voltage remains below the threshold value even after the interrupt control.

2. COMPONENT DESCRIPTION



EN-10447

(A) Electromotive force

(D) Rich

(B) Air fuel ratio

(E) Theoretical air fuel ratio

(C) Lean

(F) Comparative voltage

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Sub feedback	In operation
Amount of intake air	≥ 10 g/s (0.35 oz/s)
Estimated temperature of the rear oxygen sensor element	≥ 500 °C (932 °F)
Enable conditions at interrupt control are as follows	
Air fuel ratio reduced from target air fuel ratio	= Value of Map
Continuous time when rear oxygen sensor output voltage is less than 0.55 V	≥ 5000 ms

Map

Output voltage of rear oxygen sensor V	0.000	0.150	0.200	0.400	0.600
Air fuel ratio reduced from target air fuel ratio %	-0.150	-0.150	-0.040	-0.040	-0.040

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once after the enable conditions have been established.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage of rear oxygen sensor	< 0.55 V

Time Needed for Diagnosis: 15000 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

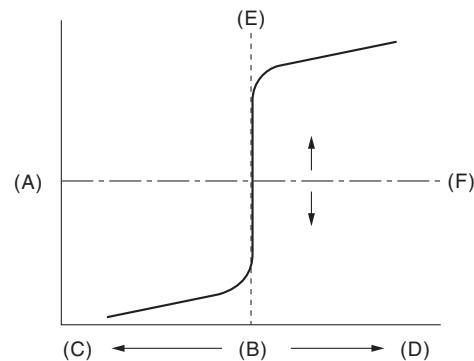
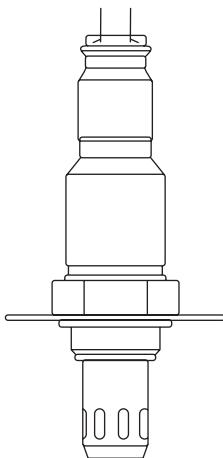
FP:DTC P2271 O2 SENSOR SIGNAL BIASED/STUCK RICH (BANK 1 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

Detect the stuck of rear oxygen sensor voltage in rich state.

Detect the stuck in rich state and judge as NG if rear oxygen sensor voltage remains above the threshold value for predetermined time.

2. COMPONENT DESCRIPTION



EN-10447

(A) Electromotive force	(B) Air fuel ratio	(C) Lean
(D) Rich	(E) Theoretical air fuel ratio	(F) Comparative voltage

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$
Fuel cut time	$\geq 5000 \text{ ms}$
Estimated temperature of the rear oxygen sensor element	$\geq 500 \text{ }^{\circ}\text{C} (932 \text{ }^{\circ}\text{F})$

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once after the enable conditions have been established.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage of rear oxygen sensor	$> 0.15 \text{ V}$

Time Needed for Diagnosis: 500 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

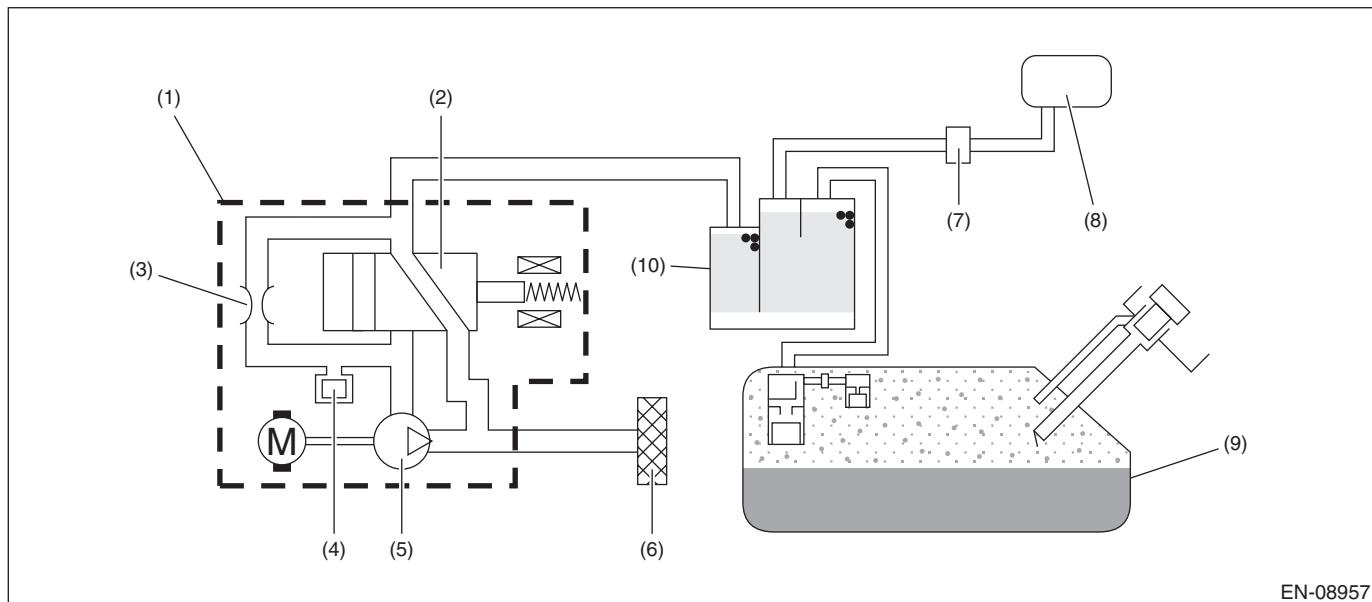
GENERAL DESCRIPTION

**FQ:DTC P2401 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP
CONTROL CIRCUIT LOW**

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the ELCM vacuum pump.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1)	ELCM	(5)	Vacuum pump	(9)	Fuel tank
(2)	Switching valve	(6)	Drain filter	(10)	Canister
(3)	Reference orifice (0.02 inch orifice)	(7)	Purge control solenoid valve		
(4)	Pressure sensor	(8)	Intake manifold		

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9
ELCM vacuum pump drive signal	OFF

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal output voltage when ECM outputs OFF signal	\leq Battery voltage \times 0.34

Time Needed for Diagnosis: 2500 ms

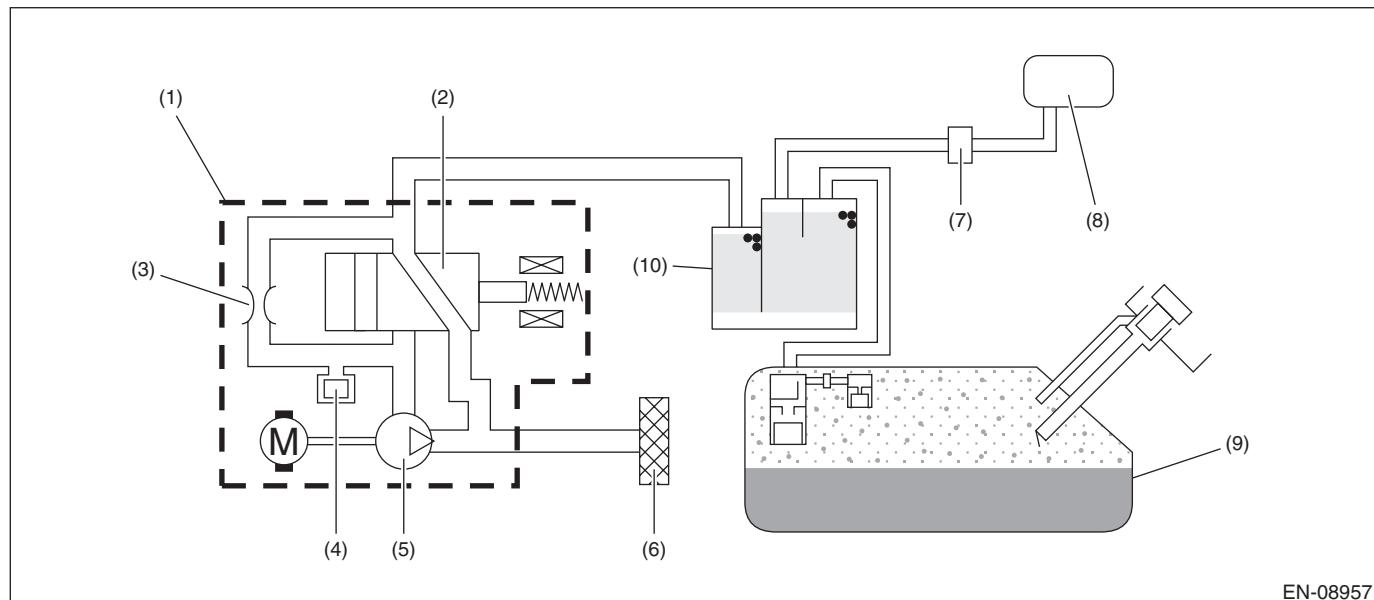
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

FR:DTC P2402 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP CONTROL CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the ELCM vacuum pump.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) ELCM	(5) Vacuum pump	(9) Fuel tank
(2) Switching valve	(6) Drain filter	(10) Canister
(3) Reference orifice (0.02 inch orifice)	(7) Purge control solenoid valve	
(4) Pressure sensor	(8) Intake manifold	

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9
ELCM vacuum pump drive signal	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal output current when ECM outputs ON signal	≥ 12 A

Time Needed for Diagnosis: 2500 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

FS:DTC P2404 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP SENSE CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

NOTE:

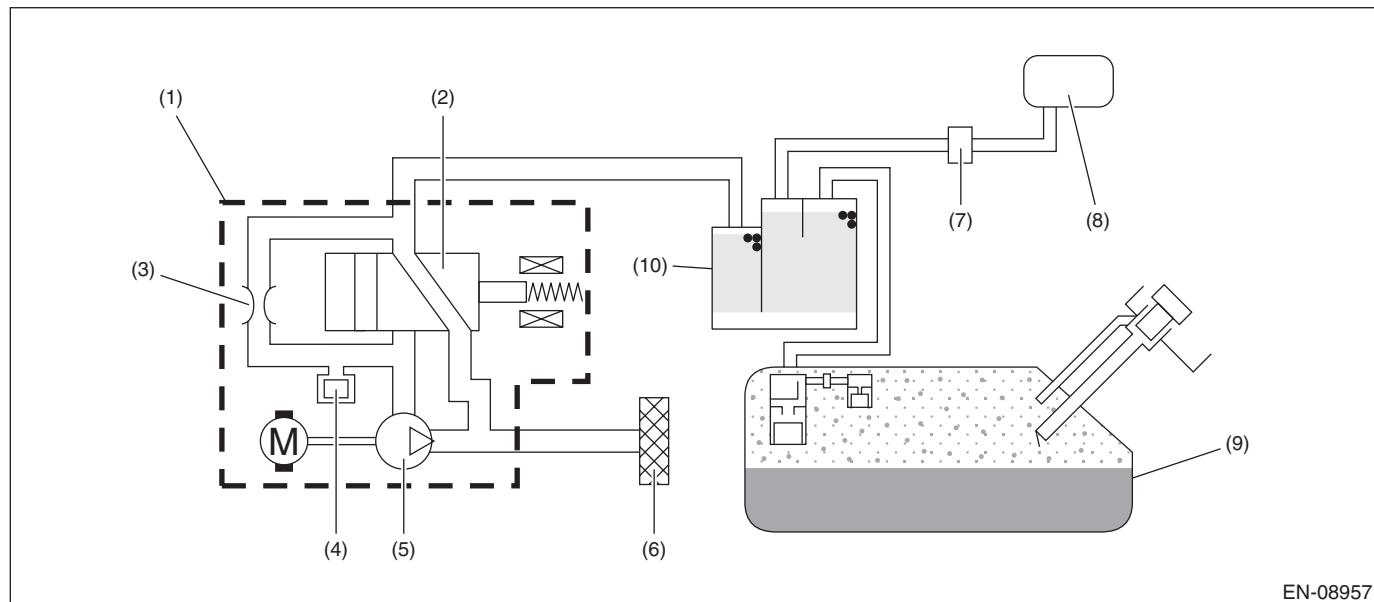
For the detection standard, refer to DTC P0455. <Ref. to GD(H4DO HEV)-115, DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

FT:DTC P2419 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the ELCM switching valve.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) ELCM	(5) Vacuum pump	(9) Fuel tank
(2) Switching valve	(6) Drain filter	(10) Canister
(3) Reference orifice (0.02 inch orifice)	(7) Purge control solenoid valve	
(4) Pressure sensor	(8) Intake manifold	

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9
ELCM switching valve drive signal	OFF

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal output voltage when ECM outputs OFF signal	$\leq \text{Battery voltage} \times 0.34$

Time Needed for Diagnosis: 2500 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

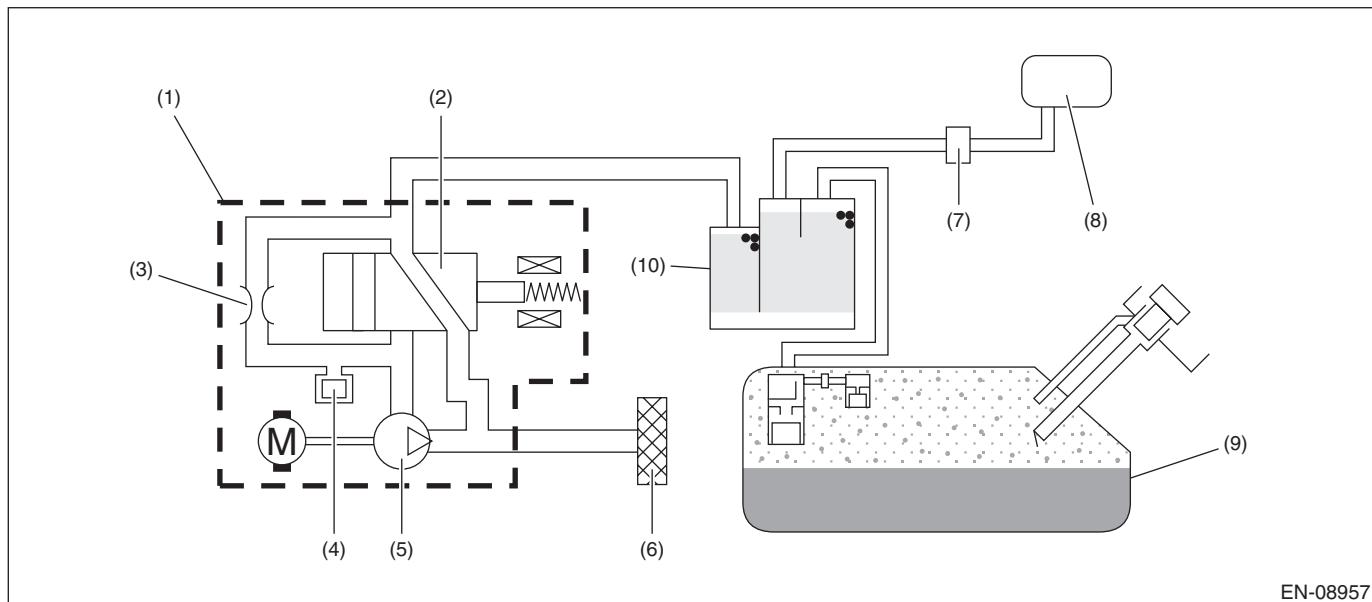
GENERAL DESCRIPTION

FU:DTC P2420 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the ELCM switching valve.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) ELCM	(5) Vacuum pump	(9) Fuel tank
(2) Switching valve	(6) Drain filter	(10) Canister
(3) Reference orifice (0.02 inch orifice)	(7) Purge control solenoid valve	
(4) Pressure sensor	(8) Intake manifold	

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9
ELCM switching valve drive signal	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal output current when ECM outputs ON signal	≥ 12 A

Time Needed for Diagnosis: 2500 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

FV:DTC P2530 IGNITION SWITCH RUN POSITION CIRCUIT

1. OUTLINE OF DIAGNOSIS

Detect instantaneous open in ignition switch input circuit to ECM.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION

ECM monitors the voltage of the ignition switch input circuit. Judge as ignition switch ON when the voltage is the specified value or more.

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Engine speed or Vehicle speed	≥ 550 rpm or ≥ 2 km/h(1.2 MPH)

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after the enable conditions have been established.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established within the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Number of instantaneous opens in ignition switch input circuit	≥ 5 time(s)

Time Needed for Diagnosis: 5000 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

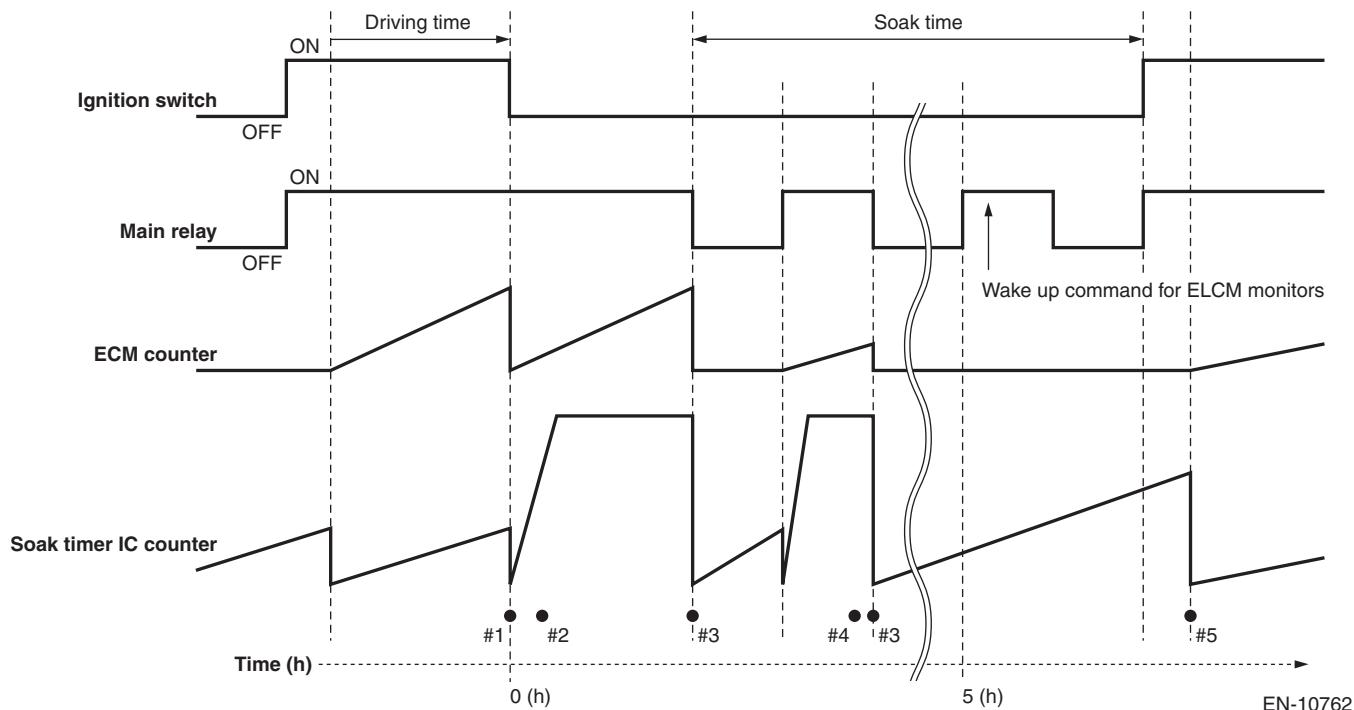
FW:DTC P2610 ECM/PCM INTERNAL ENGINE OFF TIMER PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect malfunction of soaking timer IC by the five diagnoses below.

Monitor Number	Explanation	Time required for diagnosis
Monitor #1 <Timer diagnosis>	Perform diagnosis of the soaking timer IC accuracy	128 ms
Monitor #2 <Full count diagnosis>	Perform diagnosis of the soaking timer IC counter function	128 ms
Monitor #3 <Soaking timer IC setting diagnosis>	Perform diagnosis of communication between ECM and soaking timer IC	128 ms
Monitor #4 <Timer diagnosis (during soaking)>	Perform diagnosis of the soaking timer IC accuracy during soaking	None
Monitor #5 <Wake-up diagnosis>	Perform diagnosis of wake-up function	None

This is an example of ELCM monitor execution at soak time of 5 hours.

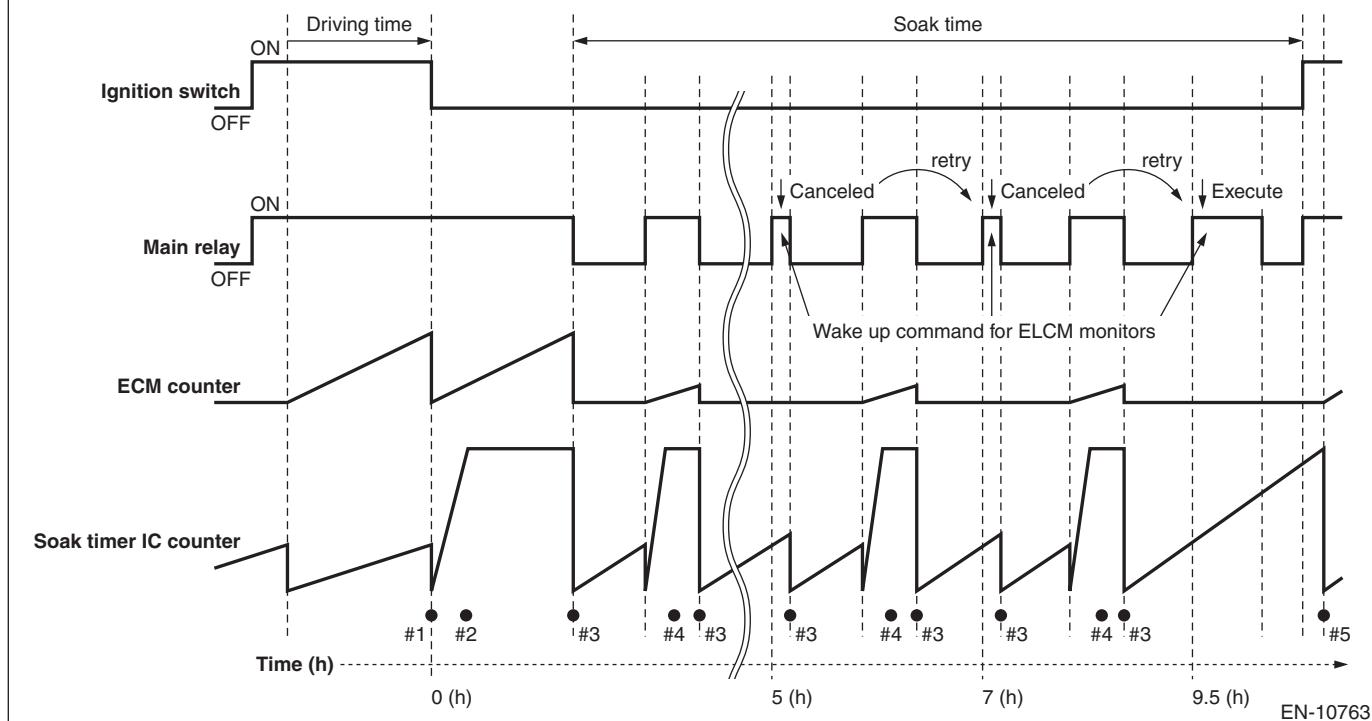


EN-10762

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

This is an example of ELCM monitor execution at soak time of 9.5 hours.



2. COMPONENT DESCRIPTION

The soaking timer IC is built into the ECM.

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
<Timer diagnosis>	
Battery voltage	≥ 10.9 V
Ignition switch	OFF
Elapsed time after starting the engine	> 600 s and < 61380 s
<Full count diagnosis>	
Battery voltage	≥ 10.9 V
Ignition switch	OFF
Counter in ECM	≥ 4 s
<Soaking timer IC setting diagnosis>	
Battery voltage	≥ 10.9 V
Ignition switch	OFF
<Timer diagnosis (during soaking)>	
Battery voltage	≥ 10.9 V
Ignition switch	OFF
<Wake-up diagnosis>	
Ignition switch	ON
Time in the soaking timer IC	> 3600 s

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once when the ignition switch is OFF and when the ignition switch is ON after the soaking of one hour or more.

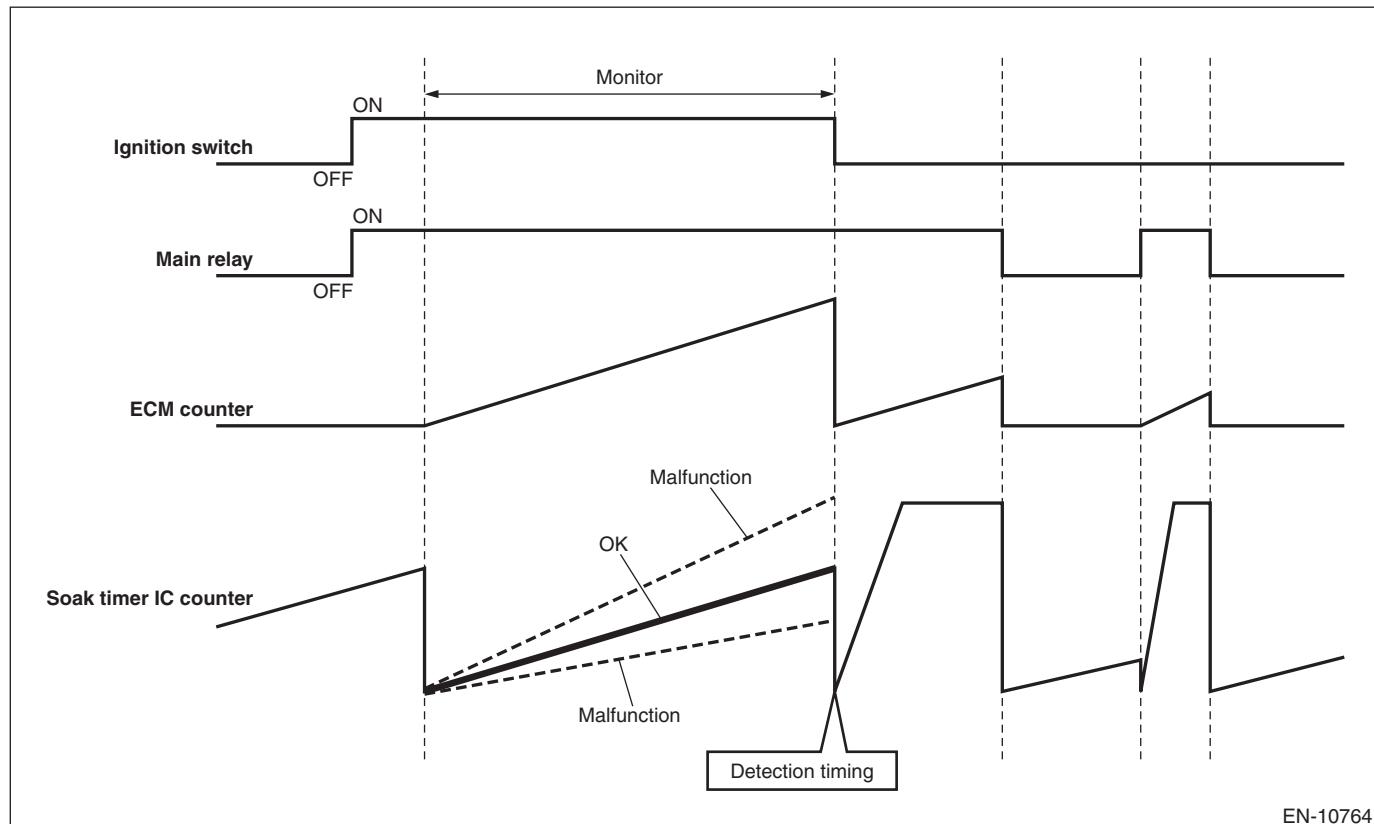
Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

<Timer diagnosis>

Start the count up operation of counters in ECM and in soaking timer IC when the engine is started. Judge as timer malfunction if the difference between the counter in ECM and counter in soaking timer IC exceeds the allowable limit when the ignition switch is OFF.



Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
$ osoaktimcpu - osoaktimic / osoaktimcpu$ osoaktimcpu = Counter in ECM osoaktimic = Counter in soaking timer IC	> 0.24

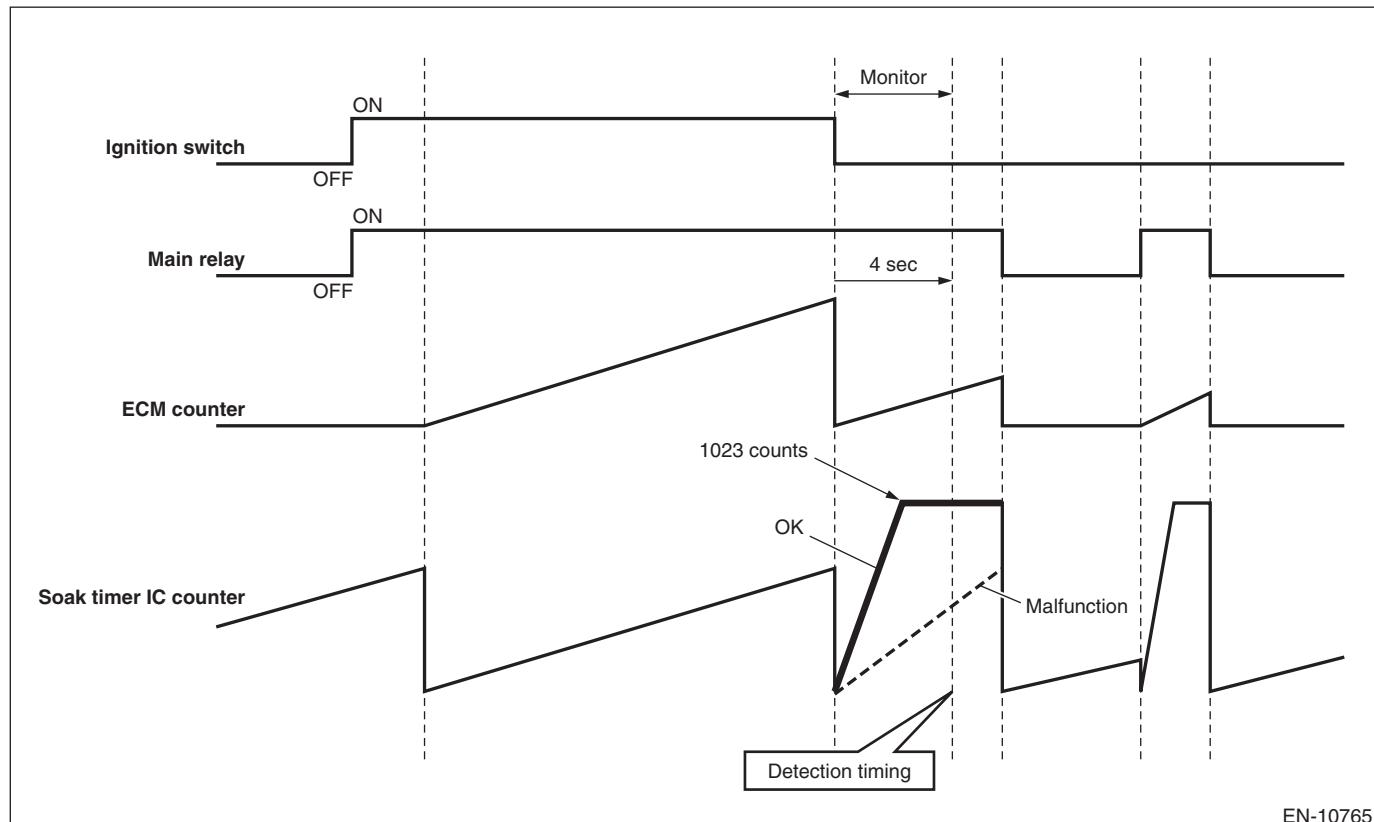
Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

<Full count diagnosis>

Reset the counter in soaking timer IC and start the count up operation.

Judge as full count diagnosis malfunction if counter in soaking timer IC is not \$3FF (1023 count) after 4 seconds.



EN-10765

Judge as NG when the following conditions are established.

Judgment Value

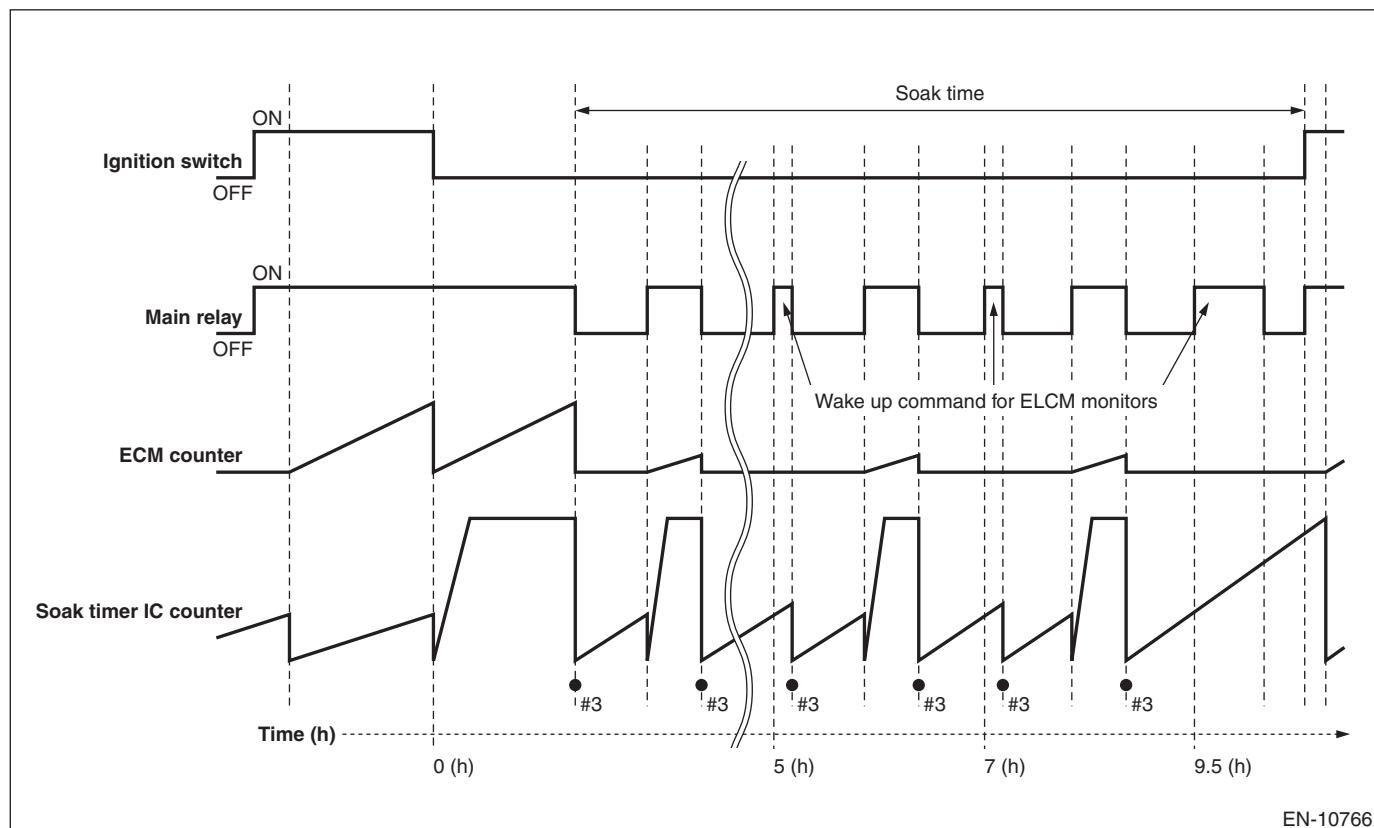
Malfunction Criteria	Threshold Value
osoakfcntic	≠ \$3FF (1023 count)
osoakfcntic = Counter in soaking timer IC	

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

<Soaking timer IC setting diagnosis>

When setting the activation setting time to soaking timer IC, compare the writing value to soaking timer IC with read out value. Judge as malfunction if the values do not match 3 times in a row.



EN-10766

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Writing value and read out value when setting the soaking timer	Unmatch

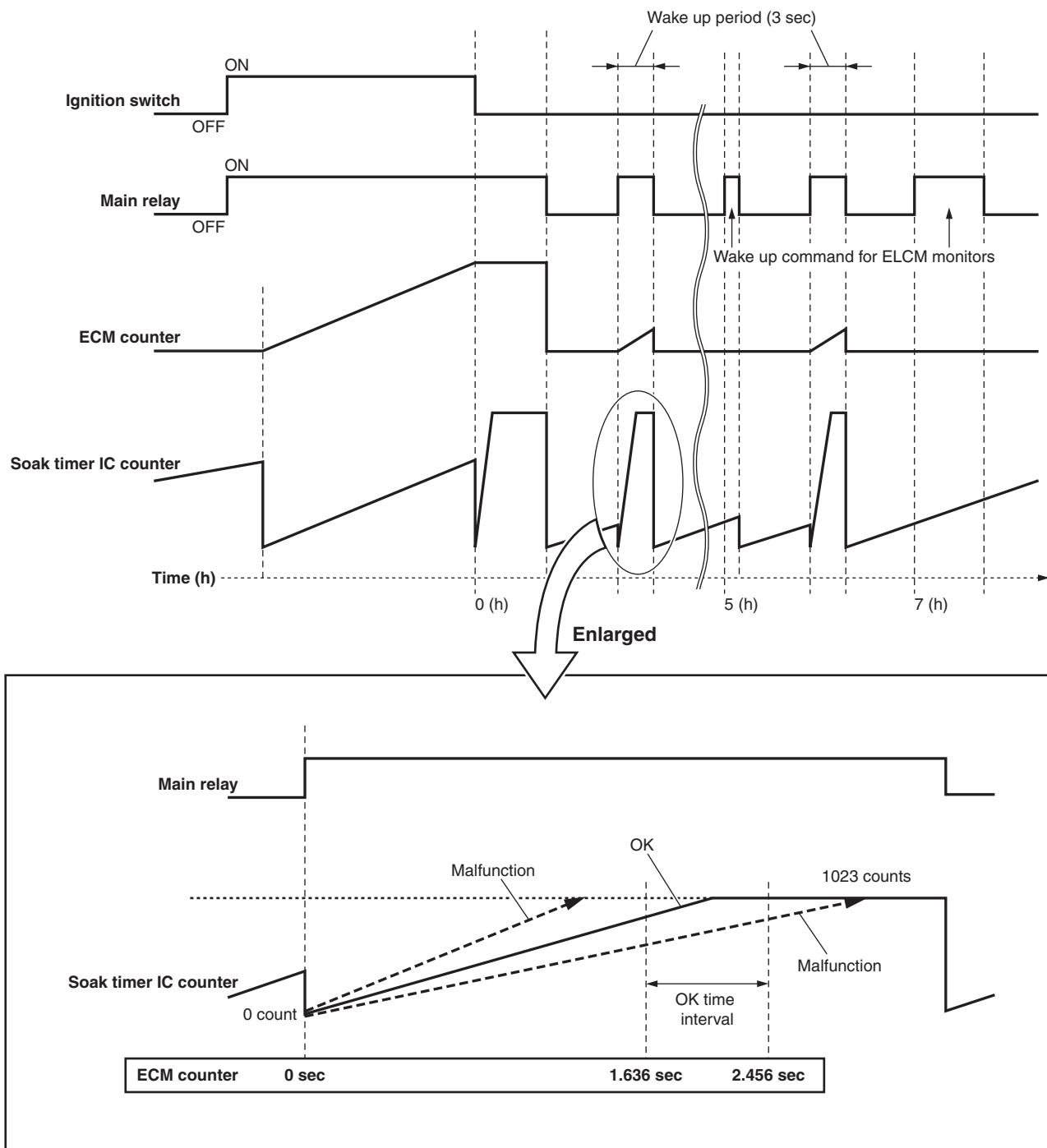
Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

<Timer diagnosis (during soaking)>

Wake-up at the predetermined interval until 5, 7 or 9.5 hours have passed after the ignition switch is OFF, and compare the counter in soaking timer IC with the counter in ECM.

Judge as malfunction if the counter in soaking timer IC is counted up to maximum value (1023 count) when the counter in ECM is 1636 ms, or if the counter in soaking timer IC is not counted up to maximum value (1023 count) when the counter in ECM is 2456 ms.



Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Judge as NG when the following conditions are established.

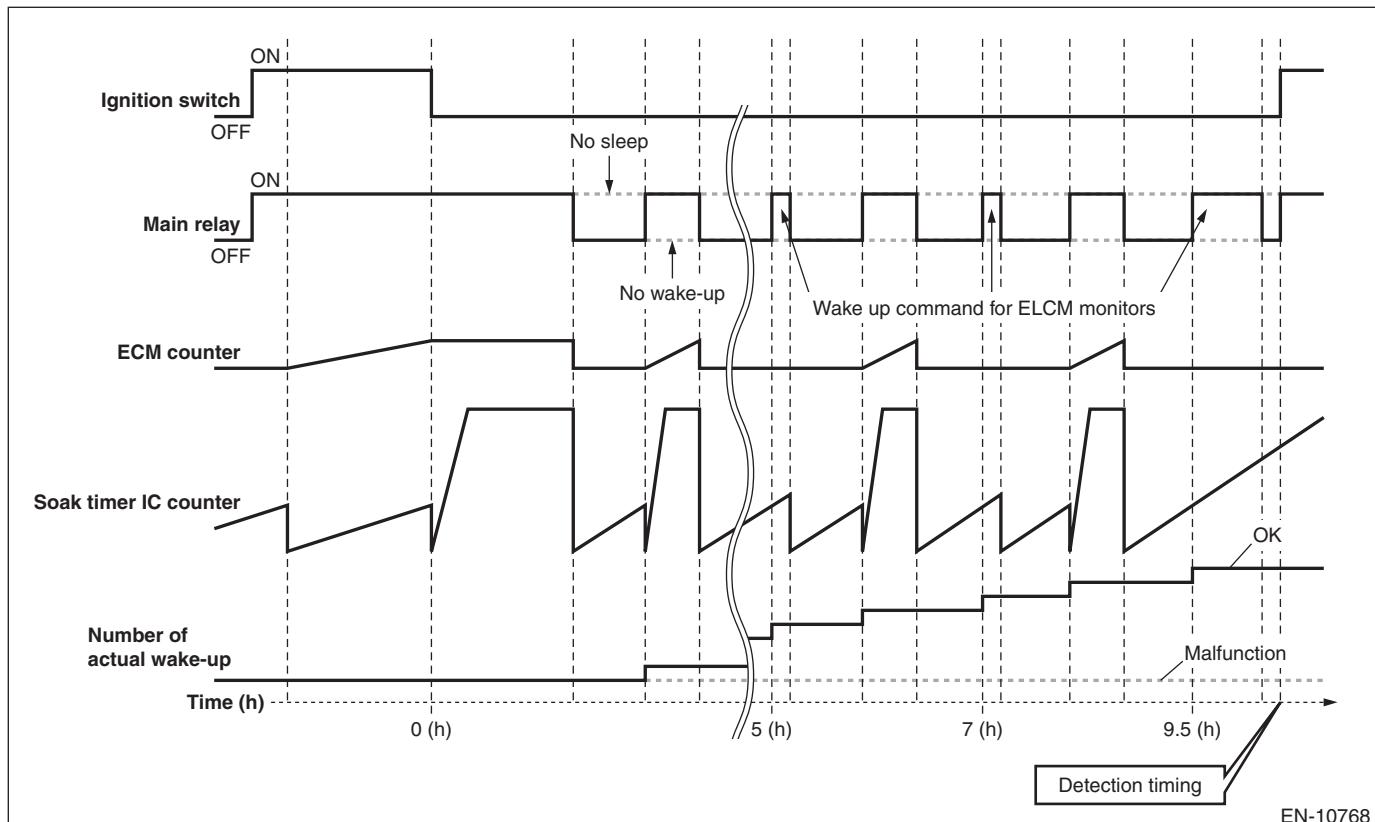
Judgment Value

Malfunction Criteria	Threshold Value
When any one of the followings is established:	
• All of the following conditions are established. Counter in ECM Counter in soaking timer IC	≤ 1636 ms = \$3FF (1023 count)
• All of the following conditions are established. Counter in ECM Counter in soaking timer IC	≥ 2456 ms $\neq \$3FF$ (1023 count)

<Wake-up diagnosis>

Store the number of wake-up activation when the ECM wakes up by the soaking timer IC.

Next time when the ignition switch is ON, if the number of wake-up activation does not reach the predetermined value even though the counter in soaking timer IC operates 1 hour or more, judge as wake-up malfunction.



Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Number of wake-up	\neq Wake-up indication count

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Ignition switch	ON
Driving cycle	Completed
When any one of the followings is established:	
• Timer diagnosis	NG
• Full count diagnosis	NG
• Soaking timer IC setting diagnosis	NG
• Timer diagnosis (during soaking)	NG
• Wake-up diagnosis	NG

Time Needed for Diagnosis: Approx. 5 — 9.5 hours

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

FX:DTC U0073 CONTROL MODULE COMMUNICATION BUS OFF

1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.

Judge as NG when CAN communication failure has occurred.

2. COMPONENT DESCRIPTION

(Common Specifications)

CAN Protocol 2.0 B (Active)

Frame Format: 11 Bit ID Frame (Standard Frame)

Conforms to ISO11898

Communication Speed: 500 kbps

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
CAN bus condition	Bus off

Time Needed for Diagnosis: 436 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

FY:DTC U0075 CONTROL MODULE COMMUNICATION BUS "PU-CAN" OFF

1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.

Judge as NG when CAN communication failure has occurred.

2. COMPONENT DESCRIPTION

(Common Specifications)

CAN Protocol 2.0 B (Active)

Frame Format: 11 Bit ID Frame (Standard Frame)

Conforms to ISO11898

Communication Speed: 500 kbps

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after ignition switch ON.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
CAN bus condition	Bus off

Time Needed for Diagnosis: 436 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

FZ:DTC U0101 LOST COMMUNICATION WITH TCM

1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.

Judge as NG when CAN communication failure between TCM, VDC CM and combination meter has occurred.

2. COMPONENT DESCRIPTION

(Common Specifications)

CAN Protocol 2.0 B (Active)

Frame Format: 11 Bit ID Frame (Standard Frame)

Conforms to ISO11898

Communication Speed: 500 kbps

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
CAN data from TCM	Lost

Time Needed for Diagnosis: 500 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

GA:DTC U0122 LOST COMMUNICATION WITH VEHICLE DYNAMICS CONTROL MODULE

1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.

Judge as NG when CAN communication failure between TCM, VDC CM and combination meter has occurred.

2. COMPONENT DESCRIPTION

(Common Specifications)

CAN Protocol 2.0 B (Active)

Frame Format: 11 Bit ID Frame (Standard Frame)

Conforms to ISO11898

Communication Speed: 500 kbps

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
CAN data from vehicle dynamics control module	Lost

Time Needed for Diagnosis: 500 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

GB:DTC U0155 LOST COMMUNICATION WITH INSTRUMENT PANEL CLUSTER (IPC) CONTROL MODULE

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC U0101. <Ref. to GD(H4DO HEV)-216, DTC U0101 LOST COMMUNICATION WITH TCM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

GC:DTC U0284 LOST COMMUNICATION WITH ACTIVE GRILLE SHUTTER MODULE "A"

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of LIN communication.

Judge as NG when LIN communication failure has occurred with active grille shutter.

2. COMPONENT DESCRIPTION

(Common Specifications)

Communication protocol: LIN 2.0

Communication Speed: 19.20 kbps

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
ID received from control module connected to LIN	None

Time Needed for Diagnosis: 2000 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

GD:DTC U0293 LOST COMMUNICATION WITH HYBRID POWERTRAIN CONTROL MODULE

1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.

Judge as NG when CAN communication failure occurs with HPCM MAIN-CAN.

2. COMPONENT DESCRIPTION

(Common Specifications)

CAN Protocol 2.0 B (Active)

Frame Format: 11 Bit ID Frame (Standard Frame)

Conforms to ISO11898

Communication Speed: 500 kbps

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after ignition switch ON.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
ID received from HPCM MAIN-CAN	None

Time Needed for Diagnosis: 500 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

GE:DTC U0402 INVALID DATA RECEIVED FROM TCM

1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.

Judge as NG when data received from TCM, VDC CM and combination meter is not normal.

2. COMPONENT DESCRIPTION

(Common Specifications)

CAN Protocol 2.0 B (Active)

Frame Format: 11 Bit ID Frame (Standard Frame)

Conforms to ISO11898

Communication Speed: 500 kbps

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Data received from control module connected to CAN	No change or Parity error

Time Needed for Diagnosis: 2 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

GF:DTC U0416 INVALID DATA RECEIVED FROM VEHICLE DYNAMICS CONTROL MODULE

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC U0402. <Ref. to GD(H4DO HEV)-220, DTC U0402 INVALID DATA RECEIVED FROM TCM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

GG:DTC U0423 INVALID DATA RECEIVED FROM INSTRUMENT PANEL CLUSTER CONTROL MODULE

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC U0402. <Ref. to GD(H4DO HEV)-220, DTC U0402 INVALID DATA RECEIVED FROM TCM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

GH:DTC U0594 INVALID DATA RECEIVED FROM HYBRID POWERTRAIN CONTROL MODULE

1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.

Judge as NG when data from HPCM MAIN-CAN is not correct.

2. COMPONENT DESCRIPTION

(Common Specifications)

CAN Protocol 2.0 B (Active)

Frame Format: 11 Bit ID Frame (Standard Frame)

Conforms to ISO11898

Communication Speed: 500 kbps

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after ignition switch ON.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Data update from HPCM MAIN-CAN	None

Time Needed for Diagnosis: 564 ms

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Data from HPCM MAIN-CAN	Parity error

Time Needed for Diagnosis: 64 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

GI: DTC U1101 LOST COMMUNICATION WITH TCM PU-CAN

1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.

Judge as NG when CAN communication failure occurs with TCM PU-CAN.

2. COMPONENT DESCRIPTION

(Common Specifications)

CAN Protocol 2.0 B (Active)

Frame Format: 11 Bit ID Frame (Standard Frame)

Conforms to ISO11898

Communication Speed: 500 kbps

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after ignition switch ON.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
ID received from TCM PU-CAN	None

Time Needed for Diagnosis: 500 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

GJ:DTC U1293 LOST COMMUNICATION WITH HYBRID POWERTRAIN CONTROL MODULE PU-CAN

1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.

Judge as NG when CAN communication failure occurs with HPCM PU-CAN.

2. COMPONENT DESCRIPTION

(Common Specifications)

CAN Protocol 2.0 B (Active)

Frame Format: 11 Bit ID Frame (Standard Frame)

Conforms to ISO11898

Communication Speed: 500 kbps

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after ignition switch ON.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
ID received from HPCM PU-CAN	None

Time Needed for Diagnosis: 500 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

GK:DTC U1402 INVALID DATA RECEIVED FROM TCM PU-CAN

1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.

Judge as NG when data from TCM PU-CAN is not correct.

2. COMPONENT DESCRIPTION

(Common Specifications)

CAN Protocol 2.0 B (Active)

Frame Format: 11 Bit ID Frame (Standard Frame)

Conforms to ISO11898

Communication Speed: 500 kbps

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after ignition switch ON.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Data from TCM PU-CAN	Check sum error

Time Needed for Diagnosis: 64 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

GL:DTC U1594 INVALID DATA RECEIVED FROM HYBRID POWERTRAIN CONTROL MODULE PU-CAN

1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.

Judge as NG when data from HPCM PU-CAN is not correct.

2. COMPONENT DESCRIPTION

(Common Specifications)

CAN Protocol 2.0 B (Active)

Frame Format: 11 Bit ID Frame (Standard Frame)

Conforms to ISO11898

Communication Speed: 500 kbps

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after ignition switch ON.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Data update from HPCM PU-CAN	None

Time Needed for Diagnosis: 564 ms

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Data from HPCM PU-CAN	Check sum error

Time Needed for Diagnosis: 64 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

TRANSMISSION SECTION

This service manual has been prepared to provide SUBARU service personnel with the necessary information and data for the correct maintenance and repair of SUBARU vehicles.

This manual includes the procedures for maintenance, disassembling, reassembling, inspection and adjustment of components and diagnostics for guidance of experienced mechanics.

Please peruse and utilize this manual fully to ensure complete repair work for satisfying our customers by keeping their vehicle in optimum condition. When replacement of parts during repair work is needed, be sure to use SUBARU genuine parts.

All information, illustration and specifications contained in this manual are based on the latest product information available at the time of publication approval.

CONTROL SYSTEMS	CS
CONTINUOUSLY VARIABLE TRANSMISSION	CVT(TR580)
CONTINUOUSLY VARIABLE TRANSMISSION (DIAGNOSTICS)	CVT (w/o HEV)(diag)
GENERAL DESCRIPTION (CVT)	GD(CVT) (w/o HEV)
CONTINUOUSLY VARIABLE TRANSMISSION	CVT(TH58A)
CONTINUOUSLY VARIABLE TRANSMISSION (DIAGNOSTICS)	CVT(HEV)(diag)
GENERAL DESCRIPTION (CVT)	GD(CVT)(HEV)
MANUAL TRANSMISSION AND DIFFERENTIAL	5MT
CLUTCH SYSTEM	CL

CONTROL SYSTEMS

CS

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