

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

2. Diagnostic Trouble Code (DTC) Detecting Criteria

A: 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	≥ 500 ms
Battery voltage	≥ 10.9 V
Engine speed	≥ 500 rpm
Engine oil temperature	≥ 0 °C (32 °F)
AVCS control	Operation
Target timing advance change amount (per 64 ms)	< 3.84 °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.

• Abnormality Judgment

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

Judgment value (U5 model)

Malfunction Criteria	Threshold Value
$\Sigma(\text{Target position} - \text{Actual position})$	> 2000 °CA (Bank 1) > 2000 °CA (Bank 2)
or $\Sigma(\text{Target position} - \text{Actual position})$	< -2000 °CA (Bank 1) < -2000 °CA (Bank 2)

Judgment value (Except for U5 model)

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

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established within the predetermined time.

Judgment value (U5 model)

Malfunction Criteria	Threshold Value
$\Sigma(\text{Target position} - \text{Actual position})$	$\leq 2000^{\circ}\text{CA}$ (Bank 1) $\leq 2000^{\circ}\text{CA}$ (Bank 2) and $\geq -2000^{\circ}\text{CA}$ (Bank 1) $\geq -2000^{\circ}\text{CA}$ (Bank 2)

Judgment value (Except for U5 model)

Malfunction Criteria	Threshold Value
$\Sigma(\text{Target position} - \text{Actual position})$	$\leq 4000^{\circ}\text{CA}$ (Bank 1) $\leq 4000^{\circ}\text{CA}$ (Bank 2) and $\geq -4000^{\circ}\text{CA}$ (Bank 1) $\geq -4000^{\circ}\text{CA}$ (Bank 2)

Time Needed for Diagnosis: 25000 ms

B: 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	≥ 500 ms
Battery voltage	≥ 10.9 V
Engine speed	≥ 500 rpm
Engine oil temperature	$\geq 0^{\circ}\text{C}$ (32°F)
Exhaust AVCS control	Operation
Target timing advance change amount (per 64 ms)	$< 3.84^{\circ}\text{CA}$

3. GENERAL DRIVING CYCLE

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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.

• Abnormality Judgment

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

Judgment value (U5 model)

Malfunction Criteria	Threshold Value
$\Sigma(\text{Target position} - \text{Actual position})$	$> 2000 {}^{\circ}\text{CA}$ (Bank 1) $> 2000 {}^{\circ}\text{CA}$ (Bank 2)
or	
$\Sigma(\text{Target position} - \text{Actual position})$	$< -2000 {}^{\circ}\text{CA}$ (Bank 1) $< -2000 {}^{\circ}\text{CA}$ (Bank 2)

Judgment value (Except for U5 model)

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

Time Needed for Diagnosis: 25000 ms

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

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established within the predetermined time.

Judgment value (U5 model)

Malfunction Criteria	Threshold Value
$\Sigma(\text{Target position} - \text{Actual position})$	$\leq 2000 {}^{\circ}\text{CA}$ (Bank 1) $\leq 2000 {}^{\circ}\text{CA}$ (Bank 2) and $\geq -2000 {}^{\circ}\text{CA}$ (Bank 1) $\geq -2000 {}^{\circ}\text{CA}$ (Bank 2)

Judgment value (Except for U5 model)

Malfunction Criteria	Threshold Value
$\Sigma(\text{Target position} - \text{Actual position})$	$\leq 4000 {}^{\circ}\text{CA}$ (Bank 1) $\leq 4000 {}^{\circ}\text{CA}$ (Bank 2) and $\geq -4000 {}^{\circ}\text{CA}$ (Bank 1) $\geq -4000 {}^{\circ}\text{CA}$ (Bank 2)

Time Needed for Diagnosis: 25000 ms

C: 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)-10, DTC P000A A CAMSHAFT POSITION SLOW RESPONSE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

D: 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)-11, DTC P000B B CAMSHAFT POSITION SLOW RESPONSE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

E: 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	≥ 5000 ms
Battery voltage	≥ 10.9 V
Engine speed	≥ 500 rpm
Engine oil temperature	≥ 0 °C (32 °F)
AVCS control	Operation

- Intermediate lock

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	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.

• Abnormality Judgment

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

Judgment Value

Malfunction Criteria	Threshold Value
• Normal (Target position – Actual position)	> 15 °CA or < -15 °CA
• Intermediate lock (Target position – Actual position)	> 15 °CA or < -15 °CA

Time Needed for Diagnosis:

- Normal: 5000 ms
- Intermediate lock: 1000 ms

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

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established within the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
• Normal (Target position – Actual position)	$\leq 15^{\circ}\text{CA}$ and $\geq -15^{\circ}\text{CA}$
• Intermediate lock (Target position – Actual position)	$\leq 15^{\circ}\text{CA}$ and $\geq -15^{\circ}\text{CA}$

Time Needed for Diagnosis:

- Normal: 5000 ms
- Intermediate lock: 1000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

F: 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	≥ 5000 ms
Battery voltage	≥ 10.9 V
Engine speed	≥ 500 rpm
Engine oil temperature	≥ 0 °C (32 °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.

• Abnormality Judgment

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

Judgment Value

Malfunction Criteria	Threshold Value
(Target position – Actual position)	> 15 °CA or < -15 °CA

Time Needed for Diagnosis: 5000 ms

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

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established within the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
(Target position – Actual position)	≤ 15 °CA and ≥ -15 °CA

Time Needed for Diagnosis: 5000 ms

G: 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	≥ 1200 rpm and < 2500 rpm
Engine coolant temperature	≥ 60 °C (140 °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.

• Abnormality Judgment

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
$ \text{Crankshaft position when camshaft position sensor signal is input} - \text{Learning value} $	> 10 °CA

Time Needed for Diagnosis: 3000 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.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
$ \text{Crankshaft position when camshaft position sensor signal is input} - \text{Learning value} $	≤ 10 °CA

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

H: 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	≥ 1200 rpm and < 2500 rpm
Engine coolant temperature	≥ 60 °C (140 °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.

• Abnormality Judgment

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: 3000 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.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

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

Time Needed for Diagnosis: Less than 1 second

I: 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)-17, DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

J: 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)-18, DTC P0017 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

K: 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)-14, DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

L: 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)-16, DTC P0014 EXHAUST AVCS SYSTEM 1 (RANGE/PERFORMANCE), Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

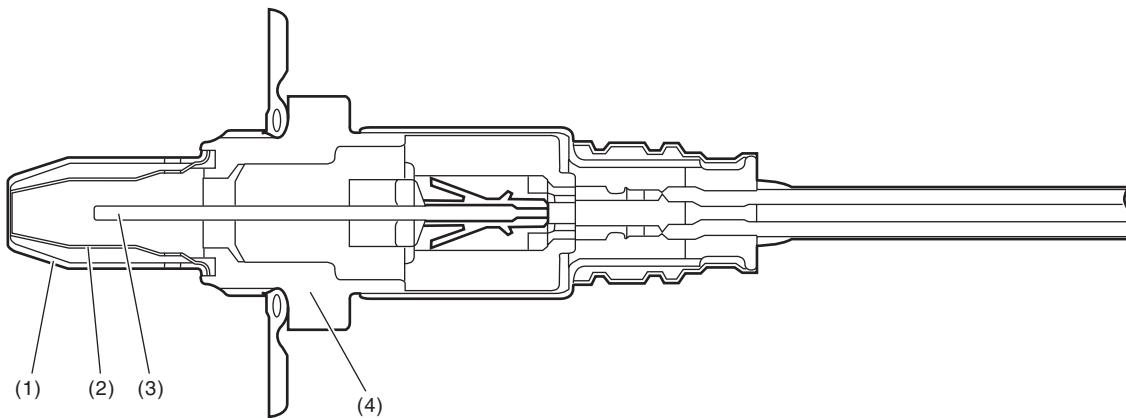
M: DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1)

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
Condition established time	≥ 42000 ms
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 seconds or more have passed since the engine started.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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	> 50 Ω

Time Needed for Diagnosis: 10000 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Front oxygen (A/F) sensor impedance	≤ 50 Ω

Time Needed for Diagnosis: 10000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

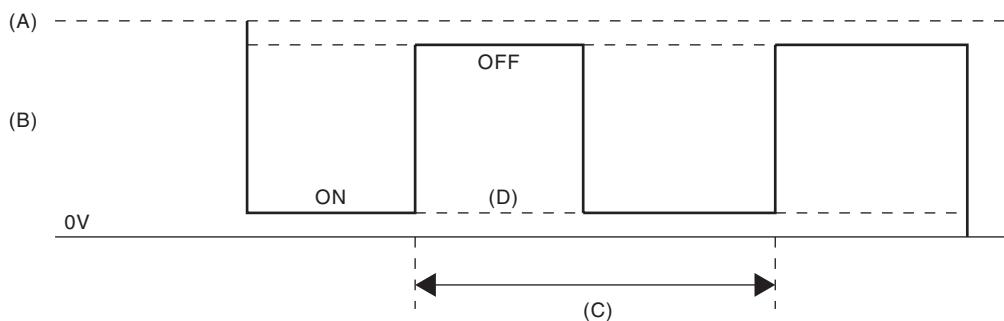
1. OUTLINE OF DIAGNOSIS

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

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

(C) 128 ms

(D) Low error

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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 level	Low
Front oxygen (A/F) sensor heater control duty	< 87.5 %

Time Needed for Diagnosis: 4 ms × 250 time(s)

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	High

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

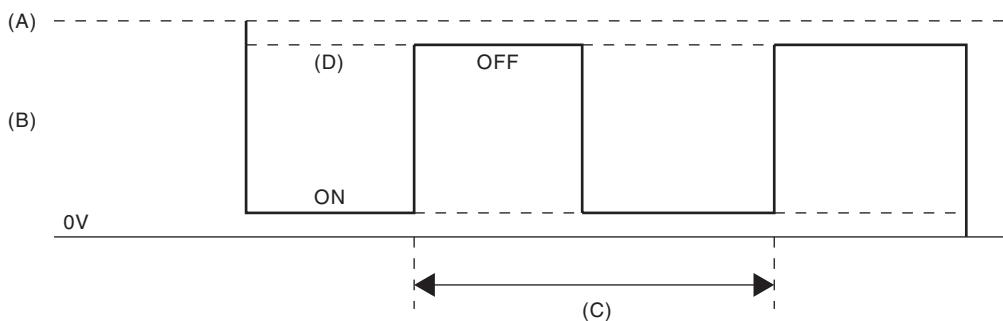
1. OUTLINE OF DIAGNOSIS

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

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

(C) 128 ms

(D) High error

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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 level	High
Front oxygen (A/F) sensor heater control duty	$\geq 12.5\%$

Time Needed for Diagnosis: 4 ms \times 500 time(s)

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	Low

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

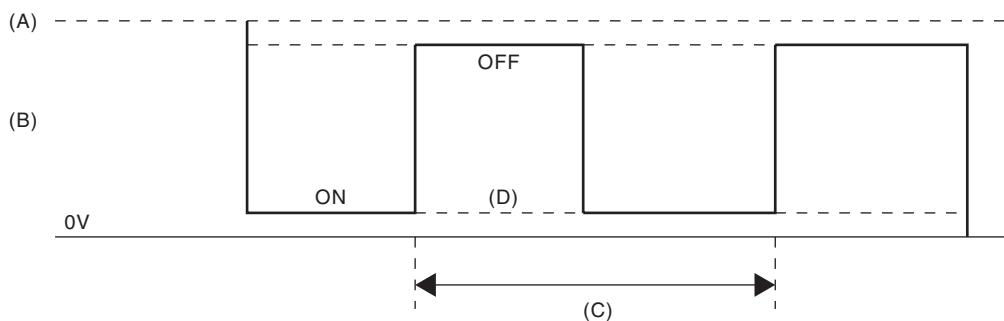
1. OUTLINE OF DIAGNOSIS

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

(B) Output voltage of the rear oxygen sensor heater

(C) 256 ms (cycle)

(D) Low error

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1 second
Engine speed	< 8000 rpm

4. GENERAL DRIVING CYCLE

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

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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 level	Low
Rear oxygen sensor heater control duty	< 75 %

Time Needed for Diagnosis: 8 ms × 1250 time(s)

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	High

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

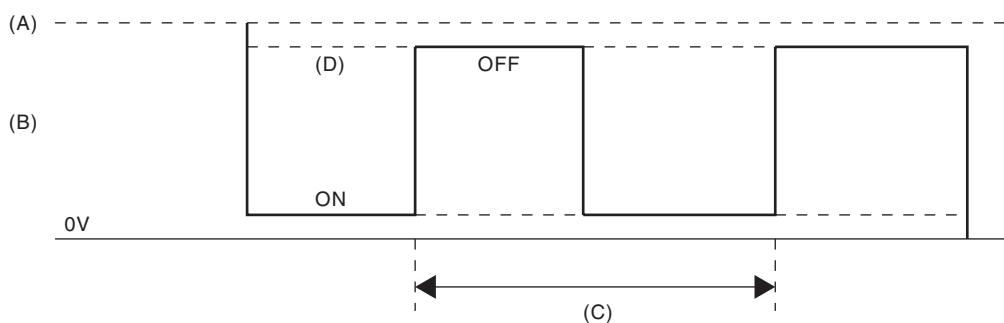
1. OUTLINE OF DIAGNOSIS

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

(B) Output voltage of the rear oxygen sensor heater

(C) 256 ms (cycle)

(D) High error

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1 second
Engine speed	< 8000 rpm

4. GENERAL DRIVING CYCLE

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

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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 level	High
Rear oxygen sensor heater control duty	$\geq 20\%$

Time Needed for Diagnosis: 8 ms \times 1250 time(s)

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	Low

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

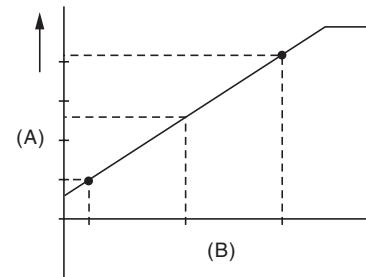
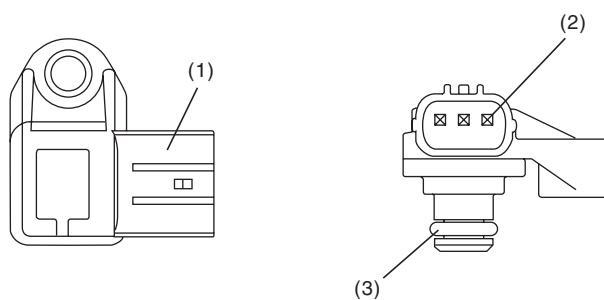
R: DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION

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	$\geq 60^{\circ}\text{C}$ (140 °F)

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after idling.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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 (U5 model)

Malfunction Criteria	Threshold Value
Low	
Engine speed	< 2900 rpm
Throttle position	≥ 12 °
Output voltage	< 1.44 V
Engine load	> 0.36 g/rev (0.01 oz/rev)
High	
Engine speed	400 rpm — 950 rpm (CVT model) 450 rpm — 950 rpm (MT model)
Throttle position	< 5.2 ° (CVT model) < 4.9 ° (MT model)
Output voltage	≥ 2.53 V
Engine load	< 0.34 g/rev (0.01 oz/rev) (CVT model) < 0.31 g/rev (0.01 oz/rev) (MT model)

Judgment value (Except for U5 model)

Malfunction Criteria	Threshold Value
Low	
Engine speed	< 2900 rpm
Throttle position	≥ 12 °
Output voltage	< 1.44 V
Engine load	> 0.36 g/rev (0.01 oz/rev)
High	
Engine speed	500 rpm — 950 rpm (CVT model) 550 rpm — 950 rpm (MT model)
Throttle position	< 5.2 ° (CVT model) < 4.9 ° (MT model)
Output voltage	≥ 2.53 V
Engine load	< 0.34 g/rev (0.01 oz/rev) (CVT model) < 0.31 g/rev (0.01 oz/rev) (MT model)

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.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Normality Judgment

Judge as OK and clear the NG when both Low side and High side become OK.

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

Judgment value (U5 model)

Malfunction Criteria	Threshold Value
Low	
Engine speed	< 2900 rpm
Throttle position	≥ 12 °
Output voltage	≥ 1.44 V
Engine load	> 0.36 g/rev (0.01 oz/rev)
High	
Engine speed	400 rpm — 950 rpm (CVT model) 450 rpm — 950 rpm (MT model)
Throttle position	< 5.2 ° (CVT model) < 4.9 ° (MT model)
Output voltage	< 2.53 V
Engine load	< 0.34 g/rev (0.01 oz/rev) (CVT model) < 0.31 g/rev (0.01 oz/rev) (MT model)

Judgment value (Except for U5 model)

Malfunction Criteria	Threshold Value
Low	
Engine speed	< 2900 rpm
Throttle position	≥ 12 °
Output voltage	≥ 1.44 V
Engine load	> 0.36 g/rev (0.01 oz/rev)
High	
Engine speed	500 rpm — 950 rpm (CVT model) 550 rpm — 950 rpm (MT model)
Throttle position	< 5.2 ° (CVT model) < 4.9 ° (MT model)
Output voltage	< 2.53 V
Engine load	< 0.34 g/rev (0.01 oz/rev) (CVT model) < 0.31 g/rev (0.01 oz/rev) (MT model)

Time Needed for Diagnosis:

Low side: Less than 1 second

High side: Less than 1 second

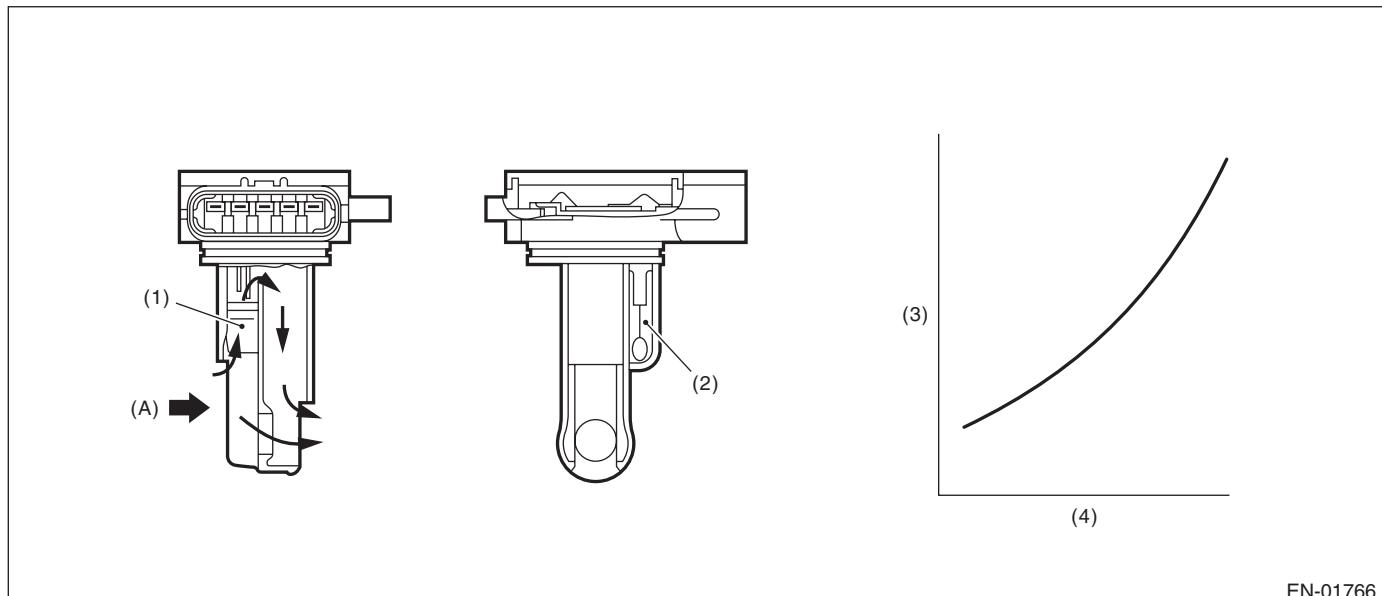
S: DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE

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



(A) Air

(1) Air flow sensor

(3) Voltage (V)

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

(2) Intake air temperature sensor

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

• Abnormality Judgment

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 (U5 model)

Malfunction Criteria	Threshold Value
Low	
Output voltage	< 1.33 V
Engine speed	≥ 1600 rpm
Throttle opening angle	≥ 12 °
Intake manifold pressure	≥ 66.7 kPa (500 mmHg, 19.7 inHg)
High (1)	
Output voltage	≥ 1.86 V
Engine speed	400 rpm — 950 rpm (CVT model) 450 rpm — 950 rpm (MT model)
Throttle opening angle	< 5.2 ° (CVT model) < 4.9 ° (MT model)
Intake manifold pressure	≥ 44.8 kPa (336.3 mmHg, 13.2 inHg) (CVT model) ≥ 44.4 kPa (332.9 mmHg, 13.1 inHg) (MT model)
High (2)	
Output voltage	≥ 1.76 V
Engine speed	400 rpm — 950 rpm (CVT model) 450 rpm — 950 rpm (MT model)
Throttle opening angle	< 5.2 ° (CVT model) < 4.9 ° (MT model)
Intake manifold pressure	≥ 44.8 kPa (336.3 mmHg, 13.2 inHg) (CVT model) ≥ 44.4 kPa (332.9 mmHg, 13.1 inHg) (MT model)
Fuel system diagnosis	Rich side malfunction

Judgment value (Except for U5 model)

Malfunction Criteria	Threshold Value
Low	
Output voltage	< 1.33 V
Engine speed	≥ 1600 rpm
Throttle opening angle	≥ 12 °
Intake manifold pressure	≥ 66.7 kPa (500 mmHg, 19.7 inHg)
High (1)	
Output voltage	≥ 1.86 V
Engine speed	500 rpm — 950 rpm (CVT model) 550 rpm — 950 rpm (MT model)
Throttle opening angle	< 5.2 ° (CVT model) < 4.9 ° (MT model)
Intake manifold pressure	≥ 44.8 kPa (336.3 mmHg, 13.2 inHg) (CVT model) ≥ 44.4 kPa (332.9 mmHg, 13.1 inHg) (MT model)
High (2)	
Output voltage	≥ 1.76 V
Engine speed	500 rpm — 950 rpm (CVT model) 550 rpm — 950 rpm (MT model)
Throttle opening angle	< 5.2 ° (CVT model) < 4.9 ° (MT model)
Intake manifold pressure	≥ 44.8 kPa (336.3 mmHg, 13.2 inHg) (CVT model) ≥ 44.4 kPa (332.9 mmHg, 13.1 inHg) (MT model)
Fuel system diagnosis	Rich side malfunction

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Time Needed for Diagnosis:

Low: 5000 ms

High: 5000 ms

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

• Normality Judgment

Judge as OK and clear the NG when both Low side and High side become OK.

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment value (U5 model)

Malfunction Criteria	Threshold Value
Low	
Output voltage	≥ 1.33 V
Engine speed	≥ 1600 rpm
Throttle opening angle	≥ 12 °
Intake manifold pressure	≥ 66.7 kPa (500 mmHg, 19.7 inHg)
High	
Output voltage	< 1.86 V
Engine speed	400 rpm — 950 rpm (CVT model) 450 rpm — 950 rpm (MT model)
Throttle opening angle	< 5.2 ° (CVT model) < 4.9 ° (MT model)
Intake manifold pressure	< 44.8 kPa (336.3 mmHg, 13.2 inHg) (CVT model) < 44.4 kPa (332.9 mmHg, 13.1 inHg) (MT model)
Fuel system diagnosis	Rich side normal

Judgment value (Except for U5 model)

Malfunction Criteria	Threshold Value
Low	
Output voltage	≥ 1.33 V
Engine speed	≥ 1600 rpm
Throttle opening angle	≥ 12 °
Intake manifold pressure	≥ 66.7 kPa (500 mmHg, 19.7 inHg)
High	
Output voltage	< 1.86 V
Engine speed	500 rpm — 950 rpm (CVT model) 550 rpm — 950 rpm (MT model)
Throttle opening angle	< 5.2 ° (CVT model) < 4.9 ° (MT model)
Intake manifold pressure	< 44.8 kPa (336.3 mmHg, 13.2 inHg) (CVT model) < 44.4 kPa (332.9 mmHg, 13.1 inHg) (MT model)
Fuel system diagnosis	Rich side normal

Time Needed for Diagnosis:

Low: Less than 1 second

High: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

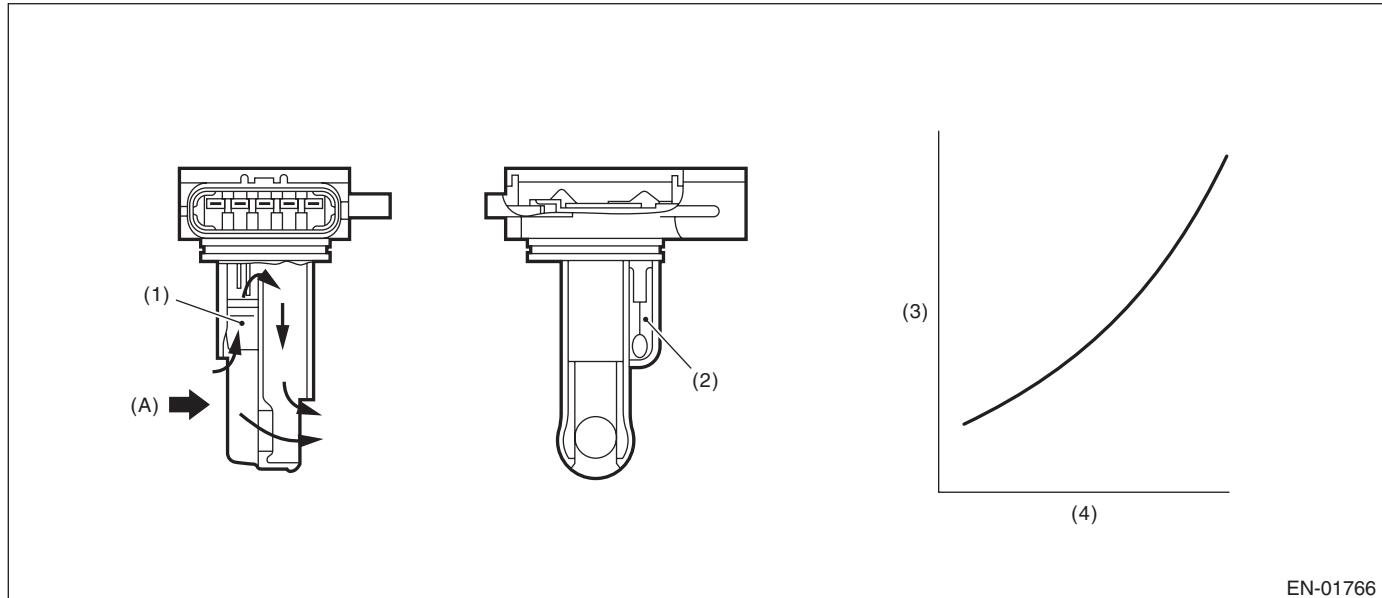
GENERAL DESCRIPTION

T: 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-01766

(A) Air

(1) Air flow sensor

(3) Voltage (V)

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

(2) Intake air temperature sensor

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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	≤ 0.22 V

Time Needed for Diagnosis: 500 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	> 0.22 V

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

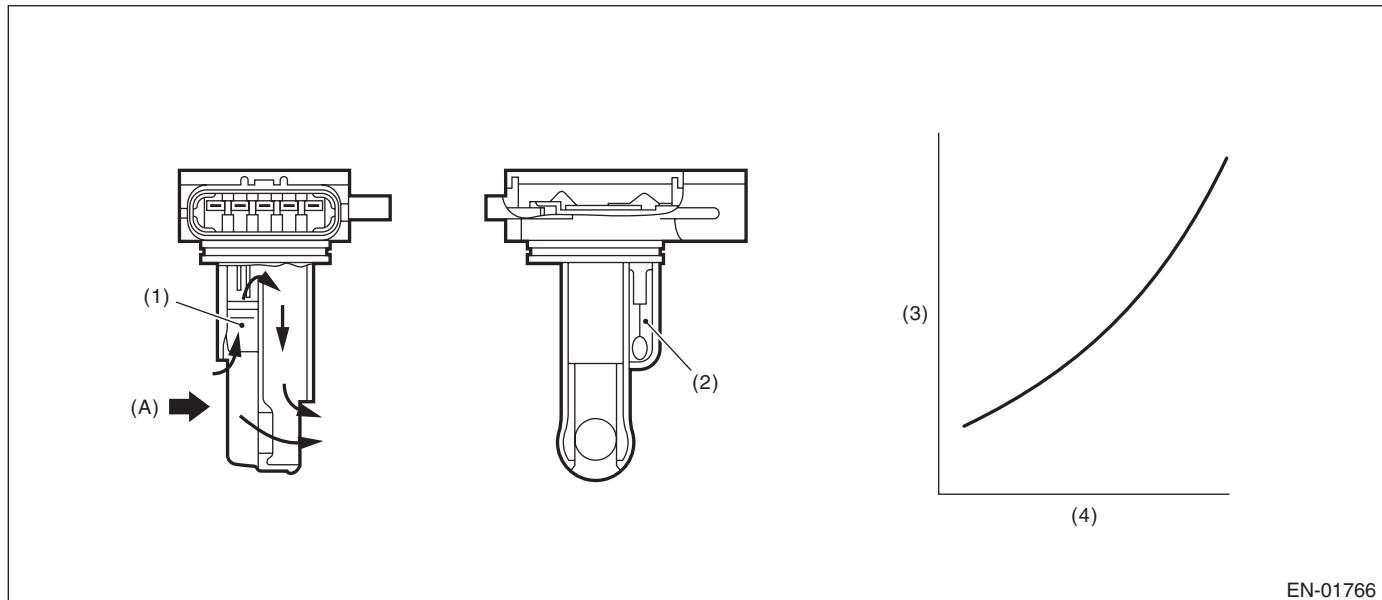
GENERAL DESCRIPTION

U: 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-01766

(A) Air

(1) Air flow sensor

(3) Voltage (V)

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

(2) Intake air temperature sensor

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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	≥ 4.071 V

Time Needed for Diagnosis: 500 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 4.071 V

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

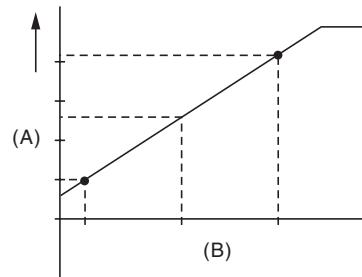
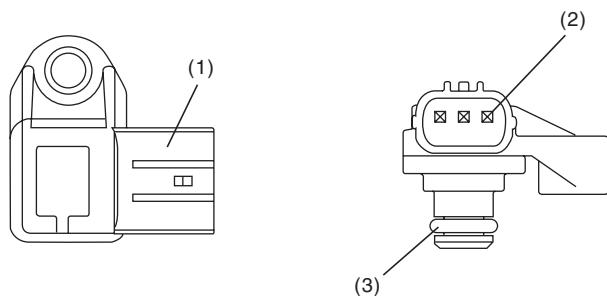
GENERAL DESCRIPTION

V: 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

• Abnormality Judgment

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	$\leq 0.606 \text{ V}$

Time Needed for Diagnosis: 500 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$> 0.606 \text{ V}$

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

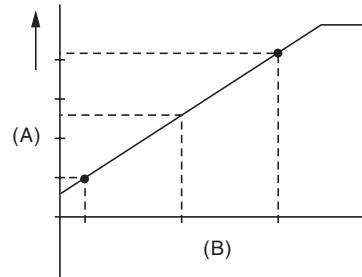
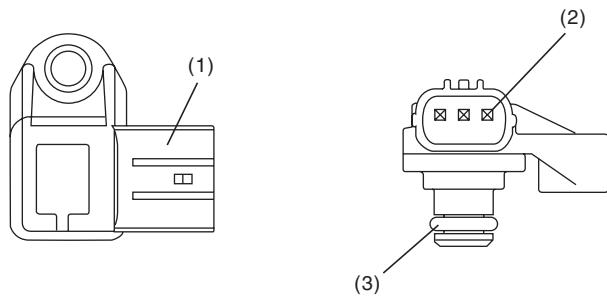
GENERAL DESCRIPTION

W: 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

• Abnormality Judgment

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	$\geq 3.906 \text{ V}$

Time Needed for Diagnosis: 500 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$< 3.906 \text{ V}$

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

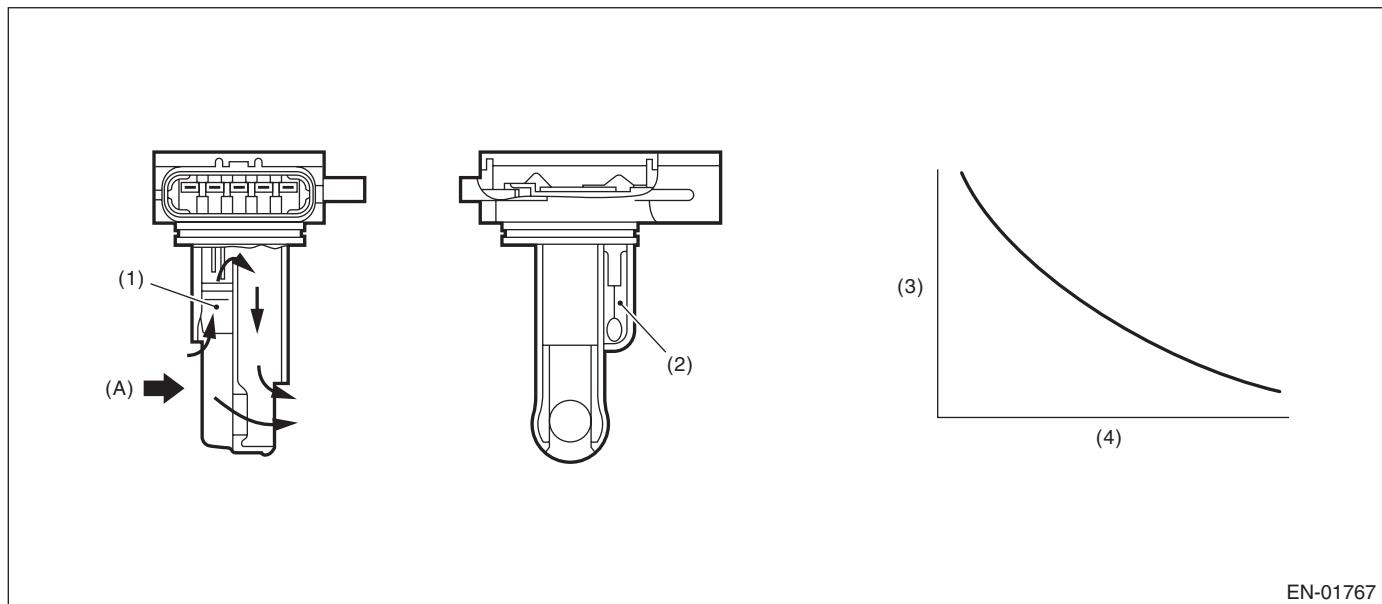
X: DTC P0111 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of intake air temperature sensor output property.

Judge as NG when the intake air temperature is not varied whereas it seemed to be varied from the viewpoint of engine condition.

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

Secondary Parameters	Enable Conditions
Engine coolant temperature at engine starting	< 200 °C (392 °F)
Battery voltage	≥ 10.9 V
Continuous time when the vehicle speed is less than 200 km/h (124.3 MPH)	≥ 1 s
Engine coolant temperature	≥ 60 °C (140 °F)
Intake air amount sum value	≥ 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)	≥ Value from Map 2
• Continuous time when vehicle speed is 40 km/h (24.9 MPH) or more and	≥ 15 s
Establishing time of 1, 2	≥ 15 s
1. Intake air amount	≥ 10 g/s (0.35 oz/s)
2. Vehicle speed	≥ 4 km/h (2.5 MPH)

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)	6500 (229.26)

Map 2

Engine coolant temperature °C (°F)	-30 (-22)	-10 (14)	0 (32)	10 (50)	20 (68)
Continuous time (s) when vehicle speed is less than 4 km/h (2.5 MPH)	180	100	70	45	20

4. GENERAL DRIVING CYCLE

Perform the diagnosis when the vehicle speed condition is met after warming up from a cold condition.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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)

Time Needed for Diagnosis: Less than 1 second

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

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage difference between Max. and Min.	≥ 0.02 V

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

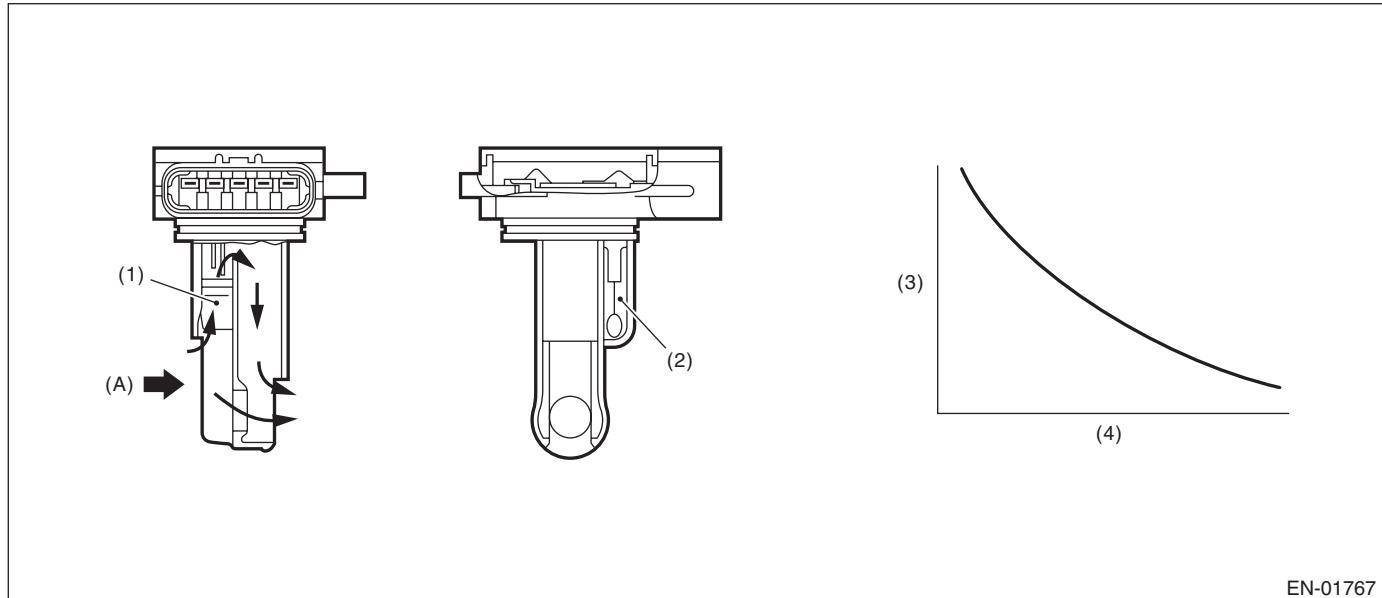
GENERAL DESCRIPTION

Y: 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



(A) Air

(1) Air flow sensor

(3) Resistance value (Ω)

(4) Intake air temperature °C (°F)

(2) Intake air temperature sensor

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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	< 0.395 V

Time Needed for Diagnosis: 500 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 0.395 V

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

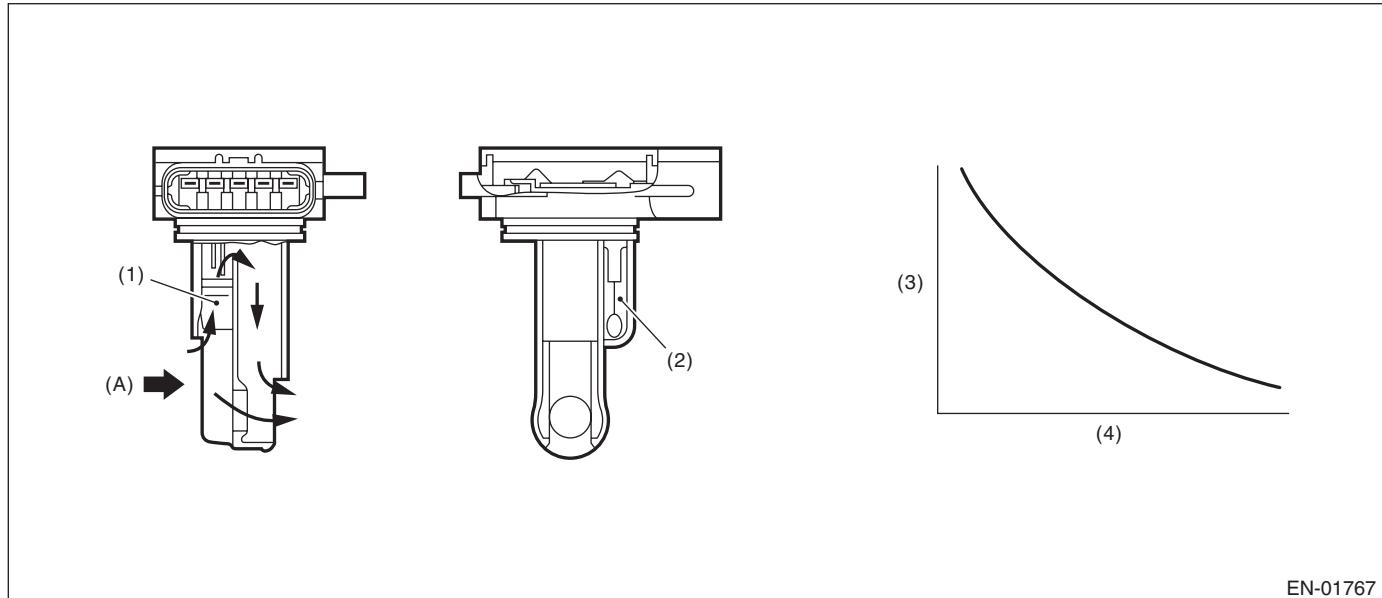
GENERAL DESCRIPTION

Z: 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



(A) Air

(1) Air flow sensor

(3) Resistance value (Ω)

(4) Intake air temperature °C (°F)

(2) Intake air temperature sensor

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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	$\geq 4.712 \text{ V}$

Time Needed for Diagnosis: 500 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$< 4.712 \text{ V}$

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

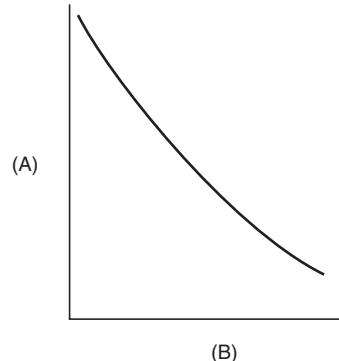
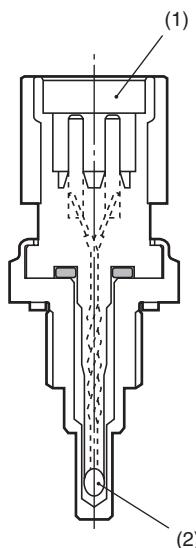
GENERAL DESCRIPTION

AA: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

• Abnormality Judgment

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	< 0.464 V

Time Needed for Diagnosis: 500 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 0.464 V

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

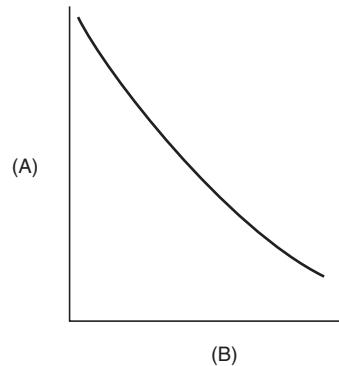
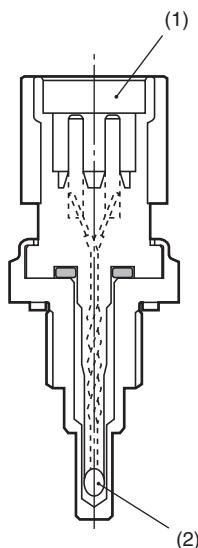
GENERAL DESCRIPTION

AB: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

• Abnormality Judgment

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	$\geq 4.702 \text{ V}$

Time Needed for Diagnosis: 500 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$< 4.702 \text{ V}$

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

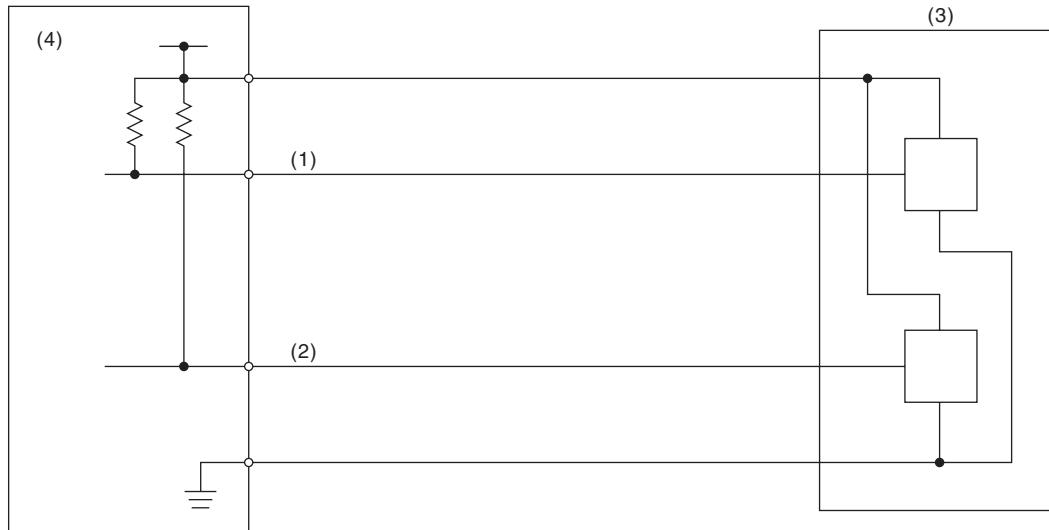
GENERAL DESCRIPTION

AC: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
Ignition switch	ON
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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	≤ 0.23 V

Time Needed for Diagnosis: 24 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	> 0.23 V

Time Needed for Diagnosis: 24 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

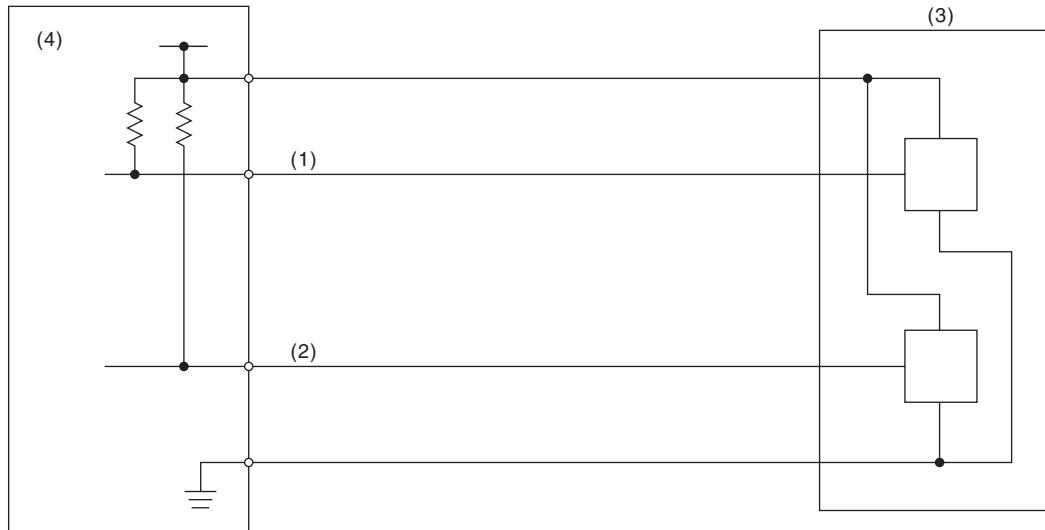
GENERAL DESCRIPTION

AD: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
Ignition switch	ON
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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	$\geq 4.858 \text{ V}$

Time Needed for Diagnosis: 24 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	$< 4.858 \text{ V}$

Time Needed for Diagnosis: 24 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

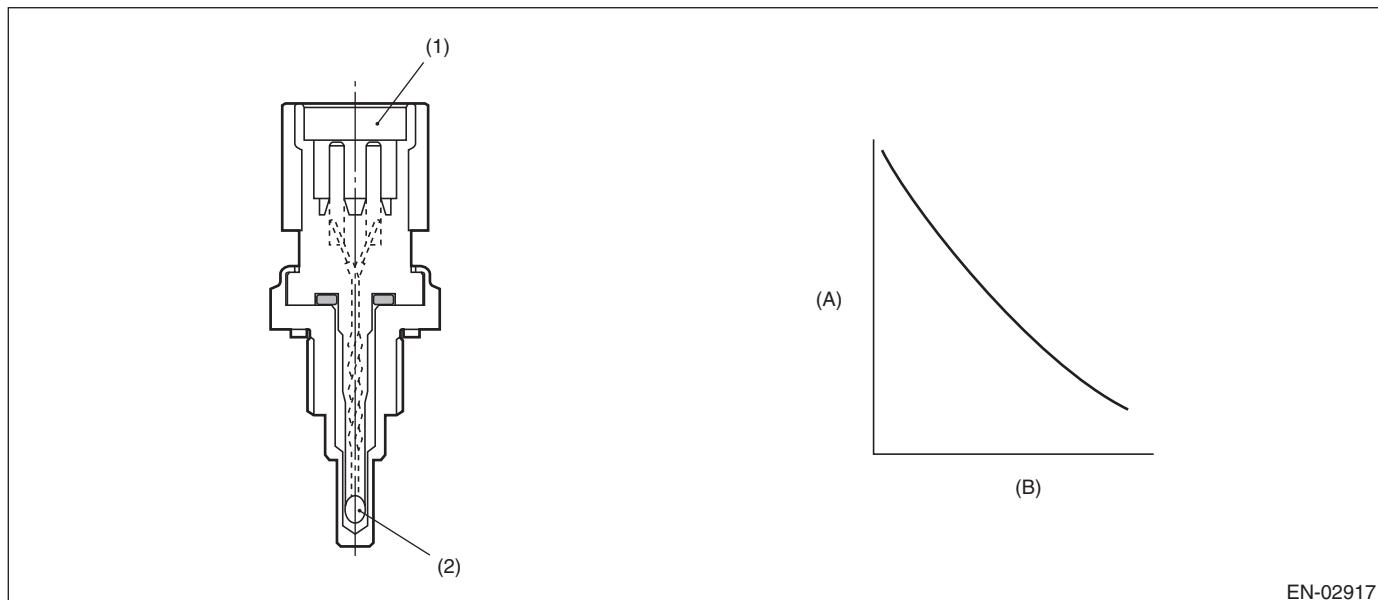
AE:DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of engine coolant temperature output property.

Judge as NG when the engine coolant temperature does not rise in driving conditions where it should.

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 speed	\geq Value from Map
Battery voltage	≥ 10.9 V

Map

Engine coolant temperature °C (°F)	-40 (-40)	-30 (-22)	-20 (-4)	-10 (14)	0 (32)	10 (50)	20 (68)	30 (86)
Engine speed rpm	500	500	500	500	500	500	500	500

Engine coolant temperature °C (°F)	40 (104)	50 (122)	60 (140)	70 (158)	80 (176)	90 (194)	100 (212)	110 (230)
Engine speed rpm	500	500	500	500	500	500	500	500

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once after engine start.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG if the criteria below are met.

Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature	< 20 °C (68 °F)
Timer for diagnosis after engine start	≥ Judgment value of timer after engine start

Timer for diagnosis after engine start

- a. Timer stop at fuel cut
- b. During the driving conditions except a) above, timer counts up as follows.

64 ms + TWCNT ms (when at 64 ms)

TWCNT is defined as follows,

TWCNT = 0 at idle switch ON,

TWCNT show on the following table at idle switch OFF.

		Vehicle speed km/h (MPH)							
		0 (0)	8 (5)	16 (9.9)	24 (14.9)	32 (19.9)	40 (24.9)	48 (29.8)	56 (34.8)
Temperature °C (°F)	-20 (-4)	0 ms	32.076 ms	39.977 ms	47.879 ms	82.544 ms	117.209 ms	154.214 ms	185.26 ms
	-10 (14)	0 ms	25.704 ms	33.606 ms	41.508 ms	68.52 ms	95.532 ms	125.667 ms	155.802 ms
	0 (32)	0 ms	17.646 ms	25.548 ms	33.45 ms	53.652 ms	73.855 ms	97.12 ms	120.386 ms
	10 (50)	0 ms	7.901 ms	15.802 ms	23.704 ms	37.941 ms	52.177 ms	68.573 ms	82.538 ms
	20 (68)	0 ms	7.901 ms	15.802 ms	23.704 ms	37.941 ms	52.177 ms	68.573 ms	82.538 ms

Judgment value of timer after engine starting

$$t = 457355 \text{ ms} - 26405 \text{ ms} \times Ti$$

Ti : The lowest coolant temperature after engine start

Time Needed for Diagnosis: Less than 1 second

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

• Normality Judgment

Judge as OK and clear the NG when the malfunction criteria below are met.

Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature	≥ 20 °C (68 °F)

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

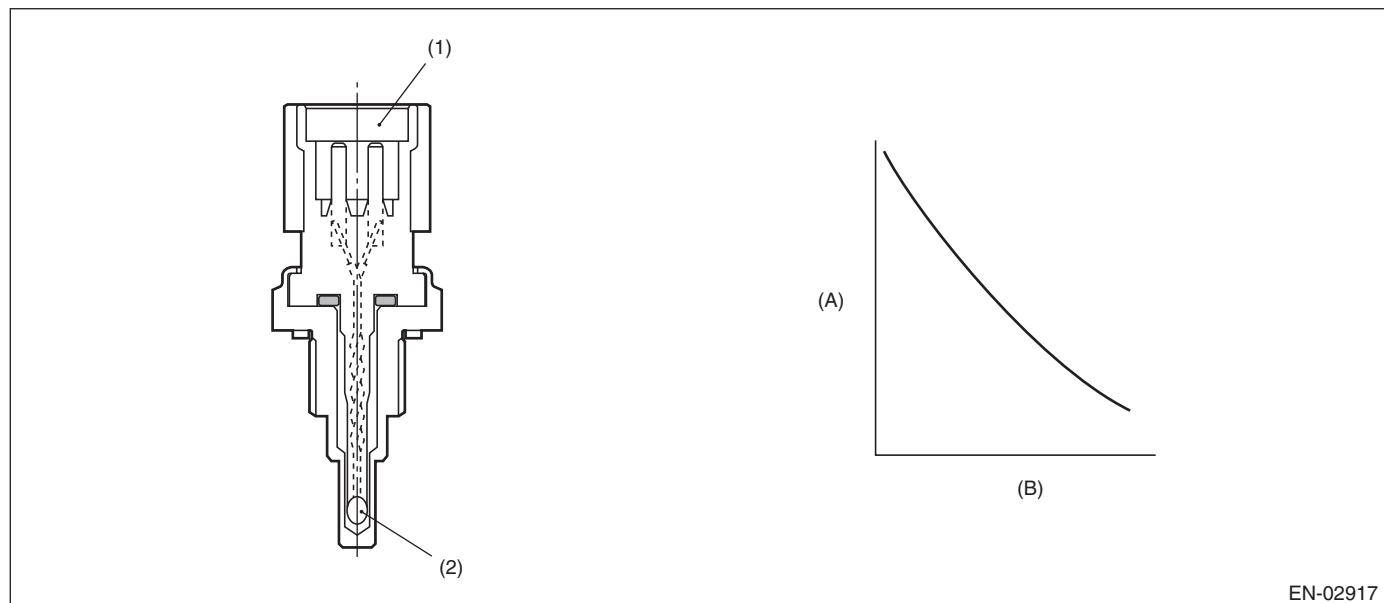
AF:DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of the engine coolant temperature sensor characteristics.

When the ignition is ON after the specified period of soaking time has elapsed, compare the engine coolant temperature with intake air temperature. Judge as NG if the difference between two temperatures is larger than the predetermined value and the engine coolant temperature becomes the specified value or more.

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
Battery voltage	≥ 10.9 V
Soaking time	≥ 21600 s
Engine coolant temperature at the last engine stop	≥ Value from Map

Map

Estimate ambient temperature °C (°F)	-7 (19.4)	8 (46.4)	10 (50)	25 (77)
Engine coolant temperature at the last engine stop °C (°F)	70.2 (158.4)	75.8 (168.4)	75.8 (168.4)	75.8 (168.4)

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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
All of the following conditions are established.	
Engine coolant temperature – intake air temperature	> 15°C (27°F)
Engine coolant temperature	> 45 °C (113 °F)

Time Needed for Diagnosis: 512 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
When any one of the followings is established.	
Engine coolant temperature – intake air temperature	≤ 15°C (27°F)
Engine coolant temperature	≤ 45 °C (113 °F)

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

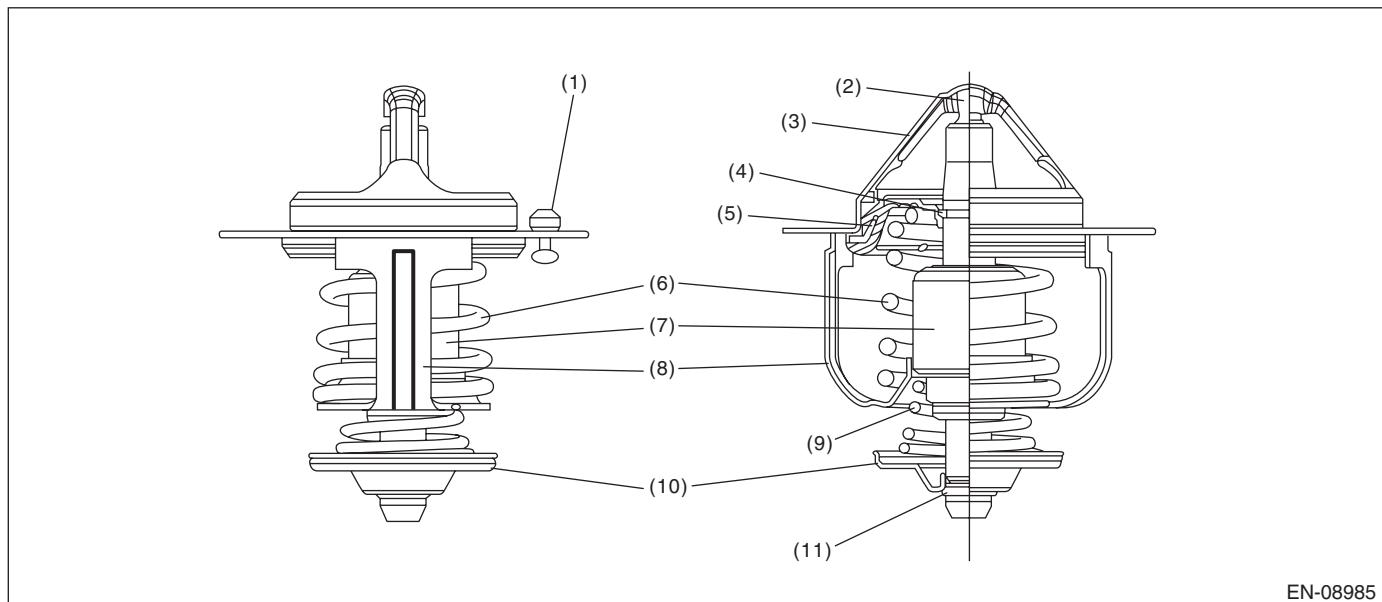
1. OUTLINE OF DIAGNOSIS

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

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)	75.8 (168.4)	75.8 (168.4)	75.8 (168.4)

Map 3

Engine coolant temperature at engine starting °C (°F)	-7 (19.4)	10 (50)	25 (77)	49.6 (121.3)
Estimated coolant temperature °C (°F)	52.3 (126.1)	59.4 (138.9)	65.5 (149.9)	75.8 (168.4)

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once after starting the engine.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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)	16.7 (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)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
All of the following conditions are established.	
<Judgment 1>	
Actual engine coolant temperature and Σ (Estimated engine coolant temperature – actual engine coolant temperature)	\geq Value of Map 4 \leq Value of Map 5
<Judgment 2>	
Actual engine coolant temperature and Σ (Estimated engine coolant temperature – actual engine coolant temperature)	\geq Regulated temperature – Value of Map 6 \leq Value of Map 7
<Judgment 3>	
Estimated engine coolant temperature – actual engine coolant temperature and Σ (Estimated engine coolant temperature – actual engine coolant temperature) and Actual engine coolant temperature	\leq Value of Map 8 \leq Value of Map 9 \geq Regulated temperature – Value of Map 10

Map 10

Estimate ambient temperature °C (°F)	-7 (19.4)	8 (46.4)	10 (50)	25 (77)
Threshold Value °C (°F)	16.7 (30.1)	11.1 (20)	11.1 (20)	11.1 (20)

Time Needed for Diagnosis: 300 — 700 seconds

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

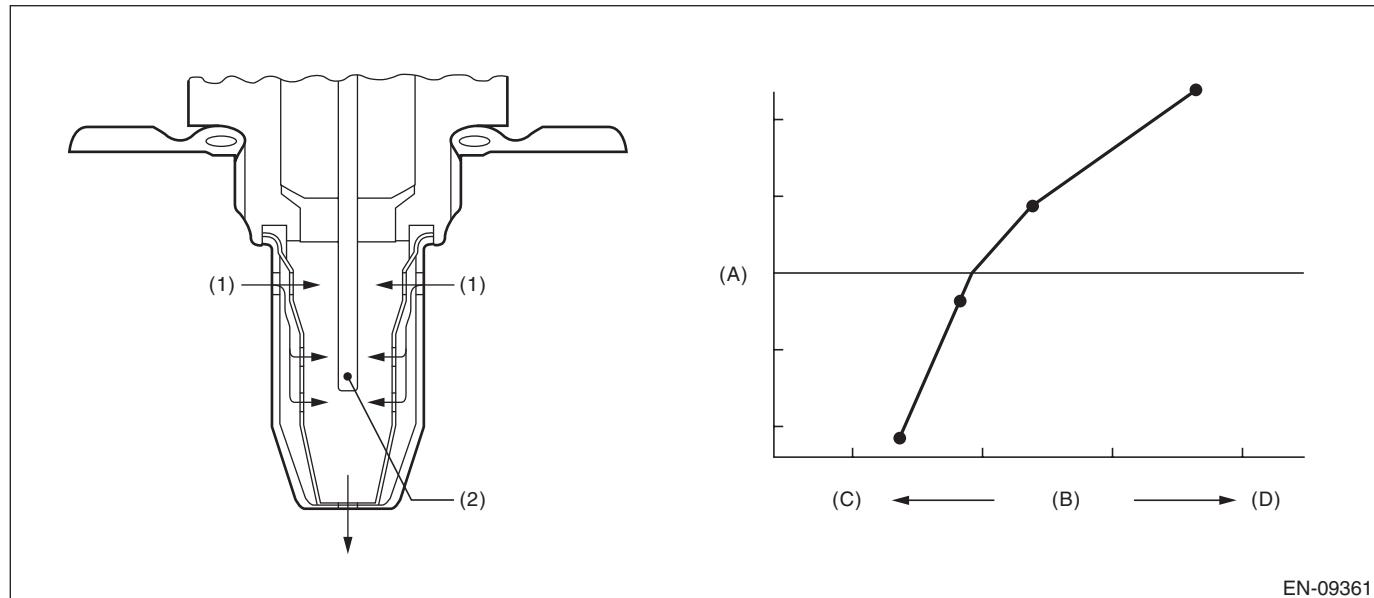
AH:DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1)

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) Rich

(B) Air fuel ratio
(2) ZrO_2

(C) Lean

(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

• Abnormality Judgment

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
Input voltage (+)	< 1.128 V
or	
Input voltage (-)	< 0.23 V
or	
$ Input\ voltage\ (+) - Input\ voltage\ (-) $	< 0.573 V

Time Needed for Diagnosis:

Input voltage (+): 1000 ms

Input voltage (-): 1000 ms

$|Input\ voltage\ (+) - Input\ voltage\ (-)|$: 1000 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Input voltage (+)	$\geq 1.128\ V$
Input voltage (-)	$\geq 0.23\ V$
$ Input\ voltage\ (+) - Input\ voltage\ (-) $	$\geq 0.573\ V$

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

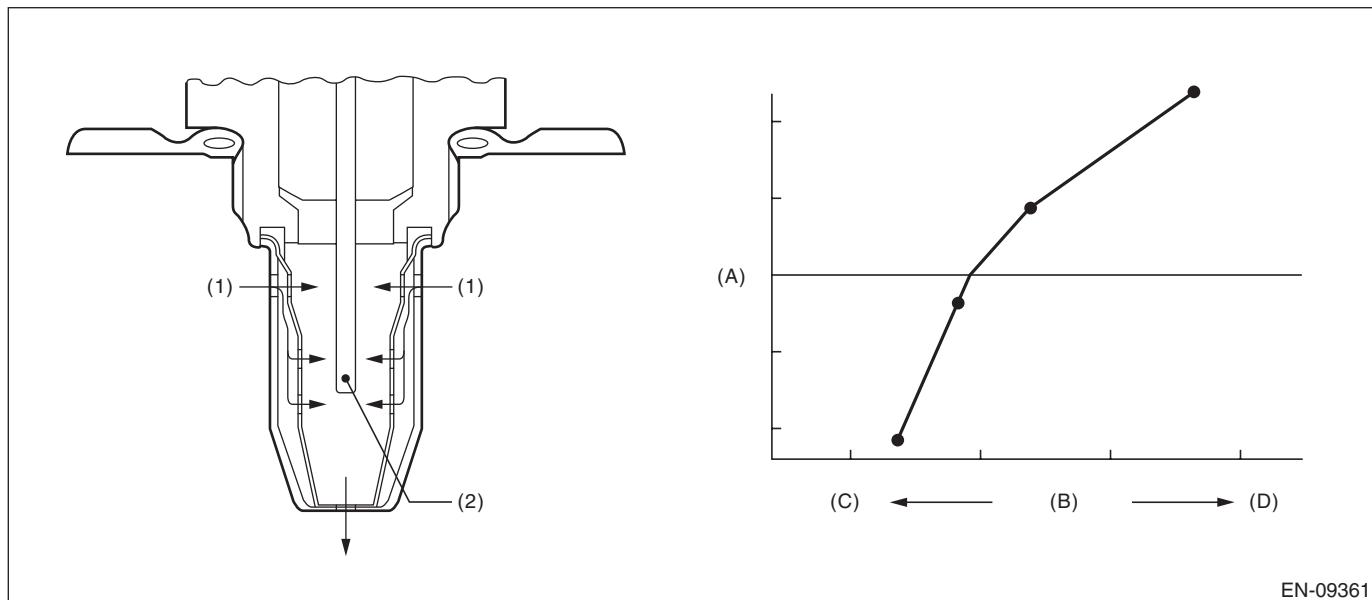
AI: DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1)

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) Rich

(B) Air fuel ratio
(2) ZrO_2

(C) Lean

(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

• Abnormality Judgment

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
Input voltage (+)	> 3.589 V
or	
Input voltage (-)	> 3.599 V

Time Needed for Diagnosis:

Input voltage (+): 1000 ms

Input voltage (-): 1000 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Input voltage (+)	\leq 3.589 V
Input voltage (-)	\leq 3.599 V

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

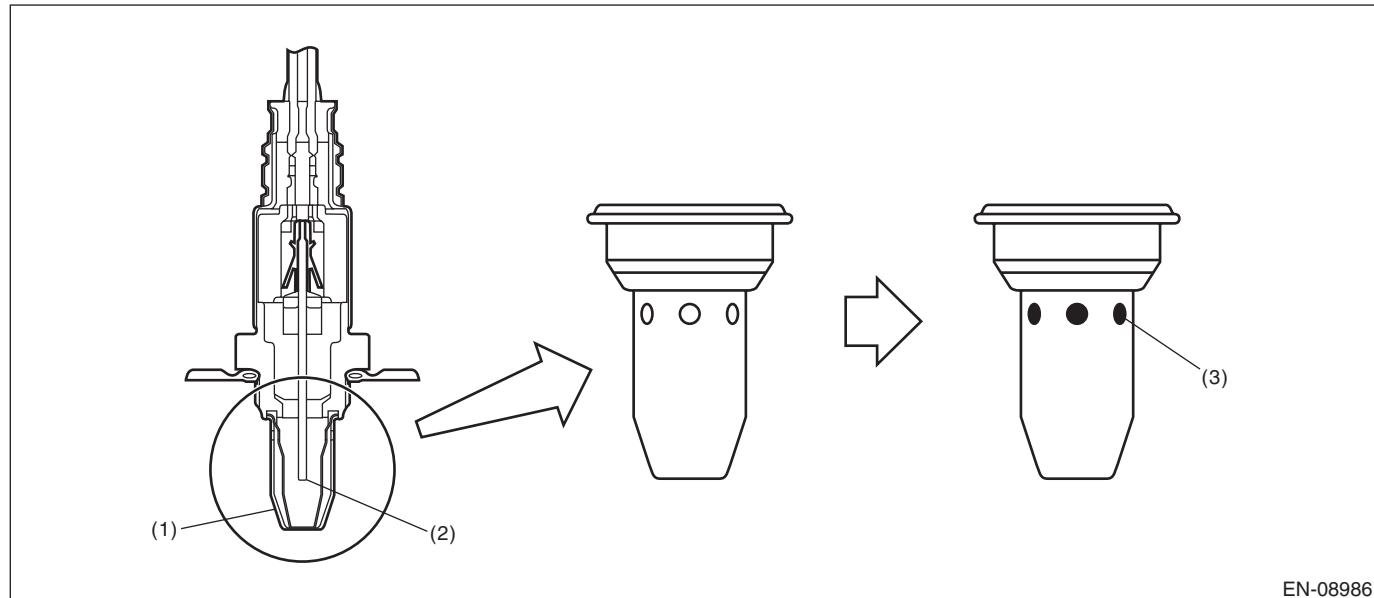
AJ:DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

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

Front oxygen (A/F) sensor cover has some ventilation holes for exhaust gas. Clogged ventilation holes are diagnosed.

When the holes are clogged, the A/F output variation becomes slow comparing with the actual A/F variation because oxygen which reaches the zirconia layer is insufficient. Therefore, if the sensor cover holes are clogged, the rich to lean judgment in the ECM is delayed when the actual change from rich to lean occurs. Judge as NG when the actual movement in comparison to the ECM control amount is slow.



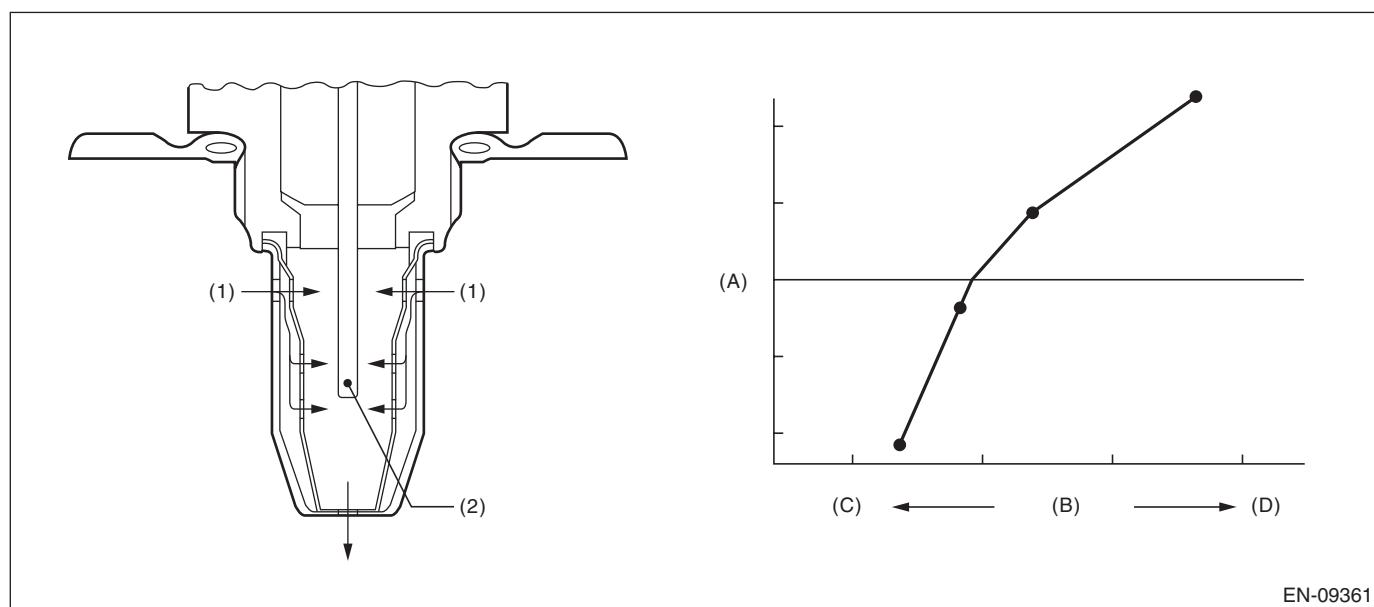
EN-08986

(1) Cover

(2) Zirconia

(3) Clogging

2. COMPONENT DESCRIPTION



EN-09361

(A) Electromotive force

(B) Air fuel ratio

(C) Lean

(D) Rich

(1) Exhaust gas

(2) ZrO₂

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Time needed for all secondary parameters to be in enable conditions	≥ 1024 ms
Battery voltage	≥ 10.9 V
Atmospheric pressure	> 75 kPa (563 mmHg, 22.2 inHg)
Closed loop control with main feedback	Operation
Front oxygen (A/F) sensor impedance	$0 \Omega - 50 \Omega$
Elapsed time after starting the engine	≥ 120000 ms
Engine coolant temperature	≥ 60 °C (140 °F)
Engine speed	1000 rpm — 10000 rpm
Vehicle speed	10 km/h — 200 km/h (6.2 MPH — 124.3 MPH)
Amount of intake air	10 g/s — 40 g/s (0.35 oz/s — 1.41 oz/s)
Engine load	< 0.02 g/rev (0 oz/rev)
Learning value of EVAP conc. during purge	< 0.24
Total time of operating canister purge	≥ 19.9 s

4. GENERAL DRIVING CYCLE

Perform diagnosis only once at a constant speed of 10 km/h — 200 km/h (6.2 MPH — 124.3 MPH) 120000 ms seconds or more after starting the engine.

5. DIAGNOSTIC METHOD

Calculate Δf difference every 32 ms × 4, and the λ value difference. Calculate the diagnostic value after calculating 820 time(s).

• Abnormality Judgment

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
$\text{parafca} = \text{td2faf}/\text{td2lmd}$ where, $\text{td2faf (N)} = \text{td2faf (n-1)} + \text{d2faf (n)} $ $\text{td2lmd (N)} = \text{td2lmd (n-1)} + \text{d2lmd (n)} $ add up to 32 ms × 4 × 820 time(s). $\text{d2faf (n)} = (\text{faf (n)} - \text{faf (n-1)}) - (\text{faf (n-1)} - \text{faf (n-2)})$ $\text{d2lmd (n)} = (\text{lmd (n)} - \text{lmd (n-1)}) - (\text{lmd (n-1)} - \text{lmd (n-2)})$ faf = main feedback compensation coefficient every 128 milliseconds lmd = output lambda every 128 milliseconds	> 0.45 (U5 model) > 0.9 (Except for U5 model)

Time Needed for Diagnosis: 32 ms × 4 × 820 time(s)

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
<p>parafca = $td2faf/td2lmd$ where, $td2faf (N) = td2faf (n-1) + d2faf (n)$ $td2lmd (N) = td2lmd (n-1) + d2lmd (n)$ add up to $32 \text{ ms} \times 4 \times 820$ time(s). $d2faf (n) = (faf (n) - faf (n-1)) - (faf (n-1) - faf (n-2))$ $d2lmd (n) = (lmd (n) - lmd (n-1)) - (lmd (n-1) - lmd (n-2))$ faf = main feedback compensation coefficient every 128 milliseconds lmd = output lambda every 128 milliseconds</p>	≤ 0.45 (U5 model) ≤ 0.9 (Except for U5 model)

Time Needed for Diagnosis: $32 \text{ ms} \times 4 \times 820$ time(s)

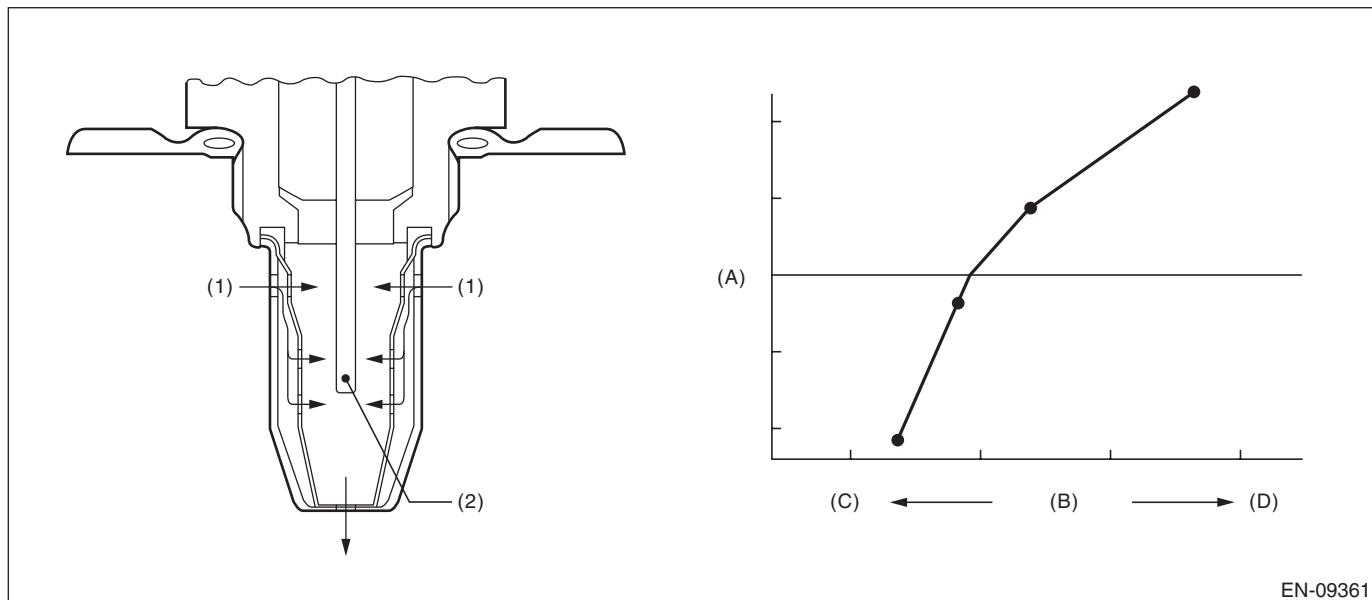
AK:DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1)

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) Rich

(B) Air fuel ratio
(1) Exhaust gas

(C) Lean

(2) ZrO₂

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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
Battery voltage	$\geq 10.9 \text{ V}$
Time of heater control duty at 70 % or more	$\geq 36000 \text{ ms}$
Front oxygen (A/F) sensor impedance.	$> 500 \Omega$

Time Needed for Diagnosis: 5000 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9 \text{ V}$
Front oxygen (A/F) sensor impedance.	$\leq 500 \Omega$

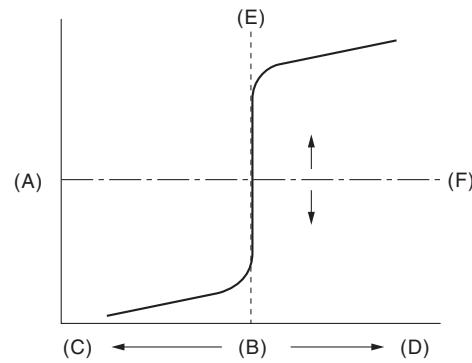
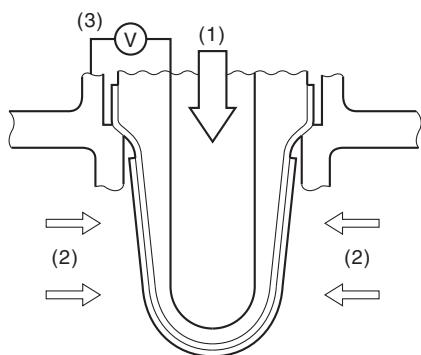
Time Needed for Diagnosis: Less than 1 second

AL: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) Rich
(D) Lean	(E) Theoretical air fuel ratio	(F) Comparative voltage
(1) Atmosphere	(2) Exhaust gas	(3) Electromotive force

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITION

Used for abnormality judgment

Secondary Parameters	Enable Conditions
High Secondary air system Closed loop control at the oxygen sensor Misfire detection every 200 rotations Front oxygen (A/F) sensor compensation coefficient Battery voltage Engine coolant temperature	Not in operation In operation < 65535 time(s) Not in limit value ≥ 10.9 V ≥ 60 °C (140 °F)
Low (1) Secondary air system Closed loop control at the oxygen sensor Misfire detection every 200 rotations Front oxygen (A/F) sensor compensation coefficient Battery voltage Engine coolant temperature Amount of intake air	Not in operation In operation < 65535 time(s) Not in limit value ≥ 10.9 V ≥ 60 °C (140 °F) ≥ 10 g/s (0.35 oz/s)
Low (2) Secondary air system Closed loop control at the oxygen sensor Misfire detection every 200 rotations Front oxygen (A/F) sensor compensation coefficient Battery voltage Engine coolant temperature Amount of intake air Current continuation time of the rear oxygen sensor heater	Not in operation In operation < 65535 time(s) Not in limit value ≥ 10.9 V ≥ 60 °C (140 °F) < 10 g/s (0.35 oz/s) ≥ 30000 ms
Low (3) Secondary air system Closed loop control at the oxygen sensor Misfire detection every 200 rotations Front oxygen (A/F) sensor compensation coefficient Battery voltage Engine coolant temperature Amount of intake air Current continuation time of the rear oxygen sensor heater Fuel cut	Not in operation In operation < 65535 time(s) Not in limit value ≥ 10.9 V ≥ 60 °C (140 °F) < 10 g/s (0.35 oz/s) ≥ 30000 ms Experienced

Used for normality judgment

Secondary Parameters	Enable Conditions
Secondary air system	Not in operation
Closed loop control at the oxygen sensor	In operation
Misfire detection every 200 rotations	< 65535 time(s)
Front oxygen (A/F) sensor compensation coefficient	Not in limit value
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ 60 °C (140 °F)

4. GENERAL DRIVING CYCLE

After starting the engine, continuously perform the diagnosis with the same engine condition.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Low (3): Value from Map

Map

Fuel cut time (ms)	0	2000	10000
Time Needed for Diagnosis (ms)	40000	40000	60000

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
High Sensor output voltage	$\leq 1.2 \text{ V}$	P0138
Low Sensor output voltage	$\geq 0.03 \text{ V}$	P0137

Time Needed for Diagnosis:

High: Less than 1 second

Low (1): Less than 1 second

Low (2): Less than 1 second

Low (3): Less than 1 second

AM: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)-75, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

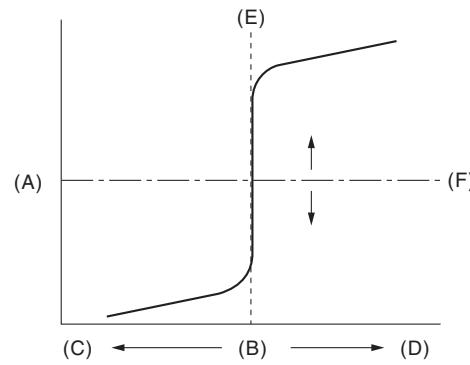
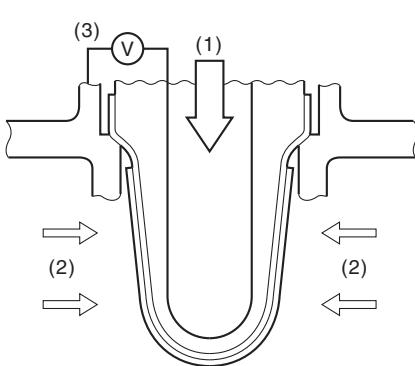
1. OUTLINE OF DIAGNOSIS

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

3. ENABLE CONDITIONS

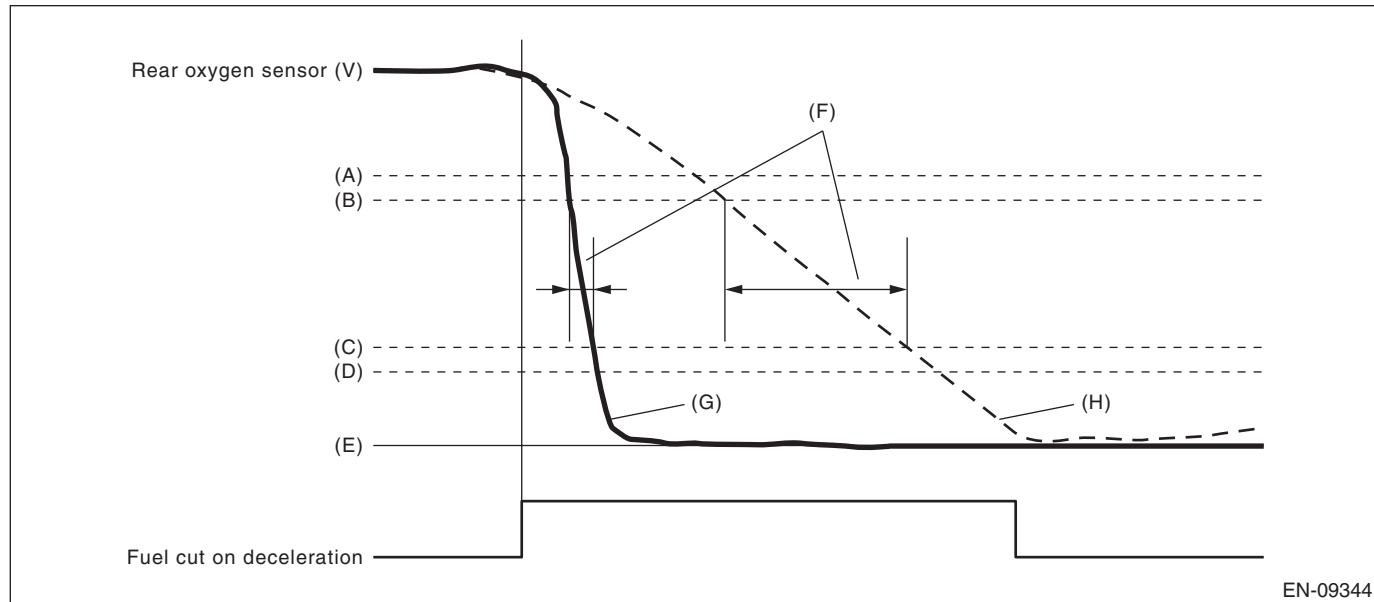
Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Rear oxygen sensor closed loop control	Operation
Current calculation time of the rear oxygen sensor heater after starting	≥ 180000 ms
Engine speed when fuel cut starts	≥ 1400 rpm
Rear oxygen sensor voltage when fuel cut starts	≥ 0.55 V
Fuel cut time	≥ 5000 ms
Engine coolant temperature when fuel cut starts	≥ 60 °C (140 °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.

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	

• Abnormality Judgment

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: 10 seconds

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

• Normality Judgment

Judge as OK and clear the NG if 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.	\leq 491 ms

Time Needed for Diagnosis: 10 seconds

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

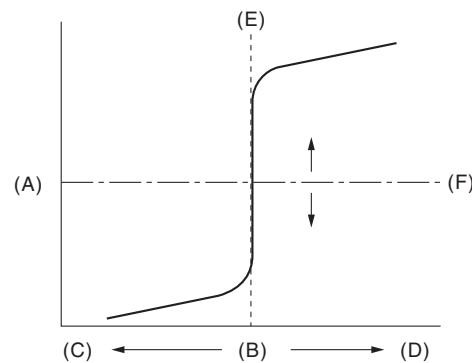
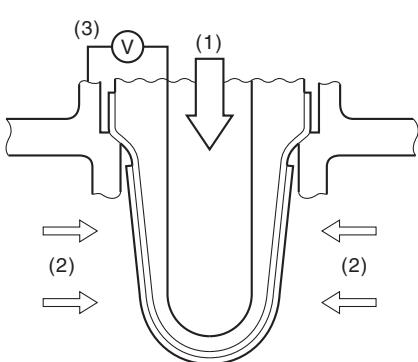
1. OUTLINE OF DIAGNOSIS

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) Rich
(D) Lean	(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
Rear oxygen sensor closed loop control	Operation
Fuel cut time	≥ 5000 ms

4. GENERAL DRIVING CYCLE

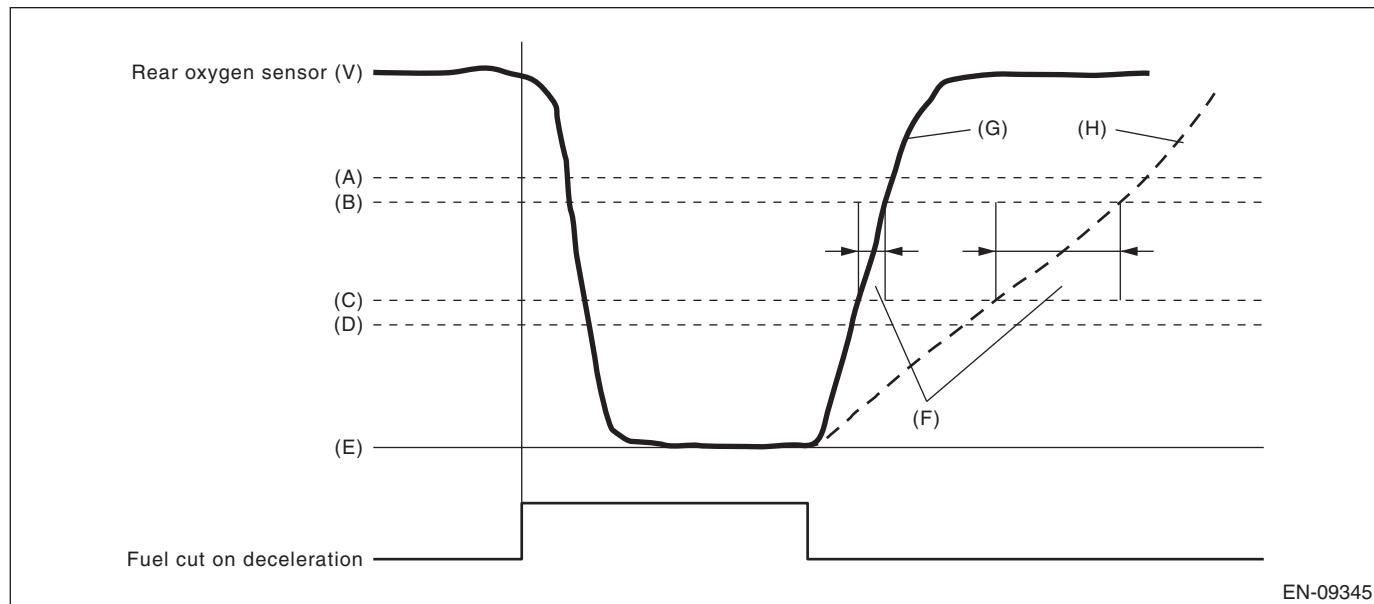
Perform diagnosis only once after recovering from a deceleration fuel cut continued for more than predetermined time.

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.



(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	

• Abnormality Judgment

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: 10 seconds

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

• Normality Judgment

Judge as OK and clear the NG if 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.	\leq 4000 ms

Time Needed for Diagnosis: 10 seconds

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

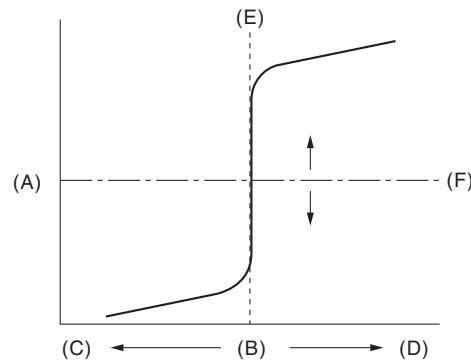
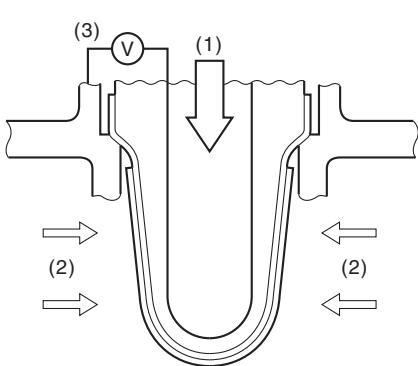
1. OUTLINE OF DIAGNOSIS

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

3. ENABLE CONDITIONS

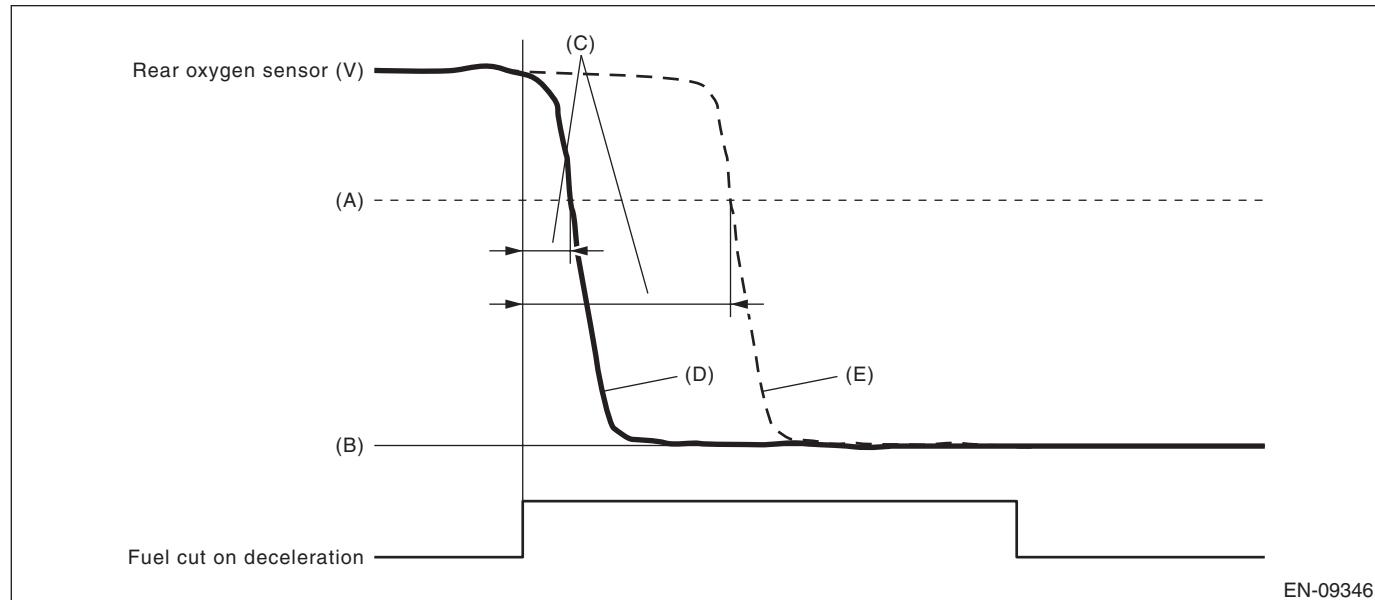
Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Rear oxygen sensor closed loop control	Operation
Engine speed when fuel cut starts	≥ 1400 rpm
Rear oxygen sensor voltage when fuel cut starts	≥ 0.55 V
Fuel cut time	≥ 5000 ms
Engine coolant temperature when fuel cut starts	≥ 60 °C (140 °F)
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.

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

• Abnormality Judgment

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: 10 seconds

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

• Normality Judgment

Judge as OK and clear the NG if 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: 10 seconds

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

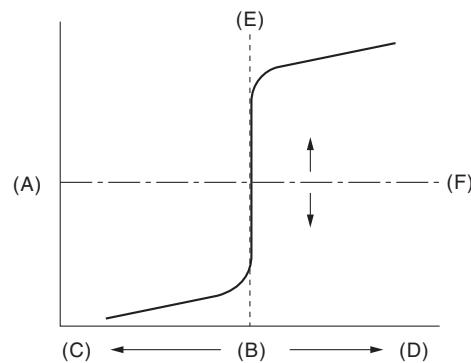
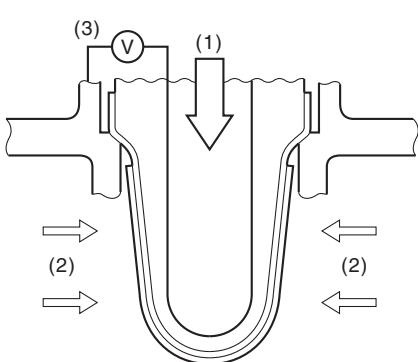
1. OUTLINE OF DIAGNOSIS

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

3. ENABLE CONDITIONS

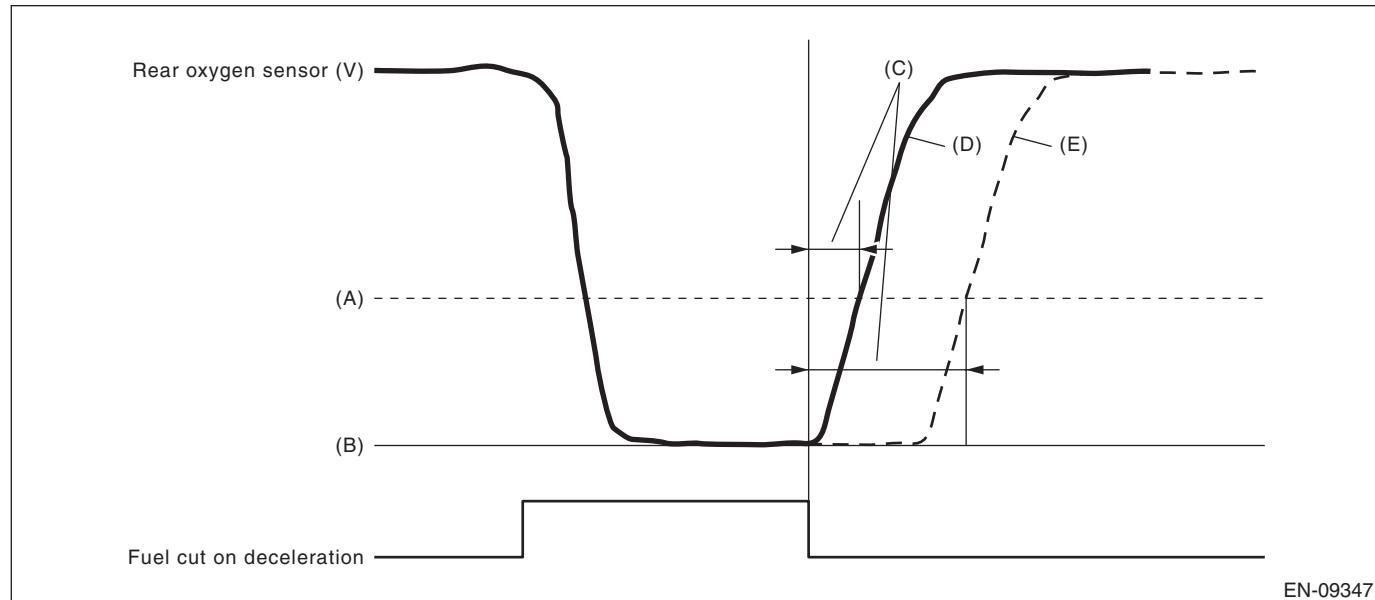
Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Rear oxygen sensor closed loop control	Operation
Engine speed	≥ 500 rpm
Rear oxygen sensor voltage when fuel cut has completed	< 0.15 V
Fuel cut time	≥ 5000 ms
Engine coolant temperature when fuel cut has completed	≥ 60 °C (140 °F)
Estimated 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.

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.



(A) 0.3 V

(D) Normal

(B) 0 V

(E) Malfunction

(C) Diagnostic parameter

• Abnormality Judgment

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: 10 seconds

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

• Normality Judgment

Judge as OK and clear the NG if 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: 10 seconds

Diagnostic Trouble Code (DTC) Detecting Criteria

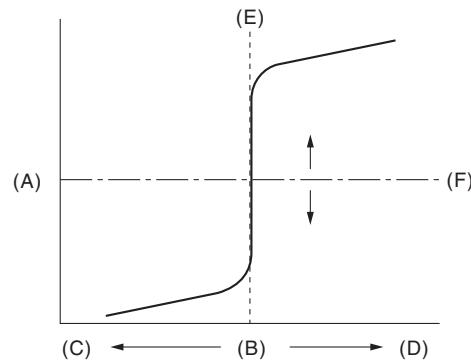
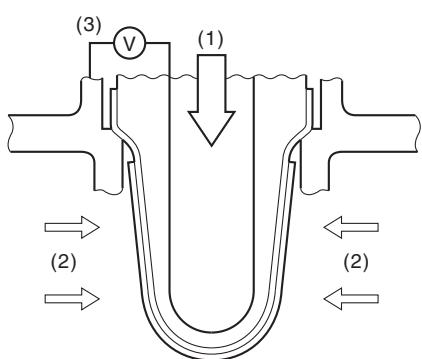
GENERAL DESCRIPTION

AR:DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK1 SENSOR2)

1. OUTLINE OF DIAGNOSIS

Detect the rear oxygen sensor open or short circuit. Judge as NG when the rear oxygen sensor voltage can be determined to be abnormal considering conditions such as intake air amount, engine coolant temperature, main feedback control and deceleration fuel cut.

2. COMPONENT DESCRIPTION



EN-01696

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

3. ENABLE CONDITION (USED ONLY FOR MALFUNCTION JUDGMENT)

Secondary Parameters	Enable Conditions
Closed loop control at the rear oxygen sensor	In operation
Target output voltage of rear oxygen sensor	$\geq 0.55 \text{ V} + 0.05 \text{ V}$
Amount of intake air	$\geq 10 \text{ g/s} (0.35 \text{ oz/s})$
Engine coolant temperature	$\geq 60^\circ \text{C} (140^\circ \text{F})$
Misfire detection every 200 rotations	< 65535 time(s)
Front oxygen (A/F) sensor compensation coefficient	Not in limit value
Battery voltage	$\geq 10.9 \text{ V}$
Deceleration fuel cut of 5000 ms or more.	Experienced

4. GENERAL DRIVING CYCLE

Perform the diagnosis once after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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
Minimum output voltage or Maximum output voltage	> 0.15 V < 0.55 V

Time Needed for Diagnosis: 200000 ms

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

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Diagnosis of the rear oxygen sensor voltage low side	Incomplete
Minimum output voltage	≤ 0.15 V
Maximum output voltage	≥ 0.55 V

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

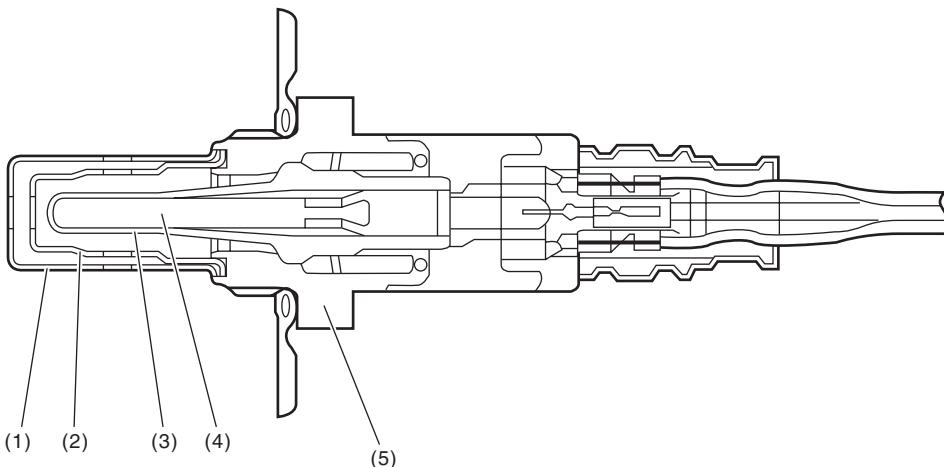
AS:DTC P0141 O2 SENSOR HEATER CIRCUIT (BANK1 SENSOR2)

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	$\geq 10.9 \text{ V}$
Elapsed time after starting the engine	$\geq 1000 \text{ ms}$
Engine coolant temperature	$\geq 60 \text{ }^{\circ}\text{C} (140 \text{ }^{\circ}\text{F})$
A/F sensor element impedance	$\leq 50 \Omega$
A/F sensor heater control duty	$\leq 75 \%$
Rear oxygen sensor heater control duty	$< 70 \%$

4. GENERAL DRIVING CYCLE

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

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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 terminal for heater characteristics failure detection	Low

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

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output terminal for heater characteristics failure detection	High

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

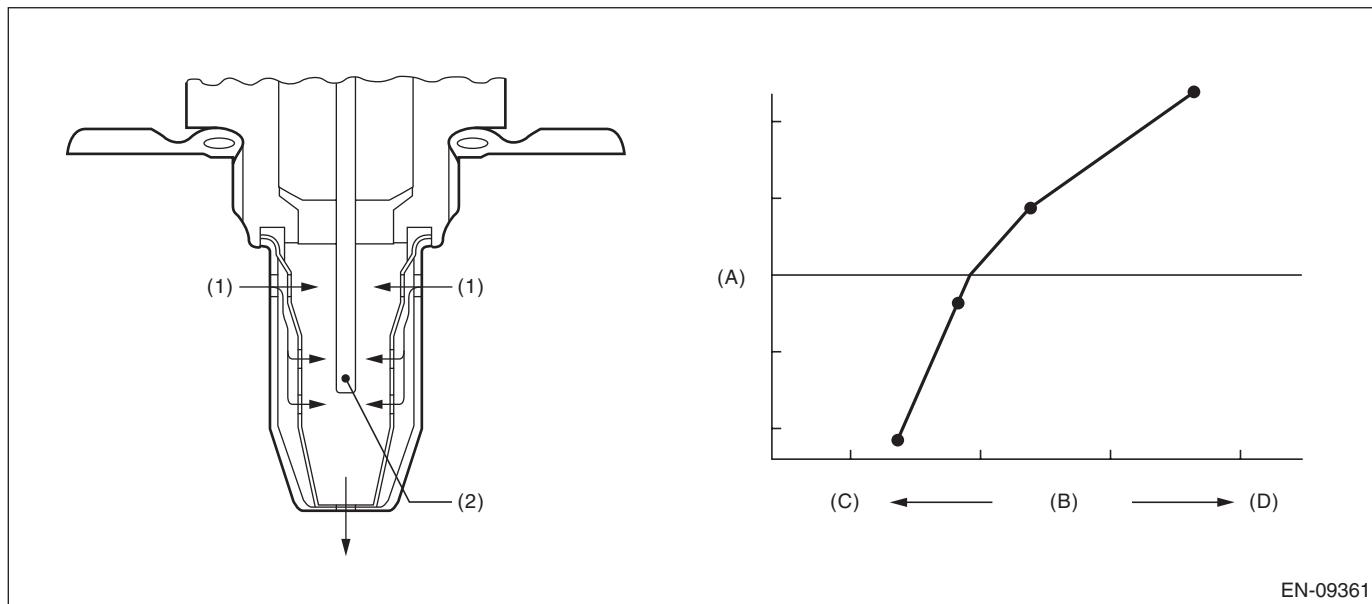
AT:DTC P014C O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1)

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
(D) Rich

(B) Air fuel ratio

(C) Lean

(1) Exhaust gas

(2) ZrO_2

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Closed loop control with main feedback	Operation
Front oxygen (A/F) sensor impedance	$\geq 0 \Omega$ and $< 50 \Omega$
Elapsed time after starting the engine	$\geq 40000 \text{ ms}$
Engine coolant temperature	$\geq 0^\circ\text{C}$ (32°F)
Engine speed	$\geq 1000 \text{ rpm}$
Amount of intake air	$\geq 10 \text{ g/s}$ (0.35 oz/s)
After fuel cut	$\geq 3000 \text{ ms}$
Learning value of EVAP conc. during purge	< 0.24
Total time of operating canister purge	$\geq 20 \text{ s}$
Engine load change	$< 0.02 \text{ g/rev}$ (0 oz/rev)
Idle switch	OFF

4. GENERAL DRIVING CYCLE

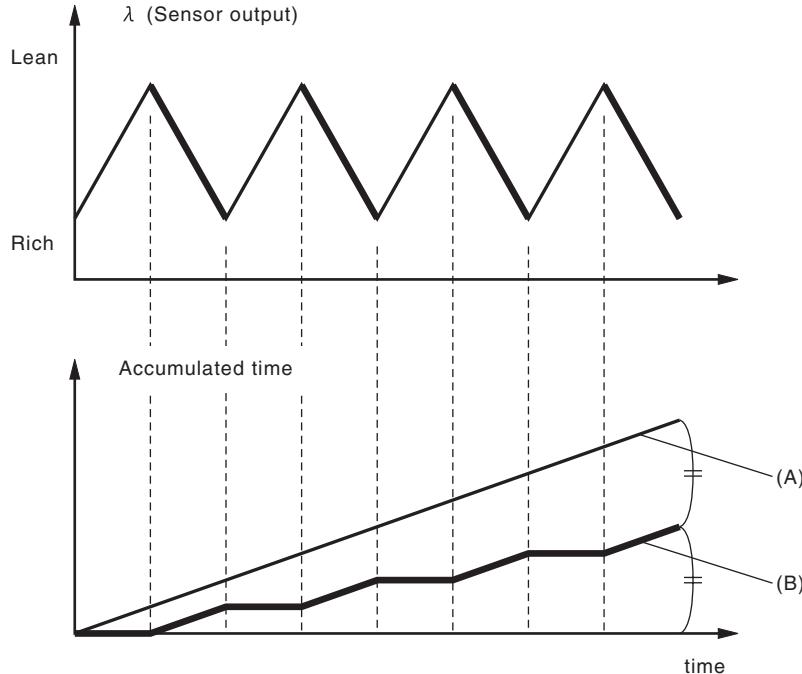
Perform diagnosis only once in a city driving including normal acceleration and deceleration.

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

• Abnormality Judgment

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
	> 0.63	P014D

Time Needed for Diagnosis: 90 seconds

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

• Normality Judgment

Judge as OK and clear the NG if 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
	≤ 0.63	P014D

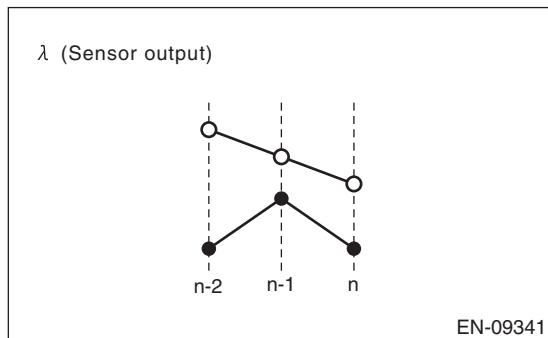
Time Needed for Diagnosis: 90 seconds

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.



EN-09341

• Abnormality Judgment

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 $\Sigma (\lambda(n) - \lambda(n-1)) - (\lambda(n-1) - \lambda(n-2)) $	< Value from Map	P014C and P014D

Map (U5 model)

Cumulative value obtained from the amount of variation in λ $\Sigma \lambda(n) - \lambda(n-1) $	0.00	4.00
Cumulative value obtained from the amount of variation in λ change	0.50	2.00

Map (Except for U5 model)

Cumulative value obtained from the amount of variation in λ $\Sigma \lambda(n) - \lambda(n-1) $	0.00	3.00
Cumulative value obtained from the amount of variation in λ change	0.50	2.00

Time Needed for Diagnosis: 90 seconds

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

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

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

Time Needed for Diagnosis: 90 seconds

AU: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)-90, DTC P014C O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

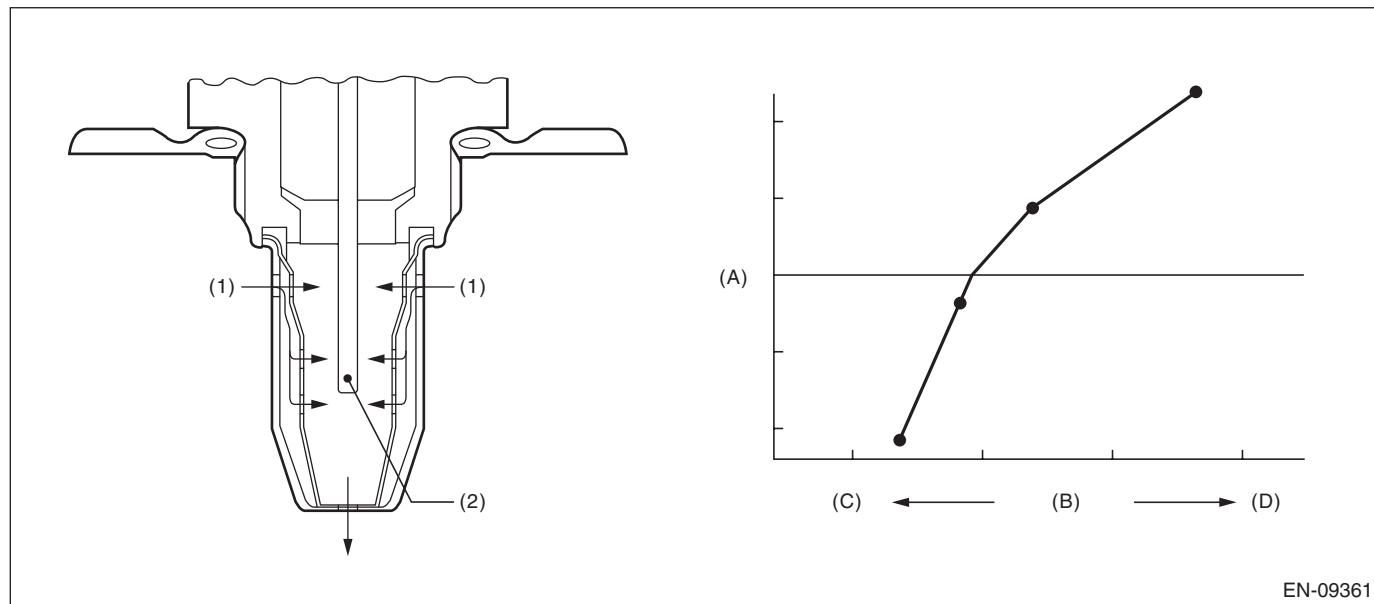
AV:DTC P015A O2 SENSOR DELAYED RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1)

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
(D) Rich

(B) Air fuel ratio

(C) 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
Front oxygen (A/F) sensor impedance	$\geq 0 \Omega$ and $< 50 \Omega$
Elapsed time after starting the engine	$\geq 40000 \text{ ms}$
Engine coolant temperature	$\geq 0^\circ \text{C}$ (32°F)
Engine speed	$\geq 1000 \text{ rpm}$
Amount of intake air	$\geq 10 \text{ g/s}$ (0.35 oz/s)
After fuel cut	$\geq 3000 \text{ ms}$
Learning value of EVAP conc. during purge	< 0.24
Total time of operating canister purge	$\geq 20 \text{ s}$
Engine load change	$< 0.02 \text{ g/rev}$ (0 oz/rev)
Idle switch	OFF

4. GENERAL DRIVING CYCLE

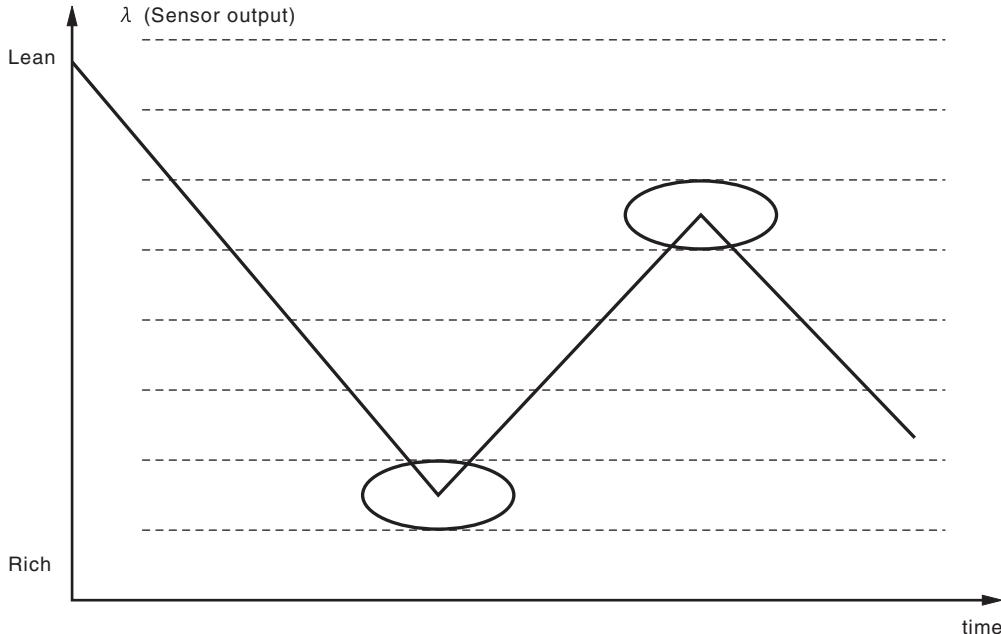
Perform diagnosis only once in a city driving including normal acceleration and deceleration.

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

• Abnormality Judgment

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.	> 100 ms (U5 model) > 220 ms (Except for U5 model)	P015A
Average value of time necessary for λ to inverse the air fuel ratio to Rich \rightarrow Lean \rightarrow Rich.	> 240 ms (U5 model) > 600 ms (Except for U5 model)	P015B

Time Needed for Diagnosis: 50 times of inversion

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

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

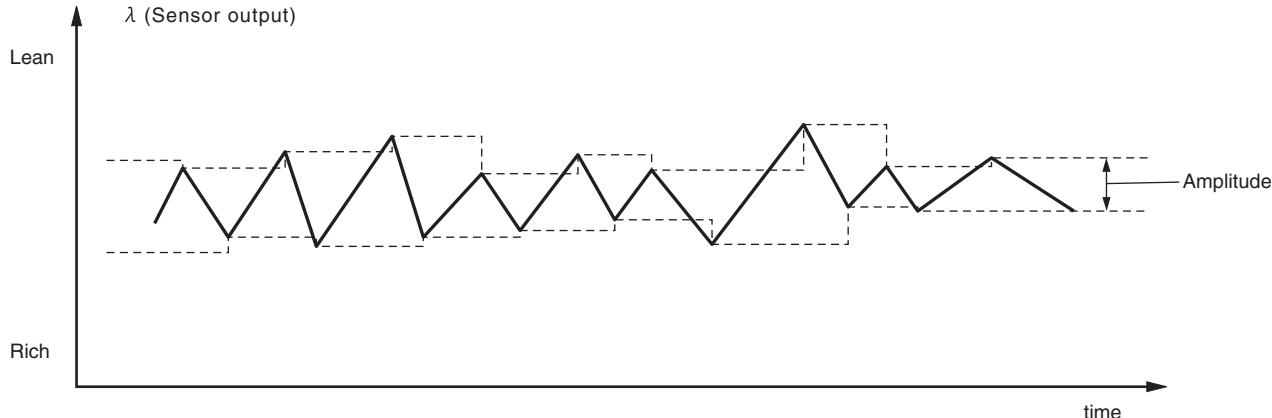
Judgment Value

Malfunction Criteria	Threshold Value	DTC
Average value of time necessary for λ to inverse the air fuel ratio to Lean \rightarrow Rich \rightarrow Lean.	\leq 100 ms (U5 model) \leq 220 ms (Except for U5 model)	P015A
Average value of time necessary for λ to inverse the air fuel ratio to Rich \rightarrow Lean \rightarrow Rich.	\leq 240 ms (U5 model) \leq 600 ms (Except for U5 model)	P015B

Time Needed for Diagnosis: 50 times of inversion

6. DIAGNOSTIC METHOD 2

Detect the malfunction by calculating the average amplitude of λ .



EN-09343

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Average value for λ amplitude	> 0.06 (U5 model) > 0.048 (Except for U5 model)	P015A and P015B

Time Needed for Diagnosis: 60 seconds

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

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Average value for λ amplitude	≤ 0.06 (U5 model) ≤ 0.048 (Except for U5 model)	P015A and P015B

Time Needed for Diagnosis: 60 seconds

AW: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)-93, 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

AX: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 learning system	In operation
Engine coolant temperature	$\geq 60^{\circ}\text{C}$ (140°F)
Engine load change	$< 0.02 \text{ g/rev}$ (0 oz/rev)
Engine load	\geq Value of Map 1

Map 1 (CVT model)

Engine speed (rpm)	Idling	600	1000	1500	2000	2500	3000	3500	4000	4500
Measured value (g (oz)/rev)	na	0.139 (0)	0.146 (0.01)	0.135 (0)	0.152 (0.01)	0.166 (0.01)	0.182 (0.01)	0.191 (0.01)	0.211 (0.01)	0.22 (0.01)

Map 1 (MT model)

Engine speed (rpm)	Idling	650	1000	1500	2000	2500	3000	3500	4000	4500
Measured value (g (oz)/rev)	na	0.136 (0)	0.138 (0)	0.127 (0)	0.13 (0)	0.146 (0.01)	0.151 (0.01)	0.168 (0.01)	0.182 (0.01)	0.188 (0.01)

3. GENERAL DRIVING CYCLE

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

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Compare the diagnostic value (fsobd) with the threshold value, and if a condition meeting the malfunction criteria below continues for $10 \text{ s} \times 5$ 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 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 (%)	1.4	1.4	1.332	1.25	1.25	1.25	1.25

Time Needed for Diagnosis: $10 \text{ s} \times 5$ time(s)

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
$fsobd = (sglmd - tglmda) + faf + flaf$	< 1.15

Time Needed for Diagnosis: 10 s

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

AY:DTC P0172 SYSTEM TOO RICH (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 learning system	In operation
Engine coolant temperature	$\geq 60^{\circ}\text{C}$ (140°F)
Engine load change	$\leq 0.02 \text{ g/rev}$ (0 oz/rev)
Learning value of EVAP conc.	< 0.2
Cumulative time of canister purge after engine start	$\geq 20 \text{ s}$
Continuous period after canister purge starting	$\geq 5000 \text{ ms}$
Engine load	$\geq \text{Value of Map 1}$

Map 1 (CVT model)

Engine speed (rpm)	Idling	600	1000	1500	2000	2500	3000	3500	4000	4500
Measured value (g (oz)/rev)	na	0.139 (0)	0.146 (0.01)	0.135 (0)	0.152 (0.01)	0.166 (0.01)	0.182 (0.01)	0.191 (0.01)	0.211 (0.01)	0.22 (0.01)

Map 1 (MT model)

Engine speed (rpm)	Idling	650	1000	1500	2000	2500	3000	3500	4000	4500
Measured value (g (oz)/rev)	na	0.136 (0)	0.138 (0)	0.127 (0)	0.13 (0)	0.146 (0.01)	0.151 (0.01)	0.168 (0.01)	0.182 (0.01)	0.188 (0.01)

3. GENERAL DRIVING CYCLE

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

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Compare the diagnostic value (fsobd) with the threshold value, and if a condition meeting the malfunction criteria below continues for $10\text{ s} \times 5$ 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	< Value of 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 (%)	0.6	0.6	0.668	0.735	0.735	0.735	0.735

Time Needed for Diagnosis: $10\text{ s} \times 5$ time(s)

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

• Normality Judgment

Judge as OK if the status that the criteria below are met continues for 10 seconds.

Judgment Value

Malfunction Criteria	Threshold Value
$\text{fsobd} = (\text{sglmd} - \text{tglmida}) + \text{faf} + \text{flaf}$	≥ 0.85

Time Needed for Diagnosis: 10 s

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

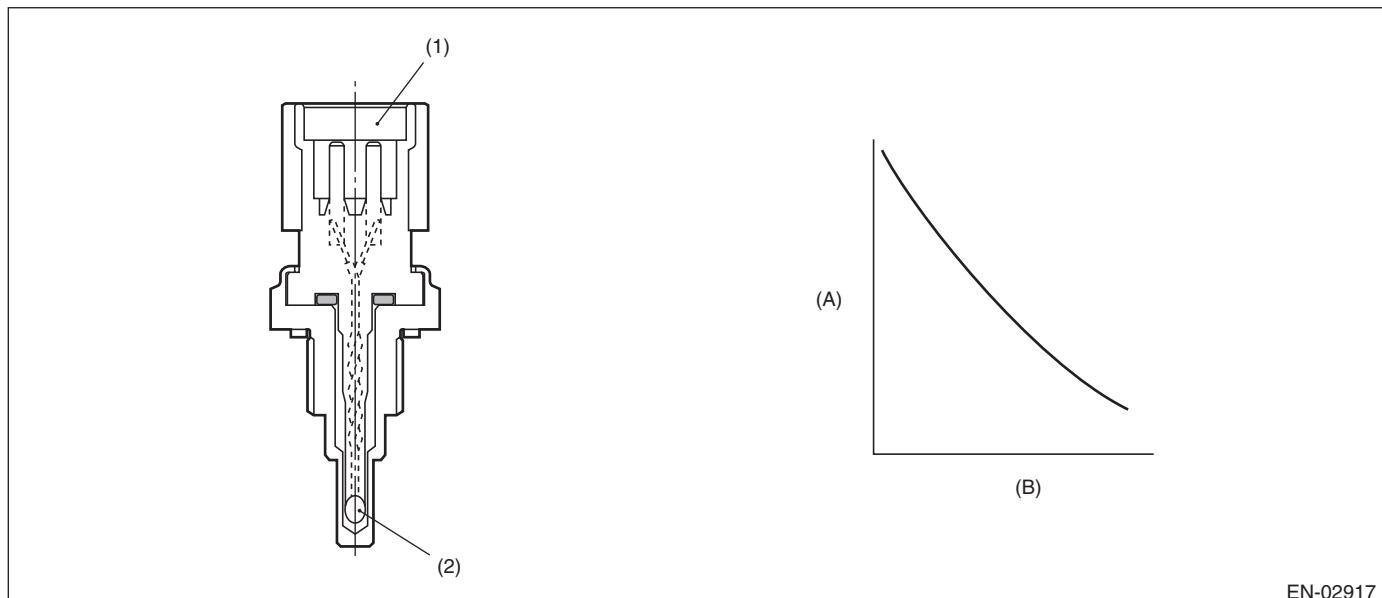
AZ:DTC P0196 ENGINE OIL TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect for abnormal values in the oil temperature sensor output properties.

Judge as NG when the oil temperature does not rise even though the engine is running under a condition where it should rise.

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
Battery voltage	≥ 10.9 V
Engine speed	≥ Value from Map

Map

Engine coolant temperature °C (°F)	-40 (-40)	-30 (-22)	-20 (-4)	-10 (14)	0 (32)	10 (50)	20 (68)	30 (86)
Engine speed rpm	500	500	500	500	500	500	500	500

Engine coolant temperature °C (°F)	40 (104)	50 (122)	60 (140)	70 (158)	80 (176)	90 (194)	100 (212)	110 (230)
Engine speed rpm	500	500	500	500	500	500	500	500

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Engine oil temperature	< 50 °C (122 °F)
After engine start oil temperature sensor characteristic diagnosis timer.	≥ Judgment value for after engine start oil temperature sensor characteristic diagnosis timer

After engine start oil temperature sensor characteristic diagnosis timer (timer for diagnosis).

- Timer stop at fuel cut
- During the driving conditions except a) above, timer counts up as follows.

64 ms + TOILCNT ms (when at 64 ms)

Where, TOILCNT is determined as follows,

TOILCNT = 0 at idle switch ON

For TOILCNT at Idle switch off, refer to the following table.

		Vehicle speed km/h (MPH)							
		0 (0)	8 (5)	16 (9.9)	24 (14.9)	32 (19.9)	40 (24.9)	48 (29.8)	56 (34.8)
Tempera- ture °C (°F)	-30 (-22)	39.8 ms	47.3 ms	55.9 ms	66.0 ms	79.7 ms	96.5 ms	117.8 ms	145.7 ms
	-20 (-4)	31.6 ms	38.6 ms	46.6 ms	56.0 ms	68.7 ms	84.7 ms	104.8 ms	131.3 ms
	-10 (14)	21.6 ms	27.9 ms	35.1 ms	43.6 ms	55.4 ms	70.1 ms	88.8 ms	113.6 ms
	0 (32)	11.8 ms	17.4 ms	23.9 ms	31.5 ms	42.3 ms	55.9 ms	73.3 ms	96.8 ms
	10 (50)	9.9 ms	15.4 ms	21.9 ms	29.5 ms	40.4 ms	54.5 ms	72.4 ms	97.4 ms

After engine start oil temperature characteristic diagnosis timer judgment value (t).

$t = 2402277 \text{ ms} - 55052 \text{ ms} \times Ti \quad (t \geq 2400000)$

Ti = The lowest coolant temperature after starting the engine.

Time Needed for Diagnosis: Less than 1 second

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

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Engine oil temperature	≥ 50 °C (122 °F)

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

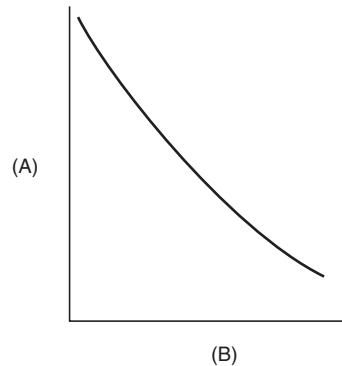
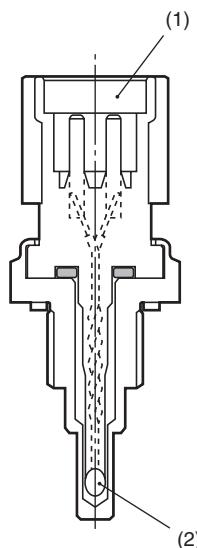
GENERAL DESCRIPTION

BA: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

• Abnormality Judgment

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	< 0.135 V

Time Needed for Diagnosis: 500 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 0.135 V

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

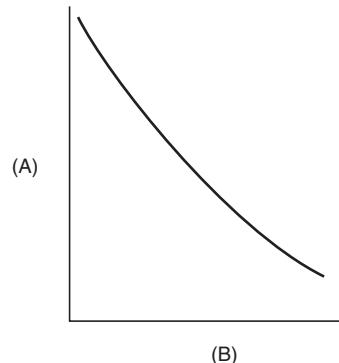
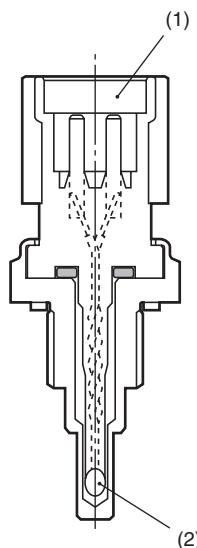
GENERAL DESCRIPTION

BB: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

• Abnormality Judgment

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	$\geq 4.876 \text{ V}$

Time Needed for Diagnosis: 500 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$< 4.876 \text{ V}$

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BC: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 time	≥ 1000 μ s and $< 120000000/\text{engine speed} - 1000$ μ s
Injection status	Not during fuel cut and Not during asynchronous injection controlled by crankshaft position sensor

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Injector driving IC information	Malfunction

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Injector driving IC information	Normal

Time Needed for Diagnosis: Less than 1 second

BD:DTC P0202 INJECTOR #2

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0201. <Ref. to GD(H4DO)-106, DTC P0201 INJECTOR #1, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BE:DTC P0203 INJECTOR #3

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0201. <Ref. to GD(H4DO)-106, DTC P0201 INJECTOR #1, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BF:DTC P0204 INJECTOR #4

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0201. <Ref. to GD(H4DO)-106, DTC P0201 INJECTOR #1, Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

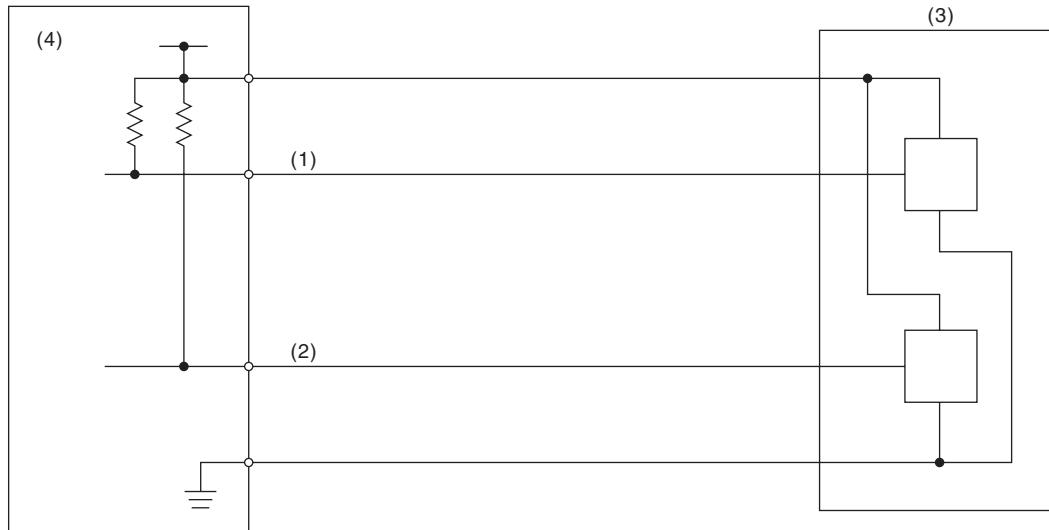
GENERAL DESCRIPTION

BG: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
Ignition switch	ON
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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	≤ 1.07 V

Time Needed for Diagnosis: 24 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	> 1.07 V

Time Needed for Diagnosis: 24 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

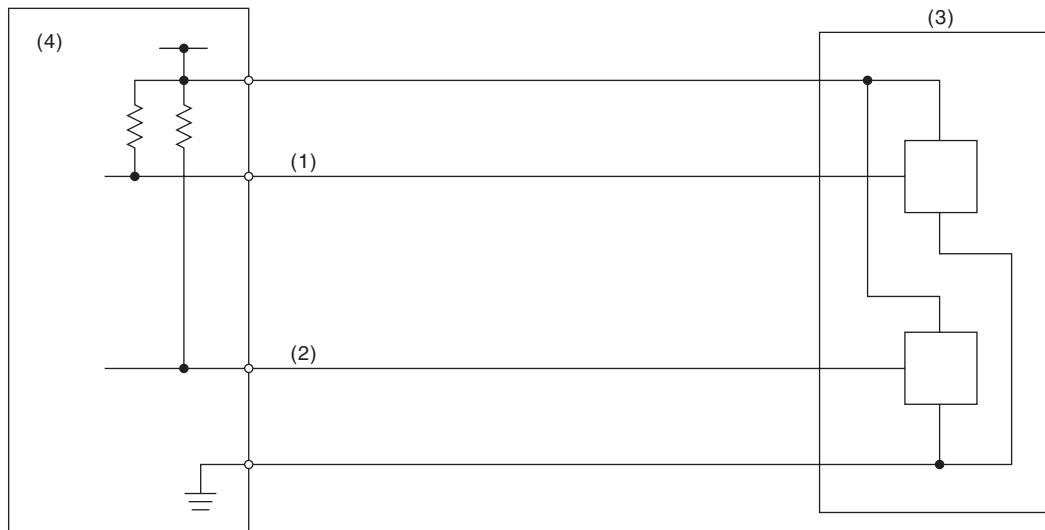
GENERAL DESCRIPTION

BH: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



(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
Ignition switch	ON
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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	≥ 4.858 V

Time Needed for Diagnosis: 24 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	< 4.858 V

Time Needed for Diagnosis: 24 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BI: 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	≥ 1024 ms
Intake manifold pressure change at 180°CA	$<$ Value of Map 1
Throttle position change during 16 milliseconds	$< 21^\circ$
Fuel shut-off function	Not in operation
Fuel level	≥ 8.25 l (2.18 US gal, 1.82 Imp gal)
Vehicle dynamic control or AT torque control	Not in operation
Evaporative system leak check	Not in operation
Engine speed	450 rpm — 6700 rpm (CVT model) 500 rpm — 6700 rpm (MT model)
Intake manifold pressure	\geq Value from Map 2
Battery voltage	≥ 8 V
Fuel parameter determination	Not extremely low volatility
Elapsed time after starting the engine	≥ 0 ms
Engine speed change during 32 milliseconds	< 1000 rpm

Map 1

- CVT model

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6300
kPa (mmHg, inHg)	26.7 (200, 7.9)												

- MT model

rpm	650	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6300
kPa (mmHg, inHg)	26.7 (200, 7.9)												

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Map 2 (CVT model)

- Normal ignition

	Barometric pressure (kPa (mmHg, inHg))								
	67.3 (505, 19.9)	72.5 (544, 21.4)	77.2 (579, 22.8)	80 (600, 23.6)	84 (630, 24.8)	87.3 (655, 25.8)	92.4 (693, 27.3)	100.4 (753, 29.6)	
Engine speed (rpm)	700	21.5 (161.6, 6.4)	20 (149.7, 5.9)	20.8 (155.7, 6.1)	21.2 (159.3, 6.3)	21.9 (164.4, 6.5)	22.5 (169.1, 6.7)	24.2 (181.6, 7.1)	25 (187.5547162, 7.4)
	1000	19.3 (144.8, 5.7)	19 (142.4, 5.6)	19.5 (146.4, 5.8)	20.1 (150.4, 5.9)	20.7 (155.5, 6.1)	21.3 (159.6, 6.3)	22.6 (169.3, 6.7)	23.4 (175.2864583, 6.9)
	1200	18.9 (141.8, 5.6)	18.8 (141.1, 5.6)	19.2 (144.4, 5.7)	19.7 (147.5, 5.8)	20.3 (152.0, 6)	21 (157.4, 6.2)	22.2 (166.5, 6.6)	23 (172.5247257, 6.8)
	1600	18.6 (139.5, 5.5)	19 (142.3, 5.6)	19.2 (144.2, 5.7)	19.8 (148.5, 5.8)	20.3 (152.3, 6)	21 (157.6, 6.2)	22 (165.1, 6.5)	22.9 (172.1126302, 6.8)
	2000	20.6 (154.8, 6.1)	21.1 (158.7, 6.2)	21.3 (159.6, 6.3)	22 (164.8, 6.5)	22.2 (166.2, 6.5)	23 (172.6, 6.8)	23.8 (178.6, 7)	25.1 (188.0311802, 7.4)
	2400	21 (157.4, 6.2)	21.2 (159.1, 6.3)	21 (157.7, 6.2)	21.7 (162.9, 6.4)	22.3 (167.1, 6.6)	24 (180.1, 7.1)	24.9 (186.7, 7.3)	26.4 (198.3294412, 7.8)
	2800	21.5 (161.5, 6.4)	21.9 (164.0, 6.5)	21.6 (162.0, 6.4)	22.3 (167.2, 6.6)	23.1 (173.4, 6.8)	24.1 (180.5, 7.1)	25.5 (191.4, 7.5)	26.6 (199.7301136, 7.9)
	3200	24.7 (185.3, 7.3)	25.6 (192.2, 7.6)	25.3 (189.7, 7.5)	25.6 (191.8, 7.6)	26.5 (198.7, 7.8)	27.3 (204.7, 8.1)	28.5 (213.8, 8.4)	29.3 (219.8410072, 8.7)
	3600	27.4 (205.9, 8.1)	28.4 (213.4, 8.4)	28.5 (213.8, 8.4)	28.7 (215.3, 8.5)	29.5 (221.0, 8.7)	30.6 (229.4, 9)	31.8 (238.3, 9.4)	32.4 (243.1353401, 9.6)
	4000	29.4 (220.3, 8.7)	29.8 (223.7, 8.8)	29.3 (219.7, 8.6)	29.9 (224.3, 8.8)	30.4 (228.4, 9)	31.9 (239.6, 9.4)	33.7 (253.0, 10)	33.1 (248.5103319, 9.8)
	4400	30.9 (232.1, 9.1)	31.4 (235.5, 9.3)	30.9 (231.5, 9.1)	31.5 (236.0, 9.3)	32 (240.2, 9.5)	33.5 (251.4, 9.9)	35.3 (264.7, 10.4)	34.7 (260.2750377, 10.2)
	4800	32.5 (243.9, 9.6)	33 (247.3, 9.7)	32.4 (243.2, 9.6)	33 (247.8, 9.8)	33.6 (251.9, 9.9)	35.1 (263.2, 10.4)	36.9 (276.5, 10.9)	36.3 (272.0397436, 10.7)
	5200	34.1 (255.6, 10.1)	34.5 (259.0, 10.2)	34 (255.0, 10)	34.6 (259.6, 10.2)	35.2 (263.7, 10.4)	36.6 (274.9, 10.8)	38.4 (288.3, 11.3)	37.8 (283.8044495, 11.2)
	5600	35.6 (267.4, 10.5)	36.1 (270.8, 10.7)	35.6 (266.8, 10.5)	36.2 (271.3, 10.7)	36.7 (275.5, 10.8)	38.2 (286.7, 11.3)	40 (300.0, 11.8)	39.4 (295.5691554, 11.6)
	6000	37.2 (279.2, 11)	37.7 (282.6, 11.1)	37.1 (278.5, 11)	37.7 (283.1, 11.1)	38.3 (287.2, 11.3)	39.8 (298.5, 11.8)	41.6 (311.8, 12.3)	41 (307.3338613, 12.1)
	6400	38.8 (290.9, 11.5)	39.2 (294.3, 11.6)	38.7 (290.3, 11.4)	39.3 (294.9, 11.6)	39.9 (299.0, 11.8)	41.4 (310.2, 12.2)	43.1 (323.6, 12.7)	42.5 (319.0985672, 12.6)
kPa (mmHg, inHg)									

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

- Idling ignition

		Barometric pressure (kPa (mmHg, inHg))							
		67.3 (505, 19.9)	72.5 (544, 21.4)	77.2 (579, 22.8)	80 (600, 23.6)	84 (630, 24.8)	87.3 (655, 25.8)	92.4 (693, 27.3)	100.4 (753, 29.6)
Engine speed (rpm)	700	21.2 (159.1, 6.3)	19.9 (149.2, 5.9)	20.6 (154.7, 6.1)	21.4 (160.5, 6.3)	21.9 (164.2, 6.5)	22.9 (172.0, 6.8)	23.9 (179.0, 7)	25 (187.3320497, 7.4)
	1000	19.7 (147.8, 5.8)	19.4 (145.8, 5.7)	20.1 (150.6, 5.9)	20.9 (156.7, 6.2)	21.5 (161.4, 6.4)	22 (165.1, 6.5)	23.2 (173.7, 6.8)	24.4 (183.0684408, 7.2)
	1200	19.3 (145.1, 5.7)	19 (142.7, 5.6)	19.7 (147.9, 5.8)	20.3 (152.3, 6)	21 (157.7, 6.2)	21.8 (163.4, 6.4)	22.9 (171.9, 6.8)	24.2 (181.8546978, 7.2)
	1600	19.1 (143.6, 5.7)	19.5 (146.4, 5.8)	20 (149.8, 5.9)	20.4 (153.4, 6)	21.1 (158.2, 6.2)	22.2 (166.4, 6.6)	23.4 (175.4, 6.9)	24.4 (182.9412842, 7.2)
	2000	20.3 (152.6, 6)	21 (157.9, 6.2)	21.4 (160.7, 6.3)	21.9 (164.7, 6.5)	22 (164.9, 6.5)	24 (180.2, 7.1)	25 (187.9, 7.4)	26.3 (197.0992606, 7.8)
	2400	20.6 (154.5, 6.1)	21.1 (158.6, 6.2)	21.4 (160.5, 6.3)	21.9 (164.3, 6.5)	22.4 (167.8, 6.6)	23.5 (176.3, 6.9)	24.5 (184.0, 7.2)	26.7 (200.5747223, 7.9)
	2800	20.9 (156.9, 6.2)	21.7 (162.8, 6.4)	21.6 (161.9, 6.4)	22.4 (167.8, 6.6)	23.1 (173.4, 6.8)	23.5 (176.0, 6.9)	25.3 (189.7, 7.5)	26.8 (201.3433838, 7.9)
	3200	26.2 (196.5, 7.7)	27.2 (203.8, 8)	25.3 (189.8, 7.5)	28.6 (214.8, 8.5)	29.2 (219.0, 8.6)	29.8 (223.4, 8.8)	31 (232.8, 9.2)	29.4 (220.8900259, 8.7)
	3600	27.9 (209.1, 8.2)	29.4 (220.4, 8.7)	28.7 (215.6, 8.5)	29.5 (221.6, 8.7)	30.3 (227.5, 9)	30.6 (229.2, 9)	33.2 (249.4, 9.8)	33.3 (250.1209122, 9.8)
	4000	29.3 (219.4, 8.6)	30.8 (230.9, 9.1)	29.6 (222.2, 8.7)	30.1 (225.5, 8.9)	31 (232.7, 9.2)	31.7 (237.9, 9.4)	34.4 (258.4, 10.2)	33.7 (252.8822955, 10)
	4400	30.8 (231.2, 9.1)	32.3 (242.7, 9.6)	31.2 (234.0, 9.2)	31.6 (237.3, 9.3)	32.6 (244.4, 9.6)	33.3 (249.7, 9.8)	36 (270.2, 10.6)	35.3 (264.6470014, 10.4)
	4800	32.4 (243.0, 9.6)	33.9 (254.4, 10)	32.8 (245.8, 9.7)	33.2 (249.1, 9.8)	34.2 (256.2, 10.1)	34.9 (261.5, 10.3)	37.6 (282.0, 11.1)	36.8 (276.4117073, 10.9)
	5200	34 (254.7, 10)	35.5 (266.2, 10.5)	34.3 (257.5, 10.1)	34.8 (260.8, 10.3)	35.7 (268.0, 10.5)	36.4 (273.2, 10.8)	39.2 (293.7, 11.6)	38.4 (288.1764131, 11.3)
	5600	35.5 (266.5, 10.5)	37.1 (278.0, 10.9)	35.9 (269.3, 10.6)	36.3 (272.6, 10.7)	37.3 (279.7, 11)	38 (285.0, 11.2)	40.7 (305.5, 12)	40 (299.941119, 11.8)
	6000	37.1 (278.3, 11)	38.6 (289.7, 11.4)	37.5 (281.1, 11.1)	37.9 (284.3, 11.2)	38.9 (291.5, 11.5)	39.6 (296.8, 11.7)	42.3 (317.2, 12.5)	41.6 (311.7058249, 12.3)
	6400	38.7 (290.0, 11.4)	40.2 (301.5, 11.9)	39 (292.8, 11.5)	39.5 (296.1, 11.7)	40.4 (303.3, 11.9)	41.1 (308.5, 12.1)	43.9 (329.0, 13)	43.1 (323.4705308, 12.7)

kPa (mmHg, inHg)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Map 2 (MT model)

- Normal ignition

		Barometric pressure (kPa (mmHg, inHg))						
		66.7 (500, 19.7)	67.6 (507, 20)	73.4 (551, 21.7)	85.4 (641, 25.2)	86.5 (649, 25.6)	92.4 (693, 27.3)	100.6 (755, 29.7)
Engine speed (rpm)	700	19.6 (146.8, 5.8)	19.6 (146.8, 5.8)	19.9 (149.2, 5.9)	21.3 (160.1, 6.3)	21.9 (164.5, 6.5)	22.7 (170.0, 6.7)	24.1 (181.0, 7.1)
	1000	18.5 (138.5, 5.5)	18.5 (138.5, 5.5)	18.2 (136.6, 5.4)	20.2 (151.5, 6)	20.6 (154.2, 6.1)	21.5 (161.0, 6.3)	22.7 (170.2, 6.7)
	1200	17.2 (129.3, 5.1)	17.2 (129.3, 5.1)	17.9 (134.2, 5.3)	19.9 (149.4, 5.9)	20.1 (151.0, 5.9)	21.1 (158.0, 6.2)	22.1 (165.9, 6.5)
	1600	17 (127.5, 5)	17 (127.5, 5)	17.8 (133.6, 5.3)	20 (149.7, 5.9)	20.4 (153.3, 6)	21.4 (160.4, 6.3)	22.5 (169.0, 6.7)
	2000	17.2 (129.3, 5.1)	17.2 (129.3, 5.1)	18 (135.4, 5.3)	20.5 (153.8, 6.1)	20.9 (156.8, 6.2)	21.5 (161.0, 6.3)	22.4 (167.8, 6.6)
	2400	17.6 (132.4, 5.2)	17.6 (132.4, 5.2)	18.5 (139.0, 5.5)	21 (157.8, 6.2)	21.3 (159.6, 6.3)	22.4 (167.8, 6.6)	23 (172.6, 6.8)
	2800	18.3 (137.2, 5.4)	18.3 (137.2, 5.4)	19.1 (143.3, 5.6)	21.7 (162.5, 6.4)	21.8 (163.4, 6.4)	22.7 (170.2, 6.7)	23.7 (178.1, 7)
	3200	21.8 (163.5, 6.4)	21.8 (163.5, 6.4)	21.9 (164.1, 6.5)	24.6 (184.5, 7.3)	24.5 (183.6, 7.2)	24.6 (184.3, 7.3)	26.7 (200.0, 7.9)
	3600	23.4 (175.8, 6.9)	23.4 (175.8, 6.9)	24.3 (182.5, 7.2)	26.8 (200.7, 7.9)	26.2 (196.7, 7.7)	27.7 (207.6, 8.2)	29.3 (219.8, 8.7)
	4000	24.6 (184.6, 7.3)	24.6 (184.6, 7.3)	24.9 (187.0, 7.4)	27.3 (204.9, 8.1)	27.6 (206.9, 8.1)	29.6 (222.4, 8.8)	27.5 (206.6, 8.1)
	4400	24.7 (185.4, 7.3)	24.7 (185.4, 7.3)	25.3 (189.6, 7.5)	27.8 (208.3, 8.2)	28 (209.8, 8.3)	29 (217.7, 8.6)	28.9 (217.1, 8.5)
	4800	27.1 (203.2, 8)	27.1 (203.2, 8)	28.5 (213.6, 8.4)	30.8 (231.4, 9.1)	31 (232.5, 9.2)	31.8 (238.6, 9.4)	30.8 (231.3, 9.1)
	5200	30.8 (230.9, 9.1)	30.8 (230.9, 9.1)	31.8 (238.8, 9.4)	34.3 (257.5, 10.1)	34.1 (255.6, 10.1)	34.8 (260.8, 10.3)	32.1 (240.6, 9.5)
	5600	33.2 (248.7, 9.8)	33.2 (248.7, 9.8)	34.2 (256.7, 10.1)	36.2 (271.7, 10.7)	36.2 (271.8, 10.7)	37.5 (281.7, 11.1)	33.8 (253.6, 10)
	6000	37.7 (282.5, 11.1)	37.7 (282.5, 11.1)	38.7 (290.4, 11.4)	40.7 (305.3, 12)	40.7 (305.4, 12)	42.5 (319.1, 12.6)	42.1 (316.0, 12.4)
	6400	39.9 (299.1, 11.8)	39.9 (299.1, 11.8)	41.3 (309.5, 12.2)	44.6 (334.2, 13.2)	44.5 (333.9, 13.1)	46.1 (345.5, 13.6)	46.1 (346.1, 13.6)
kPa (mmHg, inHg)								

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

- Idling ignition

		Barometric pressure (kPa (mmHg, inHg))						
		66.7 (500, 19.7)	67.6 (507, 20)	73.4 (551, 21.7)	85.4 (641, 25.2)	86.5 (649, 25.6)	92.4 (693, 27.3)	100.6 (755, 29.7)
Engine speed (rpm)	700	19.9 (149.2, 5.9)	19.9 (149.2, 5.9)	20.1 (150.4, 5.9)	22.2 (166.4, 6.6)	22.3 (167.4, 6.6)	23.4 (175.4, 6.9)	24.6 (184.6, 7.3)
	1000	19.3 (144.6, 5.7)	19.3 (144.6, 5.7)	20.6 (154.9, 6.1)	22.3 (167.3, 6.6)	22.4 (167.9, 6.6)	23.7 (177.6, 7)	25.1 (188.5, 7.4)
	1200	18.7 (140.3, 5.5)	18.7 (140.3, 5.5)	20 (150.1, 5.9)	22.2 (166.8, 6.6)	22.3 (167.7, 6.6)	23.5 (176.6, 7)	24.9 (186.7, 7.3)
	1600	18.9 (141.5, 5.6)	18.9 (141.5, 5.6)	19.8 (148.8, 5.9)	22.6 (169.8, 6.7)	22.8 (171.1, 6.7)	24.2 (181.6, 7.1)	25.6 (192.2, 7.6)
	2000	18.7 (140.3, 5.5)	18.7 (140.3, 5.5)	19.8 (148.8, 5.9)	22.6 (169.6, 6.7)	23.1 (173.6, 6.8)	24.2 (181.3, 7.1)	24.8 (186.1, 7.3)
	2400	19.1 (143.3, 5.6)	19.1 (143.3, 5.6)	19.9 (149.4, 5.9)	22.8 (170.7, 6.7)	23 (172.4, 6.8)	23.9 (179.5, 7.1)	28.1 (211.1, 8.3)
	2800	19.8 (148.8, 5.9)	19.8 (148.8, 5.9)	21.1 (158.6, 6.2)	22.9 (171.9, 6.8)	23.3 (174.6, 6.9)	24.3 (182.0, 7.2)	28.6 (214.8, 8.5)
	3200	31.5 (235.9, 9.3)	31.5 (235.9, 9.3)	32.5 (244.1, 9.6)	36.5 (273.6, 10.8)	36.3 (272.6, 10.7)	37.7 (282.9, 11.1)	40.3 (302.0, 11.9)
	3600	33.5 (250.9, 9.9)	33.5 (250.9, 9.9)	34.2 (256.4, 10.1)	38.3 (287.4, 11.3)	39.1 (293.4, 11.6)	39.6 (297.0, 11.7)	40.9 (307.1, 12.1)
	4000	34.6 (259.7, 10.2)	34.6 (259.7, 10.2)	35.5 (266.4, 10.5)	39.1 (293.7, 11.6)	40.7 (305.2, 12)	41 (307.5, 12.1)	40.1 (301.2, 11.9)
	4400	30.7 (230.5, 9.1)	30.7 (230.5, 9.1)	31.5 (236.0, 9.3)	34.3 (257.0, 10.1)	34.7 (260.1, 10.2)	35.3 (265.2, 10.4)	36.3 (272.0, 10.7)
	4800	30 (225.2, 8.9)	30 (225.2, 8.9)	30.8 (231.3, 9.1)	33.7 (252.9, 10)	33.7 (252.7, 9.9)	34.7 (260.0, 10.2)	40.7 (305.2, 12)
	5200	32.7 (245.5, 9.7)	32.7 (245.5, 9.7)	33.8 (253.4, 10)	36.5 (273.7, 10.8)	37 (277.8, 10.9)	37.9 (284.2, 11.2)	37 (277.3, 10.9)
	5600	34.1 (256.1, 10.1)	34.1 (256.1, 10.1)	35.1 (263.4, 10.4)	37.4 (280.9, 11.1)	38 (285.1, 11.2)	38.5 (289.1, 11.4)	37.8 (283.5, 11.2)
	6000	37.6 (281.9, 11.1)	37.6 (281.9, 11.1)	38.5 (289.2, 11.4)	41.3 (309.5, 12.2)	41.8 (313.8, 12.4)	43 (322.8, 12.7)	39.1 (293.5, 11.6)
	6400	40.2 (301.6, 11.9)	40.2 (301.6, 11.9)	41 (307.7, 12.1)	44.9 (336.6, 13.3)	44.6 (334.4, 13.2)	46.7 (350.5, 13.8)	43.8 (328.4, 12.9)
								kPa (mmHg, inHg)

3. GENERAL DRIVING CYCLE

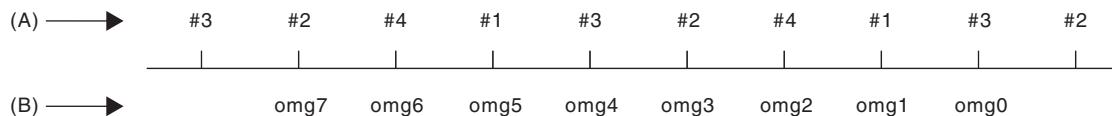
- If conditions are met, it is possible to detect the misfires from idling to high engine speed. However, to avoid excessive load or harm to the engine, perform diagnosis at idle.
- Perform the diagnosis continuously.

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

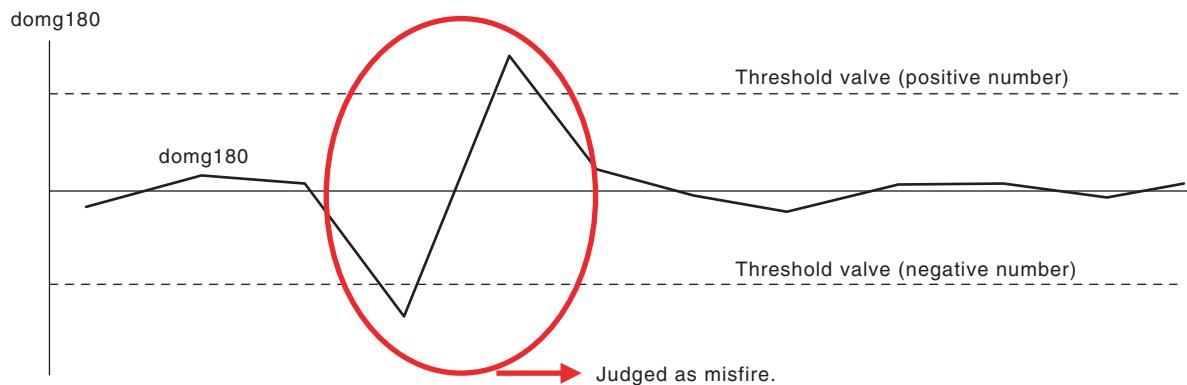
180° Interval Difference Method

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)

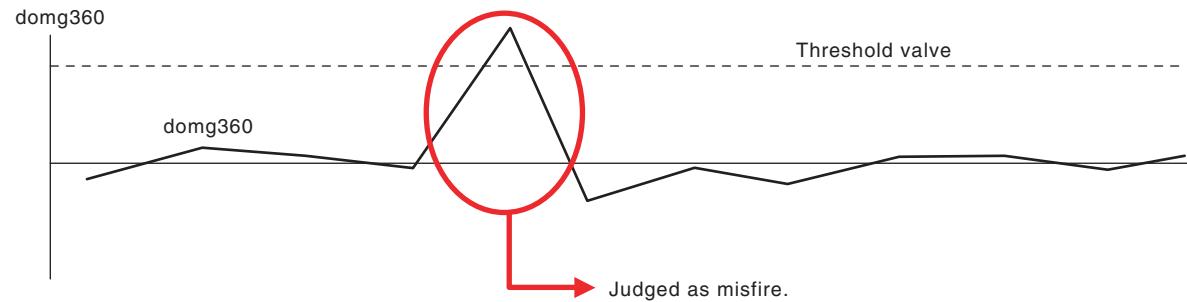


EN-02877

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



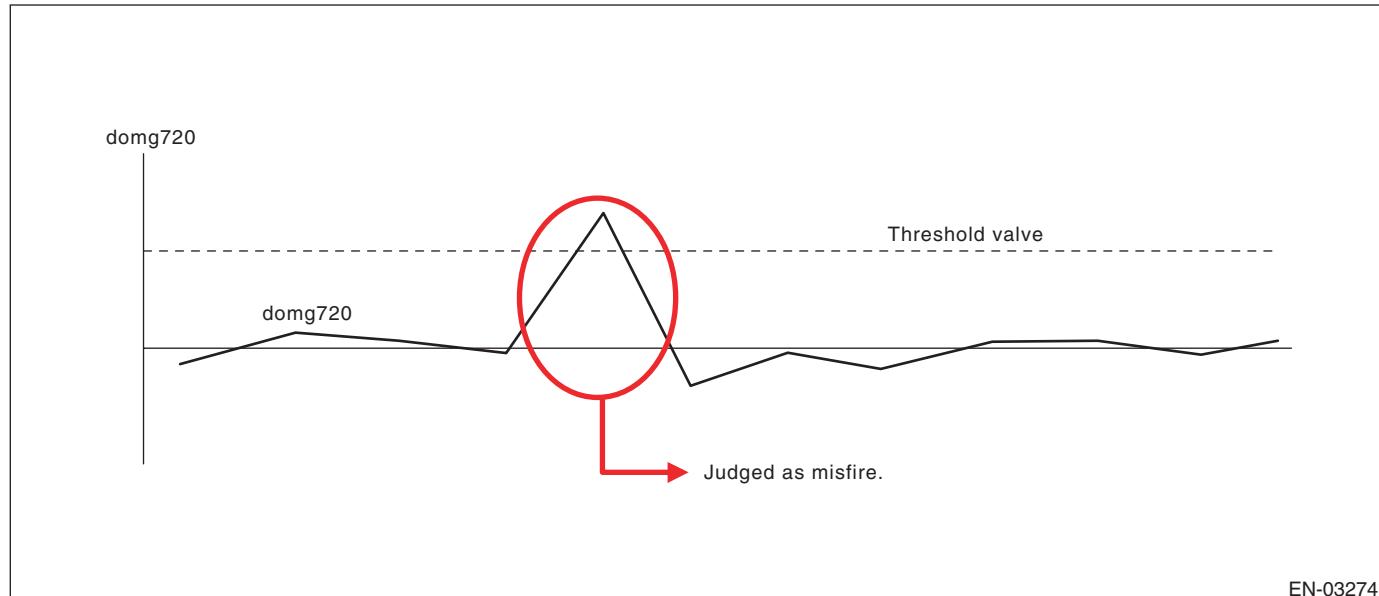
EN-03273

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)**

- **Abnormality Judgment**

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

Malfunction Criteria	Threshold Value
FTP emission diagnostic value	$\geq 17 \times 100/2000\% \text{ in 1000 revs.}$

Time Needed for Diagnosis: 1000 engine revs.

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

- **Normality Judgment**

Judgment Value

Malfunction Criteria	Threshold Value
FTP emission diagnostic value	$< 17 \times 100/2000\% \text{ in 1000 revs.}$

Time Needed for Diagnosis: 1000 engine revs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

- Catalyst damage misfire (Misfire occurrence level damaging catalyst)
- Abnormality Judgment

Judgment Value

Malfunction Criteria	Threshold Value
Catalyst damage misfire diagnostic value	\geq Value from Map 3

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	57	44	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	36	44	44	44
	5600	27	27	27	31	36	36	36	44	44	44
	6000	44	44	44	44	44	44	44	44	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.

- Normality Judgment

Judgment Value

Malfunction Criteria	Threshold Value
Catalyst damage misfire diagnostic value	$<$ Value of Map 3

Time Needed for Diagnosis: 200 engine revs.

BJ:DTC P0302 CYLINDER 2 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H4DO)-112, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BK:DTC P0303 CYLINDER 3 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H4DO)-112, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BL:DTC P0304 CYLINDER 4 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H4DO)-112, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

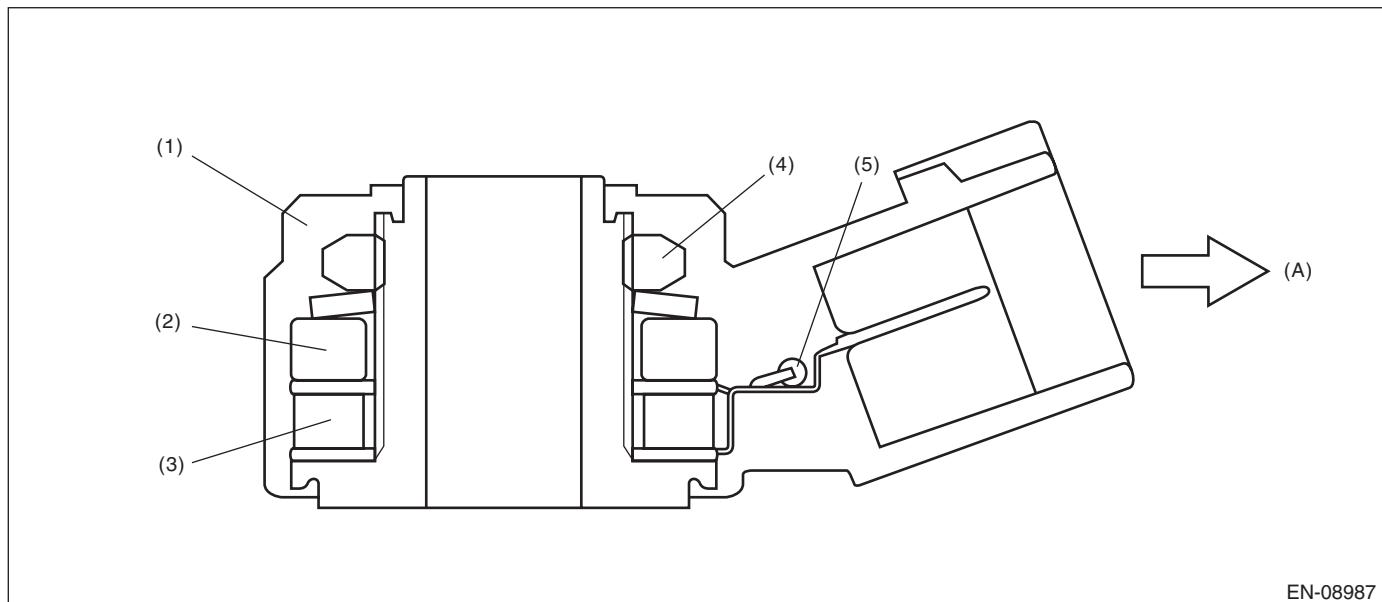
GENERAL DESCRIPTION

BM: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

• Abnormality Judgment

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	< 0.243 V

Time Needed for Diagnosis: 1000 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 0.243 V

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

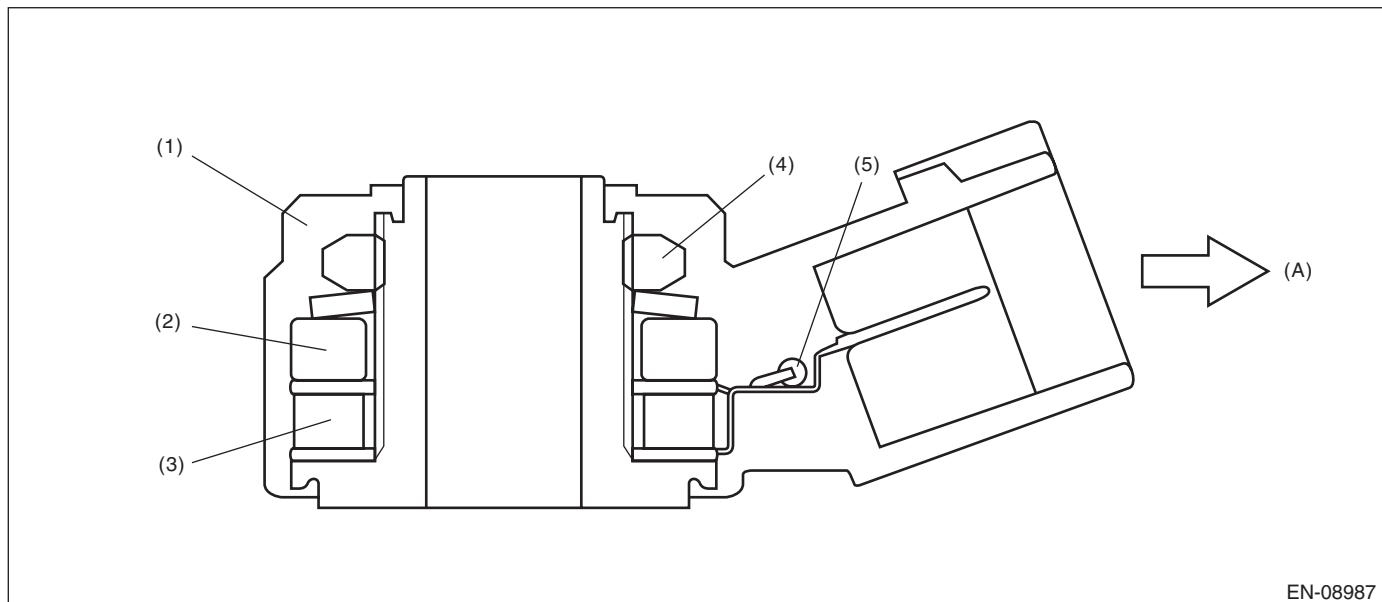
GENERAL DESCRIPTION

BN: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

• Abnormality Judgment

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	$\geq 4.709 \text{ V}$

Time Needed for Diagnosis: 1000 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$< 4.709 \text{ V}$

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

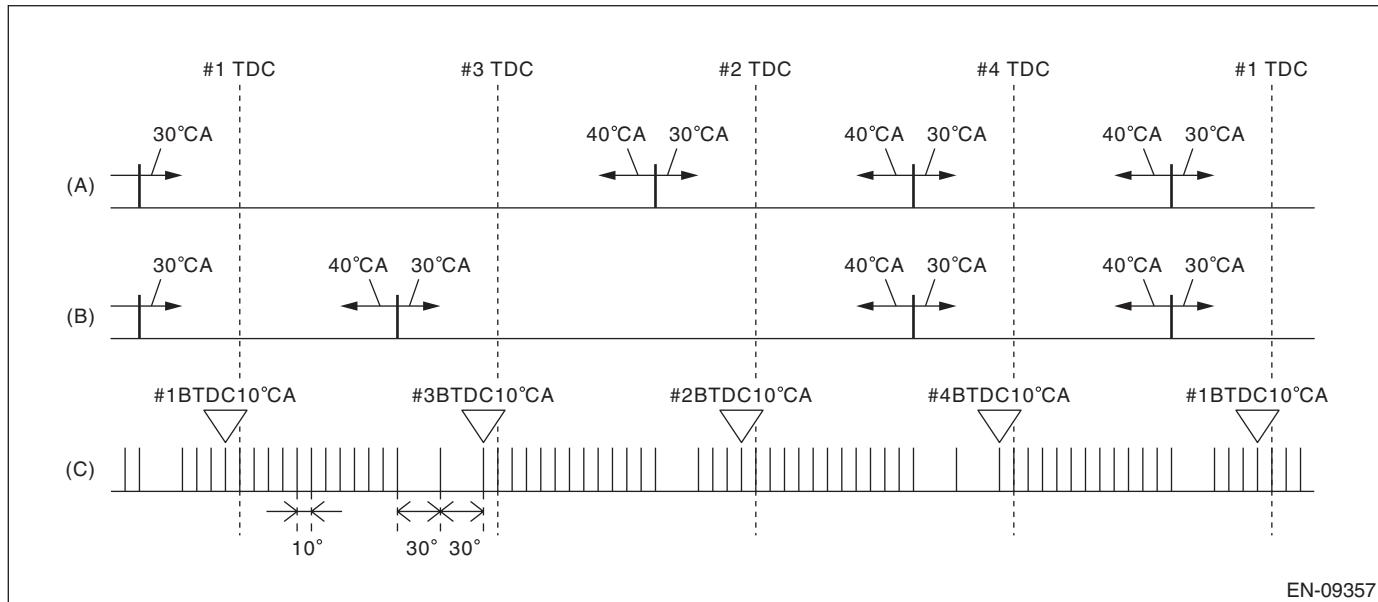
BO:DTC P0335 CRANKSHAFT POSITION SENSOR “A” CIRCUIT

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.

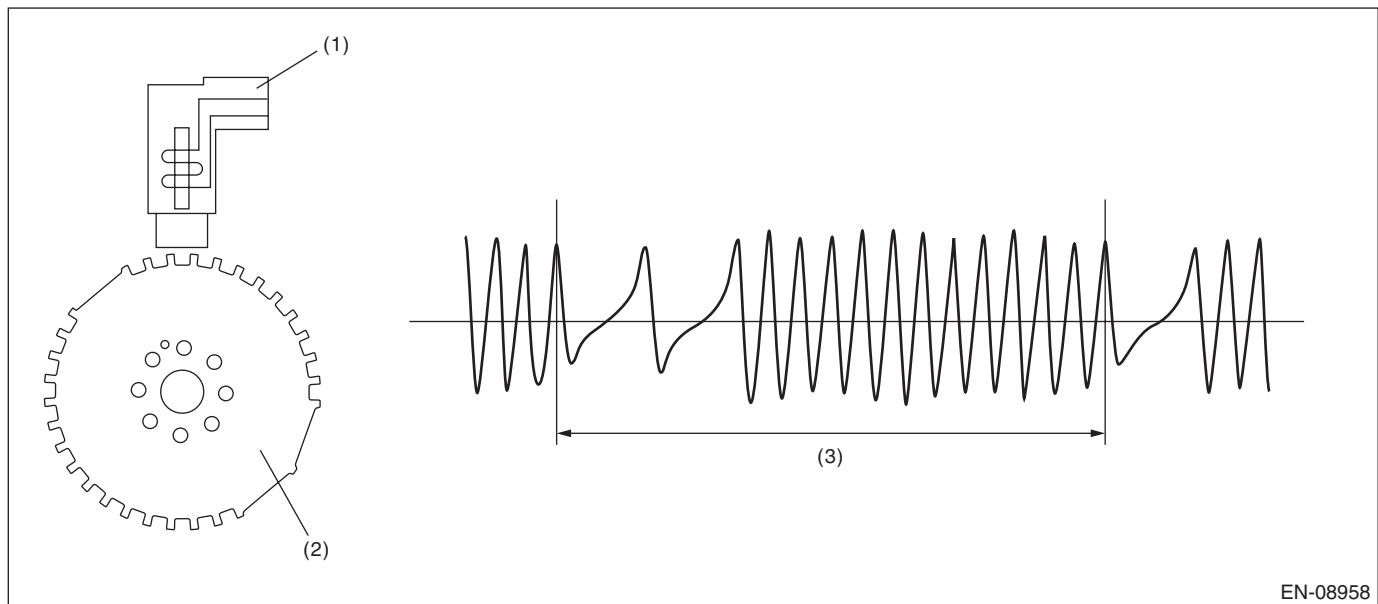
2. COMPONENT DESCRIPTION



(A) Camshaft signal (RH)

(B) Camshaft signal (LH)

(C) Crankshaft signal



(1) Crankshaft position sensor

(2) Crankshaft position sensor plate

(3) Crankshaft half-turn

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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 switch	ON
Crankshaft position sensor signal	Not detected
Battery voltage	≥ 8 V

Time Needed for Diagnosis: 3000 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Crankshaft position sensor signal	Input exists
Battery voltage	≥ 8 V

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

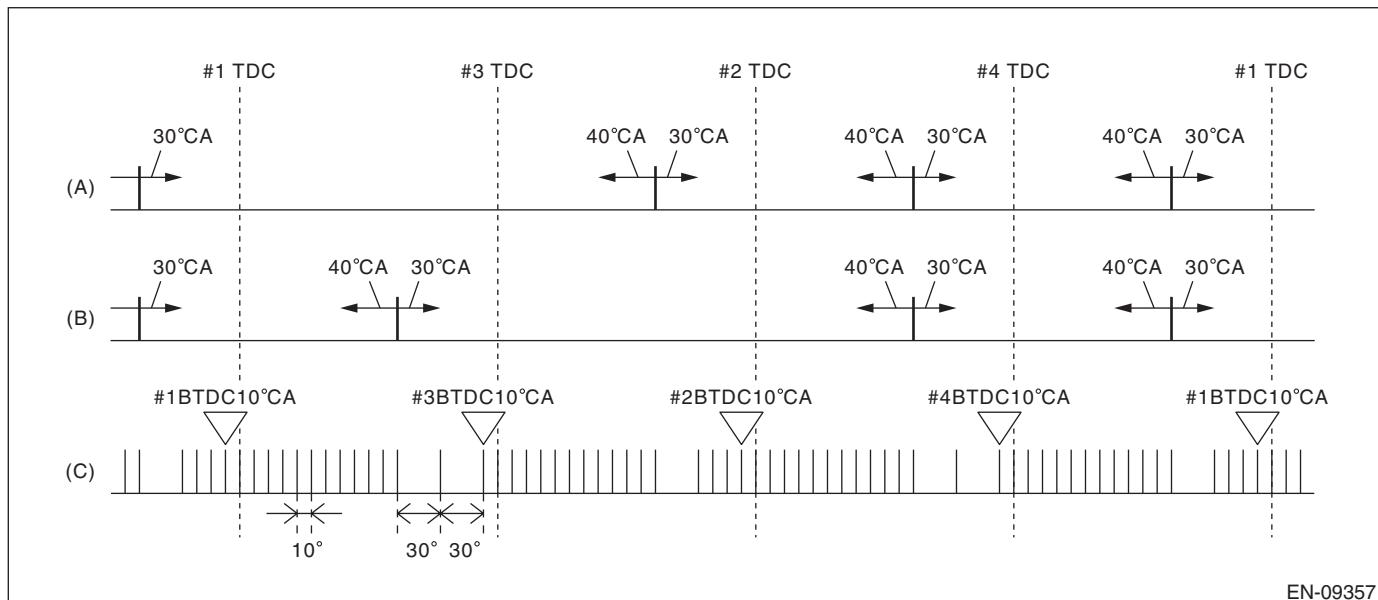
BP:DTC P0336 CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE

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.

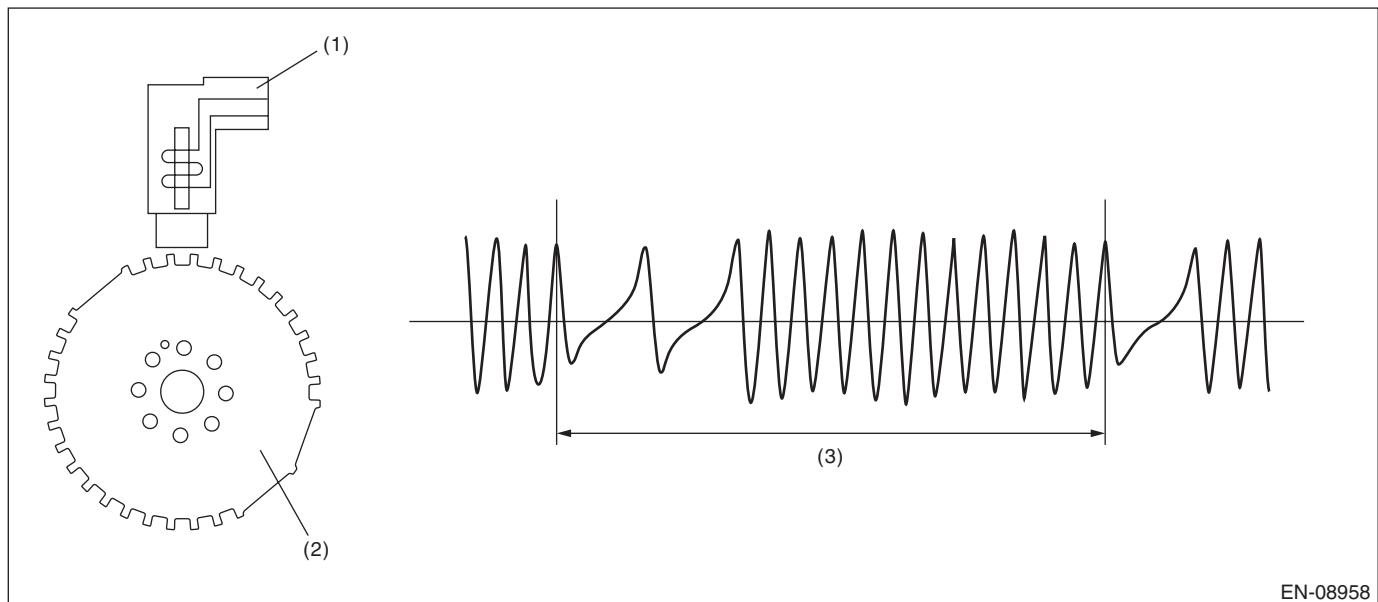
2. COMPONENT DESCRIPTION



(A) Camshaft signal (RH)

(B) Camshaft signal (LH)

(C) Crankshaft signal



(1) Crankshaft position sensor

(2) Crankshaft position sensor plate

(3) Crankshaft half-turn

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V
Engine speed	< 4000 rpm

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously under 3000 rpm engine speed.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Cylinder number identification	Completed
Amount of crank sensor signal during 1 rev of crankshaft.	Not = 30

Time Needed for Diagnosis: 10 engine revs. engine revs.

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Cylinder number identification	Completed
Amount of crank sensor signal during 1 rev of crankshaft.	= 30

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

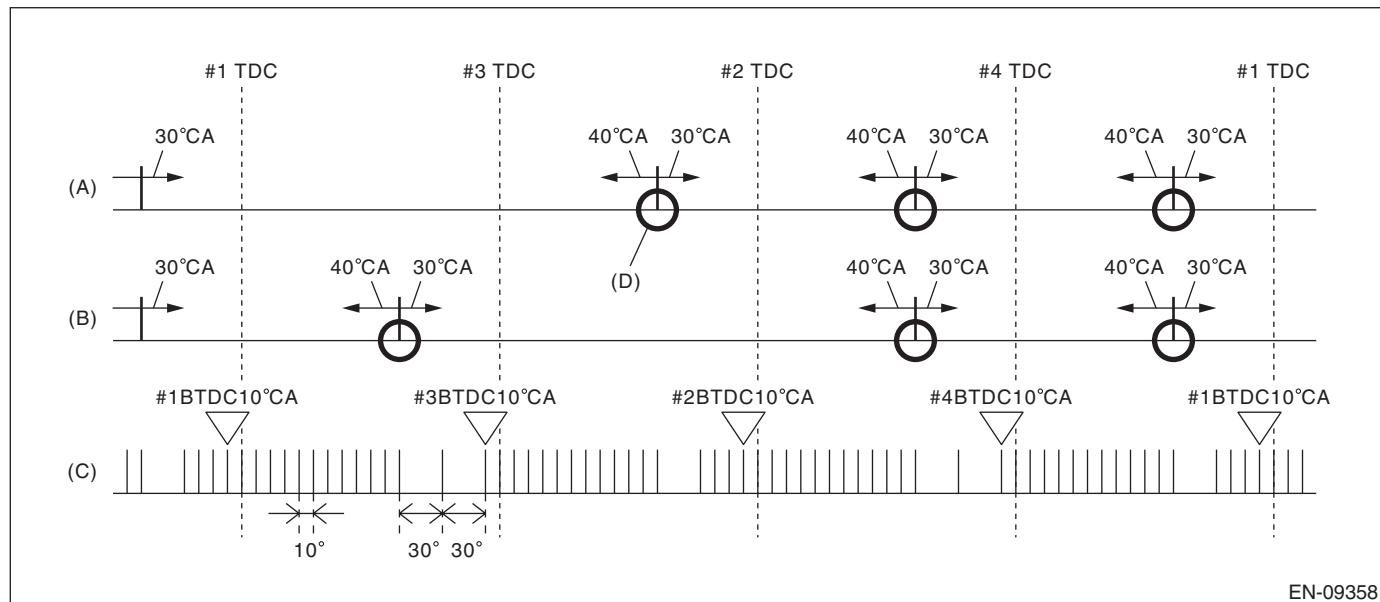
BQ:DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR)

1. OUTLINE OF DIAGNOSIS

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

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

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

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment 1

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

Judgment Value

Malfunction Criteria	Threshold Value
Amount of camshaft sensor signal during 2 revs of crankshaft.	< 3 time(s)

Time Needed for Diagnosis: Engine two revolutions \times 4 time(s)

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

• Normality Judgment 1

Judge as OK and clear the NG when the malfunction criteria below are met.

Judgment Value

Malfunction Criteria	Threshold Value
Camshaft position sensor signal	\geq 3 time(s)

Time Needed for Diagnosis: 2 engine revs.

• Abnormality Judgment 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
Starter	ON
Camshaft position sensor signal	No input

Time Needed for Diagnosis: 3000 ms

• Normality Judgment 2

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Camshaft position sensor signal	Input exists

Time Needed for Diagnosis: Less than 1 second

BR: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)-130, DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BS: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
Ignition energization time	> 2000 μ s
Ignition status	Not during ignition cut

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Ignition driving IC information	Malfunction

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Ignition driving IC information	Normal

Time Needed for Diagnosis: Less than 1 second

BT: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)-132, DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BU: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)-132, DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BV: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)-132, DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

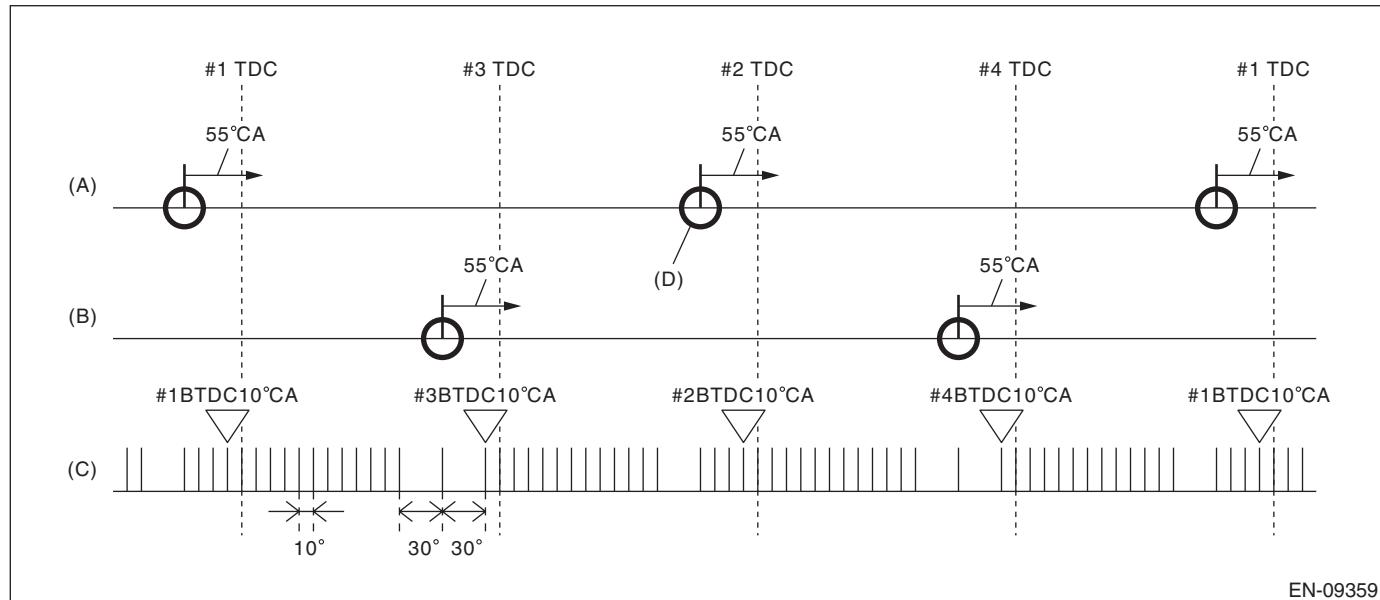
BW:DTC P0365 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 1)

1. OUTLINE OF DIAGNOSIS

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

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 2 camshaft position signals for every 2 crankshaft revolutions.

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG when the status where the number of camshaft position sensor signal in two engine revolutions is less than 2 time(s) continues.

Judgment Value

Malfunction Criteria	Threshold Value
Amount of camshaft sensor signal during 2 revs.	< 2 time(s)

Time Needed for Diagnosis: 2 engine revs. \times 4 time(s)

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

• Normality Judgment

Judge as OK and clear the NG when the malfunction criteria below are met.

Judgment Value

Malfunction Criteria	Threshold Value
Camshaft position sensor signal	\geq 2 time(s)

Time Needed for Diagnosis: 2 engine revs.

BX: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)-133, DTC P0365 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

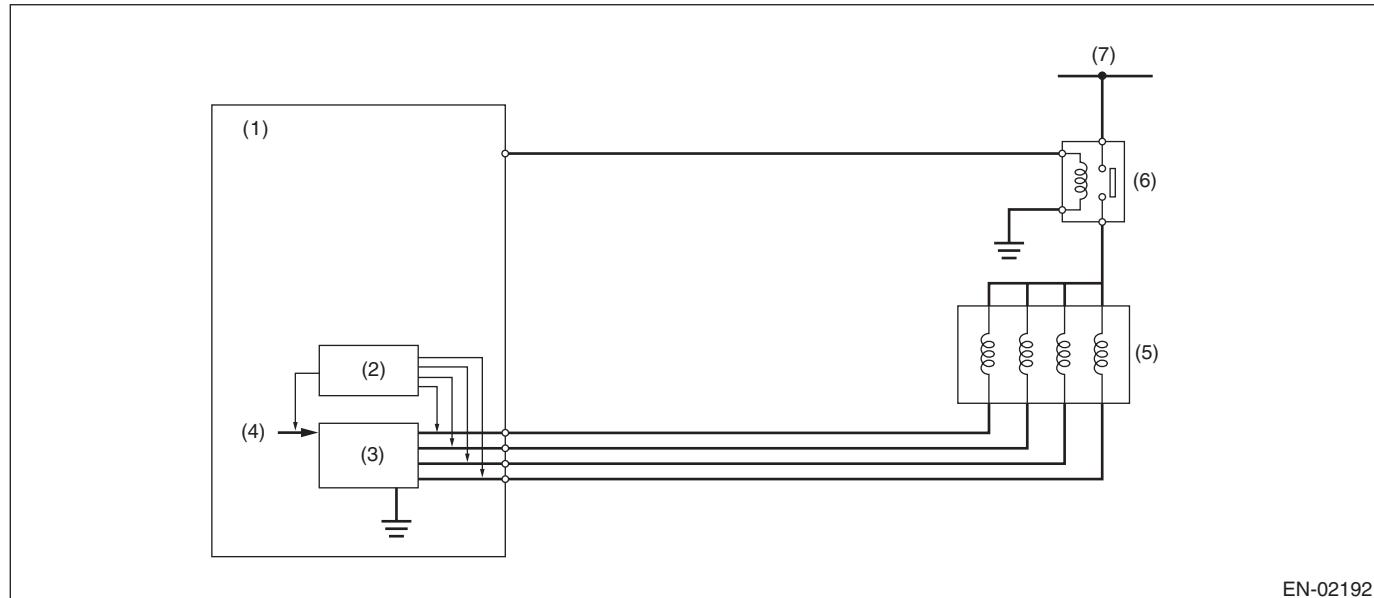
BY:DTC P0400 EXHAUST GAS RECIRCULATION FLOW

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 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) ECM	(4) CPU	(6) Main relay
(2) Detecting circuit	(5) EGR valve	(7) Battery power supply
(3) Switching circuit		

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	≥ 40 s
Engine coolant temperature	≥ 60 °C(140 °F)
Engine speed	1200 rpm — 2950 rpm
Intake manifold pressure (absolute pressure)	< 44 kPa (330 mmHg, 13 inHg)
Ambient air temperature	≥ 5 °C(41 °F)
Throttle position	< 0.25 °
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Vehicle speed	≥ 58 km/h (36 MPH)
Fuel shut-off function	In operation
Neutral switch	OFF
Elapsed time after neutral switch ON/OFF change	\geq Value from Map
No load change (A/C, power steering, lighting, rear defogger, heater fan and radiator fan)	≥ 5000 ms

Map

Engine coolant temperature °C (°F)	-40 (-40)	-30 (-22)	-20 (-4)	-10 (14)	0 (32)	10 (50)	20 (68)	30 (86)
Elapsed time after neutral switch change msec	0	0	0	0	0	0	0	0

Engine coolant temperature °C (°F)	40 (104)	50 (122)	60 (140)	70 (158)	80 (176)	90 (194)	100 (212)	110 (230)
Elapsed time after neutral switch change msec	0	600	600	600	650	650	650	650

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 50 steps (nearly full open).
2. Label the intake manifold pressure value as PMON, which is observed after one second has passed since EGR target step was set to 50 steps (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 one second has passed since EGR target step was set to 0 (after two seconds have passed since the enable conditions were established).

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

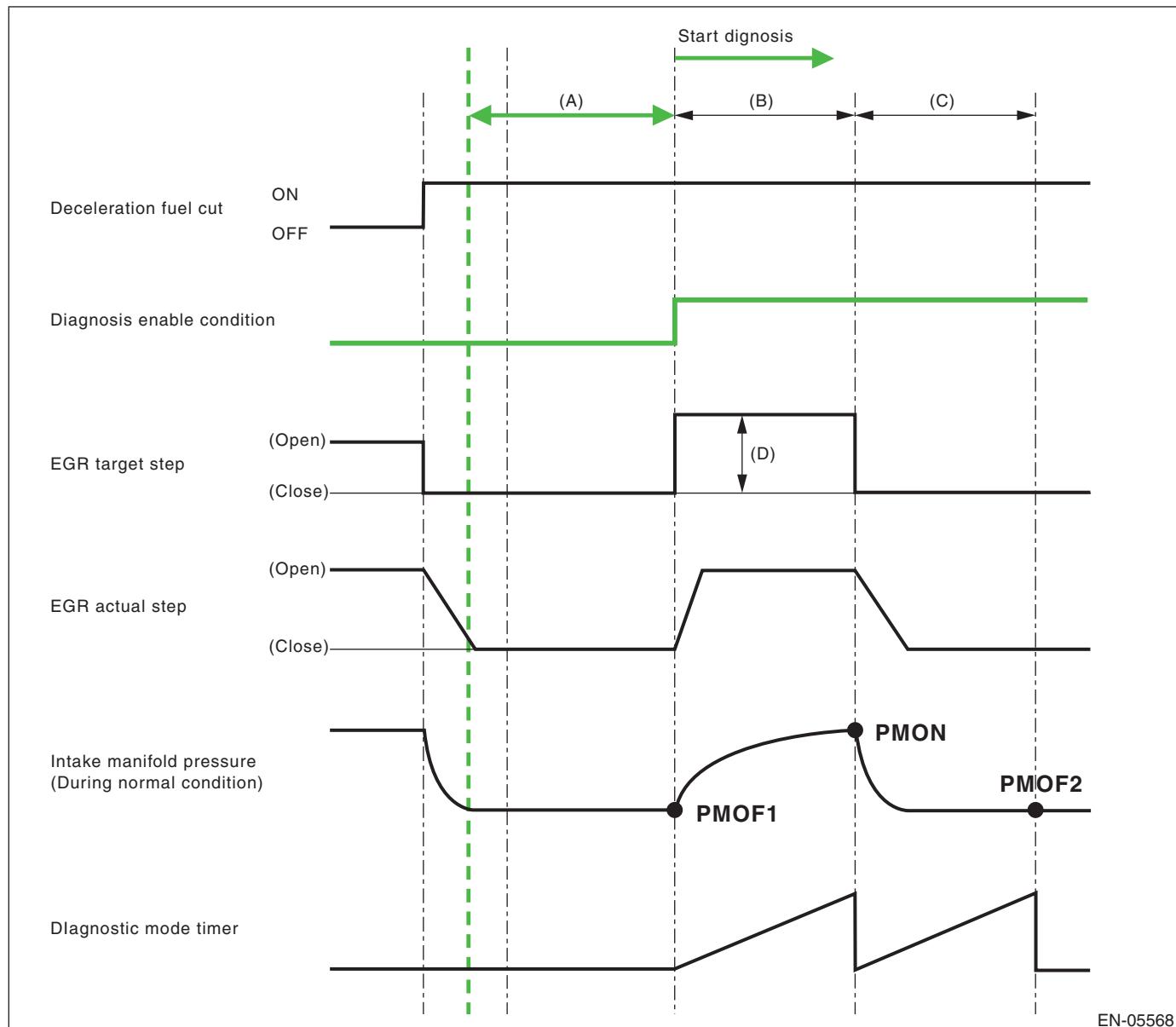
Malfunction Criteria	Threshold Value
PMON - (PMOF1 + PMOF2)/2	< 2.5 kPa (18.63 mmHg, 0.7 inHg)

Time Needed for Diagnosis: 1 time

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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



(A) 3000 ms

(B) 1000 ms

(C) 1000 ms

(D) 45 step(s)

EN-05568

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
PMON – (PMOF1 + PMOF2)/2	$\geq 2.5 \text{ kPa (18.63 mmHg, 0.7 inHg)}$

Time Needed for Diagnosis: 1 time

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

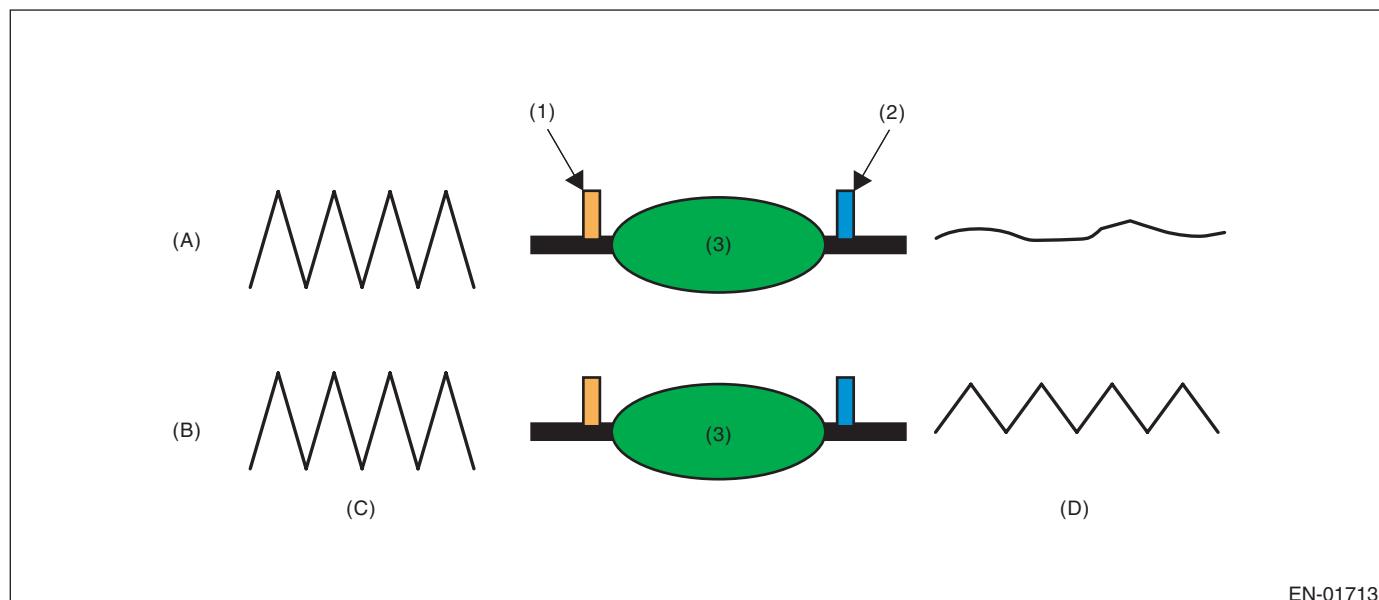
1. OUTLINE OF DIAGNOSIS

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

(B) Deterioration

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

(D) Output waveform from the front oxygen sensor

(1) Front oxygen (A/F) sensor

(2) Front oxygen sensor

(3) Catalytic converter

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Engine coolant temperature	≥ 60 °C (140 °F)
Estimated catalyst temperature	≥ 490 °C (914 °F) (CVT model) ≥ 490 °C (914 °F) (MT model)
Misfire detection every 200 rotations	< 65535 time(s)
Learning value of evaporation gas density	< 0.24
Sub feedback	In operation
Evaporative system diagnosis	Not in operation
Time of difference (< 0.10) between actual lambda and target lambda	≥ 1000 ms
Vehicle speed	> 60 km/h (37.3 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.	< 0.02 g/rev (0 oz/rev)
Rear oxygen output change from 660 mV or less to 660 mV or more	Experienced after fuel cut
Elapsed time after starting the engine	≥ 0 s
Purge execution calculated time	≥ 20 s

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once at a constant speed of 60 km/h (37.3 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.

• Abnormality Judgment

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.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is within the predetermined time.

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of purge flow by the change of ELCM pressure sensor output value before/after purge introduction.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
<Common conditions>	
Battery voltage	≥ 10.9 V
Atmospheric pressure	> 75 kPa (563 mmHg, 22.2 inHg)
<First diagnosis>	
Learning value of EVAP conc. during purge	< 0.24
Total time of canister purge operation	≥ 20 s
<Second diagnosis>	
Time after cancel of second diagnosis	≥ 60000 ms
Total time of canister purge operation	≥ 120 s
Intake manifold pressure (absolute pressure)	> 13.3 kPa (100 mmHg, 3.9 inHg)
Engine speed	≥ 1050 rpm
Intake manifold pressure (relative pressure)	< 13.3 kPa (100 mmHg, 3.9 inHg)
Vehicle speed	≥ 30 km/h (18.6 MPH)
Closed air/fuel ratio control	In operation
Air fuel ratio	> 0.76 and < 1.25
Main feedback compensation coefficient	> 0.9
Learning value of EVAP conc. during purge	< 0.2
Estimated ambient temperature value	> -25 °C (-13 °F)

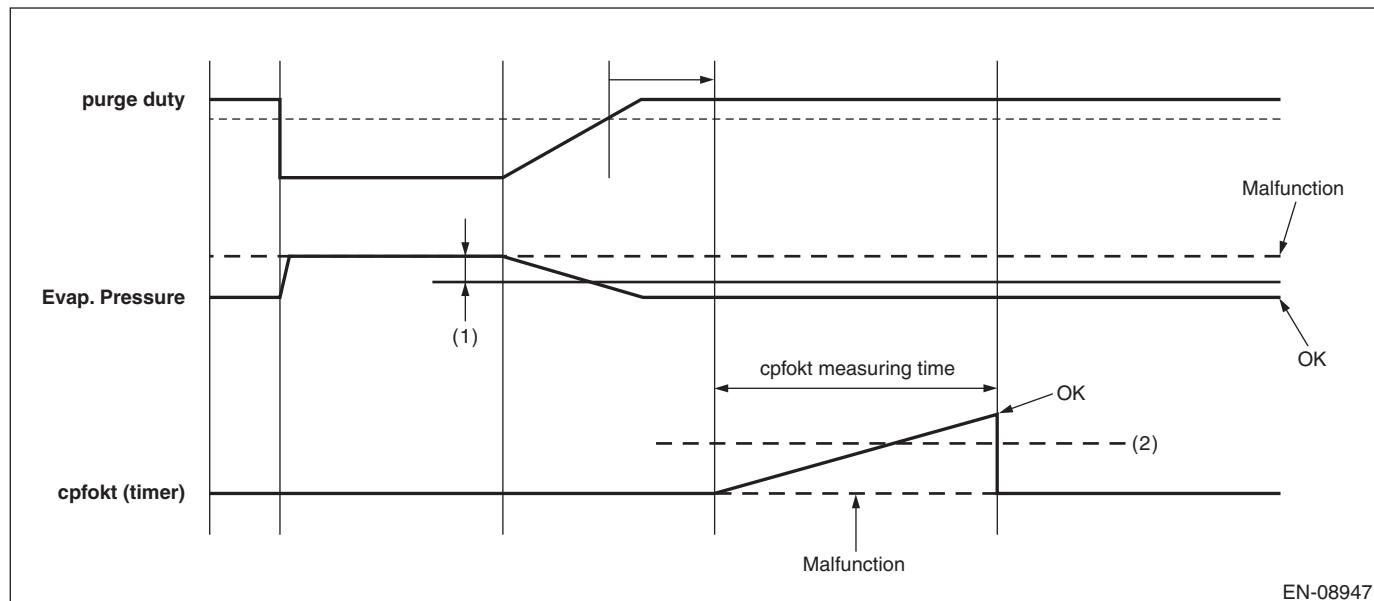
3. GENERAL DRIVING CYCLE

Perform the diagnosis only once after engine start.

4. DIAGNOSTIC METHOD

First diagnosis

Pressure decreases when the purge is introduced compared with when the purge is not performed. By using this, judge if the purge is correctly performed. If there is no pressure decrease, go to the second diagnosis.



(1) 0.0045 V

(2) 2000 ms

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
ELCM pressure sensor output voltage when purge is not performed – ELCM pressure sensor output voltage when purge is performed	> 0.0045 V
The accumulated time while the above conditions are met: cpfokt	< 2000 ms

Time Needed for Diagnosis: 26 seconds

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
ELCM pressure sensor output voltage when purge is not performed – ELCM pressure sensor output voltage when purge is performed	> 0.0045 V
The accumulated time while the above conditions are met: cpfokt	≥ 2000 ms

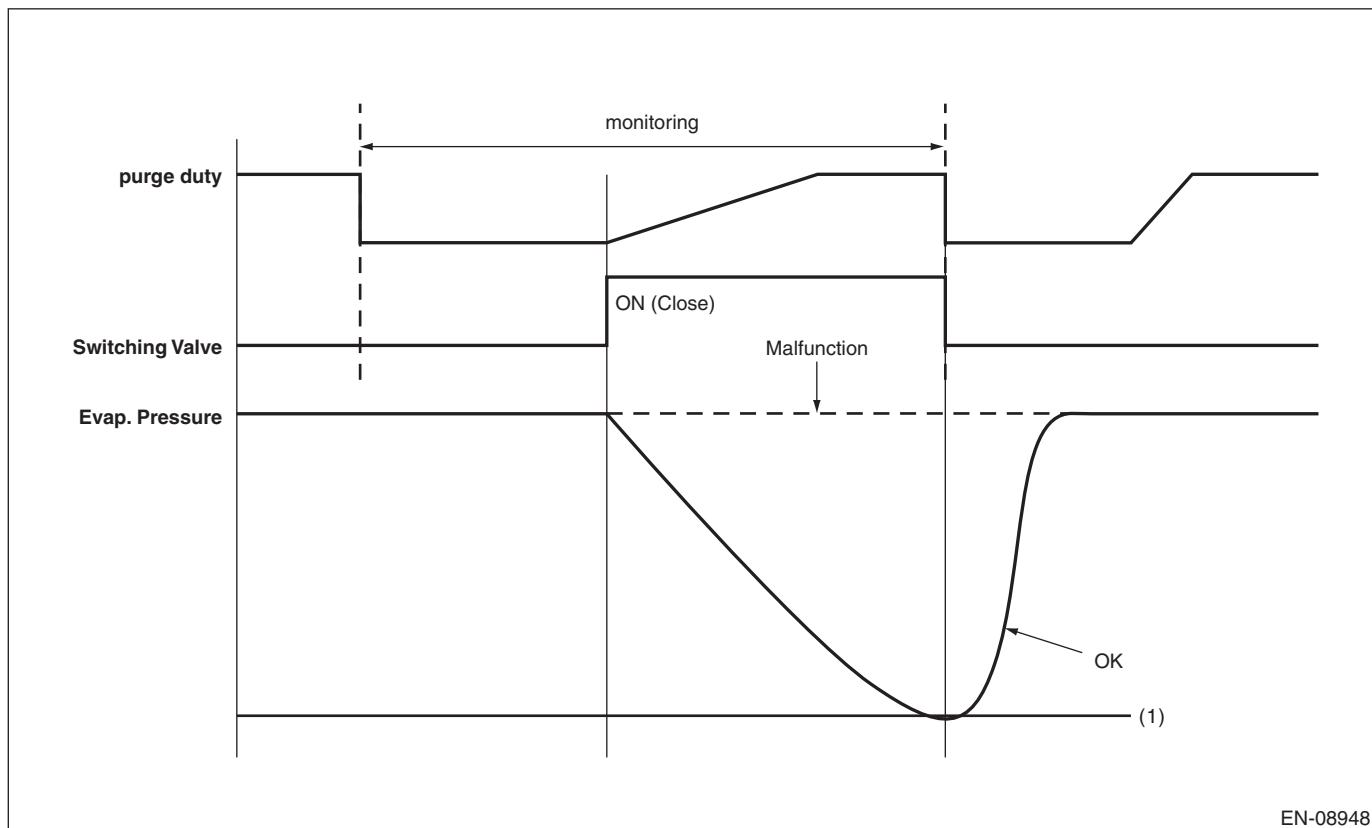
Time Needed for Diagnosis: 26 seconds

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Second diagnosis

Close the ELCM switching valve, and close the fuel tank completely, and perform the forced purging. If pressure change amount is 0.7 kPa (5 mmHg, 0.2 inHg) or less, judge as malfunction of purge flow.



EN-08948

(1) 0.7 kPa (5 mmHg, 0.2 inHg)

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
ELCM pressure sensor output voltage when purge is not performed – ELCM pressure sensor output voltage when purge is performed	< 0.7 kPa (5 mmHg, 0.2 inHg)
Time of negative pressure introduction	≥ 30000 ms

Time Needed for Diagnosis: 21 seconds

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

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
ELCM pressure sensor output voltage when purge is not performed – ELCM pressure sensor output voltage when purge is performed	≥ 0.7 kPa (5 mmHg, 0.2 inHg)

Time Needed for Diagnosis: Less than 21 seconds

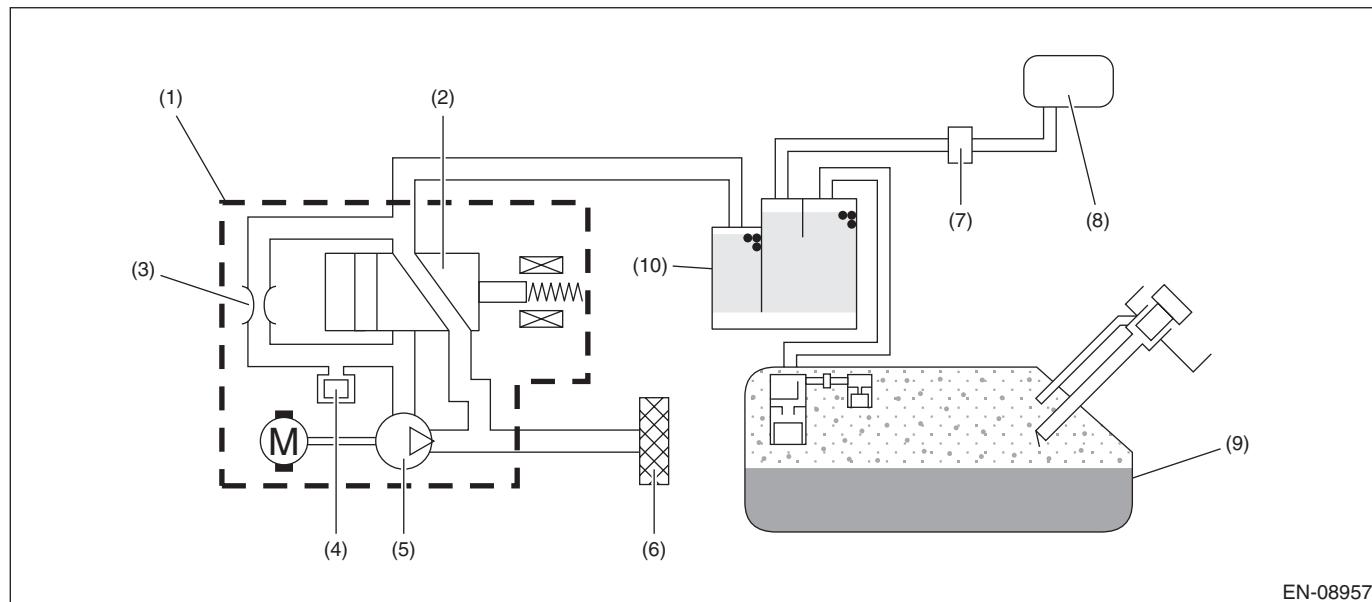
CB:DTC P0451 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/ SWITCH RANGE/PERFORMANCE

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
Ignition switch	ON
Engine speed	< 300 rpm
Vehicle speed	< 1 km/h (0.621 MPH)
Soaking time	≥ 60 s
Variation value of intake manifold pressure (absolute pressure) since ignition switch is turned to ON	< 1.332 kPa (9.99 mmHg, 0.39 inHg)
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

• Abnormality Judgment

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	> 4.3 kPa (32 mmHg, 1.3 inHg)

Time Needed for Diagnosis: 328 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
ELCM pressure sensor output value – intake manifold pressure (absolute pressure) when ignition switch is ON	$\leq 4.3 \text{ kPa (32 mmHg, 1.3 inHg)}$

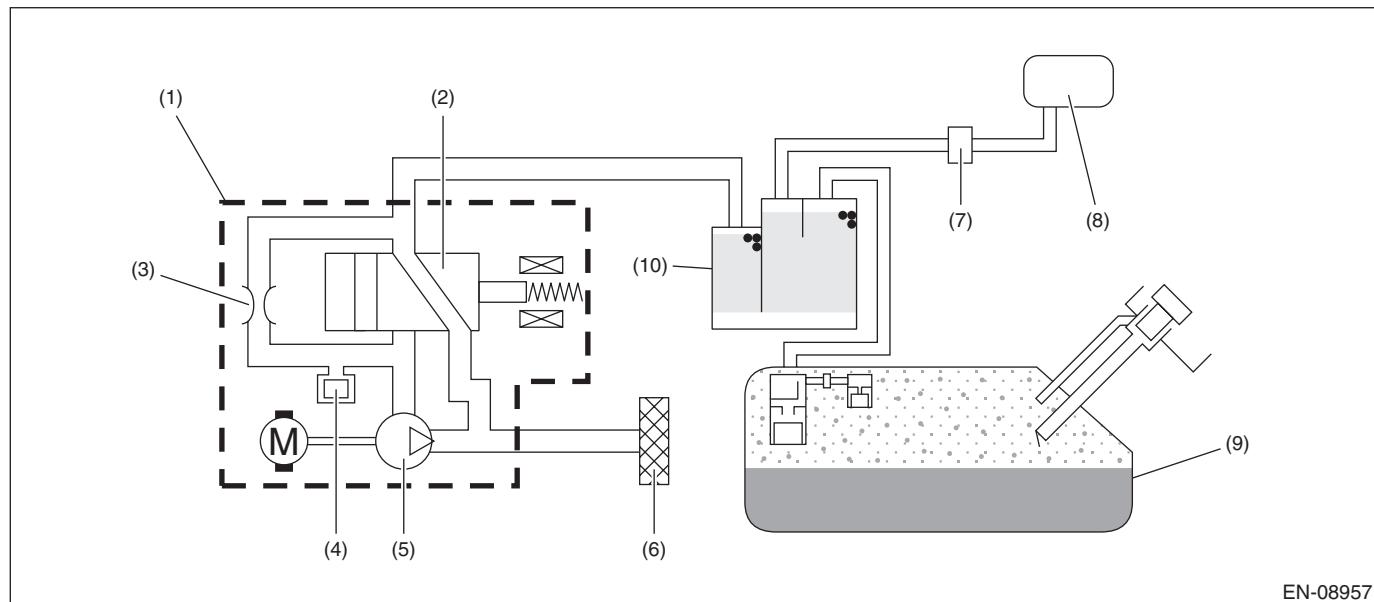
Time Needed for Diagnosis: 262 ms

CC: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



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
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 0.973 V

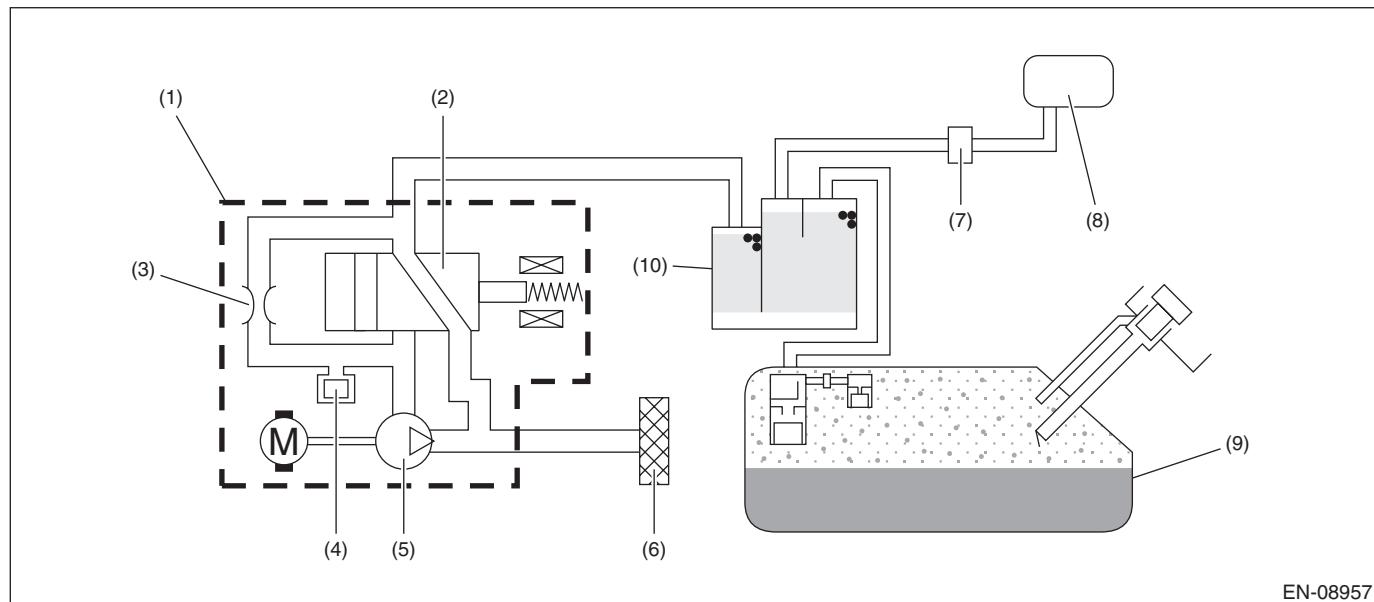
Time Needed for Diagnosis: Less than 1 second

CD: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
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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	$\geq 4.095 \text{ V}$

Time Needed for Diagnosis: 1000 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$< 4.095 \text{ V}$

Time Needed for Diagnosis: Less than 1 second

CE: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 five hours passed, ECM is activated by soaking timer, and the leak check is started.

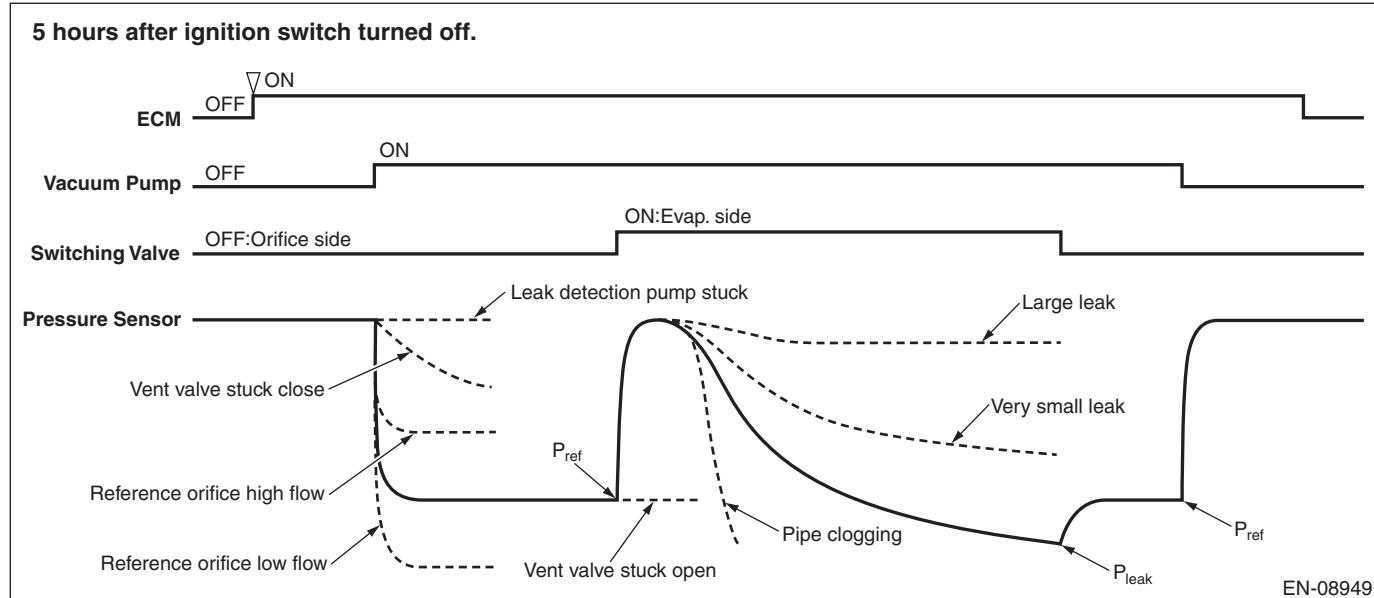
Judges whether the ELCM operation is normal or not, by measuring the reference pressure status via reference orifice (0.02 inch orifice). Judge as malfunction if the reference pressure is out of specified range. Then, judge whether there is a leak or not, by comparing the pressure (leak pressure) when 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.

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

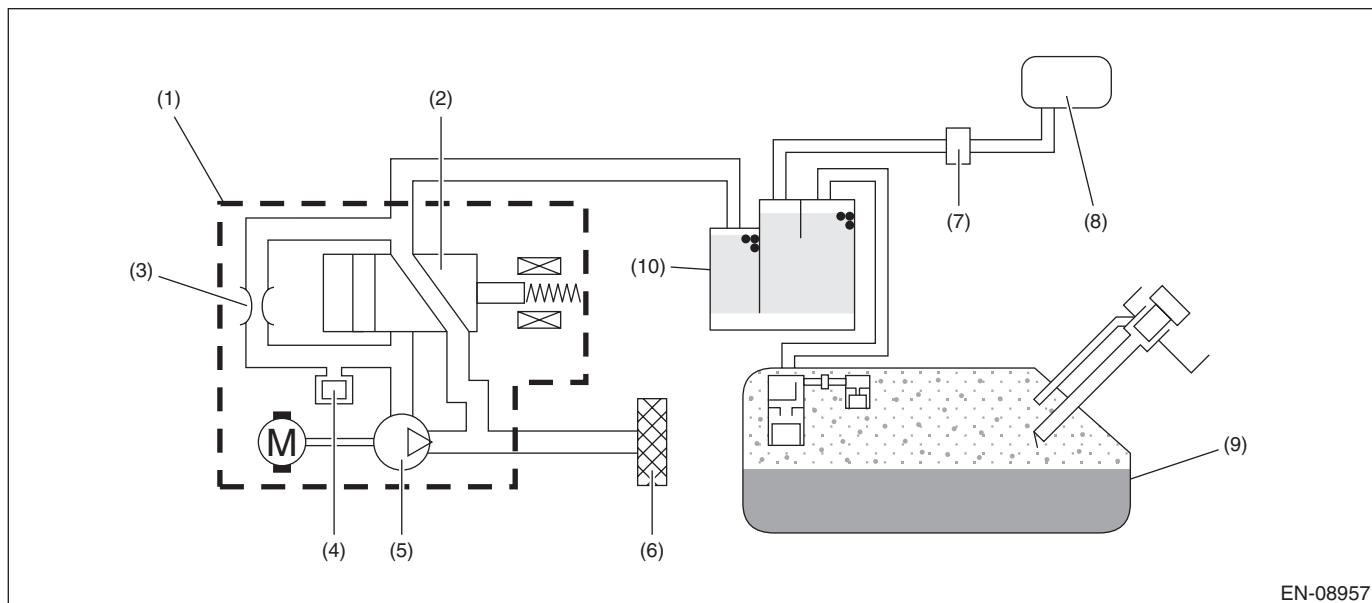


Diagnostic Trouble Code (DTC) Detecting Criteria

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	$\geq 10.9 \text{ V}$
Ignition switch	OFF
Engine coolant temperature	$\geq 4.4 \text{ }^{\circ}\text{C}$ (39.9 $^{\circ}\text{F}$) and $< 45 \text{ }^{\circ}\text{C}$ (113 $^{\circ}\text{F}$)
Intake air temperature	$\geq 4.4 \text{ }^{\circ}\text{C}$ (39.9 $^{\circ}\text{F}$)
Atmospheric pressure	$\geq 75 \text{ kPa}$ (563 mmHg, 22.2 inHg) and $< 110 \text{ kPa}$ (825 mmHg, 32.5 inHg)
EVAP conc. learning during previous driving cycle	Done
Learning value of EVAP conc. during previous driving cycle	≤ 0.2
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)	150 (5.29)	150 (5.29)	6000 (211.62)	9000 (317.43)	12000 (423.24)

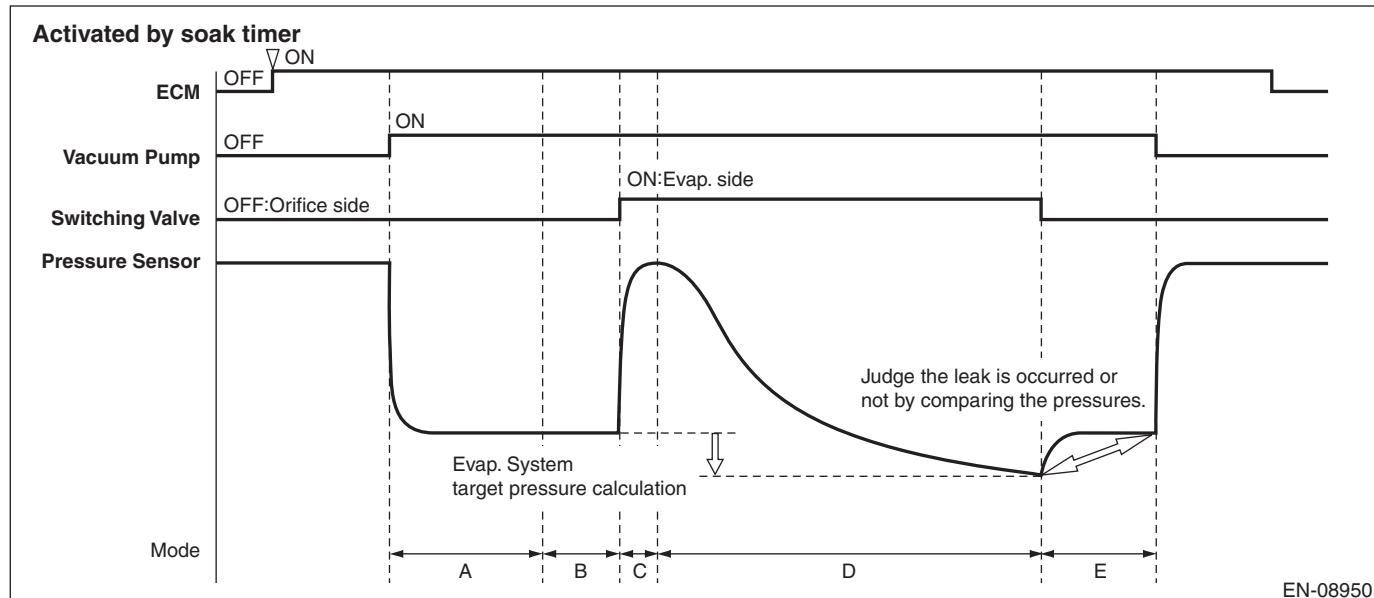
Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

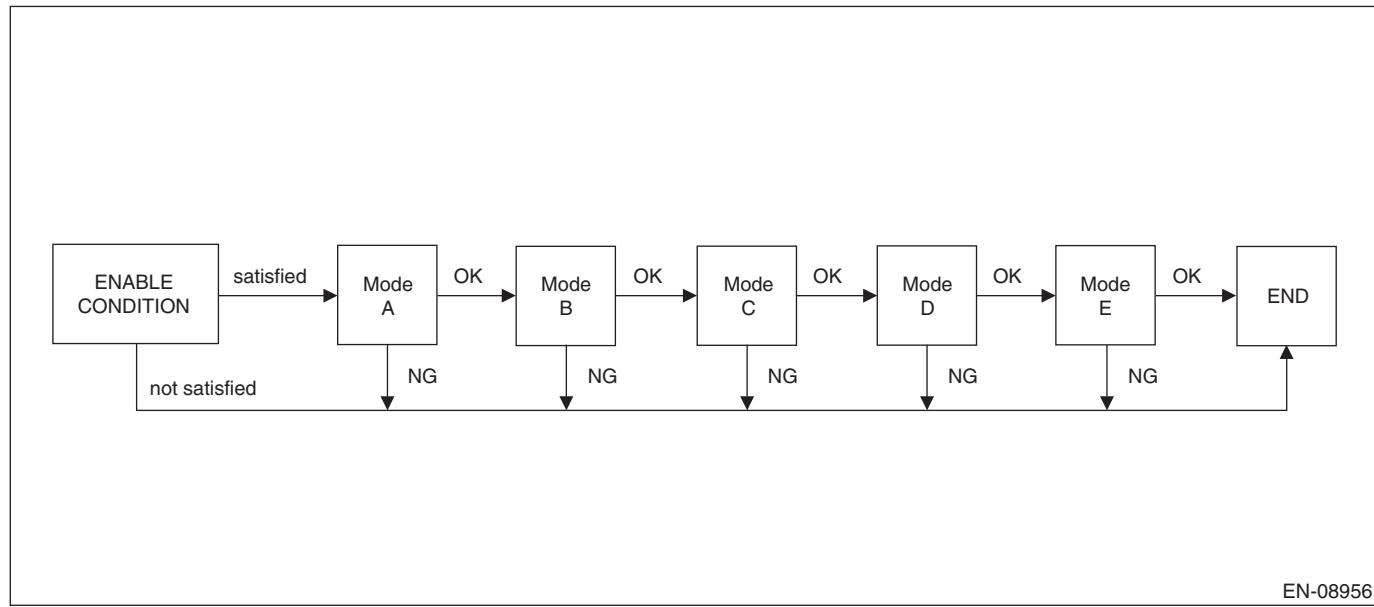
4. GENERAL DRIVING CYCLE

Perform the diagnosis only once when five hours has passed after ignition switch is OFF.

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
Elapsed time after mode change	≥ 6976 ms	P2404
Pressure sensor output value	> -0.2 kPa (-1.68 mmHg, -0.1 inHg)	

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
Elapsed time after mode change Pressure sensor maximum output value – Pressure sensor minimum output value	≥ 40 s > 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 (-29.79 , -1.2)	-4.1 (-30.593 , -1.2)	-4.2 (-31.395 , -1.2)	-4.3 (-32.19 , -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 (-7.86 , -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
Elapsed time after mode change Pressure sensor output value – Reference pressure for setting the target negative pressure	≥ 12000 ms < 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	< 52000 ms	P1451
When any one of the followings is established. <ul style="list-style-type: none">• Reference pressure for setting the target negative pressure – Pressure sensor output value• Pressure sensor output value	\geq Value of Map 4	
	< -5 kPa (-37.298 mmHg, -1.5 inHg)	

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)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	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. <ul style="list-style-type: none">• 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 kPa (-37.298 mmHg, -1.5 inHg) \geq 900000 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
Elapsed time after mode change Pressure sensor maximum output value – Pressure sensor minimum output value	≥ 40 s > 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
When any one of the followings is established. • Reference pressure for judgment • Reference pressure for setting the target negative pressure – Reference pressure for judgment	< Value of Map 5 or > Value of Map 6 > 0.9 kPa (7.058 mmHg, 0.3 inHg)	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 (–34.02, –1.3)	–4.6 (–34.815, –1.4)	–4.7 (–35.618, –1.4)	–4.9 (–36.42, –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 (–6.18, –0.2)	–0.9 (–6.983, –0.3)	–1 (–7.785, –0.3)	–1.1 (–8.58, –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 Ileakjdg = (Reference pressure for judgment) × 0.377 – (–0.341)	> Reference pressure for judgment and ≥ Ileakjdg	P0455
<Very small leak (0.02 inch)> Leak pressure	> Reference pressure for judgment and < Ileakjdg	P0456

Time Needed for Diagnosis: Approx. 23 min

• Abnormality Judgment

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.

• Normality Judgment

At next engine start, confirm whether the enable conditions are satisfied even though refueling has been done during soaking, then, if the following conditions are established, judge as OK and clear the NG.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
NG flag	Not set	P0455 P0456 P1451 P2404

CF: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)-149, DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

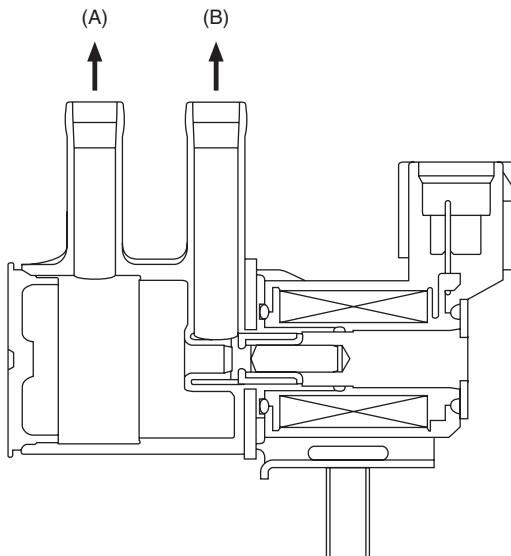
CG:DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW

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
Elapsed time after starting the engine	≥ 1 second

4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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
Duty ratio of "ON"	< 0.75
Terminal output voltage	Low

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal output voltage	High

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

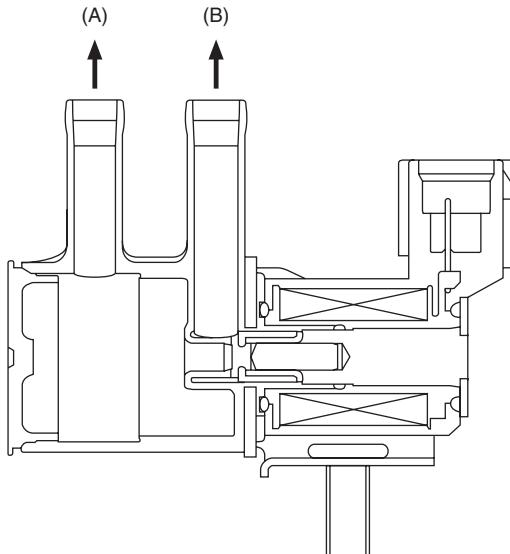
CH:DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH

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
Elapsed time after starting the engine	≥ 1 second

4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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
Duty ratio of "ON"	≥ 0.25
Terminal output voltage	High

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal output voltage	Low

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

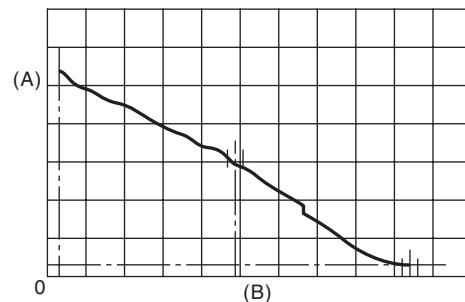
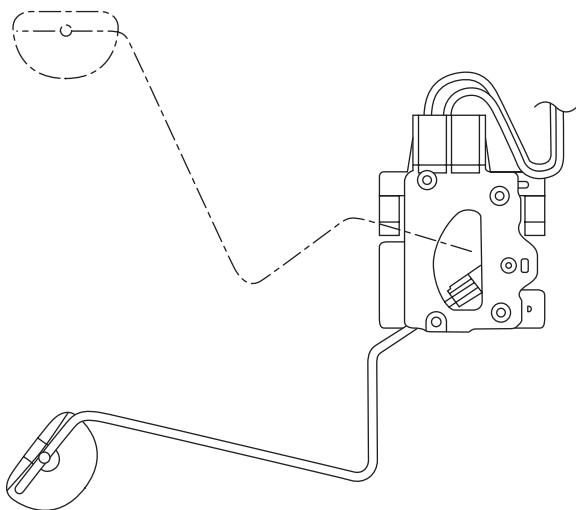
CI: DTC P0461 FUEL LEVEL SENSOR “A” CIRCUIT RANGE/PERFORMANCE

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

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

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

Time Needed for Diagnosis: Less than 1 second

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

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

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

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

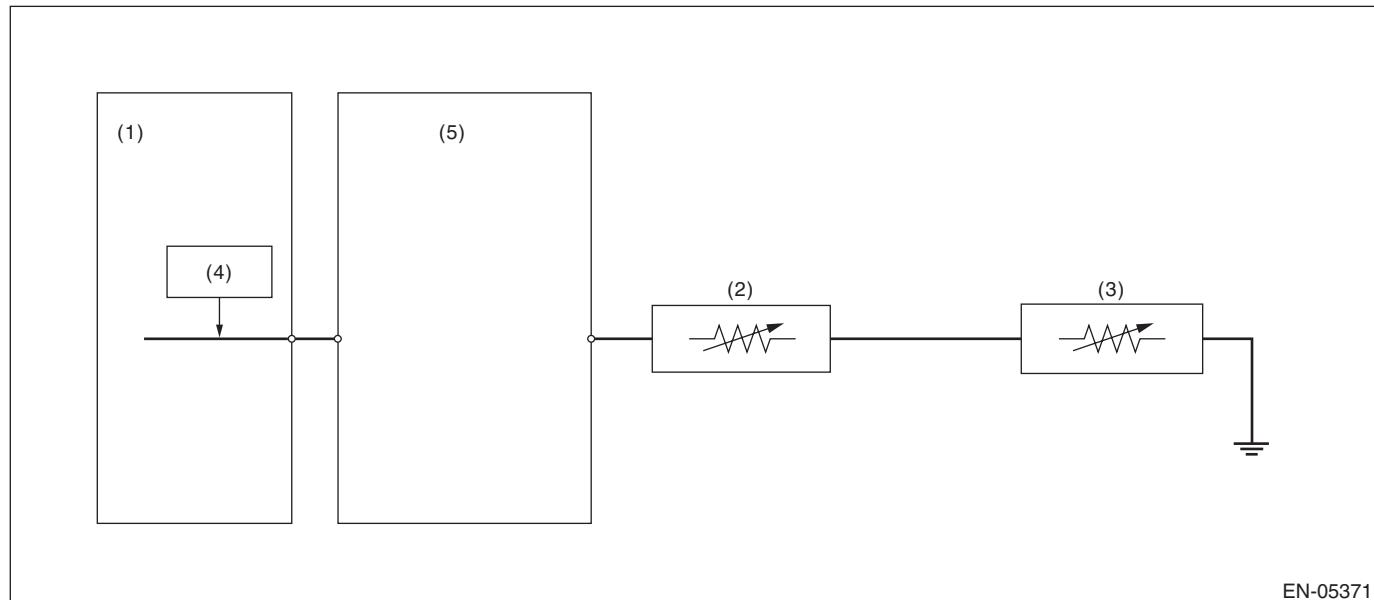
GENERAL DESCRIPTION

CJ: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



EN-05371

(1) Engine control module (ECM) (3) Fuel sub level sensor (4) Detecting circuit
(2) Fuel level sensor (5) Body integrated unit

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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
Battery voltage	$\geq 10.9 \text{ V}$
Elapsed time after starting the engine	$\geq 3000 \text{ ms}$
Output voltage	$< 0.383 \text{ V}$

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9 \text{ V}$
Elapsed time after starting the engine	$\geq 3000 \text{ ms}$
Output voltage	$\geq 0.383 \text{ V}$

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

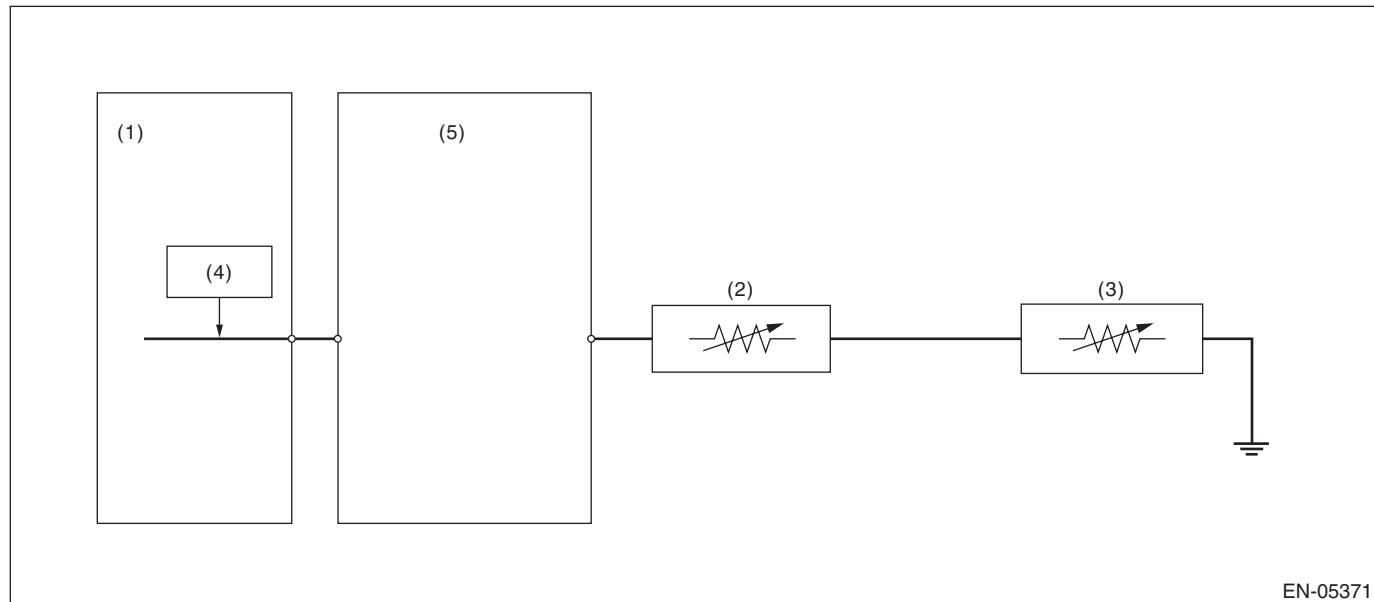
GENERAL DESCRIPTION

CK: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



EN-05371

(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
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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
Battery voltage	$\geq 10.9 \text{ V}$
Elapsed time after starting the engine	$\geq 3000 \text{ ms}$
Output voltage	$\geq 6.533 \text{ V}$

Time Needed for Diagnosis: 1000 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 10.9 \text{ V}$
Elapsed time after starting the engine	$\geq 3000 \text{ ms}$
Output voltage	$< 6.533 \text{ V}$

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CL: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
Elapsed time after starting the engine	≥ 2000 ms

4. GENERAL DRIVING CYCLE

Always perform diagnosis more than 2000 ms after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Front left wheel speed	> 0 km/h (0 MPH) and < 300 km/h (186.4 MPH)
Front right wheel speed	> 0 km/h (0 MPH) and < 300 km/h (186.4 MPH)

Time Needed for Diagnosis: 2500 ms

CM: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	$\geq 60^{\circ}\text{C}$ (140 °F)
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Fuel level	≥ 8.25 ℥ (2.18 US gal, 1.82 Imp gal)
Elapsed time after starting the engine	≥ 10.49 s
Feedback of ISC	In operation
Lambda value (left and right)	≥ 0.81 and < 1.1
After switching air conditioner to ON/OFF	≥ 5.1 s
After intake manifold pressure changes by 4 kPa (30 mmHg, 1.2 inHg) or more.	> 5.1 s
Elapsed time after switching neutral position switch to ON/OFF	> 5.1 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

• Abnormality Judgment

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 rpm
Feedback compensation for ISC	Max.

Time Needed for Diagnosis: 10 s \times 3 time(s)

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Actual engine speed – Targeted engine speed	≥ -100 rpm

Time Needed for Diagnosis: 10 s

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CN: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	$\geq 60^{\circ}\text{C}$ (140 °F)
Battery voltage	$\geq 10.9\text{ V}$
Atmospheric pressure	$\geq 75\text{ kPa}$ (563 mmHg, 22.2 inHg)
Fuel level	$\geq 8.25\text{ l}$ (2.18 US gal, 1.82 Imp gal)
Elapsed time after starting the engine	$\geq 10.49\text{ s}$
Feedback of ISC	In operation
Lambda value (left and right)	≥ 0.81 and < 1.1
After switching air conditioner to ON/OFF	$\geq 5.1\text{ s}$
After intake manifold pressure changes by 4 kPa (30 mmHg, 1.2 inHg) or more.	$> 5.1\text{ s}$
Elapsed time after switching neutral position switch to ON/OFF	$> 5.1\text{ s}$
Vehicle speed	0 km/h (0 MPH)

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling after warming up engine.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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	$\geq 200\text{ rpm}$
Feedback compensation for ISC	Min.

Time Needed for Diagnosis: 10 s \times 3 time(s)

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

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

Time Needed for Diagnosis: 10 s

CO: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)

Judge as NG if the exhaust gas temperature diagnosis or idle speed diagnosis is NG.

- Exhaust gas temperature diagnosis

Judge as NG when the estimated exhausted gas temperature in 14 seconds after the cold start is below the specified value.

- 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
<Exhaust gas temperature diagnosis>	
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Battery voltage	> 10.9 V
Engine condition	In operation
Vehicle speed	≤ 2 km/h (1.2 MPH)
Elapsed time after gear position change (P ↔ D or N ↔ D)	≥ 3000 ms
ISC feedback	In operation
Throttle opening angle	< 0.37 °
Fuel property	Not extremely low volatility
Target retard amount	≥ 14 °CA (CVT model) ≥ 14 °CA (MT model)
<Idle speed diagnosis>	
Atmospheric pressure	≥ 75 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 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 (CVT model)	4°C A	4°C A	4°C A	4°C A	4°C A	4°C A	4°C A	4°C A	4°C A	4°C A	4°C A
Target retard amount (MT model)	5°C A	5°C A	5°C A	5°C A	5°C A	5°C A	5°C A	5°C A	5°C A	5°C A	5°C A

3. GENERAL DRIVING CYCLE

Perform the diagnosis at cold start.

4. DIAGNOSTIC METHOD

- Exhaust gas temperature diagnosis

Abnormality Judgment

Calculate the estimated exhaust gas temperature when the diagnostic enable condition is established. Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Estimated exhaust gas temperature	< Value of Map 4

Map 4

Engine coolant temperature at engine starting	-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 (CVT model)	150°C (302°F)	150°C (302°F)	150°C (302°F)	150°C (302°F)	138°C (280.4°F)	131°C (267.8°F)	127°C (260.6°F)	119°C (246.2°F)	110°C (230°F)	104°C (219.2°F)	103°C (217.4°F)
Threshold value (MT model)	116°C (240.8°F)	116°C (240.8°F)	116°C (240.8°F)	116°C (240.8°F)	107°C (224.6°F)	101°C (213.8°F)	100°C (212°F)	91°C (195.8°F)	86°C (186.8°F)	83°C (181.4°F)	83°C (181.4°F)

Time Needed for Diagnosis: 14 seconds

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

Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Estimated exhaust gas temperature	≥ Value of Map 4

Time Needed for Diagnosis: Less than 1 second

- Idle speed diagnosis

Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Actual engine speed – Target engine speed	< - 125 rpm

Time Needed for Diagnosis: 5000 ms

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

Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Actual engine speed – Target engine speed	≥ - 125 rpm

Time Needed for Diagnosis: 5000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

- Final ignition timing diagnosis

Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Final ignition timing – ignition timing during CSERS* *: Ignition timing during CSERS (Cold Start Emission Reduction Strategy) = Base ignition timing – retard amount	> Value of Map 5

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 (CVT model)	4°C	4°C	4°C	4°C	4°C	4°C	4°C	4°C	4°C	4°C	4°C
Threshold value (MT model)	5°C	5°C	5°C	5°C	5°C	5°C	5°C	5°C	5°C	5°C	5°C

Time Needed for Diagnosis: 5000 ms

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

Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Final ignition timing – ignition timing during CSERS* *: Ignition timing during CSERS (Cold Start Emission Reduction Strategy) = Base ignition timing – retard amount	≤ Value of Map 5

Time Needed for Diagnosis: 5000 ms

CP:DTC P050B COLD START IGNITION TIMING PERFORMANCE

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P050A. <Ref. to GD(H4DO)-169, DTC P050A COLD START IDLE AIR CONTROL SYSTEM PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CQ:DTC P0512 STARTER REQUEST CIRCUIT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of starter SW.

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

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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 condition	After engine starting
Starter OFF signal	Not detected
Battery voltage	≥ 8 V

Time Needed for Diagnosis: 30000 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Starter OFF signal	Detected
Battery voltage	≥ 8 V

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CR:DTC P0513 INCORRECT IMMOBILIZER KEY

1. OUTLINE OF DIAGNOSIS

DTC	Item	Outline of Diagnosis
P0513	Incorrect Immobilizer Key	Incorrect immobilizer key (Use of unregistered key in body integrated unit)
P1570	Antenna	Faulty antenna
P1571	Reference Code Incompatibility	Reference code incompatibility between body integrated unit and ECM
P1572	IMM Circuit Failure (Except Antenna Circuit)	Communication failure between body integrated unit and ECM
P1574	Key Communication Failure	Failure of body integrated unit to verify key (transponder) ID code or transponder failure
P1576	EGI Control Module EEPROM	ECM malfunctioning
P1577	IMM Control Module EEPROM	Body integrated unit malfunctioning
P1578	Meter Failure	Reference code incompatibility between body integrated unit and combination meter

2. ENABLE CONDITION

When starting the engine.

3. GENERAL DRIVING CYCLE

Perform the diagnosis only after starting the engine.

4. DIAGNOSTIC METHOD

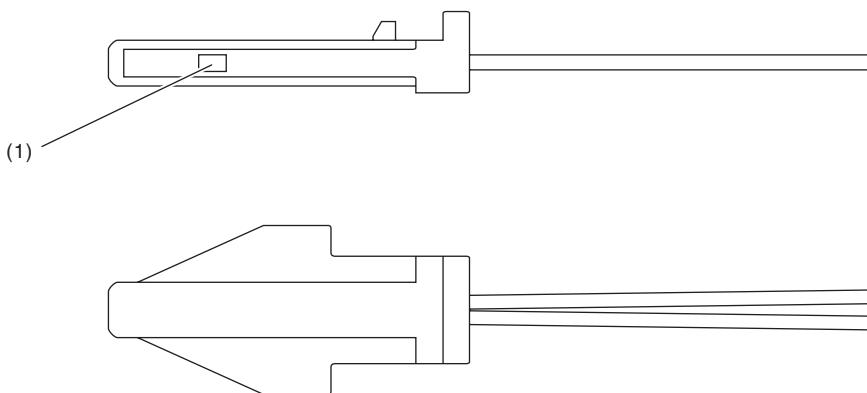
Judge as NG when the conditions for the outline of the diagnosis of the top are established.

CS:DTC P0516 BATTERY TEMPERATURE SENSOR CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



EN-09355

(1) Sensor element

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	> 1000 ms
Engine speed	> 500 rpm
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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	< 0.136 V

Time Needed for Diagnosis: 500 ms

Malfunction Indicator Light Illumination: Does not illuminate even when malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 0.136 V

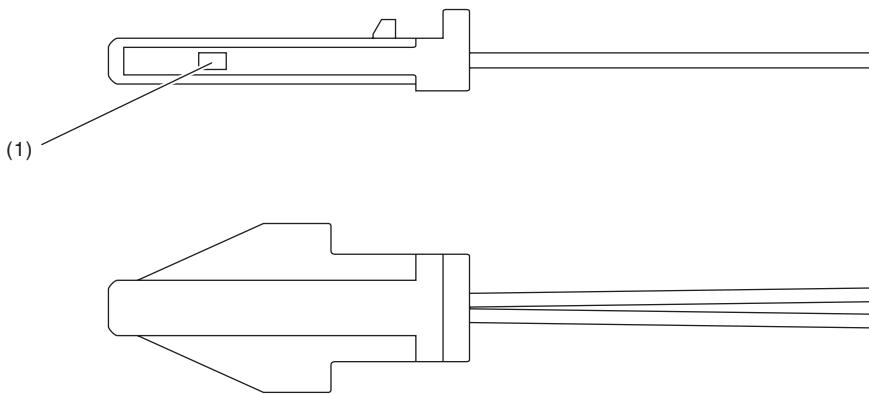
Time Needed for Diagnosis: Less than 1 second

CT:DTC P0517 BATTERY TEMPERATURE SENSOR CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



EN-09355

(1) Sensor element

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	> 1000 ms
Engine speed	> 500 rpm
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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	$\geq 4.671 \text{ V}$

Time Needed for Diagnosis: 500 ms

Malfunction Indicator Light Illumination: Does not illuminate even when malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$< 4.671 \text{ V}$

Time Needed for Diagnosis: Less than 1 second

CU: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

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Write the specified value to RAM and then read.	The written value cannot be read.

Time Needed for Diagnosis: Less than 1 second

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

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Write the specified value to RAM and then read.	The written value can be read.

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CV: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
Ignition switch	ON

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

Abnormality Judgment

Judge as NG if the criteria below are met.

Judgment Value

Malfunction Criteria	Threshold Value
SUM value of ROM	Standard

Time Needed for Diagnosis: Undetermined

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

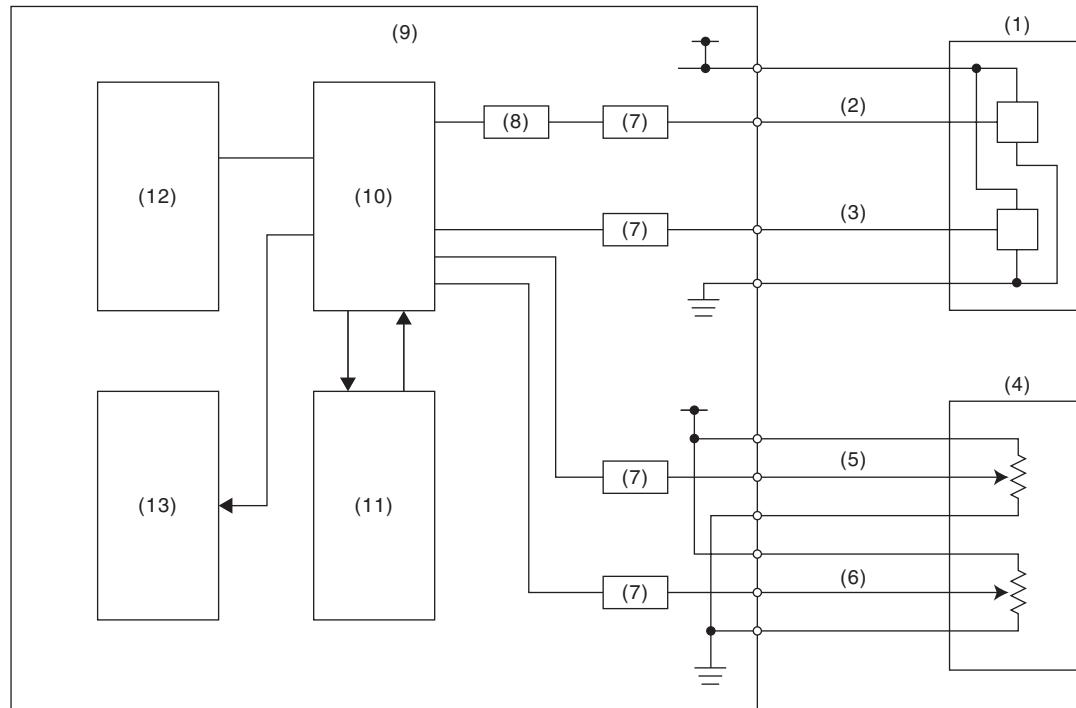
CW:DTC P0607 THROTTLE CONTROL SYSTEM CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Judge as NG when any one of the followings is established.

- (1) Monitoring IC operates abnormally. (Monitoring IC malfunction)
- (2) Input amplifier circuit of throttle position sensor 1 operates abnormally. (Fourfold amplifier malfunction)
- (3) CPU operates abnormally. (Instruction/flow check)
- (4) A/D converter operates abnormally. (ADC malfunction)
- (5) EEPROM operates abnormally. (EEPROM malfunction)
- (6) Output IC operates abnormally. (Output driver malfunction)

2. COMPONENT DESCRIPTION



EN-08016

(1) Throttle position sensor	(6) Accelerator pedal position sensor 2	(10) CPU
(2) Throttle position sensor 1	(7) I/F circuit	(11) Monitoring IC
(3) Throttle position sensor 2	(8) Amplifier circuit	(12) EEPROM
(4) Accelerator pedal position sensor	(9) Engine control module (ECM)	(13) Output IC
(5) Accelerator pedal position sensor 1		

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
(1) Battery voltage	≥ 6 V
(2) Ignition switch	ON
(2) Battery voltage	≥ 6 V
(3) Ignition switch	ON
(3) ETC control	Permitted
(4) Ignition switch	ON
(4) Battery voltage	≥ 6 V
(5) Starter switch	OFF
(5) Battery voltage	> 6 V
(6) Ignition switch	ON
(6) Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge as OK and clear the NG when the malfunction criteria below are met.

Judgment Value

Malfunction Criteria	Threshold Value
(1) Monitoring IC operation	The result and estimated value match.
(2) Throttle position sensor 1 opening angle – (Throttle position sensor 1 opening angle after passing amplifier)/4	< 3 °
(3) Main CPU calculation result	The result and estimated value match.
(4) Standard voltage – Voltage reading	< 0.078125 V
(5) EEPROM writing	Writing completed
(6) Communication with output IC	Possible to communicate

Time Needed for Diagnosis:

- (1): 200 ms
- (2): 24 ms
- (3): 192 ms
- (4): 200 ms
- (5): 48 ms
- (6): 2500 ms

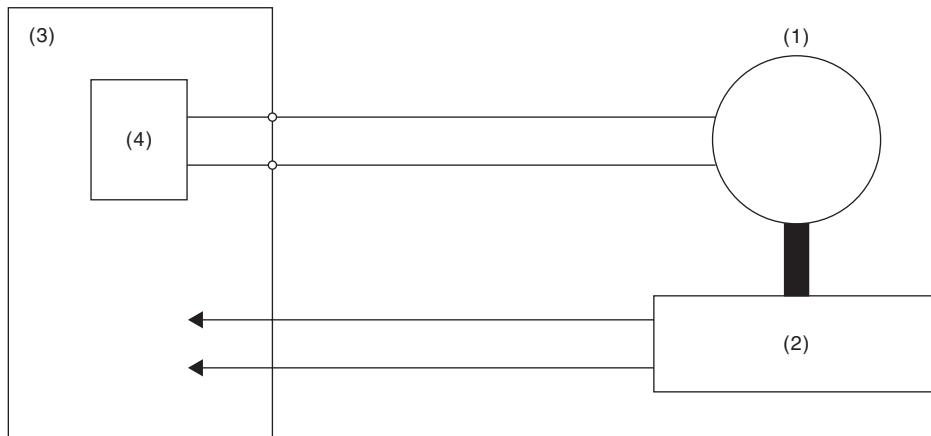
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

CX:DTC P0638 THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE (BANK 1)

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 CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
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.

Judgment Value

Malfunction Criteria	Threshold Value
Difference between target opening angle and actual opening angle	Within the OK range of judgment value detail
Output duty to drive circuit	< 95 %

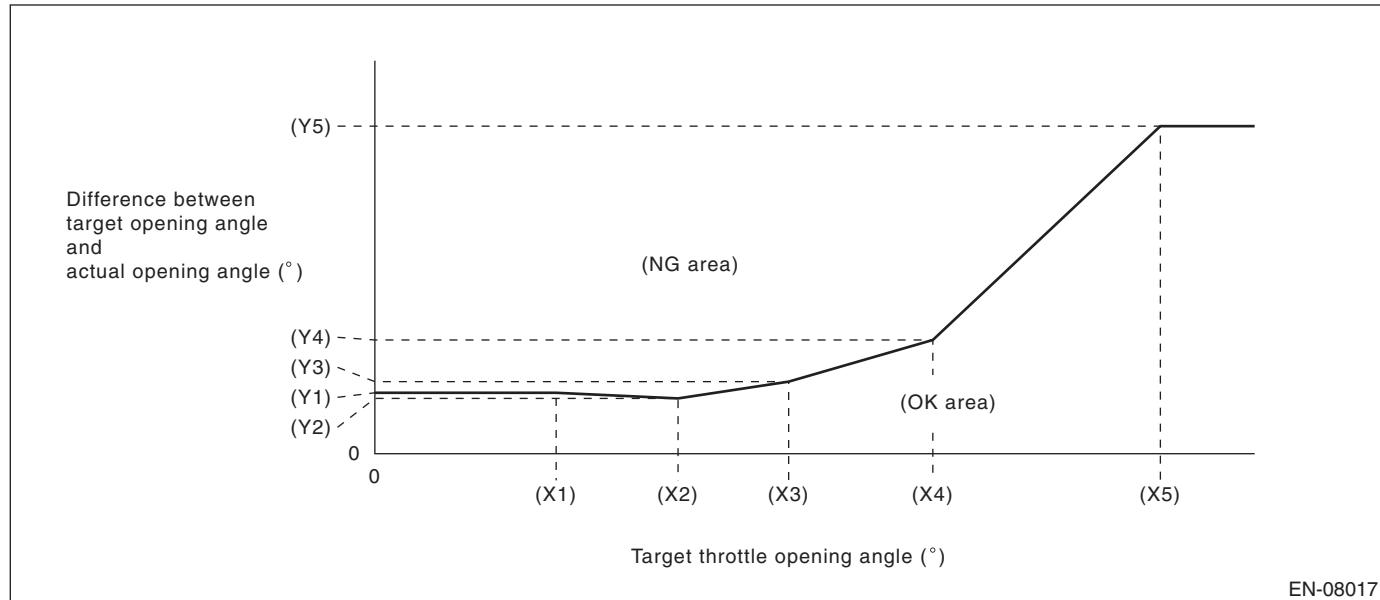
Time Needed for Diagnosis:

- Difference between target opening angle and actual opening angle:
 - NG judgment: Refer to the **judgment time detail**.
 - OK judgment: 2000 ms
- Output duty to drive circuit: 2000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Details of Judgment Value



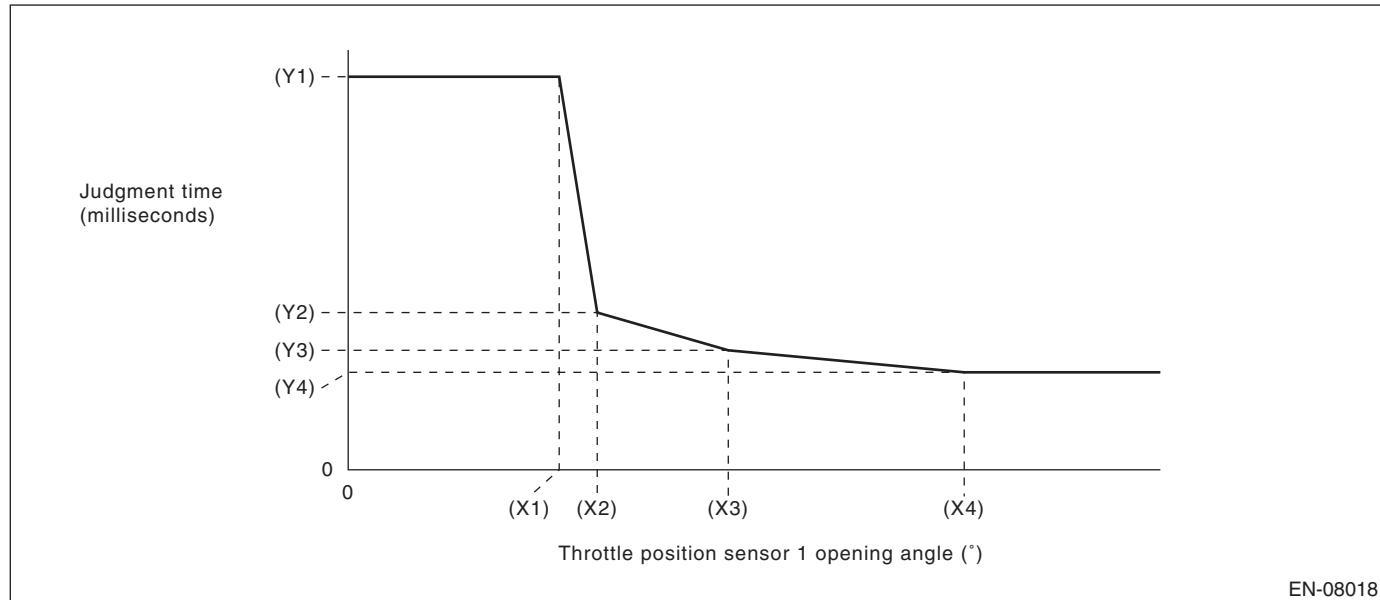
(X1) 6.915 ° (X2) 11.565 ° (X3) 15.785 °

(X4) 21.285 ° (X5) 29.965 °

(Y1) 4.65 ° (Y2) 4.22 ° (Y3) 5.5 °

(Y4) 8.68 ° (Y5) 25 °

Judgment time detail



(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 is constantly 1000 ms with Actual opening angle \leq Target opening angle.

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

CY: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
None	

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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
Battery voltage	≥ 10.9 V
MIL lighting request from TCM	Yes

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgment

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
Battery voltage	≥ 10.9 V
MIL lighting request from TCM	None

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CZ: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	OFF

3. GENERAL DRIVING CYCLE

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

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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 switch signal in ECM when "P"/ "N" range in TCM are "OFF" and when the other switches are "ON"	LOW (ON)

Time Needed for Diagnosis: 100 time(s)

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal in ECM when "P"/ "N" range in TCM are "OFF" and when the other switches are "ON"	HIGH (OFF)

Time Needed for Diagnosis: Less than 1 second

DA:DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of neutral SW.

Judge as NG when there is no change in the neutral SW even if the driving shift was applied. (There is neutral SW ON/OFF inversion from the vehicle speed and engine speed.)

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Starter relay	OFF

3. GENERAL DRIVING CYCLE

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

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the malfunction criteria below are completed determined times or more after the neutral SW change.

Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal (while changing from a to b below)	LOW (ON) continues.
Driving condition change	From a) to b)
a) Engine speed 500 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH)	
b) Engine speed 1700 rpm — 2200 rpm & Vehicle speed ≥ 64 km/h (39.8 MPH)	

Time Needed for Diagnosis: 3 time(s)

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

• Normality Judgment

Judge as OK and clear NG when there is change in the neutral SW.

Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal (while changing from a to b below)	Changes to HIGH (OFF).
Driving condition change	From a) to b)
a) Engine speed 500 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH)	
b) Engine speed 1700 rpm — 2200 rpm & Vehicle speed ≥ 64 km/h (39.8 MPH)	

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

DB: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	OFF

3. GENERAL DRIVING CYCLE

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

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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 switch signal in ECM when "P"/"N" range in TCM are "ON" and when the other switches are "OFF"	HIGH (OFF)

Time Needed for Diagnosis: 100 time(s)

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal in ECM when "P"/"N" range in TCM are "ON" and when the other switches are "OFF"	LOW (ON)

Time Needed for Diagnosis: Less than 1 second

DC:DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of neutral SW.

Judge as NG when there is no change in the neutral SW even if the driving shift was applied. (There is neutral SW ON/OFF inversion from the vehicle speed and engine speed.)

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Starter relay	OFF

3. GENERAL DRIVING CYCLE

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

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the malfunction criteria below are completed determined times or more after the neutral SW change.

Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal (while changing from a to b below)	HIGH (OFF) continues.
Driving condition change	From a) to b)
a) Engine speed 500 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH)	
b) Engine speed 1700 rpm — 2200 rpm & Vehicle speed ≥ 64 km/h (39.8 MPH)	

Time Needed for Diagnosis: 3 time(s)

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

• Normality Judgment

Judge as OK and clear NG when there is change in the neutral SW.

Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal (while changing from a to b below)	Changes to LOW (ON).
Driving condition change	From a) to b)
a) Engine speed 500 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH)	
b) Engine speed 1700 rpm — 2200 rpm & Vehicle speed ≥ 64 km/h (39.8 MPH)	

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

DD:DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1)

1. OUTLINE OF DIAGNOSIS

Detect that λ value remains low.

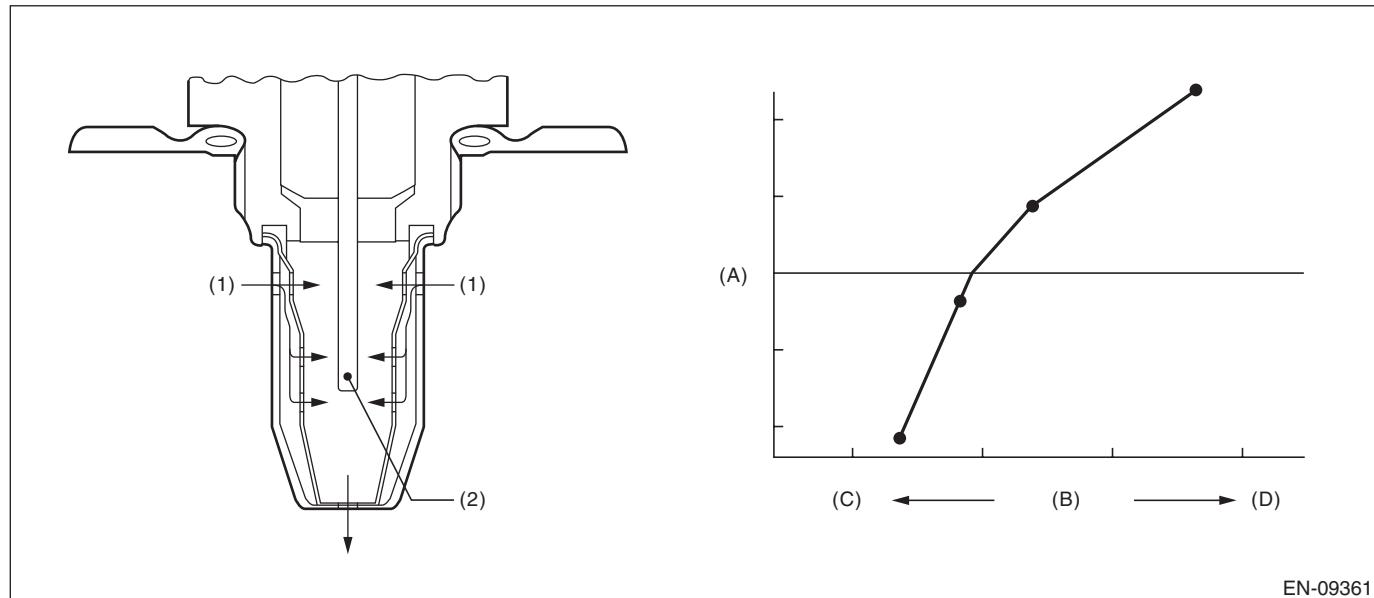
Judge as NG when lambda value is abnormal in accordance with λ value of front oxygen (A/F) sensor and running conditions such as vehicle speed, amount of intake air, engine coolant temperature, sub feedback control, etc.

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) Rich

(B) Air fuel ratio

(C) Lean

(1) Exhaust gas

(2) ZrO_2

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITION

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 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	≥ 60000 ms
Engine coolant temperature	≥ 60 °C (140 °F)
Vehicle speed	≥ 20 km/h (12.4 MPH)
Amount of intake air	≥ 6 g/s (0.21 oz/s)
Load change at 180°CA	< 0.02 g/rev (0 oz/rev)
Front oxygen (A/F) sensor impedance	0Ω — 50Ω
Learning value of evaporation gas density	< 0.24
Total time of operating canister purge	≥ 19.9 s
Targeted lambda value load compensation coefficient	-0.03 — 0.000

4. GENERAL DRIVING CYCLE

Perform diagnosis continuously at a constant speed of 20 km/h (12.4 MPH) or more after 60000 ms have passed since the engine started.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
λ value	≥ 0.85

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

DE:DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1)

1. OUTLINE OF DIAGNOSIS

Detect that λ value remains high.

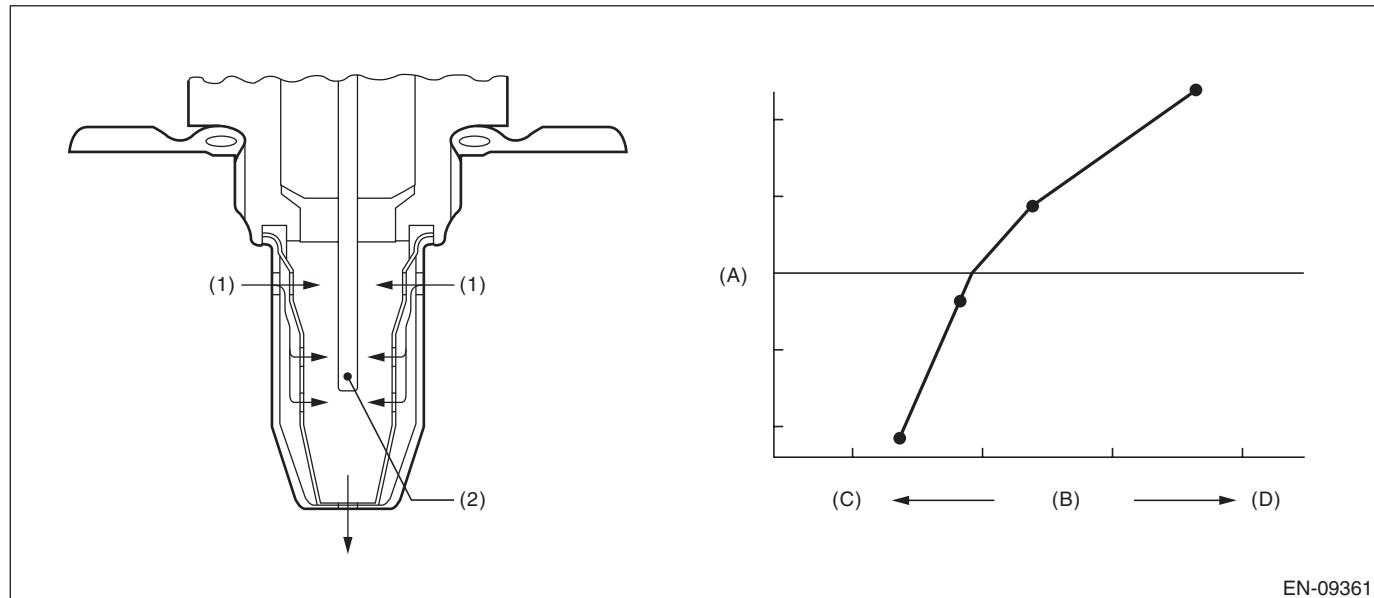
Judge as NG when lambda value is abnormal in accordance with λ value of front oxygen (A/F) sensor and running conditions such as vehicle speed, amount of intake air, engine coolant temperature, sub feedback control, etc.

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) Rich

(B) Air fuel ratio

(C) Lean

(1) Exhaust gas

(2) ZrO_2

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITION

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 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	≥ 60000 ms
Engine coolant temperature	≥ 60 °C (140 °F)
Vehicle speed	≥ 20 km/h (12.4 MPH)
Amount of intake air	≥ 6 g/s (0.21 oz/s)
Load change at 180°CA	< 0.02 g/rev (0 oz/rev)
Front oxygen (A/F) sensor impedance	0Ω — 50Ω
Learning value of evaporation gas density	< 0.24
Total time of operating canister purge	≥ 19.9 s
Targeted lambda value load compensation coefficient	-0.03 — 0.000

4. GENERAL DRIVING CYCLE

Perform diagnosis continuously at a constant speed of 20 km/h (12.4 MPH) or more after 60000 ms have passed since the engine started.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
λ value	≤ 1.15

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

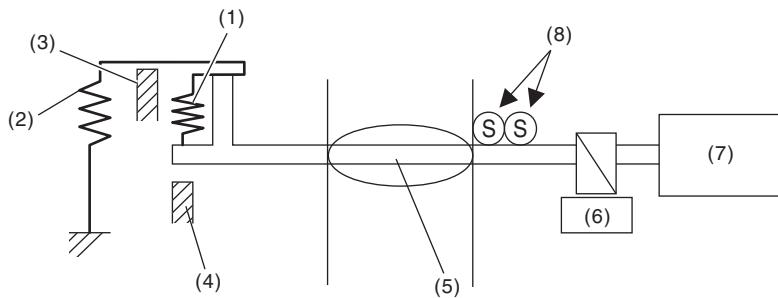
GENERAL DESCRIPTION

DF: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
Throttle position sensor	Normal

4. GENERAL DRIVING CYCLE

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

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Opening variation after continuity is set to OFF	< 2 °

Time Needed for Diagnosis: 24 ms

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

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Opening variation after continuity is set to OFF	≥ 2 °

Time Needed for Diagnosis: 3400 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

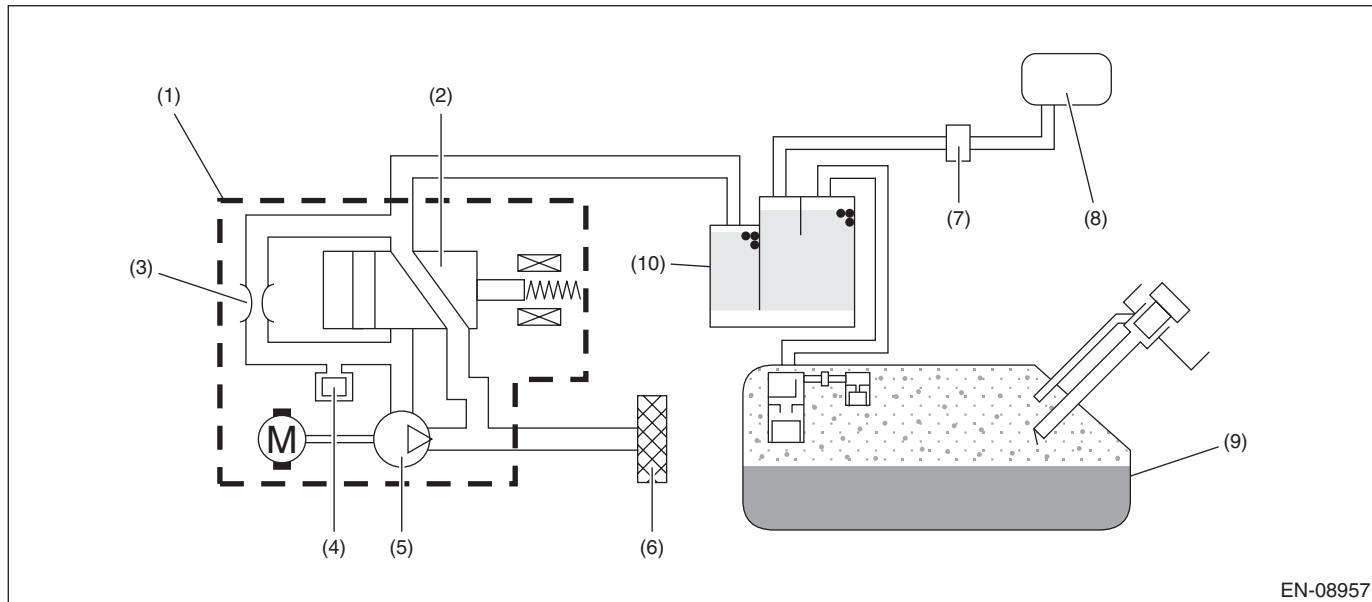
DG:DTC P1449 EVAPORATIVE EMISSION CONT. SYS. AIR FILTER CLOG

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	

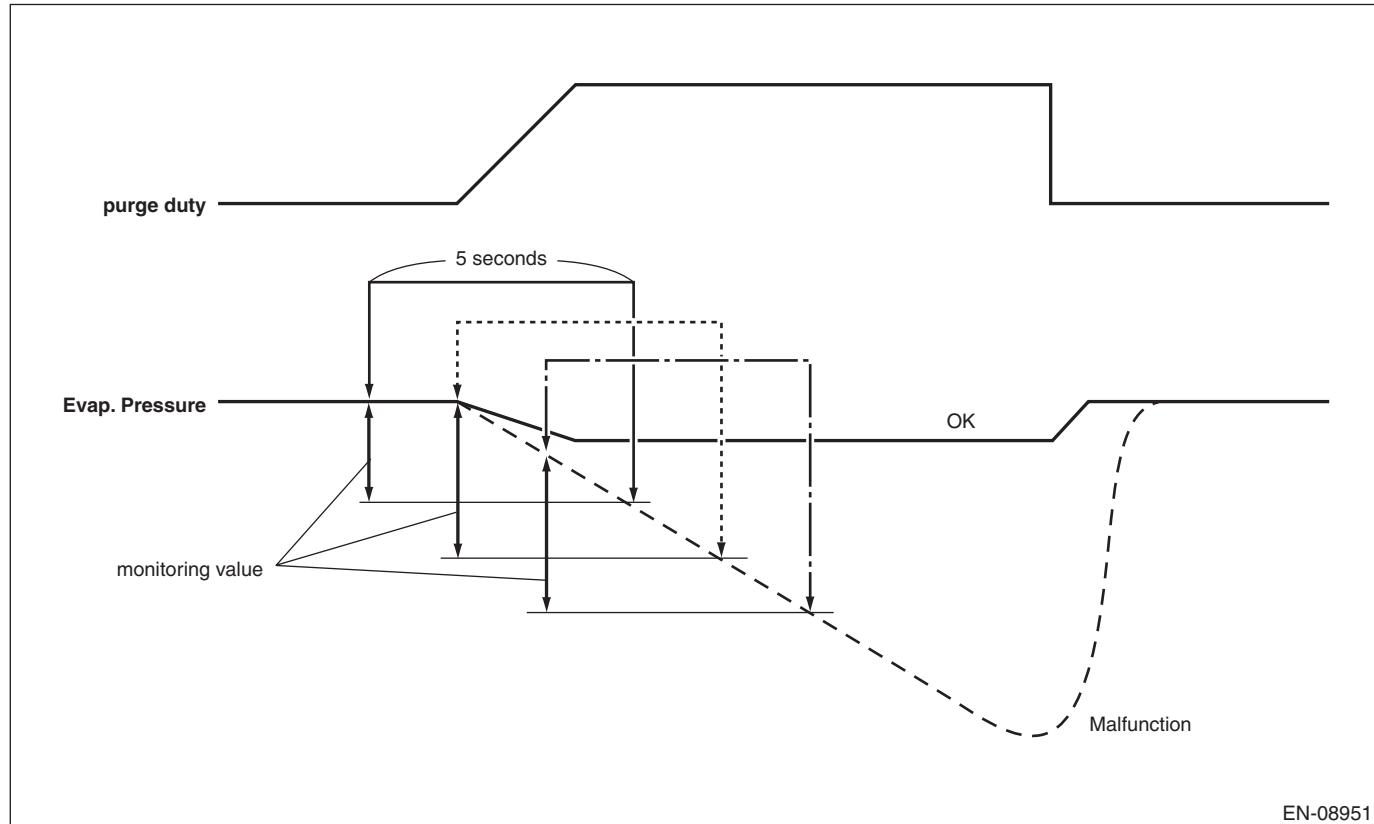
3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$
Elapsed time after starting the engine	$\geq 20000 \text{ ms}$
Continuous time of $ \text{Pressure sensor output value} - \text{Pressure sensor output value 64 ms ago} \leq 0.7 \text{ kPa}$ (5 mmHg, 0.2 inHg)	$\geq 5120 \text{ ms} + 13000 \text{ ms}$
Establishing time for following conditions	$\geq 10000 \text{ ms}$
• 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.

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Pressure sensor output value as of 5 seconds ago – Current pressure sensor output value	> Value from Map
Number of above conditions established	> 2 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)
Pressure sensor output value as of 5 seconds ago – Current pressure sensor output value kPa (mmHg, inHg)	0.8 (5.890, 0.2)	0.8 (5.890, 0.2)	0.9 (6.782, 0.3)	1 (7.682, 0.3)	1.1 (8.567, 0.3)	1.3 (9.460, 0.4)	1.4 (10.352, 0.4)	2.4 (18.287, 0.7)

Time Needed for Diagnosis: Approx. 5 seconds

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Pressure sensor output value as of 5 seconds ago – Current pressure sensor output value	≤ Value from Map

DH:DTC P1451 EVAPORATIVE EMISSION CONT. SYS.

1. OUTLINE OF DIAGNOSIS

NOTE:

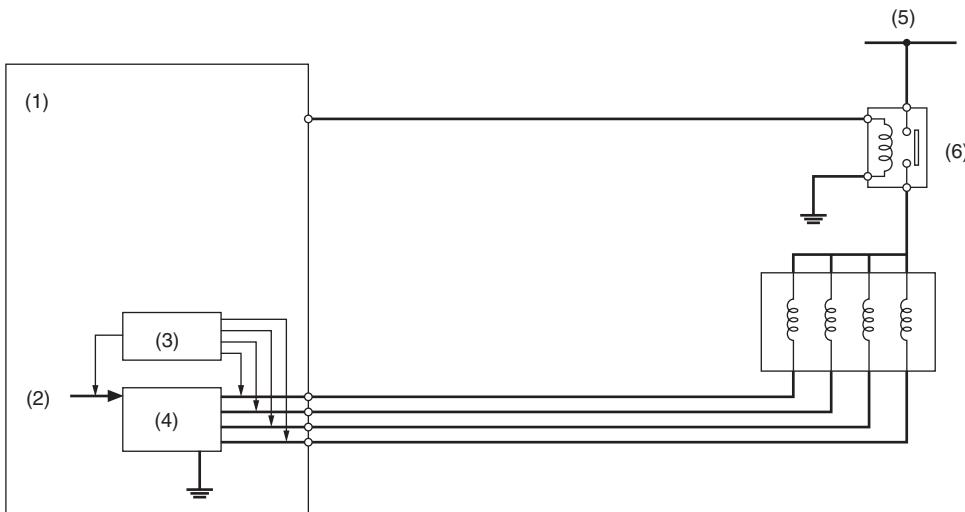
For the detection standard, refer to DTC P0455. <Ref. to GD(H4DO)-149, DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

DI: 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-02051

(1) Engine control module (ECM)
(2) Computer unit (CPU)

(3) Detecting circuit
(4) Switch circuit

(5) Battery voltage
(6) Main relay

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	≥ 1 second
EGR valve target position	> 0 step
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Perform diagnosis continuously during EGR operation.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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 voltage level when ECM outputs OFF signal	Low level
or Terminal voltage level when EGR operates	Low level

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs OFF signal	High level
Terminal voltage level when EGR operates	High level

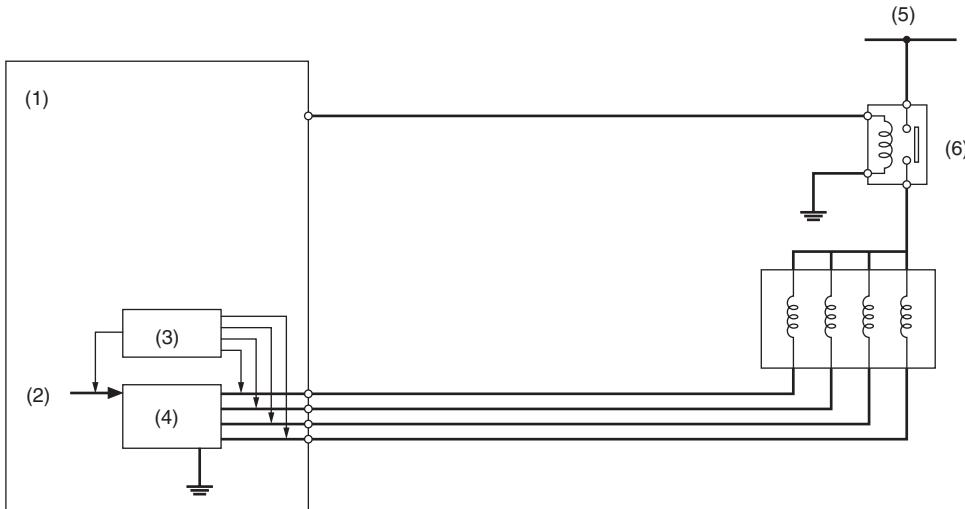
Time Needed for Diagnosis: 256 ms

DJ: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



EN-02051

(1) Engine control module (ECM)
(2) Computer unit (CPU)

(3) Detecting circuit
(4) Switch circuit

(5) Battery voltage
(6) Main relay

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	≥ 1 second
EGR valve target position	> 0 step
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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 voltage level when ECM outputs ON signal or Terminal voltage level when EGR operates	High level
	High level

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs ON signal	Low level
Terminal voltage level when EGR operates	Low level

Time Needed for Diagnosis: 256 ms

DK: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)-199, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

DL: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)-201, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

DM: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)-199, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

DN: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)-201, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

DO: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)-199, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

DP: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)-201, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

DQ:DTC P1518 STARTER SWITCH CIRCUIT LOW INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of starter SW.

Judge as OFF NG when it becomes after engine start despite no starter ON experience.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as OFF NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Vehicle speed	< 1 km/h (0.6 MPH)
Starter ON signal	Not detected
Engine condition	Changed from before start to after start
Battery voltage	≥ 8 V

Time Needed for Diagnosis: Less than 1 second

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

• Normality Judgment

Judge as OFF OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Starter ON	Experienced
Starter ON diagnosis	No diagnosis experience
Battery voltage	≥ 8 V

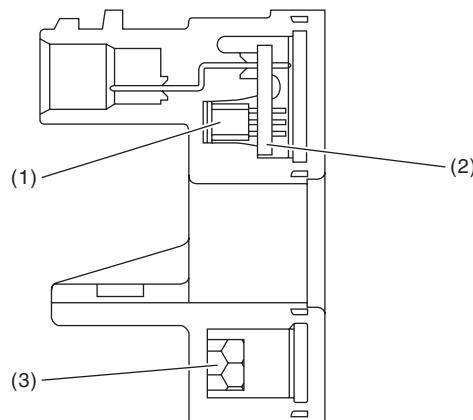
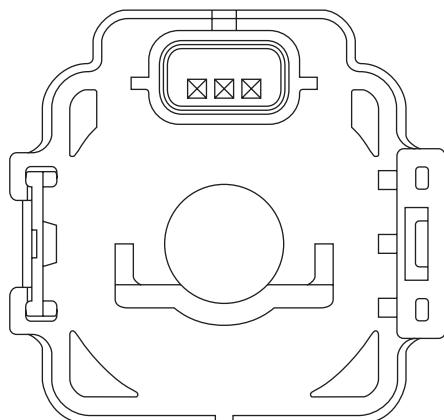
Time Needed for Diagnosis: Less than 1 second

DR:DTC P1530 BATTERY CURRENT SENSOR CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



EN-09356

(1) Hall IC

(2) Chip condenser

(3) Core

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	> 1000 ms
Engine speed	> 500 rpm
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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	< 0.22 V

Time Needed for Diagnosis: 500 ms

Malfunction Indicator Light Illumination: Does not illuminate even when malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 0.22 V

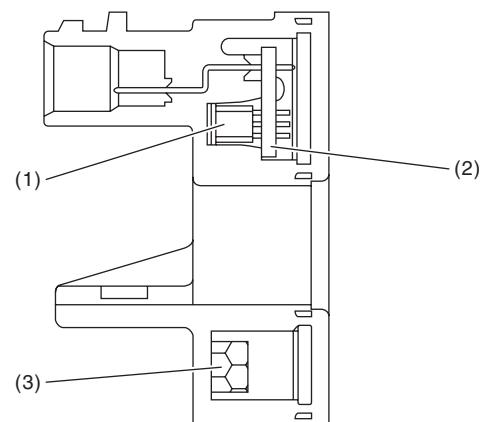
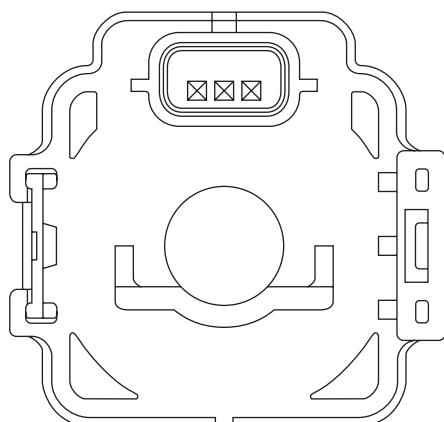
Time Needed for Diagnosis: Less than 1 second

DS:DTC P1531 BATTERY CURRENT SENSOR CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



EN-09356

(1) Hall IC

(2) Chip condenser

(3) Core

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	> 1000 ms
Engine speed	> 500 rpm
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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	$\geq 4.722 \text{ V}$

Time Needed for Diagnosis: 500 ms

Malfunction Indicator Light Illumination: Does not illuminate even when malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$< 4.722 \text{ V}$

Time Needed for Diagnosis: Less than 1 second

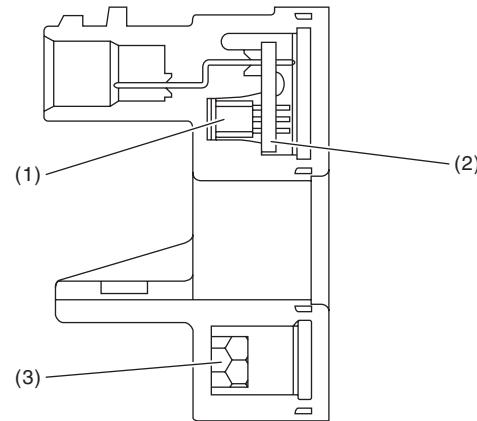
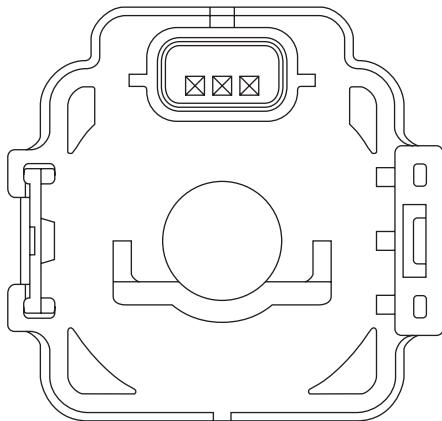
DT:DTC P1532 BATTERY CHARGING SYSTEM

1. OUTLINE OF DIAGNOSIS

Detect the output property and malfunction of battery current sensor.

Judge as NG when there is no variation (stuck) under a condition where the battery current sensor output should have changed or when difference between output and battery current value is larger than expected (characteristics malfunction).

2. COMPONENT DESCRIPTION



EN-09356

(1) Hall IC

(2) Chip condenser

(3) Core

3. ENABLE CONDITIONS

- Stuck

Secondary Parameters	Enable Conditions
Ignition switch During switchover of regulating voltage	ON High condition judgment *1 \longleftrightarrow Low condition judgment *2 However, the generator target duty has not experienced the following during switchover. $40\% \leq \text{Generator target duty} < 60\%$
*1 High condition judgment	
Continuous time during which all the conditions listed below are met • Battery voltage • Generator final output duty • Engine speed	$\geq 5000 \text{ ms}$ $\geq 13.7 \text{ V}$ $\geq 60\%$ $\geq 600 \text{ rpm}$
*2 Low condition judgment	
Continuous time during which all the conditions listed below are met • Battery voltage • Generator final output duty or • Engine speed	$\geq 5000 \text{ ms}$ $< 13.2 \text{ V}$ $< 40\%$ $< 600 \text{ rpm}$

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

- Characteristics malfunction

Secondary Parameters	Enable Conditions
Ignition switch During switchover of regulating voltage	ON High condition judgment is established. Target duty $\geq 60\%$ \rightarrow target duty $< 40\%$ or Low condition judgment is established. Target duty $< 40\%$ \rightarrow target duty $\geq 60\%$

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

- Abnormality Judgment

- Stuck

Judge as NG when the following conditions are repeated 10 time(s) or more.

Judgment Value

Malfunction Criteria	Threshold Value
Difference between maximum value and minimum value in output voltage	$< 0.07\text{ V}$

Time Needed for Diagnosis: Less than 1 second

Malfunction Indicator Light Illumination: Does not illuminate even when malfunction occurs.

- Characteristics malfunction (Charge side)

Within 30000 ms from “enable condition not met” to “enable condition met”, judge as NG when the time required for meeting the following conditions exceeds the predetermined time.

(When NG judgment is performed, NG status is retained during that driving cycle.)

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage and Battery voltage	$2.6\text{ V} \leq \text{Output voltage} < 5\text{ V}$ $< 13.2\text{ V}$

Time Needed for Diagnosis: 26000 ms

Malfunction Indicator Light Illumination: Does not illuminate even when malfunction occurs.

- Characteristics malfunction (Discharge side)

Within 30000 ms from “enable condition not met” to “enable condition met”, judge as NG when the time required for meeting the following conditions exceeds the predetermined time.

(Within 30000 ms from “enable condition not met” to “enable condition met”, the target duty $\geq 60\%$ has not been experienced.)

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage and Battery voltage	$0\text{ V} \leq \text{Output voltage} < 2.4\text{ V}$ $\geq 13.7\text{ V}$

Time Needed for Diagnosis: 26000 ms

Malfunction Indicator Light Illumination: Does not illuminate even when malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

- **Normality Judgment**

- **Stuck**

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Difference between maximum value and minimum value in output voltage	$\geq 0.07 \text{ V}$

Time Needed for Diagnosis: Less than 1 second

- **Characteristics malfunction (Charge side)**

Within 30000 ms from “enable condition not met” to “enable condition met”, judge as OK and clear the NG when the time required for meeting the following conditions does not reach the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage and Battery voltage	$2.6 \text{ V} \leq \text{Output voltage} < 5 \text{ V}$ $< 13.2 \text{ V}$

Time Needed for Diagnosis: 26000 ms

- **Characteristics malfunction (Discharge side)**

Within 30000 ms from “enable condition not met” to “enable condition met”, judge as OK and clear the NG when the time required for meeting the following conditions does not reach the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage and Battery voltage	$0 \text{ V} \leq \text{Output voltage} < 2.4 \text{ V}$ $\geq 13.7 \text{ V}$

Time Needed for Diagnosis: 26000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

DU:DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION

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 CONDITION

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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	Low
Battery voltage	≥ 10.9 V
Engine condition	After engine starting

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Voltage of back-up power supply	High
Battery voltage	≥ 10.9 V
Engine condition	After engine starting

Time Needed for Diagnosis: Less than 1 second

DV:DTC P1570 ANTENNA

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4DO)-174, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DW:DTC P1571 REFERENCE CODE INCOMPATIBILITY

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4DO)-174, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DX:DTC P1572 IMM CIRCUIT FAILURE (EXCEPT ANTENNA CIRCUIT)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4DO)-174, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DY:DTC P1574 KEY COMMUNICATION FAILURE

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4DO)-174, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DZ:DTC P1576 EGI CONTROL MODULE EEPROM

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4DO)-174, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

EA:DTC P1577 IMM CONTROL MODULE EEPROM

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4DO)-174, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

EB:DTC P1578 METER FAILURE

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4DO)-174, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

EC: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

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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 opening switch	= High
Tumble generator valve “close” signal output time	≥ 1600 ms

Time Needed for Diagnosis: 4600 ms

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

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Tumble generator valve opening switch	= Low
Tumble generator valve “close” signal output time	≥ 1600 ms

Time Needed for Diagnosis: 1600 ms

ED: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

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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 opening switch	= High
Tumble generator valve “close” signal output time	≥ 1600 ms

Time Needed for Diagnosis: 4600 ms

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

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Tumble generator valve opening switch	= Low
Tumble generator valve “close” signal output time	≥ 1600 ms

Time Needed for Diagnosis: 1600 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

EE: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

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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 opening switch	= Low
Tumble generator valve “open” signal output time	≥ 1600 ms

Time Needed for Diagnosis: 4600 ms

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

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Tumble generator valve opening switch	= High
Tumble generator valve “open” signal output time	≥ 1600 ms

Time Needed for Diagnosis: 1600 ms

EF: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

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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 opening switch	= Low
Tumble generator valve “open” signal output time	≥ 1600 ms

Time Needed for Diagnosis: 4600 ms

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

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Tumble generator valve opening switch	= High
Tumble generator valve “open” signal output time	≥ 1600 ms

Time Needed for Diagnosis: 1600 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

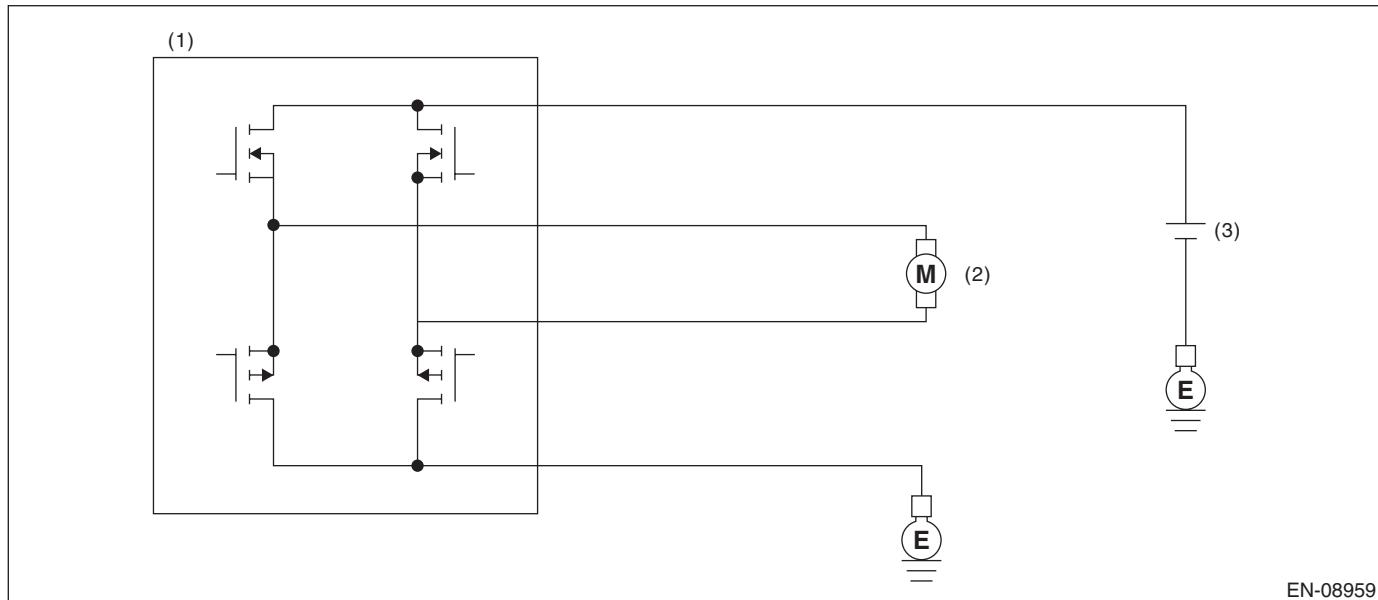
EG:DTC P2009 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 1)

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	$\geq 10.9 \text{ V}$

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

- Abnormality Judgment

At the main IC, check the sent signal at each timing which occurs just before the tumble generator valve output is set to ON → OFF, and judge open NG when the open NG signal is sent 96 ms × 10 time(s) in a row.

Judgment Value

Malfunction Criteria	Threshold Value
Overcurrent NG signal input	Low

Time Needed for Diagnosis: 96 ms × 10 time(s)

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

- **Normality Judgment**

Judge as OK and clear the NG when the OK signal is sent.

Judgment Value

Malfunction Criteria	Threshold Value
Overcurrent NG signal input	High

Time Needed for Diagnosis: Less than 1 second

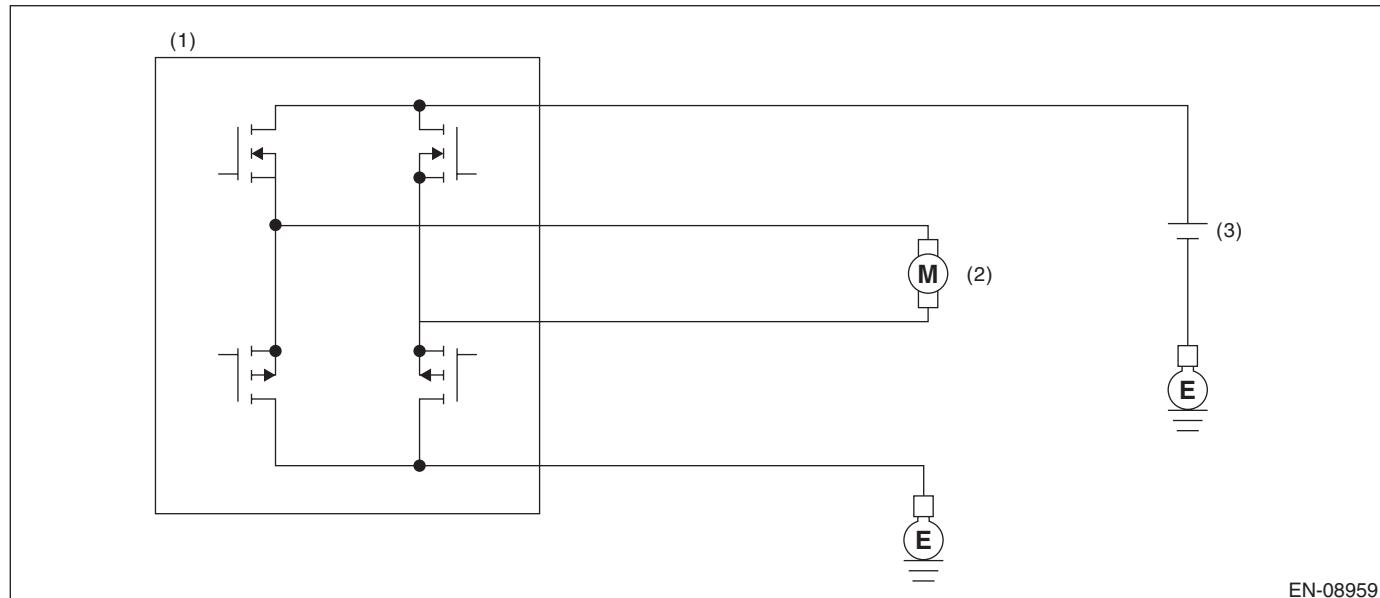
EH:DTC P2012 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 2)

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	$\geq 10.9\text{ V}$

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

- Abnormality Judgment

At the main IC, check the sent signal at each timing which occurs just before the tumble generator valve output is set to ON → OFF, and judge open NG when the open NG signal is sent 96 ms × 10 time(s) in a row.

Judgment Value

Malfunction Criteria	Threshold Value
Overcurrent NG signal input	Low

Time Needed for Diagnosis: 96 ms × 10 time(s)

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

- **Normality Judgment**

Judge as OK and clear the NG when the OK signal is sent.

Judgment Value

Malfunction Criteria	Threshold Value
Overcurrent NG signal input	High

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

EI: DTC P2088 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (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 CONDITION

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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
Battery voltage	≥ 10.9 V
Oil control solenoid control duty	≥ 99.61 %
Oil control solenoid control present current	< 0.306 A

Time Needed for Diagnosis: 2000 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Target current value of the oil control solenoid	≥ 0.14 A
Target current value of the oil control solenoid – oil control solenoid control current value	< 0.08 A

Time Needed for Diagnosis: 2000 ms

EJ:DTC P2089 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of oil control solenoid.

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

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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
Battery voltage	≥ 10.9 V
Oil control solenoid control duty	< 8 %
Oil control solenoid control present current	≥ 0.306 A

Time Needed for Diagnosis: 2000 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Target current value of the oil control solenoid – oil control solenoid control current value	< 0.08 A

Time Needed for Diagnosis: 2000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

EK:DTC P2090 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (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
None	

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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
Battery voltage	≥ 10.9 V
Oil control solenoid control duty	≥ 99.61 %
Oil control solenoid control present current	< 0.306 A

Time Needed for Diagnosis: 2000 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Target current value of the oil control solenoid	≥ 0.14 A
Target current value of the oil control solenoid – oil control solenoid control current value	< 0.08 A

Time Needed for Diagnosis: 2000 ms

EL:DTC P2091 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of oil control solenoid.

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

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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
Battery voltage	≥ 10.9 V
Oil control solenoid control duty	< 8 %
Oil control solenoid control present current	≥ 0.306 A

Time Needed for Diagnosis: 2000 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Target current value of the oil control solenoid – oil control solenoid control current value	< 0.08 A

Time Needed for Diagnosis: 2000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

EM:DTC P2092 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P2088. <Ref. to GD(H4DO)-220, DTC P2088 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

EN:DTC P2093 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P2089. <Ref. to GD(H4DO)-221, DTC P2089 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

EO:DTC P2094 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P2090. <Ref. to GD(H4DO)-222, DTC P2090 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

EP:DTC P2095 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

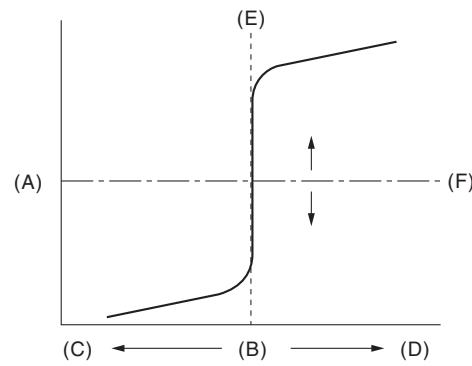
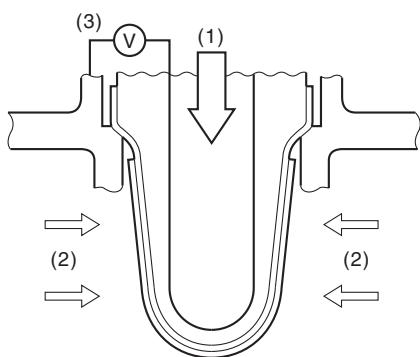
For the detection standard, refer to DTC P2091. <Ref. to GD(H4DO)-223, DTC P2091 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

EQ: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) Rich
(D) Lean	(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	Complete
Continuous time when all conditions are established.	≥ 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.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment value (U5 model)

Malfunction Criteria	Threshold Value
Sub feedback learning value	< -0.035

Judgment value (Except for U5 model)

Malfunction Criteria	Threshold Value
Sub feedback learning value	< -0.035 (CVT model)
	< -0.0295 (MT model)

Time Needed for Diagnosis: 1 s × 1 time(s)

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment value (U5 model)

Malfunction Criteria	Threshold Value
Sub feedback learning value	≥ -0.035 + 0.005

Judgment value (Except for U5 model)

Malfunction Criteria	Threshold Value
Sub feedback learning value	≥ -0.035 + 0.005 (CVT model)
	≥ -0.0295 + 0.005 (MT model)

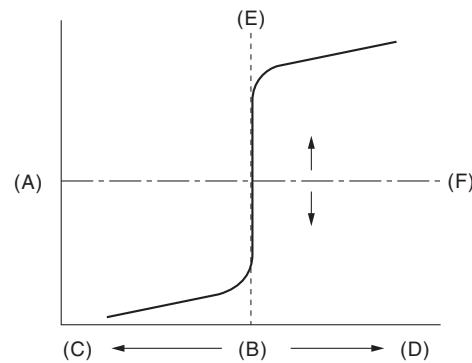
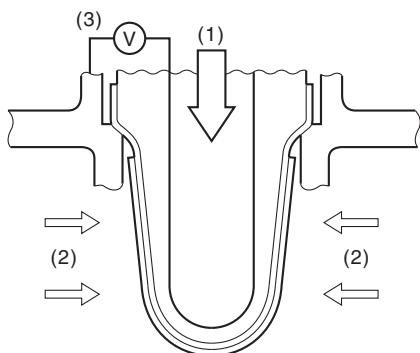
Time Needed for Diagnosis: 1 s

ER: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) Rich
(D) Lean	(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	Complete
Continuous time when all conditions are established.	≥ 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.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment value (U5 model)

Malfunction Criteria	Threshold Value
Sub feedback learning value	≥ 0.021

Judgment value (Except for U5 model)

Malfunction Criteria	Threshold Value
Sub feedback learning value	≥ 0.012

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

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment value (U5 model)

Malfunction Criteria	Threshold Value
Sub feedback learning value	$< 0.021 + 0$

Judgment value (Except for U5 model)

Malfunction Criteria	Threshold Value
Sub feedback learning value	$< 0.012 + 0$

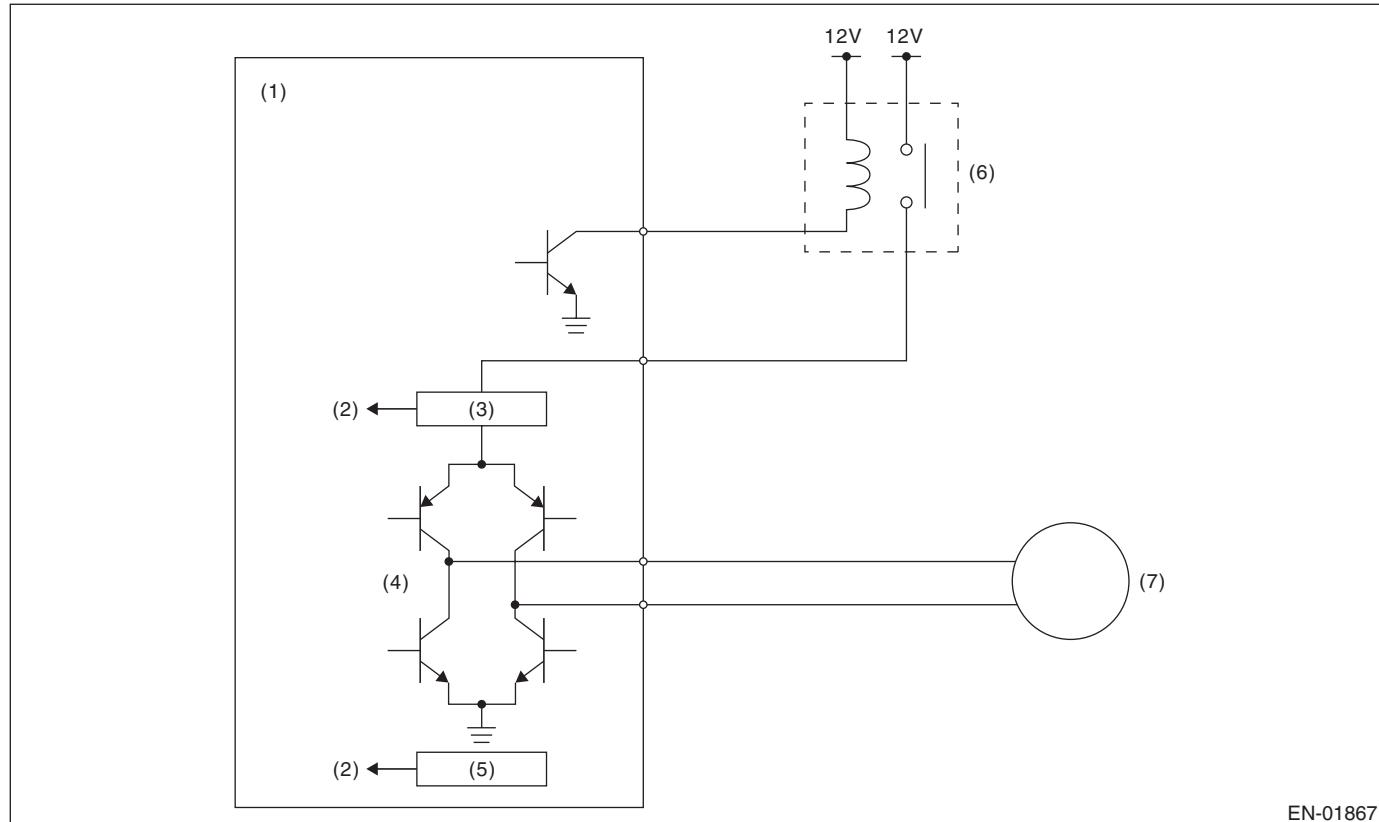
Time Needed for Diagnosis: 1 s

ES: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
CPU communication line sub → main normal judgment	Normal

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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 current	> 8 A
or	
Drive circuit inner temperature	> 175°C (347°F)

Time Needed for Diagnosis: 512 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Motor current	≤ 8 A
Drive circuit inner temperature	≤ 175°C (347°F)

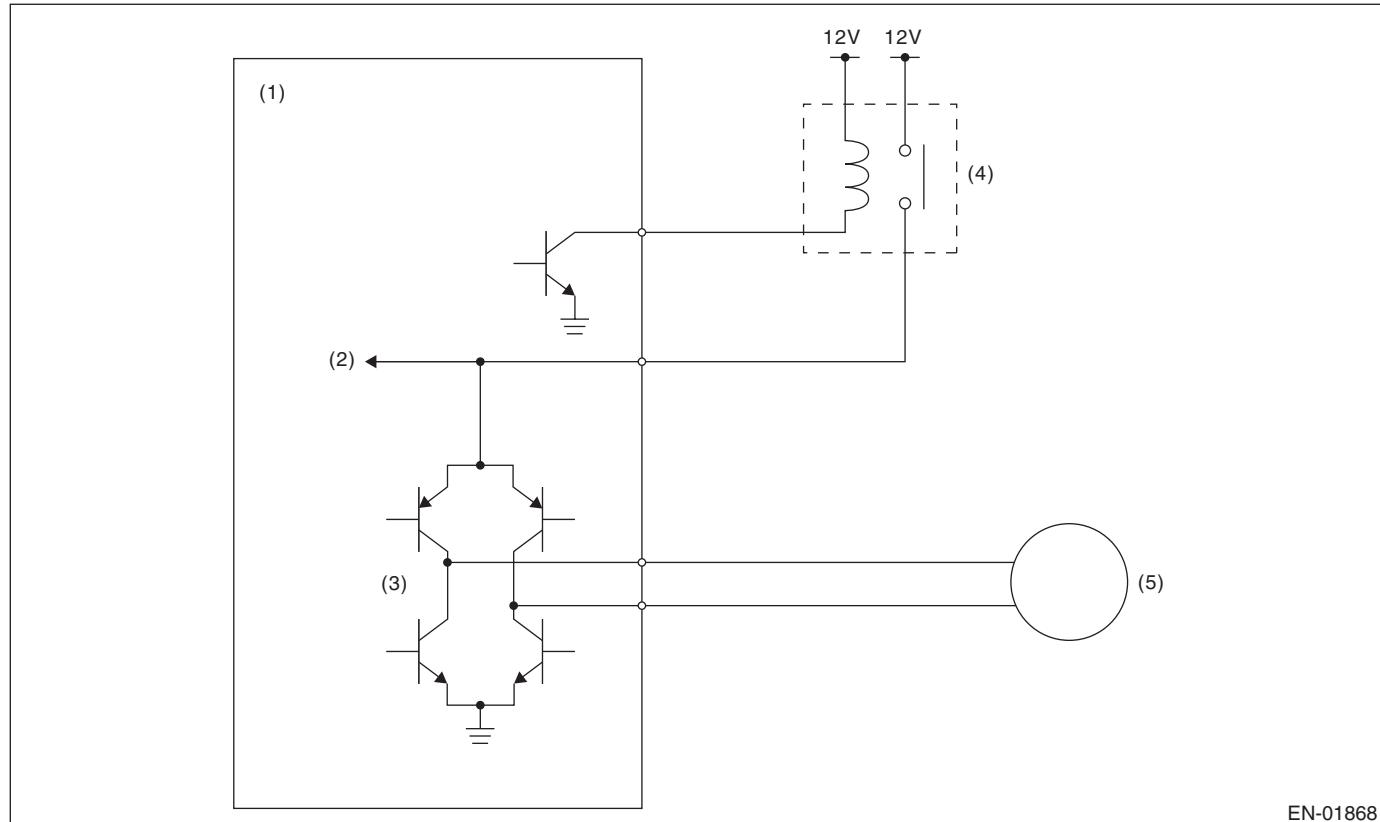
Time Needed for Diagnosis: 2000 ms

ET: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.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Motor power voltage	> 5 V

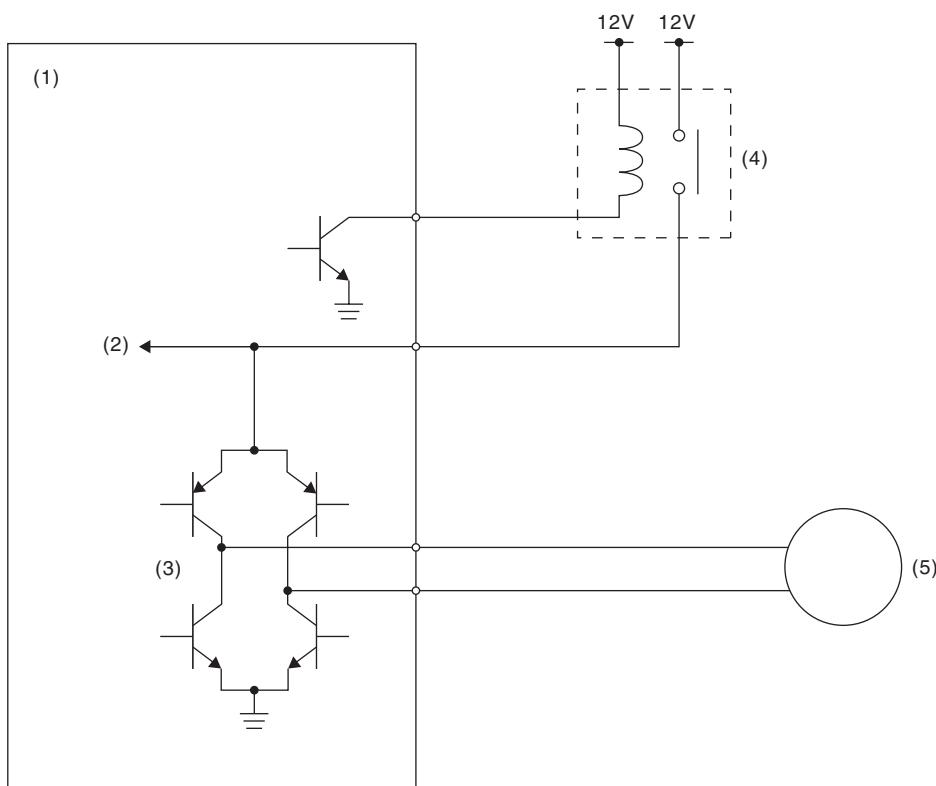
Time Needed for Diagnosis: 2000 ms

EU: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)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Motor power voltage	< 5 V

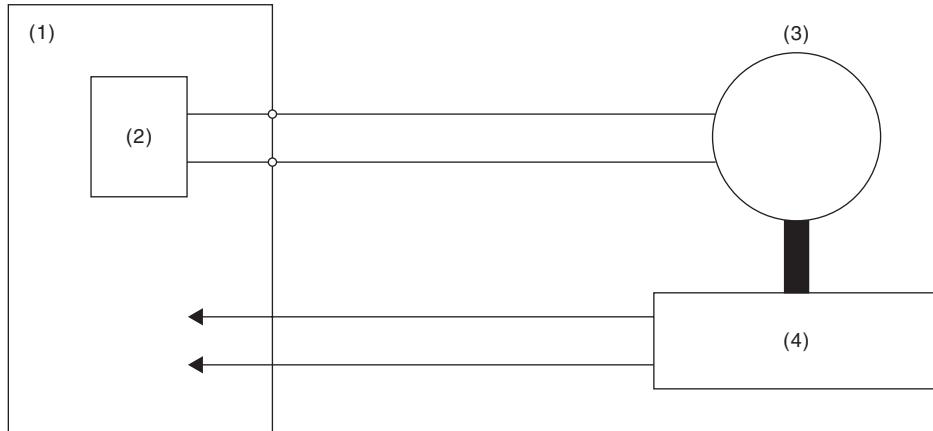
Time Needed for Diagnosis: 400 ms

EV: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
Ignition switch	ON → OFF
Ignition switch (only after clear memory)	OFF → ON

4. GENERAL DRIVING CYCLE

Perform the diagnosis at full closed point learning.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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	$< 9.884^{\circ}$ or $> 20.116^{\circ}$
or Throttle opening angle when the ignition switch is ON – Throttle minimum stop position	$< 0.887^{\circ}$

Time Needed for Diagnosis: 8 ms — 80 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Throttle sensor opening angle at full close point learning	$\geq 9.884^{\circ}$ and $\leq 20.116^{\circ}$
Throttle opening angle when the ignition switch is ON – Throttle minimum stop position	$\geq 0.887^{\circ}$

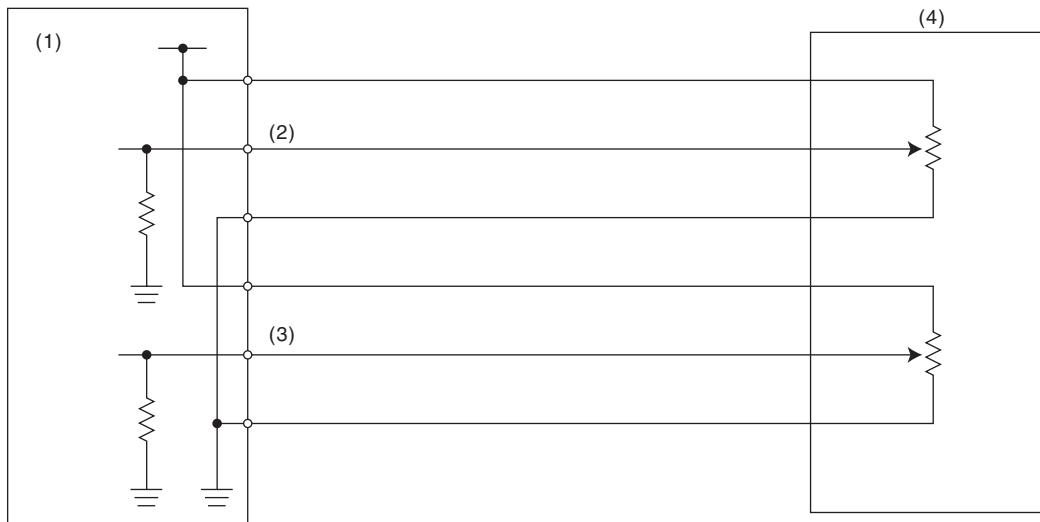
Time Needed for Diagnosis: 8 ms

EW: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 2 signal (4) Accelerator pedal position sensor 1 signal
(2) Accelerator pedal position sensor 1 signal

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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	< 0.295 V

Time Needed for Diagnosis: 100 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	≥ 0.295 V

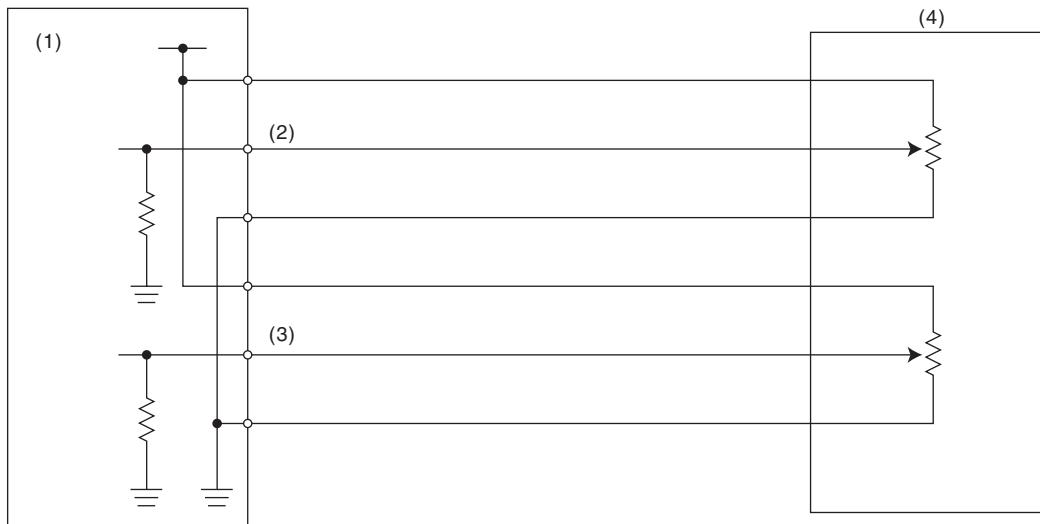
Time Needed for Diagnosis: 100 ms

EX: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 1 signal

(2) Accelerator pedal position sensor 1 signal

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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	$\geq 4.783 \text{ V}$

Time Needed for Diagnosis: 32 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	$< 4.783 \text{ V}$

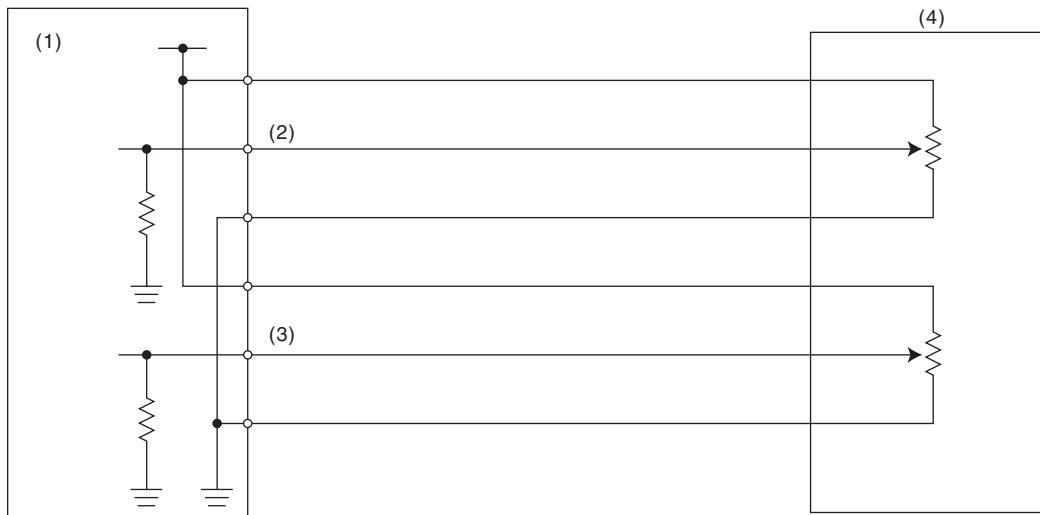
Time Needed for Diagnosis: 32 ms

EY: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
(2) Accelerator pedal position sensor
1 signal

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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	< 0.295 V

Time Needed for Diagnosis: 100 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	≥ 0.295 V

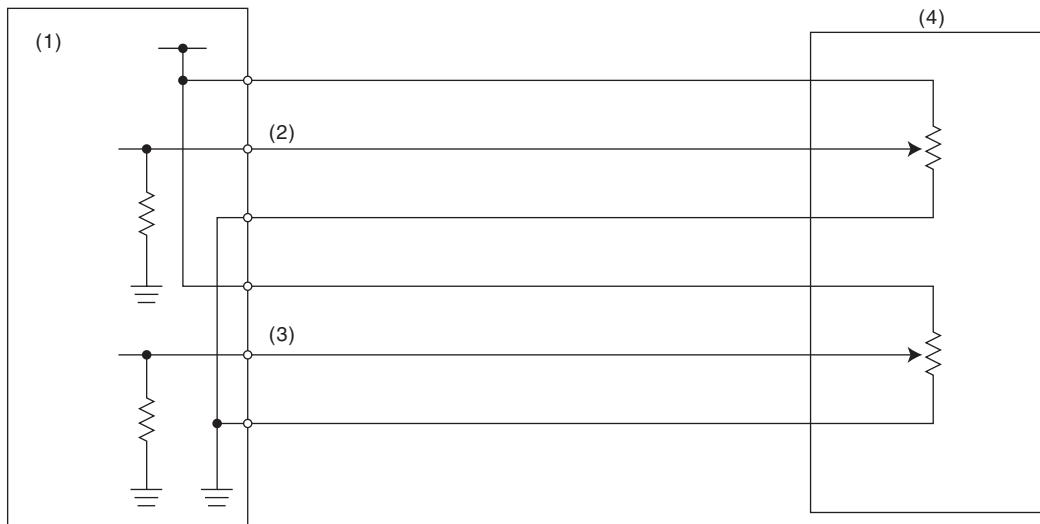
Time Needed for Diagnosis: 100 ms

EZ: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
(2) Accelerator pedal position sensor 1 signal

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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	≥ 4.783 V

Time Needed for Diagnosis: 100 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	< 4.783 V

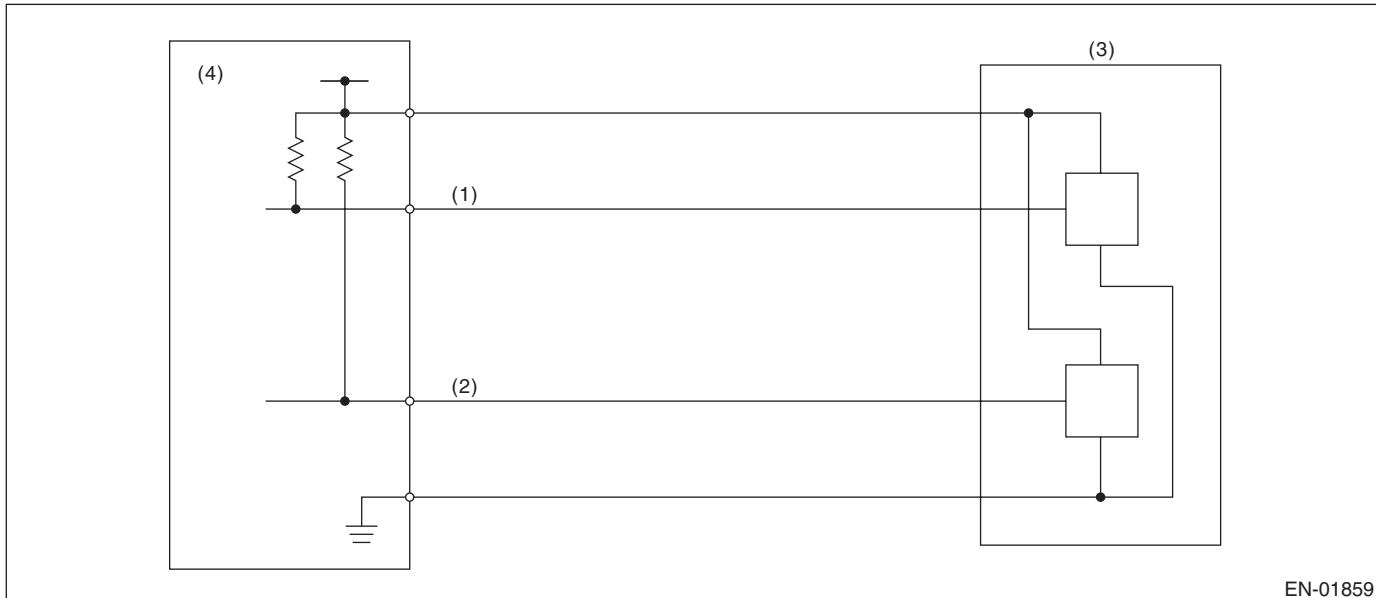
Time Needed for Diagnosis: 100 ms

FA: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



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
Ignition switch	ON
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

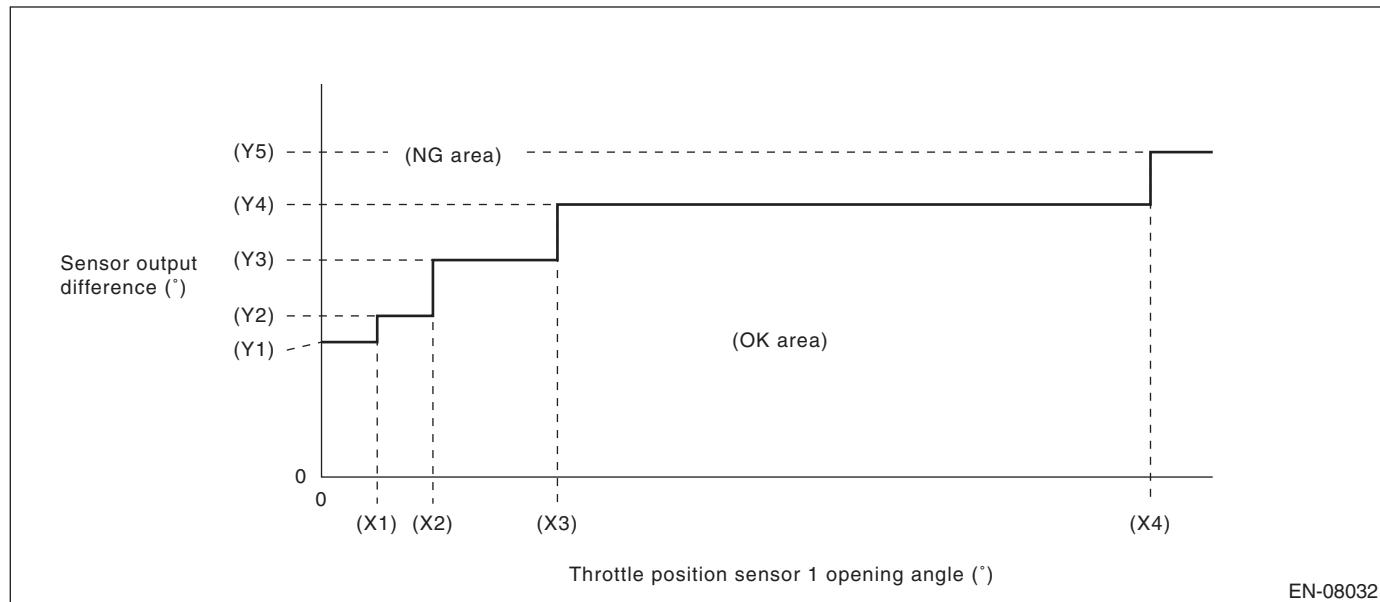
Judgment Value

Malfunction Criteria	Threshold Value
Signal difference between two sensors	Within the NG range of judgment value detail

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Details of Judgment Value



(X1) 2.125 °

(X2) 4.25 °

(X3) 9 °

(X4) 31.625 °

(Y1) 5.15 °

(Y2) 6.15 °

(Y3) 8.28 °

(Y4) 10.4 °

(Y5) 12.4 °

Time Needed for Diagnosis: 212 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Signal difference between two sensors	Within the OK range of judgment value detail

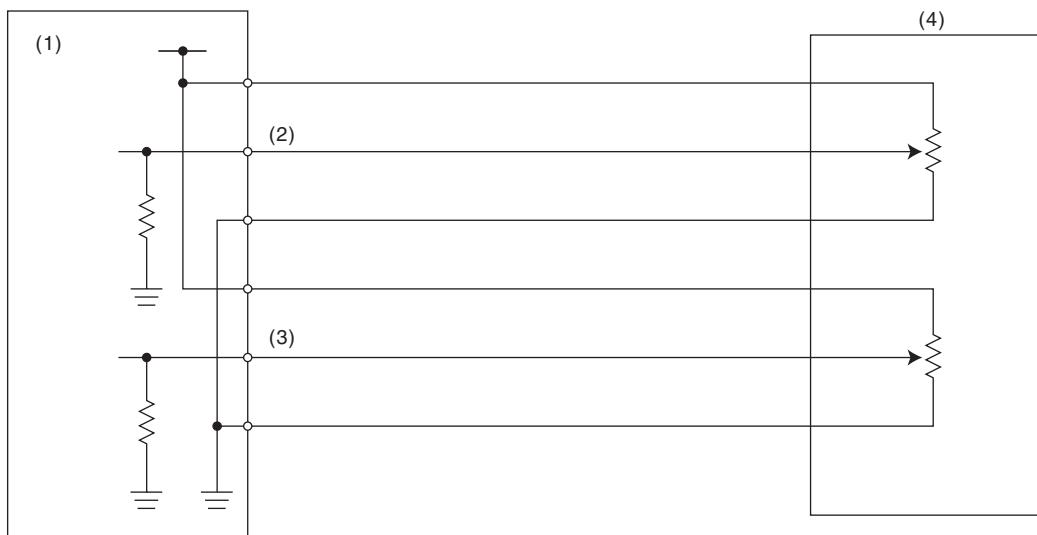
Time Needed for Diagnosis: 24 ms

FB: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 signal (4) Accelerator pedal position sensor 1 signal

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

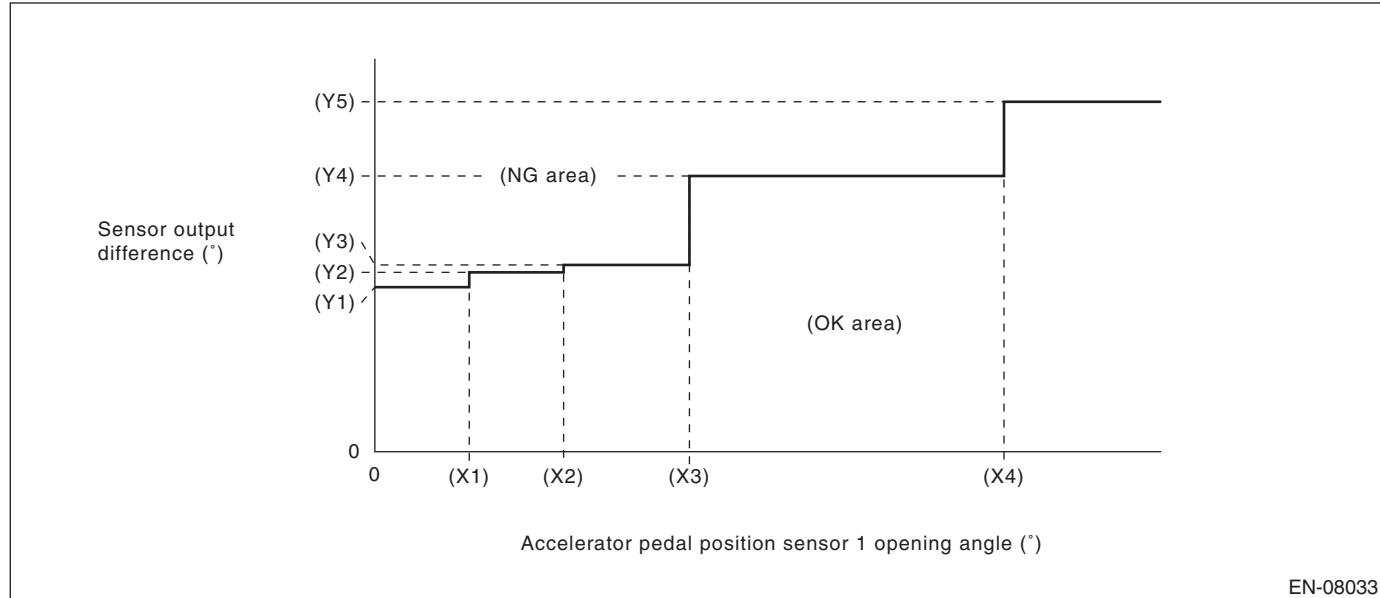
Judgment Value

Malfunction Criteria	Threshold Value
Signal difference between two sensors	Within the NG range of judgment value detail

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Signal difference between two sensors	Within the OK range of judgment value detail

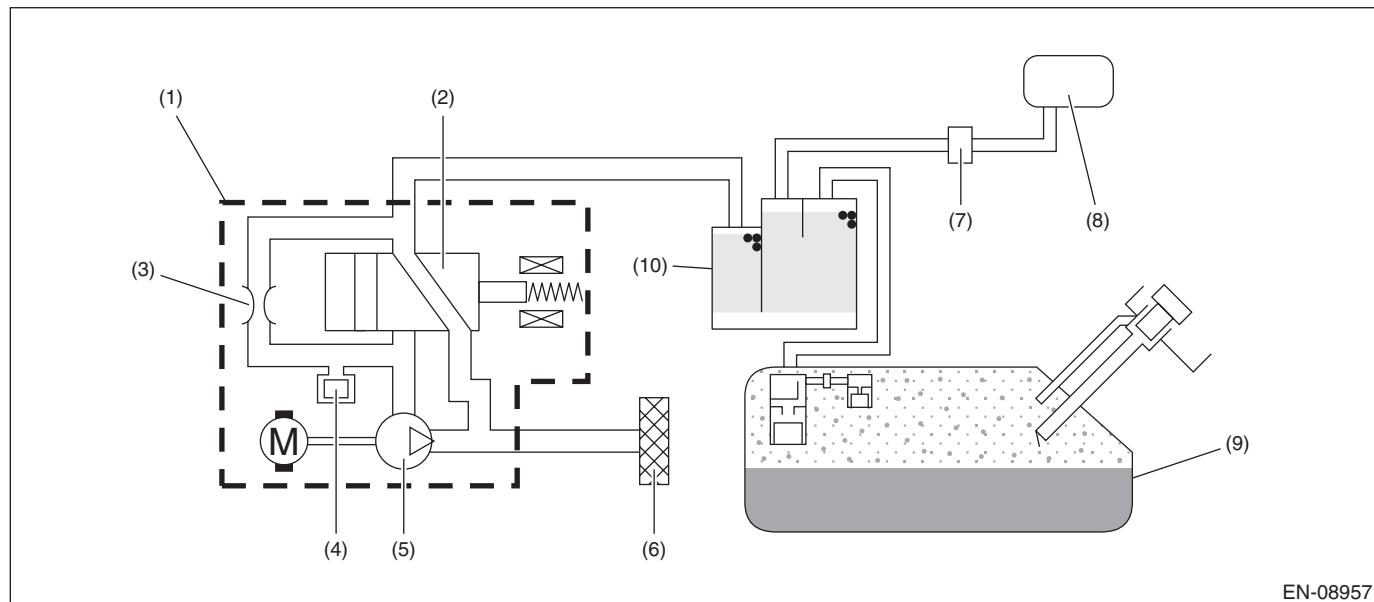
Time Needed for Diagnosis: 116 ms

FC: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
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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
Battery voltage	≥ 10.9
Terminal output voltage when ECM outputs OFF signal	Low

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9
Terminal output voltage when ECM outputs OFF signal	High

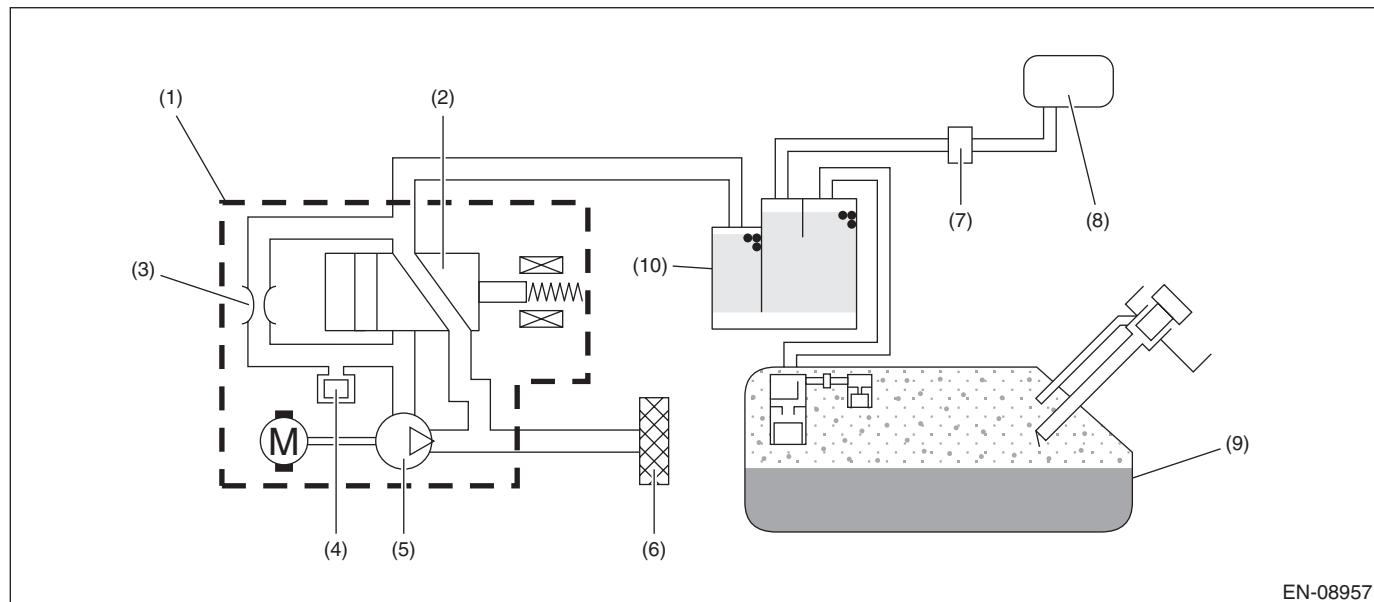
Time Needed for Diagnosis: Less than 1 second

**FD: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
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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
Battery voltage	≥ 10.9
Terminal output voltage when ECM outputs ON signal	High

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9
Terminal output voltage when ECM outputs ON signal	Low

Time Needed for Diagnosis: Less than 1 second

FE:DTC P2404 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP SENSE CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

NOTE:

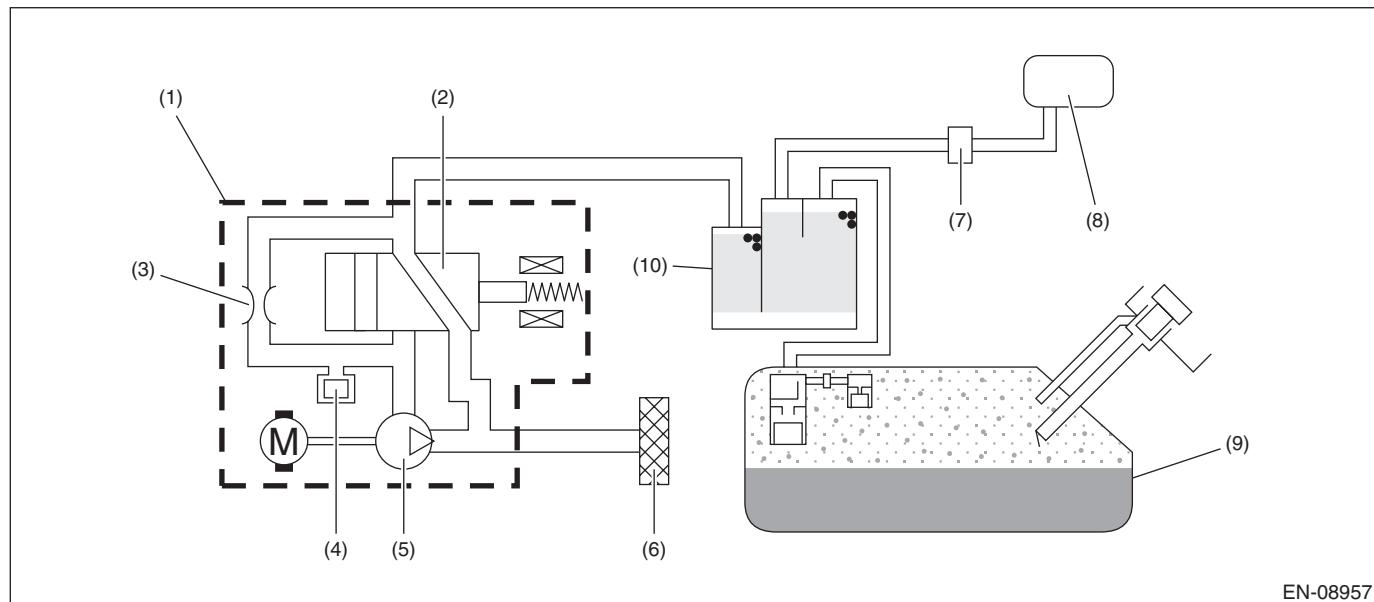
For the detection standard, refer to DTC P0455. <Ref. to GD(H4DO)-149, DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

FF: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
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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
Battery voltage	≥ 10.9
Terminal output voltage when ECM outputs OFF signal	Low

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9
Terminal output voltage when ECM outputs OFF signal	High

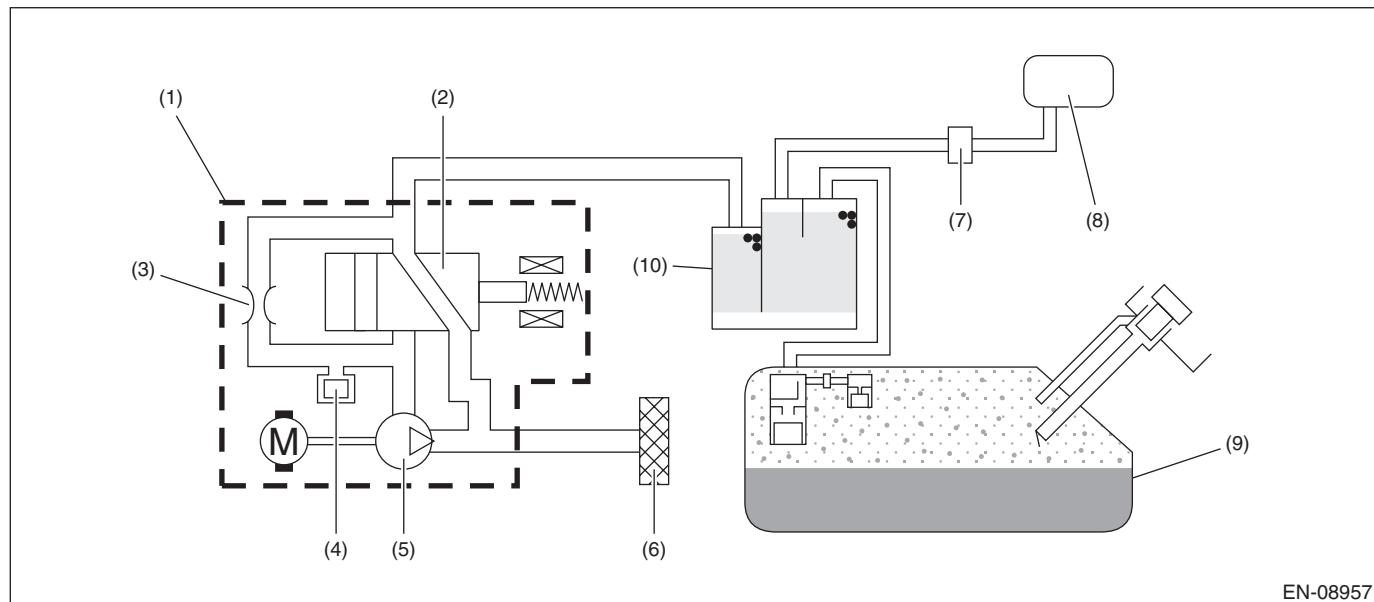
Time Needed for Diagnosis: Less than 1 second

FG: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
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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
Battery voltage	≥ 10.9
Terminal output voltage when ECM outputs ON signal	High

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9
Terminal output voltage when ECM outputs ON signal	Low

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

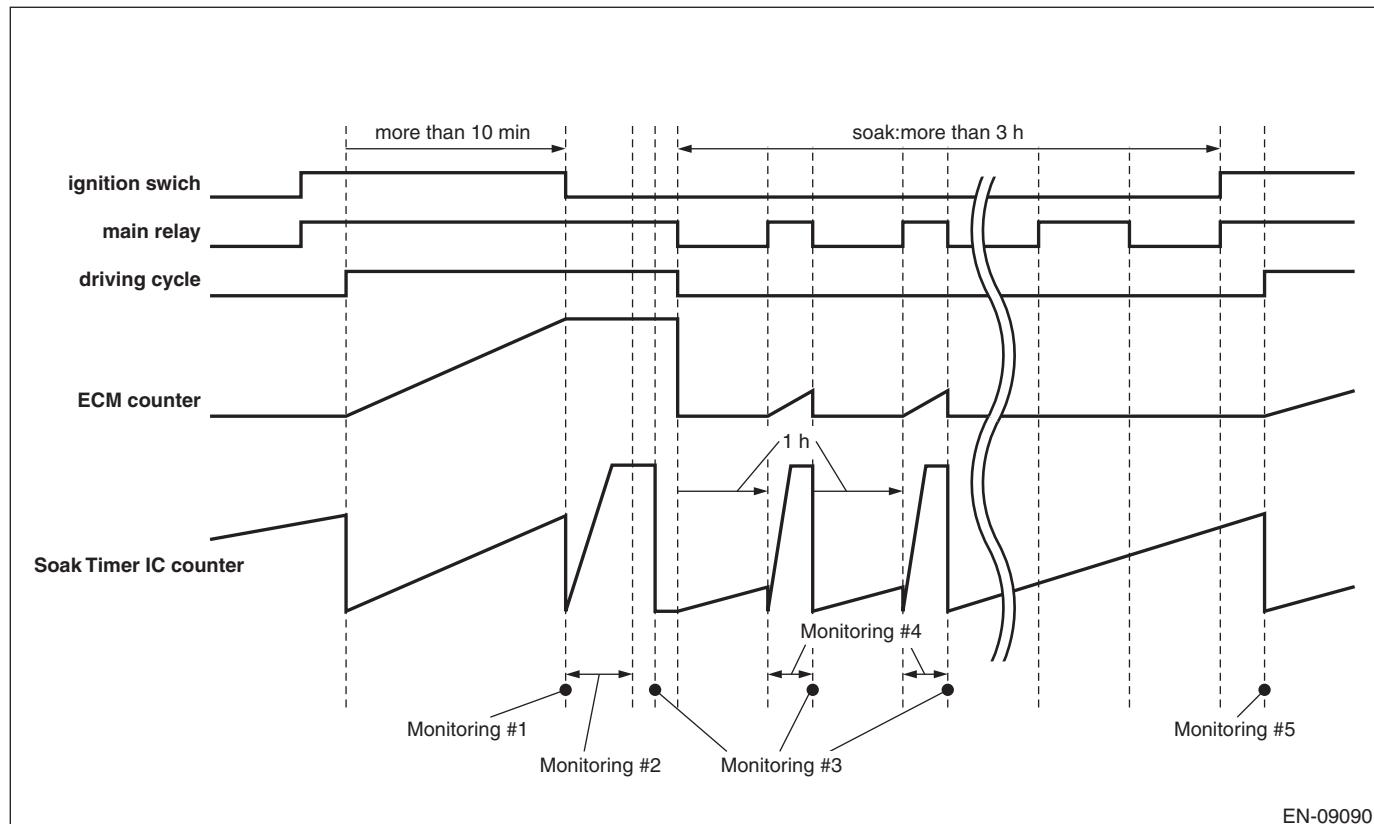
GENERAL DESCRIPTION

FH: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	196 ms
Monitor #2 <Full count diagnosis>	Perform diagnosis of the soaking timer IC counter function	4000 ms
Monitor #3 <Soaking timer IC setting diagnosis>	Perform diagnosis of communication between ECM and soaking timer IC	196 ms
Monitor #4 <Timer diagnosis (during soaking)>	Perform diagnosis of the soaking timer IC accuracy during soaking	3000 ms
Monitor #5 <Wake-up diagnosis>	Perform diagnosis of wake-up function	64 ms



EN-09090

2. COMPONENT DESCRIPTION

The soaking timer IC is built into the ECM.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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
< Full count diagnosis & 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
Number of wake-up	< 5 time(s)
<Wake-up diagnosis>	
Ignition switch	ON
Wake-up activation time setting	Completed
Time in the soaking timer IC	> 3600 s \times 5 time(s)

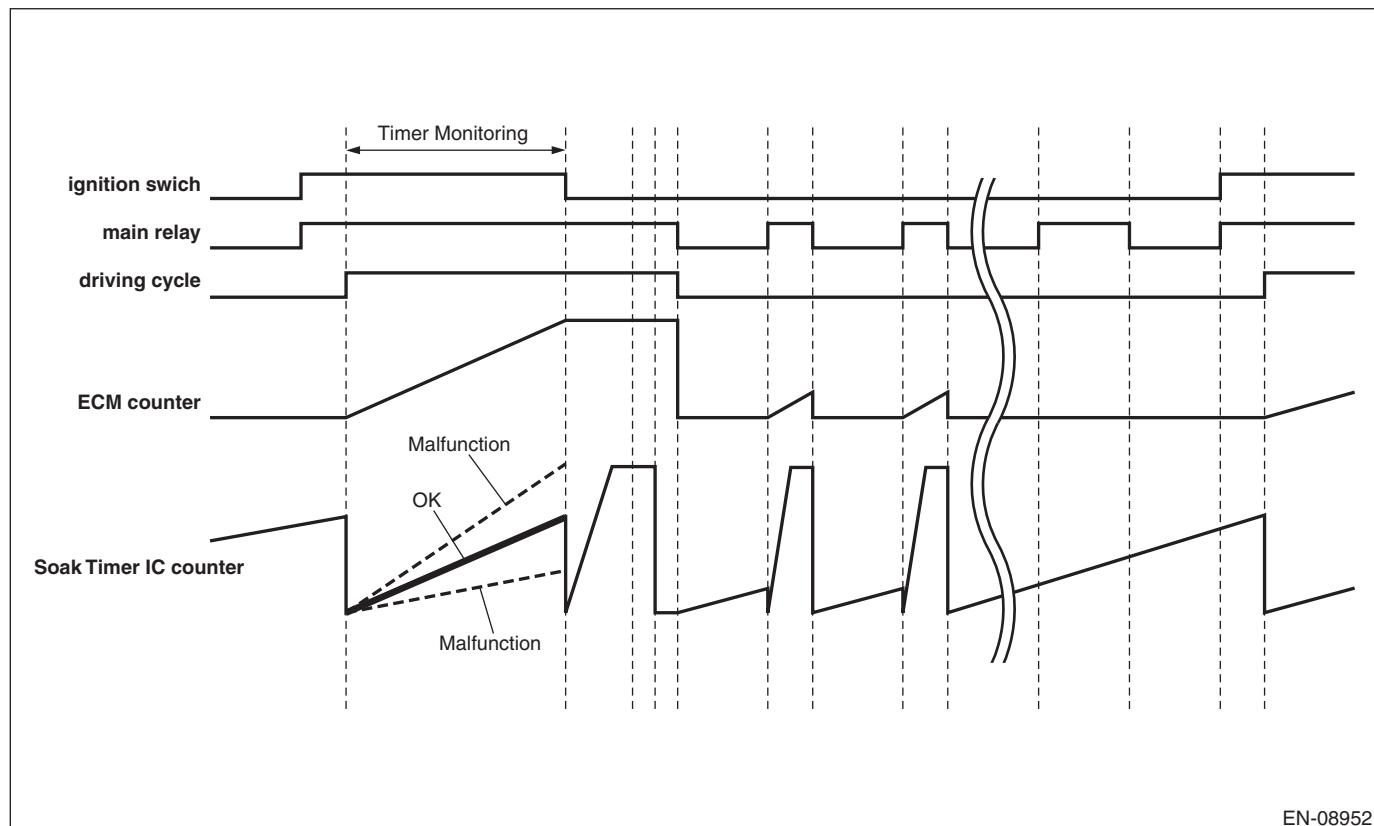
4. GENERAL DRIVING CYCLE

Perform the diagnosis only once when 10 minutes have passed after the engine start and the ignition switch is OFF, and also when the ignition switch is ON after the soaking of five hours or more.

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.



EN-08952

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
$ \text{osoaktimcpu} - \text{osoaktimic} / \text{osoaktimcpu}$	> 0.24

osoaktimcpu = Counter in ECM
osoaktimic = Counter in soaking timer IC

• Normality Judgment

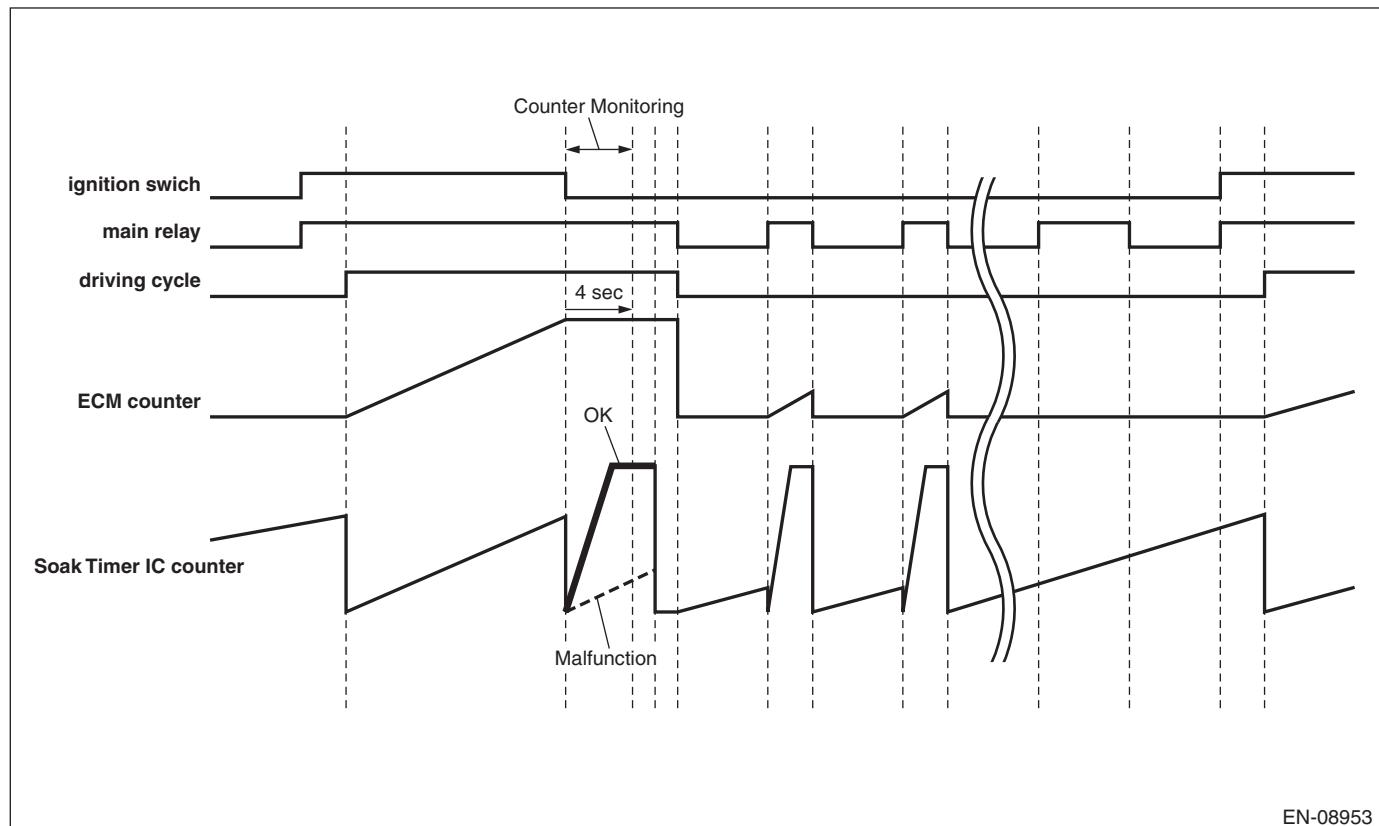
Judge as OK when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
$ \text{osoaktimcpu} - \text{osoaktimic} / \text{osoaktimcpu}$	≤ 0.24

<Full count diagnosis>

After the timer diagnosis is completed, 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-08953

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
$\text{osoakfcntic} \neq \$3FF$ (1023 count)	

osoakfcntic = Counter in soaking timer IC

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Normality Judgment

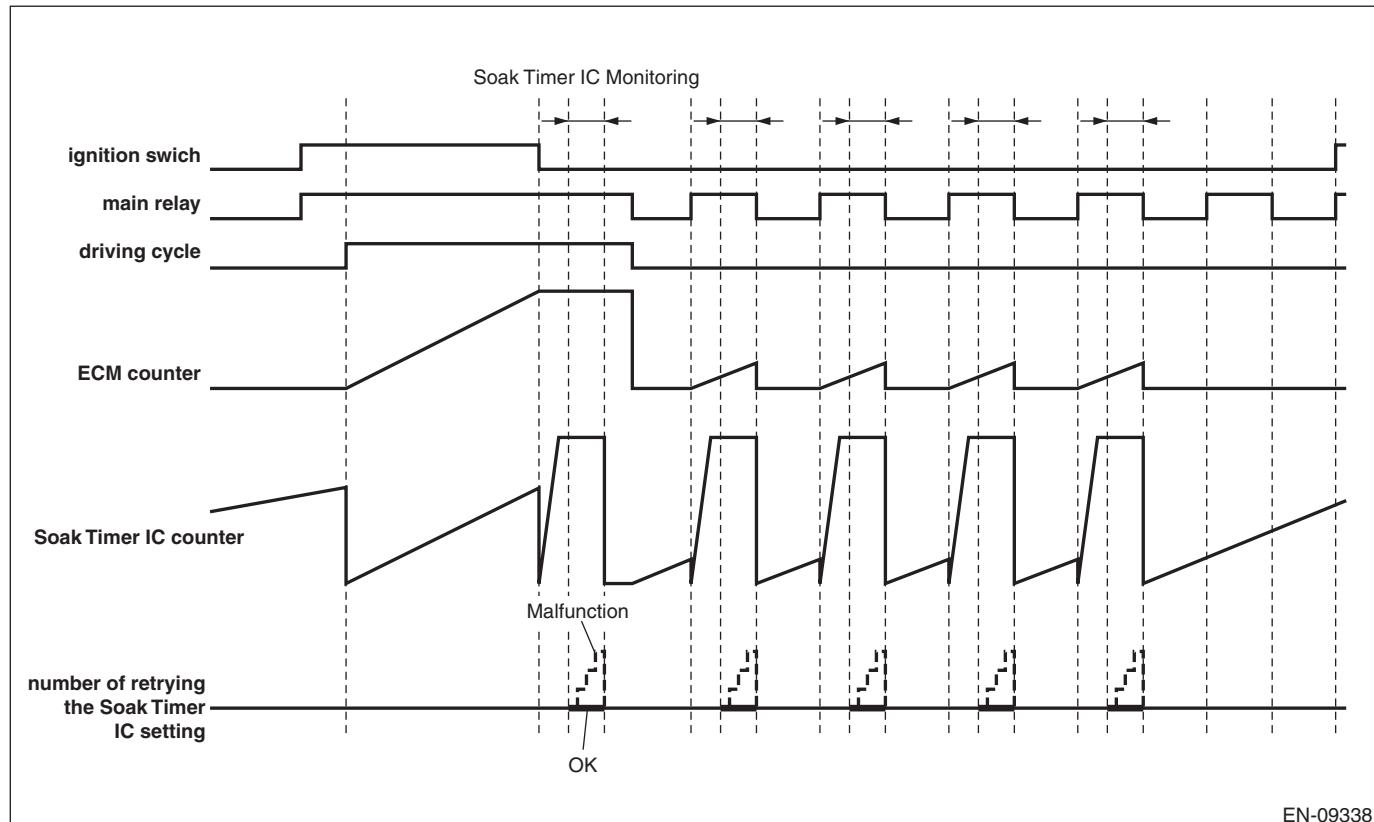
Judge as OK when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
osoakfcntic	= \$3FF (1023 count)

<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-09338

• Abnormality Judgment

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
Number of retrying the soaking timer setting	≥ 3 times

• Normality Judgment

Judge as OK when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Writing value and read out value when setting the soaking timer	Match

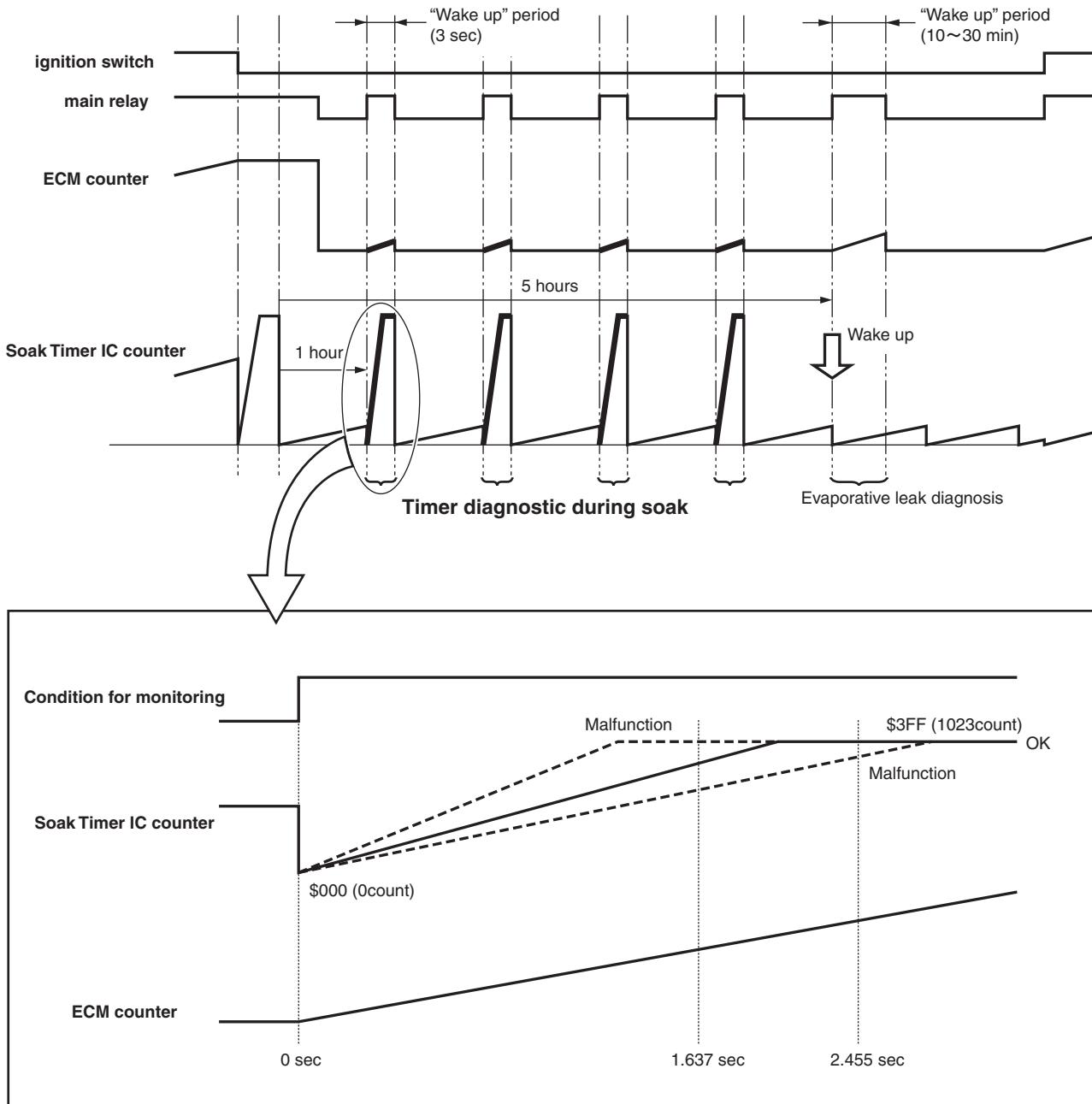
Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

<Timer diagnosis (during soaking)>

Wake-up at the predetermined interval until five 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 1637 ms, or if the counter in soaking timer IC is not counted up to maximum value (1023 count) when the counter in ECM is 2455 ms.



Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Abnormality Judgment

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	≤ 1637 ms = \$3FF (1023 count)
• All of the following conditions are established. Counter in ECM Counter in soaking timer IC	≥ 2455 ms ≠ \$3FF (1023 count)

• Normality Judgment

Judge as OK when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Following conditions are established.	
• All of the following conditions are established. Counter in ECM Counter in soaking timer IC	≤ 1637 ms ≠ \$3FF (1023 count)
• All of the following conditions are established. Counter in ECM Counter in soaking timer IC	≥ 2455 ms = \$3FF (1023 count)

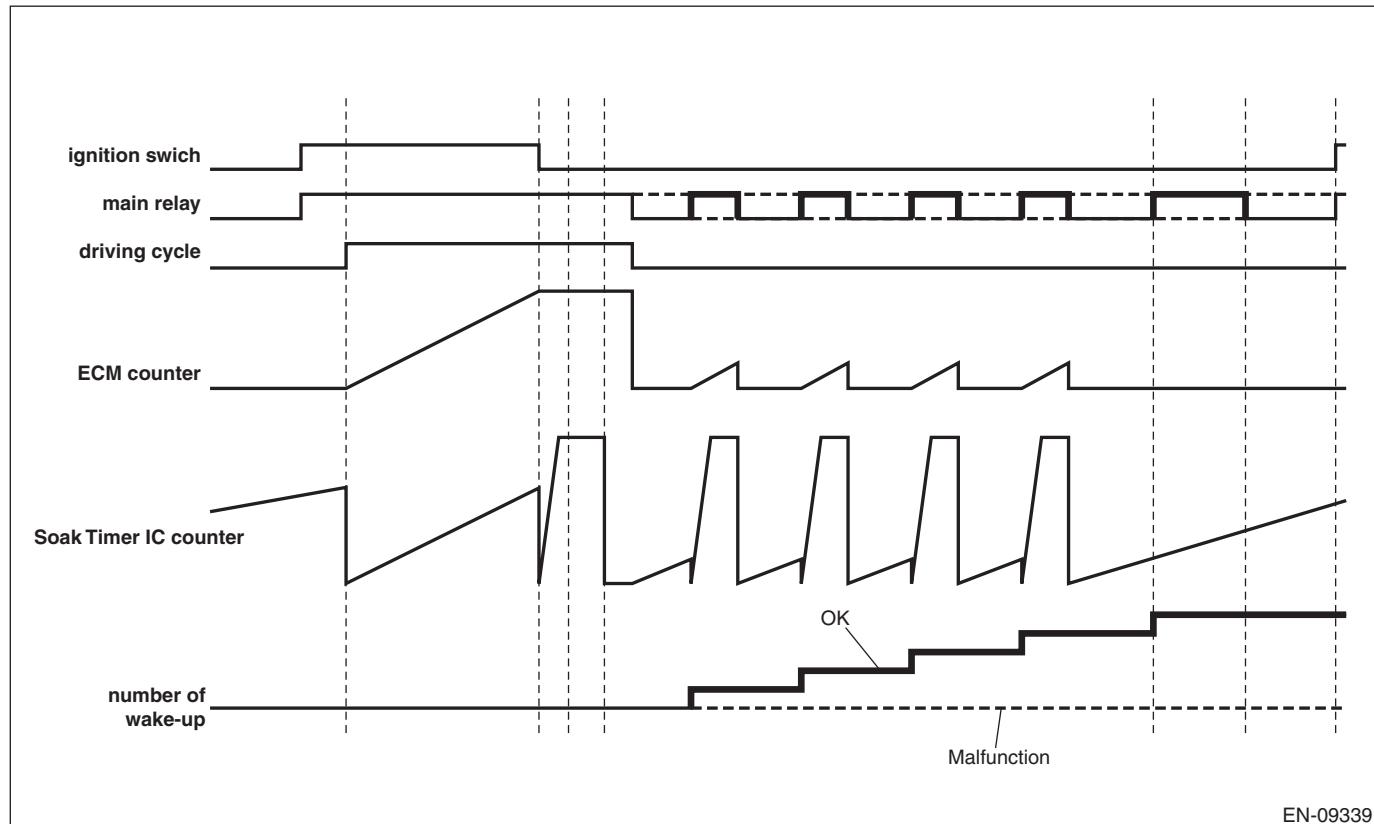
Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

<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 exceeds the activation setting time, judge as wake-up malfunction.



• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Number of wake-up	< 5 time(s)

• Normality Judgment

Judge as OK when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Number of wake-up	≥ 5 time(s)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Abnormality Judgment

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: 18620 s (Approx. 5 hours)

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

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Ignition switch	ON
Driving cycle	Completed
All of the following conditions are established.	
• Timer diagnosis	OK
• Full count diagnosis	OK
• Soaking timer IC setting diagnosis	OK
• Timer diagnosis (during soaking)	OK
• Wake-up diagnosis	OK

Time Needed for Diagnosis: 18620 s (Approx. 5 hours)

FI: DTC U0073 CONTROL MODULE COMMUNICATION BUS “A” 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
None	

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	> 10.9 V
Starter switch	OFF
Engine	run
bus off flag or error warning flag	set (error)

Time Needed for Diagnosis: 436 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Engine	run
bus off flag or error warning flag	clear (No error)

Time Needed for Diagnosis: 1000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

FJ: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
None	

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	> 10.9 V
Starter switch	OFF
Engine	run
ID received from control module connected to CAN	None during 500 milliseconds

Time Needed for Diagnosis: 500 ms

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Engine	run
ID received from control module connected to CAN	Yes

Time Needed for Diagnosis: 1000 ms

FK:DTC U0122 LOST COMMUNICATION WITH VEHICLE DYNAMICS CONTROL MODULE

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC U0101. <Ref. to GD(H4DO)-266, DTC U0101 LOST COMMUNICATION WITH TCM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

FL: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)-266, DTC U0101 LOST COMMUNICATION WITH TCM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

FM: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
None	

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	> 10.9 V
Starter switch	OFF
Engine	run
Data updated from control module connected to CAN	None during 2000 milliseconds

Time Needed for Diagnosis: 2 seconds

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

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Engine	run
Data updated from control module connected to CAN	Yes

Time Needed for Diagnosis: 1000 ms

FN: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)-268, DTC U0402 INVALID DATA RECEIVED FROM TCM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

FO: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)-268, DTC U0402 INVALID DATA RECEIVED FROM TCM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

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

CONTINUOUSLY VARIABLE TRANSMISSION (DIAGNOSTICS)

CVT(diag)

MANUAL TRANSMISSION AND DIFFERENTIAL

5MT

CLUTCH SYSTEM

CL

CONTROL SYSTEMS

CS

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