

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

2. Diagnostic Trouble Code (DTC) Detecting Criteria

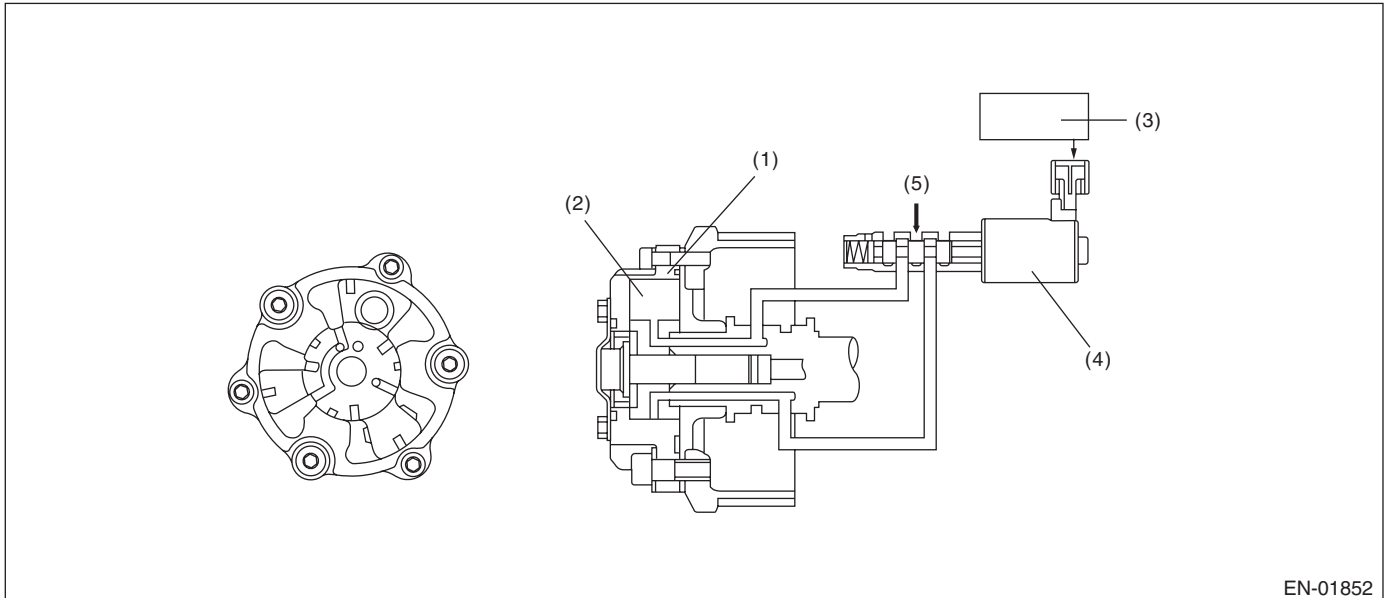
A: DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the AVCS system malfunction.

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

2. COMPONENT DESCRIPTION



(1) AVCS timing controller

(3) Engine control module (ECM)

(5) Oil pressure

(2) Vane

(4) Oil flow control solenoid valve

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Time of establishing all secondary parameter conditions	≥ 5000 ms
Battery voltage	≥ 10.9 V
Engine speed	≥ 1500 rpm
Engine coolant temperature	≥ 50 °C (122 °F)
AVCS control	Operation
Target timing advance change amount (per 64 ms)	< 1.07 °CA

4. GENERAL DRIVING CYCLE

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

- 1) 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.
- 2) 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

Malfunction Criteria	Threshold Value
$\Sigma(\text{Target position} - \text{Actual position})$	$> 7000 \text{ }^{\circ}\text{CA}(\text{Bank 1})$ $> 7000 \text{ }^{\circ}\text{CA}(\text{Bank 2})$
or	
$\Sigma(\text{Target position} - \text{Actual position})$	$< -12000 \text{ }^{\circ}\text{CA}(\text{Bank 1})$ $< -12000 \text{ }^{\circ}\text{CA}(\text{Bank 2})$

Time Needed for Diagnosis: 60000 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
$\Sigma(\text{Target position} - \text{Actual position})$	$\leq 7000 \text{ }^{\circ}\text{CA}(\text{Bank 1})$ $\leq 7000 \text{ }^{\circ}\text{CA}(\text{Bank 2})$ and $\geq -12000 \text{ }^{\circ}\text{CA}(\text{Bank 1})$ $\geq -12000 \text{ }^{\circ}\text{CA}(\text{Bank 2})$

Time Needed for Diagnosis: 60000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

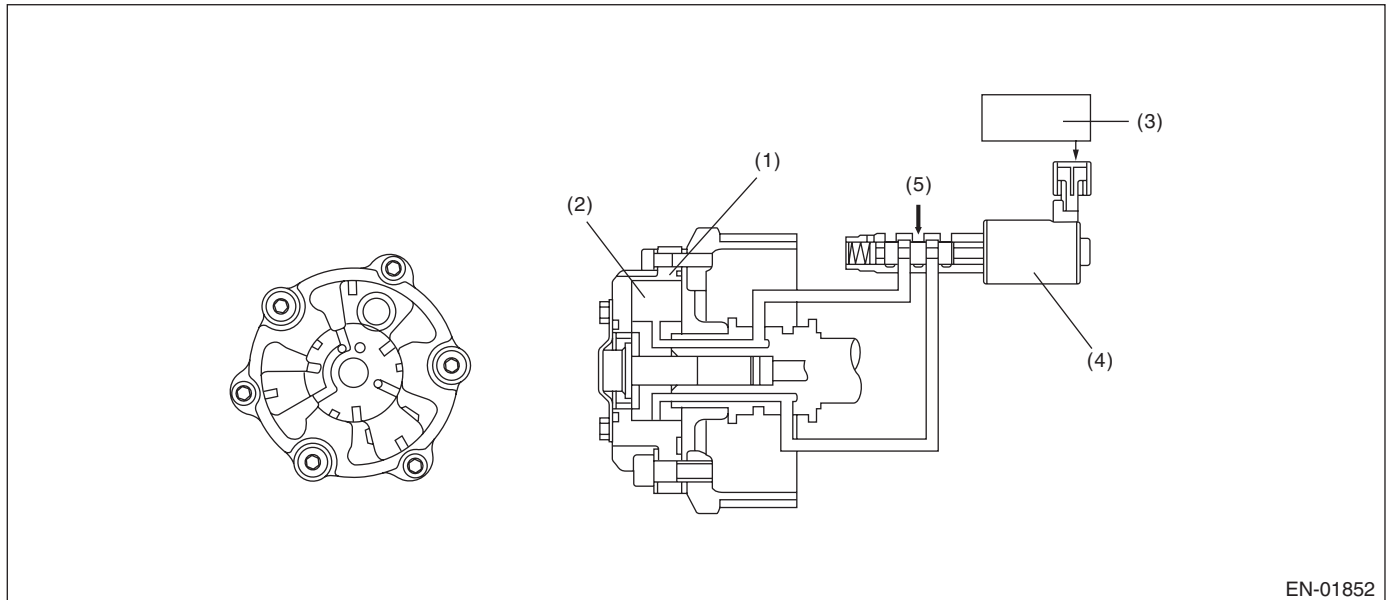
B: DTC P0014 EXHAUST AVCS SYSTEM 1 (RANGE/PERFORMANCE)

1. OUTLINE OF DIAGNOSIS

Detect the exhaust AVCS system malfunction.

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

2. COMPONENT DESCRIPTION



EN-01852

(1) Exhaust AVCS timing controller

(3) Engine control module (ECM)

(5) Oil pressure

(2) Vane

(4) Oil flow control solenoid valve

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Time of establishing all secondary parameter conditions	≥ 5000 ms
Battery voltage	≥ 10.9 V
Engine speed	≥ 1500 rpm
Engine coolant temperature	≥ 50 °C (122 °F)
Exhaust AVCS control	Operation
Target timing advance change amount (per 64 ms)	< 1.07 °CA

4. GENERAL DRIVING CYCLE

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

- 1) 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.
- 2) 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

Malfunction Criteria	Threshold Value
$\Sigma(\text{Target position} - \text{Actual position})$	> 8000 °CA (Bank 1) > 8000 °CA (Bank 2)
or	
$\Sigma(\text{Target position} - \text{Actual position})$	< -4000 °CA (Bank 1) < -4000 °CA (Bank 2)

Time Needed for Diagnosis:

50000 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
$\Sigma(\text{Target position} - \text{Actual position})$	≤ 8000 °CA (Bank 1) ≤ 8000 °CA (Bank 2) and ≥ -4000 °CA (Bank 1) ≥ -4000 °CA (Bank 2)

Time Needed for Diagnosis: 50000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

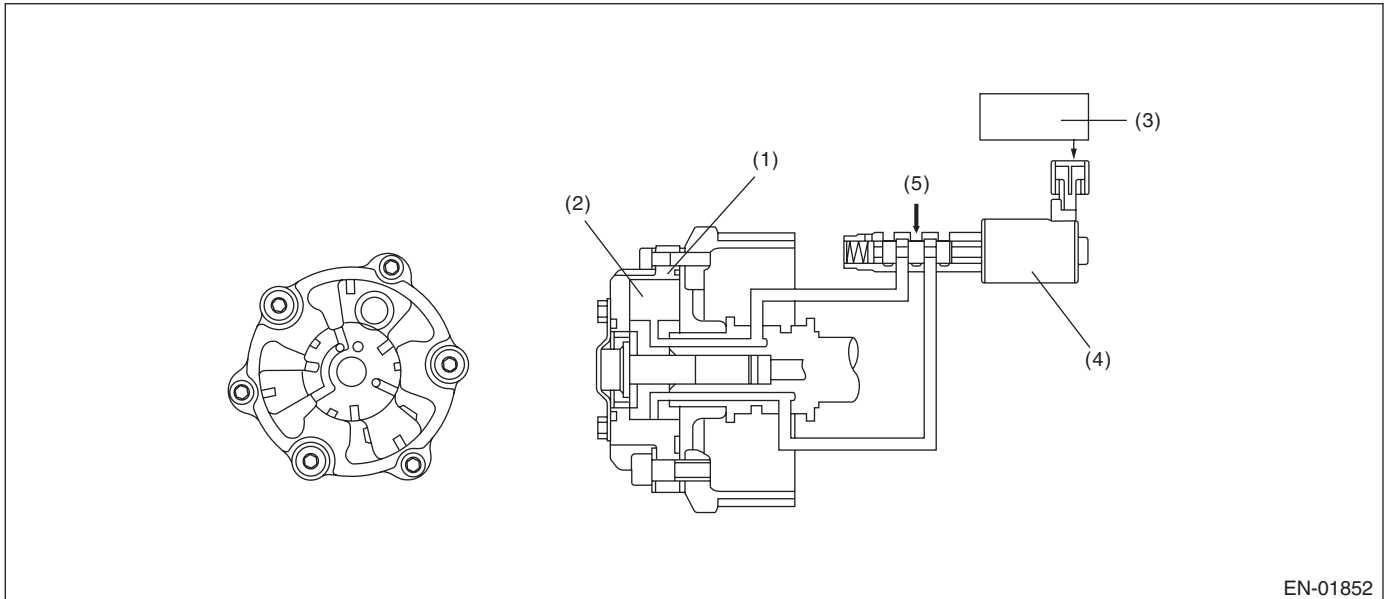
C: DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1)

1. OUTLINE OF DIAGNOSIS

Detect the AVCS system malfunction.

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

2. COMPONENT DESCRIPTION



(1) AVCS timing controller

(3) Engine control module (ECM)

(5) Oil pressure

(2) Vane

(4) Oil flow control solenoid valve

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$
Engine speed	$\geq 600 \text{ rpm}$ and $< 900 \text{ rpm}$
Engine coolant temperature	$\geq 75 \text{ }^{\circ}\text{C}$ (167 $^{\circ}\text{F}$)
AVCS control	Not in operation
Target timing advance	0 $^{\circ}\text{CA}$

4. GENERAL DRIVING CYCLE

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. 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	> 13 °CA

Time Needed for Diagnosis: 5000 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	≤ 13 °CA

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

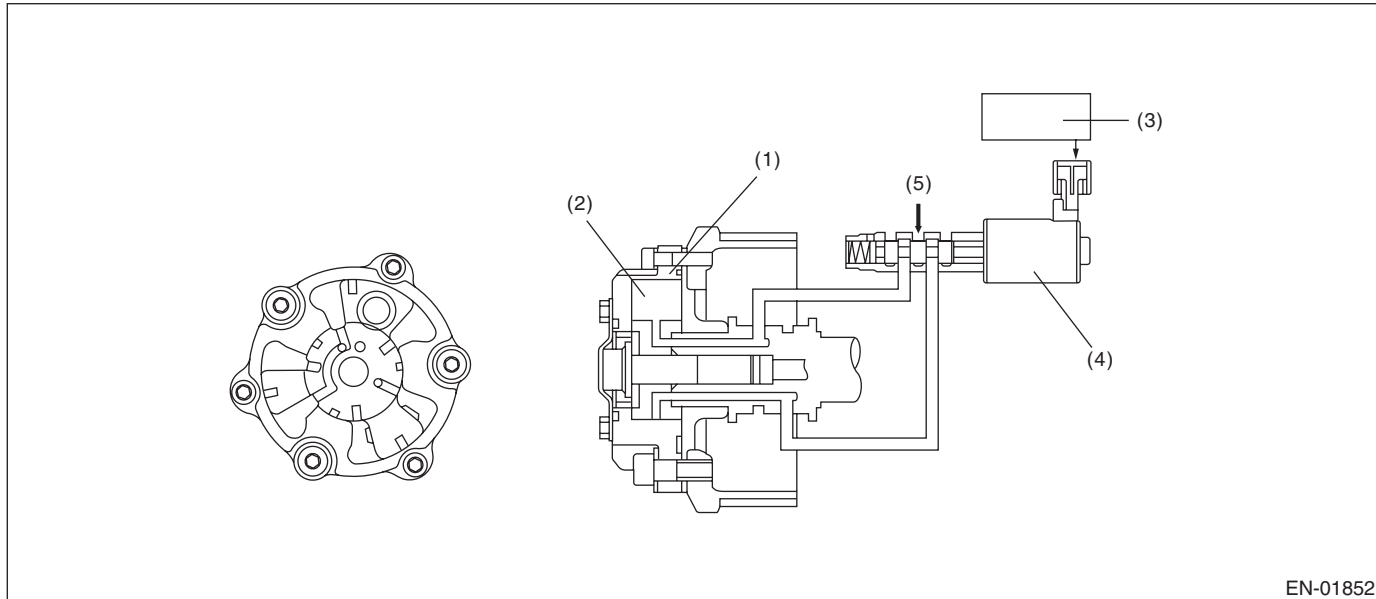
D: DTC P0017 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the exhaust AVCS system malfunction.

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

2. COMPONENT DESCRIPTION



(1) Exhaust AVCS timing controller

(3) Engine control module (ECM)

(5) Oil pressure

(2) Vane

(4) Oil flow control solenoid valve

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$
Engine speed	$\geq 600 \text{ rpm}$ and $< 900 \text{ rpm}$
Engine coolant temperature	$\geq 75 \text{ }^{\circ}\text{C}$ ($167 \text{ }^{\circ}\text{F}$)
Exhaust AVCS control	Not in operation
Target timing advance	0°CA

4. GENERAL DRIVING CYCLE

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. 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	> 13 °CA

Time Needed for Diagnosis: 5000 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	≤ 13 °CA

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0016. <Ref. to GD(H6DO)-14, DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

F: 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(H6DO)-16, DTC P0017 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

G: 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(H6DO)-10, DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

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

1. OUTLINE OF DIAGNOSIS

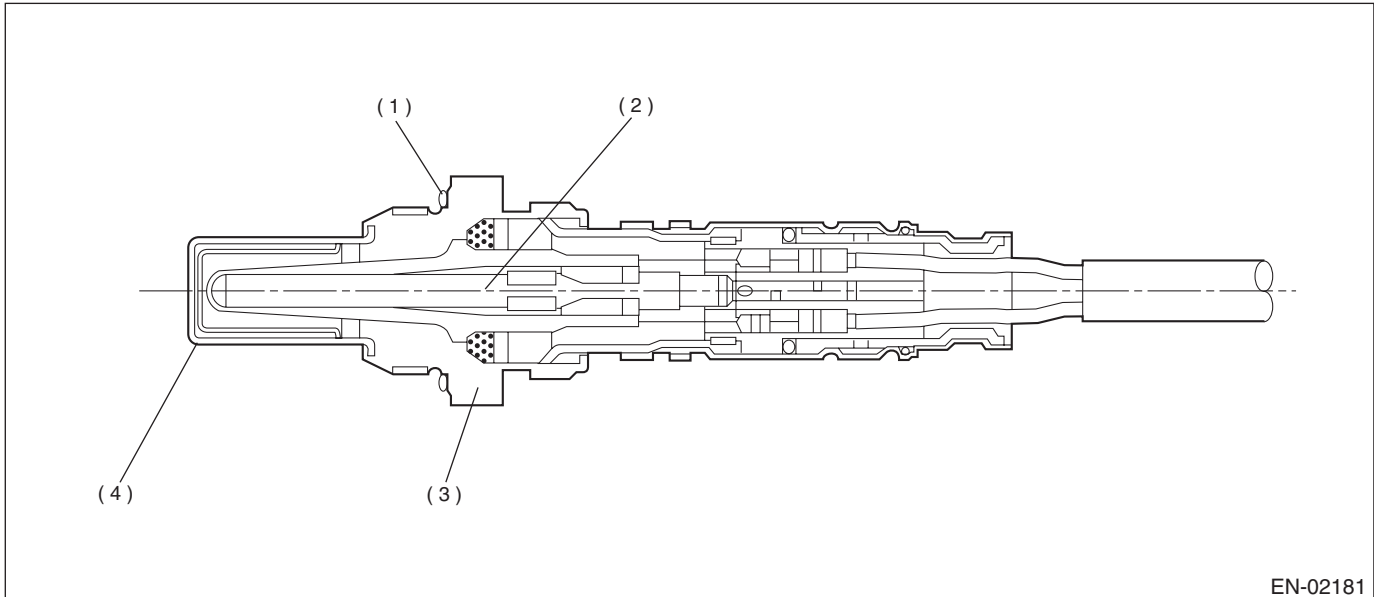
NOTE:

For the detection standard, refer to DTC P0014. <Ref. to GD(H6DO)-12, DTC P0014 EXHAUST AVCS SYSTEM 1 (RANGE/PERFORMANCE), Diagnostic Trouble Code (DTC) Detecting Criteria.>

I: 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-02181

- (1) Gasket
(2) Ceramic heater
(3) Sensor housing
(4) Protection tube

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Condition established time	≥ 30000 ms
Battery voltage	≥ 10.9 V
Heater current	Permitted
Control duty ≥ 35 %	Experienced
After fuel cut	≥ 20000 ms

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after 30000 ms seconds or more have passed since the engine started.

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
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	$\leq$ 50 Ω

Time Needed for Diagnosis: 10000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

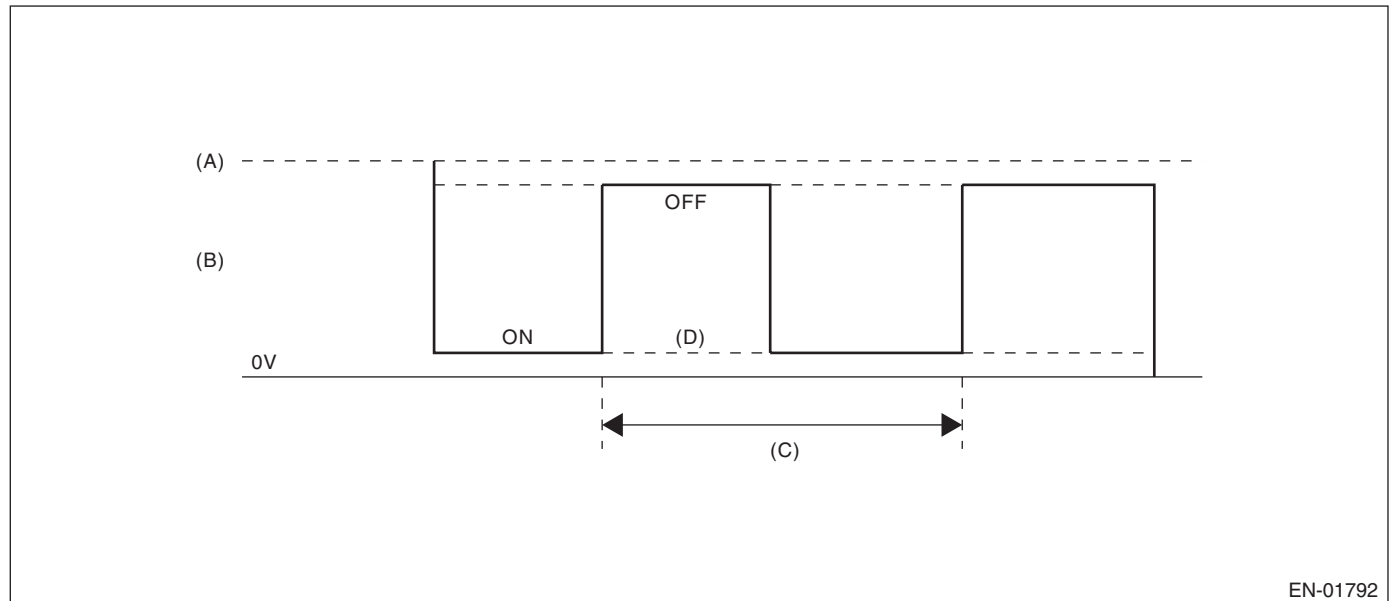
1. OUTLINE OF DIAGNOSIS

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



(A) Battery voltage

(C) 128 ms

(D) Low error

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

3. ENABLE CONDITION

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

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
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

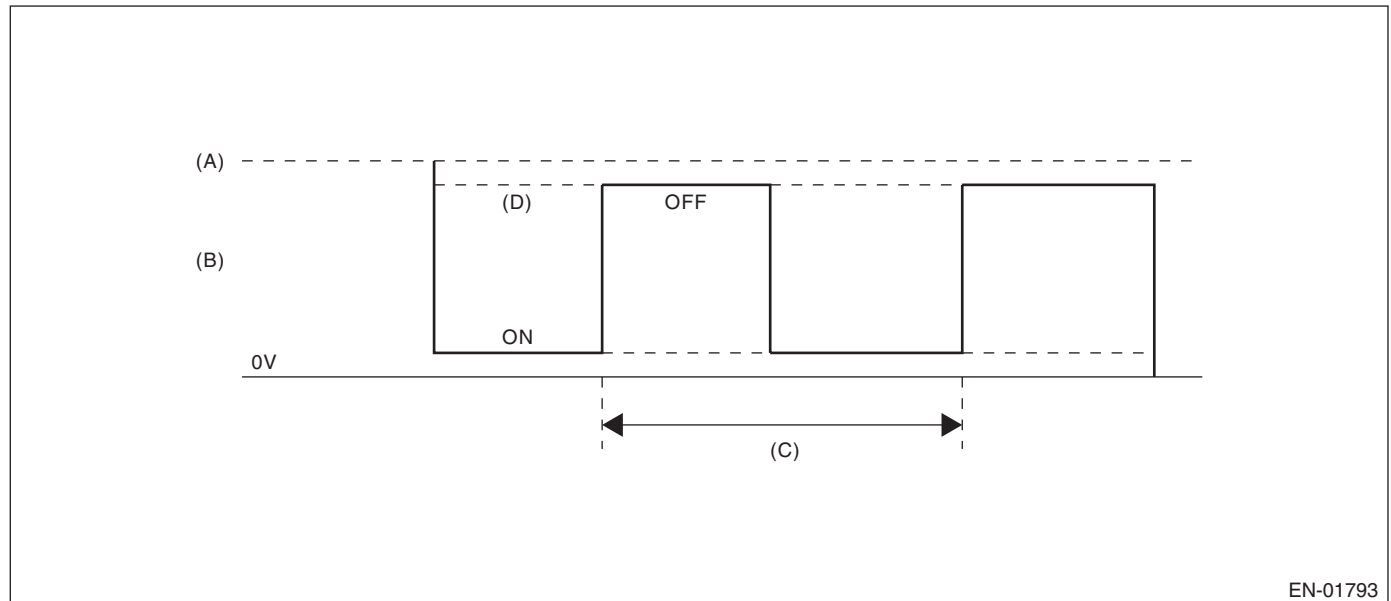
Time Needed for Diagnosis: Less than 1 second

K: 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

(A) Battery voltage

(C) 128 ms

(D) High error

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

3. ENABLE CONDITION

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

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
Output voltage level	High
Front oxygen (A/F) sensor heater control duty	≥ 12.5 %

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	Low

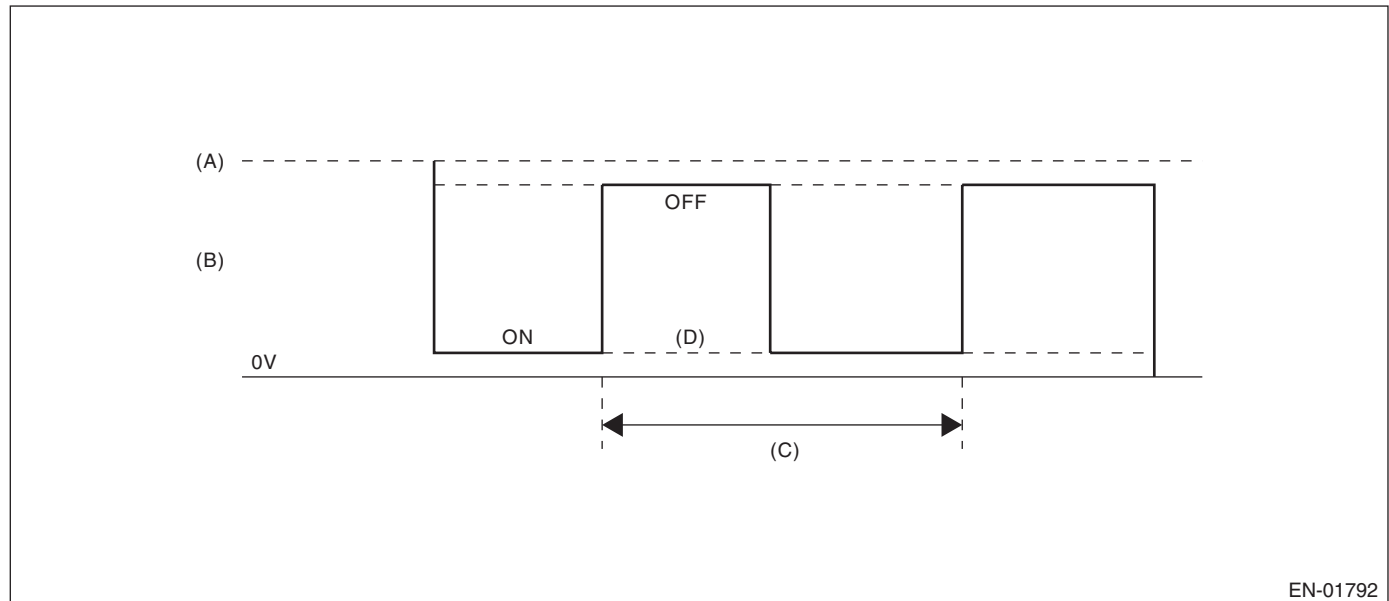
Time Needed for Diagnosis: Less than 1 second

L: 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

(C) 256 ms (cycles)

(D) Low error

(B) Output voltage of the rear oxygen sensor heater

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$
Elapsed time after starting the engine	$\geq 1 \text{ second}$
Engine speed	$< 4500 \text{ rpm}$

4. GENERAL DRIVING CYCLE

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

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 level	Low
Rear oxygen sensor heater control duty	< 75 %

Time Needed for Diagnosis: 8 ms × 320 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

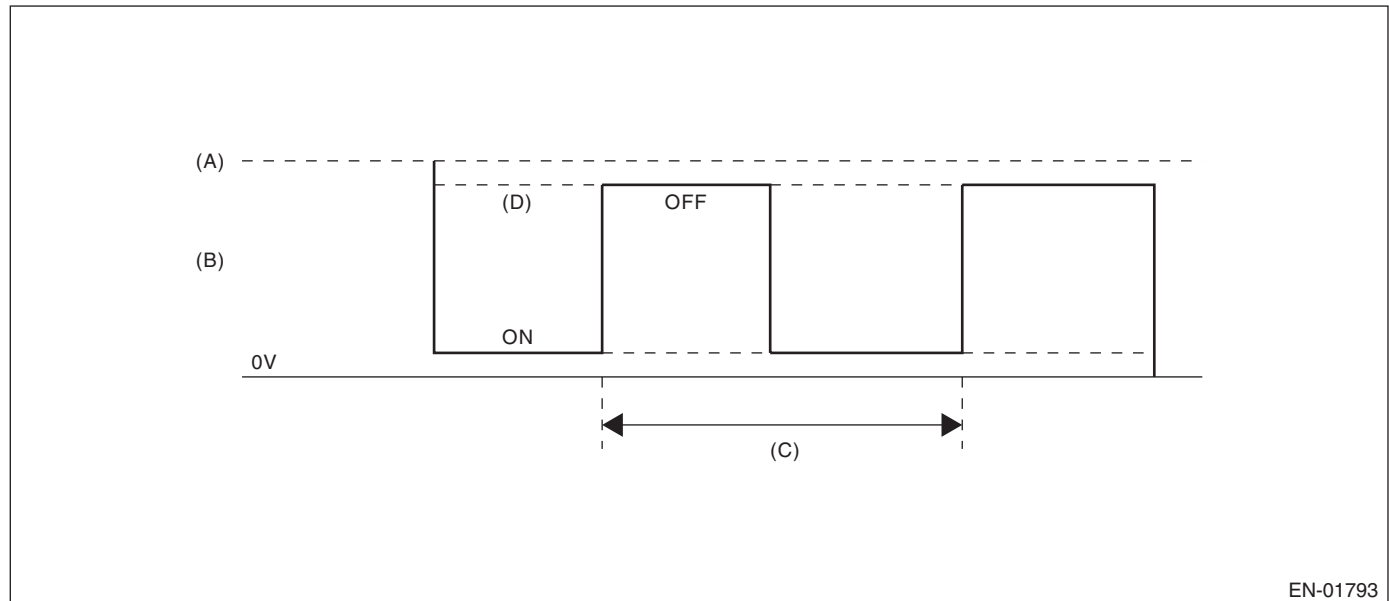
Time Needed for Diagnosis: Less than 1 second

M: 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

(C) 256 ms (cycles)

(D) High error

(B) Output voltage of the rear oxygen sensor heater

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$
Elapsed time after starting the engine	$\geq 1 \text{ second}$
Engine speed	$< 4500 \text{ rpm}$

4. GENERAL DRIVING CYCLE

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

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 level	High
Rear oxygen sensor heater control duty	≥ 15 %

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	Low

Time Needed for Diagnosis: Less than 1 second

N: DTC P0050 HO2S HEATER CONTROL CIRCUIT (BANK 2 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0030. <Ref. to GD(H6DO)-19, DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

O: DTC P0051 HO2S HEATER CONTROL CIRCUIT LOW (BANK 2 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0031. <Ref. to GD(H6DO)-21, DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

P: DTC P0052 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 2 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0032. <Ref. to GD(H6DO)-23, DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

Q: DTC P0057 HO2S HEATER CONTROL CIRCUIT LOW (BANK 2 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0037. <Ref. to GD(H6DO)-25, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

R: DTC P0058 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 2 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0038. <Ref. to GD(H6DO)-27, DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

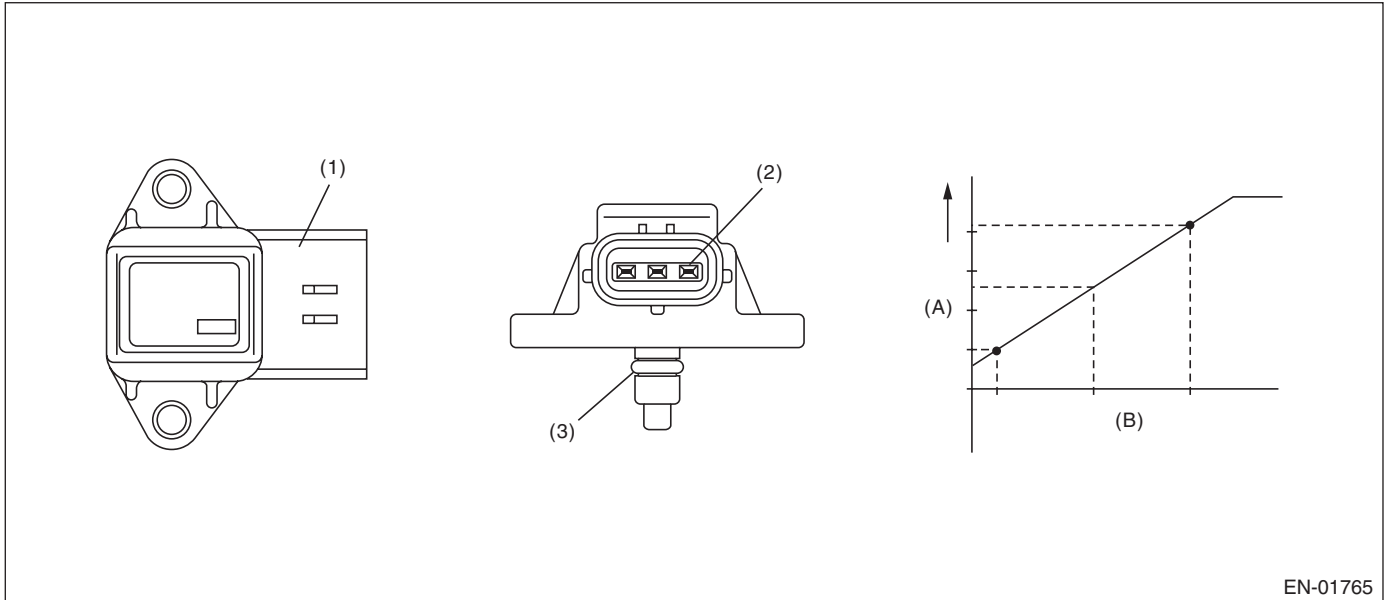
S: DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION

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-01765

(A) Output voltage

(B) Absolute pressure

(1) Connector

(2) Terminals

(3) O-ring

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	$\geq 75^{\circ}\text{C}$ (167 $^{\circ}\text{F}$)

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

Malfunction Criteria	Threshold Value
Low	
Engine speed	< 2700 rpm
Throttle position	$\geq 15^\circ$
Output voltage	< 1.99 V
Engine load	> 1 g/rev (0.04 oz/rev)
High	
Engine speed	500 rpm — 850 rpm
Throttle position	< 3.5°
Output voltage	≥ 2.78 V
Engine load	< 0.6 g/rev (0.02 oz/rev)

Time Needed for Diagnosis:

Low side: 3000 ms

High side: 10000 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.

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

Judgment Value

Malfunction Criteria	Threshold Value
Low	
Engine speed	< 2700 rpm
Throttle position	$\geq 15^\circ$
Output voltage	≥ 1.99 V
Engine load	> 1 g/rev (0.04 oz/rev)
High	
Engine speed	500 rpm — 850 rpm
Throttle position	< 3.5°
Output voltage	< 2.78 V
Engine load	< 0.6 g/rev (0.02 oz/rev)

Time Needed for Diagnosis:

Low side: Less than 1 s

High side: Less than 1 s

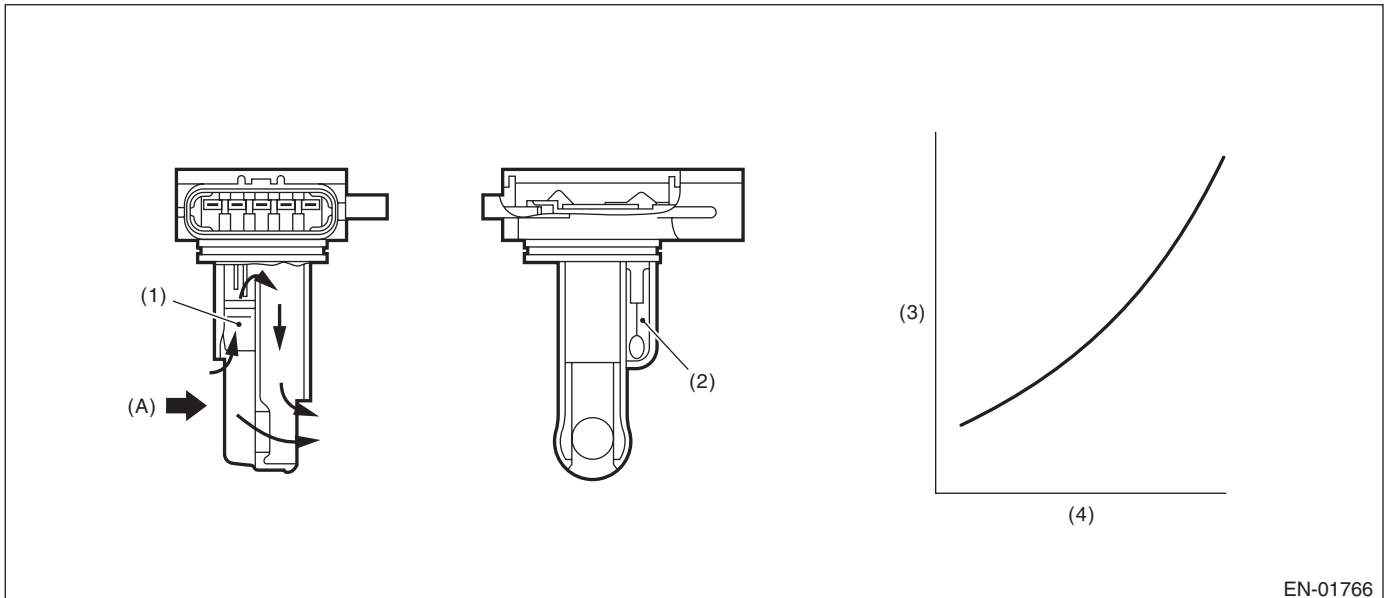
T: DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of air flow sensor output properties.

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

2. COMPONENT DESCRIPTION



EN-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
Engine coolant temperature	$\geq 200^{\circ}\text{C}$ (392 $^{\circ}\text{F}$)

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

Malfunction Criteria	Threshold Value
Low	
Output voltage	< 1.74 V
Engine speed	≥ 2000 rpm
Throttle opening angle	≥ 15 °
Intake manifold pressure	≥ 73.3 kPa (550 mmHg, 21.7 inHg)
High (1)	
Output voltage	≥ 1.83 V
Engine speed	500 rpm — 850 rpm
Throttle opening angle	< 3.5 °
Intake manifold pressure	< 46.7 kPa (350 mmHg, 13.8 inHg)
High (2)	
Output voltage	≥ 1.73 V
Engine speed	500 rpm — 850 rpm
Throttle opening angle	< 3.5 °
Intake manifold pressure	< 46.7 kPa (350 mmHg, 13.8 inHg)
Fuel system diagnosis	Rich side malfunction

Time Needed for Diagnosis:

Low: 5000 ms

High: 10000 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

Malfunction Criteria	Threshold Value
Low	
Output voltage	≥ 1.74 V
Engine speed	≥ 2000 rpm
Throttle opening angle	≥ 15 °
Intake manifold pressure	≥ 73.3 kPa (550 mmHg, 21.7 inHg)
High	
Output voltage	< 1.83 V
Engine speed	500 rpm — 850 rpm
Throttle opening angle	< 3.5 °
Intake manifold pressure	< 46.7 kPa (350 mmHg, 13.8 inHg)
Fuel system diagnosis	Rich side normal

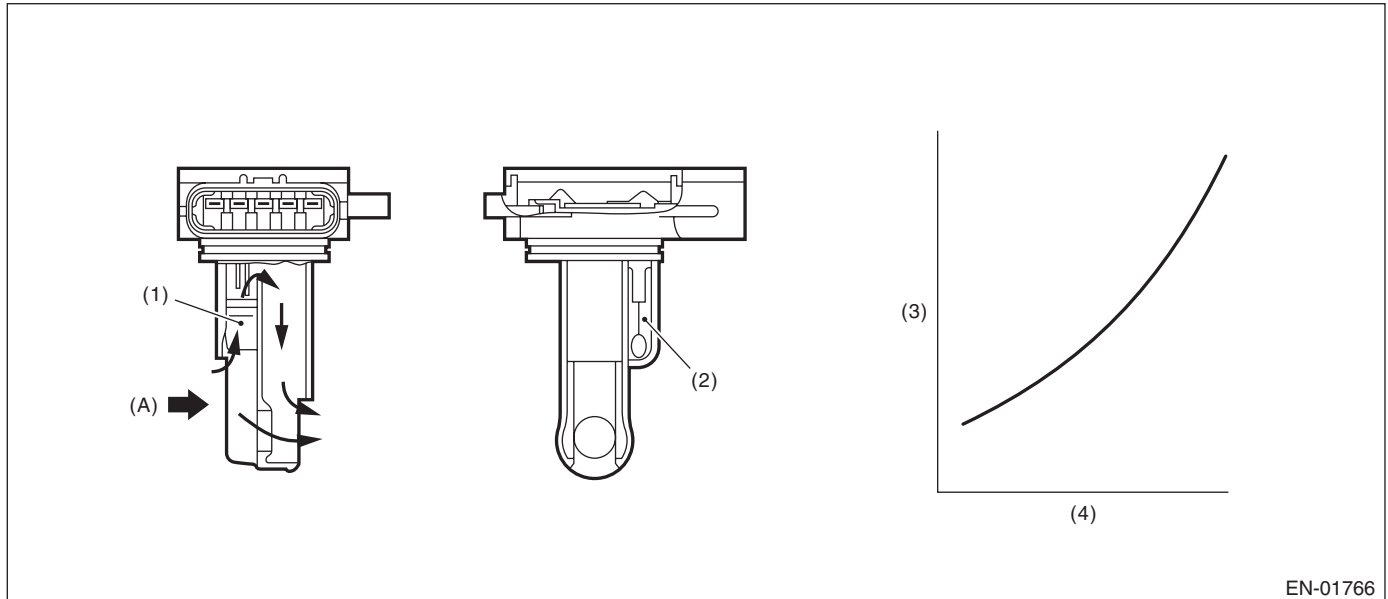
Time Needed for Diagnosis:

Low: Less than 1 s

High: Less than 1 s

U: 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	$\leq 0.2 \text{ V}$

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	$> 0.2 \text{ V}$

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

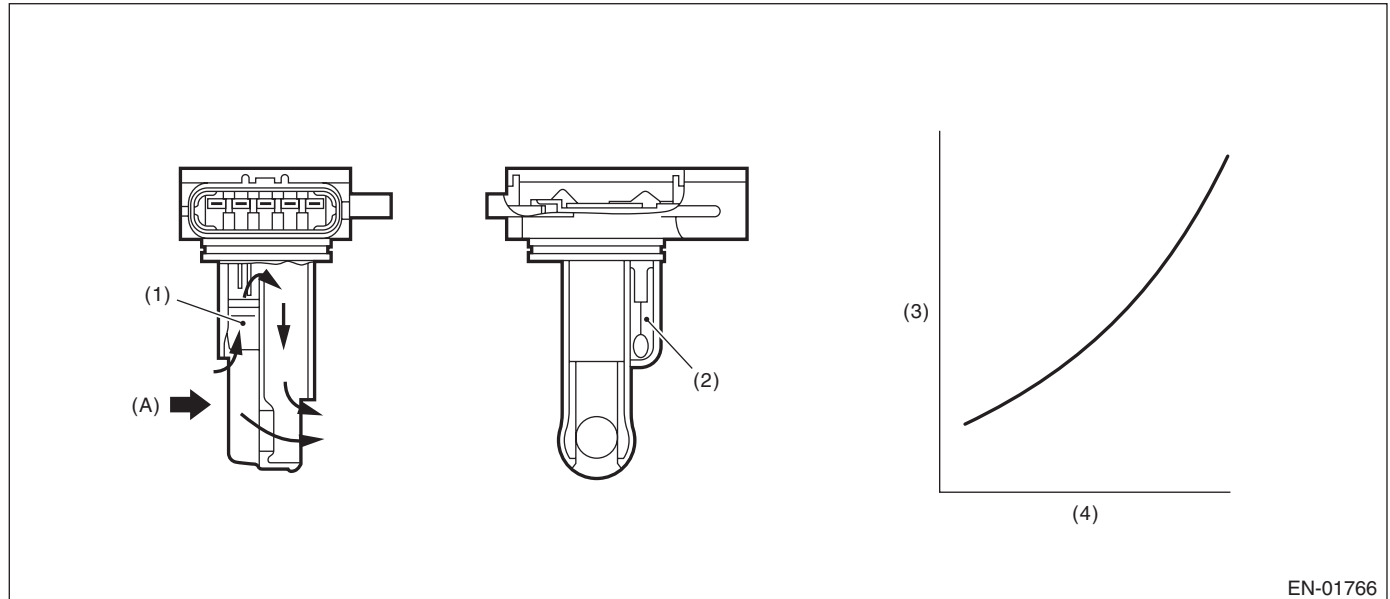
V: DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT

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	≥ 4.98 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

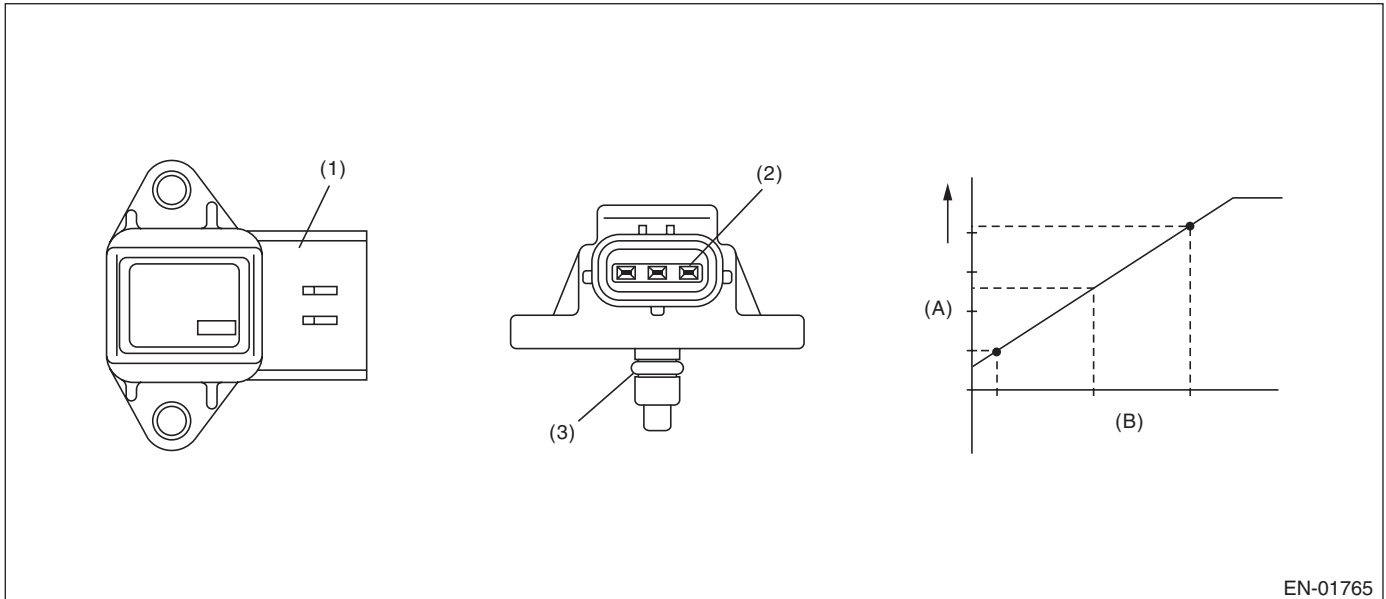
Malfunction Criteria	Threshold Value
Output voltage	< 4.98 V

Time Needed for Diagnosis: Less than 1 second

W: 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-01765

(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	$\leq 0.573 \text{ V}$

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	$> 0.573 \text{ V}$

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

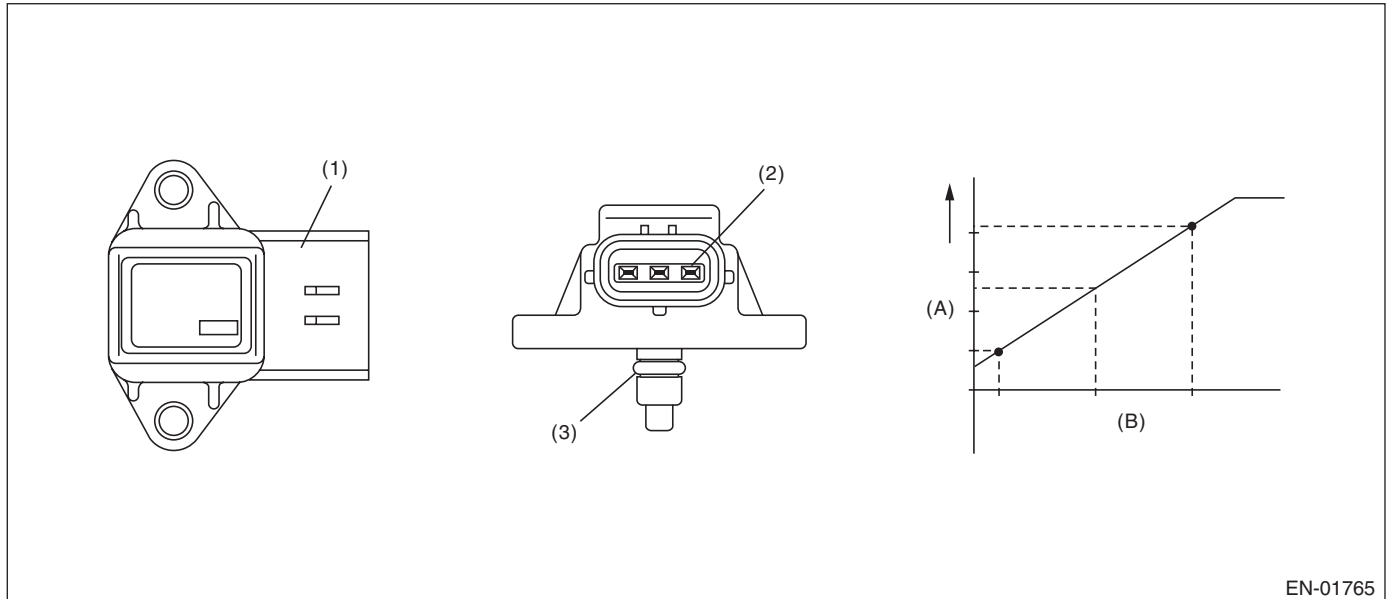
X: DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT

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-01765

(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	≥ 4.388 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

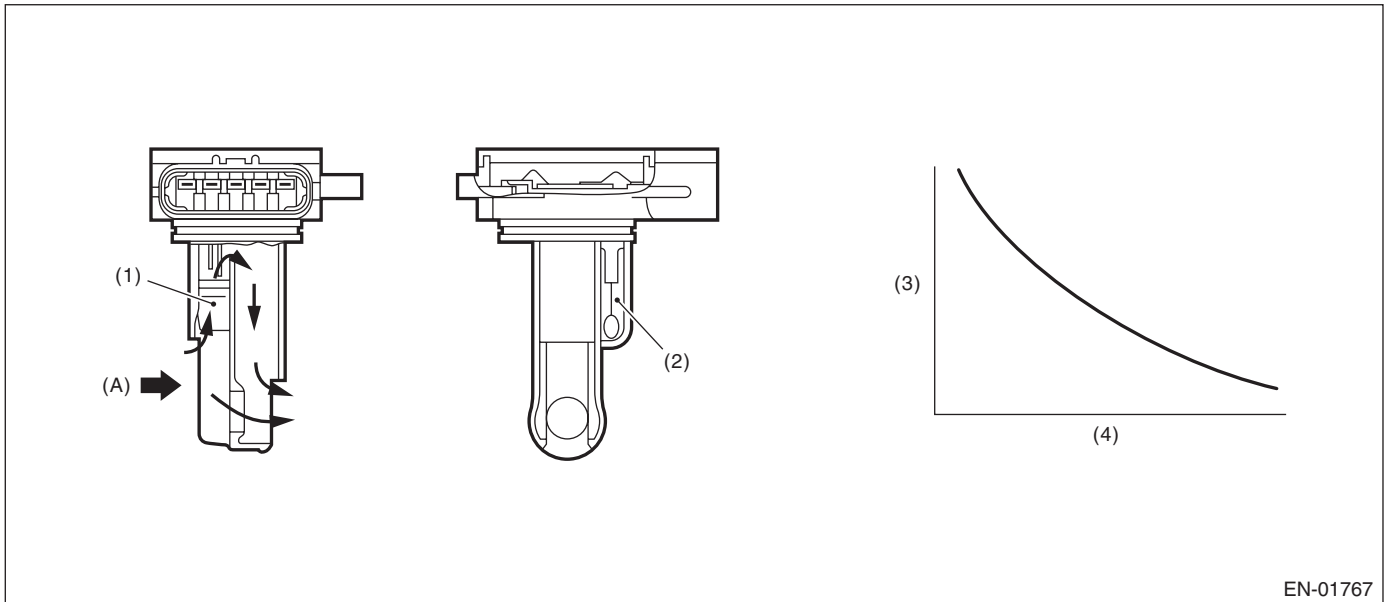
Malfunction Criteria	Threshold Value
Output voltage	< 4.388 V

Time Needed for Diagnosis: Less than 1 second

Y: 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

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature at engine starting	< 35 °C (95 °F)
Battery voltage	≥ 10.9 V
Continuous time when the vehicle speed is less than 2 km/h (1.2 MPH)	≥ 15 s
Engine coolant temperature	≥ 75 °C (167 °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	≥ 15 s
and	
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)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Map 1

Engine coolant temperature °C (°F)	-20 (-4)	-10 (14)	0 (32)	10 (50)	20 (68)
Intake air amount sum value (g (oz)/s)	50000 (1763.5)	7400 (261)	6600 (232.78)	5800 (204.57)	5000 (176.35)

Map 2

Engine coolant temperature °C (°F)	-30 (-22)	0 (32)	10 (50)	20 (68)
Continuous time (s) when vehicle speed is less than 4 km/h (2.5 MPH)	250	40	32	24

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.

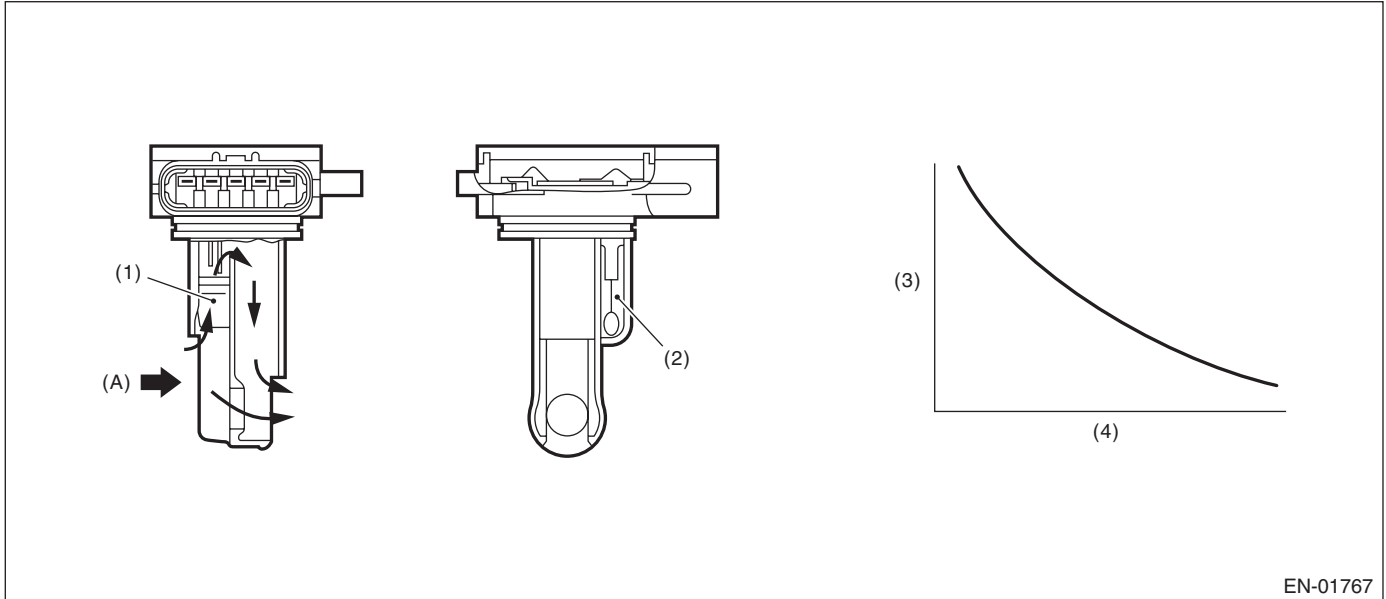
Judgment Value

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

Time Needed for Diagnosis: Less than 1 second

Z: DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW**1. OUTLINE OF DIAGNOSIS**

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

2. COMPONENT DESCRIPTION

EN-01767

(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	< 0.231 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	≥ 0.231 V

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

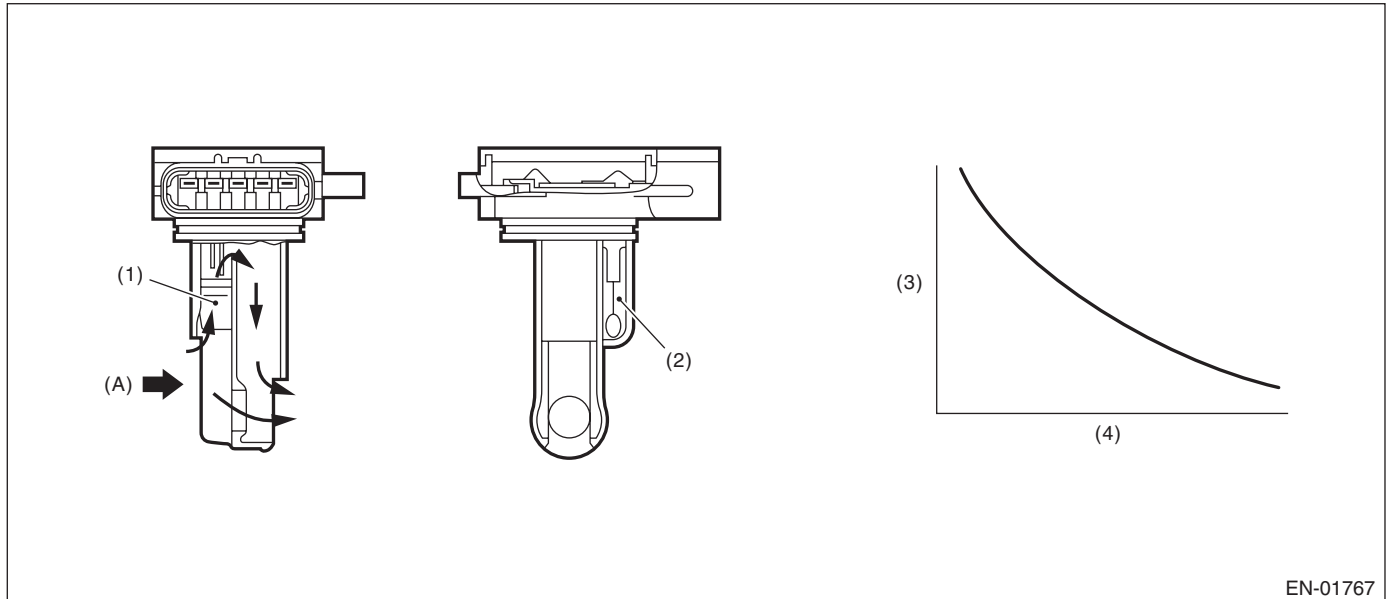
GENERAL DESCRIPTION

AA:DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



EN-01767

(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	≥ 4.716 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.

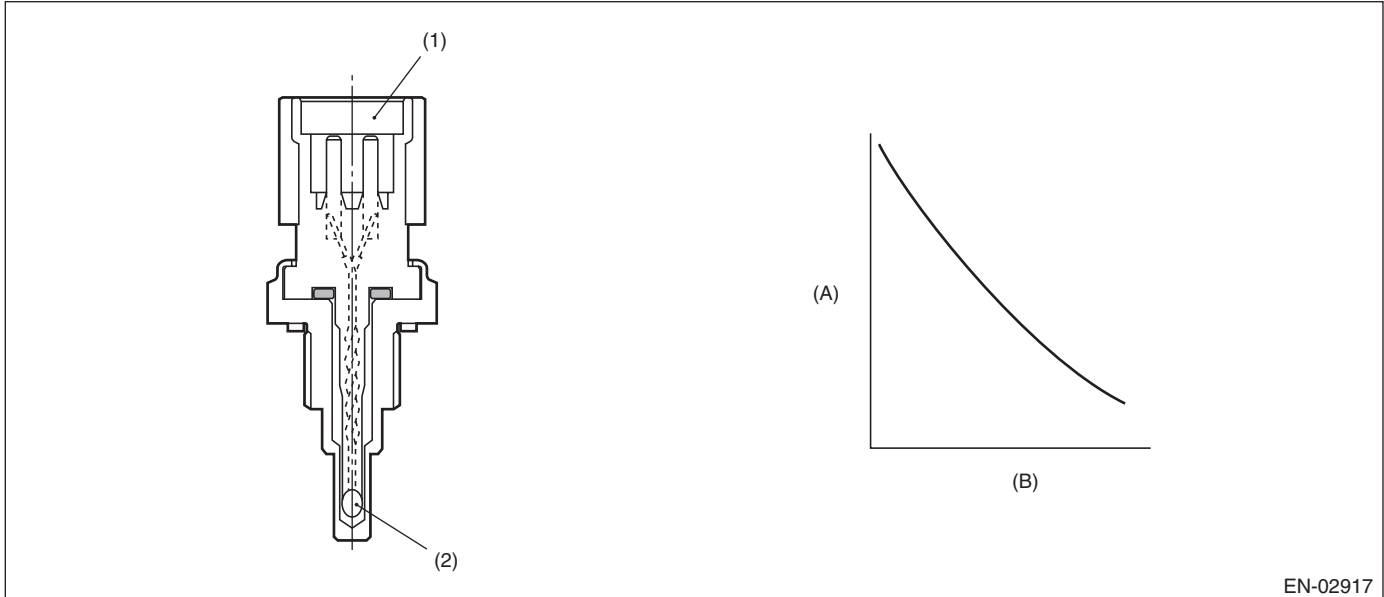
Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 4.716 V

Time Needed for Diagnosis: Less than 1 second

AB: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 (k Ω)

(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	< 0.265 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	≥ 0.265 V

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

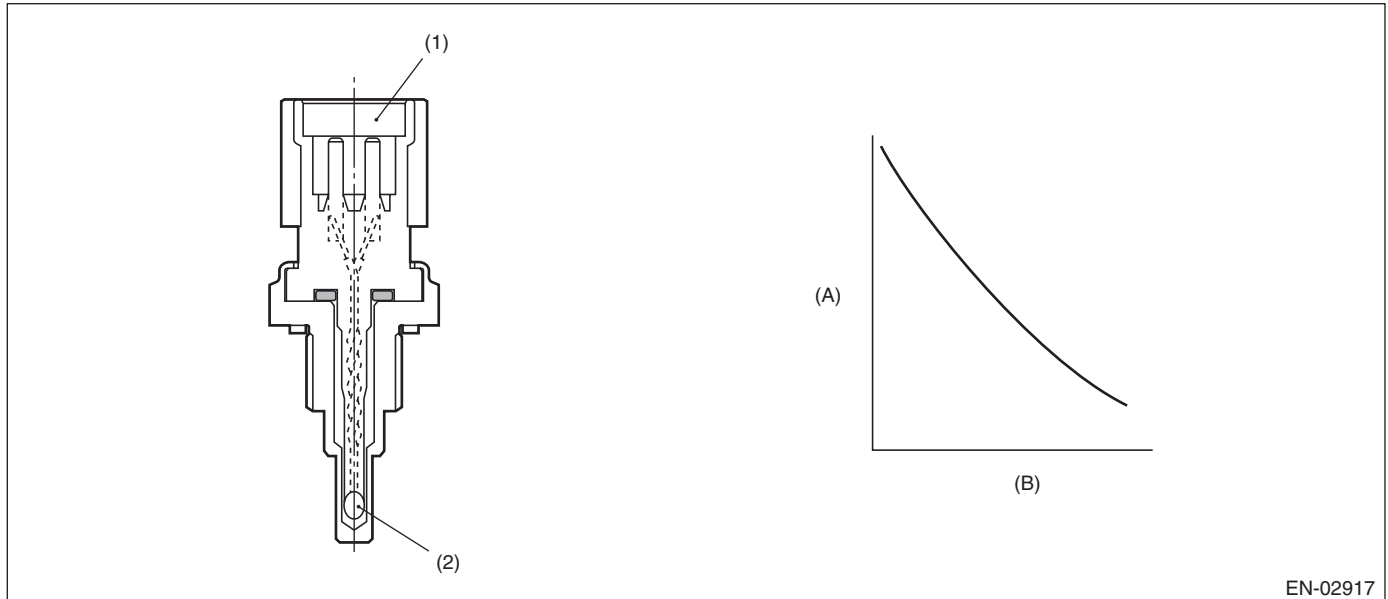
GENERAL DESCRIPTION

AC: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 (k Ω)

(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	≥ 4.716 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

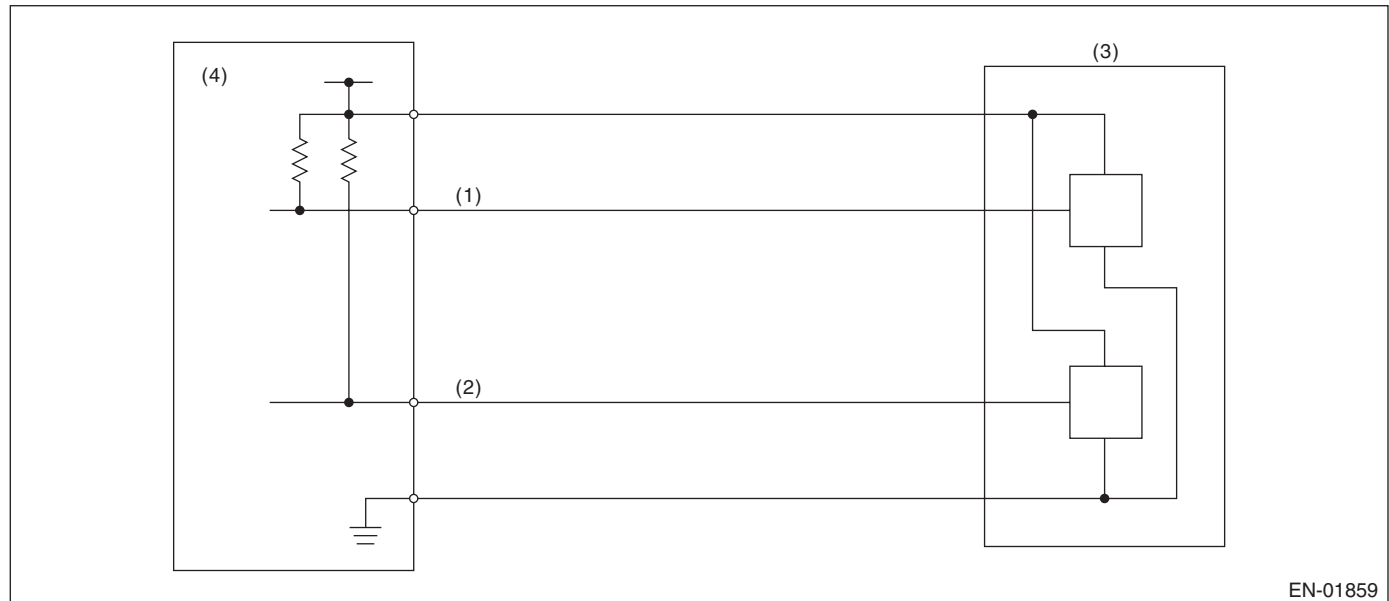
Malfunction Criteria	Threshold Value
Output voltage	< 4.716 V

Time Needed for Diagnosis: Less than 1 second

AD: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

(3) Throttle position sensor

(4) Engine control module (ECM)

(2) Throttle position sensor 2 signal

3. ENABLE CONDITION

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

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	$\leq 0.217 \text{ V}$

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	$> 0.217 \text{ V}$

Time Needed for Diagnosis: 24 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

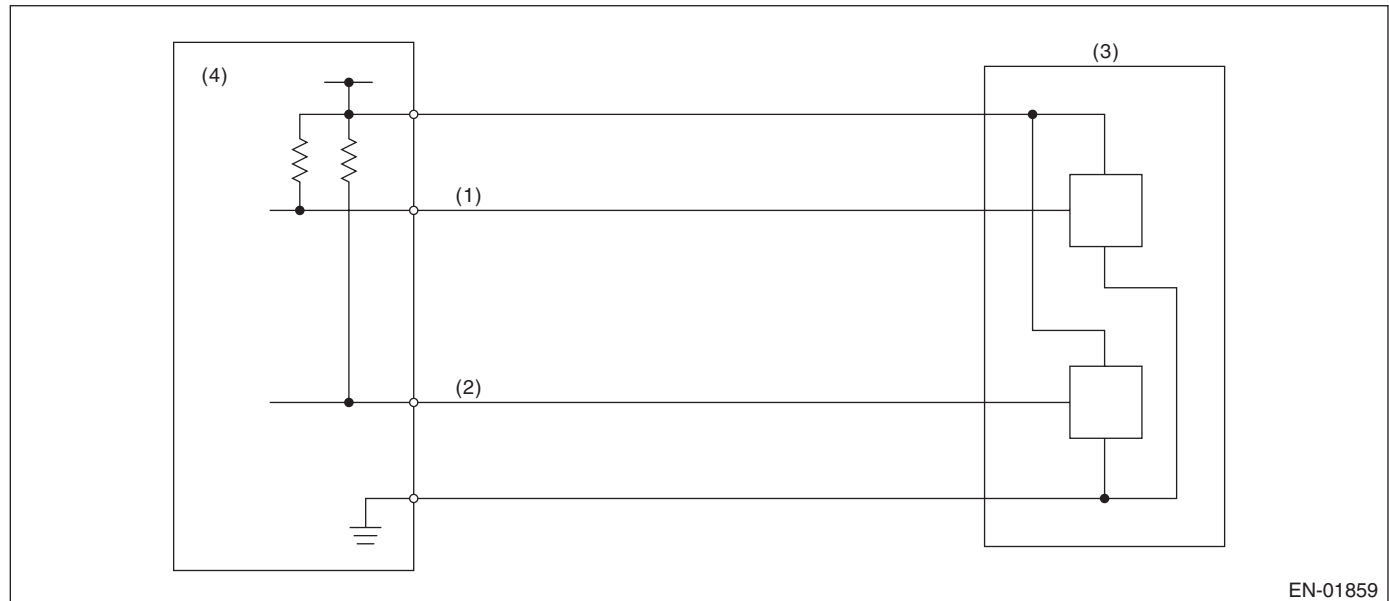
AE:DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT HIGH

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



(1) Throttle position sensor 1 signal

(3) Throttle position sensor

(4) Engine control module (ECM)

(2) Throttle position sensor 2 signal

3. ENABLE CONDITION

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

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

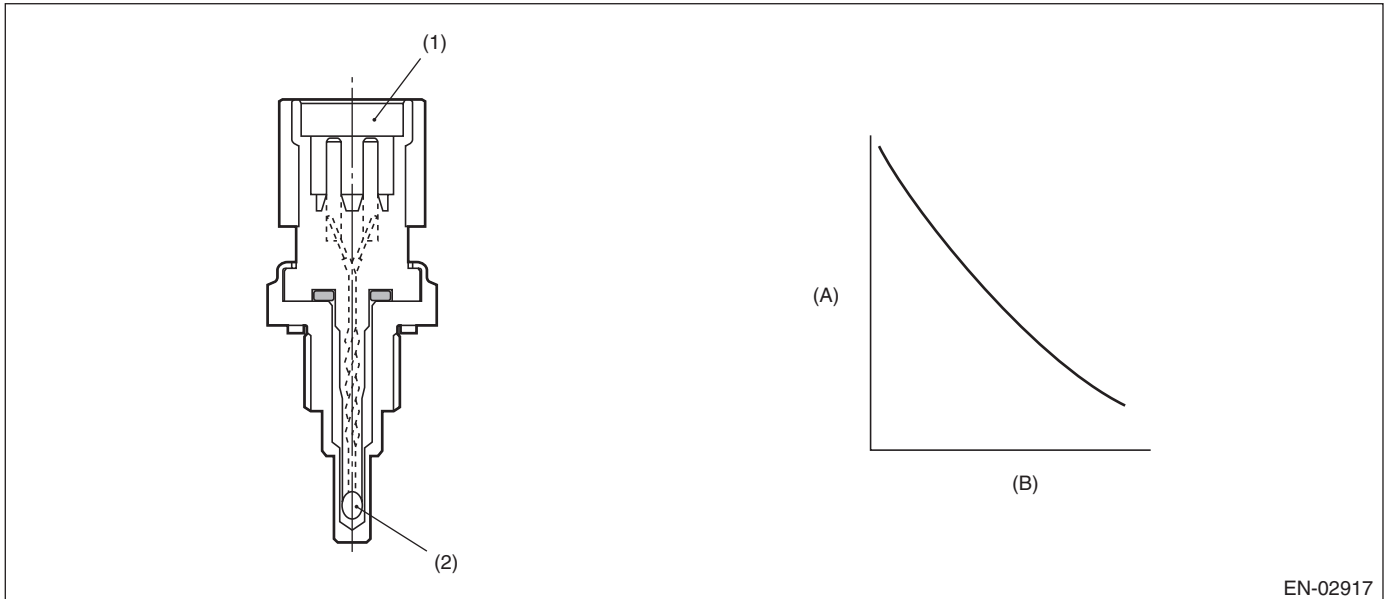
Malfunction Criteria	Threshold Value
Sensor 1 input voltage	$< 4.858 \text{ V}$

Time Needed for Diagnosis: 24 ms

AF: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	≥ 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.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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	37.136 ms	74.272 ms	111.41 ms	126.66 ms	141.91 ms	163.59 ms	185.26 ms
	-10 (14)	0 ms	27.391 ms	54.782 ms	82.173 ms	99.65 ms	117.13 ms	135.96 ms	154.8 ms
	0 (32)	0 ms	17.646 ms	35.292 ms	52.938 ms	72.64 ms	92.341 ms	108.34 ms	124.33 ms
	10 (50)	0 ms	7.9012 ms	15.802 ms	23.704 ms	45 ms	45 ms	50 ms	50 ms
	20 (68)	0 ms	7.9012 ms	15.802 ms	23.704 ms	45 ms	45 ms	50 ms	50 ms

Judgment value of timer after engine starting

$t = 429523 \text{ ms} - 28605 \text{ ms} \times T_i$

T_i : 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

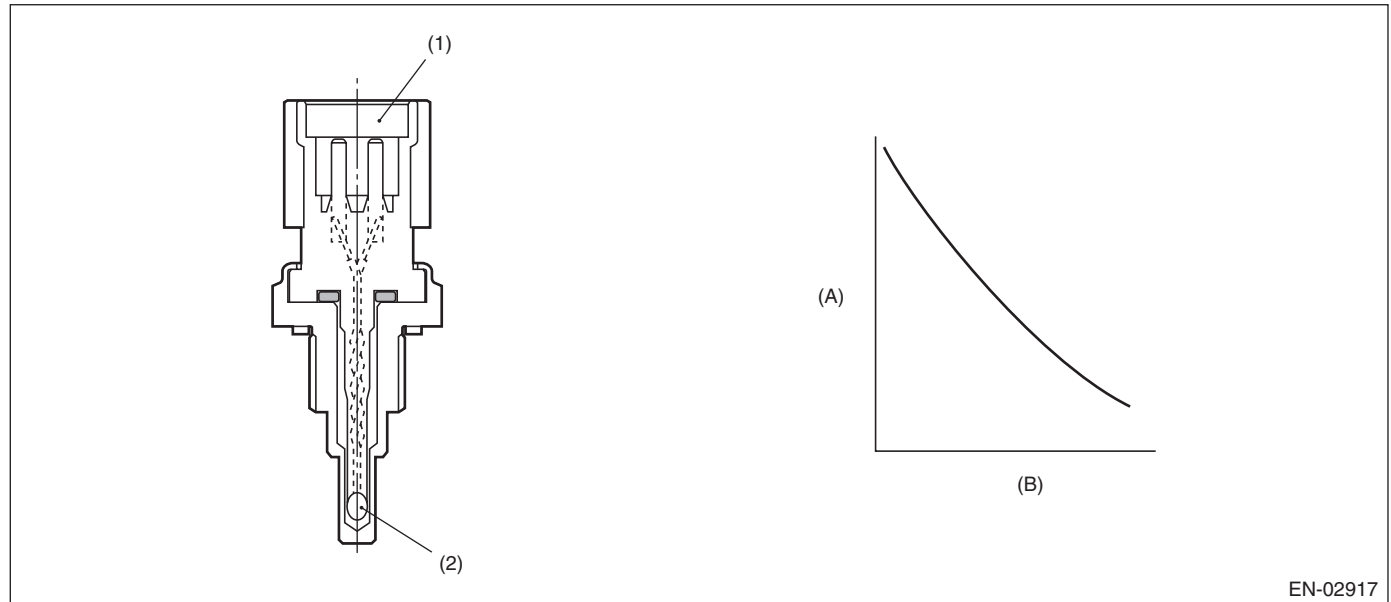
AG:DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of the engine coolant temperature sensor characteristics.

Memorize the engine coolant temperature and fuel temperature at the last engine stop, and use them to judge as NG when the engine coolant temperature does not decrease when 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
Battery voltage	≥ 10.9 V
Refueling from the last engine stop till the current engine start	None
Fuel level	≥ 15 ℓ (3.96 US gal, 3.3 Imp gal)
Engine coolant temperature at the last engine stop	≥ 75 °C (167 °F)

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
Engine coolant temperature at the last engine stop — Minimum engine coolant temperature after the engine start	< 2.5 °C (36.5 °F)
Fuel temperature at the last engine stop — fuel temperature	≥ 5 °C (41 °F)
Intake air temperature — fuel temperature	< 2.5 °C (36.5 °F)
Fuel temperature	< 35 °C (95 °F)

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
Engine coolant temperature at the last engine stop — Minimum engine coolant temperature after the engine start	≥ 2.5 °C (36.5 °F)

Time Needed for Diagnosis: Less than 1 second

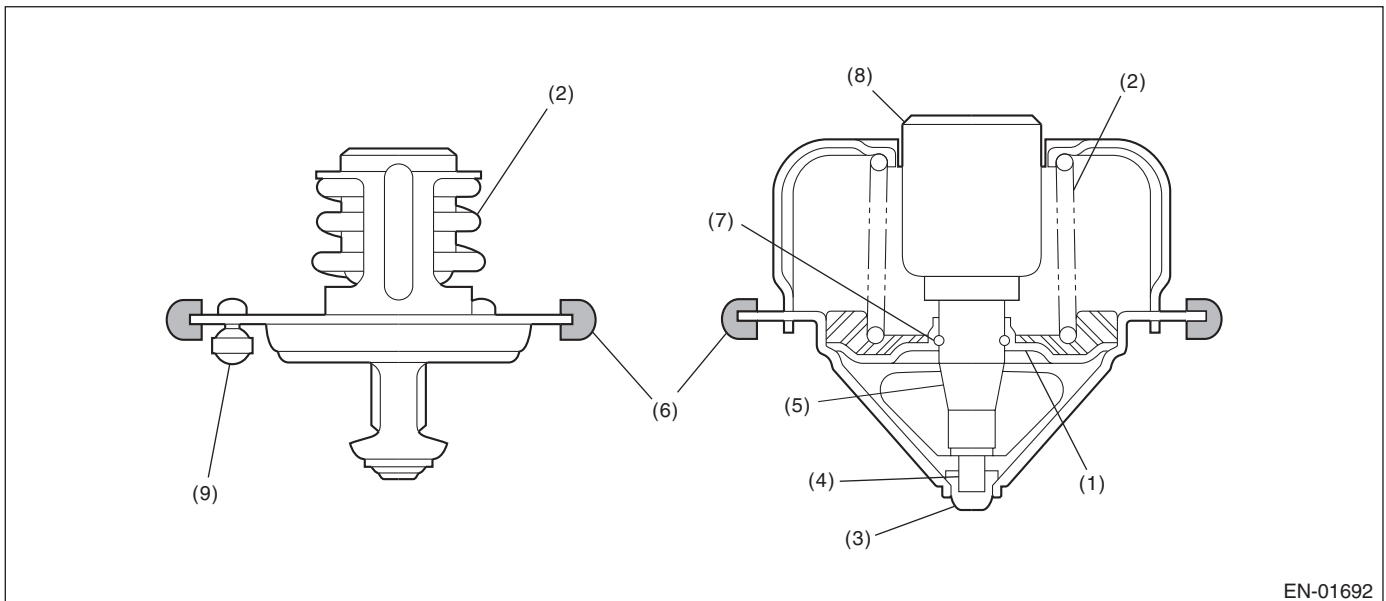
AH:DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE)

1. OUTLINE OF DIAGNOSIS

Detect malfunctions of the thermostat function.

Judge as NG when the engine coolant temperature is lower than the estimated engine coolant temperature and the difference between them is large. Judge as OK when the engine coolant temperature becomes to 75°C (167°F), and the difference is small, before judging NG.

2. COMPONENT DESCRIPTION



- | | | |
|-------------|-----------------|------------------|
| (1) Valve | (4) Piston | (7) Stop ring |
| (2) Spring | (5) Guide | (8) Wax element |
| (3) Stopper | (6) Rubber seal | (9) Jiggle valve |

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	$\geq 10.9 \text{ V}$
Estimate ambient temperature	$\geq -7 \text{ }^{\circ}\text{C}$ (19.4 $^{\circ}\text{F}$)
Thermostat malfunction diagnosis	Incomplete
Engine coolant temperature at engine starting	$< 55 \text{ }^{\circ}\text{C}$ (131 $^{\circ}\text{F}$)
Estimated coolant temperature	$\geq 75 \text{ }^{\circ}\text{C}$ (167 $^{\circ}\text{F}$)
Engine coolant temperature	$\leq 75 \text{ }^{\circ}\text{C}$ (167 $^{\circ}\text{F}$)
(Estimated – Measured) Engine coolant temperature	$> 20 \text{ }^{\circ}\text{C}$ (68 $^{\circ}\text{F}$)
Vehicle speed	$\geq 20 \text{ km/h}$ (12.4 MPH)

Time Needed for Diagnosis: 64 ms $\times$ 3 time(s) $\times$ 120 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
Battery voltage	$\geq 10.9 \text{ V}$
Estimate ambient temperature	$\geq -7 \text{ }^{\circ}\text{C}$ (19.4 $^{\circ}\text{F}$)
Thermostat malfunction diagnosis	Incomplete
Engine coolant temperature at engine starting	$< 55 \text{ }^{\circ}\text{C}$ (131 $^{\circ}\text{F}$)
Engine coolant temperature	$\geq 75 \text{ }^{\circ}\text{C}$ (167 $^{\circ}\text{F}$)
(Estimated – Measured) Engine coolant temperature	$\leq 20 \text{ }^{\circ}\text{C}$ (68 $^{\circ}\text{F}$)

Time Needed for Diagnosis: Less than 1 second

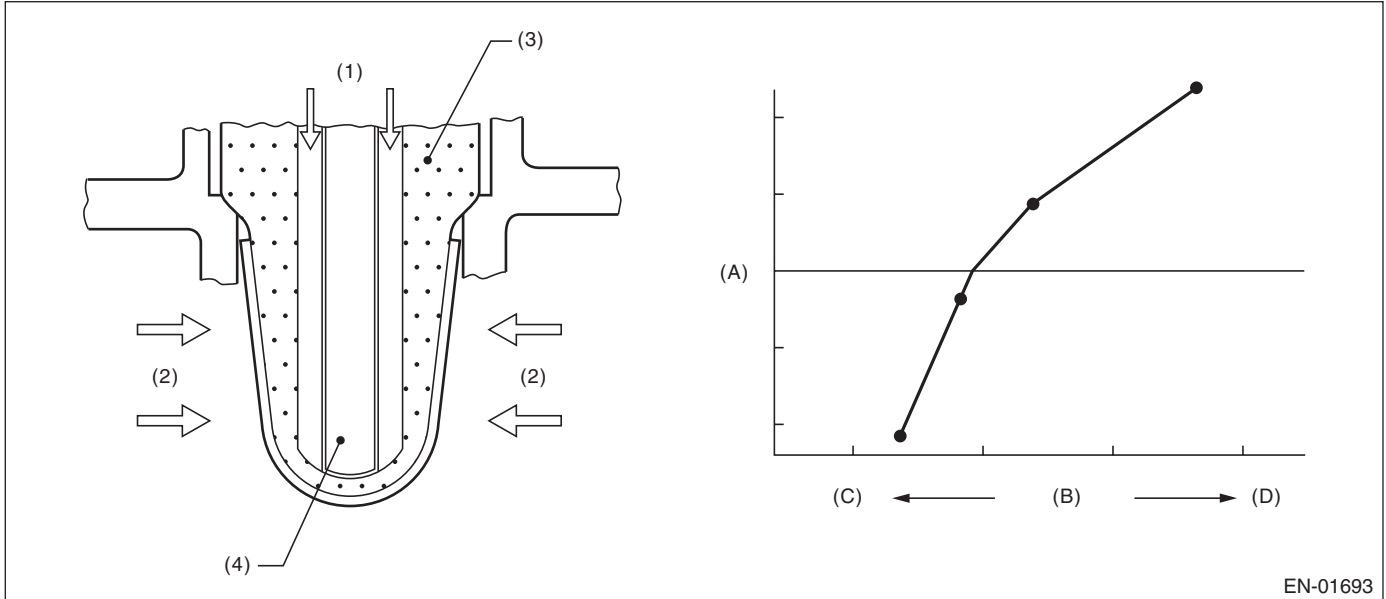
AI: DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1)

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-01693

(A) Electromotive force

(B) Air fuel ratio

(C) Lean

(D) Rich

(1) Atmosphere

(3) ZrO_2

(4) Ceramic heater

(2) Exhaust gas

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
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
Input voltage (+) or Input voltage (–) or Input voltage (+) – Input voltage (–)	< 1.128 V < 0.23 V < 0.644 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 (+) Input voltage (–) Input voltage (+) – Input voltage (–)	≥ 1.128 V ≥ 0.23 V ≥ 0.644 V

Time Needed for Diagnosis: Less than 1 second

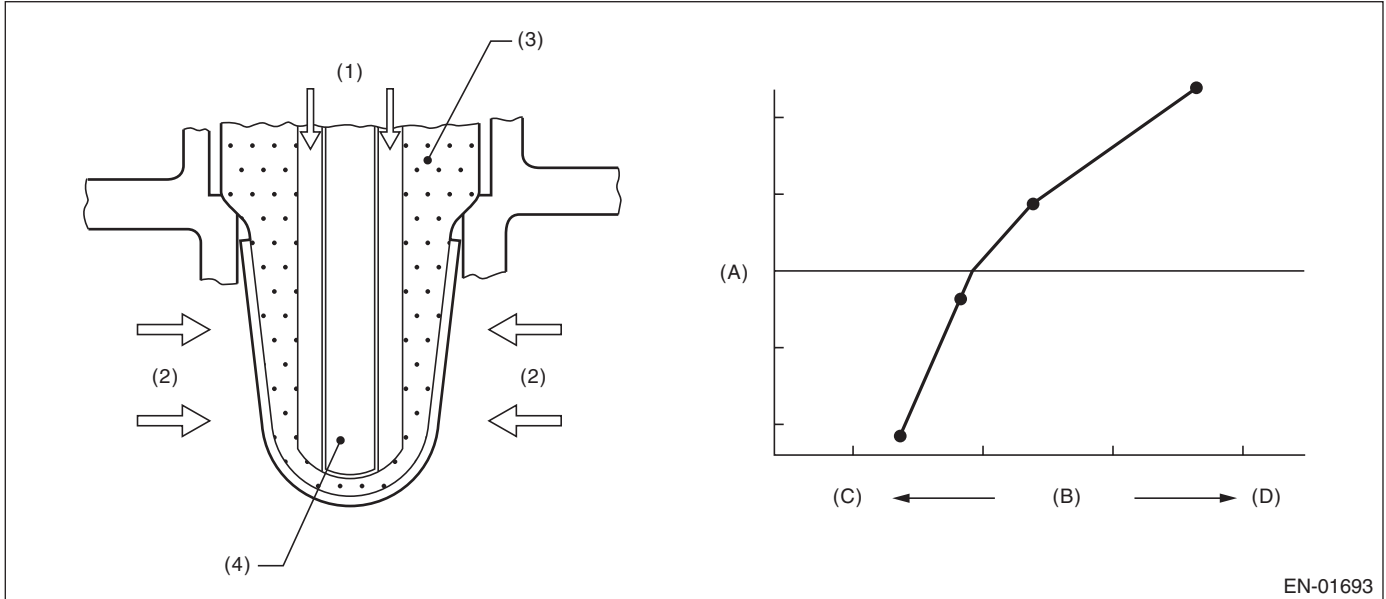
AJ:DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1)

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-01693

(A) Electromotive force

(B) Air fuel ratio

(C) Lean

(D) Rich

(1) Atmosphere

(3) ZrO_2

(4) Ceramic heater

(2) Exhaust gas

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
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
Input voltage (+) or Input voltage (–)	> 3.589 V > 3.541 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 (+) Input voltage (–)	≤ 3.589 V ≤ 3.541 V

Time Needed for Diagnosis: Less than 1 second

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

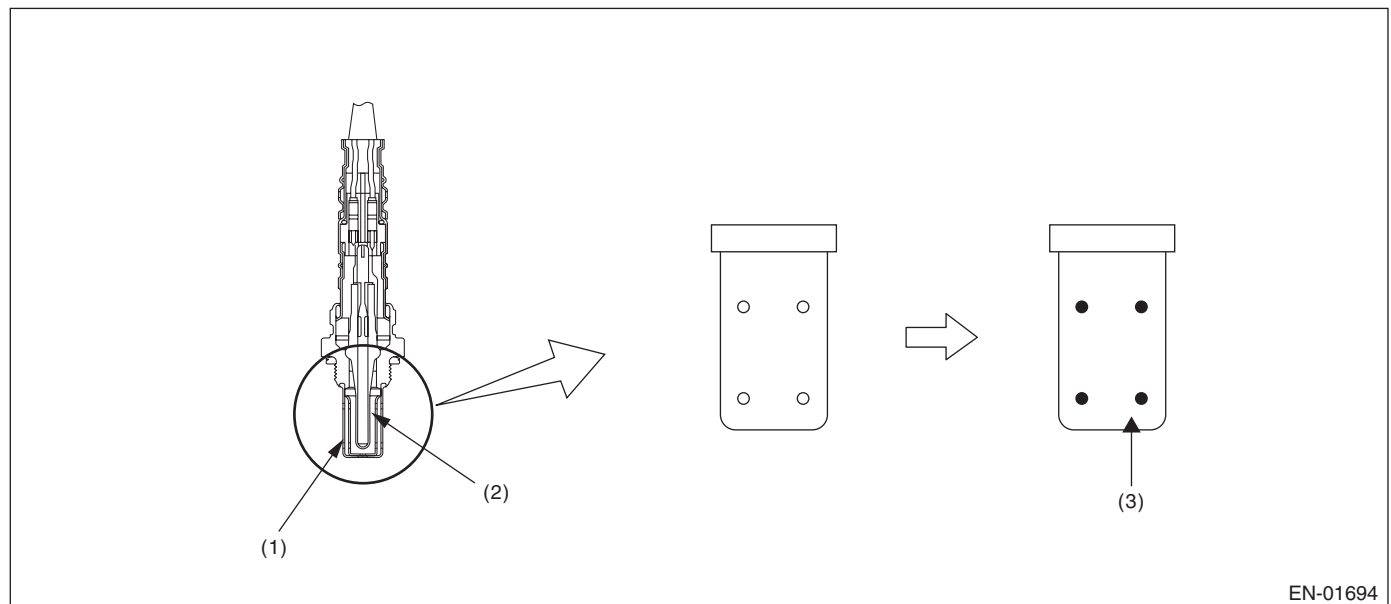
1. OUTLINE OF DIAGNOSIS

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-01694

(1) Cover

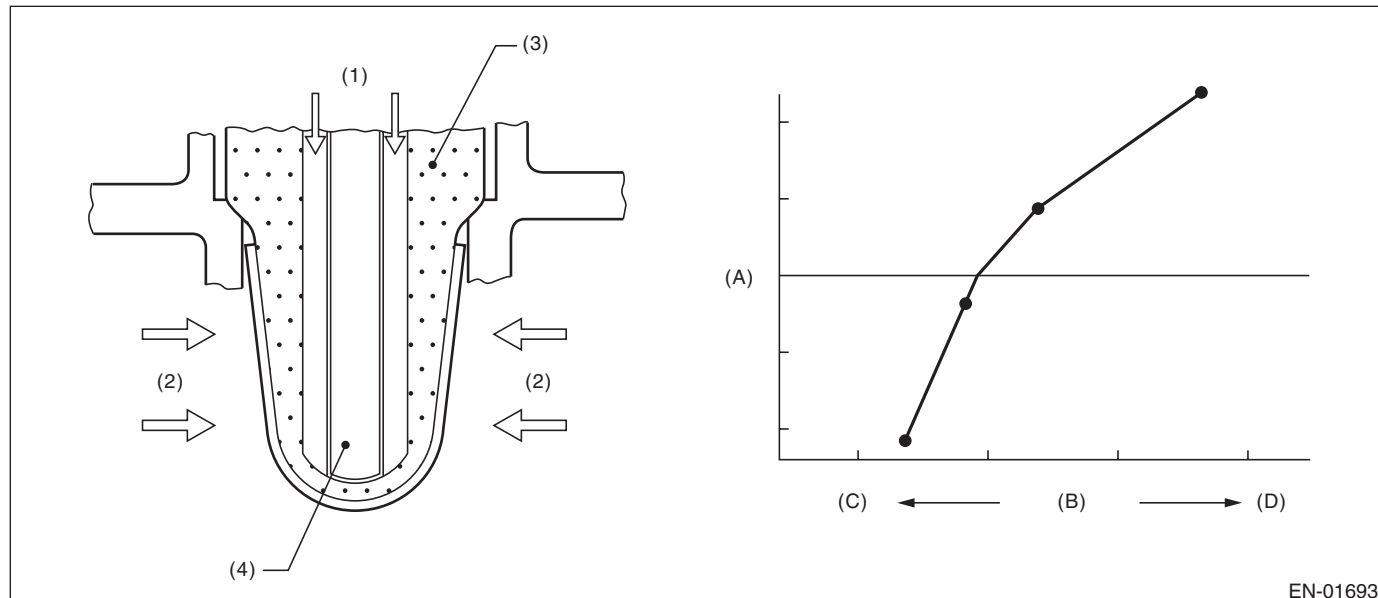
(2) Zirconia

(3) Clogging

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

2. COMPONENT DESCRIPTION



EN-01693

(A) Electromotive force

(C) Lean

(D) Rich

(B) Air fuel ratio

(1) Atmosphere

(3) ZrO₂

(4) Ceramic heater

(2) Exhaust gas

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
Barometric pressure	> 75 kPa (563 mmHg, 22.2 inHg)
Closed loop control with main feedback	Operation
Front oxygen (A/F) sensor impedance	0 Ω — 50 Ω
Elapsed time after starting the engine	≥ 120000 ms
Engine coolant temperature	≥ 75 °C (167 °F)
Engine speed	1000 rpm — 2500 rpm
Vehicle speed	10 km/h — 120 km/h (6.2 MPH — 74.6 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	< 0.2
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 — 120 km/h (6.2 MPH — 74.6 MPH) 120000 ms or more after starting the engine.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

Calculate faf difference every $32\text{ms} \times 4$, and the λ value difference. Calculate the diagnosis 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
$\text{para}fca = \text{td}2\text{faf}/\text{td}2\text{lmd}$ where, $\text{td}2\text{faf} (N) = \text{td}2\text{faf} (n-1) + \text{d}2\text{faf} (n) $ $\text{td}2\text{lmd} (N) = \text{td}2\text{lmd} (n-1) + \text{d}2\text{lmd} (n) $ add up to $32 \text{ ms} \times 4 \times 820 \text{ time(s)}$. $\text{d}2\text{faf} (n) = (\text{faf} (n) - \text{faf} (n-1)) - (\text{faf} (n-1) - \text{faf} (n-2))$ $\text{d}2\text{lmd} (n) = (\text{lmd} (n) - \text{lmd} (n-1)) - (\text{lmd} (n-1) - \text{lmd} (n-2))$ faf = main feedback compensation coefficient every 128 milliseconds lmd = output lambda every 128 milliseconds	> 0.2

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

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
$\text{para}fca = \text{td}2\text{faf}/\text{td}2\text{lmd}$ where, $\text{td}2\text{faf} (N) = \text{td}2\text{faf} (n-1) + \text{d}2\text{faf} (n) $ $\text{td}2\text{lmd} (N) = \text{td}2\text{lmd} (n-1) + \text{d}2\text{lmd} (n) $ add up to $32 \text{ ms} \times 4 \times 820 \text{ time(s)}$. $\text{d}2\text{faf} (n) = (\text{faf} (n) - \text{faf} (n-1)) - (\text{faf} (n-1) - \text{faf} (n-2))$ $\text{d}2\text{lmd} (n) = (\text{lmd} (n) - \text{lmd} (n-1)) - (\text{lmd} (n-1) - \text{lmd} (n-2))$ faf = main feedback compensation coefficient every 128 milliseconds lmd = output lambda every 128 milliseconds	≤ 0.2

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

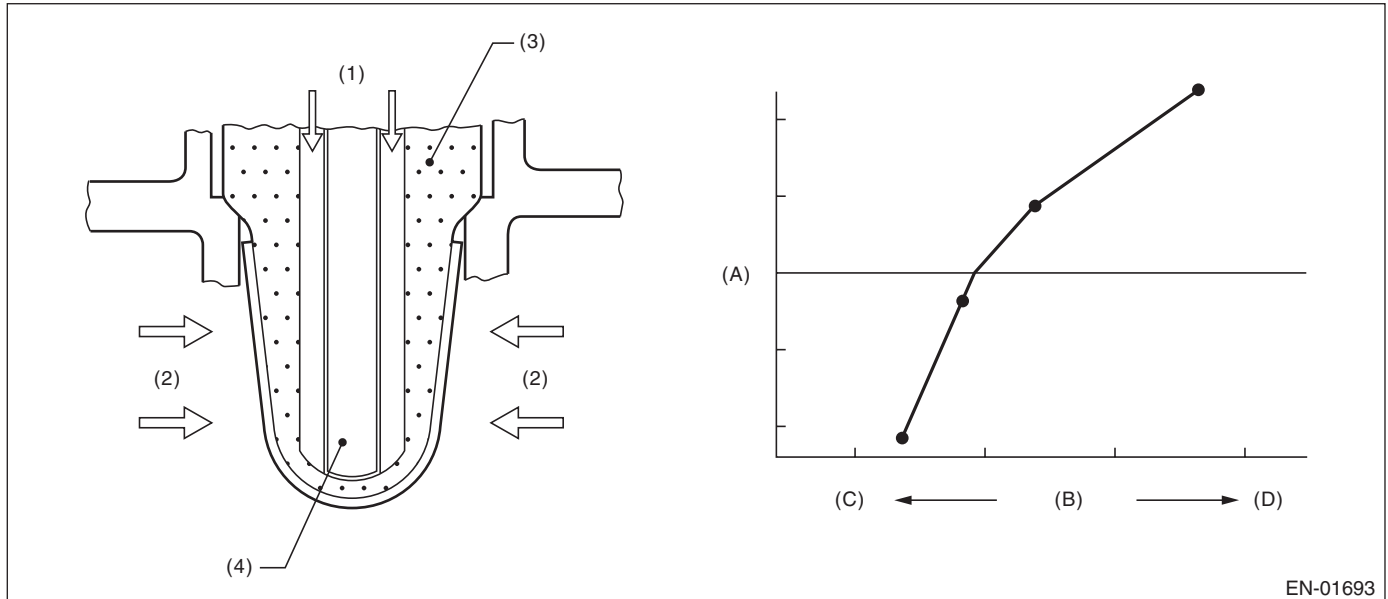
AL:DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect open circuits of the sensor.

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

2. COMPONENT DESCRIPTION



(A) Electromotive force

(B) Air fuel ratio

(C) Lean

(D) Rich

(1) Atmosphere

(2) Exhaust gas

(3) ZrO_2

(4) Ceramic heater

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	≥ 10.9 V
Time of heater control duty at 70 % or more	≥ 30000 ms
Front oxygen (A/F) sensor impedance.	> 500 Ω

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	≥ 10.9 V
Front oxygen (A/F) sensor impedance.	≤ 500 Ω

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

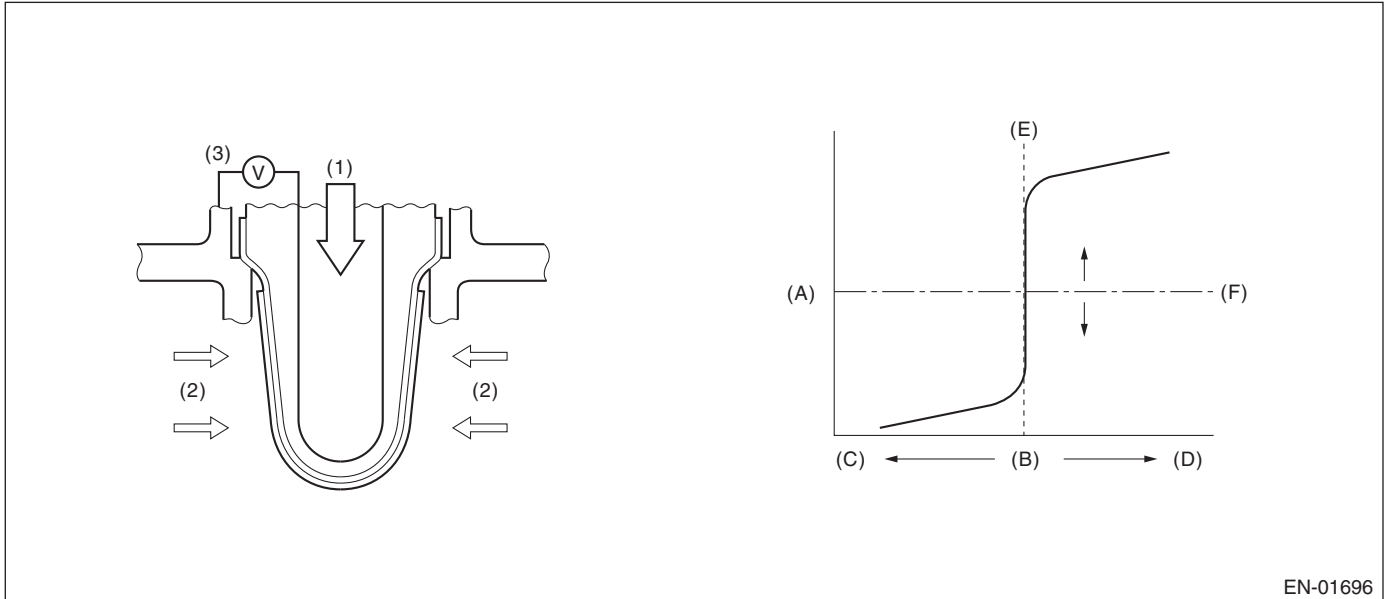
GENERAL DESCRIPTION

AM: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

(1) Atmosphere

(C) Rich

(D) Lean

(2) Exhaust gas

(E) Theoretical air fuel ratio

(F) Comparative voltage

(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	Not in operation
Closed loop control at the oxygen sensor	In operation
Misfire detection every 200 rotations	< 7 time(s)
Front oxygen (A/F) sensor compensation coefficient	Not in limit value
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ 75 °C (167 °F)
Low (1)	
Secondary air system	Not in operation
Closed loop control at the oxygen sensor	In operation
Misfire detection every 200 rotations	< 7 time(s)
Front oxygen (A/F) sensor compensation coefficient	Not in limit value
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ 75 °C (167 °F)
Amount of intake air	≥ 10 g/s (0.35 oz/s)
Low (2)	
Secondary air system	Not in operation
Closed loop control at the oxygen sensor	In operation
Misfire detection every 200 rotations	< 7 time(s)
Front oxygen (A/F) sensor compensation coefficient	Not in limit value
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ 75 °C (167 °F)
Amount of intake air	< 10 g/s (0.35 oz/s)
Current continuation time of the rear oxygen sensor heater	≥ 25000 ms
Low (3)	
Secondary air system	Not in operation
Closed loop control at the oxygen sensor	In operation
Misfire detection every 200 rotations	< 7 time(s)
Front oxygen (A/F) sensor compensation coefficient	Not in limit value
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ 75 °C (167 °F)
Amount of intake air	< 10 g/s (0.35 oz/s)
Current continuation time of the rear oxygen sensor heater	≥ 25000 ms
Fuel cut	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	< 7 time(s)
Front oxygen (A/F) sensor compensation coefficient	Not in limit value
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ 75 °C (167 °F)

4. GENERAL DRIVING CYCLE

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

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	DTC
High		P0138
Sensor output voltage	> 1.2 V	P0158
Low		P0137
Sensor output voltage	< 0.03 V	P0157

Time Needed for Diagnosis

High: 2500 ms

Low (1): 20000 ms

Low (2): 40000 ms

Low (3): Value from Map

Map

Fuel Cut Time (second)	0	2000	10000
Time needed for diagnosis (second)	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		P0138
Sensor output voltage	≤ 1.2 V	P0158
Low		P0137
Sensor output voltage	≥ 0.03 V	P0157

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

AN: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(H6DO)-60, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

AO:DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2)**1. OUTLINE OF DIAGNOSIS**

Detect the slow response of the oxygen sensor.

Judge as NG if either the rich to lean response diagnosis or lean to rich response diagnosis is NG, and judge as OK if both are OK.

[Rich → lean diagnosis response]

1. Measure the response time for oxygen sensor output changes when the A/F ratio changes to rich to lean. If the measured response time is larger than the threshold value, it is NG. If it is smaller, it is OK. Response time calculation is categorized in two by voltage difference.

- Response time in small voltage difference: Intermediate
- Response time in large voltage difference: Wide

2. Judge as NG when the oxygen sensor voltage is large (rich) even after deceleration fuel cut has occurred.

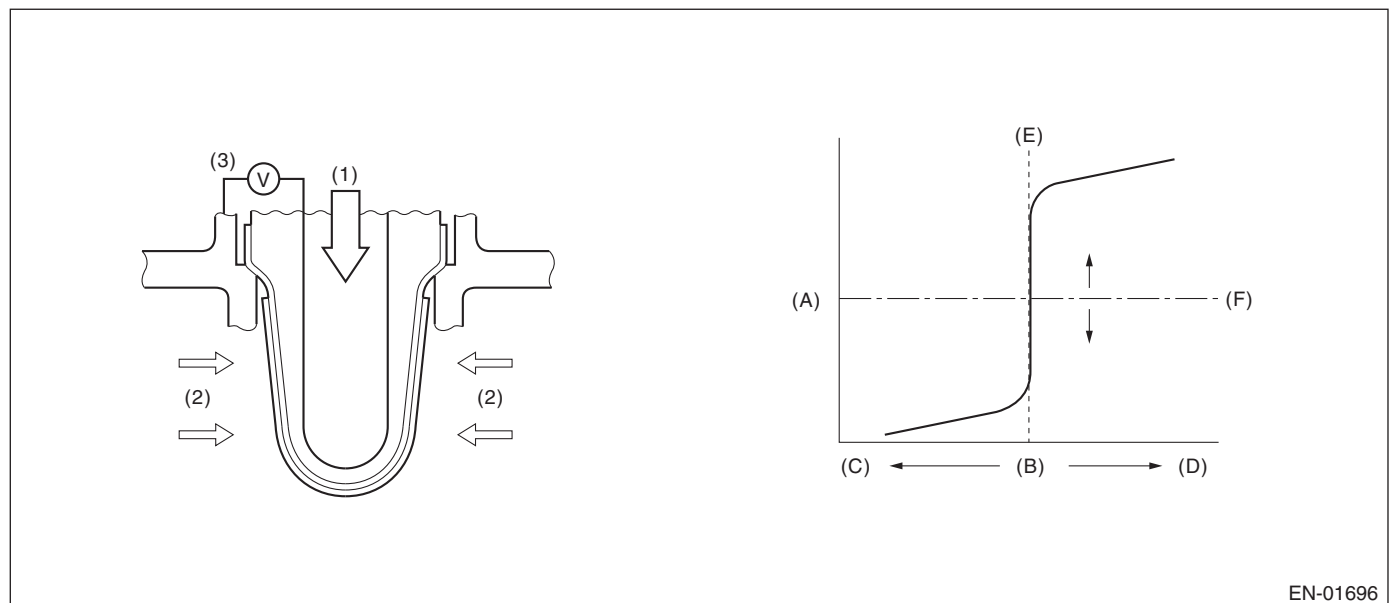
[Lean → rich diagnosis response]

1. Measure the response time for oxygen sensor output changes when the A/F ratio changes to lean to rich. If the measured response time is larger than the threshold value, it is NG.

2. Judge as NG when the oxygen sensor voltage remains small when recovering from a deceleration fuel cut.

Diagnostic method

Measure the response time of the output change of the oxygen sensor when the A/F ratio changes to rich to lean. And Judge as NG when the measured 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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITION

Rich → lean diagnosis response

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
A/F main feedback control condition	Completed
Deceleration fuel cut time of 5000 ms or more (intermediate)	Experienced
Deceleration fuel cut time of 5000 ms or more (wide)	
After fuel cut	≥ 2000 ms (Intermediate)
	≥ 2000 ms (Wide)
Estimated temperature of the rear oxygen sensor element	≥ 400 °C (752 °F) (Intermediate)
	≥ 500 °C (932 °F) (Wide)
Number of deceleration fuel cut	≥ 1 time(s)

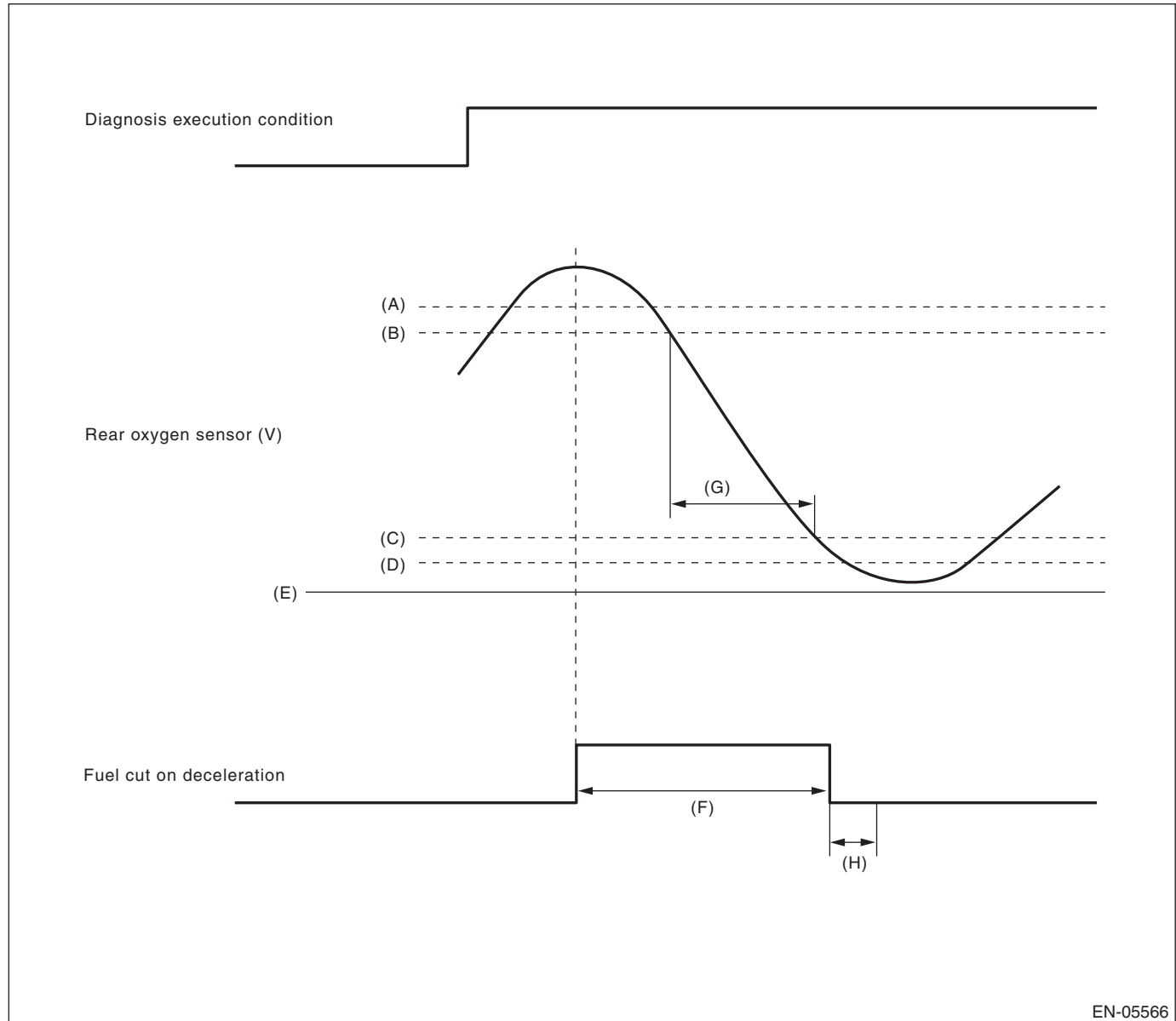
4. GENERAL DRIVING CYCLE

Perform diagnosis once during deceleration fuel cut from a constant and high speed driving, when rear oxygen sensor is warmed up sufficiently. (Pay attention to the oxygen sensor voltage for the timing of the deceleration.)

5. DIAGNOSTIC METHOD

- Intermediate

When the oxygen sensor output voltage changes from 0.55 V (rich) to 0.15 V (lean), calculate the minimum response time for output change between 0.5 V and 0.2 V for the judgment criteria.



EN-05566

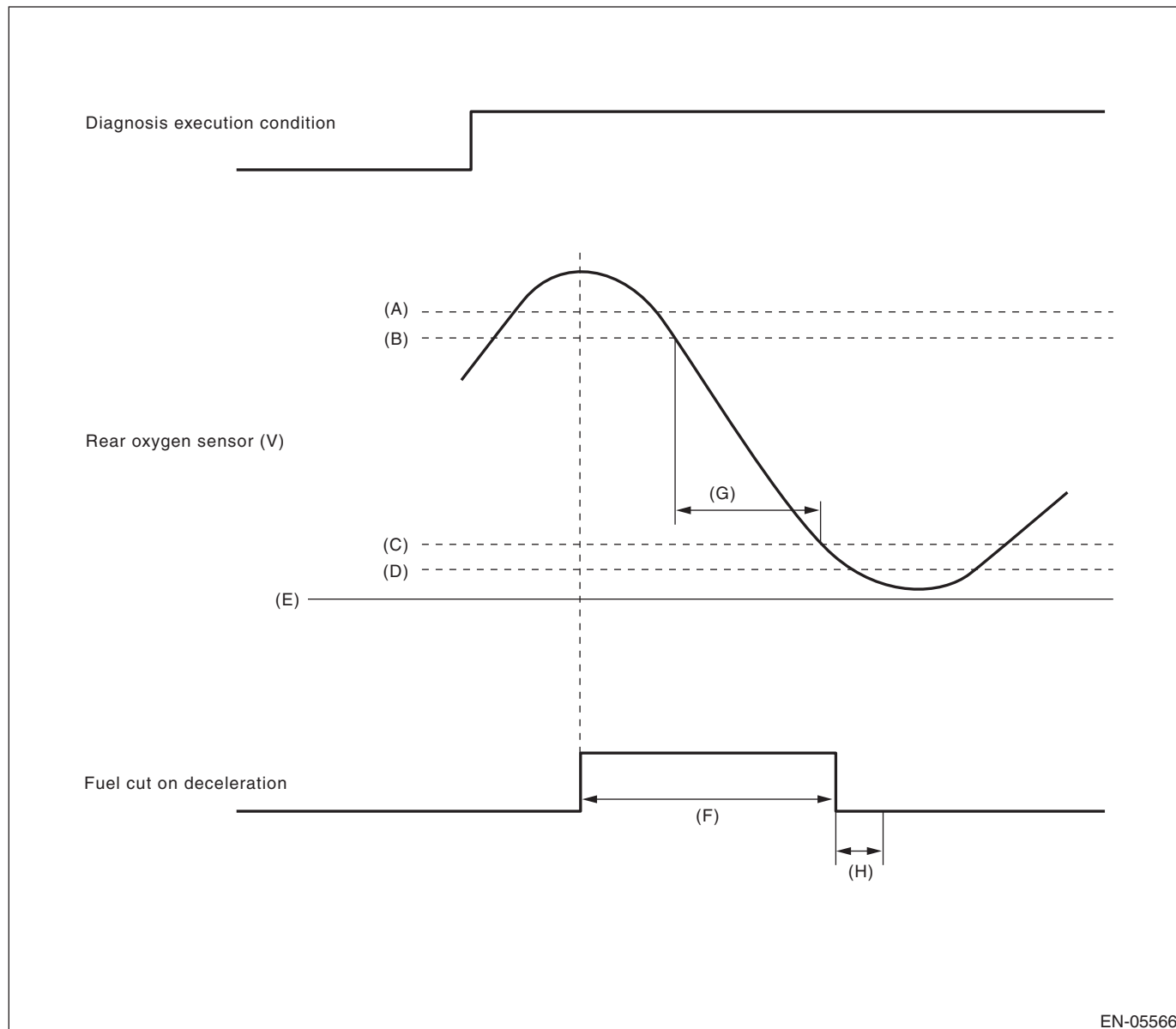
- | | | |
|--------------------------------|--|-----------------------|
| (A) 0.55 V | (B) 0.5 V | (C) 0.2 V |
| (D) 0.15 V | (E) 0 V | (F) More than 5000 ms |
| (G) Measure the response time. | (H) Execute the malfunction judgment in 2000 ms from the recovery of fuel cut on deceleration. | |

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

- Wide

When the oxygen sensor output voltage changes from 0.65 V (rich) to 0.05 V (lean), calculate the minimum response time for output change between 0.6 V and 0.1 V for the judgment criteria.



(A)	0.65 V	(B)	0.6 V	(C)	0.1 V
(D)	0.05 V	(E)	0 V	(F)	More than 5000 ms
(G)	Measure the response time.				
(H)	Execute the malfunction judgment in 2000 ms from the recovery of fuel cut on deceleration.				

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Abnormality Judgment

1) Judge as NG when the judgment value is larger than the threshold value after deceleration fuel cut.
Response time (diagnosis value) > Threshold value → Abnormal

NOTE:

Perform NG judgment only during fuel cut, when exhaust gas apparently changes from rich → lean. Even without deceleration fuel cut, judge as OK if the value is below the threshold.

2) Judge as NG when the oxygen sensor voltage at a deceleration fuel cut is large.

Judge as NG when oxygen sensor voltage is large even after a long period of deceleration fuel cut has completed.

Judgment value (intermediate)

Malfunction Criteria	Threshold Value
Shortest time change from rich (0.5 V O ₂ output) to lean (0.2 V) when voltage reduces from 0.55 V to 0.15 V or Longest time over 0.55 V	> 491 ms ≥ 2000 ms

Judgment value (Wide)

Malfunction Criteria	Threshold Value
Shortest time change from rich (0.6 V O ₂ output) to lean (0.1 V) when voltage decreases from 0.65 V to 0.05 V or Longest time over 0.65 V	> Value from Map ≥ 2000 ms

Map

Estimated temperature of rear oxygen sensor element when fuel cut starts °C (°F)	0 (32)	450 (842)	500 (932)	1000 (1832)
Longest time in rich status after fuel cut (ms)	3000	3000	2000	2000

Time Needed for Diagnosis: 1 time(s)

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

• Normality Judgment

1) Regardless of a deceleration fuel cut, if the response time (diagnosis value) when the oxygen sensor voltage has changed from rich to lean is shorter than the threshold value (judgment value), judge as a normal condition.

Response time (diagnosis value) ≤ Threshold value → Normal

2) Do not judge as a normal condition.

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

Judgment value (intermediate)

Malfunction Criteria	Threshold Value
Shortest time change from rich (0.5 V O ₂ output) to lean (0.2 V) when voltage reduces from 0.55 V to 0.15 V	≤ 491 ms

Judgment value (Wide)

Malfunction Criteria	Threshold Value
Shortest time change from rich (0.6 V O ₂ output) to lean (0.1 V) when voltage decreases from 0.65 V to 0.05 V	≤ 2000 ms

Time Needed for Diagnosis: 1 time(s)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

6. ENABLE CONDITION

Lean → rich response diagnosis

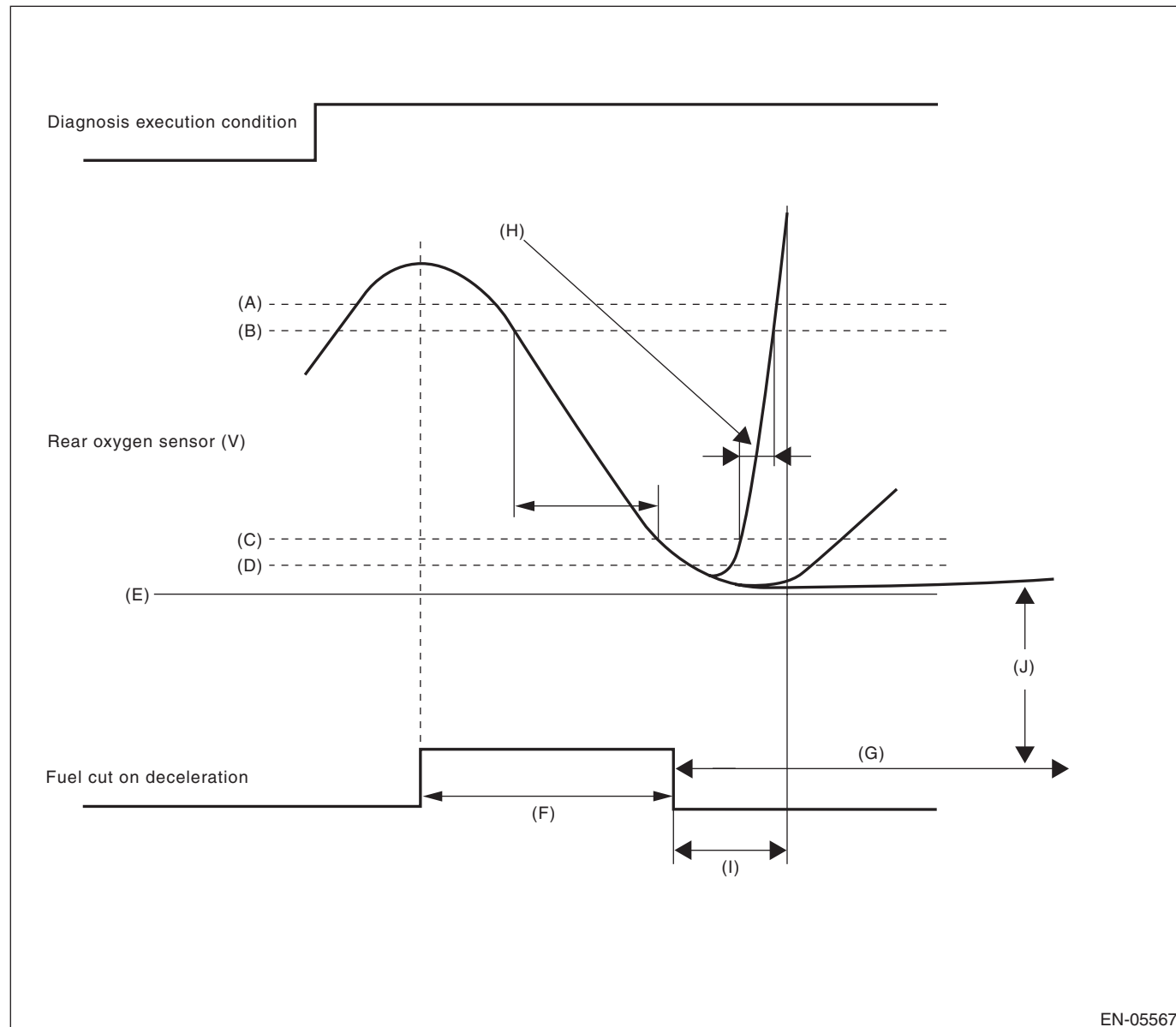
Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
A/F main feedback control condition	Completed
Deceleration fuel cut time is 5000 ms or more.	Experienced
After fuel cut	≥ 2000 ms
Number of deceleration fuel cut	≥ 1 time(s)

7. 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. (Pay attention to the oxygen sensor voltage for the timing of the deceleration.)

8. DIAGNOSTIC METHOD

When the oxygen sensor output voltage changes from 0.25 V (lean) to 0.55 V (rich), calculate the minimum response time for output change between 0.3 V and 0.5 V for the judgment criteria.



EN-05567

- | | | |
|---|---|--|
| (A) 0.55 V | (B) 0.5 V | (C) 0.3 V |
| (D) 0.25 V | (E) 0 V | (F) More than 5 seconds |
| (G) More than 120000 ms | (H) Measure the response time (diagnostic value). | (I) Execute the malfunction judgment in 4000 ms from the recovery of fuel cut on deceleration. |
| (J) Judge NG when the voltage of rear oxygen sensor is 0.25 V or less for 120000 ms or more after recovery of fuel cut on deceleration. | | |

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Abnormality Judgment

1) Judge as NG when the judgment value is larger than the threshold value after deceleration fuel cut.

Response time (diagnosis value) > Threshold value → Abnormal

2) If the oxygen sensor voltage is small after recovering from a deceleration fuel cut, and remains small, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Shortest time change from lean (0.3 V O ₂ output) to rich (0.5 V) when voltage changes from 0.25 V to 0.55 V or Longest time under 0.25 V	> 4000 ms ≥ 120000 ms

Time Needed for Diagnosis: 1 time(s)

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

• Normality Judgment

1) Regardless of a deceleration fuel cut, if the response time (diagnosis value) when the oxygen sensor voltage has changed from rich to lean is shorter than the threshold value (judgment value), judge as a normal condition.

Response time (diagnosis value) ≤ Threshold value → Normal

2) Do not judge as a normal condition.

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

Judgment Value

Malfunction Criteria	Threshold Value
Shortest time change from lean (0.3 V O ₂ output) to rich (0.5 V) when voltage changes from 0.25 V to 0.55 V	≤ 4000 ms

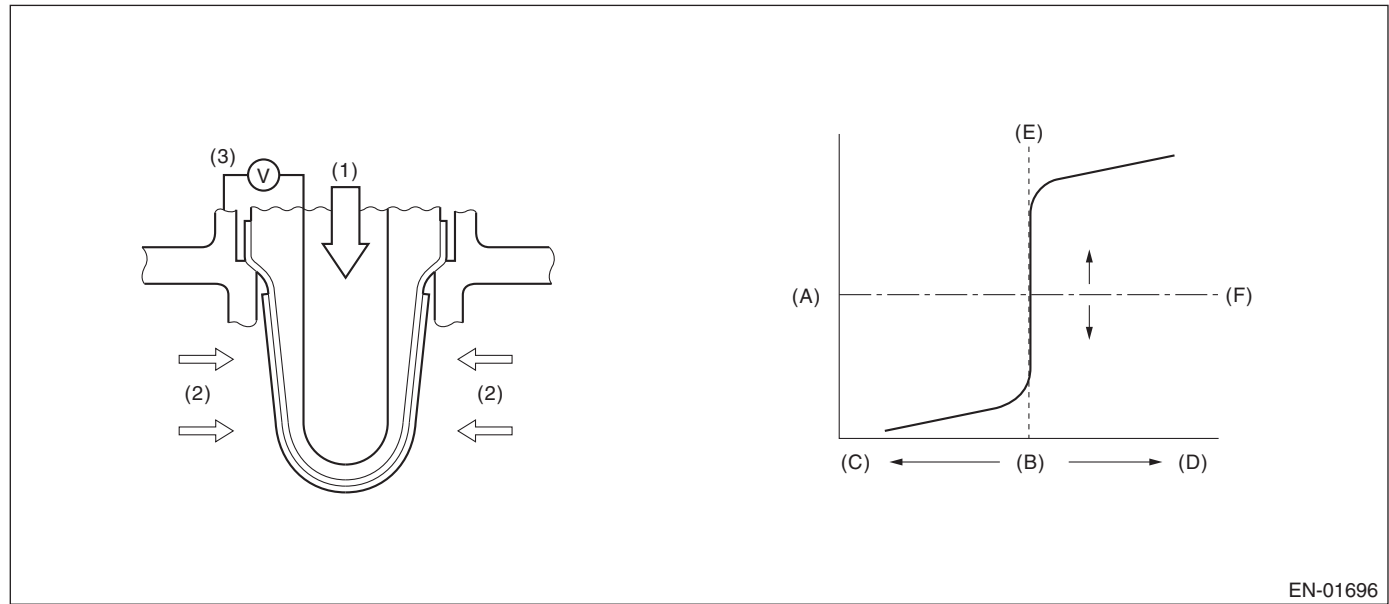
Time Needed for Diagnosis: 1 time(s)

AP: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

(C) Rich

(E) Theoretical air fuel ratio

(B) Air fuel ratio

(D) Lean

(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 oz/s)
Engine coolant temperature	$\geq 75 \text{ }^{\circ}\text{C}$ (167 $^{\circ}\text{F}$)
Misfire detection every 200 rotations	$< 7 \text{ time(s)}$
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.

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
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

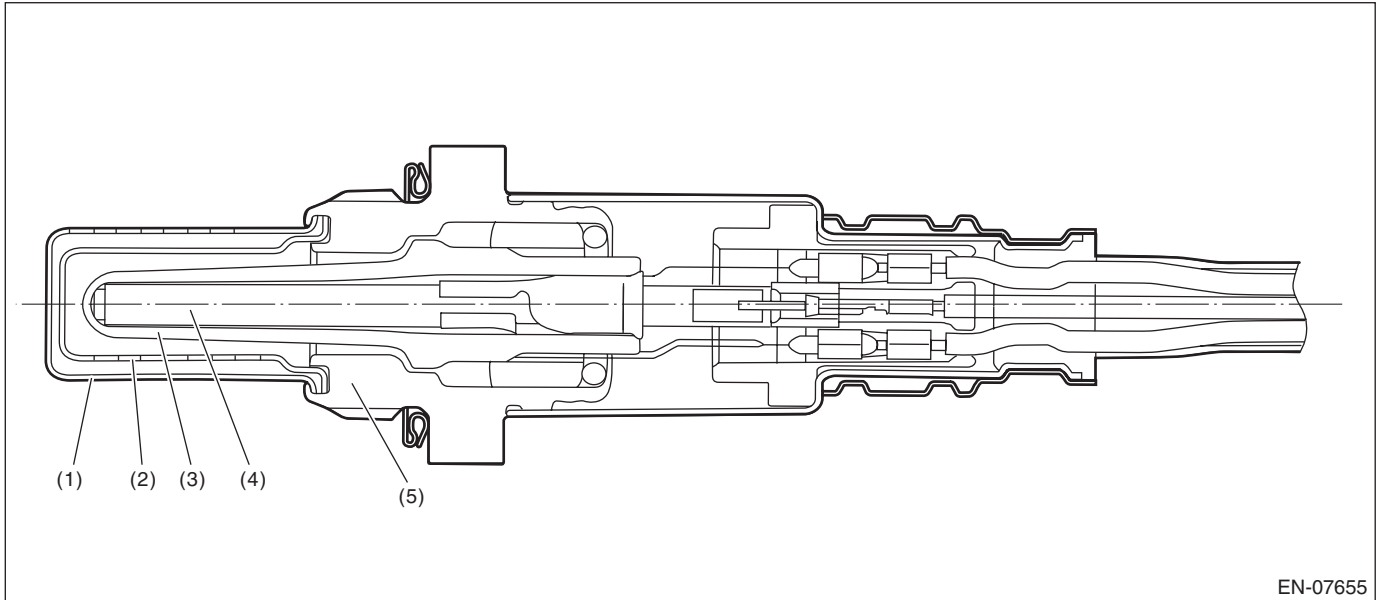
Malfunction Criteria	Threshold Value
Diagnosis of the rear oxygen sensor voltage low side	Incomplete
Minimum output voltage	≤ 0.15 V
Maximum output voltage	≥ 0.55 V

Time Needed for Diagnosis: Less than 1 second

AQ:DTC P0141 O2 SENSOR HEATER CIRCUIT (BANK1 SENSOR2)**1. OUTLINE OF DIAGNOSIS**

Detect malfunction of the rear oxygen sensor heater.

Judge as NG if it is determined that the rear oxygen sensor impedance is large by observing the engine conditions.

2. COMPONENT DESCRIPTION

(1) Element cover (outer)

(2) Element cover (inner)

(3) Sensor element

(4) Ceramic heater

(5) Sensor housing

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$
Elapsed time after starting the engine	$\geq 0 \text{ ms}$
Engine coolant temperature	$\geq 75 \text{ }^{\circ}\text{C}$ (167 $^{\circ}\text{F}$)
A/F sensor element impedance	$\leq 50 \text{ } \Omega$
A/F sensor heater control duty	$\leq 75 \text{ } \%$
Rear oxygen sensor heater control duty	$< 100 \text{ } \%$

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after 0 ms seconds or more have passed since the engine started.

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 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)

AR:DTC P0151 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 2 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0131. <Ref. to GD(H6DO)-51, DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

AS:DTC P0152 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 2 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0132. <Ref. to GD(H6DO)-53, DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

AT:DTC P0153 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 2 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0133. <Ref. to GD(H6DO)-55, DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

AU:DTC P0154 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 2 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0134. <Ref. to GD(H6DO)-58, DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

AV:DTC P0157 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 2 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0137. <Ref. to GD(H6DO)-60, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

AW:DTC P0158 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 2 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0137. <Ref. to GD(H6DO)-60, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

AX:DTC P0159 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 2 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0139. <Ref. to GD(H6DO)-63, DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

AY:DTC P0160 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK2 SENSOR2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0140. <Ref. to GD(H6DO)-71, DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK1 SENSOR2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

AZ:DTC P0161 O2 SENSOR HEATER CIRCUIT (BANK2 SENSOR2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0141. <Ref. to GD(H6DO)-73, DTC P0141 O2 SENSOR HEATER CIRCUIT (BANK1 SENSOR2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BA: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	$\geq 75^{\circ}\text{C}$ (167 °F)
Engine load change	< 0.02 g/rev (0 oz/rev)
Engine load	$\geq$ Value of Map 1

Map1

Engine speed (rpm)	Idling	700	1000	1500	2000	2500	3000	3500	4000	4500	5000
Measured value (g (oz)/rev)	na	0.357 (0.01)	0.25 (0.01)	0.25 (0.01)	0.317 (0.01)	0.326 (0.01)	0.337 (0.01)	0.397 (0.01)	0.439 (0.02)	0.454 (0.02)	0.454 (0.02)

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 diagnosed value (fsobd) with the threshold value, and if a condition meeting the malfunction criteria below continues for 10 s $\times$ 5 time(s) or more, judge that there is a fault in the fuel system.

Judgment Value

Malfunction Criteria	Threshold Value
$\text{fsobd} = (\text{sglmd} - \text{tglmda}) + \text{faf} + \text{flaf}$ In this case: sglmd = measured lambda tglmda = 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	1.265	1.265	1.265	1.265

Time Needed for Diagnosis: 10 s $\times$ 5 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
$\text{fsobd} = (\text{sglmd} - \text{tglmda}) + \text{faf} + \text{flaf}$	< 1.2

Time Needed for Diagnosis: 10 s

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BB: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	$\geq 75^{\circ}\text{C}$ (167°F)
Engine load change	≤ 0.02 g/rev (0 oz/rev)
Learning value of EVAP conc.	< 0.1
Cumulative time of canister purge after engine start	≥ 20 s
Continuous period after canister purge starting	≥ 29884 ms
Engine load	$\geq$ Value of Map 1

Map1

Engine speed (rpm)	idling	700	1000	1500	2000	2500	3000	3500	4000	4500	5000
Measured value (g (oz)/rev)	na	0.357 (0.01)	0.25 (0.01)	0.25 (0.01)	0.317 (0.01)	0.326 (0.01)	0.337 (0.01)	0.397 (0.01)	0.439 (0.02)	0.454 (0.02)	0.454 (0.02)

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 diagnosed value (fsobd) with the threshold value, and if a condition meeting the malfunction criteria below continues for 10 s $\times$ 5 time(s) or more, judge that there is a fault in the fuel system.

Judgment Value

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

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	0.688	0.715	0.725	0.735	0.735

Time Needed for Diagnosis: 10 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
$\text{fsobd} = (\text{sglmd} - \text{tglmda}) + \text{faf} + \text{flaf}$	≥ 0.8

Time Needed for Diagnosis: 10 s

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BC:DTC P0174 SYSTEM TOO LEAN (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0171. <Ref. to GD(H6DO)-76, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

BD:DTC P0175 SYSTEM TOO RICH (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0172. <Ref. to GD(H6DO)-77, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

BE:DTC P0181 FUEL TEMPERATURE SENSOR “A” CIRCUIT RANGE/PERFORMANCE**1. OUTLINE OF DIAGNOSIS**

Detect faults in the fuel temperature sensor output properties.

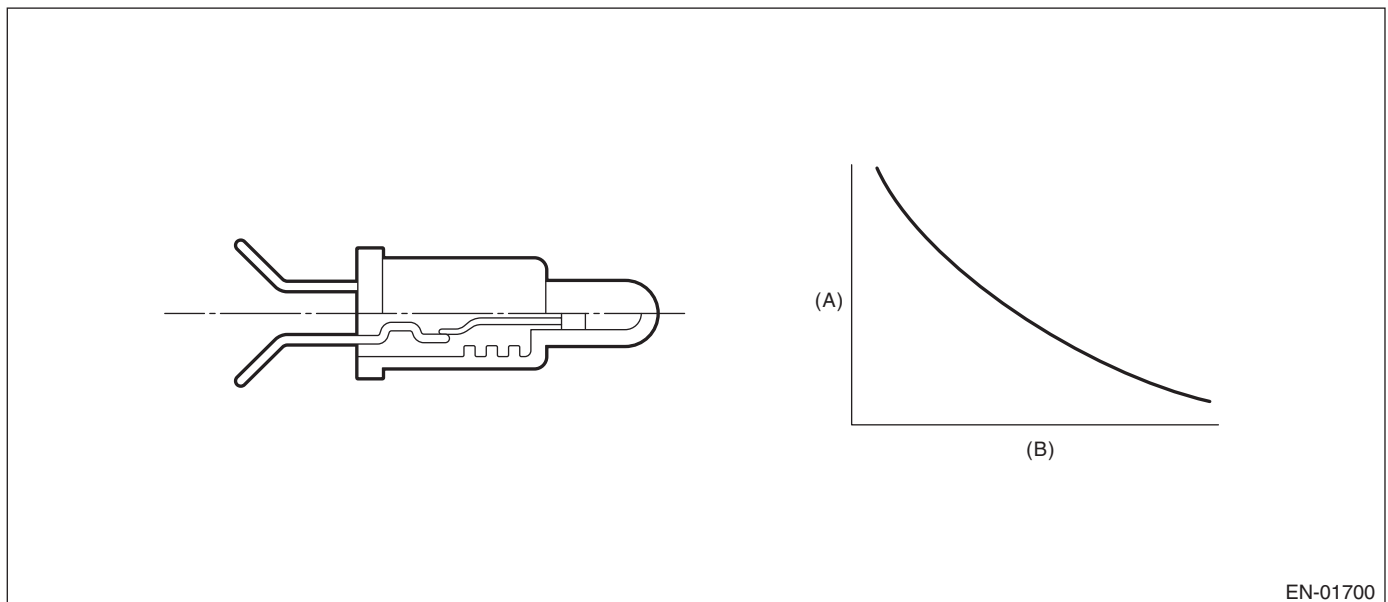
Diagnosis is performed in two methods (drift diagnosis and stuck diagnosis). If either is NG, judge as NG. If both are OK, Judge as OK and clear the NG.

Drift Diagnosis

Normally fuel temperature is lower than engine coolant temperature. When the fuel temperature becomes higher than the engine coolant temperature, the range is considered to be shifted, and judged as NG.

Stuck Diagnosis

As the engine warms up (cumulative amount of intake air after starting is large), if the fuel temperature which should rise does not, determine as being stuck and NG.

2. COMPONENT DESCRIPTION

EN-01700

(A) Resistance value (Ω)(B) Fuel temperature $^{\circ}\text{C}$ ($^{\circ}\text{F}$)**3. ENABLE CONDITION****Drift Diagnosis**

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
Fuel level	$\geq 9.6 \text{ } \ell$ (2.54 US gal, 2.11 Imp gal)
Elapsed time after starting the engine	$\geq 20 \text{ s}$
Engine coolant temperature – Engine coolant temperature at engine start	$> 10 \text{ }^{\circ}\text{C}$ (50 $^{\circ}\text{F}$)
Fuel temperature – Engine coolant temperature	$\geq 10 \text{ }^{\circ}\text{C}$ (50 $^{\circ}\text{F}$)
Battery voltage	$\geq 10.9 \text{ V}$

Time Needed for Diagnosis: 120 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
Fuel level	$\geq 9.6 \text{ } \ell$ (2.54 US gal, 2.11 Imp gal)
Elapsed time after starting the engine	$\geq 20 \text{ s}$
Engine coolant temperature – Engine coolant temperature at engine start	$> 10 \text{ }^{\circ}\text{C}$ (50 $^{\circ}\text{F}$)
Fuel temperature – Engine coolant temperature	$< 10 \text{ }^{\circ}\text{C}$ (50 $^{\circ}\text{F}$)
Battery voltage	$\geq 10.9 \text{ V}$
Engine coolant temperature	$< 75 \text{ }^{\circ}\text{C}$ (167 $^{\circ}\text{F}$)

Time Needed for Diagnosis: Less than 1 second

6. ENABLE CONDITION

Stuck Diagnosis

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	$\geq 20000 \text{ ms}$
Battery voltage	$\geq 10.9 \text{ V}$

7. GENERAL DRIVING CYCLE

Always perform diagnosis after 20 seconds have passed since the engine started.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

8. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Accumulated amount of intake air	≥ 551043 g (19435.29 oz)
Fuel temperature difference between Max. and Min.	< 2 °C (35.6 °F)

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
Fuel temperature difference between Max. and Min.	≥ 2 °C (35.6 °F)

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

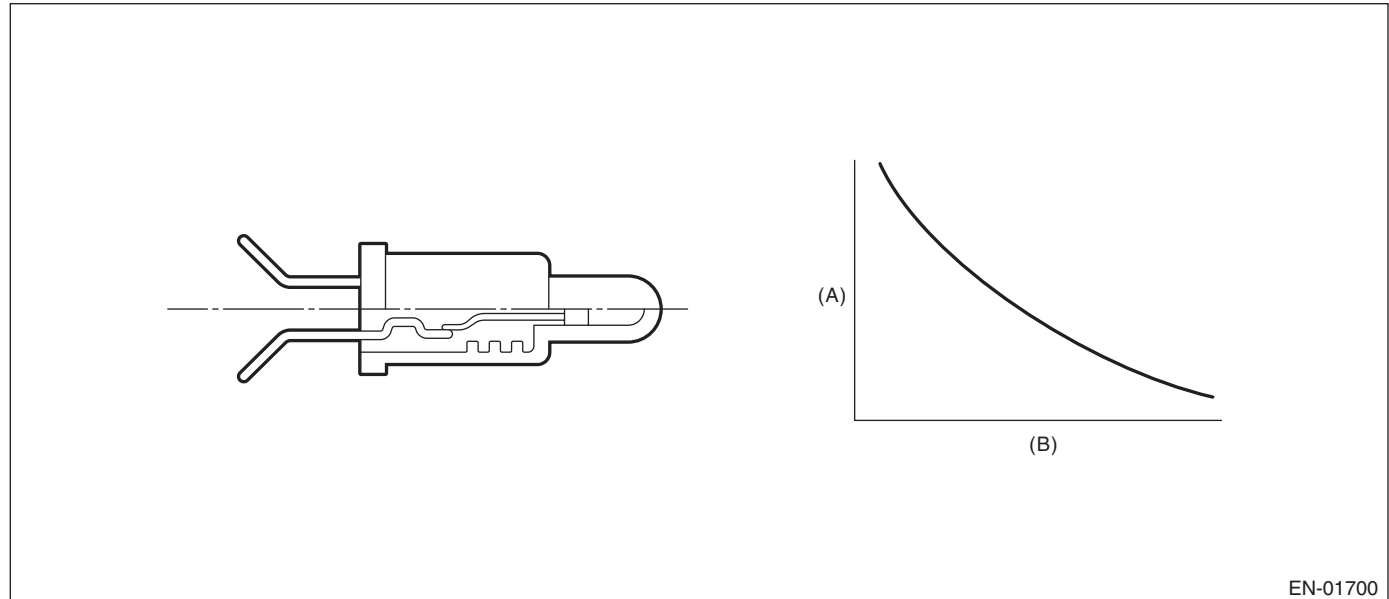
GENERAL DESCRIPTION

BF:DTC P0182 FUEL TEMPERATURE SENSOR “A” CIRCUIT LOW INPUT

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



(A) Resistance value (Ω)

(B) Fuel temperature $^{\circ}\text{C}$ ($^{\circ}\text{F}$)

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	$< 0.344 \text{ V}$
Battery voltage	$\geq 10.9 \text{ V}$

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.

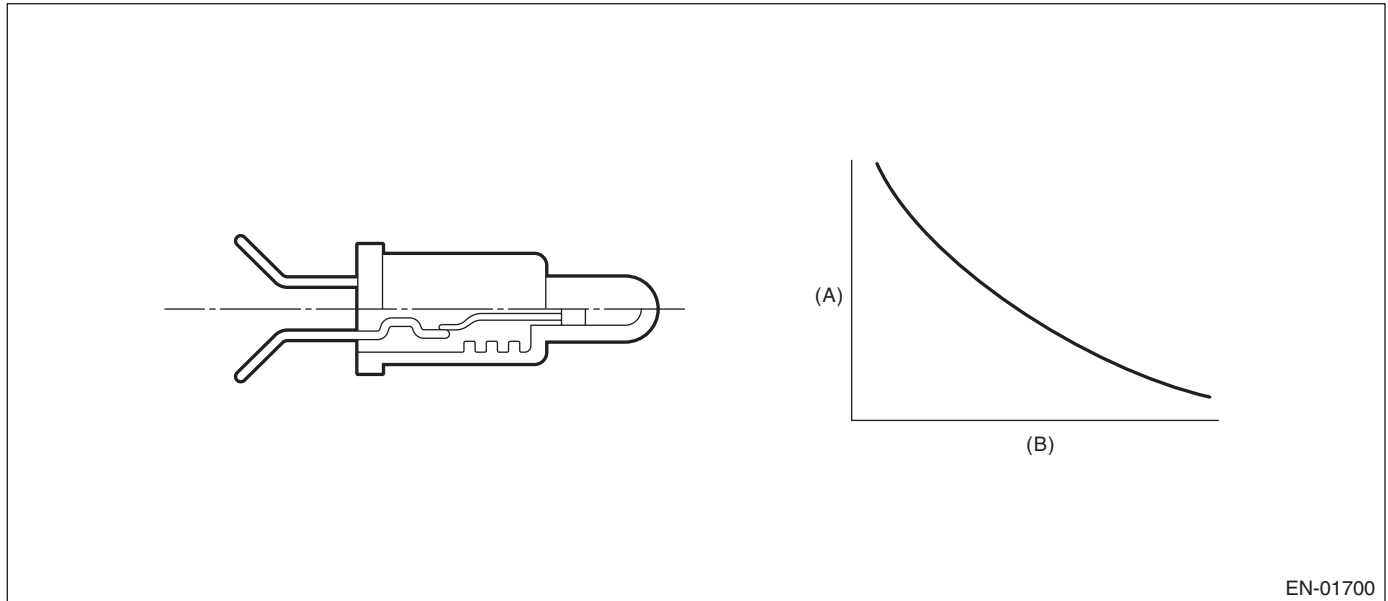
Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$\geq 0.344 \text{ V}$
Battery voltage	$\geq 10.9 \text{ V}$

Time Needed for Diagnosis: Less than 1 second

BG:DTC P0183 FUEL TEMPERATURE SENSOR “A” CIRCUIT HIGH INPUT**1. OUTLINE OF DIAGNOSIS**

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

2. COMPONENT DESCRIPTION

EN-01700

(A) Resistance value (Ω)(B) Fuel temperature $^{\circ}\text{C}$ ($^{\circ}\text{F}$)**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	$\geq 4.881 \text{ V}$
Battery voltage	$\geq 10.9 \text{ V}$

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
Output voltage	$< 4.881 \text{ V}$
Battery voltage	$\geq 10.9 \text{ V}$

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BH: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. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Engine speed	$\geq$ 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

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Engine oil temperature	< 15 °C (59 °F)
After engine start oil temperature sensor characteristic diagnosis timer.	$\geq$ Judgment value for after engine start oil temperature sensor characteristic diagnosis timer

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

- a. Timer stop at fuel cut
b. 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)	-40 (-40)	0 ms	32 ms	76 ms	130 ms	149 ms	171 ms	176 ms	181 ms
	-30 (-22)	67 ms	93 ms	121 ms	157 ms	170 ms	184 ms	193 ms	203 ms
	-20 (-4)	98 ms	123 ms	148 ms	184 ms	193 ms	204 ms	214 ms	226 ms
	-10 (14)	145 ms	166 ms	187 ms	208 ms	223 ms	239 ms	242 ms	245 ms
	0 (32)	161 ms	187 ms	212 ms	243 ms	252 ms	262 ms	266 ms	270 ms

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

$$t = 2400000 \text{ ms} - 60000 \text{ ms} \times T_i \text{ (} t \geq 2400000 \text{)}$$

T_i = 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	≥ 15 °C (59 °F)

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BI: 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. 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
Output voltage	< 0.188 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	≥ 0.188 V

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BJ: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. 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
Output voltage	≥ 4.694 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	< 4.694 V

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

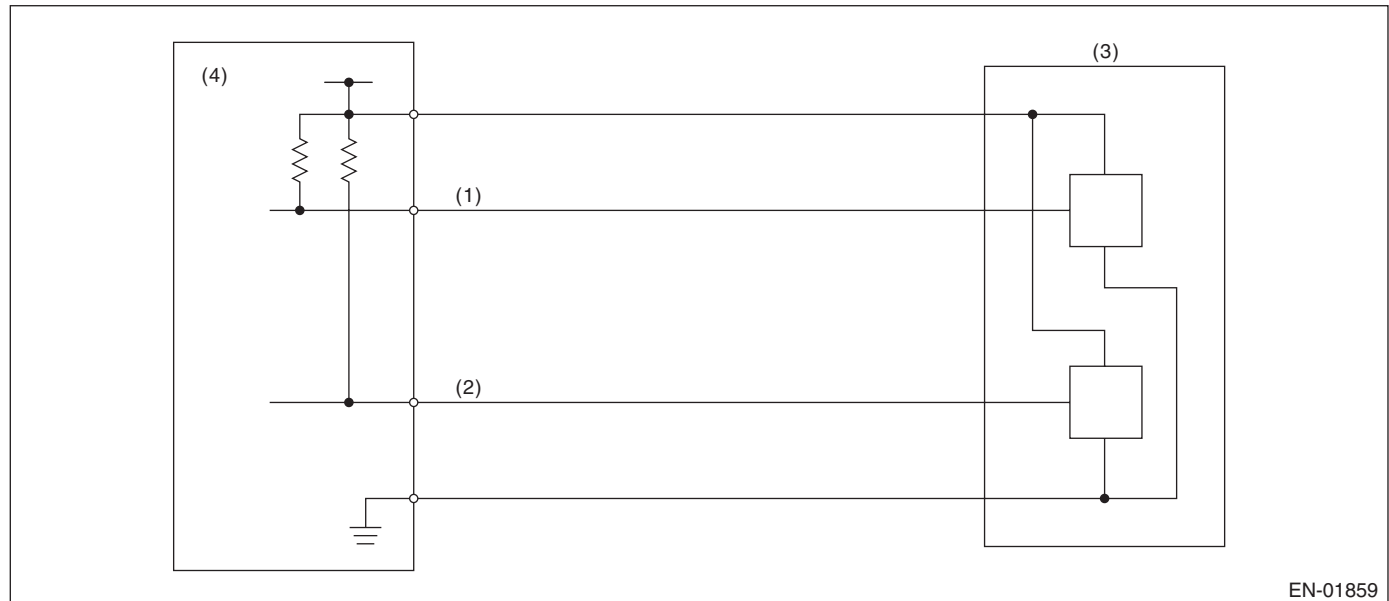
BK:DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT LOW

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



(1) Throttle position sensor 1 signal

(3) Throttle position sensor

(4) Engine control module (ECM)

(2) Throttle position sensor 2 signal

3. ENABLE CONDITION

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

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	$\leq 0.926 \text{ V}$

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

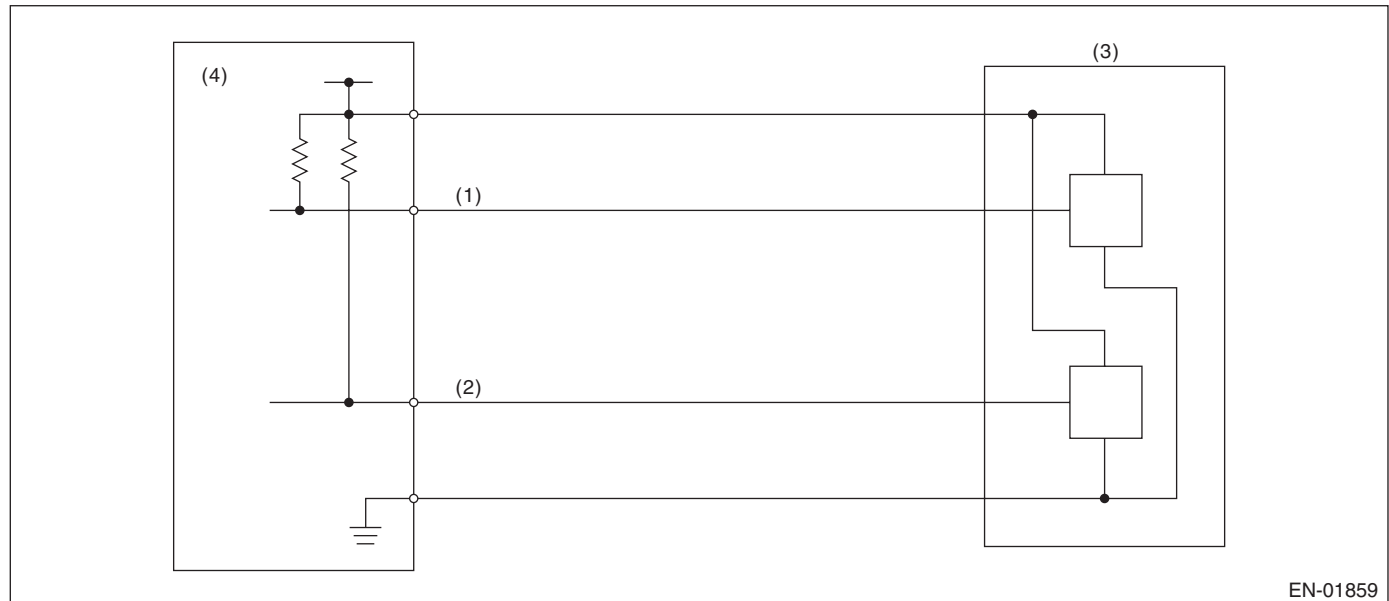
Malfunction Criteria	Threshold Value
Sensor 2 input voltage	$> 0.926 \text{ V}$

Time Needed for Diagnosis: 24 ms

BL:DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT HIGH**1. OUTLINE OF DIAGNOSIS**

Detect the open or short circuit of throttle position sensor 2.

Judge as NG if out of specification.

2. COMPONENT DESCRIPTION

EN-01859

(1) Throttle position sensor 1 signal

(3) Throttle position sensor

(4) Engine control module (ECM)

(2) Throttle position sensor 2 signal

3. ENABLE CONDITION

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

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	$\geq 4.858 \text{ V}$

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 2 input voltage	$< 4.858 \text{ V}$

Time Needed for Diagnosis: 24 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BM:DTC P0230 FUEL PUMP PRIMARY CIRCUIT

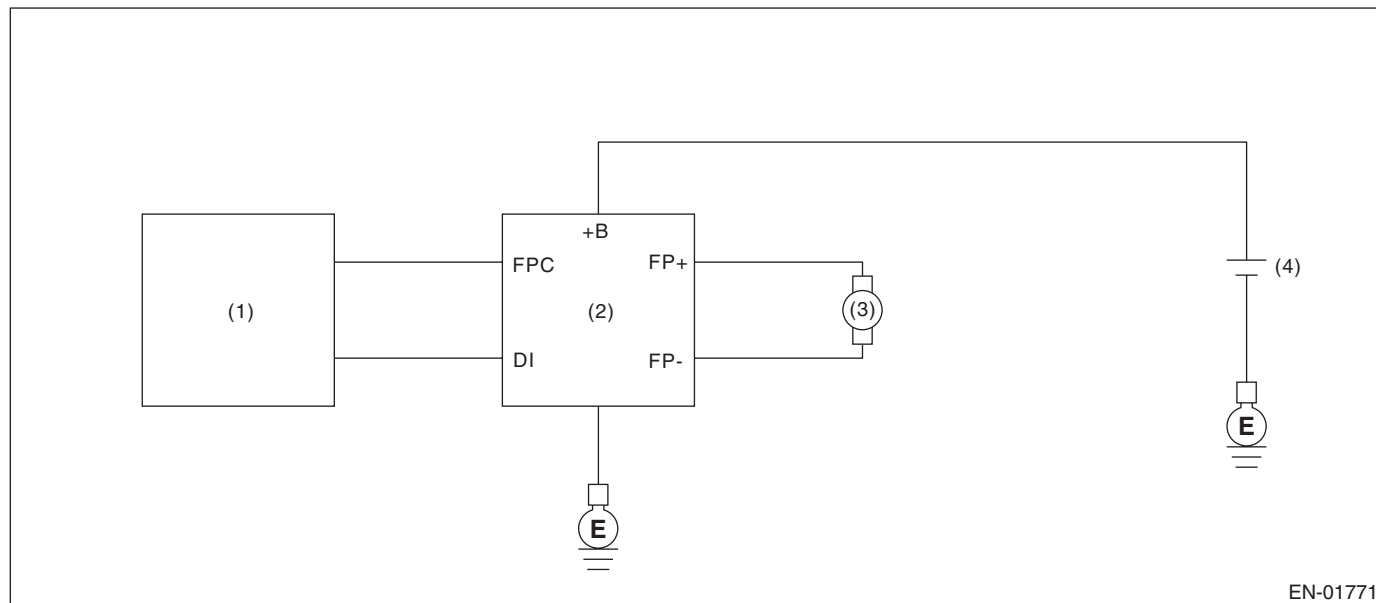
1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel pump control unit.

Judge as NG when the NG signal is sent through a diagnostic line coming from the fuel pump control unit.

Fuel pump control unit detects the open or short circuit malfunction for each line, and then sends NG signals if one of them is found NG.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)

(3) Fuel pump

(4) Battery

(2) Fuel pump control unit

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	≥ 8 V
Elapsed time after starting the engine	≥ 180000 ms
Fuel pump control	ON
Fuel pump control unit output diagnosis signal	Low
Fuel level	≥ 9.6 ℓ (2.54 US gal, 2.11 Imp gal)

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	≥ 8 V
Elapsed time after starting the engine	≥ 180000 ms
Fuel pump control	ON
Fuel pump control unit output diagnosis signal	High
Fuel level	≥ 9.6 ℓ (2.54 US gal, 2.11 Imp gal)

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BN: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

- 120° Interval Difference Method
- 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 120° CA	< Value of Map 1
Throttle position change during 16 milliseconds	< 20 °
Fuel shut-off function	Not in operation
Fuel level	≥ 10.5 ℓ (2.77 US gal, 2.31 Imp gal)
Vehicle dynamic control or AT torque control	Not in operation
Evaporative system leak check	Not in operation
Engine speed	400 rpm — 6500 rpm
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	< 500 rpm

Map 1

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	7000
kPa	20	20	20	20	20	20	20	20	20	20	20	20	20	20
(mmHg, inHg)	(150, 5.9)	(150, 5.9)	(150, 5.9)	(150, 5.9)	(150, 5.9)	(150, 5.9)	(150, 5.9)	(150, 5.9)	(150, 5.9)	(150, 5.9)	(150, 5.9)	(150, 5.9)	(150, 5.9)	(150, 5.9)

Map 2

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	7000
kPa	30.3	28	25.9	27.7	25.4	27	29	28.3	28.7	30.6	32.4	34.3	36.4	36.4
(mmHg, inHg)	(227.6, 9)	(209.9, 8.3)	(194.0, 7.6)	(207.8, 8.2)	(190.2, 7.5)	(202.9, 8)	(217.9, 8.6)	(212.5, 8.4)	(215.3, 8.5)	(229.3, 9)	(243.3, 9.6)	(257.3, 10.1)	(273.3, 10.8)	(273.3, 10.8)

3. GENERAL DRIVING CYCLE

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

Diagnostic Trouble Code (DTC) Detecting Criteria

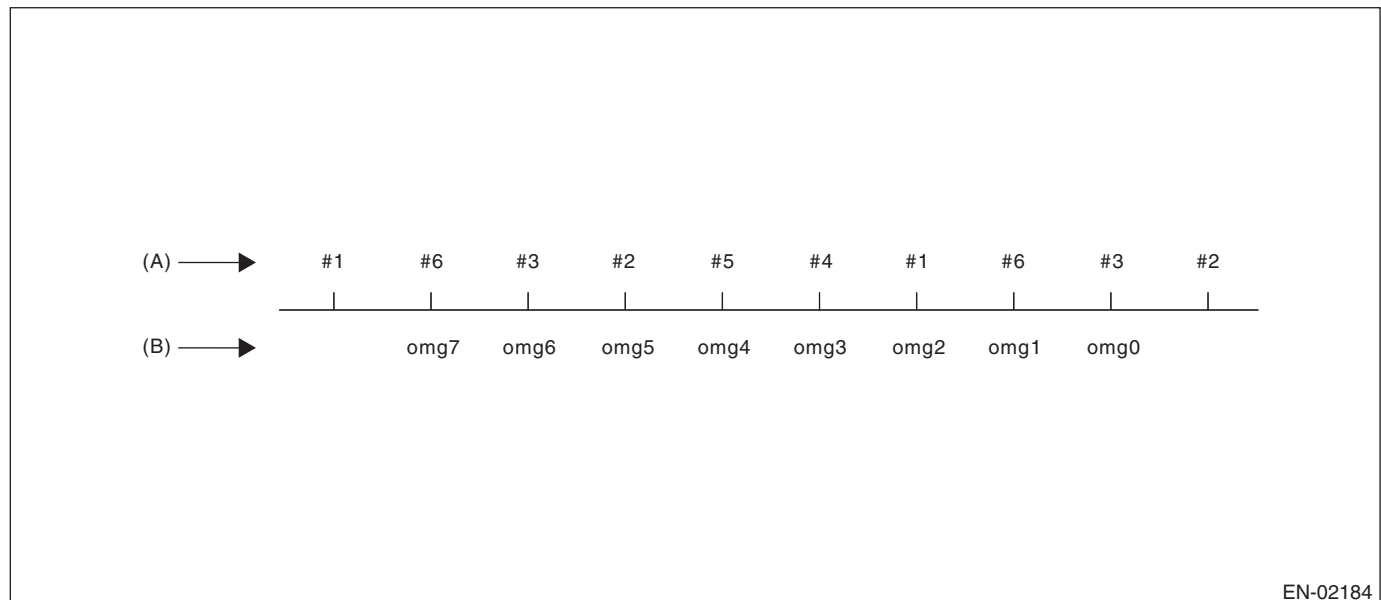
GENERAL DESCRIPTION

4. DIAGNOSTIC METHOD

When a misfire occurs, the engine speed will decreased 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. Counting 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)
	• 120° Interval Difference Method • 360° Interval Difference Method • 720° Interval Difference Method	• 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.



(A) Ignition order

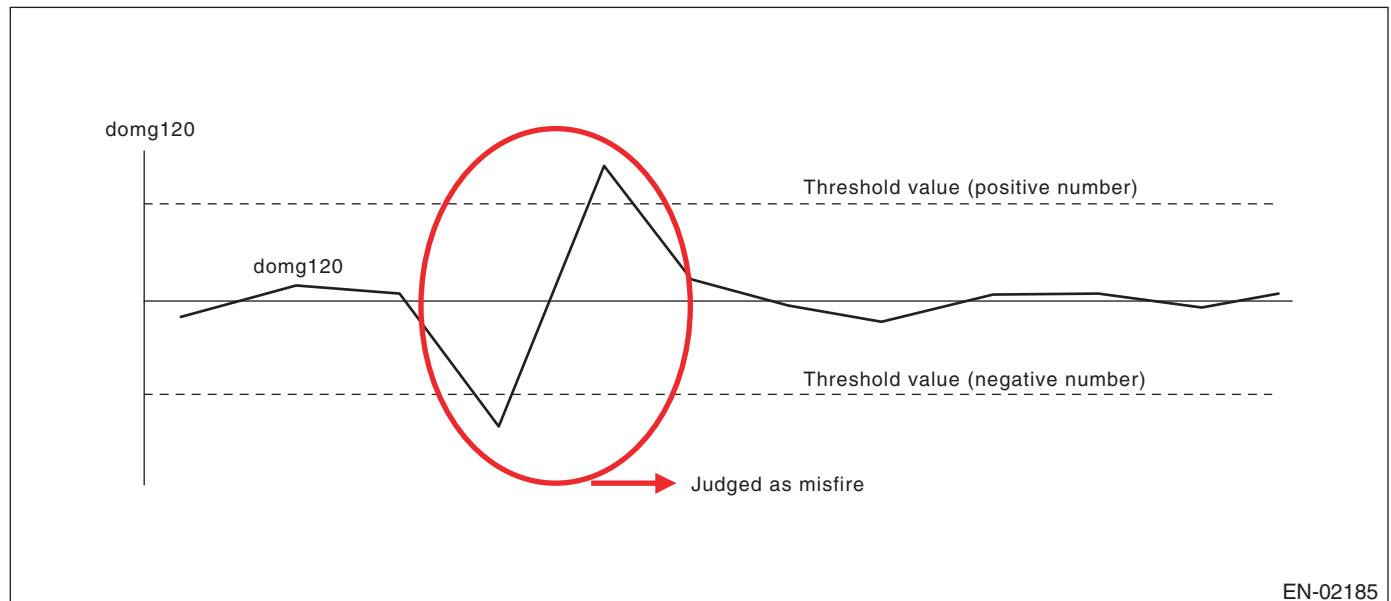
(B) Crankshaft position speed

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

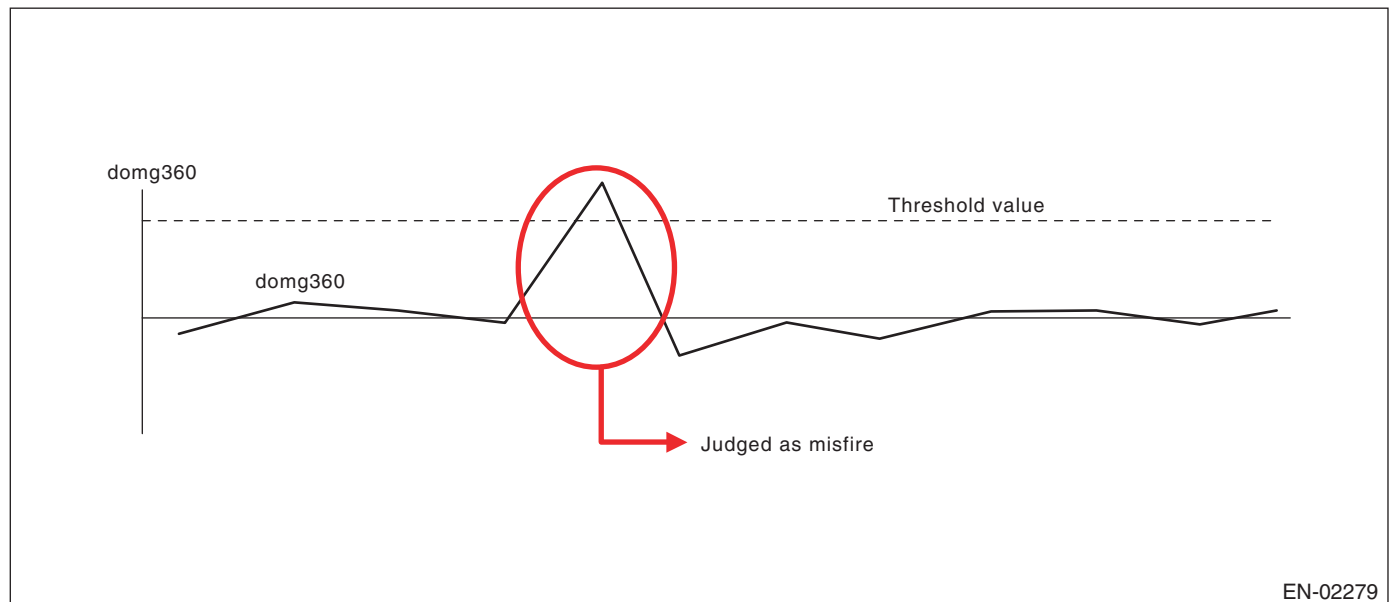
120° Interval Difference Method

Diagnostic value	$\text{domg } 120 = (\text{omg } 1 - \text{omg } 0) - (\text{omg } 7 - \text{omg } 1)/6$
Judge as a misfire in the following cases.	
• $\text{domg } 120 > \text{judgment value of positive side}$ • $\text{domg } 121 \leq \text{judgment value of negative side}$	
(Judgment value before 120° CA)	



360° Interval Difference Method

Diagnostic value	$\text{domg } 360 = (\text{omg } 1 - \text{omg } 0) - (\text{omg } 4 - \text{omg } 3)$
Misfire judgment	$\text{domg } 360 > \text{Judgment value} \rightarrow \text{Judge as misfire}$

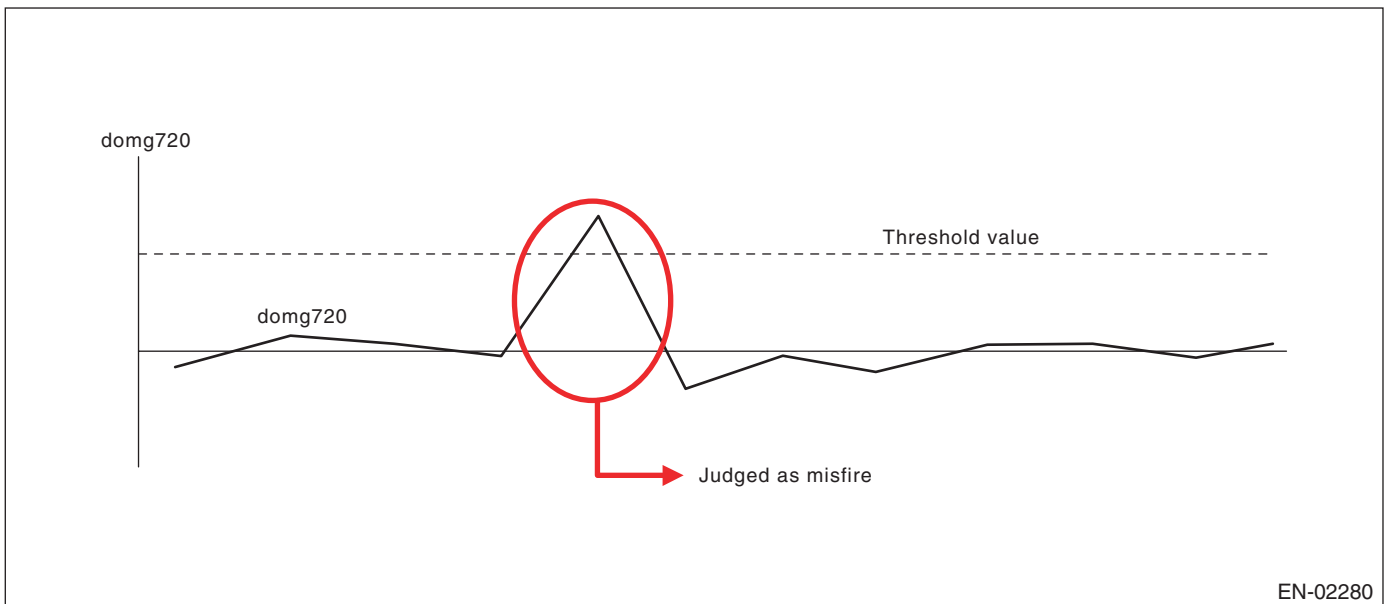


Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

720° Interval Difference Method

Diagnostic value	$\text{domg 720} = (\text{omg 1} - \text{omg 0}) - (\text{omg 7} - \text{omg 6})$
Misfire judgment	$\text{domg 720} > \text{Judgment value} \rightarrow \text{Judge as misfire}$



EN-02280

- 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 judgment value	$\geq 50 \times 100/3000\%$ 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 judgment value	$< 50 \times 100/3000\%$ 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 judgment value	≥ Value of Map 3

Map 3

		Intake air (g(oz)/rev)									
		0.2 (0.01)	0.4 (0.01)	0.6 (0.02)	0.8 (0.03)	1 (0.04)	1.2 (0.04)	1.4 (0.05)	1.6 (0.06)	1.8 (0.06)	2 (0.07)
Engine speed (rpm)	700	90	90	88	76	68	68	68	68	68	68
	1000	90	90	88	76	68	68	68	68	68	68
	1500	89	88	80	64	56	56	56	56	56	56
	2000	88	84	64	40	36	35	35	35	35	35
	2500	88	80	56	36	30	30	30	30	30	30
	3000	64	56	30	30	30	30	30	30	30	30
	3500	50	40	30	30	30	30	30	30	30	30
	4000	40	38	30	30	30	30	30	30	30	30
	4500	50	30	30	30	30	30	30	30	30	30
	5000	40	30	30	30	30	30	30	30	30	30
	5500	40	30	30	30	30	30	30	30	30	30
	6000	36	36	30	30	30	30	30	30	30	30
	6500	32	32	30	30	30	30	30	30	30	30
	7000	32	32	30	30	30	30	30	30	30	30

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 judgment value	< Value of Map 2

Time Needed for Diagnosis: 200 engine revs.

BO:DTC P0302 CYLINDER 2 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H6DO)-92, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BP:DTC P0303 CYLINDER 3 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H6DO)-92, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BQ:DTC P0304 CYLINDER 4 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H6DO)-92, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BR:DTC P0305 CYLINDER 5 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H6DO)-92, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BS:DTC P0306 CYLINDER 6 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H6DO)-92, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

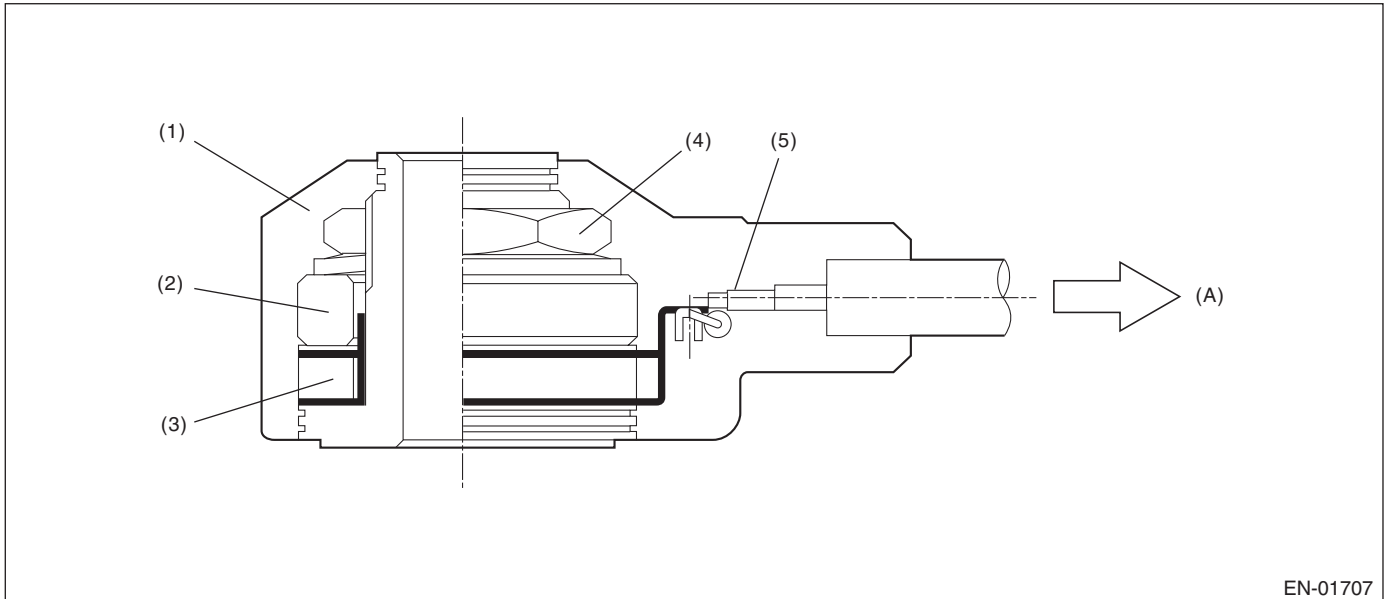
BT:DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR)

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

(2) Weight

(3) Piezoelectric element

(4) Nut

(5) Resistance

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
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

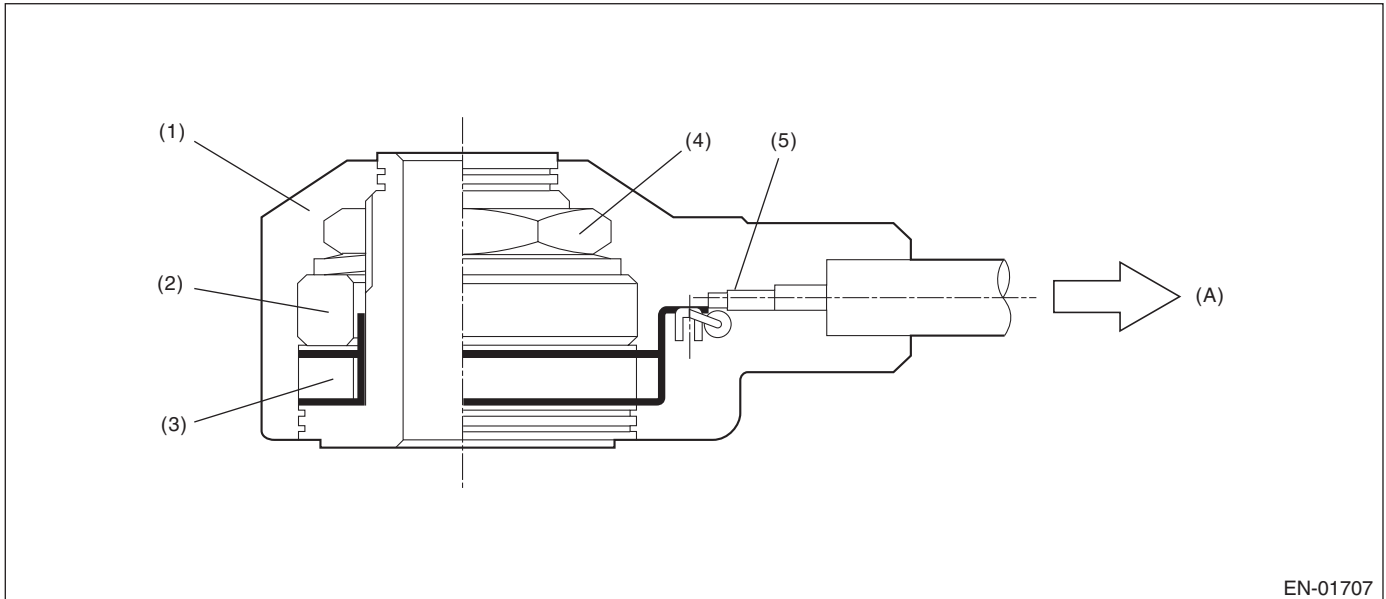
BU:DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR)

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

(2) Weight

(3) Piezoelectric element

(4) Nut

(5) Resistance

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
Output voltage	≥ 4.709 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 V

Time Needed for Diagnosis: Less than 1 second

BV:DTC P0332 KNOCK SENSOR 2 CIRCUIT LOW (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0327. <Ref. to GD(H6DO)-98, DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

BW:DTC P0333 KNOCK SENSOR 2 CIRCUIT HIGH (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0328. <Ref. to GD(H6DO)-100, DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

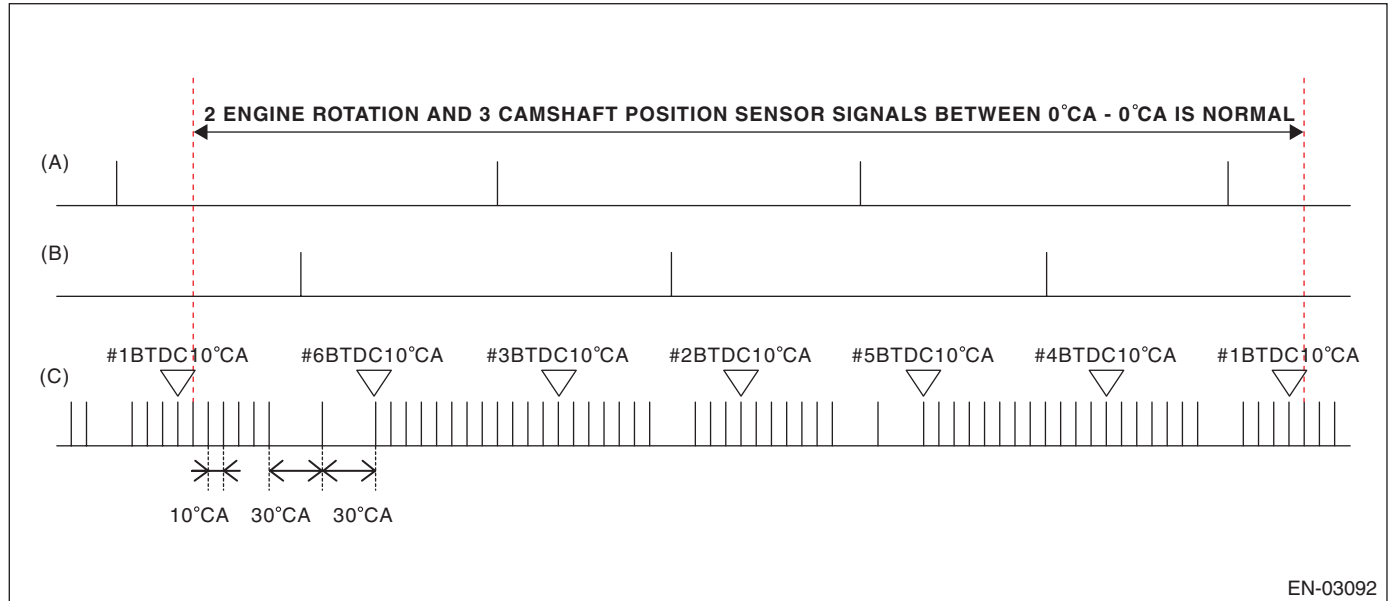
BX:DTC P0335 CRANKSHAFT POSITION SENSOR “A” CIRCUIT

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.

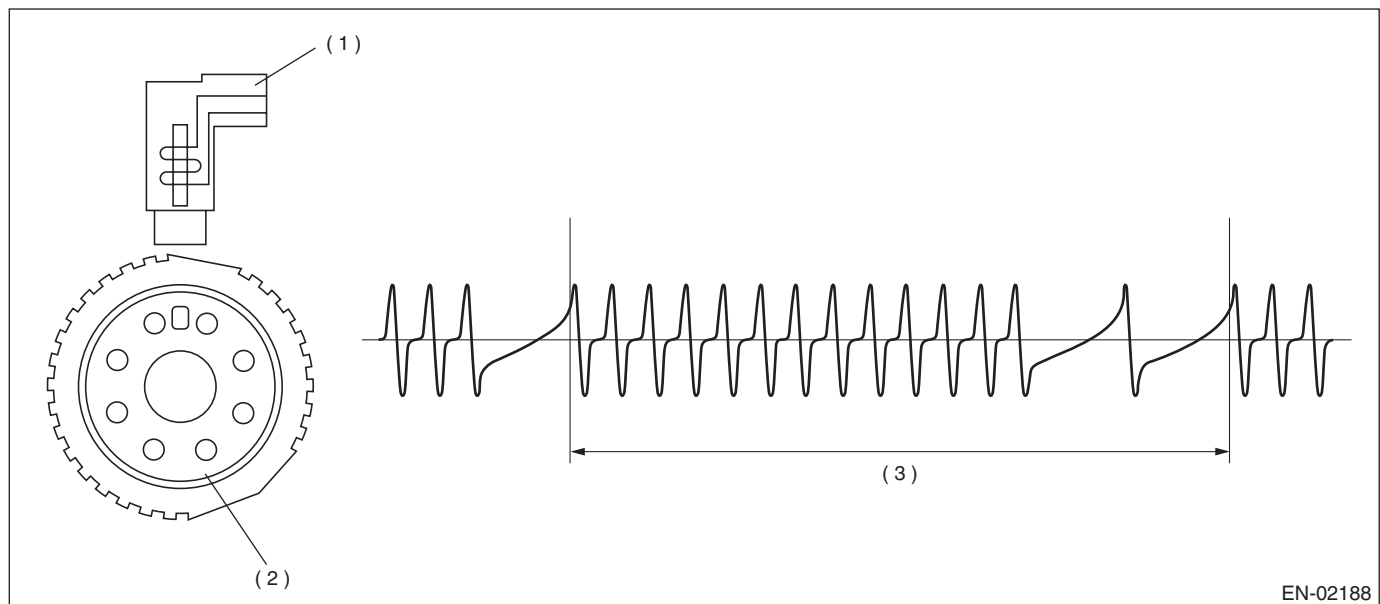
2. COMPONENT DESCRIPTION



(A) Camshaft signal (RH)

(B) Camshaft signal (LH)

(C) Crankshaft signal



(1) Crankshaft position sensor

(2) Crank sprocket

(3) Crankshaft half-turn

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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	$\geq 8 \text{ V}$

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	$\geq 8 \text{ V}$

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

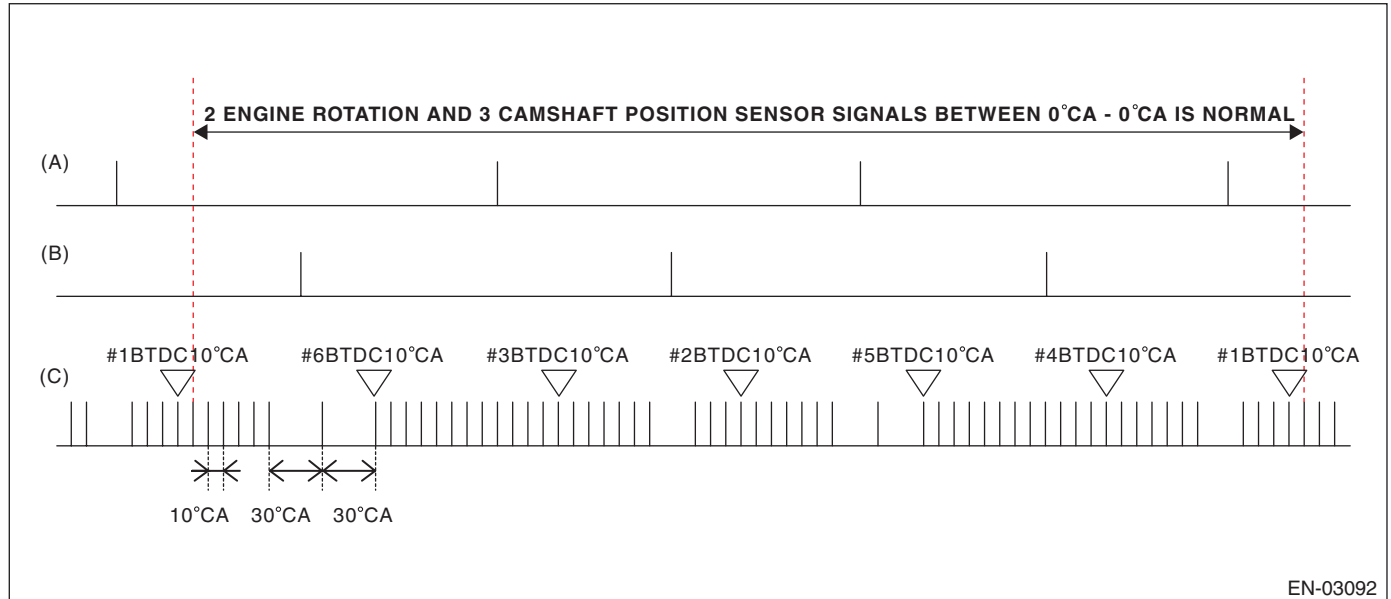
BY:DTC P0336 CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE

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.

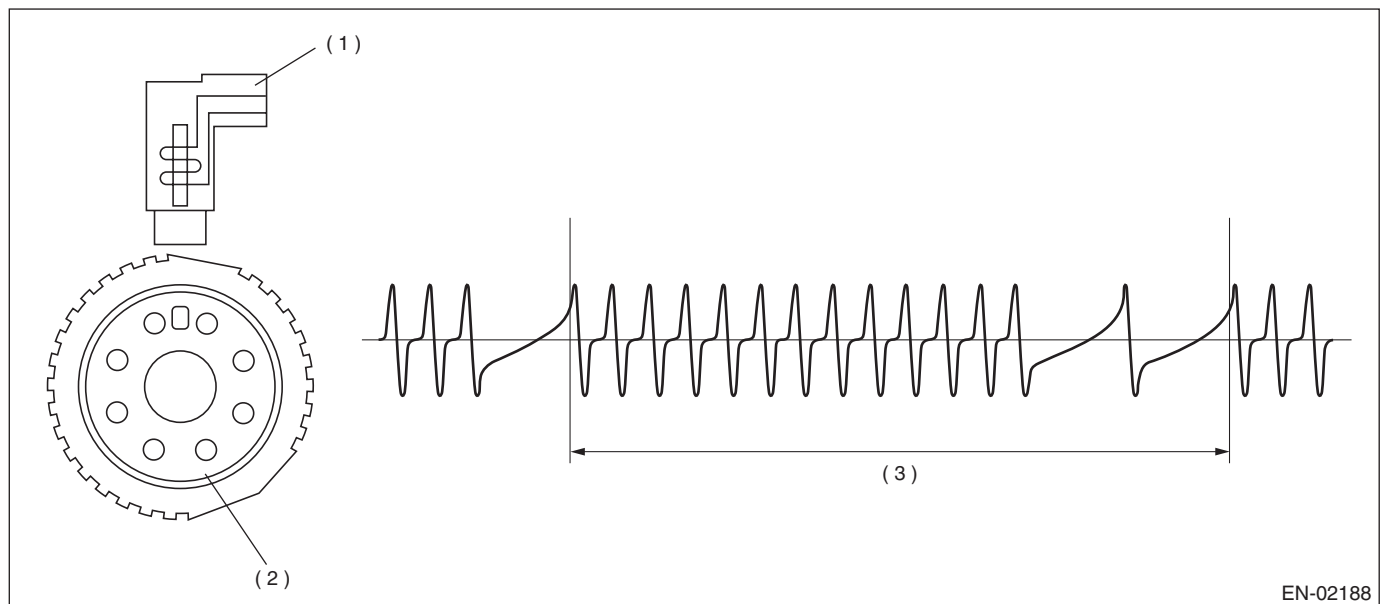
2. COMPONENT DESCRIPTION



(A) Camshaft signal (RH)

(B) Camshaft signal (LH)

(C) Crankshaft signal



(1) Crankshaft position sensor

(2) Crank sprocket

(3) Crankshaft half-turn

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 8 \text{ V}$
Engine speed	$< 3000 \text{ rpm}$

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.	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.	= 30

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

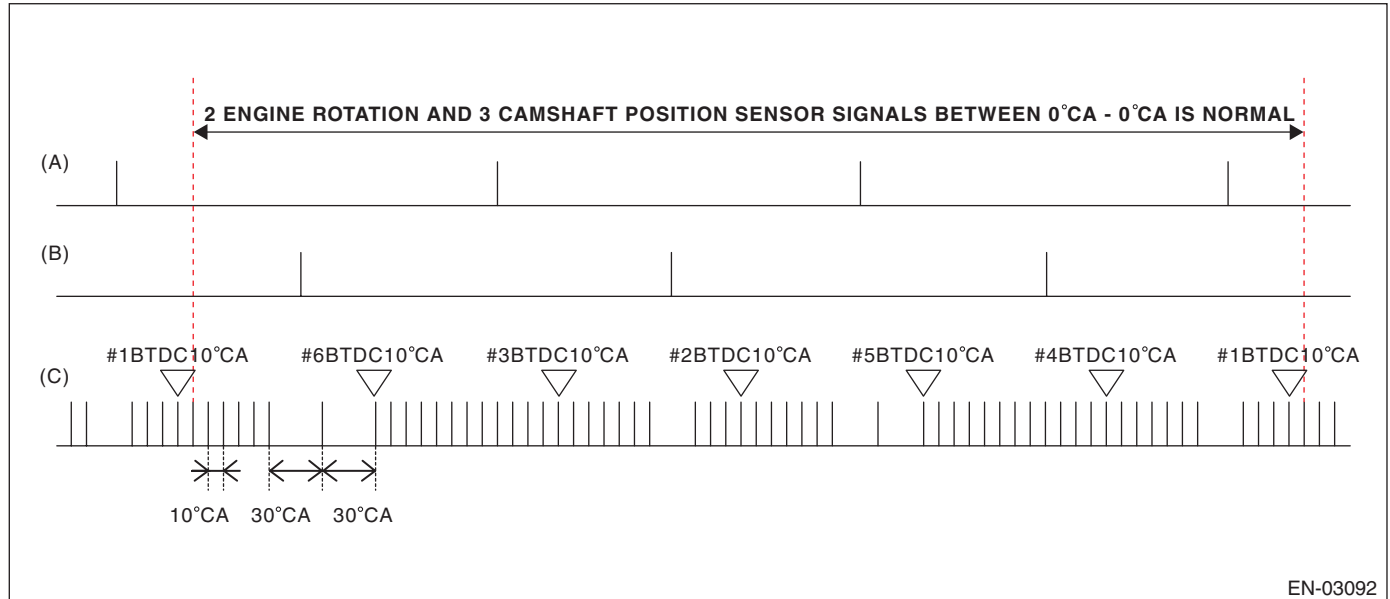
BZ:DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR)

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.

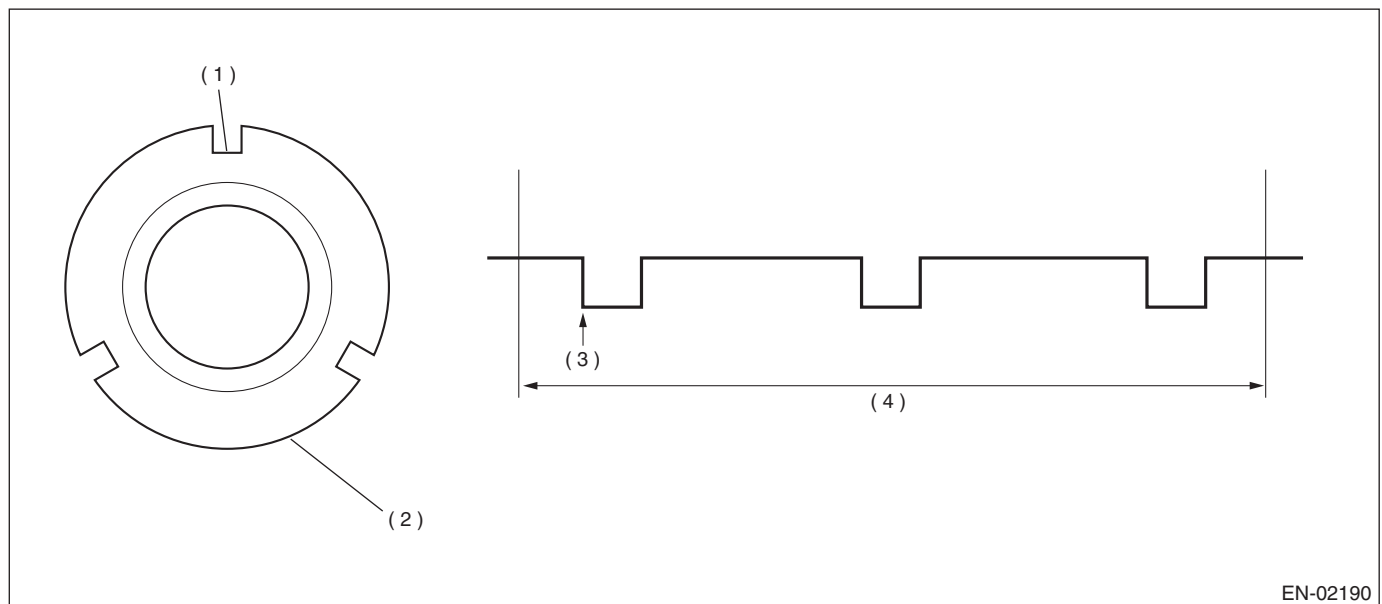
2. COMPONENT DESCRIPTION



(A) Camshaft signal (RH)

(B) Camshaft signal (LH)

(C) Crankshaft signal



(1) Throttle

(3) Detecting point

(4) Camshaft one revolution (engine two revolutions)

(2) Camshaft plate

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment 1

Judge as NG when the condition where the number of camshaft position sensor signals are less than 3 times during 2 engine speed. continues.

Judgment Value

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

Time Needed for Diagnosis: Two 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

CA: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(H6DO)-106, 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

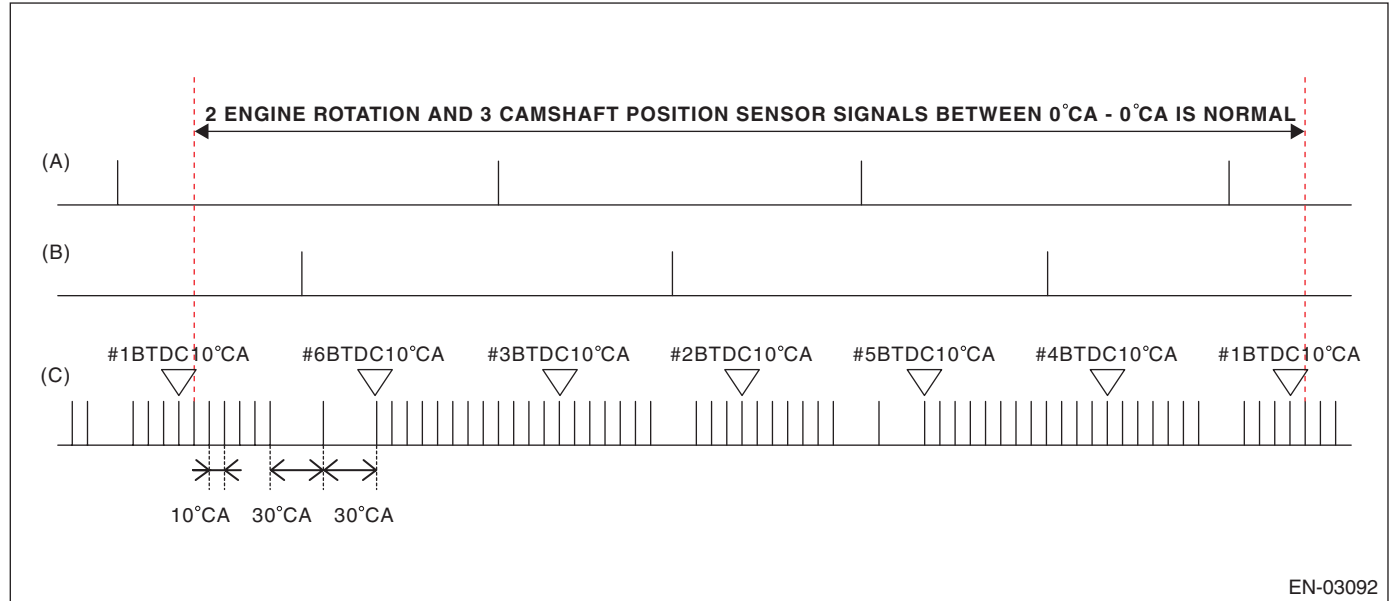
CB:DTC P0365 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 1)

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.

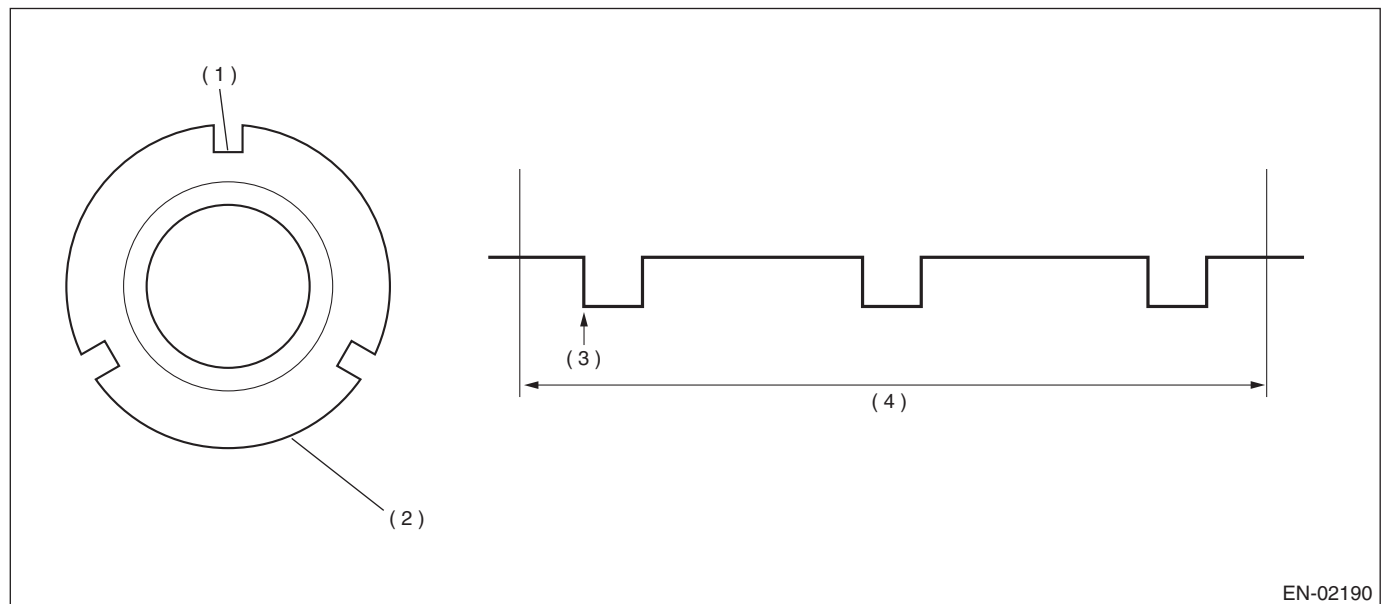
2. COMPONENT DESCRIPTION



(A) Camshaft signal (RH)

(B) Camshaft signal (LH)

(C) Crankshaft signal



(1) Throttle

(3) Detecting point

(4) Camshaft one revolution (two engine revolutions)

(2) Camshaft plate

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 8 \text{ V}$

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG when the condition where the number of camshaft position sensor signals are less than 3 time(s) during 2 engine revs. continues.

Judgment Value

Malfunction Criteria	Threshold Value
Amount of camshaft sensor signal during 2 revs.	$< 3 \text{ time(s)}$

Time Needed for Diagnosis: Two engine revolutions $\times 50$

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	$\geq 3 \text{ time(s)}$

Time Needed for Diagnosis: Two engine revolutions

CC: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(H6DO)-108, DTC P0365 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

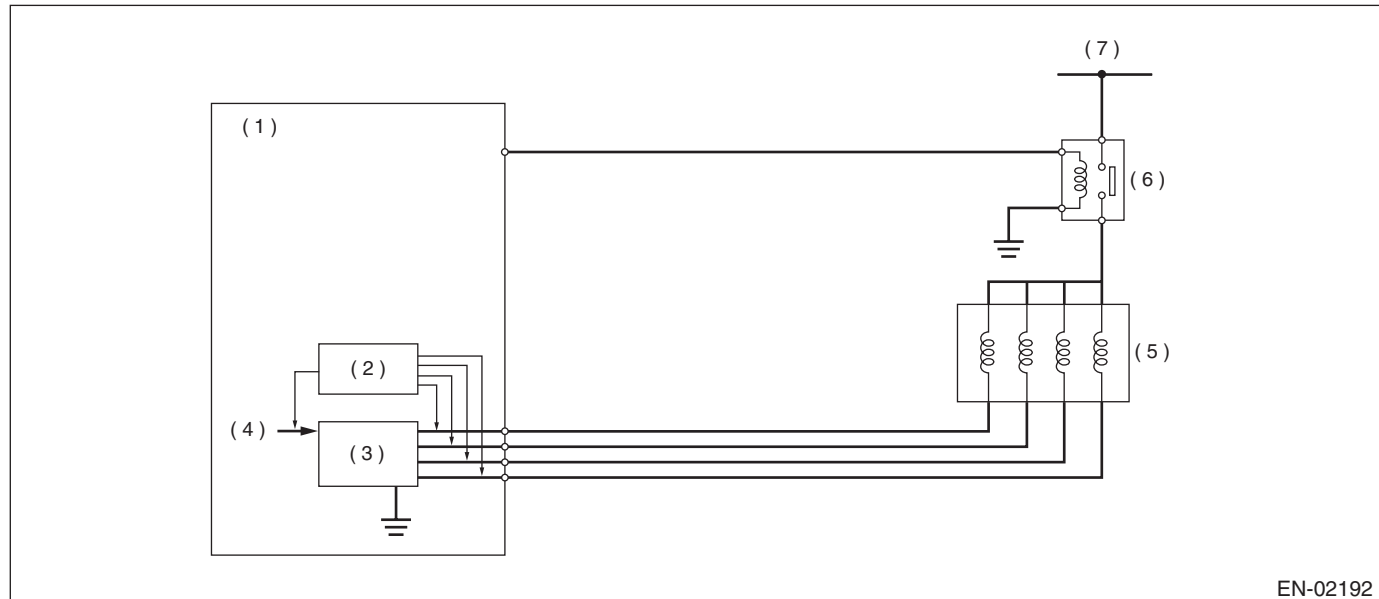
CD:DTC P0400 EXHAUST GAS RECIRCULATION FLOW

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



EN-02192

- | | | |
|-----------------------|---------------|--------------------------|
| (1) ECM | (4) CPU | (6) Main relay |
| (2) Detecting circuit | (5) EGR valve | (7) Battery power supply |
| (3) Switching circuit | | |

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	≥ 40 s
Engine coolant temperature	≥ 75 °C(167 °F)
Engine speed	1200 rpm — 3250 rpm
Intake manifold pressure (absolute pressure)	< 46.7 kPa (350 mmHg, 13.8 inHg)
Ambient air temperature	≥ 5 °C(41 °F)
Throttle position	< 0.25 °
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Vehicle speed	≥ 53 km/h (32.9 MPH)
Fuel shut-off function	In operation
Neutral switch	OFF
After neutral switch ON/OFF change	≥ Value from Map
No load change (A/C, power steering, lighting, rear defogger, heater fan and radiator fan)	≥ 5000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Map

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

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

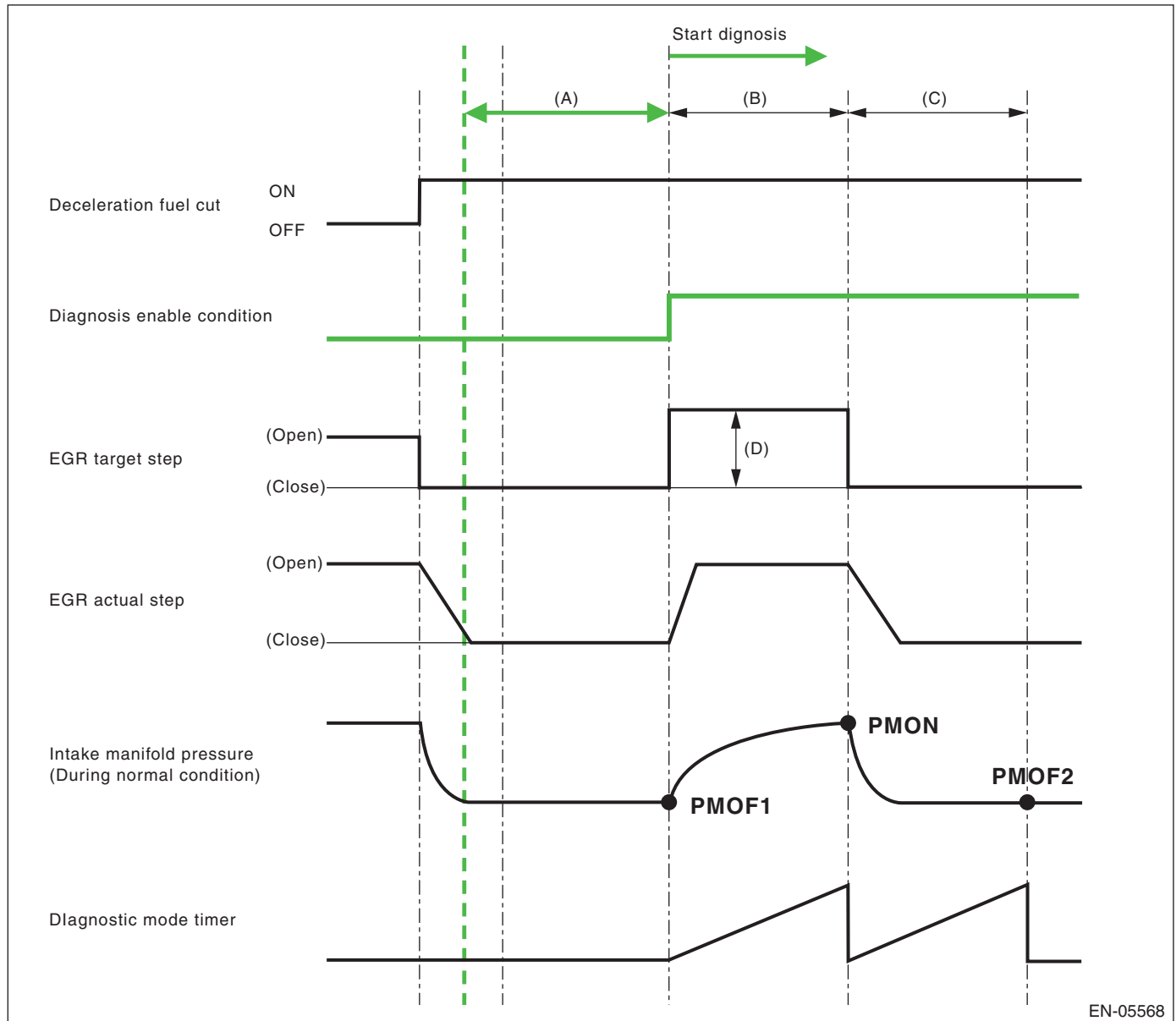
Malfunction Criteria	Threshold Value
PMON – (PMOF1 + PMOF2)/2	< 1.6 kPa (11.8 mmHg, 0.5 inHg)

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) 2000 ms

(C) 1500 ms

(D) 50 step(s)

(B) 1500 ms

• Normality Judgment

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

Judgment Value

Malfunction Criteria	Threshold Value
$PMON - (PMOF1 + PMOF2)/2$	$\geq 1.6 \text{ kPa (11.8 mmHg, 0.5 inHg)}$

Time Needed for Diagnosis: 1 time

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

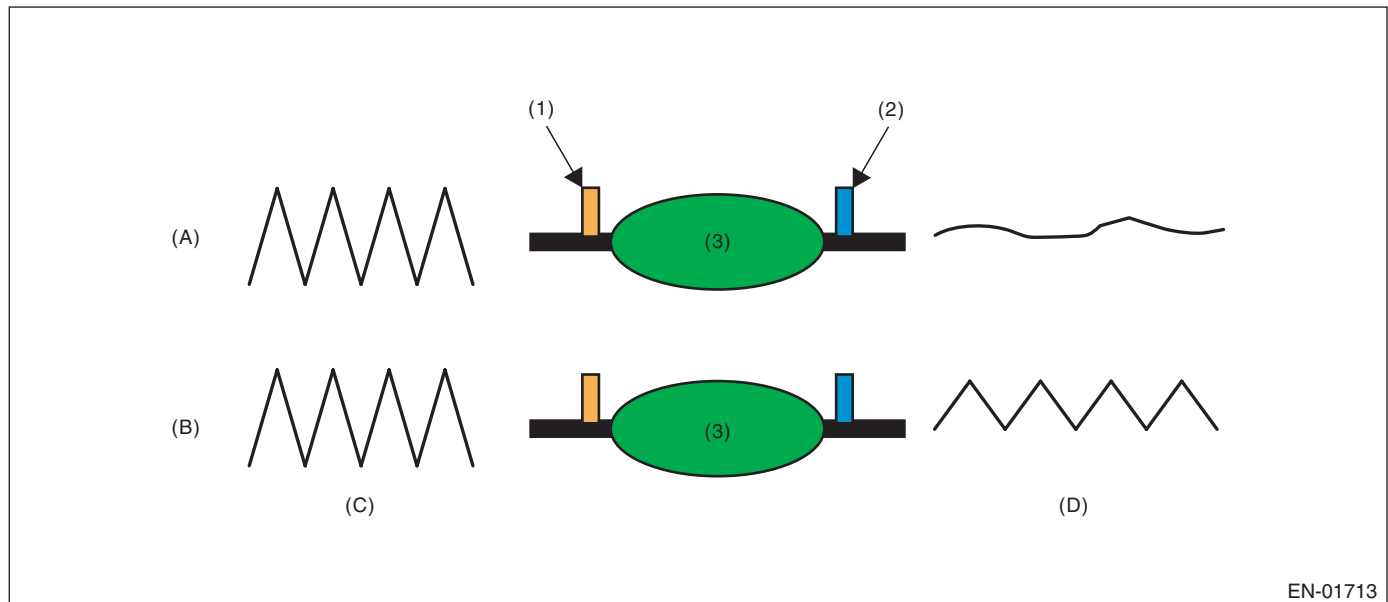
1. OUTLINE OF DIAGNOSIS

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

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

(D) Output waveform from the rear oxygen sensor

(B) Deterioration

(1) Front oxygen (A/F) sensor

(2) Front oxygen sensor

(3) Catalytic converter

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Engine coolant temperature	≥ 75 °C (167 °F)
Estimated catalyst temperature	≥ 580 °C (1076 °F)
Misfire detection every 200 rotations	< 7 time(s)
Learning value of evaporation gas density	< 0.2
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	≥ 10 g/s (0.35 oz/s) and < 70 g/s (2.47 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	≥ 220 s
Purge execution calculated time	≥ 5 s

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once at a constant 60 km/h (37.3 MPH) or higher.

5. DIAGNOSTIC METHOD

After establishing the execution conditions, calculate the front oxygen (A/F) sensor lambda deviation cumulative value per 32 milliseconds $\times 4$ ($\sum |(sglmd_n - sglmd_{n-1})|$) and rear oxygen sensor output voltage deviation cumulative value ($\sum |(ro2sad_n - ro2sad_{n-1})|$), and when the front oxygen (A/F) sensor lambda deviation cumulative value ($\sum |(sglmd_n - sglmd_{n-1})|$) becomes 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}) $	> 25

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.

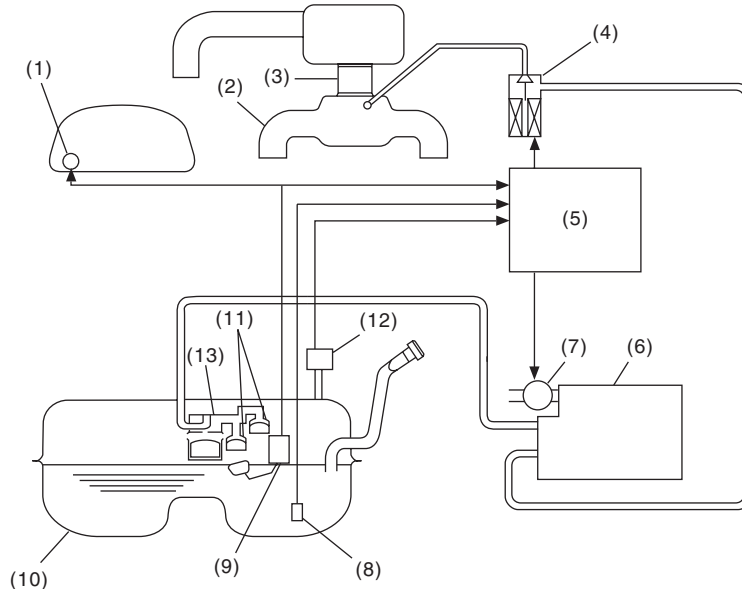
Judgment Value

Malfunction Criteria	Threshold Value
$\sum (ro2sad_n - ro2sad_{n-1}) / \sum (sglmd_n - sglmd_{n-1}) $	≤ 25

Time Needed for Diagnosis: 30 — 55 seconds

**CF:DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECT-
ED (SMALL LEAK)****1. OUTLINE OF DIAGNOSIS**

Check if there is a leakage in fuel system or not, and perform the function diagnosis of valve.



EN-03722

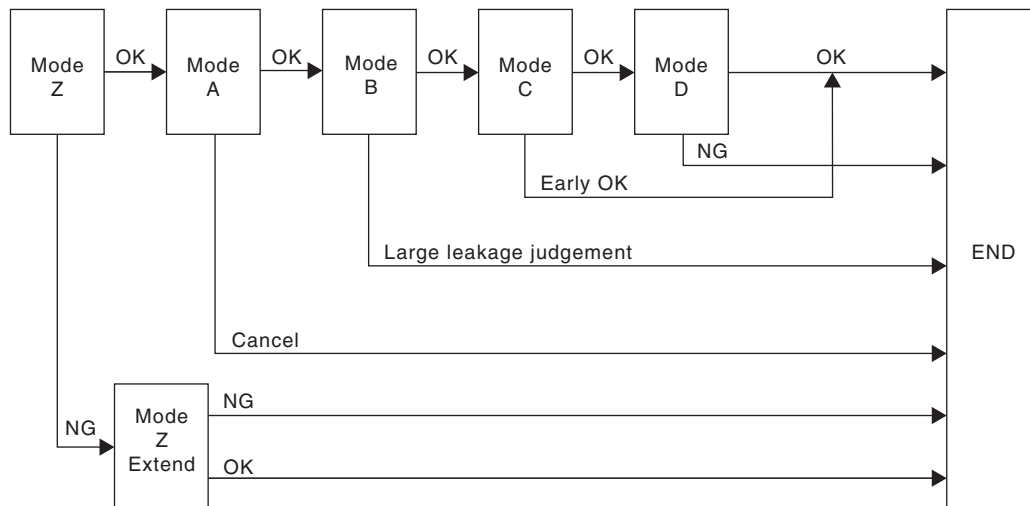
- | | | |
|----------------------------------|-----------------------------|--------------------------------|
| (1) Fuel gauge | (6) Canister | (10) Fuel tank |
| (2) Intake manifold | (7) Drain valve | (11) Fuel cut valve |
| (3) Throttle body | (8) Fuel temperature sensor | (12) Fuel tank pressure sensor |
| (4) Purge control solenoid valve | (9) Fuel level sensor | (13) Vent valve |
| (5) Engine control module (ECM) | | |

In this system diagnosis, check for leakage and valve function is conducted by changing the fuel tank pressure and monitoring the pressure change using the fuel tank pressure sensor. When in 0.04 inch diagnosis, perform in the order of mode Z → mode A → mode B → mode C and mode D; When in 0.02 inch diagnosis, perform in the order of mode A → mode B → mode C → mode D and mode E.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

0.04-inch Diagnosis



EN-02872

Mode	Mode Description	Diagnosis Period
Mode Z (Purge control solenoid valve opening failure diagnosis)	Perform purge control solenoid valve opening failure diagnosis from the size of tank pressure variation from diagnosis start.	5000 ms + 3000 ms — 5000 ms + 3000 ms + 13000 ms
Mode A (Estimated evaporation amount)	Calculate the tank pressure change amount (P1).	10000 ms
Mode B (Sealed negative pressure, large leakage judgement)	Decrease the pressure in the tank to the target value by introducing the intake manifold pressure to the fuel tank. If the tank pressure cannot be reduced, it is diagnosed as large leak.	0 — 10000 ms + 25000 ms
Mode C (Pressure increase check, advanced OK judgment)	Wait until the tank pressure returns to the target (start level of P2 calculation). If the tank pressure does not become the value, make advanced OK judgment.	0 — 14230 ms
Mode D (Negative pressure variation measurement, evaporation leakage diagnosis)	Calculate the tank pressure variation (P2), and obtain the diagnostic value using P1 found in Mode A. Perform the evaporation diagnosis using the diagnostic value.	0 ms + 10000 ms

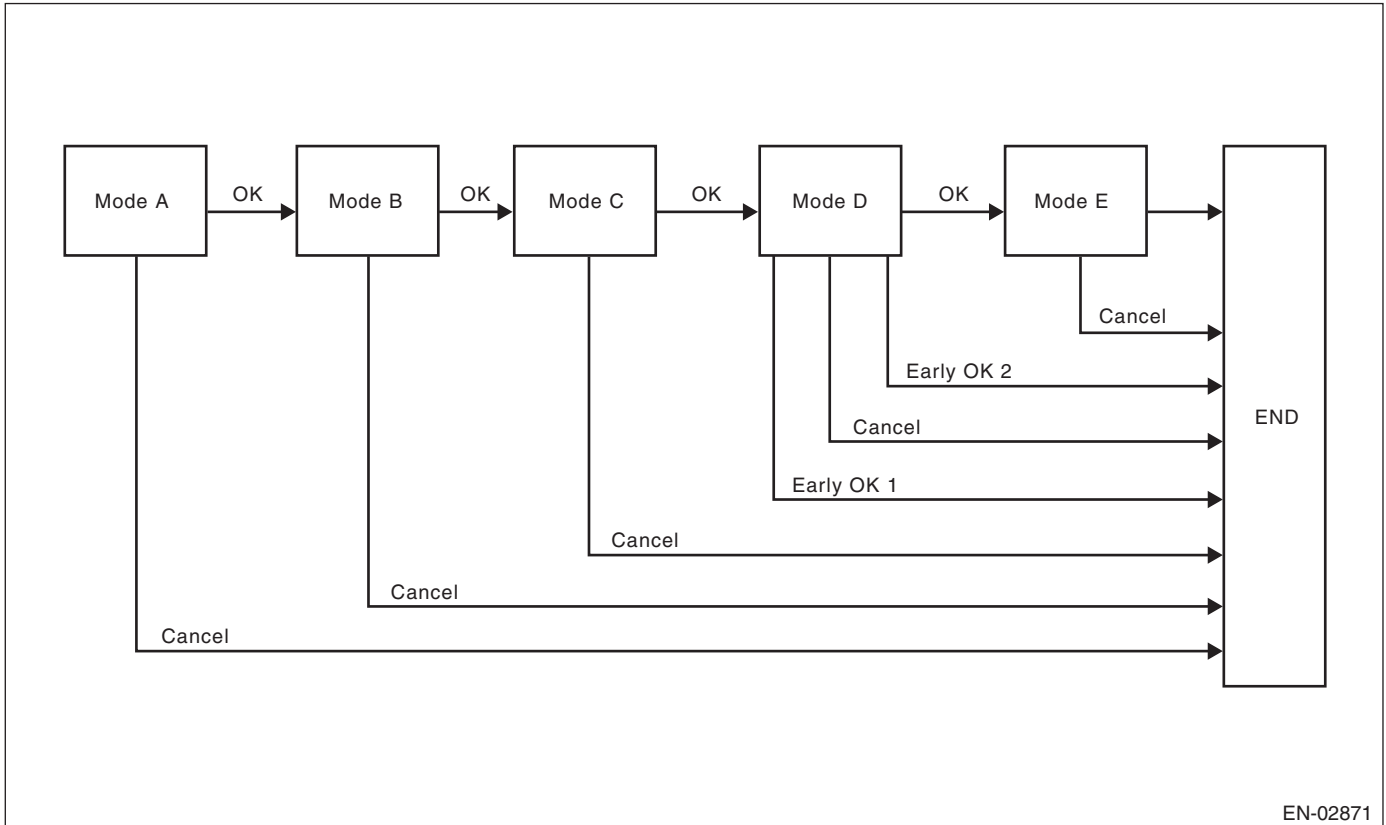
Mode Table for Evaporative Emission Control System Diagnosis

Mode	Behavior of tank internal pressure under normal conditions	Diagnostic item	DTC
Mode Z	Roughly the same as barometric pressure (Same as 0 kPa (0 mmHg, 0 inHg))	Purge control solenoid valve is judged to be open.	P0457
Mode A	Pressure is in proportion to amount of evaporative emission.	—	None
Mode B	Negative pressure is formed due to intake manifold negative pressure	Large leak	P0457
Mode C	Reaches target pressure	—	None
Mode D	Pressure change is small.	EVAP system large leak determination. [1.0 mm (0.04 in)]	P0442

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

0.02-inch Diagnosis



Mode	Mode Description	Diagnosis Period
Mode A (0 point compensation)	When the pressure in the tank is not near 0 mmHg, wait until it returns to 0 point (near 0 mmHg).	0 — Value of Map 1
Mode B (Negative pressure introduced)	Decrease the pressure in the tank to the target value by introducing the intake manifold pressure to the fuel tank.	0 — Value of Map 2
Mode C (Negative pressure maintained)	Wait until the tank pressure returns to the target (start level of P2 calculation).	Value of Map 3
Mode D (Negative pressure change calculated)	Calculate the time it takes for the tank pressure to change to the Mode E shifting pressure. If the tank pressure does not change to the Mode E shifting pressure, make advanced OK judgment.	0 — 0 ms + Value of Map 4
Mode E (Evaporation generated amount calculation)	Calculate the amount of evaporation (P1).	0 — 0 ms + Value of Map 4 + Value of Map 5

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Map 1

Fuel level (ℓ , US gal, Imp gal)	0	10, 2.64, 2.2	20, 5.28, 4.4	30, 7.93, 6.6	40, 10.57, 8.8	50, 13.21, 11	60, 15.85, 13.2
Time Needed for Diagnosis (ms)	6400	6400	6530	6660	7020	7380	7380

Map 2

Fuel level (ℓ , US gal, Imp gal)	0	10, 2.64, 2.2	20, 5.28, 4.4	30, 7.93, 6.6	40, 10.57, 8.8	50, 13.21, 11	60, 15.85, 13.2
Time Needed for Diagnosis (ms)	19600	19600	19600	19600	21050	22500	22500

Map 3

Fuel level (ℓ , US gal, Imp gal)	0	10, 2.64, 2.2	20, 5.28, 4.4	30, 7.93, 6.6	40, 10.57, 8.8	50, 13.21, 11	60, 15.85, 13.2	70, 18.49, 15.4
Time Needed for Diagnosis (ms)	18819	18819	18819	18819	18819	18819	18819	18819

Map 4

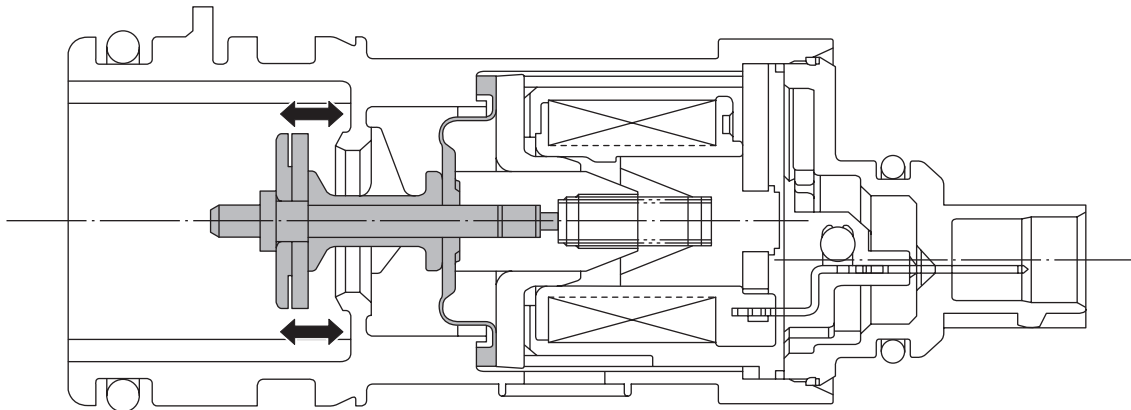
Fuel level (ℓ , US gal, Imp gal)	0	10, 2.64, 2.2	20, 5.28, 4.4	30, 7.93, 6.6	40, 10.57, 8.8	50, 13.21, 11	60, 15.85, 13.2	70, 18.49, 15.4
Time Needed for Diagnosis (ms)	200000	200000	200000	200000	200000	200000	200000	200000

Map 5

Fuel level (ℓ , US gal, Imp gal)	10	20, 5.28, 4.4	30, 7.93, 6.6	40, 10.57, 8.8	50, 13.21, 11	60, 15.85, 13.2
Time Needed for Diagnosis (ms)	80000	70000	60000	60000	60000	60000

2. COMPONENT DESCRIPTION

Drain valve controls the ambient air to be introduced to the canister.



EN-02293

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITION

0.04-inch Diagnosis

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Total time of canister purge operation	≥ 120000 ms
Learning value of evaporation gas density	< 0.08
Engine speed	1050 rpm — 7000 rpm
Fuel tank pressure	≥ -4 kPa (-30 mmHg, -1.2 inHg)
Intake manifold relative vacuum (relative pressure)	≥ -26.7 kPa (-200 mmHg, -7.9 inHg)
Duration time of fuel level 10.5 ℓ (2.77 US gal, 2.31 Imp gal) — 59.5 ℓ (15.72 US gal, 13.09 Imp gal)	≥ 5000 ms
Closed air/fuel ratio control	In operation
Fuel temperature	-10 °C (14 °F) — 45 °C (113 °F)
Intake air temperature	≥ -10 °C (14 °F)
Pressure change every 1 second	< 1.7 mmHg (Mode A) < 1.7 mmHg (Mode D)
Minimum pressure change value every one second – Maximum pressure change value every one second	< 1.7 mmHg (Mode A) < 1.7 mmHg (Mode D)
Fuel level change every 128 milliseconds	< Value of Map 6
Air fuel ratio	0.76 — 1.25
Elapsed time after starting the engine	≥ 851 s
or	
Elapsed time after starting the engine	≥ 335 s and Vehicle speed 72 km/h (44.7 MPH) or more

Map 6

Fuel level (ℓ , US gal, Imp gal)	10, 2.64, 2.2	20, 5.28, 4.4	25, 6.61, 5.5	30, 7.93, 6.6	43, 11.36, 9.46	45, 11.89, 9.9	50, 13.21, 11	60, 15.85, 13.2
Change (ℓ , US gal, Imp gal)	4, 1.06, 0.88	5, 1.32, 1.1	6.5, 1.72, 1.43	4, 1.06, 0.88	5, 1.32, 1.1	5, 1.32, 1.1	6, 1.59, 1.32	8, 2.11, 1.76

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

0.02-inch Diagnosis

Secondary Parameters	Enable Conditions
At starting a diagnosis	
Evap. diagnosis	Incomplete
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Time since last incomplete 0.02-inch leakage diagnosis	
When cancelling in mode A	> 120000 ms
When cancelling in other than mode A	> 600000 ms
Total time of canister purge operation	≥ 120000 ms
Elapsed time after starting the engine	≥ 120 s
Fuel temperature	−10 °C (14 °F) — 55 °C (131 °F)
Duration time of fuel level 10.5 ℓ (2.77 US gal, 2.31 Imp gal) — 59.5 ℓ (15.72 US gal, 13.09 Imp gal)	≥ 120000 ms
Intake manifold relative vacuum (relative pressure)	≥ −8 kPa (−60 mmHg, −2.4 inHg)
Fuel tank pressure	−0.7 kPa (−5 mmHg, −0.2 inHg) — 0.4 kPa (2.9 mmHg, 0.1 inHg)
Closed air/fuel ratio control	In operation
Engine speed	1050 rpm — 7000 rpm
Vehicle speed	50 km/h (31.1 MPH) — 510 km/h (316.9 MPH) continues for 125000 ms
During diagnosis	
Change of fuel level	≤ Value of Map 7
Pressure change every 1 second	< 0 kPa (0.3 mmHg, 0 inHg)
Minimum pressure change value every one second – Maximum pressure change value every one second	< 0.1 kPa (0.564 mmHg, 0 inHg) (Mode D)
Tank pressure change every 1 second	≤ 0.1 kPa (0.425 mmHg, 0 inHg)
Barometric pressure change	−0.5 kPa (−3.6 mmHg, −0.1 inHg) — 0.3 kPa (2.4 mmHg, 0.1 inHg) (Mode D) −0.3 kPa (−2.4 mmHg, −0.1 inHg) — 0.3 kPa (2.4 mmHg, 0.1 inHg) (Mode E)

Map 7

Fuel level (ℓ , US gal, Imp gal)	10, 2.64, 2.2	20, 5.28, 4.4	25, 6.61, 5.5	30, 7.93, 6.6	43, 11.36, 9.46	45, 11.89, 9.9	50, 13.21, 11	60, 15.85, 13.2
Change (ℓ , US gal, Imp gal)	4, 1.06, 0.88	5, 1.32, 1.1	6.5, 1.72, 1.43	4, 1.06, 0.88	5, 1.32, 1.1	5, 1.32, 1.1	6, 1.59, 1.32	8, 2.11, 1.76

4. GENERAL DRIVING CYCLE

0.04-inch Diagnosis

- Perform the diagnosis only once in 335 seconds or more after starting the engine, at a constant speed of 72 km/h (45 MPH) or more.
- Pay attention to the fuel temperature and fuel level.

0.02-inch Diagnosis

- Perform the diagnosis 125 seconds or more at a constant engine speed of 50 km/h (31 MPH) or higher to judge as NG or OK.
- If judgment cannot be made, repeat the diagnosis.
- Pay attention to the fuel level.

5. DIAGNOSTIC METHOD**Purge control solenoid valve stuck open fault diagnosis**

DTC

P0457 Evaporative Emission Control System Leak Detected (Fuel Cap Loose/Off)

Purpose of Mode Z

When performing the leakage diagnosis of EVAP system, the purge control solenoid valve must operate normally. Therefore, mode Z is used to diagnose the purge control solenoid valve stuck open condition. Note that if a purge control solenoid valve stuck open fault is detected, the EVAP system leakage diagnosis is cancelled.

Diagnostic method

Purge control solenoid valve functional diagnosis is performed by monitoring the tank pressure in mode Z.

• Abnormality Judgment

If OK judgment cannot be made, extend Mode Z, and Judge as NG when the following conditions are established after predetermined amount of time.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
evptez – evptezha	> 0.6 kPa (4.5 mmHg, 0.2 inHg)	P0457
evptezini	≤ 0.4 kPa (2.9 mmHg, 0.1 inHg)	
Time with no fuel sloshing equal to or over the value of Map 6	≥ 40000 ms	

Time Needed for Diagnosis: 5000 ms + 3000 ms + 13000 ms

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

When judgment for purge control solenoid valve stuck open NG is made, end the evaporative diagnosis.

Cancel the evaporative diagnosis when the OK/NG judgment for purge control solenoid valve stuck open cannot be made in Mode Z.

• Normality Judgment

Judge as OK and change to Mode A when the following conditions are established after 3000 ms has passed since Mode Z started.

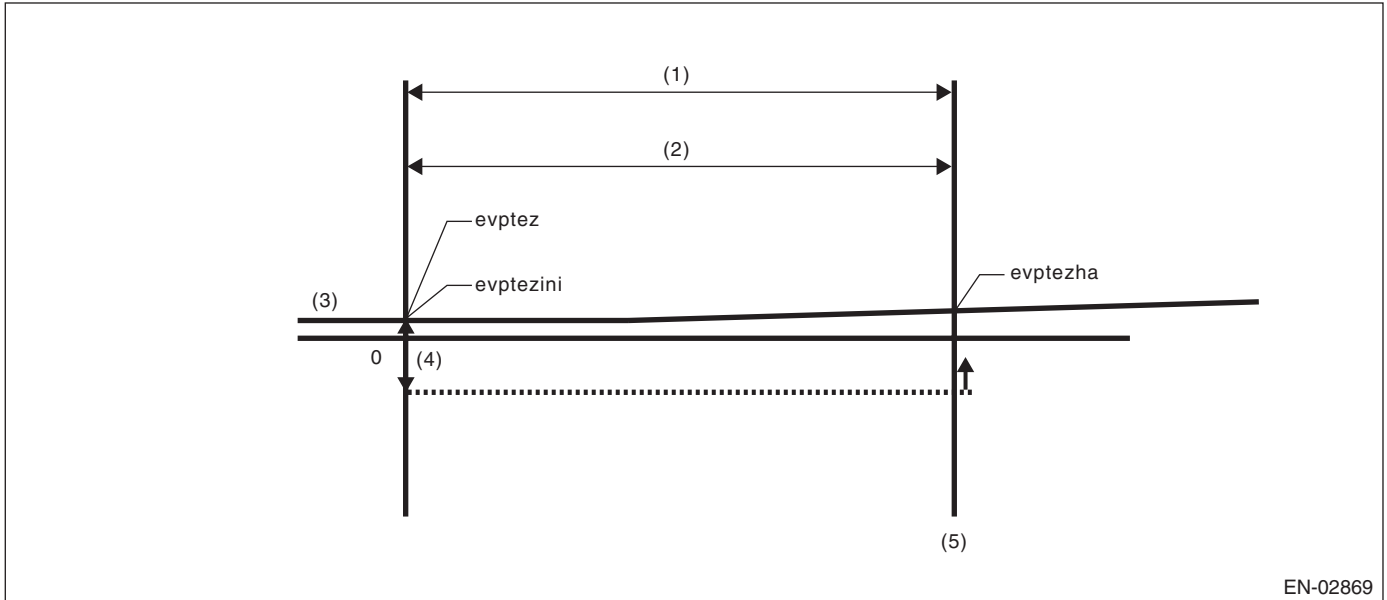
Judgment Value

Malfunction Criteria	Threshold Value	DTC
evptez – evptezha	≤ 0.4 kPa (3 mmHg, 0.1 inHg)	P0457

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Normal



- (1) Mode Z
(2) 3000 ms

- (3) Fuel tank pressure
(4) 0.4 kPa (3 mmHg, 0.1 inHg)

- (5) OK judgment

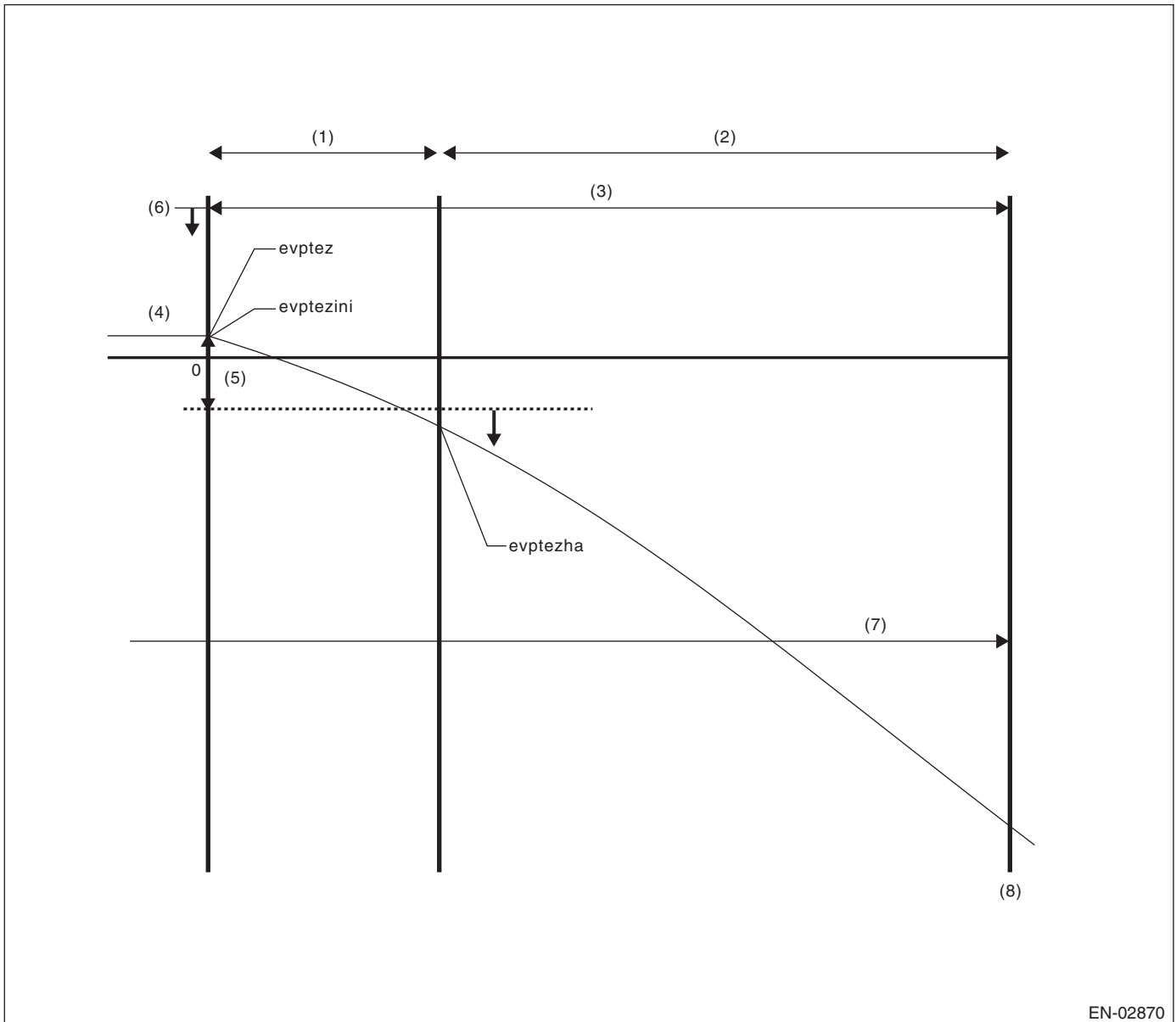
$evptez - evptezha \leq 0.4 \text{ kPa (3 mmHg, 0.1 inHg)}$ Normal when above is established

Time Needed for Diagnosis: 5000 ms + 3000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Purge control solenoid valve Open Fixation



EN-02870

- | | | |
|----------------------------------|----------------------------------|-------------------------------|
| (1) Mode Z | (4) Fuel tank pressure | (7) 40000 ms no fuel sloshing |
| (2) Extended mode Z | (5) 0.6 kPa (4.5 mmHg, 0.2 inHg) | (8) NG judgment |
| (3) 5000 ms + 3000 ms + 13000 ms | (6) 0.4 kPa (2.9 mmHg, 0.1 inHg) | |

- $evptezini \leq 0.4 \text{ kPa (2.9 mmHg, 0.1 inHg)}$
 - $evptez - evptezha > 0.6 \text{ kPa (4.5 mmHg, 0.2 inHg)}$
 - No fuel sloshing equal to or over the value of Map 6 for 40000 ms or more
- Judge as abnormal when all are established.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Leak Diagnosis

DTC

P0442 Evaporative Emission Control System Leak Detected (Small Leak)

P0457 Evaporative Emission Control System Leak Detected (Fuel Cap Loose/Off)

- The diagnostic consists of creating a sealed vacuum in the fuel tank and then determining the presence of leakage from the speed at which the tank internal pressure returns to barometric pressure.
- The diagnosis is divided into the following five phases.

Mode A: (Estimated evaporation gas amount)

Calculate the tank pressure change amount (P1) when using mode A. After calculating P1, switch to mode B.

Mode B: (Negative pressure sealed)

Introduce negative pressure in the intake manifold to the tank.

Approx. 0 → -1.4 kPa (0 → -10.5 mmHg, 0 → -0.4 inHg)

When the pressure above (desired negative pressure) is reached, enters Mode C.

In this case, if the tank pressure does not reach the target negative pressure, judge that there is a large leakage in the system and terminate the evaporative emission control system diagnosis.

Abnormality Judgment

Judge as NG (large leakage) when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Time to reach target negative pressure or Mode B time (Min. pressure value in tank when in mode B) – (Tank pressure when mode B started)	$\geq 10000 \text{ ms} + 25000 \text{ ms}$ $\geq 10000 \text{ ms}$ $> -0.5 \text{ kPa } (-4 \text{ mmHg, } -0.2 \text{ inHg})$	P0457

Time Needed for Diagnosis: 5000 ms + 3000 ms + 10000 ms + 10000 ms + 25000 ms

Mode C: (Check pressure rise)

Stop the introduction of negative pressure. (Wait until the tank pressure returns to the start level of P2 calculation.)

Change to Mode D when the tank pressure returns to the start level of P2 calculation.

Judge immediate OK and change to Mode E when it does not return in spite of spending the specified time.

Tank pressure when starting calculation of P2	Time for advanced OK judgment
-1.3 kPa (-9.75 mmHg, -0.4 inHg)	14230 ms

Time Needed for Diagnosis: 5000 ms + 3000 ms + 10000 ms + 10000 ms + 25000 ms + 14230 ms

Mode D: (Measure amount of negative pressure change)

Monitor the tank pressure change amount when using mode D. In this case, the tank pressure increases, (nears barometric pressure) because evaporation occurs. However, if any leakage exists, the pressure increases additionally in proportion to this leakage. The pressure variation of this tank is P2.

After calculating P2, perform a small leak diagnosis according to the items below.

When Mode D is ended

Assign tank variations measured in Mode A and Mode D, P1 and P2, to the formula below, judge small leaks in the system. If the measured judgment value exceeds the threshold value, it is judged to be a malfunction.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Abnormality Judgment

Judge as NG when the following conditions are established within the predetermined time. Judge as OK and clear the NG if the following conditions are not established within the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
P2 – 1.5 – × P1 P2: Tank pressure that changes every 10000 ms in mode D P1: Tank pressure that changes every 10000 ms in mode A	> Value of Map 8	P0442

*1.5 –: Evaporation amount compensation value when below negative pressure (Amount of evaporation occurrence increases as a vacuum condition increases.)

Map 8 Malfunction criteria limit for evaporation diagnosis

Fuel temperature vs. Fuel level	15 °C (59 °F)	25 °C (77 °F)	35 °C (95 °F)	45 °C (113 °F)
10.5 ℓ (2.77 US gal, 2.31 Imp gal)	0.3 kPa (2.1 mmHg, 0.1 inHg)	0.3 kPa (2.1 mmHg, 0.1 inHg)	0.3 kPa (2.3 mmHg, 0.1 inHg)	0.3 kPa (2.4 mmHg, 0.1 inHg)
27 ℓ (7.13 US gal, 5.94 Imp gal)	0.3 kPa (2.32 mmHg, 0.1 inHg)	0.3 kPa (2.5 mmHg, 0.1 inHg)	0.4 kPa (2.725 mmHg, 0.1 inHg)	0.4 kPa (2.875 mmHg, 0.1 inHg)
43 ℓ (11.36 US gal, 9.46 Imp gal)	0.4 kPa (2.876115385 mmHg, 0.1 inHg)	0.4 kPa (2.968181818 mmHg, 0.1 inHg)	0.4 kPa (3.229545455 mmHg, 0.1 inHg)	0.5 kPa (3.429545455 mmHg, 0.1 inHg)
59.5 ℓ (15.72 US gal, 13.09 Imp gal)	0.5 kPa (3.5 mmHg, 0.1 inHg)	0.5 kPa (3.5 mmHg, 0.1 inHg)	0.5 kPa (3.5 mmHg, 0.1 inHg)	0.5 kPa (3.7 mmHg, 0.1 inHg)

Time Needed for Diagnosis: 5000 ms + 3000 ms + 10000 ms + 10000 ms + 25000 ms + 14230 ms + 10000 ms

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

Leak Diagnosis

DTC

P0456 Evaporative Emission Control System Leak Detected (very small leak)

- The diagnostic consists of creating a sealed vacuum in the fuel tank and then determining the presence of leakage from the speed at which the tank internal pressure returns to barometric pressure.
- The diagnosis is divided into the following five phases.

Mode A: (0 point compensation)

When the pressure in the tank is not near 0 mmHg, wait until it returns to 0 point (near 0 mmHg). Shift to mode B when returned to the 0 point. Cancel the diagnosis when 0 point does not return in the specified time.

Mode B: (Negative pressure introduced)

Introduce negative pressure in the intake manifold to the tank.

Approx. 0 → –2 kPa (0 → –15 mmHg, 0 → –0.6 inHg)

When the pressure above (desired negative pressure) is reached, enters Mode C.

When the tank internal pressure does not reach the target negative pressure, the diagnosis is cancelled.

Mode C: (Negative pressure maintained)

Stop the introduction of negative pressure. (Wait until the tank pressure returns to the start level of P2 calculation.)

Change to Mode D either when the tank pressure returns to the start level of P2 calculation, or when the predetermined amount of time has passed.

Mode D: (Calculate the amount of negative pressure change)

Monitor the tank pressure in mode D, calculate the pressure change in the tank (P2), and measure the time (evpdset) for the tank pressure to change to the Mode E shifting pressure. When the Mode E shifting pressure is reached, Mode E is entered. If it does not change to the Mode E shifting pressure after the predetermined amount of time has passed, make advanced OK judgment or cancel the diagnosis according to the value of P2.

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
Advanced OK judgment 1 Mode D time Tank internal pressure	$\geq 0 \text{ ms} + 20000 \text{ ms}$ $\leq \text{Value of Map 9}$
Advanced OK judgment 2 Mode D time P2	$\geq 0 \text{ ms} + \text{Value of Map 10}$ $\leq \text{Value of Map 11}$

Map 9

Fuel level (ℓ, US gal, Imp gal)	0, 0, 0	10, 2.64, 2.2	20, 5.28, 4.4	30, 7.93, 6.6	40, 10.57, 8.8	50, 13.21, 11	60, 15.85, 13.2
Tank pressure (kPa, mmHg, inHg)	-1.9, -13.9, -0.5	-1.9, -13.9, -0.5	-1.8, -13.8, -0.5	-1.8, -13.7, -0.5	-1.8, -13.6, -0.5	-1.8, -13.5, -0.5	-1.8, -13.5, -0.5

Map 10

Fuel level (ℓ, US gal, Imp gal)	0	10, 2.64, 2.2	20, 5.28, 4.4	30, 7.93, 6.6	40, 10.57, 8.8	50, 13.21, 11	60, 15.85, 13.2	70, 18.49, 15.4
Time Needed for Diagnosis (ms)	200000	200000	200000	200000	200000	200000	200000	200000

Map 11

Fuel level (ℓ, US gal, Imp gal)	0, 0, 0	10, 2.64, 2.2	20, 5.28, 4.4	30, 7.93, 6.6	40, 10.57, 8.8	50, 13.21, 11	60, 15.85, 13.2
Tank pressure (kPa, mmHg, inHg)	0.9, 7, 0.3	0.9, 7, 0.3	0.9, 7.05, 0.3	0.9, 7.1, 0.3	1.1, 8.2, 0.3	1.3, 9.6, 0.4	1.3, 9.6, 0.4

Mode E: (Evaporation occurrence amount calculation)

Calculate the change of tank pressure with the time evpdset (P1) to judge as NG/OK according to the value of P1. (ambiguous determination acceptable).

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
P1	< Value of Map 12

Map 12 Malfunction criteria limit for evaporation diagnosis

Time (evpdset) vs. Fuel level	0 ms	30000 ms	50000 ms	100000 ms	160000 ms	200000 ms
16 ℓ (4.23 US gal, 3.52 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.1 kPa (0.5 mmHg, 0 inHg)	0.2 kPa (1.7 mmHg, 0.1 inHg)	0.4 kPa (2.7 mmHg, 0.1 inHg)	0.4 kPa (2.7 mmHg, 0.1 inHg)	0.4 kPa (2.7 mmHg, 0.1 inHg)
38 ℓ (10.04 US gal, 8.36 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.1 kPa (0.5 mmHg, 0 inHg)	0.2 kPa (1.7 mmHg, 0.1 inHg)	0.4 kPa (2.7 mmHg, 0.1 inHg)	0.4 kPa (2.7 mmHg, 0.1 inHg)	0.4 kPa (2.7 mmHg, 0.1 inHg)
60 ℓ (15.85 US gal, 13.2 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.1 kPa (0.5 mmHg, 0 inHg)	0.3 kPa (2 mmHg, 0.1 inHg)	0.3 kPa (2.3 mmHg, 0.1 inHg)	0.3 kPa (2.3 mmHg, 0.1 inHg)	0 kPa (0 mmHg, 0 inHg)

Time Needed for Diagnosis: Value of Map 1 + Value of Map 2 + Value of Map 3 + 0 ms + Value of Map 4 + 0 ms + Value of Map 4 + Value of Map 5

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 when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
P1	> Value of Map 13

Map 13 Malfunction criteria limit for evaporation diagnosis

Time (evpdset) vs. Fuel level	0 ms	30000 ms	50000 ms	100000 ms	160000 ms	200000 ms
16 ℓ (4.23 US gal, 3.52 Imp gal)	0.1 kPa (1 mmHg, 0 inHg)	0.5 kPa (3.5 mmHg, 0.1 inHg)	0.6 kPa (4.2 mmHg, 0.2 inHg)	0.6 kPa (4.2 mmHg, 0.2 inHg)	0.6 kPa (4.2 mmHg, 0.2 inHg)	0.6 kPa (4.2 mmHg, 0.2 inHg)
38 ℓ (10.04 US gal, 8.36 Imp gal)	0.1 kPa (1 mmHg, 0 inHg)	0.4 kPa (3 mmHg, 0.1 inHg)	0.5 kPa (3.9 mmHg, 0.2 inHg)	0.5 kPa (3.9 mmHg, 0.2 inHg)	0.5 kPa (3.9 mmHg, 0.2 inHg)	0.5 kPa (3.9 mmHg, 0.2 inHg)
60 ℓ (15.85 US gal, 13.2 Imp gal)	0.1 kPa (1 mmHg, 0 inHg)	0.2 kPa (1.5 mmHg, 0.1 inHg)	0.4 kPa (2.9 mmHg, 0.1 inHg)	0.4 kPa (2.9 mmHg, 0.1 inHg)	0.4 kPa (2.9 mmHg, 0.1 inHg)	0.4 kPa (2.9 mmHg, 0.1 inHg)

Time Needed for Diagnosis: Value of Map 1 + Value of Map 2 + Value of Map 3 + 0 ms + Value of Map 4 + 0 ms + Value of Map 4 + Value of Map 5

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

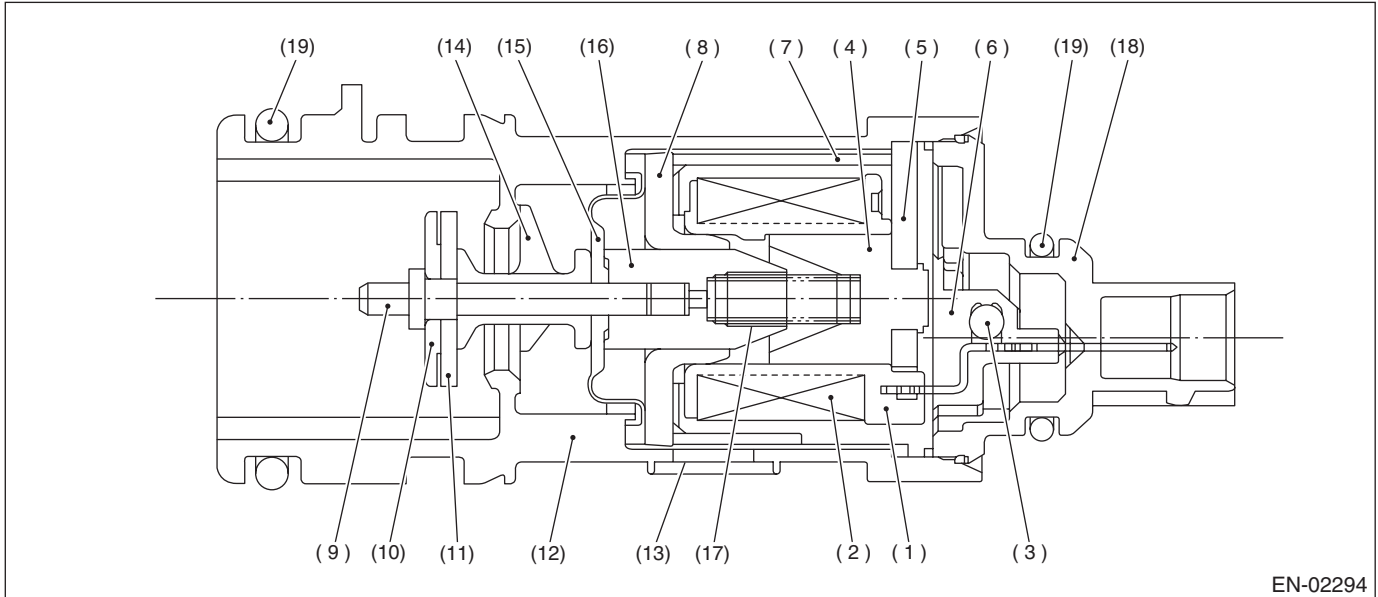
CG:DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the drain valve.

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

2. COMPONENT DESCRIPTION



- | | | |
|-----------------|--------------------|-------------------|
| (1) Bobbin | (8) Magnetic plate | (14) Retainer |
| (2) Coil | (9) Shaft | (15) Diaphragm |
| (3) Diode | (10) Plate | (16) Movable core |
| (4) Stator core | (11) Valve | (17) Spring |
| (5) End plate | (12) Housing | (18) Cover |
| (6) Body | (13) Filter | (19) O-ring |
| (7) Yoke | | |

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	$\geq 10.9 \text{ V}$
Elapsed time after starting the engine	$\geq 1 \text{ second}$
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	$\geq 10.9 \text{ V}$
Elapsed time after starting the engine	$\geq 1 \text{ second}$
Terminal output voltage when ECM outputs OFF signal	High

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

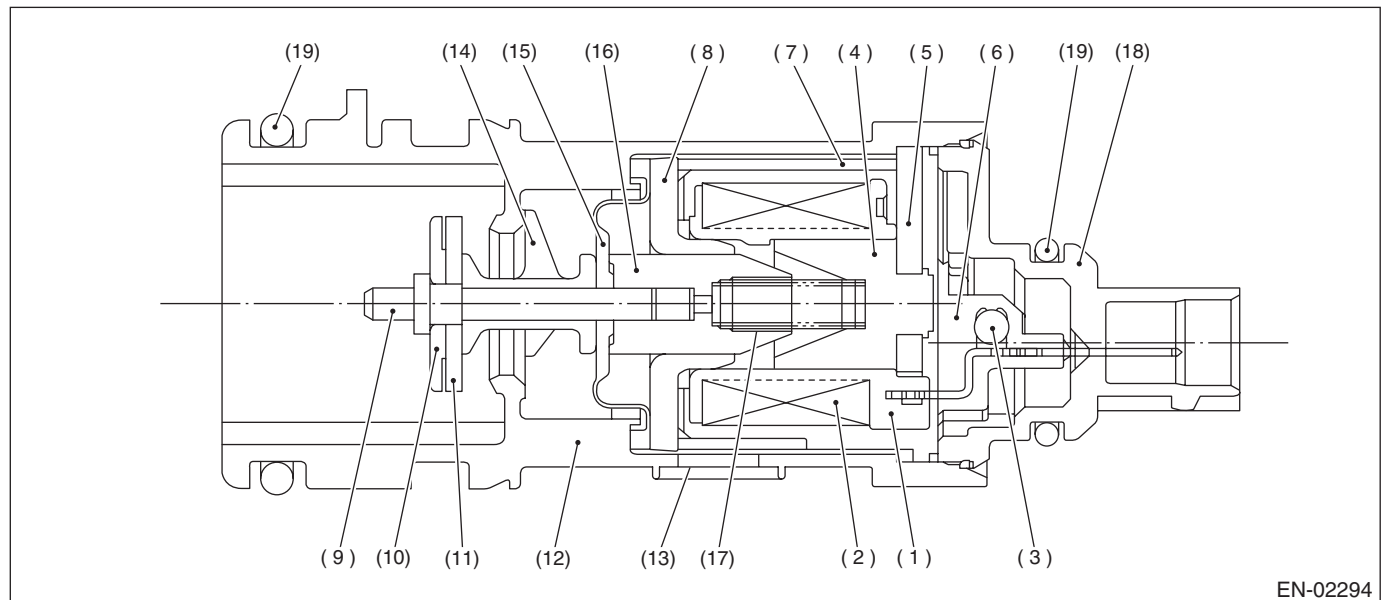
CH:DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the drain valve.

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

2. COMPONENT DESCRIPTION



- | | | |
|-----------------|--------------------|-------------------|
| (1) Bobbin | (8) Magnetic plate | (15) Diaphragm |
| (2) Coil | (9) Shaft | (16) Movable core |
| (3) Diode | (10) Plate | (17) Spring |
| (4) Stator core | (11) Valve | (18) Cover |
| (5) End plate | (12) Housing | (19) O-ring |
| (6) Body | (13) Filter | |
| (7) Yoke | (14) Retainer | |

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	≥ 10.9 V
Elapsed time after starting the engine	≥ 1 second
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 V
Elapsed time after starting the engine	≥ 1 second
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

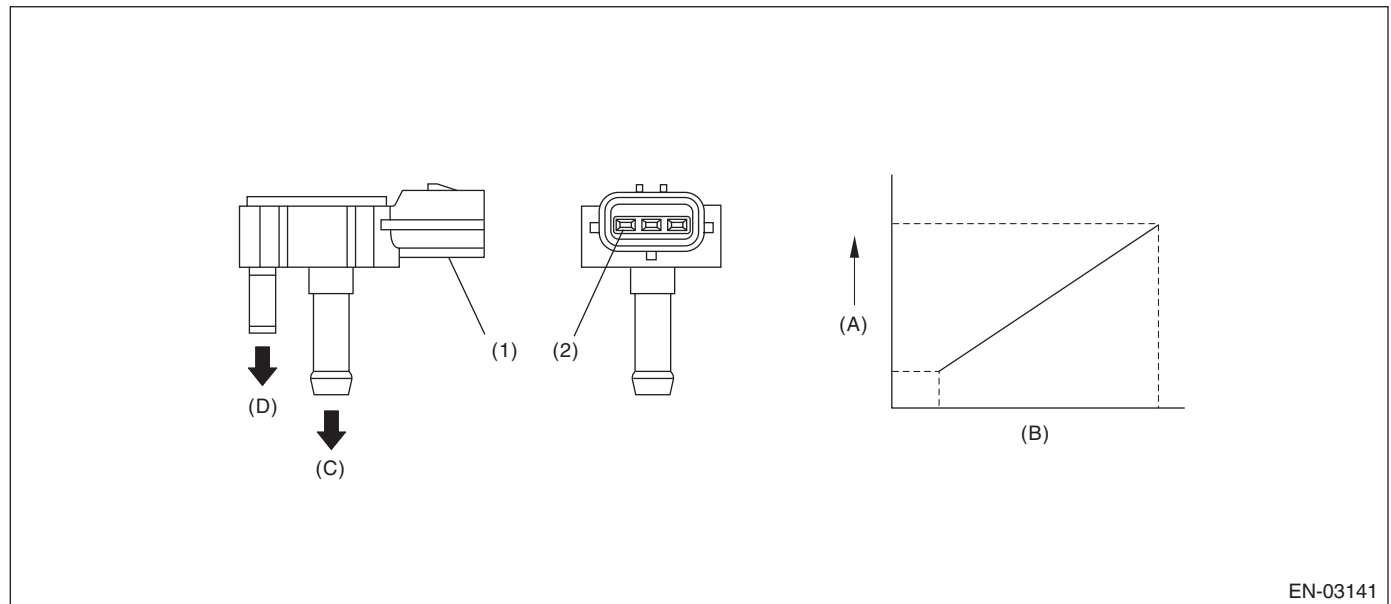
CI: DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR

1. OUTLINE OF DIAGNOSIS

Detect the tank pressure sensor output property abnormality.

Judge as NG when there is no pressure variation, which should exist in the tank, considering the engine status.

2. COMPONENT DESCRIPTION



EN-03141

(A) Output voltage

(C) To fuel tank

(D) To atmosphere

(B) Input voltage

(1) Connector

(2) Terminals

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	≥ 60 s
Fuel level	≥ 9.6 ℓ (2.54 US gal, 2.11 Imp gal)
Fuel temperature	< 35 °C (95 °F)
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)

4. GENERAL DRIVING CYCLE

- Perform the diagnosis continuously after 60 s have passed since the engine started.
- Pay attention to the fuel level and temperature.

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
Continuous time of 10000 ms or more with purge ON	Experienced
Continuous time of 10000 ms or more with purge OFF	Experienced
Number of times that the difference between the Max. fuel level every 60 s and Min. fuel level every 60 s is 2 ℓ (0.53 US gal, 0.44 Imp gal) or more (with enable condition established)	≥ 16 time(s)
Maximum – Minimum tank pressure (with enable condition completed)	< 0 kPa (0.375 mmHg, 0 inHg)
Maximum – Minimum fuel temperature (with enable condition completed)	≥ 7 °C (44.6 °F)

If the difference between the Max. fuel level every 60 s and Min. fuel level every 60 s is less than 2 ℓ (0.53 US gal, 0.44 Imp gal), extend 60 s and make judgment with the Max. and Min. values for the fuel level in 60 s × 2. 60 s If a difference does not appear, extend the time 60 s × 3, 60 s × 4, 60 s × 5 and continue the judgment. If the difference between the Max. fuel level every 60 s and Min. fuel level every 60 s is 2 ℓ (0.53 US gal, 0.44 Imp gal) or more, the diagnosis counter counts up.

Time Needed for Diagnosis: 60 s × 16 time(s) or more

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
Maximum - minimum tank pressure	≥ 0 kPa (0.375 mmHg, 0 inHg)

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

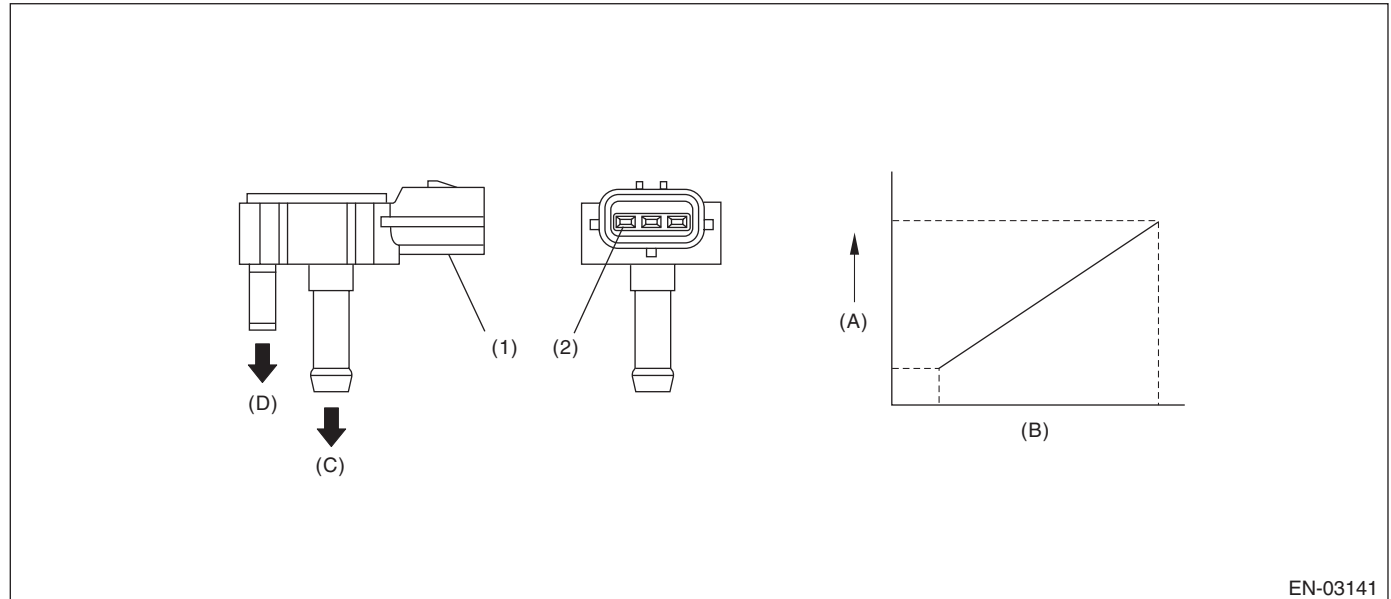
GENERAL DESCRIPTION

CJ:DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



EN-03141

(A) Output voltage

(C) To fuel tank

(D) To atmosphere

(B) Input voltage

(1) Connector

(2) Terminals

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
Fuel tank pressure	< -7.4 kPa (-55.6 mmHg, -2.2 inHg)
Battery voltage	≥ 10.9 V

Time Needed for Diagnosis: 15000 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
Fuel tank pressure	≥ -7.4 kPa (-55.6 mmHg, -2.2 inHg)
Battery voltage	≥ 10.9 V

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

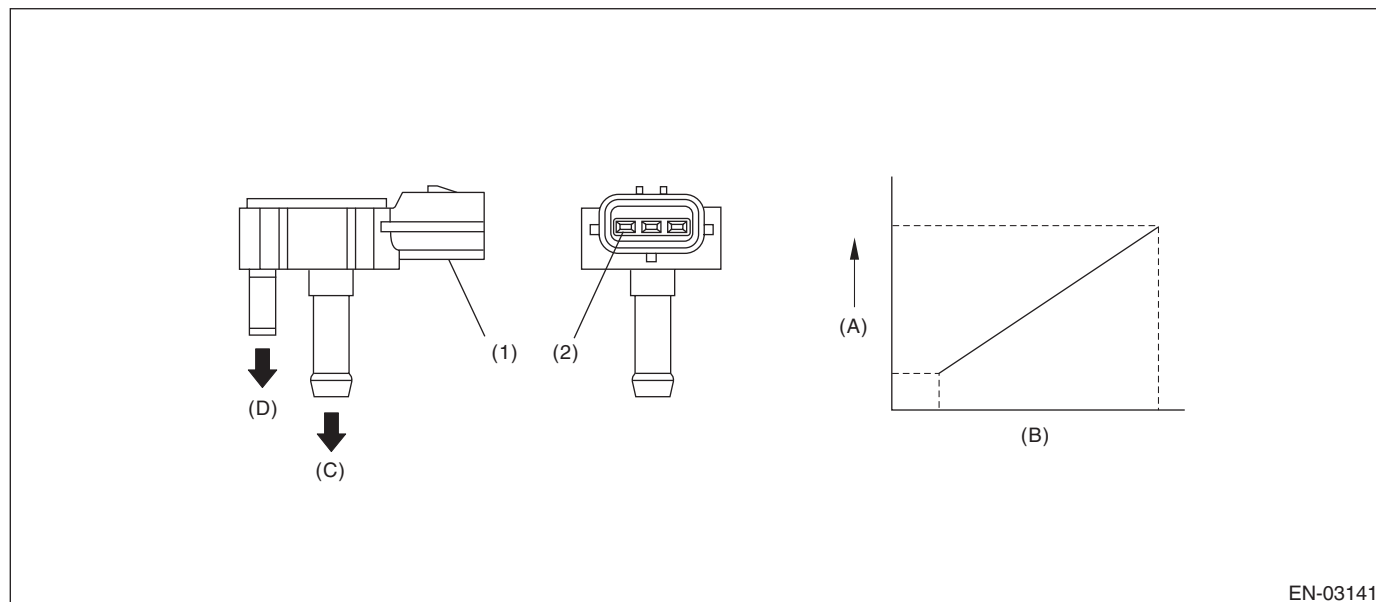
CK:DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the fuel tank pressure sensor.

Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) Output voltage

(C) To fuel tank

(D) To atmosphere

(B) Input voltage

(1) Connector

(2) Terminals

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Time needed for all secondary parameters to be in enable conditions	≥ 5000 ms
Vehicle speed	≥ 2 km/h (1.2 MPH)
All conditions of EVAP canister purge	Completed
Learning value of evaporation gas concentration (left and right)	< 0.08
Main feedback compensation coefficient (left and right)	≥ 0.9
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis when purging enable conditions are met without idling.

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
Fuel tank pressure	≥ 7.9 kPa (59.6 mmHg, 2.3 inHg)
Fuel temperature	< 35 °C (95 °F)
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)

Time Needed for Diagnosis: 15000 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
Fuel tank pressure	< 7.9 kPa (59.6 mmHg, 2.3 inHg)

Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0442. <Ref. to GD(H6DO)-115, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CM:DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0442. <Ref. to GD(H6DO)-115, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

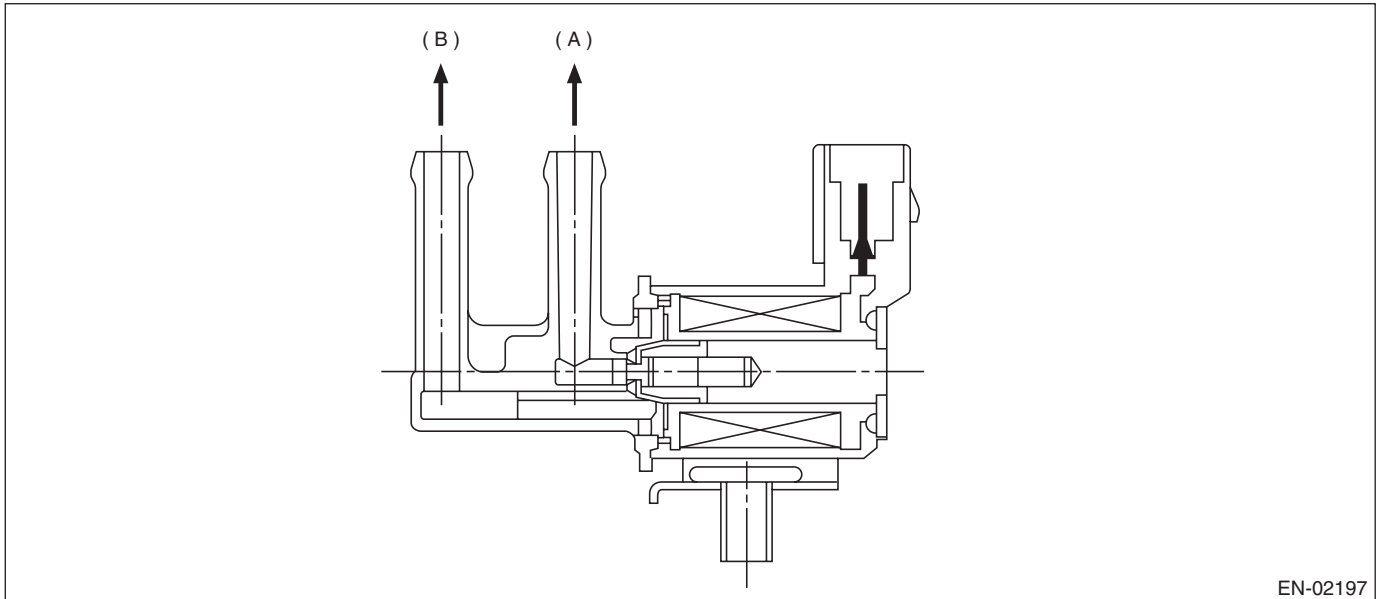
CN:DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW

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



(A) To canister

(B) To intake manifold

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$
Elapsed time after starting the engine	$\geq 1 \text{ second}$

4. GENERAL DRIVING CYCLE

Always perform the diagnosis 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
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

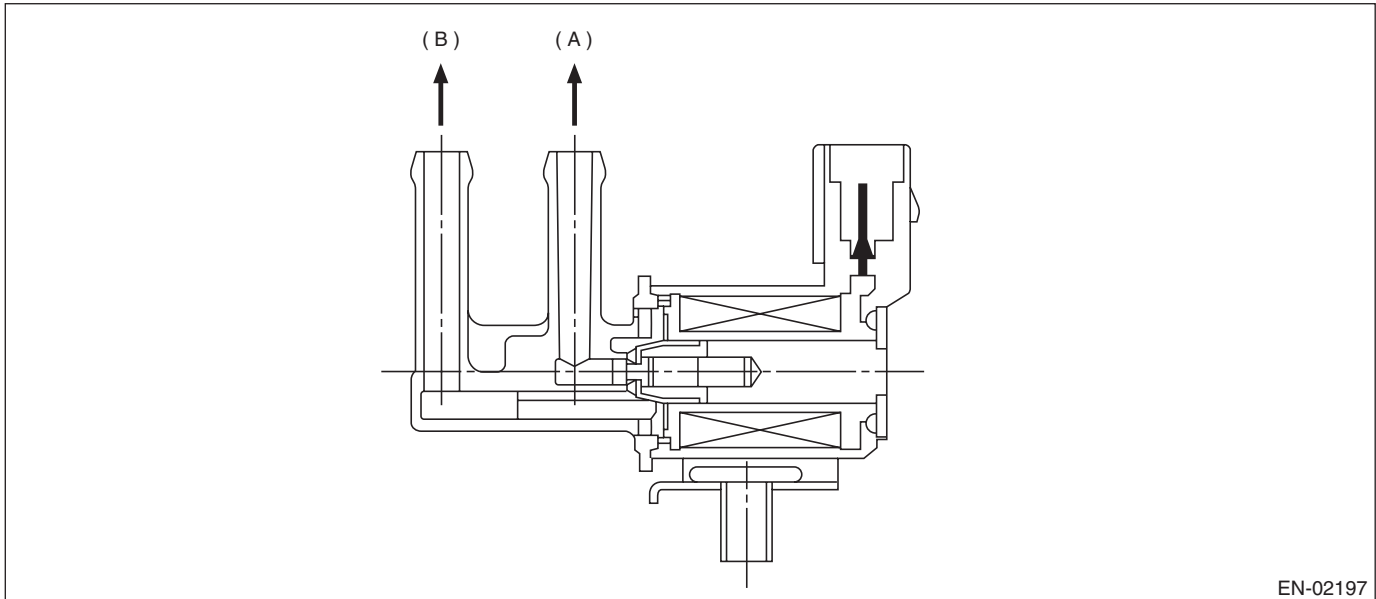
CO:DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH

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



(A) To canister

(B) To intake manifold

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$
Elapsed time after starting the engine	$\geq 1 \text{ second}$

4. GENERAL DRIVING CYCLE

Always perform the diagnosis 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
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

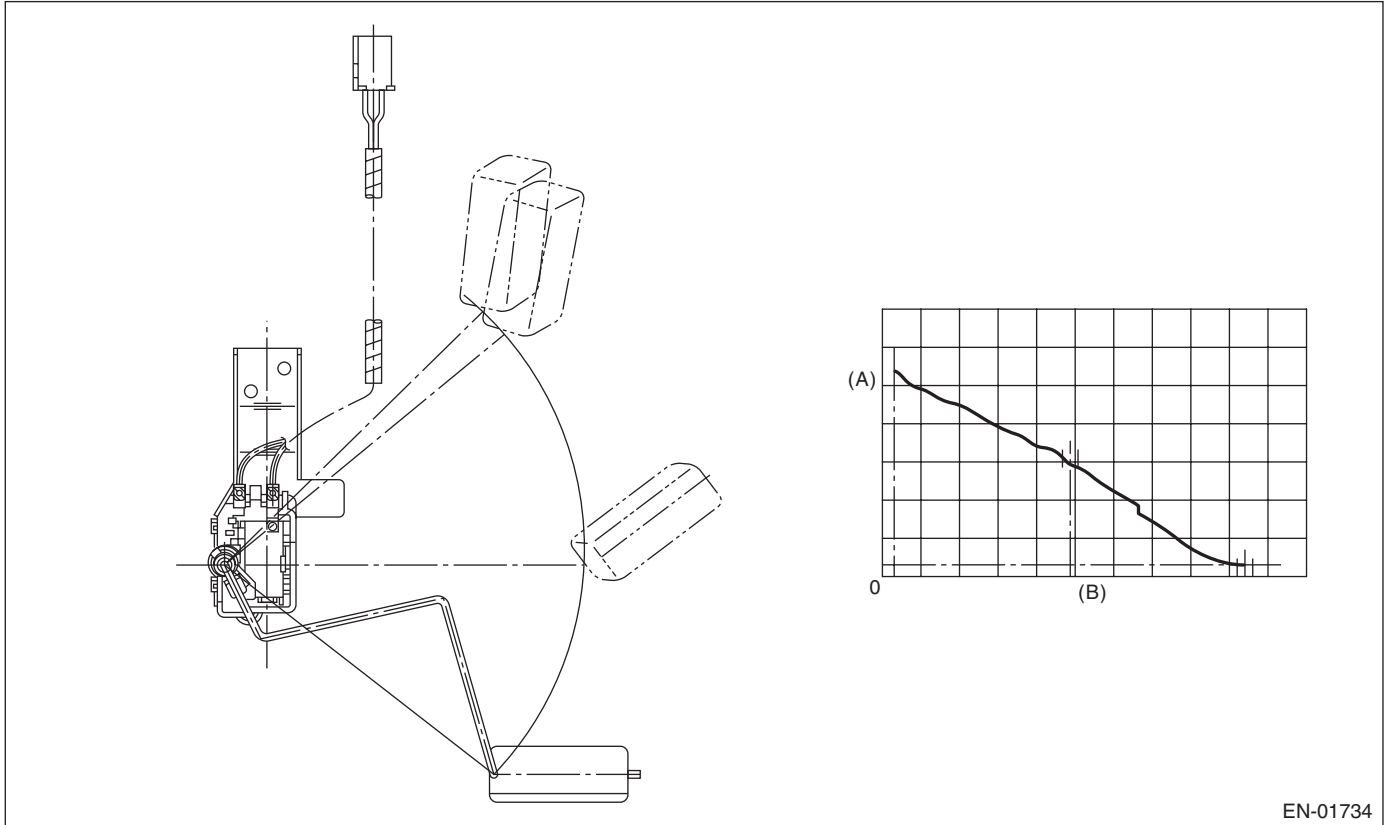
CP:DTC P0461 FUEL LEVEL SENSOR “A” CIRCUIT RANGE/PERFORMANCE

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



(A) Fuel level

(B) Resistance

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

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Accumulated amount of intake air	≥ 330957 g (11672.85 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	< 7000 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	≥ 330957 g (11672.85 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	< 7000 rpm
Elapsed time after starting the engine	≥ 5000 ms

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

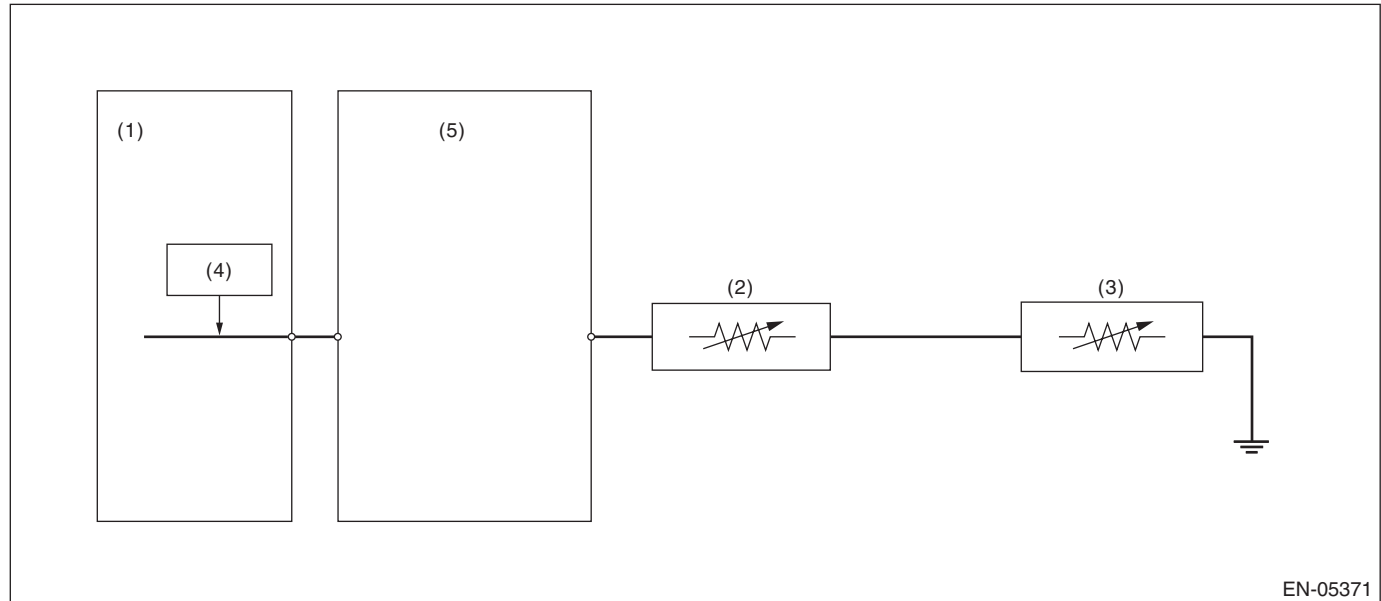
GENERAL DESCRIPTION

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

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



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

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	$\geq 10.9 \text{ V}$
Elapsed time after starting the engine	$\geq 3000 \text{ ms}$
Output voltage	$< 0.173 \text{ V}$

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	$\geq 0.173 \text{ V}$

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

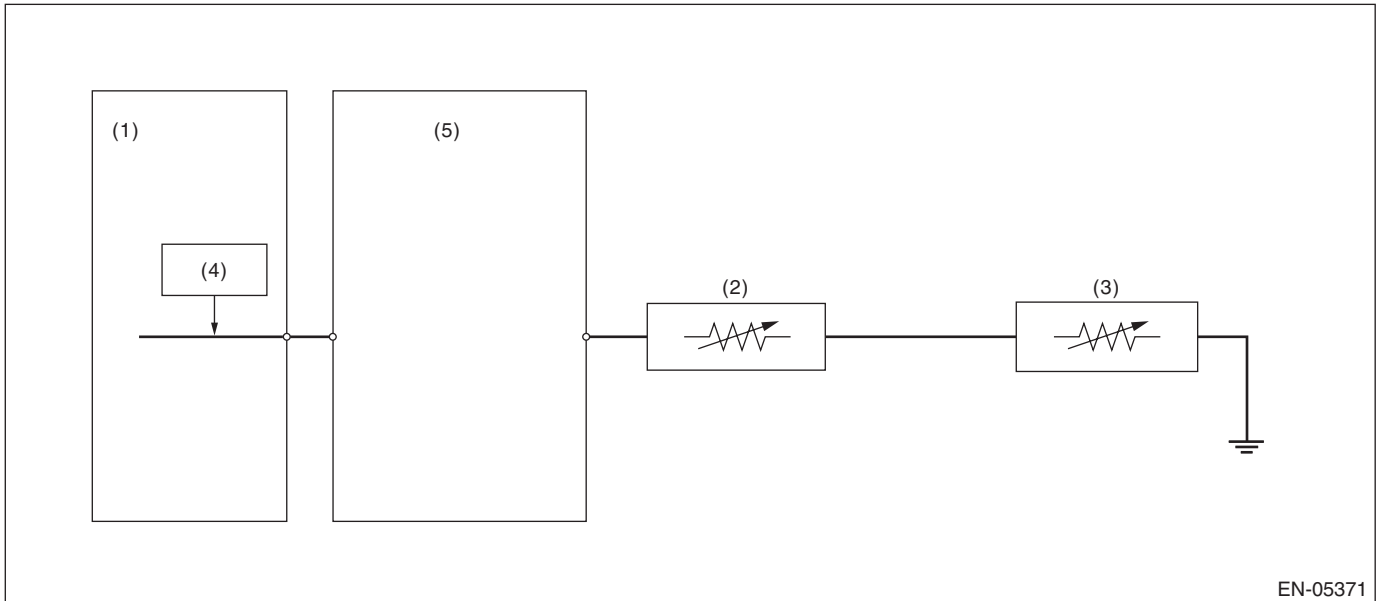
GENERAL DESCRIPTION

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

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



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

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	$\geq 10.9 \text{ V}$
Elapsed time after starting the engine	$\geq 3000 \text{ ms}$
Output voltage	$\geq 7.212 \text{ V}$

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	$< 7.212 \text{ V}$

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CS:DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT

1. OUTLINE OF DIAGNOSIS

Detect the unstable output faults from the fuel level sensor caused by noise. Judge as NG when the Max. value and cumulative value of output voltage variation of the fuel level sensor is larger than the threshold value.

2. ENABLE CONDITION

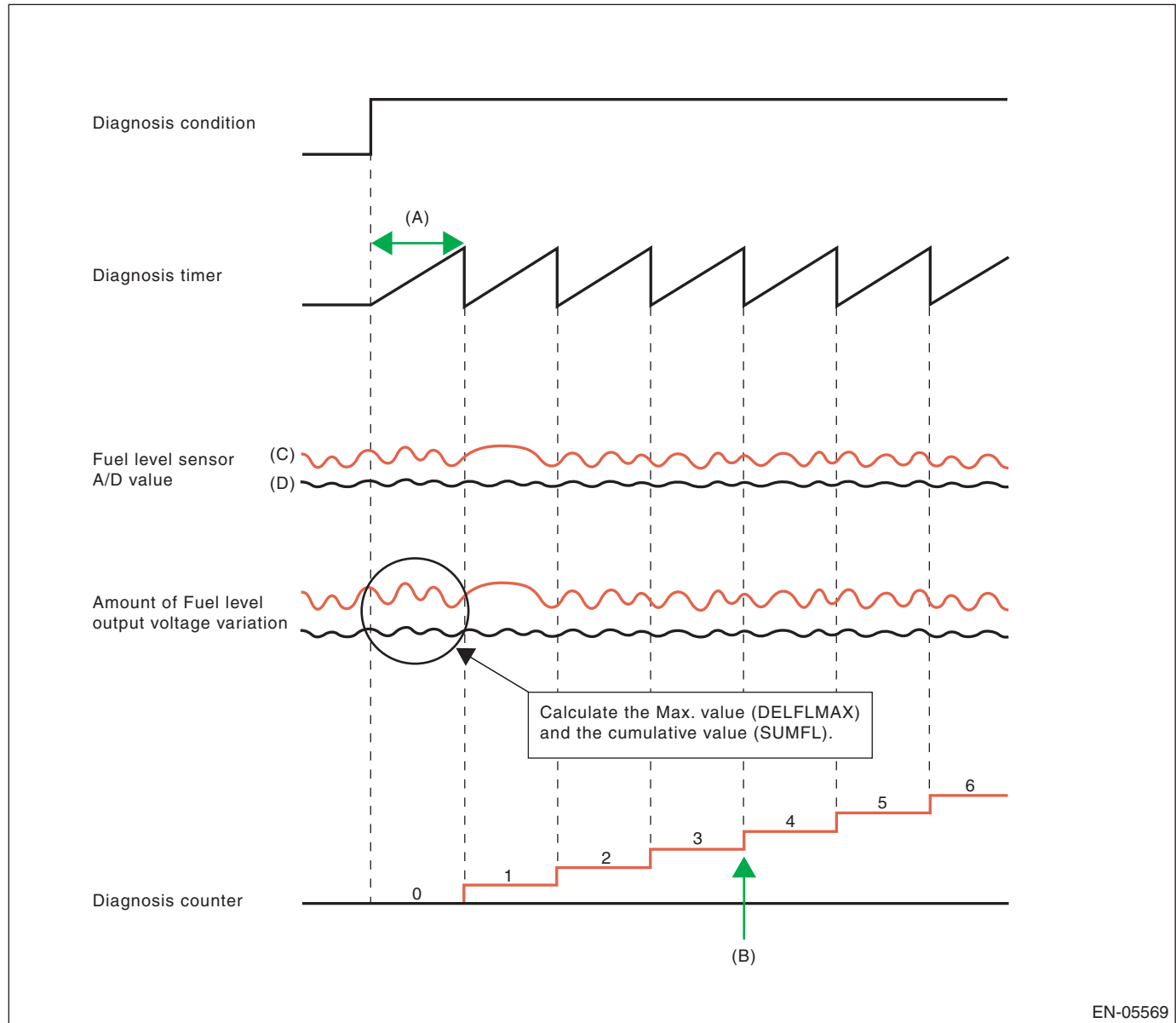
Malfunction Criteria	Threshold Value
Engine speed	≥ 500 rpm
Elapsed time after starting the engine	≥ 1 second
Battery voltage	≥ 10.9 V
Idle switch	ON
Fuel level	≥ 9.6 ℓ (2.54 US gal, 2.11 Imp gal) and < 54.4 ℓ (14.37 US gal, 11.97 Imp gal)
Vehicle speed = 0 km/h (0 MPH)	≥ 10000 ms

3. GENERAL DRIVING CYCLE

- Always perform the diagnosis continuously at idle speed.
- Pay attention to the fuel level.

4. DIAGNOSTIC METHOD

Calculate the Max. value (DELFLMAX) and cumulative value (SUMFL) of output voltage variation of fuel level sensor during 12.2 seconds. Judge it normal when both max. and cumulative values are not over the threshold value. Otherwise, when either of them is over the threshold value, the diagnosis counter counts up. Judge as NG if the counter indicated 4 time(s).



EN-05569

- (A) 12288 ms
(B) NG at 4 time(s) counts

(C) Malfunction

(D) Normal

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• 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
Integrated times of the condition reaching follows, DELFLMAX or SUMFL At this time, DELFLMAX: Maximum difference of sensor output for 12288 ms SUMFL: Integrated value of the sensor output deviation for 12288 ms	≥ 4 time(s) $\geq$ Value from Map ≥ 25.92 V

Map

Fuel level (ℓ , US gal, Imp gal)	0, 0, 0	10, 2.64, 2.2	20, 5.28, 4.4	30, 7.93, 6.6	40, 10.57, 8.8	50, 13.21, 11	60, 15.85, 13.2
Measured voltage (V)	0.27	0.27	0.426	0.582	0.738	0.894	0.894

The diagnosis counter does not count up when the following conditions are completed within 12288 ms.

Maximum value – minimum value of change of tank pressure during 12288 ms	≥ 0 kPa (0.375031 mmHg, 0 inHg)
Maximum value – minimum value of battery voltage during 12288 ms	≥ 1.2 V

Time Needed for Diagnosis: 12288 ms $\times$ 4 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
DELFLMAX SUMFL At this time, DELFLMAX: Maximum difference of sensor output for 12288 ms SUMFL: Integrated value of the sensor output deviation for 12288 ms	$<$ Value from Map < 25.92 V

Time Needed for Diagnosis: 12288 ms

CT:DTC P0500 VEHICLE SPEED SENSOR “A”**1. OUTLINE OF DIAGNOSIS**

Judge as NG when outside of the judgment value.

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

2. COMPONENT DESCRIPTION

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CU: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	≥ 75 °C (167 °F)
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Fuel level	≥ 9.6 ℓ (2.54 US gal, 2.11 Imp gal)
Elapsed time after starting the engine	≥ 10.49 s
Feedback of ISC	In operation
Lambda value (left and right)	≥ 0.9 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 value for ISC	Max.

Time Needed for Diagnosis: 10 s × 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

CV: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	$\geq 75^{\circ}\text{C}$ (167 °F)
Battery voltage	$\geq 10.9\text{ V}$
Barometric pressure	$\geq 75\text{ kPa}$ (563 mmHg, 22.2 inHg)
Fuel level	$\geq 9.6\text{ l}$ (2.54 US gal, 2.11 Imp gal)
Elapsed time after starting the engine	$\geq 10.49\text{ s}$
Feedback of ISC	In operation
Lambda value (left and right)	≥ 0.9 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 value 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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CW: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	$\geq 8 \text{ V}$

Time Needed for Diagnosis: 180000 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
Starter OFF signal	Detected
Battery voltage	$\geq 8 \text{ V}$

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CX: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.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of microcomputer (RAM).

If RAM is abnormal, judge as NG, and when it is normal, judge as OK.

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 into the RAM.	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 into the RAM.	The written value can be read.

Time Needed for Diagnosis: Less than 1 second

CZ: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.

GENERAL DESCRIPTION

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
(1) Battery voltage	$\geq 6\text{ V}$
(2) Ignition switch	ON
(2) Battery voltage	$\geq 6\text{ V}$
(3) Ignition switch	ON
(3) ETC control	Permission
(4) Ignition switch	ON
(4) Battery voltage	$\geq 6\text{ V}$
(5) Starter switch	OFF
(5) Battery voltage	$> 6\text{ V}$
(6) Ignition switch	ON
(6) Battery voltage	$\geq 10.9\text{ V}$

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 expected value match.
(2) Throttle position sensor 1 opening angle – (Throttle position sensor 1 opening angle after passing amplifier/4)	$< 3^\circ$
(3) Main CPU calculation result	The result and expected value match.
(4) standard voltage – read voltage value	$< 0.078125\text{ V}$
(5) EEPROM writing	Writing completed
(6) Communication between output ICs	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.

Diagnostic Trouble Code (DTC) Detecting Criteria

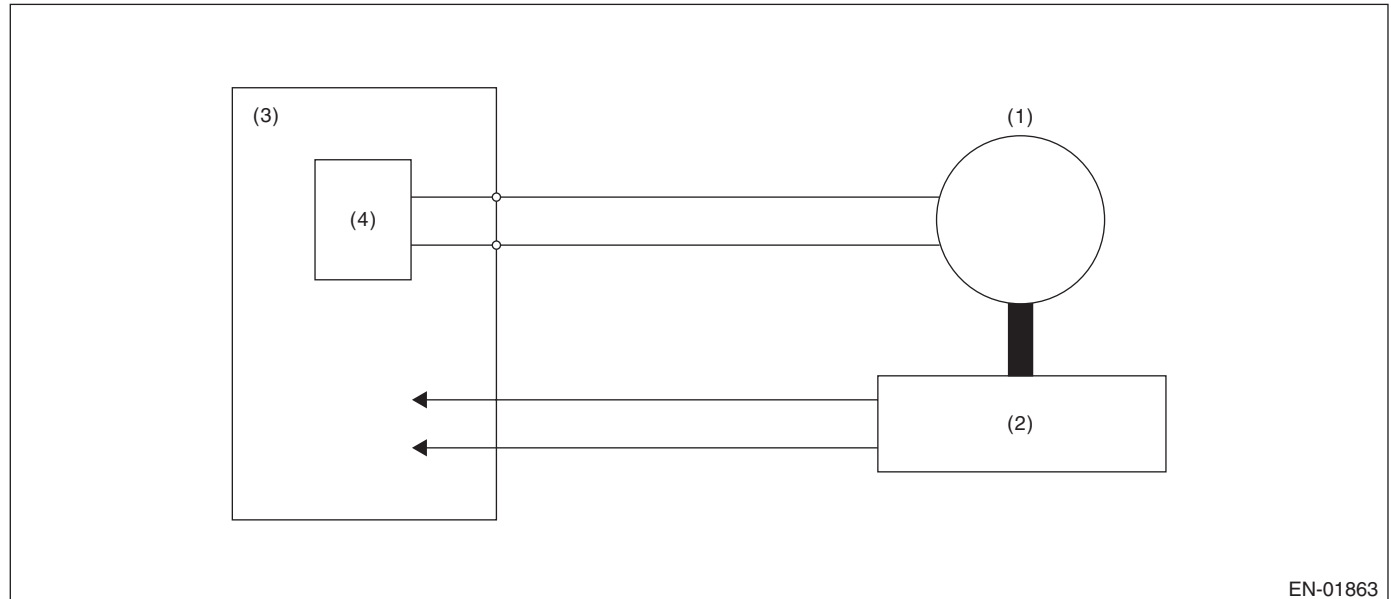
GENERAL DESCRIPTION

DB: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



- (1) Motor (3) Engine control module (ECM) (4) Drive circuit
(2) Throttle position sensor

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 OK range of Details of Judgment value
Output duty to drive circuit	< 95 %

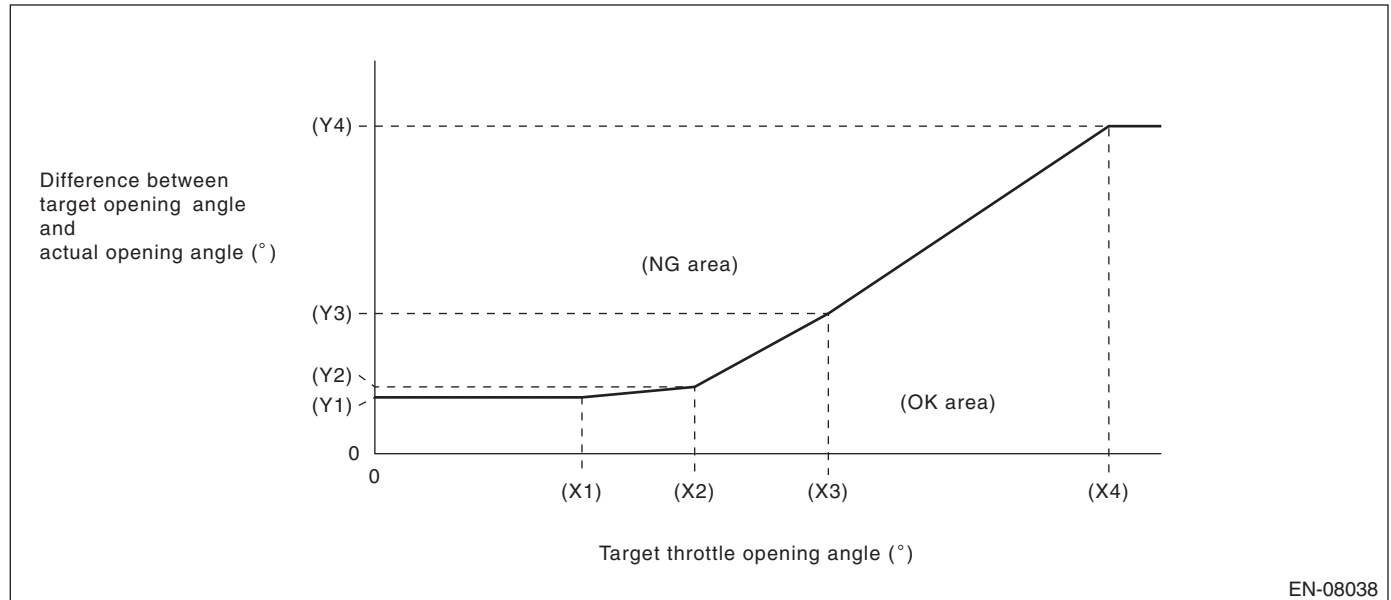
Time Needed for Diagnosis:

- Difference between target opening angle and actual opening angle:
 - NG judgment: See **Details of Judgment time**
 - OK judgment: 2000 ms
- Output duty to drive circuit: 2000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

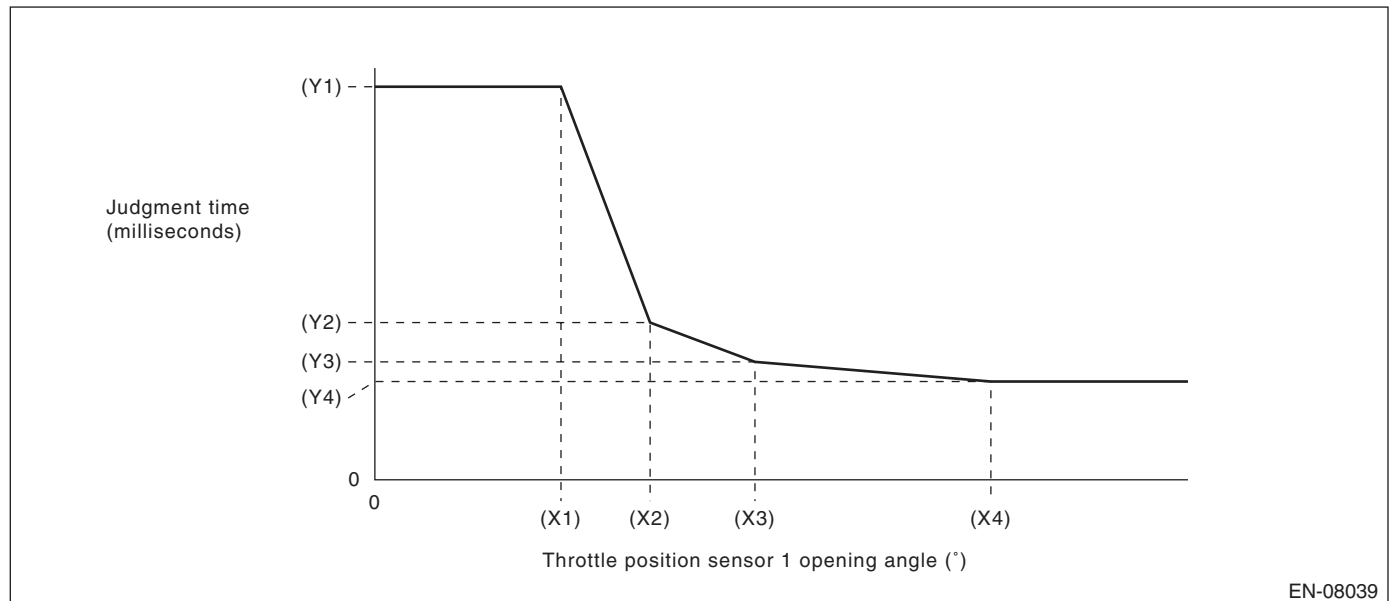
GENERAL DESCRIPTION

Details of Judgment Value



(X1) 7.9 °	(X2) 12.2 °	(X3) 17.3 °
(X4) 28 °		
(Y1) 4.3 °	(Y2) 5.1 °	(Y3) 10.7 °
(Y4) 25 °		

Details of Judgment time



(X1) 7.1 °	(X2) 10.5 °	(X3) 14.5 °
(X4) 23.5 °		
(Y1) 1000 ms	(Y2) 400 ms	(Y3) 300 ms
(Y4) 250 ms		

NOTE:

Judgment time when actual opening angle ≤ target opening angle is always 1000 milliseconds.

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

DC: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 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
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

DD:DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1)**1. OUTLINE OF DIAGNOSIS**

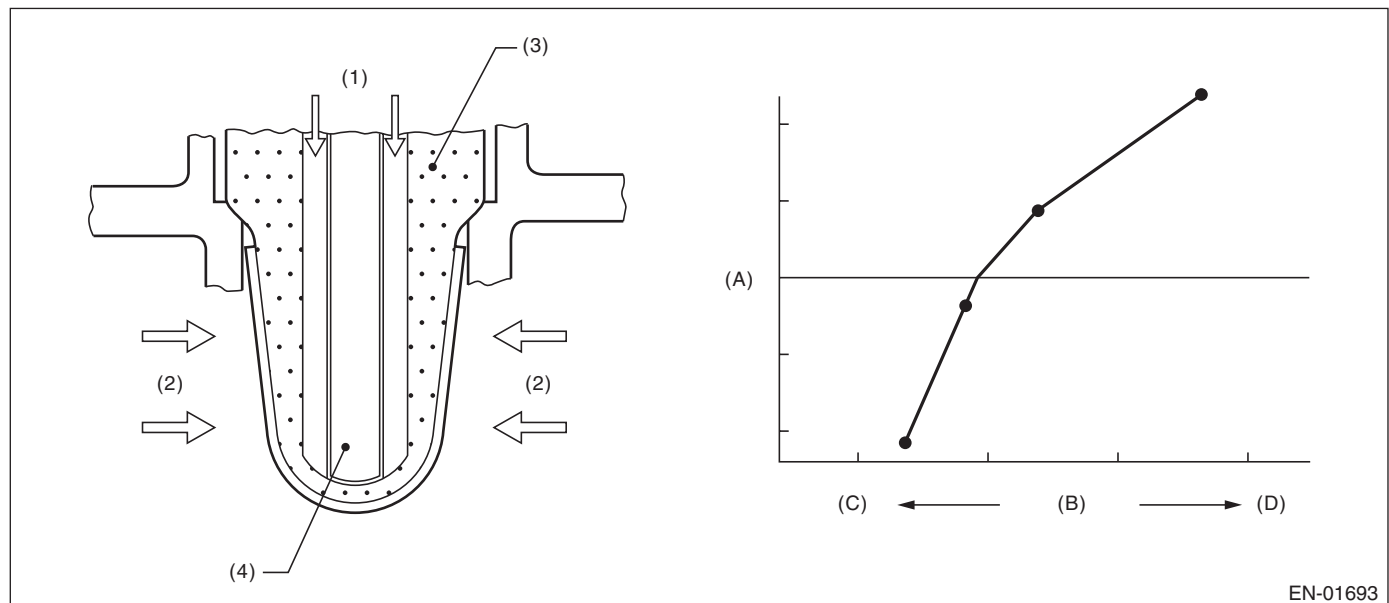
Detect that λ value remains low.

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

(A) Electromotive force

(B) Air fuel ratio

(1) Atmosphere

(2) Exhaust gas

(C) Lean

(3) ZrO_2

(D) Rich

(4) Ceramic heater

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
Barometric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Rear oxygen sensor sub feedback	Execution
Rear oxygen sensor output voltage – Feedback target voltage or Rear oxygen sensor sub feedback compensation coefficient or Rear oxygen sensor sub feedback compensation coefficient	-0.2 V — 0.1 V On Min. On Max.
Elapsed time after starting the engine	≥ 60000 ms
Engine coolant temperature	≥ 75 °C (167 °F)
Vehicle speed	≥ 20 km/h (12.4 MPH)
Amount of intake air	≥ 8 g/s (0.28 oz/s)
Load change at 120°CA	< 0.02 g/rev (0 oz/rev)
Front oxygen (A/F) sensor impedance	0Ω — 50Ω
Learning value of evaporation gas density	< 0.2
Total time of operating canister purge	≥ 19.9 s
Targeted lambda value load compensation coefficient	-0.05 — 0.050

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

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

1. OUTLINE OF DIAGNOSIS

Detect that λ value remains high.

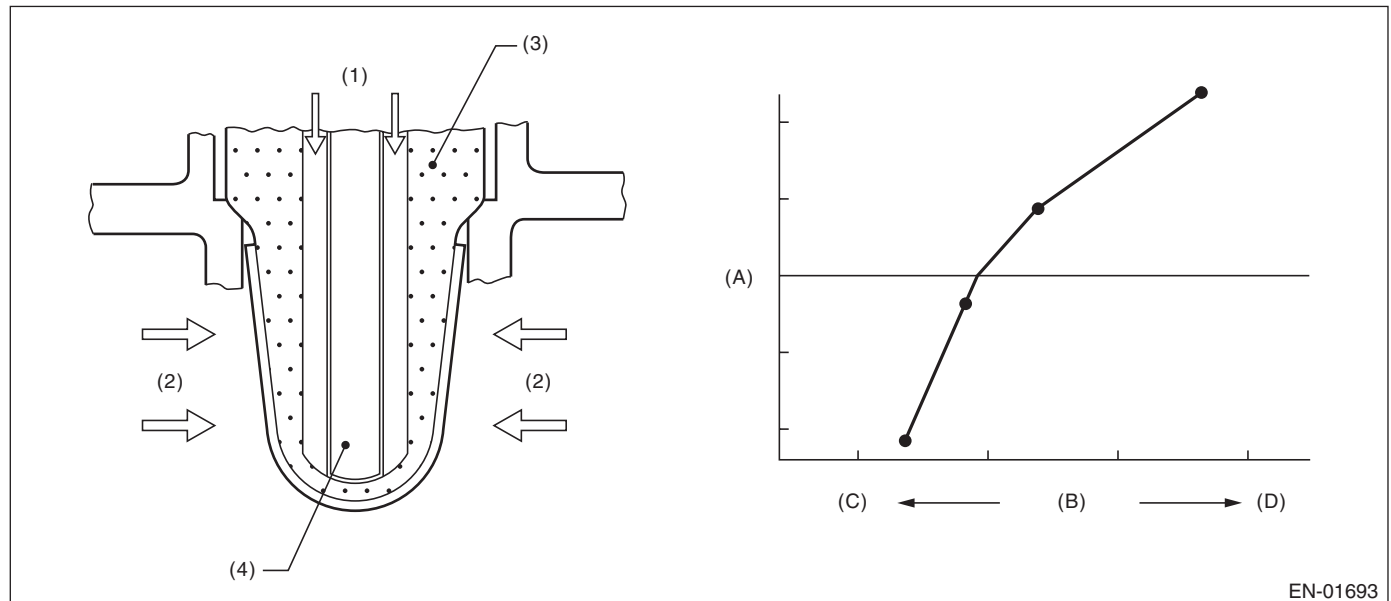
Judge as NG when lambda value is abnormal in accordance with λ value of front oxygen (A/F) sensor and running conditions such as vehicle speed, amount of intake air, engine coolant temperature, sub feedback control, etc.

λ value = Actual air fuel ratio/Theoretical air fuel ratio

$\lambda > 1$: Lean

$\lambda < 1$: Rich

2. COMPONENT DESCRIPTION



EN-01693

(A) Electromotive force

(B) Air fuel ratio

(C) Lean

(D) Rich

(1) Atmosphere

(2) Exhaust gas

(3) ZrO₂

(4) Ceramic heater

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
Barometric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Rear oxygen sensor sub feedback	Execution
Rear oxygen sensor output voltage – Feedback target voltage or Rear oxygen sensor sub feedback compensation coefficient or Rear oxygen sensor sub feedback compensation coefficient	-0.2 V — 0.1 V On Min. On Max.
Elapsed time after starting the engine	≥ 60000 ms
Engine coolant temperature	≥ 75 °C (167 °F)
Vehicle speed	≥ 20 km/h (12.4 MPH)
Amount of intake air	≥ 8 g/s (0.28 oz/s)
Load change at 120°C	< 0.02 g/rev (0 oz/rev)
Front oxygen (A/F) sensor impedance	0Ω — 50Ω
Learning value of evaporation gas density	< 0.2
Total time of operating canister purge	≥ 19.9 s
Targeted lambda value load compensation coefficient	-0.05 — 0.050

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

DF:DTC P1154 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK 2 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P1152. <Ref. to GD(H6DO)-163, DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

DG:DTC P1155 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK 2 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P1153. <Ref. to GD(H6DO)-165, DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

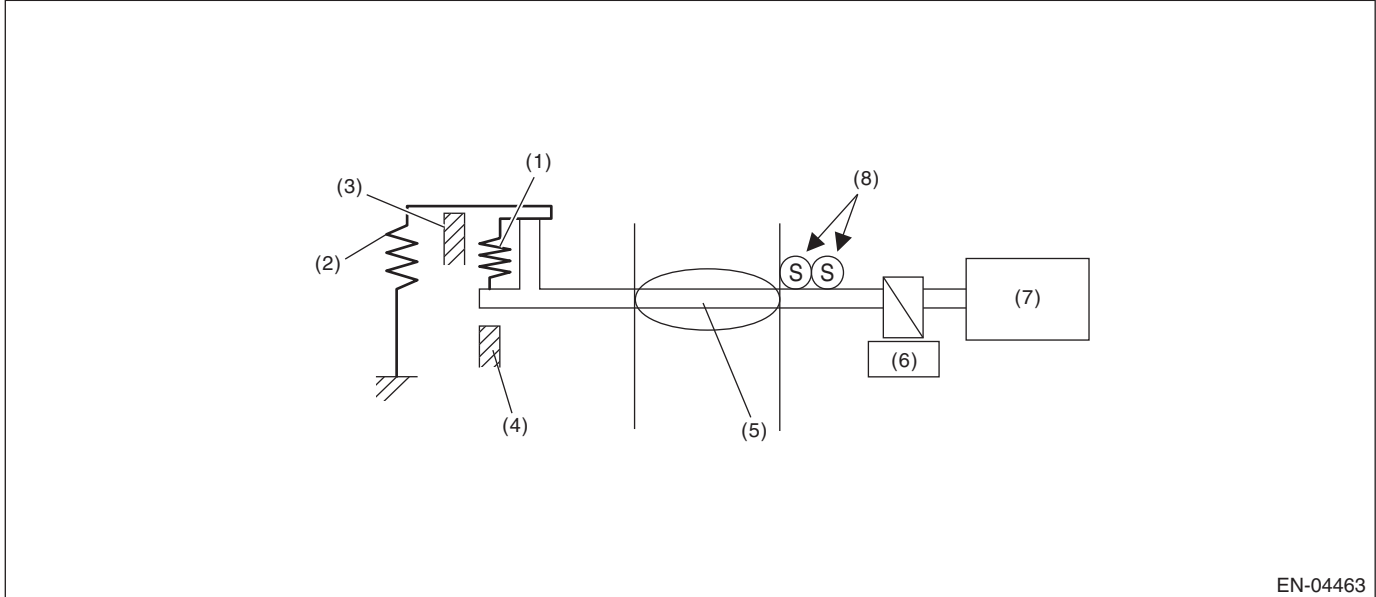
GENERAL DESCRIPTION

DH: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



- | | | |
|--------------------------|-------------------------|---|
| (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	$\geq 6 \text{ V}$
Throttle position sensor	Normal

4. GENERAL DRIVING CYCLE

- 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

Judge as NG when the following conditions are established.

Judgment Value

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

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	$\geq 2^{\circ}$

Time Needed for Diagnosis: 3400 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

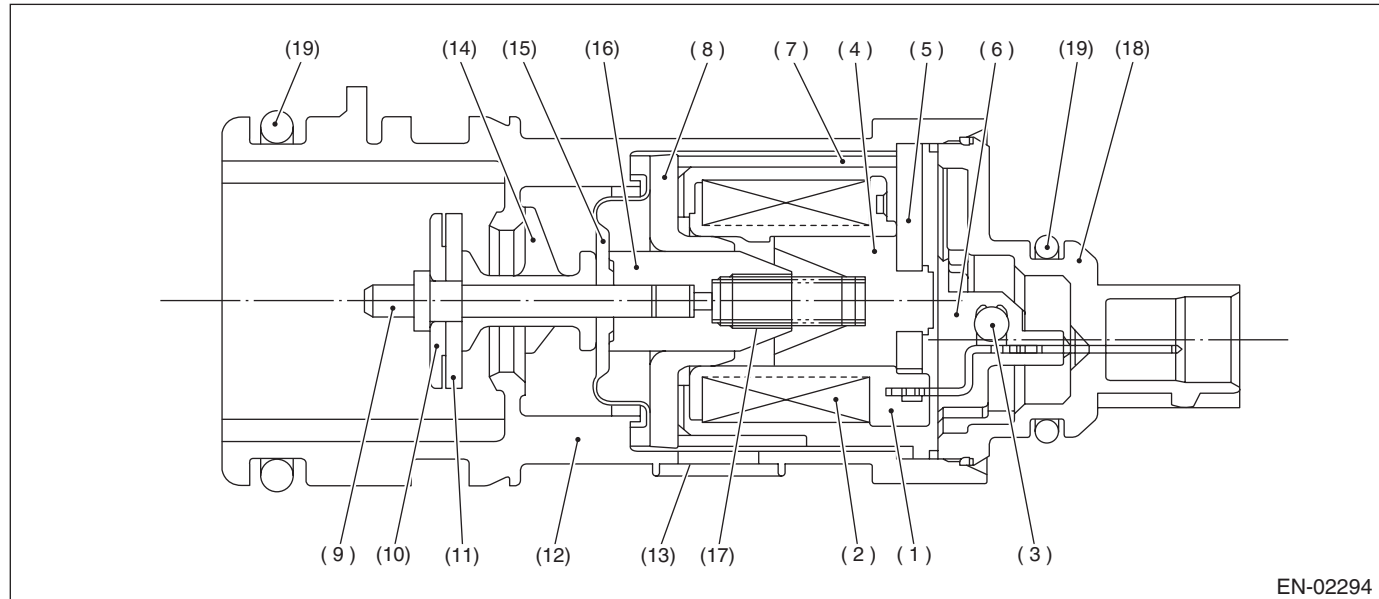
DI: DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM

1. OUTLINE OF DIAGNOSIS

Detect the abnormal function (stuck closed) of the drain valve.

Judge as NG when fuel tank pressure is low.

2. COMPONENT DESCRIPTION



- | | | |
|-----------------|--------------------|-------------------|
| (1) Bobbin | (8) Magnetic plate | (14) Retainer |
| (2) Coil | (9) Shaft | (15) Diaphragm |
| (3) Diode | (10) Plate | (16) Movable core |
| (4) Stator core | (11) Valve | (17) Spring |
| (5) End plate | (12) Housing | (18) Cover |
| (6) Body | (13) Filter | (19) O-ring |
| (7) Yoke | | |

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Drain valve	Open
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Tank pressure when starter is OFF → ON	-0.5 kPa (-4 mmHg, -0.2 inHg) and 0.4 kPa (2.9 mmHg, 0.1 inHg)

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
Fuel tank pressure	≤ -4 kPa (-30 mmHg, -1.2 inHg)

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
Fuel tank pressure	> -4 kPa (-30 mmHg, -1.2 inHg)
Cumulative time when all the malfunction criteria below are met.	≥ 30000 ms
Purge control solenoid valve duty	Not = 0
Fuel temperature	-10 °C (14 °F) — 70 °C (158 °F)
Intake manifold relative pressure	≥ -26.7 kPa (-200 mmHg, -7.9 inHg)

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

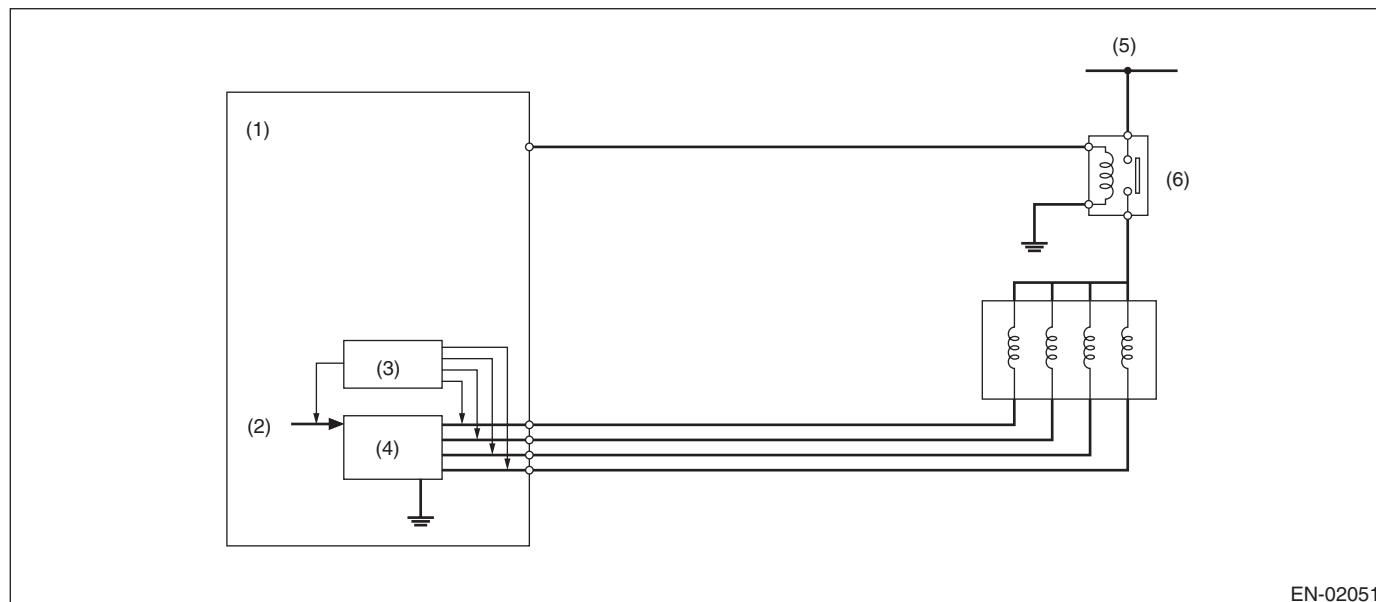
GENERAL DESCRIPTION

DJ: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



(1) Engine control module (ECM)

(2) Computer unit (CPU)

(3) Detecting circuit

(4) Switch circuit

(5) Battery voltage

(6) Main relay

3. ENABLE CONDITION

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 or Terminal voltage level when EGR operates	Low level

Time Needed for Diagnosis: 2500 ms

Malfunction Indicator Light: 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

Diagnostic Trouble Code (DTC) Detecting Criteria

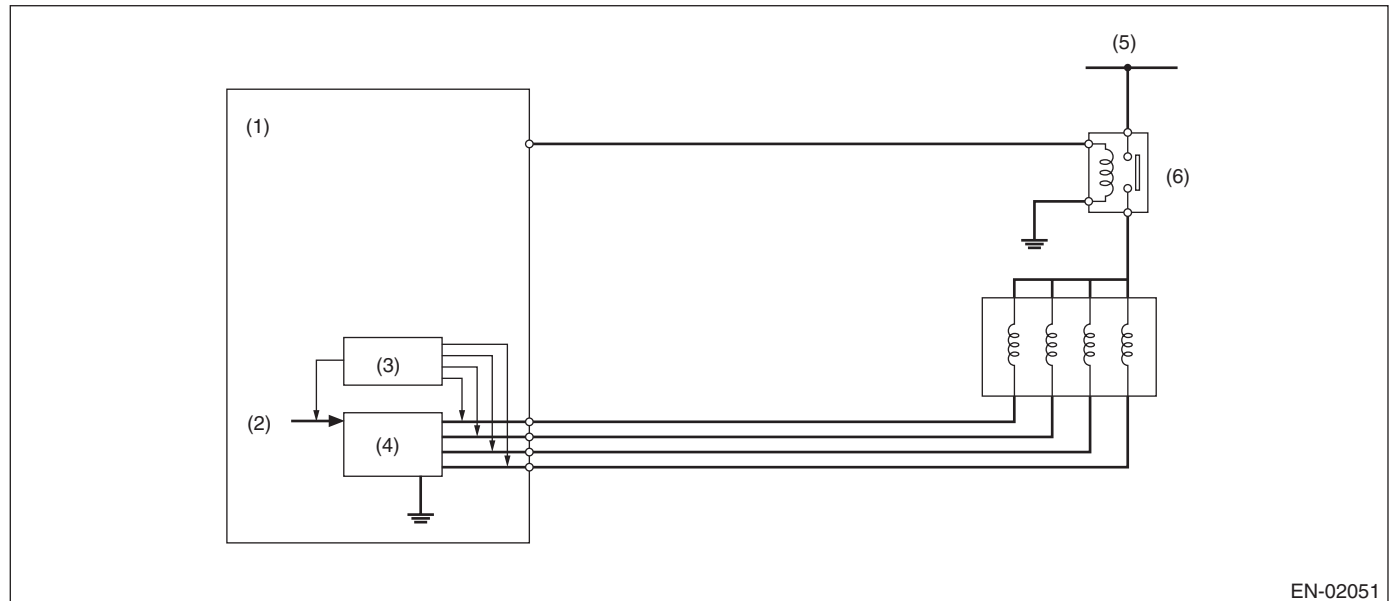
GENERAL DESCRIPTION

DK:DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT)

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



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

3. ENABLE CONDITION

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 OFF signal or Terminal voltage level when EGR operates	High level

Time Needed for Diagnosis: 2500 ms

Malfunction Indicator Light: 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	Low level
Terminal voltage level when EGR operates	Low level

Time Needed for Diagnosis: 256 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

DL: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(H6DO)-172, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

DM: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(H6DO)-174, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

DN: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(H6DO)-172, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

DO: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(H6DO)-174, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

DP: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(H6DO)-172, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

DQ: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(H6DO)-174, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

DR:DTC P1518 STARTER SWITCH CIRCUIT LOW INPUT**1. OUTLINE OF DIAGNOSIS**

Detect the open or short circuit of starter SW.

If the status becomes post engine start although the starter has not been turned to ON, judge as OFF NG.

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	Change from pre-start to post-start
Battery voltage	≥ 8 V

Time Needed for Diagnosis: Less than 1 second

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

• 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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

DS: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

DT:DTC P1570 ANTENNA

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H6DO)-155, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DU:DTC P1571 REFERENCE CODE INCOMPATIBILITY

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H6DO)-155, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

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

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H6DO)-155, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DW:DTC P1574 KEY COMMUNICATION FAILURE

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H6DO)-155, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DX:DTC P1576 EGI CONTROL MODULE EEPROM

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H6DO)-155, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DY:DTC P1577 IMM CONTROL MODULE EEPROM

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H6DO)-155, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DZ:DTC P1578 METER FAILURE

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H6DO)-155, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

EA:DTC P1602 CONTROL MODULE PROGRAMMING ERROR

1. OUTLINE OF DIAGNOSIS

Detect malfunctions of the catalyst advanced idling retard angle control.

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

Judge as NG if there is exhaust gas temperature diagnosis, idle speed diagnosis and final ignition timing diagnosis, and if any one of them 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 after terminating the retard angle control.

- Final ignition timing diagnosis

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

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Battery voltage	≥ 10.9 V
Cold start diagnosis	Incomplete
Vehicle speed	< 2 km/h (1.2 MPH)
Misfire in 200 engine revs.	< 5
Elapsed time after starting the engine	= 14 s

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 after engine starting within the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Estimated exhaust gas temperature	< Value from Map

Map

Coolant temperature after starting the engine	-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)
Estimated exhaust gas temperature	200 °C (392 °F)	200 °C (392 °F)	200 °C (392 °F)	225 °C (437 °F)	225 °C (437 °F)	220 °C (428 °F)	210 °C (410 °F)	200 °C (392 °F)	190 °C (374 °F)	190 °C (374 °F)

Time Needed for Diagnosis: 14 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
Estimated exhaust gas temperature	$\geq$ Value from Map

Time Needed for Diagnosis: Less than 1 second

• Idle speed diagnosis

Abnormality Judgment

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

Judgment Value

Malfunction Criteria	Threshold Value
Continuous time of (Target engine speed – Actual engine speed > -200 rpm)	≥ 6000 ms
Continuous time of (actual retard amount > 20 °CA)	≥ 0 ms

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
Continuous time of (Target engine speed – Actual engine speed > -200 rpm)	< 6000 ms
Continuous time of (actual retard amount > 20 °CA)	< 0 ms

Time Needed for Diagnosis: Less than 1 second

• Final ignition timing diagnosis

Abnormality Judgment

Judge as NG when the following conditions are established with diagnosis enable conditions successful.

Judgment Value

Malfunction Criteria	Threshold Value
Duration time of (Standard ignition timing – Actual ignition timing ≤ 0 °CA)	> 5000 ms

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
Duration time of (Standard ignition timing – Actual ignition timing > 0 °CA)	> 5000 ms

Time Needed for Diagnosis: 5000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

EB:DTC P2088 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the oil flow control solenoid valve.

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	$\geq 10.9 \text{ V}$
Oil flow control solenoid valve control duty	$\geq 99.61 \%$
Oil control solenoid valve control present current	$< 0.306 \text{ A}$

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	$\geq 10.9 \text{ V}$
Target current value of the oil flow control solenoid valve	$\geq 0.14 \text{ A}$
Target current value of the oil flow control solenoid valve – oil flow control solenoid valve control current value	$< 0.08 \text{ A}$

Time Needed for Diagnosis: 2000 ms

EC:DTC P2089 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1)**1. OUTLINE OF DIAGNOSIS**

Detect open or short circuit of oil flow control solenoid valve.

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	$\geq 10.9 \text{ V}$
Oil flow control solenoid valve control duty	$< 0.39 \%$
Oil control solenoid valve control present current	$\geq 0.306 \text{ A}$

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	$\geq 10.9 \text{ V}$
Target current value of the oil flow control solenoid valve – Oil flow control solenoid valve control current value	$< 0.08 \text{ A}$

Time Needed for Diagnosis: 2000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

ED:DTC P2090 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect open circuit of the oil flow control solenoid valve.

Judge as open 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	$\geq 10.9 \text{ V}$
Oil flow control solenoid valve control duty	$\geq 99.61 \%$
Oil control solenoid valve control present current	$< 0.306 \text{ A}$

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	$\geq 10.9 \text{ V}$
Target current value of the oil flow control solenoid valve	$\geq 0.14 \text{ A}$
Target current value of the oil flow control solenoid valve – Oil flow control solenoid valve control current value	$< 0.08 \text{ A}$

Time Needed for Diagnosis: 2000 ms

EE:DTC P2091 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1)**1. OUTLINE OF DIAGNOSIS**

Detect short circuit of oil flow control solenoid valve.

Judge as short 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	$\geq 10.9 \text{ V}$
Oil flow control solenoid valve control duty	$< 0.39 \%$
Oil control solenoid valve control present current	$\geq 0.306 \text{ A}$

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	$\geq 10.9 \text{ V}$
Target current value of the oil flow control solenoid valve – Oil flow control solenoid valve control current value	$< 0.08 \text{ A}$

Time Needed for Diagnosis: 2000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

EF: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(H6DO)-182, DTC P2088 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

EG: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(H6DO)-183, DTC P2089 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

EH: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(H6DO)-184, DTC P2090 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

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

1. OUTLINE OF DIAGNOSIS

NOTE:

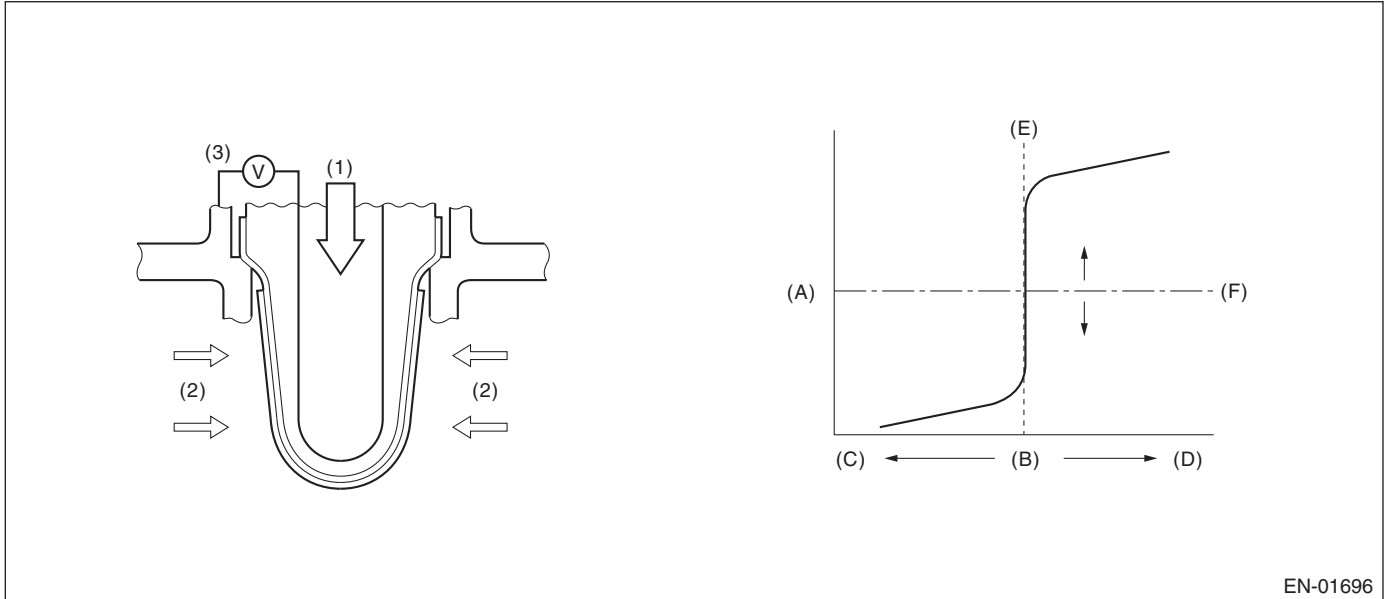
For the detection standard, refer to DTC P2091. <Ref. to GD(H6DO)-185, DTC P2091 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

EJ: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	Completed
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

Malfunction Criteria	Threshold Value
Sub feedback learning value	< -0.035

Time Needed for Diagnosis: $5 \text{ s} \times 1 \text{ time(s)}$

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
Sub feedback learning value	$\geq -0.035 + 0$

Time Needed for Diagnosis: 5 s

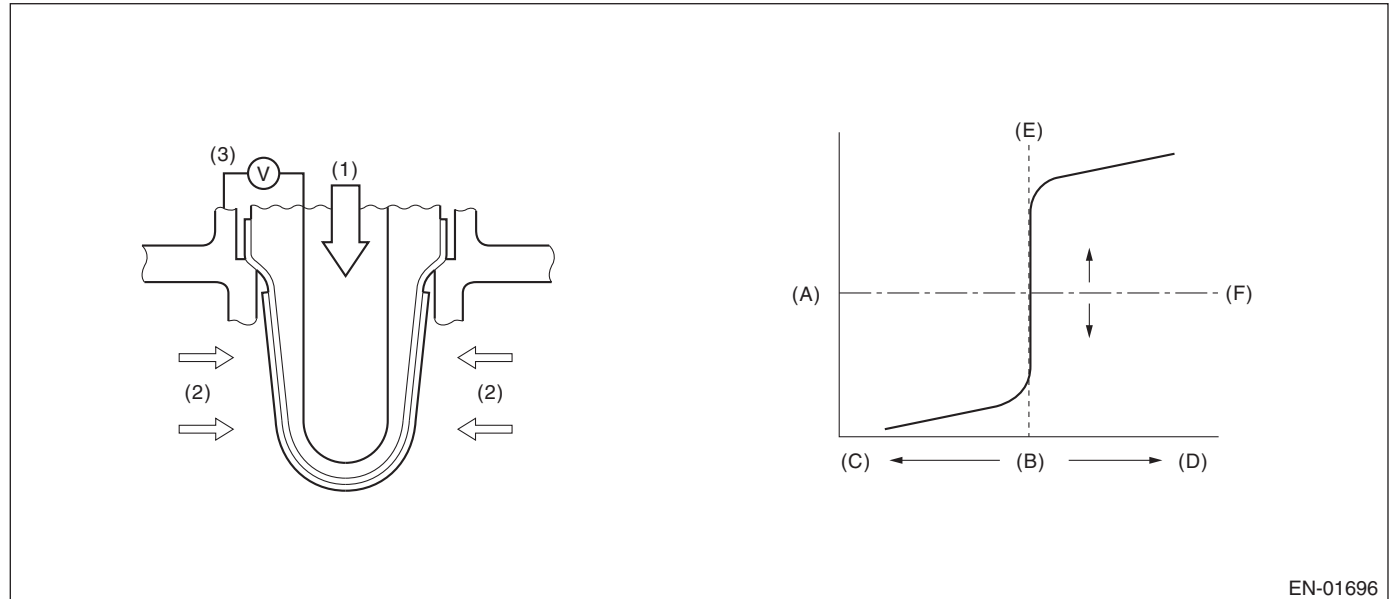
EK:DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH (BANK 1)

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	Completed
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

Malfunction Criteria	Threshold Value
Sub feedback learning value	≥ 0.031

Time Needed for Diagnosis: 5 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

Malfunction Criteria	Threshold Value
Sub feedback learning value	$< 0.031 + 0$

Time Needed for Diagnosis: 5 s

EL:DTC P2098 POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 2

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P2096. <Ref. to GD(H6DO)-187, DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

EM:DTC P2099 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 2

1. OUTLINE OF DIAGNOSIS

NOTE:

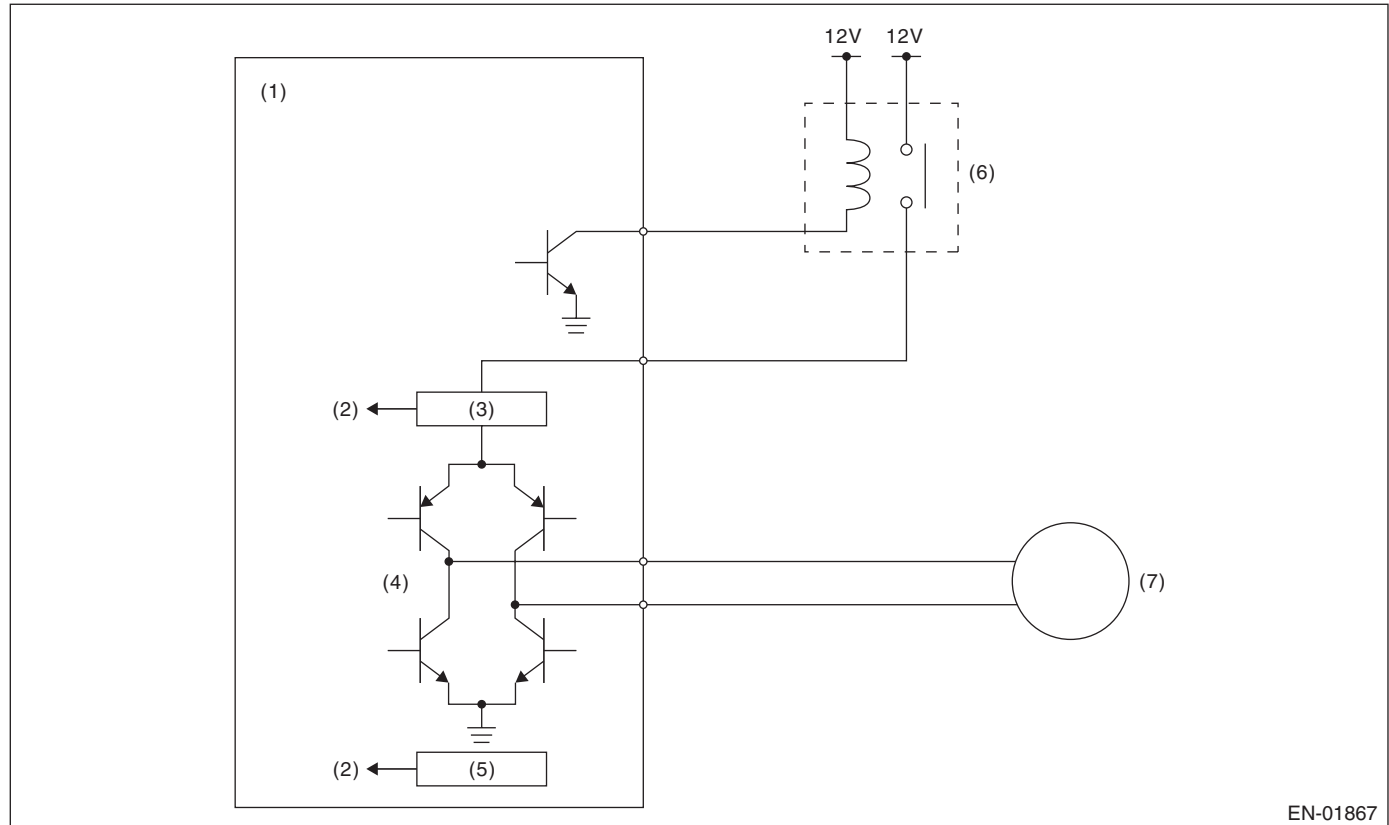
For the detection standard, refer to DTC P2097. <Ref. to GD(H6DO)-189, DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

EN: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



EN-01867

- | | | |
|-----------------------------------|-----------------------------------|---------------------------------------|
| (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

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

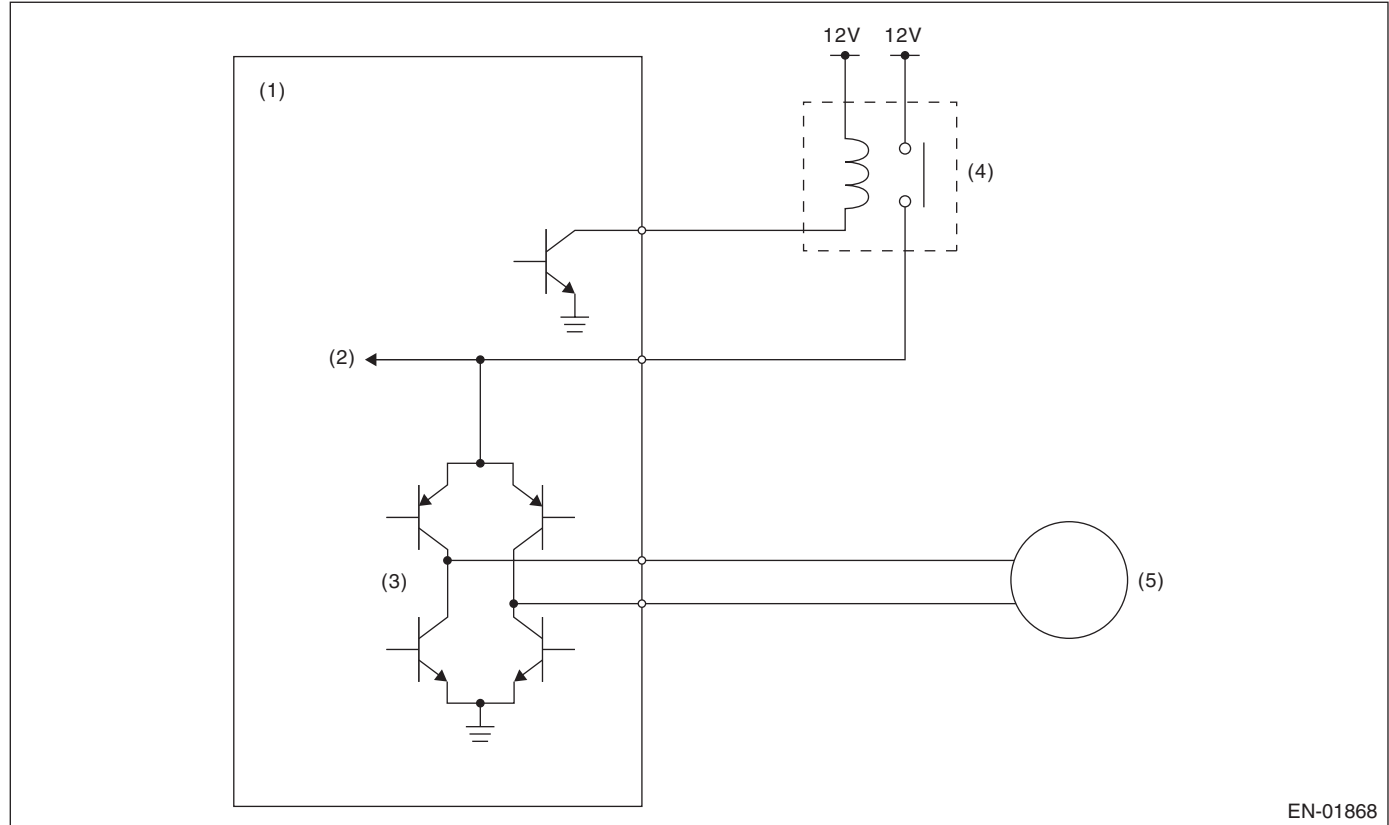
Time Needed for Diagnosis: 2000 ms

EO: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) | (3) Drive circuit | (5) Motor |
| (2) Voltage detection circuit | (4) Electronic throttle control relay | |

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 11 \text{ V}$
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	$\leq 5 \text{ V}$

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.

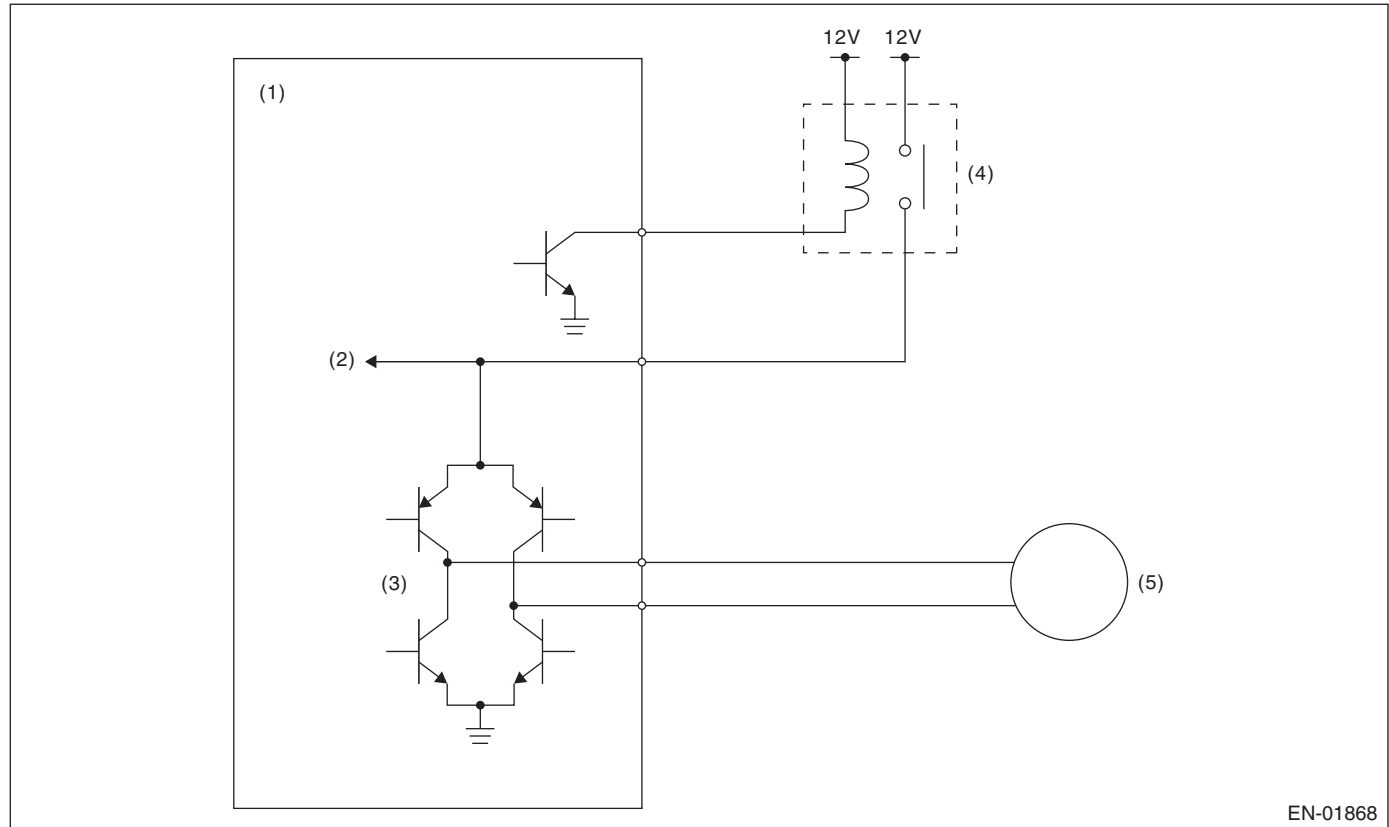
Judgment Value

Malfunction Criteria	Threshold Value
Motor power voltage	$> 5 \text{ V}$

Time Needed for Diagnosis: 2000 ms

EP: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)

(3) Drive circuit

(5) Motor

(2) Voltage detection circuit

(4) Electronic throttle control relay

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 6\text{ V}$
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	$\geq 5 \text{ V}$

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.

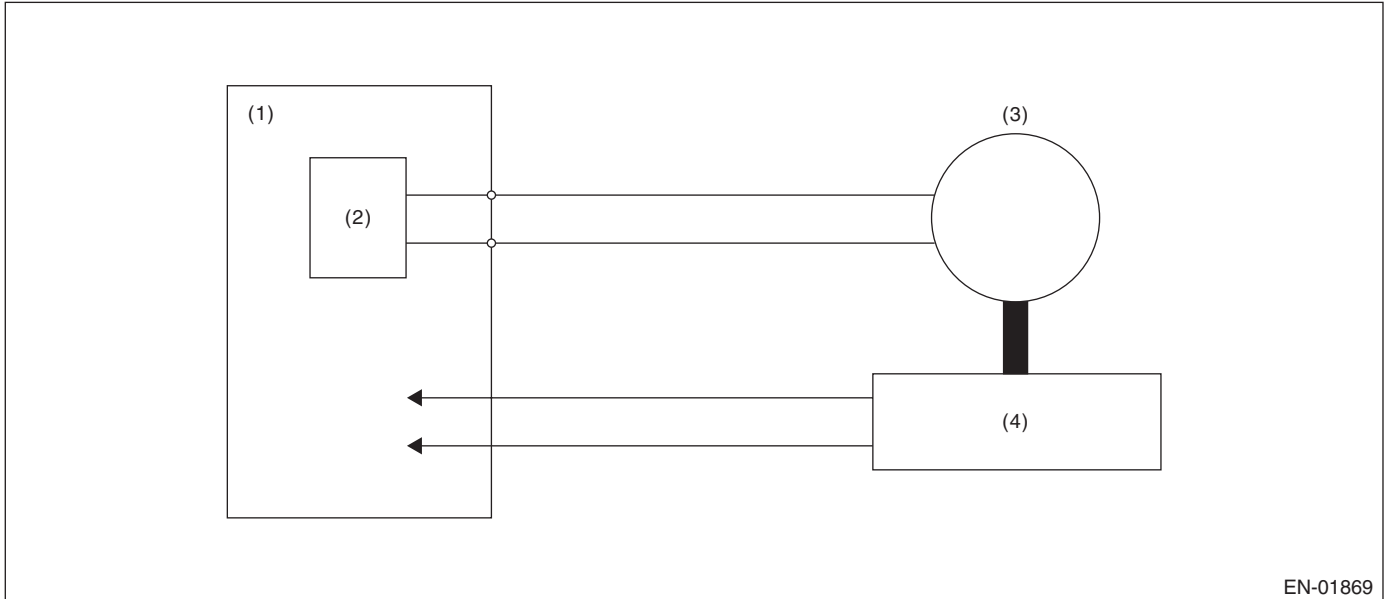
Judgment Value

Malfunction Criteria	Threshold Value
Motor power voltage	$< 5 \text{ V}$

Time Needed for Diagnosis: 400 ms

EQ:DTC P2109 THROTTLE/PEDAL POSITION SENSOR “A” MINIMUM STOP PERFORMANCE**1. OUTLINE OF DIAGNOSIS**

Judge as NG when full close point learning cannot conducted or abnormal value is detected.

2. COMPONENT DESCRIPTION

EN-01869

(1) Engine control module (ECM)

(3) Motor

(4) Throttle position sensor

(2) Drive circuit

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	< 10.384 ° or > 19.616 °
or Throttle opening angle when the ignition switch is ON – Throttle minimum stop position	< 0.887 °

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

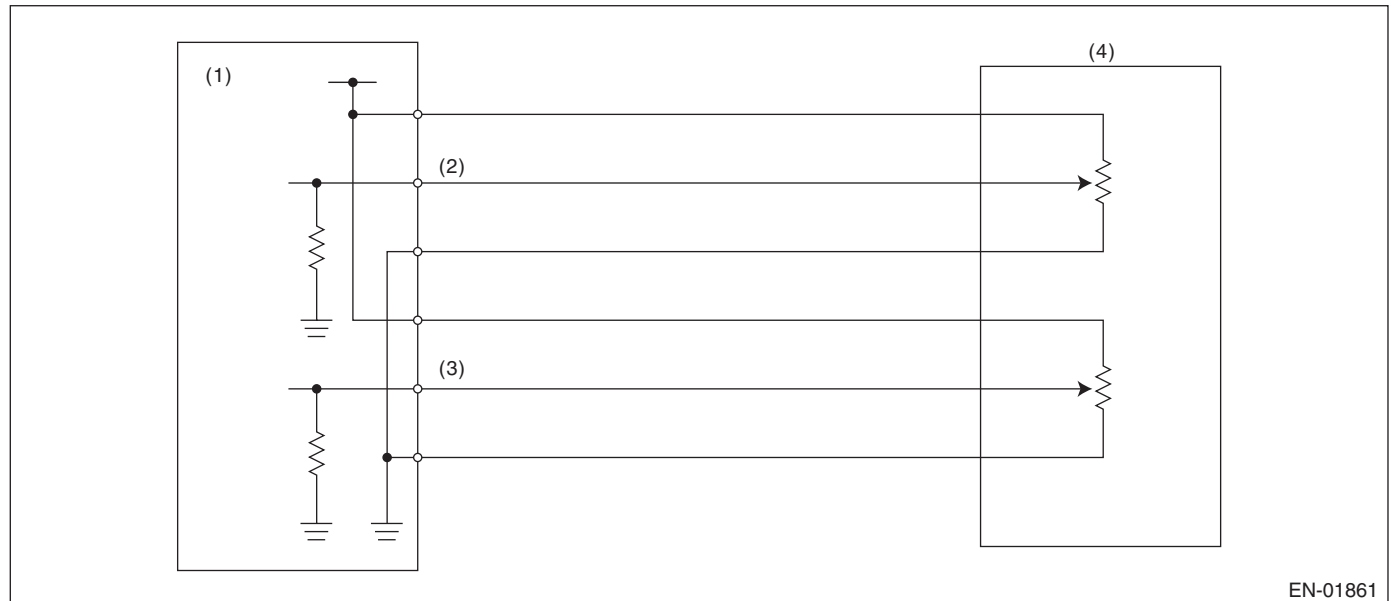
Malfunction Criteria	Threshold Value
Throttle sensor opening angle at full close point learning	≥ 10.384 ° and ≤ 19.616 °
Throttle opening angle when the ignition switch is ON – Throttle minimum stop position	≥ 0.887 °

Time Needed for Diagnosis: 8 ms

ER: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 2 signal
- (2) Accelerator pedal position sensor 1 signal

3. ENABLE CONDITION

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

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	< 0.217 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

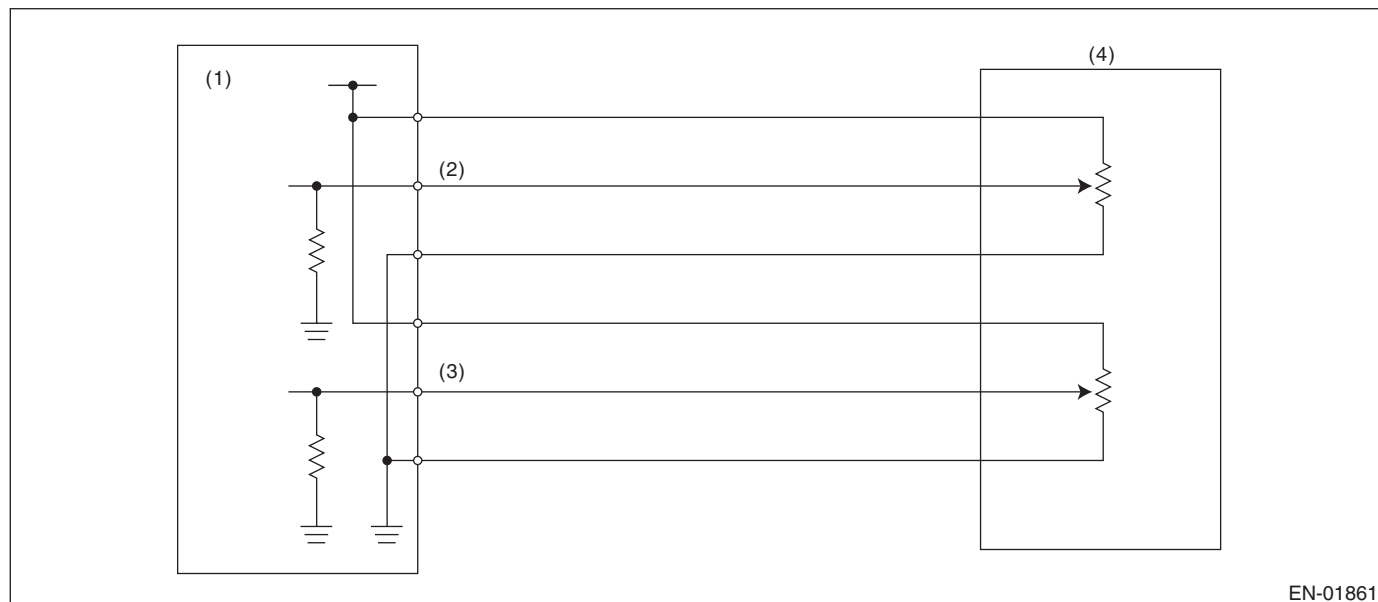
Malfunction Criteria	Threshold Value
Sensor 1 input voltage	≥ 0.217 V

Time Needed for Diagnosis: 100 ms

ES:DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT HIGH INPUT**1. OUTLINE OF DIAGNOSIS**

Detect the open or short circuit of accelerator pedal position sensor 1.

Judge as NG if out of specification.

2. COMPONENT DESCRIPTION

EN-01861

- (1) Engine control module (ECM) (3) Accelerator pedal position sensor 2 signal (4) Accelerator pedal position sensor 2 signal
- (2) Accelerator pedal position sensor 1 signal

3. ENABLE CONDITION

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

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

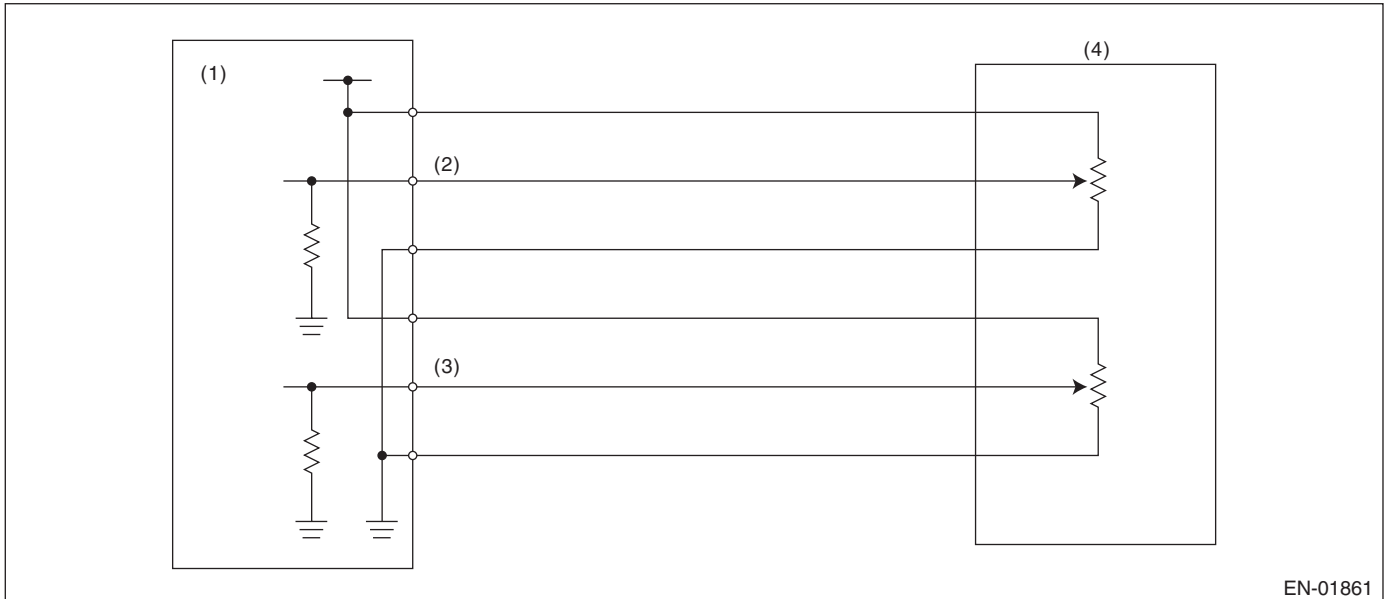
Malfunction Criteria	Threshold Value
Sensor 1 input voltage	$< 4.783 \text{ V}$

Time Needed for Diagnosis: 32 ms

**ET: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

(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	$\geq 6\text{ V}$

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	< 0.217 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

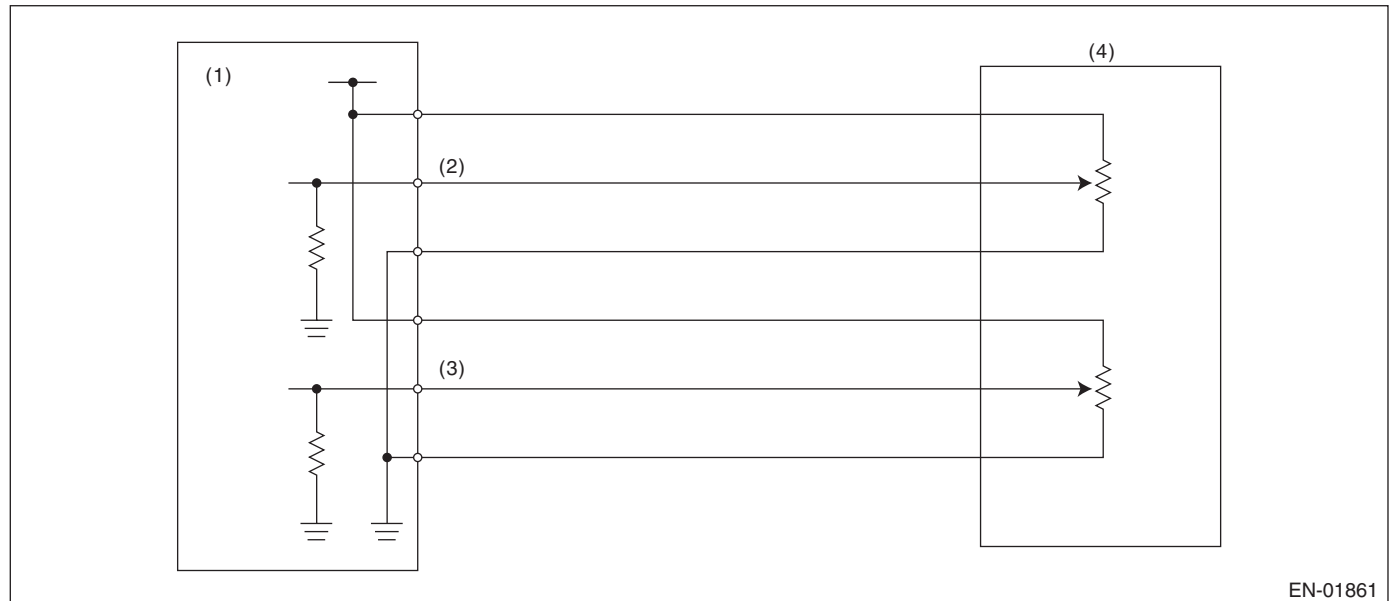
Malfunction Criteria	Threshold Value
Sensor 2 input voltage	≥ 0.217 V

Time Needed for Diagnosis: 100 ms

EU: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 signal
- (2) Accelerator pedal position sensor 1 signal

3. ENABLE CONDITION

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

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

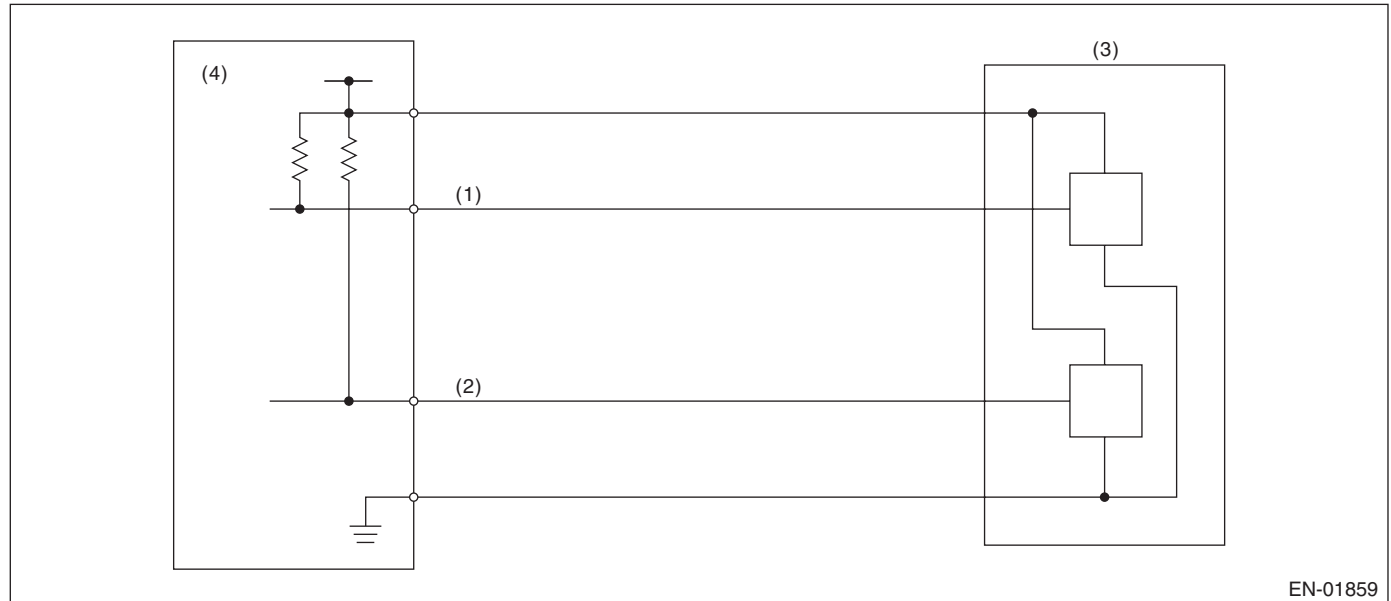
Time Needed for Diagnosis: 100 ms

EV:DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A”/“B” VOLT-AGE 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	$\geq 6 \text{ V}$

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

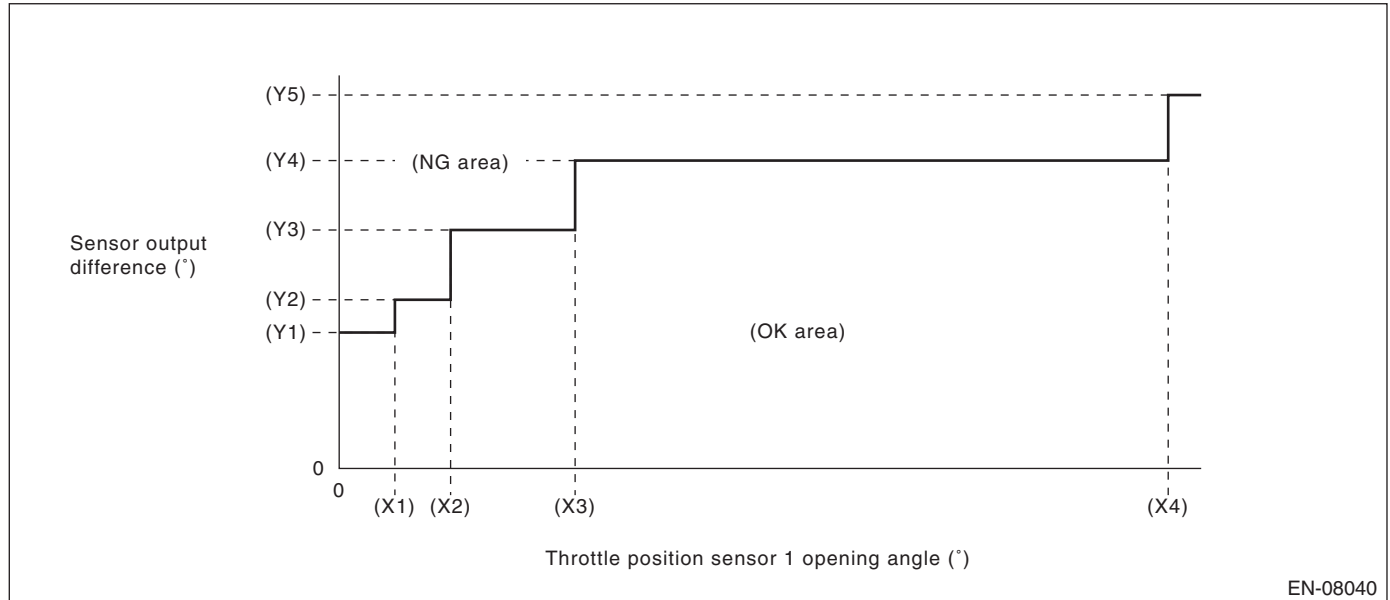
• Abnormality Judgment

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
Signal difference between two sensors	Within NG range of Details of Judgment value

Details of Judgment Value



(X1) 2.125 °	(X2) 4.25 °	(X3) 9 °
(X4) 31.625 °		
(Y1) 4.15 °	(Y2) 5.15 °	(Y3) 7.28 °
(Y4) 9.4 °	(Y5) 11.4 °	

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 OK range of Details of Judgment value

Time Needed for Diagnosis: 24 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

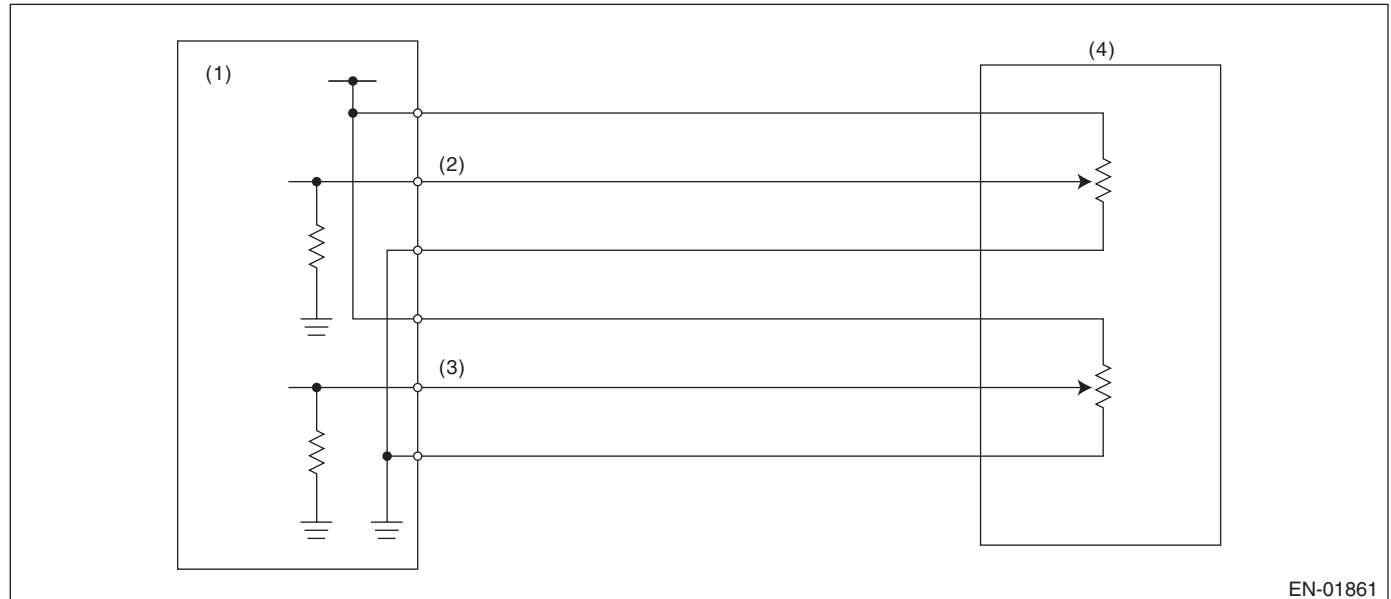
GENERAL DESCRIPTION

EW:DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLT-AGE CORRELATION

1. OUTLINE OF DIAGNOSIS

Judge as NG when the signal level of throttle position sensor 1 is different from the throttle position sensor 2.

2. COMPONENT DESCRIPTION



- (1) 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	$\geq 6\text{ V}$

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.

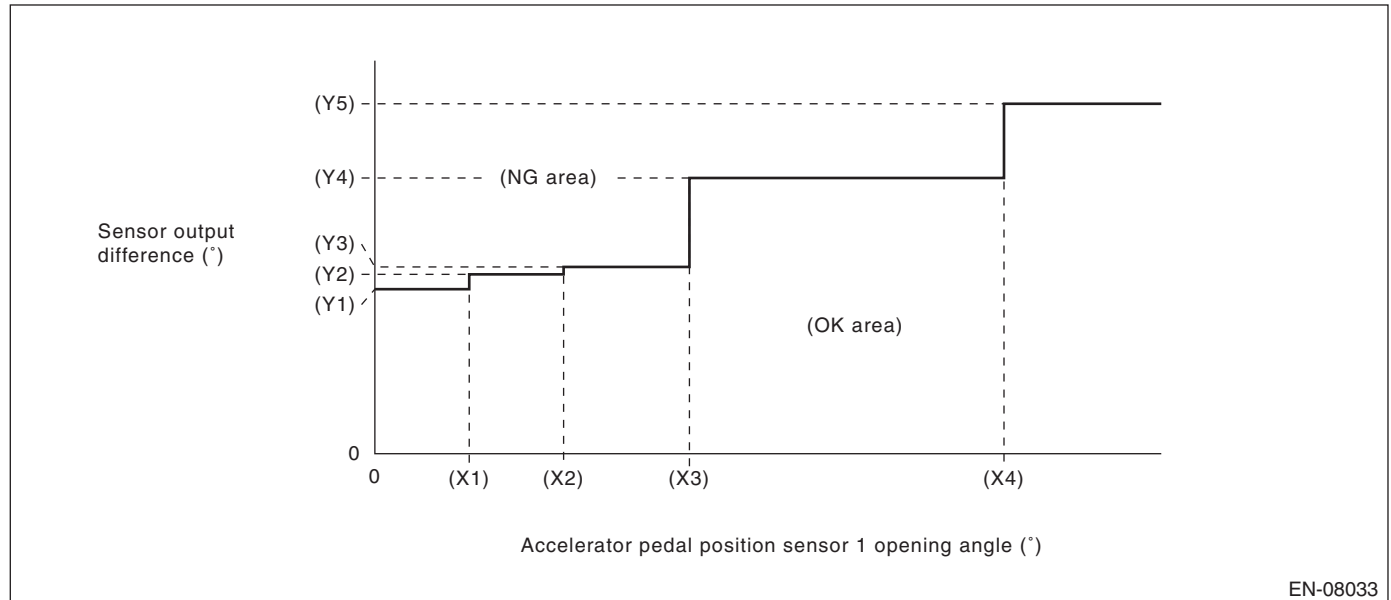
Judgment Value

Malfunction Criteria	Threshold Value
Signal difference between two sensors	Within NG range of Details of Judgment value

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Details of Judgment Value



(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 OK range of Details of Judgment value

Time Needed for Diagnosis: 116 ms

EX:DTC P2227 BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE**1. OUTLINE OF DIAGNOSIS**

Detect the malfunction of barometric pressure sensor output property.

Judge as NG when the barometric pressure sensor output is largely different from the intake manifold pressure at engine start.

2. COMPONENT DESCRIPTION

The barometric pressure sensor is built into the ECM.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	< 300 rpm
Vehicle speed	< 1 km/h (0.6 MPH)

4. GENERAL DRIVING CYCLE

Perform the diagnosis once at ignition switch ON.

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
Barometric pressure – Intake manifold pressure	≥ 26.7 kPa (200 mmHg, 7.9 inHg)
Intake manifold pressure at engine start – Intake manifold pressure	< 1.3 kPa (9.99 mmHg, 0.4 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
Barometric pressure – Intake manifold pressure	< 26.7 kPa (200 mmHg, 7.9 inHg)

Time Needed for Diagnosis: 262 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

EY:DTC P2228 BAROMETRIC PRESSURE CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of the barometric pressure sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION

The barometric pressure sensor is built into the ECM.

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	< 1.707 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	≥ 1.707 V

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

EZ:DTC P2229 BAROMETRIC PRESSURE CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of the barometric pressure sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION

The barometric pressure sensor is built into the ECM.

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	≥ 4.234 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	< 4.234 V

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

FA:DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION

1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.

When CAN communications is not possible, and CAN communications with TCM, VDC CM and body integrated unit is not possible, judge as NG if data from the TCM, VDC CM and body integrated unit are not normal.

2. COMPONENT DESCRIPTION

ECM, TCM, VDC CM and body integrated unit are connected by high speed CAN.

(Common Specifications)

CAN Protocol 2.0 B (Active)

Frame Format: 11 Bit ID Frame (Standard Frame)

(High speed CAN)

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)
or	
ID received from control module connected to driving system CAN	None during 500 milliseconds
or	
Data updated from control module connected to driving system CAN	None during 2000 milliseconds

Time Needed for Diagnosis: 2 seconds

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

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
Battery voltage	> 10.9 V
Starter switch	OFF
Engine	run
bus off flag or error warning flag	clear (No error)
ID received from control module connected to driving system CAN	Yes
Data updated from control module connected to driving system CAN	Yes

Time Needed for Diagnosis: 1000 ms

FB:DTC U0101 CAN (TCU) DATA NOT LOADED

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC U0073. <Ref. to GD(H6DO)-214, DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

FC:DTC U0122 CAN (VDC) DATA NOT LOADED

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC U0073. <Ref. to GD(H6DO)-214, DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

FD:DTC U0140 CAN (BCU) DATA NOT LOADED

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC U0073. <Ref. to GD(H6DO)-214, DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

FE:DTC U0402 CAN (TCU) DATA ABNORMAL

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC U0073. <Ref. to GD(H6DO)-214, DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

FF:DTC U0416 CAN (VDC) DATA ABNORMAL

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC U0073. <Ref. to GD(H6DO)-214, DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

FG:DTC U0422 CAN (BCU) DATA ABNORMAL

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC U0073. <Ref. to GD(H6DO)-214, DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

TRANSMISSION SECTION

CONTROL SYSTEMS	CS
AUTOMATIC TRANSMISSION	5AT
AUTOMATIC TRANSMISSION (DIAGNOSTICS)	5AT(diag)

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

	Page
1. General Description	2
2. AT Shift Lock Control System	5
3. Select Lever	19
4. Select Cable	26
5. AT Shift Lock Solenoid and "P" Range Switch	29
6. Body Integrated Unit	32
7. General Diagnostic Table	33