

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

2. Diagnostic Trouble Code (DTC) Detecting Criteria

A: DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/ PERFORMANCE (BANK 1)

1. OUTLINE OF DIAGNOSIS

Judge as NG with either Low NG or High NG.

A variable valve lift diagnosis oil pressure switch is installed for diagnosis. It is possible to determine whether the intake valve is in high mode (increase the amount of lift) or in low mode (suppressing the amount of lift) when the variable valve lift diagnosis oil pressure switch is turned ON or OFF.

• Normal

Oil switching solenoid valve duty	Intake valve	Variable valve lift diagnosis oil pressure switch
Large	High mode	OFF
Minimum	Low mode	ON

• Low NG

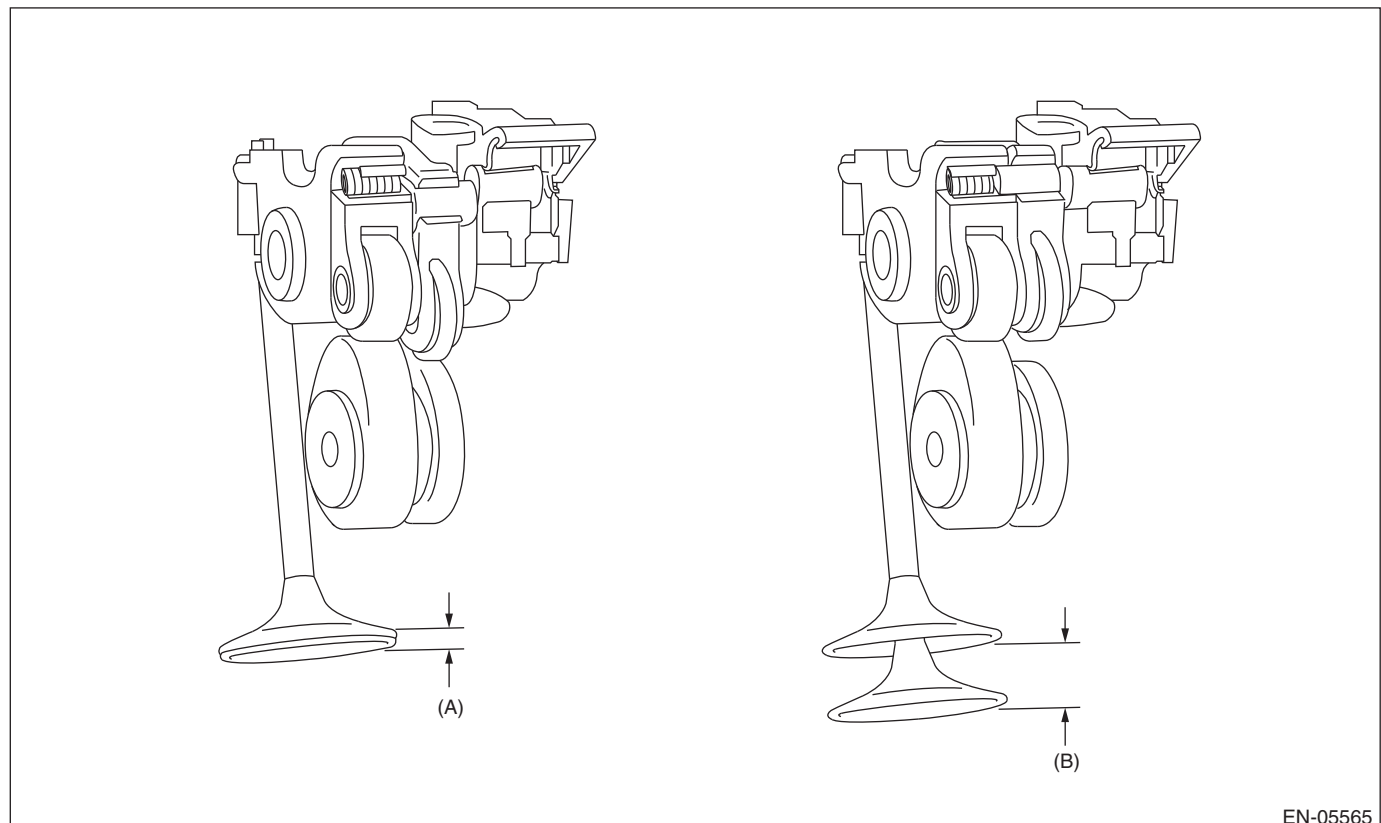
When the variable valve lift diagnosis oil pressure switch remains ON even though the intake valve tried to enter high mode (oil switching solenoid valve duty is large), this is judged as a Low NG.

• High NG

When the variable valve lift diagnosis oil pressure switch remains OFF even though the intake valve tried to enter low mode (oil switching solenoid valve duty is small), this is judged as a High NG.

2. COMPONENT DESCRIPTION

The variable valve lift system optimizes the intake valve lift by switching between the low lift cam and the high lift cam according to the engine speed. The amount of intake valve lift is varied by controlling the oil switching solenoid valve duty according to signals from the ECM.



EN-05565

(A) Low lift

(B) High lift

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
After engine starting	≥ 6000 ms
Engine oil temperature	≥ 15 °C (59 °F)
Variable valve lift control	Operation

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously 6 seconds after engine start while variable valve lift is being controlled.

5. DIAGNOSTIC METHOD

• Abnormality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Low	
Duty ratio	≥ 62 %
Variable valve lift diagnosis oil pressure switch	ON
High	
Duty ratio	< 33 %
Variable valve lift diagnosis oil pressure switch	OFF

Time Needed for Diagnosis:

Low side: 784 ms

High side: 3000 ms

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

• Normality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Low	
Duty ratio	≥ 62 %
Variable valve lift diagnosis oil pressure switch	OFF
High	
Duty ratio	< 33 %
Variable valve lift diagnosis oil pressure switch	ON

Time Needed for Diagnosis:

Low side: 208 ms

High side: 3000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

B: DTC P0028 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/ PERFORMANCE (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0026. <Ref. to GD(H4SO)-8, DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

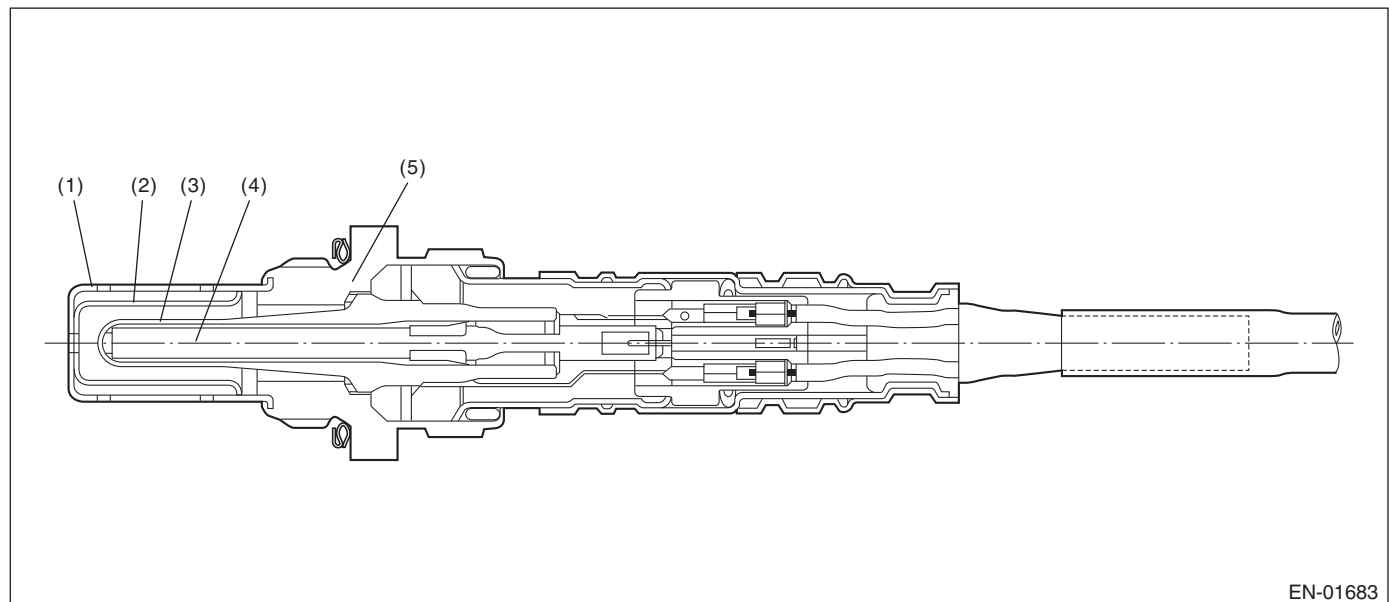
C: DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1)

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-01683

(1) Element cover (outer)

(3) Sensor element

(5) Sensor housing

(2) Element cover (inner)

(4) Ceramic heater

3. ENABLE CONDITION

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgement

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

Judgement 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 Judgement

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

Judgement 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

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

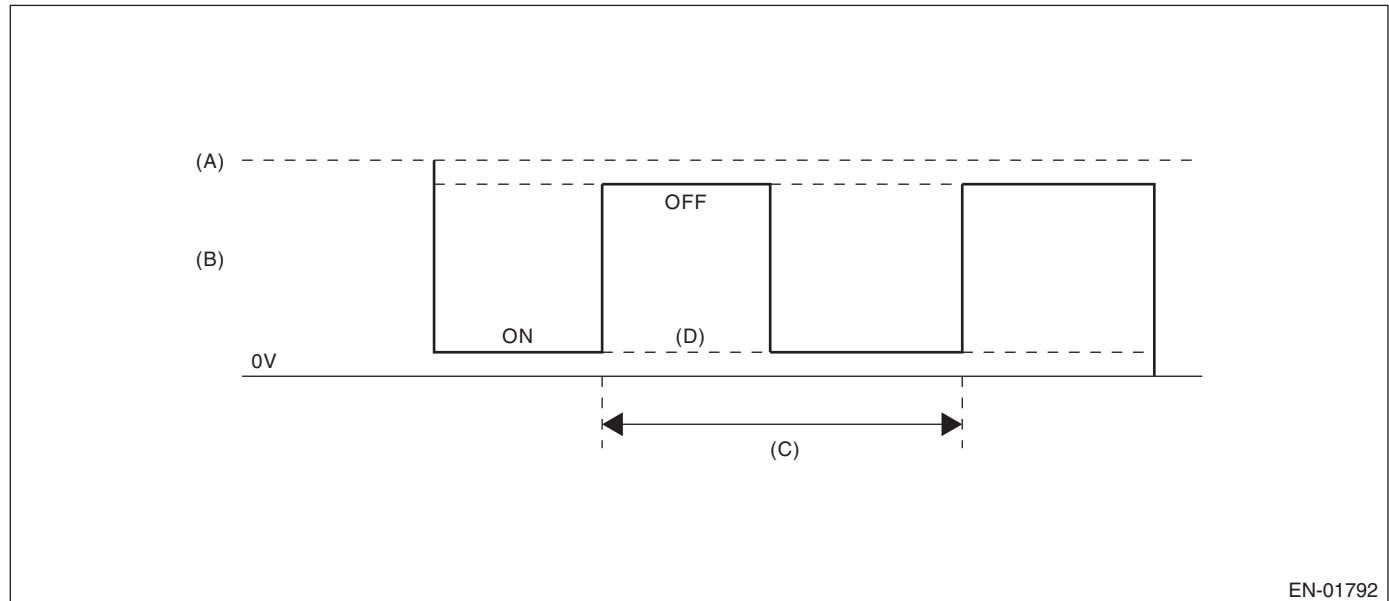
1. OUTLINE OF DIAGNOSIS

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

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

(C) 128 milliseconds

(D) Low error

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 Judgement

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

Judgement 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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Output voltage level	High

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

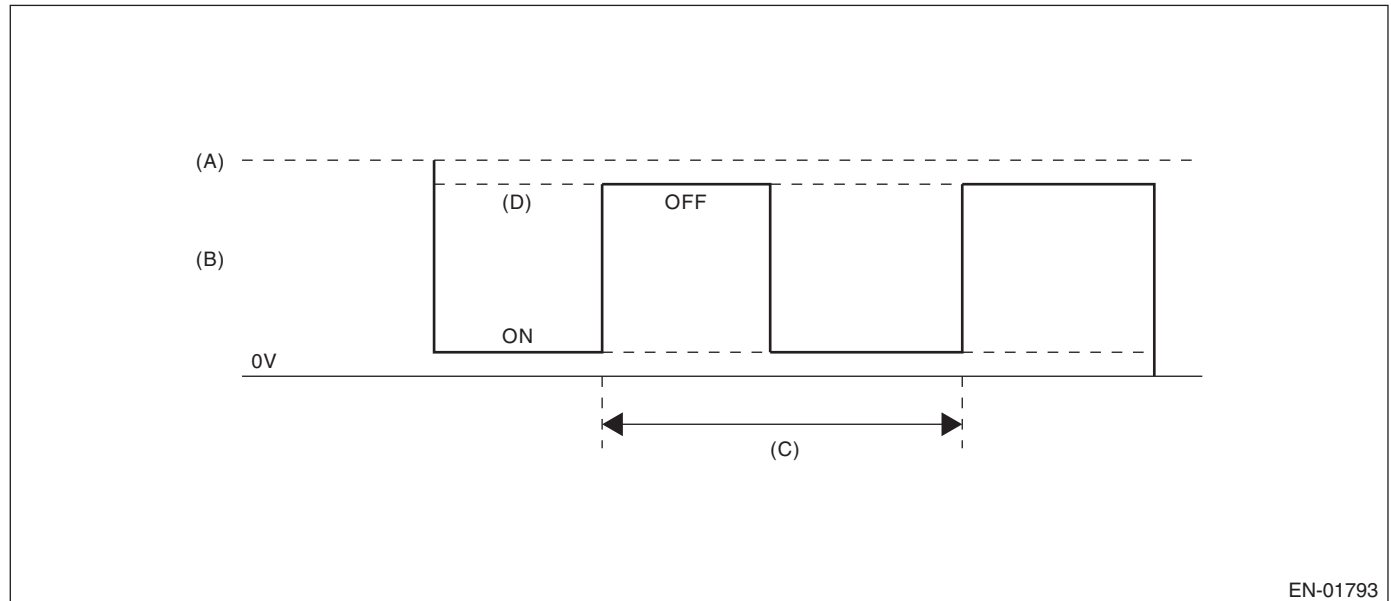
1. OUTLINE OF DIAGNOSIS

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

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

Judge as NG when the terminal voltage remains High.

2. COMPONENT DESCRIPTION



EN-01793

(A) Battery voltage

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

(C) 128 milliseconds

(D) High error

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 Judgement

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

Judgement 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 × 500 time(s)

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

• Normality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Output voltage level	Low

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

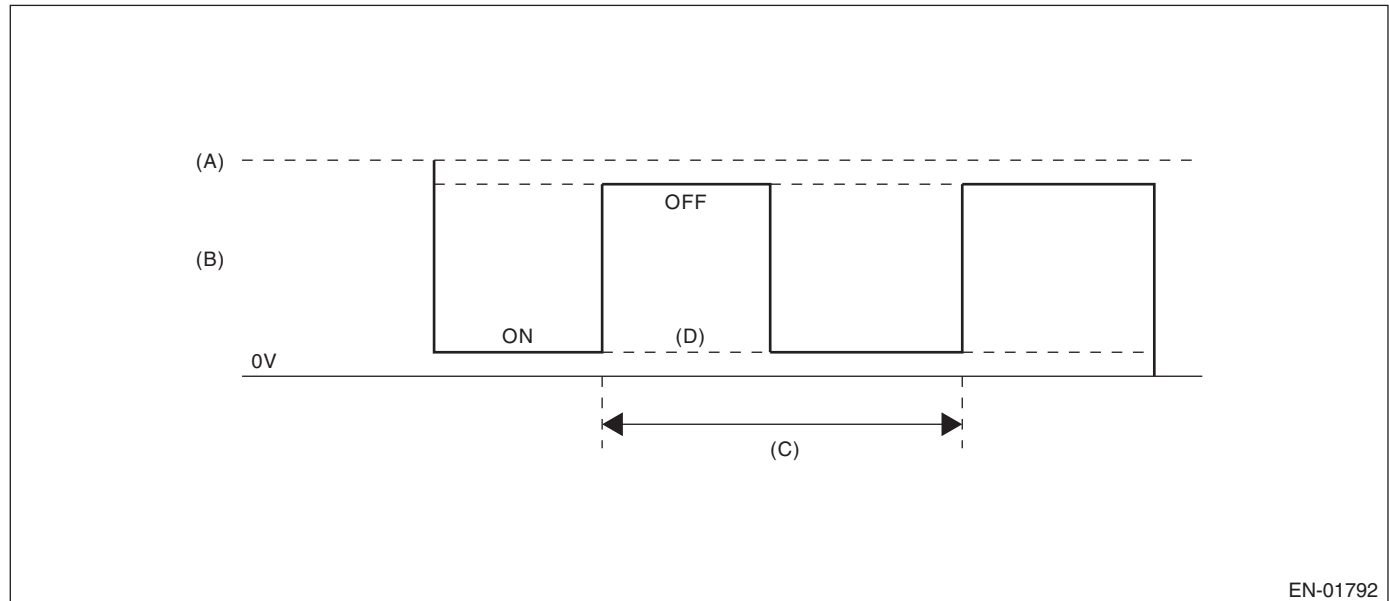
1. OUTLINE OF DIAGNOSIS

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



(A) Battery voltage

(B) Output voltage of the rear oxygen sensor heater

(C) 256 milliseconds (cycles)

(D) Low error

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$
Elapsed time after engine starting	$\geq 1 \text{ second}$
Engine speed	$< 8000 \text{ rpm}$

4. GENERAL DRIVING CYCLE

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgement

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

Judgement 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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Output voltage level	High

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

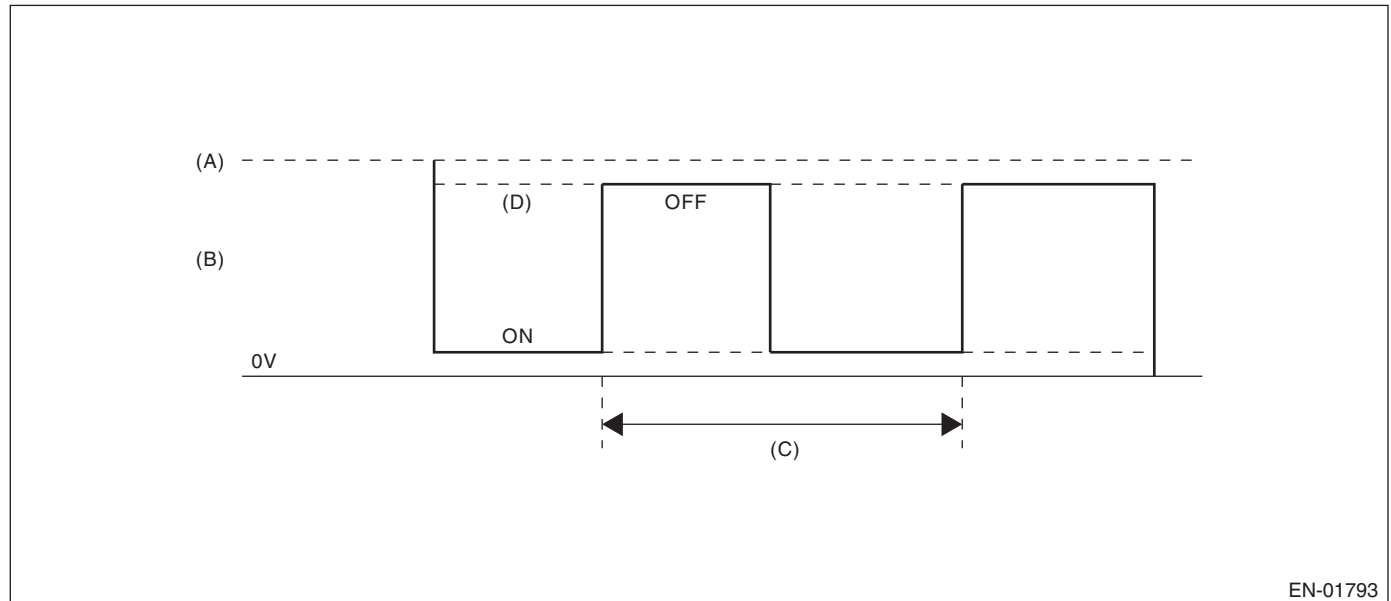
1. OUTLINE OF DIAGNOSIS

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



(A) Battery voltage

(B) Output voltage of the rear oxygen sensor heater

(C) 256 milliseconds (cycles)

(D) High error

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$
Elapsed time after engine starting	$\geq 1 \text{ second}$
Engine speed	$< 8000 \text{ rpm}$

4. GENERAL DRIVING CYCLE

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Output voltage level	High
Rear oxygen sensor heater control duty	$\geq 20 \%$

Time Needed for Diagnosis: 8 ms $\times$ 320 time(s)

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

• Normality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Output voltage level	Low

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

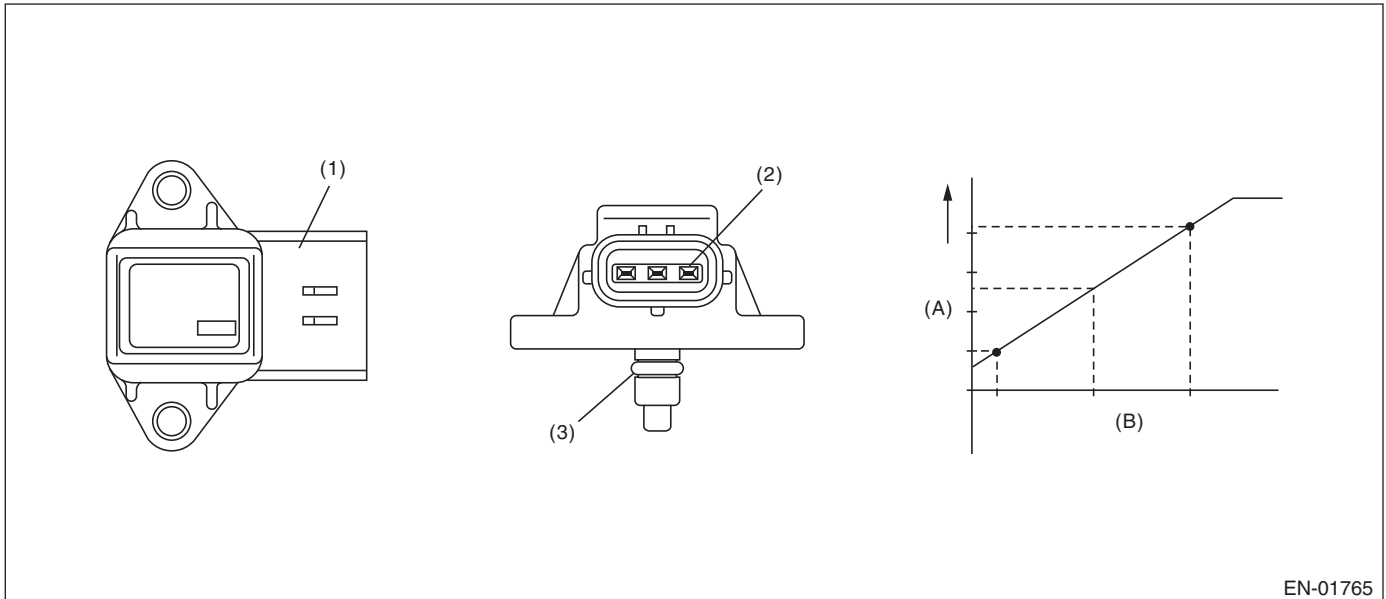
H: DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION

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	$\geq 75\text{ }^{\circ}\text{C}$ (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 Judgement

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.

Judgement Value

Malfunction Criteria	Threshold Value
Low	
Engine speed	< 2500 rpm
Throttle position	$\geq 12^\circ$
Output voltage	< 1.63 V
Engine load	> 0.6 g/rev (0.02 oz/rev)
High	
Engine speed	600 rpm — 900 rpm
Throttle position	< 2.44°
Output voltage	≥ 3.4 V
Engine load	< 0.4 g/rev (0.01 oz/rev)

Time Needed for Diagnosis:

Low side: 3000 ms

High side: 7000 ms

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

• Normality Judgement

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.

Judgement Value

Malfunction Criteria	Threshold Value
Low	
Engine speed	< 2500 rpm
Throttle position	$\geq 12^\circ$
Output voltage	≥ 1.63 V
Engine load	> 0.6 g/rev (0.02 oz/rev)
High	
Engine speed	600 rpm — 900 rpm
Throttle position	< 2.44°
Output voltage	< 3.4 V
Engine load	< 0.4 g/rev (0.01 oz/rev)

Time Needed for Diagnosis:

Low side: Less than 1 second

High side: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

I: DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the open circuit of the oil switching solenoid valve.

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

2. ENABLE CONDITION

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

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Duty ratio	$\geq 30 \%$
Control current	$< 0.026 \text{ A}$

Time Needed for Diagnosis:2000 ms

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

• Normality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Oil switching solenoid valve target current value – Oil switching solenoid valve current value	$< 0.08 \text{ A}$
Target current	$\geq 0.11 \text{ A}$

Time Needed for Diagnosis:2000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

J: DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect short circuits of the oil switching solenoid valve.

Judge as a short NG when the current is large even though the output duty is small.

2. ENABLE CONDITION

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

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Duty ratio	$< 7 \%$
Control current	$\geq 0.465 \text{ A}$

Time Needed for Diagnosis:2000 ms

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

• Normality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
$ \text{Oil switching solenoid valve target current value} - \text{Oil switching solenoid valve current value} $	$< 0.08 \text{ A}$

Time Needed for Diagnosis:2000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

K: DTC P0082 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0076. <Ref. to GD(H4SO)-22, DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

L: DTC P0083 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0077. <Ref. to GD(H4SO)-23, DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

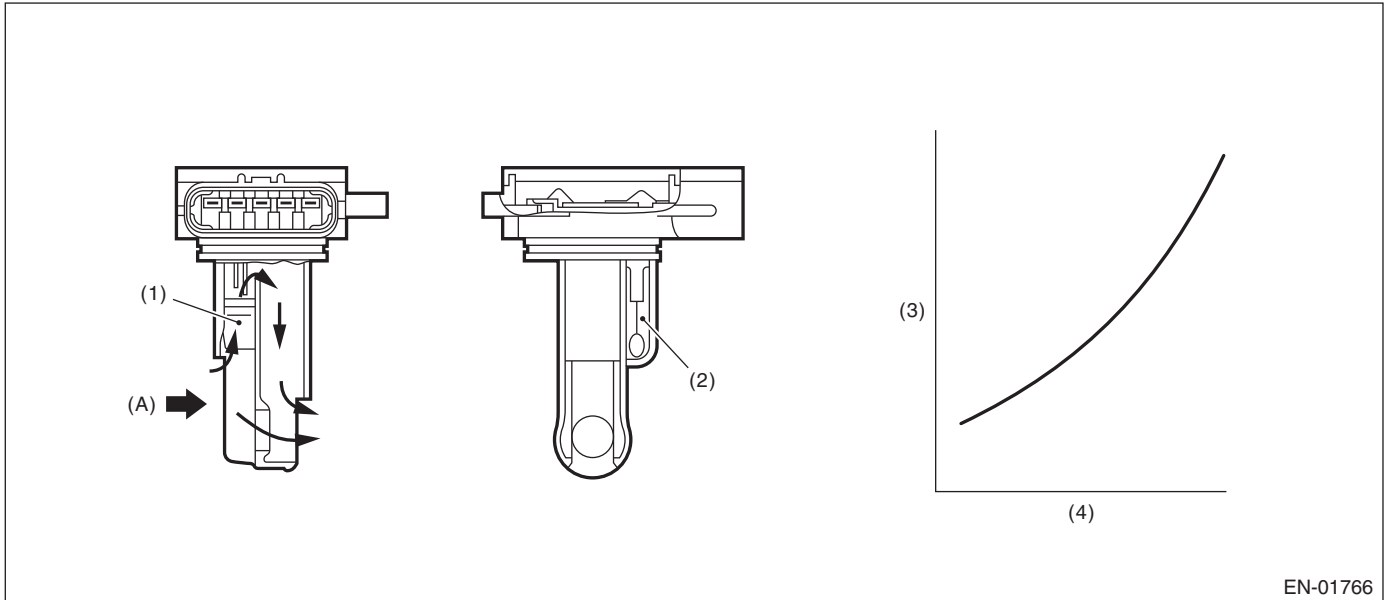
M: DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE

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	$\geq 75^{\circ}\text{C}$ (167 °F)

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after idling.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgement

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.

Judgement Value

Malfunction Criteria	Threshold Value
Low	
Output voltage	< 1.49 V
Engine speed	≥ 2000 rpm
Throttle opening angle	≥ 12 °
Intake manifold pressure	≥ 66.7 kPa (500 mmHg, 19.7 inHg)
High (1)	
Output voltage	≥ 2.66 V
Engine speed	600 rpm — 900 rpm
Throttle opening angle	< 2.44 °
Intake manifold pressure	< 40 kPa (300 mmHg, 11.8 inHg)
High (2)	
Output voltage	≥ 1.45 V
Engine speed	600 rpm — 900 rpm
Throttle opening angle	< 2.44 °
Intake manifold pressure	< 40 kPa (300 mmHg, 11.8 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 Judgement

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.

Judgement Value

Malfunction Criteria	Threshold Value
Low	
Output voltage	≥ 1.49 V
Engine speed	≥ 2000 rpm
Throttle opening angle	≥ 12 °
Intake manifold pressure	≥ 66.7 kPa (500 mmHg, 19.7 inHg)
High	
Output voltage	< 2.66 V
Engine speed	600 rpm — 900 rpm
Throttle opening angle	< 2.44 °
Intake manifold pressure	< 40 kPa (300 mmHg, 11.8 inHg)
Fuel system diagnosis	Rich side normal

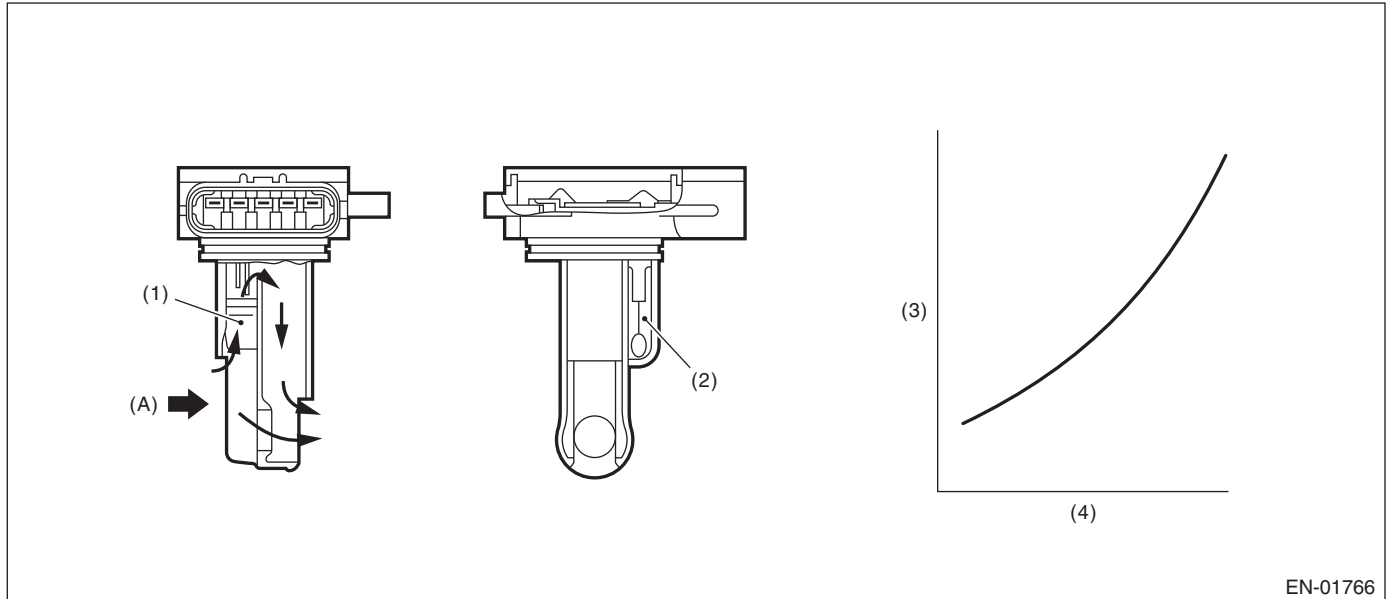
Time Needed for Diagnosis:

Low: Less than 1 second

High: Less than 1 second

N: 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)

(2) Intake air temperature sensor

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

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD**• Abnormality Judgement**

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

Judgement Value

Malfunction Criteria	Threshold Value
Output voltage	≤ 0.22 V

Time Needed for Diagnosis: 500 ms

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

• Normality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Output voltage	> 0.22 V

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

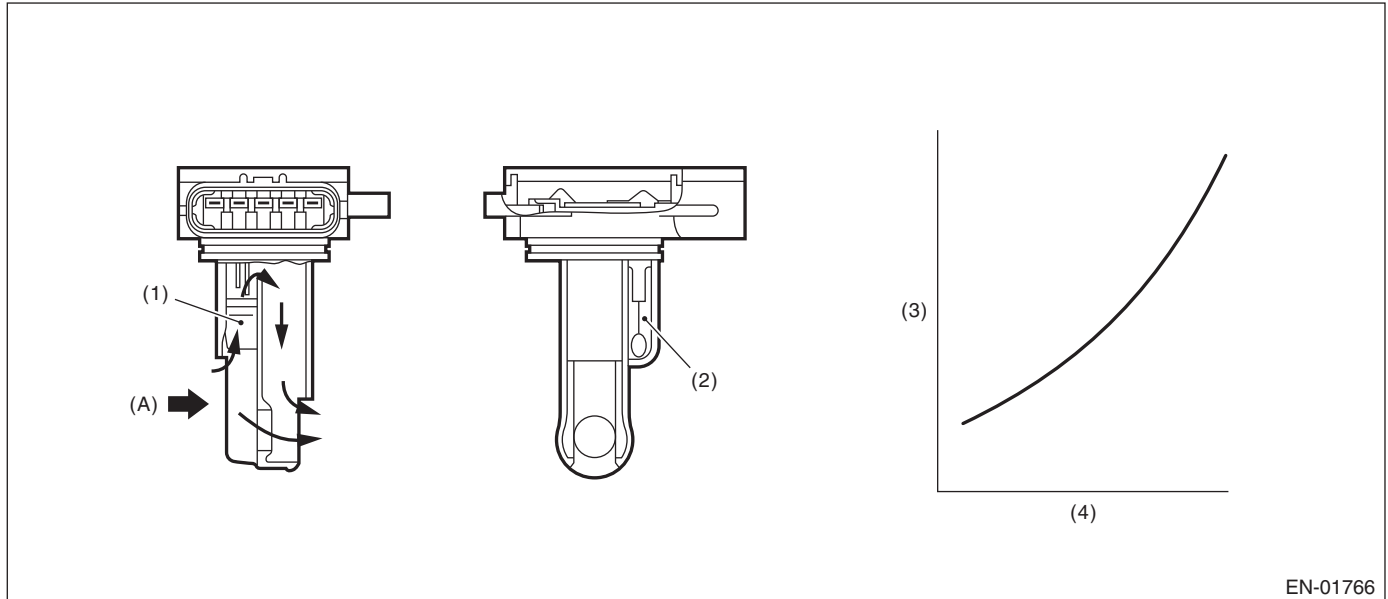
GENERAL DESCRIPTION

O: 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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.179943192 V

Time Needed for Diagnosis: 500 ms

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

• Normality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Output voltage	< 4.179943192 V

Time Needed for Diagnosis: Less than 1 second

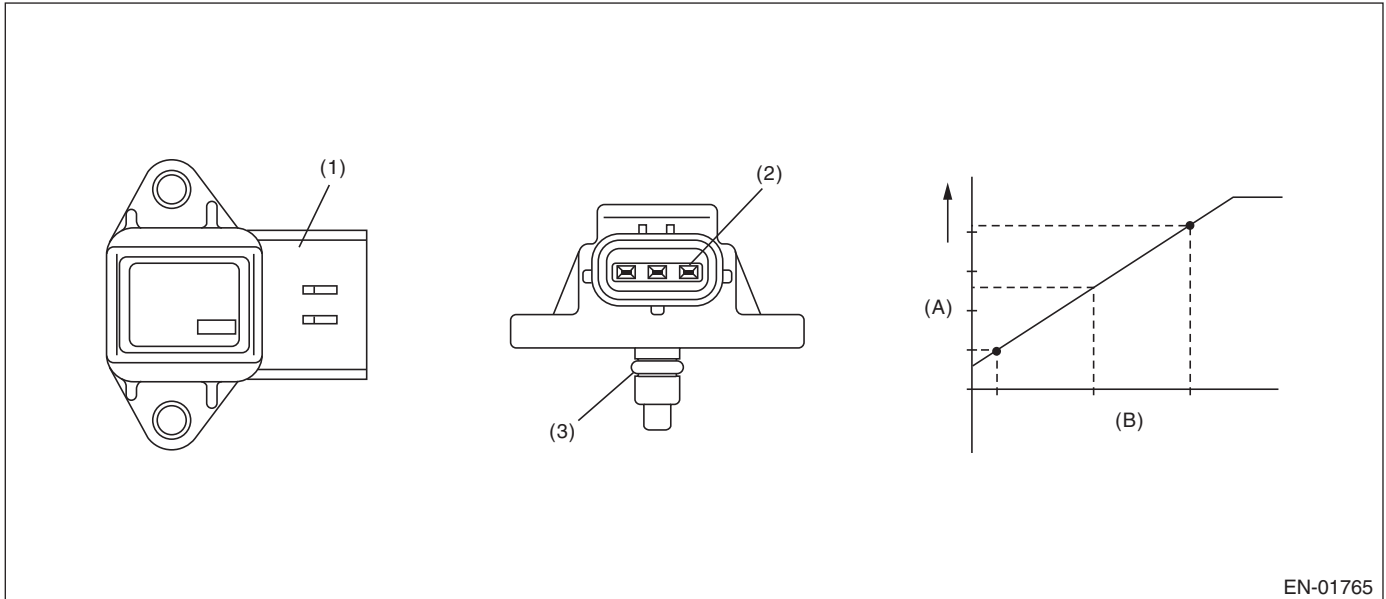
P: DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT

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 Judgement

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

Judgement 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 Judgement

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

Judgement 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

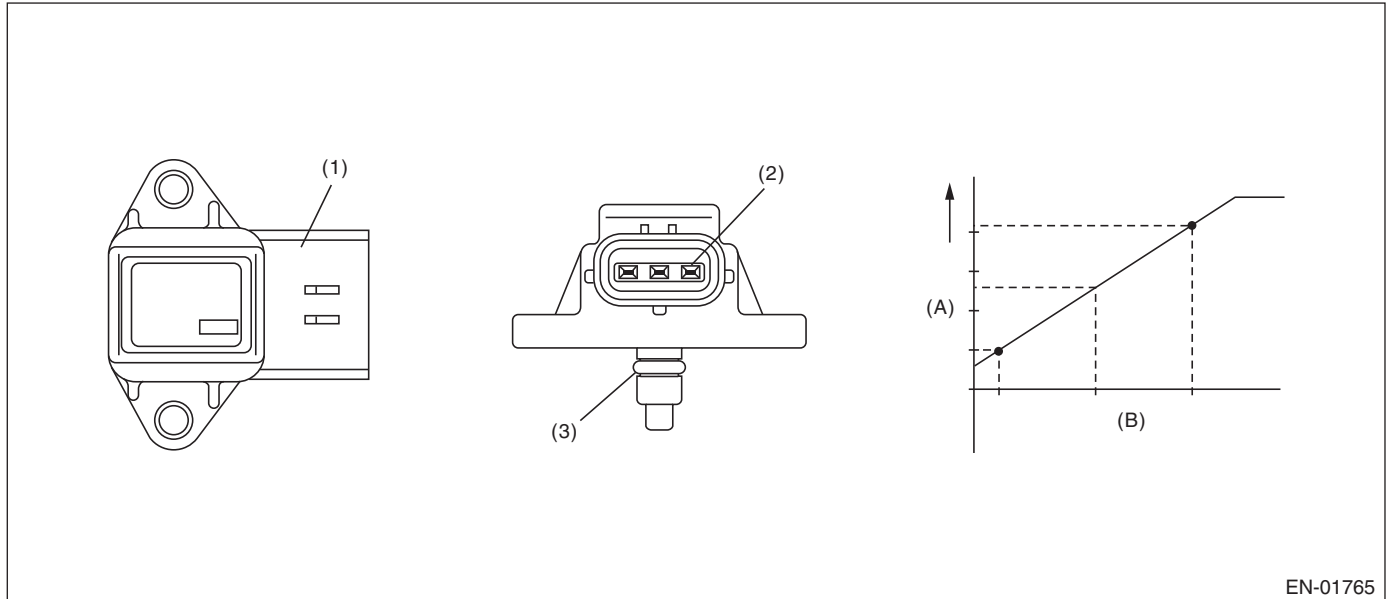
Q: DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT

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



(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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.38757221 V

Time Needed for Diagnosis: 500 ms

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

• Normality Judgement

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

Judgement Value

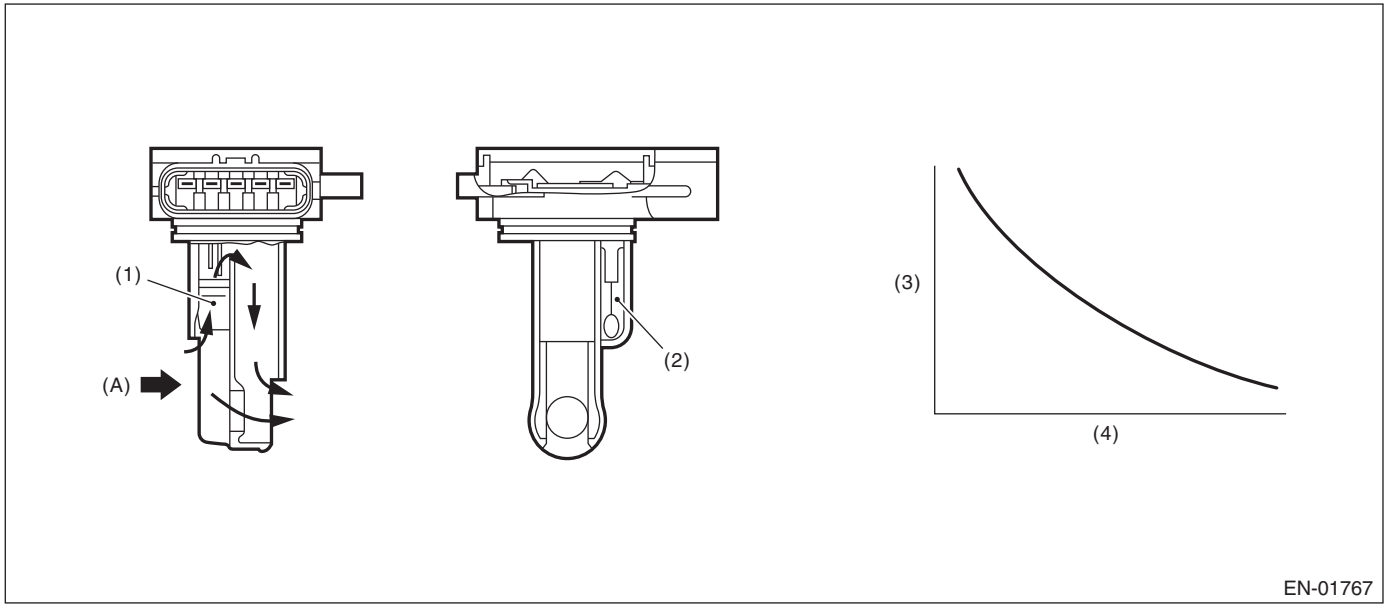
Malfunction Criteria	Threshold Value
Output voltage	< 4.38757221 V

Time Needed for Diagnosis: Less than 1 second

R: 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	< 30 °C (86 °F)
Engine coolant temperature	≥ 100 °C (212 °F)
Battery voltage	≥ 10.9 V
Continuous time when the vehicle speed is less than 60 km/h (37.3 MPH)	≥ 600 s

4. GENERAL DRIVING CYCLE

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgement

Judge as NG when the following conditions are established.

Judgement 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 Judgement

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

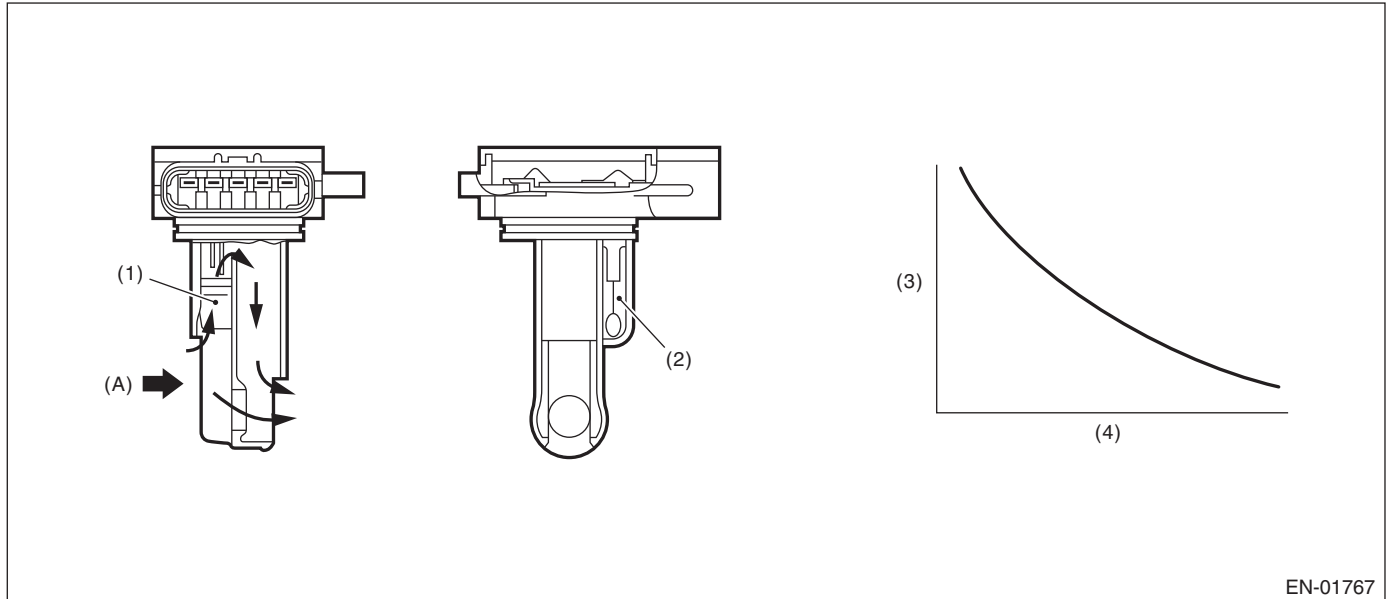
Judgement Value

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

Time Needed for Diagnosis: Less than 1 second

S: 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 Judgement**

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

Judgement Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.230975449 V

Time Needed for Diagnosis: 500 ms

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

• Normality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 0.230975449 V

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

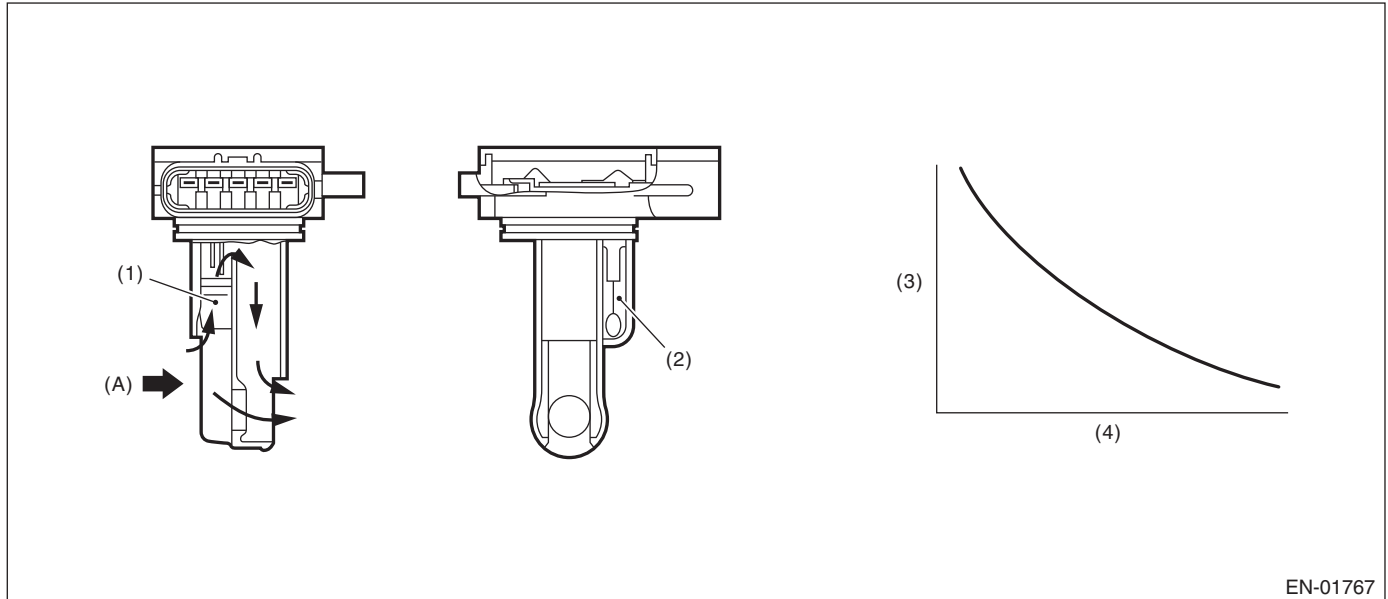
GENERAL DESCRIPTION

T: 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 Judgement

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

Judgement 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 Judgement

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

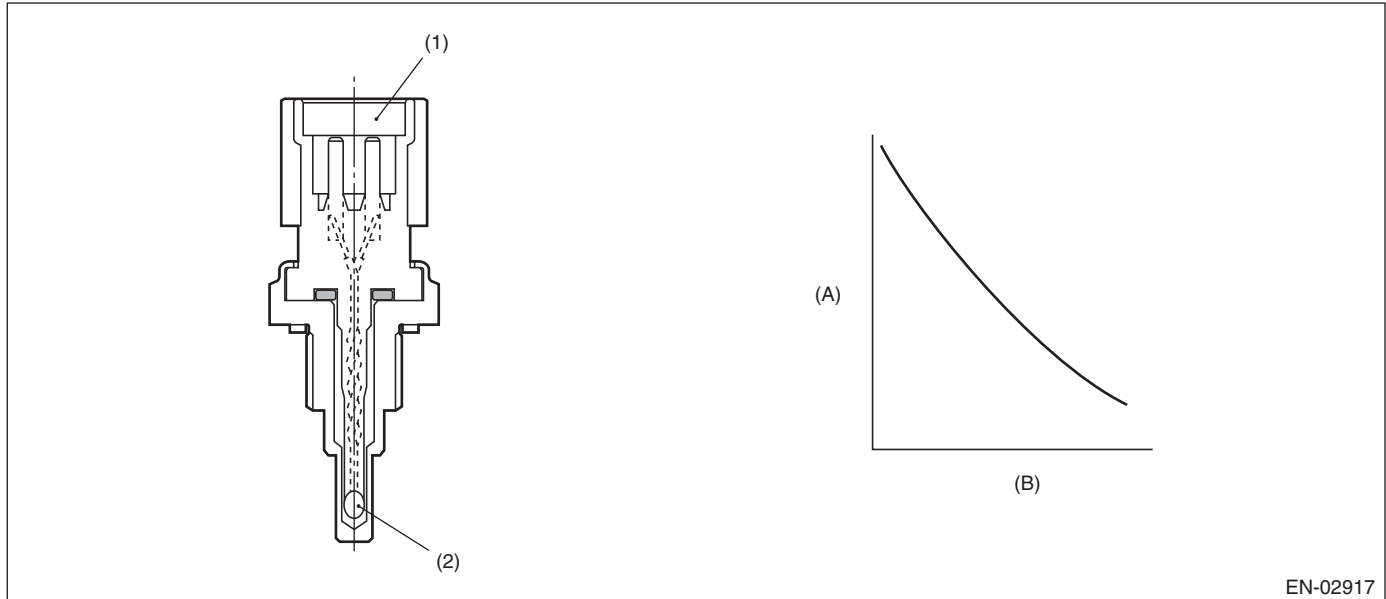
Judgement Value

Malfunction Criteria	Threshold Value
Output voltage	< 4.716 V

Time Needed for Diagnosis: Less than 1 second

U: 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 Judgement**

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

Judgement Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.264738528 V

Time Needed for Diagnosis: 500 ms

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

• Normality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Output voltage	$\geq$ 0.264738528 V

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

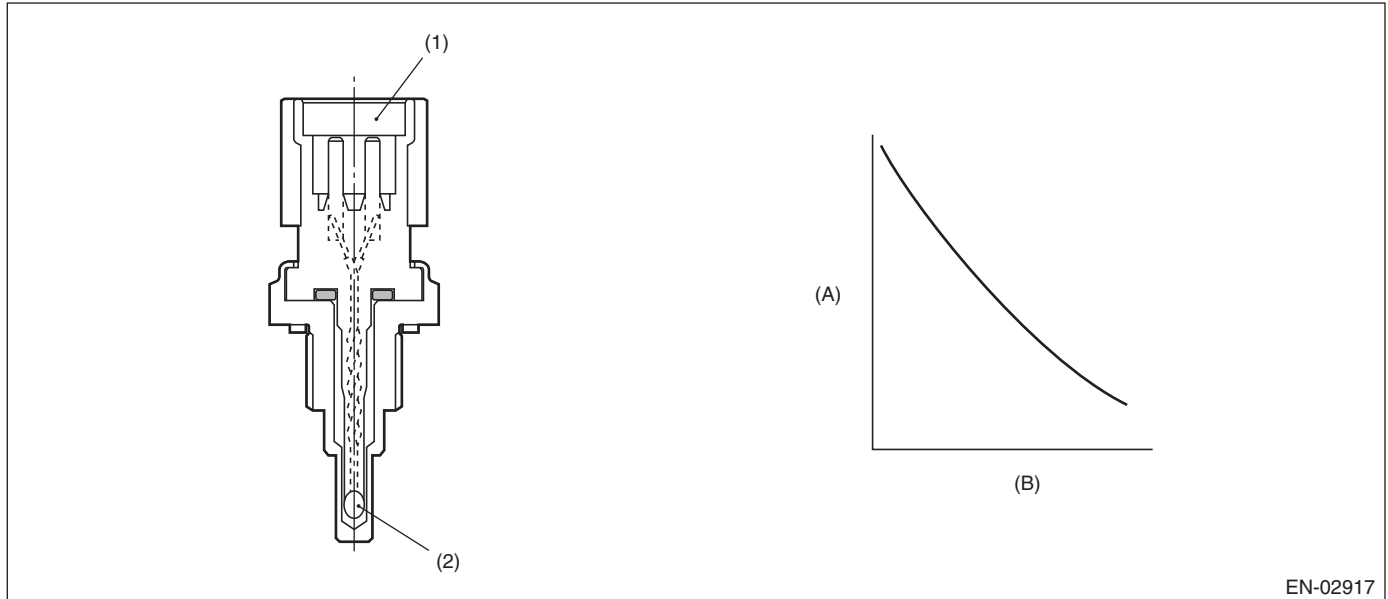
GENERAL DESCRIPTION

V: 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 Judgement

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

Judgement 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 Judgement

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

Judgement Value

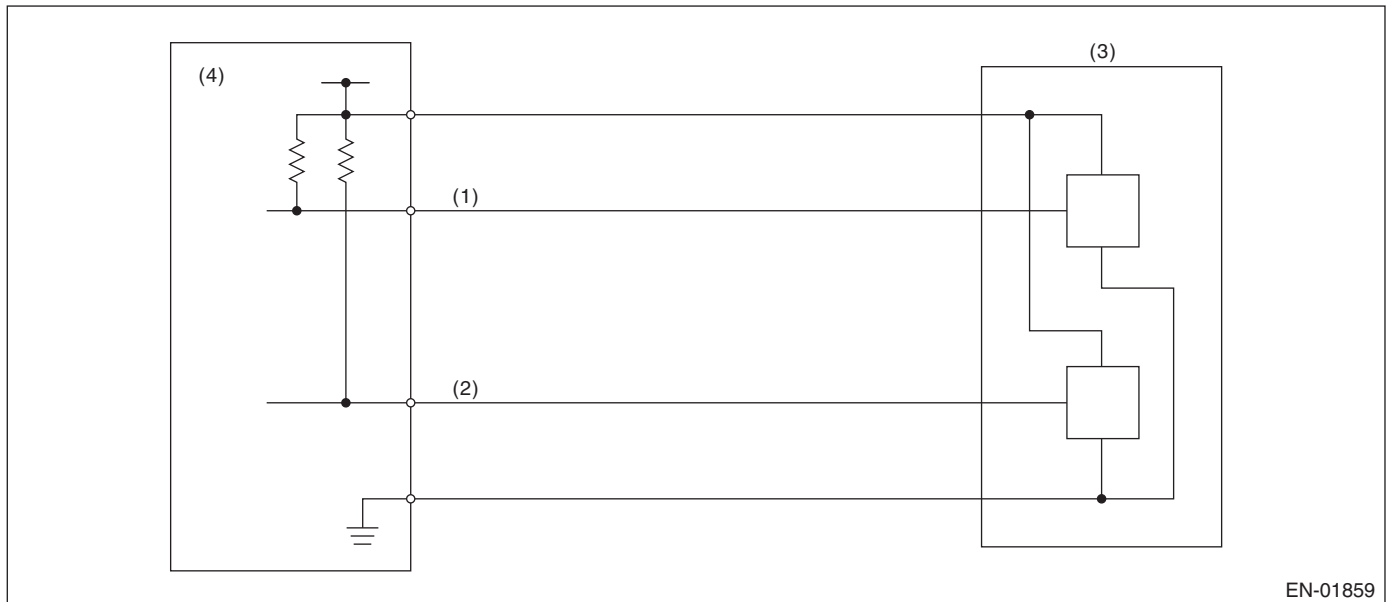
Malfunction Criteria	Threshold Value
Output voltage	< 4.716 V

Time Needed for Diagnosis: Less than 1 second

W: 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

- (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.

5. DIAGNOSTIC METHOD**• Abnormality Judgement**

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

Judgement 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 Judgement

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

Judgement 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

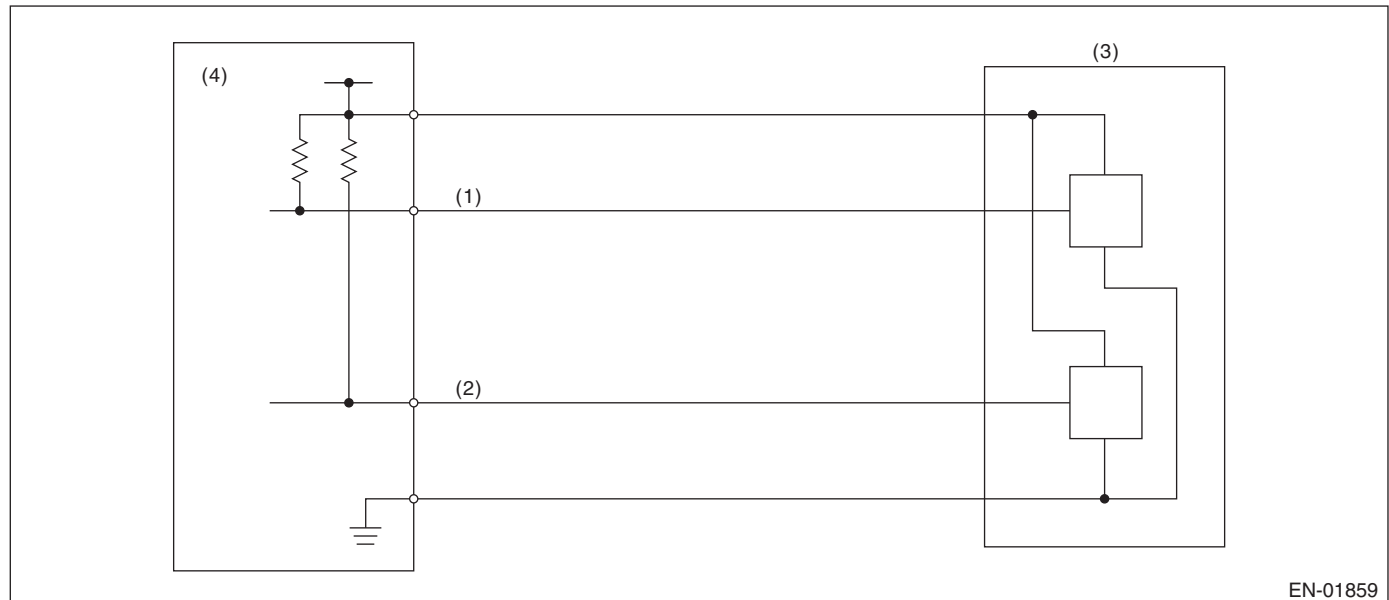
X: DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT HIGH

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
(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.

5. DIAGNOSTIC METHOD

• Abnormality Judgement

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

Judgement 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 Judgement

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

Judgement Value

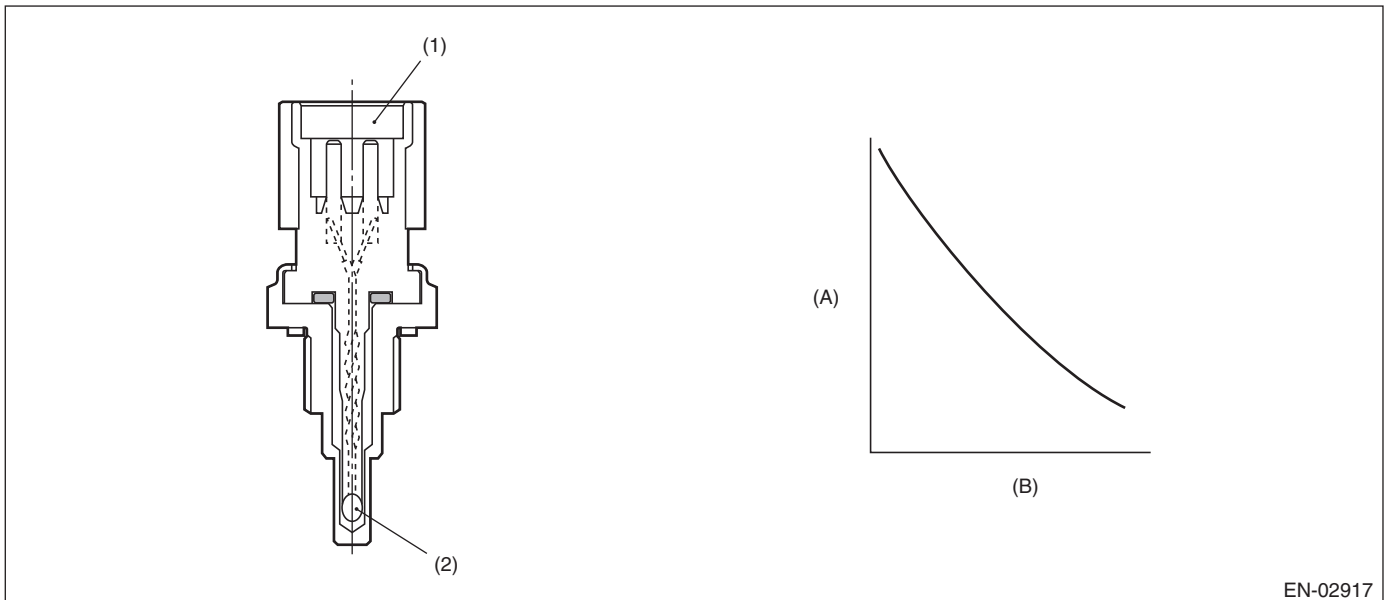
Malfunction Criteria	Threshold Value
Sensor 1 input voltage	$< 4.858 \text{ V}$

Time Needed for Diagnosis:24 ms

Y: 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

(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 Judgement

Judge as NG if the criteria below are met.

Judgement Value

Malfunction Criteria	Threshold Value
Engine coolant temperature	< 20 °C (68 °F)
Timer for diagnosis after engine start	≥ Judgement 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 milliseconds + TWCNT milliseconds (at the time of 64 milliseconds)

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)
Temper- ature °C (°F)	-20 (-4)	0 ms	32.076 ms	39.977 ms	47.879 ms	82.544 ms	117.209 ms	154.214 ms	185.26 ms
	-10 (14)	0 ms	25.704 ms	33.606 ms	41.508 ms	68.52 ms	95.532 ms	125.667 ms	155.802 ms
	0 (32)	0 ms	17.646 ms	25.548 ms	33.45 ms	53.652 ms	73.855 ms	97.12 ms	120.386 ms
	10 (50)	0 ms	7.901 ms	15.802 ms	23.704 ms	37.941 ms	52.177 ms	68.573 ms	82.538 ms
	20 (68)	0 ms	7.901 ms	15.802 ms	23.704 ms	37.941 ms	52.177 ms	68.573 ms	82.538 ms

Judgement value of timer after engine starting

$$t = 573669 \text{ ms} - 33924 \text{ ms} \times T_i$$

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 Judgement

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

Judgement Value

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

Time Needed for Diagnosis: Less than 1 second

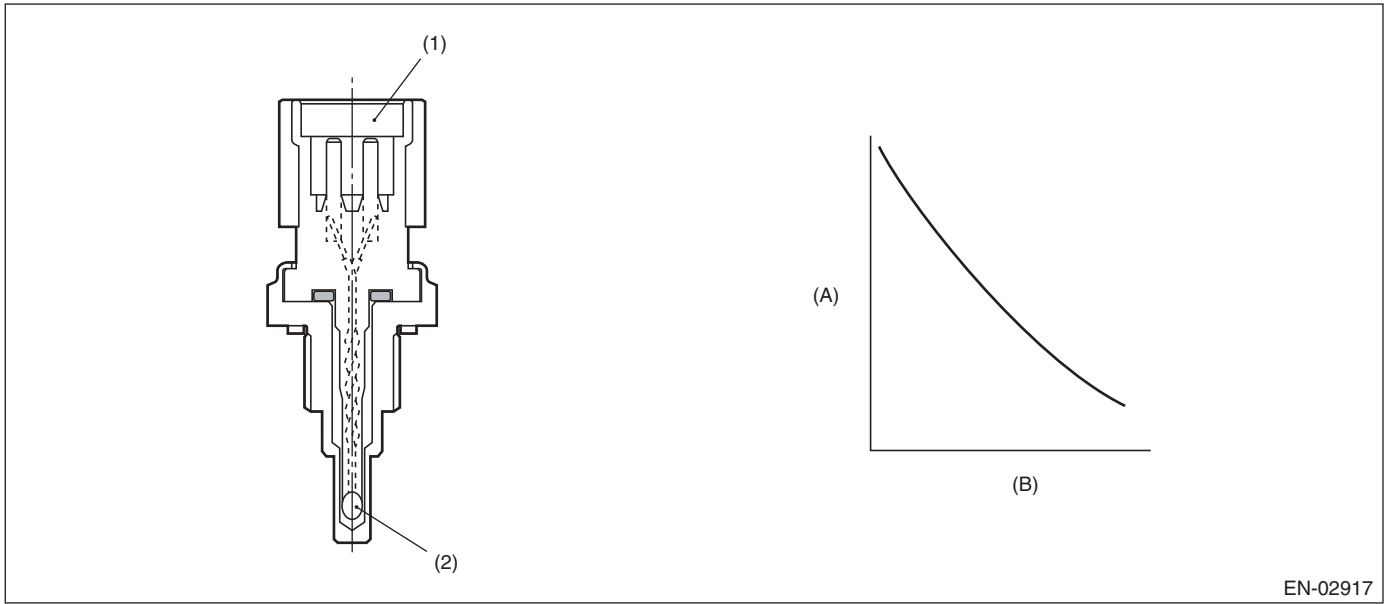
Z: DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION

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 (k Ω)

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

(1) Connector

(2) Thermistor element

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$
Refueling from the last engine stop till the current engine start	None
Fuel level	$\geq 15 \text{ } \ell$ (3.96 US gal, 3.3 Imp gal)
Engine coolant temperature at the last engine stop	$\geq 75 \text{ }^{\circ}\text{C}$ (167 $^{\circ}\text{F}$)

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 Judgement

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

Judgement 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 Judgement

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

Judgement 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

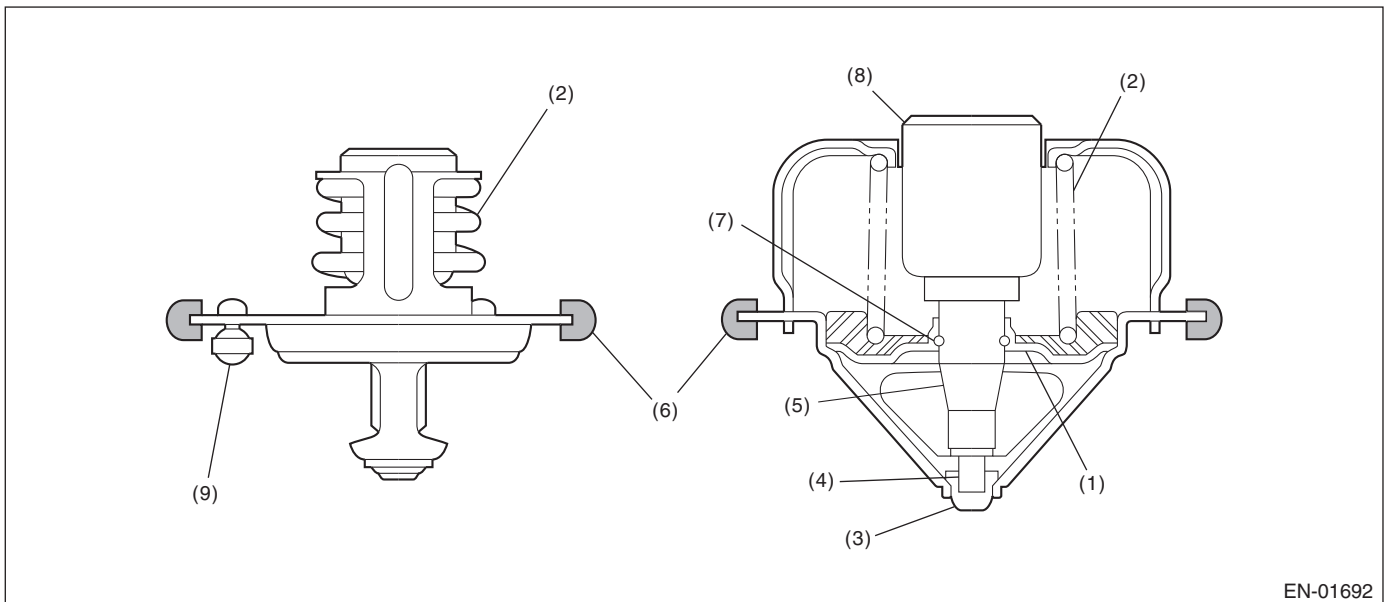
AA:DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE)

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 Judgement

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

Judgement 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	$> 30 \text{ }^{\circ}\text{C}$ (86 $^{\circ}\text{F}$)
Vehicle speed	$\geq 30 \text{ km/h}$ (18.6 MPH)

Time Needed for Diagnosis: 64 ms $\times$ 3 time(s) $\times$ 152 time(s)

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

• Normality Judgement

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

Judgement 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	$\leq 30 \text{ }^{\circ}\text{C}$ (86 $^{\circ}\text{F}$)

Time Needed for Diagnosis: Less than 1 second

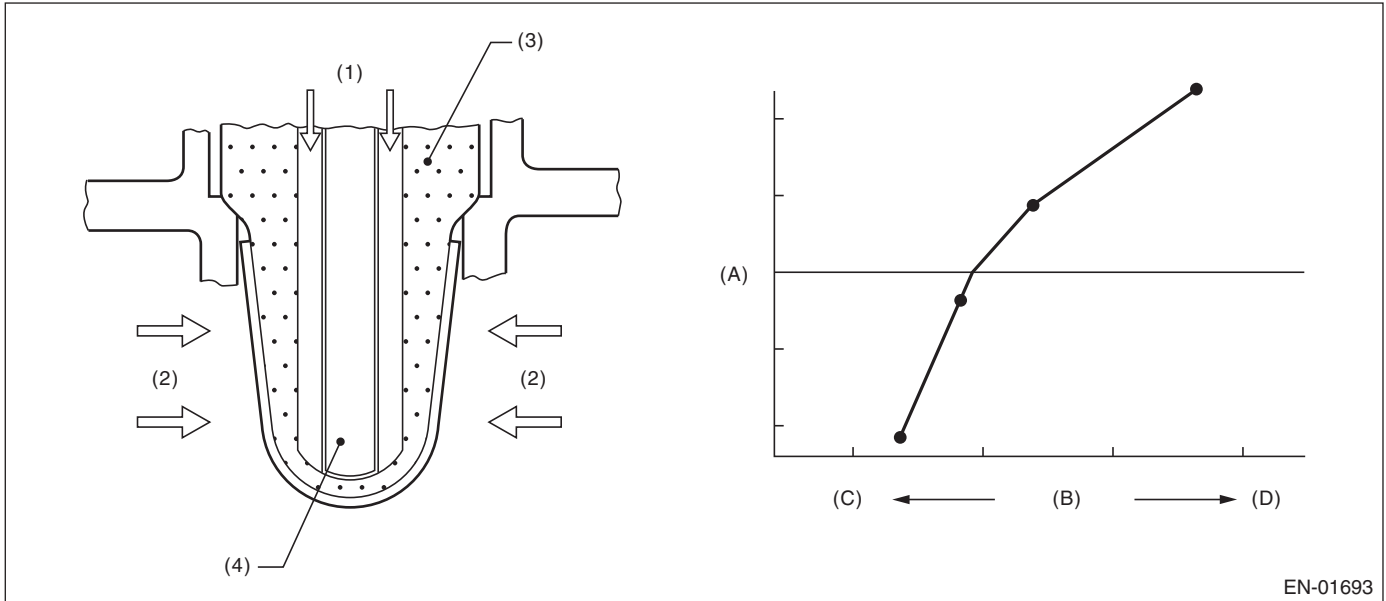
AB:DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1)

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 Judgement

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

Judgement 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 Judgement

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

Judgement 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

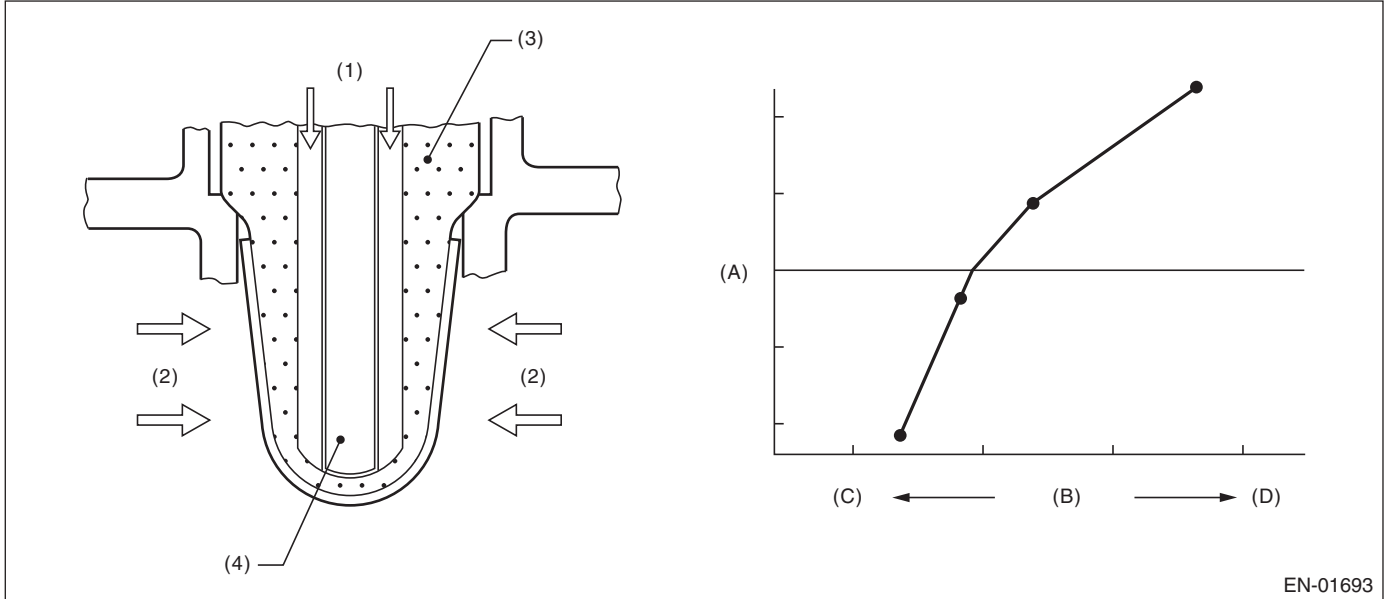
AC:DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1)

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



(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 Judgement

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

Judgement 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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Input voltage (+) Input voltage (–)	≤ 3.589 V ≤ 3.541 V

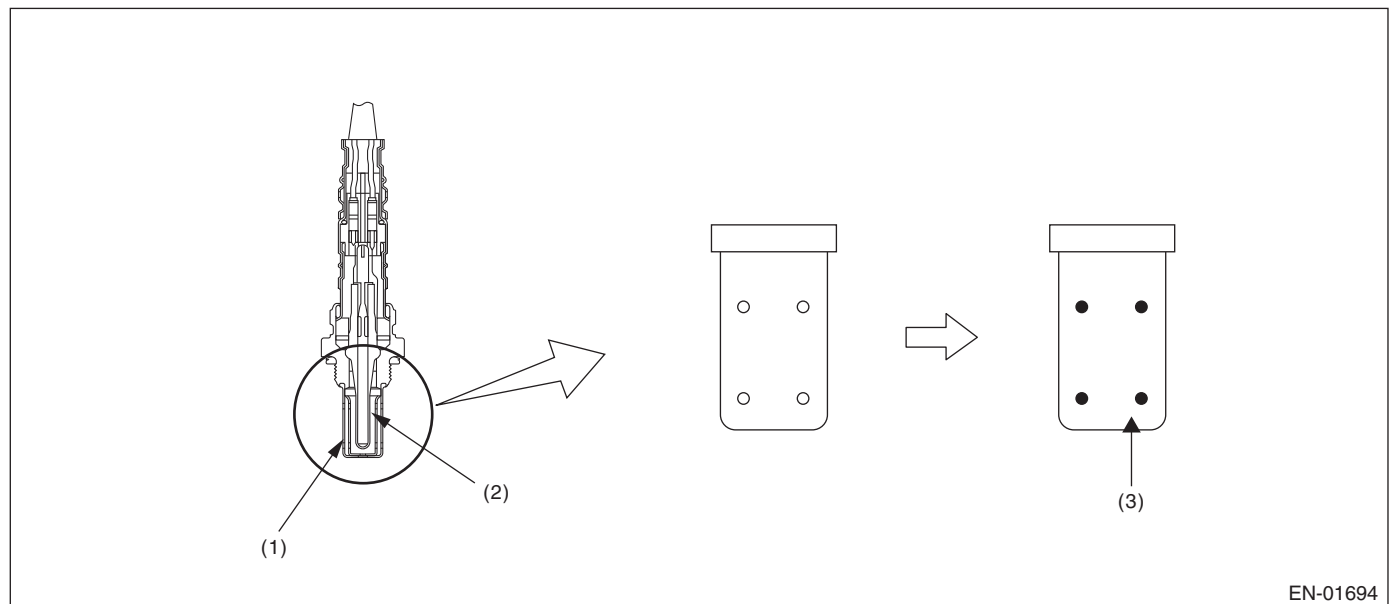
Time Needed for Diagnosis: Less than 1 second

AD: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 judgement 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

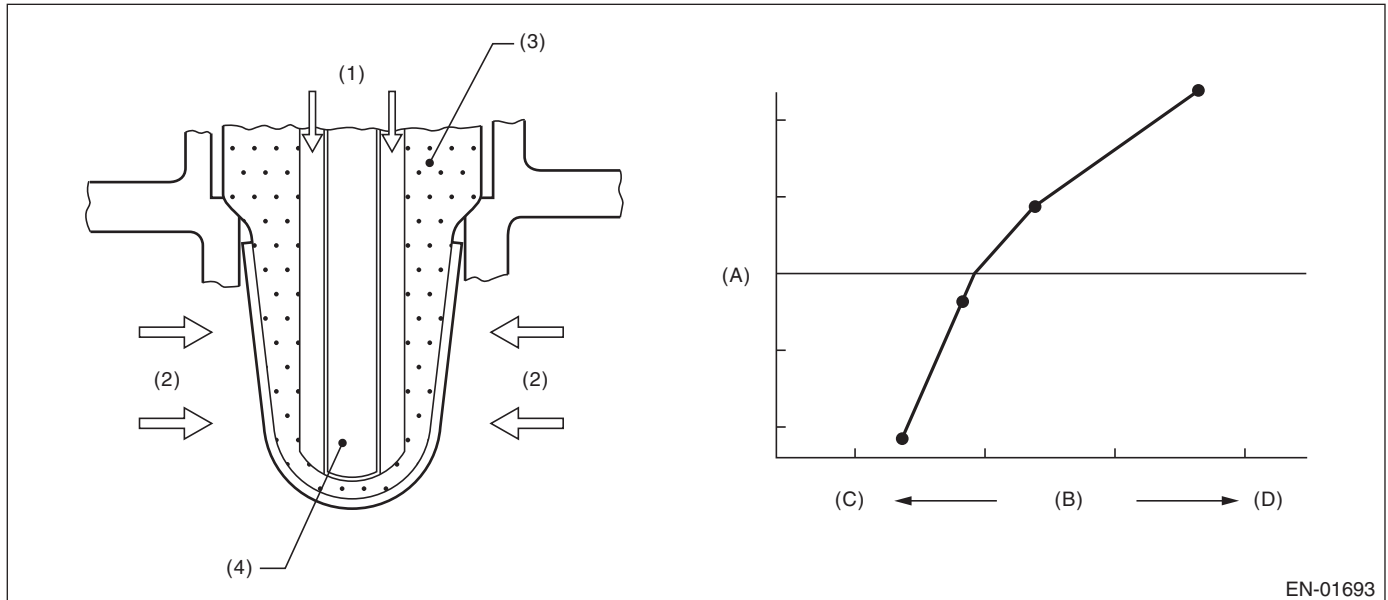
(2) Zirconia

(3) Clogging

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

2. COMPONENT DESCRIPTION



EN-01693

(A) Electromotive force

(B) Air fuel ratio

(C) Lean

(D) Rich

(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 — 3200 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.

5. DIAGNOSTIC METHOD

Calculate faf difference every 32ms × 4 , and the λ value difference. Calculate the diagnosis value after calculating 1640 time(s).

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Abnormality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
$\text{para}fca = \text{td}2faf/\text{td}2lmd$ where, $\text{td}2faf(N) = \text{td}2faf(n-1) + \text{d}2faf(n) $ $\text{td}2lmd(N) = \text{td}2lmd(n-1) + \text{d}2lmd(n) $ add up to $32\text{ ms} \times 4 \times 1640\text{ time(s)}$. $\text{d}2faf(n) = (faf(n) - faf(n-1)) - (faf(n-1) - faf(n-2))$ $\text{d}2lmd(n) = (lmd(n) - lmd(n-1)) - (lmd(n-1) - lmd(n-2))$ faf = main feedback compensation coefficient every 128 milliseconds lmd = output lambda every 128 milliseconds	> 0.4 (U5 model) > 0.45 (Other than U5 model)

Time Needed for Diagnosis: $32\text{ ms} \times 4 \times 1640\text{ time(s)}$

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

• Normality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
$\text{para}fca = \text{td}2faf/\text{td}2lmd$ where, $\text{td}2faf(N) = \text{td}2faf(n-1) + \text{d}2faf(n) $ $\text{td}2lmd(N) = \text{td}2lmd(n-1) + \text{d}2lmd(n) $ add up to $32\text{ ms} \times 4 \times 1640\text{ time(s)}$. $\text{d}2faf(n) = (faf(n) - faf(n-1)) - (faf(n-1) - faf(n-2))$ $\text{d}2lmd(n) = (lmd(n) - lmd(n-1)) - (lmd(n-1) - lmd(n-2))$ faf = main feedback compensation coefficient every 128 milliseconds lmd = output lambda every 128 milliseconds	≤ 0.4 (U5 model) ≤ 0.45 (Other than U5 model)

Time Needed for Diagnosis: $32\text{ ms} \times 4 \times 1640\text{ time(s)}$

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

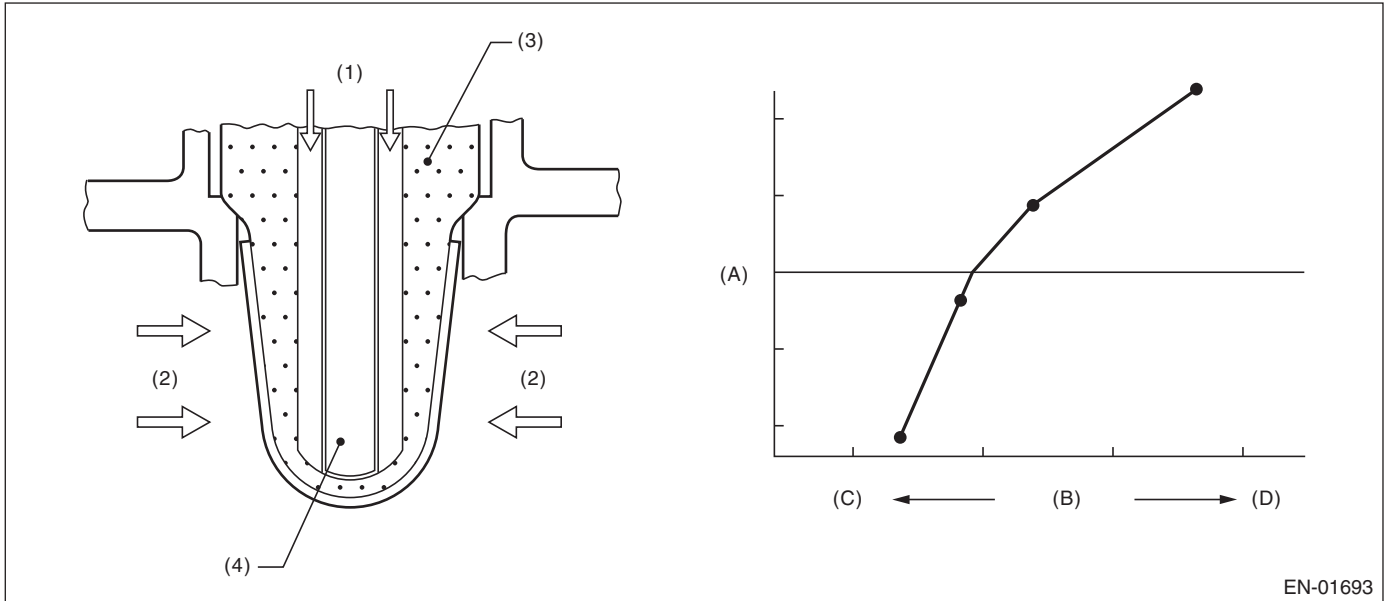
AE:DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1)

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

(3) ZrO_2

(4) Ceramic heater

(2) Exhaust gas

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 Judgement

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

Judgement Value

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

Time Needed for Diagnosis: 5000 ms

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

• Normality Judgement

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

Judgement Value

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

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

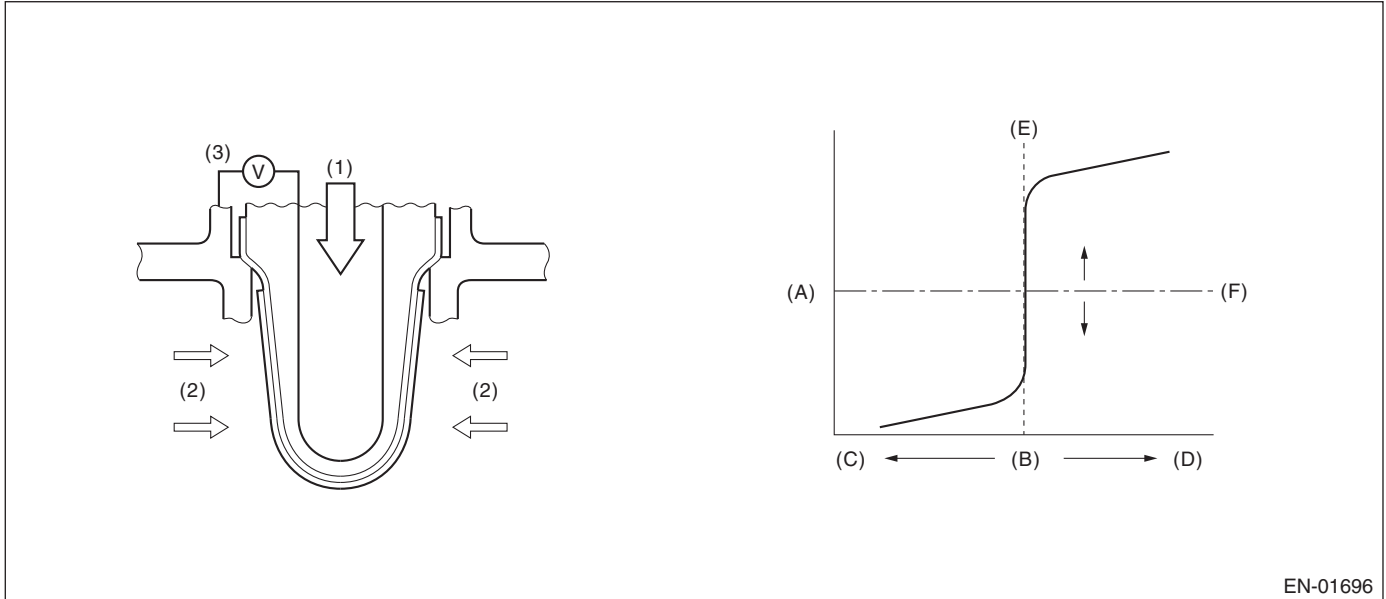
GENERAL DESCRIPTION

AF: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

(D) Lean

(1) Atmosphere

(B) Air fuel ratio

(E) Theoretical air fuel ratio

(2) Exhaust gas

(C) Rich

(F) Comparative voltage

(3) Electromotive force

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITION

Used for abnormality judgement

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	< 5 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	< 5 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	< 5 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	≥ 30000 ms
Low (3)	
Secondary air system	Not in operation
Closed loop control at the oxygen sensor	In operation
Misfire detection every 200 rotations	< 5 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	≥ 30000 ms
Fuel cut	Experienced

Used for normality judgement

Secondary Parameters	Enable Conditions
Secondary air system	Not in operation
Closed loop control at the oxygen sensor	In operation
Misfire detection every 200 rotations	< 5 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 Judgement

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

Judgement Value

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

Time Needed for Diagnosis:

High: 2500 ms

Low (1): 20000 ms

Low (2): 40000 ms

Low (3): Value from Map

Map

Fuel Cut Time (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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value	DTC
High Sensor output voltage	≤ 1.2 V	P0138
Low Sensor output voltage	≥ 0.03 V	P0137

Time Needed for Diagnosis:

High: Less than 1 second

Low (1): Less than 1 second

Low (2): Less than 1 second

Low (3): Less than 1 second

AG: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(H4SO)-54, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

AH: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 of 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.

2. Judge as NG when the oxygen sensor voltage is large (rich) when recovering from a deceleration fuel cut.

[Lean → rich diagnosis response]

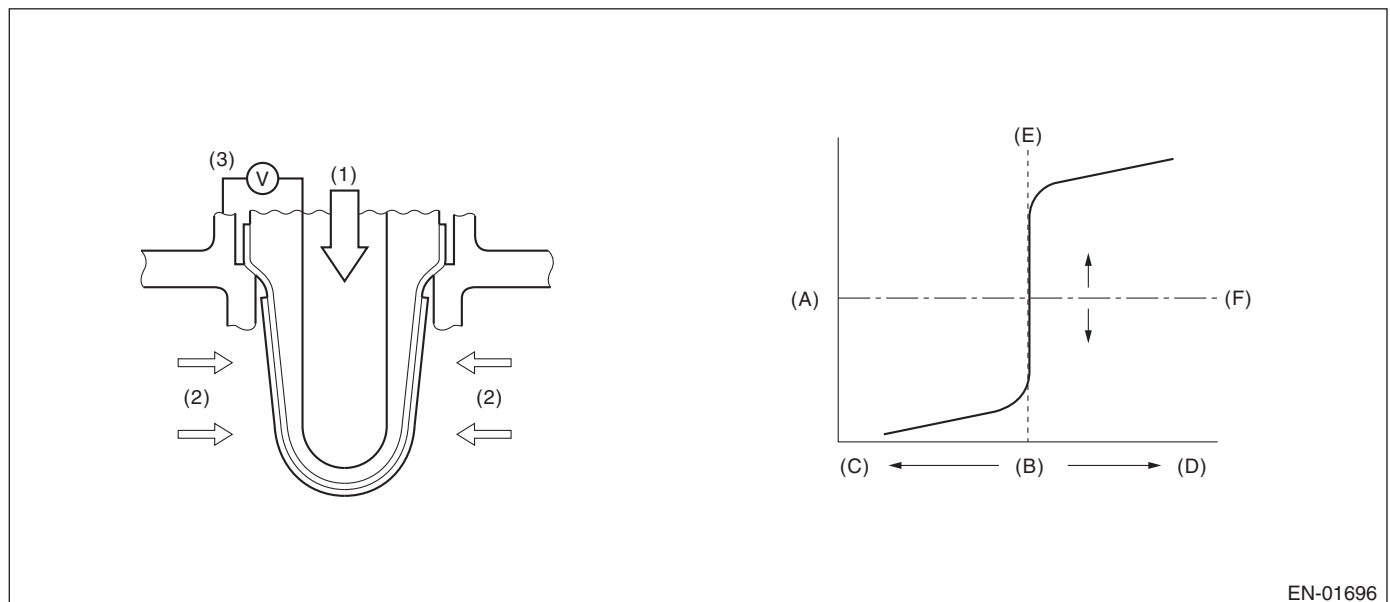
1. Measure the response time for oxygen sensor output changes when the A/F ratio changes to lean to rich. If the measured response time is larger than the threshold value, it is NG.

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

3. ENABLE CONDITION

Rich → lean diagnosis response

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 10.9 \text{ V}$
A/F main feedback control condition	Completed
Deceleration fuel cut time is 6000 ms or more.	Experienced
After fuel cut	$\geq 2000 \text{ ms}$
Current calculation time of the rear oxygen sensor heater	$\geq 55000 \text{ ms}$
Current continuation time of the rear oxygen sensor heater	$\geq 29000 \text{ ms}$
Estimated catalyst temperature	$\geq 480 \text{ }^{\circ}\text{C}$ (896 $^{\circ}\text{F}$)
Number of deceleration fuel cut	$\geq 1 \text{ time(s)}$

Diagnostic Trouble Code (DTC) Detecting Criteria

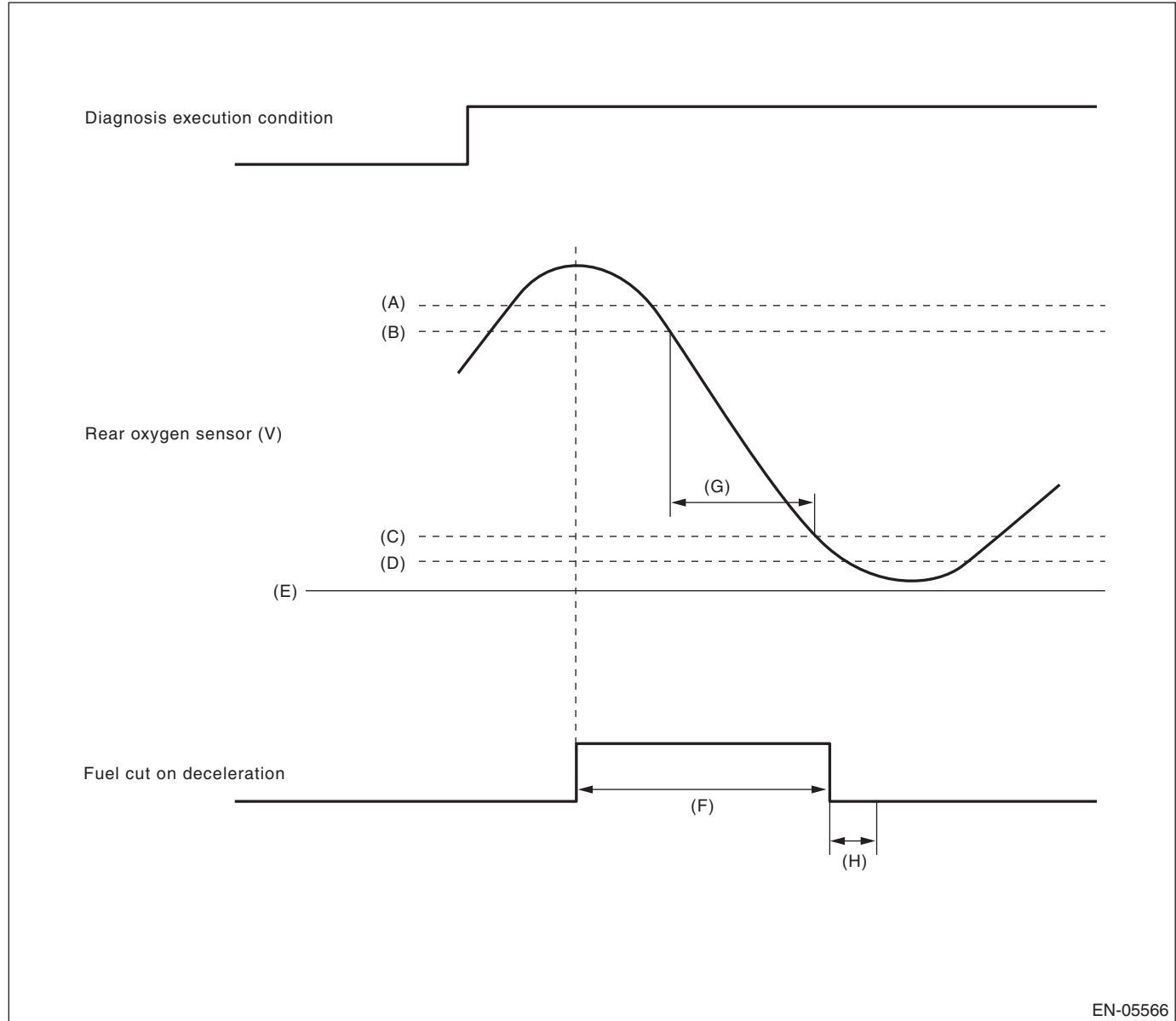
GENERAL DESCRIPTION

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once when deceleration fuel cut occurs after rapid acceleration. (Pay attention to the oxygen sensor voltage for the timing of the deceleration.)

5. DIAGNOSTIC METHOD

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 judgement criteria.



- (A) 0.55 V
- (B) 0.5 V
- (C) 0.2 V
- (D) 0.15 V

- (E) 0 V
- (F) More than 6000 ms
- (G) Measure the response time.

- (H) Execute the malfunction judgement in 2000 ms from the recovery of fuel cut on deceleration.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Abnormality Judgement

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

NOTE:

Variation time of rear oxygen sensor output voltage is short during fuel cut in deceleration. NG judgement should be performed after deceleration fuel cut. Even without deceleration fuel cut, judge as OK if the value is below the threshold.

When the deceleration fuel cut time is 6000 ms or more, judge as NG if the following criteria are met 2000 ms after recovering from the deceleration fuel cut.

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

If the fuel cut time in a deceleration fuel cut is long (6000 ms or more), and even after recovering from a deceleration fuel cut, the oxygen sensor voltage is high (0.55 V or more), judge as NG.

Judgement Value

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

Time Needed for Diagnosis: 1 time(s)

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

• Normality Judgement

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 (judgement 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.

Judgement Value

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

Time Needed for Diagnosis: 1 time(s)

6. ENABLE CONDITION

Lean → rich response diagnosis

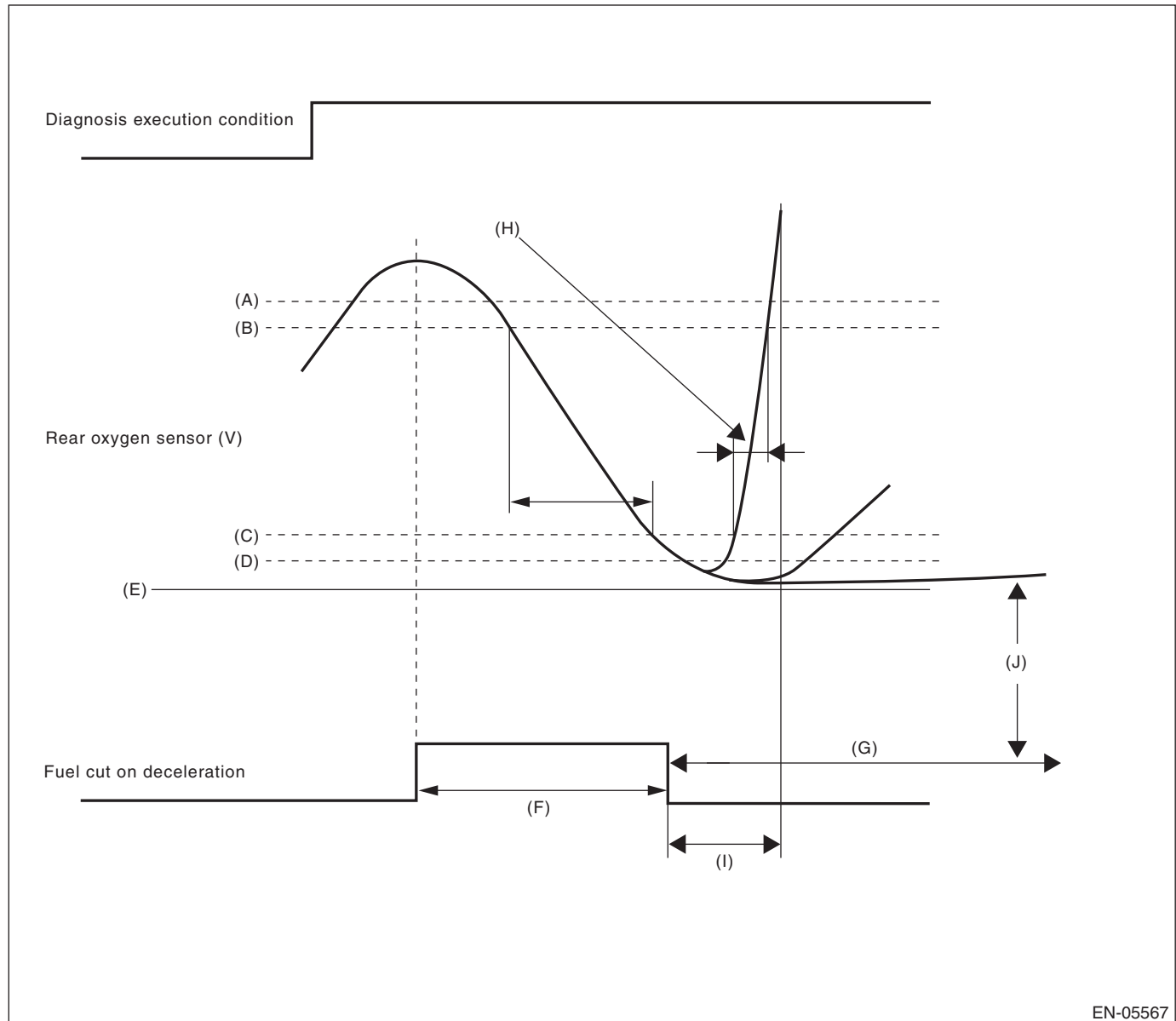
Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
A/F main feedback control condition	Completed
Deceleration fuel cut time is 6000 ms or more.	Experienced
After fuel cut	≥ 2000 ms
Current calculation time of the rear oxygen sensor heater	≥ 55000 ms
Current continuation time of the rear oxygen sensor heater	≥ 29000 ms
Estimated catalyst temperature	≥ 450 °C (842 °F)
Number of deceleration fuel cut	≥ 1 time(s)

7. GENERAL DRIVING CYCLE

Perform the diagnosis only once when deceleration fuel cut occurs after rapid acceleration. (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 judgement 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 judgement in 2000 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 Judgement

1) Judge as NG when the judgement 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.

Judgement 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	> 2000 ms ≥ 120000 ms

Time Needed for Diagnosis: 1 time(s)

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

• Normality Judgement

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 (judgement 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.

Judgement 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	≤ 2000 ms

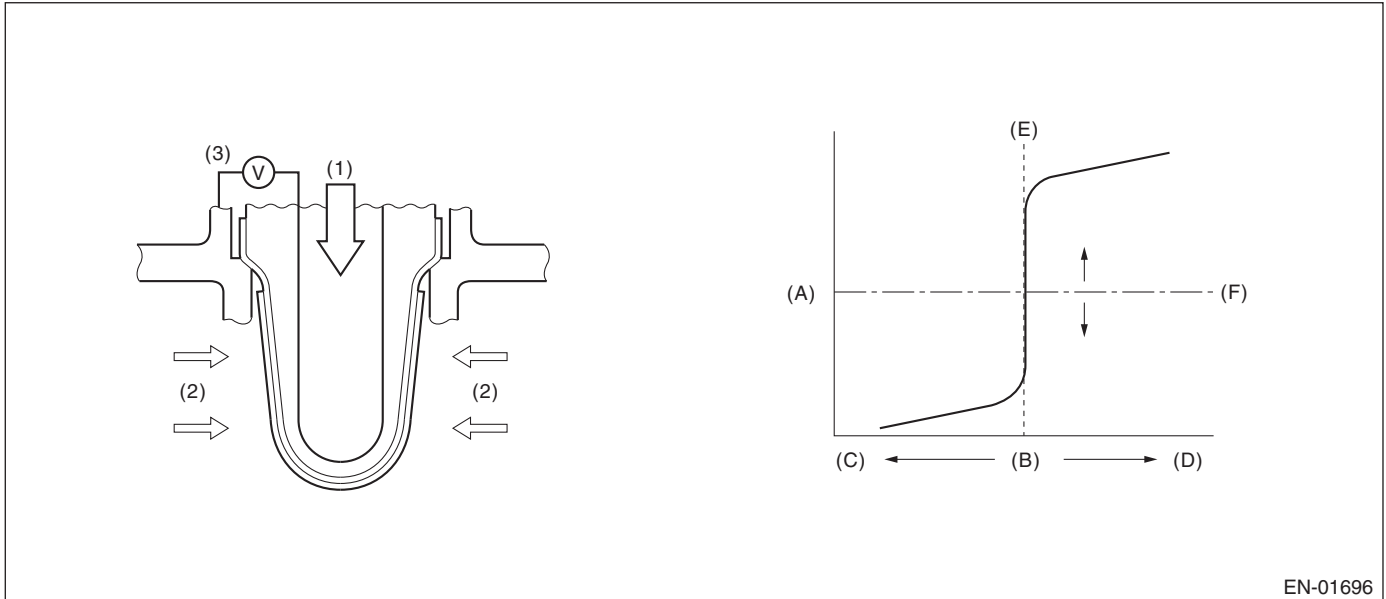
Time Needed for Diagnosis: 1 time(s)

AI: DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



EN-01696

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

3. ENABLE CONDITION (USED ONLY FOR MALFUNCTION JUDGEMENT)

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	$< 5 \text{ time(s)}$
Front oxygen (A/F) sensor compensation coefficient	Not in limit value
Battery voltage	$\geq 10.9 \text{ V}$
Deceleration fuel cut of 6000 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 Judgement

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

Judgement 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 Judgement

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

Judgement Value

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

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

AJ: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

Map 1

Engine speed (rpm)	Idling	650	1000	1500	2000	2500	3000	3500	4000	4500
Measured value (g(oz)/rev)	na	0.208 (0.01)	0.201 (0.01)	0.185 (0.01)	0.183 (0.01)	0.193 (0.01)	0.206 (0.01)	0.206 (0.01)	0.225 (0.01)	0.245 (0.01)

3. GENERAL DRIVING CYCLE

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

4. DIAGNOSTIC METHOD

• Abnormality Judgement

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.

Judgement 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 of Map 2

Map 2 (U5 model)

Amount of air (g (oz)/s)	0 (0)	3.2 (0.11)	6.4 (0.23)	9.6 (0.34)	12.8 (0.45)	16 (0.56)	19.2 (0.68)
fsobdL1 (%)	1.4	1.4	1.332	1.25	1.25	1.25	1.25

Map 2 (Other than U5 model)

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 Judgement

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

Judgement 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

AK: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.	< 0.15
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

Map 1

Engine speed (rpm)	Idling	650	1000	1500	2000	2500	3000	3500	4000	4500
Measured value (g(oz)/rev)	na	0.208 (0.01)	0.201 (0.01)	0.185 (0.01)	0.183 (0.01)	0.193 (0.01)	0.206 (0.01)	0.206 (0.01)	0.225 (0.01)	0.245 (0.01)

3. GENERAL DRIVING CYCLE

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

4. DIAGNOSTIC METHOD

• Abnormality Judgement

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.

Judgement 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	0.668	0.735	0.735	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 Judgement

Judge as OK when the malfunction criteria below continues for 10 seconds.

Judgement Value

Malfunction Criteria	Threshold Value
$\text{fsobd} = (\text{sglmd} - \text{tglmda}) + \text{faf} + \text{flaf}$	≥ 0.8

Time Needed for Diagnosis: 10 s

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

Detect faults in the fuel temperature sensor output properties.

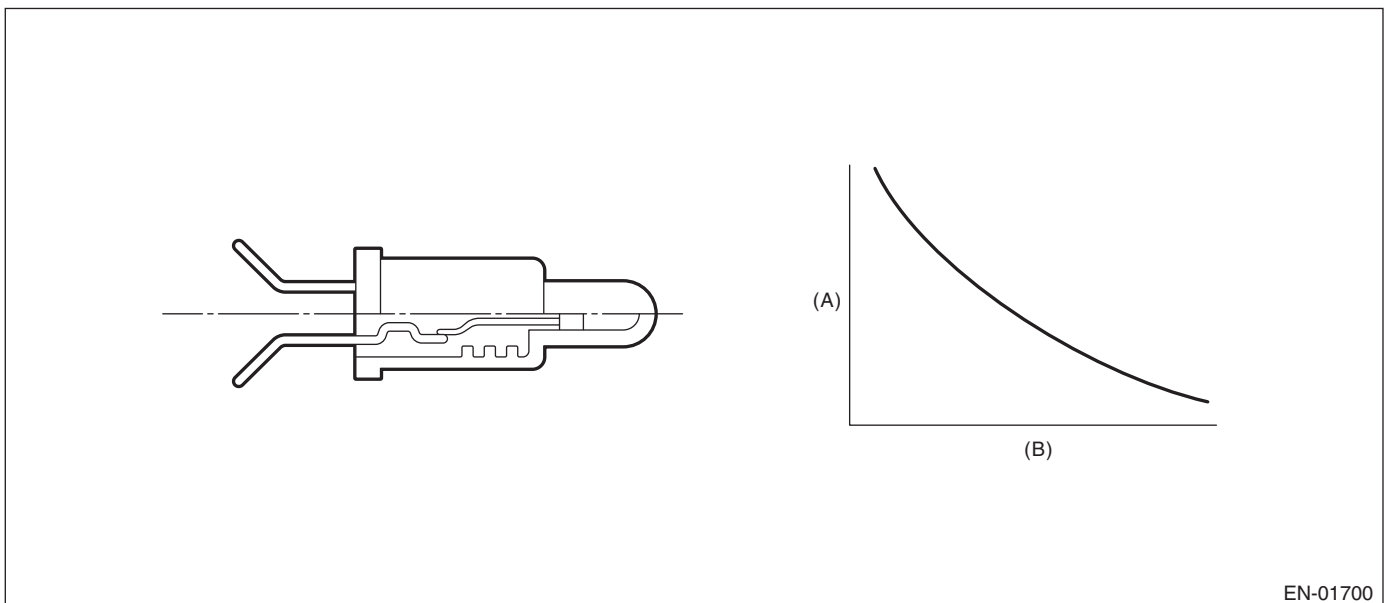
Diagnosis is performed in two methods (drift diagnosis and stuck diagnosis). If either is NG, judge as NG. If both are OK, Judge as OK and clear the NG.

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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Fuel level	≥ 9.6 ℓ (2.54 US gal, 2.11 Imp gal)
Elapsed time after starting the engine	≥ 20 s
Engine coolant temperature – Engine coolant temperature at engine start	> 10 °C (50 °F)
Fuel temperature – Engine coolant temperature	≥ 10 °C (50 °F)
Battery voltage	≥ 10.9 V

Time Needed for Diagnosis: 120 s

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

• Normality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Fuel level	≥ 9.6 ℓ (2.54 US gal, 2.11 Imp gal)
Elapsed time after starting the engine	≥ 20 s
Engine coolant temperature – Engine coolant temperature at engine start	> 10 °C (50 °F)
Fuel temperature – Engine coolant temperature	< 10 °C (50 °F)
Battery voltage	≥ 10.9 V
Engine coolant temperature	< 75 °C (167 °F)

Time Needed for Diagnosis: Less than 1 second

6. ENABLE CONDITION

STUCK DIAGNOSIS

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	≥ 20000 ms
Battery voltage	≥ 10.9 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 Judgement

Judge as NG when the following conditions are established.

Judgement 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 Judgement

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

Judgement 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

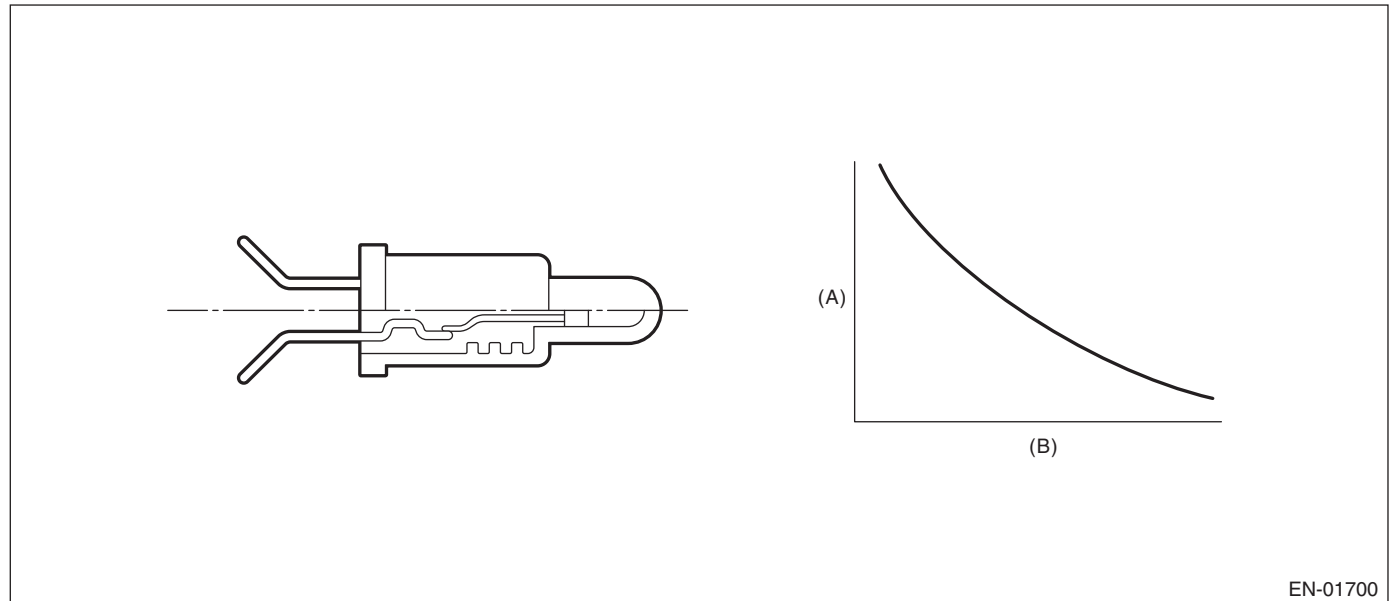
GENERAL DESCRIPTION

AM: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



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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Output voltage	$< 0.343951474 \text{ V}$
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 Judgement

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

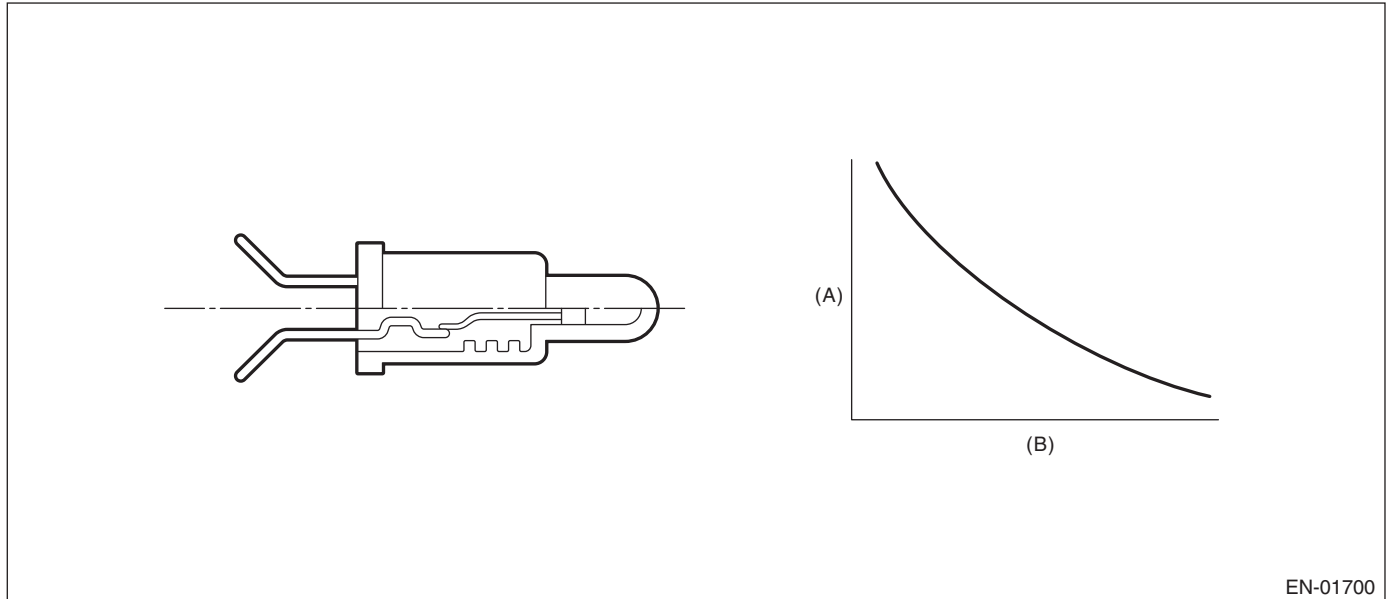
Judgement Value

Malfunction Criteria	Threshold Value
Output voltage	$\geq 0.343951474 \text{ V}$
Battery voltage	$\geq 10.9 \text{ V}$

Time Needed for Diagnosis: Less than 1 second

AN: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 Judgement**

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

Judgement Value

Malfunction Criteria	Threshold Value
Output voltage	$\geq 4.716 \text{ V}$
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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Output voltage	$< 4.716 \text{ V}$
Battery voltage	$\geq 10.9 \text{ V}$

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

AO: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	≥ 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.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

4. DIAGNOSTIC METHOD

• Abnormality Judgement

Judge as NG when the following conditions are established.

Judgement Value

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

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

a. Timer stop at fuel cut

b. During the driving conditions except a) above, timer counts up as follows.

64 milliseconds + TOILCNT milliseconds (at the time of 64 milliseconds)

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)
Temperature °C (°F)	-30 (-22)	64 ms	73.2 ms	83.9 ms	96.3 ms	113.2 ms	133.9 ms	160.2 ms	194.6 ms
	-20 (-4)	64 ms	73.3 ms	84 ms	96.6 ms	113.7 ms	135 ms	162 ms	197.4 ms
	-10 (14)	64 ms	73.4 ms	84.2 ms	96.9 ms	114.5 ms	136.4 ms	164.4 ms	201.5 ms
	0 (32)	64 ms	73.5 ms	84.5 ms	97.4 ms	115.6 ms	138.5 ms	168 ms	207.6 ms
	10 (50)	102.2 ms	114.8 ms	129.4 ms	146.7 ms	171.7 ms	203.4 ms	245.1 ms	302.1 ms

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

$t = 1882940 \text{ ms} - 43302 \text{ ms} \times T_i$ ($t \geq 2400000$)

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 Judgement

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

Judgement 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

AP: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 judgement value.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.166 V

Time Needed for Diagnosis: 500 ms

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

• Normality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 0.166 V

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

AQ: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 judgement value.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgement

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

Judgement 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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Output voltage	< 4.716 V

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

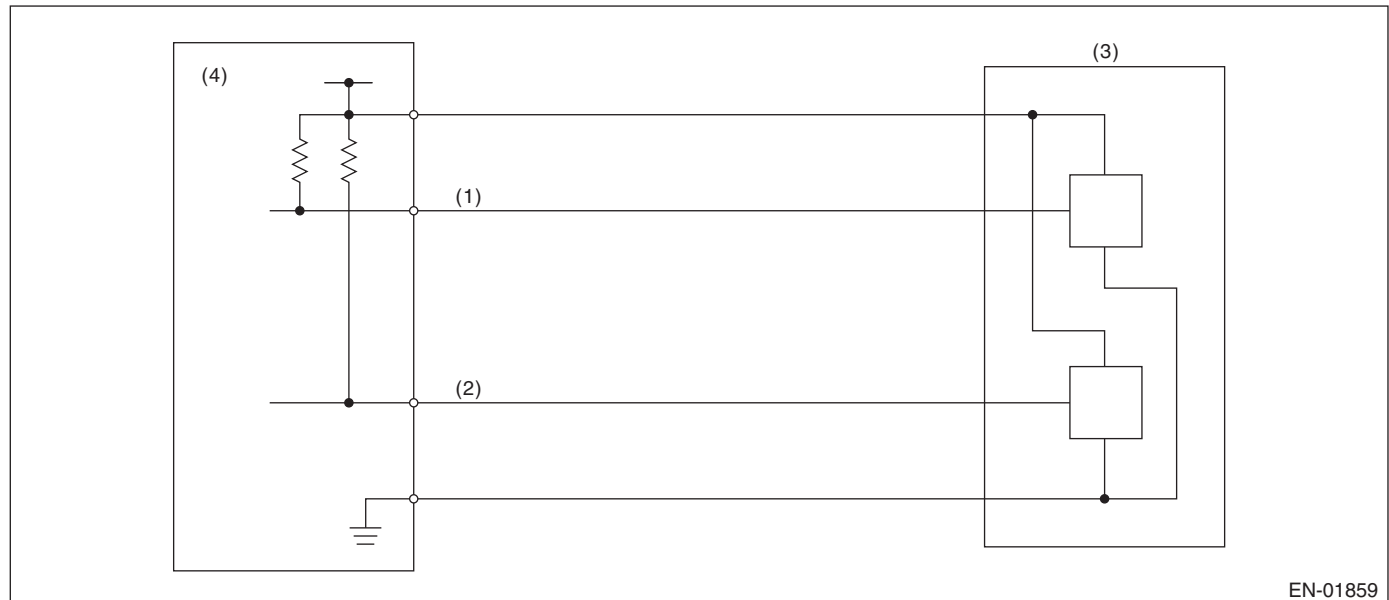
AR:DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT LOW

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
(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.

5. DIAGNOSTIC METHOD

• Abnormality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	$\leq 0.926256 \text{ V}$

Time Needed for Diagnosis: 24 ms

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

• Normality Judgement

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

Judgement Value

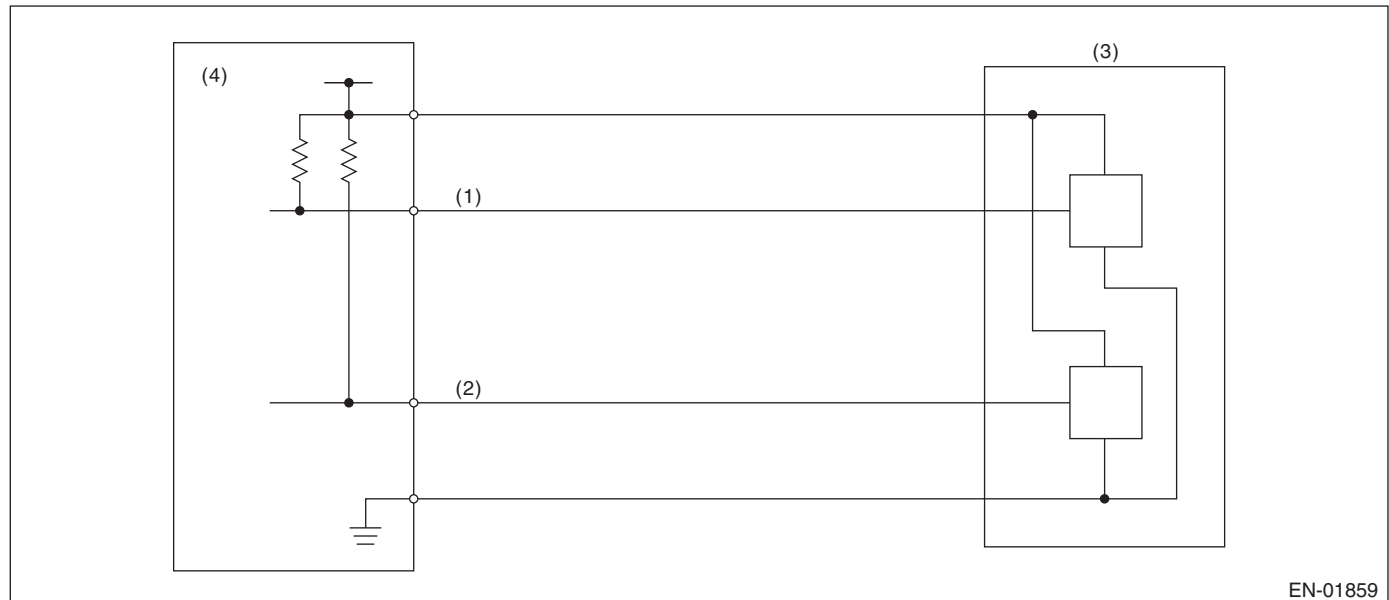
Malfunction Criteria	Threshold Value
Sensor 2 input voltage	$> 0.926256 \text{ V}$

Time Needed for Diagnosis: 24 ms

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

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

Judge as NG if out of specification.

2. COMPONENT DESCRIPTION

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

- (3) Throttle position sensor

- (4) Engine control module (ECM)

3. ENABLE CONDITION

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

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD**• Abnormality Judgement**

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

Judgement 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 Judgement

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

Judgement 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

AT:DTC P0301 CYLINDER 1 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

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

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

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

The following detecting methods are adopted for these detection.

1) Intermittent misfire: FTP 1.5 times misfire

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

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

- 360° Interval Difference Method

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
All secondary parameters enable conditions	≥ 1024 ms
Intake manifold pressure change at 180°CA	< Value of Map 1
Throttle position change during 16 milliseconds	< 21 °
Fuel shut-off function	Not in operation
Fuel level	≥ 9.6 ℓ (2.54 US gal, 2.11 Imp gal)
Vehicle dynamic control or AT torque control	Not in operation
Evaporative system leak check	Not in operation
Engine speed	460 rpm — 6300 rpm
Intake manifold pressure	≥ Value of Map 2
Battery voltage	≥ 8 V
Fuel parameter determination	Not extremely low volatility
Elapsed time after starting the engine	≥ 0 ms
Engine load change during 32 milliseconds	< 1000 rpm

Map 1

- AT model

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6300
kPa	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3
(mmHg, inHg)	(100, 3.9)	(100, 3.9)	(100, 3.9)	(100, 3.9)	(100, 3.9)	(100, 3.9)	(100, 3.9)	(100, 3.9)	(100, 3.9)	(100, 3.9)	(100, 3.9)	(100, 3.9)	(100, 3.9)

- MT model

rpm	650	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6300
kPa	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3
(mmHg, inHg)	(100, 3.9)	(100, 3.9)	(100, 3.9)	(100, 3.9)	(100, 3.9)	(100, 3.9)	(100, 3.9)	(100, 3.9)	(100, 3.9)	(100, 3.9)	(100, 3.9)	(100, 3.9)	(100, 3.9)

Map 2

- AT model

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6300
kPa	26	23.9	23.3	23.1	23.6	25.1	26.2	26.6	26.9	30	33.4	37.8	39.5
(mmHg, inHg)	(195.0, 7.7)	(179.5, 7.1)	(174.7, 6.9)	(173.2, 6.8)	(176.8, 7)	(188.0, 7.4)	(196.9, 7.8)	(199.6, 7.9)	(201.5, 7.9)	(225.0, 8.9)	(250.4, 9.9)	(283.5, 11.2)	(296.0, 11.7)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

- MT model

Vehicle speed < 64 km/h (39.8 MPH)

rpm	650	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6300
kPa (mmHg, inHg)	24.5 (184, 7.2)	22.7 (170.3, 6.7)	21.4 (160.2, 6.3)	21.5 (161.6, 6.4)	21.5 (161.4, 6.4)	23.2 (174.4, 6.9)	24.7 (185.5, 7.3)	25.8 (193.3, 7.6)	27.1 (203.2, 8)	28.8 (216.3, 8.5)	32.3 (242.2, 9.5)	36.3 (272, 10.7)	37.9 (284.5, 11.2)

Vehicle speed ≥ 68 km/h (42.3 MPH)

rpm	650	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6300
kPa (mmHg, inHg)	31.6 (237, 9.3)	31.6 (237, 9.3)	31.6 (237, 9.3)	31.1 (233, 9.2)	31.3 (235, 9.3)	33.1 (248, 9.8)	33.9 (254, 10)	28.8 (216, 8.5)	30.1 (226, 8.9)	33.3 (250, 9.8)	36.9 (277, 10.9)	40.1 (301, 11.9)	43.2 (324, 12.8)

3. GENERAL DRIVING CYCLE

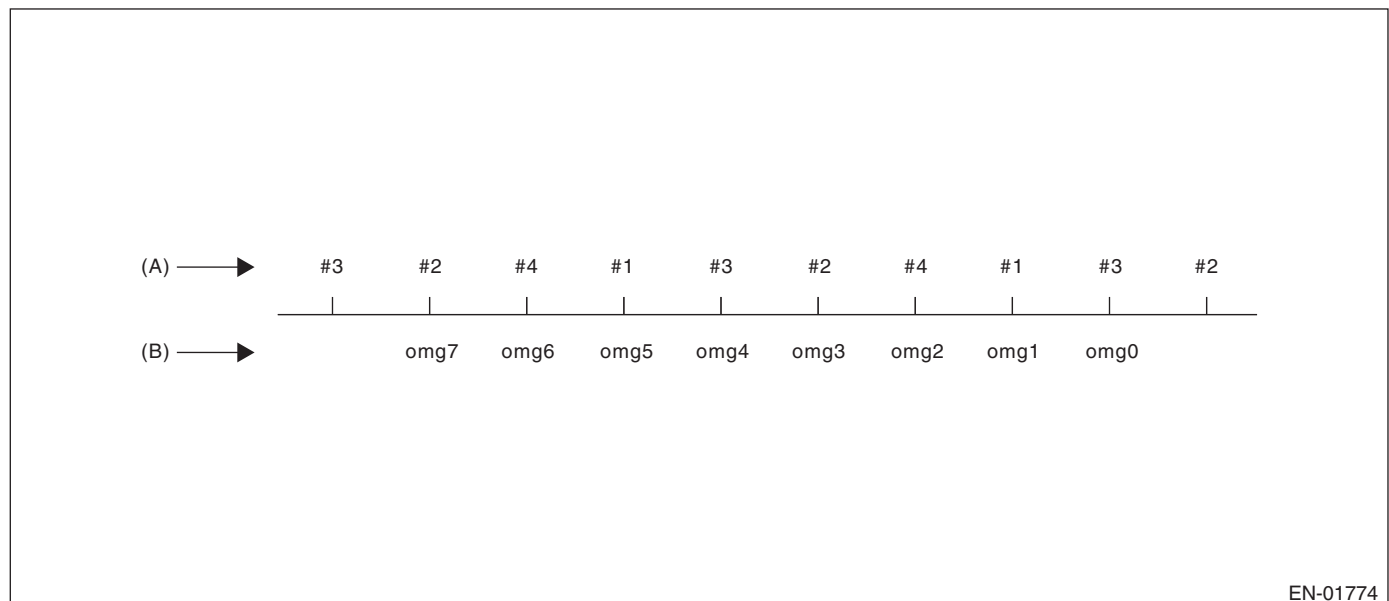
- If conditions are met, it is possible to detect the misfires from idling to high engine speed. However, in case any engine load or breakage occurs, perform with the engine at idle.
- Perform the diagnosis continuously.

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 judgement value. While 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 judgement value) →	NG judgement (Misfire occurrence judgement required by the law) (Compare number of misfire with judgement)
	• 180° Interval Difference Method • 360° Interval Difference Method • 720° Interval Difference Method	• FTP 1.5 times misfire NG judgement • Catalyst damage misfire NG judgement

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.



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(A) Ignition order

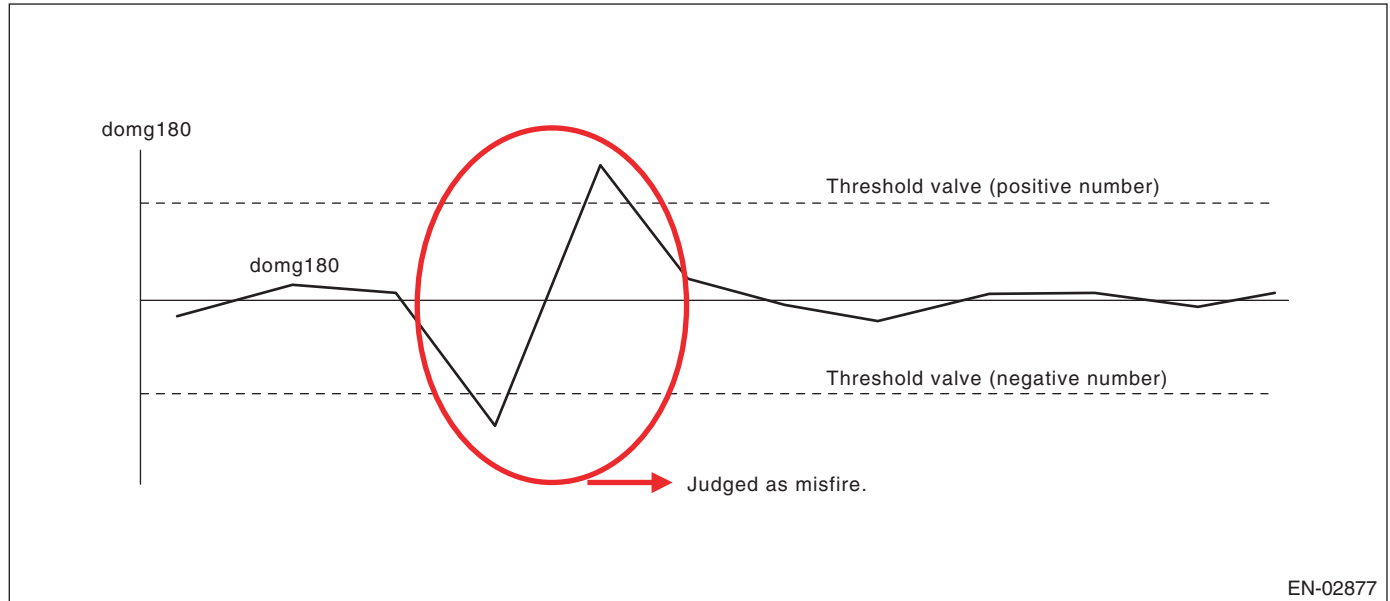
(B) Crankshaft position speed

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

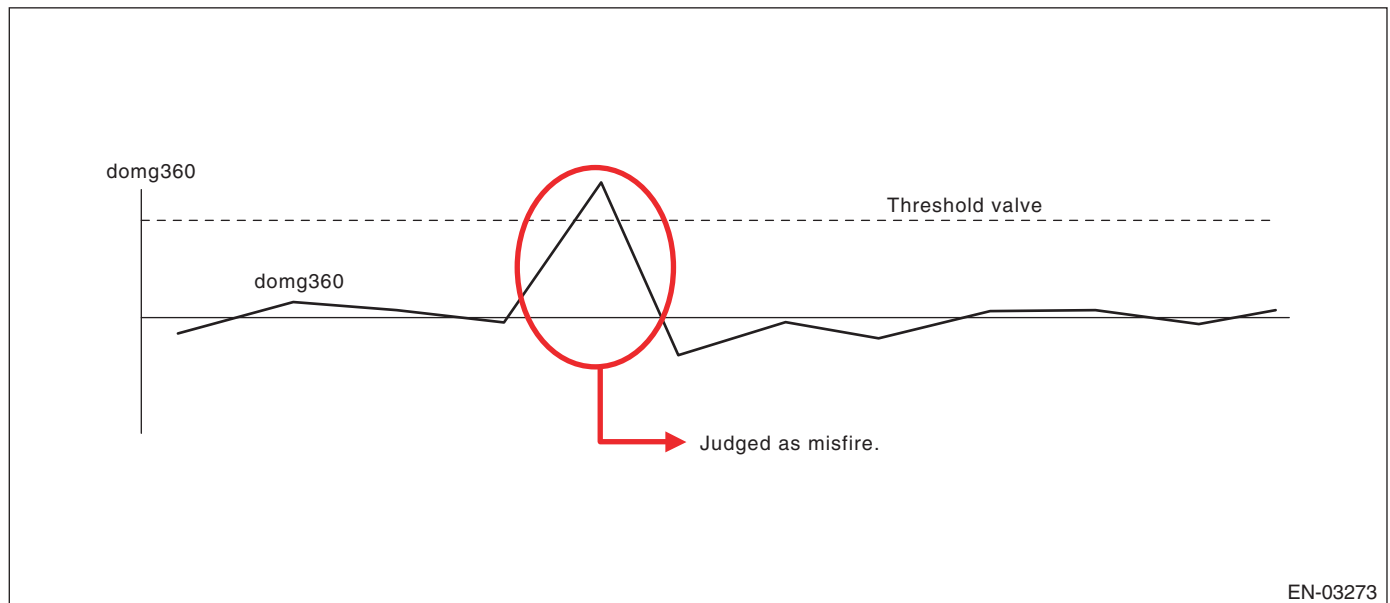
180° Interval Difference Method

Diagnostic value	$\text{domg } 180 = (\text{omg } 1 - \text{omg } 0) - (\text{omg } 5 - \text{omg } 1)/4$
Judge as a misfire in the following cases.	
• $\text{domg } 180 > \text{judgement value of positive side}$ • $\text{domg } 180 \leq \text{judgement value of negative side}$ (Judgement value before 180° CA)	



360° Interval Difference Method

Diagnostic value	$\text{domg } 360 = (\text{omg } 1 - \text{omg } 0) - (\text{omg } 3 - \text{omg } 2)$
Misfire judgement	$\text{domg } 360 > \text{Judgement value} \rightarrow \text{Judge as misfire}$

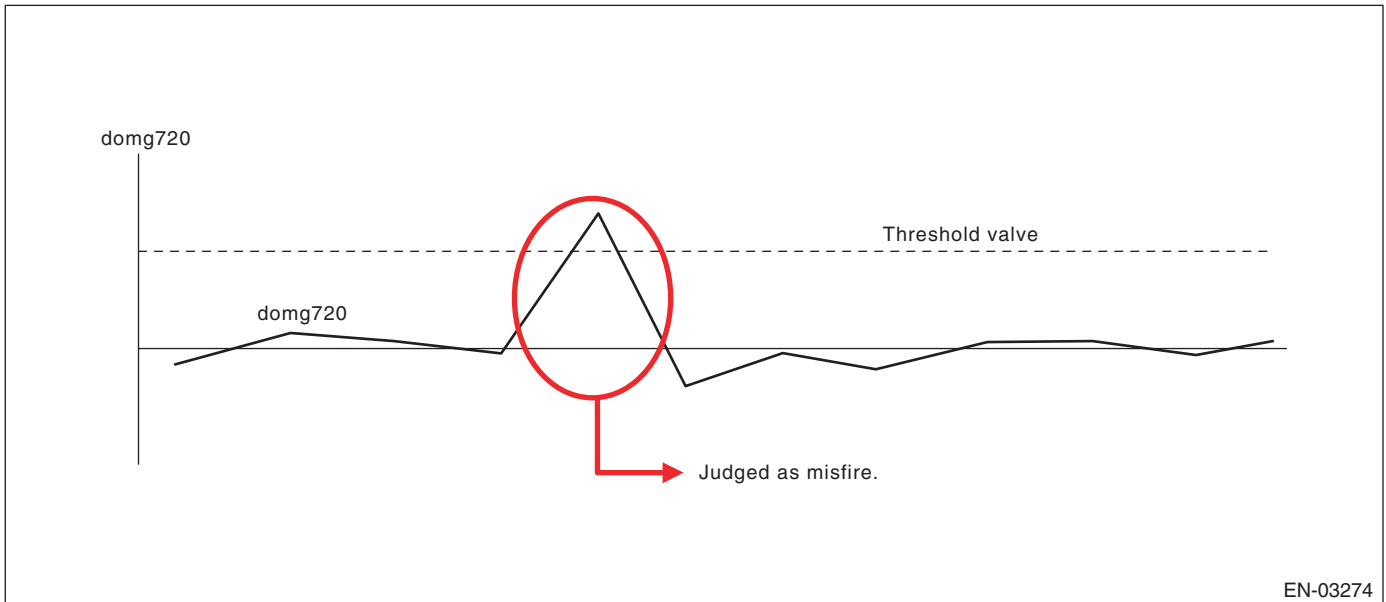


Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

720° Interval Difference Method

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



EN-03274

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

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

Malfunction Criteria	Threshold Value
FTP emission judgement value	$\geq 18 \times 100/2000\%$ in 1000 revs. (U5 model)
	$\geq 20 \times 100/2000\%$ in 1000 revs. (Other than U5 model)

Time Needed for Diagnosis: 1000 engine revs.

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

- Normality Judgement

Judgement Value

Malfunction Criteria	Threshold Value
FTP emission judgement value	$< 18 \times 100/2000\%$ in 1000 revs. (U5 model)
	$< 20 \times 100/2000\%$ in 1000 revs. (Other than U5 model)

Time Needed for Diagnosis: 1000 engine revs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

Judgement Value

Malfunction Criteria	Threshold Value
Catalyst damage misfire judgement value	≥ Value of Map 3

Map 3 (U5 model)

		Intake air (g(oz)/rev)							
		0.16 (0.01)	0.28 (0.01)	0.4 (0.01)	0.52 (0.02)	0.64 (0.02)	0.76 (0.03)	0.92 (0.03)	1.1 (0.04)
Engine speed (rpm)	700	100	100	100	100	90	80	64	48
	1000	100	100	100	100	90	80	52	24
	1500	100	100	90	80	69	57	39	22
	2000	80	80	80	80	62	44	33	21
	2500	67	67	58	50	40	31	25	20
	3000	57	57	49	40	30	20	20	20
	3500	44	44	34	24	20	20	20	20
	4000	36	36	28	20	20	20	20	20
	4500	27	27	20	20	20	20	20	20
	5000	20	20	20	20	20	20	20	20
	5500	20	20	20	20	20	20	20	20
	6000	20	20	20	20	20	20	20	20
	6300	20	20	20	20	20	20	20	20

Map 3 (Other than U5 model)

		Intake air (g(oz)/rev)							
		0.16 (0.01)	0.28 (0.01)	0.4 (0.01)	0.52 (0.02)	0.64 (0.02)	0.76 (0.03)	0.92 (0.03)	1.1 (0.04)
Engine speed (rpm)	700	100	100	100	100	90	80	64	48
	1000	100	100	100	100	90	80	63	44
	1500	100	100	90	80	73	67	54	40
	2000	80	80	80	80	68	57	51	44
	2500	80	80	73	67	62	57	51	44
	3000	67	67	62	57	51	44	44	44
	3500	67	67	56	44	40	36	34	31
	4000	57	57	44	31	24	20	20	20
	4500	44	44	33	31	20	20	20	20
	5000	44	44	38	31	20	20	20	20
	5500	36	36	31	27	20	20	20	20
	6000	20	20	20	20	20	20	20	20
	6300	20	20	20	20	20	20	20	20

Time Needed for Diagnosis: 200 engine revs.

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

- **Normality Judgement**

Judgement Value

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

Time Needed for Diagnosis: 200 engine revs.

AU:DTC P0302 CYLINDER 2 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H4SO)-78, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

AV:DTC P0303 CYLINDER 3 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H4SO)-78, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

AW:DTC P0304 CYLINDER 4 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H4SO)-78, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

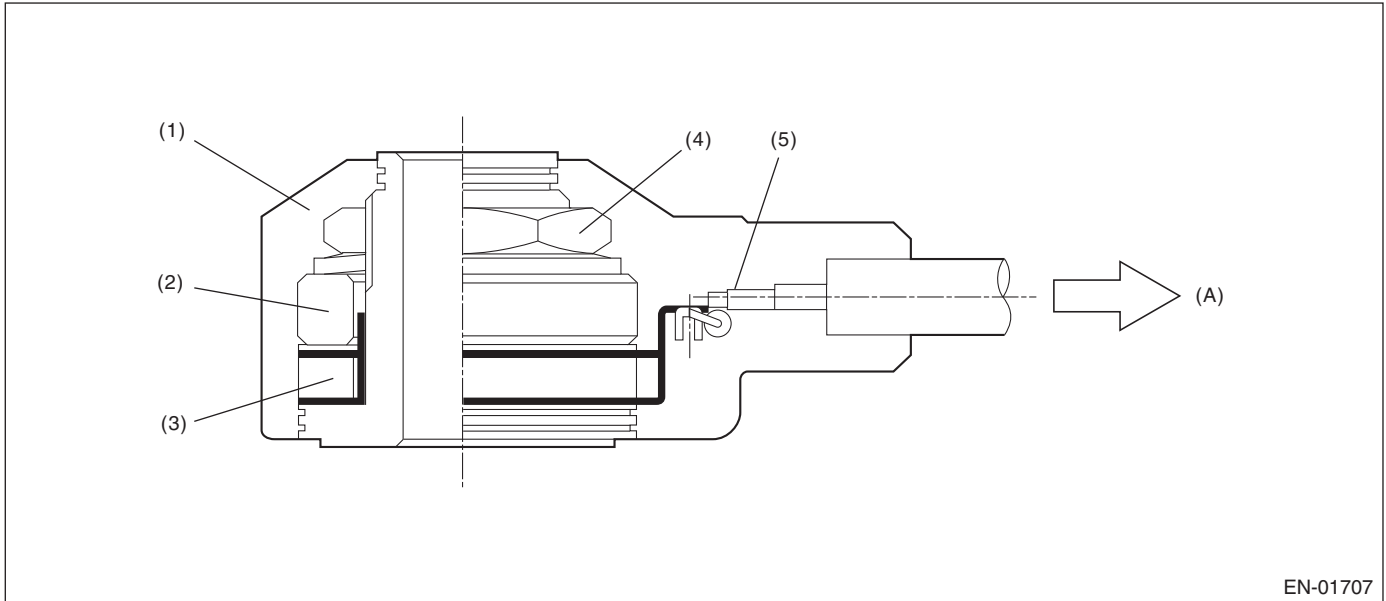
GENERAL DESCRIPTION

AX: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 Judgement

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

Judgement 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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 0.243 V

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

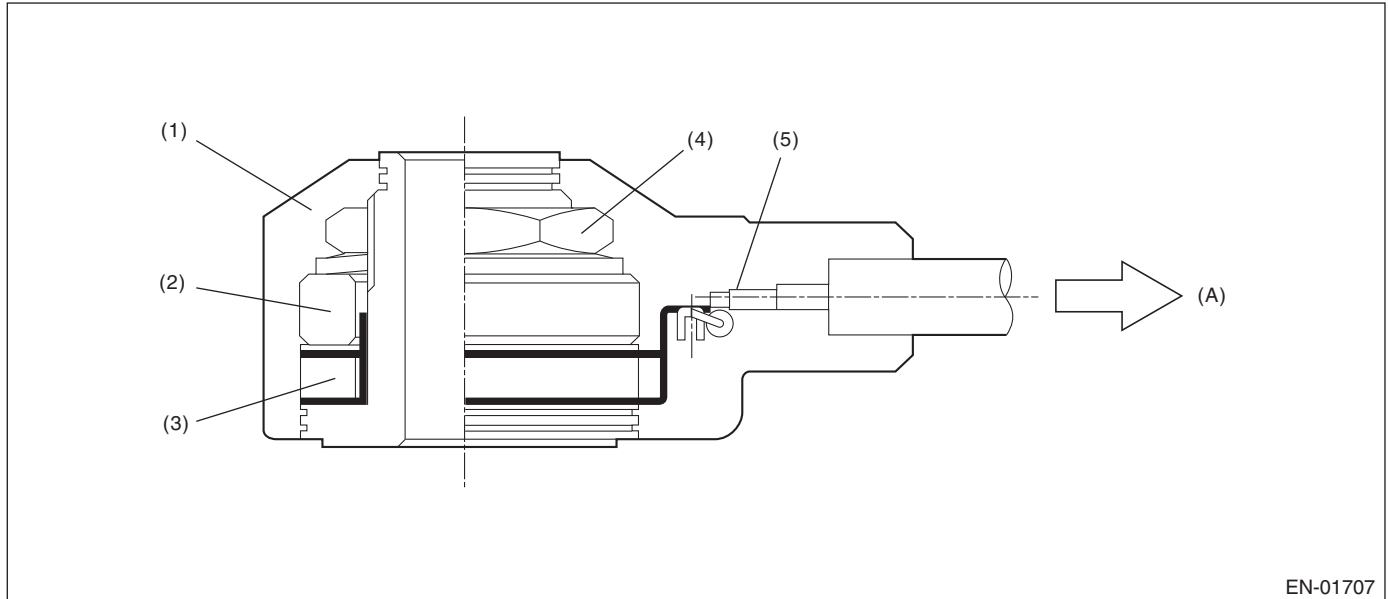
GENERAL DESCRIPTION

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

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



(A) To knock sensor harness

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

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgement

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

Judgement 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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Output voltage	< 4.709 V

Time Needed for Diagnosis: Less than 1 second

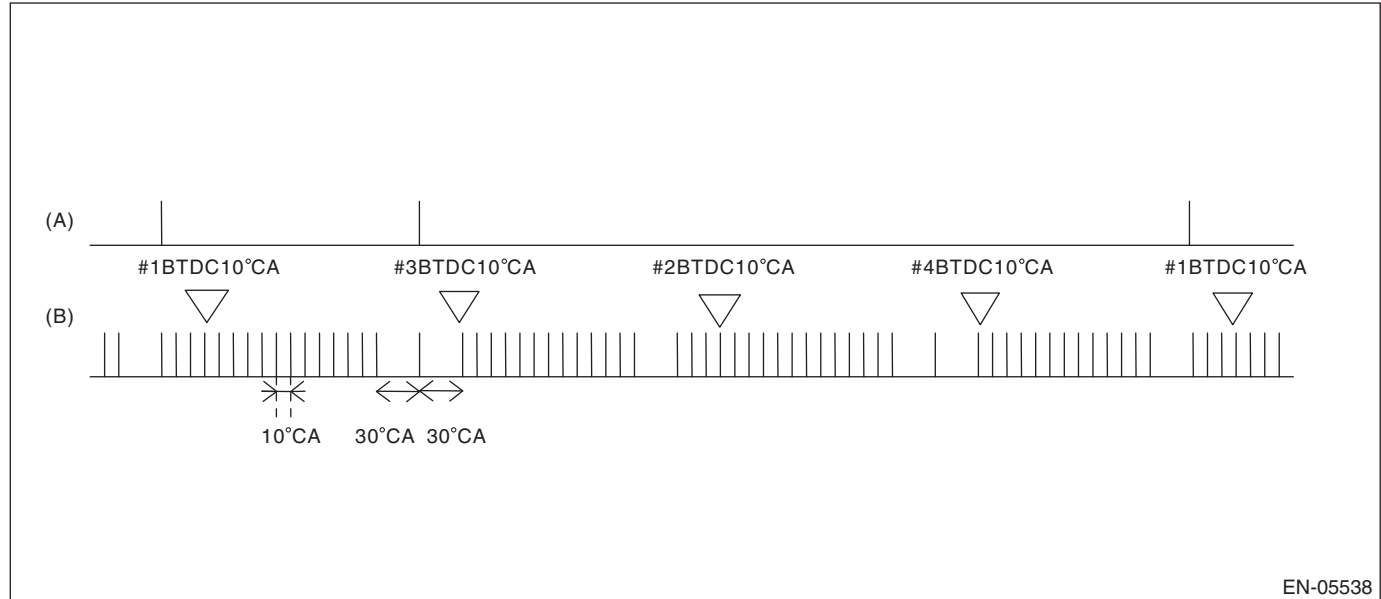
AZ:DTC P0335 CRANKSHAFT POSITION SENSOR “A” CIRCUIT

1. OUTLINE OF DIAGNOSIS

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

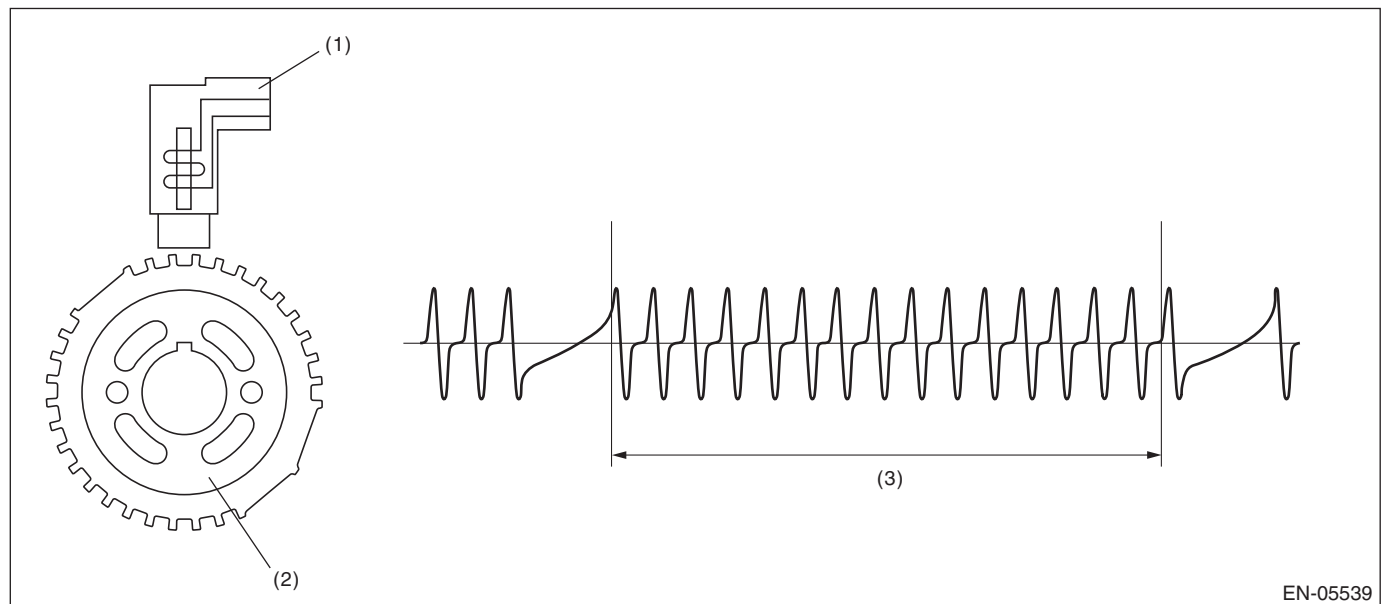
Judge as NG when the crank signal is not input even though the starter was rotated.

2. COMPONENT DESCRIPTION



(A) Cam signal

(B) Crankshaft signal



(1) Crankshaft position sensor

(2) Crank sprocket

(3) Crankshaft half-turn

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 Judgement

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

Judgement 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 Judgement

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

Judgement 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

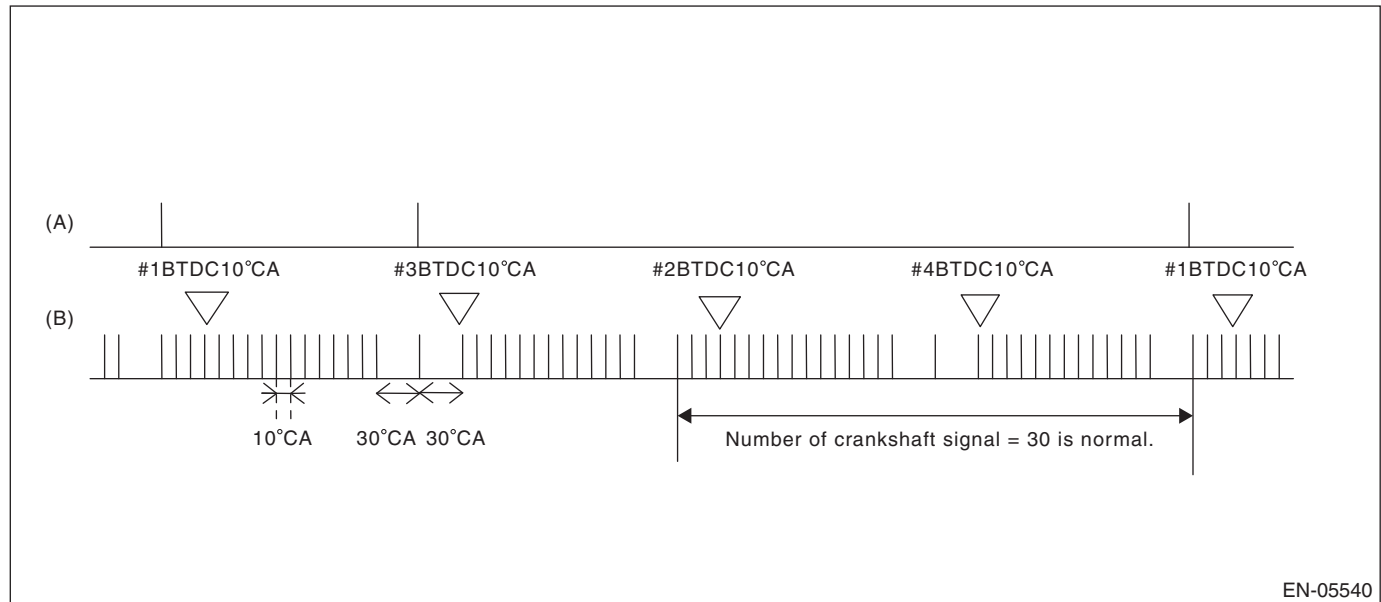
BA:DTC P0336 CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/ PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect for faults in crankshaft position sensor output properties.

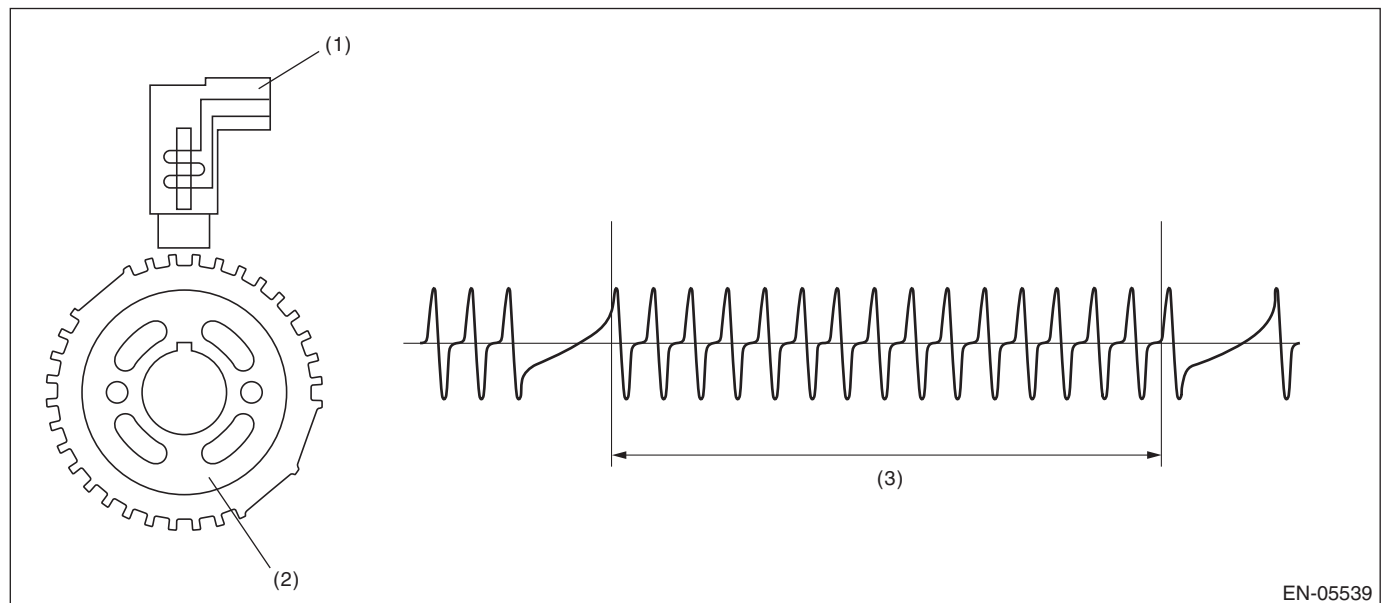
Judge as NG when there is a problem in the number of crankshaft signals for every revolution.

2. COMPONENT DESCRIPTION



(A) Cam signal

(B) Crankshaft signal



(1) Crankshaft position sensor

(2) Crank sprocket

(3) Crankshaft half-turn

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 8 \text{ V}$
Engine speed	$< 4000 \text{ rpm}$

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously under 3000 rpm engine revs.

5. DIAGNOSTIC METHOD

• Abnormality Judgement

Judge as NG when the following conditions are established.

Judgement 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.

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

• Normality Judgement

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

Judgement 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

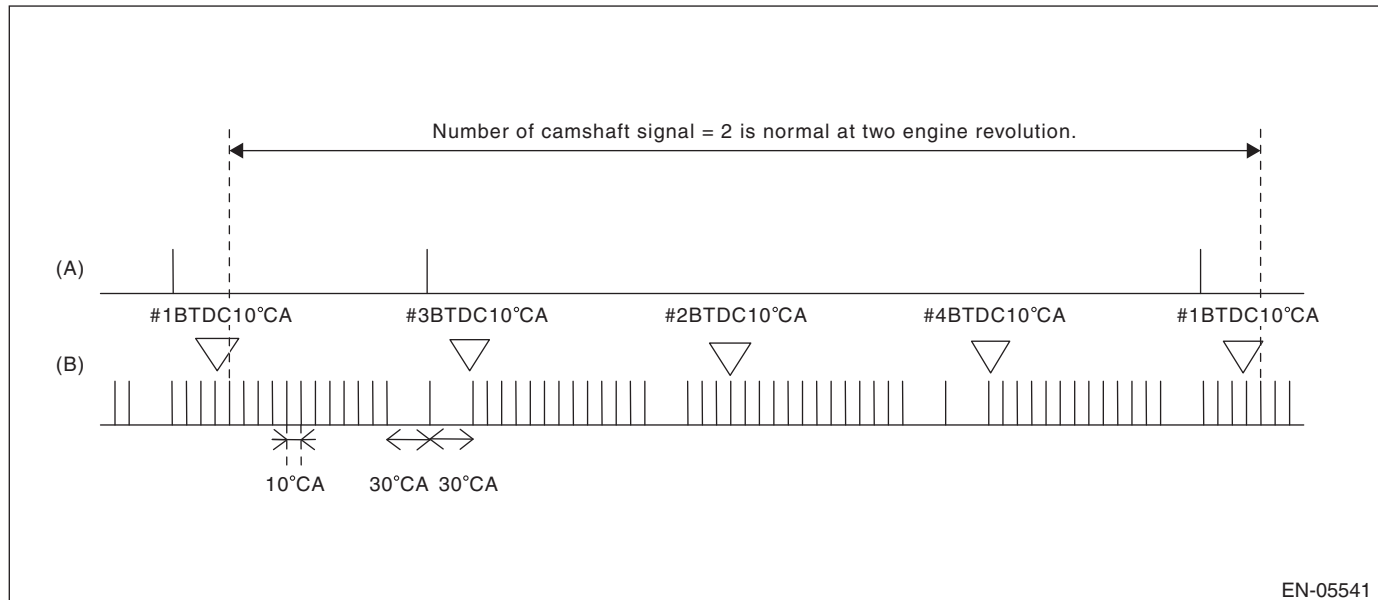
BB:DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR)

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

(B) Crankshaft signal

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Abnormality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Battery voltage	$\geq 8\text{ V}$
Amount of camshaft sensor signal during 2 revs.	Not = 2

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

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

Normality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Voltage	$\geq 8\text{ V}$
Amount of camshaft sensor signal during 2 revs.	= 2

Time Needed for Diagnosis: Two engine revs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

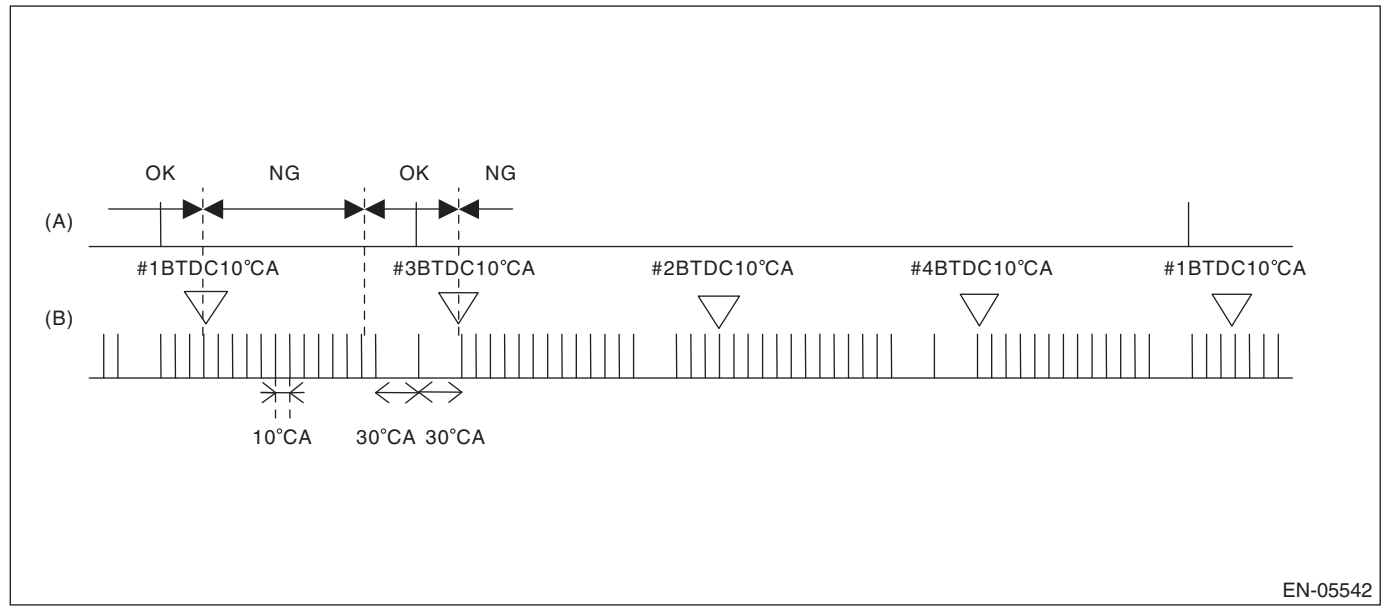
BC:DTC P0341 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/ PERFORMANCE (BANK 1 OR SINGLE SENSOR)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of camshaft position sensor output property.

Judge as NG when the camshaft line signal input timing is shifted from the crankshaft signal because of timing belt tooth chip etc.

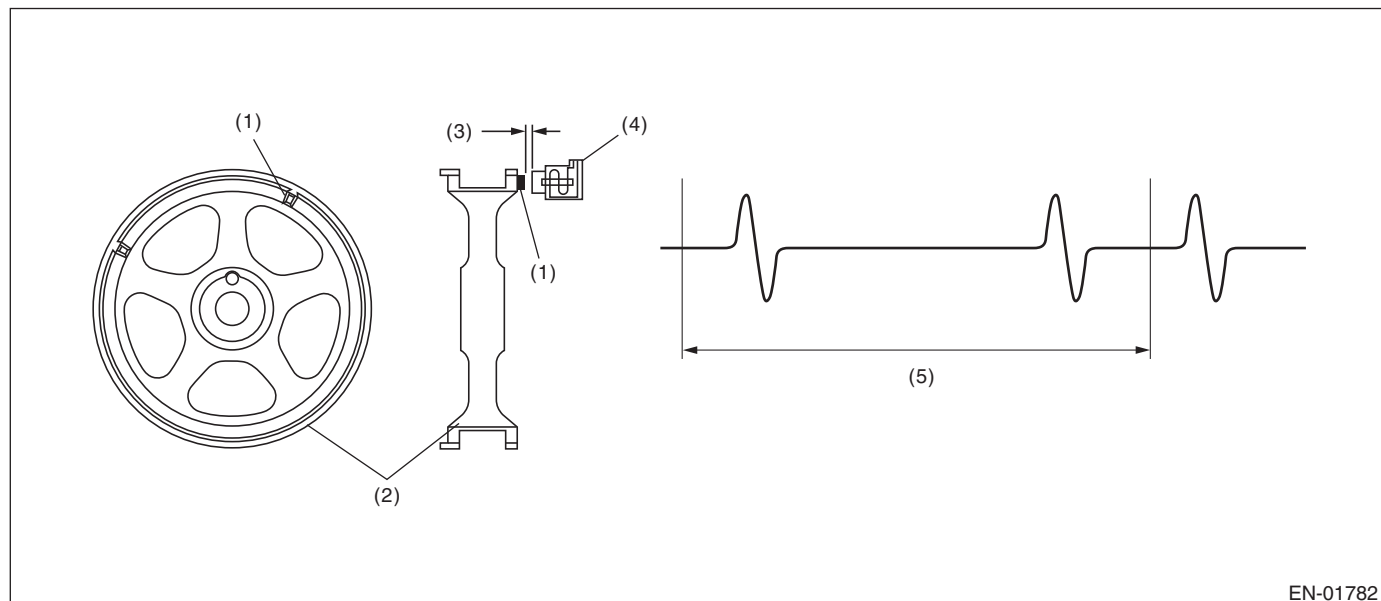
2. COMPONENT DESCRIPTION



EN-05542

(A) Camshaft signal

(B) Crankshaft signal



EN-01782

(1) Boss

(2) Cam sprocket

(3) Air gap

(4) Camshaft position sensor

(5) One camshaft revolution (two engine revolutions)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Cylinder number identification	Completed
Battery voltage	$\geq 8 \text{ V}$
Engine speed	550 rpm — 1000 rpm
Engine operation	Idling
Misfire	Not detected
Engine load change during 4 milliseconds	$\leq 12799.8 \text{ rpm}$

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously at idle speed.

5. DIAGNOSTIC METHOD

• Abnormality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Position of camshaft position sensor signal	Not between BTDC 10°CA and BTDC 80°CA

Time Needed for Diagnosis: 10 engine revs.

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

• Normality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Position of camshaft position sensor signal	Between BTDC10°CA and BTDC80°CA

Time Needed for Diagnosis: Two engine revs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

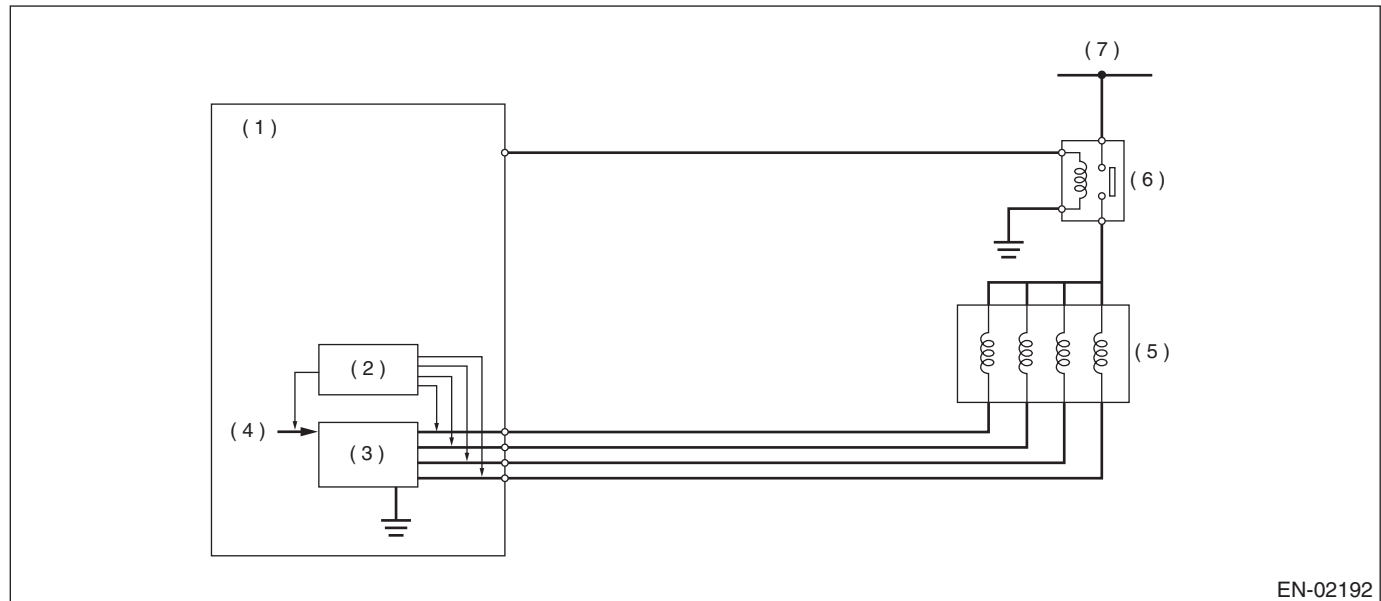
BD:DTC P0400 EXHAUST GAS RECIRCULATION FLOW

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 | | |

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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 — 2950 rpm
Intake manifold pressure (absolute pressure)	< 44 kPa (330 mmHg, 13 inHg)
Ambient air temperature	≥ 5 °C(41 °F)
Throttle position	< 0.25 °
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Vehicle speed	≥58 km/h (36 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

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).

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Abnormality Judgement

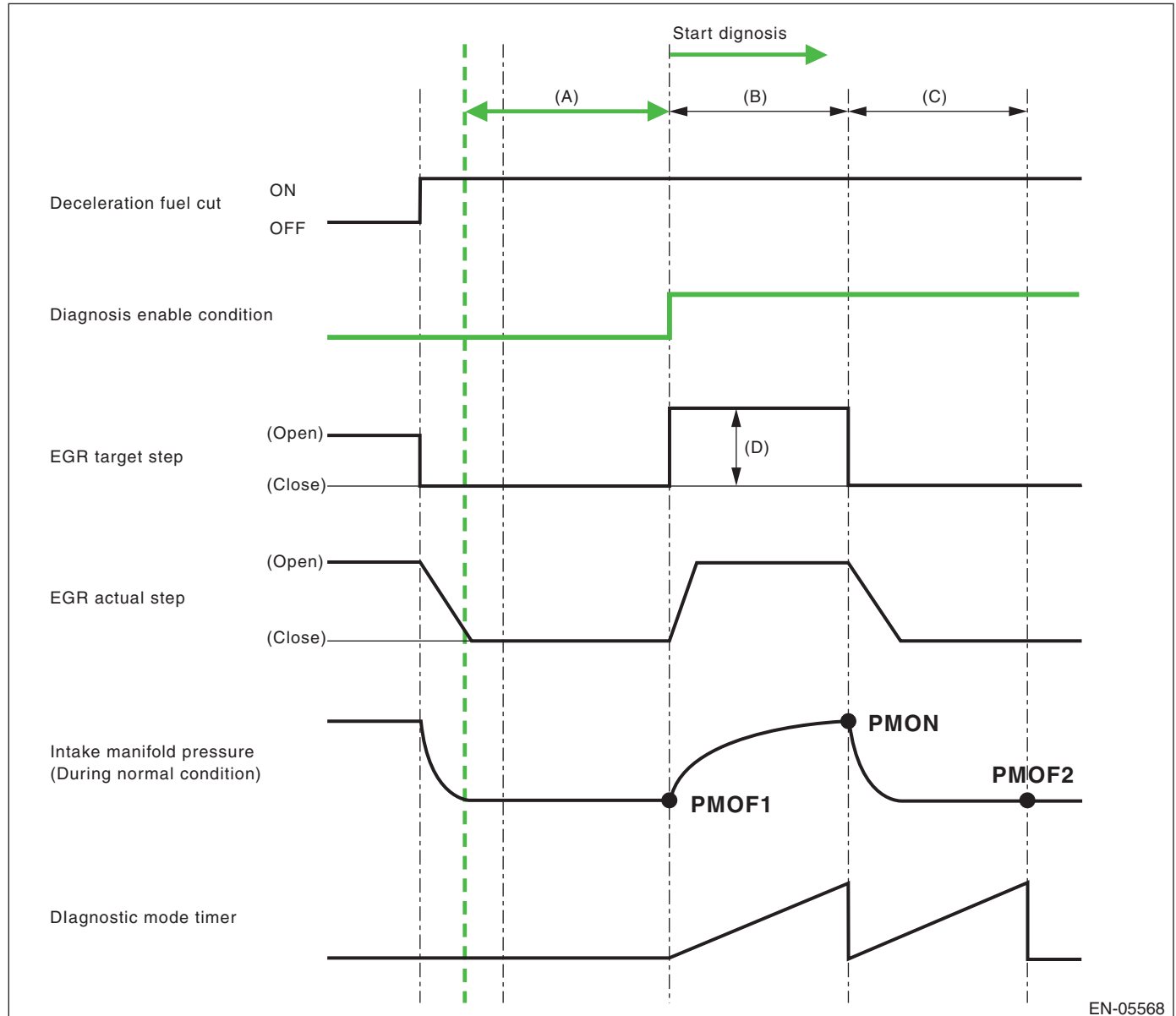
Judge as NG when the following conditions are established.

Judgement Value

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

Time Needed for Diagnosis: 1 time

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



EN-05568

(A) 3000 ms

(C) 1000 ms

(D) 45 step (s)

(B) 1000 ms

• Normality Judgement

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

Judgement Value

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

Time Needed for Diagnosis: 1 time

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

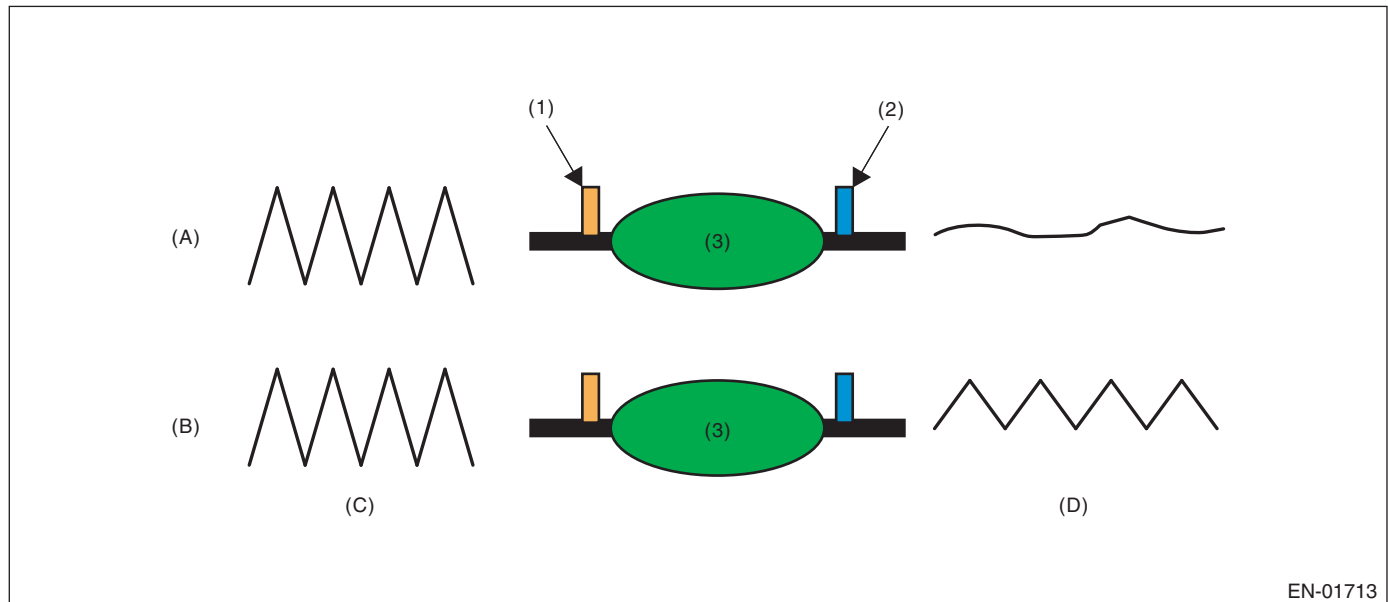
1. OUTLINE OF DIAGNOSIS

Detect the deterioration of the catalyst function.

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

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

2. COMPONENT DESCRIPTION



EN-01713

(A) Normal

(B) Deterioration

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

(D) Output waveform from the rear oxygen sensor

(1) Front oxygen (A/F) sensor

(2) Front oxygen sensor

(3) Catalytic converter

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Engine coolant temperature	≥ 70 °C (158 °F)
Estimated catalyst temperature	≥ 645 °C (1193 °F)
Misfire detection every 200 rotations	< 5 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	> 70 km/h (43.5 MPH)
Amount of intake air	≥ 10 g/s (0.35 oz/s) and < 40 g/s (1.41 oz/s)
Engine load change every 0.5 engine revs.	< 0.02 g/rev (0 oz/rev)
Rear oxygen output change from 660 mV or less to 660 mV or more	Experienced after fuel cut
Elapsed time after starting the engine	≥ 205 s
Purge execution calculated time	≥ 0 s

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once at a constant 70 km/h (43.5 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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
$\sum (ro2sad_n - ro2sad_{n-1}) / \sum (sglmd_n - sglmd_{n-1}) $	> 10 (U5 model) > 14 (Other than U5 model)

Time Needed for Diagnosis: 30 — 55 seconds

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

• Normality Judgement

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

Judgement Value

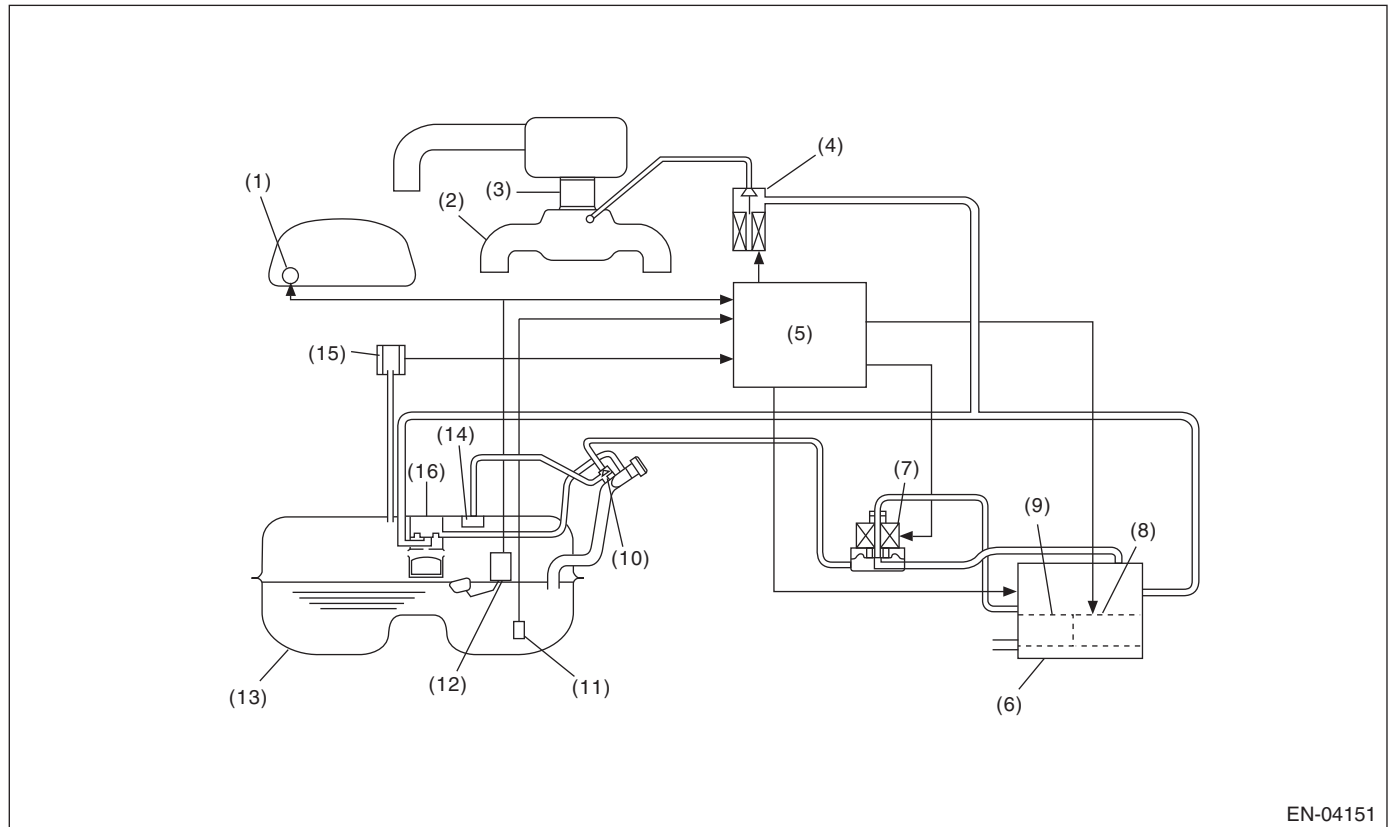
Malfunction Criteria	Threshold Value
$\sum (ro2sad_n - ro2sad_{n-1}) / \sum (sglmd_n - sglmd_{n-1}) $	≤ 10 (U5 model) ≤ 14 (Other than U5 model)

Time Needed for Diagnosis: 30 — 55 seconds

BF:DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK)

1. OUTLINE OF DIAGNOSIS

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



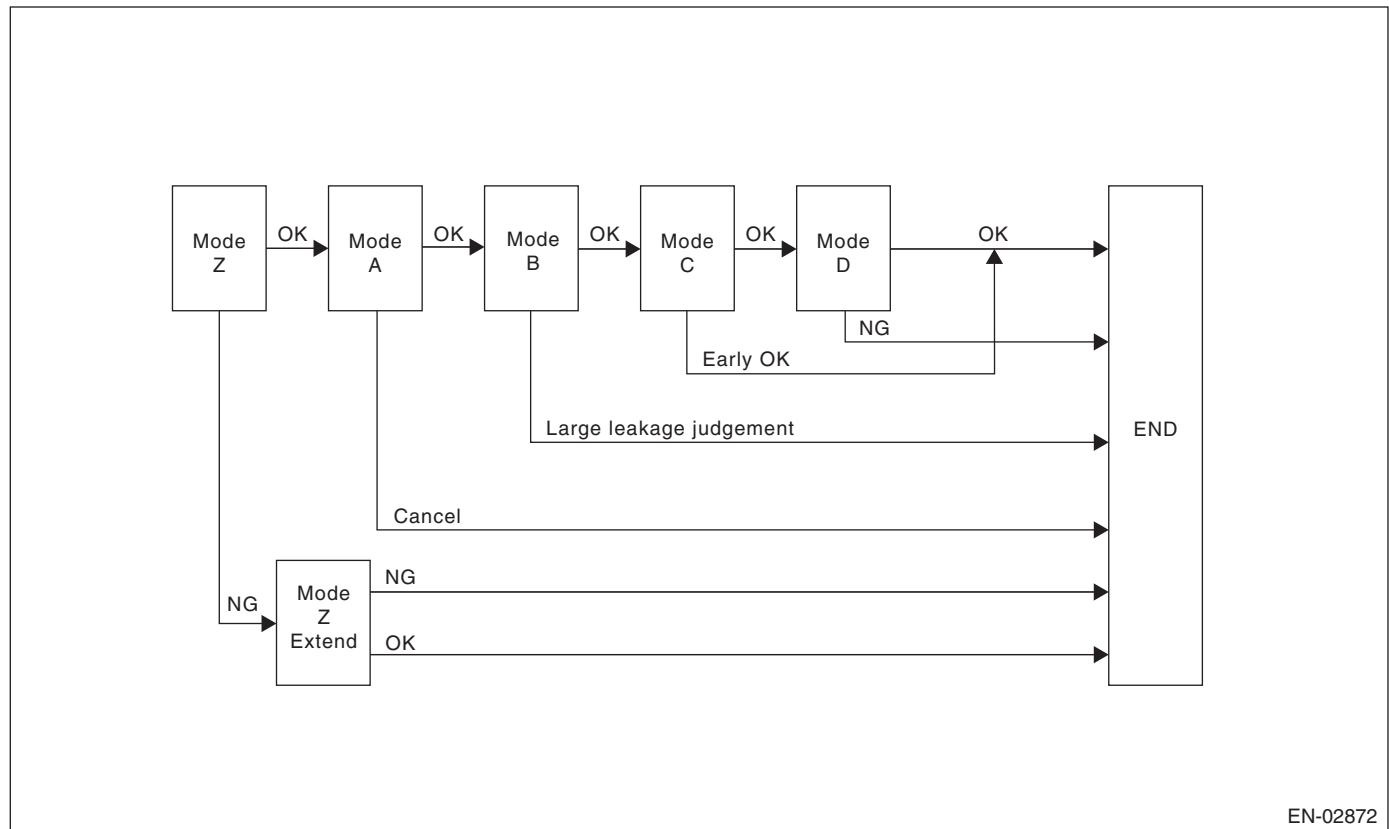
- | | | |
|----------------------------------|------------------------------|--------------------------------|
| (1) Fuel gauge | (7) Pressure control valve | (12) Fuel level sensor |
| (2) Intake manifold | (8) Drain valve | (13) Fuel tank |
| (3) Throttle body | (9) Drain filter | (14) Fuel cut valve |
| (4) Purge control solenoid valve | (10) Shut-off valve | (15) Fuel tank pressure sensor |
| (5) Engine control module (ECM) | (11) Fuel temperature sensor | (16) Vent valve |
| (6) Canister | | |

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



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.	0 ms + 3000 ms — 0 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 judgement)	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 judgement.	0 — 18600 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

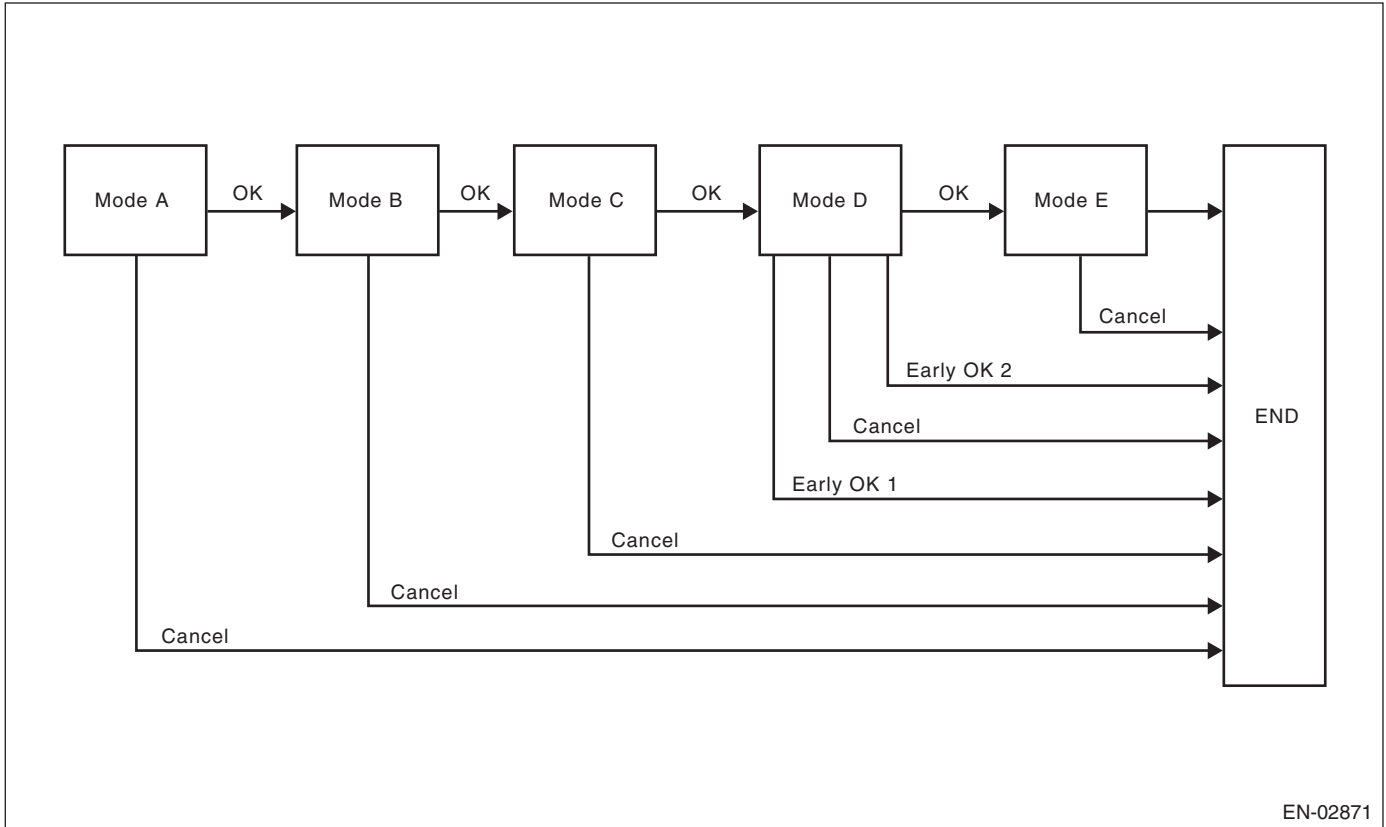
Mode Table for Evaporative Emission Control System Diagnosis

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).	0 — 25290 ms + 0 + Value of Map 2
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 judgement.	0 — 0 ms + 200000 ms
Mode E (Evaporation generated amount calculation)	Calculate the amount of evaporation (P1).	0 — 0 ms + 200000 ms + Value of Map 3

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)	13800	13800	11400	9000	7000	5000	5000

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)	20030	20030	20800	21580	21970	22360	22360

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
Time Needed for Diagnosis (ms)	80000	80000	70000	60000	60000	60000	60000

Diagnostic Trouble Code (DTC) Detecting Criteria

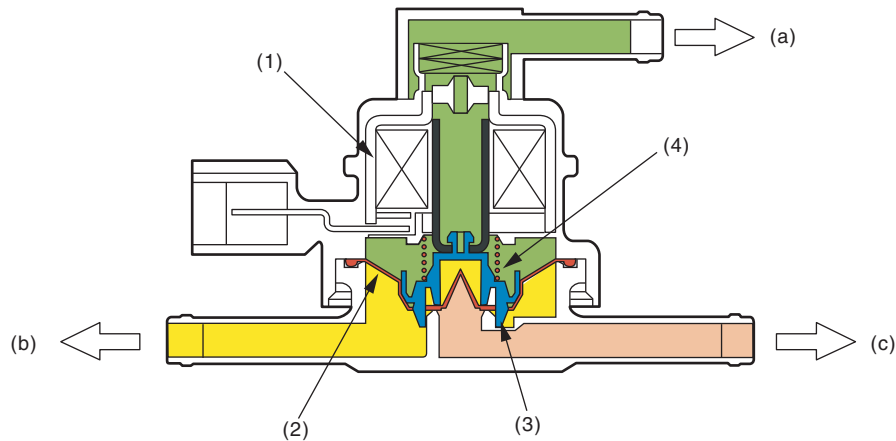
GENERAL DESCRIPTION

2. COMPONENT DESCRIPTION

Pressure control solenoid valve

PCV controls the fuel tank pressure to be equal to the atmospheric air pressure. Normally, the solenoid is set to OFF. The valve opens and closes mechanically in accordance with the pressure difference between tank and atmospheric air, or tank and canister.

The valve is forcibly opened by setting the solenoid to ON at the time of diagnosis.



EN-01715

(a) Barometric pressure

(b) Fuel tank

(c) Canister

(1) Solenoid

(3) Valve

(4) Spring

(2) Diaphragm

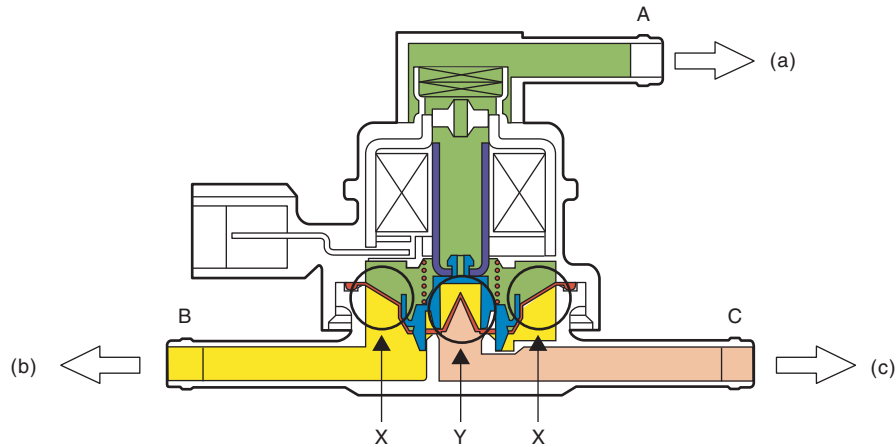
Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Valve Operation and Air Flow

In the figure below, divided by the diaphragm, the part above X is charged with atmospheric air pressure, and the part below X is charged with tank pressure. Also, the part above Y is charged with tank pressure, and the part below Y is charged with canister pressure.

If the atmospheric air pressure port is A, tank pressure port is B, and canister pressure port is C, the air flows according to pressure difference from each port as shown in the table below.



EN-01716

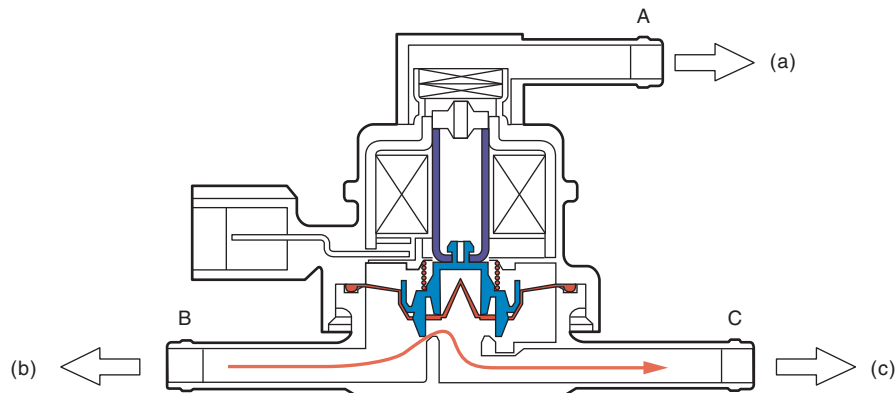
(a) Barometric pressure

(b) Fuel tank

(c) Canister

Condition of pressure	Flow
$A < B$ (solenoid OFF)	$B \rightarrow C$
$B < C$ (solenoid OFF)	$C \rightarrow B$
Solenoid ON	$B \leftrightarrow C$

When $A < B$ (solenoid OFF)



EN-01717

(a) Barometric pressure

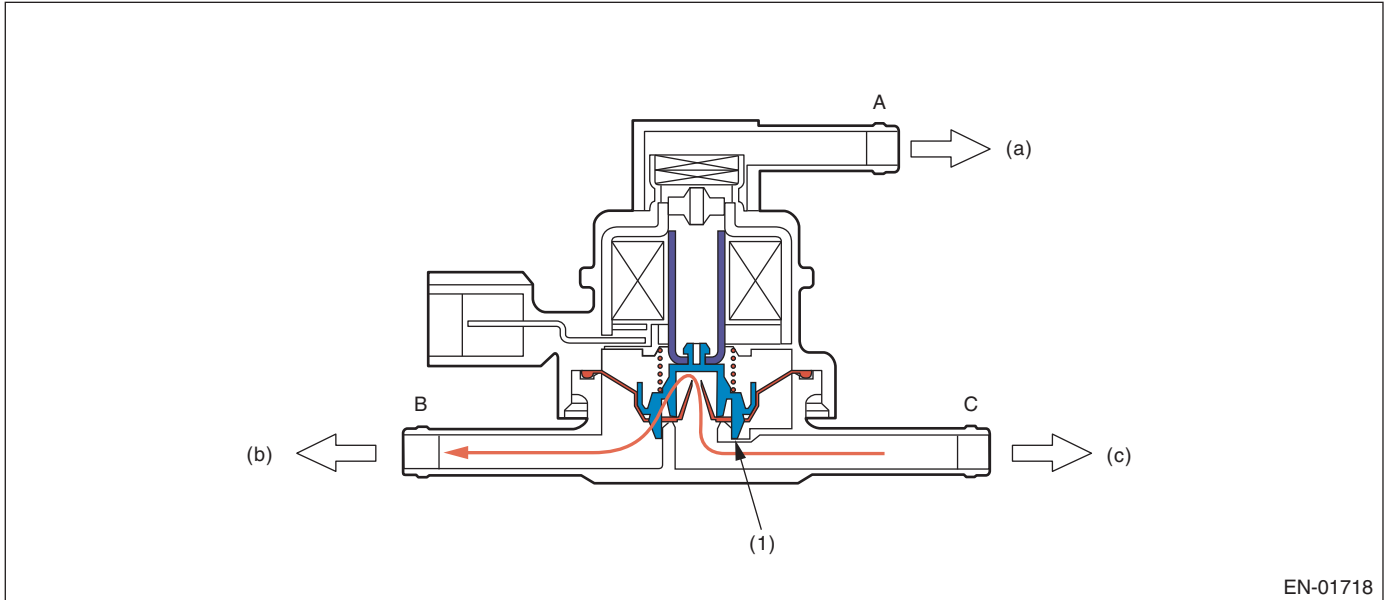
(b) Fuel tank

(c) Canister

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

When $B < C$ (solenoid OFF)



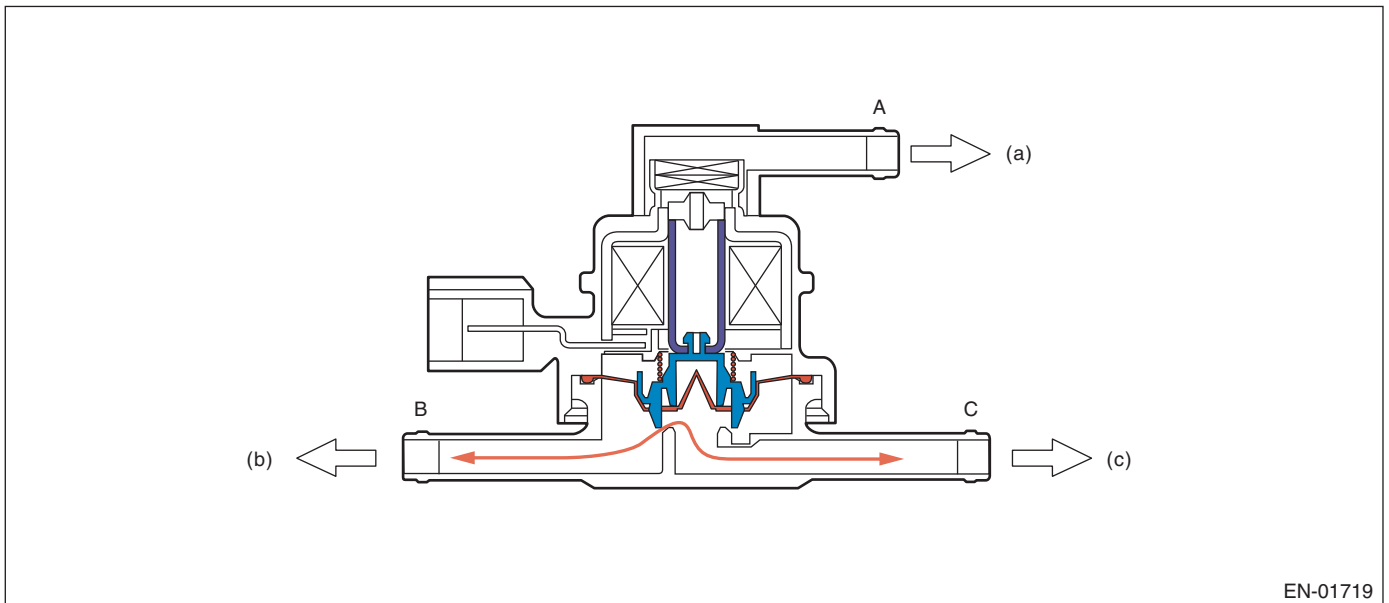
(a) Barometric pressure

(b) Fuel tank

(c) Canister

(1) Valve

When Solenoid is ON



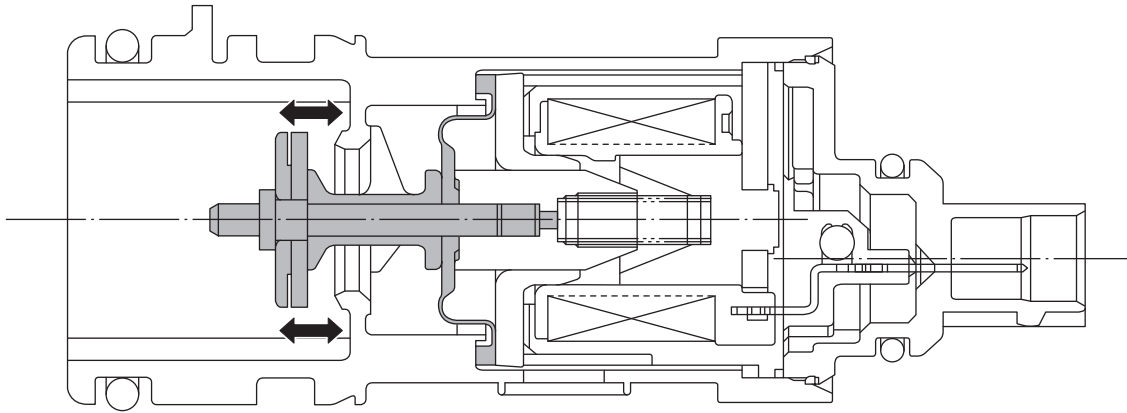
(a) Barometric pressure

(b) Fuel tank

(c) Canister

Drain valve

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



EN-02293

3. ENABLE CONDITION

0.04-inch Diagnosis

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Total time of canister purge operation	≥ 120000 ms
Elapsed time after starting the engine	≥ 856 s
Learning value of evaporation gas density	< 0.08
Engine speed	1050 rpm — 6000 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)
Vehicle speed	≥ 32 km/h (19.9 MPH)
Fuel level	9.6 ℓ (2.54 US gal, 2.11 Imp gal) — 54.4 ℓ (14.37 US gal, 11.97 Imp gal)
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 one 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)
Change of fuel level per 128 milliseconds	< 2 ℓ (0.53 US gal, 0.44 Imp gal)
Air fuel ratio	0.76 — 1.25

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	$\geq 10.9 \text{ V}$
Barometric pressure	$\geq 75 \text{ kPa}$ (563 mmHg, 22.2 inHg)
Time since last incomplete 0.02-inch leakage diagnosis	
When cancelling in mode A	$> 120000 \text{ ms}$
When cancelling in other than mode A	$> 600000 \text{ ms}$
Total time of canister purge operation	$\geq 120000 \text{ ms}$
Elapsed time after starting the engine	$\geq 120 \text{ s}$
Fuel temperature	$-10 \text{ }^{\circ}\text{C}$ (14 $^{\circ}\text{F}$) — $55 \text{ }^{\circ}\text{C}$ (131 $^{\circ}\text{F}$)
Fuel level	9.6 ℓ (2.54 US gal, 2.11 Imp gal) — 54.4 ℓ (14.37 US gal, 11.97 Imp gal)
Intake manifold relative vacuum (relative pressure)	$\geq -8 \text{ kPa}$ (-60 mmHg , -2.4 inHg)
Fuel tank pressure	-0.7 kPa (-5 mmHg , -0.2 inHg) — 1.4 kPa (10.7 mmHg, 0.4 inHg)
Vehicle speed	50 km/h (31.1 MPH) — 510 km/h (316.9 MPH) continues for 125000 ms
Closed air/fuel ratio control	In operation
Engine speed	1050 rpm — 6000 rpm
During diagnosis	
Change of fuel level	$\leq \text{Value of Map 4}$
Pressure change every one second	$< 0.1 \text{ kPa}$ (0.44 mmHg, 0 inHg)
Minimum pressure change value every one second – Maximum pressure change value every one second	$< 0.1 \text{ kPa}$ (0.51 mmHg, 0 inHg) (Mode D)
Pressure change in tank every second	$\leq 0.1 \text{ kPa}$ (0.75 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 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
Change (ℓ , US gal, Imp gal)	5, 1.32, 1.1	5, 1.32, 1.1	5, 1.32, 1.1	5, 1.32, 1.1	5, 1.32, 1.1	5, 1.32, 1.1	5, 1.32, 1.1

4. GENERAL DRIVING CYCLE

0.04-inch Diagnosis

- Perform the diagnosis only once in 856 seconds or more after starting the engine, at a constant speed of 32 km/h (20 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 judgement 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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value	DTC
evptez – evptezha	> 0.9 kPa (6.5 mmHg, 0.3 inHg)	P0457
evptezini	≤ 1.4 kPa (10.7 mmHg, 0.4 inHg)	
Time of 2 ℓ (0.53 US gal, 0.44 Imp gal) or more fuel no sloshing	≥ 40000 ms	

Time Needed for Diagnosis: 0 ms + 3000 ms + 13000 ms

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

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

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

• Normality Judgement

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

Judgement Value

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

GENERAL DESCRIPTION

The diagram illustrates a beam with several key points and dimensions:

- (1)**: Dimension from the left vertical line to the right vertical line.
- (2)**: Dimension from the left vertical line to the right vertical line, slightly below (1).
- (3)**: Point on the left vertical line where the beam starts.
- (4)**: Point on the left vertical line where the beam starts, slightly below (3).
- (5)**: Point on the right vertical line where the beam ends.
- 0**: Point on the horizontal axis where the beam starts.
- evptez**: Label for the point on the left vertical line where the beam starts.
- evptezini**: Label for the point on the left vertical line where the beam starts, slightly below evptez.
- evptezha**: Label for the point on the right vertical line where the beam ends.

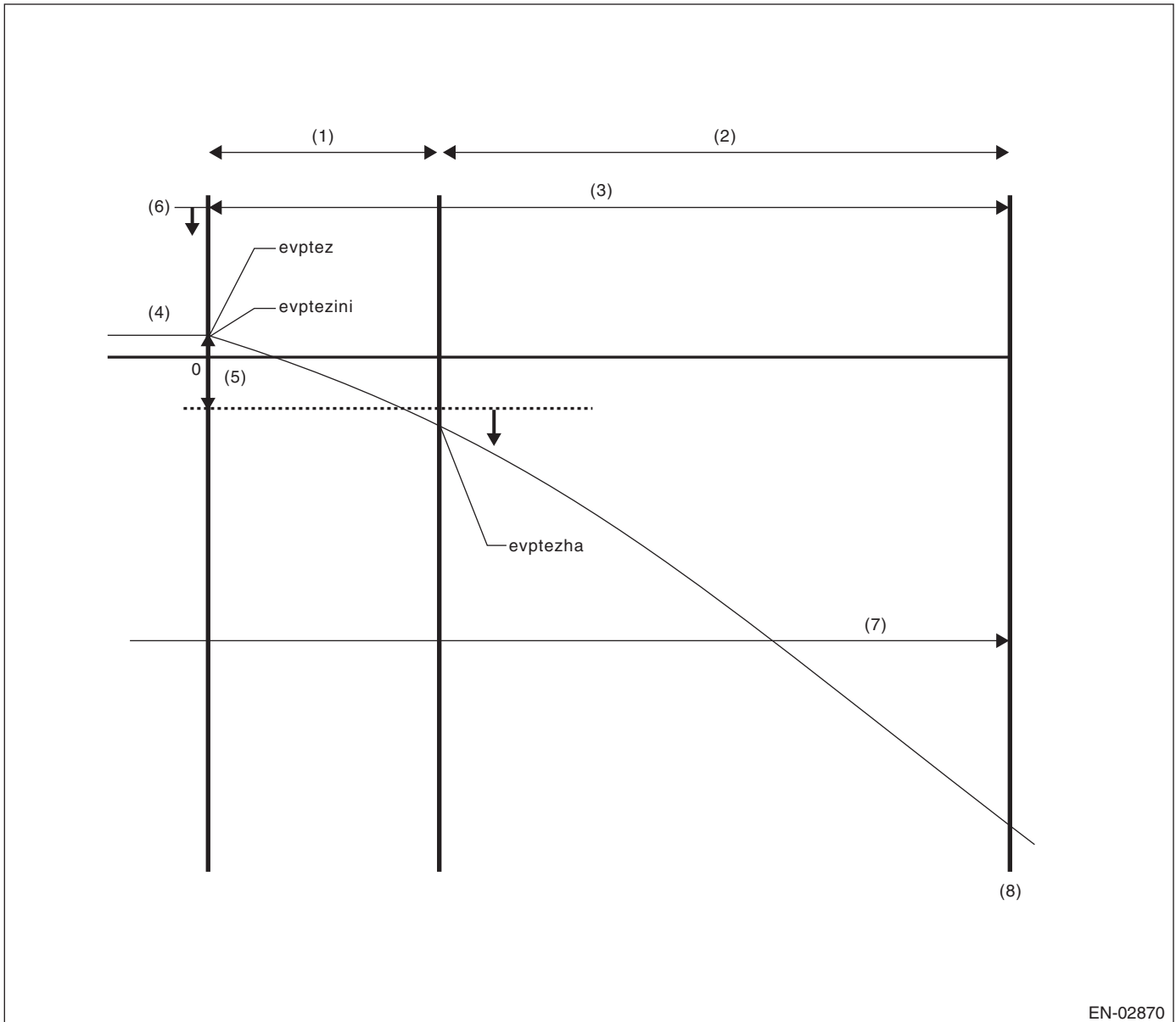
The beam is represented by a solid line that starts at point (3) and ends at point (5). A dashed line indicates the beam's position at point (4).

Time Needed for Diagnosis: 0 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) 0.9 kPa (6.5 mmHg, 0.3 inHg) | (8) NG judgement |
| (3) 3000 ms + 13000 ms | (6) 1.4 kPa (10.7 mmHg, 0.4 inHg) | |

- $evptezini \leq 1.4 \text{ kPa}$ (10.7 mmHg, 0.4 inHg)
 - $evptez - evptezha > 0.9 \text{ kPa}$ (6.5 mmHg, 0.3 inHg)
 - No fuel sloshing of over 2 $\varnothing$ (0.53 US gal, 0.44 Imp gal) lasts for more than 40000 ms.
- 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 Judgement

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

Judgement 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)	≥ 10000 ms + 25000 ms ≥ 10000 ms > -0.3 kPa (-2.5 mmHg, -0.1 inHg)	P0457

Time Needed for Diagnosis: 0 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 advanced 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 judgement
-1.4 kPa (-10.5 mmHg, -0.4 inHg)	18600 ms

Time Needed for Diagnosis: 0 ms + 3000 ms + 10000 ms + 10000 ms + 25000 ms + 18600 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 judgement value exceeds the threshold value, it is judged to be a malfunction.

Abnormality Judgement

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.

Judgement Value

Malfunction Criteria	Threshold Value	DTC
$P2 - 1.5 - \times P1$ 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 5	P0442

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Map 5 Malfunction criteria limit for evaporation diagnosis

Fuel temperature vs. Fuel level	25 °C (77 °F)	30 °C (86 °F)	35 °C (95 °F)	40 °C (104 °F)	45 °C (113 °F)
0 ℓ (0 US gal, 0 Imp gal)	0.3 kPa (2.1 mmHg, 0.1 inHg)	0.3 kPa (2.2 mmHg, 0.1 inHg)	0.3 kPa (2.3 mmHg, 0.1 inHg)	0.3 kPa (2.35 mmHg, 0.1 inHg)	0.3 kPa (2.4 mmHg, 0.1 inHg)
10 ℓ (2.64 US gal, 2.2 Imp gal)	0.3 kPa (2.1 mmHg, 0.1 inHg)	0.3 kPa (2.2 mmHg, 0.1 inHg)	0.3 kPa (2.3 mmHg, 0.1 inHg)	0.3 kPa (2.35 mmHg, 0.1 inHg)	0.3 kPa (2.4 mmHg, 0.1 inHg)
20 ℓ (5.28 US gal, 4.4 Imp gal)	0.3 kPa (2.3 mmHg, 0.1 inHg)	0.3 kPa (2.4 mmHg, 0.1 inHg)	0.3 kPa (2.5 mmHg, 0.1 inHg)	0.3 kPa (2.6 mmHg, 0.1 inHg)	0.4 kPa (2.7 mmHg, 0.1 inHg)
30 ℓ (7.93 US gal, 6.6 Imp gal)	0.4 kPa (2.9 mmHg, 0.1 inHg)	0.4 kPa (3.05 mmHg, 0.1 inHg)	0.4 kPa (3.15 mmHg, 0.1 inHg)	0.4 kPa (3.25 mmHg, 0.1 inHg)	0.4 kPa (3.35 mmHg, 0.1 inHg)
40 ℓ (10.57 US gal, 8.8 Imp gal)	0.4 kPa (2.9 mmHg, 0.1 inHg)	0.4 kPa (3.15 mmHg, 0.1 inHg)	0.4 kPa (3.3 mmHg, 0.1 inHg)	0.5 kPa (3.4 mmHg, 0.1 inHg)	0.5 kPa (3.5 mmHg, 0.1 inHg)
50 ℓ (13.21 US gal, 11 Imp gal)	0.4 kPa (3.2 mmHg, 0.1 inHg)	0.4 kPa (3.3 mmHg, 0.1 inHg)	0.5 kPa (3.5 mmHg, 0.1 inHg)	0.5 kPa (3.6 mmHg, 0.1 inHg)	0.5 kPa (3.7 mmHg, 0.1 inHg)
60 ℓ (15.85 US gal, 13.2 Imp gal)	0.4 kPa (3.2 mmHg, 0.1 inHg)	0.4 kPa (3.3 mmHg, 0.1 inHg)	0.5 kPa (3.5 mmHg, 0.1 inHg)	0.5 kPa (3.6 mmHg, 0.1 inHg)	0.5 kPa (3.7 mmHg, 0.1 inHg)

Time Needed for Diagnosis: 0 ms + 3000 ms + 10000 ms + 10000 ms + 25000 ms + 18600 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 pre-determined 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 pre-determined amount of time has passed, make advanced OK judgement or cancel the diagnosis according to the value of P2.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Normality Judgement

Judge as OK when the following conditions are established.

Judgement Value

Malfunction Criteria	Threshold Value
Advanced OK judgement 1	
Mode D time	$\geq 0 \text{ ms} + 10000 \text{ ms}$
Tank internal pressure	$\leq \text{Value of Map 6}$
Advanced OK judgement 2	
Mode D time	$\geq 0 \text{ ms} + 200000 \text{ ms}$
P2	$\leq \text{Value of Map 7}$

Map 6

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, -14.62, -0.6	-1.9, -14.62, -0.6	-1.9, -14.59, -0.6	-1.9, -14.56, -0.6	-1.9, -14.42, -0.6	-1.9, -14.28, -0.6	-1.9, -14.28, -0.6

Map 7

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).

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Abnormality Judgement

Judge as NG when the following conditions are established.

Judgement Value

Malfunction Criteria	Threshold Value
P1	< Value of Map 8

Map 8 Malfunction criteria limit for evaporation diagnosis

Time (evpdset) vs. Fuel level	0 ms	30000 ms	50000 ms	100000 ms	160000 ms	200000 ms
0 ℓ (0 US gal, 0 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)
10 ℓ (2.64 US gal, 2.2 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)
20 ℓ (5.28 US gal, 4.4 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)
30 ℓ (7.93 US gal, 6.6 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)
40 ℓ (10.57 US gal, 8.8 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.1 kPa (0.5 mmHg, 0 inHg)	0.2 kPa (1.85 mmHg, 0.1 inHg)	0.3 kPa (2.5 mmHg, 0.1 inHg)	0.3 kPa (2.5 mmHg, 0.1 inHg)	0.3 kPa (2.5 mmHg, 0.1 inHg)
50 ℓ (13.21 US gal, 11 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)
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 + 25290 ms + 0 + Value of Map 2 + 0 ms + 200000 ms + Value of Map 3 + 0 ms + 200000 ms

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Normality Judgement

Judge as OK when the following conditions are established.

Judgement Value

Malfunction Criteria	Threshold Value
P1	> Value of Map 9

Map 9 Malfunction criteria limit for evaporation diagnosis

Time (evpdset) vs. Fuel level	0 ms	30000 ms	50000 ms	100000 ms	160000 ms	200000 ms
0 ℓ (0 US gal, 0 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)
10 ℓ (2.64 US gal, 2.2 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)
20 ℓ (5.28 US gal, 4.4 Imp gal)	0.1 kPa (1 mmHg, 0 inHg)	0.4 kPa (3.25 mmHg, 0.1 inHg)	0.5 kPa (4.1 mmHg, 0.2 inHg)	0.5 kPa (4.1 mmHg, 0.2 inHg)	0.5 kPa (4.1 mmHg, 0.2 inHg)	0.5 kPa (4.1 mmHg, 0.2 inHg)
30 ℓ (7.93 US gal, 6.6 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)
40 ℓ (10.57 US gal, 8.8 Imp gal)	0.1 kPa (1 mmHg, 0 inHg)	0.3 kPa (2.25 mmHg, 0.1 inHg)	0.5 kPa (3.4 mmHg, 0.1 inHg)	0.5 kPa (3.4 mmHg, 0.1 inHg)	0.5 kPa (3.4 mmHg, 0.1 inHg)	0.5 kPa (3.4 mmHg, 0.1 inHg)
50 ℓ (13.21 US gal, 11 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)
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 + 25290 ms + 0 + Value of Map 2 + 0 ms + 200000 ms + Value of Map 3 + 0 ms + 200000 ms

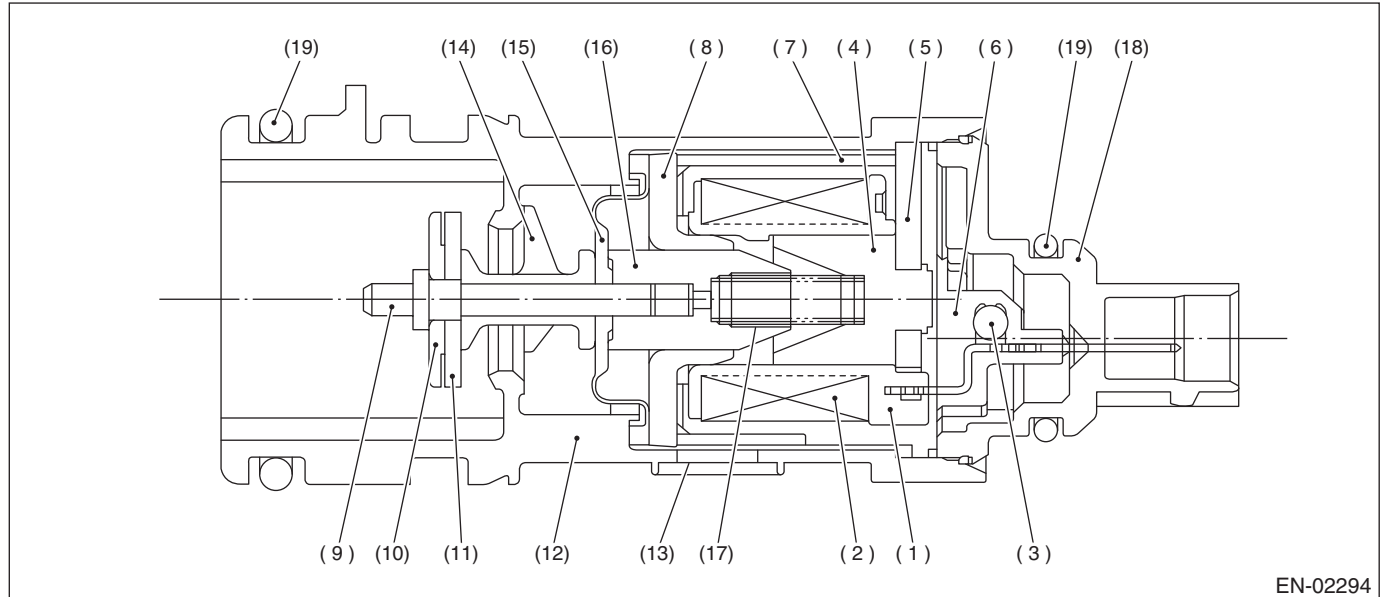
BG:DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN

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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1 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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1 second
Terminal output voltage when ECM outputs OFF signal	High

Time Needed for Diagnosis: Less than 1 second

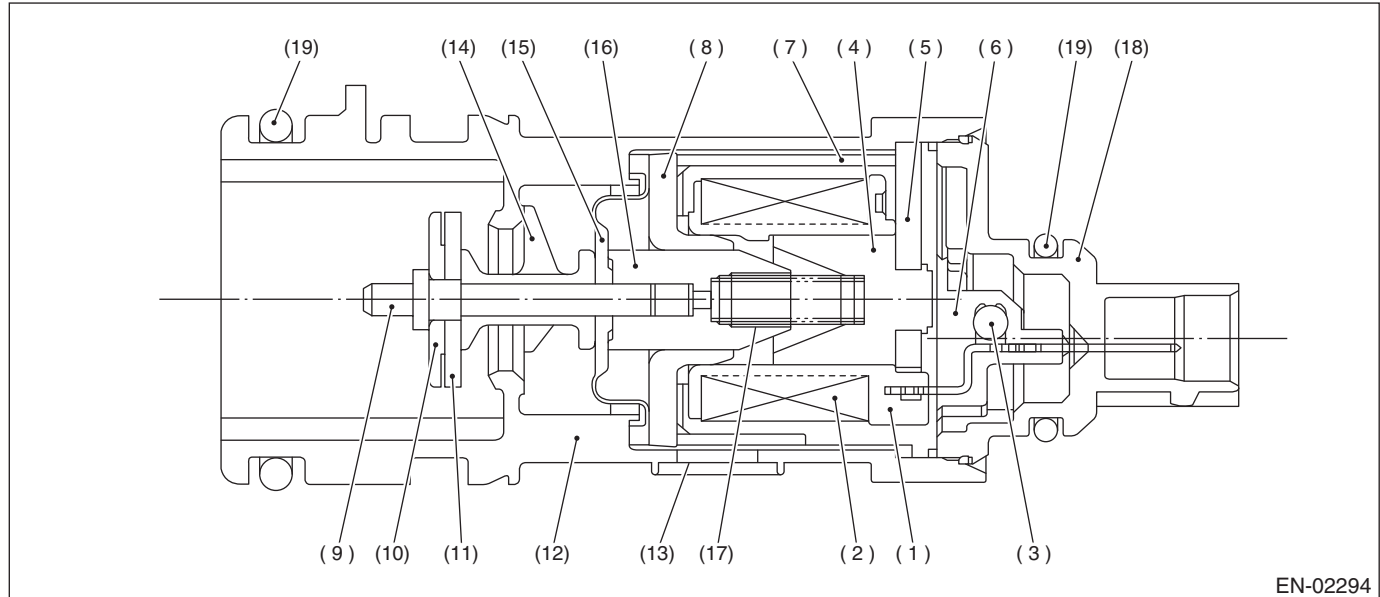
BH:DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED

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 | (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 Judgement

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

Judgement 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 Judgement

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

Judgement Value

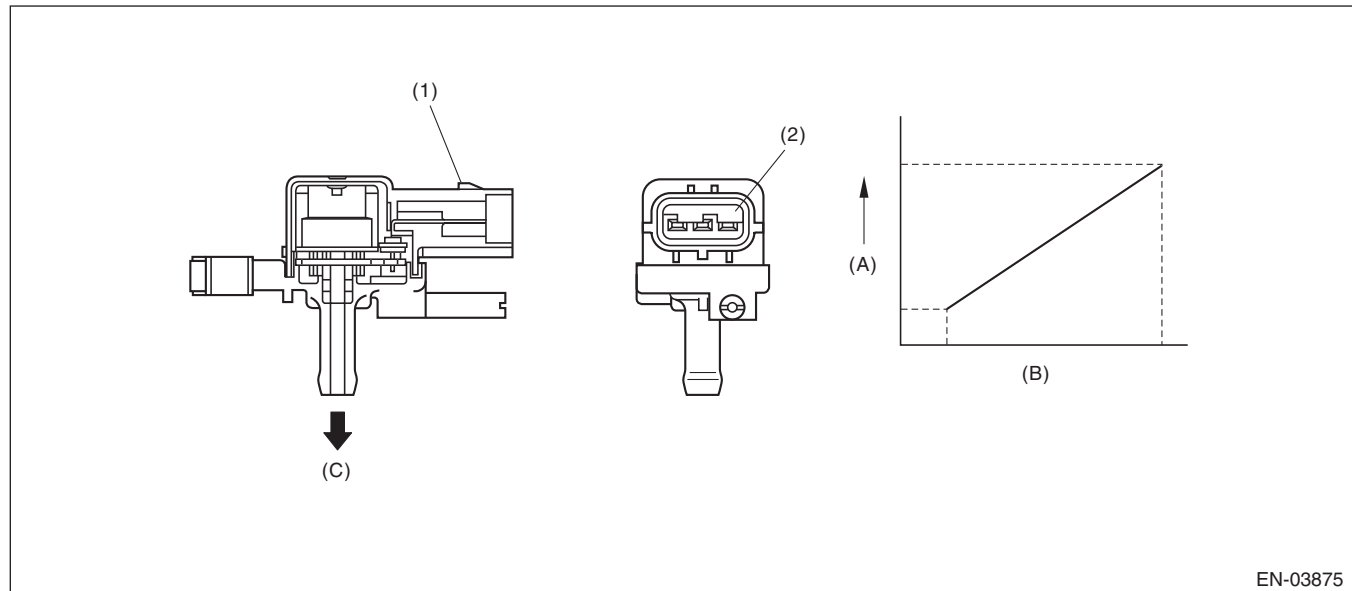
Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1 second
Terminal output voltage when ECM outputs ON signal	Low

Time Needed for Diagnosis: Less than 1 second

BI: 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-03875

(A) Output voltage

(B) Input voltage

(C) To fuel tank

(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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
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 judgement with the Max. and Min. values for the fuel level in 60 s × 2. If a difference does not appear, extend the time (60 s × 3, 60 s × 4, 60 s × 5) and continue the judgement. 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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Maximum — Minimum tank pressure	≥ 0 kPa (0.375 mmHg, 0 inHg)

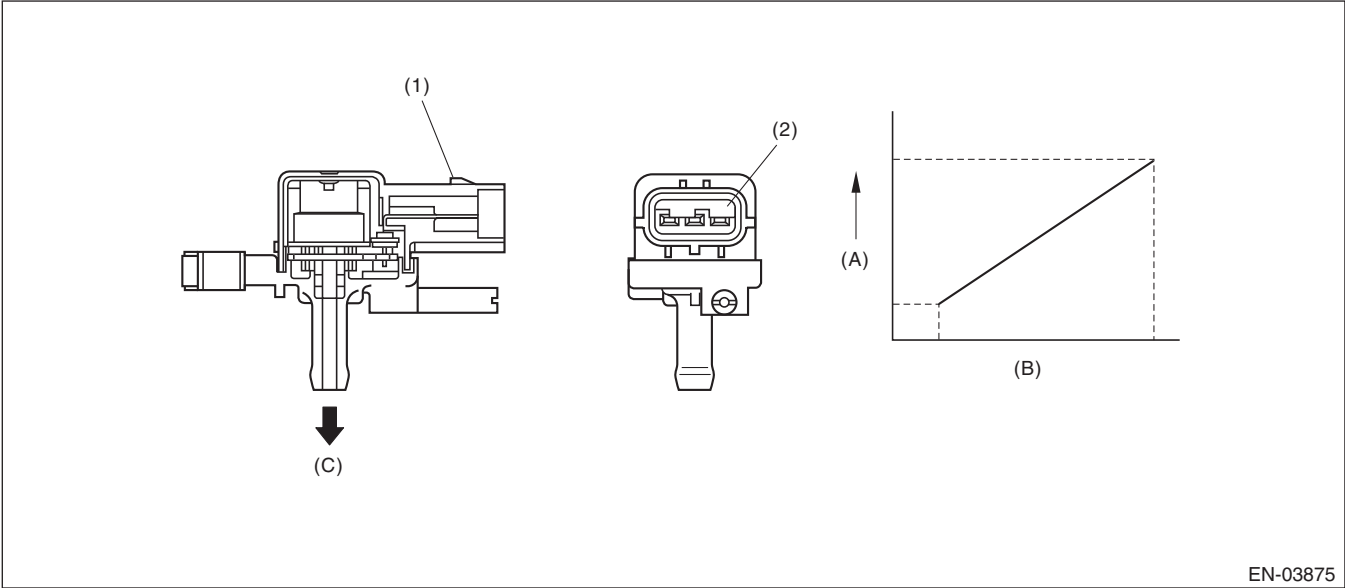
Time Needed for Diagnosis: Less than 1 second

**BJ: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-03875

(A) Output voltage

(B) Input voltage

(C) To fuel tank

(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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	< -7.5 kPa (-55.9 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 Judgement

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

Judgement Value

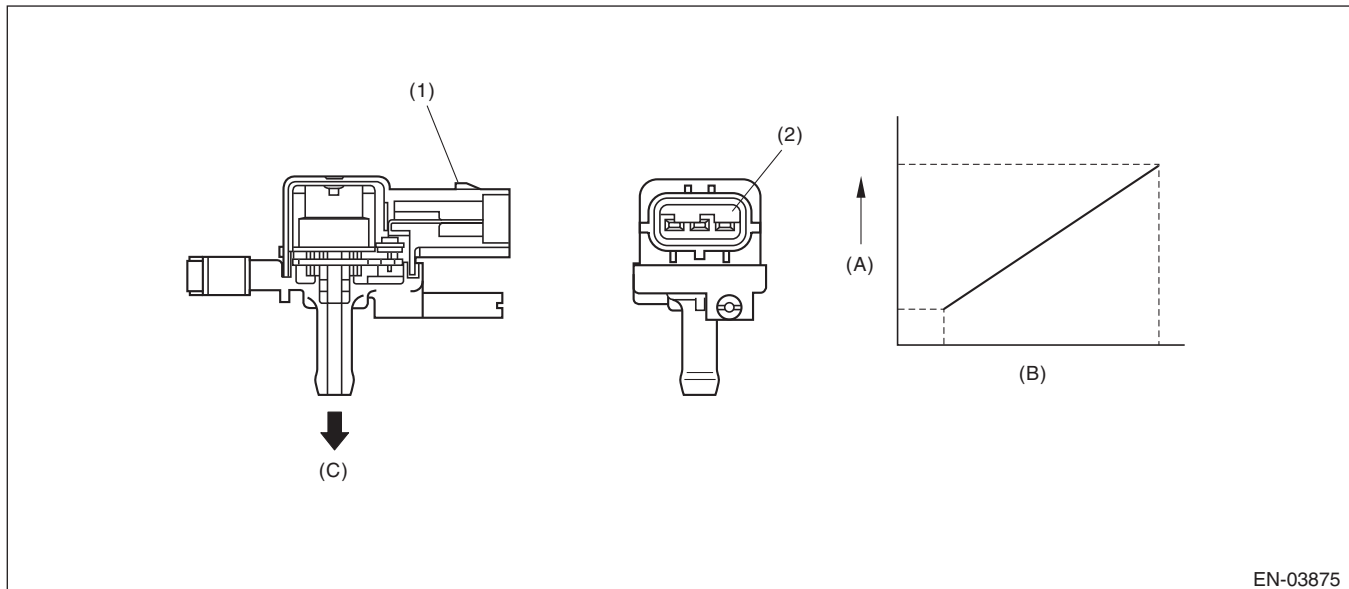
Malfunction Criteria	Threshold Value
Fuel tank pressure	≥ -7.5 kPa (-55.9 mmHg, -2.2 inHg)
Battery voltage	≥ 10.9 V

Time Needed for Diagnosis: Less than 1 second

**BK: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

EN-03875

(A) Output voltage

(B) Input voltage

(C) To fuel tank

(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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	≥ 7.9 kPa (59.6 mmHg, 2.3 inHg)
Fuel temperature	< 35 °C (95 °F)
Barometric 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 Judgement

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

Judgement 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

BL: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(H4SO)-99, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

BM: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(H4SO)-99, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

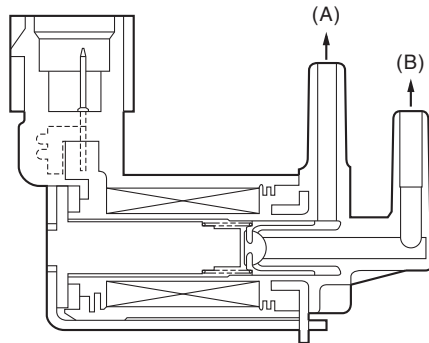
BN:DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

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

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

2. COMPONENT DESCRIPTION



EN-01733

(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.

5. DIAGNOSTIC METHOD

• Abnormality Judgement

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

Judgement 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 Judgement

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

Judgement Value

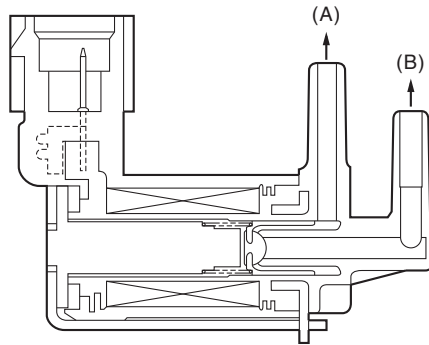
Malfunction Criteria	Threshold Value
Terminal output voltage	High

Time Needed for Diagnosis: Less than 1 second

BO:DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH**1. OUTLINE OF DIAGNOSIS**

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

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

2. COMPONENT DESCRIPTION

EN-01733

(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.

5. DIAGNOSTIC METHOD**• Abnormality Judgement**

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

Judgement 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 Judgement

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

Judgement 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

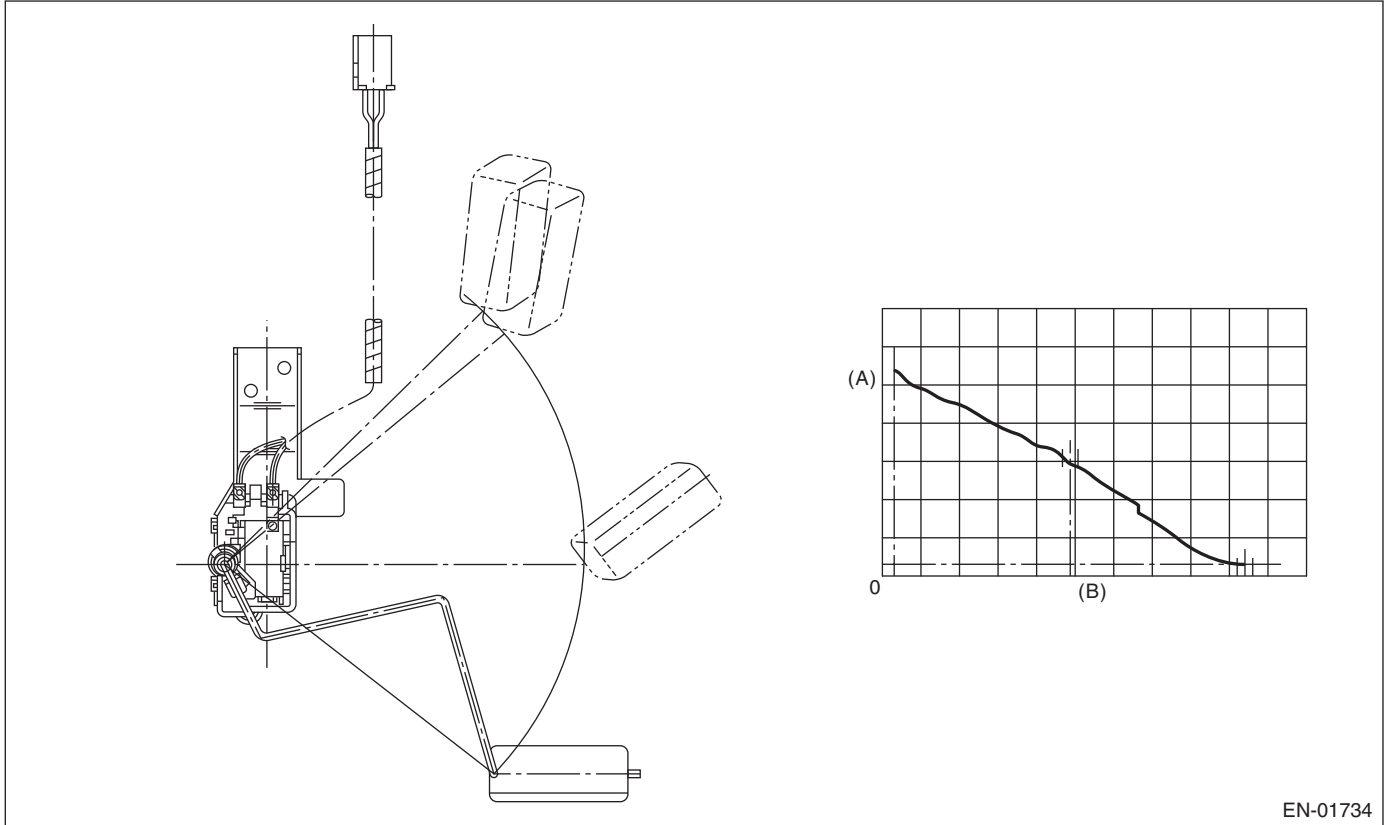
BP:DTC P0461 FUEL LEVEL SENSOR “A” CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect malfunctions of the fuel level sensor output property.

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

2. COMPONENT DESCRIPTION



EN-01734

(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 Judgement

Judge as NG when the following conditions are established.

Judgement 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	< 6000 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 Judgement

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

Judgement 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	< 6000 rpm
Elapsed time after starting the engine	≥ 5000 ms

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

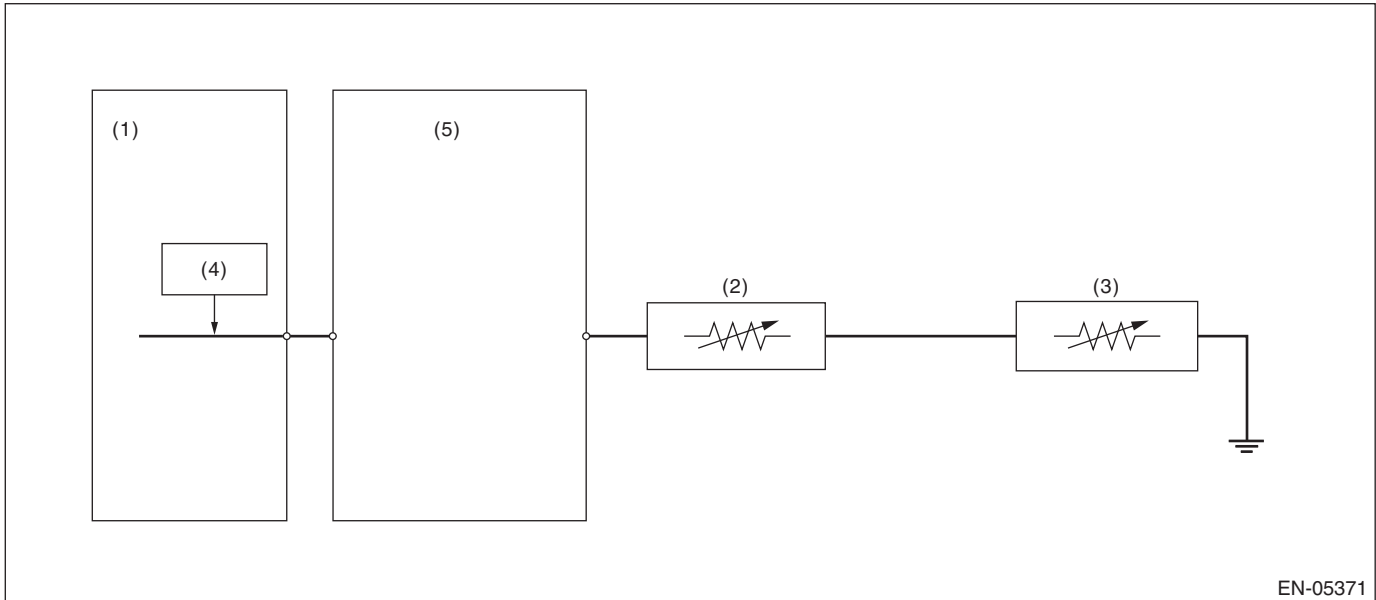
GENERAL DESCRIPTION

BQ: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 Judgement

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

Judgement 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 Judgement

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

Judgement 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

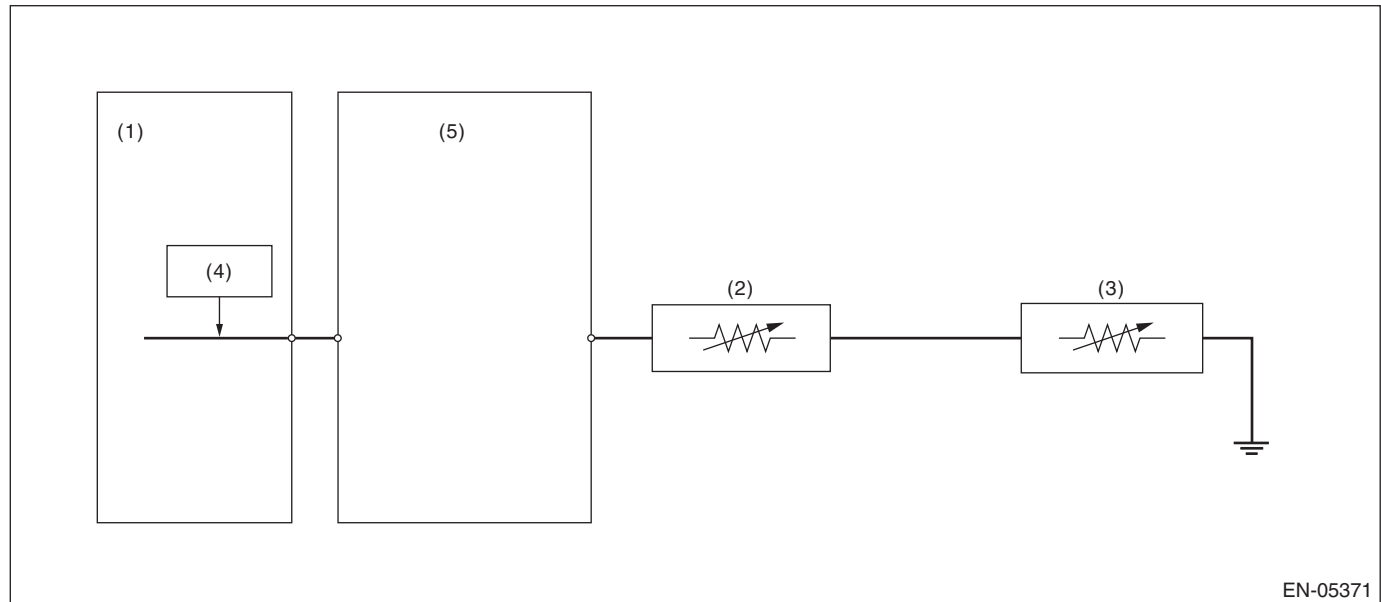
GENERAL DESCRIPTION

BR: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 Judgement

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

Judgement 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 Judgement

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

Judgement 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

BS: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

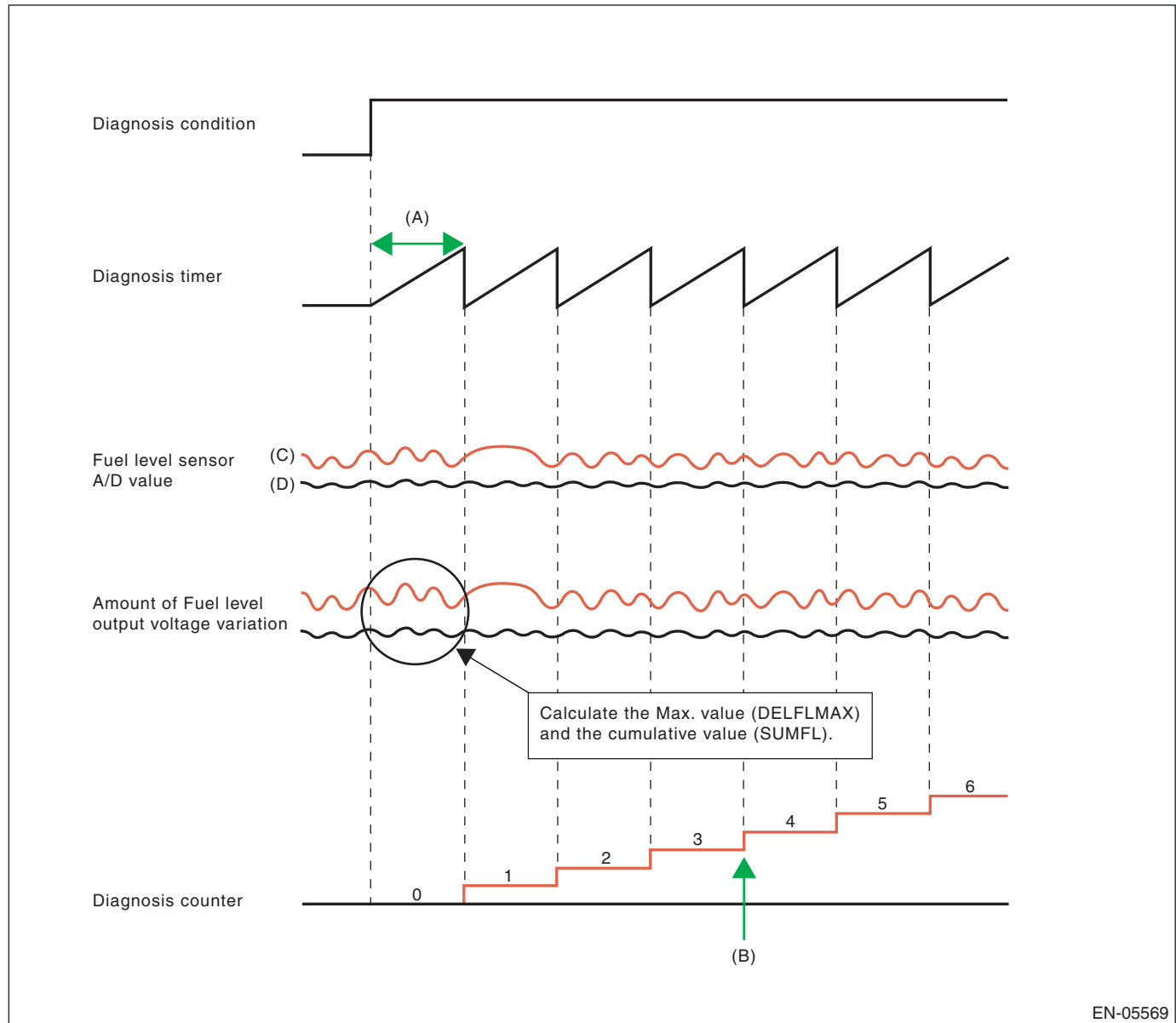
Malfunction Criteria	Threshold Value
Engine speed	≥ 500 rpm
Elapsed time after starting the engine	≥ 1 second
Battery voltage	≥ 10.9 V
Idle switch	ON
Fuel level	≥ 9.6 ℓ (2.54 US gal, 2.11 Imp gal) and < 54.4 ℓ (14.37 US gal, 11.97 Imp gal)
Vehicle speed = 0 km/h (0 MPH)	≥ 10000 ms

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 Judgement

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

Judgement 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	$\geq 4 \text{ time(s)}$ $\geq \text{Value from Map}$ $\geq 25.92 \text{ V}$

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	$\geq 0 \text{ kPa (0.375 mmHg, 0 inHg)}$
Maximum value – Minimum value of battery voltage during 12288 ms	$\geq 1.09 \text{ V}$

Time Needed for Diagnosis: 12288 ms × 4 time(s)

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

• Normality Judgement

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

Judgement 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	$< \text{Value from Map}$ $< 25.92 \text{ V}$

Time Needed for Diagnosis: 12288 ms

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

Judge as NG when outside of the judgement value.

Judge 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 engine starting	≥ 2000 ms

4. GENERAL DRIVING CYCLE

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

5. DIAGNOSTIC METHOD**• Abnormality Judgement**

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

Judgement 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 Judgement

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

Judgement 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

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

1. OUTLINE OF DIAGNOSIS

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

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	$\geq 75^{\circ}\text{C}$ (167 $^{\circ}\text{F}$)
Battery voltage	$\geq 10.9\text{ V}$
Barometric pressure	$\geq 75\text{ kPa}$ (563 mmHg, 22.2 inHg)
Fuel level	$\geq 9.6\text{ }\ell$ (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)	≥ 0.81 and < 1.1
After switching air conditioner to ON/OFF	$\geq 5.1\text{ s}$
After intake manifold pressure changes by 4 kPa (30 mmHg, 1.2 inHg) or more.	$> 5.1\text{ s}$
Elapsed time after switching neutral position switch to ON/OFF	$> 5.1\text{ s}$
Vehicle speed	0 km/h (0 MPH)

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling after warming up engine.

4. DIAGNOSTIC METHOD

• Abnormality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Actual engine speed — Targeted engine speed	$< -100\text{ rpm}$
Feedback value for ISC	Max.

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

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

• Normality Judgement

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

Judgement Value

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

Time Needed for Diagnosis: 10 s

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BV: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)	≥ 0.81 and < 1.1
After switching air conditioner to ON/OFF	$\geq 5.1\text{ s}$
After intake manifold pressure changes by 4 kPa (30 mmHg, 1.2 inHg) or more.	$> 5.1\text{ s}$
Elapsed time after switching neutral position switch to ON/OFF	$> 5.1\text{ s}$
Vehicle speed	0 km/h (0 MPH)

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling after warming up engine.

4. DIAGNOSTIC METHOD

• Abnormality Judgement

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

Judgement 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 Judgement

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

Judgement 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

BW: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 Judgement

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

Judgement 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 when malfunction occurs in 2 continuous driving cycles.

• Normality Judgement

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

Judgement 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

BX: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

BY:DTC P0600 SERIAL COMMUNICATION LINK

1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.

When CAN communications is not possible, and CAN communications with TCM is not possible, judge as NG if data from the TCM is 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 CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgement

Judge as NG when the following conditions are established.

Judgement 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 500 milliseconds

Time Needed for Diagnosis: Less than 1 second

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

• Normality Judgement

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

Judgement 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

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

BZ:DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR**1. OUTLINE OF DIAGNOSIS**

Detect the malfunction of microcomputer (RAM).

When there is a problem in the main CPU normal RAM, or the sub CPU normal RAM, judge as NG. Judge as OK when both are operating properly.

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 Judgement**

Judge as NG if the criteria below are met.

Judgement Value

Malfunction Criteria	Threshold Value
Main CPU normal RAM abnormal	
Write 5AA5A55A and then read. (Whole area of RAM)	5AA5A55A cannot be read.
Write A55A5AA5 and then read. (Whole area of RAM)	A55A5AA5 cannot be read.
Sub CPU normal RAM abnormal	
Write 5AA5 and then read. (Whole area of RAM)	5AA5 cannot be read.
Write A55A and then read. (Whole area of RAM)	A55A cannot be read.

Time Needed for Diagnosis: Undetermined

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

Normality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Main CPU normal RAM abnormal	
Write 5AA5A55A and then read. (Whole area of RAM)	5AA5A55A can be read.
And write A55A5AA5 and then read. (Whole area of RAM)	A55A5AA5 can be read.
Sub CPU normal RAM abnormal	
Write 5AA5 and then read. (Whole area of RAM)	5AA5 can be read.
And write A55A and then read. (Whole area of RAM)	A55A can be read.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CA: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 Judgement

Judge as NG if the criteria below are met.

Judgement 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.

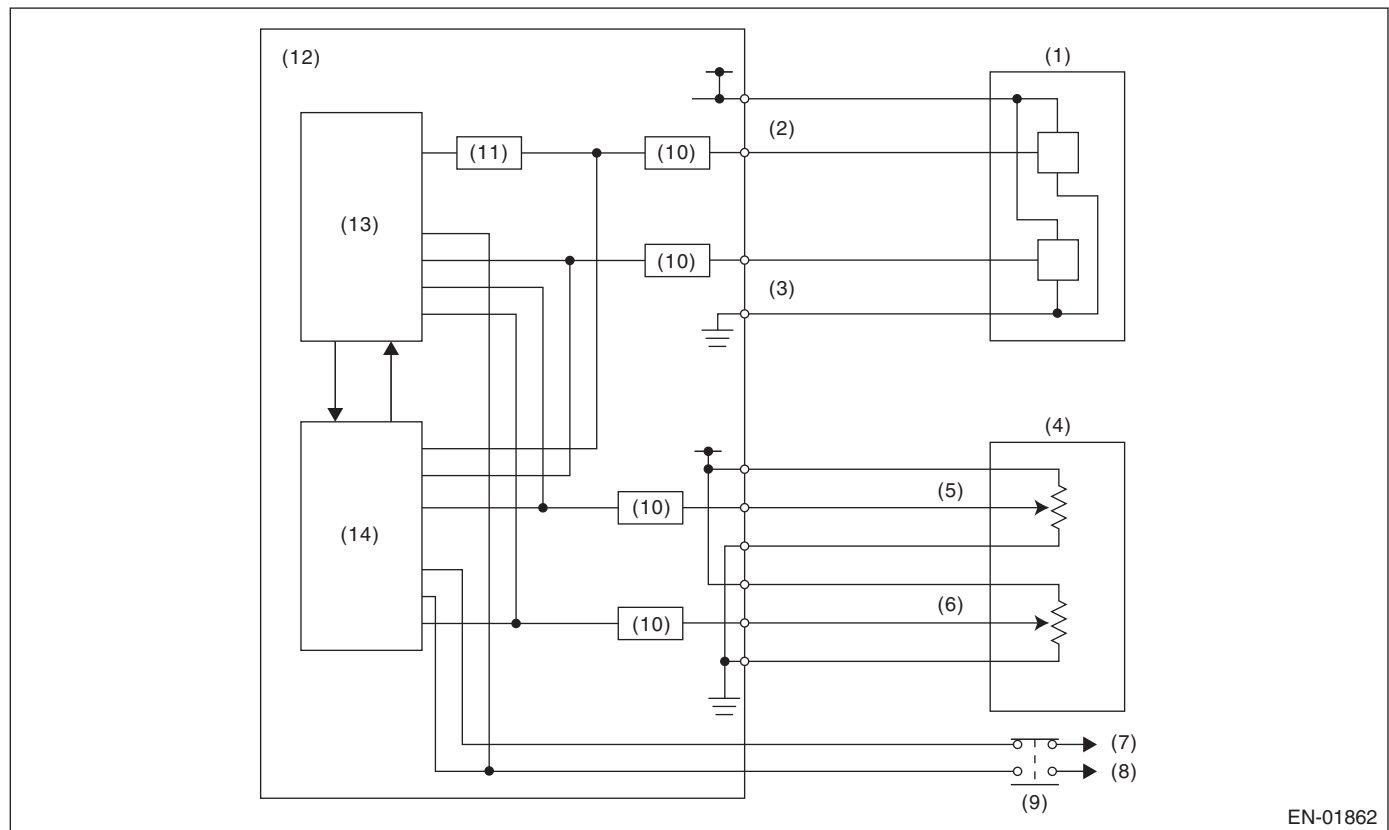
CB:DTC P0607 THROTTLE CONTROL SYSTEM CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

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

- 1) When the read value of throttle position sensor 1 signal is mismatched between main CPU and sub CPU.
- 2) When the read value of accelerator pedal position sensor 1 signal is mismatched between main CPU and sub CPU.
- 3) When the sub CPU operates abnormally.
- 4) When the communication between main CPU $\longleftrightarrow$ sub CPU is abnormal.
- 5) When the input amplifier circuit of throttle position sensor 1 is abnormal.
- 6) When the cruise control cannot be canceled correctly.
- 7) When the signal of brake SW1 and 2 is mismatched.

2. COMPONENT DESCRIPTION



- | | | |
|---|---|----------------------------------|
| (1) Throttle position sensor | (6) Accelerator pedal position sensor 2 | (11) Amplifier circuit |
| (2) Throttle position sensor 1 | (7) Battery | (12) Engine control module (ECM) |
| (3) Throttle position sensor 2 | (8) Stop light | (13) Sub CPU |
| (4) Accelerator pedal position sensor | (9) Brake switch | (14) Main CPU |
| (5) Accelerator pedal position sensor 1 | (10) I/F circuit | |

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
(1) Ignition switch	ON
(2) Ignition switch	ON
(3) None	—
(4) None	—
(5) Throttle opening angle	—
(6) Brake switch (only with cruise control)	ON
(7) None	—

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

4. GENERAL DRIVING CYCLE

- (1) — (4): Always perform the diagnosis continuously.
- (5): Always perform the diagnosis continuously when idling.
- (6): Perform the diagnosis when the brake pedal is depressed.
- (7): Always perform the diagnosis continuously.
- (8): Always perform the diagnosis continuously when the cruise control pedal is not operating.

5. DIAGNOSTIC METHOD

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

Judgement Value

Malfunction Criteria	Threshold Value
(1) Difference of CPU reading value of the throttle position sensor signal	$\leq 0.0858 \text{ V}$
(2) Difference of CPU read value of the accelerator pedal position sensor signal	$\leq 0.35 \text{ V}$
(3) WD pulse from sub CPU	WD pulse occur
(4) Communication between CPU	Possible to communicate
(5) Throttle position sensor 1 opening angle — (Throttle position sensor 1 opening angle after passing amplifier) 1/4	$< 3^\circ$
(6) Cruise control cancel signal at brake ON	Cruise control cancel signal ON
(7) Brake switch 1, 2 signal	SW 1 and 2 are matched

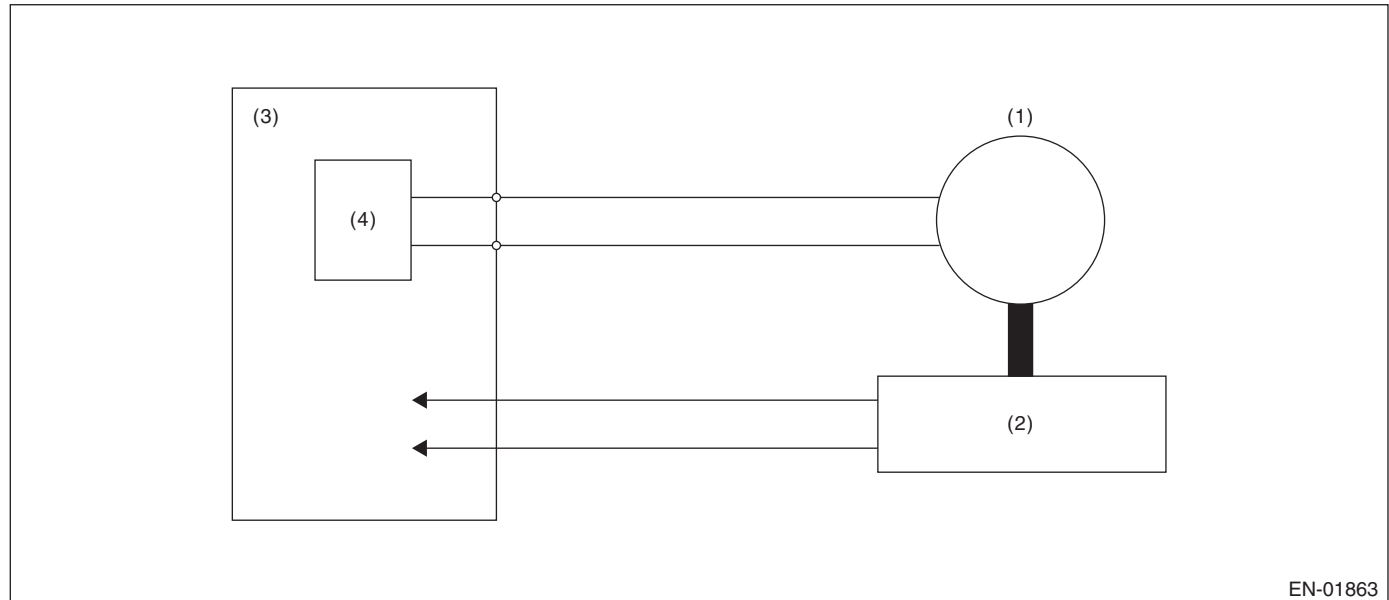
Time Needed for Diagnosis:

- 1. 600 ms
- 2. 830 ms
- 3. 200 ms
- 4. 200 ms
- 5. 24 ms
- 6. 250 ms
- 7. 200 ms

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

**CC:DTC P0638 THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE
(BANK 1)****1. OUTLINE OF DIAGNOSIS**

Judge as NG when the target opening angle and actual opening angle is mismatched or the current to motor is the specified duty or more for specified time continuously.

2. COMPONENT DESCRIPTION

EN-01863

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

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Normal operation of electronic throttle control	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously when the electronic throttle control is operating.

5. DIAGNOSTIC METHOD

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

Judgement Value

Malfunction Criteria	Threshold Value
Difference between target opening angle and actual opening angle	3.5° or less
Output duty to drive circuit	95% or less

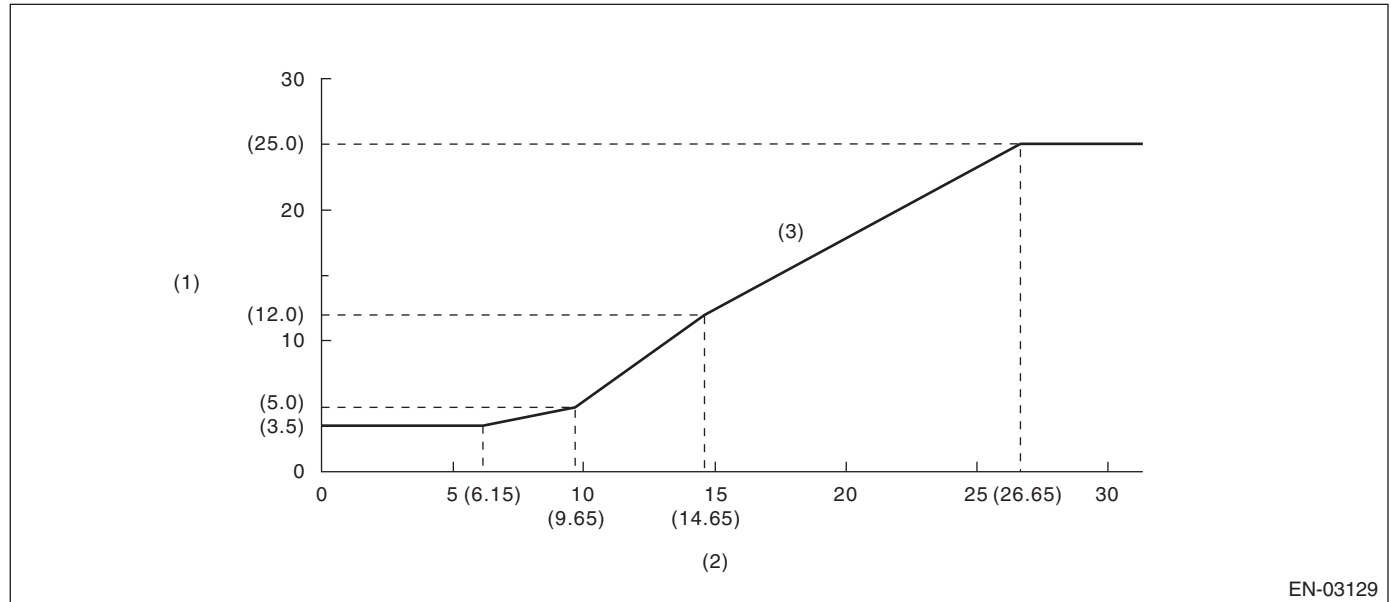
Time Needed for Diagnosis:

- Target opening angle and actual opening angle: 250 milliseconds (For NG), 2000 milliseconds (For OK)
- Output duty to drive circuit: 2000 milliseconds

Diagnostic Trouble Code (DTC) Detecting Criteria

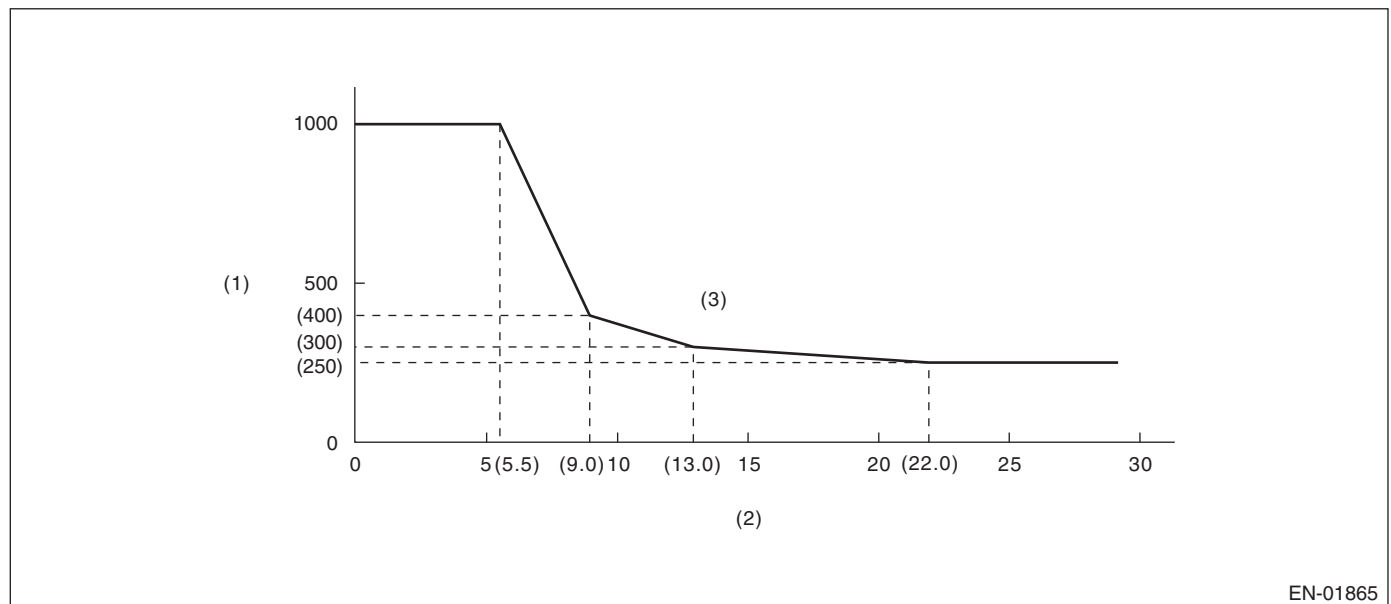
GENERAL DESCRIPTION

Details of Judgement Value



- (1) Difference between target opening angle and actual opening angle (°) (2) Target throttle opening angle (°) (3) NG area

Details of Judgement time (The actual opening angle $\leq$ target opening angle is always 1000 milliseconds)



- (1) Judgement time (milliseconds) (2) Throttle position sensor 1 opening angle (3) NG area

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CD: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 Judgement

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

Judgement 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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
MIL lighting request from TCM	None

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

1. OUTLINE OF DIAGNOSIS

Judge the open or short circuit of the neutral SW.

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

2. ENABLE CONDITION

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

3. GENERAL DRIVING CYCLE

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

4. DIAGNOSTIC METHOD

• Abnormality Judgement

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

Judgement Value

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

Time Needed for Diagnosis: 100 time(s)

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

• Normality Judgement

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

Judgement Value

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

Time Needed for Diagnosis: Less than 1 second

CF:DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL)**1. OUTLINE OF DIAGNOSIS**

Detect the open or short circuit of neutral SW.

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

2. ENABLE CONDITION

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

3. GENERAL DRIVING CYCLE

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

4. DIAGNOSTIC METHOD**• Abnormality Judgement**

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

Judgement Value

Malfunction Criteria	Threshold Value
Neutral switch signal (while changing from a to b below)	LOW (ON) continues.
Driving condition change	From a) to b)
a) Engine speed 600 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH)	
b) Engine speed 1600 rpm — 900 rpm & Vehicle speed ≥ 0 km/h (0 MPH)	

Time Needed for Diagnosis: 3 time(s)

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

• Normality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Neutral switch signal (while changing from a to b below)	Changes to HIGH (OFF).
Driving condition change	From a) to b)
a) Engine speed 600 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH)	
b) Engine speed 1600 rpm — 2550 rpm & Vehicle speed ≥ 64 km/h (39.8 MPH)	

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

1. OUTLINE OF DIAGNOSIS

Judge the open or short circuit of the neutral SW.

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

2. ENABLE CONDITION

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

3. GENERAL DRIVING CYCLE

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

4. DIAGNOSTIC METHOD

• Abnormality Judgement

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

Judgement Value

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

Time Needed for Diagnosis: 100 time(s)

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

• Normality Judgement

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

Judgement Value

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

Time Needed for Diagnosis: Less than 1 second

CH:DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL)**1. OUTLINE OF DIAGNOSIS**

Detect the open or short circuit of neutral SW.

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

2. ENABLE CONDITION

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

3. GENERAL DRIVING CYCLE

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

4. DIAGNOSTIC METHOD**• Abnormality Judgement**

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

Judgement Value

Malfunction Criteria	Threshold Value
Neutral switch signal (while changing from a to b below)	HIGH (OFF) continues.
Driving condition change	From a) to b)
a) Engine speed 600 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH)	
b) Engine speed 1600 rpm — 2550 rpm & Vehicle speed ≥ 64 km/h (39.8 MPH)	

Time Needed for Diagnosis: 3 time(s)

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

• Normality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Neutral switch signal (while changing from a to b below)	Changes to LOW (ON).
Driving condition change	From a) to b)
a) Engine speed 600 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH)	
b) Engine speed 1600 rpm — 2550 rpm & Vehicle speed ≥ 64 km/h (39.8 MPH)	

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

1. OUTLINE OF DIAGNOSIS

Detect that λ value remains low.

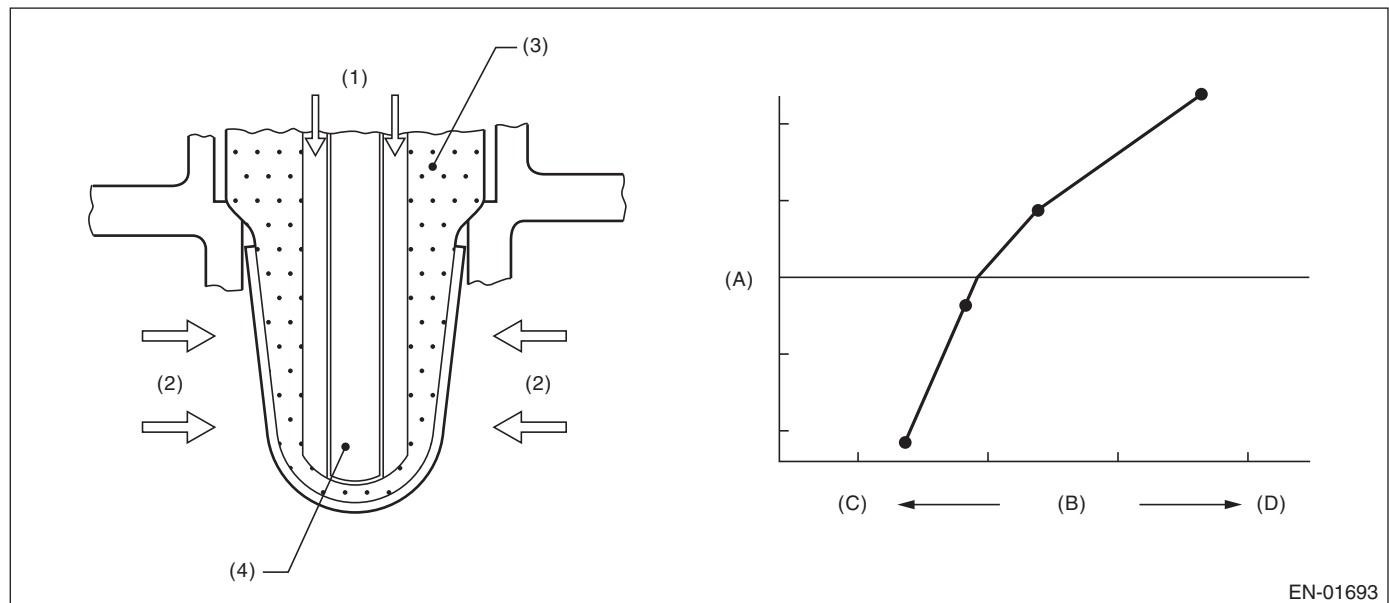
Judge as NG when lambda value is abnormal in accordance with λ value of front oxygen (A/F) sensor and running conditions such as vehicle speed, amount of intake air, engine coolant temperature, sub feedback control, etc.

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

$\lambda > 1$: Lean

$\lambda < 1$: Rich

2. COMPONENT DESCRIPTION



EN-01693

(A) Electromotive force

(D) Rich

(B) Air fuel ratio

(3) ZrO_2

(C) Lean

(4) Ceramic heater

(1) Atmosphere

(2) Exhaust gas

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	≥ 6 g/s (0.21 oz/s)
Load change at 180°CA	< 0.02 g/rev (0 oz/rev)
Front oxygen (A/F) sensor impedance	0Ω — 50Ω
Learning value of evaporation gas density	< 0.2
Total time of operating canister purge	≥ 19.9 s
Targeted lambda value load compensation coefficient	-0.03 — 0.000

4. GENERAL DRIVING CYCLE

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

5. DIAGNOSTIC METHOD

• Abnormality Judgement

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

Judgement 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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
λ value	≥ 0.85

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

1. OUTLINE OF DIAGNOSIS

Detect that λ value remains high.

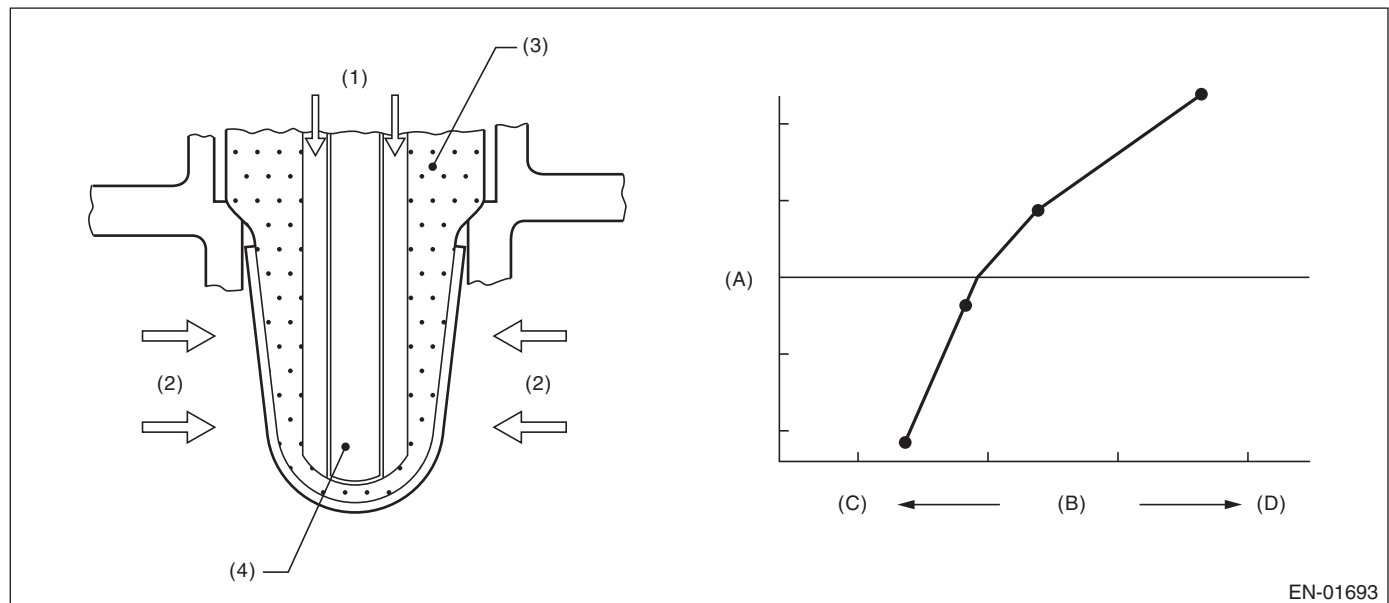
Judge as NG when lambda value is abnormal in accordance with λ value of front oxygen (A/F) sensor and running conditions such as vehicle speed, amount of intake air, engine coolant temperature, sub feedback control, etc.

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

$\lambda > 1$: Lean

$\lambda < 1$: Rich

2. COMPONENT DESCRIPTION



(A) Electromotive force

(B) Air fuel ratio

(C) Lean

(D) Rich

(1) Atmosphere

(3) ZrO_2

(4) Ceramic heater

(2) Exhaust gas

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	≥ 6 g/s (0.21 oz/s)
Load change at 180°CA	< 0.02 g/rev (0 oz/rev)
Front oxygen (A/F) sensor impedance	0Ω — 50Ω
Learning value of evaporation gas density	< 0.2
Total time of operating canister purge	≥ 19.9 s
Targeted lambda value load compensation coefficient	-0.03 — 0.000

4. GENERAL DRIVING CYCLE

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

5. DIAGNOSTIC METHOD

• Abnormality Judgement

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

Judgement 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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
λ value	≤ 1.15

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

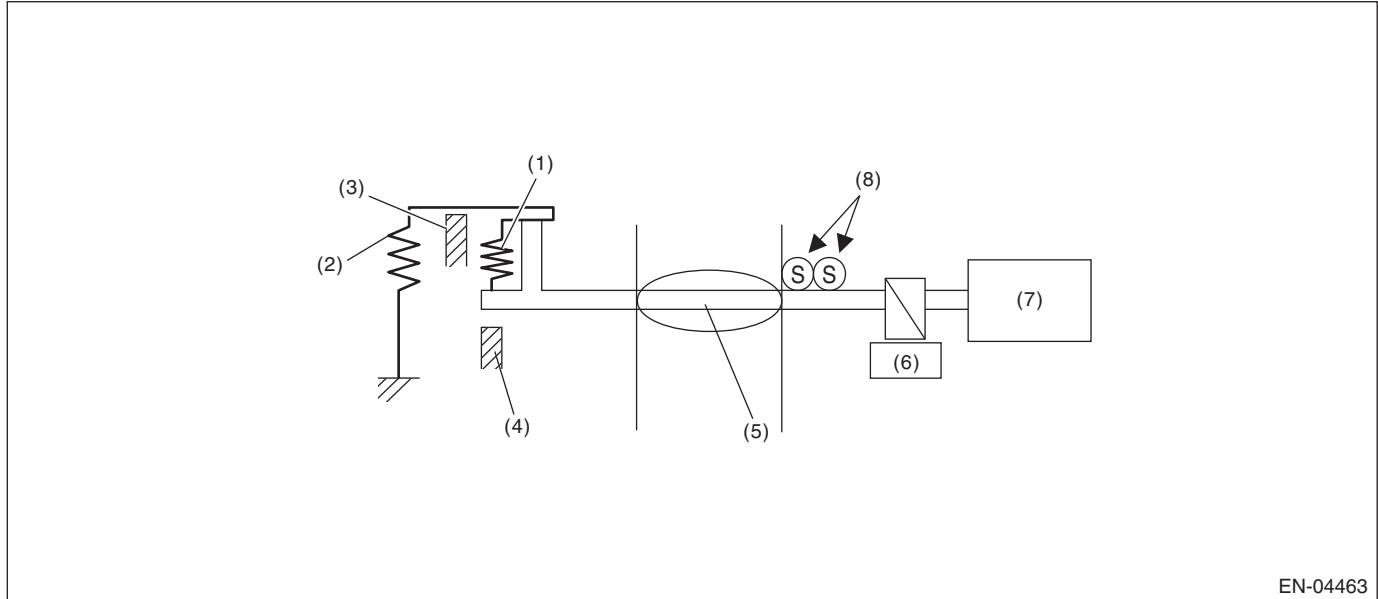
GENERAL DESCRIPTION

CK: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)

5. DIAGNOSTIC METHOD

• Abnormality Judgement

Judge as NG when the following conditions are established.

Judgement 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 Judgement

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

Judgement Value

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

Time Needed for Diagnosis:3400 ms

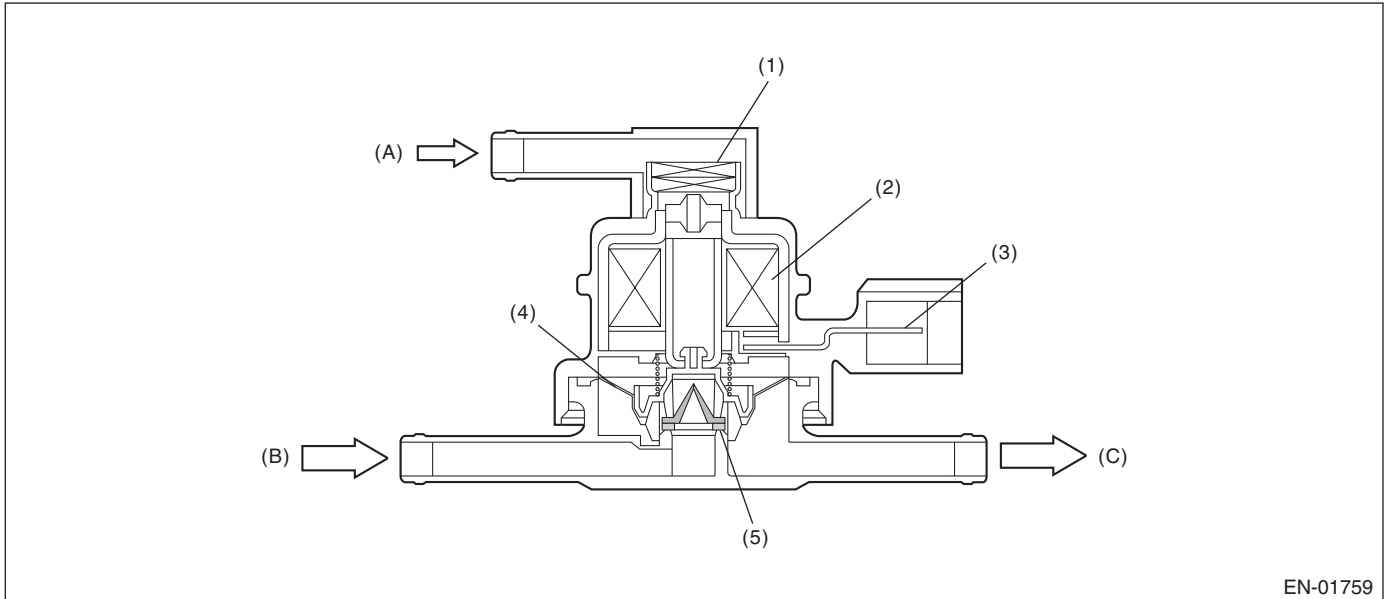
CL:DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of pressure control solenoid valve.

Judge as NG when ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



(A) Barometric pressure

(B) Shut-off valve

(C) To fuel tank

(1) Filter

(3) Connector terminal

(5) Valve

(2) Coil

(4) Diaphragm

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1 second
Terminal output voltage when ECM outputs OFF signal	Low

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1 second
Terminal output voltage when ECM outputs OFF signal	High

Time Needed for Diagnosis: Less than 1 second

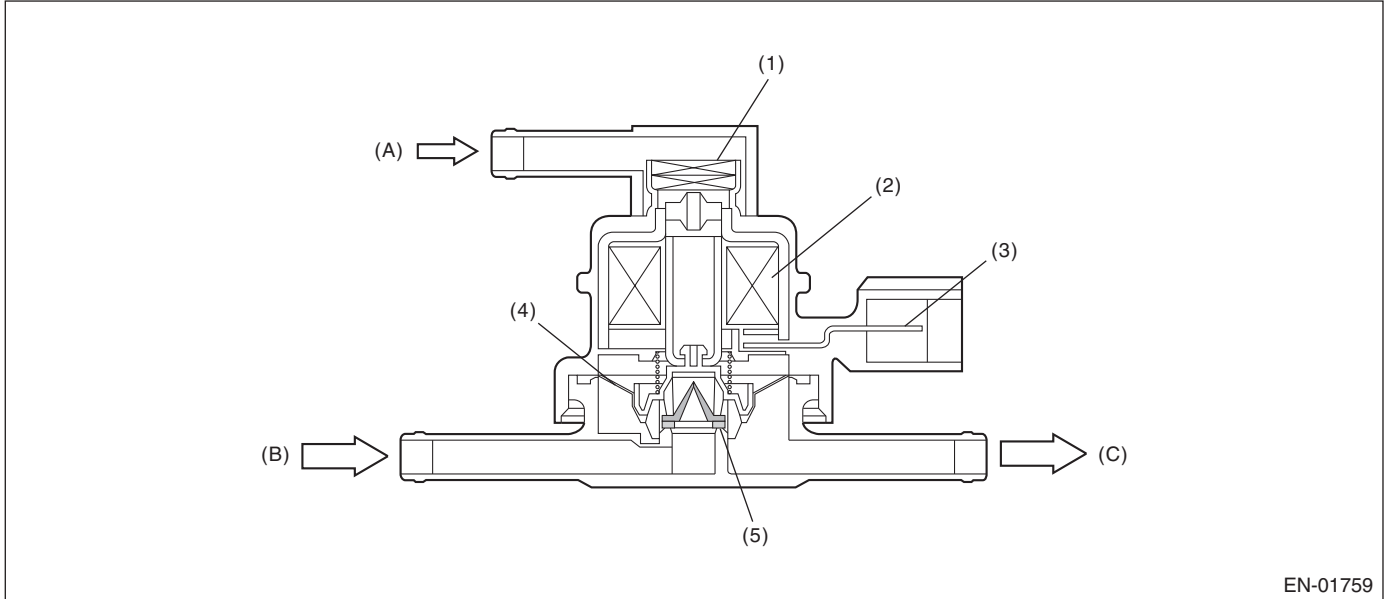
CM:DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of pressure control solenoid valve.

Judge as NG when ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



EN-01759

(A) Barometric pressure

(B) Shut-off valve

(C) To fuel tank

(1) Filter

(3) Connector terminal

(5) Valve

(2) Coil

(4) Diaphragm

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgement

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

Judgement 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 when malfunction occurs in 2 continuous driving cycles.

• Normality Judgement

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

Judgement Value

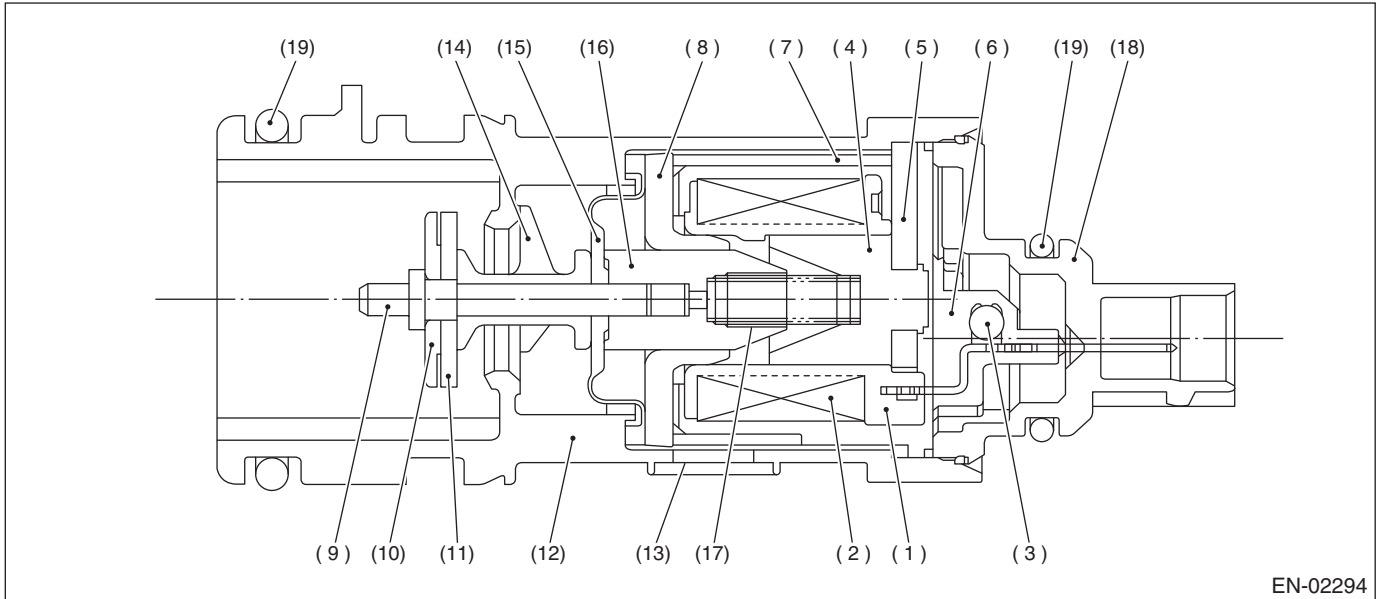
Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1 second
Terminal output voltage when ECM outputs ON signal	Low

Time Needed for Diagnosis: Less than 1 second

CN: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

EN-02294

- | | | |
|-----------------|--------------------|-------------------|
| (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	-0.4 kPa (-3.2 mmHg, -0.1 inHg) and 1.4 kPa (10.7 mmHg, 0.4 inHg)

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	≤ -4 kPa (-30 mmHg, -1.2 inHg)

Time Needed for Diagnosis: 3000 s

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

• Normality Judgement

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

Judgement 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 s
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)

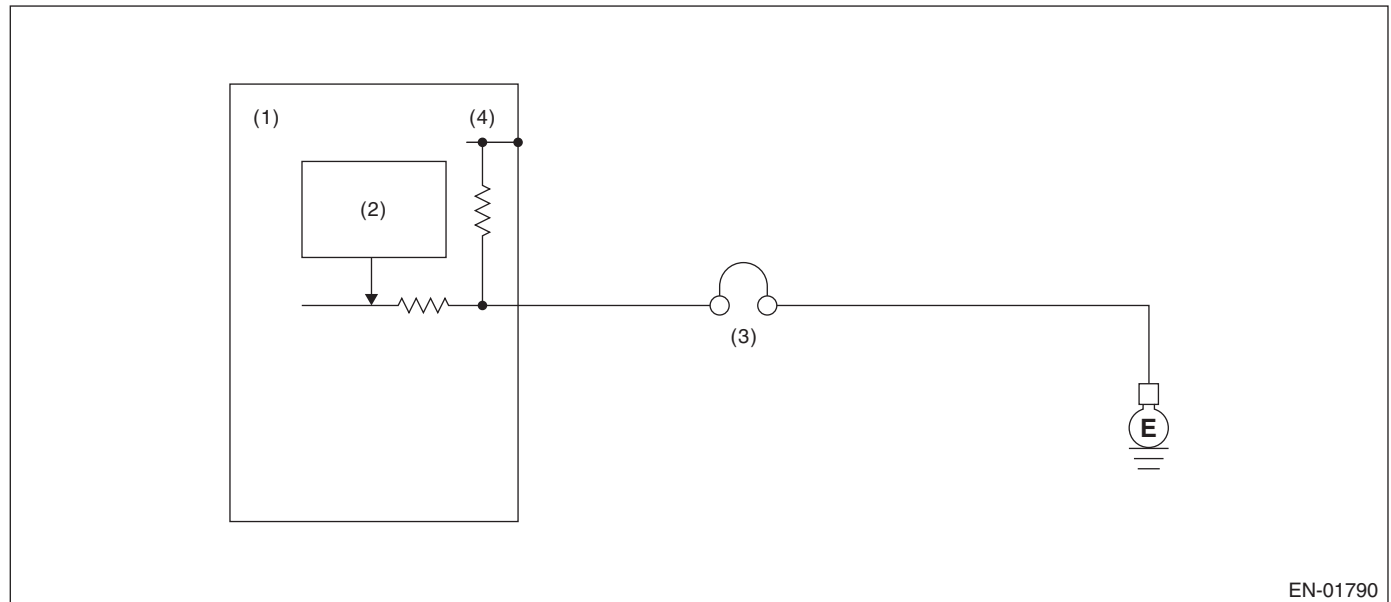
Time Needed for Diagnosis: Less than 1 second

CO:DTC P1491 POSITIVE CRANKCASE VENTILATION (BLOW-BY) FUNCTION PROBLEM

1. OUTLINE OF DIAGNOSIS

Detect the blow-by hose disconnection abnormality.
Judge as NG when the diagnosis terminal voltage is high.

2. COMPONENT DESCRIPTION



- (1) Engine control module (ECM) (3) PCV diagnosis connector (4) 5 V
(2) 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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Engine condition	After engine starting
Positive crankcase ventilation diagnosis voltage	High

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Engine condition	After engine starting
Positive crankcase ventilation diagnosis voltage	Low

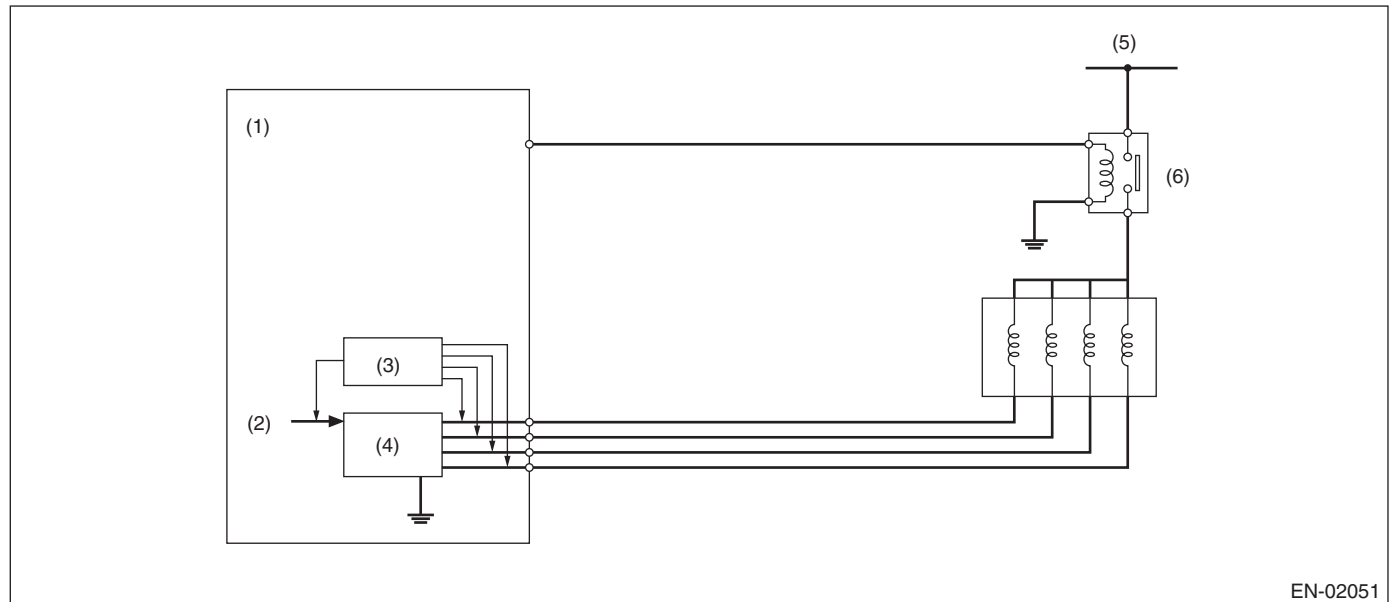
Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



EN-02051

- | | | |
|---------------------------------|-----------------------|---------------------|
| (1) Engine control module (ECM) | (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

Perform diagnosis continuously during EGR operation.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgement

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

Judgement 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 Judgement

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

Judgement Value

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

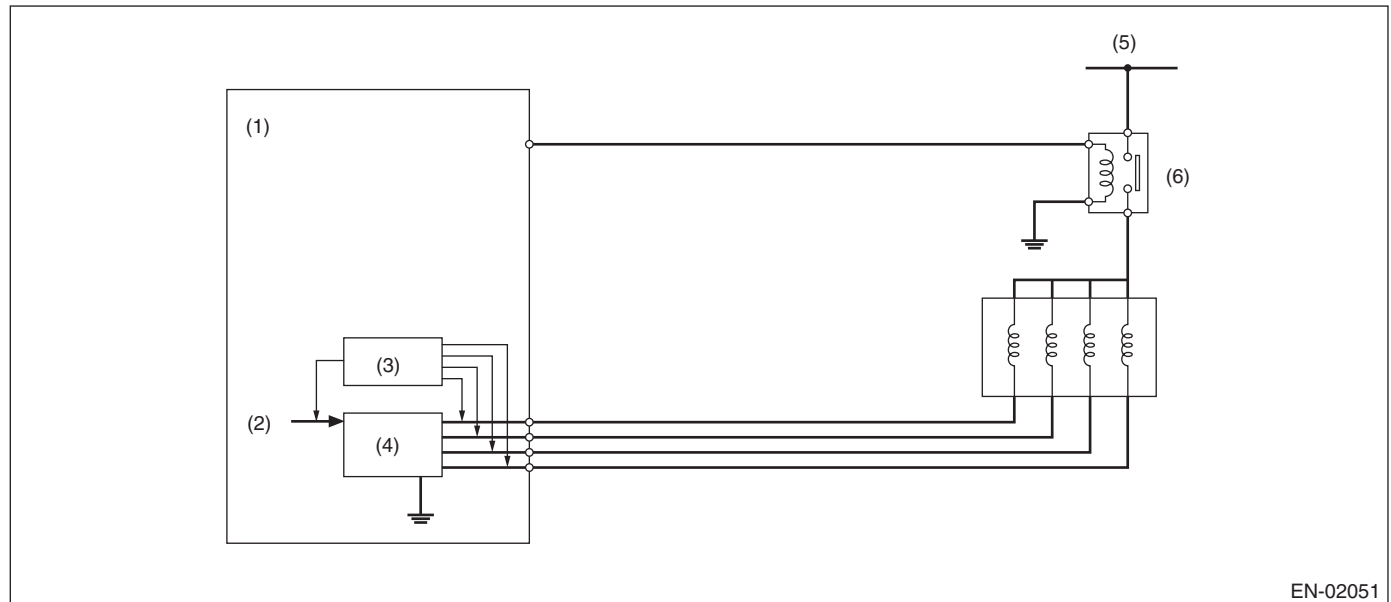
Time Needed for Diagnosis:128 ms

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

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



EN-02051

- | | | |
|---------------------------------|-----------------------|---------------------|
| (1) Engine control module (ECM) | (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 Judgement

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

Judgement 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 Judgement

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

Judgement Value

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

Time Needed for Diagnosis:128 ms

CR: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(H4SO)-167, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CS: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(H4SO)-169, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CT: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(H4SO)-167, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CU: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(H4SO)-169, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CV: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(H4SO)-167, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CW: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(H4SO)-169, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CX: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 Judgement

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

Judgement 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 Judgement

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

Judgement 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

CY:DTC P1570 ANTENNA

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-141, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CZ:DTC P1571 REFERENCE CODE INCOMPATIBILITY

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-141, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

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

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-141, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DB:DTC P1574 KEY COMMUNICATION FAILURE

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-141, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DC:DTC P1576 EGI CONTROL MODULE EEPROM

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-141, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DD:DTC P1577 IMM CONTROL MODULE EEPROM

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-141, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DE:DTC P1578 METER FAILURE

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-141, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

DF: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 and idle speed diagnosis and if either 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.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Barometric 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 within 200 engine revs.	< 5
Time after starting	= 14 seconds

3. GENERAL DRIVING CYCLE

Perform the diagnosis at cold start.

4. DIAGNOSTIC METHOD

- Exhaust gas temperature diagnosis

Abnormality Judgement

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.

Judgement Value

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

Map (U5 model)

Coolant temperature after starting the engine	-40 °C (-40 °F)	-30 °C (-22 °F)	-20 °C (-4 °F)	-10 °C (14 °F)	0 °C (32 °F)	10 °C (50 °F)	20 °C (68 °F)	30 °C (86 °F)	40 °C (104 °F)	50 °C (122 °F)
Threshold value (AT model)	220 °C (428 °F)	220 °C (428 °F)	220 °C (428 °F)	220 °C (428 °F)	220 °C (428 °F)	214 °C (417.2 °F)	206 °C (402.8 °F)	206 °C (402.8 °F)	184 °C (363.2 °F)	178 °C (352.4 °F)
Threshold value (MT model)	214 °C (417.2 °F)	214 °C (417.2 °F)	214 °C (417.2 °F)	214 °C (417.2 °F)	214 °C (417.2 °F)	214 °C (417.2 °F)	214 °C (417.2 °F)	198 °C (388.4 °F)	194 °C (381.2 °F)	190 °C (374 °F)

Map (Other than U5 model)

Coolant temperature after starting the engine	-40 °C (-40 °F)	-30 °C (-22 °F)	-20 °C (-4 °F)	-10 °C (14 °F)	0 °C (32 °F)	10 °C (50 °F)	20 °C (68 °F)	30 °C (86 °F)	40 °C (104 °F)	50 °C (122 °F)
Threshold value (AT model)	162 °C (323.6 °F)	162 °C (323.6 °F)	162 °C (323.6 °F)	162 °C (323.6 °F)	162 °C (323.6 °F)	162 °C (323.6 °F)	162 °C (323.6 °F)	154 °C (309.2 °F)	142 °C (287.6 °F)	142 °C (287.6 °F)
Threshold value (MT model)	168 °C (334.4 °F)	168 °C (334.4 °F)	168 °C (334.4 °F)	168 °C (334.4 °F)	168 °C (334.4 °F)	168 °C (334.4 °F)	168 °C (334.4 °F)	160 °C (320 °F)	145 °C (293 °F)	145 °C (293 °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 Judgement

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

Judgement Value

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

Time Needed for Diagnosis: Less than 1 second

• Idle speed diagnosis

Abnormality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Continuous time of (Target engine speed – Actual engine speed > –200 rpm) (U5 model)	≥ 6000 ms
Continuous time of (Target engine speed – Actual engine speed > –300 rpm) (Other than U5 model)	
Continuous time of (actual retard amount > 30 °CA)	≥ 0 ms

Time Needed for Diagnosis: 14 seconds

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

Normality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Continuous time of (Target engine speed – Actual engine speed > –200 rpm) (U5 model)	< 6000 ms
Continuous time of (Target engine speed – Actual engine speed > –300 rpm) (Other than U5 model)	
Continuous time of (actual retard amount > 30 °CA)	< 0 ms

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

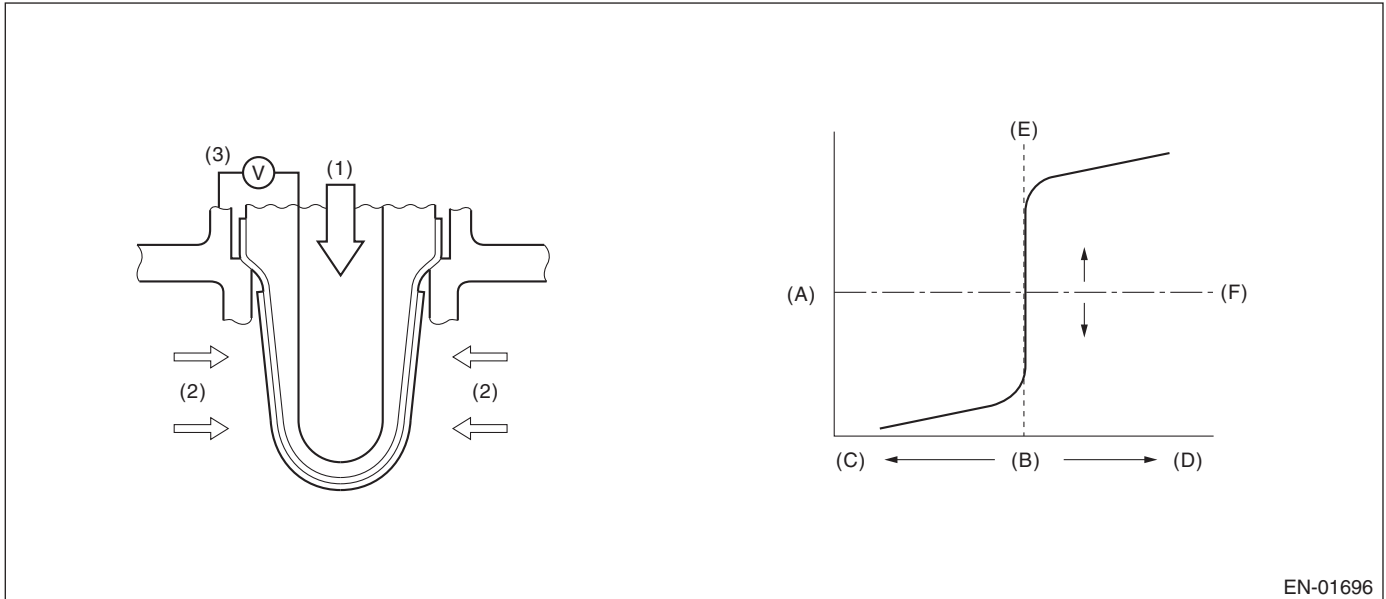
GENERAL DESCRIPTION

DG: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



(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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Sub feedback learning value	< -0.04 (U5 model) < -0.041 (Other than U5 model)

Time Needed for Diagnosis: 5 s × 1 time(s)

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

• Normality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Sub feedback learning value	≥ -0.04 + 0 (U5 model) ≥ -0.041 + 0 (Other than U5 model)

Time Needed for Diagnosis: 5 s

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

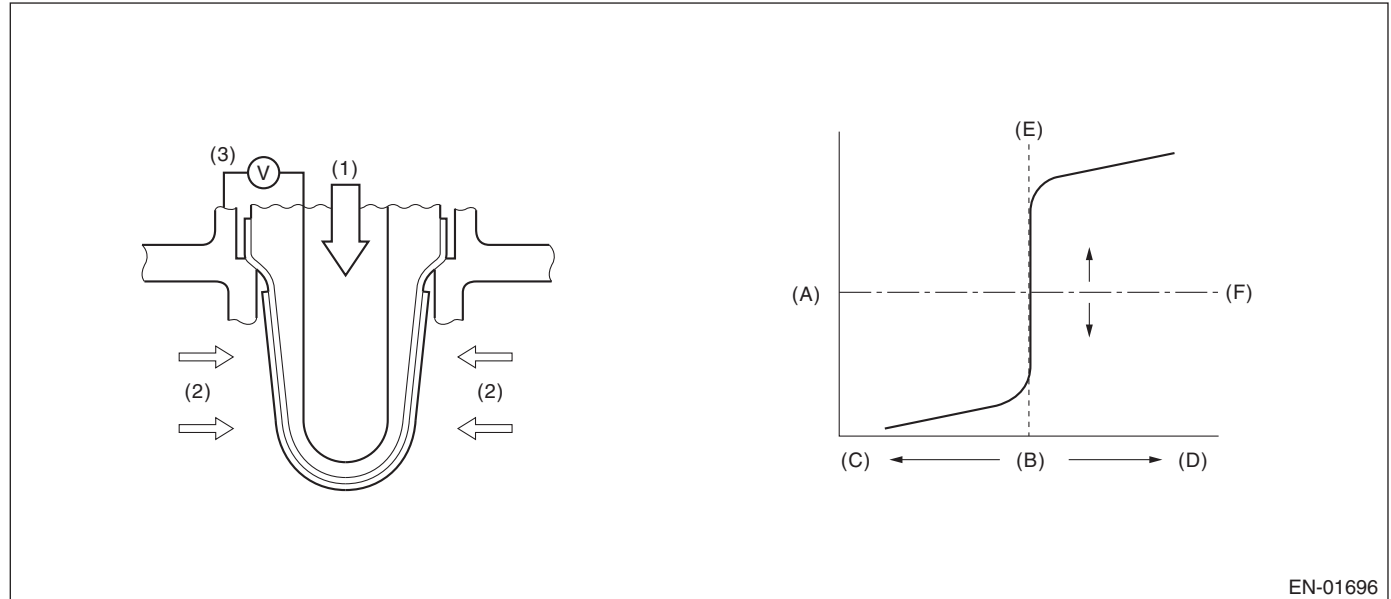
DH:DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH (BANK 1)

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



(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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Sub feedback learning value	≥ 0.03 (U5 model) ≥ 0.04 (Other than U5 model)

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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Sub feedback learning value	$< 0.03 + -0.002$ (U5 model) < 0.04 (Other than U5 model) $+ -0.002$

Time Needed for Diagnosis: 5 s

Diagnostic Trouble Code (DTC) Detecting Criteria

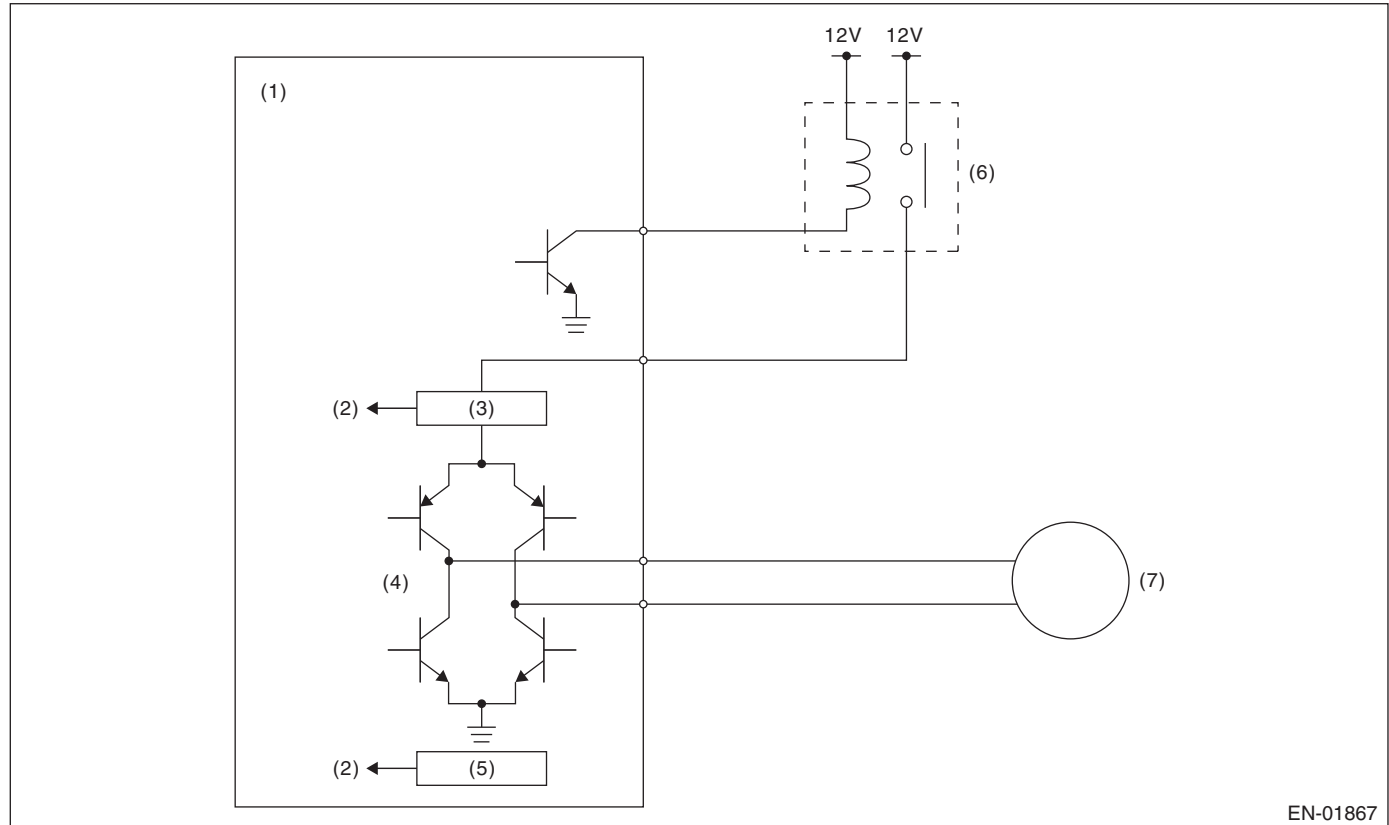
GENERAL DESCRIPTION

DI: DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Judge as NG when the motor current becomes large or drive circuit is heated.

2. COMPONENT DESCRIPTION



- | | | |
|-----------------------------------|-----------------------------------|---------------------------------------|
| (1) Engine control module (ECM) | (4) Drive circuit | (6) Electronic throttle control relay |
| (2) Detecting circuit | (5) Temperature detection circuit | (7) Motor |
| (3) Overcurrent detection circuit | | |

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Under control of electronic throttle control	ON

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.

Judgement Value

Malfunction Criteria	Threshold Value
Motor current	$\leq 8 \text{ A}$
Drive circuit inner temperature	$\leq 175^{\circ}\text{C}$ (347°F)

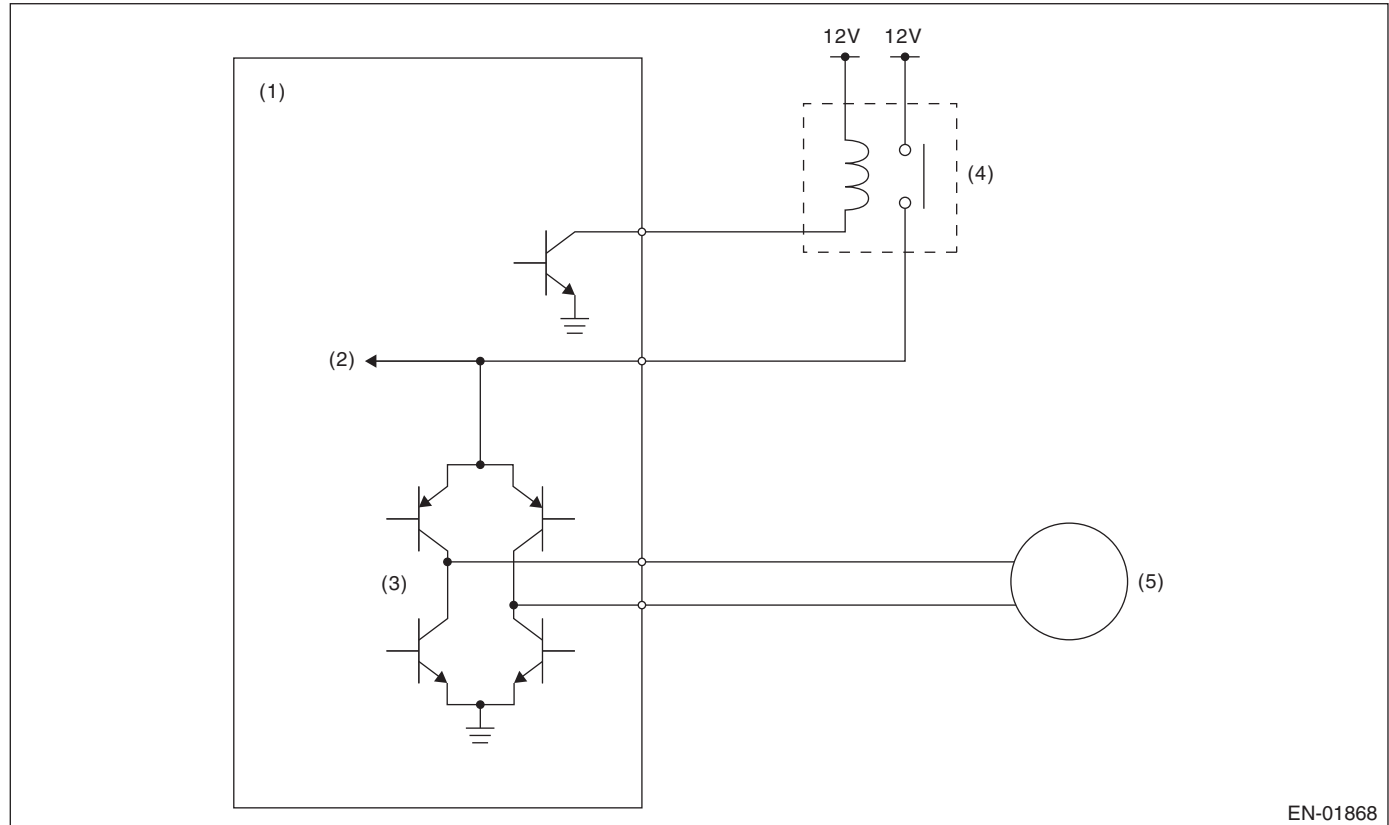
Time Needed for Diagnosis:

- 500 milliseconds (For NG)
- 2000 milliseconds (For OK)

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

DJ: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 electric control throttle 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
Electronic throttle control relay output	ON

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.

Judgement Value

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

Time Needed for Diagnosis:

- 400 milliseconds (For NG)
- 2000 milliseconds (For OK)

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

Diagnostic Trouble Code (DTC) Detecting Criteria

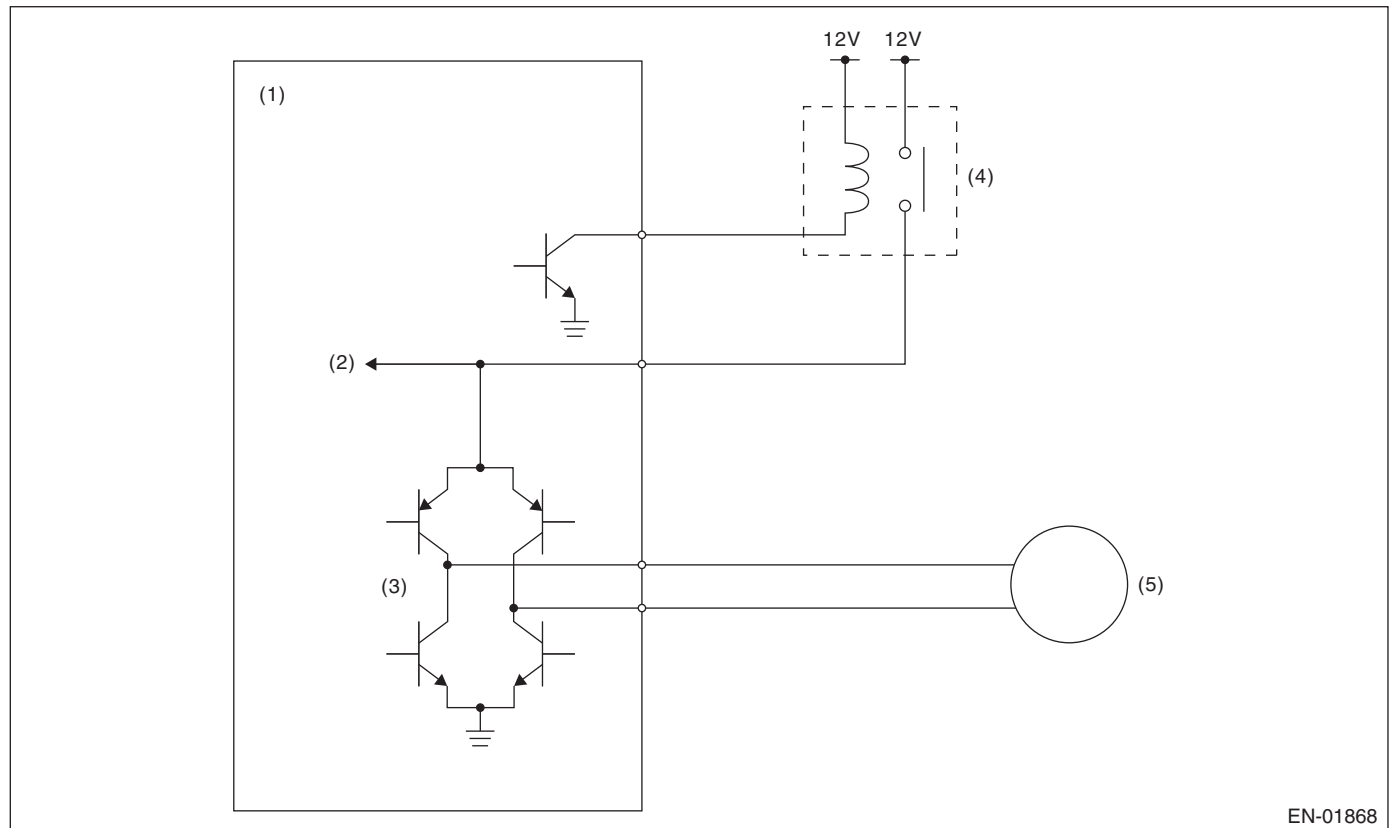
GENERAL DESCRIPTION

DK: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
Electronic throttle control relay output	OFF

4. GENERAL DRIVING CYCLE

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

5. DIAGNOSTIC METHOD

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

Judgement Value

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

Time Needed for Diagnosis:

- 600 milliseconds (For NG)
- 400 milliseconds (For OK)

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

Diagnostic Trouble Code (DTC) Detecting Criteria

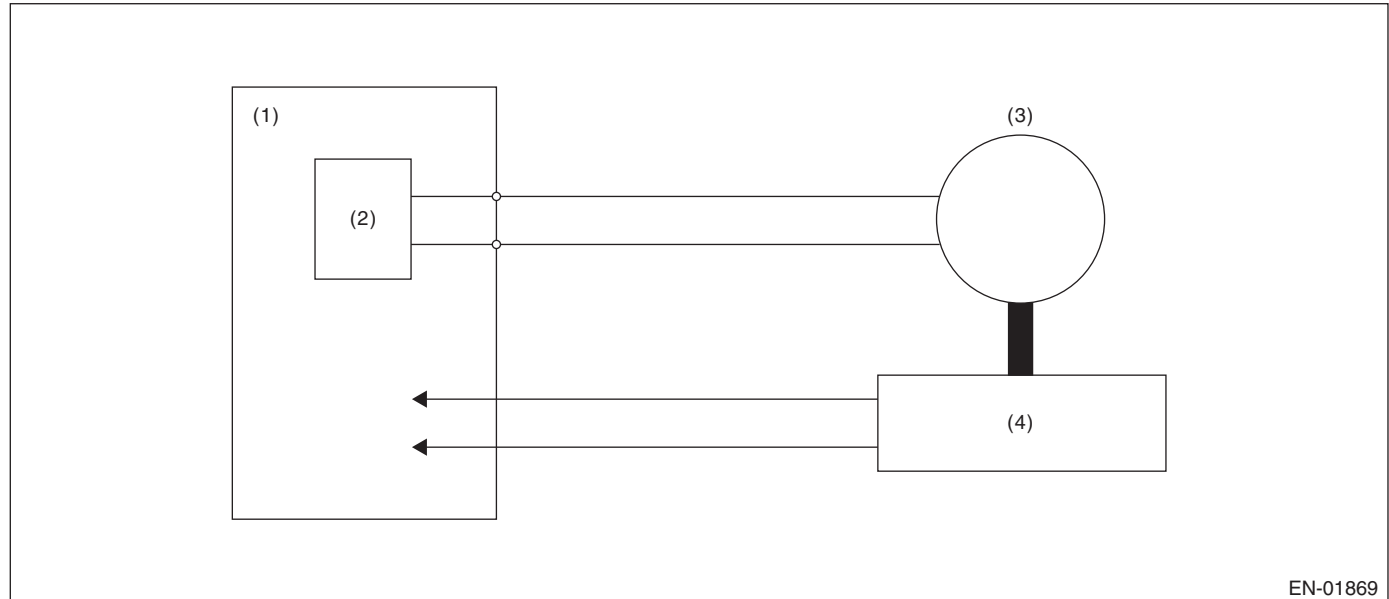
GENERAL DESCRIPTION

DL: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.

5. DIAGNOSTIC METHOD

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

Judgement Value

Malfunction Criteria	Threshold Value
Throttle sensor opening angle at full close point learning	10.127° or more, 19.872° or less
Throttle opening angle when the ignition switch is ON – Throttle minimum stop position	≥ 1.683°

Time Needed for Diagnosis: 8 — 80 milliseconds

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

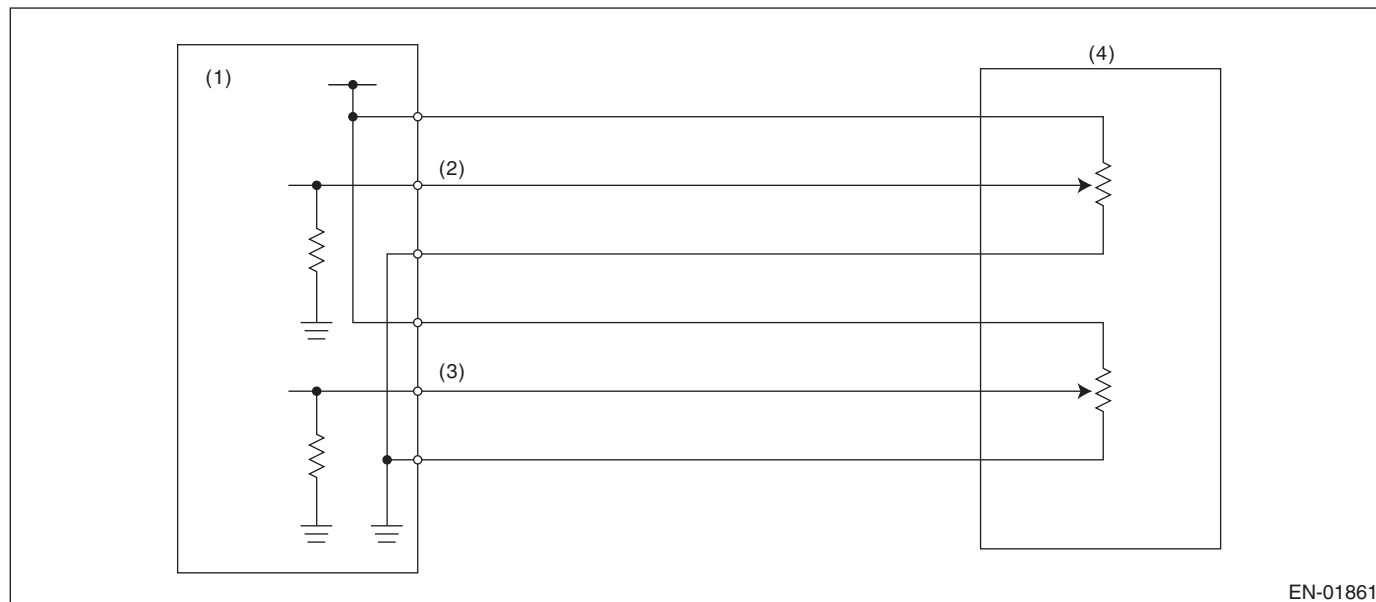
DM:DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT LOW INPUT

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



- (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 Judgement

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

Judgement 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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	≥ 0.217 V

Time Needed for Diagnosis:100 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

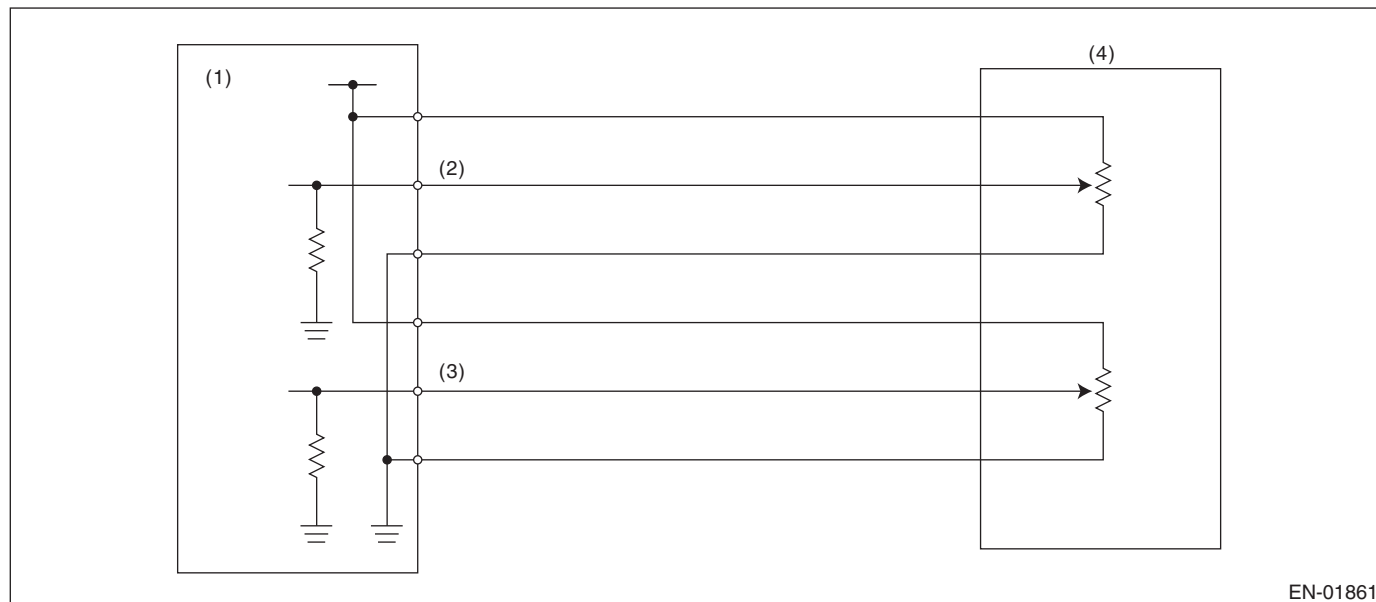
DN:DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT HIGH INPUT

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



(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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	≥ 4.783 V

Time Needed for Diagnosis:32 ms

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

• Normality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	< 4.783 V

Time Needed for Diagnosis:32 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

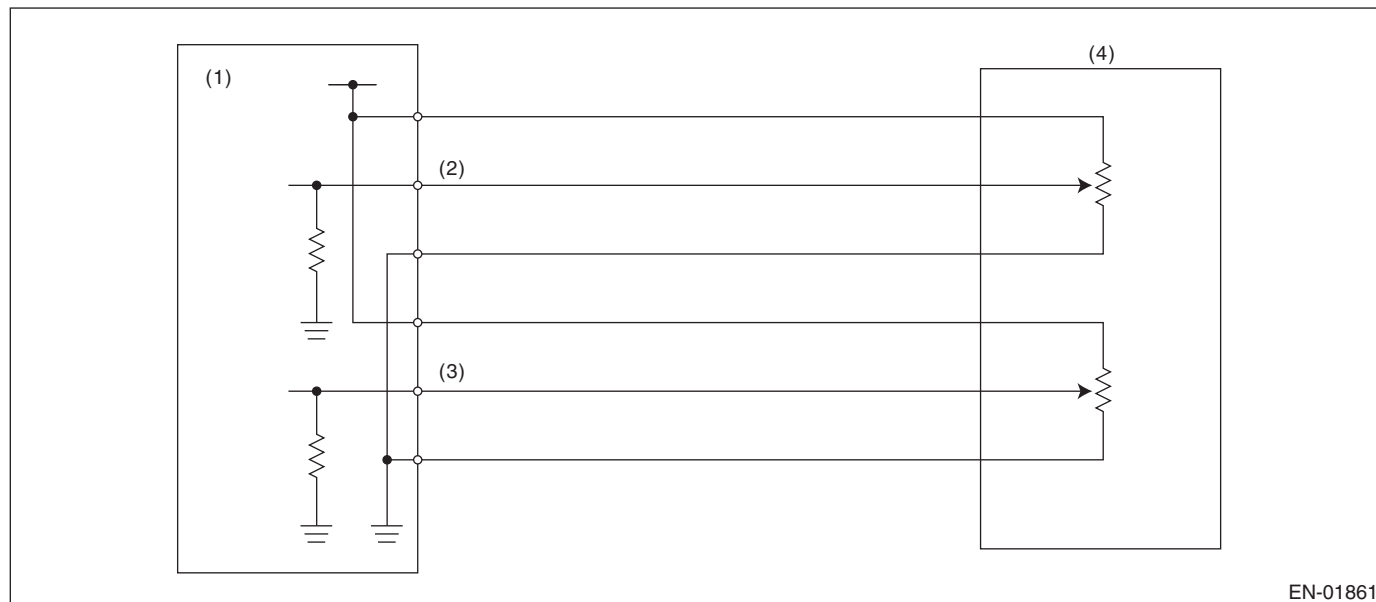
DO:DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT LOW INPUT

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 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 Judgement

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

Judgement 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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	≥ 0.217 V

Time Needed for Diagnosis:100 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

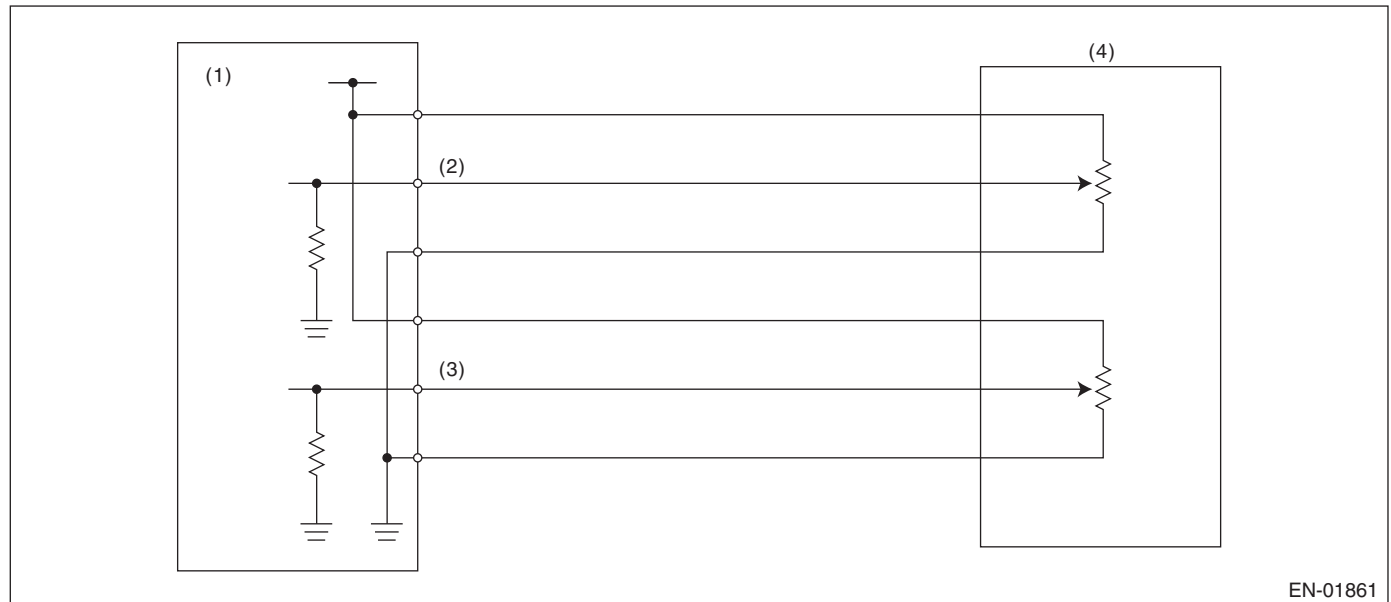
DP:DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT HIGH INPUT

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



- (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 Judgement

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

Judgement 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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	< 4.783 V

Time Needed for Diagnosis:100 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

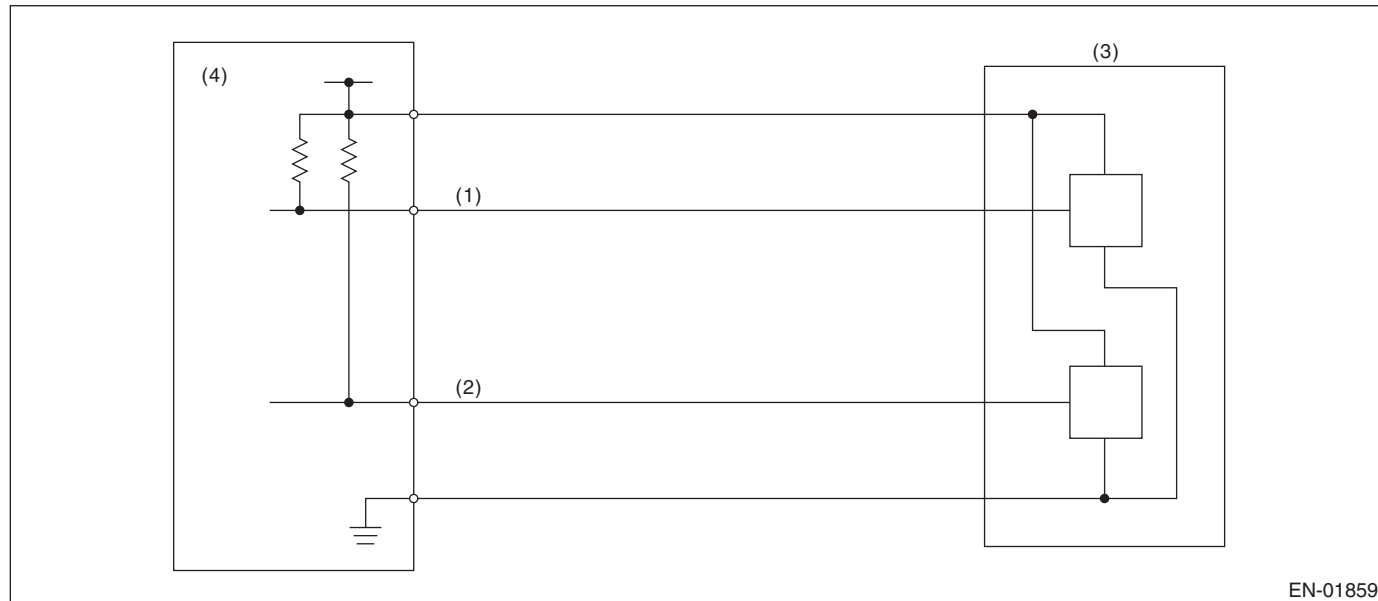
GENERAL DESCRIPTION

DQ:DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A”/“B” VOLTAGE CORRELATION

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



(1) Throttle position sensor 1 signal

(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.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Signal difference between two sensors	> Value from Map

Map

Throttle position sensor 1 opening angle (°) = d	$0^{\circ} \leq d < 2.125^{\circ}$	$2.125^{\circ} \leq d < 4.25^{\circ}$	$4.25^{\circ} \leq d < 9^{\circ}$	$9^{\circ} \leq d < 31.625^{\circ}$	$31.625^{\circ} \leq d$
Sensor output difference (°)	5.15 °	6.15 °	8.28 °	10.4 °	12.4 °

Time Needed for Diagnosis:212 ms

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

• Normality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Signal difference between two sensors	$\leq$ Value from Map

Time Needed for Diagnosis:24 ms

GENERAL DESCRIPTION

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Signal difference between two sensors	> Value from Map

Map

Throttle position sensor 1 opening angle (°) = d	$0^{\circ} \leq d < 0.6^{\circ}$	$0.6^{\circ} \leq d < 1.2^{\circ}$	$1.2^{\circ} \leq d < 2^{\circ}$	$2^{\circ} \leq d < 4^{\circ}$	$4^{\circ} \leq d$
Sensor output difference (°)	1.465 °	1.597 °	1.663 °	2.455 °	3.116 °

Time Needed for Diagnosis:116 ms

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

• Normality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Signal difference between two sensors	$\leq$ Value from Map

Time Needed for Diagnosis:116 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

DS: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 Judgement

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

Judgement 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 Judgement

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

Judgement 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

DT: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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Output voltage	< 1.706646812 V

Time Needed for Diagnosis:500 ms

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

• Normality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 1.706646812 V

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

DU: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 Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.233789985 V

Time Needed for Diagnosis: 500 ms

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

• Normality Judgement

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

Judgement Value

Malfunction Criteria	Threshold Value
Output voltage	< 4.233789985 V

Time Needed for Diagnosis: Less than 1 second

ENGINE 2 SECTION

This service manual has been prepared to provide SUBARU service personnel with the necessary information and data for the correct maintenance and repair of SUBARU vehicles.

This manual includes the procedures for maintenance, disassembling, reassembling, inspection and adjustment of components and diagnostics for guidance of experienced mechanics.

Please peruse and utilize this manual fully to ensure complete repair work for satisfying our customers by keeping their vehicle in optimum condition. When replacement of parts during repair work is needed, be sure to use SUBARU genuine parts.

All information, illustration and specifications contained in this manual are based on the latest product information available at the time of publication approval.

FUEL INJECTION (FUEL SYSTEMS)

FU(H4DOTC)

EMISSION CONTROL
(AUX. EMISSION CONTROL DEVICES)

EC(H4DOTC)

INTAKE (INDUCTION)

IN(H4DOTC)

MECHANICAL

ME(H4DOTC)

EXHAUST

EX(H4DOTC)

COOLING

CO(H4DOTC)

LUBRICATION

LU(H4DOTC)

SPEED CONTROL SYSTEMS

SP(H4DOTC)

IGNITION

IG(H4DOTC)

STARTING/CHARGING SYSTEMS

SC(H4DOTC)

ENGINE (DIAGNOSTICS)

EN(H4DOTC)
(diag)

GENERAL DESCRIPTION

GD(H4DOTC)

FUEL INJECTION (FUEL SYSTEMS)

FU(H4DOTC)

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