

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

2. Diagnostic Trouble Code (DTC) Detecting Criteria

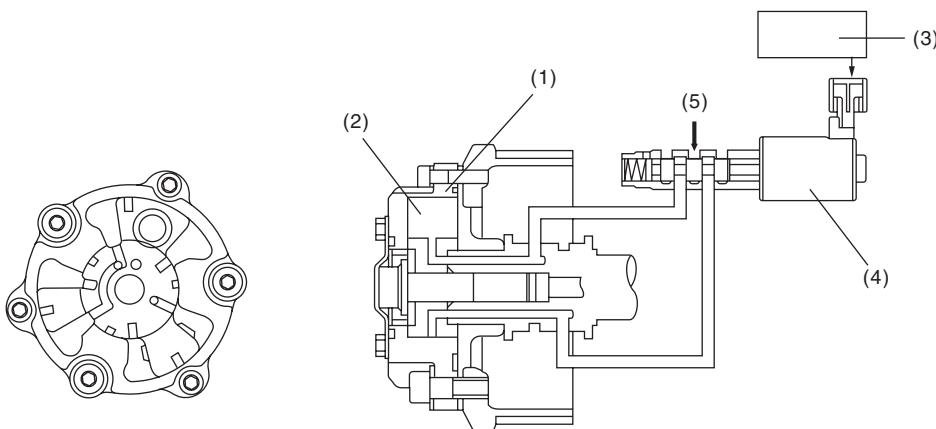
A: DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the AVCS system malfunction.

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

2. COMPONENT DESCRIPTION



EN-01852

(1) AVCS timing controller

(3) Engine control module (ECM)

(5) Oil pressure

(2) Vane

(4) Oil flow control solenoid valve

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|---|-------------------|
| Time of establishing all secondary parameter conditions | ≥ 3000 ms |
| Battery voltage | ≥ 10.9 V |
| Engine speed | ≥ 1500 rpm |
| Engine coolant temperature | ≥ 20 °C (68 °F) |
| AVCS control | Operation |
| Target timing advance change amount (per 64 ms) | < 1.07 °CA |

4. GENERAL DRIVING CYCLE

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

5. DIAGNOSTIC METHOD

- 1) When the conditions during which the differences of AVCS target timing advance amount and AVCS actual timing advance amount is large continues for certain amount of time.
- 2) When the differences of target timing advance amount and actual timing advance amount is calculated during AVCS control, and the difference per predetermined time is the specified value or larger.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|--|
| $\Sigma(\text{Target position} - \text{Actual position})$ or $\Sigma(\text{Target position} - \text{Actual position})$ | $> 4500 {}^{\circ}\text{CA}$ (Bank 1) $> 4500 {}^{\circ}\text{CA}$ (Bank 2) |
| | $< -7000 {}^{\circ}\text{CA}$ (Bank 1) $< -7000 {}^{\circ}\text{CA}$ (Bank 2) |

Time Needed for Diagnosis: 30000 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|---|
| $\Sigma(\text{Target position} - \text{Actual position})$ | $\leq 4500 {}^{\circ}\text{CA}$ (Bank 1) $\leq 4500 {}^{\circ}\text{CA}$ (Bank 2) and $\geq -7000 {}^{\circ}\text{CA}$ (Bank 1) $\geq -7000 {}^{\circ}\text{CA}$ (Bank 2) |

Time Needed for Diagnosis: 30000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

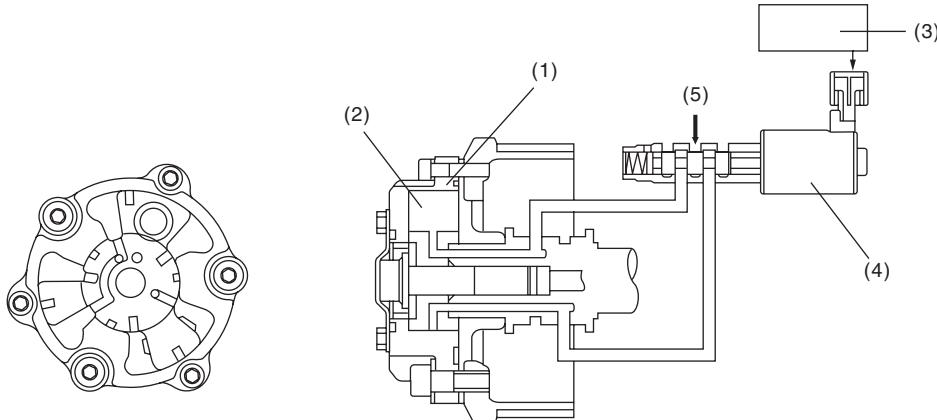
B: DTC P0014 EXHAUST AVCS SYSTEM 1 (RANGE/PERFORMANCE)

1. OUTLINE OF DIAGNOSIS

Detect the exhaust AVCS system malfunction.

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

2. COMPONENT DESCRIPTION



EN-01852

| | | |
|------------------------------------|-------------------------------------|------------------|
| (1) Exhaust AVCS timing controller | (3) Engine control module (ECM) | (5) Oil pressure |
| (2) Vane | (4) Oil flow control solenoid valve | |

3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|---|-------------------|
| Time of establishing all secondary parameter conditions | ≥ 3000 ms |
| Battery voltage | ≥ 10.9 V |
| Engine speed | ≥ 1500 rpm |
| Engine coolant temperature | ≥ 20 °C (68 °F) |
| Exhaust AVCS control | Operation |
| Target timing advance change amount (per 64 ms) | < 1.07 °CA |

4. GENERAL DRIVING CYCLE

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

5. DIAGNOSTIC METHOD

- 1) When the conditions during which the differences of exhaust AVCS target timing advance amount and exhaust AVCS actual timing advance amount is large continues for certain amount of time.
- 2) When the differences of target timing advance amount and actual timing advance amount is calculated during exhaust AVCS control, and the difference per predetermined time is the specified value or larger.

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|--|
| $\Sigma(\text{Target position} - \text{Actual position})$ | $> 6000 {}^{\circ}\text{CA}$ (Bank 1) $> 6000 {}^{\circ}\text{CA}$ (Bank 2) |
| or | |
| $\Sigma(\text{Target position} - \text{Actual position})$ | $< -6000 {}^{\circ}\text{CA}$ (Bank 1) $< -6000 {}^{\circ}\text{CA}$ (Bank 2) |

Time Needed for Diagnosis:

30000 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|---|
| $\Sigma(\text{Target position} - \text{Actual position})$ | $\leq 6000 {}^{\circ}\text{CA}$ (Bank 1) $\leq 6000 {}^{\circ}\text{CA}$ (Bank 2) and $\geq -6000 {}^{\circ}\text{CA}$ (Bank 1) $\geq -6000 {}^{\circ}\text{CA}$ (Bank 2) |

Time Needed for Diagnosis: 30000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

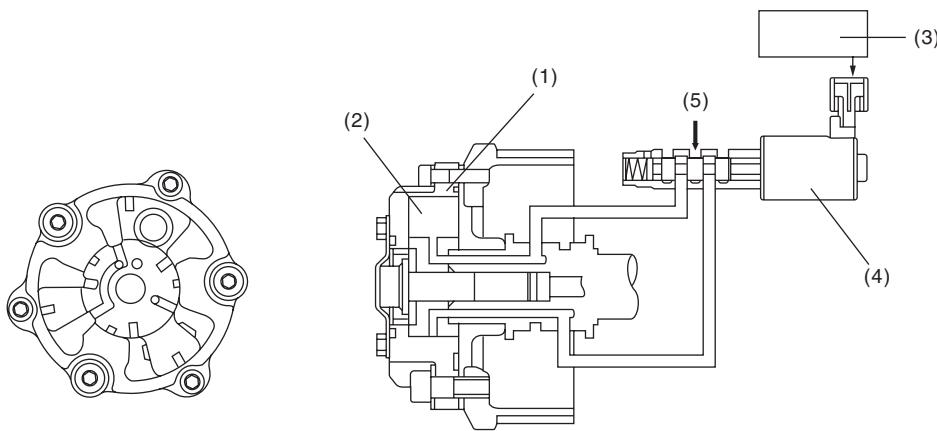
C: DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1)

1. OUTLINE OF DIAGNOSIS

Detect the AVCS system malfunction.

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

2. COMPONENT DESCRIPTION



EN-01852

| | | |
|----------------------------|-------------------------------------|------------------------|
| (1) AVCS timing controller | (3) Engine control module (ECM) | (5) Hydraulic pressure |
| (2) Vane | (4) Oil flow control solenoid valve | |

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------------|--------------------------------------|
| Battery voltage | ≥ 10.9 V |
| Engine speed | ≥ 600 rpm and < 975 rpm |
| Engine coolant temperature | ≥ 72 °C (161.6 °F) |
| AVCS control | Not in operation |
| Target timing advance | 0°CA |

4. GENERAL DRIVING CYCLE

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

5. DIAGNOSTIC METHOD

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

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|-----------------|
| Crankshaft position when camshaft position sensor signal is input – Learning value | > 9 °CA |

Time Needed for Diagnosis: 20000 ms

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

NOTE:

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|-----------------|
| Crankshaft position when camshaft position sensor signal is input – Learning value | ≤ 9 °CA |

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

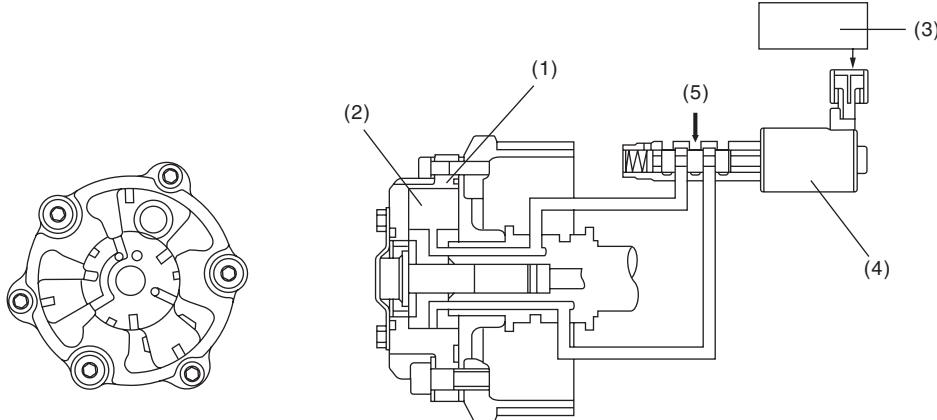
D: DTC P0017 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the exhaust AVCS system malfunction.

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

2. COMPONENT DESCRIPTION



EN-01852

(1) Exhaust AVCS timing controller

(3) Engine control module (ECM)

(5) Oil pressure

(2) Vane

(4) Oil flow control solenoid valve

3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|----------------------------|--------------------------------------|
| Battery voltage | ≥ 10.9 V |
| Engine speed | ≥ 600 rpm and < 975 rpm |
| Engine coolant temperature | ≥ 72 °C (161.6 °F) |
| Exhaust AVCS control | Not in operation |
| Target timing advance | 0°CA |

4. GENERAL DRIVING CYCLE

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

5. DIAGNOSTIC METHOD

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

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|-----------------|
| Crankshaft position when camshaft position sensor signal is input – Learning value | > 9 °CA |

Time Needed for Diagnosis: 20000 ms

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

NOTE:

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|-----------------|
| Crankshaft position when camshaft position sensor signal is input – Learning value | ≤ 9 °CA |

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0016. <Ref. to GD(H4DOTC)-14, DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

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

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0017. <Ref. to GD(H4DOTC)-16, DTC P0017 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

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

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0011. <Ref. to GD(H4DOTC)-10, DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

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

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0014. <Ref. to GD(H4DOTC)-12, DTC P0014 EXHAUST AVCS SYSTEM 1 (RANGE/PERFORMANCE), Diagnostic Trouble Code (DTC) Detecting Criteria.>

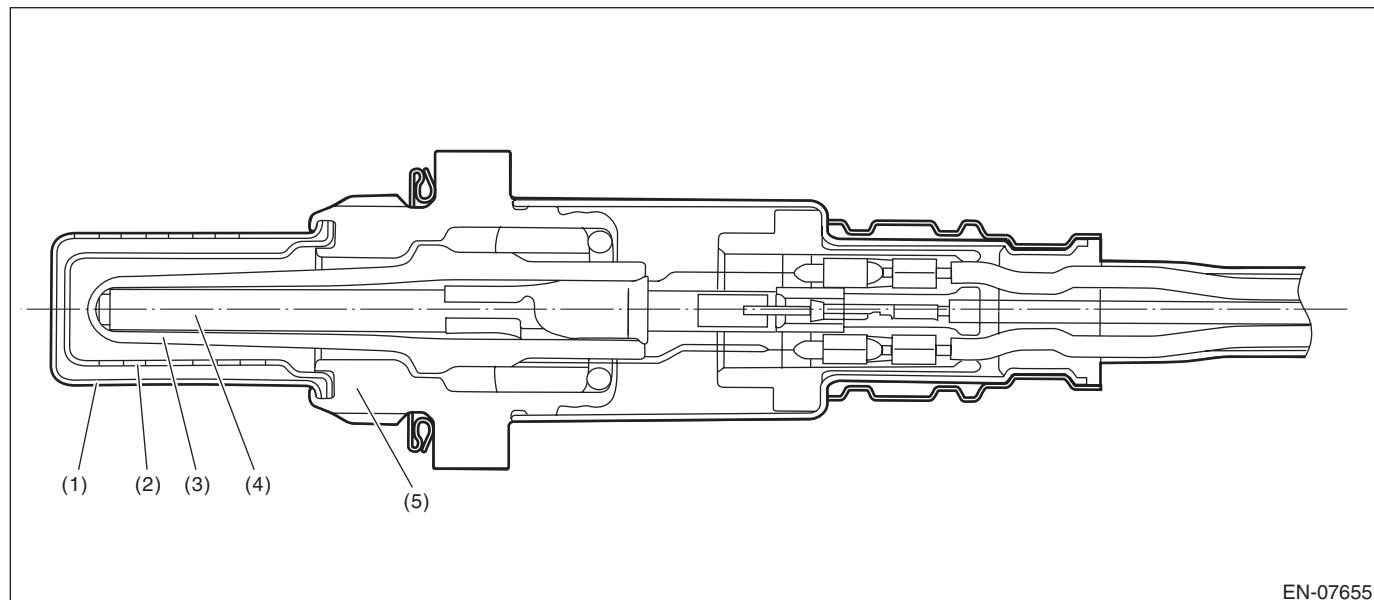
I: DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

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

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

2. COMPONENT DESCRIPTION



| | | |
|---------------------------|--------------------|--------------------|
| (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 Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|-------------------------------------|-----------------|
| Front oxygen (A/F) sensor impedance | > 50 Ω |

Time Needed for Diagnosis: 10000 ms

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

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: 10000 ms

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

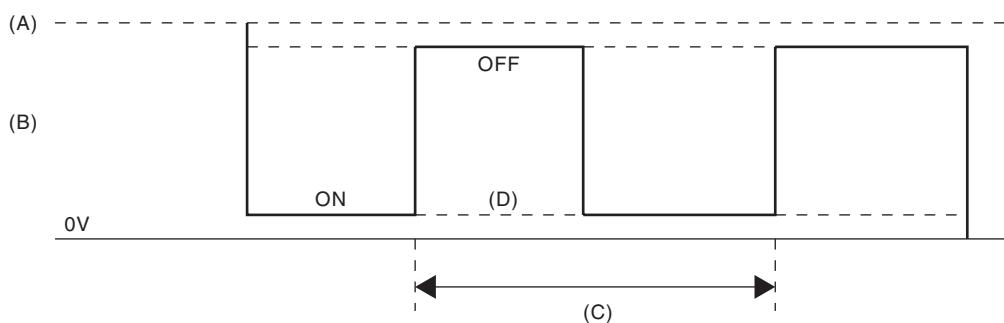
1. OUTLINE OF DIAGNOSIS

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

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

Judge as NG when the terminal voltage remains Low.

2. COMPONENT DESCRIPTION



EN-01792

(A) Battery voltage

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

(C) 128 ms

(D) Low error

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| Battery voltage | ≥ 10.9 V |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|-----------------|
| Output voltage level | Low |
| Front oxygen (A/F) sensor heater control duty | < 87.5 % |

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

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage level | High |

Time Needed for Diagnosis: Less than 1 second

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

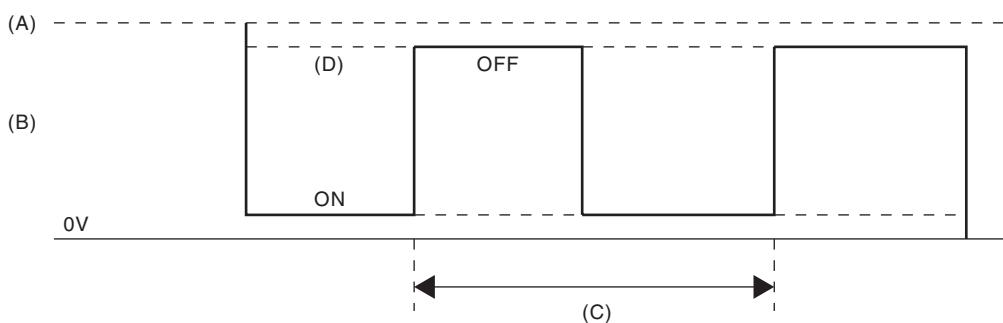
1. OUTLINE OF DIAGNOSIS

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

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

Judge as NG when the terminal voltage remains High.

2. COMPONENT DESCRIPTION



EN-01793

(A) Battery voltage

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

(C) 128 ms

(D) High error

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| Battery voltage | ≥ 10.9 V |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|-----------------|
| Output voltage level | High |
| Front oxygen (A/F) sensor heater control duty | $\geq 12.5\%$ |

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

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage level | Low |

Time Needed for Diagnosis: Less than 1 second

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

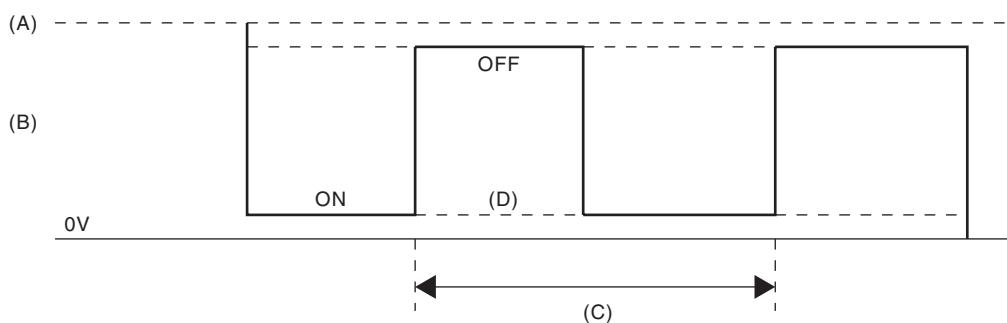
1. OUTLINE OF DIAGNOSIS

Detect the rear oxygen sensor heater open or short circuit.

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

Judge as NG when the terminal voltage remains Low.

2. COMPONENT DESCRIPTION



EN-01792

(A) Battery voltage

(B) Output voltage of the rear oxygen sensor heater

(C) 256 ms (cycle)

(D) Low error

3. ENABLE CONDITION

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

4. GENERAL DRIVING CYCLE

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|-----------------|
| Output voltage level | Low |
| Rear oxygen sensor heater control duty | < 75 % |

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

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage level | High |

Time Needed for Diagnosis: Less than 1 second

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

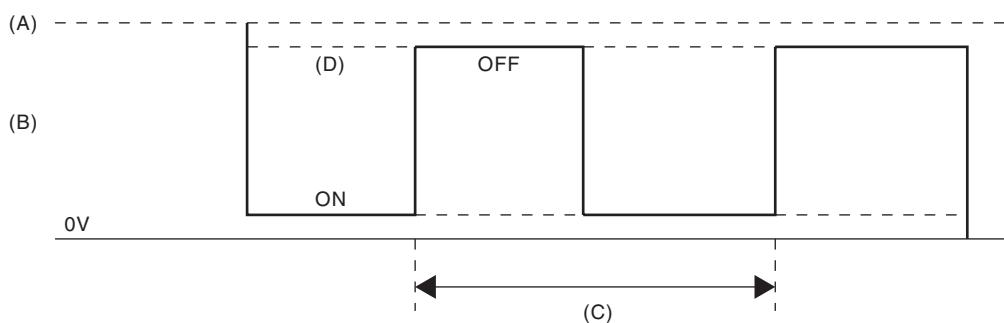
1. OUTLINE OF DIAGNOSIS

Detect the rear oxygen sensor heater open or short circuit.

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

Judge as NG when the terminal voltage remains High.

2. COMPONENT DESCRIPTION



EN-01793

(A) Battery voltage

(B) Output voltage of the rear oxygen sensor heater

(C) 256 ms (cycle)

(D) High error

3. ENABLE CONDITION

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

4. GENERAL DRIVING CYCLE

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|-----------------|
| Output voltage level | High |
| Rear oxygen sensor heater control duty | $\geq 25\%$ |

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

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage level | Low |

Time Needed for Diagnosis: Less than 1 second

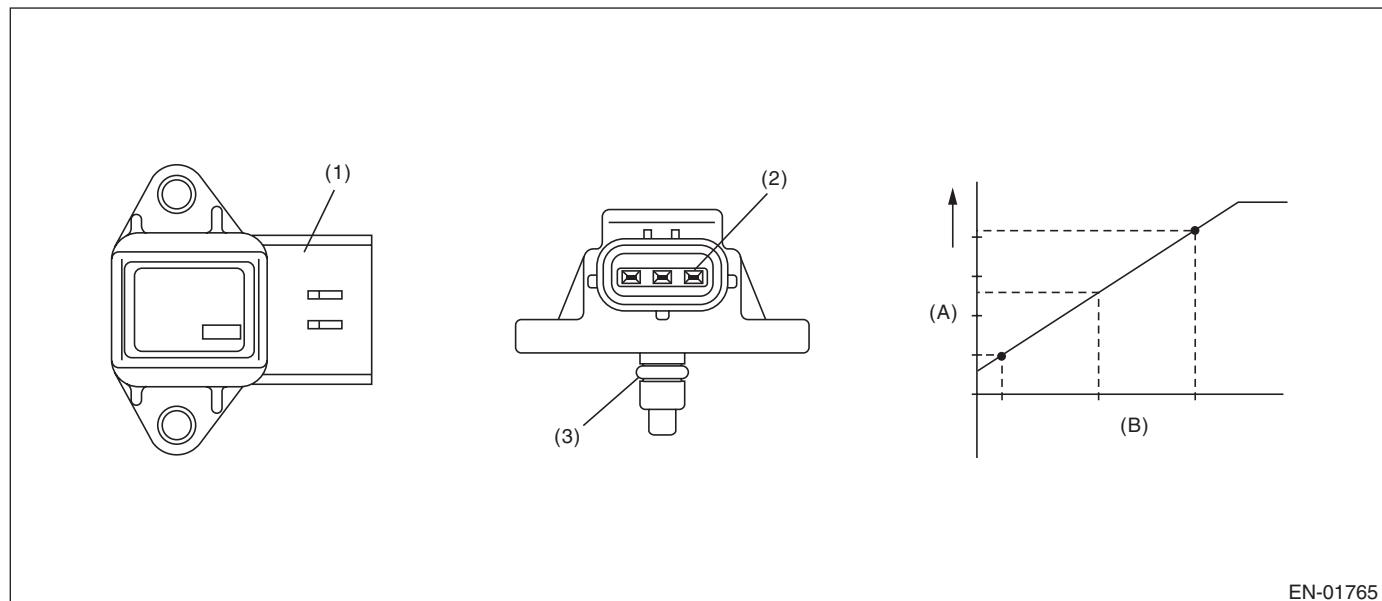
N: DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION

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



(A) Output voltage (B) Absolute pressure

(1) Connector (2) Terminals (3) O-ring

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------------|---|
| Engine coolant temperature | $\geq 72^{\circ}\text{C}$ (161.6 $^{\circ}\text{F}$) |

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after idling.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|----------------------------|
| Low | |
| Engine speed | < 3000 rpm |
| Throttle position | ≥ 16 ° |
| Output voltage | < 1 V |
| Engine load | > 0.96 g/rev (0.03 oz/rev) |
| High | |
| Engine speed | 600 rpm — 900 rpm |
| Throttle position | < 5.13 ° |
| Output voltage | ≥ 2.36 V |
| Engine load | < 0.48 g/rev (0.02 oz/rev) |

Time Needed for Diagnosis:

Low side: 3000 ms

High side: 3000 ms

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

• Normality Judgment

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

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|----------------------------|
| Low | |
| Engine speed | < 3000 rpm |
| Throttle position | ≥ 16 ° |
| Output voltage | ≥ 1 V |
| Engine load | > 0.96 g/rev (0.03 oz/rev) |
| High | |
| Engine speed | 600 rpm — 900 rpm |
| Throttle position | < 5.13 ° |
| Output voltage | < 2.36 V |
| Engine load | < 0.48 g/rev (0.02 oz/rev) |

Time Needed for Diagnosis:

Low side: Less than 1 second

High side: Less than 1 second

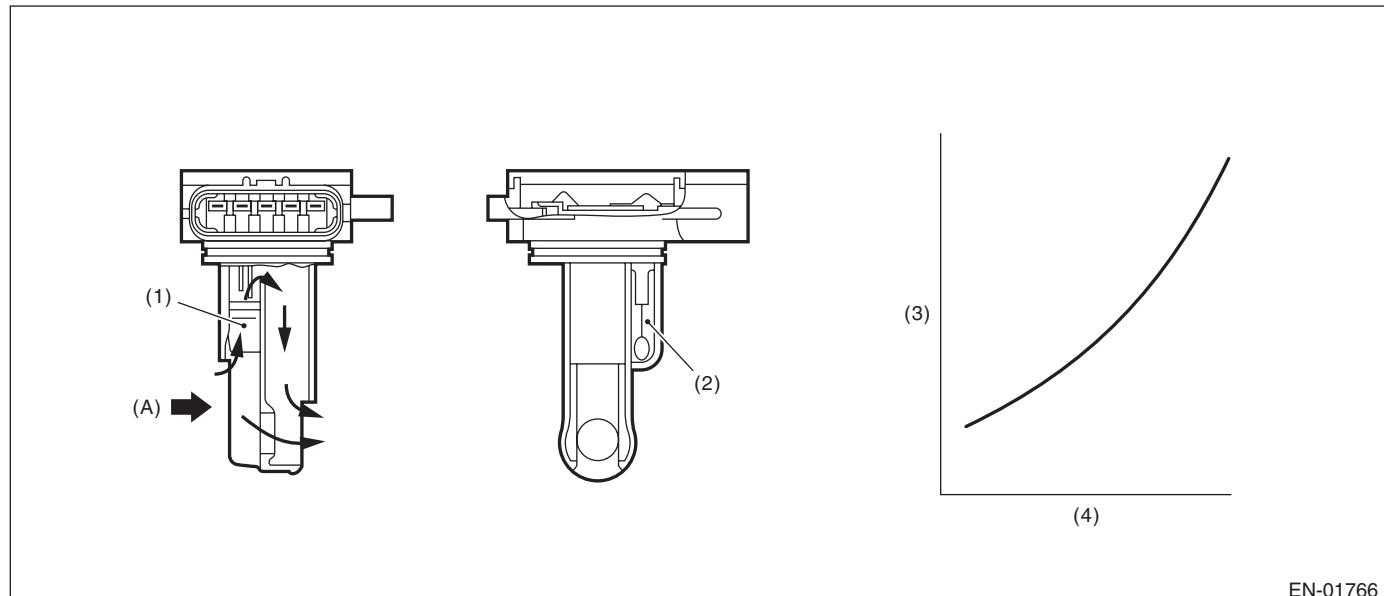
O: DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of air flow sensor output properties.

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

2. COMPONENT DESCRIPTION



(A) Air

(1) Air flow sensor

(3) Voltage (V)

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

(2) Intake air temperature sensor

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------------|---|
| Engine coolant temperature | $\geq 72^{\circ}\text{C}$ (161.6°F) |

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after idling.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--------------------------|----------------------------------|
| Low | |
| Output voltage | < 1.5 V |
| Engine speed | ≥ 2300 rpm |
| Throttle opening angle | ≥ 16 ° |
| Intake manifold pressure | ≥ 66.7 kPa (500 mmHg, 19.7 inHg) |
| High (1) | |
| Output voltage | ≥ 1.95 V |
| Engine speed | 600 rpm — 900 rpm |
| Throttle opening angle | < 5.13 ° |
| Intake manifold pressure | ≥ 50 kPa (375 mmHg, 14.8 inHg) |
| High (2) | |
| Output voltage | ≥ 1.65 V |
| Engine speed | 600 rpm — 900 rpm |
| Throttle opening angle | < 5.13 ° |
| Intake manifold pressure | ≥ 50 kPa (375 mmHg, 14.8 inHg) |
| Fuel system diagnosis | Rich side malfunction |

Time Needed for Diagnosis:

Low: 3000 ms

High: 10000 ms

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

• Normality Judgment

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

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--------------------------|----------------------------------|
| Low | |
| Output voltage | ≥ 1.5 V |
| Engine speed | ≥ 2300 rpm |
| Throttle opening angle | ≥ 16 ° |
| Intake manifold pressure | ≥ 66.7 kPa (500 mmHg, 19.7 inHg) |
| High | |
| Output voltage | < 1.95 V |
| Engine speed | 600 rpm — 900 rpm |
| Throttle opening angle | < 5.13 ° |
| Intake manifold pressure | < 50 kPa (375 mmHg, 14.8 inHg) |
| Fuel system diagnosis | Rich side normal |

Time Needed for Diagnosis:

Low: Less than 1 second

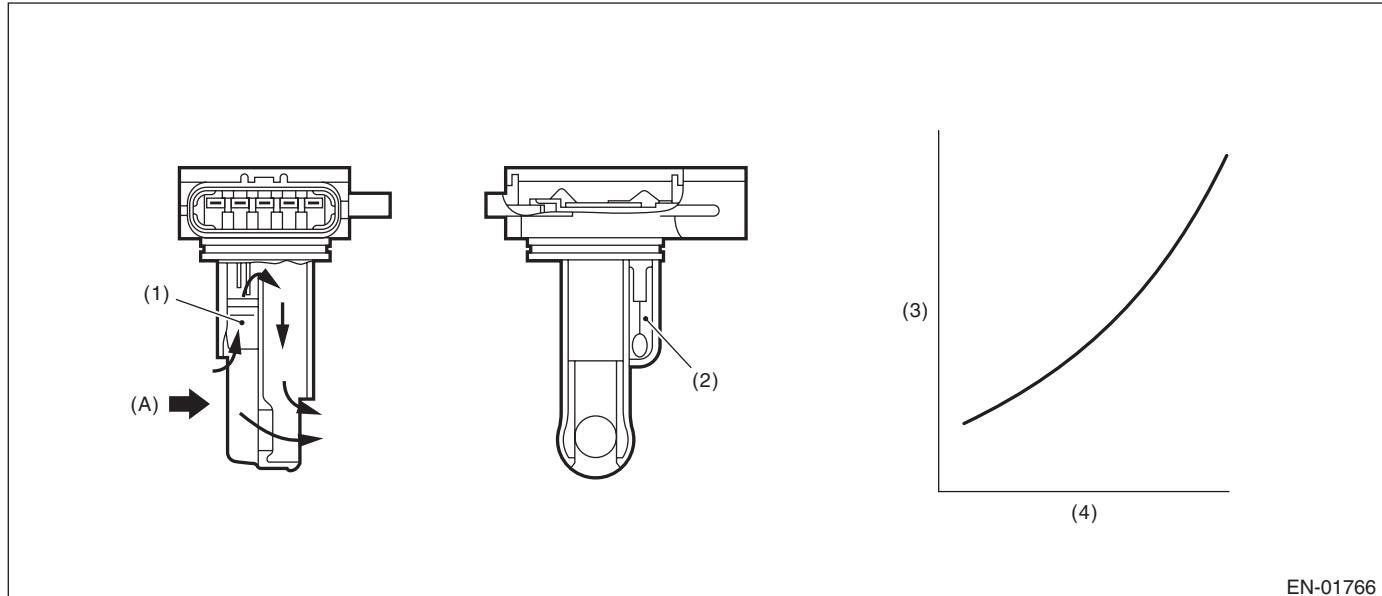
High: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



EN-01766

(A) Air

(1) Air flow sensor

(3) Voltage (V)

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

(2) Intake air temperature sensor

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | ≤ 0.22 V |

Time Needed for Diagnosis: 500 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | > 0.22 V |

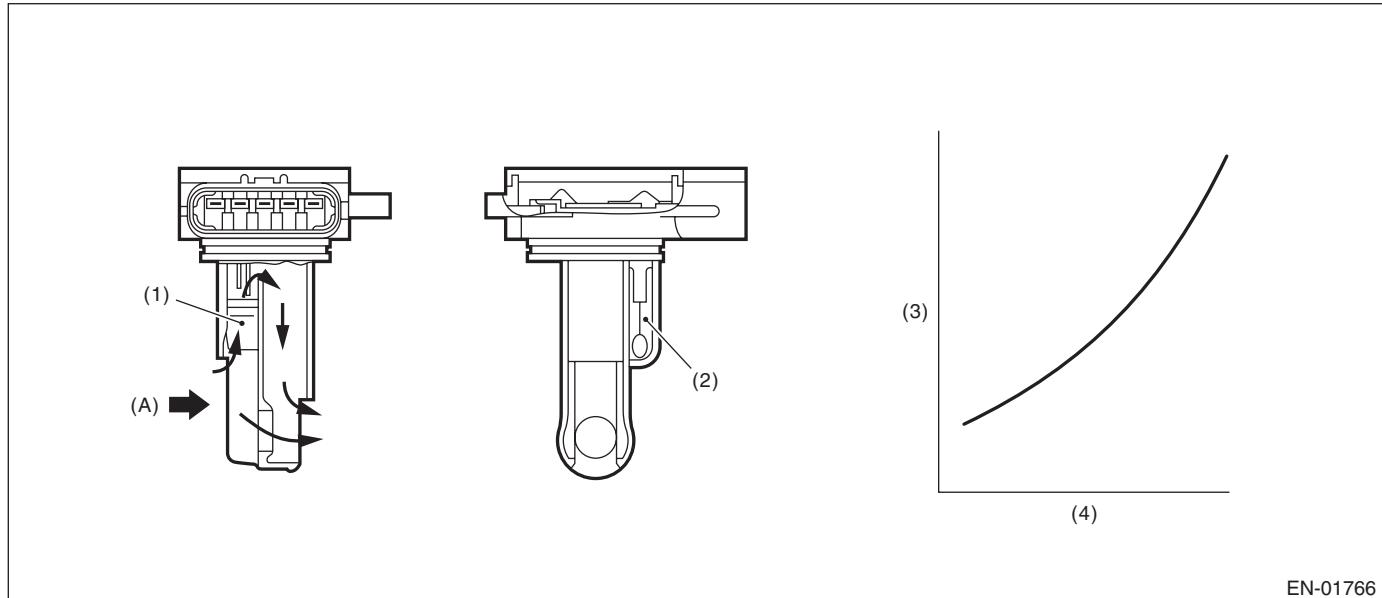
Time Needed for Diagnosis: Less than 1 second

Q: 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.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | ≥ 4.98 V |

Time Needed for Diagnosis: 500 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | < 4.98 V |

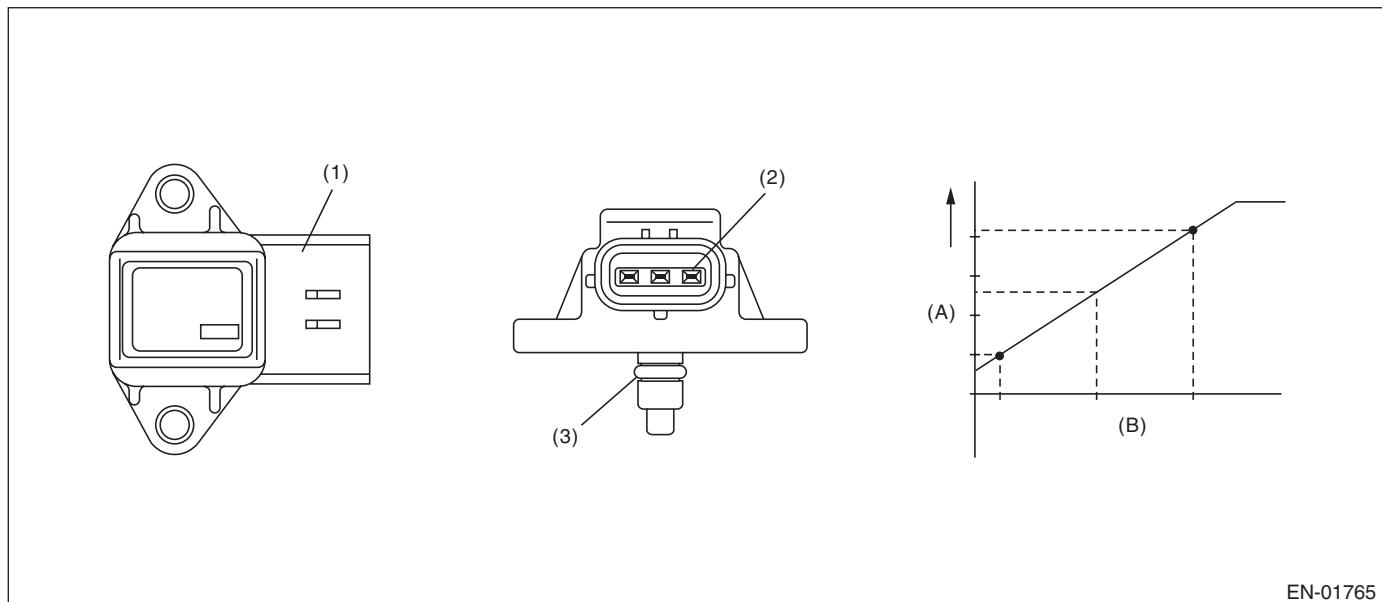
Time Needed for Diagnosis: Less than 1 second

R: 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.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|------------------------|
| Output voltage | $\leq 0.573 \text{ V}$ |

Time Needed for Diagnosis: 500 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|---------------------|
| Output voltage | $> 0.573 \text{ V}$ |

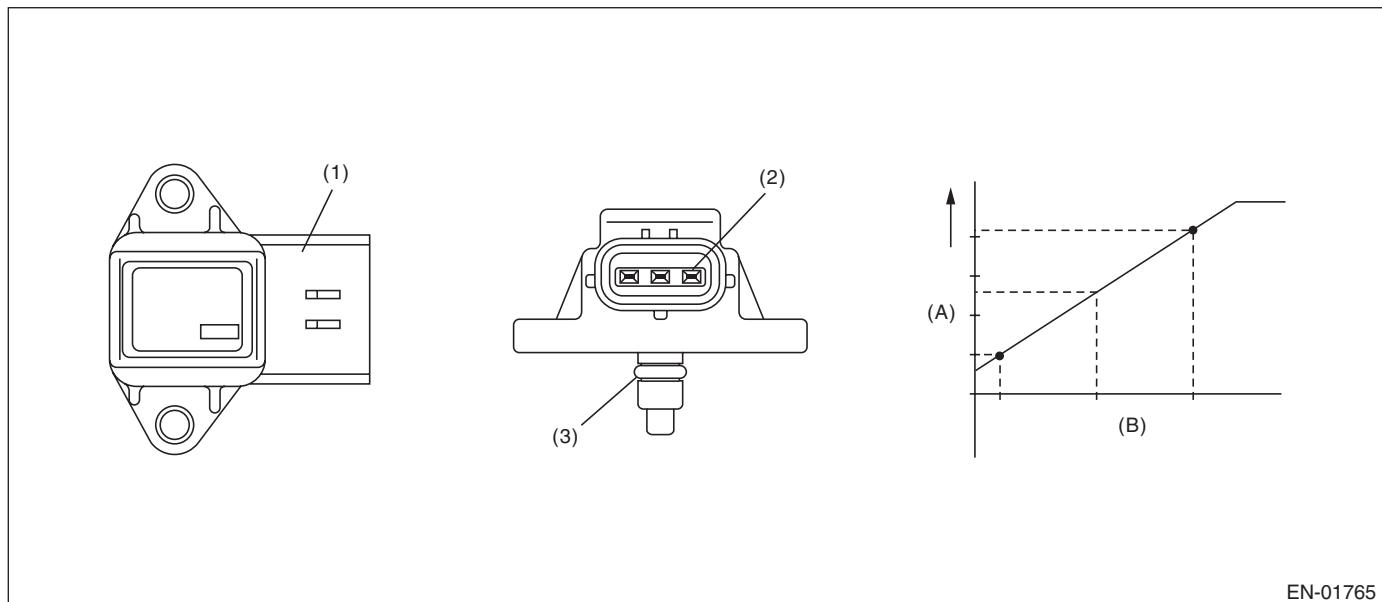
Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



EN-01765

(A) Output voltage

(B) Absolute pressure

(1) Connector

(2) Terminals

(3) O-ring

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | ≥ 4.596 V |

Time Needed for Diagnosis: 500 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | < 4.596 V |

Time Needed for Diagnosis: Less than 1 second

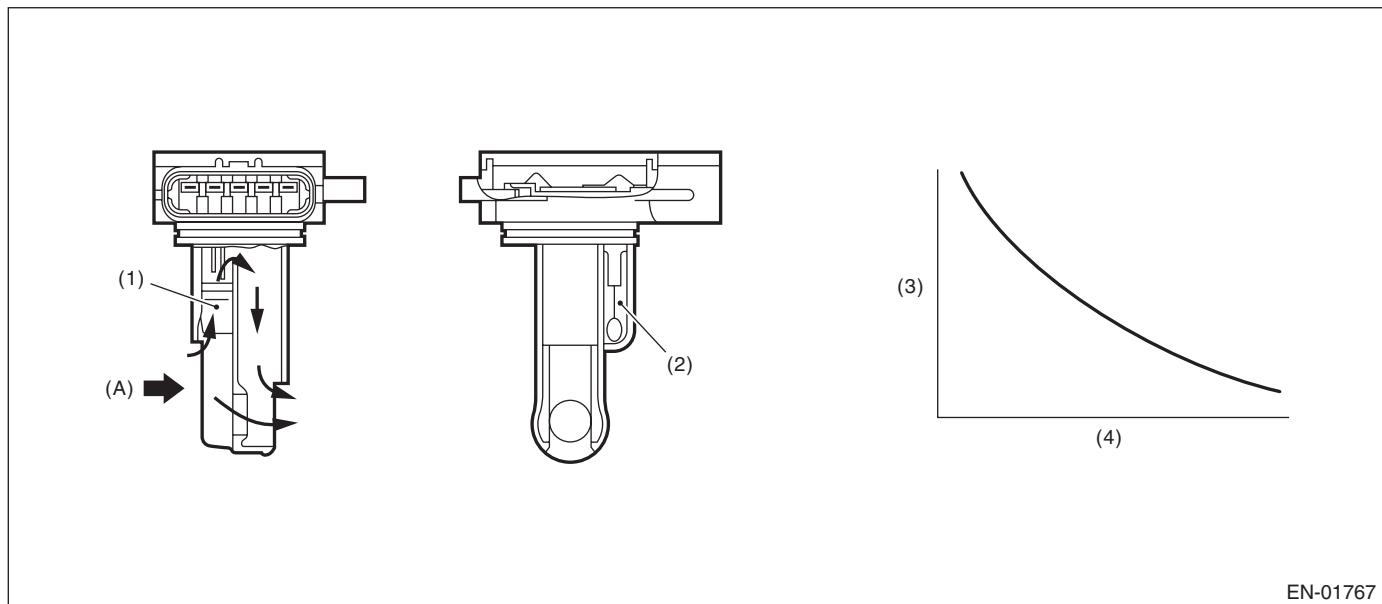
T: DTC P0111 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of intake air temperature sensor output property.

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

2. COMPONENT DESCRIPTION



EN-01767

(A) Air

(1) Air flow sensor

(3) Resistance value (Ω)

(4) Intake air temperature °C (°F)

(2) Intake air temperature sensor

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|--|----------------------|
| Engine coolant temperature at engine starting | < 35 °C (95 °F) |
| Battery voltage | ≥ 10.9 V |
| Continuous time when the vehicle speed is less than 140 km/h (87 MPH) | ≥ 610 s |
| Engine coolant temperature | ≥ 72 °C (161.6 °F) |
| Intake air amount sum value | ≥ Value of Map 1 |
| Number of experiences under conditions below | ≥ 3 time(s) |
| • Continuous time when vehicle speed is less than 4 km/h (2.5 MPH) | ≥ Value from Map 2 |
| • Continuous time when vehicle speed is 40 km/h (24.9 MPH) or more and | ≥ 15 s |
| Establishing time of 1, 2 | ≥ 15 s |
| 1. Intake air amount | ≥ 15 g/s (0.53 oz/s) |
| 2. Vehicle speed | ≥ 4 km/h (2.5 MPH) |

Map 1

| | | | | | |
|--|--------------------|-----------------|------------------|------------------|------------------|
| Engine coolant temperature °C (°F) | -20 (-4) | -10 (14) | 0 (32) | 10 (50) | 20 (68) |
| Intake air amount sum value (g (oz)/s) | 76000 (2680.52) | 8880 (313.2) | 8153 (287.56) | 7427 (261.95) | 6009 (211.94) |

Map 2

| | | | | |
|--|-------------|-------------|-----------|------------|
| Engine coolant temperature °C (°F) | -20 (-4) | -10 (14) | 5 (41) | 20 (68) |
| Continuous time (s) when vehicle speed is less than 4 km/h (2.5 MPH) | 250 | 40 | 32 | 24 |

4. GENERAL DRIVING CYCLE

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

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

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

Time Needed for Diagnosis: Less than 1 second

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

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

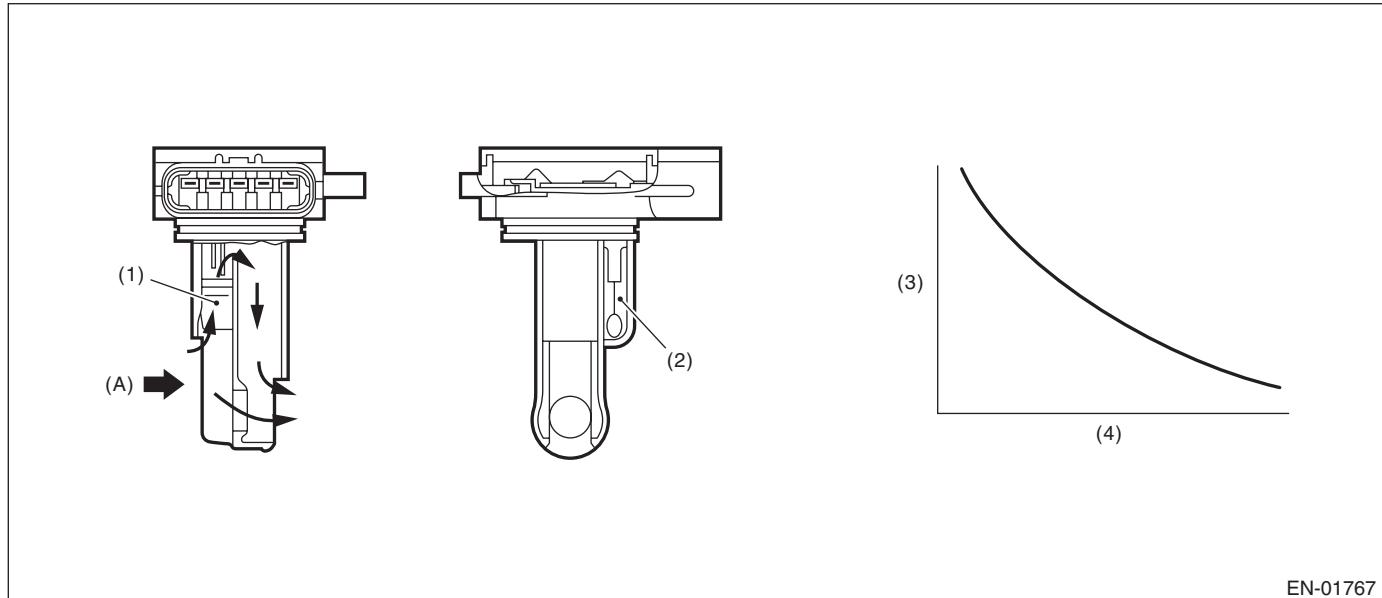
GENERAL DESCRIPTION

U: DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



EN-01767

(A) Air

(1) Air flow sensor

(3) Resistance value (Ω)

(4) Intake air temperature °C (°F)

(2) Intake air temperature sensor

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | < 0.231 V |

Time Needed for Diagnosis: 500 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | ≥ 0.231 V |

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

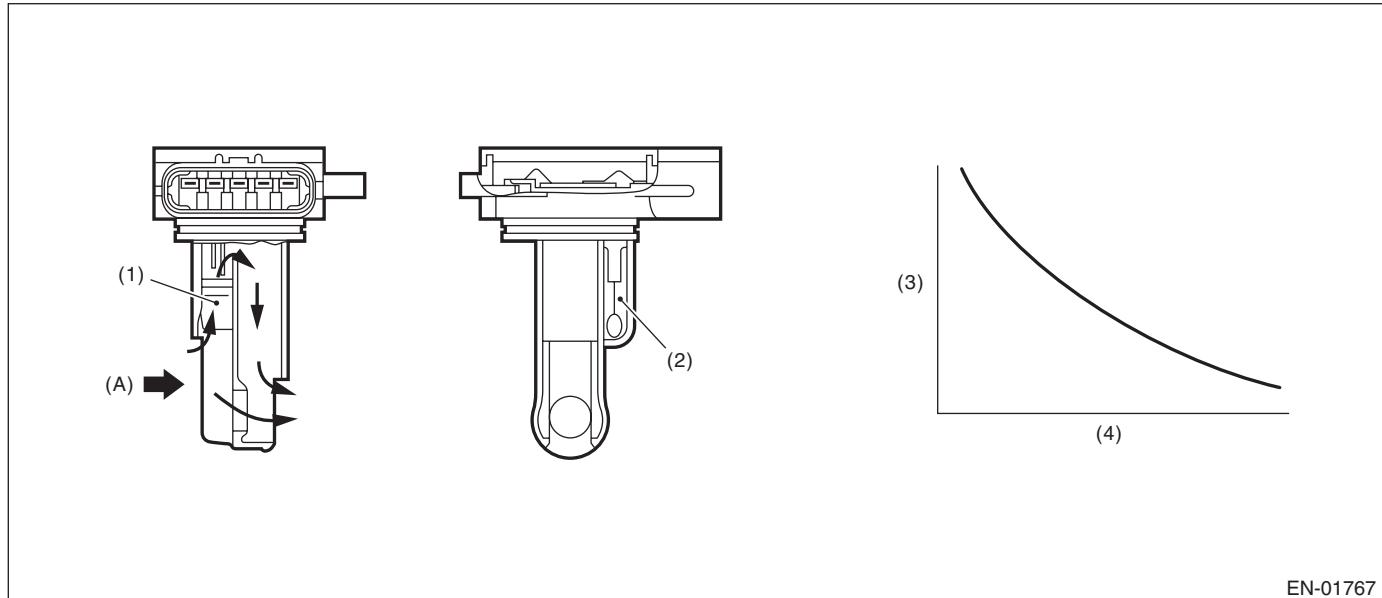
GENERAL DESCRIPTION

V: DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



(A) Air

(1) Air flow sensor

(3) Resistance value (Ω)

(4) Intake air temperature °C (°F)

(2) Intake air temperature sensor

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: 500 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|---------------------|
| Output voltage | $< 4.716 \text{ V}$ |

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

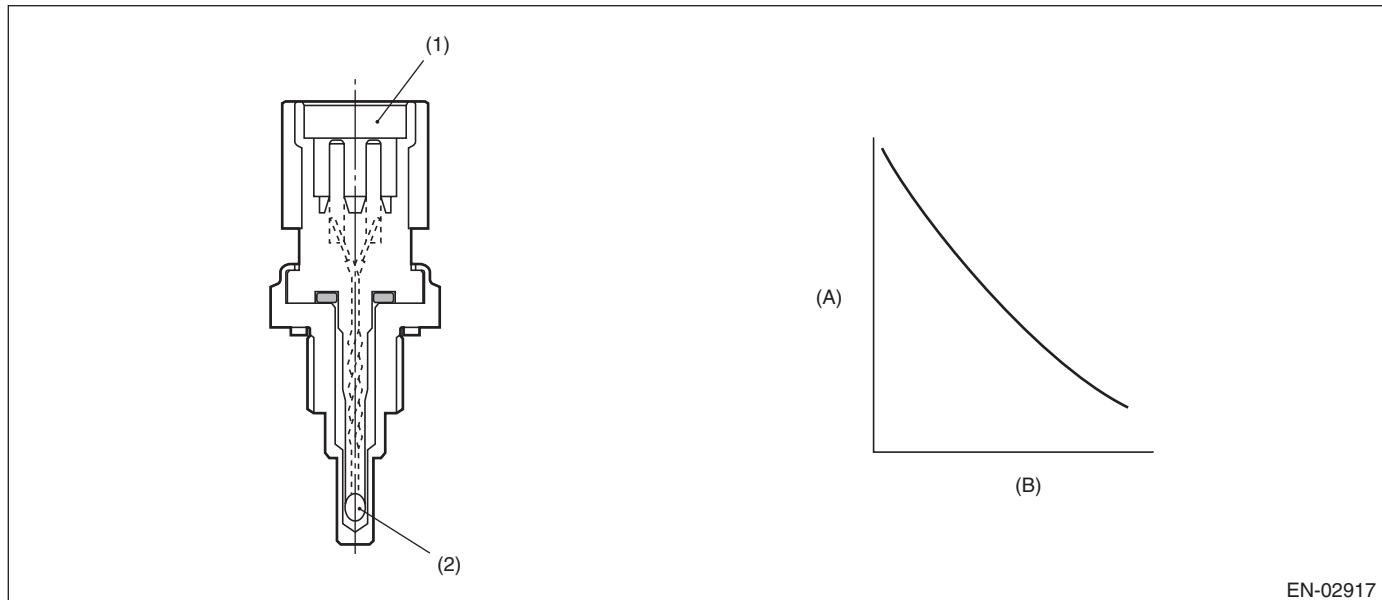
GENERAL DESCRIPTION

W: DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



EN-02917

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

(1) Connector (2) Thermistor element

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | < 0.275 V |

Time Needed for Diagnosis: 500 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | ≥ 0.275 V |

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

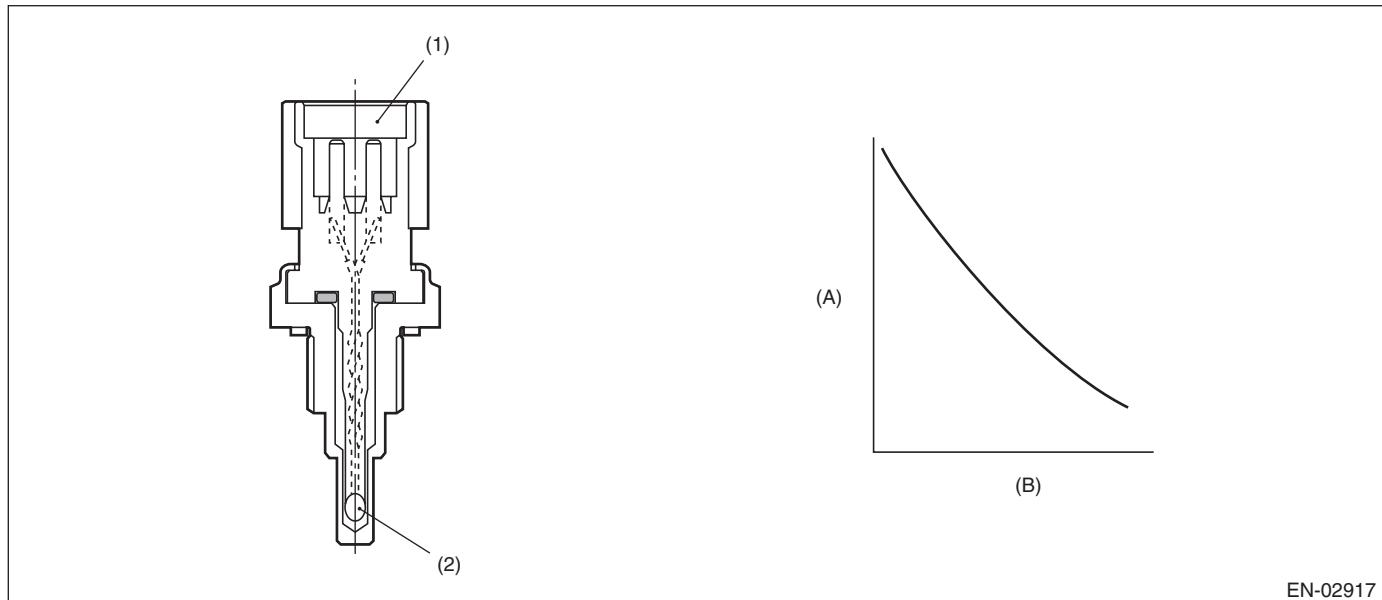
GENERAL DESCRIPTION

X: DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



EN-02917

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

(1) Connector (2) Thermistor element

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: 500 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|---------------------|
| Output voltage | $< 4.716 \text{ V}$ |

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

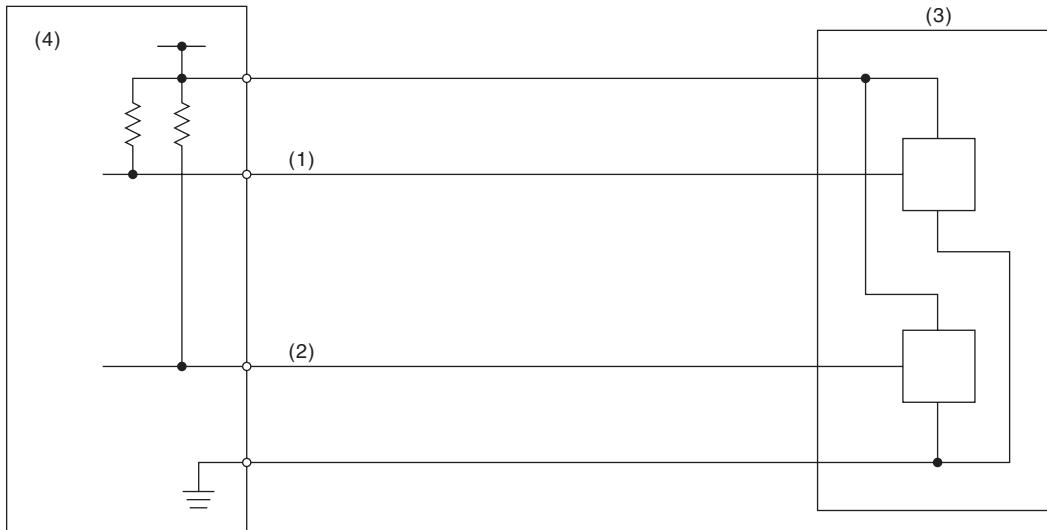
GENERAL DESCRIPTION

Y: 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 | ≥ 6 V |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|------------------------|------------------------|
| Sensor 1 input voltage | $\leq 0.217 \text{ V}$ |

Time Needed for Diagnosis: 24 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|------------------------|---------------------|
| Sensor 1 input voltage | $> 0.217 \text{ V}$ |

Time Needed for Diagnosis: 24 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

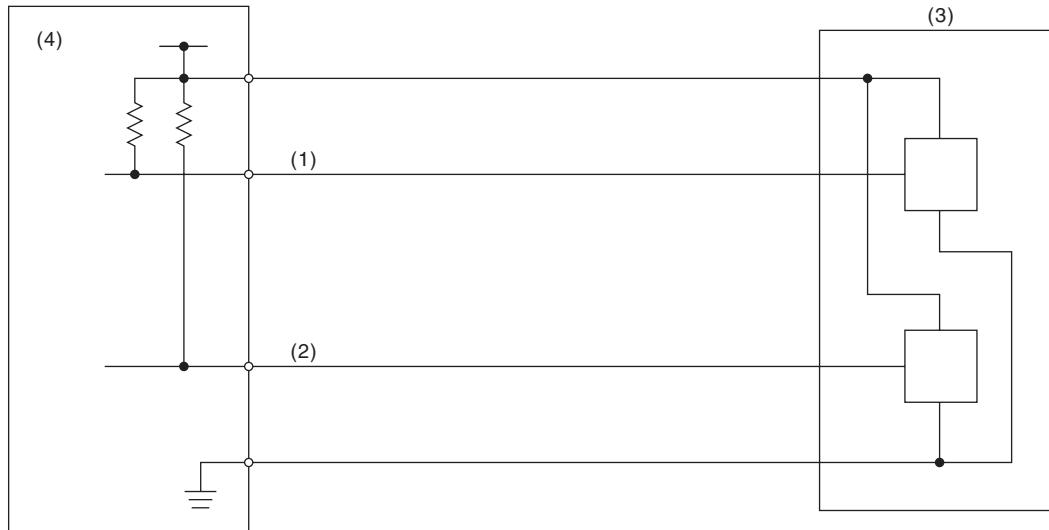
GENERAL DESCRIPTION

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

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



EN-01859

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

(3) Throttle position sensor

(4) Engine control module (ECM)

3. ENABLE CONDITION

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

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|------------------------|------------------------|
| Sensor 1 input voltage | $\geq 4.858 \text{ V}$ |

Time Needed for Diagnosis: 24 ms

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

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: 24 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

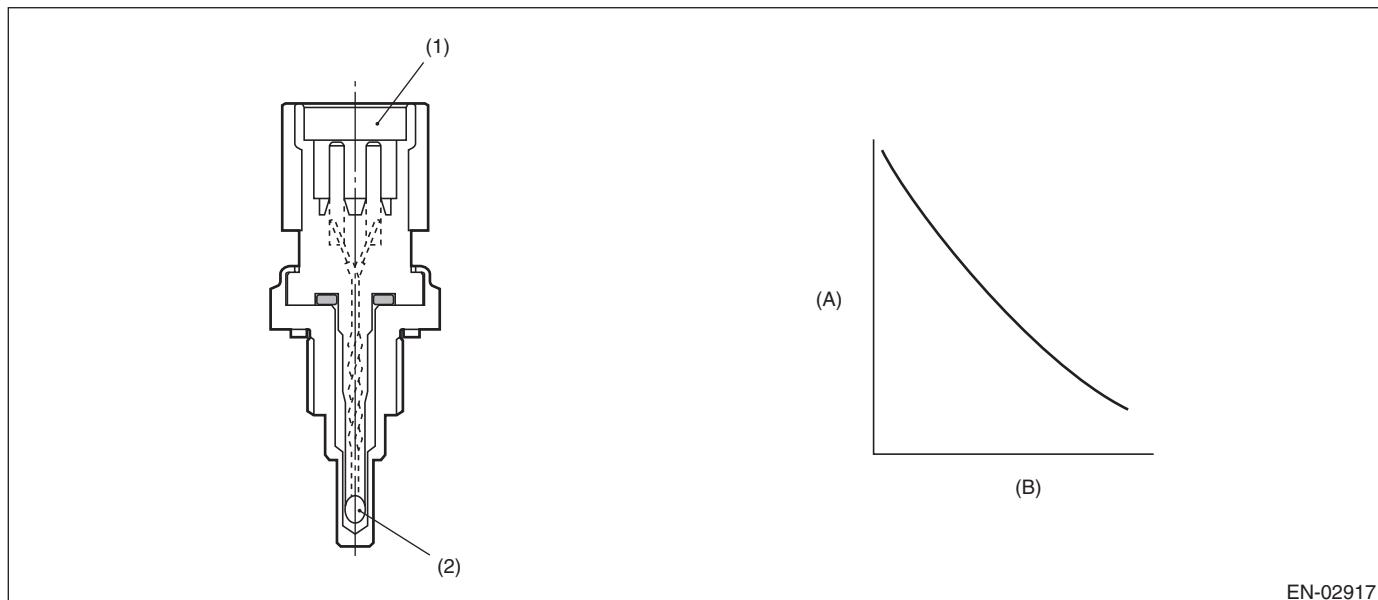
AA:DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL

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 | \geq Value from Map |
| Battery voltage | ≥ 10.9 V |

Map

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

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

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once after engine start.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG if the criteria below are met.

Judgment Value

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

Timer for diagnosis after engine start

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

64 ms + TWCNT ms (at 64 ms)

TWCNT is defined as follows,

TWCNT = 0 at idle switch ON,

TWCNT show on the following table at idle switch OFF.

| | | Vehicle speed km/h (MPH) | | | | | | | |
|---------------------|----------|--------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| | | 0 (0) | 8 (5) | 16 (9.9) | 24 (14.9) | 32 (19.9) | 40 (24.9) | 48 (29.8) | 56 (34.8) |
| Temperature °C (°F) | -20 (-4) | 0 ms | 37.136 ms | 74.272 ms | 111.41 ms | 126.66 ms | 141.91 ms | 163.59 ms | 185.26 ms |
| | -10 (14) | 0 ms | 27.391 ms | 54.782 ms | 82.173 ms | 99.65 ms | 117.13 ms | 135.96 ms | 154.8 ms |
| | 0 (32) | 0 ms | 17.646 ms | 35.292 ms | 52.938 ms | 72.64 ms | 92.341 ms | 108.34 ms | 124.33 ms |
| | 10 (50) | 0 ms | 7.9012 ms | 15.802 ms | 23.704 ms | 45.63 ms | 67.556 ms | 80.711 ms | 93.867 ms |
| | 20 (68) | 0 ms | 7.9012 ms | 15.802 ms | 23.704 ms | 45.63 ms | 67.556 ms | 80.711 ms | 93.867 ms |

Judgment value of timer after engine starting

$$t = 451056 \text{ ms} - 25870 \text{ ms} \times Ti$$

Ti : The lowest coolant temperature after engine start

Time Needed for Diagnosis: Less than 1 second

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

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

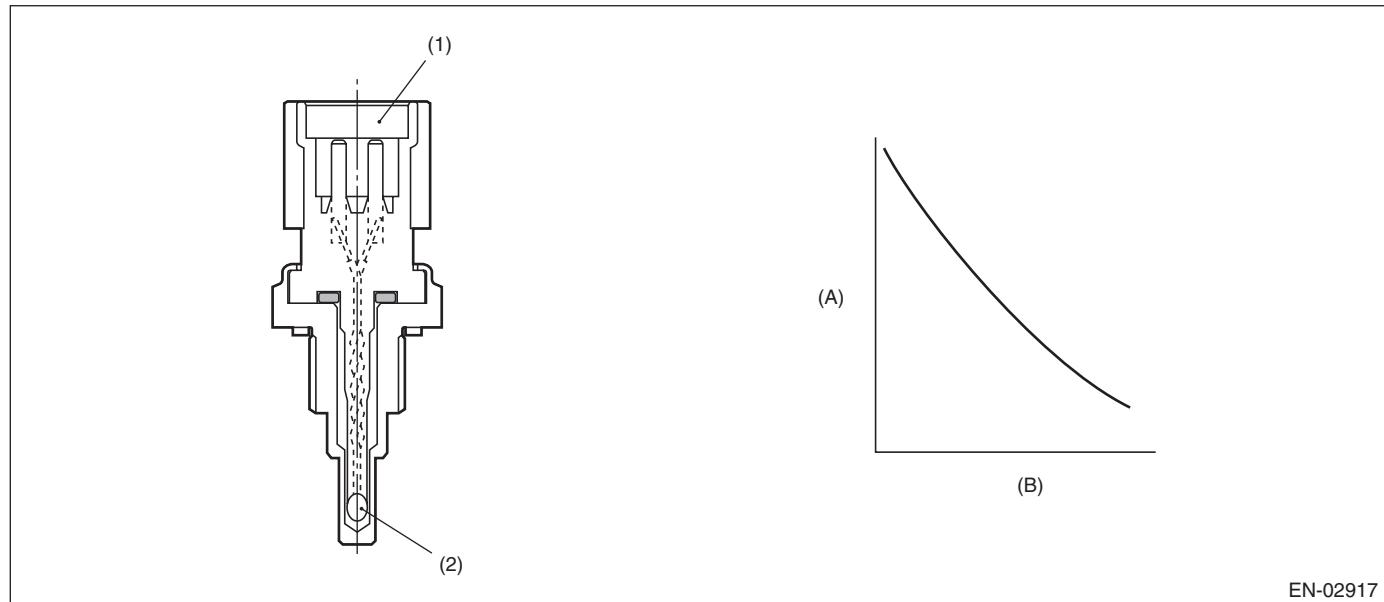
AB:DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of the engine coolant temperature sensor characteristics.

Memorize the engine coolant temperature and fuel temperature at the last engine stop, and use them to judge as NG when the engine coolant temperature does not decrease when it should.

2. COMPONENT DESCRIPTION



EN-02917

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

(1) Connector (2) Thermistor element

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|---|--|
| Battery voltage | ≥ 10.9 V |
| Refueling from the last engine stop till the current engine start | None |
| Fuel level | ≥ 15 ℥ (3.96 US gal, 3.3 Imp gal) |
| Engine coolant temperature at the last engine stop | ≥ 72 °C (161.6 °F) |

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|------------------|
| Engine coolant temperature at the last engine stop – Minimum engine coolant temperature after the engine start | < 2.5 °C (4.5°F) |
| Fuel temperature at the last engine stop – fuel temperature | ≥ 5 °C (9°F) |
| Intake air temperature – fuel temperature | < 2.5 °C (4.5°F) |
| Fuel temperature | < 35 °C (95 °F) |

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|------------------|
| Engine coolant temperature at the last engine stop – Minimum engine coolant temperature after the engine start | ≥ 2.5 °C (4.5°F) |

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

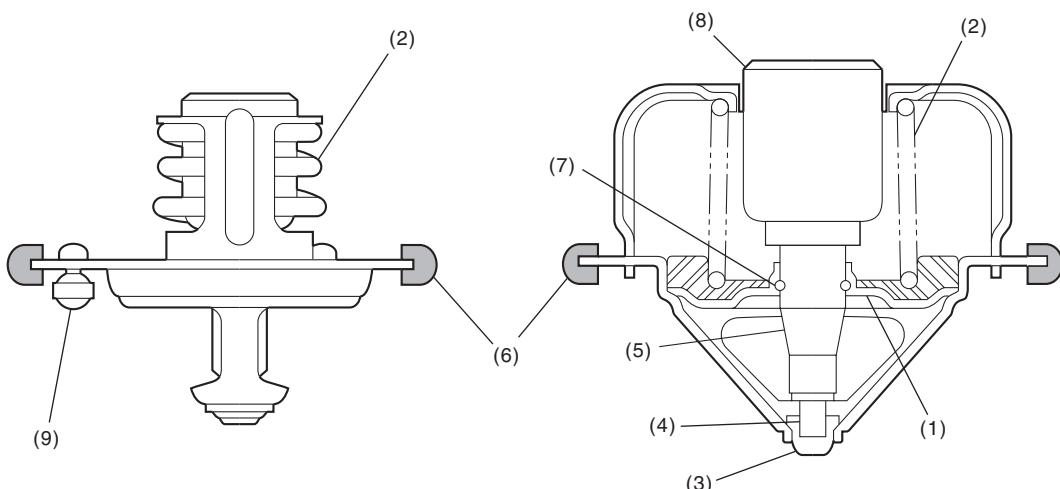
AC:DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE)

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



EN-01692

| | | |
|-------------|-----------------|------------------|
| (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.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|---|
| Battery voltage | $\geq 10.9 \text{ V}$ |
| Estimate ambient temperature | $\geq -7 \text{ }^{\circ}\text{C} (19.4 \text{ }^{\circ}\text{F})$ |
| Thermostat malfunction diagnosis | Incomplete |
| Engine coolant temperature at engine starting | $< 55 \text{ }^{\circ}\text{C} (131 \text{ }^{\circ}\text{F})$ |
| Estimated coolant temperature | $\geq 73 \text{ }^{\circ}\text{C} (163.4 \text{ }^{\circ}\text{F})$ |
| Engine coolant temperature | $\leq 73 \text{ }^{\circ}\text{C} (163.4 \text{ }^{\circ}\text{F})$ |
| (Estimated – Measured) Engine coolant temperature | $> 25 \text{ }^{\circ}\text{C} (45 \text{ }^{\circ}\text{F})$ |
| 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 Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|---|
| Battery voltage | $\geq 10.9 \text{ V}$ |
| Estimate ambient temperature | $\geq -7 \text{ }^{\circ}\text{C} (19.4 \text{ }^{\circ}\text{F})$ |
| Thermostat malfunction diagnosis | Incomplete |
| Engine coolant temperature at engine starting | $< 55 \text{ }^{\circ}\text{C} (131 \text{ }^{\circ}\text{F})$ |
| Engine coolant temperature | $\geq 73 \text{ }^{\circ}\text{C} (163.4 \text{ }^{\circ}\text{F})$ |
| (Estimated – Measured) Engine coolant temperature | $\leq 25 \text{ }^{\circ}\text{C} (45 \text{ }^{\circ}\text{F})$ |

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

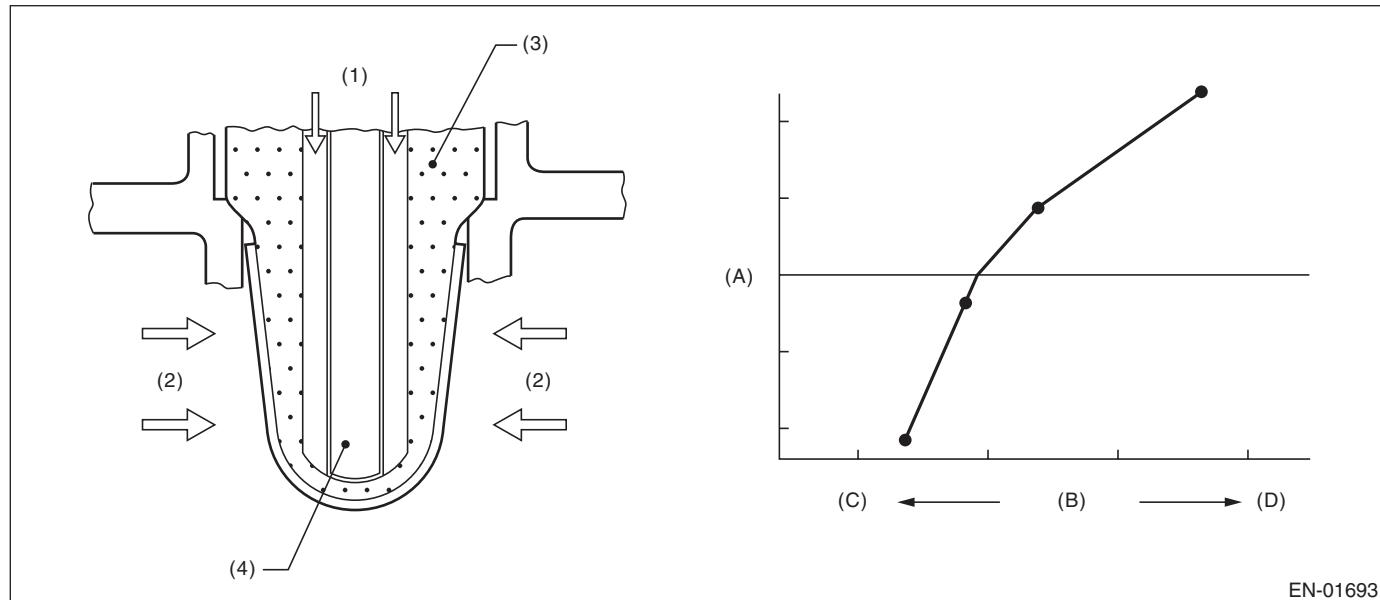
AD:DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1)

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
(D) Rich

(B) Air fuel ratio

(C) Lean

(1) Atmosphere
(2) Exhaust gas

(3) ZrO_2

(4) Ceramic heater

3. ENABLE CONDITION

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

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|-----------------|
| Input voltage (+) | < 1.128 V |
| or | |
| Input voltage (-) | < 0.23 V |
| or | |
| $ Input voltage (+) - Input voltage (-) $ | < 0.644 V |

Time Needed for Diagnosis:

Input voltage (+): 1000 ms

Input voltage (-): 1000 ms

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

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|-----------------|
| Input voltage (+) | $\geq 1.128 V$ |
| Input voltage (-) | $\geq 0.23 V$ |
| $ Input voltage (+) - Input voltage (-) $ | $\geq 0.644 V$ |

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

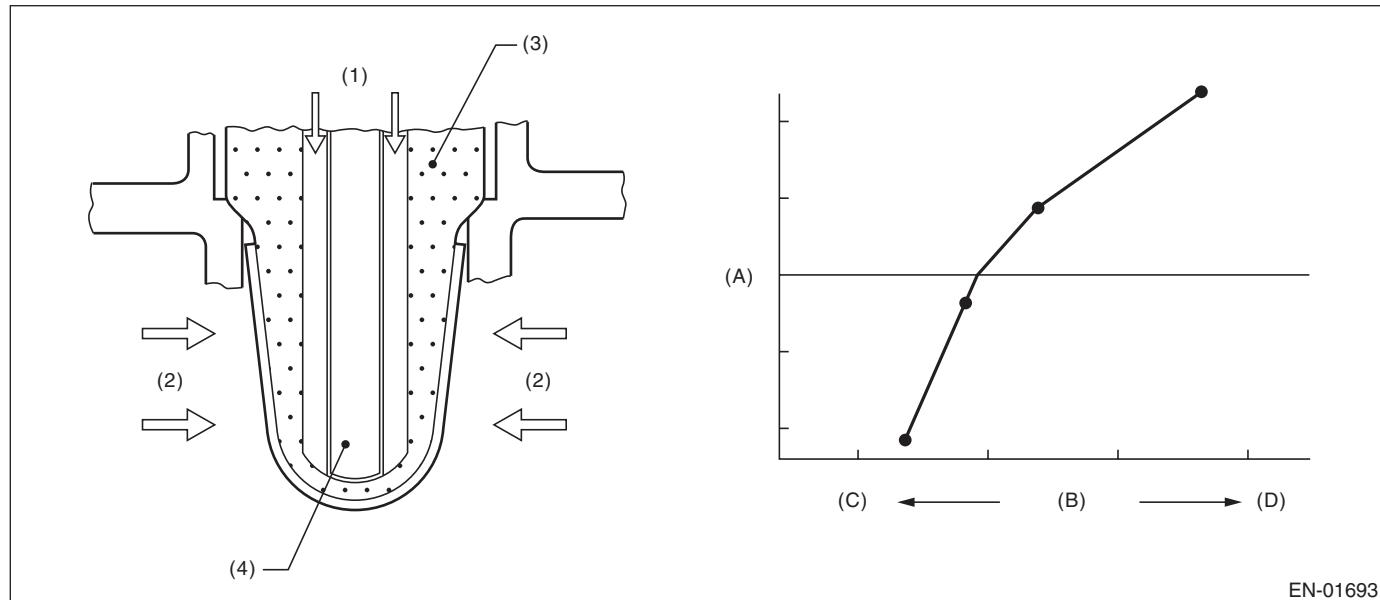
AE:DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of sensor.

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

2. COMPONENT DESCRIPTION



EN-01693

(A) Electromotive force
(D) Rich

(B) Air fuel ratio

(C) Lean

(1) Atmosphere
(2) Exhaust gas

(3) ZrO_2

(4) Ceramic heater

3. ENABLE CONDITION

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

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Input voltage (+) | > 3.589 V |
| or | |
| Input voltage (-) | > 3.541 V |

Time Needed for Diagnosis:

Input voltage (+): 1000 ms

Input voltage (-): 1000 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Input voltage (+) | \leq 3.589 V |
| Input voltage (-) | \leq 3.541 V |

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

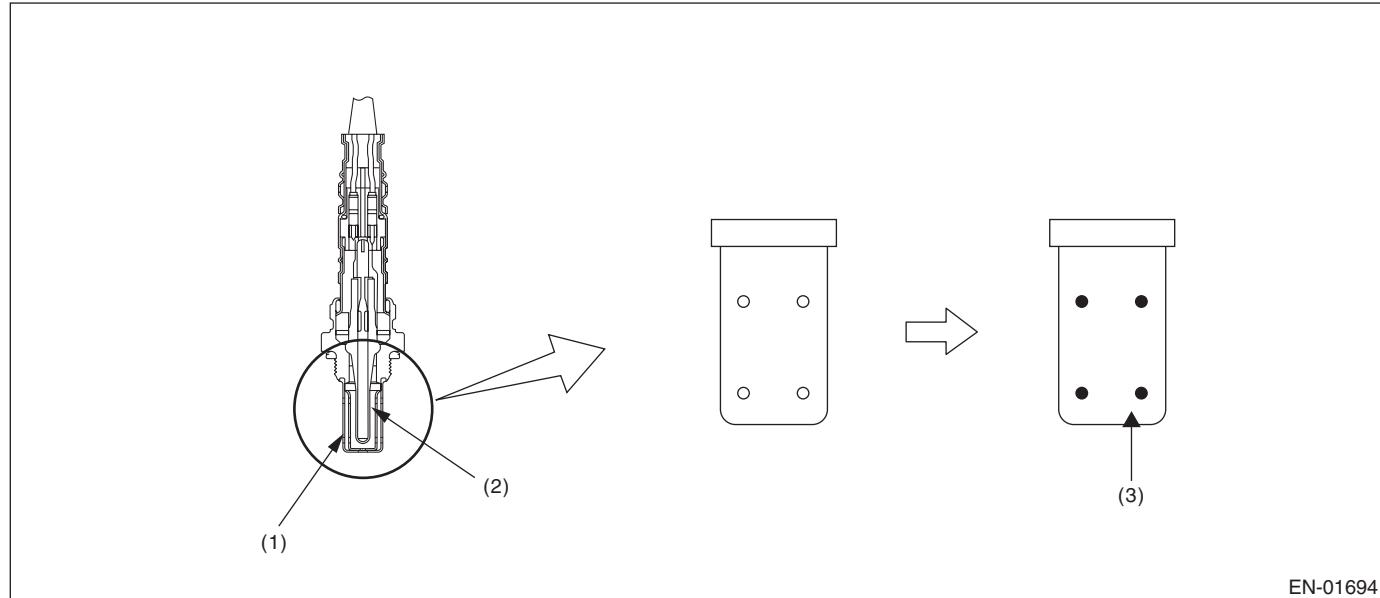
AF:DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

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

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

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

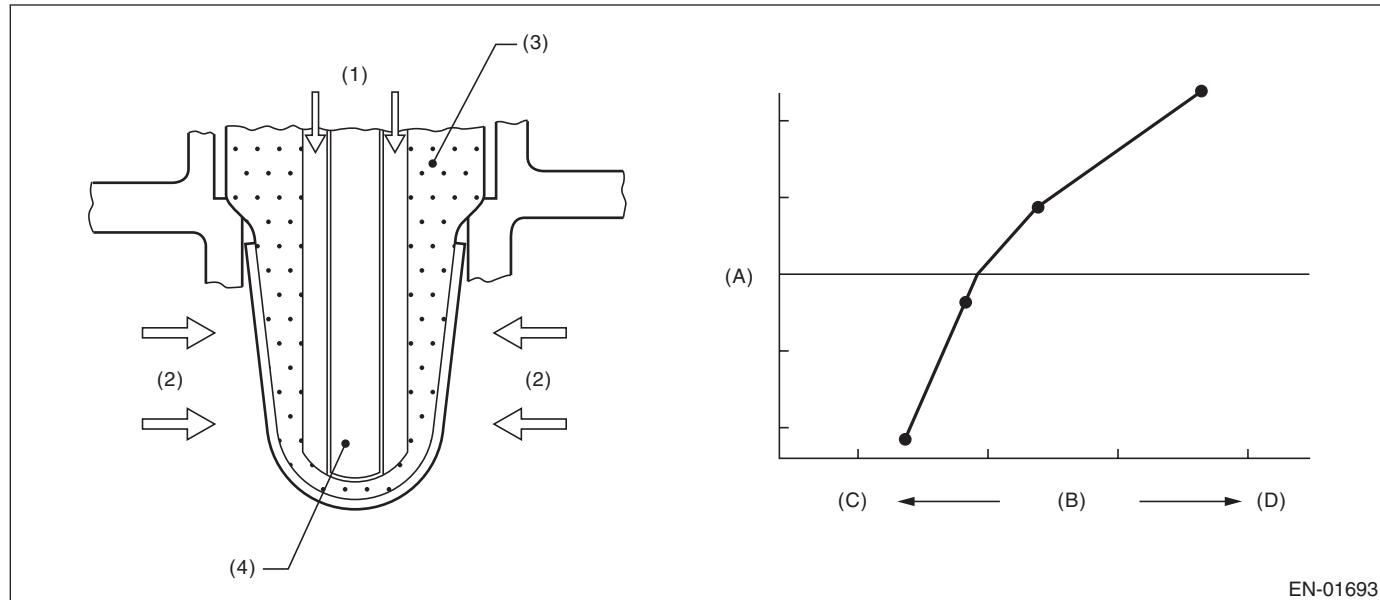


(1) Cover

(2) Zirconia

(3) Clogging

2. COMPONENT DESCRIPTION



EN-01693

(A) Electromotive force
(D) Rich

(B) Air fuel ratio

(C) Lean

(1) Atmosphere
(2) Exhaust gas

(3) ZrO_2

(4) Ceramic heater

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|---|---|
| Time needed for all secondary parameters to be in enable conditions | $\geq 1024 \text{ ms}$ |
| Battery voltage | $\geq 10.9 \text{ V}$ |
| Atmospheric pressure | $> 75 \text{ kPa (563 mmHg, 22.2 inHg)}$ |
| Closed loop control with main feedback | Operation |
| Front oxygen (A/F) sensor impedance | $0 \Omega - 50 \Omega$ |
| Elapsed time after starting the engine | $\geq 120000 \text{ ms}$ |
| Engine coolant temperature | $\geq 72 \text{ }^{\circ}\text{C (161.6 }^{\circ}\text{F)}$ |
| Engine speed | $1000 \text{ rpm} - 3200 \text{ rpm}$ |
| Vehicle speed | $10 \text{ km/h} - 120 \text{ km/h (6.2 MPH - 74.6 MPH)}$ |
| Amount of intake air | $10 \text{ g/s} - 31 \text{ g/s (0.35 oz/s - 1.09 oz/s)}$ |
| Engine load | $< 0.02 \text{ g/rev (0 oz/rev)}$ |
| Learning value of EVAP conc. during purge | < 0.2 |
| Total time of operating canister purge | $\geq 19.9 \text{ s}$ |

4. GENERAL DRIVING CYCLE

Perform diagnosis only once at a constant speed of $10 \text{ km/h} - 120 \text{ km/h (6.2 MPH - 74.6 MPH)}$ 120000 ms or more after starting the engine.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

Calculate faf difference every $32\text{ ms} \times 4$, and the λ value difference. Calculate the diagnosis value after calculating 820 time(s).

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|-----------------|
| $\text{parafca} = \text{td2faf}/\text{td2lmd}$ where, $\text{td2faf (N)} = \text{td2faf (n-1)} + \text{d2faf (n)} $ $\text{td2lmd (N)} = \text{td2lmd (n-1)} + \text{d2lmd (n)} $ add up to $32\text{ ms} \times 4 \times 820$ time(s). $\text{d2faf (n)} = (\text{faf (n)} - \text{faf (n-1)}) - (\text{faf (n-1)} - \text{faf (n-2)})$ $\text{d2lmd (n)} = (\text{lmd (n)} - \text{lmd (n-1)}) - (\text{lmd (n-1)} - \text{lmd (n-2)})$ faf = main feedback compensation coefficient every 128 milliseconds lmd = output lambda every 128 milliseconds | > 0.379 |

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

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|-----------------|
| $\text{parafca} = \text{td2faf}/\text{td2lmd}$ where, $\text{td2faf (N)} = \text{td2faf (n-1)} + \text{d2faf (n)} $ $\text{td2lmd (N)} = \text{td2lmd (n-1)} + \text{d2lmd (n)} $ add up to $32\text{ ms} \times 4 \times 820$ time(s). $\text{d2faf (n)} = (\text{faf (n)} - \text{faf (n-1)}) - (\text{faf (n-1)} - \text{faf (n-2)})$ $\text{d2lmd (n)} = (\text{lmd (n)} - \text{lmd (n-1)}) - (\text{lmd (n-1)} - \text{lmd (n-2)})$ faf = main feedback compensation coefficient every 128 milliseconds lmd = output lambda every 128 milliseconds | ≤ 0.379 |

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

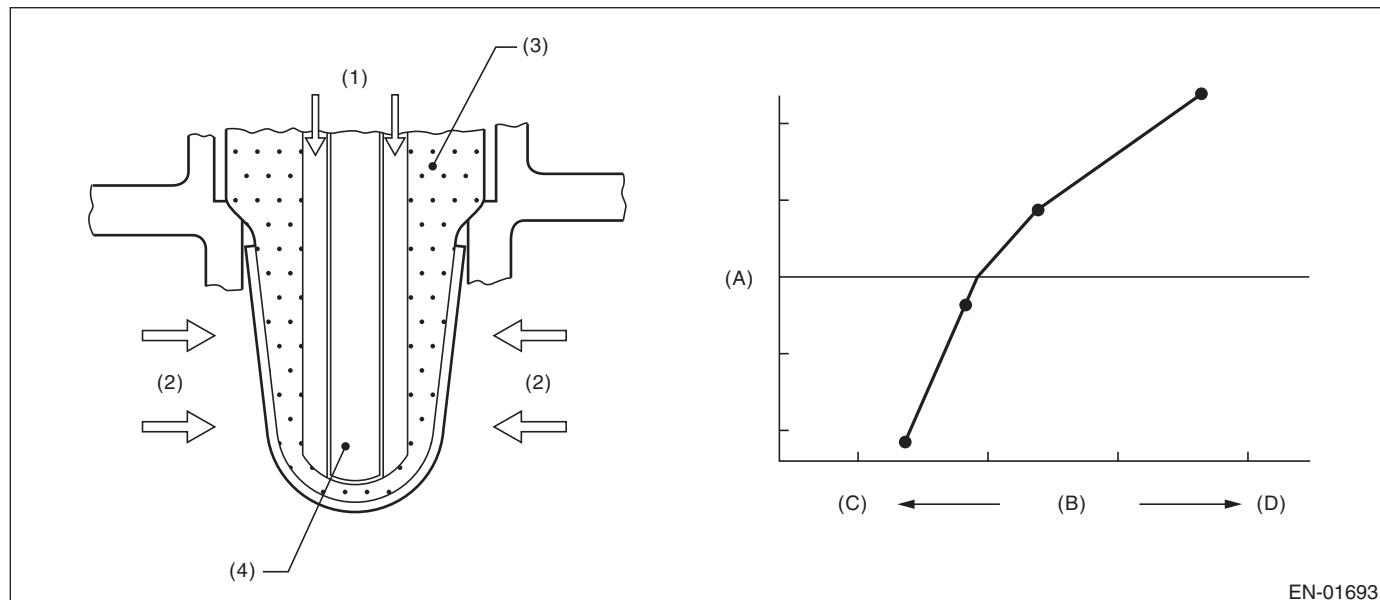
AG:DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect open circuits of the sensor.

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

2. COMPONENT DESCRIPTION



EN-01693

(A) Electromotive force
(D) Rich

(B) Air fuel ratio

(C) Lean

(1) Atmosphere
(2) Exhaust gas

(3) ZrO_2

(4) Ceramic heater

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: 5000 ms

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

• Normality Judgment

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

Judgment Value

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

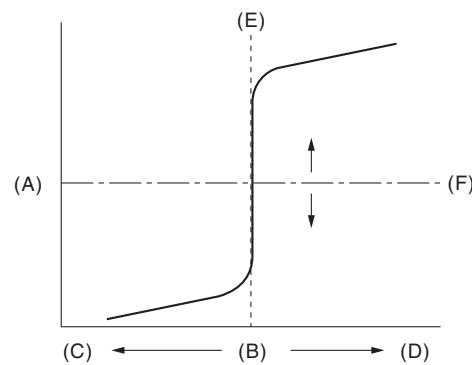
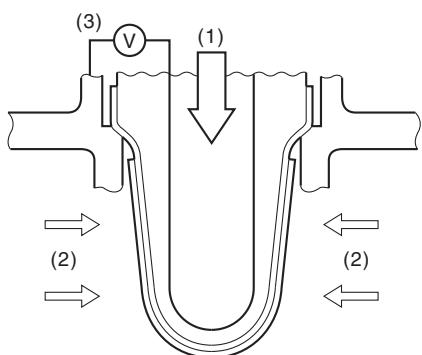
Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



EN-01696

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITION

Used for abnormality judgment

| Secondary Parameters | Enable Conditions |
|--|---|
| High Secondary air system Closed loop control at the oxygen sensor Misfire detection every 200 rotations Front oxygen (A/F) sensor compensation coefficient Battery voltage Engine coolant temperature | Not in operation In operation < 5 time(s) Not in limit value ≥ 10.9 V ≥ 72 °C (161.6 °F) |
| Low (1) Secondary air system Closed loop control at the oxygen sensor Misfire detection every 200 rotations Front oxygen (A/F) sensor compensation coefficient Battery voltage Engine coolant temperature Amount of intake air | Not in operation In operation < 5 time(s) Not in limit value ≥ 10.9 V ≥ 72 °C (161.6 °F) ≥ 10 g/s (0.35 oz/s) |
| Low (2) Secondary air system Closed loop control at the oxygen sensor Misfire detection every 200 rotations Front oxygen (A/F) sensor compensation coefficient Battery voltage Engine coolant temperature Amount of intake air Current continuation time of the rear oxygen sensor heater | Not in operation In operation < 5 time(s) Not in limit value ≥ 10.9 V ≥ 72 °C (161.6 °F) < 10 g/s (0.35 oz/s) ≥ 25000 ms |
| Low (3) Secondary air system Closed loop control at the oxygen sensor Misfire detection every 200 rotations Front oxygen (A/F) sensor compensation coefficient Battery voltage Engine coolant temperature Amount of intake air Current continuation time of the rear oxygen sensor heater Fuel cut | Not in operation In operation < 5 time(s) Not in limit value ≥ 10.9 V ≥ 72 °C (161.6 °F) < 10 g/s (0.35 oz/s) ≥ 25000 ms Experienced |

Used for normality judgment

| Secondary Parameters | Enable Conditions |
|--|-------------------------|
| Secondary air system | Not in operation |
| Closed loop control at the oxygen sensor | In operation |
| Misfire detection every 200 rotations | < 5 time(s) |
| Front oxygen (A/F) sensor compensation coefficient | Not in limit value |
| Battery voltage | ≥ 10.9 V |
| Engine coolant temperature | ≥ 72 °C (161.6 °F) |

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

4. GENERAL DRIVING CYCLE

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

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

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

Time Needed for Diagnosis:

High: 2500 ms

Low (1): 20000 ms

Low (2): 150000 ms

Low (3): Value from Map

Map

| | | | |
|--------------------------------|--------|--------|--------|
| Fuel cut time (ms) | 0 | 2000 | 10000 |
| Time Needed for Diagnosis (ms) | 150000 | 150000 | 150000 |

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

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis:

High: Less than 1 second

Low (1): Less than 1 second

Low (2): Less than 1 second

Low (3): Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

AI: 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(H4DOTC)-71, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

AJ:DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

Detect the slow response of the oxygen sensor.

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

[Rich → lean diagnosis response]

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

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

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

[Lean → rich diagnosis response]

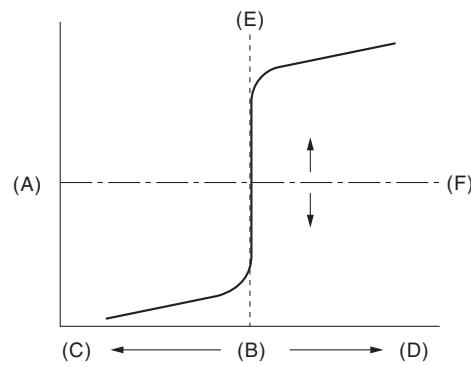
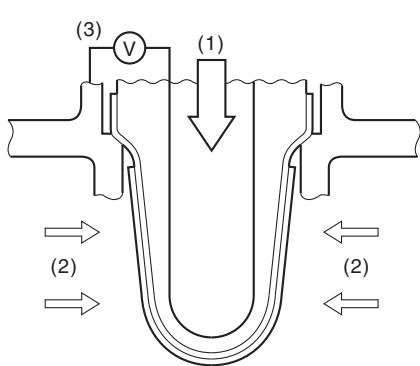
1. Measure the response time for oxygen sensor output changes when the A/F ratio changes to lean to rich. If the measured response time is larger than the threshold value, it is NG.

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

Diagnostic method

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

2. COMPONENT DESCRIPTION



EN-01696

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITION

Rich → lean diagnosis response

| Secondary Parameters | Enable Conditions |
|--|--|
| Battery voltage | ≥ 10.9 V |
| A/F main feedback control condition | Complete |
| Deceleration fuel cut time of 5000 ms or more (intermediate) | Experienced |
| Deceleration fuel cut time of 5000 ms or more (wide) | |
| After fuel cut | ≥ 2000 ms (Intermediate) ≥ 2000 ms (Wide) |
| Estimated temperature of the rear oxygen sensor element | ≥ 450 °C (842 °F) (Intermediate) ≥ 450 °C (842 °F) (Wide) |
| Number of deceleration fuel cut | ≥ 1 time(s) |

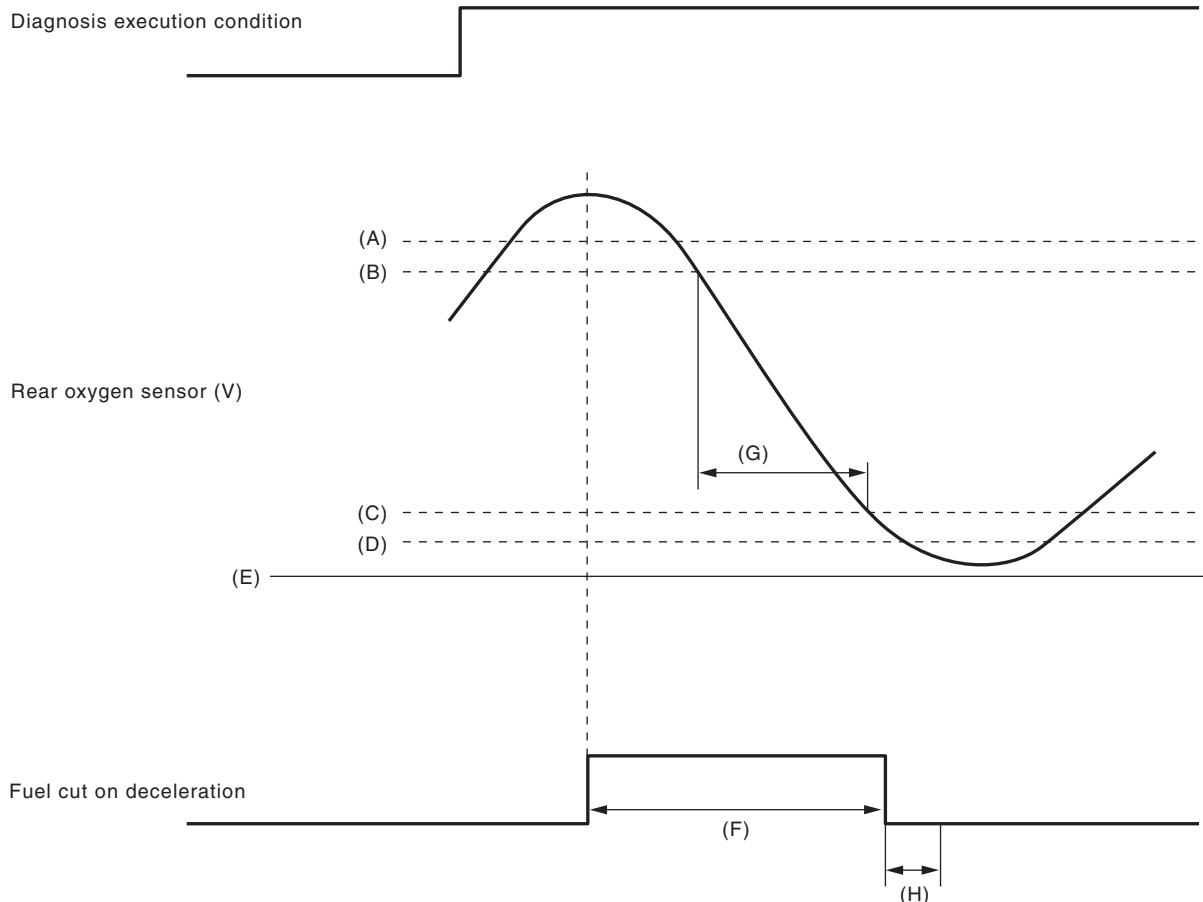
4. GENERAL DRIVING CYCLE

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

5. DIAGNOSTIC METHOD

- Intermediate

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



EN-05566

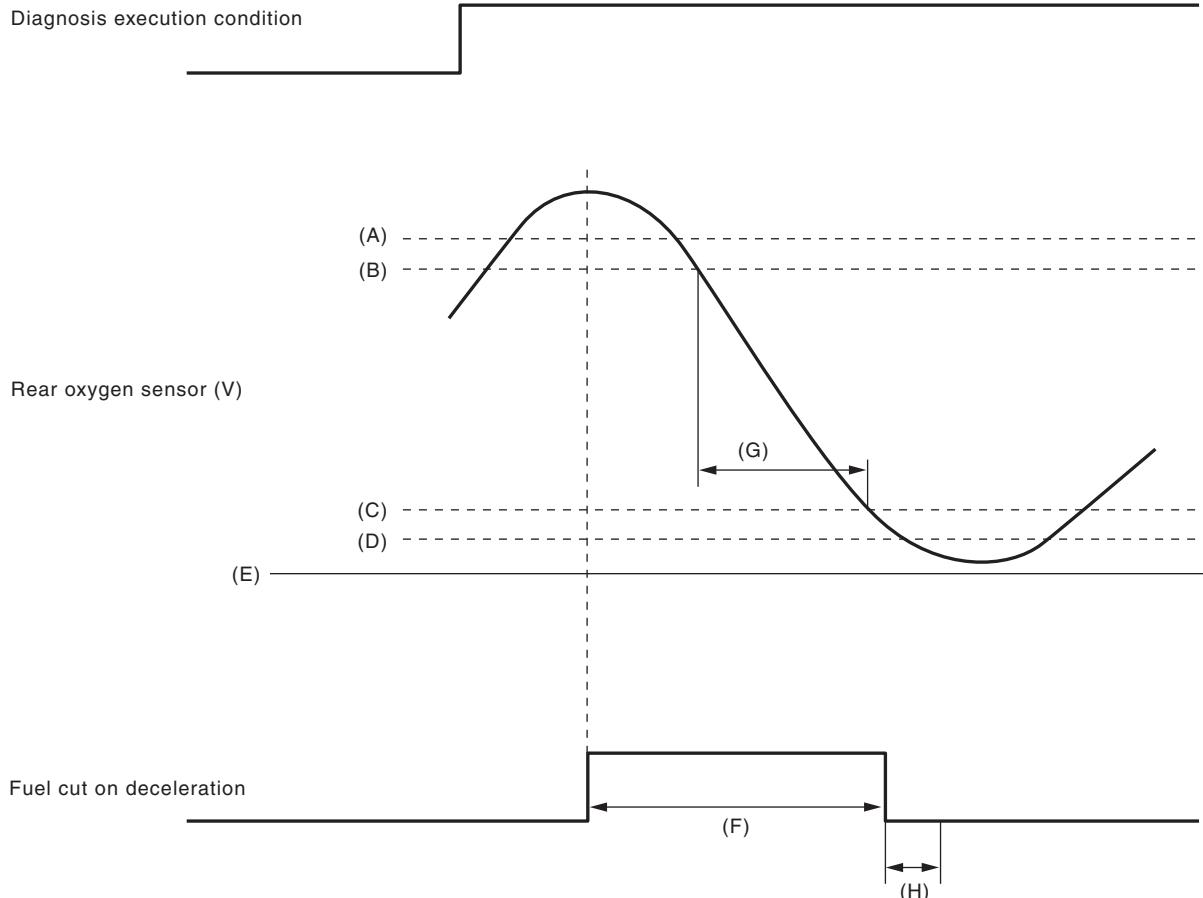
| | | |
|--------------------------------|--|-----------------------|
| (A) 0.55 V | (B) 0.5 V | (C) 0.2 V |
| (D) 0.15 V | (E) 0 V | (F) More than 5000 ms |
| (G) Measure the response time. | (H) Execute the malfunction judgment in 2000 ms from the recovery of fuel cut on deceleration. | |

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

- Wide

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



EN-05566

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Abnormality Judgment

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

NOTE:

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

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

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

Judgment value (Intermediate)

| Malfunction Criteria | Threshold Value |
|---|-----------------|
| Shortest time change from rich (0.5 V O ₂ output) to lean (0.2 V) when voltage reduces from 0.55 V to 0.15 V | > 837 ms |
| or | |
| Longest time over 0.55 V | ≥ 2000 ms |

Judgment value (Wide)

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

Map

| | | | | | |
|--|-----------|--------------|--------------|--------------|----------------|
| Estimated temperature of rear oxygen sensor element when fuel cut starts °C (°F) | 0 (32) | 450 (842) | 480 (896) | 500 (932) | 1000 (1832) |
| Longest time in rich status after fuel cut (ms) | 5000 | 5000 | 3000 | 2000 | 2000 |

Time Needed for Diagnosis: 1 time(s)

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

• Normality Judgment

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

Response time (diagnosis value) ≤ threshold value → normal

2) Do not judge as a normal condition.

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

Judgment value (Intermediate)

| Malfunction Criteria | Threshold Value |
|---|-----------------|
| Shortest time change from rich (0.5 V O ₂ output) to lean (0.2 V) when voltage reduces from 0.55 V to 0.15 V | ≤ 837 ms |

Judgment value (Wide)

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

Time Needed for Diagnosis: 1 time(s)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

6. ENABLE CONDITION

Lean → rich response diagnosis

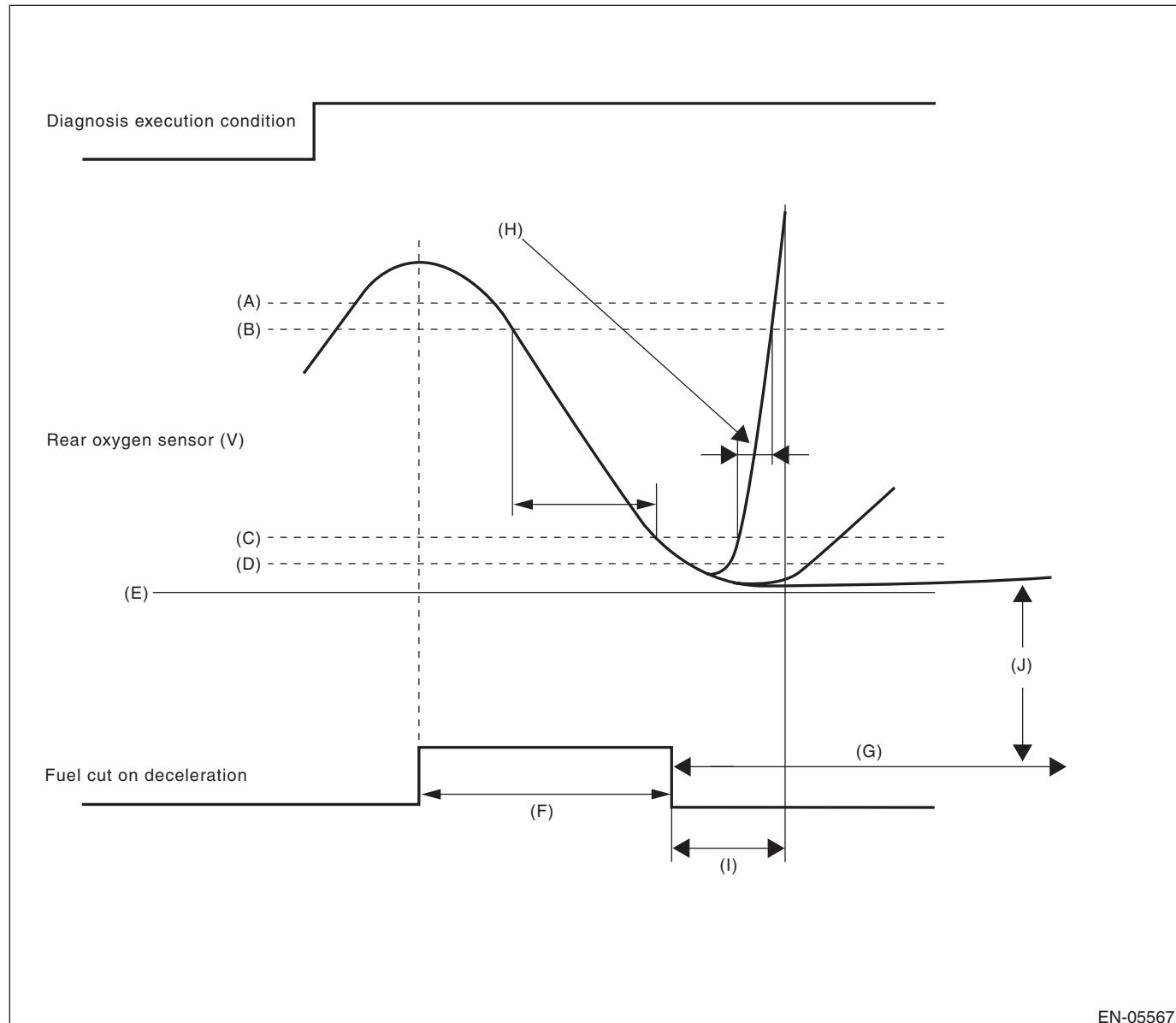
| Secondary Parameters | Enable Conditions |
|--|-------------------|
| Battery voltage | ≥ 10.9 V |
| A/F main feedback control condition | Complete |
| Deceleration fuel cut time is 6000 ms or more. | Experienced |
| After fuel cut | ≥ 2000 ms |
| Number of deceleration fuel cut | ≥ 1 time(s) |

7. GENERAL DRIVING CYCLE

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

8. DIAGNOSTIC METHOD

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



EN-05567

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Abnormality Judgment

- 1) Judge as NG when the judgment value is larger than the threshold value after deceleration fuel cut.
Response time (diagnosis value) > threshold value → abnormal
- 2) If the oxygen sensor voltage is small after recovering from a deceleration fuel cut, and remains small, judge as NG.

Judgment Value

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

Time Needed for Diagnosis: 1 time(s)

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

• Normality Judgment

- 1) Regardless of a deceleration fuel cut, if the response time (diagnosis value) when the oxygen sensor voltage has changed from rich to lean is shorter than the threshold value (judgment value), judge as a normal condition.
Response time (diagnosis value) ≤ threshold value → normal
- 2) Do not judge as a normal condition.
Judge as OK and clear the NG if the following conditions are established.

Judgment Value

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

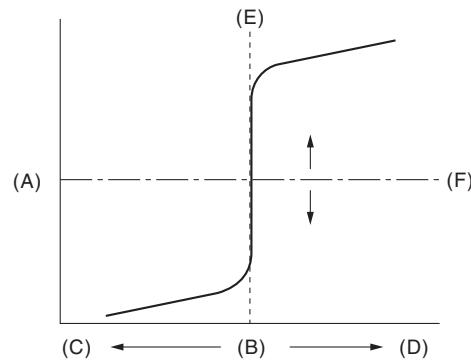
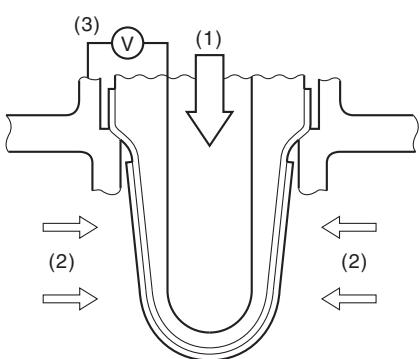
Time Needed for Diagnosis: 1 time(s)

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

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



EN-01696

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

3. ENABLE CONDITION (USED ONLY FOR MALFUNCTION JUDGMENT)

| Secondary Parameters | Enable Conditions |
|--|---|
| Closed loop control at the rear oxygen sensor | In operation |
| Target output voltage of rear oxygen sensor | $\geq 0.55 \text{ V} + 0.05 \text{ V}$ |
| Amount of intake air | $\geq 10 \text{ g/s} (0.35 \text{ oz/s})$ |
| Engine coolant temperature | $\geq 72^\circ \text{C} (161.6^\circ \text{F})$ |
| 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 5000 ms or more. | Experienced |

4. GENERAL DRIVING CYCLE

Perform the diagnosis once after starting the engine.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|--------------------------|
| Minimum output voltage or Maximum output voltage | > 0.15 V < 0.55 V |

Time Needed for Diagnosis: 200000 ms

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

• Normality Judgment

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

Judgment Value

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

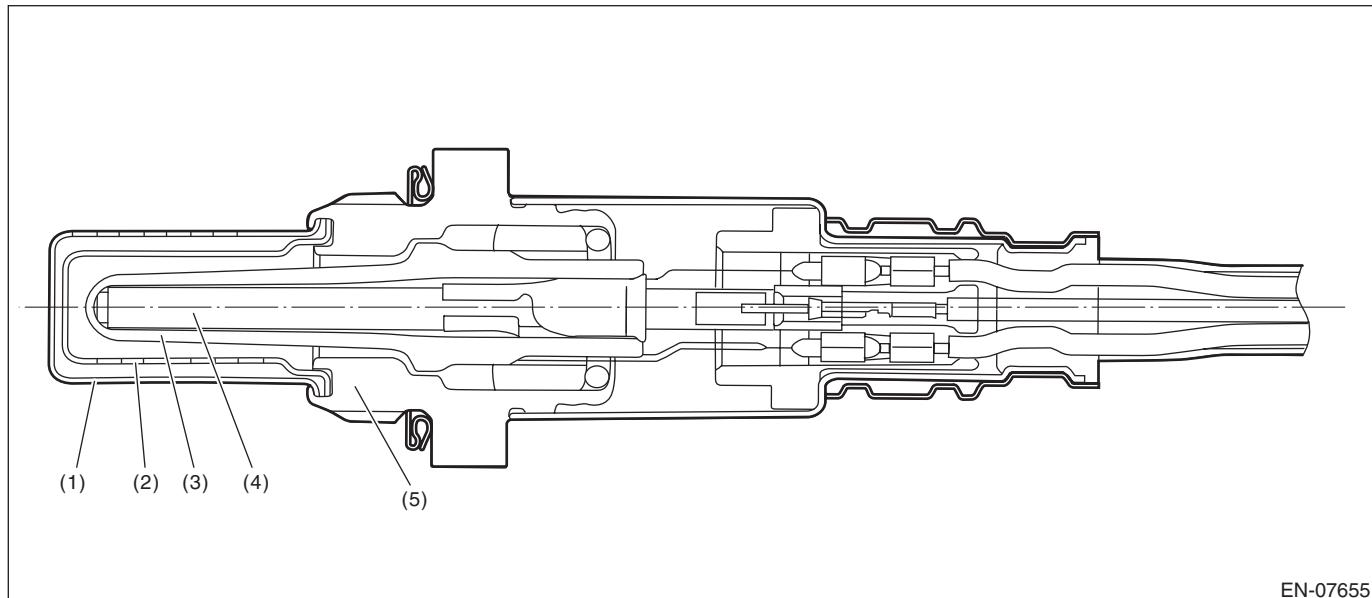
AL:DTC P0141 O2 SENSOR HEATER CIRCUIT (BANK1 SENSOR2)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of rear oxygen sensor heater.

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

2. COMPONENT DESCRIPTION



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

3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|--|---|
| Battery voltage | $\geq 10.9 \text{ V}$ |
| Elapsed time after starting the engine | $\geq 1000 \text{ ms}$ |
| Engine coolant temperature | $\geq 72 \text{ }^{\circ}\text{C} (161.6 \text{ }^{\circ}\text{F})$ |
| A/F sensor element impedance | $\leq 50 \Omega$ |
| A/F sensor heater control duty | $\leq 75 \%$ |
| Rear oxygen sensor heater control duty | $< 70 \%$ |

4. GENERAL DRIVING CYCLE

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|-----------------|
| Output terminal for heater characteristics fault detection | Low |

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

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|-----------------|
| Output terminal for heater characteristics fault detection | High |

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

AM: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 | $\geq 72^{\circ}\text{C}$ (161.6°F) |
| Engine load change | $< 0.02 \text{ g/rev}$ (0 oz/rev) |
| Engine load | \geq Value of Map 1 |

Map 1

| | | | | | | | | | | | |
|-----------------------------|--------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Engine speed (rpm) | Idling | 700 | 1200 | 1600 | 2000 | 2400 | 2800 | 3200 | 3600 | 4000 | 4400 |
| Measured value (g (oz)/rev) | na | 0.230 (0.01) | 0.217 (0.01) | 0.213 (0.01) | 0.210 (0.01) | 0.210 (0.01) | 0.220 (0.01) | 0.223 (0.01) | 0.240 (0.01) | 0.252 (0.01) | 0.261 (0.01) |

3. GENERAL DRIVING CYCLE

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

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|-------------------------|
| $fsobd = (sglmd - tglmda) +faf + flaf$ In this case: $sglmd$ = measured lambda $tglmda$ = target lambda faf = Main feedback compensation coefficient (every 64 ms) $flaf$ = main feedback learning compensation coefficient | \geq Value from Map 2 |

Map 2

| | | | | | | | |
|--------------------------|-------|-------------------|------------------|-------------------|--------------|--------------------|------------------|
| Amount of air (g (oz)/s) | 0 (0) | 2.34375 (0.08) | 4.6875 (0.17) | 7.03125 (0.25) | 9.375 (0.33) | 11.71875 (0.41) | 14.0625 (0.5) |
| fsobdL1 (%) | 1.4 | 1.4 | 1.368623 | 1.319185 | 1.26975 | 1.265 | 1.265 |

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

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|-----------------|
| $fsobd = (sglmd - tglmda) +faf + flaf$ | < 1.2 |

Time Needed for Diagnosis: 10 s

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

AN: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 | $\geq 72^{\circ}\text{C}$ (161.6 °F) |
| Engine load change | $\leq 0.02 \text{ g/rev}$ (0 oz/rev) |
| Learning value of EVAP conc. | < 0.1 |
| Cumulative time of canister purge after engine start | $\geq 20 \text{ s}$ |
| Continuous period after canister purge starting | $\geq 29884 \text{ ms}$ |
| Engine load | $\geq \text{Value of Map 1}$ |

Map 1

| | | | | | | | | | | | |
|-----------------------------|--------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Engine speed (rpm) | Idling | 700 | 1200 | 1600 | 2000 | 2400 | 2800 | 3200 | 3600 | 4000 | 4400 |
| Measured value (g (oz)/rev) | na | 0.230 (0.01) | 0.217 (0.01) | 0.213 (0.01) | 0.210 (0.01) | 0.210 (0.01) | 0.220 (0.01) | 0.223 (0.01) | 0.240 (0.01) | 0.252 (0.01) | 0.261 (0.01) |

3. GENERAL DRIVING CYCLE

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

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

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

Map 2

| | | | | | | | |
|--------------------------|-------|----------------|---------------|----------------|--------------|-----------------|---------------|
| Amount of air (g (oz)/s) | 0 (0) | 2.34375 (0.08) | 4.6875 (0.17) | 7.03125 (0.25) | 9.375 (0.33) | 11.71875 (0.41) | 14.0625 (0.5) |
| fsobdL1 (%) | 0.6 | 0.6 | 0.63137 | 0.68082 | 0.71025 | 0.72525 | 0.73025 |

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

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

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: 10 s

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

AO: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.

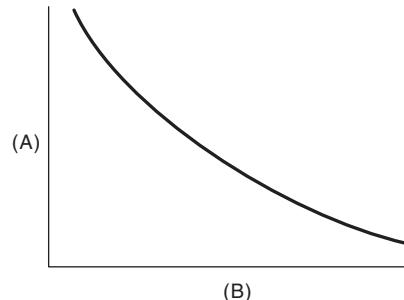
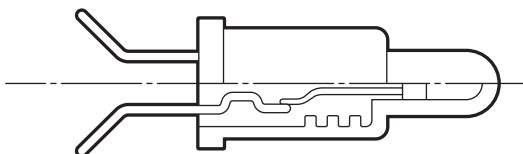
Drift Diagnosis

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.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|---|
| Fuel level | $\geq 10.5 \text{ l}$ (2.77 US gal, 2.31 Imp gal) |
| Elapsed time after starting the engine | $\geq 20 \text{ s}$ |
| Engine coolant temperature – Engine coolant temperature at engine start | $> 10 \text{ }^{\circ}\text{C}$ (18°F) |
| Fuel temperature – Engine coolant temperature | $\geq 10 \text{ }^{\circ}\text{C}$ (18°F) |
| Battery voltage | $\geq 10.9 \text{ V}$ |

Time Needed for Diagnosis: 120 s

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|---|
| Fuel level | $\geq 10.5 \text{ l}$ (2.77 US gal, 2.31 Imp gal) |
| Elapsed time after starting the engine | $\geq 20 \text{ s}$ |
| Engine coolant temperature – Engine coolant temperature at engine start | $> 10 \text{ }^{\circ}\text{C}$ (18°F) |
| Fuel temperature – Engine coolant temperature | $< 10 \text{ }^{\circ}\text{C}$ (18°F) |
| Battery voltage | $\geq 10.9 \text{ V}$ |
| Engine coolant temperature | $< 70 \text{ }^{\circ}\text{C}$ (158 °F) |

Time Needed for Diagnosis: Less than 1 second

6. ENABLE CONDITION

Stuck Diagnosis

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

7. GENERAL DRIVING CYCLE

Perform the diagnosis continuously 20 seconds after starting engine.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

8. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|-------------------------------|
| Accumulated amount of intake air | ≥ 551043 g (19435.29 oz) |
| Fuel temperature difference between Max. and Min. | < 2 °C (3.6°F) |

Time Needed for Diagnosis: Less than 1 second

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|---------------------|
| Fuel temperature difference between Max. and Min. | ≥ 2 °C (3.6°F) |

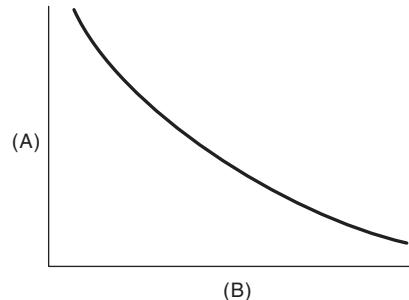
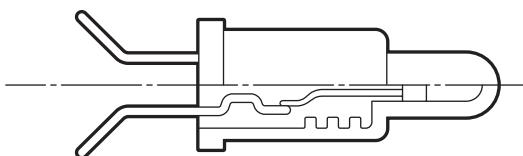
Time Needed for Diagnosis: Less than 1 second

AP: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.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | < 0.573 V |
| Battery voltage | ≥ 10.9 V |

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | ≥ 0.573 V |
| Battery voltage | ≥ 10.9 V |

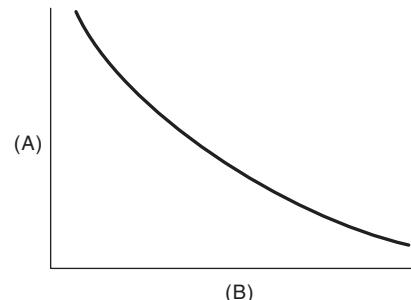
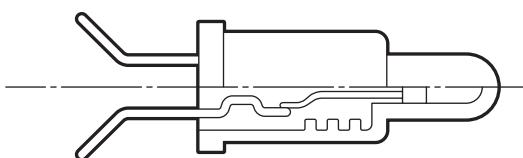
Time Needed for Diagnosis: Less than 1 second

AQ: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.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | ≥ 4.716 V |
| Battery voltage | ≥ 10.9 V |

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | < 4.716 V |
| Battery voltage | ≥ 10.9 V |

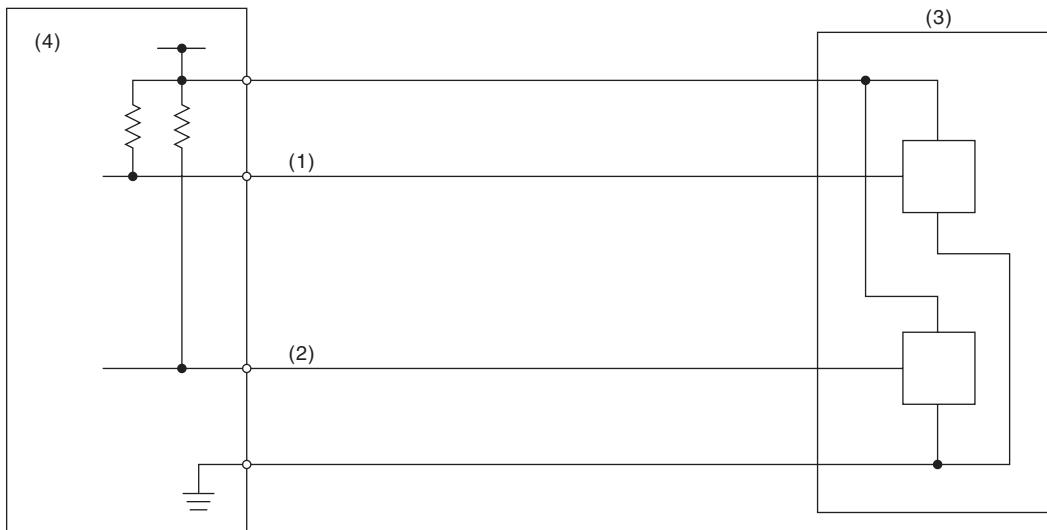
Time Needed for Diagnosis: Less than 1 second

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



EN-01859

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

(3) Throttle position sensor

(4) Engine control module (ECM)

3. ENABLE CONDITION

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

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|------------------------|------------------------|
| Sensor 2 input voltage | $\leq 0.926 \text{ V}$ |

Time Needed for Diagnosis: 24 ms

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

• Normality Judgment

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

Judgment Value

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

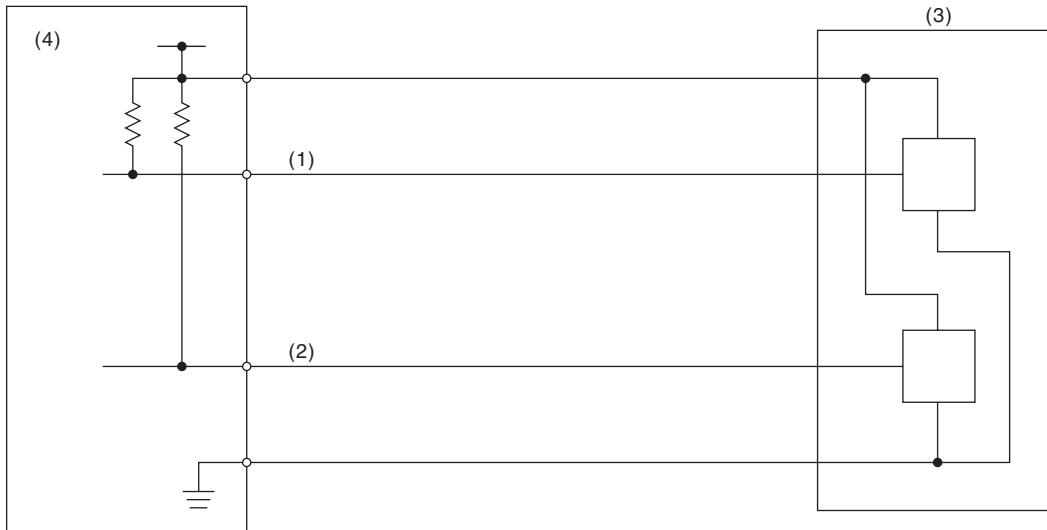
Time Needed for Diagnosis: 24 ms

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



EN-01859

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

(3) Throttle position sensor

(4) Engine control module (ECM)

3. ENABLE CONDITION

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

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|------------------------|------------------------|
| Sensor 2 input voltage | $\geq 4.858 \text{ V}$ |

Time Needed for Diagnosis: 24 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|------------------------|---------------------|
| Sensor 2 input voltage | $< 4.858 \text{ V}$ |

Time Needed for Diagnosis: 24 ms

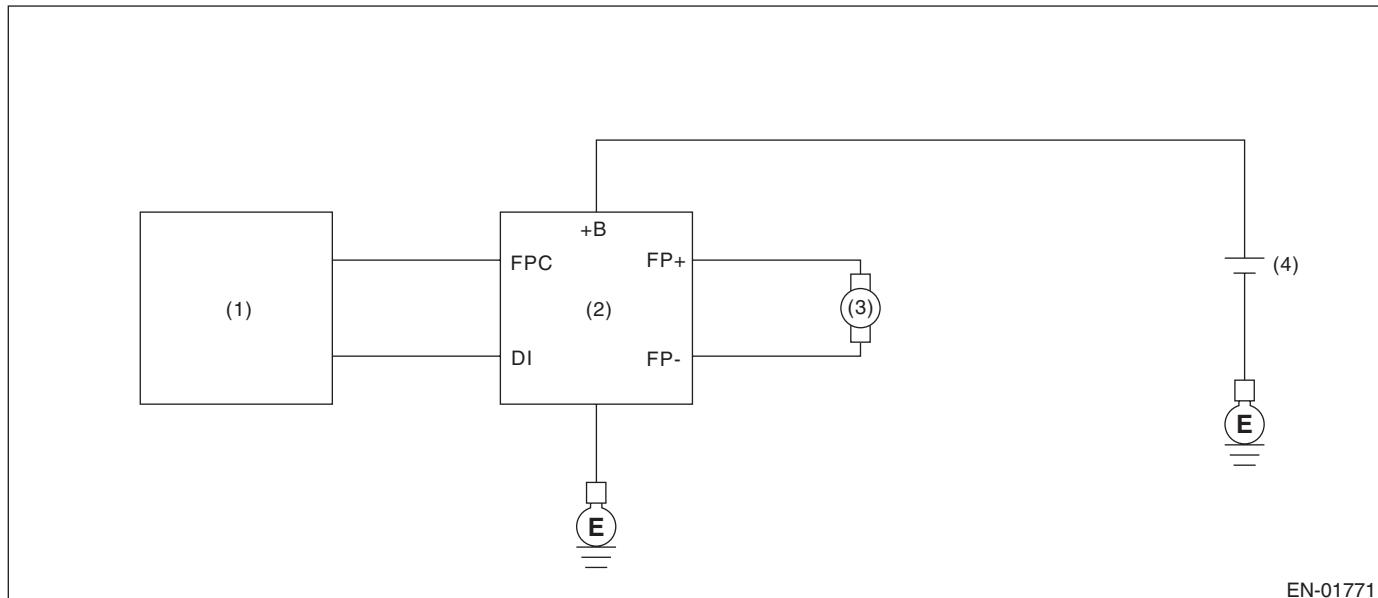
AT:DTC P0230 FUEL PUMP PRIMARY CIRCUIT

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel pump control unit.

Judge as NG when the NG signal is sent through a diagnostic line coming from the fuel pump control unit. Fuel pump control unit detects the open or short circuit malfunction for each line, and then sends NG signals if one of them is found NG.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)

(3) Fuel pump

(4) Battery

(2) Fuel pump control unit

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|--|
| Battery voltage | ≥ 8 V |
| Elapsed time after starting the engine | ≥ 180000 ms |
| Fuel pump control | ON |
| Fuel pump control unit output diagnosis signal | Low |
| Fuel level | ≥ 10 ℥ (2.64 US gal, 2.2 Imp gal) |

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|--|
| Battery voltage | ≥ 8 V |
| Elapsed time after starting the engine | ≥ 180000 ms |
| Fuel pump control | ON |
| Fuel pump control unit output diagnosis signal | High |
| Fuel level | ≥ 10 ℥ (2.64 US gal, 2.2 Imp gal) |

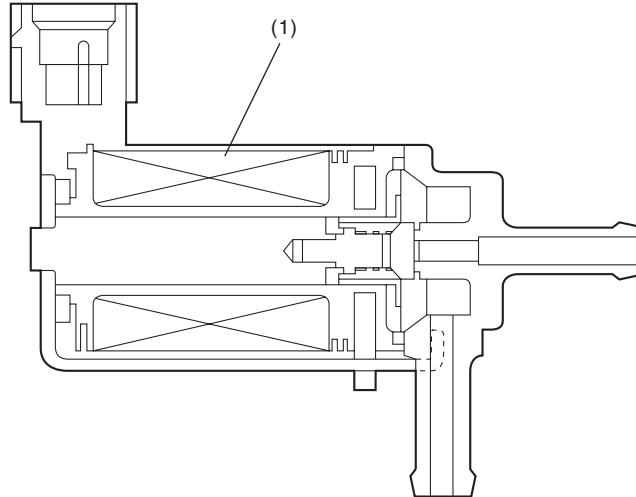
Time Needed for Diagnosis: Less than 1 second

AU:DTC P0244 TURBO/SUPER CHARGER WASTEGATE SOLENOID "A" RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of wastegate control solenoid valve function.
Judge as NG when becoming high wastegate pressure.

2. COMPONENT DESCRIPTION



EN-01772

(1) Coil

3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--------------------------|-----------------------|
| Intake manifold pressure | \geq Value from Map |

Map

| | | Atmospheric pressure (kPa (mmHg, inHg)) | | | | | | | |
|-----------------------|------|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | | 64 (480, 18.9) | 70.6 (530, 20.9) | 77.3 (580, 22.8) | 84 (630, 24.8) | 90.6 (680, 26.8) | 93.3 (700, 27.6) | 96 (720, 28.3) | 97.3 (730, 28.7) |
| Engine speed (rpm) | 2000 | 194.6 (1460, 57.5) | 194.6 (1460, 57.5) | 194.6 (1460, 57.5) | 194.6 (1460, 57.5) | 194.6 (1460, 57.5) | 194.6 (1460, 57.5) | 194.6 (1460, 57.5) | 194.6 (1460, 57.5) |
| | 2400 | 197.3 (1480, 58.3) | 197.3 (1480, 58.3) | 197.3 (1480, 58.3) | 197.3 (1480, 58.3) | 197.3 (1480, 58.3) | 197.3 (1480, 58.3) | 197.3 (1480, 58.3) | 197.3 (1480, 58.3) |
| | 2800 | 197.3 (1480, 58.3) | 197.3 (1480, 58.3) | 197.3 (1480, 58.3) | 197.3 (1480, 58.3) | 197.3 (1480, 58.3) | 197.3 (1480, 58.3) | 197.3 (1480, 58.3) | 197.3 (1480, 58.3) |
| | 3200 | 193.9 (1454, 57.3) | 194.7 (1461, 57.5) | 195.6 (1467, 57.8) | 196.4 (1474, 58) | 197.3 (1480, 58.3) | 197.3 (1480, 58.3) | 197.3 (1480, 58.3) | 197.3 (1480, 58.3) |
| | 3600 | 188.3 (1413, 55.6) | 190.9 (1432, 56.4) | 193.5 (1451, 57.1) | 196 (1471, 57.9) | 198.6 (1490, 58.7) | 198.6 (1490, 58.7) | 198.6 (1490, 58.7) | 198.6 (1490, 58.7) |
| | 4000 | 182.6 (1370, 53.9) | 187 (1403, 55.2) | 191.3 (1435, 56.5) | 195.6 (1468, 57.8) | 200 (1500, 59.1) | 200 (1500, 59.1) | 200 (1500, 59.1) | 200 (1500, 59.1) |
| | 4400 | 172.2 (1292, 50.9) | 178.3 (1338, 52.7) | 184.4 (1383, 54.4) | 190.4 (1429, 56.2) | 196.5 (1474, 58) | 198.2 (1487, 58.5) | 200 (1500, 59.1) | 200 (1500, 59.1) |
| | 4800 | 161.8 (1214, 47.8) | 169.6 (1273, 50.1) | 177.4 (1331, 52.4) | 185.2 (1390, 54.7) | 193 (1448, 57) | 196.5 (1474, 58) | 200 (1500, 59.1) | 200 (1500, 59.1) |
| | 5200 | 155.2 (1164, 45.8) | 164.9 (1237, 48.7) | 174.7 (1311, 51.6) | 184.4 (1384, 54.5) | 194.2 (1457, 57.4) | 198.6 (1490, 58.7) | 203.1 (1523, 60) | 203.9 (1530, 60.2) |
| | 5600 | 149 (1118, 44) | 160.8 (1206, 47.5) | 172.6 (1295, 51) | 184.4 (1383, 54.5) | 196.2 (1472, 57.9) | 200.7 (1506, 59.3) | 205.2 (1540, 60.6) | 207.9 (1560, 61.4) |
| | 6000 | 138.3 (1038, 40.8) | 151.7 (1138, 44.8) | 165.1 (1239, 48.8) | 178.5 (1339, 52.7) | 191.9 (1440, 56.7) | 196.4 (1473, 58) | 200.8 (1507, 59.3) | 205.3 (1540, 60.6) |
| | 6400 | 137 (1028, 40.5) | 150.3 (1128, 44.4) | 163.5 (1227, 48.3) | 176.8 (1326, 52.2) | 190 (1426, 56.1) | 194.5 (1459, 57.4) | 198.9 (1492, 58.7) | 203.3 (1525, 60) |

kPa (mmHg, inHg)

Time Needed for Diagnosis: 2000 ms

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--------------------------|--|
| Intake manifold pressure | < Value from Map – 20 kPa (150 mmHg, 5.9 inHg) |

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

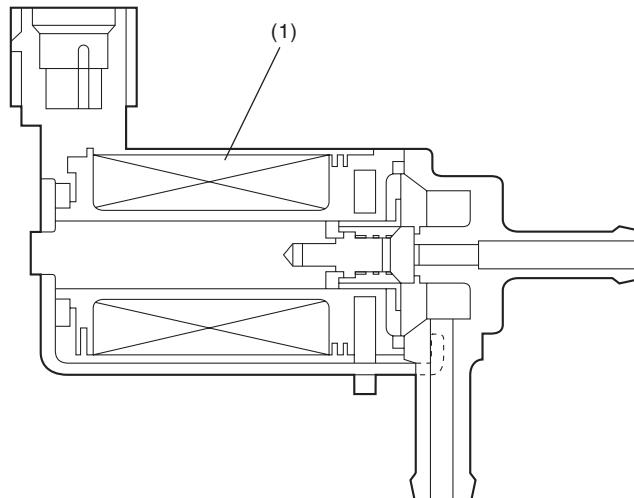
AV:DTC P0245 TURBO/SUPER CHARGER WASTEGATE SOLENOID "A" LOW

1. OUTLINE OF DIAGNOSIS

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

Judge as NG when the terminal output voltage remains Low during outputting the duty signal.

2. COMPONENT DESCRIPTION



EN-01772

(1) Coil

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|--|-------------------|
| Battery voltage | ≥ 10.9 V |
| Elapsed time after starting the engine | ≥ 1 second |

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---------------------------------|-----------------|
| Terminal output voltage | Low |
| Duty ratio of wastegate control | $< 75\%$ |

Time Needed for Diagnosis: 4 ms \times 640 ms

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

Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|-------------------------|-----------------|
| Terminal output voltage | High |

Time Needed for Diagnosis: Less than 1 second

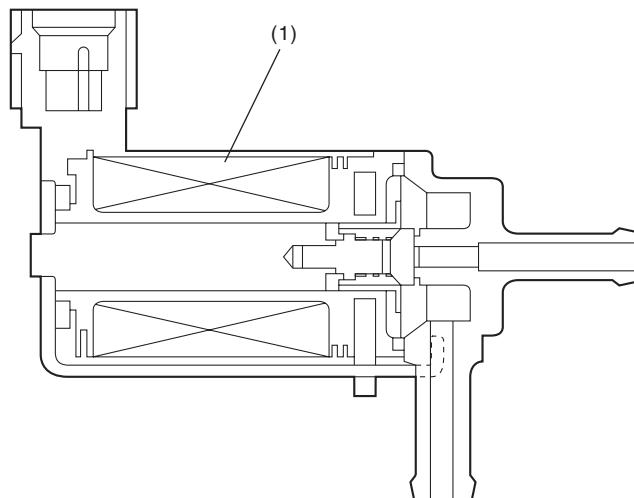
AW:DTC P0246 TURBO/SUPER CHARGER WASTEGATE SOLENOID "A" HIGH

1. OUTLINE OF DIAGNOSIS

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

Judge as NG when the terminal output voltage remains Low or High during outputting the duty signal.

2. COMPONENT DESCRIPTION



EN-01772

(1) Coil

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|--|-------------------|
| Battery voltage | ≥ 10.9 V |
| Elapsed time after starting the engine | ≥ 1 second |

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---------------------------------|-----------------|
| Terminal output voltage | High |
| Duty ratio of wastegate control | $\geq 25\%$ |

Time Needed for Diagnosis: 4 ms \times 640 ms

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

Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|-------------------------|-----------------|
| Terminal output voltage | Low |

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

AX: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 variation for 16 ms | < 14 ° |
| Fuel shut-off function | Not in operation |
| Fuel level | ≥ 10.5 ℥ (2.77 US gal, 2.31 Imp gal) |
| Vehicle dynamic control or AT torque control | Not in operation |
| Evaporative system leak check | Not in operation |
| Engine speed | 550 rpm — 6700 rpm |
| Intake manifold pressure | \geq Value from Map 2 |
| Battery voltage | ≥ 8 V |
| Fuel parameter determination | Not extremely low volatility |
| Elapsed time after starting the engine | ≥ 0 ms |
| Engine speed variation for 32 ms | < 1000 rpm |

Map 1

| rpm | 700 | 1000 | 1500 | 2000 | 2500 | 3000 | 3500 | 4000 | 4500 | 5000 | 5500 | 6000 | 6500 | 6700 |
|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| kPa (mmHg, inHg) | 13.3 (100, 3.9) |

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Map 2

- Tumble generator valve open

Vehicle speed < 64 km/h (39.8 MPH)

| rpm | 700 | 1000 | 1500 | 2000 | 2500 | 3000 | 3500 | 4000 | 4500 | 5000 | 5500 | 6000 | 6500 | 6700 |
|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|
| kPa (mmHg, inHg) | 28.8 (216, 8.5) | 24.9 (187, 7.4) | 21.1 (158, 6.2) | 21.7 (163, 6.4) | 22.3 (167, 6.6) | 23.1 (173, 6.8) | 28.5 (214, 8.4) | 28.4 (213, 8.4) | 31.6 (237, 9.3) | 32.5 (244, 9.6) | 37.1 (278, 10.9) | 41.9 (314, 12.4) | 46.9 (352, 13.9) | 51.1 (383, 15.1) |

Vehicle speed \geq 68 km/h (42.3 MPH)

| rpm | 700 | 1000 | 1500 | 2000 | 2500 | 3000 | 3500 | 4000 | 4500 | 5000 | 5500 | 6000 | 6500 | 6700 |
|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| kPa (mmHg, inHg) | 25.1 (188, 7.4) | 24.8 (186, 7.3) | 31.6 (237, 9.3) | 33.1 (248, 9.8) | 32.1 (241, 9.5) | 31.6 (237, 9.3) | 36.7 (275, 10.8) | 35.1 (263, 10.4) | 38.3 (287, 11.3) | 39.2 (294, 11.6) | 43.7 (328, 12.9) | 48.5 (364, 14.3) | 53.6 (402, 15.8) | 54.7 (410, 16.1) |

- Tumble generator valve closed

Vehicle speed < 64 km/h (39.8 MPH)

| rpm | 700 | 1000 | 1500 | 2000 | 2500 | 3000 | 3500 | 4000 | 4500 | 5000 | 5500 | 6000 | 6500 | 6700 |
|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|
| kPa (mmHg, inHg) | 28.8 (216, 8.5) | 24.9 (187, 7.4) | 21.1 (158, 6.2) | 21.7 (163, 6.4) | 22.3 (167, 6.6) | 23.1 (173, 6.8) | 28.5 (214, 8.4) | 28.4 (213, 8.4) | 31.6 (237, 9.3) | 32.5 (244, 9.6) | 37.1 (278, 10.9) | 41.9 (314, 12.4) | 46.9 (352, 13.9) | 51.1 (383, 15.1) |

Vehicle speed \geq 68 km/h (42.3 MPH)

| rpm | 700 | 1000 | 1500 | 2000 | 2500 | 3000 | 3500 | 4000 | 4500 | 5000 | 5500 | 6000 | 6500 | 6700 |
|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| kPa (mmHg, inHg) | 25.1 (188, 7.4) | 24.8 (186, 7.3) | 31.6 (237, 9.3) | 33.1 (248, 9.8) | 32.1 (241, 9.5) | 31.6 (237, 9.3) | 36.7 (275, 10.8) | 35.1 (263, 10.4) | 38.3 (287, 11.3) | 39.2 (294, 11.6) | 43.7 (328, 12.9) | 48.5 (364, 14.3) | 53.6 (402, 15.8) | 54.7 (410, 16.1) |

3. GENERAL DRIVING CYCLE

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

4. DIAGNOSTIC METHOD

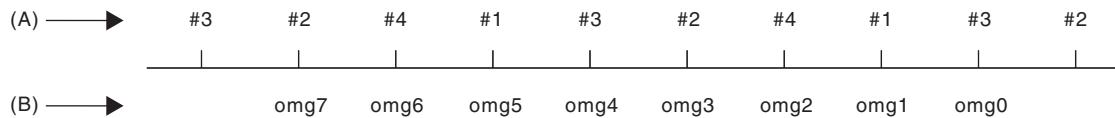
When a misfire occurs, the engine speed will decrease and the crankshaft position speed will change. Calculate the interval difference value (diagnostic value) from crankshaft position speed by the following formula, and judge whether a misfire is occurring or not comparing the calculated result with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

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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



EN-01774

(A) Ignition order

(B) Crankshaft position speed

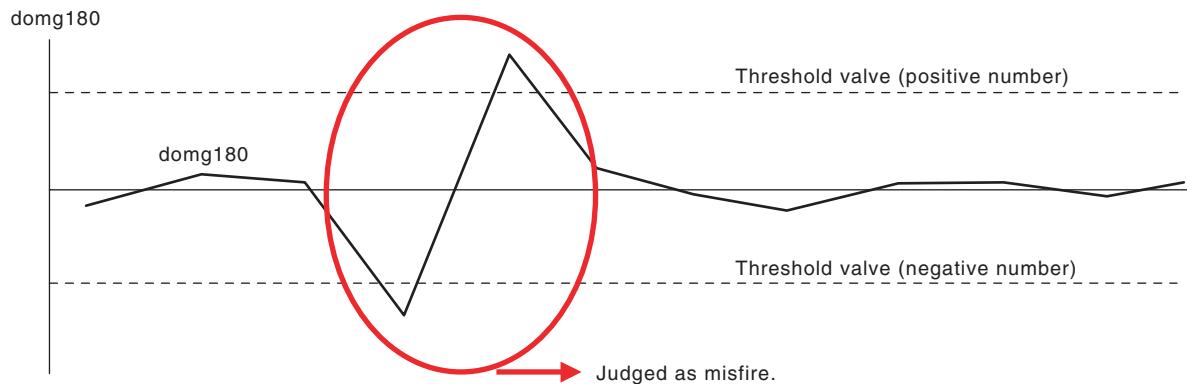
180° Interval Difference Method

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

Judge as a misfire in the following cases.

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

(Judgment value before 180° CA)



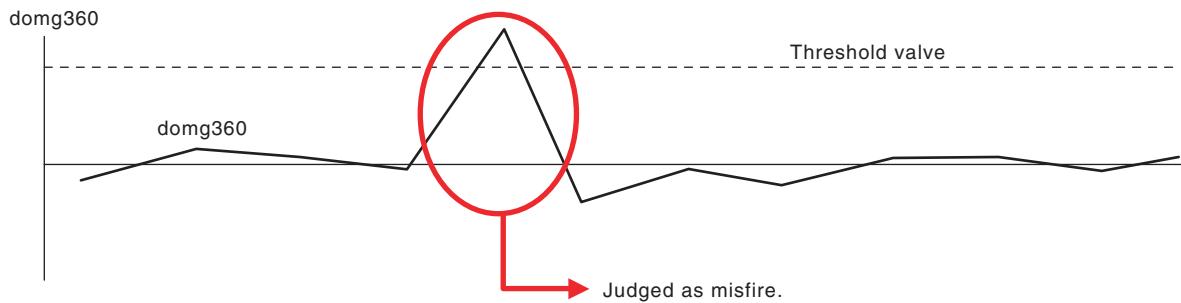
EN-02877

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

360° Interval Difference Method

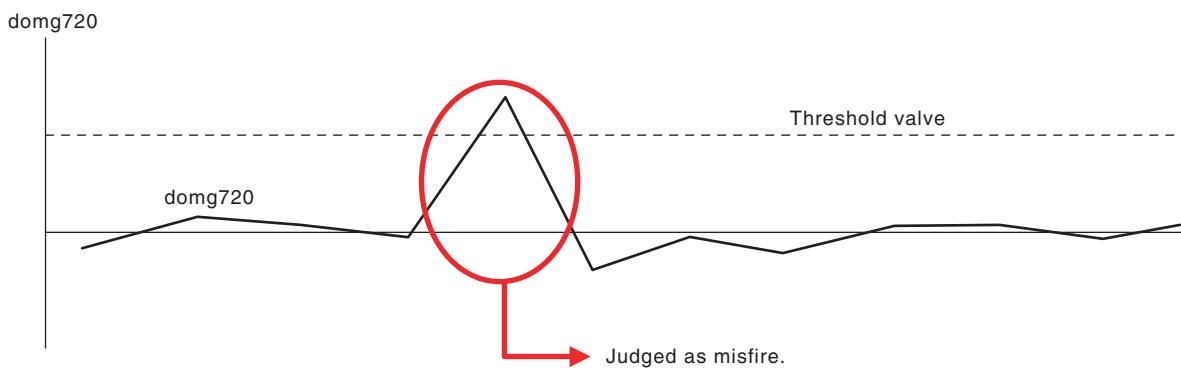
| | |
|------------------|--|
| Diagnostic value | $domg\ 360 = (omg\ 1 - omg\ 0) - (omg\ 3 - omg\ 2)$ |
| Misfire judgment | $domg\ 360 > Judgment\ value \rightarrow Judge\ as\ misfire$ |



EN-03273

720° Interval Difference Method

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



EN-03274

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

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

| Malfunction Criteria | Threshold Value |
|-----------------------------|---|
| FTP emission judgment value | $\geq 30 \times 100/2000\%$ in 1000 revs. |

Time Needed for Diagnosis: 1000 engine revs.

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

- **Normality Judgment**

Judgment Value

| Malfunction Criteria | Threshold Value |
|-----------------------------|--|
| FTP emission judgment value | $< 30 \times 100/2000\%$ in 1000 revs. |

Time Needed for Diagnosis: 1000 engine revs.

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

- **Abnormality Judgment**

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|-----------------------|
| Catalyst damage misfire judgment value | \geq Value of Map 3 |

Map 3

| | | Intake air (g/oz)/rev) | | | | | | | | | |
|-----------------------|------|------------------------|---------------|---------------|---------------|-------------|---------------|---------------|---------------|---------------|-------------|
| | | 0.2 (0.01) | 0.4 (0.01) | 0.6 (0.02) | 0.8 (0.03) | 1 (0.04) | 1.2 (0.04) | 1.4 (0.05) | 1.6 (0.06) | 1.8 (0.06) | 2 (0.07) |
| Engine speed (rpm) | 700 | 126 | 109 | 99 | 90 | 85 | 77 | 77 | 77 | 77 | 77 |
| | 1000 | 126 | 109 | 97 | 88 | 78 | 72 | 72 | 72 | 72 | 72 |
| | 1500 | 119 | 100 | 87 | 77 | 72 | 72 | 72 | 61 | 61 | 61 |
| | 2000 | 109 | 77 | 77 | 62 | 49 | 37 | 34 | 31 | 27 | 20 |
| | 2500 | 99 | 74 | 48 | 38 | 33 | 31 | 29 | 27 | 26 | 20 |
| | 3000 | 92 | 74 | 49 | 33 | 31 | 31 | 27 | 26 | 24 | 20 |
| | 3500 | 83 | 63 | 37 | 23 | 20 | 20 | 20 | 20 | 20 | 20 |
| | 4000 | 59 | 52 | 34 | 23 | 20 | 20 | 20 | 20 | 20 | 20 |
| | 4500 | 51 | 47 | 29 | 21 | 20 | 20 | 20 | 20 | 20 | 20 |
| | 5000 | 47 | 47 | 29 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | 5500 | 46 | 46 | 28 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | 6000 | 44 | 44 | 27 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | 6500 | 43 | 43 | 26 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | 6700 | 43 | 43 | 26 | 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 Judgment**

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|--------------------|
| Catalyst damage misfire judgment value | $<$ Value of Map 3 |

Time Needed for Diagnosis: 200 engine revs.

AY:DTC P0302 CYLINDER 2 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H4DOTC)-108, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

AZ:DTC P0303 CYLINDER 3 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H4DOTC)-108, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BA:DTC P0304 CYLINDER 4 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0301. <Ref. to GD(H4DOTC)-108, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

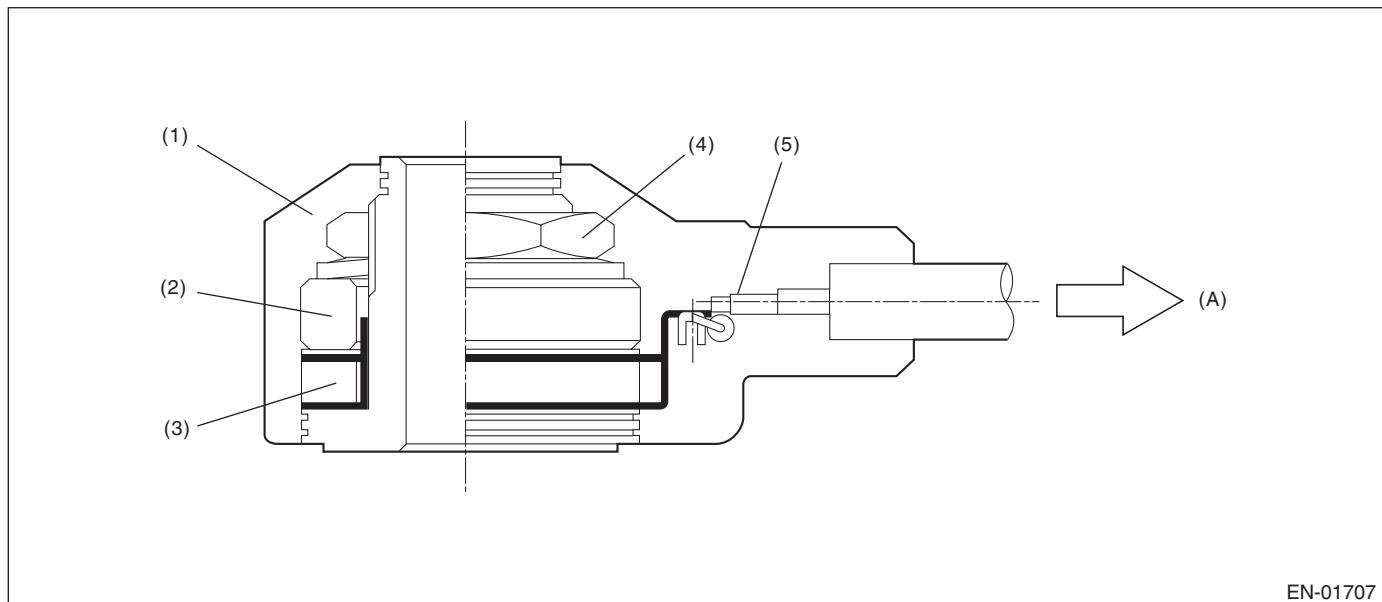
GENERAL DESCRIPTION

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

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



(A) To knock sensor harness

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

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | < 0.243 V |

Time Needed for Diagnosis: 1000 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | ≥ 0.243 V |

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

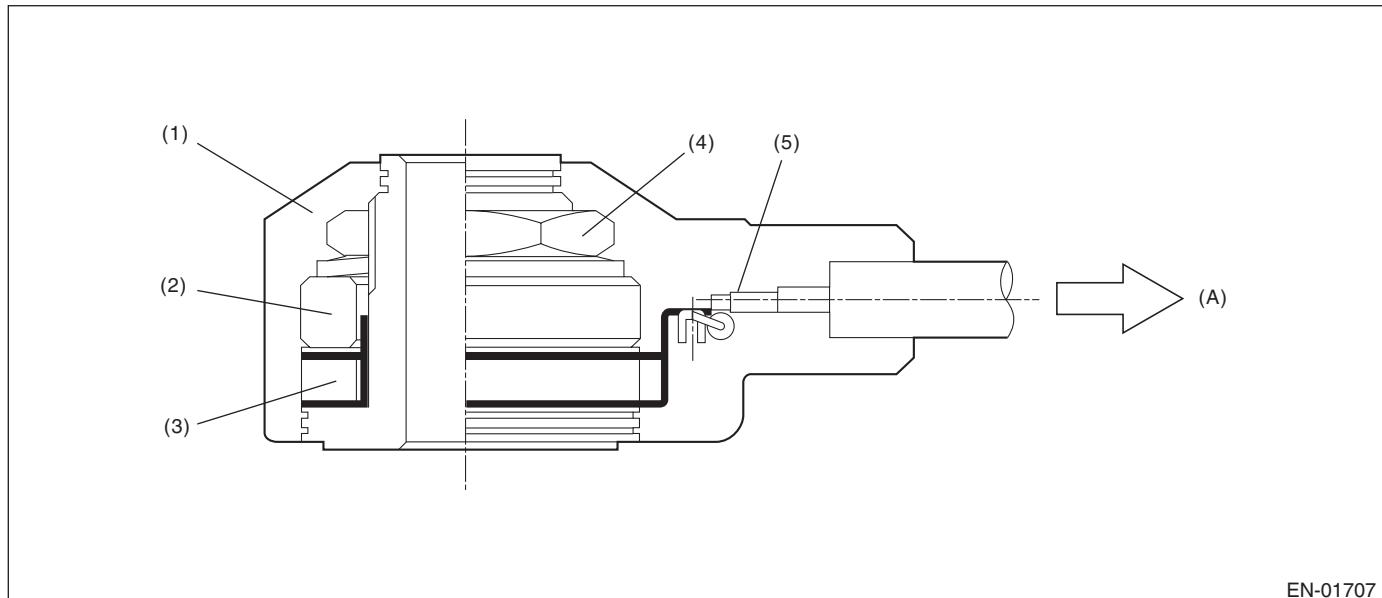
BC:DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of knock sensor.

Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) To knock sensor harness

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

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|------------------------|
| Output voltage | $\geq 4.709 \text{ V}$ |

Time Needed for Diagnosis: 1000 ms

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

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

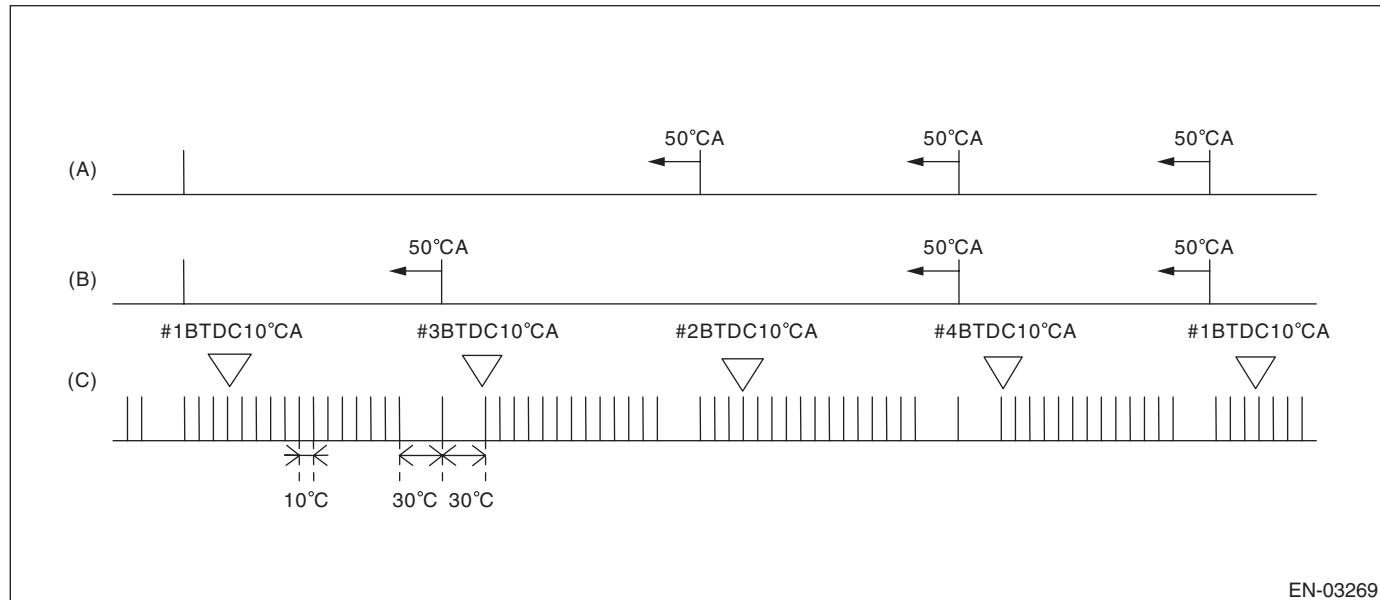
BD:DTC P0335 CRANKSHAFT POSITION SENSOR “A” CIRCUIT

1. OUTLINE OF DIAGNOSIS

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

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

2. COMPONENT DESCRIPTION

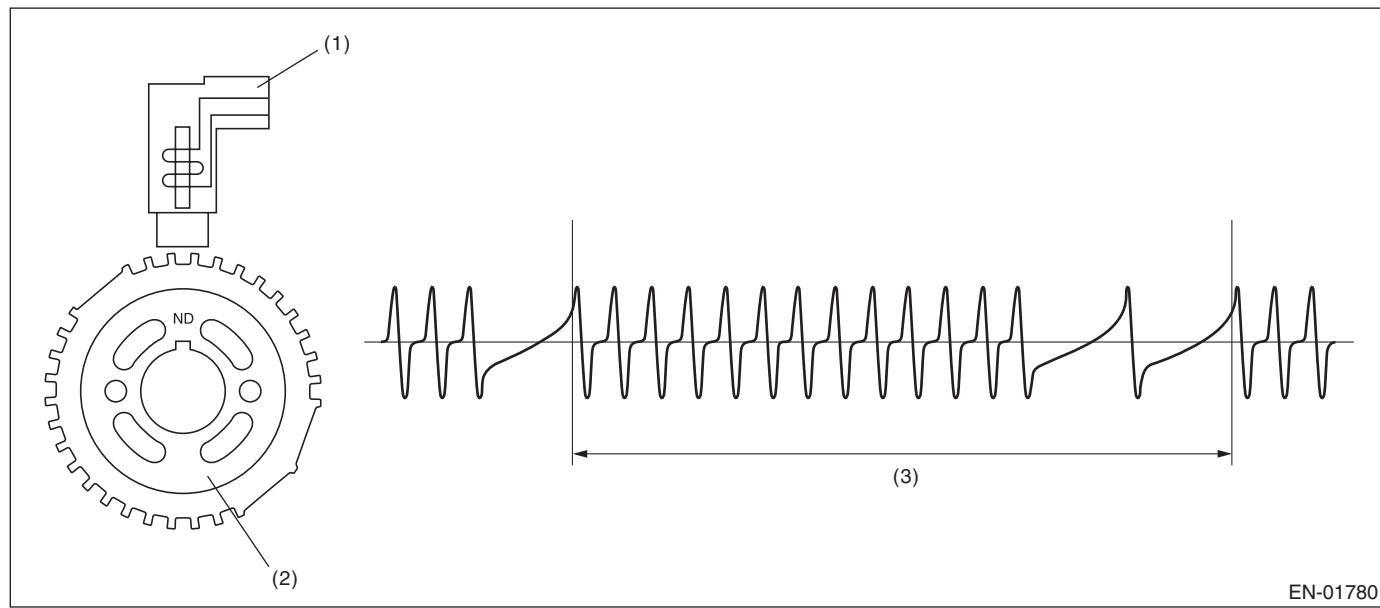


EN-03269

(A) Camshaft signal (RH)

(B) Camshaft signal (LH)

(C) Crankshaft signal



EN-01780

(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.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|-----------------------------------|-----------------|
| Starter switch | ON |
| Crankshaft position sensor signal | Not detected |
| Battery voltage | ≥ 8 V |

Time Needed for Diagnosis: 3000 ms

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

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

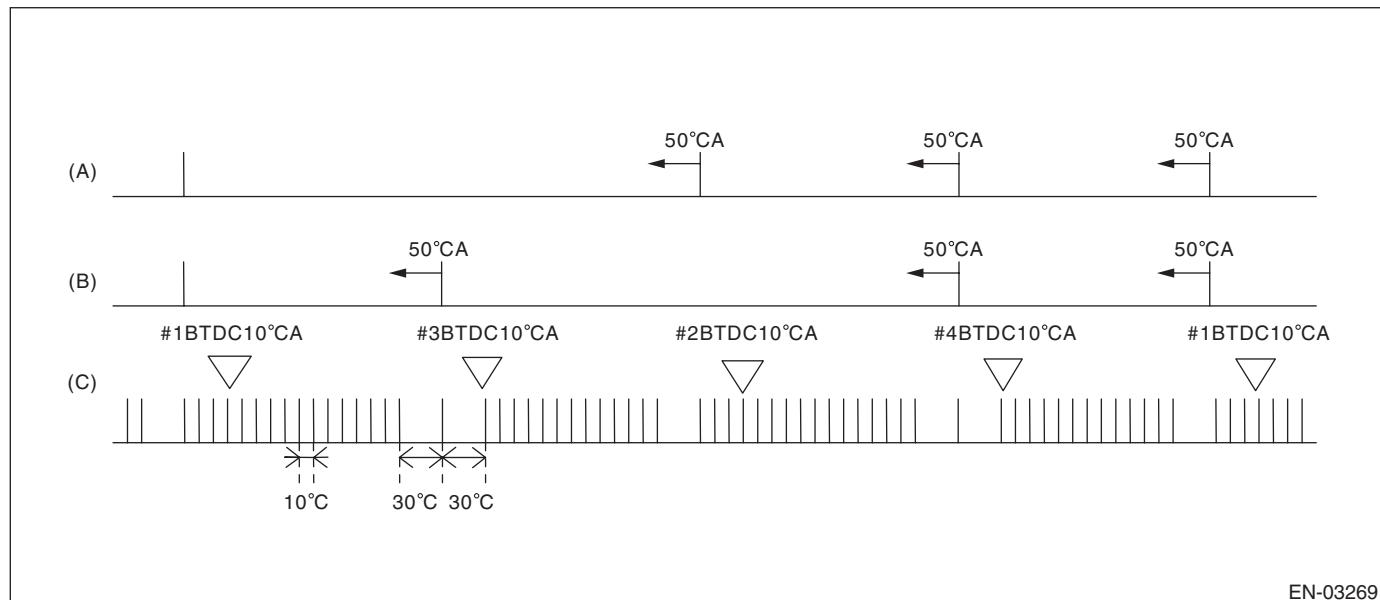
BE:DTC P0336 CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect for faults in crankshaft position sensor output properties.

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

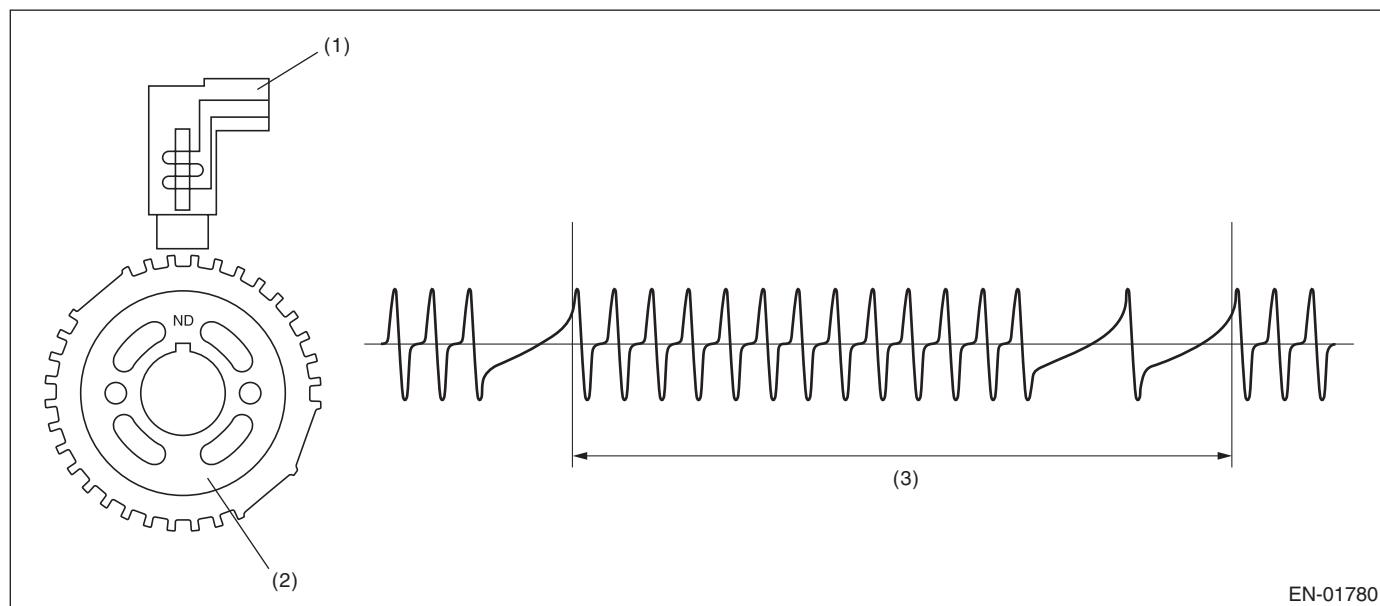
2. COMPONENT DESCRIPTION



(A) Camshaft signal (RH)

(B) Camshaft signal (LH)

(C) Crankshaft signal



(1) Crankshaft position sensor

(2) Crank sprocket

(3) Crankshaft half-turn

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| Battery voltage | ≥ 8 V |
| Engine speed | < 3000 rpm |

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously under 3000 rpm engine speed.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

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

Time Needed for Diagnosis: 10 engine revs.

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

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

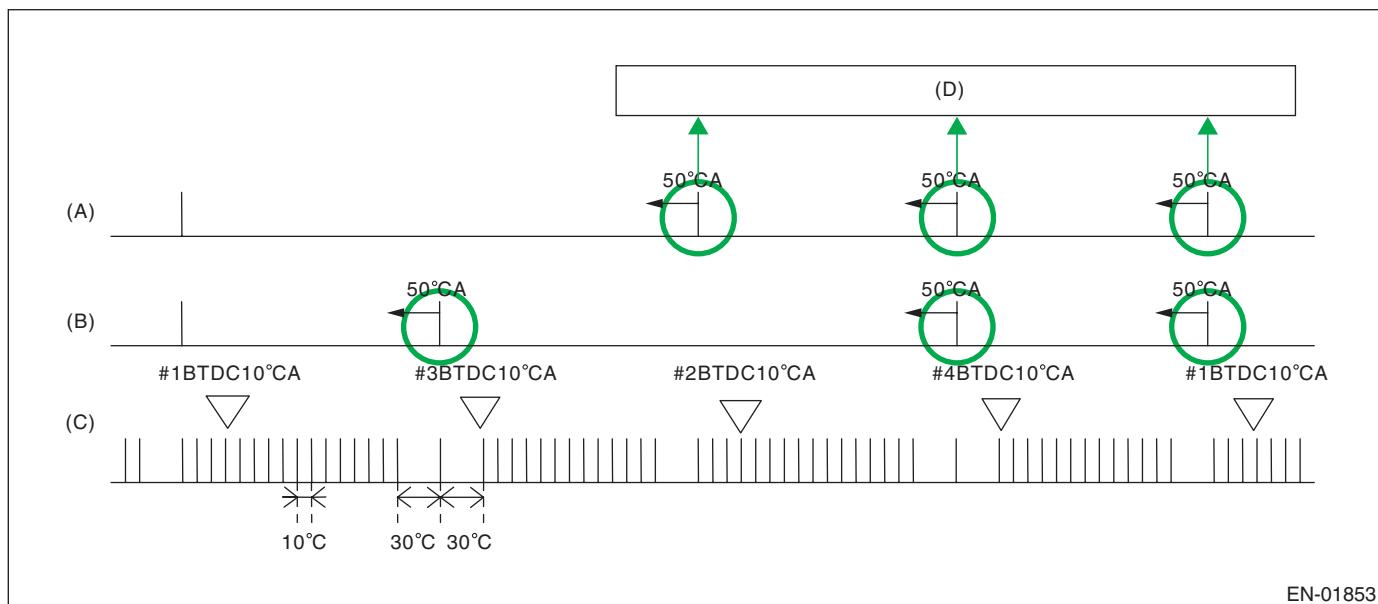
BF:DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR)

1. OUTLINE OF DIAGNOSIS

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

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

2. COMPONENT DESCRIPTION



(A) Camshaft signal (RH)

(B) Camshaft signal (LH)

(C) Crankshaft signal

(D) Number of camshaft position signals = When normal, there will be 3 cam signals for every two engine revolutions.

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| Battery voltage | ≥ 8 V |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment 1

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

Judgment Value

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

Time Needed for Diagnosis: Engine two revolutions × 50 time(s)

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

• Normality Judgment 1

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---------------------------------|-----------------|
| Camshaft position sensor signal | ≥ 3 time(s) |

Time Needed for Diagnosis: Two engine revolutions

• Abnormality Judgment 2

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---------------------------------|-----------------|
| Starter | ON |
| Camshaft position sensor signal | No input |

Time Needed for Diagnosis: 3000 ms

• Normality Judgment 2

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---------------------------------|-----------------|
| Camshaft position sensor signal | Input exists |

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BG:DTC P0345 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0340. <Ref. to GD(H4DOTC)-122, DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

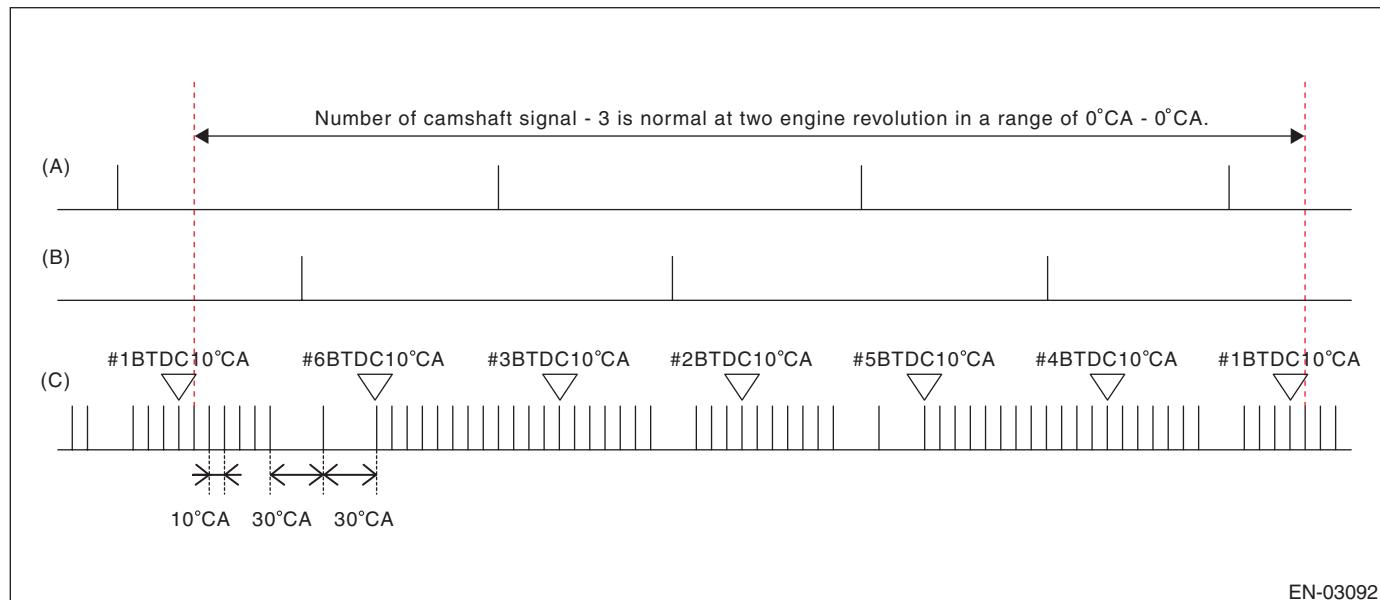
BH:DTC P0365 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 1)

1. OUTLINE OF DIAGNOSIS

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

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

2. COMPONENT DESCRIPTION

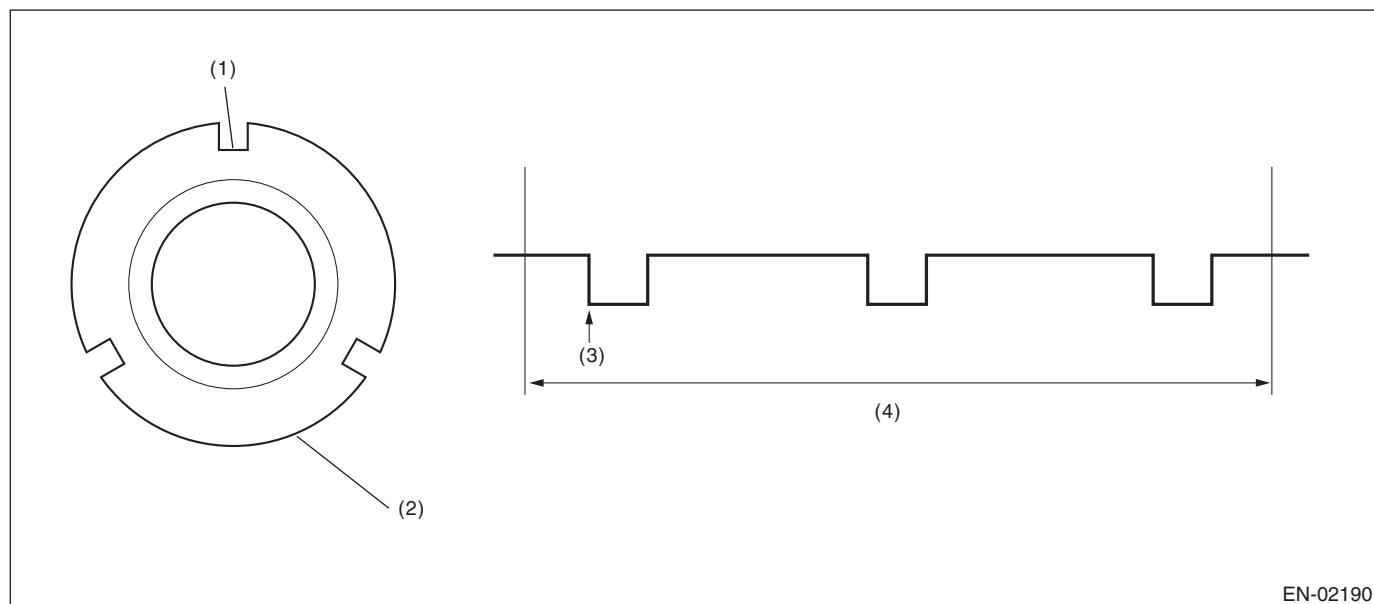


EN-03092

(A) Cam signal (RH)

(B) Cam signal (LH)

(C) Crankshaft signal



EN-02190

(1) Throttle

(3) Detecting point

(4) Camshaft one revolution (crank-shaft two revolutions)

(2) Camshaft plate

3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| Battery voltage | ≥ 8 V |

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: Engine two revolutions × 50

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---------------------------------|-----------------|
| Camshaft position sensor signal | ≥ 2 time(s) |

Time Needed for Diagnosis: Two engine revolutions

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

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0365. <Ref. to GD(H4DOTC)-125, DTC P0365 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

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

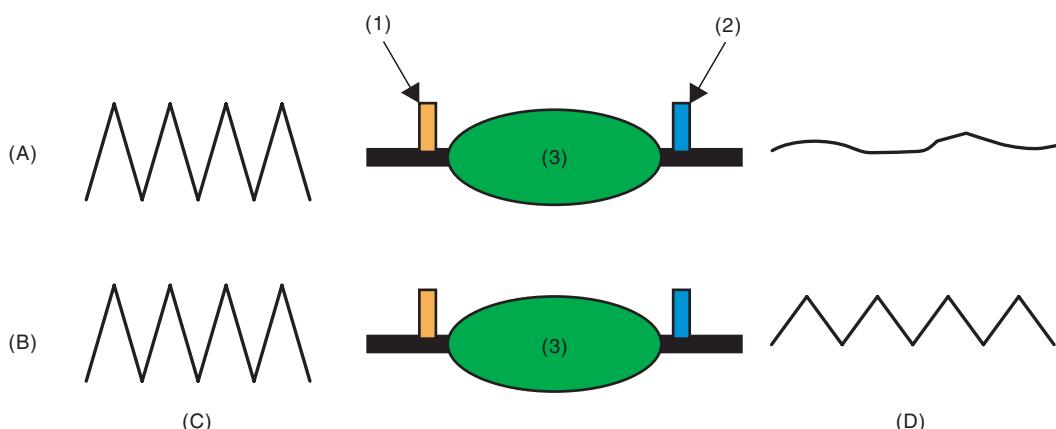
1. OUTLINE OF DIAGNOSIS

Detect the deterioration of the catalyst function.

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

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

2. COMPONENT DESCRIPTION



EN-01713

(A) Normal (B) Deterioration (C) Output waveform from the front oxygen (A/F) sensor
(D) Output waveform from the front oxygen sensor (1) Front oxygen (A/F) sensor (2) Front oxygen sensor (3) Catalytic converter

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|---|--|
| Battery voltage | $\geq 10.9 \text{ V}$ |
| Atmospheric pressure | $\geq 75 \text{ kPa (563 mmHg, 22.2 inHg)}$ |
| Engine coolant temperature | $\geq 72 \text{ }^{\circ}\text{C (161.6 }^{\circ}\text{F)}$ |
| Estimated catalyst temperature | $\geq 540 \text{ }^{\circ}\text{C (1004 }^{\circ}\text{F)}$ |
| Misfire detection every 200 rotations | $< 5 \text{ time(s)}$ |
| 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 | $\geq 1000 \text{ ms}$ |
| Vehicle speed | $> 60 \text{ km/h (37.3 MPH)}$ |
| Amount of intake air | $\geq 6.5 \text{ g/s (0.23 oz/s)}$ and $< 50 \text{ g/s (1.76 oz/s)}$ $< 0.02 \text{ g/rev (0 oz/rev)}$ |
| Engine load change every 0.5 engine revs. | Experienced after fuel cut |
| Rear oxygen output change from 660 mV or less to 660 mV or more | |
| Elapsed time after starting the engine | $\geq 230 \text{ second}$ |
| Purge execution calculated time | $\geq 5 \text{ s}$ |

4. GENERAL DRIVING CYCLE

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

5. DIAGNOSTIC METHOD

After the enable conditions have been established, calculate the front oxygen (A/F) sensor lambda value deviation sum value ($\sum |(sglmd_n - sglmd_{n-1})|$), and rear oxygen sensor output voltage deviation sum value ($\sum |(ro2sad_n - ro2sad_{n-1})|$) in every $32 \text{ ms} \times 4$ times. If the front oxygen (A/F) sensor lambda value deviation sum value ($\sum |(sglmd_n - sglmd_{n-1})|$) is the predetermined value or more, calculate the judgment value.

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|-----------------|
| $\sum (ro2sad_n - ro2sad_{n-1}) / \sum (sglmd_n - sglmd_{n-1}) $ | > 9.03 |

Time Needed for Diagnosis: 30 — 55 seconds

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

• Normality Judgment

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

Judgment Value

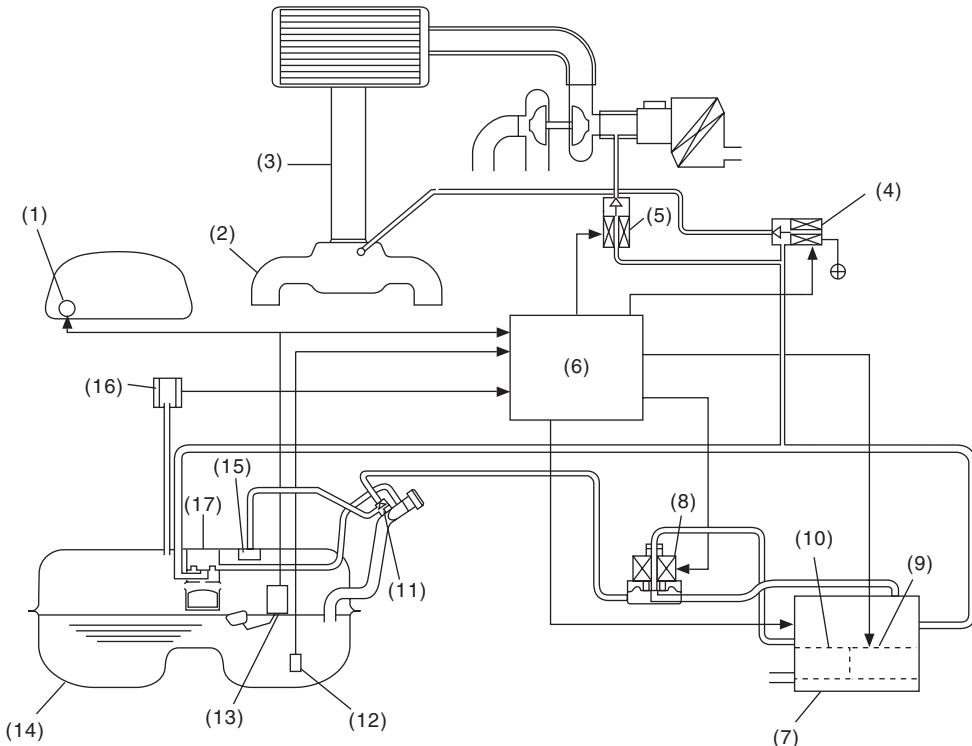
| Malfunction Criteria | Threshold Value |
|---|-----------------|
| $\sum (ro2sad_n - ro2sad_{n-1}) / \sum (sglmd_n - sglmd_{n-1}) $ | ≤ 9.03 |

Time Needed for Diagnosis: 30 — 55 seconds

BK: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.



EN-05372

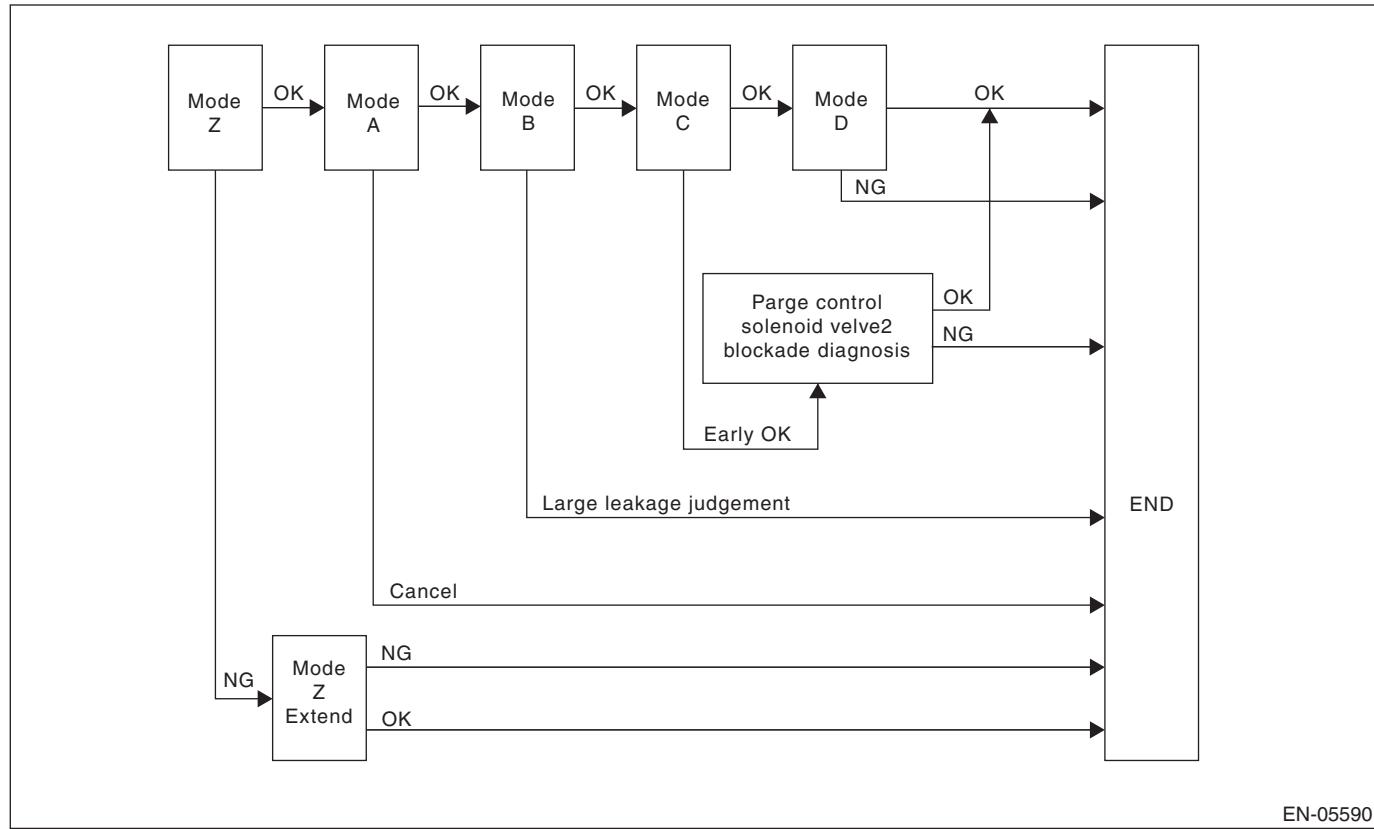
| | | | | | |
|-----|--------------------------------|------|-------------------------|------|---------------------------|
| (1) | Fuel gauge | (7) | Canister | (13) | Fuel level sensor |
| (2) | Intake manifold | (8) | Pressure control valve | (14) | Fuel tank |
| (3) | Throttle body | (9) | Drain valve | (15) | Fuel cut valve |
| (4) | Purge control solenoid valve | (10) | Drain filter | (16) | Fuel tank pressure sensor |
| (5) | Purge control solenoid valve 2 | (11) | Shut-off valve | (17) | Vent valve |
| (6) | Engine control module (ECM) | (12) | Fuel temperature sensor | | |

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 judgment) | Decrease the pressure in the tank to the target value by introducing the intake manifold pressure to the fuel tank. If the tank pressure cannot be reduced, it is diagnosed as large leak. | 0 — 10000 ms + 25000 ms |
| Mode C (Pressure increase check, advanced OK judgment) | Wait until the tank pressure returns to the target (start level of P2 calculation). If the tank pressure does not become the value, make advanced OK judgment. | 0 — 23635 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 |

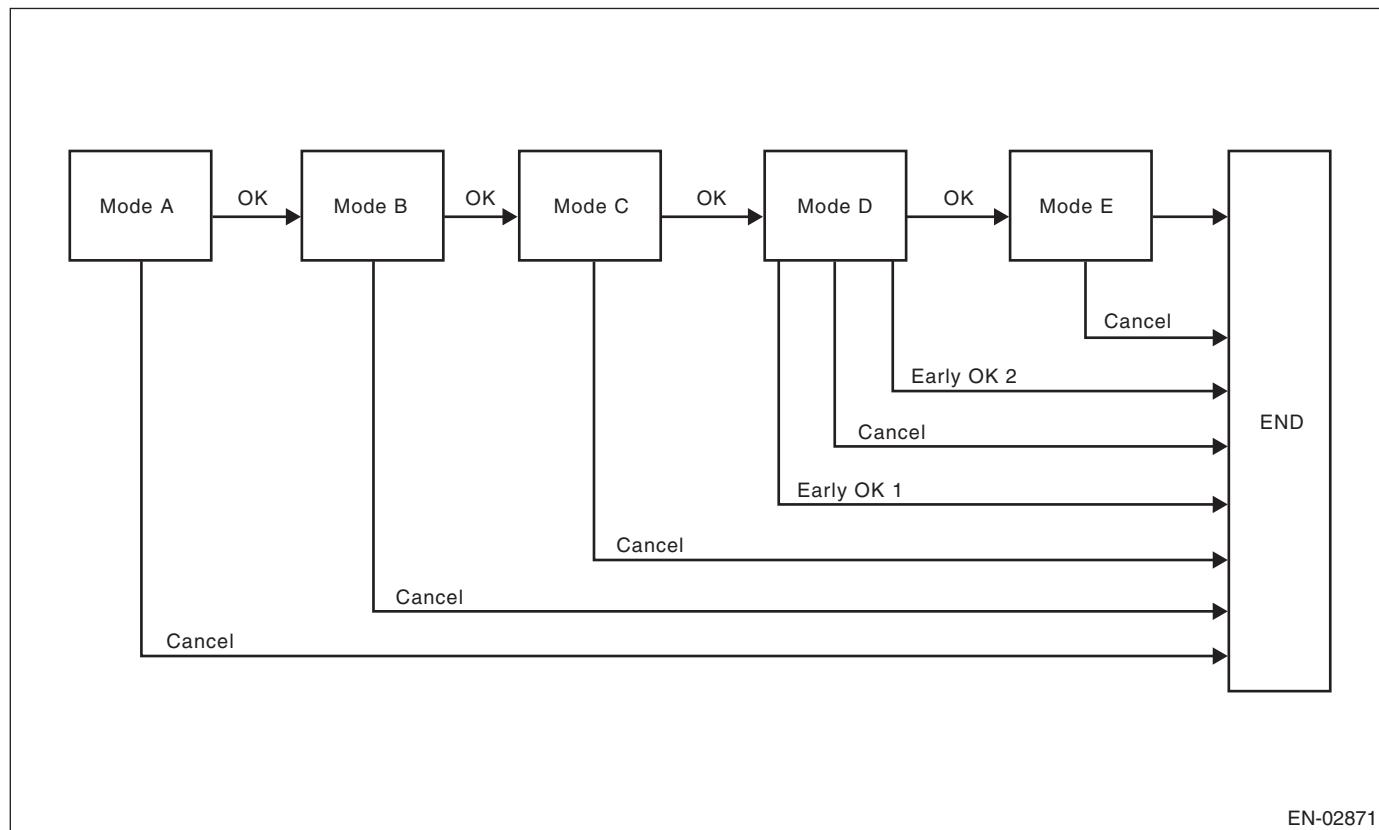
Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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 |

0.02-inch Diagnosis



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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Map 1

| | | | | |
|-----------------------------------|------|----------------|-----------------|--------------------|
| Fuel level (0 , US gal, Imp gal) | 10 | 27, 7.13, 5.94 | 43, 11.36, 9.46 | 59.5, 15.72, 13.09 |
| Time Needed for Diagnosis (ms) | 9216 | 9216 | 7936 | 4736 |

Map 2

| | | | | |
|-----------------------------------|-------|----------------|-----------------|--------------------|
| Fuel level (0 , US gal, Imp gal) | 10 | 27, 7.13, 5.94 | 43, 11.36, 9.46 | 59.5, 15.72, 13.09 |
| Time Needed for Diagnosis (ms) | 21180 | 23924 | 24931 | 24931 |

Map 3

| | | | | |
|-----------------------------------|-------|----------------|-----------------|--------------------|
| Fuel level (0 , US gal, Imp gal) | 10 | 27, 7.13, 5.94 | 43, 11.36, 9.46 | 59.5, 15.72, 13.09 |
| Time Needed for Diagnosis (ms) | 51830 | 32722 | 18045 | 13071 |

Map4

| | | | | | | |
|-----------------------------------|--------|---------------|---------------|----------------|---------------|-----------------|
| Fuel level (0 , US gal, Imp gal) | 10 | 20, 5.28, 4.4 | 30, 7.93, 6.6 | 40, 10.57, 8.8 | 50, 13.21, 11 | 60, 15.85, 13.2 |
| Time Needed for Diagnosis (ms) | 200000 | 200000 | 200000 | 200000 | 200000 | 200000 |

Map 5

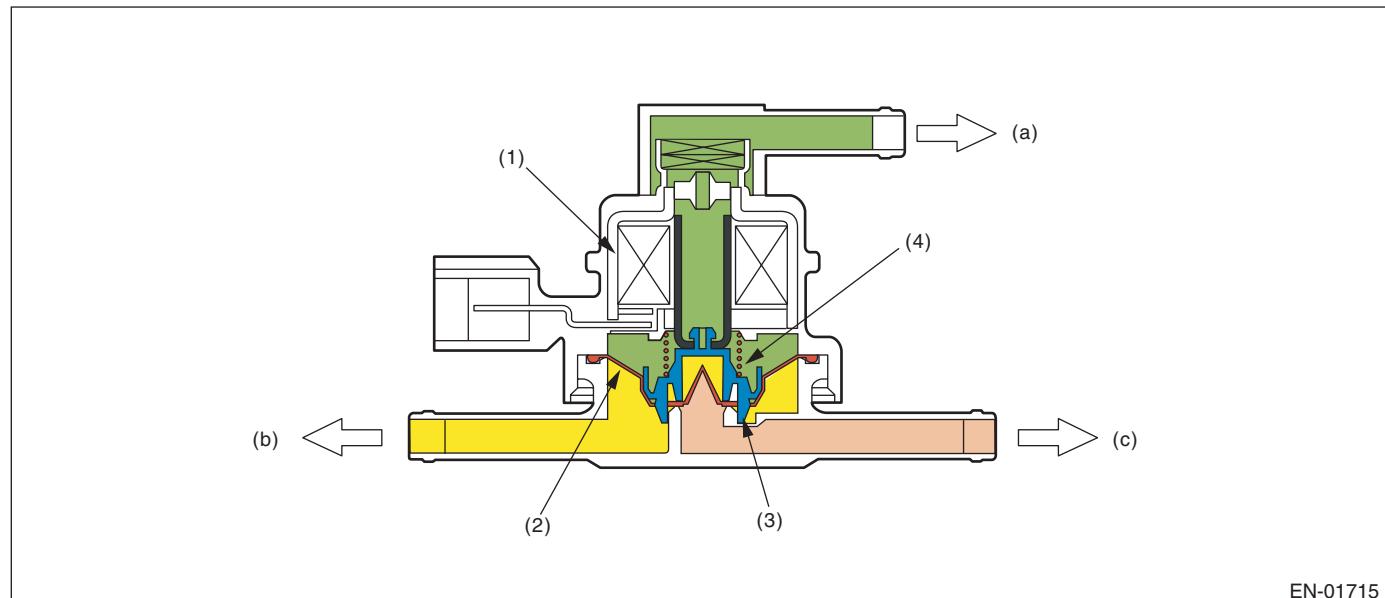
| | | | | | | |
|-----------------------------------|-------|---------------|---------------|----------------|---------------|-----------------|
| Fuel level (0 , US gal, Imp gal) | 10 | 20, 5.28, 4.4 | 30, 7.93, 6.6 | 40, 10.57, 8.8 | 50, 13.21, 11 | 60, 15.85, 13.2 |
| Time Needed for Diagnosis (ms) | 80000 | 70000 | 60000 | 60000 | 60000 | 60000 |

2. COMPONENT DESCRIPTION

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) Atmospheric pressure

(b) Fuel tank

(c) Canister

(1) Solenoid

(3) Valve

(4) Spring

(2) Diaphragm

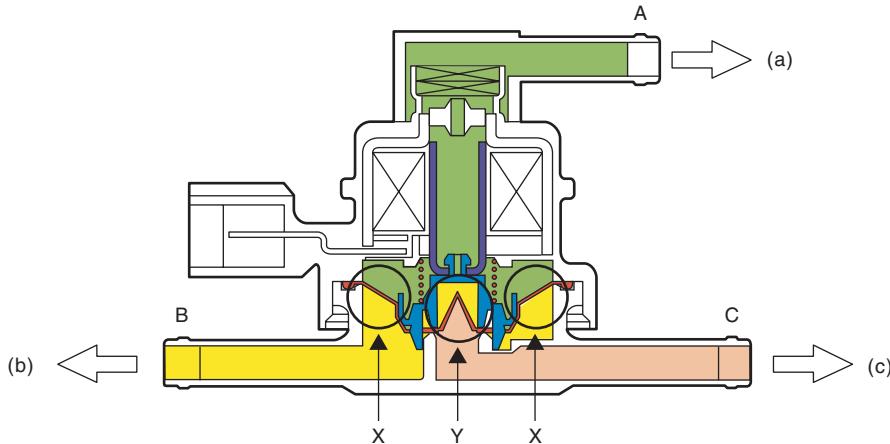
Diagnostic Trouble Code (DTC) Detecting Criteria

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

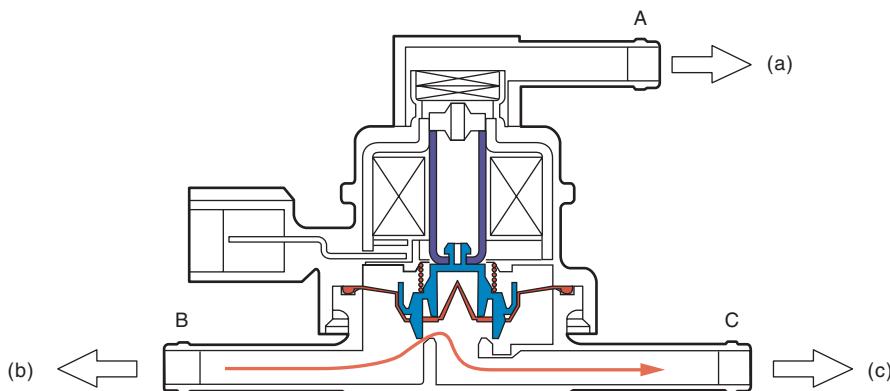
(a) Atmospheric pressure

(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) Atmospheric pressure

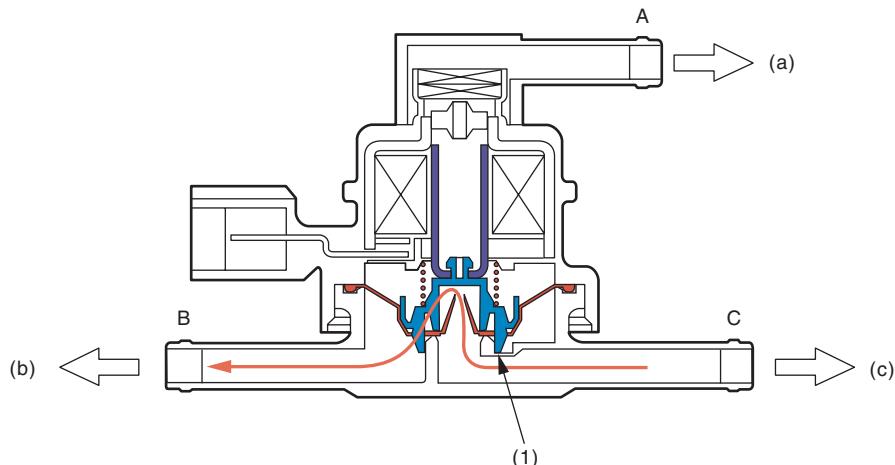
(b) Fuel tank

(c) Canister

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

When $B < C$ (solenoid OFF)



EN-01718

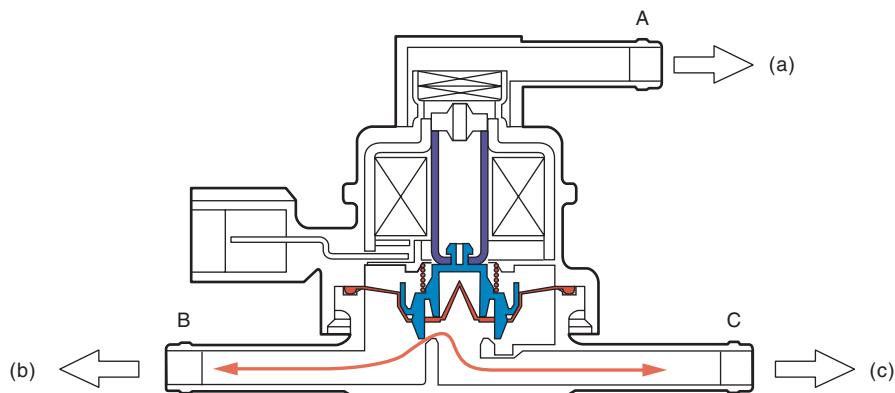
(a) Atmospheric pressure

(b) Fuel tank

(c) Canister

(1) Valve

When Solenoid is ON



EN-01719

(a) Atmospheric pressure

(b) Fuel tank

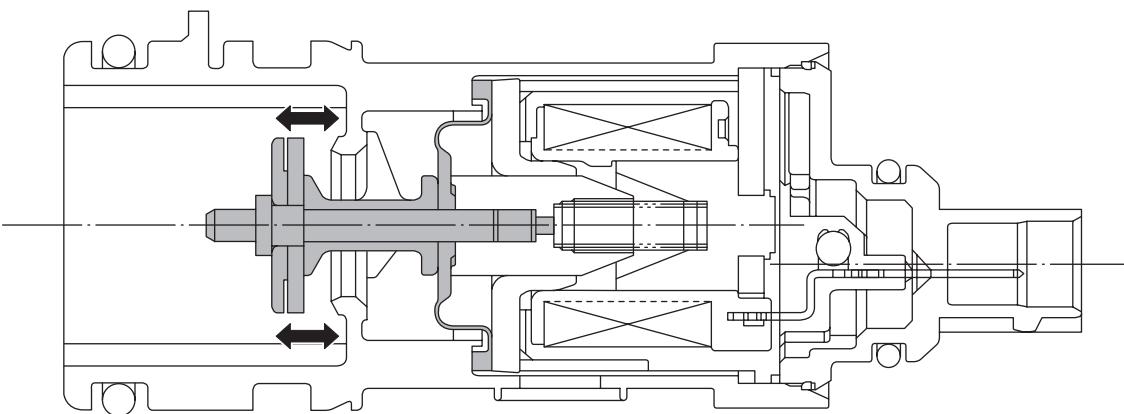
(c) Canister

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Drain valve

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



EN-02293

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITION

0.04-inch Diagnosis

| Secondary Parameters | Enable Conditions |
|---|---|
| Battery voltage | ≥ 10.9 V |
| Atmospheric pressure | ≥ 75 kPa (563 mmHg, 22.2 inHg) |
| Total time of canister purge operation | ≥ 120000 ms |
| Learning value of evaporation gas density | < 0.08 |
| Engine speed | 1050 rpm — 4000 rpm |
| Fuel tank pressure | ≥ -4 kPa (-30 mmHg, -1.2 inHg) |
| Intake manifold relative vacuum (relative pressure) | ≥ -13.3 kPa (-100 mmHg, -3.9 inHg) |
| Continuous time of the status where fuel level is 10.5 ℥ (2.77 US gal, 2.31 Imp gal) — 59.5 ℥ (15.72 US gal, 13.09 Imp gal) | ≥ 37000 ms |
| Closed air/fuel ratio control | In operation |
| Fuel temperature | -10 °C (14 °F) — 45 °C (113 °F) |
| Intake air temperature | ≥ -10 °C (14 °F) |
| Pressure change every 1 second | < 1.7 mmHg (Mode A) < 1.7 mmHg (Mode D) |
| Minimum pressure change value every one second — Maximum pressure change value every one second | < 1.7 mmHg (Mode A) < 1.7 mmHg (Mode D) |
| Fuel level change every 128 milliseconds | $<$ Value of Map 6 |
| Air fuel ratio | 0.76 — 1.25 |
| Elapsed time after starting the engine or | ≥ 856 s |
| Elapsed time after starting the engine | ≥ 335 s and Vehicle speed 72 km/h (44.7 MPH) or more |

Map 6

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

0.02-inch Diagnosis

| Secondary Parameters | Enable Conditions |
|---|--|
| At starting a diagnosis | |
| Evap. diagnosis | Incomplete |
| Battery voltage | ≥ 10.9 V |
| Atmospheric pressure | ≥ 75 kPa (563 mmHg, 22.2 inHg) |
| Time since last incomplete 0.02-inch leakage diagnosis | |
| When cancelling in mode A | > 120000 ms |
| When cancelling in other than mode A | > 240000 ms |
| Total time of canister purge operation | ≥ 120000 ms |
| Elapsed time after starting the engine | ≥ 120 s |
| Fuel temperature | -10 °C (14 °F) — 55 °C (131 °F) |
| Continuous time of the status where fuel level is 10.5 ℥ (2.77 US gal, 2.31 Imp gal) — 59.5 ℥ (15.72 US gal, 13.09 Imp gal) | ≥ 37000 ms |
| Intake manifold relative vacuum (relative pressure) | ≥ -13.3 kPa (-100 mmHg, -3.9 inHg) |
| Fuel tank pressure | -0.7 kPa (-5 mmHg, -0.2 inHg) — 1.4 kPa (10.7 mmHg, 0.4 inHg) |
| Closed air/fuel ratio control | In operation |
| Engine speed | 1050 rpm — 4000 rpm |
| Vehicle speed | Continue the status of 50 km/h (31.1 MPH) — 510 km/h (316.9 MPH) for 125000 ms or more. |
| During diagnosis | |
| Change of fuel level | \leq Value of Map 7 |
| Pressure change every 1 second | < 0.1 kPa (0.44 mmHg, 0 inHg) |
| Minimum pressure change value every one second — Maximum pressure change value every one second | < 0.1 kPa (0.51 mmHg, 0 inHg) (Mode D) |
| Tank pressure change every 1 second | ≤ 0.1 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 7

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

4. GENERAL DRIVING CYCLE

0.04-inch Diagnosis

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

0.02-inch Diagnosis

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

5. DIAGNOSTIC METHOD

Purge control solenoid valve stuck open fault diagnosis

DTC

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

Purpose of Mode Z

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

Diagnostic method

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

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value | DTC |
|--|---------------------------------|-------|
| evptez – evptezha | > 0.9 kPa (6.5 mmHg, 0.3 inHg) | P0457 |
| evptezini | ≤ 1.4 kPa (10.7 mmHg, 0.4 inHg) | |
| Time with no fuel sloshing equal to or over the value of Map 6 | ≥ 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 judgment for purge control solenoid valve stuck open NG is made, end the evaporative diagnosis. Cancel the evaporative diagnosis when the OK/NG judgment for purge control solenoid valve stuck open cannot be made in Mode Z.

• Normality Judgment

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

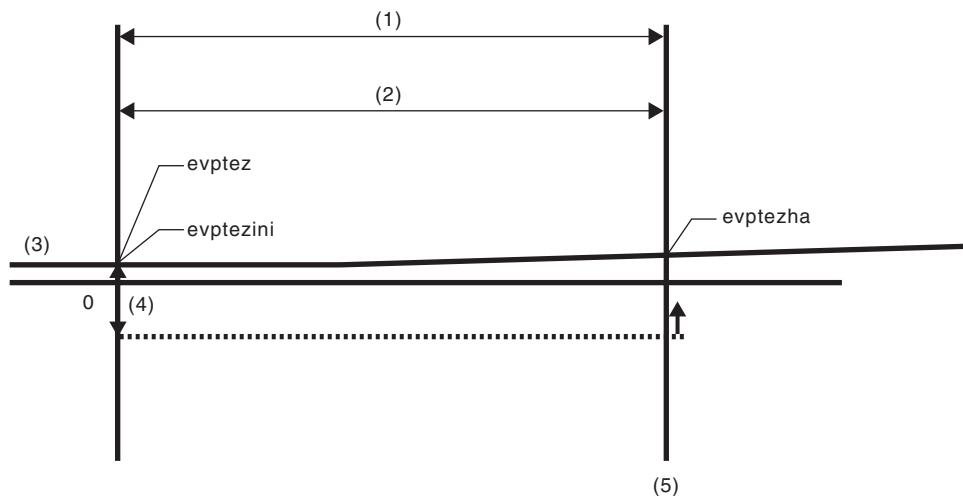
Judgment Value

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Normal



EN-02869

(1) Mode Z

(2) 3000 ms

(3) Fuel tank pressure

(4) 0.4 kPa (3 mmHg, 0.1 inHg)

(5) OK judgment

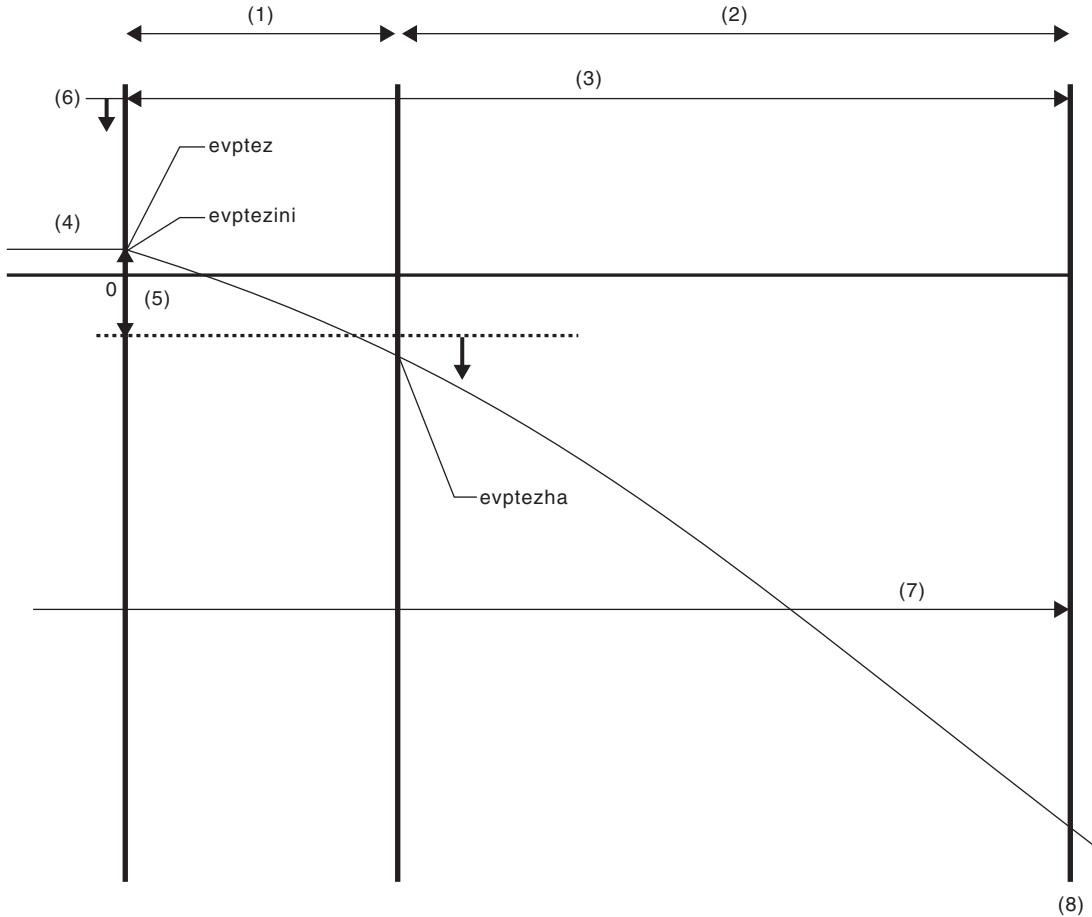
evptez – evptezha \leq 0.4 kPa (3 mmHg, 0.1 inHg) Normal when above is established

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 judgment |
| (3) 0 ms + 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 with value from Map 6 or more lasts for 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 Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value | DTC |
|---|-------------------------------------|-------|
| Time to reach target negative pressure or Mode B time | ≥ 10000 ms + 25000 ms ≥ 10000 ms | P0457 |
| (Min. pressure value in tank when in mode B) – (Tank pressure when mode B started) | > -0.3 kPa (-2.5 mmHg, -0.1 inHg) | |

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

| Tank pressure when starting calculation of P2 | Time for advanced OK judgment |
|---|-------------------------------|
| -1.4 kPa (-10.5 mmHg, -0.4 inHg) | 23635 ms |

Time Needed for Diagnosis: 0 ms + 3000 ms + 10000 ms + 10000 ms + 25000 ms + 23635 ms

Mode D: (Measure amount of negative pressure change)

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

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

When Mode D is ended

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

Abnormality Judgment

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

Judgment Value

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

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Map 8 Malfunction criteria limit for evaporation diagnosis

| Fuel temperature vs. Fuel level | 15 °C (59 °F) | 25 °C (77 °F) | 35 °C (95 °F) | 45 °C (113 °F) |
|--------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| 10.5 ℥ (2.77 US gal, 2.31 Imp gal) | 0.3 kPa (2.00 mmHg, 0.1 inHg) | 0.3 kPa (2.17 mmHg, 0.1 inHg) | 0.3 kPa (2.34 mmHg, 0.1 inHg) | 0.4 kPa (2.66 mmHg, 0.1 inHg) |
| 27 ℥ (7.13 US gal, 5.94 Imp gal) | 0.3 kPa (2.12 mmHg, 0.1 inHg) | 0.3 kPa (2.22 mmHg, 0.1 inHg) | 0.3 kPa (2.40 mmHg, 0.1 inHg) | 0.4 kPa (3.07 mmHg, 0.1 inHg) |
| 43 ℥ (11.36 US gal, 9.46 Imp gal) | 0.4 kPa (2.74 mmHg, 0.1 inHg) | 0.4 kPa (2.91 mmHg, 0.1 inHg) | 0.4 kPa (3.08 mmHg, 0.1 inHg) | 0.4 kPa (3.26 mmHg, 0.1 inHg) |
| 59.5 ℥ (15.72 US gal, 13.09 Imp gal) | 0.5 kPa (3.38 mmHg, 0.1 inHg) | 0.5 kPa (3.86 mmHg, 0.2 inHg) | 0.5 kPa (3.87 mmHg, 0.2 inHg) | 0.5 kPa (4.07 mmHg, 0.2 inHg) |

Time Needed for Diagnosis: 0 ms + 3000 ms + 10000 ms + 10000 ms + 25000 ms + 23635 ms + 10000 ms

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Leak Diagnosis

DTC

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

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

Mode A: (0 point compensation)

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

Mode B: (Negative pressure introduced)

Introduce negative pressure in the intake manifold to the tank.

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

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

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

Mode C: (Negative pressure maintained)

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

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

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

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

Normality Judgment

Judge as OK when the following conditions are established.

Judgment Value

| Malfunction Criteria | Threshold Value |
|-------------------------------|--------------------------|
| Advanced OK judgment 1 | |
| Mode D time | ≥ 0 ms + 20000 ms |
| Tank internal pressure | ≤ Value of Map 9 |
| Advanced OK judgment 2 | |
| Mode D time | ≥ 0 ms + Value of Map 10 |
| P2 | ≤ Value of Map 11 |

Map 9

| | | | | |
|---------------------------------|--------------------|--------------------|--------------------|--------------------|
| Fuel level (l, US gal, Imp gal) | 10, 2.64, 2.2 | 27, 7.13, 5.94 | 43, 11.36, 9.46 | 59.5, 15.72, 13.09 |
| Tank pressure (kPa, mmHg, inHg) | -1.9, -14.61, -0.6 | -1.9, -14.61, -0.6 | -1.8, -13.64, -0.5 | -1.8, -13.13, -0.5 |

Map 10

| | | | | | | |
|---------------------------------|---------------|---------------|---------------|----------------|---------------|-----------------|
| Fuel level (l, US gal, Imp gal) | 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) | 200000 | 200000 | 200000 | 200000 | 200000 | 200000 |

Map 11

| | | | | |
|---------------------------------|----------------|----------------|-----------------|--------------------|
| Fuel level (l, US gal, Imp gal) | 10, 2.64, 2.2 | 27, 7.13, 5.94 | 43, 11.36, 9.46 | 59.5, 15.72, 13.09 |
| Tank pressure (kPa, mmHg, inHg) | 1.1, 8.52, 0.3 | 1.1, 8.52, 0.3 | 1.3, 10, 0.4 | 1.3, 10, 0.4 |

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Mode E: (Evaporation occurrence amount calculation)

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

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

| Malfunction Criteria | | Threshold Value | |
|----------------------|--|-------------------|--|
| P1 | | < Value of Map 12 | |

Map 12 Malfunction criteria limit for evaporation diagnosis

| Time (evpdset) vs. Fuel level | 40000 ms | 60000 ms | 105000 ms | 110000 ms | 140000 ms | 160000 ms | 180000 ms | 200000 ms |
|--------------------------------------|---------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
| 10.5 ℥ (2.77 US gal, 2.31 Imp gal) | 0 kPa (0.00 mmHg, 0 inHg) | 0.1 kPa (0.70 mmHg, 0.1 inHg) | 0.3 kPa (2.18 mmHg, 0.1 inHg) | 0.3 kPa (2.23 mmHg, 0.1 inHg) | 0.3 kPa (2.53 mmHg, 0.1 inHg) | 0.4 kPa (2.72 mmHg, 0.1 inHg) | 0.4 kPa (2.90 mmHg, 0.1 inHg) | 0.4 kPa (2.90 mmHg, 0.1 inHg) |
| 27 ℥ (7.13 US gal, 5.94 Imp gal) | 0 kPa (0.00 mmHg, 0 inHg) | 0.2 kPa (1.81 mmHg, 0.1 inHg) | 0.3 kPa (2.46 mmHg, 0.1 inHg) | 0.3 kPa (2.53 mmHg, 0.1 inHg) | 0.4 kPa (2.90 mmHg, 0.1 inHg) |
| 43 ℥ (11.36 US gal, 9.46 Imp gal) | 0 kPa (0.00 mmHg, 0 inHg) | 0.2 kPa (1.53 mmHg, 0.1 inHg) | 0.3 kPa (2.49 mmHg, 0.1 inHg) | 0.3 kPa (2.60 mmHg, 0.1 inHg) | 0 kPa (0.00 mmHg, 0 inHg) |
| 59.5 ℥ (15.72 US gal, 13.09 Imp gal) | 0 kPa (0.00 mmHg, 0 inHg) | 0.2 kPa (1.31 mmHg, 0.1 inHg) | 0.3 kPa (2.53 mmHg, 0.1 inHg) | 0.2 kPa (1.26 mmHg, 0 inHg) | 0 kPa (0.00 mmHg, 0 inHg) |

Time needed for diagnosis: Value from Map 1 + Value from Map 2 + Value from Map 3 + 0 ms + Value from Map 4 + 0 ms + Value from Map 4 + Value from Map 5

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

• Normality Judgment

Judge as OK when the following conditions are established.

Judgment Value

| Malfunction Criteria | | Threshold Value | |
|----------------------|--|-------------------|--|
| P1 | | > Value of Map 13 | |

Map 13 Malfunction criteria limit for evaporation diagnosis

| Time (evpdset) vs. Fuel level | 20000 ms | 60000 ms | 105000 ms | 110000 ms | 140000 ms | 160000 ms | 180000 ms | 200000 ms |
|--------------------------------------|---------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
| 10.5 ℥ (2.77 US gal, 2.31 Imp gal) | 0 kPa (0.00 mmHg, 0 inHg) | 0.3 kPa (2.20 mmHg, 0.1 inHg) | 0.5 kPa (3.68 mmHg, 0.1 inHg) | 0.5 kPa (3.73 mmHg, 0.1 inHg) | 0.5 kPa (4.03 mmHg, 0.2 inHg) | 0.6 kPa (4.22 mmHg, 0.2 inHg) | 0.6 kPa (4.40 mmHg, 0.2 inHg) | 0.6 kPa (4.40 mmHg, 0.2 inHg) |
| 27 ℥ (7.13 US gal, 5.94 Imp gal) | 0 kPa (0.00 mmHg, 0 inHg) | 0.4 kPa (3.31 mmHg, 0.1 inHg) | 0.5 kPa (3.96 mmHg, 0.2 inHg) | 0.5 kPa (4.03 mmHg, 0.2 inHg) | 0.6 kPa (4.40 mmHg, 0.2 inHg) |
| 43 ℥ (11.36 US gal, 9.46 Imp gal) | 0 kPa (0.00 mmHg, 0 inHg) | 0.4 kPa (3.03 mmHg, 0.1 inHg) | 0.5 kPa (3.99 mmHg, 0.2 inHg) | 0.5 kPa (4.10 mmHg, 0.2 inHg) | 0.2 kPa (1.50 mmHg, 0.1 inHg) |
| 59.5 ℥ (15.72 US gal, 13.09 Imp gal) | 0 kPa (0.00 mmHg, 0 inHg) | 0.4 kPa (2.81 mmHg, 0.1 inHg) | 0.5 kPa (4.03 mmHg, 0.2 inHg) | 0.4 kPa (2.76 mmHg, 0.1 inHg) | 0.2 kPa (1.50 mmHg, 0.1 inHg) |

Time needed for diagnosis: Value from Map 1 + Value from Map 2 + Value from Map 3 + 0 ms + Value from Map 4 + 0 ms + Value from Map 4 + Value from Map 5

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

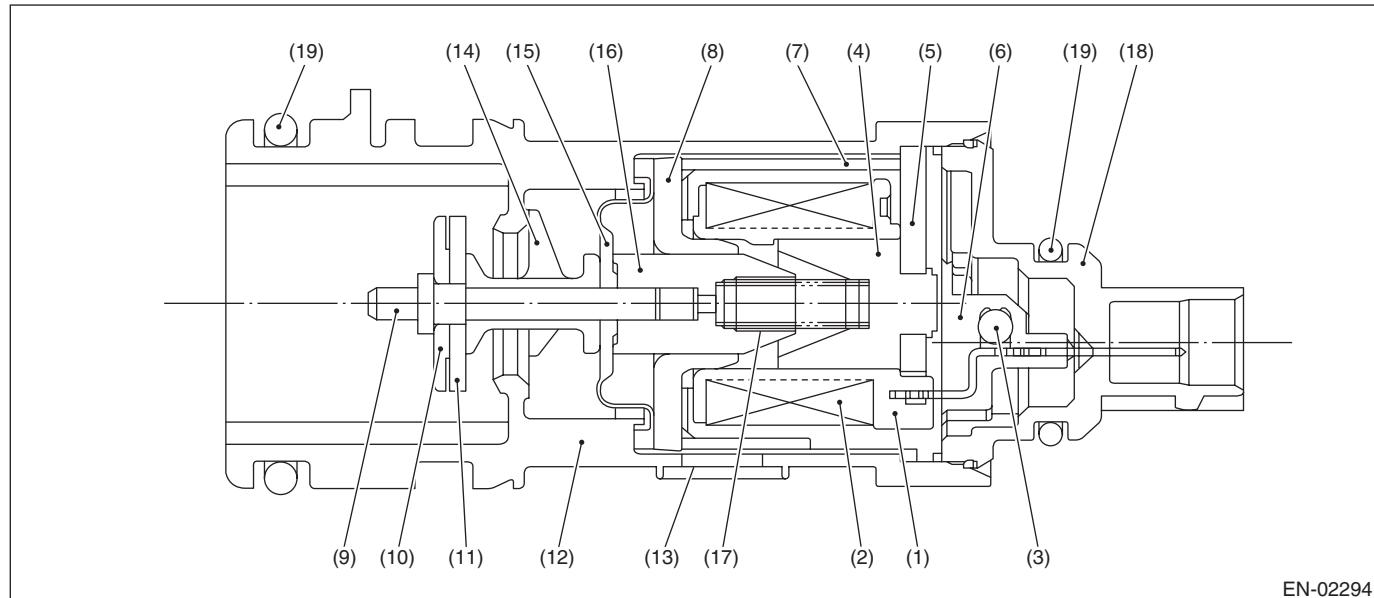
BL:DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN

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

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|-----------------|
| Battery voltage | ≥ 10.9 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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

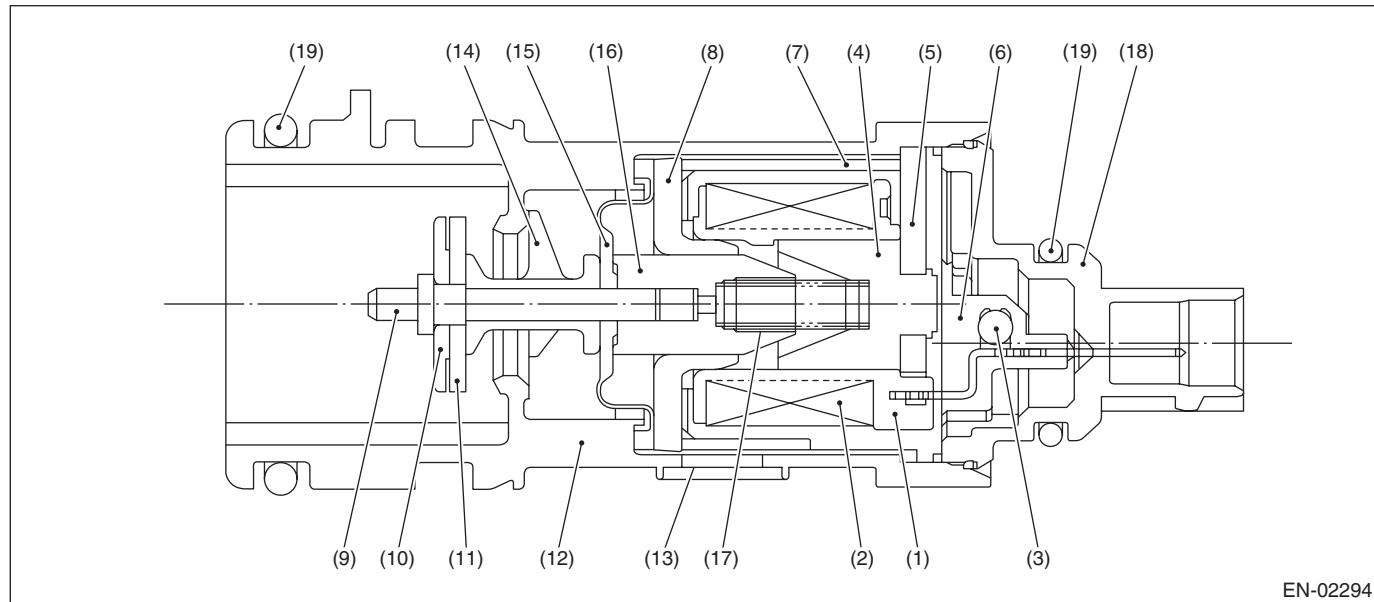
BM:DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the drain valve.

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

2. COMPONENT DESCRIPTION



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

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

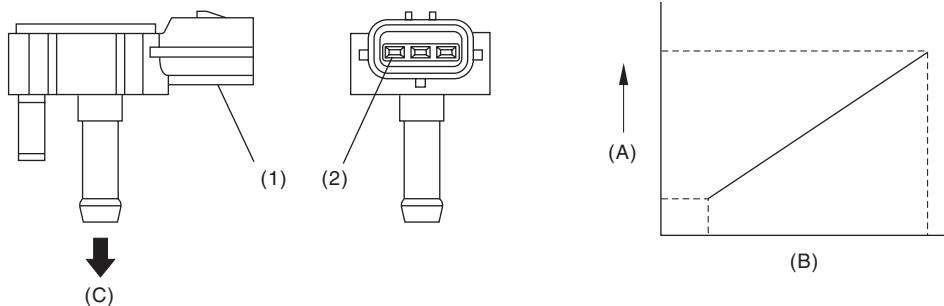
BN:DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR

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-04462

(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 | ≥ 10.5 l (2.77 US gal, 2.31 Imp gal) |
| Fuel temperature | < 35 °C (95 °F) |
| Battery voltage | ≥ 10.9 V |
| Atmospheric 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.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|------------------------------|
| Number of times that the difference between the Max. fuel level every 60 s and Min. fuel level every 60 s is 2 ℥ (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 (12.6°F) |

If the difference between the Max. fuel level every 60 s and Min. fuel level every 60 s is less than 2 ℥ (0.53 US gal, 0.44 Imp gal), extend 60 s and make judgment with the Max. and Min. values for the fuel level in 60 s × 2. If there is no difference after the extension of 60 s, continue further to 60 s × 3, 60 s × 4, 60 s × 5. If the difference between the Max. fuel level every 60 s and Min. fuel level every 60 s is 2 ℥ (0.53 US gal, 0.44 Imp gal) or more, the diagnosis counter counts up.

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

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

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

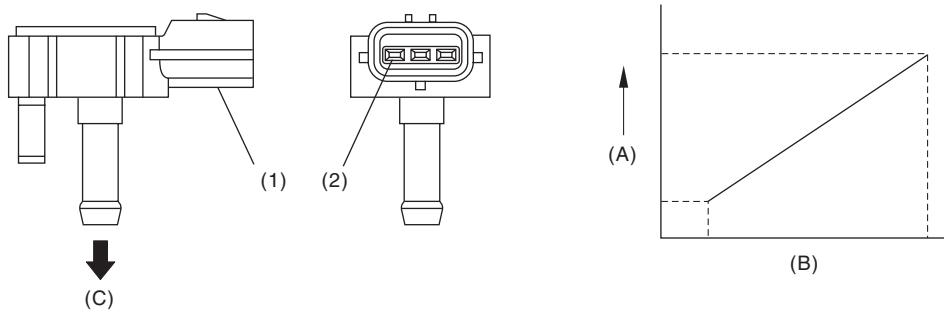
GENERAL DESCRIPTION

BO: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-04462

(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.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|------------------------------------|
| Fuel tank pressure | < -7.4 kPa (-55.6 mmHg, -2.2 inHg) |
| Battery voltage | ≥ 10.9 V |

Time Needed for Diagnosis: 15000 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|------------------------------------|
| Fuel tank pressure | ≥ -7.4 kPa (-55.6 mmHg, -2.2 inHg) |
| Battery voltage | ≥ 10.9 V |

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

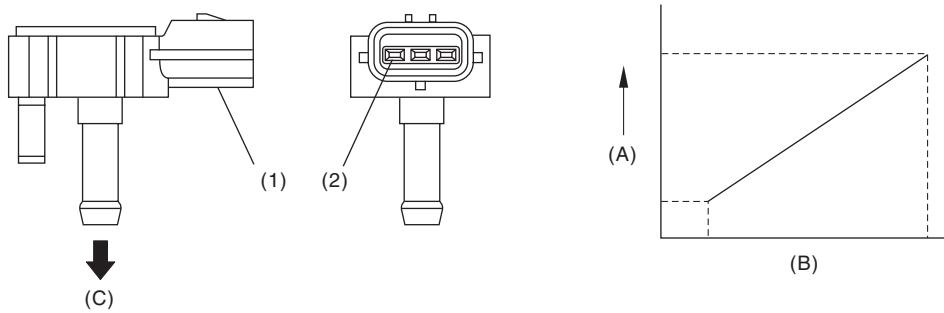
GENERAL DESCRIPTION

BP: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-04462

(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 | Complete |
| 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.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: 15000 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|---------------------------------|
| Fuel tank pressure | < 7.9 kPa (59.6 mmHg, 2.3 inHg) |

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BQ: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(H4DOTC)-129, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

BR: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(H4DOTC)-129, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

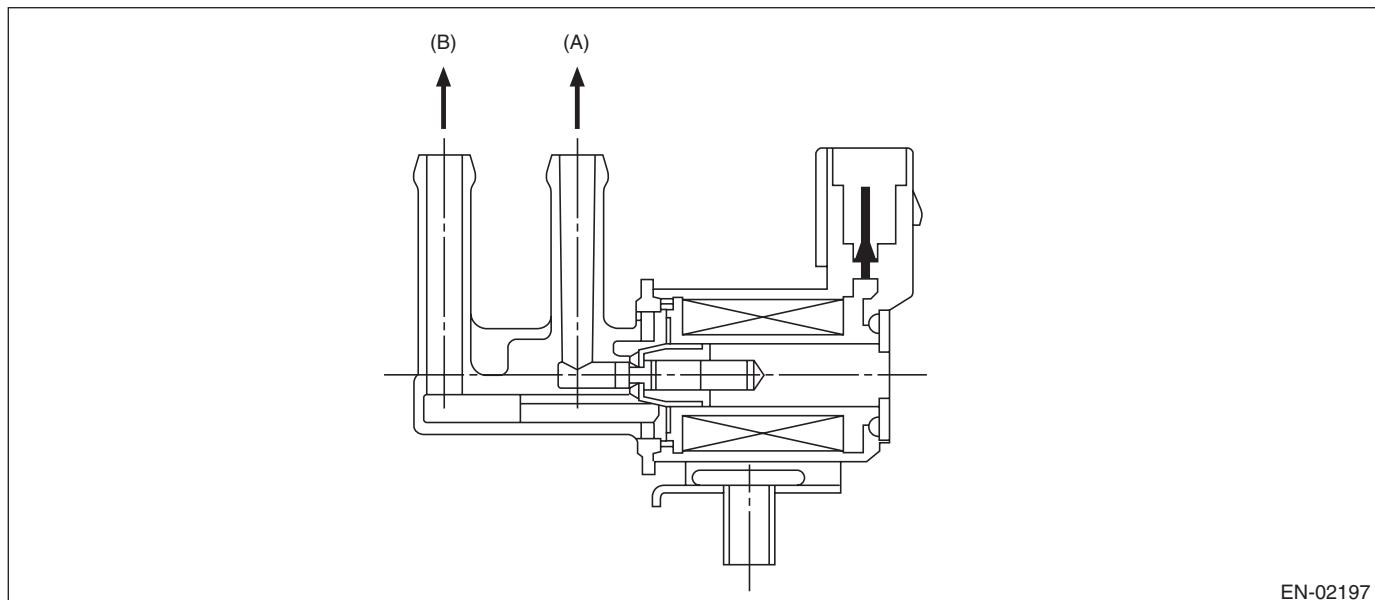
BS:DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

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

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

2. COMPONENT DESCRIPTION



(A) To canister

(B) To intake manifold

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|--|-------------------|
| Battery voltage | ≥ 10.9 V |
| Elapsed time after starting the engine | ≥ 1 second |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|-------------------------|-----------------|
| Duty ratio of "ON" | < 0.75 |
| Terminal output voltage | Low |

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|-------------------------|-----------------|
| Terminal output voltage | High |

Time Needed for Diagnosis: Less than 1 second

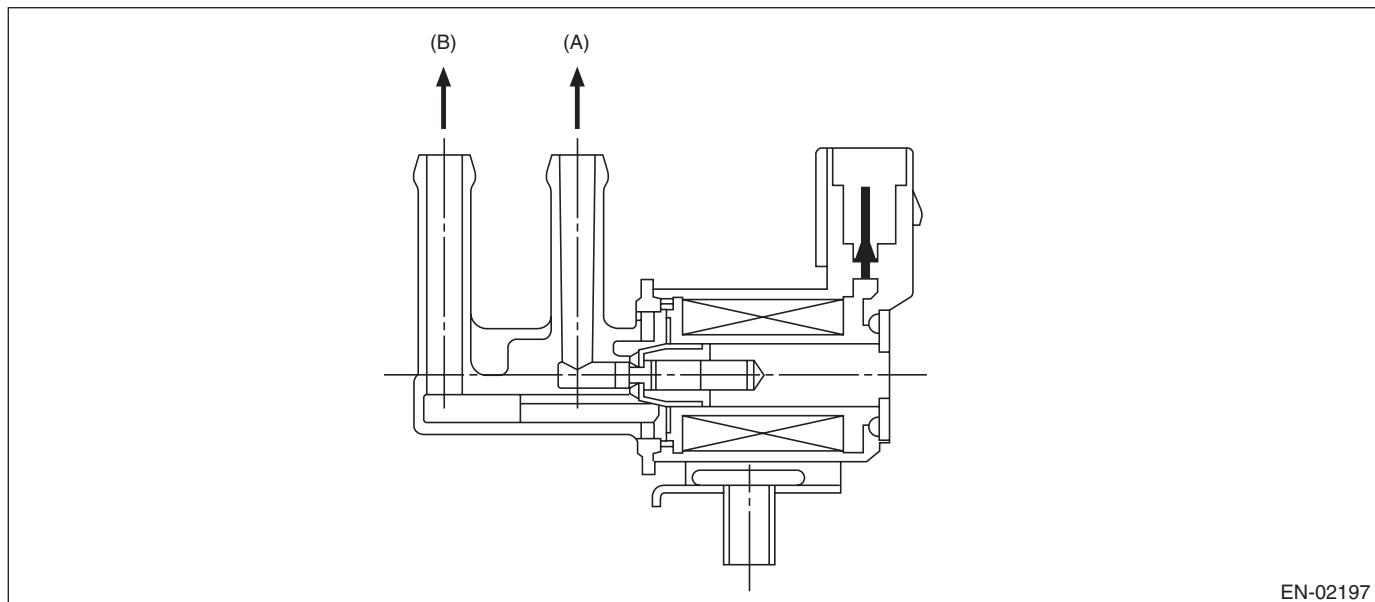
BT:DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

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

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

2. COMPONENT DESCRIPTION



(A) To canister

(B) To intake manifold

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|--|-------------------|
| Battery voltage | ≥ 10.9 V |
| Elapsed time after starting the engine | ≥ 1 second |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|-------------------------|-----------------|
| Duty ratio of "ON" | ≥ 0.25 |
| Terminal output voltage | High |

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|-------------------------|-----------------|
| Terminal output voltage | Low |

Time Needed for Diagnosis: Less than 1 second

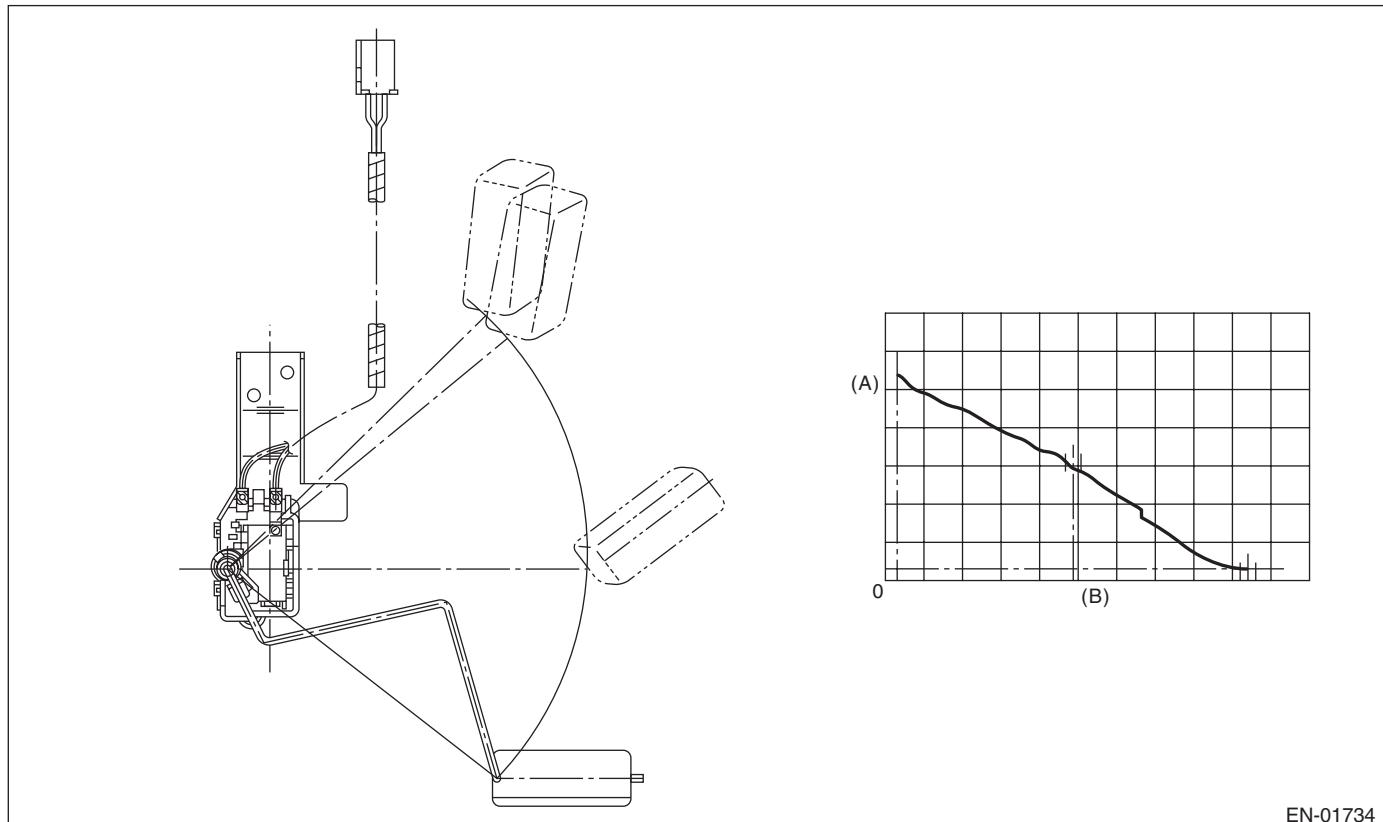
BU:DTC P0461 FUEL LEVEL SENSOR “A” CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect malfunctions of the fuel level sensor output property.

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

2. COMPONENT DESCRIPTION



(A) Fuel level

(B) Resistance

EN-01734

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|---|
| Accumulated amount of intake air | $\geq 330957 \text{ g (11672.85 oz)}$ |
| Max. – min. values of fuel level output | $< 2.6 \text{ l (0.69 US gal, 0.57 Imp gal)}$ |
| Battery voltage | $\geq 10.9 \text{ V}$ |
| Engine speed | $< 4000 \text{ rpm}$ |
| Elapsed time after starting the engine | $\geq 5000 \text{ ms}$ |

Time Needed for Diagnosis: Less than 1 second

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|--|
| Accumulated amount of intake air | $\geq 330957 \text{ g (11672.85 oz)}$ |
| Max. – min. values of fuel level output | $\geq 2.6 \text{ l (0.69 US gal, 0.57 Imp gal)}$ |
| Battery voltage | $\geq 10.9 \text{ V}$ |
| Engine speed | $< 4000 \text{ rpm}$ |
| Elapsed time after starting the engine | $\geq 5000 \text{ ms}$ |

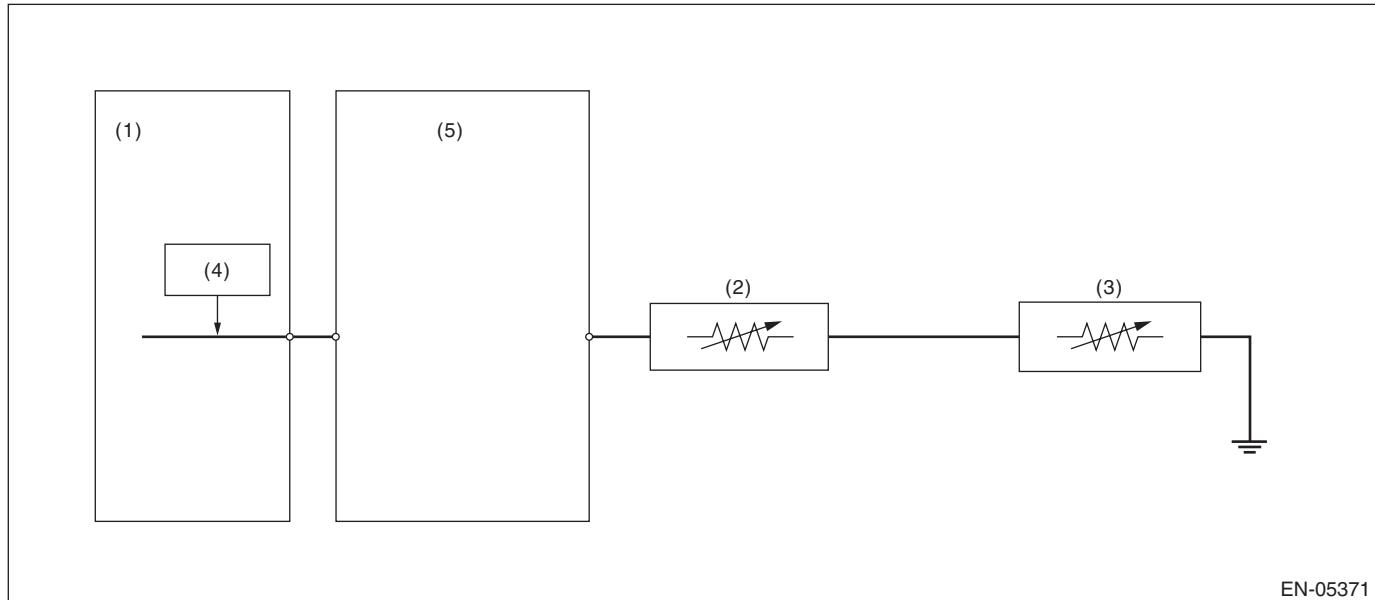
Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)

(2) Fuel level sensor

(3) Fuel sub level sensor

(5) Body integrated unit

(4) Detecting circuit

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|------------------------|
| Battery voltage | $\geq 10.9 \text{ V}$ |
| Elapsed time after starting the engine | $\geq 3000 \text{ ms}$ |
| Output voltage | $< 0.173 \text{ V}$ |

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|------------------------|
| Battery voltage | $\geq 10.9 \text{ V}$ |
| Elapsed time after starting the engine | $\geq 3000 \text{ ms}$ |
| Output voltage | $\geq 0.173 \text{ V}$ |

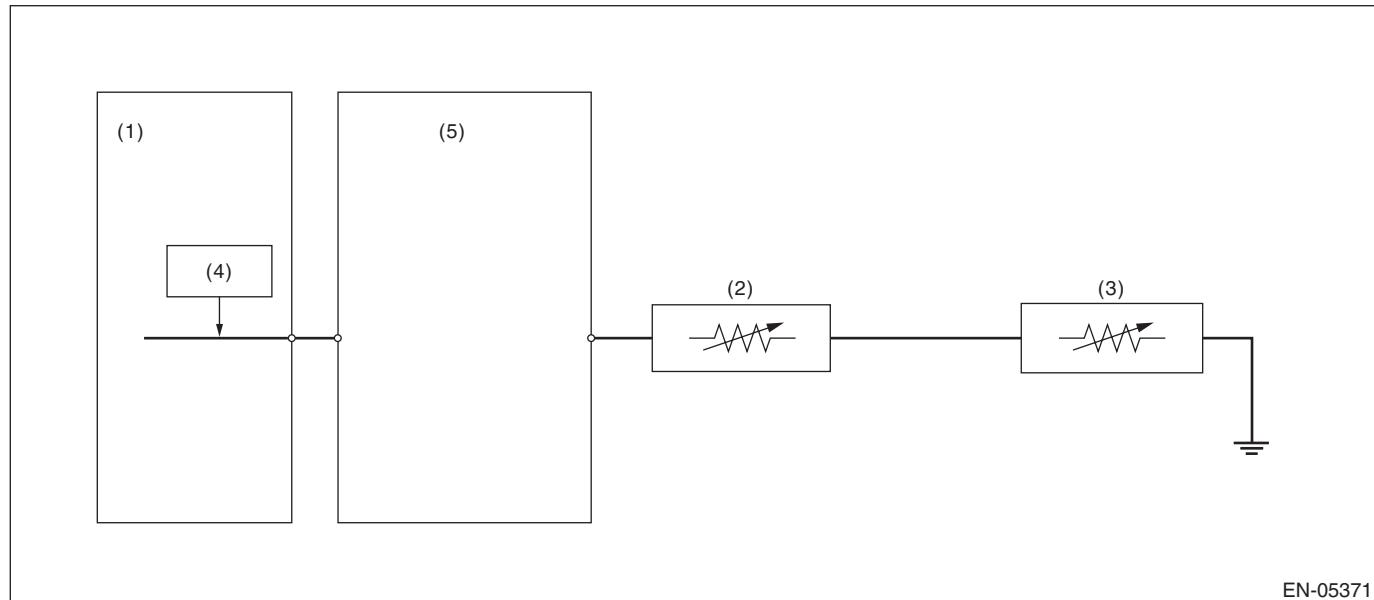
Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



EN-05371

(1) Engine control module (ECM)

(2) Fuel level sensor

(3) Fuel sub level sensor

(5) Body integrated unit

(4) Detecting circuit

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|------------------------|
| Battery voltage | $\geq 10.9 \text{ V}$ |
| Elapsed time after starting the engine | $\geq 3000 \text{ ms}$ |
| Output voltage | $\geq 7.212 \text{ V}$ |

Time Needed for Diagnosis: 1000 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|------------------------|
| Battery voltage | $\geq 10.9 \text{ V}$ |
| Elapsed time after starting the engine | $\geq 3000 \text{ ms}$ |
| Output voltage | $< 7.212 \text{ V}$ |

Time Needed for Diagnosis: Less than 1 second

BX: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 | $\geq 10.5 \text{ } \ell$ (2.77 US gal, 2.31 Imp gal) and $< 59.5 \text{ } \ell$ (15.72 US gal, 13.09 Imp gal) |
| Vehicle speed = 0 km/h (0 MPH) | ≥ 10000 ms |

3. GENERAL DRIVING CYCLE

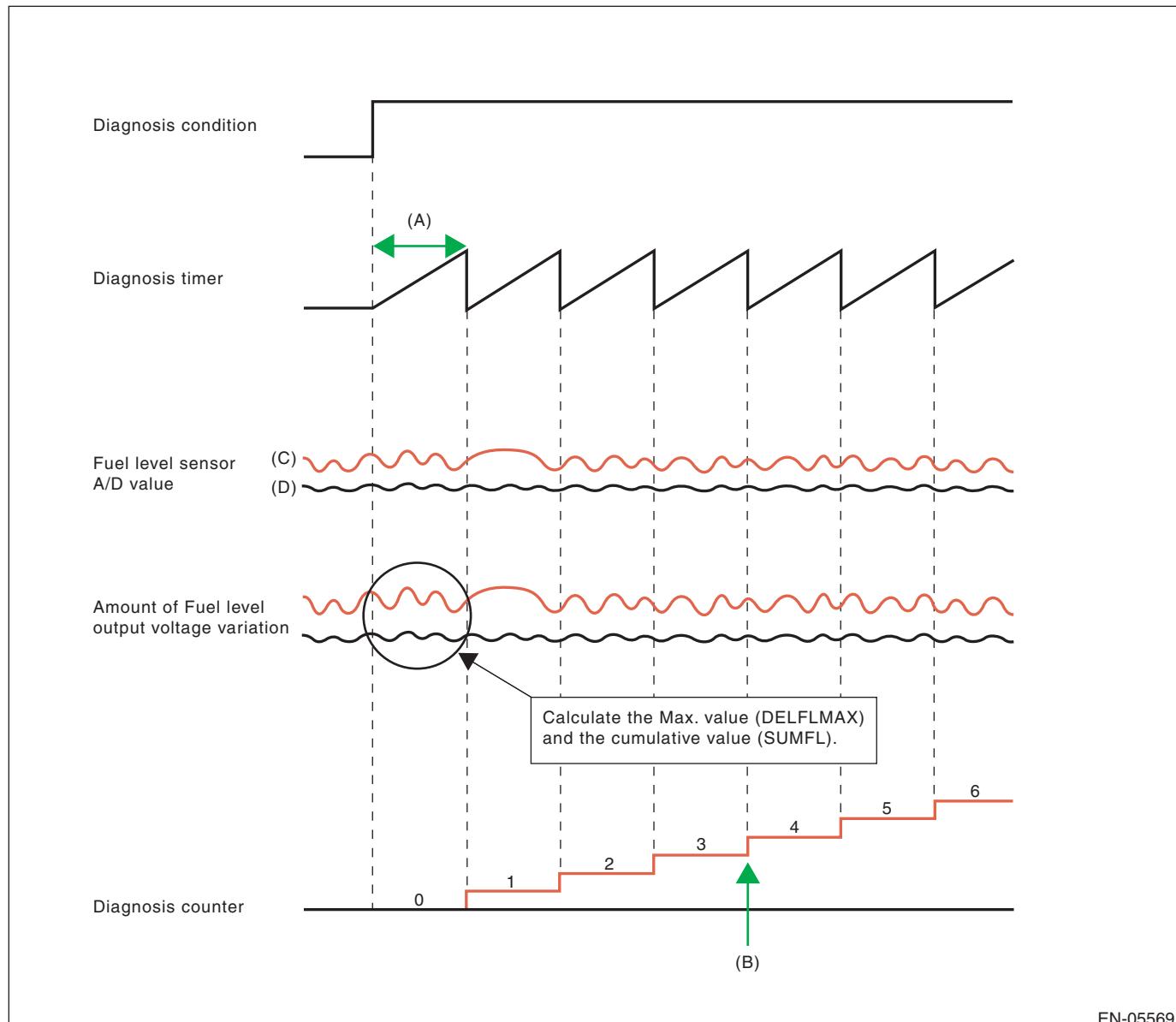
- Always perform the diagnosis continuously at idle speed.
- Pay attention to the fuel level.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

4. DIAGNOSTIC METHOD

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



EN-05569

(A) 12288 ms

(B) NG at 4 time(s) counts

(C) Malfunction

(D) Normal

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|--|
| Integrated times of the condition reaching follows, DEFLMAX or SUMFL At this time, DEFLMAX: Maximum difference of sensor output for 12288 ms SUMFL: Integrated value of the sensor output deviation for 12288 ms | ≥ 4 time(s) \geq Value from Map ≥ 23.8 V |

Map

| | | | | | | | |
|---------------------------------|------------------|------------------|------------------|------------------|--------------------|-------------------|------------------|
| Fuel level (l, US gal, Imp gal) | 10, 2.64, 2.2 | 20, 5.28, 4.4 | 25, 6.61, 5.5 | 30, 7.93, 6.6 | 43, 11.36, 9.46 | 45, 11.89, 9.9 | 50, 13.21, 11 |
| Measured voltage (V) | 0.248 | 0.519 | 0.796 | 0.6 | 1.025 | 1.069 | 1.402 |

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

| | |
|--|-----------------------------------|
| Maximum value – minimum value of change of tank pressure during 12288 ms | ≥ 0 kPa (0.375 mmHg, 0 inHg) |
| Maximum value – minimum value of battery voltage during 12288 ms | ≥ 0.969 V |

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

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|------------------------------|
| DEFLMAX SUMFL At this time, DEFLMAX: Maximum difference of sensor output for 12288 ms SUMFL: Integrated value of the sensor output deviation for 12288 ms | < Value from Map < 23.8 V |

Time Needed for Diagnosis: 12288 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BY:DTC P0500 VEHICLE SPEED SENSOR “A”

1. OUTLINE OF DIAGNOSIS

Judge as NG when outside of the judgment value.

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

2. COMPONENT DESCRIPTION

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

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|--|-------------------|
| Battery voltage | ≥ 10.9 V |
| Elapsed time after starting the engine | ≥ 2000 ms |

4. GENERAL DRIVING CYCLE

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

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: 2500 ms

BZ: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 | $\geq 72^{\circ}\text{C}$ (161.6 °F) |
| Battery voltage | ≥ 10.9 V |
| Atmospheric pressure | ≥ 75 kPa (563 mmHg, 22.2 inHg) |
| Fuel level | ≥ 10.5 ℥ (2.77 US gal, 2.31 Imp gal) |
| Elapsed time after starting the engine | ≥ 10.49 s |
| Feedback of ISC | In operation |
| Lambda value (left and right) | ≥ 0.9 and < 1.1 |
| After switching air conditioner to ON/OFF | ≥ 5.1 s |
| After intake manifold pressure changes by 4 kPa (30 mmHg, 1.2 inHg) or more. | > 5.1 s |
| Elapsed time after switching neutral position switch to ON/OFF | > 5.1 s |
| Vehicle speed | 0 km/h (0 MPH) |

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling after warming up engine.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|-----------------|
| Actual engine speed – Targeted engine speed | < -100 rpm |
| Feedback compensation for ISC | Max. |

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

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

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: 10 s

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CA: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 | $\geq 72^{\circ}\text{C}$ (161.6 $^{\circ}\text{F}$) |
| Battery voltage | ≥ 10.9 V |
| Atmospheric pressure | ≥ 75 kPa (563 mmHg, 22.2 inHg) |
| Fuel level | ≥ 10.5 ℓ (2.77 US gal, 2.31 Imp gal) |
| Elapsed time after starting the engine | ≥ 10.49 s |
| Feedback of ISC | In operation |
| Lambda value (left and right) | ≥ 0.9 and < 1.1 |
| After switching air conditioner to ON/ OFF | ≥ 5.1 s |
| After intake manifold pressure changes by 4 kPa (30 mmHg, 1.2 inHg) or more. | > 5.1 s |
| Elapsed time after switching neutral position switch to ON/OFF | > 5.1 s |
| Vehicle speed | 0 km/h (0 MPH) |

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling after warming up engine.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|-------------------------------|-----------------|
| Actual – Target engine speed | ≥ 200 rpm |
| Feedback compensation for ISC | Min. |

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

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|------------------------------|-----------------|
| Actual – Target engine speed | < 200 rpm |

Time Needed for Diagnosis: 10 s

CB:DTC P050A COLD START IDLE AIR CONTROL SYSTEM PERFORMANCE

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 any one of them is NG.

- Exhaust gas temperature diagnosis

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

- Idle speed diagnosis

Judge as NG when actual engine speed is not close to target engine speed after terminating the retard angle control.

2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|-----------------------------|--------------------------------|
| Atmospheric pressure | ≥ 75 kPa (563 mmHg, 22.2 inHg) |
| Battery voltage | ≥ 10.9 V |
| Cold start diagnosis | Incomplete |
| Vehicle speed | < 3 km/h (1.9 MPH) |
| Misfire in 200 engine revs. | < 5 |
| Time after starting | = 14 s |

3. GENERAL DRIVING CYCLE

Perform the diagnosis at cold start.

4. DIAGNOSTIC METHOD

- Exhaust gas temperature diagnosis

Abnormality Judgment

Calculate the estimated exhaust gas temperature when the diagnostic enable condition is established. Judge as NG when the following conditions are established after engine starting within the predetermined time.

Judgment Value

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

Map

| | | | | | | | | | | |
|---|--------------------|--------------------|-------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|-------------------|
| Coolant temperature after starting the engine | -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) | 45 °C (113 °F) |
| Estimated exhaust gas temperature | 0 °C (32 °F) | 0 °C (32 °F) | 0 °C (32 °F) | 79 °C (174.2 °F) | 78 °C (172.4 °F) | 76 °C (168.8 °F) | 74 °C (165.2 °F) | 72 °C (161.6 °F) | 69 °C (156.2 °F) | 65 °C (149 °F) |

Time Needed for Diagnosis: 14 seconds

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

Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Idle speed diagnosis

Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|-----------------|
| Continuous time of (Target engine speed – Actual engine speed > –200 rpm) | ≥ 6000 ms |
| Continuous time of (actual retard amount > 30 °CA) | ≥ 0 ms |

Time Needed for Diagnosis: 14 seconds

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

Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|-----------------|
| Continuous time of (Target engine speed – Actual engine speed > –200 rpm) | < 6000 ms |
| Continuous time of (actual retard amount > 30 °CA) | < 0 ms |

Time Needed for Diagnosis: Less than 1 second

CC:DTC P050B COLD START IGNITION TIMING PERFORMANCE

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

2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|-----------------------------|---|
| Atmospheric pressure | $\geq 75 \text{ kPa (563 mmHg, 22.2 inHg)}$ |
| Battery voltage | $\geq 10.9 \text{ V}$ |
| Cold start diagnosis | Incomplete |
| Vehicle speed | $< 3 \text{ km/h (1.9 MPH)}$ |
| Misfire in 200 engine revs. | < 5 |
| Time after starting | = 14 s |

3. GENERAL DRIVING CYCLE

Perform the diagnosis at cold start.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|-----------------|
| Duration time of (Standard ignition timing – Actual ignition timing $\leq 0 \text{ }^{\circ}\text{CA}$) | > 5000 ms |

Time Needed for Diagnosis: 5000 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|-----------------|
| Continuous time of (Standard ignition timing – Actual ignition timing $> 0 \text{ }^{\circ}\text{CA}$) | > 5000 ms |

Time Needed for Diagnosis: 5000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CD:DTC P0512 STARTER REQUEST CIRCUIT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of starter SW.

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

2. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------------|
| Engine condition | After engine starting |
| Starter OFF signal | Not detected |
| Battery voltage | ≥ 8 V |

Time Needed for Diagnosis: 60000 ms

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

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: Less than 1 second

CE: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

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

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of microcomputer (RAM).

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

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

2. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

Diagnosis with the initial routine.

3. GENERAL DRIVING CYCLE

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

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

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

Time Needed for Diagnosis: Less than 1 second

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

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

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

2. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| Ignition switch | ON |

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

Abnormality Judgment

Judge as NG if the criteria below are met.

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| SUM value of ROM | Standard |

Time Needed for Diagnosis: Undetermined

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

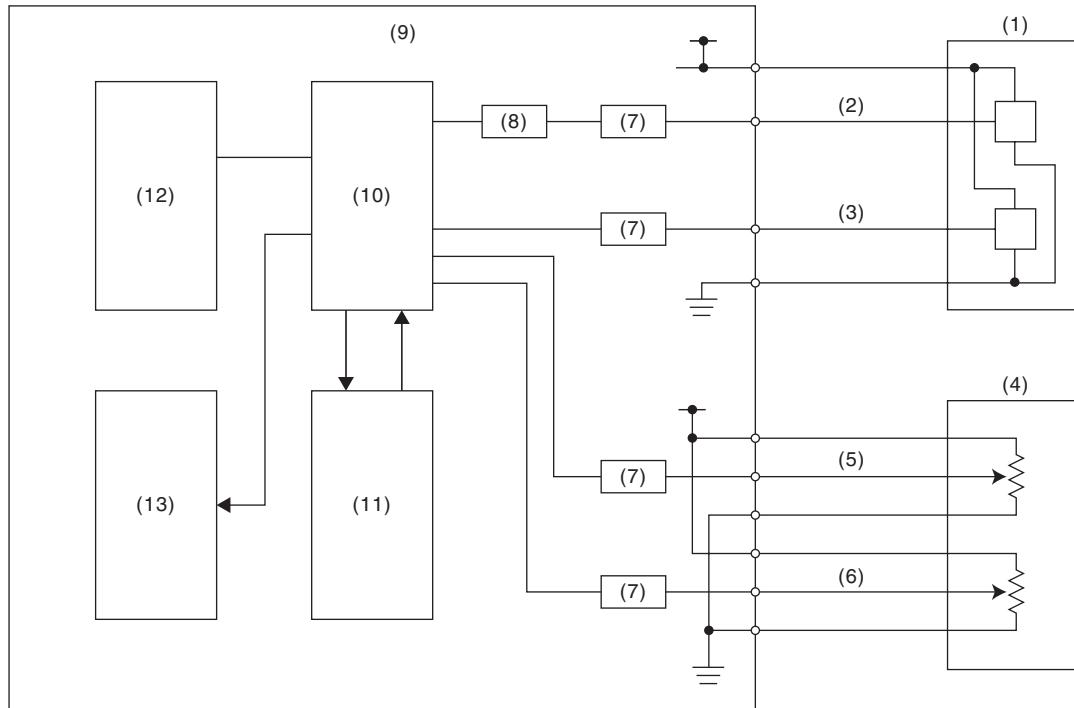
CH:DTC P0607 THROTTLE CONTROL SYSTEM CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

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

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

2. COMPONENT DESCRIPTION



EN-08016

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

3. ENABLE CONDITION

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

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

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

Judgment Value

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

Time Needed for Diagnosis:

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

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

Diagnostic Trouble Code (DTC) Detecting Criteria

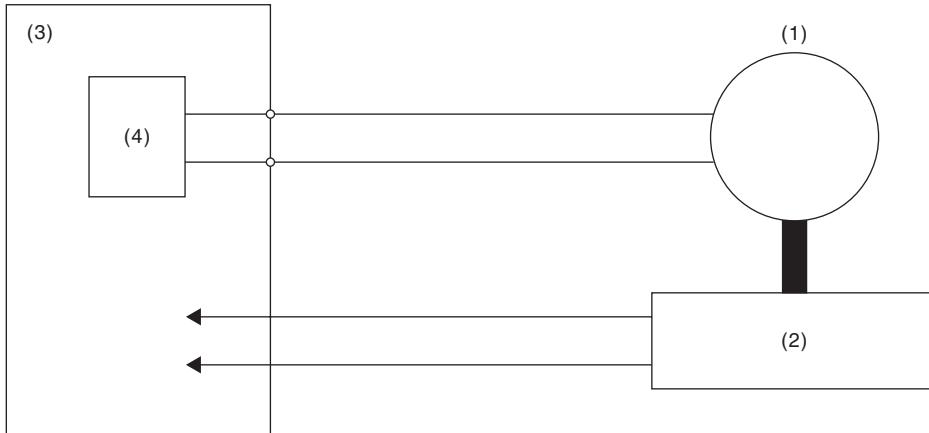
GENERAL DESCRIPTION

CI: 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

(3) Engine control module (ECM)

(4) Drive circuit

(2) Throttle position sensor

3. ENABLE CONDITION

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

4. GENERAL DRIVING CYCLE

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

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

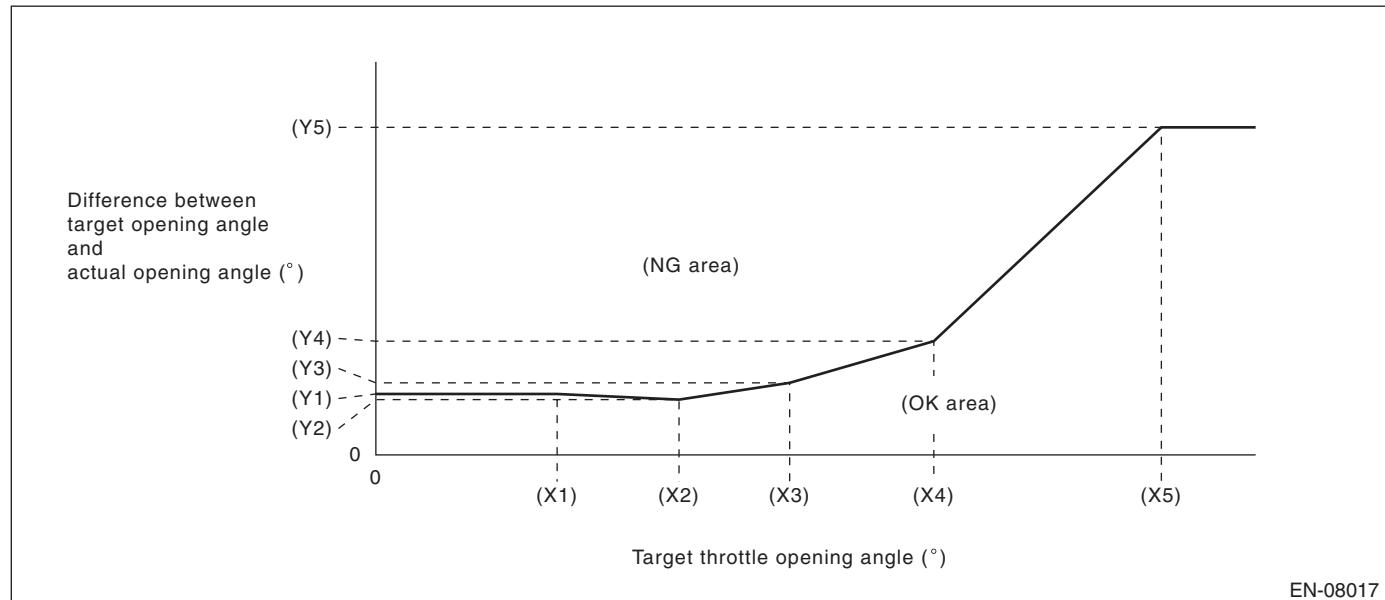
Judgment Value

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

Time Needed for Diagnosis:

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

Details of Judgment Value



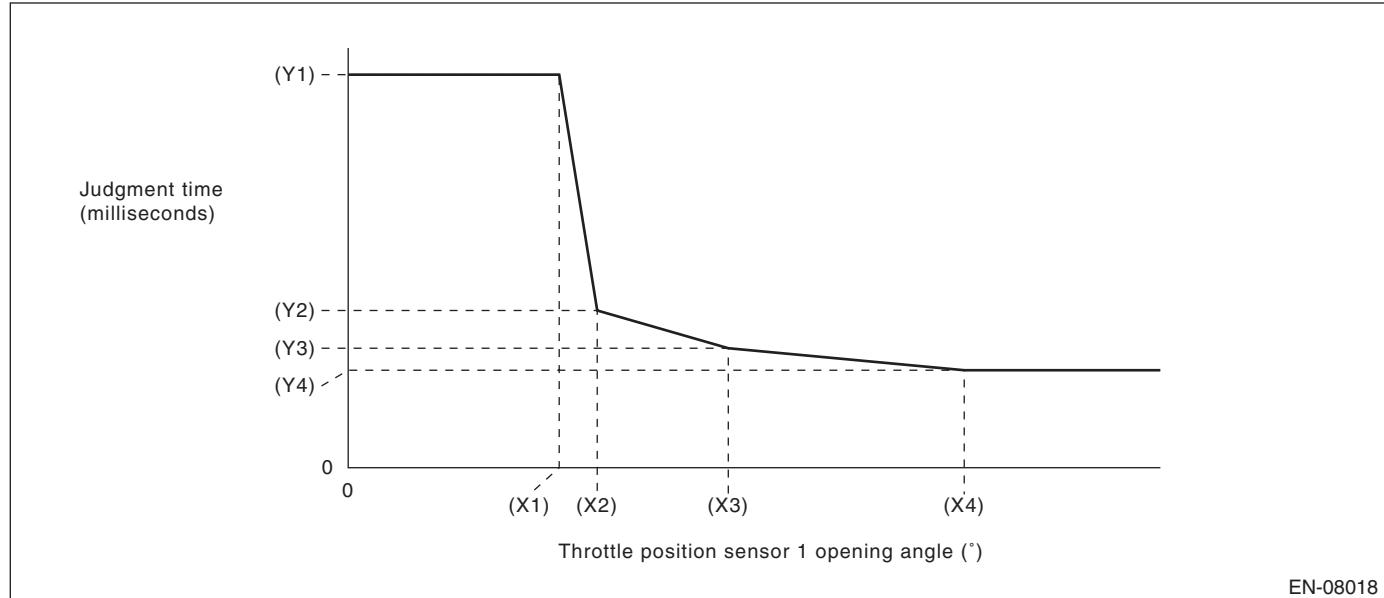
(X1) 6.915 ° (X2) 11.565 ° (X3) 15.785 °
(X4) 21.285 ° (X5) 29.965 °

(Y1) 4.65 ° (Y2) 4.22 ° (Y3) 5.5 °
(Y4) 8.68 ° (Y5) 25 °

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Judgment time detail



EN-08018

(X1) 8.049999237 °

(X2) 9.5 °

(X3) 14.5 °

(X4) 23.5 °

(Y1) 1000 ms

(Y2) 400 ms

(Y3) 304 ms

(Y4) 248 ms

NOTE:

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

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

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of neutral SW.

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

2. ENABLE CONDITION

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

3. GENERAL DRIVING CYCLE

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

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|---------------------|
| Neutral switch signal (while changing from a to b below) | LOW (ON) continues. |
| Driving condition change | From a) to b) |
| a) Engine speed 600 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH) | |
| b) Engine speed 1600 rpm — 2000 rpm & Vehicle speed ≥ 64 km/h (39.8 MPH) | |

Time Needed for Diagnosis: 3 time(s)

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|------------------------|
| Neutral switch signal (while changing from a to b below) | Changes to HIGH (OFF). |
| Driving condition change | From a) to b) |
| a) Engine speed 600 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH) | |
| b) Engine speed 1600 rpm — 2000 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

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of neutral SW.

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

2. ENABLE CONDITION

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

3. GENERAL DRIVING CYCLE

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

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|-----------------------|
| Neutral switch signal (while changing from a to b below) | HIGH (OFF) continues. |
| Driving condition change | From a) to b) |
| a) Engine speed 600 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH) | |
| b) Engine speed 1600 rpm — 2000 rpm & Vehicle speed ≥ 64 km/h (39.8 MPH) | |

Time Needed for Diagnosis: 3 time(s)

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|----------------------|
| Neutral switch signal (while changing from a to b below) | Changes to LOW (ON). |
| Driving condition change | From a) to b) |
| a) Engine speed 600 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH) | |
| b) Engine speed 1600 rpm — 2000 rpm & Vehicle speed ≥ 64 km/h (39.8 MPH) | |

Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

Detect that λ value remains low.

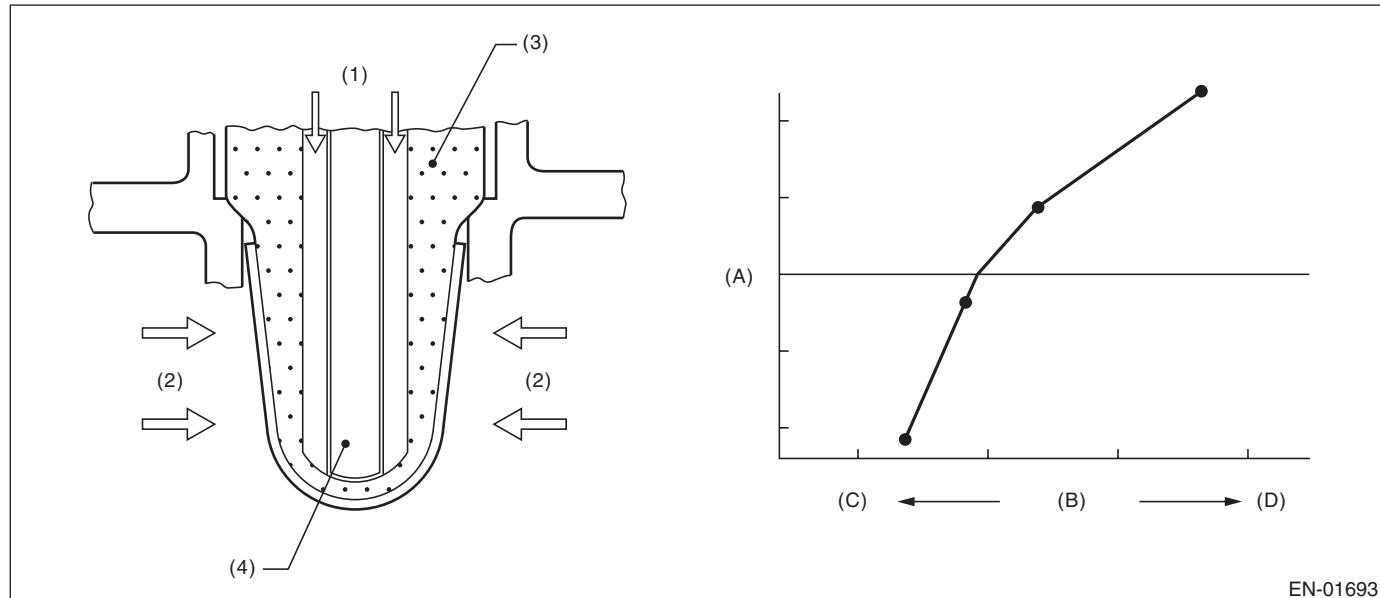
Judge as NG when lambda value is abnormal in accordance with λ value of front oxygen (A/F) sensor and running conditions such as vehicle speed, amount of intake air, engine coolant temperature, sub feedback control, etc.

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

(C) Lean

(1) Atmosphere
(2) Exhaust gas

(3) ZrO_2

(4) Ceramic heater

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|---|-------------------------------------|
| Time needed for all secondary parameters to be in enable conditions | ≥ 4096 ms |
| Battery voltage | ≥ 10.9 V |
| Atmospheric pressure | ≥ 75 kPa (563 mmHg, 22.2 inHg) |
| Rear oxygen sensor sub feedback | Execution |
| Rear oxygen sensor output voltage – Feedback target voltage | -0.2 V — 0.1 V |
| or rear oxygen sensor sub feedback compensation coefficient | On Min. |
| or rear oxygen sensor sub feedback compensation coefficient | On Max. |
| Elapsed time after starting the engine | ≥ 60000 ms |
| Engine coolant temperature | ≥ 72 °C (161.6 °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 | -1 — 1 |

4. GENERAL DRIVING CYCLE

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

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| λ value | < 0.85 |

Time Needed for Diagnosis: 10000 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| λ value | ≥ 0.85 |

Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

Detect that λ value remains high.

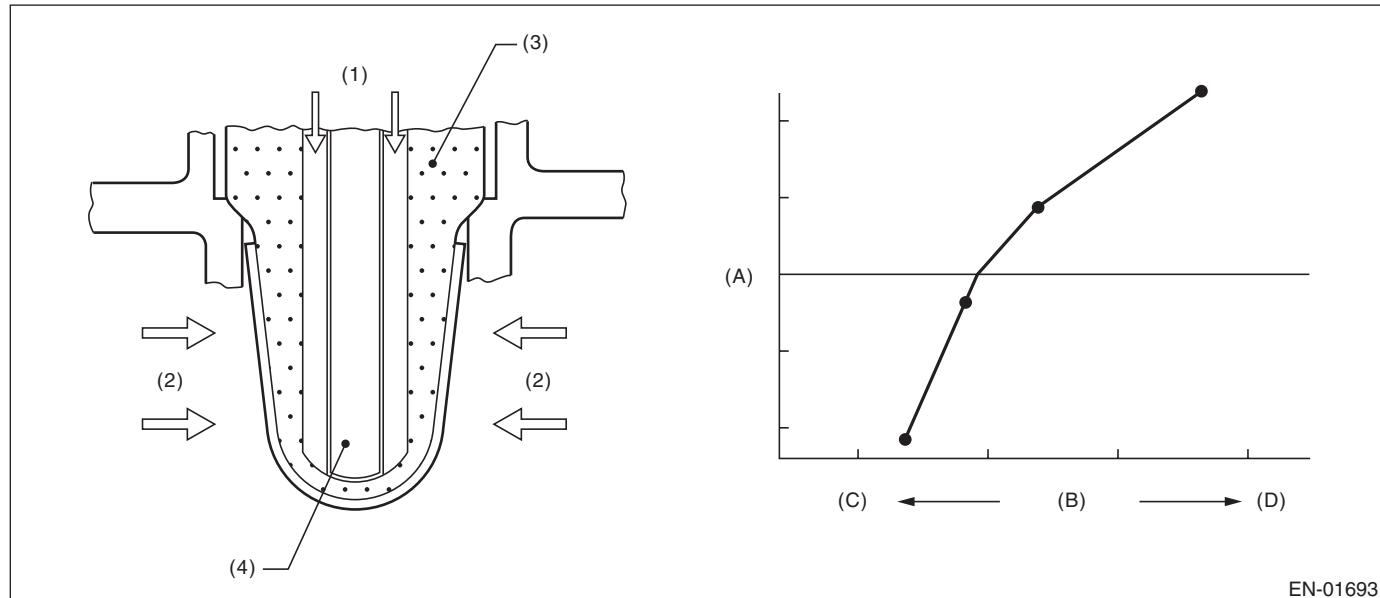
Judge as NG when lambda value is abnormal in accordance with λ value of front oxygen (A/F) sensor and running conditions such as vehicle speed, amount of intake air, engine coolant temperature, sub feedback control, etc.

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

$\lambda > 1$: Lean

$\lambda < 1$: Rich

2. COMPONENT DESCRIPTION



(A) Electromotive force
(D) Rich

(B) Air fuel ratio

(C) Lean

(1) Atmosphere
(2) Exhaust gas

(3) ZrO_2

(4) Ceramic heater

EN-01693

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|---|-------------------------------------|
| Time needed for all secondary parameters to be in enable conditions | ≥ 4096 ms |
| Battery voltage | ≥ 10.9 V |
| Atmospheric pressure | ≥ 75 kPa (563 mmHg, 22.2 inHg) |
| Rear oxygen sensor sub feedback | Execution |
| Rear oxygen sensor output voltage – Feedback target voltage | -0.2 V — 0.1 V |
| or rear oxygen sensor sub feedback compensation coefficient | On Min. |
| or rear oxygen sensor sub feedback compensation coefficient | On Max. |
| Elapsed time after starting the engine | ≥ 60000 ms |
| Engine coolant temperature | ≥ 72 °C (161.6 °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 | -1 — 1 |

4. GENERAL DRIVING CYCLE

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

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| λ value | > 1.15 |

Time Needed for Diagnosis: 10000 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| λ value | ≤ 1.15 |

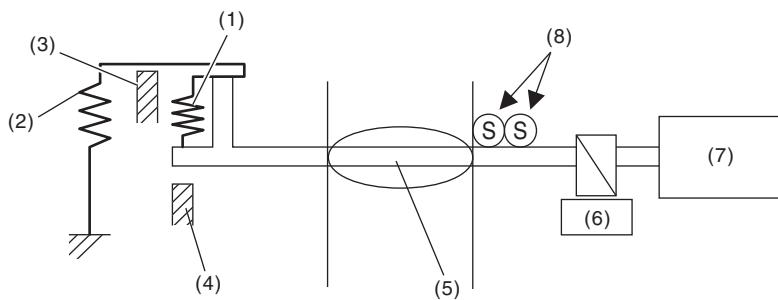
Time Needed for Diagnosis: Less than 1 second

CN:DTC P1160 RETURN SPRING FAILURE

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



EN-04463

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

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|--------------------------|-------------------|
| Battery voltage | ≥ 6 V |
| Throttle position sensor | Normal |

4. GENERAL DRIVING CYCLE

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

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

Time Needed for Diagnosis: 24 ms

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

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: 3400 ms

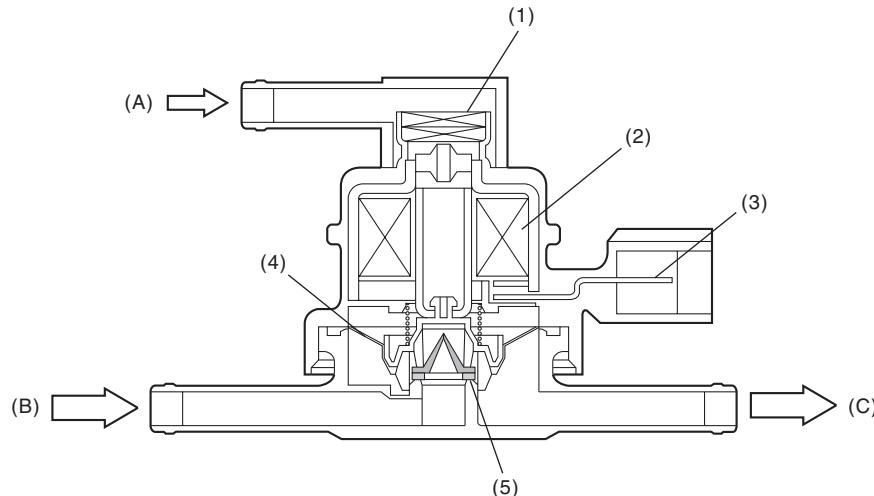
CO:DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW

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



EN-01759

(A) Atmospheric 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 Judgment

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

Judgment Value

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

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|-----------------|
| 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

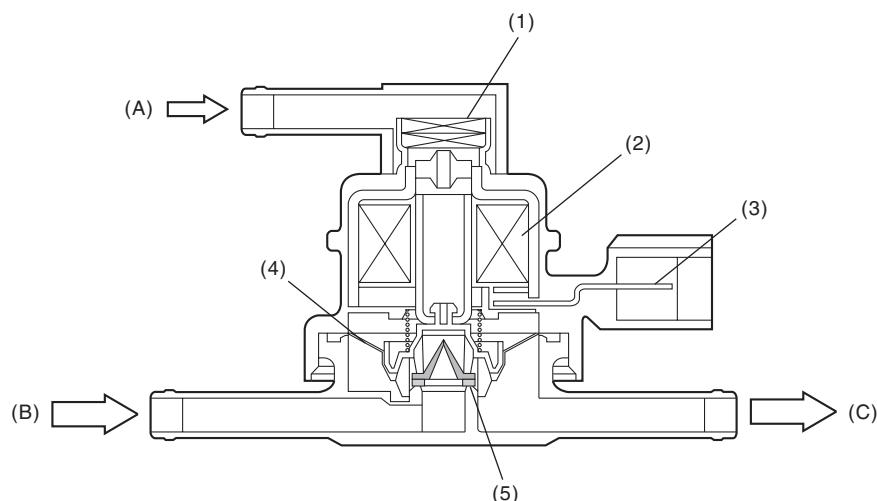
CP:DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH

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) Atmospheric 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 Judgment

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

Judgment Value

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

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgment

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

Judgment Value

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

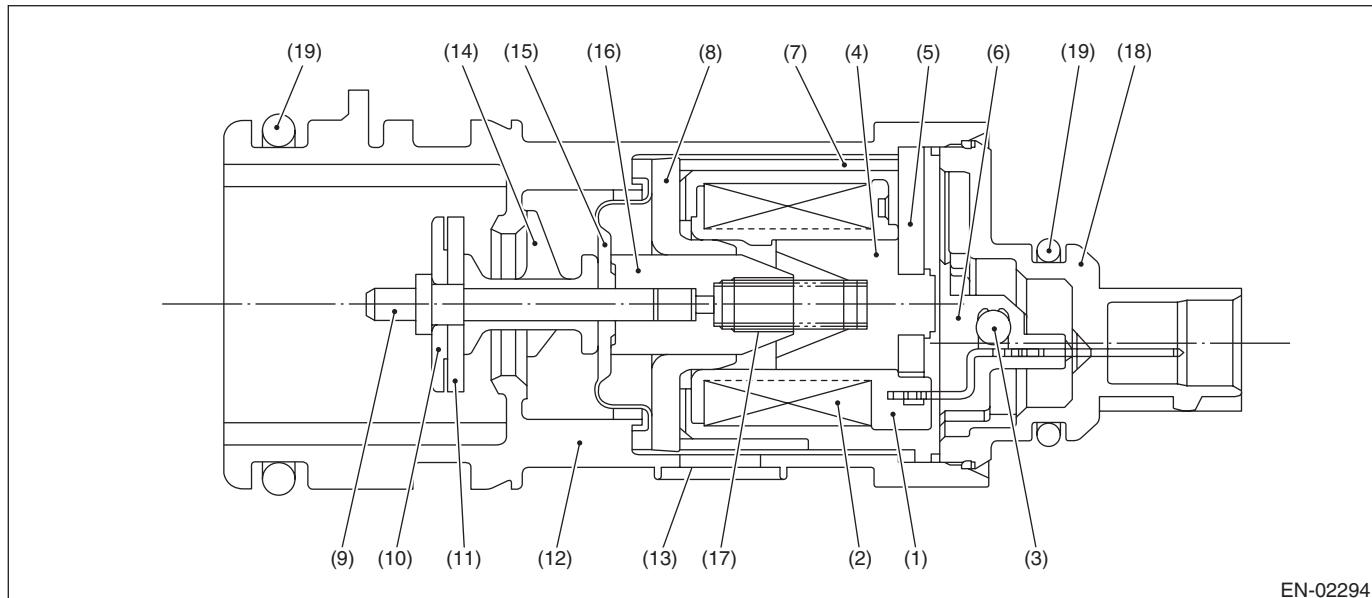
Time Needed for Diagnosis: Less than 1 second

CQ:DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM

1. OUTLINE OF DIAGNOSIS

Detect the abnormal function (stuck closed) of the drain valve.
Judge as NG when fuel tank pressure is low.

2. COMPONENT DESCRIPTION



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

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|--|--|
| Drain valve | Open |
| Battery voltage | ≥ 10.9 V |
| Atmospheric pressure | ≥ 75 kPa (563 mmHg, 22.2 inHg) |
| Tank pressure when starter is OFF \rightarrow ON | -0.7 kPa (-5 mmHg, -0.2 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 Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|---|
| Fuel tank pressure | $\leq -4 \text{ kPa} (-30 \text{ mmHg}, -1.2 \text{ inHg})$ |

Time Needed for Diagnosis: 3000 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|---|
| Fuel tank pressure | $> -4 \text{ kPa} (-30 \text{ mmHg}, -1.2 \text{ inHg})$ |
| Cumulative time when all the malfunction criteria below are met. | $\geq 30000 \text{ ms}$ |
| Purge control solenoid valve duty | Not = 0 |
| Fuel temperature | $-10 \text{ }^{\circ}\text{C} (14 \text{ }^{\circ}\text{F}) — 55 \text{ }^{\circ}\text{C} (131 \text{ }^{\circ}\text{F})$ |
| Intake manifold relative pressure | $\geq -26.7 \text{ kPa} (-200 \text{ mmHg}, -7.9 \text{ inHg})$ |

Time Needed for Diagnosis: Less than 1 second

CR:DTC P1518 STARTER SWITCH CIRCUIT LOW INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of starter SW.

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

2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as OFF NG when the following conditions are established.

Judgment Value

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

Time Needed for Diagnosis: Less than 1 second

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

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CS:DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION

1. OUTLINE OF DIAGNOSIS

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

2. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: Less than 1 second

CT:DTC P1570 ANTENNA

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4DOTC)-177, DTC P0513 INCORRECT IM-MOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CU:DTC P1571 REFERENCE CODE INCOMPATIBILITY

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4DOTC)-177, DTC P0513 INCORRECT IM-MOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

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

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4DOTC)-177, DTC P0513 INCORRECT IM-MOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CW:DTC P1574 KEY COMMUNICATION FAILURE

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4DOTC)-177, DTC P0513 INCORRECT IM-MOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CX:DTC P1576 EGI CONTROL MODULE EEPROM

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4DOTC)-177, DTC P0513 INCORRECT IM-MOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CY:DTC P1577 IMM CONTROL MODULE EEPROM

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4DOTC)-177, DTC P0513 INCORRECT IM-MOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CZ:DTC P1578 METER FAILURE

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P0513. <Ref. to GD(H4DOTC)-177, DTC P0513 INCORRECT IM-MOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

DA:DTC P2004 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of tumble generator valve motor function.

Judge open fixing malfunction when the opening degree is large even after finishing the tumble generator valve closing driving.

2. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------------|------------------------|
| Battery voltage | ≥ 10.9 V |
| Engine coolant temperature | ≥ -30 °C (-22 °F) |
| Ambient air temperature | ≥ -30 °C (-22 °F) |

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|-----------------|
| Tumble generator valve opening | ≥ 64.3 ° |
| Tumble generator valve “close” signal output | ≥ 3200 ms |

Time Needed for Diagnosis: 3000 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|-----------------|
| Tumble generator valve opening | < 64.3 ° |
| Tumble generator valve “close” signal output | ≥ 3200 ms |

Time Needed for Diagnosis: Less than 1 second

DB:DTC P2005 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 2)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of tumble generator valve motor function.

Judge open fixing malfunction when the opening degree is large even after finishing the tumble generator valve closing driving.

2. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------------|------------------------|
| Battery voltage | ≥ 10.9 V |
| Engine coolant temperature | ≥ -30 °C (-22 °F) |
| Ambient air temperature | ≥ -30 °C (-22 °F) |

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|-----------------|
| Tumble generator valve opening | ≥ 64.3 ° |
| Tumble generator valve “close” signal output | ≥ 3200 ms |

Time Needed for Diagnosis: 3000 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|-----------------|
| Tumble generator valve opening | < 64.3 ° |
| Tumble generator valve “close” signal output | ≥ 3200 ms |

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

DC:DTC P2006 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of tumble generator valve motor function.

Judge close fixing malfunction when the opening degree is small even after finishing the tumble generator valve open driving.

2. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------------|------------------------|
| Battery voltage | ≥ 10.9 V |
| Engine coolant temperature | ≥ -30 °C (-22 °F) |
| Ambient air temperature | ≥ -30 °C (-22 °F) |

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|-----------------|
| Tumble generator valve opening | < 64.3 ° |
| Tumble generator valve “open” signal output | ≥ 4600 ms |

Time Needed for Diagnosis: 3000 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|-----------------|
| Tumble generator valve opening | ≥ 64.3 ° |
| Tumble generator valve “open” signal output | ≥ 4600 ms |

Time Needed for Diagnosis: Less than 1 second

DD:DTC P2007 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 2)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of tumble generator valve motor function.

Judge close fixing malfunction when the opening degree is small even after finishing the tumble generator valve open driving.

2. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------------|------------------------|
| Battery voltage | ≥ 10.9 V |
| Engine coolant temperature | ≥ -30 °C (-22 °F) |
| Ambient air temperature | ≥ -30 °C (-22 °F) |

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|-----------------|
| Tumble generator valve opening | < 64.3 ° |
| Tumble generator valve “open” signal output | ≥ 4600 ms |

Time Needed for Diagnosis: 3000 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|-----------------|
| Tumble generator valve opening | ≥ 64.3 ° |
| Tumble generator valve “open” signal output | ≥ 4600 ms |

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

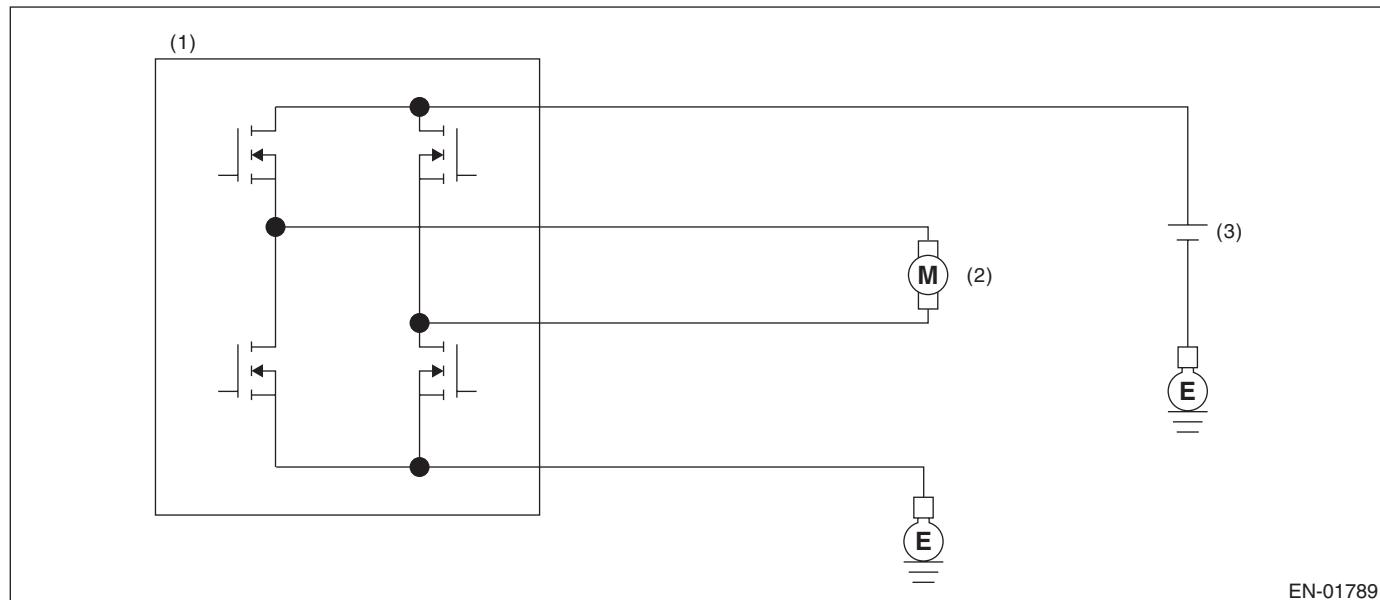
DE:DTC P2008 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT / OPEN (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of tumble generator valve motor.

Judge as NG when the open signal is sent from IC after tumble generator valve driving IC diagnosis.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)

(2) Tumble generator valve

(3) Battery

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| Battery voltage | ≥ 10.9 V |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

At the main IC, check the sent signal at each timing which occurs immediately after the tumble generator valve output is set to ON → OFF, and judge open NG when the open NG signal is sent 96 ms × 20 time(s) in a row.

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Open NG signal input | Low |

Time Needed for Diagnosis: 96 ms × 20 time(s)

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Open NG signal input | High |

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

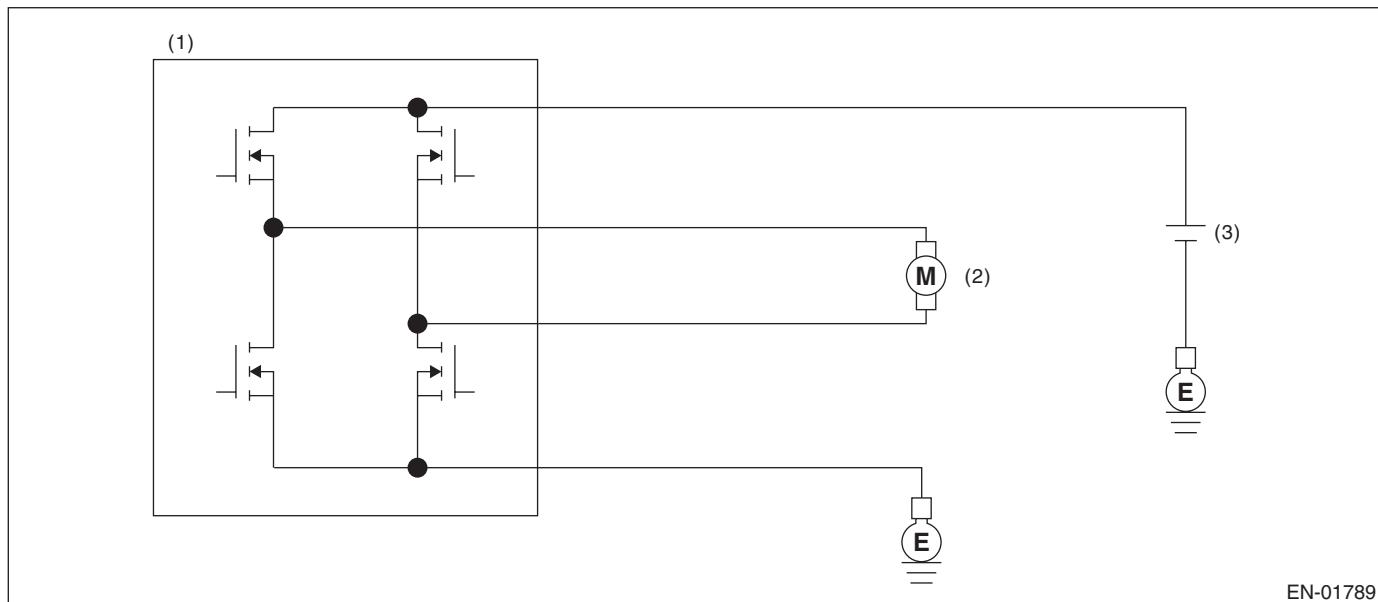
DF:DTC P2009 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of tumble generator valve motor.

Judge as NG when the overcurrent signal is sent from IC after tumble generator valve driving IC diagnosis.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)

(2) Tumble generator valve

(3) Battery

3. ENABLE CONDITION

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

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|-----------------------------|-----------------|
| Overcurrent NG signal input | Low |

Time Needed for Diagnosis: $96 \text{ ms} \times 10$ time(s)

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|-----------------------------|-----------------|
| Overcurrent NG signal input | High |

Time Needed for Diagnosis: Less than 1 second

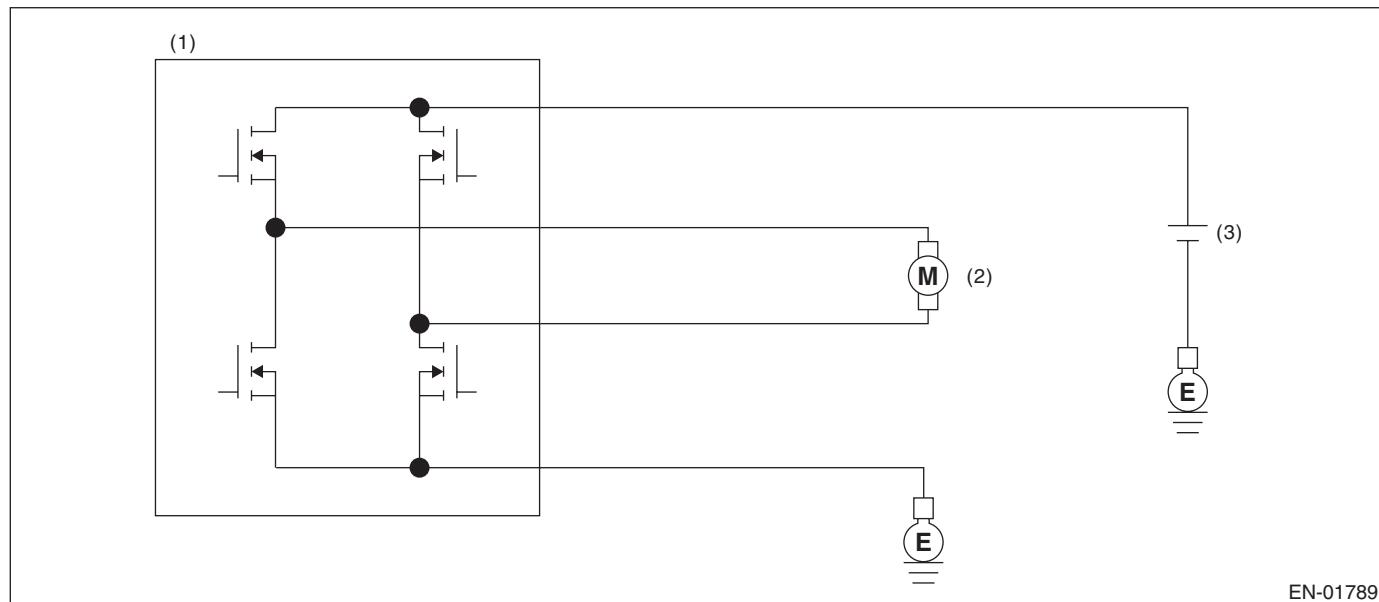
DG:DTC P2011 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT / OPEN (BANK 2)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of tumble generator valve motor.

Judge as NG when the open signal is sent from IC after tumble generator valve driving IC diagnosis.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)

(2) Tumble generator valve

(3) Battery

EN-01789

3. ENABLE CONDITION

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

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

At the main IC, check the sent signal at each timing which occurs just before the tumble generator valve output is set to ON → OFF, and judge open NG when the open NG signal is sent $96 \text{ ms} \times 20 \text{ time(s)}$ in a row.

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Open NG signal input | Low |

Time Needed for Diagnosis: $96 \text{ ms} \times 20 \text{ time(s)}$

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Open NG signal input | High |

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

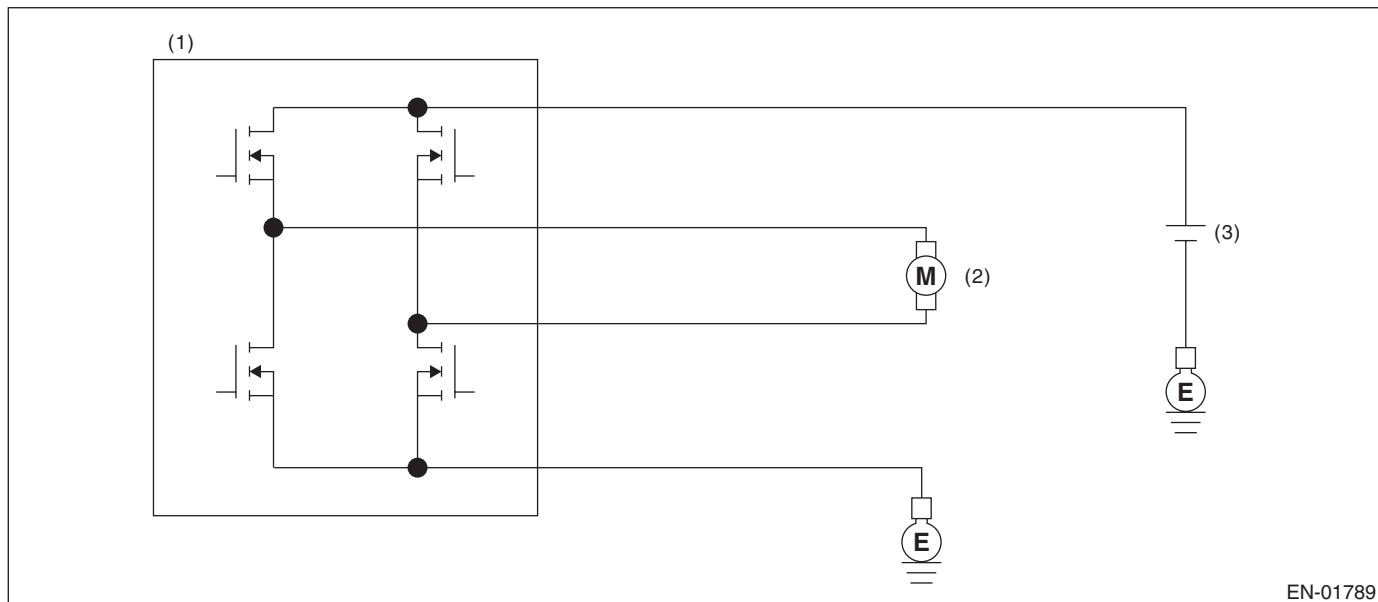
DH:DTC P2012 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 2)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of tumble generator valve motor.

Judge as NG when the overcurrent signal is sent from IC after tumble generator valve driving IC diagnosis.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)

(2) Tumble generator valve

(3) Battery

3. ENABLE CONDITION

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

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|-----------------------------|-----------------|
| Overcurrent NG signal input | Low |

Time Needed for Diagnosis: $96 \text{ ms} \times 10$ time(s)

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|-----------------------------|-----------------|
| Overcurrent NG signal input | High |

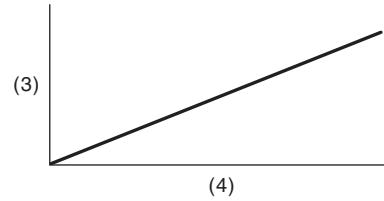
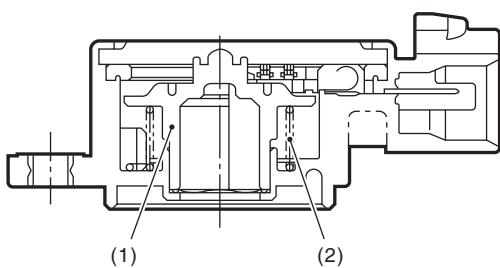
Time Needed for Diagnosis: Less than 1 second

DI: DTC P2016 INTAKE MANIFOLD RUNNER POSITION SENSOR / SWITCH CIRCUIT LOW (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of tumble generator valve position sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-01768

(1) Rotor

(3) Voltage (V)

(4) Tumble generator valve opening (°)

(2) Return spring

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | < 0.217 V |

Time Needed for Diagnosis: 500 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | ≥ 0.217 V |

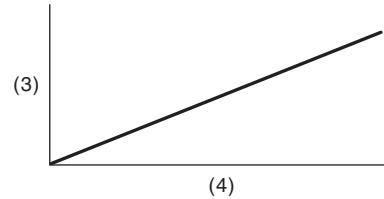
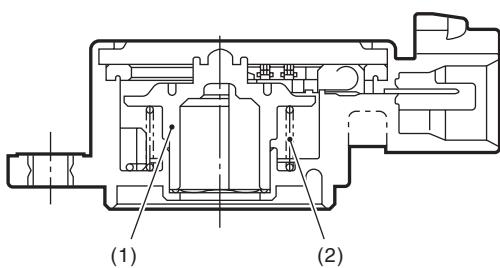
Time Needed for Diagnosis: Less than 1 second

DJ:DTC P2017 INTAKE MANIFOLD RUNNER POSITION SENSOR / SWITCH CIRCUIT HIGH (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of tumble generator valve position sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-01768

(1) Rotor
(2) Return spring

(3) Voltage (V)

(4) Throttle valve opening angle (°)

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | ≥ 4.783 V |

Time Needed for Diagnosis: 500 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | < 4.783 V |

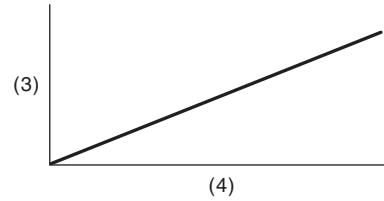
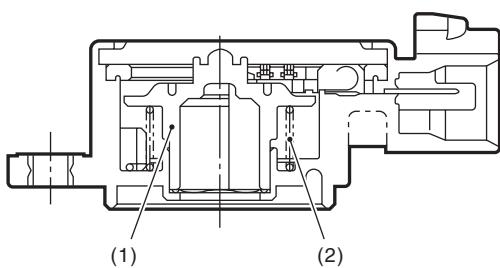
Time Needed for Diagnosis: Less than 1 second

DK:DTC P2021 INTAKE MANIFOLD RUNNER POSITION SENSOR / SWITCH CIRCUIT LOW (BANK 2)

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of tumble generator valve position sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-01768

(1) Rotor

(3) Voltage (V)

(4) Tumble generator valve opening (°)

(2) Return spring

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | < 0.217 V |

Time Needed for Diagnosis: 500 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | ≥ 0.217 V |

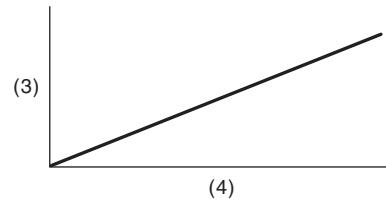
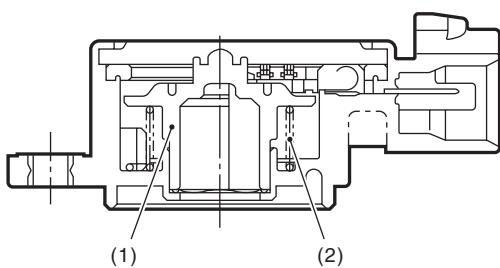
Time Needed for Diagnosis: Less than 1 second

DL:DTC P2022 INTAKE MANIFOLD RUNNER POSITION SENSOR / SWITCH CIRCUIT HIGH (BANK 2)

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of tumble generator valve position sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



EN-01768

(1) Rotor

(3) Voltage (V)

(4) Tumble generator valve opening (°)

(2) Return spring

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | ≥ 4.783 V |

Time Needed for Diagnosis: 500 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | < 4.783 V |

Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

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

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

2. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|-----------------|
| Battery voltage | ≥ 10.9 V |
| Oil flow control solenoid valve control duty | ≥ 99.61 % |
| Oil control solenoid valve control present current | < 0.306 A |

Time Needed for Diagnosis: 2000 ms

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

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: 2000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

1. OUTLINE OF DIAGNOSIS

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

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

2. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|-----------------|
| Battery voltage | ≥ 10.9 V |
| Oil flow control solenoid valve control duty | < 0.39 % |
| Oil control solenoid valve control present current | ≥ 0.306 A |

Time Needed for Diagnosis: 2000 ms

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

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: 2000 ms

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

1. OUTLINE OF DIAGNOSIS

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

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

2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|-----------------|
| Battery voltage | ≥ 10.9 V |
| Oil flow control solenoid valve control duty | ≥ 99.61 % |
| Oil control solenoid valve control present current | < 0.306 A |

Time Needed for Diagnosis: 2000 ms

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

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: 2000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

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

1. OUTLINE OF DIAGNOSIS

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

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

2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|-----------------|
| Battery voltage | ≥ 10.9 V |
| Oil flow control solenoid valve control duty | < 0.39 % |
| Oil control solenoid valve control present current | ≥ 0.306 A |

Time Needed for Diagnosis: 2000 ms

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

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: 2000 ms

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

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P2088. <Ref. to GD(H4DOTC)-219, DTC P2088 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

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

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P2089. <Ref. to GD(H4DOTC)-220, DTC P2089 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

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

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P2090. <Ref. to GD(H4DOTC)-221, DTC P2090 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

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

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC P2091. <Ref. to GD(H4DOTC)-222, DTC P2091 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

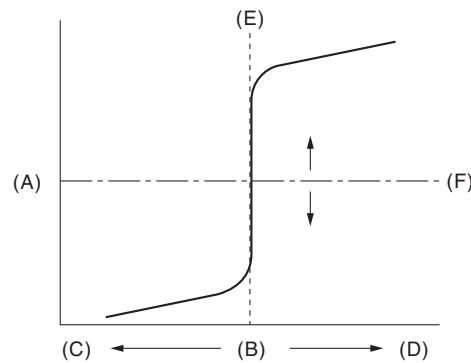
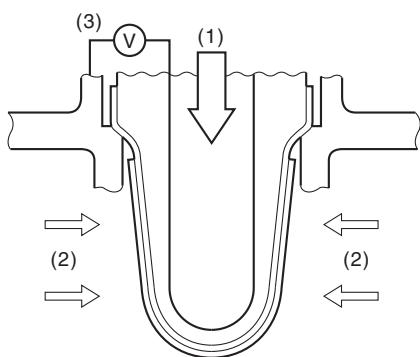
GENERAL DESCRIPTION

DU:DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel system from the size of the sub feedback learning value. Control the sub feedback learning and judge as NG when the learning value is in the lean zone.

2. COMPONENT DESCRIPTION



EN-01696

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

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|---|-------------------|
| Conditions for carrying out the sub feedback learning | Complete |
| Continuous time when all conditions are established. | ≥ 1 s |

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when the vehicle is idling or running at a constant speed of 80 km/h (50 MPH) or more.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|-----------------------------|-----------------|
| Sub feedback learning value | < -0.05 |

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

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|-----------------------------|-----------------|
| Sub feedback learning value | ≥ -0.05 + 0 |

Time Needed for Diagnosis: 5 s

Diagnostic Trouble Code (DTC) Detecting Criteria

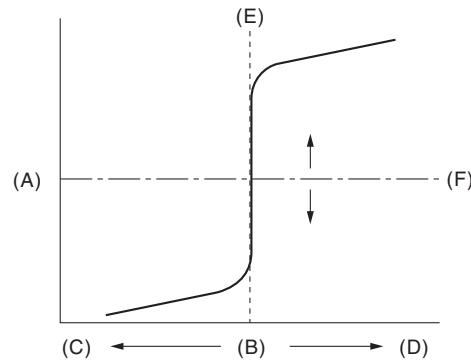
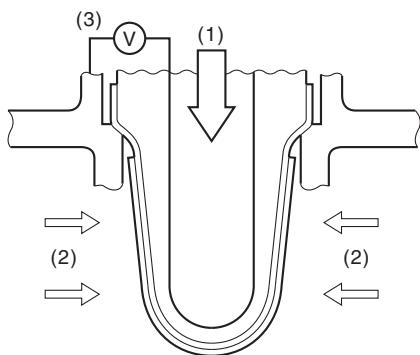
GENERAL DESCRIPTION

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

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel system from the size of the sub feedback learning value. Sub feedback learning is being performed. When the learning value goes to the rich side, judge as NG.

2. COMPONENT DESCRIPTION



EN-01696

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

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|---|-------------------|
| Conditions for carrying out the sub feedback learning | Complete |
| Continuous time when all conditions are established. | ≥ 1 s |

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when the vehicle is idling or running at a constant speed of 80 km/h (50 MPH) or more.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|-----------------------------|-----------------|
| Sub feedback learning value | ≥ 0.03 |

Time Needed for Diagnosis: 5 s \times 1 time(s)

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|-----------------------------|-----------------|
| Sub feedback learning value | $< 0.03 + 0$ |

Time Needed for Diagnosis: 5 s

Diagnostic Trouble Code (DTC) Detecting Criteria

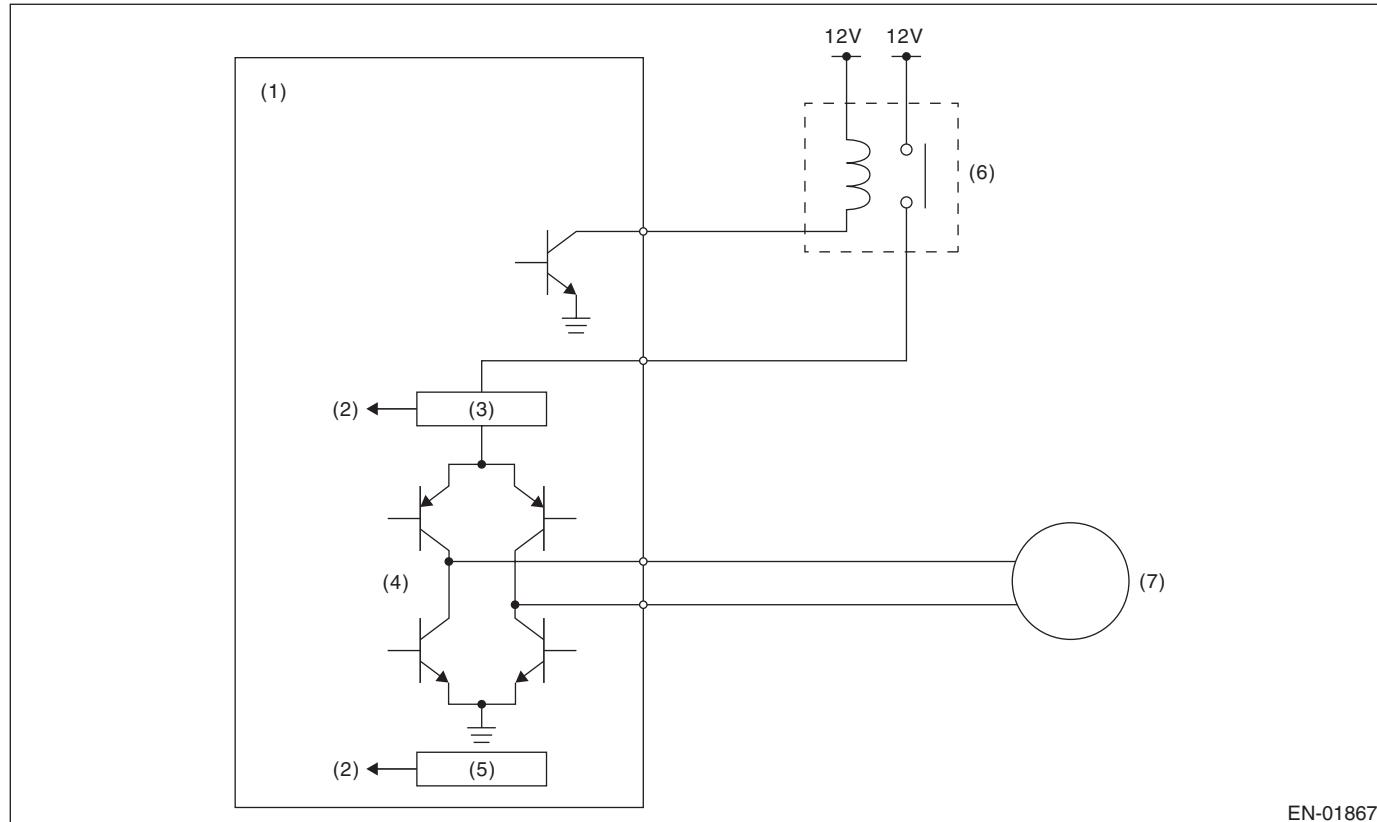
GENERAL DESCRIPTION

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

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



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

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|---|-------------------|
| Under control of electronic throttle control | ON |
| CPU communication line sub → main normal judgment | Normal |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---------------------------------|-----------------|
| Motor current | > 8 A |
| or | |
| Drive circuit inner temperature | > 175°C (347°F) |

Time Needed for Diagnosis: 512 ms

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

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: 2000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

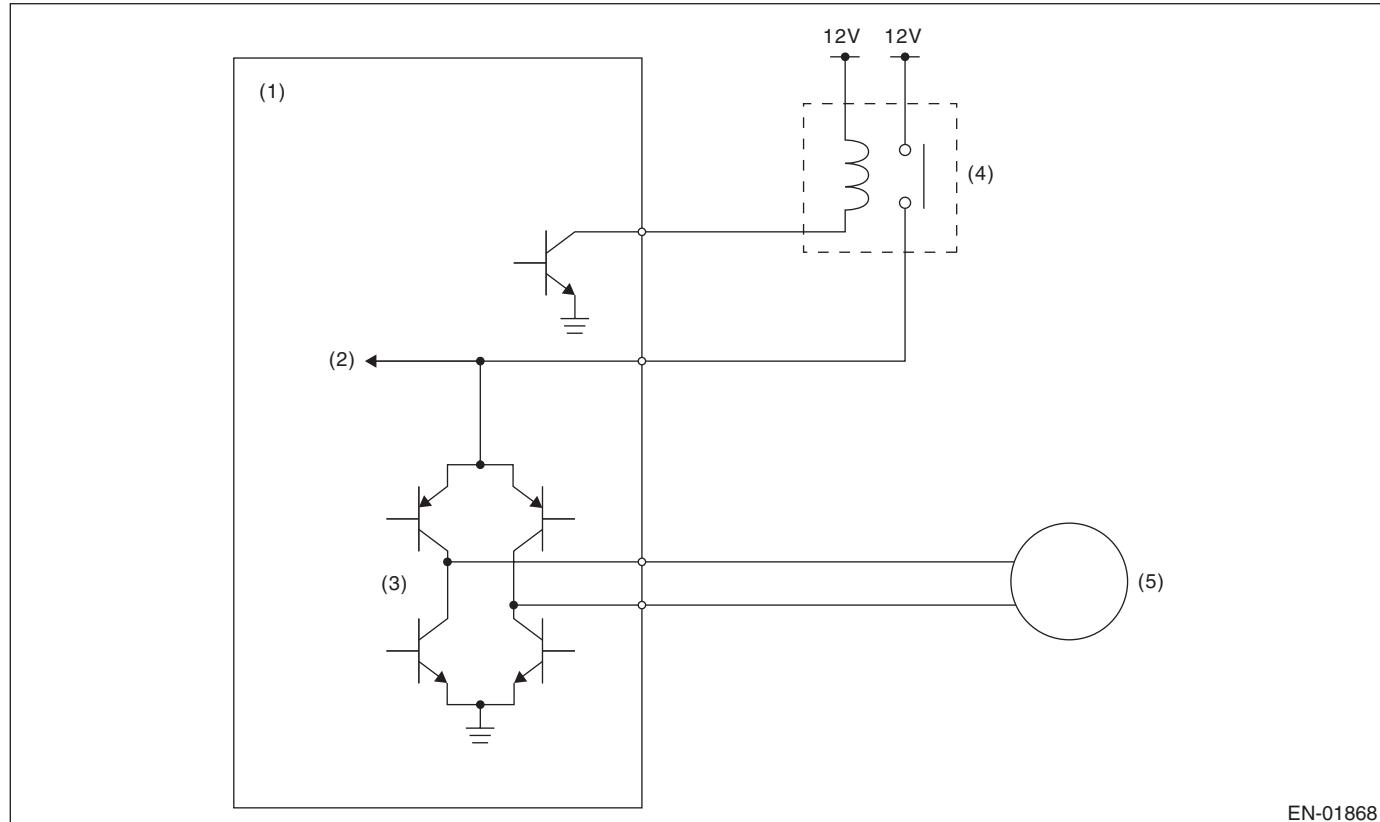
GENERAL DESCRIPTION

DX:DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Judge as NG when the electronic throttle control power is not supplied even when ECM sets the electronic throttle control relay to ON.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Voltage detection circuit

(3) Drive circuit
(4) Electronic throttle control relay

(5) Motor

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|--|-------------------|
| Battery voltage | ≥ 11 V |
| Electronic throttle control relay output | ON |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Motor power voltage | ≤ 5 V |

Time Needed for Diagnosis: 352 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Motor power voltage | > 5 V |

Time Needed for Diagnosis: 2000 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

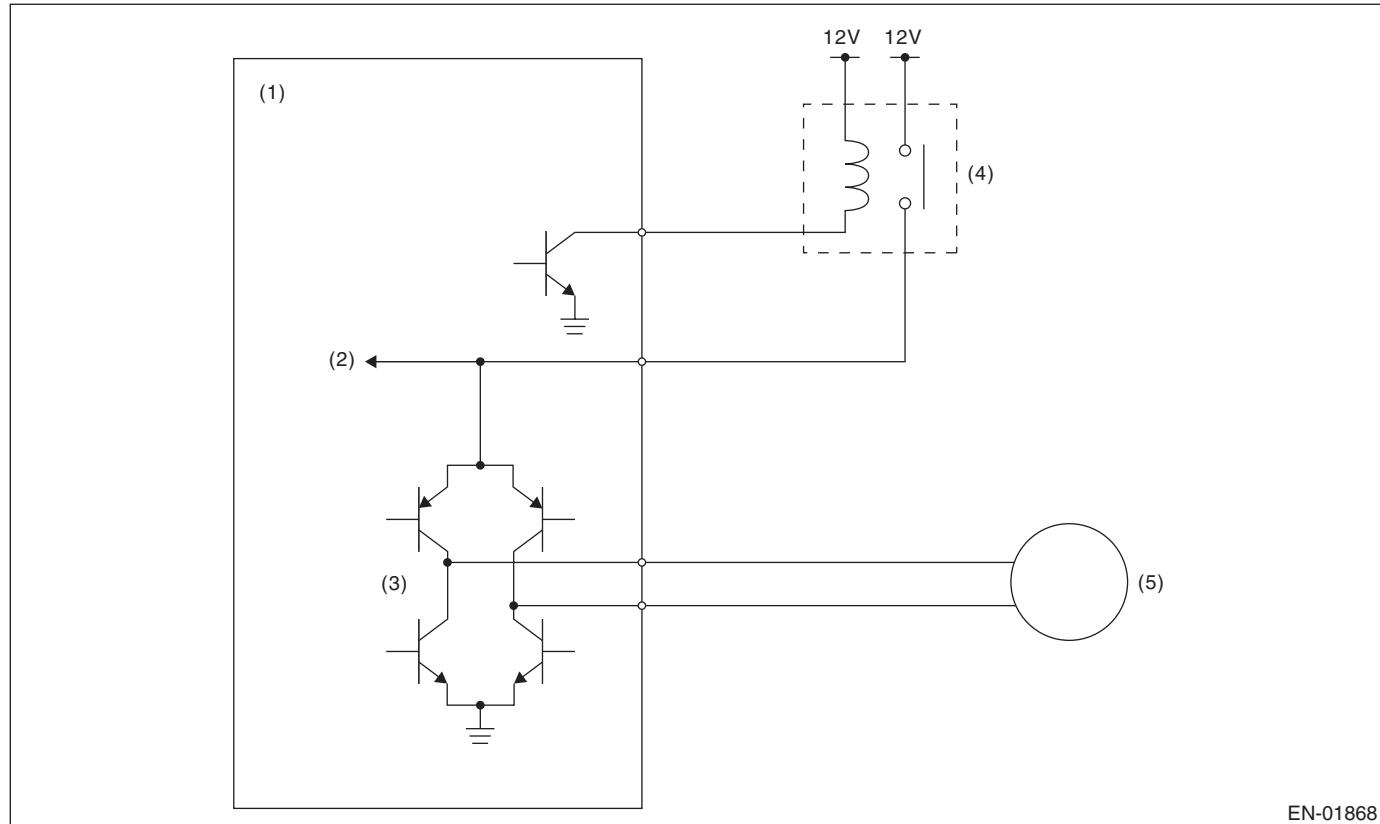
GENERAL DESCRIPTION

DY:DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Judge as NG when the electronic throttle control power is supplied even when ECM sets the electronic throttle control relay to OFF.

2. COMPONENT DESCRIPTION



EN-01868

(1) Engine control module (ECM)

(2) Voltage detection circuit

(3) Drive circuit

(4) Electronic throttle control relay

(5) Motor

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|--|-------------------|
| Battery voltage | ≥ 6 V |
| Electronic throttle control relay output | OFF |

4. GENERAL DRIVING CYCLE

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

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Motor power voltage | ≥ 5 V |

Time Needed for Diagnosis: 600 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Motor power voltage | < 5 V |

Time Needed for Diagnosis: 400 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

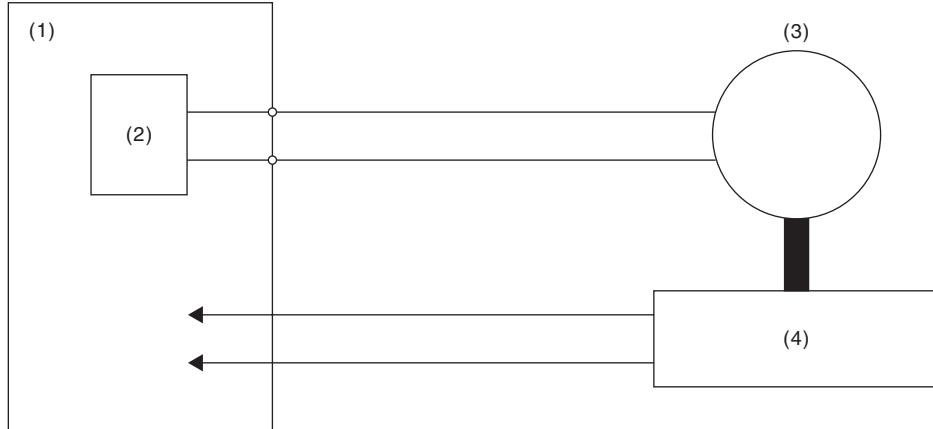
GENERAL DESCRIPTION

DZ:DTC P2109 THROTTLE/PEDAL POSITION SENSOR “A” MINIMUM STOP PERFORMANCE

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



EN-01869

(1) Engine control module (ECM)
(2) Drive circuit

(3) Motor

(4) Throttle position sensor

3. ENABLE CONDITION

| Secondary Parameters | Enable Conditions |
|---|-------------------|
| Ignition switch | ON → OFF |
| Ignition switch (only after clear memory) | OFF → ON |

4. GENERAL DRIVING CYCLE

Perform the diagnosis at full closed point learning.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: 8 ms — 80 ms

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

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: 8 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

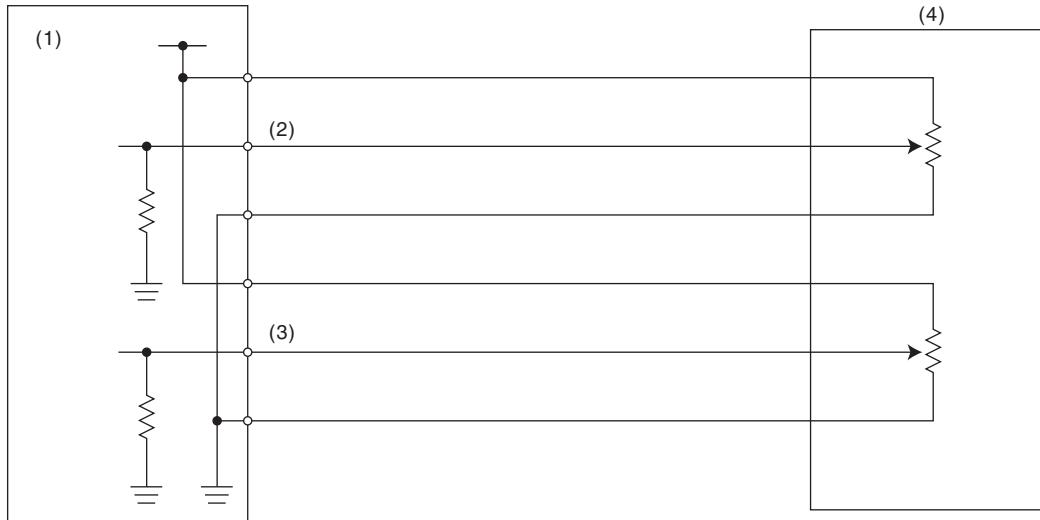
GENERAL DESCRIPTION

EA:DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT LOW INPUT

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



EN-01861

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

3. ENABLE CONDITION

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

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|------------------------|-----------------|
| Sensor 1 input voltage | < 0.217 V |

Time Needed for Diagnosis: 100 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|------------------------|-----------------|
| Sensor 1 input voltage | ≥ 0.217 V |

Time Needed for Diagnosis: 100 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

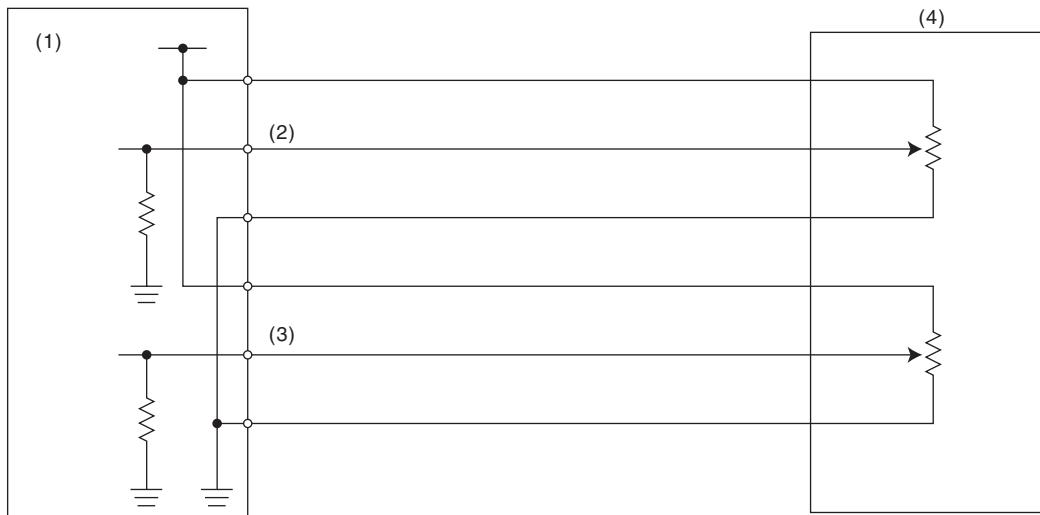
GENERAL DESCRIPTION

EB:DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT HIGH INPUT

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



EN-01861

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

3. ENABLE CONDITION

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

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|------------------------|------------------------|
| Sensor 1 input voltage | $\geq 4.783 \text{ V}$ |

Time Needed for Diagnosis: 32 ms

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

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: 32 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

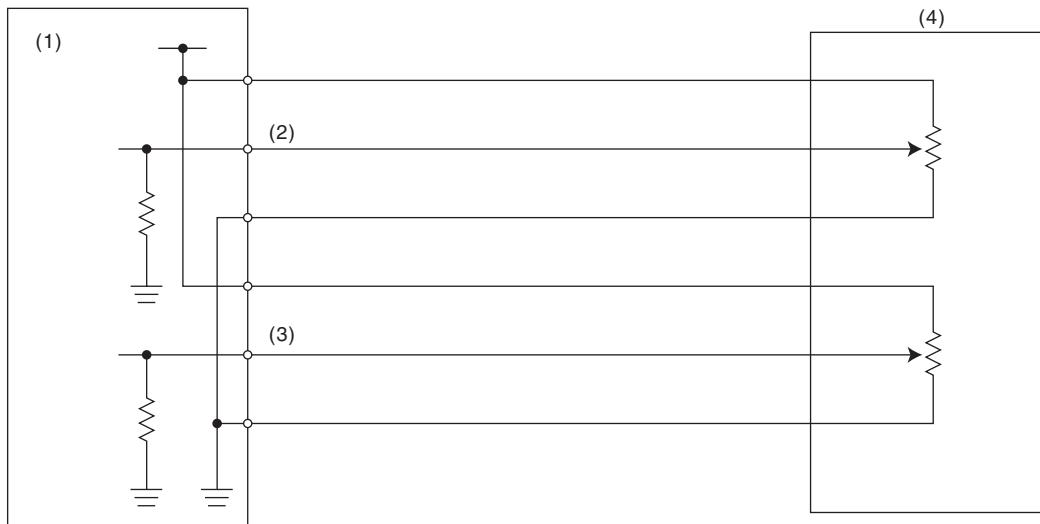
GENERAL DESCRIPTION

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

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



EN-01861

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

3. ENABLE CONDITION

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

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|------------------------|-----------------|
| Sensor 2 input voltage | < 0.217 V |

Time Needed for Diagnosis: 100 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|------------------------|-----------------|
| Sensor 2 input voltage | ≥ 0.217 V |

Time Needed for Diagnosis: 100 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

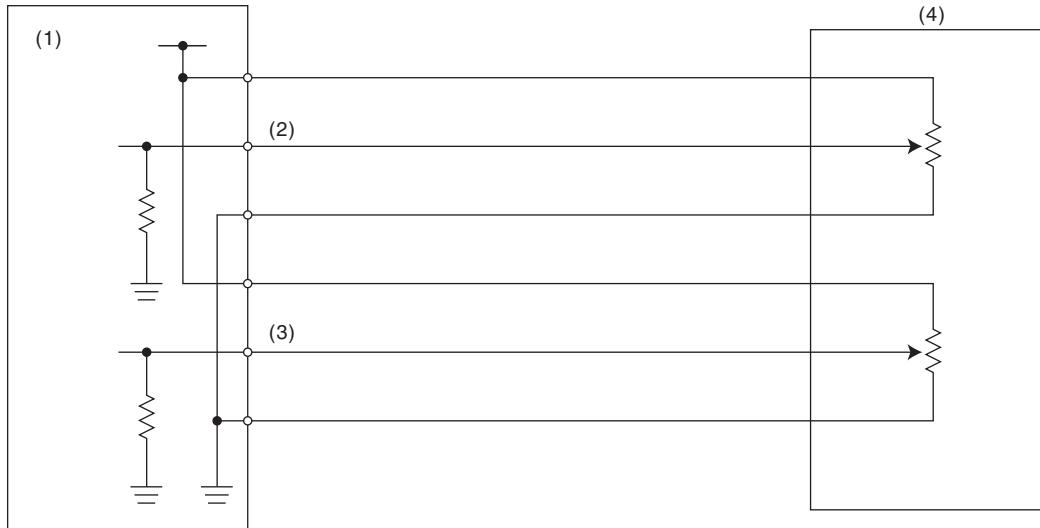
GENERAL DESCRIPTION

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

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



EN-01861

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

3. ENABLE CONDITION

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

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|------------------------|------------------------|
| Sensor 2 input voltage | $\geq 4.783 \text{ V}$ |

Time Needed for Diagnosis: 100 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|------------------------|---------------------|
| Sensor 2 input voltage | $< 4.783 \text{ V}$ |

Time Needed for Diagnosis: 100 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

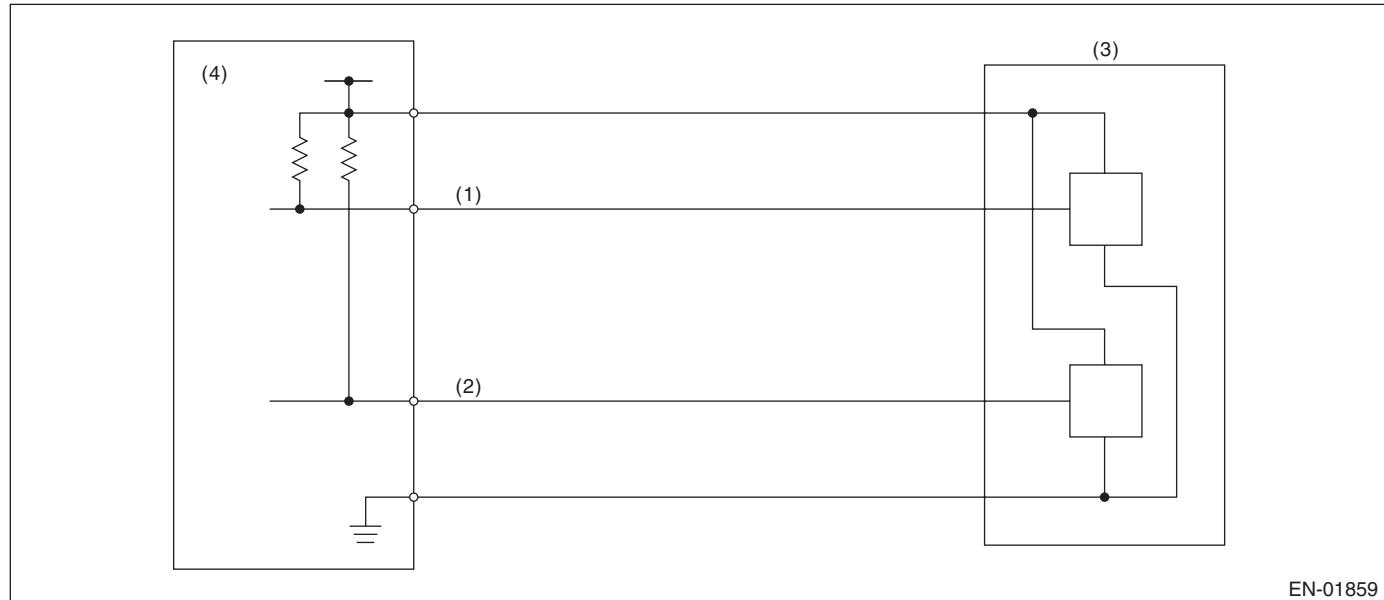
GENERAL DESCRIPTION

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

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



EN-01859

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

(3) Throttle position sensor

(4) Engine control module (ECM)

3. ENABLE CONDITION

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

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

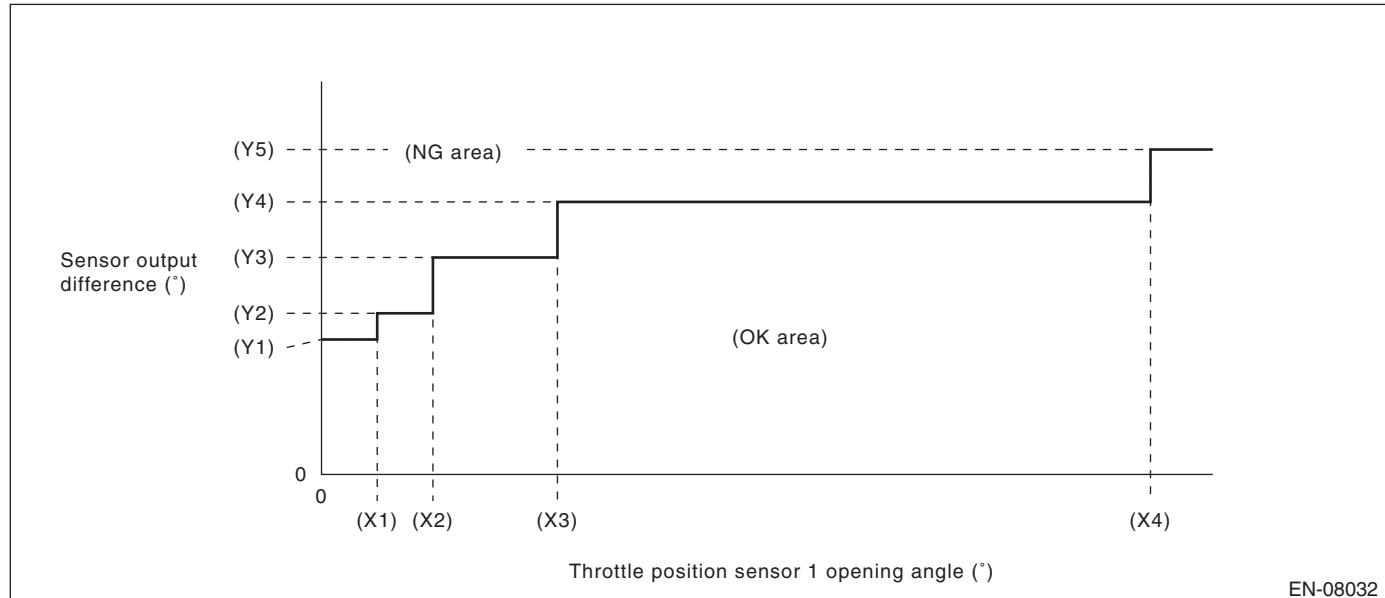
• Abnormality Judgment

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

Judgment Value

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

Details of Judgment Value



EN-08032

(X1) 2.125 ° (X2) 4.25 ° (X3) 9 °
(X4) 31.625 °

(Y1) 5.15 ° (Y2) 6.15 ° (Y3) 8.28 °
(Y4) 10.4 ° (Y5) 12.4 °

Time Needed for Diagnosis: 212 ms

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

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: 24 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

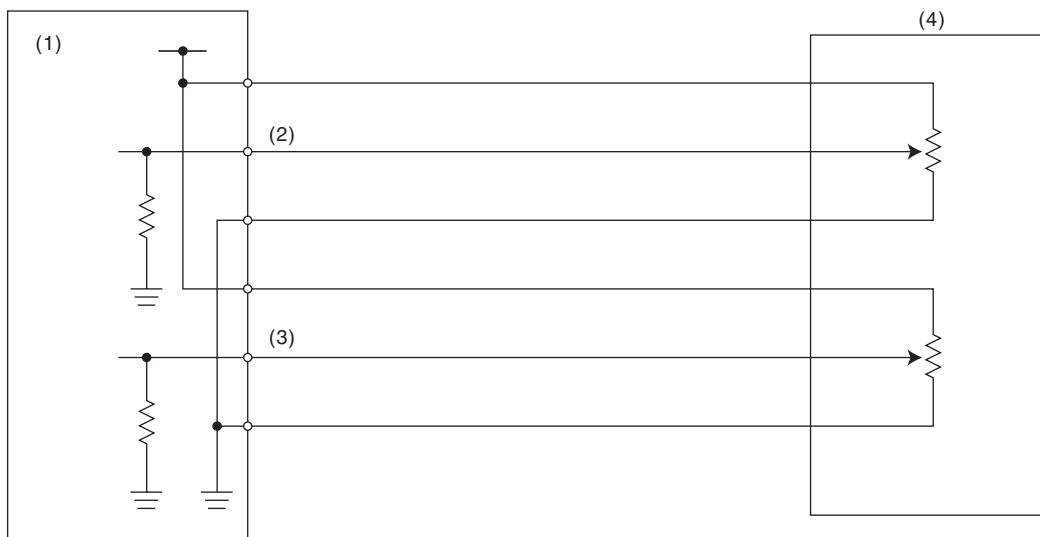
GENERAL DESCRIPTION

EF:DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



EN-01861

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

3. ENABLE CONDITION

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

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

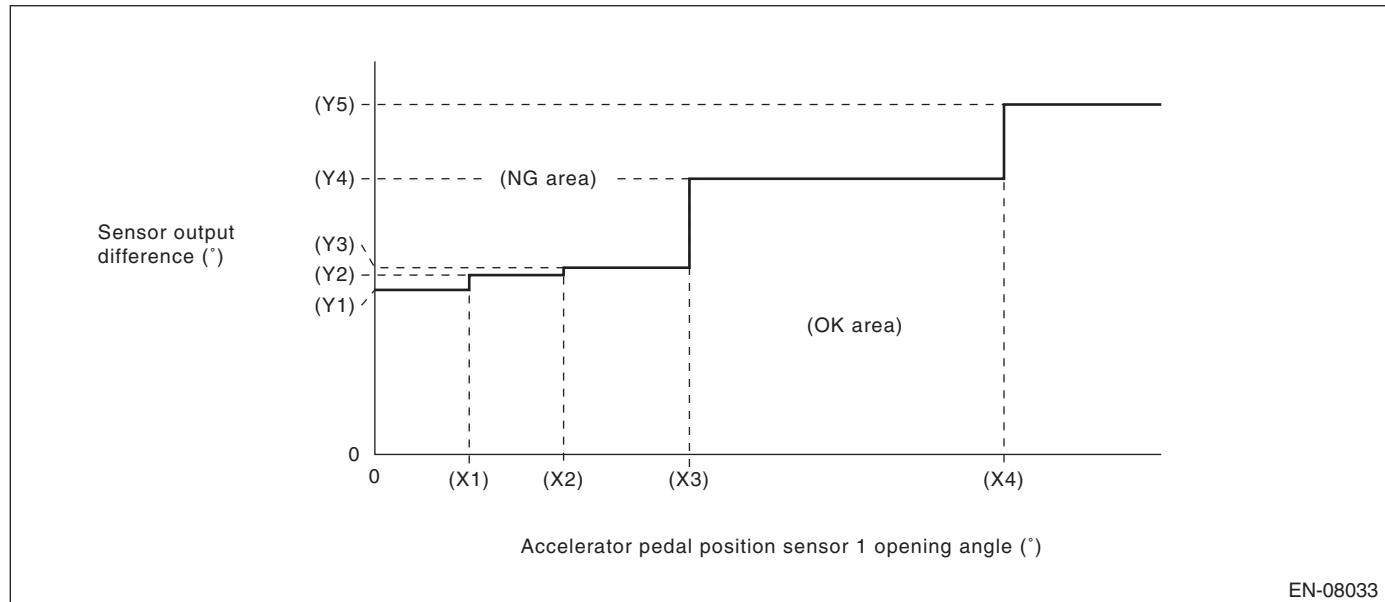
- **Abnormality Judgment**

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

Judgment Value

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

Details of Judgment Value



(X1) 0.6 °
(X4) 4 °

(X2) 1.2 °

(X3) 2 °

(Y1) 1.465 °
(Y4) 2.455 °
(Y2) 1.597 °
(Y5) 3.116 °
(Y3) 1.663 °

Time Needed for Diagnosis: 116 ms

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

- **Normality Judgment**

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

Judgment Value

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

Time Needed for Diagnosis: 116 ms

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

EG:DTC P219A BANK 1 AIR-FUEL RATIO IMBALANCE

1. OUTLINE OF DIAGNOSIS

Detect malfunction of air fuel ratio deviation between cylinders from main feedback learning value, sub feedback learning value and engine speed variation.

2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|--|--------------------------------|
| Battery voltage | > 10.9 V |
| Atmospheric pressure | > 75 kPa (563 mmHg, 22.2 inHg) |
| A/F main learning system | In operation |
| Engine speed | > 550 rpm |
| Engine coolant temperature | > 72 °C (161.6 °F) |
| Intake air temperature | < 70 °C (158 °F) |
| Engine load | > Value of Map 1 |
| Engine load change | < 0.02 g/rev (0 oz/rev) |
| Evaporative system leak check | Not in operation |
| Cumulative time of canister purge after engine start | ≥ 20 s |
| Learning value of EVAP conc. | < 0.2 |
| Vehicle dynamic control or AT torque control | Not in operation |
| Intake manifold pressure change at 180° CA | < Value of Map 2 |
| Throttle position change during 16 milliseconds | < 14 ° |
| Fuel shut-off function | Not in operation |

Map 1

| | | | | | | | | | | |
|-----------------------------|--------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Engine speed (rpm) | Idling | 700 | 1200 | 1600 | 2000 | 2400 | 2800 | 3200 | 3600 | 4000 |
| Measured value (g (oz)/rev) | na | 0.230 (0.01) | 0.217 (0.01) | 0.213 (0.01) | 0.210 (0.01) | 0.210 (0.01) | 0.220 (0.01) | 0.223 (0.01) | 0.240 (0.01) | 0.252 (0.01) |

Map 2

| | | | | | | | | | | | | | |
|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| rpm | 700 | 1000 | 1500 | 2000 | 2500 | 3000 | 3500 | 4000 | 4500 | 5000 | 5500 | 6000 | 6500 |
| kPa (mmHg, inHg) | 13.3 (100, 3.9) |

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|---|
| Rich Main feedback learning value Sub feedback learning value When any one of the followings is established. <ul style="list-style-type: none">• any one of the rich side misfire counters for each cylinder when in idling• total of the rich side misfire counters for each cylinder when in idling• any one of the rich side misfire counters for each cylinder when not in idling• total of the rich side misfire counters for each cylinder when not in idling | < -0.125 < -0.0327 > 13 time(s) > 13 time(s) > 30 time(s) > 30 time(s) |
| Lean Main feedback learning value Sub feedback learning value When any one of the followings is established. <ul style="list-style-type: none">• any one of the lean side misfire counters for each cylinder when in idling• total of the lean side misfire counters for each cylinder when in idling• any one of the lean side misfire counters for each cylinder when not in idling• total of the lean side misfire counters for each cylinder when not in idling | > -0.035 < -0.0143 > 25 time(s) > 65535 time(s) > 30 time(s) > 65535 time(s) |

Time Needed for Diagnosis: 1000 engine revs.

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|---|
| Rich Main feedback learning value or Sub feedback learning value or All following conditions are established. <ul style="list-style-type: none">• any one of the rich side misfire counters for each cylinder when in idling• total of the rich side misfire counters for each cylinder when in idling• any one of the rich side misfire counters for each cylinder when not in idling• total of the rich side misfire counters for each cylinder when not in idling | ≥ -0.125 ≥ -0.0327 ≤ 13 time(s) ≤ 13 time(s) ≤ 30 time(s) ≤ 30 time(s) |
| Lean Main feedback learning value or Sub feedback learning value or All following conditions are established. <ul style="list-style-type: none">• any one of the lean side misfire counters for each cylinder when in idling• total of the lean side misfire counters for each cylinder when in idling• any one of the lean side misfire counters for each cylinder when not in idling• total of the lean side misfire counters for each cylinder when not in idling | ≤ -0.035 ≥ -0.0143 ≤ 25 time(s) ≤ 65535 time(s) ≤ 30 time(s) ≤ 65535 time(s) |

Time Needed for Diagnosis: 1000 engine revs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

EH: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 CONDITIONS

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

4. GENERAL DRIVING CYCLE

Perform the diagnosis once at ignition switch ON.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|---------------------------------|
| Barometric pressure – Intake manifold pressure | ≥ 26.7 kPa (200 mmHg, 7.9 inHg) |
| Intake manifold pressure at engine start – Intake manifold pressure | < 1.3 kPa (9.99 mmHg, 0.4 inHg) |

Time Needed for Diagnosis: 328 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|---------------------------------|
| Barometric pressure – Intake manifold pressure | < 26.7 kPa (200 mmHg, 7.9 inHg) |

Time Needed for Diagnosis: 262 ms

EI: 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 CONDITIONS

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | < 2.006 V |

Time Needed for Diagnosis: 500 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | ≥ 2.006 V |

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

EJ: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 CONDITIONS

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | ≥ 4.016 V |

Time Needed for Diagnosis: 500 ms

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

• Normality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|----------------------|-----------------|
| Output voltage | < 4.016 V |

Time Needed for Diagnosis: Less than 1 second

EK:DTC P2419 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the purge control solenoid valve 2.

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

2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

| Malfunction Criteria | Threshold Value |
|---|-----------------|
| Battery voltage | ≥ 10.9 V |
| 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 Judgment

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

Judgment Value

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

Time Needed for Diagnosis: Less than 1 second

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

EL:DTC P2420 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the purge control solenoid valve 2.

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

2. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: 2500 ms

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

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.

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

2. COMPONENT DESCRIPTION

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

(Common Specifications)

CAN Protocol 2.0 B (Active)

Frame Format: 11 Bit ID Frame (Standard Frame)

(High speed CAN)

Conforms to ISO11898

Communication Speed: 500 kbps

3. ENABLE CONDITIONS

| Secondary Parameters | Enable Conditions |
|----------------------|-------------------|
| None | |

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

| Malfunction Criteria | Threshold Value |
|--|-------------------------------|
| Battery voltage | > 10.9 V |
| Starter switch | OFF |
| Engine | run |
| bus off flag or error warning flag | set (error) |
| or | |
| ID received from control module connected to driving system CAN | None during 500 milliseconds |
| or | |
| Data updated from control module connected to driving system CAN | None during 2000 milliseconds |

Time Needed for Diagnosis: 2 seconds

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

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Normality Judgment

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

Judgment Value

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

Time Needed for Diagnosis: 1000 ms

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

EN:DTC U0101 CAN (TCU) DATA NOT LOADED

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC U0073. <Ref. to GD(H4DOTC)-255, DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

EO:DTC U0122 CAN (VDC) DATA NOT LOADED

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC U0073. <Ref. to GD(H4DOTC)-255, DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

EP:DTC U0140 CAN (BCU) DATA NOT LOADED

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC U0073. <Ref. to GD(H4DOTC)-255, DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

EQ:DTC U0402 CAN (TCU) DATA ABNORMAL

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC U0073. <Ref. to GD(H4DOTC)-255, DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

ER:DTC U0416 CAN (VDC) DATA ABNORMAL

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC U0073. <Ref. to GD(H4DOTC)-255, DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

ES:DTC U0422 CAN (BCU) DATA ABNORMAL

1. OUTLINE OF DIAGNOSIS

NOTE:

For the detection standard, refer to DTC U0073. <Ref. to GD(H4DOTC)-255, DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

ENGINE 3 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.

| | |
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| FUEL INJECTION (FUEL SYSTEMS) | FU(H6DO) |
| EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES) | EC(H6DO) |
| INTAKE (INDUCTION) | IN(H6DO) |
| MECHANICAL | ME(H6DO) |
| EXHAUST | EX(H6DO) |
| COOLING | CO(H6DO) |
| LUBRICATION | LU(H6DO) |
| SPEED CONTROL SYSTEMS | SP(H6DO) |
| IGNITION | IG(H6DO) |
| STARTING/CHARGING SYSTEMS | SC(H6DO) |
| ENGINE (DIAGNOSTICS) | EN(H6DO) (diag) |
| GENERAL DESCRIPTION | GD(H6DO) |

FUEL INJECTION (FUEL SYSTEMS)

FU(H6DO)

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