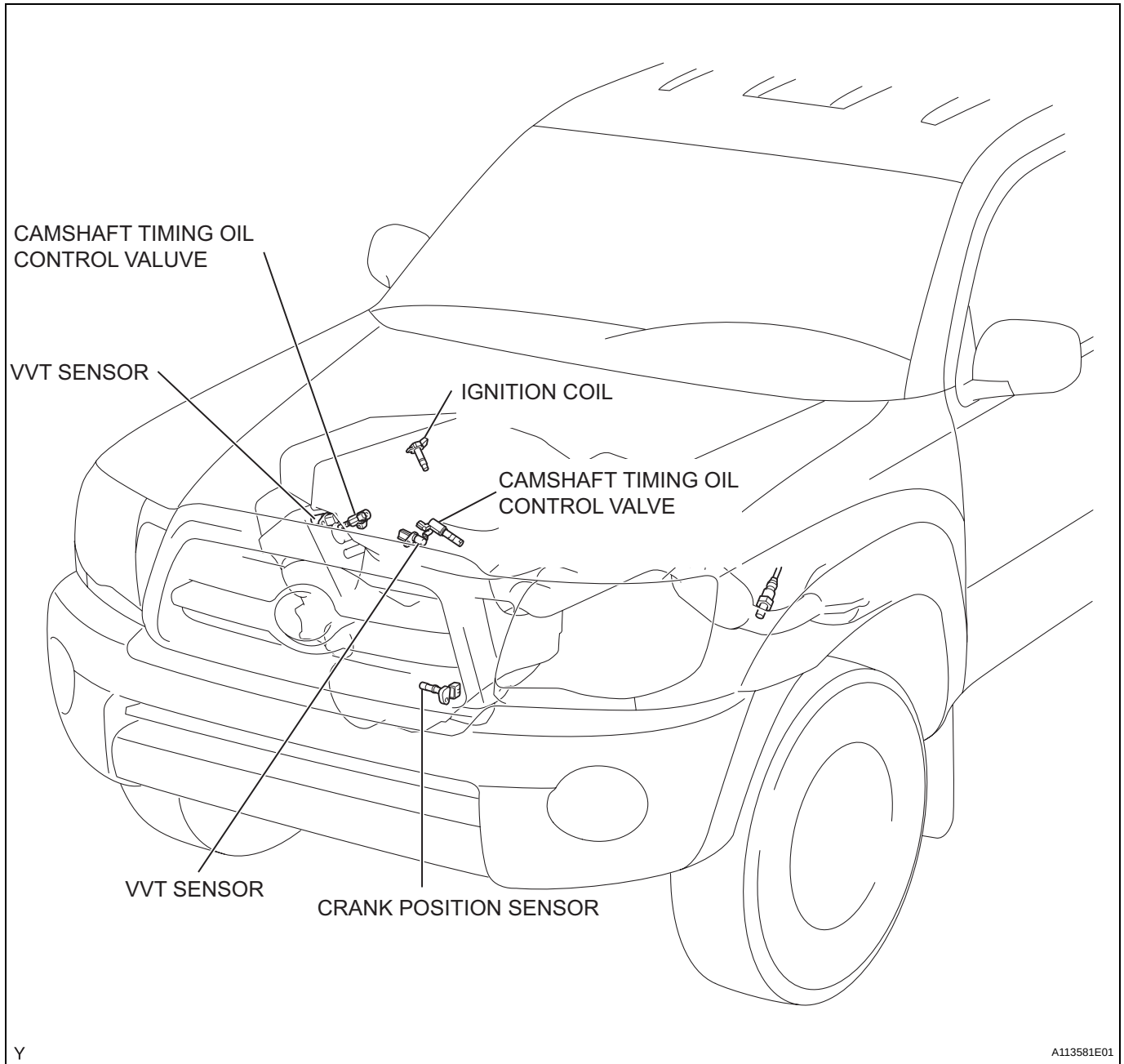
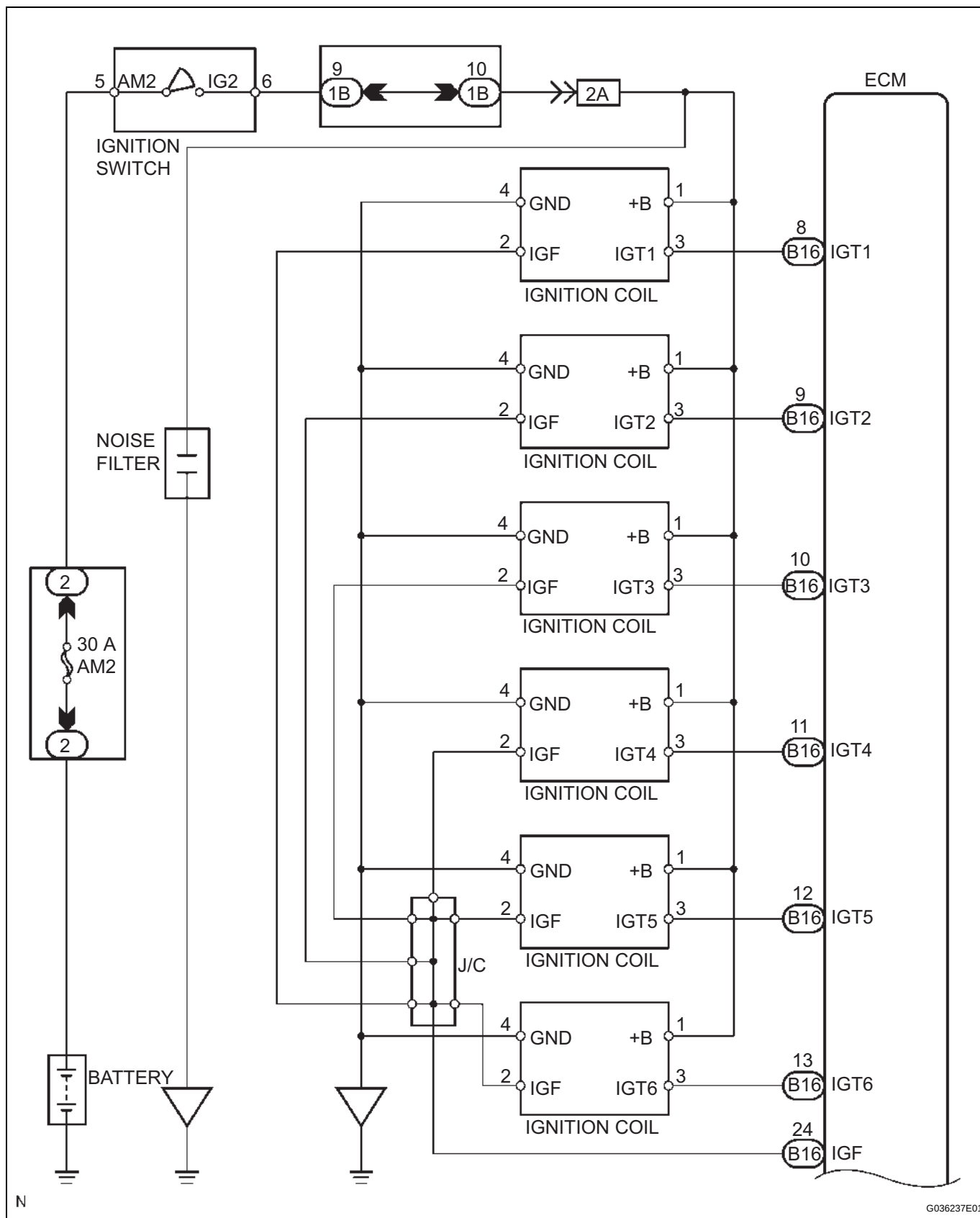


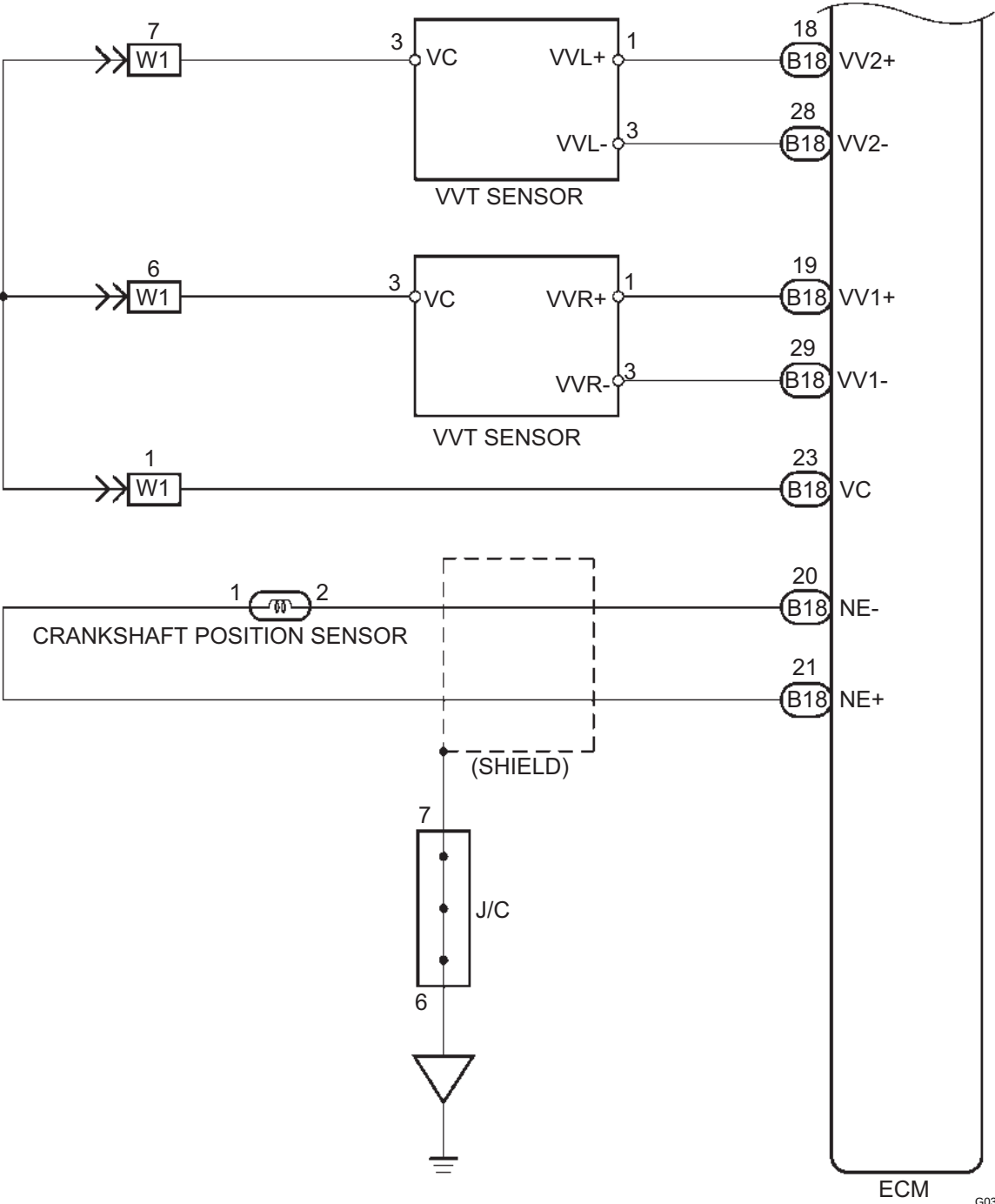
# IGNITION SYSTEM

## PARTS LOCATION



## SYSTEM DIAGRAM





## ON-VEHICLE INSPECTION

### 1. CHECK IGNITION COIL ASSEMBLY AND PERFORM SPARK TEST

- (a) Check for DTCs.

**NOTICE:**

**If any DTC is present, perform troubleshooting in accordance with a procedure for that DTC.**

- (b) Check that sparks occur.
- (1) Remove the ignition coils.
  - (2) Using a 16 mm plug wrench, remove the spark plugs.
  - (3) Install the spark plugs to each ignition coil, and connect the ignition coil connectors.
  - (4) Disconnect the 6 injector connectors.
  - (5) Ground the spark plugs.
  - (6) Check if sparks occur at each spark plug while the engine is being cranked.

**NOTICE:**

- **Be sure to ground the spark plug when checking.**
- **Replace the ignition coil if it receives an impact.**
- **Do not crank the engine for more than 2 seconds.**

If sparks do not occur, perform the following test:

- (c) Spark test flow chart.
- (1) Check that the wire harness side connector of ignition coil with igniter is securely connector.

**Result**

| Result | Proceed to        |
|--------|-------------------|
| NG     | Connect securely. |
| OK     | Go to next step.  |

- (2) Perform spark test on each ignition coil with igniter.
1. Replace ignition coil with igniter with a normal one.
  2. Perform spark test again.

**Result**

| Result | Proceed to                          |
|--------|-------------------------------------|
| NG     | Replace ignition coil with igniter. |
| OK     | Go to next step.                    |

- (3) Check power supply to ignition coil.
1. Turn ignition switch ON.
  2. Check that there is battery positive (+) voltage at ignition coil positive (+) terminal.

**Result**

| Result | Proceed to                                                       |
|--------|------------------------------------------------------------------|
| NG     | Check wiring between ignition switch and ignition coil assembly. |
| OK     | Go to next step.                                                 |

- (4) Check resistance in VVT sensor out put voltage (see step 2).

**Result**

| Result | Proceed to              |
|--------|-------------------------|
| NG     | Following test 1 and 2. |
| OK     | Go to next step.        |

1. Check that the wiring between VVT sensor and ECM.

**Result**

| Result | Proceed to                                |
|--------|-------------------------------------------|
| NG     | Repair wiring between VVT sensor and ECM. |
| OK     | Repair VVT sensor                         |

- (5) Check resistance in crankshaft position sensor.

**Standard resistance**

| Standard condition | Specified condition   |
|--------------------|-----------------------|
| at 20°C (68°F)     | 1850 to 2450 $\Omega$ |

**Result**

| Result | Proceed to                              |
|--------|-----------------------------------------|
| NG     | Replace the crankshaft position sensor. |
| OK     | Go to next step.                        |

- (6) Check IGT signal from ECM.

**Result**

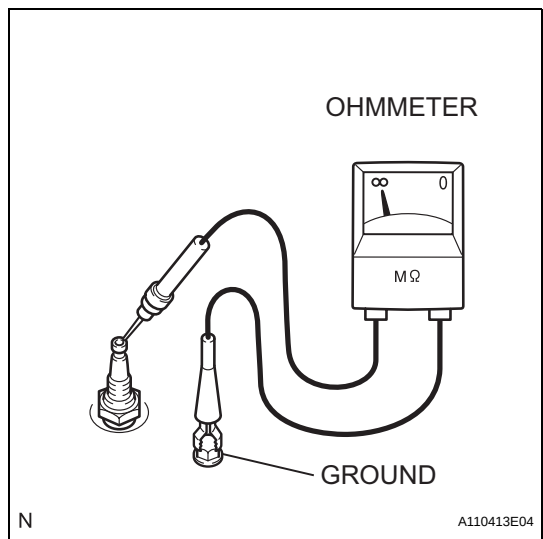
| Result | Proceed to                                   |
|--------|----------------------------------------------|
| NG     | Check ECM                                    |
| OK     | Repair wiring between ignition coil and ECM. |

- (d) Using a 16 mm plug wrench, install the spark plugs.  
(e) Install the ignition coils.

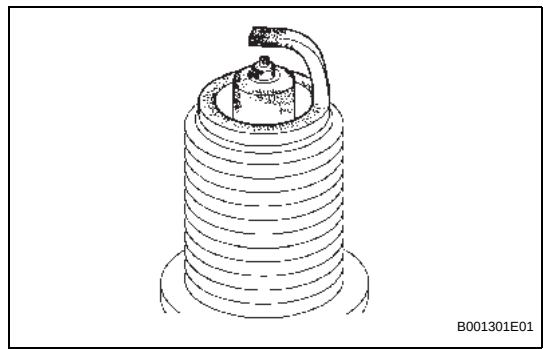
**2. CHECK SPARK PLUG****NOTICE:**

- Never use a wire brush for cleaning.
- Never attempt to adjust the electrode gap on a used spark plug.
- The spark plug should be replaced every 200,000 km (120,000 miles).

- (a) Remove the engine cover.  
(b) Remove the air cleaner.  
(c) Remove the ignition coil.  
(d) Remove the spark plug.



- (e) Check the electrode.
- (1) Using an ohmmeter, measure the insulation resistance.
- Correct insulation resistance:**  
**10 MΩ or more**
- If the resistance is below the specified range, remove the spark plug.
- HINT:**  
If an ohmmeter is not available, perform the following simple inspection.

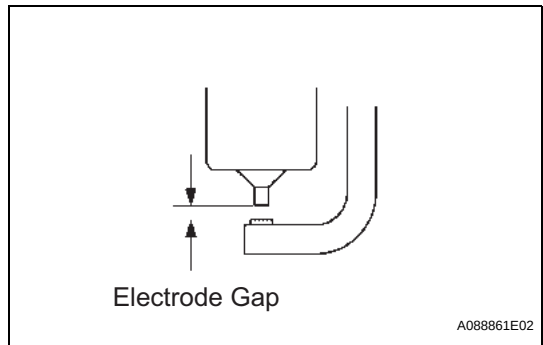


- (f) Alternative inspection method:
- (1) Quickly accelerate the engine to 4,000 rpm 5 times.
- (2) Remove the spark plug.
- (3) Visually check the spark plug.
- If the electrode is dry, the spark plug is functioning properly. If the electrode is damp, proceed to the next step.
- (g) Check the spark plug for any damage on its threads and insulator.
- If there is damage, replace the spark plug. If not, reinstall the spark plug.

**Recommended spark plug**

| Manufacturer | Spark Plug Type |
|--------------|-----------------|
| DENSO        | K20HR-U11       |
| NGK          | LFR6C11         |

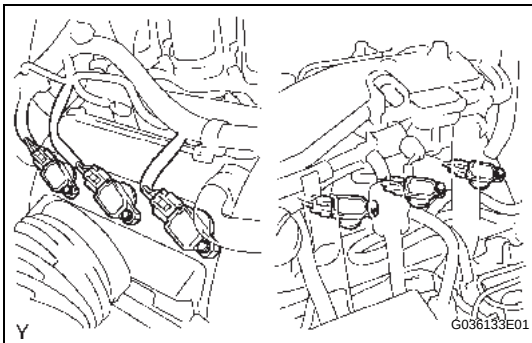
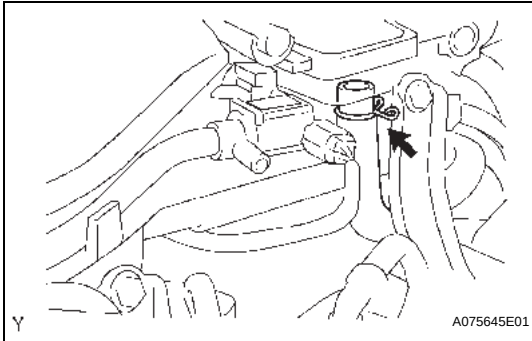
- (h) Check the spark plug electrode gap.
- Standard electrode gap:**  
**1.0 to 1.1 mm (0.039 to 0.043 in.)**
- If the electrode gap is larger than the standard, replace the spark plug.



## IGNITION COIL

### REMOVAL

1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**
2. **REMOVE V-BANK COVER** (See page [ES-414](#))
3. **REMOVE AIR CLEANER ASSEMBLY** (See page [ES-415](#))
4. **DISCONNECT VENTILATION HOSE**
  - (a) Disconnect the ventilation hose from the intake air surge tank.



5. **REMOVE IGNITION COIL ASSEMBLY**
  - (a) Disconnect the 6 connectors.
  - (b) Remove the 6 bolts, then remove the 6 ignition coils.

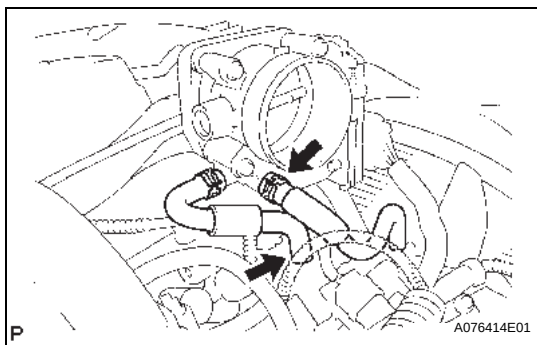
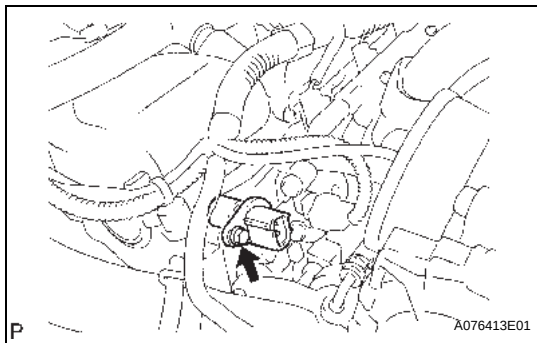
## INSTALLATION

1. **INSTALL IGNITION COIL ASSEMBLY**
  - (a) Install the 6 ignition coils with the 6 bolts.  
**Torque: 10 N\*m (102 kgf\*cm, 7.4 ft.\*lbf)**
  - (b) Connect the 6 ignition coil connectors.
2. **CONNECT VENTILATION HOSE**
3. **INSTALL AIR CLEANER ASSEMBLY** (See page [ES-416](#))
4. **INSTALL V-BANK COVER** (See page [ES-416](#))
5. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**  
**Torque: 3.9 N\*m (40 kgf\*cm, 35 in.\*lbf)**
6. **INSPECT IGNITION TIMING** (See page [EM-1](#))
7. **INSPECT ENGINE IDLING SPEED** (See page [EM-2](#))

## VVT SENSOR

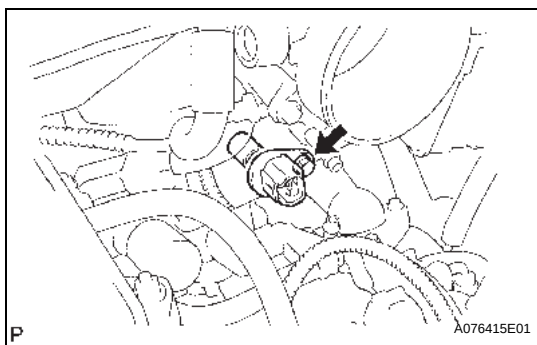
### REMOVAL

1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL
2. DRAIN ENGINE COOLANT (See page [CO-3](#))
3. REMOVE V-BANK COVER (See page [ES-414](#))
4. REMOVE AIR CLEANER ASSEMBLY (See page [ES-415](#))
5. REMOVE VVT SENSOR
  - (a) RH bank side VVT sensor:
    - (1) Disconnect the VVT sensor connector.
    - (2) Remove the bolt and VVT sensor.



- (b) LH bank side VVT sensor:
  - (1) Disconnect the water by-pass hoses No. 4 and No. 5 .
  - (2) Disconnect the VVT sensor connector.

- (3) Remove the bolt and VVT sensor.



## INSTALLATION

### 1. INSTALL VVT SENSOR

- (a) LH bank side VVT sensor:
  - (1) Apply a light coat of engine oil to the O-ring of the VVT sensor.
  - (2) Install the VVT sensor with the bolt.  
**Torque: 8.0 N\*m (82 kgf\*cm, 71 in.\*lbf)**
  - (3) Connect the VVT sensor connector.
  - (4) Connect the water by-pass hoses No. 4 and No. 5.
- (b) RH bank side VVT sensor:
  - (1) Apply a light coat of engine oil to the O-ring of the VVT sensor.
  - (2) Install the VVT sensor with the bolt.  
**Torque: 8.0 N\*m (82 kgf\*cm, 71 in.\*lbf)**
  - (3) Connect the VVT sensor connector.

### 2. INSTALL AIR CLEANER ASSEMBLY (See page [ES-416](#))

### 3. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

**Torque: 3.9 N\*m (40 kgf\*cm, 35 in.\*lbf)**

### 4. ADD ENGINE COOLANT (See page [CO-3](#))

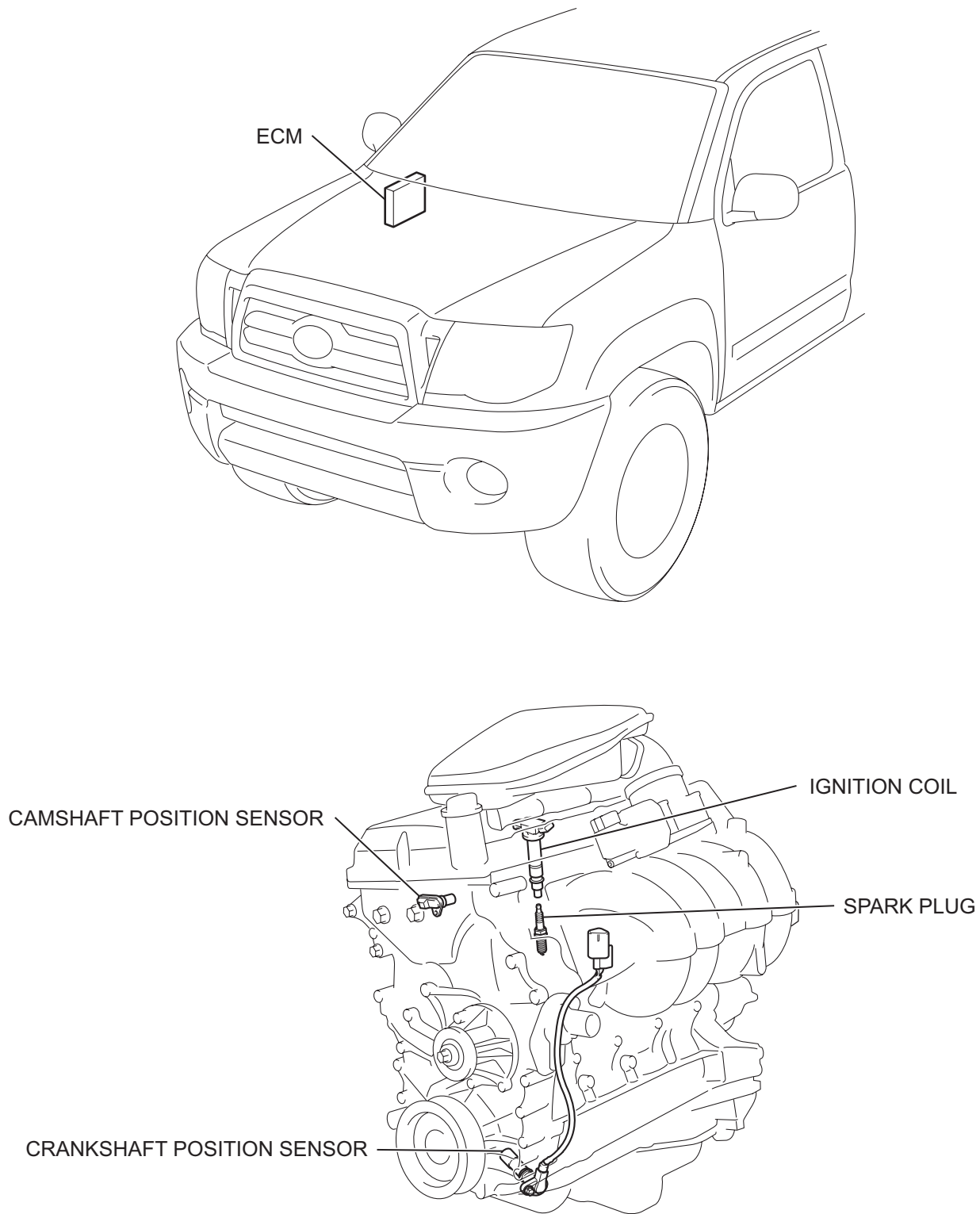
### 5. CHECK FOR ENGINE COOLANT LEAKAGE (See page [CO-4](#))

### 6. INSTALL V-BANK COVER

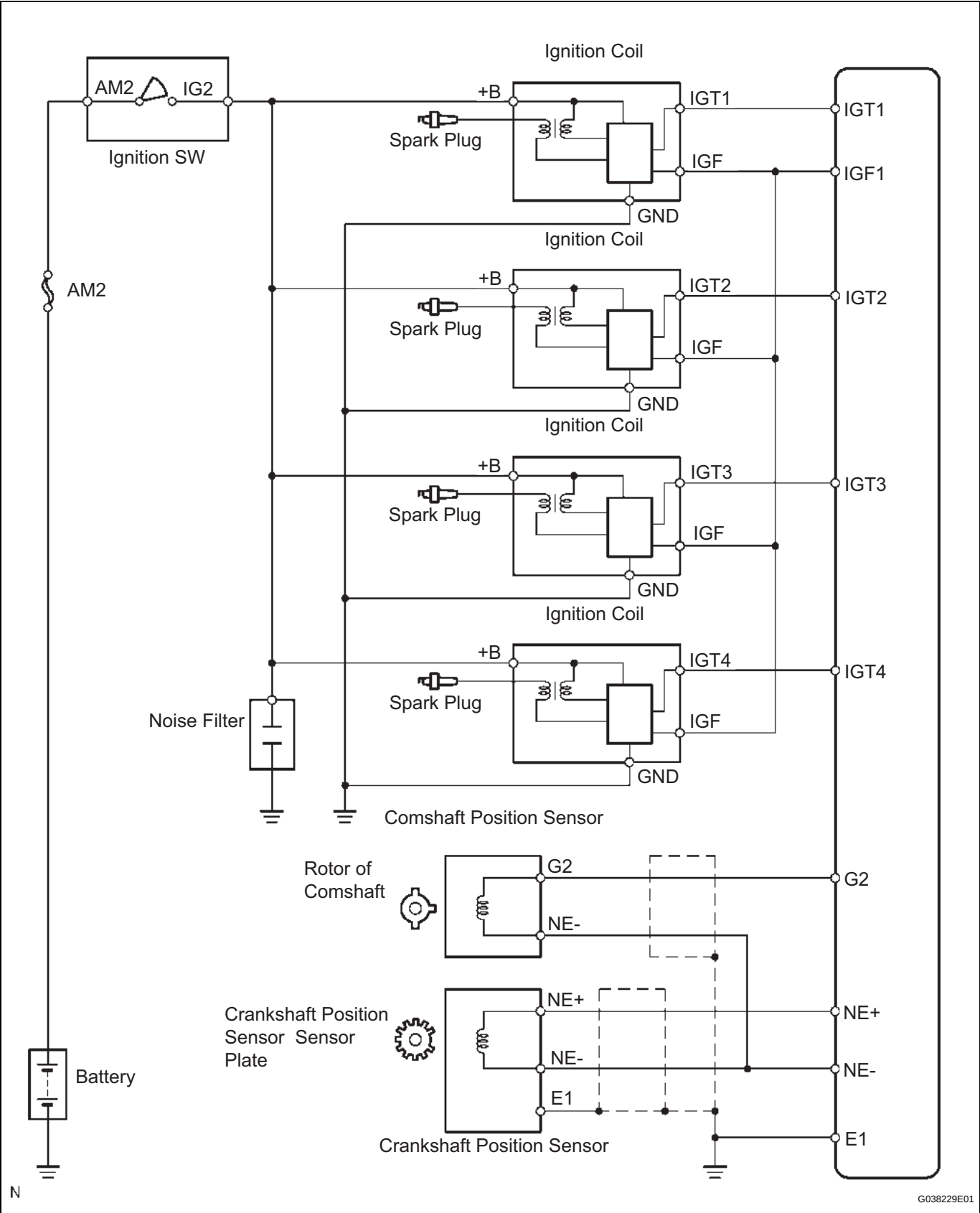
- (a) Install the V-bank cover with the 2 nuts.  
**Torque: 7.5 N\*m (76 kgf\*cm, 66 in.\*lbf)**

# IGNITION SYSTEM

## PARTS LOCATION



SYSTEM DIAGRAM



## ON-VEHICLE INSPECTION

### NOTICE:

In this section, the terms "cold" and "hot" refer to the temperature of the coils. "Cold" means approximately -10 to 50°C (14 to 122°F). "Hot" means approximately 50 to 100°C (122 to 212°F).

### 1. PERFORM SPARK TEST

- (a) Check for DTCs.

#### NOTICE:

**If a DTC is present, perform troubleshooting procedures for that DTC.**

- (b) Check if sparks occur.
- (1) Remove the ignition coil.
  - (2) Remove the spark plug.
  - (3) Install the spark plug to the ignition coil and connect the ignition coil connector.
  - (4) Disconnect the 4 injector connectors.
  - (5) Ground the spark plug.
  - (6) Visually check that sparks occur while the engine is being cranked.

#### NOTICE:

- **Be sure to ground the spark plug when checking.**
- **If the ignition coil has been struck or dropped, replace it.**
- **Do not crank the engine for more than 2 seconds.**

- (c) Spark test flow chart.

- (1) Check that the wire harness side connector of the ignition coil with igniter is securely connected.

#### Result

| Result | Proceed to       |
|--------|------------------|
| NG     | Connect securely |
| OK     | Go to next step  |

- (2) Perform spark test on each ignition coil with igniter.

1. Replace ignition coil with igniter with a normal one.
2. Perform spark test again.

#### Result

| Result | Proceed to                         |
|--------|------------------------------------|
| OK     | Replace ignition coil with igniter |
| NG     | Go to next step                    |

- (3) Check power supply to ignition coil with igniter.
  1. Turn the ignition switch ON.

2. Check that there is battery voltage at ignition coil positive (+) terminal.

**Result**

| Result | Proceed to                                                        |
|--------|-------------------------------------------------------------------|
| NG     | Check wiring between engine switch and ignition coil with igniter |
| OK     | Go to next step                                                   |

- (4) Check resistance of camshaft position sensor.

**Standard resistance**

| Temperature | Specified Condition     |
|-------------|-------------------------|
| Cold        | 835 to 1,400 $\Omega$   |
| Hot         | 1,060 to 1,645 $\Omega$ |

**Result**

| Result | Proceed to                       |
|--------|----------------------------------|
| NG     | Replace camshaft position sensor |
| OK     | Go to next step                  |

- (5) Check resistance of crankshaft position sensor.

**Standard resistance**

| Temperature | Specified Condition     |
|-------------|-------------------------|
| Cold        | 1,690 to 2,740 $\Omega$ |
| Hot         | 2,065 to 3,225 $\Omega$ |

**Result**

| Result | Proceed to                          |
|--------|-------------------------------------|
| NG     | Replace crankshaft position sensor. |
| OK     | Go to next step                     |

- (6) Check IGT signal from ECM.

**Result**

| Result | Proceed to                                  |
|--------|---------------------------------------------|
| NG     | Check ECM                                   |
| OK     | Repair wiring between ignition coil and ECM |

- (d) Using a 16 mm plug wrench, install the spark plug.

**Torque: 18 N\*m (183 kgf\*cm, 13 ft.\*lbf)**

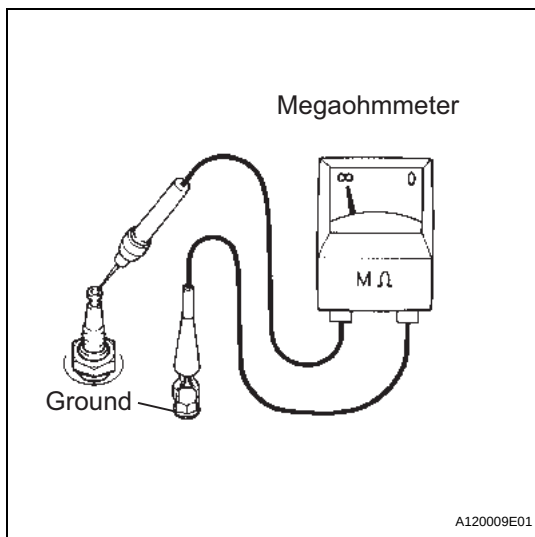
- (e) Install the ignition coil.

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf)**

**2. CHECK SPARK PLUG**

**NOTICE:**

- Do not use a wire brush for cleaning.
- Do not attempt to adjust the electrode gap of a used spark plug.



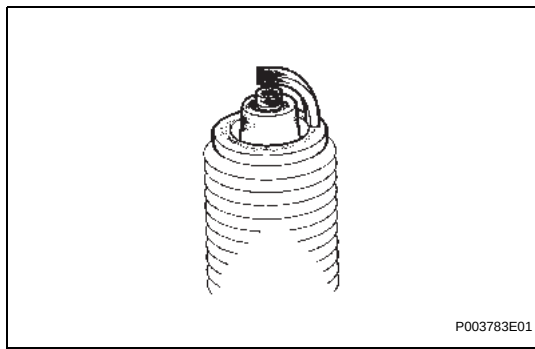
- (a) Check the electrode.
- (1) Using a megohmmeter, measure the insulation resistance.

**Insulation resistance:**

**10 MΩ or more**

**HINT:**

If a megohmmeter is not available, perform the following simple inspection instead.



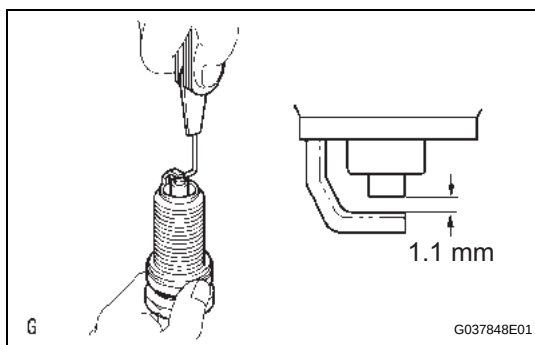
- (b) Alternative inspection method:
- (1) Quickly accelerate the engine to 4,000 rpm 5 times.
  - (2) Remove the spark plug.
  - (3) Visually check the spark plug.  
If the electrode is dry, the spark plug is functioning properly. If the electrode is damp, proceed to the next step.

- (c) Check the spark plug for any damage on its thread and insulator.

If there is damage, replace the spark plug. If not, reinstall the spark plug.

**Recommended spark plug**

| Manufacturer | Spark Plug Type |
|--------------|-----------------|
| DENSO made   | SK20R11         |
| NGK made     | ILFR6C11        |



- (d) Check the spark plug electrode gap.
- Maximum electrode gap for used spark plug:**  
**1.3 mm (0.051 in.)**

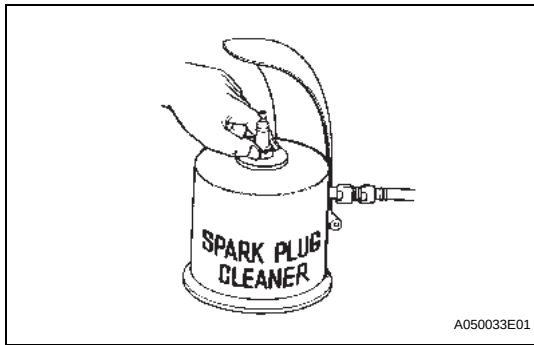
If the gap is greater than the maximum, replace the spark plug.

**Electrode gap for new spark plug:**

**1.1 mm (0.043 in.)**

**NOTICE:**

When adjusting the gap of a new spark plug, bend only the base of the ground electrode. Do not touch the tip. Never attempt to adjust the gap of a used plug.



- (e) Clean the spark plugs.

If the electrode has traces of wet carbon, clean the electrode with a spark plug cleaner and then dry it.

**Air pressure:**

**588 kPa (6 kgf/cm<sup>2</sup>, 85 psi)**

**Duration:**

**20 seconds or less**

**HINT:**

Only use the spark plug cleaner when the electrode is free of oil. If the electrode has traces of oil, use gasoline to clean off the oil before using the spark plug cleaner.