SECTION FL
FUEL SYSTEM

CONTENTS

PRECAUTION

PRECAUTIONS

Precaution for Supplemental Restraint System (SRS) "AIR BAG" and "SEAT BELT PRE-TENSIONER"

INFOID:0000000014418353

The Supplemental Restraint System such as “AIR BAG” and “SEAT BELT PRE-TENSIONER”, used along with a front seat belt, helps to reduce the risk or severity of injury to the driver and front passenger for certain types of collision. Information necessary to service the system safely is included in the SR and SB section of this Service Manual.

WARNING:

- **To avoid rendering the SRS inoperative, which could increase the risk of personal injury or death in the event of a collision which would result in air bag inflation, it is recommended that all maintenance and repair be performed by an authorized NISSAN/INFINITI dealer.**
- **Improper repair, including incorrect removal and installation of the SRS, can lead to personal injury caused by unintentional activation of the system. For removal of Spiral Cable and Air Bag Module, see the SR section.**
- **Do not use electrical test equipment on any circuit related to the SRS unless instructed to in this Service Manual. SRS wiring harnesses can be identified by yellow and/or orange harnesses or harness connectors.**

PRECAUTIONS WHEN USING POWER TOOLS (AIR OR ELECTRIC) AND HAMMERS

WARNING:

- **When working near the Air Bag Diagnosis Sensor Unit or other Air Bag System sensors with the Ignition ON or engine running, DO NOT use air or electric power tools or strike near the sensor(s) with a hammer. Heavy vibration could activate the sensor(s) and deploy the air bag(s), possibly causing serious injury.**
- **When using air or electric power tools or hammers, always switch the Ignition OFF, disconnect the battery or batteries, and wait at least three minutes before performing any service.**

General Precautions

INFOID:0000000014418354

WARNING:

When replacing fuel line parts, be sure to observe the following:

- **Put a “CAUTION: FLAMMABLE” sign in the workshop.**
- **Be sure to work in a well ventilated area and furnish workshop with a CO_2 fire extinguisher.**
- **Do not smoke while servicing fuel system. Keep open flames and sparks away from the work area.**

CAUTION:

- **Use gasoline required by the regulations for octane number. Refer to GI-27, "Fuel".**
- **Before removing fuel line parts, perform the following procedures:**
- **Put drained fuel in an explosion-proof container and put the lid on securely. Keep the container in safe area.**
- **Release fuel pressure from the fuel lines. Refer to EC-205, "Work Procedure".**
- **Disconnect the battery cable from the negative terminal.**
- **Always replace O-ringS and clamps with new ones.**
- **Do not kink or twist tubes when they are being installed.**
- **Do not tighten hose clamps excessively to avoid damaging hoses.**
- **After installing tubes, check that there are no fuel leaks at connections in the following steps.**
- **Apply fuel pressure to fuel lines by turning ignition switch “ON” (with engine stopped). Then check for fuel leaks at connections.**
- **Start engine and rev it up and check for fuel leaks at connections.**
- **Use only a genuine NISSAN fuel filler cap as a replacement. If an incorrect fuel filler cap is used, the “MIL” may come on.**

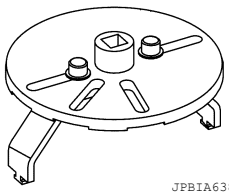
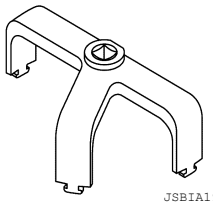
PREPARATION

PREPARATION

Special Service Tool

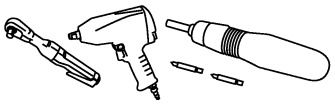
INFOID:0000000014418355

The actual shape of the tools may differ from those illustrated here.

Tool number (TechMate No.) Tool name	Description
KV101207S0 (—) Unified fuel lock ring wrench  JPBIA6384ZZ	Removing and installing fuel tank lock ring
— (J-46536) Fuel tank lock ring wrench  JSBIA1952ZZ	

Commercial Service Tool

INFOID:0000000014418356

Tool name	Description
Power tool  PIIB1407E	Loosening nuts, screws and bolts

PERIODIC MAINTENANCE

FUEL SYSTEM

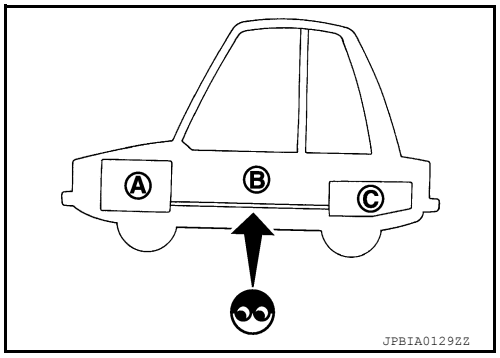
Inspection

INFOID:0000000014418357

Inspect fuel lines, fuel filler cap, and fuel tank for improper attachment, leaks, cracks, damage, loose connections, chafing or deterioration.

(A) : Engine
(B) : Fuel line
(C) : Fuel tank

If necessary, repair or replace damaged parts.



Quick Connector

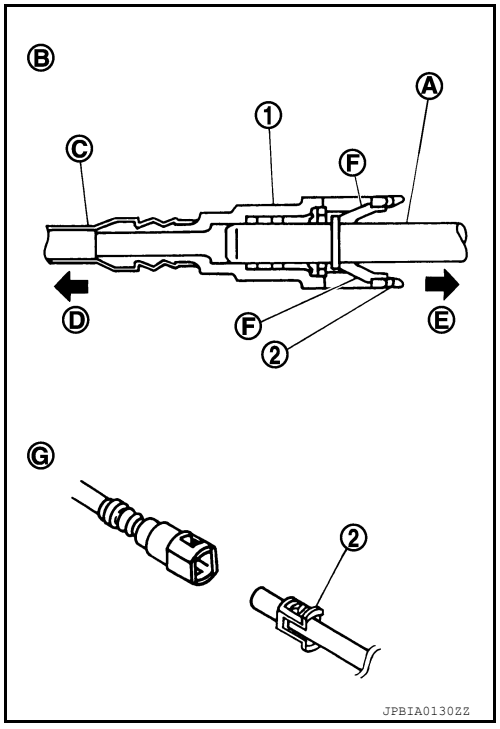
INFOID:0000000014418358

CAUTION:

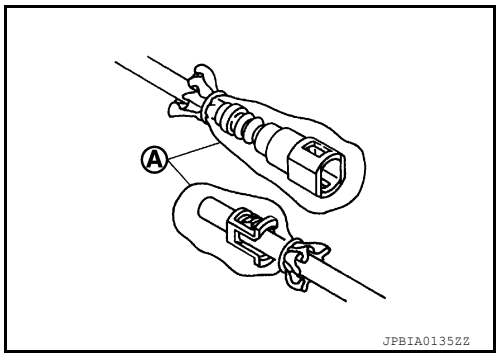
- **After connecting fuel tube quick connectors, check that quick connectors are secure.**
- **Ensure that connector and resin tube never contact any adjacent parts.**
- **Quick connector (1) can be disconnected when the tabs (F) are depressed completely. Do not twist it more than necessary.**

(B) : Connection (cross-section)
(D) : To under floor fuel line
(E) : To fuel tank
(G) : Disconnection

- **Do not use any tools to disconnect quick connector.**
- **Keep resin tube (C) away from heat. Be especially careful when welding near the resin tube.**
- **Prevent acid liquid such as battery electrolyte, etc., from getting on resin tube.**
- **Do not bend or twist resin tube during installation and disconnection.**
- **Do not remove the remaining retainer (2) from hard tube (or the equivalent) (A) except when resin tube or retainer is replaced.**
- **When resin tube or hard tube (or the equivalent) is replaced, also replace retainer with new one.**



- **To keep the connecting portions clean and to avoid damage and foreign materials, cover them completely with plastic bags (A) or something similar.**

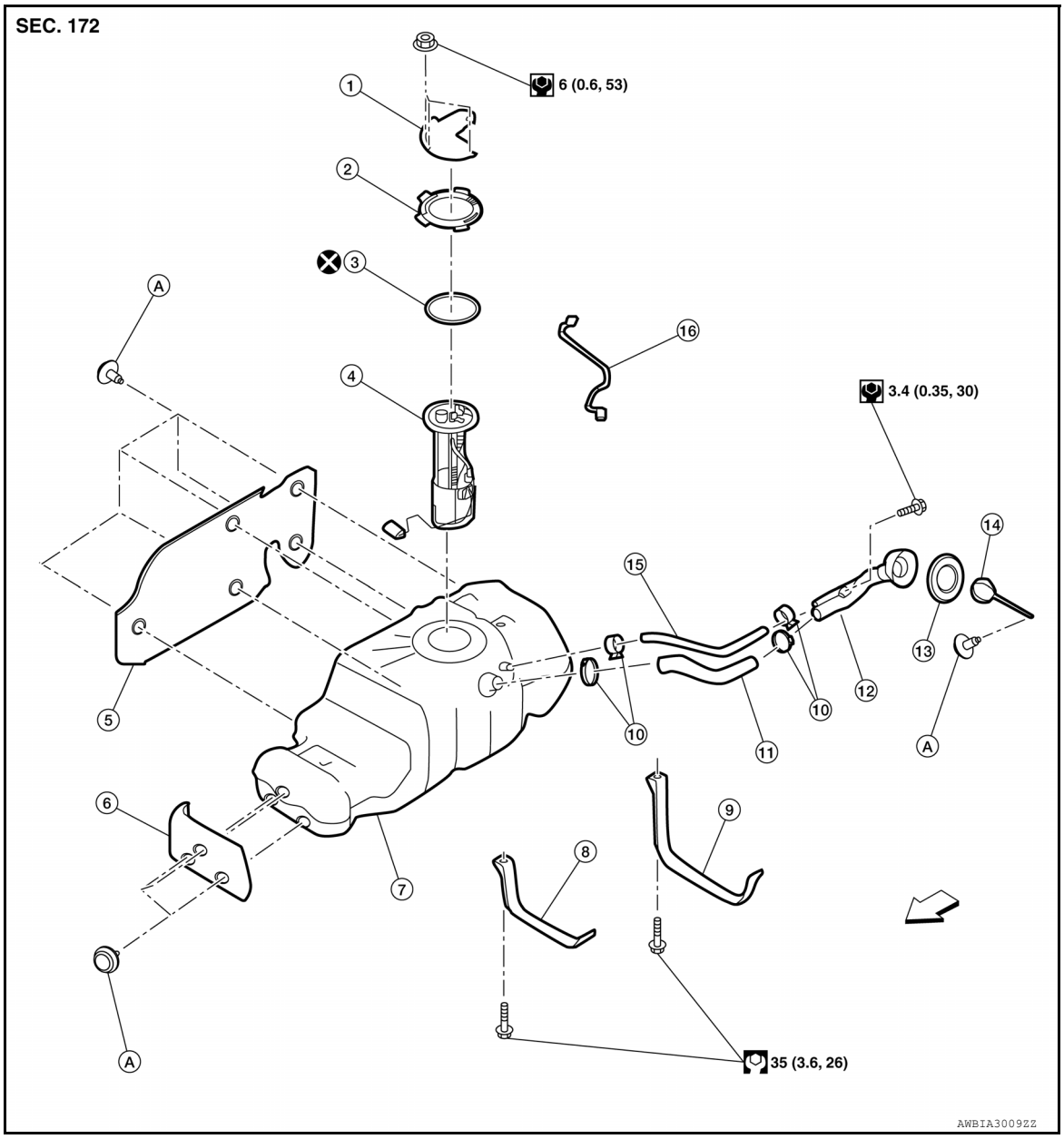


REMOVAL AND INSTALLATION

FUEL LEVEL SENSOR UNIT AND FUEL PUMP ASSEMBLY

Exploded View

INFOID:0000000014418359



1. Fuel level sensor unit protector	2. Lock ring	3. O-ring
4. Fuel level sensor unit	5. Fuel tank protector	6. Fuel tank protector
7. Fuel tank	8. Fuel tank mounting strap	9. Fuel tank mounting strap
10. Clamp	11. Fuel filler hose	12. Fuel filler tube
13. Grommet	14. Fuel filler cap	15. Fuel filler return hose
16. EVAP hose	⇦ Front	A. Clip

Removal and Installation

INFOID:0000000014418360

REMOVAL

WARNING:

Follow the "General Precautions" before working on the fuel system. Refer to GI-24, "General Precautions".

NOTE:

When removing components such as hoses, tubes/lines, etc., cap or plug openings to prevent fluid from spilling.

1. Remove the fuel tank. Refer to FL-9, "Removal and Installation".
2. Remove the lock ring using Tool.

Tool number : — (J-46536)
: KV101207S0 (—)

3. Remove the fuel level sensor, fuel filter and fuel pump assembly. Remove and discard the O-ring.

CAUTION:
- **Do not bend the float arm during removal.**
- **Avoid impacts such as dropping when handling the components.**
- **Do not reuse O-ring.**

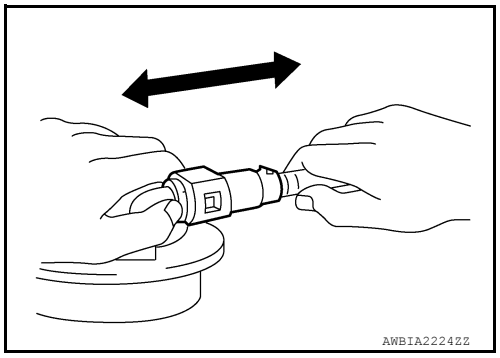
INSTALLATION

Installation is in the reverse order of removal.

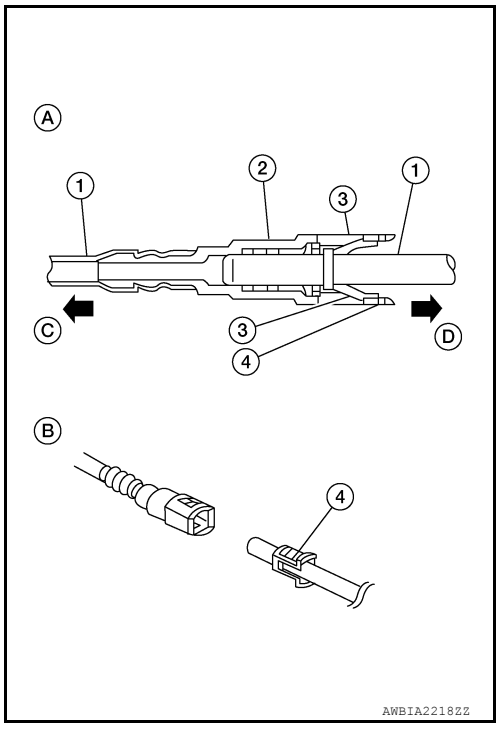
- Install the fuel level sensor unit and fuel pump assembly with the fuel feed hose facing the left side of the vehicle. Use a new O-ring.

CAUTION:
Do not reuse O-ring.

- Connect the quick connector as follows:
- Check the connection for damage or any foreign materials.
- Align the connector with the tube, then insert the connector straight into the tube until a click is heard.
- After the tube is connected, make sure the connection is secure by performing the following checks:
- Pull the tube and the connector to make sure they are securely connected.



- Visually confirm that the two retainer tabs (3) are connected to the quick connector (2).
  (1): Resin tube
  (4): Retainer
  (A): Connection (cross-section)
  (B): Disconnection
  (C): To under floor fuel line
  (D): To fuel tank



Inspection

INFOID:0000000014418361

INSPECTION AFTER INSTALLATION

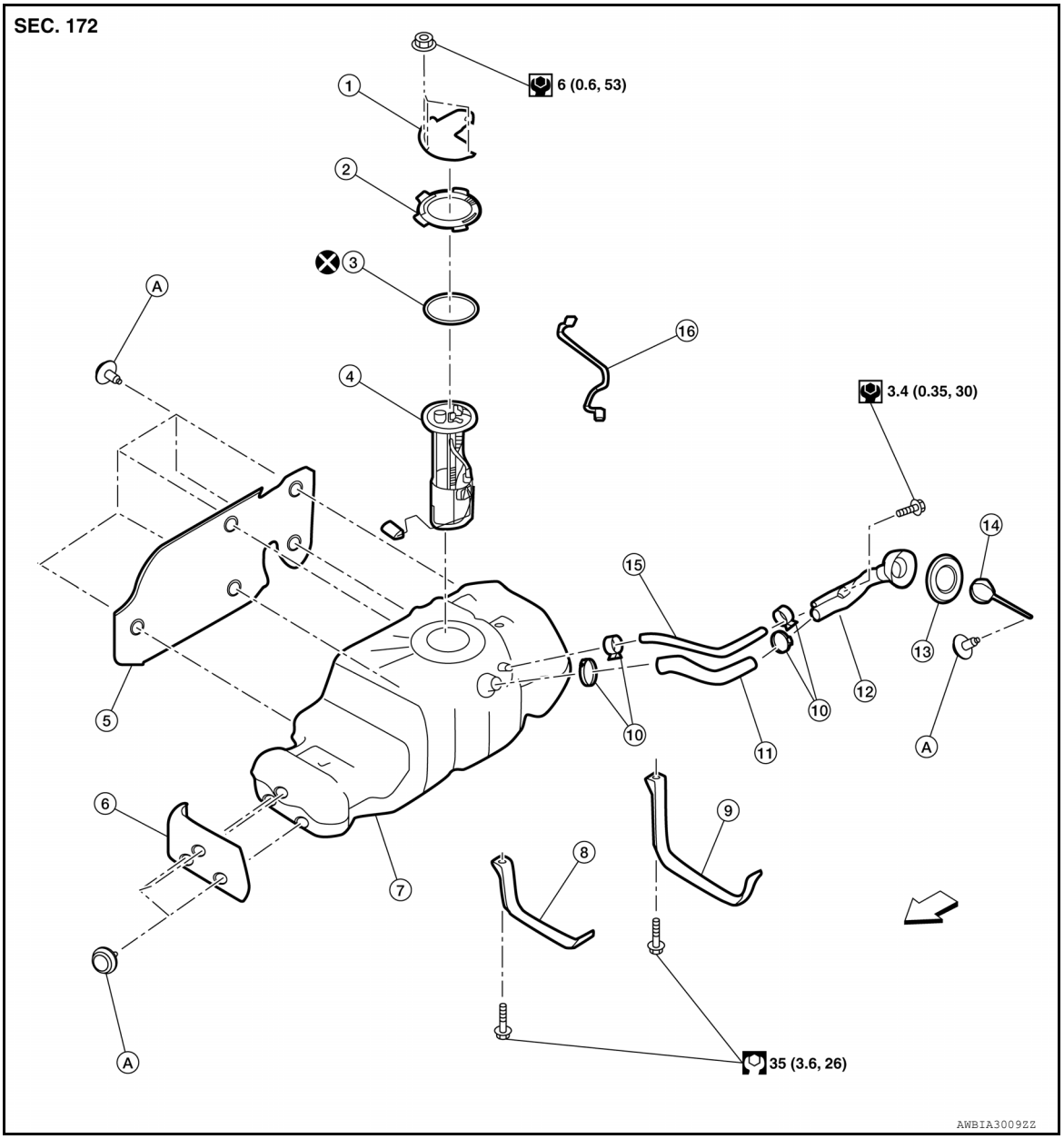
Use the following procedure to check for fuel leaks:

1. Turn ignition switch “ON” (with engine stopped) then check connections for leaks by applying fuel pressure to fuel piping.
2. Start engine. Then let it idle and check that there are no fuel leaks at the fuel system connections.

FUEL TANK

Exploded View

INFOID:0000000014418362



1. Fuel level sensor unit protector	2. Lock ring	3. O-ring
4. Fuel level sensor unit	5. Fuel tank protector	6. Fuel tank protector
7. Fuel tank	8. Fuel tank mounting strap	9. Fuel tank mounting strap
10. Clamp	11. Fuel filler hose	12. Fuel filler tube
13. Grommet	14. Fuel filler cap	15. Fuel filler return hose
16. EVAP hose	⇦ Front	A. Clip

Removal and Installation

INFOID:0000000014418363

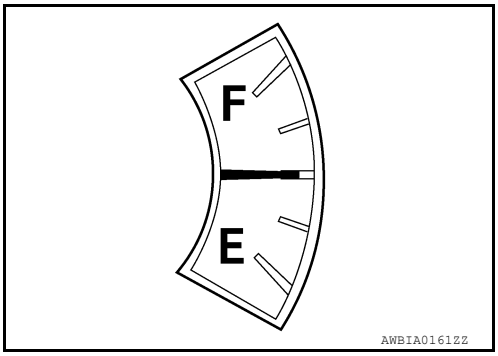
REMOVAL

WARNING:

Follow the “General Precautions” before working on the fuel system. Refer to GI-24, "General Precautions".

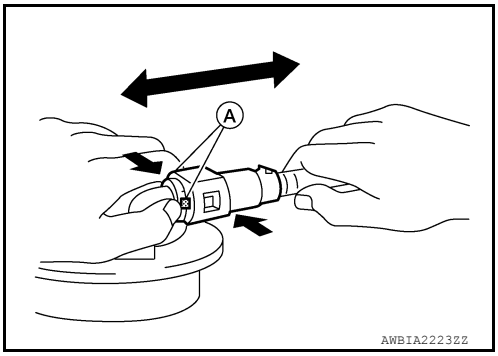
NOTE:
When removing components such as hoses, tubes/lines, etc., cap or plug openings to prevent fluid from spilling.

1. Check the fuel level with the vehicle on a level surface. If the fuel gauge indicates more than the level as shown (1/2 full), drain the fuel from the fuel tank until the fuel gauge indicates a level at or below as shown (1/2 full).
   - In case the fuel pump does not operate, use the following procedure.



a. Insert fuel tubing of less than 25 mm (0.98 in) diameter into the fuel filler tube through the fuel filler opening to drain fuel from the fuel filler tube.
b. Disconnect the fuel filler hose from the fuel filler tube.
c. Insert fuel tubing into the fuel tank through the fuel filler hose to drain fuel from the fuel tank.
   - As a guide, if the fuel tank is full the fuel level reaches or is less than the level on the fuel gauge as shown, when approximately 49.2 ℓ (12 US gal, 10-7/8 Imp gal) of fuel is drained from a full fuel tank.
2. Remove the fuel filler cap to release the pressure from inside the fuel tank.
3. Release the fuel pressure from the fuel lines. Refer to EC-205, "Work Procedure".
4. Disconnect the battery or batteries. Refer to PG-185, "Battery Disconnect".
5. Remove rear under cover. Refer to EXT-38, "REAR UNDER COVER : Removal and Installation".
6. Remove rear left fender protector. Refer to EXT-42, "Removal and Installation - Rear Fender Protector".
7. Remove the three nuts and fuel level sensor unit protector.
8. Remove EVAP canister bolt and EVAP canister protector. Refer to FL-14, "Exploded View".
9. Disconnect the EVAP hose from the EVAP canister.
10. Disconnect the fuel level sensor and fuel pump assembly harness connector from the fuel level sensor unit.

Disconnect the quick connector as follows:
- Hold the sides of the connector, push in tabs (A) and pull out the tube in the direction shown.
- If the connector and the tube are stuck together, push and pull several times until they start to move. Then disconnect them by pulling in the direction shown.

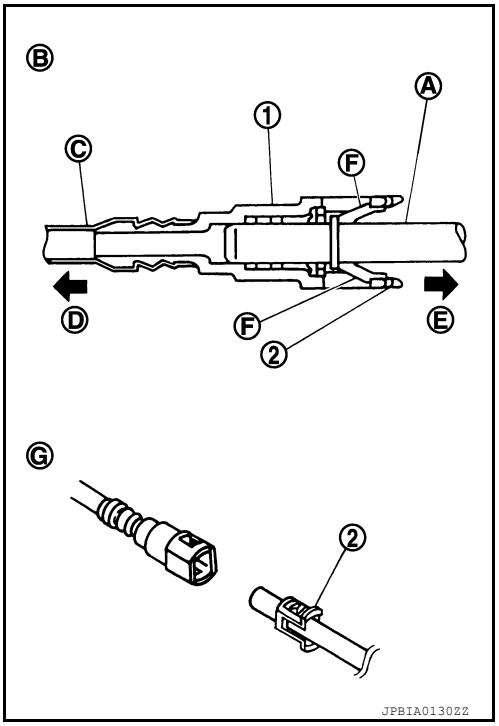


CAUTION:

- **Quick connector (1) can be disconnected when the tabs (F) are depressed completely. Do not twist it more than necessary.**

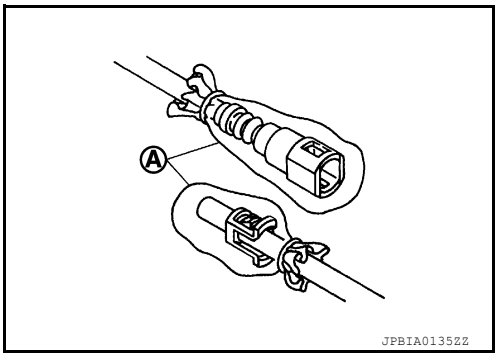
(B) : Connection (cross-section)
(D) : To under floor fuel line
(E) : To fuel tank
(G) : Disconnection

- **Do not use any tools to disconnected quick connector.**
- **Keep resin tube (C) away from heat. Be especially careful when welding near the resin tube.**
- **Prevent acid liquid such as battery electrolyte, etc. from getting on resin tube.**
- **Do not bend or twist resin tube during installation and disconnection.**
- **Do not remove the remaining retainer (2) on hard tube (or the equivalent) (A) except when resin tube or retainer is replaced.**
- **When resin tube or hard tube (or the equivalent) is replaced, also replace retainer with new one.**



JPBIA0130ZZ

- **To keep the connecting portion clean and to avoid damage and foreign materials, cover them completely with plastic bags (A) or something similar.**



JPBIA0135ZZ

11. Disconnect the fuel filler return line from the fuel tank.
12. Disconnect the fuel filler hose from the fuel filler tube.
13. Remove rear propeller shaft (for Non-XD models). Refer to DLN-166, "Removal and Installation".
14. Disconnect the fuel tank mounting straps while supporting the fuel tank with a suitable jack.
    CAUTION:
    Fuel tank may be in an unstable condition, due to the shape of the fuel tank bottom. Be sure to secure fuel tank at all times.
15. Lower the fuel tank using a suitable lift jack and remove it from the vehicle.
16. Disconnect the EVAP hose from the fuel level sensor unit and remove.
17. If necessary, remove the lock ring using Tool.

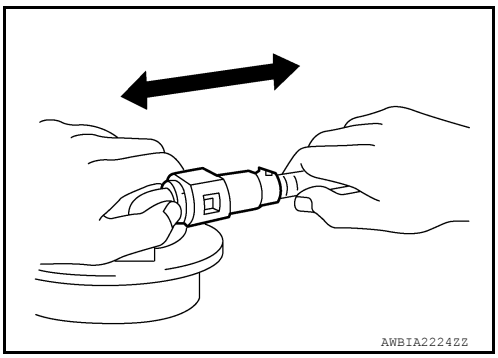
Tool number : — (J-46536)
: KV101207S0 (—)

18. If necessary, remove the fuel level sensor unit and fuel pump assembly. Discard the O-ring.
    CAUTION:
    - **Do not bend the float arm during removal.**
    - **Avoid impacts such as dropping when handling the components.**
    - **Do not reuse O-ring.**

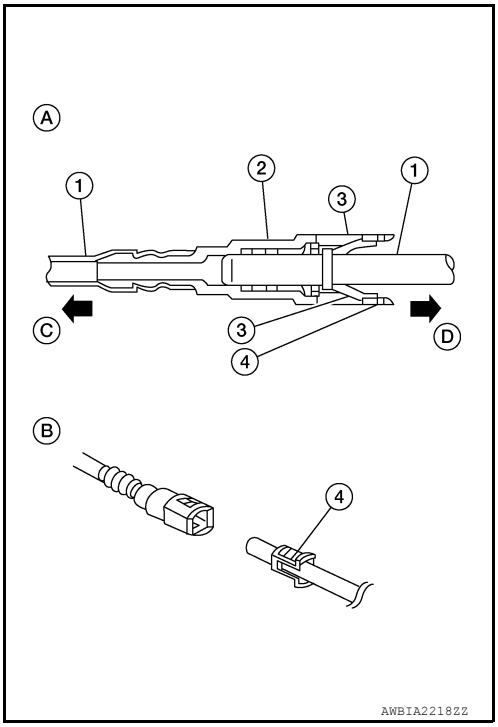
INSTALLATION

Installation is in the reverse order of removal.

- Connect the quick connector as follows:
- Check the connection for damage or any foreign materials.
- Align the connector with the tube, then insert the connector straight into the tube until a click is heard.
- After the tube is connected, make sure the connection is secure by performing the following checks:
- Pull the tube and the connector to make sure they are securely connected.



- Visually confirm that the two retainer tabs (3) are connected to the quick connector (2).
  (1): Resin tube
  (4): Retainer
  (A): Connection (cross-section)
  (B): Disconnection
  (C): To under floor fuel line
  (D): To fuel tank

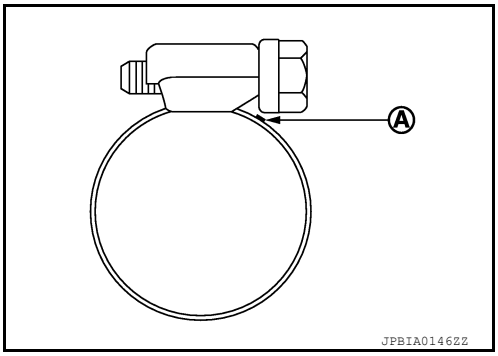


Fuel Filler Hose

- Insert fuel filler hose to the length below:

: 35 mm (1.38 in)

- Be sure hose clamp is not placed on swollen area of fuel filler tube.
- Tighten the clamp hand with the top mark (A) until the mark is on the bolt head flange.



Inspection

INFOID:0000000014418364

INSPECTION AFTER INSTALLATION

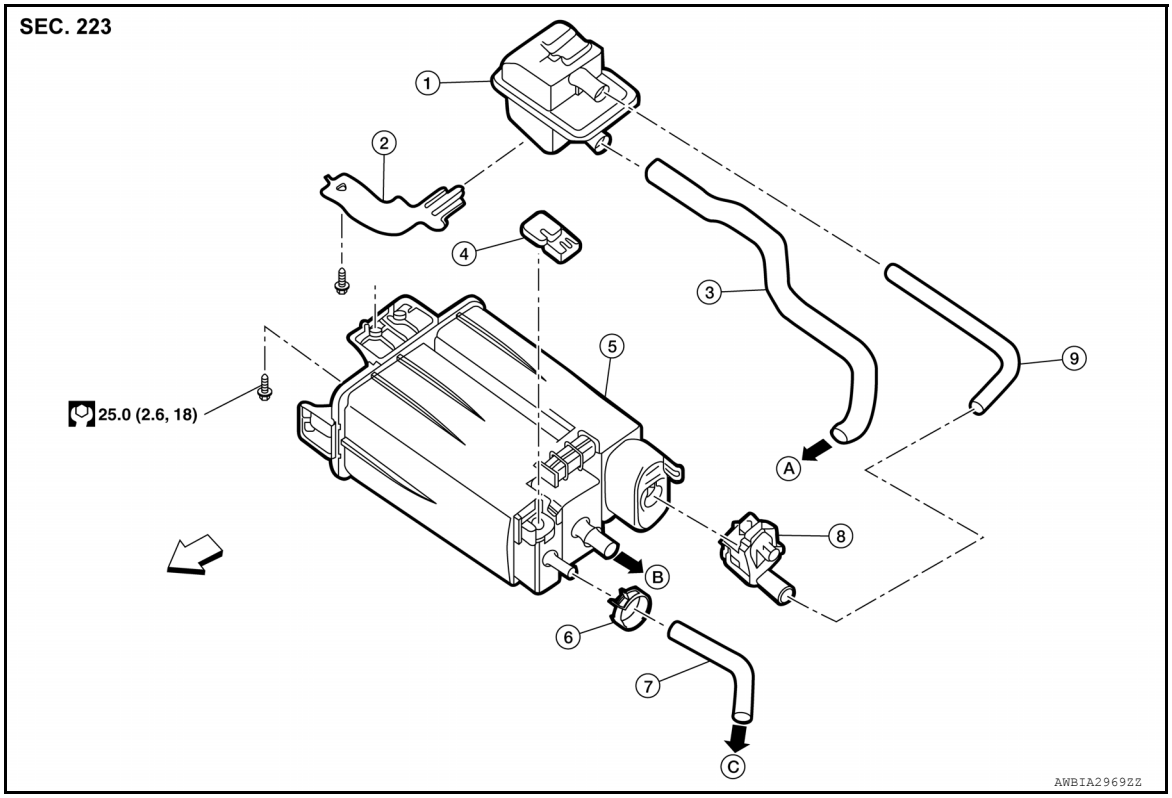
Use the following procedure to check for fuel leaks:

1. Turn the ignition switch ON (without starting the engine). Then check the connections for fuel leaks by applying fuel pressure to the fuel piping.
2. Start engine, raise idle and verify there are no leaks at the fuel system connections.

EVAP CANISTER

Exploded View

INFOID:0000000014418365



1.	EVAP canister filter	2.	EVAP filter bracket	3.	EVAP canister filter vent hose
4.	EVAP control system pressure sensor (with O-ring)	5.	EVAP canister	6.	Clamp
7.	EVAP canister purge hose	8.	EVAP canister vent control valve (with O-ring)	9.	EVAP canister vent control valve hose
A.	To vehicle body	B.	To fuel tank	C.	To EVAP tube
⇦	Front				

Removal and Installation

INFOID:0000000014418366

EVAP CANISTER

NOTE:
The EVAP canister vent control valve and EVAP canister system pressure sensor can be removed without removing the EVAP canister.

REMOVAL

1. Remove the left rear tire. Refer to WT-69, "Removal and Installation".
2. Disconnect the EVAP hose from the EVAP canister. Refer to FL-9, "Exploded View".
3. Remove EVAP canister protector and EVAP canister bolt.
4. Disconnect the harness connector from the EVAP control system pressure sensor.
5. Disconnect the EVAP canister purge hose from the EVAP canister.
6. Disconnect the harness connector from the EVAP canister vent control valve.
7. Disconnect the EVAP canister control valve hose from the EVAP canister vent control valve.
8. Remove the EVAP canister bolt.
9. Remove the EVAP canister.

INSTALLATION

Installation is in the reverse order of removal.

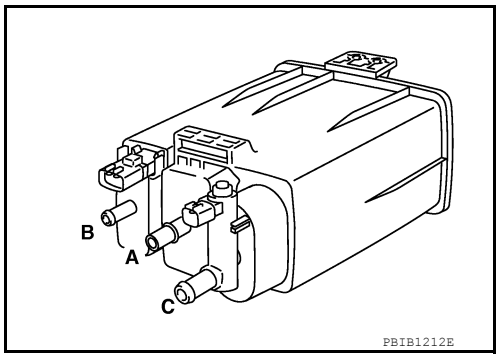
Inspection

INFOID:0000000014418367

EVAP CANISTER

Check EVAP canister as follows:

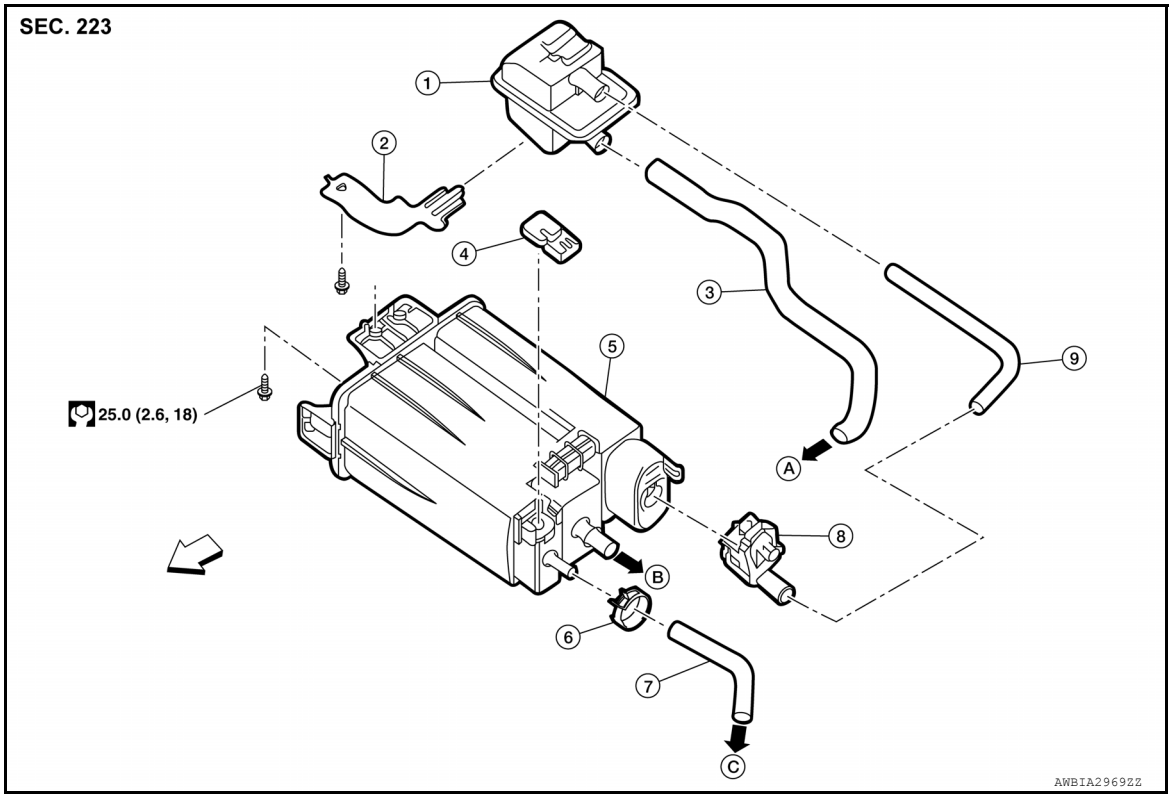
1. Block port (B).
2. Blow air into port (A) and check that it flows freely out of port (C).
3. Release blocked port (B).
4. Apply vacuum pressure to port (B) and check that vacuum pressure exists at the ports (A) and (C).
5. Block port (A) and (B).
6. Apply pressure to port (C) and check that there is no leakage.



EVAP CANISTER FILTER

Exploded View

INFOID:0000000014418368



1.	EVAP canister filter	2.	EVAP filter bracket	3.	EVAP canister filter vent hose
4.	EVAP control system pressure sensor (with O-ring)	5.	EVAP canister	6.	Clamp
7.	EVAP canister purge hose	8.	EVAP canister vent control valve (with O-ring)	9.	EVAP canister vent control valve hose
A.	To vehicle body	B.	To fuel tank	C.	To EVAP tube
⇦	Front				

Removal and Installation

INFOID:0000000014418369

EVAP CANISTER FILTER

REMOVAL

1. Disconnect the EVAP canister vent control valve hose from the EVAP canister filter.
2. Disconnect the EVAP canister filter vent hose from the EVAP canister filter.
3. Remove EVAP canister filter from EVAP canister filter bracket.

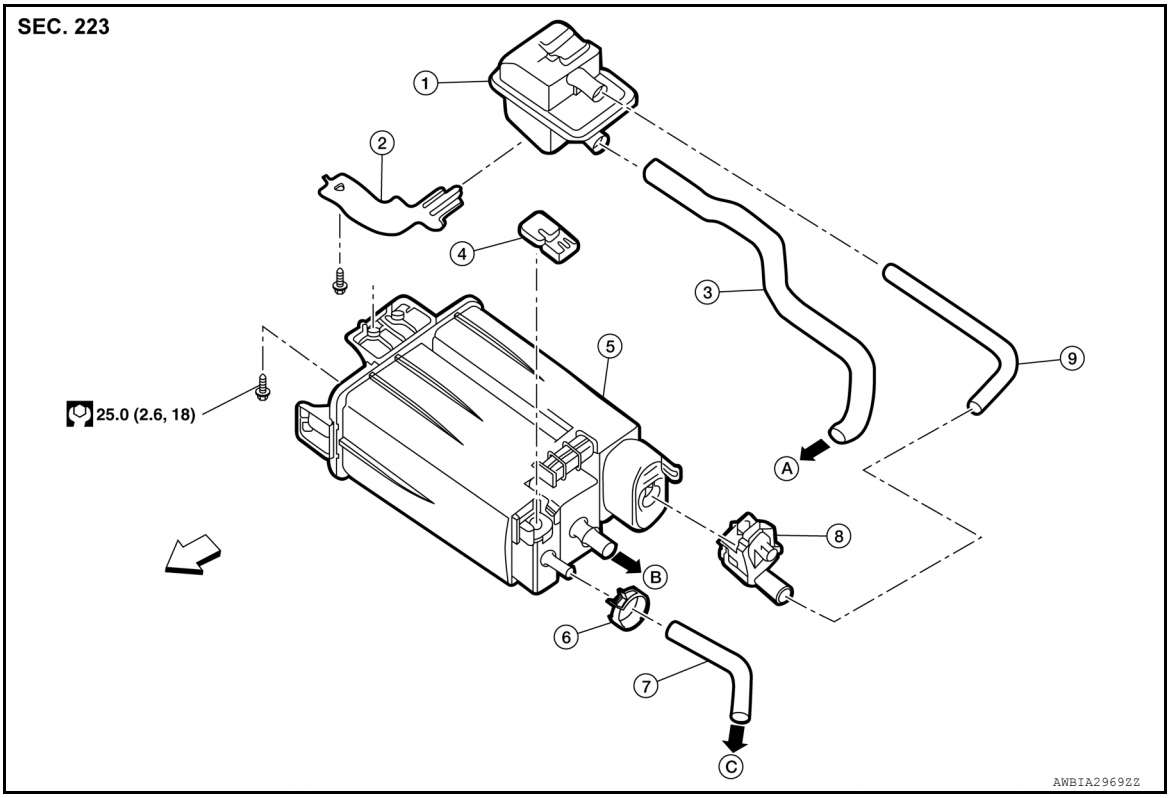
INSTALLATION

Installation is in the reverse order of removal.

EVAP CANISTER VENT CONTROL VALVE

Exploded View

INFOID:0000000014418370



1. EVAP canister filter
2. EVAP filter bracket
3. EVAP canister filter vent hose
4. EVAP control system pressure sensor (with O-ring)
5. EVAP canister
6. Clamp
7. EVAP canister purge hose
8. EVAP canister vent control valve (with O-ring)
9. EVAP canister vent control valve hose

A. To vehicle body
B. To fuel tank
C. To EVAP tube

⇦ Front

Removal and Installation

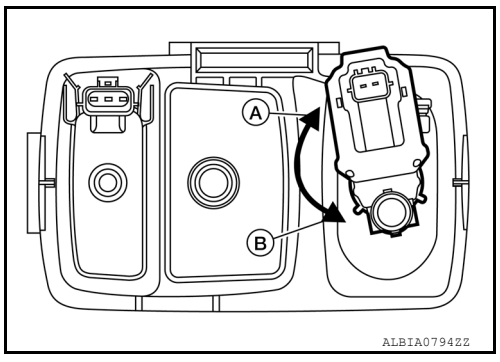
INFOID:0000000014418371

EVAP CANISTER VENT CONTROL VALVE

REMOVAL

1. Disconnect the harness connector from EVAP canister vent control valve.
2. Disconnect the EVAP canister vent control valve hose from the EVAP canister vent control valve.
3. Turn the EVAP canister vent control valve counterclockwise.

(A) : Lock
(B) : Unlock



4. Remove the EVAP canister vent control valve.

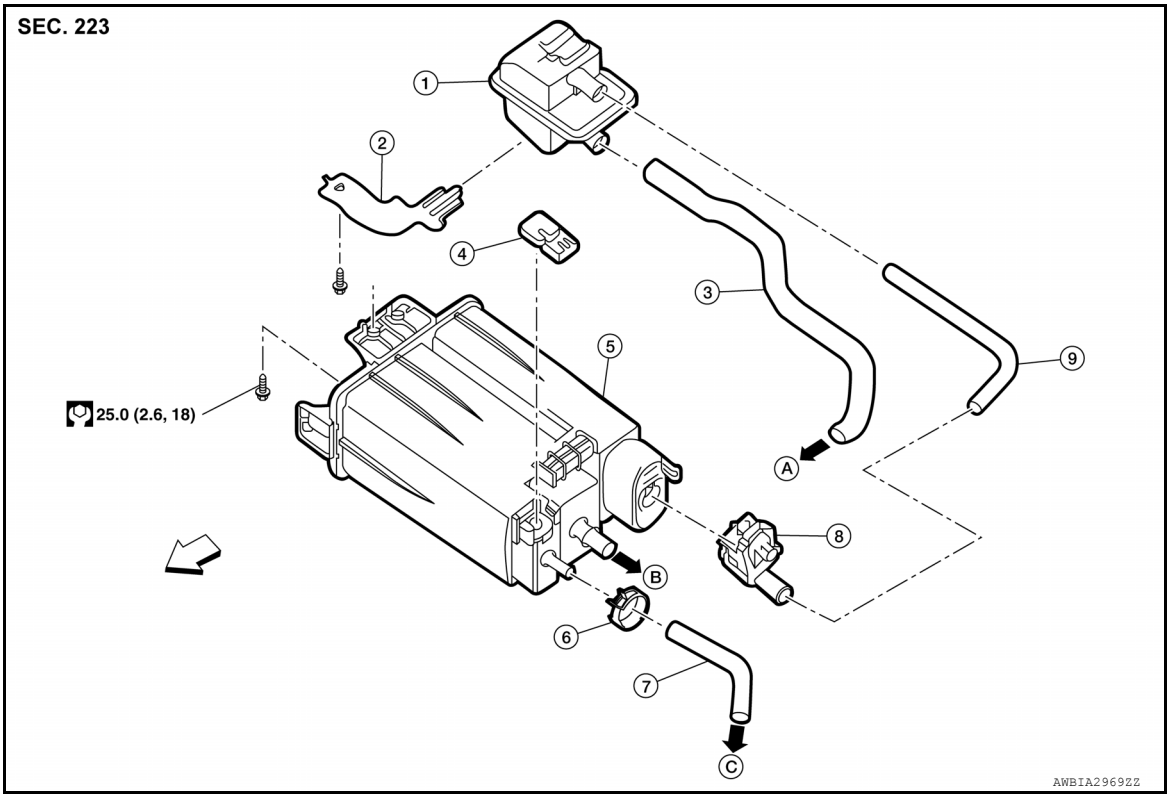
INSTALLATION

Installation is in the reverse order of removal.

EVAP CONTROL SYSTEM PRESSURE SENSOR

Exploded View

INFOID:0000000014418372



1.	EVAP canister filter	2.	EVAP filter bracket	3.	EVAP canister filter vent hose
4.	EVAP control system pressure sensor (with O-ring)	5.	EVAP canister	6.	Clamp
7.	EVAP canister purge hose	8.	EVAP canister vent control valve (with O-ring)	9.	EVAP canister vent control valve hose
A.	To vehicle body	B.	To fuel tank	C.	To EVAP tube
⇦	Front				

Removal and Installation

INFOID:0000000014418373

EVAP CONTROL SYSTEM PRESSURE SENSOR

REMOVAL

1. Remove EVAP canister protector and EVAP canister retaining bolt.
2. Disconnect the harness connector from EVAP control system pressure sensor.
3. Remove the EVAP canister control pressure sensor.

INSTALLATION

Installation is in the reverse order of removal.

SERVICE DATA AND SPECIFICATIONS (SDS)

SERVICE DATA AND SPECIFICATIONS (SDS)

Fuel Tank

INFOID:0000000014418374

Standard and Limit

Fuel tank capacity	Approx. 98.4 ℓ (26 US gal, 21-5/8 Imp gal)
Fuel recommendation	Refer to MA-13, "VK56VD Gasoline Engine : Fluids and Lubricants".

PRECAUTION

PRECAUTIONS

Precaution for Supplemental Restraint System (SRS) "AIR BAG" and "SEAT BELT PRE-TENSIONER"

INFOID:0000000014418375

The Supplemental Restraint System such as “AIR BAG” and “SEAT BELT PRE-TENSIONER”, used along with a front seat belt, helps to reduce the risk or severity of injury to the driver and front passenger for certain types of collision. Information necessary to service the system safely is included in the SR and SB section of this Service Manual.

WARNING:

- **To avoid rendering the SRS inoperative, which could increase the risk of personal injury or death in the event of a collision which would result in air bag inflation, it is recommended that all maintenance and repair be performed by an authorized NISSAN/INFINITI dealer.**
- **Improper repair, including incorrect removal and installation of the SRS, can lead to personal injury caused by unintentional activation of the system. For removal of Spiral Cable and Air Bag Module, see the SR section.**
- **Do not use electrical test equipment on any circuit related to the SRS unless instructed to in this Service Manual. SRS wiring harnesses can be identified by yellow and/or orange harnesses or harness connectors.**

PRECAUTIONS WHEN USING POWER TOOLS (AIR OR ELECTRIC) AND HAMMERS

WARNING:

- **When working near the Air Bag Diagnosis Sensor Unit or other Air Bag System sensors with the Ignition ON or engine running, DO NOT use air or electric power tools or strike near the sensor(s) with a hammer. Heavy vibration could activate the sensor(s) and deploy the air bag(s), possibly causing serious injury.**
- **When using air or electric power tools or hammers, always switch the Ignition OFF, disconnect the battery or batteries, and wait at least three minutes before performing any service.**

General Precaution

INFOID:0000000014418376

WARNING:

When replacing fuel line parts, be sure to observe the following:

- **Put a “CAUTION: FLAMMABLE” sign in the workshop.**
- **Be sure to work in a well ventilated area and furnish workshop with a CO_2 fire extinguisher.**
- **Do not smoke while servicing fuel system. Keep open flames and sparks away from the work area.**

CAUTION:

- **Use diesel fuel required by the regulations for octane number. Refer to GI-27, "Fuel".**
- **Before removing fuel line parts, perform the following procedures:**
- **Put drained fuel in an explosion-proof container and put the lid on securely. Keep the container in safe area.**
- **Release fuel pressure from the fuel lines. Refer to EC-1989, "Exhaust System Diagnostics".**
- **Disconnect the battery cable from the negative terminal.**
- **Always replace O-rings and clamps with new ones.**
- **Do not kink or twist tubes when they are being installed.**
- **Do not tighten hose clamps excessively to avoid damaging hoses.**
- **After installing tubes, check that there are no fuel leaks at connections in the following steps:**
- **Apply fuel pressure to fuel lines by turning ignition switch “ON” (with engine stopped). Then check for fuel leaks at connections.**
- **Start engine and rev it up and check for fuel leaks at connections.**
- **Use only a genuine NISSAN fuel filler cap as a replacement. If an incorrect fuel filler cap is used, the “MIL” may come on.**

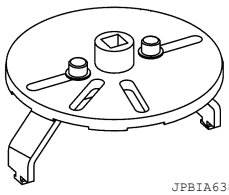
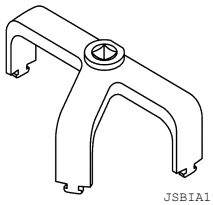
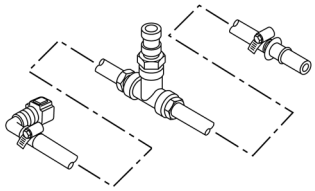
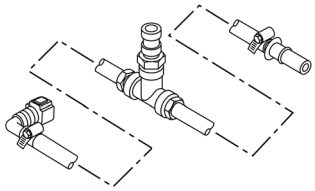
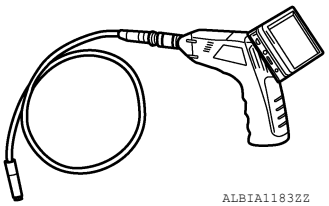
PREPARATION

PREPARATION

Special Service Tool

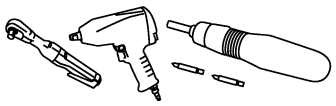
INFOID:0000000014418377

The actual shape of the tools may differ from those illustrated here.

Tool number (TechMate No.) Tool name		Description
KV101207S0 (—) Unified fuel lock ring wrench	 JPBIA6384ZZ	Removing and installing fuel tank lock ring
— (J-46536) Fuel tank lock ring wrench	 JSBIA1952ZZ	
— (J-54420) Fuel supply pressure/ restriction gauge adapter	 ALBIA2732ZZ	Used to take fuel supply pressure and restriction measurements in the low pressure fuel system.
— (J-54421) Fuel drain pressure/restriction gauge adapter	 ALBIA2732ZZ	Used to take fuel drain pressure and rrestriction measurements in the low pressure fuel system.
— (J-50079) Video Boroscope	 ALBIA1183ZZ	Inspecting fuel connections for leaks.

Commercial Service Tool

INFOID:0000000014418378

Tool name	Description
Power tool  PIIB1407E	Loosening nuts, screws and bolts

BASIC INSPECTION

FUEL SYSTEM

Low-Pressure System Check

INFOID:0000000014418379

GENERAL INFORMATION

- The following procedure contains measurement steps and specifications regarding the engines fuel system components. This procedure is not intended to take the place of troubleshooting tree repair direction. Refer to the appropriate troubleshooting tree for repair direction. The following low pressure system checks are written so all tests can be performed at the same time, or the tools can be installed one at a time and tests can be performed separately.
- The procedures listed below are important fuel system checks to perform when troubleshooting fuel system related issues. Use the corresponding procedures for additional Fuel System diagnostic checks:

- Air in Fuel: Refer to FL-24, "Low-Pressure System Check".
- Fuel Inlet Restriction: Refer to FL-29, "Inspection".
- Fuel Drain Line Restriction: Refer to FL-30, "Inspection".
- Fuel System Priming: Refer to EM-219, "Priming".
- Fuel System Specifications: Refer to FL-58, "Standard and Limit".

CAUTION:

Clean all fittings before disassembly. Dirt or contaminants can damage the fuel system.

INITIAL SETUP

WARNING:

- **When using compressed air for cleaning, to avoid the risk of personal injury from flying debris and dirt:**
- **Do not exceed 30psi (207 kPa).**
- **Wear appropriate eye protection and protective clothing including gloves.**
- **When using high-pressure water or steam cleaning equipment, to avoid the risk of personal injury from flying debris and hot steam:**
- **Wear appropriate eye protection and protective clothing including gloves and a face shield.**
- **The fuel system (fuel pump, high pressure fuel lines, fuel rail, injectors) contain very high pressure fuel. To avoid the risk of personal injury or fire:**
- **Do not loosen any fittings while the engine is running.**
- **Wait at least 10 minutes after shutting down the engine before loosening any fittings in the high-pressure fuel system to allow pressure to decrease to a lower level.**
- **Wear appropriate eye protection and protective equipment as high-pressure fuel spray can penetrate the skin.**
- **Never smoke or allow sparks or flames (such as pilot lights, electrical switches, or welding equipment) in the work area. Never allow diesel fuel to spill onto a hot exhaust manifold which can cause a fire.**
- **Diesel fuel and diesel fuel vapor is flammable. To avoid risk of fire or burns, never smoke or allow sparks or flames (such as pilot lights, electrical switches, or welding equipment) in the work area. Never allow diesel fuel to spill onto a hot exhaust manifold which can cause a fire.**

NOTE:

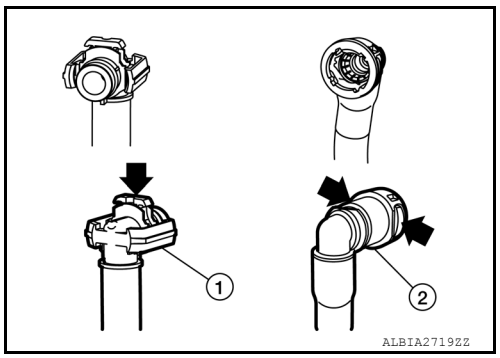
Before diagnosing any fuel system component, (such as fuel lines, fuel pump, fuel injectors, fuel rail, etc.) which would expose the fuel system or internal engine component to potential contaminants, prior to disassembly, clean the fittings, mounting hardware, and the area around the component to be removed. Dirt or contaminants can be introduced into the fuel system and engine if the surrounding areas are not cleaned, resulting in damage to the fuel system and engine.

Air In Fuel and Fuel Inlet Restriction

1. Use the following instructions for air in fuel and fuel inlet restriction setup.

a. Disconnect the two-button quick disconnect connector (2):
   - Disconnect the two-button quick disconnect connector by pressing in the locking tabs on both sides of the connector.
   - After pressing the opposing locking tabs, the quick disconnect connector can be removed from the Stage 1 fuel filter fitting.

   (1) : One-button quick disconnect connector

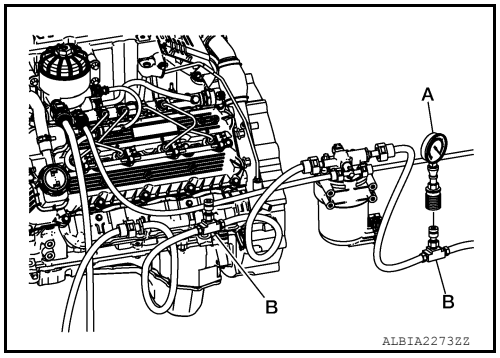


b. Install Tools (B) between the Stage 1 fuel filter outlet connection and the fuel supply line.

Tool : — (J-54420)

c. Disconnect the fuel supply line quick disconnect style fuel line from the inlet of the Stage 1 fuel filter.

d. Install Tool (B) between the Stage I fuel filter inlet connection and the fuel supply line.
NOTE:
The Tool has clear lines allow for the inspection of air in the fuel.



Tool : — (J-54420)

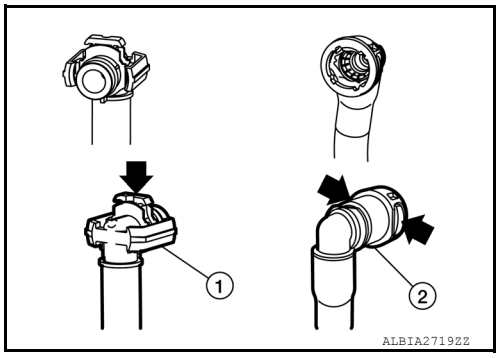
e. Attach a suitable tool (A) capable of reading 0 - 101.6 kPa (0 - 1.036 kg/cm^2, 0 to 14.73 psi) to the Tool.
NOTE:
Make sure to calibrate the suitable tool before attaching to Tool.

f. Make certain the test lines are not kinked or leaking after installation.

Fuel Filter Restriction

1. Disconnect the two-button quick disconnect connector (2):
- Disconnect the two-button quick disconnect connector by pressing in the locking tabs on both sides of the connector.
- After pressing the opposing locking tabs, the quick disconnect connector can be removed from the Stage 2 fuel filter fitting.

(1) : One-button quick disconnect connector

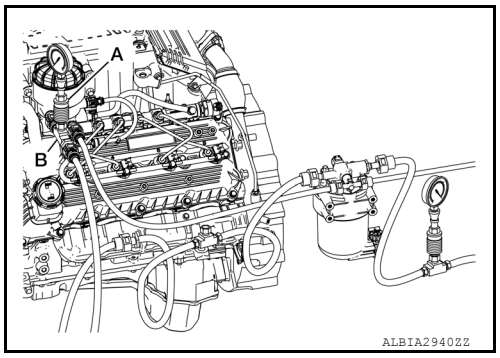


2. Install the Tool (B) between the fuel supply line and the stage 2 fuel filter inlet connection.

Tool : — (J-54420)

3. Connect a suitable tool (A) capable of reading 0 - 1034 kPa (0 - 10.55 kg/cm^2, 0 - 149.9 psi) to the Tool.
NOTE:
Make sure that the suitable tool is calibrated before attaching to the Tool.

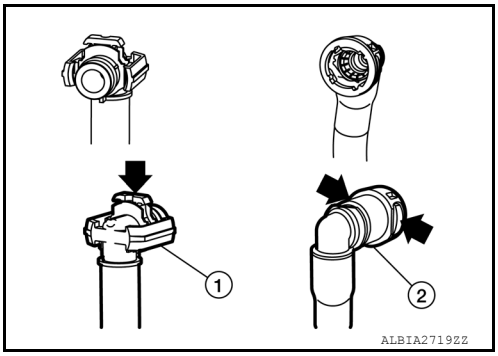
4. Make certain the test lines are not kinked or leaking after installation.



Drain Line Restriction

1. Disconnect the two-button quick disconnect connector (2):
- Disconnect the two-button quick disconnect connector by pressing in the locking tabs on both sides of the connector.
- After pressing the opposing locking tabs, the quick disconnect connector can be removed from the Stage 2 fuel filter drain fitting.

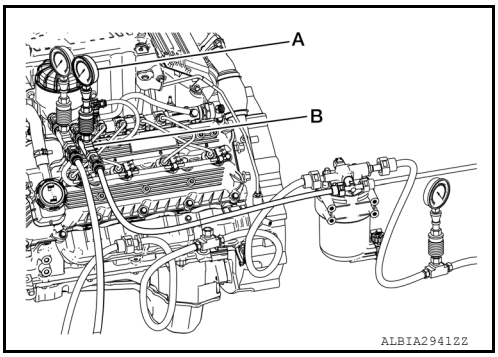
(1) : One-button quick disconnect connector



2. Install the Tool (B) between the drain line and the Stage 2 fuel filter drain connection.

Tool : — (J-54421)

3. Connect a suitable tool (A) capable of reading 0 - 1034 kPa (0 - 10.55 kg/cm^2, 0 - 149.9 psi) to the Tool.
NOTE:
Make sure that the suitable tool is calibrated before attaching to the Tool.
4. Make sure the test lines are not kinked or leaking after installation.



Tools Installed
- Tool (A) between the fuel supply line and the Stage 2 fuel filter inlet connection. This line is used to take fuel filter restriction measurements.

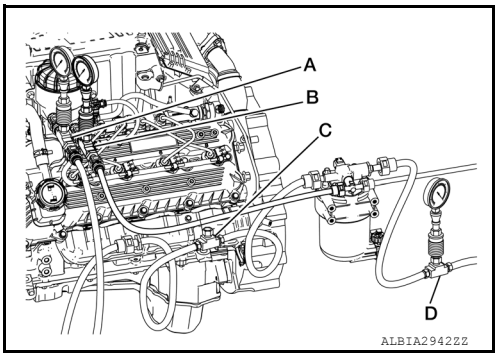
Tool : — (J-54420)

- Tool (D) between the Stage 1 fuel filter inlet connection and the fuel supply line. This line is used to take fuel inlet restriction measurements and check for air in fuel.

Tool : — (J-54420)

- Tool (B) between the Stage 2 fuel filter drain connection and the drain line. This line is used to check the fuel drain line restriction.

Tool : — (J-54421)



- Tool (C) between the Stage 1 fuel filter outlet connection and the fuel supply line. This line is used to check for air in the fuel.

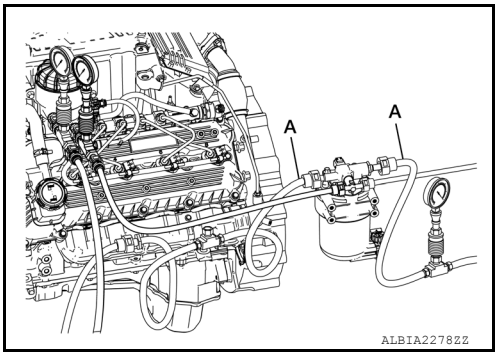
Tool : — (J-54420)

- Prime the fuel system and to help remove air from the fuel system introduced while installing the Tools. Use the following procedure for fuel system priming information. Refer to EM-219, "Priming".
NOTE:
  - Prior to performing the low pressure system checks, be sure the fuel system is primed and air is purged from the fuel system due to the newly installed Tools.
  - If the engine will not start, perform low pressure system checks at engine cranking.
  - If the engine will start, allow the engine to operate for 1 minute, then perform the low pressure system checks.

Measurement - Engine Will Start

1. This part of the procedure is for measuring the low pressure system for an engine that will start.
   - Check for air in the fuel with engine running at idle.
   - Check for air in the fuel in the Tool (A) between the fuel supply line and the Stage 1 fuel filter inlet.
   - Check for air in the fuel in the Tool (A) between the Stage 1 fuel filter outlet and the fuel supply line.
   - There should not be any air present.

   Tool : — (J-54420)



2. Refer to the appropriate troubleshooting tree for repair direction.
   NOTE:
   If air in the fuel is not present before the Stage 1 fuel filter, but present at the outlet of the Stage 1 fuel filter, this indicates air is being ingested at the inlet connection to the Stage 1 fuel filter or the Stage 1 fuel filter.
3. Measure inlet restriction with the engine running at low idle.

   Maximum fuel inlet restriction at idle : 20 kPa (0.204 kg/cm^2, 2.9 psi)

4. Measure drain line restriction with the engine running at low idle.

   Maximum drain line restriction at idle : 100 kPa (1.02 kg/cm^2, 14.5 psi)

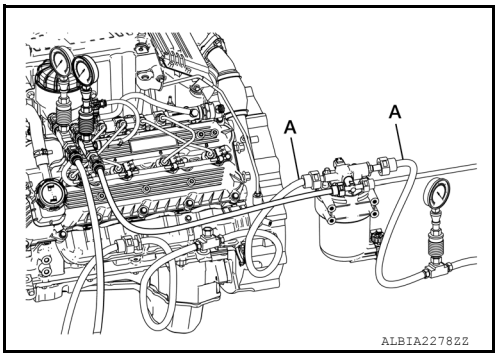
5. Measure the fuel filter restriction with the engine running at low idle.
   - Record the fuel pressure at the inlet of the Stage 2 fuel filter from the fuel pressure gauge or multimeter.
   - Record the fuel pressure at the outlet of the Stage 2 fuel filter through CONSULT (Fuel Supply Pressure).
   - The fuel pressure reading in CONSULT is in absolute pressure. Make sure the ambient pressure is subtracted from the CONSULT reading so that the pressures are in gage.
   - Subtract the inlet reading from the outlet reading to determine the fuel filter restriction.

   Maximum pressure drop across fuel filter : 34 kPa (0.35 kg/cm^2, 4.9 psi)

Measurement - Engine Will Not Start

1. This part of the procedure is for measuring the low pressure system for an engine that will not start.
2. Check for air in the fuel with the engine cranking.
   - Check for air in the fuel in the Tool (A) between the fuel supply line and the Stage 1 fuel filter inlet.
   - Check for air in the fuel in the Tool (A) between the Stage 1 fuel filter outlet and the fuel supply line.
   - There should not be any air present.

   Tool : — (J-54420)



3. If air in the fuel is present at the inlet of the Stage 1 fuel filter, this indicates air is being ingested in the fuel tank, fuel supply line connections at the fuel tank, or the fuel line between the tank and the Stage 1 fuel filter.
4. If air in the fuel is not present before the Stage 1 fuel filter, but present at the outlet of the Stage 1 fuel filter, this indicates air is being ingested at the inlet connection to the Stage 1 fuel filter or the Stage 1 fuel filter.
5. Measure drain line restriction with the engine cranking.

   Maximum drain line restriction engine cranking (150 RPM minimum) : 100 kPa (1.02 kg/cm^2, 14.5 psi)

6. Measure inlet restriction with the engine cranking.

Maximum fuel inlet restriction engine cranking (150 RPM minimum)	**: 100 kPa (1.02 kg/cm^2, 14.5 psi)**

7. Measure the fuel filter restriction with the engine cranking.
   - Record the fuel pressure at the inlet of the Stage 2 fuel filter from the fuel pressure gauge or multimeter.
   - Record the fuel pressure at the outlet of the Stage 2 fuel filter through CONSULT (Fuel Supply Pressure).
   - The fuel pressure reading in CONSULT is in absolute pressure. Make sure the ambient pressure is subtracted from the CONSULT reading so that the pressures are in gage.
   - Subtract the inlet reading from the outlet reading to determine the fuel filter restriction.

Maximum Stage 2 fuel filter restriction with engine cranking (150 RPM minimum)	**: 34 kPa (0.35 kg/cm^2, 4.9 psi)**

FINISHING STEPS

1. Remove all Tools.
2. Prime the fuel system. Refer to EM-219, "Priming".
3. Operate the engine and check for leaks.

PERIODIC MAINTENANCE

FUEL TANK INLET VALVE

Inspection

INFOID:0000000014418380

GENERAL INFORMATION

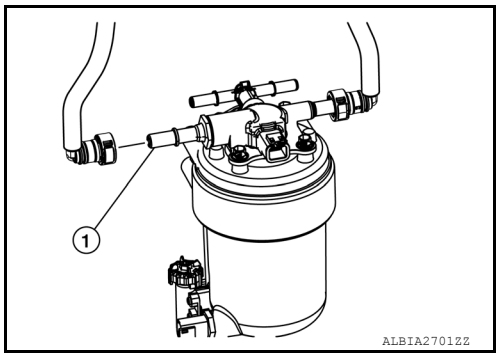
WARNING:

Diesel fuel and diesel fuel vapor is flammable. To avoid risk of fire or burns, never smoke or allow sparks or flames (such as pilot lights, electrical switches, or welding equipment) in the work area. Never allow diesel fuel to spill onto a hot exhaust manifold which can cause a fire.

- Fuel inlet restriction is measured near the point at which the fuel supply line is connected to the stage 1 fuel filter (fuel lift pump inlet).

SETUP

1. Disconnect the fuel supply line from the Stage I fuel filter inlet (lift pump inlet) connection (1).



2. Install fuel pressure test kit between the fuel supply line and the inlet to the lift pump.

Tool number : — (J-54420)

3. Install a vacuum gauge with a range of at least 0 to 101.6 kPa (0-1.04 kg/cm^2, 0-14.7 psi) onto the pressure gauge adapter.

MEASURE

1. Operate the engine at idle (minimum 600 to maximum 1000 rpm) and measure the fuel inlet restriction.
2. Observe the reading on the gauge.

Maximum Fuel Inlet Restriction Vacuum at High Idle : 20 mm (6 in)

NOTE:

With the engine running, there should not be any air bubbles in the clear pressure adapter test line at the Stage 1 fuel filter inlet. Air bubbles are a sign of severe inlet restriction, loose suction-side fittings, or a system that is not yet primed.

3. If the fuel inlet restriction is too high, check the fuel lines from the tank for proper size. Make certain there are no kinks or bends in the fuel lines and the fuel lines are not clogged.
4. Check the fuel tank for debris (plastic wrappers, paper, etc.) that can intermittently block the fuel pickup tubes.
5. Check the fuel lines for internal damage, such as damaged wall linings, that can intermittently block fuel flow.
6. Check the fuel tank vents or fill cap vents for plugging.
7. Make sure there are no clogged fuel strainers or filters, or malfunctioning check valves.
8. If no issues are found, replace the suction-side fuel filter and prime the fuel system. Refer to EM-219, "Priming".

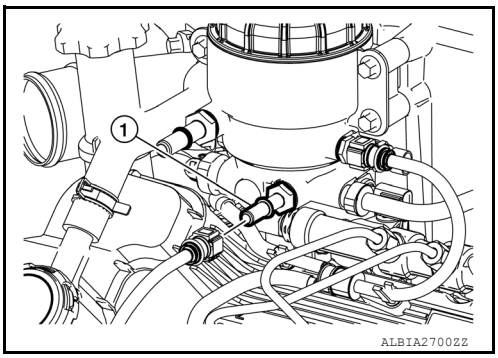
FUEL LINE

Inspection

INFOID:0000000014418381

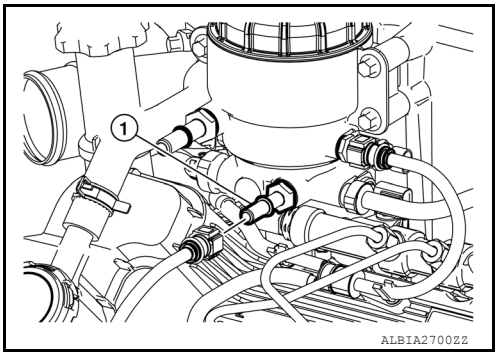
General Information

1. The fuel drain line restriction is measured at the point at which the fuel drain line is connected to the Stage 2 fuel filter drain connection (1).



Setup

1. Remove the fuel drain line from the Stage 2 fuel filter drain connection (1).



2. Install fuel pressure test kit between the fuel supply line and the inlet to the lift pump.

Tool number : — (J-54420)

3. Attach the fuel pressure gauge.

Measure

1. Operate the engine at cranking or idle (minimum 600 to maximum 1000 rpm) and measure the fuel pressure.
2. Observe the reading on the gauge.

Maximum drain line restriction	**: 100 kPa (1.02 kg/cm^2, 14.5 psi)**

3. If the fuel drain line restriction is too high:
   - Check the fuel lines to the tank for proper size, leaks, bends, or clogs.
   - Check the fuel tank vents for plugging.

FUEL-WATER SEPERATOR

Drain

INFOID:0000000014418382

WARNING:
To avoid the risk of personal injury or fire, drain diesel fuel into an approved container and safely dispose of in accordance with local environmental regulations.

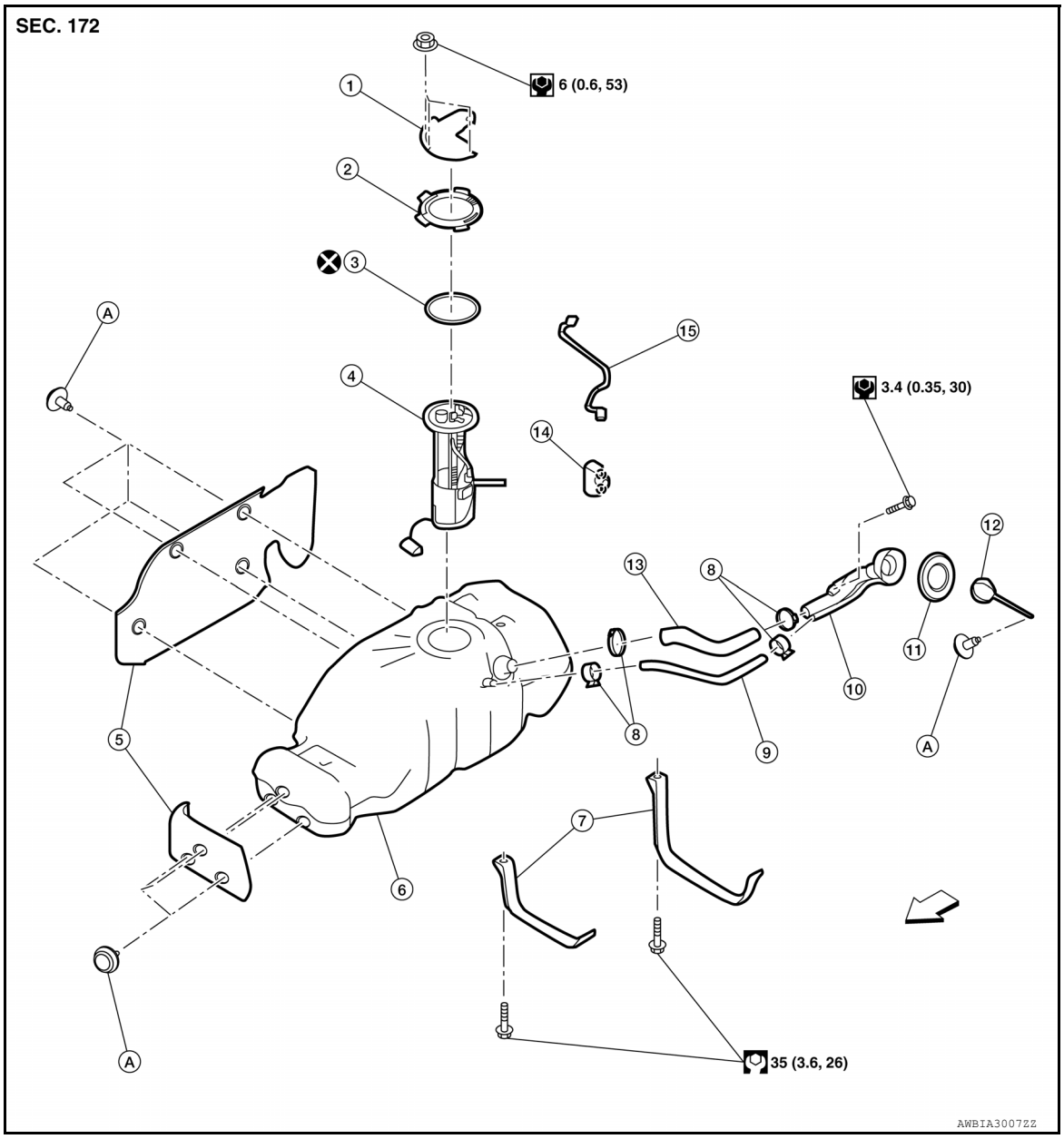
1. A fuel-water separator or fuel filter must be installed in the fuel supply system.
2. Drain the water and sediment from the separator daily.
3. Shut the engine OFF.
4. Open the drain valve. Turn the valve counterclockwise ¼ turn.
5. Drain the filter sump until clear fuel is visible.
6. If draining the fuel filter housing, drain until fuel reduces to a trickle.
7. To close the valve, turn valve clockwise ¼ turn.

REMOVAL AND INSTALLATION

FUEL TANK

Exploded View

INFOID:0000000014418383



1. Fuel level sensor unit protector	2. Lock ring	3. O-ring
4. Fuel level sensor unit	5. Fuel tank protector	6. Fuel tank
7. Fuel tank mounting strap	8. Clamp	9. Fuel filler return hose
10. Fuel filler tube	11. Grommet	12. Fuel filler cap
13. Fuel filler hose	14. Chamber assembly	15. Breather tube
A. Clip	Pawl	Front

Removal and Installation

INFOID:0000000014418384

REMOVAL

WARNING:

Follow the "General Precautions" before working on the fuel system. Refer to FL-21, "General Precaution".

WARNING:

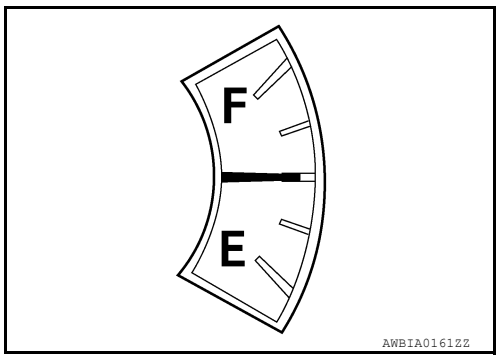
The fuel system (fuel pump, high pressure fuel lines, fuel rail, injectors) contains very high pressure fuel. To avoid the risk of personal injury or fire:

- **Do not loosen any fittings while the engine is running.**
- **Wait at least 10 minutes after shutting down the engine before loosening any fittings in the high-pressure fuel system to allow pressure to decrease to a lower level.**
- **Wear appropriate eye protection and protective equipment as high-pressure fuel spray can penetrate skin.**
- **Never smoke or allow sparks or flames (such as pilot lights, electrical switches, or welding equipment) in the work area.**
- **Never allow diesel fuel to spill onto a hot exhaust manifold which can cause a fire.**

NOTE:

When removing components such as hoses, tubes/lines, etc., cap or plug openings to prevent fluid from spilling.

1. Remove the fuel filler cap to release the pressure from inside the fuel tank.
2. Check the fuel level on level gauge. If the fuel gauge indicates more than the level as shown (half tank), drain the fuel from the fuel tank until the fuel gauge indicates the level as shown, or less.
   - As a guide, the fuel level reaches the fuel gauge position as shown, or less, when approximately 49.2 ℓ (12 US gal, 10-7/8 Imp gal) of fuel is drained from a full tank.
   - If the fuel pump does not operate, use the following procedure to drain the fuel to the specified level.
   - Insert a suitable hose of less than 15 mm (0.59 in) in diameter into the fuel filler pipe through the fuel filler opening to drain the fuel from fuel filler pipe.



3. Release the fuel pressure from the fuel lines. Refer to EC-1989, "Exhaust System Diagnostics".
4. Disconnect the battery or batteries. Refer to PG-185, "Battery Disconnect".
5. Remove fender protector. Refer to EXT-41, "Removal and Installation - Front Fender Protector".
6. Disconnect fuel supply line at the fuel filter housing (Stage 1).
7. Disconnect the fuel filler hose from fuel filler tube and fuel tank using the following steps:

a. Directions for service of a one-button quick-disconnect connector (1):

i. Disconnect the one-button quick-disconnect connector by pressing in the raised section of the clip on the connector.

ii. With the clip fully depressed, the fuel line can be removed from the female mating port.

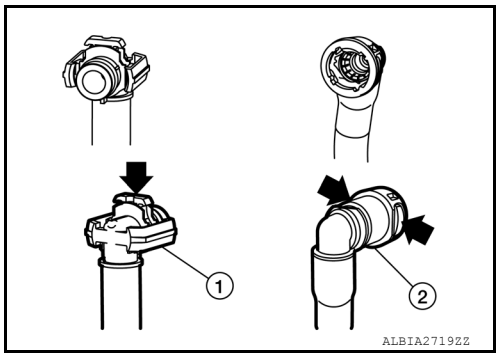
iii. Connect the one-button quick-disconnect connector by pushing the connector into the female mating port until it clicks.

b. Directions for service of a two-button quick-disconnect connector (2):

i. Disconnect the two-button quick-disconnect connector by pressing in the locking tangs on both sides of the connector.

ii. After pressing the opposing locking tangs, the quick-disconnect connector can be removed from the male fuel fitting.

iii. Connect the two-button quick-disconnect connector by pushing the quick-disconnect connector onto the male fuel fitting until it clicks.



CAUTION:

- **The quick connector can be disconnected when the tabs are completely depressed. Do not twist the quick connector more than necessary.**
- **Do not use any tools to disconnect the quick connector.**
- **Keep the resin tube away from heat. Be especially careful when welding near the tube.**
- **Prevent any acid liquids such as battery electrolyte, from getting on the resin tube.**
- **Do not bend or twist the resin tube during connection.**

- **Do not remove the remaining retainer on the hard tube (or the equivalent) except when the resin tube or the retainer is replaced.**
- **When the resin tube or hard tube, or the equivalent, is replaced, also replace the retainer with a new one (white colored retainer).**
- **To keep the connecting portions clean and to avoid damage and foreign materials, cover them completely with plastic bags or something similar.**

8. Remove fuel filler tube.
9. Disconnect the fuel tube return line.
10. Remove front fuel tank protector.
11. Release fuel lines from frame.
12. Position a suitable jack under the fuel tank.
13. Remove rear fuel tank mounting strap.
14. Remove side fuel tank protector.
15. Remove front fuel tank mounting strap.
16. While using a suitable jack, lower tank approximately 4 in.
    CAUTION:
    Fuel tank may be in an unstable condition, due to the shape of the fuel tank bottom. Be sure to secure fuel tank at all times.
17. Disconnect the fuel level sensor and the breather hose.
18. Lower the fuel tank using a suitable lift jack and remove it from the vehicle.

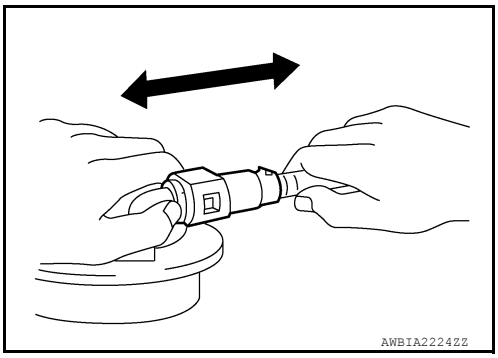
CAUTION:
Fuel tank may be in an unstable condition, due to the shape of the fuel tank bottom. Be sure to secure fuel tank at all times.

19. If replacing the fuel tank, remove the fuel level sensor unit to transfer to the new fuel tank. Refer to FL-36, "Removal and Installation".
    CAUTION:
    - **Do not reuse the O-ring.**
    - **Do not bend float arm during removal and installation.**

INSTALLATION

Installation is in the reverse order of removal.

- Connect the quick connector as follows:
- Check the connection for damage or any foreign materials.
- Align the connector with the tube, then insert the connector straight into the tube until a click is heard.
- After the tube is connected, make sure the connection is secure by performing the following check:
- Pull the tube and the connector to make sure they are securely connected.



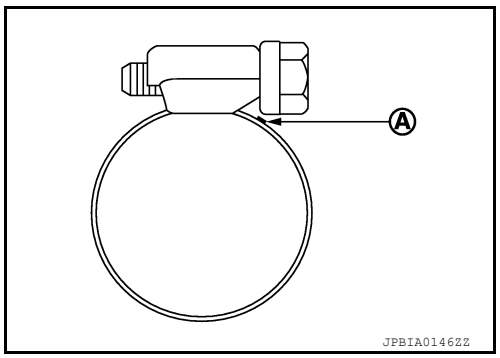
Fuel Filler Hose

- Insert fuel filler hose to the length below:

: 35 mm (1.38 in)

- Be sure hose clamp is not placed on swollen area of fuel filler tube.

- Tighten the clamp hand with the top mark (A) until the mark is on the bolt head flange.



INSPECTION AFTER INSTALLATION

1. Turn the ignition switch ON but do not start engine, then check the fuel pipe and hose connections for leaks Using Tool by applying fuel pressure to the system.

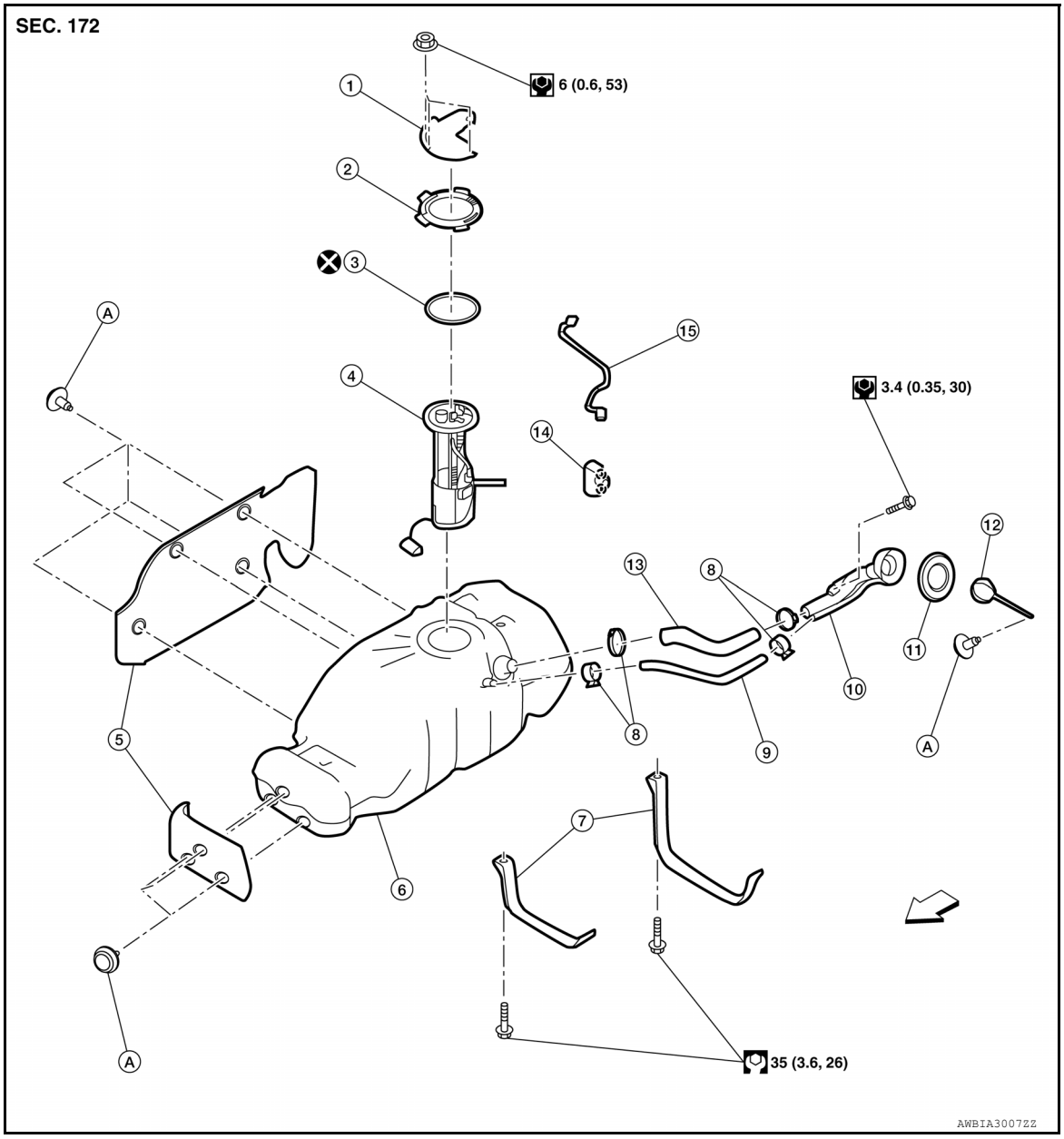
Tool Number : — (J-50079)

2. Start the engine and rev it above idle speed, then check that there are no fuel leaks at any of the fuel pipe and hose connections.

FUEL LEVEL SENSOR UNIT

Exploded View

INFOID:0000000014418385



1. Fuel level sensor unit protector	2. Lock ring	3. O-ring
4. Fuel level sensor unit	5. Fuel tank protector	6. Fuel tank
7. Fuel tank mounting strap	8. Clamp	9. Fuel filler return hose
10. Fuel filler tube	11. Grommet	12. Fuel filler cap
13. Fuel filler hose	14. Chamber assembly	15. Breather tube
A. Clip	Pawl	Front

Removal and Installation

INFOID:0000000014418386

REMOVAL

WARNING:

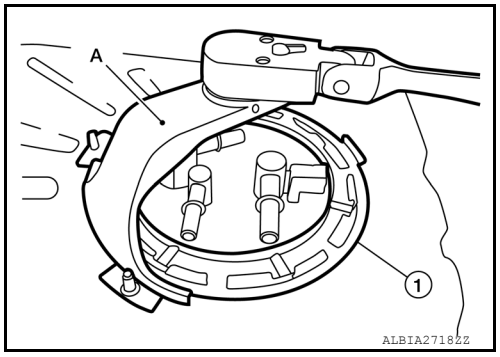
Follow the “General Precautions” before working on the fuel system. Refer to FL-21, "General Precaution".

WARNING:
The fuel system (fuel pump, high pressure fuel lines, fuel rail, injectors) contains very high pressure fuel. To avoid the risk of personal injury or fire:
- **Do not loosen any fittings while the engine is running.**
- **Wait at least 10 minutes after shutting down the engine before loosening any fittings in the high-pressure fuel system to allow pressure to decrease to a lower level.**
- **Wear appropriate eye protection and protective equipment as high-pressure fuel spray can penetrate skin.**
- **Never smoke or allow sparks or flames (such as pilot lights, electrical switches, or welding equipment) in the work area.**
- **Never allow diesel fuel to spill onto a hot exhaust manifold which can cause a fire.**

NOTE:
When removing components such as hoses, tubes/lines, etc., cap or plug openings to prevent fluid from spilling.

1. Remove fuel tank. Refer to FL-32, "Removal and Installation".
2. Remove the lock ring (1) using Tool (A) as shown.

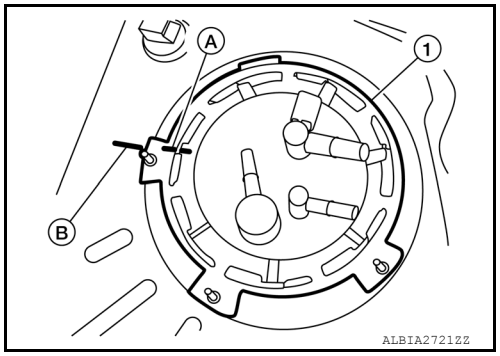
Tool number : — (J-46536) (shown)
: KV101207S0 (—)



3. Remove the fuel level sensor unit and discard the O-ring.
   CAUTION:
   - **Do not bend the float arm during removal.**
   - **Avoid impacts such as dropping when handling the components.**
   - **Do not reuse O-ring.**
4. Release pawls and remove chamber assembly from fuel tank (if necessary).

INSPECTION AFTER REMOVAL

After removal, observe the alignment on the fuel level sensor unit (1) between the fuel level sensor unit tabs (A) and the matching mark (B) on the fuel tank as shown. This alignment is necessary for proper installation.

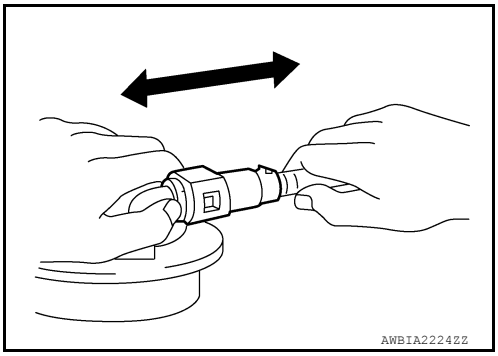


INSTALLATION

Installation is in the reverse order of removal.

CAUTION:
Do not reuse O-ring.

- Connect the quick connector as follows:
- Check the connection for damage or any foreign materials.
- Align the connector with the tube, then insert the connector straight into the tube until a click is heard.
- After the tube is connected, make sure the connection is secure by performing the following check:
- Pull the tube and the connector to make sure they are securely connected.



INSPECTION AFTER INSTALLATION

1. Turn the ignition switch ON but do not start engine, then check the fuel pipes and hose connections for leaks while applying fuel pressure to the system using Tool.

Tool number : — (J-50079)

2. Start the engine and rev it above idle speed, then check that there are no fuel leaks at any of the fuel pipe and hose connections.

FUEL FILTER (STAGE 1)

Removal and Installation

INFOID:0000000014418387

GENERAL INFORMATION

It is possible that fault codes may become active after fuel filter replacement due to air introduced into the system. Be sure to operate the engine until air is purged and clear the fault code(s) before releasing the vehicle.

REMOVAL

WARNING:

Diesel fuel and diesel fuel vapor is flammable. To avoid risk of fire or burns, never smoke or allow sparks or flames (such as pilot lights, electrical switches, or welding equipment) in the work area. Never allow diesel fuel to spill onto a hot exhaust manifold which can cause a fire.

WARNING:

Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:

- **Wear appropriate goggles and protective clothing.**
- **Always properly ventilate the area where service is being performed.**
- **Never allow battery fluid to come into contact with skin, eyes, fabrics or painted surfaces.**
- **To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.**
- **If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.**

WARNING:

When using compressed air for cleaning, to avoid the risk of personal injury from flying debris and dirt:

- **Do not exceed 30 psi (207 kPa).**
- **Wear appropriate eye protection and protective clothing including gloves.**

WARNING:

When using high-pressure water or steam cleaning equipment, to avoid the risk of personal injury from flying debris and hot steam:

- **Wear appropriate eye protection and protective clothing including gloves.**

WARNING:

The fuel system (fuel pump, high pressure fuel lines, fuel rail, injectors) contains very high pressure fuel. To avoid the risk of personal injury or fire:

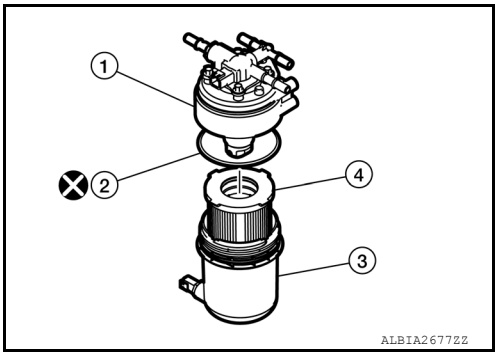
- **Do not loosen any fittings while the engine is running.**
- **Wait at least 10 minutes after shutting down the engine before loosening any fittings in the high-pressure fuel system to allow pressure to decrease to a lower level.**
- **Wear appropriate eye protection and protective equipment as high-pressure fuel spray can penetrate skin.**
- **Never smoke or allow sparks or flames (such as pilot lights, electrical switches, or welding equipment) in the work area.**
- **Never allow diesel fuel to spill onto a hot exhaust manifold which can cause a fire.**

CAUTION:

- **Clean all around the filter area before disassembly. Dirt or contaminants can damage the fuel system.**
- **The fuel filter housing can be damaged by rocking the filter back and forth.**
- **Place an approved container under the fuel filter housing (Stage 1) to ensure fuel dripping from housing during service is captured.**

1. Disconnect the battery or batteries. Refer to PG-185, "Battery Disconnect".
2. Clean the area around the fuel filter.
3. Drain the fuel filter housing (Stage 1). Refer to FL-31, "Drain".
4. Close the water-in-fuel drain.
5. Disconnect the harness connector from the water-in-fuel sensor. Refer to FL-43, "Removal and Installation".
6. Remove fuel filter housing (Stage 1) protector.

7. Remove the fuel filter housing [Stage 1 (3)] from the module (1). Refer to FL-43, "Removal and Installation".
8. Remove the fuel filter element (4) by lifting the element straight out of the fuel filter housing (Stage 1).



NOTE:
- It may be necessary to use a suitable tool in the slots provided to remove the fuel filter from the housing.
- If fuel filter element does not release with housing remove the element by twisting and pulling directly away from module simultaneously.

9. Remove and discard the O-ring (2) on the fuel filter housing (Stage 1).
   CAUTION:
   Do not reuse O-ring.

NOTE:
Leaving the fuel filter housing (Stage 1) un-installed from the module for extended periods of time (overnight) could cause the fuel tank to drain through the Stage 1 fuel filter module.

INSPECTION AFGTER REMOVAL

1. Inspect the fuel filter housing (Stage 1) and module for cracks or passage blockages. Replace if damage is found. Refer to FL-43, "Removal and Installation".

INSTALLATION

WARNING:
Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:
- **Wear appropriate goggles and protective clothing.**
- **Always properly ventilate the area where service is being performed.**
- **Never allow battery fluid to come into contact with skin, eyes, fabrics or painted surfaces.**
- **To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.**
- **If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.**

CAUTION:
Do not pre-fill the Stage 1 fuel filter with fuel. Pre-filling the Stage 1 fuel filter can result in debris entering the fuel system and damaging fuel system components.

1. Lubricate the inner seal with petroleum jelly or white lithium grease.
2. Install new O-ring on fuel filter housing (Stage 1). Lubricate with petroleum jelly or white lithium grease.

NOTE:
If you are using a new housing that has not had fuel in it, lubricate the lip seal at the bottom of the element with petroleum jelly or white lithium grease before placing it into the housing.

3. Install the fuel filter element into the fuel filter housing (Stage 1) and make sure the four tabs are properly seated into the four slots.
4. Install the fuel filter housing (Stage 1) on the module.
5. Connect the harness connector to the water-in-fuel sensor. Refer to FL-43, "Removal and Installation".
6. Connect the battery or batteries. Refer to PG-185, "Battery Disconnect".
7. Prime the fuel system. Refer to EM-219, "Priming".
8. Operate the engine and check for leaks.

FUEL FILTER (STAGE 2)

Removal and Installation

INFOID:0000000014418388

GENERAL INFORMATION

It is possible that fault codes may become active after fuel filter replacement due to air introduced into the system. Be sure to operate the engine until air is purged and clear the fault code(s) before releasing the vehicle.

REMOVAL

WARNING:

Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:

- **Wear appropriate goggles and protective clothing.**
- **Always properly ventilate the area where service is being performed.**
- **Never allow battery fluid to come into contact with skin, eyes, fabrics or painted surfaces.**
- **To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.**
- **If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.**

WARNING:

When using compressed air for cleaning, to avoid the risk of personal injury from flying debris and dirt:

- **Do not exceed 30 psi (207 kPa).**
- **Wear appropriate eye protection and protective clothing including gloves.**

WARNING:

When using high-pressure water or steam cleaning equipment, to avoid the risk of personal injury from flying debris and hot steam:

- **Wear appropriate eye protection and protective clothing including gloves.**

WARNING:

Diesel fuel and diesel fuel vapor are flammable. To avoid risk of fire or burns, never smoke or allow sparks or flames (such as pilot lights, electrical switches, or welding equipment) in the work area. Never allow diesel fuel to spill onto a hot exhaust manifold which can cause a fire.

CAUTION:

Clean all around the filter area before disassembly. Dirt or contaminants can damage the fuel system.

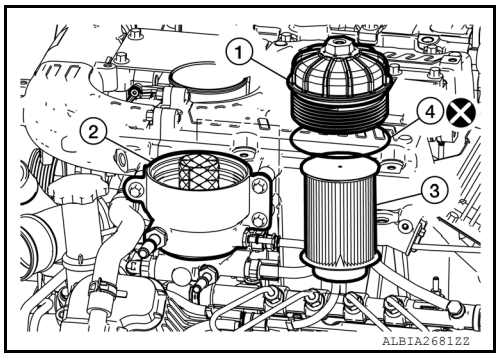
CAUTION:

Wait for 10 minutes after engine shutdown to allow the fuel pressure to decay to minimize fuel spillage when the cover is removed.

NOTE:

For best results, the fuel filter (Stage 1) should be changed prior to changing the fuel filter (Stage 2).

1. Disconnect the battery or batteries. Refer to PG-185, "Battery Disconnect".
2. Remove the air cleaner lid and air inlet connection air ducts.
3. Remove the lid (1) from the fuel filter housing [Stage 2 (2)].
   NOTE:
   Remove the lidslowly to avoid fuel spillage.
4. Remove the fuel filter [Stage 2 (3)] from the lid by hand.
5. Remove and discard the sealing O-ring (4) from the fuel filter (Stage 2) lid (1).
   CAUTION:
   Do not reuse O-ring.



INSPECTION AFTER REMOVAL

1. Inspect the fuel filter housing and cover for cracks, passage blockages, and other damage. Replace if damage is found. Refer to FL-46, "Removal and Installation".

INSTALLATION

WARNING:
Diesel fuel and diesel fuel vapor are flammable. To avoid risk of fire or burns, never smoke or allow sparks or flames (such as pilot lights, electrical switches, or welding equipment) in the work area. Never allow diesel fuel to spill onto a hot exhaust manifold which can cause a fire.
CAUTION:
Do not pre-fill the fuel filter with fuel. Pre-filling the filter can result in debris entering the fuel system and damaging fuel system components.

1. Install a new O-ring on the fuel filter (Stage 2) lid. Lubricate the O-ring with petroleum jelly or white lithium grease.
2. Lubricate the inner seal on the fuel filter (Stage 2) with petroleum jelly or white lithium grease.
3. Install the fuel filter (Stage 2) onto the standpipe in the fuel filter housing (Stage 2).
   NOTE:
   Be sure the fuel filter element is seated in the housing by pushing downward on the top of the element. If the fuel filter (Stage 2) is not fully seated in the housing after installation, the engine can fail to start.
4. Install and tighten the fuel filter (Stage 2) lid.

Torque Value : 25 N·m (2.6 kg-m, 18 ft-lb)

NOTE:
If the fuel filter (Stage 2) is not fully seated in the fuel filter housing (Stage 2), the engine can fail to start after servicing the fuel filter (Stage 2).

5. Connect the battery or batteries. Refer to PG-185, "Battery Disconnect".
6. Prime the fuel system. Refer to EM-219, "Priming".
7. Operate the engine and check for leaks.

FUEL FILTER HOUSING (STAGE 1)

Removal and Installation

INFOID:0000000014418389

GENERAL INFORMATION

The Stage 1 fuel filter houses the Stage 1 fuel filter element, acts as a water fuel separator, and contains the lift pump and thermal recirculating valve.

REMOVAL

WARNING:

Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:

- **Wear appropriate goggles and protective clothing.**
- **Always properly ventilate the area where service is being performed.**
- **Never allow battery fluid to come into contact with skin, eyes, fabrics or painted surfaces.**
- **To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.**
- **If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.**

WARNING:

Diesel fuel and diesel fuel vapor are flammable. To avoid risk of fire or burns, never smoke or allow sparks or flames (such as pilot lights, electrical switches, or welding equipment) in the work area. Never allow diesel fuel to spill onto a hot exhaust manifold which can cause a fire.

WARNING:

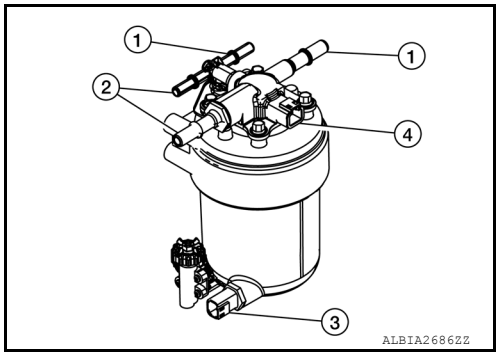
To avoid the risk of personal injury or fire, drain diesel fuel into an approved container and safely dispose of in accordance with local environmental regulations.

WARNING:

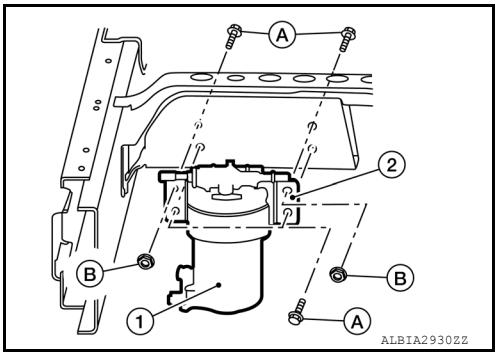
The fuel system (fuel pump, high pressure fuel lines, fuel rail, injectors) contains very high pressure fuel. To avoid the risk of personal injury or fire:

- **Do not loosen any fittings while the engine is running.**
- **Wait at least 10 minutes after shutting down the engine before loosening any fittings in the high-pressure fuel system to allow pressure to decrease to a lower level.**
- **Wear appropriate eye protection and protective equipment as high-pressure fuel spray can penetrate skin.**
- **Never smoke or allow sparks or flames (such as pilot lights, electrical switches, or welding equipment) in the work area.**
- **Never allow diesel fuel to spill onto a hot exhaust manifold which can cause a fire.**

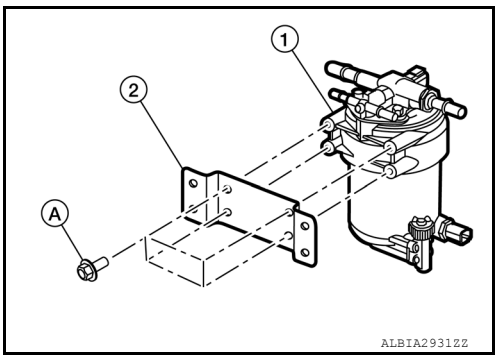
1. Disconnect the battery or batteries. Refer to PG-185, "Battery Disconnect".
2. Drain the fuel filter housing. Refer to FL-31, "Drain".
3. Disconnect the harness connector from the water-in-fuel sensor (3) at the bottom of fuel filter housing (Stage 1).
4. Disconnect the harness connector from the fuel lift pump (4) at the top of fuel filter housing (Stage 1).
5. Disconnect the fuel supply and return line quick-connect fittings (1) feeding from the fuel filter housing (Stage 2). When these hoses are disconnected, fuel from the engine side will drain.
6. Disconnect the fuel supply and return line quick-disconnect fitting lines feeding from the fuel tank (2).



7. Remove bolts (A) and nuts (B) that secure the fuel filter housing [Stage 1 (1)] to the chassis.
8. Remove the fuel filter housing (Stage 1), with bracket (2) attached, from the vehicle frame.



9. Place plastic protector caps on the openings of the fuel filter (Stage 1) and fuel lines.
10. Remove bolts (A) from fuel filter housing [Stage 1 (1)] bracket (2).
11. Remove fuel filter housing (Stage 1) from bracket.



INSPECTION AFTER REMOVAL

1. Inspect the fuel filter housing (Stage 1) for cracks or damage to fittings. Replace if damage is found.

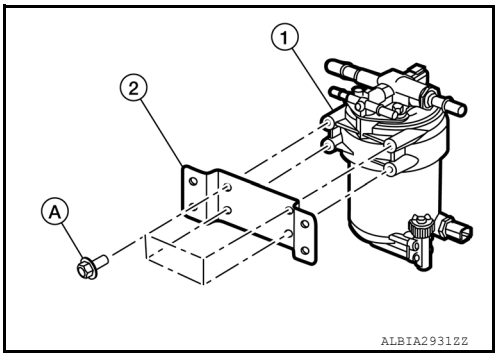
INSTALLATION

WARNING:

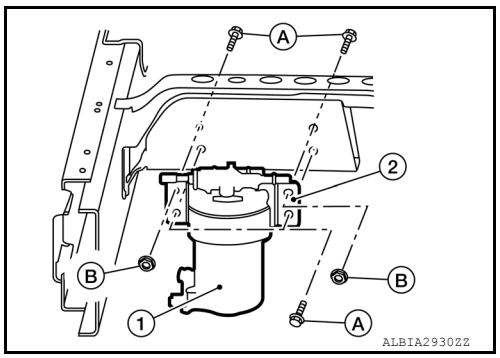
Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:

- **Wear appropriate goggles and protective clothing.**
- **Always properly ventilate the area where service is being performed.**
- **Never allow battery fluid to come into contact with skin, eyes, fabrics or painted surfaces.**
- **To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.**
- **If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.**

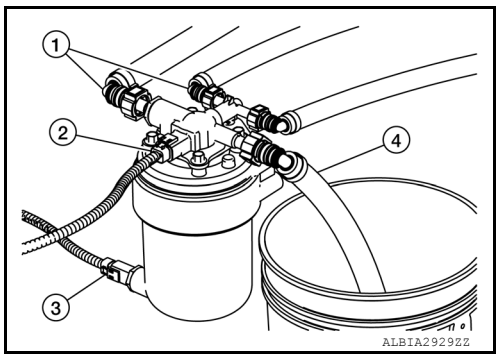
1. Tighten bolts (A) securing fuel filter housing [Stage 1 (1)] to bracket (2).



2. Install fuel filter housing [Stage 1 (1)]by tightening bolts (A) and nuts (B) on bracket (2) to vehicle frame.



3. Connect the fuel supply and return line quick-connect fittings (1) feeding from the fuel tank.
4. Attach suitable tool to the supply outlet (4) of the fuel filter housing (Stage 1). Allow the male end of the tool to flow into a bucket.
5. Connect the harness connector to the fuel lift pump (2) at the top of the fuel filter housing (Stage 1).
6. Connect the harness connector to the water-in-fuel sensor (3) at the bottom of the fuel filter housing (Stage 1).



7. Connect the battery or batteries. Refer to PG-185, "Battery Disconnect".
8. Key ON the vehicle to allow the lift pump to run. The fuel lift pump should run for 1 minute. If the lift pump does not run for 1 minute, cycle the key quickly to put the lift pump into 1 minute priming mode. Fuel should begin flowing out of the service tool into the bucket within the key cycle. If fuel does not begin flowing after 1 cycle, repeat the process for a maximum of 3 times. Refer to EM-219, "Priming".
9. Remove the service tool from the fuel filter housing (Stage 1).
10. Connect the fuel supply and return line quick-connect fittings feeding to the fuel filter housing (Stage 2).
11. Prime the fuel system. Refer to EM-219, "Priming".
12. Operate the engine and check for leaks.

FUEL FILTER HOUSING (STAGE 2)

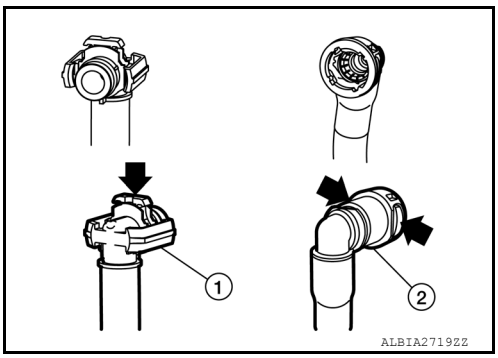
Removal and Installation

INFOID:0000000014418390

GENERAL INFORMATION

NOTE:
It is possible that fault codes can become active due to air introduced into the fuel system. Be sure to operate the engine until the air is purged and use an electronic service tool to clear the fault code(s) before releasing the vehicle.

CAUTION:
Do not use any tools to disconnect the quick connector. This can result in damage to the quick-disconnect fitting.



Directions for service of a one-button quick-disconnect connector (1):
- Disconnect the one-button quick-disconnect connector by pressing in the raised section of the clip on the connector.
- With the clip fully depressed, the fuel line can be removed from the female mating port.
- Connect the one-button quick-disconnect connector by pushing the connector into the female mating port until it clicks.

Directions for service of a two-button quick-disconnect connector (2):
- Disconnect the two-button quick-disconnect connector by pressing in the locking tangs on both sides of the connector.
- After pressing the opposing locking tangs, the quick-disconnect connector can be removed from the male fuel fitting.
- Connect the two-button quick-disconnect connector by pushing the quick-disconnect connector onto the male fuel fitting until it clicks.

REMOVAL

WARNING:
Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:
- **Wear appropriate goggles and protective clothing.**
- **Always properly ventilate the area where service is being performed.**
- **Never allow battery fluid to come into contact with skin, eyes, fabrics or painted surfaces.**
- **To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.**
- **If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.**

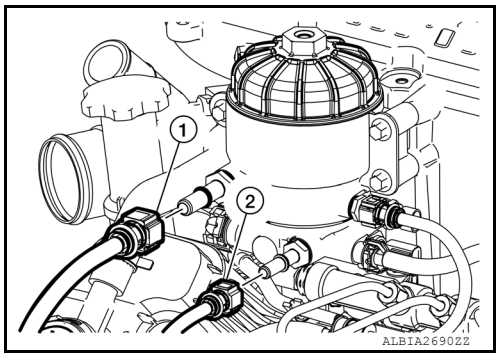
WARNING:
The fuel system (fuel pump, high pressure fuel lines, fuel rail, injectors) contain very high pressure fuel. To avoid the risk of personal injury or fire:
- **Do not loosen any fittings while the engine is running.**
- **Wait at least 10 minutes after shutting down the engine before loosening any fittings in the high-pressure fuel system to allow pressure to decrease to a lower level.**
- **Wear appropriate eye protection and protective equipment as high-pressure fuel spray can penetrate skin.**
- **Never smoke or allow sparks or flames (such as pilot lights, electrical switches, or welding equipment) in the work area.**
- **Never allow diesel fuel to spill onto a hot exhaust manifold which can cause a fire.**

WARNING:
Diesel fuel and diesel fuel vapor are flammable. To avoid risk of fire or burns, never smoke or allow sparks or flames (such as pilot lights, electrical switches, or welding equipment) in the work area. Never allow diesel fuel to spill onto a hot exhaust manifold which can cause a fire.

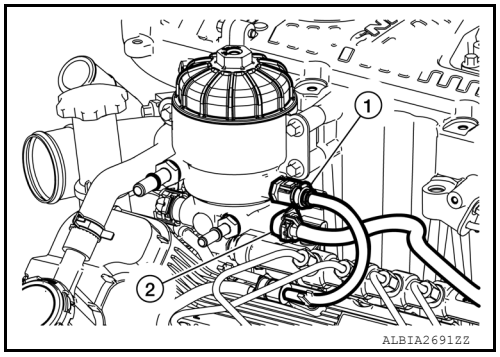
WARNING:
When using high-pressure water or steam cleaning equipment, to avoid the risk of personal injury from flying debris and hot steam:
- **Wear appropriate eye protection and protective clothing including gloves.**

CAUTION:
Clean all around the filter area before disassembly. Dirt or contaminants can damage the fuel system.

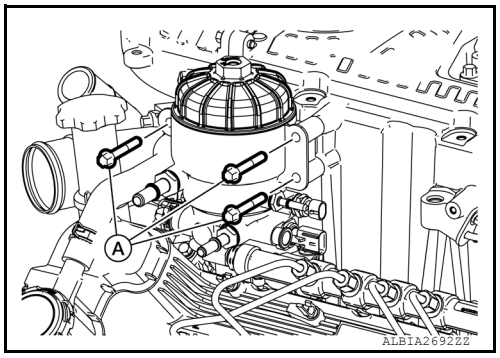
1. Disconnect the battery or batteries. Refer to PG-185, "Battery Disconnect".
2. Drain the fuel filter (Stage 2). Refer to FL-31, "Drain".
3. Remove air cleaner lid and air inlet connection air ducts.
4. Disconnect the harness connector from the fuel pressure sensor. Refer to FL-56, "Removal and Installation".
5. Disconnect the harness connector from the fuel temperature sensor. Refer to FL-54, "Removal and Installation".
6. Disconnect the fuel supply (1) and return lines (2) from the fuel filter housing (Stage 2).



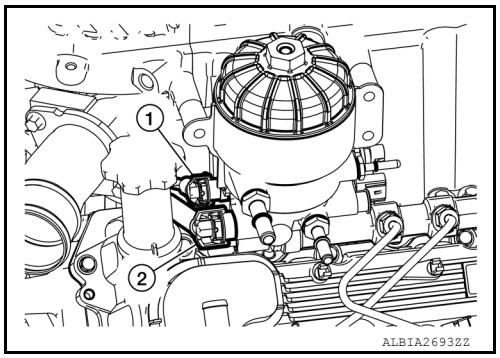
7. Disconnect the injector drain line two-button connector (1) from the fuel filter housing (Stage 2).
8. Disconnect the fuel rail drain line one-button connector (2) from the fuel filter housing (Stage 2).



9. Remove the bolts (A) that secure the fuel filter housing (Stage 2) to the air intake manifold and the air intake connection.
   NOTE:
   Gently moving the fuel filter housing (Stage 2) away from the air intake manifold and air intake connection will aid in the removal of the fuel pump supply and drain lines.



10. Disconnect the fuel pump supply line one-button connector (2) from the fuel filter housing (Stage 2).
11. Disconnect the fuel pump drain line one-button connector (1) from the fuel filter housing (Stage 2).



12. Remove the fuel filter housing (Stage 2).

INSPECTION AFTER REMOVAL

1. Inspect the fuel filter housing (Stage 2) for cracks or other damage to the connectors.
2. Replace any damaged components.

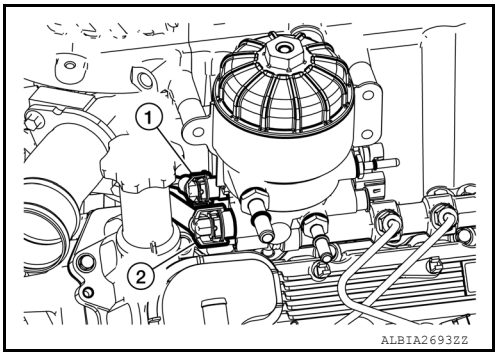
INSTALLATION

WARNING:

Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:

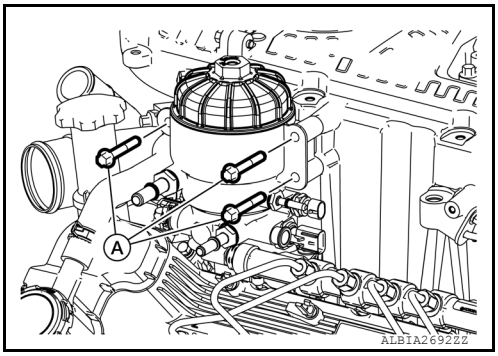
- **Wear appropriate goggles and protective clothing.**
- **Always properly ventilate the area where service is being performed.**
- **Never allow battery fluid to come into contact with skin, eyes, fabrics or painted surfaces.**
- **To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.**
- **If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.**

1. Position the fuel filter housing (Stage 2) against the air intake manifold and the air intake connection.
2. Connect the fuel pump drain line one-button connector (1) to the fuel filter housing (Stage 2).
3. Connect the fuel pump supply line one-button connector (2) to the fuel filter housing (Stage 2).

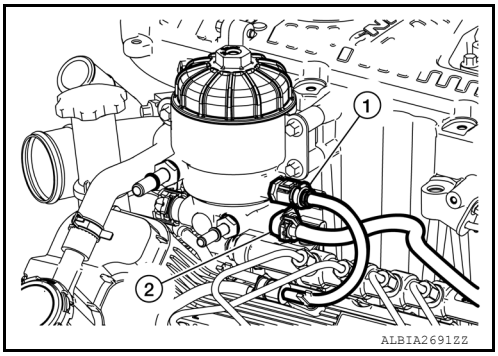


4. Install and tighten bolts (A) to secure the fuel filter housing (Stage 2) to the air intake manifold and the air intake connection.

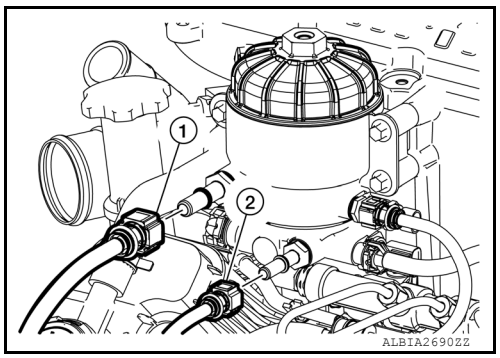
Bolts : 18 N·m (1.8 kg-m, 13 ft-lb)



5. Connect the fuel rail drain line one-button connector (2) to the fuel filter housing (Stage 2).
6. Connect the injector drain line two-button connector (1) to the fuel filter housing (Stage 2).



7. Connect the fuel supply (1) and return lines (2) to the fuel filter housing (Stage 2).



8. Connect the harness connector to the fuel temperature sensor. Refer to FL-54, "Removal and Installation".
9. Connect the harness connector to the fuel pressure sensor. Refer to FL-56, "Removal and Installation".
10. Connect the battery or batteries. Refer to PG-185, "Battery Disconnect".
11. Prime the fuel system. Refer to EM-219, "Priming".
12. Operate the engine and check for leaks.

FUEL-WATER SEPERATOR

Removal and Installation

INFOID:0000000014418391

REMOVAL

WARNING:
Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:
- **Wear appropriate goggles and protective clothing.**
- **Always properly ventilate the area where service is being performed.**
- **Never allow battery fluid to come into contact with skin, eyes, fabrics or painted surfaces.**
- **To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.**
- **If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.**

WARNING:
Diesel fuel and diesel fuel vapor are flammable. To avoid risk of fire or burns, never smoke or allow sparks or flames (such as pilot lights, electrical switches, or welding equipment) in the work area. Never allow diesel fuel to spill onto a hot exhaust manifold which can cause a fire.

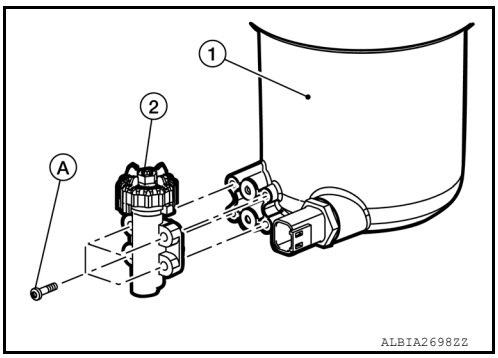
WARNING:
When using compressed air for cleaning, to avoid the risk of personal injury from flying debris and dirt:
- **Do not exceed 30 psi (207 kPa).**
- **Wear appropriate eye protection and protective clothing including gloves.**

WARNING:
When using high-pressure water or steam cleaning equipment, to avoid the risk of personal injury from flying debris and hot steam:
- **Wear appropriate eye protection and protective clothing including gloves.**

WARNING:
The fuel system (fuel pump, high pressure fuel lines, fuel rail, injectors) contains very high pressure fuel. To avoid the risk of personal injury or fire:
- **Do not loosen any fittings while the engine is running.**
- **Wait at least 10 minutes after shutting down the engine before loosening any fittings in the high-pressure fuel system to allow pressure to decrease to a lower level.**
- **Wear appropriate eye protection and protective equipment as high-pressure fuel spray can penetrate skin.**
- **Never smoke or allow sparks or flames (such as pilot lights, electrical switches, or welding equipment) in the work area.**
- **Never allow diesel fuel to spill onto a hot exhaust manifold which can cause a fire.**

CAUTION:
Clean all fittings before disassembly. Dirt or contaminants can damage the fuel system.

1. Disconnect the battery or batteries. Refer to PG-185, "Battery Disconnect".
2. Drain the fuel from the fuel filter housing (Stage 1). Refer to FL-31, "Drain".
3. Remove the bolts (A) which fasten the fuel-water separator (2) to the fuel filter housing [Stage 1 (1)].

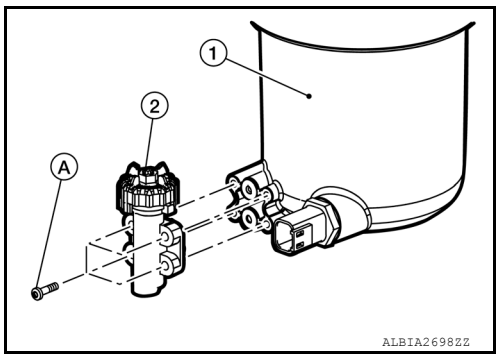


4. Remove fuel-water separator.

INSTALLATION

WARNING:
Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:
- **Wear appropriate goggles and protective clothing.**
- **Always properly ventilate the area where service is being performed.**
- **Never allow battery fluid to come into contact with skin, eyes, fabrics or painted surfaces.**
- **To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.**
- **If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.**

1. Install the fuel-water separator (2) into the fuel filter housing [Stage 1 (1)].
2. Tighten the bolts (A) into the fuel filter housing (Stage 1).
3. Connect the battery or batteries. Refer to PG-185, "Battery Disconnect".
4. Prime the fuel system. Refer to EM-219, "Priming".
5. Operate the engine and check for leaks.



WATER-IN-FUEL FILTER SENSOR

Removal and Installation

INFOID:0000000014418392

REMOVAL

WARNING:

Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:

- **Wear appropriate goggles and protective clothing.**
- **Always properly ventilate the area where the service is being performed.**
- **Never allow battery fluid to come in contact with skin, eyes, fabrics, or painted surfaces.**
- **To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.**
- **If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.**

WARNING:

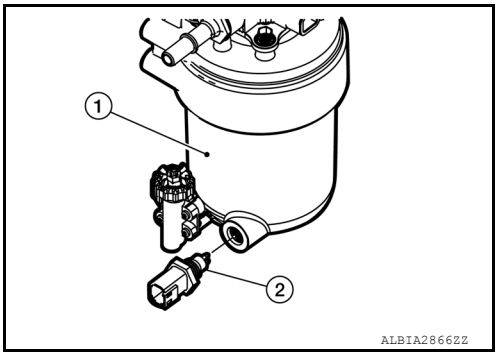
The fuel system (fuel pump, high pressure fuel lines, fuel rail, injectors) contains very high pressure fuel. To avoid the risk of personal injury or fire:

- **Do not loosen any fittings while the engine is running.**
- **Wait at least 10 minutes after shutting down the engine before loosening any fittings in the high-pressure fuel system to allow pressure to decrease to a lower level.**
- **Wear appropriate eye protection and protective equipment as high-pressure fuel spray can penetrate skin.**
- **Never smoke or allow sparks or flames (such as pilot lights, electrical switches, or welding equipment) in the work area.**
- **Never allow diesel fuel to spill onto a hot exhaust manifold which can cause a fire.**

CAUTION:

Make sure to close the peacock valve after draining the water from the Stage 1 fuel filter. Failing to do so could cause fuel to drain from the Stage 1 fuel filter when the engine is running.

1. Disconnect the battery or batteries. Refer to PG-185, "Battery Disconnect".
2. Drain the fuel filter housing (Stage 1). Refer to FL-31, "Drain".
3. Disconnect the harness connector from the water-in-fuel sensor.
4. Remove water-in-fuel sensor (2) from fuel filter housing [Stage 1 (1)].



INSPECTION AFTER REMOVAL

1. Inspect the engine harness connector and water-in-fuel sensor for the following:
   - Cracked or broken connector shell.
   - Missing or damaged connector seals.
   - Dirt, debris, or moisture in or on the connector pins.
   - Corroded, bent, broken, pushed back, or expanded pins.
   - Chipped, cracked, extruded, or damaged sensor.

   Repair or replace parts as necessary.
2. Inspect the water-in-fuel sensor for the following:
   - Damaged seal surface on the sensor.
   - Damaged sensor hex surfaces.
   - Corrosion on the sensor mounting threads.

   Replace the water-in-fuel sensor if damage is found.

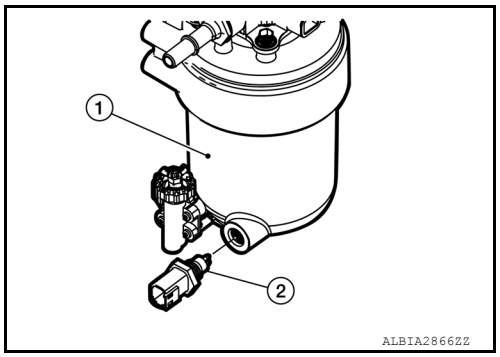
INSTALLATION

WARNING:

Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:

- **Wear appropriate goggles and protective clothing.**
- **Always properly ventilate the area where the service is being performed.**
- **Never allow battery fluid to come in contact with skin, eyes, fabrics, or painted surfaces.**
- **To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.**
- **If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.**

1. Check to be sure the water-in-fuel sensor has an O-ring installed.
2. Lubricate the O-ring with clean diesel fuel.
3. Install the water-in-fuel sensor (2) into the fuel filter housing [Stage 1 (1)].



4. Tighten the water-in-fuel sensor.

Torque Value : 3.9 N·m (0.4 kg-m, 35 in-lb)

5. Connect the harness connector to the water-in-fuel sensor.
6. Connect the battery or batteries. Refer to PG-185, "Battery Disconnect".
7. Operate the engine and check for leaks.

FUEL TEMPERATURE SENSOR

Removal and Installation

INFOID:0000000014418393

REMOVAL

WARNING:

Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:

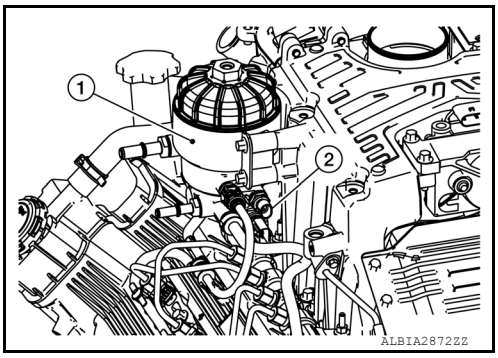
- **Wear appropriate goggles and protective clothing.**
- **Always properly ventilate the area where the service is being performed.**
- **Never allow battery fluid to come in contact with skin, eyes, fabrics, or painted surfaces.**
- **To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.**
- **If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.**

WARNING:

The fuel system (fuel pump, high pressure fuel lines, fuel rail, injectors) contains very high pressure fuel. To avoid the risk of personal injury or fire:

- **Do not loosen any fittings while the engine is running.**
- **Wait at least 10 minutes after shutting down the engine before loosening any fittings in the high-pressure fuel system to allow pressure to decrease to a lower level.**
- **Wear appropriate eye protection and protective equipment as high-pressure fuel spray can penetrate skin.**
- **Never smoke or allow sparks or flames (such as pilot lights, electrical switches, or welding equipment) in the work area.**
- **Never allow diesel fuel to spill onto a hot exhaust manifold which can cause a fire.**

1. Disconnect the battery or batteries. Refer to PG-185, "Battery Disconnect".
2. Remove the air cleaner lid and air inlet connection air ducts.
3. Clean the area around the fuel temperature sensor.
4. Disconnect the harness connector from the fuel temperature sensor (2).
5. Using a suitable tool, remove the fuel temperature sensor from the fuel filter housing [Stage 2 (1)].



INSPECTION AFTER REMOVAL

1. Inspect the harness connector and fuel temperature sensor for the following:
   - Cracked or broken connector shell
   - Missing or damaged connector seals
   - Dirt, debris, or moisture in or on the connector pins
   - Corroded, bent, broken, pushed back, or expanded pins
   - Chipped, cracked, extruded, or damaged sensor

   Repair or replace parts as necessary.
2. Inspect the fuel temperature sensor for the following:
   - Damaged O-ring seal
   - Thread damage

   Replace the fuel temperature sensor if damage is found.

INSTALLATION

WARNING:

Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:

- **Wear appropriate goggles and protective clothing.**
- **Always properly ventilate the area where the service is being performed.**
- **Never allow battery fluid to come in contact with skin, eyes, fabrics, or painted surfaces.**
- **To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.**
- **If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.**

1. Check that the new fuel temperature sensor has an O-ring installed.
2. Lubricate the O-ring with clean diesel fuel and install the new fuel temperature sensor into the fuel filter housing (Stage 2).

Torque Value : 20 N·m (2.0 kg-m, 15 ft-lb)

3. Remove all dirt and moisture from the harness connector.
4. Connect the harness connector to the fuel temperature sensor.
5. Connect the battery or batteries. Refer to PG-185, "Battery Disconnect".
6. Operate the engine to check for leaks.

FUEL PRESSURE SENSOR

Removal and Installation

INFOID:0000000014418394

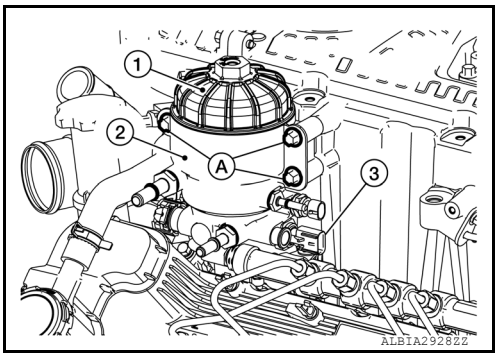
REMOVAL

WARNING:

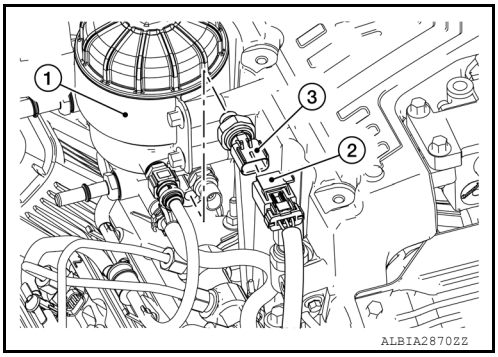
Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:

- **Wear appropriate goggles and protective clothing.**
- **Always properly ventilate the area where the service is being performed.**
- **Never allow battery fluid to come in contact with skin, eyes, fabrics, or painted surfaces.**
- **To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.**
- **If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.**

1. Disconnect the battery or batteries. Refer to PG-185, "Battery Disconnect".
2. Remove air cleaner lid and air inlet connection air ducts.
3. Loosen the fuel filter housing (Stage 2) lid (1) to allow fuel to drain back to the fuel tank.



4. Disconnect the harness connector (2) from the fuel pressure sensor (3).
5. Loosen the bolts (A) securing the fuel filter housing [Stage 2 (2)] to the intake manifold to access the fuel pressure sensor (3).
6. Remove the fuel pressure sensor from the fuel filter housing [Stage 2 (1)].



INSPECTION AFTER REMOVAL

1. Inspect the harness connector and fuel pressure sensor for the following:
   - Cracked or broken connector shell
   - Missing or damaged connector seals
   - Dirt, debris, or moisture in or on the connector pins
   - Corroded, bent, broken, pushed back, or expanded pins
   - Chipped, cracked, extruded, or damaged sensor

   Repair or replace parts as necessary.

INSTALLATION

WARNING:

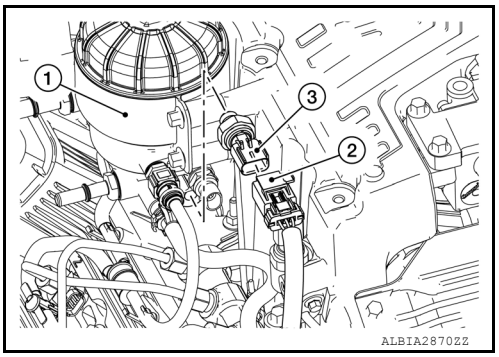
Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:

- **Wear appropriate goggles and protective clothing.**
- **Always properly ventilate the area where the service is being performed.**
- **Never allow battery fluid to come in contact with skin, eyes, fabrics, or painted surfaces.**
- **To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.**

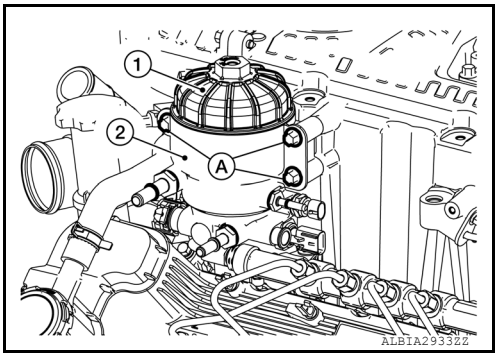
- **If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.**

1. Check that the new fuel pressure sensor has an O-ring installed.
2. Lubricate the O-ring with clean diesel fuel.
3. Using a suitable tool, install the fuel pressure sensor into the fuel filter housing [Stage 2 (1)].
   CAUTION:
   Do not overtighten the fuel pressure sensor.

   Torque Value : 21 N·m (2.1 kg-m, 15 ft-lb)



4. Connect the harness connector (2) to the fuel pressure sensor (3).
5. Tighten the bolts (A) securing the fuel filter housing [Stage 2 (2)] to the intake manifold.
6. Lubricate an O-ring with clean diesel fuel and install on the fuel filter housing (Stage 2) lid (1).



7. Tighten the lid onto the fuel filter housing (Stage 2).

   Torque Value : 25 N·m (2.6 kg-m, 18 ft-lb)

8. Connect the battery or batteries. Refer to PG-185, "Battery Disconnect".
9. Prime the fuel system. Refer to EM-219, "Priming".
10. Operate the engine to check for leaks.

SERVICE DATA AND SPECIFICATIONS (SDS)

SERVICE DATA AND SPECIFICATIONS (SDS)

Standard and Limit

INFOID:0000000014418395

Fuel tank capacity	98.4 ℓ (26 US gal, 21-5/8 Imp gal)
Maximum fuel inlet restriction (vacuum)	120 kPa (1.22 kg/cm^2, 17.4 psi)
Fuel pressure range at Fuel Filter (Stage 1) inlet and outlet (engine cranking)	600 kPa – 2350 kPa (6.2 kg/cm^2 – 23.97 kg/cm^2, 87 psi – 340.8 psi)
Fuel pressure range at Fuel Filter (Stage 2) inlet and outlet (engine running)	600 kPa – 2350 kPa (6.2 kg/cm^2 – 23.97 kg/cm^2, 87 psi – 340.8 psi)
Maximum pressure drop across Fuel Filter (Stage 2)	334 kPa (3.41 kg/cm^2, 48.4 psi)
Maximum fuel drain line restriction	100 kPa (14.5 psi)
Fuel inlet temperature	71°C (160°)