

SECTION

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ENGINE LUBRICATION SYSTEM

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DESCRIPTION

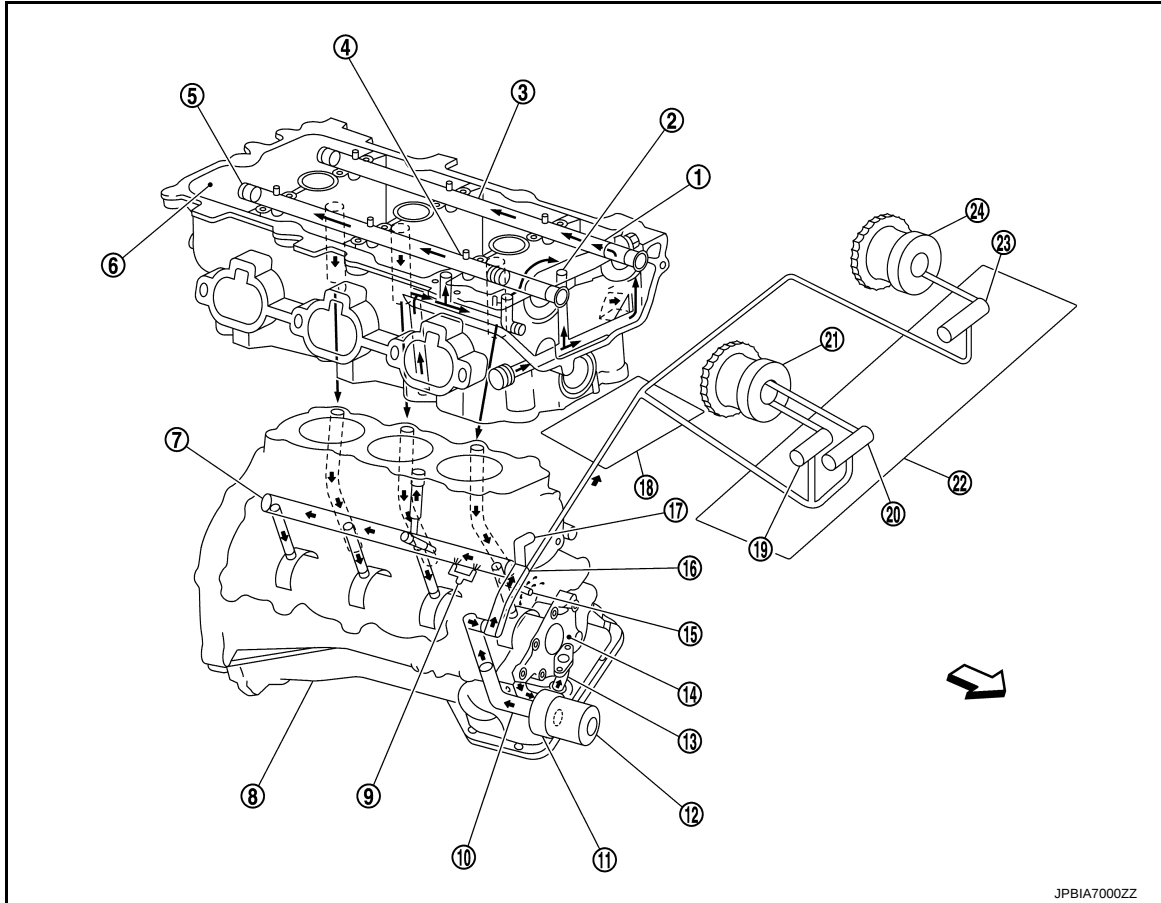
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SYSTEM DESCRIPTION

DESCRIPTION

Engine Lubrication System

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- | | | |
|--|--|-------------------------------------|
| 1. Exhaust camshaft journal (No.1) | 2. Timing chain tensioner (secondary)oil gallery | 3. Camshaft (EXH) |
| 4. Intake camshaft journal (No. 2) | 5. Camshaft (INT) | 6. Cylinder head (bank 2) |
| 7. Main oil gallery | 8. Oil pan | 9. Piston oil jet |
| 10. Oil pan oil gallery | 11. Oil cooler | 12. Oil filter |
| 13. Oil strainer | 14. Oil pump | 15. Timing chain oil jet |
| 16. Timing chain case oil gallery | 17. Timing chain tensioner (primary) | 18. Timing chain case |
| 19. Intake valve timing control solenoid-valve | 20. Intake valve timing intermediate lock control solenoid valve | 21. Intake valve timing controller |
| 22. Camshaft sprocket cover (bank 2) | 23. Exhaust valve timing control solenoid valve | 24. Exhaust valve timing controller |

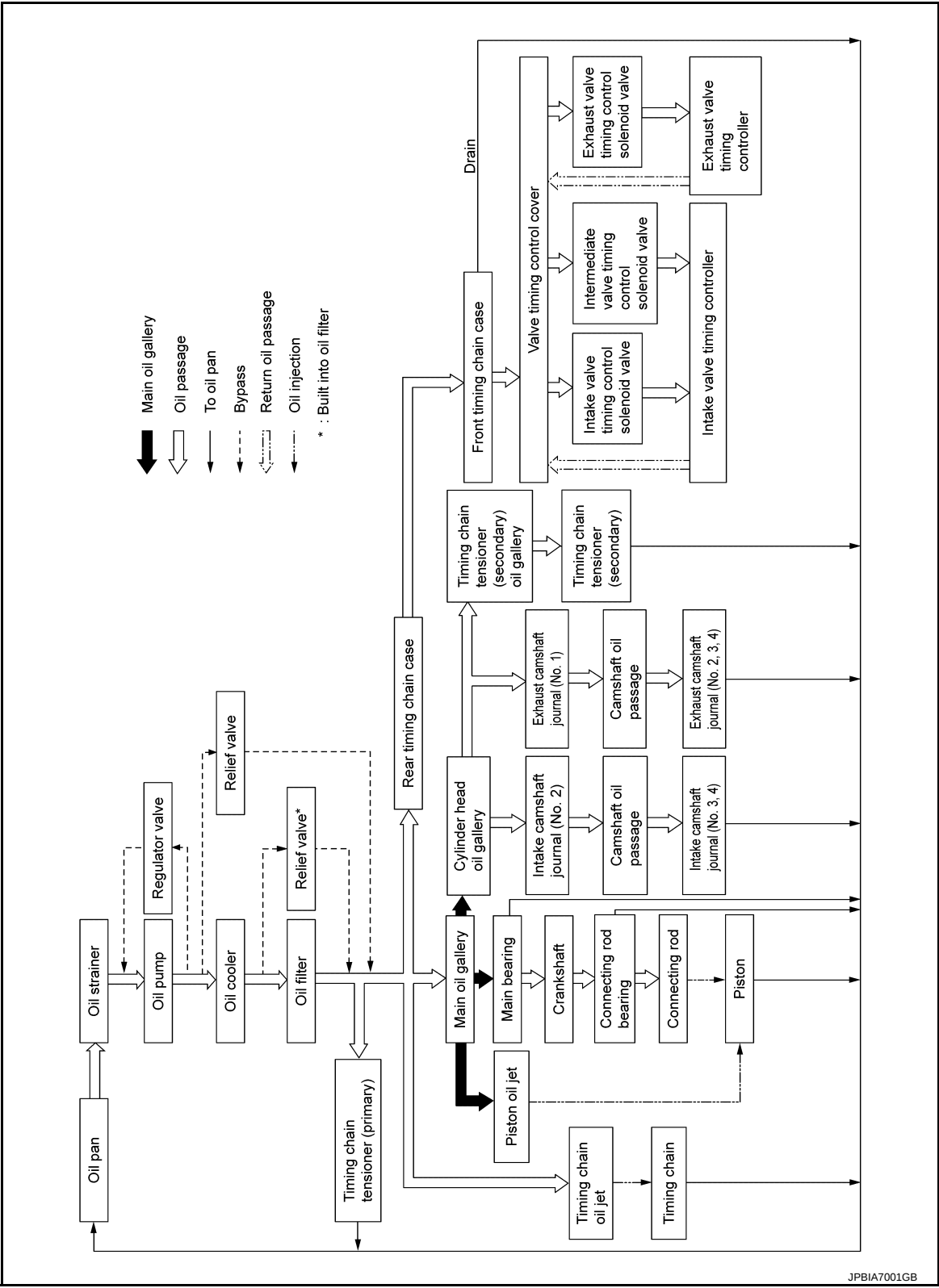
↶ : Engine front

DESCRIPTION

< SYSTEM DESCRIPTION >

Engine Lubrication System Schematic

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PRECAUTIONS

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PRECAUTION

PRECAUTIONS

Precautions for Removing Battery Terminal

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- When removing the 12V battery terminal, turn OFF the ignition switch and wait at least 30 seconds.

NOTE:

ECU may be active for several tens of seconds after the ignition switch is turned OFF. If the battery terminal is removed before ECU stops, then a DTC detection error or ECU data corruption may occur.

- For vehicles with the 2-batteries, be sure to connect the main battery and the sub battery before turning ON the ignition switch.

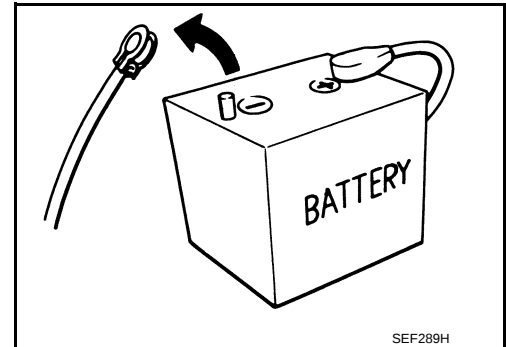
NOTE:

If the ignition switch is turned ON with any one of the terminals of main battery and sub battery disconnected, then DTC may be detected.

- After installing the 12V battery, always check "Self Diagnosis Result" of all ECUs and erase DTC.

NOTE:

The removal of 12V battery may cause a DTC detection error.



Precaution for Liquid Gasket

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LIQUID GASKET APPLICATION PROCEDURE

- Remove old liquid gasket adhering to the liquid gasket application surface and the mating surface.
 - Remove liquid gasket completely from the liquid gasket application surface, mounting bolts, and bolt holes.
- Wipe the liquid gasket application surface and the mating surface with white gasoline (lighting and heating use) to remove adhering moisture, grease and foreign materials.
- Apply liquid gasket to the liquid gasket application surface.

Use Genuine RTV Silicone Sealant or equivalent. Refer to [GI-22, "Recommended Chemical Products and Sealants"](#).

 - Within 5 minutes of liquid gasket application, install in the mating component.
 - If liquid gasket protrudes, wipe it off immediately.
 - Never retighten mounting bolts or nuts after the installation.
 - After 30 minutes or more have passed from the installation, fill engine oil and engine coolant.

Precautions For Engine Service

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DISCONNECTING FUEL PIPING

- Before starting work, check no fire or spark producing items are in the work area.
- Release fuel pressure before disconnecting and disassembly.
- After disconnecting pipes, plug openings to stop fuel leakage.

DRAINING ENGINE COOLANT

Drain engine coolant and engine oil when the engine is cooled.

INSPECTION, REPAIR AND REPLACEMENT

Before repairing or replacing, thoroughly inspect parts. Inspect new replacement parts in the same way, and replace if necessary.

REMOVAL AND DISASSEMBLY

- When instructed to use SST, use specified tools. Always be careful to work safely, avoid forceful or uninstructed operations.
- Exercise maximum care to avoid damage to mating or sliding surfaces.

PRECAUTIONS

< PRECAUTION >

- Dowel pins are used for several parts alignment. When replacing and reassembling parts with dowel pins, check that dowel pins are installed in the original position.
- Must cover openings of engine system with a tape or equivalent, to seal out foreign materials.
- Mark and arrange disassembly parts in an organized way for easy troubleshooting and reassembly.
- When loosening nuts and bolts, as a basic rule, start with the one furthest outside, then the one diagonally opposite, and so on. If the order of loosening is specified, do exactly as specified. Power tools may be used in the step.

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ASSEMBLY AND INSTALLATION

- Use torque wrench to tighten bolts or nuts to specification.
- When tightening nuts and bolts, as a basic rule, equally tighten in several different steps starting with the ones in center, then ones on inside and outside diagonally in this order. If the order of tightening is specified, do exactly as specified.
- Replace with new gasket, packing, oil seal or O-ring.
- Thoroughly wash, clean, and air-blow each part. Carefully check engine oil or engine coolant passages for any restriction and blockage.
- Avoid damaging sliding or mating surfaces. Completely remove foreign materials such as cloth lint or dust. Before assembly, oil sliding surfaces well.
- After disassembling, or exposing any internal engine parts, change engine oil and replace oil filter with a new one.
- Release air within route when refilling after draining engine coolant.
- After repairing, start the engine and increase engine speed to check engine coolant, fuel, engine oil, and exhaust gases for leakage.

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PREPARATION

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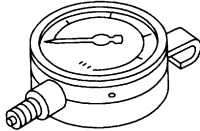
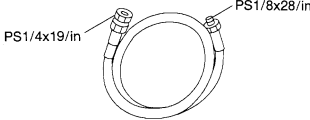
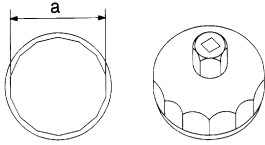
PREPARATION

PREPARATION

Special Service Tool

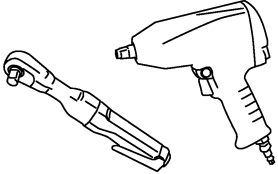
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The actual shapes of TechMate tools may differ from those of special service tools illustrated here.

Tool number (TechMate No.) Tool name	Description
ST25051001 (J-25695-1) Oil pressure gauge  NT050	Measuring oil pressure Maximum measuring range: 2,452 kPa (25 kg/cm², 356 psi)
ST25052000 (J-25695-2) Hose  S-NT559	Adapting oil pressure gauge to oil pan (upper)
KV10115801 (J-38956) Oil filter wrench  S-NT375	Removing oil filter a: 64.3 mm (2.531 in)

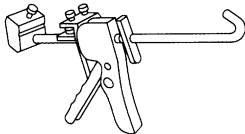
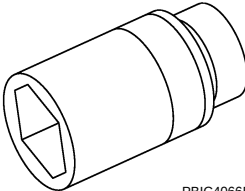
Commercial Service Tool

INFOID:000000011321644

Tool name	Description
Power tools  PBIC0190E	Loosening nuts and bolts

PREPARATION

< PREPARATION >

Tool name	Description
Tube presser  NT052	Pressing the tube of liquid gasket  PBIC4066E
Deep socket	Removing and installing oil pressure switch 27 mm (1.06 in)

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PERIODIC MAINTENANCE

ENGINE OIL

Inspection

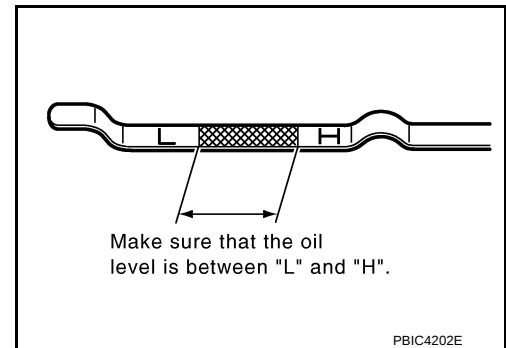
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ENGINE OIL LEVEL

NOTE:

Before starting engine, put vehicle horizontally and check the engine oil level. If engine is already started, stop it and allow 10 minutes before checking.

1. Pull out oil level gauge and wipe it clean.
2. Insert oil level gauge and check the engine oil level is within the range shown in the figure.
3. If it is out of range, adjust it.



ENGINE OIL APPEARANCE

- Check engine oil for white turbidity or heavy contamination.
- If engine oil becomes turbid and white, it is highly probable that it is contaminated with engine coolant. Repair or replace damaged parts.

ENGINE OIL LEAKAGE

Check for engine oil leakage around the following areas:

- Oil pans (lower and upper)
- Oil pan drain plug
- Oil pressure switch
- Oil temperature sensor
- Oil filter
- Oil cooler
- Camshaft sprocket cover (bank 1 and bank 2)
- Intake valve timing control solenoid valve (bank 1 and bank 2)
- Intake valve timing intermediate lock control solenoid valve (bank 1 and bank 2)
- Mating surface between cylinder head and rocker cover
- Mating surface between front timing chain case and rear timing chain case
- Mating surface between rear timing chain case and cylinder head
- Mating surface between rear timing chain case and cylinder block
- Mating surface between rear timing chain case and oil pan (upper)
- Mating surface between cylinder block and cylinder head
- Crankshaft oil seals (front and rear)
- Camshaft position sensor (PHASE)
- Exhaust valve timing control position sensor.

OIL PRESSURE CHECK

WARNING:

- **Be careful not to get burn yourself, as engine oil may be hot.**
 - **Oil pressure check should be done in "Parking position".**
1. Check the engine oil level.
 2. Remove splash guard (RH). Refer to [EXT-23. "Exploded View"](#).

ENGINE OIL

< PERIODIC MAINTENANCE >

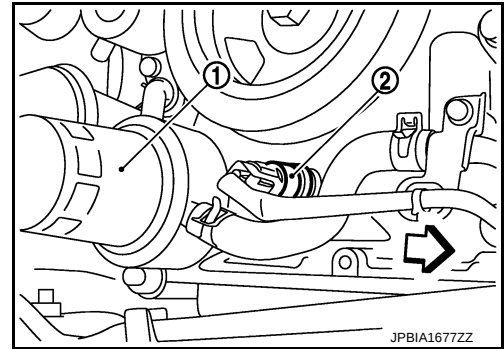
3. Disconnect harness connector at oil pressure switch (2), and remove oil pressure switch using deep socket (commercial service tool).

1 : Oil filter

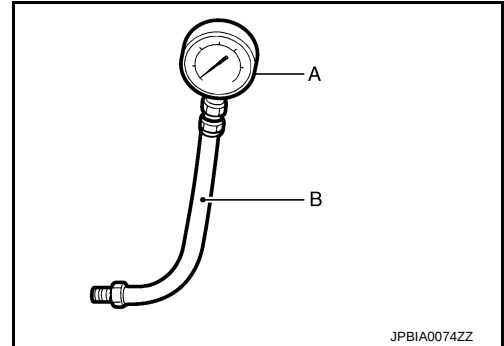
↩ : Vehicle front

CAUTION:

Never drop or shock oil pressure switch.



4. Install the oil pressure gauge [SST: ST25051001 (J-25695-1)] (A) and hose [SST: ST25052000 (J-25695-2)] (B).



5. Start the engine and warm it up to normal operating temperature.
6. Check the engine oil pressure with engine running under no-load.

NOTE:

When the engine oil temperature is low, the engine oil pressure becomes high.

Engine oil pressure : Refer to [LU-17, "Engine Oil Pressure"](#).

If difference is extreme, check engine oil passage and oil pump for engine oil leakage.

7. After the inspections, install oil pressure switch as follows:
 - a. Remove old liquid gasket adhering to oil pressure switch and the mating surface.
 - b. Apply liquid gasket and tighten oil pressure switch to the specification.

Use Genuine RTV Silicone Sealant or equivalent. Refer to [GI-22, "Recommended Chemical Products and Sealants"](#).

Tightening torque : Refer to [EM-39, "Exploded View"](#).

- c. After warming up engine, check there is no leakage of engine oil with running engine.

Draining

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WARNING:

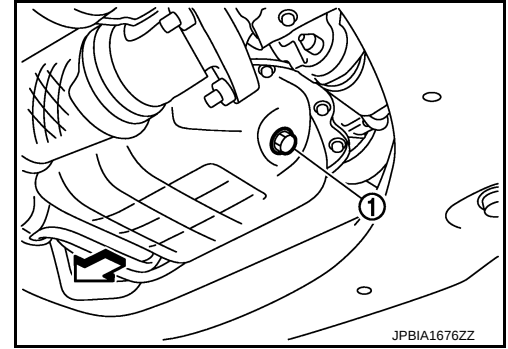
- Be careful not to get burn yourself, as engine oil may be hot.
 - Prolonged and repeated contact with used engine oil may cause skin cancer. Try to avoid direct skin contact with used engine oil. If skin contact is made, wash thoroughly with soap or hand cleaner as soon as possible.
1. Warm up the engine, and check for engine oil leakage from engine components. Refer to [LU-8, "Inspection"](#).
 2. Stop the engine and wait for 10 minutes.
 3. Loosen oil filler cap.

ENGINE OIL

< PERIODIC MAINTENANCE >

4. Remove drain plug (1) and then drain engine oil.

⇐ : Vehicle front



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Refilling

1. Install drain plug with new drain plug washer. Refer to [EM-39, "Exploded View"](#).

CAUTION:

- Do not reuse drain plug washer.
- Be sure to clean drain plug and install with new drain plug washer.

Tightening torque : Refer to [EM-39, "Exploded View"](#).

2. Refill with new engine oil.

Engine oil specification and viscosity: Refer to [MA-10, "Fluids and Lubricants"](#).

Engine oil capacity : Refer to [LU-17, "Periodical Maintenance Specification"](#).

CAUTION:

- When filling engine oil, never pull out oil level gauge.
 - The refill capacity depends on the engine oil temperature and drain time. Use these specifications for reference only.
 - Always use oil level gauge to determine the proper amount of engine oil in engine.
3. Warm up the engine and check area around drain plug and oil filter for engine oil leakage.
 4. Stop the engine and wait for 10 minutes.
 5. Check the engine oil level. Refer to [LU-8, "Inspection"](#).

OIL FILTER

< PERIODIC MAINTENANCE >

OIL FILTER

Removal and Installation

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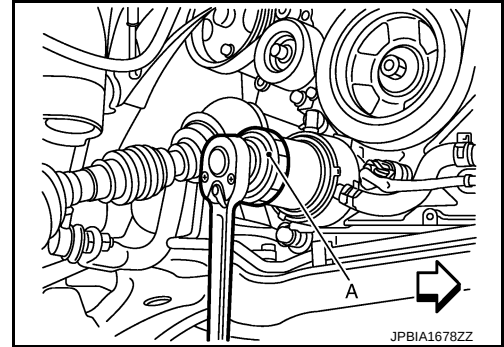
REMOVAL

CAUTION:

- Oil filter is provided with relief valve. Use genuine NISSAN oil filter or equivalent.
- Be careful not to get burned when engine and engine oil may be hot.
- When removing, prepare a shop cloth to absorb any engine oil leakage or spillage.
- Never allow engine oil to adhere to drive belt.
- Completely wipe off any engine oil that adheres to engine and vehicle.

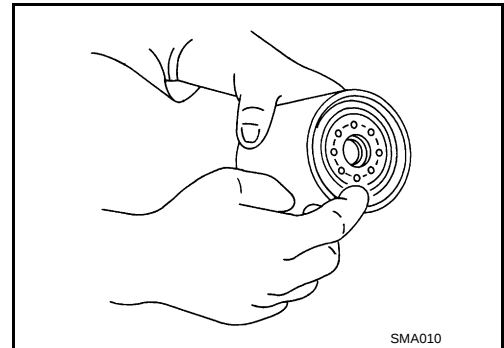
1. Remove splash guard (RH). Refer to [EXT-23. "Exploded View"](#).
2. Using oil filter wrench [SST: KV10115801 (J-38956)] (A), remove oil filter.

⇐ : Vehicle front



INSTALLATION

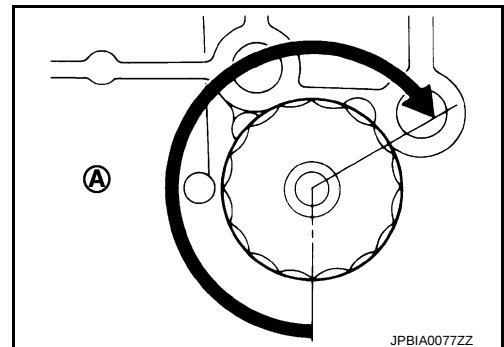
1. Remove foreign materials adhering to oil filter installation surface.
2. Apply engine oil to the oil seal contact surface of new oil filter.



3. Screw oil filter manually until it touches the installation surface, then tighten it by 2/3 turn (A). Or tighten to the specification.

Oil filter:

: 17.6 N·m (1.8 kg-m, 13 ft-lb)



Inspection

INFOID:0000000011321649

INSPECTION AFTER INSTALLATION

1. Check the engine oil level. Refer to [LU-8. "Inspection"](#).
2. Start the engine, and check there is no leakage of engine oil.
3. Stop the engine and wait for 10 minutes.
4. Check the engine oil level, and adjust the level. Refer to [LU-8. "Inspection"](#).

OIL COOLER

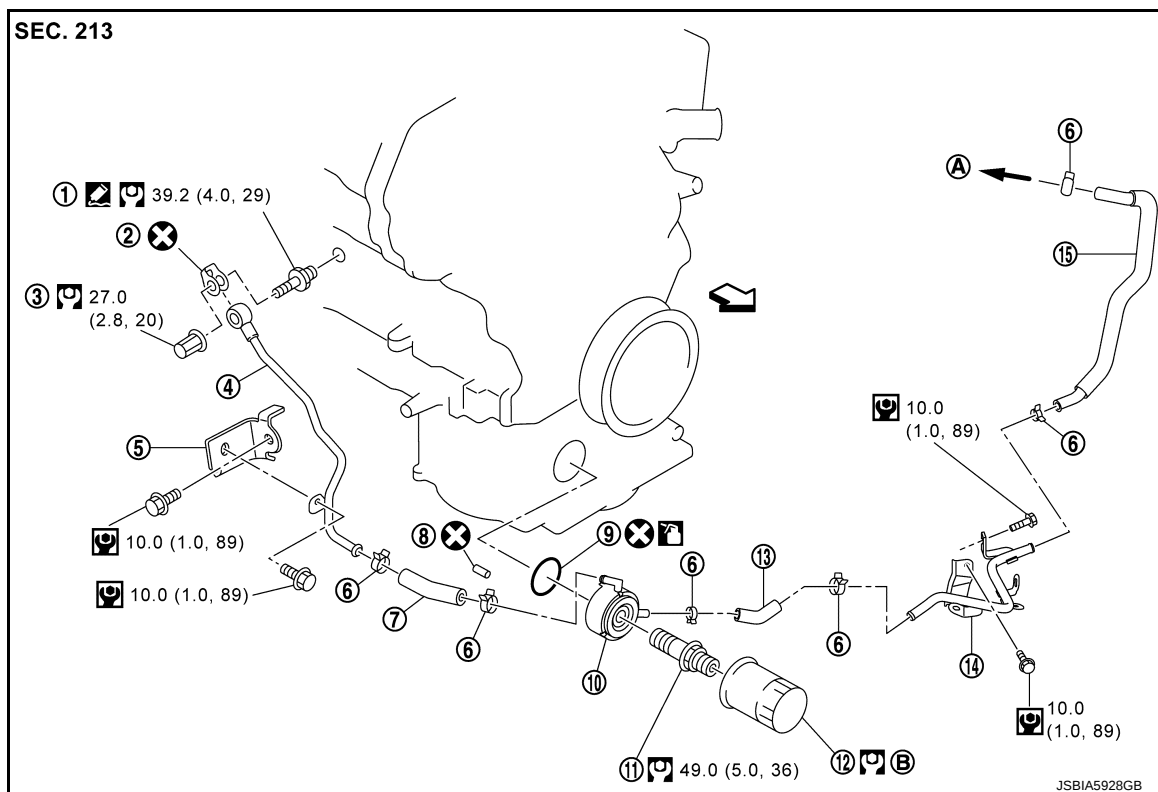
< REMOVAL AND INSTALLATION >

REMOVAL AND INSTALLATION

OIL COOLER

Exploded View

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- | | | |
|-----------------------|---|---------------------|
| 1. Connector bolt | 2. Copper gasket | 3. Water drain plug |
| 4. Water pipe | 5. Bracket | 6. Clamp |
| 7. Water hose | 8. Relief valve | 9. O-ring |
| 10. Oil cooler | 11. Connector bolt | 12. Oil filter |
| 13. Water hose | 14. Water pipe | 15. Water hose |
| A. To water connector | B. Comply with the assembly procedure when tightening. Refer to LU-11 | |

↔ : Engine front

⊗ : Always replace after every disassembly.

⊙ : N·m (kg-m, ft-lb)

⊕ : N·m (kg-m, in-lb)

⚙ : Should be lubricated with oil.

⚡ : Sealing point

Removal and Installation

INFOID:0000000011321651

REMOVAL

WARNING:

Be careful not to get burn yourself, as engine oil and engine coolant may be hot.

NOTE:

When remove oil cooler only, step 2 is unnecessary.

OIL COOLER

< REMOVAL AND INSTALLATION >

1. Remove front wheel (RH).
2. Remove splash guard (RH). Refer to [EXT-23, "Exploded View"](#).
3. Drain engine coolant from radiator and cylinder block. Refer to [CO-8, "Draining"](#) and [EM-65, "Setting"](#).
NOTE:
Perform this step when removing water pipes.
4. Remove oil filter. Refer to [LU-11, "Removal and Installation"](#).
CAUTION:
Never spill engine oil on drive belt.
5. Disconnect water hoses from oil cooler.
 - When removing oil cooler only, pinching water hoses near oil cooler to prevent engine coolant from spilling out.
 - Remaining engine coolant in piping will come out. Use a tray to collect it.**CAUTION:**
 - **Perform this step when the engine is cold.**
 - **Never spill engine coolant on drive belt.**
6. Remove connector bolt, and remove oil cooler.
CAUTION:
Never spill engine oil to rubber parts such as drive belt.
7. Remove water hoses if necessary.

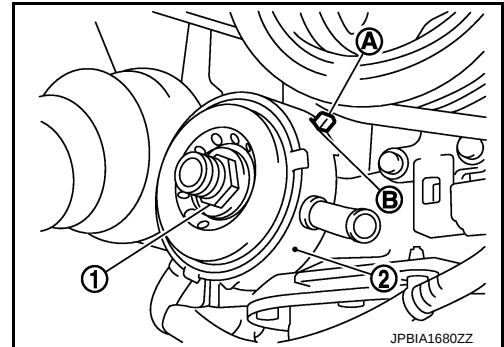
INSTALLATION

CAUTION:

Do not reuse O-rings.

Note the following, and install in the reverse order of removal.

- Check that no foreign objects are adhering to the installation surfaces of oil cooler and oil pan (upper).
- Align cutout (B) on oil cooler (2) with protrusion (A) on oil pan (upper) side, and tighten connector bolt (1).



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Inspection

INSPECTION AFTER REMOVAL

Oil Cooler

Check oil cooler for cracks. Check oil cooler for clogging by blowing through engine coolant inlet. If necessary, replace oil cooler.

Relief Valve

Inspect relief valve for movement, cracks and breaks by pushing the ball. If replacement is necessary, remove relief valve by prying it out with a suitable tool. Install a new relief valve in place by tapping it.

INSPECTION AFTER INSTALLATION

1. Check the engine oil level and the engine coolant level and add engine oil and engine coolant. Refer to [LU-8, "Inspection"](#) and [CO-8, "Inspection"](#).
2. Start the engine, and check there is no leakage of engine oil or engine coolant.
3. Stop the engine and wait for 10 minutes.
4. Check the engine oil level and the engine coolant level again. Refer to [LU-8, "Inspection"](#) and [CO-8, "Inspection"](#).

OIL PUMP

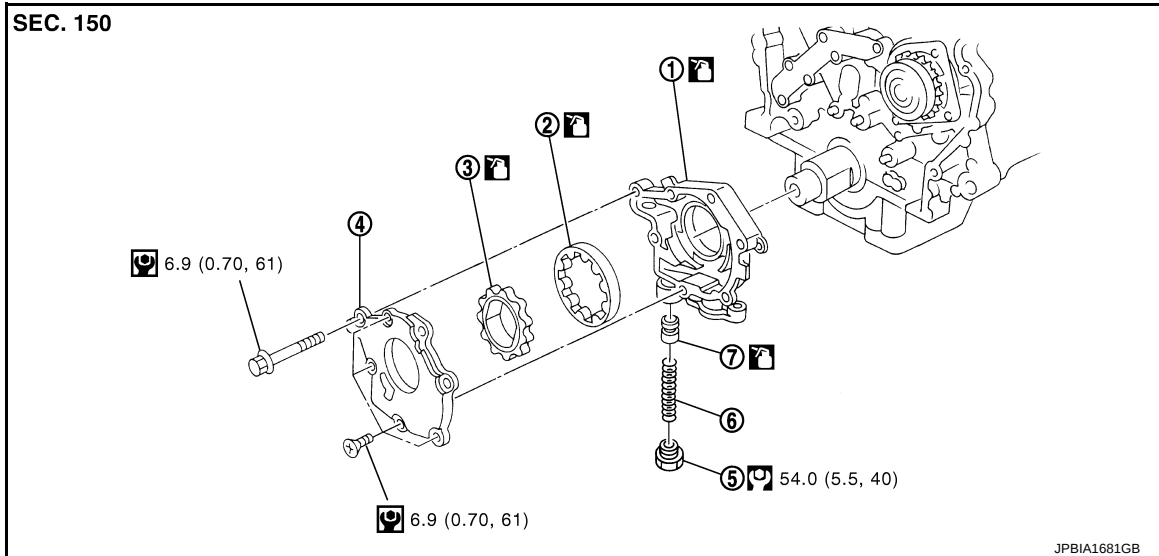
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UNIT DISASSEMBLY AND ASSEMBLY

OIL PUMP

Exploded View

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- | | | |
|--------------------|-------------------------|---------------------------|
| 1. Oil pump body | 2. Oil pump outer rotor | 3. Oil pump inner rotor |
| 4. Oil pump cover | 5. Regulator valve plug | 6. Regulator valve spring |
| 7. Regulator valve | | |

: N·m (kg-m, ft-lb)

: N·m (kg-m, in-lb)

: Should be lubricated with oil.

Removal and Installation

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REMOVAL

1. Remove oil pan (lower and upper) and oil strainer. Refer to [EM-39. "Exploded View"](#).
2. Remove front timing chain case and timing chain (primary). Refer to [EM-68. "Exploded View"](#).
3. Remove oil pump assembly.

INSTALLATION

Note the following, and install in the reverse order of removal.

- When installing, align crankshaft flat faces with oil pump inner rotor flat faces.

Disassembly and Assembly

INFOID:0000000011321655

DISASSEMBLY

1. Remove oil pump cover.
2. Remove oil pump inner rotor and oil pump outer rotor from oil pump body.
3. After removing regulator valve plug, remove regulator valve spring and regulator valve.

ASSEMBLY

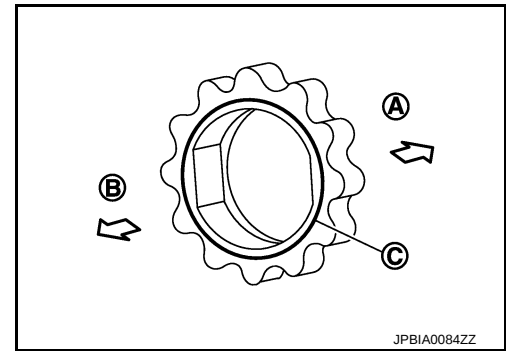
Note the following, and assemble in the reverse order of disassembly.

OIL PUMP

< UNIT DISASSEMBLY AND ASSEMBLY >

- Install oil pump inner rotor with the groove (C) faced to oil pump cover side (B).

A : Oil pump body side



INFOID:0000000011321656

Inspection

INSPECTION AFTER DISASSEMBLY

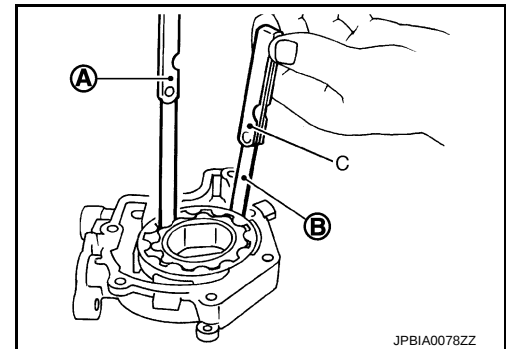
Oil Pump Clearance

- Measure the clearance with feeler gauge (C).
- Clearance between oil pump outer rotor and oil pump body. [Position (B)]

Standard : Refer to [LU-17, "Oil Pump"](#).

- Tip clearance between oil pump inner rotor and oil pump outer rotor. [Position (A)]

Standard : Refer to [LU-17, "Oil Pump"](#).

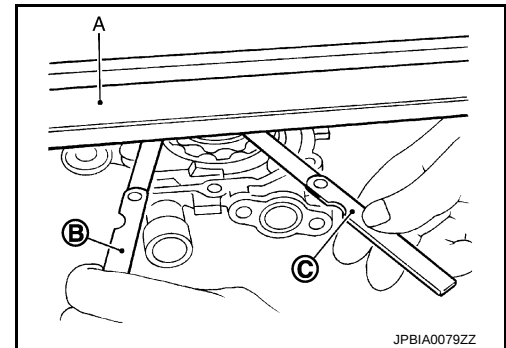


- Measure the clearance with feeler gauge and straightedge (A).
- Side clearance between oil pump inner rotor and oil pump body. [Position (C)]

Standard : Refer to [LU-17, "Oil Pump"](#).

- Side clearance between oil pump outer rotor and oil pump body. [Position (B)]

Standard : Refer to [LU-17, "Oil Pump"](#).



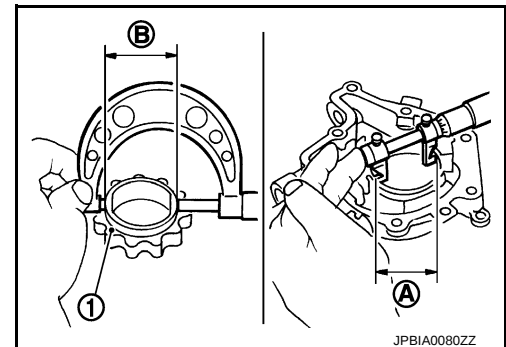
- Calculate the clearance between oil pump inner rotor and oil pump body as follows:

OIL PUMP BODY INNER DIAMETER

- Measure the inner diameter of oil pump body with inside micrometer. [Position (A)]

OIL PUMP INNER ROTOR OUTER DIAMETER

- Measure the outer diameter of protruded portion of oil pump inner rotor (1) with micrometer. [Position (B)]



OIL PUMP INNER ROTOR TO OIL PUMP BODY CLEARANCE

- (Clearance) = (Oil pump body inner diameter) – (Oil pump inner rotor outer diameter)

OIL PUMP

< UNIT DISASSEMBLY AND ASSEMBLY >

Standard : Refer to [LU-17, "Oil Pump"](#).

- If measured/calculated values are out of the standard, replace oil pump assembly.

Regulator Valve Clearance

(Clearance) = (Regulator valve hole diameter) – (Regulator valve outer diameter)

- 1 : Regulator valve
- 2 : Oil pump body

Standard : Refer to [LU-17, "Regulator Valve"](#).

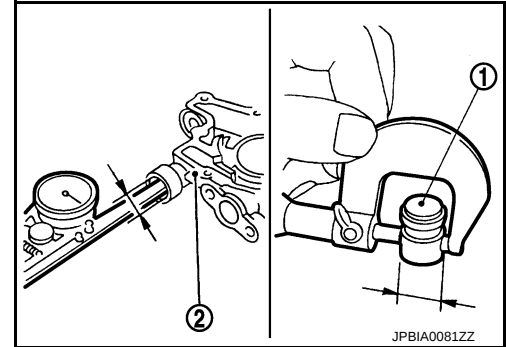
- If the calculated value is out of the standard, replace oil pump assembly.

CAUTION:

- Coat regulator valve with engine oil.
- Check that it falls smoothly into valve hole by its own weight.

INSPECTION AFTER INSTALLATION

1. Check the engine oil level. Refer to [LU-8, "Inspection"](#).
2. Start the engine, and check that there is no leakage of engine oil.
3. Stop the engine and wait for 10 minutes.
4. Check the engine oil level and adjust the level. Refer to [LU-8, "Inspection"](#).



SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

SERVICE DATA AND SPECIFICATIONS (SDS)

SERVICE DATA AND SPECIFICATIONS (SDS)

Periodical Maintenance Specification

INFOID:0000000011321657

ENGINE OIL CAPACITY (APPROXIMATE)

Unit: ℓ (US qt, Imp qt)

Drain and refill	With oil filter change	4.6 (4-7/8, 4)
	Without oil filter change	4.3 (4-1/2, 3-3/4)
Dry engine (Overhaul)		5.3 (5-5/8, 4-5/8)

Engine Oil Pressure

INFOID:0000000011321658

Unit: kPa (kg/cm², psi)

Engine speed	Approximate discharge pressure*
Idle speed	More than 98 (1.0, 14)
2,000 rpm	More than 294 (3.0, 43)

*: Engine oil temperature at 80°C (176°F)

Oil Pump

INFOID:0000000011321659

Unit: mm (in)

Clearance between oil pump outer rotor and oil pump body	0.114 - 0.260 (0.0045 - 0.0102)
Tip clearance between oil pump inner rotor and oil pump outer rotor	Below 0.180 (0.0071)
Side clearance between oil pump inner rotor and oil pump body	0.030 - 0.070 (0.0012 - 0.0028)
Side clearance between oil pump outer rotor and oil pump body	0.030 - 0.090 (0.0012 - 0.0035)
Oil pump inner rotor to oil pump body clearance	0.045 - 0.091 (0.0018 - 0.0036)

Regulator Valve

INFOID:0000000011321660

Unit: mm (in)

Regulator valve to oil pump body clearance	0.040 - 0.097 (0.0016 - 0.0038)
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