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SECTION LU

ENGINE LUBRICATION SYSTEM

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PRECAUTIONS

< PRECAUTION >

PRECAUTION

PRECAUTIONS

Liquid Gasket

INFOID:000000009012385

LIQUID GASKET APPLICATION PROCEDURE

1. 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.
2. 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.
3. 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 five minutes of liquid gasket application, install the mating component.
 - If liquid gasket protrudes, wipe it off immediately.
 - Do not 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.
- 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.

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.

PRECAUTIONS

< PRECAUTION >

- 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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Precautions for Removing of 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.

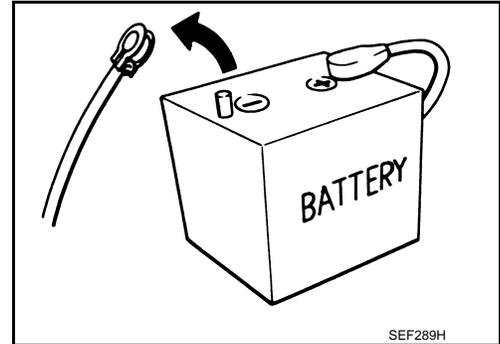
NOTE:

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.



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PREPARATION

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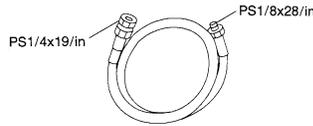
Special Service Tool

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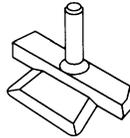
Tool number (Kent-Moore No.) Tool name	Description
ST25051001 (J-25695-1) Oil pressure gauge	Measuring oil pressure Maximum measuring range: 2,452 kPa (25 kg/cm², 356 psi)
ST25052000 (J-25695-2) Hose	Adapting oil pressure gauge to cylinder block
KV10111100 (J-37228) Seal cutter	Removing steel oil pan and rear timing chain case
KV10115801 (J-38956) Oil filter wrench	Removing and installing oil filter a: 64.3 mm (2.531 in)



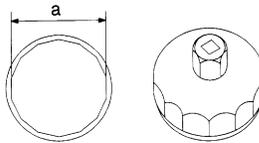
S-NT050



S-NT559



NT046



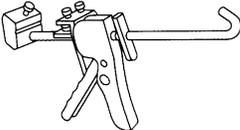
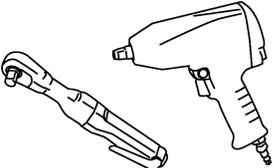
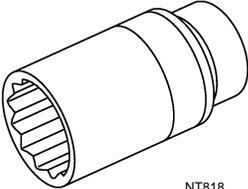
S-NT375

Commercial Service Tool

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PREPARATION

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Tool name	Description
<p>Tube presser</p>  <p>S-NT052</p>	<p>Pressing the tube of liquid gasket</p>
<p>Power tool</p>  <p>PBIC0190E</p>	<p>Loosening bolts and nuts</p>
<p>Deep socket</p>  <p>NT818</p>	<p>Removing and installing oil pressure switch Deep socket 26 mm</p>

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LUBRICATION SYSTEM

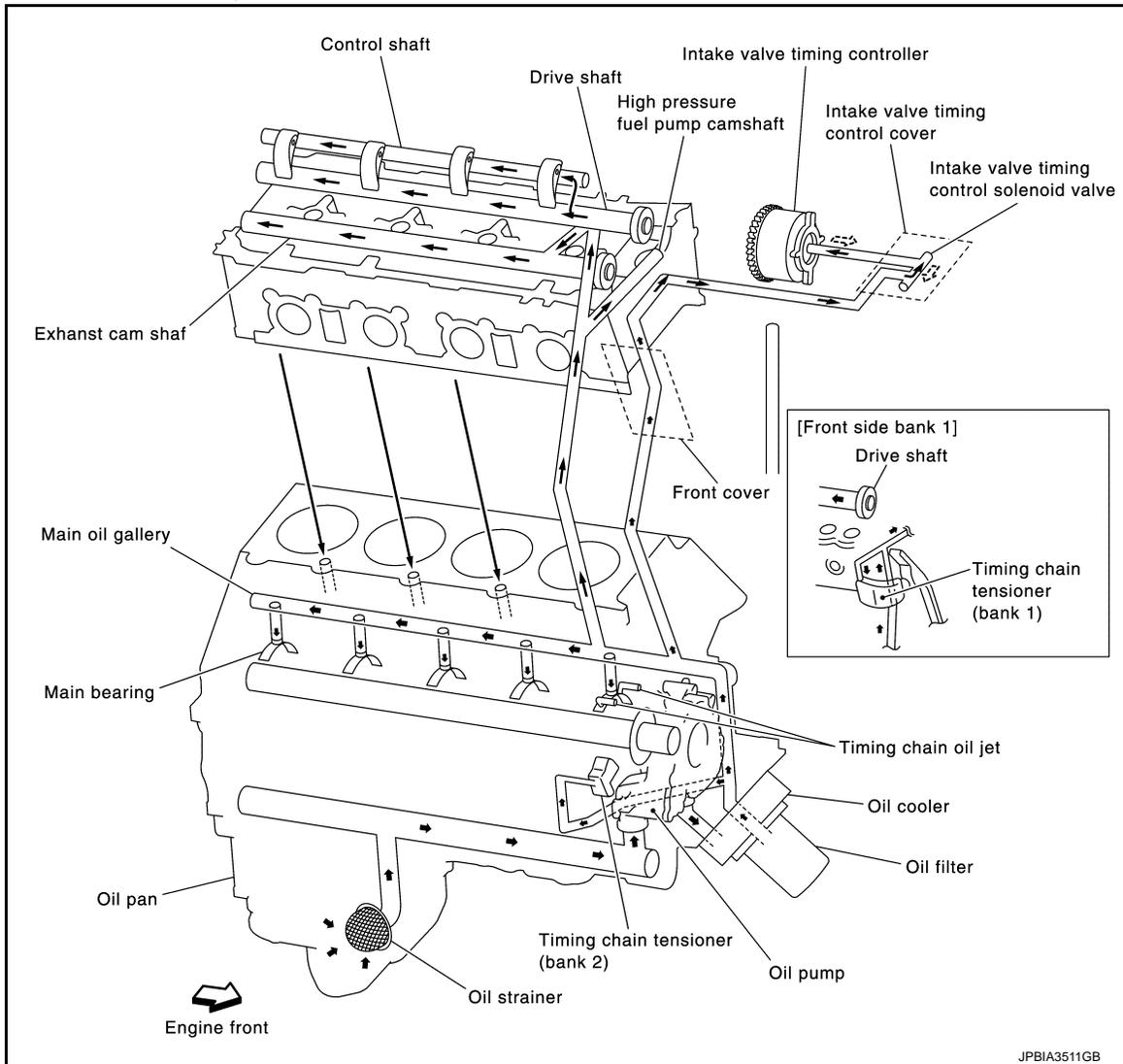
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SYSTEM DESCRIPTION

LUBRICATION SYSTEM

Engine Lubrication System

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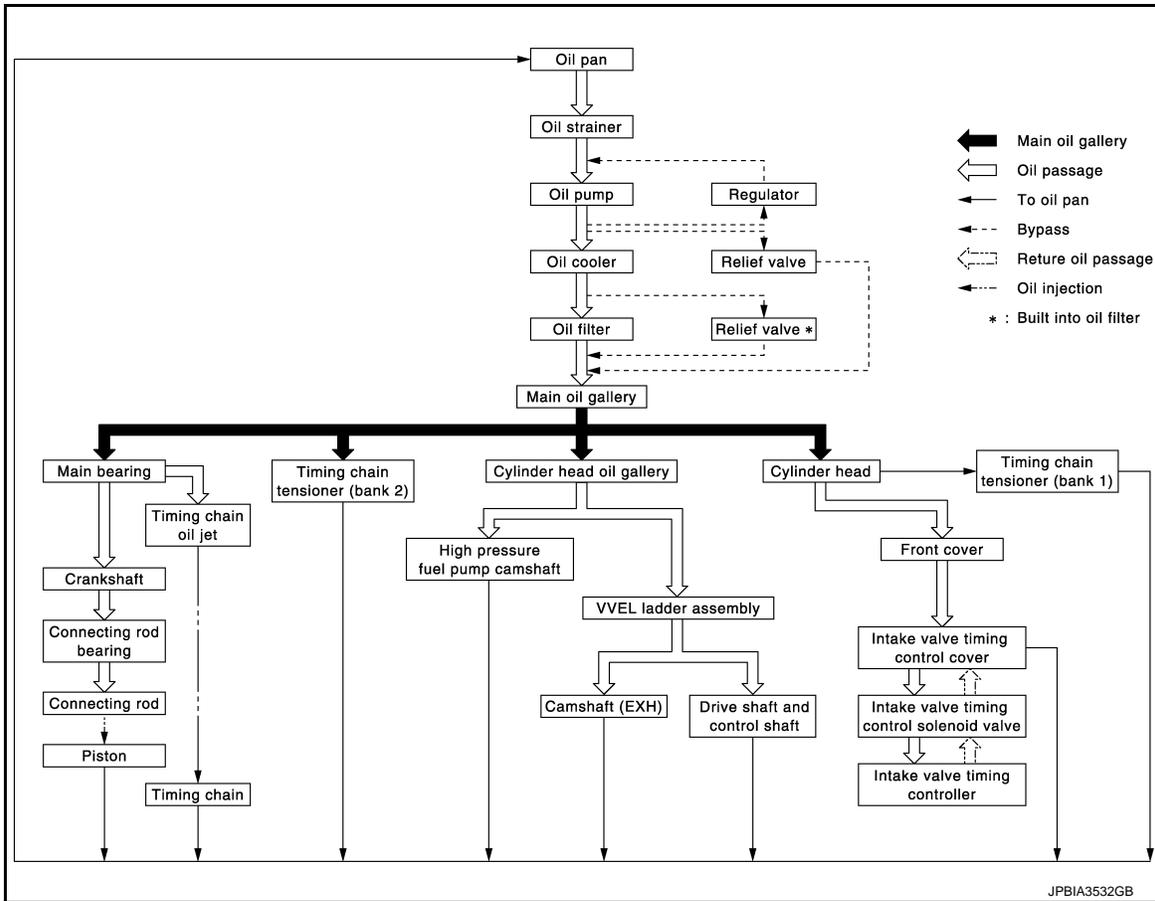


LUBRICATION SYSTEM

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Engine Lubrication System Schematic

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ENGINE OIL

< PERIODIC MAINTENANCE >

PERIODIC MAINTENANCE

ENGINE OIL

Inspection

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OIL LEVEL

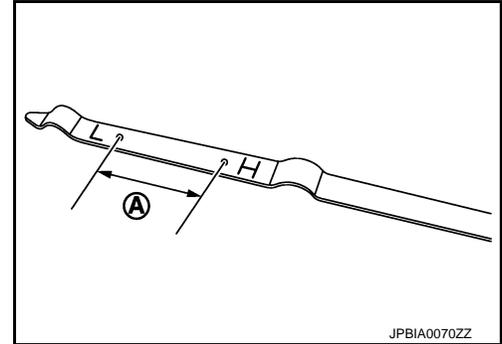
NOTE:

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 (A) shown in the figure.
3. If it is out of range, adjust it.

CAUTION:

Do not overfill the engine with oil.



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OIL APPEARANCE

- Check the engine oil for a white milky appearance or excessive contamination.
- If the engine oil is milky, it is highly probable that it is contaminated with engine coolant. Repair or replace damaged parts.

OIL LEAKAGE

Check for oil leakage around the following areas:

- Oil pan
- Oil pan drain plug
- Oil pressure switch
- Oil filter
- Oil cooler
- Intake valve timing control cover
- Intake valve timing control solenoid valve
- Front cover
- Mating surface between cylinder block and cylinder head
- Mating surface between cylinder head and rocker cover
- Crankshaft oil seal (front and rear)

OIL PRESSURE CHECK

WARNING:

- **Be careful not to burn yourself, as the engine and engine oil may be hot.**
- **Put the A/T shift selector in the Park "P" position.**

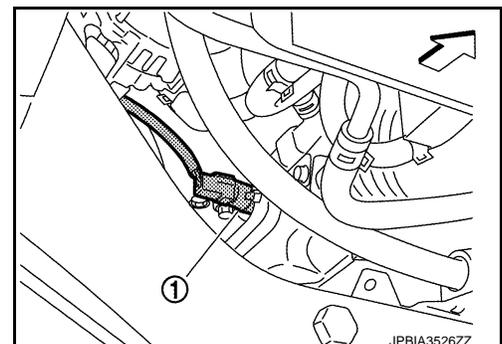
1. Check the engine oil level.
2. Remove front under cover.
3. Disconnect the oil pressure switch (1) harness connector.

⇐ :Vehicle front

4. Remove the oil pressure switch.

CAUTION:

Do not drop or shock oil pressure switch.

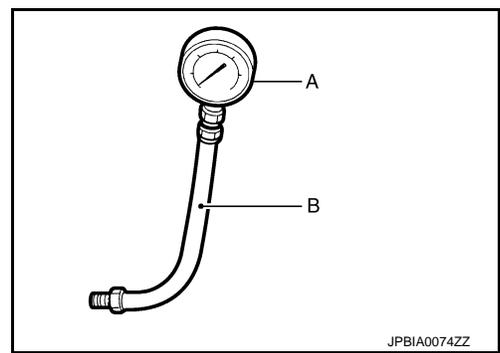


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ENGINE OIL

< PERIODIC MAINTENANCE >

5. Install the oil pressure gauge [SST: ST25051001 (J25695-1)] (A) and hose [SST: ST25052000 (J25695-2)] (B).



6. Start the engine and warm it up to normal operating temperature.
7. Check the engine oil pressure with engine running under no-load. Refer to [LU-19, "Engine Oil Pressure"](#).
CAUTION:
If the difference is extreme, check the oil passages and oil pump for leaks and blockages.
8. After the inspections, install oil pressure switch as follows:
 - a. Remove old liquid gasket adhering to oil pressure switch and engine.
 - 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"](#).

Oil pressure switch torque : Refer to [EM-59, "Exploded View"](#).

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

Draining

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WARNING:

- Be careful not to burn yourself, as the engine and 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 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 any oil leaks.
 2. Stop the engine and wait for at least 10 minutes.
 3. Remove drain plug and oil filler cap to drain the old oil.

Refilling

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1. Install drain plug with new washer.

CAUTION:

Be sure to clean drain plug and install with new washer.

Tightening torque : Refer to [EM-56, "Exploded View"](#).

2. Refill with new engine oil.
Engine oil specification and viscosity, refer to the following table:

For NORTH AMERICA	MA-15, "FOR NORTH AMERICA : Fluids and Lubricants"
For MEXICO	MA-16, "FOR MEXICO : Fluids and Lubricants"

Engine oil capacity : Refer to [LU-19, "Periodical Maintenance Specification"](#).

CAUTION:

- 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.

ENGINE OIL

< PERIODIC MAINTENANCE >

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

INFOID:000000009012394

REMOVAL

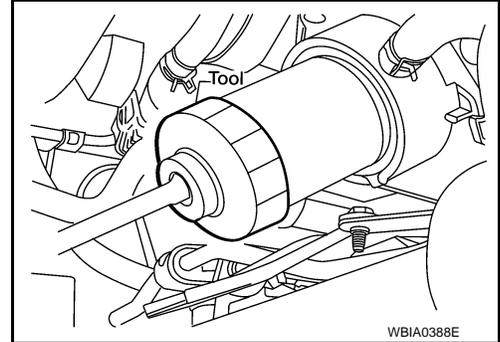
1. Remove front under cover.
2. Drain engine oil. Refer to [LU-9, "Draining"](#).
3. Remove oil filter using oil filter wrench [SST: KV10115801 (J-38956)].

WARNING:

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

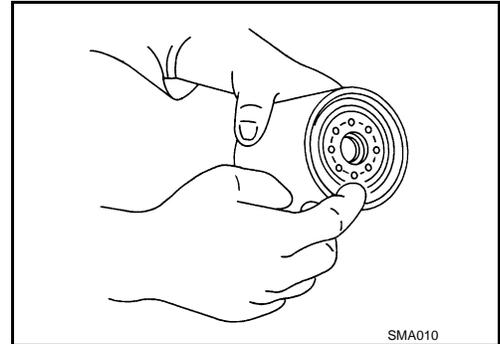
CAUTION:

- The oil filter is equipped with a pressure relief valve.
- Use Genuine NISSAN oil filter or equivalent.
- When removing, prepare a shop cloth to absorb any engine oil leaks or spills.
- Do not allow engine oil to adhere to the drive belts.
- Completely wipe off any engine oil that adheres to the engine and the vehicle.



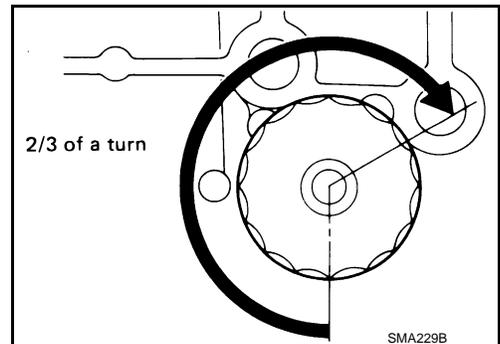
INSTALLATION

1. Remove foreign materials adhering to the oil filter seal mating surface.
2. Apply clean engine oil to the oil filter seal circumference of the new oil filter as shown.



3. Screw on the oil filter manually until it touches the installation surface, then tighten it by 2/3 turn as shown. Or tighten to specification.

Oil filter : 17.7 N·m (1.8 kg·m, 13 ft·lb)



4. Refill engine with new engine oil. Refer to [LU-9, "Refilling"](#).
5. Inspect engine for oil leaks. Refer to [LU-8, "Inspection"](#).
6. Install front under cover.

Inspection

INFOID:000000009012395

INSPECTION AFTER INSTALLATION

1. Check engine oil level. Refer to [LU-8, "Inspection"](#).
2. Start engine and check for engine oil leaks.
3. Stop engine and wait for 10 minutes.

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OIL FILTER

< PERIODIC MAINTENANCE >

4. Check engine oil level and add engine oil as required.

OIL COOLER

< REMOVAL AND INSTALLATION >

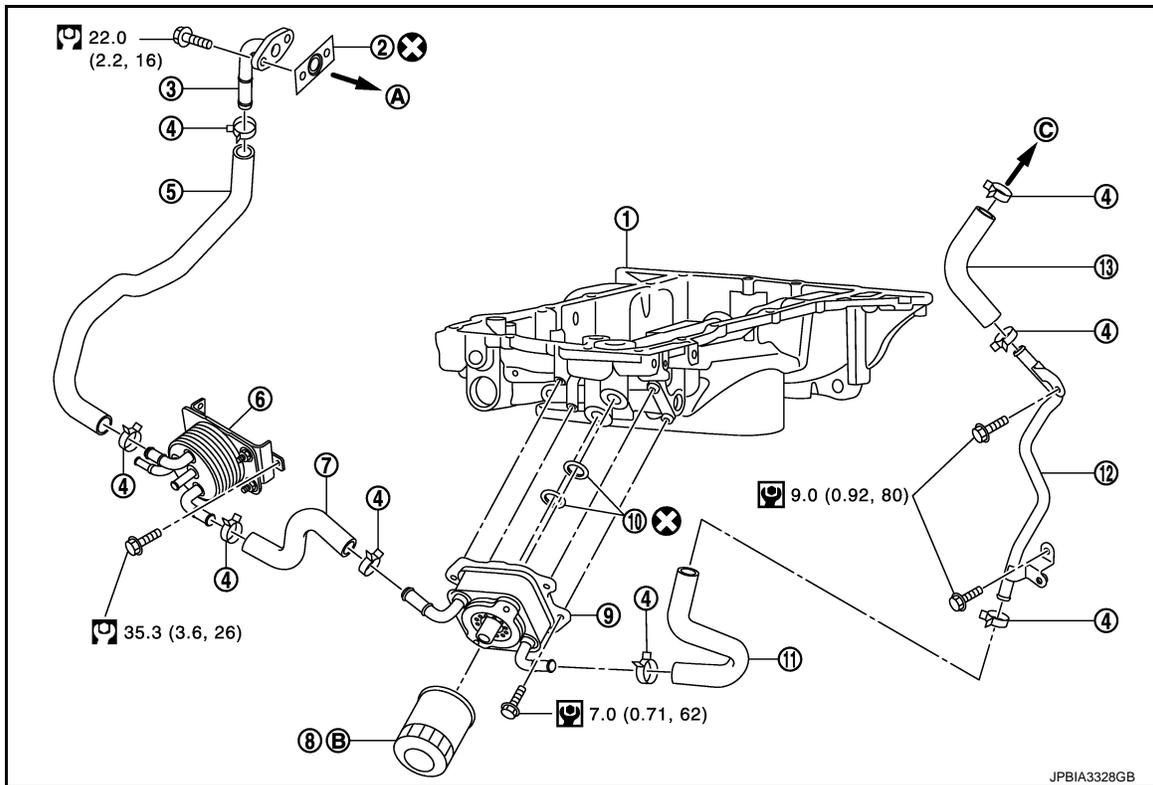
REMOVAL AND INSTALLATION

OIL COOLER

Exploded View

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|----------------------|---|--------------------------|
| 1. Oil pan (upper) | 2. Gasket | 3. Connector pipe |
| 4. Clamp | 5. Water hose | 6. A/T fluid warmer |
| 7. Water hose | 8. Oil filter | 9. Oil cooler |
| 10. O-ring | 11. Water hose | 12. Water pipe |
| 13. Water hose | | |
| A. To cylinder block | B. Comply with the assembly procedure when tightening. Refer to LU-11 | C. To thermostat housing |

Refer to [GI-4, "Components"](#) for symbols in the figure.

Removal and Installation

INFOID:000000009012397

WARNING:

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

CAUTION:

- Do not spill engine coolant on the drive belt.
- Do not spill engine oil on rubber parts such as drive belts and engine mounting insulator.

REMOVAL

NOTE:

When removing oil cooler only, step 1 is unnecessary.

1. Drain engine coolant from radiator and cylinder block. Refer to [CO-8, "Draining"](#) and [EM-116, "Disassembly and Assembly"](#).

NOTE:

Perform this step only when removing water pipes and hoses.

2. Remove front under cover.

OIL COOLER

< REMOVAL AND INSTALLATION >

3. Disconnect water hoses from oil cooler, pinching hoses near oil cooler to prevent engine coolant from spilling.
CAUTION:
Perform this step when engine is cold.
4. Remove oil filter. Refer to [LU-11, "Removal and Installation"](#).
5. Remove connector bolt, and remove oil cooler.

INSTALLATION

Installation is in the reverse order of removal, paying attention to the following:

CAUTION:

Do not reuse O-rings.

- Confirm that no foreign objects are adhering to the sealing surfaces of the oil cooler and oil pan.

Inspection

INFOID:000000009012398

INSPECTION AFTER REMOVAL

Oil Cooler

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

Relief Valve

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

INSPECTION AFTER INSTALLATION

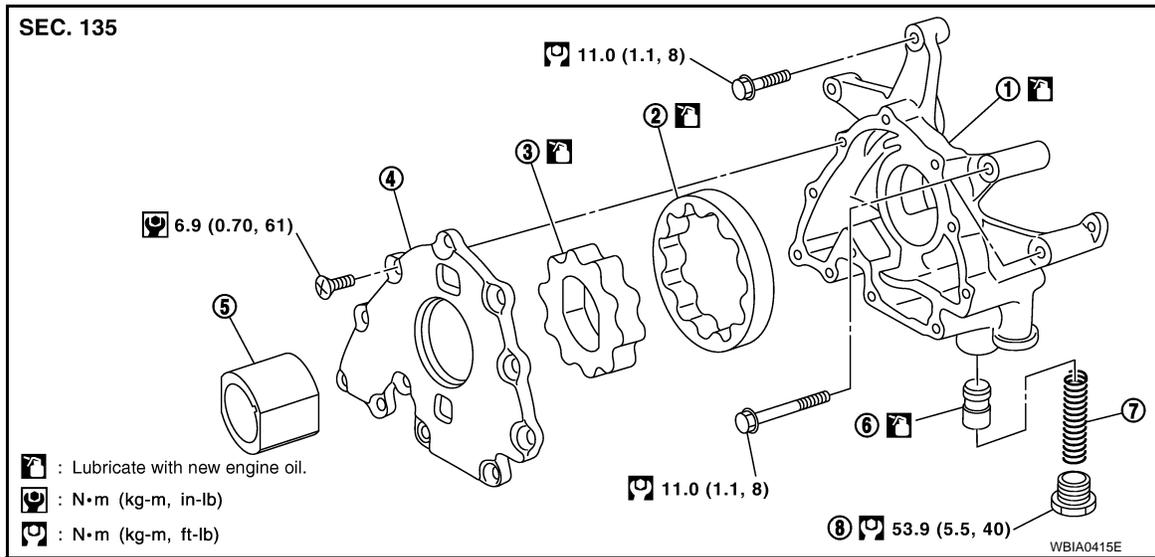
1. Check engine oil and engine coolant levels and add engine oil and engine coolant. Refer to [LU-8, "Inspection"](#) and [CO-8, "Inspection"](#).
2. Start the engine, and check for leaks of engine oil or engine coolant.
3. Stop the engine and wait for 10 minutes.
4. Check the engine oil level and engine coolant level again. Refer to [LU-8, "Inspection"](#) and [CO-8, "Inspection"](#).

OIL PUMP

< REMOVAL AND INSTALLATION >

OIL PUMP

Exploded View



- | | | |
|---------------------|--------------------------|--------------------|
| 1. Oil pump body | 2. Outer rotor | 3. Inner rotor |
| 4. Oil pump cover | 5. Oil pump drive spacer | 6. Regulator valve |
| 7. Regulator spring | 8. Regulator plug | |

Removal and Installation

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REMOVAL

NOTE:

Do not remove the engine assembly to perform this procedure.

1. Disconnect battery cable from negative terminal. Refer to [PG-123, "Exploded View"](#).
2. Drain engine oil. Refer to [LU-9, "Draining"](#).
3. Drain engine coolant from radiator. Refer to [CO-8, "Draining"](#).

CAUTION:

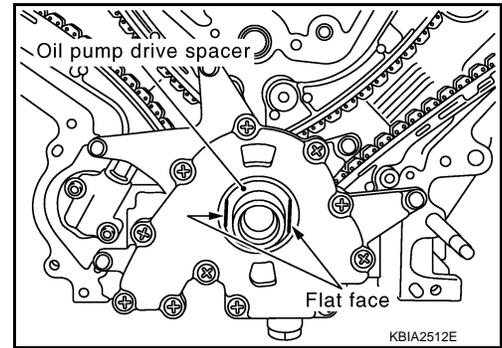
- Perform this step when engine is cold.
- Never spill engine coolant on drive belts.

4. Remove the following components and related parts:
 - Air cleaner case assembly and air duct. Refer to [EM-28, "Exploded View"](#).
 - Drive belt auto tensioner and idler pulley. Refer to [EM-27, "Exploded View"](#).
 - Fan shroud. Refer to [CO-14, "Exploded View"](#).
 - Cooling fan, fan coupling and fan bracket. Refer to [CO-18, "Exploded View"](#).
 - Front under cover. Refer to [EXT-26, "Exploded View"](#).
 - Protector A and B. Refer to [SCS-32, "FRONT TUBE ASSEMBLY : Exploded View"](#).
 - Front suspension rear cross member. Refer to [TM-215, "2WD : Exploded View"](#) (2WD models) or [TM-218, "4WD : Exploded View"](#) (AWD models).
 - Steering gear assembly. Refer to [ST-41, "Exploded View"](#).
 - Front final drive assembly. Refer to [DLN-174, "Exploded View"](#).
 - Power steering oil pump. Refer to [ST-48, "Exploded View"](#).
 - Alternator, alternator bracket and alternator stay. Refer to [CHG-28, "Exploded View"](#).
 - Oil pan (lower) and oil strainer. Refer to [EM-56, "Exploded View"](#).
 - Oil pan (upper). Refer to [EM-59, "Exploded View"](#).
 - Electric throttle control actuator. Refer to [EM-31, "Exploded View"](#).
 - Radiator hoses. Refer to [CO-14, "Exploded View"](#).
 - Water suction hose and water suction pipe. Refer to [CO-22, "Exploded View"](#).
 - Water pump pulley. Refer to [CO-20, "Exploded View"](#).
 - Rocker cover. Refer to [EM-34, "Exploded View"](#).

OIL PUMP

< REMOVAL AND INSTALLATION >

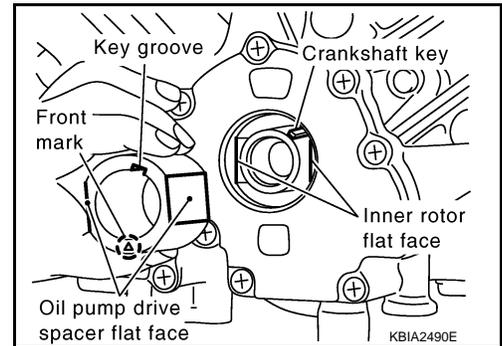
- Remove the oil pump drive spacer.
 - Hold and remove the flat space of the oil pump drive spacer by pulling it forward.



- Remove the oil pump. Refer to [LU-15. "Exploded View"](#).

INSTALLATION

- Install the oil pump.
- Install the oil pump drive spacer as follows:
 - When inserting the oil pump drive spacer, align the crankshaft key and the flat face of the inner rotor.
 - If they are not aligned, rotate the oil pump inner rotor by hand.
 - Make sure that each part is aligned and tap lightly until it reaches the end.



- Installation of the remaining components is in the reverse order of removal.

Disassembly and Assembly

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DISASSEMBLY

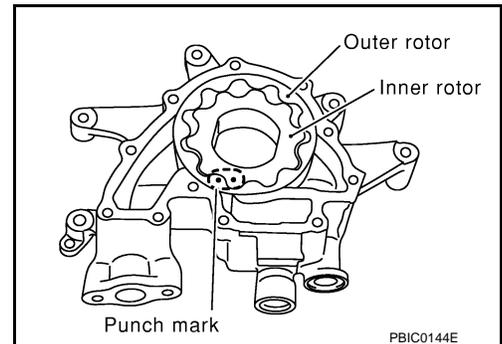
- Remove oil pump cover.
- Remove inner rotor and outer rotor from oil pump body.
- Remove the regulator valve plug, regulator valve spring and regulator valve.

ASSEMBLY

Installation is in the reverse order of removal.

NOTE:

Install the oil pump inner rotor and outer rotor with the punched marks on the oil pump cover side.



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Inspection

INSPECTION AFTER DISASSEMBLY

Clearance of Oil Pump Parts

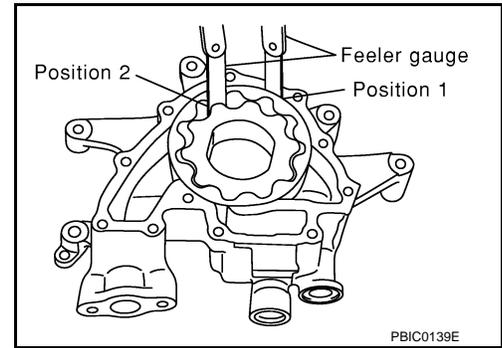
OIL PUMP

< REMOVAL AND INSTALLATION >

- Measure radial clearance using a suitable tool.

Body to outer rotor (position 1) : Refer to [LU-19, "Oil Pump"](#).

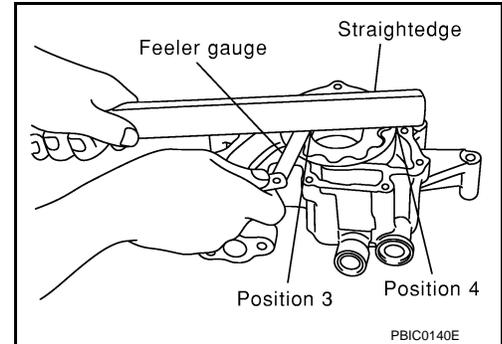
Inner rotor to outer rotor tip (position 2) : Refer to [LU-19, "Oil Pump"](#).



- Measure side clearance using suitable tools.

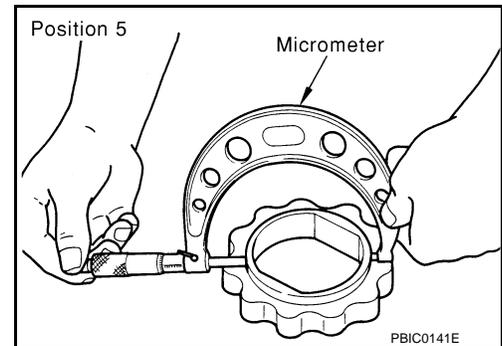
Body to inner rotor (position 3) : Refer to [LU-19, "Oil Pump"](#).

Body to outer rotor (position 4) : Refer to [LU-19, "Oil Pump"](#).

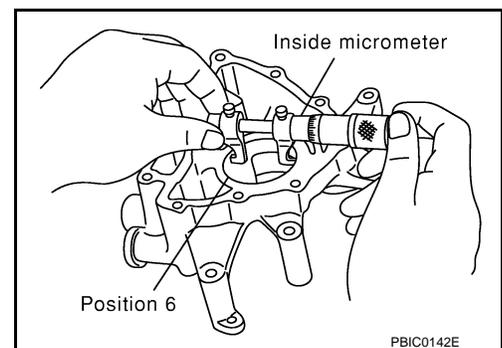


- Calculate the clearance between inner rotor and oil pump body as follows.

1. Measure the outer diameter of protruded portion of inner rotor (position 5) using suitable tool.



2. Measure the inner diameter of oil pump body to brazed portion (position 6) using suitable tool.



3. Calculate the clearance using the following formula.

- (Clearance) = (Inner diameter of oil pump body) - (Outer diameter of inner rotor)

Inner rotor to brazed portion of housing clearance : Refer to [LU-19, "Oil Pump"](#).

Regulator Valve Clearance

Check regulator valve to oil pump cover clearance using the following formula.

OIL PUMP

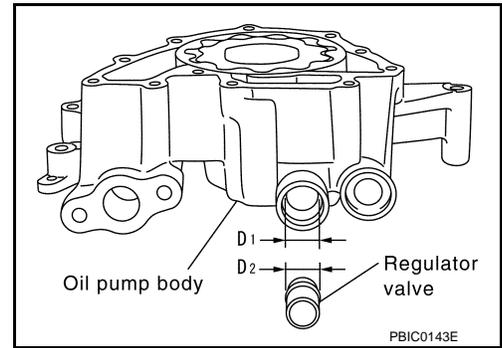
< REMOVAL AND INSTALLATION >

- (Clearance) = D1 (Valve hole diameter) - D2 (Outer Diameter of valve)

Regulator valve : Refer to [LU-19, "Regulator Valve"](#).
to oil pump cover

CAUTION:

- Coat regulator valve with engine oil.
- Check that it falls smoothly into the regulator 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 for engine oil leaks.
3. Stop the engine and wait 10 minutes.
4. Check the engine oil level and adjust the engine oil level as required. Refer to [LU-8, "Inspection"](#).

SERVICE DATA AND SPECIFICATIONS (SDS)

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Periodical Maintenance Specification

INFOID:000000009012403

ENGINE OIL CAPACITY (APPROXIMATE)

Unit: ℓ (US qt, Imp qt)

Drain and refill	With oil filter change	6.5 (6-7/8, 5-3/4)
	Without oil filter change	6.2 (6-4/8, 5-1/2)
Dry engine (engine overhaul)		7.6 (8, 6-3/4)

Engine Oil Pressure

INFOID:000000009012404

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:000000009012405

Unit: mm (in)

Oil pump body to oil pump outer rotor radial clearance	0.114 - 0.200 (0.0045 - 0.0079)
Oil pump inner rotor to oil pump outer rotor tip clearance	Below 0.180 (0.0071)
Oil pump body to oil pump inner rotor axial clearance	0.030 - 0.070 (0.0012 - 0.0028)
Oil pump body to oil pump outer rotor axial clearance	0.030 - 0.090 (0.0012 - 0.0035)
Oil pump inner rotor to brazed portion of housing clearance	0.045 - 0.091 (0.0018 - 0.0036)

Regulator Valve

INFOID:000000009012406

Unit: mm (in)

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