SECTION LU
ENGINE LUBRICATION SYSTEM

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1.6L/2.0L TURBO ENGINE

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PRECAUTION

PRECAUTIONS

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

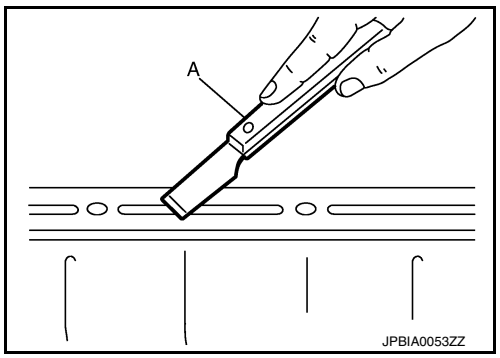
- Use torque wrench to tighten bolts or nuts to specification.
- When tightening nuts and bolts, as a basic rule, equally tighten in several different steps starting with the ones in center, then ones on inside and outside diagonally in this order. If the order of tightening is specified, do exactly 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.
- 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.

Liquid Gasket

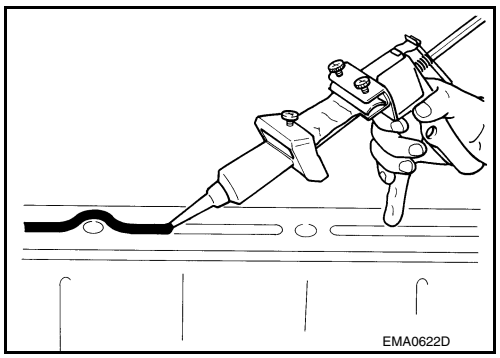
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LIQUID GASKET APPLICATION PROCEDURE

1. Using a scraper (A), remove old liquid gasket adhering to the liquid gasket application surface and the mating surface.
   - Remove liquid gasket completely from the groove of 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.



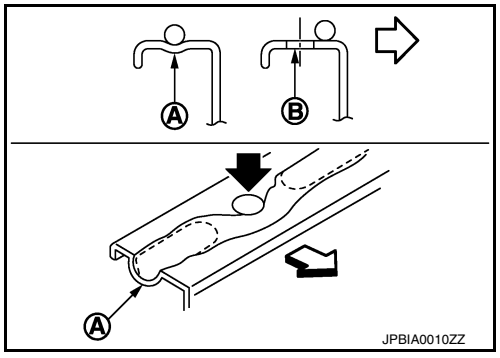
3. Attach liquid gasket tube to the tube presser (commercial service tool).
   Use Genuine Liquid Gasket or equivalent.
4. Apply liquid gasket without gaps to the specified location according to the specified dimensions.
   - If there is a groove for liquid gasket application, apply liquid gasket to the groove.



- As for bolt holes Ⓑ, normally apply liquid gasket inside the holes. Occasionally, it should be applied outside the holes. Check to read the text of this manual.

  Ⓐ : Groove

  ⇦ : Inside



- 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.

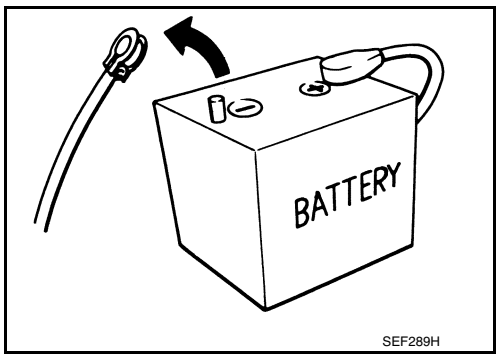
CAUTION:
If there are specific instructions in this manual, observe them.

Precautions for Removing Battery Terminal

INFOID:0000000013536973

When disconnecting the battery terminal, pay attention to the following.
- Always use a 12V battery as power source.
- Never disconnect battery terminal while engine is running.
- When removing the 12V battery terminal, turn OFF the ignition switch and wait at least 30 seconds.
- For vehicles with the engine listed below, remove the battery terminal after a lapse of the specified time:

BR08DE	: 4 minutes	YD25DDTi	: 2 minutes
D4D engine	: 20 minutes	YS23DDT	: 4 minutes
HRA2DDT	: 12 minutes	YS23DDTT	: 4 minutes
K9K engine	: 4 minutes	ZD30DDTi	: 60 seconds
M9R engine	: 4 minutes	ZD30DDTT	: 60 seconds
R9M engine	: 4 minutes		
V9X engine	: 4 minutes		



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.

- After high-load driving, if the vehicle is equipped with the V9X engine, turn the ignition switch OFF and wait for at least 15 minutes to remove the battery terminal.

  NOTE:

  - Turbocharger cooling pump may operate in a few minutes after the ignition switch is turned OFF.
  - Example of high-load driving
  - Driving for 30 minutes or more at 140 km/h (86 MPH) or more.
  - Driving for 30 minutes or more on a steep slope.
- 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:

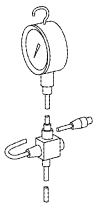
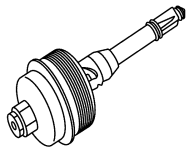
  The removal of 12V battery may cause a DTC detection error.

PREPARATION

PREPARATION

Special Service Tools

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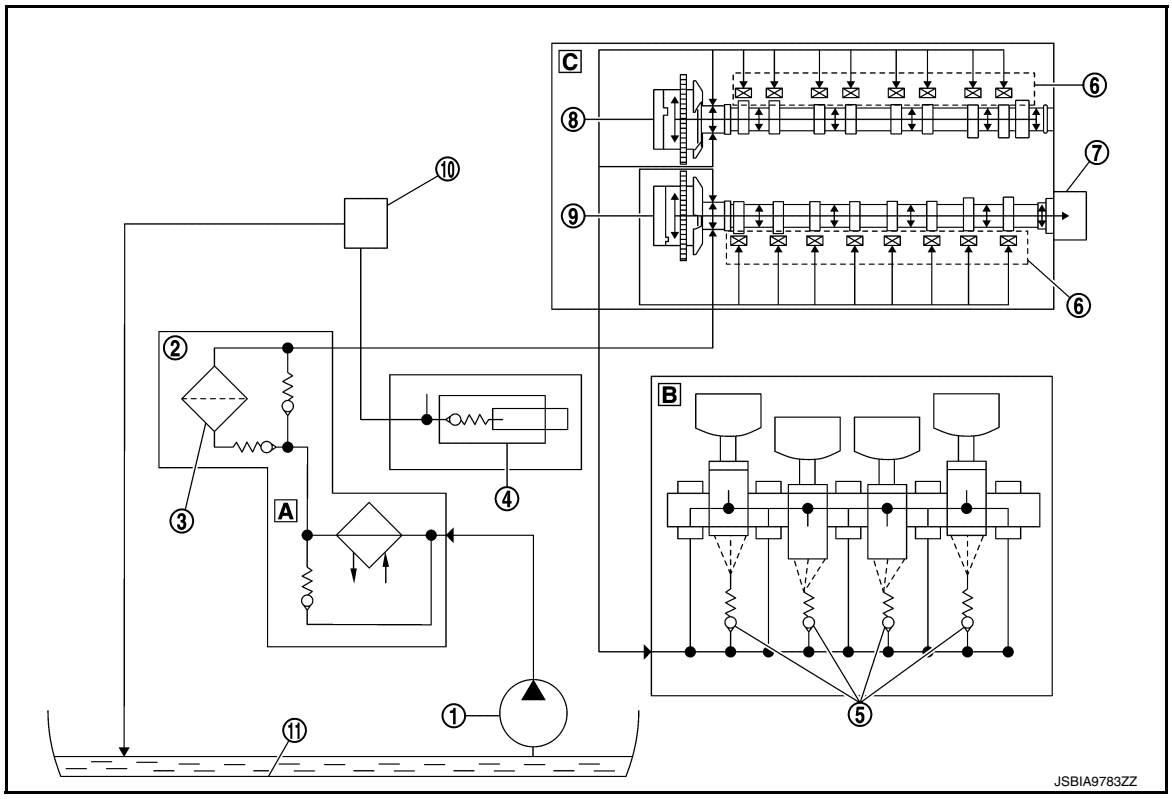
Tool number (DAIMLER tool No.) Tool name		Description
KV115H0070 (DAIMLER tool No.103 589 00 21 00) Gauge oil press	 JSBIA3891ZZ	0-10 bar test equipment for gasoline and oil pressure measurements.
KV105H0050 (DAIMLER tool No.270 589 00 63 00) Oil pressure tester cap	 JSBIA5233ZZ	Tester cap for checking oil pressure.

SYSTEM DESCRIPTION

DESCRIPTION

Engine Lubrication System Schematic

INFOID:0000000013536975



① Oil pump	② Oil filter housing	③ Oil filter
④ Chain tensioner	⑤ Oil spray nozzles	⑥ Hydraulic valve clearance compensation
⑦ Vacuum pump	⑧ Intake camshaft adjuster	⑨ Exhaust camshaft adjuster
⑩ Turbocharger	⑪ Oil pan	
A Engine oil / coolant heat exchanger	B Cylinder block	C Cylinder head

PERIODIC MAINTENANCE

ENGINE OIL

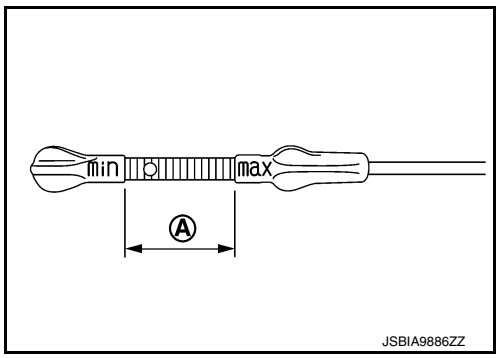
Inspection

INFOID:0000000013536976

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:

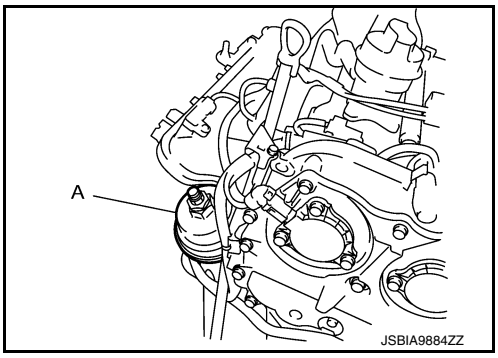
- Oil pan
- Oil drain screw
- Oil filter
- Oil filter housing
- Front cover
- Mating surface between timing chain case and cylinder head
- Mating surface between timing chain case and cylinder block
- Mating surface between timing chain case and oil pan
- Mating surface between cylinder block and cylinder head
- Mating surface between cylinder head and cylinder head cover
- Crankshaft oil seals (front and rear)
- Vacuum pump
- Exhaust manifold and turbocharger assembly
- Oil tube connecting parts from exhaust manifold and turbocharger assembly
- High pressure fuel pump

OIL PRESSURE CHECK

WARNING:
- **Never get burn yourself, as engine oil may be hot.**
- **Oil pressure check should be done in “Parking position”.**

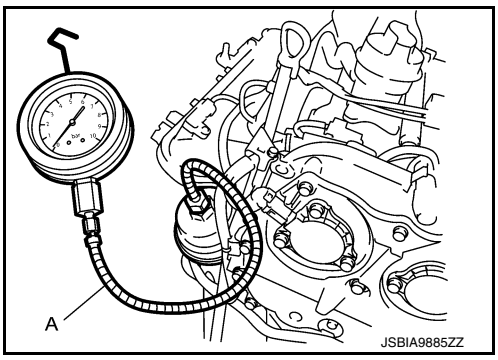
1. Engine oil temperature until 100°C (212 °F) by using the CONSULT, to warm up the engine.
2. Stop the engine and wait for 10 minutes.
3. Check the engine oil level.
4. Remove engine cover. Refer to EM-20, "Removal and Installation".
5. Place a tray or an equivalent around the oil filter housing in case engine oil spills.
6. Remove oil filter screw cap.
   CAUTION:
   Never spill engine oil on drive belt.

7. Remove oil filter from oil filter screw cap.
8. Install the oil pressure tester cap [SST: KV106H0050 (270 589 00 63 00)] (A).



9. Install the gauge oil press [SST: KV115H0070 (103 589 00 21 00)] (A).
10. Check the engine oil pressure with engine running under no-load.
CAUTION:
When the engine oil temperature reached 90 °C (194 °F), check the oil pressure.

Engine oil pressure : Refer to LU-17, "Engine Oil Pressure".



11. Install in the reverse order of removal.

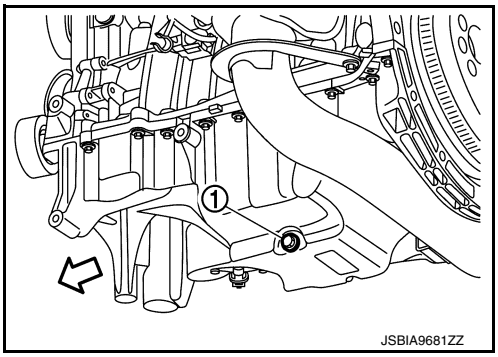
Draining

INFOID:0000000013536977

WARNING:
- **Never 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-7, "Inspection".
2. Remove oil filter. Refer to LU-10, "Removal and Installation".
3. Loosen oil filler cap.
4. Remove oil drain screw ① and then drain engine oil and wait for 5 minutes.

⇦ : Engine front



Refilling

INFOID:0000000013536978

1. Install oil drain screw with new oil drain screw washer. Refer to EM-76, "Exploded View".
CAUTION:
Be sure to clean oil drain screw and install with new oil drain screw washer.
2. Install engine oil filter. Refer to LU-10, "Removal and Installation".
3. Refill with new engine oil.
Engine oil specification and viscosity: Refer to MA-12, "FOR NORTH AMERICA : Fluids and Lubricants" (For NORTH AMERICA) or MA-13, "FOR MEXICO : Fluids and Lubricants" (For MEXICO).

Engine oil capacity : Refer to LU-17, "Periodical Maintenance Specification".

CAUTION:
- **When filling engine oil, do not 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.**

4. Warm up the engine and check area around drain plug and oil filter for engine oil leakage.
5. Stop the engine and wait for 10 minutes.
6. Check the engine oil level. Refer to LU-7, "Inspection".
7. Perform "MAINTENANCE". Refer to MWI-68, "On Board Diagnosis Function".
   NOTE:
   Reset a service interval after refill with engine oil.

OIL FILTER

Removal and Installation

INFOID:0000000013536979

REMOVAL

CAUTION:

- **Never get burned when engine and engine oil may be hot.**
- **Completely wipe off any engine oil that adheres to engine and vehicle.**

1. Remove engine cover. Refer to EM-20, "Removal and Installation".
2. Remove engine oil level gauge. Refer to LU-7, "Inspection".
3. Place a tray or an equivalent around the oil filter housing in case engine oil spills.
4. Remove oil filter screw cap.
   CAUTION:
   Never spill engine oil on drive belt.
5. Remove oil filter from oil filter screw cap.

INSTALLATION

1. Remove foreign materials adhering to oil filter installation surface.
2. Apply engine oil to the oil ring contact surface of new oil filter.
   CAUTION:
   Do not reuse O-rings.
3. Screw oil filter screw cap manually until it touches the installation surface, then tighten to the specification. Refer to LU-11, "Exploded View".

Inspection

INFOID:0000000013536980

INSPECTION AFTER INSTALLATION

1. Check the engine oil level. Refer to LU-7, "Inspection".
2. Start the engine, and check there is no leak 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-7, "Inspection".

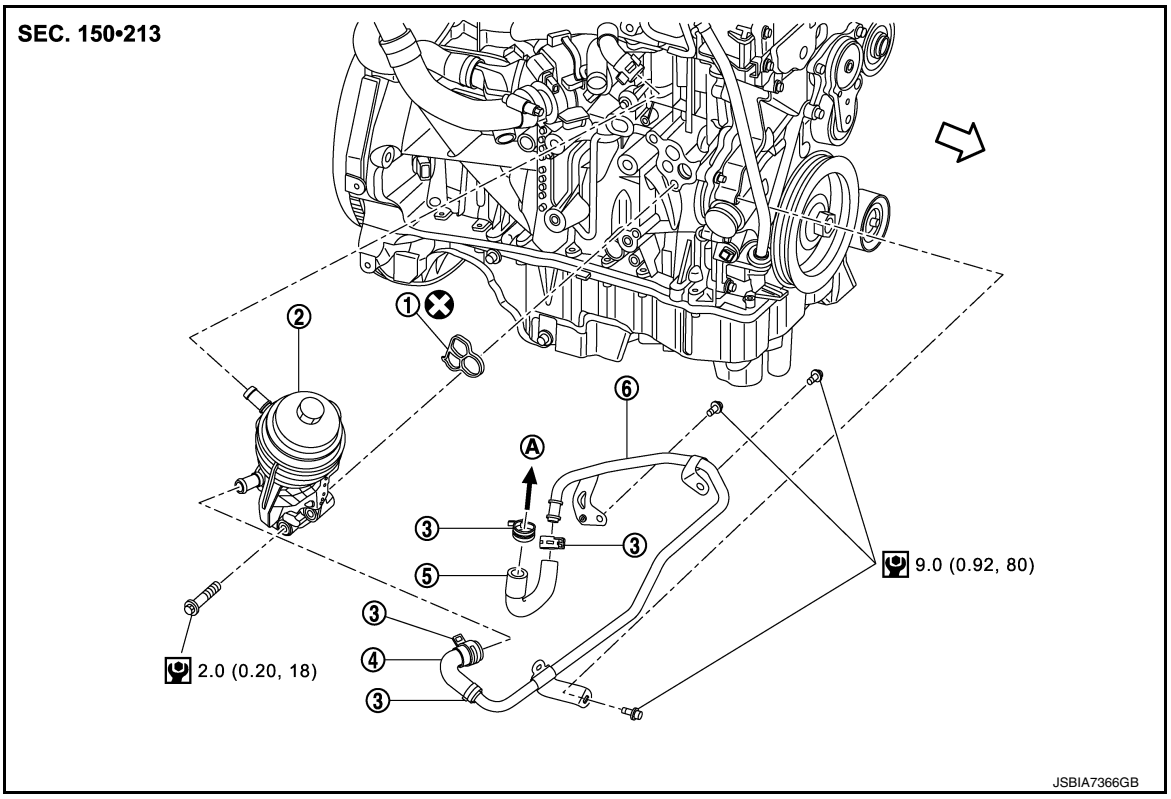
REMOVAL AND INSTALLATION

OIL FILTER HOUSING

Exploded View

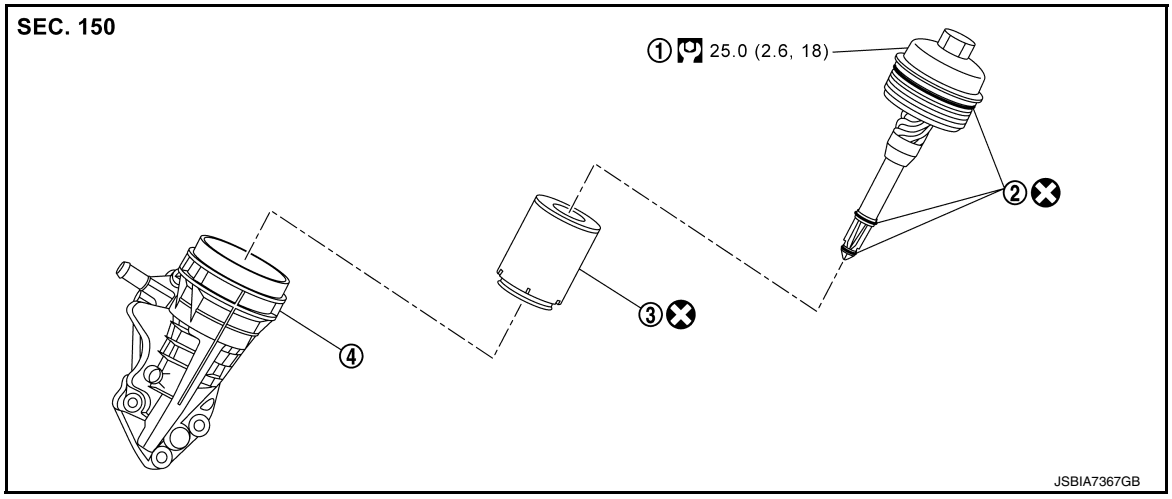
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REMOVAL



① Gasket
② Oil filter housing assembly
③ Clamp
④ Water hose
⑤ Water hose
⑥ Water pipe
Ⓐ To Water pump
⇦ : Engine front
: N·m (kg-m, in-lb)
: Always replace after every disassembly.

DISASSEMBLE



① Oil filter screw cap ② O-ring ③ Oil filter
④ Oil filter housing
: N·m (kg-m, ft-lb)
: Always replace after every disassembly.

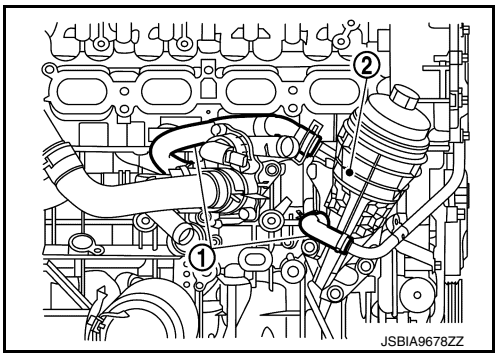
Removal and Installation

INFOID:0000000013536982

REMOVAL

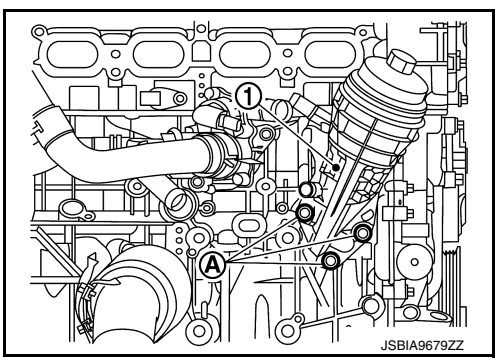
Oil Filter Housing

1. Drain engine coolant from radiator. Refer to CO-7, "Draining".
   CAUTION:
   - **Perform this step when the engine is cold.**
   - **Never spill engine coolant on drive belt.**
2. Remove charge air manifold. Refer to EM-29, "Removal and Installation".
3. Disconnect water hoses ① from oil filter housing ②.



4. Remove oil filter housing ①.

Ⓐ : Bolts



Water Pipe

1. Drain engine coolant from radiator. Refer to CO-7, "Draining".
   CAUTION:
   - **Perform this step when the engine is cold.**
   - **Never spill engine coolant on drive belt.**
2. Remove engine mount. Refer to EM-95, "Exploded View".
3. Remove water pipe.

INSTALLATION

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

CAUTION:

Do not reuse O-rings.

Inspection

INFOID:0000000013536983

INSPECTION AFTER REMOVAL

Oil Filter Housing

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

INSPECTION AFTER INSTALLATION

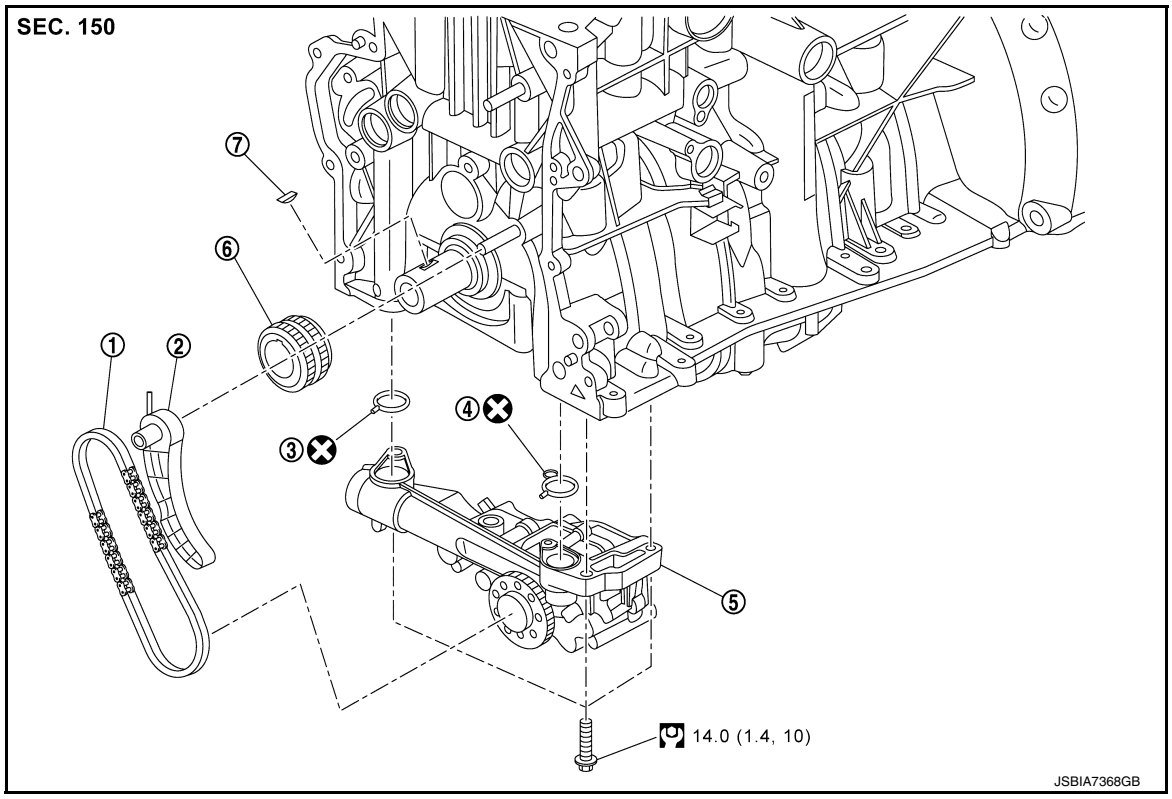
1. Check the engine oil level and the engine coolant level and add engine oil and engine coolant. Refer to LU-7, "Inspection" and CO-7, "Inspection".
2. Start the engine, and check there is no leakage of engine oil or engine coolant.
3. Stop the engine and wait for 10 minutes.
4. Check the engine oil level and the engine coolant level again. Refer to LU-7, "Inspection" and CO-7, "Inspection".

OIL PUMP

Exploded View

INFOID:0000000013536984

REMOVAL

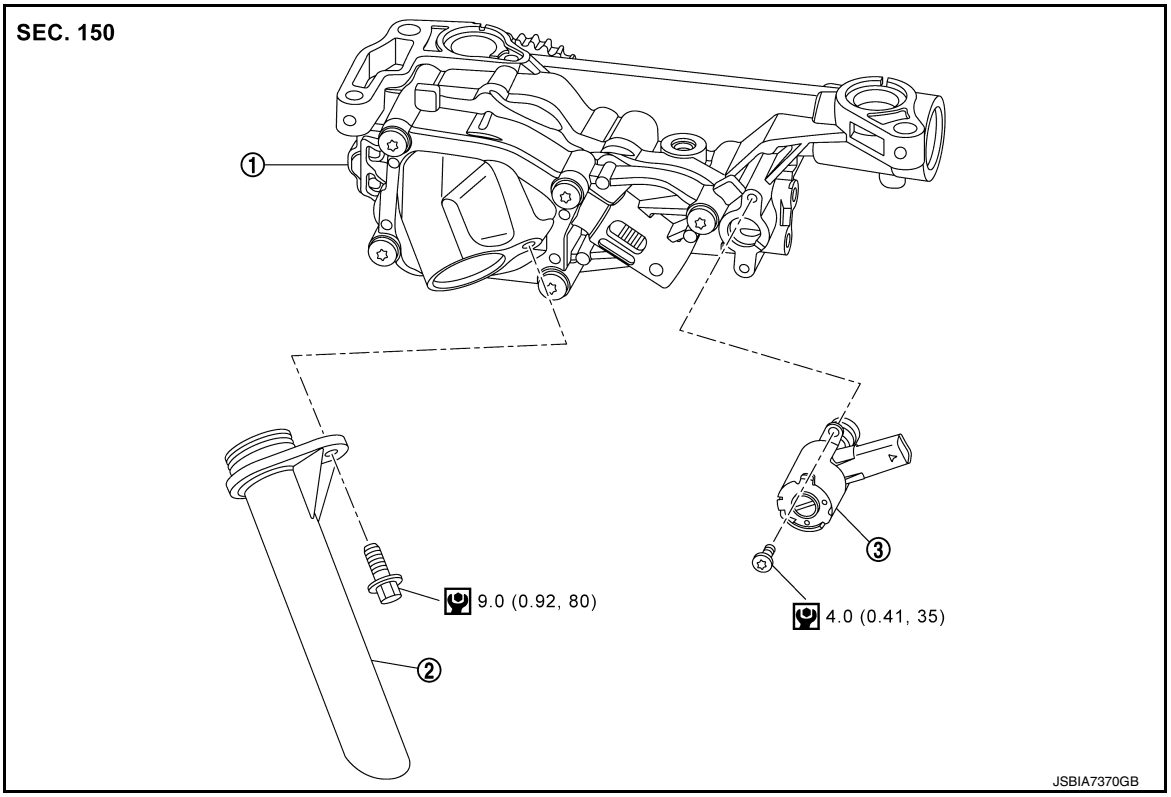


① Timing chain (oil pump) ② Timing chain guide ③ O-ring
④ O-ring ⑤ Engine oil pump ⑥ Crankshaft sprocket
⑦ Key

: Always replace after every disassembly.

: N·m (kg-m, ft-lb)

DISASSEMBLE



① Engine oil pump ② Oil suction pipe ③ Engine oil pump valve

: N·m (kg-m, in-lb)

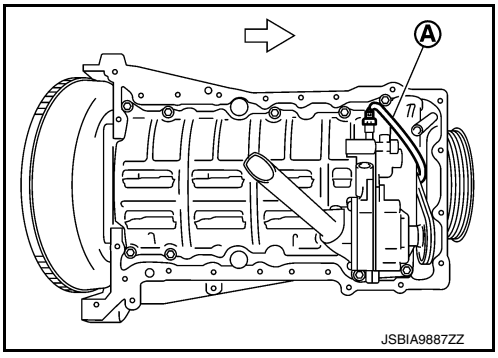
Removal and Installation

INFOID:0000000013536985

REMOVAL

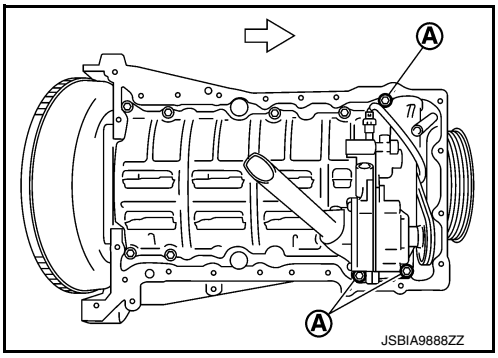
Engine Oil Pump

1. Remove oil pan. Refer to EM-76, "Removal and Installation".
2. Disconnect engine oil pump harness connector Ⓐ.



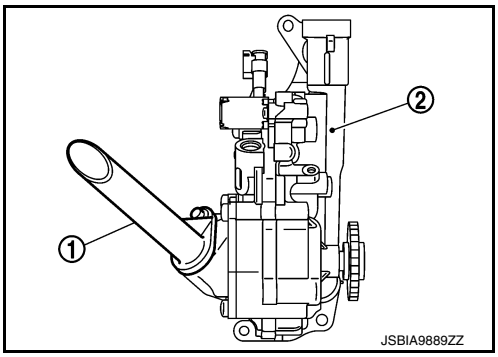
: Engine front

3. Remove oil pump mounting bolts Ⓐ.



: Engine front

4. Remove oil suction pipe ① from oil pump ②.
5. Remove engine oil pump valve, if necessary.



Timing Chain (Oil Pump)

1. Remove timing chain. Refer to EM-89, "Removal and Installation"
2. Remove engine oil pump.
3. Remove timing chain (oil pump) and timing chain guide.

INSTALLATION

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

NOTE:

- If sensors is replaced, carry out the reset of adoption of sensors. Refer to EC-182, "Special Repair Requirement List".

Inspection

INFOID:0000000013536986

INSPECTION AFTER INSTALLATION

1. Check the engine oil level. Refer to LU-7, "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-7, "Inspection".

SERVICE DATA AND SPECIFICATIONS (SDS)

SERVICE DATA AND SPECIFICATIONS (SDS)

Periodical Maintenance Specification

INFOID:0000000013536987

ENGINE OIL CAPACITY (APPROXIMATE)

Unit: ℓ (US qt, Imp qt)

Drain and refill	With oil filter change	1.6 L TURBO ENGINE	5.8 (6-1/8, 5-1/8)
		2.0 L TURBO ENGINE	5.6 (5-7/8, 4-7/8)

Engine Oil Pressure

INFOID:0000000013536988

Unit: kPa (kg/cm^2, psi)

Engine speed	Approximate discharge pressure*
650 rpm	More than 50 (0.51, 7.25)
1,000 rpm	More than 90 (0.918, 13.05)
2,000 rpm	More than 170 (1.734, 24.65)
4,000 rpm	More than 350 (3.57, 50.75)

*: Engine oil temperature at 90°C (194°F)