SECTION LU
ENGINE LUBRICATION SYSTEM

CONTENTS

PRECAUTION

PRECAUTIONS

Precautions For Engine Service

INFOID:0000000012952582

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 unin-structed 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

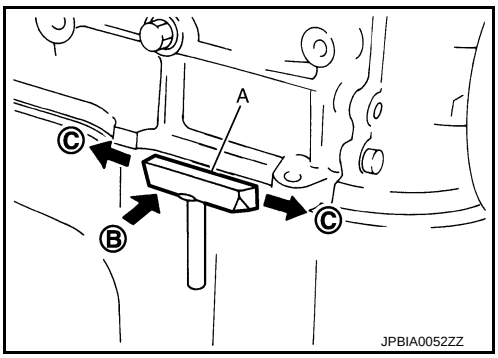
- Use torque wrench to tighten bolts or nuts to specification.
- When tightening nuts and bolts, as a basic rule, equally tighten in several different steps starting with the ones in center, then ones on inside and outside diagonally in this order. If the order of tightening is specified, do exactly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

INFOID:0000000012952583

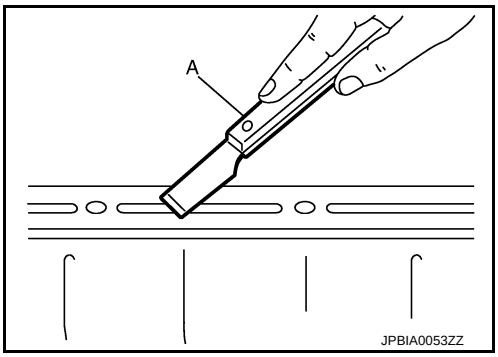
REMOVAL OF LIQUID GASKET SEALING

- After removing mounting nuts and bolts, separate the mating surface using the seal cutter [SST: KV10111100] (A) and remove old liquid gasket sealing.
  CAUTION:
  Never damage the mating surfaces.
- Tap the seal cutter [SST: KV10111100] to insert it Ⓑ, and then slide it Ⓒ by tapping on the side as shown in the figure.
- In areas where the seal cutter [SST: KV10111100] is difficult to use, lightly tap the parts using a plastic hammer to remove it.
  CAUTION:
  If for some unavoidable reason tool such as a screwdriver is used, be careful not to damage the mating surfaces.

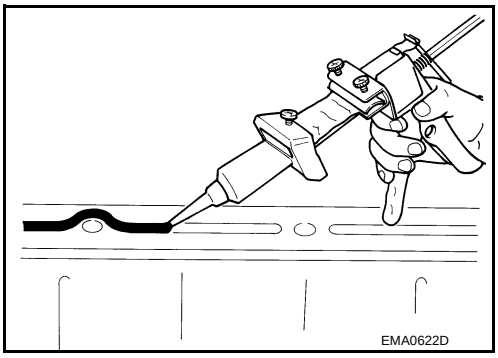


LIQUID GASKET APPLICATION PROCEDURE

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.



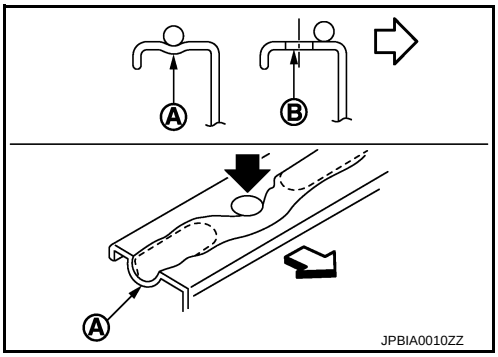
3. Attach liquid gasket tube to the tube presser (commercial service tool).
   Use Genuine Liquid Gasket or equivalent.
4. Apply liquid gasket without gaps to the specified location according to the specified dimensions.
   - If there is a groove for liquid gasket application, apply liquid gasket to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

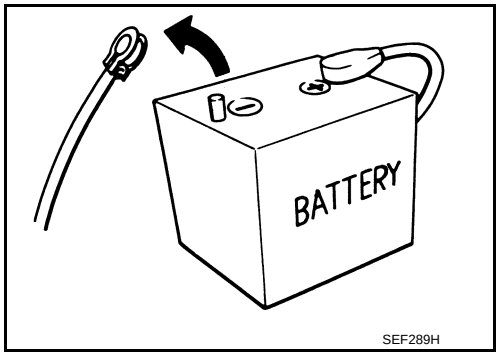
Precautions for Removing Battery Terminal

INFOID:0000000013517285

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	V9X engine	: 4 minutes
D4D engine	: 20 minutes	YD25DDTi	: 2 minutes
HR09DET	: 12 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		



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.

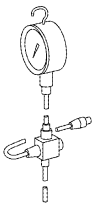
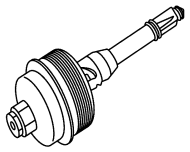
NOTE:
The removal of 12V battery may cause a DTC detection error.

PREPARATION

PREPARATION

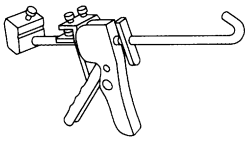
Special Service Tools

INFOID:0000000012952585

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) OIil pressure tester cap  JSBIA5233ZZ	Tester cap for checking oil puressure on oil filter insert.

Commercial Service Tools

INFOID:0000000012952586

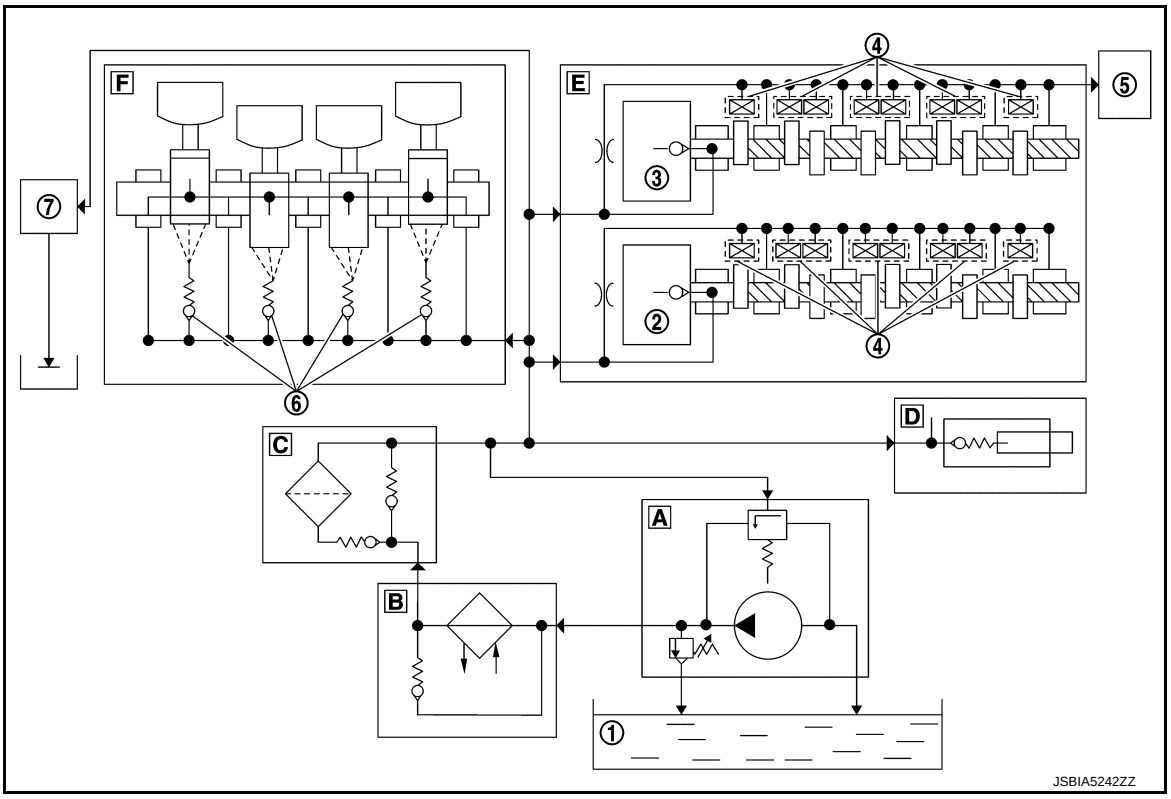
Tool name	Description
Tube presser  NT052	Pressing tube of liquid gasket

SYSTEM DESCRIPTION

DESCRIPTION

Engine Lubrication System Schematic

INFOID:0000000012952587



① Oil pan	② Intaka camshaft adjuster	③ Exhaust camshaft adjuster
④ Hydraulic valve clearance compensation	⑤ Vacuum pump	⑥ Oil spray nozzles
⑦ Turbocharger		
A Oil pump	B Engine oil / coolant heat exchanger with thermovalve	C Oil filter module with return stop and pressure differential valve
D Chain tensioner with oil spray nozzle	E Cylinder head	F Crankcase

PERIODIC MAINTENANCE

ENGINE OIL

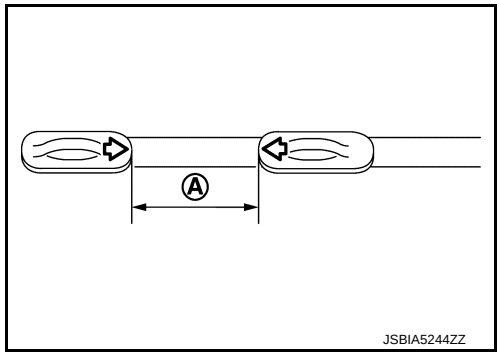
Inspection

INFOID:0000000012952588

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 pan drain plug
- Oil filter
- Oil cooler
- Chain case
- 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
- Turbocharger
- Oil tube connecting parts from turbocharger
- Fuel pump

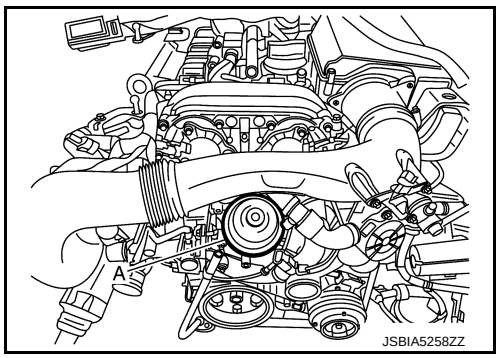
OIL PRESSURE CHECK

WARNING:

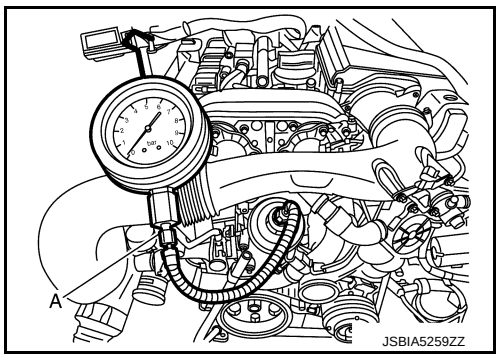
- **Never get burn yourself, as engine oil may be hot.**
- **Oil pressure check should be done in “Parking position”.**

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-22, "Removal and Installation".
5. Remove oil filter screw cap.
   CAUTION:
   Never spill engine oil on drive belt.
6. Remove oil filter from oil filter screw cap.

7. Install the oil pressure tester cap [SST: KV105H0050 (270 589 00 63 00)] (A).



8. Install the gauge oil press [SST: KV115H0070 (103 589 00 21 00)] (A).



9. 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-18, "Engine Oil Pressure".

10. Install in the reverse order of removeal.

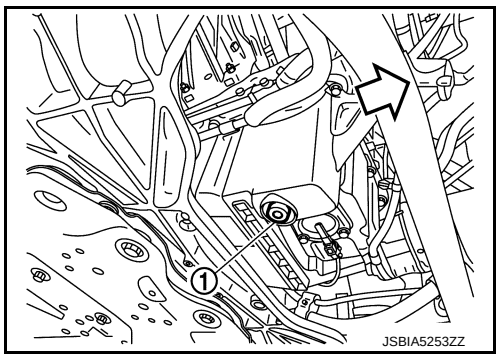
Draining

INFOID:0000000012952589

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-8, "Inspection".
2. Remove oil filter.
3. Loosen oil filler cap.
4. Remove drain plug ① and then drain engine oil and wait for 5 minutes.

⇦ : Engine front



Refilling

INFOID:0000000012952590

1. Install drain plug with new seal ring. Refer to EM-109, "2WD : Exploded View" (2WD), EM-79, "Exploded View" (AWD).

CAUTION:
Be sure to clean drain plug and install with new seal ring.

Tightening torque : Refer to EM-109, "2WD : Exploded View" (2WD), EM-79, "Exploded View" (AWD).

2. Install engine oil filter. Refer to LU-11, "Removal and Installation".
3. Refill with new engine oil.
   Engine oil specification and viscosity: Refer to MA-20, "Recommeded Fluids and Lubricants".

   Engine oil capacity : Refer to LU-18, "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-8, "Inspection".

OIL FILTER

Removal and Installation

INFOID:0000000012952591

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-22, "Removal and Installation".
2. Remove engine oil level gauge. Refer to EM-109, "2WD : Exploded View" (2WD), EM-79, "Exploded View" (AWD).
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.

Oil filter screw cap:

: 25.0 N·m (2.6 kg-m, 18 ft-lb)

Inspection

INFOID:0000000012952592

INSPECTION AFTER INSTALLATION

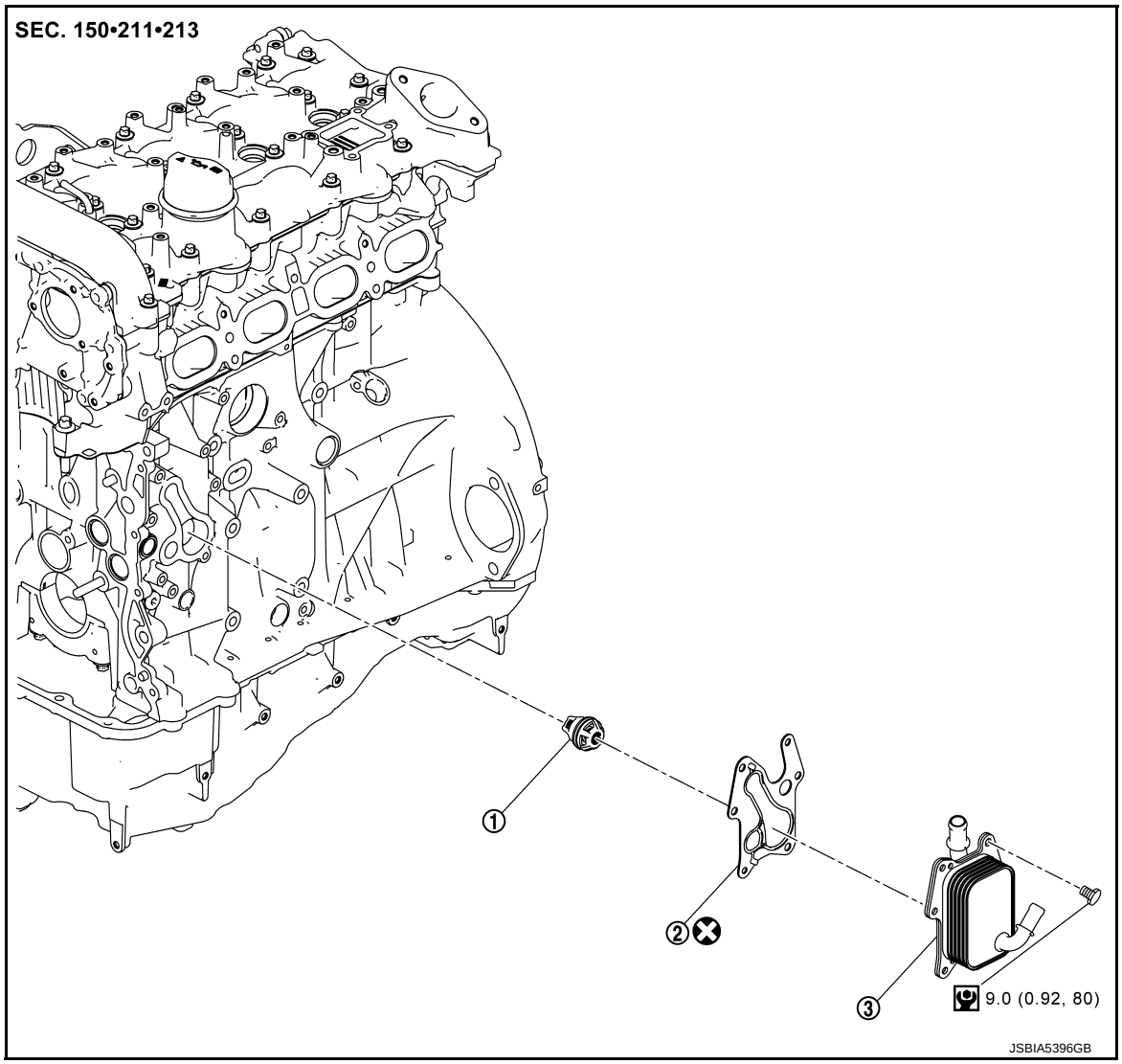
1. Check the engine oil level. Refer to LU-8, "Inspection".
2. Start the engine, and check there is no leak of engine oil.
3. Stop the engine and wait for 10 minutes.
4. Check the engine oil level, and adjust the level. Refer to LU-8, "Inspection".

REMOVAL AND INSTALLATION

OIL COOLER

Exploded View

INFOID:0000000012952593



① Oil temperature regulator ② Gasket ③ Oil cooler

: N·m (kg-m, in-lb)

: Always replace after every disassembly.

Removal and Installation

INFOID:0000000012952594

REMOVAL

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. Remove alternator. Refer to CHG-25, "2.0L TURBO GASOLINE ENGINE : Removal and Installation".
4. Disconnect cooling hose from oil cooler.

5. Remove oil cooler.

INSTALLATION

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

CAUTION:

Do not reuse O-rings.

Inspection

INFOID:0000000012952595

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.

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-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-8, "Inspection" and CO-7, "Inspection".

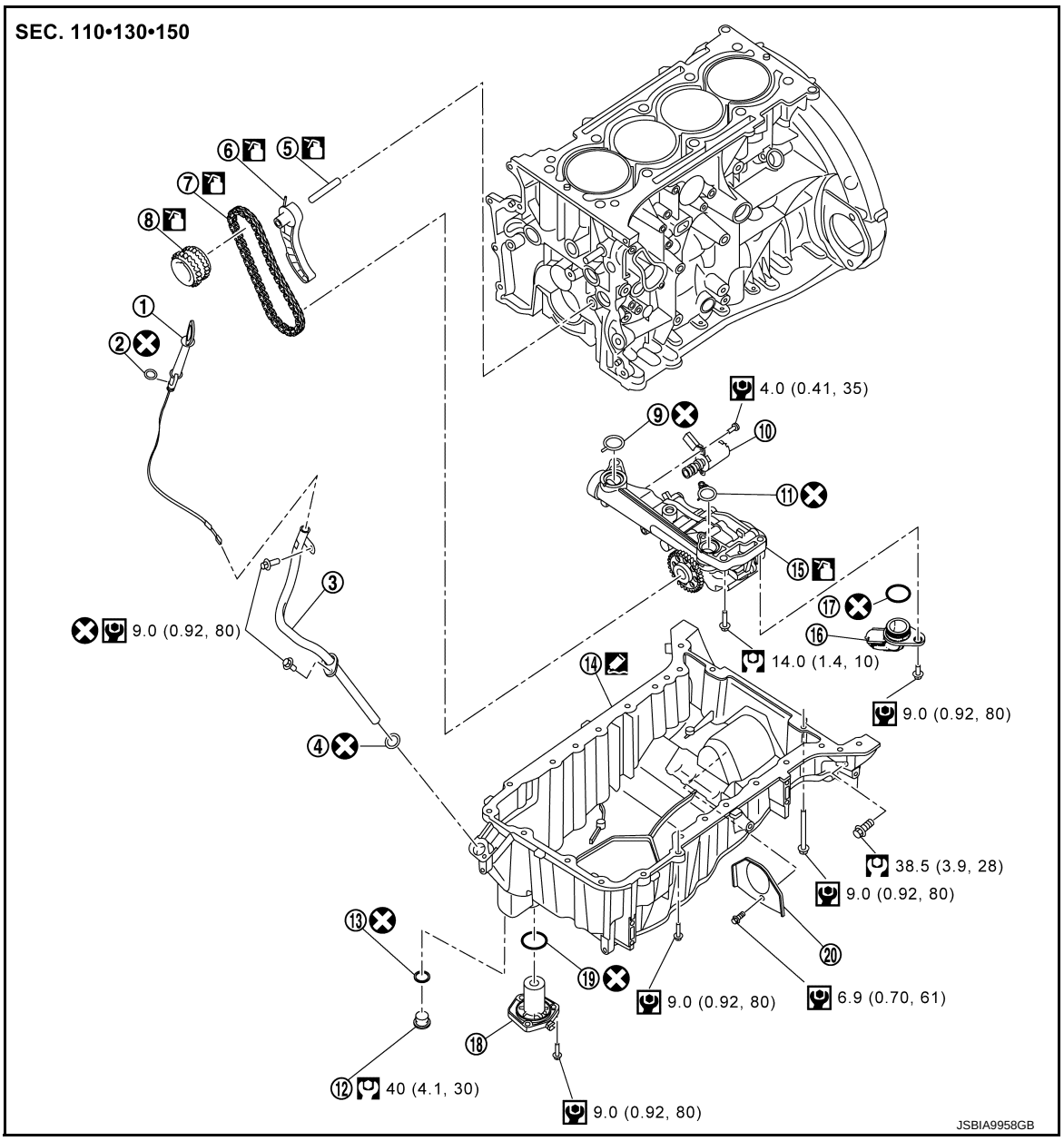
UNIT DISASSEMBLY AND ASSEMBLY

OIL PUMP

Exploded View

INFOID:0000000012952596

2WD



① Oil level gauge
② O-ring
③ Oil level gauge guide
④ O-ring
⑤ Slide rail pin
⑥ Timing chain guide
⑦ Timing chain (oil pump)
⑧ Crank sprocket
⑨ O-ring
⑩ Engine oil pump valve
⑪ O-ring
⑫ Oil drain screw
⑬ Oil drain screw washer
⑭ Oil pan
⑮ Engine oil pump
⑯ Oil suction pipe
⑰ O-ring
⑱ Engine oil level switch
⑲ O-ring
⑳ Rear plate cover

: Always replace after every disassembly.

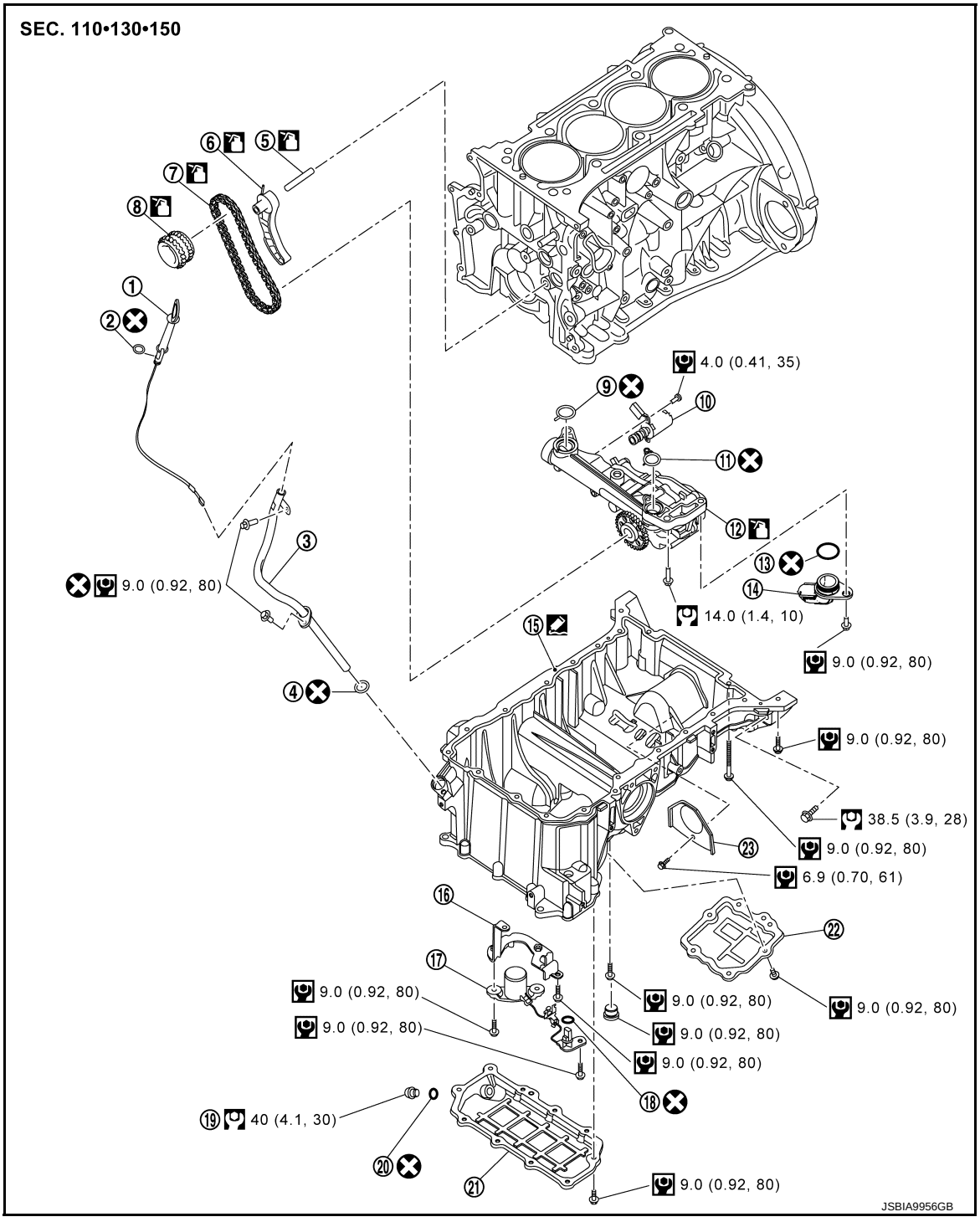
: N·m (kg-m, in-lb)

: N·m (kg-m, ft-lb)

: Sealing point

: Should be lubricated with oil.

AWD



① Oil level gauge ② O-ring ③ Oil level gauge guide
④ O-ring ⑤ Slide rail pin ⑥ Timing chain guide
⑦ Timing chain (oil pump) ⑧ Crank sprocket ⑨ O-ring

⑩ Engine oil pump valve
⑪ O-ring
⑫ Engine oil pump
⑬ O-ring
⑭ Oil suction pipe
⑮ Oil pan
⑯ Engine oil level switch bracket
⑰ Engine oil level switch
⑱ O-ring
⑲ Oil drain screw
⑳ Oil drain screw washer
㉑ Oil pan (lower front)
㉒ Oil pan (lower rear)
㉓ Rear plate cover

: Always replace after every disassembly.
: N·m (kg-m, in-lb)
: N·m (kg-m, ft-lb)
: Sealing point
: Should be lubricated with oil.

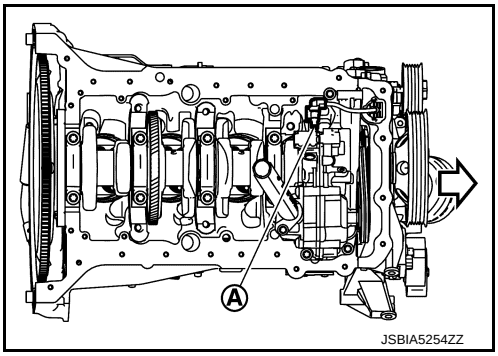
Removal and Installation

INFOID:0000000012952597

REMOVAL

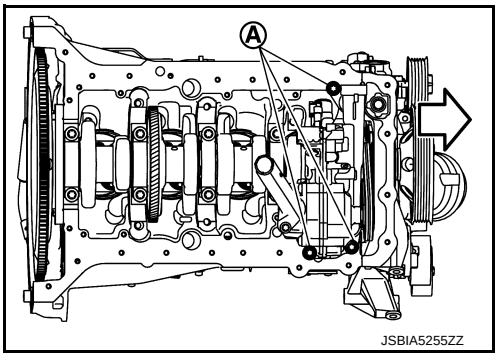
1. Remove oil pan. Refer to EM-110, "2WD : Removal and Installation" (2WD), EM-112, "AWD : Removal and Installation" (AWD).
2. Disconnect engine oil pump harness connector Ⓐ.

⇦ : Engine front



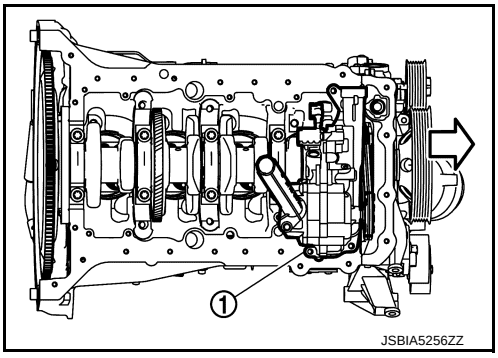
3. Remove oil pump mounting bolts Ⓐ.

⇦ : Engine front

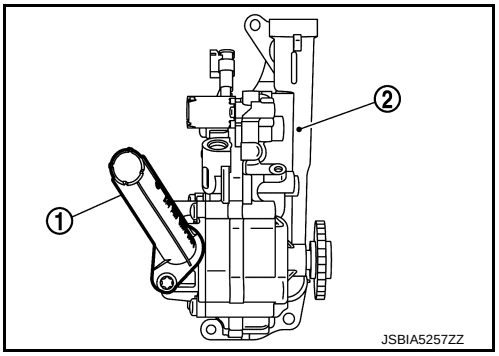


4. Press and hold the oil pump chain tensioner, remove oil pump ①.

⇦ : Engine front



5. Remove oil suction pipe ① from oil pump ②.



INSTALLATION

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

NOTE:

• If a sensors is replaced, carry out the reset of adaption of sensors. Refer to EC4-216, "Description".

Inspection

INFOID:0000000012952598

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".

SERVICE DATA AND SPECIFICATIONS (SDS)

SERVICE DATA AND SPECIFICATIONS (SDS)

Periodical Maintenance Specification

INFOID:0000000012952599

ENGINE OIL CAPACITY (APPROXIMATE)

Unit: ℓ (US qt, Imp qt)

Drain and refill	2WD	With oil filter change	6.3 (6 -5/8, 5 -4/8)
		Without oil filter change	5.8 (6 -1/8, 5 -1/8)
	AWD	With oil filter change	6.6 (7, 5 -6/8)
		Without oil filter change	6.1 (6 -4/8, 5 -3/8)

Engine Oil Pressure

INFOID:0000000012952600

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

Engine speed	Approximate discharge pressure*
650 rpm	More than 50 (0.50, 0.51, 7.25)
1,000 rpm	More than 90 (0.90, 0.918, 13.05)
2,000 rpm	More than 170 (1.70, 1.734, 24.65)
4,000 rpm	More than 350 (3.50, 3.57, 50.75)

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

PRECAUTION

PRECAUTIONS

Precautions For Engine Service

INFOID:0000000013607973

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.

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- 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.

Precautions for Removing Battery Terminal

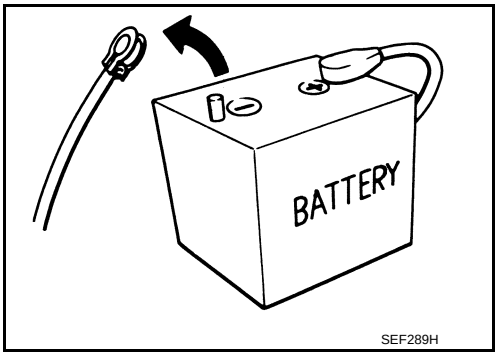
INFOID:0000000013607974

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	V9X engine	: 4 minutes
D4D engine	: 20 minutes	YD25DDTi	: 2 minutes
HR09DET	: 12 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		



SEF289H

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.

Liquid Gasket

INFOID:0000000013607975

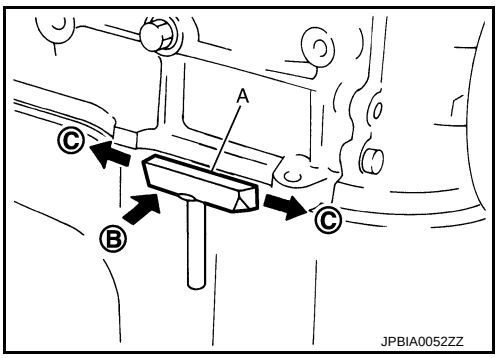
REMOVAL OF LIQUID GASKET SEALING

- After removing mounting nuts and bolts, separate the mating surface using the seal cutter [SST: KV10111100] (A) and remove old liquid gasket sealing.

CAUTION:
Never damage the mating surfaces.

- Tap the seal cutter [SST: KV10111100] to insert it Ⓑ, and then slide it Ⓒ by tapping on the side as shown in the figure.
- In areas where the seal cutter [SST: KV10111100] is difficult to use, lightly tap the parts using a plastic hammer to remove it.

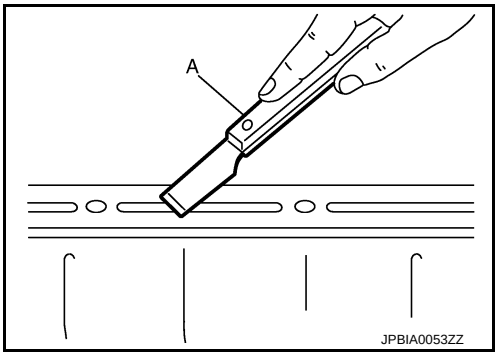
CAUTION:
If for some unavoidable reason tool such as a screwdriver is used, be careful not to damage the mating surfaces.



JPBIA0052ZZ

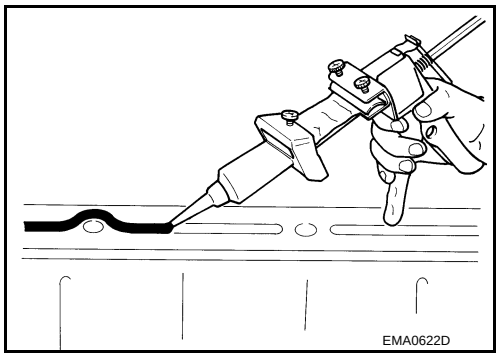
LIQUID GASKET APPLICATION PROCEDURE

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.

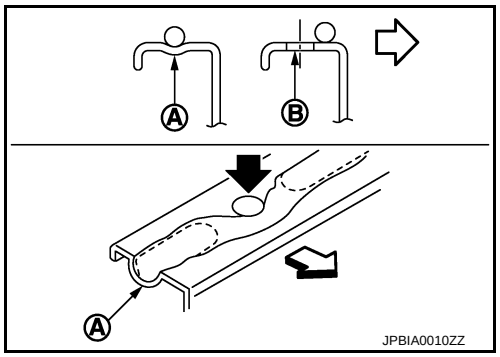


JPBIA0053ZZ

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.

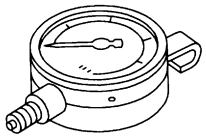
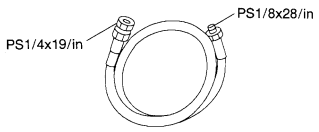
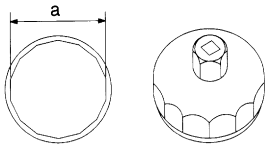
PREPARATION

PREPARATION

Special Service Tools

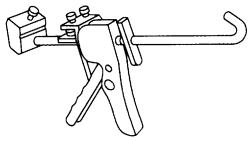
INFOID:0000000013607976

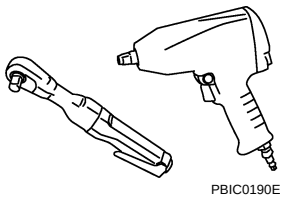
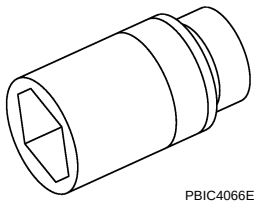
The actual shapes of TechMate tools may differ from those of special service tools illustrated here.

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/cm^2, 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 and installing oil filter **a: 64.3 mm (2.531 in)**

Commercial Service Tools

INFOID:0000000013607977

Tool name	Description
Tube presser  NT052	Pressing tube of liquid gasket

Tool name	Description
Power tools  PBIC0190E	Loosening nuts and bolts
Deep socket  PBIC4066E	Removing and installing oil pressure switch **27 mm (1.06 in)**

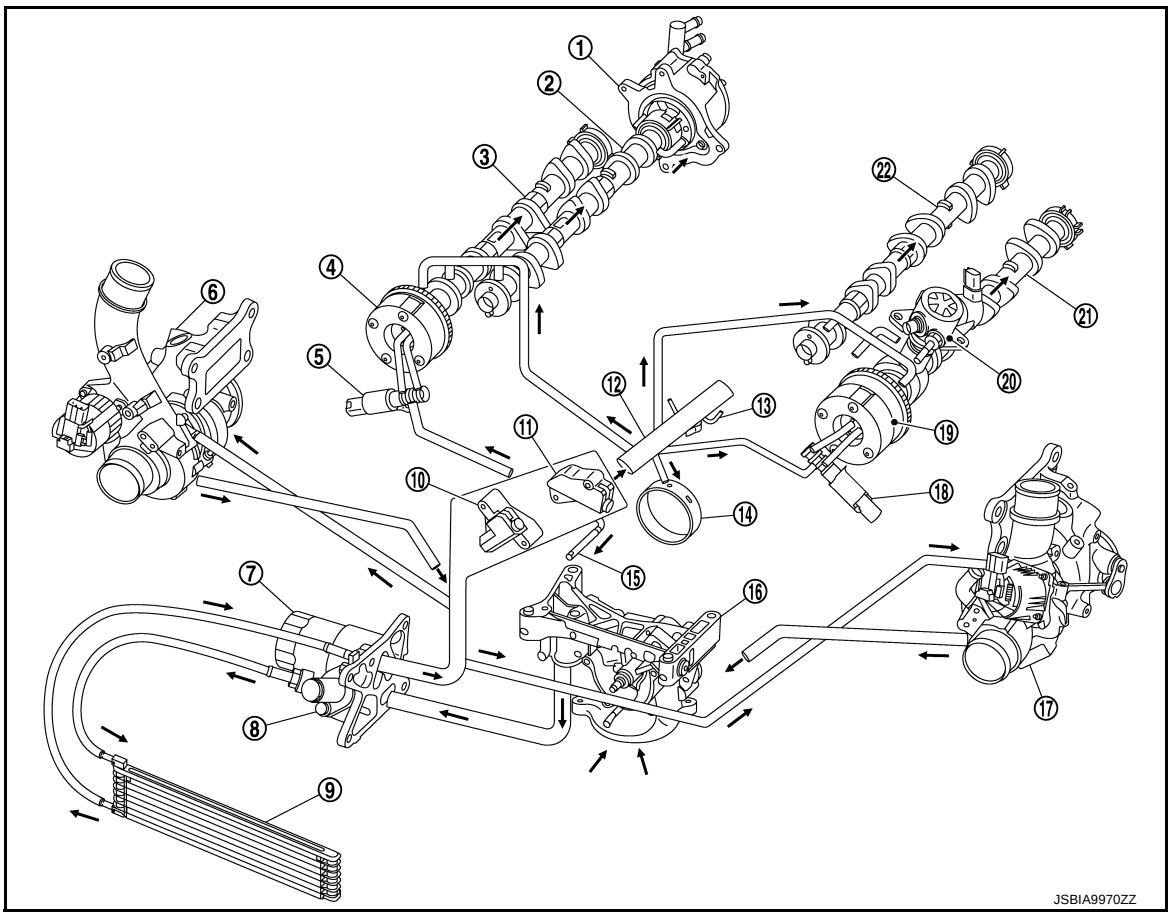
SYSTEM DESCRIPTION

DESCRIPTION

Engine Lubrication System

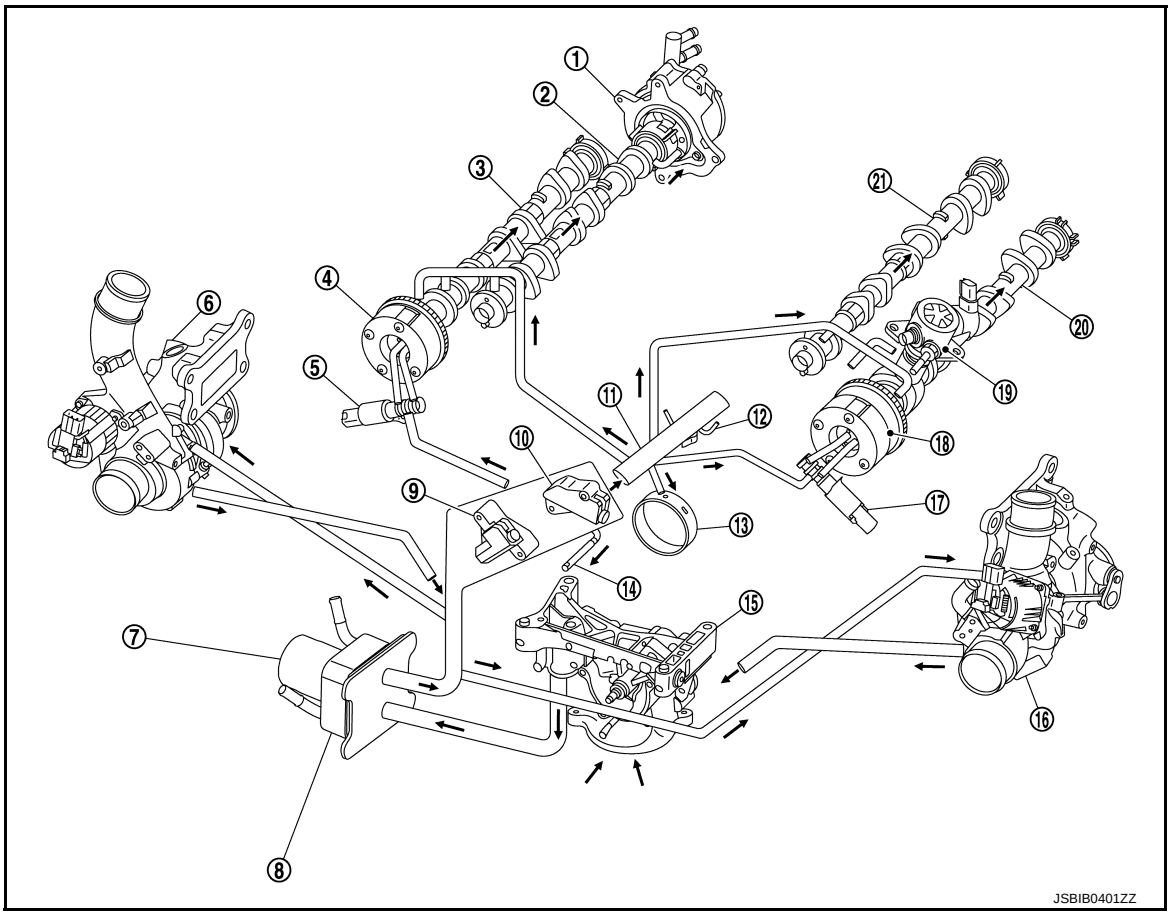
INFOID:0000000013607978

ENGINE OIL COOLER AIR COOLING TYPE



① Vacuum pump	② Intake camshaft (bank 1)	③ Exhaust camshaft (bank 1)
④ Exhaust camshaft sprocket (bank 1)	⑤ Exhaust valve timing control solenoid valve (bank 1)	⑥ Turbocharger (bank 1)
⑦ Oil filter	⑧ Relief valve	⑨ Oil cooler
⑩ Timing chain tensioner (bank 1)	⑪ Timing chain tensioner (bank 2)	⑫ Oil gallery
⑬ Oil jet	⑭ Main bearing	⑮ Timing chain oil jet
⑯ Oil pump	⑰ Turbocharger (bank 2)	⑱ Exhaust valve timing control solenoid valve (bank 2)
⑲ Exhaust camshaft sprocket (bank 2)	⑳ High pressure fuel pump	㉑ Exhaust camshaft (bank 2)
㉒ Intake camshaft (bank 2)		

ENGINE OIL COOLER WATER COOLING TYPE

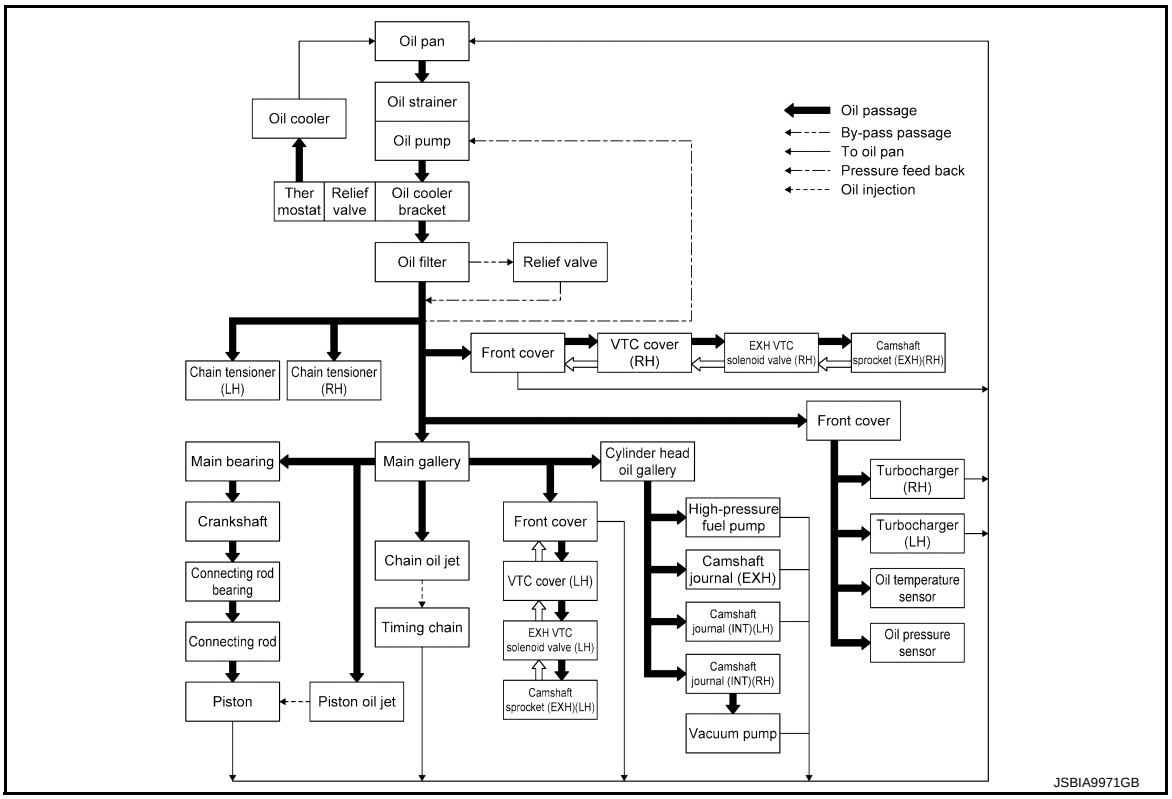


① Vacuum pump	② Intake camshaft (bank 1)	③ Exhaust camshaft (bank 1)
④ Exhaust camshaft sprocket (bank 1)	⑤ Exhaust valve timing control solenoid valve (bank 1)	⑥ Turbocharger (bank 1)
⑦ Oil filter	⑧ Oil cooler	⑨ Timing chain tensioner (bank 1)
⑩ Timing chain tensioner (bank 2)	⑪ Oil gallery	⑫ Oil jet
⑬ Main bearing	⑭ Timing chain oil jet	⑮ Oil pump
⑯ Turbocharger (bank 2)	⑰ Exhaust valve timing control solenoid valve (bank 2)	⑱ Exhaust camshaft sprocket (bank 2)
⑲ High pressure fuel pump	⑳ Exhaust camshaft (bank 2)	㉑ Intake camshaft (bank 2)

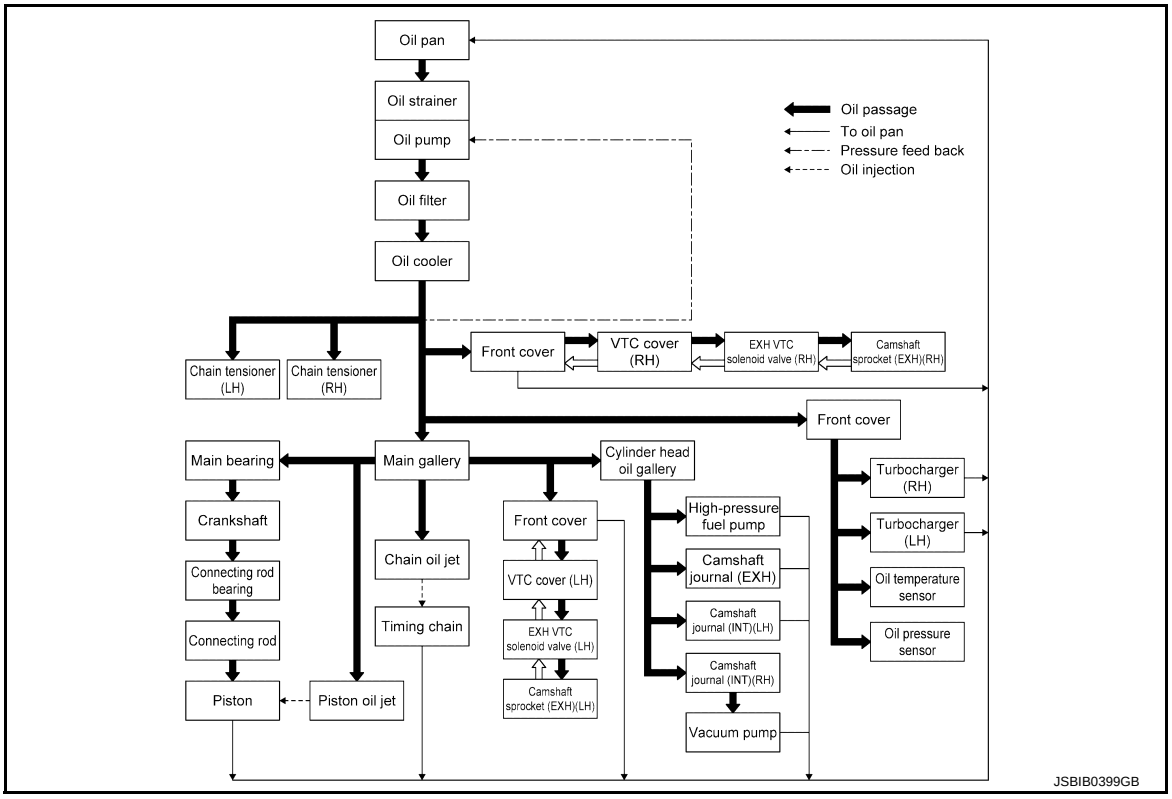
Engine Lubrication System Schematic

INFOID:0000000013607979

ENGINE OIL COOLER AIR COOLING TYPE



ENGINE OIL COOLER WATER COOLING TYPE



PERIODIC MAINTENANCE

ENGINE OIL

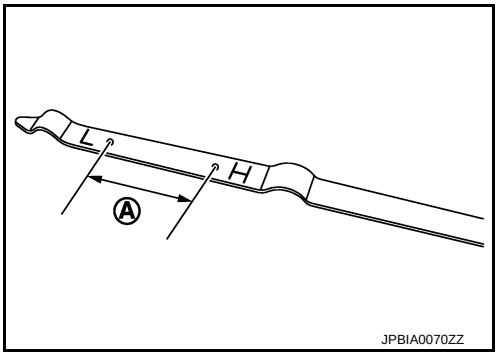
Inspection

INFOID:0000000013607980

ENGINE OIL LEVEL

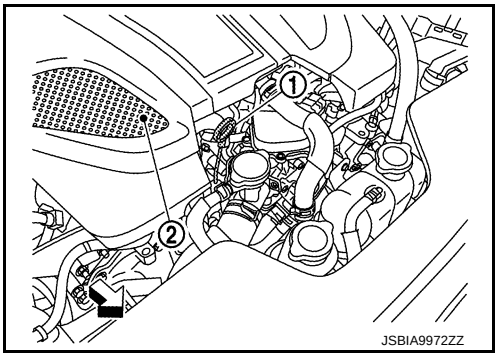
NOTE:
Before starting engine, put vehicle horizontally and check the engine oil level. If engine is already started, stop it and allow 10 minutes before checking.

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.



NOTE:
When checking the engine oil level, insert oil level gauge ① with its tip aligned with oil level gauge guide.

② : Engine cover
⇦ : Engine front



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 (upper and lower)
- Oil pan drain plug
- Oil pressure sensor
- Oil temperature sensor
- Oil filter
- Oil cooler bracket
- Oil cooler
- Valve timing control cover
- Mating surface between cylinder head and rocker cover
- Mating surface between cylinder block and cylinder head
- Mating surface between lower cylinder block and cylinder block
- Crankshaft oil seals (front and rear)
- Camshaft position sensor and exhaust valve timing control solenoid valve

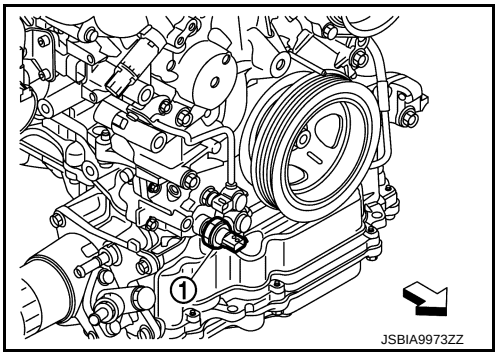
OIL PRESSURE CHECK

WARNING:

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

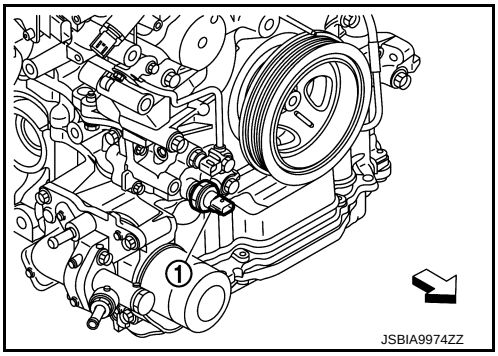
1. Check the engine oil level.
2. Remove front under cover using a power tool (commercial service tool). Refer to EXT-33, "FRONT UNDER COVER : Exploded View".
3. Disconnect harness connector at oil pressure sensor, and remove oil pressure sensor using deep socket (commercial service tool).
   CAUTION:
   Never drop or shock oil pressure sensor.
   - 2WD models

     ① : Oil pressure sensor
     ⇦ : Engine front

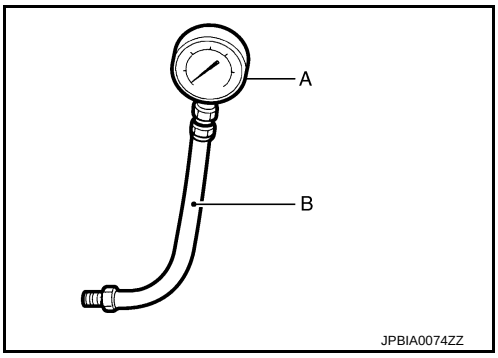


   - AWD models

     ① : Oil pressure sensor
     ⇦ : Engine front



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-41, "2WD : Engine Oil Pressure" (2WD).** **: Refer to LU-41, "AWD : Engine Oil Pressure" (AWD).**

   If difference is extreme, check engine oil passage and oil pump for engine oil leakage.
7. After the inspections, install oil pressure sensor as follows:

a. Remove old liquid gasket adhering to oil pressure sensor and the mating surface.

b. Apply liquid gasket and tighten oil pressure sensor to the specification.
Use Genuine Liquid Gasket (Three Bond 1386G or 1211) or equivalent.

Tightening torque : Refer to EM-238, "Exploded View"

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

Draining

INFOID:0000000013607981

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-27, "Inspection".
2. Stop the engine and wait for 10 minutes.
3. Loosen oil filler cap.
4. Remove front under cover. Refer to EXT-35, "FRONT UNDER COVER : Removal and Installation".
5. Remove drain plug and then drain engine oil.

Refilling

INFOID:0000000013607982

1. Install drain plug with new washer. Refer to EM-189, "2WD : Exploded View" (2WD) or EM-190, "AWD : Exploded View" (AWD).
CAUTION:
Be sure to clean drain plug and install with new washer.
2. Refill with new engine oil.
Engine oil specification and viscosity: Refer to MA-20, "Recommeded Fluids and Lubricants".

Engine oil capacity	**: Refer to LU-41, "2WD : Periodical Maintenance Specification" (2WD).** **: Refer to LU-41, "AWD : Periodical Maintenance Specification" (AWD).**

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.**

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-27, "Inspection".
6. Perform the “Engine Oil Data Reset”. Refer to EC6-278, "Description" (FOR USA AND CANADA) or EC6-1211, "Description" (FOR MEXICO).

OIL FILTER

Removal and Installation

INFOID:0000000013607983

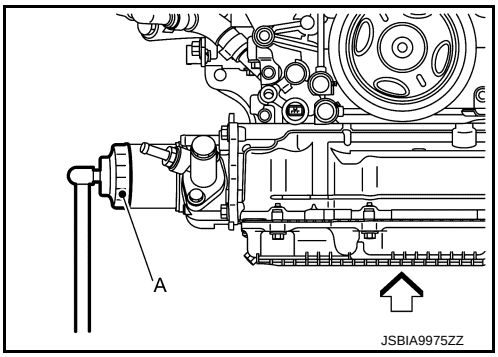
REMOVAL

CAUTION:

- **Oil filter is provided with relief valve. Use genuine NISSAN oil filter or equivalent.**
- **Never 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.**

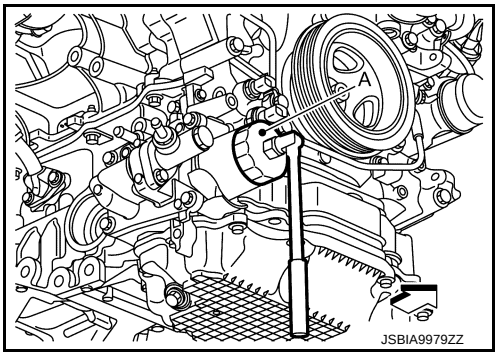
1. Remove front under cover, using a power tool. Refer to EXT-35, "FRONT UNDER COVER : Removal and Installation".
2. Using oil filter wrench [SST: KV10115801 (J-38956)] (A), remove oil filter.
   - 2WD models

     ⇦ : Engine front



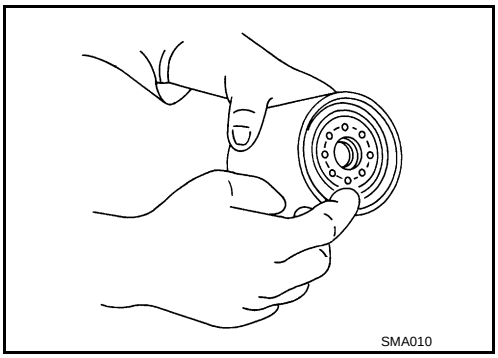
   - AWD models

     ⇦ : Engine front



INSTALLATION

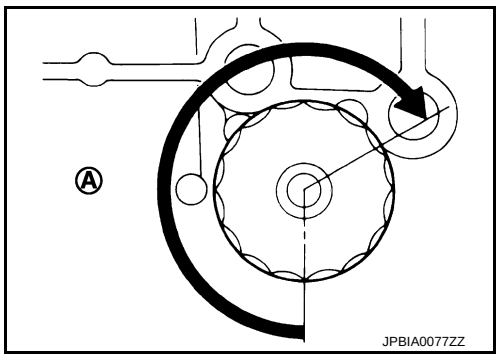
1. Remove foreign materials adhering to oil filter installation surface.
2. Apply engine oil to the oil seal contact surface of new oil filter.



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

Oil filter:

: 17.7 N·m (1.8 kg-m, 13 ft-lb)



Inspection

INFOID:0000000013607984

INSPECTION AFTER INSTALLATION

1. Check the engine oil level. Refer to LU-27, "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-27, "Inspection".

REMOVAL AND INSTALLATION

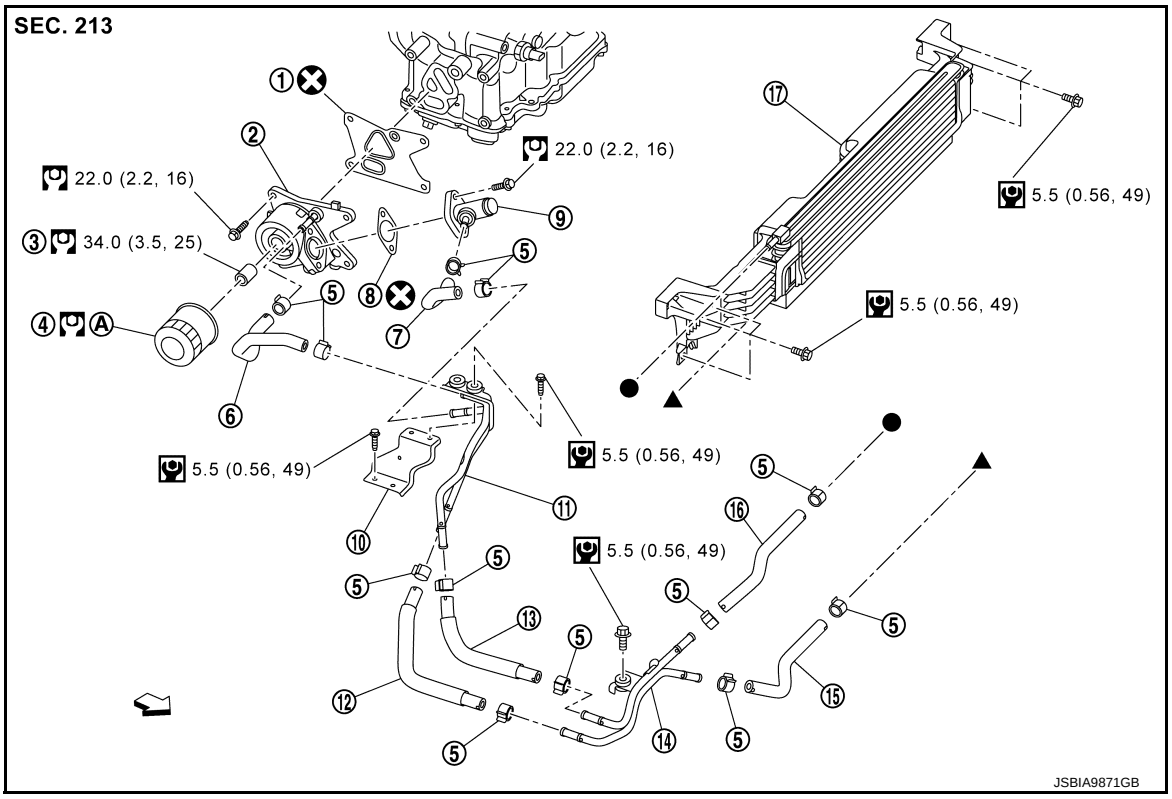
OIL COOLER

AIR COOLING TYPE

AIR COOLING TYPE : Exploded View

INFOID:0000000013804358

2WD



① Gasket	② Oil cooler bracket	③ Connector bolt
④ Oil filter	⑤ Clamp	⑥ Oil cooler hose 1
⑦ Oil cooler hose 2	⑧ Gasket	⑨ Relife valve
⑩ Bracket	⑪ Oil cooler pipe 1	⑫ Oil cooler hose 3
⑬ Oil cooler hose 4	⑭ Oil cooler pipe 2	⑮ Oil cooler hose 5
⑯ Oil cooler hose 6	⑰ Oil cooler	

Ⓐ Comply with the installation procedure when tightening. Refer to LU-30

⇦ : Engine front

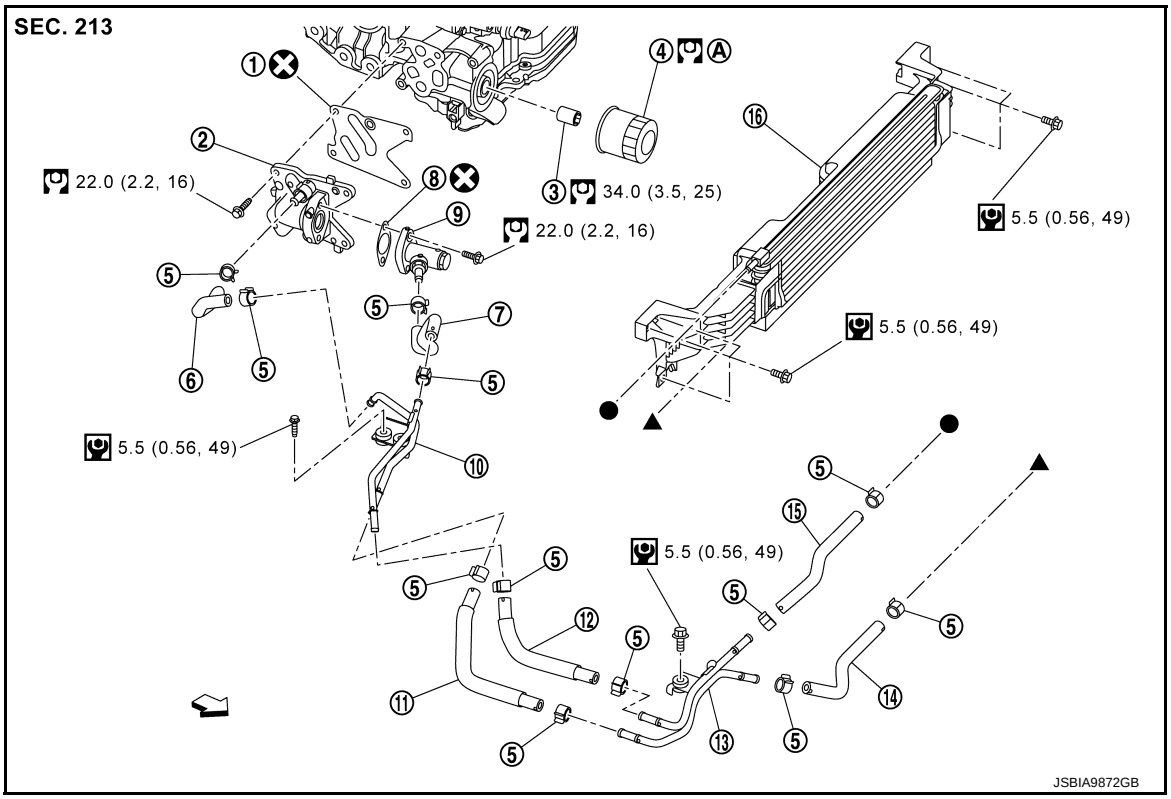
: N·m (kg-m, ft-lb)

: N·m (kg-m, in-lb)

: Always replace after every disassembly.

●, ▲ Indicates that the part is connected at points with same symbol in actual vehicle.

AWD



① Gasket	② Oil cooler bracket	③ Connector bolt
④ Oil filter	⑤ Clamp	⑥ Oil cooler hose 1
⑦ Oil cooler hose 2	⑧ Gasket	⑨ Relife valve
⑩ Oil cooler pipe 1	⑪ Oil cooler hose 3	⑫ Oil cooler hose 4
⑬ Oil cooler pipe 2	⑭ Oil cooler hose 5	⑮ Oil cooler hose 6
⑯ Oil cooler		

Ⓐ Comply with the installation procedure when tightening. Refer to LU-30

⇦ : Engine front

: N·m (kg-m, ft-lb)

: N·m (kg-m, in-lb)

: Always replace after every disassembly.

●, ▲ Indicates that the part is connected at points with same symbol in actual vehicle.

AIR COOLING TYPE : Removal and Installation

INFOID:0000000013804359

REMOVAL

WARNING:

Never get burn yourself, as engine oil and engine coolant may be hot.

Oil cooler

1. Remove front under cover, using a power tool (commercial servive tool). Refer to EXT-35, "FRONT UNDER COVER : Removal and Installation".
2. Drain engine oil. Refer to LU-29, "Draining".
3. Remove front bumper fasia. Refer to EXT-15, "Removal and Installation".
4. Disconnect oil cooler hose 5 and 6 from oil cooler.
5. Remove oil cooler mounting bolts and remove oil cooler.

Oil cooler bracket (2WD)

1. Remove front under cover, using a power tool (commercial servive tool). Refer to EXT-35, "FRONT UNDER COVER : Removal and Installation".
2. Drain engine oil. Refer to LU-29, "Draining".
3. Remove oil filter. Refer to LU-30, "Removal and Installation".
4. Remove connector bolt.
5. Disconnect oil cooler hose 1 from oil cooler bracket.
6. Disconnect oil cooler hose 2 from relife valve.
7. Remove relife valve if necessary.
8. Remove oil cooler bracket.

Oil cooler bracket (AWD)

1. Remove front under cover, using a power tool (commercial servive tool). Refer to EXT-35, "FRONT UNDER COVER : Removal and Installation".
2. Drain engine oil. Refer to LU-29, "Draining".
3. Disconnect oil cooler hose 1 from oil cooler bracket.
4. Disconnect oil cooler hose 2 from relife valve.
5. Remove relife valve if necessary.
6. Remove oil cooler bracket.

INSTALLATION

CAUTION:
Do not reuse gasket.
Install in the reverse order of removal.

AIR COOLING TYPE : Inspection

INFOID:0000000013804360

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
Check relief valve with the following procedure.

- Press steel ball of relief valve using a clean plastic stick. Check that valve moves smoothly and proper spring repulsion is felt.
- Replace relief valve, if necessary, with the following procedure.

- Remove the relief valve by prying using a screwdriver.
  CAUTION:
  Never damage the mounting hole.
- Press in the relief valve until it reaches a depth of 7 mm (0.28 in) from end surface of oil pan (upper) using approximately 10 mm (0.39 in) diameter drift.
  CAUTION:
  Carefully press in the relief valve by aligning its mounting hole side with the axle center so as not to cause deformation.

INSPECTION AFTER INSTALLATION

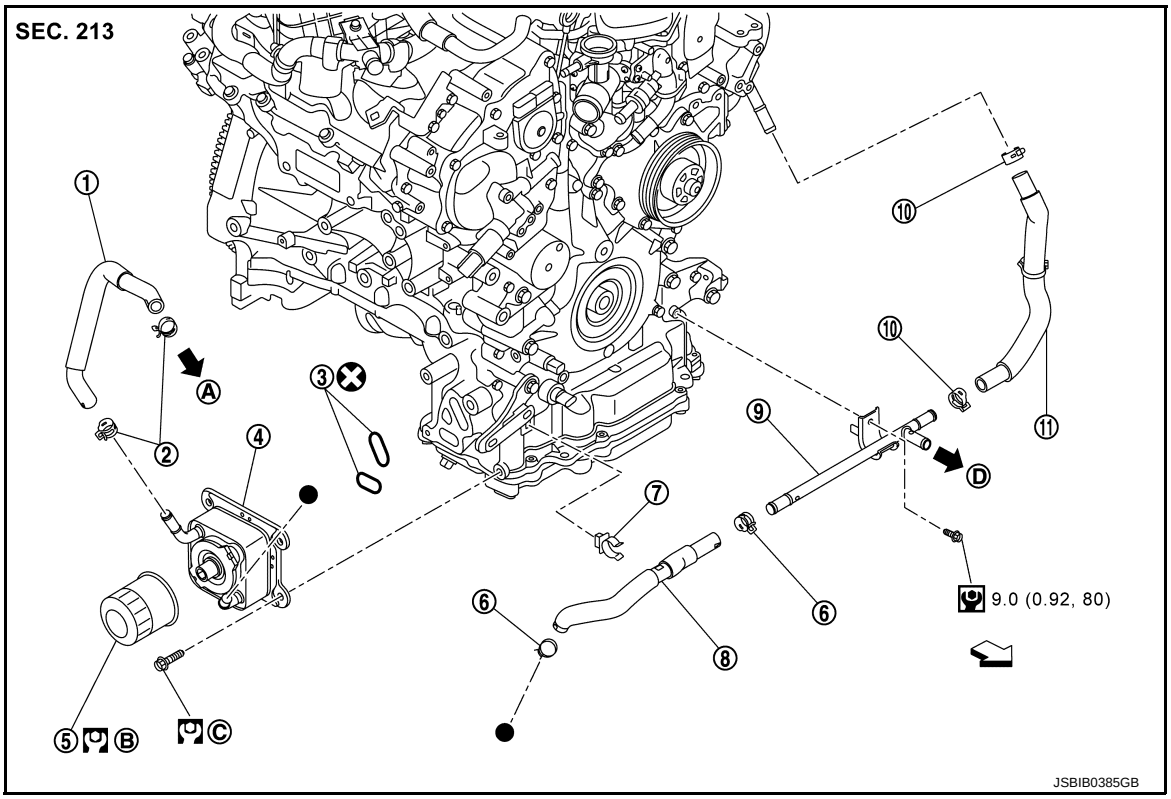
1. Check the engine oil level and the engine coolant level and add engine oil and engine coolant. Refer to LU-27, "Inspection" and CO-33, "Inspection".
2. Start the engine, and check there is no leakage of engine oil or engine coolant.
3. Stop the engine and wait for 10 minutes.
4. Check the engine oil level and the engine coolant level again. Refer to LU-27, "Inspection" and CO-33, "Inspection".

WATER COOLING TYPE

WATER COOLING TYPE : Exploded View

INFOID:0000000013804361

2WD



①	Oil cooler hose 1	②	Clamp	③	O-ring
④	Oil cooler	⑤	Oil filter	⑥	Clamp
⑦	Hose clip	⑧	Oil cooler hose 2	⑨	Water pipe
⑩	Clamp	⑪	Oil cooler hose 3		
Ⓐ	To water pipe	Ⓑ	Comply with the installation procedure when tightening. Refer to LU-30	Ⓒ	Comply with the installation procedure when tightening. Refer to LU-36
Ⓓ	To A/T fluid warmer				

⇦ : Engine front

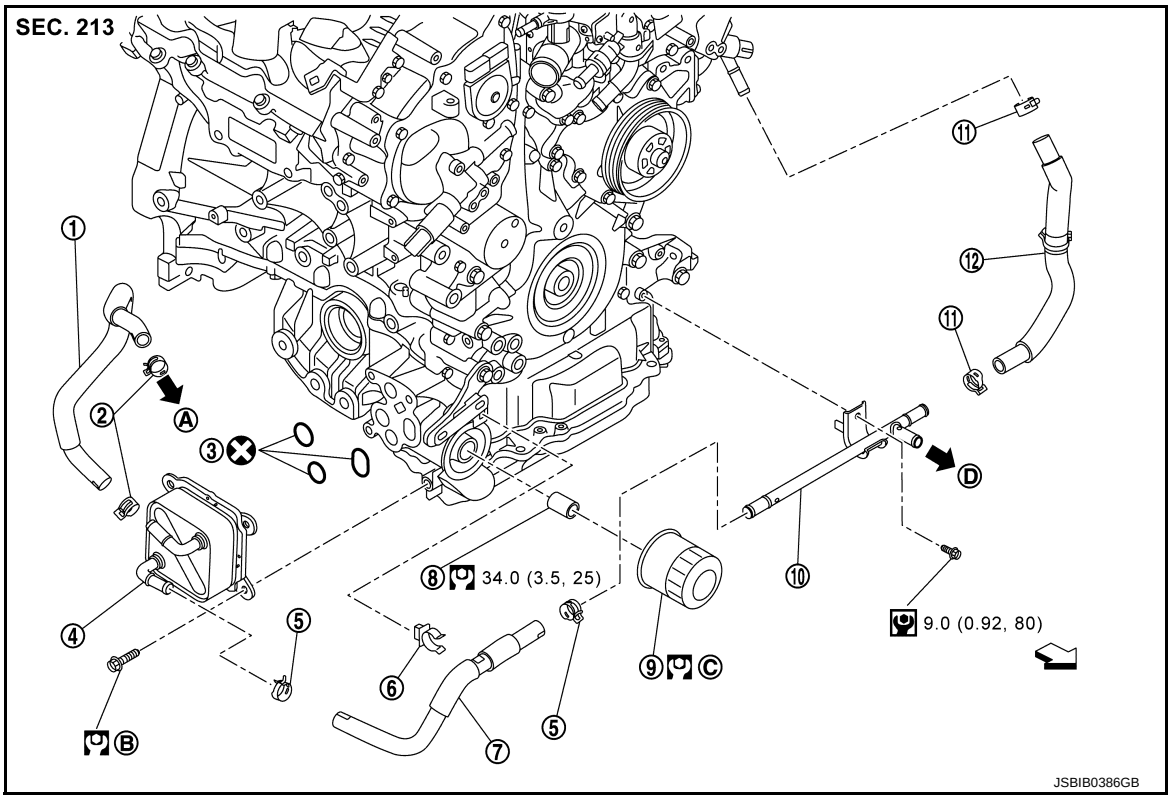
: N·m (kg-m, ft-lb)

: N·m (kg-m, in-lb)

: Always replace after every disassembly.

●, Indicates that the part is connected at points with same symbol in actual vehicle.

AWD



① Oil cooler hose 1	② Clamp	③ O-ring
④ Oil cooler	⑤ Clamp	⑥ Hose clamp
⑦ Oil cooler hose 2	⑧ Connector bolt	⑨ Oil filter
⑩ Water pipe	⑪ Clamp	⑫ Oil cooler hose 3
Ⓐ To water pipe	Ⓑ Comply with the installation procedure when tightening. Refer to LU-36	Ⓒ Comply with the installation procedure when tightening. Refer to LU-30

Ⓓ To A/T fluid warmer

⇦ : Engine front

: N·m (kg-m, ft-lb)

: N·m (kg-m, in-lb)

: Always replace after every disassembly.

WATER COOLING TYPE : Removal and Installation

INFOID:0000000013804362

REMOVAL

WARNING:

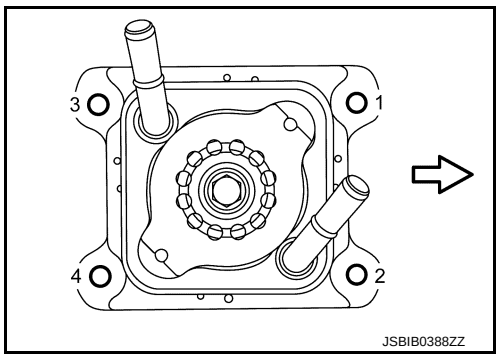
Never get burn yourself, as engine oil and engine coolant may be hot.

Oil cooler

1. Remove front under cover, using a power tool. Refer to EXT-35, "FRONT UNDER COVER : Removal and Installation".
2. Drain engine coolrant. Refer to CO-33, "Draining".
3. Drain engine oil. Refer to LU-29, "Draining".
4. Remove oil filter. Refer to LU-30, "Removal and Installation".
5. Remove oil cooler hose 1 and 2.
6. Loosen mounting bolts in the order from 4 to 1 as shown in the figure to remove.

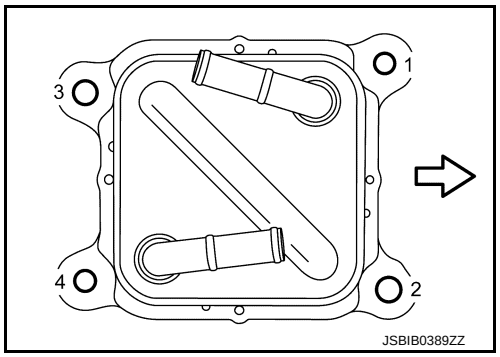
- 2WD models

⇦ : Engine front



- AWD models

⇦ : Engine front



7. Remove oil cooler.

INSTALLATION

CAUTION:

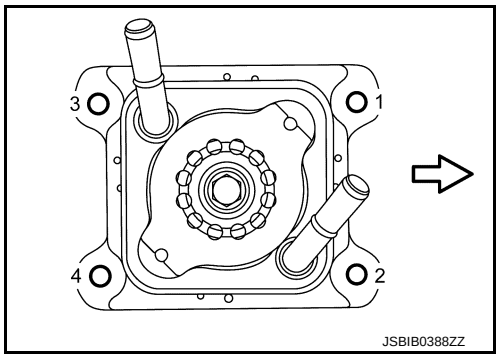
Do not reuse gasket.

Note the followings. and install in the reverse order of removal.

Tighten mounting bolts in the order from 1 to 4 as shown in the figure.

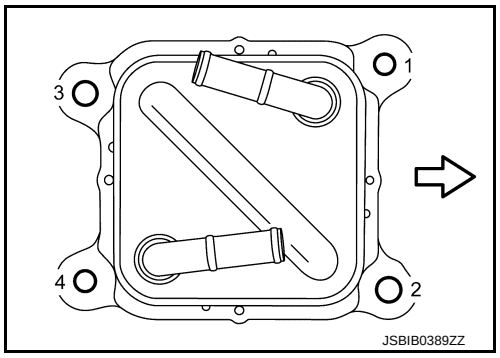
- 2WD models

⇦ : Engine front



- AWD models

⇦ : Engine front



WATER COOLING TYPE : Inspection

INFOID:0000000013804363

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.

INSPECTION AFTER INSTALLATION

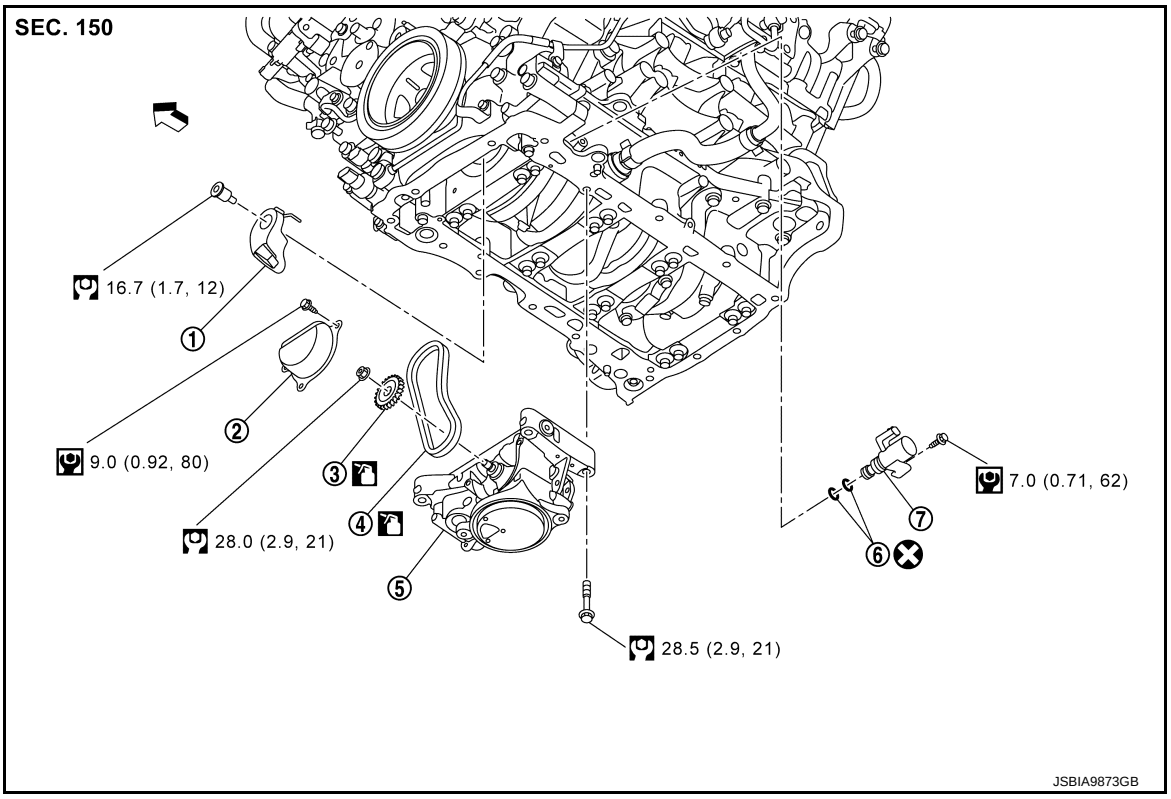
1. Check the engine oil level and the engine coolant level and add engine oil and engine coolant. Refer to LU-27, "Inspection" and CO-33, "Inspection".
2. Start the engine, and check there is no leakage of engine oil or engine coolant.
3. Stop the engine and wait for 10 minutes.
4. Check the engine oil level and the engine coolant level again. Refer to LU-27, "Inspection" and CO-33, "Inspection".

UNIT DISASSEMBLY AND ASSEMBLY

OIL PUMP

Exploded View

INFOID:0000000013607988



① Oil pump drive chain tensioner ② Cover ③ Oil pump sprocket
④ Oil pump drive chain ⑤ Oil pump assembly ⑥ O-ring
⑦ Engine oil pressure control solenoid valve
⇦ : Engine front
: Always replace after every disassembly.
: N·m (kg-m, ft-lb)
: N·m (kg-m, in-lb)
: Should be lubricated with oil.

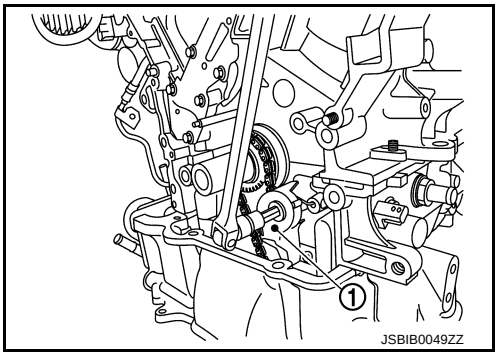
Removal and Installation

INFOID:0000000013607989

REMOVAL

1. Remove oil pan (lower). Refer to EM-191, "Removal and Installation".
2. Remove front timing chain case and timing chain. Refer to EM-239, "Removal and Installation".
3. Remove the crankshaft sprocket and the oil pump drive related parts with the following procedure.

a. Remove chain tensioner ① (for oil pump drive chain).

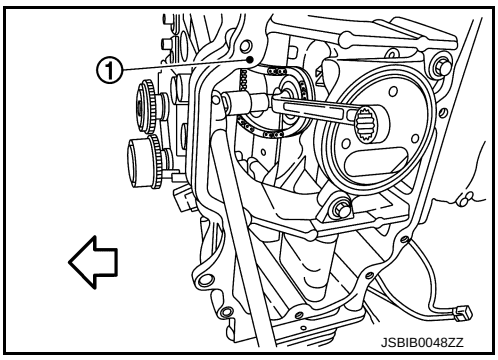


b. Remove cover.

c. Hold the top of the oil pump shaft using the TORX socket, and then loosen the oil pump sprocket nuts and remove them.

① : oil pan (upper)

⇦ : Engine front



d. Remove the crankshaft sprocket, the oil pump drive chain, and the oil pump sprocket at the same time.

4. Remove oil pan (upper). Refer to EM-218, "2WD : Disassembly and Assembly" (2WD models) or EM-222, "AWD : Disassembly and Assembly" (AWD models).

5. Remove oil pump assembly.

INSTALLATION

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

CAUTION:

- **Check that oil pump chain is correctly install on the oil pump sprocket.**
- **Before crank the engine, rotate crankshaft by hand to be sure that oil pump chain is correctly.**
- **Do not reuse O-ring.**

Inspection

INFOID:0000000013607990

INSPECTION AFTER INSTALLATION

1. Check the engine oil level. Refer to LU-27, "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-27, "Inspection".

SERVICE DATA AND SPECIFICATIONS (SDS)

SERVICE DATA AND SPECIFICATIONS (SDS)

2WD

2WD : Periodical Maintenance Specification

INFOID:0000000013607991

ENGINE OIL CAPACITY (APPROXIMATE)

Unit: ℓ (US qt, Imp qt)

Drain and refill	With oil filter change	4.8 (5-1/8, 4-2/8)
	Without oil filter change	4.6 (4-7/8, 4)
Dry engine (Overhaul)		6.1 (6-4/8, 5-3/8)

2WD : Engine Oil Pressure

INFOID:0000000013607992

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

Engine speed	Approximate discharge pressure*
Idle speed	More than 40 (0.408, 5.8)
2,000 rpm	More than 170 (1.734, 24.65)

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

AWD

AWD : Periodical Maintenance Specification

INFOID:0000000013607993

ENGINE OIL CAPACITY (APPROXIMATE)

Unit: ℓ (US qt, Imp qt)

Drain and refill	With oil filter change	5.4 (5-6/8, 4-6/8)
	Without oil filter change	5.2 (5-4/8, 4-5/8)
Dry engine (Overhaul)		6.6 (7, 5-6/8)

AWD : Engine Oil Pressure

INFOID:0000000013607994

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

Engine speed	Approximate discharge pressure*
Idle speed	More than 100 (1.02, 14.5)
2,000 rpm	More than 170 (1.734, 24.65)

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