SECTION EM
ENGINE MECHANICAL

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1.6L/2.0L TURBO ENGINE

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PRECAUTION

PRECAUTIONS

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

INFOID:0000000013536844

Risk of injury

There is a risk of injury caused by parts becoming projectiles if uncontrolled deployment of air bag or seat belt pre-tensioner occurs, or by storing air bag with the deployment side facing downwards. When scrapping air bag or seat belt pre-tensioner by means of controlled deployment, there is also a danger present if a sufficiently safe distance is not maintained, or if opening using cutting torches or other cutting tools, or due to smelting or if parts that are not yet triggered are exposed to a blaze or a smoldering fire at landfills.

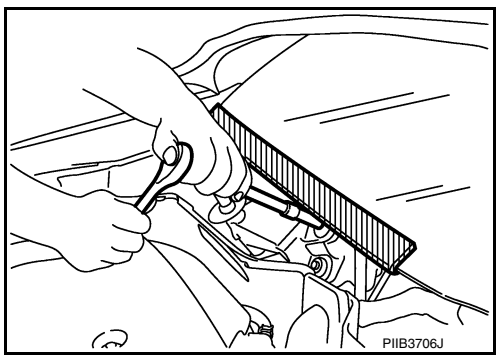
Safety instructions/precautions

- Removed air bag must always be stored with deployment side facing up.
- Acquisition, transportation, storage, testing and assembly work should only be performed or supervised by properly trained personnel.
- Install air bag or seat belt pre-tensioner immediately following retrieval from storage.
- Air bag and seat belt pre-tensioner must be protected from flying sparks, open fires and temperature exceeding 100°C (212°F).
- Never transport air bag and seat belt pre-tensioner in the passenger compartment. Store them securely in the luggage room of the vehicle in their original replacement part packaging and secure them so that they cannot slip around.
- Never allow air bag and seat belt pre-tensioner to come into contact with grease, oil, or cleaning agents.
- Perform system tests using approved testing equipment only, and only when the units are properly installed and the vehicle is unoccupied.
- Before the initial hookup of the battery or an external power supply, the ignition must be switched on and the vehicle unoccupied.
- Air bag and seat belt pre-tensioner that fall from a height of more than 0.5 m must be replaced.
- When scrapping by means of controlled deployment of air bag and seat belt pre-tensioner, a safe distance of at least 10 m must be maintained.
- Before starting work on air bag and seat belt pre-tensioner and work on components that are connected to air bag and seat belt pre-tensioner or require and intervention in their electric circuit (e.g. when removing the steering wheel):
  - Disconnect any external power sources (e.g. charger).
  - Disconnect and insulate ground line of battery
- Before starting bodywork in combination with welding or retrofitting, during which work is performed on uninsulated, current-carrying lines or require an intervention in their electric circuit (e.g. when removing the steering wheel):
  - Disconnect any external power sources (e.g. charger).
  - Disconnect and insulate ground line of battery.
  - During welding, disconnect plug connection and from control unit of air bag.
- When the air bag deploys, the pyrofuse activates and the power source from the battery is disconnected. This prevents possible fires caused by electric leakage after an accident occurs.

Precaution for Procedure without Cowl Top Cover

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When performing the procedure after removing cowl top cover, cover the lower end of windshield with urethane, etc to prevent damage to windshield.



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.

Parts Requiring Angle Tightening

INFOID:0000000013536847

- Use the angle wrench [SST: KV10112100] for the final tightening of the following engine parts:
- Camshaft sprocket (INT) bolt
- Cylinder head bolts
- Main bearing cap bolts
- Connecting rod cap bolts
- Crankshaft pulley bolt (No the angle wrench is required as bolt flange is provided with notches for angle tightening)
- Do not use a torque value for final tightening.
- The torque value for these parts are for a preliminary step.
- Ensure thread and seat surfaces are clean and coated with engine oil.

Precaution for Handling High Pressure Fuel System

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- High pressure fuel system components are between high pressure fuel pump and fuel injector.

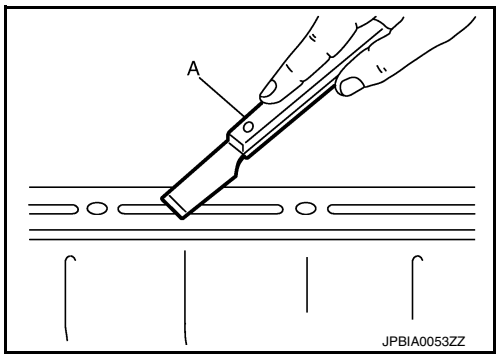
- Always release fuel pressure and never start the engine when performing removal and installation.
- When removing or installing parts without releasing fuel pressure, fuel may be splashed and, if fuel contacts skin or eyes, it may cause inflammation.

Liquid Gasket

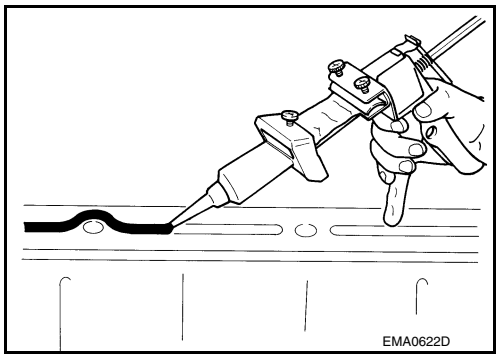
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LIQUID GASKET APPLICATION PROCEDURE

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.



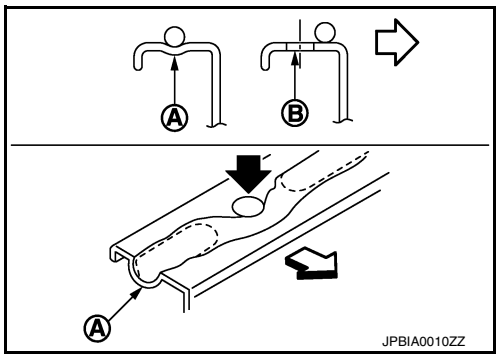
3. Attach liquid gasket tube to the tube presser (commercial service tool).
   Use Genuine Liquid Gasket or equivalent.
4. Apply liquid gasket without gaps to the specified location according to the specified dimensions.
   - If there is a groove for liquid gasket application, apply liquid gasket to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

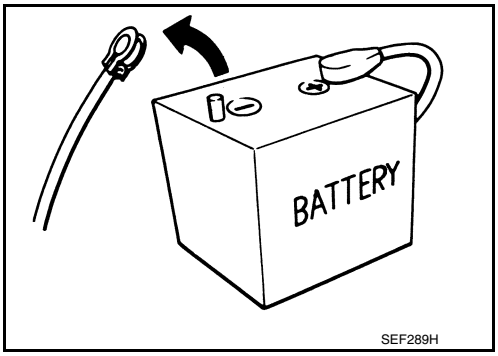
Precautions for Removing Battery Terminal

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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.

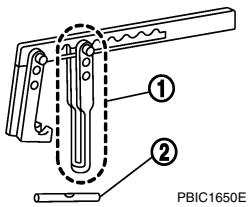
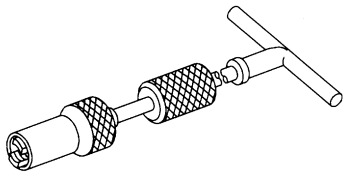
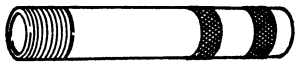
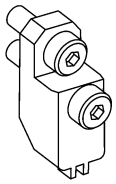
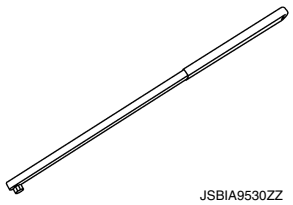
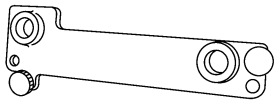
NOTE:
The removal of 12V battery may cause a DTC detection error.

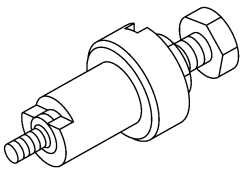
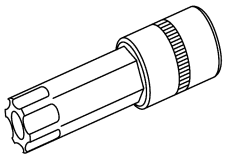
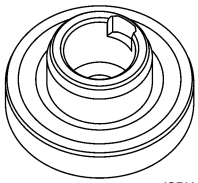
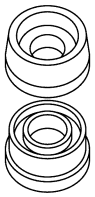
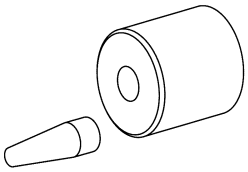
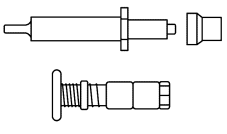
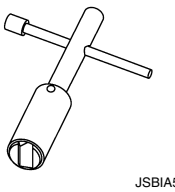
PREPARATION

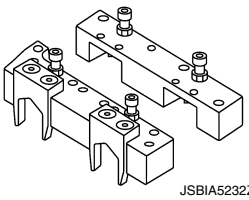
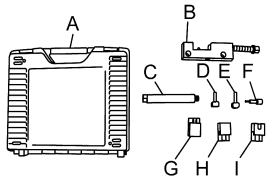
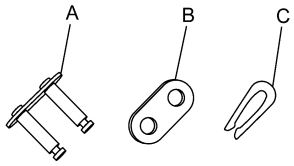
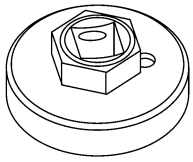
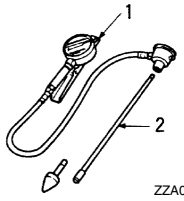
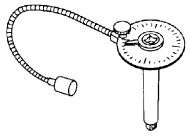
PREPARATION

Special Service Tool

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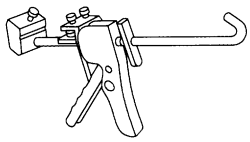
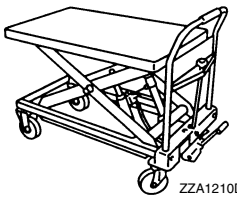
Tool number (DAIMLER tool No.) Tool name	Description
KV10116200 (DAIMLER tool No.—) Valve spring compressor 1. KV10115900 (DAIMLER tool No.—) Attachment 2. KV10109220 (DAIMLER tool No.—) Adapter  PBIC1650E	Disassembling and assembling valve mechanism Part ① is a component of KV10116200,but Part ② is not so.
KV10107902 (DAIMLER tool No.—) Valve oil seal puller  NT011	Removing valve oil seal
KV10115600 (DAIMLER tool No.—) Valve oil seal drift  ZZA0996D	Installing valve oil seal
KV105H0070 (DAIMLER tool No.270 589 02 40 00) Stopper flywheel  JSBIA9890ZZ	To lock drive plate for a removed transaxle.
KV105H0390 (DAIMLER tool No.270 589 00 07 00) Assembly lever  JSBIA9530ZZ	Loosen drive belt auto-tensioner.
KV105H0600 (DAIMLER tool No.270 589 01 33 00) Puller  JSBIA9895ZZ	To pull out the gliding rails pins. **NOTE:** In combination with the spindle (KV115H0420).

Tool number (DAIMLER tool No.) Tool name		Description
KV105H0420 (DAIMLER tool No.270 589 00 33 02) Spindle	 JSBIA9893ZZ	For the extractor slide rail pins. **NOTE:** In combination with puller (KV115H0600).
KV105H0090 (DAIMLER tool No.271 589 00 10 00) Socket wrench	 JSBIA5226ZZ	Torx T100 socket with drilled hole for releasing and bolting on the central valve of the camshaft adjuster.
KV105H0400 (DAIMLER tool No.270 589 00 15 00) Drift	 JSBIA9894ZZ	Insertion tool for inserting the front oil seal.
KV105H0100 (DAIMLER tool No.271 589 00 43 00) Crankshaft seal installation	 JSBIA5218ZZ	Insertion tool for inserting the rear oil seal.
KV105H0110 (DAIMLER tool No.272 589 00 43 00) Injector seal installation	 JSBIA5227ZZ	Installing fuel injector seal ring.
KV105H0160 (DAIMLER tool No.278 589 01 15 00) Drift seal installation	 JSBIA5229ZZ	For indentation of the sealing package for the rail.
KV105H0170 (DAIMLER tool No.278 589 00 33 00) Injector puller	 JSBIA5230ZZ	For pulling out individual injectors.

Tool number (DAIMLER tool No.) Tool name		Description
KV105H0210 (DAIMLER tool No.270 589 01 61 00) Camshaft holder	 JSBIA5232ZZ	For holding down and fixing in place of the camshaft in TDC.
KV105H0530 (DAIMLER tool No.276 589 00 39 00) Rivet press tool • A: Case • B: Base carrier • C: Handle • D: Thrust piece A2 • E: Thrust piece B2 • F: Thrust piece C2 • G: Mount A1 • H: Mount B1 • I: Mount C1	 JSBIB0189ZZ	For riveting and compacting the timing chain. **NOTE:** Only for INA timing chains.
KV105H0510 (DAIMLER tool No.271 589 09 63 00) Assembly element • A: Link • B: Plate • C: Lock	 JSBIB0190ZZ	For connecting the repair chain with the installed chain when changing the timing chain. **NOTE:** The assembly element must be removed from the engine after repairs have been completed.
KV105H0450 (DAIMLER tool No.270 589 01 07 00) Socket wrench bit	 JSBIA9892ZZ	Socket to turn the camshaft.
1:EG15050001 (DAIMLER tool No.—) Compression gauge set 2:EG15050300 (DAIMLER tool No.—) Compression gauge adapter	 ZZA0008D	Checking compression pressure.
KV10112100 (DAIMLER tool No.—) Angle wrench	 ZZA0120D	Tightening bolts for main bearing cap, cylinder head, etc.

Commercial Service Tool

INFOID:0000000013536852

Tool name	Description
Tube presser  NT052	Pressing the tube of liquid gasket
Manual lift table caddy  ZZA1210D	Removing and installing engine

Lubricant or/and Sealant

INFOID:0000000013536853

Name	Description	Note
Cleaner from package	Air cleaner housing cover	(Adolf Würth GmbH & Co.KG), or equivalent
Antifriction paste, rubber parts 2.5 kg, DB supply specification 6867.00	Air cleaner and Air duct	Antifriction paste, rubber parts 2.5 kg, DB supply specification 6867.00 or equivalent
Loctite 7200	• Oil pan • Cylinder head cover • Oil seal	Loctite 7200 or equivalent
Loctite 7063 Cleaning spray	• Oil pan • Cylinder head cover • Oil seal	Loctite 7063 Cleaning spray, or equivalent
Loctite 5970 sealant	• Oil pan • Cylinder head cover • Oil seal	Loctite 5970 sealant, or equivalent

BASIC INSPECTION

COMPRESSION PRESSURE

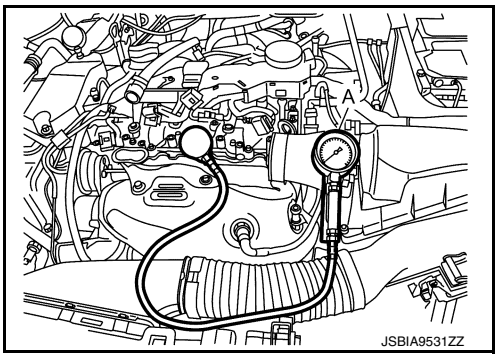
Inspection

INFOID:0000000013536854

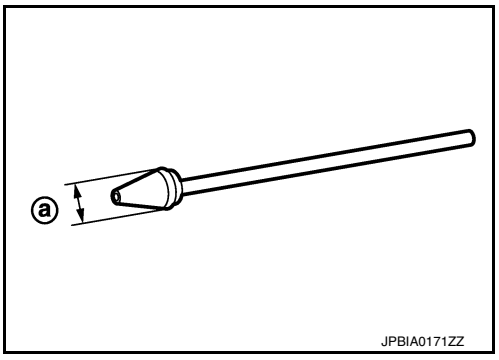
1. Warm up engine thoroughly. Then, stop it.
2. Remove engine cover. Refer to EM-20, "Removal and Installation".
3. Check DTC using CONSULT.
   NOTE:
   Before starting the work procedure, check if there is already-detected DTC to distinguish it from DTC detected during fuel pressure release.
4. Release fuel pressure as follows:

a. Remove fuel pump fuse.
b. Start the engine.
c. After engine stalls, crank it two or three times to release all fuel pressure.
d. Turn ignition switch OFF.

5. Remove ignition coil and spark plug from each cylinder. Refer to EM-18, "Removal and Installation".
6. Connect engine tachometer (not required in use of CONSULT).
7. Install compression gauge set [SST: EG15050001] (A) with compression gauge adapter [SST: EG15050300] onto spark plug hole.



- Use compression tester whose end ⓐ (rubber portion) is smaller than 20 mm (0.79 in) in diameter. Otherwise, it may be caught by cylinder head during removal.



8. With accelerator pedal fully depressed, turn ignition switch to “START” for cranking. When the gauge pointer stabilizes, read the compression pressure and engine rpm. Perform these steps to check each cylinder.

Compression pressure : Refer to EM-102, "General Specification".

CAUTION:
Always use a fully changed battery to obtain specified engine speed.
- If the engine speed is out of specified range, check battery liquid for proper gravity. Check engine speed again with normal battery gravity.
- If compression pressure is below minimum value, check valve clearances and parts associated with combustion chamber (Valve, valve seat, piston, piston ring, cylinder bore, cylinder head, cylinder head gasket). After the checking, measure the compression pressure again.

- If some cylinder has low compression pressure, pour small amount of engine oil into the spark plug hole of the cylinder to re-check it for compression.
  - If the added engine oil improves the compression, piston rings may be worn out or damaged. Check piston rings and replace if necessary.
  - If the compression pressure remains at low level despite the addition of engine oil, valves may be malfunctioning. Check valves for damage. Replace valve or valve seat accordingly.
- If two adjacent cylinders have respectively low compression pressure and their compression remains low even after the addition of engine oil, gaskets are leaking. In such a case, replace cylinder head gaskets.

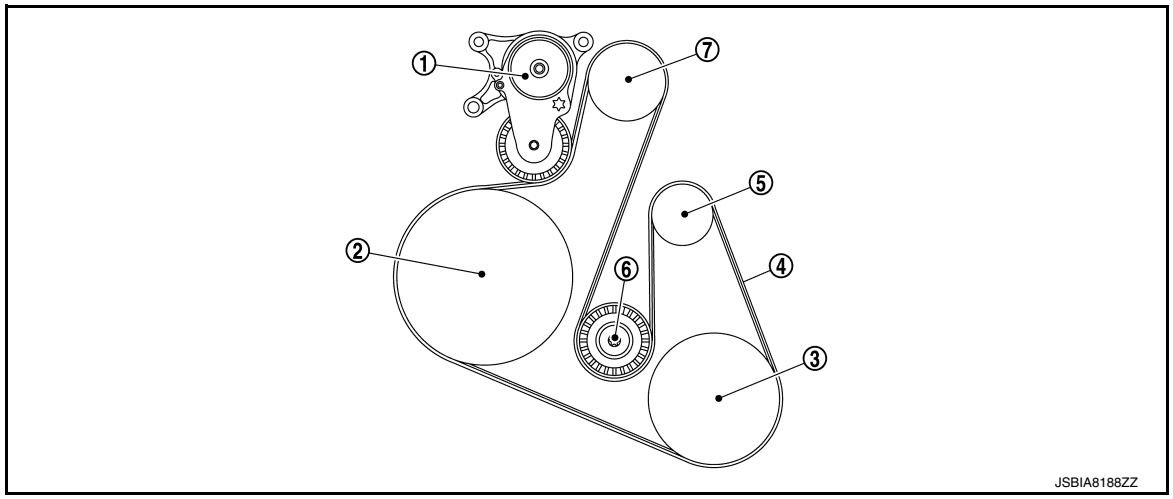
9. After inspection is completed, install removed parts.
10. Check DTC and erase DTC.
    NOTE:
    Erase DTC detected while releasing fuel pressure.
11. Start engine, and confirm that engine runs smoothly.

PERIODIC MAINTENANCE

DRIVE BELT

Exploded View

INFOID:0000000013536855



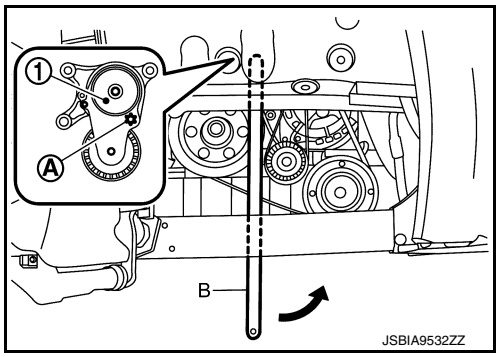
① Drive belt auto-tensioner ② Crankshaft pulley ③ A/C compressor
④ Drive belt ⑤ Alternator ⑥ Idler pulley
⑦ Water pump

Removal and Installation

INFOID:0000000013536856

REMOVAL

1. Remove front fender protector. Refer to EXT-41, "FENDER PROTECTOR : Removal and Installation".
2. Hold the torx part Ⓐ of drive belt auto-tensioner ① with a assembly lever [SST: KV105H0390 (270 589 00 07 00)] (B) securely. Then move the assembly lever handle in the direction of arrow (loosening direction of tensioner).
   CAUTION:
   Avoid placing hand in a location where pinching may occur if the holding tool accidentally comes off.
3. Remove drive belt, and then detention drive belt auto-tensioner.

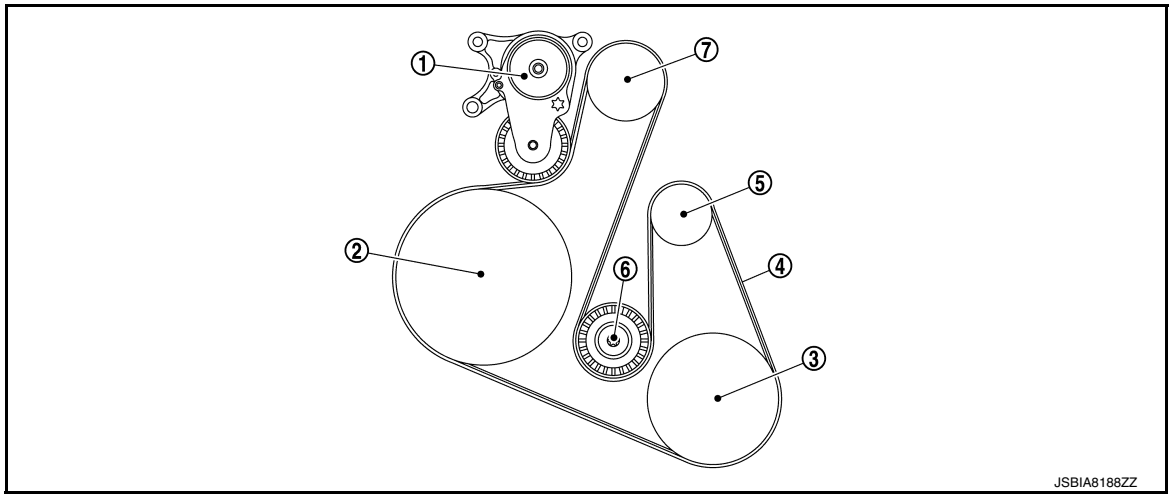


INSTALLATION

1. Set drive belt except drive belt auto-tensioner.
   CAUTION:
   - **Do not use belt wax or similar products.**
   - **Check for engine oil, working fluid and engine coolant are not adhered to drive belt and each pulley groove.**
2. Apply tension drive belt auto-tensioner, and set drive belt.
   CAUTION:
   Confirm drive belt is completely set to pulleys.
3. Turn crankshaft pulley clockwise several times to equalize tension between each pulley.

Inspection

INFOID:0000000013536857



① Drive belt auto-tensioner ② Crankshaft pulley ③ A/C compressor
④ Drive belt ⑤ Alternator ⑥ Idler pulley
⑦ Water pump

CAUTION:
Never use the indicator of drive belt auto-tensioner.
NOTE:
- Visually check entire drive belt for wear, damage or cracks.
- Replace drive belt if belt is damaged.

Adjustment

INFOID:0000000013536858

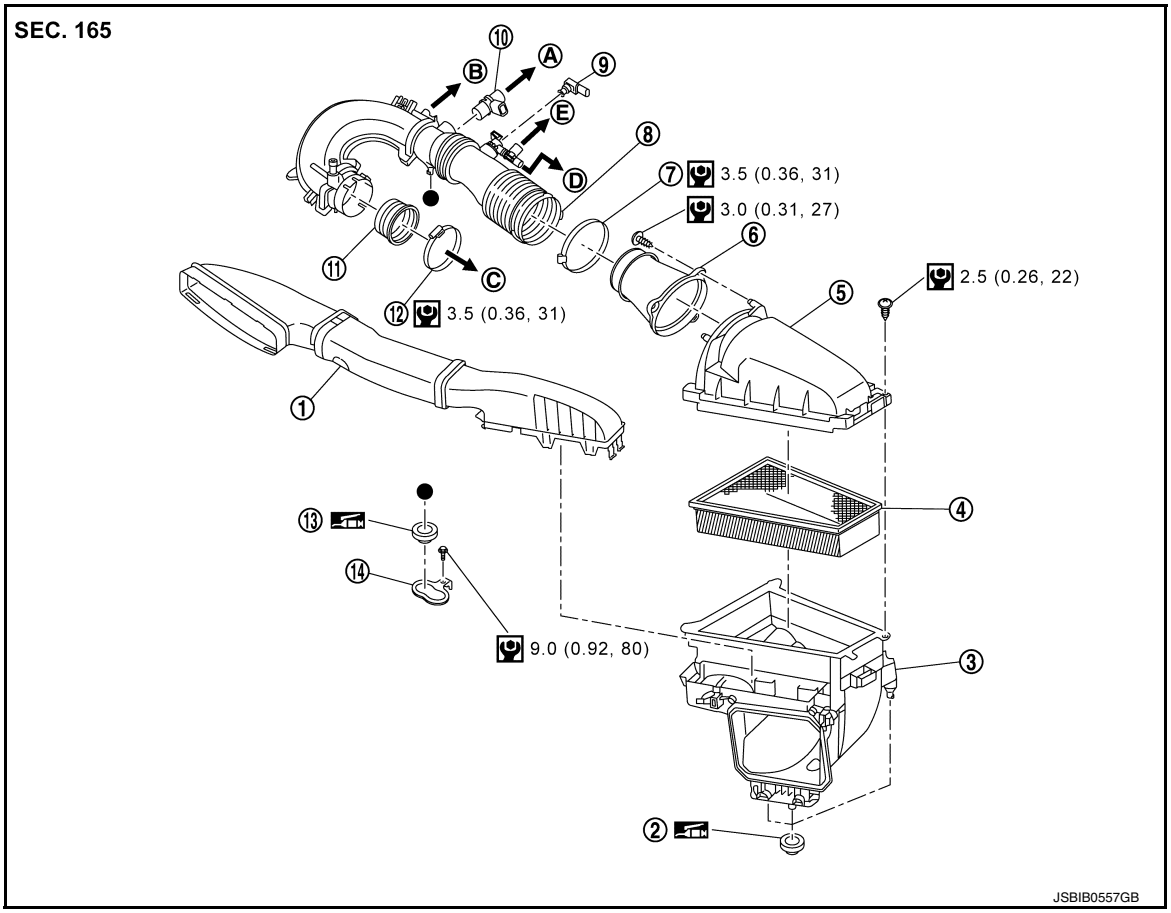
Refer to : EM-102, "Drive Belt".

AIR CLEANER FILTER

Exploded View

INFOID:0000000013536859

Except for MEXICO



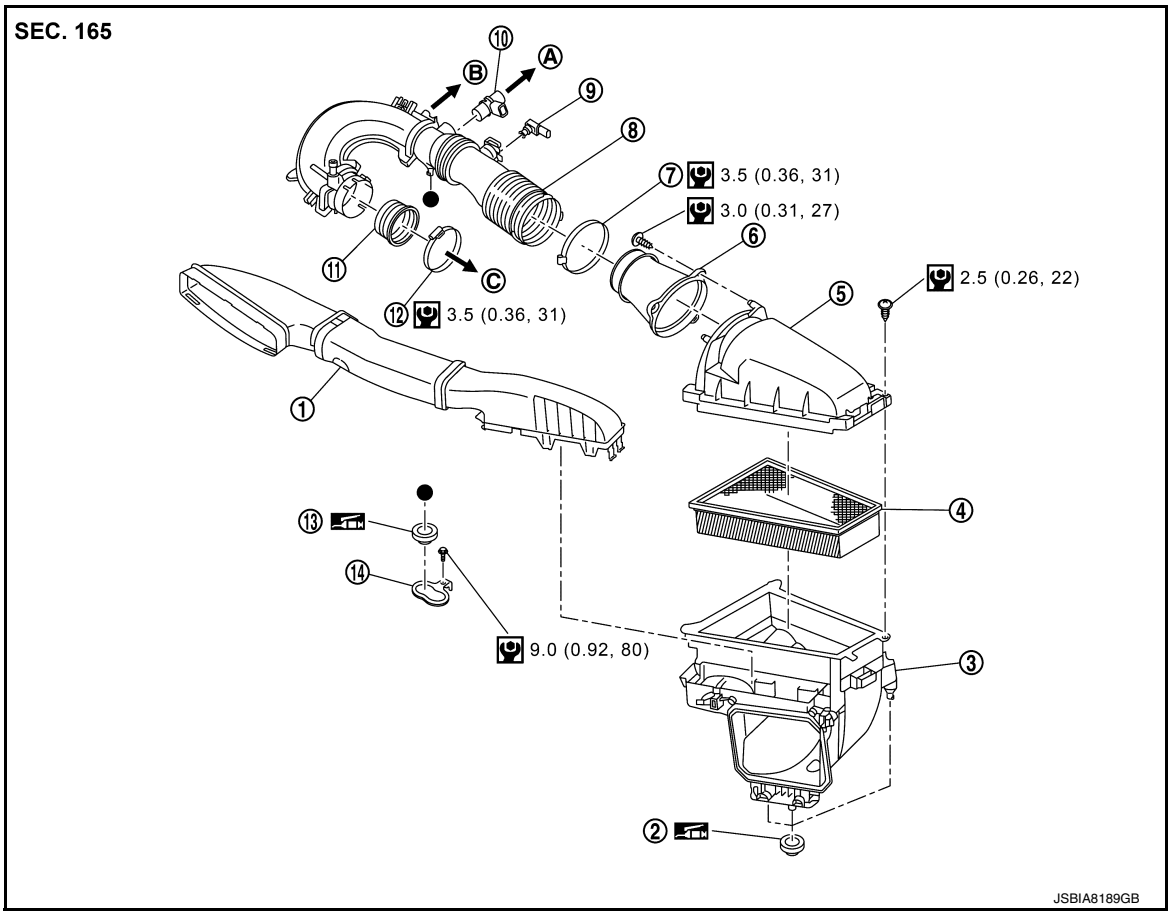
①	Air duct (dust side)	②	Mounting rubber	③	Air cleaner housing
④	Air cleaner filter element	⑤	Air cleaner housing cover	⑥	Air duct
⑦	Clamp	⑧	Air duct (turbocharger side)	⑨	Pressure sensor downstream of air filter
⑩	Full-load operation vent line heater element	⑪	Sealing ring	⑫	Clamp
⑬	Mounting rubber	⑭	Bracket		
Ⓐ	To full-load operation vent line	Ⓑ	To vent line	Ⓒ	To exhaust manifold and the turbocharger assembly
Ⓓ	To purge line (intake pipe side)	Ⓔ	To purge line (charge air manifold side)		

: N·m (kg-m, in-lb)

: Should be lubricated with antifriction paste.

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

For MEXICO



①	Air duct (dust side)	②	Mounting rubber	③	Air cleaner housing
④	Air cleaner filter element	⑤	Air cleaner housing cover	⑥	Air duct
⑦	Clamp	⑧	Air duct (turbocharger side)	⑨	Pressure sensor downstream of air filter
⑩	Full-load operation vent line heater element	⑪	Sealing ring	⑫	Clamp
⑬	Mounting rubber	⑭	Bracket		
Ⓐ	To full-load operation vent line	Ⓑ	To vent line	Ⓒ	To exhaust manifold and the turbocharger assembly

: N·m (kg-m, in-lb)

: Should be lubricated with antifriction paste.

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

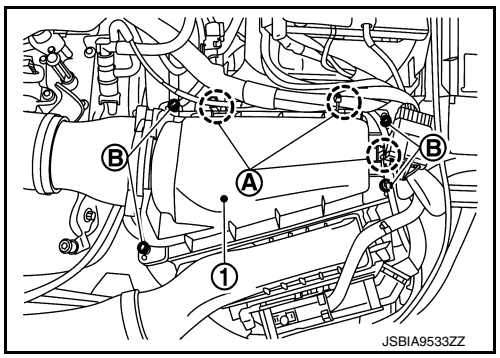
Removal and Installation

INFOID:0000000013536860

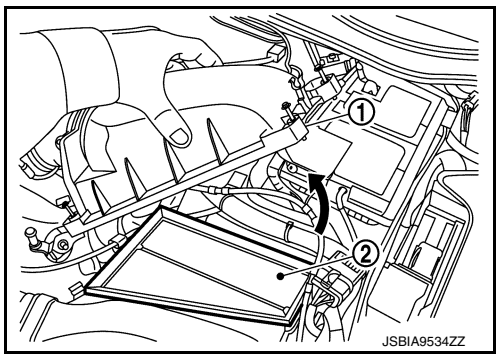
REMOVAL

1. Remove engine cover. Refer to EM-20, "Removal and Installation"

2. Remove vacuum tube from clamps Ⓐ.
3. Loosen air cleaner housing cover mounting bolt Ⓑ.
   NOTE:
   The bolts remain the air cleaner housing cover ①.



4. Pull up air cleaner housing cover ① and remove air cleaner filter element ②.



INSTALLATION

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

NOTE:

Clean the inside of air cleaner housing and the air cleaner housing cover.

Inspection

INFOID:0000000013536861

INSPECTION AFTER REMOVAL

Examine with eyes that there is no stain, clogging, or damage on air cleaner filter element.

- Remove dusts (such as dead leafs) on air cleaner filter element surface and inside cleaner case.
- To clean air cleaner filter element, blow it from intake manifold side towards air intake side to remove trash or dust.
- If clogging or damage is observed, replace the air cleaner filter element.

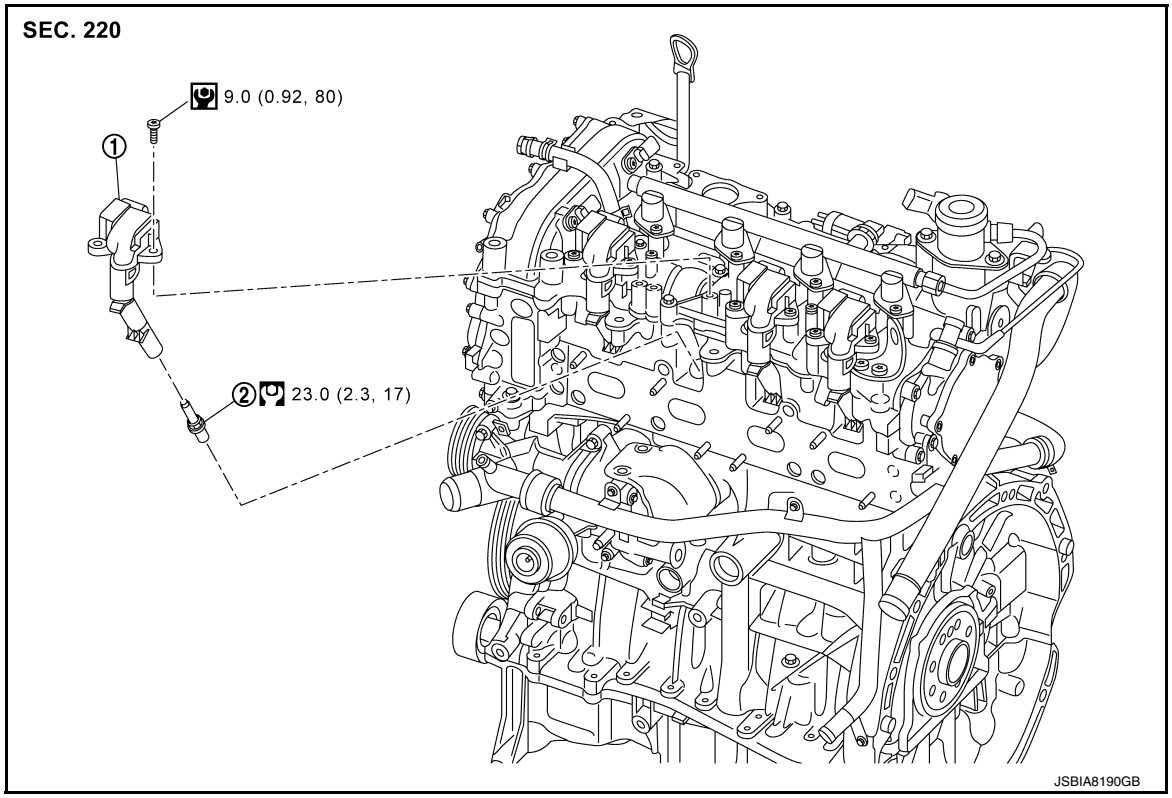
MAINTENANCE INTERVAL

Refer to MA-8, "FOR NORTH AMERICA : Introduction of Periodic Maintenance" (For NORTH AMERICA) or MA-10, "FOR MEXICO : Periodic Maintenance" (For MEXICO).

SPARK PLUG

Exploded View

INFOID:0000000013536862



① Ignition coil ② Spark plug

: N·m (kg-m, ft-lb)

: N·m (kg-m, in-lb)

Removal and Installation

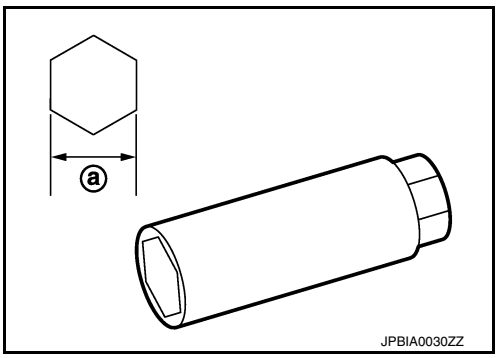
INFOID:0000000013536863

REMOVAL

1. Remove engine cover. Refer to EM-20, "Removal and Installation".
2. Remove air duct (turbocharger side). Refer to EM-23, "Removal and Installation".
3. Remove ignition coil. Refer to EM-58, "Removal and Installation".
4. Remove spark plug with spark plug wrench (commercial service tool).

ⓐ: **14 mm (0.55 in)**

CAUTION:
- **Never drop or shock spark plug.**
- **Never disassemble ignition coil.**



INSTALLAITON

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:0000000013536864

INSPECTION AFTER REMOVAL

Use standard type spark plug for normal condition.

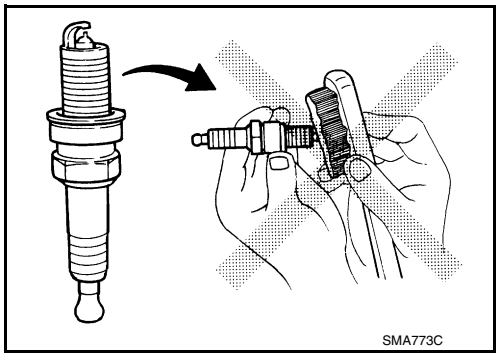
Spark plug (standard) : Refer to EM-102, "Spark Plug".

Visually check the electrode for dirt and wear and the insulator for burning.

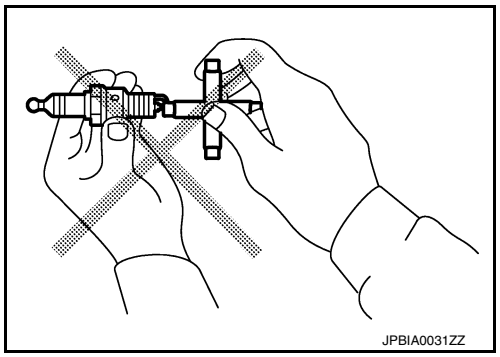
CAUTION:

- **Never drop or shock spark plug.**
- **Never use wire brush for cleaning.**
- **If plug tip is covered with carbon, spark plug cleaner may be used.**

Cleaner air pressure:	**Less than 588 kPa (6 kg/cm^2, 85 psi)**
Cleaning time:	**Less than 20 seconds**



- **Checking and adjusting plug gap is not required between change intervals.**

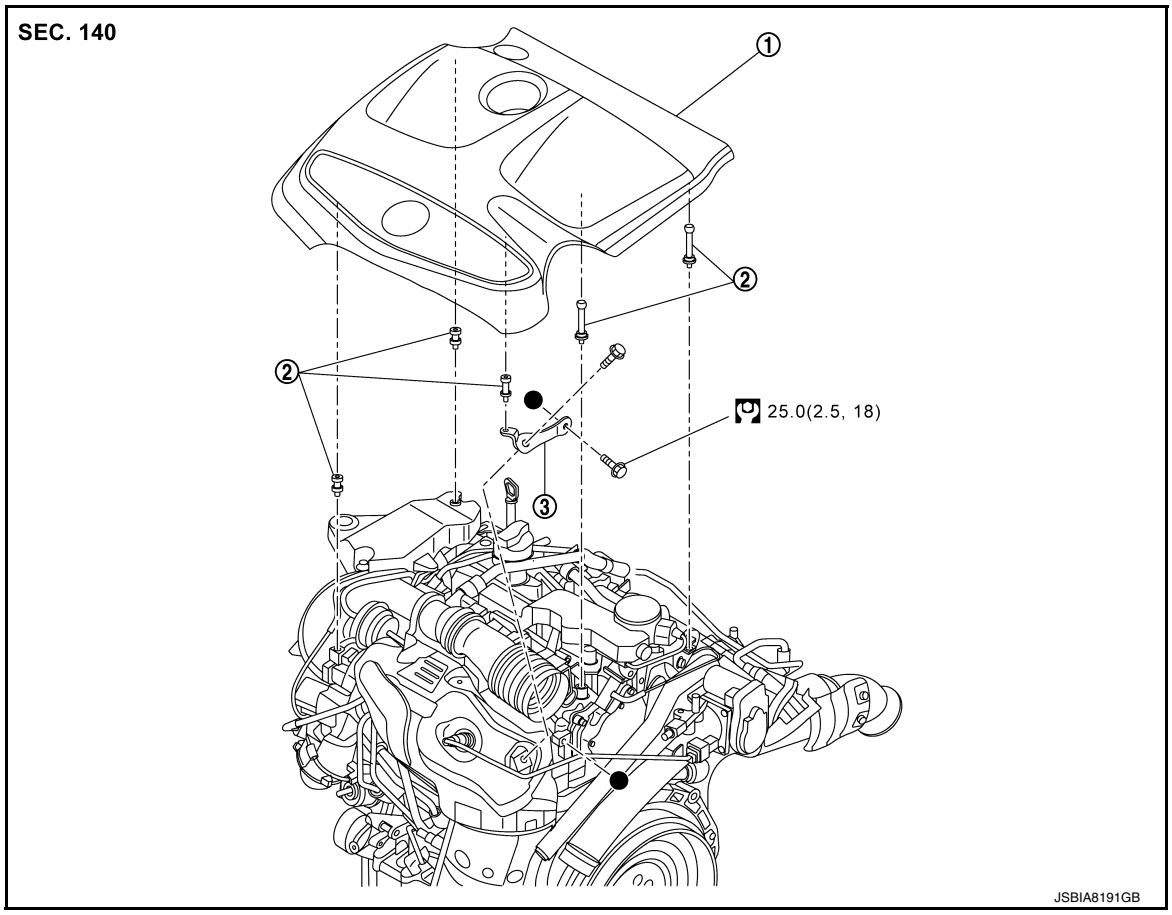


REMOVAL AND INSTALLATION

ENGINE COVER

Exploded View

INFOID:0000000013536865



① Engine cover ② Pin ③ Bracket

: N·m (kg-m, ft-lb)

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

Removal and Installation

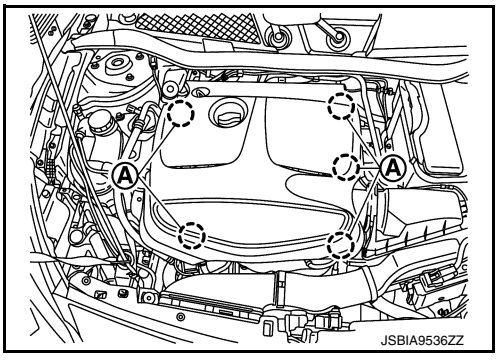
INFOID:0000000013536866

REMOVAL

CAUTION:

Handle with care not to damage the engine cover.

1. Lift up on engine cover firmly to dislodge snap fit mounts Ⓐ.
2. Remove engine cover.
3. Remove bracket, if necessary.



INSTALLATION

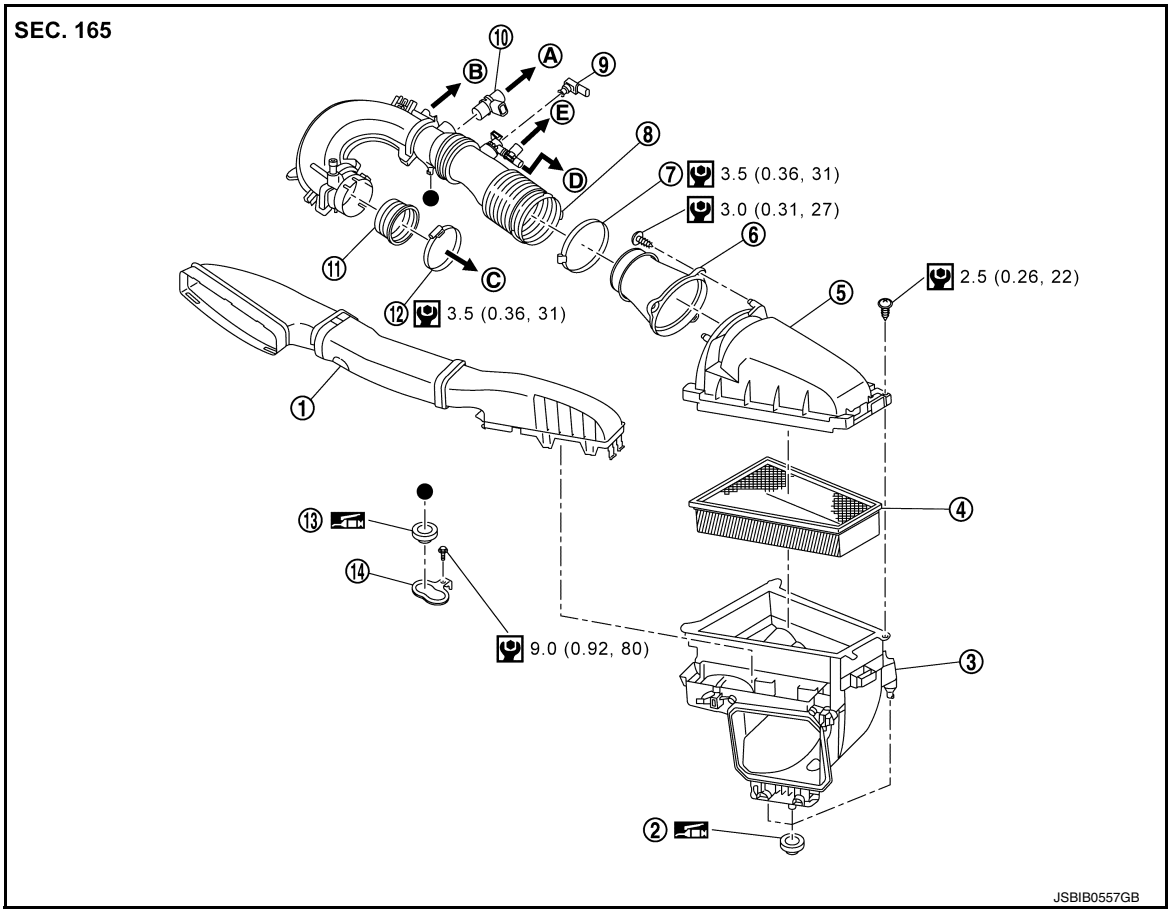
Install in the reverse order of removal.

AIR CLEANER AND AIR DUCT

Exploded View

INFOID:0000000013536867

Except for MEXICO



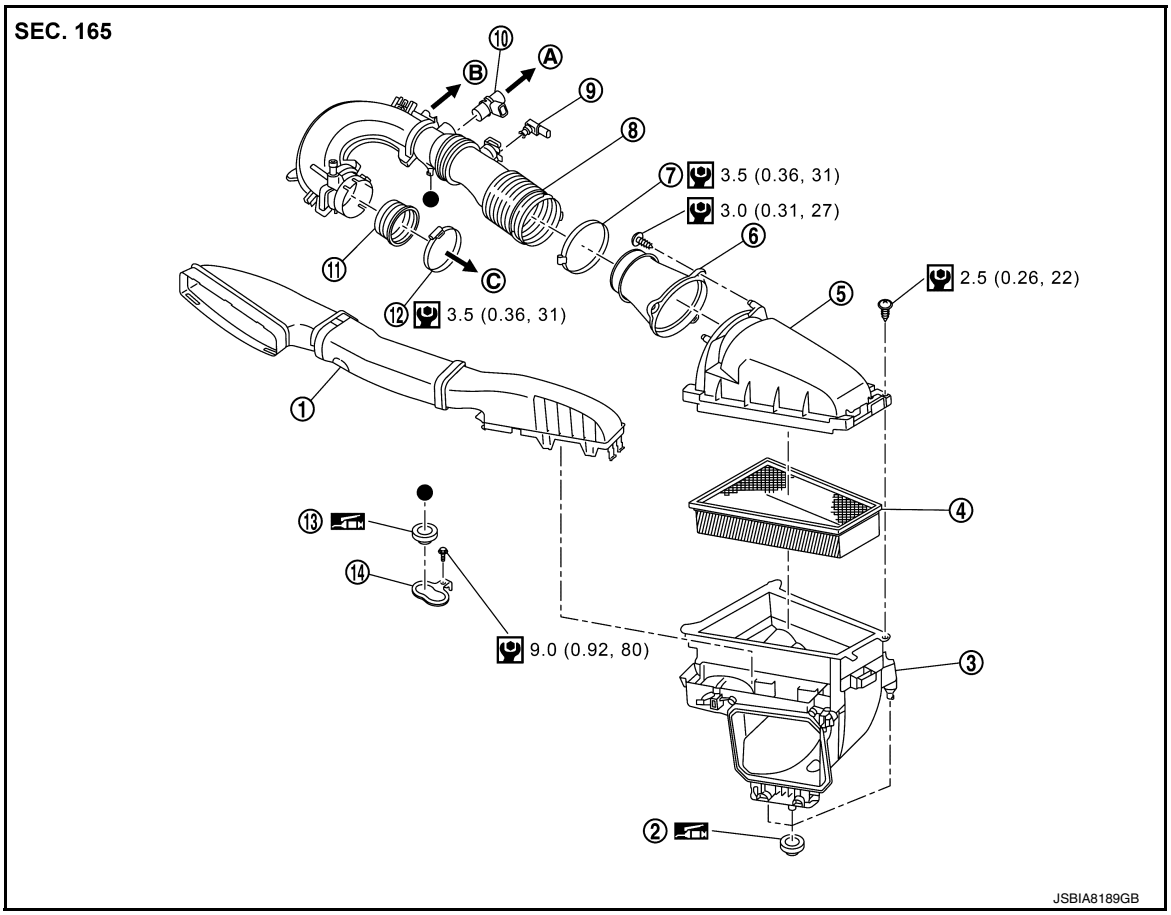
①	Air duct (dust side)	②	Mounting rubber	③	Air cleaner housing
④	Air cleaner filter element	⑤	Air cleaner housing cover	⑥	Air duct
⑦	Clamp	⑧	Air duct (turbocharger side)	⑨	Pressure sensor downstream of air filter
⑩	Full-load operation vent line heater element	⑪	Sealing ring	⑫	Clamp
⑬	Mounting rubber	⑭	Bracket		
Ⓐ	To full-load operation vent line	Ⓑ	To vent line	Ⓒ	To exhaust manifold and the turbocharger assembly
Ⓓ	To purge line (intake pipe side)	Ⓔ	To purge line (charge air manifold side)		

: N·m (kg-m, in-lb)

: Should be lubricated with antifriction paste.

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

For MEXICO



① Air duct (dust side)	② Mounting rubber	③ Air cleaner housing
④ Air cleaner filter element	⑤ Air cleaner housing cover	⑥ Air duct
⑦ Clamp	⑧ Air duct (turbocharger side)	⑨ Pressure sensor downstream of air filter
⑩ Full-load operation vent line heater element	⑪ Sealing ring	⑫ Clamp
⑬ Mounting rubber	⑭ Bracket	
Ⓐ To full-load operation vent line	Ⓑ To vent line	Ⓒ To exhaust manifold and the turbocharger assembly

: N·m (kg-m, in-lb)

: Should be lubricated with antifriction paste.

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

Removal and Installation

INFOID:0000000013536868

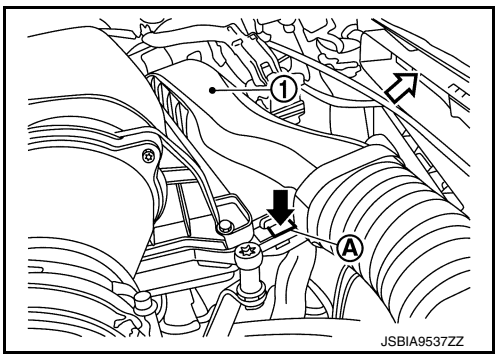
REMOVAL

Air Cleaner Housing Assembly

1. Remove engine cover. Refer to EM-20, "Removal and Installation".

2. Push (⬅) pawl Ⓐ and remove air duct (dust side) ① upward.

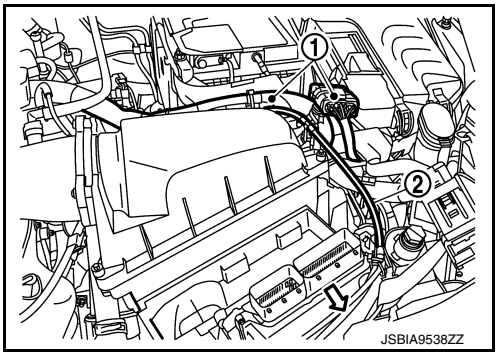
⇦ : Vehicle front



3. Remove harnesses ① and vacuum tube ② from air cleaner housing assembly.

⇦ : Vehicle front

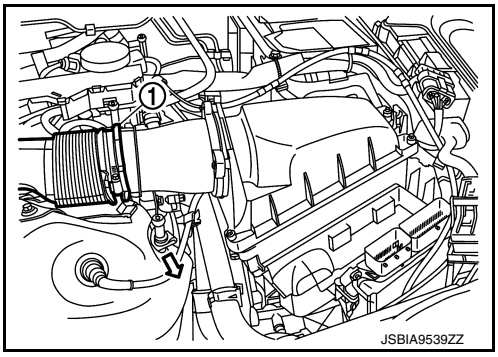
4. Remove ECM. Refer to EC-963, "Removal and Installation".



5. Remove air duct (turbocharger side) ①.

⇦ : Vehicle front

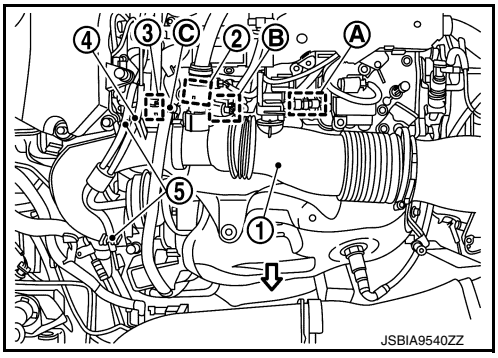
6. Pull air cleaner housing assembly upward and remove it.



Air Duct (Turbocharger Side)

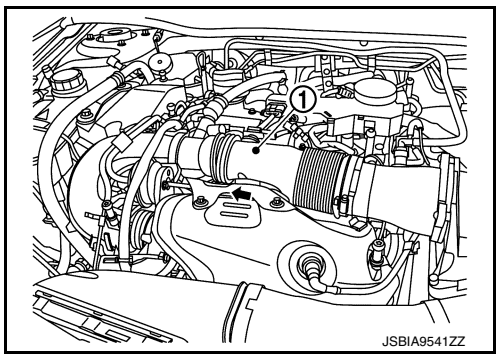
1. Remove air cleaner housing cover. Refer to EM-16, "Removal and Installation".
2. Remove parts and connector from the air duct (turbocharger side) ① shown in the figure.

Ⓐ : Pressure sensor downstream of air filter harness connector
Ⓑ : Full-load operation vent line heater element harness connector
Ⓒ : Harness clip
② : Full-load operation vent line
③ : Vent line
④ : Vacuum hose
⑤ : Vacuum hose
⇦ : Vehicle front

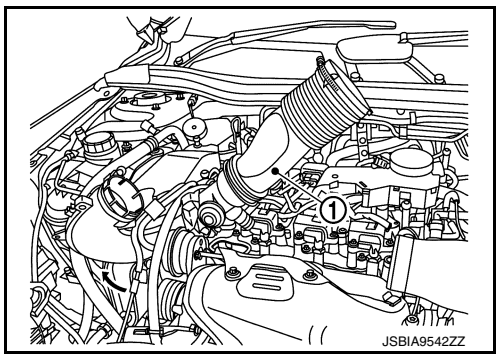


3. Loosen clamps.
4. Remove air duct (turbocharger side) with the following procedure.

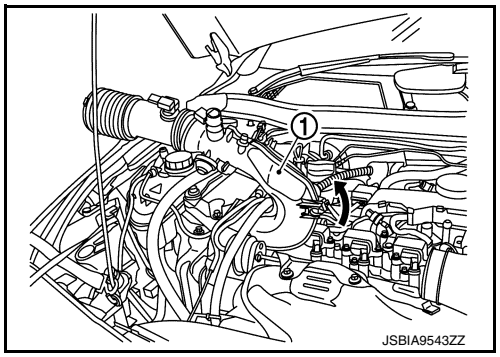
a. Slide air duct (turbocharger side) ① in the direction of arrow.



b. Turn air duct (turbocharger side) ① in the direction of arrow.



c. Remove air duct (turbocharger side) ① in the direction of arrow.



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".
- Clean the inside of air cleaner housing and the air cleaner housing cover.
- Apply antifriction paste, rubber parts 2.5 kg, DB supply specification 6867.00 to mounting rubber.

Inspection

INFOID:0000000013536869

INSPECTION AFTER REMOVAL

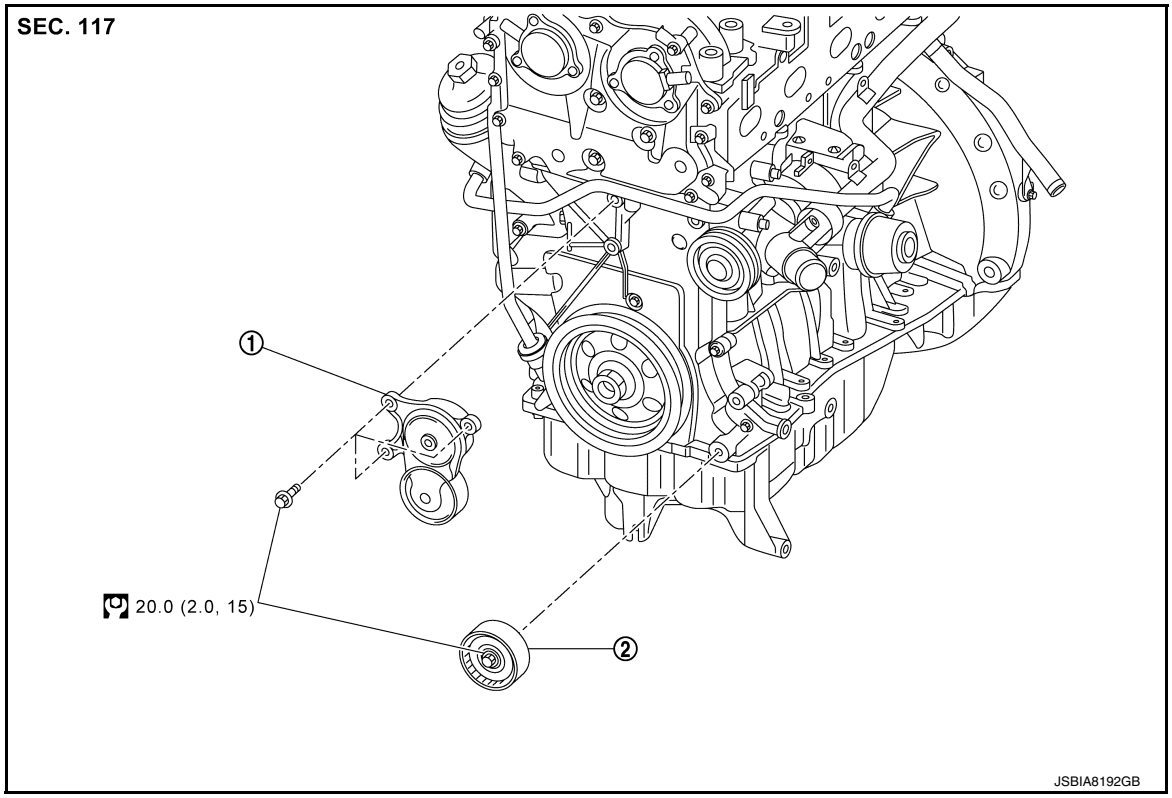
Inspect air duct and for crack or tear.

- If anything found, replace air duct.

DRIVE BELT AUTO TENSIONER AND IDLER PULLEY

Exploded View

INFOID:0000000013536870



① Drive belt auto-tensioner ② Idler pulley

: N·m (kg-m, ft-lb)

Removal and Installation

INFOID:0000000013536871

CAUTION:
- **Never disassemble drive belt auto-tensioner.**
- **Never run the engine without the drive belt to avoid damaging the crankshaft pulley.**

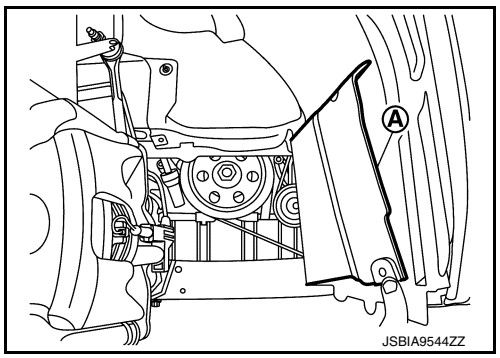
REMOVAL

Drive Belt Auto-tensioner

1. Remove drive belt. Refer to EM-13, "Removal and Installation".
2. Support the bottom surface of engine using a transmission jack, and then remove the engine mount. Refer to EM-95, "Removal and Installation".
   CAUTION:
   When using the jack, apply a piece of wood to the oil pan to protect the bottom of engine from being scratched.
3. Remove drive belt auto-tensioner.

Idler Pulley

1. Open service flap Ⓐ on fender protector.
2. Remove drive belt from idler pulley. Refer to EM-13, "Removal and Installation".
3. Remove idler pulley.



INSTALLATION

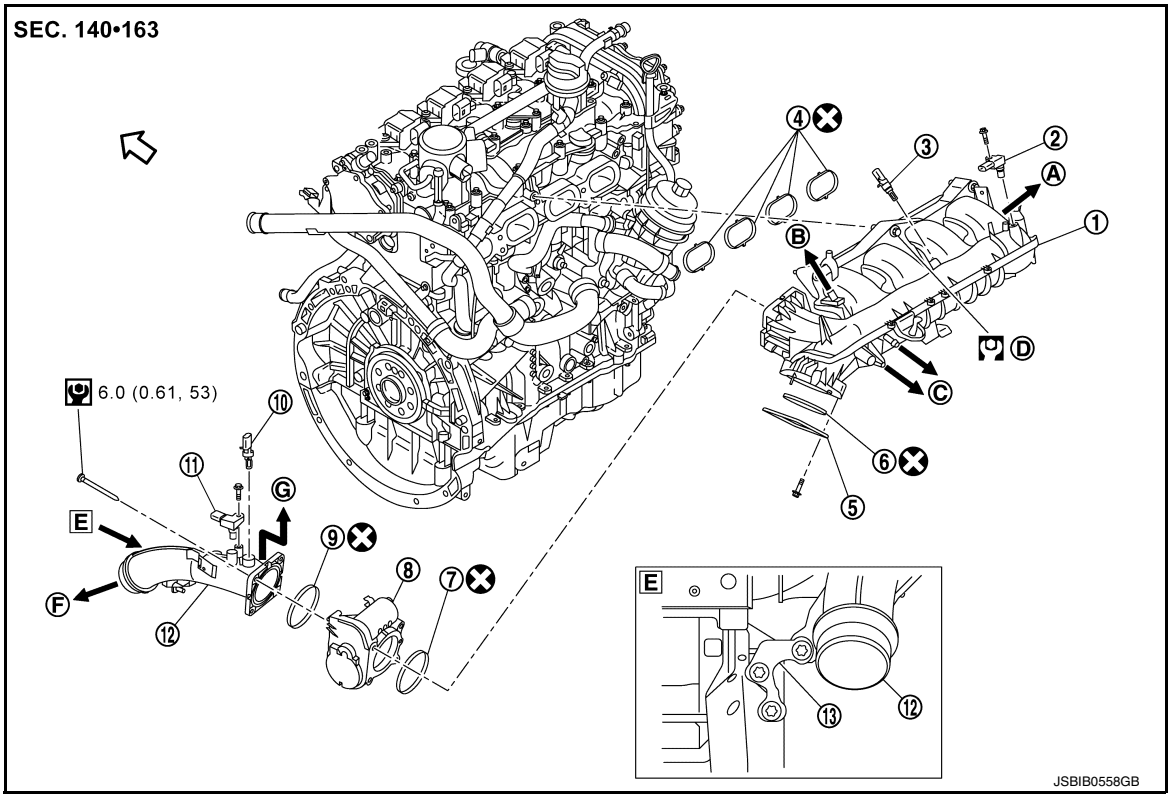
Install in the reverse order of removal.

CHARGE AIR MANIFOLD

Exploded View

INFOID:0000000013536872

Except for MEXICO



① Charge air manifold	② Pressure sensor downstream of throttle valve	③ Charge air temperature sensor downstream of throttle valve
④ Gasket	⑤ Charge air manifold cover	⑥ Gasket
⑦ Gasket	⑧ Throttle valve actuator	⑨ Gasket
⑩ Charge air temperature sensor upstream of throttle valve	⑪ Pressure sensor upstream of throttle valve	⑫ Intake pipe
⑬ Bracket		
Ⓐ To boost pressure control vacuum transducer	Ⓑ To vacuum pump	Ⓒ To ventilation system
Ⓓ Comply with the installation procedure when tightening. Refer to EM-29, "Removal and Installation".	Ⓔ View Ⓔ	Ⓕ To charge air cooler
Ⓖ To ventilation system		

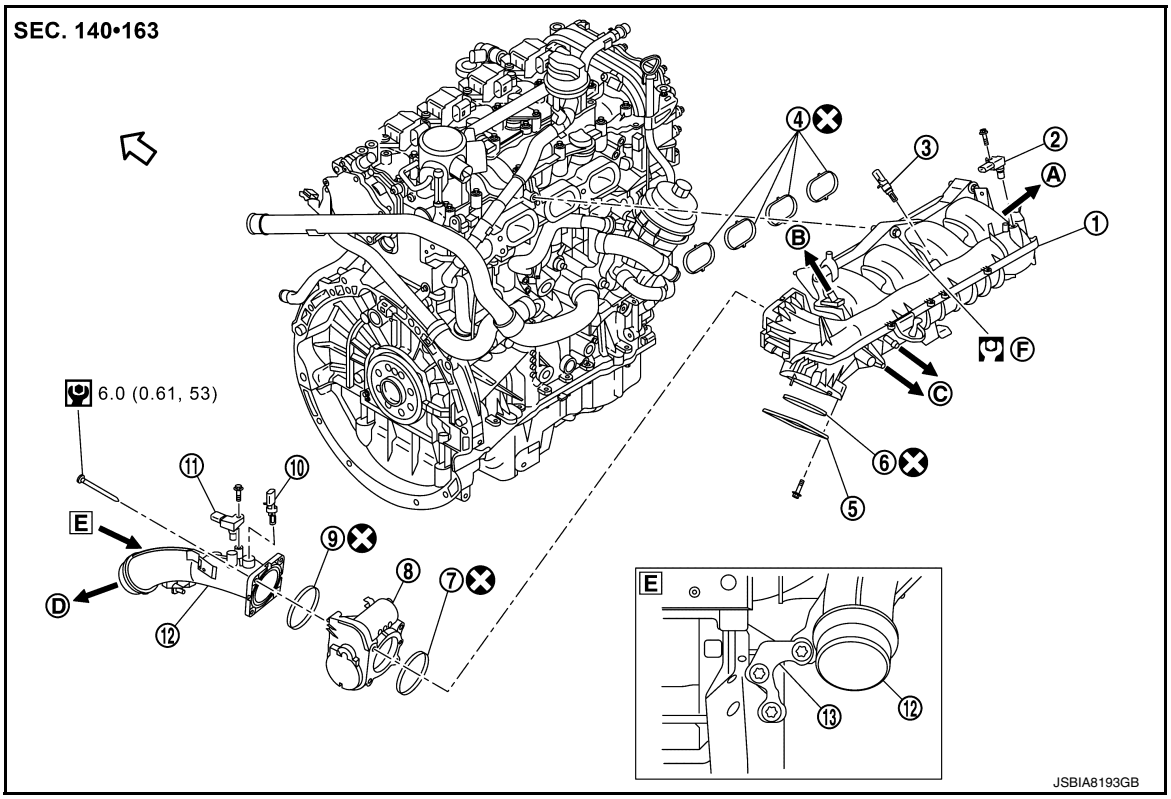
⇦ : Vehicle front

⊗ : Always replace after every disassembly.

: N·m (kg-m, ft-lb)

: N·m (kg-m, in-lb)

For MEXICO



① Charge air manifold	② Pressure sensor downstream of throttle valve	③ Charge air temperature sensor downstream of throttle valve
④ Gasket	⑤ Charge air manifold cover	⑥ Gasket
⑦ Gasket	⑧ Throttle valve actuator	⑨ Gasket
⑩ Charge air temperature sensor upstream of throttle valve	⑪ Pressure sensor upstream of throttle valve	⑫ Intake pipe
⑬ Bracket		
Ⓐ To boost pressure control vacuum transducer	Ⓑ To vacuum pump	Ⓒ To ventilation system
Ⓓ To charge air cooler	Ⓔ View Ⓔ	Ⓕ Comply with the installation procedure when tightening. Refer to EM-29, "Removal and Installation".

⇦ : Vehicle front

⊗ : Always replace after every disassembly.

: N·m (kg-m, ft-lb)

: N·m (kg-m, in-lb)

Removal and Installation

INFOID:0000000013536873

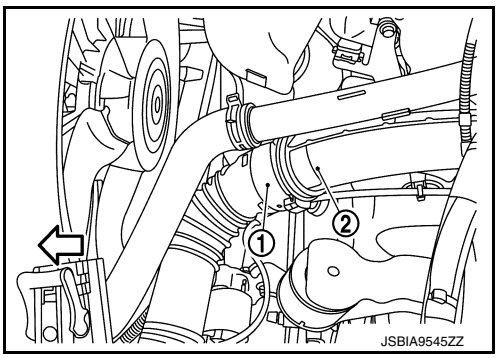
REMOVAL

Throttle Valve Actuator

1. Remove air cleaner housing assembly. Refer to EM-23, "Removal and Installation".

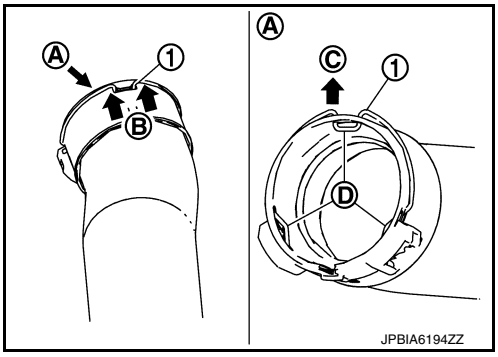
2. Disconnect charge air tube ① from intake pipe ② with the following procedure.

⇦ : Vehicle front



a. Insert a suitable tool between charge air tube and retainer ①.

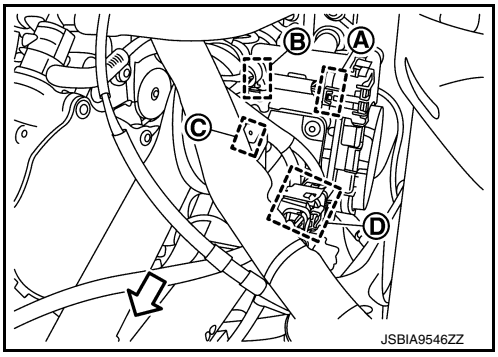
Ⓐ : View Ⓐ
Ⓑ : Insert position
Ⓒ : Movement direction of the retainer
Ⓓ : Projection



b. Unlock the retainer and pull out charge air tube.

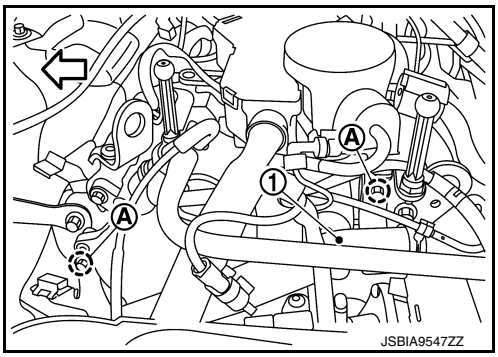
3. Disconnect harness connectors.

Ⓐ : Throttle valve actuator
Ⓑ : Charge air temperature sensor upstream of throttle valve
Ⓒ : Pressure sensor upstream of throttle valve
Ⓓ : Air fuel ratio sensor
⇦ : Vehicle front



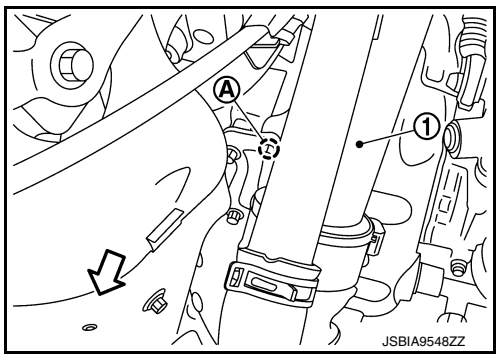
4. Remove bolts Ⓐ of water pipe ①.

⇦ : Vehicle front



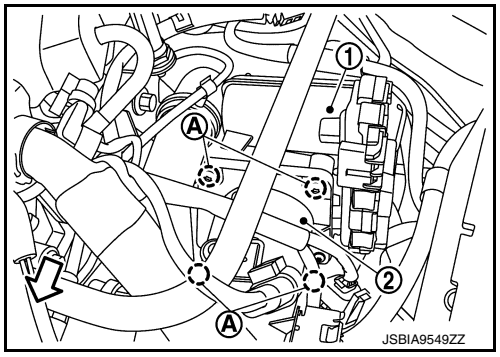
5. Remove bolt Ⓐ of intake pipe ①.

⇦ : Vehicle front



6. Remove screws Ⓐ, and then remove throttle valve actuator ① and intake pipe ②.

⇦ : Vehicle front

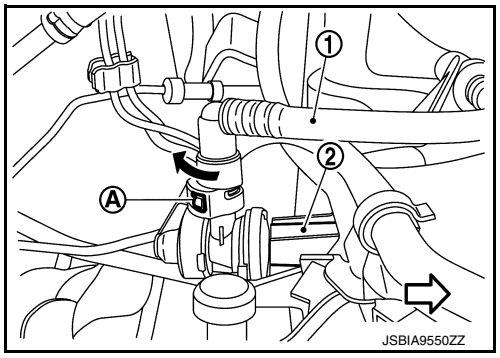


Charge Air Manifold

1. Remove throttle valve actuator.
2. Disconnect vacuum hoses. Refer to EM-39, "Exploded View".
3. Remove bracket with coolant pump switchover valve and boost pressure control vacuum transducer. Refer to EM-59, "Exploded View".
4. Turn tab Ⓐ, and then disconnect EVAP tube ① upward.

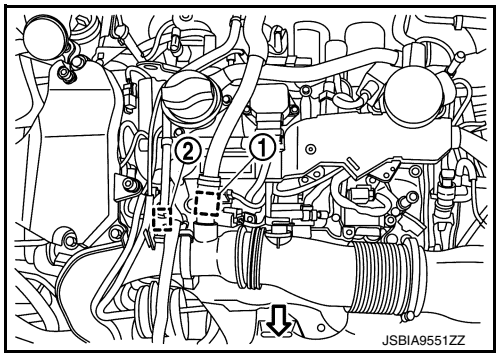
② : Charge air manifold

⇦ : Vehicle front

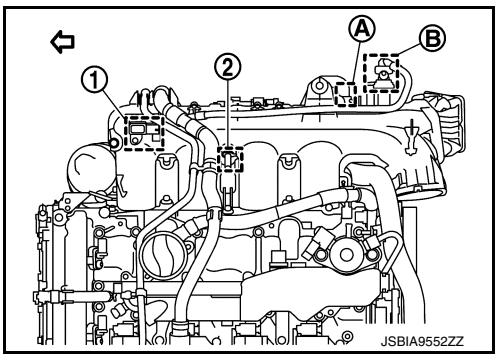


5. Disconnect full-load operation vent line ① and vent line ②.

⇦ : Vehicle front

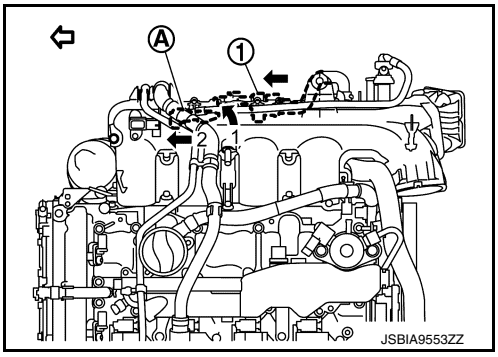


6. Remove parts and connector from the charge air manifold shown in the figure.



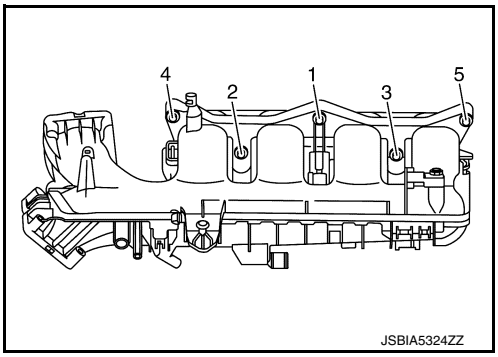
① : Pressure sensor downstream of throttle valve
② : Charge air temperature sensor downstream of throttle valve
Ⓐ : Partial load throttle bleed line
Ⓑ : EVAP tube connection part
⇦ : Engine front

7. Remove the harness clamp Ⓐ and partial load operation crankcase ventilation valve ① under the charge air manifold in the direction of arrow.



⇦ : Engine front

8. Remove the bolts in the reverse order shown remove the charge air manifold assembly with gasket.
NOTE:
Charge air manifold mounting bolt is of remains type in the hose.

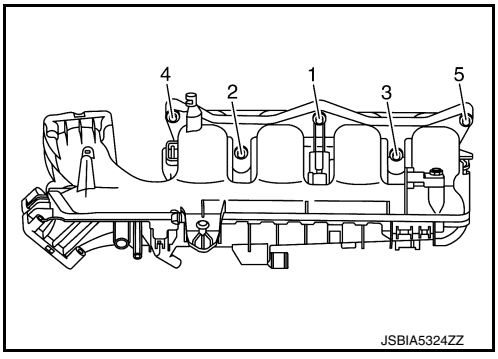


INSTALLATION

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".
- If throttle valve actuator is replaced, carry out the teach in of throttle valve actuator. Refer to EC-182, "Special Repair Requirement List".

Charge Air Manifold

1. Securely install gasket to the mounting groove.
CAUTION:
Do not reuse gasket.
2. Tighten in numerical order as shown.



: 14.0 N·m (1.4 kg-m, 10 ft-lb)

Throttle Valve Actuator

1. Install a new gasket on the throttle valve actuator.
   CAUTION:
   Do not reuse gasket.

Inspection

INFOID:0000000013536874

INSPECTION AFTER INSTALLATION

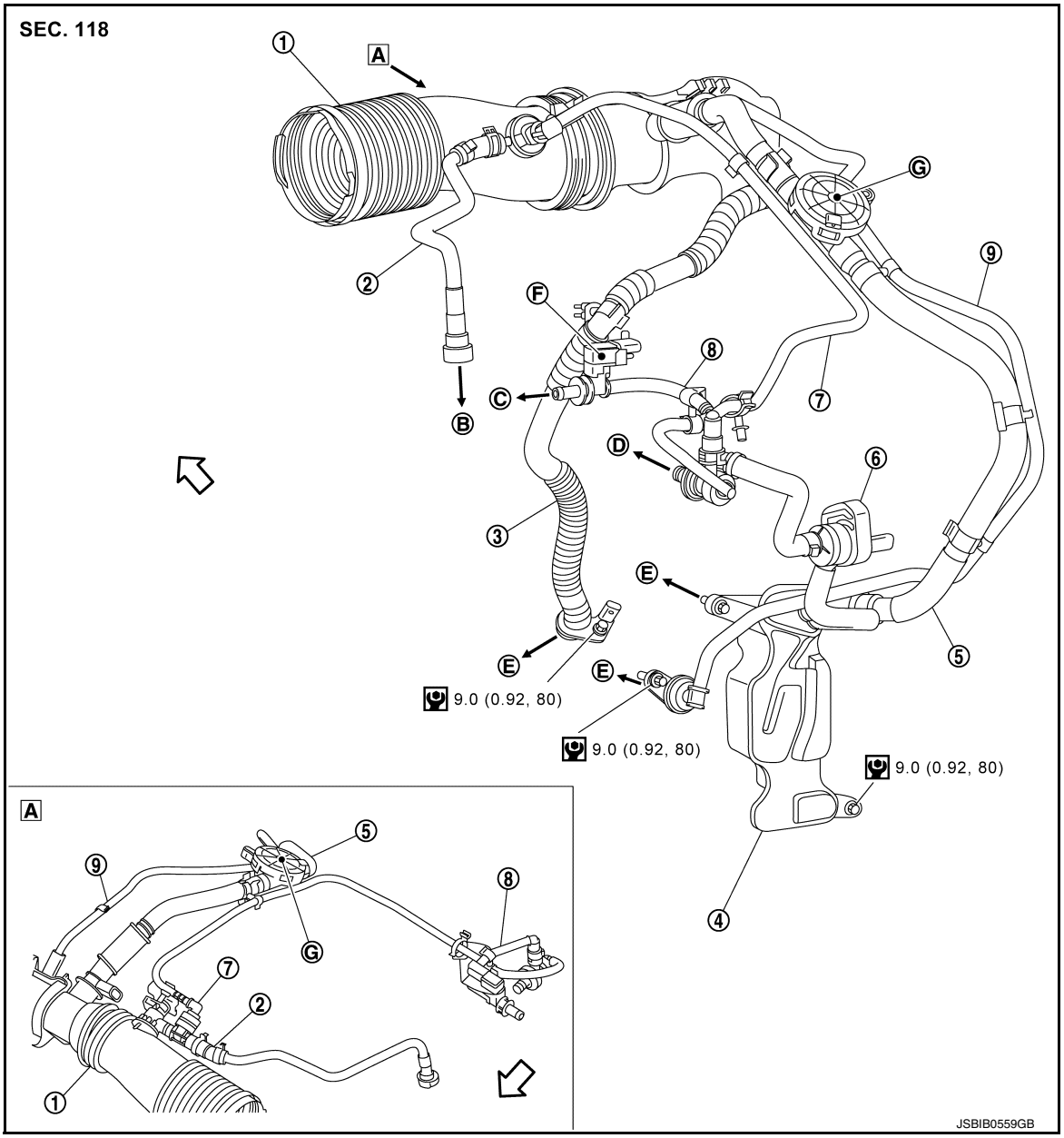
Check that intake air leakage or noise does not occur from the serviced area while the engine is running.

VENTILATION SYSTEM

Exploded View

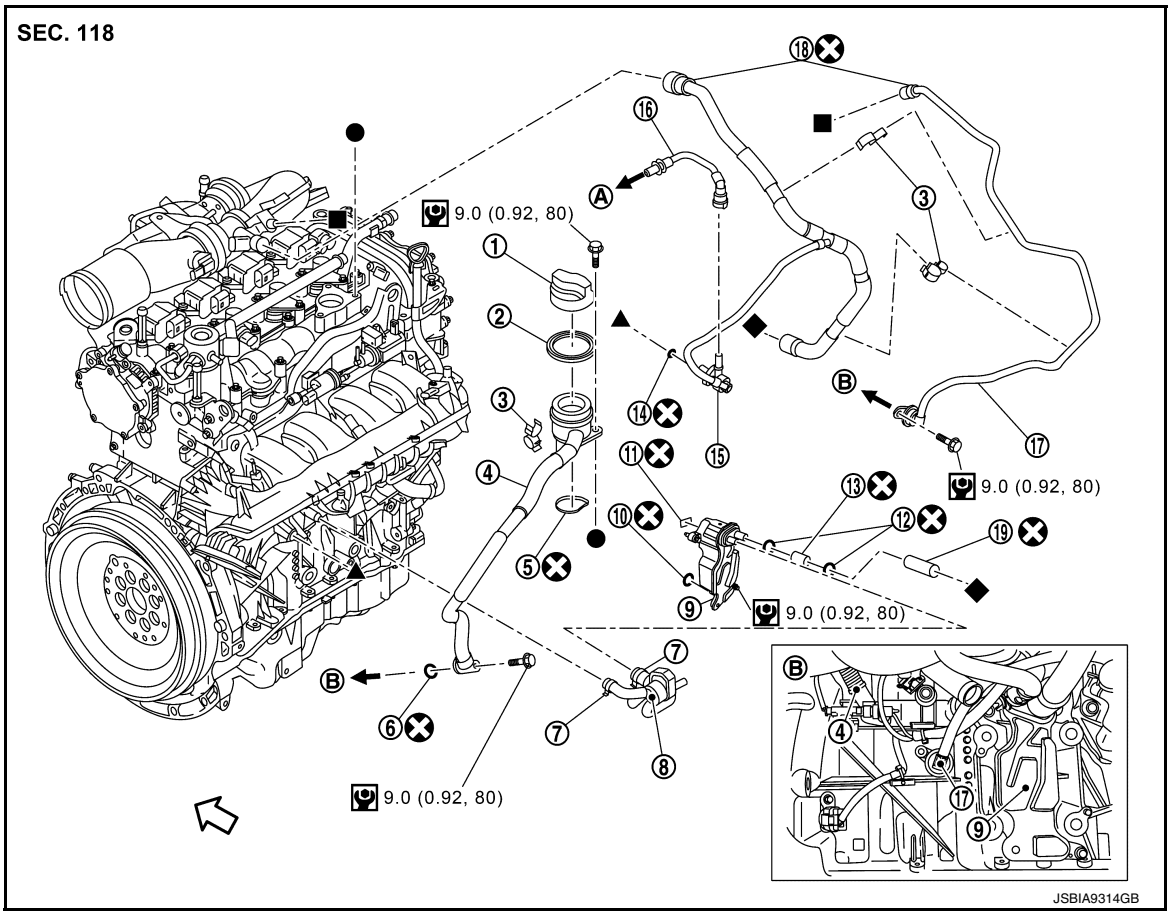
INFOID:0000000013536875

Except for MEXICO



① Air duct (turbocharger side)	② Purge line	③ Filler neck
④ Oil separator	⑤ Full-load operation vent line	⑥ Partial load operation crankcase ventilation valve
⑦ Purge line	⑧ EVAP tube	⑨ Vent line
A View A	Ⓑ To intake pipe	Ⓒ To EVAP purge control valve
Ⓓ To charge air manifold	Ⓔ To cylinder block	Ⓕ Purging pressure sensor
Ⓖ Vent valve		
⇦ : Vehicle front		
: N·m (kg-m, in-lb)		

For MEXICO



① Cap	② Seal	③ Clamp
④ Filler neck	⑤ Gasket	⑥ O-ring
⑦ Clamp	⑧ Partial load operation crankcase ventilation valve	⑨ Oil separator
⑩ O-ring	⑪ O-ring	⑫ O-ring
⑬ Adapter	⑭ O-ring	⑮ Full-load operation vent line
⑯ EVAP tube	⑰ Vent line	⑱ Adapter
⑲ Shrink tube		
Ⓐ To EVAP purge control valve	Ⓑ View Ⓑ	

⇦ : Vehicle front

⊗ : Always replace after every disassembly.

: N·m (kg-m, in-lb)

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

Removal and Installation

INFOID:0000000013536876

REMOVAL

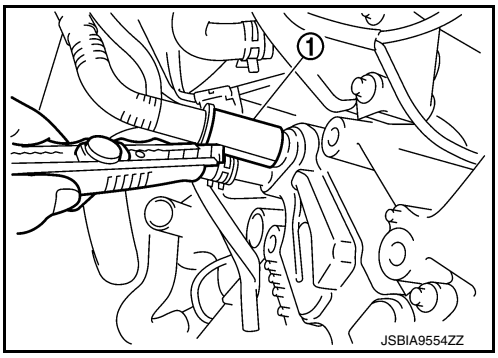
Partial Load Operation Crankcase Ventilation Valve

1. Remove the charge air manifold. Refer to EM-29, "Removal and Installation".
2. Remove the partial load operation crankcase ventilation valve.

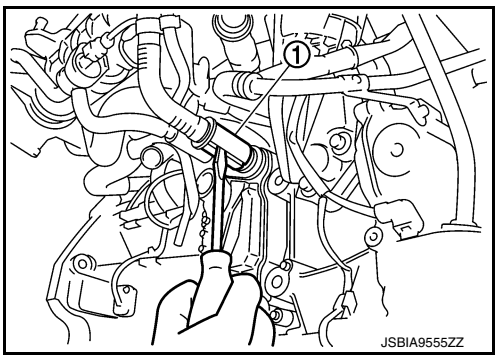
Oil Separator

1. Remove the charge air manifold. Refer to EM-29, "Removal and Installation".
2. Remove the partial load operation crankcase ventilation valve.

3. Remove the vent line.
4. Cut the shrink tube ① (oil separator side) of the full-load operation vent line, and then remove it.



5. Cut the cutout part of the adapter ① (oil separator side) of the full-load operation vent line, and then remove it.
6. Remove the support bearing bracket. Refer to FAX-19, "RIGHT SIDE : Removal and Installation".
7. Remove the oil separator.



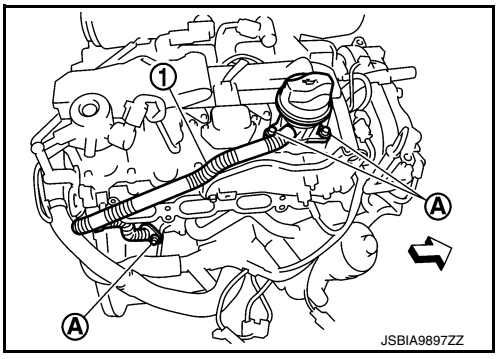
Filler neck

1. Remove the charge air manifold. Refer to EM-29, "Removal and Installation".
2. Remove filler neck ①.

Ⓐ : Bolts

⇦ : Engine front

3. Remove filler cap, seal, gasket and o-ring from filler neck.



INSTALLATION

CAUTION:

Do not reuse O-rings.

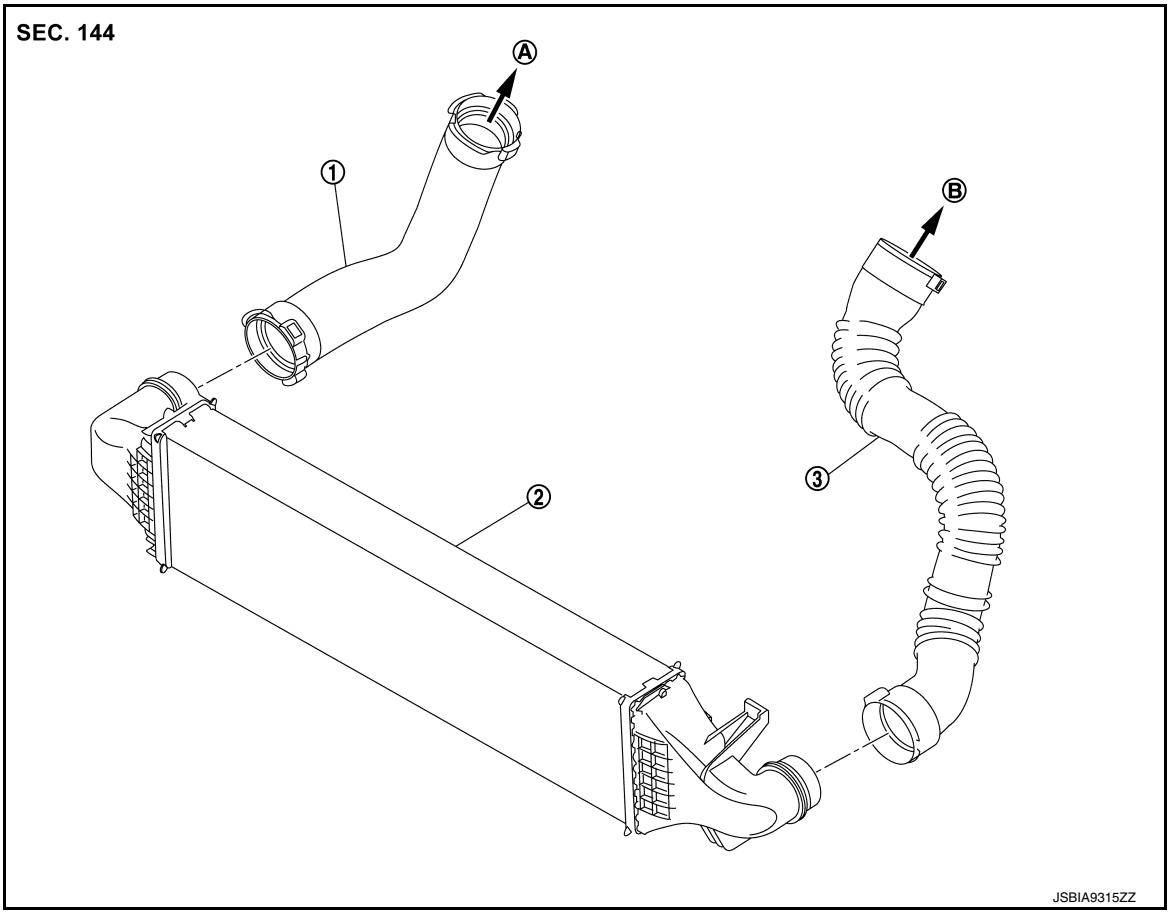
Install in the reverse order of removal.

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

CHARGE AIR COOLER

Exploded View

INFOID:0000000013536877



①	Charge air hose	②	Charge air cooler	③	Charge air tube
Ⓐ	To turbocharger	Ⓑ	To throttle valve actuator		

Removal and Installation

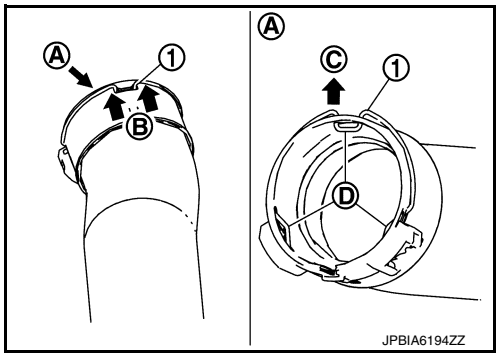
INFOID:0000000013536878

REMOVAL

1. Remove the following parts:
   - Air cleaner housing assembly. Refer to EM-23, "Removal and Installation".
   - Engine under cover. Refer to EM-20, "Removal and Installation".
   - Front bumper fascia. Refer to EXT-21, "Removal and Installation".
2. Place a matching marks on each connecting part for easier installation.
3. Remove charge air hose and charge air tube with the following procedure.

a. Insert a suitable tool between charge air hose and retainer ①.

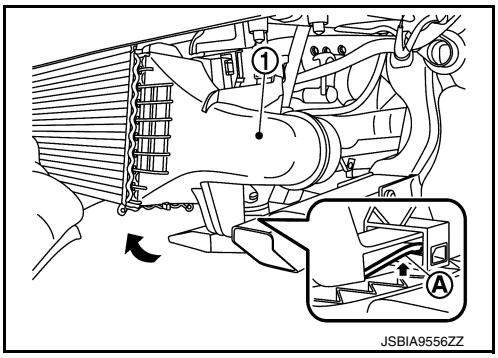
Ⓐ : View Ⓐ
Ⓑ : Insert position
Ⓒ : Movement direction of the retainer
Ⓓ : Projection



b. Unlock the retainer and pull out hose.
CAUTION:
When removing charge air cooler, close opening on turbocharger and on intake manifold with shop cloth or other suitable material.

4. Remove radiator lower air guide. Refer to DLK-236, "Removal and Installation".

5. Release pawls Ⓐ and remove charge air cooler ① in the direction of arrow.



INSTALLATION

Install in the reverse order of removal.

CAUTION:
Check that there is not interference with other parts in the installed condition.

Inspection

INFOID:0000000013536879

INSPECTION AFTER REMOVAL

- Check air passages of charge air cooler core and fins for clogging, leaks or deformation. Clean or replace charge air cooler if necessary.
- Check charge air cooler for mud or clogging. Refer to “CLEANING”.

CLEANING

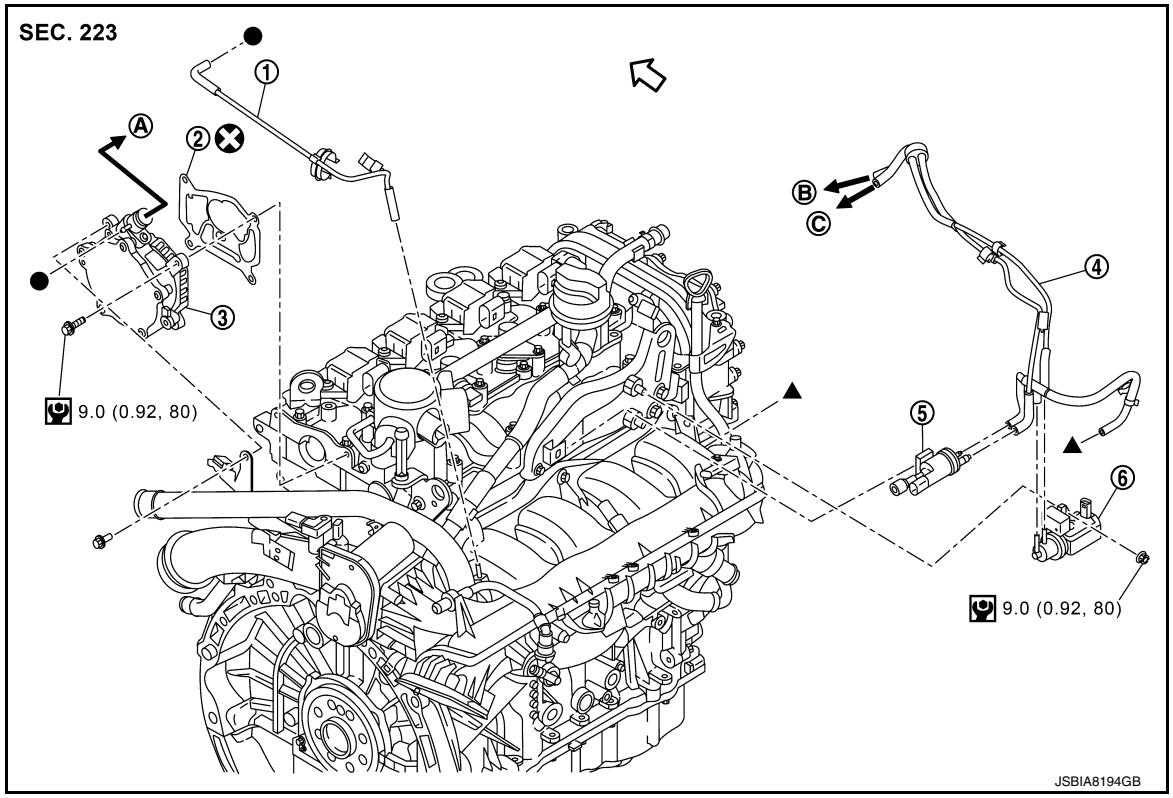
CAUTION:
- **Be careful not to bend or damage charge air cooler fins.**
- **When charge air cooler cleaned without removal, remove all surrounding parts. Then tape harness and harness connectors to prevent water from entering.**
- **Apply water again to all charge air cooler core surfaces once per minute.**

1. Apply water by hose to the back side of the charge air cooler core vertically downward.
2. Stop washing if any stains no longer flow out from charge air cooler.
3. Blow air into the back side of charge air cooler core vertically downward.
CAUTION:
   - **Use compressed air lower than 490 kPa (5 kg/cm^2, 71 psi) and keep distance more than 30 cm (11.81 in).**
   - **Blow air again into all the charge air cooler core surfaces once per minute until no water sprays out.**

VACUUM PUMP

Exploded View

INFOID:0000000013536880



① Vacuum hose	② Gasket	③ Vacuum pump
④ Vacuum hose	⑤ Coolant pump switchover valve	⑥ Boost pressure control vacuum transducer
Ⓐ To charge air manifold	Ⓑ To water pump	Ⓒ To exhaust manifold and turbocharger assembly

⇦ : Vehicle front

⊗ : Always replace after every disassembly.

: N·m (kg-m, in-lb)

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

Removal and Installation

INFOID:0000000013536881

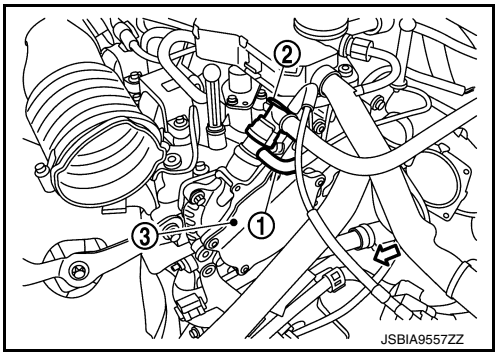
REMOVAL

Vacuum Pump

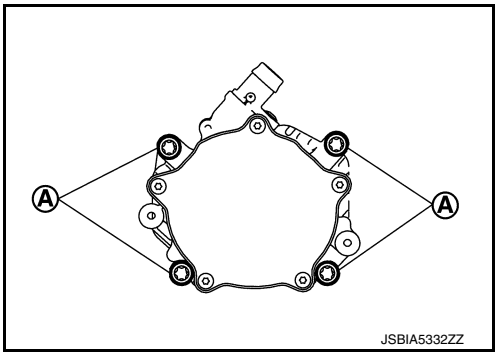
1. Disconnect the battery cable from the negative terminal. Refer to EM-5, "Precautions for Removing Battery Terminal".
2. Remove intake pipe. Refer to EM-29, "Removal and Installation".

3. Remove the vacuum hose ① and vacuum tube ② from vacuum pump ③.

⇦ : Vehicle front



4. Remove the vacuum pump mounting bolts Ⓐ.
5. Remove vacuum pump and gasket.
CAUTION:
Never disassemble vacuum pump.



Coolant Pump Switchover Valve

1. Disconnect vacuum hose and harness connector.
2. Remove coolant pump switchover valve.

Boost Pressure Control Vacuum Transducer

1. Disconnect vacuum hose and harness connector.
2. Remove boost pressure control vacuum transducer.

INSTALLATION

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

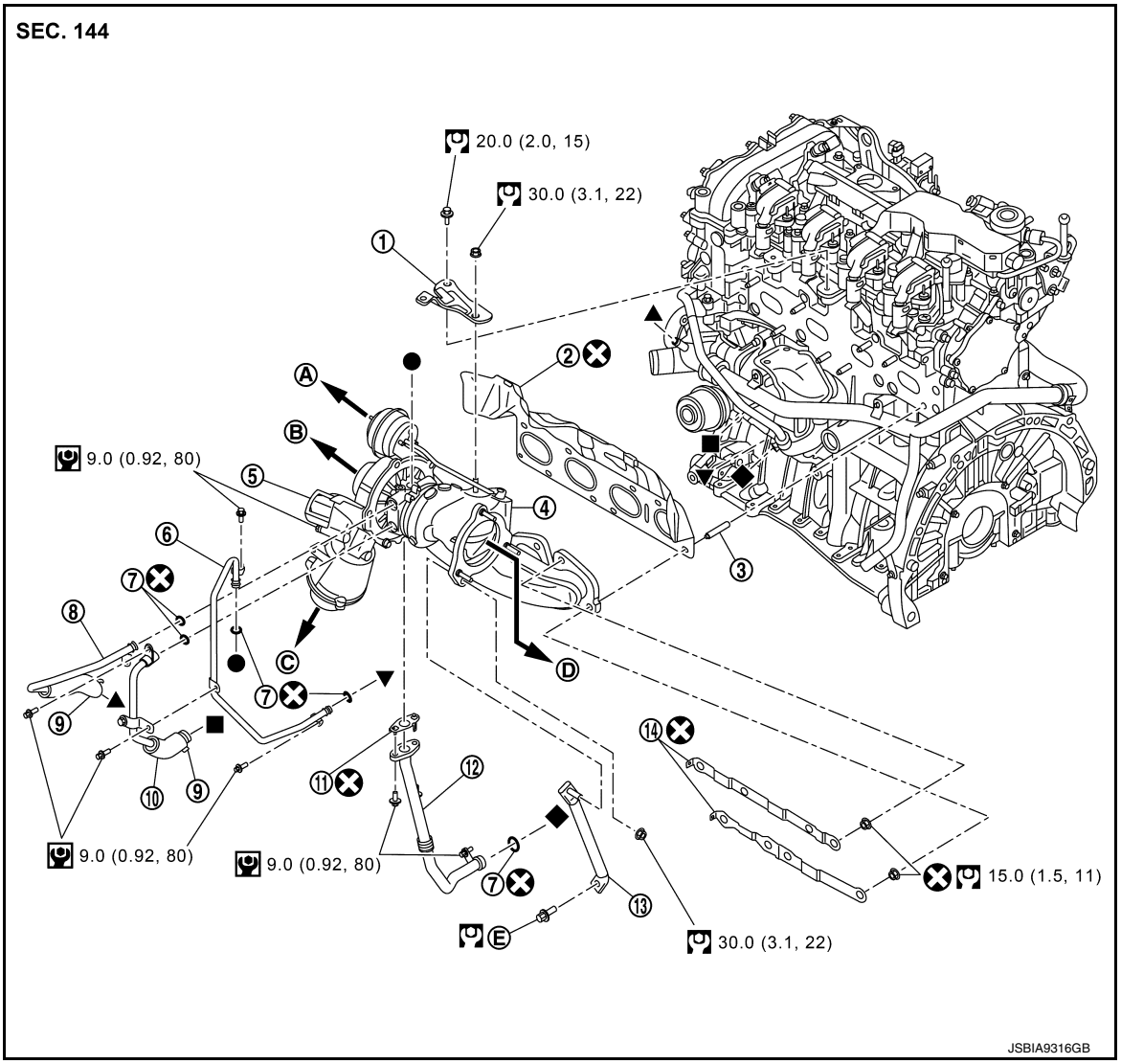
NOTE:

- Always install the vacuum pump in the right position of the vacuum pump driver.
- Clean surface of the vacuum pump and cylinder head.
- If sensors is replaced, carry out the reset of adoption of sensors. Refer to EC-182, "Special Repair Requirement List".

EXHAUST MANIFOLD AND TURBOCHARGER ASSEMBLY

Exploded View

INFOID:0000000013536882



① Upper support brace	② Gasket	③ Stud bolt
④ Exhaust manifold and turbocharger assembly	⑤ Divert air switchover valve	⑥ Oil feed pipe
⑦ O-ring	⑧ Coolant return pipe	⑨ Clamp
⑩ Coolant feed pipe	⑪ Gasket	⑫ Oil return pipe
⑬ Lower support brace	⑭ Plate	
Ⓐ To vacuum hose	Ⓑ To air cleaner	Ⓒ To charge air cooler
Ⓓ To front tube (catalytic converter)	Ⓔ Comply with the installation procedure when tightening. Refer to EM-42, "Removal and Installation".	

: Always replace after every disassembly.

: N·m (kg-m, in-lb)

: N·m (kg-m, ft-lb)

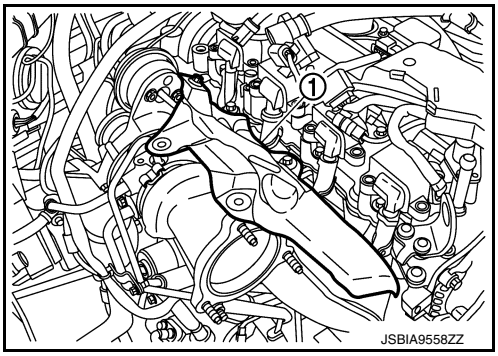
●, ▲, ■, ▼, ◆ : Indicates that the part is connected at points with same symbol in actual vehicle.

Removal and Installation

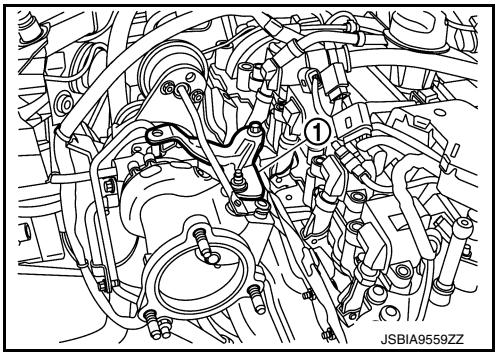
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REMOVAL

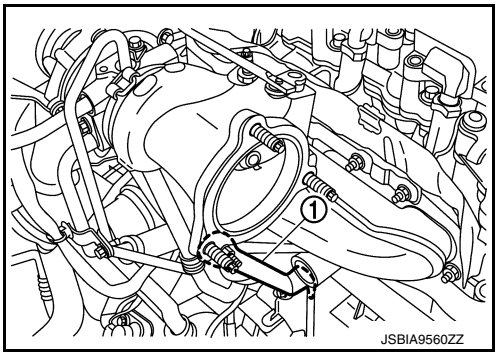
1. Remove the charge air cooler, charge air hose and charge air tube. Refer to EM-37, "Removal and Installation".
2. Remove the exhaust front tube. Refer to EX-7, "Removal and Installation".
3. Remove air cleaner housing assembly, air duct (turbocharger side) and bracket. Refer to EM-23, "Removal and Installation".
4. Drain coolant. Refer to CO-7, "Draining".
5. Remove heat insulator ①.



6. Remove upper support brace ①.

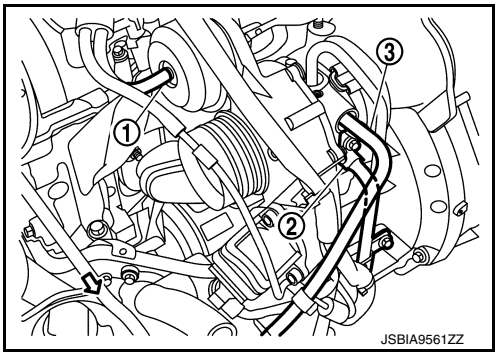


7. Remove lower support brace ①.

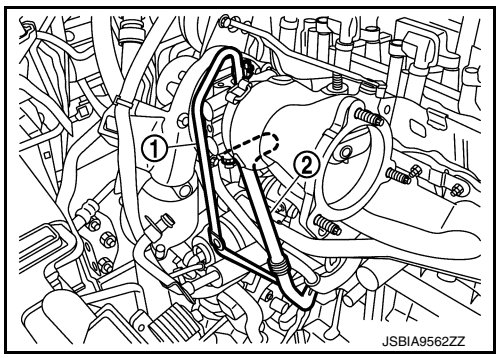


8. Remove vacuum hose ①, coolant feed pipe ② and coolant return pipe ③.

⇦ : Vehicle front

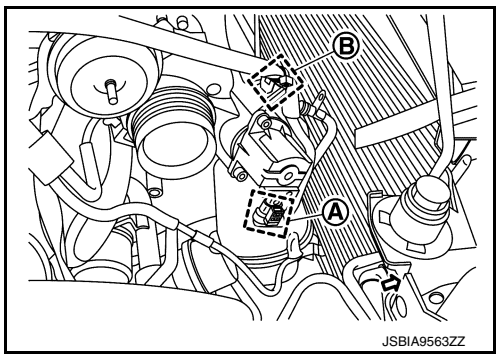


9. Remove the oil feed pipe ① and the oil return pipe ②.



10. Remove the divert air switchover valve harness connector Ⓐ and harness clip Ⓑ.

⇦ : Vehicle front



11. Remove the exhaust manifold mounting nuts and plates.
12. Remove the exhaust manifold and turbocharger assembly to the vehicle upper.
13. Remove the divert air switchover valve from the exhaust manifold and turbocharger assembly, if necessary.

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".

CAUTION:

Do not reuse o-rings and gaskets.

1. Tighten lower support brace bolt (lower side) with the following procedure.

a. Tighten bolt.

: 15.0 N·m (1.5 kg-m, 11 ft-lb)

b. Turn bolts clockwise.

Angle tightening : 90°

CAUTION:

Check and confirm the tightening angle by using an angle wrench (SST: KV10112100) or protractor. Avoid judgment by visual inspection without the tool.

Inspection

INFOID:0000000013536884

INSPECTION AFTER INSTALLATION

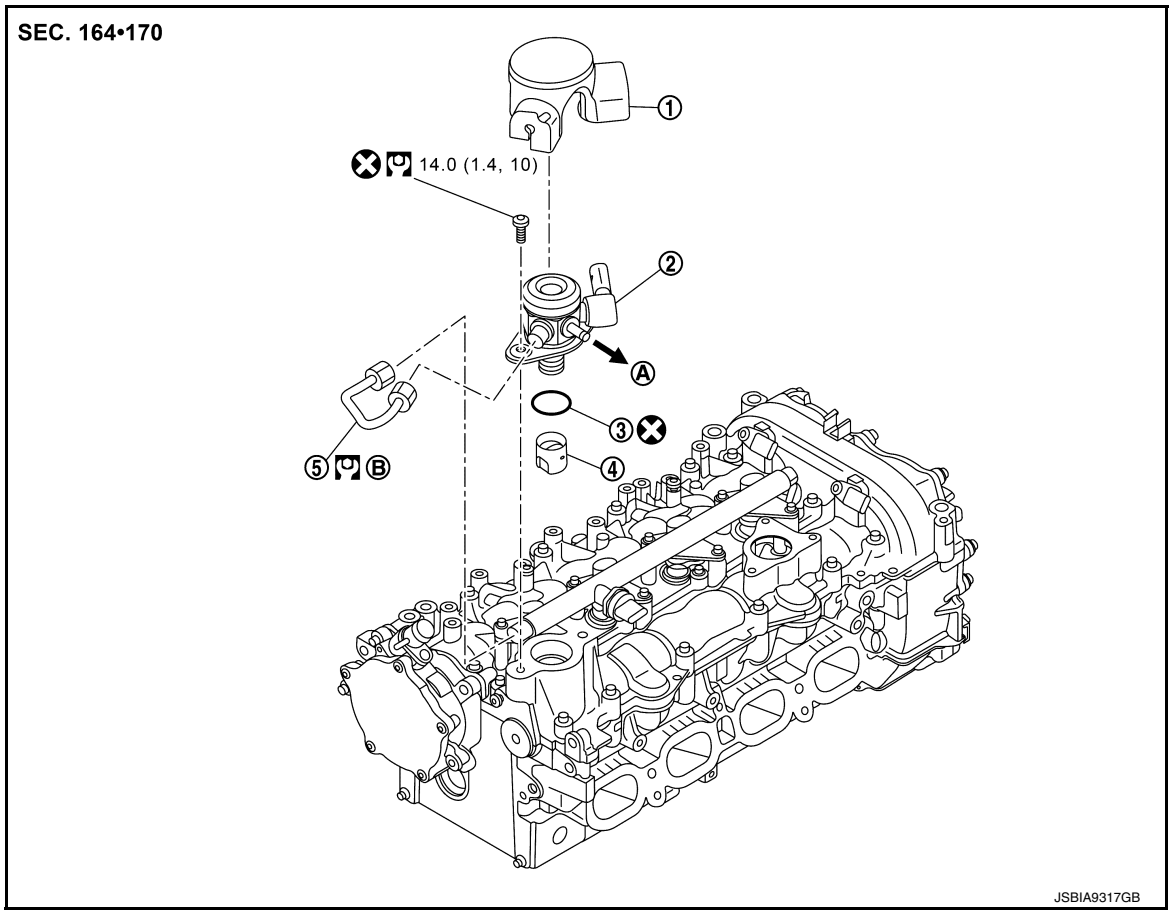
Start engine and raise engine speed to check for exhaust emission leakage.

HIGH PRESSURE FUEL PUMP AND FUEL HOSE

Exploded View

INFOID:0000000013536885

CAUTION:
Never remove or disassemble parts unless instructed as shown in the figure.



①	High pressure fuel pump insulator	②	High pressure fuel pump	③	O-ring
④	Plunger element	⑤	High pressure fuel line		
Ⓐ	To centralized under-floor piping	Ⓑ	Comply with the installation procedure when tightening. Refer to EM-44.		

: Always replace after every disassembly.

: N·m (kg-m, ft-lb)

Removal and Installation

INFOID:0000000013536886

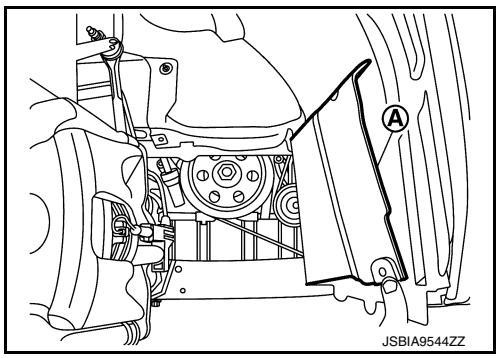
REMOVAL

WARNING:
- **Be sure to read EM-4, "Precaution for Handling High Pressure Fuel System" when working on the high pressure fuel system.**
- **Put a "CAUTION: FLAMMABLE" sign in the workshop.**
- **Be sure to work in a well ventilated area and furnish workshop with a CO_2 fire extinguisher.**
- **Never smoke while servicing fuel system. Keep open flames and sparks away from the work area.**
- **To avoid the danger of being scalded, never drain engine coolant when engine is hot.**
- **Clean the high pressure fuel pump and the high pressure fuel line using a [cleaner from package (Adolf Würth GmbH & Co.KG), or equivalent].**

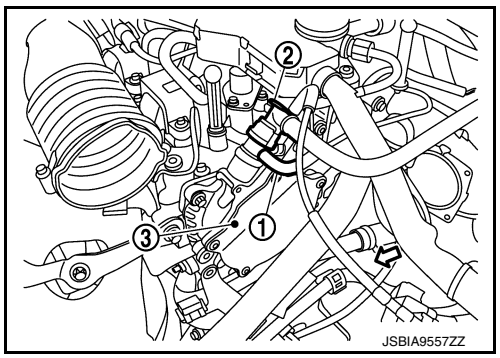
1. Check DTC using CONSULT.

NOTE:
Before starting the work procedure, check if there is already-detected DTC to distinguish it from DTC detected during fuel pressure release.

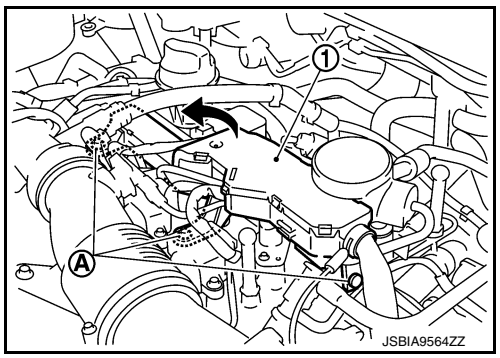
2. Release fuel pressure as follows:
a. Remove fuel pump fuse.
b. Start the engine.
c. After engine stalls, crank it two or three times to release all fuel pressure.
d. Turn ignition switch OFF.
3. Disconnect the battery cable from the negative terminal. Refer to EM-5, "Precautions for Removing Battery Terminal".
4. Open service flap Ⓐ on fender protector.
5. Rotate the crankshaft pulley and align the mark (KW 79°) with the timing indicator in front cover.
6. Remove the engine cover. Refer to EM-20, "Removal and Installation".
7. Remove the engine harness connectors.



8. Remove the vacuum hose ① and vacuum tube ② from vacuum pump ③.
9. Remove the high pressure fuel pump insulator.



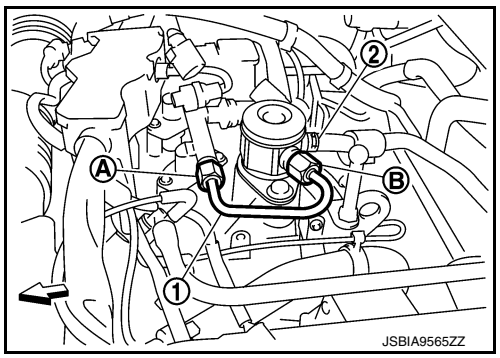
10. Remove the engine harness mounting bolt Ⓐ to move the engine harness ① to the arrow direction (⬅).
11. Remove the high pressure fuel pump connector.



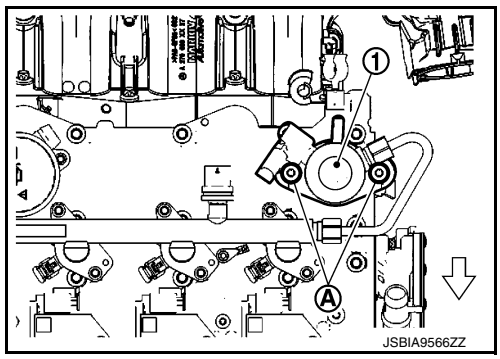
12. Remove the high pressure fuel line ① and the low pressure fuel line ② from the high pressure fuel pump.

Ⓐ, Ⓑ : Flare nut
⇦ : Vehicle front

CAUTION:
Never bent or twist the high pressure fuel line during installation/removal.



13. Note the following, remove the high pressure fuel pump ① mounting bolts Ⓐ.



⇦ : Vehicle front

CAUTION:
To prevent damage to high pressure fuel pump and camshaft bracket, loosen bolt alternately by 180° turn at a time until the reaction force applied on the high pressure fuel pump disappears.

14. Remove the high pressure fuel pump.
15. Remove the plunger element from the cylinder head cover.

INSTALLATION

NOTE:

- If sensors is replaced, carry out the reset of adoption of sensors. Refer to EC-182, "Special Repair Requirement List".
- If high pressure fuel pump is replaced, carry out the counter clear of high pressure fuel pump. Refer to EC-182, "Special Repair Requirement List".

CAUTION:
To prevent damage to parts due to generated abnormal stress and eccentric load, always observe the installation procedure.

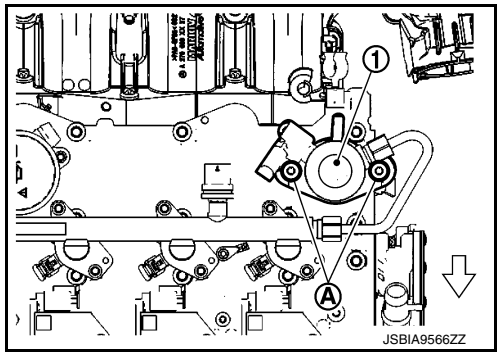
1. Install high pressure fuel pump according to the following procedure.

a. Install the plunger element.

CAUTION:
- **Check the appearance of the drive roller part. If the drive roller part is damaged, uneven wear, etc., replace it as necessary.**
- **Check that the drive roller part of the plunger element is positioned onto the camshaft.**

b. Install high pressure fuel pump with the following procedure.

i. Temporarily tighten the bolt Ⓐ by hand. Alternately tighten the bolt by 180° turn at a time until the flange part of the high pressure fuel pump ① reaches the camshaft bracket.



⇦ : Vehicle front

ii. Tighten the bolt Ⓐ to the specified torque.

2. Install the high pressure fuel pump insulator.
3. Install the high pressure fuel line with the following procedure.

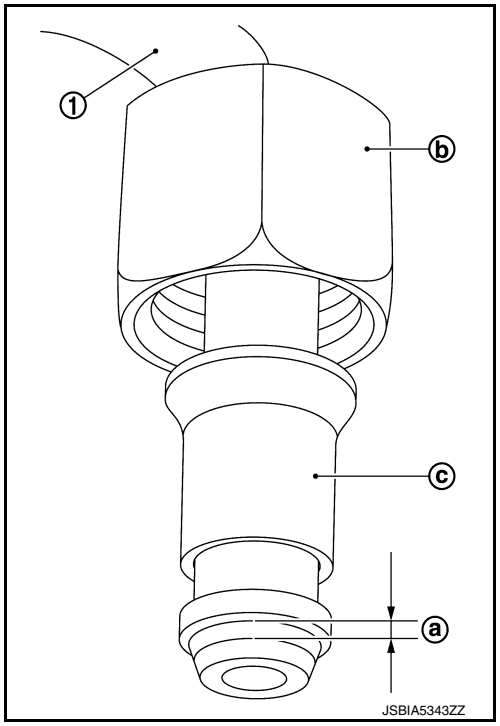
CAUTION:
- **Never use the high pressure fuel line if its terminal tip is damaged.**
- **Observe the tightening order and the tightening torque.**
- **Clean the high pressure fuel pump and the high pressure fuel line using a [cleaner from package (Adolf Würth GmbH & Co.KG), or equivalent].**

a. Check that the dimension of the terminal tip part ⓐ of the high pressure fuel line ① is more than the limit value.

ⓑ : Union nut
ⓒ : Thrust piece

Standard and limit : 1.00 (0.04 in) mm or more

CAUTION:
If the measured value is less than the limit value, replace the high pressure fuel line.

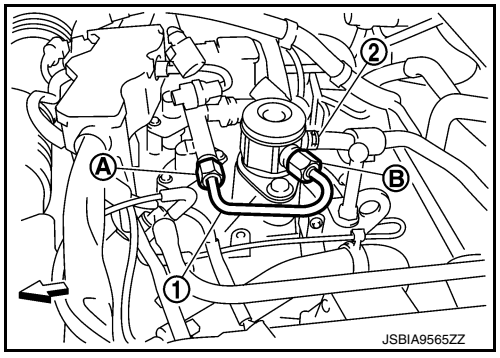


b. Tighten the flare nut Ⓐ and Ⓑ of the high pressure fuel line ① in the alphabetical order.

: 15.0 N·m (1.5 kg-m, 11 ft-lb)

② : Low pressure fuel line
⇦ : Vehicle front

CAUTION:
When temporarily tightening flare nut, place pipe in the center of the nut inner diameter.



c. Turn the flare nut Ⓐ and Ⓑ 75 degrees clockwise in the alphabetical order. (angle tightening)
d. Turn the flare nut Ⓐ and Ⓑ 25 degrees clockwise in the alphabetical order. (angle tightening)
4. Install the high pressure fuel pump insulator.
5. Note the following and install in the reverse order of removal, for the rest of parts.
CAUTION:
- **Install fuel pump fuse before installing battery negative terminal.**
- **Check for fuel leakage before installing engine cover. Refer to EM-47, "Inspection".**

6. Check DTC and erase DTC.
NOTE:
Erase DTC detected while releasing fuel pressure.

Inspection

INFOID:0000000013536887

INSPECTION AFTER INSTALLATION

Check for Fuel Leakage

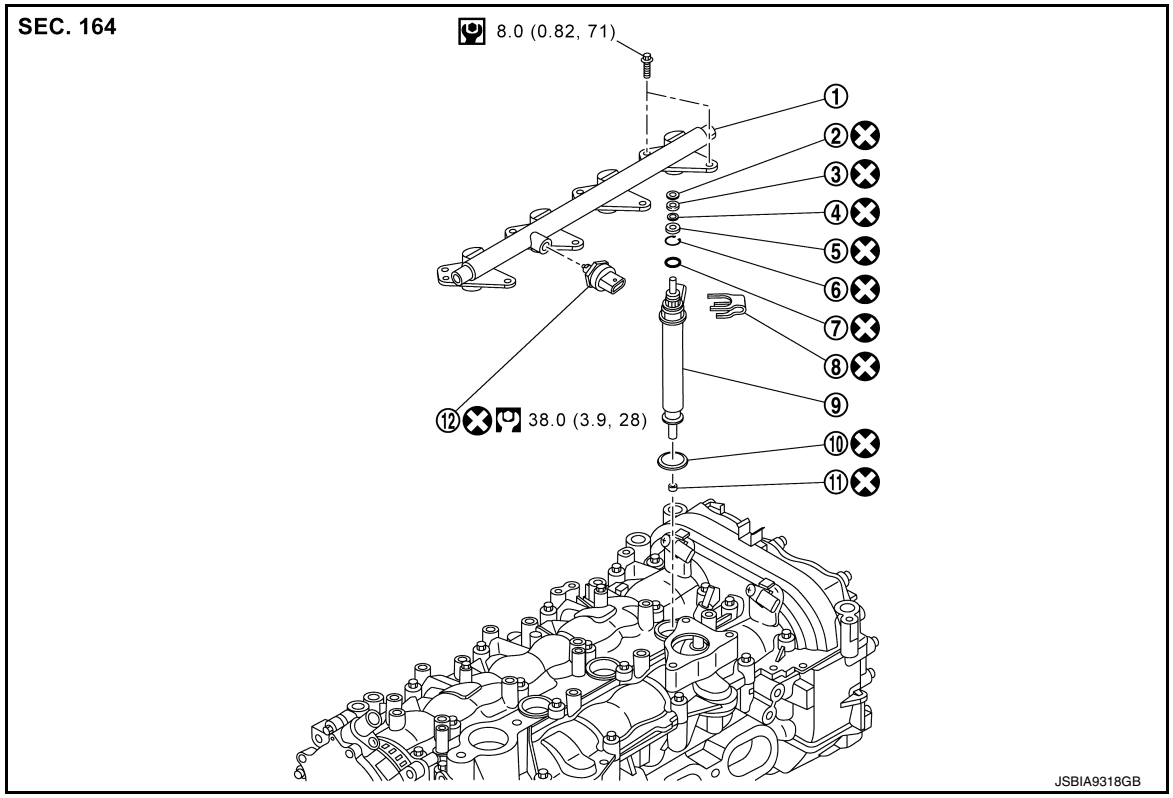
1. Turn ignition switch “ON” (with the engine stopped) for more than 5 seconds. With fuel pressure applied to fuel piping, check that there is no fuel leakage at connection points.
NOTE:
Use mirrors for checking at points out of clear sight.
2. Start the engine. With engine speed increased, check again that there is no fuel leakage at connection points.
CAUTION:

Never touch the engine immediately after it is stopped because the engine is extremely hot.

FUEL INJECTOR

Exploded View

INFOID:0000000013536888



① Fuel rail	② Plastic support ring (white)	③ Seal ring
④ Plastic support ring (slit)	⑤ Metal support disk	⑥ Snap ring
⑦ Seal ring	⑧ Fuel injector holder	⑨ Fuel injector
⑩ Fuel injector dust seal	⑪ Seal ring	⑫ Fuel pressure sensor

: N·m (kg-m, ft-lb)

: N·m (kg-m, in-lb)

: Always replace after every disassembly.

CAUTION:
Never remove or disassemble parts unless instructed as shown in the figure.

Removal and Installation

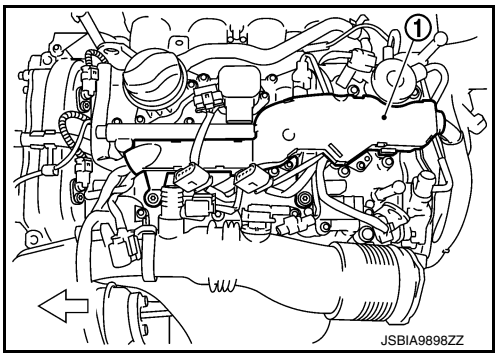
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WARNING:
- **Be sure to read EM-4, "Precaution for Handling High Pressure Fuel System" when working on the high pressure fuel system.**
- **Put a "CAUTION: FLAMMABLE" sign in the workshop.**
- **Be sure to work in a well ventilated area and furnish workshop with a CO_2 fire extinguisher.**
- **Never smoke while servicing fuel system. Keep open flames and sparks away from the work area.**
- **To avoid the danger of being scalded, never drain engine coolant when engine is hot.**

REMOVAL

1. Check DTC using CONSULT.
   NOTE:
   Before starting the work procedure, check if there is already-detected DTC to distinguish it from DTC detected during fuel pressure release.

2. Release fuel pressure as follows:
a. Remove fuel pump fuse.
b. Start the engine.
c. After engine stalls, crank it two or three times to release all fuel pressure.
d. Turn ignition switch OFF.
3. Disconnect the battery cable from the negative terminal. Refer to EM-5, "Precautions for Removing Battery Terminal".
4. Remove the engine cover. Refer to EM-20, "Removal and Installation".
5. Disconnect vent line and full-load operation vent line from air duct (turbocharger side). Refer to EM-34, "Exploded View".
6. Remove the engine harness ①.

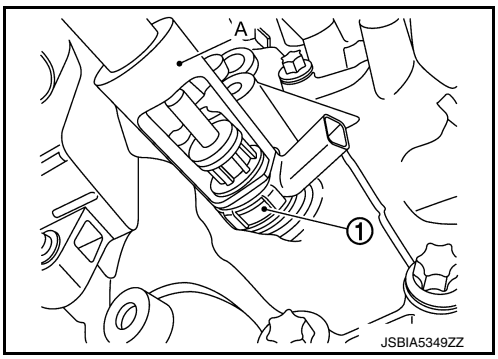


⇦ : Engine front

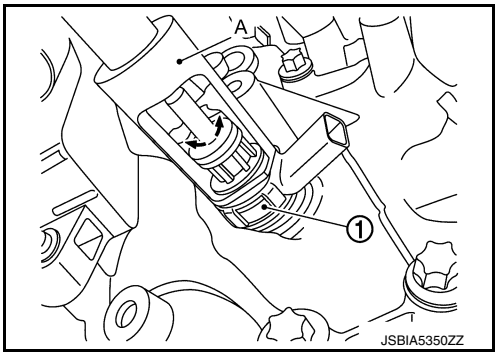
7. Remove intake camshaft valve lift switchover actuator. Refer to EM-60, "Removal and Installation".
8. Remove the high pressure fuel line from the high pressure fuel pump. Refer to EM-44, "Removal and Installation".
CAUTION:
Prepare a tray and waste beforehand as fuel leaks out.
9. Remove the fuel rail mounting bolt.
10. Remove the fuel injector holder.
11. Remove fuel rail.
CAUTION:
- **When removing, be careful to avoid any interference with fuel injector.**
- **Use a shop cloth to absorb any fuel leakage from fuel rail.**

12. Remove the fuel injector from the cylinder head with following procedure.
CAUTION:
- **When reusing the fuel injector, place the matching mark to install it to the original position.**
- **Be careful with remaining fuel that may go out from fuel rail.**
- **Be careful not to damage injector nozzles during removal.**
- **Never bump or drop fuel injector.**
- **Never disassemble fuel injector.**

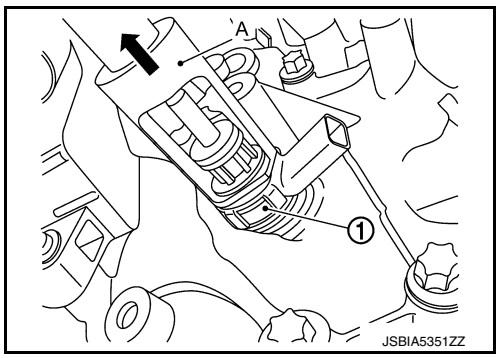
a. Install an injector puller [SST: KV105H0170 (278 589 00 33 00)] (A) to the fuel injector ①.



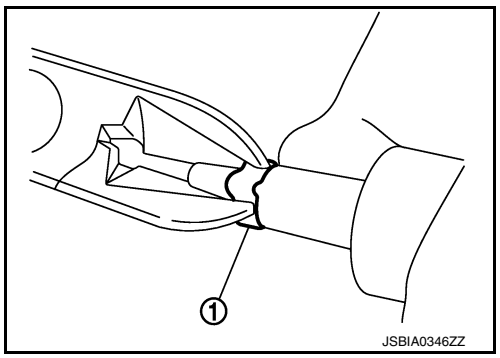
b. Rotate the fuel injector ① to the right and left direction with the injector puller [SST: KV105H0170 (278 589 00 33 00)] (A).



c. Pull out the fuel injector ① from the cylinder head with the injector puller [SST: KV105H0170 (278 589 00 33 00)] (A)

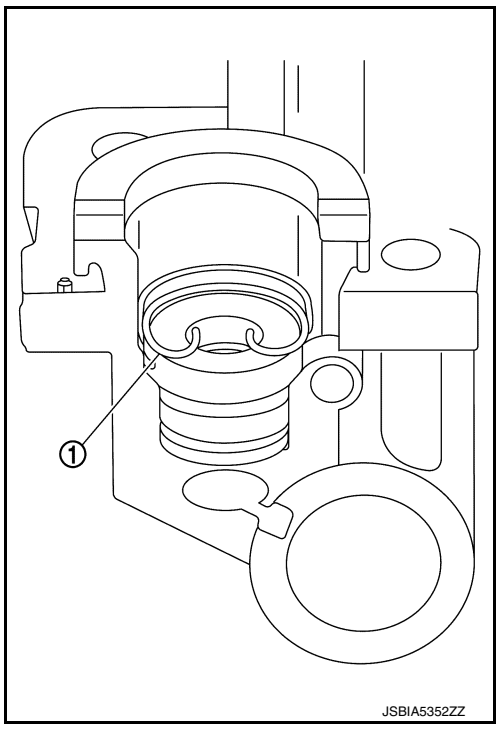


d. Cut the seal ring ① while pinching it. Be careful not to damage the fuel injector.

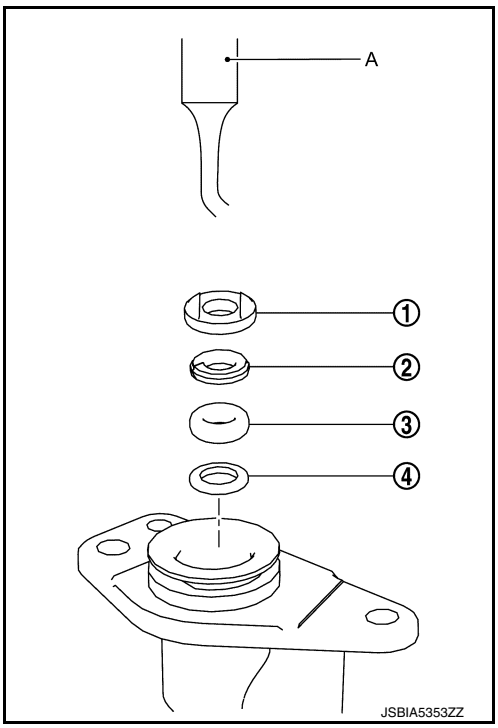


13. Remove the seal ring unit from the fuel rail with following procedure.
CAUTION:
Always use the drift seal installation [SST: KV105H0160 (278 589 01 15 00)].

a. Remove the snap ring ① with a snap ring pliers (commercial service tool).



b. Remove the seal ring unit in the numerical order with the drift seal installation [SST: KV105H0160 (278 589 01 15 00)] (A).



① : Metal support disk
② : Plastic support ring (with slit)
③ : Seal ring
④ : Plastic support ring (white)

14. Remove the fuel pressure sensor from fuel rail as necessary.

INSTALLATION

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

NOTE:

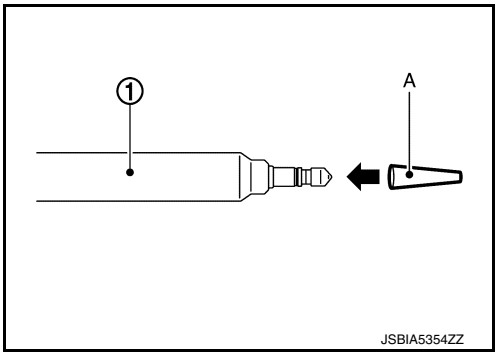
- If sensors is replaced, carry out the reset of adoption of sensors. Refer to EC-182, "Special Repair Requirement List".
- If fuel injector is replaced, carry out the injector injection quantity adjustment of adoption of fuel injector. Refer to EC-182, "Special Repair Requirement List".

1. Install the seal ring to the fuel injector with the following procedure.

CAUTION:

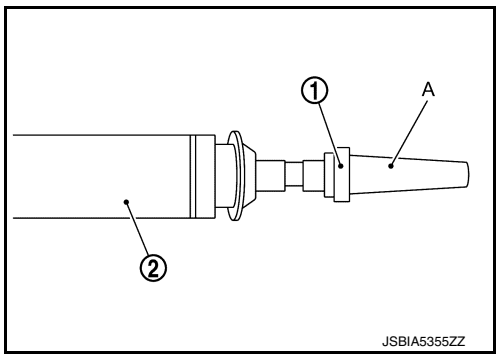
- **The seal ring expands with the humidity. Install the fuel injector as soon as installing the seal ring.**
- **Handle the seal ring with bare hands. Never wear gloves.**
- **Never apply the engine oil to the seal ring.**
- **Never clean the seal ring with solvent.**
- **Clean the high pressure fuel pump and the high pressure fuel line using a [cleaner from package (Adolf Würth GmbH & Co.KG), or equivalent].**

a. Install an injector seal installation [SST: KV105H0110 (272 589 00 43 00)] (A) to the fuel injector ①.



b. Set the seal ring ① to an injector seal installation [SST: KV105H0110 (272 589 00 43 00)] (A).

② : Fuel injector



c. Straightly insert the seal ring ① to the groove portion of the fuel injector.

CAUTION:

Be careful that seal ring does not exceed the groove portion of the fuel injector.

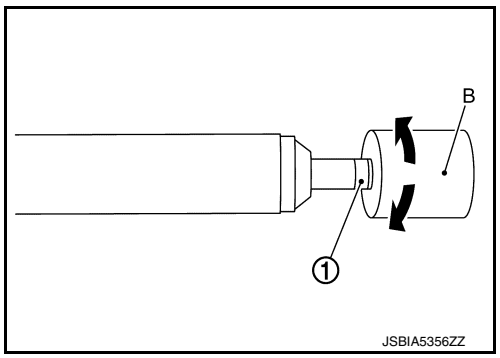
d. After installing the seal ring ① to the fuel injector, insert the injector seal installation [SST: KV105H0110 (272 589 00 43 00)] (B) (mark “A” side) to the fuel injector and rotate clockwise and counterclockwise by 90° while pressing the seal ring to fit it.

CAUTION:

The seal ring expands with the humidity. Install the fuel injector as soon as installing the seal ring.

NOTE:

Compress seal ring, because this operation is for rectifying stretch of seal ring caused by installation and for preventing sticking when inserting injector into cylinder head.



2. Note the following, install the seal ring unit to the fuel rail.

CAUTION:

- **Handle the seal ring unit with bare hands. Never wear gloves.**
- **Never clean the seal ring unit with solvent.**
- **Check that the seal ring unit and its the mating part are free of foreign material.**
- **When installing the seal ring unit, be careful not to scratch it with tool or fingernails.**

a. Install the seal ring unit to the drift seal installation [SST: KV105H0160 (278 589 01 15 00)] (A) in the numerical order.

① : Plastic support ring (with slit)

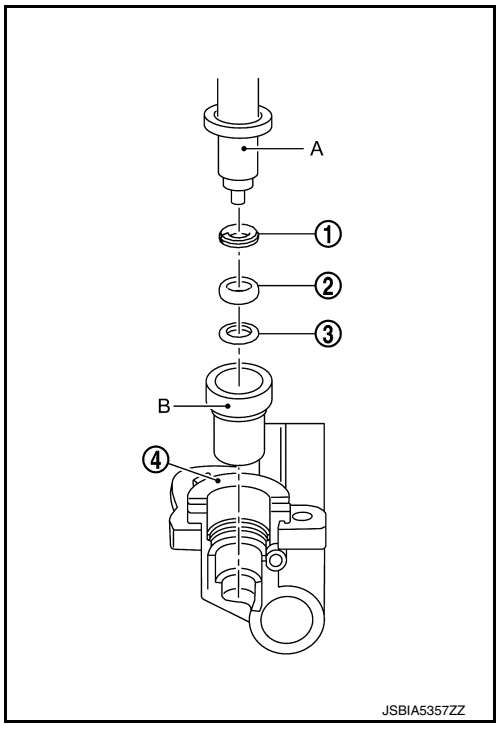
② : Seal ring

③ : Plastic support ring (white)

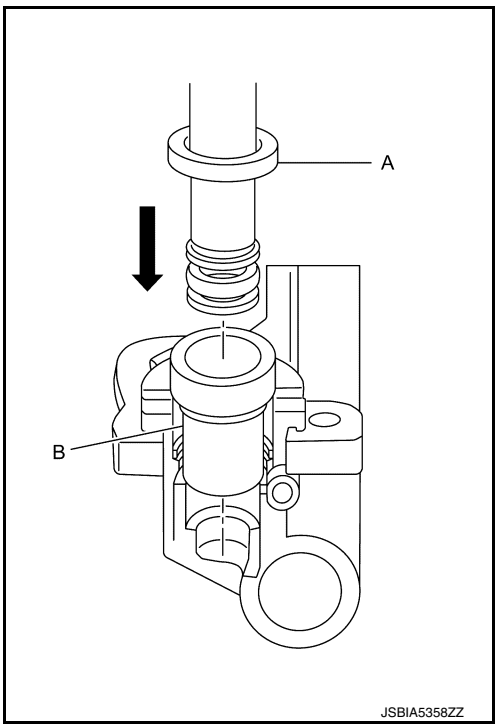
CAUTION:

- **Install the seal ring unit with the flat side of the plastic support ring (with slit) facing the seal ring.**
- **Never reuse the seal ring unit.**

b. Set the drift seal installation [SST: KV105H0160 (278 589 01 15 00)] (B) to the fuel rail ④.



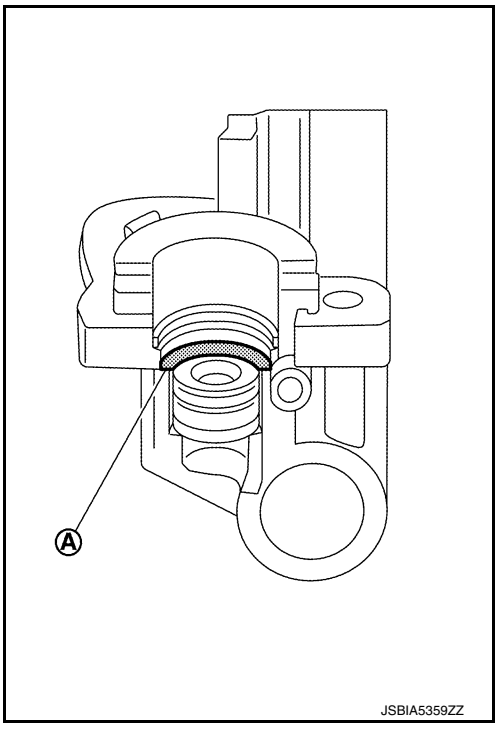
c. Insert the drift seal installation [SST: KV105H0160 (278 589 01 15 00)] (A) (installed the seal ring unit) into the drift seal installation [SST: KV105H0160 (278 589 01 15 00)] (B) until it reaches the stopper.



d. Remove the drift seal installation [SST: KV105H0160 (278 589 01 15 00)] from the fuel rail.

CAUTION:

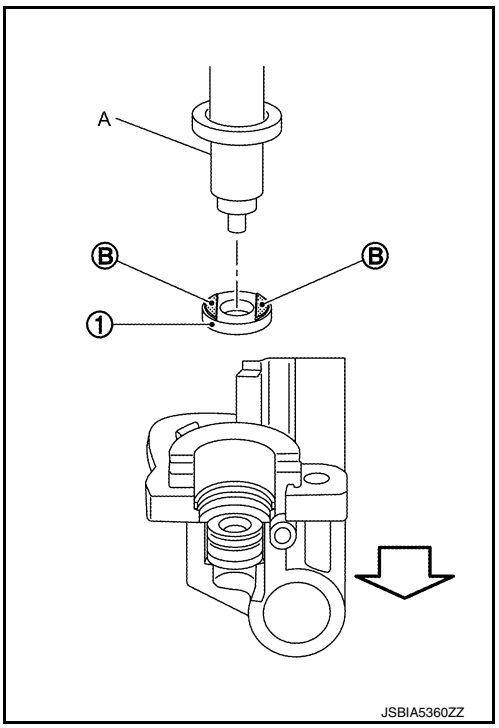
Check that the plastic support ring (with slit) is installed certainly at the inner side more than the end Ⓐ of the fuel retainer.



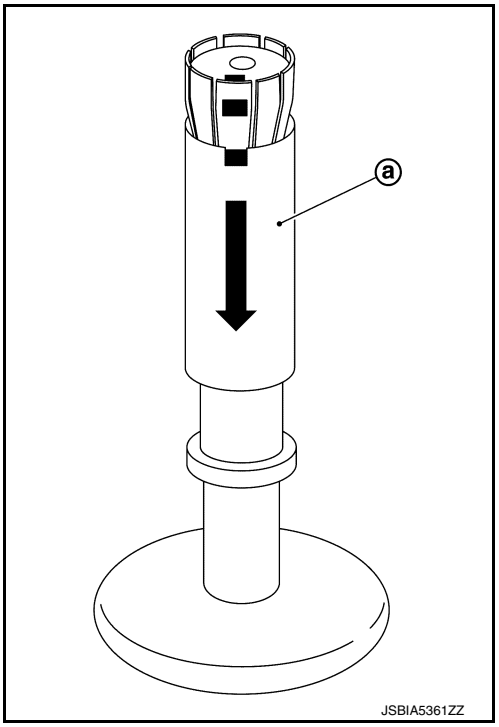
e. Set the metal support disk ① onto the plastic support ring (with slit) with its Ⓑ part facing upper. And then, insert the metal support disk into the fuel rail side with the drift seal installation [SST: KV105H0160 (278 589 01 15 00)] (A).

Ⓑ : Metal support disk projection part

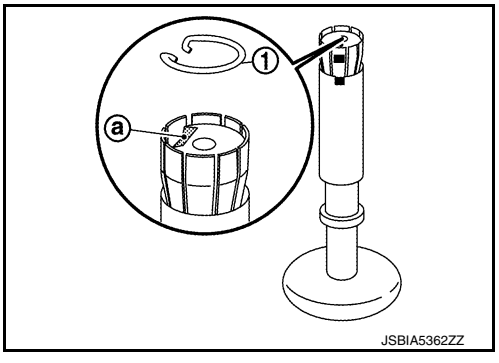
⇦ : Engine front



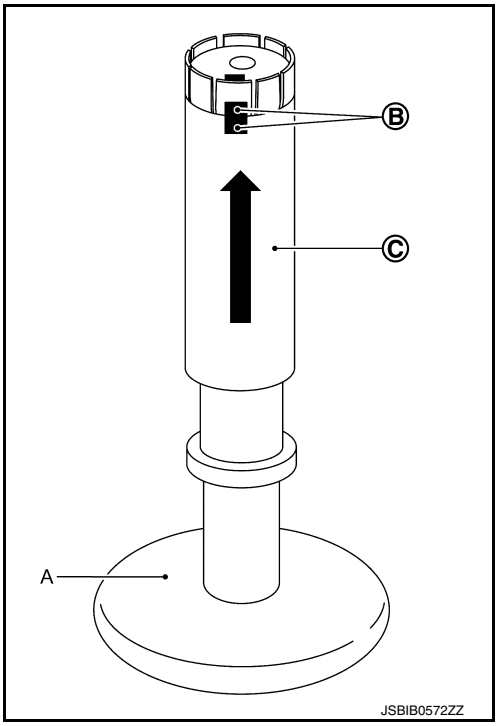
f. Move the ⓐ part of the drift seal installation [SST: KV105H0160 (278 589 01 15 00)] to the arrow direction as shown in the figure.



g. Align both end of the snap ring ① with the groove ⓐ of the drift seal installation [SST: KV105H0160 (278 589 01 15 00)] to set the snap ring, as shown in the figure.



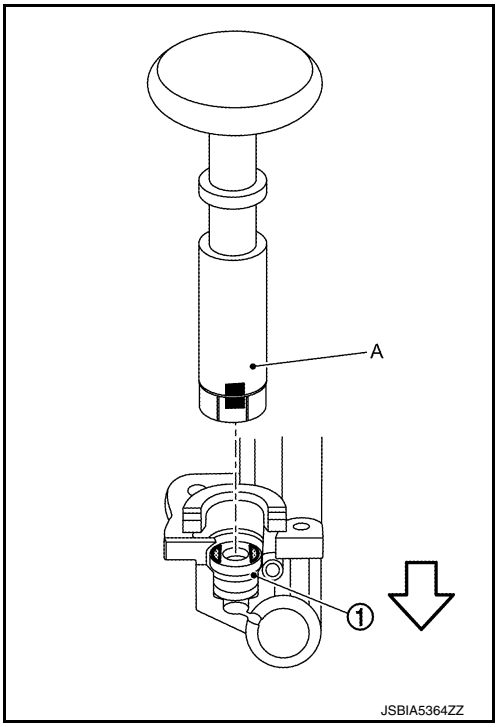
h. Align the matching marks Ⓑ of the drift seal installation [SST: KV105H0160 (278 589 01 15 00)] (A), and then move the Ⓒ part to the arrow direction to lock the drift seal installation [SST: KV105H0160 (278 589 01 15 00)].



i. Align the drift seal installation [SST: KV105H0160 (278 589 01 15 00)] (A) with the projection part of the metal support disk ① to insert the drift seal installation [SST: KV105H0160 (278 589 01 15 00)] into the fuel rail until a “click” sound is heard.

⇦ : Engine front

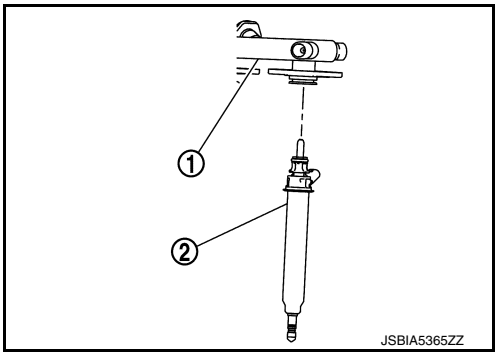
CAUTION:
- **Check that the snap ring is installed certainly in the groove.**
- **Check that the snap ring rotates smoothly.**



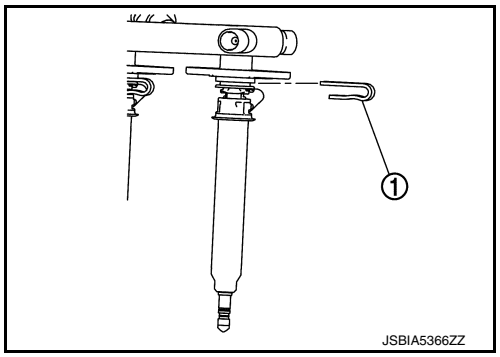
3. Install the fuel injector to the fuel rail with the following procedure.

CAUTION:
- **When replacing the fuel injector to a new one, install it within 1 hour to avoid leaking the fuel.**
- **When using the fuel injector, install it to the original position.**
- **Always install the fuel injector to the fuel rail before installing them.**
- **Handle the seal ring unit with bare hands. Never wear gloves.**
- **Never clean the seal ring unit with solvent.**
- **When installing the seal ring unit, be careful not to scratch it with tool or fingernails.**

a. Install the fuel injector ② to the fuel rail ①.



b. Install the fuel injector holder ①.



4. When removing the fuel rail pressure sensor, install the fuel rail pressure sensor.
CAUTION:
Never reuse the fuel rail pressure sensor.
5. Note the following and install in the reverse order of removal.
CAUTION:
- **Install fuel pump fuse before installing battery negative terminal.**
- **Check for fuel leakage before installing engine cover. Refer to EM-57, "Inspection".**

6. Check DTC and erase DTC.
NOTE:
Erase DTC detected while releasing fuel pressure.

Inspection

INFOID:0000000013536890

INSPECTION AFTER INSTALLATION

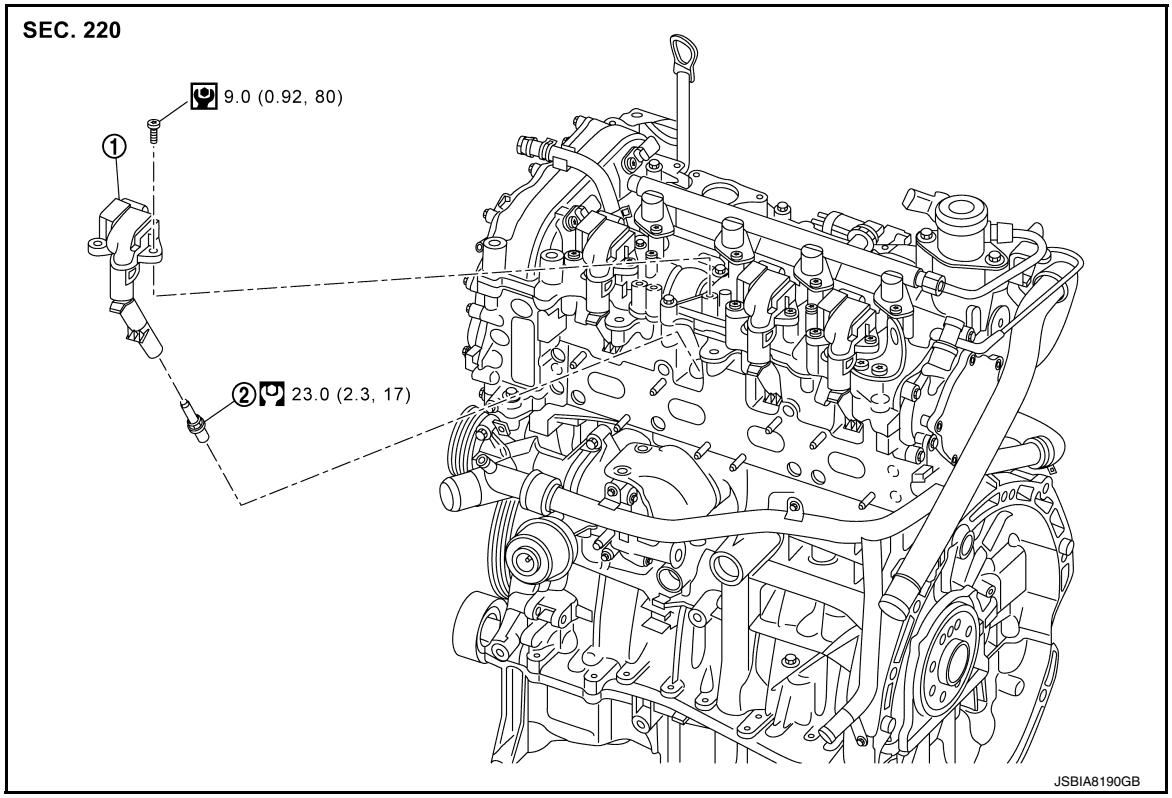
Check on Fuel Leakage

1. Turn ignition switch “ON” (with the engine stopped). With fuel pressure applied to fuel piping, check there are no fuel leakage at connection points.
NOTE:
Use mirrors for checking at points out of clear sight.
2. Start the engine. With engine speed increased, check again that there are no fuel leakage at connection points.
CAUTION:
Never touch the engine immediately after stopped, as the engine becomes extremely hot.

IGNITION COIL

Exploded View

INFOID:0000000013536891



① Ignition coil
② Spark plug
: N·m (kg-m, ft-lb)
: N·m (kg-m, in-lb)

Removal and Installation

INFOID:0000000013536892

REMOVAL

1. Remove the engine cover. Refer to EM-20, "Removal and Installation".
2. Remove air duct (turbocharger side). Refer to EM-23, "Removal and Installation".
3. Remove the ignition coil.
4. Remove the spark plug, if necessary.

INSTALLATION

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

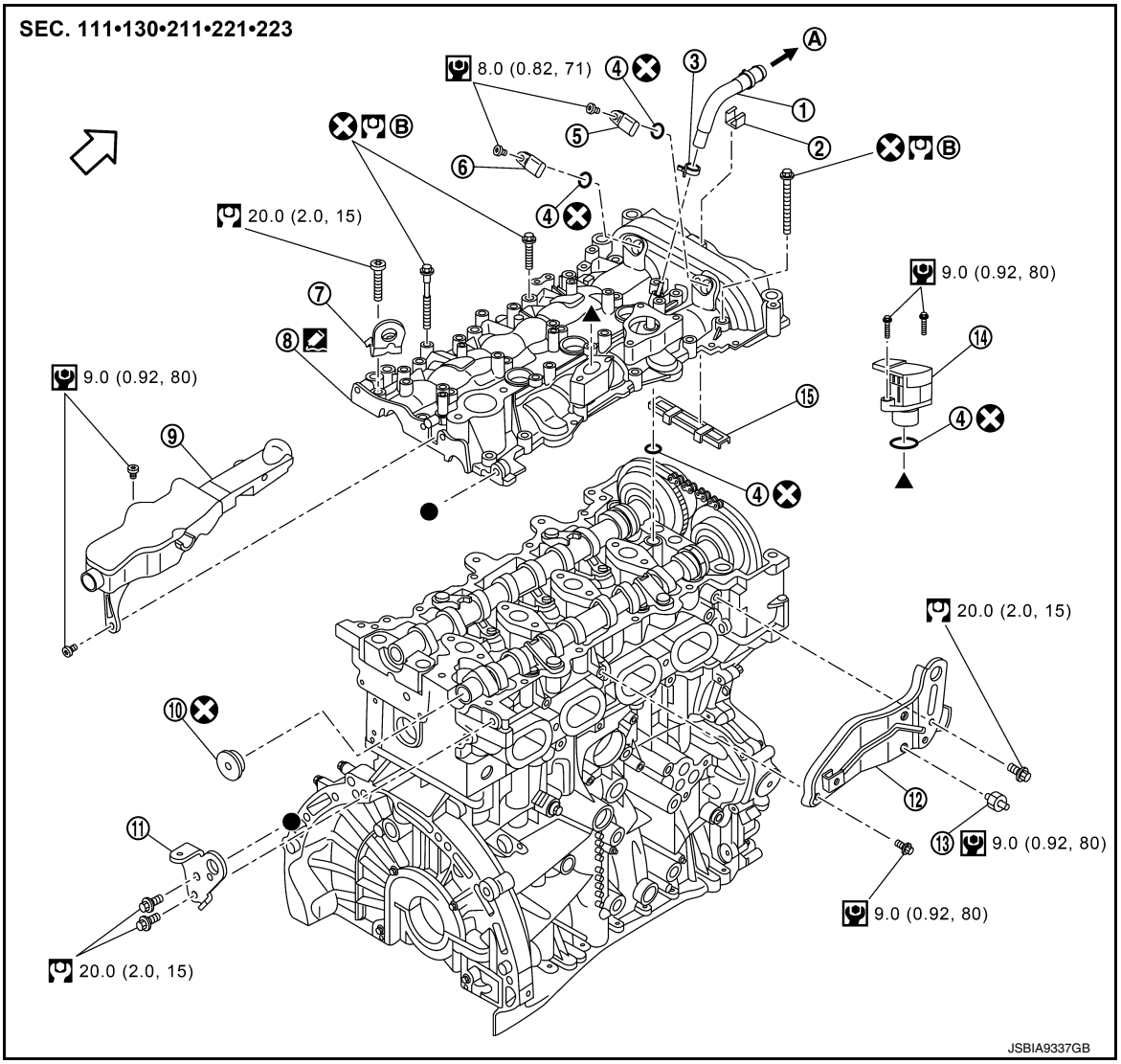
NOTE:

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

CYLINDER HEAD COVER

Exploded View

INFOID:0000000013536893



①	Water hose	②	Clip	③	Clamp
④	O-ring	⑤	Intake camshaft position sensor	⑥	Exhaust camshaft position sensor
⑦	Engine lifting eye (LH)	⑧	Cylinder head cover	⑨	Harness bracket
⑩	Cap	⑪	Engine lifting eye (RR)	⑫	Engine lifting eye (RH)
⑬	Stud	⑭	Intake camshaft valve lift switchover actuator (1.6L turbo engine)	⑮	Timing chain slide rail
Ⓐ	To reservoir tank	Ⓑ	Comply with the installation procedure when tightening. Refer to EM-60.		

⇦ Engine front

: N·m (kg-m, ft-lb)

: N·m (kg-m, in-lb)

: Always replace after every disassembly.

: Sealing point

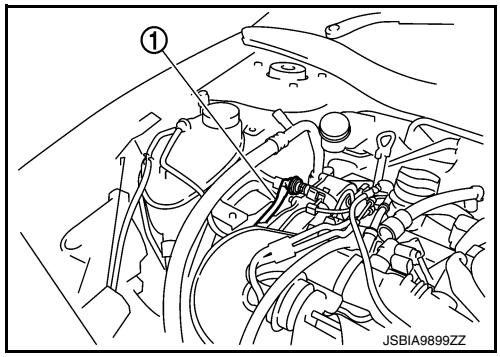
●, ▲ : Indicates that the part is connected at points with same symbol in actual vehicle.

Removal and Installation

INFOID:0000000013536894

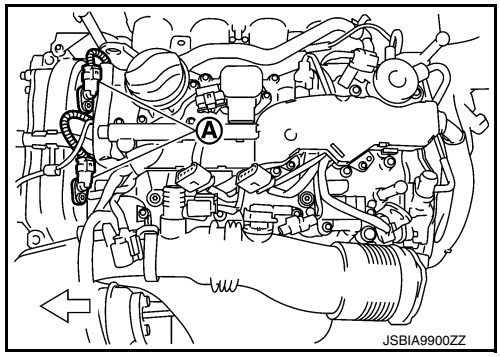
REMOVAL

1. Drain engine coolant from radiator. Refer to CO-7, "Draining".
2. Remove the engine cover. Refer to EM-20, "Removal and Installation".
3. Remove supporting flame. Refer to EM-95, "Exploded View".
4. Remove the reservoir tank tube (return) ①.



5. Disconnect the intake camshaft position sensor and the exhaust camshaft position sensor harness connectors Ⓐ.

⇦ : Engine front

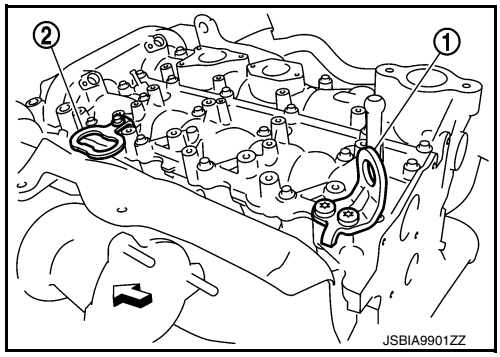


6. Remove the air cleaner housing assembly and the air duct (turbocharger side). Refer to EM-23, "Removal and Installation".
7. Remove front fender protector (RH). Refer to EXT-41, "FENDER PROTECTOR : Removal and Installation".
8. Remove reservoir tank. Refer to CO-13, "Exploded View".
9. Support the bottom surface of engine using a transmission jack, and then remove the engine mount. Refer to EM-95, "Removal and Installation".

CAUTION:
When using the jack, apply a piece of wood to the oil pan to protect the bottom of engine from being scratched.

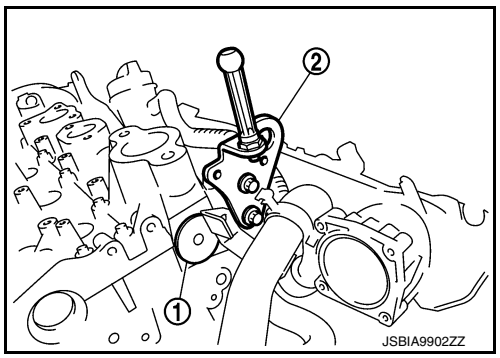
10. Remove the front cover. Refer to EM-88, "Exploded View".
11. Remove the ignition coil. Refer to EM-58, "Removal and Installation".
12. Remove the high pressure fuel pump. Refer to EM-44, "Removal and Installation".
13. Remove the fuel rail. Refer to EM-49, "Removal and Installation".
14. Remove the oil lever gauge guide bolt and turn oil lever gauge guide backward.
15. Remove engine lifting eye (RH).
16. Remove filter neck. Refer to EM-35, "Removal and Installation".
17. Remove the engine lifting eye (LH) ① and bracket ②. Refer to EM-22, "Exploded View".

⇦ : Engine front



18. Remove the vacuum pump. Refer to EM-39, "Removal and Installation".

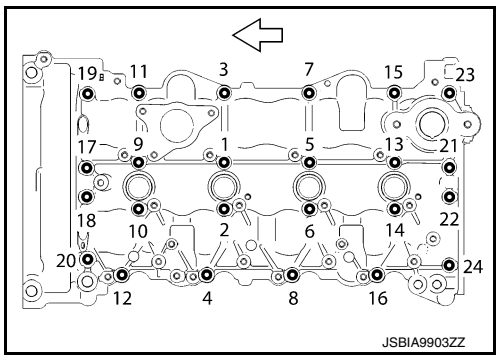
19. Remove the cap ① and engine lifting eye (RR) ②.



20. Remove the cylinder head cover with the following procedure.

a. Loosen the mounting bolts in the order from 24 to 1 as shown in the figure.

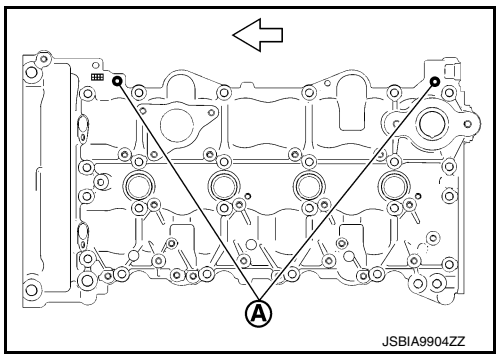
⇦ : Engine front



b. Remove the cylinder head cover with installing and tightening the mounting bolt to the Ⓐ position.

⇦ : Engine front

CAUTION:
Never drive the tool between the cylinder head and cylinder head cover.



21. Remove the intake camshaft actuator, the exhaust camshaft actuator and the timing chain slide rail as necessary.
CAUTION:
If the timing chain slide rail is damaged, replace it.

INSTALLATION

Note the following, 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".

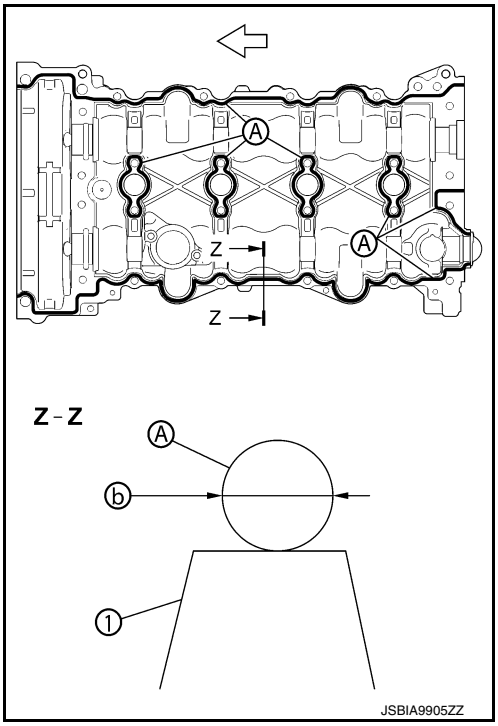
1. Install the cylinder head cover with the following procedure.
CAUTION:
Clean the cylinder head and the cylinder head cover using a [loctite 7200 (Henkel Loctite Deutschland GmbH) and loctite 7063 150ml (A 001 986 71 71 10), or equivalent].

a. Apply the liquid gasket Ⓐ evenly (no break, no overlap) to the matching surface of the cylinder head cover ① as shown in the figure. Refer to EM-5, "Liquid Gasket".
- Use Genuine Liquid Gasket [Loctite 5970 (A 003 989 98 20)] or equivalent.

CAUTION:
Install the cylinder head cover within 10 minutes after applying the liquid gasket.

ⓑ : 0.7 – 1.3 mm (0.028 – 0.051 in)

⇦ : Engine front



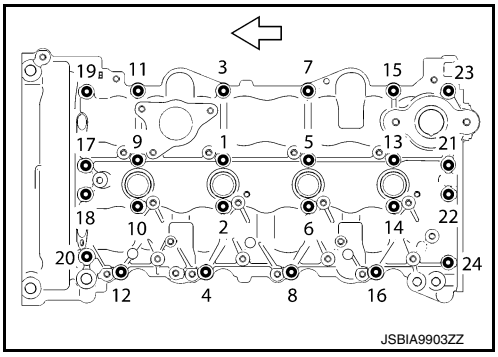
b. Tighten the mounting bolts in the order from 1 to 24 as shown in the figure.

⇦ : Engine front

: 10.0 N·m (1.0 kg-m, 89 in-lb)

c. Turn the mounting bolts clockwise in the order from 1 to 24 as shown in the figure.

Angle tightening : 90°

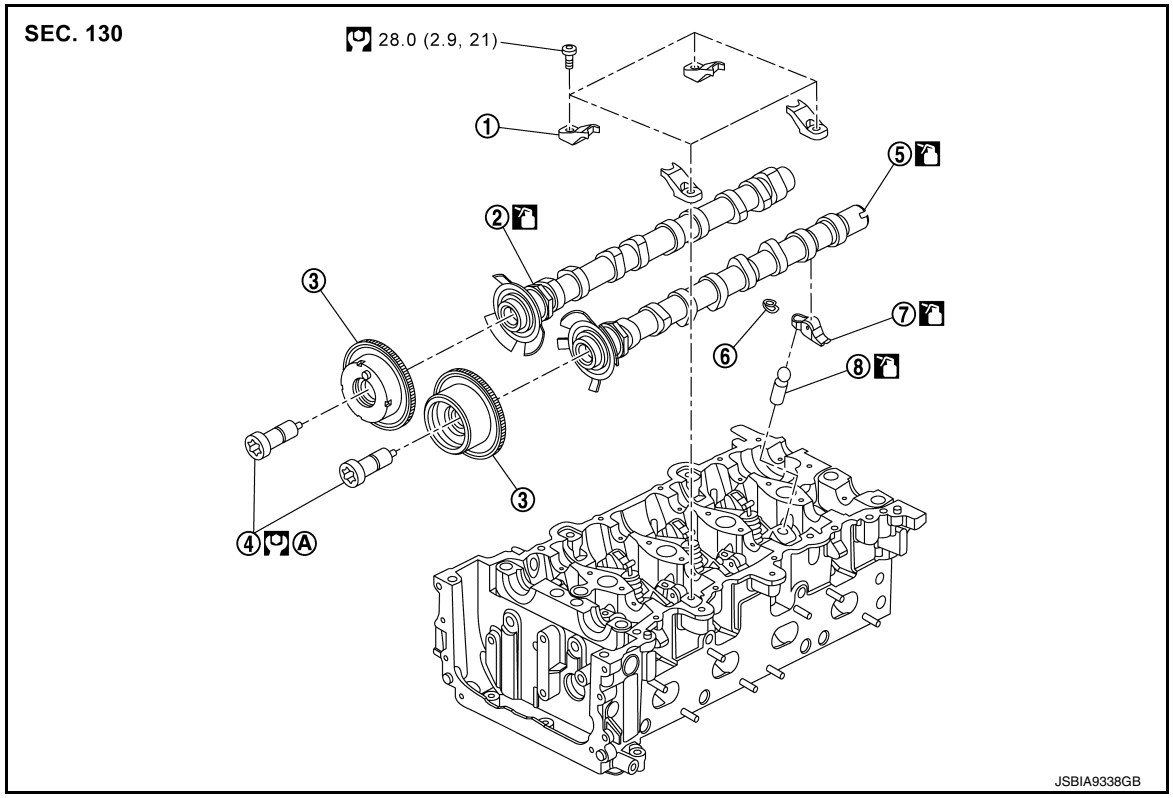


d. Wipe out the extra liquid gasket leaking after tightening the mounting bolts.

CAMSHAFT

Exploded View

INFOID:0000000013536895



①	Camshaft holding clamp	②	Intake camshaft	③	Camshaft adjuster
④	Camshaft central valve	⑤	Exhaust camshaft	⑥	Clip
⑦	Rocker arm	⑧	Hydraulic valve clearance adjustment element		
Ⓐ	Comply with the installation procedure when tightening. Refer to EM-63.				

: N·m (kg-m, ft-lb)

: Should be lubricated with oil.

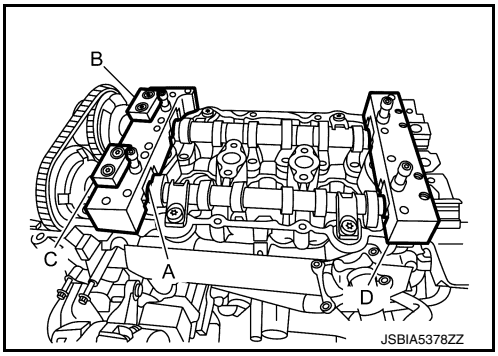
Removal and Installation

INFOID:0000000013536896

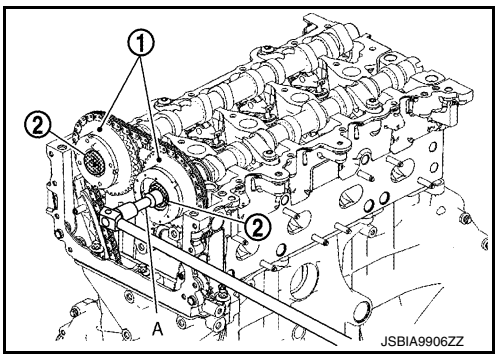
REMOVAL

1. Remove the engine cover. Refer to EM-20, "Removal and Installation".
2. Remove the engine under cover. Refer to EM-20, "Removal and Installation".
3. Set No. 1 cylinder at TDC of its compression stroke. Refer to EM-66, "Inspection".
4. Remove the cylinder head cover. Refer to EM-60, "Removal and Installation".
5. Remove the timing chain tensioner. Refer to EM-89, "Removal and Installation".
6. Remove the camshaft adjuster with the following procedure.

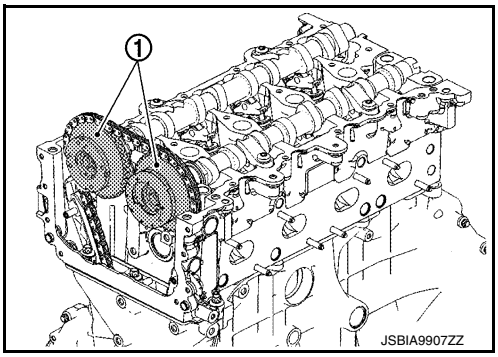
a. Install the camshaft holder [SST: KV105H0210 (270 589 01 61 00)] (A), (B), (C) and (D) as shown in the figure.
NOTE:
Camshaft holder (A) is chosen to intake camshaft.



b. Remove the camshaft central valve ② of the camshaft adjuster ① with the socket wrench [SST: KV105H0090 (271 589 00 10 00)] (A) as shown in the figure.

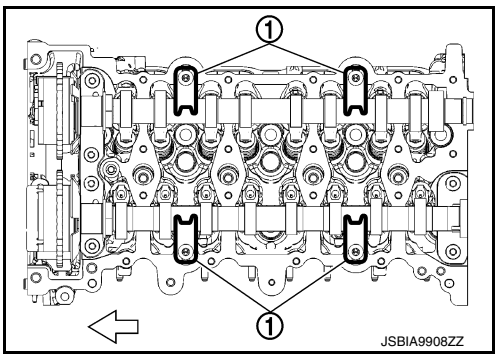


c. Remove the camshaft adjuster ①.
d. Remove the camshaft holder [SST: KV105H0210 (270 589 01 61 00)].



7. Remove the camshaft holding clamp ①.

⇦ : Engine front



8. Remove the camshaft.
9. Remove the rocker arm and the hydraulic valve clearance adjustment element.
CAUTION:
Identify installation positions, and store them without mixing them up.

a. Press the hydraulic valve clearance adjustment element by hand firmly and slowly, and check that it moves up and down smoothly.
CAUTION:
- **Never press the hydraulic valve clearance adjustment element using metallic tools.**
- **If any malfunction is found in the hydraulic valve clearance adjustment element, replace it with a new one.**
- **If several malfunctions are found in the hydraulic valve clearance adjustment element, check the oil line.**

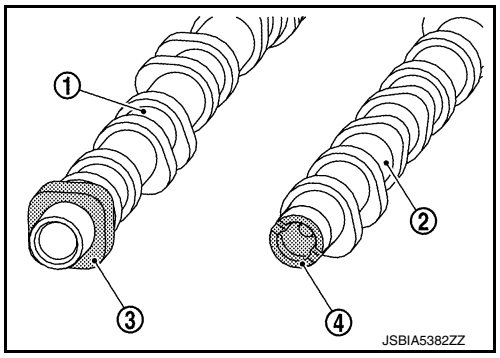
INSTALLATION

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".

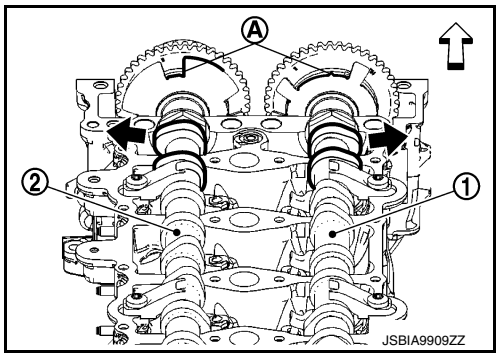
1. Install the rocker arm and the hydraulic valve clearance adjustment element.
   CAUTION:
   Install them in the original positions.
2. Install the camshaft with the following procedure.

a. Distinguish between the intake and the exhaust by looking at the different shapes of the rear ends of the camshaft



① : Camshaft (INT)
② : Camshaft (EXT)
③ : High pressure fuel pump drive cam
④ : Vacuum pump drive spline

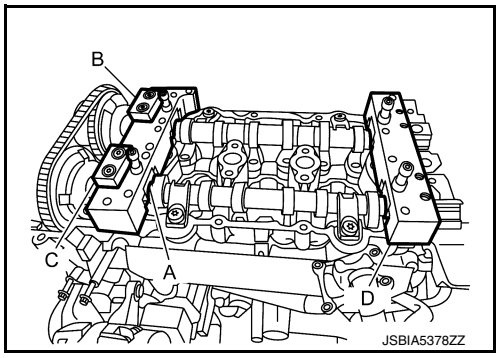
b. Install the camshaft with the cam noses of the No. 1 cylinder located (⬅) as shown in the figure. (No. 1 cylinder at TDC)



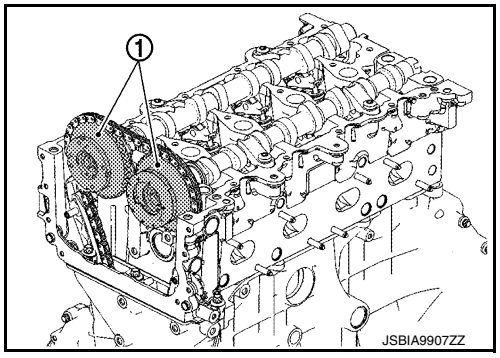
① : Camshaft (INT)
② : Camshaft (EXT)
Ⓐ : Measurement position of segment disk
⇦ : Engine front

- Rotate the camshaft using a socket wrench bit [SST: KV105H0450 (270 589 01 07 00)], if necessary.

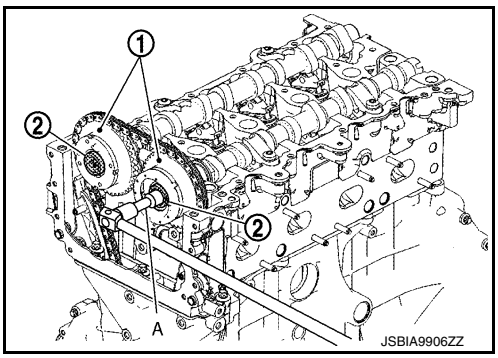
c. Install the camshaft holder [SST: KV105H0210 (270 589 01 61 00)] (A), (B), (C) and (D) as shown in the figure.



d. Install the camshaft adjuster ①.



e. Tighten the camshaft central valve ② of the camshaft adjuster ① with the socket wrench [SST: KV105H0090 (271 589 00 10 00)] (A) as shown in the figure.



: 18.0 N·m (1.8 kg-m, 13 ft-lb)

f. Turn the camshaft central valve of the camshaft adjuster with the socket wrench [SST: KV105H0090 (271 589 00 10 00)].

Angle tightening : 40°

3. Install in the reverse order of removal, for the rest of parts.
4. After assembling, always perform the check of camshaft basic position. Refer to EM-66, "Inspection".

Inspection

INFOID:0000000013536897

INSPECTION AFTER REMOVAL

Camshaft Journal Oil Clearance

CAMSHAFT BRACKET INNER DIAMETER
- Measure the inner diameter of camshaft bracket.

Standard : Refer to EM-102, "Camshaft".

Checking the Hydraulic Valve Clearance Adjustment Element

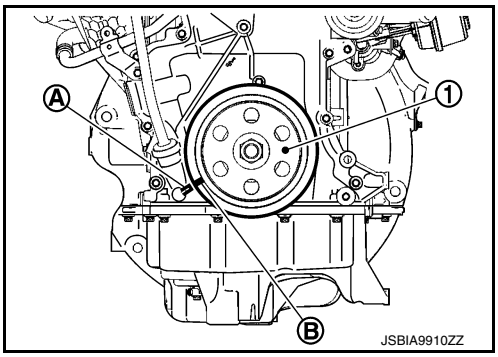
1. Press the hydraulic valve clearance adjustment element by hand firmly and slowly, and check that it moves up and down smoothly.
   CAUTION:
   - **Never press the hydraulic valve clearance adjustment element using metallic tools.**
   - **If any malfunction is found in the hydraulic valve clearance adjustment element, replace it with a new one.**
   - **If several malfunctions are found in the hydraulic valve clearance adjustment element, check the oil line.**

INSPECTION AFTER INSTALLATION

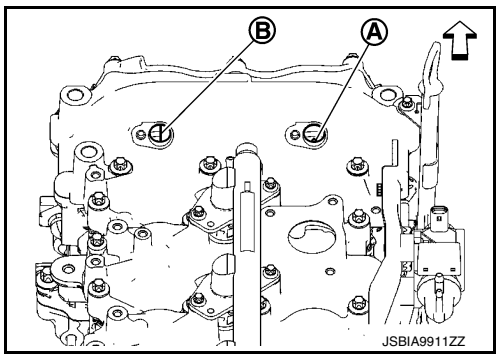
Checking the Camshaft Basic Position

1. Remove the camshaft intake position sensor and the camshaft exhaust position sensor. Refer to EM-59, "Exploded View".
2. Set No. 1 cylinder at TDC of its compression stroke as follows:

a. Rotate the crankshaft pulley ① in the direction of engine rotation, and align the mark “0 °” Ⓑ with the timing indicator Ⓐ in timing case cover.



3. Check that each segment disk is located as shown in the figure by visually checking from the mounting hole of the camshaft intake position sensor and the camshaft exhaust position sensor.



Ⓐ : Measurement position of segment disk measurement mark (INT)

Ⓑ : Measurement position of segment disk edge (EXH)

⇦ : Engine front

4. If there is misalignment, perform adjustment of camshaft basic position. Refer to EM-67, "Adjustment".

Inspection for Leakage

The following are procedures for checking fluid leakage, lubricants leakage, and exhaust gases leakage.

- Before starting engine, check oil/fluid levels including engine coolant and engine oil. If any are less than the required quantity, fill them to the specified level. Refer to MA-12, "FOR NORTH AMERICA : Fluids and Lubricants" (FOR NORTH AMERICA) or MA-13, "FOR MEXICO : Fluids and Lubricants" (FOR MEXICO).
- Follow the procedure below to check for fuel leakage.
- Turn ignition switch to the “ON” position (with engine stopped). With fuel pressure applied to fuel piping, check for fuel leakage at connection points.
- Start engine. With engine speed increased, check again for fuel leakage at connection points.
- Run engine to check for unusual noise and vibration.
- Warm up engine thoroughly to check that there is no leakage of fuel, or any oil/fluids including engine oil and engine coolant.
- Bleed air from lines and hoses of applicable lines, such as in cooling system.
- After cooling down engine, again check oil/fluid levels including engine oil and engine coolant. Refill them to the specified level, if necessary.

Summary of the inspection items:

Items		Before starting engine	Engine running	After engine stopped
Engine coolant		Level	Leakage	Level
Engine oil		Level	Leakage	Level
Transmission /transaxle fluid	AT & CVT Models	Leakage	Level / Leakage	Leakage
	M/T Models	Level / Leakage	Leakage	Level / Leakage
Other oils and fluids*		Level	Leakage	Level
Fuel		Leakage	Leakage	Leakage
Exhaust gases		—	Leakage	—

*: Power steering fluid, brake fluid, etc.

Adjustment

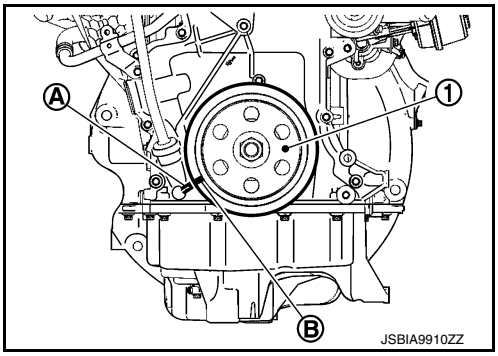
INFOID:0000000013536898

ADJUSTMENT AFTER INSTALLATION

Adjusting the Camshaft Basic Position

1. Remove cylinder head cover. Refer to EM-60, "Removal and Installation".
2. Remove the intake camshaft position sensor and exhaust camshaft position sensor. Refer to EM-60, "Removal and Installation".
3. Set No. 1 cylinder at TDC of its compression stroke with the following procedure.

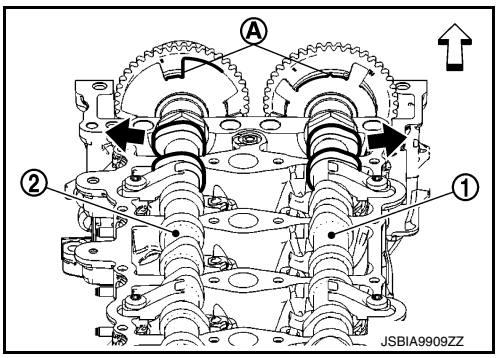
a. Rotate the crankshaft pulley ① in the direction of engine rotation, and align the mark “0 °” Ⓑ with the timing indicator Ⓐ in front cover.



b. At the same time, check that the cam noses of the No. 1 cylinder are located (⬅) as shown in the figure.

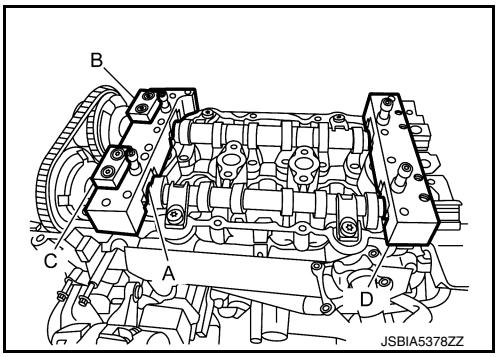
① : Camshaft (INT)
② : Camshaft (EXT)
Ⓐ : Measurement position
⇦ : Engine front

• If not, rotate the crankshaft pulley one revolution (360 degrees) are align as shown in the figure.



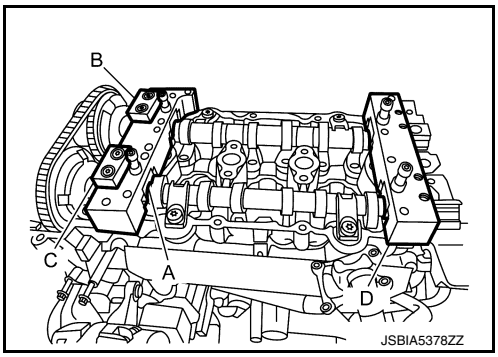
4. Loosen camshaft central valve. Refer to EM-63, "Removal and Installation".
5. Install the camshaft holder [SST: KV105H0210 (270 589 01 61 00)] (A) and (D).
6. Install the camshaft holder [SST: KV105H0210 (270 589 01 61 00)] (B) and (C).

CAUTION:
Never install the camshaft holder forcibly with hitting it.

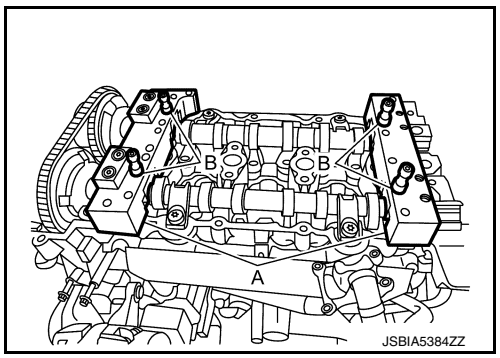


7. Remove the camshaft holder [SST: KV105H0210 (270 589 01 61 00)] (B) and (C) from (A).

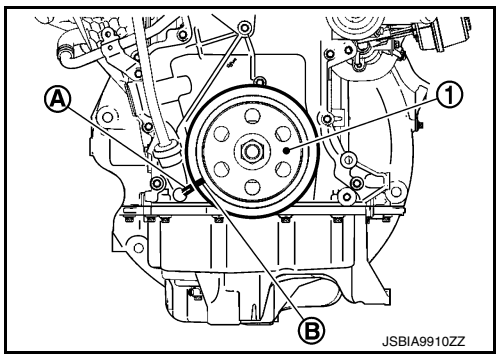
CAUTION:
Never remove the camshaft holder [SST: KV105H0210 (270 589 01 61 00)] (D).



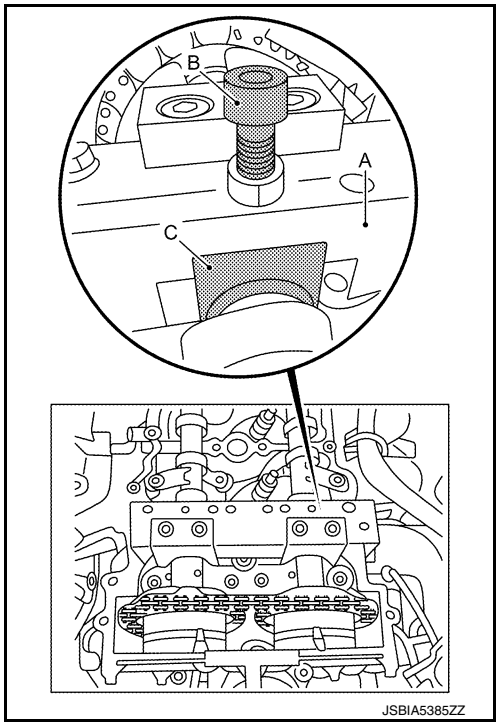
8. Loosen the adjusting bolts (B) of the camshaft holder [SST: KV105H0210 (270 589 01 61 00)] (A) until the camshaft rotates smoothly.
9. Install the chain tensioner. Refer to EM-89, "Removal and Installation".



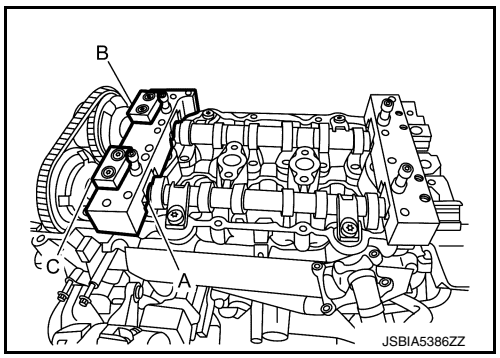
10. Rotate the crankshaft pulley ① in the direction of engine rotation by 2 turns, and align the mark “0 °” Ⓑ with the timing indicator Ⓐ in timing case cover. (No. 1 cylinder at TDC)



11. Tighten the adjusting bolt (B) of the camshaft holder [SST: KV105H0210 (270 589 01 61 00)] (A) until the bearing bracket (C) reaches the cylinder head.
12. Tighten the camshaft central valve the specified torque. Refer to EM-63, "Removal and Installation".



13. Install the camshaft holder [SST: KV105H0210 (270 589 01 61 00)] (B) and (C) to (A) by hand.
CAUTION:
- **Never install the camshaft holder forcibly with hitting it.**
- **If installing it by hand is not possible, return to the step 1.**
14. Remove the all camshaft holder [SST: KV105H0210 (270 589 01 61 00)].
15. Install in the reverse order of removal, for the rest of parts.

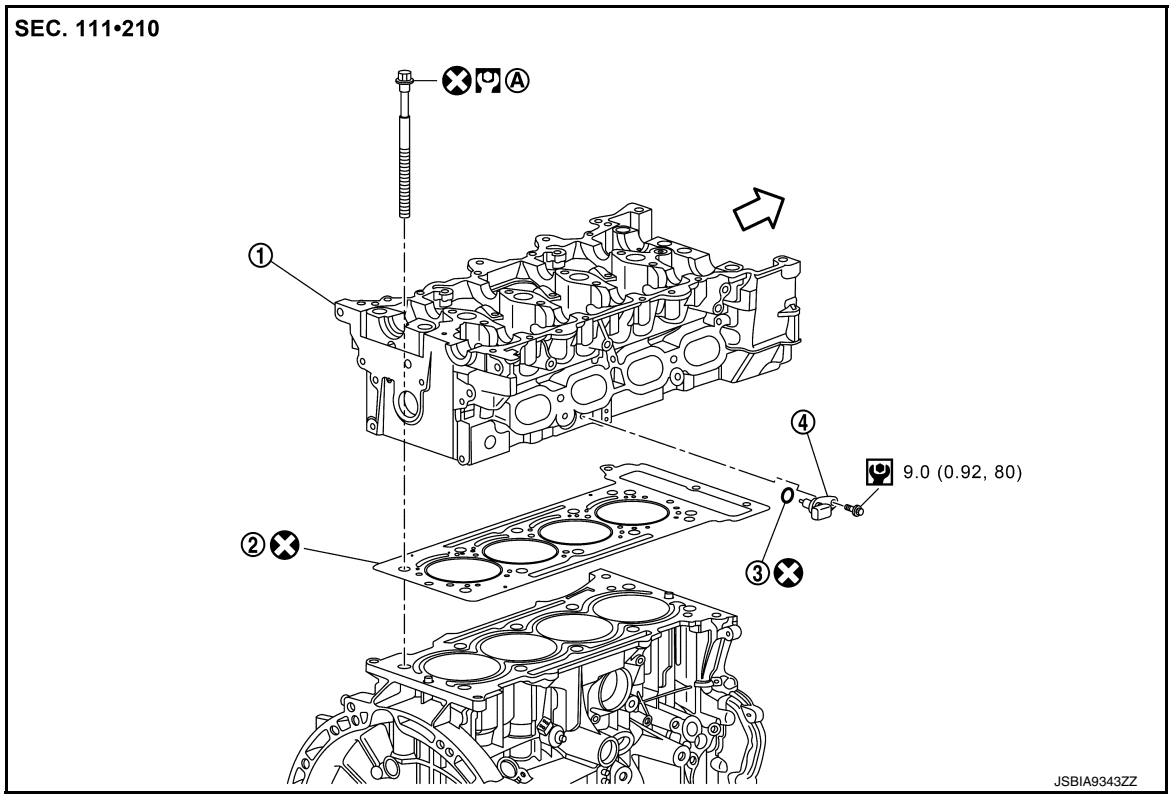


CYLINDER HEAD

Exploded View

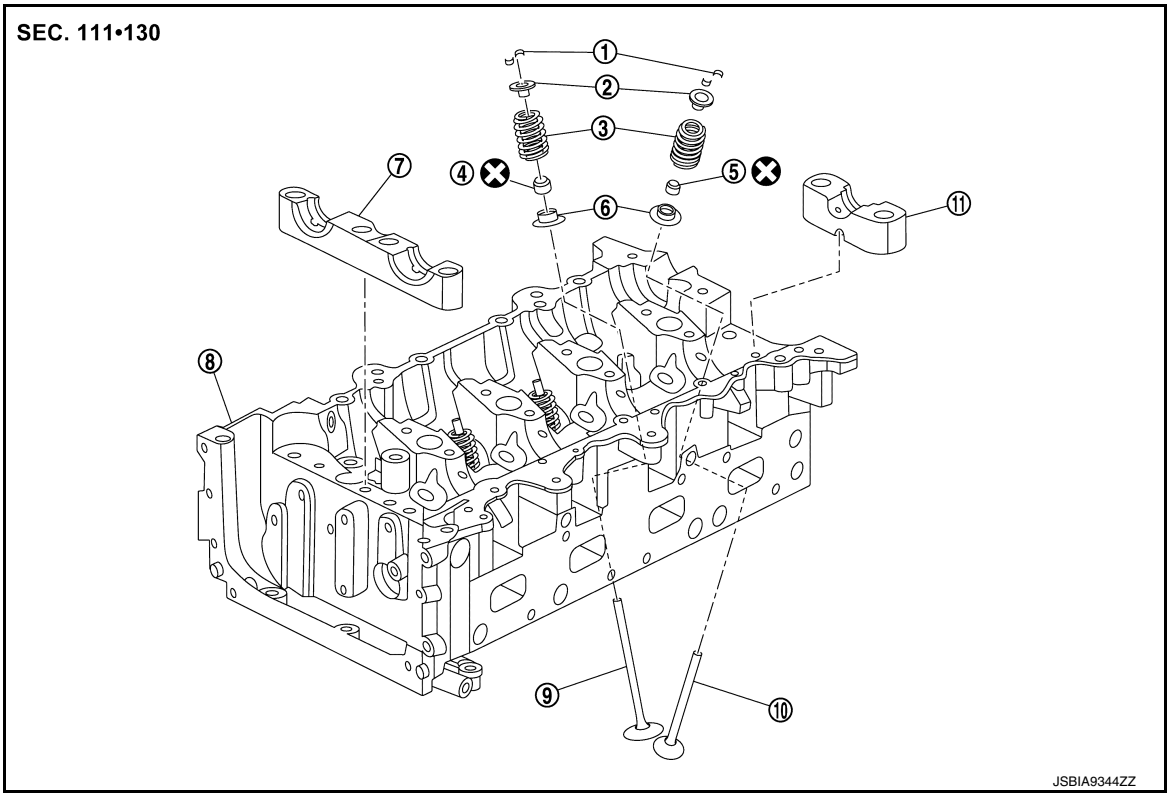
INFOID:0000000013536899

REMOVAL



① Cylinder head
② Cylinder head gasket
③ O-ring
④ Engine coolant temperature sensor
Ⓐ Comply with the installation procedure when tightening. Refer to EM-60, "Removal and Installation".
⇦ : Engine front
: Always replace after every disassembly.
: N·m (kg-m, ft-lb)
: N·m (kg-m, in-lb)

DISASSEMBLY



① Valve collet	② Valve spring retainer	③ Valve spring
④ Valve oil seal	⑤ Valve oil seal	⑥ Valve spring seat
⑦ Camshaft bearing bridge	⑧ Cylinder head	⑨ Intake valve
⑩ Exhaust valve	⑪ Camshaft bearing bridge	

⊗ : Always replace after every disassembly.

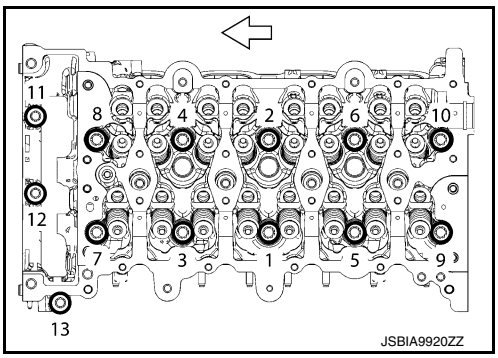
Removal and Installation

INFOID:0000000013536900

REMOVAL

1. Drain engine oil. Refer to LU-8, "Draining".
2. Drain engine coolant. Refer to CO-7, "Draining".
3. Remove the following components and related parts.
   - Charge air manifold: Refer to EM-29, "Removal and Installation".
   - Exhaust manifold and turbocharger assembly: Refer to EM-42, "Removal and Installation".
   - Cylinder head cover: Refer to EM-60, "Removal and Installation".
   - Front cover: Refer to EM-89, "Removal and Installation".
   - Camshaft: Refer to EM-63, "Removal and Installation".
   - Vacuum pump: Refer to EM-39, "Removal and Installation".
   - Spark plug: Refer to EM-18, "Removal and Installation".
   - Mounting bolts of water pipe: Refer to CO-18, "Exploded View".
4. Disconnect the coolant temperature sensor harness connector.
5. Remove the slide rail pin by puller [SST: KV105H0600 (270 589 01 33 00)] and spindle [SST: KV105H0420 (270 589 00 33 02)]. Refer to EM-88, "Exploded View".

6. Loosen the mounting bolts in the order from 13 to 1 as shown in the figure to remove the cylinder head.



⇦ : Engine front

CAUTION:
Perform this step when the engine is cold.

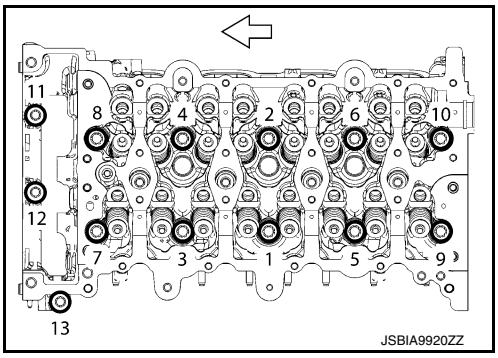
7. Remove the hydraulic valve clearance adjustment element as necessary. Refer to EM-63, "Removal and Installation".

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".

1. Clean the cylinder head and the cylinder head cover using a [loctite 7200 (Henkel Loctite Deutschland GmbH) and loctite 7063 150ml (A 001 986 71 71 10), or equivalent].
2. Remove the cylinder head gasket.
3. Tighten the mounting bolts in the order from 1 to 13 as shown in the figure to install the cylinder head.



⇦ : Engine front

a. Tighten the mounting bolts in the order from 1 to 10 in the figure.

Step 1 : **10.0 N·m (1.0 kg-m, 89 in-lb)**

Step 2 : **40.0 N·m (4.1 kg-m, 30 ft-lb)**

b. Turn the mounting bolts clockwise in the order from 1 to 10 in the figure.

Angle tightening : 90°

c. Turn the mounting bolts clockwise in the order from 1 to 10 in the figure again.

Angle tightening : 90°

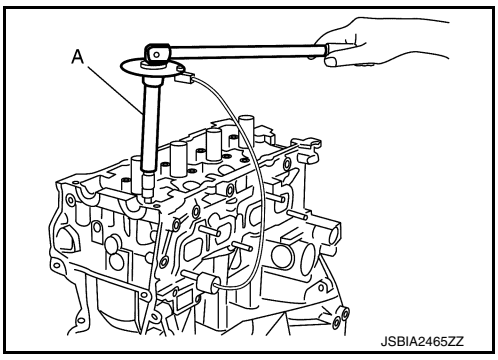
d. Turn the mounting bolts clockwise in the order from 1 to 10 in the figure again.

Angle tightening : 90°

e. Tightening the mounting bolts in the order from 11 to 13 in the figure to specified torque. Refer to EM-88, "Exploded View".

CAUTION:
Check and confirm the tightening angle by using an angle wrench (SST: KV10112100) (A) or protractor. Avoid judgment by visual inspection without the tool.

4. Install in the reverse order of removal, for the rest of parts.

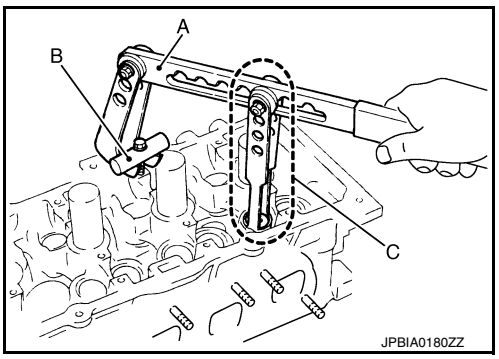


Disassembly and Assembly

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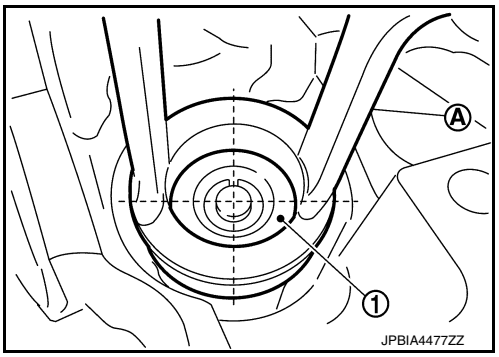
DISASSEMBLY

1. Remove valve collet.
   - Compress valve spring with the valve spring compressor [SST: KV10116200] (A), the attachment [SST: KV10115900] (C) and the adapter [SST: KV10109220] (B). Remove valve collet with a magnet hand.

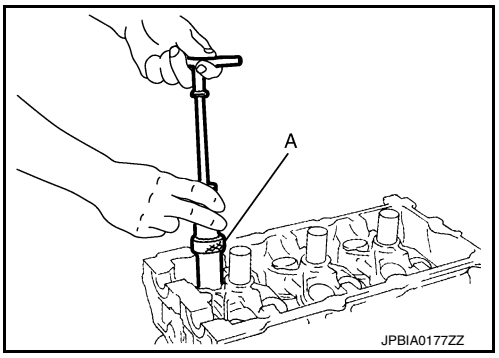


CAUTION:
- **Be careful not to damage cylinder head.**
- **Fit the attachment [SST: KV10115900] in the center of valve spring retainer to press it.**

① : Valve spring retainer
Ⓐ : Attachment



2. Remove valve spring retainer, valve spring and valve spring seat.
3. Push valve stem to combustion chamber side, and remove valve.
   - Identify installation positions, and store them without mixing them up.
4. Remove valve oil seal using the valve oil seal puller [SST: KV10107902] (A).



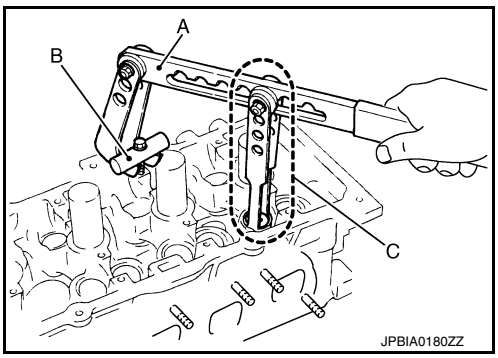
ASSEMBLY

1. Install valve spring seat.
2. Install new valve oil seals as follows:

a. Apply new engine oil on valve oil seal joint and seal lip.
b. Install valve oil seal with the valve oil seal drift [SST: KV10115600]. Refer to EM-84, "VALVE OIL SEAL : Removal and Installation".

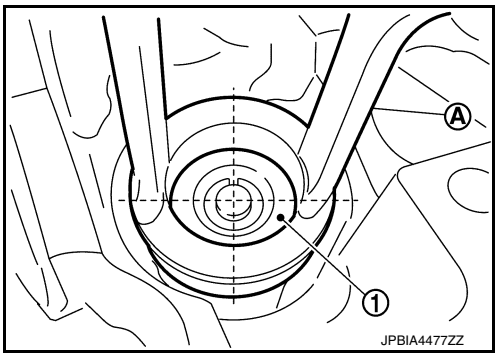
3. Install valve.
4. Install valve spring.
5. Install valve spring retainer.
6. Install valve collet.

- Compress valve spring with the valve spring compressor [SST: KV10116200] (A), the attachment [SST: KV10115900] (C) and the adapter [SST: KV10109220] (B). Install valve collet with a magnet hand.



CAUTION:
- **Be careful not to damage cylinder head.**
- **Fit the attachment [SST: KV10115900] in the center of valve spring retainer to press it.**

① : Valve spring retainer
Ⓐ : Attachment



- Tap valve stem edge lightly with plastic hammer after installation to check its installed condition.

7. Install in the reverse order of removal after this step.

Inspection

INFOID:0000000013536902

INSPECTION AFTER REMOVAL

Cylinder Head Distortion

1. Clean the cylinder head and the cylinder block using a [loctite 7200 (Henkel Loctite Deutschland GmbH) and loctite 7063 150ml (A 001 986 71 71 10), or equivalent].
   CAUTION:
   Never allow any foreign material to enter passages for engine oil or water.
2. Check for a distortion, crack and damage at the matching surface of cylinder block.
   CAUTION:
   Even if there is small distortion from the front to the rear side of cylinder head, it will be corrected when the cylinder head is assembled. Therefore, grinding the surface is not necessary.

INSPECTION AFTER INSTALLATION

Inspection for Leakage

The following are procedures for checking fluid leakage, lubricants leakage, and exhaust gases leakage.

- Before starting engine, check oil/fluid levels including engine coolant and engine oil. If any are less than the required quantity, fill them to the specified level. Refer to MA-12, "FOR NORTH AMERICA : Fluids and Lubricants" (FOR NORTH AMERICA) or MA-13, "FOR MEXICO : Fluids and Lubricants" (FOR MEXICO).
- Follow the procedure below to check for fuel leakage.
- Turn ignition switch to the “ON” position (with engine stopped). With fuel pressure applied to fuel piping, check for fuel leakage at connection points.
- Start engine. With engine speed increased, check again for fuel leakage at connection points.
- Run engine to check for unusual noise and vibration.
- Warm up engine thoroughly to check that there is no leakage of fuel, or any oil/fluids including engine oil and engine coolant.
- Bleed air from lines and hoses of applicable lines, such as in cooling system.
- After cooling down engine, again check oil/fluid levels including engine oil and engine coolant. Refill them to the specified level, if necessary.

Summary of the inspection items:

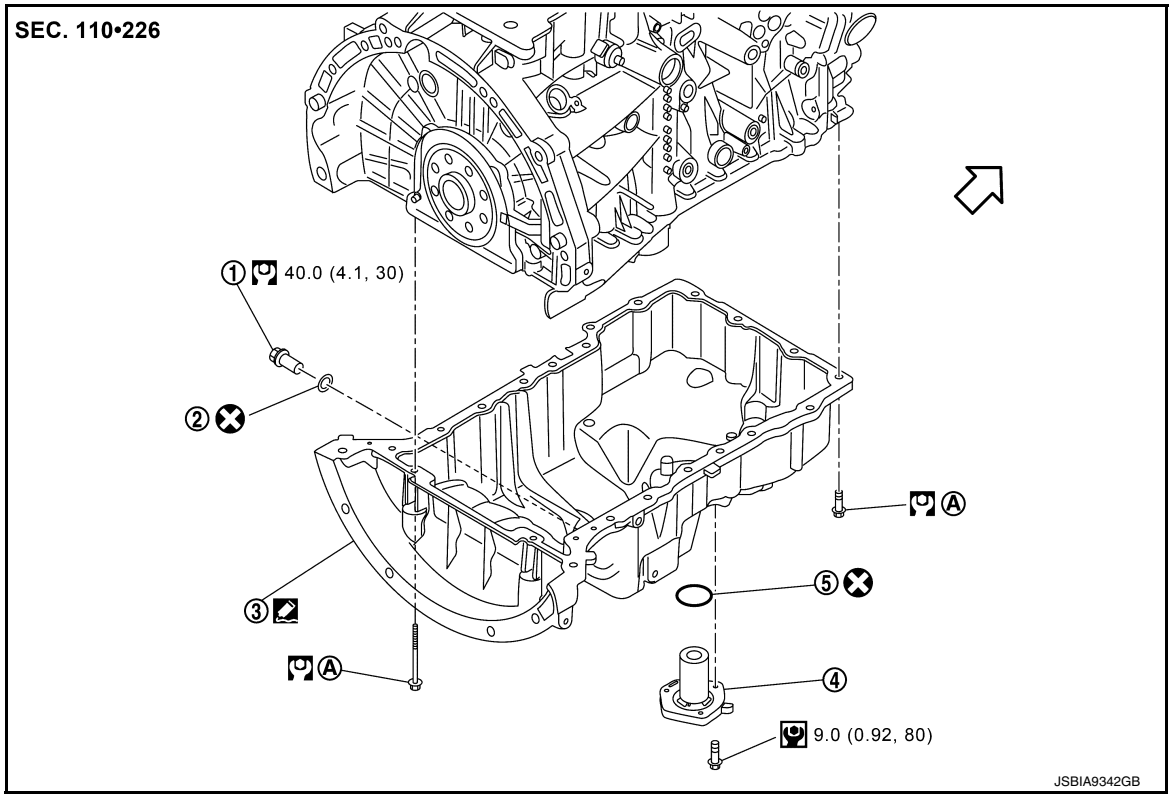
Items		Before starting engine	Engine running	After engine stopped
Engine coolant		Level	Leakage	Level
Engine oil		Level	Leakage	Level
Transmission /transaxle fluid	AT & CVT Models	Leakage	Level / Leakage	Leakage
	M/T Models	Level / Leakage	Leakage	Level / Leakage
Other oils and fluids*		Level	Leakage	Level
Fuel		Leakage	Leakage	Leakage
Exhaust gases		—	Leakage	—

*: Power steering fluid, brake fluid, etc.

OIL PAN

Exploded View

INFOID:0000000013536903



① Oil drain screw	② Oil drain screw washer	③ Oil pan
④ Engine oil level switch	⑤ O-ring	
Ⓐ Comply with the installation procedure when tightening. Refer to EM-76, "Removal and Installation"		

⇦ : Engine front

: Always replace after every disassembly.

: N·m (kg-m, in-lb)

: N·m (kg-m, ft-lb)

: Sealing point

Removal and Installation

INFOID:0000000013536904

REMOVAL

Engine oil level switch

1. Drain engine oil. Refer to LU-8, "Draining".
2. Disconnect engine oil level switch harness connector.
3. Remove engine oil level switch.
4. Remove O-ring from engine oil level switch.

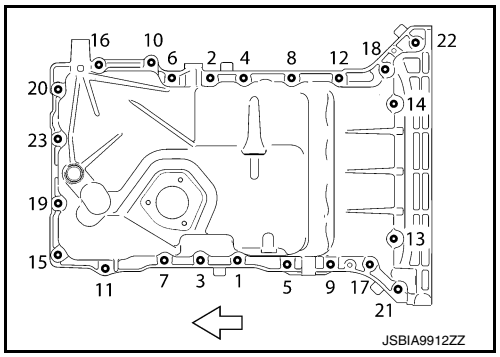
Oil pan

1. Drain engine oil. Refer to LU-8, "Draining".
2. Remove the A/C compressor. Refer to HA-25, "Removal and Installation".

3. Remove lower torsion bar linkage. Refer to EM-95, "Exploded View".
4. Remove support bearing bracket. Refer to FAX-15, "Exploded View".
5. Remove exhaust front tube. Refer to EX-7, "Removal and Installation"
6. Disconnect engine oil level switch harness connector.
7. Remove bolts (transaxle to oil pan). Refer to TM-228, "Removal and Installation".
8. Remove the oil pan with the following procedure.

a. Remove the mounting bolts of oil pan in the order from 23 to 1.

⇦ : Engine front



b. Cut the liquid gasket by prying around the oil pan, and then remove the oil pan.

CAUTION:
- **Never use the seal cutter.**
- **Be careful not to damage the mating surface.**
- **Never pick the area forcibly with a screw driver.**

INSTALLATION

CAUTION:

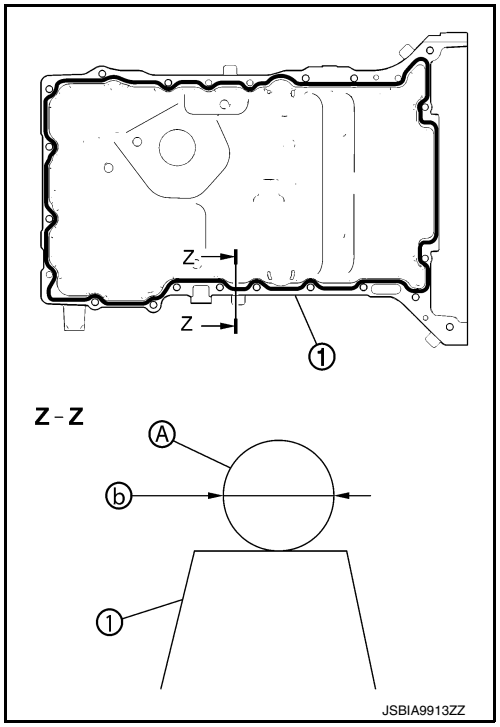
Clean the oil pan and the cylinder block using a [loctite 7200 (Henkel Loctite Deutschland GmbH) and loctite 7063 150ml (A 001 986 71 71 10), or equivalent].

1. Install the oil pan with the following procedure.

a. Apply the liquid gasket Ⓐ evenly (no break, no overlap) to the matching surface of oil pan ① as shown in the figure. Refer to EM-5, "Liquid Gasket".

Ⓑ : ϕ1.0 – 3.0 mm (0.04 – 0.11 in)

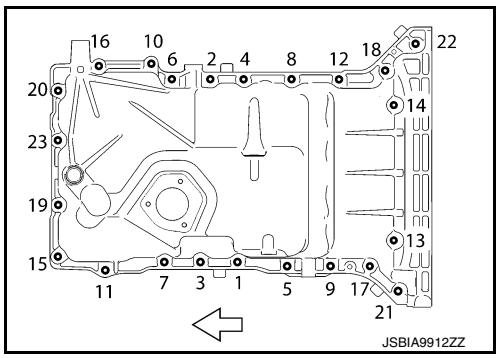
- Use Genuine Liquid Gasket [Loctite 5970 (A 003 989 98 20)] or equivalent.



b. Tighten the mounting bolts of oil pan in the order from 1 to 23.

⇦ : Engine front

: 11.0 N·m (1.1 kg-m, 8 ft-lb)



2. Install the oil drain screw.

CAUTION:

Never reuse the oil drain screw washer.

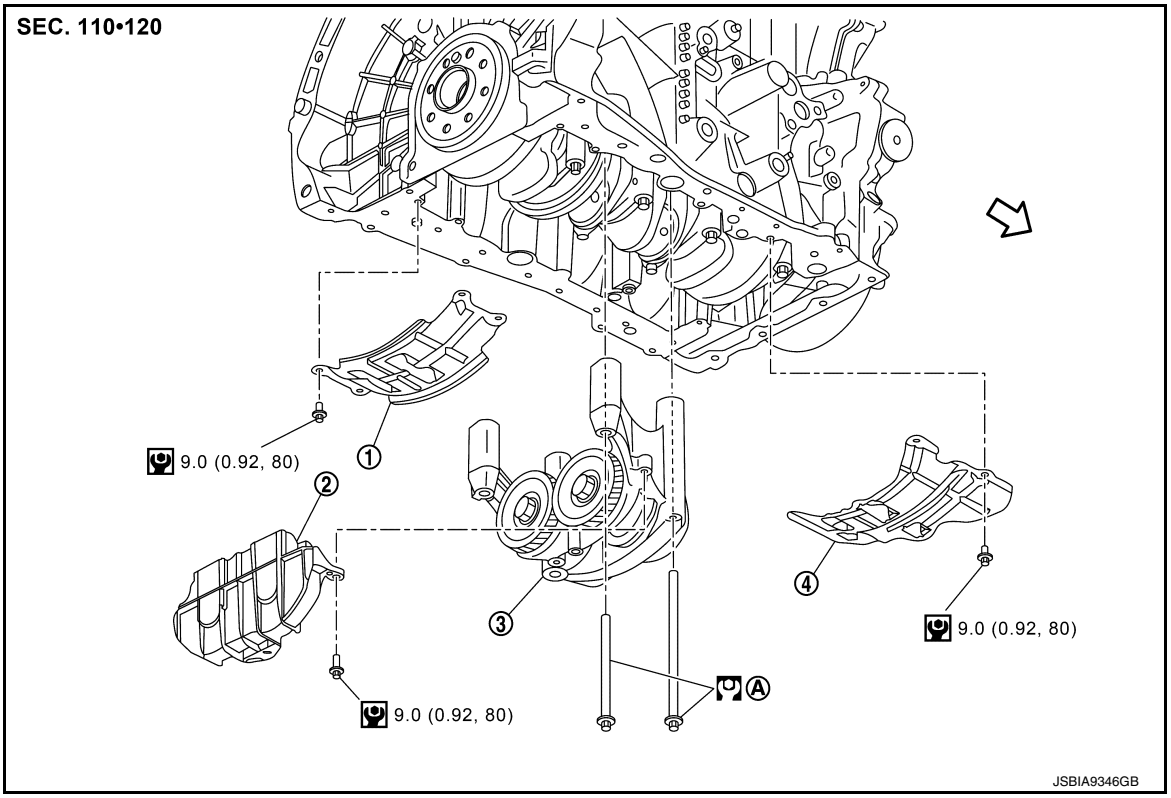
3. Install in the reverse order of removal, for the rest of parts.

CAUTION:
Wait at least 30 minutes after oil pan is installed before pouring engine oil.

LANCHESTER BALANCER

Exploded View

INFOID:0000000013536905



① Oil baffle 2
② Cover
③ Lanchester balancer
④ Oil baffle 1
Ⓐ Comply with the installation procedure when tightening. Refer to EM-79.
⇦ : Engine front
: N·m (kg-m, ft-lb)
: N·m (kg-m, in-lb)

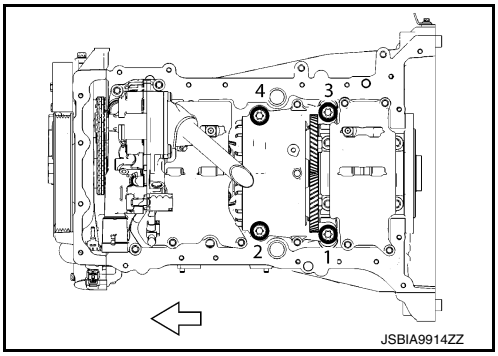
Removal and Installation

INFOID:0000000013536906

REMOVAL

1. Set No.1 cylinder at TDC of its compression stroke. Refer to EM-66, "Inspection".
2. Remove oil pan. Refer to EM-76, "Removal and Installation".
3. Remove the oil baffle 2.
4. Remove the cover.

5. Remove the mounting bolts of lanchester balancer in the order from 4 to 1.



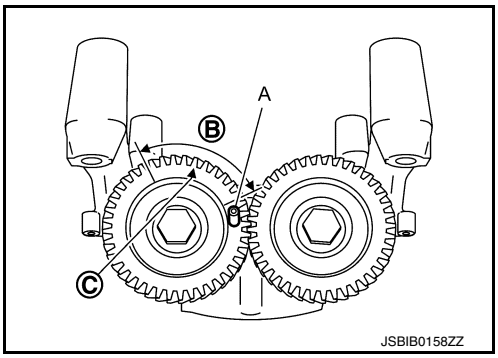
⇦ : Engine front

6. Remove the oil baffle 1, if necessary.

INSTALLATION

New Lanchester Balancer

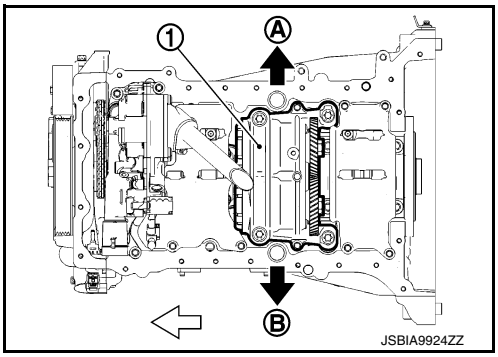
1. Install new lanchester balancer on cylinder block when the allow Ⓒ on left spur gear indicates crankshaft gear side.



A : Pin

Ⓑ : Coating area

- Press the lanchester balancer ① in the direction Ⓑ.



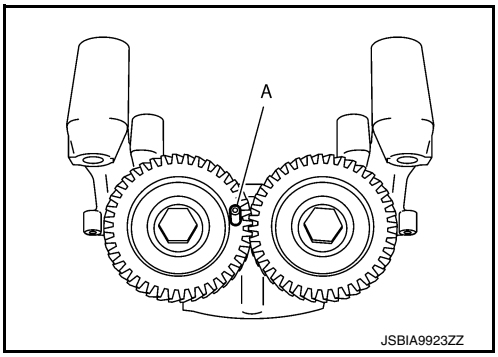
⇦ : Engine front

Ⓐ : Adjusting direction

- Tighten mounting bolts by hand.

CAUTION:
Do not reuse mounting bolts.

2. Remove the pin (A).



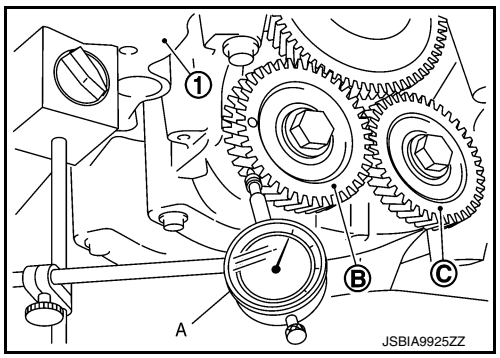
3. Measure the torsional play of lanchester balancer with the following procedure.

a. Set a dial indicator (A) to the cylinder block ① and set it at 0 point.

Ⓑ : Left spur gear
Ⓒ : Right spur gear

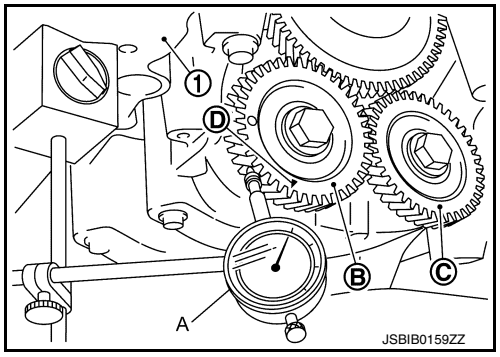
b. Turn right spur gear in the direction of engine rotation to measure the torsion play.

Standard : 0.00 – 0.02 mm (0.0000 – 0.0008 in)



4. Turn crankshaft 90° to place the allow Ⓓ on left spur gear shown in the figure.

① : Cylinder block
A : Dial indicator
Ⓑ : Left spur gear
Ⓒ : Right spur gear



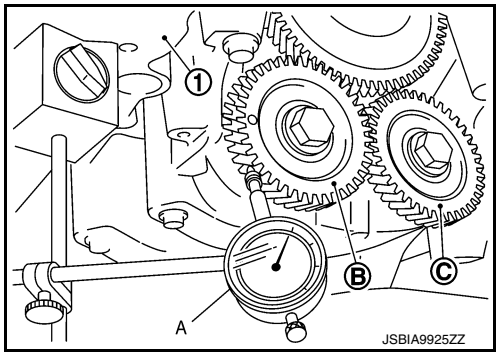
5. Measure the torsional play of lanchester balancer with the following procedure.

a. Set a dial indicator (A) to the cylinder block ① and set it at 0 point.

Ⓑ : Left spur gear
Ⓒ : Right spur gear

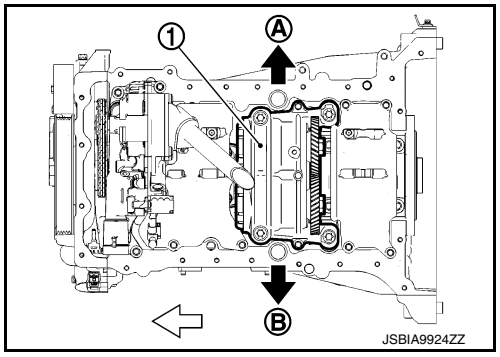
b. Turn right spur gear in the direction of engine rotation to measure the torsion play.

Standard : 0.12 – 0.19 mm (0.0047 – 0.0075 in)



- If torsional play is too small, press the lanchester balancer ① in the direction Ⓐ.

⇦ : Engine front
Ⓑ : Basic position



6. Tighten the mounting bolts of the lanchester balancer to the specified torque.

Step1 : 5.0 N·m (0.51 kg-m, 44 in-lb)
Step2 : 27.0 N·m (2.8 kg-m, 20 ft-lb)

a. Turn the mounting bolts clockwise.

Step3 Angle tightening : 90°
Step4 Angle tightening : 90°

CAUTION:
Check and confirm the tightening angle by using an angle wrench (SST: KV10112100) or protractor. Avoid judgment by visual inspection without the tool.

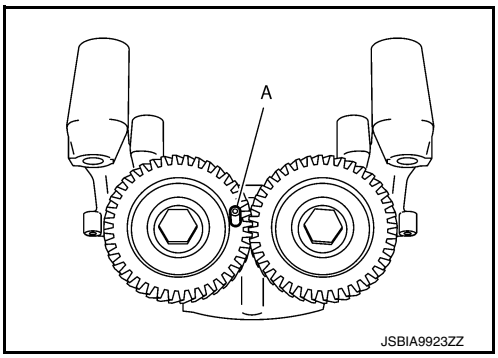
7. Measure the torsional play again.

Standard : 0.10 – 0.17 mm (0.0039 – 0.0067 in)

8. Install in the reverse order of removal, for the rest of parts.

Reuse Lanchester Balancer

1. Install a suitable pin (A) to lock spur gear shown in the figure.



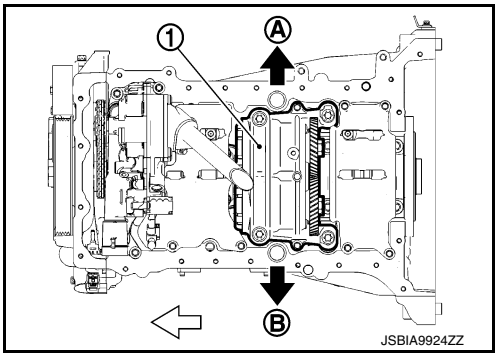
2. Install the lanchester balancer.
   - Press the lanchester balancer ① in the direction Ⓑ.

     ⇦ : Engine front

     Ⓐ : Adjusting direction

   - Tighten mounting bolts by hand.

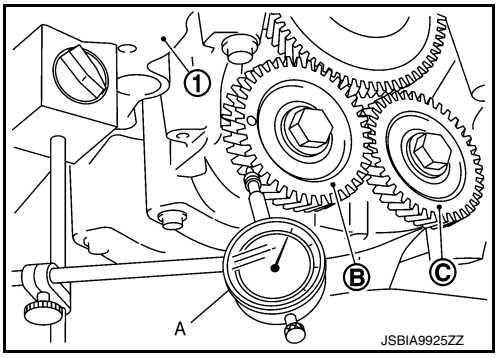
   CAUTION:
   Do not reuse mounting bolts.
3. Remove the pin.
4. Measure the torsional play of lanchester balancer with the following procedure.



a. Set a dial indicator (A) to the cylinder block ① and set it at 0 point.

   Ⓑ : Left spur gear

   Ⓒ : Right spur gear



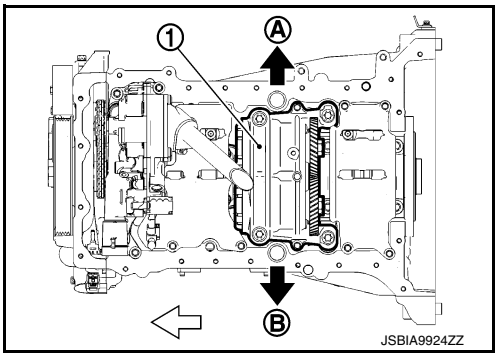
b. Turn right spur gear in the direction of engine rotation to measure the torsion play.

Standard : 0.12 – 0.19 mm (0.0047 – 0.0075 in)

   - If torsional play is too small, press the lanchester balancer ① in the direction Ⓐ.

     ⇦ : Engine front

     Ⓑ : Basic position



5. Tighten the mounting bolts of the lanchester balancer to the specified torque.

Step1 : 5.0 N·m (0.51 kg-m, 44 in-lb)

Step2 : 27.0 N·m (2.8 kg-m, 20 ft-lb)

a. Turn the mounting bolts clockwise.

Step3 Angle tightening : 90°
Step4 Angle tightening : 90°

CAUTION:
Check and confirm the tightening angle by using an angle wrench (SST: KV10112100) or protractor. Avoid judgment by visual inspection without the tool.

6. Measure the torsional play again.

Standard : 0.10 – 0.17 mm (0.0039 – 0.0067 in)

7. Install in the reverse order of removal, for the rest of parts.

OIL SEAL

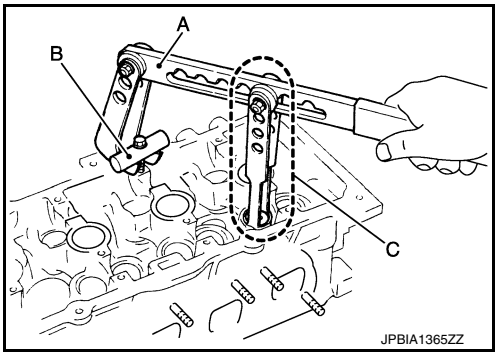
VALVE OIL SEAL

VALVE OIL SEAL : Removal and Installation

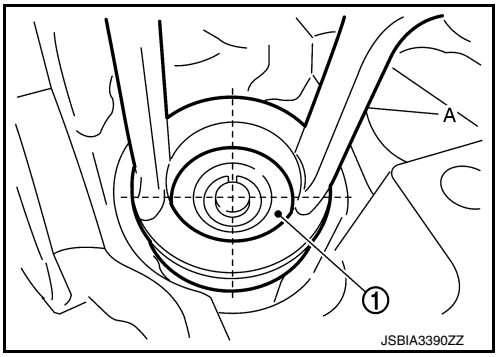
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REMOVAL

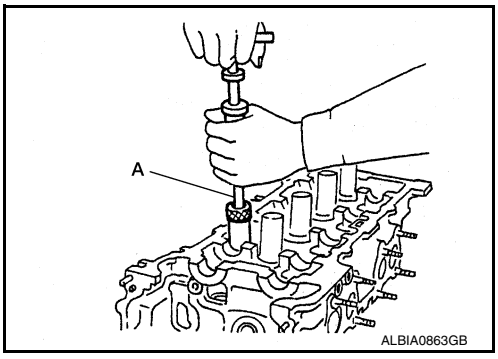
1. Remove the camshaft. Refer to EM-63, "Removal and Installation".
2. Rotate crankshaft, and set piston whose valve oil seal is to be removed to TDC. This will prevent valve from dropping into cylinder.
   CAUTION:
   When rotating crankshaft, be careful to avoid scarring front cover with timing chain.
3. Remove valve collet.
   - Compress valve spring with the valve spring compressor (SST: KV10116200) (A), the attachment (SST: KV10115900) (C), and the adapter (SST: KV10119220) (B). Remove valve collet with magnet hand.



   CAUTION:
   - **Never damage cylinder head.**
   - **Fit the attachment (SST: KV10115900) (A) in the center of valve spring retainer ① to press it.**
4. Remove valve spring retainer and valve spring.



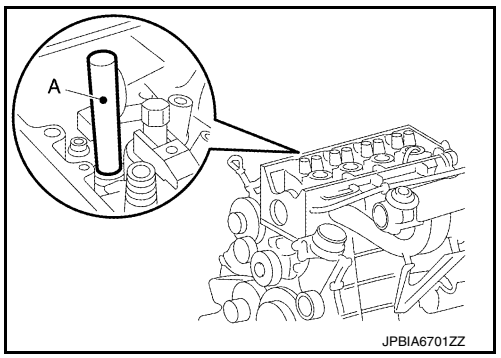
5. Remove valve oil seal with the valve oil seal puller (SST: KV10107902) (A).



INSTALLATION

1. Apply new engine oil to valve oil seal joint surface and seal lip.

2. Press in valve oil seal with the valve oil seal drift (SST: KV10115600) (A).
3. Install in the reverse order of removal, for the rest of parts.



FRONT OIL SEAL

FRONT OIL SEAL : Removal and Installation

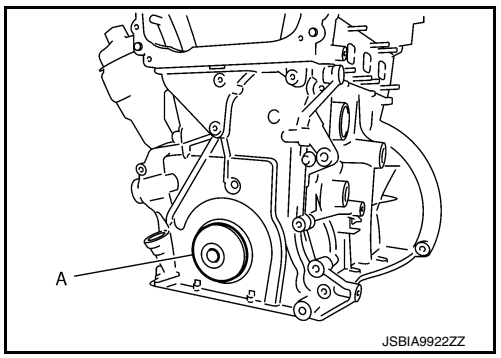
INFOID:0000000013536908

REMOVAL

1. Remove the following parts.
   - Front fender protector (RH), refer to EXT-41, "FENDER PROTECTOR : Removal and Installation".
   - Engine under cover, refer to EM-20, "Removal and Installation".
   - For drive belt, refer to EM-13, "Removal and Installation".
   - For crankshaft pulley, refer to EM-89, "Removal and Installation".
2. Remove the front oil seal using a flat-bladed screwdriver.
   CAUTION:
   Never damage the oil pump assembly and the crankshaft.

INSTALLATION

1. Press the front oil seal with a drift [SST: KV105H0400 (270 589 00 15 00)] (A).
   CAUTION:
   - **Be careful not to damage the front cover and the crankshaft.**
   - **When installing, never incline the oil seal.**
2. Install removed parts in the reverse order of removal.



REAR OIL SEAL

REAR OIL SEAL : Removal and Installation

INFOID:0000000013536909

REMOVAL

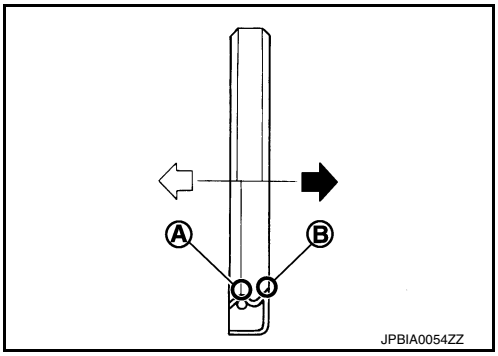
1. Remove transaxle. Refer to TM-228, "Removal and Installation".
2. Remove the drive plate, crankshaft position sensor and pulse ring. Refer to EM-100, "Removal and Installation".
3. Remove the crankshaft end cover.
   CAUTION:
   - **Be careful not to damage the matching surface and the crankshaft.**
   - **Never reuse the crankshaft end cover.**

INSTALLATION

CAUTION:
Clean the crankshaft end cover, oil pan and the cylinder block using a [loctite 7200 (Henkel Loctite Deutschland GmbH) and loctite 7063 150ml (A 001 986 71 71 10), or equivalent].

1. Refer to the figure and check the press-fitting direction.

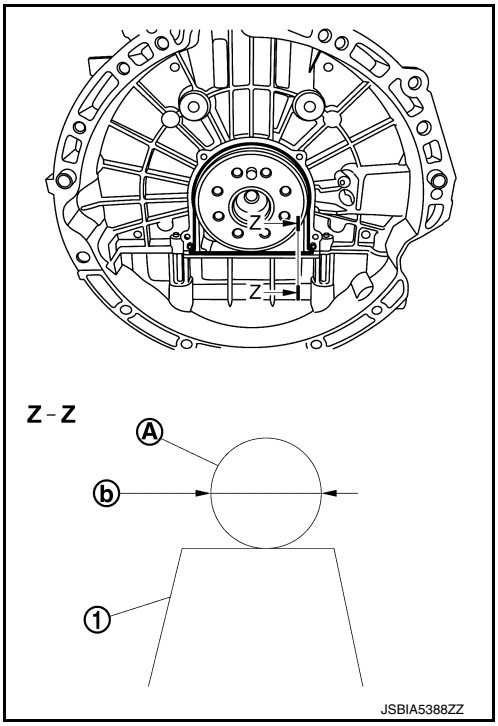
Ⓐ : Oil seal lip
Ⓑ : Dust seal lip
⇦ : Engine front side
⬅ : Transmission side



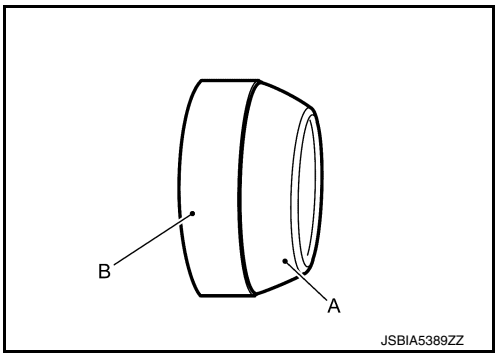
2. Apply the liquid gasket evenly (no break, no overlap) to the matching surface of the crankshaft end cover ① as shown in the figure. Refer to EM-5, "Liquid Gasket".
   • Use Genuine Liquid Gasket [Loctite 5970 (A 003 989 98 20)] or equivalent.

CAUTION:
Install the crankshaft end cover within 5 minutes after applying the liquid gasket.

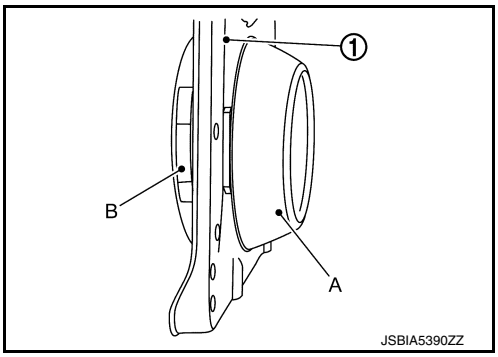
Ⓐ : Liquid gasket
ⓑ : 1.5 – 2.5 mm (0.059 – 0.098 in)



3. Note the following, install the crankshaft end cove with the crankshaft seal installation [SST: KV105H0100 (271 589 00 43 00)] (A) and (B).
   • Set the crankshaft seal installation [SST: KV105H0100 (271 589 00 43 00)] in the installed condition as shown in the figure.

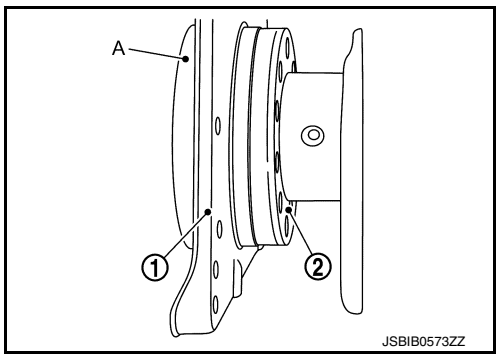


   • Install the crankshaft seal installation [SST: KV105H0100 (271 589 00 43 00)] (A) and (B) to the crankshaft end cover ① as shown in the figure.
   • Remove the crankshaft seal installation [SST: KV105H0100 (271 589 00 43 00)] (A) from the crankshaft end cover ①.



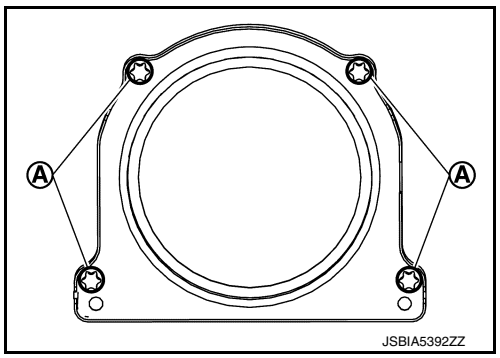
- Install the crankshaft seal installation [SST: KV105H0100 (271 589 00 43 00)] (A) installed to crankshaft end cover ① to the crankshaft flange ②.

CAUTION:
Be careful not to damage the crankshaft, and the matching surface between oil pan and crankshaft end cover.



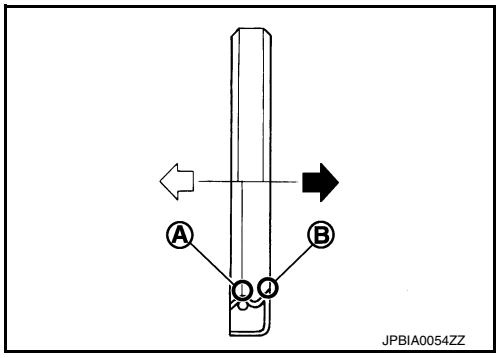
- Tighten the mounting bolts Ⓐ of crankshaft end cover diagonally in several steps.

CAUTION:
- **Be careful not to damage the crankshaft, and the matching surface between oil pan and crankshaft end cover.**
- **When installing, never incline the oil seal.**



4. Remove the crankshaft seal installation [SST: KV105H0100 (271 589 00 43 00)].
5. Refer to the figure, check that the seal lip part is not malfunction.

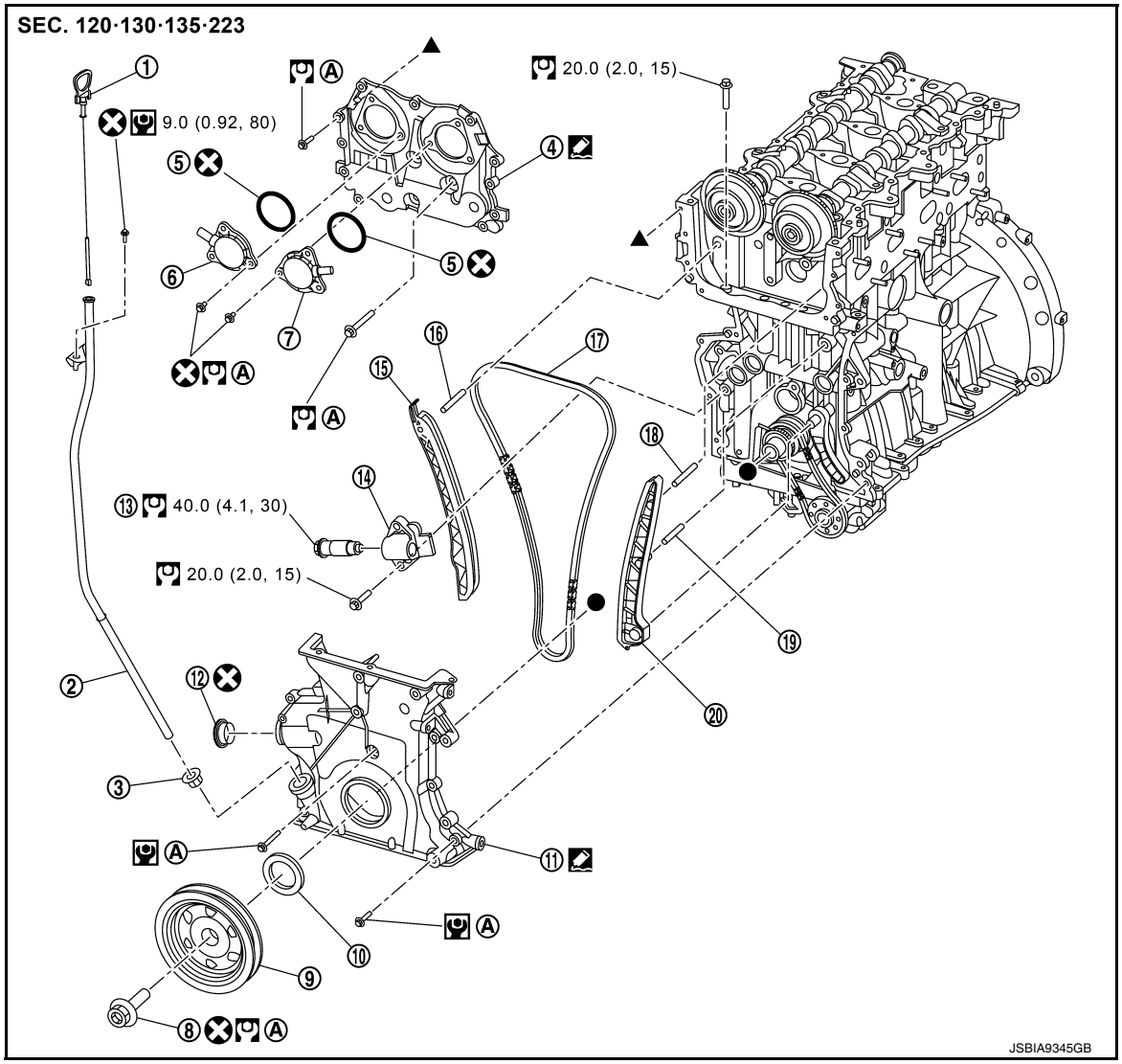
Ⓐ : Oil seal lip
Ⓑ : Dust seal lip
⇦ : Engine front side
⬅ : Transmission side



TIMING CHAIN

Exploded View

INFOID:0000000013536910



① Oil level gauge	② Oil level gauge guide	③ Gasket
④ Front cover	⑤ O-ring	⑥ Intake camshaft actuator
⑦ Exhaust camshaft actuator	⑧ Centering bolt	⑨ Crankshaft pulley
⑩ Front oil seal	⑪ Timing case cover	⑫ Chain tensioner cover
⑬ Chain tensioner	⑭ Chain tensioner bracket	⑮ Timing chain slide rail 1
⑯ Slide rail pin	⑰ Timing chain	⑱ Slide rail pin
⑲ Slide rail pin	⑳ Timing chain slide rail 2	

Ⓐ Comply with the assembly procedure when tightening. Refer to EM-89.

: Always replace after every disassembly.

: N·m (kg-m, ft-lb)

: N·m (kg-m, in-lb)

: Sealing point

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

Removal and Installation

INFOID:0000000013536911

NOTE:
When remove timing chain, remove engine assembly from vehicle. Refer to EM-95, "Removal and Installation".

REMOVAL

1. Remove the following components and related parts.
   - Water pump: Refer to CO-18, "Removal and Installation".
   - Drive belt: Refer to EM-13, "Removal and Installation".
   - Drive belt auto-tensioner, idler pulley: Refer to EM-26, "Removal and Installation".
   - A/C compressor: Refer to HA-25, "Removal and Installation".
   - Alternator: Refer to CHG-35, "1.6L/2.0L TURBO ENGINE : Removal and Installation".
   - Oil pan: Refer to EM-76, "Removal and Installation".
   - Cylinder head cover: Refer to EM-60, "Removal and Installation".
   - Water pipe: Refer to LU-12, "Removal and Installation".
2. Remove oil level gauge and oil level gauge guide.
3. Remove the crankshaft pulley with the following procedure.

a. Fix the drive plate with stopper flywheel [SST: KV105H0070 (270 589 02 40 00)].

b. Loosen the centering bolt to remove the crankshaft pulley.

4. Remove the chain tensioner with the following procedure.

a. Remove the chain tensioner cover from timing case cover.
NOTE:
Using a suitable tool, puncture the center of the chain tensioner cover and pry out it.

b. Loosen the chain tensioner to remove the chain tensioner.

5. Remove the front cover with the following procedure.

a. Disconnect the harness connector of the intake camshaft actuator and the exhaust camshaft actuator.

b. Remove the mounting bolts of front cover.

c. Remove front cover.
CAUTION:
- **Never use the seal cutter.**
- **Be careful not to damage the mating surface.**

d. Remove the intake camshaft actuator and the exhaust camshaft actuator as necessary.

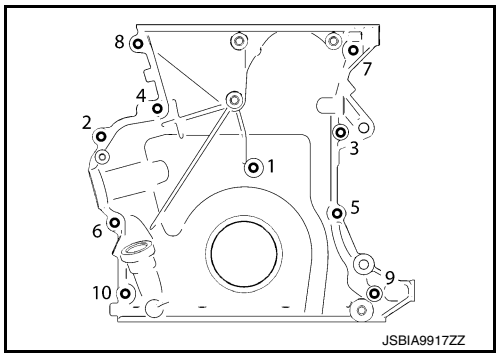
6. Remove the camshaft adjuster. Refer to EM-63, "Removal and Installation".
7. Remove the timing case cover with the following procedure.

a. Remove the engine oil pump valve harness from timing case cover.

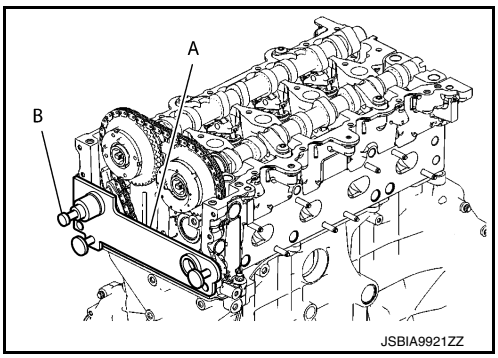
b. Loosen the mounting bolts (cylinder head to timing case cover).

c. Loosen the mounting bolts in the order from 10 to 1.

d. Remove the timing case cover.



8. Remove the side rail pin by puller [SST: KV105H0600 (270 589 01 33 00)] (A) and spindle [SST: KV105H0420 (270 589 00 33 02)] (B).
9. Remove the timing chain slide rail 1 and the timing chain slide rail 2.
10. Remove the timing chain.



INSTALLATION

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

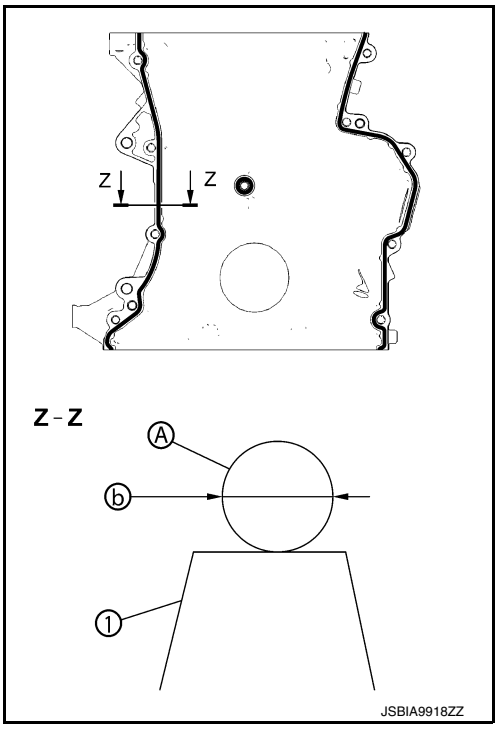
NOTE:

- If an intake camshaft actuator, exhaust camshaft actuator and timing chain replaced, carry out followings:
- Teach of camshaft position: Refer to EC-194, "Description".
- Camshaft reference adaptation: Refer to EC-193, "Description".
- If sensors and actuators is replaced, carry out the resting of adaptation values. Refer to EC-195, "Description".

1. Install the timing chain.
2. Install the timing chain slide rail 1 and the timing chain slide rail 2.
3. Install the side rail pin.
   CAUTION:
   Install the slide rail pin with its thread part facing to the engine front.
4. Install the timing case cover with the following procedure.
   CAUTION:
   Clean the timing case cover, cylinder block and the oil pan using a [loctite 7200 (Henkel Loctite Deutschland GmbH) and loctite 7063 150ml (A 001 986 71 71 10), or equivalent].

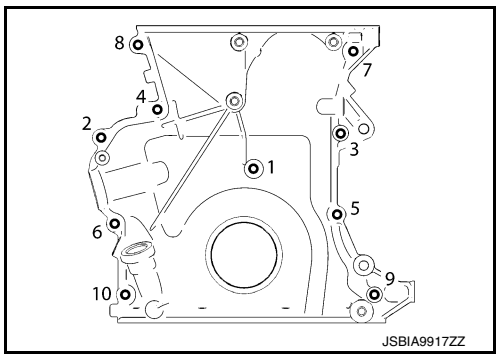
a. Apply the liquid gasket Ⓐ evenly (no break, no overlap) to the matching surface of the timing case cover ① as shown in the figure. Refer to EM-5, "Liquid Gasket"
   - Use Genuine Liquid Gasket [Loctite 5970 (A 003 989 98 20)] or equivalent.

   ⓑ : ϕ1.1 – 1.5 mm (ϕ0.043 – 0.059 in)



b. Tighten the mounting bolts in the order from 1 to 10.

: 9.0 N·m (0.92 kg-m, 80 in-lb)



c. Tighten the mounting bolts (cylinder head to timing case cover).

d. Install the engine oil pump valve harness to timing case cover.

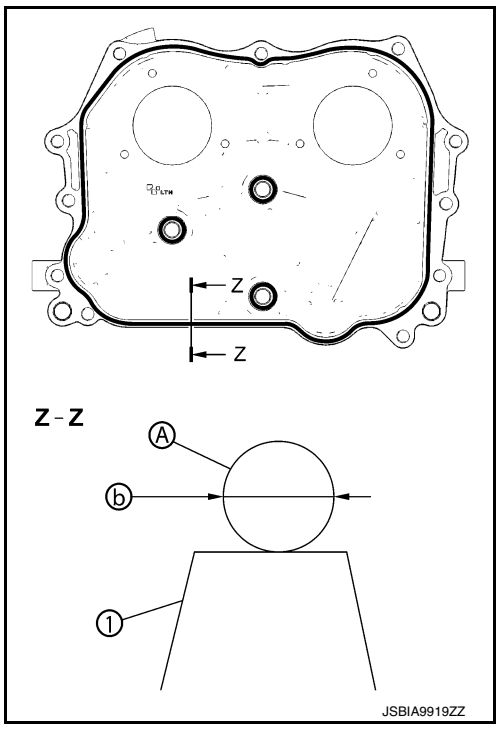
CAUTION:
Never reuse the gasket.

5. Install the front cover with the following procedure.

CAUTION:
Clean the front cover and the cylinder head using a [loctite 7200 (Henkel Loctite Deutschland GmbH) and loctite 7063 150ml (A 001 986 71 71 10), or equivalent].

a. Apply the liquid gasket Ⓐ evenly (no break, no overlap) to the matching surface of the front cover ① as shown in the figure. Refer to EM-5, "Liquid Gasket"

ⓑ : ϕ0.7 – 1.3 mm (ϕ0.028 – 0.051 in)



b. Install the front cover mounting bolts in diagonal order.

M6 bolt : 9.0 N·m (0.92 kg-m, 80 in-lb)

M8 bolt : 19.0 N·m (1.9 kg-m, 14 ft-lb)

c. Tighten the mounting bolts of the intake camshaft actuator and the exhaust camshaft actuator to the specified torque.

: 4.0 N·m (0.41 kg-m, 35 in-lb)

d. Turn the mounting bolts clockwise.

Angle tightening : 90°

CAUTION:
Check and confirm the tightening angle by using an angle wrench (SST: KV10112100) or protractor. Avoid judgment by visual inspection without the tool.

e. Connect the harness connector of the intake camshaft actuator and the exhaust camshaft actuator.

f. Install the mounting bracket of the coolant pump switchover valve and the boost pressure control vacuum transducer to timing case cover.

6. Install the chain tensioner with the following procedure.

CAUTION:
Press the chain tensioner, and check that it returns smoothly.

a. Tighten the chain tensioner to the specified torque.

b. Install the chain tensioner cover to the timing case.

7. Install the crankshaft pulley with the following procedure.

a. Fix the drive plate with stopper flywheel [SST: KV105H0070 (270 589 02 40 00)].

b. Tighten the crankshaft pulley mounting bolts to the specified torque.

: 200.0 N·m (20.0 kg-m, 148 ft-lb)

c. Turn mounting bolts clockwise.

Angle tightening : 90°

CAUTION:
Check and confirm the tightening angle by using an angle wrench (SST: KV10112100) or protractor. Avoid judgment by visual inspection without the tool.

8. Install in the reverse order of removal, for the rest of parts.

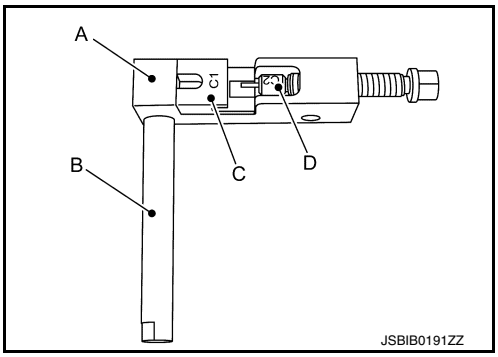
Replacement

INFOID:0000000013536912

1. Remove camshaft. Refer to EM-63, "Removal and Installation".
2. Replace timing chain as follows:

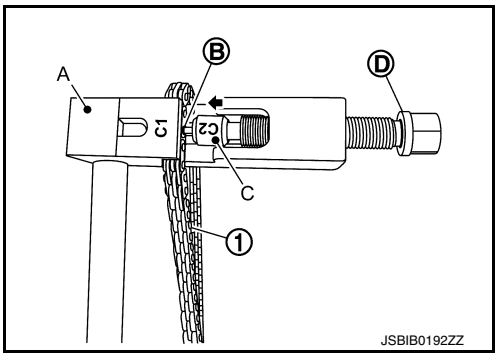
a. Assemble the rivet press tool [SST: KV105H0530 (276 589 00 39 00)].

A : Base carrier
B : Handle
C : Mount C1
D : Thrust piece C2



b. Set timing chain ① to rivet press tool (A).
CAUTION:
When slide (⬅) the thrust piece C2 (C), check that it is touching the pin Ⓑ securely.

Ⓓ : Spindle

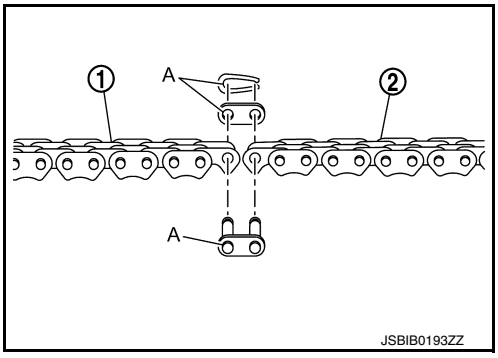


c. Screw in the spindle to press out the pin of timing chain link, and cut the timing chain.
CAUTION:
When the pin of timing chain link is pressed out, never droppin into the timing case cover.

d. Connect a new timing chain ① to the old timing chain ② using an assembly element [SST: KV105H0510 (271 589 09 63 00)] (A).

e. Crank slowly in the direction of rotation until the connection surface appears.

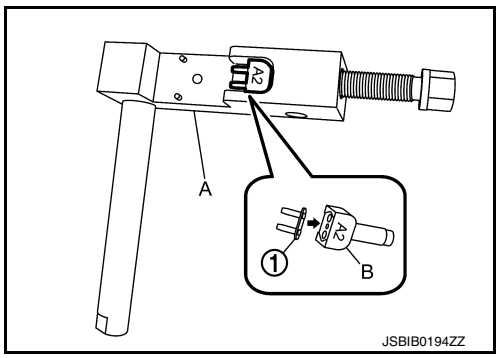
f. Remove the assembly element and the old timing chain.



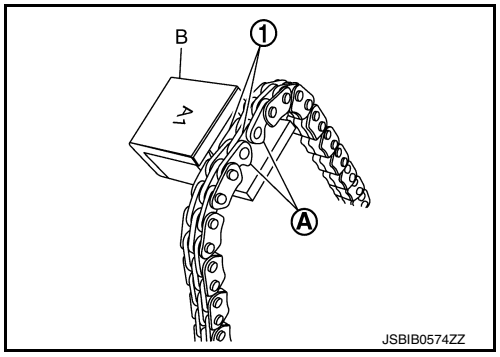
3. Assemble timing chain as follows:

a. Set riveted link ① to the rivet press tool [SST: KV105H0530 (276 589 00 39 00)].

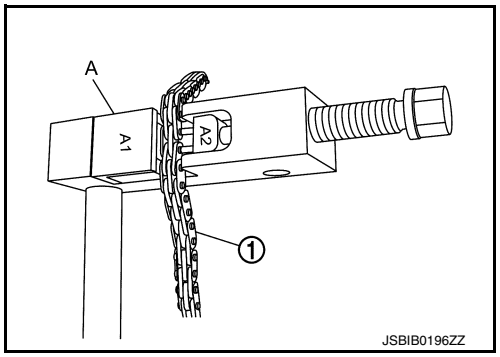
A : Base carrier
B : Thrust piece A2



b. Set plates ① and both ends Ⓐ of new timing chain to mount A1 (B).
CAUTION:
Never drop the new riveted link into the timing case cover.

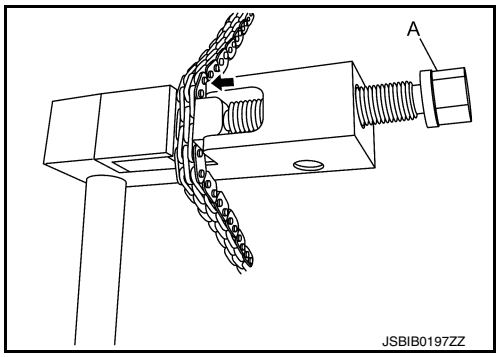


c. Install mount A1 (A) with timing chain ①.



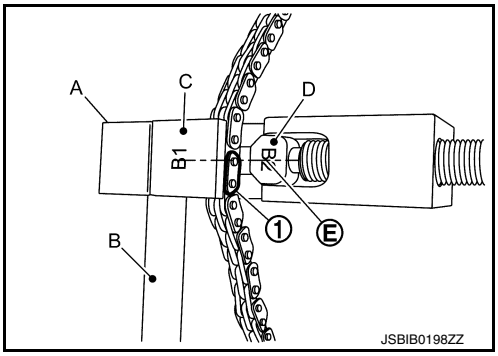
d. Screw in the spindle (A) to press riveted link.
CAUTION:
Confirm that there is a gap between timing chain, riveted link and plates.

e. Remove timing chain from rivet press tool [SST: KV105H0530 (276 589 00 39 00)].
CAUTION:
Confirm that the part which inserted riveted link moves.



4. Rivet the riveted link according to the following procedure:

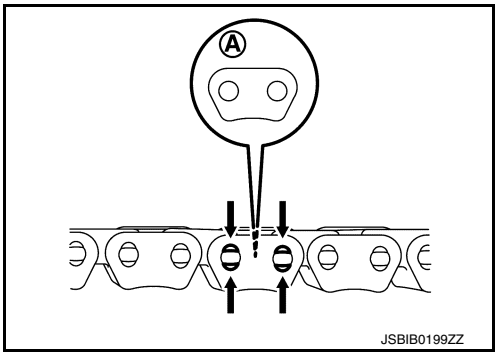
a. Assemble the rivet press tool [SST: KV105H0530 (276 589 00 39 00)].



① : Plate
A : Base carrier
B : Handle
C : Mount B1
D : Thrust piece B2
Ⓔ : Tool center

b. Insert the timing chain in to the rivet press tool [SST: KV105H0530 (276 589 00 39 00)].
NOTE:
Set a timing chain with a plate for thrust piece B2 side.
c. Screw in the spindle (A) to rivet the riveted link.
d. Loosen the spindle.
e. Rivet the other side of riveted link according to step b to d.
NOTE:
Using the thrust piece B2 both pins of the riveted link can be riveted once.

5. Check riveting (⬅) on riveted link and rerivet if necessary.



Ⓐ : Non rivet condition

6. Install removed parts in the reverse order of removal.
7. If a timing chain is replaced and removed, carry out the resetting of leaned values of camshaft position sensor. Refer to EC-182, "Special Repair Requirement List".

Inspection

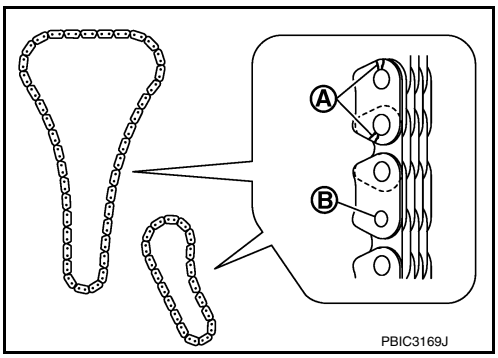
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INSPECTION AFTER REMOVAL

Appearance of Crankshaft Pulley
- Check for any excessive wear and damage at the matching surface of oil seal.
- If anything found, replace crankshaft pulley.

Appearance of Timing Chain Slide Rail
- Check for cracks, any excessive wear and damage at the timing chain slide rail.
- If anything found, replace timing chain slide rail.

Appearance of Timing Chain
- Check for cracks and any excessive wear at link plates and roller links of timing chain.



Ⓐ : Crack
Ⓑ : Wear

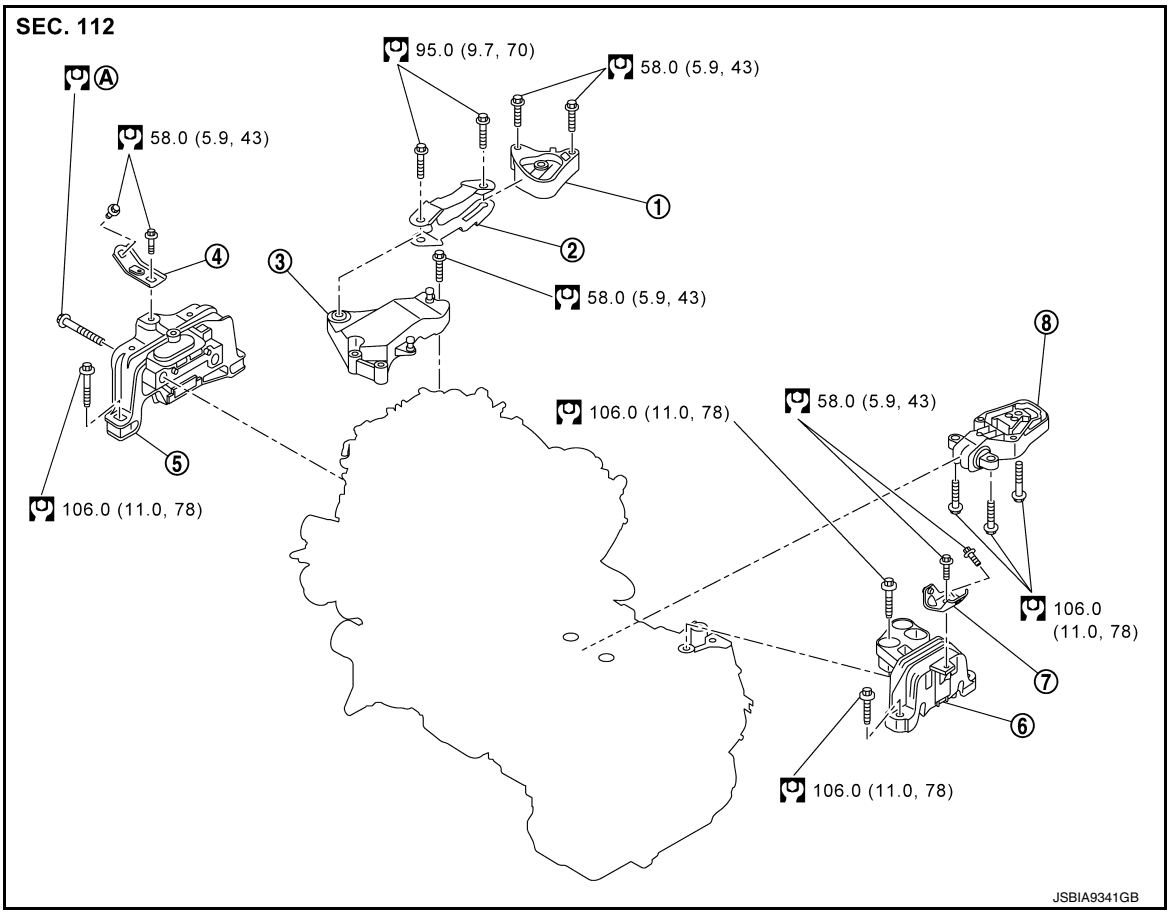
- If anything found, replace timing chain.

UNIT REMOVAL AND INSTALLATION

ENGINE ASSEMBLY

Exploded View

INFOID:0000000013536914



①	Torsion bar rod bearing	②	Connecting strut	③	Supporting frame
④	Engine mount bracket	⑤	Engine mount	⑥	Transaxle mount
⑦	Transaxle mount bracket	⑧	Lower torsion bar linkage		

Ⓐ Comply with the installation procedure when tightening. Refer to EM-95, "Removal and Installation".

: N·m (kg-m, ft-lb)

Removal and Installation

INFOID:0000000013536915

WARNING:
- **Situate the vehicle on a flat and solid surface.**
- **Place chocks at the front and back of rear wheels.**

CAUTION:
- **Always be careful to work safely, and avoid forceful or uninstructed operations.**
- **Never start working until exhaust system and engine coolant are cool enough.**
- **If items or work required are not covered by the engine section, refer to the applicable sections.**
- **Always use the support point specified for lifting.**
- **Use either 2-pole lift type or separate type lift as much as possible. If board-on type is used for unavoidable reasons, support at rear axle jacking point with transmission jack or similar tool before starting work, in preparation for the backward shift of the center of gravity.**

- **For supporting points for lifting and jacking point at rear axle, refer to GI-46, "Garage Jack and Safety Stand and 2-Pole Lift".**

NOTE:
When removing components such as hoses, tube/line, etc., cap or plug openings prevent fluid spilling.

REMOVAL

Outline

At first, remove the engine and the transaxle assembly facing downward. Then separate the engine from transaxle.

Preparation

1. Check DTC using CONSULT.
   NOTE:
   Before starting the work procedure, check if there is already-detected DTC to distinguish it from DTC detected during fuel pressure release.
2. Release fuel pressure as follows:

a. Remove fuel pump fuse.
b. Start the engine.
c. After engine stalls, crank it two or three times to release all fuel pressure.
d. Turn ignition switch OFF.

3. Remove battery. Refer to PG-108, "MAIN BATTERY : Exploded View".
4. Remove the following parts:
   - Engine cover: Refer to EM-20, "Removal and Installation".
   - Front bumper fascia: Refer to EXT-21, "Removal and Installation".
   - Front road wheel and tires
   - Engine under cover: Refer to EXT-44, "ENGINE UNDER COVER : Removal and Installation".
   - Fender protector front (LH and RH) and splash guard (LH and RH): Refer to EXT-41, "FENDER PROTECTOR : Removal and Installation".
   - Battery tray: Refer to PG-117, "MAIN BATTERY : Removal and Installation".
   - ECM: Refer to EC-963, "Removal and Installation".
5. Drain engine coolant from radiator. Refer to CO-7, "Draining".
   CAUTION:
   - **Perform this step when engine is cold.**
   - **Never spill engine coolant on drive belt.**
6. Remove drive belt. Refer to EM-13, "Removal and Installation".
7. Remove coolant hoses (upper and lower). Refer to CO-13, "Exploded View".

Engine Room LH

1. Remove air cleaner housing assembly. Refer to EM-23, "Removal and Installation".
2. Remove charge air hose and charge air tube. Refer to EM-37, "Exploded View".
3. Remove harness from starter. Refer to STR-18, "1.6L/2.0L TURBO ENGINE : Removal and Installation"
4. Remove harness from alternator. Refer to CHG-35, "1.6L/2.0L TURBO ENGINE : Removal and Installation".
5. Disconnect A/C compressor harness connector.
6. Remove low-pressure flexible hose and high-pressure flexible hose from A/C compressor. Refer to HA-27, "Exploded View".

Engine room RH

1. Remove torsion bar rod bearing, connecting strut and supporting flame.
2. Remove reservoir tank and reservoir tank hose. Refer to CO-13, "Exploded View".

Engine room Rear

1. Disconnect brake booster vacuum hose from engine side. Refer to EM-39, "Removal and Installation".
2. Disconnect heater hoses.

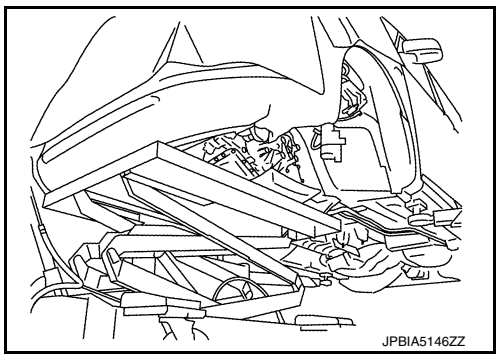
Vehicle Underbody

1. Remove propeller shaft. Refer to DLN-87, "Removal and Installation" (AWD models).

2. Disconnect steering lower joint at power steering gear assembly side, and release steering lower shaft. Refer to ST-11, "Removal and Installation".
3. Remove lower torsion bar linkage.
4. Separate transverse link (LH and RH) from steering knuckle. Refer to FSU-14, "Removal and Installation".
5. Remove front drive shaft. Refer to FAX-16, "LEFT SIDE : Removal and Installation" (left side), FAX-19, "RIGHT SIDE : Removal and Installation" (right side).
6. Remove front suspension member. Refer to FSU-19, "Removal and Installation".
7. Remove exhaust front tube. Refer to EX-7, "Removal and Installation".

Removal Work

1. Remove fuel hose, from centralized under-floor piping.
2. Use a manual lift table caddy (commercial service tool) or equivalently rigid tool such as a transmission jack. Securely support bottom of suspension member and the transmission assembly.
   CAUTION:
   Use a piece of wood or a similar item as the supporting surface to secure a completely stable condition.



3. Carefully lower jack, or raise lift, to remove the engine and the transmission assembly. When performing work, observe the following caution items:
   CAUTION:
   - **Confirm there is no interference with the vehicle.**
   - **Check that all connection points have been disconnected.**
   - **Keep in mind that the center of gravity of the vehicle changes. If necessary, use jack(s) to support the vehicle at rear jacking point(s) to prevent it from falling off the lift.**
4. Remove engine mount and transaxle mount.

Separation Work

1. Remove starter motor. Refer to STR-18, "1.6L/2.0L TURBO ENGINE : Removal and Installation".
2. Lift with hoist and separate the engine from the transmission assembly. Refer to TM-228, "Removal and Installation".

INSTALLATION

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

CAUTION:

- **Install fuel pump fuse before installing battery negative terminal.**
- **Check for fuel leakage before installing engine cover. Refer to EM-98, "Inspection".**
- If a engine assembly is replaced, carry out followings:
- Teach of camshaft position: Refer to EC-194, "Description".
- Camshaft reference adaptation: Refer to EC-193, "Description".
- If a starter motor is replaced, carry out of the starter operation counter clear. Refer to EC-197, "Description".
- If sensors and actuators is replaced, carry out the resting of adaptation values. Refer to EC-195, "Description".
- Do not damage engine mounting insulator and do not spill oil on it.
- For a location with a positioning pin, insert it securely into hole of mating part.
- For a part with a specified installation orientation, refer to component figure in EM-95, "Exploded View".
- Check DTC and erase DTC.
  NOTE:
  Erase DTC detected while releasing fuel pressure.
- When Installing engine mount with the following procedure:

1. Tighten engine mount bolts.

: 80.0 N·m (8.2 kg-m, 59 ft-lb)

2. Turn engine mount bolts 90 degrees clockwise (angle tightening).
   CAUTION:
   Check and confirm the tightening angle by using an angle wrench (SST: KV10112100) or protractor. Avoid judgment by visual inspection without the tool.

Inspection

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INSPECTION AFTER INSTALLATION

Inspection for Leakage

The following are procedures for checking fluid leakage, lubricant leakage.

- Before starting engine, check oil/fluid levels including engine coolant and engine oil. If any are less than the required quantity, fill them to the specified level. Refer to MA-12, "FOR NORTH AMERICA : Fluids and Lubricants" (For NORTH AMERICA) or MA-13, "FOR MEXICO : Fluids and Lubricants" (For MEXICO).
- Follow the procedure below to check for fuel leakage.
- Turn ignition switch to the “ON” position (with engine stopped). With fuel pressure applied to fuel piping, check for fuel leakage at connection points.
- Start engine. With engine speed increased, check again for fuel leakage at connection points.
- Run engine to check for unusual noise and vibration.
  NOTE:
  If hydraulic pressure inside chain tensioner drops after removal/installation, slack in guide may generate a pounding noise during and just after the engine start. However, this does not indicate a malfunction. The noise will stop after hydraulic pressure rises.
- Warm up engine thoroughly to check that there is no leakage of fuel, or any oil/fluids including engine oil and engine coolant.
- Bleed air from lines and hoses of applicable lines, such as in cooling system.
- After cooling down engine, again check oil/fluid levels including engine oil and engine coolant. Refill them to the specified level, if necessary.

Summary of the inspection items:

Items		Before starting engine	Engine running	After engine stopped
Engine coolant		Level	Leakage	Level
Engine oil		Level	Leakage	Level
Transmission / transaxle fluid	AT & CVT Models	Leakage	Level / Leakage	Leakage
	MT Models	Level / Leakage	Leakage	Level / Leakage
Other oils and fluids*		Level	Leakage	Level
Fuel		Leakage	Leakage	Leakage
Exhaust gases		—	Leakage	—

*: Power steering fluid, brake fluid, etc.

UNIT DISASSEMBLY AND ASSEMBLY

ENGINE STAND SETTING

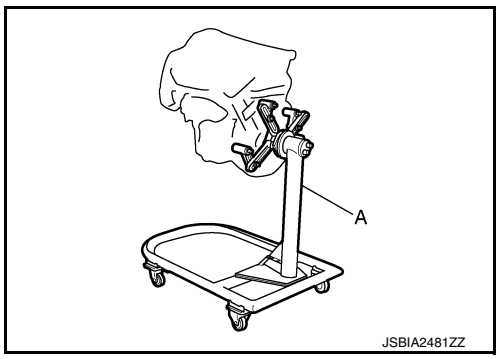
Setting

INFOID:0000000013536917

1. Remove the engine and transaxle assembly from the vehicle, and separate the transaxle assembly from engine assembly. Refer to EM-95, "Removal and Installation".
2. Install engine to engine stand with the following procedure:
   NOTE:
   Explained here is how to disassemble with engine stand supporting transaxle surface. When using different type of engine stand, note with difference in steps and etc.

a. Remove the drive plate. Refer to EM-100, "Removal and Installation".

b. Lift the engine with a hoist to install it onto widely use engine stand (A).
   CAUTION:
   Before removing the hanging chains, check the engine stand is stable and there is no risk of overturning.

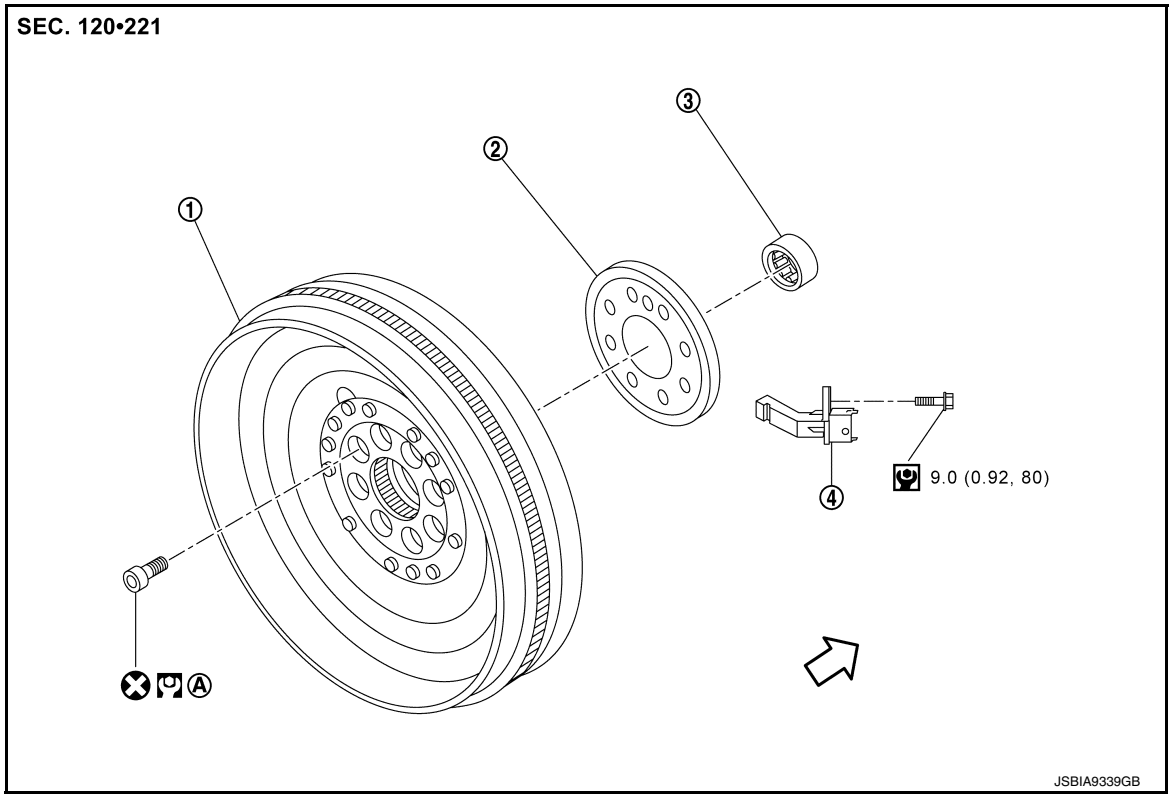


3. Drain engine oil. Refer to LU-8, "Draining".

DRIVE PLATE

Exploded View

INFOID:0000000013536921



① Drive plate
② Pulse ring
③ Pilot bearing
④ Crankshaft position sensor
Ⓐ Comply with the assembly procedure when tightening. Refer to EM-100.
⇦ : Engine front
: N·m (kg-m, ft-lb)
: N·m (kg-m, in-lb)
: Always replace after every disassembly.

Removal and Installation

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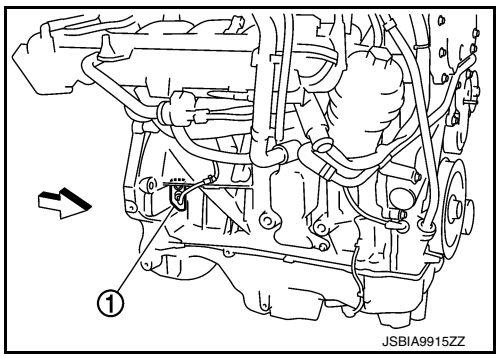
REMOVAL

Crankshaft Position Sensor

1. Remove heat insulator. Refer to FAX-15, "Exploded View".

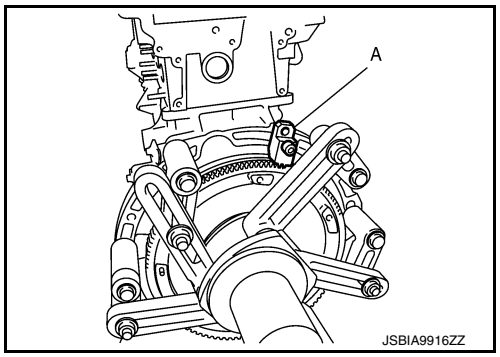
2. Remove the crankshaft position sensor ①.

⇦ : Engine front



Drive Plate

1. Remove the transaxle assembly from engine assembly. Refer to TM-228, "Exploded View".
2. Fix the drive plate with stopper flywheel [SST: KV105H0070 (270 589 02 40 00)] (A) to remove the mounting bolts of the drive plate.
   NOTE:
   Loosen the mounting bolts in diagonal order.
3. Remove the pulse ring from crankshaft if necessary.
   CAUTION:
   - **When removing the pulse ring, never use the sharp tool.**
   - **The magnetic substance never contact with the pulse ring.**



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".
- If crankshaft position sensor is replaced, carry out the synchronization adjustment of adoption of crankshaft position sensor. refer to EC-182, "Special Repair Requirement List".

1. Install drive plate with the following procedure.
   CAUTION:
   Never use a power tool.

a. Tighten drive plate mounting bolt.

: 45.0 N·m (4.6 kg-m, 33 ft-lb)

NOTE:
Tighten mounting bolts in diagonal order.

b. Turn drive plate mounting bolts clockwise.

Angle tightening : 90°

NOTE:
Tighten mounting bolts in diagonal order.

SERVICE DATA AND SPECIFICATIONS (SDS)

SERVICE DATA AND SPECIFICATIONS (SDS)

General Specification

INFOID:0000000013536923

GENERAL SPECIFICATION

		1.6L turbo engine	2.0L turbo engine
Cylinder arrangement		In-line 4	
Valve arrangement		DOHC	
Firing order		1-3-4-2	
Number of piston rings	Compression	2	
	Oil	1	
Number of main bearings		5	
Compression pressure Unit: kPa (bar, kg/cm^2, psi)	Standard	1,200 (12.0, 12.24, 174)	1,550 (15.5, 15.81, 224.75)
	Minimum	850 (8.5, 8.67, 123)	1,150 (11.5, 11.73, 166.75)
	Differential limit between cylinders	150 (1.5, 1.53, 21.75)	150 (1.5, 1.53, 21.75)

Drive Belt

INFOID:0000000013536924

DRIVE BELT

Tension of drive belt	Belt tension is not necessary, as it is automatically adjusted by drive belt auto-tensioner.

Spark Plug

INFOID:0000000013536925

SPARK PLUG

Unit: mm (in)

Make	NGK
Standard type*	SILZKFR8C7S

*: Always check with the Parts Department for the latest parts information.

Camshaft

INFOID:0000000013536926

CAMSHAFT

Unit: mm (in)

Items	Standard	Limit
Camshaft bearing inner diameter	31.947 - 31.963 (1.2578 - 1.2584)	—