

# SECTION **EM**

## ENGINE MECHANICAL

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PRECAUTION

PRECAUTIONS

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

INFOID:000000013513319

The Supplemental Restraint System such as "AIR BAG" and "SEAT BELT PRE-TENSIONER", used along with a front seat belt, helps to reduce the risk or severity of injury to the driver and front passenger for certain types of collision. This system includes seat belt switch inputs and dual stage front air bag modules. The SRS system uses the seat belt switches to determine the front air bag deployment, and may only deploy one front air bag, depending on the severity of a collision and whether the front occupants are belted or unbelted. Information necessary to service the system safely is included in the "SRS AIR BAG" and "SEAT BELT" of this Service Manual.

**WARNING:**

Always observe the following items for preventing accidental activation.

- To avoid rendering the SRS inoperative, which could increase the risk of personal injury or death in the event of a collision that would result in air bag inflation, it is recommended that all maintenance and repair be performed by an authorized NISSAN/INFINITI dealer.
- Improper repair, including incorrect removal and installation of the SRS, can lead to personal injury caused by unintentional activation of the system. For removal of Spiral Cable and Air Bag Module, see "SRS AIR BAG".
- Never use electrical test equipment on any circuit related to the SRS unless instructed to in this Service Manual. SRS wiring harnesses can be identified by yellow and/or orange harnesses or harness connectors.

PRECAUTIONS WHEN USING POWER TOOLS (AIR OR ELECTRIC) AND HAMMERS

**WARNING:**

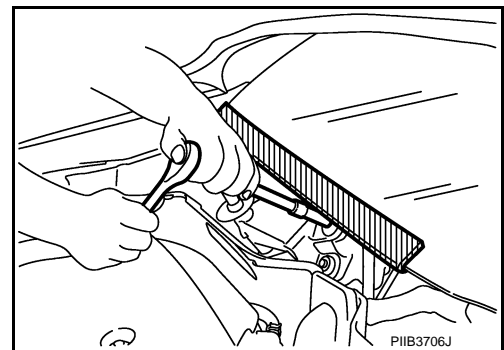
Always observe the following items for preventing accidental activation.

- When working near the Air Bag Diagnosis Sensor Unit or other Air Bag System sensors with the ignition ON or engine running, never use air or electric power tools or strike near the sensor(s) with a hammer. Heavy vibration could activate the sensor(s) and deploy the air bag(s), possibly causing serious injury.
- When using air or electric power tools or hammers, always switch the ignition OFF, disconnect the battery or batteries, and wait at least 3 minutes before performing any service.

Precaution for Procedure without Cowl Top Cover

INFOID:000000012947327

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

INFOID:000000012947328

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.

A  
EM  
C  
D  
E  
F  
G  
H  
I  
J  
K  
L  
M  
N  
O  
P

# PRECAUTIONS

[2.0L TURBO GASOLINE ENGINE]

< PRECAUTION >

## 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:0000000012947329

- 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

INFOID:0000000012947330

- 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

INFOID:0000000012947331

## REMOVAL OF LIQUID GASKET SEALING

# PRECAUTIONS

## < PRECAUTION >

## [2.0L TURBO GASOLINE ENGINE]

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

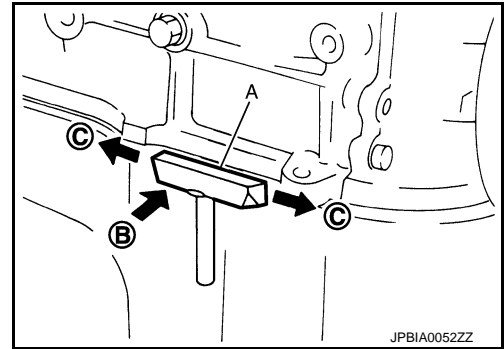
### CAUTION:

**Never damage the mating surfaces.**

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

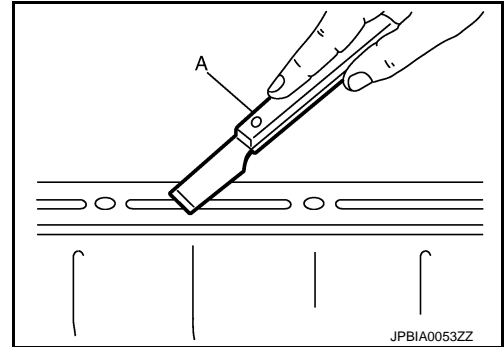
### CAUTION:

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

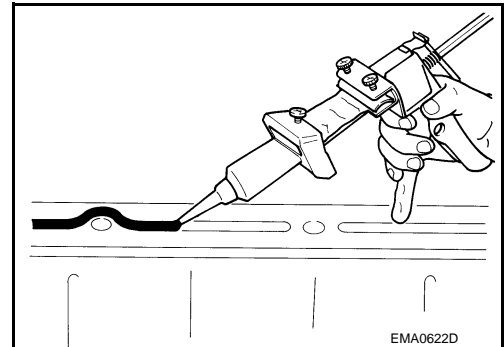


## LIQUID GASKET APPLICATION PROCEDURE

- 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.
- 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.



- Attach liquid gasket tube to the tube presser (commercial service tool).  
**Use Genuine Liquid Gasket or equivalent.**
- 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 (B), normally apply liquid gasket inside the holes. Occasionally, it should be applied outside the holes. Check to read the text of this manual.

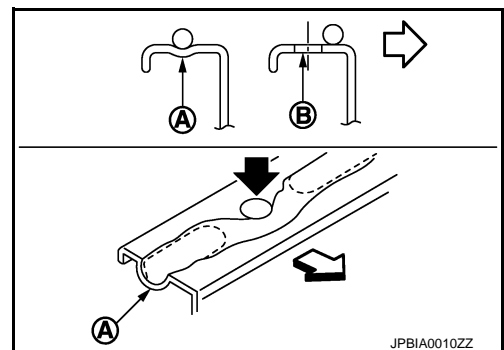
(A) : Groove

⇐ : Inside

- Within five minutes of liquid gasket application, install the mating component.
- If liquid gasket protrudes, wipe it off immediately.
- Do not retighten mounting bolts or nuts after the installation.
- After 30 minutes or more have passed from the installation, fill engine oil and engine coolant.

### CAUTION:

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



## Precautions for Removing Battery Terminal

INFOID:0000000013513324

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.

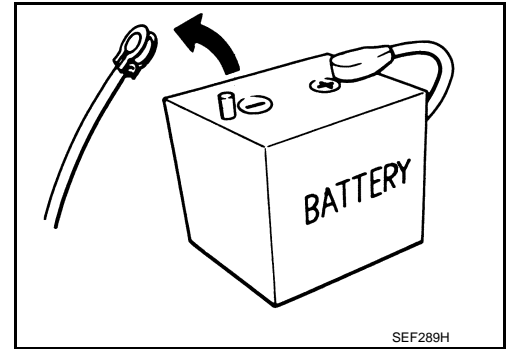
# PRECAUTIONS

## < PRECAUTION >

## [2.0L TURBO GASOLINE ENGINE]

- When removing the 12V battery terminal, turn OFF the ignition switch and wait at least 30 seconds.
- For vehicles with the engine listed below, remove the battery terminal after a lapse of the specified time:

BR08DE	: 4 minutes	V9X engine	: 4 minutes
D4D engine	: 20 minutes	YD25DDTi	: 2 minutes
HR09DET	: 12 minutes	YS23DDT	: 4 minutes
HRA2DDT	: 12 minutes	YS23DDTT	: 4 minutes
K9K engine	: 4 minutes	ZD30DDTi	: 60 seconds
M9R engine	: 4 minutes	ZD30DDTT	: 60 seconds
R9M engine	: 4 minutes		



### NOTE:

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

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

### NOTE:

- Turbocharger cooling pump may operate in a few minutes after the ignition switch is turned OFF.
- Example of high-load driving
  - Driving for 30 minutes or more at 140 km/h (86 MPH) or more.
  - Driving for 30 minutes or more on a steep slope.
- For vehicles with the 2-batteries, be sure to connect the main battery and the sub battery before turning ON the ignition switch.

### NOTE:

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

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

### NOTE:

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

# PREPARATION

< PREPARATION >

[2.0L TURBO GASOLINE ENGINE]

## PREPARATION

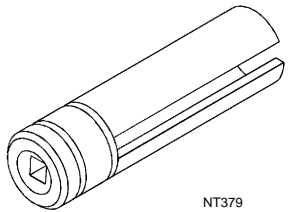
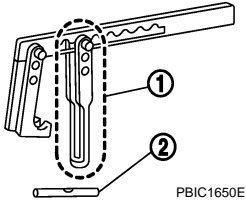
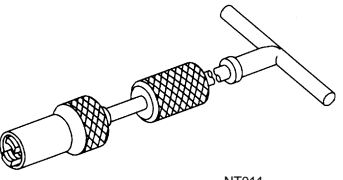
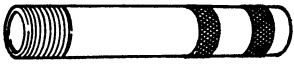
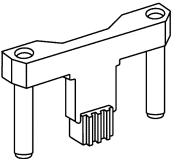
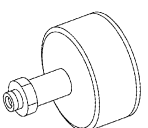
### PREPARATION

#### Special Service Tool

INFOID:000000012947333

A

EM

Tool number (DAIMLER tool No.) Tool name	Description
KV10117100 (DAIMLER tool No.—) Heated oxygen sensor wrench 	Loosening or tightening air fuel ratio sensor 1 <b>For 22 mm (0.87 in) width hexagon nut</b>
KV10116200 (DAIMLER tool No.—) Valve spring compressor 1. KV10115900 (DAIMLER tool No.—) Attachment 2. KV10109220 (DAIMLER tool No.—) Adapter 	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 	Removing valve oil seal
KV10115600 (DAIMLER tool No.—) Valve oil seal drift 	Installing valve oil seal
KV105H0020 (DAIMLER tool No.112 589 03 40 00) Crankshaft stopper 	Retaining lock for holding crankshaft via ring gear for flywheel or clutch plate.
KV115H0180 (DAIMLER tool No.116 589 20 33 00) Extractor impac 	Impact extractor for guide rail bolts (basic equipment).

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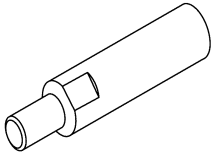
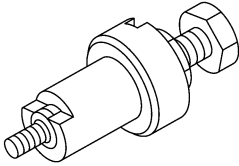
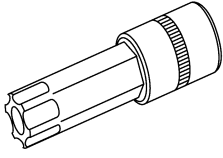
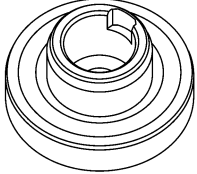
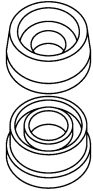
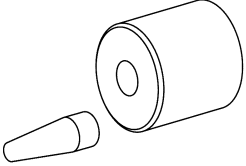
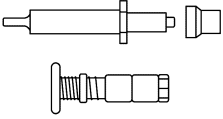
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# PREPARATION

< PREPARATION >

[2.0L TURBO GASOLINE ENGINE]

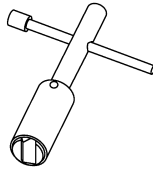
Tool number (DAIMLER tool No.) Tool name	Description
KV105H0030 (DAIMLER tool No.270 589 00 34 00) Threaded pin  <small>JSBIA5220ZZ</small>	To pull out roll pins. In combination with KV115H0180 (DAIMLER tool No.116 589 20 33 00) extractor.
KV105H0410 (DAIMLER tool No.270 589 00 33 00) Puller  <small>JSBIA9893ZZ</small>	For the extractor slide rail pins. <b>NOTE:</b> In combination with puller <ul style="list-style-type: none"> <li>• KV105H0420</li> <li>• DAIMLER tool No.270 589 00 33 02</li> </ul>
KV105H0090 (DAIMLER tool No.271 589 00 10 00) Socket wrench  <small>JSBIA5226ZZ</small>	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  <small>JSBIA9894ZZ</small>	Insertion tool for inserting the front oil seal.
KV105H0100 (DAIMLER tool No.271 589 00 43 00) Crankshaft seal installation  <small>JSBIA5218ZZ</small>	Insertion tool for inserting the rear crankshaft radial shaft sealing ring.
KV105H0110 (DAIMLER tool No.272 589 00 43 00) Injector seal installation  <small>JSBIA5227ZZ</small>	Installing fuel injector seal ring.
KV105H0160 (DAIMLER tool No.278 589 01 15 00) Drift seal installation  <small>JSBIA5229ZZ</small>	For indentation of the sealing package for the rail.

# PREPARATION

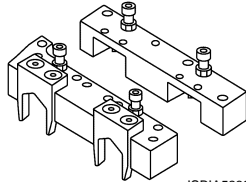
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[2.0L TURBO GASOLINE ENGINE]

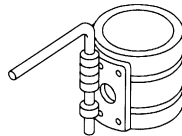
Tool number (DAIMLER tool No.) Tool name	Description	A
KV105H0170 (DAIMLER tool No.278 589 00 33 00) Injector puller	For pulling out individual injectors.	EM
KV105H0210 (DAIMLER tool No.270 589 01 61 00) Camshaft holder	For holding down and fixing in place of the camshaft in TDC.	C D E F
EM03470000 (DAIMLER tool No.— ) Piston ring compressor	Installing piston assembly into cylinder bore.	G H
1:EG15050001 (DAIMLER tool No.— ) Compression gauge set 2:EG15050300 (DAIMLER tool No.— ) Compression gauge adapter	Checking compression pressure.	I J K
KV10112100 (DAIMLER tool No.— ) Angle wrench	Tightening bolts for main bearing cap, cylinder head, etc.	L M N O P



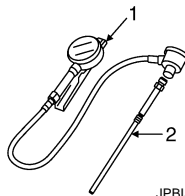
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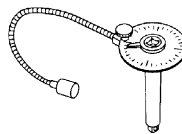
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JPBIA6744ZZ

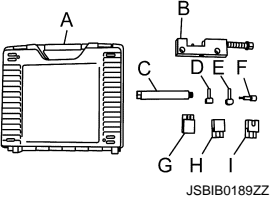
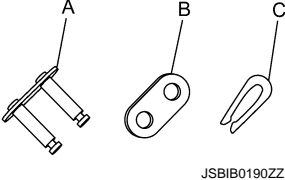


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# PREPARATION

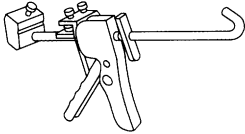
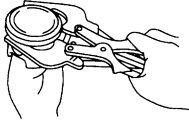
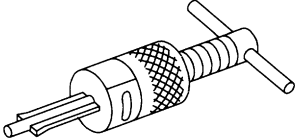
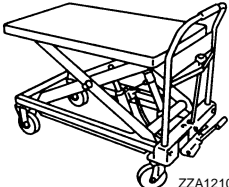
< PREPARATION >

[2.0L TURBO GASOLINE ENGINE]

Tool number (DAIMLER tool No.) Tool name	Description
<p>KV105H0530 (DAIMLER tool No.276 589 00 39 00) Rivet press tool</p> <ul style="list-style-type: none"> <li>• A: Case</li> <li>• B: Base carrier</li> <li>• C: Handle</li> <li>• D: Thrust piece A2</li> <li>• E: Thrust piece B2</li> <li>• F: Thrust piece C2</li> <li>• G: Mount A1</li> <li>• H: Mount B1</li> <li>• I: Mount C1</li> </ul> 	<p>For riveting and compacting the timing chain. <b>NOTE:</b> Only for INA timing chains.</p>
<p>KV105H0510 (DAIMLER tool No.271 589 09 63 00) Assembly element</p> <ul style="list-style-type: none"> <li>• A: Link</li> <li>• B: Plate</li> <li>• C: Lock</li> </ul> 	<p>For connecting the repair chain with the installed chain when changing the timing chain. <b>NOTE:</b> The assembly element must be removed from the engine after repairs have been completed.</p>

## Commercial Service Tool

INFOID:000000012947334

Tool name	Description
<p>Tube presser</p> 	<p>Pressing the tube of liquid gasket</p>
<p>Piston ring expander</p> 	<p>Removing and installing piston ring</p>
<p>Pilot bushing puller</p> 	<p>Removing pilot converter</p>
<p>Manual lift table caddy</p> 	<p>Removing and installing engine</p>



# PREPARATION

< PREPARATION >

[2.0L TURBO GASOLINE ENGINE]

## Lubricant or/and Sealant

INFOID:000000012947335

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
Paste, hot lubrication, DB supply specification 6879.20	Catalytic converter	(DEUTSCHE BP AG), or equivalent
Loctite 7200	<ul style="list-style-type: none"> <li>• Oil pan</li> <li>• Cylinder head cover</li> <li>• Oil seal</li> </ul>	Loctite 7200 or equivalent
Loctite 7063 Cleaning spray	<ul style="list-style-type: none"> <li>• Oil pan</li> <li>• Cylinder head cover</li> <li>• Oil seal</li> </ul>	Loctite 7063 Cleaning spray, or equivalent
Loctite 5970 sealant	<ul style="list-style-type: none"> <li>• Oil pan</li> <li>• Cylinder head cover</li> <li>• Oil seal</li> </ul>	Loctite 5970 sealant, or equivalent
Loctite 566 sealant	Cylinder block	Loctite 566 or equivalent
Loctite 241 sealant	Cylinder block core plug	Loctite 241 or equivalent

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## BASIC INSPECTION

### COMPRESSION PRESSURE

#### Inspection

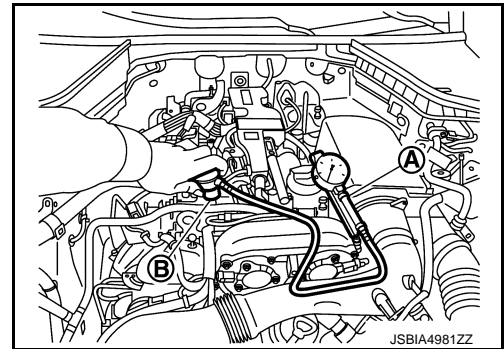
INFOID:000000012947336

1. Warm up engine thoroughly. Then, stop it.
2. Remove engine cover. Refer to [EM-22, "Removal and Installation"](#).
3. Check DTC using CONSULT.

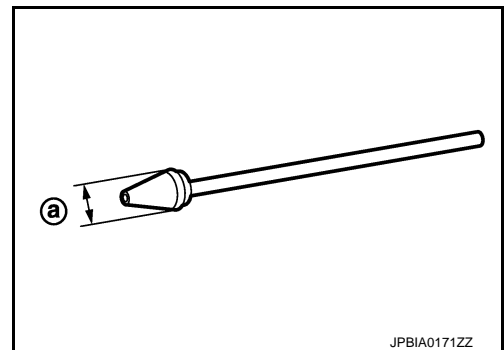
**NOTE:**

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 located.
  - 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-20, "Removal and Installation"](#).
6. Connect engine tachometer (not required in use of CONSULT).
7. Install compression tester [SST: EG15050001] (A) with adapter [SST: EG15050300] (B) onto spark plug hole.



- Use compression tester whose end (a) (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-132, "General Specification"](#).

**CAUTION:**

**Always use a fully charged 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.

# COMPRESSION PRESSURE

< BASIC INSPECTION >

[2.0L TURBO GASOLINE ENGINE]

- 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.

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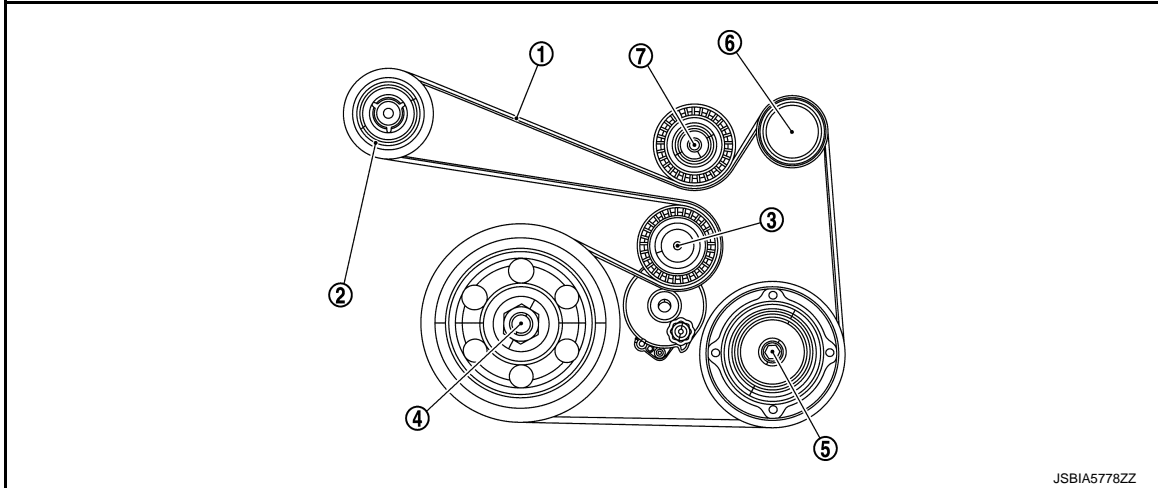
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## PERIODIC MAINTENANCE

### DRIVE BELT

#### Exploded View

INFOID:0000000012947337



JSBIA5778ZZ

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

### Removal and Installation

INFOID:0000000012947338

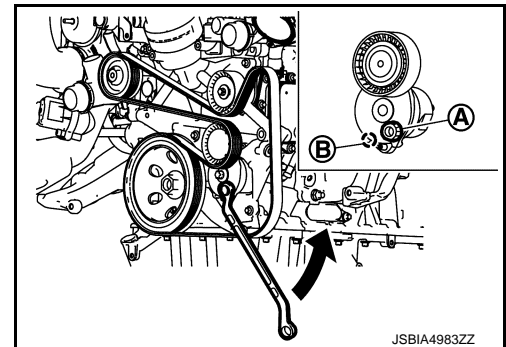
#### REMOVAL

1. Remove front under cover. Refer to [EXT-35. "FRONT UNDER COVER : Removal and Installation"](#).
2. Hold the hexagonal part ① of drive belt auto-tensioner with a wrench securely. Then move the wrench 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. Insert a rod approximately 4 mm (0.16 in) in diameter such as short-length screwdriver into the hole ② of the retaining boss to fix drive belt auto-tensioner.
  - Keep drive belt auto-tensioner pulley arm locked after drive belt is removed.
4. Remove drive belt.



JSBIA4983ZZ

#### INSTALLATION

1. Install drive belt.
 

**CAUTION:**

  - Never use the indicator of drive belt auto-tensioner.
  - Confirm drive belt is completely set to pulleys.
  - 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. Release drive belt auto-tensioner, and apply tension to drive belt.

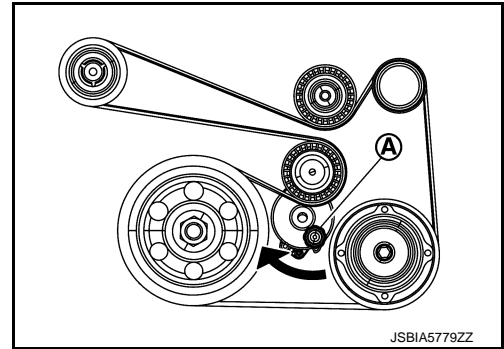
# DRIVE BELT

< PERIODIC MAINTENANCE >

[2.0L TURBO GASOLINE ENGINE]

3. Tighten drive belt auto-tensioner (A) to the specified torque in the direction shown by arrow.

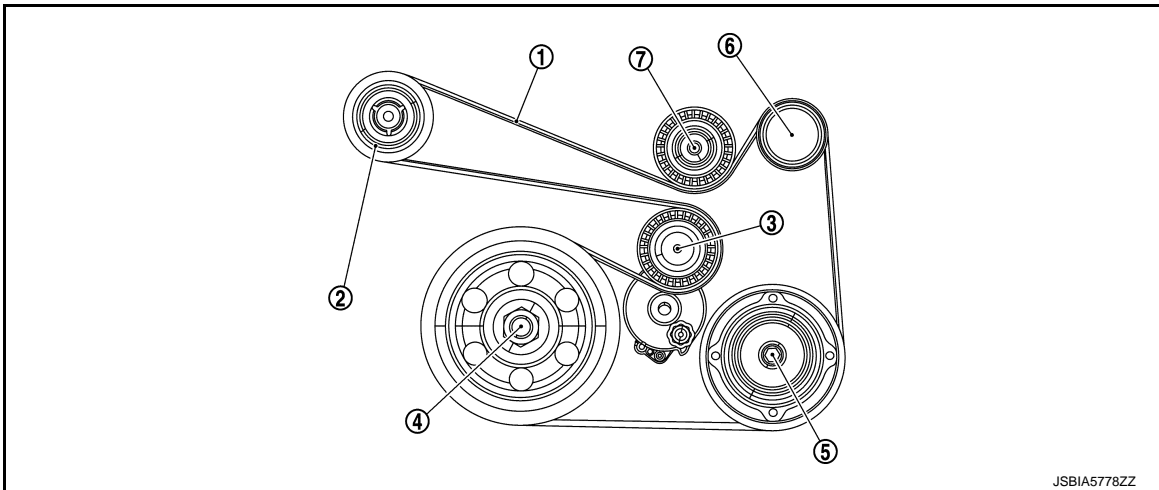
 : 45.0N-m (4.6 kg-m,33 ft-lb)



4. Turn crankshaft pulley clockwise several times to equalize tension between each pulley.
5. Confirm tension of drive belt at indicator (notch on fixed side) is within the possible use range. Refer to [EM-16. "Exploded View"](#).

## Inspection

INFOID:000000012947339



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

### 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:000000012947340

Refer to : [EM-132. "Drive Belt"](#).

# AIR CLEANER FILTER

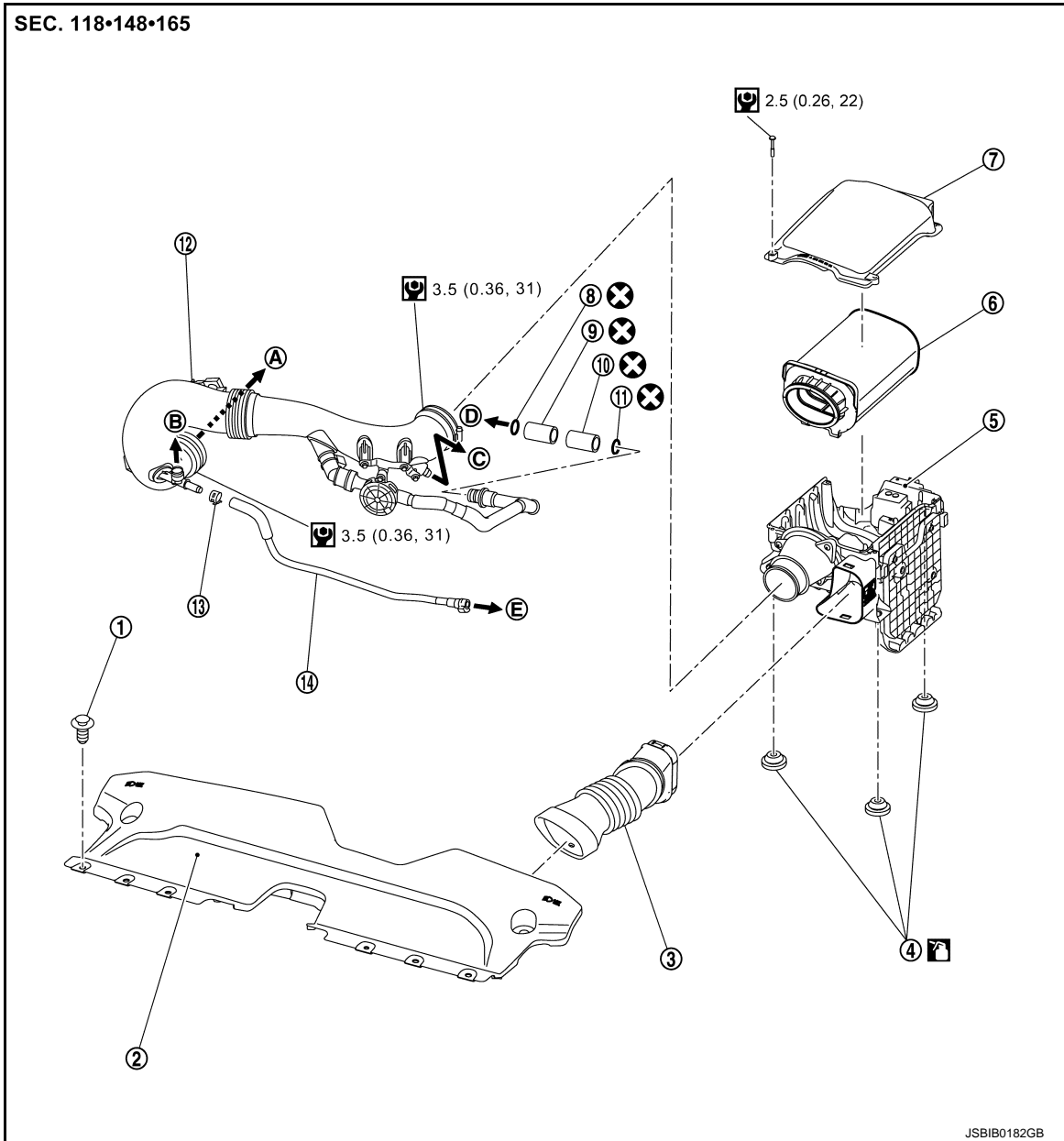
< PERIODIC MAINTENANCE >

[2.0L TURBO GASOLINE ENGINE]

## AIR CLEANER FILTER

Exploded View

INFOID:000000012947341



- |                             |                       |                                |
|-----------------------------|-----------------------|--------------------------------|
| ① Clip                      | ② Air duct (inlet)    | ③ Air duct (dust side)         |
| ④ Mounting rubber           | ⑤ Air cleaner housing | ⑥ Air cleaner filter element   |
| ⑦ Air cleaner housing cover | ⑧ O-ring              | ⑨ Shrink tube                  |
| ⑩ Adapter                   | ⑪ O-ring              | ⑫ Air duct (turbocharger side) |
| ⑬ Clamp                     | ⑭ Bypass hose         |                                |
| Ⓐ To turbocharger assembly  | Ⓑ To EVAP piping      | Ⓒ To vent line                 |
| Ⓓ To oil separator 2        | Ⓔ To air duct         |                                |

: N·m (kg·m, in·lb)

: Should be lubricated with oil.

: Always replace after every disassembly.

# AIR CLEANER FILTER

< PERIODIC MAINTENANCE >

[2.0L TURBO GASOLINE ENGINE]

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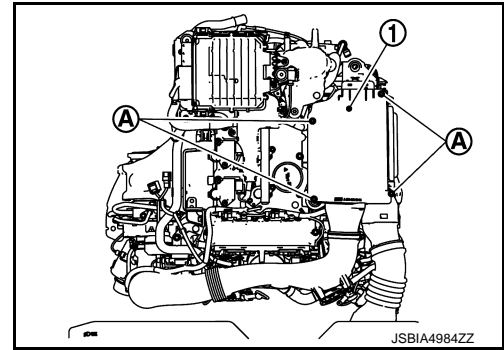
## Removal and Installation

### REMOVAL

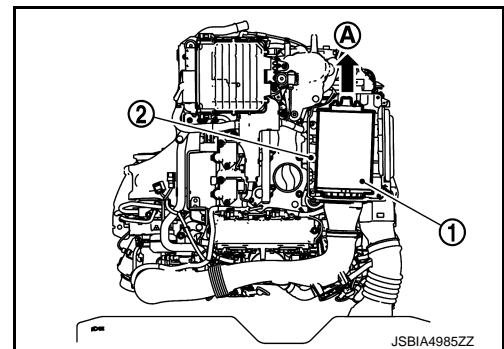
1. Remove engine cover. Refer to [EM-22. "Removal and Installation"](#)
2. Loosen air cleaner housing cover mounting bolt (A) to remove air cleaner housing cover (1).

**NOTE:**

The bolts remain the air cleaner housing cover.



3. Pull up air cleaner filter element (1) backward (A) and remove it, from air cleaner housing (2).



### INSTALLATION

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

**NOTE:**

If a sensors is replaced, carry out the reset of adaption of sensors. Refer to [EC4-216. "Description"](#).  
Clean the inside of air cleaner housing and the air cleaner housing cover.

### Inspection

INFOID:000000012947343

#### INSPECTION AFTER REMOVAL

- Examine with eyes that there is no stain, clogging, or damage on air cleaner element.
- Remove dust (such as dead leaves) on air cleaner element surface and inside cleaner case.
- If clogging or damage is observed, replace the air cleaner element.

**CAUTION:**

**Never clean the viscous paper type air cleaner element by blowing as there is a risk of deterioration of its performance**

#### MAINTENANCE INTERVAL

Refer to [MA-10. "FOR NORTH AMERICA : Introduction of Periodic Maintenance"](#).

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# SPARK PLUG

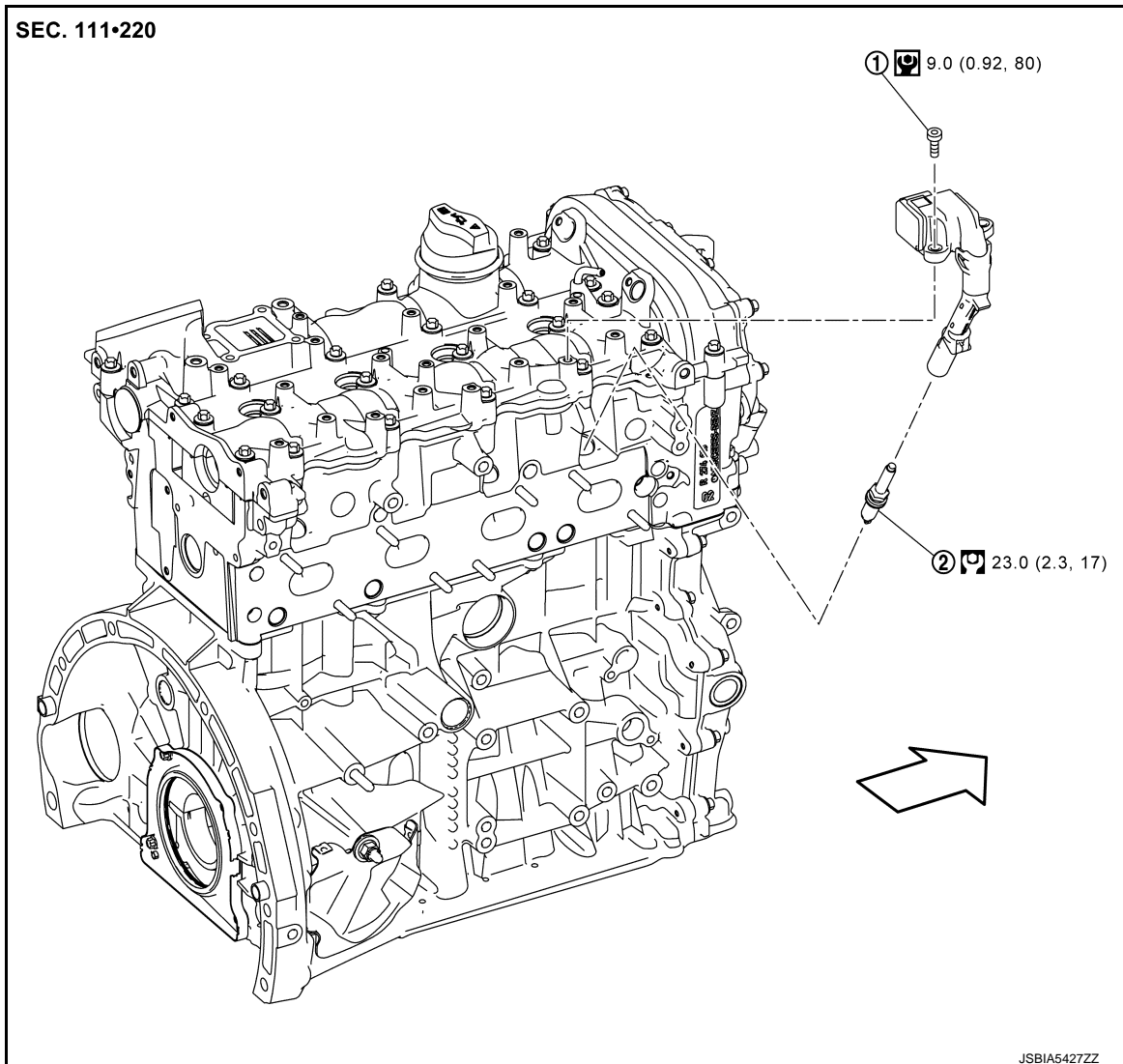
< PERIODIC MAINTENANCE >

[2.0L TURBO GASOLINE ENGINE]

## SPARK PLUG

Exploded View


INFOID:000000012947344




JSBIA5427ZZ

① Ignition coil

② Spark plug

 : N·m (kg-m, ft-lb)

 : N·m (kg-m, in-lb)

 : Engine front

## Removal and Installation

INFOID:000000012947345

### REMOVAL

1. Remove engine cover. Refer to [EM-22. "Removal and Installation"](#).
2. Remove ignition coil. Refer to [EM-62. "Removal and Installation"](#).



# SPARK PLUG

## < PERIODIC MAINTENANCE >

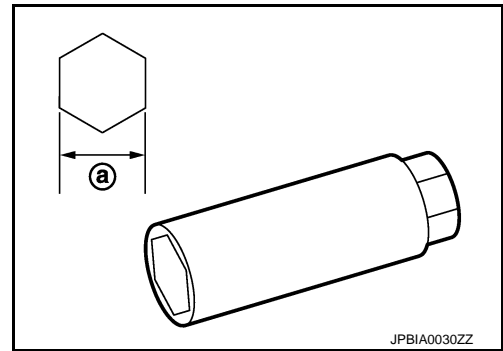
[2.0L TURBO GASOLINE ENGINE]

3. 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.



## INSTALLATION

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

**NOTE:**

If a sensor is replaced, carry out the reset of adaptation of sensors. Refer to [EC4-216. "Description"](#).

## Inspection

INFOID:000000012947346

## INSPECTION AFTER REMOVAL

Use standard type spark plug for normal condition.

**Spark plug (standard) :** Refer to [EM-132. "Spark Plug"](#).

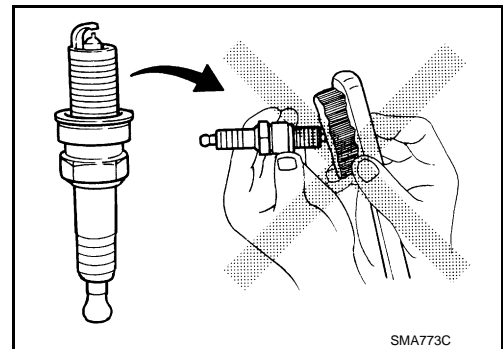
Visually check the electrode for dirt and wear and the insulator for burning.

**CAUTION:**

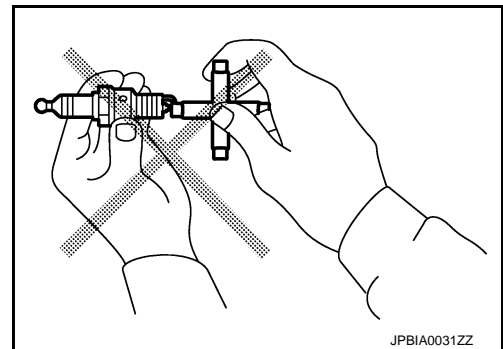
- Never drop or shock spark plug.
- Never use wire brush for cleaning.
- If plug tip is covered with carbon, spark plug cleaner may be used.

**Cleaner air pressure:** Less than 588 kPa (5.9 bar , 6 kg/cm<sup>2</sup>, 85 psi)

**Cleaning time:** Less than 20 seconds



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



# ENGINE COVER

< REMOVAL AND INSTALLATION >

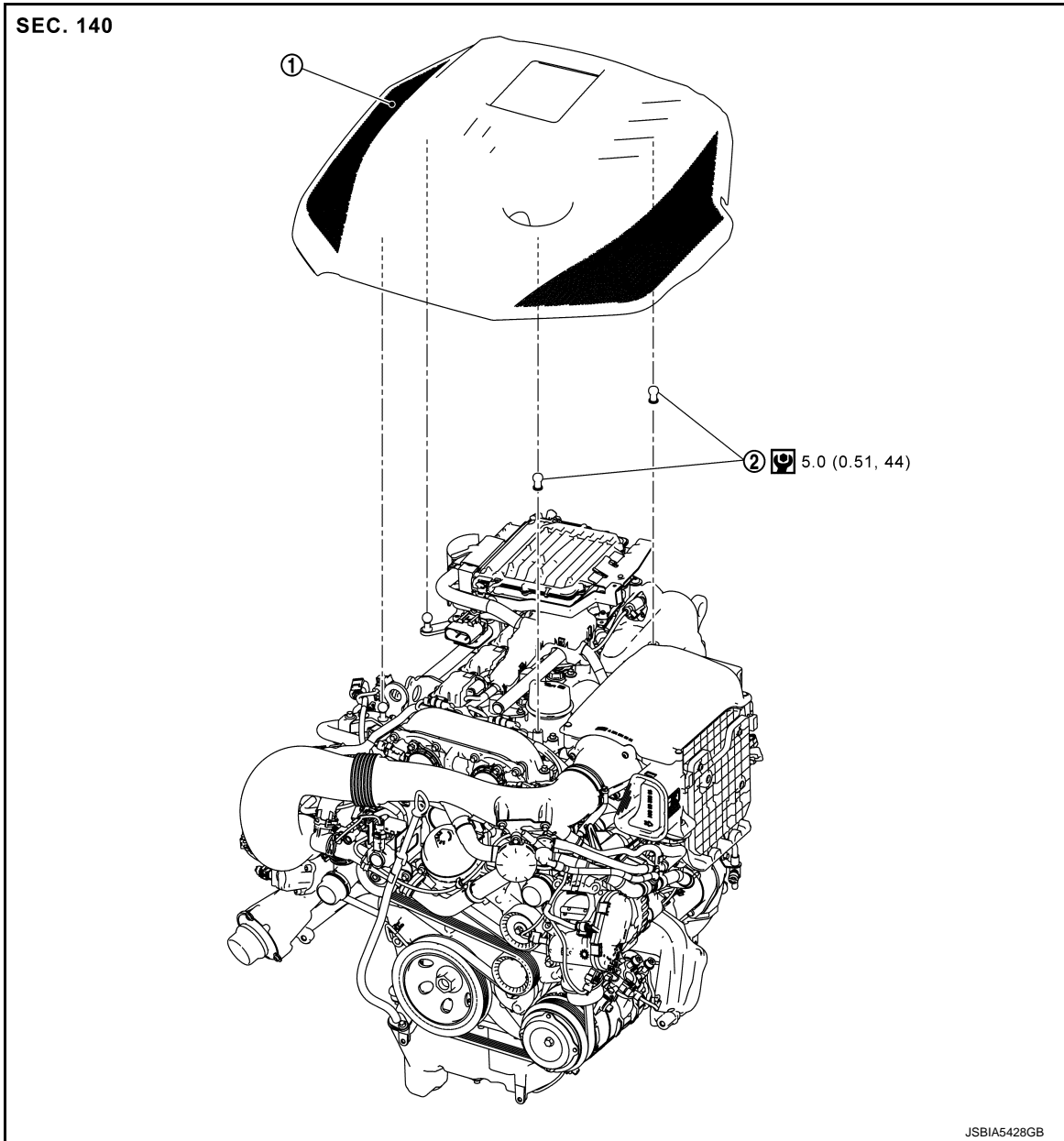
[2.0L TURBO GASOLINE ENGINE]

## REMOVAL AND INSTALLATION

### ENGINE COVER

Exploded View

INFOID:000000012947347



① Engine cover

② Pin

: N·m (kg·m, in·lb)

### Removal and Installation

INFOID:000000012947348

#### REMOVAL

#### **CAUTION:**

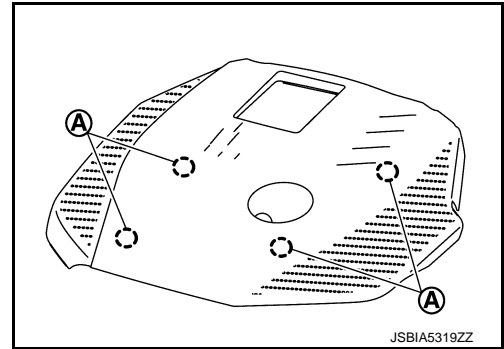
Handle with care not to damage the engine cover.

# ENGINE COVER

## < REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

1. Lift up on engine cover firmly to dislodge snap fit mounts (A).



2. Remove engine cover.

## INSTALLATION

Install in the reverse order of removal.

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# AIR CLEANER AND AIR DUCT

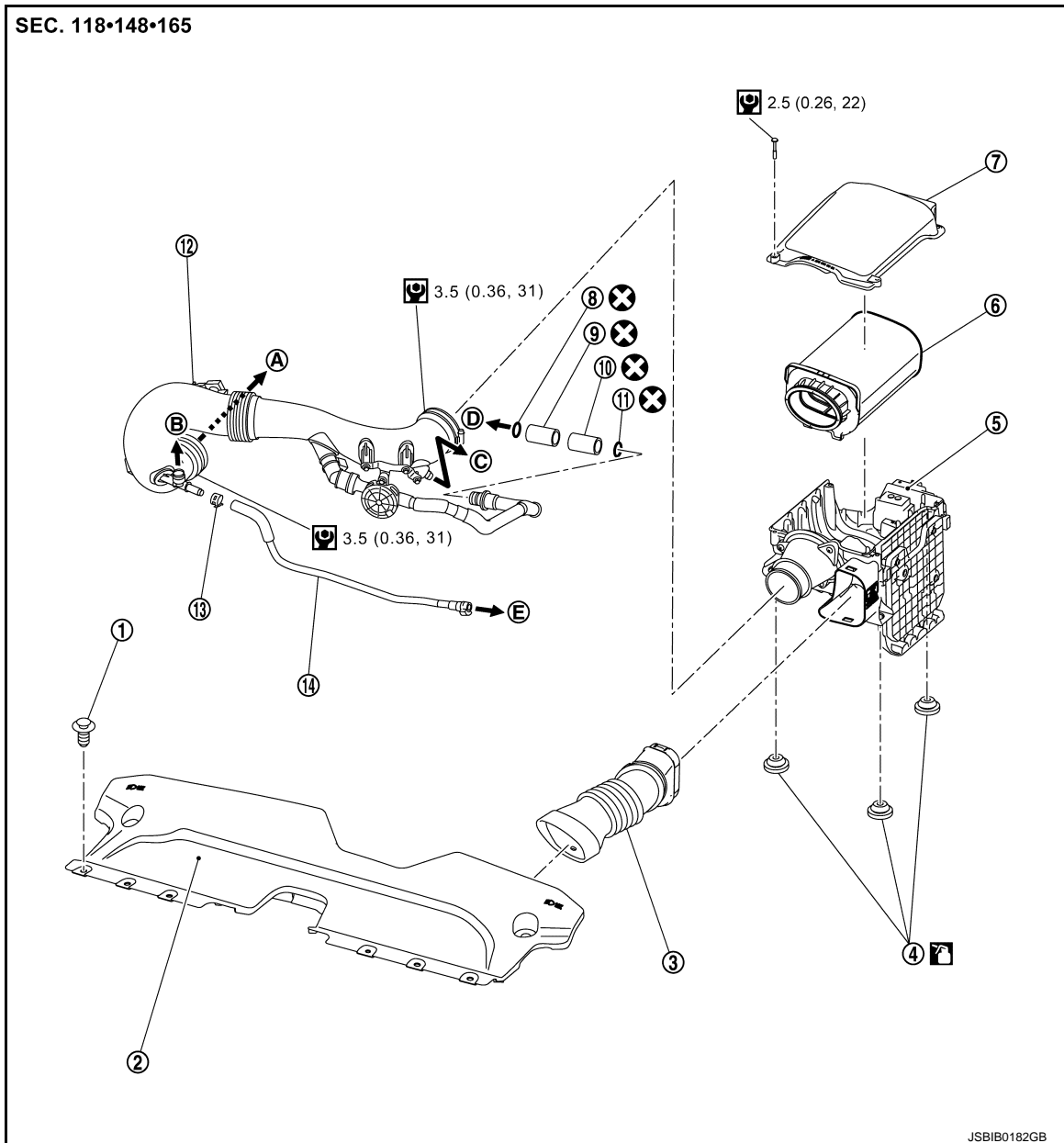
< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

## AIR CLEANER AND AIR DUCT

Exploded View

INFOID:000000013524366



- |                             |                       |                                |
|-----------------------------|-----------------------|--------------------------------|
| ① Clip                      | ② Air duct (inlet)    | ③ Air duct (dust side)         |
| ④ Mounting rubber           | ⑤ Air cleaner housing | ⑥ Air cleaner filter element   |
| ⑦ Air cleaner housing cover | ⑧ O-ring              | ⑨ Shrink tube                  |
| ⑩ Adapter                   | ⑪ O-ring              | ⑫ Air duct (turbocharger side) |
| ⑬ Clamp                     | ⑭ Bypass hose         |                                |
| Ⓐ To turbocharger assembly  | Ⓑ To EVAP piping      | Ⓒ To vent line                 |
| Ⓓ To oil separator 2        | Ⓔ To air duct         |                                |

: N·m (kg·m, in·lb)

: Should be lubricated with oil.

: Always replace after every disassembly.

# AIR CLEANER AND AIR DUCT

< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

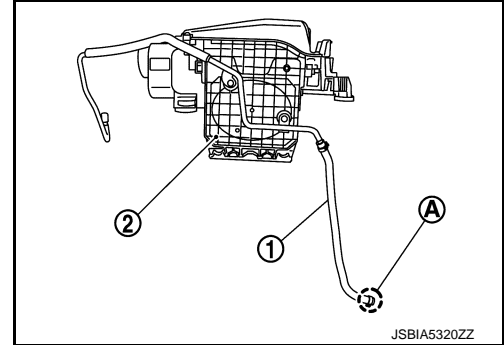
## Removal and Installation

INFOID:000000012947350

### REMOVAL

1. Remove engine cover. Refer to [EM-22. "Removal and Installation"](#).
2. Remove air duct (inlet).
3. Remove front under cover. Refer to [EXT-35. "FRONT UNDER COVER : Removal and Installation"](#).
4. Disconnect EVAP control system pressure sensor hose ① from the engine side ②.

② :Air cleaner housing



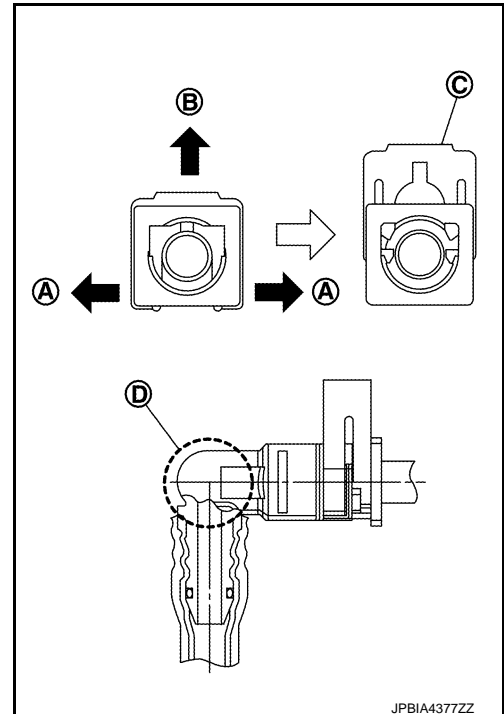
5. Disconnect EVAP control system pressure sensor hose from the EVAP control system pressure sensor valve side as follows:
  - a. Disengage ① and pull up ② the pawl of the fuel feed hose connector retainer ③ to disconnect the fuel feed hose from high pressure fuel pump.

#### NOTE:

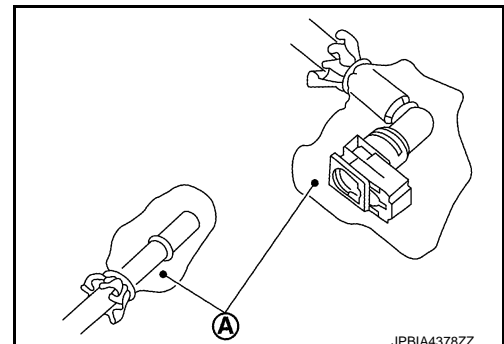
If the fuel feed hose is stuck, hold the fuel pipe by hand and disconnect it by pushing and pulling.

#### CAUTION:

- Keep parts away from heat source. Especially, be careful when welding is performed around them.
- Never expose parts to battery electrolyte or other acids.
- Never bent or twist connection between quick connector and fuel feed hose (with damper) during installation/removal.
- Pull quick connector holding ④.
- Never remove the retainer.
- Prepare a tray and waste beforehand as fuel leaks out.
- Never pull with lateral force applied. O-ring inside quick connector may be damaged.



- To prevent damage to each joint and protect it from the entry of foreign matter, cover the joint with plastic bag ⑤ or an equivalent.



6. Remove engine oil level gauge. Refer to [EM-109. "2WD : Exploded View"](#) (2WD), [EM-111. "AWD : Exploded View"](#) (AWD).

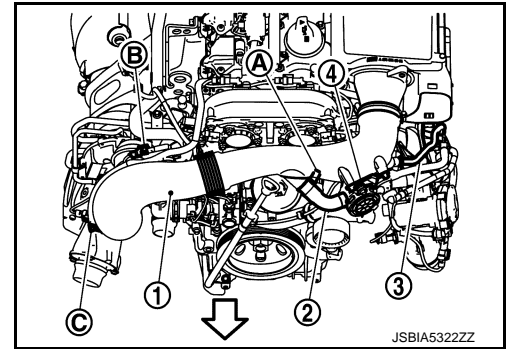
# AIR CLEANER AND AIR DUCT

[2.0L TURBO GASOLINE ENGINE]

## < REMOVAL AND INSTALLATION >

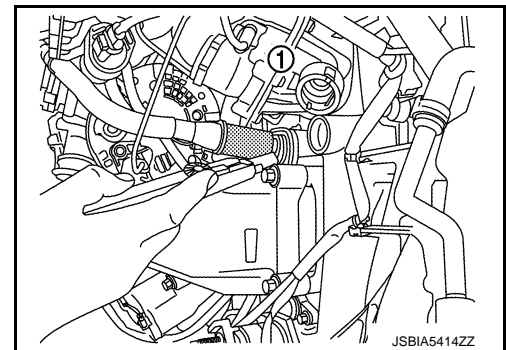
7. Remove parts and connector from the air duct (turbocharger side) ① shown in the figure.

- Ⓐ : Full-load operation vent line heater element
- Ⓑ : Pressure sensor downstream of air filter
- Ⓒ : Harness clip
- ② : Blow by hose
- ③ : Cylinder block vent line
- ④ : Full-load operation vent line heater element hose bracket
- ⇐ : Engine front

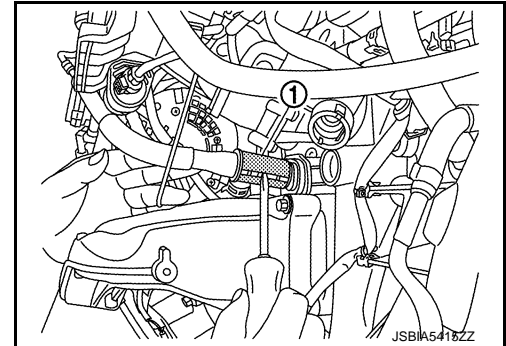


8. Remove air duct (turbocharger side) as follows, if necessary:

- a. Remove the charge air manifold. Refer to [EM-29, "Removal and Installation"](#).
- b. Remove the vent line. Refer to [EM-31, "Removal and Installation"](#).
- c. Cut the the shrink tube ① (oil separator 2 side) of the air duct (turbocharger side), and then remove it.



- d. Cut the cutout part of the adapter ① (oil separator 2 side) of the air duct (turbocharger side), and then remove it.



- e. Separate the the air duct (turbocharger side) from oil separator 2. Refer to [EM-31, "Removal and Installation"](#).
  - f. Remove air duct (turbocharger side).
9. Pull air cleaner housing assembly upward and remove.

## INSTALLATION

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

### NOTE:

- If an sensors is replaced, carry out the reset of adaption of sensors. Refer to [EC4-216, "Description"](#).
- 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 [A 000 989 01 60] to mounting rubber.

## Inspection

INFOID:0000000012947351

## INSPECTION AFTER REMOVAL

Inspect air duct and for crack or tear.

- If anything found, replace air duct.

# DRIVE BELT AUTO TENSIONER AND IDLER PULLEY

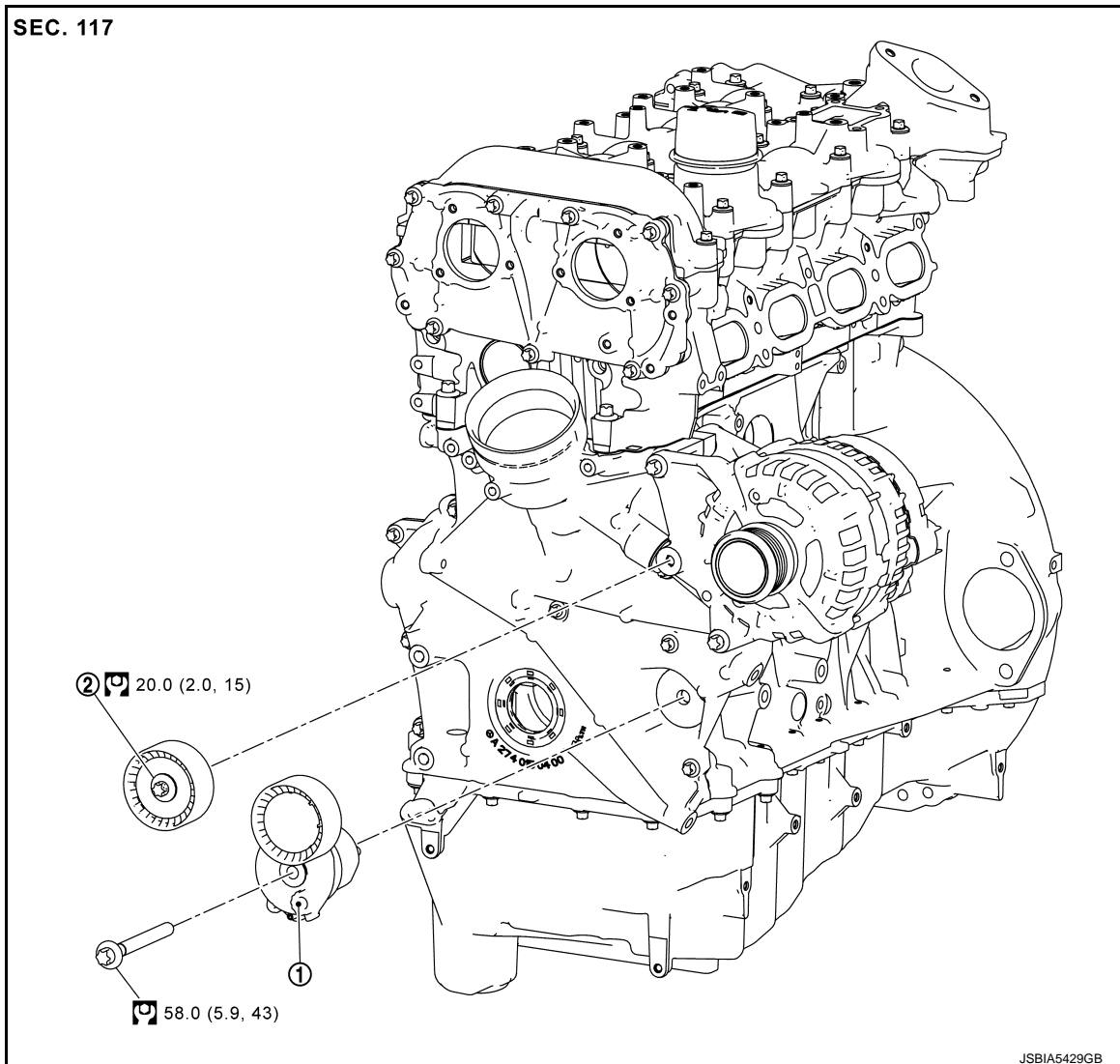
< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

## DRIVE BELT AUTO TENSIONER AND IDLER PULLEY


Exploded View

INFOID:000000012947352



① Drive belt auto-tensioner

② Idler pulley

 : N·m (kg-m, ft-lb)

### Removal and Installation

INFOID:000000012947353

#### CAUTION:

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

#### REMOVAL

1. Remove drive belt. Refer to [EM-16, "Removal and Installation"](#).
  - Keep drive belt auto-tensioner pulley arm locked after drive belt is removed.
2. Remove drive belt auto-tensioner.
3. Remove idler pulley.

#### INSTALLATION

Install in the reverse order of removal.

# CHARGE AIR MANIFOLD

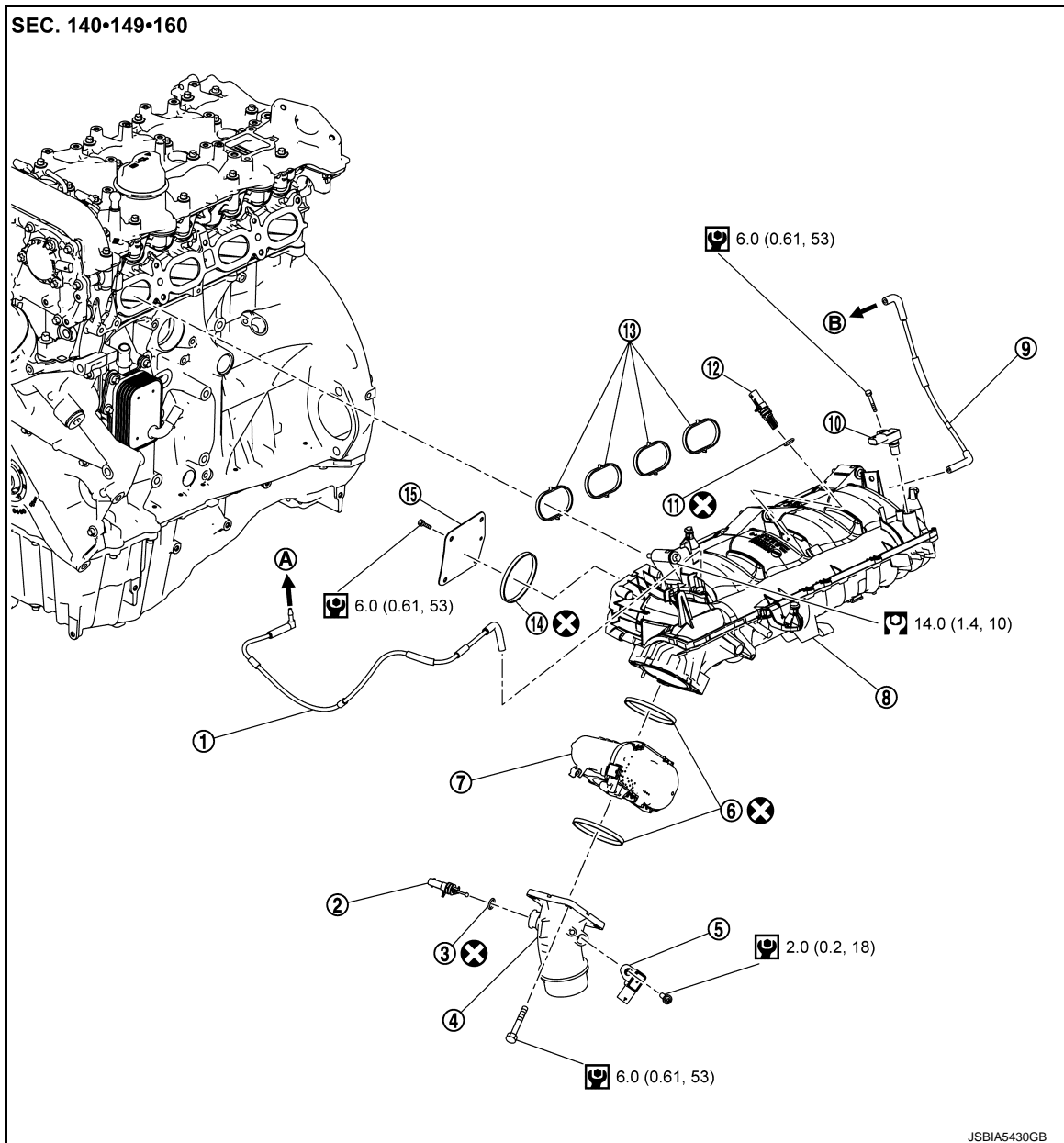
< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

## CHARGE AIR MANIFOLD

Exploded View

INFOID:000000012947354




- |  |  |  |
|--|--|--|
| ① Vacuum hose                                  | ② Charge air temperature sensor upstream of throttle valve | ③ O-ring   |
| ④ Air duct                                     | ⑤ Pressure sensor upstream of throttle valve               | ⑥ O-ring   |
| ⑦ Throttle valve actuator                      | ⑧ Charge air manifold                                      | ⑨ Vacuum hose  |
| ⑩ Pressure sensor downstream of throttle valve | ⑪ O-ring   | ⑫ Charge air temperature sensor downstream of throttle valve |
| ⑬ Gasket                                       | ⑭ Gasket   | ⑮ Charge air manifold cover                                  |
- Ⓐ To boost pressure control vacuum transducer  
 Ⓑ To vacuum pump  
 ⊗ : Always replace after every disassembly.




# CHARGE AIR MANIFOLD

< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

 : N·m (kg-m, ft-lb)

 : N·m (kg-m, in-lb)

## Removal and Installation


INFOID:000000012947355

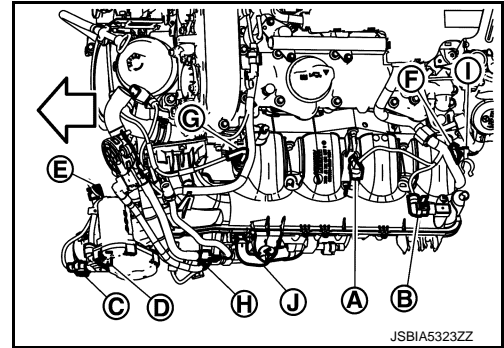
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### REMOVAL

1. Remove air cleaner housing and air duct (turbocharger side). Refer to [EM-25. "Removal and Installation"](#).
2. Remove parts and connector from the charge air manifold shown in the figure.

- (A) : Charge air temperature sensor downstream of throttle valve connector
- (B) : Pressure sensor downstream of throttle valve connector
- (C) : Pressure sensor upstream of throttle valve connector
- (D) : Throttle valve actuator connector
- (E) : Charge air temperature sensor upstream of throttle valve connector
- (F) : Engine harness clip
- (G) : Vacuum hose
- (H) : Vent line
- (I) : Vacuumline
- (J) : Partial load throttle bleed line
-  : Engine front



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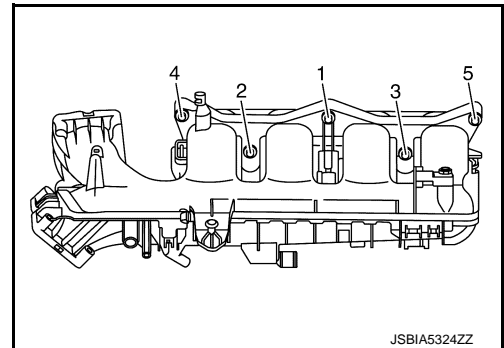
G

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3. 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.




I

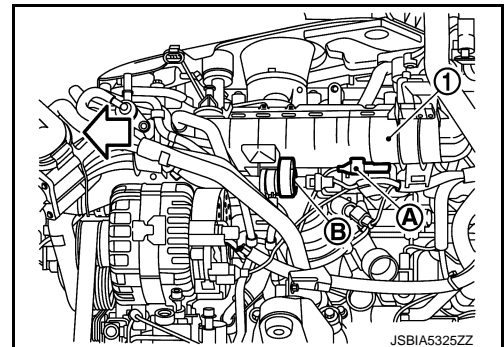
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4. Lift the engine side of the charge air manifold (1), and remove the harness clamp (A) of and partial load operation crankcase ventilation valve (B) under the charge air manifold.

 : Engine front



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5. Remove the charge air manifold along with the throttle valve actuator.

P

# CHARGE AIR MANIFOLD

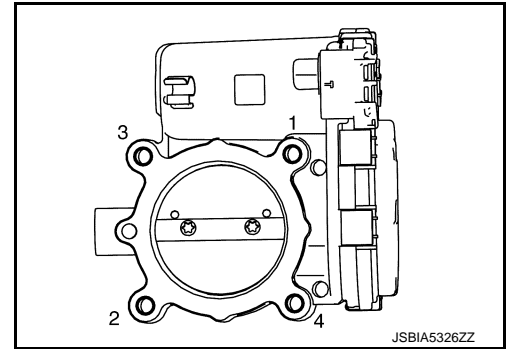
[2.0L TURBO GASOLINE ENGINE]

## < REMOVAL AND INSTALLATION >

- Loosen bolts in reverse order as shown, then remove throttle valve actuator and gasket.

**CAUTION:**

Handle carefully to avoid any damage.



## INSTALLATION

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

**NOTE:**

- If an sensors is replaced, carry out the reset of adaption of sensors. Refer to [EC4-216. "Description"](#).
- If an throttle valve actuator is replaced, carry out the teach in of throttle valve actuator. Refer to [EC4-213. "Description"](#).

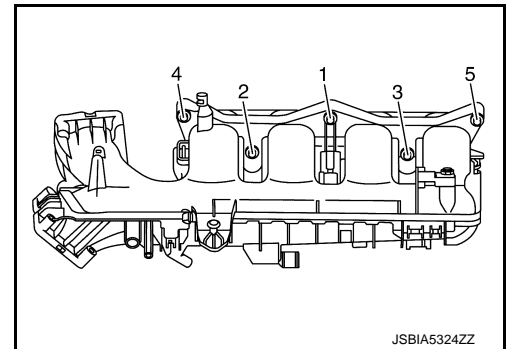
Charge Air Manifold

- Securely install gasket to the mounting groove.

**CAUTION:**

Do not reuse gasket.

- Tighten in numerical order as shown.



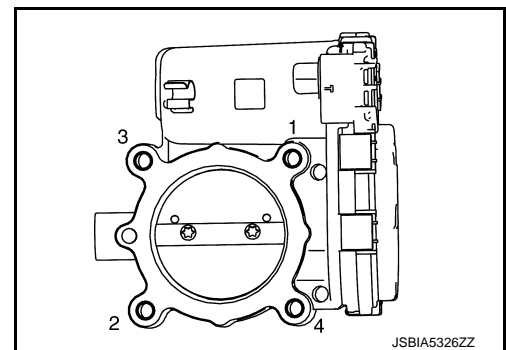
Throttle Valve Actuator

- Install a new gasket on the throttle valve actuator.

**CAUTION:**

Do not reuse gasket.

- Tighten the bolts of throttle valve actuator equally and diagonally in several steps in numerical order as shown.



## Inspection

INFOID:000000012947356

## INSPECTION AFTER INSTALLATION

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

# VENTILATION SYSTEM

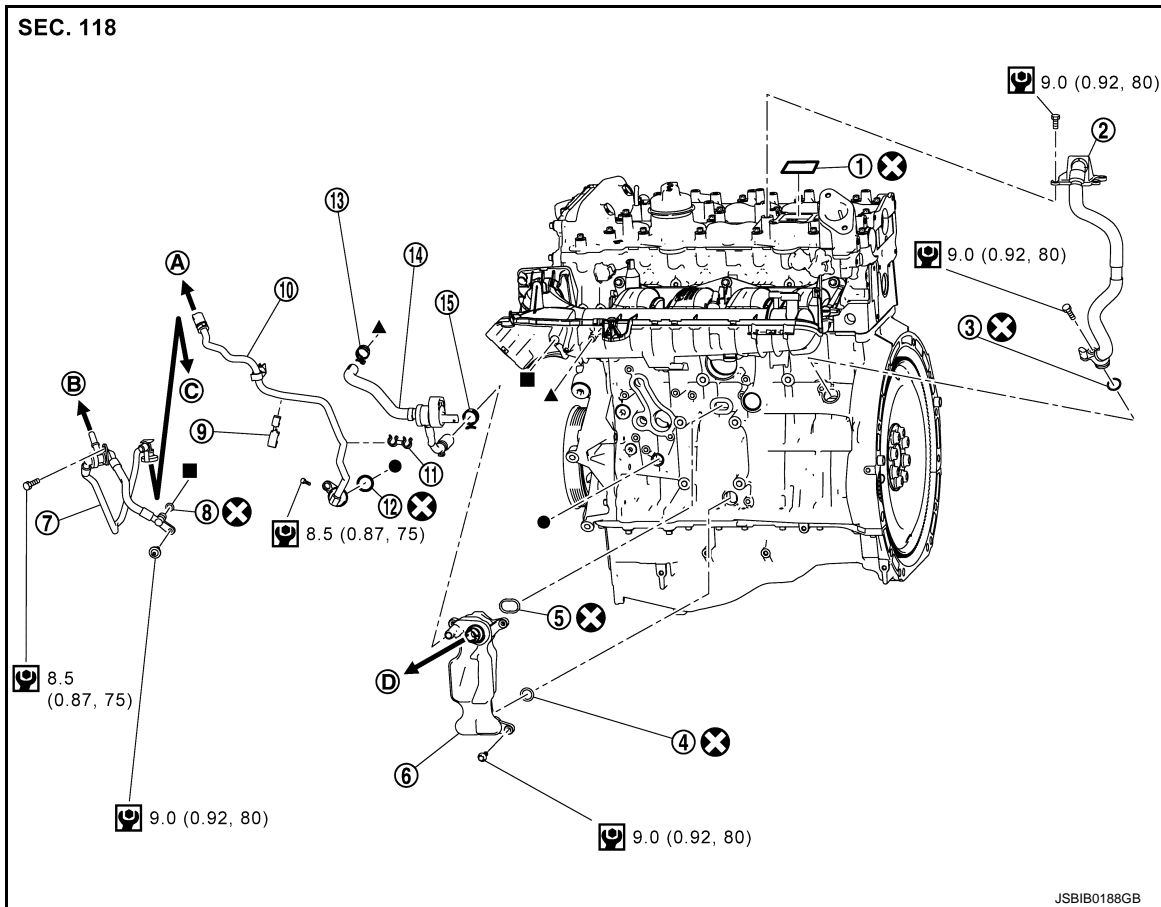
< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

## VENTILATION SYSTEM

Exploded View

INFOID:000000012947357



- |                                   |  |                                   |
|-----------------------------------|--|-----------------------------------|
| ① Gasket                          | ② Oil separator 1                                    | ③ O-ring                          |
| ④ O-ring                          | ⑤ O-ring   | ⑥ Oil separator 2                 |
| ⑦ EVAP piping                     | ⑧ O-ring   | ⑨ Clamp                           |
| ⑩ Vent line                       | ⑪ Clamp  | ⑫ O-ring                          |
| ⑬ Clamp                           | ⑭ Partial load operation crankcase ventilation valve | ⑮ Clamp                           |
| Ⓐ To air duct (turbocharger side) | Ⓑ To EVAP control system pressure sensor             | Ⓒ To air duct (turbocharger side) |
| Ⓓ To full-load vent line          |  |                                   |
- ⊗ : Always replace after every disassembly.  
 ☞ : N·m (kg-m, in-lb)

## Removal and Installation

INFOID:000000012947358

### REMOVAL

#### Oil Separator 1

1. Remove the engine cover. Refer to [EM-22. "Removal and Installation"](#).
2. Remove the shield of the high pressure fuel pump. Refer to [EM-47. "Removal and Installation"](#).
3. Remove the high pressure fuel line between the high pressure fuel pump and the fuel rail. Refer to [EM-47. "Removal and Installation"](#).
4. Remove the oil separator 1.

# VENTILATION SYSTEM

< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

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Crank Ventilation (Full-load), Oil Separator 2

1. Remove the charge air manifold. Refer to [EM-29. "Removal and Installation"](#).
2. Remove the vent line.
3. Separate the air duct (turbocharger side) from the oil separator 2. Refer to [EM-25. "Removal and Installation"](#).
4. Remove the partial load operation crankcase ventilation valve.
5. Remove the oil separator 2 .

## INSTALLATION

If an sensors is replaced, carry out the reset of adaption of sensors. Refer to [EC4-216. "Description"](#).

# CHARGE AIR COOLER

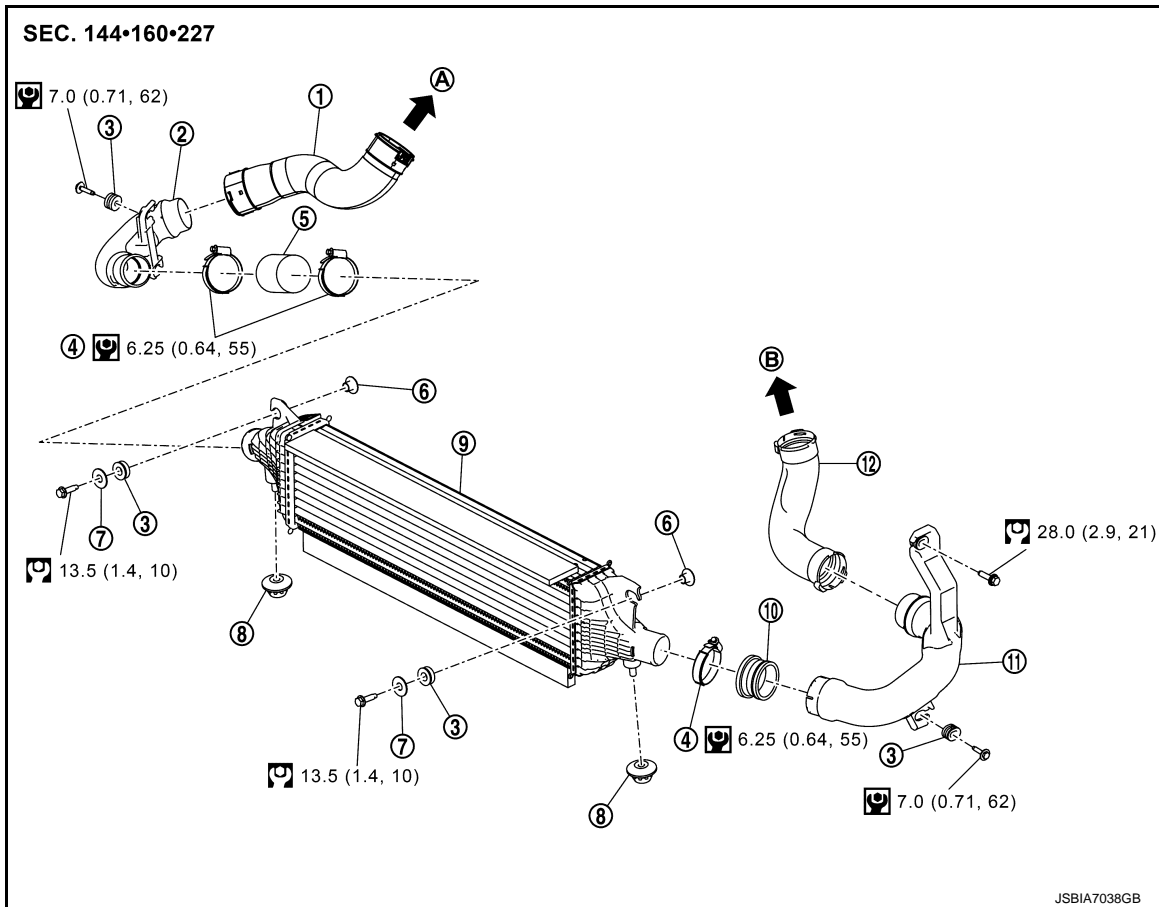
< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

## CHARGE AIR COOLER

### Exploded View

INFOID:000000012947359



- |   |                   |   |                            |   |                   |
|---|-------------------|---|----------------------------|---|-------------------|
| ① | Charge air hose 1 | ② | Charge air tube 1          | ③ | Bush              |
| ④ | Clamp             | ⑤ | Charge air hose 3          | ⑥ | Collar            |
| ⑦ | Washer            | ⑧ | Mount bush                 | ⑨ | Charge air cooler |
| ⑩ | Sealing ring      | ⑪ | Charge air tube 2          | ⑫ | Charge air hose 2 |
| Ⓐ | To turbocharger   | Ⓑ |                            |   |                   |
| Ⓑ |                   | Ⓒ | To throttle valve actuator |   |                   |

: N·m (kg·m, in·lb)

: N·m (kg·m, ft·lb)

### Removal and Installation

INFOID:000000012947360

#### REMOVAL

- Remove the following parts:
  - Air duct (inlet). Refer to [EM-25, "Removal and Installation"](#).
  - Front undercover. Refer to [EXT-35, "FRONT UNDER COVER : Removal and Installation"](#).
  - Front tire (LH) and (RH). Refer to [WT-74, "Removal and Installation"](#).
  - Front fender protector (LH) and (RH). Refer to [EXT-30, "FENDER PROTECTOR : Removal and Installation"](#).
  - Splash guard (LH) and (RH). Refer to [EXT-30, "FENDER PROTECTOR : Removal and Installation"](#).
  - Front bumper. Refer to [EXT-15, "Removal and Installation"](#).
- Place a matching marks on each connecting part for easier installation.
- Remove charge air hose 1 and charge air hose 2 with the following procedure.

# CHARGE AIR COOLER

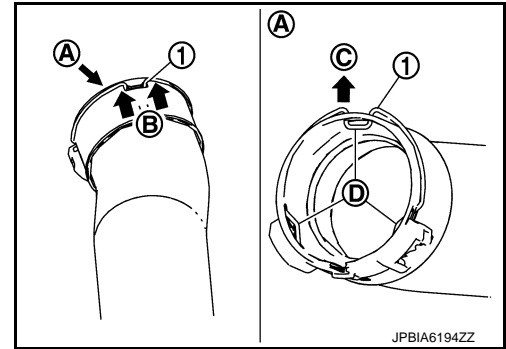
## < REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

- a. Insert a suitable tool between air 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 washer tank. Refer to [WW-63, "WASHER TANK : Removal and Installation"](#).
5. Remove charge air tube 1 and charge air tube 2.
6. Remove charge air cooler mounting bracket.
7. Loosen charge air cooler mounting bolts to remove charge air cooler.

## INSTALLATION

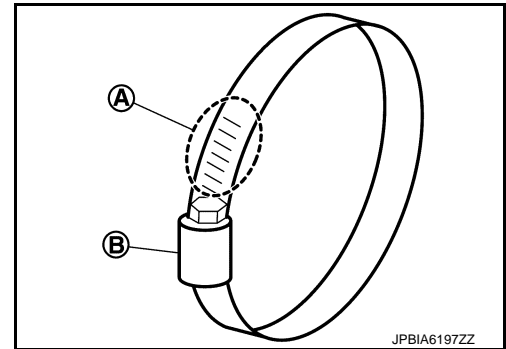
Note the following, and install in the reverse order of removal.

- When installing hoses, insert hose all the way to the end.
- When installing clamps, check that the screw Ⓑ and band Ⓐ of clamp have no damage and permanent strain. Replace with a new one if the clamp has damage of permanent strain.
- Apply soapy water to the insert position of the air inlet hose.

### CAUTION:

**Never use engine oil.**

- Align marks. Attach each joint.
- After installing the each parts temporarily, tighten each clamps to the specified torque.
- After tightening the clamps, check the installation of each air inlet hose certainly.
- Do not retighten clamp.



### CAUTION:

**If it is necessary to retighten a clamp, loosen it and visually check that there is no damage. After this, tighten the clamp to the specified torque.**

### CAUTION:

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

## Inspection

INFOID:000000012947361

## 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 is 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:

## CHARGE AIR COOLER

< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

- Use compressed air lower than 490 kPa (4.9 bar, 5 kg/cm<sup>2</sup>, 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.

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# VACUUM PUMP

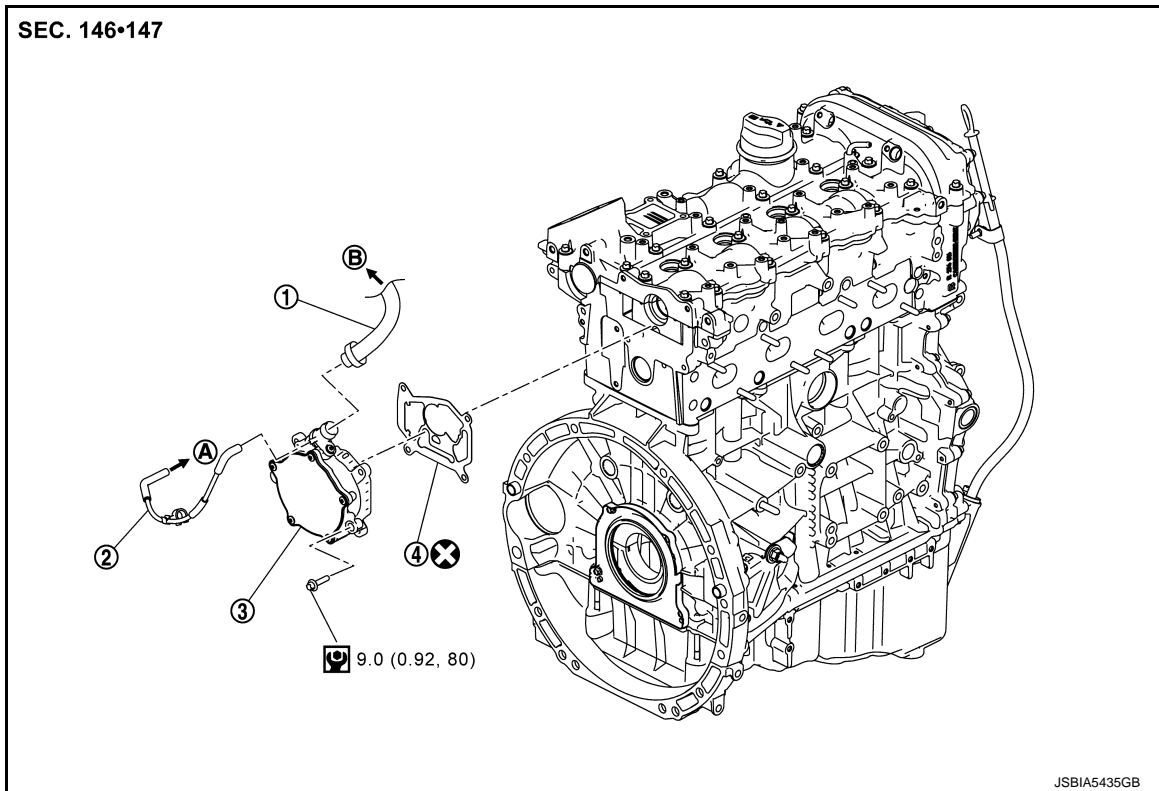
< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

## VACUUM PUMP

### Exploded View

INFOID:000000012947362



- ① Vacuum hose
- ② Vacuum hose
- ③ Vacuum pump
- ④ Gasket
- Ⓐ To charge air manifold
- Ⓑ To booster
- ⊗ : Always replace after every disassembly.
- Ⓜ : N·m (kg·m, in·lb)

## Removal and Installation

INFOID:000000012947363

### REMOVAL

1. Disconnect the battery cable from the negative terminal. Refer to [PG-264, "2.0L TURBO GASOLINE ENGINE : Removal and Installation"](#).
2. Drain engine coolant from radiator. Refer to [CO-7, "Draining"](#).
3. Remove engine cover. Refer to [EM-22, "Removal and Installation"](#).
4. Remove ECM. Refer to [EC4-967, "Removal and Installation"](#).
5. Remove the air duct (turbocharger side).



# VACUUM PUMP

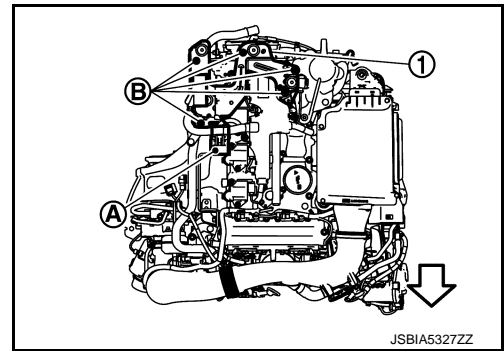
## < REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

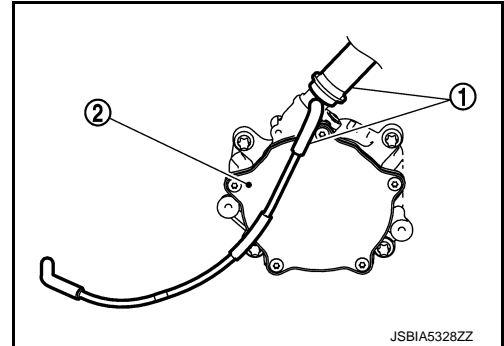
6. Remove the engine harness connector (A) from the ECM bracket 2 (1).

← : Engine front

7. Remove the ECM bracket 2 mounting bolts (B) to remove ECM bracket 2.

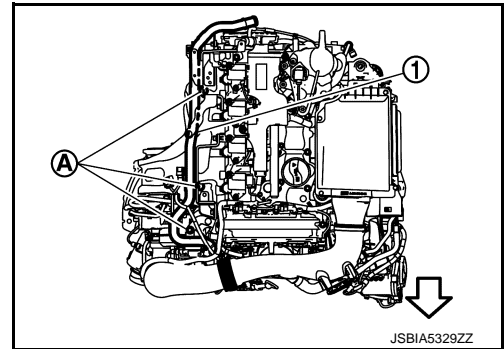


8. Separate the vacuum hose (1) from vacuum pump (2).



9. Remove the heater piping mounting bolts (A) to remove the heater piping (1).

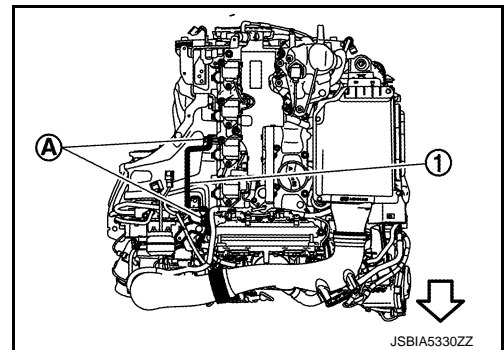
← : Engine front



10. Remove the engine harness from the harness bracket (1).

← : Engine front

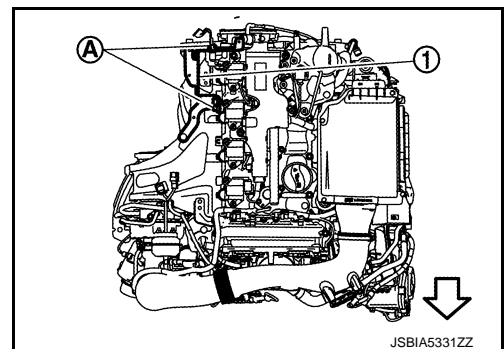
11. Remove the harness bracket mounting bolts (A) to remove harness bracket.



12. Remove the engine harness from the engine lifting eye (1).

← : Engine front

13. Remove the engine lifting eye mounting bolts (A) to remove the engine lifting eye .



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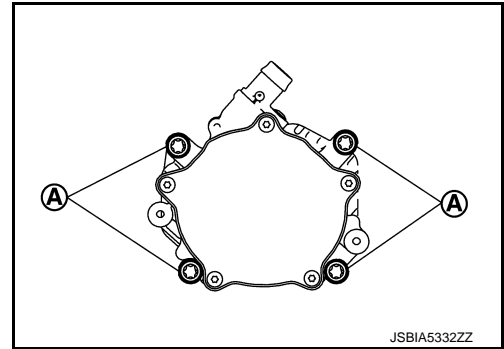
P

## VACUUM PUMP

< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

14. Remove the vacuum pump mounting bolts (A).



15. Remove vacuum pump.

**CAUTION:**

**Never disassemble vacuume pump.**

### 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 a sensors is replaced, carry out the reset of adaption of sensors. Refer to [EC4-216, "Description"](#).

# CATALYTIC CONVERTER

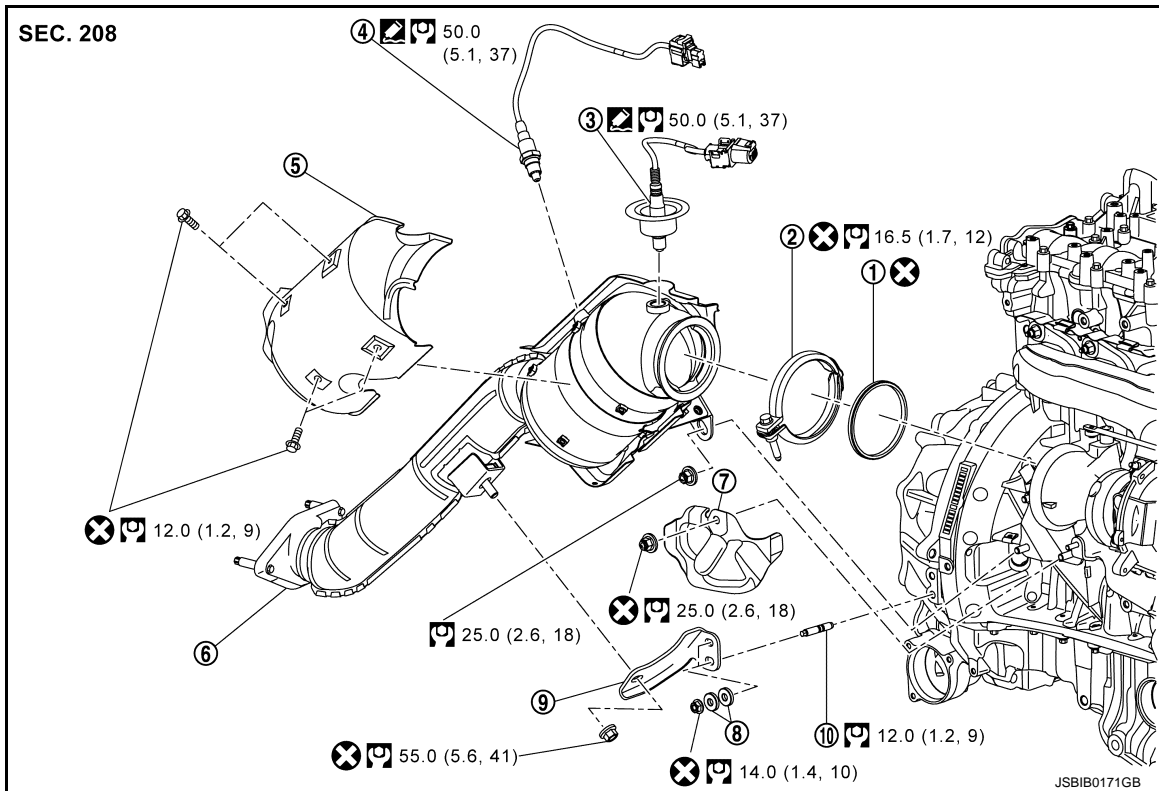
< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

## CATALYTIC CONVERTER

Exploded View

INFOID:000000012947364



- |                                    |                                      |                                       |
|------------------------------------|--------------------------------------|---------------------------------------|
| ① Gasket                           | ② Clamp                              | ③ A/F sensor                          |
| ④ Heated oxygen sensor             | ⑤ Catalytic converter shroud (upper) | ⑥ Catalytic converter                 |
| ⑦ Crankshaft position sensor cover | ⑧ Washer                             | ⑨ Catalytic converter support bracket |
| ⑩ Stud bolt                        |                                      |                                       |
- ⊗ : Always replace after every disassembly.  
 ◻ : N-m (kg-m, ft-lb)  
 ◻ : Sealing point

### Removal and Installation

INFOID:000000012947365

#### REMOVAL

1. Disconnect the battery cable from the negative terminal. Refer to [PG-264, "2.0L TURBO GASOLINE ENGINE : Removal and Installation"](#).
2. Remove engine cover. Refer to [EM-22, "Removal and Installation"](#).

# CATALYTIC CONVERTER

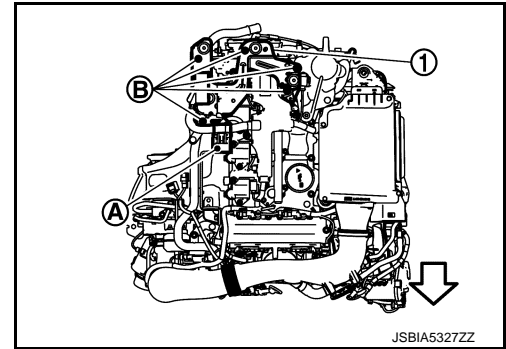
## < REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

3. Remove the engine harness connector (A) from the ECM bracket 2 (1).

(B) : ECM bracket 2

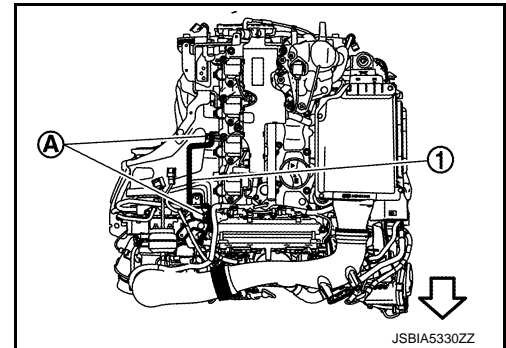
⇐ : Engine front



4. Remove the engine harness from the harness bracket (1).

⇐ : Engine front

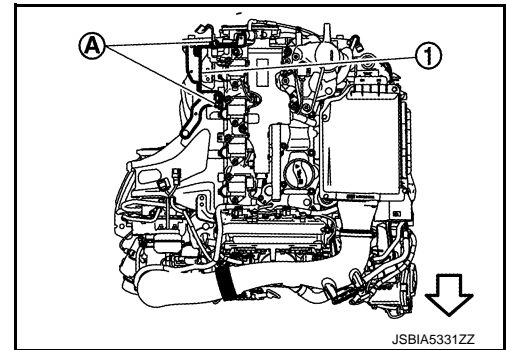
5. Remove the harness bracket mounting bolts (A) to remove harness bracket.



6. Remove the engine harness from the engine lifting eye (1).

⇐ : Engine front

7. Remove the engine lifting eye mounting bolts (A) to remove engine lifting eye .



8. Remove exhaust manifold heat insulator. Refer to [EM-42, "Removal and Installation"](#).

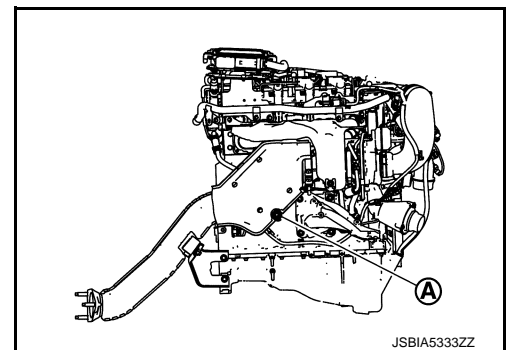
9. Remove the heat insulator of the exhaust system.

10. Remove the heat insulator of the catalytic converter.

11. Remove the mounting clamp (turbocharger side) of the catalytic converter.

12. Remove the exhaust front tube. Refer to [EX-12, "Removal and Installation"](#).

13. Remove the mounting nut (A) of the catalytic converter support bracket (upper).

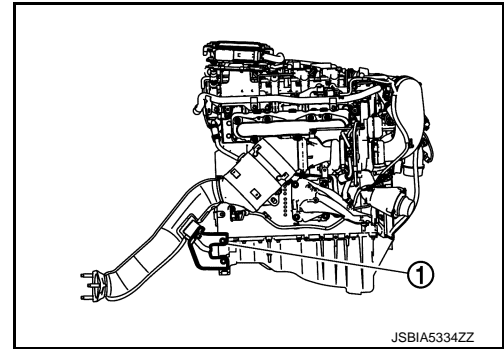


# CATALYTIC CONVERTER

< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

14. Remove the catalytic converter support bracket (lower) ①.



15. Remove the catalytic converter and the gasket to the vehicle upper.

**CAUTION:**

**Never impact the catalytic converter.**

16. Remove the A/F sensor and the heated oxygen sensor if necessary.

- Using heated oxygen sensor wrench (SST: KV10113700 or KV10117100), install the A/F sensor and the heated oxygen sensor.

**CAUTION:**

- **Discard any sensor which has been dropped from a height of more than 0.5 m (19.7 in) onto a hard surface such as a concrete floor; use a new one.**
- **Before installing new sensors, clean the exhaust threads.**

## INSTALLATION

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

**NOTE:**

- If a sensors is replaced, carry out the reset of adaption of sensors. Refer to [EC4-216. "Description"](#).
- If an crankshaft position sensor is replaced, carry out the synchronization adjustment of adaption of crankshaft position sensors. Refer to [EC4-211. "Description"](#).

1. Install the A/F sensor and the heated oxygen sensor

**CAUTION:**

- **Before installing new sensors, clean the exhaust threads.**
- **Apply paste, hot lubrication 1 kg, DB supply specification 6879.20 [A 000 989 76 51] to senser threads.**
- **Discard any sensor which has been dropped from a height of more than 0.5 m (19.7 in) onto a hard surface such as a concrete floor; use a new one.**

A

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# EXHAUST MANIFOLD AND TURBOCHARGER ASSEMBLY

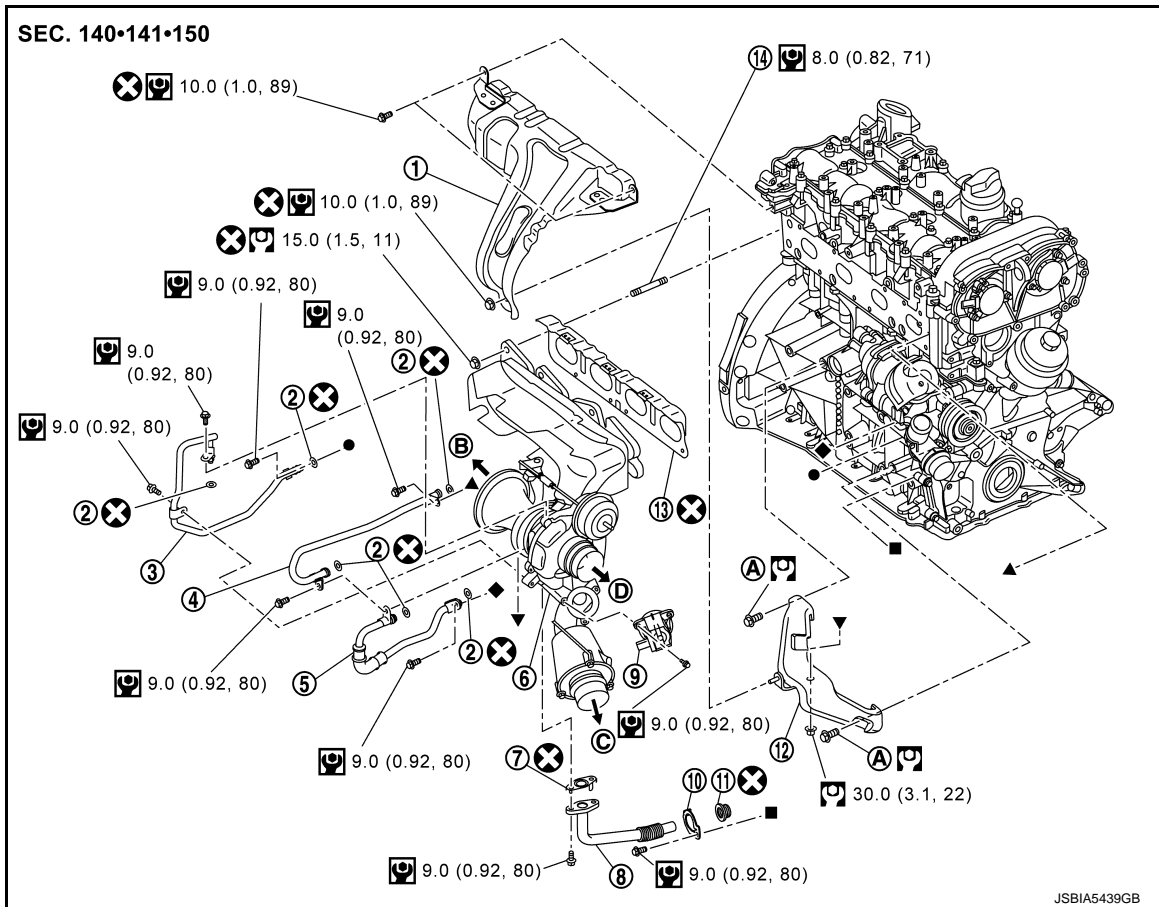
< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

## EXHAUST MANIFOLD AND TURBOCHARGER ASSEMBLY

Exploded View

INFOID:000000012947366



- |  |                          |  |
|--|--------------------------|--|
| ① Exhaust manifold heat insulator  | ② O-ring                 | ③ Oil feed pipe 1                                    |
| ④ Coolant pipe 1   | ⑤ Coolant pipe 2         | ⑥ Exhaust manifold and turbocharger assembly         |
| ⑦ Gasket   | ⑧ Oil feed pipe 2        | ⑨ Divert air switchover valve                        |
| ⑩ Lower seal holder  | ⑪ Lower seal             | ⑫ Exhaust manifold and turbocharger assembly bracket |
| ⑬ Gasket   | ⑭ Stud bolt              |  |
| Ⓐ Comply with the assembly procedure when tightening. Refer to <a href="#">EM-42</a> . | Ⓑ To catalytic converter | Ⓒ To charge air cooler                               |
| Ⓓ To air cleaner   |                          |  |

⊗ : 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

INFOID:000000012947367

### REMOVAL

2WD

1. Remove the catalytic converter. Refer to [EM-39. "Removal and Installation"](#).

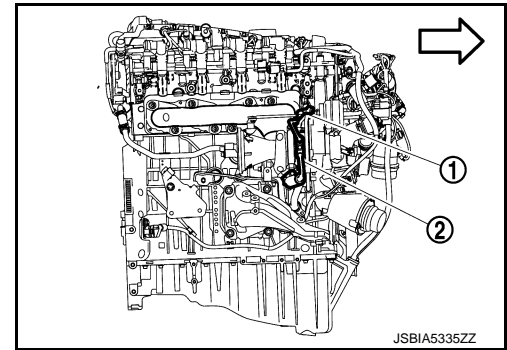
# EXHAUST MANIFOLD AND TURBOCHARGER ASSEMBLY

## < REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

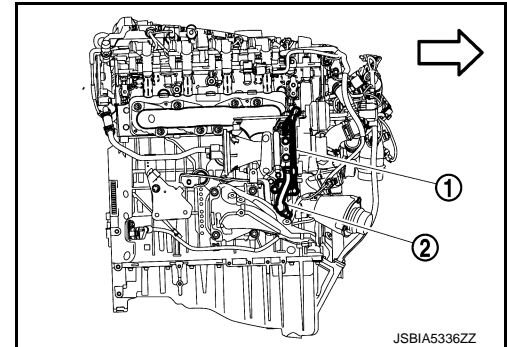
2. Remove the charge air hose 1. Refer to [EM-33. "Removal and Installation"](#).
3. Remove the coolant piping 1 ① and the coolant piping 2 ②.

← : Engine front



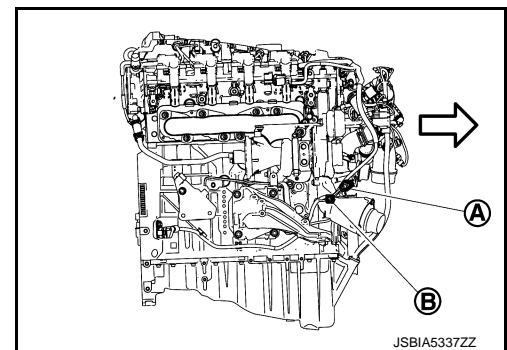
4. Remove the oil feed piping 1 ① and the oil feed piping 2 ②.

← : Engine front



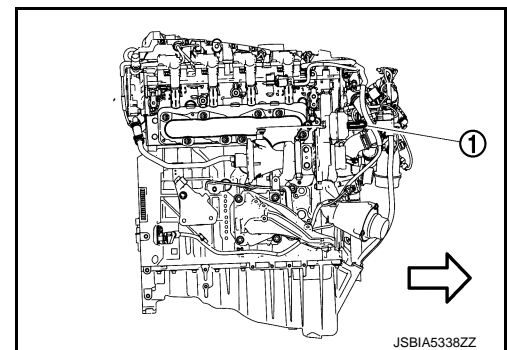
5. Remove the divert air switchover valve harness connector (A) and the divert air switchover valve harness clip (B).

← : Engine front



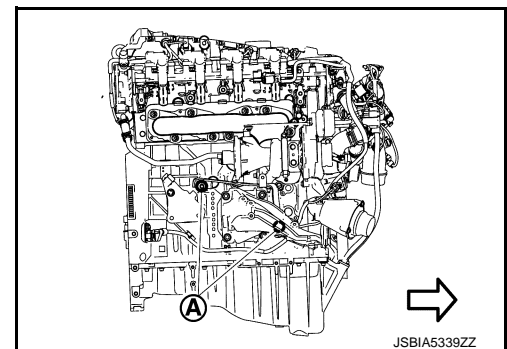
6. Separate the vacuum hose ① from the turbocharger.

← : Engine front



7. Remove the turbocharger bracket mounting bolt (A).

← : Engine front



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# EXHAUST MANIFOLD AND TURBOCHARGER ASSEMBLY

< REMOVAL AND INSTALLATION >

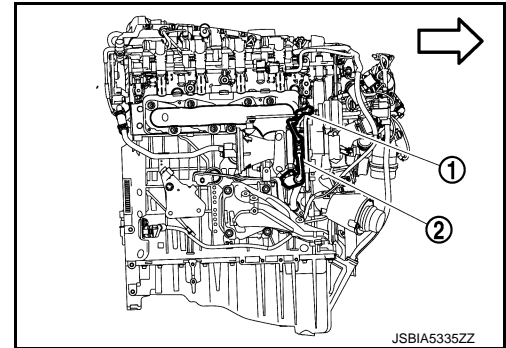
[2.0L TURBO GASOLINE ENGINE]

8. Remove the exhaust manifold mounting nut.
9. Remove the exhaust manifold and the turbocharger assembly to the vehicle upper.
10. Remove the turbocharger bracket from the exhaust manifold and the turbocharger assembly.

4WD

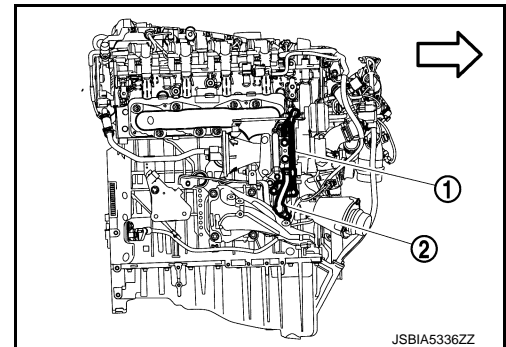
1. Remove engine assembly. Refer to [EM-102, "Removal and Installation"](#).
2. Remove the catalytic converter. Refer to [EM-39, "Removal and Installation"](#).
3. Remove the coolant piping 1 ① and the coolant piping 2 ②.

⇐ : Engine front



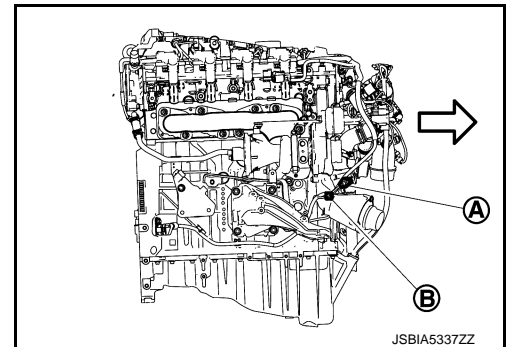
4. Remove the oil feed piping 1 ① and the oil feed piping 2 ②.

⇐ : Engine front



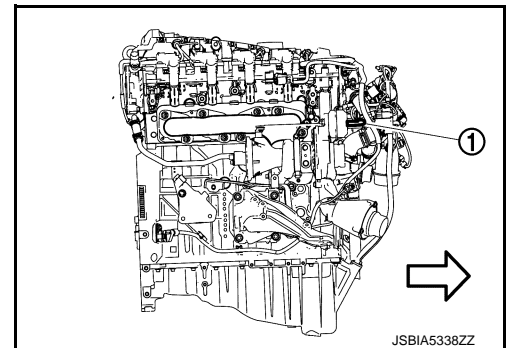
5. Remove the divert air switchover valve harness connector (A) and the divert air switchover valve harness clip (B).

⇐ : Engine front



6. Separate the vacuum hose ① from the turbocharger.

⇐ : Engine front





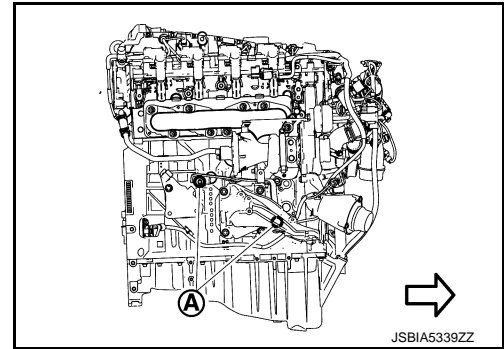
# EXHAUST MANIFOLD AND TURBOCHARGER ASSEMBLY

< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

7. Remove the turbocharger bracket mounting bolt (A).

↩ : Engine front



8. Remove the exhaust manifold mounting nut.  
9. Remove the exhaust manifold and the turbocharger assembly to the vehicle upper.  
10. Remove the turbocharger bracket from the exhaust manifold and the turbocharger assembly.

## INSTALLATION

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


### NOTE:

If a sensors is replaced, carry out the reset of adaption of sensors. Refer to [EC4-216. "Description"](#).

### CAUTION:

- After installing the turbocharger bracket to the exhaust manifold and the turbocharger assembly, install them to the engine.
- Check that the lower seal and the lower seal holder of the oil feed piping are installed properly.

1. Install the turbocharger bracket with the following procedure.  
a. Tighten the mounting bolts.

 : 15.0 N·m ( 1.5 kg-m, 11 ft-lb)

- b. Turn the mounting bolts clockwise.

Angle tightening : 90°

## Inspection

INFOID:000000012947368

## INSPECTION AFTER INSTALLATION

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

# HIGH PRESSURE FUEL PUMP AND FUEL HOSE

< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

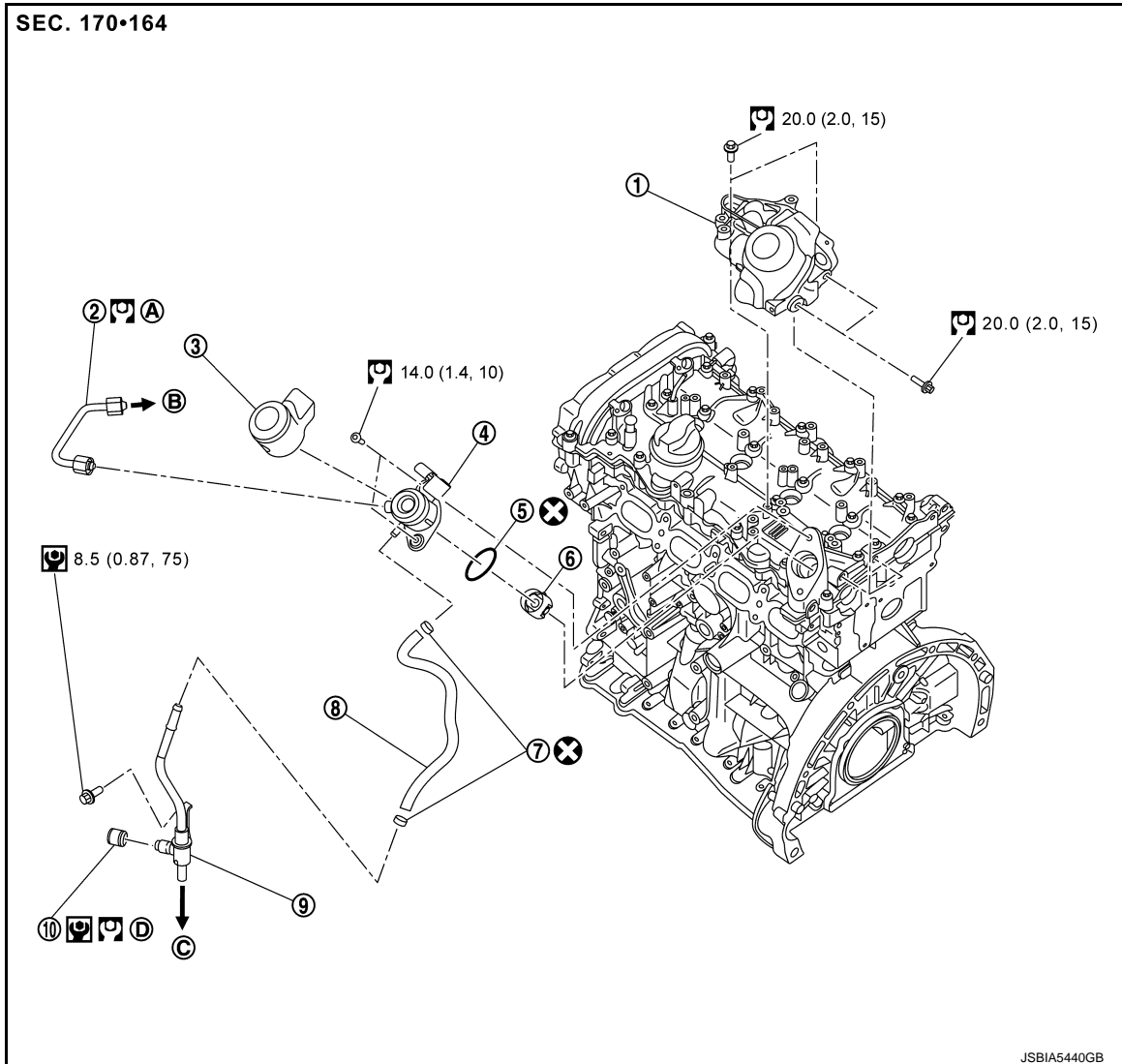
## HIGH PRESSURE FUEL PUMP AND FUEL HOSE

Exploded View

INFOID:000000012947369

**CAUTION:**

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



- |                           |                           |                                     |
|---------------------------|---------------------------|-------------------------------------|
| ① Shield                  | ② High pressure fuel line | ③ High pressure fuel pump insulator |
| ④ High pressure fuel pump | ⑤ O-ring                  | ⑥ Plunger element                   |
| ⑦ Clamp                   | ⑧ Low pressure fuel line  | ⑨ Service valve                     |
| ⑩ Protection cap          |                           |                                     |

Comply with the assembly procedure when tightening. Refer to [EM-47](#).  
 (A) To fuel rail  
 (B) To centralized under-floor piping  
 (C) To centralized under-floor piping

- (D) Plastic cap : 2.0(0.2, 18)  
 Metal cap : 15.0(1.5, 11)

: N-m (kg-m, ft-lb)

: N-m (kg-m, in-lb)

: Always replace after every disassembly.

# HIGH PRESSURE FUEL PUMP AND FUEL HOSE

< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

## Removal and Installation

INFOID:000000012947370

### REMOVAL

#### WARNING:

- Be sure to read [EM-6. "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 CO2 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 Wurth GmbH & Co.KG), or equivalent].

1. Check DTC using CONSULT.

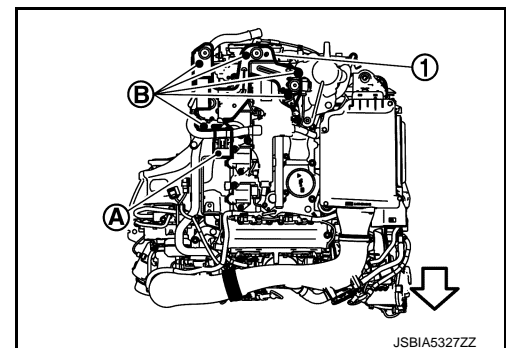
#### NOTE:

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

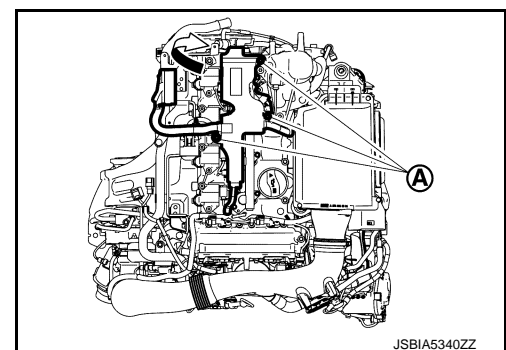
2. Release fuel pressure as follows:
  - a. Remove fuel pump fuse located.
  - b. Start the engine.
  - c. After engine stalls, crank it two or three times to release all fuel pressure.
  - d. Turn ignition switch OFF.
3. Remove the engine cover. Refer to [EM-22. "Removal and Installation"](#).
4. Remove ECM. Refer to [EC4-967. "Removal and Installation"](#).
5. Remove the engine harness connector (A) from the ECM bracket 2 (1).

↶ : Engine front

6. Remove the ECM bracket 2 mounting bolts (B) to remove the ECM bracket 2.



7. Remove the engine harness mounting bolt (A) to move the engine harness to the arrow direction (➡).



8. Rotate the crankshaft pulley and align the mark (KW 79°) with the timing indicator in front cover.
9. Remove the high pressure fuel pump connector.
10. Remove the shield.
11. Remove the high pressure fuel line and the low pressure fuel line from the high pressure fuel pump.

#### CAUTION:

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

12. Remove the high pressure fuel pump insulator.

# HIGH PRESSURE FUEL PUMP AND FUEL HOSE

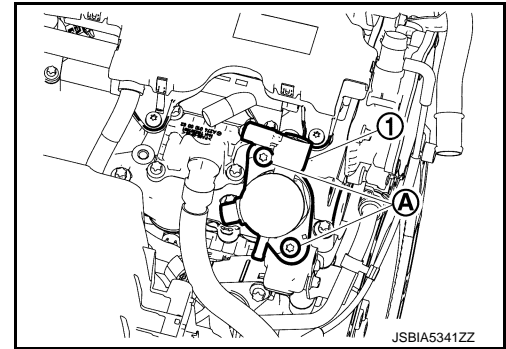
[2.0L TURBO GASOLINE ENGINE]

## < REMOVAL AND INSTALLATION >

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

**CAUTION:**

To prevent damage to high pressure fuel pump and camshaft bracket, loosen bolt ① 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 a sensors is replaced, carry out the reset of adaption of sensors. Refer to [EC4-216, "Description"](#).
- If a high pressure fuel pump is replaced, carry out the counter clear of high pressure fuel pump. Refer to [EC4-219, "Description"](#).

**CAUTION:**

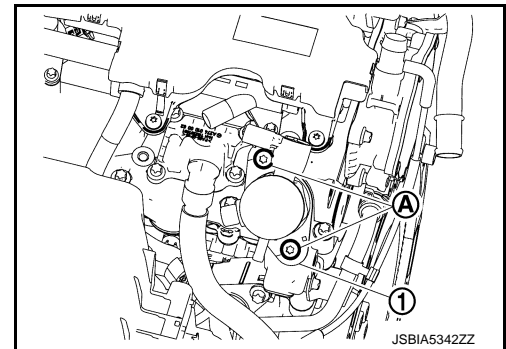
To prevent damage to parts due to generated abnormal stress and eccentric load, always observe the installation procedure.

1. Install high pressure fuel pump according to the following procedure.
  - a. Rotate the crankshaft pulley and align the mark (KW 79°) with the timing indicator in front cover.
  - b. Install the plunger element.

**CAUTION:**

- Check the appearance of the drive roller part. If the 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.

- c. Install high pressure fuel pump with the following procedure.
  - i. Temporarily tighten the bolt ① 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.
  - ii. Tighten the bolt ① to the specified torque.



2. Install the 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 Wurth GmbH & Co.KG), or equivalent].

# HIGH PRESSURE FUEL PUMP AND FUEL HOSE

[2.0L TURBO GASOLINE ENGINE]

## < REMOVAL AND INSTALLATION >

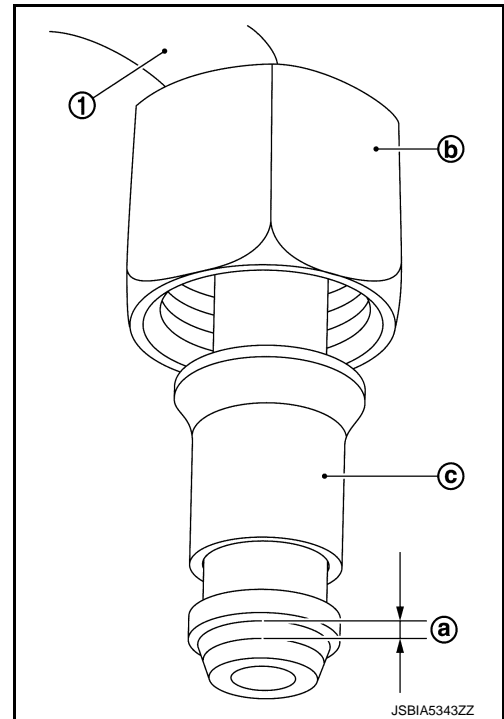
- a. Check that the dimension of the terminal tip part ① of the high pressure fuel line ① is more than the limit value.

- ② : Union nut  
③ : 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.



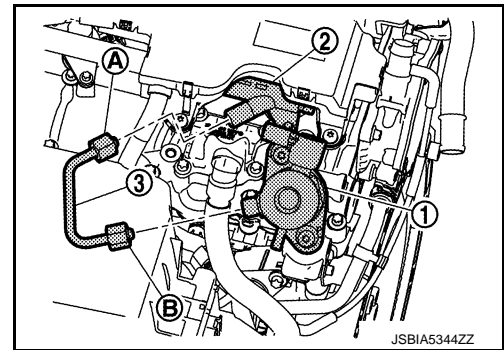
- b. Tighten the flare nut ① and ② of the high pressure fuel line ③ in the alphabetical order.

 : 15.0 N·m (1.5 kg·m, 11 ft·lb)

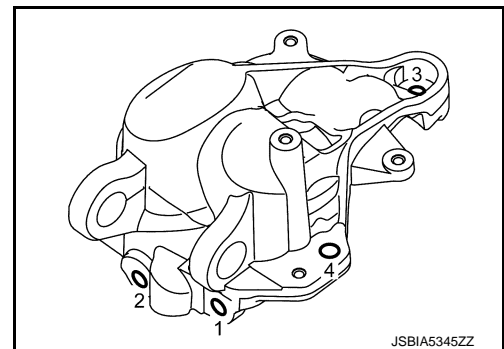
- ① : High pressure fuel pump  
② : Fuel rail

**CAUTION:**

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



- c. Turn the flare nut ① and ② 75 degrees clockwise in the alphabetical order. (angle tightening)  
d. Turn the flare nut ① and ② 25 degrees clockwise in the alphabetical order. (angle tightening)  
4. Install the high pressure fuel pump insulator.  
5. Tighten the shield mounting bolts in the order from 1 to 4 as shown in the figure.



6. Note the following and install in the reverse order of removal, for the rest of parts.

**CAUTION:**

- Install fuel pump 15A fuse before installing battery negative terminal.
- Check for fuel leakage before installing engine cover. Refer to [EM-50, "Inspection"](#).

7. Check DTC and erase DTC.

**NOTE:**

Erase DTC detected while releasing fuel pressure.

# HIGH PRESSURE FUEL PUMP AND FUEL HOSE

< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

---

## Inspection

INFOID:000000012947371

### 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

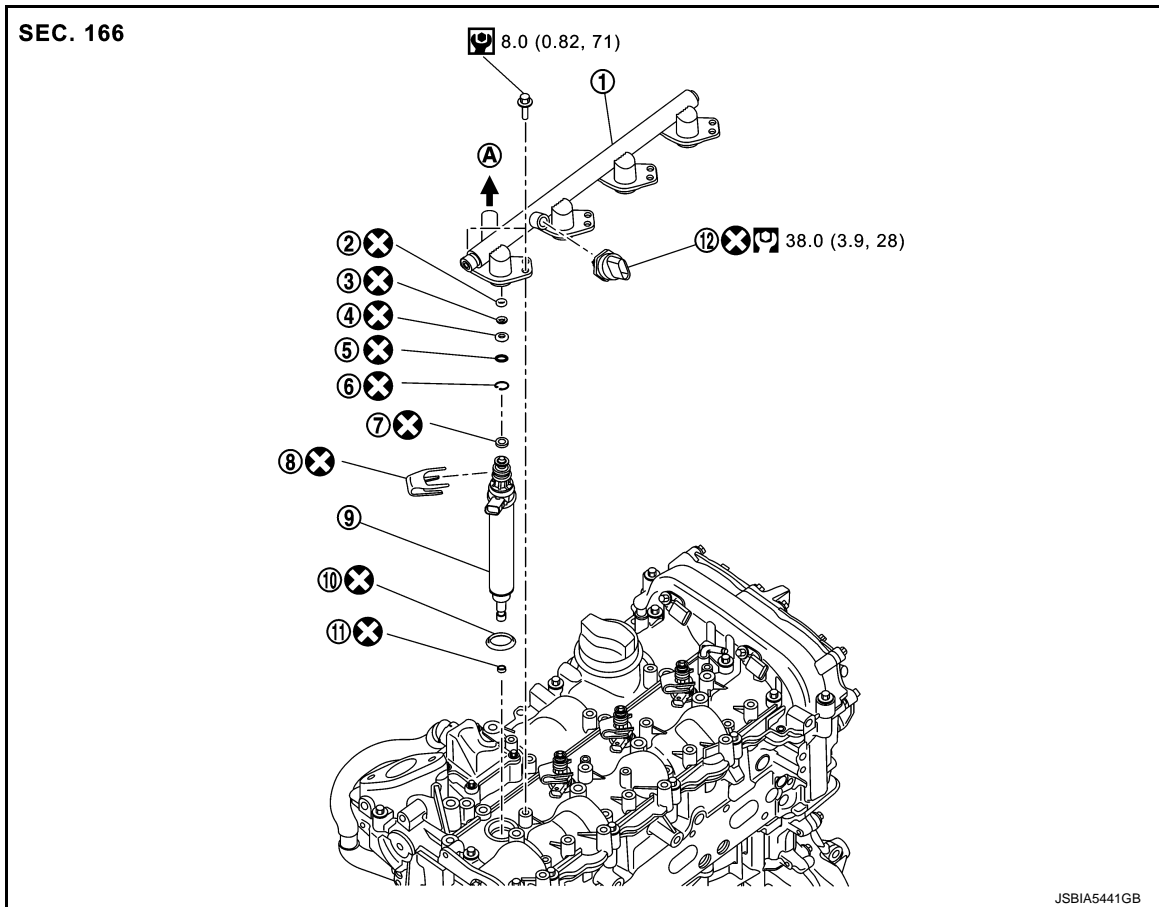
< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

## FUEL INJECTOR

Exploded View

INFOID:000000012947372



- |                               |                                |                        |
|-------------------------------|--------------------------------|------------------------|
| 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 |

(A) To high pressure fuel pump

: 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

INFOID:000000012947373

### WARNING:

- Be sure to read [EM-6. "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<sub>2</sub> 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

# FUEL INJECTOR

## < REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

1. Check DTC using CONSULT.

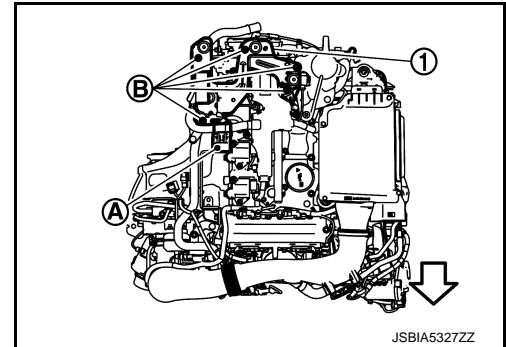
**NOTE:**

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 located.
  - 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 [PG-261. "2.0L TURBO GASOLINE ENGINE : Removal and Installation"](#).
4. Remove the engine cover. Refer to [EM-22. "Removal and Installation"](#).
5. Remove ECM. Refer to [EC4-967. "Removal and Installation"](#).
6. Remove the engine harness connector (A) from the ECM bracket 2 (1).

⇐ : Engine front

7. Remove the ECM bracket 2 mounting bolts (B) to remove the ECM bracket 2.

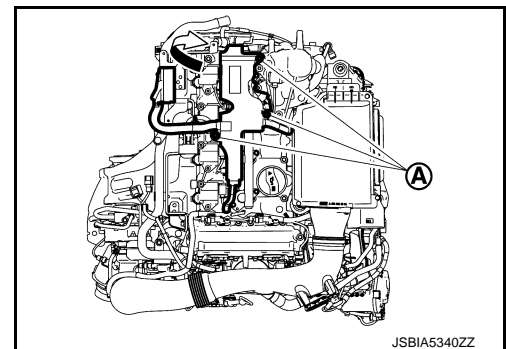


8. Remove the shield.
9. Remove the high pressure fuel line from the high pressure fuel pump. Refer to [EM-47. "Removal and Installation"](#).

**CAUTION:**

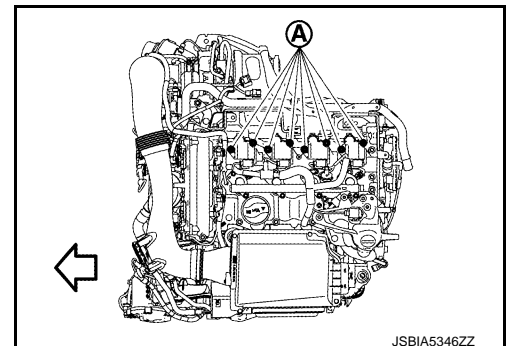
**Prepare a tray and waste beforehand as fuel leaks out.**

10. Disconnect the fuel pressure sensor harness connector.
11. Remove the engine harness mounting bolts (A) to move the engine harness to the arrow direction (➡).



12. Remove the ignition coil mounting bolts (A).

⇐ : Engine front





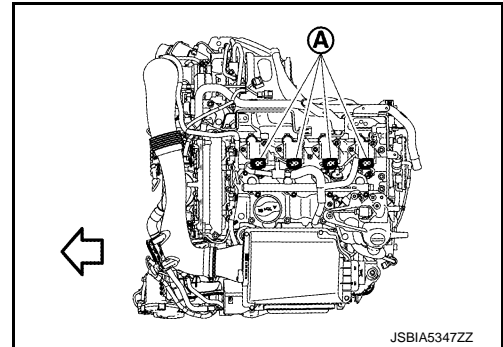
# FUEL INJECTOR

## < REMOVAL AND INSTALLATION >

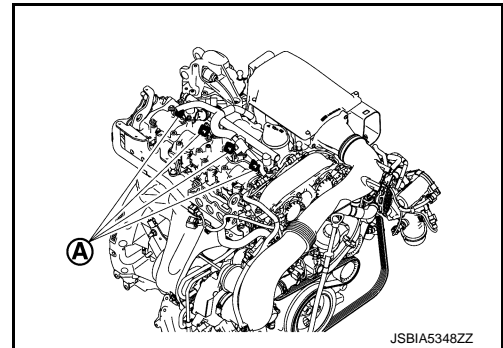
[2.0L TURBO GASOLINE ENGINE]

13. Pull up the ignition coil to disconnect the ignition coil connector ①.

← : Engine front



14. Disconnect the fuel injector harness connector ①.



15. Remove the fuel rail mounting bolt.  
16. Remove the fuel injector holder.  
17. Remove fuel rail.

**CAUTION:**

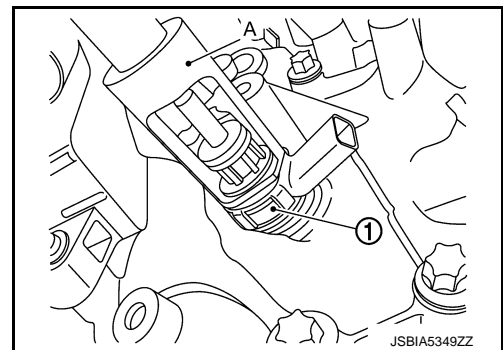
- When removing, be careful to avoid any interference with fuel injector.
- Use a shop cloth to absorb any fuel leakage from fuel rail.

18. 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.



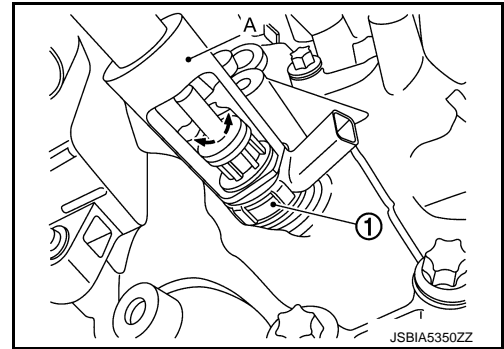
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## FUEL INJECTOR

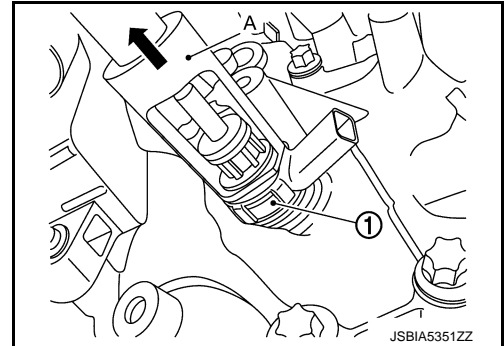
### < REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

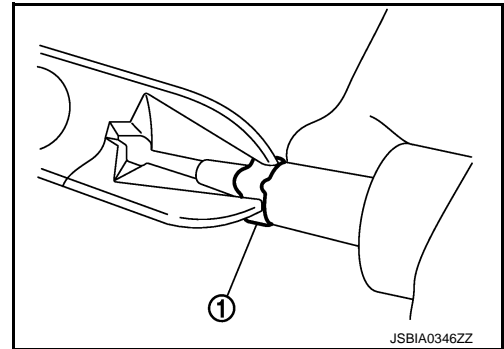
- b. Rotate the fuel injector ① to the right and left direction with the injector puller [SST: KV105H0170 (278 589 00 33 00)] (A).



- 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.



19. Remove the seal ring unit from the fuel rail with following procedure.

**CAUTION:**

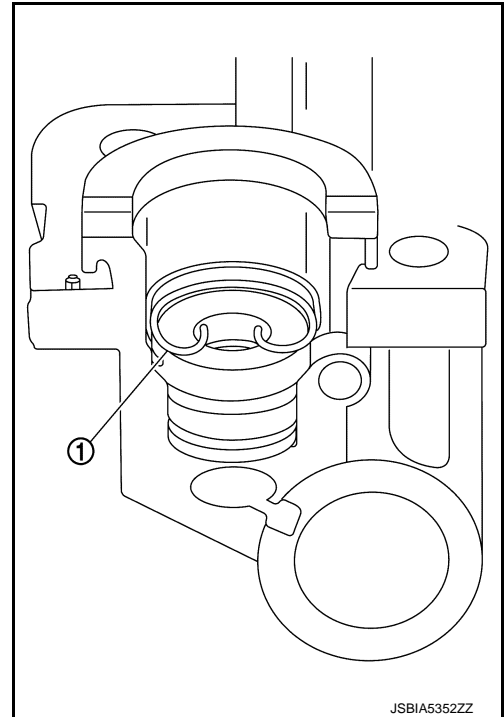
Always use the drift seal installation [SST: KV105H0160 (278 589 01 15 00)].

# FUEL INJECTOR

## < REMOVAL AND INSTALLATION >

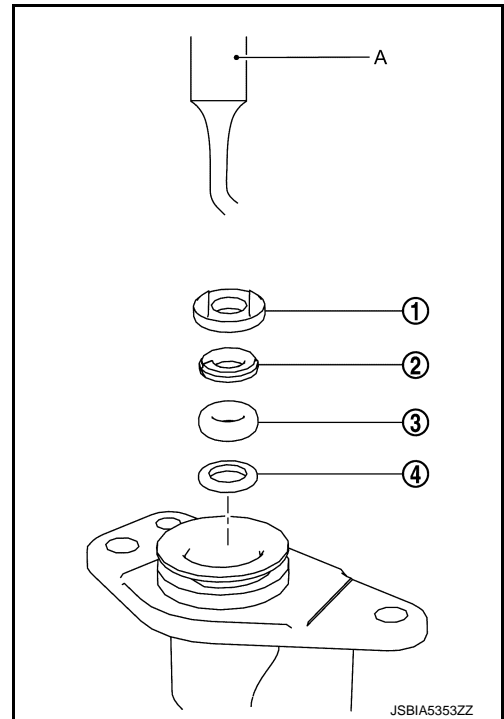
[2.0L TURBO GASOLINE ENGINE]

- 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)



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

## INSTALLATION

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

### NOTE:

- If a sensors is replaced, carry out the reset of adoption of sensors. Refer to [EC4-216. "Description"](#).
- If a fuel injector is replaced, carry out the injector injection quantity adjustment of adoption of fuel injector. Refer to [EC4-210. "Description"](#).

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.**

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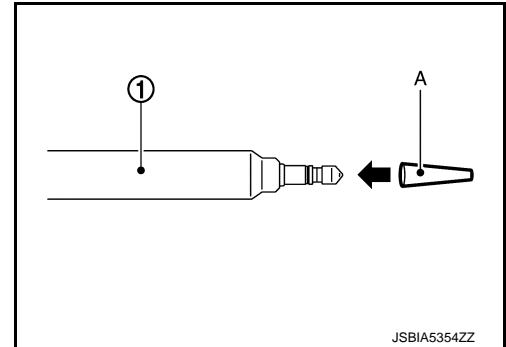
# FUEL INJECTOR

< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

- 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 Wurth GmbH & Co.KG), or equivalent].

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



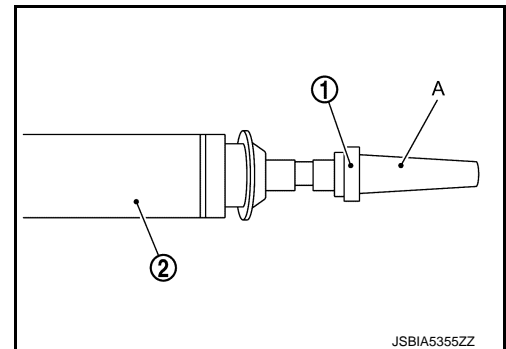
- b. Set the seal ring ① to an injector seal installation [SST: KV105H0110 (272 589 00 43 00)] (A).

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.**



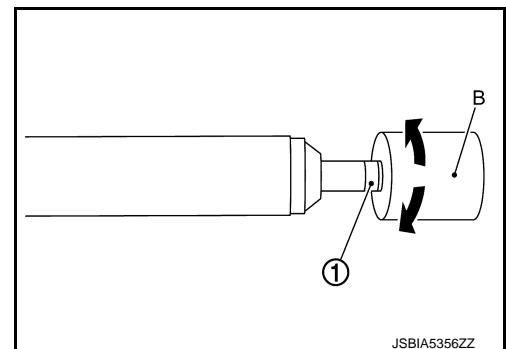
- d. After installing the seal ring to the fuel injector, insert the injector seal installation [SST: KV105H0110 (272 589 00 43 00)] (B) to the fuel injector and rotate clockwise and counterclockwise by 90° while pressing the seal ring to fit it.

**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.

# FUEL INJECTOR

[2.0L TURBO GASOLINE ENGINE]

## < REMOVAL AND INSTALLATION >

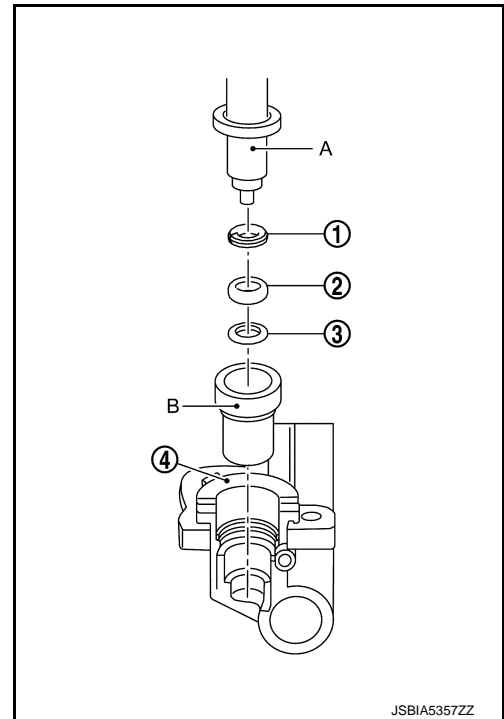
- a. Install the seal ring unit to the drift seal installation [SST: KV105H0160 (278 589 01 15 00)] (A) in the numerical order.

- ① : Plastic support ring (with slit)
- ② : Seal ring
- ③ : Plastic support ring (white)

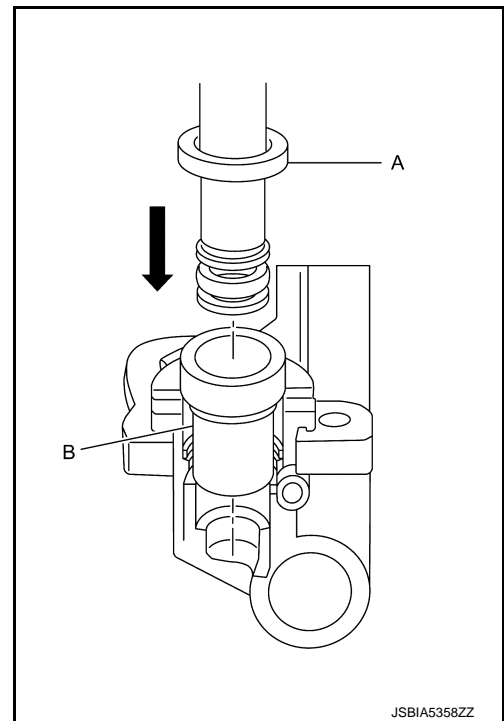
**CAUTION:**

- 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:**

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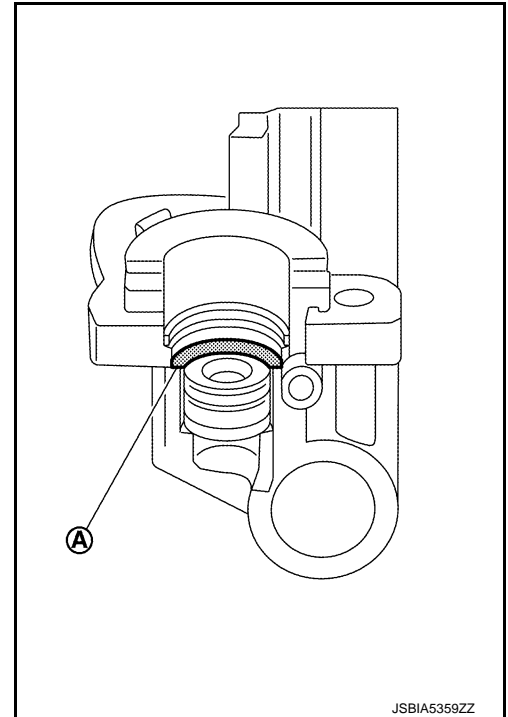
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# FUEL INJECTOR

## < REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

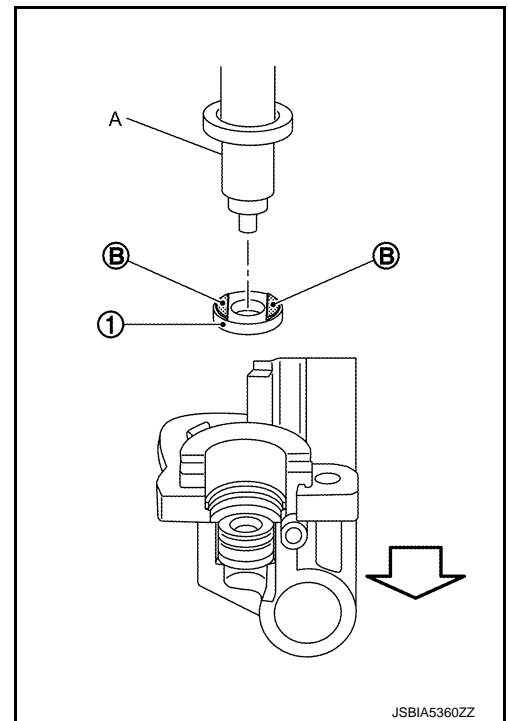
Check that the plastic support ring (with slit) is installed certainly at the inner side more than the end ① of the fuel retainer.



- e. Set the metal support disk ① onto the plastic support ring (with slit) with its ② 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).

② : Metal support disk projection part

⇐ : Engine front

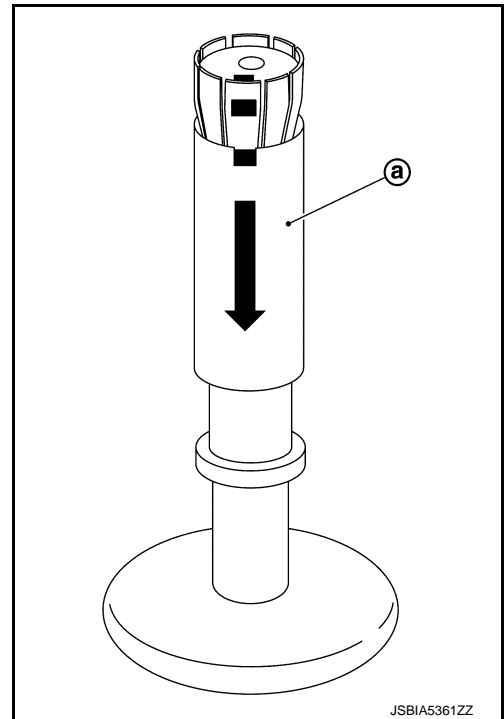


# FUEL INJECTOR

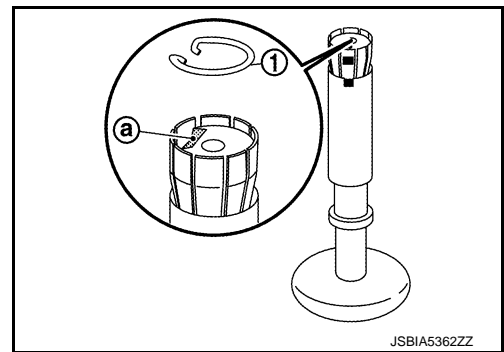
## < REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

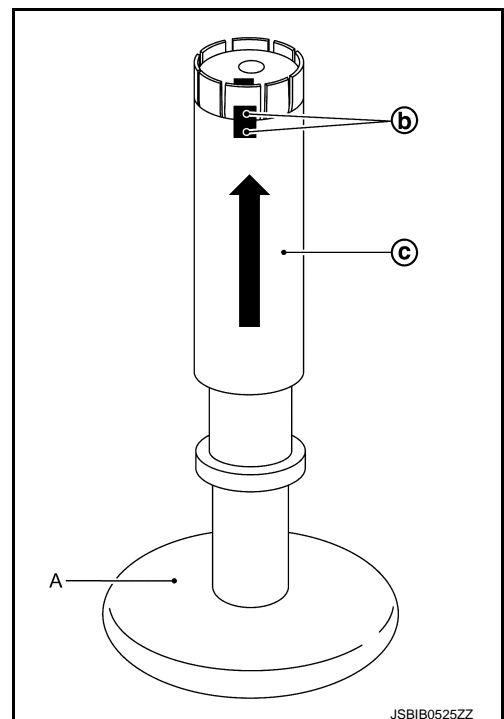
- f. Move the (a) part of the drift seal installation [SST: KV105H0160 (278 589 01 15 00)] to the arrow direction as shown in the figure.



- g. Align both end of the snap ring (1) with the groove (a) 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 (b) of the drift seal installation [SST: KV105H0160 (DAIMLER tool No.278 589 01 15 00)] (A), and then move the (c) part to the arrow direction to lock the drift seal installation [SST: KV105H0160 (DAIMLER tool No.278 589 01 15 00)].



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# FUEL INJECTOR

## < REMOVAL AND INSTALLATION >

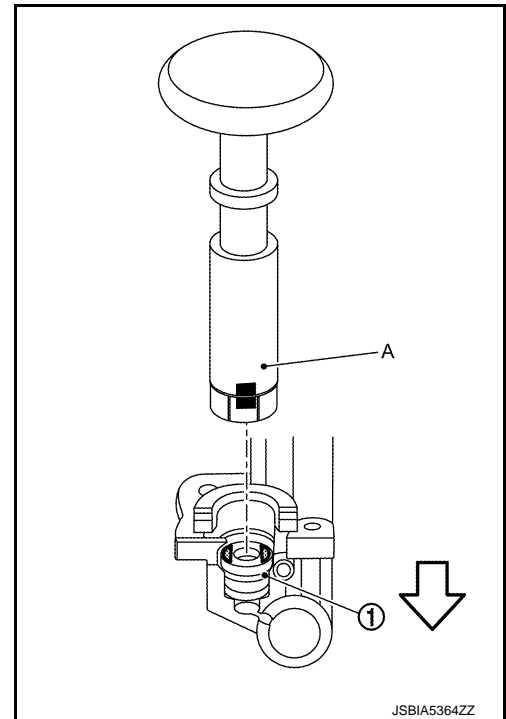
[2.0L TURBO GASOLINE ENGINE]

- 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.

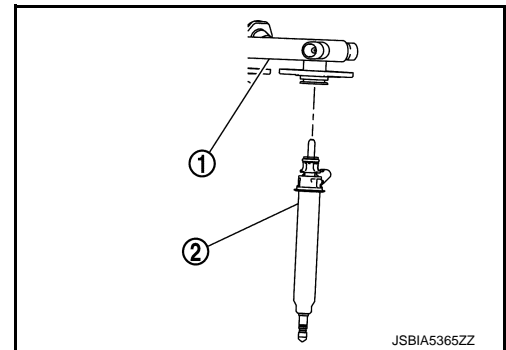


3. Install the fuel injector to the fuel rail with the following procedure.

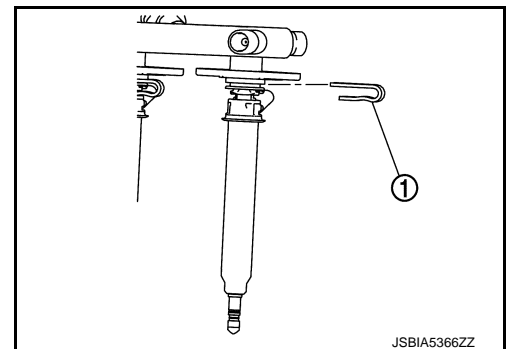
**CAUTION:**

- 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.



# FUEL INJECTOR

< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

5. Note the following and install in the reverse order of removal, for the rest of parts.

**CAUTION:**

- Install fuel pump 15A fuse before installing battery negative terminal.
- Check for fuel leakage before installing engine cover. Refer to [EM-61, "Inspection"](#).

6. Check DTC and erase DTC.

**NOTE:**

Erase DTC detected while releasing fuel pressure.

## Inspection

INFOID:000000012947374

### 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.

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# IGNITION COIL AND SPARK PLUG

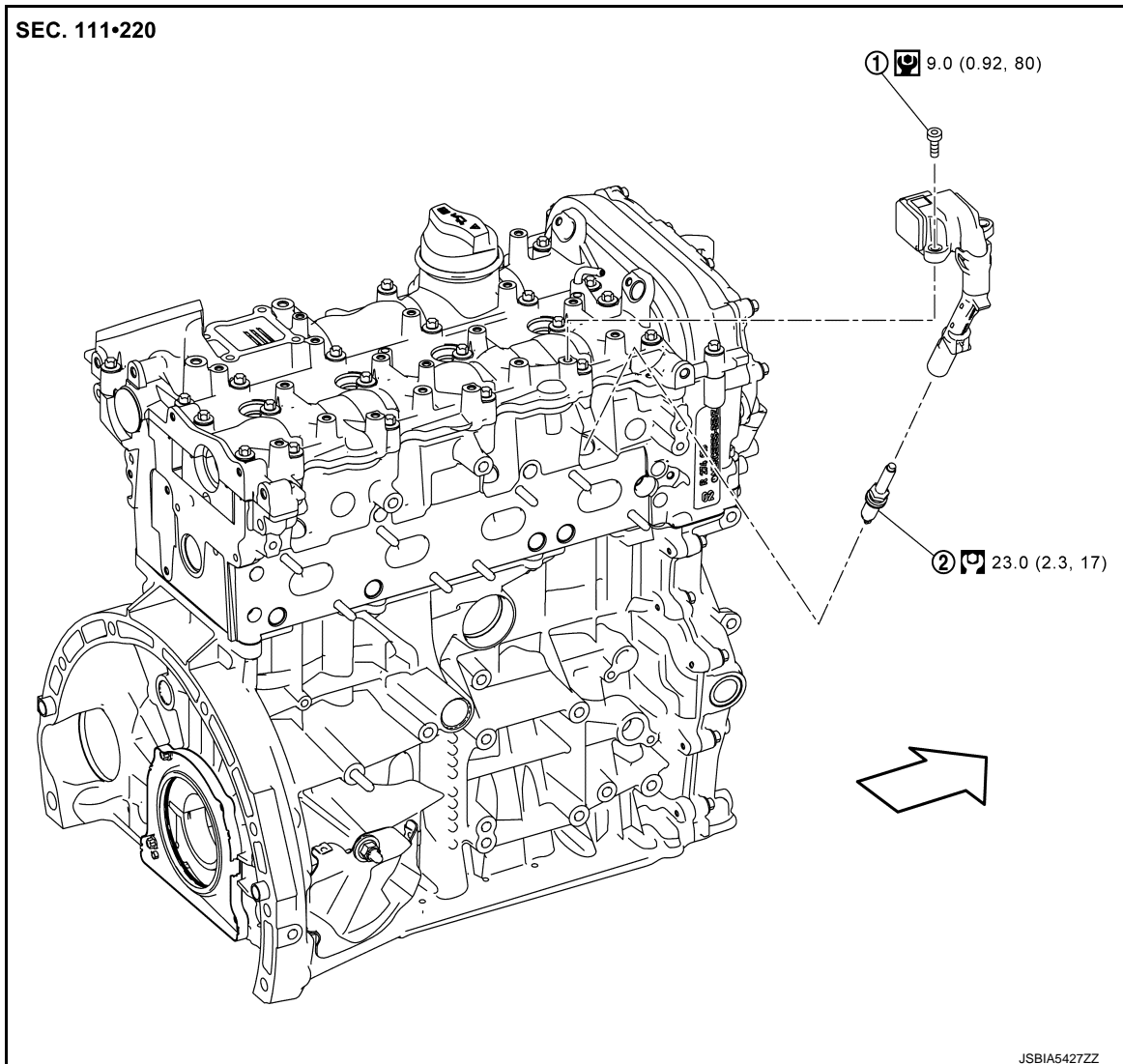
< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

## IGNITION COIL AND SPARK PLUG

Exploded View

INFOID:000000012947375



① Ignition coil

② Spark plug

: N·m (kg-m, ft-lb)

: N·m (kg-m, in-lb)

: Engine front

## Removal and Installation

INFOID:000000012947376

### REMOVAL

1. Remove the engine cover. Refer to [EM-22, "Removal and Installation"](#).
2. Remove ECM. Refer to [EC4-967, "Removal and Installation"](#).

# IGNITION COIL AND SPARK PLUG

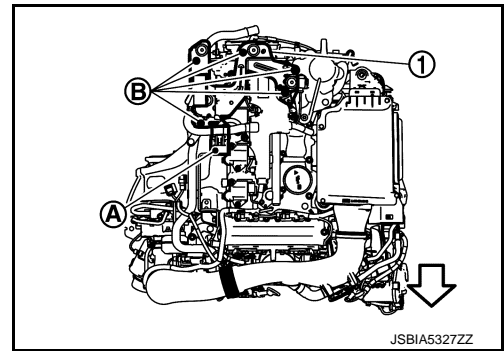
## < REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

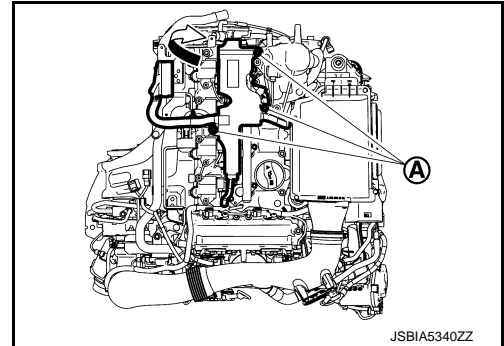
3. Remove the engine harness connector (A) from the ECM bracket 2 (1).

← : Engine front

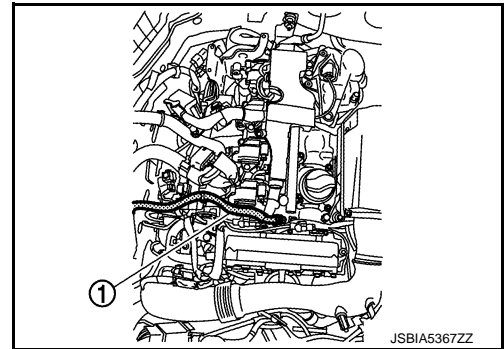
4. Remove the ECM bracket lower mounting bolts (B) to remove the ECM bracket lower.



5. Remove the engine harness mounting bolts (A) to move the engine harness to the arrow direction (→).

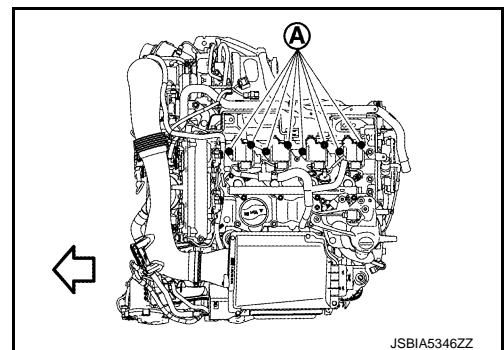


6. Separate the water line (1) from the engine.



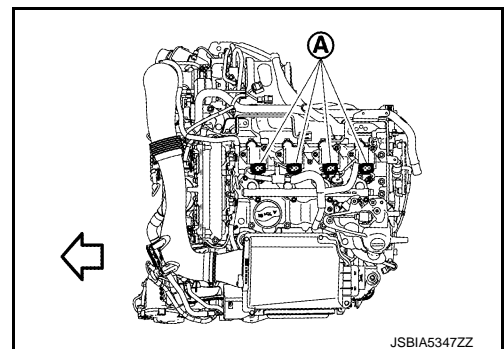
7. Remove the ignition coil mounting bolts (A).

← : Engine front



8. Pull up the ignition coil to disconnect the ignition coil connector (A).

← : Engine front



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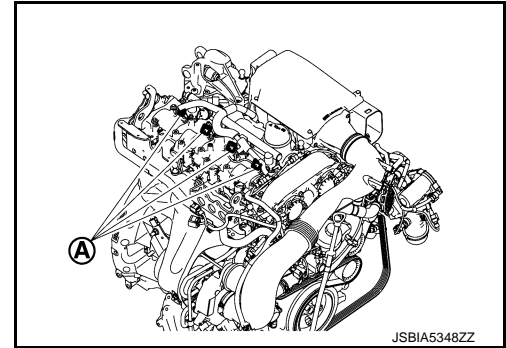
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## IGNITION COIL AND SPARK PLUG

< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

9. Remove the ignition coil.
10. Remove the spark plug.
11. Disconnect the fuel injector harness connector (A).



### INSTALLATION

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

**NOTE:**

If a sensors is replaced, carry out the reset of adaption of sensors. Refer to [EC4-216, "Description"](#).

# CYLINDER HEAD COVER

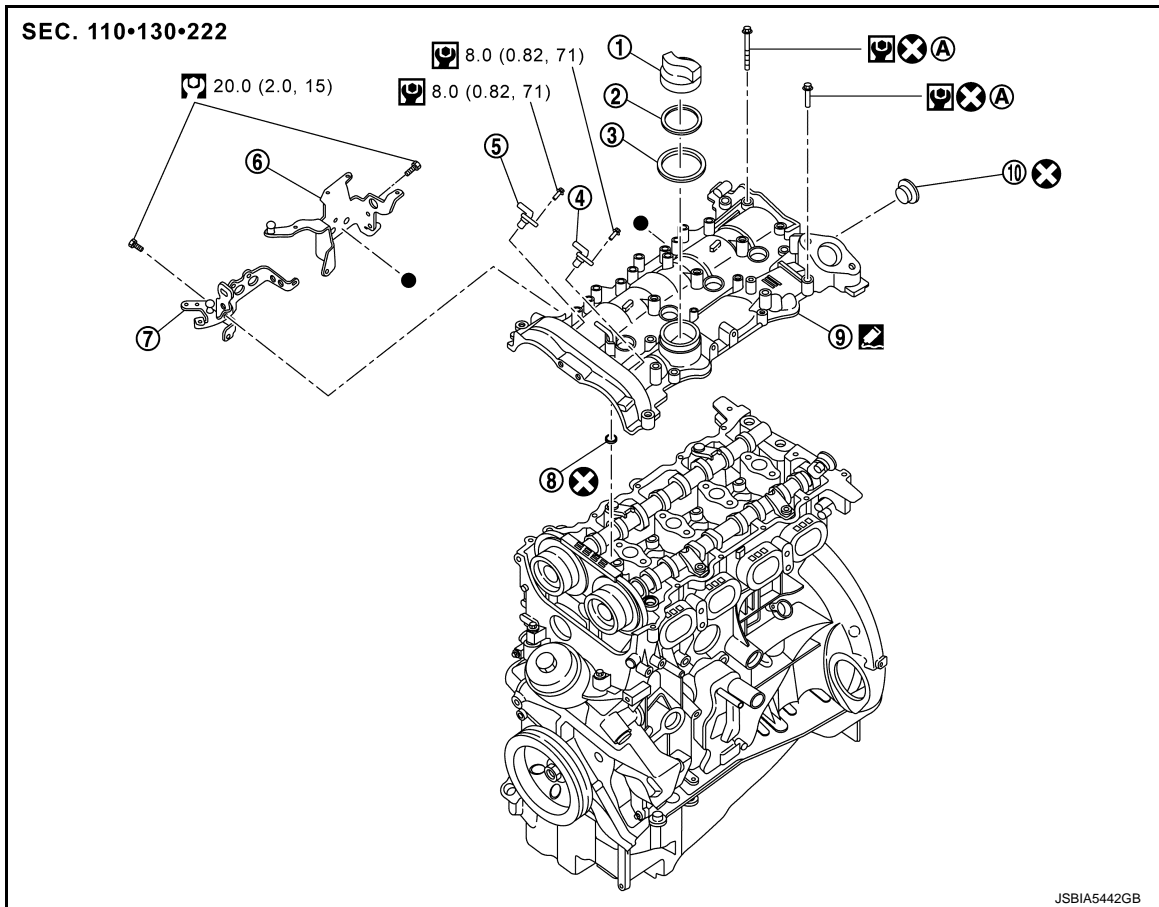
< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

## CYLINDER HEAD COVER

Exploded View

INFOID:000000012947377



- |   |                                 |   |                                  |   |                     |
|---|---------------------------------|---|----------------------------------|---|---------------------|
| ① | Filler cap                      | ② | Gasket                           | ③ | Gasket              |
| ④ | Intake camshaft position sensor | ⑤ | Exhaust camshaft position sensor | ⑥ | Engine lifting eye  |
| ⑦ | Harness bracket                 | ⑧ | O-ring                           | ⑨ | Cylinder head cover |
| ⑩ | Cap                             |   |                                  |   |                     |

(A) Comply with the assembly procedure when tightening. Refer to [EM-65](#).

: 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:000000012947378

### REMOVAL

1. Drain engine coolant from radiator. Refer to [CO-7, "Draining"](#).
2. Remove the engine cover. Refer to [EM-22, "Removal and Installation"](#).
3. Remove the air cleaner housing assembly and the air duct (turbocharger side). Refer to [EM-25, "Removal and Installation"](#).

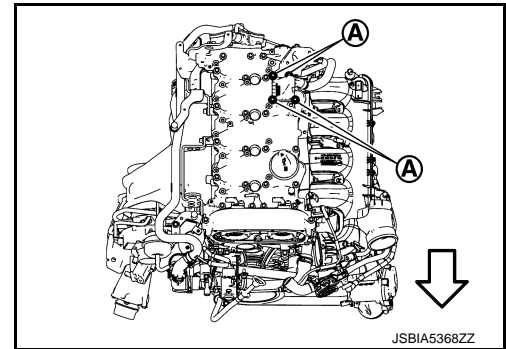
# CYLINDER HEAD COVER

[2.0L TURBO GASOLINE ENGINE]

## < REMOVAL AND INSTALLATION >

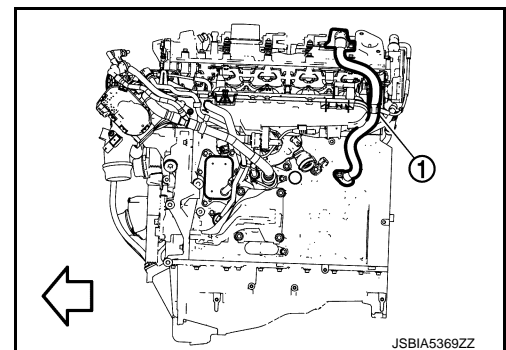
4. Remove the front cover. Refer to [EM-22, "Removal and Installation"](#).
5. Remove the ignition coil. Refer to [EM-62, "Removal and Installation"](#).
6. Remove the high pressure fuel pump. Refer to [EM-47, "Removal and Installation"](#).
7. Remove the fuel rail. Refer to [EM-51, "Removal and Installation"](#).
8. Remove the oil separator 1 mounting bolts (A). Refer to [EM-31, "Removal and Installation"](#).

← : Engine front

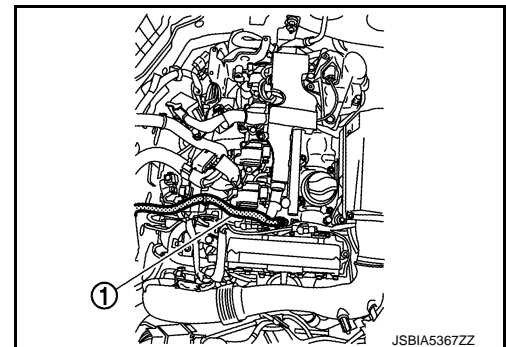


9. Remove the oil separator 1 (1) from the cylinder head cover. Refer to [EM-31, "Removal and Installation"](#).

← : Engine front

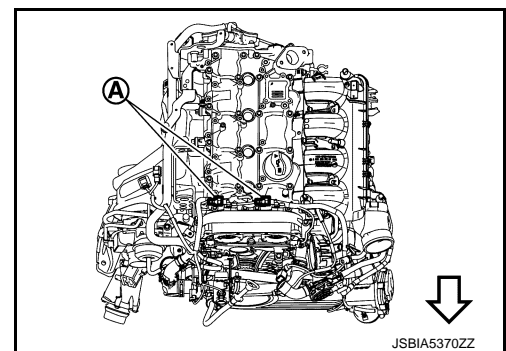


10. Remove the coolant vent hose (1) from cylinder head cover. Refer to [EM-65, "Exploded View"](#).



11. Disconnect the intake camshaft position sensor and the exhaust camshaft position sensor harness connectors (A).

← : Engine front

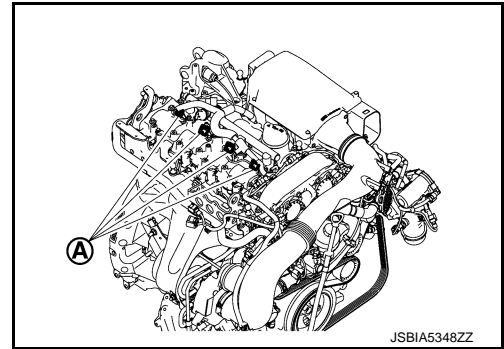


# CYLINDER HEAD COVER

< REMOVAL AND INSTALLATION >

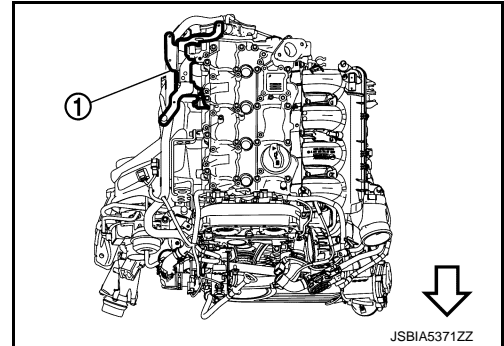
[2.0L TURBO GASOLINE ENGINE]

12. Disconnect the fuel injector harness connectors (A).



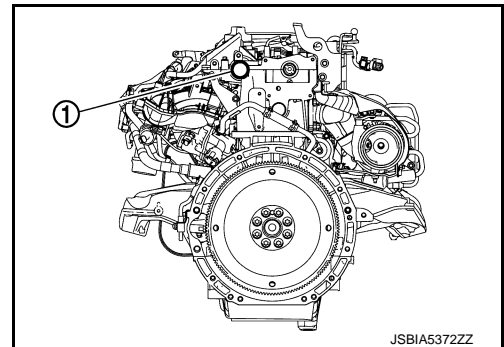
13. Remove the engine lifting eye (1).

← : Engine front



14. Remove the vacuum pump. Refer to [EM-36. "Removal and Installation"](#).

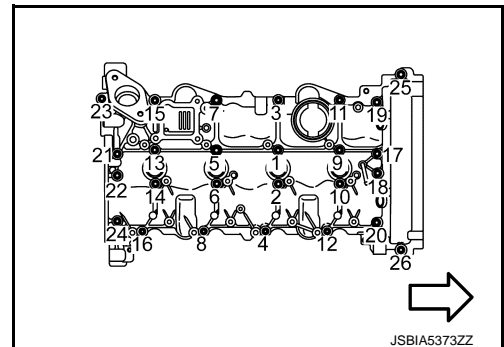
15. Remove the cap (1).



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

a. Loosen the mounting bolts in the order from 26 to 1 as shown in the figure.

← : Engine front



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# CYLINDER HEAD COVER

## < REMOVAL AND INSTALLATION >

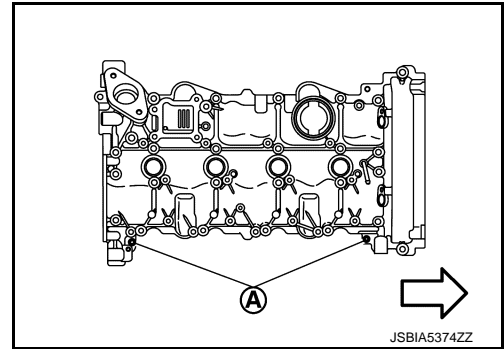
[2.0L TURBO GASOLINE ENGINE]

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

**CAUTION:**

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

← : Engine front



17. Remove the intake camshaft actuator, the exhaust camshaft actuator and the slide rail as necessary.

**CAUTION:**

If the slide rail is damaged, replace it.

### INSTALLATION

Note the following, install in the reverse order of removal

**NOTE:**

If a sensors is replaced, carry out the reset of adaption of sensors. Refer to [EC4-216. "Description"](#).

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 Co) and loctite 7063 150ml (A 001 986 71 71 10), or equivalent].

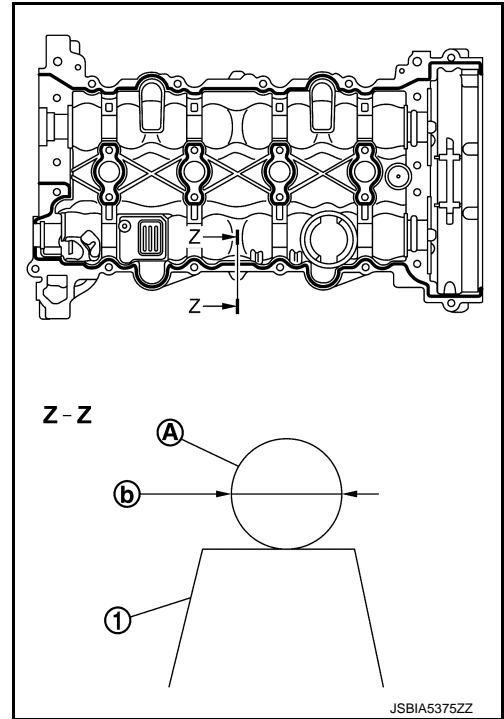
- a. Apply the liquid gasket evenly (no break, no overlap) to the matching surface of the cylinder head cover (1) as shown in the figure. Refer to [EM-6. "Liquid Gasket"](#).

- 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.

- (1) : Cylinder head cover
- (A) : Liquid gasket
- (b) : 0.7 – 1.3 mm (0.028 – 0.051 in)



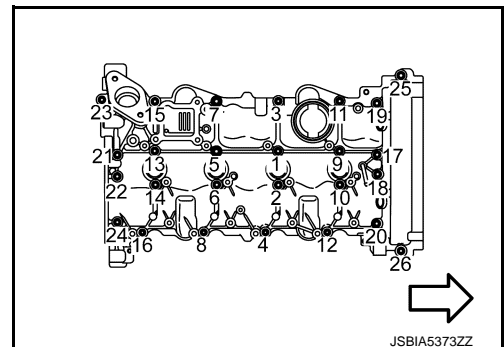
- b. Tighten the mounting bolts in the order from 1 to 26 as shown in the figure.

← : 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 26 as shown in the figure.

Angle tightening : 90°





# CYLINDER HEAD COVER

< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

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

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# CAMSHAFT

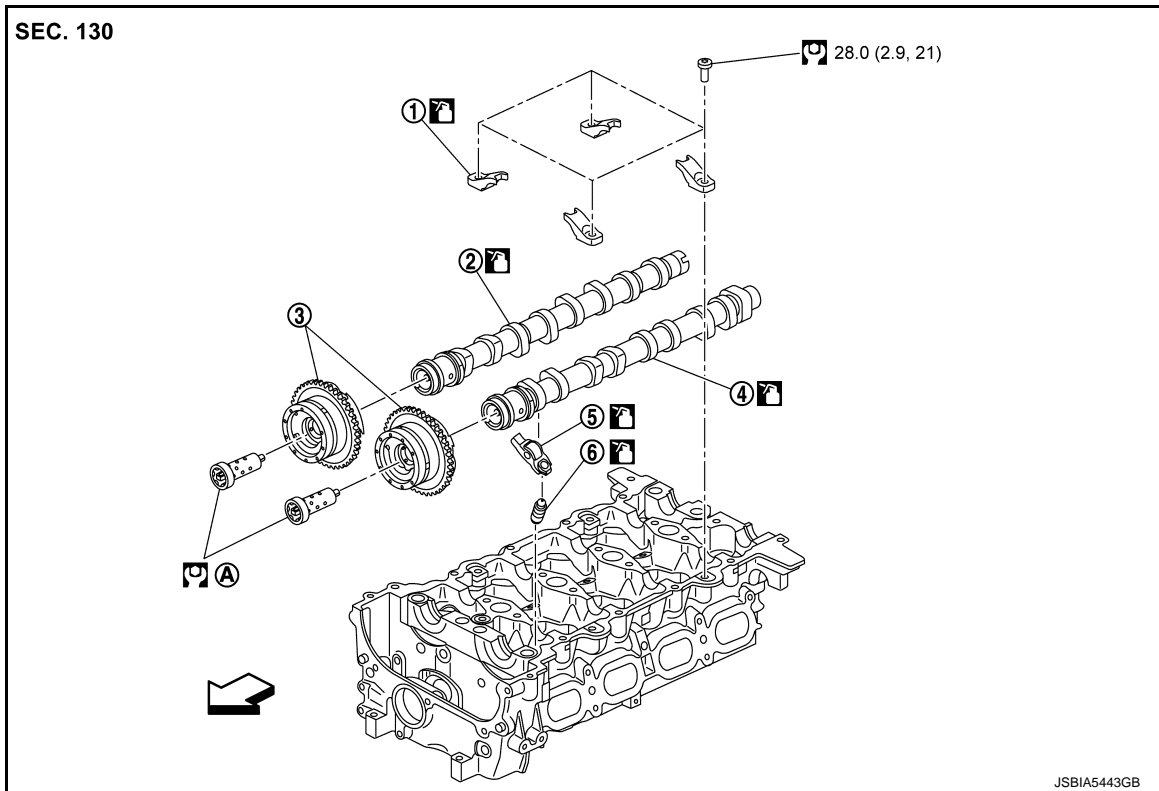
< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

## CAMSHAFT

Exploded View

INFOID:000000012947379



- |                          |                    |  |
|--------------------------|--------------------|--|
| ① Camshaft holding clamp | ② Exhaust camshaft | ③ Camshaft adjuster                            |
| ④ Intake camshaft        | ⑤ Rocker arm       | ⑥ Hydraulic valve clearance adjustment element |

Ⓐ Comply with the assembly procedure when tightening. Refer to [EM-70](#).

: N·m (kg-m, ft-lb)

: Always replace after every disassembly.

: Should be lubricated with oil.

: Engine front

## Removal and Installation

INFOID:000000012947380

### REMOVAL

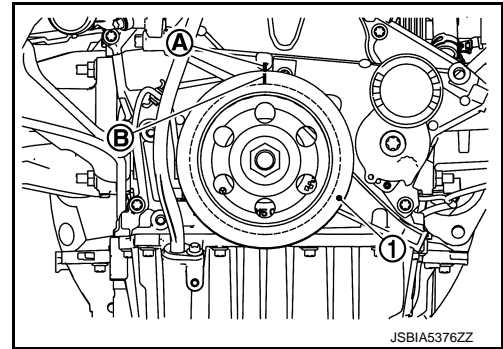
1. Remove the engine cover. Refer to [EM-22. "Removal and Installation"](#).
2. Remove the front under cover. Refer to [EXT-35. "FRONT UNDER COVER : Removal and Installation"](#).
3. Remove the cylinder head cover. Refer to [EM-65. "Removal and Installation"](#).
4. Set No. 1 cylinder at TDC of its compression stroke with the following procedure.

# CAMSHAFT

## < REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

- a. Rotate the crankshaft pulley ① in the direction of engine rotation, and align the mark "0 °" ② with the timing indicator ③ in front cover.



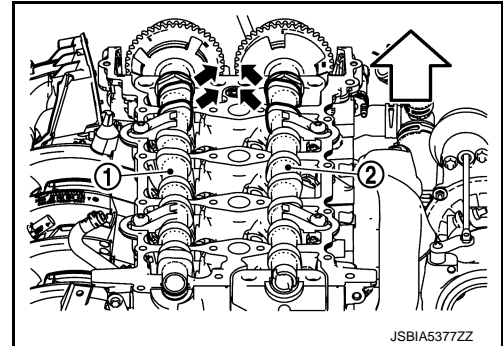
- b. At the same time, check that the cam noses of the No. 1 cylinder are located (←) as shown in the figure.

① : Camshaft (INT)

② : Camshaft (EXT)

← : Engine front

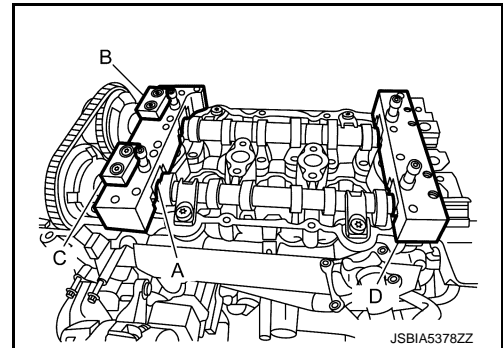
- If not, rotate the crankshaft pulley one revolution (360 degrees) are align as shown in the figure.



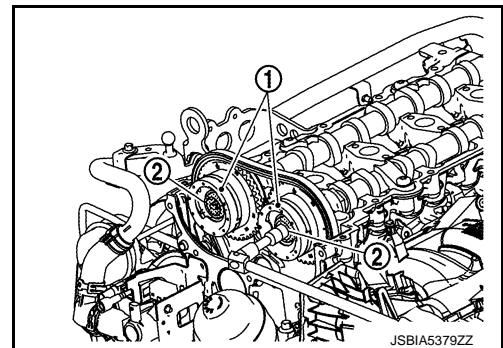
5. Remove the timing chain tensioner. Refer to [EM-93. "Removal and Installation"](#).

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.



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

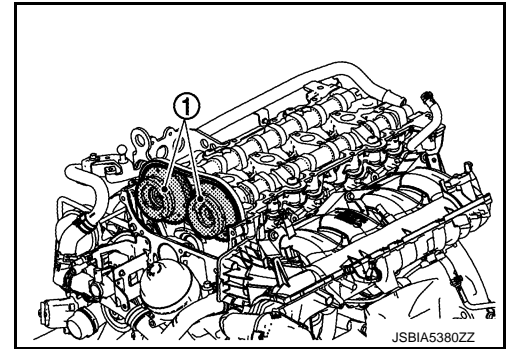


# CAMSHAFT

## < REMOVAL AND INSTALLATION >

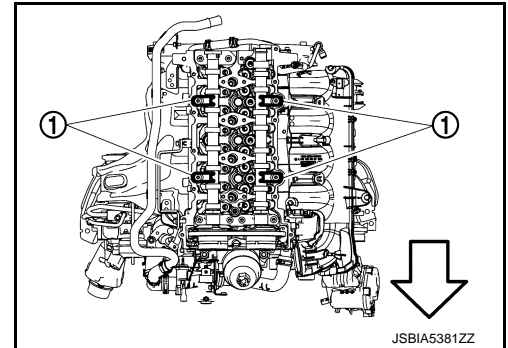
[2.0L TURBO GASOLINE ENGINE]

- c. Remove the camshaft adjuster ①.



- d. Remove the camshaft holder [SST: KV105H0210 (270 589 01 61 00)].  
7. Remove the camshaft 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 a sensor is replaced, carry out the reset of adaption of sensors. Refer to [EC4-216, "Description"](#).

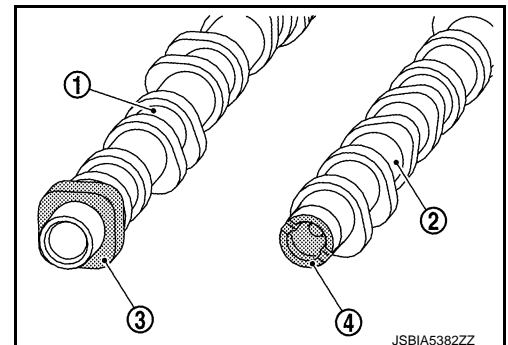
1. Install the rocker arm and the hydraulic valve clearance adjustment element.

### 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



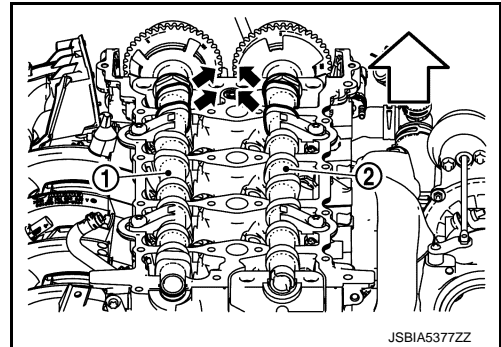
# CAMSHAFT

## < REMOVAL AND INSTALLATION >

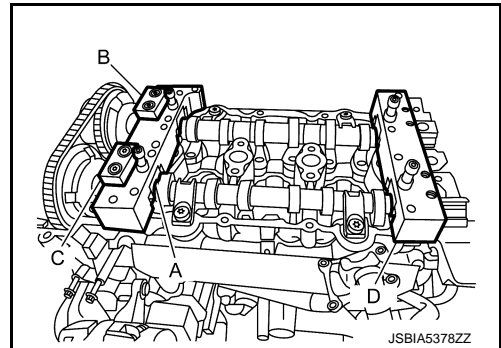
[2.0L TURBO GASOLINE ENGINE]

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

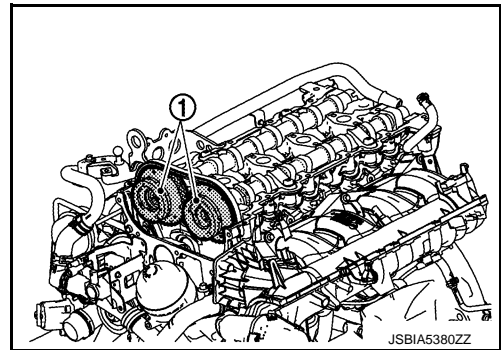
- ① : Camshaft (INT)
- ② : Camshaft (EXT)
- ← : Engine front




- 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.

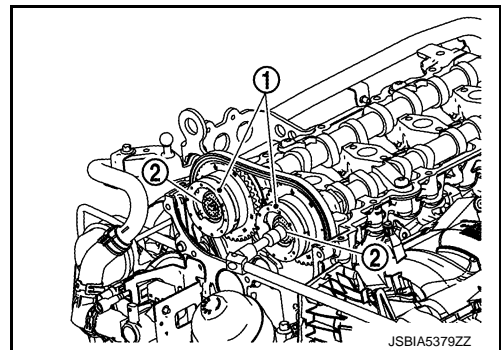


- e. Tighten the camshaft central valve ② of the camshaft adjuster ① with the socket wrench [SST: KV105H0090 (271 589 00 10 00)] as shown in the figure.

 : 18.0 N·m ( 1.8 kg-m, 13 ft-lb)

- f. Turn the camshaft central valve ② of the camshaft adjuster ① 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-73. "Inspection"](#).

## Inspection

INFOID:000000012947381

### INSPECTION AFTER REMOVAL

#### Camshaft Journal Oil Clearance

#### CAMSHAFT BRACKET INNER DIAMETER

- Measure the inner diameter of camshaft bracket.

# CAMSHAFT

< REMOVAL AND INSTALLATION >

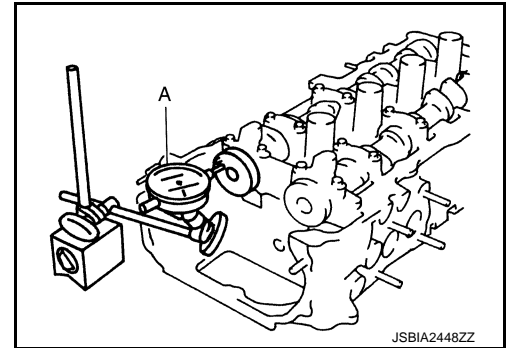
[2.0L TURBO GASOLINE ENGINE]

**Standard** : Refer to [EM-132, "Camshaft"](#).

## Camshaft End Play

- Install dial indicator (A) in thrust direction on front end of camshaft. Read the end play of dial indicator when camshaft is moved forward/backward (in direction to axis).

**Standard** : Refer to [EM-132, "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.

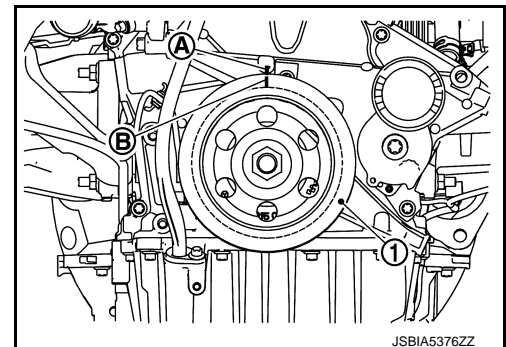
### **CAUTION:**

- **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-65, "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" ② with the timing indicator ③ in front cover.



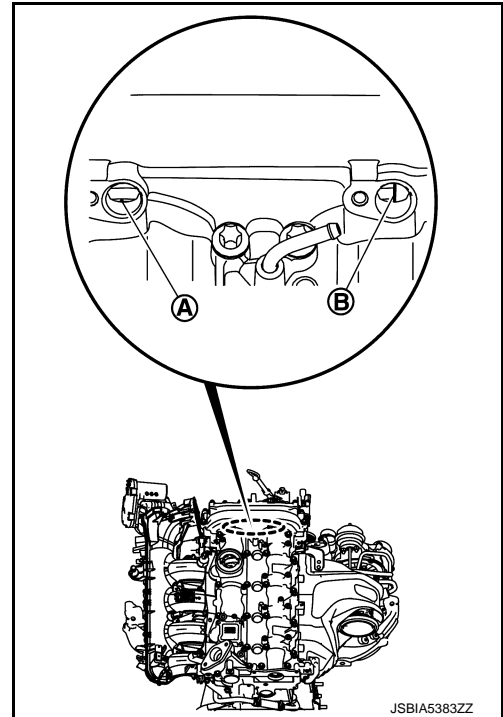
# CAMSHAFT

## < REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

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)



4. If there is misalignment, perform adjustment of camshaft basic position. Refer to [EM-75. "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-20. "Recommended Fluids and Lubricants"](#).
- 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:0000000012947382

### ADJUSTMENT AFTER INSTALLATION

Adjusting the Camshaft Basic position

1. Remove cylinder head cover. Refer to [EM-65. "Removal and Installation"](#).

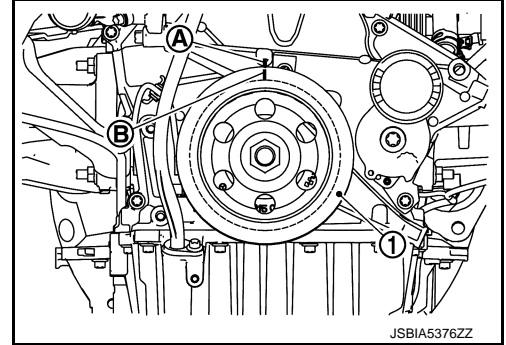


# CAMSHAFT

## < REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

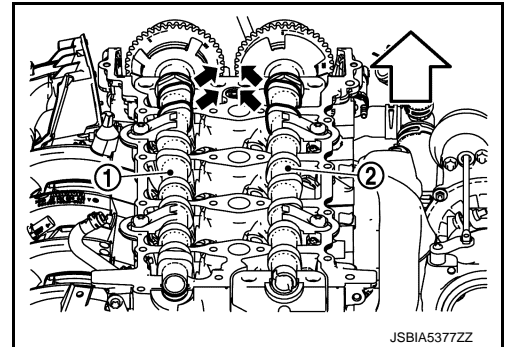
2. Remove the intake camshaft position sensor and exhaust camshaft position sensor. Refer to [EM-65, "Removal and Installation"](#).
3. Set No. 1 cylinder at TDC of its compression stroke with the following procedure.
  - a. Rotate the crankshaft pulley ① in the direction of engine rotation, and align the mark "0 °" ② with the timing indicator ③ 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)
- ← : Engine front

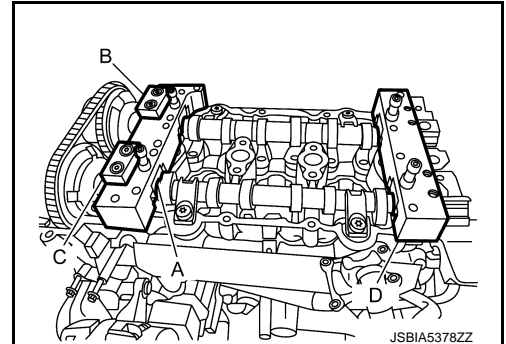
- If not, rotate the crankshaft pulley one revolution (360 degrees) and align as shown in the figure.



4. Loosen camshaft central valve. Refer to [EM-70, "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:**

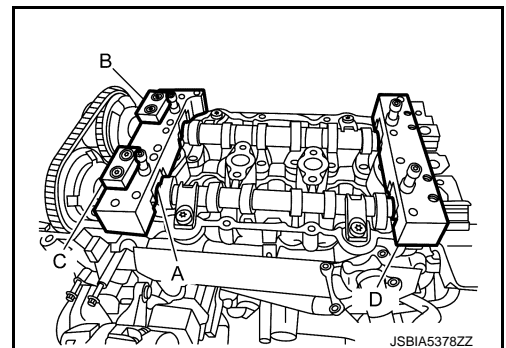
**Never install the camshaft holder forcibly with hitting it.**



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).**



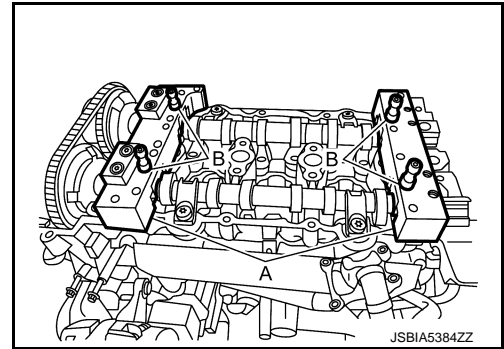


# CAMSHAFT

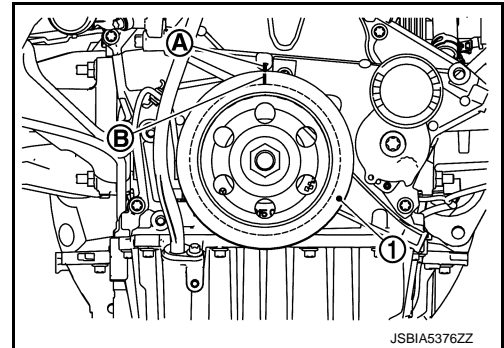
## < REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

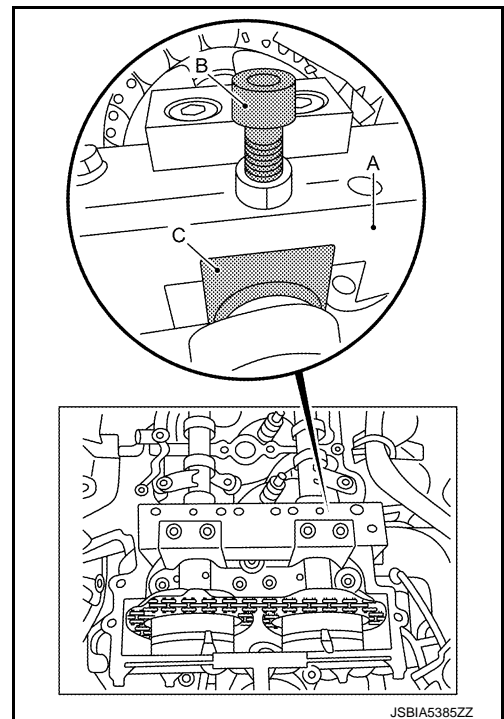
8. Loosen the adjusting bolts (B) of the camshaft holder [SST: KV105H0210 (270 589 01 61 00)] (A) until the camshaft rotates smoothly.



9. Install the chain tensioner. Refer to [EM-93, "Removal and Installation"](#).
10. Rotate the crankshaft pulley ① in the direction of engine rotation by 2 turns, and align the mark "0 °" ② with the timing indicator ③ in front 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-70, "Removal and Installation"](#).

A  
EM  
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P

## CAMSHAFT

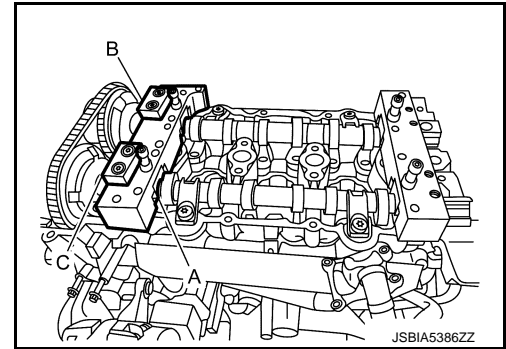
### < REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

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.

# OIL PAN (LOWER)

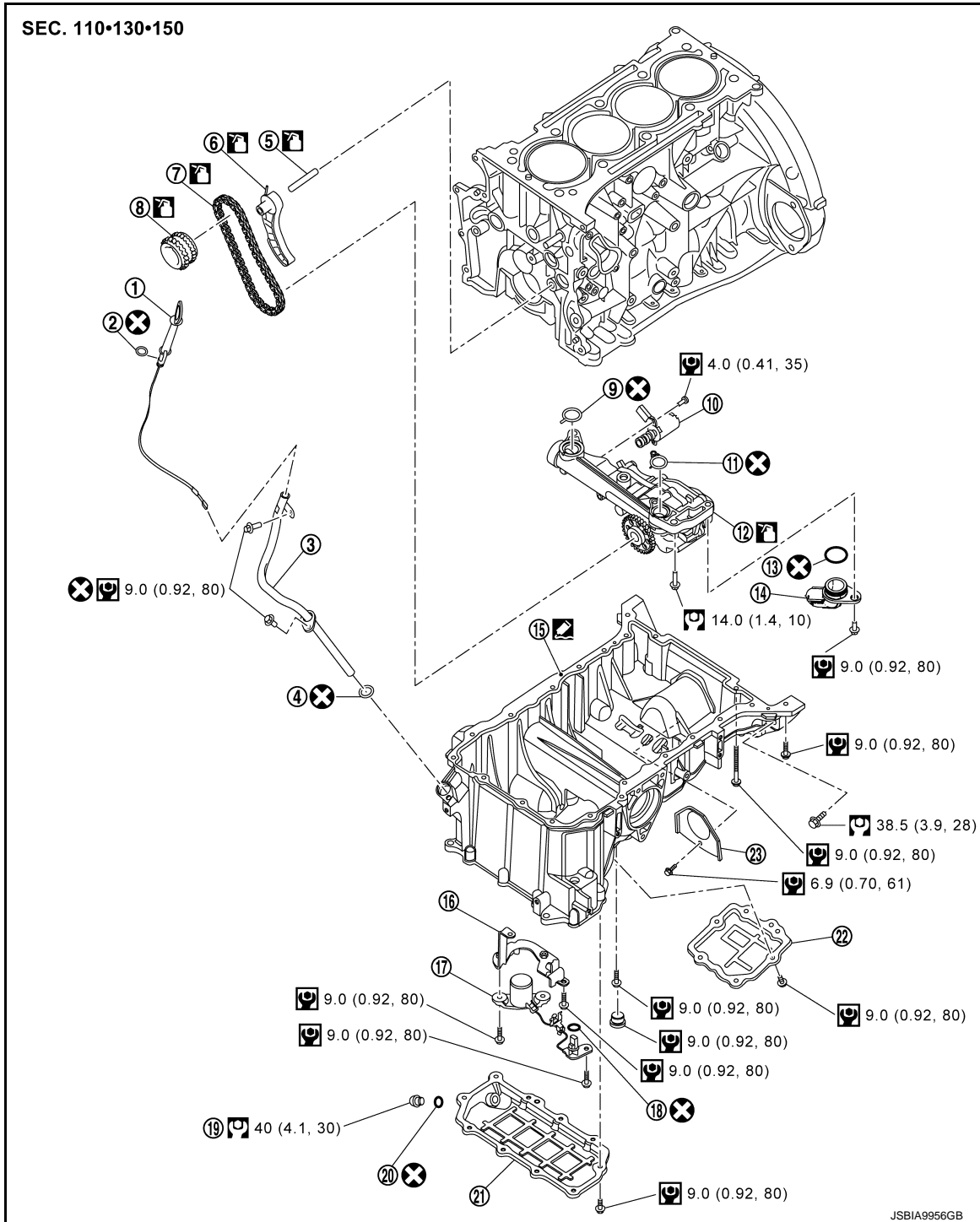
< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

## OIL PAN (LOWER)

Exploded View

INFOID:000000013476162







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

# OIL PAN (LOWER)

[2.0L TURBO GASOLINE ENGINE]

## < REMOVAL AND INSTALLATION >

- |                         |                           |                          |
|-------------------------|---------------------------|--------------------------|
| ①9 Oil drain screw      | ②0 Oil drain screw washer | ②1 Oil pan (lower front) |
| ②2 Oil pan (lower rear) | ②3 Rear plate cover       |                          |
- ⊗ : Always replace after every disassembly.
-  : N·m (kg·m, in·lb)
-  : N·m (kg·m, ft·lb)
-  : Sealing point
-  : Should be lubricated with oil.

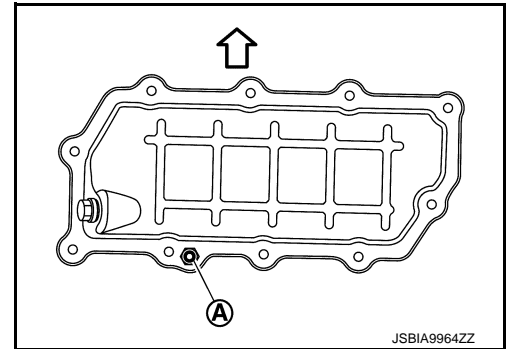
## Removal and Installation

INFOID:000000013476163

### REMOVAL

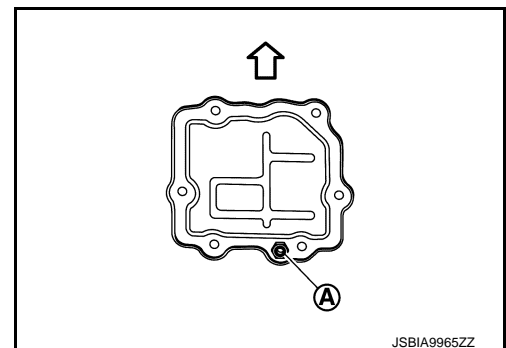
#### Oil Pan (Lower Front)

1. Remove front undercover. Refer to [EXT-35, "FRONT UNDER COVER : Removal and Installation"](#).
2. Drain engine oil. Refer to [LU-9, "Draining"](#).
3. Remove oil pan (lower front) mounting bolts.
4. Tighten an M6 bolt in bolt hole (A), and remove the oil pan (lower front).



#### Oil Pan (Lower Rear)

1. Remove front undercover. Refer to [EXT-35, "FRONT UNDER COVER : Removal and Installation"](#).
2. Drain engine oil. Refer to [LU-9, "Draining"](#).
3. Remove engine assembly. Refer to [EM-102, "Removal and Installation"](#).
4. Remove oil pan (lower rear) mounting bolts.
5. Tighten an M6 bolt in bolt hole (A), and remove the oil pan (lower rear).



### INSTALLATION

Install in the reverse order of removal.

### Inspection

INFOID:000000013476164

### INSPECTION AFTER INSTALLATION

- Check the engine oil level and adjust engine oil. Refer to [LU-8, "Inspection"](#).
- Start engine, and check there is no leakage of engine oil.

# ENGINE OIL LEVEL SWITCH

< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

## ENGINE OIL LEVEL SWITCH

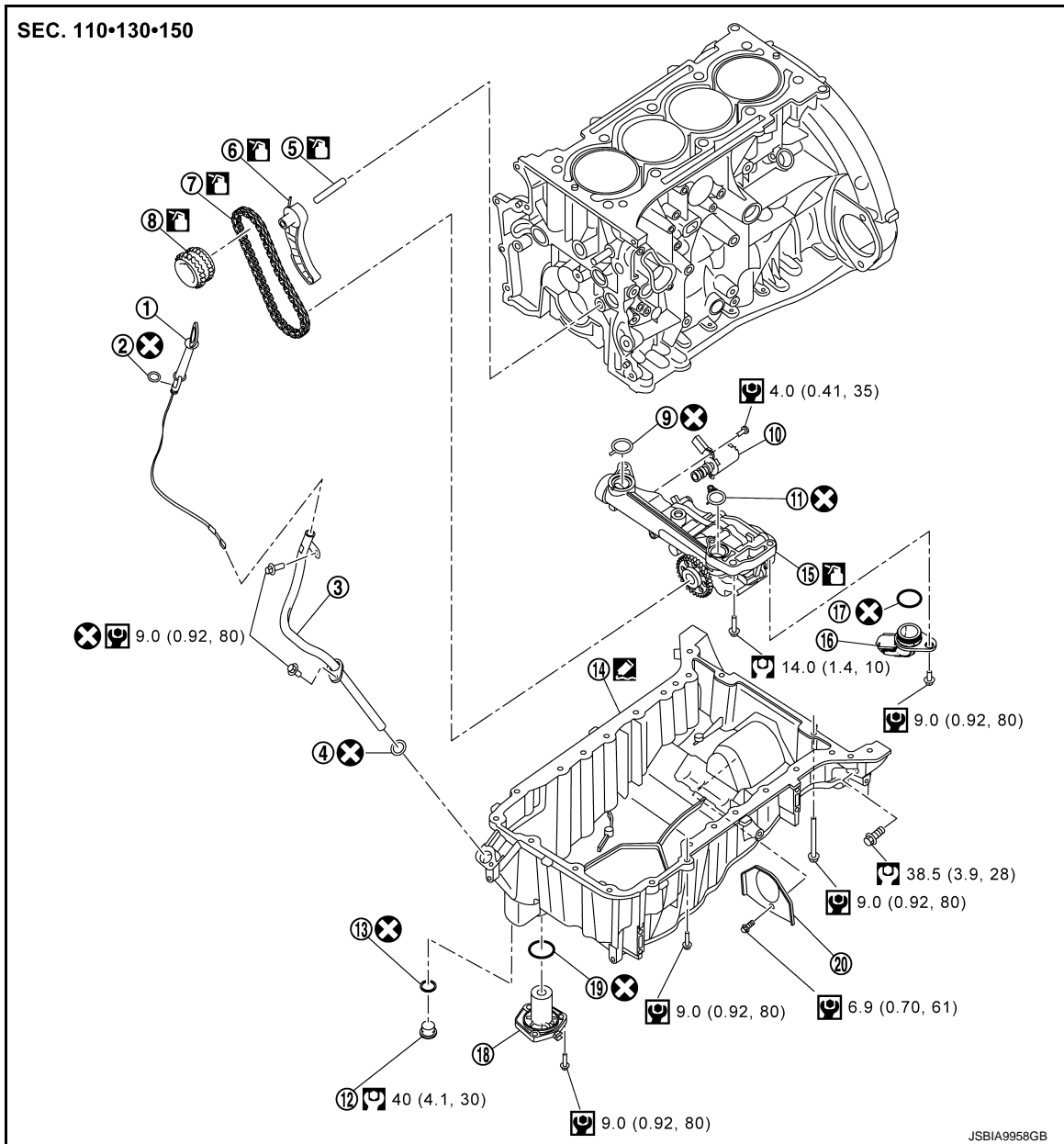
2WD

2WD : Exploded View

INFOID:0000000013476174

A

EM



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P


# ENGINE OIL LEVEL SWITCH

< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

 : N·m (kg-m, ft-lb)


 : Sealing point


 : Should be lubricated with oil.

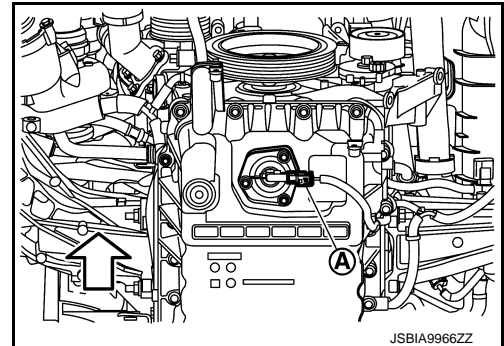
## 2WD : Removal and Installation

INFOID:000000013476175

### REMOVAL

1. Remove front undercover. Refer to [EXT-35, "FRONT UNDER COVER : Removal and Installation"](#).
2. Drain engine oil. Refer to [LU-9, "Draining"](#).
3. Disconnect engine oil level switch harness connector .

 : Engine front



4. Remove engine oil level switch.

### INSTALLATION

Install in the reverse order of removal.

## 2WD : Inspection

INFOID:000000013476176

### INSPECTION AFTER INSTALLATION

- Check the engine oil level and adjust engine oil. Refer to [LU-8, "Inspection"](#).
- Start engine, and check there is no leakage of engine oil.

## AWD

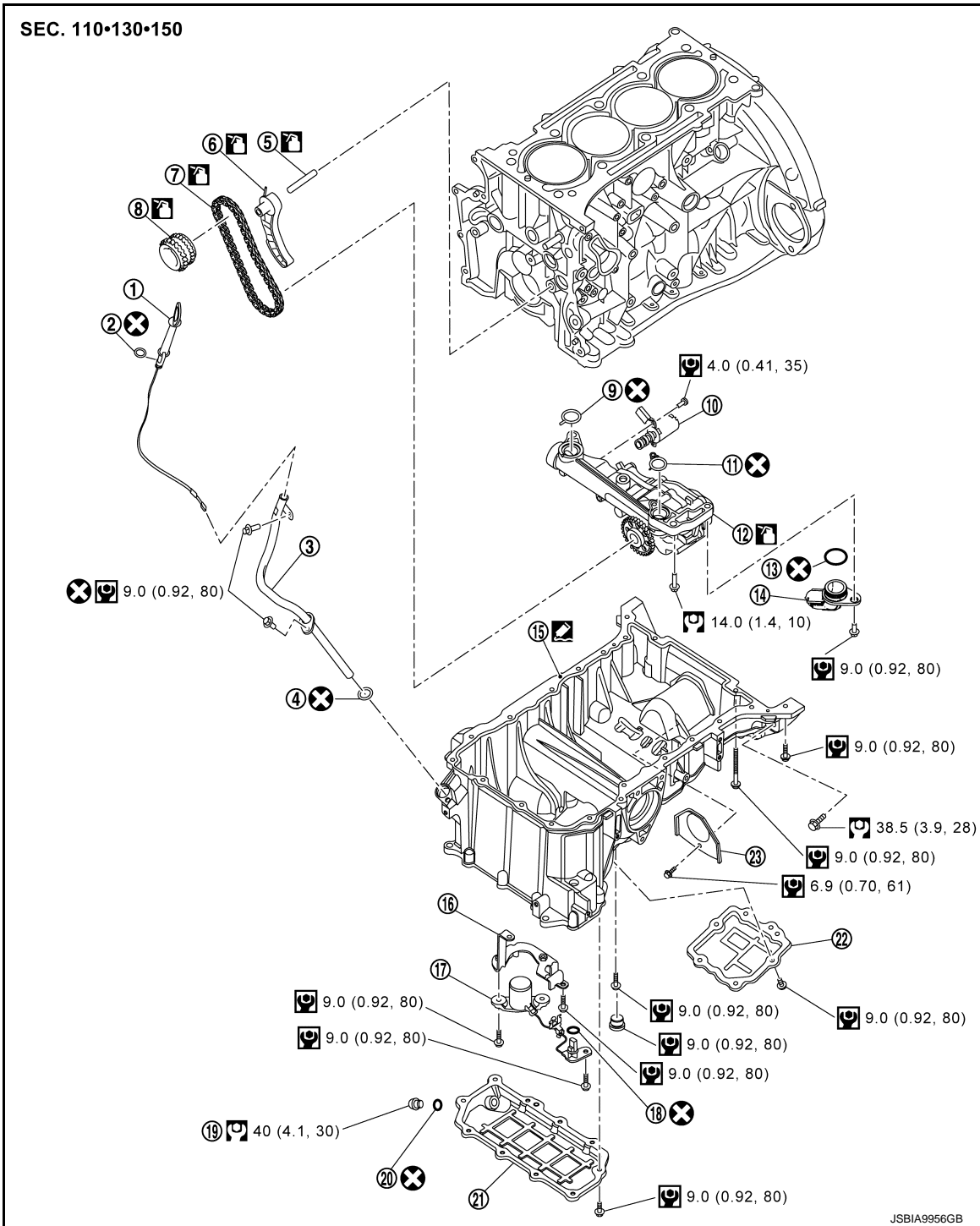
# ENGINE OIL LEVEL SWITCH

< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

AWD : Exploded View

INFOID:000000013477891



- |                                   |                           |                         |
|-----------------------------------|---------------------------|-------------------------|
| ① Oil level gauge                 | ② O-ring                  | ③ Oil level gauge guide |
| ④ O-ring                          | ⑤ Slide rail pin          | ⑥ Timing chain guide    |
| ⑦ Timing chain (oil pump)         | ⑧ Crank sprocket          | ⑨ O-ring                |
| ⑩ Engine oil pump valve           | ⑪ O-ring                  | ⑫ Engine oil pump       |
| ⑬ O-ring                          | ⑭ Oil suction pipe        | ⑮ Oil pan               |
| ⑯ Engine oil level switch bracket | ⑰ Engine oil level switch | ⑱ O-ring                |
| ⑲ Oil drain screw                 | ⑳ Oil drain screw washer  | ㉑ Oil pan (lower front) |

A  
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# ENGINE OIL LEVEL SWITCH

< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

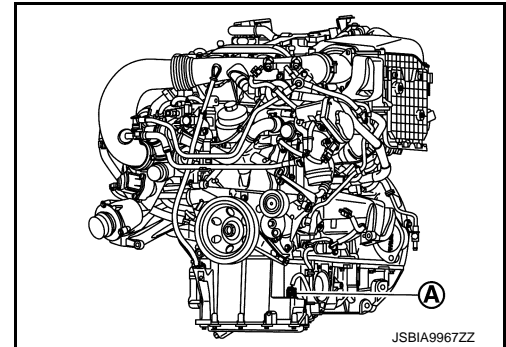
- ②② Oil pan (lower rear)
- ②③ Rear plate cover
- ⊗ : Always replace after every disassembly.
- 🔧 : N·m (kg-m, in-lb)
- 🔧 : N·m (kg-m, ft-lb)
- 🔧 : Sealing point
- 🔧 : Should be lubricated with oil.

## AWD : Removal and Installation

INFOID:0000000013476166

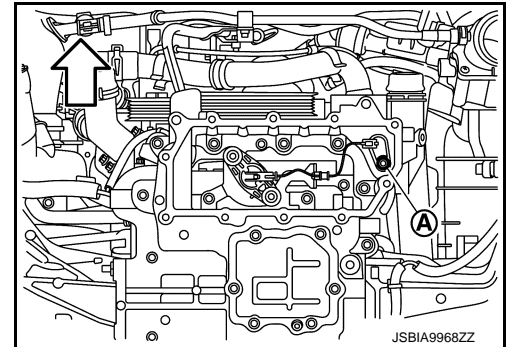
### REMOVAL

1. Remove oil pan lower (front). Refer to [EM-80, "Removal and Installation"](#).
2. Disconnect engine oil level switch harness connector ①.



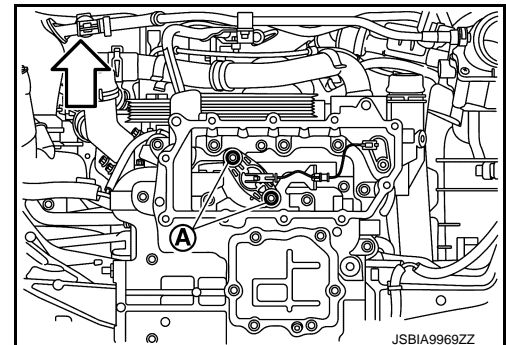
3. Remove engine oil level switch harness connector bolt ①.

← : Engine front



4. Remove engine oil level switch mounting bolt ①.

← : Engine front



5. Remove engine oil level switch.

### INSTALLATION

Install in the reverse order of removal.

### AWD : Inspection

INFOID:0000000013476167

### INSPECTION AFTER INSTALLATION

- Check the engine oil level and adjust engine oil. Refer to [LU-8, "Inspection"](#).



# ENGINE OIL LEVEL SWITCH

< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

- Start engine, and check there is no leakage of engine oil.

A

EM

C

D

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# DRIVE PLATE

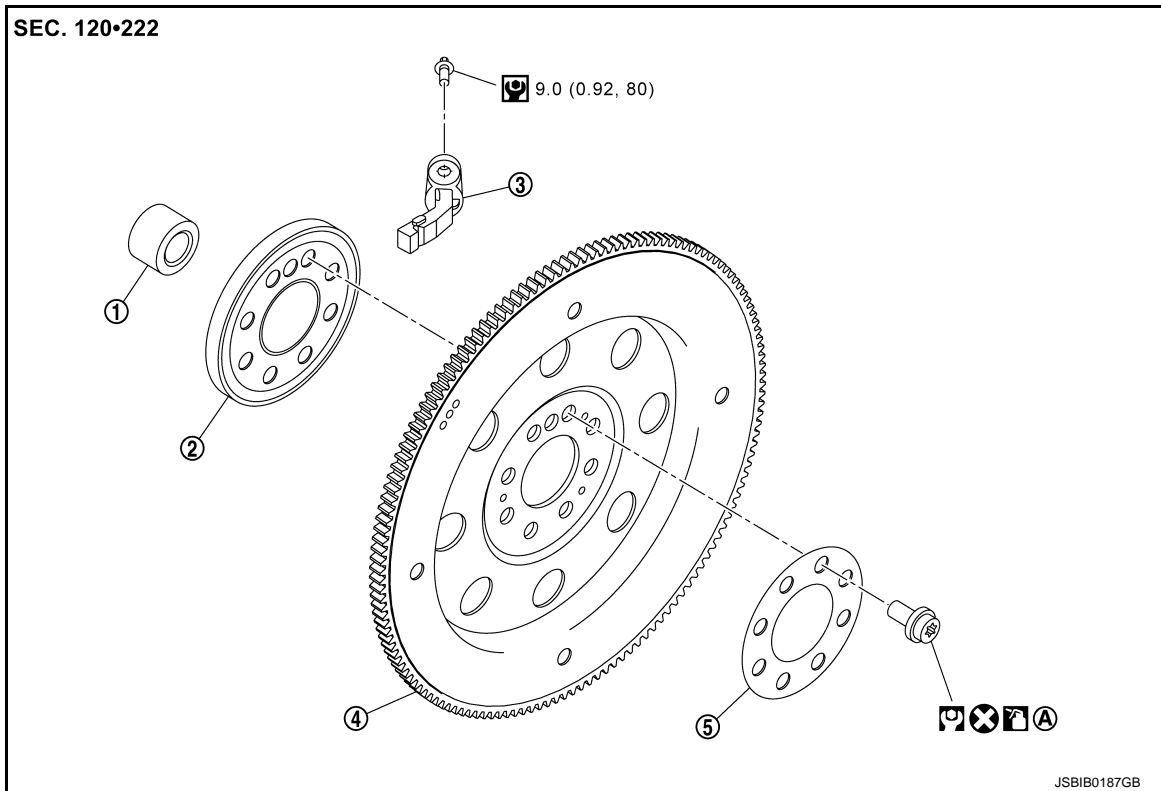
< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

## DRIVE PLATE

### Exploded View

INFOID:000000012947383



- ① Pilot converter
- ② Crankshaft position sensor
- ③ Signal plate
- ④ Drive plate
- ⑤ Reinforcement plate

Ⓐ Comply with the assembly procedure when tightening. Refer to [EM-86](#).

: N·m (kg-m, ft-lb)

: N·m (kg-m, in-lb)

: Should be lubricated with oil.

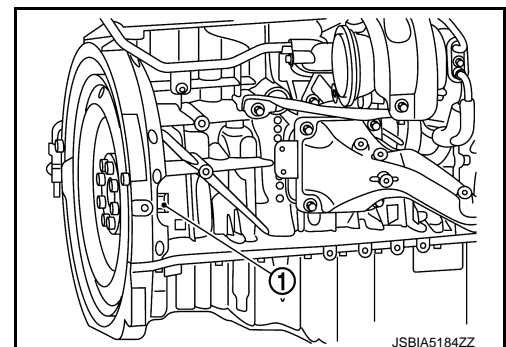
: Always replace after every disassembly.

## Removal and Installation

INFOID:000000012947384

### REMOVAL

1. Remove the transmission assembly from engine assembly. Refer to [TM-334, "2.0L TURBO GASOLINE ENGINE : Removal and Installation"](#) (2WD), [TM-339, "VR30DDTT : Removal and Installation"](#) (AWD).
2. Remove the cylinder head cover of crankshaft position sensor. Refer to [EM-65, "Exploded View"](#).
3. Remove the crankshaft position sensor ①.



# DRIVE PLATE

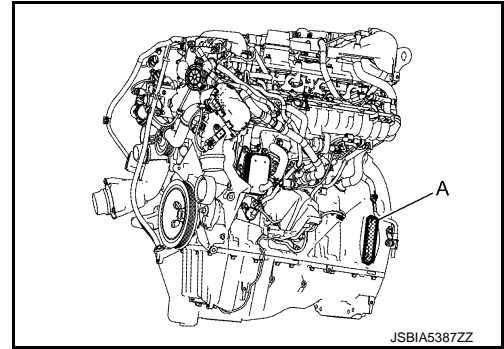
## < REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

4. Remove the starter motor. Refer to [STR-23. "2.0L TURBO GASOLINE ENGINE : Removal and Installation"](#).
5. Fix the drive plate to starter motor mounting position with crankshaft stopper [SST: KV105H0020 (112 589 03 40 00)] (A) to remove the mounting bolts of the drive plate.

**NOTE:**

Loosen the mounting bolts in diagonal order.



6. Remove the pilot converter using the pilot bushing puller (commercial service tool) if necessary.
7. Remove the crankshaft pulse sensor from the drive plate if necessary.

**CAUTION:**

- When removing the pulse ring, never use the sharp tool.
- The magnetic substance never contact with the the pulse ring.

## INSTALLATION

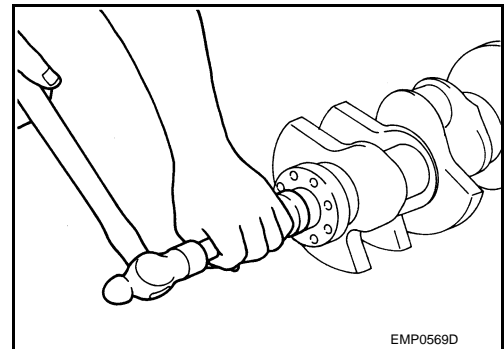
Note the following, and install in the reverse order of removal.

**NOTE:**

- If a sensors is replaced, carry out the reset of adaption of sensors. Refer to [EC4-216. "Description"](#).
- If a crankshaft position sensor is replaced, carry out the synchronization adjustment of adaption of crankshaft position sensors. refer to [EC4-211. "Description"](#).

1. Install pilot converter to crankshaft as follows, if removed:
  - a. Remove crankshaft.
  - b. Install pilot converter to crankshaft.
    - With a drift of the following outer diameter, press-fit as far as it will go.[outer diameter: approx. 35 mm (1.38 in)]

**Outer diameter : approx 33φ mm (1.30 in)**



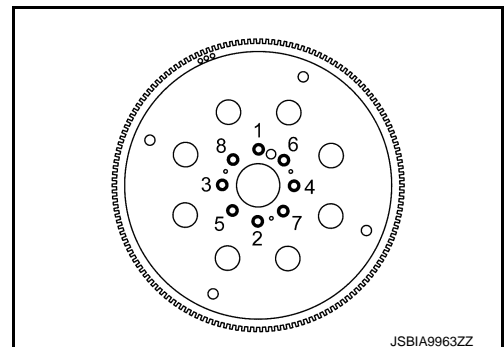
2. Install drive plate with the following procedure.

**CAUTION:**

**Never use a power tool.**

- a. Tighten drive plate mounting bolts in the order from 1 to 8 as shown in the figure.

: **45.0 N·m (4.6 kg-m, 33 ft-lb)**



## DRIVE PLATE

[2.0L TURBO GASOLINE ENGINE]

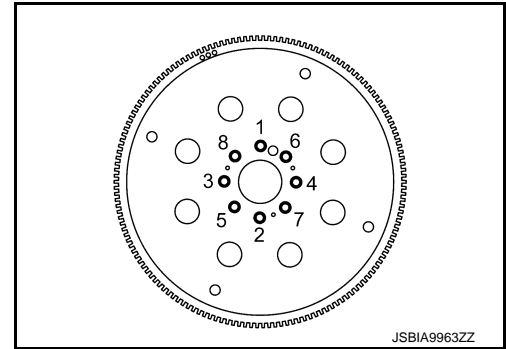
### < REMOVAL AND INSTALLATION >

- b. Tighten drive plate mounting bolts in the order from 1 to 8 as shown in the figure.

**Angle tightening : 90°**

**NOTE:**

Tighten mounting bolts in diagonal order.



## OIL SEAL

## VALVE OIL SEAL

## VALVE OIL SEAL : Removal and Installation

INFOID:0000000012947385

A

EM

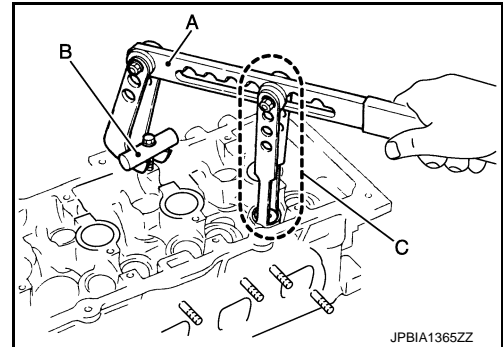
## REMOVAL

1. Remove the camshaft and the adjuster. Refer to [EM-70. "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.

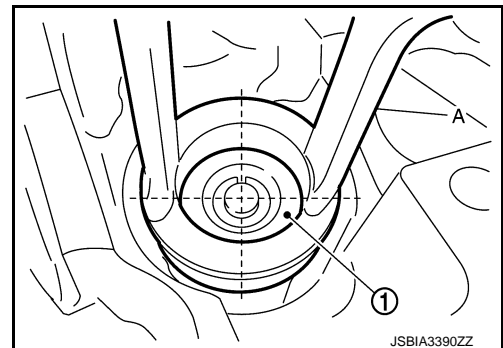
**CAUTION:**

**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 valve lifter holes.
- Fit the attachment (SST: KV10115900) (A) in the center of valve spring retainer ① to press it.

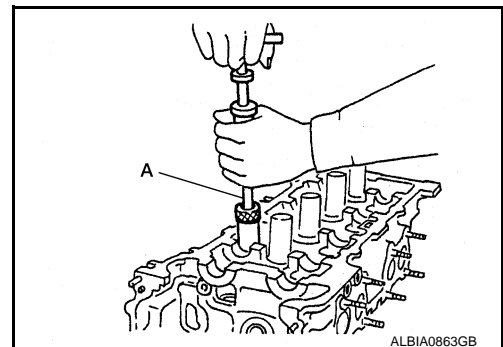


4. Remove valve spring retainer and valve spring (with valve spring seat).

**CAUTION:**

**Never remove valve spring seat from valve spring.**

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



## INSTALLATION

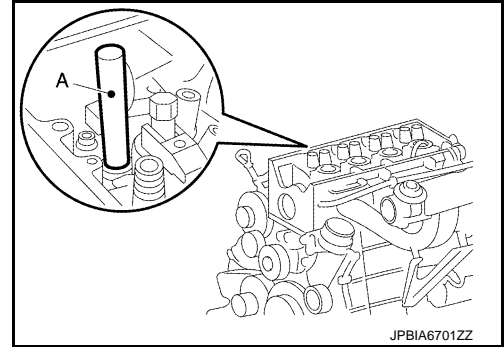
1. Apply new engine oil to valve oil seal joint surface and seal lip.

# OIL SEAL

## < REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

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

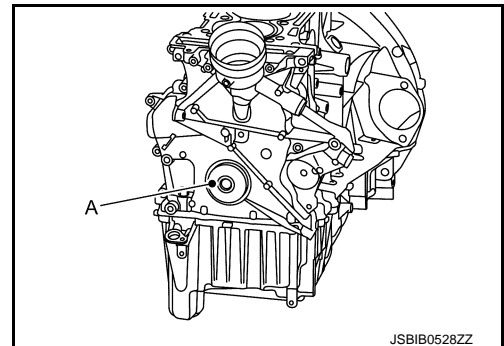
INFOID:000000012947386

#### REMOVAL

1. Remove the following parts.
  - Front under cover, refer to [EXT-35, "FRONT UNDER COVER : Removal and Installation"](#).
  - For engine drive belt, refer to [EM-16, "Removal and Installation"](#).
  - For vibration damper, refer to [EM-93, "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 (DAIMLER tool No.270 589 00 15 00)] (A).  
**CAUTION:**
  - **Be careful not to damage the timing case 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:000000012947387

#### REMOVAL

1. Remove transmission. Refer to [TM-334, "2.0L TURBO GASOLINE ENGINE : Removal and Installation"](#) (2WD), [TM-339, "VR30DDTT : Removal and Installation"](#) (AWD).
2. Remove the drive plate. Refer to [EM-86, "Removal and Installation"](#).
3. Remove the crankshaft position sensor. Refer to [EM-86, "Removal and Installation"](#).
4. Remove the crankshaft pulse sensor. Refer to [EM-86, "Removal and Installation"](#).
5. 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:**

# OIL SEAL

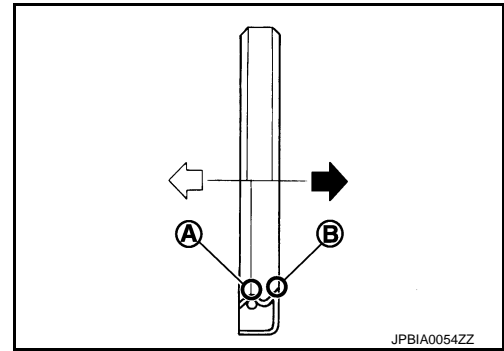
## < REMOVAL AND INSTALLATION >

## [2.0L TURBO GASOLINE ENGINE]

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

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

- (A) : Oil seal lip
- (B) : Dust seal lip
- ⇐ : Engine front side
- ⇨ : Transmission side



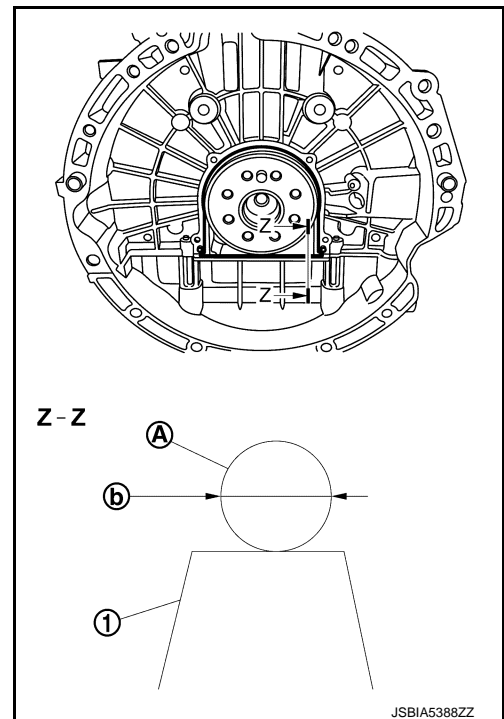
2. Apply the liquid gasket evenly (no break, no overlap) to the matching surface of the crankshaft end cover ① as shown in the figure. Refer to [EM-6. "Liquid Gasket"](#).

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

**CAUTION:**

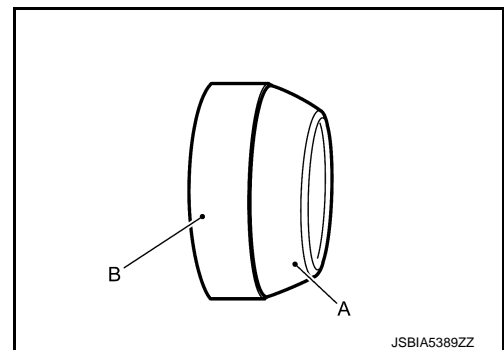
Install the crankshaft end cover within 5 minutes after applying the liquid gasket.

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



3. Note the following, install the crankshaft end cover 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.



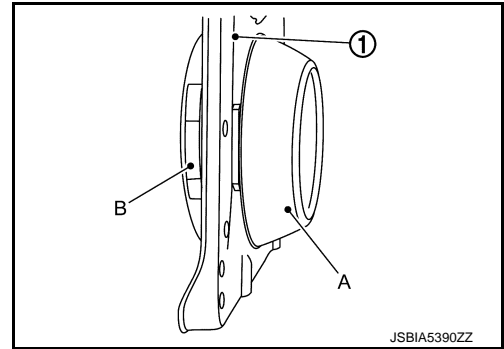
A  
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# OIL SEAL

## < REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

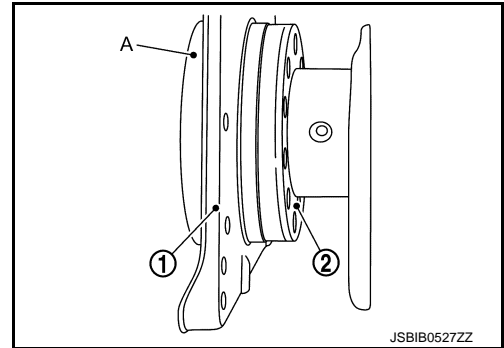
- Install the crankshaft seal installation [SST: KV105H0100 (271 589 00 43 00)] (A) and (B) to the crankshaft end cover ① as shown in the figure.
- Remove the crankshaft seal installation [SST: KV105H0100 (271 589 00 43 00)] (A) from the crankshaft end cover ①.



- Install the crankshaft seal installation [SST: KV105H0100 (DAIMLER tool No.271 589 00 43 00)] (A) installed to crankshaft end cover ① to the crankshaft flange ②.

**CAUTION:**

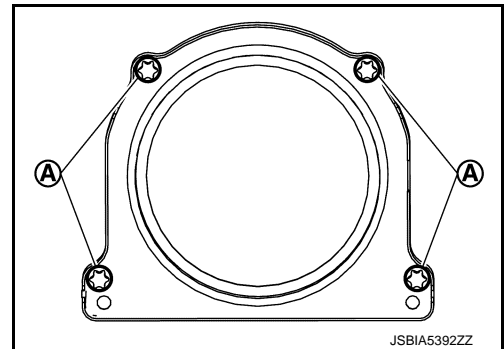
Be careful not to damage the crankshaft, and the matching surface between oil pan and crankshaft end cover.



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

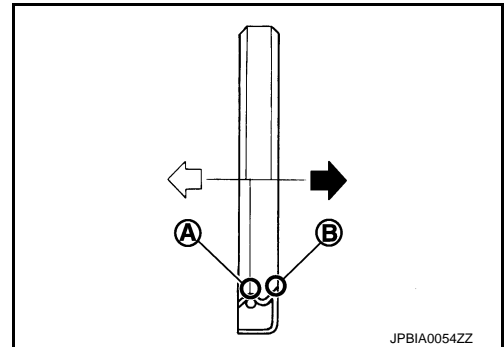
**CAUTION:**

- 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

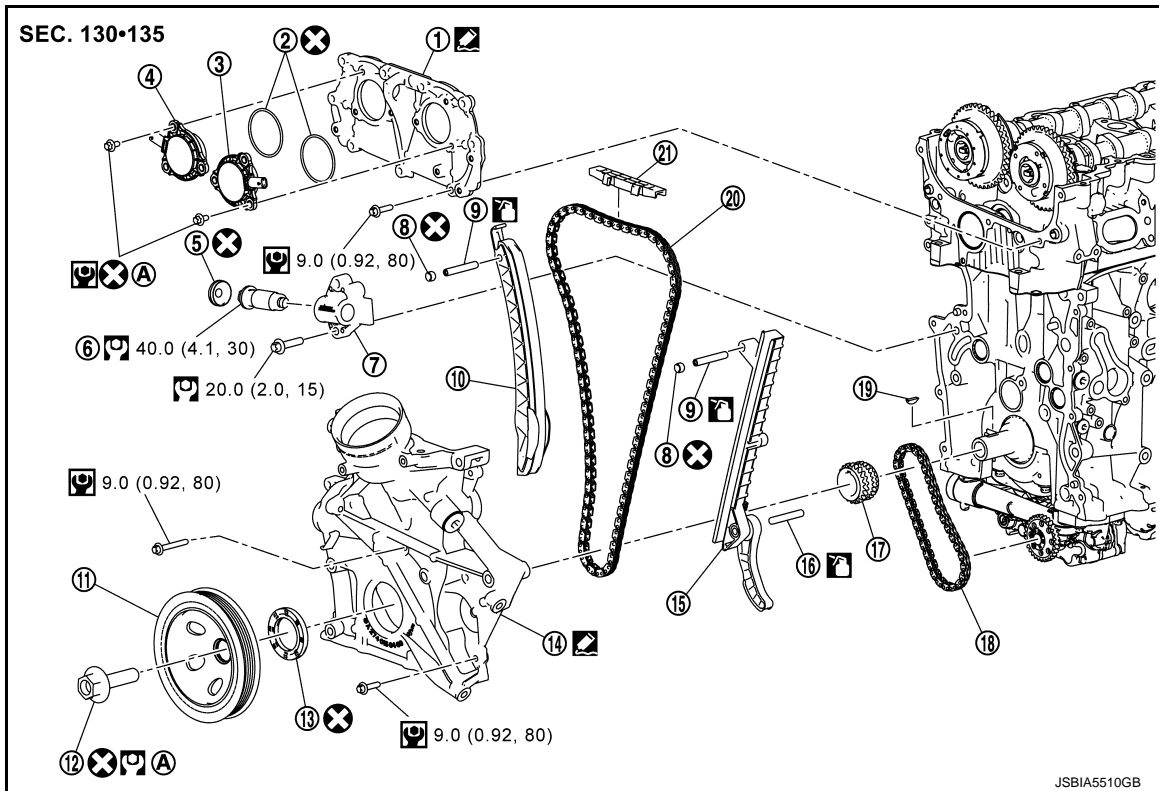
< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

## TIMING CHAIN

### Exploded View

INFOID:000000012947397



- |                             |                         |                             |
|-----------------------------|-------------------------|-----------------------------|
| ① Cylinder head front cover | ② O-ring                | ③ Intake camshaft actuator  |
| ④ Exhaust camshaft actuator | ⑤ Chain tensioner cover | ⑥ Chain tensioner           |
| ⑦ Chain tensioner bracket   | ⑧ Slide rail pin cap    | ⑨ Slide rail pin            |
| ⑩ Timing chain slide rail 1 | ⑪ Vibration damper      | ⑫ Centering bolt            |
| ⑬ Front oil seal            | ⑭ Timing case cover     | ⑮ Timing chain slide rail 2 |
| ⑯ Slide rail pin            | ⑰ Crank sprocket        | ⑱ Timing chain (oil pump)   |
| ⑲ Crank shaft key           | ⑳ Timing chain          | ㉑ Timing chain slide rail 3 |

Comply with the assembly procedure when tightening. Refer to [EM-93](#).

Ⓐ : N-m (kg-m, ft-lb)

⊗ : Always replace after every disassembly.

Ⓜ : N-m (kg-m, ft-lb)

Ⓜ : N-m (kg-m, in-lb)

Ⓜ : Sealing point

Ⓜ : Should be lubricated with oil.

## Removal and Installation

INFOID:000000012947398

### REMOVAL

#### NOTE:

When remove timing chain, remove engine assembly from vehicle. Refer to [EM-102, "Removal and Installation"](#).

1. Remove the following components and related parts.

# TIMING CHAIN

## < REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

- Charge air manifold: Refer to [EM-29, "Removal and Installation"](#).
- Water pump: Refer to [CO-15, "Removal and Installation"](#).
- Drive belt: Refer to [EM-16, "Removal and Installation"](#).
- Drive belt auto-tensioner, idler pulley: Refer to [EM-27, "Removal and Installation"](#).
- A/C compressor: Refer to [HA-31, "Removal and Installation"](#).
- Alternator: Refer to [CHG-25, "2.0L TURBO GASOLINE ENGINE : Removal and Installation"](#).
- Oil pan: Refer to [EM-110, "2WD : Removal and Installation"](#).
- Cylinder head cover: Refer to [EM-65, "Removal and Installation"](#).

2. Remove the timing chain slide rail 3.
3. Remove the vibration damper with the following procedure.
  - a. Fix the drive plate with crankshaft stopper [SST: KV105H0020 (112 589 03 40 00)].
  - b. Loosen the mounting bolts of the vibration damper to remove the vibration damper.
4. Remove the chain tensioner with the following procedure.
  - a. Remove the chain tensioner cover from timing case cover.

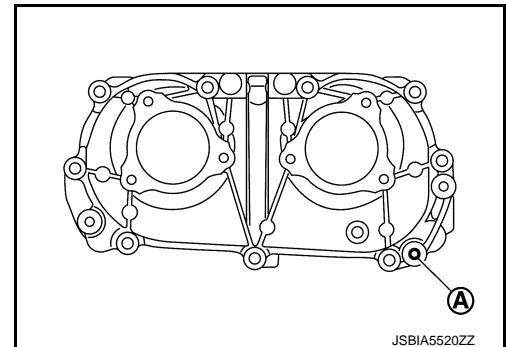
**NOTE:**

Using a suitable tool, puncture the center of the chain tensioner cover and pry out it.

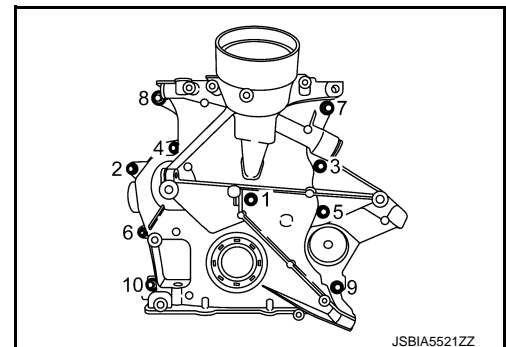
- b. Loosen the chain tensioner to remove the chain tensioner.
5. Remove the cylinder head front cover with the following procedure.
    - a. Remove the mounting bracket of the coolant pump switchover valve and the boost pressure control vacuum transducer from timing case cover.
    - b. Disconnect the harness connector of the intake camshaft actuator and the exhaust camshaft actuator.
    - c. Remove the oil filter screw cap. Refer to [LU-11, "Removal and Installation"](#).
    - d. Remove the mounting bolts of cylinder head front cover.
    - e. Install the cylinder head front cover mounting bolts to the (A) part of cylinder head front cover.

**CAUTION:**

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



- f. Remove the intake camshaft actuator and the exhaust camshaft actuator as necessary.
6. Remove the cylinder head. Refer to [EM-119, "Removal and Installation"](#).
  7. Remove the timing case cover with the following procedure.
    - a. Separate the coolant hose (between the coolant thermostat and water pump) from the coolant thermostat.
    - b. Remove the engine oil pump valve harness from timing case cover.
    - c. Loosen the mounting bolts in the order from 10 to 1.



- d. Remove the timing case cover.
8. Remove the slide rail pin cap.

**NOTE:**

# TIMING CHAIN

## < REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

Using a suitable tool, puncture the center of the slide rail pin cap and pry out it.

9. Remove the side rail pin by extractor impact [SST: KV115H0180 (116 589 20 33 00)] and threaded pin [SST: KV105H0030 (271 589 00 34 00)].
10. Remove the timing chain slide rail 1 and the timing chain slide rail 2.
11. Remove the timing chain.
12. Remove the engine oil pump. Refer to [LU-16, "Removal and Installation"](#).
13. Remove the timing chain (oil pump).

## 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 [EC4-215, "Description"](#).
  - Camshaft reference adaptation: Refer to [EC4-214, "Description"](#).
- If a sensors and actuators is replaced, carry out the resting of adaptation values. Refer to [EC4-216, "Description"](#).

1. Install the timing chain (oil pump).
2. Install the engine oil pump. Refer to [LU-16, "Removal and Installation"](#).
3. Install the timing chain.
4. Install the timing chain slide rail 1 and the timing chain slide rail 2.
5. Use the extractor impact [SST: KV115H0180 (DAIMLER tool No.116 589 20 33 00)] and threaded pin [SST: KV105H0030 (DAIMLER tool No.270 589 00 34 00)] or spindle [SST: KV105H0420 (DAIMLER tool No.270 589 00 33 02)] and plastic hammer in order to install the side rail pin.

### CAUTION:

**Install the slide rail pin with its thread part facing to the engine front.**

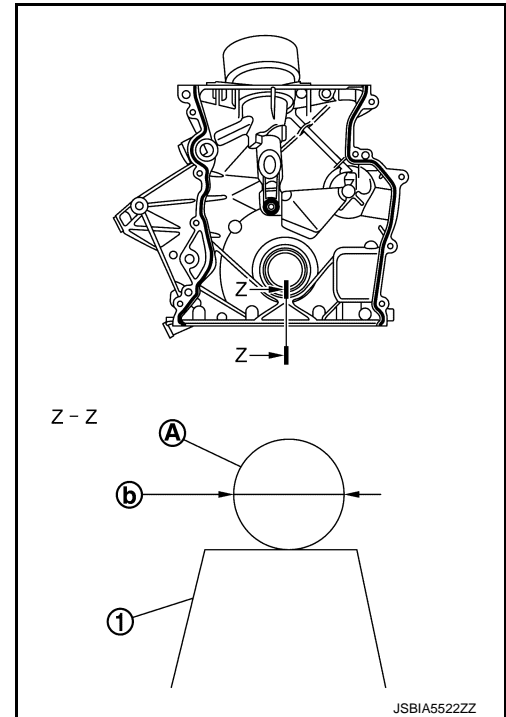
6. Install the slide rail pin cap.
7. Install the timing case cover with the following procedure.

### CAUTION:

**Clean the timing case cover, cylinder block and the oil pan using a [loctite 7200 (Henkel Loctite Deutschland GmbH Co) 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 as shown in the figure. Refer to [EM-6, "Liquid Gasket"](#)
  - Use Genuine Liquid Gasket [Loctite 5970 (A 003 989 98 20)] or equivalent.

- ① : Timing case cover
- Ⓐ : Liquid gasket
- Ⓑ :  $\phi 1.1 - 1.5 \text{ mm } (\phi 0.043 - 0.059 \text{ in})$



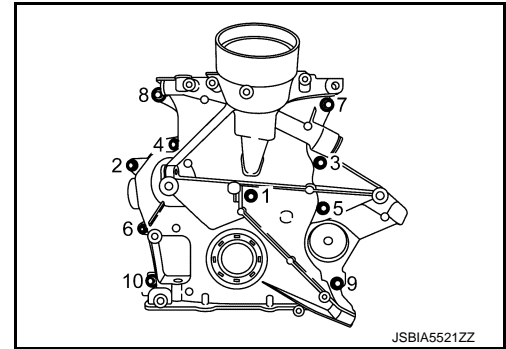
JSBIA5522ZZ

# TIMING CHAIN

## < REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

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



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

**CAUTION:**

**Never reuse the gasket.**

- d. Install the coolant hose (between the coolant thermostat and water pump) to the coolant thermostat.

8. Install the cylinder head. Refer to [EM-119, "Removal and Installation"](#).

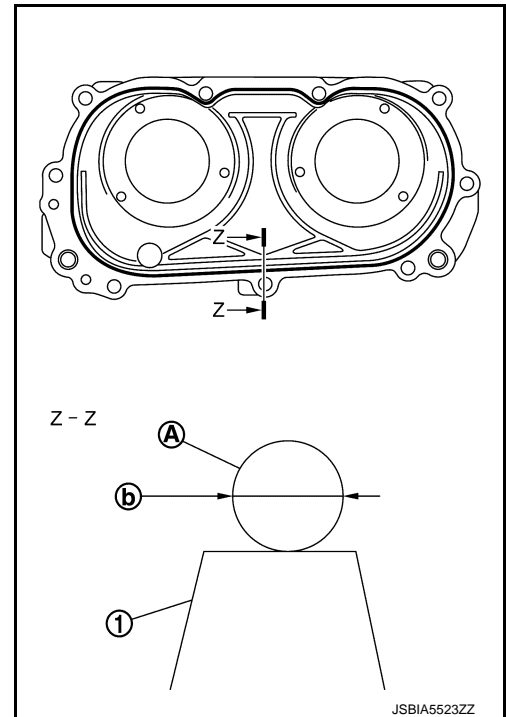
9. Install the cylinder head front cover with the following procedure.

**CAUTION:**

**Clean the cylinder head front cover and the cylinder head using a [loctite 7200 (Henkel Loctite Deutschland GmbH Co) 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 as shown in the figure. Refer to [EM-6, "Liquid Gasket"](#)

- ① : Cylinder head front cover
- Ⓐ : Liquid gasket
- ⓑ :  $\phi 0.7 - 1.3 \text{ mm}$  ( $\phi 0.028 - 0.051 \text{ in}$ )



- b. Install the cylinder head front cover mounting bolts in diagonal order.

- c. Install the oil filter screw cap. Refer to [LU-11, "Removal and Installation"](#).

- d. 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)**

- e. 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.**

# TIMING CHAIN

< REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

- f. Connect the harness connector of the intake camshaft actuator and the exhaust camshaft actuator.
- g. Install the mounting bracket of the coolant pump switchover valve and the boost pressure control vacuum transducer to timing case cover.
10. 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.
11. Install the vibration damper with the following procedure.
  - a. Fix the drive plate with crankshaft stopper [SST: KV105H0020 (112 589 03 40 00)].
  - b. Tighten the vibration damper mounting bolts to the specified torque.

 : 200.0 N·m (20.0 kg-m, 148 in-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.**

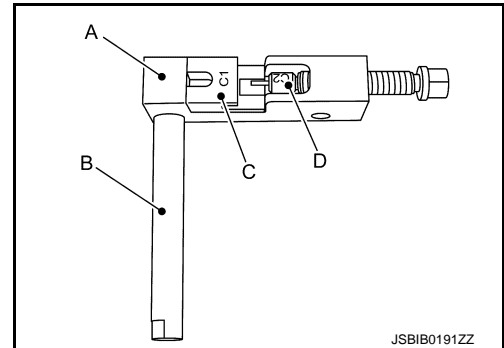
12. Install the timing chain slide rail 3.
13. Install in the reverse order of removal, for the rest of parts.

## Replacement

INFOID:000000014502179

1. Remove camshaft. Refer to [EM-70. "Removal and Installation"](#).
2. Replace timing chain as follows:
  - a. Assemble the rivet press tool [SST: KV105H0530 (DAIMLER tool No.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:**

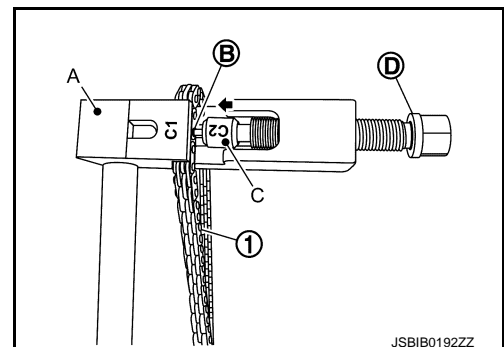
**When slide (←) the thrust piece C2 (C), check that it is touching the pin (B) securely.**

- ⓓ : 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 drop pin into the timing case cover.**

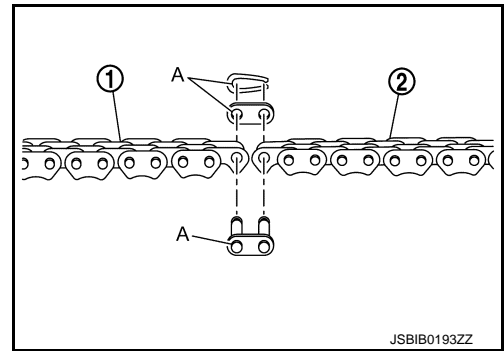


# TIMING CHAIN

## < REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

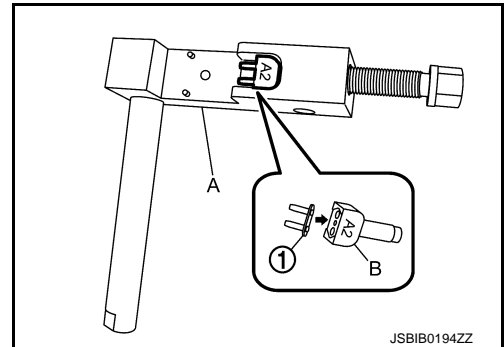
- d. Connect a new timing chain ① to the old timing chain ② using an assembly element [SST: KV105H0510 (DAIMLER tool No.271 589 09 63 00)] (A).
- e. Crank slowly in the direction of rotation until the connection surface appears.
- f. Remove the assembly element and the old timing chain.



### 3. Assemble timing chain as follows:

- a. Set riveted link ① to the rivet press tool [SST: KV105H0530 (DAIMLER tool No.276 589 00 39 00)].

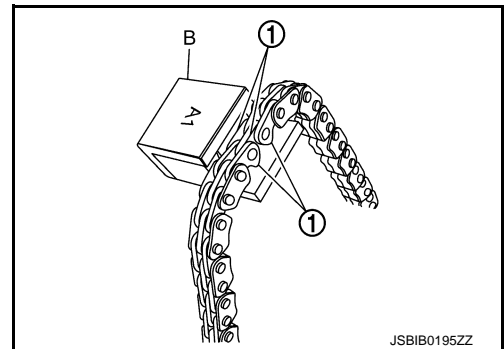
- A : Base carrier
- B : Thrust piece A2



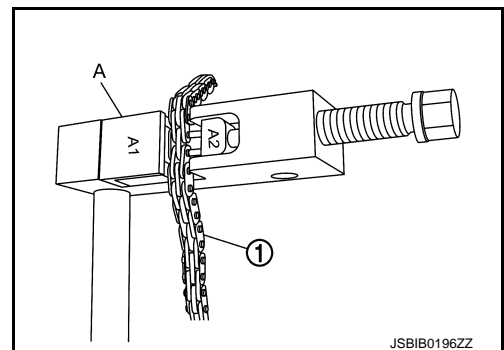
- b. Set plates ① and both ends ① of new timing chain to mount A1 (B).

**CAUTION:**

**Never drop the new riveted link into the timing case cover.**



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



# TIMING CHAIN

## < REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

- d. Screw in the spindle (A) to press riveted link.

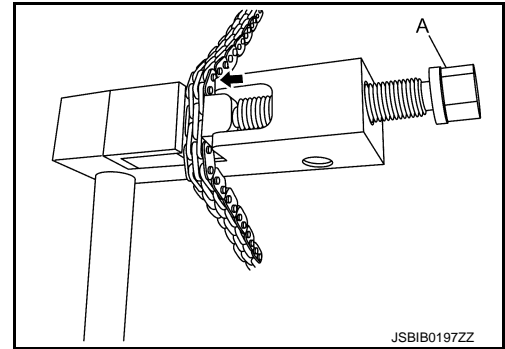
**CAUTION:**

Confirm that there is a gap between timing chain, riveted link and plates.

- e. Remove timing chain from rivet press tool [SST: KV105H0530 (DAIMLER tool No.276 589 00 39 00)].

**CAUTION:**

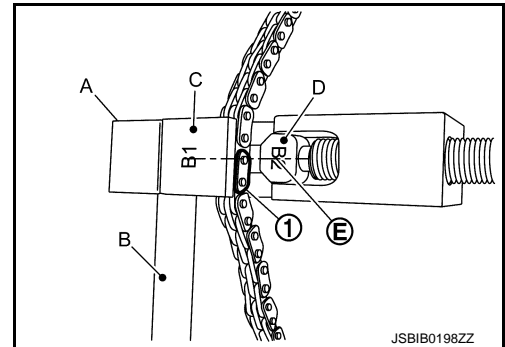
Confirm that the part which inserted riveted link moves.



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

- a. Assemble the rivet press tool [SST: KV105H0530 (DAIMLER tool No.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 (DAIMLER tool No.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.

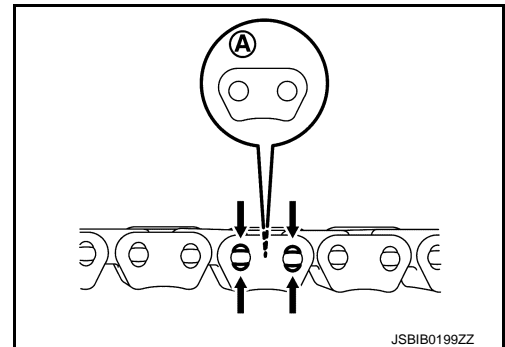
**NOTE:**

Using the thrust piece B2 both pins of the riveted link can be riveted once.

5. Check riveting (◀) on riveted link and rivet 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 [EC4-206](#), "[Special Repair Requirement List](#)".



INFOID:000000012947399

## Inspection

### INSPECTION AFTER REMOVAL

#### Appearance of Vibration Damper

- Check for any excessive wear and damage at the matching surface of oil seal.
- If anything found, replace vibration damper.

#### 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

## TIMING CHAIN

### < REMOVAL AND INSTALLATION >

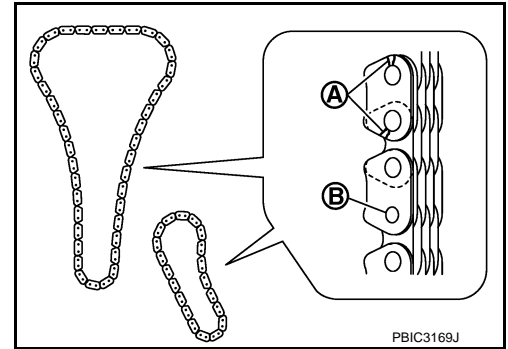
[2.0L TURBO GASOLINE ENGINE]

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

Ⓐ : Crack

Ⓑ : Wear

- If anything found, replace timing chain.





# ENGINE ASSEMBLY

< UNIT REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

## UNIT REMOVAL AND INSTALLATION

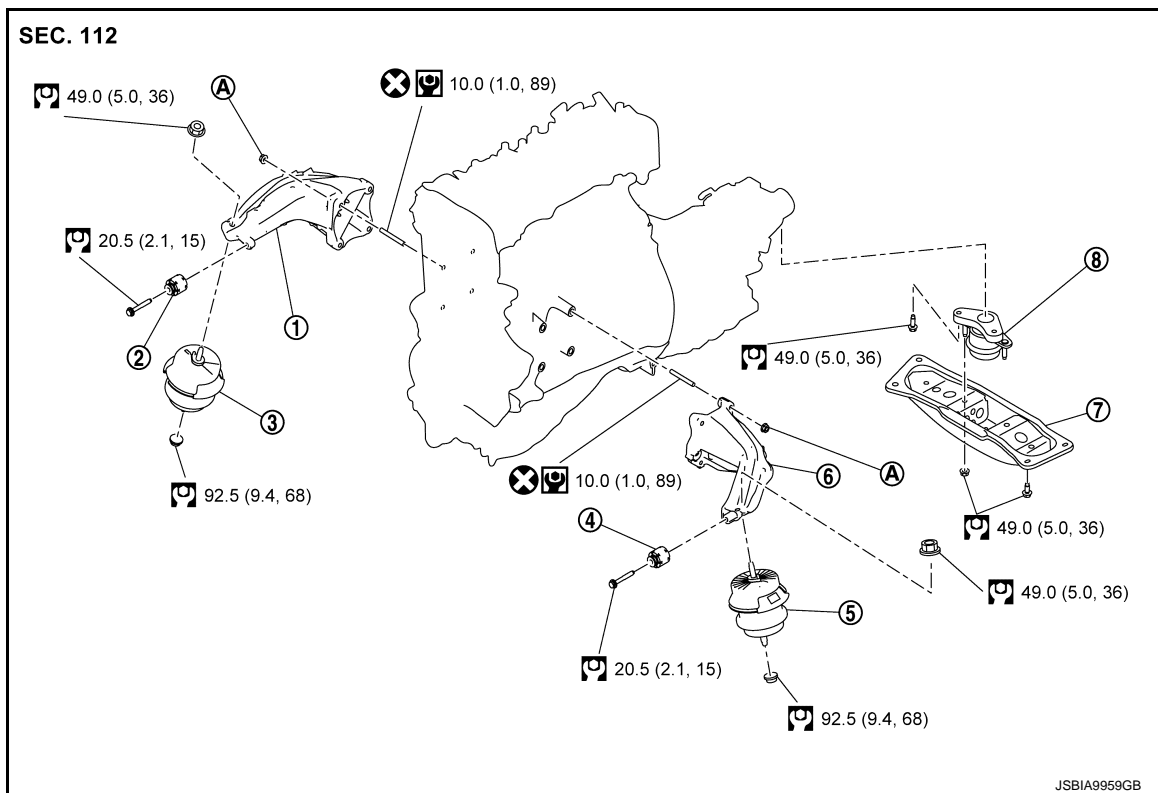
### ENGINE ASSEMBLY

Exploded View

INFOID:000000012947388

EM

2WD



- |                                |                                  |                                  |
|--------------------------------|----------------------------------|----------------------------------|
| ① Engine mounting bracket (RH) | ② Dynamic damper (RH)            | ③ Engine mounting insulator (RH) |
| ④ Dynamic damper (LH)          | ⑤ Engine mounting insulator (LH) | ⑥ Engine mounting bracket (LH)   |
| ⑦ Rear engine mounting member  | ⑧ Rear engine mount              |                                  |

Comply with the assembly procedure when tightening. Refer to [EM-102, "Removal and Installation"](#).

⊗: Always replace after every disassembly

Ⓜ: N-m (kg-m, ft-lb)

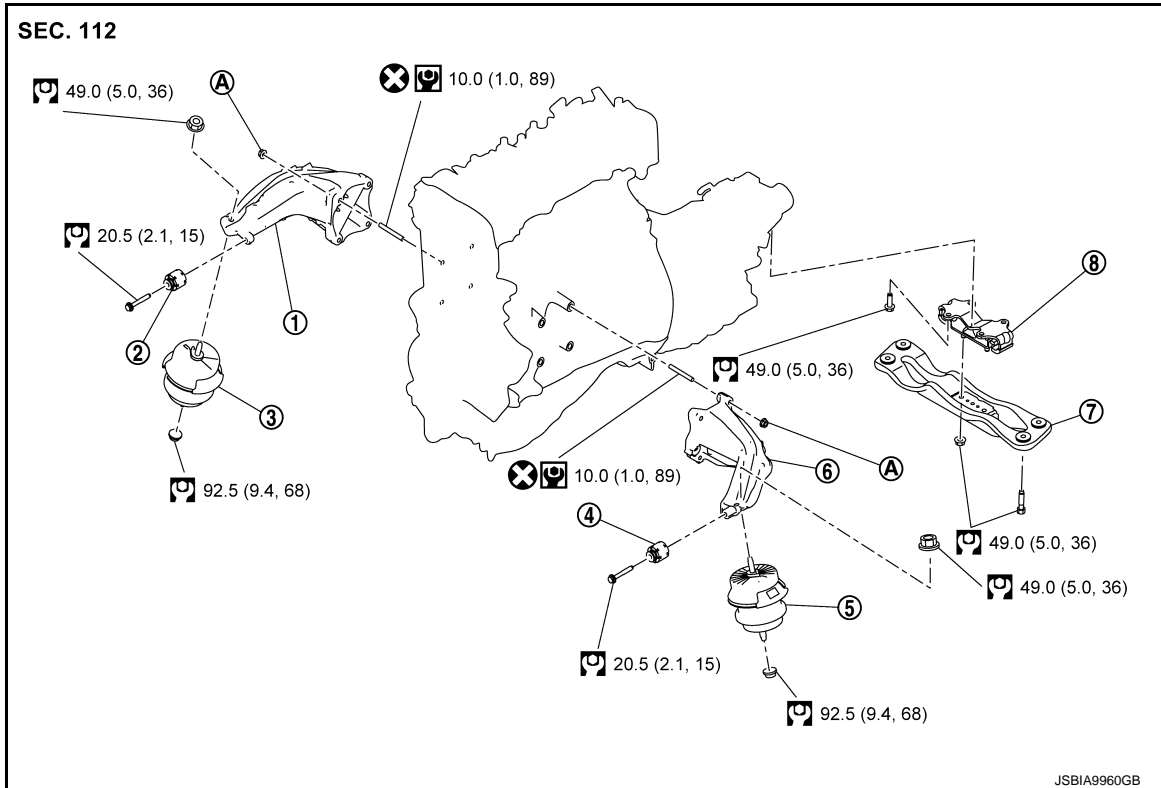
Ⓜ: N-m (kg-m, in-lb)

# ENGINE ASSEMBLY

< UNIT REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

AWD



- |                                |                                  |                                  |
|--------------------------------|----------------------------------|----------------------------------|
| ① Engine mounting bracket (RH) | ② Dynamic damper (RH)            | ③ Engine mounting insulator (RH) |
| ④ Dynamic damper (LH)          | ⑤ Engine mounting insulator (LH) | ⑥ Engine mounting bracket (LH)   |
| ⑦ Rear engine mounting member  | ⑧ Rear engine mount              |                                  |

A Comply with the assembly procedure when tightening. Refer to [EM-102, "Removal and Installation"](#).

X Always replace after every disassembly

U N·m (kg-m, ft-lb)

V N·m (kg-m, in-lb)

## Removal and Installation

INFOID:000000012947389

### WARNING:

- Situate the vehicle on a flat and solid surface.
- Place chocks at the front and back of rear wheels.
- For engines not equipped with engine slingers, attach proper slingers and bolts described in PARTS CATALOG.

### 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-30, "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

# ENGINE ASSEMBLY

## < UNIT REMOVAL AND INSTALLATION >

## [2.0L TURBO GASOLINE ENGINE]

### Outline

At first, remove the engine and the transmission assembly with front suspension member facing downward. Then separate the engine from transmission.

### 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 located.
  - 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 both battery cables. Refer to [PG-261, "2.0L TURBO GASOLINE ENGINE : Removal and Installation"](#).
4. Drain engine coolant from radiator. Refer to [CO-7, "Draining"](#).

#### CAUTION:

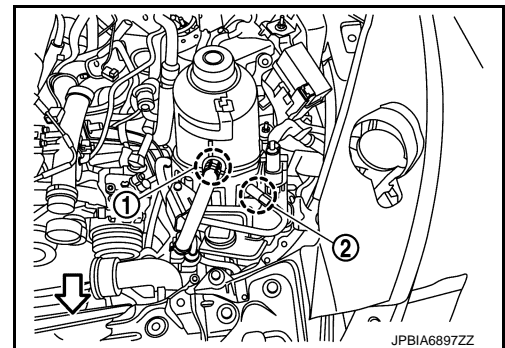
- Perform this step when engine is cold.
- Never spill engine coolant on drive belt.

5. Remove the following parts:
  - Engine cover: Refer to [EM-22, "Removal and Installation"](#).
  - Air duct (inlet): Refer to [EM-25, "Removal and Installation"](#).
  - Front road wheel and tires
  - Front undercover: Refer to [EXT-35, "FRONT UNDER COVER : Removal and Installation"](#).
  - Floor undercover: Refer to [EXT-36, "FLOOR UNDER COVER : Removal and Installation"](#).
  - Fender protector front (LH and RH) and splash guard (LH and RH): Refer to [EXT-30, "FENDER PROTECTOR : Removal and Installation"](#).
  - Air duct (turbocharger side): Refer to [EM-25, "Removal and Installation"](#).
  - ECM: Refer to [EC4-967, "Removal and Installation"](#).
  - Oil level gauge and oil level gauge guide: Refer to [EM-109, "2WD : Exploded View"](#) (2WD), [EM-111, "AWD : Exploded View"](#) (AWD).
6. Remove drive belt. Refer to [EM-16, "Removal and Installation"](#).
7. Remove coolant hoses (upper and lower). Refer to [CO-11, "Removal and Installation"](#).
8. Disconnect reservoir tank hose from engine side. Refer to [CO-11, "Exploded View"](#).

### Engine Room LH

1. Remove air cleaner case assembly. Refer to [EM-25, "Removal and Installation"](#).
2. Remove charge air tube 2. Refer to [EM-33, "Exploded View"](#).
3. Remove charge air manifold. Refer to [EM-29, "Removal and Installation"](#).
4. Remove alternator. Refer to [CHG-25, "2.0L TURBO GASOLINE ENGINE : Removal and Installation"](#).
5. Remove power steering hose from vehicle side as follows:
  - a. Disconnect power steering hose ① and pipe ② from power steering reservoir tank.

← : Vehicle front

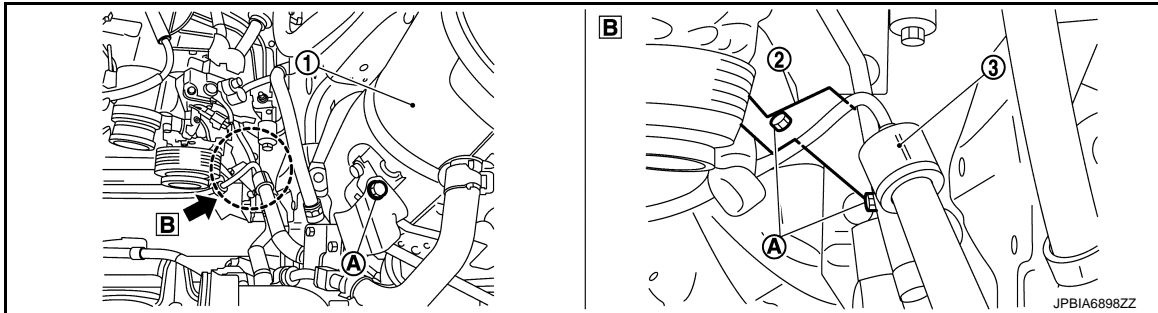


# ENGINE ASSEMBLY

## < UNIT REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

- b. Remove mounting bolts (A) of power steering hose and pipe brackets.



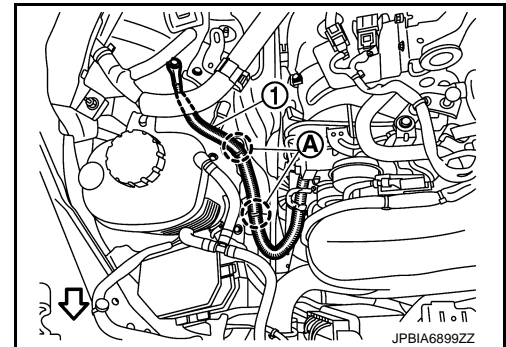
- ① Power steering reservoir tank      ② Bracket      ③ Clamp  
 B View B

- c. Move power steering hose and pipe to engine side, and temporarily secure it aside.  
 d. Disconnect A/C compressor harness connector.  
 6. Remove A/C compressor mounting bolts, and temporarily fasten it on vehicle with a rope. Refer to [HA-31. "Removal and Installation"](#).

### Engine room RH

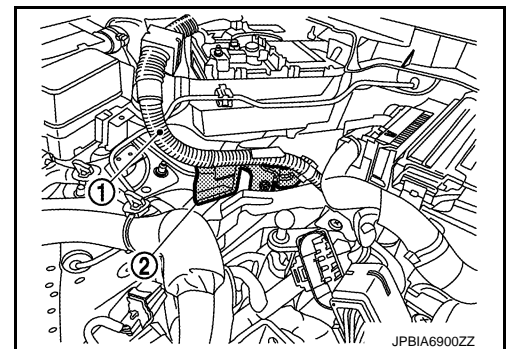
1. Remove charge air hose 1. Refer to [EM-33. "Exploded View"](#).  
 2. Remove ground cable (1) from vehicle side.

← : Vehicle front



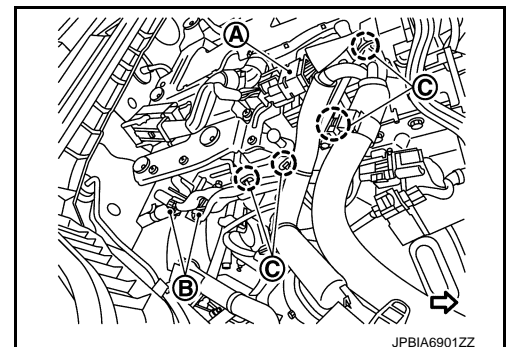
3. Remove hoodledge cover LH. Refer to [EXT-27. "Removal and Installation"](#).  
 4. Remove battery cable bracket (2).

① : Battery cable



5. Disconnect engine harness connectors (A) and (B), temporarily secure it aside after disconnect harness clips (C)

← : Vehicle front



# ENGINE ASSEMBLY

## < UNIT REMOVAL AND INSTALLATION >

## [2.0L TURBO GASOLINE ENGINE]

### Engine room Rear

1. Disconnect brake booster vacuum hose from engine side. Refer to [BR-46, "Removal and Installation"](#).
2. Disconnect heater hoses from engine side.

### Vehicle Underbody

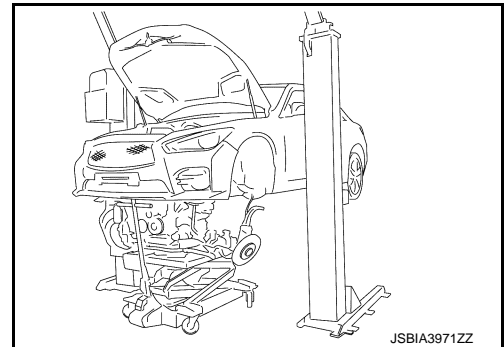
1. Remove exhaust front tube. Refer to [EX-12, "Exploded View"](#).
2. Remove front propeller shaft.(AWD models) Refer to [DLN-101, "Removal and Installation"](#).
3. Remove front drive shaft.(AWD models) Refer to [FAX-27, "Exploded View"](#).
4. Remove propeller shaft. Refer to [DLN-111, "2WD : Removal and Installation"](#) (2WD), [DLN-115, "AWD : Removal and Installation"](#) (AWD).
5. Disengage A/T control rod at A/T shift selector side. Then, temporarily secure it on the transmission assembly, so that it does not sag. Refer to [TM-292, "Removal and Installation"](#).
6. Remove A/T fluid cooler hoses from engine side. Refer to [TM-318, "2.0L TURBO GASOLINE ENGINE : Removal and Installation"](#).
7. Disconnect steering lower joint at power steering gear assembly side, and release steering lower shaft. Refer to [ST-40, "Removal and Installation"](#).
8. Disconnect ground cables from engine side.
9. Separate upper link (LH and RH) from steering knuckle. Refer to [FSU-17, "Exploded View"](#).
10. Separate shock absorber (LH and RH) from transverse link. Refer to [FSU-11, "Removal and Installation"](#) (2WD), [FSU-58, "Removal and Installation"](#) (AWD).
11. Remove brake caliper assembly (LH and RH). Refer to [BR-58, "BRAKE CALIPER ASSEMBLY \(2 PISTON TYPE\) : Removal and Installation"](#).
12. Remove front wheel sensor (LH and RH) for ABS from steering knuckle. Refer to [BRC-191, "FRONT WHEEL SENSOR : 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. Remove rear engine mounting member bolts.
4. Remove front suspension member mounting bolts and nuts. Refer to [FSU-43, "Exploded View"](#) (2WD), [FSU-71, "Exploded View"](#) (4WD).
5. Carefully lower jack, or raise lift, to remove the engine, the transmission assembly and front suspension member. 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.**

### Separation Work

1. Remove engine mounting insulators (RH and LH) under side nuts with power tool.
2. Lift with hoist and separate the engine and the transmission assembly from front suspension member.

#### **CAUTION:**

- **Before and during this lifting, always check that any harnesses are left connected.**

# ENGINE ASSEMBLY

< UNIT REMOVAL AND INSTALLATION >

[2.0L TURBO GASOLINE ENGINE]

- Never damage engine mounting insulator and avoid oil/grease smearing or spills onto engine mounting insulator.
3. Remove fluid cooler tube A and fluid cooler tube B. Refer to [TM-318, "2.0L TURBO GASOLINE ENGINE : Removal and Installation"](#).
  4. Remove starter motor. Refer to [STR-23, "2.0L TURBO GASOLINE ENGINE : Removal and Installation"](#).
  5. Separate the engine from the transmission assembly. Refer to [TM-334, "2.0L TURBO GASOLINE ENGINE : Removal and Installation"](#) (2WD), [TM-339, "VR30DDTT : Removal and Installation"](#) (4WD).
  6. Remove each engine mounting insulator and each engine mounting bracket from the engine with power tool.
  7. Remove stud bolts from engine.

## 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-107, "Inspection"](#).
- If a engine assembly is replaced, carry out followings:
  - Teach of camshaft position: Refer to [EC4-215, "Description"](#).
  - Camshaft reference adaptation: Refer to [EC4-214, "Description"](#).
- If a starter motor is replaced, carry out of the starter operation counter clear. Refer to [EC4-218, "Description"](#).
- If an sensors and actuators is replaced, carry out the resting of adaptation values. Refer to [EC4-216, "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-101, "Exploded View"](#).
- Check DTC and erase DTC.

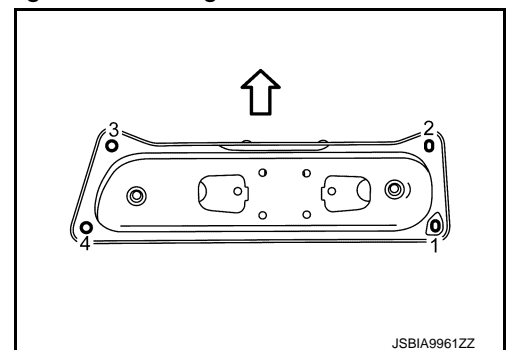
### NOTE:

- Erase DTC detected while releasing fuel pressure.
- When Installing engine mounting bracket with the following procedure:
  1. Tighten engine mounting bracket mounting bolts.

 **Torque: 20.0 N·m (2.0 kg·m, 15 ft·lb)**

2. Turn engine mounting bracket mounting bolts 90 degrees clockwise (angle tightening).
  - Check that all engine mounting insulators are seated properly, then tighten mounting nuts.
  - Tighten rear engine mounting member bolts in the order from 1 to 4 as shown in the figure.(2WD models)

 : Vehicle front



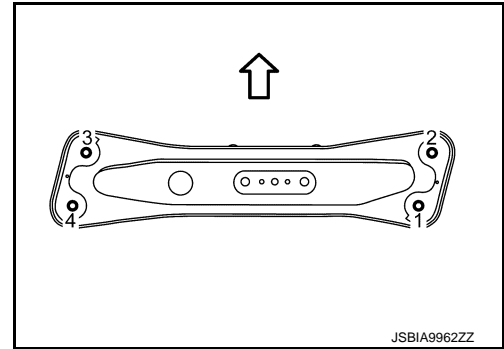
# ENGINE ASSEMBLY

## < UNIT REMOVAL AND INSTALLATION >

## [2.0L TURBO GASOLINE ENGINE]

- Tighten rear engine mounting member bolts in the order from 1 to 4 as shown in the figure.(AWD models)

← : Vehicle front



## Inspection

INFOID:000000012947390

### 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-20, "Recommended Fluids and Lubricants"](#).
- 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:000000012947391

1. Remove the engine assembly and transmission assembly from the vehicle, and separate the transmission assembly from engine assembly. Refer to [TM-334, "2.0L TURBO GASOLINE ENGINE : Removal and Installation"](#) (2WD), [TM-339, "VR30DDTT : Removal and Installation"](#) (AWD).
2. Install engine to engine stand with the following procedure:

**NOTE:**

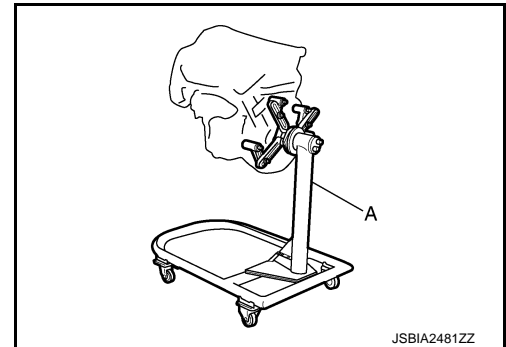
Explained here is how to disassemble with engine stand supporting transmission surface. When using different type of engine stand, note with difference in steps and etc.

- a. Remove the drive plate. Refer to [EM-86, "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-9, "Draining"](#).



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# OIL PAN

< UNIT DISASSEMBLY AND ASSEMBLY >

[2.0L TURBO GASOLINE ENGINE]

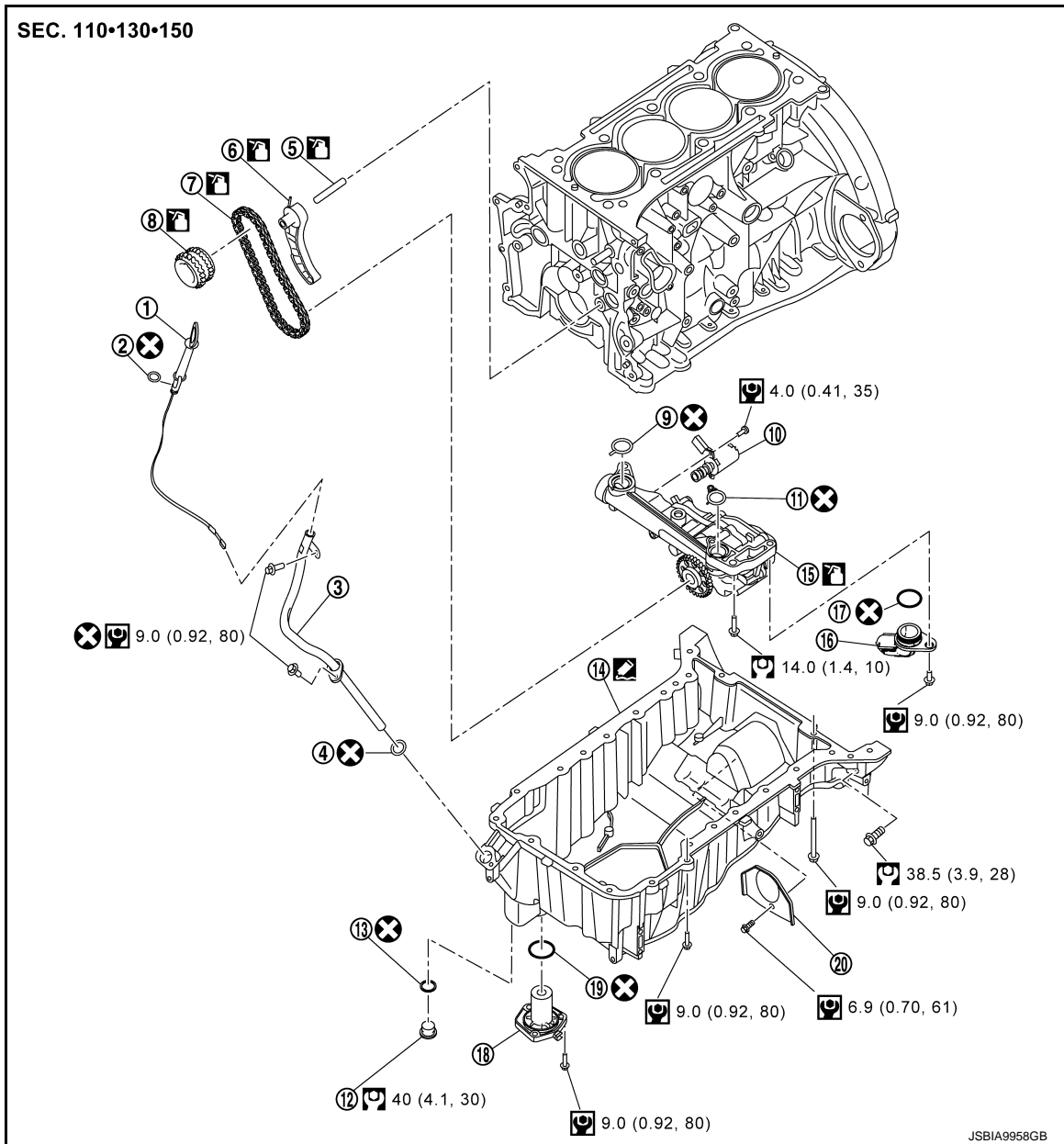
## OIL PAN

2WD

2WD : Exploded View

INFOID:000000013477893

A  
EM




C  
D  
E  
F  
G  
H  
I  
J  
K  
L  
M  
N

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


⊗ : Always replace after every disassembly.

🔧 : N·m (kg-m, in-lb)

O  
P

 : N·m (kg-m, ft-lb)

 : Sealing point

 : Should be lubricated with oil.

## 2WD : Removal and Installation

INFOID:000000012947393

### REMOVAL

1. Drain engine oil. Refer to [LU-9, "Draining"](#).
2. Remove the drive plate. Refer to [EM-86, "Removal and Installation"](#).
3. Remove the oil pan with the following procedure.
  - a. Remove the mounting bolts of oil pan.
  - 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:

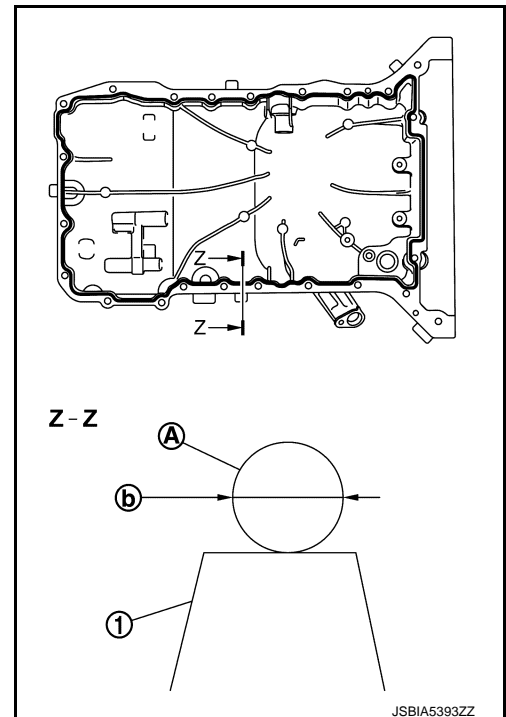
Clean the cylinder head and the cylinder head cover using a [Loctite 7200 (Henkel Loctite Deutschland GmbH Co) and Loctite 7063 150ml (A 001 986 71 71 10), or equivalent].

1. Install the oil pan with the following procedure.
  - a. Apply the liquid gasket (A) evenly (no break, no overlap) to the matching surface of oil pan (1) as shown in the figure. Refer to [EM-6, "Liquid Gasket"](#).
    - Use Genuine Liquid Gasket [Loctite 5970 (A 003 989 98 20)] or equivalent.

① : Oil pan

(A) : Liquid gasket

(b) :  $\phi 1.0 - 3.0$  mm (0.04 - 0.11 in)



JSBIA5393ZZ

2. Install the oil pan drain plug.
 

#### CAUTION:

Never reuse the drain plug 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.

### AWD

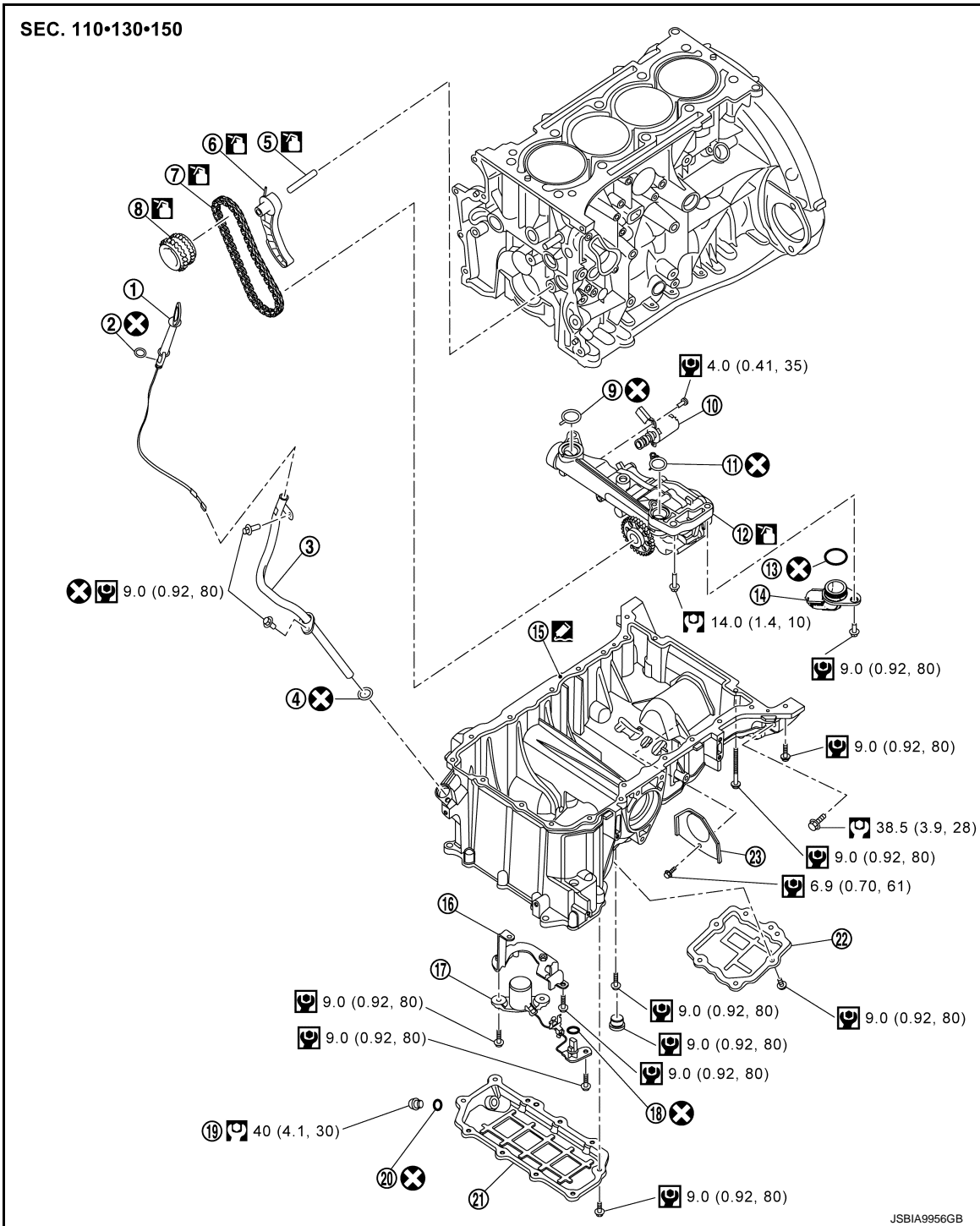
# OIL PAN

< UNIT DISASSEMBLY AND ASSEMBLY >

[2.0L TURBO GASOLINE ENGINE]

AWD : Exploded View

INFOID:000000013477892



- |                                   |                           |                         |
|-----------------------------------|---------------------------|-------------------------|
| ① Oil level gauge                 | ② O-ring                  | ③ Oil level gauge guide |
| ④ O-ring                          | ⑤ Slide rail pin          | ⑥ Timing chain guide    |
| ⑦ Timing chain (oil pump)         | ⑧ Crank sprocket          | ⑨ O-ring                |
| ⑩ Engine oil pump valve           | ⑪ O-ring                  | ⑫ Engine oil pump       |
| ⑬ O-ring                          | ⑭ Oil suction pipe        | ⑮ Oil pan               |
| ⑯ Engine oil level switch bracket | ⑰ Engine oil level switch | ⑱ O-ring                |
| ⑲ Oil drain screw                 | ⑳ Oil drain screw washer  | ㉑ Oil pan (lower front) |

JSBIA9956GB

- ②② Oil pan (lower rear)                      ②③ Rear plate cover
- ⊗ : Always replace after every disassembly.
- 🔧 : N·m (kg-m, in-lb)
- 🔧 : N·m (kg-m, ft-lb)
- 🔧 : Sealing point
- 🛢️ : Should be lubricated with oil.

## AWD : Removal and Installation

INFOID:000000013476179

### REMOVAL

1. Drain engine oil. Refer to [LU-9, "Draining"](#).
2. Remove the drive plate. Refer to [EM-86, "Removal and Installation"](#).
3. Remove the oil pan with the following procedure.
  - a. Remove the mounting bolts of oil pan.
  - b. Cut the liquid gasket by prying around the oil pan, and then remove the oil pan.

**CAUTION:**

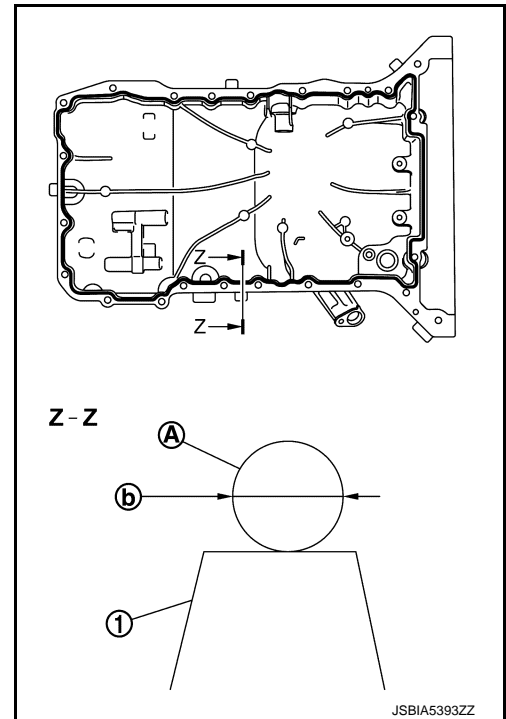
  - Never use the seal cutter.
  - Be careful not to damage the mating surface.
  - Never pick the area forcibly with a screw driver.

### INSTALLATION

**CAUTION:**  
**Clean the cylinder head and the cylinder head cover using a [loctite 7200 (Henkel Loctite Deutschland GmbH Co) 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 (A) evenly (no break, no overlap) to the matching surface of oil pan (1) as shown in the figure. Refer to [EM-6, "Liquid Gasket"](#).
    - Use Genuine Liquid Gasket [Loctite 5970 (A 003 989 98 20)] or equivalent.

- ① : Oil pan
- Ⓐ : Liquid gasket
- ⓑ :  $\phi 1.0 - 3.0$  mm (0.04 - 0.11 in)



2. Install the oil pan drain plug.
 

**CAUTION:**  
**Never reuse the drain plug washer.**
3. Install in the reverse order of removal, for the rest of parts.

# OIL PAN

< UNIT DISASSEMBLY AND ASSEMBLY >

[2.0L TURBO GASOLINE ENGINE]

**CAUTION:**

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

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# LANCHESTER BALANCER

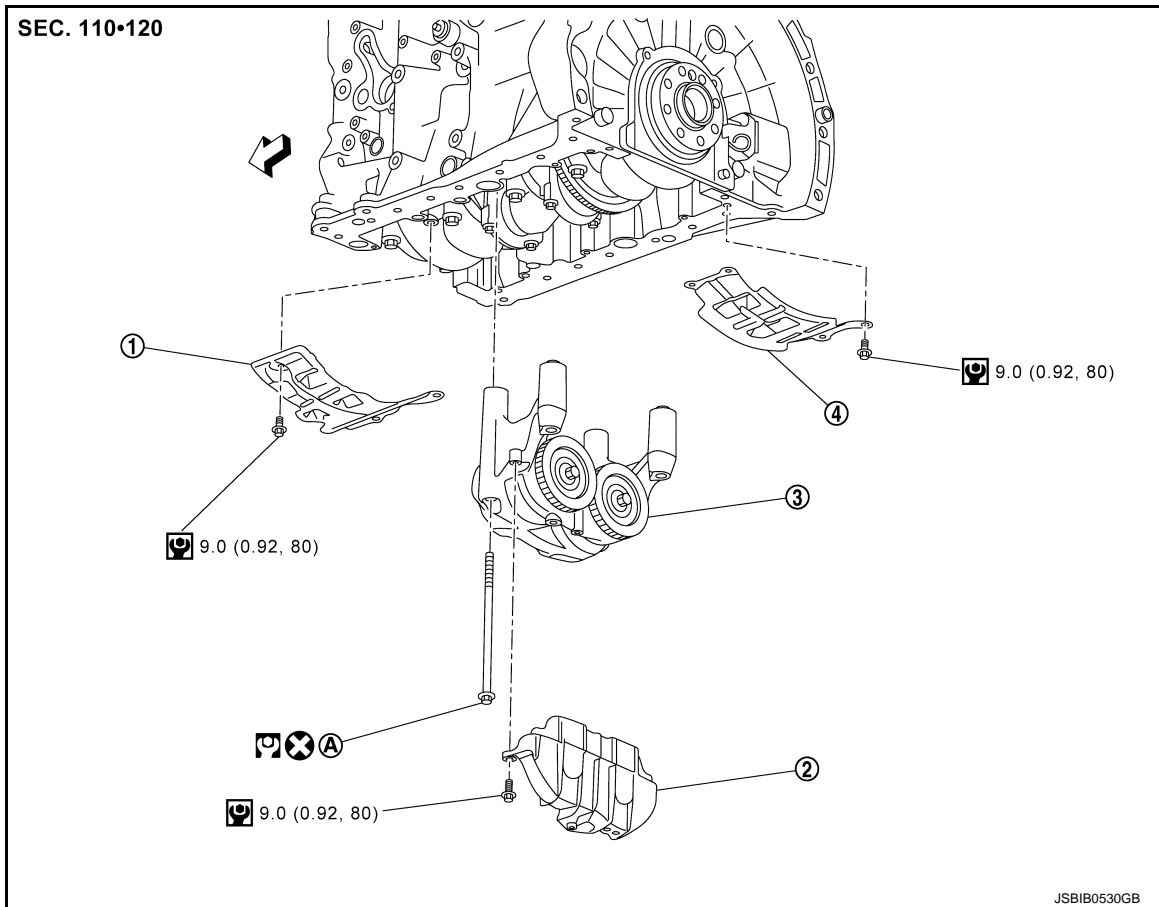
< UNIT DISASSEMBLY AND ASSEMBLY >

[2.0L TURBO GASOLINE ENGINE]

## LANCHESTER BALANCER

### Exploded View

INFOID:000000014502180



- ① Deflector 2
- ② Cover
- ③ Lanchester balancer
- ④ Deflector 1

Comply with the installation procedure when tightening. Refer to [EM-114](#).

⇐ : Engine front

⊙ : N-m (kg-m, ft-lb)

⊛ : N-m (kg-m, in-lb)

⊗ : Always replace after every disassembly.

## Removal and Installation

INFOID:000000014502181

### REMOVAL

1. Set No.1 cylinder at TDC of its compression stroke. Refer to [EM-70, "Removal and Installation"](#).
2. Remove oil pan. Refer to [EM-110, "2WD : Removal and Installation"](#) (2WD) [EM-112, "AWD : Removal and Installation"](#) (AWD).
3. Remove the oil suction pipe. Refer to [LU-16, "Removal and Installation"](#).
4. Remove the oil deflector 1.
5. Remove the cover.

# LANCHESTER BALANCER

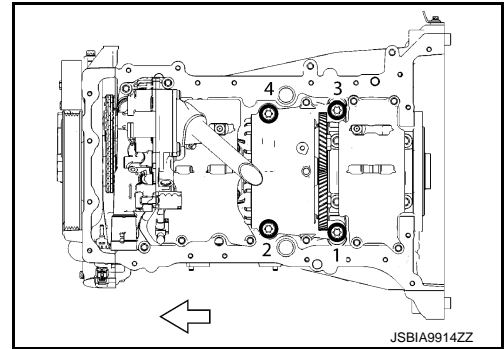
< UNIT DISASSEMBLY AND ASSEMBLY >

[2.0L TURBO GASOLINE ENGINE]

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

← : Engine front

- Remove the oil deflector 2, if necessary.



## INSTALLATION

New Lanchester Balancer

### CAUTION:

When installing a lanchester balancer, always check that cylinder head and crankshaft are installed to cylinder block.

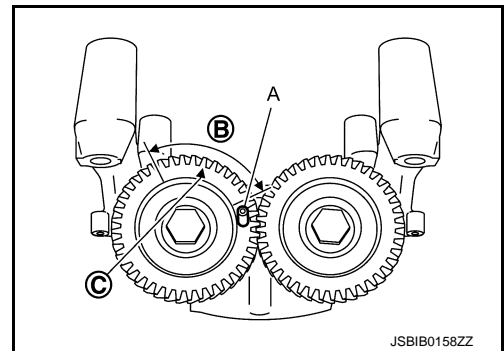
- Check that the marking shown by arrow © on the left spur gear is aligned with the one on the crankshaft gear side and install a new lanchester balancer to cylinder block.

### CAUTION:

Never scratch the coating area.

A : Pin

ⓑ : Coating area



- Press the lanchester balancer ① in the direction ⓑ.

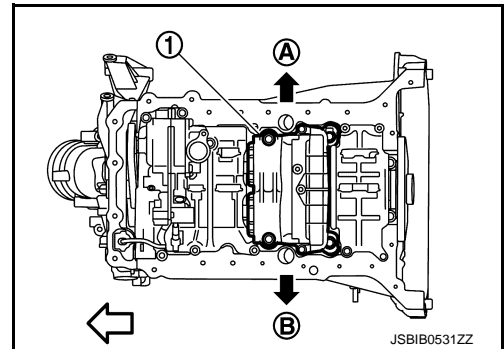
← : Engine front

Ⓐ : Adjusting direction

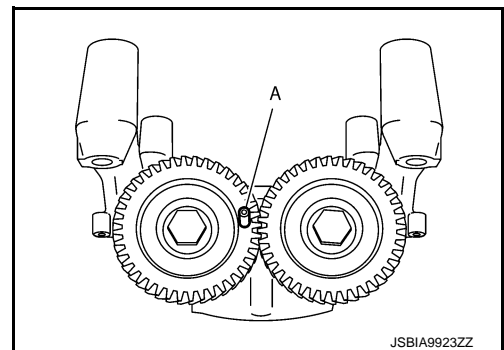
- Tighten mounting bolts by hand.

### CAUTION:

Do not reuse mounting bolts.



- Remove the pin (A).



- Measure the torsional play of lanchester balancer according to the following procedure.

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

### CAUTION:

# LANCHESTER BALANCER

< UNIT DISASSEMBLY AND ASSEMBLY >

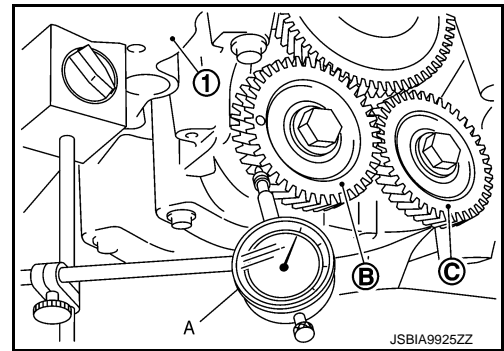
[2.0L TURBO GASOLINE ENGINE]

Use a flat tip dial gauge.

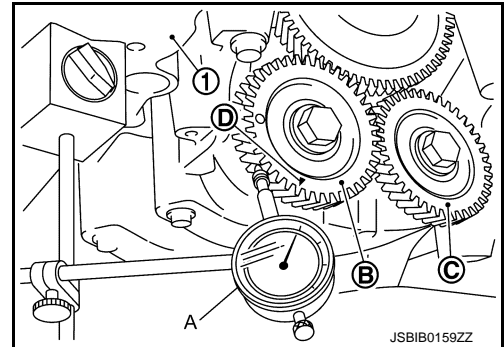
- Ⓑ : Left spur gear
- Ⓒ : Right spur gear

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

**Standard : 0.09 – 0.15 mm (0.0035 – 0.0059 in)**



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



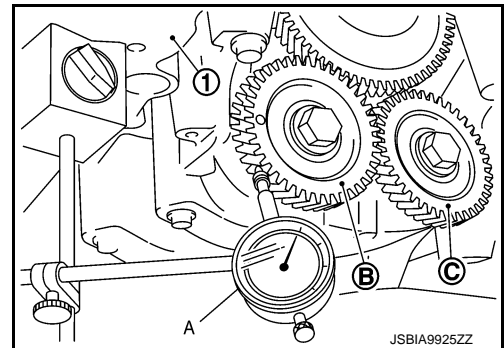
5. Measure the torsional play of lanchester balancer with the following procedure.

- 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 : 0.09 – 0.15 mm (0.0035 – 0.0059 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.

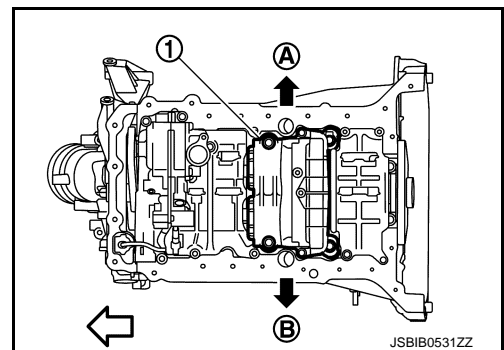
**Step1**  : 5.0 N·m (0.51 kg·m, 44 in·lb)

**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.



# LANCHESTER BALANCER

< UNIT DISASSEMBLY AND ASSEMBLY >

[2.0L TURBO GASOLINE ENGINE]

7. Measure the torsional play again.

**Standard : 0.07 – 0.13 mm (0.0028 – 0.0051 in)**

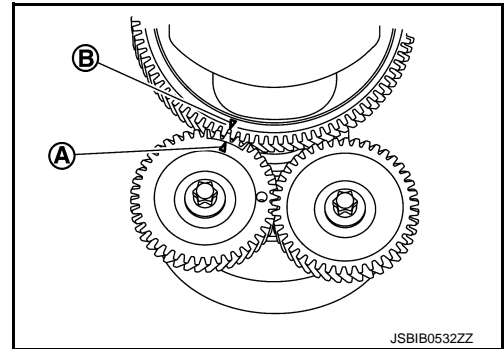
8. For the rest of parts, install in the reverse order of removal.

When Reusing Lanchester Balancer

**CAUTION:**

**When installing a lanchester balancer, always check that cylinder head and crankshaft are installed to cylinder block.**

1. Check that the marking shown by arrow (A) on the left spur gear is aligned with the one shown by arrow (B) on the crankshaft gear side and install lanchester balancer to cylinder block.



2. Install the lanchester balancer.

- Press the lanchester balancer (1) in the direction (B).

← : Engine front

(A) : 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.

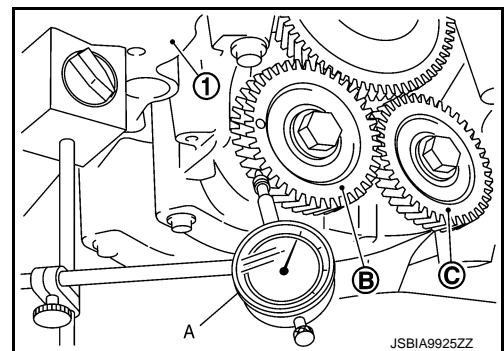
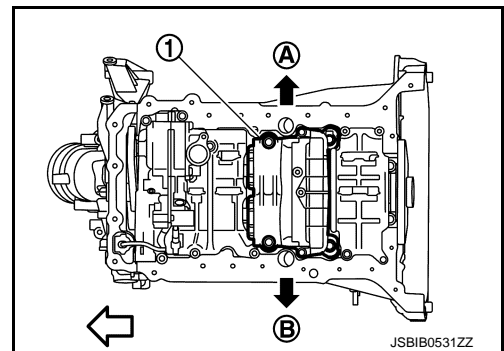
a. Set a dial indicator (A) to the cylinder block (1) and set it at 0 point.

(B) : Left spur gear

(C) : Right spur gear

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

**Standard : 0.09 – 0.15 mm (0.0035 – 0.0059 in)**



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

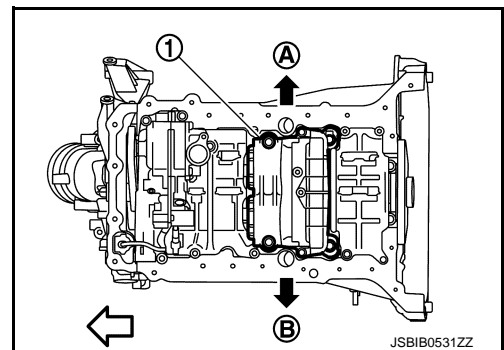
← : Engine front

(B) : 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)



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## LANCHESTER BALANCER

< UNIT DISASSEMBLY AND ASSEMBLY >

[2.0L TURBO GASOLINE ENGINE]

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- 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 : 0.07 – 0.13 mm (0.0028 – 0.0051 in)**

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

# CYLINDER HEAD

< UNIT DISASSEMBLY AND ASSEMBLY >

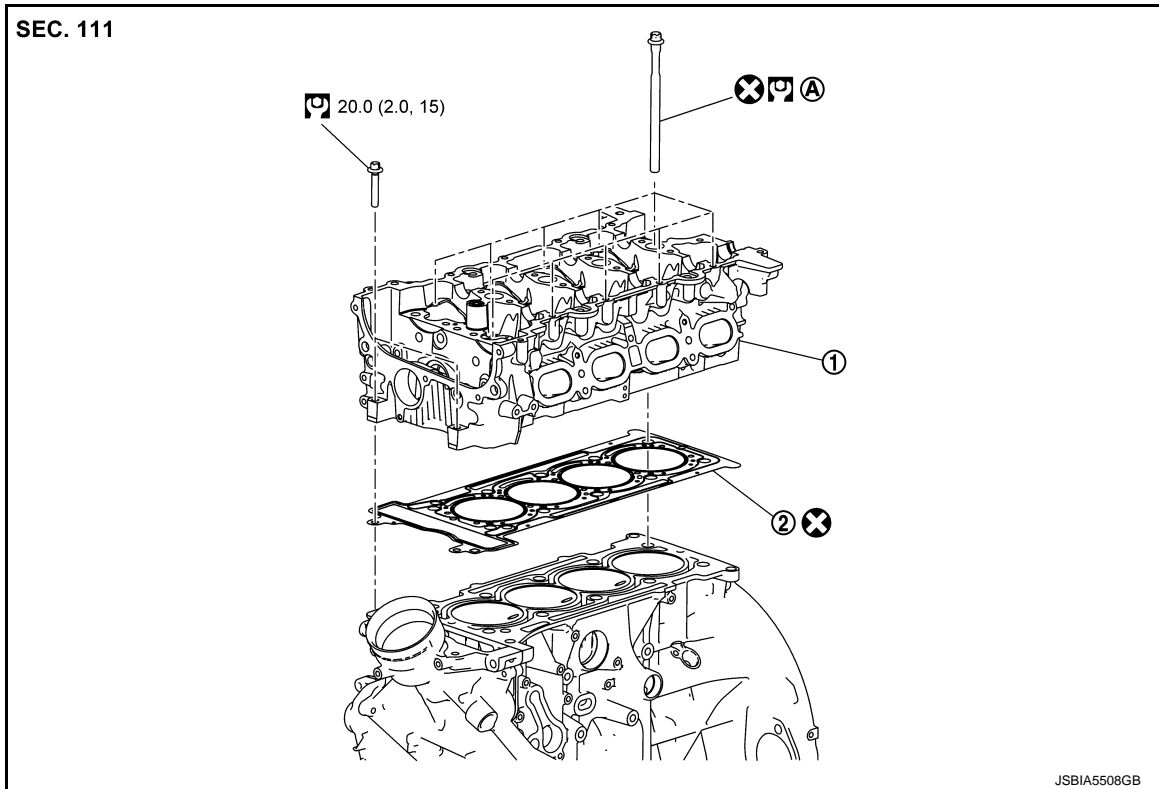
[2.0L TURBO GASOLINE ENGINE]

## CYLINDER HEAD

Exploded View

INFOID:000000012947394

REMOVAL



- ① Cylinder head                      ② Cylinder head gasket

Comply with the assembly procedure

- A when tightening. Refer to [EM-65, "Removal and Installation"](#).

⊗ : Always replace after every disassembly.

⊗ : N·m (kg·m, ft·lb)

## Removal and Installation

INFOID:000000012947395

### REMOVAL

1. Drain engine oil. Refer to [LU-9, "Draining"](#).
2. 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-65, "Removal and Installation"](#).
  - Cylinder head front cover: Refer to [EM-93, "Removal and Installation"](#).
  - Camshaft: Refer to [EM-70, "Removal and Installation"](#).

# CYLINDER HEAD

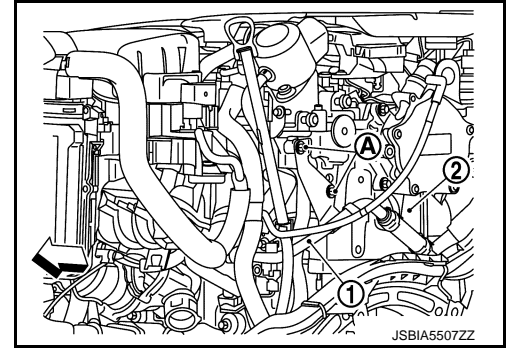
## < UNIT DISASSEMBLY AND ASSEMBLY >

[2.0L TURBO GASOLINE ENGINE]

3. Remove the mounting bolts (A) of the coolant line bracket to remove the coolant line (1).

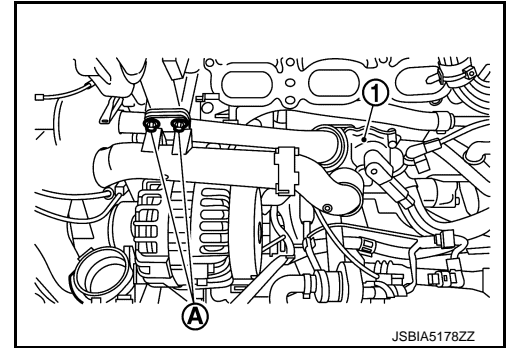
(2) : Cylinder head

← : Engine front



4. Remove the mounting bolts (A) of the coolant thermostat.

(1) : Coolant thermostat



5. Disconnect the coolant temperature sensor harness connector.  
6. Remove the spark plug. Refer to [EM-62. "Removal and Installation"](#).  
7. Remove the slide rail pin cap. Refer to [EM-93. "Exploded View"](#).

### NOTE:

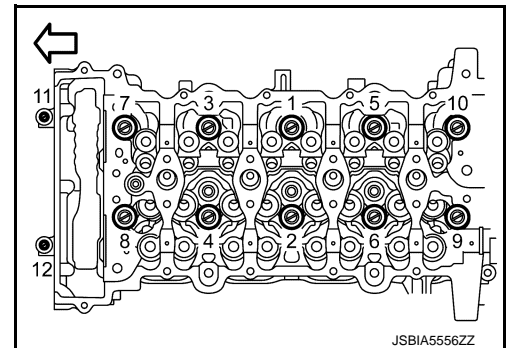
Using a suitable tool, puncture the center of the slide rail pin cap and pry out it.

8. Use the extractor impact [SST: KV115H0180 (116 589 20 33 00)] and threaded pin [SST: KV105H0030 (DAIMLER tool No.270 589 00 34 00)] or puller [SST: KV105H0410 (DAIMLER tool No.270 589 00 33 00)] and spindle [SST: KV105H0420 (270 589 00 33 02)] in order to remove the slide rail pin. Refer to [EM-93. "Removal and Installation"](#).  
9. Loosen the mounting bolts in the order from 12 to 1 as shown in the figure to remove the cylinder head.

← : Engine front

### CAUTION:

Perform this step when the engine is cold.



10. Remove the hydraulic valve clearance adjustment element as necessary. Refer to [EM-70. "Removal and Installation"](#).

## INSTALLATION

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

### NOTE:

If a sensors is replaced, carry out the reset of adaption of sensors. Refer to [EC4-216. "Description"](#).

1. Clean the cylinder head and the cylinder head cover using a [loctite 7200 (Henkel Loctite Deutschland GmbH Co) and loctite 7063 150ml (A 001 986 71 71 10), or equivalent].  
2. Use the extractor impact [SST: KV115H0180 (116 589 20 33 00)] and threaded pin [SST: KV105H0030 (DAIMLER tool No.270 589 00 34 00)] or spindle [SST: KV105H0410 (DAIMLER tool No.270 589 00 33 00)] and plastic hammer in order to install the side rail pin.

### CAUTION:

Install the slide rail pin with its thread part facing to the engine front.

# CYLINDER HEAD


< UNIT DISASSEMBLY AND ASSEMBLY >

[2.0L TURBO GASOLINE ENGINE]

- Remove the cylinder head gasket.
- Tighten the mounting bolts in the order from 1 to 12 as shown in the figure to install the cylinder head.

← : Engine front

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

 : 40.0 N·m (4.1 kg·m, 30 ft·lb)

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

**Angle tightening : 90°**

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

**Angle tightening : 90°**

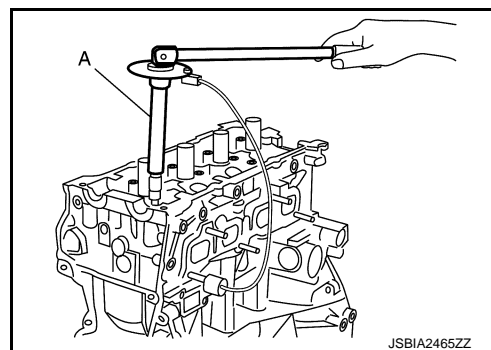
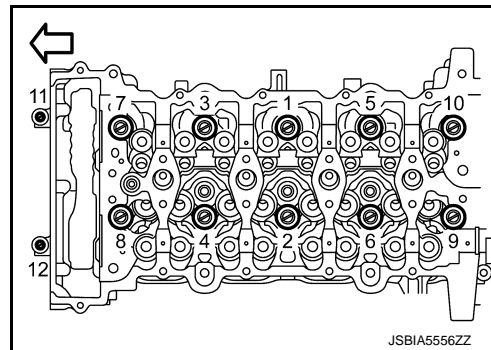
- Turn the mounting bolts clockwise in the order from 1 to 10 in the figure again.

**Angle tightening : 90°**

- Tightening the mounting bolts in the order from 11 to 12 in the figure to specified torque.

## 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.



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

## Inspection

INFOID:000000012947396

### INSPECTION AFTER REMOVAL

#### Cylinder Head Distortion

- Clean the cylinder head and the cylinder block using a [loctite 7200 (Henkel Loctite Deutschland GmbH Co) 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.**

- 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-20. "Recommended Fluids and Lubricants"](#).
- Follow the procedure below to check for fuel leakage.

## CYLINDER HEAD

< UNIT DISASSEMBLY AND ASSEMBLY >

**[2.0L TURBO GASOLINE ENGINE]**

- 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.

# CYLINDER BLOCK

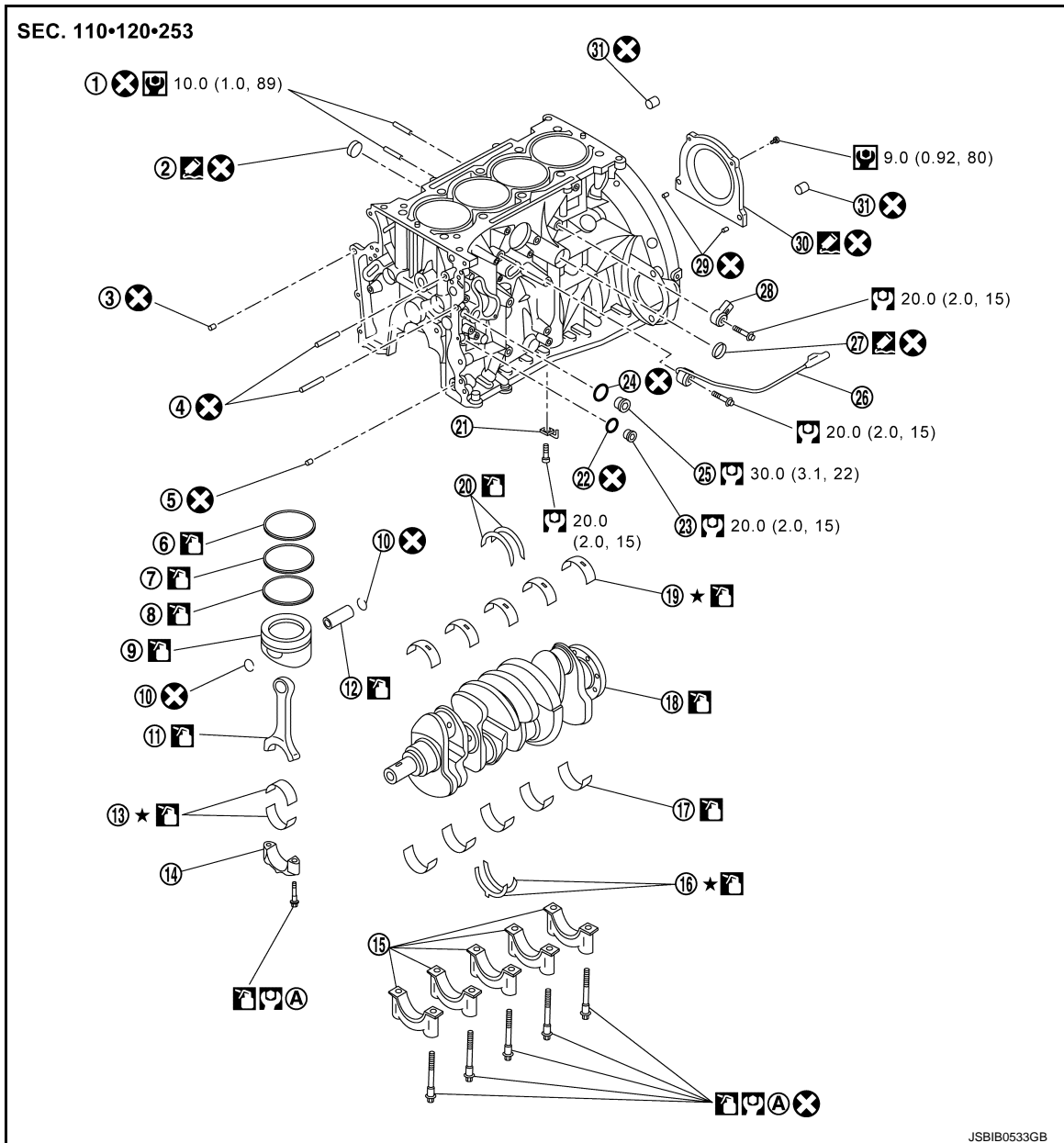
< UNIT DISASSEMBLY AND ASSEMBLY >

[2.0L TURBO GASOLINE ENGINE]

## CYLINDER BLOCK

Exploded View

INFOID:000000014502182








- |                          |                            |                            |
|--------------------------|----------------------------|----------------------------|
| ① Stud bolt              | ② Cylinder block core plug | ③ Dowel pin                |
| ④ Slide rail pin         | ⑤ Dowel pin                | ⑥ Piston ring (Top)        |
| ⑦ Piston ring (2nd)      | ⑧ Piston ring (Oil ring)   | ⑨ Piston                   |
| ⑩ Snap ring              | ⑪ Connecting rod           | ⑫ Piston pin               |
| ⑬ Connecting rod bearing | ⑭ Connecting rod cap       | ⑮ Crankshaft cap           |
| ⑯ Thrust bearing         | ⑰ Main bearing lower       | ⑱ Crankshaft               |
| ⑲ Main bearing upper     | ⑳ Thrust bearing           | ㉑ Oil jet                  |
| ㉒ O-ring                 | ㉓ Screw plug               | ㉔ O-ring                   |
| ㉕ Screw plug             | ㉖ Knock sensor 1           | ㉗ Cylinder block core plug |
| ㉘ Knock sensor 2         | ㉙ Dowel pin                | ㉚ Crankshaft end cover     |

# CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[2.0L TURBO GASOLINE ENGINE]

- ③1 Dowel pin
- : Comply with the assembly procedure when tightening. Refer to [EM-124](#), "Disassembly and Assembly".
-  : N·m (kg-m, ft-lb)
-  : N·m (kg-m, in-lb)
-  : Always replace after every disassembly.
-  : Should be lubricated with oil.
-  : Sealing point
- ★ : Select with proper thickness.

## Disassembly and Assembly

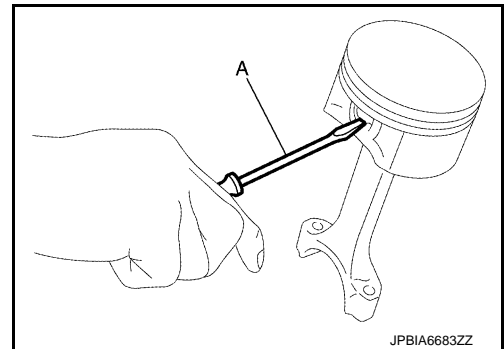
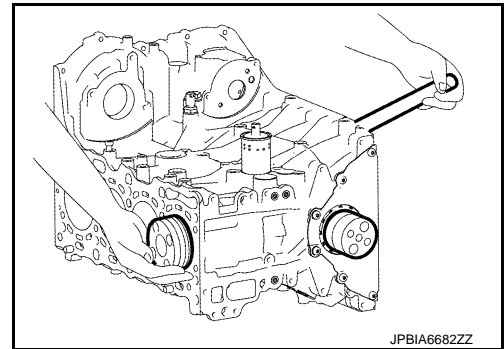
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### DISASSEMBLY

1. Remove cylinder block end cover.
2. Remove crankshaft end cover from cylinder block.
3. Remove oil jet.
4. Remove piston and connecting rod assembly.
  - Put a matching mark between the piston upper surface and the cylinder block upper surface.
  - Put a matching mark between the connecting rod bearing cap and the connecting rod.
- a. Move crankshaft pin to be removed to approximately BDC.
- b. Remove connecting rod caps.
- c. Using the grip of a hammer, press the piston and connecting rod assembly out to cylinder head side.

#### CAUTION:

- **Be careful not to damage the cylinder wall and crankshaft pin, resulting from an interference of the connecting rod big end.**
- Put a matching mark between the piston and the connecting rod.
  5. Install the connecting rod using a vice with backplates.
  6. Remove pistons from connecting rods.
    - a. Using the screwdriver (A), remove snap rings.



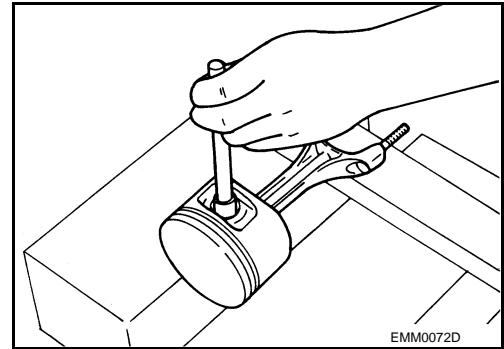


# CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[2.0L TURBO GASOLINE ENGINE]

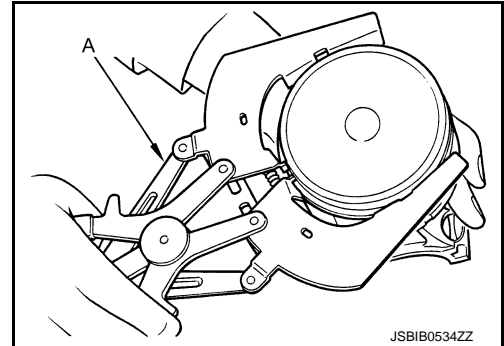
- b. Using rod with outer diameter, press piston pins out.



7. Remove piston rings from pistons using the piston ring expander (commercial service tool) (A).

**CAUTION:**

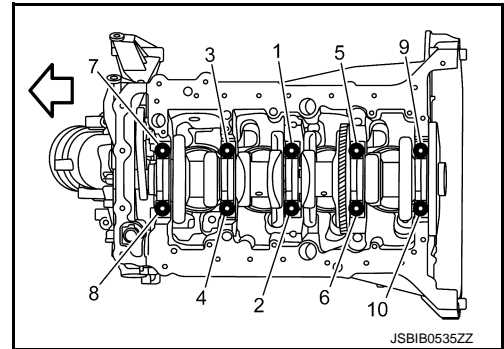
- When removing, prevent pistons from being damaged.
- Never expand piston rings excessively. This may damage piston rings.



8. Remove the main bearing cap bolts in the order of 10 to 1 as shown in the figure.

← : Engine front

- Before loosening the main bearing cap bolts, measure crankshaft end play. Refer to [EM-129, "Inspection"](#).



9. Remove crankshaft.

10. Remove main bearings and thrust bearings from cylinder block and main bearing caps.

**CAUTION:**

**Check the correct installation locations of removed parts. Store them so they never get mixed up.**

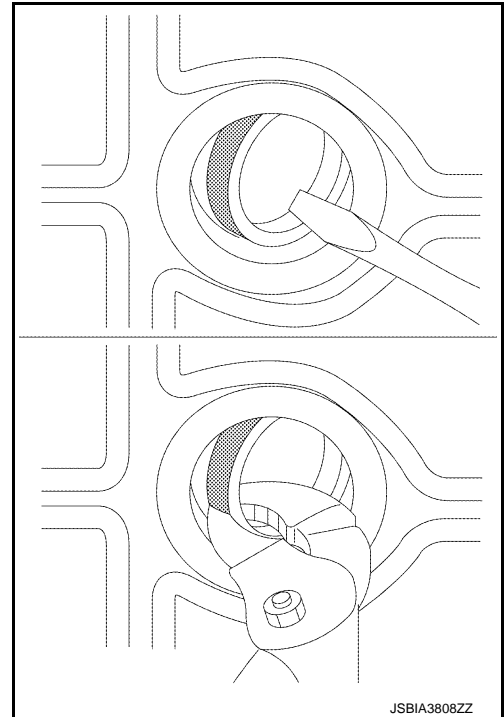
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## CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[2.0L TURBO GASOLINE ENGINE]

11. If necessary, tap the cylinder block core plug using a flat-bladed screwdriver and remove as shown in the figure.



12. If necessary, remove oil spray nozzle shutoff valve installed to the cylinder block.
13. If necessary, remove sensors and drain plugs installed to the cylinder block.

### ASSEMBLY

1. Blow air sufficiently to inside engine coolant passage, engine oil passage, crankcase and cylinder bore to remove foreign matter.

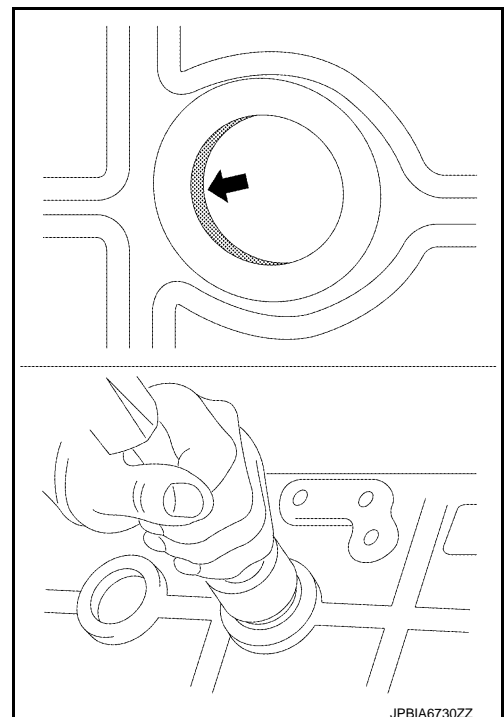
**CAUTION:**

**Wear goggles to protect eye.**

**NOTE:**

When cleaning the contact surface of cylinder block, oil pan (upper), and timing case, use [Loctite 566 Cleaning spray, or equivalent].

2. Install drain plugs in the cylinder block.
3. Apply [Thread locking adhesive Loctite 241, or equivalent] to the contact surface of cylinder block core plug and cylinder block, and install it by tapping so that they are flush with each other as shown in the figure.



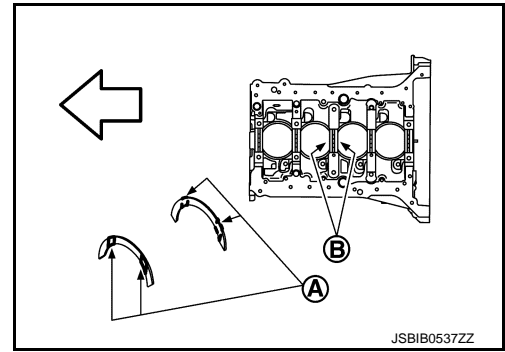
# CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[2.0L TURBO GASOLINE ENGINE]

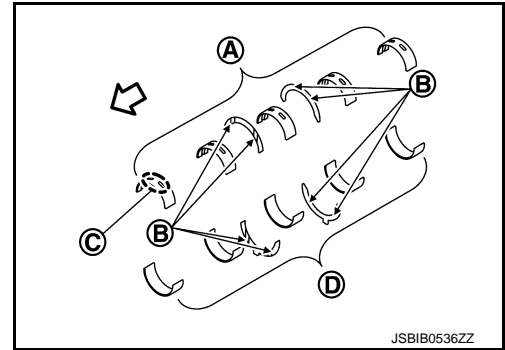
4. Install sensors to the cylinder block.
5. Install main bearings and thrust bearings.
  - a. Remove contamination, dust and engine oil from bearing mounting positions on cylinder block and main bearing caps.
  - b. Install thrust bearings on both sides of No. 3 housing ② on cylinder block.
    - Install thrust bearings with oil groove ① facing to crankshaft arm (outside).

⇐ : Engine front



- c. Being careful with the direction, install main bearings.
  - Install main bearings with the oil holes ③ and grooves ② onto the cylinder block side ①, and those without oil holes and grooves onto the main cap side ④.
  - While installing bearings, apply engine oil to bearing surfaces (inside). Do not apply engine oil to rear surfaces, but clean them completely.
  - Align stopper notches on bearings to install them.
  - Check that the oil holes on the cylinder block body are mated with the oil hole positions on the bearings.

⇐ : Engine front



6. Install crankshaft to cylinder block.
  - Check crankshaft rotates smoothly by hand.
7. Check the main bearing cap bolts for deformation. Refer to [EM-129, "Inspection"](#).

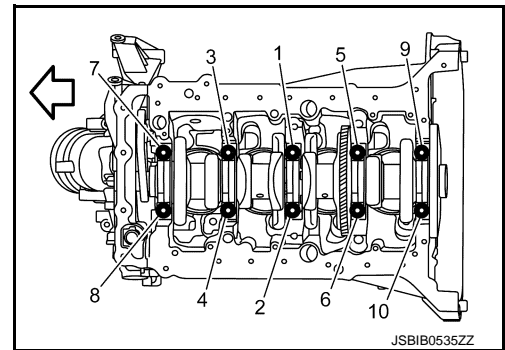
8. Tighten the main bearing cap bolts according to the following procedure:

**CAUTION:**

**When the main bearing cap bolt is reused, check the outer diameter in advance. Refer to [EM-129, "Inspection"](#).**

⇐ : Engine front

- a. Apply engine oil to the threaded part and seat surface of each bolt.
- b. Tighten all bolts in numerical order shown in the figure.



 : 36.0 N·m (3.7 kg·m, 27 ft·lb)

- c. Put alignment marks (with paint) on each bolt and the main bearing cap, all in the same direction. (When using a protractor)

- d. Then, tighten 120 degrees. (angle tightening)

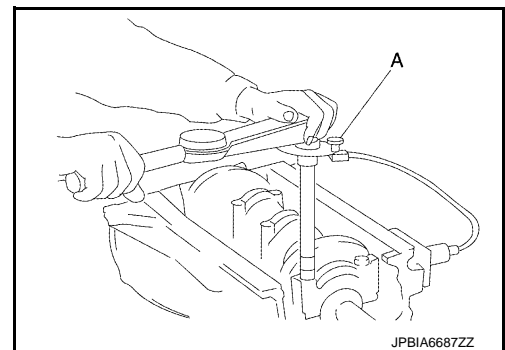
**CAUTION:**

**Always use either the angle wrench [SST: KV10112100 (TechMate No.BT-8653-A)] (A) or protractor during angular tightening. Avoid tightening based on visual checks alone.**

- After tightening bolts to specified torque, check that crankshaft rotates smoothly.
- Check crankshaft end play. Refer to [EM-132, "Cylinder Block"](#).

9. Install the piston to the connecting rod.

- a. Use snap ring pliers (commercial service tool) to install the snap ring in the snap ring installation groove on the rear side of piston.



# CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[2.0L TURBO GASOLINE ENGINE]

**CAUTION:**

**Check that snap ring is securely seated in the groove.**

- b. Install the piston to the connecting rod.
  - Align the matching marks, and insert the piston pin into the piston and connecting rod by using finger, and then install the snap ring pliers.
- c. Install a new snap ring to the groove on the front side of piston.

**CAUTION:**

**After installation, check that snap ring is securely seated in the groove.**

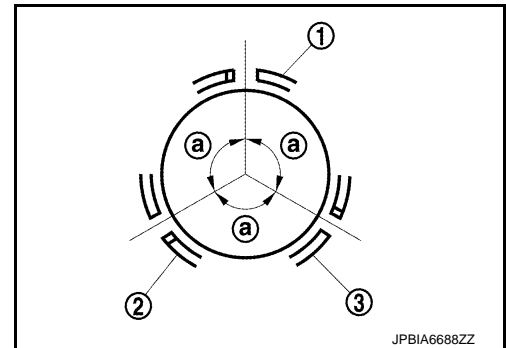
- Check that the connecting rod moves smoothly.

10. Use the piston ring expander (commercial service tool) to install piston rings.

**CAUTION:**

**When installing, prevent piston from being damaged.**

- Install top ring ①, second ring ② and oil ring ③ as shown in the figure.
- Install rings so that three closed gap position 120 degrees (a) apart one another.
- Closed gaps do not need to face in a specific directions, as long as each are positioned 120 degrees apart.



11. Install connecting rod bearings to connecting rod and connecting rod bearing cap.

**CAUTION:**

**Never drop connecting rod bearing, and to scratch the surface.**


- Apply engine oil to the bearing surface (inner surface) before installing connecting rod bearing. Never apply engine oil to connecting rod bearing. Thoroughly clean the back surface of connecting rod bearing.
- When installing, align connecting rod bearing stopper protrusion with cutout of connecting rods and connecting rod bearing caps.

12. Tighten connecting rod bolts according to the following procedure:

- a. Apply engine oil to the threaded part and seat surface of each bolt.
- b. Tighten the connecting rod bolts.

 : 5 N·m (0.51 kg·m, 44 in-lb)

- c. Tighten connecting rod bolts.

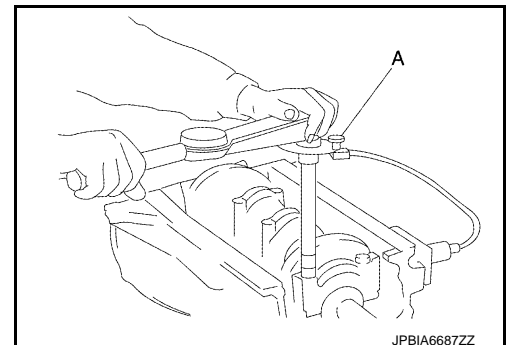
 : 15 N·m (1.5 kg·m, 11 ft-lb)

- d. Tighten the connecting rod bolt by 90 degrees. (Angular tightening)

**CAUTION:**

**Use angle wrench [SST: KV10112100] (A) for angular tightening. Never judge by visual check.**

- After tightening bolts, check that the crankshaft rotates smoothly.



# CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[2.0L TURBO GASOLINE ENGINE]

INFOID:000000014502184

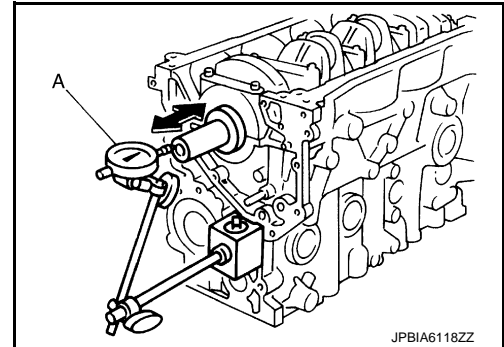
## Inspection

### CRANKSHAFT END PLAY

- Using dial gauge (A), measure crankshaft travel amount by moving the crankshaft forward or backward.

**Standard and limit** : Refer to [EM-132, "Cylinder Block"](#).

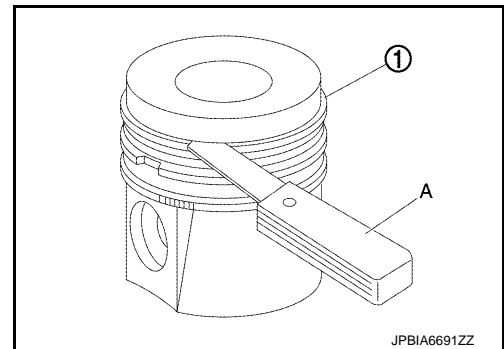
- If the value exceeds the limit, replace thrust bearings with new ones and measure again.  
If the measurement exceeds the limit again, replace crankshaft with a new one.



### PISTON RING SIDE CLEARANCE

- Measure the side clearance of piston ring ① and piston ring groove with a feeler gauge (A).

**Standard and limit** : Refer to [EM-132, "Cylinder Block"](#).

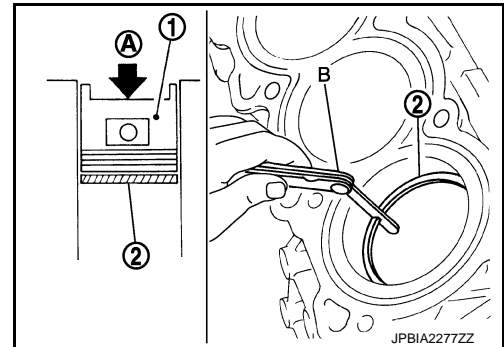


### PISTON RING END GAP

- Check that the cylinder bore inner diameter is within the specification.
- Lubricate with new engine oil to piston ① and piston ring ②, and then insert piston ring until middle of cylinder with piston, and measure the piston ring end gap with a feeler gauge (B).

Ⓐ : Press-fit

**Standard and limit** : Refer to [EM-132, "Cylinder Block"](#).



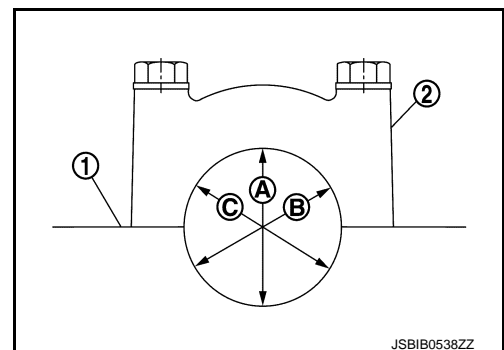
- If the measured value exceeds the limit, replace piston ring, and measure again. If it still exceeds the limit, re-bore cylinder and use oversize piston and piston rings.

### MAIN BEARING HOUSING INNER DIAMETER

- Install main bearing cap ② without installing main bearings, and tighten lanchester balancer bolts to the specified torque. Refer to [EM-124, "Disassembly and Assembly"](#) for the tightening procedure.

① : Cylinder block

- To check the uniformity of main bearing cap installation condition, measure ①, ②, and ③.
- Measure the inner diameter ① of main bearing housing with a bore gauge.



**Standard** : Refer to [EM-133, "Main Bearing"](#).

- If out of the standard, replace cylinder block and main bearing cap as assembly.

**NOTE:**

# CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[2.0L TURBO GASOLINE ENGINE]

Cylinder block cannot be replaced as a single part, because it is machined together with main bearing cap.

## MAIN BEARING

Check Main bearing for scratches and seizure. Replace if necessary.

- If crankshaft, engine block and main bearing cap are damaged along with Main bearing, replace them. Refer to [EM-131, "Main Bearing"](#).

## CONNECTING ROD BEARING CAP BOLT DEFORMATION

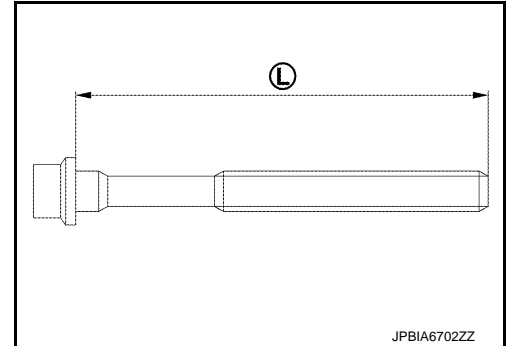
- Measure the bolt length  $\textcircled{L}$  in the position shown in the figure.

**Bolt diameter : M7**

**Standard : 38.0 mm ( $\phi$ 1.496 in)**

**Repair limit : 38.4 mm (1.511 in)**

- Replace connec rod bearing cap bolts if it exceeds the repair limit (the difference between the dimensions are large).

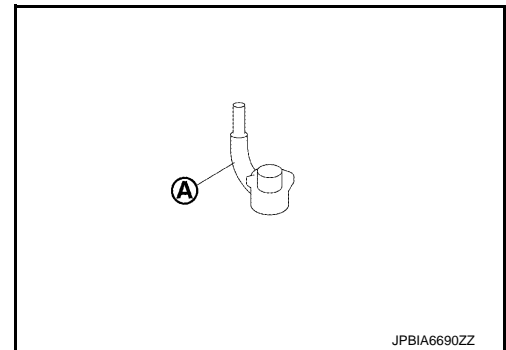


## OIL JET

- Check nozzle  $\textcircled{A}$  for deformation and damage.
- Blow compressed air from nozzle, and check for clogs.

**Standard : No deformation and no damage.**

- If out of the standard, replace oil jet.



# HOW TO SELECT PISTON AND BEARING

< UNIT DISASSEMBLY AND ASSEMBLY >

[2.0L TURBO GASOLINE ENGINE]

## HOW TO SELECT PISTON AND BEARING

### Description

INFOID:000000014502185

Position	Selective-fit service parts	Item to be selected	Selection method
Between cylinder block and crankshaft	Main bearing	Main bearing grade (Bearing thickness)	Select the proper size according to the cylinder block main bearing housing grade (housing inner diameter) and crankshaft main journal grade (journal outer diameter).

- Identification grade stamped on each part shows the dimension measured when it is new as a grade. It is not applied when it is reused.
- When part is used or corrected, measure its dimension and decide appropriate grade by referring to Selective-fit Service Parts Table in this section.
- Refer to the direction specified in the text for details of measurement method for each part, reusable standard, and selection method for selective-fit service parts.

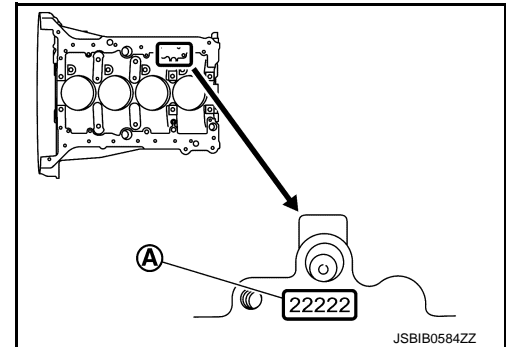
### Main Bearing

INFOID:000000014502186

#### MAIN BEARING GRADE TABLE

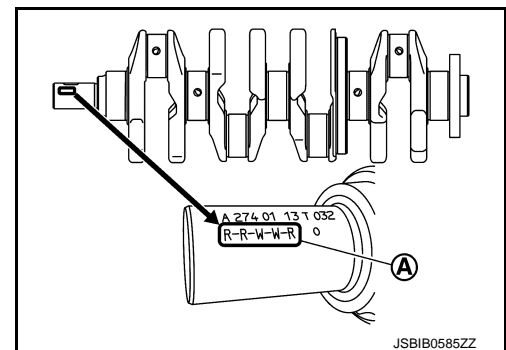
1. Find the bearing grade number cylinder block side (A) of the selective-fit main bearing upper grade table.

**Main bearing grade table** : Refer to [EM-133, "Main Bearing"](#).



2. Find the bearing grade letter main bearing cap side (A) of the selective-fit main bearing lower grade table.

**Main bearing grade table** : Refer to [EM-133, "Main Bearing"](#).



# SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[2.0L TURBO GASOLINE ENGINE]

## SERVICE DATA AND SPECIFICATIONS (SDS)

### SERVICE DATA AND SPECIFICATIONS (SDS)

#### General Specification

INFOID:0000000012947400

#### GENERAL SPECIFICATION

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 ratio		15
Compression pressure Unit: kPa (bar, kg/cm <sup>2</sup> , psi)	Standard	1.550 (15.5, 15.81, 224.75)
	Minimum	1.150 (11.5, 11.73, 166.75)
	Differential limit between cylinders	150 (1.5, 1.53, 21.75)

#### Drive Belt

INFOID:0000000012947401

#### DRIVE BELT

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

#### Spark Plug

INFOID:0000000012947402

#### SPARK PLUG

Unit: mm (in)

Make	DENSO
Standard type*	SILZKFR8C7S

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

#### Camshaft

INFOID:0000000012947403

#### CAMSHAFT

Unit: mm (in)

Items	Standard	Limit
Camshaft bracket inner diameter	31.947 - 31.963 (1.25775 - 1.25838)	—
Cam shaft end play	0.05 (0.00197)	—

#### Cylinder Block

INFOID:0000000014502187

#### CYLINDER BLOCK

Unit: mm (in)

Cylinder bore	Inner diameter	Group code letter X	83.000 - 83.015 (3.2677 - 3.2683)
---------------	----------------	---------------------	-----------------------------------

#### PISTON RING

Unit: mm (in)

Items	Standard
-------	----------



# SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[2.0L TURBO GASOLINE ENGINE]

Side clearance	Top	0.04 - 0.075 (0.0016 - 0.0030)
	2nd	0.03 - 0.07 (0.0012 - 0.0028)
	Oil ring	-
End gap	Top	0.18 - 0.30 (0.0071 - 0.0118)
	2nd	0.30 - 0.50 (0.0118 - 0.0197)
	Oil ring	0.20 - 0.70 (0.079 - 0.0276)

## CRANKSHAFT

Unit: mm (in)

Width of fitted bearing at crankshaft	—	24.550 - 24.590 (0.9665 - 0.9681)
End play	Standard	0.120 - 0.300 (0.0047 - 0.0118)
	Limit	—

## Main Bearing

INFOID:0000000014502188

## MAIN BEARING

Unit: mm (in)

Grade number	UPR / LWR	Thickness	Identification color	bearing grade number and letter	Remarks
52	UPR	2.009 - 2.014 (0.0791 - 0.0793)	Blue	1	Grade and color are different between upper and lower bearings.
	LWR	2.009 - 2.014 (0.0791 - 0.0793)	Blue	B	
54	UPR	2.014 - 2.019 (0.0793 - 0.0795)	Yellow	2	
	LWR	2.014 - 2.019 (0.0793 - 0.0795)	Yellow	G	
56	UPR	2.019 - 2.024 (0.0795 - 0.0797)	Red	3	
	LWR	2.019 - 2.024 (0.0795 - 0.0797)	Red	R	
57	UPR	—	—	—	
	LWR	2.024 - 2.029 (0.0797 - 0.0799)	White	W	
58	UPR	—	—	—	
	LWR	2.029 - 2.034 (0.0799 - 0.0801)	Purple	V	

## MAIN BEARING OIL CLEARANCE

Unit: mm (in)

Items	Standard	Limit
Main bearing oil clearance	0.019 - 0.043 (0.0007 - 0.0017)	—

## MAIN BEARING HOUSING INNER DIAMETER

Unit: mm (in)

Items	Standard	Limit
Main bearing housing inner diameter	59.000 - 59.019 (2.3228 - 2.3236)	—
Main bearing housing inner diameter uniformity	—	0.03 (0.0012)

## MAIN BEARING CAP WIDTH

Unit: mm (in)

Items	Standard	Limit
Main bearing cap width	19.967 - 20.000 (0.7861 - 0.7874)	—

## Connecting Rod Bearing

INFOID:0000000014502189

## CONNECTING ROD BEARING OIL CLEARANCE

Unit: mm (in)

## SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[2.0L TURBO GASOLINE ENGINE]

Items	Standard	Limit
Connecting rod bearing oil clearance	0.017 - 0.068 (0.0007 - 0.0027)	—

# HOW TO USE THIS MANUAL

## APPLICATION NOTICE

### Information

INFOID:000000013804991

EM

Check the engine type to use the service information in this section.  
 As per the engine type, refer to [GI-35, "Model Variation"](#)

Service information	Engine type
Type 1	Turbo high pressure
Type 2	Turbo low pressure

A  
C  
D  
E  
F  
G  
H  
I  
J  
K  
L  
M  
N  
O  
P

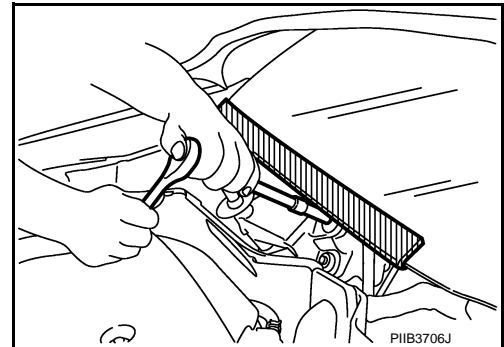
## PRECAUTION

### PRECAUTIONS

#### Precaution for Procedure without Cowl Top Cover

INFOID:000000013607783

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



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

INFOID:000000013637860

The Supplemental Restraint System such as "AIR BAG" and "SEAT BELT PRE-TENSIONER", used along with a front seat belt, helps to reduce the risk or severity of injury to the driver and front passenger for certain types of collision. This system includes seat belt switch inputs and dual stage front air bag modules. The SRS system uses the seat belt switches to determine the front air bag deployment, and may only deploy one front air bag, depending on the severity of a collision and whether the front occupants are belted or unbelted. Information necessary to service the system safely is included in the "SRS AIR BAG" and "SEAT BELT" of this Service Manual.

**WARNING:**

Always observe the following items for preventing accidental activation.

- To avoid rendering the SRS inoperative, which could increase the risk of personal injury or death in the event of a collision that would result in air bag inflation, it is recommended that all maintenance and repair be performed by an authorized NISSAN/INFINITI dealer.
- Improper repair, including incorrect removal and installation of the SRS, can lead to personal injury caused by unintentional activation of the system. For removal of Spiral Cable and Air Bag Module, see "SRS AIR BAG".
- Never use electrical test equipment on any circuit related to the SRS unless instructed to in this Service Manual. SRS wiring harnesses can be identified by yellow and/or orange harnesses or harness connectors.

#### PRECAUTIONS WHEN USING POWER TOOLS (AIR OR ELECTRIC) AND HAMMERS

**WARNING:**

Always observe the following items for preventing accidental activation.

- When working near the Air Bag Diagnosis Sensor Unit or other Air Bag System sensors with the ignition ON or engine running, never use air or electric power tools or strike near the sensor(s) with a hammer. Heavy vibration could activate the sensor(s) and deploy the air bag(s), possibly causing serious injury.
- When using air or electric power tools or hammers, always switch the ignition OFF, disconnect the battery or batteries, and wait at least 3 minutes before performing any service.

#### Precautions for Removing Battery Terminal

INFOID:000000013607785

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.

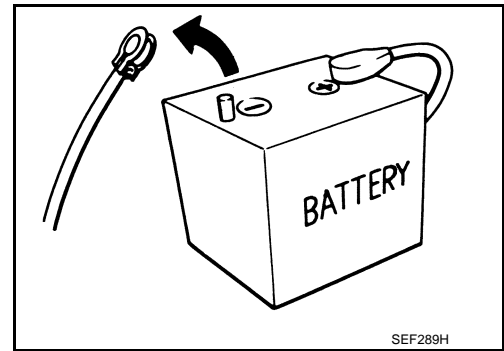
# PRECAUTIONS

[VR30DDTT]

## < PRECAUTION >

- When removing the 12V battery terminal, turn OFF the ignition switch and wait at least 30 seconds.
- For vehicles with the engine listed below, remove the battery terminal after a lapse of the specified time:

BR08DE	: 4 minutes	V9X engine	: 4 minutes
D4D engine	: 20 minutes	YD25DDTi	: 2 minutes
HR09DET	: 12 minutes	YS23DDT	: 4 minutes
HRA2DDT	: 12 minutes	YS23DDTT	: 4 minutes
K9K engine	: 4 minutes	ZD30DDTi	: 60 seconds
M9R engine	: 4 minutes	ZD30DDTT	: 60 seconds
R9M engine	: 4 minutes		



A

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### 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.

## Precautions For Engine Service

INFOID:0000000013607786

### 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.

# PRECAUTIONS

[VR30DDTT]

< PRECAUTION >

## 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.

## Precaution for Handling High Pressure Fuel System

INFOID:0000000013637883

- 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.

## Parts Requiring Angle Tightening

INFOID:0000000013607787

- Use the angle wrench [SST: KV10112100 (BT8653-A)] 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.

## Liquid Gasket

INFOID:0000000013607788

### REMOVAL OF LIQUID GASKET SEALING

- After removing mounting nuts and bolts, separate the mating surface using the seal cutter [SST: KV10111100 (J-37228)] (A) and remove old liquid gasket sealing.

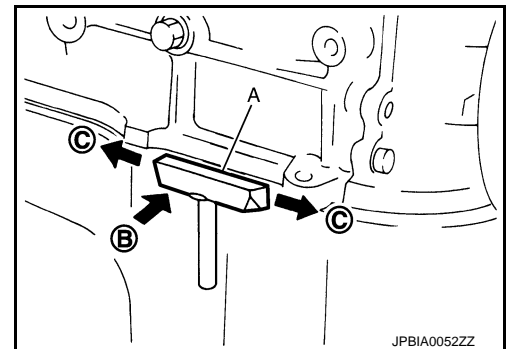
**CAUTION:**

**Never damage the mating surfaces.**

- Tap the seal cutter [SST: KV10111100 (J-37228)] to insert it (B), and then slide it (C) by tapping on the side as shown in the figure.
- In areas where the seal cutter [SST: KV10111100 (J-37228)] is difficult to use, lightly tap the parts using a plastic hammer to remove it.

**CAUTION:**

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



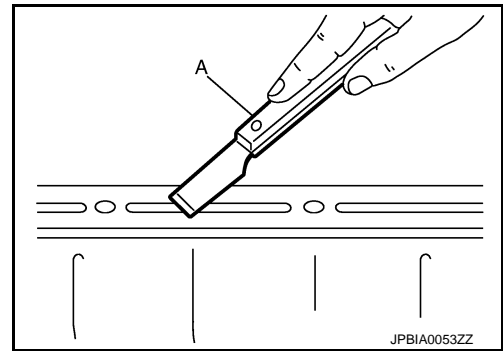
### LIQUID GASKET APPLICATION PROCEDURE

# PRECAUTIONS

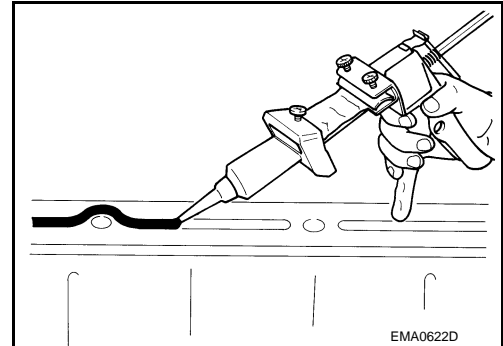
[VR30DDTT]

## < PRECAUTION >

- 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.
- 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.



- Attach liquid gasket tube to the tube presser (commercial service tool).  
**Use Genuine Liquid Gasket or equivalent.**
- 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.

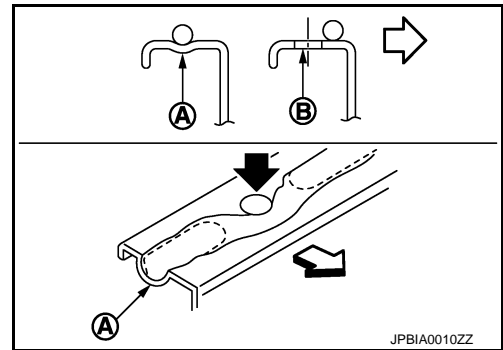


- As for bolt holes (B), normally apply liquid gasket inside the holes. Occasionally, it should be applied outside the holes. Check to read the text of this manual.

(A) : 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.

## Definitions of Bank Names

INFOID:000000013607789

- In this manual, each bank name is defined as follows:

(A) : Bank 1 (The conventional right bank)

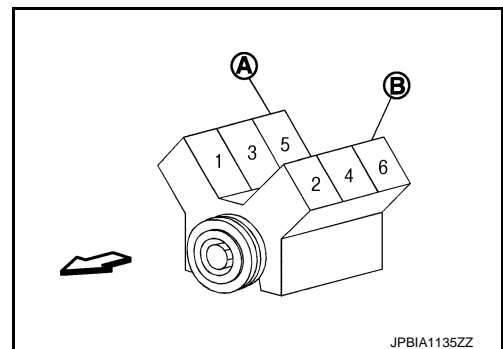
(B) : Bank 2 (The conventional left bank)

← : Engine front

- For cylinder numbers and bank layout, refer to the illustration.

**Bank 1** : The bank side including cylinder No. 1 (odd-numbered cylinder side)

**Bank 2** : The other bank side of the above (even-numbered cylinder side)



# PREPARATION

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[VR30DDTT]

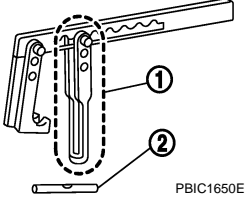
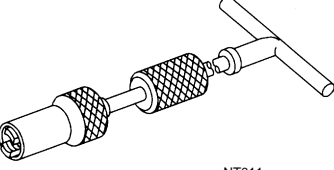
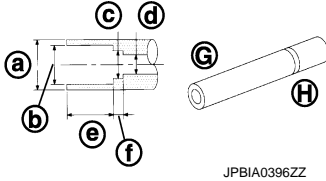
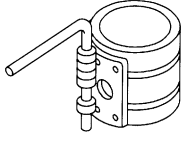
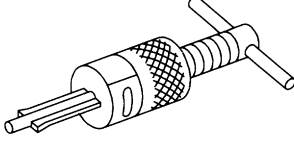
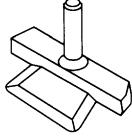
## PREPARATION

### PREPARATION

#### Special Service Tools

INFOID:0000000013607790

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

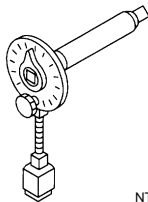
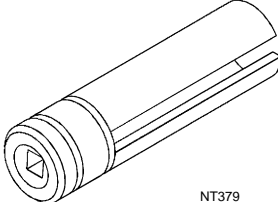
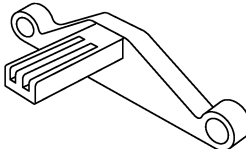
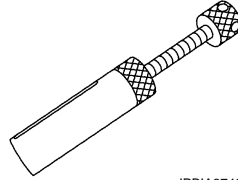
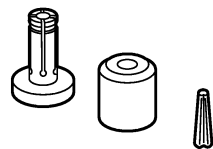
Tool number (TechMate No.) Tool name	Image	Description
KV10116200 (J-26336-A) Valve spring compressor 1. KV10115900 (J-26336-20) Attachment 2. KV10109220 ( — ) Adapter	 <p style="text-align: center;">PBIC1650E</p>	Disassembling valve mechanism Part ① is a component of KV10116200 (J-26336-A), but Part ② is not so.
KV10107902 (J-38959) Valve oil seal puller	 <p style="text-align: center;">NT011</p>	Replacing valve oil seal
KV10115600 (J-38958) Valve oil seal drift	 <p style="text-align: center;">JPBIA0396ZZ</p>	Installing valve oil seal <b>Use side A ③.</b> ①: 20 (0.79) dia.      ④: 8 (0.31) dia. ②: 13 (0.51) dia.      ⑤: 10.7 (0.421) ③: 10.3 (0.406) dia.    ⑥: 5 (0.20) ⑦: side B Unit: mm (in)
EM03470000 (J-8037) Piston ring compressor	 <p style="text-align: center;">NT044</p>	Installing piston assembly into cylinder bore
ST16610001 (J-23907) Pilot bushing puller	 <p style="text-align: center;">NT045</p>	Removing pilot converter
KV10111100 (J-37228) Seal cutter	 <p style="text-align: center;">NT046</p>	Removing oil pan (upper), timing chain case, etc.



# PREPARATION

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[VR30DDTT]

Tool number (TechMate No.) Tool name	Description	A
KV10112100 (BT8653-A) Angle wrench  <p style="text-align: center;">NT014</p>	Tightening bolts for connecting rod bearing cap, cylinder head, etc. at an angle	EM
KV10117100 (J-3647-A) Heated oxygen sensor wrench  <p style="text-align: center;">NT379</p>	Loosening or tightening air fuel ratio sensor 1 and heated oxygen sensor <b>For 22 mm (0.87 in) width hexagon nut</b>	C D E F
KV10118600 (J-48641) Ring gear stopper  <p style="text-align: center;">JPBIA0409ZZ</p>	Removing and installing crankshaft pulley	G H
KV10119600 ( — ) Injector remover  <p style="text-align: center;">JPBIA3746ZZ</p>	Removing fuel injector	I J
KV101197S0 ( — ) Injector seal drift set  <p style="text-align: center;">JPBIA3281ZZ</p>	Installing fuel injector seal ring	K L M

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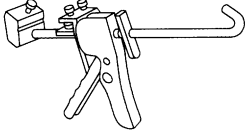
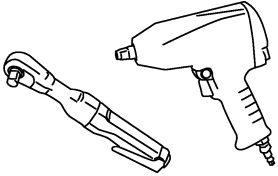
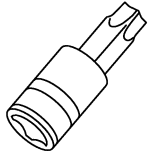
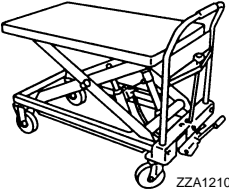
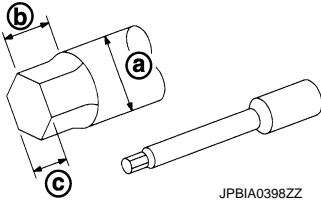
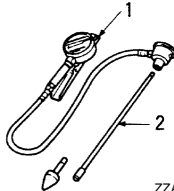
# PREPARATION

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[VR30DDTT]

## Commercial Service Tools

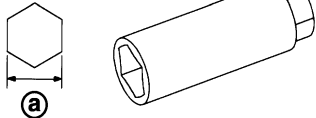
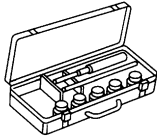
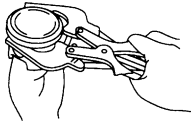
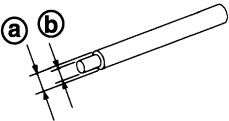
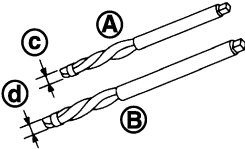
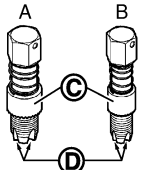
INFOID:000000013607791

(TechMate No.) Tool name	Description
( — ) Tube presser <div style="text-align: center; margin-top: 20px;">  <p style="font-size: x-small; margin-top: 5px;">NT052</p> </div>	Pressing the tube of liquid gasket
( — ) Power tool <div style="text-align: center; margin-top: 20px;">  <p style="font-size: x-small; margin-top: 5px;">PBIC0190E</p> </div>	Loosening nuts and bolts
( — ) TORX socket <div style="text-align: center; margin-top: 20px;">  <p style="font-size: x-small; margin-top: 5px;">PBIC1113E</p> </div>	Removing and installing drive plate
( — ) Manual lift table caddy <div style="text-align: center; margin-top: 20px;">  <p style="font-size: x-small; margin-top: 5px;">ZZA1210D</p> </div>	Removing and installing engine
(J-24239-01) Cylinder head bolt wrench <div style="text-align: center; margin-top: 20px;">  <p style="font-size: x-small; margin-top: 5px;">JPBIA0398ZZ</p> </div>	Loosening and tightening cylinder head bolt, and used with the angle wrench [SST: KV10112100 (BT8653-A)] Ⓐ: 13 (0.51) dia. Ⓑ: 12 (0.47) Ⓒ: 10 (0.39) Unit: mm (in)
( — ) 1.Compression gauge 2.Adapter <div style="text-align: center; margin-top: 20px;">  <p style="font-size: x-small; margin-top: 5px;">ZZA0008D</p> </div>	Checking compression pressure

# PREPARATION

[VR30DDTT]

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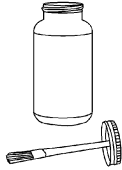
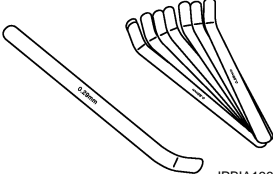
(TechMate No.) Tool name	Description
( — ) Spark plug wrench   JPBIA0399ZZ	Removing and installing spark plug Ⓐ: 14 mm (0.55 in)
( — ) Valve seat cutter set   NT048	Finishing valve seat (EXH) dimensions
( — ) Piston ring expander   NT030	Removing and installing piston ring
( — ) Valve guide drift   JPBIA0400ZZ	Removing and installing valve guide (EXH) <b>Exhaust:</b> Ⓐ: 9.5 mm (0.374 in) dia. Ⓑ: 5.5 mm (0.217 in) dia.
( — ) Valve guide reamer   JPBIA0401ZZ	Ⓐ: Reaming valve guide (EXH) inner hole Ⓑ: Reaming hole for oversize valve guide (EXH) <b>Exhaust:</b> Ⓒ: 6.0 mm (0.236 in) dia. Ⓓ: 10.2 mm (0.402 in) dia.
(J-43897-18) (J-43897-12) Oxygen sensor thread cleaner   JPBIA0238ZZ	Reconditioning the exhaust system threads before installing a new air fuel ratio sensor and heated oxygen sensor (Use with anti-seize lubricant shown below.) <b>A: J-43897-18 [18 mm (0.71 in) dia.] for zirconia heated oxygen sensor and air fuel ratio sensor</b> <b>B: J-43897-12 [12 mm (0.47 in) dia.] for titania heated oxygen sensor</b> Ⓒ: Mating surface shave cylinder Ⓓ: Flutes

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[VR30DDTT]

(TechMate No.) Tool name	Description
( — ) Anti-seize lubricant (Permatex 133AR or equivalent meeting MIL specification MIL-A-907)	 <p style="text-align: center; font-size: small;">AEM489</p> Lubricating oxygen sensor thread cleaning tool when reconditioning exhaust system threads
( — ) Feeler gauge	 <p style="text-align: center; font-size: small;">JPBIA1362ZZ</p> Inspection valve clearance (Use a curved-tip gauge)

## Service Parts

INFOID:000000013646499

Name	Description
Engine slinger 10005 5CA0A: Front 10006 5CA0A: Rear	Supporting and hoisting engine

## Lubricant or/and Sealant

INFOID:000000013608585

Name	Description	Note
Three bond 1215	Cylinder block	Water drain plug
Three bond 1217H	<ul style="list-style-type: none"> <li>Rocker cover</li> <li>Vacuum pump</li> <li>Timing chain</li> <li>Oil pan (upper)</li> <li>Camshaft</li> <li>Cylinder block</li> </ul>	—
Three bond 1386B	Cylinder block	Plug

## BASIC INSPECTION

### CAMSHAFT VALVE CLEARANCE

#### Inspection and Adjustment

INFOID:0000000013607792

A

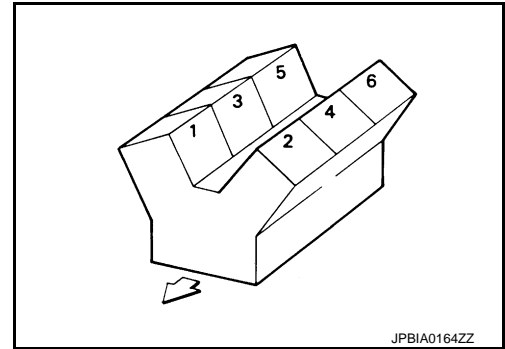
EM

#### INSPECTION

Perform inspection as follows after removal, installation or replacement of camshaft or valve-related parts, or if there is unusual engine conditions regarding valve clearance.

In cases of removing/installing or replacing camshaft and valve-related parts, or of unusual engine conditions due to changes in valve clearance (found malfunctions during starting, idling or causing noise), perform inspection as follows:

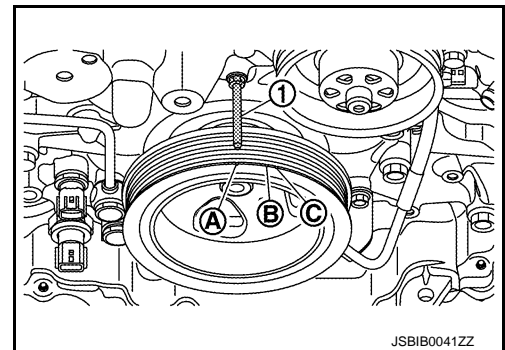
↔ : Engine front



1. Remove rocker covers (bank 1 and bank 2). Refer to [EM-193, "Removal and Installation"](#).
2. Measure the valve clearance as follows:
  - a. Set No. 1 cylinder at TDC of its compression stroke.
    - Rotate crankshaft pulley clockwise to align TDC mark (grooved line without color) ① with timing indicator ②.

Ⓑ : White paint mark

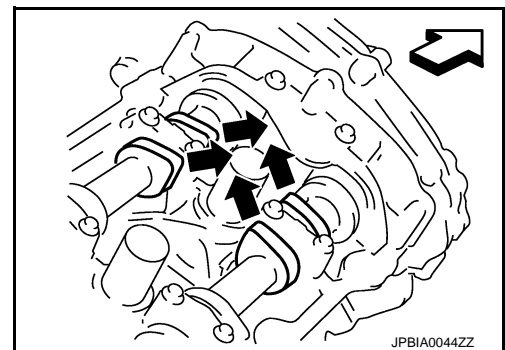
Ⓒ : White paint mark



- Check that intake and exhaust cam nose on No. 1 cylinder (engine front side of bank 1) are located as shown in the figure.

↔ : Engine front

- If not, turn crankshaft one revolution (360 degrees) and align as shown in the figure.



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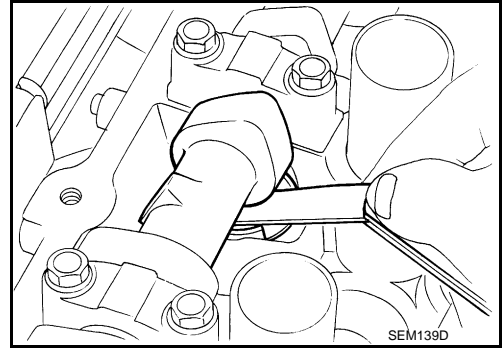
# CAMSHAFT VALVE CLEARANCE

[VR30DDTT]

## < BASIC INSPECTION >

- b. Use a feeler gauge (commercial service tool), measure the clearance between valve lifter and camshaft.

Valve clearance : Refer to [EM-296. "Camshaft"](#).

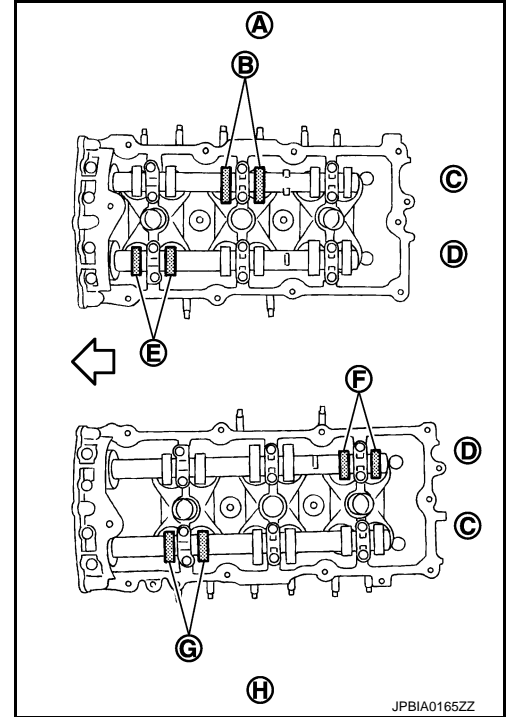


- By referring to the figure, measure the valve clearances at locations marked "x" as shown in the table below (locations indicated in the figure).

← : Engine front

- No. 1 cylinder at compression TDC

Measuring position [bank 1 (A)]		No. 1 CYL.	No. 3 CYL.	No. 5 CYL.
No. 1 cylinder at compression TDC	EXH (C)		x (B)	
	INT (D)	x (E)		
Measuring position [bank 2 (H)]		No. 2 CYL.	No. 4 CYL.	No. 6 CYL.
No. 1 cylinder at compression TDC	INT (D)			x (F)
	EXH (C)	x (G)		

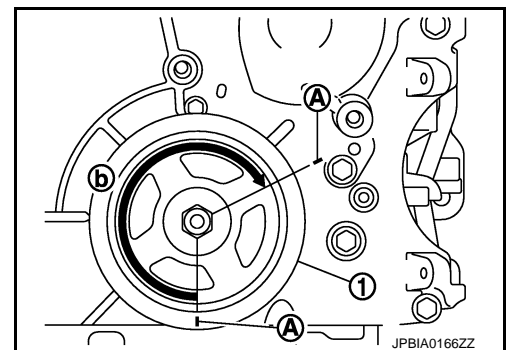


- c. Rotate crankshaft 240 degrees clockwise (when viewed from engine front) to align No. 3 cylinder at TDC its compression stroke.

### NOTE:

Mark a position 240 degrees (b) from a corner of the hexagonal part of crankshaft pulley mounting bolt as shown in the figure. Use the hexagonal part as a guide.

- (1) : Crankshaft pulley
- (A) : Paint mark



# CAMSHAFT VALVE CLEARANCE

[VR30DDTT]

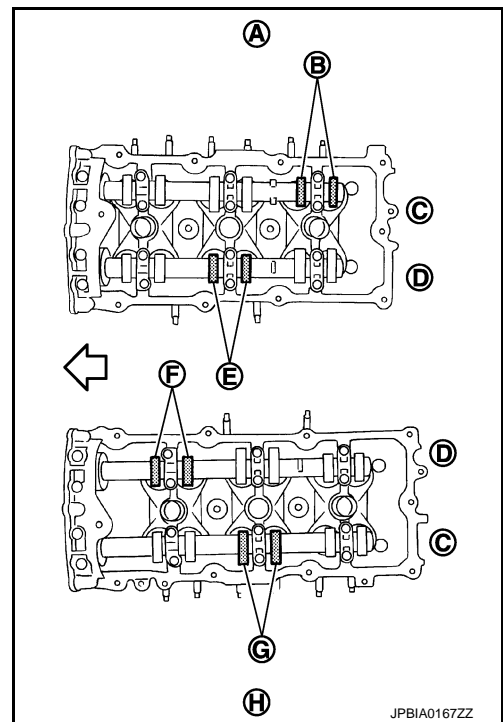
## < BASIC INSPECTION >

- By referring to the figure, measure the valve clearances at locations marked "x" as shown in the table below (locations indicated in the figure).

← : Engine front

- No. 3 cylinder at compression TDC

Measuring position [bank 1 (A)]		No. 1 CYL.	No. 3 CYL.	No. 5 CYL.
No. 3 cylinder at compression TDC	EXH (C)			x (B)
	INT (D)		x (E)	
Measuring position [bank 2 (H)]		No. 2 CYL.	No. 4 CYL.	No. 6 CYL.
No. 3 cylinder at compression TDC	INT (D)	x (F)		
	EXH (C)		x (G)	

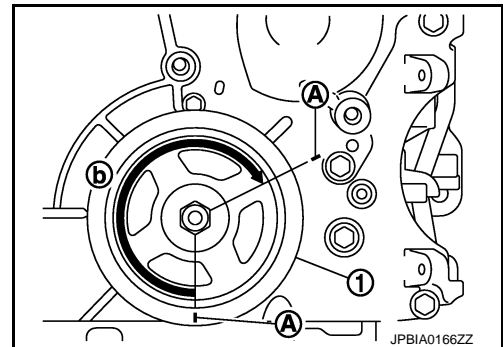


- d. Rotate crankshaft 240 degrees clockwise (when viewed from engine front) to align No. 5 cylinder at TDC of compression stroke.

### NOTE:

Mark a position 240 degrees (b) from a corner of the hexagonal part of crankshaft pulley mounting bolt as shown in the figure. Use the hexagonal part as a guide.

- (1) : Crankshaft pulley
- (A) : Paint mark



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# CAMSHAFT VALVE CLEARANCE

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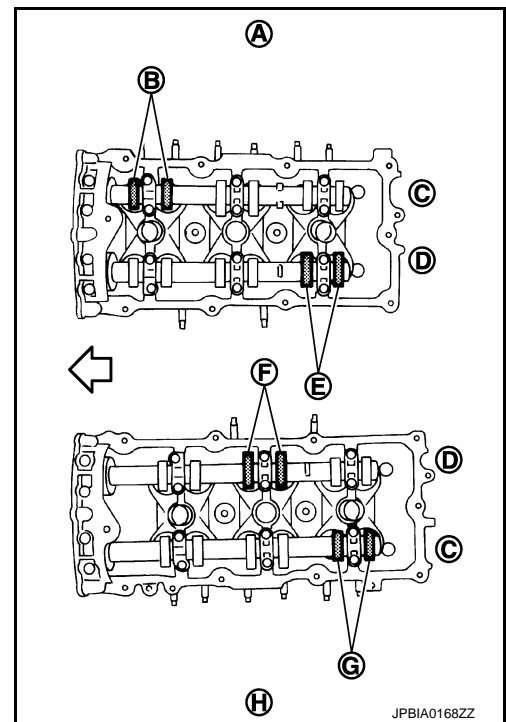
## < BASIC INSPECTION >

- By referring to the figure, measure the valve clearances at locations marked "x" as shown in the table below (locations indicated in the figure).

← : Engine front

- No. 5 cylinder at compression TDC

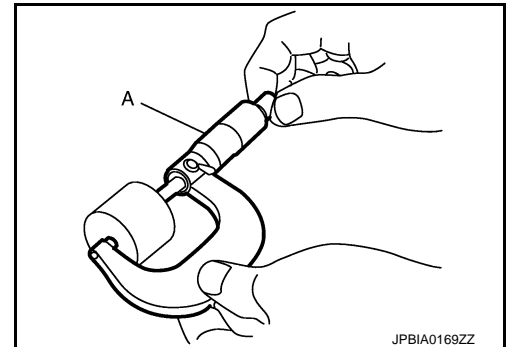
Measuring position [bank 1 (A)]		No. 1 CYL.	No. 3 CYL.	No. 5 CYL.
No. 5 cylinder at compression TDC	EXH (C)	x (B)		
	INT (D)			x (E)
Measuring position [bank 2 (H)]		No. 2 CYL.	No. 4 CYL.	No. 6 CYL.
No. 5 cylinder at compression TDC	INT (D)		x (F)	
	EXH (C)			x (G)



- Perform adjustment if the measured value is out of the standard. Refer to "ADJUSTMENT".

## ADJUSTMENT

- Perform adjustment depending on selected head thickness of valve lifter.
  - Measure the valve clearance. Refer to "INSPECTION".
  - Remove camshaft. Refer to [EM-251. "Removal and Installation"](#).
  - Remove valve lifters at the locations that are out of the standard.
  - Measure the center thickness of the removed valve lifters with a micrometer (A).



- Use the equation below to calculate valve lifter thickness for replacement.

**Valve lifter thickness calculation:  $t = t_1 + (C_1 - C_2)$**

**t = Valve lifter thickness to be replaced**

**t<sub>1</sub> = Removed valve lifter thickness**

**C<sub>1</sub> = Measured valve clearance**

**C<sub>2</sub> = Standard valve clearance:**

**Intake : 0.30 mm (0.012 in)**

**Exhaust : 0.31 mm (0.012 in)**



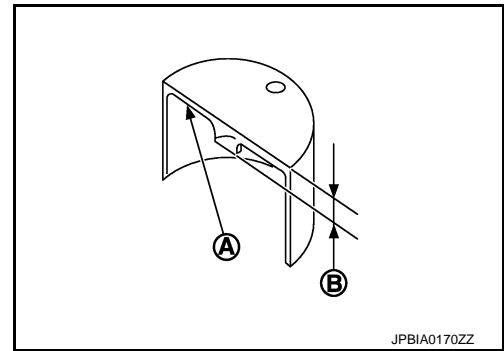
# CAMSHAFT VALVE CLEARANCE

[VR30DDTT]

## < BASIC INSPECTION >

- Thickness of new valve lifter can be identified by stamp marks on the reverse side (inside the cylinder).  
Stamp mark 300 indicates 3.00 mm (0.1181 in) in thickness.

- Ⓐ : Stamp
- Ⓑ : Thickness of valve lifter



Available thickness of valve lifter: 26 sizes with range 3.00 to 3.50 mm (0.1181 to 0.1378 in) in steps of 0.02 mm (0.0008 in) (when manufactured at factory). Refer to [EM-296, "Camshaft"](#).

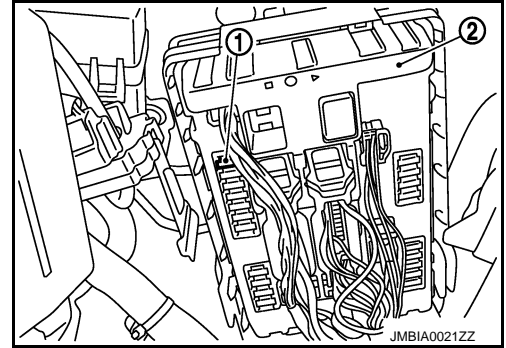
6. Install selected valve lifter.
7. Install camshaft. Refer to [EM-251, "Removal and Installation"](#).
8. Manually turn crankshaft pulley a few turns.
9. Check that the valve clearances for cold engine are within the specifications by referring to the specified values. Refer to "INSPECTION".
10. Install all removal parts in the reverse order of removal.
11. Warm up the engine, and check for unusual noise and vibration.

## COMPRESSION PRESSURE

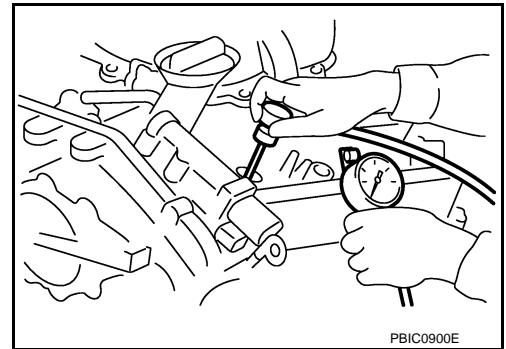
### Inspection

INFOID:000000013607793

1. Warm up engine thoroughly. Then, stop it.
2. Release fuel pressure. Refer to [EC6-279, "Work Procedure"](#) (FOR USA AND CANADA) or [EC6-1212, "Work Procedure"](#) (FOR MEXICO).
3. Disconnect fuel pump fuse ① from IPDM E/R ② to avoid fuel injection during measurement.

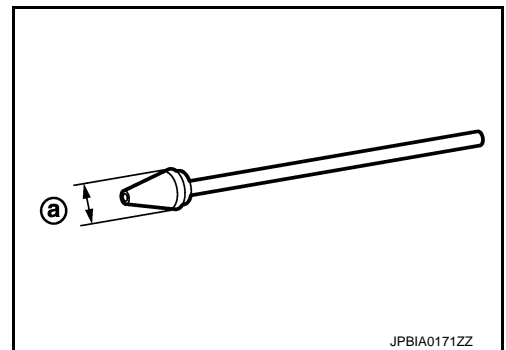


4. Remove engine cover. Refer to [EM-163, "Removal and Installation"](#).
5. Remove ignition coil and spark plug from each cylinder. Refer to [EM-193, "Removal and Installation"](#).
6. Connect engine tachometer (not required in use of CONSULT).
7. Install compression gauge with an adapter (commercial service tool) onto spark plug hole.



- Use the adapter whose picking up end inserted to spark plug hole is smaller than 20 mm (0.79 in) in diameter. Otherwise, it may be caught by cylinder head during removal.

① : 20 mm (0.79 in)



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

**Compression pressure** : Refer to [EM-295, "General Specification"](#).

**CAUTION:**

- Measure a six-cylinder under the same conditions since a measurement depends on measurement conditions (engine water temperature, etc.).
- Always use a fully charged battery to obtain the specified engine speed.
- If the engine speed is out of the specified range, check battery liquid for proper gravity. Check the engine speed again with normal battery gravity.

# COMPRESSION PRESSURE

[VR30DDTT]

## < BASIC INSPECTION >

- If compression pressure is below the 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 checking, measure compression pressure again. A
  - If a cylinder has low compression pressure, pour a small amount of engine oil into the spark plug hole of the cylinder to recheck it for compression. EM
  - 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. C
  - If two adjacent cylinders have respectively low compression pressure and their compression remains low even after the addition of engine oil, cylinder head gaskets are leaking. In such a case, replace cylinder head gaskets. D
9. After inspection is completed, install removed parts.
10. Start the engine, and check that the engine runs smoothly.
11. Perform trouble diagnosis. If DTC appears, erase it. Refer to [EC6-294, "Description"](#) (FOR USA AND CANADA) or [EC6-1220, "Description"](#) (FOR MEXICO). E

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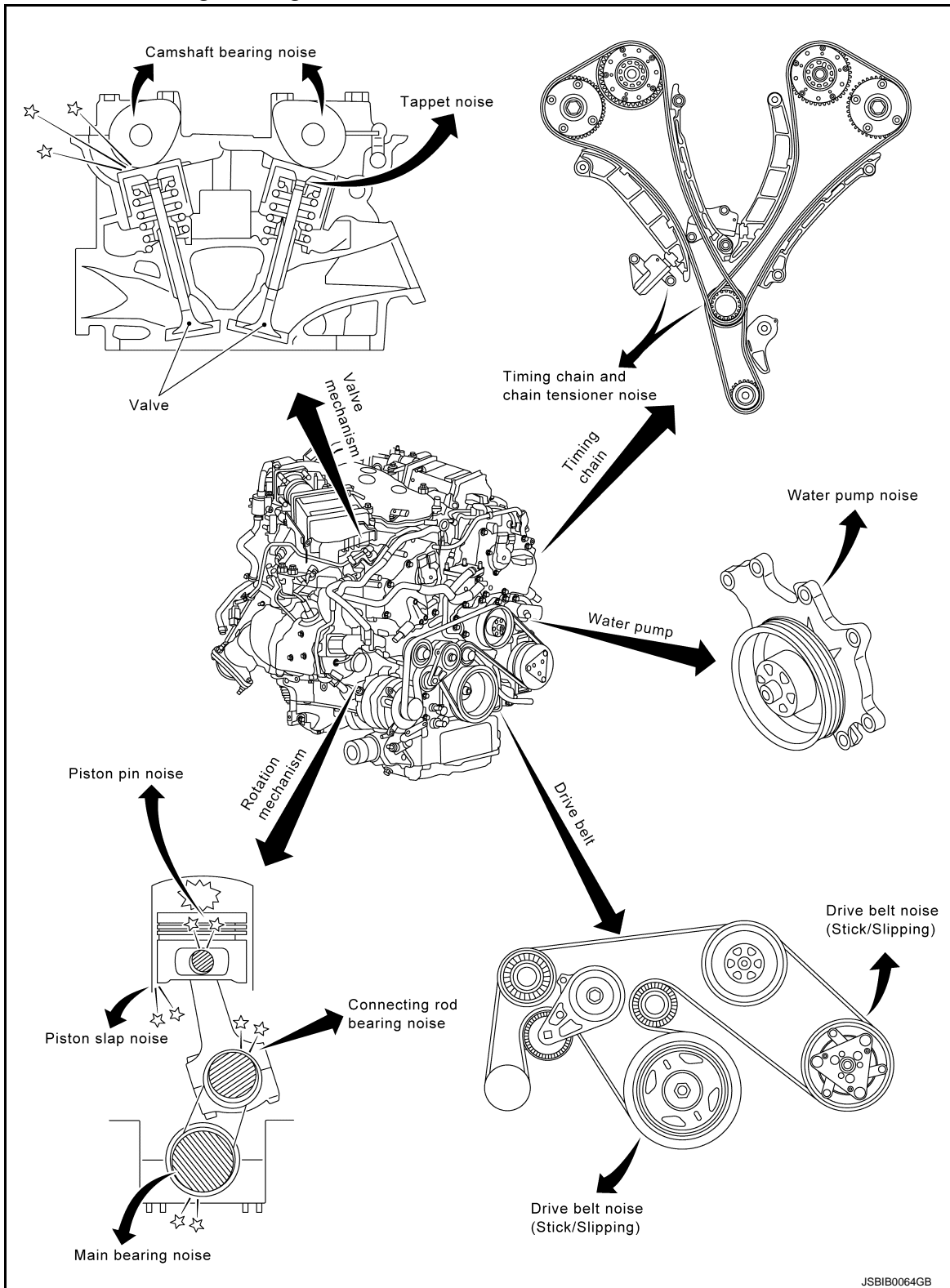
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**SYMPTOM DIAGNOSIS**

**NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING**

**NVH Troubleshooting - Engine Noise**

INFOID:000000013607794



Use the Chart Below to Help You Find the Cause of the Symptom

INFOID:000000013607795

1. Locate the area where noise occurs.

# NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING

< SYMPTOM DIAGNOSIS >

[VR30DDTT]

2. Confirm the type of noise.
3. Specify the operating condition of the engine.
4. Check specified noise source.

If necessary, repair or replace these parts.

Location of noise	Type of noise	Operating condition of engine						Source of noise	Check item	Reference page
		Before warm-up	After warm-up	When starting	When idling	When racing	While driving			
Top of engine Rocker cover Cylinder head	Ticking or clicking	C	A	—	A	B	—	Tappet noise	Valve clearance	<a href="#">EM-145</a>
	Rattle	C	A	—	A	B	C	Camshaft bearing noise	Camshaft runout Camshaft journal oil clearance	<a href="#">EM-296</a>
Crankshaft pulley Cylinder block (Side of engine) Oil pan	Slap or knock	—	A	—	B	B	—	Piston pin noise	Piston to piston pin oil clearance Connecting rod bushing oil clearance	<a href="#">EM-301</a>
	Slap or rap	A	—	—	B	B	A	Piston slap noise	Piston to cylinder bore clearance Piston ring side clearance Piston ring end gap Connecting rod bend and torsion	<a href="#">EM-301</a>
	Knock	A	B	C	B	B	B	Connecting rod bearing noise	Connecting rod bushing oil clearance Connecting rod bearing oil clearance	<a href="#">EM-301</a> <a href="#">EM-305</a>
	Knock	A	B	—	A	B	C	Main bearing noise	Main bearing oil clearance Crankshaft runout	<a href="#">EM-304</a> <a href="#">EM-301</a>
Front of engine Timing chain case	Tapping or ticking	A	A	—	B	B	B	Timing chain and timing chain tensioner noise	Timing chain cracks and wear Timing chain tensioner operation	<a href="#">EM-248</a> <a href="#">EM-239</a>
Front of engine	Squeaking or fizzing	A	B	—	B	—	C	Drive belt (Sticking or slipping)	Drive belt deflection	<a href="#">EM-155</a>
	Creaking	A	B	A	B	A	B	Drive belt (Slipping)	Idler pulley bearing operation	
	Squall Creak	A	B	—	B	A	B	Water pump noise	Water pump operation	<a href="#">CO-48</a>

A: Closely related B: Related C: Sometimes related —: Not related

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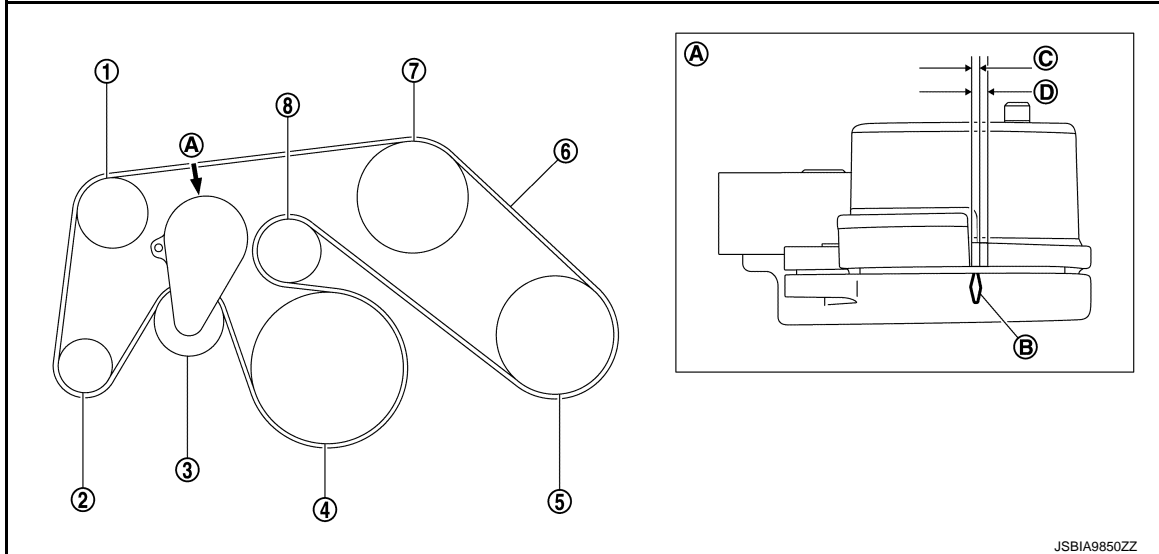
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## PERIODIC MAINTENANCE

### DRIVE BELT

#### Exploded View

INFOID:000000013607796



- |                        |                  |  |
|------------------------|------------------|--|
| ① Idler pulley         | ② Alternator     | ③ Drive belt auto-tensioner                |
| ④ Crankshaft pulley    | ⑤ A/C compressor | ⑥ Drive belt                               |
| ⑦ Water pump           | ⑧ Idler pulley   |  |
| (A) View               | (B) Indicator    | (C) Range when new drive belt is installed |
| (D) Possible use range |                  |  |

### Removal and Installation

INFOID:000000013607797

#### REMOVAL

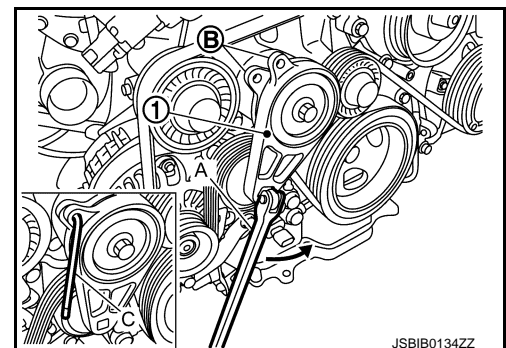
1. Remove front under cover, using a power tool (commercial service tool). Refer to [EXT-35. "FRONT UNDER COVER : Removal and Installation"](#).

2. While securely holding the square hole in pulley center of drive belt auto tensioner ① with a spinner handle (A), move spinner handle in the direction of arrow (loosening direction of drive belt).

**CAUTION:**

**Never place hand in a location where pinching may occur if the holding tool accidentally comes off.**

- (B) : Holding boss
- C : Metallic bar [approximately 6 mm (0.24 in) in diameter]\*
- ← : Loosening direction of drive belt



\*: Hexagonal wrench shown as example in the figure

3. Under the above condition, insert a metallic bar through the holding boss to lock drive belt auto-tensioner pulley arm.
4. Remove drive belt.

#### INSTALLATION

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

**CAUTION:**

- Check drive belt is securely installed around all pulleys.

# DRIVE BELT

< PERIODIC MAINTENANCE >

[VR30DDTT]

- Check drive belt is correctly engaged with the pulley groove.
- Check for engine oil and engine coolant are not adhered drive belt and pulley groove.

A

## Inspection

INFOID:0000000013607798

### INSPECTION BEFORE REMOVAL

EM

#### **WARNING:**

**Be sure to perform the this step when engine is stopped.**

- Check that the indicator (notch on fixed side) of drive belt auto-tensioner is within the possible use range.

C

#### **NOTE:**

- Check the drive belt auto-tensioner indication when the engine is cold.
- Visually check the entire drive belt for wear, damage or crack.
- If the indicator (notch on fixed side) is out of the possible use range or belt is damaged, replace drive belt.

D

### INSPECTION AFTER INSTALLATION

- Turn crankshaft pulley clockwise several times to equalize tension between each pulley, and then confirm tension of drive belt at indicator (notch on fixed side) is within the possible use range. Refer to [EM-154, "Exploded View"](#).

E

## Adjustment

INFOID:0000000013607799

Refer to [EM-296, "Drive Belt"](#).

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# AIR CLEANER FILTER

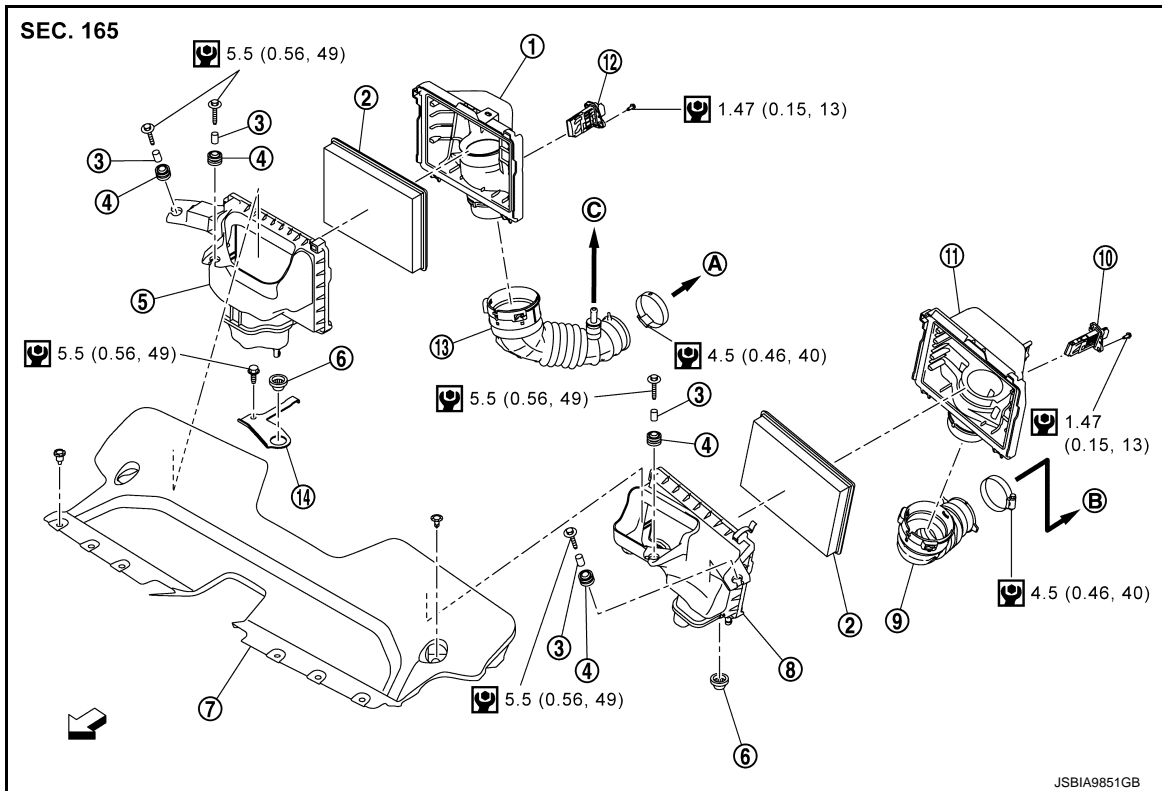
< PERIODIC MAINTENANCE >

[VR30DDTT]

## AIR CLEANER FILTER

### Exploded View

INFOID:000000013607800



- |                                     |                                     |                                 |
|-------------------------------------|-------------------------------------|---------------------------------|
| ① Air cleaner cover (bank 1)        | ② Air cleaner filter                | ③ Speaser                       |
| ④ Grommet                           | ⑤ Air cleaner body (bank 1)         | ⑥ Grommet                       |
| ⑦ Air duct (inlet)                  | ⑧ Air cleaner body (bank 2)         | ⑨ Air duct (bank 2)             |
| ⑩ Mass air flow sensor (bank 2)     | ⑪ Air cleaner cover (bank 2)        | ⑫ Mass air flow sensor (bank 1) |
| ⑬ Air duct (bank 1)                 | ⑭ Bracket                           |                                 |
| Ⓐ To turbocharger assembly (bank 1) | Ⓑ To turbocharger assembly (bank 2) | Ⓒ To rocker cover (bank 1)      |

← : Engine front

Ⓜ : N-m (kg-m, in-lb)

## Removal and Installation

INFOID:000000013607801

### REMOVAL

#### Bank 1 side

1. Remove engine cover. Refer to [EM-163, "Removal and Installation"](#).
2. Loosen bolts Ⓐ of fuel tube protector ①.

#### NOTE:

- Loosen mounting bolt from fuel tube protector to position (B).

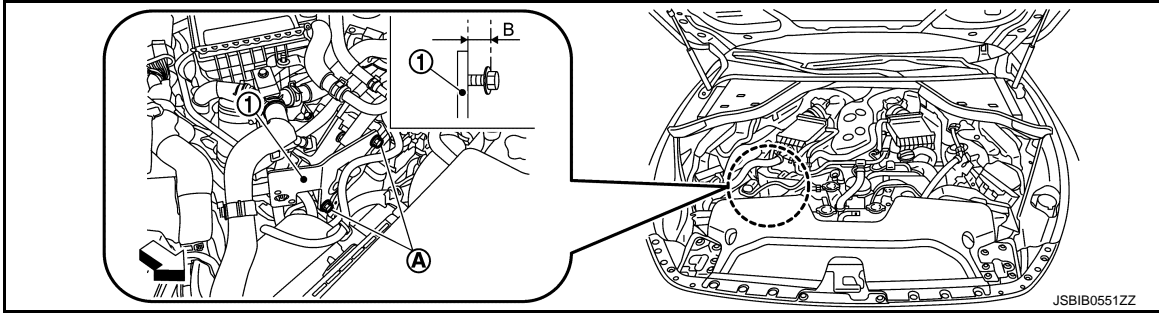


# AIR CLEANER FILTER

< PERIODIC MAINTENANCE >

[VR30DDTT]

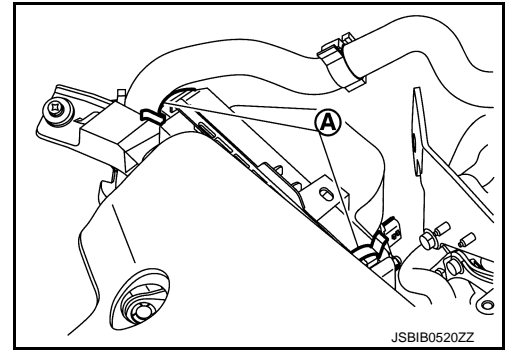
- This step must be performed for securing the clearance for removing / installing air cleaner filter.



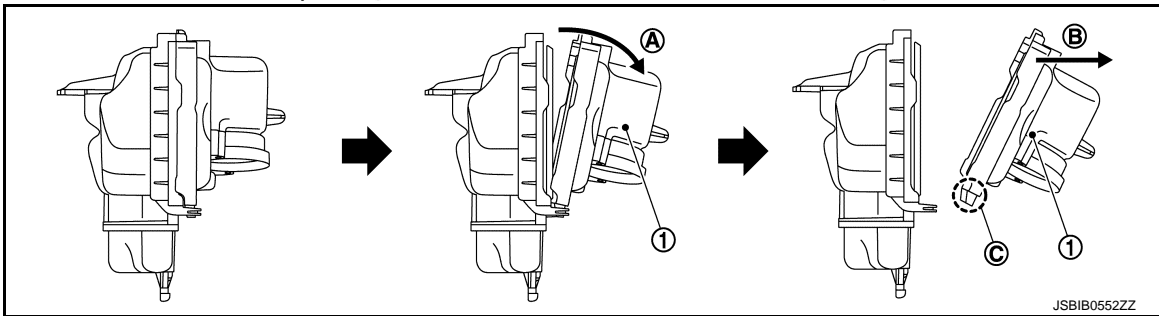
B 8 - 10 mm (0.31 - 0.39 in)

↶ : Vehicle front

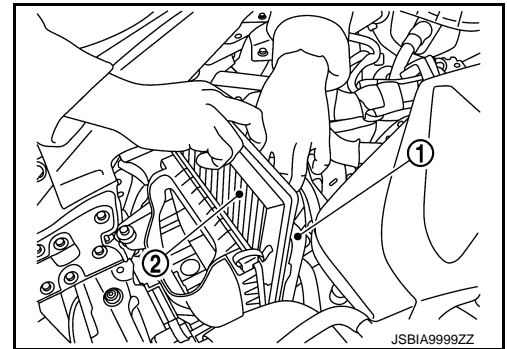
3. Unhook clips (A).



4. Separate air cleaner cover (1) from air cleaner body according to the following instructions:
  - Tilt air cleaner cover backward (A).
  - Pull out air cleaner cover pawl (C) and move air cleaner cover backward (B).



5. To remove air cleaner filter (2), widen the clearance between air cleaner body and air cleaner cover (1).



Bank 2 side

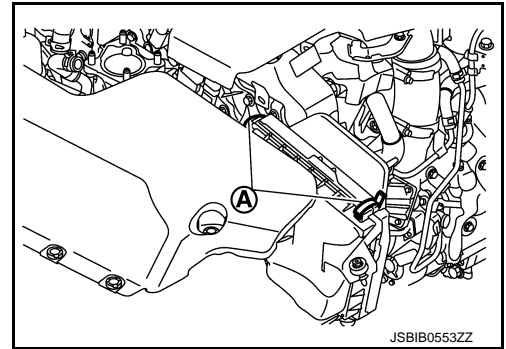
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# AIR CLEANER FILTER

[VR30DDTT]

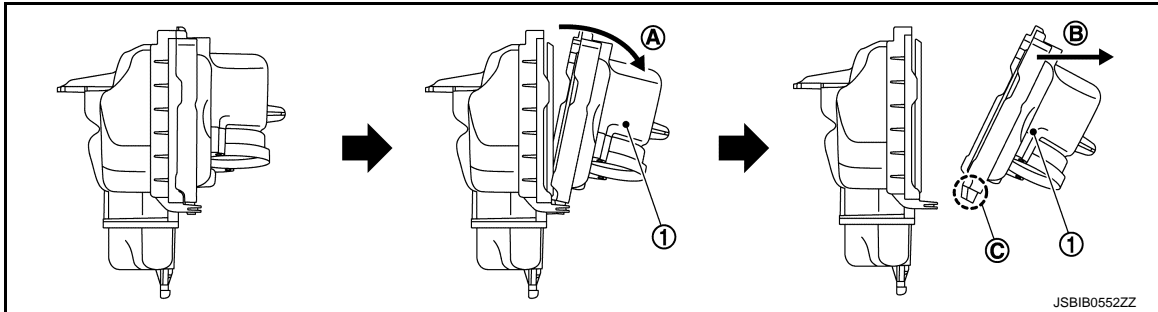
## < PERIODIC MAINTENANCE >

1. Unhook clips (A).

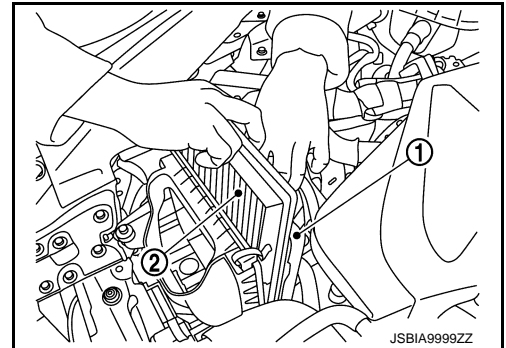


2. Separate air cleaner cover (1) from air cleaner body according to the following instructions:

- Tilt air cleaner cover backward (A).
- Pull out air cleaner cover pawl (C) and move air cleaner cover backward (B).



3. To remove air cleaner filter (2), widen the clearance between air cleaner body and air cleaner cover (1).



## INSTALLATION

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

- Install the air cleaner filter by aligning the seal with the notch of air cleaner body.

# AIR CLEANER FILTER

[VR30DDTT]

## < PERIODIC MAINTENANCE >

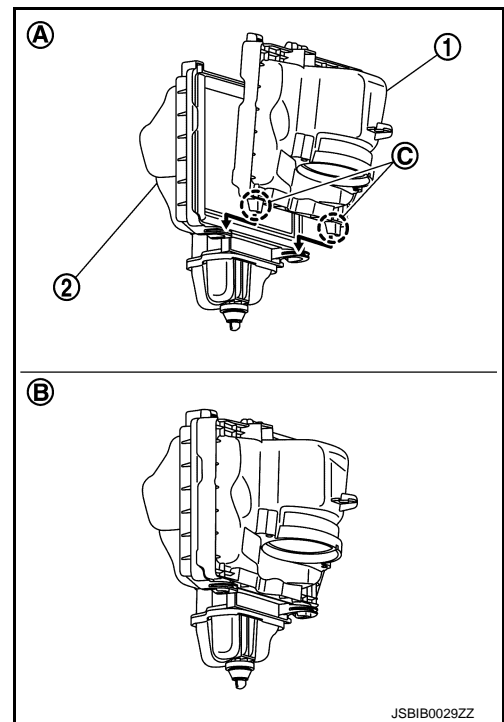
- Insert the pawl ③ of air cleaner cover ① into air cleaner body ② and fix with clip.

Ⓐ : Before installation

Ⓑ : After installation

### NOTE:

Tilt air cleaner cover backward and insert pawl into air cleaner body.



- Tighten mounting bolts of fuel tube protector to the specified torque. Refer to [EM-178, "Exploded View"](#).

## Inspection (Viscous Paper Type)

INFOID:000000013607802

### INSPECTION AFTER REMOVAL

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

- Remove dusts (such as dead leaves) on air cleaner element surface and inside cleaner case.
- If clogging or damage is observed, replace the air cleaner element.

### CAUTION:

**Never clean the viscous paper type air cleaner element by blowing as there is a risk of deterioration of its performance**

### MAINTENANCE INTERVAL

Refer to [MA-10, "FOR NORTH AMERICA : Introduction of Periodic Maintenance"](#) (FOR NORTH AMERICA) or [MA-16, "FOR MEXICO : Periodic Maintenance"](#) (FOR MEXICO).

# SPARK PLUG

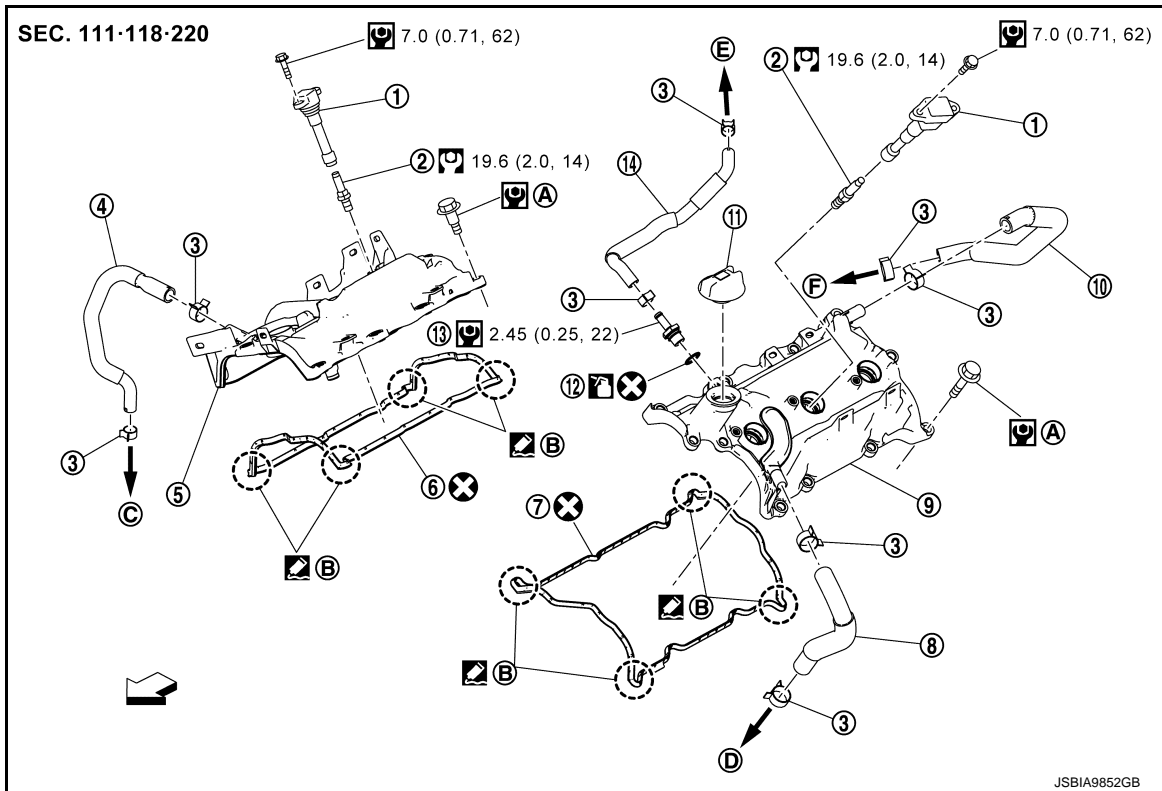
< PERIODIC MAINTENANCE >

[VR30DDTT]

## SPARK PLUG

### Exploded View

INFOID:000000013607803



- |   |                                |                                |
|---|--------------------------------|--------------------------------|
| ① Ignition coil   | ② Spark plug                   | ③ Clamp                        |
| ④ Blow-by hose (bank 1)   | ⑤ Rocker cover (bank 1)        | ⑥ Rocker cover gasket (bank 1) |
| ⑦ Rocker cover gasket (bank 2)  | ⑧ Blow-by hose (bank 2)        | ⑨ Rocker cover (bank 2)        |
| ⑩ Blow-by hose (rear)   | ⑪ Oil filler cap               | ⑫ Gasket                       |
| ⑬ PCV valve   | ⑭ Blow-by hose (front)         |                                |
| Ⓐ Comply with the installation procedure when tightening. Refer to <a href="#">EM-193</a> . | Ⓑ Camshaft bracket side        | Ⓒ To air duct (bank 1)         |
| Ⓓ To turbocharger (bank 2)  | Ⓔ To intake manifold collector | Ⓕ To cylinder block            |

← : Engine front

: N·m (kg·m, ft·lb)

: N·m (kg·m, in·lb)

: Always replace after every disassembly.

: Should be lubricated with oil.

: Sealing point

## Removal and Installation

INFOID:000000013607804

### REMOVAL

#### NOTE:

Do not drain coolant to remove spark plug.

1. Remove engine cover. Refer to [EM-163, "Removal and Installation"](#).
2. Disconnect turbocharger boost sensor (bank1 and 2) harness connector. Refer to [EM-167, "Exploded View"](#).

# SPARK PLUG

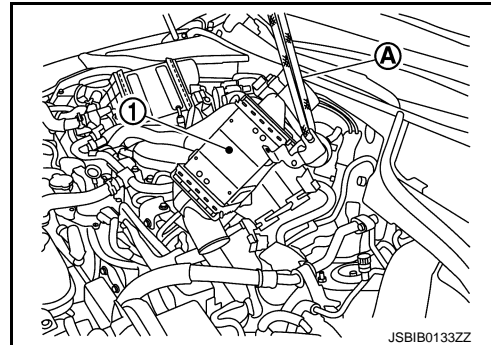
[VR30DDTT]

## < PERIODIC MAINTENANCE >

- Loosen air inlet hose clamp between charge air cooler and turbocharger. (charge air cooler side only). Refer to [EM-167, "Exploded View"](#).
- Loosen air inlet hose clamp between charge air cooler and electric throttle actuator. Refer to [EM-167, "Exploded View"](#).
- Remove mounting bolts of charge air cooler bracket and temporarily secure them on engine. Refer to [EM-167, "Exploded View"](#).

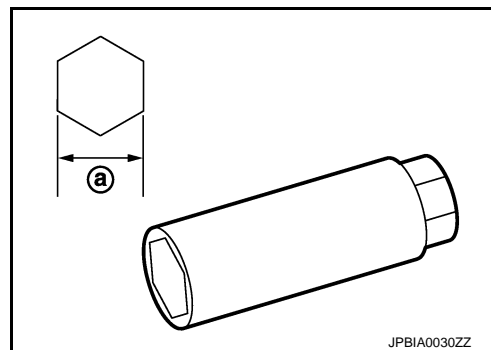
### NOTE:

Lift up the charge air cooler ① and fix this condition with a rope ② to secure work space.



- Remove ignition coil. Refer to [EM-193, "Removal and Installation"](#).
- Remove spark plug with a spark plug wrench (commercial service tool).

Ⓐ : 14 mm (0.55 in)



## INSTALLATION

Note the following and installation is the reverse order of removal. Install air inlet hose. Refer to [EM-168, "Removal and Installation"](#).

## Inspection

INFOID:000000013607805

## INSPECTION AFTER REMOVAL

Use the standard type spark plug for normal condition.

**Spark plug (Standard type) :** Refer to [EM-296, "Spark Plug"](#).

### CAUTION:

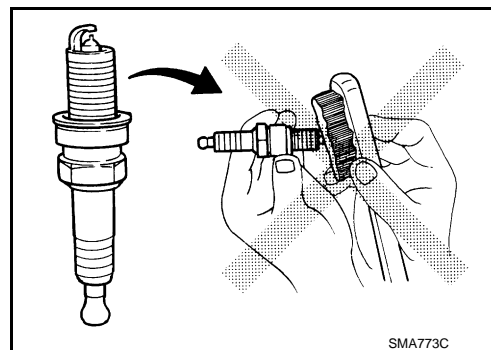
- Never drop or shock spark plug.
- Never use a wire brush for cleaning.
- If plug tip is covered with carbon, use spark plug cleaner to clean.

### Cleaner air pressure

: Less than 588 kPa (6 kg/cm<sup>2</sup>, 85 psi)

### Cleaning time

: Less than 20 seconds

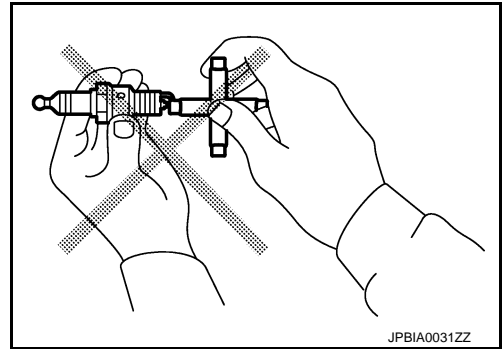


## SPARK PLUG

< PERIODIC MAINTENANCE >

[VR30DDTT]

- Check and adjustment of plug gap is not required between change intervals.



## REMOVAL AND INSTALLATION

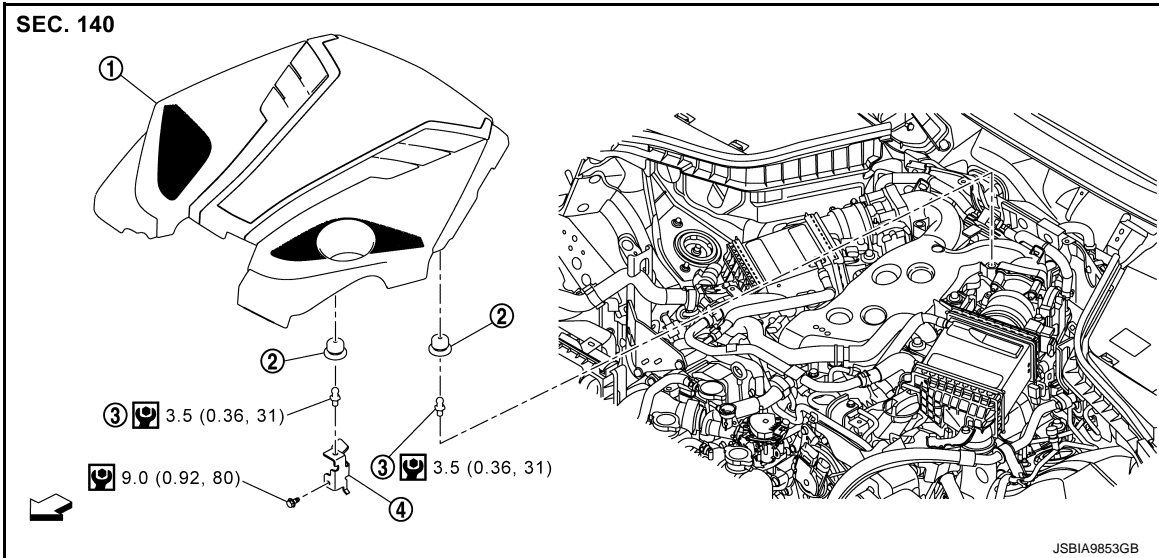
### ENGINE COVER

#### Exploded View

INFOID:0000000013607806

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EM



- ① Engine cover
- ② Grommet
- ③ Stud bolt
- ④ Bracket
- ↔ : Engine front
- ⊙ : N·m (kg-m, in-lb)

### Removal and Installation

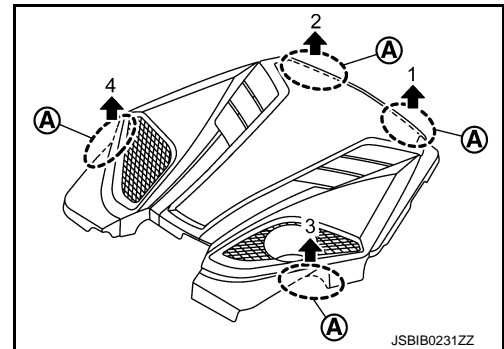
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#### REMOVAL

Remove fixed points (A) of the engine cover in the order from 1 to 4 as shown in the figure to remove engine cover.

#### CAUTION:

- Never damage or scratch engine cover when installing or removing.
- Never pull out engine cover forcibly.



#### INSTALLATION

Install in the reverse order removal.

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# DRIVE BELT AUTO TENSIONER AND IDLER PULLEY

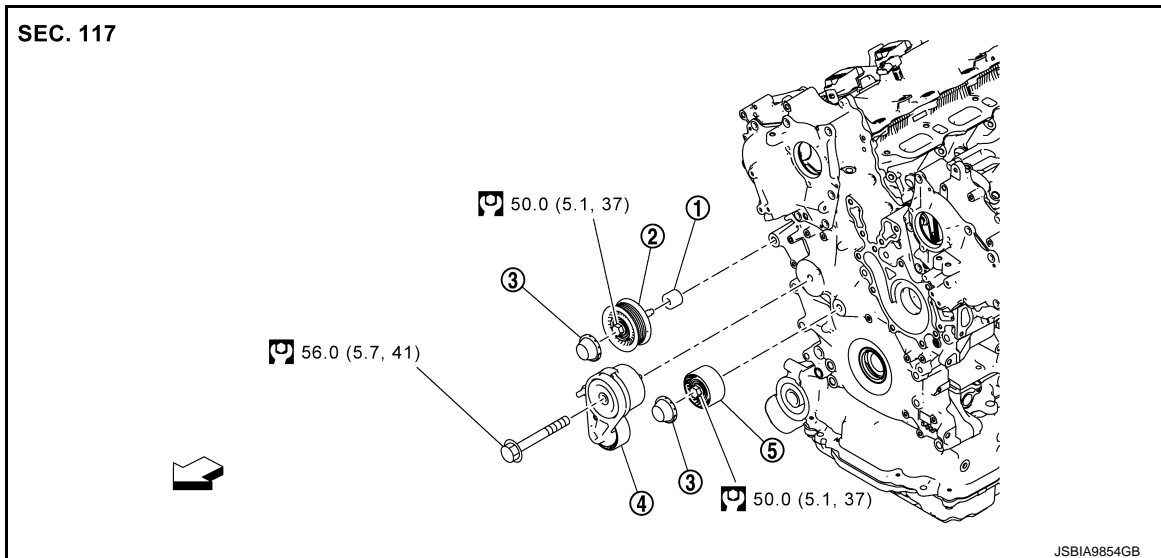
< REMOVAL AND INSTALLATION >

[VR30DDTT]

## DRIVE BELT AUTO TENSIONER AND IDLER PULLEY

Exploded View

INFOID:000000013607808



- |                             |                |              |
|-----------------------------|----------------|--------------|
| ① Spacer                    | ② Idler pulley | ③ Bolt cover |
| ④ Drive belt auto-tensioner | ⑤ Idler pulley |              |

⇐ : Engine front

🔧 : N·m (kg-m, ft-lb)

## Removal and Installation

INFOID:000000013607809

### REMOVAL

1. Remove drive belt. Refer to [EM-154. "Removal and Installation"](#).
  - Keep drive belt auto-tensioner pulley arm locked after drive belt is removed.
2. Remove drive belt auto-tensioner and idler pulley.
  - Keep drive belt auto-tensioner pulley arm locked to install or remove drive belt auto-tensioner.

### INSTALLATION

Installation is the reverse order of removal.

#### **CAUTION:**

**If there is damage greater than peeled paint, replace drive belt auto-tensioner.**



# AIR CLEANER AND AIR DUCT

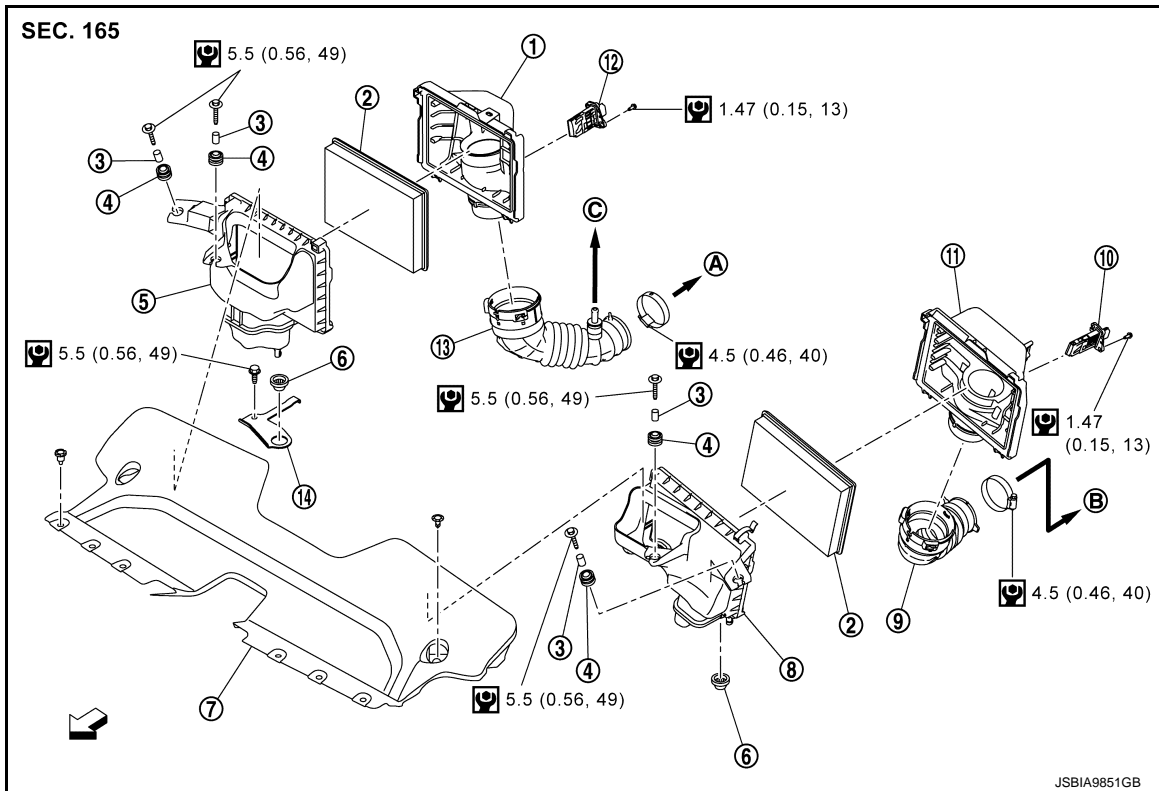
< REMOVAL AND INSTALLATION >

[VR30DDTT]

## AIR CLEANER AND AIR DUCT

### Exploded View

INFOID:000000013607810



- |                                 |                              |                                 |
|---------------------------------|------------------------------|---------------------------------|
| ① Air cleaner cover (bank 1)    | ② Air cleaner filter         | ③ Spesaser                      |
| ④ Grommet                       | ⑤ Air cleaner body (bank 1)  | ⑥ Grommet                       |
| ⑦ Air duct (inlet)              | ⑧ Air cleaner body (bank 2)  | ⑨ Air duct (bank 2)             |
| ⑩ Mass air flow sensor (bank 2) | ⑪ Air cleaner cover (bank 2) | ⑫ Mass air flow sensor (bank 1) |
| ⑬ Air duct (bank 1)             | ⑭ Bracket                    |                                 |
| Ⓐ To turbocharger (bank 1)      | Ⓑ To turbocharger (bank 2)   | Ⓒ To rocker cover (bank 1)      |

← : Engine front

Ⓜ : N-m (kg-m, in-lb)

## Removal and Installation

INFOID:000000013607811

### REMOVAL

#### NOTE:

Mass air flow sensor is removable under the car-mounted condition.

1. Remove air duct (inlet).
2. Remove air cleaner filter. Refer to [EM-156. "Removal and Installation"](#).
3. Disconnect mass air flow sensor harness connector.
4. Disconnect mass air flow sensor harness clip from air cleaner cover.
5. Remove hood side seal assembly. Refer to [DLK-200. "HOOD SEAL : Removal and Installation"](#).
6. Remove air cleaner body.
7. Remove air cleaner cover.

#### NOTE:

Widen air duct clip to pull up air cleaner cover.

# AIR CLEANER AND AIR DUCT

[VR30DDTT]

## < REMOVAL AND INSTALLATION >

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8. Remove mass air flow sensor from air cleaner cover, if necessary.

**CAUTION:**

**Handle mass air flow sensor according to the following instructions.**

- **Never shock the mass air flow sensor.**
- **Never disassemble the mass air flow sensor.**
- **Never touch the sensor of the mass air flow sensor.**

## INSTALLATION

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

- Align marks. Attach each joint. Screw clamps firmly.
- If a mass air flow sensor is replaced, carry out the teach of "Idle Air Volume Learning". Refer to [EC6-273. "Description"](#) (FOR USA AND CANADA) or [EC6-1206. "Description"](#) (FOR MEXICO).

## Inspection

INFOID:000000013607812

## INSPECTION AFTER REMOVAL

Inspect air duct for crack or tear.

- If anything is found, replace air duct.

# CHARGE AIR COOLER

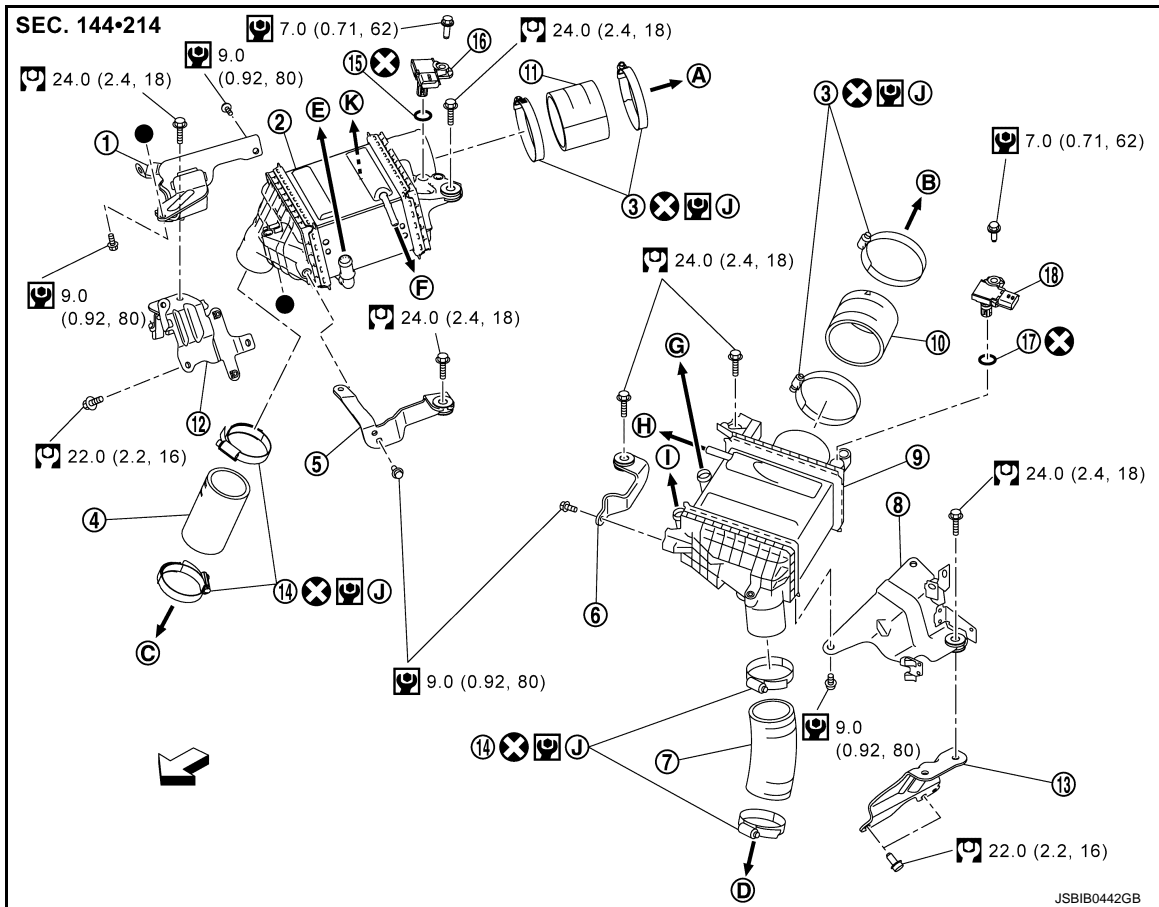
< REMOVAL AND INSTALLATION >

[VR30DDTT]

## CHARGE AIR COOLER

Exploded View

INFOID:000000013607813



- |   |  |                                      |
|---|--|--------------------------------------|
| ① Bracket 1   | ② Charge air cooler (bank 1)                     | ③ Clamp 1                            |
| ④ Air inlet hose 1 (bank 1)   | ⑤ Bracket 2                                      | ⑥ Bracket 3                          |
| ⑦ Air inlet hose 2 (bank 2)   | ⑧ Bracket 4                                      | ⑨ Charge air cooler (bank 2)         |
| ⑩ Air inlet hose 3 (bank 2)   | ⑪ Air inlet hose 4 (bank 1)                      | ⑫ Bracket 5                          |
| ⑬ Bracket 6   | ⑭ Clamp 2  | ⑮ O-ring                             |
| ⑯ Turbocharger boost sensor (bank 1)  | ⑰ O-ring   | ⑱ Turbocharger boost sensor (bank 2) |
| Ⓐ To electric throttle control actuator (bank 1)                                      | Ⓑ To electric throttle control actuator (bank 2) | Ⓒ To turbocharger assembly (bank 1)  |
| Ⓓ To turbocharger assembly (bank 2)   | Ⓔ To water hose 13                               | Ⓕ To water hose 12                   |
| Ⓖ To water hose 16  | Ⓖ To water hose 10                               | Ⓖ To water hose 11                   |
| Ⓙ Comply with the assembly procedure when tightening. Refer to <a href="#">EM-168</a> | Ⓚ To water hose 17                               |                                      |

← : Engine front

⊗ : Always replace after every disassembly

Ⓜ : N·m (kg·m, in·lb)

Ⓝ : N·m (kg·m, ft·lb)

● : Indicates that the parts is connected at points with same symbols in actual vehicle.

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# CHARGE AIR COOLER

< REMOVAL AND INSTALLATION >

[VR30DDTT]

## Removal and Installation

INFOID:000000013607814

### REMOVAL

1. Drain charge air cooler coolant from drain plug. Refer to [CO-51, "Draining and Refilling"](#).
2. Remove engine cover. Refer to [EM-163, "Removal and Installation"](#).
3. Remove air cleaner assembly. Refer to [EM-165, "Removal and Installation"](#).
4. Disconnect manifold absolute pressure sensor harness connector. Refer to [EM-173, "Exploded View"](#).
5. Remove cover stay. Refer to [EM-178, "Exploded View"](#).
6. Loosen all air inlet hose clamps.
7. Remove all water hose from charge air cooler. Refer to [CO-65, "Exploded View"](#).
8. Remove bolts of bracket 1 and 4.
9. Remove charge air cooler.
10. Remove all air inlet hose.

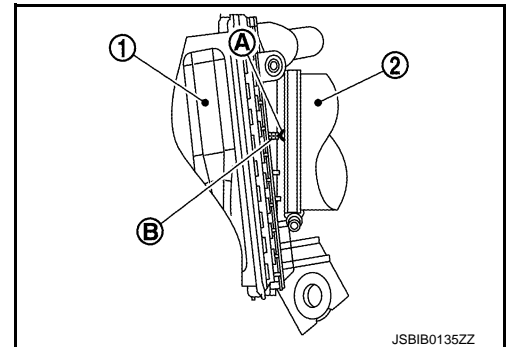
### INSTALLATION

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

Air inlet hose 3 and 4.

1. Insert air inlet hose to the charge air cooler all the way to stopper.
2. Fit the matching mark of charge air cooler ① with that of air inlet hose ②.

- (A) : Matching mark (white)  
(B) : Matching mark (rib)



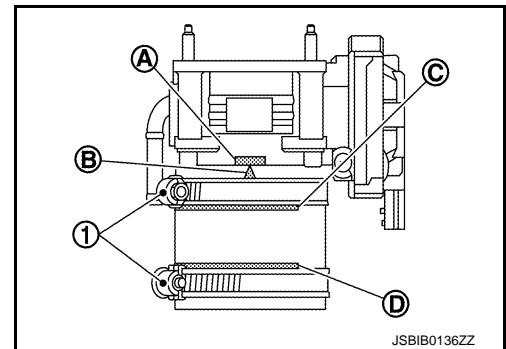
3. Insert air inlet hose to electric throttle control actuator.
  - Fit the matching mark of air inlet hose to electric throttle control actuator.

- (A) : Matching mark (rib)  
(B) : Matching mark (white)

#### CAUTION:

- Install clamp ① along the paint.
- Never install clamp on the paint.

- (C) : Paint mark (yellow)  
(D) : Paint mark (white)



### NOTE:

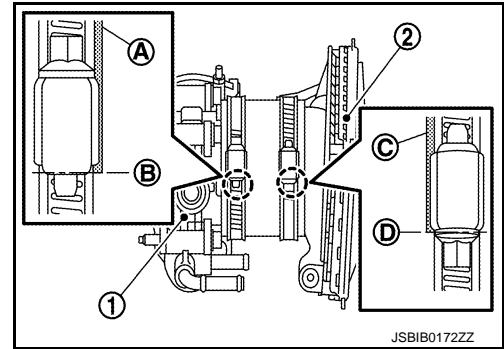
# CHARGE AIR COOLER

[VR30DDTT]

## < REMOVAL AND INSTALLATION >

- Align the clamp of the electric throttle control actuator side with the end of clamp housing **Ⓑ** and that of paint mark **Ⓐ** (yellow).
- Align the electric throttle control actuator side clamp with clamp housing head and the end **Ⓓ** of paint mark **Ⓒ** (white).

- ① : Electric throttle control actuator
- ② : Charge air cooler



4. Tighten clamp to the specified torque.

: **7.0 N·m (0.71kg·m, 62 in-lb)**

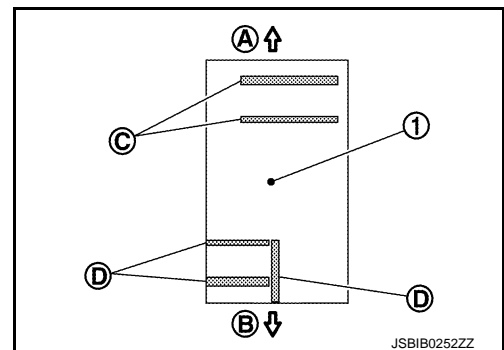
5. Tighten clamp to the specified torque again.

: **7.0 N·m (0.71kg·m, 62 in-lb)**

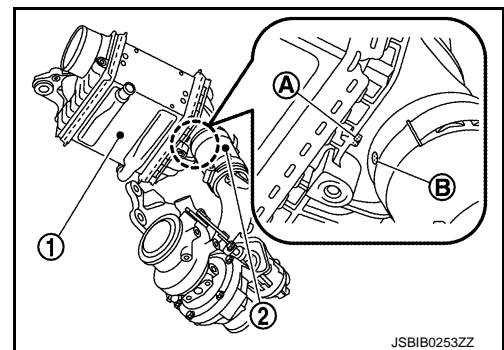
Air inlet hose 1

Install air inlet hose 1 ① as follows:.

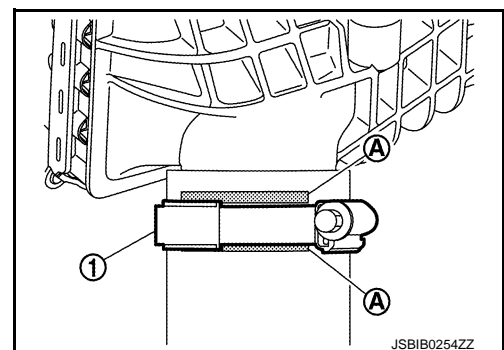
- Ⓐ : Charge air cooler side
- Ⓑ : Turbocharger assembly side
- Ⓒ : Paint mark (yellow)
- Ⓓ : Paint mark (white)



1. Insert air inlet hose 1 into charge air cooler. [Insert margin: 30 mm (1.18 in)]
2. Align charge air cooler ① matching mark **Ⓐ** with air inlet hose ② matching mark **Ⓑ**.



3. Install and tighten clamp ① within paint mark (yellow) **Ⓐ**.



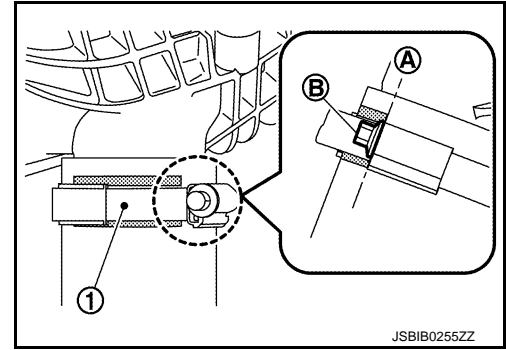
# CHARGE AIR COOLER

< REMOVAL AND INSTALLATION >

[VR30DDTT]

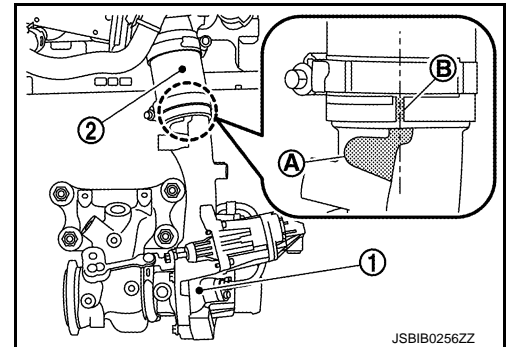
**NOTE:**

Tighten clamp ① at the end of bolt housing ② and paint mark (yellow) ③.

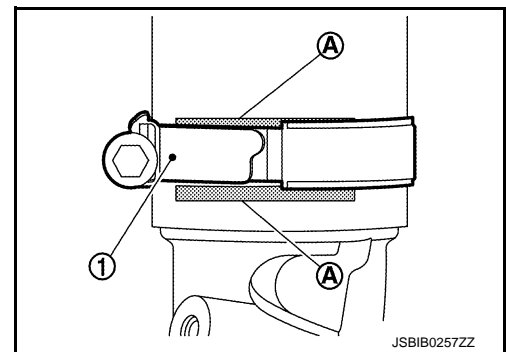


4. Install air inlet hose 1 into turbocharger. [Insert margin: 30 mm (1.18 in)]
5. Align turbocharger matching mark ④ with air inlet hose matching mark ⑤.

- ① : Turbocharger assembly (bank 1)
- ② : Air inlet hose 1

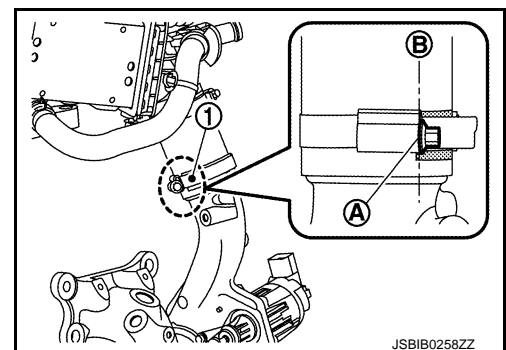


6. Install and tighten clamp ① within paint mark (white) ④.



**NOTE:**

Tighten clamp ① at the end of bolt housing ④ and paint mark (white) ⑤.



7. Tighten clamp to the specified torque.

 **7.0 N·m (0.71kg·m, 62 in·lb)**

8. Tighten clamp to the specified torque again.

 **7.0 N·m (0.71kg·m, 62 in·lb)**

# CHARGE AIR COOLER

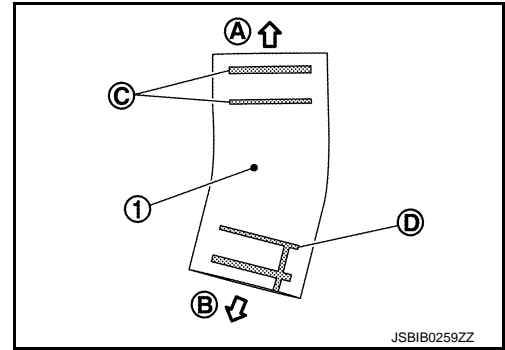
[VR30DDTT]

## < REMOVAL AND INSTALLATION >

Air inlet hose 2

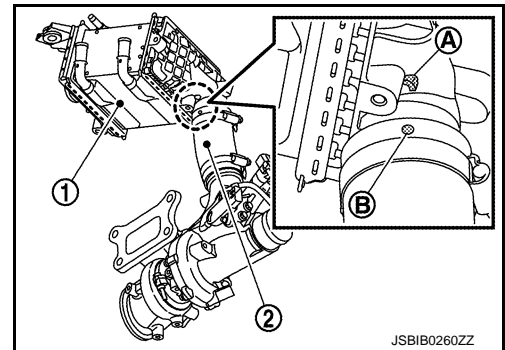
Install air inlet hose 2 ① as follows:

- Ⓐ : Charge air cooler side
- Ⓑ : Turbocharger assembly side
- Ⓒ : Paint mark (yellow)
- Ⓓ : Paint mark (pink)

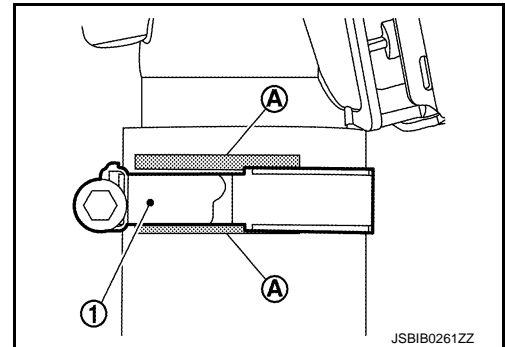


1. Install air inlet hose 2 into charger air cooler. [Insert margin: 30 mm (1.18 in)]
2. Align charger air cooler matching mark Ⓐ with air inlet hose matching mark Ⓑ.

- ① : Charge air cooler (bank 2)
- ② : Air inlet hose 2

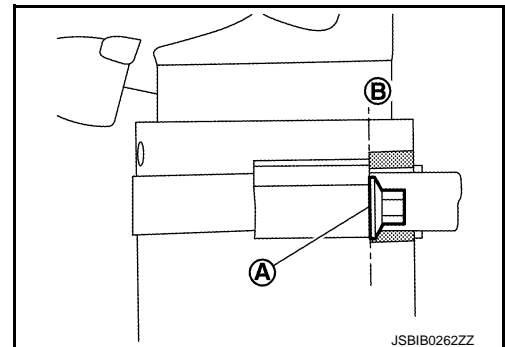


3. Install and tighten clamp ① within paint mark (yellow) Ⓐ.



### NOTE:

Tighten clamp at the end of bolt housing Ⓐ and paint mark (yellow) Ⓑ.



4. Install air inlet hose 2 into turbocharger. [Insert margin: 30 mm (1.18 in)]

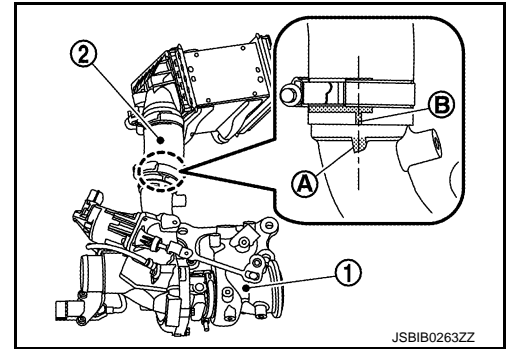
# CHARGE AIR COOLER

[VR30DDTT]

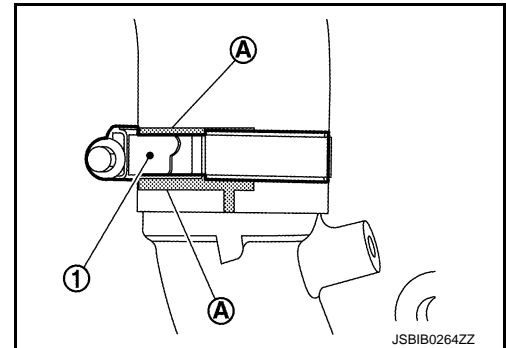
## < REMOVAL AND INSTALLATION >

5. Align turbocharger matching mark (A) with air inlet hose matching mark (B).

- ① : Turbocharger assembly (bank 2)  
② : Air inlet hose 2

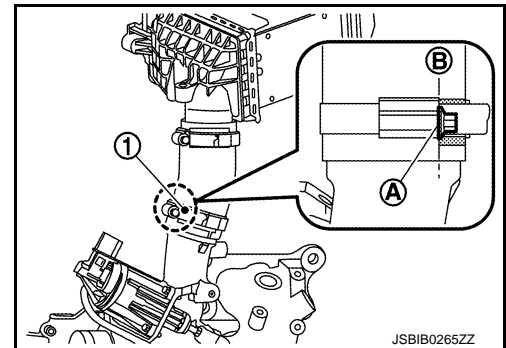


6. Install and tighten clamp (1) within paint mark (pink) (A).



### NOTE:

Tighten clamp (1) at the end of bolt housing (A) and paint mark (pink) (B).



7. Tighten clamp to the specified torque.

: **7.0 N-m (0.71kg-m, 62 in-lb)**

8. Tighten clamp to the specified torque again.

: **7.0 N-m (0.71kg-m, 62 in-lb)**

## Inspection

INFOID:000000013607815

### 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.

- **Be careful not to deform core fins.**



# INTAKE MANIFOLD COLLECTOR

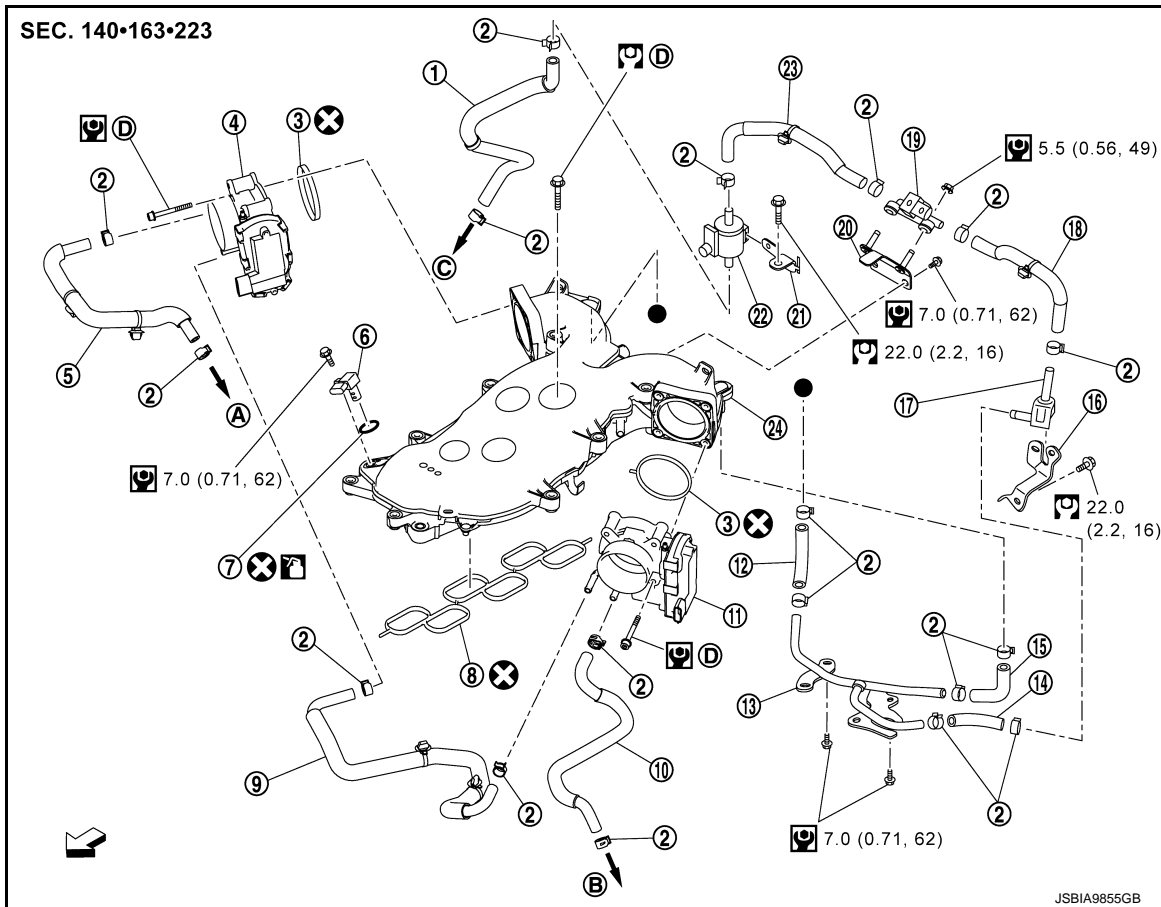
< REMOVAL AND INSTALLATION >

[VR30DDTT]

## INTAKE MANIFOLD COLLECTOR

Exploded View

INFOID:000000013607816



- |   |   |                                     |
|---|---|-------------------------------------|
| ① EVAP hose 1                                 | ② Clamp                                       | ③ Gasket                            |
| ④ Electric throttle control actuator (bank 1) | ⑤ Water hose 1                                | ⑥ Manifold absolute pressure sensor |
| ⑦ O-ring                                      | ⑧ Gasket                                      | ⑨ Water hose 3                      |
| ⑩ Water hose 2                                | ⑪ Electric throttle control actuator (bank 2) | ⑫ EVAP hose 1                       |
| ⑬ EVAP tube assembly                          | ⑭ EVAP hose 2                                 | ⑮ EVAP hose 3                       |
| ⑯ Bracket                                     | ⑰ Check valve                                 | ⑱ EVAP hose 4                       |
| ⑲ EVAP canister purge control solenoid valve  | ⑳ Bracket                                     | ㉑ Bracket                           |
| ㉒ EVAP service port                           | ㉓ EVAP hose 5                                 | ㉔ Intake manifold collector         |
| Ⓐ To water pipe                               | Ⓑ To turbocharger assembly                    | Ⓒ To under floor piping             |

Ⓓ Comply with the assembly procedure when tightening. Refer to [EM-174](#).

← : Engine front

Ⓔ : N·m (kg-m, ft-lb)

Ⓕ : N·m (kg-m, in-lb)

Ⓖ : Always replace after every disassembly.

Ⓗ : Should be lubricated with oil.

● : Indicates that the parts is connected at points with same symbols in actual vehicle.

# INTAKE MANIFOLD COLLECTOR

< REMOVAL AND INSTALLATION >

[VR30DDTT]

## Removal and Installation

INFOID:000000013607817

### REMOVAL

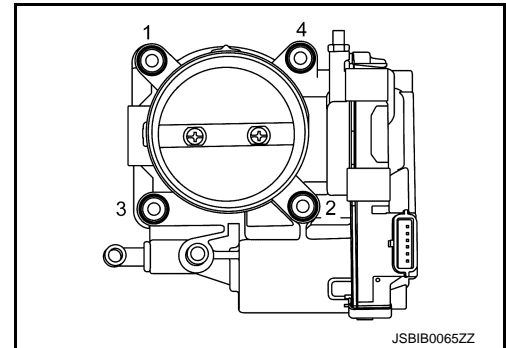
1. Remove engine cover. Refer to [EM-163, "Removal and Installation"](#).
2. Remove charge air cooler. Refer to [EM-168, "Removal and Installation"](#).
3. Remove electric throttle control actuator as follows:
  - a. Drain engine coolant. When water hoses are disconnected, attach plug to prevent engine coolant leakage.
- b. Disconnect water hoses from electric throttle control actuator. When engine coolant is not drained from radiator, attach plug to water hoses to prevent engine coolant leakage.
- c. Disconnect electric throttle control actuator harness connector.
- d. Loosen mounting bolts in the order from 4 to 1 as shown in the figure.

#### NOTE:

- When removing only intake manifold collector, move electric throttle control actuator without disconnecting the water hose.
- The figure shows the electric throttle control actuator (bank 1) viewed from the air duct side.
- Viewed from the air duct side, the order of loosening mounting bolts of electric throttle control actuator (bank 2) is the same as that of the electric throttle control actuator (bank 1).

#### CAUTION:

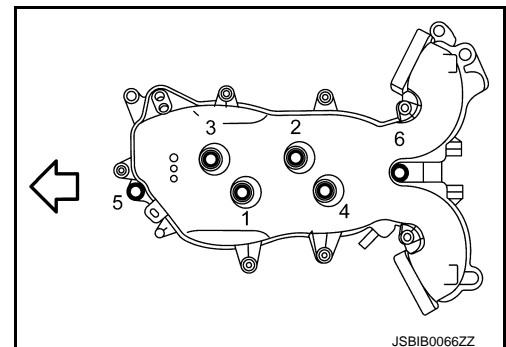
Handle carefully to avoid any shock to electric throttle control actuator.



- e. Remove gasket.
4. Disconnect vacuum hose, blow-by hose and EVAP hose from intake manifold collector.
  5. Remove EVAP canister purge volume control solenoid valve harness connector.
  6. Loosen mounting bolts in the order from 6 to 1 as shown in the figure to remove intake manifold collector.

⇐ : Engine front

7. Remove gasket.
8. Remove following parts, if necessary.
  - EVAP tube assembly
  - EVAP canister purge volume control solenoid valve



### INSTALLATION

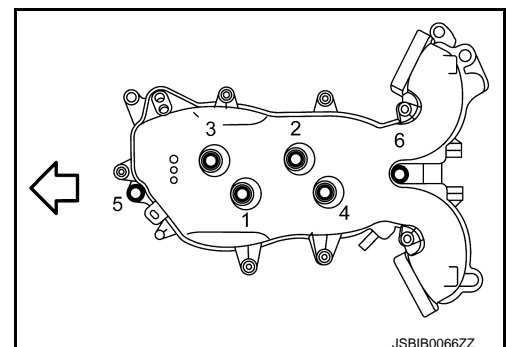
Note the following, and install in the reverse order of removal.

#### INTAKE MANIFOLD COLLECTOR

- Tighten mounting bolts to the torque specified below in the order from 1 to 6 as shown in the figure.

: **25.0 N·m (2.6 kg·m, 18 ft·lb)**

⇐ : Engine front



# INTAKE MANIFOLD COLLECTOR

< REMOVAL AND INSTALLATION >

[VR30DDTT]

## WATER HOSE

- Insert hose by 27 to 32 mm (1.06 to 1.26 in) from connector end.
- Clamp hose at location of 3 to 7 mm (0.12 to 0.28 in) from hose end.

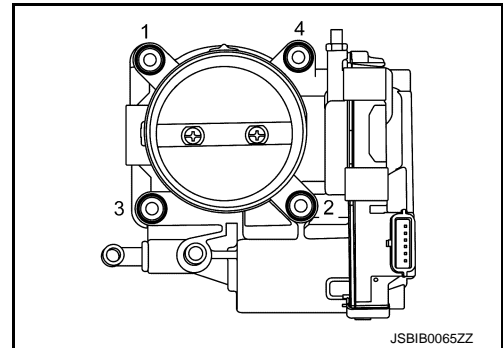
## ELECTRIC THROTTLE CONTROL ACTUATOR (BANK 1 AND BANK 2)

- Tighten to the torque specified below in the order from 1 to 4 as shown in the figure.

 **8.43 N·m (0.86 kg·m, 75 in·lb)**

### NOTE:

- The figure shows the electric throttle control actuator (bank 1) viewed from the air duct side.
- Viewed from the air duct side, the order of tightening mounting bolts of electric throttle control actuator (bank 2) is the same as that of the electric throttle control actuator (bank 1).
- Perform the "Throttle Valve Closed Position Learning" when harness connector of electric throttle control actuator is disconnected. Refer to [EC6-272, "Description"](#) (FOR USA AND CANADA) or [EC6-1205, "Description"](#) (FOR MEXICO).
- Perform the "Idle Air Volume Learning" and "Throttle Valve Closed Position Learning" when electric throttle control actuator is replaced. Refer to [EC6-273, "Description"](#) and [EC6-272, "Description"](#) (FOR USA AND CANADA) or [EC6-1206, "Description"](#) and [EC6-1205, "Description"](#) (FOR MEXICO).



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# INTAKE MANIFOLD

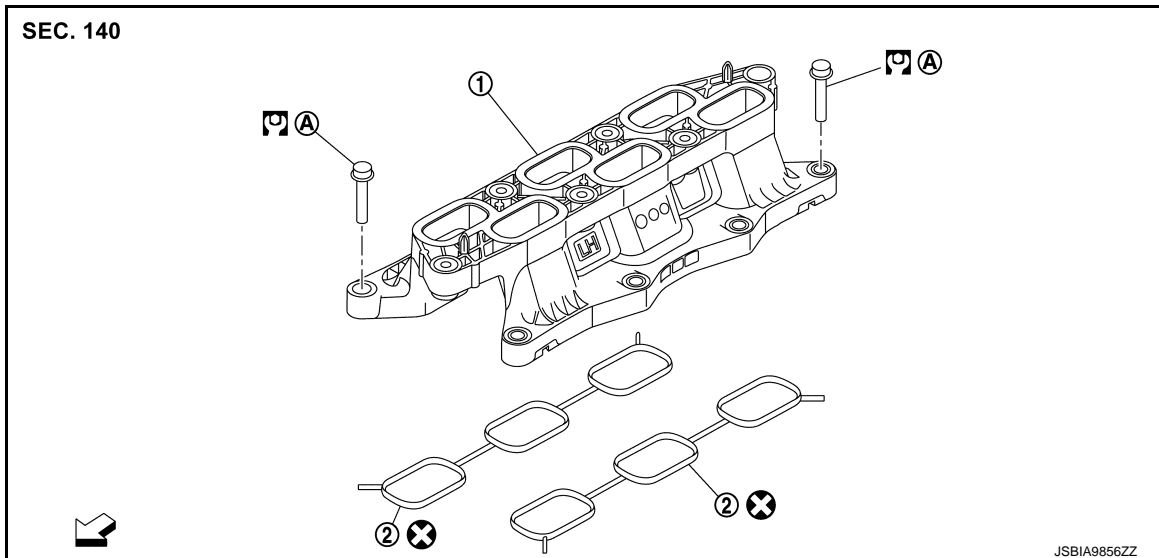
< REMOVAL AND INSTALLATION >

[VR30DDTT]

## INTAKE MANIFOLD

Exploded View

INFOID:000000013607818



① Intake manifold                      ② Gasket

Ⓐ Comply with the installation procedure when tightening. Refer to [EM-176](#).

← : Engine front

Ⓐ : N-m (kg-m, ft-lb)

⊗ : Always replace after every disassembly.

## Removal and Installation

INFOID:000000013607819

### REMOVAL

1. Remove intake manifold collector. Refer to [EM-174. "Removal and Installation"](#).
2. Loosen mounting bolts in the order from 8 to 1 as shown in the figure to remove intake manifold, using a power tool (commercial service tool).

← : Engine front

#### CAUTION:

- Cover engine openings to avoid entry of foreign materials.
- Put a mark on the intake manifold and the cylinder head with paint before removal because they need to be installed in the specified direction.

#### NOTE:

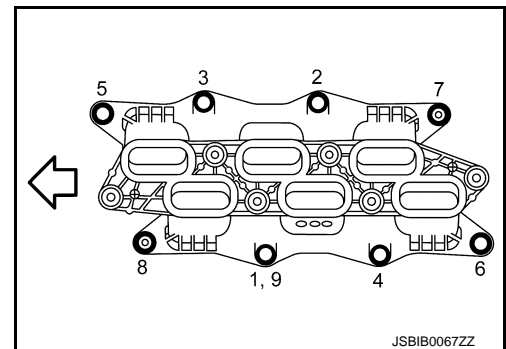
Disregard No. 9 when loosening.

3. Remove gaskets.

### INSTALLATION

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

INTAKE MANIFOLD




# INTAKE MANIFOLD

[VR30DDTT]

## < REMOVAL AND INSTALLATION >

- Tighten all mounting bolts to torque specified below in the order from 1 to 9 as shown in the figure.

: **25.0 N·m (2.6 kg-m, 18 ft-lb)**

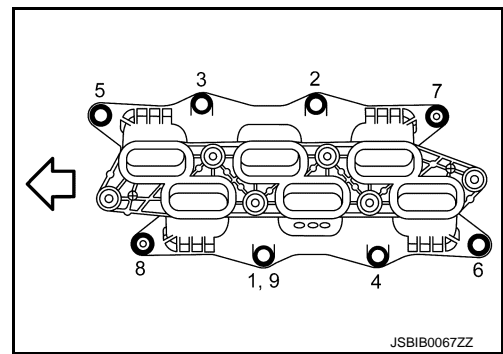
 : Engine front

### CAUTION:

- Install intake manifold with the marks (put on the intake manifold and the cylinder head before removal) aligned.

### NOTE:

- Tighten bolt No.1 in two step.
- The numerical order No. 9 shows the second step.



## Inspection

INFOID:000000013607820

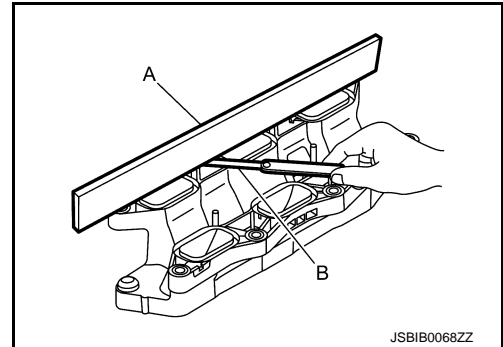
### INSPECTION AFTER REMOVAL

#### Surface Distortion

- Check the surface distortion of the intake manifold mating surface with a straightedge (A) and a feeler gauge (B) (commercial service tool).

**Limit** : Refer to [EM-296, "Intake Manifold"](#).

- If it exceeds the limit, replace intake manifold.



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# HIGH PRESSURE FUEL PUMP AND FUEL HOSE

< REMOVAL AND INSTALLATION >

[VR30DDTT]

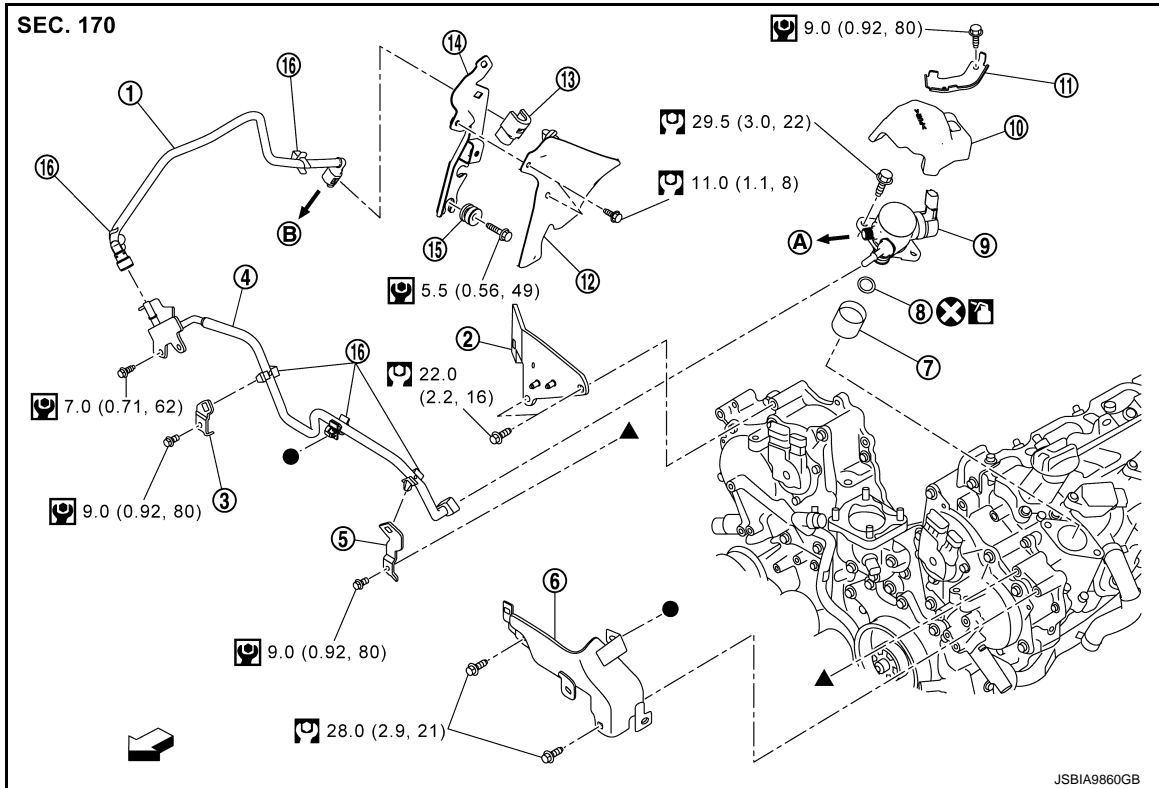
## HIGH PRESSURE FUEL PUMP AND FUEL HOSE

Exploded View

INFOID:000000013607821

**CAUTION:**

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



- |                                     |                                     |                           |
|-------------------------------------|-------------------------------------|---------------------------|
| ① Fuel feed hose 2                  | ② Fuel tube protector               | ③ Bracket                 |
| ④ Fuel feed hose 1                  | ⑤ Bracket                           | ⑥ Fuel tube protector     |
| ⑦ High pressure fuel pump lifter    | ⑧ O-ring                            | ⑨ High pressure fuel pump |
| ⑩ High pressure fuel pump insulator | ⑪ Cover stay                        | ⑫ Bracket                 |
| ⑬ Fuel hose connector cover         | ⑭ Bracket                           | ⑮ Grommet                 |
| ⑯ Clip                              |                                     |                           |
| Ⓐ To fuel tube assembly             | Ⓑ To centralized under-floor piping |                           |

← : Engine front

: N-m (kg-m, ft-lb)

: N-m (kg-m, in-lb)

: Always replace after every disassembly.

: Should be lubricated with oil.

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

## Removal and Installation

INFOID:000000013607822

### REMOVAL

**WARNING:**

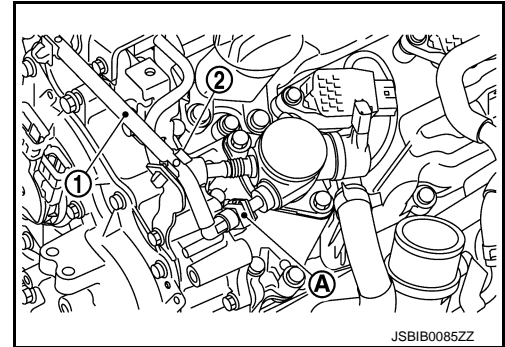
- Be sure to read [EM-138, "Precaution for Handling High Pressure Fuel System"](#) when working on the high pressure fuel system.
- Put a "CAUTION: FLAMMABLE" sign in the workshop.

# HIGH PRESSURE FUEL PUMP AND FUEL HOSE

[VR30DDTT]

## < REMOVAL AND INSTALLATION >

- Be sure to work in a well ventilated area and furnish workshop with a CO<sub>2</sub> fire extinguisher.
  - Never smoke while servicing fuel system. Keep open flames and sparks away from the work area.
1. Release fuel pressure. Refer to [EC6-279. "Work Procedure"](#) (FOR USA AND CANADA) or [EC6-1212. "Work Procedure"](#) (FOR MEXICO).
  2. Remove engine cover. Refer to [EM-163. "Removal and Installation"](#).
  3. Remove cover stay, and remove high pressure fuel pump insulator.
  4. Disconnect high pressure fuel pump harness connector.
  5. Disconnect quick connector (A) with the following procedure.
  - a. Disconnect fuel feed hose (1) from bracket hose clamp (2).



- b. Disengage (A) and pull up (B) the pawl of the fuel feed hose connector retainer (C) to disconnect the fuel feed hose from high pressure fuel pump.

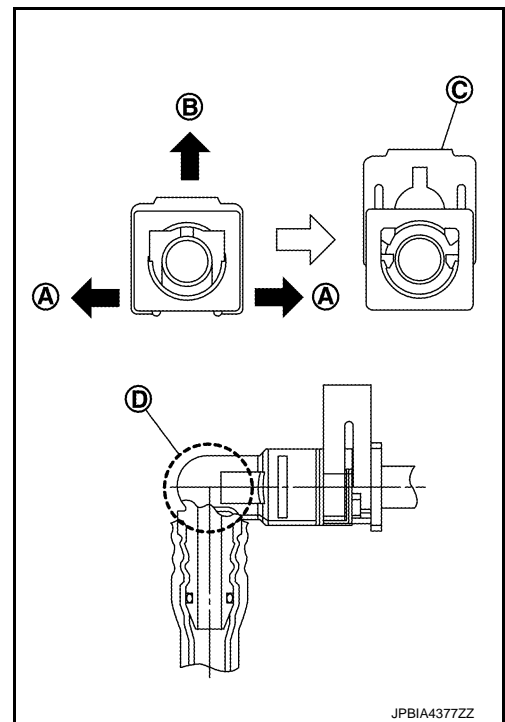
### NOTE:

If the fuel feed hose is stuck, hold the fuel pipe by hand and disconnect it by pushing and pulling.

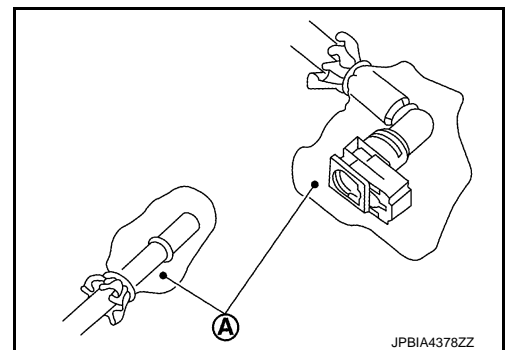
### CAUTION:

- Keep parts away from heat source. Especially, be careful when welding is performed around them.
- Never expose parts to battery electrolyte or other acids.
- Never bent or twist connection between quick connector and fuel feed hose (with damper) during installation/removal.
- Pull quick connector holding (D).
- Never remove the retainer.
- Prepare a tray and waste beforehand as fuel leaks out.
- Never pull with lateral force applied. O-ring inside quick connector may be damaged.

Retainer color : Red



- To prevent damage to each joint and protect it from the entry of foreign matter, cover the joint with plastic bag (A) or an equivalent.



6. Remove fuel tube assembly. Refer to [EM-182. "Removal and Installation"](#).



# HIGH PRESSURE FUEL PUMP AND FUEL HOSE

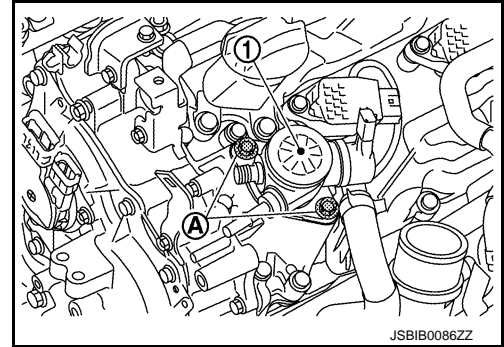
< REMOVAL AND INSTALLATION >

[VR30DDTT]

7. Remove high pressure fuel pump ① and lifter.

**CAUTION:**

To prevent damage to high pressure fuel pump and camshaft bracket, loosen bolt ④ alternately by one turn at a time until the reaction force applied on the high pressure fuel pump disappears.



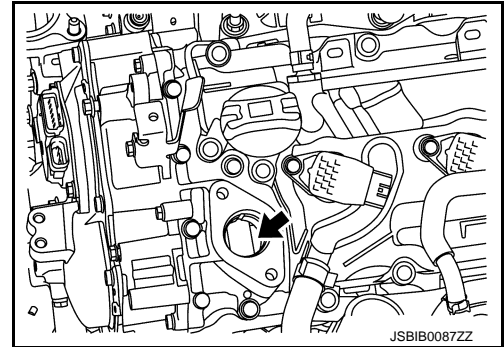
## INSTALLATION

**CAUTION:**

- Do not reuse O-rings.
- 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. Check the orientation of pump cam from the mounting area (view arrow) of high pressure fuel pump.

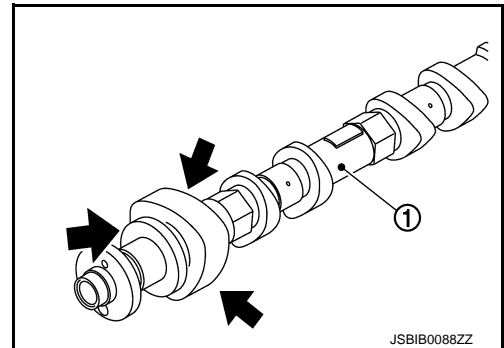


- b. Aim pump cam at the BDC area (arrow position).

① : Camshaft (EXH)

**NOTE:**

For BDC area, anywhere within the area indicated by arrow can be accepted.



- c. Install O-ring to high pressure fuel pump. When handling new O-ring, paying attention to the following caution items:

**CAUTION:**

- Do not reuse O-ring.
- Handle O-ring with bare hands. Never wear gloves.
- Lubricate O-ring with new engine oil.
- Never clean O-ring with solvent.
- Check that O-ring and its mating part are free of foreign material.
- Never damage O-ring with tools and fingernails during the installation. In addition, twisting or stretching O-ring is not allowed. If O-ring is stretched during the installation to high pressure fuel pump, never install high pressure fuel pump immediately.

- d. Install high pressure fuel pump lifter.
- e. Apply oil to the fitting area of high pressure fuel pump O-ring and camshaft bracket side to install high pressure fuel pump.
- f. Install high pressure fuel pump. To prevent damage to high pressure fuel pump and camshaft bracket, the following instructions must be observed.



# HIGH PRESSURE FUEL PUMP AND FUEL HOSE

< REMOVAL AND INSTALLATION >

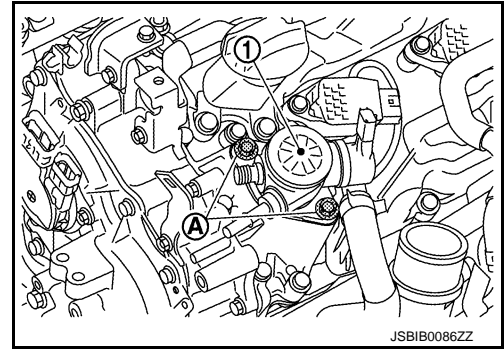
[VR30DDTT]

## CAUTION:

- Temporarily tighten bolt (A) by hand. Alternately tighten bolt by one turn at a time until high pressure fuel pump reaches camshaft bracket.

① : High pressure fuel pump

- After a pump flange sitting, tighten the bolts to the specified torque.



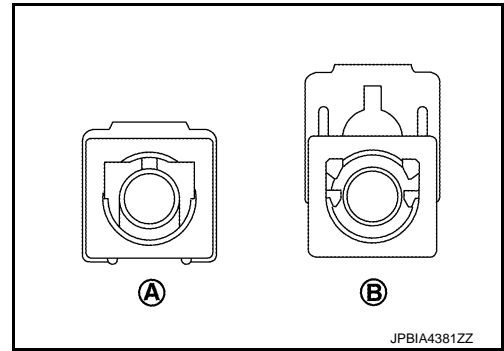
2. Connect fuel feed hose with the following procedure, and then install the fuel feed hose.
  - a. Check no foreign substances are deposited in and around matching pipe and quick connector, and no damage on them.
  - b. Quick connector shall be inserted gradually, aligning with the axis of the matching pipe.
  - c. Insert the retainer until it clicks and check the retainer is locked. After insertion, pull the connector and check that the connector is locked.

(A) : Lock position

(B) : Unlock position

## CAUTION:

If retainer cannot be installed smoothly, quick connector may be have not been installed correctly. Check connection again.



- d. After attaching the quick connector and fix the hose to the clamp.
3. Install the fuel tube assembly. Refer to [EM-182, "Removal and Installation"](#).
  4. Install in the reverse order of removal after this step.

## Inspection

INFOID:0000000013607823

## INSPECTION AFTER INSTALLATION

### Check for Fuel Leakage

1. Turn ignition switch "ON" (with the engine stopped). 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

< REMOVAL AND INSTALLATION >

[VR30DDTT]

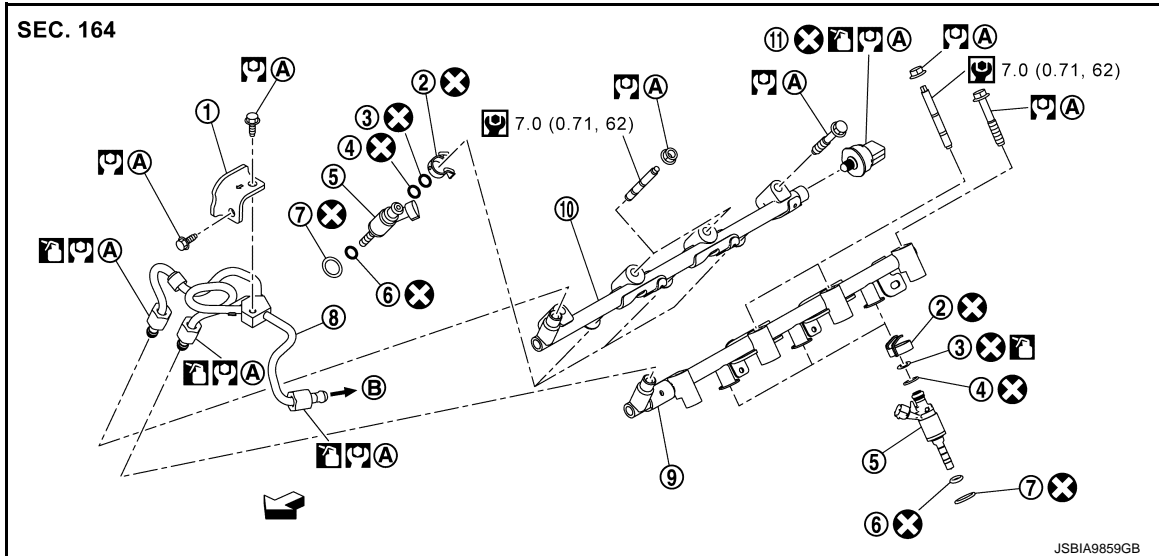
## FUEL INJECTOR

Exploded View

INFOID:000000013607824

### CAUTION:

Never disassemble or remove components beyond the configuration shown in the figure.



- |                           |                             |                           |
|---------------------------|-----------------------------|---------------------------|
| ① Bracket                 | ② Injector holder           | ③ O-ring (blue)           |
| ④ Backup ring             | ⑤ Fuel injector             | ⑥ Seal ring (white)       |
| ⑦ Insulator               | ⑧ Fuel tube assembly        | ⑨ Fuel rail (bank 2 side) |
| ⑩ Fuel rail (bank 1 side) | ⑪ Fuel rail pressure sensor |                           |
- Ⓐ Comply with the assembly procedure when tightening. Refer to [EM-182](#)    Ⓑ To high pressure fuel pump

⇐: Engine front

⊗: Always replace after every disassembly.

Ⓜ: N-m (kg-m, ft-lb)

Ⓜ: N-m (kg-m, in-lb)

Ⓜ: Should be lubricated with oil.

## Removal and Installation

INFOID:000000013607825

### WARNING:

- Be sure to read [EM-138, "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 CO2 fire extinguisher.
- Never smoke while servicing fuel system. Keep open flames and sparks away from the work area.

### REMOVAL

1. Release fuel pressure. Refer to [EC6-279, "Work Procedure"](#) (FOR USA AND CANADA) or [EC6-1212, "Work Procedure"](#) (FOR MEXICO).
2. Disconnect battery cable from the negative terminal.
3. Remove engine cover. Refer to [EM-163, "Removal and Installation"](#).
4. Remove air cleaner assembly. Refer to [EM-165, "Removal and Installation"](#).
5. Remove charge air cooler. Refer to [EM-168, "Removal and Installation"](#).
6. Remove intake manifold. Refer to [EM-176, "Removal and Installation"](#).

# FUEL INJECTOR

[VR30DDTT]

## < REMOVAL AND INSTALLATION >

7. Remove fuel tube assembly.

**CAUTION:**

**Because fuel leakage occurs, prepare a tray, shop cloth, and other items in advance.**

8. Disconnect the fuel rail pressure sensor harness connector.

9. Disconnect the fuel injector harness connector.

10. Remove the fuel rail pressure sensor if necessary.

11. Remove the fuel rail.

**CAUTION:**

- Be careful that no parts interfere with the fuel injectors.
- Because fuel leakage occurs, prepare a tray, shop cloth, and other items in advance.

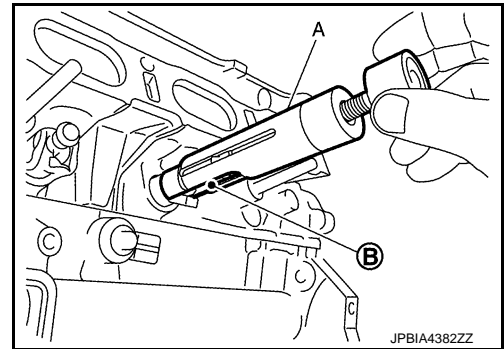
12. Follow the procedure below and remove the fuel injector from the fuel tube.

**CAUTION:**

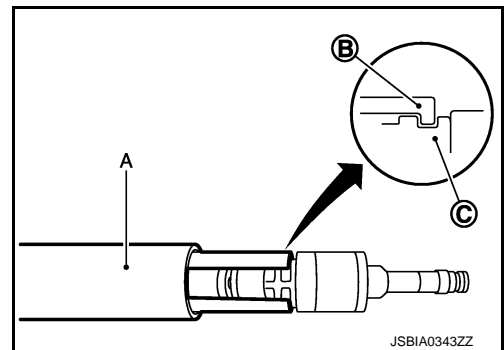
- Be careful of leakage of fuel remaining in fuel tube.
- Never damage the nozzle of fuel injector.
- Never subject parts to impact by dropping or hitting.
- Never disassemble or adjust. (Disassembly and adjustment of this part is prohibited.)

- a. Remove the injector holder.

- b. Install the injector remover [SST: KV10119600 (—)] (A) with the slit (B) aligned with the fuel injector connector.



- Insert the tab (B) of the injector remover [SST: KV10119600 (—)] (A) into the fuel injector groove (C).



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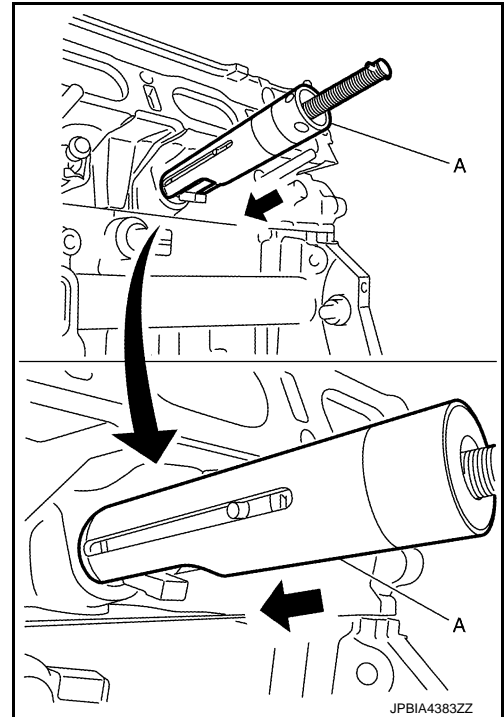
P

# FUEL INJECTOR

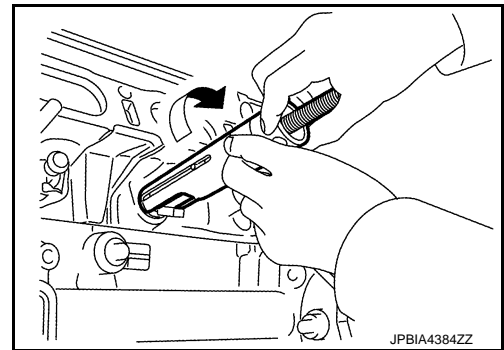
[VR30DDTT]

## < REMOVAL AND INSTALLATION >

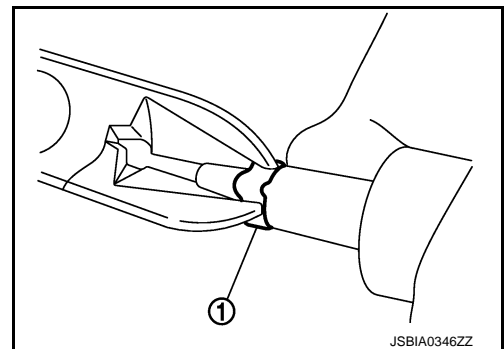
- c. Press the body of the injector remover [SST: KV10119600 (—)] (A) until it contacts the cylinder head.



- d. Tighten the injector remover [SST: KV10119600 (—)] clockwise, and remove injector from cylinder head.



- e. Pinch the seal ring ① and cut it off. Never scratch the fuel injector.



## INSTALLATION

1. After removing fuel pressure sensor, install fuel pressure sensor according to the instructions below:
  - a. Fix fuel rail in a vice.  
**CAUTION:**  
**Never scratch or crack fuel rail during work procedure.**
  - b. Apply engine oil to the entire perimeter of the fuel pressure sensor screw and the tip.  
**CAUTION:**  
**Check that fuel rail and fuel pressure sensor screw have no damage, foreign matter, or stains.**
  - c. Tighten fuel pressure sensor.

# FUEL INJECTOR

< REMOVAL AND INSTALLATION >

[VR30DDTT]

 : 10.0 N·m (1.0 kg·m, 89 in·lb)

### CAUTION:

- Before tightening fuel pressure sensor, securely install a hexagon tool.
- Never use impact applied fuel pressure sensor or gasket, such as dropped.

- d. Tighten fuel rail pressure sensor again by using angle wrench [SST: KV10112100] and torque wrench. (Angle tightening)

 : 35°

### CAUTION:

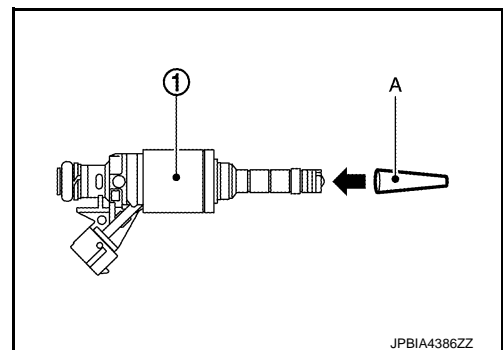
- To check tightening angle, use angle wrench [SST: KV10112100]. Never judge the angle by visual inspection.
- The torque value for the angle tightening must be 60 N·m (6.1 kg·m, 44 ft·lb) or less.
- If torque value reaches 60 N·m (6.1 kg·m, 44 ft·lb), then replace fuel rail and pressure sensor with a new one.

2. Install seal ring to fuel injector as per the following:

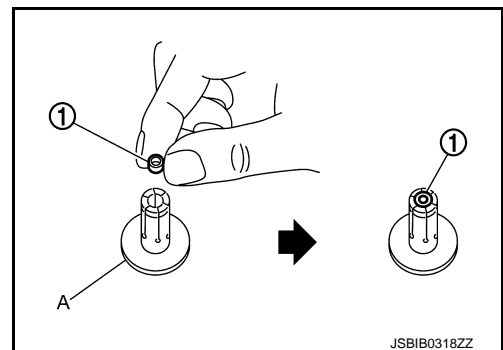
### CAUTION:

- Handle the O-ring with bare hands. (Never wear gloves when handling O-ring.)
- Never apply engine oil to the seal ring.
- Never use solvents or similar substances to clean the seal ring.

- a. Install the injector seal drift [SST: KV101197S0 (—)] (A) onto the fuel injector ①.



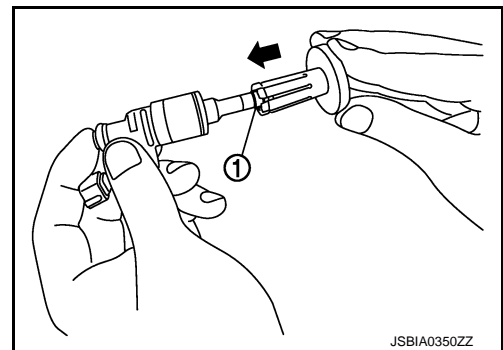
- b. Set the seal ring ① onto the injector seal drift [SST: KV101197S0 (—)] (A).



- c. Install the seal ring ① set in step 2 by inserting it straight into the fuel injector as shown in the figure.

### CAUTION:

When inserting the seal ring, never insert it further than the groove portion of the fuel injector.



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# FUEL INJECTOR

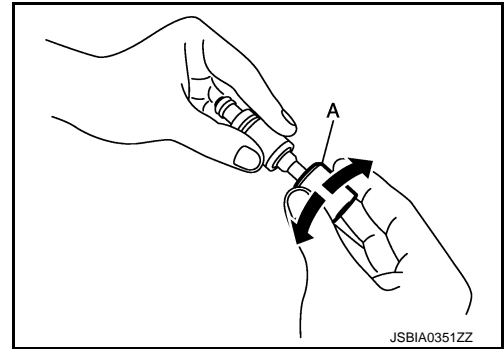
[VR30DDTT]

## < REMOVAL AND INSTALLATION >

- d. After installing the seal ring onto the fuel injector, install the injector seal drift [SST: KV101197S0 (—)] (A) onto the fuel injector as shown in the figure. Turn it left and right by 90° at a time until it contacts the seal ring to settle the seal ring in place.

**NOTE:**

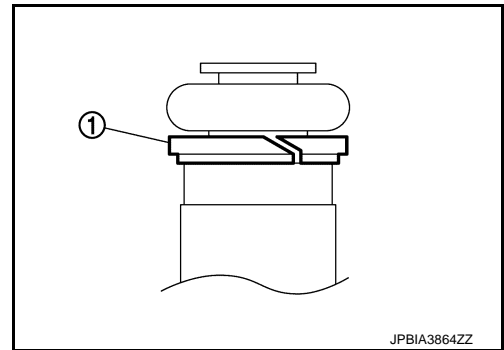
For correcting any elongation of the seal ring that occurs when the injector seal drift is installed, use the drift so that the seal ring is pressed and contracted.



3. Note the following points and install the O-ring and backup ring to the fuel injector.

**CAUTION:**


- Be sure to handle the O-ring with bare hands. (Never wear gloves.)
- Apply engine oil to the O-ring.
- Never use solvents or similar substances when cleaning the O-ring seal.
- Check that the O-ring and its mating part are free of foreign material.
- When installing O-ring, never scratch it with tool or fingernail. Also never twist or stretch O-ring. If O-ring is stretched while being attached, never insert it immediately.
- Insert O-ring straight onto fuel tube. Never decenter or turn it.
- Both the fuel rail adapter and backup ring ① have a tapered cross-section shape. Therefore, be careful of the orientation when installing them.




4. Follow the procedure below and install the fuel rail ② to the fuel injector ①.

③ : O-ring (blue)

④ : Backup ring

 : Should be lubricated with oil.

 : Always replace after every disassembly.

- a. Install the injector holder ⑤ onto the fuel injector.

**CAUTION:**

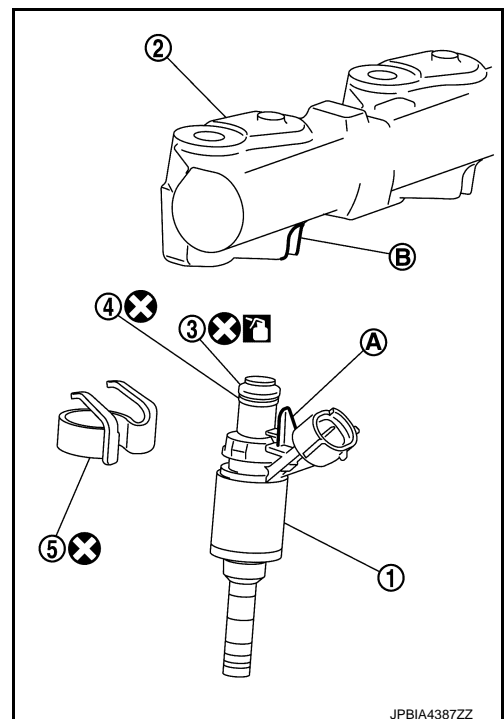
- Never reuse the injector holder. Always use a new one.
- Check that the injector holder does not contact the O-ring. If the clip contacts the O-ring, replace the O-ring.

- b. With the injector holder installed, insert the fuel injector into the fuel rail.

- Check that the axis is lined up when inserting.
- Insert so that the fuel tube projection ④ is aligned with the notch ⑤.

- c. Check that the fuel injector is securely installed, and does not turn or come out.

- Check that the projection on the fuel injector is fastened into the fastening groove on the fuel rail.



5. Install the fuel injector assembly into the cylinder head installation hole.

**CAUTION:**

# FUEL INJECTOR



< REMOVAL AND INSTALLATION >

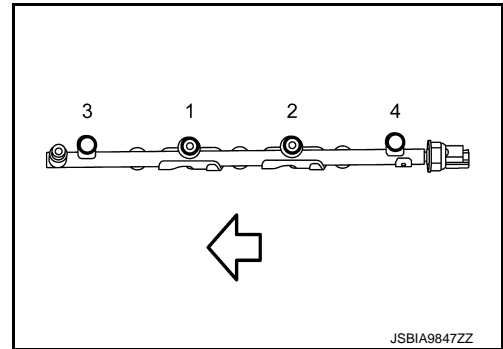
[VR30DDTT]

**Be careful to prevent contact with the end of the injector nozzle.**

- Tighten mounting bolts and nuts in two steps in the order from 1 to 4 shown in the figure.

← : Engine front

- First tightening** : **10.0 N·m (1.0 kg·m, 89 in-lb)**
- Second tightening** : **22.0 N·m (2.2 kg·m, 16 ft-lb)**

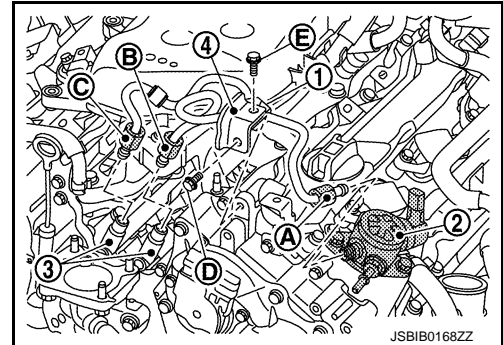


- Connect the fuel rail pressure sensor harness connector.
- Connect the fuel injector harness connector.
- Install fuel tube according to the following procedure.

**CAUTION:**

- **Never use fuel tube if its terminal tip is damaged.**
- **Observe the tightening order and the tightening torque.**

- Apply engine oil to the tip of nipples on both ends and nuts.
- Temporarily tighten fuel tube flare nut (A) by turning it 2 or 3 turns.
- Temporarily tighten fuel tube flare nut (B) and (C) by turning them 2 or 3 turns.
- Temporarily tighten bolt (D) of bracket (4) until it fits.
- Temporarily tighten bolt (E) of fuel tube assembly (1) until it fits.
- Temporarily tighten fuel tube flare nuts in the order of (B) → (C) → (A) until fuel rail (3) fits.
- Tighten fuel tube flare nut (B).



: **15.0 N·m**


- Tighten fuel tube flare nut (C).

: **15.0 N·m**

- Tighten fuel tube flare nut (A).

: **15.0 N·m**

- Tighten fuel tube flare nuts to the specified torque in the order of (B) → (C) → (A).

: **36.0 N·m (3.7 kg·m , 27 ft-lb)**


- Retighten fuel tube flare nuts to the specified torque in the order of (B) → (C) → (A).

: **36.0 N·m (3.7 kg·m , 27 ft-lb)**

- Tighten bracket bolt (D) to the specified torque by pushing it rearward.

: **13.5 N·m (1.4 kg·m , 10 ft-lb)**

- Tighten bracket bolt (E) to the specified torque.

 **13.5 N·m (1.4 kg-m , 10 ft-lb)**

**CAUTION:**

- After installing fuel tube, retighten flare nut with 34.0 N-m or more.
- When the tightening torque is lower than 34.0 N-m, retighten flare nut until it reaches 34.0 N-m or more.

9. Install removed parts in the reverse order of removal.

## Inspection

INFOID:000000013607826

## INSPECTION AFTER INSTALLATION

### Fuel Leakage Inspection

Check for fuel leakage according to the following procedure.

1. Turn ignition switch ON (with engine stopped). With fuel pressure applied to fuel piping, check for fuel leakage at the locations where parts are removed and reinstalled.

**NOTE:**

Use a mirror or other means to check locations that cannot be seen directly.

2. Start the engine, increase the engine speed, and check again for fuel leakage at the locations where parts are removed and reinstalled.

**CAUTION:**

**Be careful of burns when checking.**



# OIL PAN (LOWER)

< REMOVAL AND INSTALLATION >

[VR30DDTT]

## OIL PAN (LOWER)

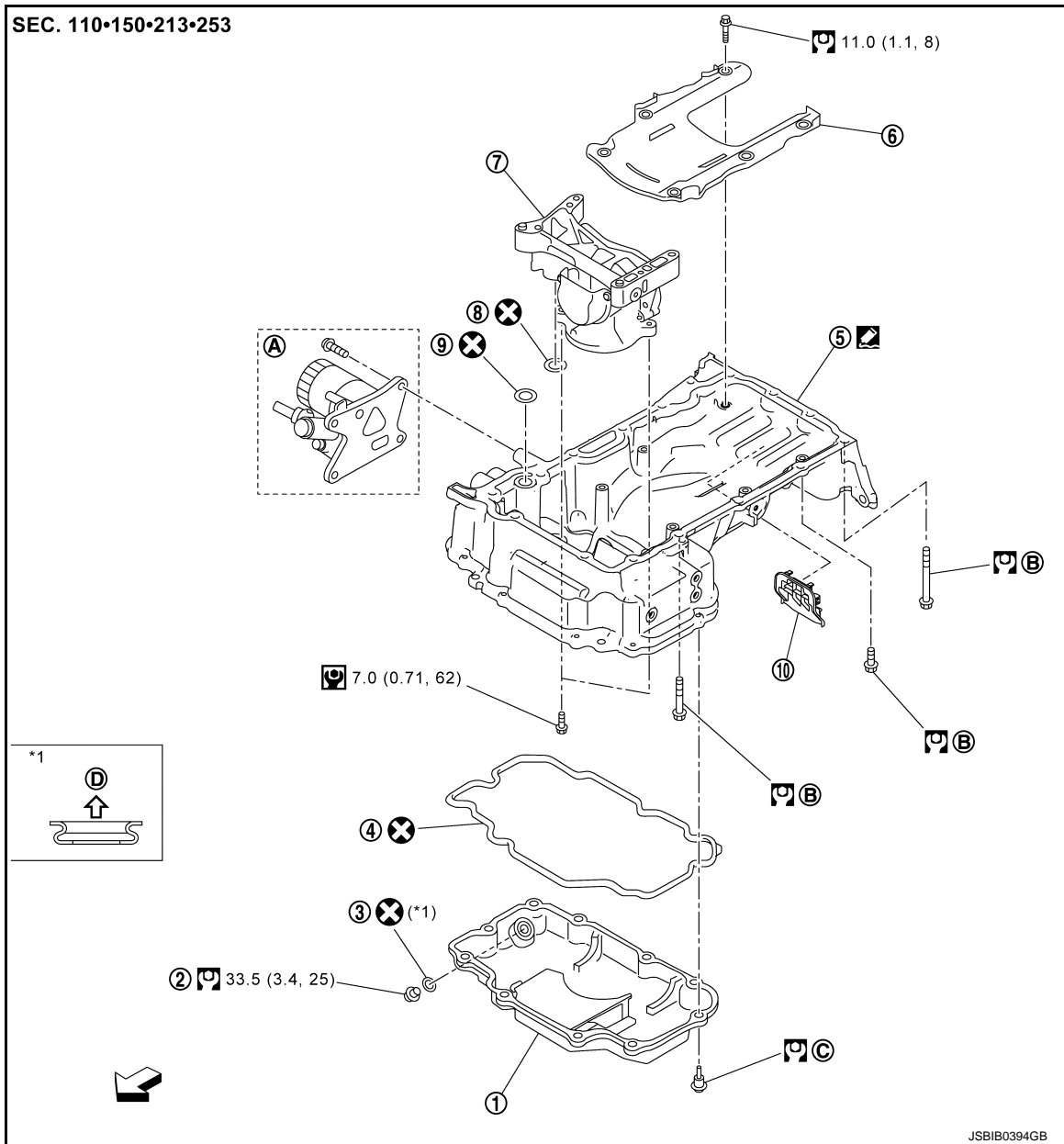
2WD

2WD : Exploded View

INFOID:000000013607827

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- |                     |                   |                     |
|---------------------|-------------------|---------------------|
| ① Oil pan (lower)   | ② Drain plug      | ③ Drain plug washer |
| ④ Gasket            | ⑤ Oil pan (upper) | ⑥ Baffle plate      |
| ⑦ Oil pump assembly | ⑧ O-ring          | ⑨ O-ring            |
| ⑩ Rear plate cover  |                   |                     |

Comply with the installation procedure when tightening.

- (A)
- Oil cooler air cooling type: Refer to [LU-33](#)
  - Oil cooler water cooling type: Refer to [LU-36](#)

- (B) Comply with the installation procedure when tightening. Refer to [EM-218](#)
- (C) Comply with the installation procedure when tightening. Refer to [EM-191](#)
- (D) Oil pan side

← : Engine front





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# OIL PAN (LOWER)

[VR30DDTT]

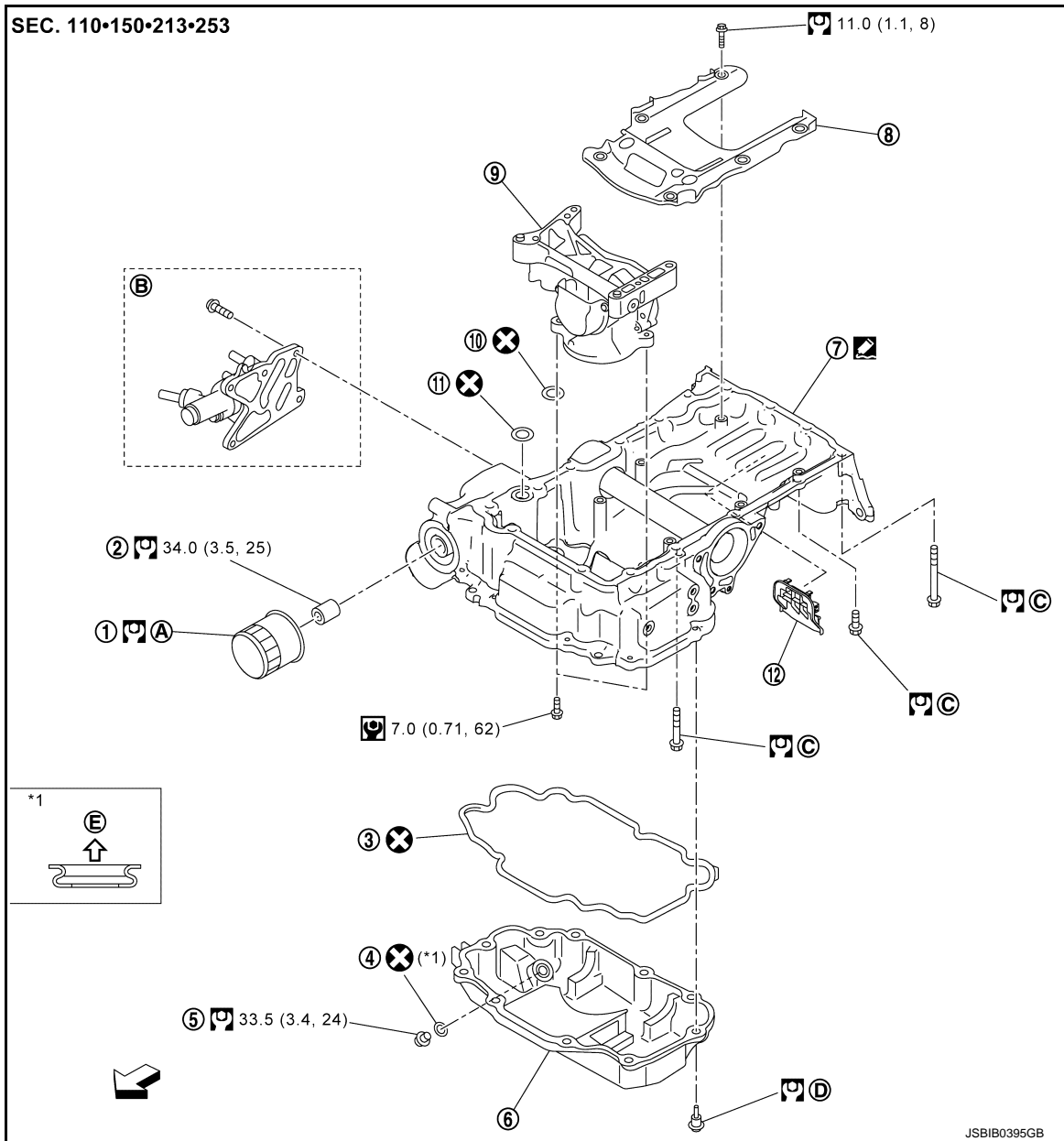
## < REMOVAL AND INSTALLATION >

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

AWD

AWD : Exploded View

INFOID:000000013607828



- |                     |                  |                     |
|---------------------|------------------|---------------------|
| ① Oil filter        | ② Connector bolt | ③ Gasket            |
| ④ Drain plug washer | ⑤ Drain plug     | ⑥ Oil pan (lower)   |
| ⑦ Oil pan (upper)   | ⑧ Baffle plate   | ⑨ Oil pump assembly |
| ⑩ O-ring            | ⑪ O-ring         | ⑫ Rear plate cover  |

# OIL PAN (LOWER)

[VR30DDTT]

## < REMOVAL AND INSTALLATION >

- Ⓐ Comply with the installation procedure when tightening. Refer to [LU-30](#). Ⓑ Comply with the installation procedure when tightening. Refer to [LU-33](#) and [LU-36](#).
- Ⓒ Comply with the installation procedure when tightening. Refer to [EM-222](#). Ⓓ Comply with the installation procedure when tightening. Refer to [EM-191](#). Ⓔ Oil pan side
- Ⓔ Oil pan side
- ⇐ : Engine front
- 🔩 : N·m (kg·m, ft·lb)
- 🔩 : N·m (kg·m, in·lb)
- ⊗ : Always replace after every disassembly.
- 🔩 : Sealing point

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## Removal and Installation

INFOID:000000013607829

### REMOVAL

#### CAUTION:

**Never drain engine oil when the engine is hot to avoid the danger of being scalded.**

1. Remove front under cover using a power tool (commercial service tool). Refer to [EXT-35, "FRONT UNDER COVER : Removal and Installation"](#).
2. Drain engine oil. Refer to [LU-29, "Draining"](#).
3. Remove oil pan (lower).

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### INSTALLATION

#### CAUTION:

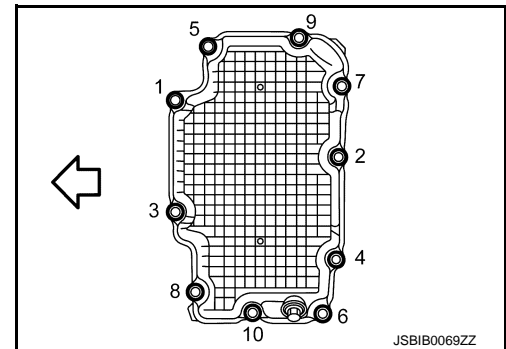
**Do not reuse gasket for oil pan (lower).**

1. Install oil pan (lower).
  - Tighten mounting bolts in two steps in the order from 1 to 10 as shown in the figure.

⇐ : Engine front

🔩 **1st step: 2.96 N·m (0.3 kg·m, 26 in·lb)**

🔩 **2nd step: 8.33 N·m (0.85 kg·m, 74 in·lb)**



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2. Install oil pan drain plug.

#### CAUTION:

**Do not reuse drain plug washer.**

- Refer to the figure of the components of on the prior page for installation direction of drain plug washer. Refer to [EM-189, "2WD : Exploded View"](#) (2WD models) or [EM-190, "AWD : Exploded View"](#) (AWD models).

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

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## Inspection

INFOID:000000013607830

### INSPECTION AFTER REMOVAL

Clean oil strainer if any object is attached.

### INSPECTION AFTER INSTALLATION

1. Check the engine oil level and adjust engine oil. Refer to [LU-27, "Inspection"](#).
2. Start engine, and check there is no leakage of engine oil.
3. Stop engine and wait for 10 minutes.

P

## OIL PAN (LOWER)

< REMOVAL AND INSTALLATION >

[VR30DDTT]

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4. Check the engine oil level again. Refer to [LU-27. "Inspection"](#).

# IGNITION COIL, SPARK PLUG AND ROCKER COVER

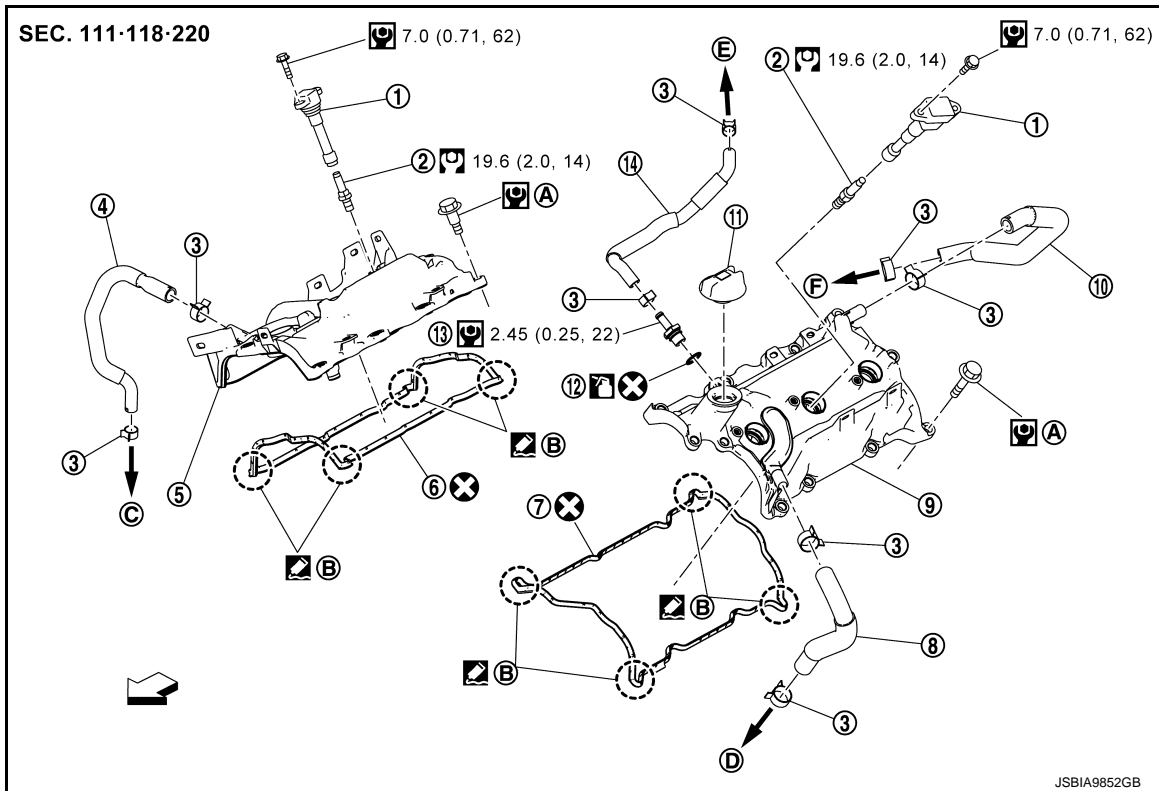
< REMOVAL AND INSTALLATION >

[VR30DDTT]

## IGNITION COIL, SPARK PLUG AND ROCKER COVER

Exploded View

INFOID:000000013610145



- |   |                                  |                                |
|---|----------------------------------|--------------------------------|
| ① Ignition coil   | ② Spark plug                     | ③ Clamp                        |
| ④ Blow-by hose (bank 1)   | ⑤ Rocker cover (bank 1)          | ⑥ Rocker cover gasket (bank 1) |
| ⑦ Rocker cover gasket (bank 2)  | ⑧ Blow-by hose (bank 2)          | ⑨ Rocker cover (bank 2)        |
| ⑩ Blow-by hose (rear)   | ⑪ Oil filler cap                 | ⑫ Gasket                       |
| ⑬ PCV valve   | ⑭ Blow-by hose (front)           |                                |
| (A) Comply with the installation procedure when tightening. Refer to <a href="#">EM-193</a> . | (B) Camshaft bracket side        | (C) To air duct (bank 1)       |
| (D) To turbocharger (bank 2)  | (E) To intake manifold collector | (F) To cylinder block          |

← : Engine front

: N-m (kg-m, ft-lb)

: N-m (kg-m, in-lb)

: Always replace after every disassembly.

: Should be lubricated with oil.

: Sealing point

## Removal and Installation

INFOID:000000013607832

### REMOVAL

- Remove the following parts:
  - Engine cover: Refer to [EM-163, "Removal and Installation"](#).
  - Air cleaner assembly: Refer to [EM-165, "Removal and Installation"](#).
  - Charge air cooler: Refer to [EM-168, "Removal and Installation"](#).
  - Intake manifold collector: Refer to [EM-174, "Removal and Installation"](#).

# IGNITION COIL, SPARK PLUG AND ROCKER COVER

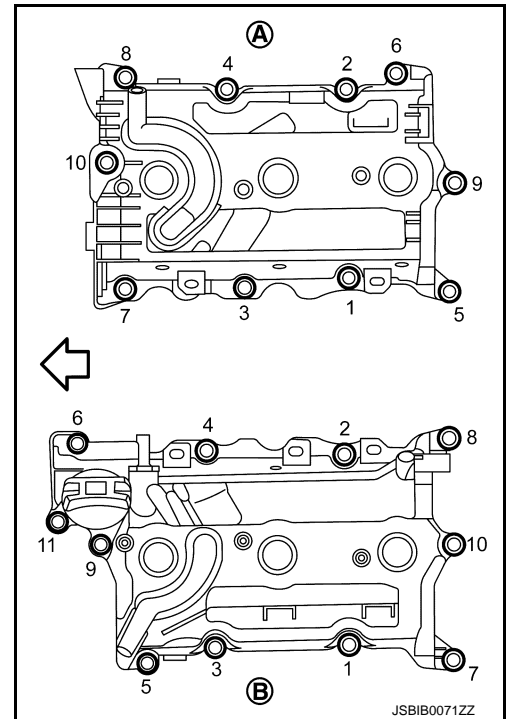
[VR30DDTT]

## < REMOVAL AND INSTALLATION >

2. Disconnect blow-by hoses from rocker cover.
3. Remove all blow-by control valve and o-ring from rocker cover, if necessary.
4. Remove oil filler cap from rocker cover, if necessary.
5. Remove ignition coil.
- CAUTION:**  
**Never shock ignition coil.**
6. Remove harness clips on the rocker cover.
7. Remove harness bracket.
8. Loosen mounting bolts in the order from 10 to 1 (bank 1 **A**), and for (bank 2 **B**), from 11 to 1 as shown in the figure.

← : Engine front

9. Remove rocker cover gasket from rocker cover.



## INSTALLATION

### **CAUTION:**

**Do not reuse O-rings.**

1. Install rocker cover gasket to rocker cover.
2. Install rocker cover.
  - Check that rocker cover gasket does not drop from the installation groove of rocker cover.

# IGNITION COIL, SPARK PLUG AND ROCKER COVER

[VR30DDTT]

## < REMOVAL AND INSTALLATION >

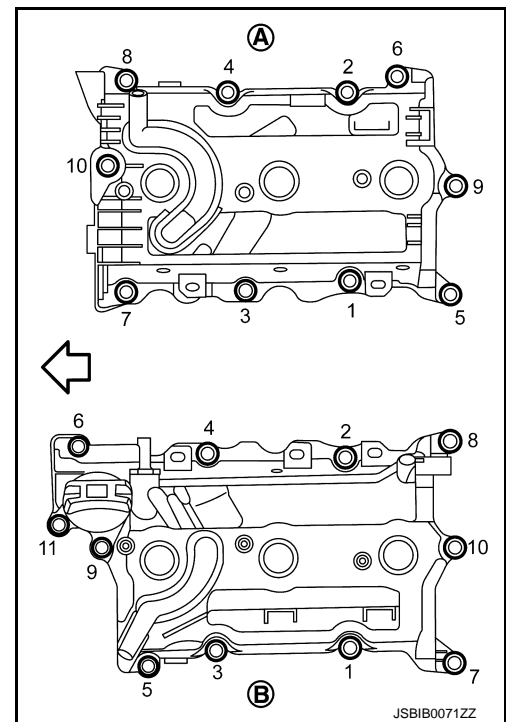
- Tighten bolts in two steps separately in the order from 1 to 10 (bank 1 **A**), and for (bank 2 **B**), from 1 to 11 as shown in the figure.

← : Engine front

 **1st step: 2.0 N·m (0.2 kg·m, 18 in·lb)**

 **2nd step: 8.3 N·m (0.85 kg·m, 73 in·lb)**

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



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# VACUUM PUMP

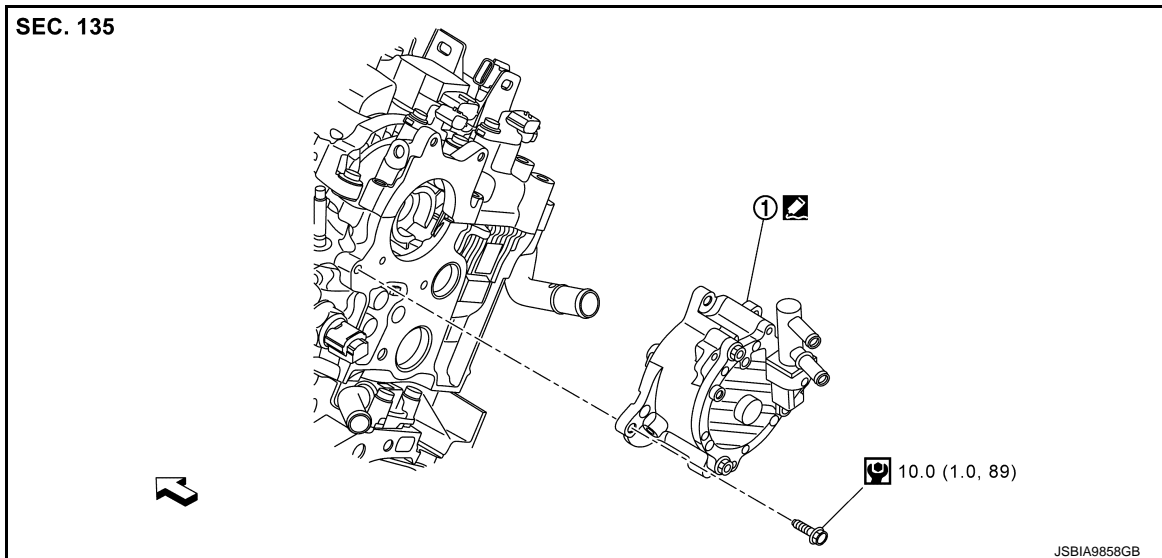
< REMOVAL AND INSTALLATION >

[VR30DDTT]

## VACUUM PUMP

### Exploded View

INFOID:000000013607833



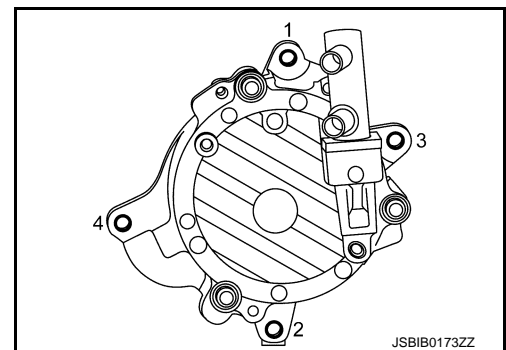
- ① Vacuum pump
- ← : Vehicle front
- ⊙ : N·m (kg-m, in-lb)
- ▣ : Sealing point

### Removal and Installation

INFOID:000000013607834

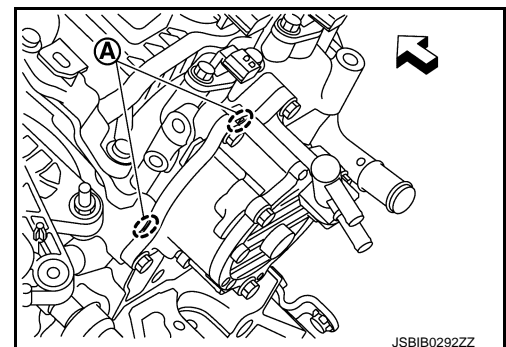
#### REMOVAL

1. Remove intake manifold collector. Refer to [EM-174, "Removal and Installation"](#).
2. Disconnect vacuum hoses from vacuum pump.
3. Remove mounting bolts of vacuum pump in the order from 4 to 1 as shown in the figure.



4. Apply minus driver for removing liquid gasket at point A

← : Engine front





# VACUUM PUMP

[VR30DDTT]

## < REMOVAL AND INSTALLATION >

5. Remove vacuum pump.

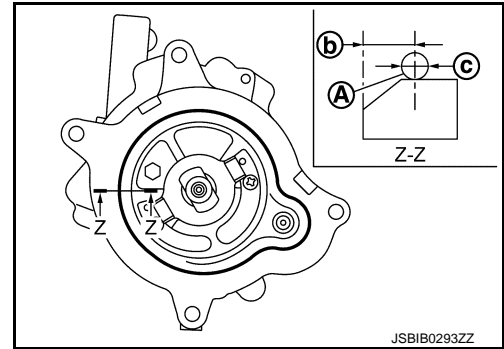
### INSTALLATION

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

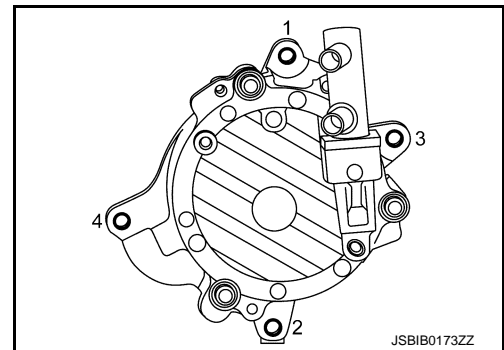
1. Apply a continuous bead of liquid gasket with the tube presser (commercial service tool) to the vacuum pump as shown in the figure.

**Use Genuine Liquid Gasket (Three Bond 1217H) or equivalent.**

- (A) : Protrusion
- (b) :  $\phi 5.5 - 7.5$  mm (0.217 - 0.295 in)
- (c) :  $\phi 4.0 - 5.0$  mm (0.157 - 0.197 in)



2. Tighten mounting bolts of vacuum pump in the order from 1 to 4 as shown in the figure.



### Inspection

INFOID:000000013607835

#### INSPECTION BEFORE REMOVAL

1. Disconnect vacuum hose, and connect a vacuum gauge via 3-way connector.
  - Disconnect point where vacuum from vacuum pump can be measured directly and install 3-way connector.
2. Start engine and measure generated vacuum at idle speed.

**NOTE:**

Measuring condition

- Engine oil temperature :  $40 \pm 5$  °C
- Engine oil used : 0W - 20

Degree of vacuum [kpa (mbar, mmHg, inHg)]	- 55.0 (-550, -412.55, - 16.24)	- 66.7 (-667, -500.31, - 19.69)	- 74.0 (-740, -555.07, - 21.85)	- 92.0 (-920, -690.09, - 27.16)	- 93.3 (-930, -697.59, - 27.46)
Standard time (sec)	9	11.8	14.9	31.5	34.7

- If out of standard, check for air suction in vacuum route, and measure again.
- If still outside of standard, replace vacuum pump.

# DRIVE PLATE

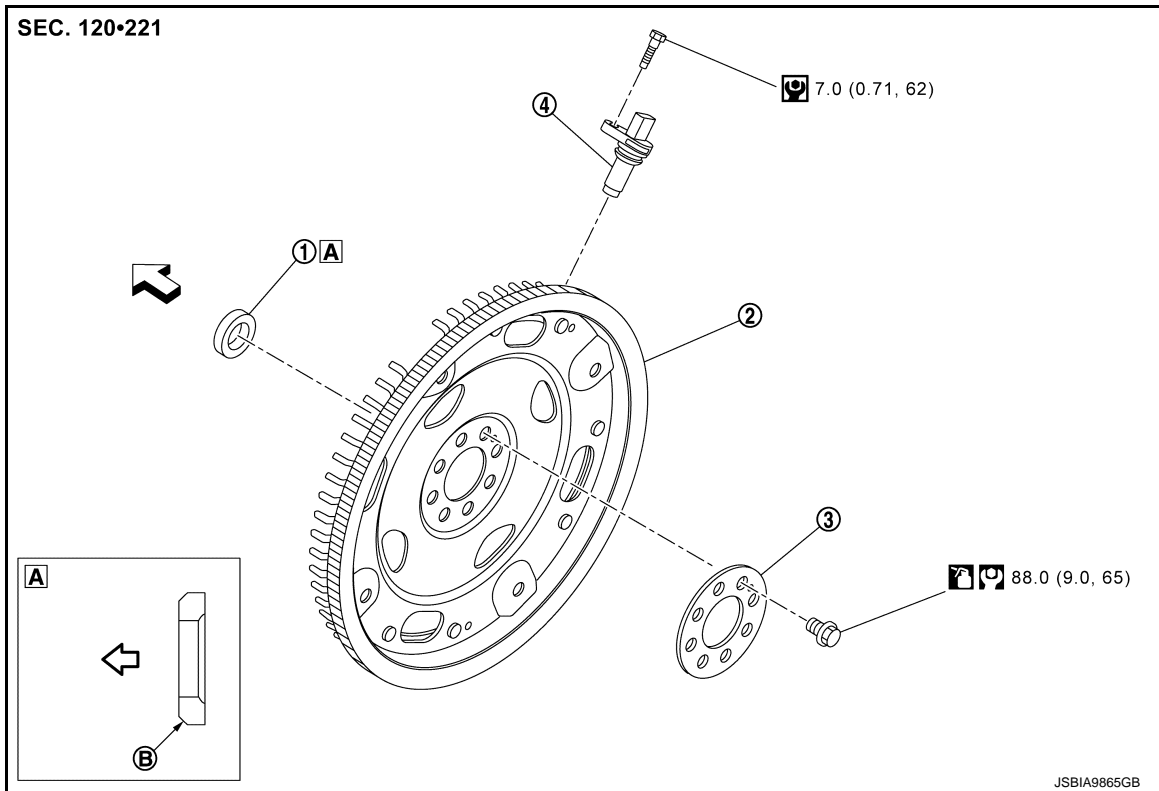
< REMOVAL AND INSTALLATION >

[VR30DDTT]

## DRIVE PLATE

### Exploded View

INFOID:000000013607836



- ① Pilot converter
- ② Drive plate
- ③ Reinforcement plate
- ④ Crankshaft position sensor
- Ⓐ Side view
- Ⓑ Chamfered
- ← : Crankshaft side
- ⊗ : Always replace after every disassembly.
- Ⓜ : N·m (kg-m, in-lb)
- Ⓝ : N·m (kg-m, ft-lb)

## Removal and Installation

INFOID:000000013607837

### REMOVAL

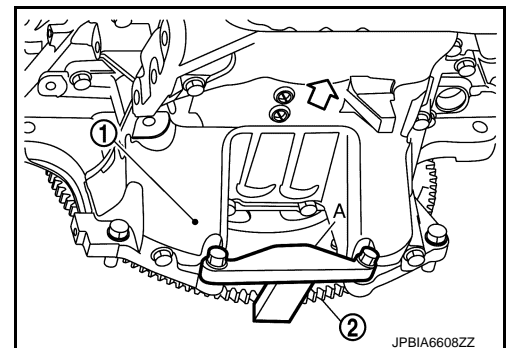
1. Remove transmission assembly. Refer to [TM-339. "VR30DDTT : Removal and Installation"](#).
2. Remove drive plate as per the following procedure.
  - a. Set the ring gear stopper [SST: KV10118600 (J-48641)] (A) as shown in the figure.

- ① : Oil pan (upper)
- ② : Drive plate
- ← : Engine front

- b. Loosen the bolts diagonally, and then pull drive plate with both hands to remove it.

#### CAUTION:

- Never disassemble them.



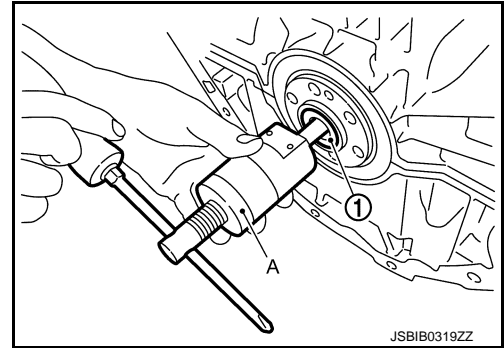
# DRIVE PLATE

< REMOVAL AND INSTALLATION >

[VR30DDTT]

- Never place them with signal plate facing down.
- When handling signal plate, take care not to damage or scratch them.
- Handle signal plate in a manner that prevents them from becoming magnetized.
- Take care not to damage the periphery of the sensing area.
- Any dropped drive plate shall not be used. (The drive plate to which the sensing area shall not be placed on the floor.)
- Never touch drive plate with bare hands. Always use urethane coating gloves or skin gloves when removing these parts.
- Never use torn glove.

3. Remove pilot converter ① using the pilot bush puller [SST: ST16610001 (J-23907)] (A), if necessary.



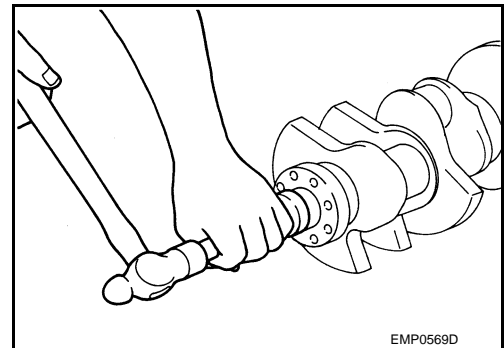
## INSTALLATION

### NOTE:

If an crankshaft position sensor is replaced, carry out the teach of "Electric IVT Control Actuator Position Learning". Refer to [EC6-276, "Description"](#) (FOR USA AND CANADA) or [EC6-1209, "Description"](#) (FOR MEXICO).

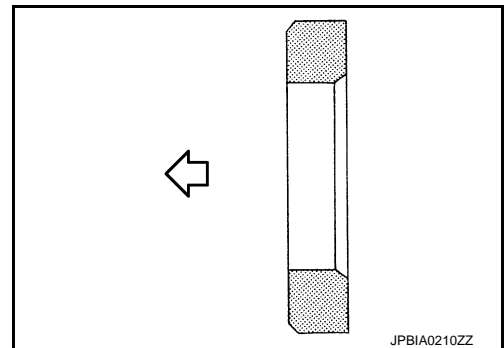
1. Install pilot converter to the crankshaft using suitable tool, if removed.
- With a drift of the following outer diameter, press-fit as far as it will go.

**Pilot converter : Approx.  $\phi 33$  mm (1.30 in)**



- Press-fit pilot converter with its chamfering side facing crankshaft shown in the figure.

← : Crankshaft side



2. Install drive plate in the reverse order of removal.

# DRIVE PLATE

[VR30DDTT]

## < REMOVAL AND INSTALLATION >

- Install drive plate ③ and reinforcement plate ④ as shown in the figure.

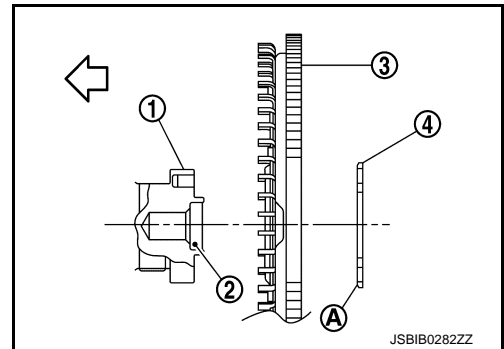
- ① : Crankshaft
- ② : Pilot converter
- Ⓐ : Rounded
- ↔ : Engine front

- When installing drive plate to crankshaft, be sure to correctly align crankshaft side dowel pin and drive plate side dowel pin hole.

**CAUTION:**

**If these are not aligned correctly, engine runs roughly and “MIL” illuminates.**

- Holding ring gear with the ring gear stopper [SST: KV10118600 (J-48641)].
- Tighten the mounting bolts crosswise over several times.



## Inspection

INFOID:000000013607838

### DRIVE PLATE DEFLECTION

- Check drive plate ① and signal plate Ⓐ for deformation or damage.

- ↔ : Engine front

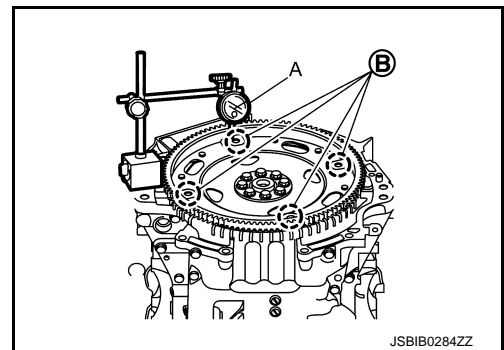
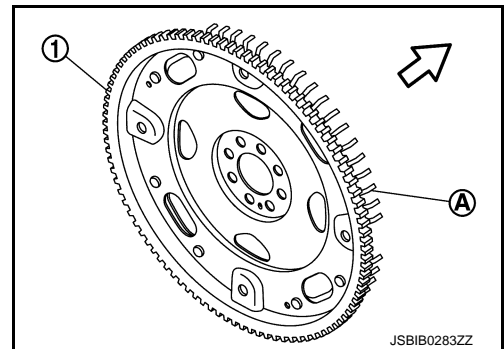
**CAUTION:**

- **Never disassemble drive plate.**
- **Never place drive plate with signal plate facing down.**
- **When handling signal plate, take care not to damage or scratch it.**
- **Handle signal plate in a manner that prevents it from becoming magnetized.**
- If damage is found, replace drive plate.
- Measure the deflection of drive plate contact surface to torque converter with a dial indicator (A).
- Measure the deflection at the area (B).

Ⓑ :  $\phi$  11.0 - 21.0 mm (0.43 - 0.83 in)

**Limit : 0.35 mm (0.0138 in) or less.**

- If measured value is out of the standard, replace drive plate.



## OIL SEAL FRONT OIL SEAL

### FRONT OIL SEAL : Removal and Installation

INFOID:000000013607839

A

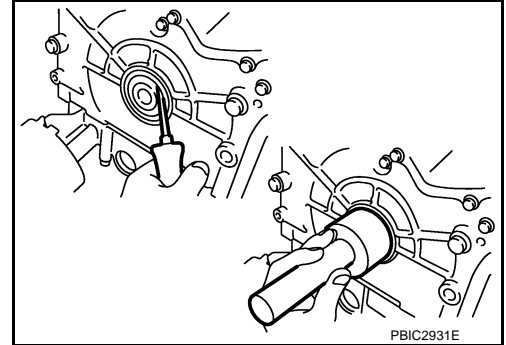
EM

#### REMOVAL

1. Remove the following parts:
  - Front under cover using a power tool (commercial service tool). Refer to [EXT-35. "FRONT UNDER COVER : Removal and Installation"](#).
  - Drive belt: Refer to [EM-154. "Removal and Installation"](#).
  - Crankshaft pulley: Refer to [EM-271. "Disassembly and Assembly"](#).
2. Remove front oil seal using a suitable tool.

**CAUTION:**

**Never damage front timing chain case and crankshaft.**



C

D

E

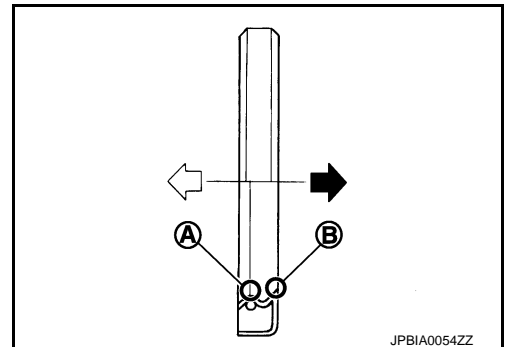
F

G

#### INSTALLATION

1. Apply new engine oil to both oil seal lip and dust seal lip of new front oil seal.
2. Install front oil seal.
  - Install front oil seal so that each seal lip is oriented as shown in the figure.

- Ⓐ : Oil seal lip
- Ⓑ : Dust seal lip
- ← : Engine inside
- : Engine outside



H

I

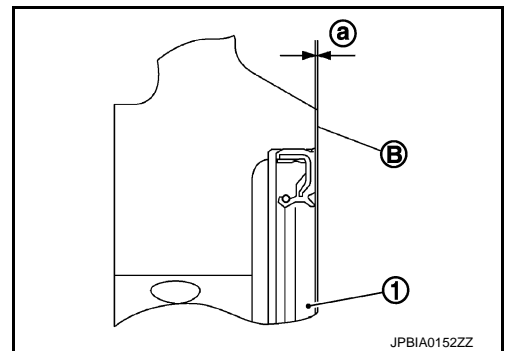
J

K

L

- Press in front oil seal ① to the position as shown in the figure.

- Ⓑ : Front cover rear end face
- ⓐ : 0 - 0.5 mm (0 - 0.020 in)



M

N

O

P

# OIL SEAL

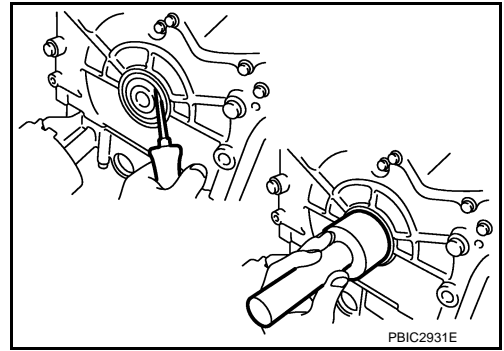
[VR30DDTT]

## < REMOVAL AND INSTALLATION >

- Using a suitable drift, press-fit until the height of front oil seal is level with the mounting surface.
- Suitable drift: outer diameter 60 mm (2.36 in), inner diameter 50 mm (1.97 in).
- Check that the garter spring is in position and seal lips are not inverted.

### CAUTION:

- **Never damage front timing chain case and crankshaft.**
- **Press-fit straight and avoid causing burrs or tilting oil seal.**



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

## REAR OIL SEAL

### REAR OIL SEAL : Removal and Installation

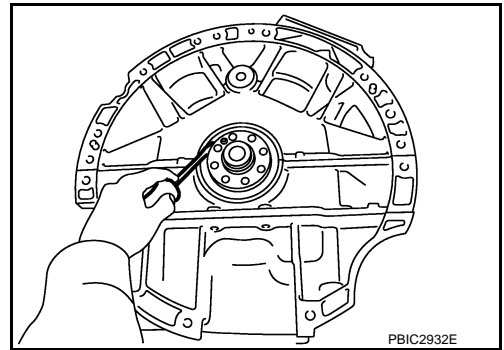
INFOID:000000013607840

#### REMOVAL

1. Remove transmission assembly. Refer to [TM-339, "VR30DDTT : Removal and Installation"](#).
2. Remove drive plate. Refer to [EM-198, "Removal and Installation"](#).
3. Remove rear oil seal with a suitable tool.

### CAUTION:

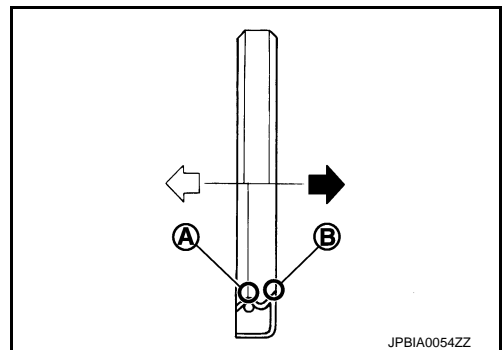
**Never damage crankshaft and cylinder block.**



#### INSTALLATION

1. Install rear oil seal.
  - Install rear oil seal so that each seal lip is oriented as shown in the figure.

- Ⓐ : Oil seal lip
- Ⓑ : Dust seal lip
- ⇐ : Engine inside
- ➡ : Engine outside



# OIL SEAL

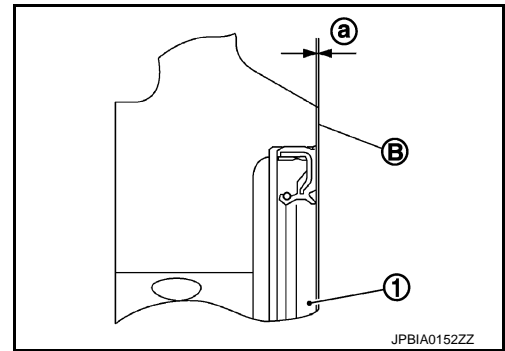
[VR30DDTT]

## < REMOVAL AND INSTALLATION >

- Press in rear oil seal ① to the position as shown in the figure.

Ⓑ : Cylinder block rear end face

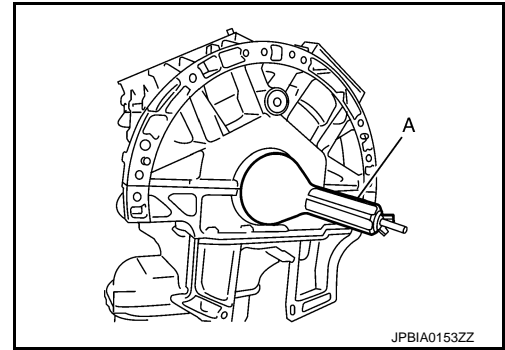
ⓐ : 0 - 0.5 mm (0 - 0.020 in)



- Using a suitable drift (A), press-fit until the height of rear oil seal is level with the mounting surface.
- Suitable drift: outer diameter 100 mm (3.94 in), inner diameter 85 mm (3.35 in).

### CAUTION:

- **Never damage crankshaft and cylinder block.**
- **Press-fit straight and avoid causing burrs or tilting oil seal.**



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

A  
EM  
C  
D  
E  
F  
G  
H  
I  
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K  
L  
M  
N  
O  
P

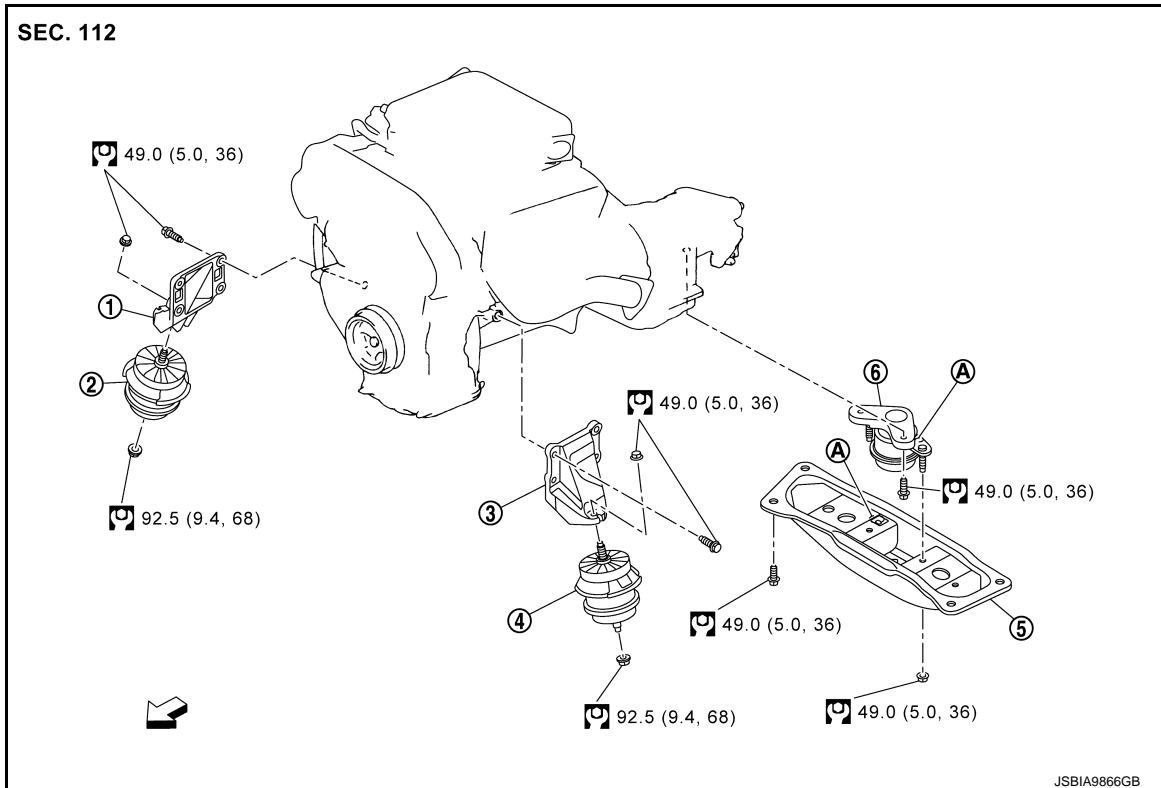
## UNIT REMOVAL AND INSTALLATION

### ENGINE ASSEMBLY

2WD

2WD : Exploded View

INFOID:000000013607841



- |                                  |                                  |                                    |
|----------------------------------|----------------------------------|------------------------------------|
| ① Engine mounting bracket (RH)   | ② Engine mounting insulator (RH) | ③ Engine mounting bracket (LH)     |
| ④ Engine mounting insulator (LH) | ⑤ Rear engine mounting member    | ⑥ Engine mounting insulator (rear) |
| A Front mark                     |                                  |                                    |
| ← : Vehicle front                |                                  |                                    |
| ⊕ : N·m (kg-m, ft-lb)            |                                  |                                    |

2WD : Removal and Installation

INFOID:000000013607842

#### WARNING:

- Situate the vehicle on a flat and solid surface.
- Place chocks at the front and back of rear wheels.
- For engines not equipped with engine slingers, attach proper slingers and bolts described in PARTS CATALOG.

#### 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-30, "Garage Jack and Safety Stand and 2-Pole Lift"](#).



# ENGINE ASSEMBLY

< UNIT REMOVAL AND INSTALLATION >

[VR30DDTT]

## NOTE:

When removing components such as hoses, tubes/lines, etc., cap or plug openings to prevent fluid from spilling.

## REMOVAL

### Outline

At first, remove the engine and the transmission assembly with front suspension member facing downward. Then separate the engine from transmission.

### Preparation

1. Release fuel pressure. Refer to [EC6-279, "Work Procedure"](#) (FOR USA AND CANADA) or [EC6-1212, "Work Procedure"](#) (FOR MEXICO).
2. Disconnect battery cables from negative terminal. Refer to [PG-259, "VR30DDTT : Exploded View"](#).
3. Drain engine coolant from radiator. Refer to [CO-33, "Draining"](#).  
**CAUTION:**
  - Perform this step when engine is cold.
  - Never spill engine coolant on drive belt.
4. Drain charge air cooler coolant from sub radiator. Refer to [CO-51, "Draining and Refilling"](#).  
**CAUTION:**  
**Perform this step when engine is cold.**
5. Remove the following parts:
  - Radiator reservoir tank: Refer to [CO-39, "Exploded View"](#) and [CO-49, "Exploded View"](#).
  - Engine cover: Refer to [EM-163, "Removal and Installation"](#).
  - Front road wheel and tires (power tool): Refer to [WT-74, "Removal and Installation"](#).
  - Front under cover and front under cover rear (power tool): Refer to [EXT-35, "FRONT UNDER COVER : Removal and Installation"](#).
  - Cowl top cover: Refer to [EXT-27, "Removal and Installation"](#).
  - Air duct (inlet) and air cleaner assembly (bank 1 and bank 2): Refer to [EM-165, "Removal and Installation"](#).
  - Cooling fan assembly: Refer to [CO-45, "Removal and Installation"](#).
  - Battery: Refer to [PG-259, "VR30DDTT : Removal and Installation"](#).
6. Discharge refrigerant from A/C circuit. Refer to [HA-71, "Recycle Refrigerant"](#).
7. Remove radiator hoses (upper and lower). Refer to [CO-39, "Exploded View"](#).
8. Remove water hose 12. Refer to [CO-65, "Exploded View"](#).

### Engine Room LH

1. Disconnect heater hose at vehicle side, and fit a plug onto hose end to prevent engine coolant leakage.
2. Disconnect A/C piping from A/C compressor, and temporarily fasten it on vehicle with a rope. Refer to [HA-83, "Exploded View"](#).
3. Disconnect brake booster vacuum hose. Refer to [BR-50, "VR30DDTT : Exploded View"](#).
4. Disconnect ground cable.

### Engine Room RH

1. Disconnect battery positive cable at vehicle side and temporarily fasten it on engine.
2. Disconnect all clips and connectors of the engine room harness from engine back side.
3. Disconnect fuel feed hose 1. Refer to [EM-178, "Exploded View"](#).  
**CAUTION:**  
**Fit plugs onto disconnected hoses to prevent fuel leakage.**
4. Disconnect ECM harness connector.  
**CAUTION:**  
**After temporarily securing, cover connectors with vinyl or similar material to protect against adhesion of foreign materials.**

### Vehicle Underbody

1. Remove A/T fluid cooler hoses.
2. Disconnect heated oxygen sensor 2 harness. Refer to [EM-226, "Exploded View"](#).
3. Remove exhaust front tube and exhaust system. Refer to [EX-6, "Exploded View"](#).

# ENGINE ASSEMBLY

[VR30DDTT]

## < UNIT REMOVAL AND INSTALLATION >

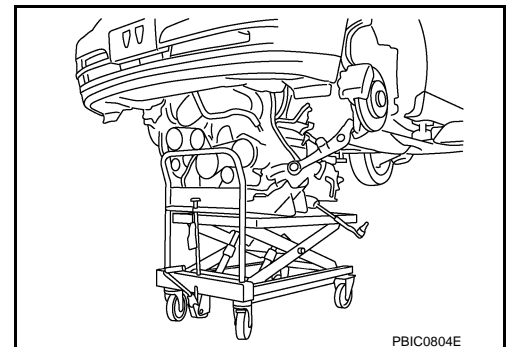
4. Disconnect steering lower joint at steering gear assembly side, and release steering lower shaft. Refer to [ST-89, "Exploded View"](#) (without DIRECT ADAPTIVE STEERING) or [ST-139, "Exploded View"](#) (with DIRECT ADAPTIVE STEERING).
5. Remove rear propeller shaft. Refer to [DLN-111, "2WD : Removal and Installation"](#).
6. Disengage A/T control rod at A/T shift selector side. Then, temporarily secure it on the transmission assembly, so that it does not sag. Refer to [TM-292, "Exploded View"](#).
7. Remove suspension member stay. Refer to [FSU-43, "Exploded View"](#).
8. Remove front fender protector (front) (with DIRECT ADAPTIVE STEERING). Refer to [EXT-30, "FENDER PROTECTOR : Removal and Installation"](#).
9. Disconnect harness connectors of DIRECT ADAPTIVE STEERING.
10. Remove harness clamp and bracket of DIRECT ADAPTIVE STEERING, and move the harness aside.
11. Remove front wheel sensor from steering knuckle. Refer to [BRC-191, "FRONT WHEEL SENSOR : Removal and Installation"](#).
12. Remove rear plate cover from oil pan (upper). Then remove bolts fixing drive plate to torque converter.
13. Remove transmission joint bolts that pierce at oil pan (upper) lower rear side. Refer to [EM-217, "2WD : Exploded View"](#).
14. Remove front stabilizer connecting rod from transverse link. Refer to [FSU-41, "Exploded View"](#).
15. Remove dynamic digital suspension lower side. Refer to [FSU-41, "Exploded View"](#).
16. Remove lower ends of left and right steering knuckle from transverse link. Refer to [FAX-8, "Exploded View"](#).
17. Separate steering outer sockets from steering knuckle. Refer to [ST-93, "Exploded View"](#) (without DIRECT ADAPTIVE STEERING), or [ST-143, "Exploded View"](#) (with DIRECT ADAPTIVE STEERING).
18. Remove transverse links mounting bolts at suspension member side. Refer to [FSU-37, "Exploded View"](#).

### Removal Work

1. 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.**



PBIC0804E

2. Remove rear engine mounting member bolts.
3. Remove front suspension member mounting bolts and nuts. Refer to [FSU-43, "Exploded View"](#).
4. Carefully lower jack, or raise lift, to remove the engine, the transmission assembly and front suspension member. 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.

### Separation Work

# ENGINE ASSEMBLY

## < UNIT REMOVAL AND INSTALLATION >

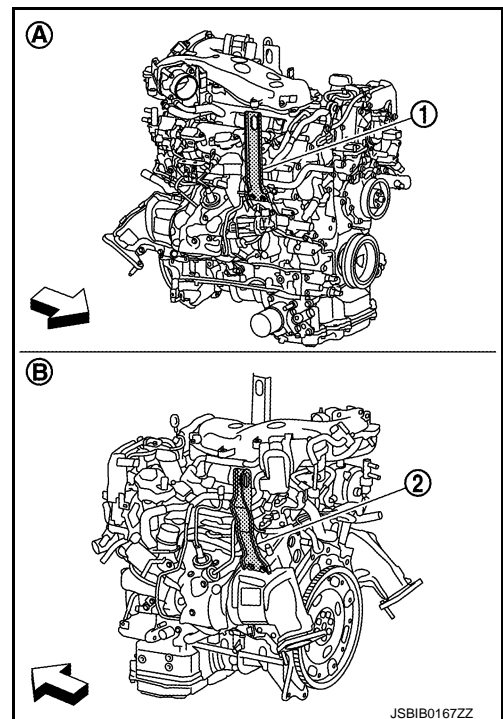
[VR30DDTT]

1. Install engine slingers into front of cylinder head (bank 1) and rear of cylinder head (bank 2).

- ① : Engine front slinger (10005 5CA0A)
- ② : Engine rear slinger (10006 5CA0A)
- Ⓐ : Bank 1
- Ⓑ : Bank 2
- ⇐ : Engine front

### Slinger bolts:

: 28.0 N·m (2.9 kg·m, 21 ft·lb)



2. Remove engine mounting insulators (RH and LH) under side nuts using a power tool (commercial service tool).
3. Lift with hoist and separate the engine and the transmission assembly from front suspension member.  
**CAUTION:**
  - Before and during this lifting, always check that any harnesses are left connected.
  - Never damage engine mounting insulator and avoid oil/grease smearing or spills onto engine mounting insulator.
4. Remove alternator. Refer to [CHG-56, "VR30DDTT : Exploded View"](#).
5. Remove starter motor. Refer to [STR-44, "VR30DDTT : Exploded View"](#).
6. Remove catalyst converter. Refer to [EM-227, "Removal and Installation"](#).
7. Remove turbocharger. Refer to [EM-233, "Removal and Installation"](#).
8. Remove charge air cooler. Refer to [EM-168, "Removal and Installation"](#).
9. Remove crankshaft position sensor. Refer to [EM-198, "Exploded View"](#).  
**CAUTION:**
  - Handle it carefully and avoid impacts.
  - Never disassemble.
  - Never place sensor in a location where it is exposed to magnetism.
10. Separate the engine from the transmission assembly. Refer to [TM-338, "VR30DDTT : Exploded View"](#).
11. Remove each engine mounting insulator and each engine mounting bracket from the engine using a power tool (commercial service tool).

## INSTALLATION

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

- 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-204, "2WD : Exploded View"](#).

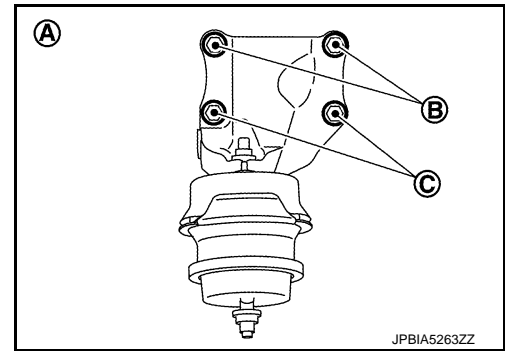
# ENGINE ASSEMBLY

[VR30DDTT]

## < UNIT REMOVAL AND INSTALLATION >

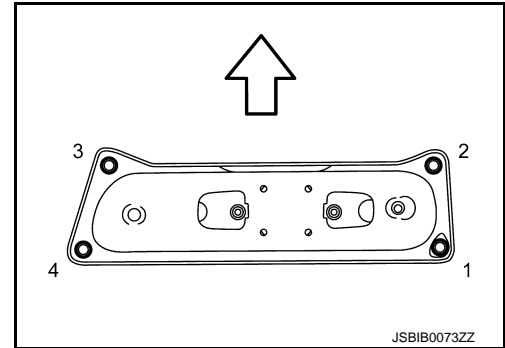
- When installing engine mounting bracket (RH and LH) on cylinder block, tighten two upper bolts [shown as ② in the figure] first. Then tighten two lower bolts [shown as ③ in the figure].

① : Example Left



- Check that all engine mounting insulators are seated properly, then tighten mounting nuts.
- Tighten rear engine mounting member bolts in the order from 1 to 4 as shown in the figure.

↔ : Vehicle front



INFOID:0000000013607843

## 2WD : Inspection

### 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-20, "Recommended Fluids and Lubricants"](#).
- 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.

# ENGINE ASSEMBLY

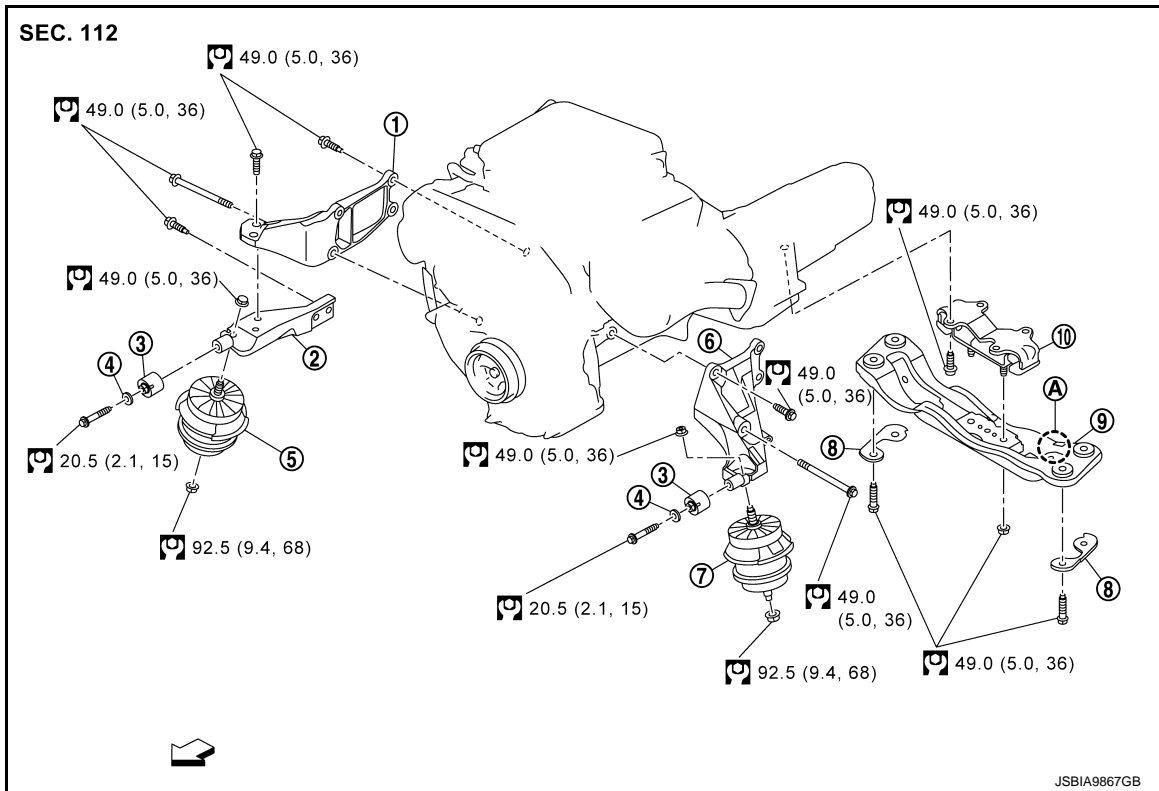
< UNIT REMOVAL AND INSTALLATION >

[VR30DDTT]

AWD

AWD : Exploded View

INFOID:000000013607844



- |                                    |  |                                |
|------------------------------------|--|--------------------------------|
| ① Engine mounting bracket (RH)     | ② Engine mounting bracket (RH) (lower) | ③ Dynamic damper               |
| ④ Washer                           | ⑤ Engine mounting insulator (RH)       | ⑥ Engine mounting bracket (LH) |
| ⑦ Engine mounting insulator (LH)   | ⑧ Heat insulator                       | ⑨ Rear engine mounting member  |
| ⑩ Engine mounting insulator (rear) |  |                                |
| Ⓐ Front mark                       |  |                                |
| ← : Vehicle front                  |  |                                |
| Ⓜ : N·m (kg-m, ft-lb)              |  |                                |

AWD : Removal and Installation

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## WARNING:

- Situate the vehicle on a flat and solid surface.
- Place chocks at front and back of rear wheels.
- For engines not equipped with engine slingers, attach proper slingers and bolts described in PARTS CATALOG.

## CAUTION:

- Always be careful to work safely, 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 center of gravity.
- For supporting points for lifting and jacking point at rear axle, refer to [GI-30, "Garage Jack and Safety Stand and 2-Pole Lift"](#).

NOTE:

# ENGINE ASSEMBLY

< UNIT REMOVAL AND INSTALLATION >

[VR30DDTT]

When removing components such as hoses, tubes/lines, etc., cap or plug openings to prevent fluid from spilling.

## REMOVAL

### Outline

At first, remove the engine, the transmission assembly, the transfer assembly and the front final drive assembly with front suspension member downward. Then separate the engine, the transmission assembly, the transfer and the front final drive assembly.

### Preparation

1. Release fuel pressure. Refer to [EC6-279, "Work Procedure"](#) (FOR USA AND CANADA) or [EC6-1212, "Work Procedure"](#) (FOR MEXICO).
2. Disconnect battery cables from negative terminal. Refer to [PG-259, "VR30DDTT : Exploded View"](#).
3. Drain engine coolant from radiator. Refer to [CO-33, "Draining"](#).  
**CAUTION:**
  - Perform this step when engine is cold.
  - Never spill engine coolant on drive belt.
4. Drain charge air cooler coolant from sub radiator. Refer to [CO-51, "Draining and Refilling"](#).  
**CAUTION:**  
**Perform this step when engine is cold.**
5. Remove the following parts:
  - Reservoir tank: Refer to [CO-39, "Exploded View"](#) and [CO-49, "Exploded View"](#).
  - Engine cover: Refer to [EM-163, "Removal and Installation"](#).
  - Front road wheel and tires: Refer to [WT-74, "Exploded View"](#).
  - Front under cover: Refer to [EXT-35, "FRONT UNDER COVER : Removal and Installation"](#).
  - Front cross bar: Refer to [FSU-71, "Exploded View"](#).
  - Cowl top cover: Refer to [EXT-27, "Removal and Installation"](#).
  - Air duct (inlet) and air cleaner assembly (bank 1 and bank 2): Refer to [EM-165, "Removal and Installation"](#).
  - Cooling fan assembly: Refer to [CO-45, "Removal and Installation"](#).
  - Battery: Refer to [PG-259, "VR30DDTT : Removal and Installation"](#).
6. Discharge refrigerant from A/C circuit. Refer to [HA-71, "Recycle Refrigerant"](#).
7. Remove radiator hoses (upper and lower). Refer to [CO-39, "Exploded View"](#).
8. Remove water hose 12. Refer to [CO-39, "Exploded View"](#).

### Engine Room LH

1. Disconnect heater hose from vehicle side, and fit a plug onto hose end to prevent engine coolant leak.
2. Disconnect A/C piping from A/C compressor, and temporarily fasten it on vehicle with a rope. Refer to [HA-83, "Exploded View"](#).
3. Disconnect brake booster vacuum hose. Refer to [BR-50, "VR30DDTT : Exploded View"](#).
4. Disconnect ground cables.

### Engine Room RH

1. Disconnect battery positive cable vehicle side and temporarily fasten it on engine.
2. Disconnect all clips and connectors of the engine room harness from engine back side.
3. Disconnect fuel feed hose 1. Refer to [EM-178, "Exploded View"](#).  
**CAUTION:**  
**Fit plugs onto disconnected hoses to prevent fuel leakage.**
4. Disconnect ECM harness connectors.  
**CAUTION:**  
**After temporarily securing, cover connectors with vinyl or similar material to protect against adhesion of foreign materials.**

### Vehicle Underbody

1. Remove A/T fluid cooler hoses.
2. Disconnect heated oxygen sensor 2 harness. Refer to [EM-226, "Exploded View"](#).
3. Remove exhaust front tube and exhaust system. Refer to [EX-6, "Exploded View"](#).



# ENGINE ASSEMBLY

[VR30DDTT]

## < UNIT REMOVAL AND INSTALLATION >

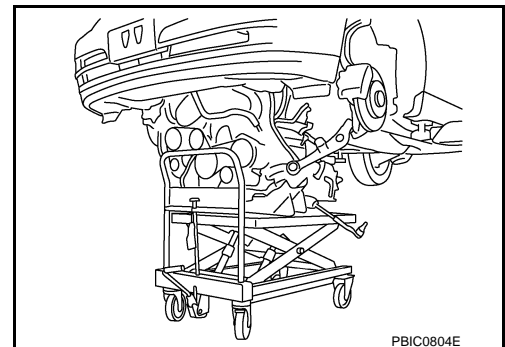
4. Disconnect steering lower joint at power steering gear assembly side, and release steering lower shaft. Refer to [ST-89, "Exploded View"](#) (without DIRECT ADAPTIVE STEERING) or [ST-139, "Exploded View"](#) (with DIRECT ADAPTIVE STEERING).
5. Remove rear propeller shaft. Refer to [DLN-115, "AWD : Removal and Installation"](#).
6. Remove front drive shaft (both side). Refer to [FAX-27, "Exploded View"](#).
7. Disengage A/T control rod at A/T shift selector side. Then, temporarily secure it on the transmission assembly, so that it does not sag. Refer to [TM-292, "Exploded View"](#).
8. Remove front fender protector front (with DIRECT ADAPTIVE STEERING). Refer to [EXT-30, "FENDER PROTECTOR : Removal and Installation"](#).
9. Disconnect harness connectors of DIRECT ADAPTIVE STEERING.
10. Remove harness clamp and bracket of DIRECT ADAPTIVE STEERING, and move the harness aside.
11. Remove front wheel sensor from steering knuckle. Refer to [BRC-191, "FRONT WHEEL SENSOR : Removal and Installation"](#).
12. Remove rear plate cover from oil pan (upper). Then remove bolts fixing drive plate to torque converter.
13. Remove transmission joint bolts that pierce at oil pan (upper) lower rear side. Refer to [EM-221, "AWD : Exploded View"](#).
14. Remove front stabilizer connecting rod from transverse link. Refer to [FSU-69, "Exploded View"](#).
15. Remove shock absorber lower side. Refer to [FSU-57, "Exploded View"](#).
16. Remove lower ends of left and right steering knuckle from transverse link. Refer to [FAX-19, "Exploded View"](#).
17. Separate steering outer sockets from steering knuckle. Refer to [ST-93, "Exploded View"](#) (without DIRECT ADAPTIVE STEERING) or [ST-143, "Exploded View"](#) (with DIRECT ADAPTIVE STEERING).
18. Remove transverse links mounting bolts at suspension member side. Refer to [FSU-64, "Exploded View"](#).

### Removal Work

1. 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.**



2. Remove rear engine mounting member bolts.
3. Remove front suspension member mounting bolts and nuts. Refer to [FSU-71, "Exploded View"](#).
4. Carefully lower jack, or raise lift to remove the engine, transmission assembly, transfer, front final drive assembly and front suspension member. When performing work, observe the following caution:

**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.**

### Separation Work

# ENGINE ASSEMBLY

## < UNIT REMOVAL AND INSTALLATION >

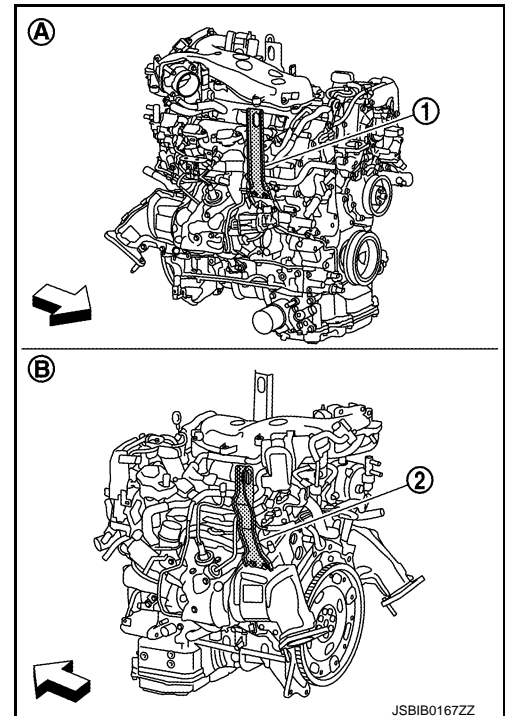
[VR30DDTT]

1. Install engine slingers into front of cylinder head (bank 1) and rear of cylinder head (bank 2).

- ① : Engine front slinger (10005 5CA0A)
- ② : Engine rear slinger (10006 5CA0A)
- Ⓐ : Bank 1
- Ⓑ : Bank 2
- ↔ : Engine front

### Slinger bolts:

: 28.0 N·m (2.9 kg·m, 21 ft·lb)



2. Remove engine mounting insulators (RH and LH) under side nuts using a power tool (commercial service tool).
3. Lift with hoist and separate the engine, transmission assembly, transfer, front final drive assembly and front suspension member.  
**CAUTION:**
  - Before and during this lifting, always check any harnesses are left connected.
  - Never damage engine mounting insulator and avoid oil/grease smearing or spills onto engine mounting insulator.
4. Remove alternator. Refer to [CHG-56, "VR30DDTT : Exploded View"](#).
5. Remove charge air cooler. Refer to [EM-168, "Removal and Installation"](#).
6. Remove starter motor. Refer to [STR-44, "VR30DDTT : Exploded View"](#).
7. Remove catalyst converter. Refer to [EM-227, "Removal and Installation"](#).
8. Remove turbocharger. Refer to [EM-233, "Removal and Installation"](#).
9. Remove crankshaft position sensor. Refer to [EM-198, "Exploded View"](#).  
**CAUTION:**
  - Handle it carefully and avoid impacts.
  - Never disassemble.
  - Never place sensor in a location where it is exposed to magnetism.
10. Remove front propeller shaft from the front final drive assembly side. Refer to [DLN-101, "Exploded View"](#).
11. Disconnect harness connector from transmission assembly and transfer assembly.
12. Separate the engine from the transmission assembly. Refer to [TM-338, "VR30DDTT : Exploded View"](#).
13. Remove the front final drive assembly from oil pan (upper). Refer to [DLN-140, "VR30DDTT : Exploded View"](#).
14. Remove each engine mounting insulator and each engine mounting bracket from the engine using a power tool (commercial service tool).

## INSTALLATION

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

- 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-209, "AWD : Exploded View"](#).



# ENGINE ASSEMBLY

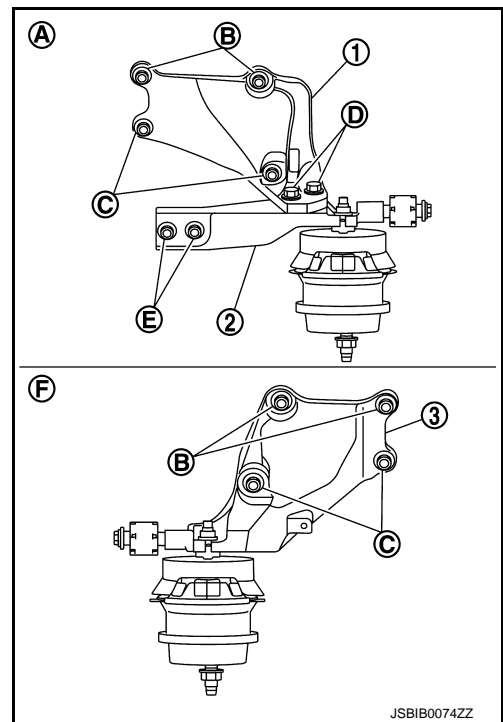
[VR30DDTT]

## < UNIT REMOVAL AND INSTALLATION >

- When installing engine mounting bracket (RH and LH) on cylinder block, tighten two upper bolts [shown as ② in the figure] first. Then tighten two lower bolts [shown as ③ in the figure].

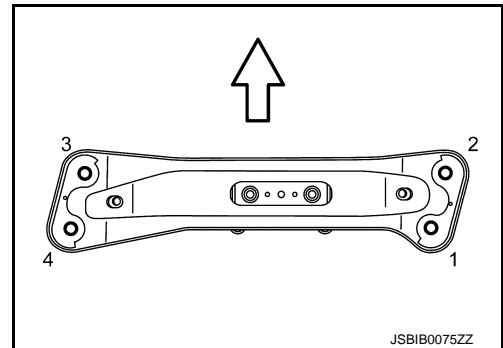
- ③ : Engine mounting bracket (LH)
- ① : Right side
- ② : Left side

- Install engine mounting bracket (RH) (lower) ② as follows:
  - Temporarily tighten mounting bolts [shown as ④, ⑤ and ⑥ in the figure].
  - Tighten mounting bolts to the specified torque with following mounting surfaces touched.
- Engine mounting bracket (RH) ① to engine mounting bracket (RH) (lower) [shown as and in figure].
- Front final drive to engine mounting bracket (RH) (lower) [shown as in figure].



- Check all engine mounting insulators are seated properly, then tighten mounting nuts.
- Tighten rear engine mounting member bolts in the order from 1 to 4 as shown in the figure.

← : Vehicle front



## AWD : Inspection

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### INSPECTION AFTER INSTALLATION

#### Inspection for Leaks

The following are procedures for checking fluids leak, lubricates leak and exhaust gases leak.

- Before starting engine, check oil/fluid levels including engine coolant and engine oil. If any are less than the required quantity, fill to the specified level. Refer to [MA-20, "Recommended Fluids and Lubricants"](#).
- Follow the procedure below to check for fuel leakage.
  - Turn ignition switch to the "ON" (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.

# ENGINE ASSEMBLY

## < UNIT REMOVAL AND INSTALLATION >

[VR30DDTT]

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:0000000013607847

A

EM

**NOTE:**

Explained here is how to disassemble with engine stand supporting transmission surface. When using a different type of engine stand, note the difference in the steps, etc.

1. Remove the engine assembly from the vehicle. Refer to [EM-204, "2WD : Removal and Installation"](#) (2WD models) or [EM-209, "AWD : Removal and Installation"](#) (AWD models).
2. Remove the parts that may restrict installation of engine to a widely use engine stand.

**NOTE:**

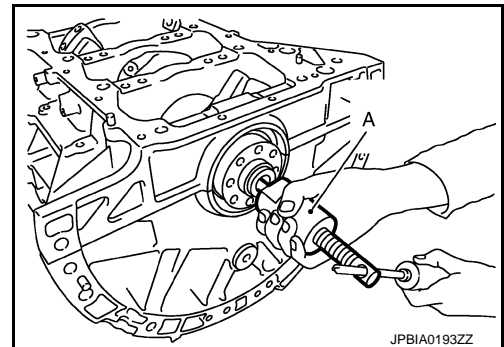
The procedure is described assuming that you use a widely use engine stand holding the surface, to which transmission is installed.

- Remove drive plate using a power tool (commercial service tool). Fix crankshaft with a ring gear stopper [SST: KV10118600 (J-48641)], and remove mounting bolts.
- Loosen mounting bolts in diagonal order.
- Check for deformation or damage of drive plate. Refer to [EM-200, "Inspection"](#).

**CAUTION:**

- **Never disassemble drive plate.**
- **Never place drive plate with signal plate facing down.**
- **When handling signal plate, take care not to damage or scratch it.**
- **Handle signal plate in a manner that prevents it from becoming magnetized.**

3. Remove pilot converter using the pilot bushing puller [SST: ST16610001 (J-23907)] (A) if necessary.



4. Lift the engine with hoist to install it onto the widely use engine stand.

**CAUTION:**

**Use an engine stand that has a load capacity [220 kg (485 lb) or more] large enough for supporting the engine weight.**

- If the load capacity of the stand is not adequate, remove the following parts beforehand to reduce the potential risk of overturning the stand.
  - Remove charge air cooler. Refer to [EM-168, "Removal and Installation"](#).
  - Remove intake manifold collector. Refer to [EM-174, "Removal and Installation"](#).
  - Remove intake manifold. Refer to [EM-176, "Removal and Installation"](#).
  - Remove fuel injector and fuel tube assembly. Refer to [EM-182, "Removal and Installation"](#).
  - Remove ignition coil. Refer to [EM-193, "Exploded View"](#).
  - Remove rocker cover. Refer to [EM-193, "Removal and Installation"](#).
  - Other removable brackets.

**NOTE:**

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# ENGINE STAND SETTING

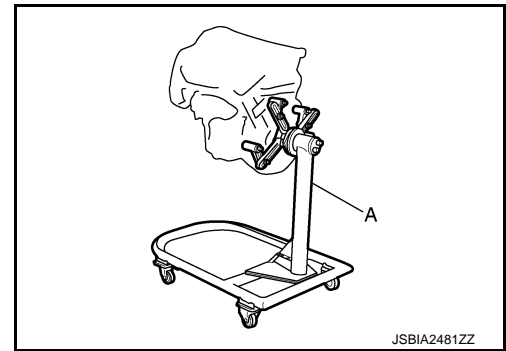
[VR30DDTT]

## < UNIT DISASSEMBLY AND ASSEMBLY >

The figure shows an example of widely use engine stand (A) that can hold mating surface of transmission with drive plate removed.

**CAUTION:**

**Before removing the hanging chains, check the engine stand is stable and there is no risk of overturning.**



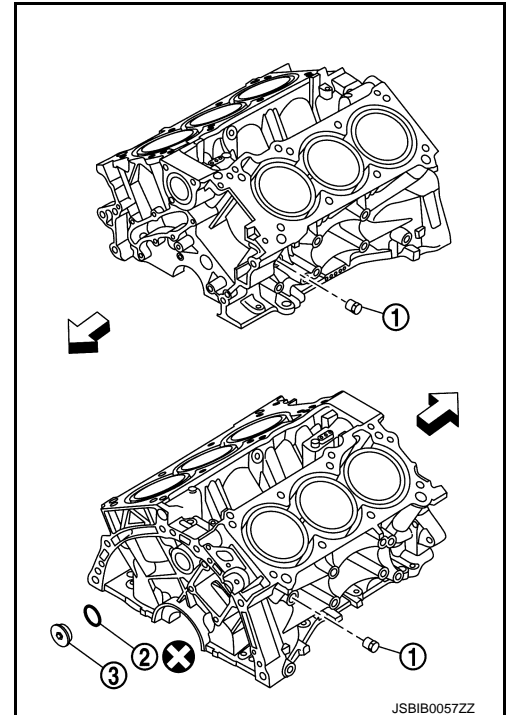
5. Drain engine oil. Refer to [LU-29. "Draining"](#).
6. Drain engine coolant by removing water drain plug ① from both sides of the cylinder block as shown in the figure.

② : Washer

③ : Plug

⊗ : Always replace after every disassembly

↶ : Engine front



# OIL PAN (UPPER)

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

## OIL PAN (UPPER)

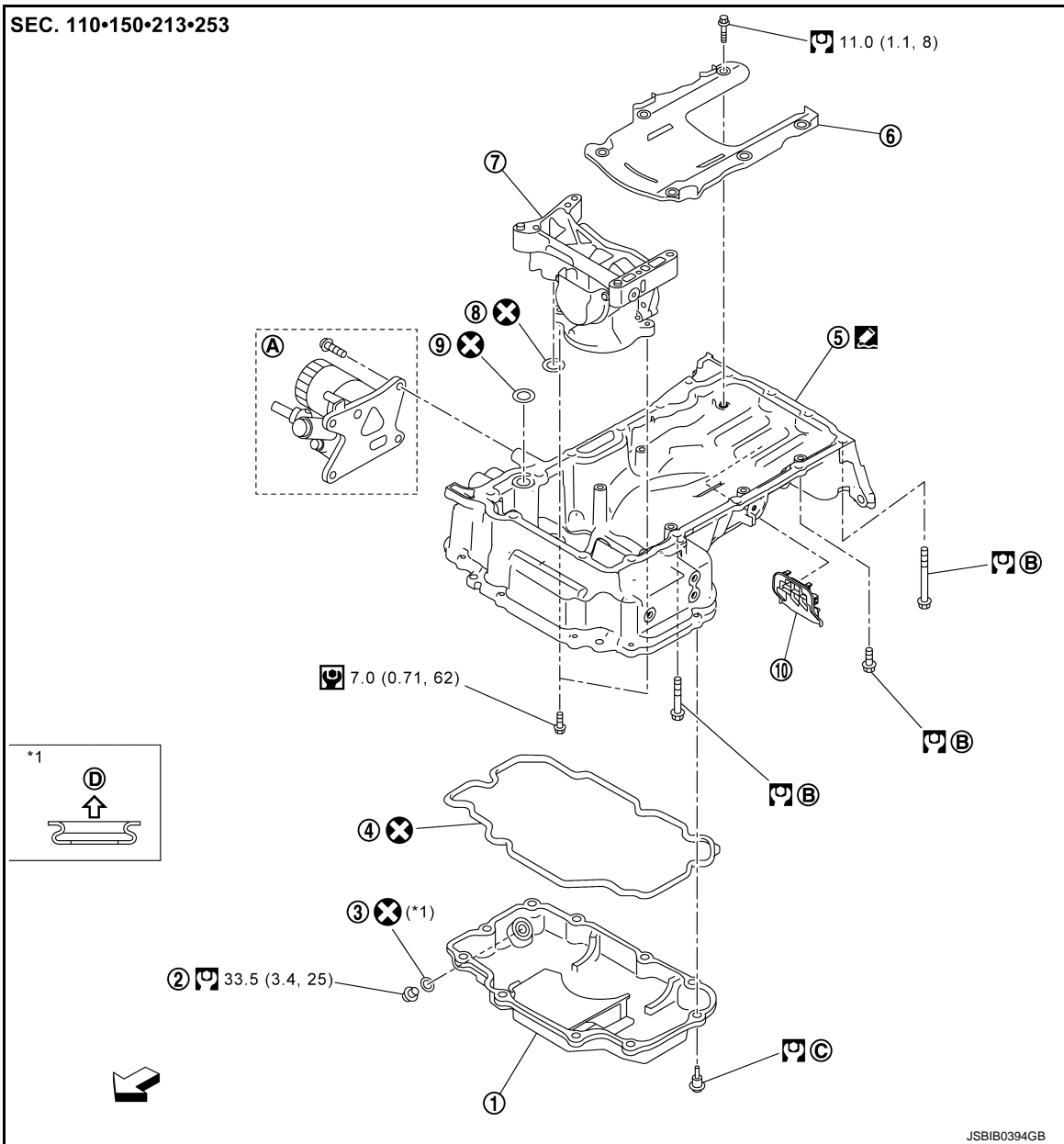
2WD

2WD : Exploded View

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|---------------------|-------------------|---------------------|
| ① Oil pan (lower)   | ② Drain plug      | ③ Drain plug washer |
| ④ Gasket            | ⑤ Oil pan (upper) | ⑥ Baffle plate      |
| ⑦ Oil pump assembly | ⑧ O-ring          | ⑨ O-ring            |
| ⑩ Rear plate cover  |                   |                     |

Comply with the installation procedure when tightening.

- (A)
- Oil cooler air cooling type: Refer to [LU-33](#)
  - Oil cooler water cooling type: Refer to [LU-36](#)

- (B) Comply with the installation procedure when tightening. Refer to [EM-218](#)
- (C) Comply with the installation procedure when tightening. Refer to [EM-191](#)
- (D) Oil pan side

← : Engine front


O


P


# OIL PAN (UPPER)

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

 : N·m (kg·m, ft·lb)

 : N·m (kg·m, in·lb)

 : Always replace after every disassembly.

 : Sealing point


## 2WD : Disassembly and Assembly

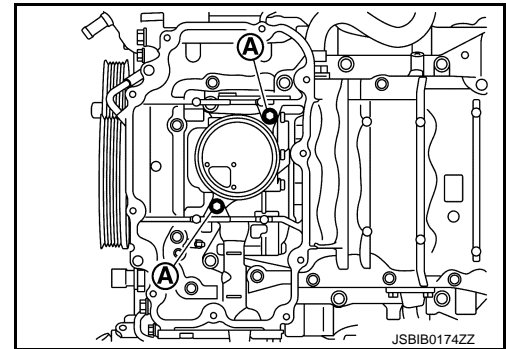
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### REMOVAL


#### CAUTION:

**Never drain engine oil when the engine is hot to avoid the danger of being scalded.**

1. Remove oil level gauge. Refer to [EM-238, "Exploded View"](#).
2. Drain engine oil. Refer to [LU-29, "Draining"](#).
3. Drain engine coolant. Refer to [CO-33, "Draining"](#). (For engine oil cooler water cooling type)
4. Remove oil filter. Refer to [LU-30, "Removal and Installation"](#).
5. Remove oil cooler bracket. Refer to [LU-33, "AIR COOLING TYPE : Removal and Installation"](#). (For engine oil cooler air cooling type).
6. Remove oil cooler. Refer to [LU-36, "WATER COOLING TYPE : Removal and Installation"](#). (For engine oil cooler water cooling type)
7. Remove oil pan (lower). Refer to [EM-191, "Removal and Installation"](#).
8. Remove oil pump mounting bolts .



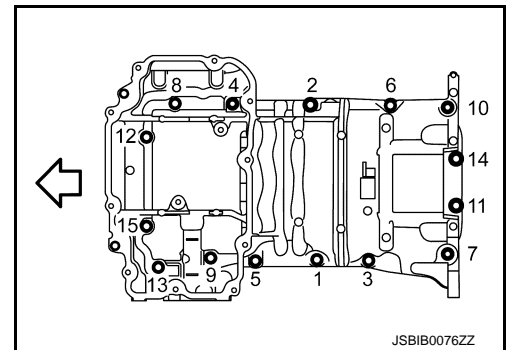
9. Loosen mounting bolts in the order from 15 to 1 as shown in the figure using a power tool (commercial service tool) to remove.

 : Engine front


- Insert the seal cutter [SST: KV10111100 (J-37228)] between oil pan (upper) and lower cylinder block. Slide seal cutter by tapping on the side of tool with a hammer. Remove oil pan (upper).

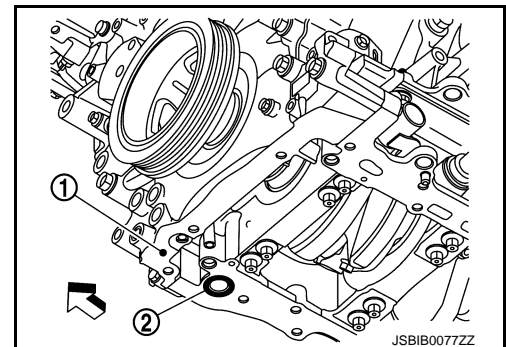
#### CAUTION:

- **Never damage the mating surfaces.**
- **Never insert a screwdriver, because this damages the mating surfaces.**



10. Remove O-rings  from bottom of lower cylinder block .

 : Engine front



# OIL PAN (UPPER)

[VR30DDTT]

< UNIT DISASSEMBLY AND ASSEMBLY >

## INSTALLATION

### CAUTION:

**Do not reuse O-rings.**

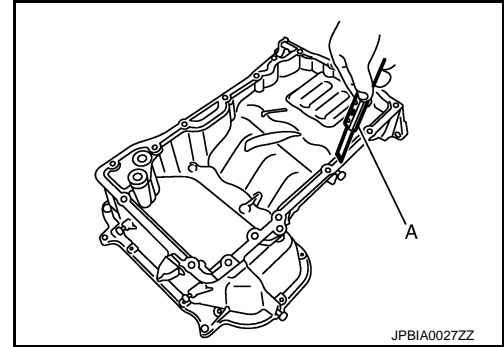
1. Install oil pan (upper) as follows:

- a. Use a scraper (A) to remove old liquid gasket from mating surfaces.

### CAUTION:

**Never scratch or damage the mating surfaces when cleaning off old liquid gasket.**

- Also remove old liquid gasket from mating surface of lower cylinder block.
- Remove old liquid gasket from the bolt holes and threads.

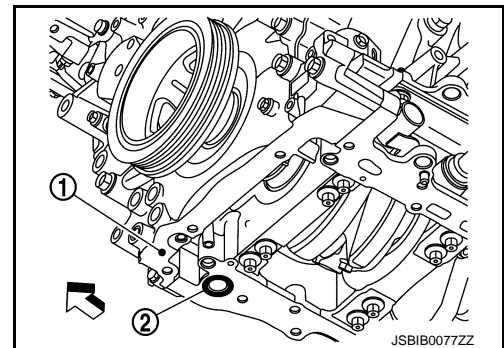


- b. Install new O-rings ② on the bottom of lower cylinder block ①.

### CAUTION:

**Do not reuse O-rings.**

← : Engine front



- c. Apply a continuous bead of liquid gasket with the tube presser (commercial service tool) to the cylinder block mating surface of oil pan (upper) to a limited portion as shown in the figure.

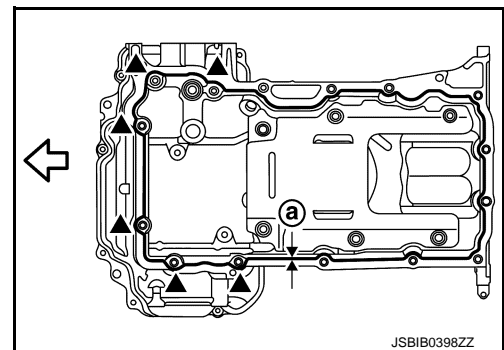
Ⓐ :  $\phi 4.0 - 5.0$  mm (0.157 - 0.197 in)

← : Engine front

**Use Genuine Liquid Gasket (Three Bond 1217H) or equivalent.**

### CAUTION:

- For bolt holes with ▲ marks (6 locations), apply liquid gasket outside the holes.
- Attaching should be done within 5 minutes after coating.



- d. Install oil pan (upper).

### CAUTION:

**Never misalign both O-rings during installation.**

- Tighten mounting bolts to the torque specified below in the order from 1 to 15 as shown in the figure.

: **17.2 N·m (1.8 kg-m, 13 ft-lb)**

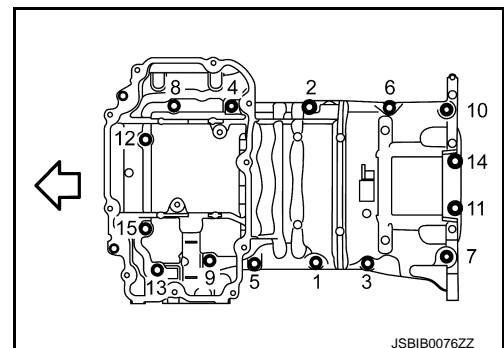
← : Engine front

- There are three types of mounting bolts. Refer to the following for locating bolts.

**M8 × 25 mm (0.98 in) : 1, 2, 3, 5, 6, 8, 9, 11, 12, 13, 14, 15**

**M8 × 50 mm (1.97 in) : 4**

**M8 × 80 mm (3.15 in) : 7, 10**



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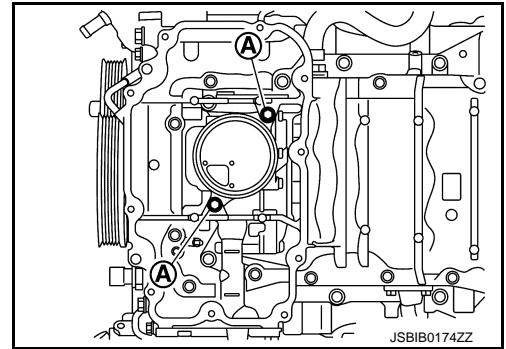
## OIL PAN (UPPER)

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

2. Tighten oil pump mounting bolts (A) to the torque specified below.

: 7.0 N·m (0.71 kg·m, 62 ft·in)



3. Install oil pan (lower). Refer to [EM-191, "Removal and Installation"](#).
4. Install oil pan drain plug.
  - Refer to the figure of components on the prior page for installation direction of drain plug washer. Refer to [EM-189, "2WD : Exploded View"](#).
5. Install in the reverse order of removal after this step.

**NOTE:**

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

### 2WD : Inspection

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#### INSPECTION AFTER REMOVAL

Clean oil strainer if any object is attached.

#### INSPECTION AFTER INSTALLATION

1. Check the engine oil level and adjust engine oil. Refer to [LU-27, "Inspection"](#).
2. Start engine, and check there is no leakage of engine oil.
3. Stop engine and wait for 10 minutes.
4. Check the engine oil level again. Refer to [LU-27, "Inspection"](#).

### AWD



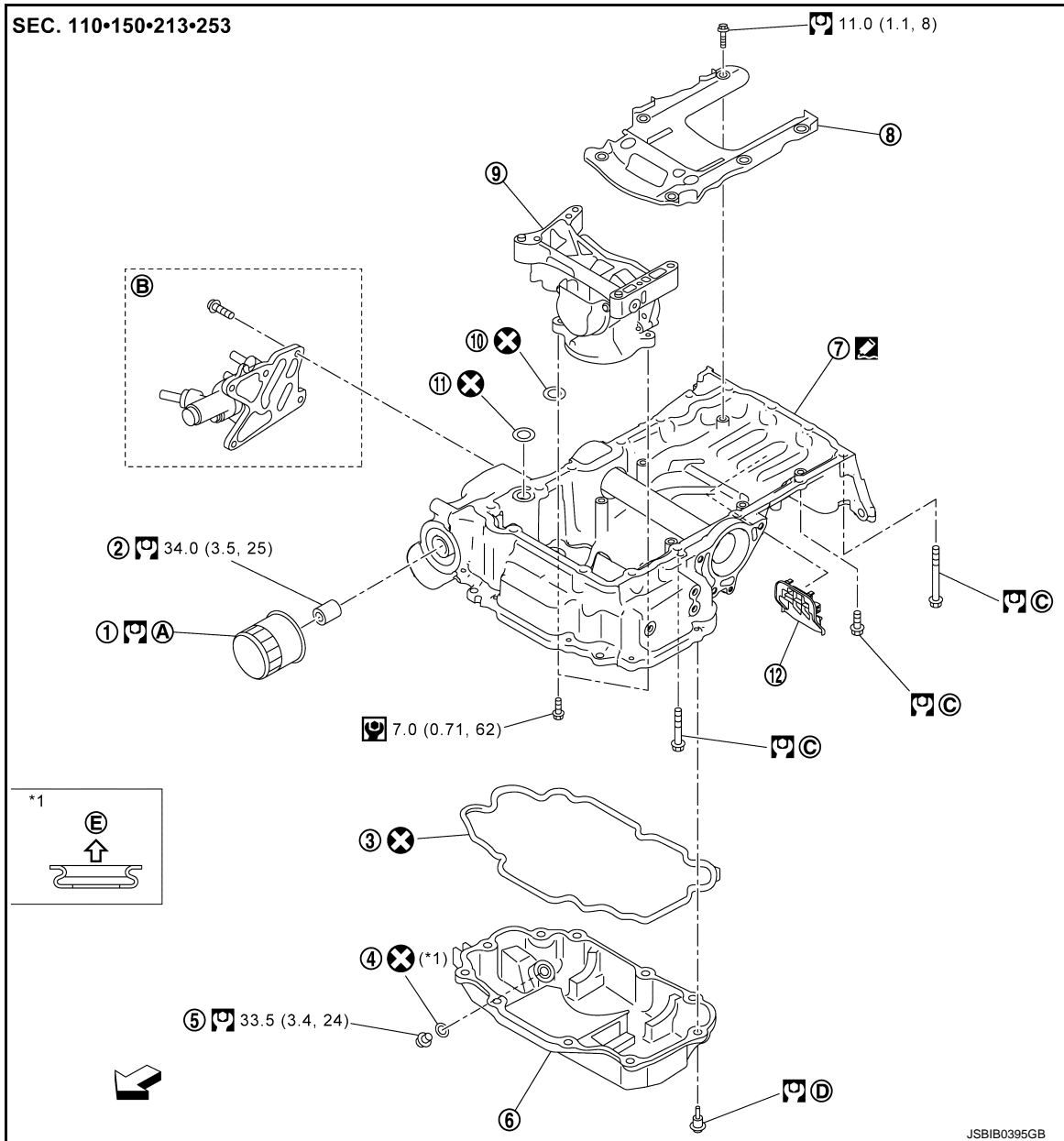
# OIL PAN (UPPER)

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

AWD : Exploded View

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- |  |   |   |
|--|---|---|
| ① Oil filter   | ② Connector bolt  | ③ Gasket  |
| ④ Drain plug washer  | ⑤ Drain plug  | ⑥ Oil pan (lower)   |
| ⑦ Oil pan (upper)  | ⑧ Baffle plate  | ⑨ Oil pump assembly   |
| ⑩ O-ring   | ⑪ O-ring  | ⑫ Rear plate cover  |
| Ⓐ Comply with the installation procedure when tightening. Refer to <a href="#">LU-30</a> . | Ⓑ Comply with the installation procedure when tightening. Refer to <a href="#">EM-222</a> . | Ⓒ Comply with the installation procedure when tightening. Refer to <a href="#">EM-191</a> . |
| Ⓔ Comply with the installation procedure when tightening. Refer to <a href="#">LU-33</a> . | Ⓕ Comply with the installation procedure when tightening. Refer to <a href="#">LU-36</a> .  | Ⓖ Oil pan side  |

Ⓔ Oil pan side

← : Engine front

Ⓜ : N-m (kg-m, ft-lb)

Ⓜ : N-m (kg-m, in-lb)

A  
EM  
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M

# OIL PAN (UPPER)

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

⊗ : Always replace after every disassembly.

▣ : Sealing point

## AWD : Disassembly and Assembly

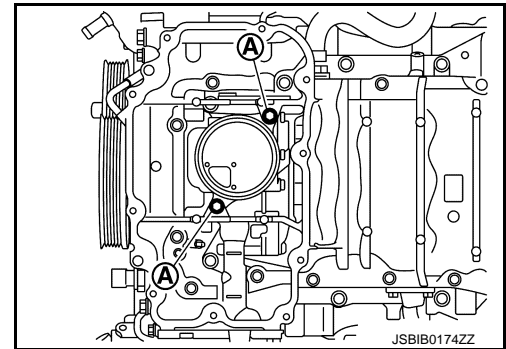
INFOID:000000013607852

### REMOVAL

#### CAUTION:

**Never drain engine oil when the engine is hot to avoid the danger of being scalded.**

1. Remove oil level gauge, oil pressure sensor and oil temperature sensor. Refer to [EM-238, "Exploded View"](#).
2. Drain engine oil. Refer to [LU-29, "Draining"](#).
3. Drain engine coolant. Refer to [CO-33, "Draining"](#). (For engine oil cooler water cooling type)
4. Remove oil filter. Refer to [LU-30, "Removal and Installation"](#).
5. Remove oil cooler bracket. Refer to [LU-33, "AIR COOLING TYPE : Removal and Installation"](#). (For engine oil cooler air cooling type).
6. Remove oil cooler. Refer to [LU-36, "WATER COOLING TYPE : Removal and Installation"](#). (For engine oil cooler water cooling type)
7. Remove oil pan (lower). Refer to [EM-190, "AWD : Exploded View"](#).
8. Remove oil pump mounting bolts (A).



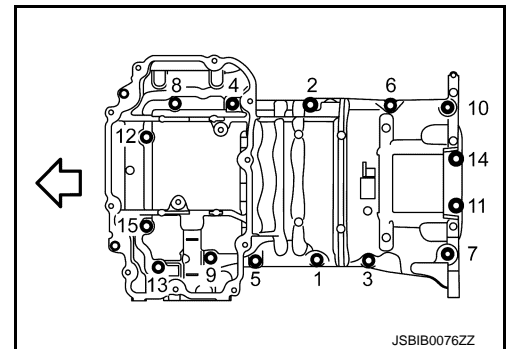
9. Loosen mounting bolts in the order from 15 to 1 as shown in the figure to remove.

⇐ : Engine front

- Insert the seal cutter [SST: KV10111100 (J-37228)] between oil pan (upper) and lower cylinder block. Slide seal cutter by tapping on the side of tool with a hammer. Remove oil pan (upper).

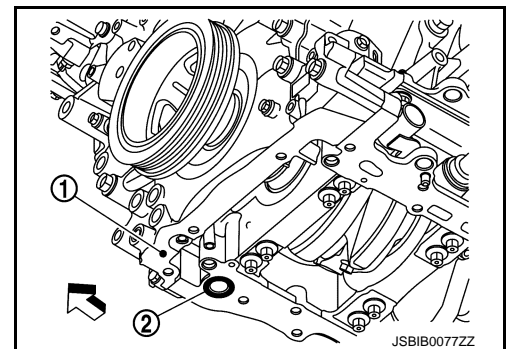
#### CAUTION:

- **Never damage the mating surfaces.**
- **Never insert a screwdriver, because this will damage the mating surfaces.**



10. Remove O-rings (2) from bottom of lower cylinder block (1).

⇐ : Engine front



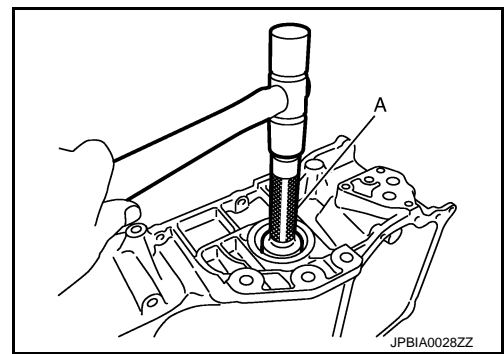
11. Remove axle pipe, if necessary.

# OIL PAN (UPPER)

[VR30DDTT]

## < UNIT DISASSEMBLY AND ASSEMBLY >

- Remove axle pipe from oil pan (upper) using a suitable drift (A) [outer diameter: 37 mm (1.46 in)].



A

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D

## INSTALLATION

### CAUTION:

**Do not reuse O-rings.**

- Install axle pipe ③ to oil pan (upper), if removed.

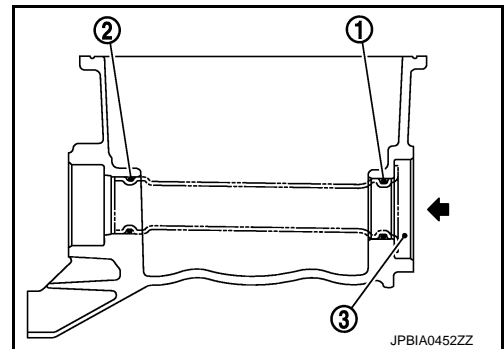
### CAUTION:

**Do not reuse O-rings.**

- Lubricate O-ring groove of axle pipe, O-rings ①, ②, and O-ring joint of oil pan with new engine oil.

Unit: mm (in)

Items	O-ring inner diameter
Final drive side (right side)	31.4 (1.236)
Axle pipe flange side (left side)	33.6 (1.323)



E

F

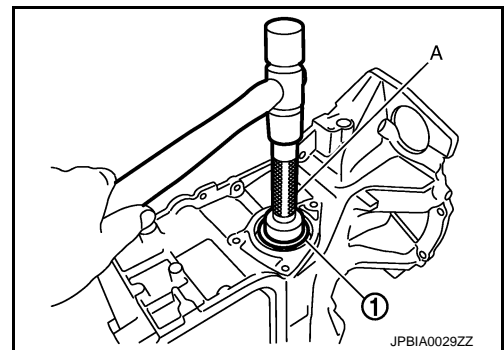
G

H

- Install axle pipe ① to oil pan (upper) from axle pipe flange side (left side) using a suitable drift (A) [outer diameter: 43 to 57 mm (1.69 to 2.24 in)].

### CAUTION:

**Insert it with care to prevent O-ring from sliding.**



I

J

K

L

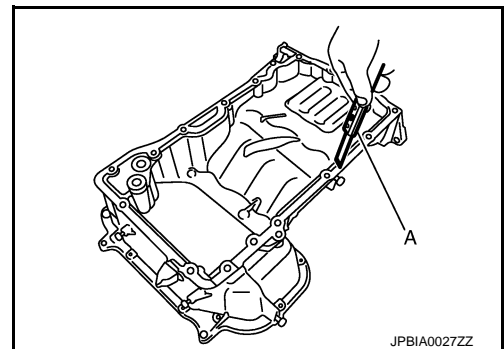
- Install oil pan (upper) as follows:

- Use a scraper (A) to remove old liquid gasket from mating surfaces.

### CAUTION:

**Never scratch or damage the mating surfaces when cleaning off old liquid gasket.**

- Also remove old liquid gasket from mating surface of lower cylinder block.
- Remove old liquid gasket from the bolt holes and threads.



M

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# OIL PAN (UPPER)

< UNIT DISASSEMBLY AND ASSEMBLY >

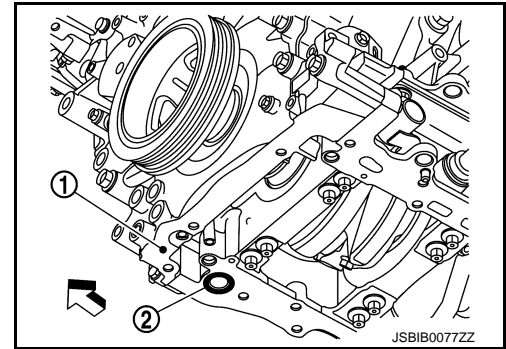
[VR30DDTT]

- b. Install new O-rings ② on the bottom of lower cylinder block ① and oil pump ③.

**CAUTION:**

**Do not reuse O-rings.**

↶ : Engine front



- c. Apply a continuous bead of liquid gasket with the tube presser (commercial service tool) to the cylinder block mating surface of oil pan (upper) to a limited portion as shown in the figure.

Ⓐ :  $\phi 4.0 - 5.0$  mm (0.157 - 0.197 in)

↶ : Engine front

**Use Genuine Liquid Gasket (Three Bond 1217H) or equivalent.**

**CAUTION:**

- For bolt holes with ▲ marks (6 locations), apply liquid gasket outside the holes.
- Attaching should be done within 5 minutes after coating.

- d. Install oil pan (upper).

**CAUTION:**

**Never misalign both O-rings during installation.**

- Tighten mounting bolts to the torque specified below in the order from 1 to 15 as shown in the figure.

 **17.2 N·m (1.8 kg·m, 13 ft·lb)**

↶ : Engine front

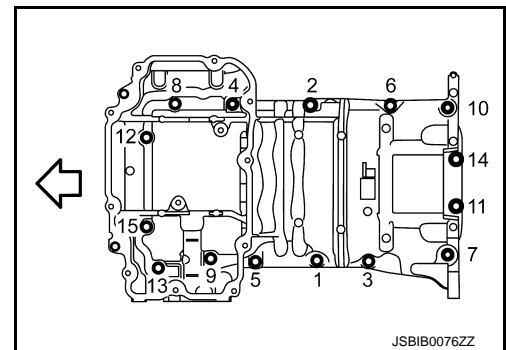
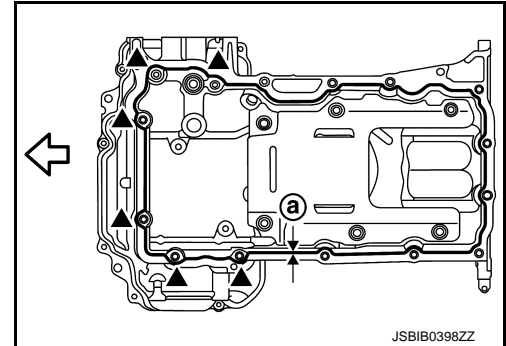
- There are four of mounting bolts. Refer to the following for locating bolts.

**M8 × 25 mm (0.98 in) : 3, 6, 8, 9, 11, 12, 13, 14, 15**

**M8 × 50 mm (1.97 in) : 4**

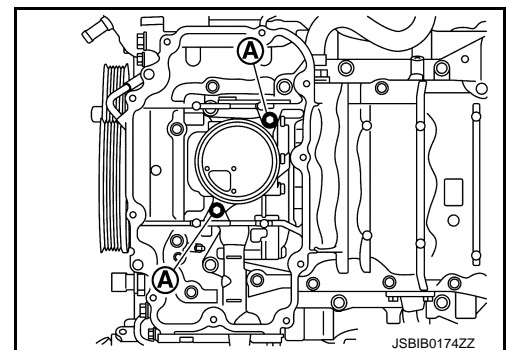
**M8 × 60 mm (2.36 in) : 2**

**M8 × 80 mm (3.15 in) : 1, 5, 7, 10**



3. Tighten oil pump mounting bolts ① to the torque specified below.

 **7.0 N·m (0.71 kg·m, 62 ft·in)**



4. Install oil pan (lower). Refer to [EM-191. "Removal and Installation"](#).  
5. Install oil pan drain plug.

# OIL PAN (UPPER)

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

- Refer to the figure of components on the prior page for installation direction of drain plug washer. Refer to [EM-190, "AWD : Exploded View"](#).

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

**NOTE:**

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

## AWD : Inspection

INFOID:000000013607853

### INSPECTION AFTER REMOVAL

Clean oil strainer if any object attached.

### INSPECTION AFTER INSTALLATION

1. Check the engine oil level and adjust engine oil. Refer to [LU-27, "Inspection"](#).
2. Start engine, and check there is no leakage of engine oil.
3. Stop engine and wait for 10 minutes.
4. Check the engine oil level again. Refer to [LU-27, "Inspection"](#).

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# CATALYST

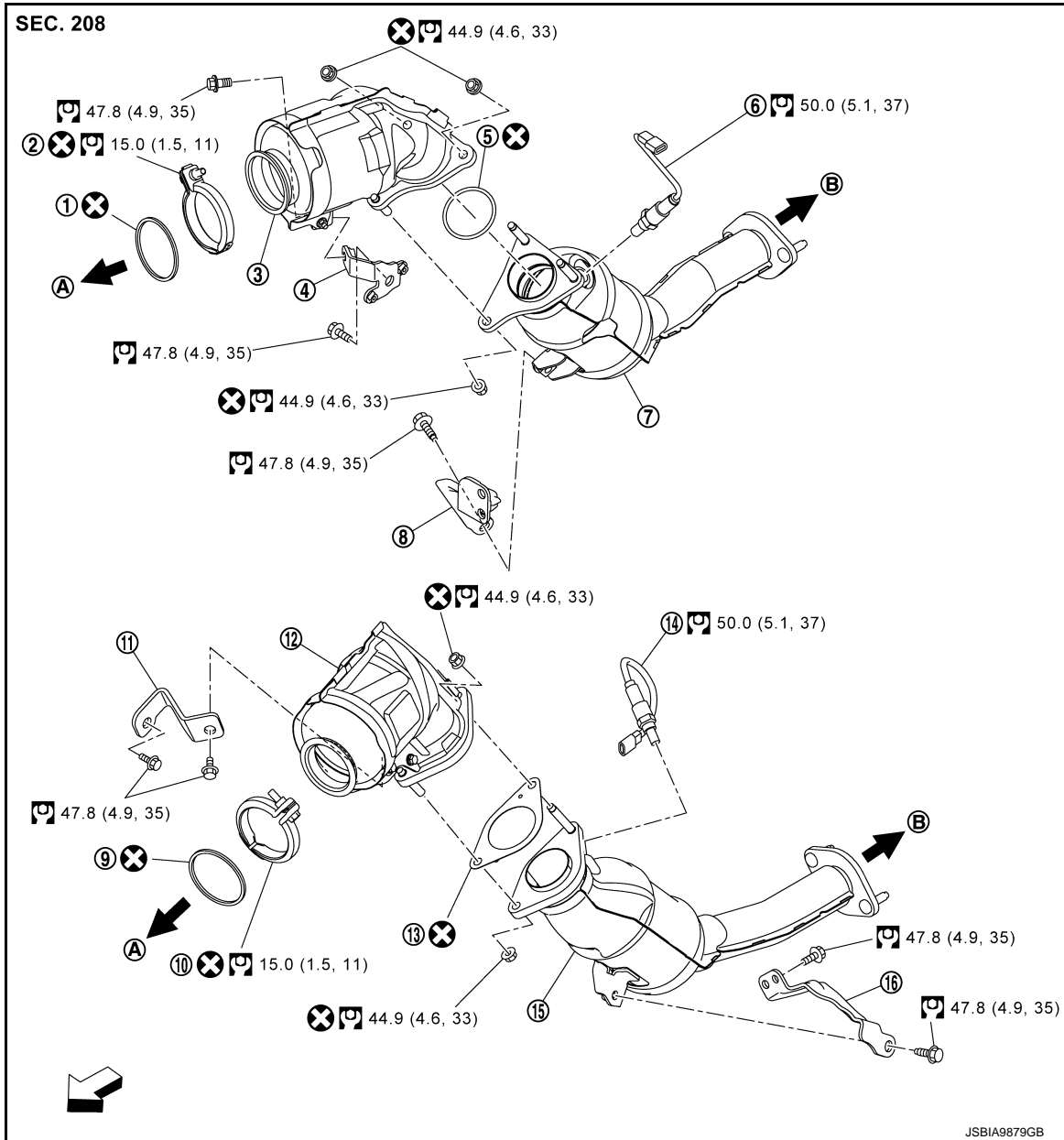
< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

## CATALYST

### Exploded View

INFOID:000000013607854



- |   |  |                                   |
|---|--|-----------------------------------|
| ① Gasket                                      | ② Clamp                                      | ③ Catalyst converter (bank 1)     |
| ④ Catalyst converter support bracket (bank 1) | ⑤ Gasket                                     | ⑥ Heated oxygen sensor (bank 1)   |
| ⑦ 2nd catalyst converter (bank 1)             | ⑧ Bracket                                    | ⑨ Gasket                          |
| ⑩ Clamp                                       | ⑪ Catalyst converter support bracket (bank2) | ⑫ Catalyst converter (bank 2)     |
| ⑬ Gasket                                      | ⑭ Heated oxygen sensor (bank 2)              | ⑮ 2nd catalyst converter (bank 2) |
| ⑯ Bracket                                     |  |                                   |
| Ⓐ To turbocharger assembly                    | Ⓑ To exhaust front tube                      |                                   |

↙: Engine front

⊗ : Always replace after every disassembly.

ⓐ : N·m (kg-m, ft-lb)

## Removal and Installation

INFOID:000000013607855

A

EM

### REMOVAL

1. Using the heated oxygen sensor wrench [SST: KV10117100 (J-3647-A)], remove air fuel ratio sensor 1. Refer to [EM-231, "Exploded View"](#). C
2. Remove exhaust temperature sensor from turbocharger. Refer to [EM-231, "Exploded View"](#).
3. Remove heat insulator (upper). Refer to [EM-231, "Exploded View"](#). D
4. Loosen clamp between turbocharger and catalyst converter.
5. Remove catalyst converter support bracket. E
6. Remove 2nd catalyst converter. F
7. Using the heated oxygen sensor wrench [SST: KV10117100 (J-3647-A)], remove heated oxygen sensor, if necessary.

### INSTALLATION

#### NOTE:

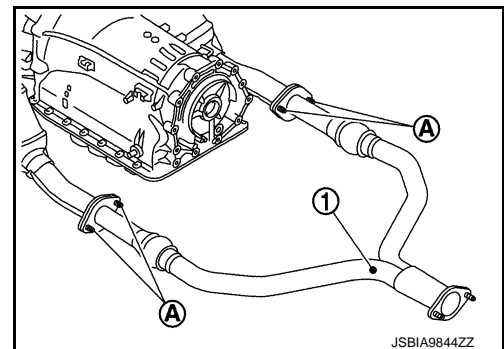
If a heated oxygen sensor is replaced, carry out the teach of "Idle Air Volume Learning". Refer to [EC6-273, "Description"](#) (FOR USA AND CANADA) or [EC6-1206, "Description"](#) (FOR MEXICO). G

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

#### CAUTION:

**To install catalyst converter, the positioning against turbocharger is necessary. For this reason, the following instructions must be complied with.**

- a. Clean up on the gasket touching surface. I
  - b. Temporarily install catalyst converter to turbocharger. J  
**NOTE:**  
 To install, turn clamp and bolt several turns, being careful not to drop parts.
  - c. Temporarily install three way catalyst to catalyst converter. K  
**NOTE:**  
 To install, turn bolt and nut several turns, being careful not to drop parts.
  - d. Temporarily install exhaust front tube to three way catalyst. L  
**NOTE:**  
 To install, turn nut several turns, being careful not to drop parts.
  - e. Temporarily tighten the bolt and nut of temporarily-tightened parts. M  
**NOTE:**  
 Tighten bolt and nut until they fit to the parts.
- Temporarily tighten mounting nut Ⓐ of exhaust front tube ①. N



M

N

O

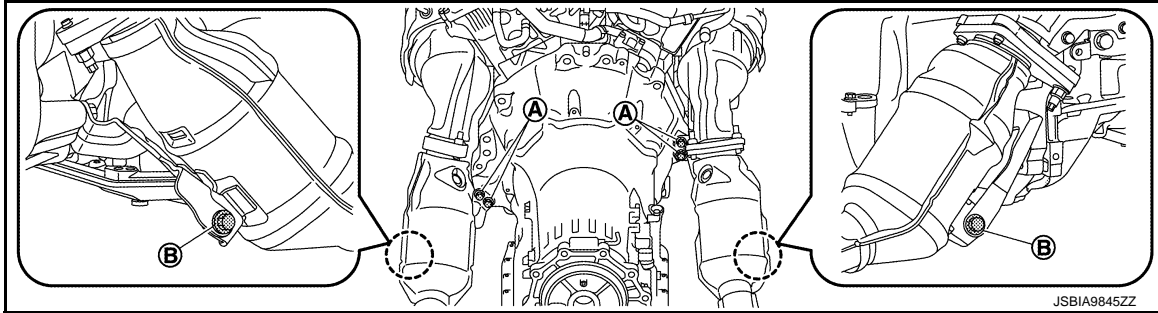
P

# CATALYST

< UNIT DISASSEMBLY AND ASSEMBLY >

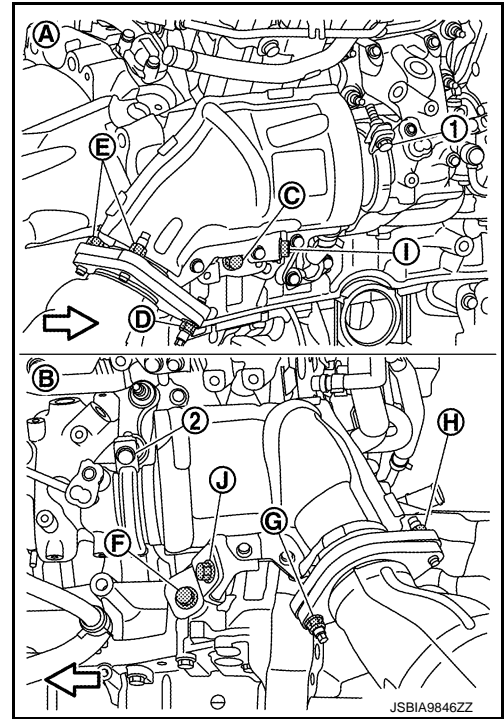
[VR30DDTT]

- Temporarily tighten mounting bolt (A) and (B) of 2nd catalyst converter bracket.



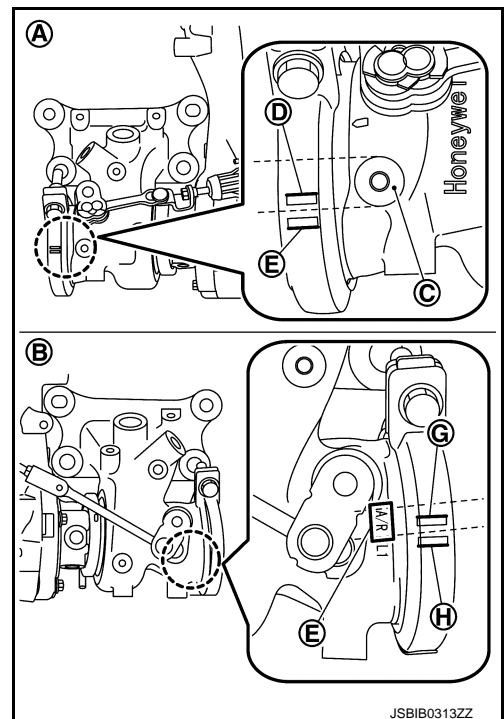
- Temporarily tighten mounting nut (D), (E), (H) and (G) of 2nd catalyst converter.
- Temporarily tighten mounting bolt (I) and (J) to reach the surface of catalyst converter bracket.
- Temporarily tighten mounting bolt (C) and (F) to reach the surface of catalyst converter bracket.
- Temporarily tighten Clamp (1) and (2).

- (A) : Bank 1
- (B) : Bank 2
- ← : Engine front



**CAUTION:**

- bank 1 side (A)
  - To install, position the upper side (D) or lower side (E) of clamp marking line within the range of the width of boss (C) as shown in the figure.
- bank 2 side (B)
  - To install, position the upper side (G) or lower side (H) of clamp marking line within the range of the width of "A/R" (E) as shown in the figure.





# CATALYST

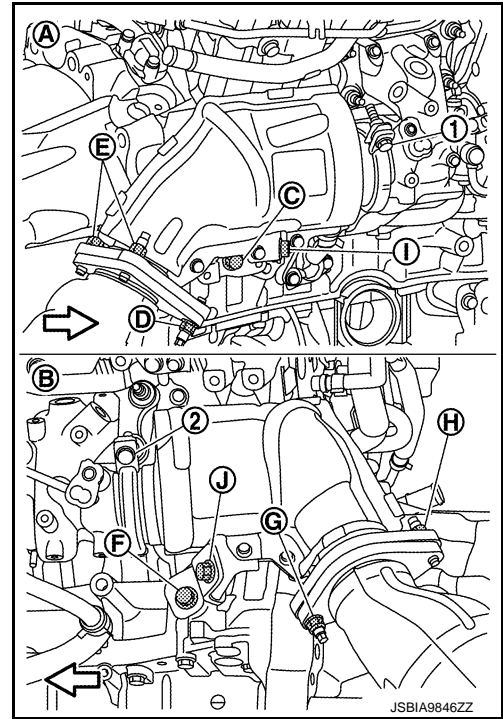
< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

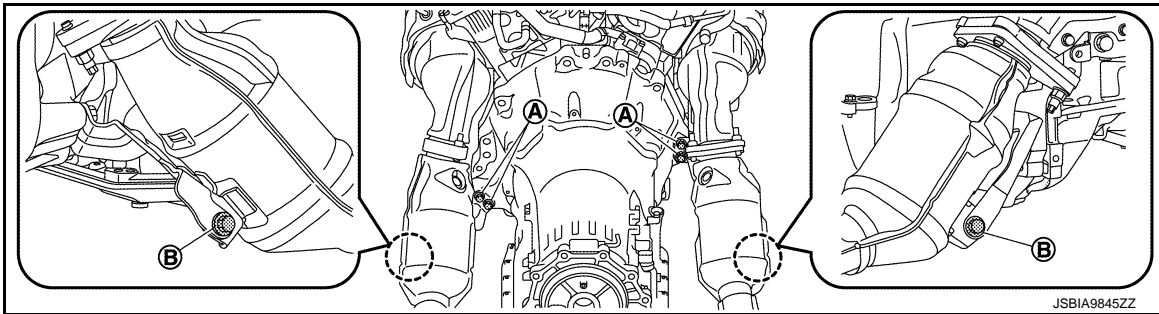
2. Tighten the temporarily tightened bolts and nuts to the specified torque, according to the following instructions:

- Tighten clamp ①. (bank 1 ①)
- Tighten mounting bolt ① of catalyst converter bracket (Bank 1).
- Tighten mounting bolt ③ of catalyst converter bracket (Bank 1).
- Tighten clamp ②. (Bank 2 ②)
- Tighten mounting bolt ④ of catalyst converter bracket (Bank 2).
- Tighten mounting bolt ⑥ of catalyst converter bracket (Bank 2).
- Tighten mounting bolt ⑩ and ⑨ of 2nd catalyst converter (Bank 1).
- Tighten mounting bolt ⑧ and ⑦ of 2nd catalyst converter (Bank 2).

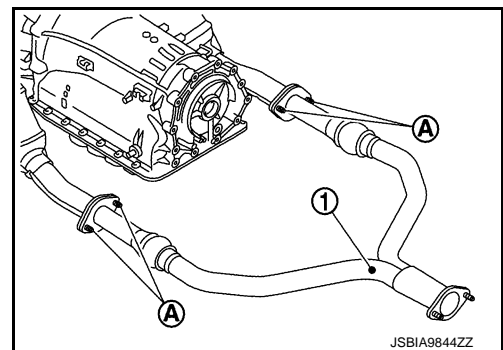
← : Engine front



- Tighten mounting bolt ① and ② of 2nd catalyst converter bracket.



- Remove mounting nut ① to remove exhaust front tube ①.



## Inspection

INFOID:000000013607856

## INSPECTION AFTER REMOVAL

Surface Distortion

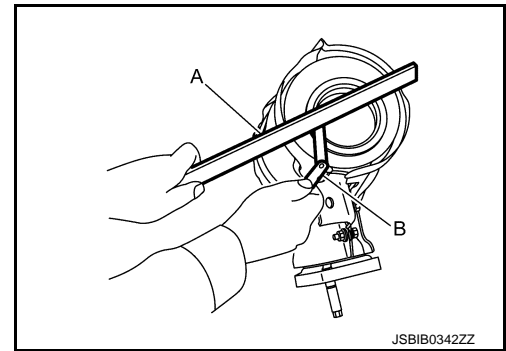
# CATALYST

## < UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

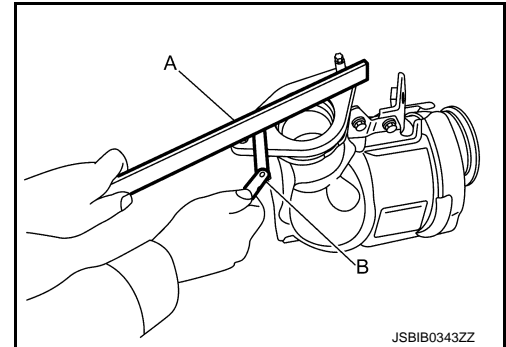
- Check the surface distortion of the catalyst converter mating surface (turbocharger side) with a straightedge (A) and a feeler gauge (B).

**Limit**      **0.5 mm ( 0.02 in )**



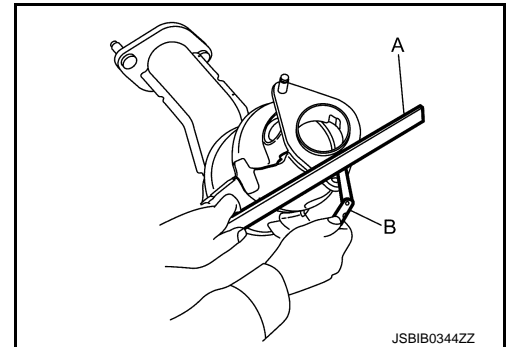
- Check the surface distortion of the catalyst converter mating surface (2nd catalyst converter side) with a straightedge (A) and a feeler gauge (B).

**Limit**      **0.3 mm ( 0.012 in )**



- Check the surface distortion of the 2nd catalyst converter mating surface (catalyst converter side) with a straightedge (A) and a feeler gauge (B).

**Limit**      **0.5 mm ( 0.02 in )**



# TURBOCHARGER

< UNIT DISASSEMBLY AND ASSEMBLY >

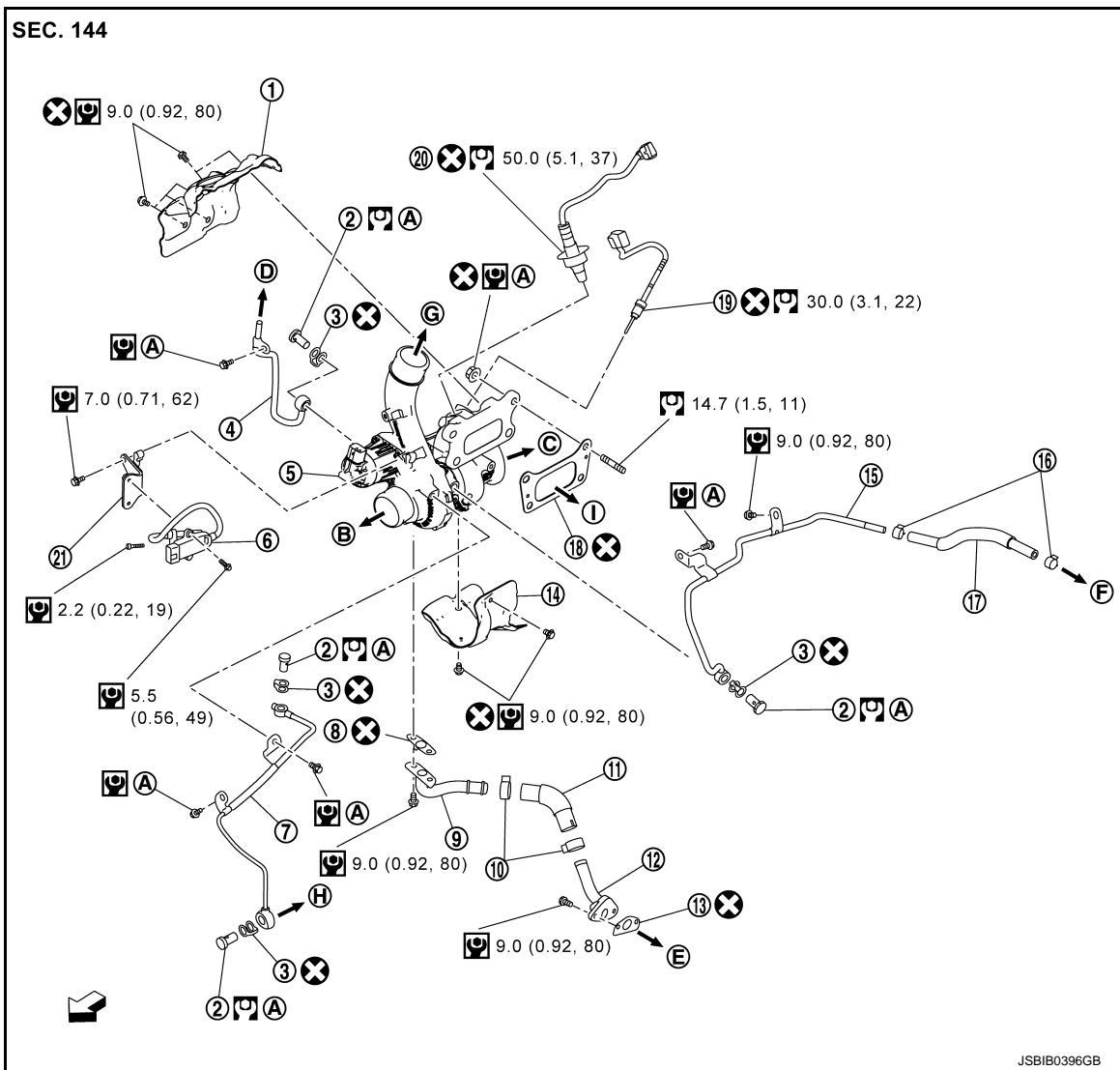
[VR30DDTT]

## TURBOCHARGER

Exploded View

INFOID:000000013607857

Bank 1 side



- |  |                                    |  |
|--|------------------------------------|--|
| ① Heat insulator (upper)   | ② Eye bolt                         | ③ Gasket   |
| ④ Water tube   | ⑤ Turbocharger assembly (bank 1)   | ⑥ Turbocharger speed sensor (bank 1)<br>(For type 1) |
| ⑦ Oil feed tube  | ⑧ Gasket                           | ⑨ Oil return pipe 1                                  |
| ⑩ Clamp  | ⑪ Oil return hose                  | ⑫ Oil return pipe 2                                  |
| ⑬ Gasket   | ⑭ Heat insulator (lower)           | ⑮ Water tube   |
| ⑯ Clamp  | ⑰ Water hose                       | ⑱ Gasket   |
| ⑲ Exhaust gas temperature sensor<br>(bank 1)   | ⑳ Air fuel ratio sensor 1 (bank 1) | ㉑ Bracket  |
| Ⓐ Comply with the assembly procedure<br>when tightening. Refer to <a href="#">EM-233</a> . | Ⓑ To air duct                      | Ⓒ To catalyst converter (bank 1)                     |
| Ⓓ To multi way control valve   | Ⓔ To lower cylinder block          | Ⓕ To water tube assembly                             |
| Ⓔ To air inlet hose (bank 1)   | Ⓕ To front cover                   | Ⓖ To cylinder head (bank 1)                          |


← Engine front


: N·m (kg·m, ft·lb)

# TURBOCHARGER

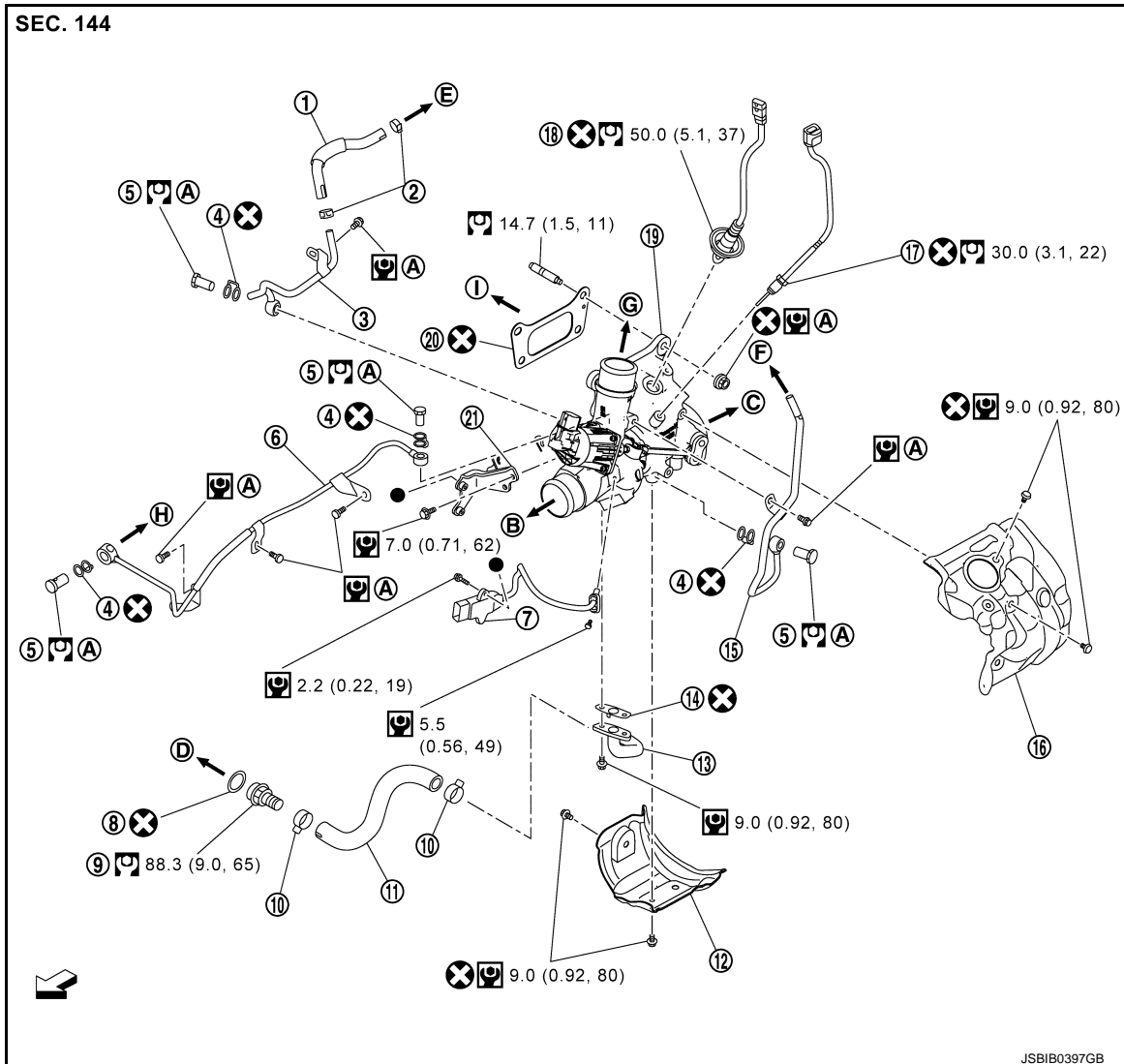
## < UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

 : N·m (kg·m, in·lb)


 : Always replace after every disassembly.

Bank 2 side



- |  |  |   |
|--|--|---|
| ① Water hose   | ② Clamp                                      | ③ Water tube  |
| ④ Gasket   | ⑤ Eye bolt                                   | ⑥ Oil feed tube                                     |
| ⑦ Turbocharger speed sensor (bank 2)<br>(For type 1)                                       | ⑧ Gasket                                     | ⑨ Hose connector                                    |
| ⑩ Clamp  | ⑪ Oil return hose                            | ⑫ Heat insulator (lower)                            |
| ⑬ Oil return pipe  | ⑭ Gasket                                     | ⑮ Water tube  |
| ⑯ Heat insulator (upper)   | ⑰ Exhaust gas temperature sensor<br>(bank 2) | ⑱ Air fuel ratio sensor 1 (bank 2)                  |
| ⑲ Turbocharger assembly (bank 2)   | ⑳ Gasket                                     | ㉑ Bracket   |
| Ⓐ Comply with the assembly procedure<br>when tightening. Refer to <a href="#">EM-233</a> . | Ⓑ To air duct                                | Ⓒ To catalyst converter (bank 2)                    |
| Ⓓ To lower cylinder block lower  | Ⓔ To heater pipe                             | Ⓕ To electric throttle control actuator<br>(bank 2) |
| Ⓖ To air inlet hose (bank 2)   | Ⓗ To cylinder head (bank 2)                  |   |


 : Engine front


 : N·m (kg·m, ft·lb)

# TURBOCHARGER

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

 : N·m (kg·m, in·lb)

 : Always replace after every disassembly.

## Removal and Installation

INFOID:000000013607858

A

EM

### REMOVAL

1. Using the heated oxygen sensor wrench [SST: KV10117100 (J-3647-A)], remove air fuel ratio sensor 1.
2. Remove exhaust temperature sensor.
3. Remove heat insulator (upper).
4. Remove catalyst converter. Refer to [EM-227, "Removal and Installation"](#).
5. Remove water tube.
6. Remove oil return pipe.
7. Remove oil feed tube.
8. Remove turbocharger speed sensor.
9. Loosen turbocharger assembly mounting nuts in the order from 4 to 1 as shown in the figure.

#### NOTE:

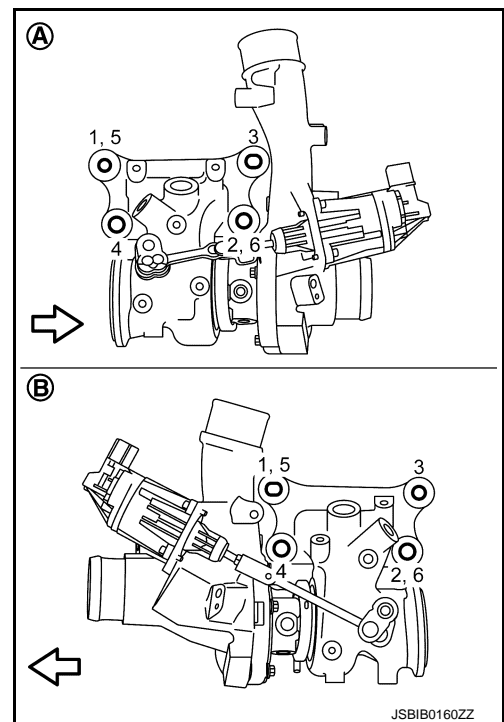
Disregard No.5 and No.6 when loosening.

Ⓐ : Bank 1

Ⓑ : Bank 2

← : Engine front

10. Remove turbocharger assembly.
11. Remove heat insulator (lower).
12. Remove gasket.



C

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J

K

L

### INSTALLATION

#### NOTE:

- If a turbocharger assembly is replaced, carry out the reset of adaption of "Turbocharger Wastegate Control Solenoid Valve Data Initialization". Refer to [EC6-277, "Description"](#) (FOR USA AND CANADA) or [EC6-1210, "Description"](#) (FOR MEXICO).
- If a air fuel sensor 1 is removed, carry out the teach of "Idle Air Volume Learning". Refer to [EC6-273, "Description"](#) (FOR USA AND CANADA) or [EC6-1206, "Description"](#) (FOR MEXICO) .

#### Turbocharger side

1. Install heat insulator (lower).
2. Install gasket.

M

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# TURBOCHARGER

[VR30DDTT]

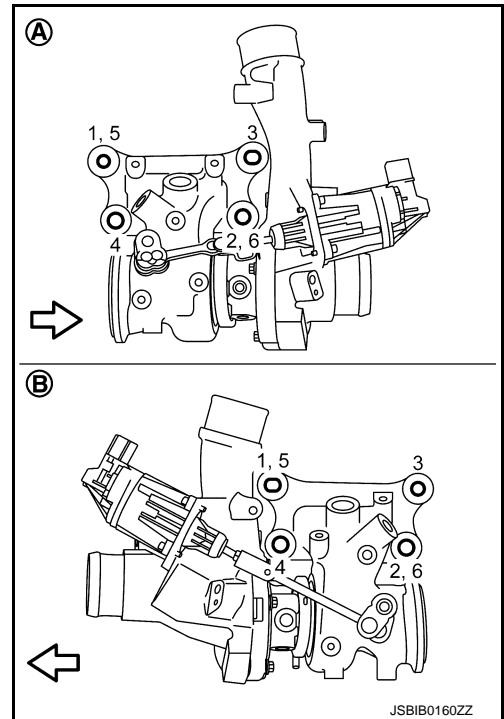
## < UNIT DISASSEMBLY AND ASSEMBLY >

3. Install turbocharger assembly in the order from 1 to 6 as shown in the figure.

**NOTE:**

The numerical order No.5 and No.6 shows the second step.

- Ⓐ : Bank 1
- Ⓑ : Bank 2
- ⇐ : Engine front



JSBIB0160ZZ

4. Install oil return pipe.  
5. Install water tube according to the following procedure.

- Ⓐ : Bank 1
- Ⓑ : Bank 2
- ⇐ : Engine front

- Temporarily tighten eye bolt.
- Temporarily tighten bracket bolt.
- Tighten eye bolt to the torque specified below.

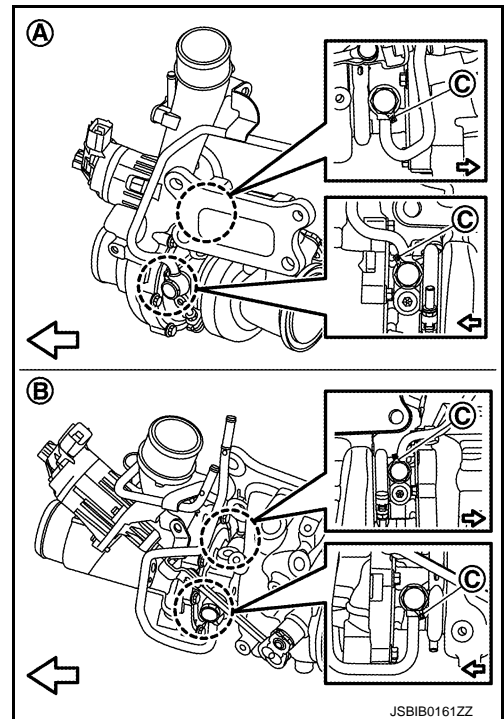
: 25.0 N·m (2.6 kg-m, 18 ft-lb)

**CAUTION:**

Position gasket protrusion © as shown in the figure.

- Tighten bracket bolt to the torque specified below.

: 9.0 N·m (0.92 kg-m, 80 in-lb)



JSBIB0161ZZ

6. Install water hose.  
- Align with paint mark (white).

# TURBOCHARGER


[VR30DDTT]

## < UNIT DISASSEMBLY AND ASSEMBLY >

7. Install the oil feed tube with the following procedure.

- Ⓐ : Bank 1
- Ⓑ : Bank 2
- ⇐ : Engine front

- Temporarily tighten eye bolt.
- Temporarily tighten bracket bolt.
- Tighten eye bolt to the torque specified below.

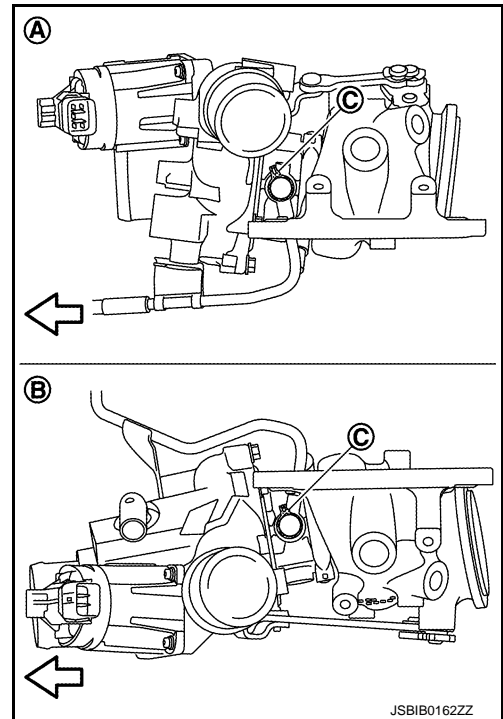
: 17.0 N·m (1.7 kg·m, 13 ft·lb)

### CAUTION:

Position gasket protrusion ③ as shown in the figure.

- Tighten bracket bolt to the torque specified below.

: 9.0 N·m (0.92 kg·m, 80 in·lb)



Oil feed tube (front side)

BANK 1 side

1. Temporarily oil feed tube bracket ①.

### NOTE:

Apply stopper ② of bracket to front case.

2. Tighten oil feed tube bracket bolt ④.
3. Temporarily tighten eye bolt.

### CAUTION:

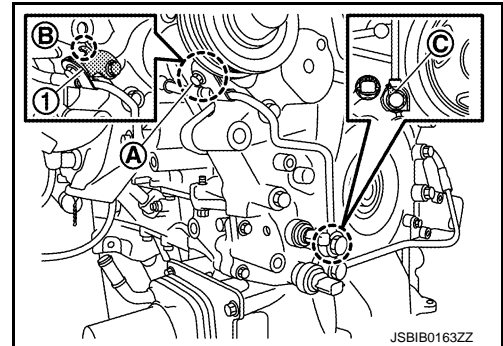
Position gasket protrusion ③ as shown in the figure.

4. Temporarily tighten bracket bolt ⑤.
5. Tighten eye bolt to the torque specified below.

: 25.0 N·m (2.6 kg·m, 18 ft·lb)

6. Tighten bracket bolt ⑥ to the torque specified below.

: 9.0 N·m (0.92 kg·m, 80 in·lb)



BANK 2 side

1. Temporarily tighten eye bolt.

### CAUTION:

Position gasket protrusion ③ as shown in the figure.

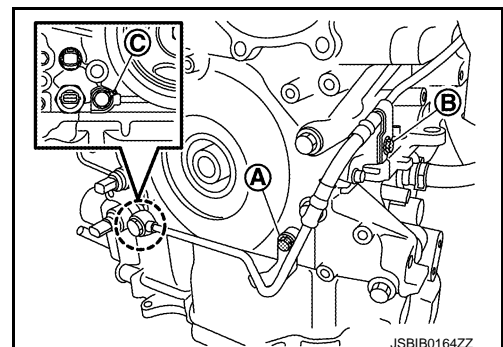
2. Temporarily tighten bracket bolt ⑦.
3. Tighten eye bolt to the torque specified below.

: 25.0 N·m (2.6 kg·m, 18 ft·lb)

4. Tighten bracket bolt ⑧ to the torque specified below.

: 9.0 N·m (0.92 kg·m, 80 in·lb)

5. Tighten bracket bolt ⑨ to the torque specified below.



# TURBOCHARGER

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

 **9.0 N·m (0.92 kg·m, 80 in·lb)**

## Inspection

INFOID:000000013607859

### INSPECTION PROCEDURE

#### Trouble Diagnosis of Turbocharger

Check items before trouble diagnosis

1. Check that the engine oil level is between L (Low level) and H (High level) of the oil level gauge. [When the engine oil amount is more than H (High level), the engine oil flows into the inlet duct through the blow-by gas passage, and the turbocharger is misjudged failure.]
2. Ask the customer if he/she always runs the vehicle in idle engine speed to cool the engine oil down after driving.
  - Replace the turbocharger assembly when any malfunction is found after unit inspections specified in the table below.
  - If no malfunction is found after the unit inspections, judge that the turbocharger body has no non-standard conditions. Check the other parts again.

Inspection Location	Result	Symptoms likely to occur when the results shown on the left exist.			
		Oil leakage	Smoke	Noise*	Poor power Poor acceleration
Turbine wheel	Wet with oil.	C	A	C	C
	Carbon deposits observed.	C	A	B	B
	"Rubs against" housing.	C	B	A	B
	Vane is bent or broken.			A	A
Compressor wheel	Inside of intake port is badly stained with oil.	B	B		
	"Rubs against" housing.	C	B	A	B
	Vane is bent or broken.			A	A
Check both turbine and compressor rotor shaft end play.	Heavy feel or catching when turned by hand.		C	C	B
	Cannot be turned by hand.				A
	Excessively loose bearing.	C	C	B	C
Rotor shaft, oil return port (Check inside using penlight.)	Carbon or sludge deposits in oil drain port.	B	A	C	C
Boost control valve actuator operation (using a handy pump)	<ul style="list-style-type: none"> <li>• Does not operate smoothly when air pressure is gradually applied.</li> <li>• Stroke amount is not compliance with the air pressure.</li> </ul>				A

**A: Highly possible. B: Possible. C: May exist.**

\* Racing under cold engine may generate a noise from the area of wastegate valve. This is not a turbocharger malfunction. The noise stops after engine warm-up.

### INSPECTION AFTER REMOVAL

Turbocharger

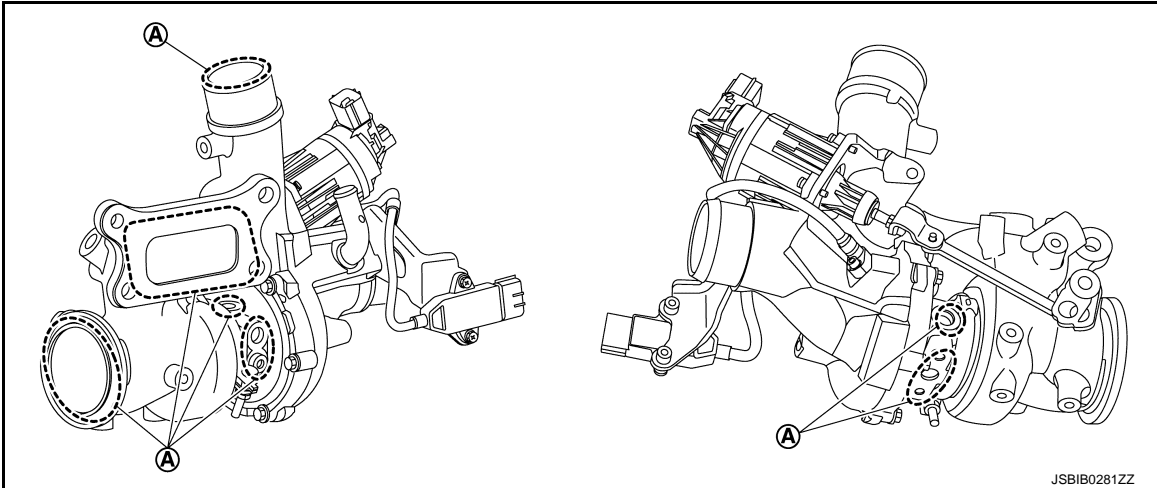


# TURBOCHARGER

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

Turbocharger



(A) Check for leakage

**CAUTION:**

When the compressor wheel, turbine wheel or rotor shaft is damaged, remove all the fragments and foreign matter left in the following passages in order to prevent a secondary failure:

**Intake side** : Between turbocharger and charge air cooler

**Exhaust side** : Between turbocharger and outlet duct

**INSPECTION AFTER INSTALLATION**

Start engine and raise engine speed to check no exhaust emission leaks.

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# TIMING CHAIN

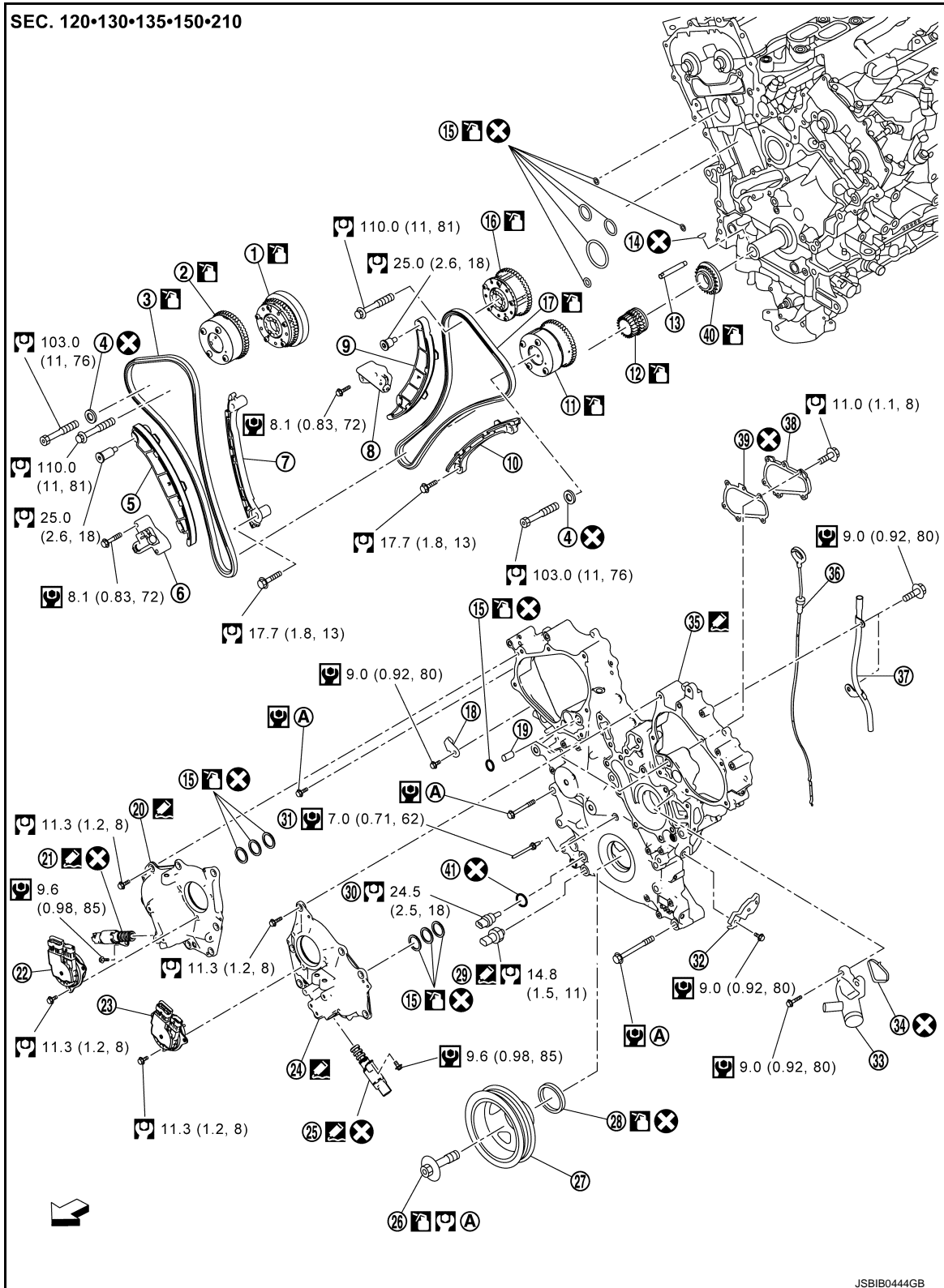
< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

## TIMING CHAIN

Exploded View

INFOID:000000013607860



- ① Intake camshaft sprocket (bank 1)
- ② Exhaust camshaft sprocket (bank 1)
- ③ Timing chain (bank 1)
- ④ Washer
- ⑤ Timing chain slack guide (bank 1)
- ⑥ Timing chain tensioner (bank 1)

# TIMING CHAIN

[VR30DDTT]

< UNIT DISASSEMBLY AND ASSEMBLY >

- |  |  |  |
|--|--|--|
| ⑦ Timing chain tension guide (bank 1)                    | ⑧ Timing chain tensioner (bank 2)                        | ⑨ Timing chain slack guide (bank 2)                |
| ⑩ Timing chain tension guide (bank 2)                    | ⑪ Exhaust camshaft sprocket (bank 2)                     | ⑫ Crankshaft sprocket                              |
| ⑬ Timing chain oil jet                                   | ⑭ Crankshaft key   | ⑮ O-ring   |
| ⑯ Intake camshaft sprocket (bank 2)                      | ⑰ Timing chain (bank 2)                                  | ⑱ Bracket  |
| ⑲ Oil filter assembly                                    | ⑳ Valve timing control cover (bank 1)                    | ㉑ Valve timing oil control solenoid valve (bank 1) |
| ㉒ Electric intake valve timing control actuator (bank 1) | ㉓ Electric intake valve timing control actuator (bank 2) | ㉔ Valve timing control cover (bank 2)              |
| ㉕ Valve timing oil control solenoid valve (bank 2)       | ㉖ Crankshaft pulley bolt                                 | ㉗ Crankshaft pulley                                |
| ㉘ Front oil seal   | ㉙ Oil pressure sensor                                    | ㉚ Oil temperature sensor                           |
| ㉛ Timing indicator                                       | ㉜ Engine harness bracket                                 | ㉝ Water inlet                                      |
| ㉞ Gasket   | ㉟ Front cover  | ㊱ Oil level gauge                                  |
| ㊲ Oil level gauge guide                                  | ㊳ Oil galley cover                                       | ㊴ Gasket   |
| ㊵ Oil pump sprocket                                      | ㊶ O-ring   |  |

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Comply with the installation procedure when tightening. Refer to [EM-239](#).

← : Engine front

 : N·m (kg·m, ft·lb)

 : N·m (kg·m, in·lb)

 : Always replace after every disassembly.

 : Should be lubricated with oil.

 : Sealing point

## Removal and Installation

INFOID:000000013607861

### REMOVAL

1. Drain engine oil. Refer to [LU-29, "Draining"](#).
2. Remove charge air cooler. Refer to [EM-168, "Removal and Installation"](#).
3. Remove intake manifold collector. Refer to [EM-174, "Removal and Installation"](#).
4. Remove intake manifold. Refer to [EM-176, "Removal and Installation"](#).
5. Remove rocker cover. Refer to [EM-193, "Removal and Installation"](#).
6. Remove turbocharger (bank 2). Refer to [EM-233, "Removal and Installation"](#).
7. Remove heater pipe. Refer to [CO-65, "Exploded View"](#).
8. Remove water pump. Refer to [CO-47, "Removal and Installation"](#).
9. Remove drive belt auto tensioner. Refer to [EM-164, "Removal and Installation"](#).
10. Remove idler pulley. Refer to [EM-164, "Removal and Installation"](#).
11. Remove multi-way control valve. Refer to [CO-63, "Removal and Installation"](#).
12. Remove valve timing control covers (bank 1 and bank 2) and gasket as follows:
  - a. Disconnect electric intake valve timing control actuator harness connector.

# TIMING CHAIN

[VR30DDTT]

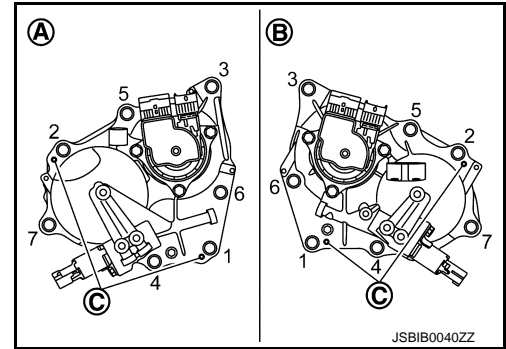
## < UNIT DISASSEMBLY AND ASSEMBLY >

b. Loosen mounting bolts in the order from 7 to 1 as shown in the figure.

- Ⓐ : Bank 1
- Ⓑ : Bank 2
- Ⓒ : Dowel pin hole

**CAUTION:**

Shaft is internally jointed with camshaft sprocket center hole. When removing, keep it horizontal until it is completely disconnected.

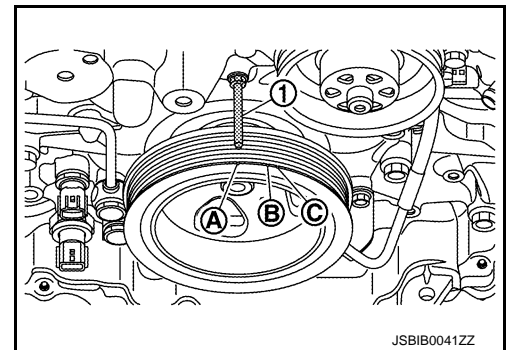


c. Shaft is engaged with camshaft sprocket center hole on inside. Pull straight out so as not to tilt until the joint is disengaged.

13. Obtain No. 1 cylinder at TDC of its compression stroke as follows:

a. Rotate crankshaft pulley clockwise to align timing mark (grooved line without color) Ⓐ with timing indicator ①.

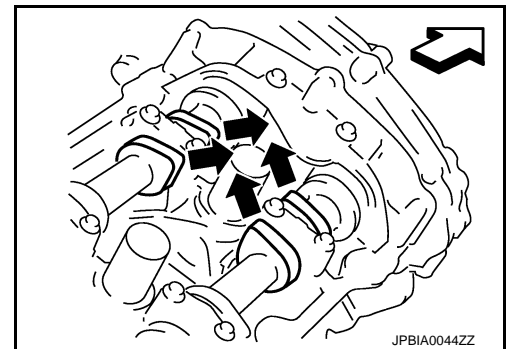
- Ⓑ : White paint mark
- Ⓒ : White paint mark



b. Check that intake and exhaust cam noses on No. 1 cylinder (engine front side of bank 1) are located as shown in the figure.

↔ : Engine front

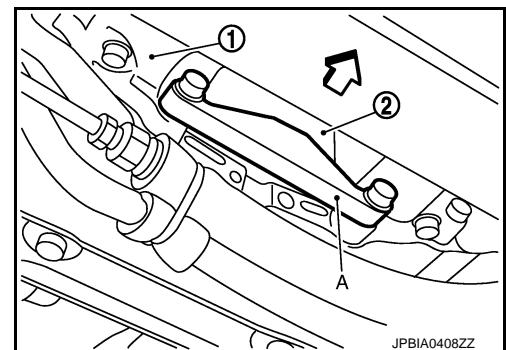
• If not, turn crankshaft one revolution (360 degrees) and align as shown in the figure.



14. Remove crankshaft pulley as follows:

a. Remove rear cover plate and set the ring gear stopper [SST: KV10118600 (J-48641)] (A) as shown in the figure.

- ① : Oil pan (upper)
- ② : Drive plate
- ↔ : Vehicle front



# TIMING CHAIN

[VR30DDTT]

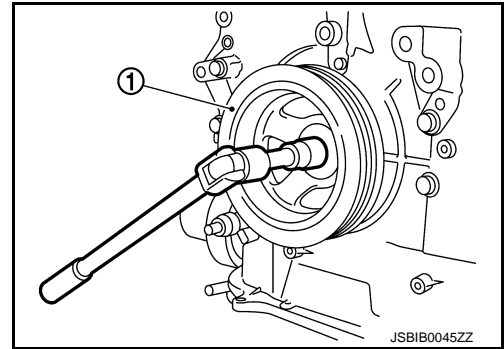
## < UNIT DISASSEMBLY AND ASSEMBLY >

- b. Loosen crankshaft pulley bolt and rotate bolt seating surface at 10 mm (0.39 in) from its original position.

① : Crankshaft pulley

**CAUTION:**

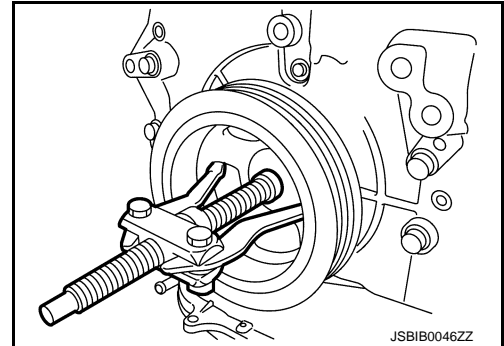
**Never remove crankshaft pulley bolt as it will be used as a supporting point for suitable puller.**



- c. Place suitable puller tab on holes of crankshaft pulley, and pull crankshaft pulley through.

**CAUTION:**

**Never put suitable puller tab on crankshaft pulley periphery, as this will damage internal damper.**

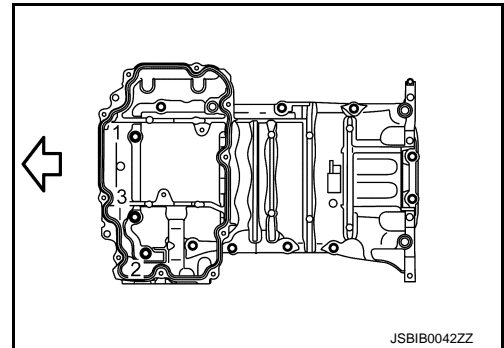


15. Remove eye bolt of oil feed pipe and mounting bolt from front cover, and move it to aside.

16. Remove oil pan (lower). Refer to [EM-191. "Removal and Installation"](#).

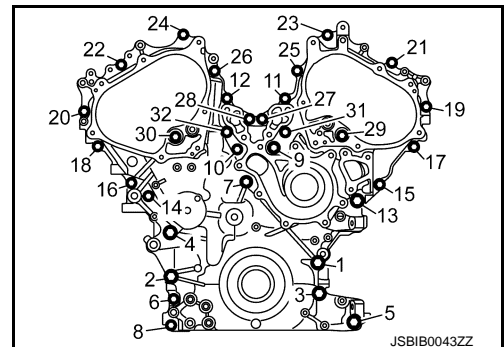
17. Loosen two mounting bolts in front of oil pan (upper), using a power tool (commercial service tool) in the order of 3, 2, 1 as shown in the figure.

⇐ : Engine front



18. Remove front timing chain case as follows:

- a. Loosen mounting bolts in the order from 32 to 1 as shown in the figure.



- b. Pry off case by moving the suitable tool.

- Use the seal cutter [SST: KV10111100 (J-37228)] to cut liquid gasket for removal.

**CAUTION:**

- **Never use a screwdriver or something similar. Failure to do this may cause damage to the parts.**
- **After removal, handle front timing chain case carefully so it does not tilt, cant, or warp under a load.**

- c. Remove dowel pin from timing chain case.

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## TIMING CHAIN

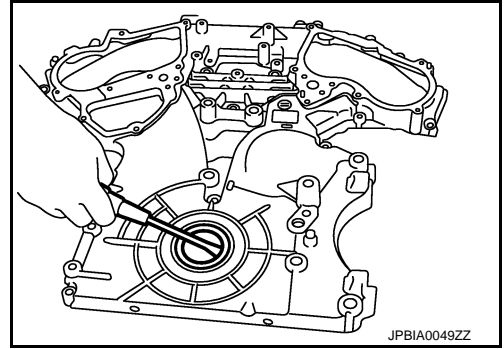
[VR30DDTT]

### < UNIT DISASSEMBLY AND ASSEMBLY >

19. Remove front oil seal from front timing chain case using a suitable tool.
- Use a screwdriver for removal.

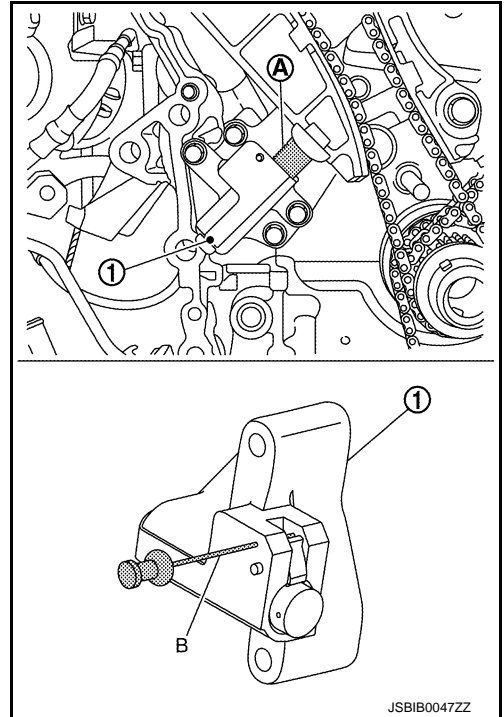
**CAUTION:**

**Never damage front timing chain case.**



20. Remove timing chain tensioner as follows:

- Insert plunger (A) into tensioner (1).
- Insert a wire such as clip (B) with the plunger inserted.
- Remove chain tensioner.



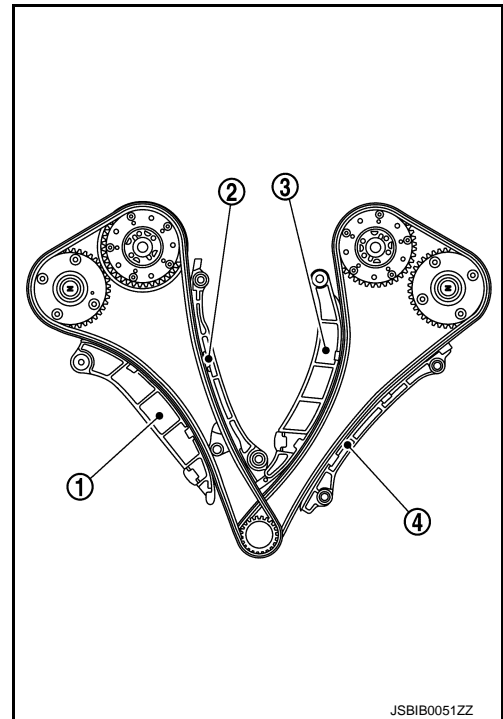
# TIMING CHAIN

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

21. Remove internal chain guide and slack guide.

- ① : Timing chain slack guide (bank 1)
- ② : Timing chain tension guide (bank 1)
- ③ : Timing chain guide (bank 2)
- ④ : Timing chain tension guide (bank 2)



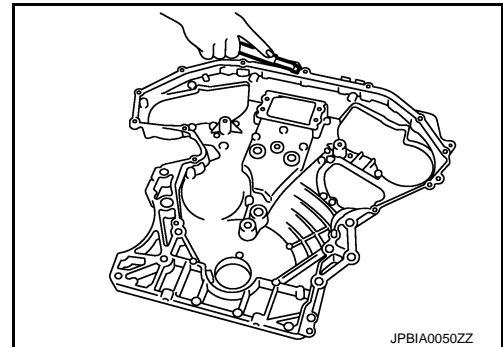
22. Remove timing chain (LH) and (RH).

23. Remove oil pump drive chain. Refer to [LU-39. "Removal and Installation"](#).

24. Use a scraper to remove all traces of old liquid gasket from front and rear timing chain cases and oil pan (upper), and liquid gasket mating surfaces.

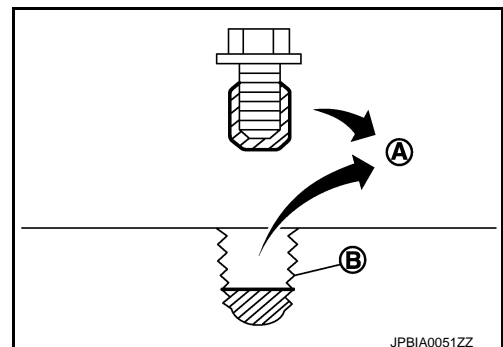
**CAUTION:**

**Never allow gasket fragments to enter oil pan.**



25. Remove old liquid gasket from bolt hole and thread.

- Ⓐ : Remove sticking old liquid gasket
- Ⓑ : Bolt hole



## INSTALLATION

**CAUTION:**

**Do not reuse O-rings.**

**NOTE:**

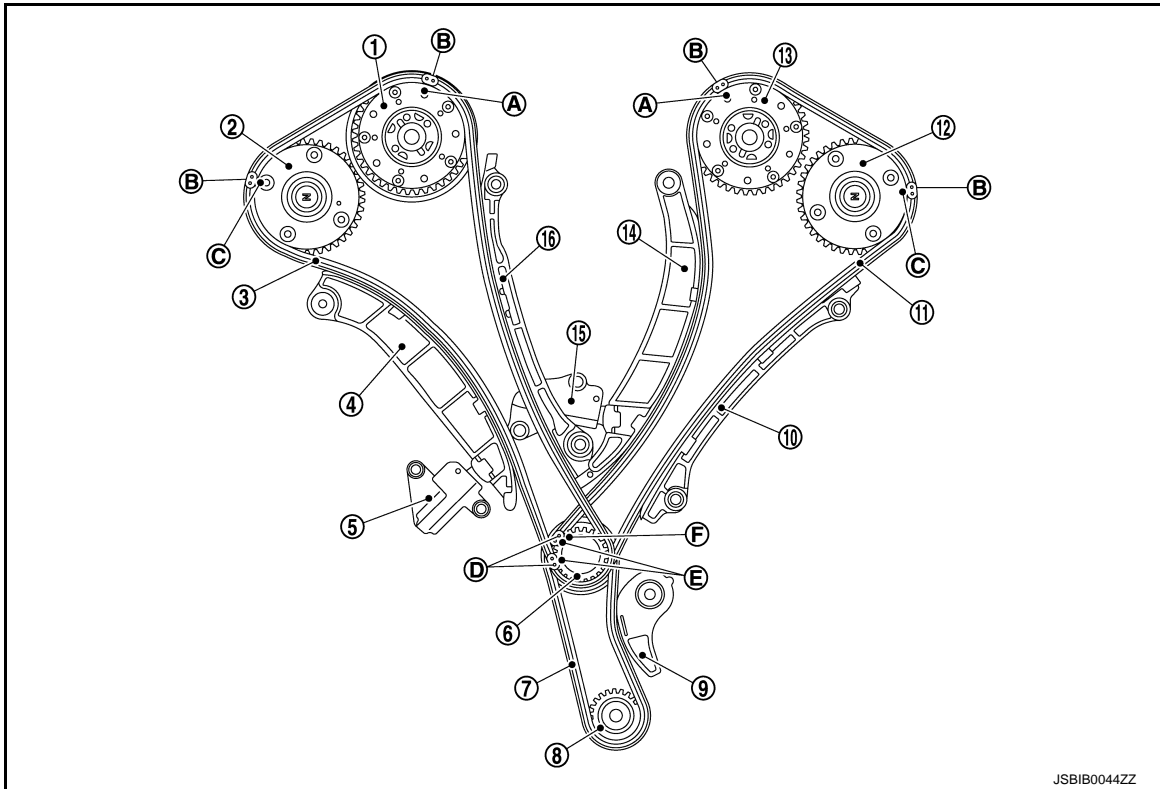
- If a timing chain is removed, carry out the teach of "Electric IVT Control Actuator Position Learning". Refer to [EC6-276, "Description"](#) (FOR USA AND CANADA) or [EC6-1209, "Description"](#) (FOR MEXICO).
- If an intake camshaft sprocket or exhaust camshaft sprocket are removed, carry out the teach of "Electric IVT Control Actuator Position Learning". Refer to [EC6-276, "Description"](#) (FOR USA AND CANADA) or [EC6-1209, "Description"](#) (FOR MEXICO).

# TIMING CHAIN

[VR30DDTT]

## < UNIT DISASSEMBLY AND ASSEMBLY >

- If an electric intake valve timing control actuator, carry out the teach of "Idle Air Volume Learning". Refer to [EC6-273, "Description"](#) (FOR USA AND CANADA) or [EC6-1206, "Description"](#) (FOR MEXICO).
- The below figure shows the relationship between the matching mark on each timing chain and that on the corresponding sprocket, with the components installed.



JSBIB004ZZ

- |                                     |                                      |                                      |
|-------------------------------------|--------------------------------------|--------------------------------------|
| ① Intake camshaft sprocket (bank 1) | ② Exhaust camshaft sprocket (bank 1) | ③ Timing chain (bank 1)              |
| ④ Timing chain slack guide          | ⑤ Timing chain tensioner             | ⑥ Crankshaft sprocket                |
| ⑦ Oil pump drive chain              | ⑧ Oil pump sprocket                  | ⑨ Oil pump drive chain tensioner     |
| ⑩ Timing chain tension guide        | ⑪ Timing chain (bank 2)              | ⑫ Exhaust camshaft sprocket (bank 2) |
| ⑬ Intake camshaft sprocket (bank 2) | ⑭ Timing chain slack guide           | ⑮ Timing chain tensioner             |
| ⑯ Timing chain tension guide        |                                      |                                      |
| A Matching mark (notched)           | B Matching mark (pink link)          | C Matching mark (punched)            |
| D Matching mark (orange link)       | E Matching mark (orange link)        | F Crankshaft key                     |

1. Check that dowel pin **A** and crankshaft key **①** are located as shown in the figure. (No. 1 cylinder at compression TDC)

### NOTE:

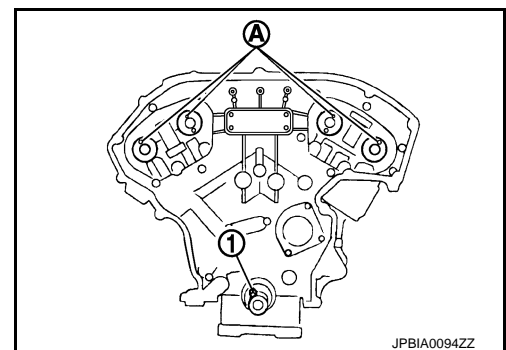
Though camshaft does not stop at the position as shown in the figure, for the placement of cam noses, it is generally accepted camshaft is placed for the same direction of the figure.

### Camshaft dowel pin

: At cylinder head upper face side in each bank.

### Crankshaft key

: At cylinder head side of bank 1.



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2. Install the crankshaft sprocket and the oil pump drive related parts with the following procedure:
  - a. Install the crankshaft sprocket, the oil pump drive chain, and the oil pump sprocket at the same time.

**NOTE:**  
There is no matching mark in the oil pump drive related parts.



# TIMING CHAIN

[VR30DDTT]

## < UNIT DISASSEMBLY AND ASSEMBLY >

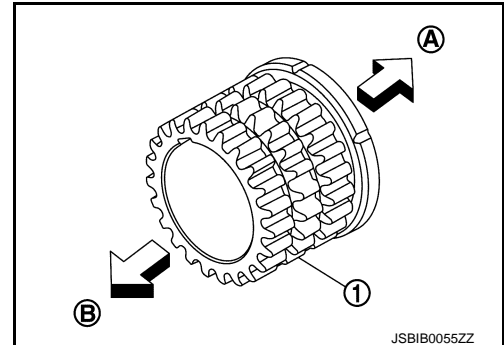
- b. Hold the top of the oil pump shaft using the TORX socket (commercial service tool), and then tighten the oil pump sprocket nuts.
- c. Install chain tensioner.
  - Check that the tension is applied to the oil pump drive chain after installing.

### 3. Install timing chain as follows:

- a. Install crankshaft sprocket ①.

- Ⓐ : Engine front
- Ⓑ : Crankshaft side

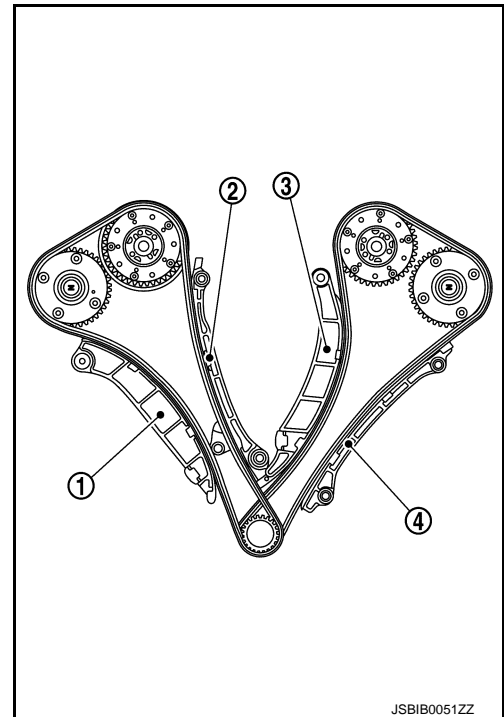
- Check the matching marks on crankshaft sprocket face the front of the engine.



- b. Install timing chain.

4. Install internal chain guide and slack guide.

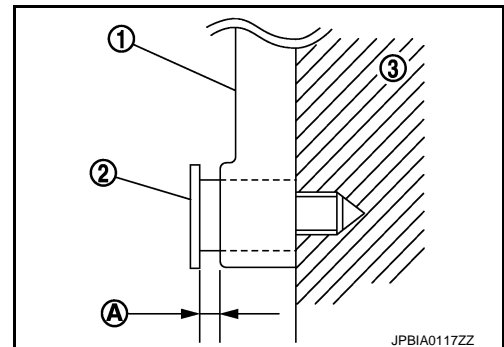
- ① : Timing chain slack guide (bank 1)
- ② : Timing chain tension guide (bank 1)
- ③ : Timing chain guide (bank 2)
- ④ : Timing chain tension guide (bank 2)



### CAUTION:

Never overtighten slack guide ① mounting bolts ②. It is normal for a gap Ⓐ to exist under the bolt seats when mounting bolts are tightened to the specification.

- ③ : Cylinder block



5. Install the timing chain tensioner.

6. Disconnect clip from chain tensioner.

7. Check again that the matching marks on sprockets and timing chain have not slipped out of alignment.

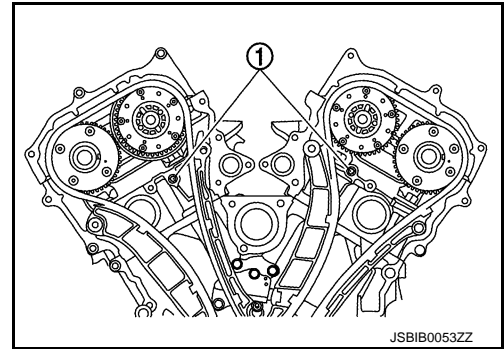
# TIMING CHAIN

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

8. Install new O-rings ① on cylinder head.

**CAUTION:**  
Do not reuse O-rings.



9. Install new front oil seal on front timing chain case. Refer to [EM-201. "FRONT OIL SEAL : Removal and Installation"](#).

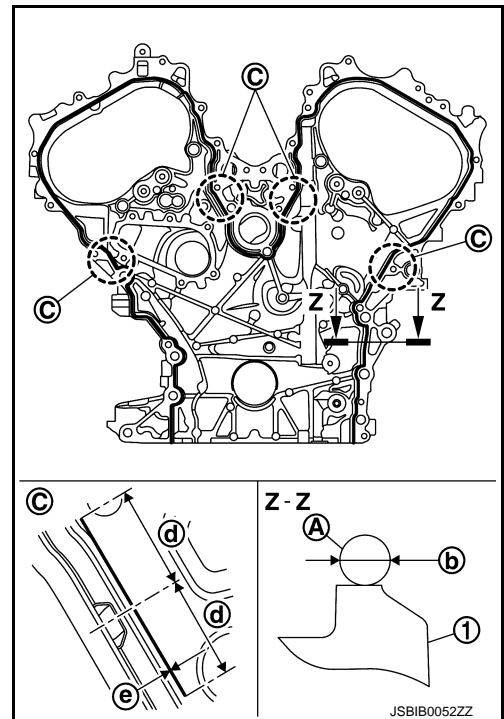
10. Install front timing chain case as follows:  
• Check O-rings stay in place during installation to rear timing chain case.

- a. Apply a continuous bead of liquid gasket with the tube presser (commercial service tool) to front timing chain case ① back side as shown in the figure.

**Use Genuine Liquid Gasket (Three Bond 1217H) or equivalent.**

**CAUTION:**  
When applying gasket, check and be careful with application point ③

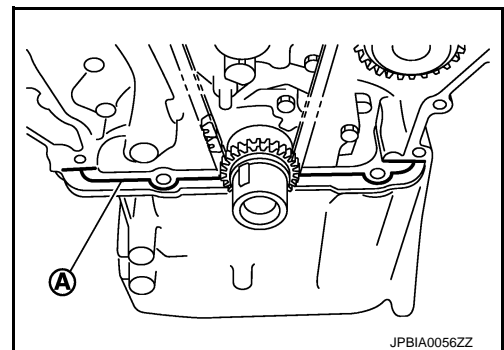
- Ⓐ : Protrusion
- Ⓑ :  $\phi 3.4 - 4.4$  mm (0.134 - 0.173 in)
- Ⓓ : 15 mm (0.59 in)
- Ⓔ :  $\phi 6.0 - 7.0$  mm (0.236 - 0.276 in)



- b. Apply liquid gasket to top surface of oil pan (upper) as shown in the figure.

- Ⓐ :  $\phi 4.0 - 5.0$  mm (0.157 - 0.197 in)

**Use Genuine Liquid Gasket (Three Bond 1217H) or equivalent.**



# TIMING CHAIN

[VR30DDTT]

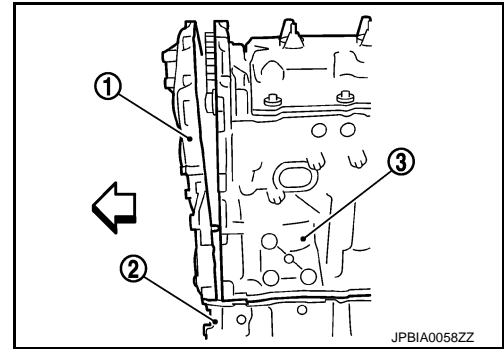
## < UNIT DISASSEMBLY AND ASSEMBLY >

c. Assemble front timing chain case.

- ① : Front timing chain case
- ② : Oil pan (upper)
- ③ : Cylinder block
- ⇐ : Engine front

**CAUTION:**

- Never damage front oil seal by interference with front end of crankshaft.
- Attaching should be done within 5 minutes after liquid gasket application.



d. Install front timing chain case as to fit its dowel pin hole together dowel pin on rear timing chain case.

e. Tighten mounting bolts to the specified torque in the order from 1 to 26 as shown in the figure.

- There are two types of mounting bolts. Refer to the following for locating bolts.

**M10 bolts** : 1, 2, 3, 4, 5, 13

: 45.0 N·m (4.6 kg-m, 33 ft-lb)

**M8 bolts** : 7, 9

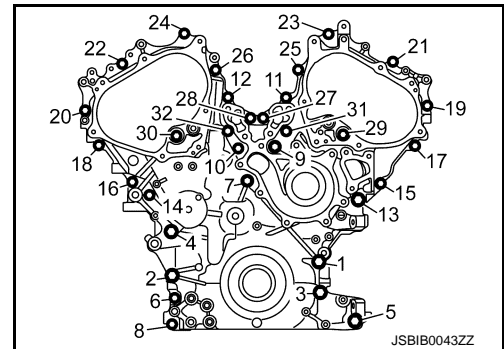
: 22.0 N·m (2.2 kg-m, 16 ft-lb)

**M6 bolts** : 31, 32

: 13.5 N·m (1.4 kg-m, 10 ft-lb)

**M6 bolts** : Except the above

: 9.0 N·m (0.92 kg-m, 80 in-lb)



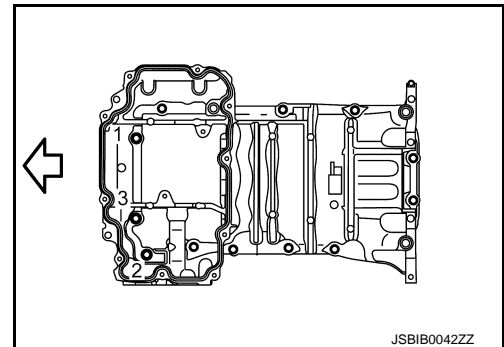
f. After all bolts are tightened, retighten them to the specified torque in numerical order shown in the figure.

**CAUTION:**

**Be sure to wipe off any excessive liquid gasket leaking on surface mating with oil pan (upper).**

g. Install two mounting bolts in front of oil pan (upper) in the order of 1, 2, 3 shown in the figure.

- ⇐ : Engine front



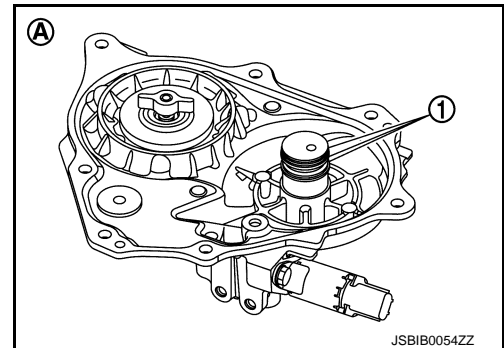
11. Install valve timing control covers (bank 1 and bank 2) as follows:

a. Install new seal rings ① in shaft grooves.

- Ⓐ : Bank 2

**CAUTION:**

**When replacing seal ring, replace all rings with new one.**



b. Install valve timing control cover with new gasket to front timing chain case.

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# TIMING CHAIN

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

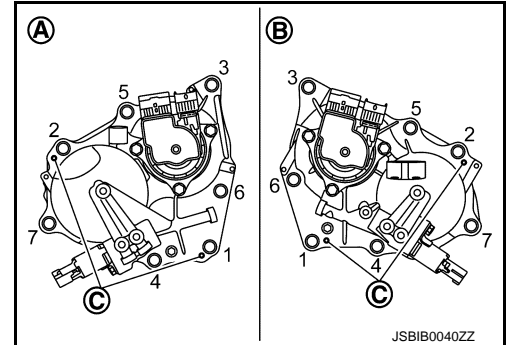
## CAUTION:

- Align the center of both shaft holes of the shaft and the camshaft sprocket, and then insert them.
- Be careful not to drop the seal ring from the shaft groove.

- c. Being careful not to move seal ring from the installation groove, align dowel pins on front timing chain case with holes to install valve timing control covers.
- d. Tighten mounting bolts in the order from 1 to 7 as shown in the figure.

- (A) : Bank 1  
(B) : Bank 2  
(C) : Dowel pin hole

- After all bolts are tightened, tighten No. 1 bolt to the specified torque again.



12. Install oil pan (lower). Refer to [EM-191, "Removal and Installation"](#).

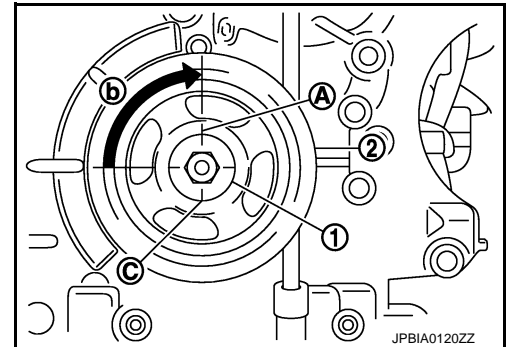
13. Install rocker covers (bank 1 and bank 2). Refer to [EM-193, "Removal and Installation"](#).

14. Install crankshaft pulley as follows:

- a. Fix the crankshaft in the same way as in removal.
- b. Install crankshaft pulley, taking care not to damage front oil seal.
- When press-fitting crankshaft pulley with plastic hammer, tap on its center portion (not circumference).
- c. Tighten crankshaft pulley bolt.

: **44.1 N·m (4.5 kg-m, 33 ft-lb)**

- d. Place a matching mark (A) on crankshaft pulley (2) aligning with the matching mark (C) of crankshaft pulley bolt (1). Tighten the bolt 90 degrees (one marks) (B).



- e. Rotate crankshaft pulley in normal direction (clockwise when viewed from front) to confirm it turns smoothly.

15. For the following operations, perform steps in the reverse order of removal.

## Inspection

INFOID:000000013607862

## INSPECTION AFTER REMOVAL

### Timing Chain

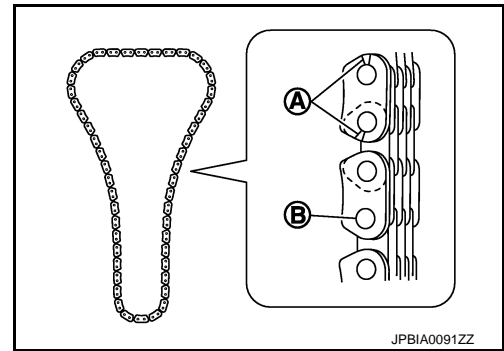
# TIMING CHAIN

[VR30DDTT]

## < UNIT DISASSEMBLY AND ASSEMBLY >

Check for cracks and any excessive wear at link plates and roller links of timing chain. Replace timing chain if necessary.

- Ⓐ : Crack
- Ⓑ : Wear



## INSPECTION AFTER INSTALLATION

### Inspection for Leakage

The following are procedures for checking fluids leakage, lubricates leakage.

- Before starting engine, check oil/fluid levels including engine coolant and engine oil. If less than required quantity, fill to the specified level. Refer to [MA-20, "Recommended Fluids and Lubricants"](#).
- Use procedure below to check for fuel leakage.
  - Turn ignition switch "ON" (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 an unusualness. Noise will stop after hydraulic pressure rises.

- Warm up engine thoroughly to check 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.

# CAMSHAFT

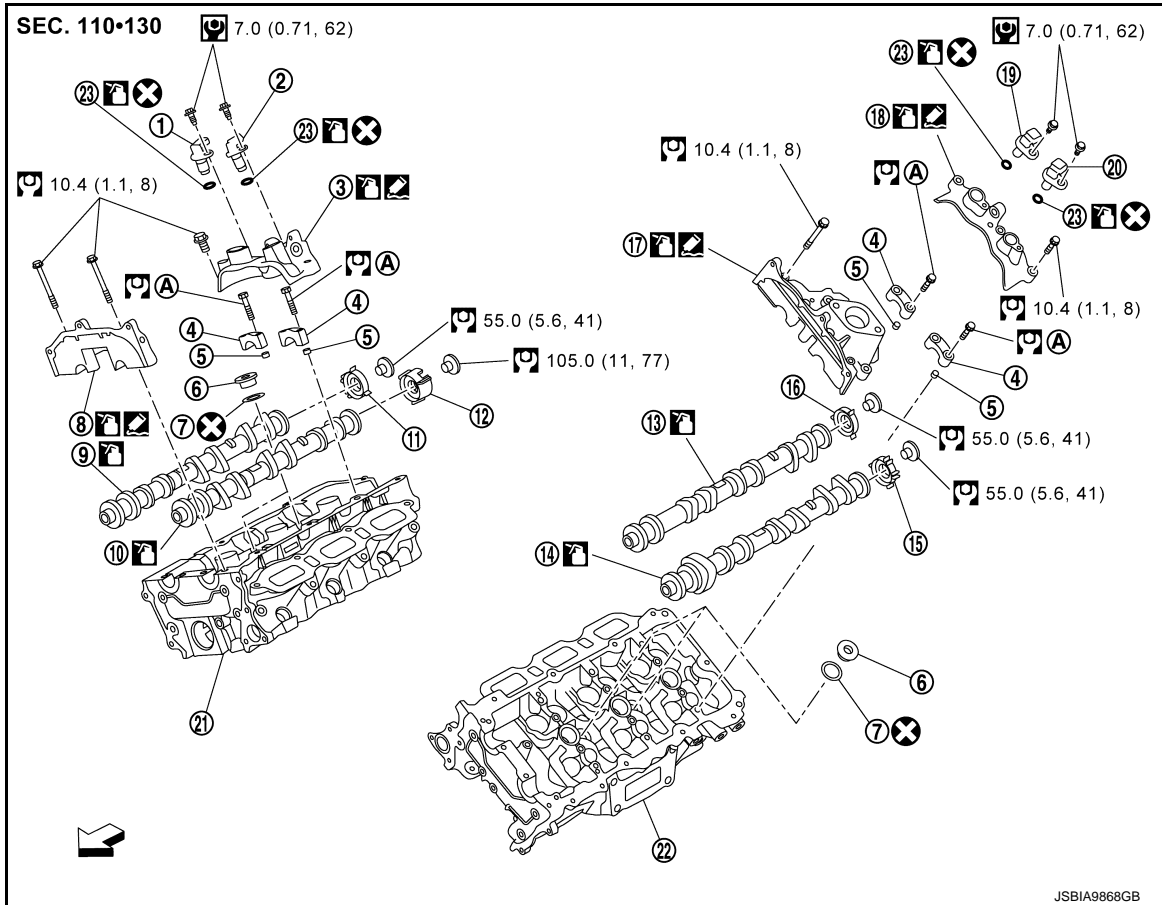
< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

## CAMSHAFT

### Exploded View

INFOID:000000013607863



- |   |   |                                    |
|---|---|------------------------------------|
| ① Exhaust camshaft position sensor (bank 1) | ② Intake camshaft position sensor (bank 1)  | ③ Camshaft sensor bracket (bank 1) |
| ④ Camshaft bracket                          | ⑤ Dowel pin                                 | ⑥ Plug                             |
| ⑦ Gasket                                    | ⑧ Camshaft bracket (No. 1) (bank 1)         | ⑨ Camshaft (EXH) (bank 1)          |
| ⑩ Camshaft (INT) (bank 1)                   | ⑪ Camshaft signal plate (EXH)               | ⑫ Camshaft signal plate (INT)      |
| ⑬ Camshaft (INT) (bank 2)                   | ⑭ Camshaft (EXH) (bank 2)                   | ⑮ Camshaft signal plate (EXH)      |
| ⑯ Camshaft signal plate (INT)               | ⑰ Camshaft bracket (No. 1) (bank 2)         | ⑱ Camshaft sensor bracket (bank 2) |
| ⑲ Intake camshaft position sensor (bank 2)  | ⑳ Exhaust camshaft position sensor (bank 2) | ㉑ Cylinder head (bank 1)           |
| ㉒ Cylinder head (bank 2)                    | ㉓ O-ring                                    |                                    |

(A) Comply with the assembly procedure when tightening. Refer to [EM-251](#).

← : Engine front

: N-m (kg-m, ft-lb)

: N-m (kg-m, in-lb)

: Always replace after every disassembly.

: Should be lubricated with oil.

: Sealing point

# CAMSHAFT

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

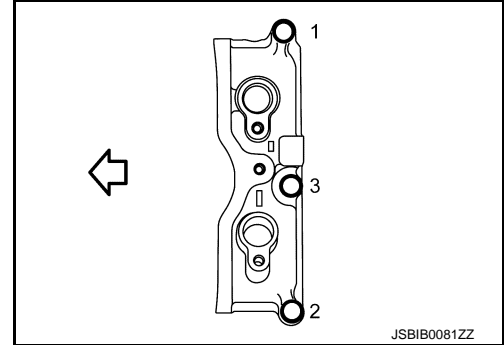
INFOID:000000013607864

## Removal and Installation

### REMOVAL

1. Remove front timing chain case, camshaft sprocket and timing chain. Refer to [EM-238, "Exploded View"](#).
2. Remove fuel tube assembly. Refer to [EM-182, "Removal and Installation"](#).
3. Remove high pressure fuel pump. Refer to [EM-178, "Removal and Installation"](#).
4. Remove camshaft position sensor bracket in the order of 3, 2, 1 as shown in the figure.

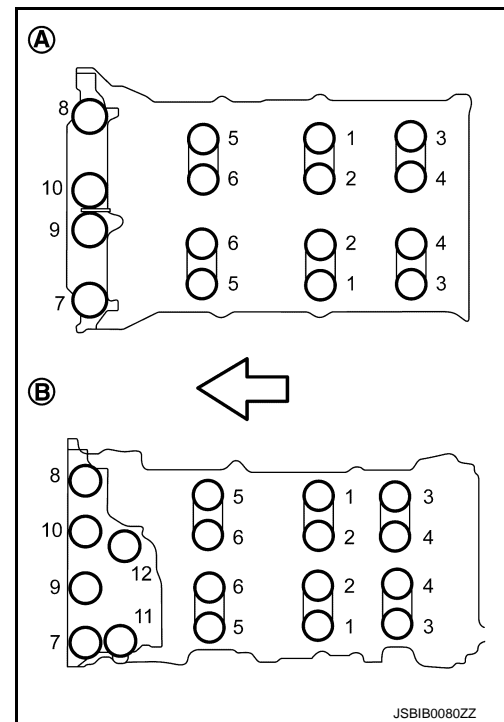
← : Engine front



5. Remove camshaft brackets.
  - Mark camshafts, camshaft brackets and bolts so they are placed in the same position and direction for installation.
  - Equally loosen camshaft bracket bolts in several steps in the order from 10 to 1 (bank 1 Ⓐ), and for (bank 2 Ⓑ), from 12 to 1 as shown in the figure.

← : Engine front

6. Remove camshaft.
7. Remove valve lifter.
  - Identify installation positions, and store them without mixing them up.



### INSTALLATION

#### NOTE:

- If an intake camshaft position sensor or exhaust camshaft position sensor are replaced, carry out the teach of "Electric IVT Control Actuator Position Learning". Refer to [EC6-276, "Description"](#) (FOR USA AND CANADA) or [EC6-1209, "Description"](#) (FOR MEXICO).
- If an intake camshaft or exhaust camshaft are removed, carry out the teach of "Electric IVT Control Actuator Position Learning". Refer to [EC6-276, "Description"](#) (FOR USA AND CANADA) or [EC6-1209, "Description"](#) (FOR MEXICO).

1. Install valve lifter.
  - Install it in the original position.
2. Install camshafts.

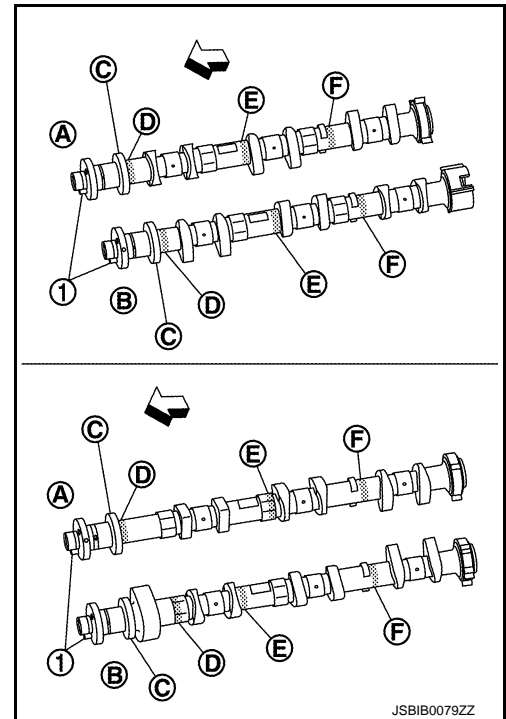
# CAMSHAFT

[VR30DDTT]

## < UNIT DISASSEMBLY AND ASSEMBLY >

- Follow your identification marks made during removal, or follow the identification marks that are present on new camshafts for proper placement and direction.

← : Engine front



JSBIB0079ZZ

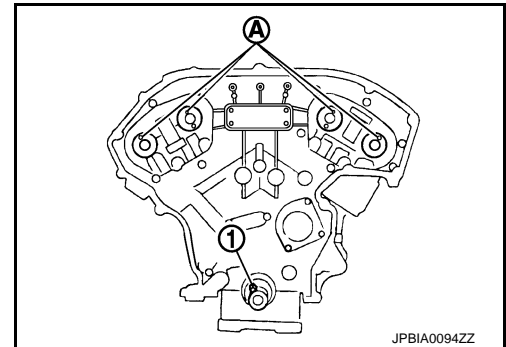
Bank	INT/EXH	Dowel pin ①	Paint marks			Identification mark ③
			M1 ⑤	M2 ⑥	M3 ④	
1	EXH ②	Yes	No	White	Green	4D
	INT ①	Yes	White	No	Green	4A
2	INT ①	Yes	White	No	Green	4C
	EXH ②	Yes	No	White	Green	4E

- Install camshaft so that dowel pin ① on front end face are positioned as shown in the figure. (No. 1 cylinder TDC on its compression stroke)

① : Crankshaft key

### NOTE:

Though camshaft does not stop at the portion as shown in the figure, for the placement of cam nose, it is generally accepted camshaft is placed for the same direction of the figure.



JPBIA0094ZZ



# CAMSHAFT

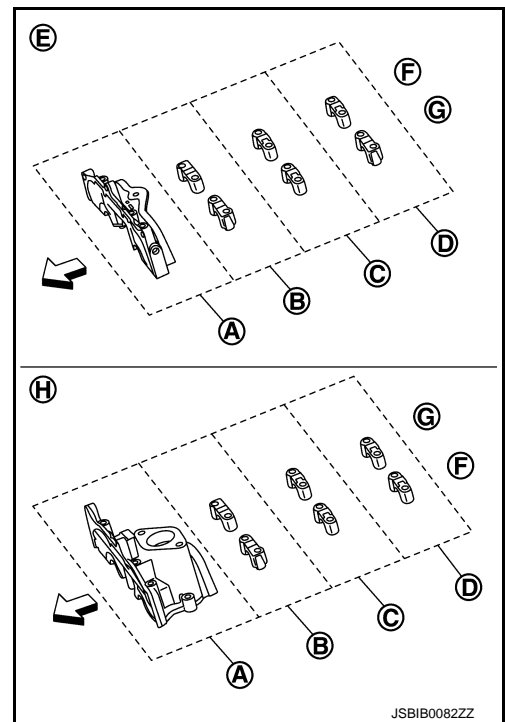
< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

## 3. Install camshaft brackets.

- (A) : No. 1
- (B) : No. 2
- (C) : No. 3
- (D) : No. 4
- (E) : Bank 1
- (F) : Exhaust side
- (G) : Intake side
- (H) : Bank 2
- ← : Engine front

- Remove foreign material completely from camshaft bracket backside and from cylinder head installation face.
- Install camshaft bracket in original position and direction as shown in figure.

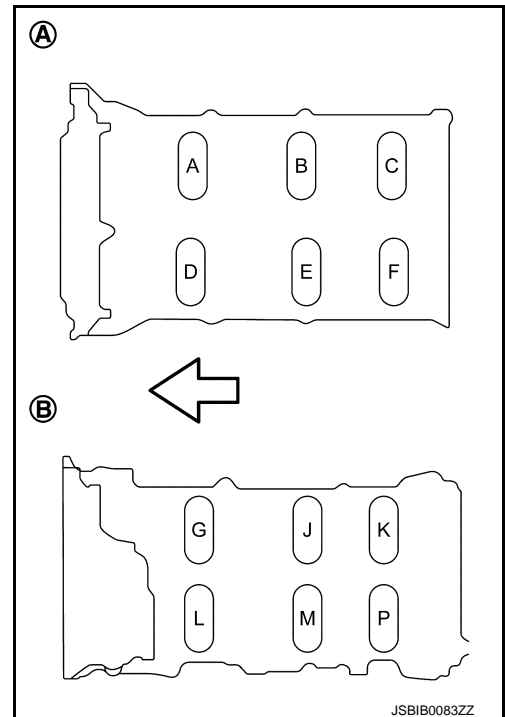


- Install camshaft brackets (No. 2 to 4) aligning the stamp marks as shown in the figure.

- (A) : Bank 1
- (B) : Bank 2
- ← : Engine front

**NOTE:**

There are no identification marks indicating bank 1 and bank 2 for camshaft bracket (No. 1).



A  
EM  
C  
D  
E  
F  
G  
H  
I  
J  
K  
L  
M  
N  
O  
P

# CAMSHAFT

## < UNIT DISASSEMBLY AND ASSEMBLY >

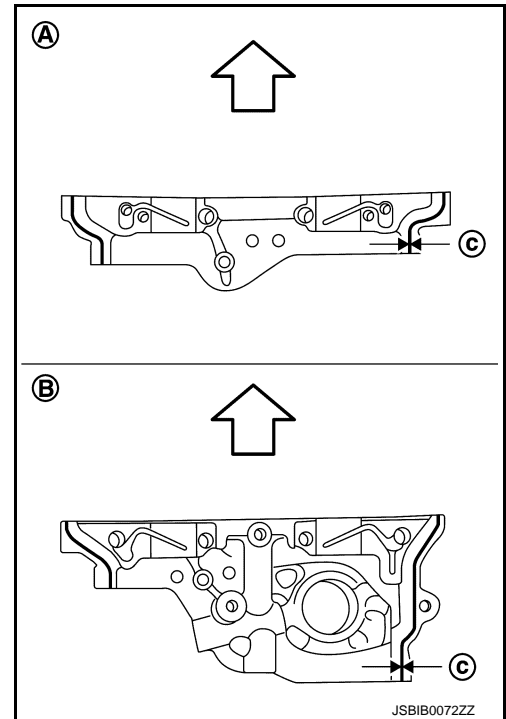
[VR30DDTT]

- Apply liquid gasket to mating surface of camshaft bracket (No. 1) as shown on both bank 1 (A) and bank 2 (B).

← : Engine front

⊕ :  $\phi 2.5$  mm (0.098 in)

**Use Genuine Liquid Gasket (Three Bond 1217H) or equivalent.**



4. Tighten camshaft bracket bolts in the following steps, as shown in the figure.

Ⓐ : Bank 1

Ⓑ : Bank 2

← : Engine front

**CAUTION:**

**Do not reuse washers.**

- a. Tighten No. 7 to 10 in numerical order as shown. (Bank1)  
Tighten No. 7 to 12 in numerical order as shown. (Bank2)

: **1.96 N·m (0.20 kg-m, 17 in-lb)**

- b. Tighten No. 1 to 6 in numerical order as shown.

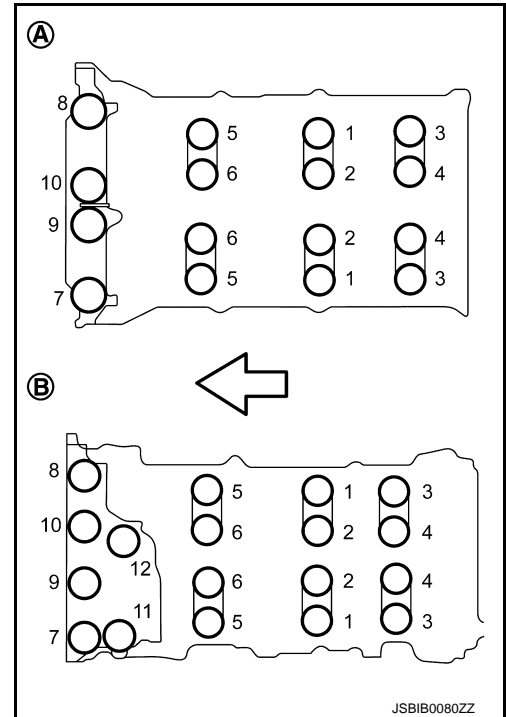
: **1.96 N·m (0.20 kg-m, 17 in-lb)**

- c. Tighten No. 1 to 10 in numerical order as shown. (Bank1)  
Tighten No. 1 to 12 in numerical order as shown. (Bank2)

: **5.88 N·m (0.60 kg-m, 52 in-lb)**

- d. Tighten No. 1 to 10 in numerical order as shown. (Bank1)  
Tighten No. 1 to 12 in numerical order as shown. (Bank2)

: **10.4 N·m (1.1 kg-m, 8 ft-lb)**



# CAMSHAFT

## < UNIT DISASSEMBLY AND ASSEMBLY >

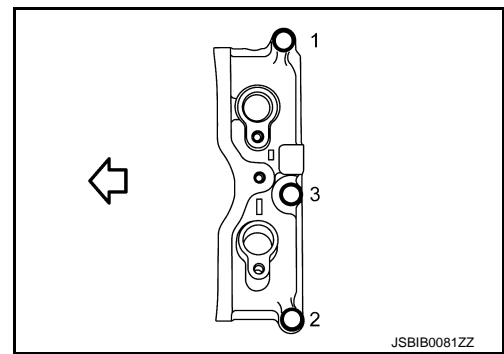
[VR30DDTT]

5. Tighten camshaft position sensor bracket bolts in the order of 1, 2, 3 as shown in the figure.

← : Engine front

### NOTE:

The order of tightening bolts is the same for bank 1 and bank 2.



6. Inspect and adjust the valve clearance. Refer to [EM-145. "Inspection and Adjustment"](#).
7. Install in the reverse order of removal after this step.

## Inspection

INFOID:000000013607865

### INSPECTION AFTER REMOVAL

#### Camshaft Runout

1. Put V-block on precise flat table, and support No. 2 and 4 journals of camshaft.

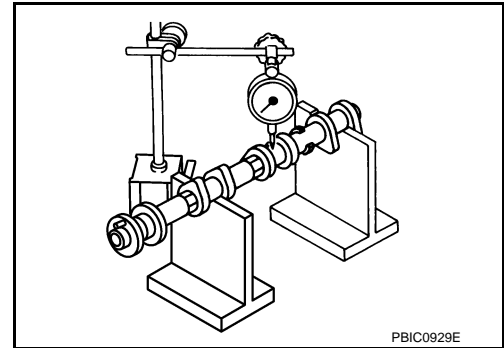
### CAUTION:

**Never support No. 1 journal (on the side of camshaft sprocket) because it has a different diameter from the other three locations.**

2. Set a dial indicator vertically to No. 3 journal.
3. Turn camshaft to one direction with hands, and measure the camshaft runout on a dial indicator. (Total indicator reading)

**Standard and limit** : Refer to [EM-296. "Camshaft"](#).

4. If it exceeds the limit, replace camshaft.



#### Camshaft Cam Height

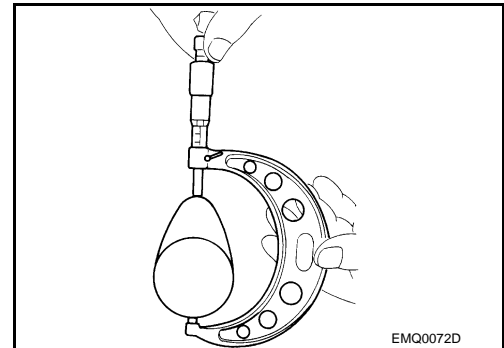
1. Measure the camshaft cam height with a micrometer.

### Standard cam height

(Intake and exhaust) : Refer to [EM-296. "Camshaft"](#).

### Cam wear limit

2. If wear exceeds the limit, replace camshaft.



#### Camshaft Journal Oil Clearance

### CAMSHAFT JOURNAL DIAMETER

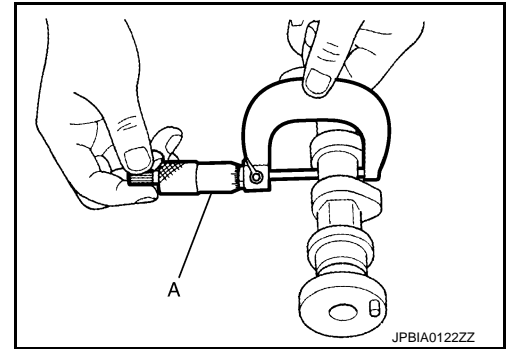
# CAMSHAFT

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

- Measure the outer diameter of camshaft journal with a micrometer (A).

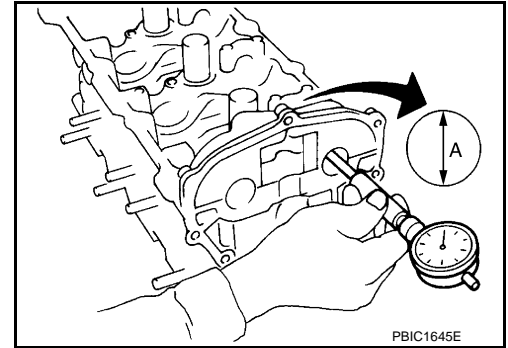
**Standard** : Refer to [EM-296, "Camshaft"](#).



## CAMSHAFT BRACKET INNER DIAMETER

- Tighten camshaft bracket bolt with the specified torque. Refer to "INSTALLATION" for the tightening procedure.
- Measure inner diameter (A) of camshaft bracket with a bore gauge.

**Standard** : Refer to [EM-296, "Camshaft"](#).



## CAMSHAFT JOURNAL OIL CLEARANCE

- (Oil clearance) = (Camshaft bracket inner diameter) – (Camshaft journal diameter).

**Standard and limit** : Refer to [EM-296, "Camshaft"](#).

- If the calculated value exceeds the limit, replace either or both camshaft and cylinder head.

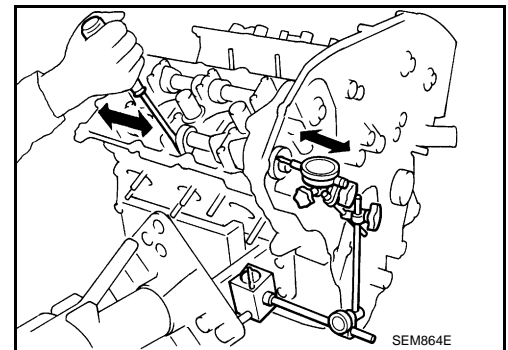
### NOTE:

Camshaft brackets cannot be replaced as single parts, because there are machined together with cylinder head. Replace whole cylinder head assembly.

## Camshaft End Play

- Install a dial indicator in thrust direction on front end of camshaft. Measure the end play of a dial indicator when camshaft is moved forward/backward (in direction to axis).

**Standard and limit** : Refer to [EM-296, "Camshaft"](#).



# CAMSHAFT

[VR30DDTT]

## < UNIT DISASSEMBLY AND ASSEMBLY >

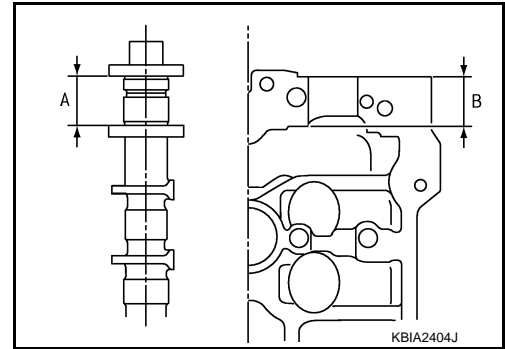
- Measure the following parts if out of the limit.
- Dimension "A" for camshaft No. 1 journal

**Standard : 27.500 - 27.548 mm (1.0827 - 1.0846 in)**

- Dimension "B" for cylinder head No. 1 journal bearing

**Standard : 27.360 - 27.385 mm (1.0772 - 1.0781 in)**

- Refer to the standards above, and then replace camshaft and/or cylinder head.



### Camshaft Sprocket Runout

1. Put V-block on precise flat table, and support No. 2 and 4 journals of camshaft.

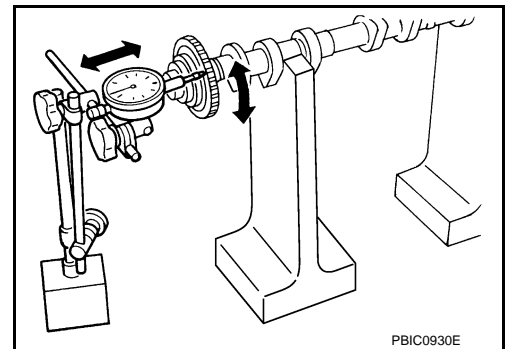
**CAUTION:**

**Never support No. 1 journal (on the side of camshaft sprocket) because it has a different diameter from the other three locations.**

2. Measure the camshaft sprocket runout with a dial indicator. (Total indicator reading)

**Limit : Refer to [EM-296, "Camshaft"](#).**

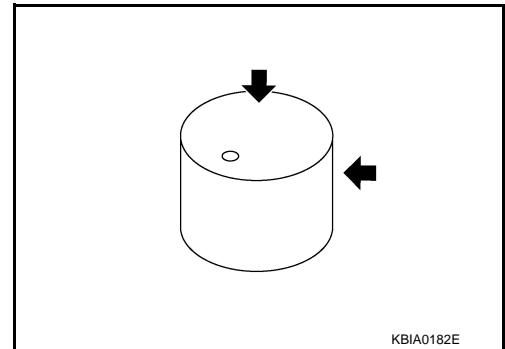
- If it exceeds the limit, replace camshaft sprocket.



### Valve Lifter

Check if surface of valve lifter has any wear or cracks.

- If anything above is found, replace valve lifter. Refer to [EM-296, "Camshaft"](#).

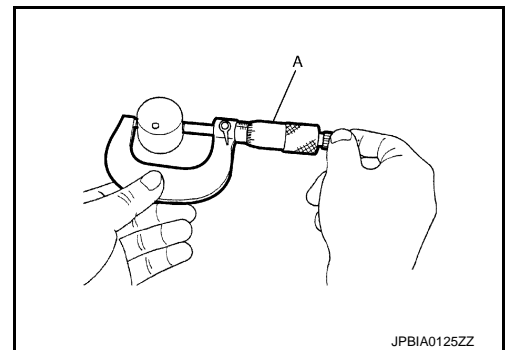


### Valve Lifter Clearance

#### VALVE LIFTER OUTER DIAMETER

- Measure the outer diameter at 1/2 height of valve lifter with a micrometer (A) since valve lifter is in barrel shape.

**Standard (Intake and exhaust) : Refer to [EM-296, "Camshaft"](#).**



#### VALVE LIFTER HOLE DIAMETER

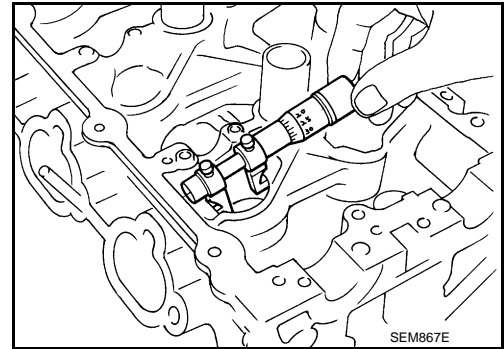
# CAMSHAFT

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

- Measure the inner diameter of valve lifter hole of cylinder head with an inside micrometer.

**Standard**  
**(Intake and exhaust)** : Refer to [EM-296, "Camshaft"](#).



## VALVE LIFTER CLEARANCE

- (Valve lifter clearance) = (Valve lifter hole diameter) – (Valve lifter outer diameter)



**Standard**  
**(Intake and exhaust)** : Refer to [EM-296, "Camshaft"](#).


- If the calculated value is out of the standard, referring to each standard of valve lifter outer diameter and valve lifter hole diameter, replace either or both valve lifter and cylinder head.

## INSPECTION AFTER INSTALLATION

Inspection of Camshaft Sprocket (EXH) Oil Groove

### CAUTION:

- Perform this inspection only when DTC P0014, P0024 is detected in self-diagnostic results of CONSULT and it is directed according to inspection procedure of EC section. Refer to [EC6-322, "DTC Description" \[\(P0014, P0024\) FOR USA AND CANADA\]](#) or [EC6-1248, "DTC Description" \[\(P0014, P0024\) FOR MEXICO\]](#).
  - Check when engine is cold so as to prevent burns from the splashing engine oil.
1. Check engine oil level. Refer to [LU-27, "Inspection"](#).
  2. Turn ignition switch to "START" for cranking.
    -  With CONSULT
      - Remove valve timing oil control solenoid valve. Refer to [EM-238, "Exploded View"](#).
    -  Without CONSULT
      - Release the fuel pressure. Refer to [EC6-279, "Work Procedure" \(FOR USA AND CANADA\)](#) or [EC6-1212, "Work Procedure" \(FOR MEXICO\)](#).
      - Disconnect fuel pump fuse from IPDM E/R to avoid fuel injection during measurement. Refer to [PCS-27, "Wiring Diagram"](#).
      - Remove valve timing oil control solenoid valve. Refer to [EM-238, "Exploded View"](#).
  3. Crank engine, and then check that engine oil comes out from exhaust valve timing control solenoid valve hole (A). End crank after checking.

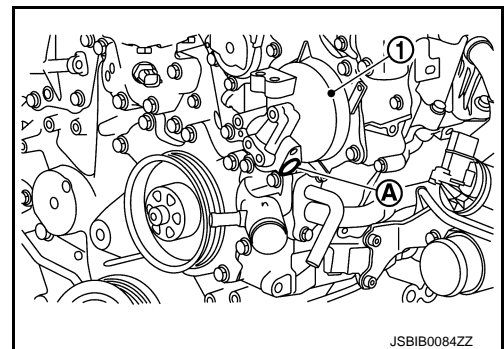
 : Valve timing control cover (bank 1)

### WARNING:

Never touch rotating parts. (crankshaft pulley, etc.)

### CAUTION:

- Prevent splashing by using a shop cloth so as to prevent the worker from injury from engine oil and so as to prevent engine oil contamination.
  - Use waste to protect the engine and vehicle from the splattering of engine oil. Special care must be taken on the protection of rubber parts, such as engine mount insulator. If engine oil splatters to the rubber parts, immediately wipe it out.
4. Perform the following inspection if engine oil does not come out from valve timing oil control solenoid valve oil hole of the cylinder head.
    - Clean oil groove between oil strainer and valve timing oil control solenoid valve. Refer to [LU-24, "Engine Lubrication System"](#).



# CAMSHAFT

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

5. Remove components between valve timing oil control solenoid valve and camshaft sprocket, and then check each oil groove for clogging.
  - Clean oil groove if necessary. Refer to [LU-24. "Engine Lubrication System"](#).
6. After inspection, install removed parts in the reverse order.

## Inspection for Leakage

The following are procedures for checking fluids leakage, lubricates leakage.

- Before starting engine, check oil/fluid levels including engine coolant and engine oil. If less than required quantity, fill to the specified level. Refer to [MA-20. "Recommended Fluids and Lubricants"](#).
- Use procedure below to check for fuel leakage.
  - Turn ignition switch "ON" (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 timing chain tensioner drops after removal/installation, slack in the guide may generate a pounding noise during and just after engine start. However, this is normal. Noise will stop after hydraulic pressure rises.

- Warm up engine thoroughly to check 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.

A

EM

C

D

E

F

G

H

I

J

K

L

M

N

O

P

# CYLINDER HEAD

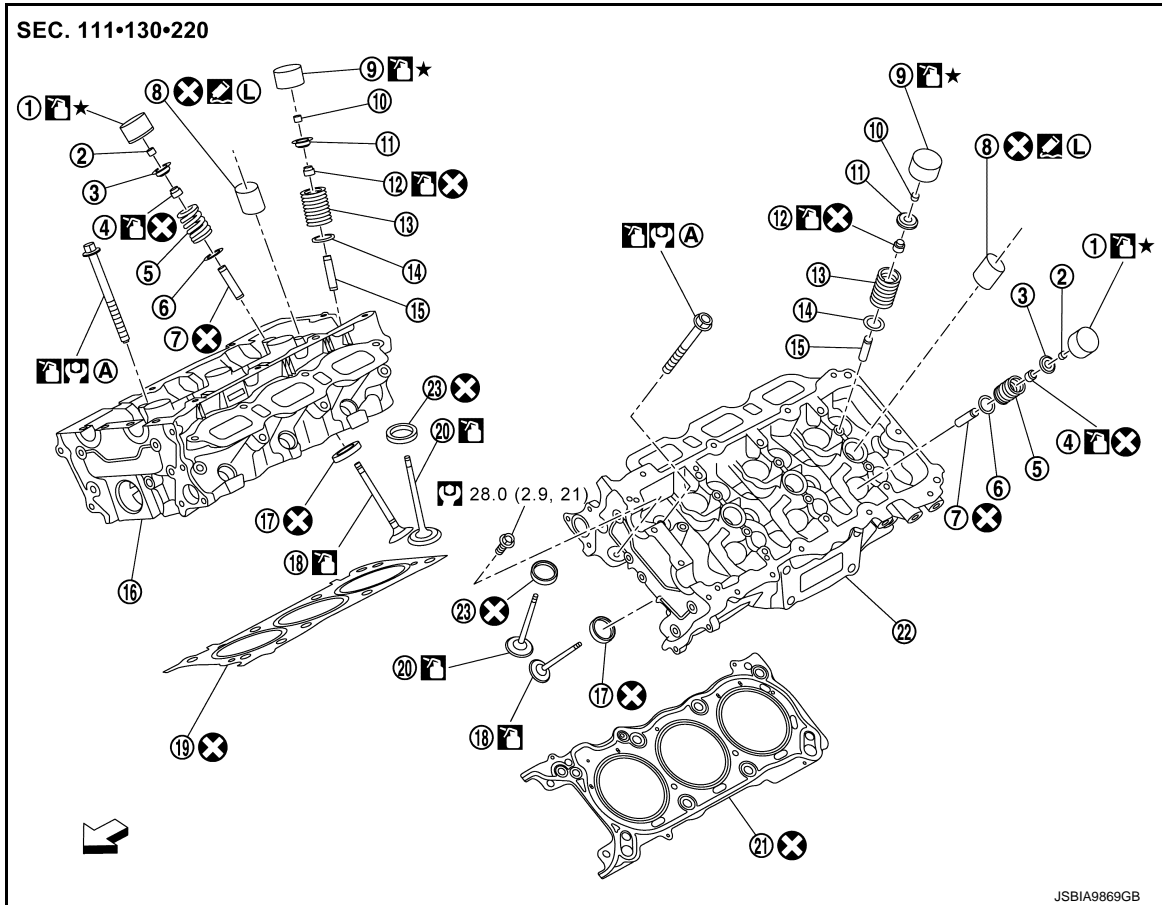
< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

## CYLINDER HEAD

### Exploded View

INFOID:000000013607866



- |                                 |                               |                                 |
|---------------------------------|-------------------------------|---------------------------------|
| ① Valve lifter (EXH)            | ② Valve collet (EXH)          | ③ Valve spring retainer (EXH)   |
| ④ Valve oil seal (EXH)          | ⑤ Valve spring (EXH)          | ⑥ Valve spring seat (EXH)       |
| ⑦ Valve guide (EXH)             | ⑧ Spark plug tube             | ⑨ Valve lifter (INT)            |
| ⑩ Valve collet (INT)            | ⑪ Valve spring retainer (INT) | ⑫ Valve oil seal (INT)          |
| ⑬ Valve spring (INT)            | ⑭ Valve spring seat (INT)     | ⑮ Valve guide (INT)             |
| ⑯ Cylinder head (bank 1)        | ⑰ Valve seat (EXH)            | ⑱ Valve (EXH)                   |
| ⑲ Cylinder head gasket (bank 1) | ⑳ Valve (INT)                 | ㉑ Cylinder head gasket (bank 2) |
| ㉒ Cylinder head (bank 2)        | ㉓ Valve seat (INT)            |                                 |

Comply with the assembly procedure when tightening. Refer to [EM-261](#).

← : Engine front

: N-m (kg-m, ft-lb)

: Always replace after every disassembly.

: Should be lubricated with oil.

(L): Sealing point with locking sealant.

★ : Select with proper thickness.



# CYLINDER HEAD

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

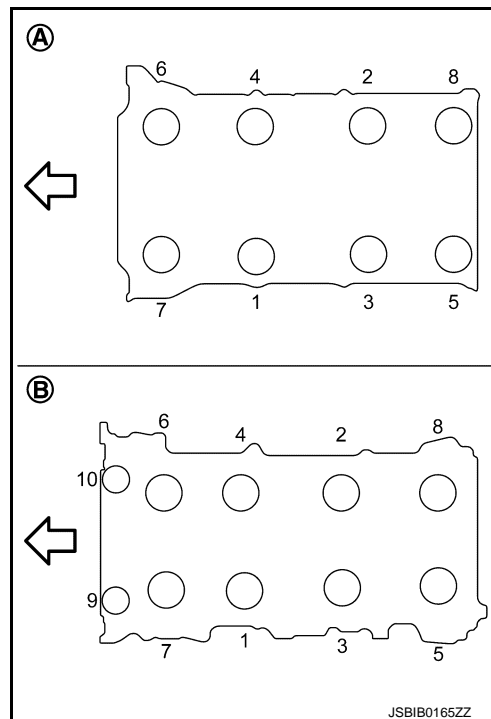
## Disassembly and Assembly

INFOID:000000013607867

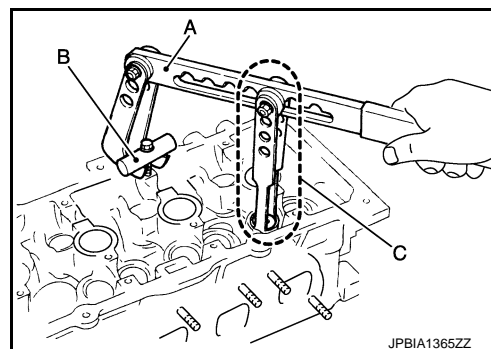
### DISASSEMBLY

1. Remove the following parts:
  - Intake manifold collector: Refer to [EM-174, "Removal and Installation"](#).
  - Spark plug: Refer to [EM-160, "Exploded View"](#).
  - Rocker cover: Refer to [EM-193, "Removal and Installation"](#).
  - Intake manifold: Refer to [EM-176, "Removal and Installation"](#).
  - Fuel tube and fuel injector assembly: Refer to [EM-182, "Removal and Installation"](#).
  - Timing chain: Refer to [EM-239, "Removal and Installation"](#).
  - Camshaft: Refer to [EM-251, "Removal and Installation"](#).
  - Turbocharger: Refer to [EM-233, "Removal and Installation"](#).
2. Remove cylinder head bolts in the order from 8 to 1 (bank 1 **Ⓐ**), and for (bank 2 **Ⓑ**), from 10 to 1 as shown in the figure with cylinder head bolt wrench (commercial service tool) and power tool to remove cylinder heads (bank 1 and bank 2).

⇐ : Engine front



3. Remove cylinder head gaskets.
4. Remove valve lifter.
  - Identify installation positions, and store them without mixing them up.
5. Remove valve collet.
  - Compress valve spring with the valve spring compressor [SST: KV10116200 (J-26336-A)] (A), the attachment [SST: KV10115900 (J-26336-20)] (C) and the adapter [SST: KV10109220 ( — )] (B). Remove valve collet with a magnet hand.



### CAUTION:

- Be careful not to damage valve lifter holes.

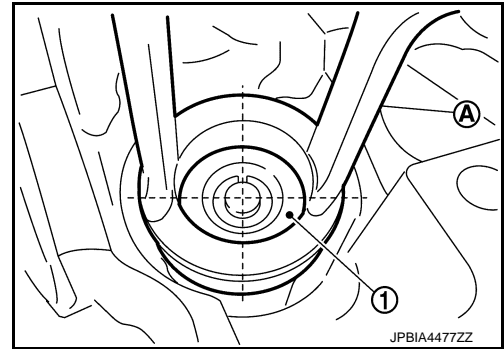
# CYLINDER HEAD

< UNIT DISASSEMBLY AND ASSEMBLY >

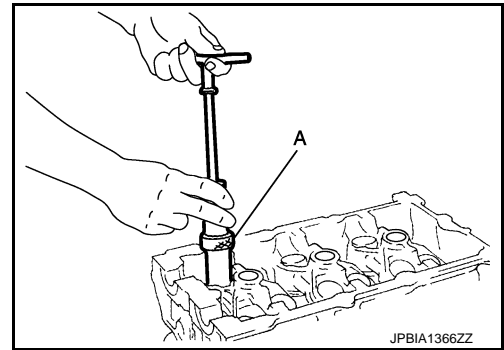
[VR30DDTT]

- Fit the attachment [SST: KV10115900 (J-26336-20)] in the center of valve spring retainer to press it.

- ① : Valve spring retainer
- Ⓐ : Attachment



6. Remove valve spring retainer, valve spring and valve spring seat.
7. Push valve stem to combustion chamber side, and remove valve.
  - Identify installation positions, and store them without mixing them up.
8. Remove valve oil seal using the valve oil seal puller [SST: KV10107902 (J-38959)] (A).

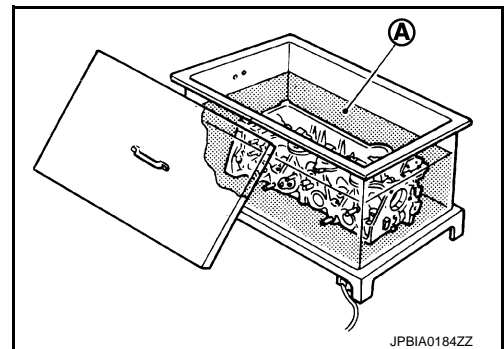


9. Remove valve seat, if valve seat must be replaced.
  - Bore out old seat until it collapses. Boring should not continue beyond the bottom face of the seat recess in cylinder head. Set the machine depth stop to ensure this. Refer to [EM-298, "Cylinder Head"](#).

**CAUTION:**

**Prevent to scratch cylinder head by excessive boring.**

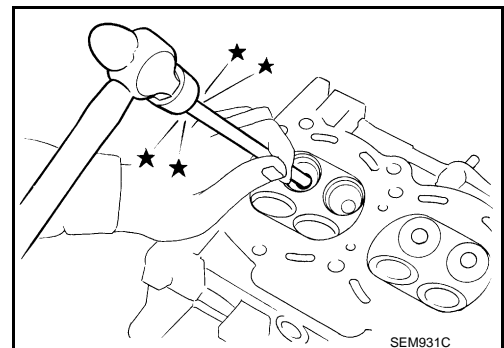
10. Remove valve guide, if valve guide must be replaced.
  - a. To remove valve guide, heat cylinder head to 110 to 130°C (230 to 266°F) by soaking in heated oil (A).



- b. Drive out valve guide with a press [under a 20 kN (2 ton, 2.2 US ton, 2.0 Imp ton) pressure] or a hammer and the valve guide drift (commercial service tool).

**WARNING:**

**Cylinder head contains heat. When working, wear protective equipment to avoid getting burned.**



ASSEMBLY

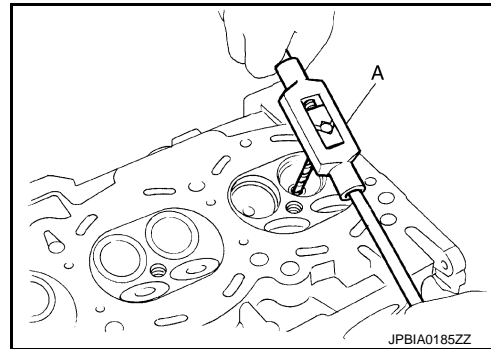
# CYLINDER HEAD

[VR30DDTT]

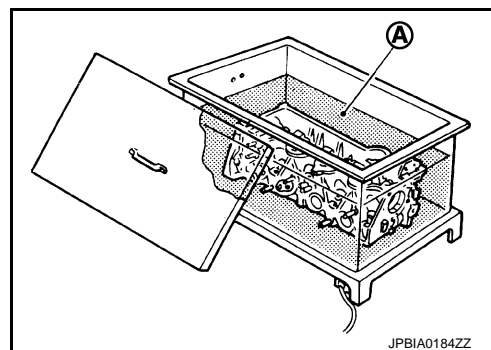
## < UNIT DISASSEMBLY AND ASSEMBLY >

1. If valve guide is removed in step 10 (DISASSEMBLY), install it.  
Replace with oversized [0.2 mm (0.008 in)] valve guide.
- a. Using the valve guide reamer (commercial service tool) (A), ream cylinder head valve guide hole.

**Oversize (service) [0.2 mm (0.008 in)]:**  
: Refer to [EM-298, "Cylinder Head"](#).



- b. Heat cylinder head to 110 to 130°C (230 to 266°F) by soaking in heated oil (A).

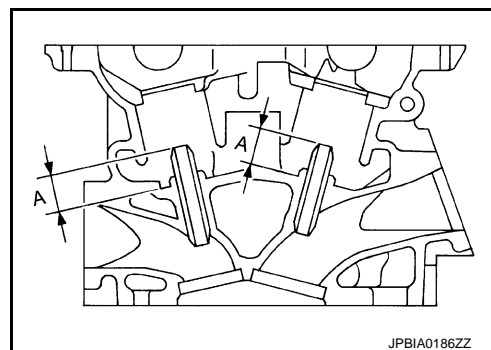


- c. Using the valve guide drift (commercial service tool), press valve guide from camshaft side to the dimensions as shown in the figure.

**Projection (A)**  
: Refer to [EM-298, "Cylinder Head"](#).

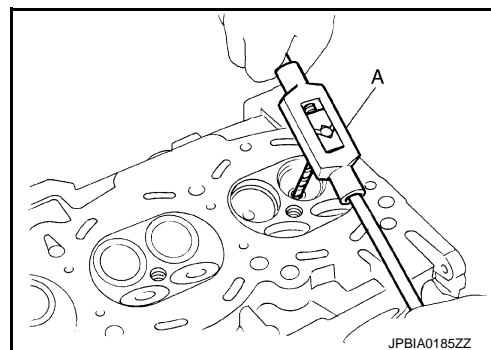
**WARNING:**

Cylinder head contains heat. When working, wear protective equipment to avoid getting burned.



- d. Using the valve guide reamer (commercial service tool) (A), apply reamer finish to valve guide.

**Standard** : Refer to [EM-298, "Cylinder Head"](#).



2. If valve seat is removed in step 9 (DISASSEMBLY), install it.  
Replace with oversize [0.5 mm (0.020 in)] valve seat.

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# CYLINDER HEAD

< UNIT DISASSEMBLY AND ASSEMBLY >

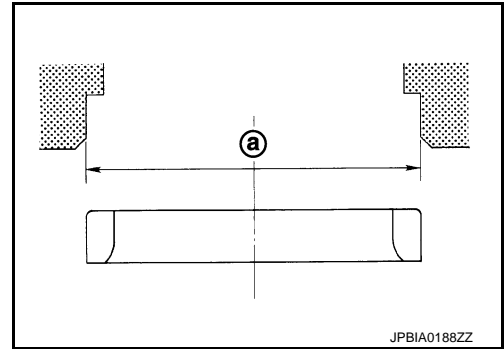
[VR30DDTT]

- a. Ream cylinder head recess diameter Ⓐ for service valve seat.

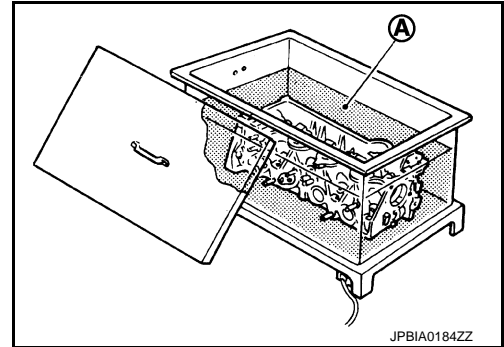
**Oversize (service) [0.5 mm (0.020 in)]:**

**: Refer to [EM-298, "Cylinder Head"](#).**

- Be sure to ream in circles concentric to valve guide center. This will enable valve to fit correctly.



- b. Heat cylinder head to 110 to 130°C (230 to 266°F) by soaking in heated oil Ⓐ.



- c. Provide valve seats cooled well with dry ice. Force fit valve seat into cylinder head.

**WARNING:**

**Cylinder head contains heat. When working, wear protective equipment to avoid getting burned.**

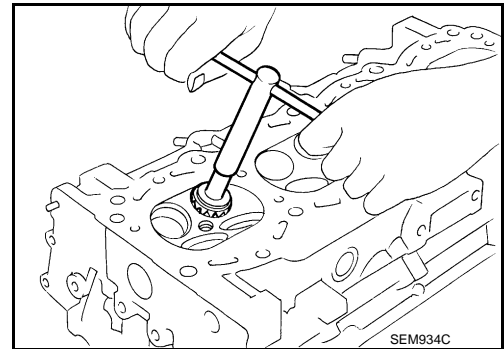
**CAUTION:**

**Avoid directly touching cold valve seats.**

- d. Using the valve seat cutter set (commercial service tool) or valve seat grinder, finish seat to the specified dimensions. Refer to [EM-298, "Cylinder Head"](#).

**CAUTION:**

**When using the valve seat cutter, firmly grip cutter handle with both hands. Then, press on the contacting surface all around the circumference to cut in a single drive. Improper pressure on cutter or cutting many different times may result in staged valve seat.**



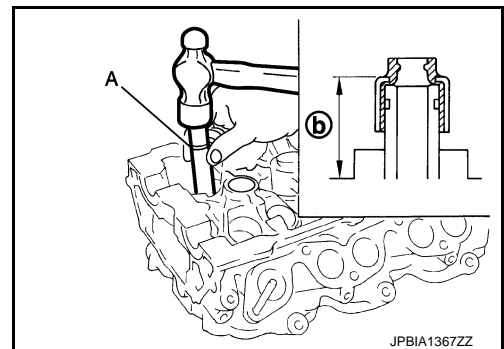
- e. Using compound, grind to adjust valve fitting.  
f. Check again for normal contact. Refer to "VALVE SEAT CONTACT".  
3. Install new valve oil seals as follows.

- a. Apply new engine oil on new valve oil seal joint and seal lip.  
b. Using the valve oil seal drift [SST: KV10115600 (J-38958)] (A), press fit valve seal to height Ⓑ shown in figure.

**NOTE:**

Dimension: Height measured before valve spring seat installation

**Height Ⓑ : 14.3 - 14.9 mm (0.563 - 0.587 in)**



4. Install valve spring seat.

# CYLINDER HEAD

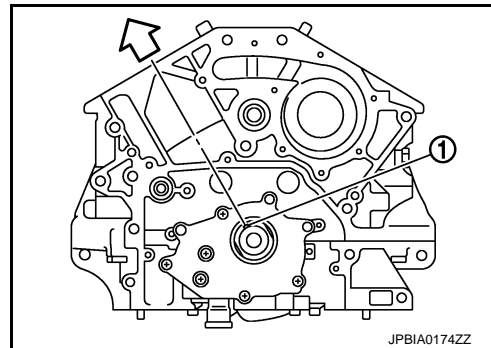
< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

5. Install valve.
- NOTE:**  
Larger diameter valves are for intake side.
6. Install new cylinder head gaskets.
7. Turn crankshaft until No. 1 piston is set at TDC.

- ① : Crankshaft key
- ↔ : Bank 1 side

- Crankshaft key should line up with the cylinder center line (bank 1) as shown in the figure.



8. Install cylinder head, and tighten cylinder head bolts in numerical order as shown in figure as follows:

- (A) : Bank 1
- (B) : Bank 2
- ↔ : Engine front

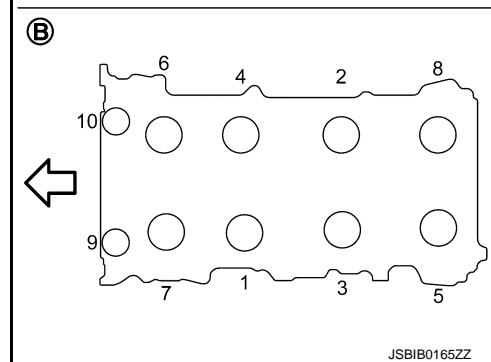
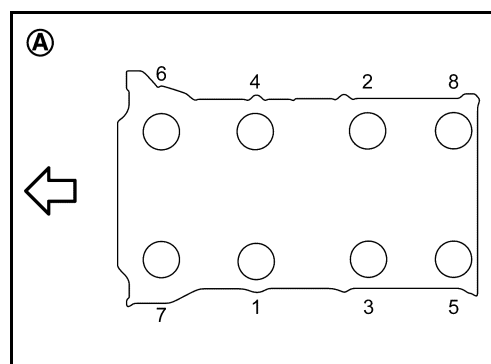
- Use the cylinder head bolt wrench [commercial service tool: — (J-24239-01)] and power tool.

**CAUTION:**

- If cylinder head bolts are re-used, check their outer diameters before installation. Refer to [EM-267, "Inspection"](#).
- Before installing cylinder head, inspect cylinder head distortion. Refer to [EM-267, "Inspection"](#).

- a. Apply new engine oil to threads and seat surfaces of cylinder head bolts.
- b. Tighten cylinder head bolts in the order from 1 to 8.

: 40 N·m (4.1 kg-m, 30 ft-lb)



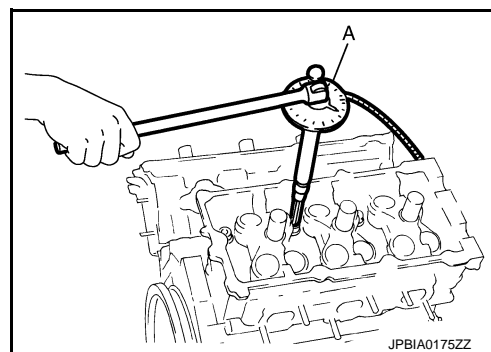
- c. Turn cylinder head bolts in the order from 1 to 8 by 115 degrees clockwise (angle tightening).

**CAUTION:**

Check the tightening angle by using the angle wrench [SST: KV10112100] (A). Avoid judgment by visual inspection without.

- Check tightening angle indicated on the angle wrench indicator plate.

- d. Turn cylinder head bolts in the order from 1 to 8 by 115 degrees clockwise again (angle tightening).



- e. Tighten all cylinder head bolts 9 and 10 (bank 2).

: 28.0 N·m (2.9 kg-m, 21 ft-lb)

9. Install valve spring (with valve spring seat).

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# CYLINDER HEAD

## < UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

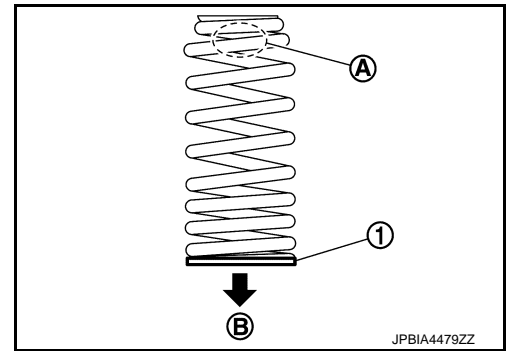
- Install large diameter side of valve spring (valve spring seat side) to cylinder head side (B).

① : Valve spring seat

- Confirm identification color (A) of valve spring.

**Intake : Pink**

**Exhaust : Yellow**

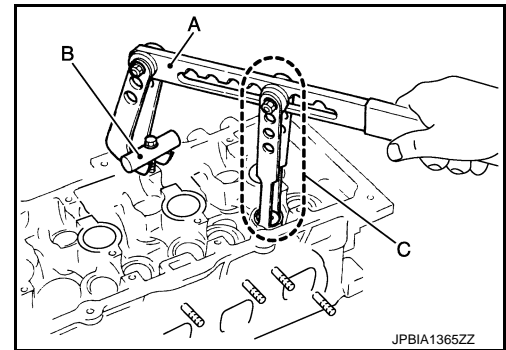


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10. Install valve spring retainer.

11. Install valve collet.

- Compress valve spring with the valve spring compressor [SST: KV10116200 (J-26336-A)] (A), the attachment [SST: KV10115900 (J-26336-20)] (C) and the adapter [SST: KV10109220 ( — )] (B). Install valve collet with a magnet hand.



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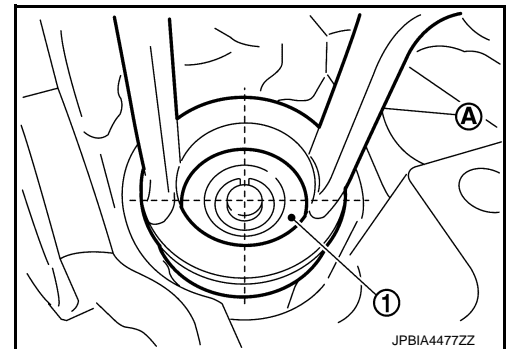
### CAUTION:

- **Be careful not to damage valve lifter holes.**
- **Fit the attachment [SST: KV10115900 (J-26336-20)] in the center of valve spring retainer to press it.**

① : Valve spring retainer

(A) : Attachment

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



JPBIA4477ZZ

12. Install valve lifter.

- Install it in the original position.

13. Install spark plug tube.

- Press-fit spark plug tube as follows:

- Remove old locking sealant adhering to cylinder head mounting hole.
- Apply sealant to area within approximately 12 mm (0.47 in) from edge of spark plug tube press-fit side.  
**Use high strength thread locking sealant or equivalent.**
- Using drift, press-fit spark plug tube so that its height (A) is as specified in the figure.

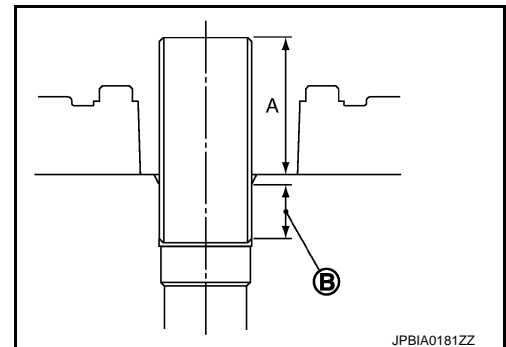
(B) : High strength thread locking sealant application area

**Standard press-fit height:**

**: 37.7 - 38.7 mm (1.484 - 1.524 in)**

### CAUTION:

- **When press-fitting, take care not to deform spark plug tube.**



JPBIA0181ZZ

# CYLINDER HEAD

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

- After press-fitting, wipe off liquid gasket protruding onto cylinder-head upper face.

14. Install spark plug. Refer to [EM-160, "Exploded View"](#).

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

## Inspection

INFOID:000000013607868

EM

### INSPECTION AFTER DISASSEMBLY

#### Cylinder Head Bolts Outer Diameter

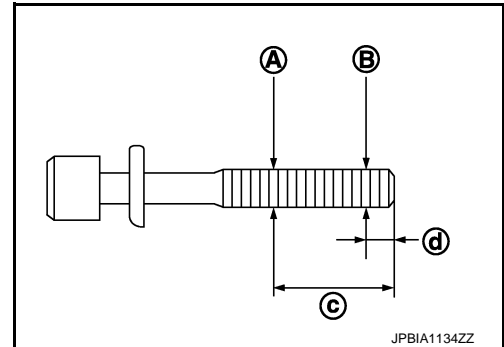
- Cylinder head bolts are tightened by plastic zone tightening method. Whenever the size difference between (B) and (A) exceeds the limit, replace them with new one.

(C) : 50.5 mm (1.988 in)

(d) : 11 mm (0.43 in)

**Limit [(B) - (A)] : 0.16 mm (0.0063 in)**

- If reduction of outer diameter appears in a position other than (A), use it as (A) point.



#### Cylinder Head Distortion

##### NOTE:

When performing this inspection, cylinder block distortion should be also checked. Refer to [EM-279, "Inspection"](#).

1. Using a scraper, wipe off oil, scale, gasket, sealant and carbon deposits from surface of cylinder head.

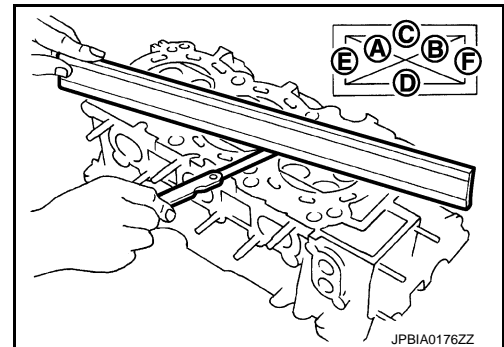
##### CAUTION:

**Never allow gasket fragments to enter engine oil or engine coolant passages.**

2. At each of several locations on bottom surface of cylinder head, measure the distortion in six directions (A), (B), (C), (D), (E), and (F).

**Limit : Refer to [EM-298, "Cylinder Head"](#).**

- If it exceeds the limit, replace cylinder head.



#### Valve Dimensions

- Check the dimensions of each valve. For the dimensions, refer to [EM-298, "Cylinder Head"](#).
- If dimensions are out of the standard, replace valve and check valve seat contact. Refer to "VALVE SEAT CONTACT"

#### Valve Guide Clearance

##### Valve Stem Diameter

- Measure the diameter of valve stem with micrometer (A).

**Standard : Refer to [EM-298, "Cylinder Head"](#).**

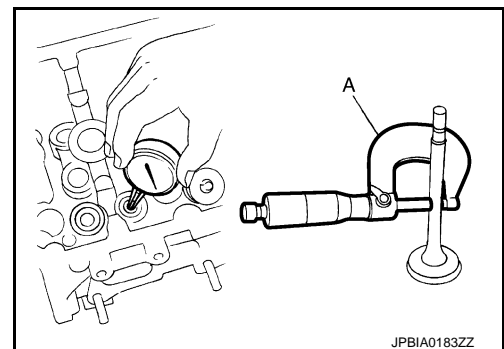
##### Valve Guide Inner Diameter

- Measure the inner diameter of valve guide with bore gauge.

**Standard : Refer to [EM-298, "Cylinder Head"](#).**

##### Valve Guide Clearance

- (Valve guide clearance) = (Valve guide inner diameter) – (Valve stem diameter)





# CYLINDER HEAD

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

**Standard** : Refer to [EM-298, "Cylinder Head"](#).

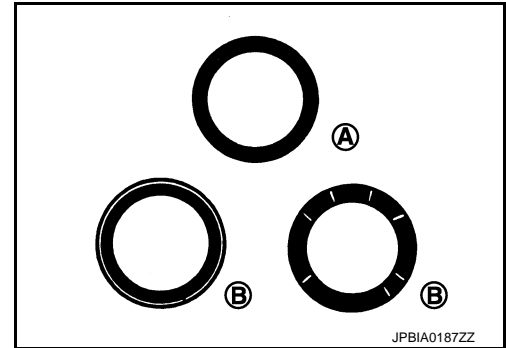
- If the calculated value exceeds the limit, replace valve and/or valve guide. When valve guide must be replaced, refer to [EM-261, "Disassembly and Assembly"](#).

## Valve Seat Contact

- After confirming that the dimensions of valve guides and valves are within the specifications, perform this procedure.
- Apply prussian blue (or white lead) onto contacting surface of valve seat to check the condition of the valve contact on the surface.
- Check if the contact area band is continuous all around the circumference.

- Ⓐ : OK
- Ⓑ : NG

- If not, grind to adjust valve fitting and check again. If the contacting surface still has "NG" conditions even after the recheck, replace valve seat. Refer to [EM-260, "Exploded View"](#).



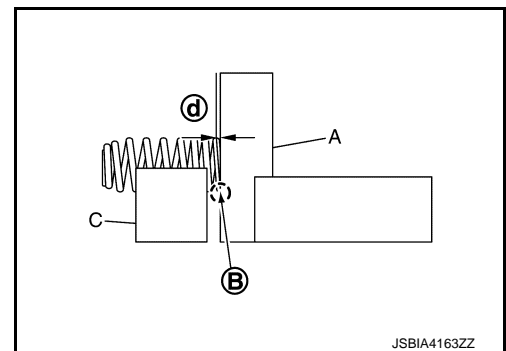
## Valve Spring Squareness

- Set a try square (A) along the side of valve spring and rotate spring. Measure the maximum clearance ⓓ between the top of spring and try square.

- Ⓑ : Contact
- C : V-block

**Limit** : Refer to [EM-298, "Cylinder Head"](#).

- If it exceeds the limit, replace valve spring.

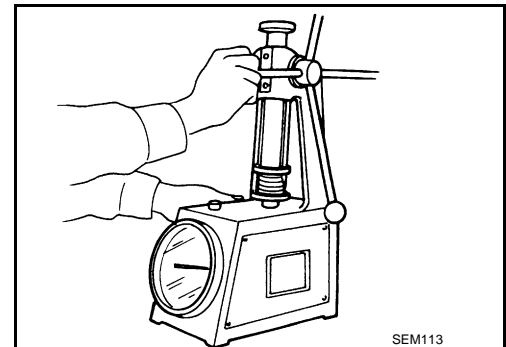


## Valve Spring Dimensions and Valve Spring Pressure Load

- Check the valve spring pressure at specified spring height.

**Standard**  
: Refer to [EM-298, "Cylinder Head"](#).

- If the installation load or load with valve open is out of the standard, replace valve spring.



## 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-20, "Recommended Fluids and Lubricants"](#).
- 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:**



# CYLINDER HEAD

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

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.

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# CYLINDER BLOCK

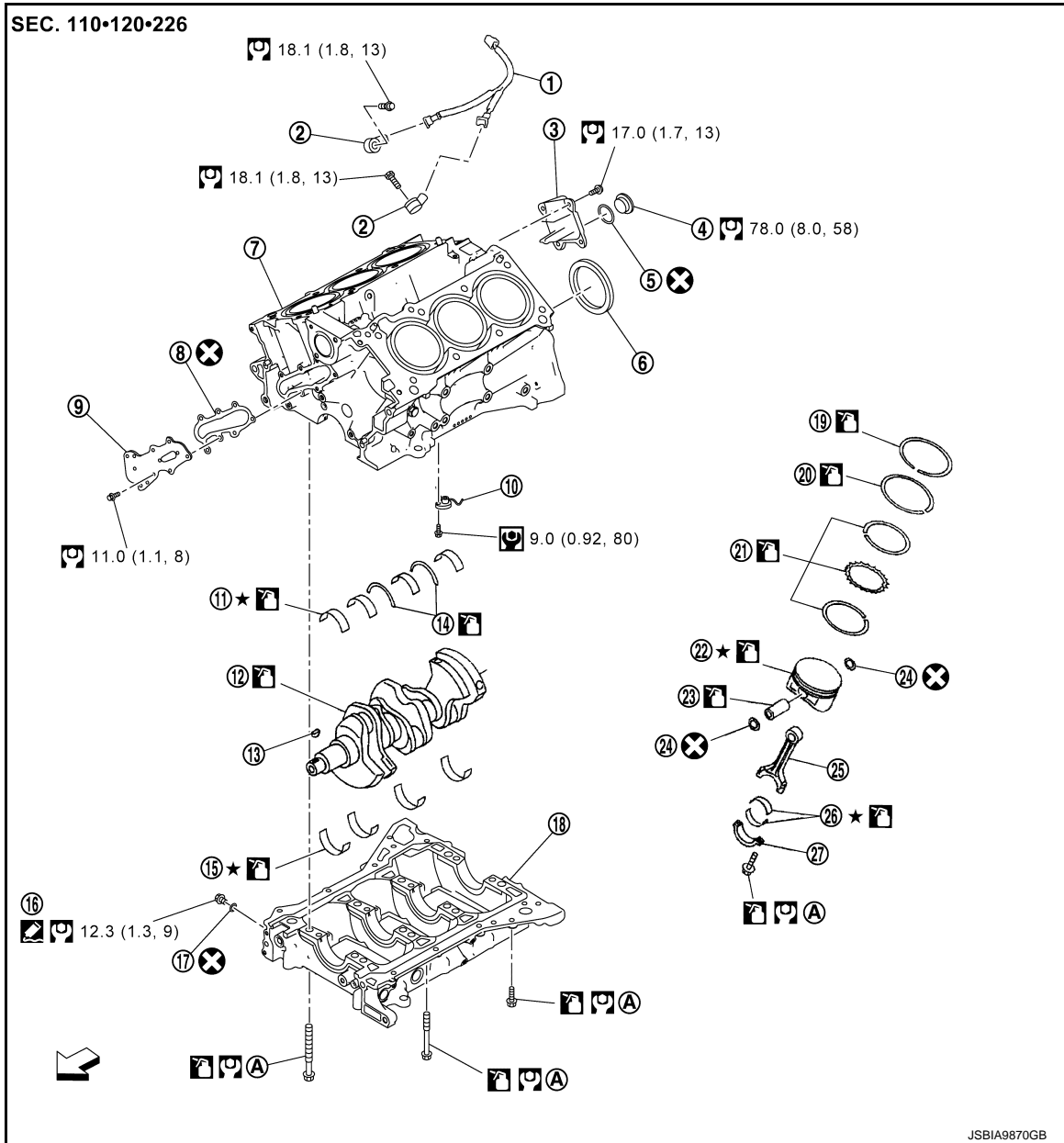
< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

## CYLINDER BLOCK

Exploded View

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JSBIA9870GB

- |   |                          |                              |
|---|--------------------------|------------------------------|
| ① Sub harness   | ② Knock sensor           | ③ Breather separator         |
| ④ Plug  | ⑤ O-ring                 | ⑥ Rear oil seal              |
| ⑦ Cylinder block  | ⑧ Gasket                 | ⑨ Oil gallery cover          |
| ⑩ Oil jet   | ⑪ Main bearing (upper)   | ⑫ Crankshaft                 |
| ⑬ Crankshaft key  | ⑭ Thrust bearing         | ⑮ Main bearing (lower)       |
| ⑯ Plug  | ⑰ Gasket                 | ⑱ Lower cylinder block       |
| ⑲ Top ring  | ⑳ Second ring            | ㉑ Oil ring                   |
| ㉒ Piston  | ㉓ Piston pin             | ㉔ Snap ring                  |
| ㉕ Connecting rod  | ㉖ Connecting rod bearing | ㉗ Connecting rod bearing cap |
| Ⓐ Comply with the assembly procedure when tightening. Refer to <a href="#">EM-271</a> . |                          |                              |

# CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

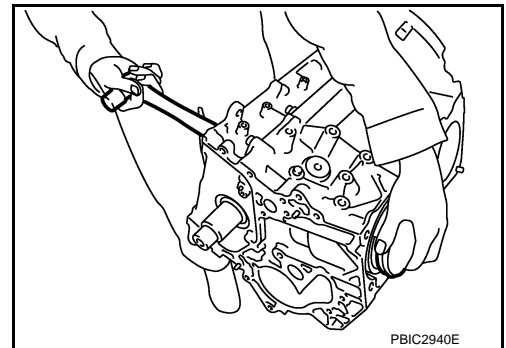
- ↶ : Engine front
- ⊗ : N-m (kg-m, ft-lb)
- ⊙ : N-m (kg-m, in-lb)
- ⊗ : Always replace after every disassembly.
- 🔧 : Should be lubricated with oil.
- 🔧 : Sealing point
- ★ : Select with proper thickness.

## Disassembly and Assembly

INFOID:000000013607870

### DISASSEMBLY

1. Remove the following parts:
  - Oil pan (lower): Refer to [EM-191, "Removal and Installation"](#).
  - Oil pan (upper): Refer to [EM-218, "2WD : Disassembly and Assembly"](#) (2WD models) or [EM-222, "AWD : Disassembly and Assembly"](#) (AWD models).
  - Timing chain: Refer to [EM-239, "Removal and Installation"](#).
  - Cylinder head: Refer to [EM-261, "Disassembly and Assembly"](#).
2. Remove knock sensor.  
**CAUTION:**  
**Carefully handle sensor avoiding shocks.**
3. Remove piston and connecting rod assembly with the following procedure:
  - Before removing piston and connecting rod assembly, check the connecting rod side clearance. Refer to [EM-279, "Inspection"](#).
  - CAUTION:**  
**Never drop connecting rod bearing, and to scratch the surface.**
  - a. Position crankshaft pin corresponding to connecting rod to be removed onto the bottom dead center.
  - b. Remove connecting rod bearing cap.
  - c. Using a hammer handle or similar tool, push piston and connecting rod assembly out to the cylinder head side.  
**CAUTION:**  
**Never damage the cylinder wall and crankshaft pin, resulting from an interference of the connecting rod big end.**
4. Remove connecting rod bearings from connecting rod and connecting rod bearing cap.  
**CAUTION:**
  - **Never drop connecting rod bearing, and to scratch the surface.**
  - **Identify installation positions, and store them without mixing them up.**
5. Remove piston rings from piston.
  - Before removing piston rings, check the piston ring side clearance. Refer to [EM-279, "Inspection"](#).



# CYLINDER BLOCK

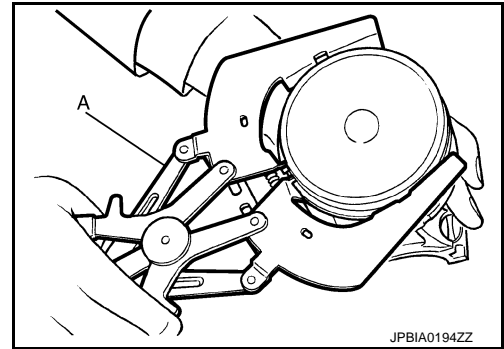
[VR30DDTT]

## < UNIT DISASSEMBLY AND ASSEMBLY >

- Use a piston ring expander (commercial service tool) (A).

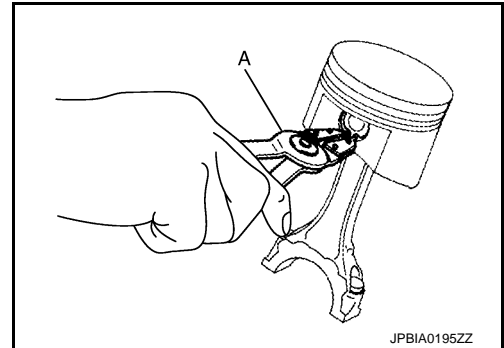
**CAUTION:**

- When removing piston rings, be careful not to damage piston.
- Never damage piston rings by expanding them excessively.

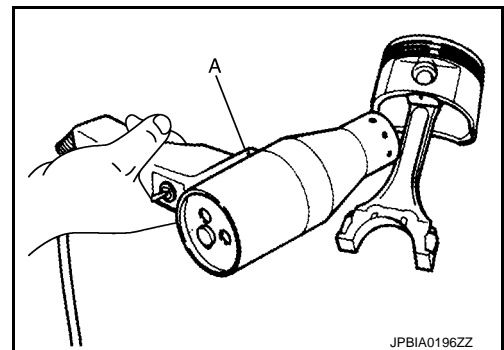


6. Remove piston from connecting rod as follows:

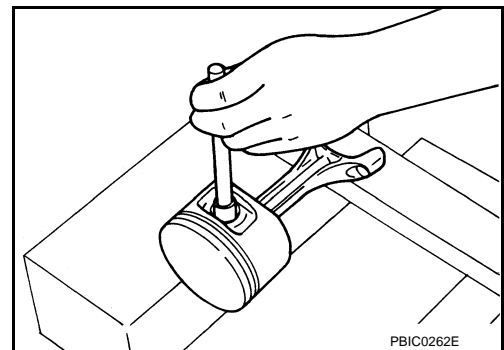
- a. Using snap ring pliers (A), remove snap rings.



- b. Heat piston to 60 to 70°C (140 to 158°F) with an industrial use dryer (A) or equivalent.



- c. Push out piston pin using a stick that has an outer diameter of approximately 20 mm (0.79 in).



7. Remove lower cylinder block bolts.

- Before loosening lower cylinder block bolts, measure the crankshaft end play. Refer to [EM-279, "Inspection"](#).

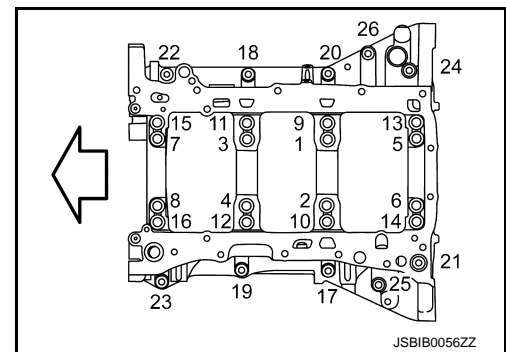
# CYLINDER BLOCK

[VR30DDTT]

## < UNIT DISASSEMBLY AND ASSEMBLY >

- Loosen lower cylinder block bolts in the order from 26 to 1 shown in the figure in several different steps.

⇐ : Engine front



- Remove lower cylinder block as follows:  
Screw M8 bolt [pitch: 1.25 mm (0.049 in) length: approximately 50 mm (1.97 in)] into bolt holes (A). Then equally tighten each bolt, and remove lower cylinder block.

⇐ : Engine front

### CAUTION:

- Never damage the mounting surfaces.
- Never tighten bolts excessively.
- Never insert screwdriver, this will damage the mating surface.

- Remove crankshaft.
- Pull rear oil seal out from rear end of crankshaft.
- Remove main bearings and thrust bearings from cylinder block and lower cylinder block.

### CAUTION:

- Never drop main bearing, and to scratch the surface.
- Identify installation positions, and store them without mixing them up.

- Remove oil jet.

## ASSEMBLY

### CAUTION:

Do not reuse O-rings or washers.

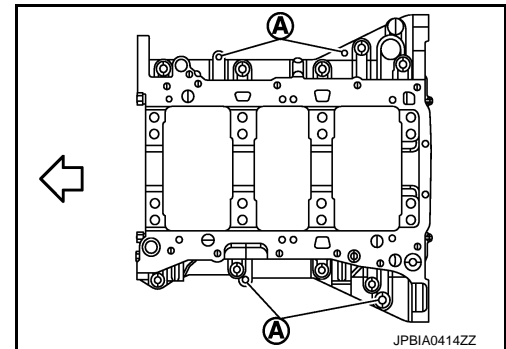
### NOTE:

If a piston, connecting rod or crankshaft are removed, carry out teach of "Electric IVT Control Actuator Position Learning". Refer to [EC6-276, "Description"](#) (FOR USA AND CANADA) or [EC6-1209, "Description"](#) (FOR MEXICO).

- Fully air-blow engine coolant and engine oil passages in cylinder block, cylinder bore and crankcase to remove any foreign material.

### CAUTION:

Use goggles to protect your eyes.



A  
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# CYLINDER BLOCK

[VR30DDTT]

## < UNIT DISASSEMBLY AND ASSEMBLY >

2. Install each plug to cylinder block as shown in the figure.

- ③ : Plug
- ← : Engine front

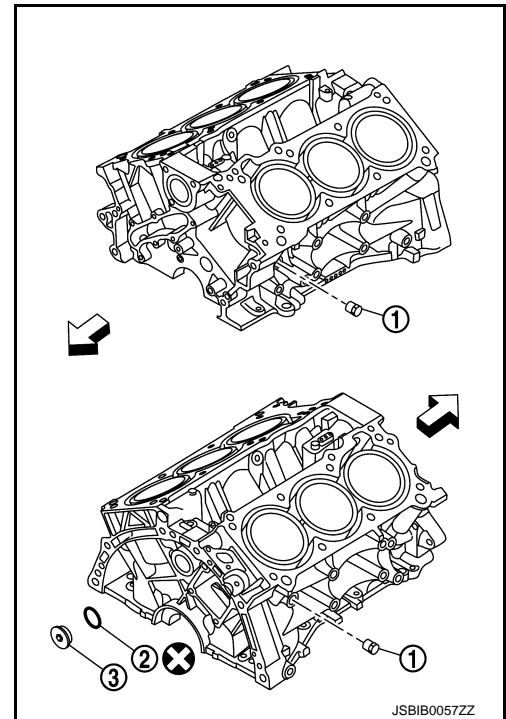
- Apply sealant to the thread of water drain plug ①.

**CAUTION:**

**Do not reuse washers.**

**Use Genuine Liquid Gasket (Three Bond 1215) or equivalent.**

- Apply sealant to the thread of plug.  
**Use Genuine High Strength Thread Locking Sealant or equivalent.**
- Replace washer ② with new one.



- Tighten each plug as specified below.

Unit: N·m (kg·m, ft·lb)

Part	Washer	Tightening torque
①	No	19.6 (2.0, 14)
③	Yes	78.0 (8.0, 58)

3. Install oil jet.

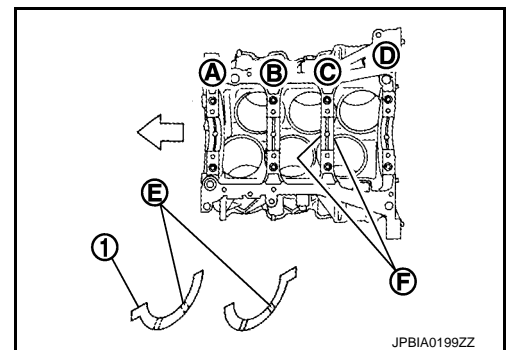
4. Install main bearings and thrust bearings as follows:

**CAUTION:**

**Never drop main bearing, and to scratch the surface.**

- a. Remove dust, dirt, and engine oil on bearing mating surfaces of cylinder block and lower cylinder block.
- b. Install thrust bearings ① to both sides of the No. 3 journal housing on cylinder block.

- Ⓐ : No. 1
- Ⓑ : No. 2
- Ⓒ : No. 3
- Ⓓ : No. 4
- Ⓕ : Thrust bearing installation position
- ← : Engine front



- Install thrust bearings with the oil groove ⑤ facing crankshaft arm (outside).

# CYLINDER BLOCK

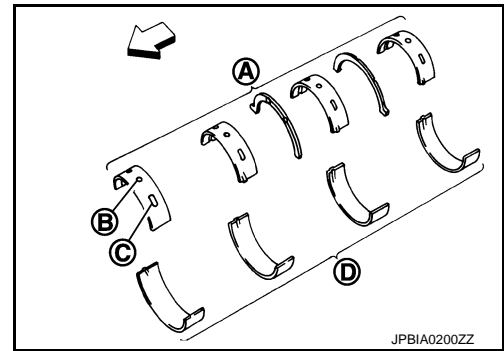
[VR30DDTT]

## < UNIT DISASSEMBLY AND ASSEMBLY >

c. Install main bearings paying attention to the direction.

- Ⓐ : Cylinder block side
- Ⓓ : Lower cylinder block side
- ↔ : Engine front

- Main bearing with oil hole Ⓑ and groove Ⓒ goes on cylinder block. The one without them goes on lower cylinder block.
- Before installing main bearings, apply engine oil to the bearing surface (inside). Do not apply engine oil to the back surface, but thoroughly clean it.
- When installing, align main bearing stopper protrusion to cut-out of cylinder block and lower cylinder block.
- Ensure the oil holes on cylinder block and those on the corresponding bearing are aligned.



5. Install crankshaft to cylinder block.
  - While turning crankshaft by hand, check that it turns smoothly.
6. Install lower cylinder block.

**CAUTION:**

**Do not reuse O-rings.**

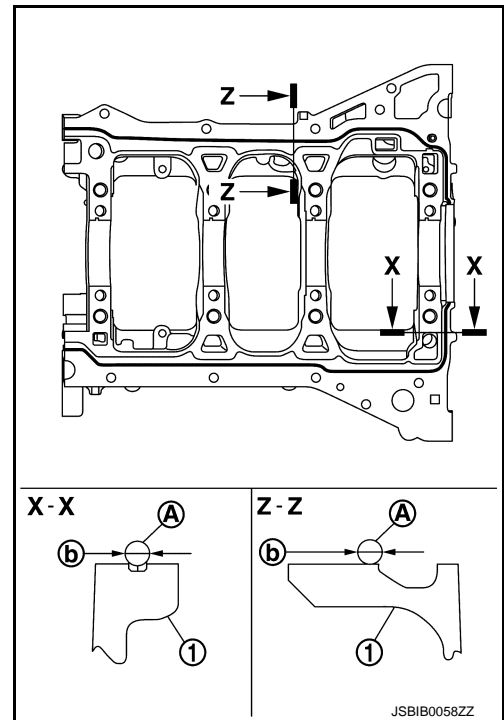
**NOTE:**

Lower cylinder block cannot be replaced as a single part, because it is machined together with cylinder block.

- Apply a continuous bead of liquid gasket Ⓐ with the tube presser (commercial service tool) to lower cylinder block ① as shown in the figure.

- ⓑ :  $\phi 4.0 - 5.0$  mm (0.157 - 0.197 in)

**Use Genuine Liquid Gasket (Three Bond 1217H) or equivalent.**



7. Inspect the outer diameter of lower cylinder block bolt. Refer to [EM-279, "Inspection"](#).
8. Install lower cylinder block bolts in numerical order as shown in the figure as follows:
  - a. Apply new engine oil to threads and seat surfaces of lower cylinder block bolts.

# CYLINDER BLOCK

[VR30DDTT]

## < UNIT DISASSEMBLY AND ASSEMBLY >

- b. Tighten bolts (No. 17 to 26) in numerical order as shown in the figure.

← : Engine front

: 25.0 N·m (2.6 kg-m, 18 ft-lb)

**CAUTION:**  
Do not reuse O-rings.

- c. Repeat step b.

- d. Tighten bolts (No. 1 to 16) in numerical order as shown in the figure.

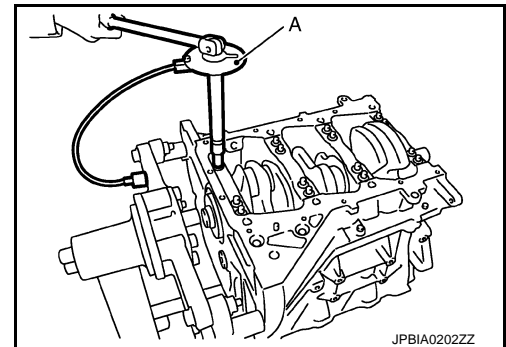
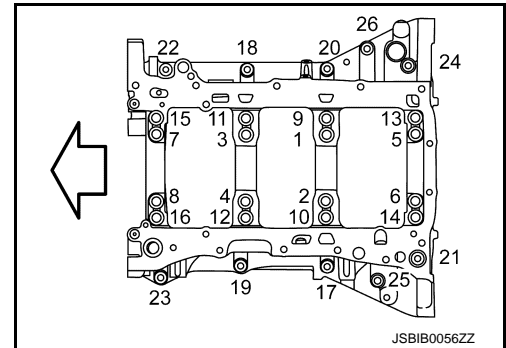
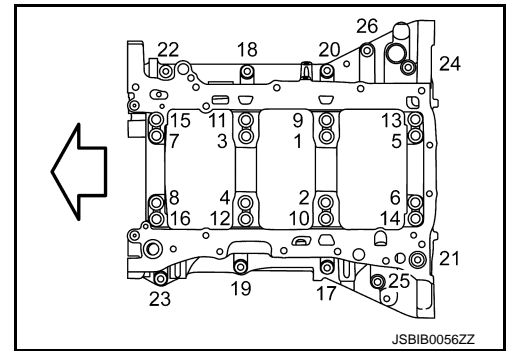
← : Engine front

**NOTE:**  
Use TORX socket (commercial service tool) for bolts No.1 to 16.

: 35.3 N·m (3.6 kg-m, 26 ft-lb)

- e. Turn bolts (No. 1 to 16) 90 degrees clockwise (angle tightening).

**CAUTION:**  
Use the angle wrench [SST: KV10112100 (BT8653-A)] (A) to check tightening angle. Never make judgment by visual inspection.



- After installing lower cylinder block bolts, check that crankshaft can be rotated smoothly by hand.
- Check the crankshaft end play. Refer to [EM-279, "Inspection"](#).

9. Install piston to connecting rod as follows:

- a. Using snap ring pliers, install new snap ring to the groove of piston rear side.
- Insert it fully into groove to install.
- b. Install piston to connecting rod.
- Using an industrial use dryer or similar tool, heat piston until piston pin can be pushed in by hand without excess force [approximately 60 to 70°C (140 to 158°F)]. From the front to the rear, insert piston pin into piston and connecting rod.
  - Assemble so that the front mark on the piston head and the cylinder number on connecting rod are positioned as shown in the figure.

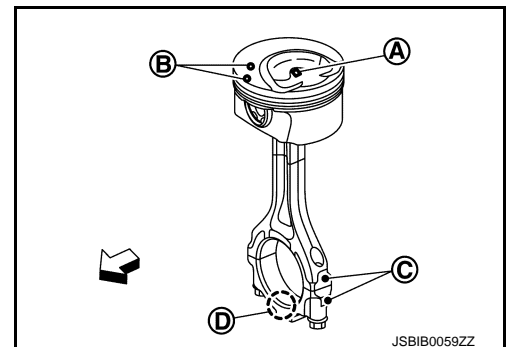
(A) : Piston grade number

(B) : Front mark

(C) : Cylinder number

(D) : Front mark

← : Engine front



- c. Install new snap ring to the groove of the piston front side.



# CYLINDER BLOCK

[VR30DDTT]

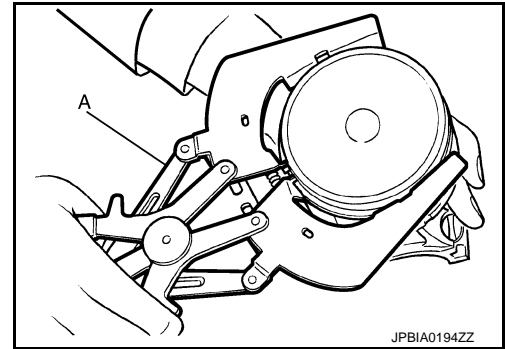
## < UNIT DISASSEMBLY AND ASSEMBLY >

- Insert it fully into groove to install.
- After installing, check that connecting rod moves smoothly.

10. Using a piston ring expander (commercial service tool) (A), install piston rings.

**CAUTION:**

- When installing piston rings, be careful not to damage piston.
- Never damage piston rings by expanding them excessively.

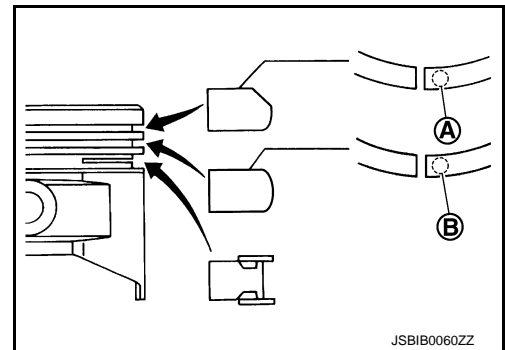


- If there is stamped mark on ring, mount it with marked side up.

**Stamped mark:**

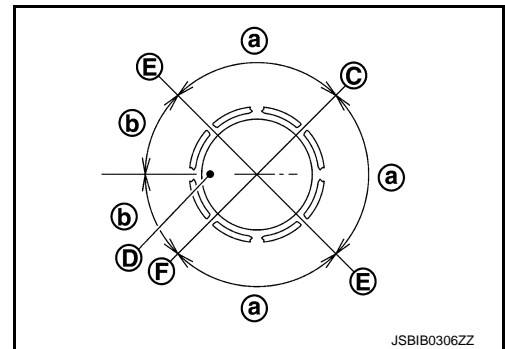
Top ring (A) : 1 N

Second ring (B) : 2 N



- Position each ring with the gap as shown in the figure referring to the piston front mark (D).

- (C) : Top ring gap
- (E) : Oil ring upper or lower rail gap (either of them)
- (F) : Second ring and oil ring spacer gap
- (a) : 90 degrees
- (b) : 45 degrees



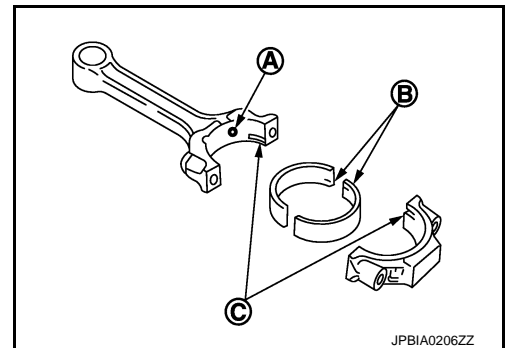
- Check the piston ring side clearance. Refer to [EM-279. "Inspection"](#).

11. Install connecting rod bearings to connecting rod and connecting rod bearing cap.

**CAUTION:**

**Never drop connecting rod bearing, and to scratch the surface.**

- Before installing connecting rod bearings, apply engine oil to the bearing surface (inside). Do not apply engine oil to the back surface, but thoroughly clean it.
- When installing, align connecting rod bearing stopper protrusion (B) with cutout (C) of connecting rods and connecting rod bearing caps to install.
- Ensure the oil hole (A) on connecting rod and that on the corresponding bearing are aligned.



12. Install piston and connecting rod assembly to crankshaft.

# CYLINDER BLOCK

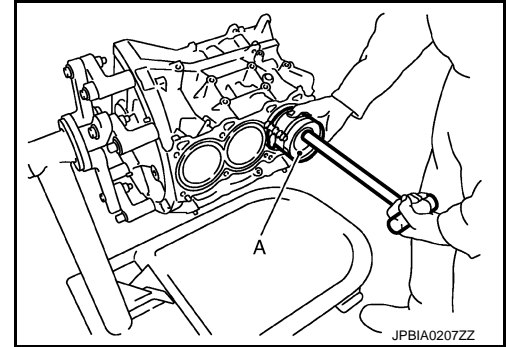
[VR30DDTT]

## < UNIT DISASSEMBLY AND ASSEMBLY >

- Position crankshaft pin corresponding to connecting rod to be installed onto the bottom dead center.
- Apply engine oil sufficiently to the cylinder bore, piston and crankshaft pin journal.
- Match the cylinder position with the cylinder number on connecting rod to install.
- Be sure that front mark on piston crown is facing the front of the engine.
- Using a piston ring compressor [SST: EM03470000 (J-8037)] (A) or suitable tool, install piston with the front mark on the piston crown facing the front of the engine.

### CAUTION:

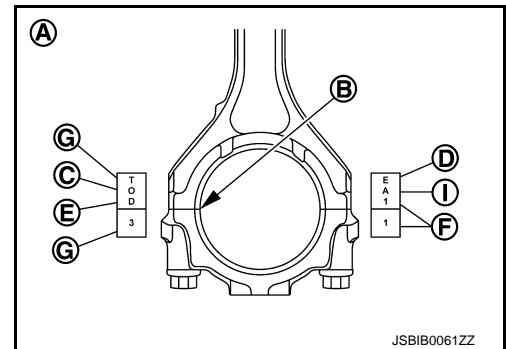
Never damage the cylinder wall and crankshaft pin, resulting from an interference of the connecting rod big end.



### 13. Install connecting rod bearing cap.

- Match the stamped cylinder number marks on connecting rod with those on connecting rod bearing cap to install.

- (A) : Sample codes
- (B) : Bearing stopper groove
- (C) : Small-end diameter grade
- (D) : Big-end diameter grade
- (E) : Weight grade
- (F) : Cylinder No.
- (G) : Management code
- (I) : Management code



- Be sure that front mark (H) on connecting rod bearing cap is facing the front of the engine.

### 14. Tighten connecting rod bolt as follows:

- Inspect the outer diameter of connecting rod bolt. Refer to [EM-279, "Inspection"](#).
- Apply engine oil to the threads and seats of connecting rod bolts.
- Tighten connecting rod bolts.

: 28.4 N·m (2.9 kg-m, 21 ft-lb)

- Completely loosen connecting rod bolts.

: 0 N·m (0 kg-m, 0 ft-lb)

- Tighten connecting rod bolts.

: 24.5 N·m (2.5 kg-m, 18 ft-lb)

- Then turn connecting rod bolts 90 degrees clockwise (angle tightening).

### CAUTION:

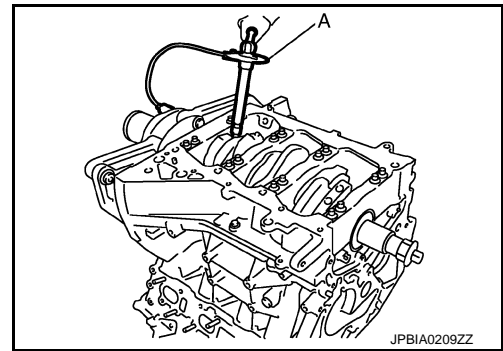
# CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

**Always use the angle wrench [SST: KV10112100 (BT8653-A)] (A). Never make judgment by visual inspection.**

- After tightening connecting rod bolts, check that crankshaft rotates smoothly.
- Check the connecting rod side clearance. Refer to [EM-279, "Inspection"](#).



15. Install baffle plate.

16. Install knock sensors ①.

↔ : Engine front

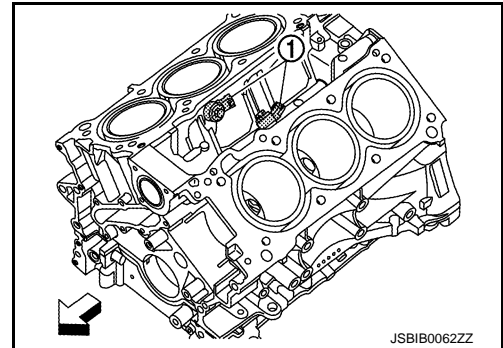
- Install knock sensor so that connector faces the rear of the engine.
- After installing knock sensor, connect harness connector, and lay it out to rear of the engine.

**CAUTION:**

- **Never tighten mounting bolts while holding connector.**
- **If any impact by dropping is applied to knock sensor, replace it with new one.**

**NOTE:**

- Check that there is no foreign material on the cylinder block mating surface and the back surface of knock sensor.
- Check that knock sensor does not interfere with other parts.



17. Install new rear oil seal. Refer to [EM-202, "REAR OIL SEAL : Removal and Installation"](#).

- Apply new engine oil to both oil seal lip and dust seal lip.

18. Install pilot converter. Refer to [EM-198, "Removal and Installation"](#).

19. Assemble in the reverse order of disassembly after this step.

## Inspection

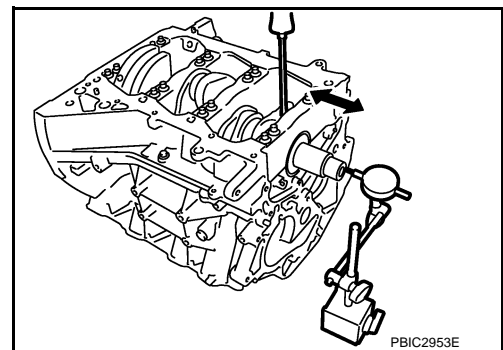
INFOID:000000013607871

### CRANKSHAFT END PLAY

- Measure the clearance between thrust bearings and crankshaft arm when crankshaft is moved fully forward or backward with a dial indicator.

**Standard and limit : Refer to [EM-301, "Cylinder Block"](#).**

- If the measured value exceeds the limit, replace thrust bearings, and measure again. If it still exceeds the limit, replace crankshaft also.



### CONNECTING ROD SIDE CLEARANCE

# CYLINDER BLOCK

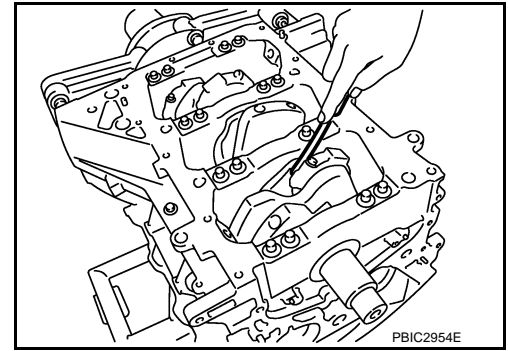
[VR30DDTT]

## < UNIT DISASSEMBLY AND ASSEMBLY >

- Measure the side clearance between connecting rod and crankshaft arm with a feeler gauge (commercial service tool).

**Standard and limit** : Refer to [EM-301, "Cylinder Block"](#).

- If the measured value exceeds the limit, replace connecting rod, and measure again. If it still exceeds the limit, replace crankshaft also.

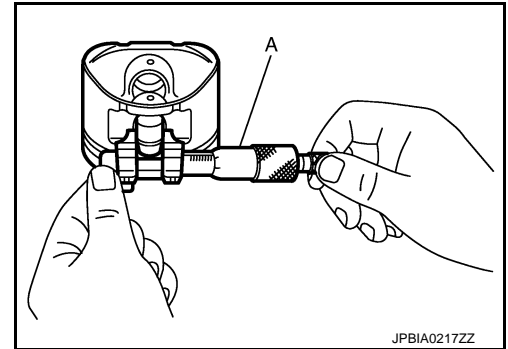


## PISTON TO PISTON PIN OIL CLEARANCE

Piston Pin Hole Diameter

Measure the inner diameter of piston pin hole with an inside micrometer (A).

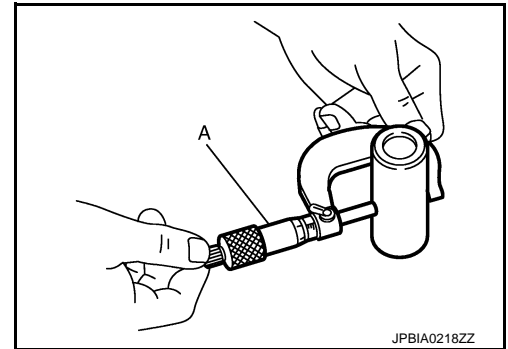
**Standard** : Refer to [EM-301, "Cylinder Block"](#).



Piston Pin Outer Diameter

Measure the outer diameter of piston pin with a micrometer (A).

**Standard** : Refer to [EM-301, "Cylinder Block"](#).



Piston to Piston Pin Oil Clearance

(Piston to piston pin oil clearance) = (Piston pin hole diameter) – (Piston pin outer diameter)

**Standard** : Refer to [EM-301, "Cylinder Block"](#).

- If the calculated value is out of the standard, replace piston and piston pin assembly.
- When replacing piston and piston pin assembly, refer to [EM-289, "Description"](#).

### NOTE:

Piston is available together with piston pin as assembly.

## PISTON RING SIDE CLEARANCE

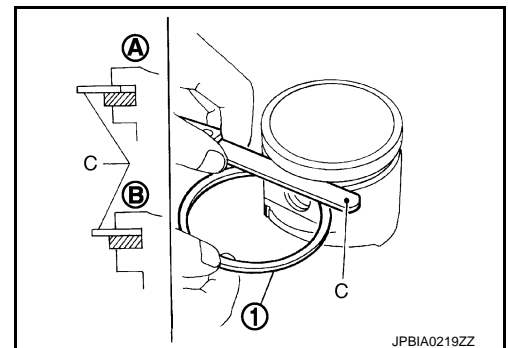
- Measure the side clearance of piston ring ① and piston ring groove with a feeler gauge (commercial service tool) (C).

Ⓐ : NG

Ⓑ : OK

**Standard and limit** : Refer to [EM-301, "Cylinder Block"](#).

- If the measured value exceeds the limit, replace piston ring, and measure again. If it still exceeds the limit, replace piston also.



# CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

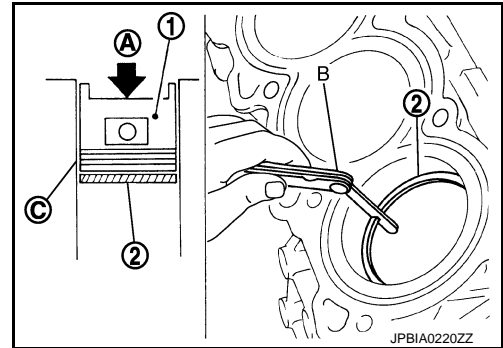
## PISTON RING END GAP

- Check that the cylinder bore inner diameter is within the specification. Refer to [EM-271, "Disassembly and Assembly"](#).
- Lubricate with new engine oil to piston ① and piston ring ②, and then insert piston ring until middle of cylinder with piston, and measure the piston ring end gap with a feeler gauge (commercial service tool) (B).

- Ⓐ : Press-fit
- Ⓒ : Measuring point

**Standard and limit** : Refer to [EM-301, "Cylinder Block"](#).

- If the measured value exceeds the limit, replace piston ring, and measure again.



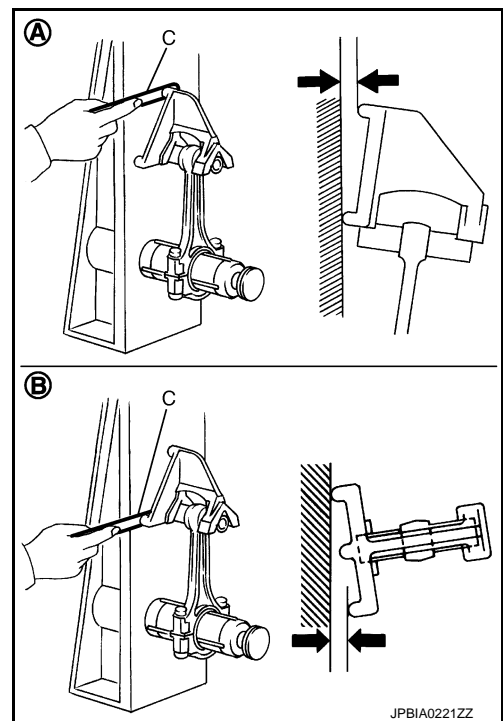
## CONNECTING ROD BEND AND TORSION

- Check with a connecting rod aligner.

- Ⓐ : Bend
- Ⓑ : Torsion
- C : Feeler gauge (commercial service tool)

**Bend limit**  
**Torsion limit** : Refer to [EM-301, "Cylinder Block"](#).

- If it exceeds the limit, replace connecting rod assembly.



## CONNECTING ROD BIG END DIAMETER

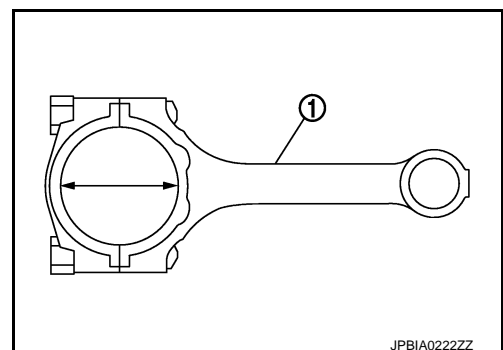
- Install connecting rod bearing cap without installing connecting rod bearing, and tighten connecting rod bolts to the specified torque. Refer to [EM-271, "Disassembly and Assembly"](#) for the tightening procedure.

- ① : Connecting rod

- Measure the inner diameter of connecting rod big end with an inside micrometer.

**Standard** : Refer to [EM-301, "Cylinder Block"](#).

- If out of the standard, replace connecting rod assembly.



## CONNECTING ROD BUSHING OIL CLEARANCE

Connecting Rod Bushing Inner Diameter

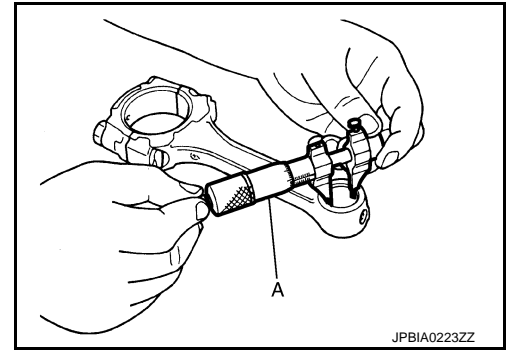
# CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

Measure the inner diameter of connecting rod bushing with an inside micrometer (A).

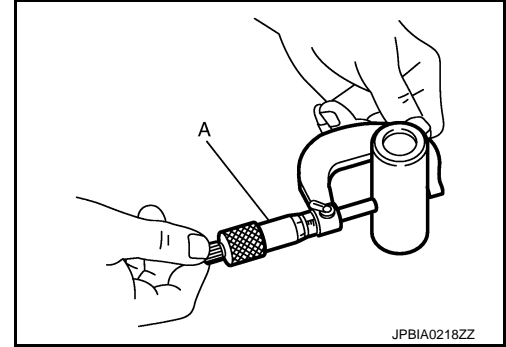
**Standard** : Refer to [EM-301, "Cylinder Block"](#).



Piston Pin Outer Diameter

Measure the outer diameter of piston pin with a micrometer (A).

**Standard** : Refer to [EM-301, "Cylinder Block"](#).



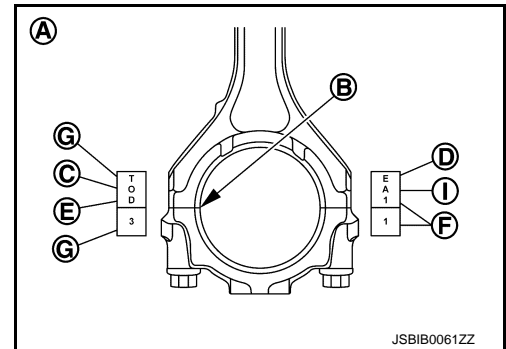
Connecting Rod Bushing Oil Clearance

(Connecting rod bushing oil clearance) = (Connecting rod bushing inner diameter) – (Piston pin outer diameter)

**Standard and limit** : Refer to [EM-301, "Cylinder Block"](#).

- If the calculated value exceeds the limit, replace connecting rod assembly and/or piston and piston pin assembly.
- If replacing piston and piston pin assembly, refer to [EM-289, "Description"](#).
- If replacing connecting rod assembly, refer to [EM-290, "Connecting Rod Bearing"](#) to select the connecting rod bearing.

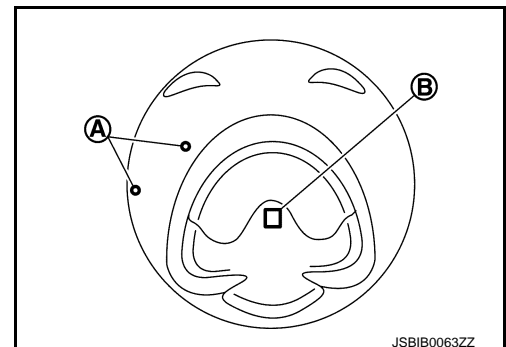
- (A) : Sample codes
- (B) : Bearing stopper groove
- (C) : Small-end diameter grade
- (D) : Big-end diameter grade
- (E) : Weight grade
- (F) : Cylinder No.
- (G) : Management code
- (I) : Management code



**Factory installed parts grading:**

- Service parts apply only to grade "0".

- (A) : Front mark
- (B) : Piston grade number



Unit: mm (in)	
Connecting rod bushing inner diameter *	23.000 - 23.006 (0.9055 - 0.9057)

# CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

Piston pin hole diameter	22.995 - 22.999 (0.9053 - 0.9055)
Piston pin outer diameter	22.989 - 22.993 (0.9051 - 0.9052)

\*: After installing in connecting rod

A

EM

## CYLINDER BLOCK DISTORTION

- Using a scraper, remove gasket on the cylinder block surface, and also remove engine oil, scale, carbon, or other contamination.

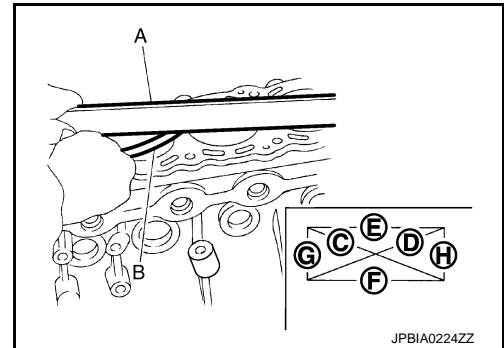
### CAUTION:

**Never allow gasket flakes to enter engine oil or engine coolant passages.**

- Measure the distortion on the cylinder block upper face at some different points in six directions (C), (D), (E), (F), (G) and (H) with a straightedge (A) and a feeler gauge (commercial service tool) (B).

**Limit** : Refer to [EM-301, "Cylinder Block"](#).

- If it exceeds the limit, replace cylinder block.



C

D

E

F

G

## MAIN BEARING HOUSING INNER DIAMETER

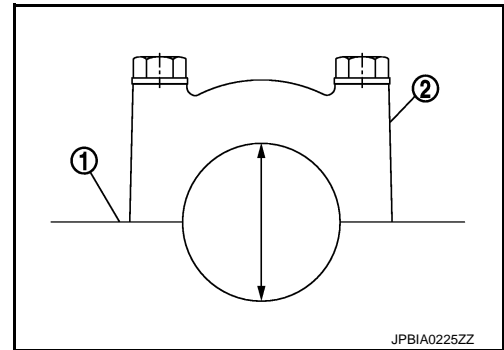
- Install lower cylinder block (2) without installing main bearings, and tighten lower cylinder block bolts to the specified torque. Refer to [EM-271, "Disassembly and Assembly"](#) for the tightening procedure.
- Measure the inner diameter of main bearing housing with a bore gauge.

**Standard** : Refer to [EM-301, "Cylinder Block"](#).

- If out of the standard, replace cylinder block (1) and lower cylinder block as assembly.

### NOTE:

Cylinder block cannot be replaced as a single part, because it is machined together with lower cylinder block.



H

I

J

K

## PISTON TO CYLINDER BORE CLEARANCE

### Cylinder Bore inner Diameter

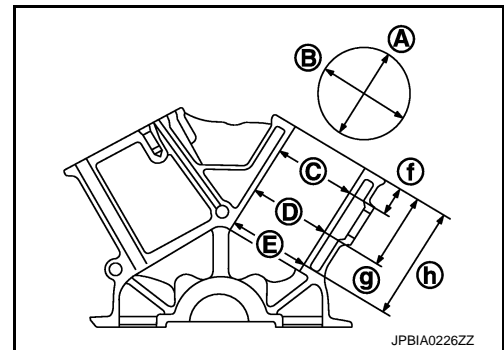
- Using a bore gauge, measure cylinder bore for wear, out-of-round and taper at six different points on each cylinder. [(A) and (B) directions at (C), (D) and (E)] is in longitudinal direction of engine.

(f) : 10 mm (0.39 in)

(g) : 60 mm (2.36 in)

(h) : 125 mm (4.92 in)

**Standard and limit** : Refer to [EM-301, "Cylinder Block"](#).



L

M

N

O

P

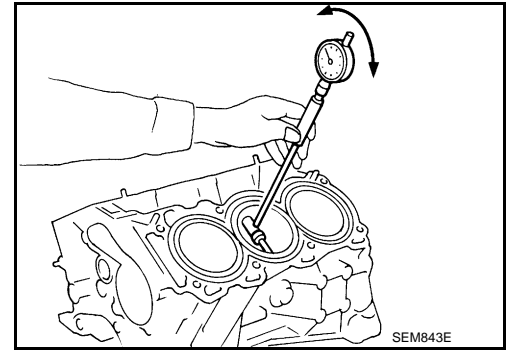


# CYLINDER BLOCK

[VR30DDTT]

## < UNIT DISASSEMBLY AND ASSEMBLY >

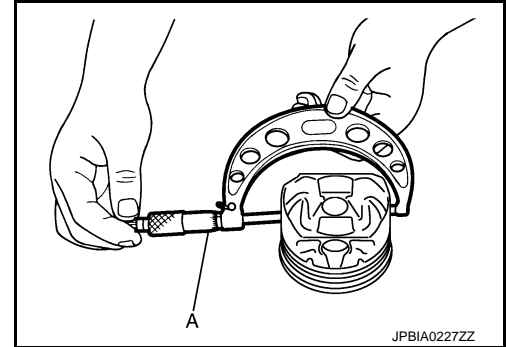
- If the measured value exceeds the limit, or if there are scratches and/or seizure on the cylinder inner wall, hone or rebores the inner wall.



### Piston Skirt Diameter

Measure the outer diameter of piston skirt with a micrometer (A).

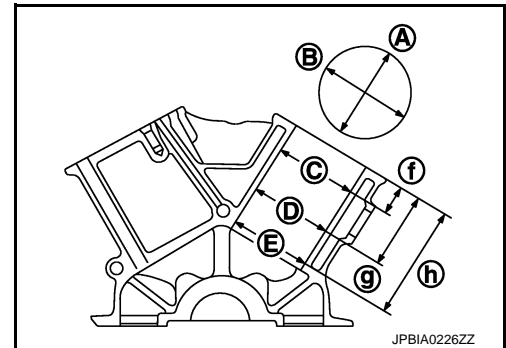
**Measure point** : Refer to [EM-301, "Cylinder Block"](#).  
**Standard**



### Piston-to-Cylinder Bore Clearance

Calculate by piston skirt diameter and cylinder bore inner diameter [direction (B), position (D)].

- (A) : **Direction (A)**
- (C) : **Position (C)**
- (E) : **Position (E)**
- (f) : **10 mm (0.39 in)**
- (g) : **60 mm (2.36 in)**
- (h) : **125 mm (4.92 in)**



(Clearance) = (Cylinder bore inner diameter) – (Piston skirt diameter).

**Standard and limit** : Refer to [EM-301, "Cylinder Block"](#).

- If the calculated value exceeds the limit, replace piston and piston pin assembly. Refer to [EM-301, "Cylinder Block"](#).

### Reboring Cylinder Bore

1. Cylinder bore size is determined by adding piston to cylinder bore clearance to piston skirt diameter.

**Re-bored size calculation:  $D = A + B - C$**

where,

**A: Piston skirt diameter as measured**

**B: Piston to cylinder bore clearance (standard value)**

**C: Honing allowance 0.02 mm (0.0008 in)**

**D: Bored diameter**

2. Install lower cylinder block, and tighten to the specified torque. Otherwise, cylinder bores may be distorted in final assembly.
3. Cut cylinder bores.

**NOTE:**



# CYLINDER BLOCK

[VR30DDTT]

## < UNIT DISASSEMBLY AND ASSEMBLY >

- When any cylinder needs boring, all other cylinders must also be bored.
  - Do not cut too much out of cylinder bore at a time. Cut only 0.05 mm (0.0020 in) or so in diameter at a time.
4. Hone cylinders to obtain the specified piston to cylinder bore clearance.
5. Measure finished cylinder bore for the out-of-round and taper.

### NOTE:

Perform measurement after cylinder bore cools down.

## CRANKSHAFT MAIN JOURNAL DIAMETER

- Measure the outer diameter of crankshaft main journals with a micrometer.

**Standard** : Refer to [EM-301, "Cylinder Block"](#).

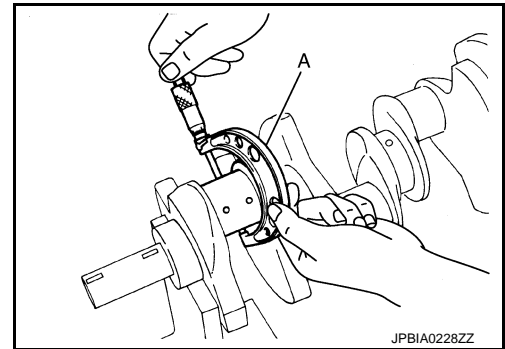
- If out of the standard, measure the main bearing oil clearance. Then use undersize bearing. Refer to [EM-292, "Main Bearing"](#).

## CRANKSHAFT PIN JOURNAL DIAMETER

- Measure the outer diameter of crankshaft pin journal with a micrometer (A).

**Standard** : Refer to [EM-301, "Cylinder Block"](#).

- If out of the standard, measure the connecting rod bearing oil clearance. Then use undersize bearing. Refer to [EM-290, "Connecting Rod Bearing"](#).

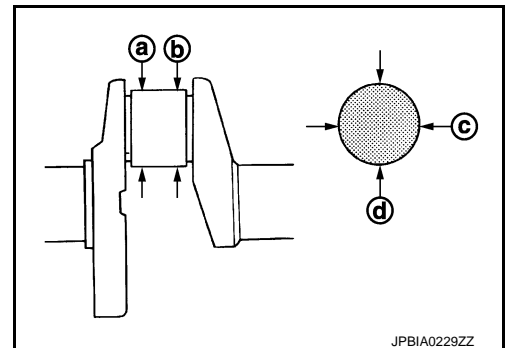


## CRANKSHAFT OUT-OF-ROUND AND TAPER

- Measure the dimensions at four different points as shown in the figure on each main journal and pin journal with a micrometer.
- Out-of-round is indicated by the difference in the dimensions between Ⓓ and Ⓒ at Ⓐ and Ⓑ.
- Taper is indicated by the difference in the dimensions between.

**Limit** : Refer to [EM-301, "Cylinder Block"](#).

- If the measured value exceeds the limit, correct or replace crankshaft.
- If corrected, measure the bearing oil clearance of the corrected main journal and/or pin journal. Then select the main bearing and/or connecting rod bearing. Refer to [EM-292, "Main Bearing"](#) and/or [EM-290, "Connecting Rod Bearing"](#).

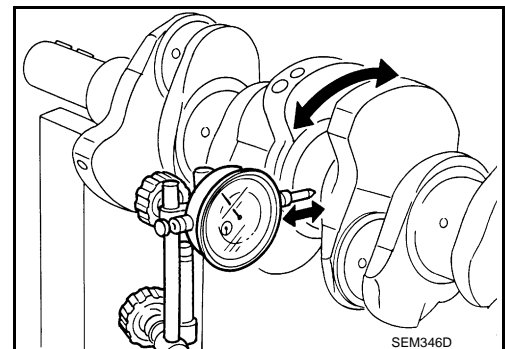


## CRANKSHAFT RUNOUT

- Place V-block on precise flat table, and support the journals on both ends of crankshaft.
- Place a dial indicator straight up on the No. 3 journal.
- While rotating crankshaft, read the movement of the pointer on a dial indicator. (Total indicator reading)

**Standard and limit** : Refer to [EM-301, "Cylinder Block"](#).

- If it exceeds the limit, replace crankshaft.



## CONNECTING ROD BEARING OIL CLEARANCE

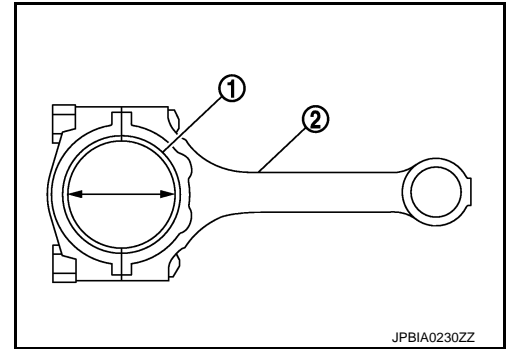
Method by Calculation

# CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

- Install connecting rod bearings ① to connecting rod ② and connecting rod cap, and tighten connecting rod bolts to the specified torque. Refer to [EM-271, "Disassembly and Assembly"](#) for the tightening procedure.



- Measure the inner diameter of connecting rod bearing with an inside micrometer.  
(Oil clearance) = (Connecting rod bearing inner diameter) – (Crankshaft pin journal diameter)

**Standard and limit** : Refer to [EM-305, "Connecting Rod Bearing"](#).

- If the calculated value exceeds the limit, select proper connecting rod bearing according to connecting rod big end diameter and crankshaft pin journal diameter to obtain the specified bearing oil clearance. Refer to [EM-289, "Description"](#).

Method of Using Plastigage

- Remove oil and dust on crankshaft pin journal and the surfaces of each bearing completely.
- Cut a plastigage slightly shorter than the bearing width, and place it in crankshaft axial direction, avoiding oil holes.
- Install connecting rod bearings to connecting rod and connecting rod bearing cap, and tighten connecting rod bolts to the specified torque. Refer to [EM-271, "Disassembly and Assembly"](#) for the tightening procedure.

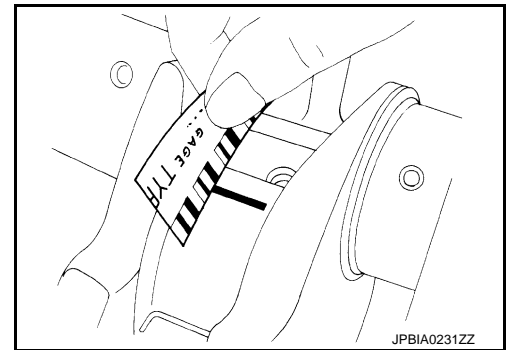
**CAUTION:**

**Never rotate crankshaft.**

- Remove connecting rod bearing cap and bearings, and using the scale on the plastigage bag, measure the plastigage width.

**NOTE:**

The procedure when the measured value exceeds the limit is the same as that described in the "Method by Calculation".



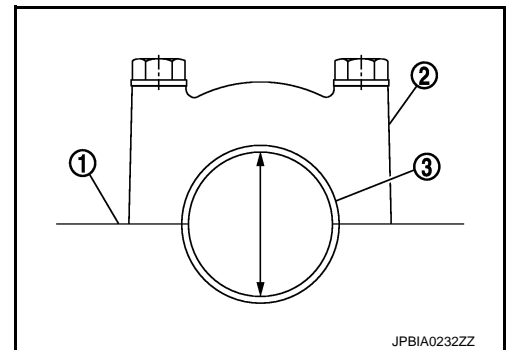
## MAIN BEARING OIL CLEARANCE

Method by Calculation

- Install main bearings ③ to cylinder block ① and lower cylinder block ②, and tighten lower cylinder block bolts to the specified torque. Refer to [EM-271, "Disassembly and Assembly"](#) for the tightening procedure.
- Measure the inner diameter of main bearing with a bore gauge.  
(Oil clearance) = (Main bearing inner diameter) – (Crankshaft main journal diameter)

**Standard and limit** : Refer to [EM-304, "Main Bearing"](#).

- If the calculated value exceeds the limit, select proper main bearing according to main bearing inner diameter and crankshaft main journal diameter to obtain the specified bearing oil clearance. Refer to [EM-289, "Description"](#).



Method of Using Plastigage

- Remove engine oil and dust on crankshaft journal and the surfaces of each bearing completely.

# CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

- Cut a plastigage slightly shorter than the bearing width, and place it in crankshaft axial direction, avoiding oil holes.
- Install main bearing to cylinder block and lower cylinder block, and tighten lower cylinder block bolts with lower cylinder block to the specified torque. Refer to [EM-271, "Disassembly and Assembly"](#) for the tightening procedure.

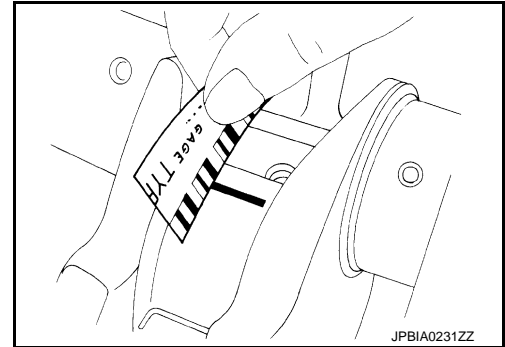
**CAUTION:**

**Never rotate crankshaft.**

- Remove lower cylinder block and bearings, and using the scale on the plastigage bag, measure the plastigage width.

**NOTE:**

The procedure when the measured value exceeds the limit is the same as that described in the "Method by Calculation".



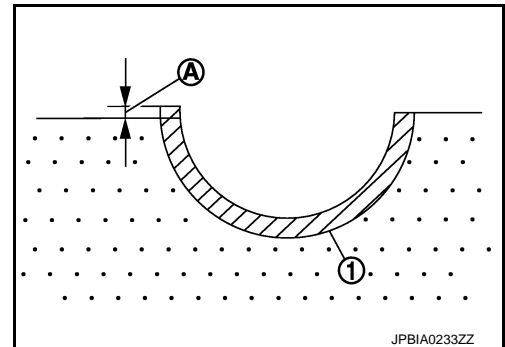
## MAIN BEARING CRUSH HEIGHT

- When lower cylinder block is removed after being tightened to the specified torque with main bearings ① installed, the tip end of bearing must protrude. Refer to [EM-271, "Disassembly and Assembly"](#) for the tightening procedure.

Ⓐ : Crush height

**Standard : There must be crush height.**

- If the standard is not met, replace main bearings.



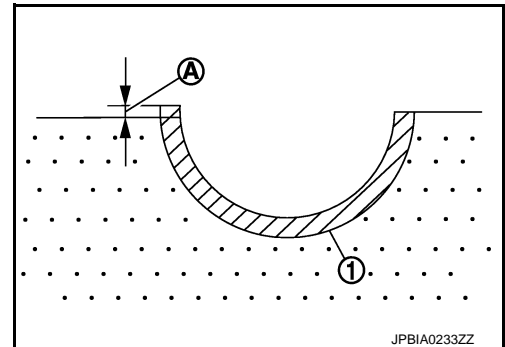
## CONNECTING ROD BEARING CRUSH HEIGHT

- When connecting rod bearing cap is removed after being tightened to the specified torque with connecting rod bearings ① installed, the tip end of bearing must protrude. Refer to [EM-271, "Disassembly and Assembly"](#) for the tightening procedure.

Ⓐ : Crush height

**Standard : There must be crush height.**

- If the standard is not met, replace connecting rod bearings.



## LOWER CYLINDER BLOCK BOLT OUTER DIAMETER

- Measure the outer diameters Ⓒ, Ⓓ at two positions as shown in the figure.

Ⓐ : 20 mm (0.79 in)

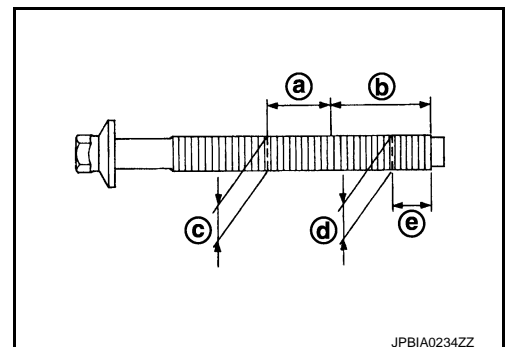
Ⓑ : 30 mm (1.18 in)

Ⓔ : 10 mm (0.39 in)

- If reduction appears in Ⓐ range, regard it Ⓒ.

**Limit [Ⓓ – Ⓒ] : 0.11 mm (0.0043 in)**

- If it exceeds the limit (large difference in dimensions), replace lower cylinder block bolt with new one.



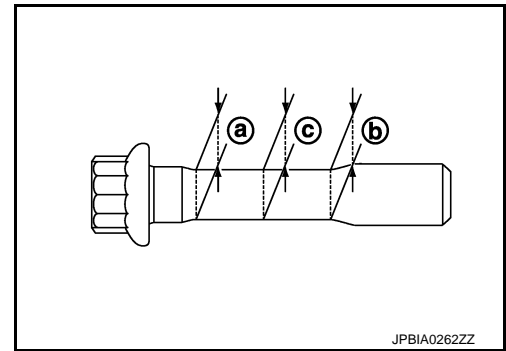
## CONNECTING ROD BOLT OUTER DIAMETER

# CYLINDER BLOCK

## < UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

1. Measure the outer diameters [a], [b] and [c] at the position shown in the figure.
  - a : Value at the end of the smaller diameter of the bolt
  - b : Value at the end of the smaller diameter of the bolt [opposite side of a]
  - c : Value of the smallest diameter of the smaller of the bolt
2. Obtain a mean value (d) of [a] and [b].
3. Subtract [c] from (d).



**Limit [(d) – (c)] : 0.09 mm (0.0035 in)**

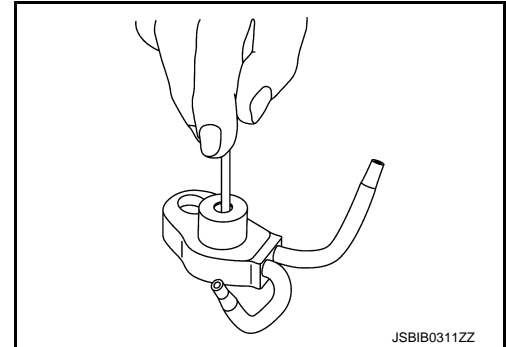
4. If it exceeds the limit (large difference in dimensions), replace the bolt with new one.

### OIL JET

- Check nozzle for deformation and damage.
- Blow compressed air from nozzle, and check for clogs.
- If it is not satisfied, clean or replace oil jet.

### OIL JET RELIEF VALVE

- Using a clean plastic stick, press check valve in oil jet relief valve. Check that valve moves smoothly with proper reaction force.
- If it is not satisfied, replace oil jet relief valve.



# HOW TO SELECT PISTON AND BEARING

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

## HOW TO SELECT PISTON AND BEARING

### Description

INFOID:000000013607872

Selection points	Selection parts	Selection items	Selection methods
Between cylinder block and crankshaft	Main bearing	Main bearing grade (bearing thickness)	Determined by match of cylinder block bearing housing grade (inner diameter of housing) and crankshaft journal grade (outer diameter of journal)
Between crankshaft and connecting rod	Connecting rod bearing	Connecting rod bearing grade (bearing thickness)	Combining service grades for connecting rod big end diameter and crankshaft pin outer diameter determine connecting rod bearing selection.
Between cylinder block and piston	Piston and piston pin assembly (Piston is available together with piston pin as assembly.)	Piston grade (piston skirt diameter)	Piston grade = cylinder bore grade (inner diameter of bore)
Between piston and connecting rod	—	—	—

- The identification grade stamped on each part is the grade for the dimension measured in new condition. This grade cannot apply to reused parts.
- For reused or repaired parts, measure the dimension accurately. Determine the grade by comparing the measurement with the values of each selection table.
- For details of the measurement method of each part, the reuse standards and the selection method of the selective fitting parts, refer to the text.

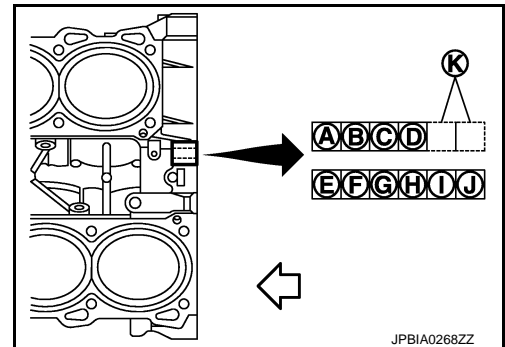
### Piston

INFOID:000000013607873

#### WHEN NEW CYLINDER BLOCK IS USED

Check the cylinder bore grade ("1", "2" or "3") on rear side of cylinder block, and select piston of the same grade.

- (A) : Bearing housing grade No. 1
- (B) : Bearing housing grade No. 2
- (C) : Bearing housing grade No. 3
- (D) : Bearing housing grade No. 4
- (E) : Cylinder bore grade No. 1
- (F) : Cylinder bore grade No. 2
- (G) : Cylinder bore grade No. 3
- (H) : Cylinder bore grade No. 4
- (I) : Cylinder bore grade No. 5
- (J) : Cylinder bore grade No. 6
- (K) : No use
- ↶ : Engine front



#### WHEN CYLINDER BLOCK IS REUSED

1. Measure the cylinder bore inner diameter. Refer to [EM-279, "Inspection"](#).

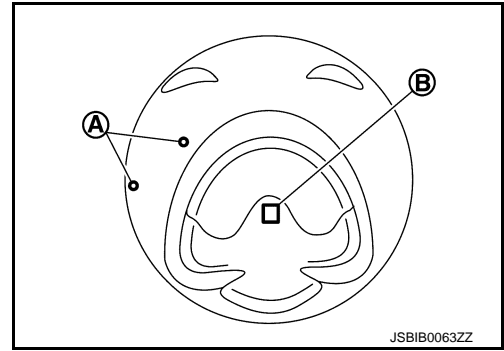
# HOW TO SELECT PISTON AND BEARING

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

2. Determine the bore grade by comparing the measurement with the values under the cylinder bore inner diameter of the "PISTON SELECTION TABLE".

- (A) : Front mark
- (B) : Piston grade number



3. Select piston of the same grade.

## PISTON SELECTION TABLE

Unit: mm (in)

Grade	1	2
Cylinder bore inner diameter	86.000 - 86.010 (3.3858 - 3.3862)	86.010 - 86.020 (3.3862 - 3.3866)
Piston skirt diameter	85.970 - 85.980 (3.3846 - 3.3850)	85.980 - 85.990 (3.3850 - 3.3854)

### NOTE:

- Piston is available together with piston pin as assembly.
- No second grade mark is available on piston.

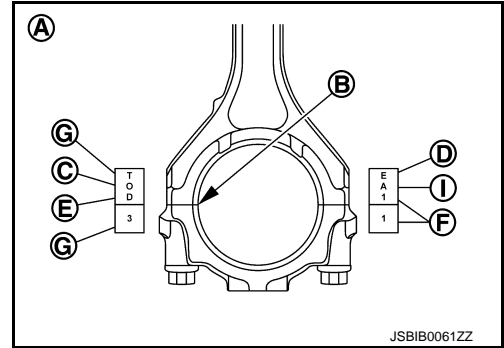
## Connecting Rod Bearing

INFOID:000000013607874

### WHEN NEW CONNECTING ROD AND CRANKSHAFT ARE USED

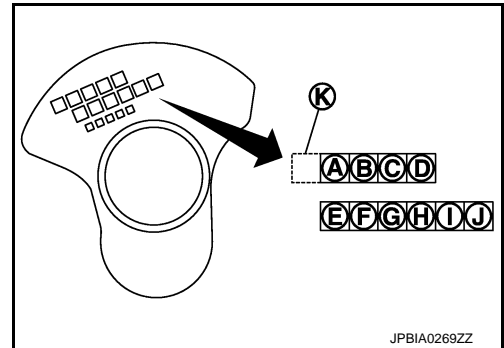
1. Apply connecting rod big end diameter grade stamped (D) on connecting rod side face to the row in the "CONNECTING ROD BEARING SELECTION TABLE".

- (A) : Sample codes
- (B) : Bearing stopper groove
- (C) : Small-end diameter grade
- (D) : Big-end diameter grade
- (E) : Weight grade
- (F) : Cylinder No.
- (G) : Management code
- (I) : Management code



2. Apply crankshaft pin journal diameter grade stamped on crankshaft front side to the column in the "CONNECTING ROD BEARING SELECTION TABLE".

- (A) : Journal diameter grade No. 1
- (B) : Journal diameter grade No. 2
- (C) : Journal diameter grade No. 3
- (D) : Journal diameter grade No. 4
- (E) : Pin diameter grade No. 1
- (F) : Pin diameter grade No. 2
- (G) : Pin diameter grade No. 3
- (H) : Pin diameter grade No. 4
- (I) : Pin diameter grade No. 5



# HOW TO SELECT PISTON AND BEARING

[VR30DDTT]

< UNIT DISASSEMBLY AND ASSEMBLY >

- Ⓧ : Pin diameter grade No. 6
- Ⓚ : Identification

3. Read the symbol at the cross point of selected row and column in the “CONNECTING ROD BEARING SELECTION TABLE”.
4. Apply the symbol obtained to the “CONNECTING ROD BEARING GRADE TABLE” to select connecting rod bearing.

## WHEN CONNECTING ROD AND CRANKSHAFT ARE REUSED

1. Measure connecting rod big end diameter and crankshaft pin journal diameter. Refer to [EM-279. "Inspection"](#).
2. Correspond the measured dimension in “connecting rod big end diameter” row of “CONNECTING ROD BEARING SELECTION TABLE”.
3. Correspond the measured dimension in “crankshaft pin diameter” column of “CONNECTING ROD BEARING SELECTION TABLE”.
4. Follow step 3 and later in “WHEN NEW CONNECTING ROD AND CRANKSHAFT ARE USED”.

## CONNECTING ROD BEARING SELECTION TABLE

Connecting rod big end diameter Unit: mm (in)		Mark														
		A	B	C	D	E	F	G	H	J	K	L	M	N		
Crankshaft pin journal diameter Unit: mm (in)		Hole diameter														
		57.000 - 57.001 (2.2441 - 2.2441)	57.001 - 57.002 (2.2441 - 2.2442)	57.002 - 57.003 (2.2442 - 2.2442)	57.003 - 57.004 (2.2442 - 2.2442)	57.004 - 57.005 (2.2442 - 2.2443)	57.005 - 57.006 (2.2443 - 2.2443)	57.006 - 57.007 (2.2443 - 2.2444)	57.007 - 57.008 (2.2444 - 2.2444)	57.008 - 57.009 (2.2444 - 2.2444)	57.009 - 57.010 (2.2444 - 2.2445)	57.010 - 57.011 (2.2445 - 2.2445)	57.011 - 57.012 (2.2445 - 2.2446)	57.012 - 57.013 (2.2446 - 2.2446)		
Mark	Axle diameter															
A	53.974 - 53.973 (2.1250 - 2.1249)	0	0	0	0	0	0	1	1	1	1	1	1	1	2	
B	53.973 - 53.972 (2.1249 - 2.1249)	0	0	0	0	0	0	1	1	1	1	1	1	1	2	2
C	53.972 - 53.971 (2.1249 - 2.1248)	0	0	0	0	0	1	1	1	1	1	1	1	2	2	2
D	53.971 - 53.970 (2.1248 - 2.1248)	0	0	0	1	1	1	1	1	1	1	2	2	2	2	2
E	53.970 - 53.969 (2.1248 - 2.1248)	0	0	1	1	1	1	1	1	1	2	2	2	2	2	2
F	53.969 - 53.968 (2.1248 - 2.1247)	0	1	1	1	1	1	1	1	2	2	2	2	2	2	2
G	53.968 - 53.967 (2.1247 - 2.1247)	1	1	1	1	1	1	1	2	2	2	2	2	2	3	3
H	53.967 - 53.966 (2.1247 - 2.1246)	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3
J	53.966 - 53.965 (2.1246 - 2.1246)	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3
K	53.965 - 53.964 (2.1246 - 2.1246)	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3
L	53.964 - 53.963 (2.1246 - 2.1245)	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3
M	53.963 - 53.962 (2.1245 - 2.1245)	1	2	2	2	2	2	2	2	3	3	3	3	3	3	3
N	53.962 - 53.961 (2.1245 - 2.1244)	2	2	2	2	2	2	2	3	3	3	3	3	3	3	4
P	53.961 - 53.960 (2.1244 - 2.1244)	2	2	2	2	2	2	3	3	3	3	3	3	3	4	4
R	53.960 - 53.959 (2.1244 - 2.1244)	2	2	2	2	3	3	3	3	3	3	3	4	4	4	4
S	53.959 - 53.958 (2.1244 - 2.1243)	2	2	2	3	3	3	3	3	3	3	4	4	4	4	4
T	53.958 - 53.957 (2.1243 - 2.1243)	2	2	3	3	3	3	3	3	3	4	4	4	4	4	4
U	53.957 - 53.956 (2.1243 - 2.1242)	2	3	3	3	3	3	3	3	4	4	4	4	4	4	4

PBIC5435E

## CONNECTING ROD BEARING GRADE TABLE

[Connecting rod bearing grade table](#) : Refer to [EM-305. "Connecting Rod Bearing"](#).

## UNDERSIZE BEARING USAGE GUIDE

# HOW TO SELECT PISTON AND BEARING

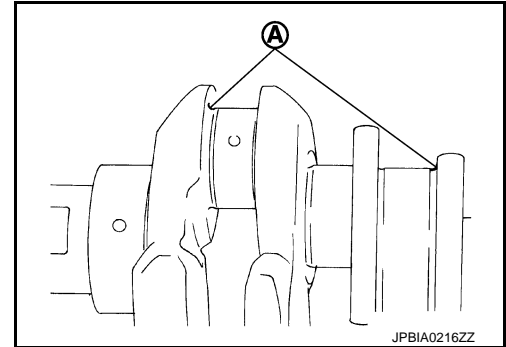
[VR30DDTT]

## < UNIT DISASSEMBLY AND ASSEMBLY >

- When the specified connecting rod bearing oil clearance is not obtained with standard size connecting rod bearings, use undersize (US) bearings.
- When using undersize (US) bearing, measure the connecting rod bearing inner diameter with bearing installed, and grind crankshaft pin so that the connecting rod bearing oil clearance satisfies the standard.

**CAUTION:**

In grinding crankshaft pin to use undersize bearings, keep the fillet R Ⓐ [1.5 - 1.7 mm (0.059 - 0.067 in)].



**Bearing undersize table** : Refer to [EM-305, "Connecting Rod Bearing"](#).

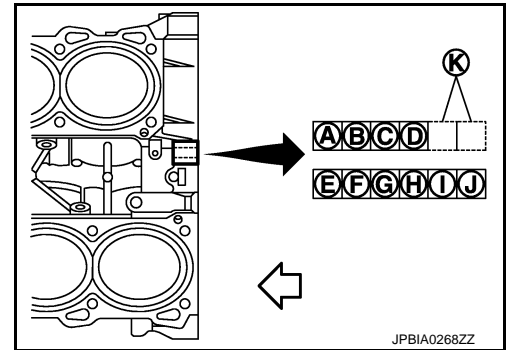
## Main Bearing

INFOID:000000013607875

### WHEN NEW CYLINDER BLOCK AND CRANKSHAFT ARE USED

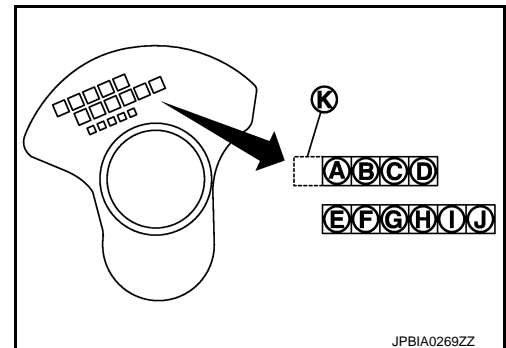
1. "MAIN BEARING SELECTION TABLE" rows correspond to bearing housing grade on rear side of cylinder block.

- Ⓐ : Bearing housing grade No. 1
- Ⓑ : Bearing housing grade No. 2
- Ⓒ : Bearing housing grade No. 3
- Ⓓ : Bearing housing grade No. 4
- Ⓔ : Cylinder bore grade No. 1
- Ⓕ : Cylinder bore grade No. 2
- Ⓖ : Cylinder bore grade No. 3
- Ⓗ : Cylinder bore grade No. 4
- Ⓙ : Cylinder bore grade No. 5
- Ⓚ : Cylinder bore grade No. 6
- Ⓚ : No use
- ⇐ : Engine front



2. "MAIN BEARING SELECTION TABLE" columns correspond to journal diameter grade on front side of crankshaft.

- Ⓐ : Journal diameter grade No. 1
- Ⓑ : Journal diameter grade No. 2
- Ⓒ : Journal diameter grade No. 3
- Ⓓ : Journal diameter grade No. 4
- Ⓔ : Pin diameter grade No. 1
- Ⓕ : Pin diameter grade No. 2
- Ⓖ : Pin diameter grade No. 3
- Ⓗ : Pin diameter grade No. 4
- Ⓙ : Pin diameter grade No. 5





# HOW TO SELECT PISTON AND BEARING

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

- Ⓜ : Pin diameter grade No. 6
- Ⓚ : Identification code

3. Select main bearing grade at the point where selected row and column meet in "MAIN BEARING SELECTION TABLE".
4. Apply sign at crossing in above step 3 to "MAIN BEARING GRADE TABLE".

**NOTE:**

- "MAIN BEARING GRADE TABLE" applies to all journals.
- Service parts are available as a set of both upper and lower.

## WHEN CYLINDER BLOCK AND CRANKSHAFT ARE REUSED

1. Measure cylinder block main bearing housing inner diameter and crankshaft main journal diameter. Refer to [EM-279, "Inspection"](#).
2. Correspond the measured dimension in "Cylinder block main bearing housing inner diameter" row of "MAIN BEARING SELECTION TABLE".
3. Correspond the measured dimension in "Crankshaft main journal diameter" column of "MAIN BEARING SELECTION TABLE".
4. Follow step 3 and later in "When New Cylinder Block and Crankshaft are Used".

## MAIN BEARING SELECTION TABLE

Cylinder block main bearing housing inner diameter Unit: mm (in)		Crankshaft main journal diameter Unit: mm (in)		Hole diameter		Mark																			
				A	B	C	4	7	X																
69.993 - 69.994 (2.7556 - 2.7557)	69.994 - 69.995 (2.7557 - 2.7557)	69.995 - 69.996 (2.7557 - 2.7557)	69.996 - 69.997 (2.7557 - 2.7558)	69.997 - 69.998 (2.7558 - 2.7558)	69.998 - 69.999 (2.7558 - 2.7559)	69.999 - 70.000 (2.7559 - 2.7559)	70.000 - 70.001 (2.7559 - 2.7559)	70.001 - 70.002 (2.7559 - 2.7560)	70.002 - 70.003 (2.7560 - 2.7560)	70.003 - 70.004 (2.7560 - 2.7561)	70.004 - 70.005 (2.7561 - 2.7561)	70.005 - 70.006 (2.7561 - 2.7561)	70.006 - 70.007 (2.7561 - 2.7562)	70.007 - 70.008 (2.7562 - 2.7562)	70.008 - 70.009 (2.7562 - 2.7563)	70.009 - 70.010 (2.7563 - 2.7563)	70.010 - 70.011 (2.7563 - 2.7563)	70.011 - 70.012 (2.7563 - 2.7564)	70.012 - 70.013 (2.7564 - 2.7564)	70.013 - 70.014 (2.7564 - 2.7565)	70.014 - 70.015 (2.7565 - 2.7565)	70.015 - 70.016 (2.7565 - 2.7565)	70.016 - 70.017 (2.7565 - 2.7566)		
Mark	Axle diameter		A	B	C	4	7	X	Y	4	7	X	Y	4	7	X	Y	4	7	X	Y	4	7	X	Y
A	64.975 - 64.974 (2.5581 - 2.5580)		0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
B	64.974 - 64.973 (2.5580 - 2.5580)		0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C	64.973 - 64.972 (2.5580 - 2.5579)		0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
D	64.972 - 64.971 (2.5579 - 2.5579)		0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
E	64.971 - 64.970 (2.5579 - 2.5579)		0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
F	64.970 - 64.969 (2.5579 - 2.5578)		0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
G	64.969 - 64.968 (2.5578 - 2.5578)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
H	64.968 - 64.967 (2.5578 - 2.5578)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
J	64.967 - 64.966 (2.5578 - 2.5577)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
K	64.966 - 64.965 (2.5577 - 2.5577)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
L	64.965 - 64.964 (2.5577 - 2.5576)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
M	64.964 - 64.963 (2.5576 - 2.5576)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
N	64.963 - 64.962 (2.5576 - 2.5576)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
P	64.962 - 64.961 (2.5576 - 2.5575)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R	64.961 - 64.960 (2.5575 - 2.5575)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
S	64.960 - 64.959 (2.5575 - 2.5574)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
T	64.959 - 64.958 (2.5574 - 2.5574)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
U	64.958 - 64.957 (2.5574 - 2.5574)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
V	64.957 - 64.956 (2.5574 - 2.5573)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
W	64.956 - 64.955 (2.5573 - 2.5573)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
X	64.955 - 64.954 (2.5573 - 2.5572)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Y	64.954 - 64.953 (2.5572 - 2.5572)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	64.953 - 64.952 (2.5572 - 2.5572)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7	64.952 - 64.951 (2.5572 - 2.5571)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

JPBIA0264ZZ

## MAIN BEARING GRADE TABLE (ALL JOURNALS)

Main bearing grade table (All journals) : Refer to [EM-304, "Main Bearing"](#).

# HOW TO SELECT PISTON AND BEARING

< UNIT DISASSEMBLY AND ASSEMBLY >

[VR30DDTT]

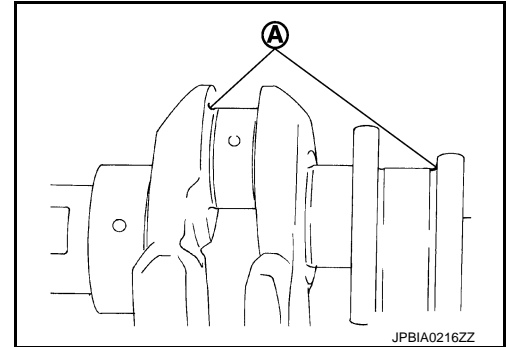
## UNDERSIZE BEARING USAGE GUIDE

- When the specified main bearing oil clearance is not obtained with standard size main bearings, use under-size (US) bearing.
- When using under-size (US) bearing, measure the main bearing inner diameter with bearing installed, and grind main journal so that the main bearing oil clearance satisfies the standard.

### CAUTION:

In grinding crankshaft main journal to use under-size bearings, keep the fillet R  $\text{\textcircled{A}}$  [1.5 - 1.7 mm (0.059 - 0.067 in)].

Bearing undersize table : Refer to [EM-304](#),  
["Main Bearing"](#).



# SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[VR30DDTT]

## SERVICE DATA AND SPECIFICATIONS (SDS)

### SERVICE DATA AND SPECIFICATIONS (SDS)

#### General Specification

INFOID:0000000013607876

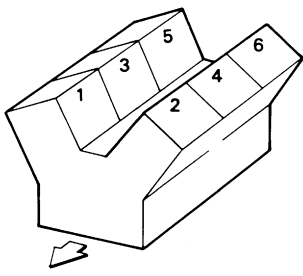
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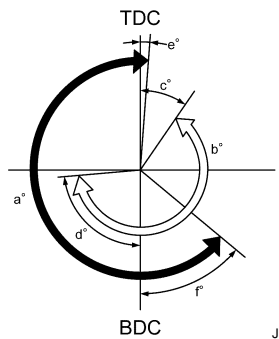
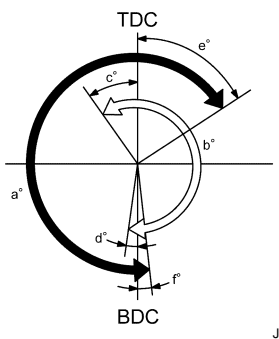
EM

#### GENERAL SPECIFICATIONS

Cylinder arrangement		V-6
Displacement cm <sup>3</sup> (cu in)		2,997 (182.89)
Bore and stroke mm (in)		86.0 x 86.0 (3.385 x 3.385)
Valve arrangement		DOHC
Firing order		1-2-3-4-5-6
Number of piston rings	Compression	2
	Oil	1
Number of main bearings		4
Compression ratio		10.3
Compression pressure kPa (kg/cm <sup>2</sup> , psi)/250 rpm	Standard	1,000 - 1,250 (10.2 - 12.75, 145.0 - 181.25)
	Minimum	800 (8.16, 116)
	Differential limit between cylinders	98 (1.0, 14)

Unit: degree

Cylinder number	 <p style="text-align: right;">JPBIA0164ZZ</p>	
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Valve timing ↔ : Intake valve ← : Exhaust valve	VTC Minimum phasing (Mechanical)		VTC Maximum phasing (Mechanical)			
	<p>VTC OFF</p>  <p style="text-align: center;">JSBIB0304GB</p>		<p>VTC ON</p>  <p style="text-align: center;">JSBIB0305GB</p>			
	a EXH valve opening angle	b INT valve opening angle	c INT open	d INT close	e EXH close	f EXH open
VTC Minimum phasing (Mechanical)	240	228	39	87	5	55
VTC Maximum phasing (Mechanical)			40	8	55	5

C

D

E

F

G

H

I

J

K

L

M

N

O

P

# SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[VR30DDTT]

## Drive Belt

INFOID:000000013607877

### DRIVE BELT

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

## Spark Plug

INFOID:000000013607878

### SPARK PLUG

Unit: mm (in)

Make	NGK
Standard type	DILKAR8K8G
Gap (Nominal)	0.8 (0.031)

## Intake Manifold Collector

INFOID:000000013607879

### INTAKE MANIFOLD COLLECTOR

Unit: mm (in)

Items		Limit
Surface distortion	Intake manifold collector	0.3 (0.012)

## Intake Manifold

INFOID:000000013607880

### INTAKE MANIFOLD

Unit: mm (in)

Items		Limit
Surface distortion	Intake manifold	0.3 (0.012)

## Turbocharger

INFOID:000000013607881

### TURBOCHARGER

Unit: mm (in)

Items		Limit
Surface distortion	Turbocharger	0.1 (0.004)

## Camshaft

INFOID:000000013607882

### CAMSHAFT

Unit: mm (in)

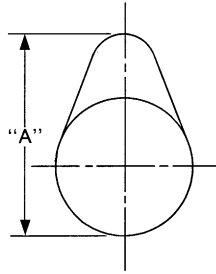
Items		Standard	Limit
Camshaft journal oil clearance	No. 1	0.045 - 0.086 (0.0018 - 0.0034)	0.150 (0.0059)
	No. 2, 3, 4	0.035 - 0.076 (0.0014 - 0.0030)	
Camshaft bracket inner diameter	No. 1	26.000 - 26.021 (1.0236 - 1.0244)	—
	No. 2, 3, 4	23.500 - 23.521 (0.9252 - 0.9260)	—
Camshaft journal diameter	No. 1	25.935 - 25.955 (1.0211 - 1.0218)	—
	No. 2, 3, 4	23.445 - 23.465 (0.9230 - 0.9238)	—
Camshaft end play		0.115 - 0.188 (0.0045 - 0.0074)	0.24 (0.0094)
Camshaft cam height "A"	Intake	44.565 - 44.755 (1.7545 - 1.7620)	0.2 (0.001)* <sup>1</sup>
	Exhaust	44.155 - 44.345 (1.7384 - 1.7459)	
	Pump	57.0 - 57.4 (2.244 - 2.260)	
Camshaft runout [TIR* <sup>2</sup> ]		Less than 0.02 (0.001)	0.05 (0.002)

# SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[VR30DDTT]

Camshaft sprocket runout [TIR* <sup>2</sup> ]	—	0.15 (0.0059)
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\*1: Cam wear limit

\*2: Total indicator reading

## VALVE LIFTER

Unit: mm (in)

Items	Standard
Valve lifter outer diameter	Intake 33.980 - 33.990 (1.3378 - 1.3382)
	Exhaust 29.977 - 29.987 (1.1802 - 1.1806)
Valve lifter hole diameter	Intake 34.000 - 34.016 (1.3386 - 1.3392)
	Exhaust 29.997 - 30.013 (1.1810 - 1.1816)
Valve lifter clearance	0.010 - 0.036 (0.0004 - 0.0014)

## VALVE CLEARANCE

Unit: mm (in)

Items	Cold	Hot* (reference data)
Intake	0.26 - 0.34 (0.010 - 0.013)	0.304 - 0.416 (0.012 - 0.016)
Exhaust	0.27 - 0.35 (0.011 - 0.014)	0.288 - 0.412 (0.011 - 0.016)

\*: Approximately 80°C (176°F)

## AVAILABLE VALVE LIFTER

Unit: mm (in)

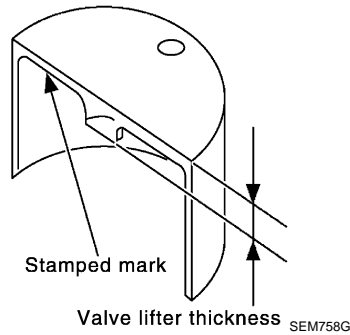
Identification mark		Thickness
Intake	Exhaust	Thickness
00FS / 00fS	300J / 300j	3.00 (0.1181)
02FS / 02fS	302J / 302j	3.02 (0.1189)
04FS / 04fS	304J / 304j	3.04 (0.1197)
06FS / 06fS	306J / 306j	3.06 (0.1205)
08FS / 08fS	308J / 308j	3.08 (0.1213)
10FS / 10fS	310J / 310j	3.10 (0.1220)
12FS / 12fS	312J / 312j	3.12 (0.1228)
14FS / 14fS	314J / 314j	3.14 (0.1236)
16FS / 16fS	316J / 316j	3.16 (0.1244)
18FS / 18fS	318J / 318j	3.18 (0.1252)
20FS / 20fS	320J / 320j	3.20 (0.1260)
22FS / 22fS	322J / 322j	3.22 (0.1268)
24FS / 24fS	324J / 324j	3.24 (0.1276)
26FS / 26fS	326J / 326j	3.26 (0.1283)

# SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[VR30DDTT]

Identification mark		Thickness
Intake	Exhaust	Thickness
28FS / 28fS	328J / 328j	3.28 (0.1291)
30FS / 30fS	330J / 330j	3.30 (0.1299)
32FS / 32fS	332J / 332j	3.32 (0.1307)
34FS / 34fS	334J / 334j	3.34 (0.1315)
36FS / 36fS	336J / 336j	3.36 (0.1323)
38FS / 38fS	338J / 338j	3.38 (0.1331)
40FS / 40fS	340J / 340j	3.40 (0.1339)
42FS / 42fS	342J / 342j	3.42 (0.1346)
44FS / 44fS	344J / 344j	3.44 (0.1354)
46FS / 46fS	346J / 346j	3.46 (0.1362)
48FS / 48fS	348J / 348j	3.48 (0.1370)
50FS / 50fS	350J / 350j	3.50 (0.1378)



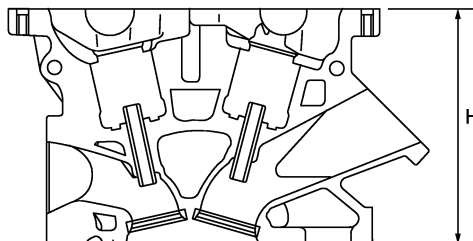
## Cylinder Head

INFOID:000000013607883

### CYLINDER HEAD

Unit: mm (in)

Items	Standard	Limit
Head surface distortion	Less than 0.03 (0.0012)	0.1 (0.004)
Normal cylinder head height "H"	126.4 (4.98)	—



PBIC0924E

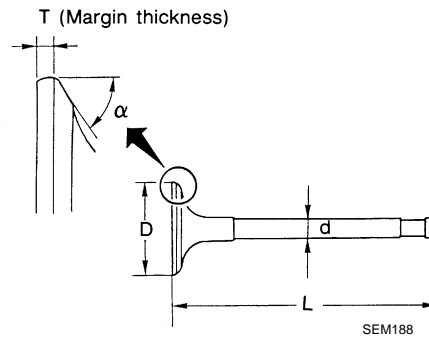
### VALVE DIMENSIONS

# SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[VR30DDTT]

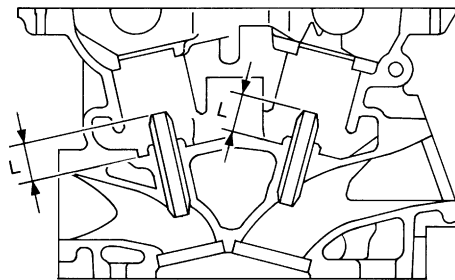
Unit: mm (in)



Valve head diameter "D"	Intake	33.2 - 33.5 (1.307 - 1.319)
	Exhaust	28.32 - 28.62 (1.115 - 1.126)
Valve length "L"	Intake	101.05 (3.9783)
	Exhaust	97.48 (3.8378)
Valve stem diameter "d"	Intake	5.465 - 5.480 (0.2152 - 0.2157)
	Exhaust	5.455 - 5.470 (0.2148 - 0.2154)
Valve seat angle " $\alpha$ "	Intake	45°15' - 45°45'
	Exhaust	
Valve margin "T"	Intake	1.1 (0.043)
	Exhaust	1.3 (0.051)
Valve margin "T" limit		0.5 (0.020)
Valve stem end surface grinding limit		0.2 (0.008)

## VALVE GUIDE

Unit: mm (in)



Items		Standard	Oversize (Service) [0.2 (0.008)]*
Valve guide	Outer diameter	9.523 - 9.534 (0.3749 - 0.3754)	9.723 - 9.734 (0.3828 - 0.3832)*
	Inner diameter (Finished size)	5.500 - 5.518 (0.2165 - 0.2172)	
Cylinder head valve guide hole diameter		9.475 - 9.496 (0.3730 - 0.3739)	10.175 - 10.196 (0.4006 - 0.4014)*
Interference fit of valve guide		0.027 - 0.059 (0.0011 - 0.0023)	
Items		Standard	Limit
Valve guide clearance	Intake	0.020 - 0.053 (0.0008 - 0.0021)	0.08 (0.0031)
	Exhaust	0.030 - 0.063 (0.0012 - 0.0025)	0.09 (0.0035)
Projection length "L"		12.6 - 12.8 (0.496 - 0.504)	

\*: Parts settings are for exhaust side only

## VALVE SEAT





# SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[VR30DDTT]

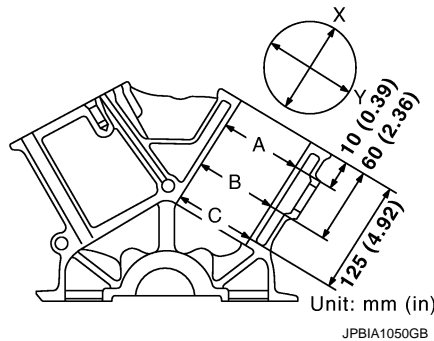
Items	Limit	
	Intake	Exhaust
Out-of-square	1.8 mm (0.071 in)	2.2 mm (0.087 in)

## Cylinder Block

INFOID:000000013607884

## CYLINDER BLOCK

Unit: mm (in)



Unit: mm (in)

JPBIA1050GB

Surface flatness		Standard	Less than 0.03 (0.0012)	
		Limit	0.1 (0.004)	
Main bearing housing inner diameter		Standard	69.993 - 70.017 (2.7556 - 2.7566)	
Cylinder bore	Inner diameter	Standard	Grade No. 1	86.000 - 86.010 (3.3858 - 3.3862)
			Grade No. 2	86.010 - 86.020 (3.3862 - 3.3866)
		Wear limit	0.2 (0.008)	
Out-of-round		Limit	0.015 (0.0006)	
Taper			0.010 (0.0004)	
Main bearing housing inner diameter grade (Without bearing)		Grade No. A	69.993 - 69.994 (2.7556 - 2.7557)	
		Grade No. B	69.994 - 69.995 (2.7557 - 2.7557)	
		Grade No. C	69.995 - 69.996 (2.7557 - 2.7557)	
		Grade No. D	69.996 - 69.997 (2.7557 - 2.7558)	
		Grade No. E	69.997 - 69.998 (2.7558 - 2.7558)	
		Grade No. F	69.998 - 69.999 (2.7558 - 2.7559)	
		Grade No. G	69.999 - 70.000 (2.7559 - 2.7559)	
		Grade No. H	70.000 - 70.001 (2.7559 - 2.7559)	
		Grade No. J	70.001 - 70.002 (2.7559 - 2.7560)	
		Grade No. K	70.002 - 70.003 (2.7560 - 2.7560)	
		Grade No. L	70.003 - 70.004 (2.7560 - 2.7561)	
		Grade No. M	70.004 - 70.005 (2.7561 - 2.7561)	
		Grade No. N	70.005 - 70.006 (2.7561 - 2.7561)	
		Grade No. P	70.006 - 70.007 (2.7561 - 2.7562)	
		Grade No. R	70.007 - 70.008 (2.7562 - 2.7562)	
		Grade No. S	70.008 - 70.009 (2.7562 - 2.7563)	
		Grade No. T	70.009 - 70.010 (2.7563 - 2.7563)	
Grade No. U	70.010 - 70.011 (2.7563 - 2.7563)			
Grade No. V	70.011 - 70.012 (2.7563 - 2.7564)			
Grade No. W	70.012 - 70.013 (2.7564 - 2.7564)			
Grade No. X	70.013 - 70.014 (2.7564 - 2.7565)			
Grade No. Y	70.014 - 70.015 (2.7565 - 2.7565)			
Grade No. 4	70.015 - 70.016 (2.7565 - 2.7565)			
Grade No. 7	70.016 - 70.017 (2.7565 - 2.7566)			
Difference in inner diameter between cylinders		Standard	Less than 0.03 (0.0012)	

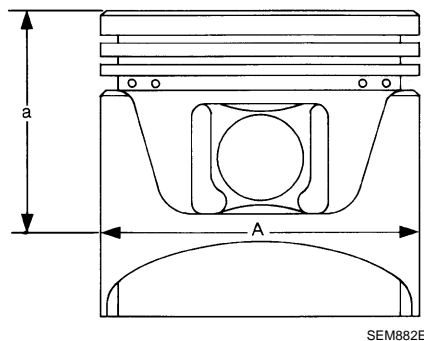
## AVAILABLE PISTON

# SERVICE DATA AND SPECIFICATIONS (SDS)

[VR30DDTT]

< SERVICE DATA AND SPECIFICATIONS (SDS)

Unit: mm (in)



Items		Standard	Limit
Piston skirt diameter "A"	Grade No. 1	85.970 - 85.980 (3.3846 - 3.3850)	—
	Grade No. 2	85.980 - 85.990 (3.3850 - 3.3854)	—
	Service	—	—
Items		Standard	Limit
"a" dimension		38.00 (1.4961)	—
Piston pin hole diameter		22.995 - 22.999 (0.9053 - 0.9055)	—
Piston to cylinder bore clearance		0.020 - 0.040 (0.0008 - 0.0016)	0.08 (0.0031)

## PISTON RING

Unit: mm (in)

Items		Standard	Limit
Side clearance	Top	0.045 - 0.080 (0.0020 - 0.0031)	0.11 (0.0043)
	2nd	0.030 - 0.070 (0.0012 - 0.0028)	0.10 (0.0039)
	Oil ring	0.045 - 0.125 (0.0018 - 0.0049)	—
End gap	Top	0.21 - 0.26 (0.0083 - 0.010)	0.50 (0.020)
	2nd	0.32 - 0.47 (0.0126 - 0.0185)	0.62 (0.024)
	Oil (rail ring)	0.20 - 0.50 (0.0079 - 0.0197)	0.80 (0.031)

## PISTON PIN

Unit: mm (in)

Items		Standard	Limit
Piston pin outer diameter		22.989 - 22.993 (0.9051 - 0.9052)	—
Piston to piston pin oil clearance		0.002 - 0.010 (0.0001 - 0.0004)	—
Connecting rod bushing oil clearance		0.007 - 0.017 (0.0003 - 0.0007)	0.030 (0.0012)

## CONNECTING ROD

Unit: mm (in)

Items		Standard	Limit
Center distance		151.75 - 151.85 (5.97 - 5.98)	—
Bend [per 100 (3.94)]		—	0.15 (0.0059)
Torsion [per 100 (3.94)]		—	0.30 (0.0118)
Connecting rod bushing inner diameter*		23.000 - 23.006 (0.9055 - 0.9057)	—

# SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

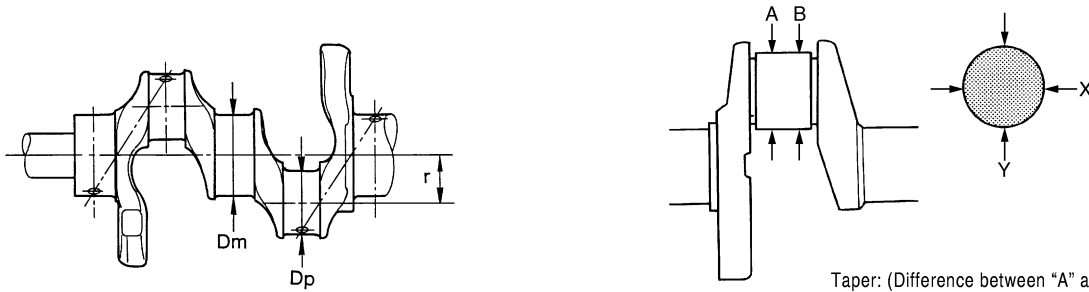
[VR30DDTT]

Connecting rod big end diameter (Without bearing)	Grade No. A	57.000 - 57.001 (2.2441 - 2.2441)	—
	Grade No. B	57.001 - 57.002 (2.2441 - 2.2442)	—
	Grade No. C	57.002 - 57.003 (2.2442 - 2.2442)	—
	Grade No. D	57.003 - 57.004 (2.2442 - 2.2442)	—
	Grade No. E	57.004 - 57.005 (2.2442 - 2.2443)	—
	Grade No. F	57.005 - 57.006 (2.2443 - 2.2443)	—
	Grade No. G	57.006 - 57.007 (2.2443 - 2.2444)	—
	Grade No. H	57.007 - 57.008 (2.2444 - 2.2444)	—
	Grade No. J	57.008 - 57.009 (2.2444 - 2.2444)	—
	Grade No. K	57.009 - 57.010 (2.2444 - 2.2445)	—
	Grade No. L	57.010 - 57.011 (2.2445 - 2.2445)	—
	Grade No. M	57.011 - 57.012 (2.2445 - 2.2446)	—
	Grade No. N	57.012 - 57.013 (2.2446 - 2.2446)	—
Side clearance	0.20 - 0.35 (0.0079 - 0.0138)	0.40 (0.0157)	

\*: After installing in connecting rod

## CRANKSHAFT

Unit: mm (in)



SEM645

SBIA0535E

Main journal diameter. "Dm" grade	Standard	Grade No. A	64.975 - 64.974 (2.5581 - 2.5580)
		Grade No. B	64.974 - 64.973 (2.5580 - 2.5580)
		Grade No. C	64.973 - 64.972 (2.5580 - 2.5579)
		Grade No. D	64.972 - 64.971 (2.5579 - 2.5579)
		Grade No. E	64.971 - 64.970 (2.5579 - 2.5579)
		Grade No. F	64.970 - 64.969 (2.5579 - 2.5578)
		Grade No. G	64.969 - 64.968 (2.5578 - 2.5578)
		Grade No. H	64.968 - 64.967 (2.5578 - 2.5578)
		Grade No. J	64.967 - 64.966 (2.5578 - 2.5577)
		Grade No. K	64.966 - 64.965 (2.5577 - 2.5577)
		Grade No. L	64.965 - 64.964 (2.5577 - 2.5576)
		Grade No. M	64.964 - 64.963 (2.5576 - 2.5576)
		Grade No. N	64.963 - 64.962 (2.5576 - 2.5576)
		Grade No. P	64.962 - 64.961 (2.5576 - 2.5575)
		Grade No. R	64.961 - 64.960 (2.5575 - 2.5575)
		Grade No. S	64.960 - 64.959 (2.5575 - 2.5574)
		Grade No. T	64.959 - 64.958 (2.5574 - 2.5574)
		Grade No. U	64.958 - 64.957 (2.5574 - 2.5574)
		Grade No. V	64.957 - 64.956 (2.5574 - 2.5573)
		Grade No. W	64.956 - 64.955 (2.5573 - 2.5573)
Grade No. X	64.955 - 64.954 (2.5573 - 2.5572)		
Grade No. Y	64.954 - 64.953 (2.5572 - 2.5572)		
Grade No. 4	64.953 - 64.952 (2.5572 - 2.5572)		
Grade No. 7	64.952 - 64.951 (2.5572 - 2.5571)		

# SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[VR30DDTT]

Pin journal diameter. "Dp" grade	Standard	Grade No. A	53.974 - 53.973 (2.1250 - 2.1249)
		Grade No. B	53.973 - 53.972 (2.1249 - 2.1249)
		Grade No. C	53.972 - 53.971 (2.1249 - 2.1248)
		Grade No. D	53.971 - 53.970 (2.1248 - 2.1248)
		Grade No. E	53.970 - 53.969 (2.1248 - 2.1248)
		Grade No. F	53.969 - 53.968 (2.1248 - 2.1247)
		Grade No. G	53.968 - 53.967 (2.1247 - 2.1247)
		Grade No. H	53.967 - 53.966 (2.1247 - 2.1246)
		Grade No. J	53.966 - 53.965 (2.1246 - 2.1246)
		Grade No. K	53.965 - 53.964 (2.1246 - 2.1246)
		Grade No. L	53.964 - 53.963 (2.1246 - 2.1245)
		Grade No. M	53.963 - 53.962 (2.1245 - 2.1245)
		Grade No. N	53.962 - 53.961 (2.1245 - 2.1244)
		Grade No. P	53.961 - 53.960 (2.1244 - 2.1244)
		Grade No. R	53.960 - 53.959 (2.1244 - 2.1244)
		Grade No. S	53.959 - 53.958 (2.1244 - 2.1243)
		Grade No. T	53.958 - 53.957 (2.1243 - 2.1243)
Grade No. U	53.957 - 53.956 (2.1243 - 2.1242)		
Center distance "r"		42.96 - 43.04 (1.6913 - 1.6945)	
Taper (Difference between "A" and "B")	Limit	0.0025 (0.0001)	
Out-of-round (Difference between "X" and "Y")		0.0025 (0.0001)	
Crankshaft runout [TIR*]	Standard	Less than 0.05 (0.002)	
	Limit	0.10 (0.0039)	
Crankshaft end play	Standard	0.10 - 0.25 (0.0039 - 0.0098)	
	Limit	0.30 (0.0118)	

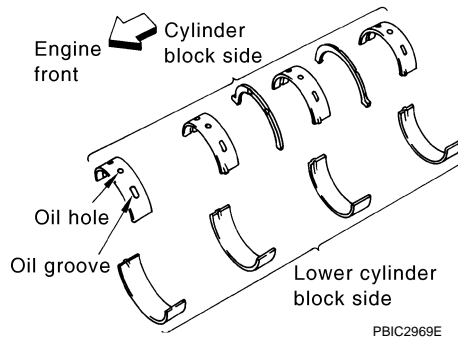
\*: Total indicator reading

## Main Bearing

INFOID:000000013607885

## MAIN BEARING

Unit: mm (in)



Grade number	Thickness	Width	Identification color	Remarks
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# SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[VR30DDTT]

0		2.500 - 2.503 (0.0984 - 0.0985)	19.9 - 20.1 (0.783 - 0.791)	Black - Black	Grade is the same for upper and lower bearings.	
1		2.503 - 2.506 (0.0985 - 0.0987)		Brown - Brown		A
2		2.506 - 2.509 (0.0987 - 0.0988)		Green - Green		EM
3		2.509 - 2.512 (0.0988 - 0.0989)		Yellow - Yellow		
4		2.512 - 2.515 (0.0989 - 0.0990)		Blue - Blue		
5		2.515 - 2.518 (0.0990 - 0.0991)		Pink - Pink		C
6		2.518 - 2.521 (0.0991 - 0.0993)		Purple - Purple		
7		2.521 - 2.524 (0.0993 - 0.0994)		White - White	D	
01	UPR	2.503 - 2.506 (0.0985 - 0.0987)		Brown - Brown	Grade and color are different for upper and lower bearings.	E
	LWR	2.500 - 2.503 (0.0984 - 0.0985)		Black - Black		F
12	UPR	2.506 - 2.509 (0.0987 - 0.0988)		Green - Green		G
	LWR	2.503 - 2.506 (0.0985 - 0.0987)		Brown - Brown		H
23	UPR	2.509 - 2.512 (0.0988 - 0.0989)		Yellow - Yellow		I
	LWR	2.506 - 2.509 (0.0987 - 0.0988)		Green - Green		J
34	UPR	2.512 - 2.515 (0.0989 - 0.0990)	Blue - Blue	K		
	LWR	2.509 - 2.512 (0.0988 - 0.0989)	Yellow - Yellow	L		
45	UPR	2.515 - 2.518 (0.0990 - 0.0991)	Pink - Pink	M		
	LWR	2.512 - 2.515 (0.0989 - 0.0990)	Blue - Blue	N		
56	UPR	2.518 - 2.521 (0.0991 - 0.0993)	Purple - Purple	O		
	LWR	2.515 - 2.518 (0.0990 - 0.0991)	Pink - Pink	P		
67	UPR	2.521 - 2.524 (0.0993 - 0.0994)	White - White	A		
	LWR	2.518 - 2.521 (0.0991 - 0.0993)	Purple - Purple	B		

## UNDERSIZE

Unit: mm (in)

Items	Thickness	Main journal diameter
0.25 (0.0098)	2.633 - 2.641 (0.1037 - 0.1040)	Grind so that bearing clearance is the specified value.

## MAIN BEARING OIL CLEARANCE

Unit: mm (in)

Items	Standard	Limit
Main bearing oil clearance	0.028 - 0.043 (0.0011 - 0.0017)*	0.056 (0.0022)

\*: Actual clearance

## Connecting Rod Bearing

INFOID:0000000013607886

## CONNECTING ROD BEARING

Unit: mm (in)

Grade number		Thickness	Identification color (mark)
0	UPR	1.467 - 1.500 (0.0589 - 0.0591)	Black
	LWR		Black - Black
1	UPR	1.500 - 1.503 (0.0591 - 0.0592)	Brown
	LWR		Brown - Brown
2	UPR	1.503 - 1.506 (0.0592 - 0.0593)	Green
	LWR		Green - Green
3	UPR	1.506 - 1.509 (0.0593 - 0.0594)	Yellow
	LWR		Yellow - Yellow

# SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[VR30DDTT]

4	UPR	1.509 - 1.512 (0.0594 - 0.0595)	Blue
	LWR		Blue - Blue

## UNDERSIZE

Unit: mm (in)

Items	Thickness	Crank pin journal diameter
0.25 (0.0098)	1.626 - 1.634 (0.0640 - 0.0643)	Grind so that bearing clearance is the specified value.

## CONNECTING ROD BEARING OIL CLEARANCE

Unit: mm (in)

Items	Standard	Limit
Connecting rod bearing oil clearance	0.036 - 0.050 (0.0014 - 0.0020)*	0.05 (0.0020)

\*: Actual clearance