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PRECAUTION

PRECAUTIONS

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

INFOID:0000000010783657

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. 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, all maintenance must be performed by an authorized NISSAN/INFINITI dealer.
- Improper maintenance, 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, and wait at least 3 minutes before performing any service.

Precaution Necessary for Steering Wheel Rotation After Battery Disconnect

INFOID:0000000010783658

CAUTION:

Comply with the following cautions to prevent any error and malfunction.

- Before removing and installing any control units, first turn the ignition power source and accessory power source to the OFF, then disconnect both battery cables.
- After finishing work, confirm that all control unit connectors are connected properly, then re-connect both battery cables.
- Always use CONSULT to perform self-diagnosis as a part of each function inspection after finishing work. If a DTC is detected, perform trouble diagnosis according to self-diagnosis results.

For vehicle with steering lock unit, if the battery is disconnected or discharged, the steering wheel will lock and cannot be turned.

If turning the steering wheel is required with the battery disconnected or discharged, follow the operation procedure below before starting the repair operation.

OPERATION PROCEDURE

1. Connect both battery cables.

NOTE:

Supply power using jumper cables if battery is discharged.

2. Open driver door.
3. Turn the ignition switch to the ON position.
(At this time, the steering lock will be released.)
4. Turn the ignition switch to OFF position with driver door open.
5. Wait for 3 minutes or longer with driver door open.

NOTE:

- Do not close driver door because the steering wheel locks when driver door is closed.

PRECAUTIONS

[MR20DD]

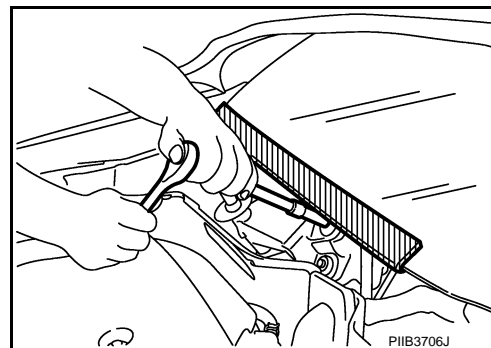
< PRECAUTION >

- The auto acc function is adapted to this vehicle. For this reason, even when the ignition switch is turned to OFF position, the accessory power source does not turned OFF and continues to be supplied for a certain amount of time.
6. Disconnect both battery cables. The steering lock will remain released with both battery cables disconnected and the steering wheel can be turned.
 7. Perform the necessary repair operation.
 8. When the repair work is completed, re-connect both battery cables. With the brake pedal released, turn the ignition switch from OFF position to ON position, then to LOCK position. (The steering wheel will lock when the ignition switch is turned to LOCK position.)
 9. Perform self-diagnosis check of all control units using CONSULT.

Precaution for Procedure without Cowl Top Cover

INFOID:0000000010783659

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 Handling High Pressure Fuel System

INFOID:0000000010783660

- 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.

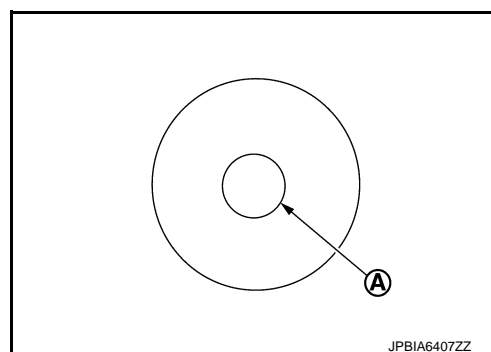
Special Cautions to Ensure the Safe Disposal of Sodium-filled Valves

INFOID:0000000010783661

Handling and disposal of sodium-filled valves requires special care and consideration. Under conditions such as breakage with subsequent contact with water, metal sodium which lines the inner portion of valve will react violently, forming sodium hydroxide and hydrogen which may result in an explosion. Sodium-filled valve is identified on the top of its stem as shown in illustration.

Identification mark of sodium-filled valve (A)

Intake	: 4BA
Exhaust	: 4BB



DEALER DISPOSAL INSTRUCTIONS

CAUTION:

- Use approved shatter-resistant eye protection when performing this procedure.
- Perform this and all subsequent disposal work procedures in an open room, away from flammable liquids. Keep a fire extinguisher, rated at least 10 ABC, in close proximity to the work area.
- Be sure to wear rubber gloves when performing the following operations.
- Make sure the resultant (high alkalinity) waste water does not contact your skin. If the waste water does contact you, wash the contacted area immediately with large quantities of water.
- Dealers should check their respective state and local regulations concerning any chemical treatment or waste water discharge permits which may be required to dispose of the resultant (high alkalinity) waste water.

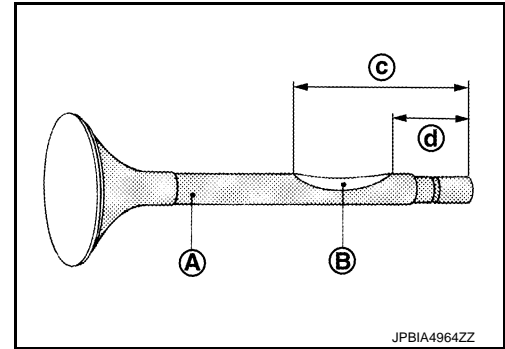
PRECAUTIONS

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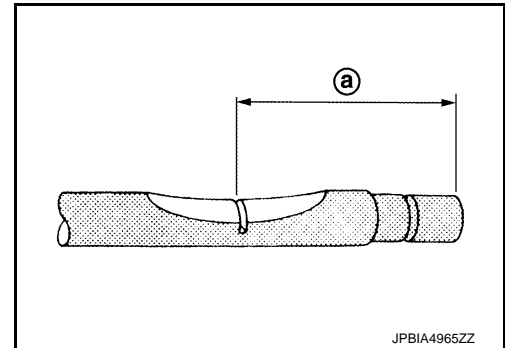
1. Clamp valve stem in a vice.
2. The valve has a specially-hardened surface. To cut through it, first remove a half-round section, approximately 30 mm (1.18 in) long using air-powered grinder until black color is removed and silver color appears.

- A : Black color
 B : Silver color
 c : 47 mm (1.85 in)
 d : 17 mm (0.67 in)

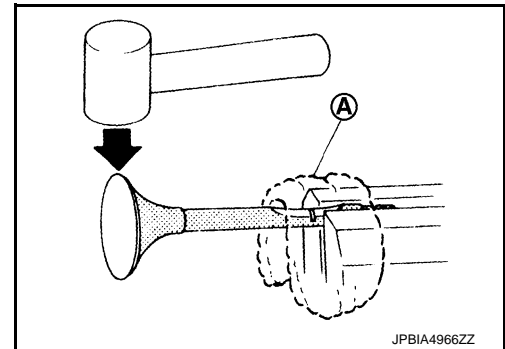


3. Use hacksaw to cut through approximately half the diameter of valve stem. Make the serration at a point 40 mm (1.57 in) from the end of valve stem.

- a : 32 mm (1.26 in)

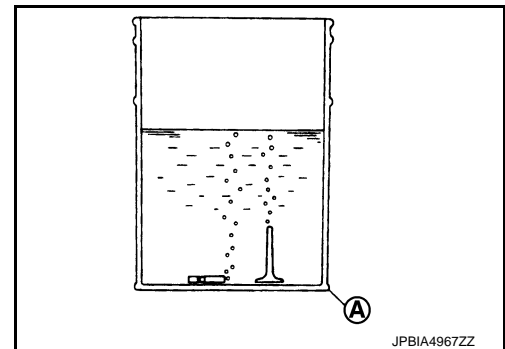


4. Cover the serrated end of the valve with a large shop towel (A). Strike the valve face end with a hammer, separating it into two pieces.
5. Fill a bucket (such as a 20 ℓ oil can) with at least 10 ℓ (2-1/4 Imp gal) of water. Carefully place the already cut (serrated) valves into the water one-at-a-time using a set of large tweezers and quickly move away at least 2.7 m (9 ft).



6. The valves should be placed in a standing position as shown in the illustration to allow complete reaction. After the bubbling action has subsided, additional valves can be placed into the bucket allowing each subsequent chemical reaction to subside. However, no more than 8 valves should be placed in the same 10 ℓ (2-1/4 Imp gal) amount of water. The complete chemical reaction may take as long as 4 to 5 hours. Remove the valves using a set of large tweezers after the chemical reaction has stopped. Afterwards, valves can be disposed as ordinary scrap.

- A : Bucket (Such as 20 ℓ oil can)



Precautions For Engine Service

INFOID:000000010783662

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

PRECAUTIONS

[MR20DD]

< PRECAUTION >

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:0000000010783663

- 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.

Liquid Gasket

INFOID:0000000010783664

REMOVAL OF LIQUID GASKET SEALING

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

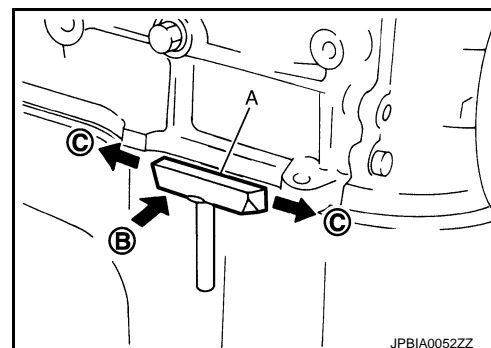
CAUTION:

Be careful not to 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, use a plastic hammer to lightly tap the parts, to remove it.

CAUTION:

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



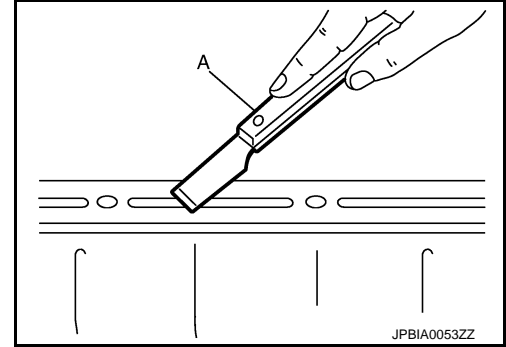
PRECAUTIONS

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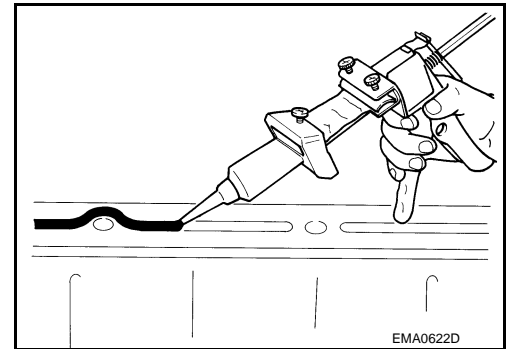
< PRECAUTION >

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 breaks to the specified location with the specified dimensions.
 - If there is a groove for liquid gasket application, apply liquid gasket to the groove.

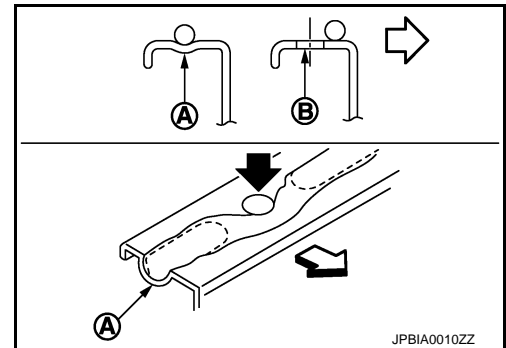


- As for bolt holes ⑥, normally apply liquid gasket inside the holes. Occasionally, it should be applied outside the holes. Check to read the text of this manual.

⑥ : 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:000000010784538

- With the adoption of Auto ACC function, ACC power is automatically supplied by operating the intelligent key or remote keyless entry or by opening/closing the driver side door. In addition, ACC power is supplied even after the ignition switch is turned to the OFF position, i.e. ACC power is supplied for a certain fixed time.
- When disconnecting the 12V battery terminal, turn off the ACC power before disconnecting the 12V battery terminal, observing "How to disconnect 12V battery terminal" described below.

NOTE:

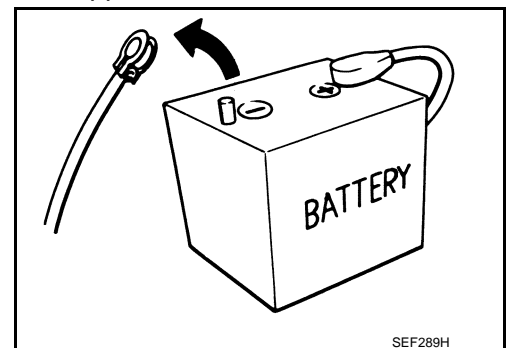
Some ECUs operate for a certain fixed time even after ignition switch is turned OFF and ignition power supply is stopped. If the battery terminal is disconnected before ECU stops, accidental DTC detection or ECU data damage may occur.

- For vehicles with the 2-batteries, be sure to connect the main battery and the sub battery before turning ON the ignition switch.

NOTE:

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

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



< PRECAUTION >

NOTE:

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

A

HOW TO DISCONNECT 12V BATTERY TERMINAL

Disconnect 12V battery terminal according to Instruction 1 or Instruction 2 described below.

For vehicles parked by ignition switch OFF, refer to Instruction 2.

EM

INSTRUCTION 1

1. Open the hood.
2. Turn key switch to the OFF position with the driver side door opened.
3. Get out of the vehicle and close the driver side door.
4. Wait at least 3 minutes. For vehicle with the engine listed below, remove the battery terminal after a lapse of the specified time.

C

D4D engine : 20 minutes

HRA2DDT : 12 minutes

K9K engine : 4 minutes

M9R engine : 4 minutes

R9M engine : 4 minutes

V9X engine : 4 minutes

E

F

CAUTION:

While waiting, never operate the vehicle such as locking, opening, and closing doors. Violation of this caution results in the activation of ACC power supply according to the Auto ACC function.

G

5. Remove 12V battery terminal.

H

CAUTION:

After installing 12V battery, always check self-diagnosis results of all ECUs and erase DTC.

INSTRUCTION 2 (FOR VEHICLES PARKED BY IGNITION SWITCH OFF)

I

1. Unlock the door with intelligent key or remote keyless entry.

NOTE:

At this moment, ACC power is supplied.

J

2. Open the driver side door.
3. Open the hood.
4. Close the driver side door.
5. Wait at least 3 minutes.

K

CAUTION:

While waiting, never operate the vehicle such as locking, opening, and closing doors. Violation of this caution results in the activation of ACC power supply according to the Auto ACC function.

L

6. Remove 12V battery terminal.

CAUTION:

After installing 12V battery, always check self-diagnosis results of all ECUs and erase DTC.

M

N

O

P

PREPARATION

< PREPARATION >

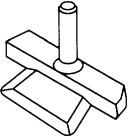
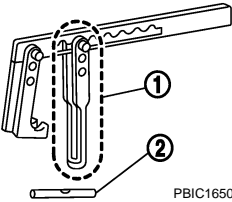
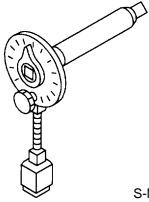
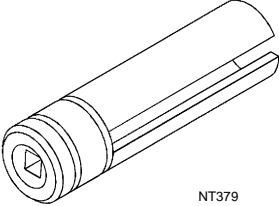
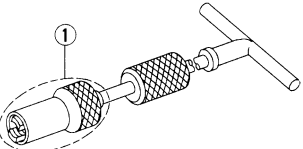
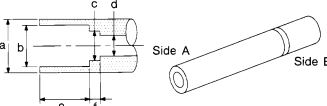
[MR20DD]

PREPARATION

PREPARATION

Special Service Tools

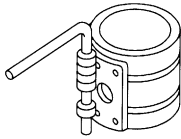
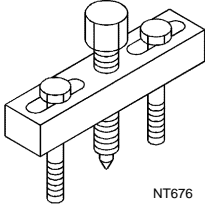
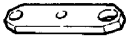
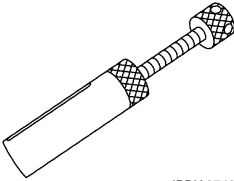
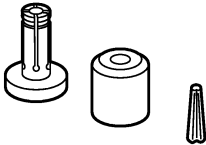
INFOID:0000000010783666

Tool number Tool name		Description
KV10111100 Seal cutter	 S-NT046	Removing oil pan (upper and lower) etc.
KV10116200 Valve spring compressor Attachment 1. KV10115900 2. KV10109220 Adapter	 PBIC1650E	Disassembling and assembling valve mechanism Part ① is a component of KV10116200, but Part ② is not so.
KV10112100 Angle wrench	 S-NT014	Tightening bolts for main bearing cap, cylinder head, etc.
KV10117100 Heated oxygen sensor wrench	 NT379	Loosening or tightening heated oxygen sensor 1 For 22 mm (0.87 in) width hexagon nut
KV10107902 Valve oil seal puller ① KV10116100 Valve oil seal puller adapter	 S-NT605	Removing valve oil seal
KV10115600 Valve oil seal drift	 S-NT603	Installing valve oil seal Use side A. a: 20 (0.79) dia. d: 8 (0.31) dia. b: 13 (0.51) dia. e: 10.7 (0.421) c: 10.3 (0.406) dia. f: 5 (0.20) Unit: mm (in)

PREPARATION

< PREPARATION >

[MR20DD]

Tool number Tool name	Description
EM03470000 Piston ring compressor	Installing piston assembly into cylinder bore
 S-NT044	
KV11103000 Pulley puller	Removing crankshaft pulley
 NT676	
KV11105210 Stopper plate	Fixing drive plate and flywheel
 ZZA0009D	
KV10119600 Injector remover	Removing fuel injector
 JPBIA3746ZZ	
KV101197S0 Injector seal drift set	Installing fuel injector seal ring
 JPBIA3281ZZ	

A

EM

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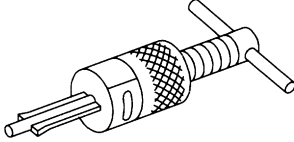
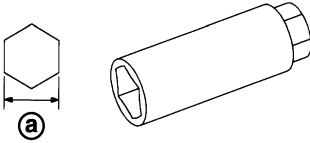

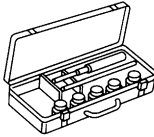
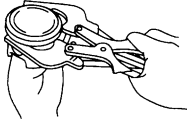
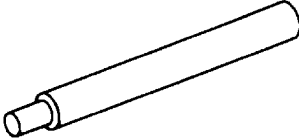
PREPARATION

< PREPARATION >

[MR20DD]

Commercial Service Tools

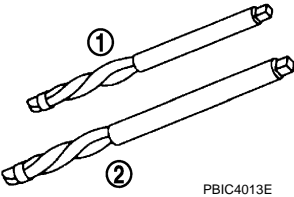
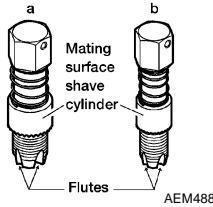
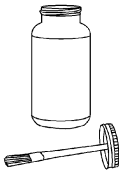
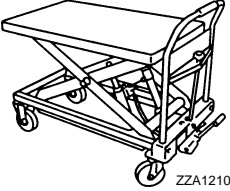
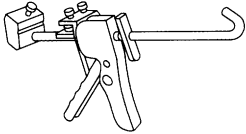
INFOID:0000000010783667

Tool name	Description
Pilot bushing puller  S-NT045	Removing pilot converter
Spark plug wrench  JPBIA0399ZZ	Removing and installing spark plug (a): 14 mm (0.55 in)
Pulley holder  ZZA1010D	Crankshaft pulley removing and installing
Valve seat cutter set  S-NT048	Finishing valve seat dimensions
Piston ring expander  S-NT030	Removing and installing piston ring
Valve guide drift  PBIC4012E	Removing and installing valve guide

PREPARATION

< PREPARATION >

[MR20DD]

Tool name	Description
Valve guide reamer 	① Reaming valve guide inner hole ② Reaming hole for oversize valve guide
Oxygen sensor thread cleaner 	Reconditioning the exhaust system threads before installing a new heated oxygen sensor (Use with anti-seize lubricant shown below.) a: 18 mm (0.71 in) dia. for zirconia heated oxygen sensor b: 12 mm (0.47 in) dia. for titania heated oxygen sensor
Anti-seize lubricant (Permatex 133AR or equivalent meeting MIL specification MIL-A-907) 	Lubricating oxygen sensor thread cleaning tool when reconditioning exhaust system threads
Manual lift table caddy 	Removing and installing engine
Tube presser 	Pressing the tube of liquid gasket

Lubricant or/and Sealant

INFOID:0000000010783668

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

BASIC INSPECTION

CAMSHAFT VALVE CLEARANCE

Inspection and Adjustment

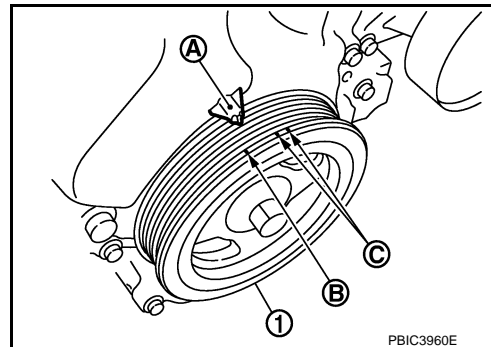
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INSPECTION

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.

1. Remove rocker cover. Refer to [EM-54, "Exploded View"](#).
2. Measure the valve clearance with the following procedure:
 - a. Set No. 1 cylinder at TDC of its compression stroke.
 - Rotate crankshaft pulley ① clockwise and align TDC mark (no paint) ② to timing indicator ③ on front cover.

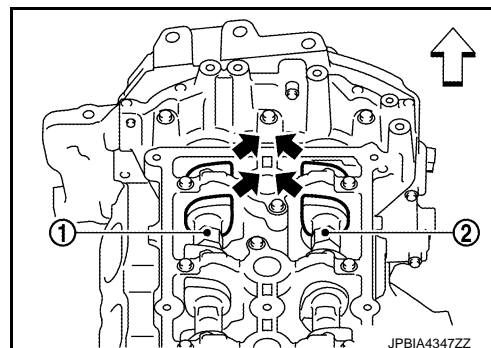
③ : White paint mark (Not use for service)



- At the same time, check that both intake and exhaust cam noses of No. 1 cylinder face inside (←) as shown in the figure.

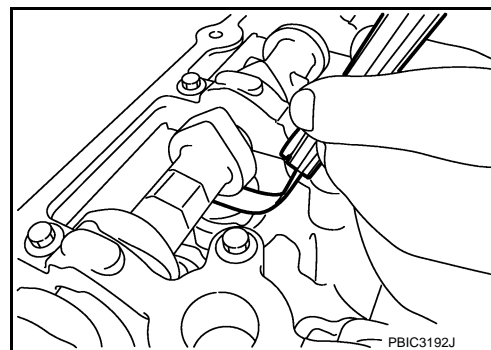
- ① : Camshaft (INT)
- ② : Camshaft (EXH)
- ← : Engine front

- If they do not face inside, rotate crankshaft pulley once more (360 degrees) and align as shown in the figure.



- b. Using a feeler gauge, measure the clearance between valve lifter and camshaft.

Valve clearance : Refer to [EM-133, "Camshaft"](#).



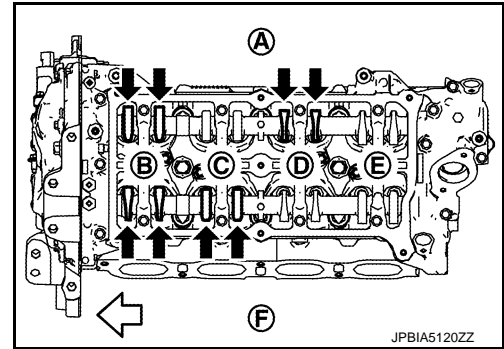
CAMSHAFT VALVE CLEARANCE

[MR20DD]

< BASIC INSPECTION >

- By referring to the figure, measure the valve clearances at locations marked "x" as shown in the table below [locations indicated with black arrow (↖) in the figure] with a feeler gauge.

- (A) : Exhaust side
 (B) : No. 1 cylinder
 (C) : No. 2 cylinder
 (D) : No. 3 cylinder
 (E) : No. 4 cylinder
 (F) : Intake side
 ↖ : Engine front



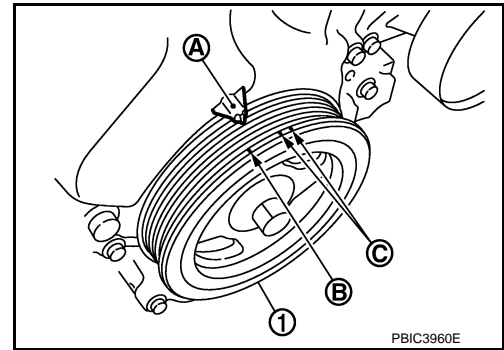
JPBIA5120ZZ

Measuring position		No. 1 CYL.	No. 2 CYL.	No. 3 CYL.	No. 4 CYL.
No. 1 cylinder at compression TDC	EXH	x		x	
	INT	x	x		

- c. Set No. 4 cylinder at TDC of its compression stroke.

- Rotate crankshaft pulley ① one revolution (360 degrees) and align TDC mark (no paint) (B) to timing indicator (A) on front cover.

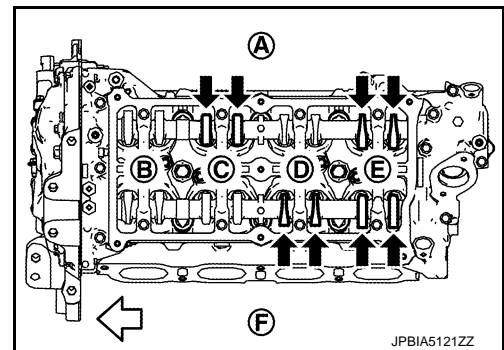
- (C) : White paint mark (Not use for service)



PBIC3960E

- By referring to the figure, measure the valve clearance at locations marked "x" as shown in the table below [locations indicated with black arrow (↖) in the figure] with a feeler gauge.

- (A) : Exhaust side
 (B) : No. 1 cylinder
 (C) : No. 2 cylinder
 (D) : No. 3 cylinder
 (E) : No. 4 cylinder
 (F) : Intake side
 ↖ : Engine front



JPBIA5121ZZ

Measuring position		No. 1 CYL.	No. 2 CYL.	No. 3 CYL.	No. 4 CYL.
No. 4 cylinder at compression TDC	EXH		x		x
	INT			x	x

3. If out of standard, perform adjustment. Refer to "ADJUSTMENT".

ADJUSTMENT

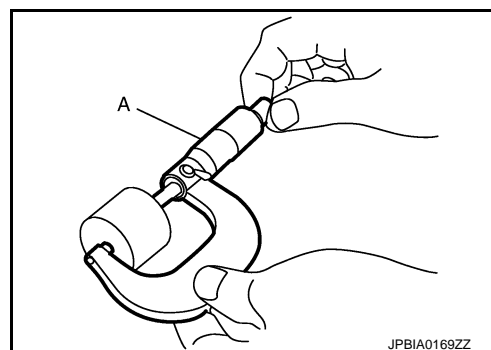
- Perform adjustment depending on selected head thickness of valve lifter.
- Remove camshaft. Refer to [EM-80, "Exploded View"](#).
 - Remove valve lifters at the locations that are out of the standard.

CAMSHAFT VALVE CLEARANCE

[MR20DD]

< BASIC INSPECTION >

3. Measure the center thickness of the removed valve lifters with a micrometer (A).



4. 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

t₁ = Removed valve lifter thickness

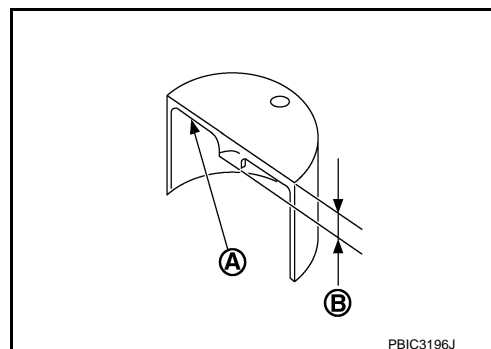
C₁ = Measured valve clearance

C₂ = Standard valve clearance:

Intake : 0.28 mm (0.011 in)

Exhaust : 0.30 mm (0.012 in)

- Thickness of new valve lifter ② can be identified by stamp mark ① on the reverse side (inside the cylinder).
- Stamp mark "302H" indicates 3.02 mm (0.1189 in) in thickness.



NOTE:

Available thickness of valve lifter: 26 sizes 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-133, "Camshaft"](#).

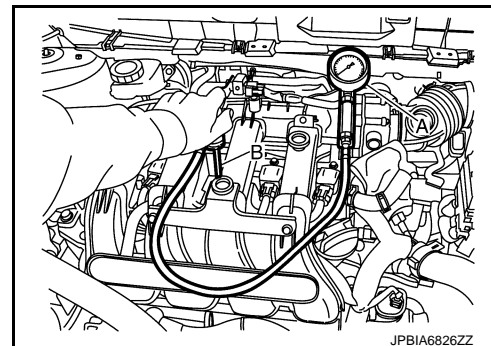
5. Install the selected valve lifter.
6. Install camshaft. Refer to [EM-80, "Exploded View"](#).
7. Install timing chain and related parts. Refer to [EM-67, "Exploded View"](#).
8. Manually rotate crankshaft pulley a few rotations.
9. Check that the valve clearances is within the standard. Refer to "INSPECTION".
10. Install remaining parts in the reverse order of removal.
11. Warm up the engine, and check for unusual noise and vibration.

COMPRESSION PRESSURE

Inspection

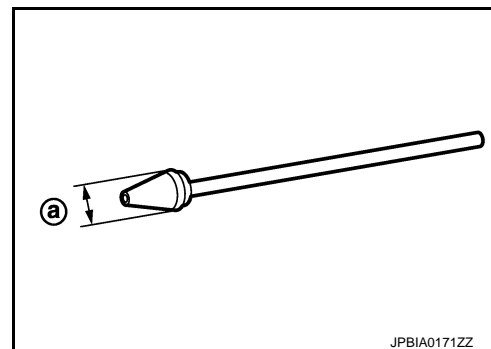
INFOID:000000010783670

1. Warm up engine thoroughly. Then, stop it.
2. Release the fuel pressure. Refer to [EC-152, "Work Procedure"](#).
3. Remove ignition coil and spark plug from each cylinder. Refer to [EM-54, "Exploded View"](#).
4. Connect engine tachometer (not required in use of CONSULT).
5. Install compression gauge (A) with an adapter (B) (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.

(a) : 20 mm (0.79 in)



6. 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-132, "General Specification"](#).

CAUTION:

Always use a fully charged battery to obtain the specified engine speed.

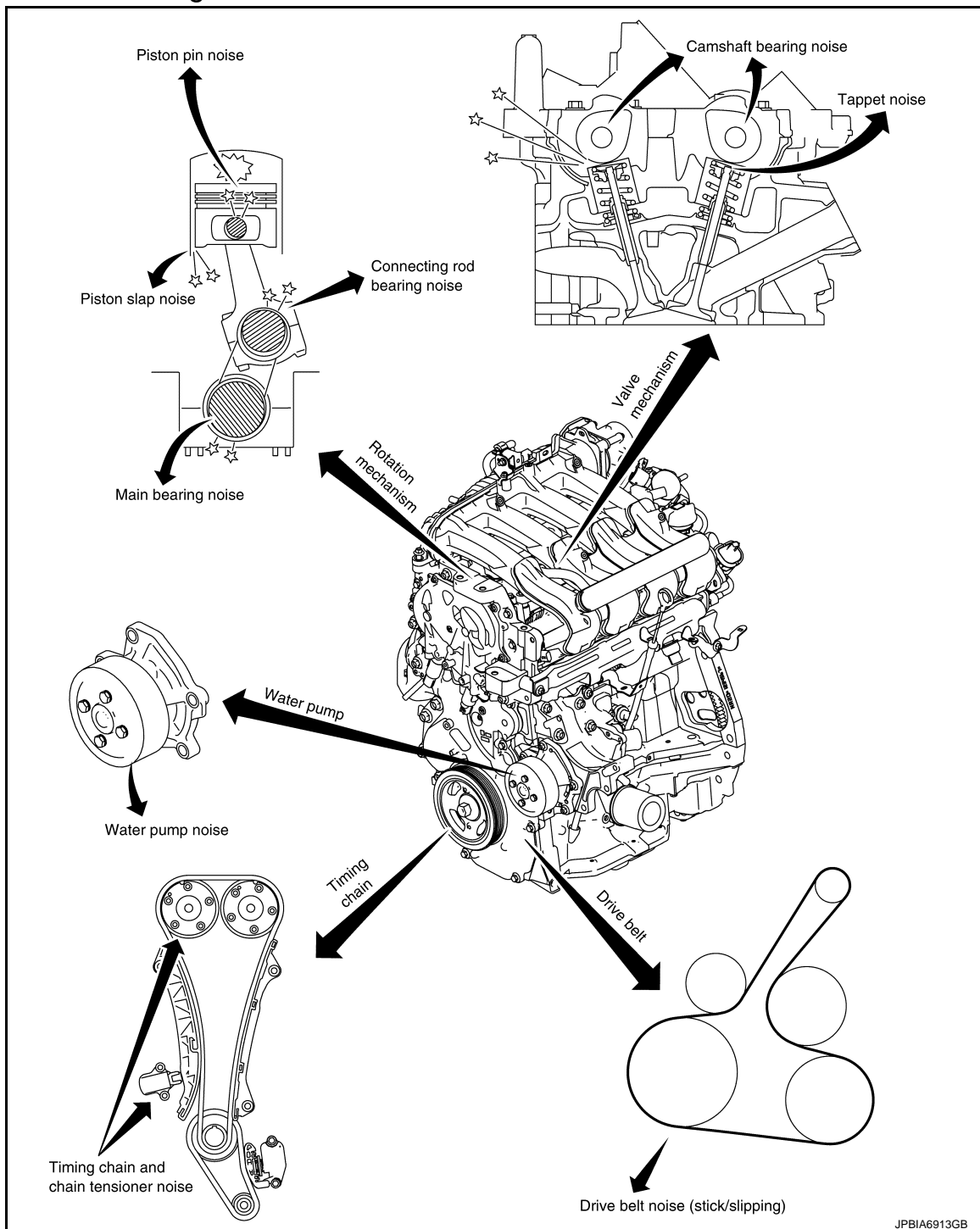
- If the engine speed is out of the specified range, check battery liquid for proper gravity. Check the engine speed again with normal battery gravity.
 - If compression pressure is below minimum value, check valve clearances, and parts associated with combustion chamber (valve, valve seat, piston, piston ring, cylinder bore, cylinder head, cylinder head gasket). After the checking, measure compression pressure again.
 - If some cylinder has low compression pressure, pour small amount of engine oil into the spark plug hole of the cylinder to recheck 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, cylinder head gaskets are leaking. In such a case, replace cylinder head gaskets.
7. After inspection is completed, install removed parts.
 8. Start the engine, and check that the engine runs smoothly.
 9. Perform trouble diagnosis. If DTC appears, erase it. Refer to [EC-81, "CONSULT Function"](#).

SYMPTOM DIAGNOSIS

NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING

NVH troubleshooting Chart

INFOID:000000010783671



1. Locate the area where noise occurs.
2. Confirm the type of noise.
3. Specify the operating condition of engine.
4. Check specified noise source.

If necessary, repair or replace these parts.

NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING

< SYMPTOM DIAGNOSIS >

[MR20DD]

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	EM-16
	Rattle	C	A	—	A	B	C	Camshaft bearing noise	Camshaft journal oil clearance Camshaft runout	EM-133
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	EM-137
	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	EM-137
	Knock	A	B	C	B	B	B	Connecting rod bearing noise	Connecting rod bushing oil clearance Connecting rod bearing oil clearance	EM-137 EM-140
	Knock	A	B	—	A	B	C	Main bearing noise	Main bearing oil clearance Crankshaft runout	EM-141 EM-137
Front of engine Front cover	Tapping or ticking	A	A	—	B	B	B	Timing chain and chain tensioner noise	Timing chain cracks and wear Timing chain tensioner operation	EM-78 EM-67
Front of engine	Squeaking or fizzing	A	B	—	B	—	C	Drive belt (Sticking or slipping)	Drive belt deflection	EM-22
	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	CO-24

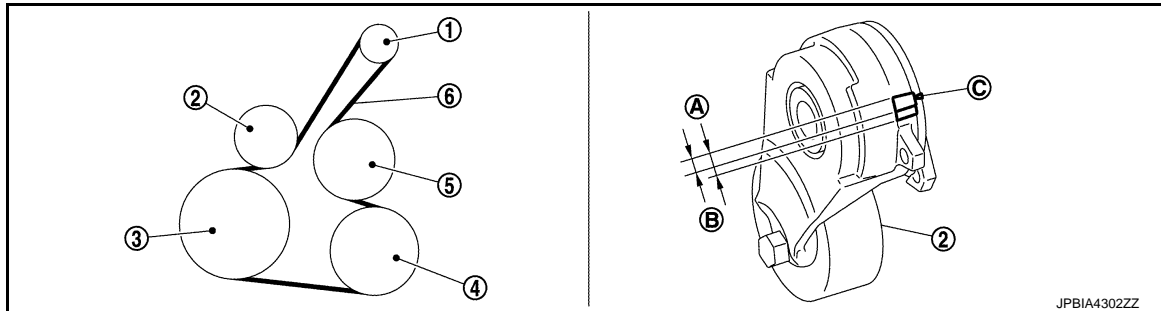
A: Closely related B: Related C: Sometimes related —: Not related

PERIODIC MAINTENANCE

DRIVE BELTS

Exploded View

INFOID:0000000010783672



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

Removal and Installation

INFOID:0000000010783673

REMOVAL

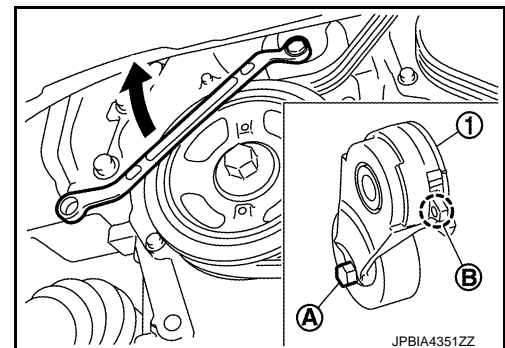
1. Remove front wheel and tire (RH). Refer to [WT-61, "Exploded View"](#).
2. Remove front fillet molding (RH). Refer to [EXT-31, "Exploded View"](#).
3. Remove front fender protector (RH). Refer to [EXT-35, "FENDER PROTECTOR : Exploded View"](#).

4. Hold the hexagonal part Ⓐ of drive belt auto-tensioner ① 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.

5. Insert a rod approximately 6 mm (0.24 in) in diameter such as short-length screwdriver into the hole Ⓑ of the retaining boss to drive belt auto-tensioner.
 - Keep drive belt auto-tensioner pulley arm locked after drive belt is removed.



INSTALLATION

CAUTION:

- Confirm drive belt is completely set to pulleys.
- Check for engine oil, working fluid and engine coolant are not adhered to drive belt and each pulley groove.

1. Release drive belt auto-tensioner, and apply tension to drive belt.
2. Turn crankshaft pulley clockwise several times to equalize tension between each pulley.
3. Confirm tension of drive belt at indicator (notch on fixed side) is within the possible use range. Refer to [EM-22, "Exploded View"](#).

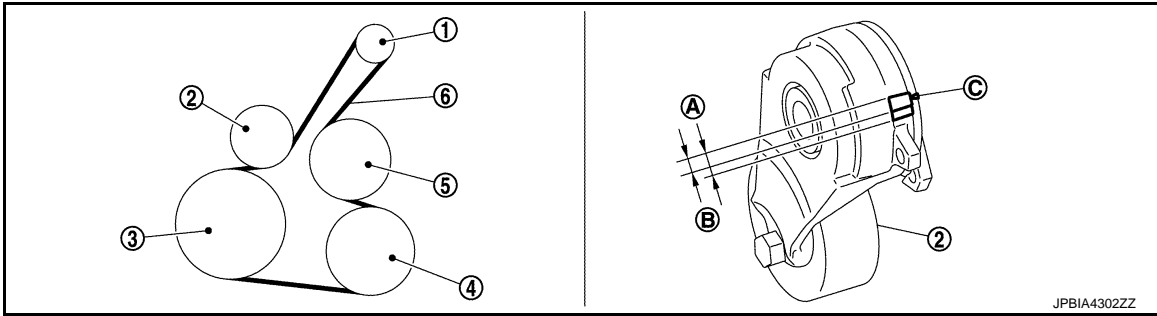
DRIVE BELTS

< PERIODIC MAINTENANCE >

[MR20DD]

Inspection

INFOID:0000000010783674



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

WARNING:

Perform 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 Ⓐ in the figure.

NOTE:

- Check the drive belt auto-tensioner indication when the engine is cold.
- When new drive belt is installed, the indicator (notch on fixed side) should be within the range Ⓑ in the figure.
- Visually check entire drive belts for wear, damage or cracks.
- If the indicator (notch on fixed side) is out of the possible use range or belts is damaged, replace belts.

Adjustment

INFOID:0000000010783675

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

AIR CLEANER FILTER

< PERIODIC MAINTENANCE >

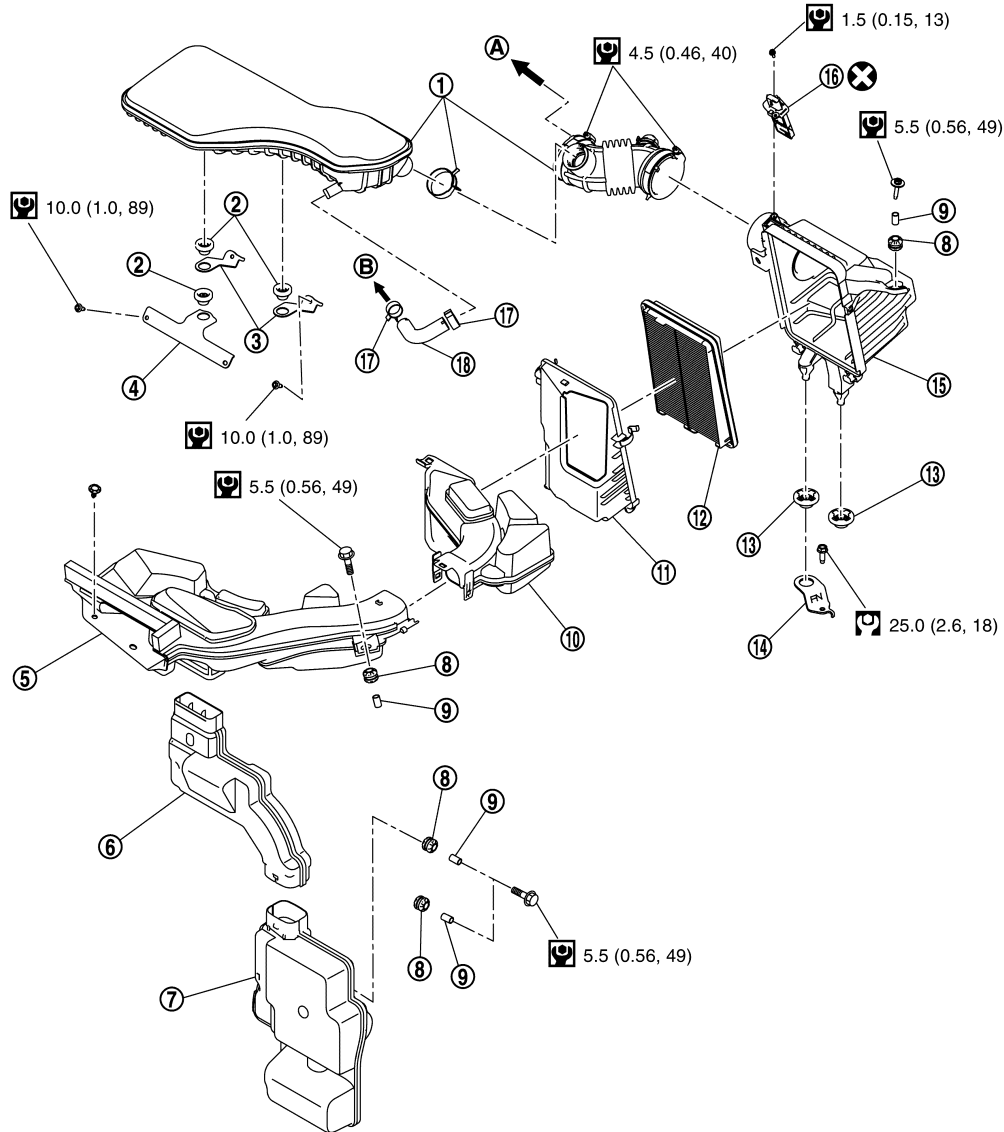
[MR20DD]

AIR CLEANER FILTER

Exploded View

INFOID:000000010783676

SEC. 118•165



JPBIA6796GB

- | | | |
|---|---------------------|----------------------|
| ① Air duct assembly | ② Mounting rubber | ③ Bracket |
| ④ Bracket | ⑤ Air duct 1 | ⑥ Resonator duct |
| ⑦ Resonator | ⑧ Grommet | ⑨ Collar |
| ⑩ Air duct 2 | ⑪ Air cleaner cover | ⑫ Air cleaner filter |
| ⑬ Mounting rubber | ⑭ Bracket | ⑮ Air cleaner body |
| ⑯ Mass air flow sensor | ⑰ Clamp | ⑱ PCV hose |
| Ⓐ To electric throttle control actuator | Ⓑ To rocker cover | |

⊗ : Always replace after every disassembly.

Ⓜ : N·m (kg-m, in-lb)

AIR CLEANER FILTER

< PERIODIC MAINTENANCE >

[MR20DD]

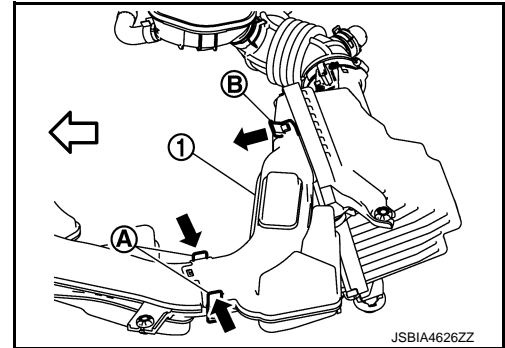
INFOID:000000010783677

Removal and Installation

REMOVAL

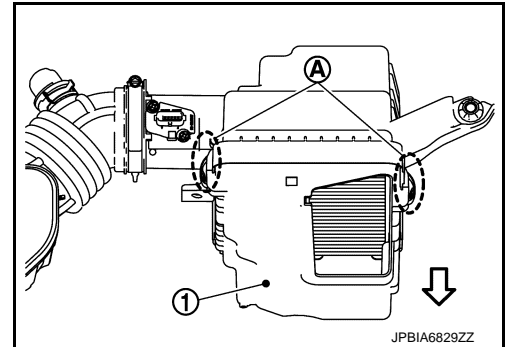
1. To remove air duct 2 ①, pinch pawl A to unlock, move pawl B frontward, and remove air duct 2 upward.

↩ : Vehicle front



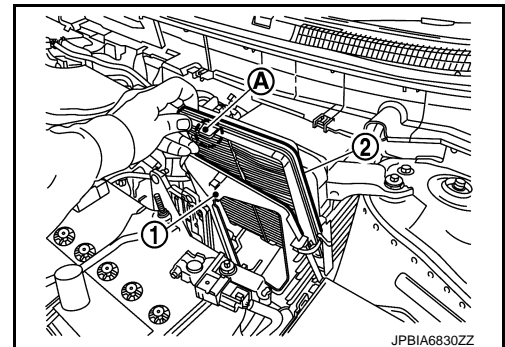
2. Remove the clips A of air cleaner cover ①.

↩ : Vehicle front



3. Shift air cleaner cover ① to car front side and remove air cleaner element ②.

A : Projection

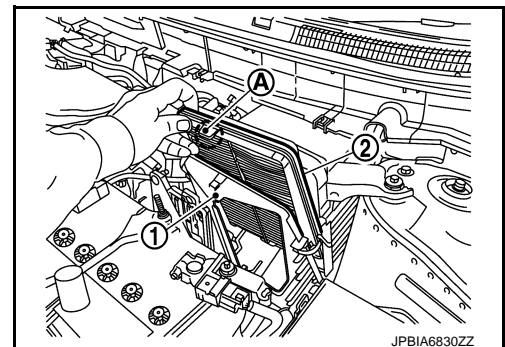


INSTALLATION

Install in the reverse order of removal.

- Insert the projection A of air cleaner element ② in such a way so that it becomes the position (upper front side of car) of illustration.

A : Projection



- Verify that there is no looseness in air cleaner cover and has been fixed accurately.

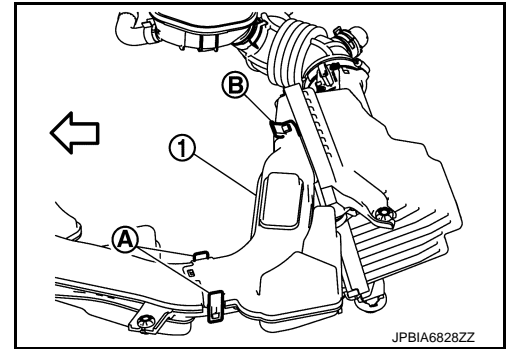
AIR CLEANER FILTER

[MR20DD]

< PERIODIC MAINTENANCE >

- Check that pawls ① and ② (3 in total) of air duct 2 ① are engaged.

⇐ : Vehicle front



Inspection (Dry Paper Type)

INFOID:000000010783678

INSPECTION AFTER REMOVAL

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

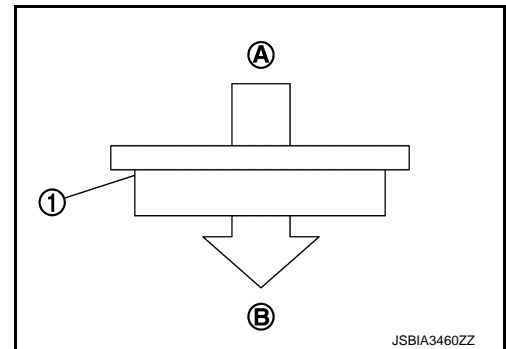
- Remove dusts (such as dead leaves) on air cleaner element surface and inside cleaner case.
- To clean air cleaner element ①, blow air on it from the air intake manifold side ① to remove trash or dust.

② Ambient air side

⇐ Air blow direction

CAUTION:

- When blowing air on the air cleaner element, attach the cover to the air cleaner case and stay away from the vehicle as much as possible to prevent the entry of dirt into the air cleaner case.
- Never blow air from the ambient air side to prevent clogging. When the ambient air side needs to be cleaned, attach the cover to the intake manifold side and lightly dust by hand.



- If clogging or damage is observed, replace the air cleaner element.

MAINTENANCE INTERVAL

Refer to [MA-8, "Periodic Maintenance"](#).

SPARK PLUG

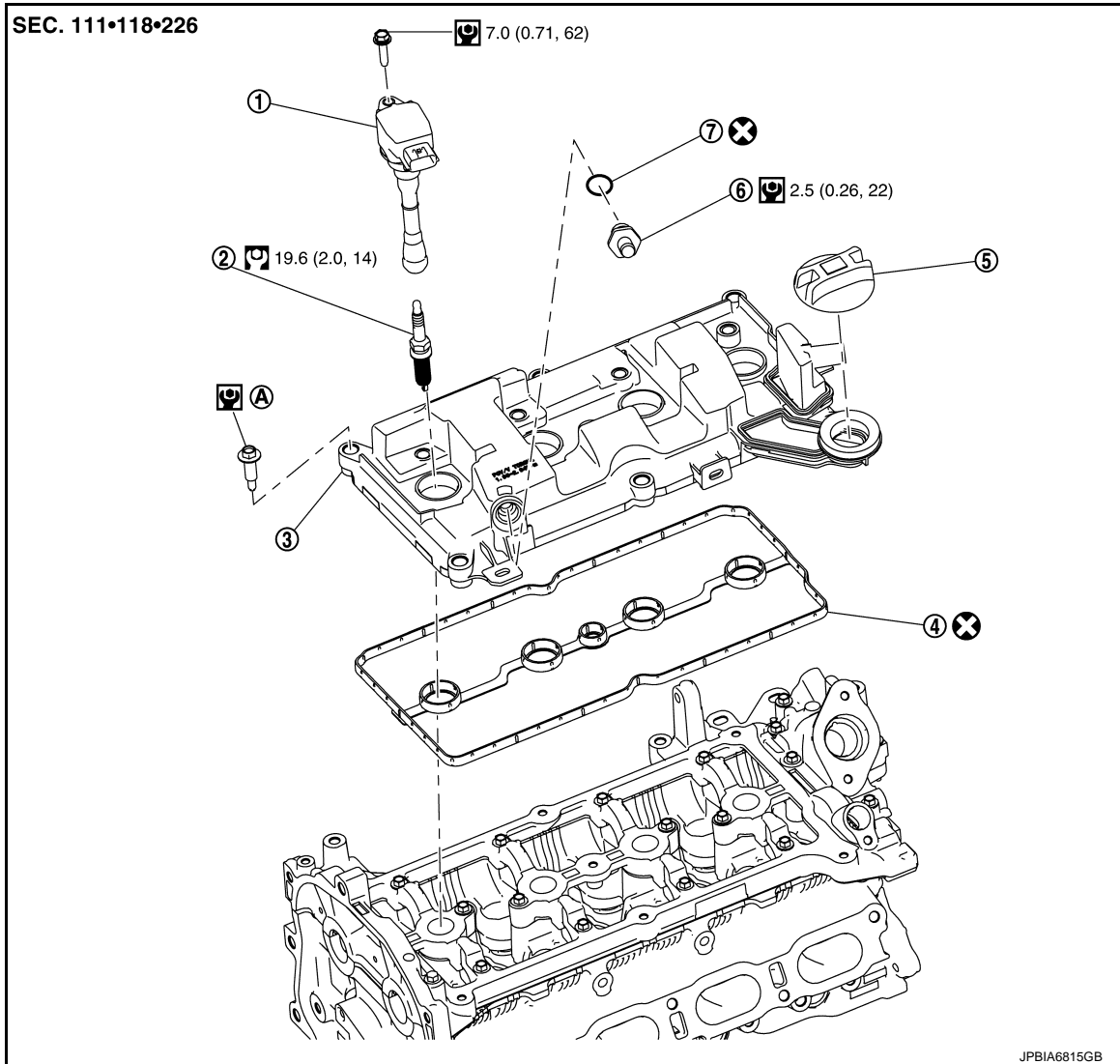
< PERIODIC MAINTENANCE >

[MR20DD]

SPARK PLUG

Exploded View

INFOID:000000010783680



- | | | |
|--|------------------|----------------|
| ① Ignition coil | ② Spark plug | ③ Rocker cover |
| ④ Rocker cover gasket | ⑤ Oil filler cap | ⑥ PCV valve |
| ⑦ O-ring | | |
| (A) Comply with the installation procedure when tightening. Refer to EM-54 | | |
| ⊗ : Always replace after every disassembly. | | |
| ⊞ : N·m (kg·m, ft·lb) | | |
| ⊞ : N·m (kg·m, in·lb) | | |

Removal and Installation

INFOID:000000010783681

REMOVAL

1. Remove resonator of air duct assembly. Refer to [EM-30, "Exploded View"](#).
2. Remove ignition coil. Refer to [EM-54, "Exploded View"](#).

SPARK PLUG

[MR20DD]

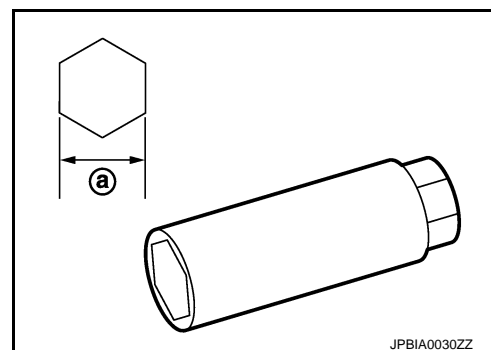
< PERIODIC MAINTENANCE >

3. Remove spark plug with a spark plug wrench (commercial service tool).

(a) : 14 mm (0.55 in)

CAUTION:

Never drop or shock spark plug.



INSTALLATION

Install in the reverse order of removal.

Inspection

INFOID:000000010783682

INSPECTION AFTER REMOVAL

Use the standard type spark plug for normal condition.

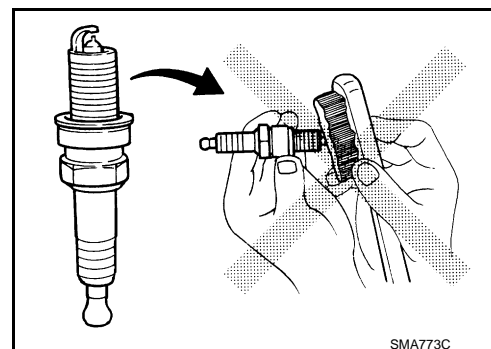
Spark plug (Standard type) : Refer to [EM-132, "Spark Plug"](#).

CAUTION:

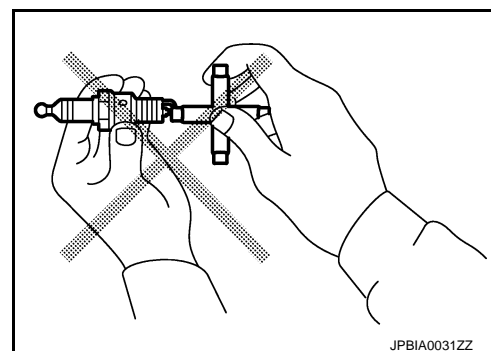
- Never drop or shock spark plug.
- Never use a wire brush for cleaning.
- If plug tip is covered with carbon, spark plug cleaner may be used.

Cleaner air pressure : Less than 588 kPa (5.88 bar, 6 kg/cm², 85 psi)

Cleaning time : Less than 20 seconds



- Checking and adjusting plug gap is not required between replacement intervals.
- Measure spark plug gap. when it exceeds the limit, replace spark plug even if it is within the specified replacement mileage. Refer to [EM-132, "Spark Plug"](#).



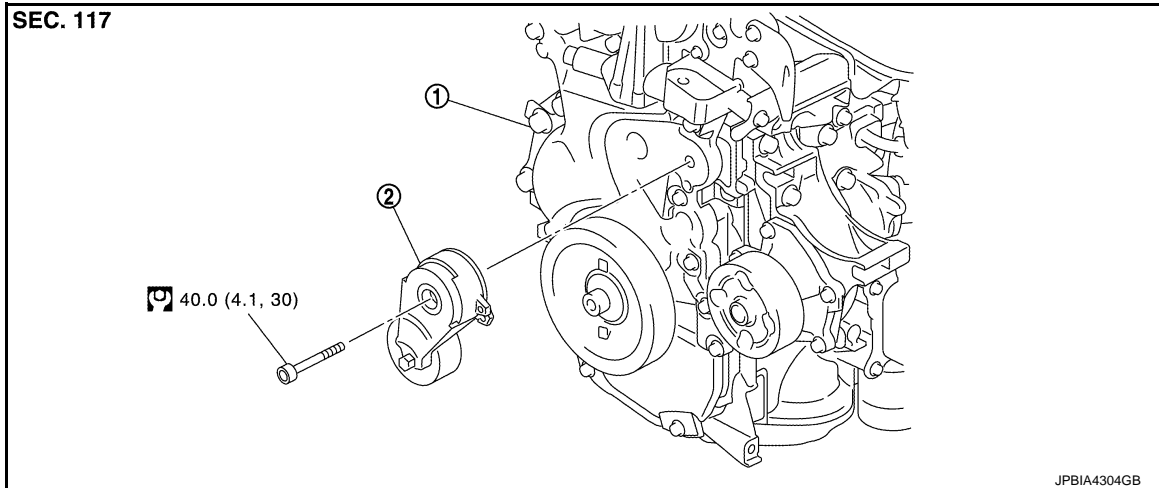
REMOVAL AND INSTALLATION

DRIVE BELT AUTO-TENSIONER

Exploded View

INFOID:0000000010783685

EM



- ① Front cover ② Drive belt auto-tensioner

40.0 (4.1, 30) : N·m (kg-m, ft-lb)

Removal and Installation

INFOID:0000000010783686

Removal

- Remove drive belt. Refer to [EM-22, "Removal and Installation"](#).
 - Keep each auto-tensioner pulley arm locked after drive belts are removed.
- Support the bottom surface of engine using a transmission jack, and then remove the rear torque rod and the engine mounting insulator (RH). Refer to [EM-56, "Exploded View"](#).

CAUTION:

When using the jack, apply a piece of wood to the oil pan (lower) mounting bolt to protect the bottom of engine from being scratched.

- Remove drive belt auto-tensioner mounting bolt ② from service hole ③ of right side member ①.

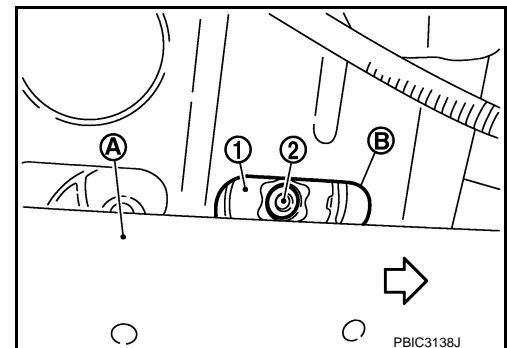
① : Drive belt auto-tensioner

: Vehicle front

NOTE:

Lift the front side of engine with a jack supporting the bottom of engine and align drive belt auto-tensioner mounting bolt position with the service hole.

- Remove drive belt auto-tensioner.



Installation

Install in the reverse order of removal.

CAUTION:

When installing drive belt auto-tensioner, be careful not to interfere with water pump pulley.

AIR CLEANER AND AIR DUCT

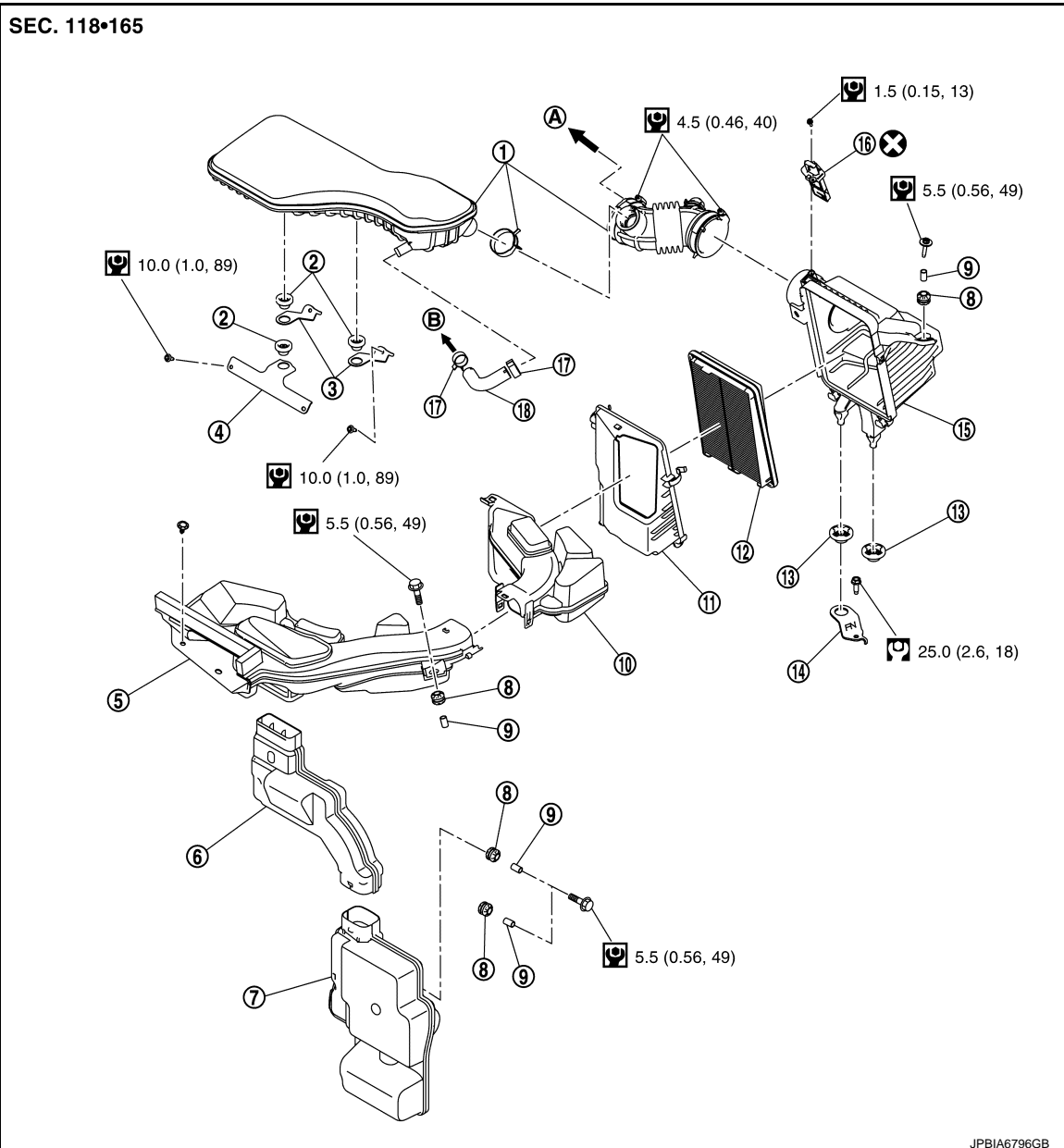
< REMOVAL AND INSTALLATION >

[MR20DD]

AIR CLEANER AND AIR DUCT

Exploded View

INFOID:000000010783687



- | | | |
|---|---------------------|----------------------|
| ① Air duct assembly | ② Mounting rubber | ③ Bracket |
| ④ Bracket | ⑤ Air duct 1 | ⑥ Resonator duct |
| ⑦ Resonator | ⑧ Grommet | ⑨ Collar |
| ⑩ Air duct 2 | ⑪ Air cleaner cover | ⑫ Air cleaner filter |
| ⑬ Mounting rubber | ⑭ Bracket | ⑮ Air cleaner body |
| ⑯ Mass air flow sensor | ⑰ Clamp | ⑱ PCV hose |
| Ⓐ To electric throttle control actuator | Ⓑ To rocker cover | |

⊗ : Always replace after every disassembly.

Ⓜ : N·m (kg-m, in-lb)

Removal and Installation

INFOID:000000010783688

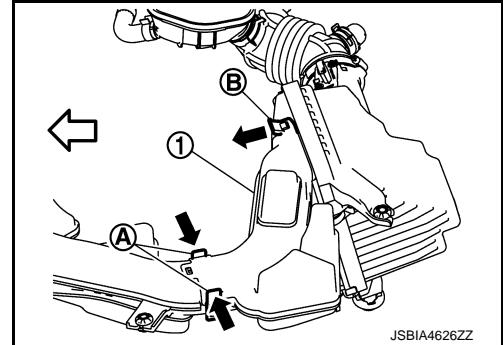
REMOVAL

NOTE:

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

1. Remove air duct 1 and air duct 2.
 - To remove air duct 2 ①, pinch pawl (A) to unlock, move pawl (B) frontward, and remove air duct 2 ① upward.

← : Vehicle front



2. Remove battery. Refer to [PG-140, "EXCEPT FOR R9M : Exploded View"](#).
3. Remove battery tray. Refer to [PG-146, "EXCEPT FOR R9M : Exploded View"](#).
4. Disconnect mass air flow sensor harness connector.
5. Loosen clamps of air duct assembly.
 - Add mating marks if necessary for easier installation.
6. Remove air cleaner assembly (cover and body).
7. Remove mass air flow sensor from air cleaner body, if necessary.

CAUTION:
Handle the mass air flow sensor with following cares.

 - Never shock the mass air flow sensor.
 - Never disassemble the mass air flow sensor.
 - Never touch the sensor of the mass air flow sensor.
8. Disconnect PCV hose.
9. Remove air duct assembly.
10. Remove bracket, if necessary.

INSTALLATION

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

Air cleaner body

CAUTION:

Check that mounting rubber is positioned in the mounting location and be careful not to allow it to be dislocated when installing air cleaner body.

Air duct assembly

- To install air duct assembly ①, align the matching marks (A) on both ends with the others.

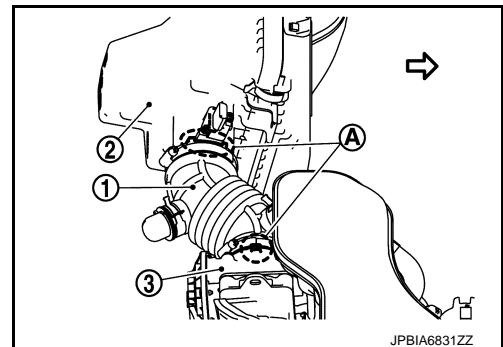
- ② : Air cleaner body
 ③ : Electric throttle control actuator
 ← : Vehicle front

CAUTION:

Never allow foreign materials (i.e. lint) to adhere to the mounting part of air duct assembly and each mating part.

- Install hose clamps and tighten to the torque specified below.

 : 4.5 Nm (0.46 kg-m, 40 in-lb)



Air duct 1

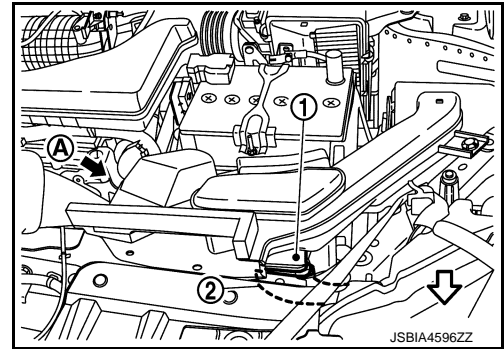
AIR CLEANER AND AIR DUCT

[MR20DD]

< REMOVAL AND INSTALLATION >

To install air duct 1 ①, hold resonator duct ② by hand (see ①) and securely engage the joint.

⇐ : Vehicle front



INFOID:000000010783689

Inspection

INSPECTION AFTER REMOVAL

Inspect air duct assembly for crack or tear.

- If anything found, replace air duct assembly.

INTAKE MANIFOLD

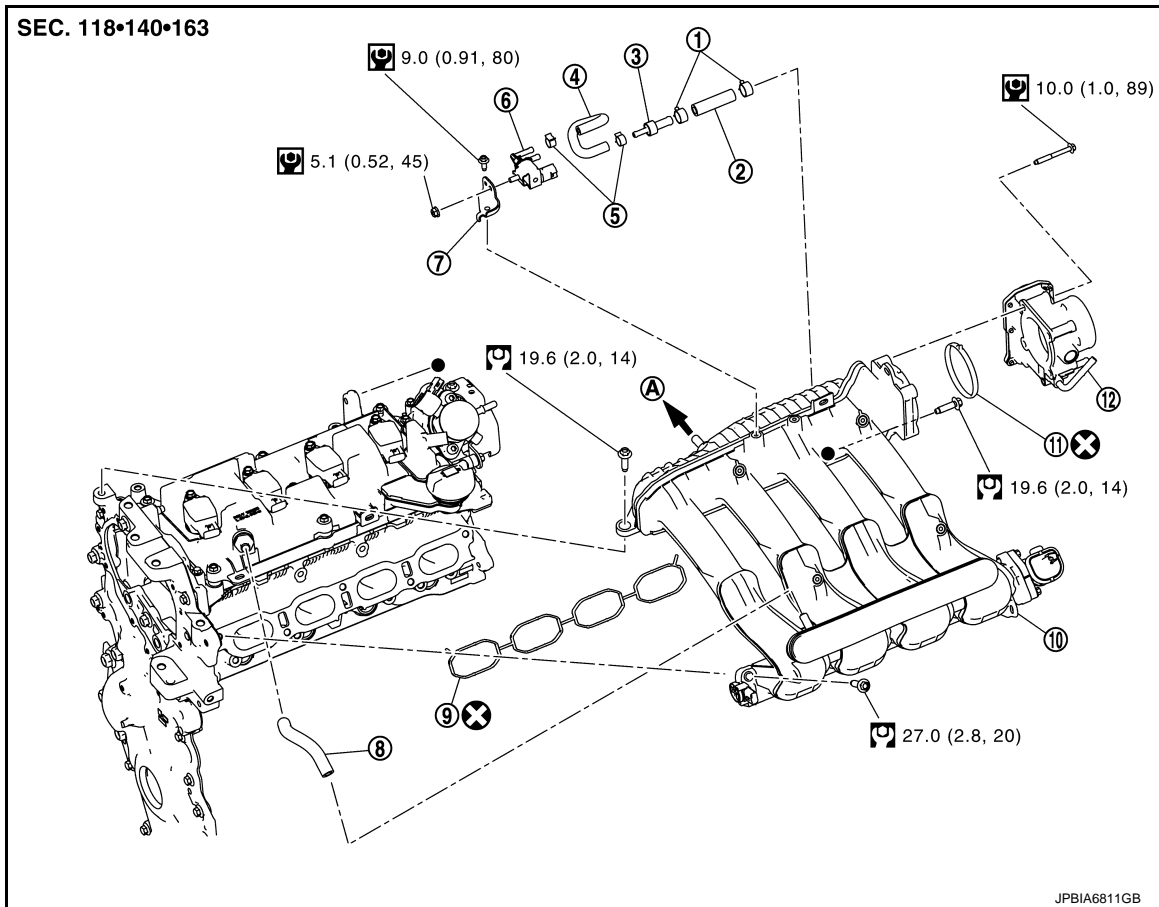
< REMOVAL AND INSTALLATION >

[MR20DD]

INTAKE MANIFOLD

Exploded View

INFOID:0000000010783690



- | | | |
|-------------------|-------------|---|
| ① Clamp | ② EVAP hose | ③ Connector |
| ④ EVAP hose | ⑤ Clamp | ⑥ EVAP canister purge volume control solenoid valve |
| ⑦ Bracket | ⑧ PCV hose | ⑨ Gasket |
| ⑩ Intake manifold | ⑪ Gasket | ⑫ Electric throttle control actuator |

(A) To brake booster

⊗ : Always replace after every disassembly.

⊞ : N·m (kg-m, ft-lb)

⊞ : N·m (kg-m, in-lb)

Removal and Installation

INFOID:0000000010783691

REMOVAL

1. Remove air cleaner assembly and air duct assembly. Refer to [EM-33, "Exploded View"](#).
2. Pull out oil level gauge.

CAUTION:

Cover the oil level gauge guide openings to avoid entry of foreign materials.

INTAKE MANIFOLD

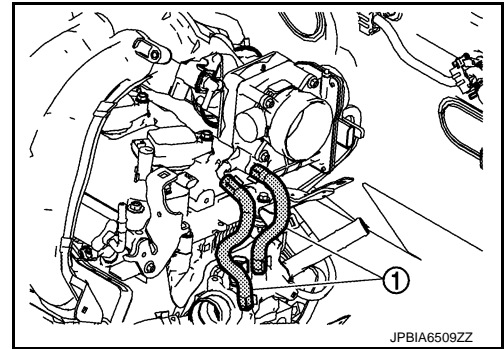
< REMOVAL AND INSTALLATION >

[MR20DD]

3. Disconnect water hoses ① from electric throttle control actuator as follows:
- Drain engine coolant from radiator or attach plug to prevent engine coolant leakage when engine coolant is not drained. Refer to [CO-13, "Draining"](#).

CAUTION:

Perform this step when the engine is cold.



4. Remove electric throttle control actuator.

CAUTION:

- Handle carefully to avoid any shock to electric throttle control actuator.
- Never disassemble electric throttle control actuator.

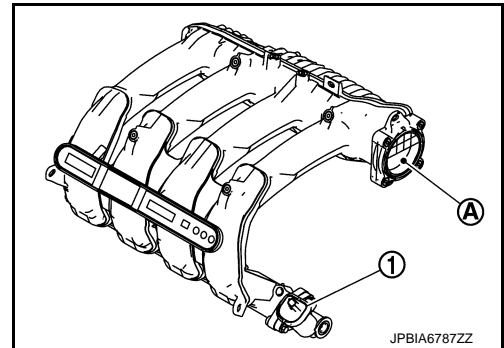
5. Disconnect vacuum hose from intake manifold.
6. Disconnect PCV hose from intake manifold and rocker cover.
7. Remove intake manifold with the following procedure:

CAUTION:

- Handle carefully to avoid any shock to intake manifold runner control valve motor ①.

Ⓐ : Electric throttle control actuator side

- Never remove intake manifold runner control valve motor. (Not designed for disassembly)
- Cover engine openings to avoid entry of foreign materials.

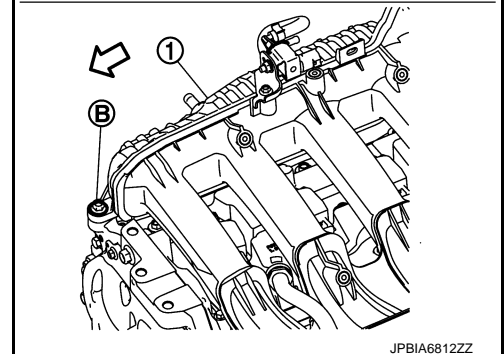
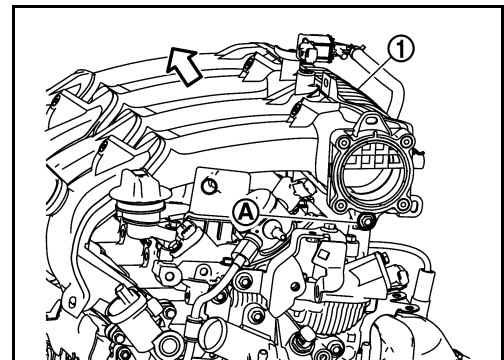


- a. Loosen and remove intake manifold mounting bolts Ⓐ and Ⓑ.

① : Intake manifold

⇐ : Engine front

- b. Remove harness clip from intake manifold side.
c. Disconnect EVAP hose from intake manifold.
d. Disconnect harness connector from EVAP canister purge volume control valve.



INTAKE MANIFOLD

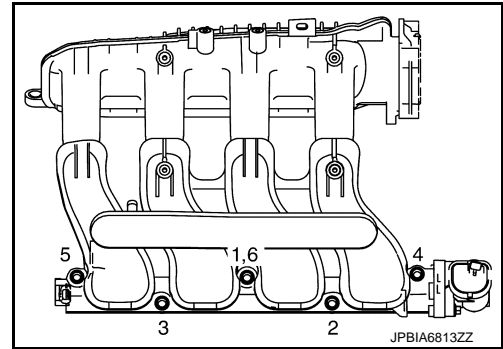
< REMOVAL AND INSTALLATION >

[MR20DD]

- e. Loosen mounting bolts in the order from 5 to 1 shown in the figure.

CAUTION:

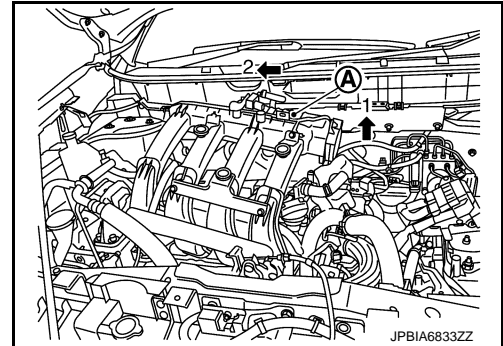
Cover engine openings to avoid entry of foreign materials.



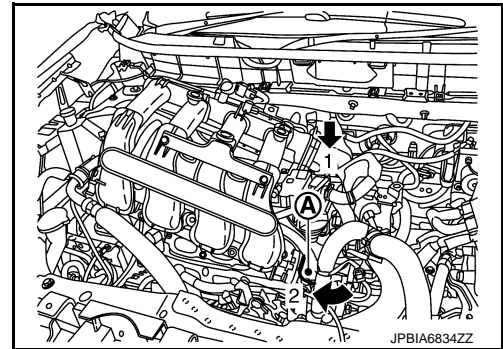
- f. Lift the surge tank side (A) of intake manifold to move it in the direction of engine front.

NOTE:

Keep off the brake reservoir tank and A/C low pressure pipe.



- g. Lower the surge tank side to pull out intake manifold runner control valve (A) from between harness and cylinder head.



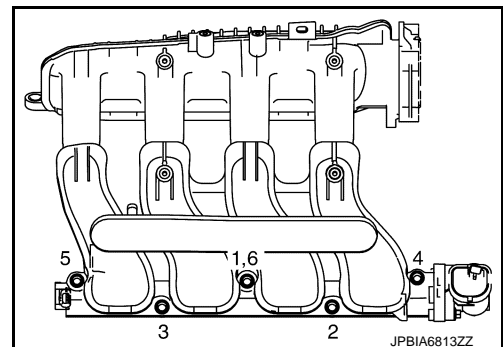
8. Remove brackets from intake manifold, if necessary. (For air duct assembly and/or engine cover)
9. Remove EVAP canister purge volume control solenoid valve from intake manifold, if necessary.

INSTALLATION

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

Intake Manifold

1. Check if gasket is not dropped from the installation groove of intake manifold.
2. Install intake manifold with the following procedure:
 - a. Temporary tighten in the order 4 to 5 as shown in the figure.
 - b. Tighten in the order from 1 to 6 as shown in the figure.



INTAKE MANIFOLD

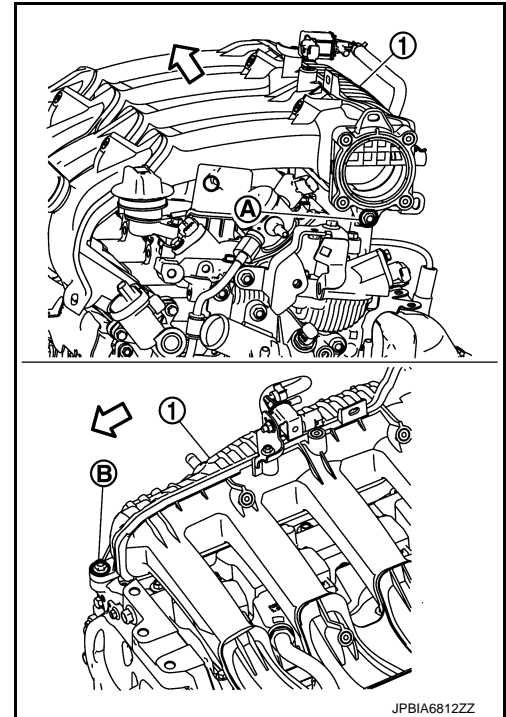
< REMOVAL AND INSTALLATION >

[MR20DD]

- c. Tighten intake manifold mounting bolt ①. Then tighten intake manifold mounting bolt ②.

① : Intake manifold

⇐ : Engine front



Electric Throttle Control Actuator

- Tighten bolts of electric throttle control actuator equally and diagonally in several steps.
- Perform "Throttle Valve Closed Position Learning" after repair when removing harness connector of the electric throttle control actuator. Refer to [EC-145, "Description"](#).
- Perform "Throttle Valve Closed Position Learning" and "Idle Air Volume Learning" after repair when replacing electric throttle control actuator. Refer to [EC-145, "Description"](#) and [EC-146, "Description"](#).

EXHAUST MANIFOLD

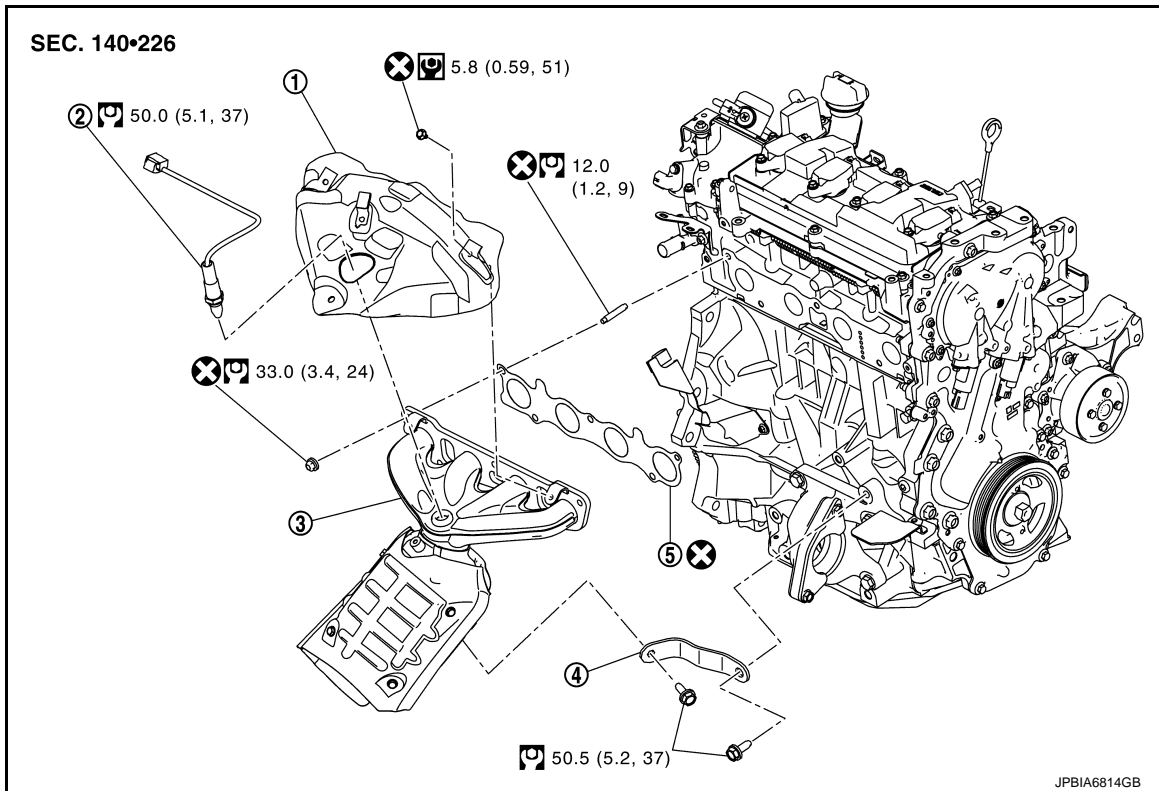
< REMOVAL AND INSTALLATION >

[MR20DD]

EXHAUST MANIFOLD

Exploded View

INFOID:0000000010783692



- ① Exhaust manifold cover ② Air fuel ratio sensor 1 ③ Exhaust manifold
④ Exhaust manifold stay ⑤ Gasket

⊗ : Always replace after every disassembly.

⊞ : N·m (kg-m, ft-lb)

⊞ : N·m (kg-m, in-lb)

Removal and Installation

INFOID:0000000010783693

REMOVAL

1. Remove intake manifold. Refer to [EM-33. "Exploded View"](#).
2. Remove the air fuel ratio sensor 1.
 - Using heated oxygen sensor wrench [SST: KV10117100], remove air fuel ratio sensor 1.
- CAUTION:**
Handle air fuel ratio sensor 1 carefully and avoid impacts.
3. Remove exhaust manifold cover.
4. Remove exhaust front tube. Refer to [EX-6. "Exploded View"](#).

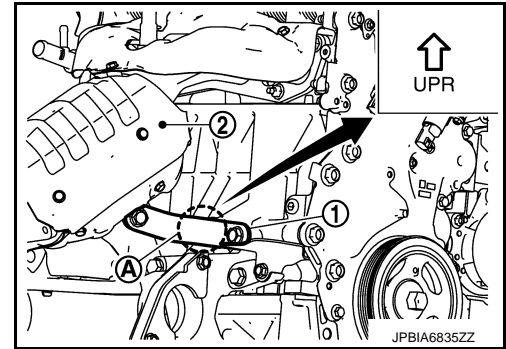
EXHAUST MANIFOLD

[MR20DD]

< REMOVAL AND INSTALLATION >

5. Remove exhaust manifold stay ①.

- ② : Exhaust manifold
- Ⓐ : Upper mark



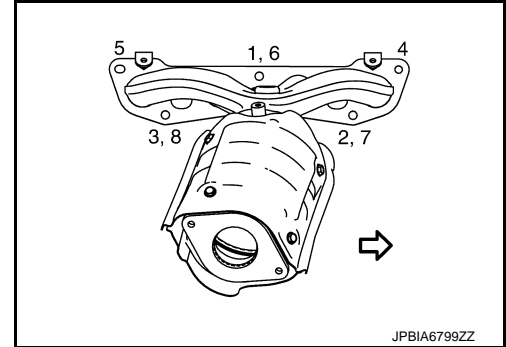
6. Remove exhaust manifold.

- Loosen nuts in the order from 5 to 1 as shown in the figure.

⇐ : Engine front

NOTE:

Disregard No. 6 to 8 when loosening.



7. Remove gasket.

CAUTION:

Cover engine openings to avoid entry of foreign materials.

8. Remove stud bolts from cylinder head.

Torx : Size E8

INSTALLATION

CAUTION:

Never reuse stud bolts, mounting nuts, and gasket. Always replace them with new ones.

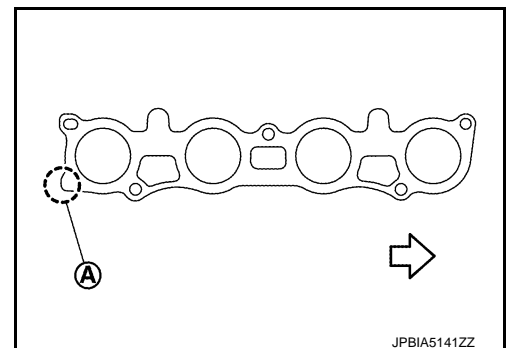
1. Install stud bolts to cylinder head.

Torx : Size E8

2. Install gasket to cylinder head as shown in the figure.

Ⓐ : Identification

⇐ : Engine front



3. Install exhaust manifold with the following procedure:

EXHAUST MANIFOLD

[MR20DD]

< REMOVAL AND INSTALLATION >

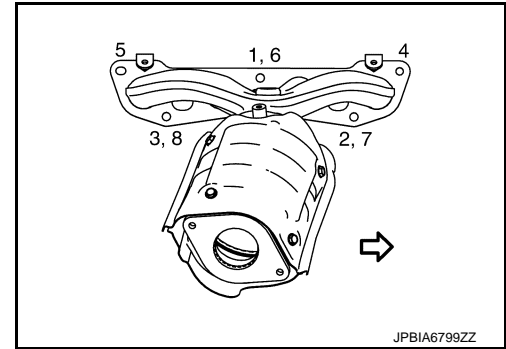
- a. Tighten nuts in the order from 1 to 8 as shown in the figure.

⇐ : Engine front

NOTE:

No. 6 to 8 mean double of nuts No. 1 to 3.

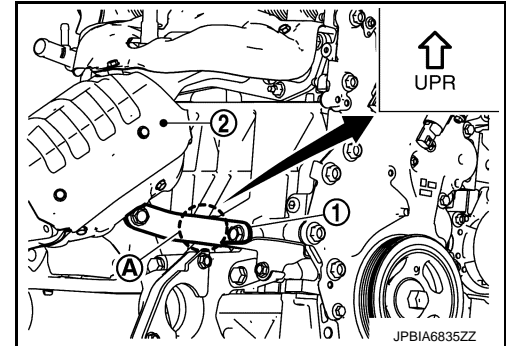
- b. Retighten nuts in the order from 1 to 8 as shown in the figure.



4. Install exhaust manifold stay ① in the direction as shown in the figure.

② : Exhaust manifold

Ⓐ : Upper mark



5. Install remaining parts in the reverse order of removal.

- Air fuel ratio sensor 1

CAUTION:

Prevent rust preventives from adhering to the sensor body.

NOTE:

If a stud bolt on the exhaust front tube side comes off, install it with a torque socket (E7).

Inspection

INFOID:0000000010783694

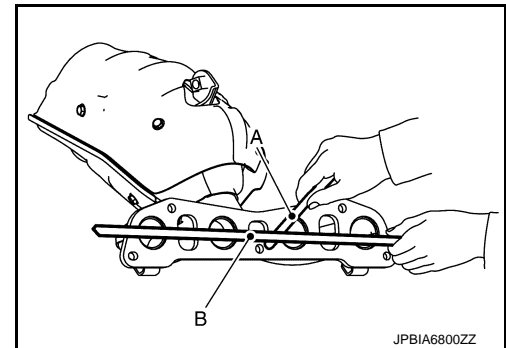
INSPECTION AFTER REMOVAL

Surface Distortion

- Using feeler gauge (A) and straightedge (B), check the surface distortion of exhaust manifold mating surface in each exhaust port and entire part.

Limit : Refer to [EM-133, "Exhaust Manifold"](#).

- If it exceeds the limit, replace exhaust manifold.



INSPECTION AFTER INSTALLATION

Check the joint of parts with the engine in running state. Check that there is no leakage of exhaust gas and abnormal sound.

OIL PAN (LOWER)

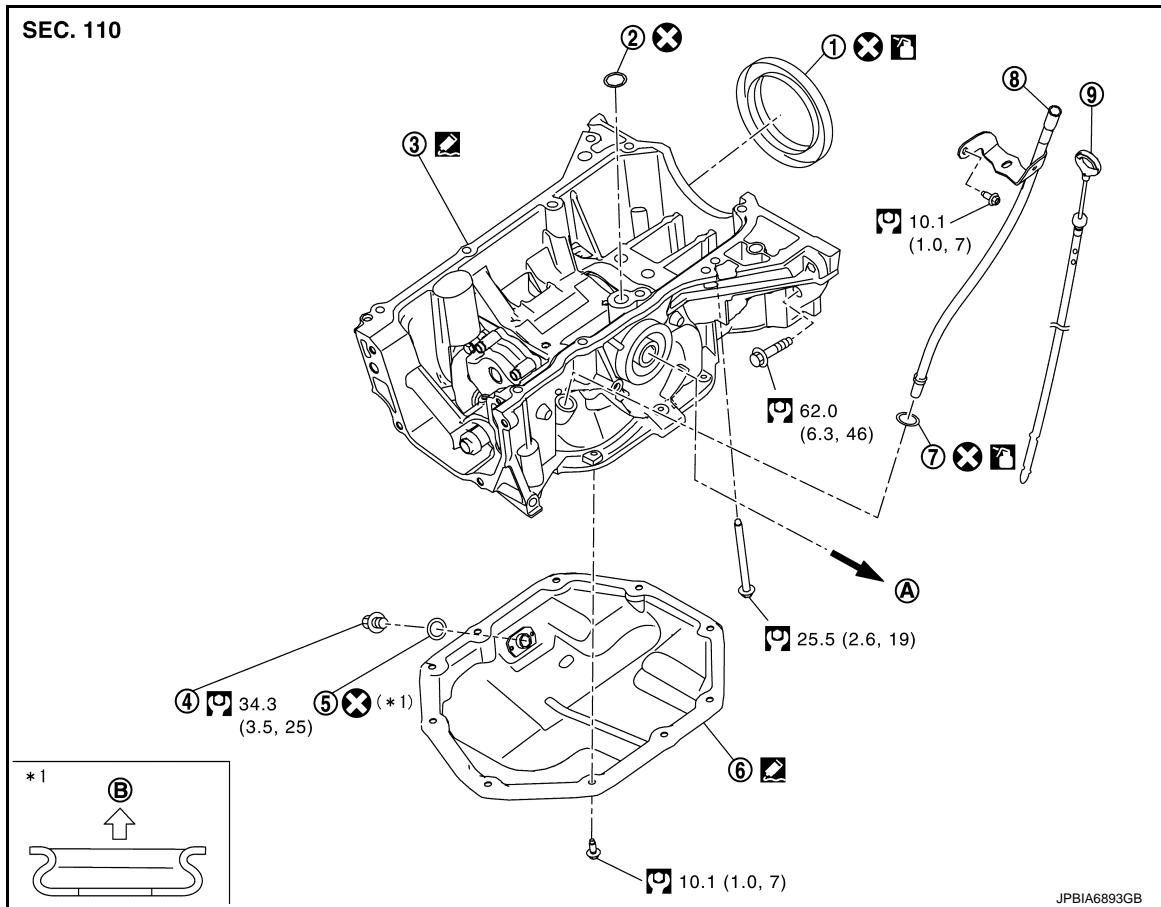
< REMOVAL AND INSTALLATION >

[MR20DD]

OIL PAN (LOWER)

Exploded View

INFOID:000000010783695



- | | | |
|-----------------|-------------------------|-------------------|
| ① Rear oil seal | ② O-ring | ③ Oil pan (upper) |
| ④ Drain plug | ⑤ Drain plug washer | ⑥ Oil pan (lower) |
| ⑦ O-ring | ⑧ Oil level gauge guide | ⑨ Oil level gauge |
| Ⓐ To oil cooler | Ⓑ Oil pan (lower) side | |

↶ : Oil pan side

⊗ : Always replace after every disassembly.

Ⓐ : N·m (kg-m, ft-lb)

Ⓐ : Should be lubricated with oil.

Ⓐ : Sealing point

Removal and Installation

INFOID:000000010783696

REMOVAL

1. Remove engine under cover.
2. Drain engine oil. Refer to [LU-10. "Draining"](#).
3. Remove oil pan (lower) with the following procedure:

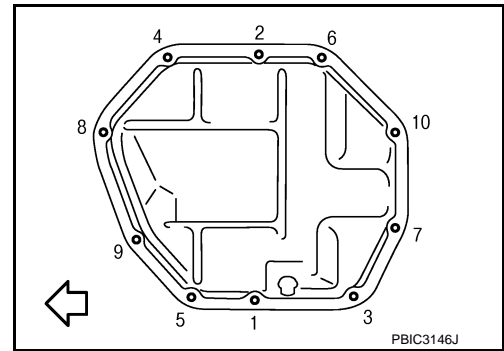
OIL PAN (LOWER)

[MR20DD]

< REMOVAL AND INSTALLATION >

- a. Loosen mounting bolts in reverse order as shown in the figure.

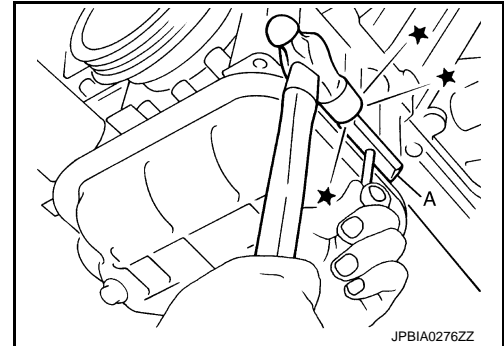
↶ : Engine front



- b. Insert seal cutter [SST: KV10111100] (A) between oil pan (upper) and oil pan (lower).

CAUTION:

- Be careful not to damage the mating surface.
- Since factory default liquid gasket has better adhesion than conventional one, never pick the area forcibly with a screw driver.



INSTALLATION

CAUTION:

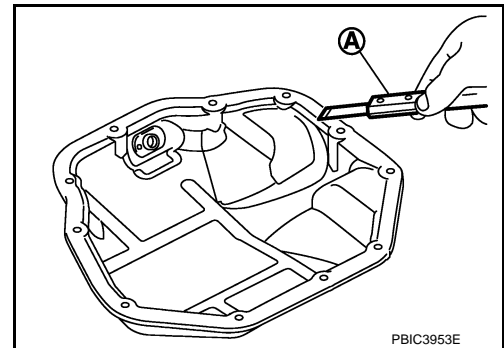
Do not reuse O-rings or washers.

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

1. Install oil pan (lower) with the following procedure:
 - a. Use a scraper (A) to remove old liquid gasket from mating surfaces.
 - Also remove old liquid gasket from mating surface of oil pan (upper).
 - Remove old liquid gasket from the bolt holes and threads.

CAUTION:

Never scratch or damage the mating surface when cleaning off old liquid gasket.



OIL PAN (LOWER)

[MR20DD]

< REMOVAL AND INSTALLATION >

- b. Apply a continuous bead of liquid gasket (A) with a tube presser (commercial service tool) as shown in the figure.

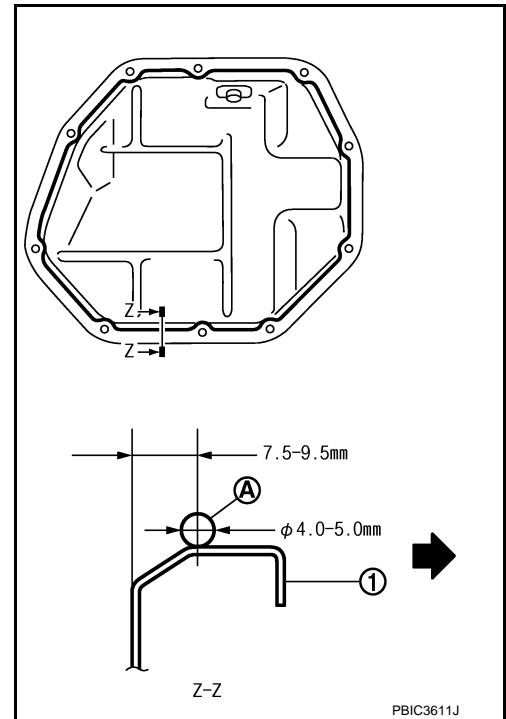
① : Oil pan (lower)

← : Engine outside

Use Genuine Liquid Gasket (Three Bond 1217H) or equivalent.

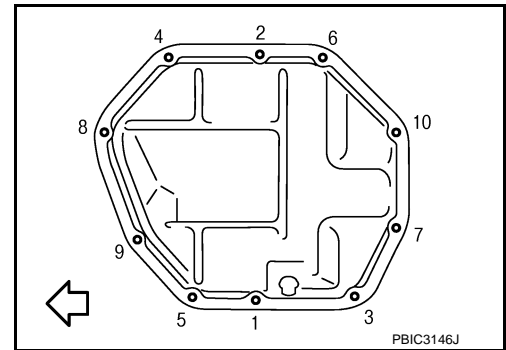
CAUTION:

Attaching should be done within 5 minutes after liquid gasket application.



- c. Tighten bolts in numerical order as shown in the figure.

⇐ : Engine front



2. Install drain plug.
3. Install in the reverse order of removal after this steps.

NOTE:

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

Inspection

INFOID:0000000010783697

INSPECTION AFTER REMOVAL

Clean oil strainer portion [part of the oil pan (upper)] if any object attached.

INSPECTION AFTER INSTALLATION

1. Check the engine oil level and adjust engine oil. Refer to [LU-9. "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-9. "Inspection"](#).

HIGH PRESSURE FUEL PUMP AND FUEL HOSE

< REMOVAL AND INSTALLATION >

[MR20DD]

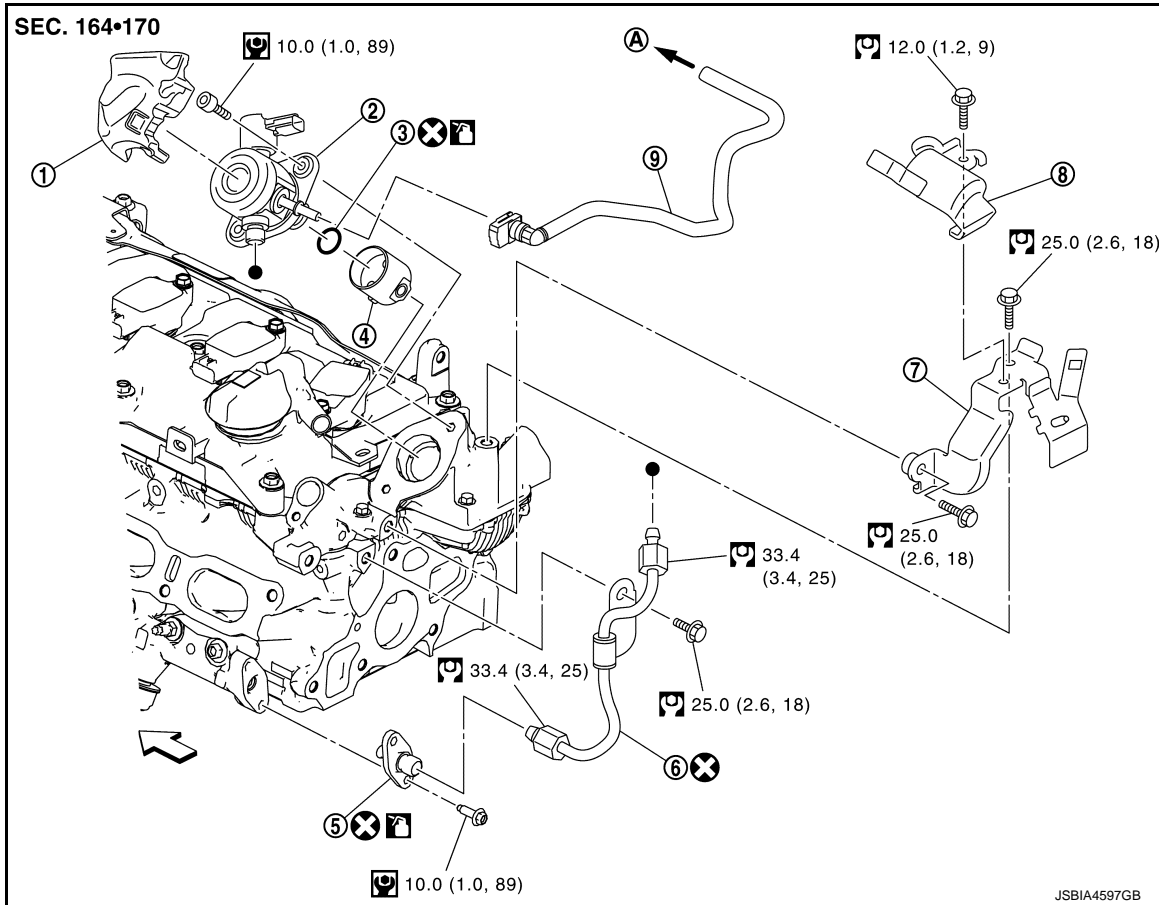
HIGH PRESSURE FUEL PUMP AND FUEL HOSE

Exploded View

INFOID:0000000010783698

CAUTION:

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



- | | | |
|-------------------------------------|---------------------------------|------------------|
| ① High pressure fuel pump insulator | ② High pressure fuel pump | ③ O-ring |
| ④ High pressure fuel pump lifter | ⑤ Fuel rail connector | ⑥ Fuel tube |
| ⑦ Bracket | ⑧ Fuel pump connector protector | ⑨ Fuel feed hose |

Ⓐ 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:0000000010783699

REMOVAL

WARNING:

- Be sure to read [EM-7, "Precaution for Handling High Pressure Fuel System"](#) when working on the high pressure fuel system.
- Put a "CAUTION: FLAMMABLE" sign in the workshop.

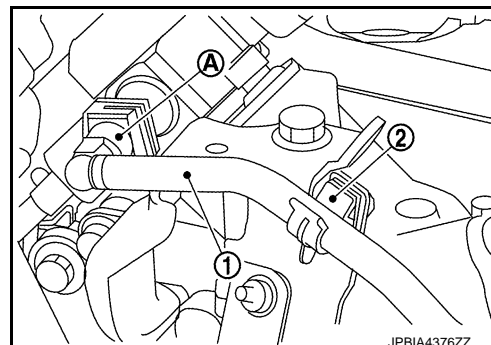
HIGH PRESSURE FUEL PUMP AND FUEL HOSE

[MR20DD]

< REMOVAL AND INSTALLATION >

- 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.

1. Release fuel pressure. Refer to [EC-152. "Work Procedure"](#).
2. Remove fuel pump connector protector, and remove high pressure fuel pump insulator.
3. Disconnect quick connector ① with the following procedure.
 - a. Disconnect fuel feed hose ① from bracket hose clamp ②.



- b. 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.

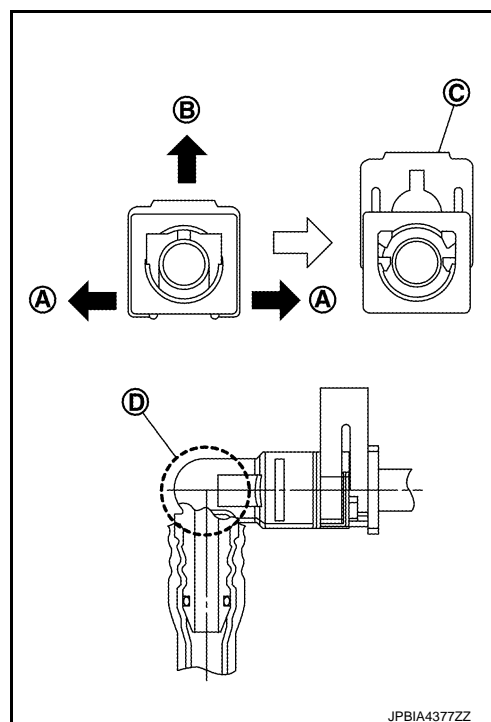
NOTE:

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

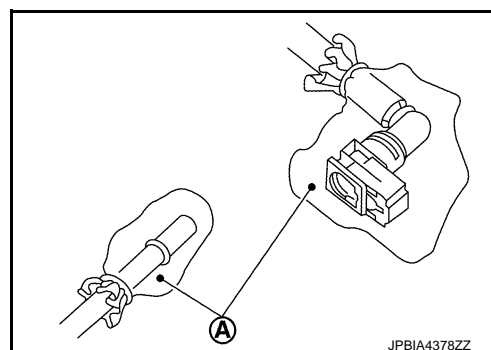
CAUTION:

- 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.

Retainer color : Red



- 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.



4. Remove intake manifold. Refer to [EM-33. "Removal and Installation"](#).
5. Remove fuel tube.
6. Remove fuel rail connector.

HIGH PRESSURE FUEL PUMP AND FUEL HOSE

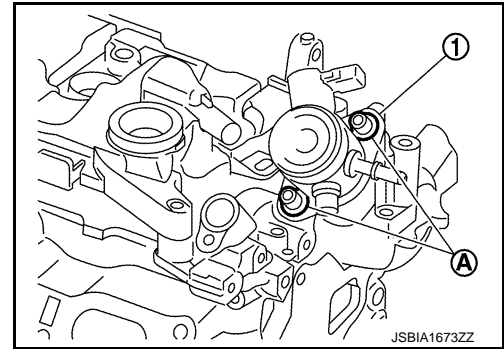
< REMOVAL AND INSTALLATION >

[MR20DD]

7. Remove high pressure fuel pump ① and lifter.

CAUTION:

To prevent damage to high pressure fuel pump and camshaft bracket, loosen bolt ① alternately by one turn at a time until the reaction force applied on the high pressure fuel pump disappears.



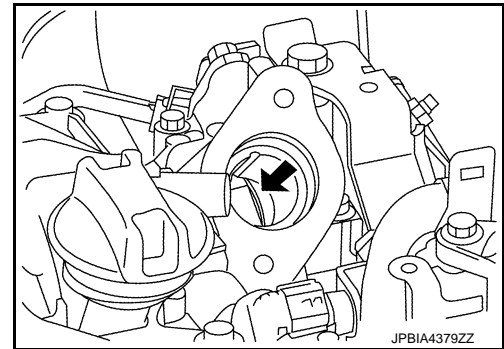
INSTALLATION

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.

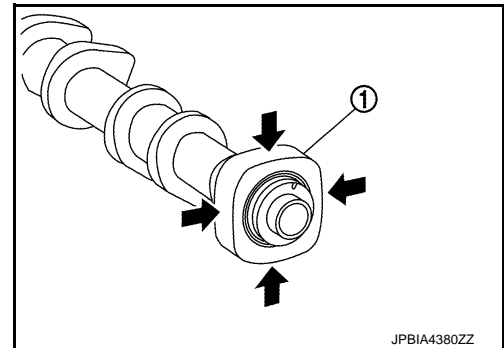


- b. Aim pump cam at the BDC area (arrow position).

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 >

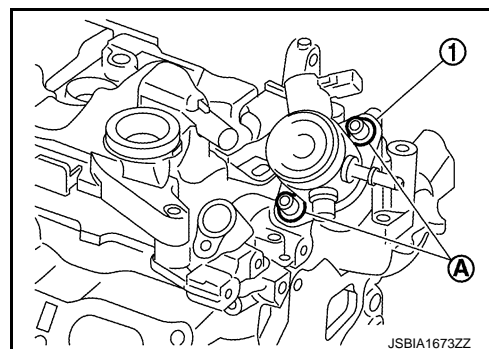
[MR20DD]

CAUTION:

- Temporarily tighten bolt ① 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.



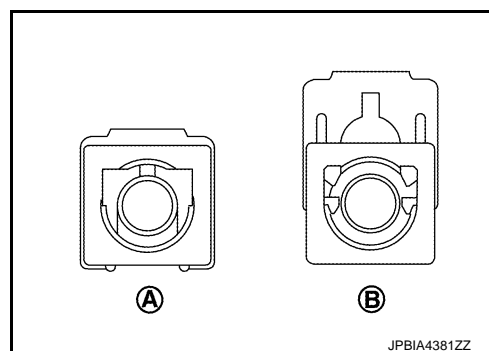
2. Connect fuel feed hose with the following procedure, and then install the fuel feed hose.
 - a. Check no foreign substances are deposited in and around matching pipe and quick connector, and no damage on them.
 - b. Quick connector shall be inserted gradually, aligning with the axis of the matching 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.

Ⓐ : Lock position

Ⓑ : Unlock position

CAUTION:

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

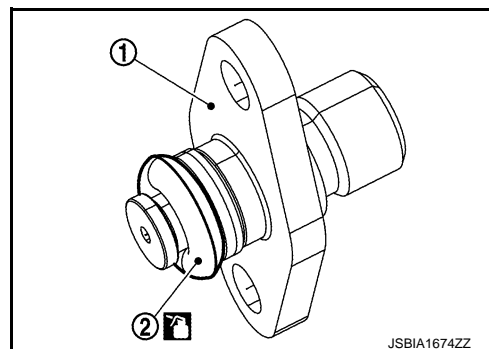


- d. After attaching the quick connector and fix the hose to the clamp.
3. Install new fuel rail connector ①.

② : O-ring

CAUTION:

- Never reuse fuel rail connector.
- 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 scratch O-ring with tools or fingernails when installing fuel rail connector.
- Insert new fuel rail connector straight into fuel rail. Never decenter or twist the fuel rail connector during insertion.



4. Install the fuel tube with the following procedure.

CAUTION:

- When removing fuel tube, always replace fuel rail connector together with fuel tube.
- Never reuse fuel tube.
- Never use fuel tube if its terminal tip is damaged.
- Observe the tightening order and the tightening torque.

HIGH PRESSURE FUEL PUMP AND FUEL HOSE

< REMOVAL AND INSTALLATION >

[MR20DD]

- a. Temporarily tighten flare nut ① and ② of fuel tube ③ until seated.

① : High pressure fuel pump

② : Fuel rail connector

CAUTION:

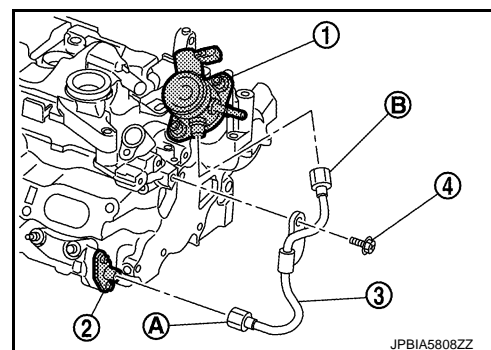
When temporarily tightening flare nut, place pipe in the center of the nut inner diameter.

- b. Temporarily tighten bolt ④ until the seat of bracket is seated.
c. Tighten flare nut ① and ② in alphabetical order.

CAUTION:

Always fit the tool completely with the nut.

- d. Tighten bolt ④.
5. Install in the reverse order of removal after this step.



Inspection

INFOID:0000000010783700

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 AND FUEL TUBE

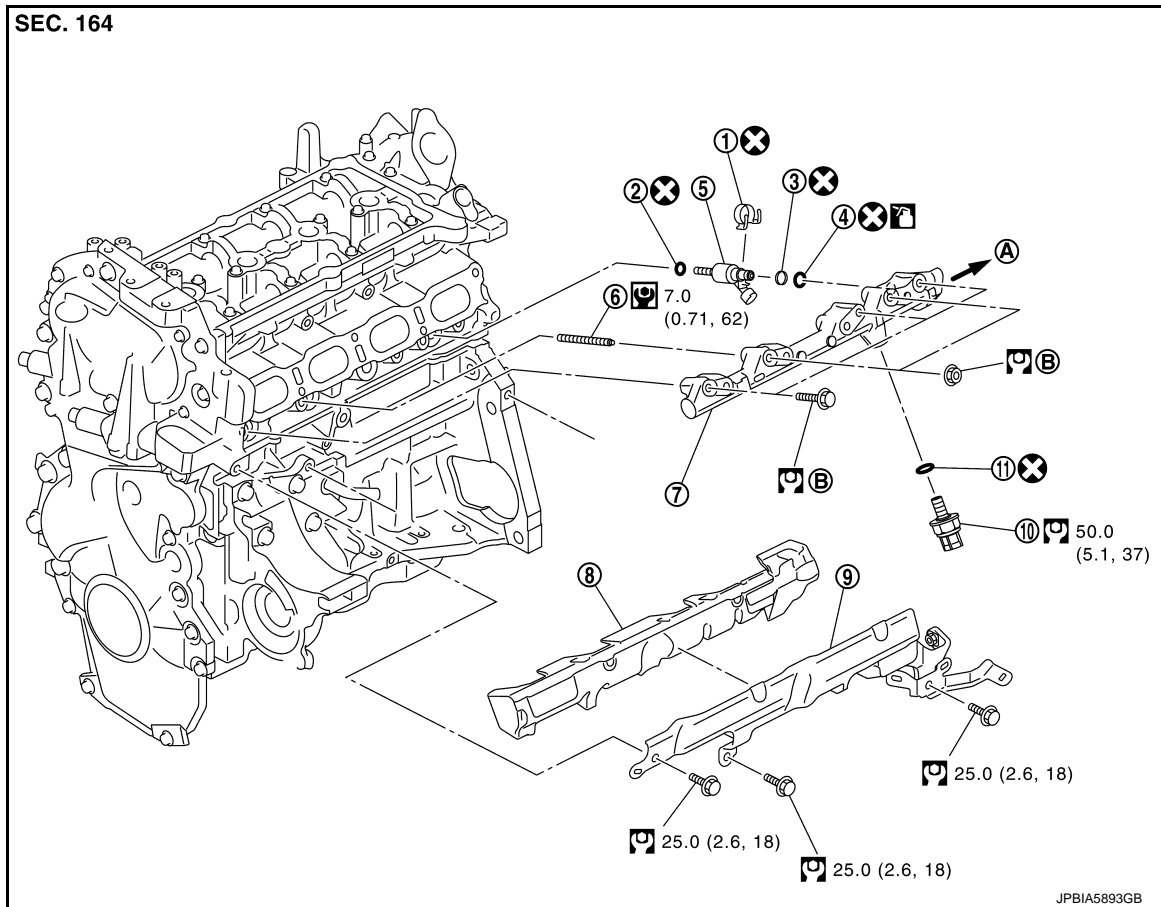
< REMOVAL AND INSTALLATION >

[MR20DD]

FUEL INJECTOR AND FUEL TUBE

Exploded View

INFOID:000000010783701



- | | | |
|---|---|-------------------|
| ① Holder | ② Seal ring (white) | ③ Backup ring |
| ④ O-ring (blue) | ⑤ Fuel injector | ⑥ Stud bolt |
| ⑦ Fuel rail | ⑧ Fuel rail insulator | ⑨ Fuel rail cover |
| ⑩ Fuel pressure sensor | ⑪ Gasket | |
| (A) To fuel rail connector and fuel tube.
Refer to EM-43 . | (B) Comply with the assembly procedure
when tightening. Refer to EM-48 | |

: N·m (kg-m, ft-lb)

: N·m (kg-m, in-lb)

: Always replace after every disassembly.

: Should be lubricated with oil.

CAUTION:

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

Removal and Installation

INFOID:000000010783702

WARNING:

- Be sure to read [EM-7, "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.

FUEL INJECTOR AND FUEL TUBE

[MR20DD]

< REMOVAL AND INSTALLATION >

- To avoid the danger of being scalded, never drain engine coolant when engine is hot.

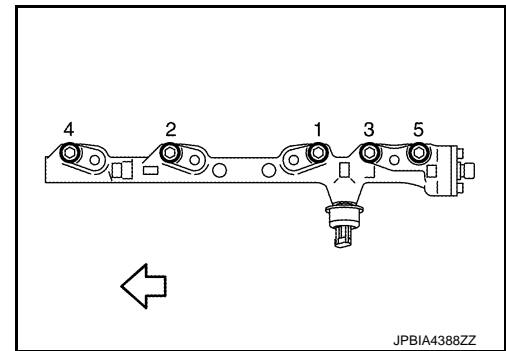
REMOVAL

1. Release the fuel pressure. Refer to [EC-152, "Work Procedure"](#).
2. Remove oil level gauge. Refer to [EM-106, "Exploded View"](#).
3. Remove intake manifold. Refer to [EM-33, "Exploded View"](#).
4. Remove alternator. Refer to [CHG-44, "MR20DD : Exploded View"](#).
5. Remove oil level gauge guide. Refer to [EM-106, "Exploded View"](#).
6. Remove fuel rail cover, and then remove fuel rail insulator.
7. Remove fuel tube and fuel rail connector. Refer to [EM-43, "Exploded View"](#).
8. Disconnect fuel pressure sensor harness connector.
9. Disconnect fuel injector harness connector.
10. Remove fuel pressure sensor, if necessary.
11. Remove fuel rail.
 - Loosen mounting bolts in reverse order as shown in the figure.

← : Engine front

CAUTION:

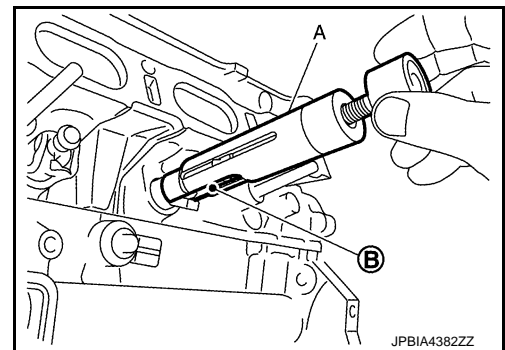
- When removing, be careful to avoid any interference with fuel injector.
- Use a shop cloth to absorb any fuel leakage from fuel rail.



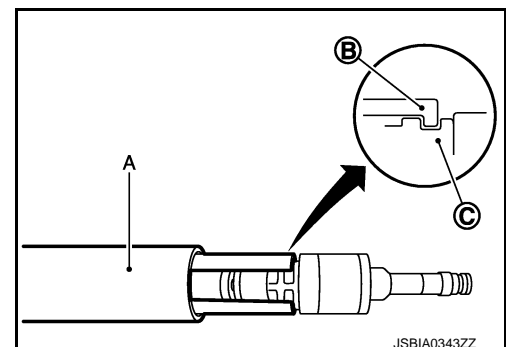
12. Remove fuel injector from cylinder head as per the following.

CAUTION:

- 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. Remove injector holder.
 - b. Install an remover [SST: KV10119600 (—)] (A) to the injector connector side so that cutout (B) of injector remover faces the injector connector side.



- Hook pawl portion (B) of injector remover [SST: KV10119600 (—)] (A) to groove portion (C) of injector

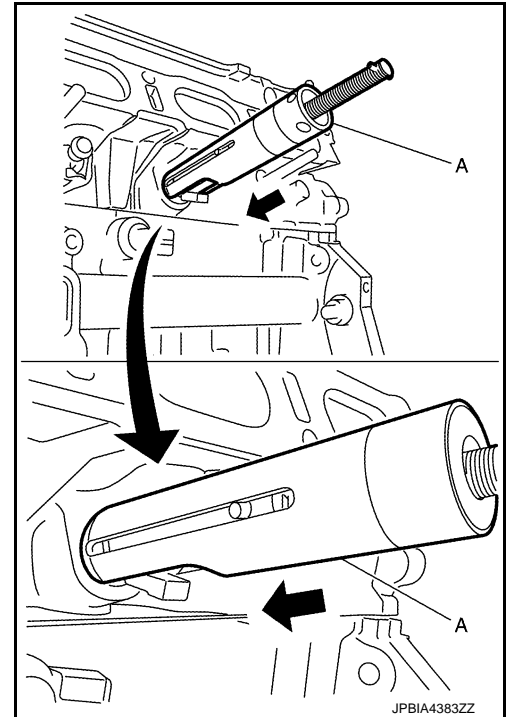


FUEL INJECTOR AND FUEL TUBE

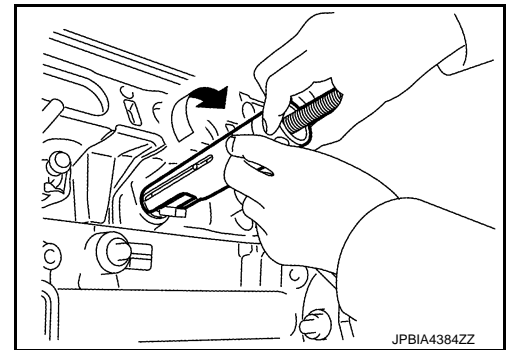
< REMOVAL AND INSTALLATION >

[MR20DD]

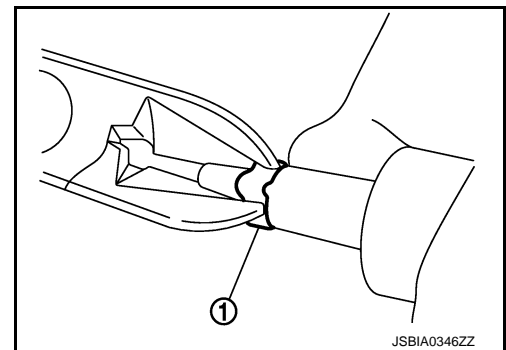
- c. Press down body portion of injector remover [SST: KV10119600 (—)] (A) until it contacts cylinder head.



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



- e. Cut seal ring ① while pinching it. Be careful not to damage injector.



INSTALLATION

CAUTION:

Do not reuse O-rings.

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

CAUTION:

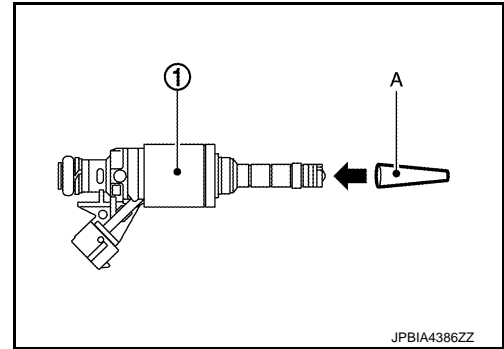
- Handle seal ring with bare hands. Never wear gloves.
- Never apply engine oil to seal ring.
- Never clean seal ring with solvent.

FUEL INJECTOR AND FUEL TUBE

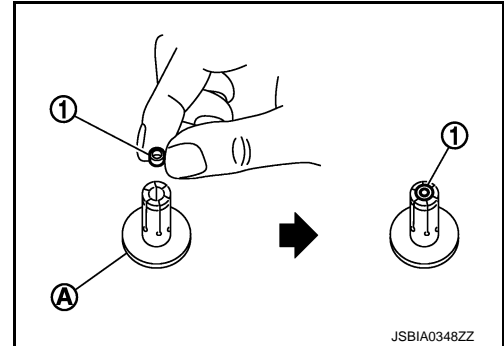
< REMOVAL AND INSTALLATION >

[MR20DD]

- a. Install an injector seal drift set [SST: KV101197S0 (—)] (A) to fuel injector ①.



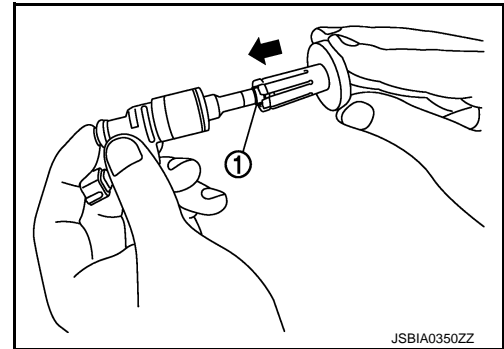
- b. Set seal ring ① to injector seal drift set [SST: KV101197S0 (—)] (A).



- c. Straightly insert seal ring ①, which is set in step 2, to fuel injector as shown in the figure and install.

CAUTION:

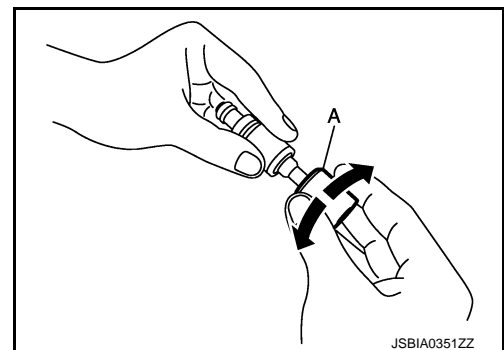
Be careful that seal ring does not exceed the groove portion of fuel injector.



- d. Insert injector seal drift set [SST: KV101197S0 (—)] (A) to injector and rotate clockwise and counterclockwise by 90° while pressing seal ring to fit it.

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. Install O-ring and backup ring to fuel injector. When handing new O-ring and backup ring, paying attention to the following caution items:

CAUTION:

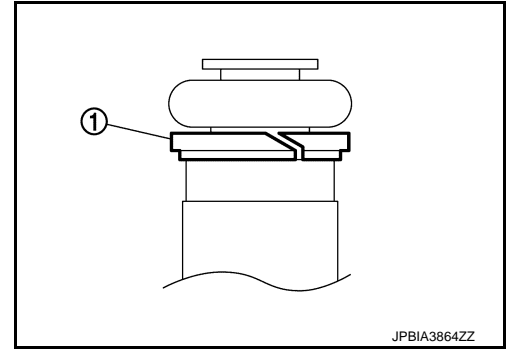
- Do not reuse O-ring.
- Handle O-ring with bare hands. Never wear gloves.
- Lubricate O-ring with new engine oil.
- Never clean O-ring with solvent.
- Check that O-ring and its mating part are free of foreign material.
- When installing O-ring, be careful not to scratch it with tool or fingernails. Also be careful not to twist or stretch O-ring. If O-ring was stretched while it was being attached, never insert it quickly into fuel tube.

FUEL INJECTOR AND FUEL TUBE

< REMOVAL AND INSTALLATION >

[MR20DD]

- Insert new O-ring straight into fuel rail. Never decenter or twist it.
- Always install the back up ring ① in the right direction as instructed.



3. Install fuel injector ① to fuel rail ② as per the following:

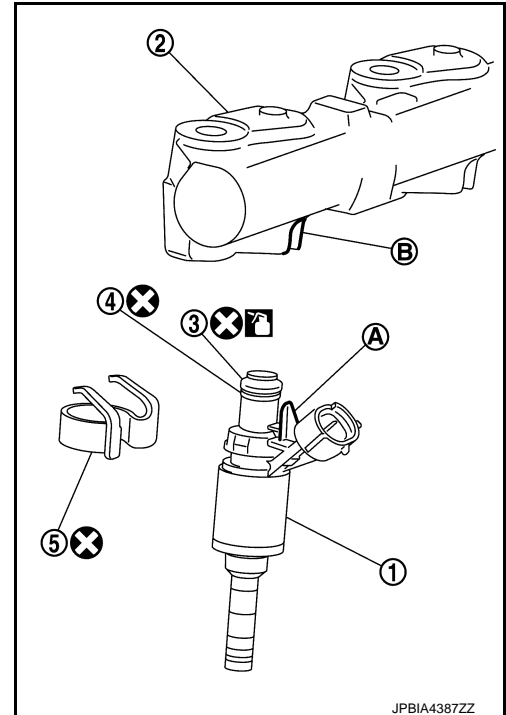
- ③ : O-ring (blue)
- ④ : Backup ring

a. Install fuel injector holder ⑤ to fuel injector.

CAUTION:

- Never reuse fuel injector holder. Replace it with a new one.
- Be careful to keep fuel injector holder from interfering with O-ring. If interference occurs, replace O-ring.

- b. Insert fuel injector into fuel rail with fuel injector holder attached.
- Insert it while matching it to the axial center.
 - Insert so that protrusion A of fuel injector is aligned to cutout B.
- c. Check that installation is complete by checking that fuel injector does not rotate or come off.
- Check that protrusions of fuel injectors and fuel rail are aligned with cutouts of clips after installation.



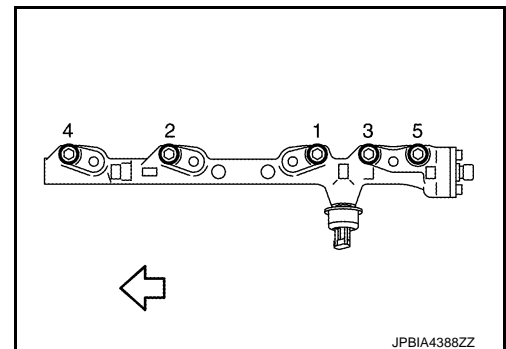
4. Install fuel rail and fuel injector assembly to cylinder head.

- Tighten mounting bolts and nuts in two steps in numerical order as shown in the figure.

← : Engine front

1st step : 10.0 N·m (1.0 kg-m, 89 in-lb)

2nd step : 20.5 N·m (2.1 kg-m, 15 ft-lb)



5. Connect injector harness connector.
6. Install fuel pressure sensor, if removed.
7. Install fuel rail insulator.

CAUTION:

- As covering part of fuel tube connector at the back end of common rail can easily move because of its shape, do not remove it before installation.
- Install the insulator so that it is placed under lower side of intake manifold flange.

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

FUEL INJECTOR AND FUEL TUBE

< REMOVAL AND INSTALLATION >

[MR20DD]

Inspection

INFOID:0000000010783703

A

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.

EM

C

D

E

F

G

H

I

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L

M

N

O

P

IGNITION COIL, SPARK PLUG AND ROCKER COVER

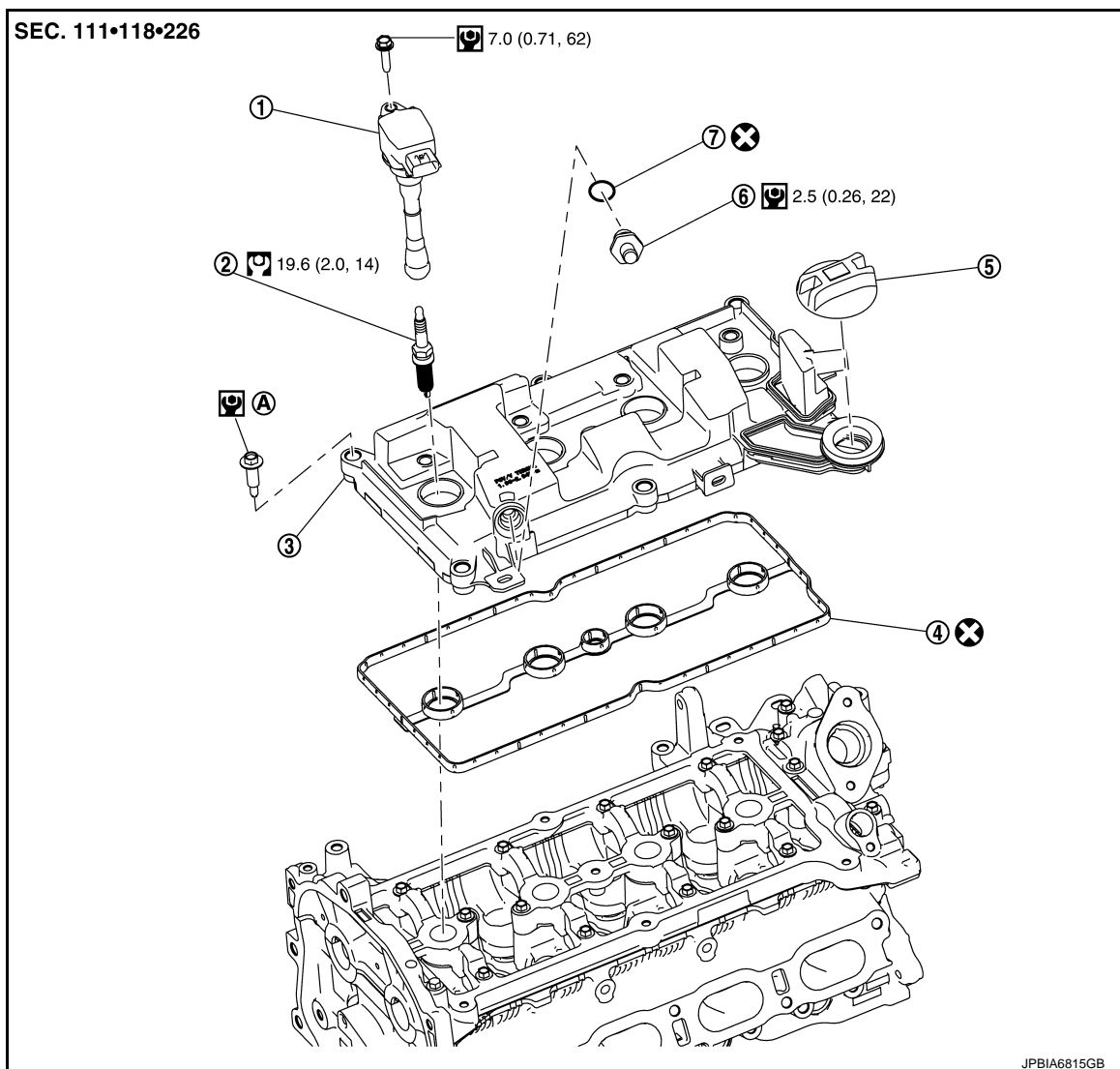
< REMOVAL AND INSTALLATION >

[MR20DD]

IGNITION COIL, SPARK PLUG AND ROCKER COVER

Exploded View

INFOID:000000010783704



- | | | |
|-----------------------|------------------|----------------|
| ① Ignition coil | ② Spark plug | ③ Rocker cover |
| ④ Rocker cover gasket | ⑤ Oil filler cap | ⑥ PCV valve |

⑦ O-ring

Ⓐ Comply with the installation procedure when tightening. Refer to [EM-54](#)

ⓧ : Always replace after every disassembly.

Ⓜ : N·m (kg-m, ft-lb)

Ⓜ : N·m (kg-m, in-lb)

Removal and Installation

INFOID:000000010783705

REMOVAL

1. Remove intake manifold. Refer to [EM-33. "Exploded View"](#).
2. Remove PCV valve and PCV hose, if necessary.
3. Remove ignition coil.

IGNITION COIL, SPARK PLUG AND ROCKER COVER

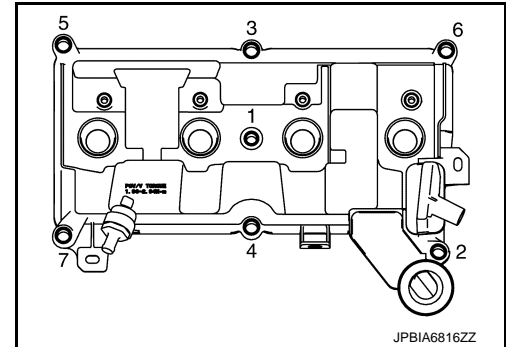
< REMOVAL AND INSTALLATION >

[MR20DD]

CAUTION:

- Never drop or shock ignition coil.
- Never disassemble ignition coil.

4. Remove rocker cover.
 - Loosen bolts in the order from 7 to 1 shown in the figure.



5. Remove rocker cover gasket from rocker cover.
6. Use scraper to remove all traces of liquid gasket from camshaft bracket.

CAUTION:

Never scratch or damage the mating surface when cleaning off old liquid gasket.

INSTALLATION

CAUTION:

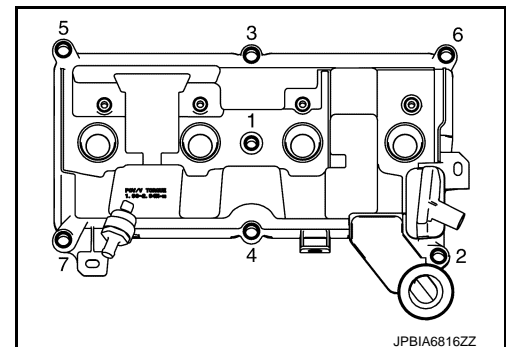
Do not reuse O-ring.

1. Install the rocker cover gasket to rocker cover.
 - CAUTION:
Check the gasket is not dropped.
2. Install rocker cover.
 - Tighten bolts in two steps separately in the order from 1 to 7 as shown in the figure.

 **1st step** : 1.96 N·m (0.20 kg-m, 17 in-lb)

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

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

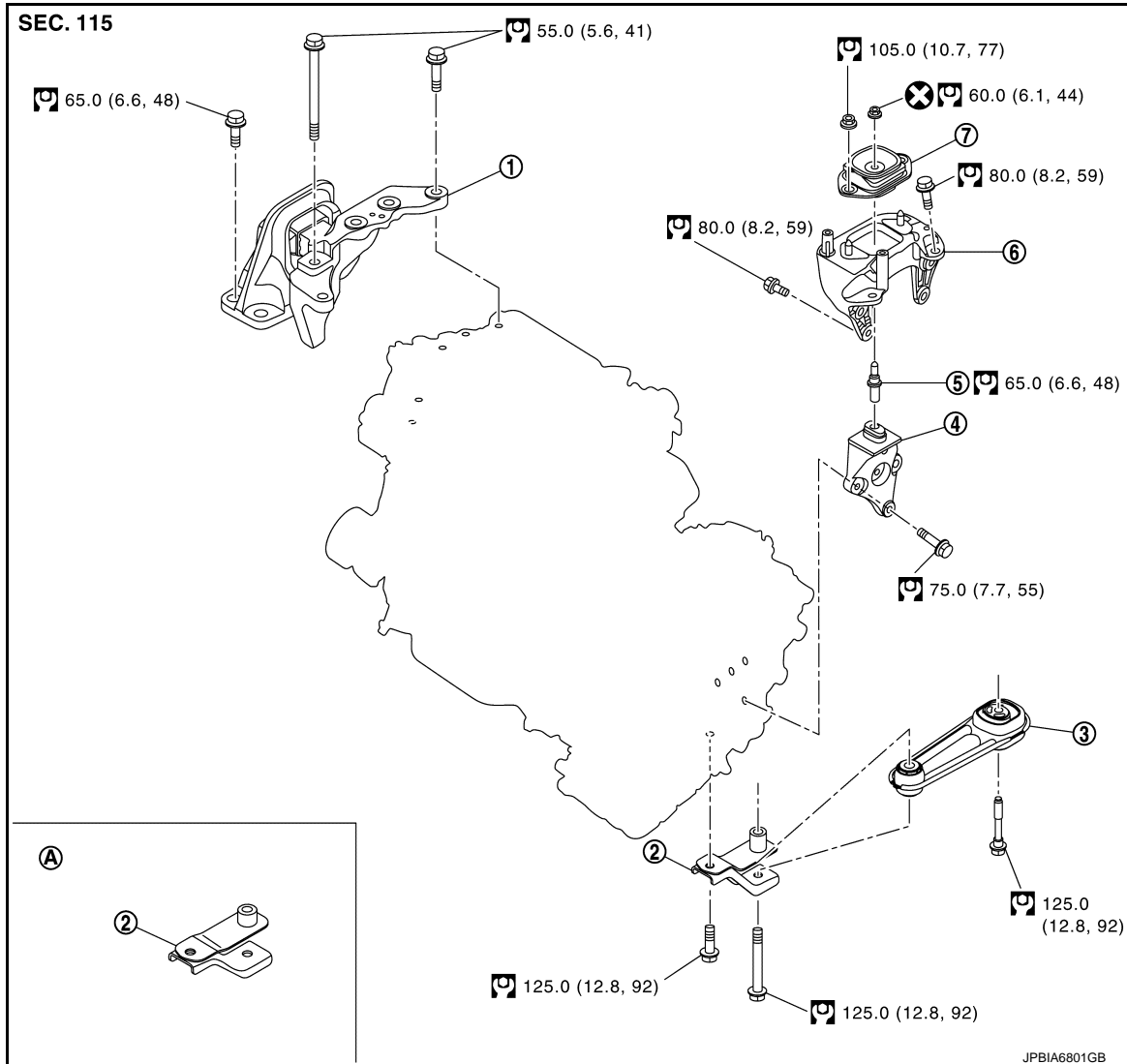


UNIT REMOVAL AND INSTALLATION

ENGINE ASSEMBLY

Exploded View

INFOID:0000000010783706



JPBIA6801GB

- | | | |
|----------------------------------|---------------------------|--|
| ① Engine mounting insulator (RH) | ② Rear torque rod bracket | ③ Rear torque rod |
| ④ Engine mounting bracket (LH) | ⑤ Stud bolt | ⑥ Engine mounting bracket support (LH) |

⑦ Engine mounting insulator (LH)

A 4WD models

⊗ : Always replace after every disassembly.

⊙ : N·m (kg·m, ft·lb)

Removal and Installation

INFOID:0000000010783707

WARNING:

- Situate the vehicle on a flat and solid surface.
- Place chocks at front and back of rear wheels.
- Attach proper slingers and bolts described in PARTS CATALOG if engine slingers are not equipped.

CAUTION:

ENGINE ASSEMBLY

< UNIT REMOVAL AND INSTALLATION >

[MR20DD]

- Always be careful to work safely, avoid forceful or uninstructed operations.
- Never start working until exhaust system and 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 best you can. If board-on type is used for unavoidable reasons, support at the rear axle jacking point with a 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-31, "Garage Jack and Safety Stand and 2-Pole Lift"](#).

NOTE:

When removing components such as hoses, tubes/lines, etc., cap or plug openings to prevent fluid from spilling.

REMOVAL

Outline

Remove the engine and the transaxle assembly from the vehicle downward. Separate the engine and the transaxle.

Preparation

1. Release the fuel pressure. Refer to [EC-152, "Work Procedure"](#).
2. Drain engine coolant from radiator. Refer to [CO-13, "Draining"](#).
CAUTION:
 - Perform this step when the engine is cold.
 - Never spill engine coolant on drive belts.
3. Remove the following parts.
 - Engine under cover: Refer to [EXT-39, "ENGINE UNDER COVER : Exploded View"](#).
 - Front road wheels and tires: Refer to [WT-61, "Exploded View"](#).
 - Front fender protector (RH and LH): Refer to [EXT-35, "FENDER PROTECTOR : Exploded View"](#).
 - Drive belts: Refer to [EM-22, "Exploded View"](#).
 - Battery: Refer to [PG-140, "EXCEPT FOR R9M : Exploded View"](#).
 - Battery tray: Refer to [PG-146, "EXCEPT FOR R9M : Exploded View"](#).
 - TCM: Refer to [TM-415, "Exploded View"](#). (CVT models)
 - Air duct 1 and 2, air duct assembly, and air cleaner assembly: Refer to [EM-30, "Exploded View"](#).
 - Radiator hose (upper and lower): Refer to [CO-17, "Exploded View"](#).
 - Exhaust front tube: Refer to [EX-6, "Exploded View"](#).

Engine Room LH

1. Disconnect all connections of engine harness around the battery, and then temporarily secure the engine harness into the engine side.
CAUTION:
Protect connectors using a resin bag against foreign materials during the operation.
2. Disconnect fuel feed tube at engine side. Refer to [EM-43, "Exploded View"](#).
3. Disconnect heater hoses.
4. Disconnect control cable from transaxle. Refer to [TM-406, "MR20DD : Exploded View"](#).
5. Remove EVAP hoses. Refer to [EM-33, "Exploded View"](#).

Engine Room RH

1. Disconnect vacuum hose from intake manifold. Refer to [EM-33, "Exploded View"](#).
2. Disconnect A/C piping from A/C compressor. Refer to [HA-78, "Exploded View"](#).
3. Disconnect ground cable above the alternator.

Vehicle Underbody

1. Disconnect steering lower joint at steering gear assembly side, and release steering shaft. Refer to [ST-17, "Exploded View"](#).
2. Remove ground cable at transaxle side.
3. Remove rear propeller shaft. Refer to [DLN-214, "Exploded View"](#). (4WD models)
4. Remove front wheel sensor (RH and LH) for ABS from steering knuckle. Refer to [BRC-212, "FRONT WHEEL SENSOR : Exploded View"](#).

ENGINE ASSEMBLY

< UNIT REMOVAL AND INSTALLATION >

[MR20DD]

5. Remove lock plate of brake hose from strut. Refer to [BR-24, "FRONT : Exploded View"](#) (LHD models) or [BR-88, "FRONT : Exploded View"](#) (RHD models).
6. Remove brake caliper assembly with piping connected from steering knuckle. Temporarily secure it on the vehicle side with a rope to avoid load on it. Refer to the following table:

TYPE		Reference
LHD models		BR-50, "BRAKE CALIPER ASSEMBLY (1 PISTON TYPE) : Exploded View"
RHD models	1 piston type	BR-110, "BRAKE CALIPER ASSEMBLY (1 PISTON TYPE) : Exploded View"
	2 piston type	BR-115, "BRAKE CALIPER ASSEMBLY (2 PISTON TYPE) : Exploded View"

7. Disconnect steering outer sockets from steering knuckle. Refer to [ST-20, "LHD : Exploded View"](#) (LHD models) or [ST-21, "RHD : Exploded View"](#) (RHD models).
8. Remove front drive shafts (RH and LH). Refer to [FAX-34, "MR20DD : Exploded View"](#) (2WD models) or [FAX-100, "MR20DD : Exploded View"](#) (4WD models).

NOTE:

Cap or plug openings to prevent fluid from spilling.

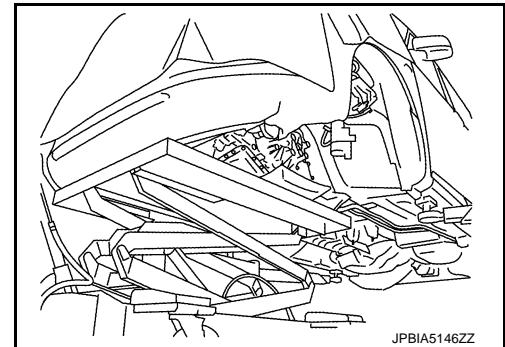
9. Remove rear torque rod.
10. Remove stabilizer connecting rod. Refer to [FSU-19, "Exploded View"](#).
11. Remove front suspension member. Refer to [FSU-22, "Exploded View"](#).
12. Preparation for the separation work of transaxle is as follows:
 - Remove transaxle joint bolts which pierce at oil pan (upper) lower rear side. Refer to [EM-102, "Exploded View"](#).

Removal

1. Use a manual lift table caddy (commercial service tool) or equivalently rigid tool such as a transmission jack. Securely support bottom of the engine and the transaxle assembly.

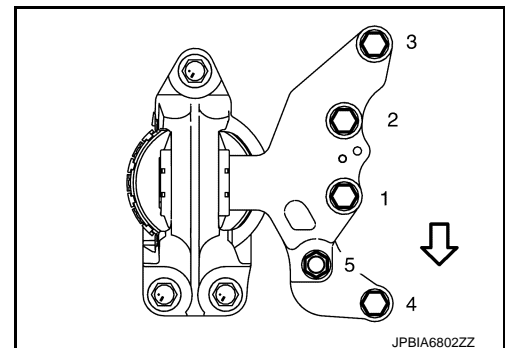
CAUTION:

Put a piece of wood or an equivalent as the supporting surface, secure a completely stable condition.



2. Remove engine mounting bolts on engine mounting insulator (RH).
 - Loosen mounting bolts in the reverse order as shown in the figure.

⇐ : Vehicle front



ENGINE ASSEMBLY

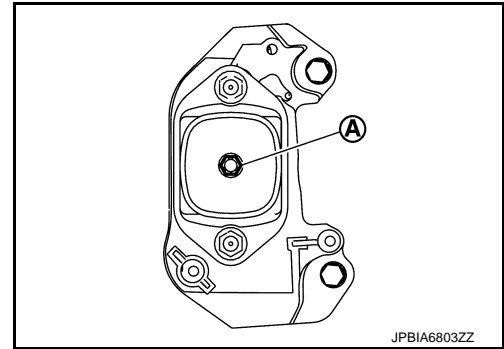
[MR20DD]

< UNIT REMOVAL AND INSTALLATION >

3. Remove engine mounting insulator (LH) mounting nut (A) to the transaxle.
4. Carefully lower jack, or raise lift to remove the engine and the transaxle assembly. When performing work, observe the following caution.

CAUTION:

- Check that no part interferes with the vehicle side.
- Before and during this lifting, always check if any harnesses are left connected.
- During the removal, always be careful to prevent the vehicle from falling off the lift due to changes in the center of gravity.
- If necessary, support the vehicle by setting jack or suitable tool at the rear.

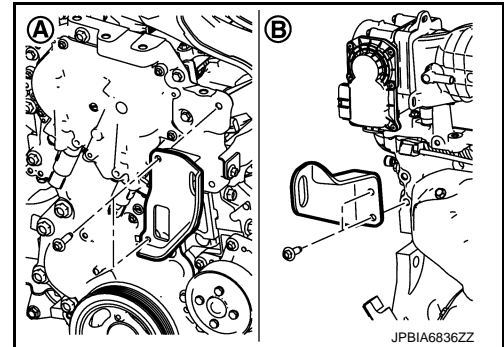


Separation

1. Install engine slinger to front cover front left side (A) and cylinder head rear right side (B).

Slinger bolts

: 32.9 N·m (3.4 kg-m, 24 ft-lb)



2. Remove starter motor. Refer to [STR-26, "MR20DD : Exploded View"](#).
3. Lift with a hoist and separate the engine from the transaxle assembly. Refer to [TM-41, "Exploded View"](#) (6MT models) or [TM-449, "Exploded View"](#) (CVT models).

INSTALLATION

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

CAUTION:

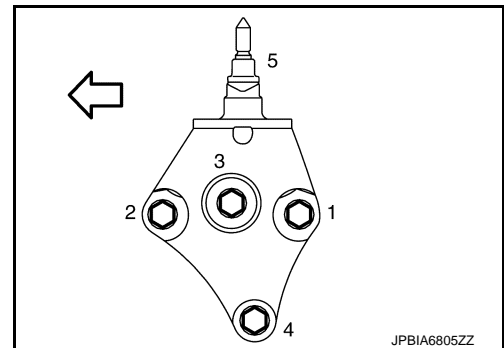
- Never allow engine oil to get on engine mounting insulator. Be careful not to damage engine mounting insulator.
- Check that each mounting insulator is seated properly, and tighten mounting nuts and bolts.

Engine mounting bracket (LH)

1. Tighten the bolt No. 1 to 4 as shown in the figure. (temporarily)

: Vehicle front

2. Tighten the bolts No. 1 to 4 as shown in the figure. (specified torque)
3. Check that stud bolt No. 5 shown in the figure is tightened to the specified torque.



Engine mounting bracket support (LH)

1. Install the engine mounting bracket support (LH) to the body.

ENGINE ASSEMBLY

< UNIT REMOVAL AND INSTALLATION >

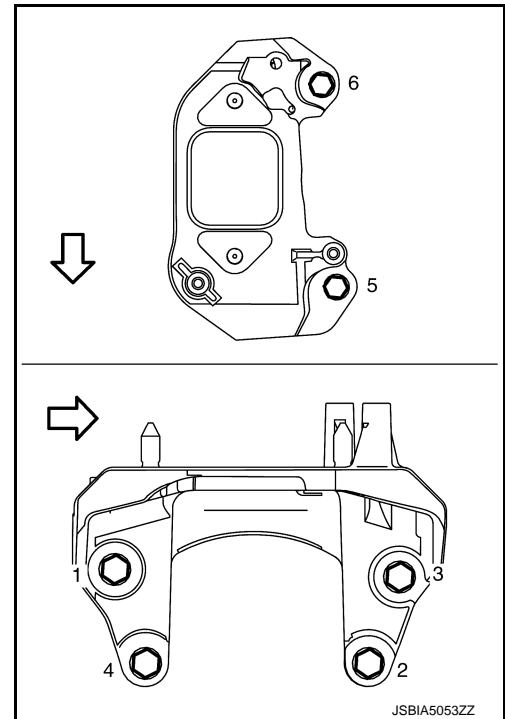
[MR20DD]

- a. Temporarily tighten the bolts.

Tightening procedure : 5 → 6 → 1

↩ : Vehicle front

- b. Tighten the bolts No. 1 to 6 as shown in the figure. (specified torque)



Inspection

INFOID:0000000010783708

INSPECTION AFTER INSTALLATION

Inspection for Leakage

The following are procedures for checking fluids leakage, lubricates leakage, and exhaust gases 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-23. "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.
- Warm up engine thoroughly to check there is no leakage of fuel, exhaust gases, 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 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:0000000010783709

EM

NOTE:

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

1. Remove the engine and the transaxle assembly from the vehicle, and separate the transaxle from the engine. Refer to [EM-56, "Exploded View"](#).
2. Install engine to engine stand with the following procedure:
 - a. Remove flywheel or drive plate. Refer to [EM-62, "Exploded View"](#) or [EM-65, "Exploded View"](#).
 - b. Lift the engine with a hoist to install it onto widely use engine stand.

CAUTION:

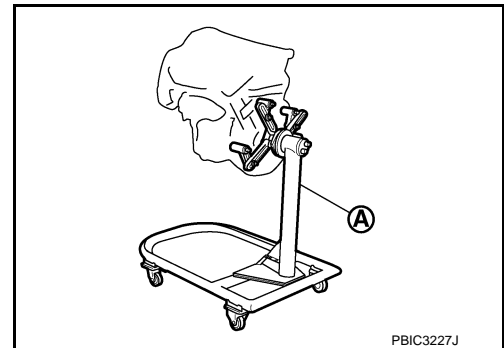
- Use the engine stand that has a load capacity [approximately 135 kg (298 lb) or more] large enough for supporting the engine weight.
- If the load capacity of stand is not adequate, remove the following parts beforehand to reduce the potential risk of overturning stand.
 - Intake manifold: Refer to [EM-33, "Exploded View"](#).
 - Exhaust manifold: Refer to [EM-37, "Exploded View"](#).

NOTE:

The figure shows an example of widely used engine stand ① that can support mating surface of transaxle with drive plate removed.

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-10, "Draining"](#).

CAUTION:

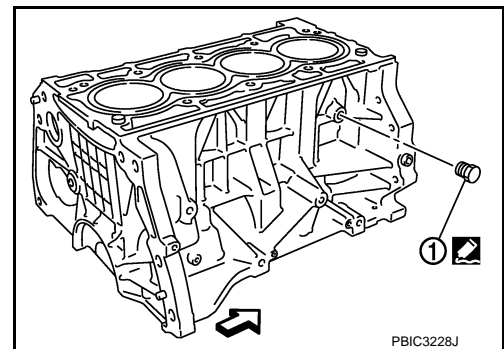
Be sure to clean drain plug and install with new drain plug washer.

4. Drain engine coolant by removing water drain plug ① from inside of the engine.

⇐ : Engine front

Tightening torque : Refer to [EM-107, "Disassembly and Assembly"](#).

Use Genuine Liquid Gasket (Three Bond 1217H) or equivalent.



FLYWHEEL

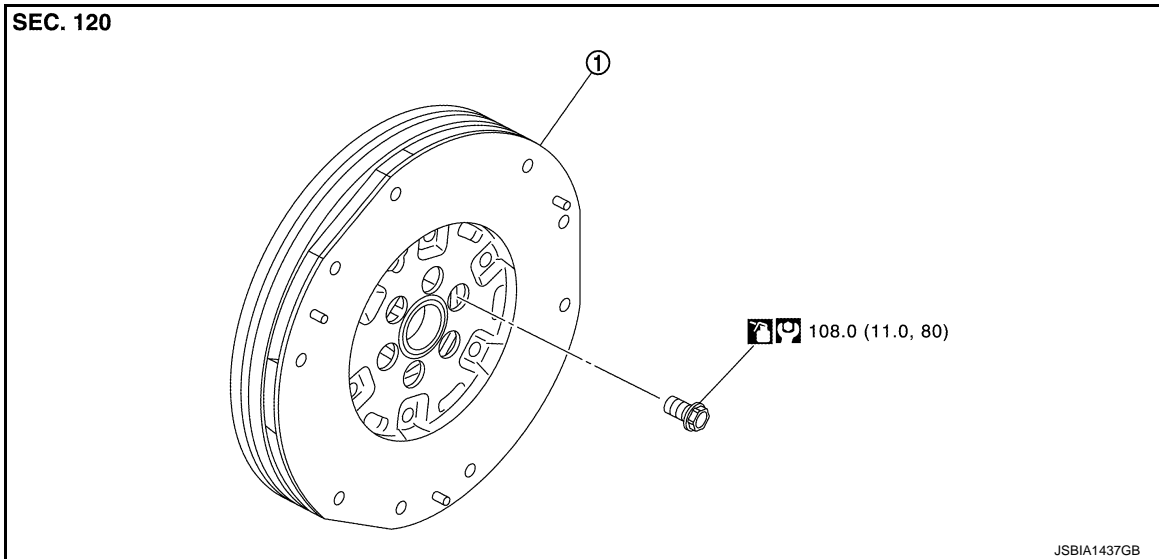
< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

FLYWHEEL

Exploded View

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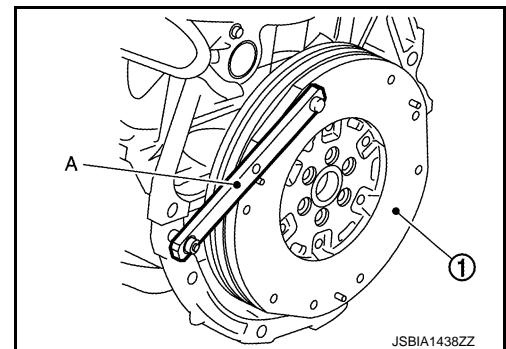


Removal and Installation

INFOID:0000000010783711

REMOVAL

1. Remove the engine and the transaxle assembly from the vehicle, and separate the transaxle from the engine. Refer to [EM-56, "Exploded View"](#).
2. Remove flywheel.
 - Secure flywheel ① with a stopper plate [SST: KV11105210] (A), and remove mounting bolts.



CAUTION:

- Never disassemble them.
- 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.

INSTALLATION

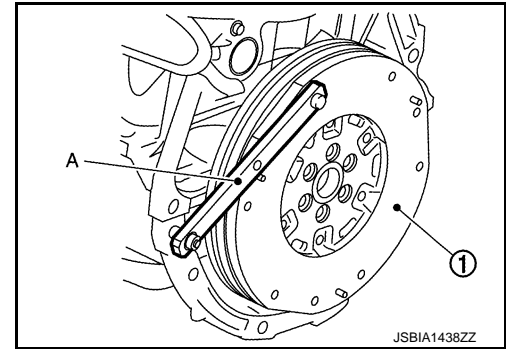
1. Install flywheel.

FLYWHEEL

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

- Secure flywheel ① with a stopper plate [SST: KV11105210] (A), and tighten mounting bolts.
- Using TORX socket (size E20), tighten mounting bolts.



CAUTION:

Never damage or scratch and contact surface for clutch disc of flywheel.

Inspection

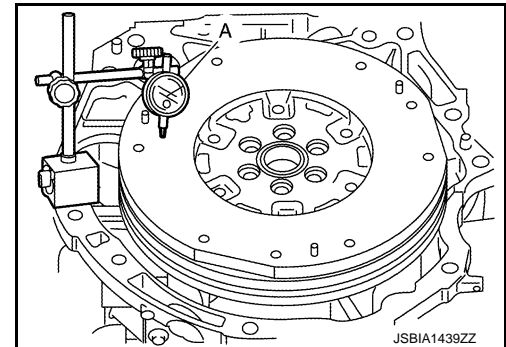
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FLYWHEEL DEFLECTION

- Measure the deflection of flywheel contact surface to torque with a dial indicator (A).
- Measure the deflection at 210 mm (8.27 in) diameter.

Limit : 0.45 mm (0.0177 in) or less.

- If measured value is out of the standard, replace flywheel.
- If a trace of burn or discoloration is found on the surface, repair it with sandpaper.



MOVEMENT AMOUNT OF FLYWHEEL

CAUTION:

Never disassemble double mass flywheel.

Movement Amount of Thrust (Fore-and-Aft) Direction

- Measure the movement amount of thrust (fore-and-aft) direction when 100 N (10.2 kg, 22 lb) force is added at the portion of 125 mm (4.92 in) radius from the center of flywheel.

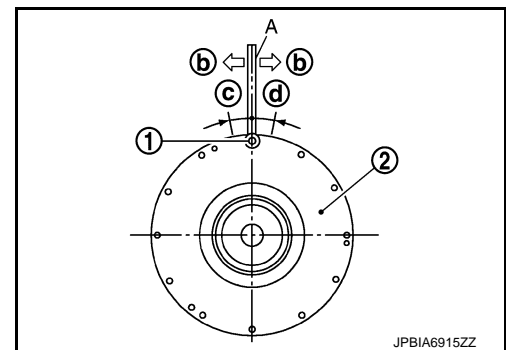
Standard : 1.8 mm (0.071 in) or less

- If measured value is out of the standard, replace flywheel.

Movement Amount in Radial (Rotation) Direction

Check the movement amount of radial (rotation) direction with the following procedure:

1. Install clutch cover mounting bolt ① to clutch cover mounting hole, and place a torque wrench (A) on the extended line of the flywheel ② center line.
 - Tighten bolt at a force of 9.8 N·m (1.0 kg-m, 87 in-lb) to keep it from loosening.
2. Put a mating mark on circumferences of the two flywheel masses without applying any load (Measurement standard points).
3. Apply a force of ⑥ [9.8 N·m (1.0 kg-m, 87 in-lb)] in each direction, and mark the movement amount on the mass on the transaxle side.
4. Measure the dimensions of movement amounts ③ and ④ on circumference of the flywheel on the transaxle side.



Limit : 33.2 mm (1.307 in) or less.

FLYWHEEL

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

-
- If measured value is out of the standard, replace flywheel.

DRIVE PLATE

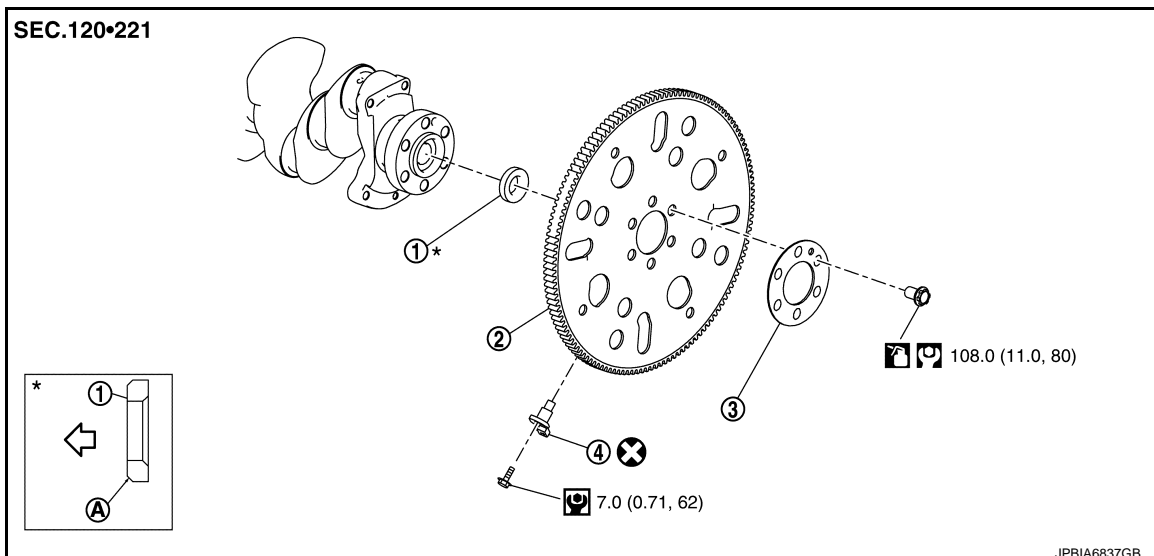
< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

DRIVE PLATE

Exploded View

INFOID:0000000010783713



- ① Pilot converter ② Drive plate ③ Reinforcement plate

- ④ Crankshaft position sensor 2

- Ⓐ Chamfered

- ⇐ : Crankshaft side

- ⊗ : 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

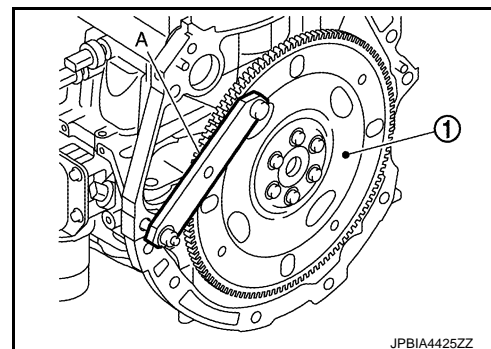
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REMOVAL

1. Remove the engine and the transaxle assembly from the vehicle, and separate the transaxle from the engine. Refer to [EM-56, "Exploded View"](#).
2. Remove drive plate.
 - Secure drive plate ① with a stopper plate [SST: KV11105210] (A), and remove mounting bolts.
 - Using TORX socket (size E20), loosen mounting bolts.
 - loosen mounting bolts in diagonal order.

CAUTION:

 - **Never disassemble them.**

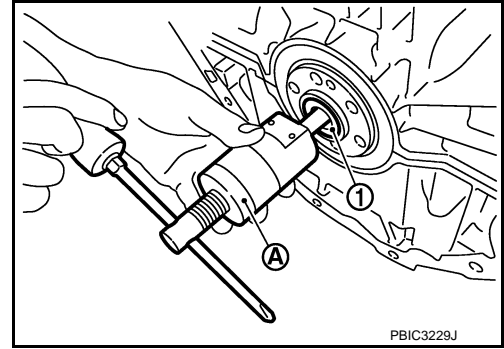


DRIVE PLATE

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

3. Remove pilot converter ①, from the rear end of the crankshaft. Use a pilot bush puller (commercial service tool) (A), if necessary.

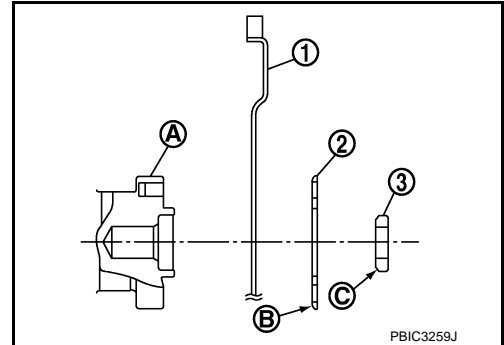


INSTALLATION

1. Install drive plate ①, reinforcement plate ② and pilot converter ③ as shown in figure.

- (A) : Crankshaft rear end
- (B) : Rounded
- (C) : Chamfered

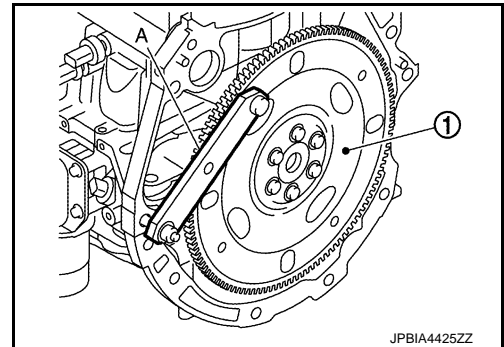
- Using a drift of 33 mm (1.30 in) in diameter, press-fit pilot converter into the end of crankshaft until it stops.



CAUTION:

Be careful not to damage or scratch and contact surface for clutch disc of flywheel.

2. Install drive plate.
 - Secure drive plate ① with a stopper plate [SST: KV11105210] (A), and remove mounting bolts.
 - Using TORX socket (size E20), tighten mounting bolts.
 - Install mounting bolts in diagonal order.



Inspection

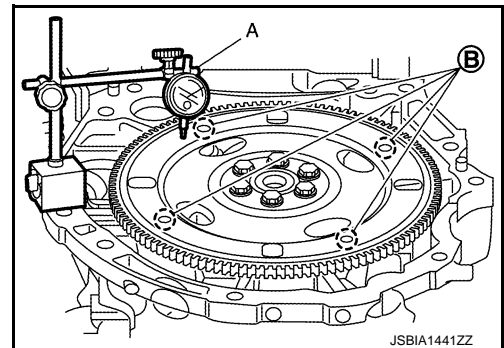
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DRIVE PLATE DEFLECTION

- Measure the deflection of drive plate contact surface to torque converter with a dial indicator (A).
- Measure the deflection at the area limited between 11.0 mm (0.433 in) dia and 20.6 mm (0.811 in) dia around hole (B).

Limit : 0.20 mm (0.0079 in) or less.

- If measured value is out of the standard, replace drive plate.



TIMING CHAIN

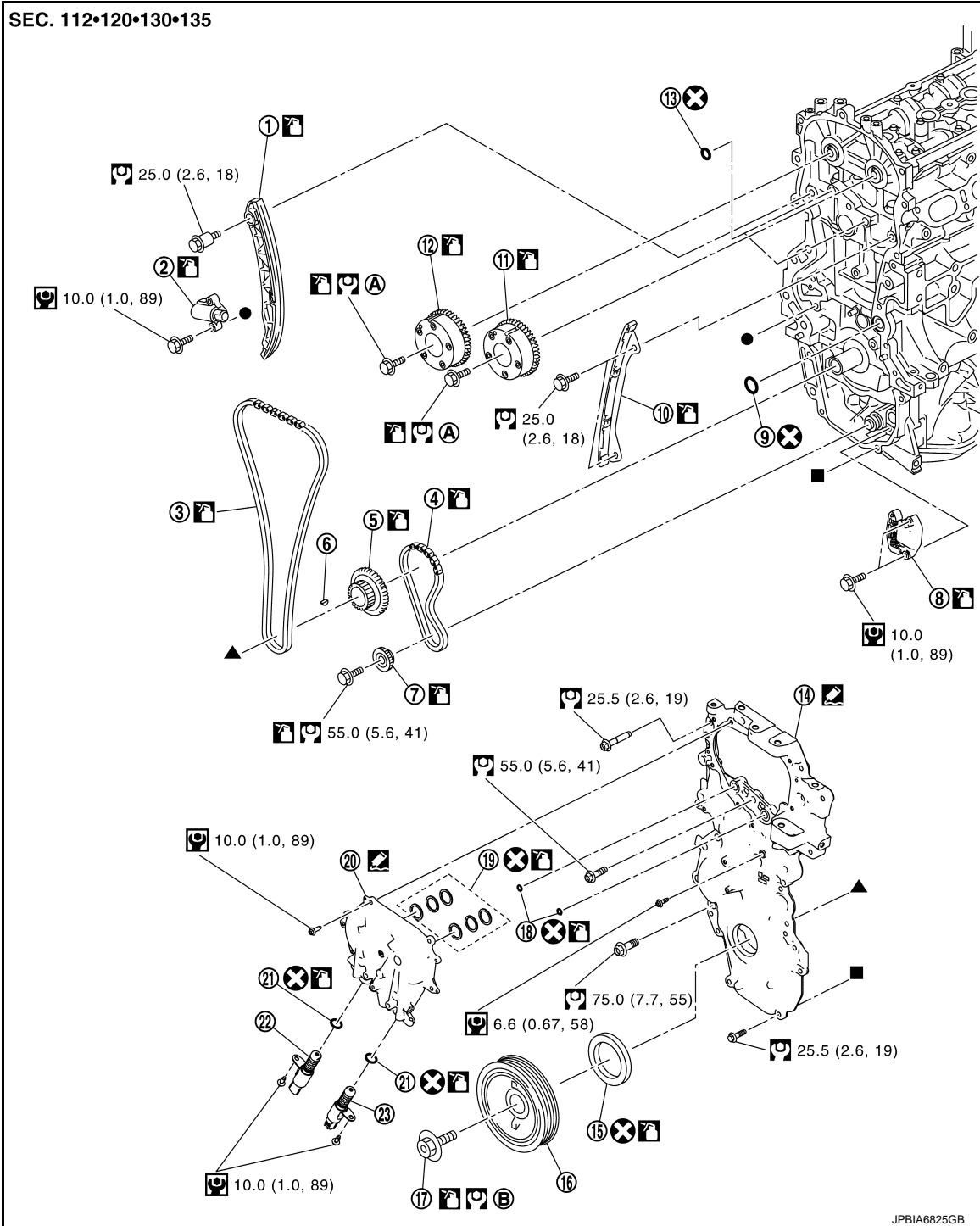
< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

TIMING CHAIN

Exploded View

INFOID:000000010783716



- | | | |
|------------------------------|--|---------------------------|
| ① Slack guide | ② Timing chain tensioner | ③ Timing chain |
| ④ Balancer unit timing chain | ⑤ Crankshaft sprocket | ⑥ Crankshaft key |
| ⑦ Balancer unit sprocket | ⑧ Balancer unit timing chain tensioner | ⑨ O-ring |
| ⑩ Timing chain tension guide | ⑪ Camshaft sprocket (INT) | ⑫ Camshaft sprocket (EXH) |
| ⑬ O-ring | ⑭ Front cover | ⑮ Front oil seal |
| ⑯ Crankshaft pulley | ⑰ Crankshaft pulley bolt | ⑱ O-ring |

TIMING CHAIN

[MR20DD]

< UNIT DISASSEMBLY AND ASSEMBLY >

- | | | |
|--|---|--|
| ①9 O-ring | ②0 VTC cover | ②1 O-ring |
| ②2 Exhaust valve timing control solenoid valve | ②3 Intake valve timing control solenoid valve | |
| Comply with the installation procedure when tightening. Refer to EM-81. "Removal and Installation" | | Comply with the installation procedure when tightening. Refer to EM-68. "Removal and Installation" |

⊗ : Always replace after every disassembly.

⊙ : N·m (kg-m, ft-lb)

⊙ : N·m (kg-m, in-lb)

⊙ : Should be lubricated with oil.

⊙ : Sealing point

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

Removal and Installation

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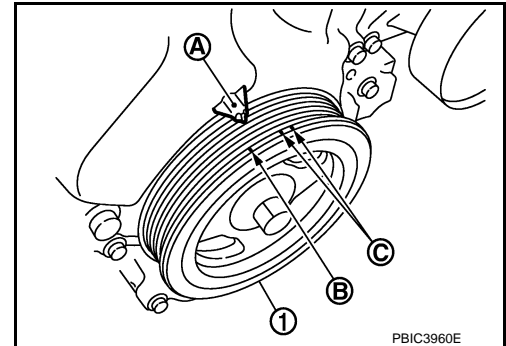
REMOVAL

CAUTION:

The rotating direction in the text indicates all directions seen from the engine front.

1. Drain engine oil. Refer to [LU-10. "Draining"](#).
2. Remove rocker cover. Refer to [EM-54. "Exploded View"](#).
3. Remove drive belts. Refer to [EM-22. "Removal and Installation"](#).
4. Set No. 1 cylinder at TDC on its compression stroke with the following procedure:
 - a. Rotate crankshaft pulley ① clockwise and align TDC mark (no paint) ② to timing indicator ③ on front cover.

③ : White paint mark (Not use for service)



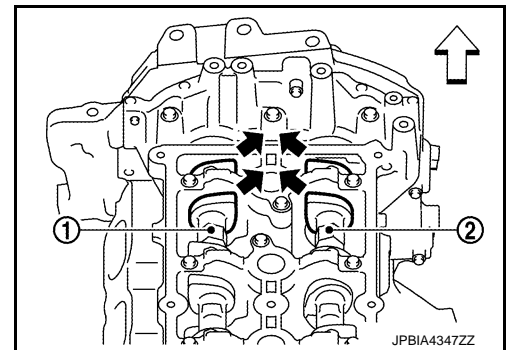
- b. At the same time, check that the cam noses of the No. 1 cylinder are located (↔) as shown in the figure.

① : Camshaft (INT)

② : Camshaft (EXH)

↔ : Engine front

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



5. Remove crankshaft pulley with the following procedure:

TIMING CHAIN

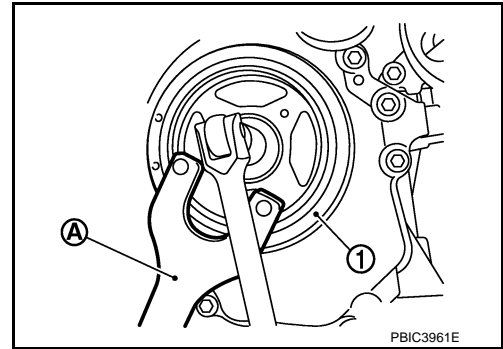
< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

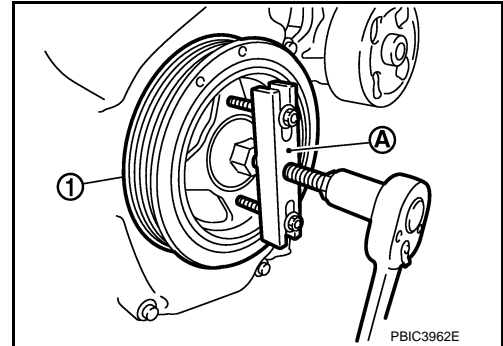
- a. Fix crankshaft pulley ① with a pulley holder ① (commercial service tool), loosen crankshaft pulley bolt, and locate bolt seating surface at 10 mm (0.39 in) from its original position.

CAUTION:

Never remove the crankshaft pulley bolt as they will be used as a supporting point for the pulley puller [SST: KV11103000].



- b. Attach a pulley puller [SST: KV11103000] ① in the M6 thread hole on crankshaft pulley ①, and remove crankshaft pulley.



6. Remove oil pan (lower). Refer to [EM-40, "Exploded View"](#).

NOTE:

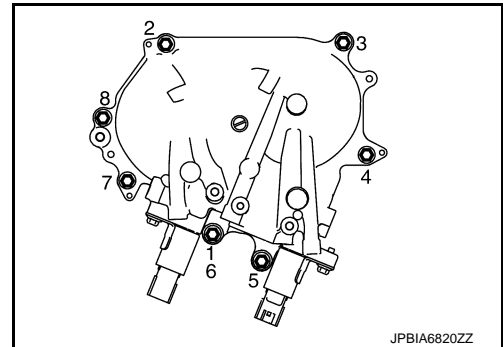
If crankshaft sprocket and balancer unit component are not removed, this step is unnecessary.

7. Remove intake valve timing control solenoid valve and exhaust valve timing control solenoid valve.
8. Remove idler pulley assembly. Refer to [EM-29, "Exploded View"](#).
9. Remove VTC cover.

- Loosen mounting bolts in the order from 8 to 1 as shown in the figure.

NOTE:

Disregard No. 6 when loosening.



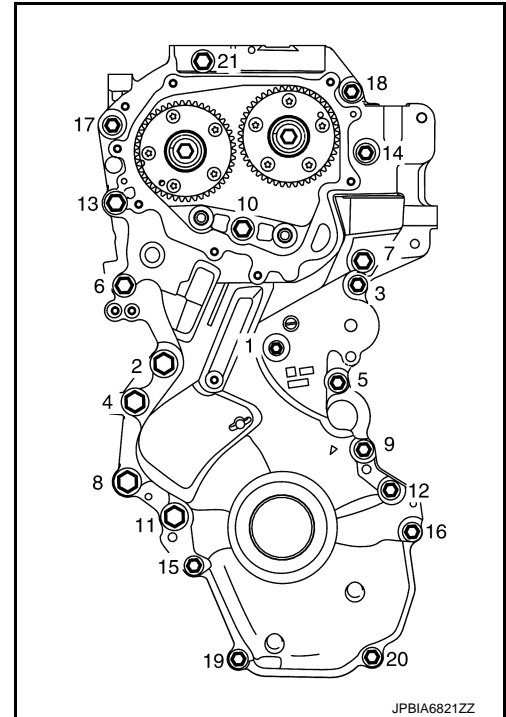
10. Remove front cover with the following procedure:

TIMING CHAIN

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

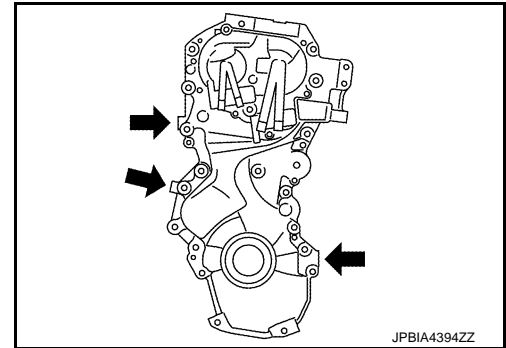
- a. Loosen mounting bolts in the order from 21 to 1 as shown in the figure.



- b. Cut liquid gasket by prying the position (↖) shown in the figure, and then remove the front cover.

CAUTION:

- Be careful not to damage the mating surface.
- A more adhesive liquid gasket is applied compared to previous types when shipped, so it should not be forced off the position not specified.



11. Remove front oil seal from front cover.

CAUTION:

Be careful not to damage front cover.

- Lift up front oil seal using a screwdriver.

12. Remove timing chain tensioner with the following procedure:

- a. Push in timing chain tensioner plunger.

TIMING CHAIN

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

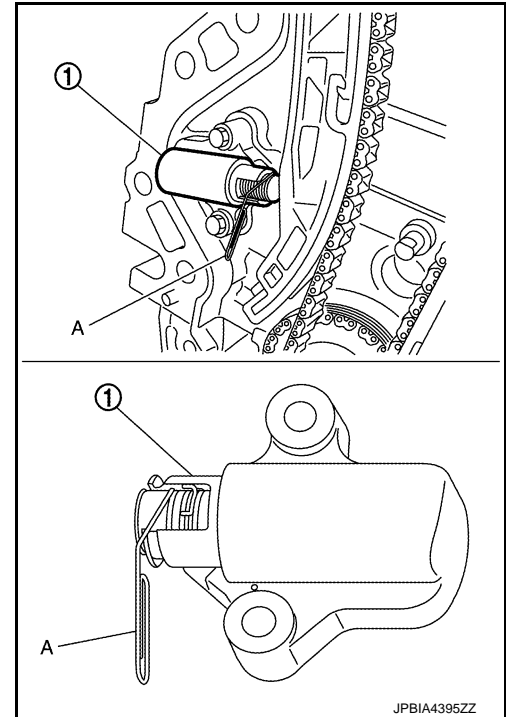
- b. Insert a stopper pin (A) into the body hole, and then fix it with the plunger pushed in.

① : Timing chain tensioner

NOTE:

Use approximately 1.5 mm (0.059 in) diameter. hard metal pin as a stopper pin.

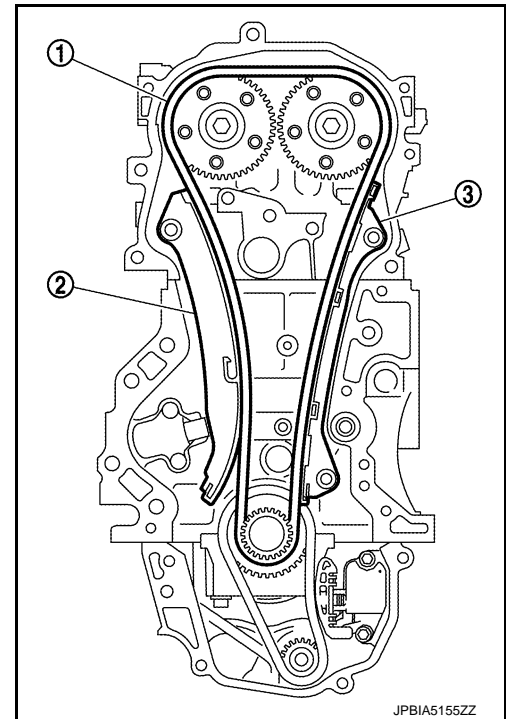
- c. Remove timing chain tensioner.



13. Remove slack guide ②, tension guide ③ and timing chain ①.

CAUTION:

Never rotate each crankshaft and camshaft individually while timing chain is removed. It causes interference between valve and piston.



14. Remove crankshaft sprocket and balancer unit drive component with the following procedure:

TIMING CHAIN

[MR20DD]

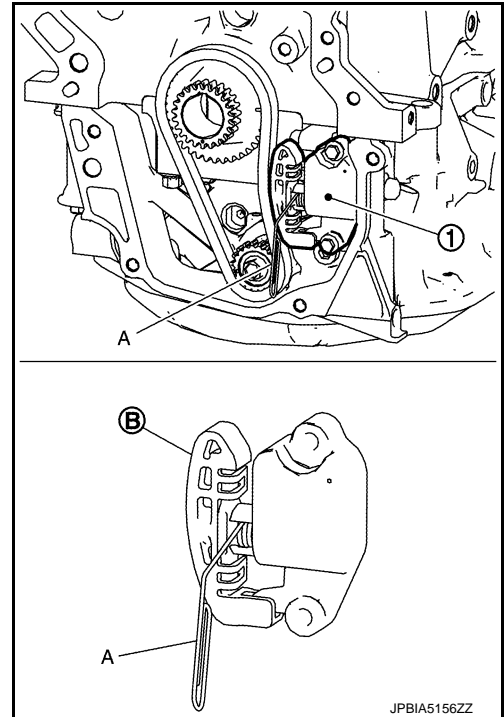
< UNIT DISASSEMBLY AND ASSEMBLY >

- a. Press the balancer unit timing chain slack guide ② toward balancer unit timing chain tensioner ①.
- b. Insert a stopper pin (A) into tensioner body slit to secure the balancer unit timing chain slack guide.

NOTE:

Use a hard metal pin with the diameter of approximately 1.5 mm (0.059 in) as a stopper pin.

- c. Remove balancer unit timing chain tensioner.
 - When the holes on lever and tensioner body cannot be aligned, align these holes by slightly moving the balancer unit timing chain slack guide.



- d. Hold the WAF part of balancer shaft [WAF: 19 mm (0.75 in)] ③, and then loosen the balancer unit sprocket bolt.

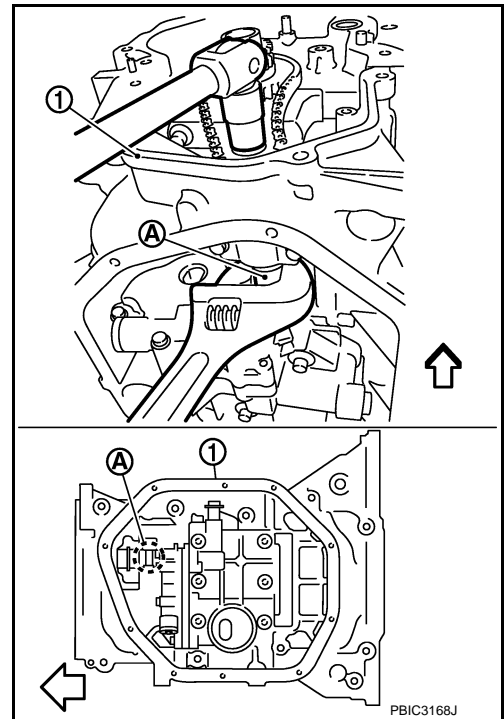
① : Oil pan (upper)

⇐ : Engine front

CAUTION:

- Secure the balancer unit shaft with the WAF part.
- Never loosen the balancer unit sprocket bolt by tightening the balancer unit drive chain.

- e. Remove crankshaft sprocket, balancer unit sprocket and balancer unit timing chain as a set.



INSTALLATION

CAUTION:

Do not reuse O-rings.

NOTE:

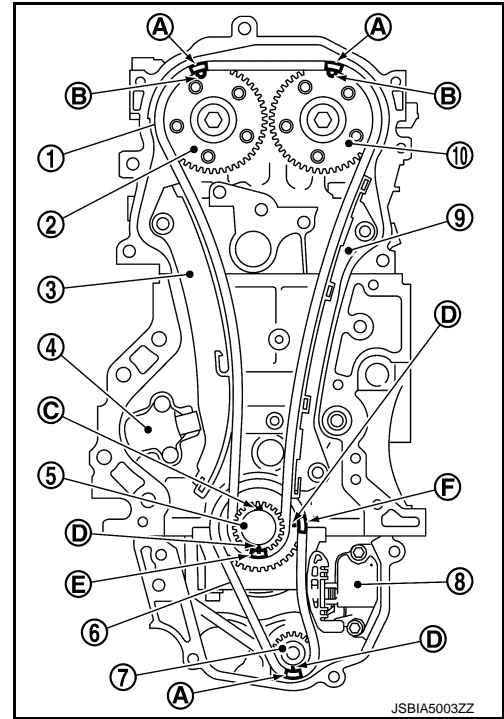
TIMING CHAIN

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

The figure shows the relationship between the matching mark on each timing chain and that on the corresponding sprocket, with the components installed.

- ① : Timing chain
- ② : Camshaft sprocket (EXH)
- ③ : Slack guide
- ④ : Timing chain tensioner
- ⑤ : Crankshaft sprocket
- ⑥ : Balancer unit timing chain
- ⑦ : Balancer unit sprocket
- ⑧ : Balancer unit timing chain tensioner
- ⑨ : Tension guide
- ⑩ : Camshaft sprocket (INT)
- Ⓐ : Matching mark (dark blue link)
- Ⓑ : Matching mark (stamping)
- Ⓒ : Crankshaft key position (straight up)
- Ⓓ : Matching mark (stamping)
- Ⓔ : Matching mark (yellow link)
- Ⓕ : Matching mark (white link)



*: There are two outer grooves in camshaft sprocket (INT). The wider one is a matching mark.

1. Check that crankshaft key points straight up.
2. If the tension guide (front cover side) is removed, install it to the front cover.

CAUTION:

Check the joint condition by sound or feeling.

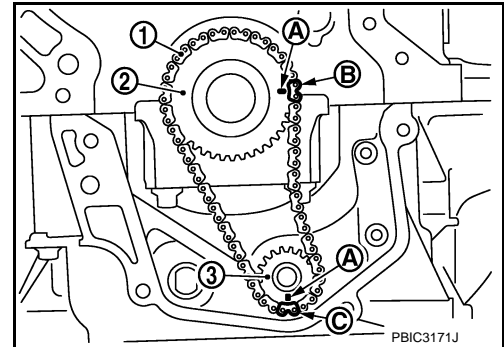
3. Install crankshaft sprocket ②, balancer unit sprocket ③ and balancer unit timing chain ①.

- Ⓐ : Matching mark (stamping)
- Ⓑ : Matching mark (white link)
- Ⓒ : Matching mark (dark blue link)

- Install it by aligning matching marks on each sprocket and balancer unit timing chain.
- If these matching marks are not aligned, rotate the balancer shaft slightly to correct the position.

CAUTION:

Check matching mark position of each sprocket after installing the balancer unit timing chain.



TIMING CHAIN

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

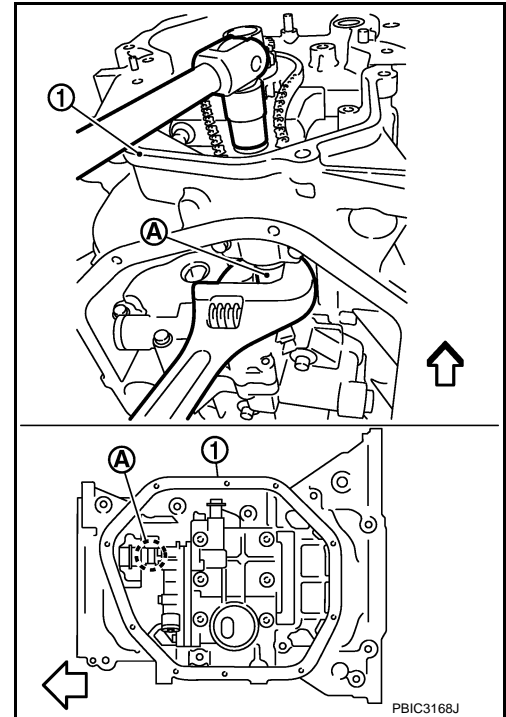
4. Hold the WAF part of balancer unit shaft [WAF: 19 mm (0.75 in)]
Ⓐ, and then tighten the balancer shaft sprocket bolt.

① : Oil pan (upper)

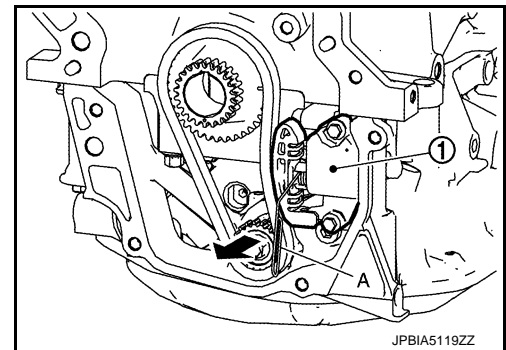
⇐ : Engine front

CAUTION:

- Secure the balancer unit shaft with the WAF part.
- Never loosen the balancer shaft sprocket bolt by tightening the balancer unit timing chain.



5. Install balancer unit timing chain tensioner ①.
- Fix the plunger at the most compressed position using a stopper pin (A), and then install it.
 - Securely pull out (⇐) the stopper pin after installing the balancer unit timing chain tensioner.
 - Check matching mark position of balancer unit timing chain and each sprocket again.



TIMING CHAIN

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

6. Align the matching marks of each sprocket with the matching marks of timing chain.

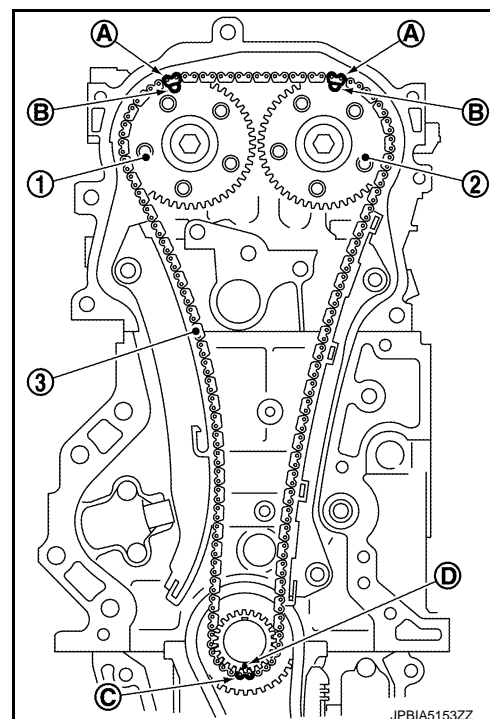
- ① : Camshaft sprocket (EXH)
- ② : Camshaft sprocket (INT)
- ③ : Timing chain
- Ⓐ : Matching mark (dark blue link)
- Ⓑ : Matching mark (stamping)
- Ⓒ : Matching mark (yellow link)
- Ⓓ : Matching mark (stamping)

*: There are 2 outer grooves in camshaft sprocket (INT). The wider one is a matching mark.

- If these matching marks are not aligned, rotate the camshaft slightly by holding the hexagonal portion to correct the position.

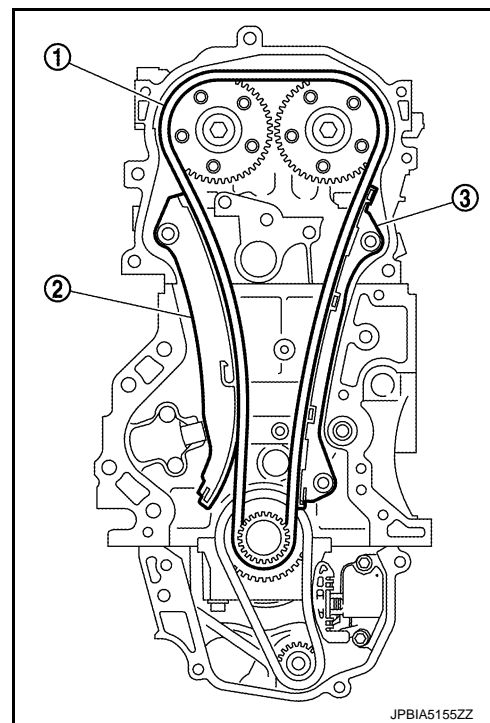
CAUTION:

Check matching mark position of each sprocket and timing chain again after installing the timing chain.



7. Install the tension guide ③ and the slack guide ②.

- ① : Timing chain

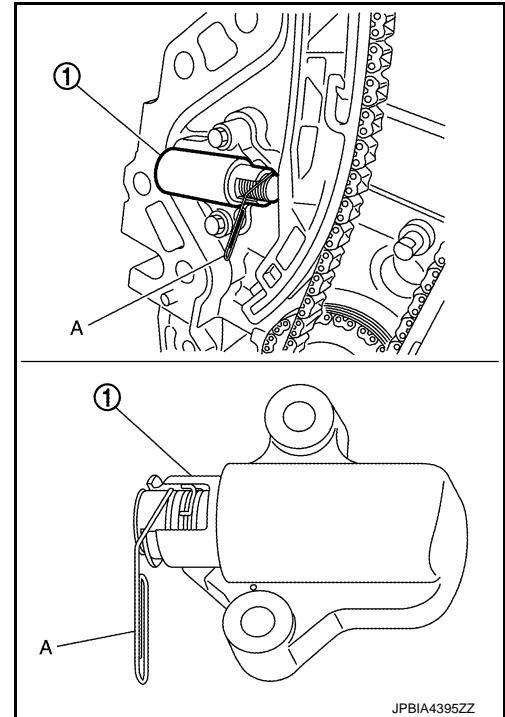


TIMING CHAIN

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

8. Install timing chain tensioner ①.
 - Fix the plunger at the most compressed position using a stopper pin (A), and then install it.
 - Securely pull out the stopper pin after installing the timing chain tensioner.



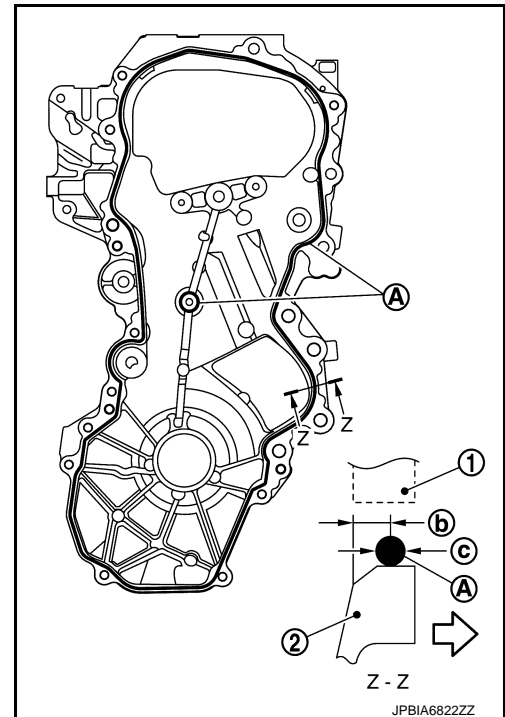
9. Check matching mark position of timing chain and each sprocket again.
10. Install front oil seal. Refer to [EM-90, "FRONT OIL SEAL : Removal and Installation"](#).
11. Install front cover with the following procedure:
 - a. Install new O-ring to cylinder block.

CAUTION:

 - Do not reuse O-ring.
 - Never misalign O-ring.
 - b. Apply a continuous bead of liquid gasket (A) with a tube presser (commercial service tool) to front cover ② as shown in the figure.

- ② : 4.0 - 5.6 mm (0.157 - 0.220 in)
 ③ : ϕ 3.4 - 4.4 mm (0.134 - 0.173 in)
 ⇐ : Engine outside

Use Genuine Liquid Gasket (Three Bond 1217H) or equivalent.



- c. Check that matching marks of timing chain and each sprocket are still aligned. Then install front cover.

CAUTION:





 - Check O-ring on cylinder block is correctly installed.
 - Be careful not to damage front oil seal by interference with front end of crankshaft.

TIMING CHAIN

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

- d. Install front cover, and tighten mounting bolts in the order from 1 to 22 as shown in the figure.
- Refer to the following for the installation position of bolts.

M6 bolt	: No. 1
	: 6.6 N·m (0.67 kg-m, 58 in-lb)
M10 bolts	: No. 6, 7, 10, 13, 21
	: 55.0 N·m (5.6 kg-m, 41 ft-lb)
M12 bolts	: No. 2, 4, 8, 11
	: 75.0 N·m (7.7 kg-m, 55 ft-lb)
M8 bolts	: Except the above
	: 25.0 N·m (2.6 kg-m, 19 ft-lb)

CAUTION:

Attaching should be done within 5 minutes after liquid gasket application.

- e. After all bolts are tightened, retighten them to specified torque in numerical order as shown in the figure.

CAUTION:

Be sure to wipe off any excessive liquid gasket leaking.

12. Install VTC cover according to the following instructions:

- a. a. Apply liquid gasket (A) (Three Bond 1217H or an equivalent) evenly (no break, no overlap) to the position shown in the figure. Refer to [EM-9. "Liquid Gasket"](#).

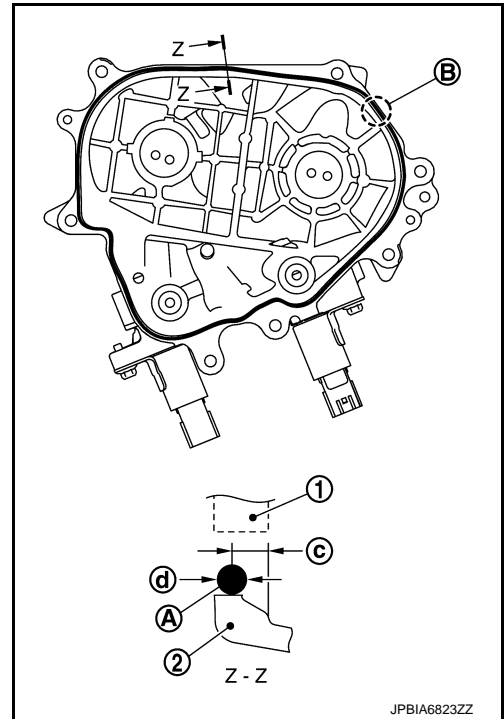
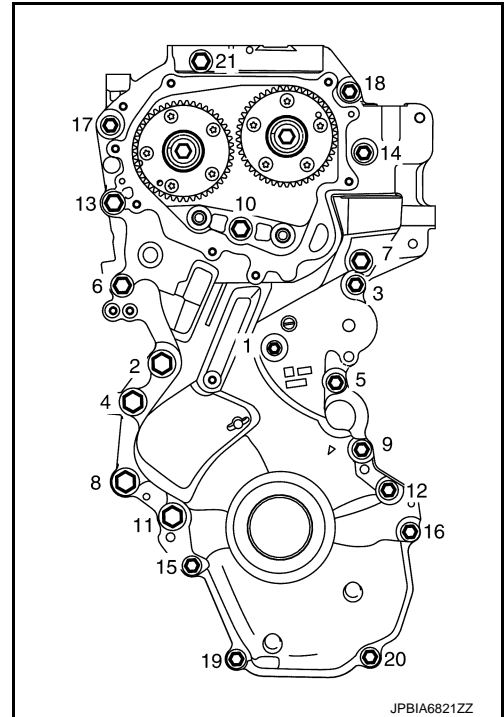
- ① : Front cover
- ② : VTC cover
- Ⓑ : Start/End of liquid gasket application
- Ⓒ : 4.0 – 5.6 mm
- Ⓓ : $\phi 3.4 - 4.4$ mm

CAUTION:

Install within 5 minutes after applying liquid gasket.

NOTE:

Overlap the start and end of liquid gasket application positions at least 5 mm.



TIMING CHAIN

< UNIT DISASSEMBLY AND ASSEMBLY >

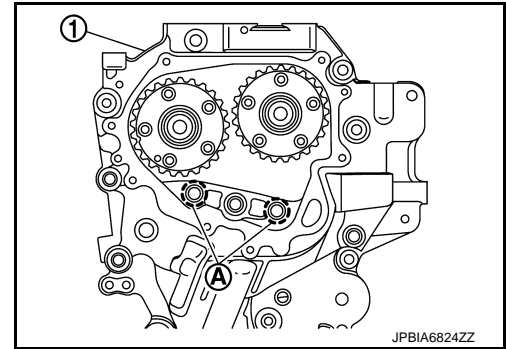
[MR20DD]

- b. Install O-ring to the groove of front cover ①.

Ⓐ : O-ring installation position

CAUTION:

Oil filter must be inserted to the end of O-ring installation part.



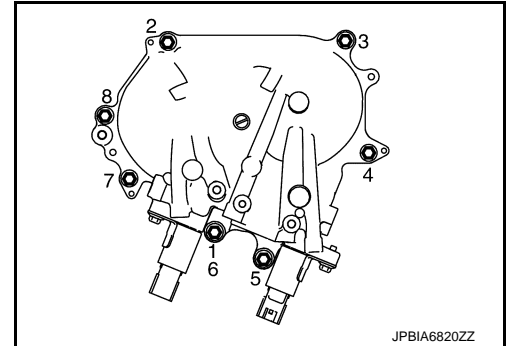
- c. Tighten mounting bolts to the specified torque in the order from 1 to 8 as shown in the figure.

CAUTION:

After tightening mounting bolts, wipe out extra liquid gasket.

NOTE:

Bolt 1 must be tightened twice, the second tightening is shown by 6.



13. Install crankshaft pulley with the following procedure:

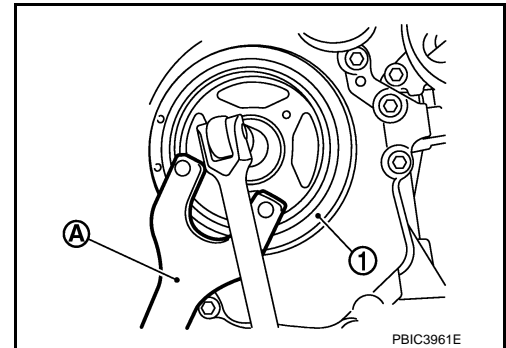
- a. When inserting crankshaft pulley with a plastic hammer, tap on its center portion (not circumference).

CAUTION:

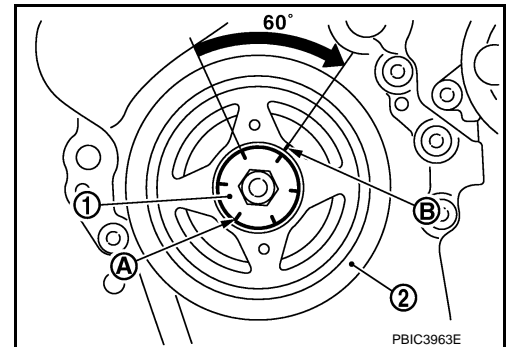
Never damage front oil seal lip portion.

- b. Secure crankshaft pulley ① with a pulley holder (commercial service tool) Ⓐ.
c. Apply new engine oil to thread and seat surfaces of crankshaft pulley bolt.
d. Tighten crankshaft pulley bolt.

 : 29.4 N·m (3.0 kg-m, 22 ft-lb)



- e. Put a paint mark Ⓑ on crankshaft pulley ②, matching with any one of six easy to recognize angle marks Ⓐ on crankshaft pulley bolt ① flange.
f. Turn another 60 degrees clockwise (angle tightening).
• Check the tightening angle with movement of one angle mark.
g. Check that crankshaft rotates clockwise smoothly.



14. Install remaining parts in the reverse order of removal.

Inspection

INSPECTION AFTER REMOVAL

Timing Chain

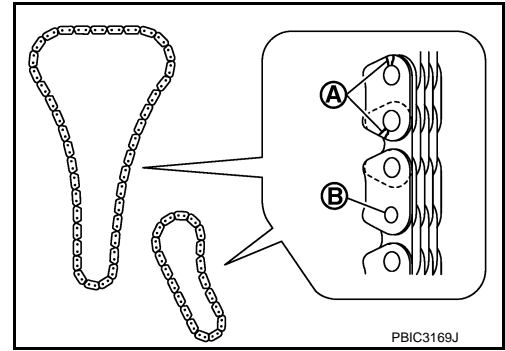
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TIMING CHAIN

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

Check for cracks (A) and any excessive wear (B) at link plates and roller links of timing chain. Replace timing chain if necessary.



INSPECTION AFTER INSTALLATION

Inspection for Leakage

The following are procedures for checking fluids leakage, lubricates leakage, and exhaust gases 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-23. "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 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

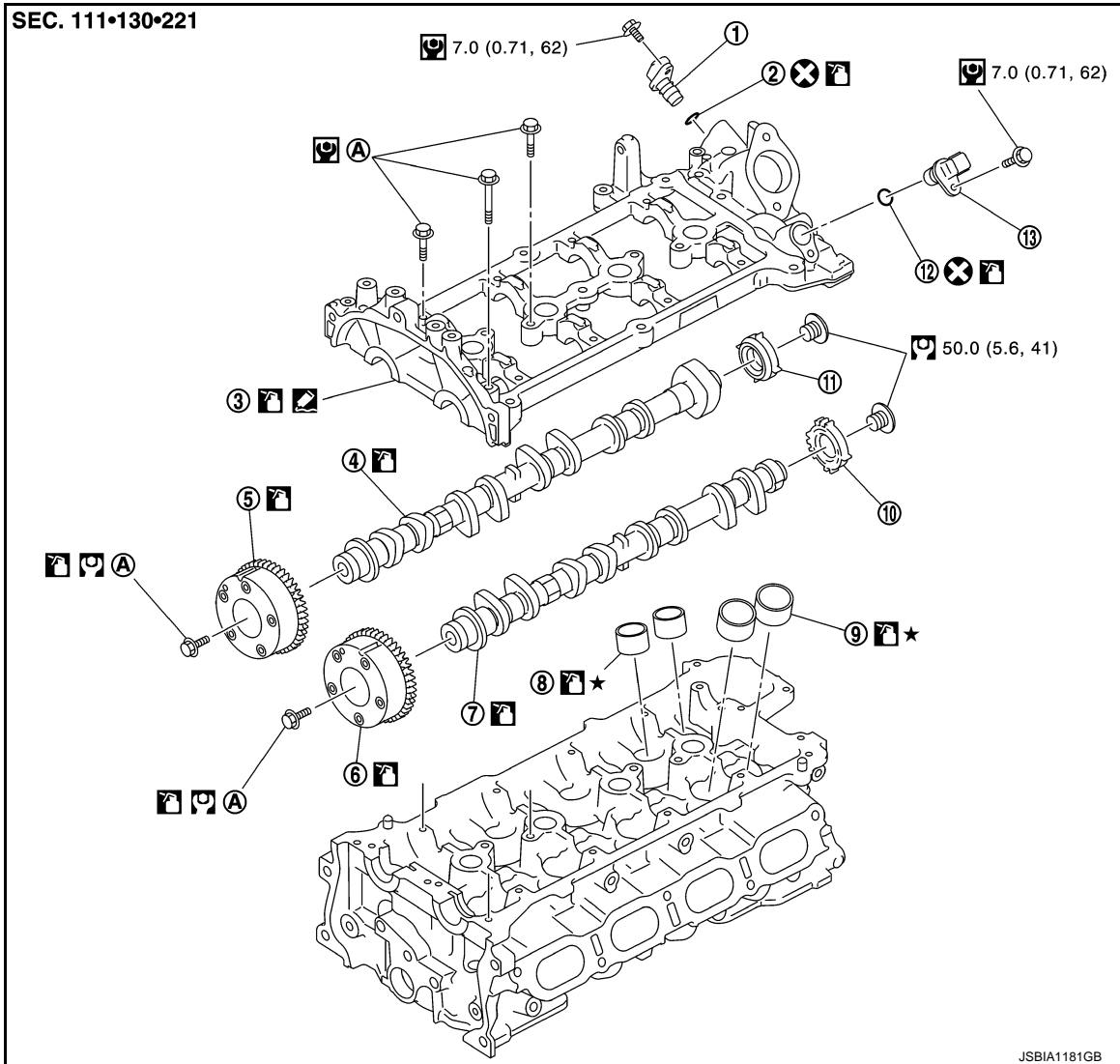
< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

CAMSHAFT

Exploded View

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- | | | |
|--|---------------------------|---------------------------|
| ① Exhaust valve timing control position sensor | ② O-ring | ③ Camshaft bracket |
| ④ Camshaft (EXH) | ⑤ Camshaft sprocket (EXH) | ⑥ Camshaft sprocket (INT) |
| ⑦ Camshaft (INT) | ⑧ Valve lifter (EXH) | ⑨ Valve lifter (INT) |
| ⑩ Signal plate (INT) | ⑪ Signal plate (EXH) | ⑫ O-ring |
| ⑬ Camshaft position sensor (PHASE) | | |

(A) Comply with the assembly procedure when tightening. Refer to [EM-81](#)

: 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.

Removal and Installation

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CAUTION:

The rotating direction in the text indicates all directions seen from the engine front.

REMOVAL

1. Remove the following parts.

- Intake manifold: Refer to [EM-33, "Exploded View"](#).
- Rocker cover: Refer to [EM-54, "Exploded View"](#).
- Front cover and timing chain related parts: Refer to [EM-67, "Exploded View"](#).

NOTE:

Removal of oil pump drive related part is not necessary.

2. Remove camshaft position sensor (PHASE) and exhaust valve timing control position sensor from camshaft bracket.

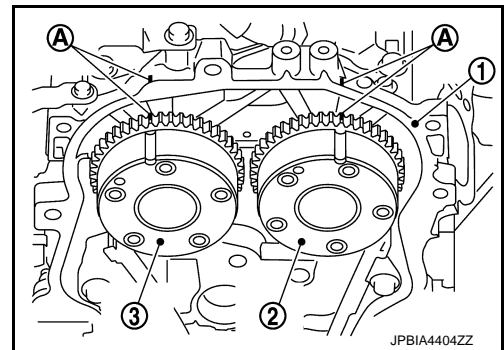
CAUTION:

- Handle camshaft position sensor (PHASE) and exhaust valve timing control position sensor carefully and avoid impacts.
- Never disassemble camshaft position sensor (PHASE) and exhaust valve timing control position sensor.
- Never place sensor where it is exposed to magnetism.

3. Put the matching mark (A) on the camshaft sprocket (INT) (2), camshaft sprocket (EXH) (3) and the camshaft bracket (1) as shown in the figure.

NOTE:

It prevents the knock pin of the camshaft (INT) from engaging with the incorrect pin hole when installing the camshaft sprocket (INT).



4. Remove camshaft sprockets (INT and EXH).

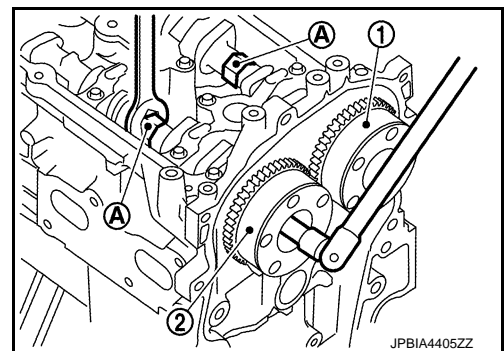
- Secure hexagonal part (A) of camshaft with a wrench. Loosen camshaft sprocket mounting bolts and remove camshaft sprocket.

① : Camshaft sprocket (INT)

② : Camshaft sprocket (EXH)

CAUTION:

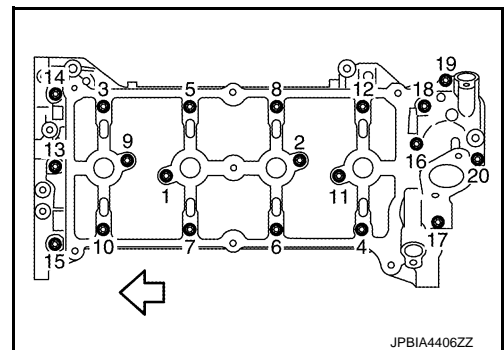
- Never rotate crankshaft or camshaft while timing chain is removed. It causes interference between valve and piston.
- Never loosen the mounting bolts with securing anything other than the camshaft hexagonal part or with tensioning the timing chain.



5. Remove camshaft bracket with the following procedure:

- a. Loosen mounting bolts in reverse order as shown in the figure.

← : Engine front



CAMSHAFT

< UNIT DISASSEMBLY AND ASSEMBLY >

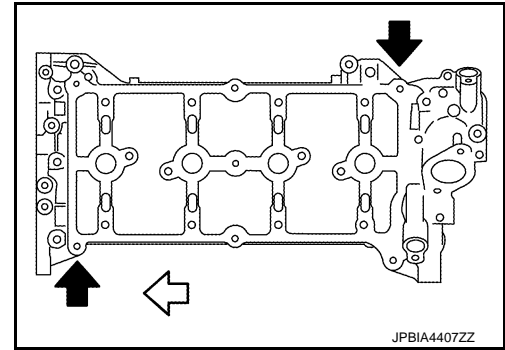
[MR20DD]

- b. Cut liquid gasket by prying the position (←) shown in the figure, and then remove the camshaft bracket.

← : Engine front

CAUTION:

- Never damage the mating surface.
- A more adhesive liquid gasket is applied compared to previous types when shipped, so it should not be forced off the position not specified.



- Remove camshafts.
- Remove valve lifters.
 - Identify installation positions, and store them without mixing them up.
- Remove signal plate from camshaft, if necessary.

INSTALLATION

CAUTION:

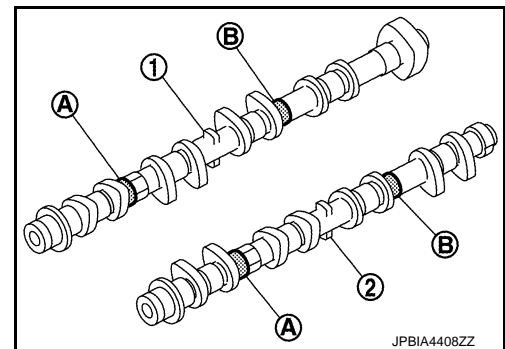
Do not reuse O-rings.

- Install valve lifters.
 - Install them in the original positions.
- Install camshafts.
 - Clean camshaft journal to remove any foreign material.
 - Distinguish between the intake and the exhaust by looking at the different shapes of the front and rear ends of the camshaft or using the identification colors ① and ②.

① : Camshaft (EXH)

② : Camshaft (INT)

Identification color	①	②
Camshaft (EXH)	—	Brown
Camshaft (INT)	Purple	—



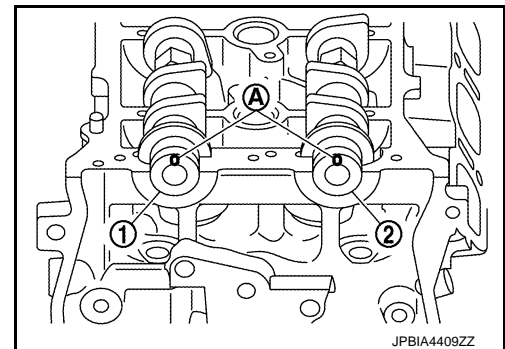
- Install camshafts so that camshaft dowel pins ① on the front side are positioned as shown in the figure.

① : Camshaft (EXH)

② : Camshaft (INT)

NOTE:

Though camshaft does not stop at the positions 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.



- Install camshaft bracket with the following procedure:
 - Remove foreign material completely from camshaft bracket backside and from cylinder head installation face.

CAMSHAFT

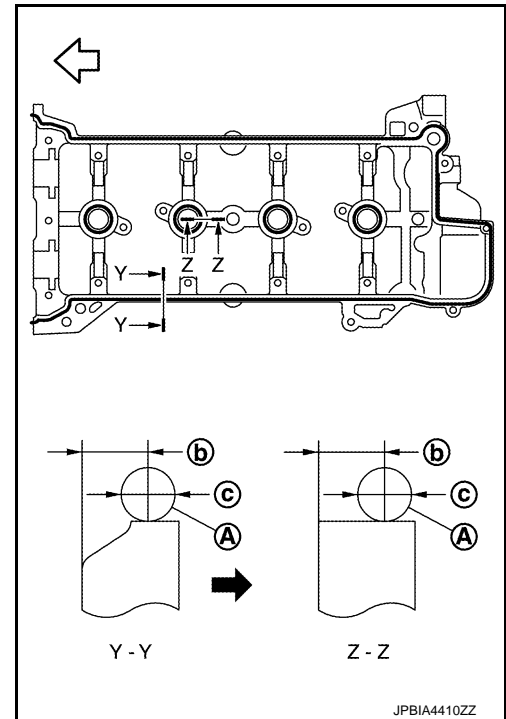
< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

- b. Apply liquid gasket (A) to camshaft bracket as shown in the figure.

- (b) : Plug hole inner wall
- (c) : ϕ 3.4 - 4.4 mm (0.134 - 0.173 in)
- ↩ : Engine front
- ➡ : Engine outside

Use Genuine Liquid Gasket (Three Bond 1217H) or equivalent.



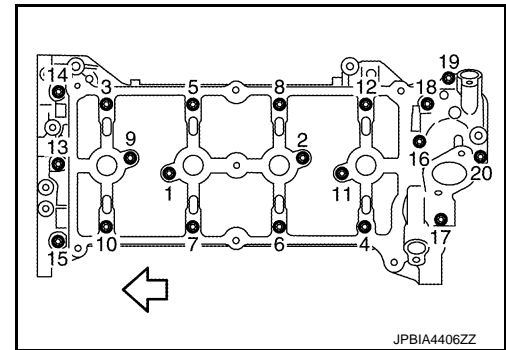
- c. Tighten mounting bolts of camshaft brackets in the following steps, in numerical order as shown in the figure.

↩ : Engine front

- There are two types of mounting bolts. Refer to the following for locating bolts.

M6 bolts [thread length: 57.5 mm (2.264 in)]
: 13, 14, and 15 in the figure

M6 bolts [thread length: 35.0 mm (1.378 in)]
: Except the above



- i. Tighten mounting bolts in numerical order.

: **1.96 N·m (0.20 kg-m, 17 in-lb)**

- ii. Tighten mounting bolts in numerical order.

: **5.88 N·m (0.60 kg-m, 52 in-lb)**

- iii. Tighten mounting bolts in numerical order.

: **9.5 N·m (0.97 kg-m, 84 in-lb)**

CAUTION:

After tightening mounting bolts of camshaft brackets, be sure to wipe off excessive liquid gasket from the mating surface of cylinder head.

4. Install the camshaft sprocket to the camshaft with the following procedure.

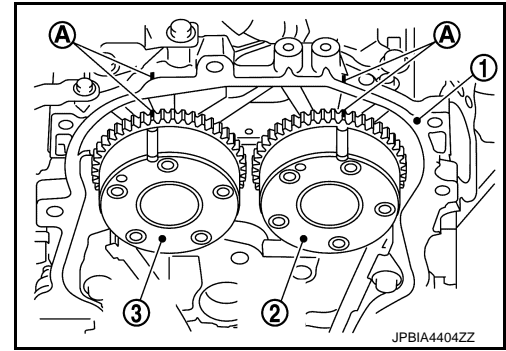
CAMSHAFT

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

- a. When the camshaft sprocket (INT) ② and camshaft sprocket (EXH) ③ is removed, refer to the paint mark (A) put according to step "3". Securely align the knock pin and the pin hole, and then install them.

① : Camshaft bracket



- b. Tighten bolts in the following steps.
- Secure the hexagonal part of camshaft using wrench to tighten mounting bolt.
- i. Tighten camshaft mounting bolt.

: 35.0 N·m (3.6 kg-m, 26 ft-lb)

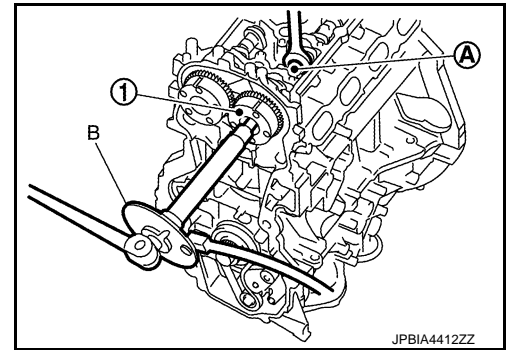
- ii. Turn 30 degrees clockwise (angle tightening).

CAUTION:

Check the tightening angle by using an angle wrench [SST: KV10112100] (B) or protractor. Never judge by visual inspection without an angle wrench.

① : Camshaft sprocket

(A) : Camshaft hexagonal part



5. Install timing chain and related parts. Refer to [EM-67, "Exploded View"](#).
6. Inspect and adjust valve clearance. Refer to [EM-16, "Inspection and Adjustment"](#).
7. Install remaining parts in the reverse order of removal.

Inspection

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INSPECTION AFTER REMOVAL

Camshaft Runout

1. Put V-block on a precise flat table, and support No. 2 and 5 journal of camshaft.

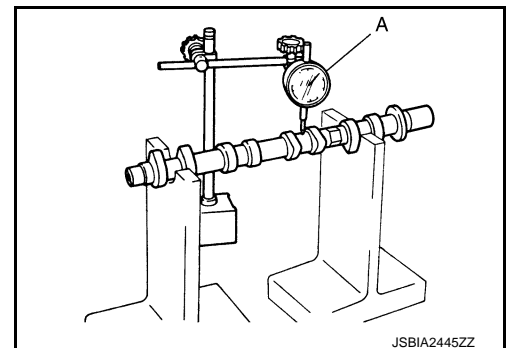
CAUTION:

Never support No. 1 journal (on the side of camshaft sprocket) because it has a different diameter from the other four locations.

2. Set dial indicator (A) vertically to No. 3 journal.
3. Turn camshaft to one direction with hands, and measure the camshaft runout on dial indicator. (Total indicator reading)

Standard and Limit : Refer to [EM-133, "Camshaft"](#).

4. If it exceeds the limit, replace camshaft.



Camshaft Cam Height

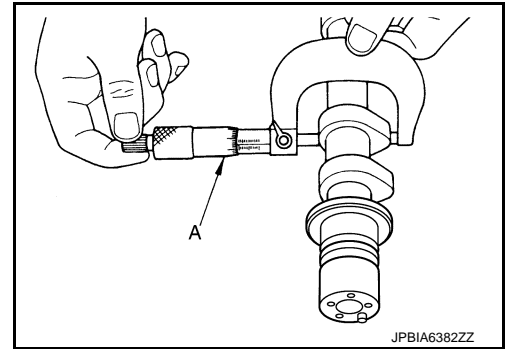
CAMSHAFT

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

1. Measure the camshaft cam height with a micrometer (A).

Standard and Limit : Refer to [EM-133, "Camshaft"](#).



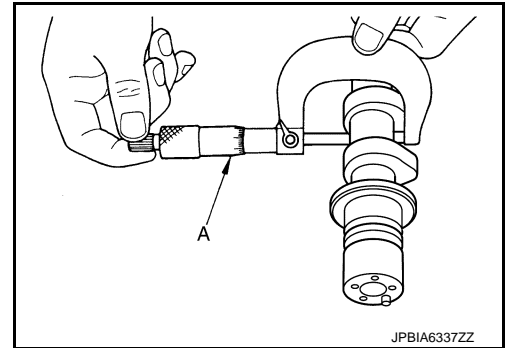
2. If it exceeds the limit, replace camshaft.

Camshaft Journal Oil Clearance

CAMSHAFT JOURNAL OUTER DIAMETER

Measure the outer diameter of camshaft journal with a micrometer (A).

Standard : Refer to [EM-133, "Camshaft"](#).

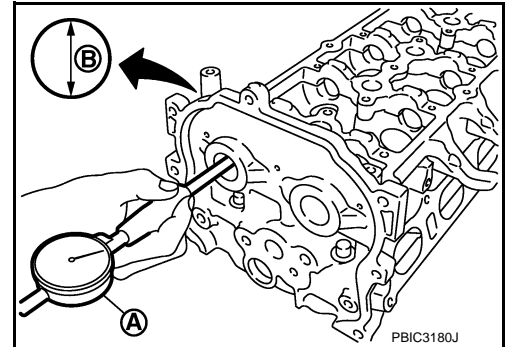


CAMSHAFT BRACKET INNER DIAMETER

- Tighten camshaft bracket bolts with specified torque. Refer to [EM-81, "Removal and Installation"](#).
- Measure the inner diameter of camshaft bracket with a cylinder gauge (A).

Ⓑ : Measuring direction of inner diameter

Standard : Refer to [EM-133, "Camshaft"](#).



CAMSHAFT JOURNAL OIL CLEARANCE

- (Oil clearance) = (Camshaft bracket inner diameter) – (Camshaft journal diameter)

Standard and Limit : Refer to [EM-133, "Camshaft"](#).

- If it exceeds the limit, replace camshaft or cylinder head, or both.

NOTE:

Camshaft bracket cannot be replaced as a single part, because it is machined together with cylinder head. Replace whole cylinder head assembly.

Camshaft End Play

1. Install camshaft in cylinder head. Refer to [EM-81, "Removal and Installation"](#).

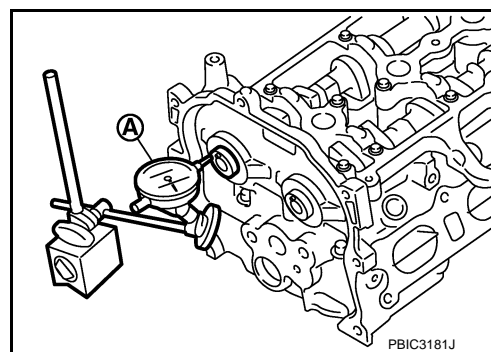
CAMSHAFT

[MR20DD]

< UNIT DISASSEMBLY AND ASSEMBLY >

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

Standard and Limit : Refer to [EM-133. "Camshaft"](#).



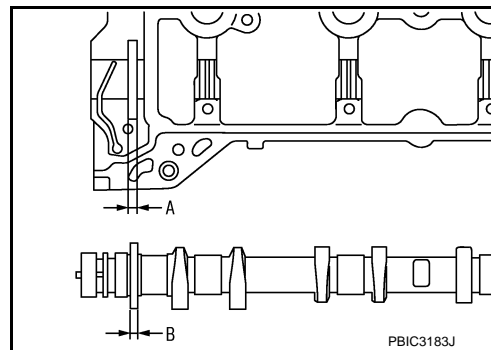
- Measure the following parts if out of the standard.
- Dimension (A) for groove of cylinder head No. 1 journal

Standard : 4.000 - 4.030 mm (0.1575 - 0.1587 in)

- Dimension (B) for camshaft flange

Standard : 3.877 - 3.925 mm (0.1526 - 0.1545 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 5 journals of camshaft.

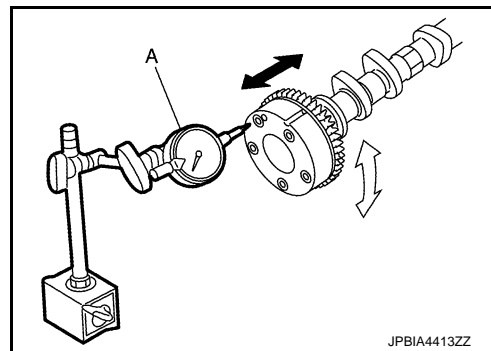
CAUTION:

Never support No. 1 journal (on the side of camshaft sprocket) because it has a different diameter from the other four locations.

2. Measure the camshaft sprocket runout with a dial indicator (A). (Total indicator reading)

Limit : Refer to [EM-133. "Camshaft"](#).

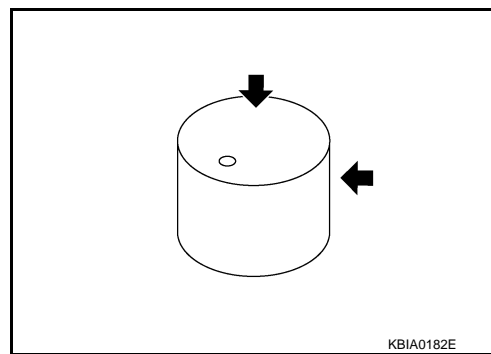
- If it exceeds the limit, replace camshaft sprocket.



Valve Lifter

Check if surface of valve lifter has any wear or cracks.

- If anything above is found, replace valve lifter. Refer to [EM-133. "Camshaft"](#).



Valve Lifter Clearance

VALVE LIFTER OUTER DIAMETER

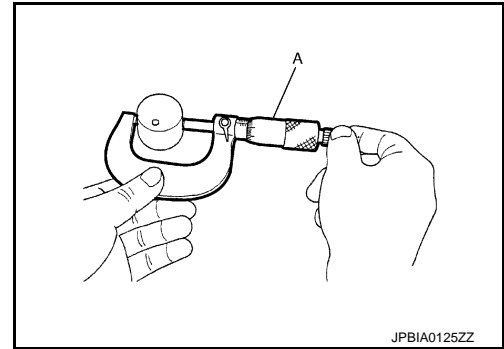
CAMSHAFT

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

- Measure the outer diameter of valve lifter with a micrometer (A).

Standard : Refer to [EM-133, "Camshaft"](#).



VALVE LIFTER HOLE DIAMETER

Measure the inner diameter of valve lifter hole of cylinder head with an inside micrometer (A).

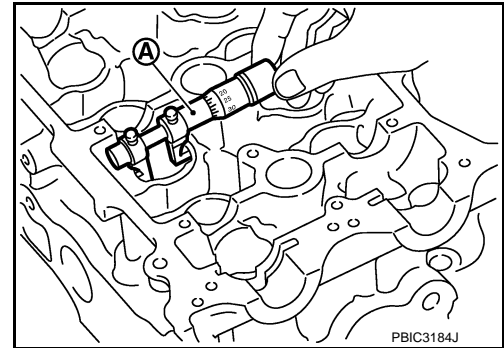
Standard : Refer to [EM-133, "Camshaft"](#).

VALVE LIFTER CLEARANCE

- (Valve lifter clearance) = (Valve lifter hole diameter) – (Valve lifter outer diameter)

Standard : Refer to [EM-133, "Camshaft"](#).

- If out of the standard, referring to the 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 (INT), (EXH) Oil Groove

CAUTION:

- Perform this inspection only when DTC P0011 or P0014 is detected in self-diagnostic results of CONSULT and it is directed according to inspection procedure of EC section. Refer to [EC-174, "Diagnosis Procedure"](#) (P0011) or [EC-178, "Diagnosis Procedure"](#) (P0014).
 - Check when engine is cold so as to prevent burns by the splashing engine oil.
1. Check engine oil level. Refer to [LU-9, "Inspection"](#).
 2. Perform the following procedure so as to prevent the engine from being unintentionally started while checking.
 - a. Release the fuel pressure. Refer to [EC-152, "Work Procedure"](#).
 - b. Remove intake manifold. Refer to [EM-33, "Exploded View"](#).
 - c. Disconnect ignition coil and injector harness connectors.
 - d. Support the bottom surface of engine using a transmission jack, and then remove the engine mounting bracket (RH) and engine mounting insulator (RH). Refer to [EM-56, "Exploded View"](#).
 3. Remove intake or exhaust valve timing control solenoid valve. Refer to [EM-67, "Exploded View"](#).
 - Lift the front side of the engine with a jack base to remove intake or exhaust valve timing control solenoid valve.
 4. Clean the mounting area of intake or exhaust valve timing control solenoid valve, and then insert a clean waste with no oil adhesion into the oil hole of the cylinder head.
 5. Install engine mounting insulator (RH) and engine mounting bracket (RH). (After the removal of intake or exhaust valve timing control solenoid valve and insertion of a waste into the oil hole.)
 6. Perform cranking to check that engine oil comes out from the oil hole (mounting hole of intake or exhaust valve timing control solenoid valve) of cylinder head.
 - Regarding the engine oil check, judge it by the amount of oil adhered to the wasted inserted into the oil hole.

WARNING:

- Never insert fingers into the oil hole.
- Never touch rotating parts (drive belt, idler pulleys and crankshaft pulley, etc.).

CAUTION:

- **Never perform cranking without installing the engine mounting insulator (RH) and engine mounting bracket (RH).**
 - **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.**
 - **Prevent splashing by using a shop cloth so as to prevent engine oil from being splashed to engine and vehicle. Especially, be careful not to apply engine oil to rubber parts of drive belt, engine mounting insulator, etc. Wipe engine oil off immediately if it is splashed.**
7. Perform the following inspection if engine oil does not come out from intake or exhaust valve timing control solenoid valve oil hole of the cylinder head.
 - Clean oil groove between oil strainer and intake valve timing control solenoid valve. Refer to [LU-7, "Engine Lubrication System"](#) and [LU-8, "Engine Lubrication System Schematic"](#).
 8. Remove components between intake or exhaust valve timing control solenoid valve and camshaft sprocket (INT) or (EXH), and then check each oil groove for clogging.
 - Clean oil groove if necessary. Refer to [LU-7, "Engine Lubrication System"](#) and [LU-8, "Engine Lubrication System Schematic"](#).
 9. After inspection, install removed parts in the reverse order.

OIL SEAL

VALVE OIL SEAL

VALVE OIL SEAL : Removal and Installation

INFOID:0000000010783722

EM

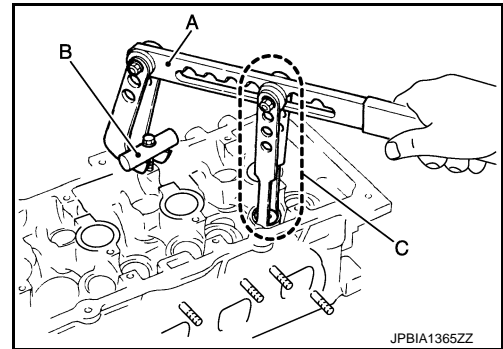
REMOVAL

1. Remove camshafts. Refer to [EM-80. "Exploded View"](#).
2. Remove valve lifters. Refer to [EM-80. "Exploded View"](#).
3. 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.

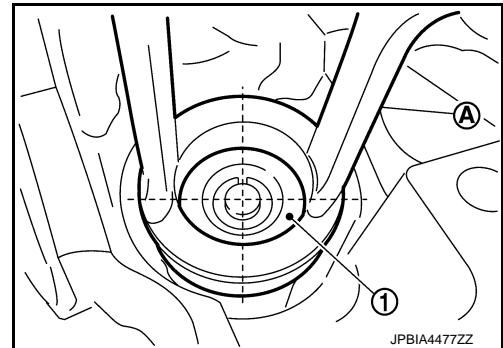
4. Remove valve collet.
 - Compress valve spring with the valve spring compressor [SST: KV10116200] (A), the attachment [SST: KV10115900] (C), and the adapter [SST: KV10109220] (B). Remove valve collet with magnet hand.

**CAUTION:**

- Never damage valve lifter holes.
- Fit the attachment [SST: KV10115900] in the center of valve spring retainer to press it.

① : Valve spring retainer

Ⓐ : Attachment

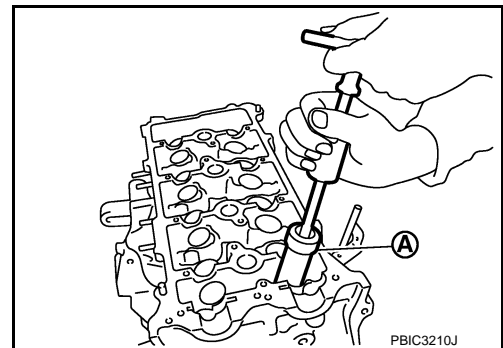


5. Remove valve spring retainer and valve spring (with valve spring seat).

CAUTION:

Never remove valve spring seat from valve spring.

6. Remove valve oil seal with the valve oil seal puller [SST: KV10107902] Ⓐ.



INSTALLATION

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

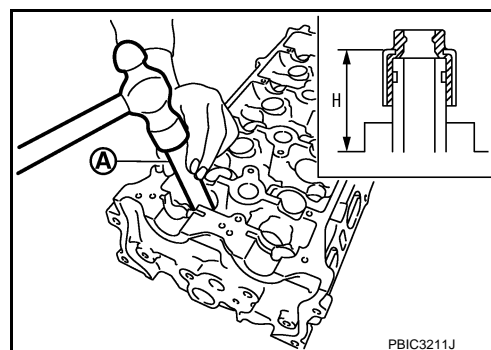
OIL SEAL

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

- Press in valve oil seal to the height (H) shown in the figure with the valve oil seal drift [SST: KV10115600] (A).

Height (H) : 15.1 - 15.7 mm (0.594 - 0.618 in)



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

FRONT OIL SEAL

FRONT OIL SEAL : Removal and Installation

INFOID:0000000010783723

REMOVAL

- Remove the following parts.
 - Front fender protector (RH): Refer to [EXT-35, "FENDER PROTECTOR : Exploded View"](#).
 - Drive belt: Refer to [EM-22, "Exploded View"](#).
 - Crankshaft pulley: Refer to [EM-106, "Exploded View"](#).
- Remove front oil seal with a suitable tool.

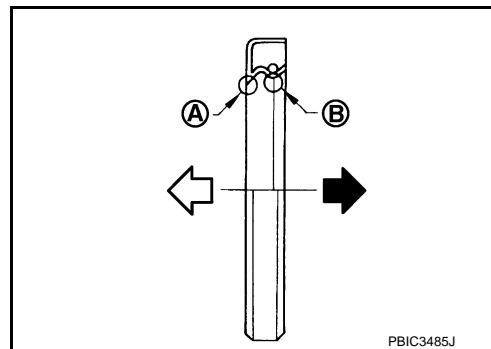
CAUTION:

Never damage front cover and crankshaft.

INSTALLATION

- Apply new engine oil to new front oil seal joint surface and seal lip.
- Install front oil seal so that each seal lip is oriented as shown in the figure.

- (A) : Dust seal lip
(B) : Oil seal lip
⇐ : Engine outside
⇐ : Engine inside



- Press-fit front oil seal using a suitable drift with outer diameter 57 mm (2.24 in) and inner diameter 45 mm (1.77 in).

Within 0.3 mm (0.012 in) toward engine front (crankshaft pulley side)

Within 0.5 mm (0.020 in) toward engine rear (crankshaft sprocket side)

CAUTION:

- Never damage front cover and crankshaft.**
- Press-fit oil seal straight to avoid causing burrs or tilting.**

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

REAR OIL SEAL

REAR OIL SEAL : Removal and Installation

INFOID:0000000010783724

REMOVAL

OIL SEAL

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

1. Remove transaxle assembly. Refer to [TM-449, "Exploded View"](#) (CVT models) or [TM-41, "Exploded View"](#) (6MT models).
2. Remove clutch cover and clutch disk (6MT models). Refer to [CL-32, "MR20DD : Exploded View"](#)
3. Remove drive plate (CVT models) or flywheel (6MT models). Refer to [EM-65, "Exploded View"](#) (CVT models) or [EM-62, "Exploded View"](#) (6MT models).
4. Remove rear oil seal with a suitable tool.

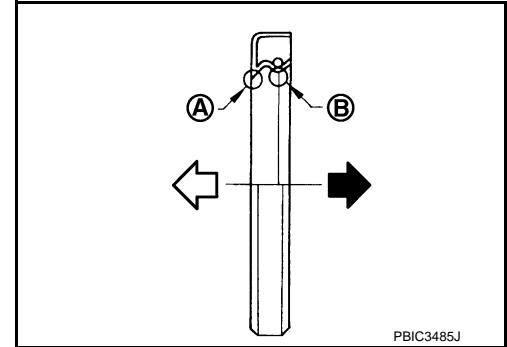
CAUTION:

Never damage crankshaft and cylinder block.

INSTALLATION

1. Apply the liquid gasket lightly to entire outside area of new rear oil seal.
Use Genuine Liquid Gasket or equivalent.
2. Install rear oil seal so that each seal lip is oriented as shown in the figure.

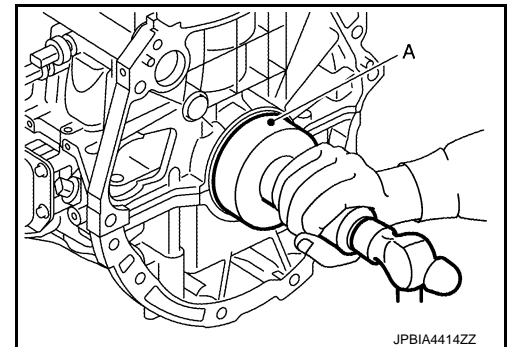
- (A) : Dust seal lip
(B) : Oil seal lip
⇐ : Engine outside
➡ : Engine inside



- Press-fit rear oil seal with a suitable drift (A) outer diameter 115 mm (4.53 in) and inner diameter 90 mm (3.54 in).

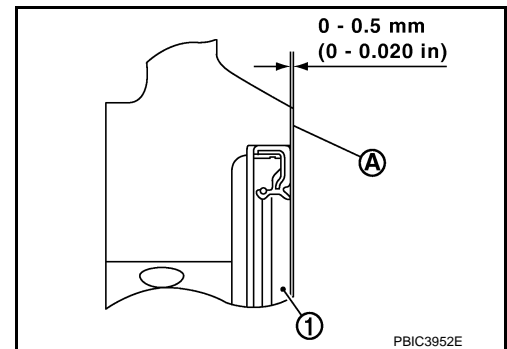
CAUTION:

- **Never damage crankshaft and cylinder block.**
- **Press-fit oil seal straight to avoid causing burrs or tilting.**
- **Never touch grease applied onto oil seal lip.**



- Press in rear oil seal ① to the position as shown in the figure.

- (A) : Rear end surface of cylinder block



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

CYLINDER HEAD

< UNIT DISASSEMBLY AND ASSEMBLY >

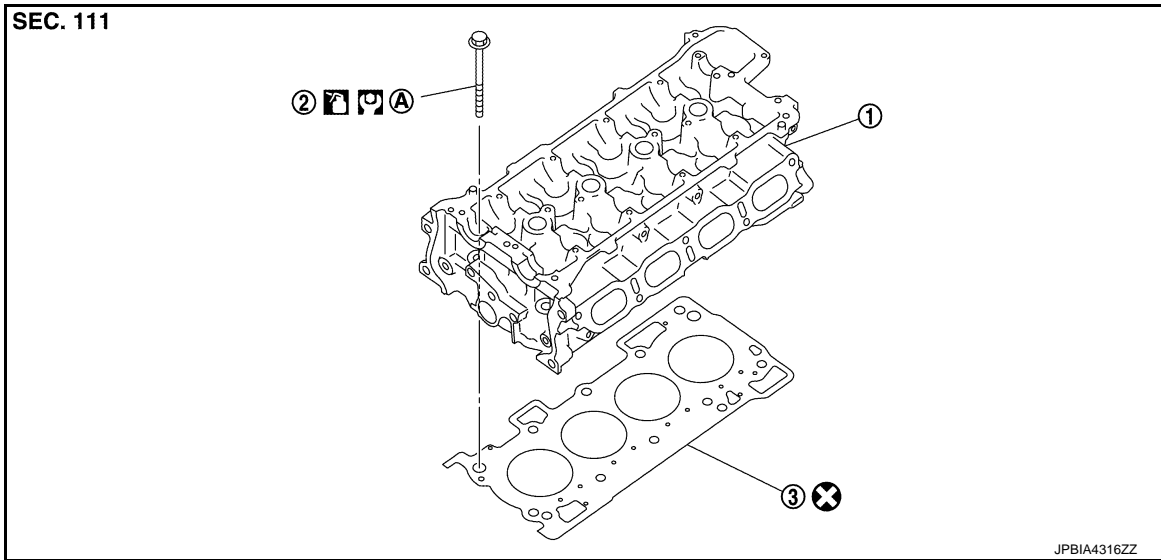
[MR20DD]

CYLINDER HEAD

Exploded View

INFOID:000000010783725

REMOVAL



① Cylinder head assembly

② Cylinder head bolt

③ Cylinder head gasket

② ① ① ②

② Comply with the installation procedure when tightening. Refer to [EM-93](#)

X : Always replace after every disassembly.

U : N·m (kg·m, ft·lb)

③ X

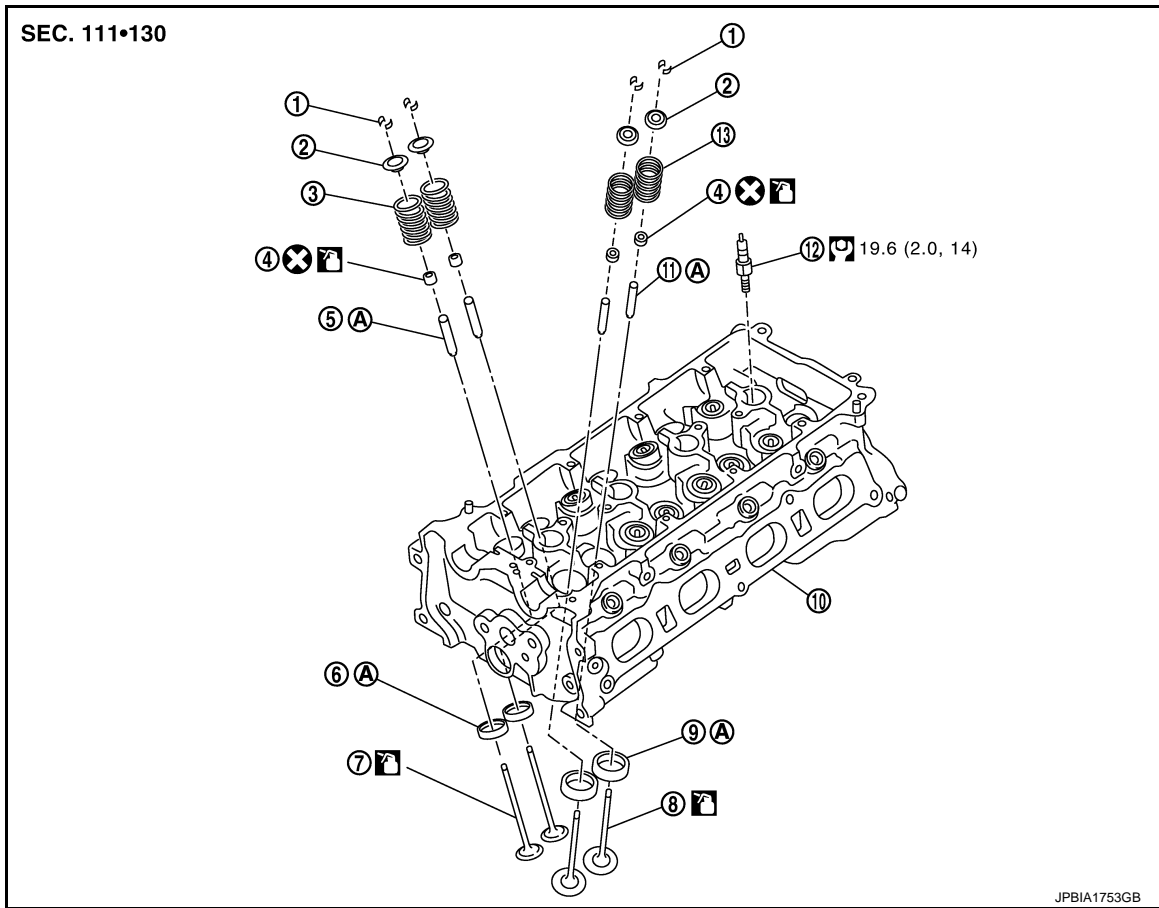
③ : Should be lubricated with oil.

DISASSEMBLY

CYLINDER HEAD

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]



- | | | |
|--|-------------------------|---|
| ① Valve collet | ② Valve spring retainer | ③ Valve spring (with valve spring seat) (EXH) |
| ④ Valve oil seal | ⑤ Valve guide (EXH) | ⑥ Valve seat (EXH) |
| ⑦ Valve (EXH) | ⑧ Valve (INT) | ⑨ Valve seat (INT) |
| ⑩ Cylinder head | ⑪ Valve guide (INT) | ⑫ Spark plug |
| ⑬ Valve spring (with valve spring seat) (INT) | | |
| Ⓐ Comply with the installation procedure when tightening. Refer to EM-94 | | |
| ⊗ : Always replace after every disassembly. | | |
| Ⓜ : N·m (kg·m, ft·lb) | | |
| Ⓛ : Should be lubricated with oil. | | |

Removal and Installation

INFOID:0000000010783726

REMOVAL

1. Release fuel pressure. Refer to [EC-152, "Work Procedure"](#).
2. Drain engine coolant and engine oil. Refer to [CO-13, "Draining"](#) and [LU-10, "Draining"](#).
3. Remove the following components and related parts.
 - Intake manifold: Refer to [EM-33, "Exploded View"](#).
 - Exhaust manifold: Refer to [EM-37, "Exploded View"](#).
 - High pressure fuel pump: Refer to [EM-43, "Exploded View"](#).
 - Fuel tube and fuel injector assembly: Refer to [EM-48, "Exploded View"](#).
 - Water outlet: Refer to [CO-28, "Exploded View"](#).
 - Rocker cover: Refer to [EM-54, "Exploded View"](#).
 - Front cover, timing chain: Refer to [EM-67, "Exploded View"](#).

CYLINDER HEAD

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

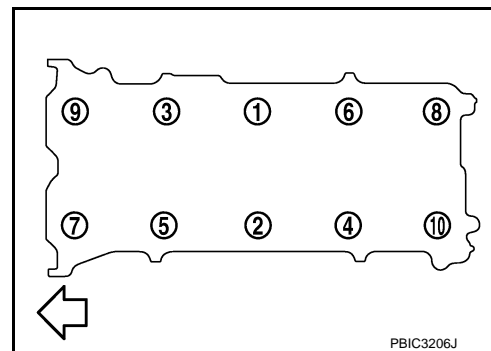
- Camshaft: Refer to [EM-80, "Exploded View"](#).

4. Remove cylinder head.

- Loosen cylinder head bolts in the order from 10 to 1 as shown in the figure.

⇐ : Engine front

- Using TORX socket (size: E18), loosen cylinder head bolts.



5. Remove cylinder head gasket.

INSTALLATION

1. Install cylinder head gasket.

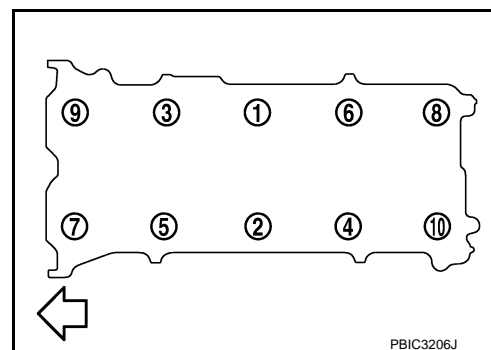
2. Install cylinder head, and tighten cylinder head bolts in the order from 1 to 10 as shown in the figure with the following procedure.

⇐ : Engine front

CAUTION:

If cylinder head bolts are reused, check their outer diameters before installation. Refer to [EM-99, "Inspection"](#).

- Apply new engine oil to threads and seating surface of mounting bolts.
- Tighten all cylinder head bolts.



: 40.0 N·m (4.1 kg-m, 30 ft-lb)

c. Turn all cylinder head bolts 100 degrees clockwise (angle tightening).

CAUTION:

Check and confirm the tightening angle by using an angle wrench [SST: KV10112100] [Ⓐ] or protractor. Never judge by visual inspection without the tool.

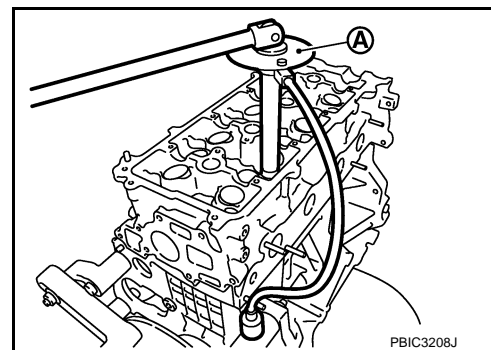
d. Completely loosen.

: 0 N·m (0 kg-m, 0 ft-lb)

CAUTION:

In this step, loosen cylinder head bolts in reverse order that indicated in the figure.

e. Tighten all cylinder head bolts.



: 40.0 N·m (4.1 kg-m, 30 ft-lb)

f. Turn all cylinder head bolts 95 degrees clockwise (angle tightening).

g. Turn all cylinder head bolts 95 degrees clockwise again (angle tightening).

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

Disassembly and Assembly

INFOID:0000000010783727

DISASSEMBLY

1. Remove spark plug with spark plug wrench (commercial service tool).

2. Remove valve lifter.

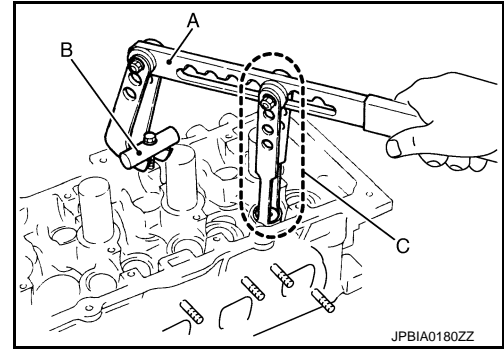
- Identify installation positions, and store them without mixing them up.

CYLINDER HEAD

< UNIT DISASSEMBLY AND ASSEMBLY >

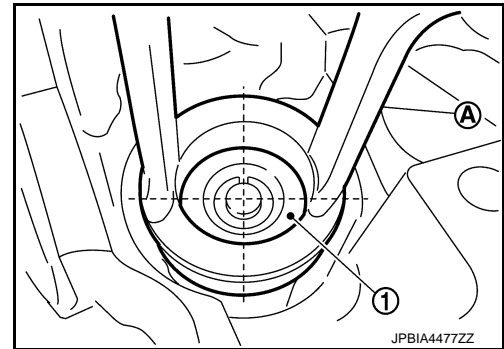
[MR20DD]

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



CAUTION:

- Be careful not to damage valve lifter holes.
- Fit the attachment [SST: KV10115900 (J-26336-20)] (A) in the center of valve spring retainer ① to press it.

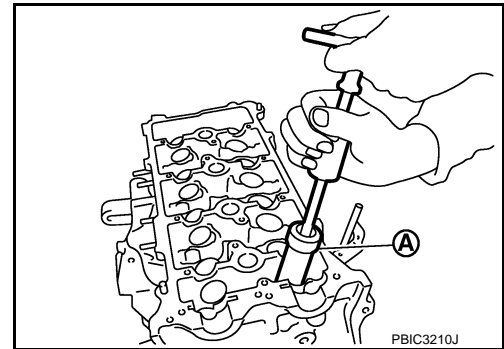


4. Remove valve spring retainer and valve spring (with valve spring seat).

CAUTION:

Never remove valve spring seat from valve spring.

5. Push valve stem to combustion chamber side, and remove valve.
 - Identify installation positions, and store them without mixing them up.
6. Remove valve oil seal with a valve oil seal puller [SST: KV10107902] (A).



7. When 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-135. "Cylinder Head"](#).
8. When valve guide must be replaced.

CAUTION:

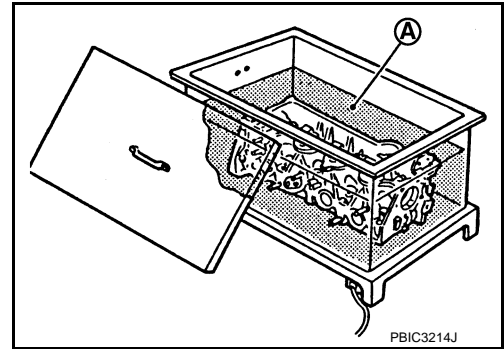
Never bore excessively to prevent cylinder head from scratching.

CYLINDER HEAD

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

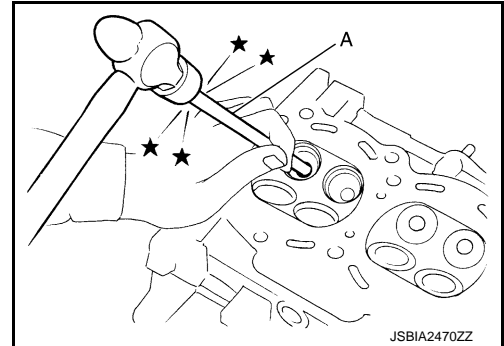
- a. To remove valve guide, heat cylinder head to 110 to 130°C (230 to 266°F) by soaking in heated oil (A).



- b. Drive out valve guide with a hammer and valve guide drift (commercial service tool) (A).

CAUTION:

Cylinder head contains heat, wear protective equipment to avoid getting burned.



ASSEMBLY

1. When valve guide is removed, install it.

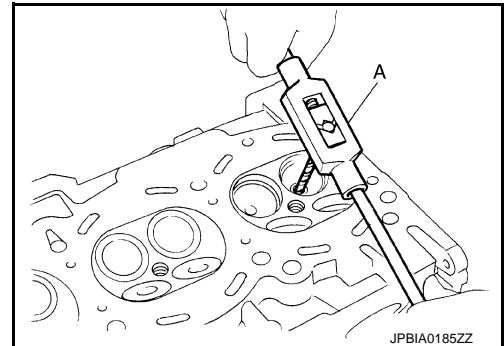
CAUTION:

Replace with oversize [0.2 mm (0.008 in)] valve guide.

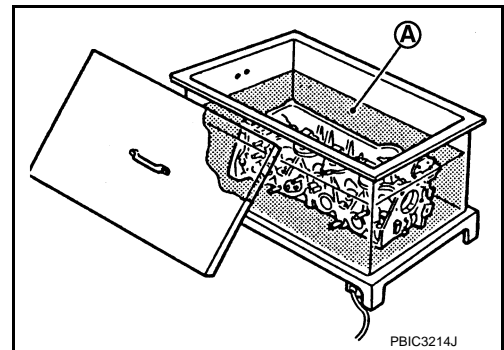
- a. Ream cylinder head valve guide hole with a valve guide reamer (commercial service tool) (A).

For service parts: Oversize [0.2 mm (0.008 in)]

Refer to [EM-135, "Cylinder Head"](#).



- b. Heat cylinder head to 110 to 130°C (230 to 266°F) by soaking in heated oil (A).



CYLINDER HEAD

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

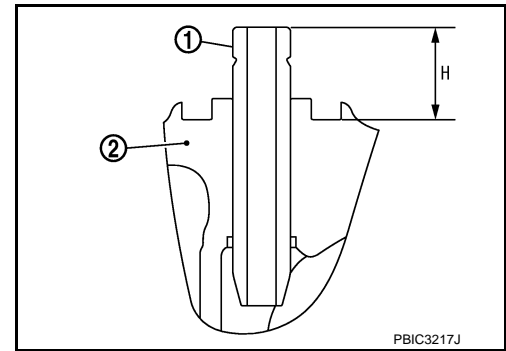
- c. Press valve guide ① from camshaft side to dimensions as shown in the figure.

② : Cylinder head

Projection (H) : Refer to [EM-135, "Cylinder Head"](#).

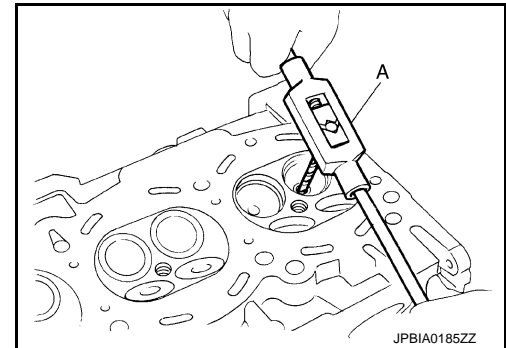
CAUTION:

Cylinder head contains heat, wear protective equipment to avoid getting burned.



- d. Apply reamer finish to valve guide with a valve guide reamer (commercial service tool) (A).

Standard : Refer to [EM-135, "Cylinder Head"](#).



2. When valve seat is removed, install it.

CAUTION:

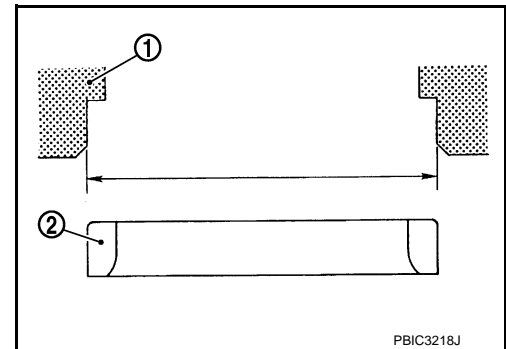
Replace with oversize [0.5 mm (0.020 in)] valve seat.

- a. Ream cylinder head ① recess diameter for service valve seat ②.

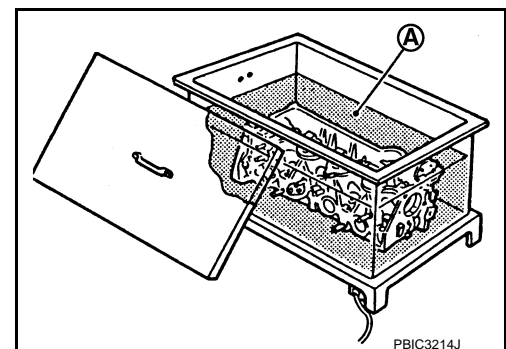
For service parts: Oversize [0.5 mm (0.020 in)]

Refer to [EM-135, "Cylinder Head"](#).

- Be sure to ream in circles concentric to the valve guide center. This will enable valve seat to fit correctly.



- b. Heat cylinder head to 110 to 130°C (230 to 266°F) by soaking in heated oil (A).



- c. Provide valve seats cooled well with dry ice. Press-fit valve seat into cylinder head.

CAUTION:

- **Never touch cold valve seats directly.**
- **Cylinder head contains heat, wear protective equipment to avoid getting burned.**

CYLINDER HEAD

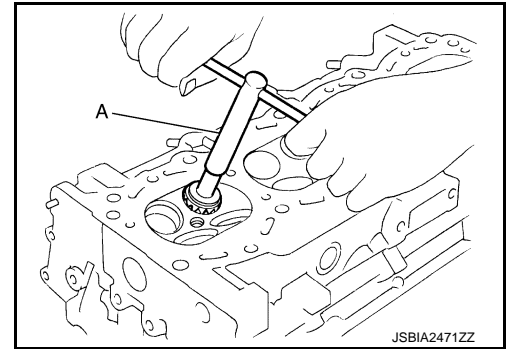
< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

- d. Using valve seat cutter set (commercial service tool) (A) or valve seat grinder, finish valve seat to the specified dimensions. For dimensions, refer to [EM-135, "Cylinder Head"](#).

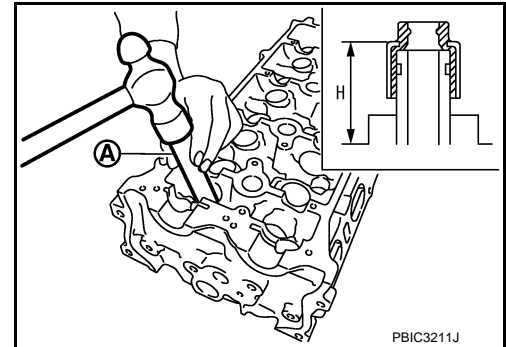
CAUTION:

When using valve seat cutter, firmly grip the cutter handle with both hands. Then, press on the contacting surface all around the circumference to cut in a single drive. Improper pressure on with the cutter or cutting many different times may result in stage valve seat.



- e. Using compound, grind to adjust valve fitting.
f. Check again for normal contact. Refer to [EM-99, "Inspection"](#).
3. Install valve oil seal.
• Install with a valve oil seal drift [SST: KV10115600] (A) to match dimension in the figure.
NOTE:
Dimension is height that measured before installing valve spring (with valve spring seat).

Height (H) : 15.1 - 15.7 mm (0.594 - 0.618 in)

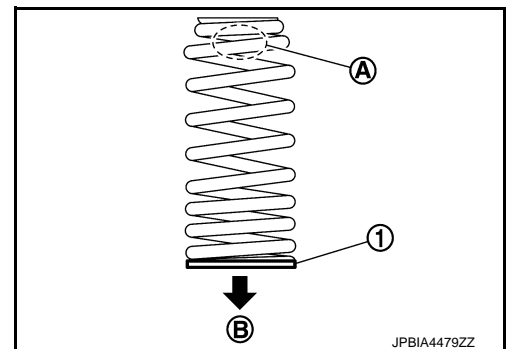


4. Install valve.
• Install larger diameter to intake side.
5. Install valve spring (with valve spring seat).
• Install smaller pitch (valve spring seat side) to cylinder head side (B).

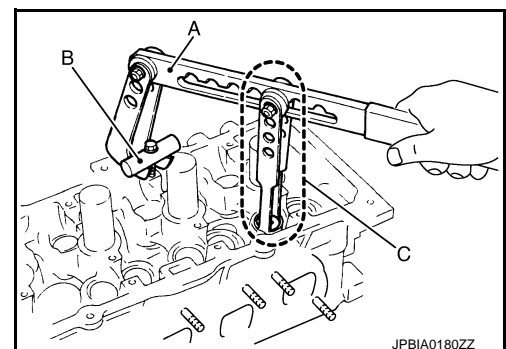
① : Valve spring seat (Do not remove from valve spring.)

- Confirm identification color (A) of valve spring.

Intake : White
Exhaust : Orange



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



CAUTION:

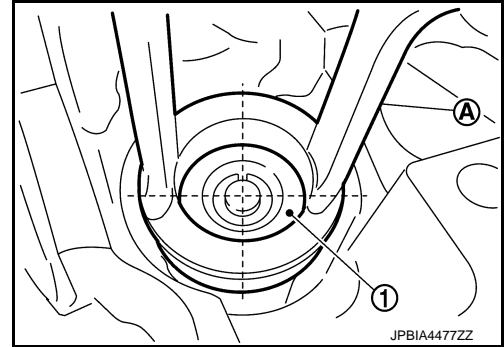
- Be careful not to damage valve lifter holes.

CYLINDER HEAD

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

- Fit the attachment [SST: KV10115900 (J-26336-20)] ① in the center of valve spring retainer ① to press it.
- Tap valve stem edge lightly with a plastic hammer after installation to check its installed condition.



8. Install valve lifter.
 - Install it in the original position.
9. Install spark plug with spark plug wrench (commercial service tool).

Inspection

INFOID:0000000010783728

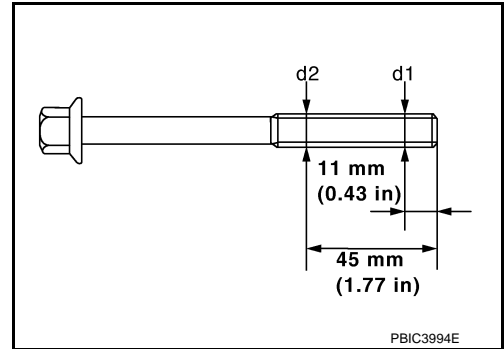
INSPECTION AFTER REMOVAL

Cylinder Head Bolts Outer Diameter

- Cylinder head bolts are tightened by plastic zone tightening method. Whenever the size difference between (d1) and (d2) exceeds the limit, replace them with a new one.

Limit [(d1) – (d2)]: 0.15 mm (0.0059 in)

- If reduction of outer diameter appears in a position other than (d2), use it as (d2) point.



Cylinder Head Distortion

NOTE:

When performing this inspection, cylinder block distortion should be also checked. Refer to [EM-115, "Inspection"](#).

1. Wipe off engine oil and remove water scale (like deposit), gasket, sealant, carbon, etc. with a scraper.

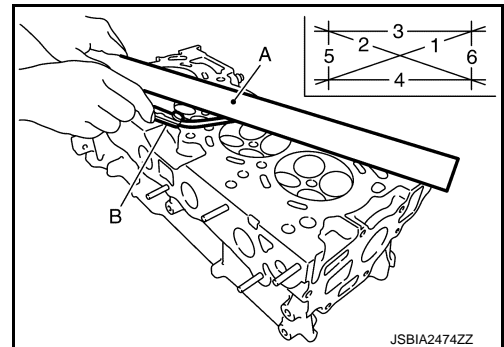
CAUTION:

Never allow gasket debris to enter passages for engine oil or water.

2. At each of several locations on bottom surface of cylinder head, measure the distortion in six directions using straightedge (A) and feeler gauge (B).

Limit: Refer to [EM-135, "Cylinder Head"](#).

- If it exceeds the limit, replace cylinder head.



INSPECTION AFTER DISASSEMBLY

VALVE DIMENSIONS

- Check the dimensions of each valve. For the dimensions, refer to [EM-135, "Cylinder Head"](#).
- If dimensions are out of the standard, replace valve and check valve seat contact. Refer to "VALVE SEAT CONTACT".

VALVE GUIDE CLEARANCE

CYLINDER HEAD

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

Valve Stem Diameter

- Measure the diameter of valve stem with micrometer (B).

Standard: Refer to [EM-135, "Cylinder Head"](#).

Valve Guide Inner Diameter

- Measure the inner diameter of valve guide with bore gauge (A).

Standard: Refer to [EM-135, "Cylinder Head"](#).

Valve Guide Clearance

- (Valve guide clearance) = (Valve guide inner diameter) – (Valve stem diameter)

Standard and Limit: Refer to [EM-135, "Cylinder Head"](#).

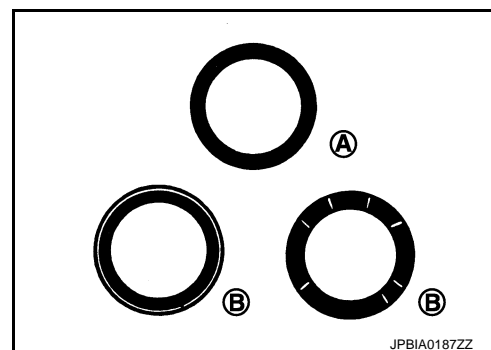
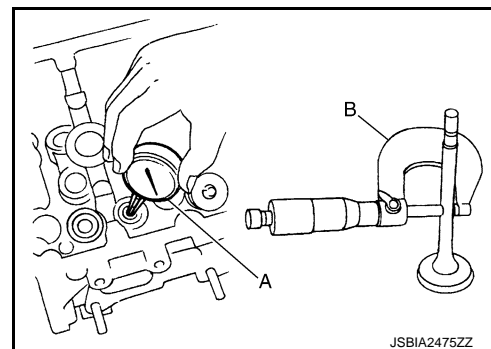
- If the calculated value exceeds the limit, replace valve and/or valve guide. When valve guide must be replaced. Refer to [EM-94, "Disassembly and Assembly"](#).

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

- 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-94, "Disassembly and Assembly"](#).



VALVE SPRING SQUARENESS

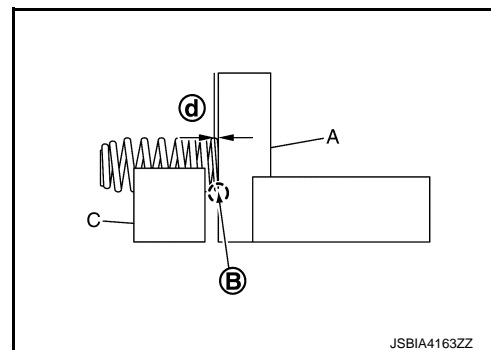
- Set a try square (A) along the side of valve spring and rotate spring. Measure the maximum clearance ⓓ between the top of spring and try square.

Ⓑ : Contact

C : V-block

Limit : Refer to [EM-135, "Cylinder Head"](#).

- If it exceeds the limit, replace valve spring.



VALVE SPRING DIMENSIONS AND VALVE SPRING PRESSURE LOAD

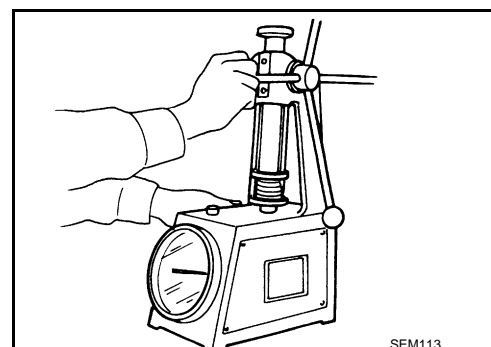
- Check valve spring pressure with valve spring seat installed at the specified spring height.

CAUTION:

Never remove valve spring seat from valve spring.

Standard : Refer to [EM-135, "Cylinder Head"](#).

- If the installation load or load with valve open is out of the standard, replace valve spring (with valve spring seat).



CYLINDER HEAD

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

INSPECTION AFTER INSTALLATION

Inspection for Leakage

The following are procedures for checking fluids leakage, lubricates leakage, and exhaust gases 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-23. "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.
- Warm up engine thoroughly to check there is no leakage of fuel, exhaust gases, 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 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.

[MR20DD]

Exploded View

INFOID:0000000010783729



- 
- : Sealing point

INFOID:0000000010783730

1. Remove oil pan (lower). Refer to [.EM-40. "Exploded View"](#)
2. Remove oil filter. Refer to [LU-12. "Removal and Installation"](#).
3. Remove water hoses of oil cooler.
4. Remove oil level gauge and oil level gauge guide.
5. Remove front cover, timing chain, balancer unit timing cha
["Exploded View"](#).

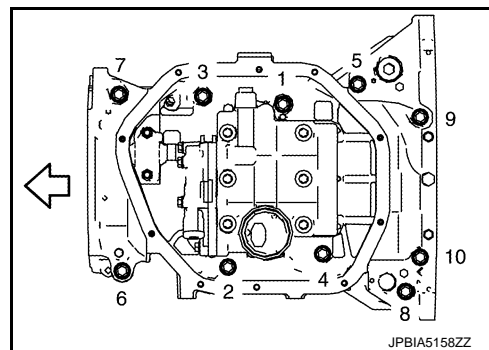
OIL PAN (UPPER)

[MR20DD]

< UNIT DISASSEMBLY AND ASSEMBLY >

6. Remove oil pan (upper) with the following procedure:
 - a. Loosen bolts in the order from 10 to 1 as shown in the figure.

← : Engine front

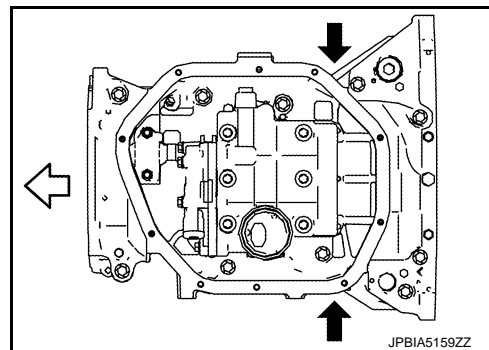


- b. Insert a screwdriver shown by the arrow (↔) in the figure and open up a crack between oil pan (upper) and cylinder block.

← : Engine front

CAUTION:

A more adhesive liquid gasket is applied compared to previous types when shipped, so it should not be forced off the position not specified.



- c. Insert seal cutter [SST: KV10111100] between oil pan (upper) and cylinder block, and slide it by tapping on the side of the tool with a hammer.

CAUTION:

Be careful not to damage the mating surface.

7. Remove O-ring between cylinder block and oil pan (upper).
8. Remove rear oil seal. Refer to [EM-90. "REAR OIL SEAL : Removal and Installation"](#).
9. Remove oil temperature sensor, if necessary.
10. Remove oil cooler, if necessary. Refer to [LU-13. "Exploded View"](#).

INSTALLATION

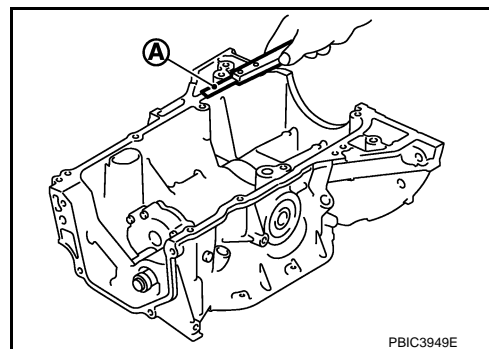
CAUTION:

Do not reuse O-rings.

1. Install oil pan (upper) with the following procedure:
 - a. Use a scraper (A) to remove old liquid gasket from mating surfaces.
 - Remove the old liquid gasket from mating surface of cylinder block.
 - Remove old liquid gasket from the bolt holes and threads.

CAUTION:

Never scratch or damage the mating surfaces when cleaning off old liquid gasket.



OIL PAN (UPPER)

[MR20DD]

< UNIT DISASSEMBLY AND ASSEMBLY >

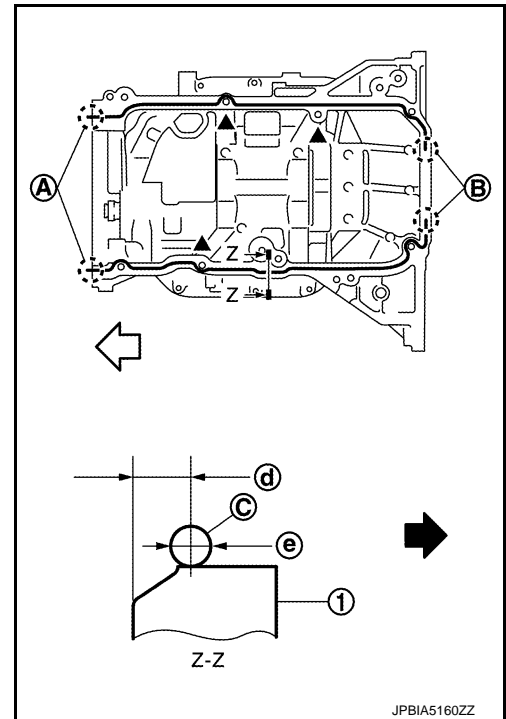
- b. Apply a continuous bead of liquid gasket ③ with a tube presser (commercial service tool) as shown in the figure.

- ① : Oil pan (upper)
- Ⓐ : 2 mm (0.08 in) protruded to outside
- Ⓑ : 2 mm (0.08 in) protruded to rear oil seal mounting side
- Ⓓ : 6.5 mm (0.26 in)
- Ⓔ : $\phi 4.0 - 5.0$ (0.157 - 0.197 in)
- ⇐ : Engine front
- ← : Engine outside

Use Genuine Liquid Gasket (Three Bond 1217H) or equivalent.

CAUTION:

- Apply liquid gasket to outside of bolt hole for the positions shown by ▲ marks.
- Attaching should be done within 5 minutes after liquid gasket application.



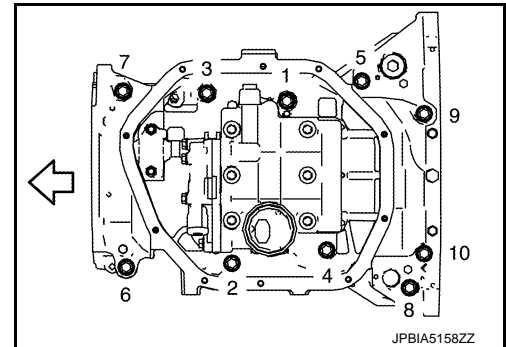
- c. Install new O-ring at cylinder block side.

CAUTION:

Install avoiding misalignment of O-ring.

- d. Tighten bolts in the order from 1 to 10 as shown in the figure.

- ⇐ : Engine front

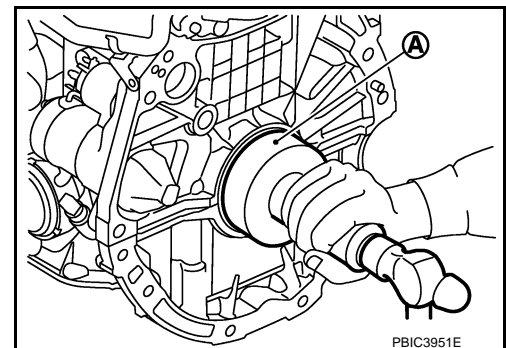


2. Install rear oil seal with the following procedure.

CAUTION:

- The installation of rear oil seal should be completed within 5 minutes after installing oil pan (upper).
- Always replace rear oil seal with new one.
- Never touch oil seal lip.

- a. Wipe off liquid gasket protruding to the rear oil seal mounting part of oil pan (upper) and cylinder block using a scraper.
- b. Apply engine oil to entire outside area of rear oil seal.
- c. Press-fit the rear oil seal using a suitable drift ① with outer diameter 115 mm (4.53 in) and inner diameter 90 mm (3.54 in).



OIL PAN (UPPER)

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

- Press-fit to the specified dimensions as shown in the figure.

- ① : Rear oil seal
- Ⓐ : Cylinder block rear end surface
- Ⓑ : 0 - 0.5 mm (0 - 0.020 in)

CAUTION:

- **Never touch the grease applied to the oil seal lip.**
- **Be careful not to damage the rear oil seal mounting part of oil pan (upper) and cylinder block or the crankshaft.**
- **Press-fit straight, checking that rear oil seal does not curl or tilt.**

NOTE:

The standard surface of the dimension is the rear end surface of cylinder block.

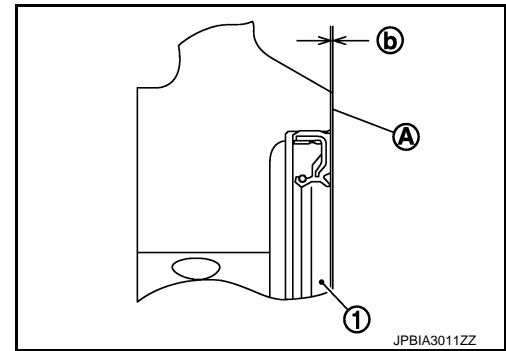
3. Install in the reverse order of removal, for the rest of parts.

Inspection

INFOID:0000000010783731

INSPECTION AFTER REMOVAL

Clean oil strainer portion (part of the oil pump) if any object attached.



A

EM

C

D

E

F

G

H

I

J

K

L

M

N

O

P

CYLINDER BLOCK

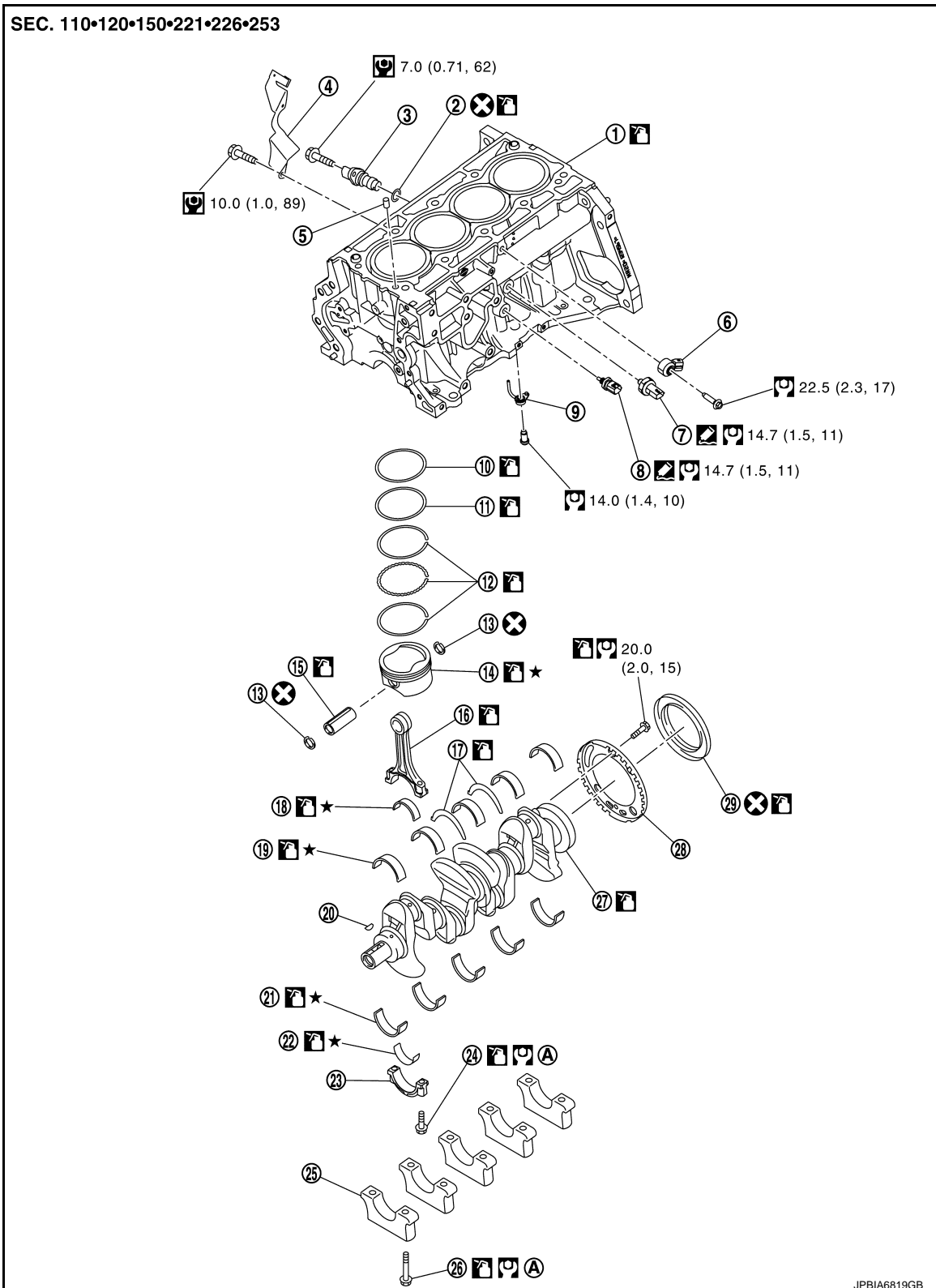
< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

CYLINDER BLOCK

Exploded View

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- | | | |
|--|--|------------------------------------|
| ① Cylinder block | ② O-ring | ③ Crankshaft position sensor (POS) |
| ④ Crankshaft position sensor (POS) cover | ⑤ Oil filter (for intake valve timing control) | ⑥ Knock sensor |

CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

- | | | |
|----------------------------------|--------------------------|----------------------------------|
| ⑦ Oil pressure switch | ⑧ Oil temperature sensor | ⑨ Oil jet |
| ⑩ Top ring | ⑪ Second ring | ⑫ Oil ring |
| ⑬ Snap ring | ⑭ Piston | ⑮ Piston pin |
| ⑯ Connecting rod | ⑰ Thrust bearing | ⑱ Connecting rod bearing (upper) |
| ⑲ Main bearing (upper) | ⑳ Crankshaft key | ㉑ Main bearing (lower) |
| ㉒ Connecting rod bearing (lower) | ㉓ Connecting rod cap | ㉔ Connecting rod cap bolt |
| ㉕ Main bearing cap | ㉖ Main bearing cap bolt | ㉗ Crankshaft |
| ㉘ Signal plate | ㉙ Rear oil seal | |

Ⓐ Comply with the installation procedure when tightening. Refer to [EM-107](#)

⊗ : Always replace after every disassembly.

Ⓐ : N·m (kg-m, ft-lb)

Ⓐ : N·m (kg-m, in-lb)

Ⓐ : Sealing point

Ⓐ : Should be lubricated with oil.

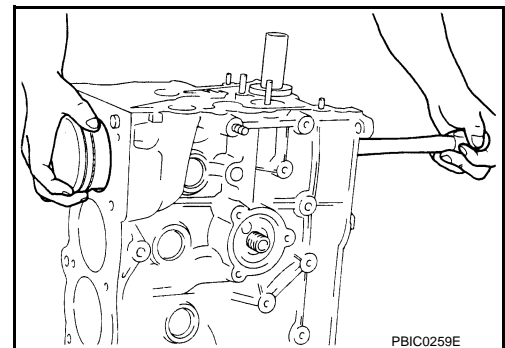
★ : Select with proper thickness.

Disassembly and Assembly

INFOID:0000000010783733

DISASSEMBLY

- Remove oil pan (upper). Refer to [EM-102, "Exploded View"](#).
- Remove thermostat housing. Refer to [CO-26, "Exploded View"](#).
- Remove knock sensor.
CAUTION:
Handle it carefully and avoid impacts.
- Remove crankshaft position sensor (POS) cover and crankshaft position sensor (POS).
CAUTION:
 - Handle crankshaft position sensor (POS) carefully and avoid impacts.
 - Never disassemble.
 - Never place crankshaft position sensor (POS) in a location where it is exposed to magnetism.
- Remove oil filter (for intake valve timing control).
- 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-115, "Inspection"](#).
- Position crankshaft pin corresponding to connecting rod to be removed onto the bottom dead center.
- Remove connecting rod cap.
- Using a hammer handle or similar tool, push piston and connecting rod assembly out to the cylinder head side.
CAUTION:
 - Be careful not to damage matching surface with connecting rod cap.
 - Be careful not to damage the cylinder wall and crankshaft pin, resulting from an interference of the connecting rod big end.



- Remove connecting rod bearings.

CAUTION:

When removing them, note the installation position. Keep them in the correct.

CYLINDER BLOCK

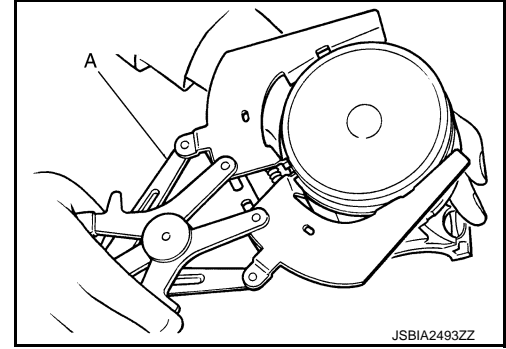
[MR20DD]

< UNIT DISASSEMBLY AND ASSEMBLY >

8. Remove piston rings from piston.
- Before removing piston rings, check the piston ring side clearance. Refer to [EM-115, "Inspection"](#).
 - Use a piston ring expander (commercial service tool) (A).

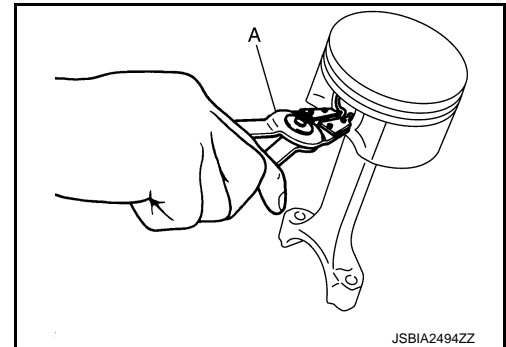
CAUTION:

- When removing piston rings, be careful not to damage the piston.
- Be careful not to damage piston rings by expanding them excessively.

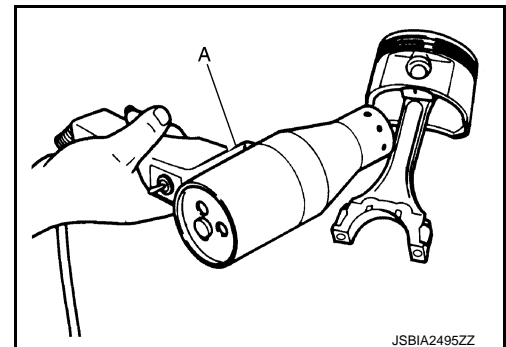


9. Remove piston from connecting rod with the following procedure:

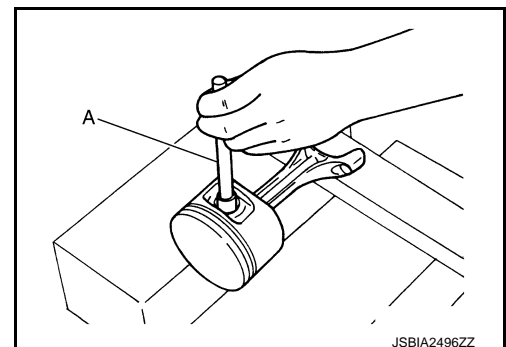
- a. Using snap ring pliers (A), remove snap rings.



- b. Heat piston to 60 to 70°C (140 to 158°F) with an industrial use drier (A) or equivalent.



- c. Push out piston pin with stick (A) of outer diameter approximately 18 mm (0.71 in).



10. Remove main bearing cap bolts.

- Measure crankshaft end play before loosening main bearing cap bolts. Refer to [EM-115, "Inspection"](#).

CYLINDER BLOCK

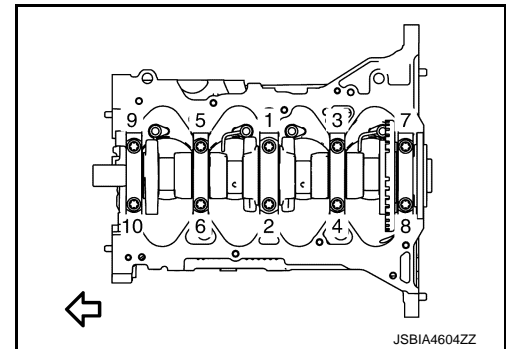
[MR20DD]

< UNIT DISASSEMBLY AND ASSEMBLY >

- Loosen and remove main bearing cap bolts in the order from 10 to 1 as shown in the figure.

↩ : Engine front

- Use TORX socket.



- Remove main bearing caps.
 - Tap main bearing caps lightly with a plastic hammer for removal.

CAUTION:

Be careful not to damage the mounting surface.

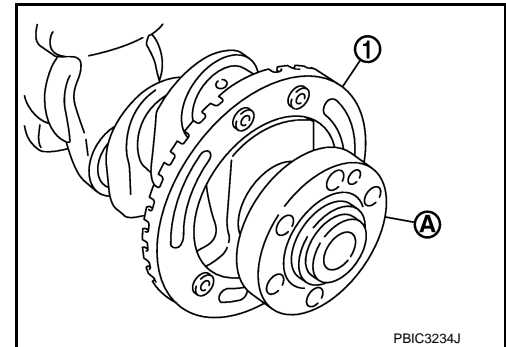
- Remove crankshaft.

CAUTION:

- Be careful not to damage or deform signal plate ① mounted on rear end of crankshaft ②.
- When setting crankshaft on a flat floor surface, use a block of wood to avoid interference between signal plate and the floor surface.
- Never remove signal plate unless it is necessary to do so.

NOTE:

When removing or installing signal plate, use TORX socket.



- Pull rear oil seal out from rear end of crankshaft.
- Remove main bearings and thrust bearings from cylinder block and main bearing caps.

CAUTION:

Identify installation positions, and store them without mixing them up.

ASSEMBLY

CAUTION:

Do not reuse O-rings or washers.

- Fully air-blow engine coolant and engine oil passages in cylinder block, cylinder bore and crankcase to remove any foreign material.

CAUTION:

Use a goggles to protect your eye.

- Install each plug to cylinder block as shown in the figure.

② : Washer

↩ : Engine front

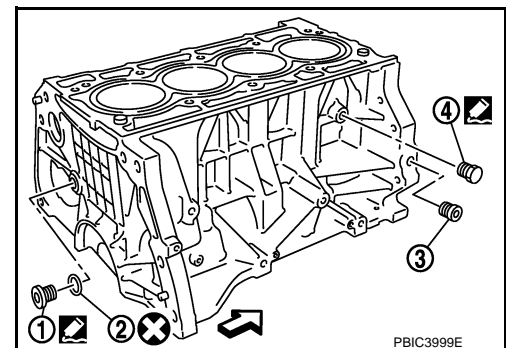
CAUTION:

Do not reuse washer.

- Apply liquid gasket to the thread of water drain plug ④. Use Genuine Liquid Gasket (Three Bond 1215) or equivalent.
- Apply sealant to the thread of plug ①. Use genuine high strength thread locking sealant (Three Bond 1386B) or equivalent.

NOTE:

Do not apply liquid gasket or high strength thread locking sealant to the plug ③.



- Tighten each plug as specified below.

CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

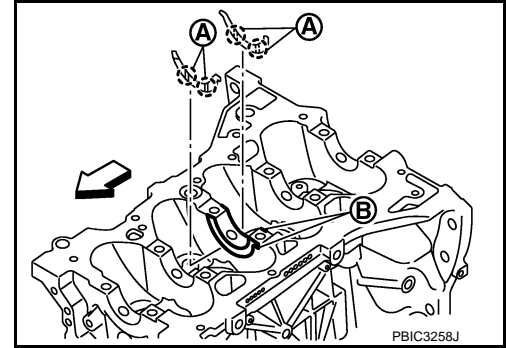
Part	Washer	Tightening torque
①	Yes	54.0 N·m (5.5 kg-m, 40 ft-lb)
③	No	19.6 N·m (2.0 kg-m, 14 ft-lb)
④	No	9.8 N·m (1.0 kg-m, 87 in-lb)

3. Install main bearings and thrust bearings with the following procedure:

- Remove dust, dirt, and engine oil on the bearing mating surfaces of cylinder block and main bearing cap.
- Install thrust bearings to the both sides of the No. 3 journal housing ② on cylinder block.

⇐ : Engine front

- Install thrust bearings with the oil groove ① facing crankshaft arm (outside).

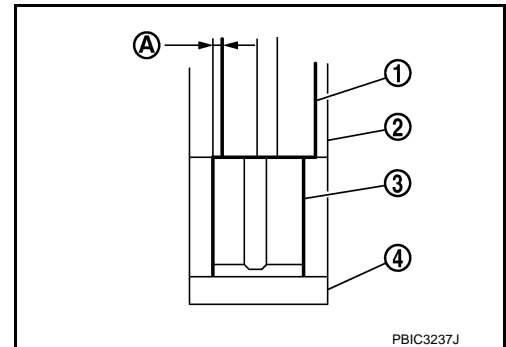


c. Install the main bearings paying attention to the direction.

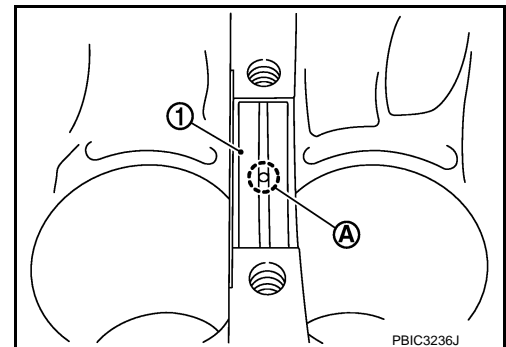
- Before installing main bearings, apply new engine oil to the bearing surface (inside). Do not apply new engine oil to the back surface, but thoroughly clean it.
- When installing, align main bearing to the center position of cylinder block and main bearing cap.
- The difference ① between main bearing (upper) ① and main bearing (lower) ③ should be 0.85 mm (0.0335 in) or less when installing.

② : Cylinder block

④ : Main bearing cap



- Ensure the oil holes on cylinder block and oil holes ① on the main bearings ① are aligned.



4. Install signal plate to crankshaft if removed.

- Set the signal plate with the flange facing toward the counter weight side (engine front side) to the crankshaft rear surface.
- Apply new engine oil to threads and seat surfaces of mounting bolts.

CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

- c. Position crankshaft ② and signal plate ① using a dowel pin (service part), and tighten mounting bolts in the order from 1 to 4 as shown in the figure using TORX socket.

Ⓐ : Dowel pin hole

NOTE:

Dowel pin of crankshaft and signal plate is provided as a set for each.

- d. Tighten mounting bolts in numerical order as shown in the figure again.
- e. Remove dowel pin. (service parts)

CAUTION:

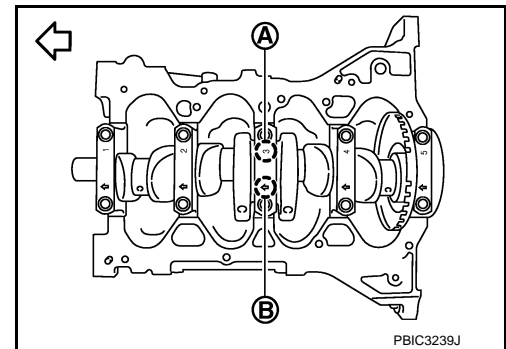
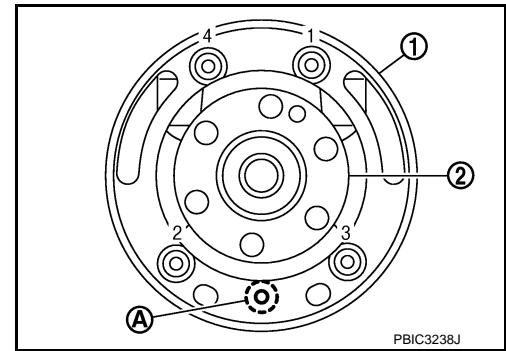
Be sure to remove dowel pin.

5. Install crankshaft to cylinder block.
- While turning crankshaft by hand, check that it turns smoothly.
6. Install main bearing caps with the following procedure:
- a. Install main bearing caps referring to the journal No. stamp Ⓐ and front mark Ⓑ as shown in the figure.

↶ : Engine front

NOTE:

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

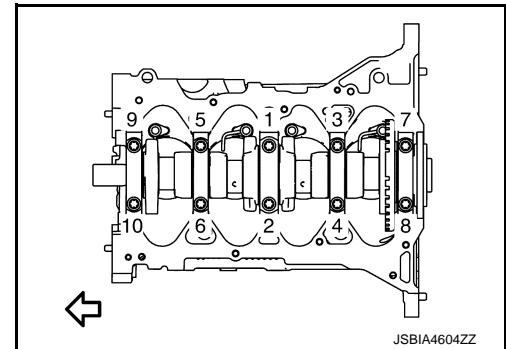


- b. Tighten main bearing cap bolts in the order from 1 to 10 as shown in the figure with the following procedure:

↶ : Engine front

- i. Apply new engine oil to threads and seat surfaces of mounting bolts.
- ii. Tighten main bearing cap bolts.

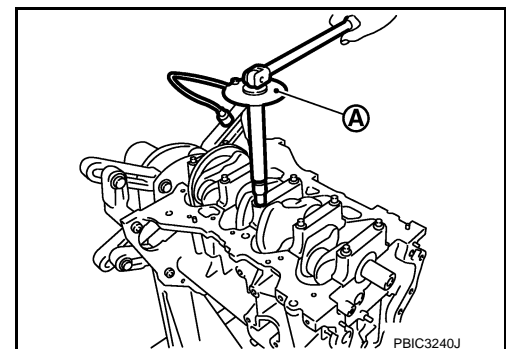
: 34.3 N·m (3.5 kg-m, 25 ft-lb)



- iii. Turn main bearing cap bolts 60 degrees clockwise (angle tightening) in order from No. 1 to 10 in the figure.

CAUTION:

Confirm the tightening angle by using an angle wrench [SST: KV10112100] Ⓐ or protractor. Never judge by visual inspection without the tool.



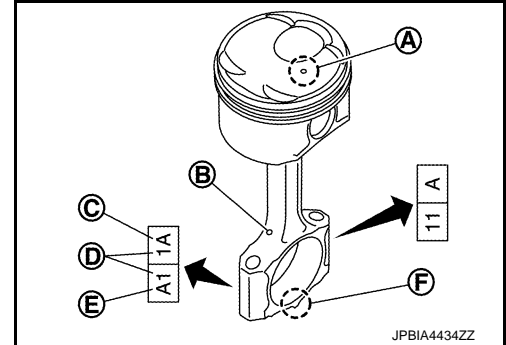
- After installing mounting bolts, check that crankshaft can be rotated smoothly by hand.
 - Check crankshaft end play. Refer to [EM-115, "Inspection"](#).
7. Install piston to connecting rod with the following procedure:

CYLINDER BLOCK

[MR20DD]

< UNIT DISASSEMBLY AND ASSEMBLY >

- a. Using snap ring pliers, install new snap ring to the groove of the piston rear side.
 - Insert it fully into groove to install.
- b. Assemble piston to connecting rod.
 - Using an industrial use drier or similar tool, heat the piston until the 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 (A) on the piston head and the oil hole (B) and the cylinder number (D) on connecting rod are positioned as shown in the figure.

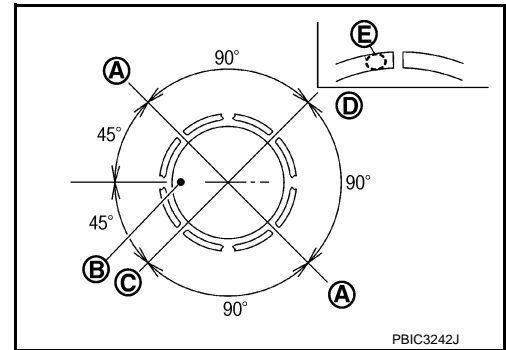


- (C) : Management code
 - (E) : Big end diameter grade
 - (F) : Front mark (connecting rod cap)
- c. Install new snap ring to the groove of the piston front side.
 - Insert it fully into groove to install.
 - After installing, check that connecting rod moves smoothly.
 8. Using a piston ring expander (commercial service tool), install piston rings.

CAUTION:

- Be careful not to damage piston.
- Be careful not to damage piston rings by expanding them excessively.
- Position each ring with the gap as shown in the figure referring to the piston front mark.

- (A) : Oil ring upper or lower rail gap
- (B) : Front mark
- (C) : Second ring and oil ring spacer gap
- (D) : Top ring gap
- (E) : Stamped mark



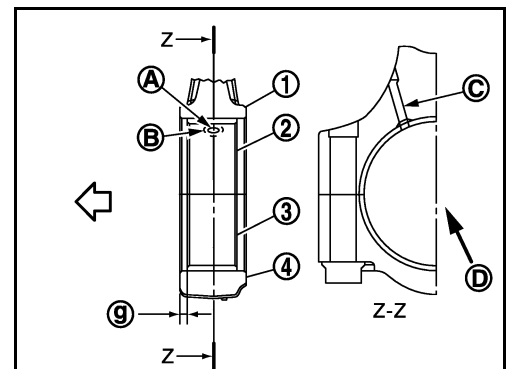
CAUTION:

Never contact the rail end gap under the oil ring with the oil drain cast groove of piston.

- Install second ring with the stamped surface facing upward.

9. Install connecting rod bearing upper (2) and lower (3) to connecting rod (1) and connecting rod cap (4).

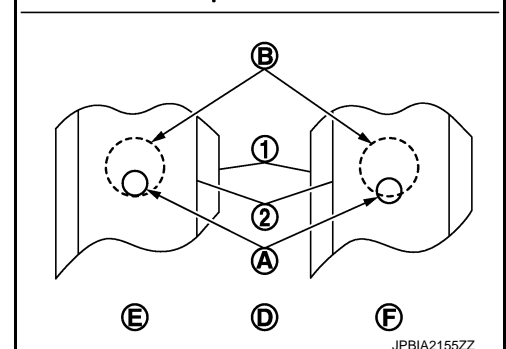
- (C) : Oil hole (connecting rod)
- (D) : View D
- (E) : OK
- (F) : NG
- (G) : 2.55 - 2.95 mm (0.1004 - 0.1161 in)
- ↔ : Engine front



- Install the connecting rod in the dimension shown in the figure.
- Check that connecting rod bearing oil hole (A) is completely in the inside of connecting rod oil hole chamfered area (B).
- When installing connecting rod bearings, apply new engine oil to the bearing surface (inside). Do not apply new engine oil to the back surface, but thoroughly clean it.

NOTE:

- There is no positioning tab.



CYLINDER BLOCK

[MR20DD]

< UNIT DISASSEMBLY AND ASSEMBLY >

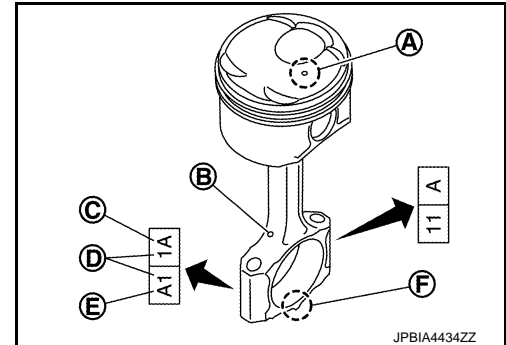
- Install the connecting rod bearings in the center of connecting rod and connecting rod cap as shown in the figure. For service operation, the center position can be checked, visually.

10. Install piston and connecting rod assembly to crankshaft.

- Position crankshaft pin corresponding to connecting rod to be installed onto the bottom dead center.
- Apply new engine oil sufficiently to the cylinder bore, piston and crankshaft pin.
- Match the cylinder position with the cylinder number ① on connecting rod to install.

- Ⓑ : Oil hole
- Ⓒ : Management code
- Ⓔ : Big end diameter grade
- Ⓕ : Front mark (connecting rod cap)

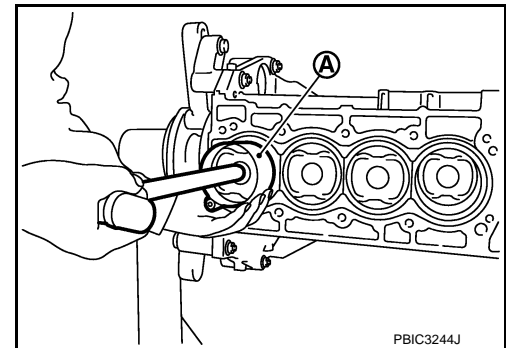
- Install so that front mark Ⓐ on the piston head faces the front of engine.



- Using a piston ring compressor [SST: EM03470000] Ⓐ or suitable tool, install piston with the front mark on the piston head facing the front of the engine.

CAUTION:

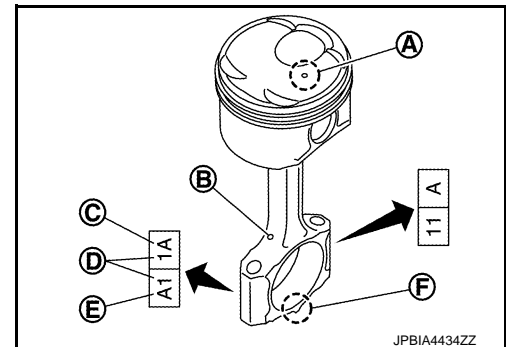
Be careful not to damage the cylinder wall and crankshaft pin, resulting from an interference of the connecting rod big end.



11. Install connecting rod cap.

- Match the stamped cylinder number marks ① on connecting rod with those on connecting rod cap to install.

- Ⓐ : Front mark (piston)
- Ⓑ : Oil hole
- Ⓒ : Management code
- Ⓔ : Big end diameter grade
- Ⓕ : Front mark (connecting rod cap)



12. Tighten connecting rod cap bolt with the following procedure:

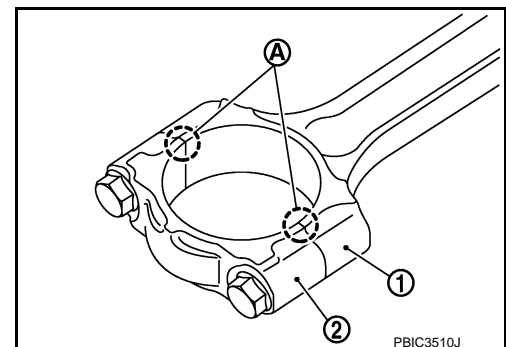
CAUTION:

- Check that there is no gap in the thrust surface Ⓐ of the joint between connecting rod ① and connecting rod cap ② and that these parts are in the correct position. And then, tighten the connecting rod cap bolts.
- If the connecting rod cap bolts are reused, measure the outer diameter. Refer to [EM-115, "Inspection"](#).

- Apply new engine oil to the threads and seats of connecting rod cap bolts.
- Tighten connecting rod cap bolts.

: 27.5 N·m (2.8 kg-m, 20 ft-lb)

- Completely loosen connecting rod cap bolts.



: 0 N·m (0 kg-m, 0 ft-lb)

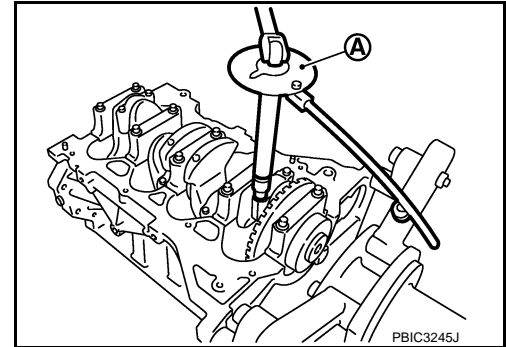
- d. Tighten connecting rod cap bolts.

: 19.6 N·m (2.0 kg-m, 14 ft-lb)

- e. Then turn all connecting rod cap bolts 60 degrees clockwise (angle tightening).

CAUTION:

Check and confirm the tightening angle by using an angle wrench [SST: KV10112100] (A) or protractor. Never judge by visual inspection without the tool.



- After tightening connecting rod cap bolt, check that crankshaft rotates smoothly.
- Check the connecting rod side clearance. Refer to [EM-115, "Inspection"](#).

13. Install oil pan (upper). Refer to [EM-102, "Exploded View"](#).

NOTE:

Install the rear oil seal after installing the oil pan (upper).

14. Install rear oil seal. Refer to [EM-90, "REAR OIL SEAL : Removal and Installation"](#).

15. Install drive plate. Refer to [EM-65, "Removal and Installation"](#)

16. Install knock sensor.

- Install knock sensor ① with harness connector facing toward the rear of engine.

(A) : Cylinder block left side

⇐ : Engine front

CAUTION:

- Never tighten mounting bolts while holding the harness connector.
- If any impact by dropping is applied to knock sensor, replace it with a new one.

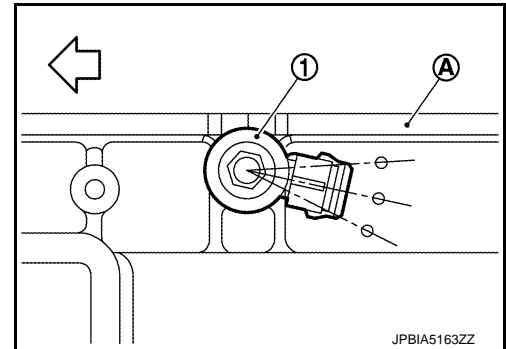
NOTE:

- 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 crankshaft position sensor (POS) and crankshaft position sensor (POS) cover.

CAUTION:

- Handle crankshaft position sensor (POS) carefully and avoid impacts.
- Never disassemble.
- Never place crankshaft position sensor (POS) in a location where it is exposed to magnetism.

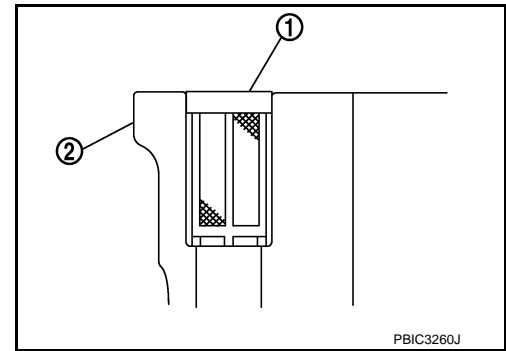


CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

18. Install oil filter (for intake valve timing control) ① in the direction shown in the figure.
- Check that the oil filter (for intake valve timing control) does not protrude from the upper surface of cylinder block ② after installation.



19. Assemble in the reverse order of disassembly.

Inspection

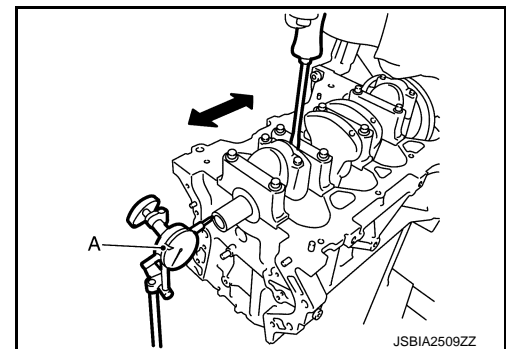
INFOID:000000010783734

CRANKSHAFT END PLAY

- Measure the clearance between thrust bearings and crankshaft arm when crankshaft is moved fully forward or backward with a dial indicator (A).

Standard and Limit : Refer to [EM-137, "Cylinder Block"](#).

- If the measured value exceeds the limit, replace thrust bearings, and measure again. If it still exceeds the limit, replace crankshaft also.

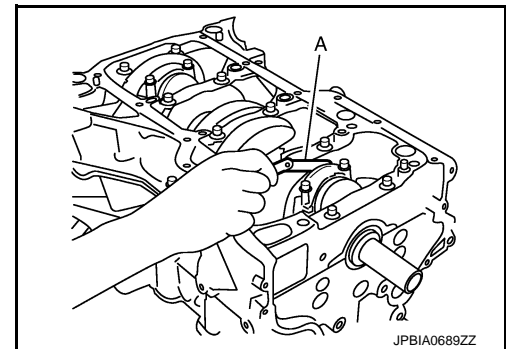


CONNECTING ROD SIDE CLEARANCE

- Measure the side clearance between connecting rod and crankshaft arm with a feeler gauge (A).

Standard and Limit : Refer to [EM-137, "Cylinder Block"](#).

- If the measured value exceeds the limit, replace connecting rod, and measure again. If it still exceeds the limit, replace crankshaft also.

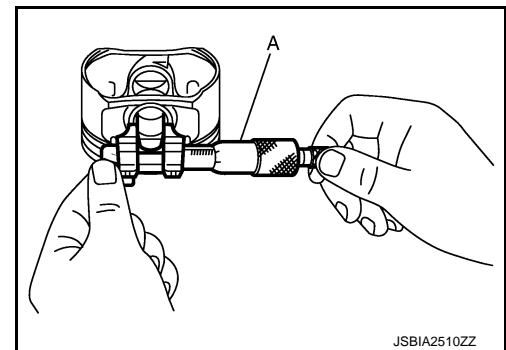


PISTON TO PISTON PIN OIL CLEARANCE

Piston Pin Hole Diameter

Measure the inner diameter of piston pin hole with an inside micrometer (A).

Standard : Refer to [EM-137, "Cylinder Block"](#).



Piston Pin Outer Diameter

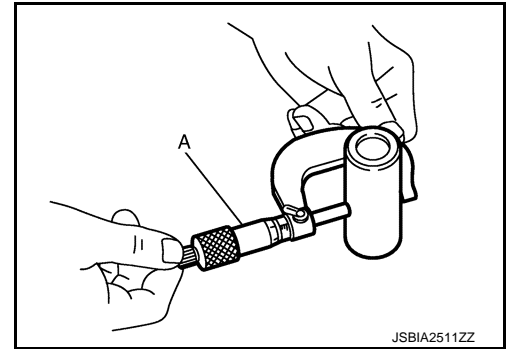
CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

Measure the outer diameter of piston pin with a micrometer (A).

Standard : Refer to [EM-137, "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-137, "Cylinder Block"](#).

- If oil clearance is out of the standard, replace piston and piston pin assembly.
- When replacing piston and piston pin assembly. Refer to [EM-124, "Description"](#).

NOTE:

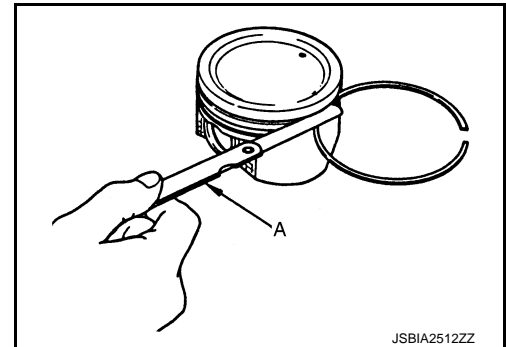
- Piston is available together with piston pin as assembly.
- Piston pin (piston pin hole) grade is provided only for the parts installed at the plant. For service parts, no grades can be selected. (Only grade "0" is available.)

PISTON RING SIDE CLEARANCE

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

Standard and Limit : Refer to [EM-137, "Cylinder Block"](#).

- If the measured value exceeds the limit, replace piston ring, and measure again. If it still exceeds the limit, replace piston also.

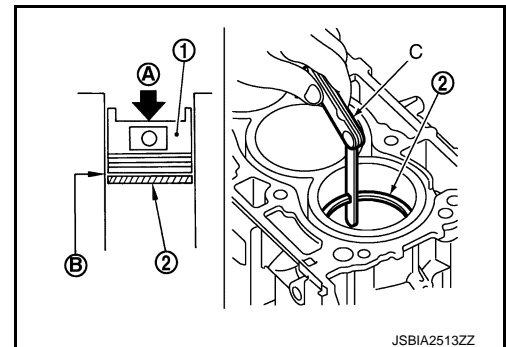


PISTON RING END GAP

- Check that cylinder bore inner diameter is within specification. Refer to "PISTON TO CYLINDER BORE CLEARANCE".
- Lubricate with new engine oil to piston ① and piston ring ②, and then insert (A) piston ring until middle of cylinder (B) with piston, and measure piston ring end gap with a feeler gauge (C).

Standard and Limit : Refer to [EM-137, "Cylinder Block"](#).

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



CONNECTING ROD BEND AND TORSION

CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

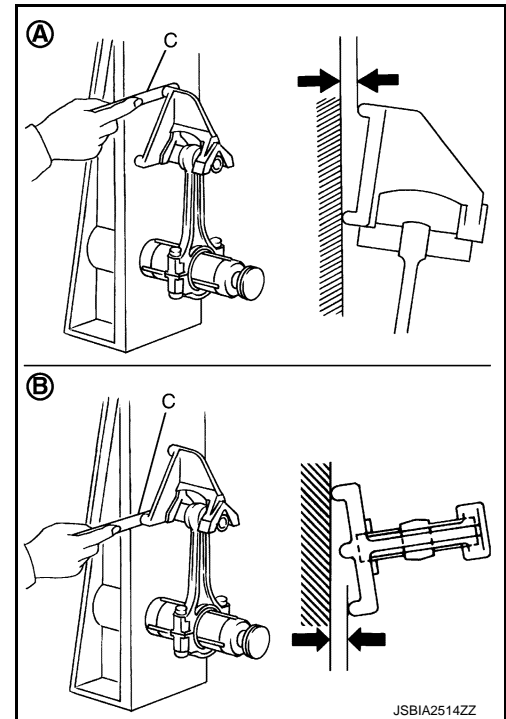
[MR20DD]

- Check with a connecting rod aligner.

- Ⓐ : Bend
Ⓑ : Torsion
C : Feeler gauge

Limit : Refer to [EM-137, "Cylinder Block"](#).

- If it exceeds the limit, replace connecting rod assembly.

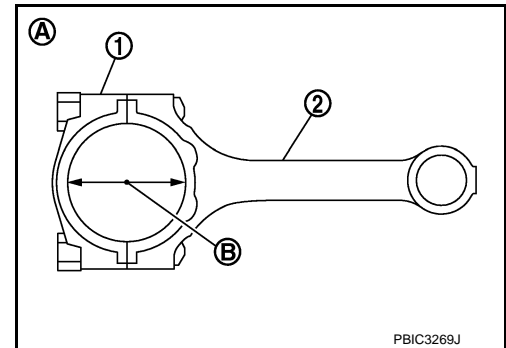


CONNECTING ROD BIG END DIAMETER

- Install connecting rod cap ① without connecting rod bearing installed, and tightening connecting rod cap bolts to the specified torque. Refer to [EM-107, "Disassembly and Assembly"](#).

- ② : Connecting rod
Ⓐ : Example
Ⓑ : Measuring direction of inner diameter

- Measure the inner diameter of connecting rod big end with an inside micrometer.



Standard : Refer to [EM-137, "Cylinder Block"](#).

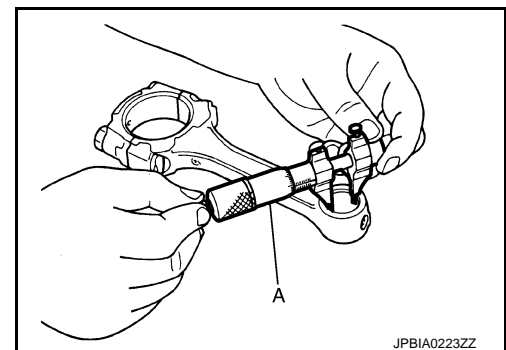
- If out of the standard, replace connecting rod assembly.

CONNECTING ROD BUSHING OIL CLEARANCE

Connecting Rod Bushing Inner Diameter

Measure the inner diameter of connecting rod bushing with an inside micrometer (A).

Standard : Refer to [EM-137, "Cylinder Block"](#).



Piston Pin Outer Diameter

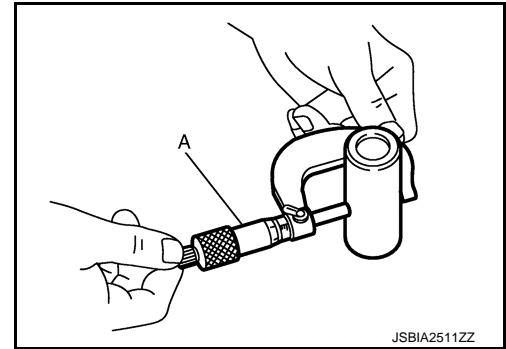
CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

Measure the outer diameter of piston pin with a micrometer (A).

Standard : Refer to [EM-137, "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-137, "Cylinder Block"](#).

- If the measured value is out of the standard, replace connecting rod assembly and/or piston and piston pin assembly.
- If replacing piston and piston pin assembly. Refer to [EM-124, "Piston"](#).
- If replacing connecting rod assembly. Refer to [EM-125, "Connecting Rod Bearing"](#).

CYLINDER BLOCK TOP SURFACE DISTORTION

- Using a scraper, remove gasket on the cylinder block surface, and also remove engine oil, scale, carbon, or other contamination.

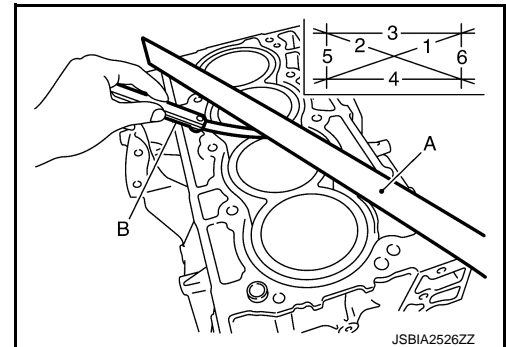
CAUTION:

Be careful not to 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 with a straight edge (A) and feeler gauge (B).

Limit : Refer to [EM-137, "Cylinder Block"](#).

- If it exceeds the limit, replace cylinder block.



MAIN BEARING HOUSING INNER DIAMETER

- Install main bearing cap without main bearings installed, and tighten main bearing cap mounting bolts to the specified torque. Refer to [EM-107, "Disassembly and Assembly"](#).
- Measure the inner diameter of main bearing housing with a cylinder gauge.
- Measure the position shown in the figure [5 mm (0.20 in)] backward from main bearing housing front side in the 2 directions as shown in the figure. The smaller one is the measured value.

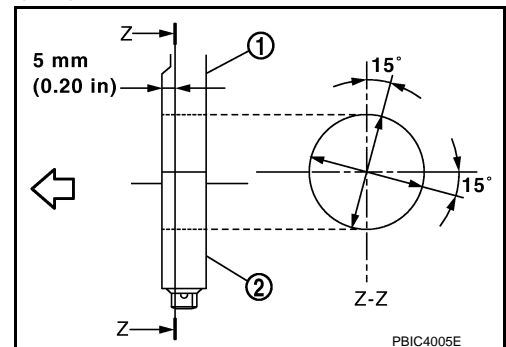
- ① : Cylinder block
 ② : Main bearing cap
 ⇐ : Engine front

Standard : Refer to [EM-137, "Cylinder Block"](#).

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

NOTE:

Main bearing caps cannot be replaced as a single, because it is machined together with cylinder block.



PISTON TO CYLINDER BORE CLEARANCE

CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

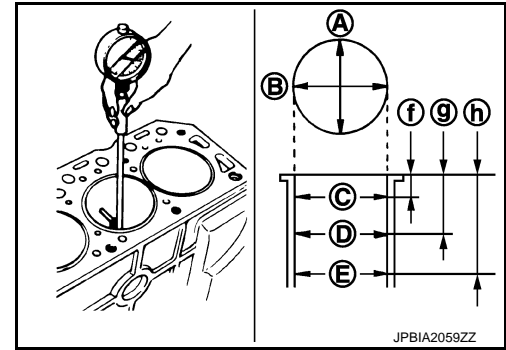
Cylinder Bore Inner Diameter

- Using a cylinder gauge, measure the 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] [A is in longitudinal direction of engine]

- (f) : 10 mm (0.39 in)
 (g) : 60 mm (2.36 in)
 (h) : 130 mm (5.12 in)

NOTE:

When determining cylinder bore grade, measure the cylinder bore (B) direction at (D) position.



Standard:

Cylinder bore inner diameter

: Refer to [EM-137, "Cylinder Block"](#).

Limit:

Out-of-round [Difference between (A) and (B)]

Taper [Difference between (C) and (D)]

: Refer to [EM-137, "Cylinder Block"](#).

- If the measured value exceeds the limit, or if there are scratches and/or seizure on the cylinder inner wall, replace cylinder block.

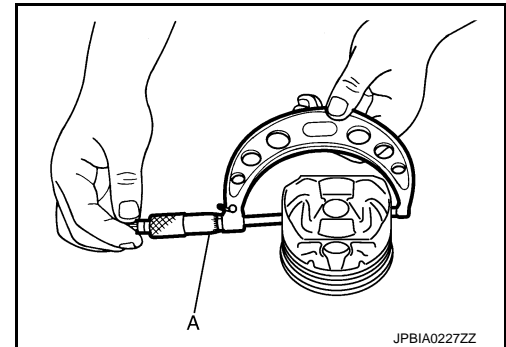
NOTE:

Oversize piston is not provided.

Piston Skirt Diameter

Measure the outer diameter of piston skirt with a micrometer (A).

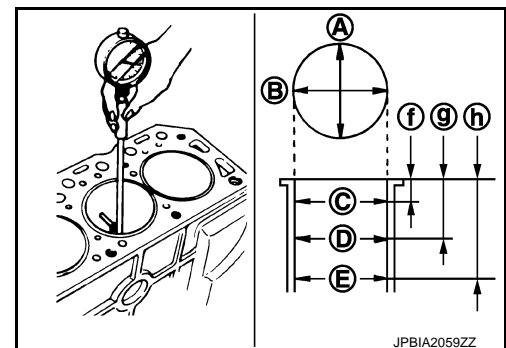
Standard : Refer to [EM-137, "Cylinder Block"](#).



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) : 130 mm (5.12 in)



(Clearance) = (Cylinder bore inner diameter) – (Piston skirt diameter)

Standard and Limit : Refer to [EM-137, "Cylinder Block"](#).

CYLINDER BLOCK

[MR20DD]

< UNIT DISASSEMBLY AND ASSEMBLY >

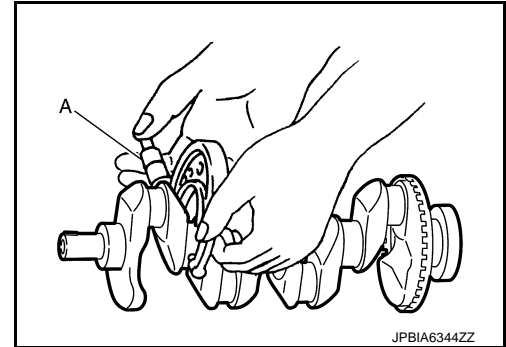
- If it exceeds the limit, replace piston and piston pin assembly and/or cylinder block. Refer to [EM-124, "Piston"](#).

CRANKSHAFT MAIN JOURNAL DIAMETER

- Measure the outer diameter of crankshaft main journals with a micrometer (A).

Standard : Refer to [EM-137, "Cylinder Block"](#).

- If out of the standard, measure the main bearing oil clearance. Then use undersize bearing. Refer to [EM-141, "Main Bearing"](#).



CRANKSHAFT PIN JOURNAL DIAMETER

- Measure the outer diameter of crankshaft pin journal with a micrometer.

Standard : Refer to [EM-137, "Cylinder Block"](#).

- If out of the standard, measure the connecting rod bearing oil clearance. Then use undersize bearing. Refer to [EM-125, "Connecting Rod Bearing"](#).

OUT-OF-ROUND AND TAPER OF CRANKSHAFT

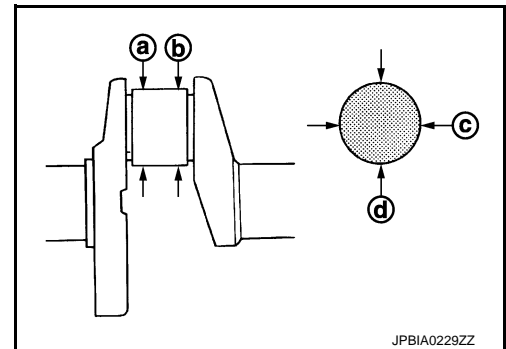
- Measure the dimensions at four different points as shown in the figure on each main journal and pin journal with a micrometer.
- Out-of-round is indicated by the difference in dimensions between (c) and (d) at (a) and (b).
- Taper is indicated by the difference in dimension between (a) and (b) at (c) and (d).

Limit:

Out-of-round [Difference between (X) and (Y)]

Taper [Difference between (A) and (B)]

: Refer to [EM-137, "Cylinder Block"](#).



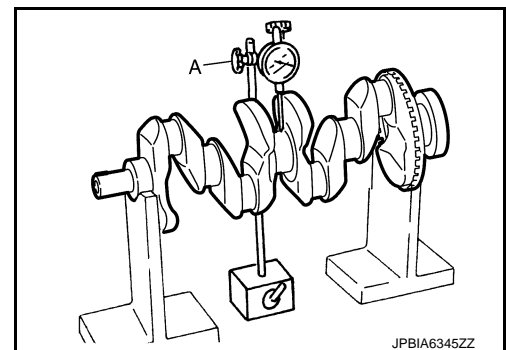
- If the measured value exceeds the limit, correct or replace crankshaft.
- If corrected, measure the bearing oil clearance of the corrected main journal and/or pin journal. Then select main bearing and/or connecting rod bearing. Refer to [EM-125, "Connecting Rod Bearing"](#) and/or [EM-127, "Main Bearing"](#).

CRANKSHAFT RUNOUT

- Place a V-block on a precise flat table to support the journals on the both end of the crankshaft.
- Place a dial indicator (A) straight up on the No. 3 journal.
- While rotating crankshaft, read the movement of the pointer on the dial indicator. (Total indicator reading)

Standard and Limit : Refer to [EM-137, "Cylinder Block"](#).

- If it exceeds the limit, replace crankshaft.



CONNECTING ROD BEARING OIL CLEARANCE

Method by Calculation

CYLINDER BLOCK

[MR20DD]

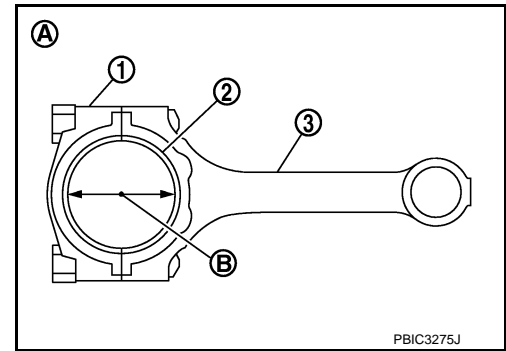
< UNIT DISASSEMBLY AND ASSEMBLY >

- Install connecting rod bearings ② to connecting rod ③ and connecting rod bearing cap ①, and tighten connecting rod cap bolts to the specified torque. Refer to [EM-107, "Disassembly and Assembly"](#).

Ⓐ : Example

Ⓑ : Inner diameter measuring direction

- Measure the inner diameter of connecting rod bearing with an inside micrometer.
(Bearing oil clearance) = (Connecting rod bearing inner diameter) – (Crankshaft pin journal diameter)



Standard and Limit : Refer to [EM-140, "Connecting Rod Bearing"](#).

- If clearance exceeds the limit, select proper connecting rod bearing according to connecting rod big end diameter and crankshaft pin journal diameter to obtain specified bearing oil clearance. Refer to [EM-125, "Connecting Rod Bearing"](#).

Method of Using Plastigage

- Remove engine oil and dust on crankshaft pin 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 cap, and tighten connecting rod cap bolts to the specified torque. Refer to [EM-107, "Disassembly and Assembly"](#).

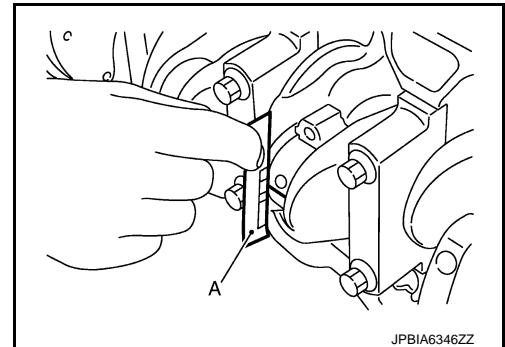
CAUTION:

Never rotate crankshaft.

- Remove connecting rod cap and bearing, and using the scale (A) on the plastigage bag, measure the plastigage width.

NOTE:

The procedure when the measured value exceeds the limit is same as that described in the "Method by Calculation".



MAIN BEARING OIL CLEARANCE

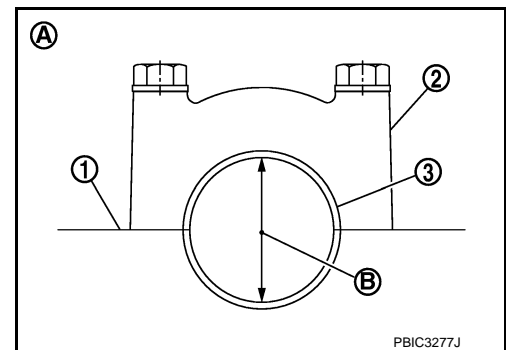
Method by Calculation

- Install main bearings ③ to cylinder block ① and main bearing cap ②, and tighten main bearing cap mounting bolts to the specified torque. Refer to [EM-107, "Disassembly and Assembly"](#).

Ⓐ : Example

Ⓑ : Inner diameter measuring direction

- Measure the inner diameter of main bearing with a cylinder gauge.
(Bearing oil clearance) = (Main bearing inner diameter) – (Crankshaft main journal diameter)



Standard and Limit : Refer to [EM-141, "Main Bearing"](#).

- If clearance exceeds the limit, select proper main bearing according to main bearing inner diameter and crankshaft main journal diameter to obtain specified bearing oil clearance. Refer to [EM-127, "Main Bearing"](#).

Method of Using Plastigage

- Remove engine oil and dust on crankshaft main 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.

CYLINDER BLOCK

[MR20DD]

< UNIT DISASSEMBLY AND ASSEMBLY >

- Install main bearings to cylinder block and main bearing cap, and tighten main bearing cap mounting bolts to the specified torque. Refer to [EM-107, "Disassembly and Assembly"](#).

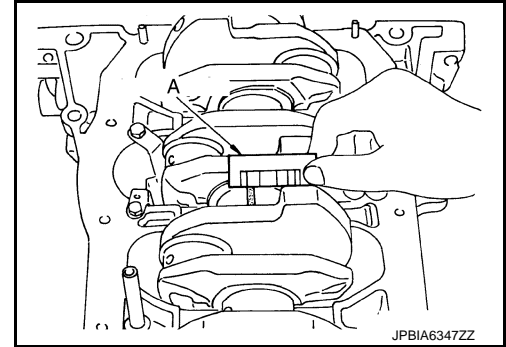
CAUTION:

Never rotate crankshaft.

- Remove main bearing cap and bearings, and using the scale (A) on the plastigage bag, measure the plastigage width.

NOTE:

The procedure when the measured value exceeds the limit is same as that described in the "Method by Calculation".



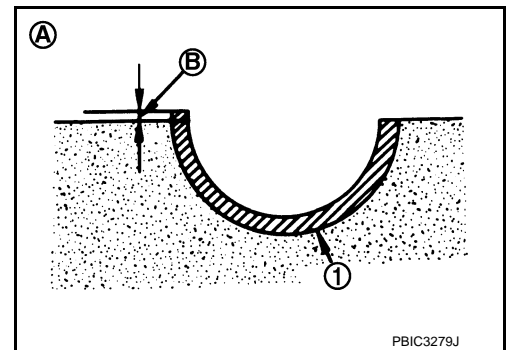
MAIN BEARING CRUSH HEIGHT

- When main bearing cap is removed after being tightened to the specified torque with main bearings ① installed, the tip end of bearing must protrude ②. Refer to [EM-107, "Disassembly and Assembly"](#).

② : Example

Standard : There must be crush height.

- If the standard is not met, replace main bearings.



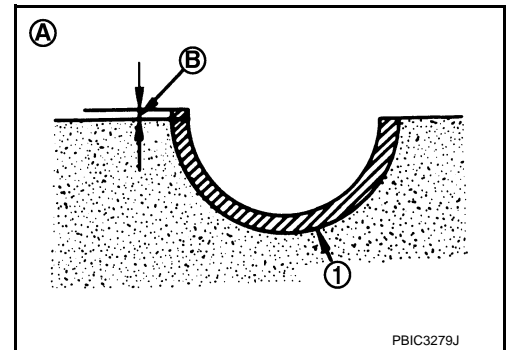
CONNECTING ROD BEARING CRUSH HEIGHT

- When connecting rod cap is removed after being tightened to the specified torque with connecting rod bearings ① installed, the tip end of bearing must protrude ②. Refer to [EM-107, "Disassembly and Assembly"](#).

② : Example

Standard : There must be crush height.

- If the standard is not met, replace connecting rod bearings.



MAIN BEARING CAP BOLT OUTER DIAMETER

- Measure the outer diameters (d1) and (d2) at two positions as shown in the figure.

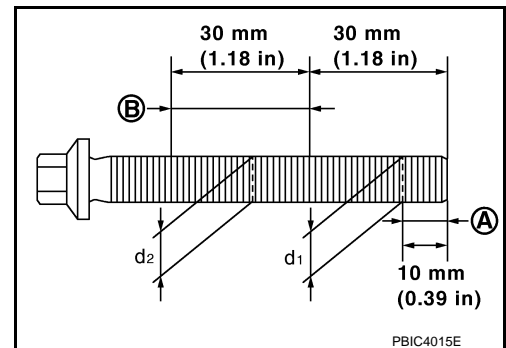
② : (d1) measuring position

③ : (d2) measuring position

- If reduction appears in places other than ③ range, regard it as (d2).

Limit [(d1) – (d2)]: 0.15 mm (0.0059 in)

- If it exceeds the limit (a large difference in dimensions), replace main bearing cap mounting bolt with a new one.



CONNECTING ROD CAP BOLT OUTER DIAMETER

CYLINDER BLOCK

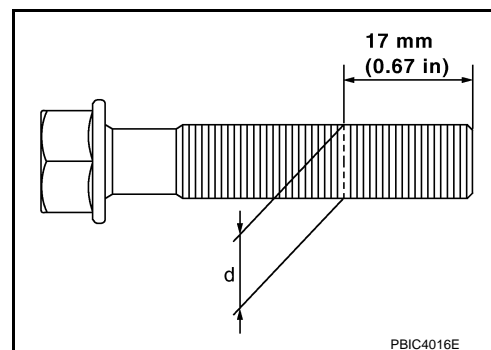
< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

- Measure the outer diameter (d) at position as shown in the figure.
- If reduction appears in a position other than (d), regard it as (d).

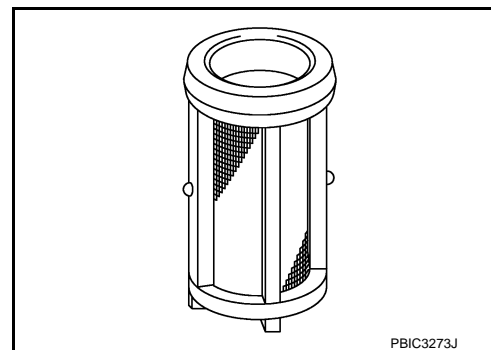
Limit: 7.75 mm (0.3051 in)

- When (d) exceeds the limit (when it becomes thinner), replace connecting rod cap bolt with a new one.



CLOGGED OR DAMAGED OIL FILTER (FOR VALVE TIMING CONTROL)

- Check that there is no foreign material on the oil filter and check it for clogging.
 - Clean it if necessary.
- Check the oil filter for damage.
 - Replace it if necessary.



HOW TO SELECT PISTON AND BEARING

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

HOW TO SELECT PISTON AND BEARING

Description

INFOID:0000000010783735

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 an assembly.)	Piston grade (piston outer diameter)	Piston grade = cylinder bore grade (inner diameter of bore)

- 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

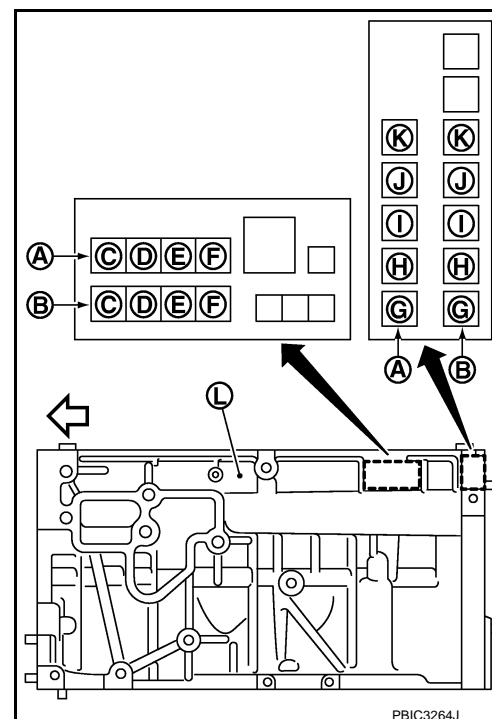
INFOID:0000000010783736

WHEN NEW CYLINDER BLOCK IS USED

- Check the cylinder bore grade on rear left side of cylinder block ①, and select piston of the same grade.

- ① : Correction stamp
 ② : Standard stamp
 ③ : Cylinder No. 1 bore grade
 ④ : Cylinder No. 2 bore grade
 ⑤ : Cylinder No. 3 bore grade
 ⑥ : Cylinder No. 4 bore grade
 ⑦ : No. 1 main bearing housing grade
 ⑧ : No. 2 main bearing housing grade
 ⑨ : No. 3 main bearing housing grade
 ⑩ : No. 4 main bearing housing grade
 ⑪ : No. 5 main bearing housing grade
 ⇐ : Engine front

- If there is a correction stamp mark on the cylinder block, use it as a correct reference.



WHEN CYLINDER BLOCK IS REUSED

1. Measure the cylinder bore inner diameter. Refer to [EM-137. "Cylinder Block"](#).
2. Determine the bore grade by comparing the measurement with the values under the cylinder bore inner diameter of the "Piston Selection Table".

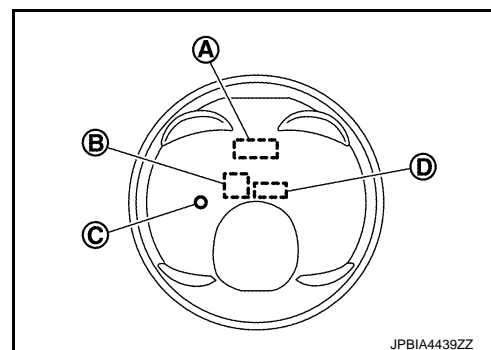
HOW TO SELECT PISTON AND BEARING

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

3. Select piston of the same grade.

- (A) : Identification code
- (B) : Piston grade number
- (C) : Front mark
- (D) : Sub grade number



PISTON SELECTION TABLE

Unit: mm (in)		
Grade number (Mark)	1	2 [or no mark (piston only)]
Cylinder bore Inner diameter	84.000 - 84.010 (3.3071 - 3.3075)	84.010 - 84.020 (3.3075 - 3.3079)
Piston skirt diameter	83.970 - 83.980 (3.3059 - 3.3063)	83.980 - 83.990 (3.3063 - 3.3067)

NOTE:

Piston is available together with piston pin as an assembly.

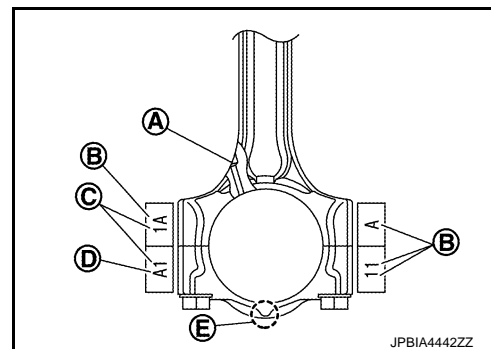
Connecting Rod Bearing

INFOID:0000000010783737

WHEN NEW CONNECTING ROD AND CRANKSHAFT ARE USED

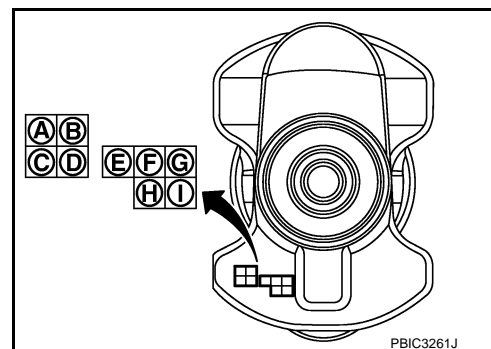
1. Apply connecting rod big end diameter grade stamped on connecting rod side face to the row in the "Connecting Rod Bearing Selection Table".

- (A) : Oil hole
- (B) : Management code
- (C) : Cylinder number
- (D) : Big end diameter grade
- (E) : Front mark



2. Apply crankshaft pin journal diameter grade stamped on crankshaft front side to the column in the "Connecting Rod Bearing Selection Table".

- (A) : No. 1 pin journal diameter grade
- (B) : No. 2 pin journal diameter grade
- (C) : No. 3 pin journal diameter grade
- (D) : No. 4 pin journal diameter grade
- (E) : No. 1 main journal diameter grade
- (F) : No. 2 main journal diameter grade
- (G) : No. 3 main journal diameter grade
- (H) : No. 4 main journal diameter grade
- (I) : No. 5 main journal diameter grade



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

HOW TO SELECT PISTON AND BEARING

[MR20DD]

< UNIT DISASSEMBLY AND ASSEMBLY >

1. Measure the dimensions of the connecting rod big end diameter and crankshaft pin journal diameter individually. Refer to [EM-115, "Inspection"](#).
2. Apply the measured dimension to the "Connecting Rod Bearing Selection Table".
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.

CONNECTING ROD BEARING SELECTION TABLE

<div>Connecting rod big end diameter Unit: mm (in)</div> <div>Crankshaft pin journal diameter Unit: mm (in)</div>		Mark																
		Hole diameter	A	B	C	D	E	F	G	H	J	K	L	M	N			
Mark	Axle diameter		47.000 - 47.001 (1.8504 - 1.8504)	47.001 - 47.002 (1.8504 - 1.8505)	47.002 - 47.003 (1.8505 - 1.8505)	47.003 - 47.004 (1.8505 - 1.8505)	47.004 - 47.005 (1.8505 - 1.8506)	47.005 - 47.006 (1.8506 - 1.8506)	47.006 - 47.007 (1.8506 - 1.8507)	47.007 - 47.008 (1.8507 - 1.8507)	47.008 - 47.009 (1.8507 - 1.8507)	47.009 - 47.010 (1.8507 - 1.8508)	47.010 - 47.011 (1.8508 - 1.8508)	47.011 - 47.012 (1.8508 - 1.8509)	47.012 - 47.013 (1.8509 - 1.8509)			
A	43.970 - 43.971 (1.7311 - 1.7311)	0	0	0	0	0	0	01	01	01	1	1	1	12	12			
B	43.969 - 43.970 (1.7311 - 1.7311)	0	0	0	0	0	01	01	01	1	1	1	1	12	12			
C	43.968 - 43.969 (1.7310 - 1.7311)	0	0	0	0	01	01	01	1	1	1	1	12	12	12			
D	43.967 - 43.968 (1.7310 - 1.7310)	0	0	0	0	01	01	01	1	1	1	12	12	12	2			
E	43.966 - 43.967 (1.7309 - 1.7310)	0	0	0	0	01	01	01	1	1	1	12	12	12	2			
F	43.965 - 43.966 (1.7309 - 1.7309)	0	0	0	0	01	01	01	1	1	1	12	12	12	2			
G	43.964 - 43.965 (1.7309 - 1.7309)	0	0	0	0	01	01	01	1	1	1	12	12	12	2			
H	43.963 - 43.964 (1.7308 - 1.7309)	0	0	0	0	01	01	01	1	1	1	12	12	12	2			
J	43.962 - 43.963 (1.7308 - 1.7308)	0	0	0	0	01	01	01	1	1	1	12	12	12	2			
K	43.961 - 43.962 (1.7307 - 1.7308)	0	0	0	0	01	01	01	1	1	1	12	12	12	2			
L	43.960 - 43.961 (1.7307 - 1.7307)	0	0	0	0	01	01	01	1	1	1	12	12	12	2			
M	43.959 - 43.960 (1.7307 - 1.7307)	0	0	0	0	01	01	01	1	1	1	12	12	12	2			
N	43.958 - 43.959 (1.7306 - 1.7307)	0	0	0	0	01	01	01	1	1	1	12	12	12	2			
P	43.957 - 43.958 (1.7306 - 1.7306)	0	0	0	0	01	01	01	1	1	1	12	12	12	2			
R	43.956 - 43.957 (1.7305 - 1.7306)	0	0	0	0	01	01	01	1	1	1	12	12	12	2			
S	43.955 - 43.956 (1.7305 - 1.7305)	0	0	0	0	01	01	01	1	1	1	12	12	12	2			
T	43.954 - 43.955 (1.7305 - 1.7305)	0	0	0	0	01	01	01	1	1	1	12	12	12	2			
U	43.953 - 43.954 (1.7304 - 1.7305)	0	0	0	0	01	01	01	1	1	1	12	12	12	2			

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CONNECTING ROD BEARING GRADE TABLE

Connecting rod bearing grade table : Refer to [EM-140, "Connecting Rod Bearing"](#).

UNDERSIZE BEARINGS USAGE GUIDE

- 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 the crankshaft pin so that the connecting rod bearing oil clearance satisfies the standard.

CAUTION:

HOW TO SELECT PISTON AND BEARING

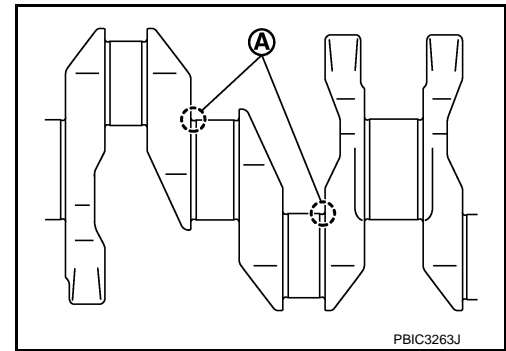
< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

In grinding crankshaft pin to use undersize bearings, keep the fillet R [1.5 - 1.7 mm (0.059 - 0.067 in)] (A).

Bearing undersize table

: Refer to [EM-140, "Connecting Rod Bearing"](#).



Main Bearing

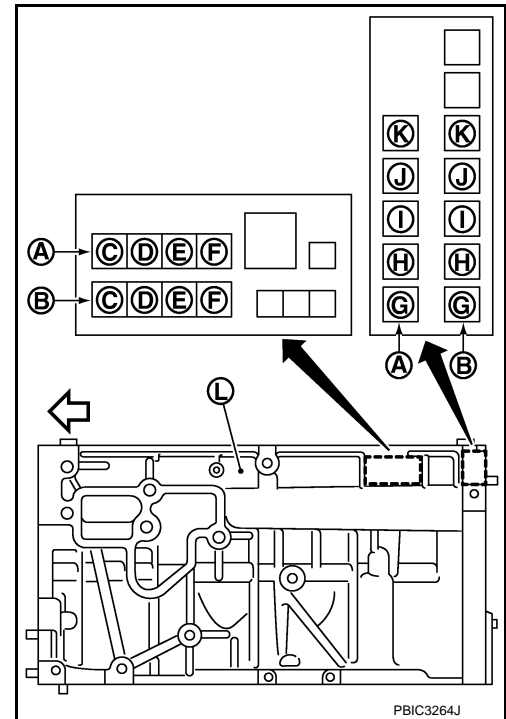
INFOID:000000010783738

WHEN NEW CYLINDER BLOCK AND CRANKSHAFT ARE USED

1. "Main Bearing Selection Table" rows correspond to main bearing housing grade on rear left side of cylinder block (L).

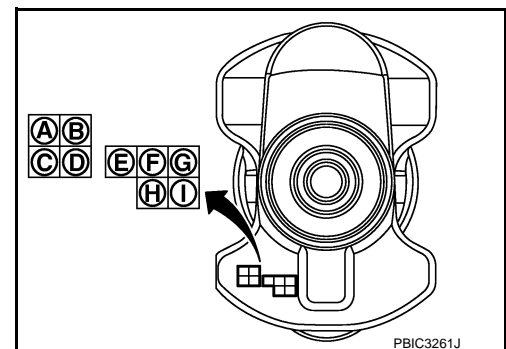
- (A) : Correction stamp
- (B) : Standard stamp
- (C) : Cylinder No. 1 bore grade
- (D) : Cylinder No. 2 bore grade
- (E) : Cylinder No. 3 bore grade
- (F) : Cylinder No. 4 bore grade
- (G) : No. 1 main bearing housing grade
- (H) : No. 2 main bearing housing grade
- (I) : No. 3 main bearing bearing housing grade
- (J) : No. 4 main bearing housing grade
- (K) : No. 5 main bearing housing grade
- ← : Engine front

- If there is a correction stamp mark on cylinder block, use it as a correct reference.



2. Apply main journal diameter grade stamped on crankshaft front side to column in the "Main Bearing Selection Table".

- (A) : No. 1 pin journal diameter grade
- (B) : No. 2 pin journal diameter grade
- (C) : No. 3 pin journal diameter grade
- (D) : No. 4 pin journal diameter grade
- (E) : No. 1 main journal diameter grade
- (F) : No. 2 main journal diameter grade
- (G) : No. 3 main journal diameter grade
- (H) : No. 4 main journal diameter grade
- (I) : No. 5 main journal diameter grade



3. Read the symbol at the cross point of selected row and column in the "Main Bearing Selection Table".

CAUTION:

HOW TO SELECT PISTON AND BEARING

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

There are two main bearing selection tables. One is for No. 1 and 4 journals and the other is for No. 2, 3 and 5 journals. Make certain to use the appropriate table. This is due to differences in the specified clearances.

4. Apply the symbol obtained to the "Main Bearing Grade Table" to select main bearing.

NOTE:

Service part is available as a set of both upper and lower.

WHEN CYLINDER BLOCK AND CRANKSHAFT ARE REUSED

1. Measure the dimensions of the cylinder block main bearing housing inner diameter and crankshaft main journal diameter individually. Refer to [EM-115, "Inspection"](#).
2. Apply the measured dimension to the "Main Bearing Selection Table".
3. Read the symbol at the cross point of selected row and column in the "Main Bearing Selection Table".

CAUTION:

There are two main bearing selection tables. One is for No. 1 and 4 journals and the other is for No. 2, 3 and 5 journals. Make certain to use the appropriate table. This is due to differences in the specified clearances.

4. Apply the symbol obtained to the "Main Bearing Grade Table" to select main bearing.

NOTE:

Service part is available as a set of both upper and lower.

HOW TO SELECT PISTON AND BEARING

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

MAIN BEARING SELECTION TABLE (No. 1 AND 4 JOURNAL)

Cylinder block main bearing housing inner diameter Unit: mm (in)		Mark	Hole diameter																															
			A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V	W												
Crankshaft main journal diameter Unit: mm (in)	Mark	Axle diameter	Hole diameter																															
			A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V	W												
A	51.978 - 51.979 (2.0464 - 2.0464)	0	0	0	0	0	0	0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	23	23	23	23	23	23	23	23	23	23
B	51.977 - 51.978 (2.0463 - 2.0464)	0	0	0	0	0	0	0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	23	23	23	23	23	23	23	23	23	23
C	51.976 - 51.977 (2.0463 - 2.0463)	0	0	0	0	0	0	01	01	01	1	1	1	1	12	12	12	2	2	2	23	23	23	23	23	23	23	23	23	23	23	23	23	23
D	51.975 - 51.976 (2.0463 - 2.0463)	0	0	0	0	0	01	01	01	1	1	1	1	12	12	12	2	2	2	2	23	23	23	23	23	23	23	23	23	23	23	23	23	23
E	51.974 - 51.975 (2.0462 - 2.0463)	0	0	0	0	01	01	01	1	1	1	1	12	12	12	2	2	2	2	2	23	23	23	23	23	23	23	23	23	23	23	23	23	23
F	51.973 - 51.974 (2.0462 - 2.0462)	0	0	0	0	01	01	01	1	1	1	1	12	12	12	2	2	2	2	2	23	23	23	23	23	23	23	23	23	23	23	23	23	23
G	51.972 - 51.973 (2.0461 - 2.0462)	0	0	0	0	01	01	01	1	1	1	1	12	12	12	2	2	2	2	2	23	23	23	23	23	23	23	23	23	23	23	23	23	23
H	51.971 - 51.972 (2.0461 - 2.0461)	0	0	0	0	01	01	01	1	1	1	1	12	12	12	2	2	2	2	2	23	23	23	23	23	23	23	23	23	23	23	23	23	23
J	51.970 - 51.971 (2.0461 - 2.0461)	0	0	0	0	01	01	01	1	1	1	1	12	12	12	2	2	2	2	2	23	23	23	23	23	23	23	23	23	23	23	23	23	23
K	51.969 - 51.970 (2.0460 - 2.0461)	0	0	0	0	01	01	01	1	1	1	1	12	12	12	2	2	2	2	2	23	23	23	23	23	23	23	23	23	23	23	23	23	23
L	51.968 - 51.969 (2.0460 - 2.0460)	0	0	0	0	01	01	01	1	1	1	1	12	12	12	2	2	2	2	2	23	23	23	23	23	23	23	23	23	23	23	23	23	23
M	51.967 - 51.968 (2.0459 - 2.0460)	0	0	0	0	01	01	01	1	1	1	1	12	12	12	2	2	2	2	2	23	23	23	23	23	23	23	23	23	23	23	23	23	23
N	51.966 - 51.967 (2.0459 - 2.0459)	0	0	0	0	01	01	01	1	1	1	1	12	12	12	2	2	2	2	2	23	23	23	23	23	23	23	23	23	23	23	23	23	23
P	51.965 - 51.966 (2.0459 - 2.0459)	0	0	0	0	01	01	01	1	1	1	1	12	12	12	2	2	2	2	2	23	23	23	23	23	23	23	23	23	23	23	23	23	23
R	51.964 - 51.965 (2.0458 - 2.0459)	0	0	0	0	01	01	01	1	1	1	1	12	12	12	2	2	2	2	2	23	23	23	23	23	23	23	23	23	23	23	23	23	23
S	51.963 - 51.964 (2.0458 - 2.0458)	0	0	0	0	01	01	01	1	1	1	1	12	12	12	2	2	2	2	2	23	23	23	23	23	23	23	23	23	23	23	23	23	23
T	51.962 - 51.963 (2.0457 - 2.0458)	0	0	0	0	01	01	01	1	1	1	1	12	12	12	2	2	2	2	2	23	23	23	23	23	23	23	23	23	23	23	23	23	23
U	51.961 - 51.962 (2.0457 - 2.0457)	0	0	0	0	01	01	01	1	1	1	1	12	12	12	2	2	2	2	2	23	23	23	23	23	23	23	23	23	23	23	23	23	23
V	51.960 - 51.961 (2.0457 - 2.0457)	0	0	0	0	01	01	01	1	1	1	1	12	12	12	2	2	2	2	2	23	23	23	23	23	23	23	23	23	23	23	23	23	23
W	51.959 - 51.960 (2.0456 - 2.0457)	0	0	0	0	01	01	01	1	1	1	1	12	12	12	2	2	2	2	2	23	23	23	23	23	23	23	23	23	23	23	23	23	23

PBIC4078E

HOW TO SELECT PISTON AND BEARING

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

MAIN BEARING SELECTION TABLE (No. 2, 3 AND 5 JOURNAL)

<div>Cylinder block main bearing housing inner diameter Unit: mm (in)</div> <div>Crankshaft main journal diameter Unit: mm (in)</div>		Mark																													
		Hole diameter																													
Mark	Axle diameter	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V	W										
A	51.978 - 51.979 (2.0464 - 2.0464)	55.997 - 55.998 (2.2046 - 2.2046)	55.998 - 55.999 (2.2046 - 2.2047)	55.999 - 56.000 (2.2047 - 2.2047)	56.000 - 56.001 (2.2047 - 2.2048)	56.001 - 56.002 (2.2048 - 2.2048)	56.002 - 56.003 (2.2048 - 2.2048)	56.003 - 56.004 (2.2048 - 2.2049)	56.004 - 56.005 (2.2049 - 2.2049)	56.005 - 56.006 (2.2049 - 2.2050)	56.006 - 56.007 (2.2050 - 2.2050)	56.007 - 56.008 (2.2050 - 2.2050)	56.008 - 56.009 (2.2050 - 2.2051)	56.009 - 56.010 (2.2051 - 2.2051)	56.010 - 56.011 (2.2051 - 2.2052)	56.011 - 56.012 (2.2052 - 2.2052)	56.012 - 56.013 (2.2052 - 2.2052)	56.013 - 56.014 (2.2052 - 2.2053)	56.014 - 56.015 (2.2053 - 2.2053)	56.015 - 56.016 (2.2053 - 2.2053)	56.016 - 56.017 (2.2053 - 2.2054)										
B	51.977 - 51.978 (2.0463 - 2.0464)	1 12 12 12 2 2 2 2 23 23 23 3 3 3 3 34 34 34 4 4 4 4 45 45 45 5 5 5 5 56 56 56 6 6 6 6 67 67 67 7 7 7 7 78 78 78 8 8 8 8 89 89 89 9 9 9 9 90 90 90 10 10 10 10 101 101 101 11 11 11 11 112 112 112 12 12 12 12 123 123 123 13 13 13 13 134 134 134 14 14 14 14 145 145 145 15 15 15 15 156 156 156 16 16 16 16 167 167 167 17 17 17 17 178 178 178 18 18 18 18 189 189 189 19 19 19 19 190 190 190 20 20 20 20 201 201 201 21 21 21 21 212 212 212 22 22 22 22 223 223 223 23 23 23 23 234 234 234 24 24 24 24 245 245 245 25 25 25 25 256 256 256 26 26 26 26 267 267 267 27 27 27 27 278 278 278 28 28 28 28 289 289 289 29 29 29 29 290 290 290 30 30 30 30 301 301 301 31 31 31 31 312 312 312 32 32 32 32 323 323 323 33 33 33 33 334 334 334 34 34 34 34 345 345 345 35 35 35 35 356 356 356 36 36 36 36 367 367 367 37 37 37 37 378 378 378 38 38 38 38 389 389 389 39 39 39 39 390 390 390 40 40 40 40 401 401 401 41 41 41 41 412 412 412 42 42 42 42 423 423 423 43 43 43 43 434 434 434 44 44 44 44 445 445 445 45 45 45 45 456 456 456 46 46 46 46 467 467 467 47 47 47 47 478 478 478 48 48 48 48 489 489 489 49 49 49 49 490 490 490 50 50 50 50 501 501 501 51 51 51 51 512 512 512 52 52 52 52 523 523 523 53 53 53 53 534 534 534 54 54 54 54 545 545 545 55 55 55 55 556 556 556 56 56 56 56 567 567 567 57 57 57 57 578 578 578 58 58 58 58 589 589 589 59 59 59 59 590 590 590 60 60 60 60 601 601 601 61 61 61 61 612 612 612 62 62 62 62 623 623 623 63 63 63 63 634 634 634 64 64 64 64 645 645 645 65 65 65 65 656 656 656 66 66 66 66 667 667 667 67 67 67 67 678 678 678 68 68 68 68 689 689 689 69 69 69 69 690 690 690 70 70 70 70 701 701 701 71 71 71 71 712 712 712 72 72 72 72 723 723 723 73 73 73 73 734 734 734 74 74 74 74 745 745 745 75 75 75 75 756 756 756 76 76 76 76 767 767 767 77 77 77 77 778 778 778 78 78 78 78 789 789 789 79 79 79 79 790 790 790 80 80 80 80 801 801 801 81 81 81 81 812 812 812 82 82 82 82 823 823 823 83 83 83 83 834 834 834 84 84 84 84 845 845 845 85 85 85 85 856 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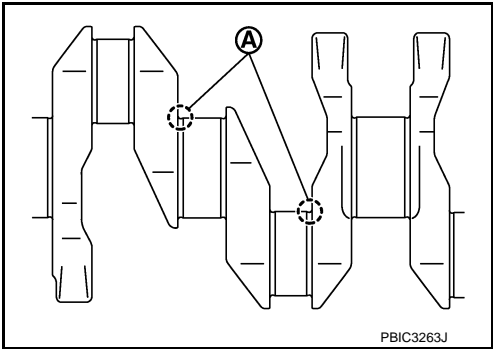
HOW TO SELECT PISTON AND BEARING

< UNIT DISASSEMBLY AND ASSEMBLY >

[MR20DD]

In grinding crankshaft main journal to use undersize bearings, keep the fillet R [1.5 - 1.7 mm (0.059 - 0.067 in)] (A).

Bearing undersize table:
Refer to [EM-141, "Main Bearing"](#).



A
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SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[MR20DD]

SERVICE DATA AND SPECIFICATIONS (SDS)

SERVICE DATA AND SPECIFICATIONS (SDS)

General Specification

INFOID:0000000010783739

GENERAL SPECIFICATIONS

Engine type		MR20DD
Cylinder arrangement		In-line 4
Displacement cm ³ (cu in)		1,997 (121.86)
Bore and stroke mm (in)		84.0×90.1 (3.307×3.547)
Valve arrangement		DOHC
Firing order		1-3-4-2
Number of piston rings	Compression	2
	Oil	1
Compression ratio		11.2
Compression pressure kPa (bar, kg/cm ² , psi)/250 rpm	Standard	1,530 (15.3, 15.6, 222)
	Minimum	1,280 (12.8, 13.1, 186)
	Differential limit between cylinders	100 (1.0, 1.0, 15)

Unit: degree

Valve timing ↶: Intake valve ↷: Exhaust valve	VTC Minimum phasing (Mechanical)			VTC Maximum phasing (Mechanical)		
	a	b	c	d	e	f
	EXH valve opening angle	INT valve opening angle	INT open	INT close	EXH close	EXH open
VTC Minimum phasing (Mechanical)	220	240	18	78	0	40
VTC Maximum phasing (Mechanical)			24	36	57	17

Drive Belt

INFOID:0000000010783740

DRIVE BELT

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

INFOID:0000000010783741

SPARK PLUG

SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[MR20DD]

Unit: mm (in)

Make	NGK	
Standard type	DILKAR7D11H	
Gap (Nominal)	Standard	1.1 (0.043)
	Limit	1.3 (0.051)

Exhaust Manifold

INFOID:0000000010783742

EXHAUST MANIFOLD

Unit: mm (in)

Items		Limit
Surface distortion	Each exhaust port	0.3 (0.012)
	Entire part	0.7 (0.028)

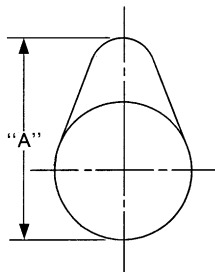
Camshaft

INFOID:0000000010783743

CAMSHAFT

Unit: mm (in)

Items		Standard	Limit
Camshaft journal oil clearance	No. 1	0.045 - 0.086 (0.0018 - 0.0034)	0.15 (0.0059)
	No. 2, 3, 4, 5	0.030 - 0.071 (0.0012 - 0.0028)	
Camshaft bracket inner diameter	No. 1	28.000 - 28.021 (1.1024 - 1.1032)	—
	No. 2, 3, 4, 5	25.000 - 25.021 (0.9843 - 0.9851)	—
Camshaft journal diameter	No. 1	27.935 - 27.955 (1.0998 - 1.1006)	—
	No. 2, 3, 4, 5	24.950 - 24.970 (0.9823 - 0.9831)	—
Camshaft end play		0.075 - 0.153 (0.0030 - 0.0060)	0.24 (0.0094)
Camshaft cam height "A"	Intake	45.265 - 45.455 (1.7821 - 1.7896)	45.085 (1.7750)
	Exhaust	43.775 - 43.965 (1.7234 - 1.7309)	43.575 (1.7156)
Camshaft runout [TIR*]		Less than 0.02 (0.0008)	0.05 (0.0020)
Camshaft sprocket runout [TIR*]		—	0.15 (0.0059)



SEM671

*: Total indicator reading

VALVE LIFTER

Unit: mm (in)

Items		Standard
Valve lifter outer diameter	Intake	33.977 - 33.987 (1.3377 - 1.3381)
	Exhaust	29.977 - 29.987 (1.1802 - 1.1806)

SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[MR20DD]

Valve lifter hole diameter	Intake	34.000 - 34.021 (1.3386 - 1.3394)
	Exhaust	30.000 - 30.021 (1.1811 - 1.1819)
Valve lifter clearance		0.013 - 0.044 (0.0005 - 0.0017)

VALVE CLEARANCE

Unit: mm (in)

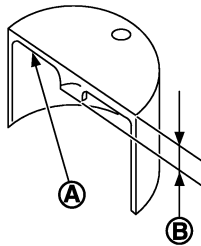
Items	Cold	Hot* (reference data)
Intake	0.24 - 0.32 (0.009 - 0.013)	0.304 - 0.416 (0.012 - 0.016)
Exhaust	0.26 - 0.34 (0.010 - 0.013)	0.308 - 0.432 (0.012 - 0.017)

*: Approximately 80°C (176°F)

AVAILABLE VALVE LIFTER

Unit: mm (in)

Identification mark ①	Thickness ②
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JPBIA0170ZZ

300H	3.00 (0.1181)
302H	3.02 (0.1189)
304H	3.04 (0.1197)
306H	3.06 (0.1205)
308H	3.08 (0.1213)
310H	3.10 (0.1220)
312H	3.12 (0.1228)
314H	3.14 (0.1236)
316H	3.16 (0.1244)
318H	3.18 (0.1252)
320H	3.20 (0.1260)
322H	3.22 (0.1268)
324H	3.24 (0.1276)
326H	3.26 (0.1283)
328H	3.28 (0.1291)
330H	3.30 (0.1299)
332H	3.32 (0.1307)
334H	3.34 (0.1315)
336H	3.36 (0.1323)
338H	3.38 (0.1331)
340H	3.40 (0.1339)
342H	3.42 (0.1346)
344H	3.44 (0.1354)

SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[MR20DD]

Identification mark (A)	Thickness (B)
346H	3.46 (0.1362)
348H	3.48 (0.1370)
350H	3.50 (0.1378)

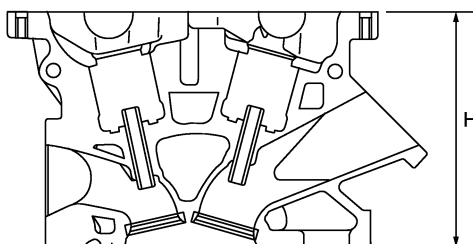
Cylinder Head

INFOID:0000000010783744

CYLINDER HEAD

Unit: mm (in)

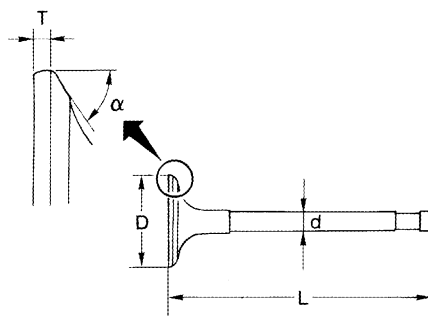
Items	Standard	Limit
Head surface distortion	—	0.1 (0.004)
Normal cylinder head height "H"	130.9 (5.15)	—



PBIC0924E

VALVE DIMENSIONS

Unit: mm (in)



JSBIA1166ZZ

Valve head diameter "D"	Intake	33.8 - 34.1 (1.331 - 1.343)
	Exhaust	27.6 - 27.9 (1.087 - 1.098)
Valve length "L"	Intake	106.42 (4.19)
	Exhaust	105.41 (4.15)
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 "α"		45°15' - 45°45'
Valve margin "T"	Intake	1.2 (0.047)
	Exhaust	1.4 (0.055)

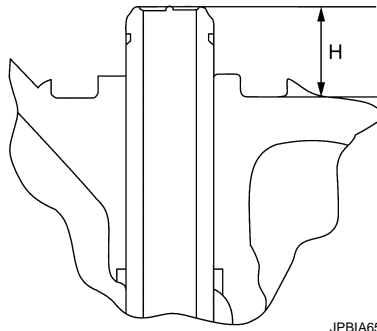
VALVE GUIDE

SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[MR20DD]

Unit: mm (in)

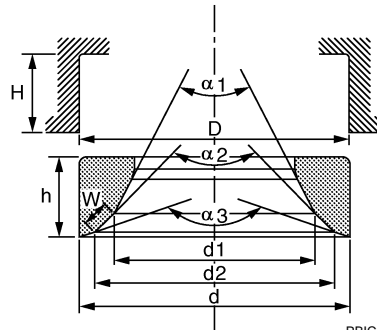


JPBIA6515ZZ

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)	9.675 - 9.696 (0.3809 - 0.3817)
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)	0.1 (0.004)
	Exhaust	0.030 - 0.063 (0.0012 - 0.0025)	
Projection length “H”		13.35 - 13.65 (0.5256 - 0.5374)	

VALVE SEAT

Unit: mm (in)



PBIC2745E

Items		Standard	Oversize (service) [0.5 (0.02)]
Cylinder head seat recess diameter "D"	Intake	34.700 - 34.727 (1.3661 - 1.3672)	35.200 - 35.227 (1.3858 - 1.3869)
	Exhaust	28.700 - 28.727 (1.1299 - 1.1310)	29.200 - 29.227 (1.1496 - 1.1507)
Valve seat outer diameter "d"	Intake	34.808 - 34.824 (1.3704 - 1.3710)	35.308 - 35.324 (1.3901 - 1.3907)
	Exhaust	28.808 - 28.824 (1.1342 - 1.1348)	29.308 - 29.324 (1.1539 - 1.1545)
Valve seat interference fit		0.081 - 0.124 (0.0032 - 0.0049)	
Diameter "d1"*1	Intake	31.8 (1.252)	
	Exhaust	25.3 (0.996)	
Diameter "d2"*2	Intake	33.1 - 33.6 (1.303 - 1.323)	
	Exhaust	26.9 - 27.4 (1.059 - 1.079)	
Angle "α1"	Intake	70°	
	Exhaust	45°	
Angle "α2"		88°45' - 90°15'	
Angle "α3"		120°	

SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[MR20DD]

Contacting width "W"*3	Intake	1.0 - 1.4 (0.039 - 0.055)	
	Exhaust	1.2 - 1.6 (0.047 - 0.063)	
Height "h"	Intake	5.9 - 6.0 (0.232 - 0.236)	5.03 - 5.13 (0.1980 - 0.2020)
	Exhaust		4.95 - 5.05 (0.1949 - 0.1988)
Depth "H"	Intake	6.04 (0.2378)	
	Exhaust	6.05 (0.2382)	

*1: Diameter made by intersection point of conic angles "α1" and "α2"

*2: Diameter made by intersection point of conic angles "α2" and "α3"

*3: Machining data

VALVE SPRING

Items	Standard	
	Intake	Exhaust
Free height	49.4 - 49.6 mm (1.945 - 1.953 in)	54.5 - 54.7 mm (2.146 - 2.154 in)
Installation height	38.46 mm (1.514 in)	38.46 mm (1.514 in)
Installation load	151 - 175 N (15.4 - 17.9 kg, 34 - 39 lb)	257 - 289 N (26.2 - 29.5 kg, 57.8 - 65.0 lb)
Height during valve open	28.86 mm (1.1362 in)	30.03 mm (1.1823 in)
Load with valve open	344 - 392 N (35.0 - 40.0 kg, 77.3 - 88.1 lb)	450 - 502 N (45.9 - 51.2 kg, 101.2 - 112.9 lb)
Identification color	White	Yellow green

Unit: mm (in)

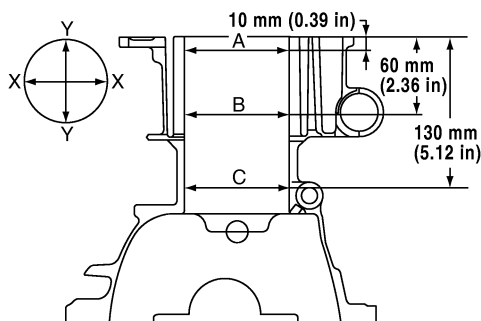
Items	Limit
Valve spring squareness	1.0 (0.039)

Cylinder Block

INFOID:0000000010783745

CYLINDER BLOCK

Unit: mm (in)



PBIC4017E

Cylinder block top surface distortion	Limit	0.1 (0.004)	
Cylinder bore inner diameter	Standard	Grade No. 1	84.000 - 84.010 (3.3071 - 3.3075)
		Grade No. 2	84.010 - 84.020 (3.3075 - 3.3079)

SERVICE DATA AND SPECIFICATIONS (SDS)

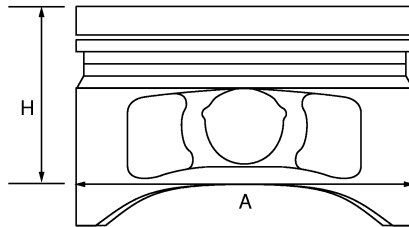
< SERVICE DATA AND SPECIFICATIONS (SDS)

[MR20DD]

Out-of-round	Limit	0.015 (0.0006)
Taper		0.010 (0.0004)
Main bearing housing inner diameter grade	Grade No. A	55.997 - 55.998 (2.2046 - 2.2046)
	Grade No. B	55.998 - 55.999 (2.2046 - 2.2047)
	Grade No. C	55.999 - 56.000 (2.2047 - 2.2047)
	Grade No. D	56.000 - 56.001 (2.2047 - 2.2048)
	Grade No. E	56.001 - 56.002 (2.2048 - 2.2048)
	Grade No. F	56.002 - 56.003 (2.2048 - 2.2048)
	Grade No. G	56.003 - 56.004 (2.2048 - 2.2049)
	Grade No. H	56.004 - 56.005 (2.2049 - 2.2049)
	Grade No. J	56.005 - 56.006 (2.2049 - 2.2050)
	Grade No. K	56.006 - 56.007 (2.2050 - 2.2050)
	Grade No. L	56.007 - 56.008 (2.2050 - 2.2050)
	Grade No. M	56.008 - 56.009 (2.2050 - 2.2051)
	Grade No. N	56.009 - 56.010 (2.2051 - 2.2051)
	Grade No. P	56.010 - 56.011 (2.2051 - 2.2052)
	Grade No. R	56.011 - 56.012 (2.2052 - 2.2052)
	Grade No. S	56.012 - 56.013 (2.2052 - 2.2052)
	Grade No. T	56.013 - 56.014 (2.2052 - 2.2053)
	Grade No. U	56.014 - 56.015 (2.2053 - 2.2053)
	Grade No. V	56.015 - 56.016 (2.2053 - 2.2053)
	Grade No. W	56.016 - 56.017 (2.2053 - 2.2054)

AVAILABLE PISTON

Unit: mm (in)



PBIC0188E

Piston skirt diameter “A”	Standard	Grade No. 1	83.970 - 83.980 (3.3059 - 3.3063)
		Grade No. 2	83.980 - 83.990 (3.3063 - 3.3067)
Measure point “H”			39.2 (1.543)
Piston pin hole diameter			19.993 - 19.999 (0.7871 - 0.7874)
Piston to cylinder bore clearance	Standard		0.020 - 0.040 (0.0008 - 0.0016)
	Limit		0.08 (0.0031)

PISTON RING

Unit: mm (in)

Items		Standard	Limit
Piston ring side clearance	Top	0.04 - 0.08 (0.0016 - 0.0031)	0.11 (0.0043)
	2nd	0.03 - 0.07 (0.0012 - 0.0028)	0.10 (0.0039)
	Oil ring	0.055 - 0.155 (0.0022 - 0.0061)	—
Piston ring end gap	Top	0.20 - 0.30 (0.0079 - 0.0118)	0.49 (0.0193)
	2nd	0.50 - 0.65 (0.0197 - 0.0256)	0.81 (0.0319)
	Oil (rail ring)	0.15 - 0.45 (0.0059 - 0.0177)	0.76 (0.0299)

PISTON PIN

SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[MR20DD]

Unit: mm (in)

Items	Standard	Limit
Piston pin outer diameter	19.989 - 19.995 (0.7870 - 0.7872)	—
Piston to piston pin oil clearance	0.002 - 0.006 (0.0001 - 0.0002)	—

CONNECTING ROD

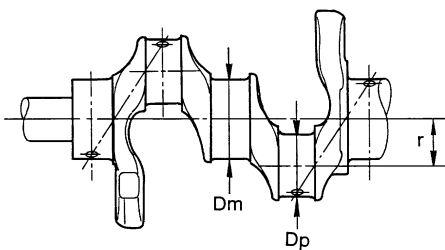
Unit: mm (in)

Center distance		138.97 - 139.07 (5.47 - 5.48)
Bend [per 100 (3.94)]	Limit	0.15 (0.0059)
Torsion [per 100 (3.94)]	Limit	0.30 (0.0118)
Connecting rod bushing inner diameter*	Standard	20.000 - 20.012 (0.7874 - 0.7879)
Connecting rod bushing oil clearance	Standard	0.005 - 0.023 (0.0002 - 0.0009)
	Limit	0.03 (0.0012)
Connecting rod side clearance	Standard	0.20 - 0.35 (0.0079 - 0.0138)
	Limit	0.4 (0.016)
Connecting rod big end diameter grade	Grade No. A	47.000 - 47.001 (1.8504 - 1.8504)
	Grade No. B	47.001 - 47.002 (1.8504 - 1.8505)
	Grade No. C	47.002 - 47.003 (1.8505 - 1.8505)
	Grade No. D	47.003 - 47.004 (1.8505 - 1.8505)
	Grade No. E	47.004 - 47.005 (1.8505 - 1.8506)
	Grade No. F	47.005 - 47.006 (1.8506 - 1.8506)
	Grade No. G	47.006 - 47.007 (1.8506 - 1.8507)
	Grade No. H	47.007 - 47.008 (1.8507 - 1.8507)
	Grade No. J	47.008 - 47.009 (1.8507 - 1.8507)
	Grade No. K	47.009 - 47.010 (1.8507 - 1.8508)
	Grade No. L	47.010 - 47.011 (1.8508 - 1.8508)
	Grade No. M	47.011 - 47.012 (1.8508 - 1.8509)
	Grade No. N	47.012 - 47.013 (1.8509 - 1.8509)

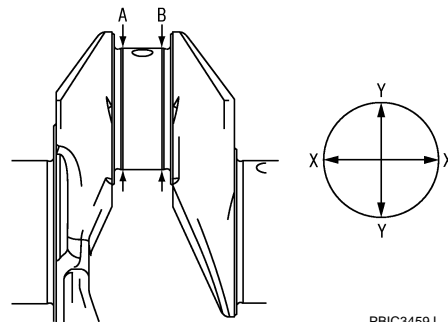
*: After installing in connecting rod

CRANKSHAFT

Unit: mm (in)



SEM645



PBIC3459J

Center distance "r"		44.89 - 44.97 (1.7673 - 1.7705)
Out-of-round	Limit	0.0035 (0.0001)
Taper	Limit	
Runout [TIR*]	Standard	0.05 (0.0020)
	Limit	0.1 (0.004)
Crankshaft end play	Standard	0.10 - 0.26 (0.0039 - 0.0102)
	Limit	0.3 (0.012)

SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[MR20DD]

Crankshaft pin journal diameter "Dp" grade.	Grade No. A	43.970 - 43.971 (1.7311 - 1.7311)
	Grade No. B	43.969 - 43.970 (1.7311 - 1.7311)
	Grade No. C	43.968 - 43.969 (1.7310 - 1.7311)
	Grade No. D	43.967 - 43.968 (1.7310 - 1.7310)
	Grade No. E	43.966 - 43.967 (1.7309 - 1.7310)
	Grade No. F	43.965 - 43.966 (1.7309 - 1.7309)
	Grade No. G	43.964 - 43.965 (1.7309 - 1.7309)
	Grade No. H	43.963 - 43.964 (1.7308 - 1.7309)
	Grade No. J	43.962 - 43.963 (1.7308 - 1.7308)
	Grade No. K	43.961 - 43.962 (1.7307 - 1.7308)
	Grade No. L	43.960 - 43.961 (1.7307 - 1.7307)
	Grade No. M	43.959 - 43.960 (1.7307 - 1.7307)
	Grade No. N	43.958 - 43.959 (1.7306 - 1.7307)
	Grade No. P	43.957 - 43.958 (1.7306 - 1.7306)
	Grade No. R	43.956 - 43.957 (1.7305 - 1.7306)
	Grade No. S	43.955 - 43.956 (1.7305 - 1.7305)
	Grade No. T	43.954 - 43.955 (1.7305 - 1.7305)
	Grade No. U	43.953 - 43.954 (1.7304 - 1.7305)
Crankshaft main journal diameter "Dm" grade.	Grade No. A	51.978 - 51.979 (2.0464 - 2.0464)
	Grade No. B	51.977 - 51.978 (2.0463 - 2.0464)
	Grade No. C	51.976 - 51.977 (2.0463 - 2.0463)
	Grade No. D	51.975 - 51.976 (2.0463 - 2.0463)
	Grade No. E	51.974 - 51.975 (2.0462 - 2.0463)
	Grade No. F	51.973 - 51.974 (2.0462 - 2.0462)
	Grade No. G	51.972 - 51.973 (2.0461 - 2.0462)
	Grade No. H	51.971 - 51.972 (2.0461 - 2.0461)
	Grade No. J	51.970 - 51.971 (2.0461 - 2.0461)
	Grade No. K	51.969 - 51.970 (2.0460 - 2.0461)
	Grade No. L	51.968 - 51.969 (2.0460 - 2.0460)
	Grade No. M	51.967 - 51.968 (2.0459 - 2.0460)
	Grade No. N	51.966 - 51.967 (2.0459 - 2.0459)
	Grade No. P	51.965 - 51.966 (2.0459 - 2.0459)
	Grade No. R	51.964 - 51.965 (2.0458 - 2.0459)
	Grade No. S	51.963 - 51.964 (2.0458 - 2.0458)
	Grade No. T	51.962 - 51.963 (2.0457 - 2.0458)
	Grade No. U	51.961 - 51.962 (2.0457 - 2.0457)
	Grade No. V	51.960 - 51.961 (2.0457 - 2.0457)
	Grade No. W	51.959 - 51.960 (2.0456 - 2.0457)

*: Total indicator reading

Connecting Rod Bearing

INFOID:0000000010783746

CONNECTING ROD BEARING GRADE TABLE

Unit: mm (in)

Grade number		Thickness	Identification color	Remarks
0		1.494 - 1.497 (0.0588 - 0.0589)	Black - Black	Grade and color are the same for upper and lower bearings.
		1.497 - 1.500 (0.0589 - 0.0591)	Brown - Brown	
		1.500 - 1.503 (0.0591 - 0.0592)	Green - Green	
		1.503 - 1.506 (0.0592 - 0.0593)	Yellow - Yellow	
		1.506 - 1.509 (0.0593 - 0.0594)	Blue - Blue	
01	UPR	1.494 - 1.497 (0.0588 - 0.0589)	Black - Black	Grade and color are different between upper and lower bearings.
	LWR	1.497 - 1.500 (0.0589 - 0.0591)	Brown - Brown	
12	UPR	1.497 - 1.500 (0.0589 - 0.0591)	Brown - Brown	
	LWR	1.500 - 1.503 (0.0591 - 0.0592)	Green - Green	
23	UPR	1.500 - 1.503 (0.0591 - 0.0592)	Green - Green	
	LWR	1.503 - 1.506 (0.0592 - 0.0593)	Yellow - Yellow	
34	UPR	1.503 - 1.506 (0.0592 - 0.0593)	Yellow - Yellow	
	LWR	1.506 - 1.509 (0.0593 - 0.0594)	Blue - Blue	

SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[MR20DD]

UNDERSIZE TABLE

Unit: mm (in)

Items	Thickness	Crank pin journal diameter
US 0.25 (0.0098)	1.623 - 1.631 (0.0639 - 0.0642)	Grind so that bearing clearance is the specified value.

CONNECTING ROD BEARING OIL CLEARANCE

Unit: mm (in)

Connecting rod bearing oil clearance	Standard	0.037 - 0.047 (0.0015 - 0.0019)
	Limit	0.07 (0.0028)

Main Bearing

INFOID:0000000010783747

MAIN BEARING GRADE TABLE (ALL JOURNALS)

Unit: mm (in)

Grade number		Thickness	Identification color	Remarks
0		1.996 - 1.999 (0.0786 - 0.0787)	Black - Black	Grade and color are the same for upper and lower bearings.
1		1.999 - 2.002 (0.0787 - 0.0788)	Brown - Brown	
2		2.002 - 2.005 (0.0788 - 0.0789)	Green - Green	
3		2.005 - 2.008 (0.0789 - 0.0791)	Yellow - Yellow	
4		2.008 - 2.011 (0.0791 - 0.0792)	Blue - Blue	
5		2.011 - 2.014 (0.0792 - 0.0793)	Pink - Pink	
6		2.014 - 2.017 (0.0793 - 0.0794)	Purple - Purple	
7		2.017 - 2.020 (0.0794 - 0.0795)	White - White	
01	UPR	1.996 - 1.999 (0.0786 - 0.0787)	Black - Black	Grade and color are different between upper and lower bearings.
	LWR	1.999 - 2.002 (0.0787 - 0.0788)	Brown - Brown	
12	UPR	1.999 - 2.002 (0.0787 - 0.0788)	Brown - Brown	
	LWR	2.002 - 2.005 (0.0788 - 0.0789)	Green - Green	
23	UPR	2.002 - 2.005 (0.0788 - 0.0789)	Green - Green	
	LWR	2.005 - 2.008 (0.0789 - 0.0791)	Yellow - Yellow	
34	UPR	2.005 - 2.008 (0.0789 - 0.0791)	Yellow - Yellow	
	LWR	2.008 - 2.011 (0.0791 - 0.0792)	Blue - Blue	
45	UPR	2.008 - 2.011 (0.0791 - 0.0792)	Blue - Blue	
	LWR	2.011 - 2.014 (0.0792 - 0.0793)	Pink - Pink	
56	UPR	2.011 - 2.014 (0.0792 - 0.0793)	Pink - Pink	
	LWR	2.014 - 2.017 (0.0793 - 0.0794)	Purple - Purple	
67	UPR	2.014 - 2.017 (0.0793 - 0.0794)	Purple - Purple	
	LWR	2.017 - 2.020 (0.0794 - 0.0795)	White - White	

UNDERSIZE TABLE

Unit: mm (in)

Items	Thickness	Main journal diameter
US 0.25 (0.0098)	2.126 - 2.134 (0.0837 - 0.0840)	Grind so that bearing clearance is the specified value.

MAIN BEARING OIL CLEARANCE

Unit: mm (in)

Main bearing oil clearance	Standard	No. 1 and 4	0.024 - 0.034 (0.0009 - 0.0013)
		No. 2, 3 and 5	0.012 - 0.022 (0.0005 - 0.0009)
	Limit		0.065 (0.0026)

PRECAUTION

PRECAUTIONS

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

INFOID:0000000010783748

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. 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, all maintenance must be performed by an authorized NISSAN/INFINITI dealer.
- Improper maintenance, 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, and wait at least 3 minutes before performing any service.

Precaution Necessary for Steering Wheel Rotation After Battery Disconnect

INFOID:0000000010783749

CAUTION:

Comply with the following cautions to prevent any error and malfunction.

- Before removing and installing any control units, first turn the ignition power source and accessory power source to the OFF, then disconnect both battery cables.
- After finishing work, confirm that all control unit connectors are connected properly, then re-connect both battery cables.
- Always use CONSULT to perform self-diagnosis as a part of each function inspection after finishing work. If a DTC is detected, perform trouble diagnosis according to self-diagnosis results.

For vehicle with steering lock unit, if the battery is disconnected or discharged, the steering wheel will lock and cannot be turned.

If turning the steering wheel is required with the battery disconnected or discharged, follow the operation procedure below before starting the repair operation.

OPERATION PROCEDURE

1. Connect both battery cables.

NOTE:

Supply power using jumper cables if battery is discharged.

2. Open driver door.
3. Turn the ignition switch to the ON position.
(At this time, the steering lock will be released.)
4. Turn the ignition switch to OFF position with driver door open.
5. Wait for 3 minutes or longer with driver door open.

NOTE:

- Do not close driver door because the steering wheel locks when driver door is closed.

PRECAUTIONS

[QR25DE]

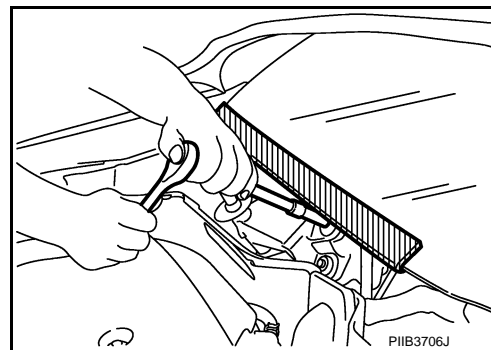
< PRECAUTION >

- The auto acc function is adapted to this vehicle. For this reason, even when the ignition switch is turned to OFF position, the accessory power source does not turned OFF and continues to be supplied for a certain amount of time.
6. Disconnect both battery cables. The steering lock will remain released with both battery cables disconnected and the steering wheel can be turned.
 7. Perform the necessary repair operation.
 8. When the repair work is completed, re-connect both battery cables. With the brake pedal released, turn the ignition switch from OFF position to ON position, then to LOCK position. (The steering wheel will lock when the ignition switch is turned to LOCK position.)
 9. Perform self-diagnosis check of all control units using CONSULT.

Precaution for Procedure without Cowl Top Cover

INFOID:0000000010783750

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:0000000010783751

DISCONNECTING FUEL PIPING

- Before starting work, check no fire or spark producing items are in the work area.
- Release fuel pressure before disconnecting and disassembly.
- After disconnecting pipes, plug openings to stop fuel leakage.

DRAINING ENGINE COOLANT

Drain engine coolant and engine oil when the engine is cooled.

INSPECTION, REPAIR AND REPLACEMENT

Before repairing or replacing, thoroughly inspect parts. Inspect new replacement parts in the same way, and replace if necessary.

REMOVAL AND DISASSEMBLY

- When instructed to use SST, use specified tools. Always be careful to work safely, avoid forceful or uninstructed operations.
- Exercise maximum care to avoid damage to mating or sliding surfaces.
- Dowel pins are used for several parts alignment. When replacing and reassembling parts with dowel pins, check that dowel pins are installed in the original position.
- Must cover openings of engine system with a tape or equivalent, to seal out foreign materials.
- Mark and arrange disassembly parts in an organized way for easy troubleshooting and reassembly.
- When loosening nuts and bolts, as a basic rule, start with the one furthest outside, then the one diagonally opposite, and so on. If the order of loosening is specified, do exactly as specified. Power tools may be used in the step.

ASSEMBLY AND INSTALLATION

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

PRECAUTIONS

[QR25DE]

< PRECAUTION >

- 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.

Special Cautions to Ensure the Safe Disposal of Sodium-filled Exhaust Valves

INFOID:0000000010783752

Handling and disposal of sodium-filled exhaust valves requires special care and consideration. Under conditions such as breakage with subsequent contact with water, metal sodium which lines the inner portion of exhaust valve will react violently, forming sodium hydroxide and hydrogen which may result in an explosion. Sodium-filled exhaust valve is identified on the top of its stem as shown in illustration.

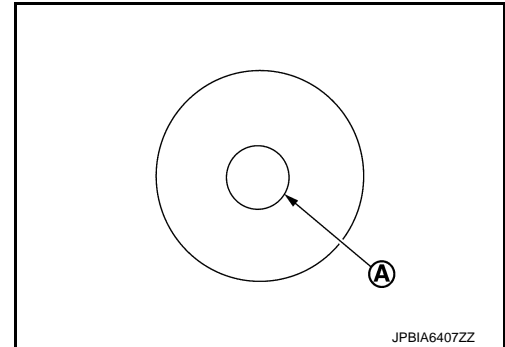
Identification mark of sodium-filled exhaust valve (A)

For CHINA

: 3T1

Except for CHINA

: 3T1 or 3TA



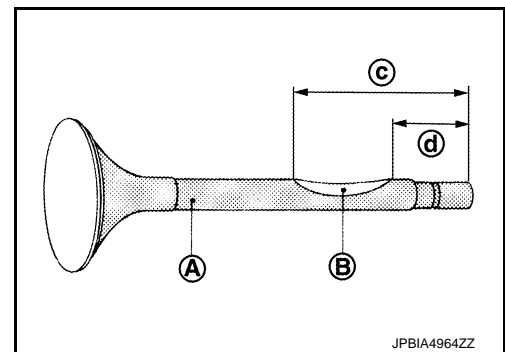
DEALER DISPOSAL INSTRUCTIONS

CAUTION:

- Use approved shatter-resistant eye protection when performing this procedure.
- Perform this and all subsequent disposal work procedures in an open room, away from flammable liquids. Keep a fire extinguisher, rated at least 10 ABC, in close proximity to the work area.
- Be sure to wear rubber gloves when performing the following operations.
- Make sure the resultant (high alkalinity) waste water does not contact your skin. If the waste water does contact you, wash the contacted area immediately with large quantities of water.
- Dealers should check their respective state and local regulations concerning any chemical treatment or waste water discharge permits which may be required to dispose of the resultant (high alkalinity) waste water.

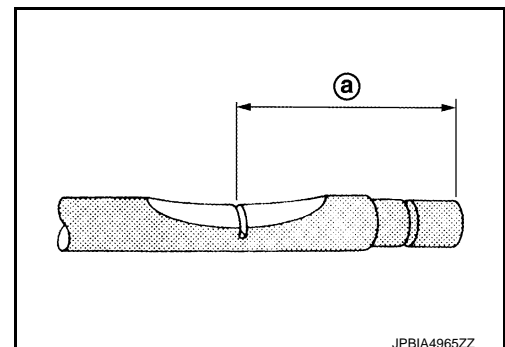
1. Clamp valve stem in a vice.
2. The valve has a specially-hardened surface. To cut through it, first remove a half-round section, approximately 30 mm (1.18 in) long using air-powered grinder until black color is removed and silver color appears.

- (A) : Black color
- (B) : Silver color
- (C) : 47 mm (1.85 in)
- (d) : 17 mm (0.67 in)



3. Use hacksaw to cut through approximately half the diameter of valve stem. Make the serration at a point 40 mm (1.57 in) from the end of valve stem.

- (a) : 32 mm (1.26 in)

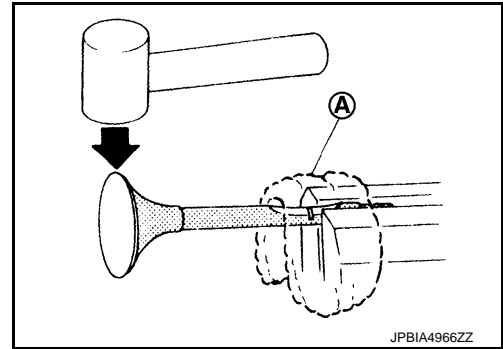


PRECAUTIONS

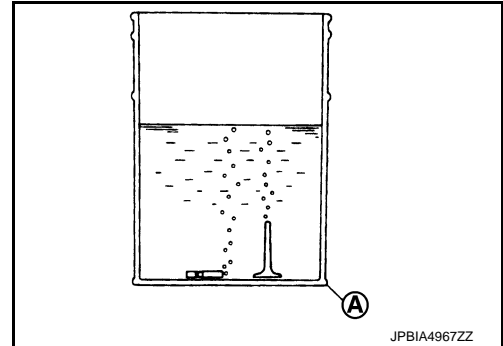
[QR25DE]

< PRECAUTION >

4. Cover the serrated end of the valve with a large shop towel (A). Strike the valve face end with a hammer, separating it into two pieces.



5. Fill a bucket (A) (such as a 20 ℓ oil can) with at least 10 ℓ (2-1/4 Imp gal) of water. Carefully place the already cut (serrated) valves into the water one-at-a-time using a set of large tweezers and quickly move away at least 2.7 m (9 ft).
6. The valves should be placed in a standing position as shown in the illustration to allow complete reaction. After the bubbling action has subsided, additional valves can be placed into the bucket allowing each subsequent chemical reaction to subside. However, no more than 8 valves should be placed in the same 10 ℓ (2-1/4 Imp gal) amount of water. The complete chemical reaction may take as long as 4 to 5 hours. Remove the valves using a set of large tweezers after the chemical reaction has stopped. Afterwards, valves can be disposed as ordinary scrap.



Parts Requiring Angle Tightening

INFOID:0000000010783753

- 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.

Liquid Gasket

INFOID:0000000010783754

REMOVAL OF LIQUID GASKET SEALING

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

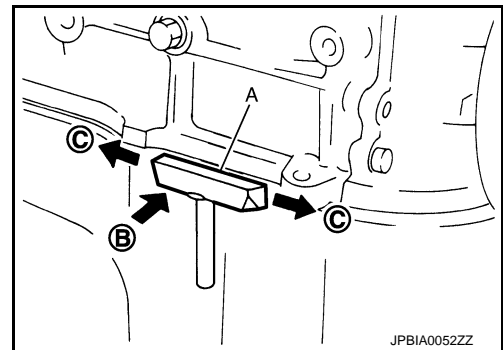
CAUTION:

Never damage the mating surfaces.

- Tap the seal cutter [SST: KV10111100] to insert it (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.



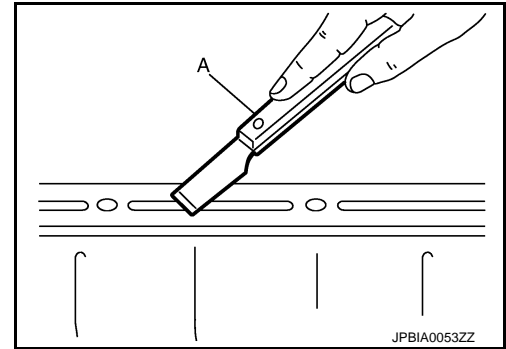
LIQUID GASKET APPLICATION PROCEDURE

PRECAUTIONS

[QR25DE]

< PRECAUTION >

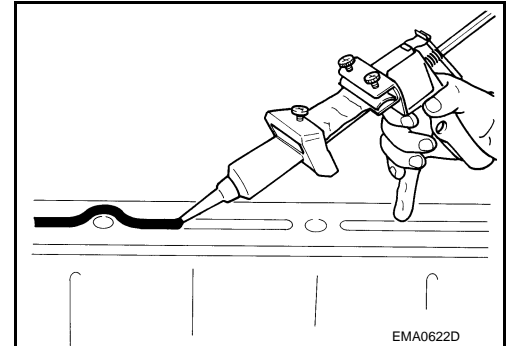
- Using a scraper (A), remove old liquid gasket adhering to the liquid gasket application surface and the mating surface.
 - Remove liquid gasket completely from the groove of the liquid gasket application surface, mounting bolts, and bolt holes.
- Wipe the liquid gasket application surface and the mating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

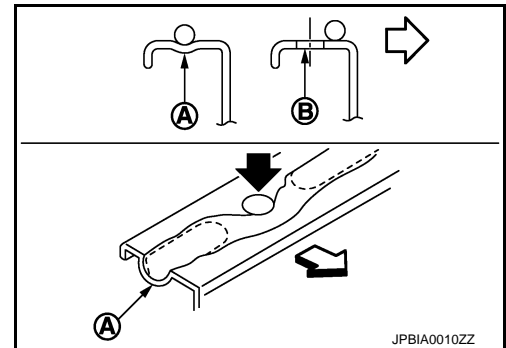


- As for bolt holes ⑥, normally apply liquid gasket inside the holes. Occasionally, it should be applied outside the holes. Check to read the text of this manual.

⑥ : 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:0000000010784539

- With the adoption of Auto ACC function, ACC power is automatically supplied by operating the intelligent key or remote keyless entry or by opening/closing the driver side door. In addition, ACC power is supplied even after the ignition switch is turned to the OFF position, i.e. ACC power is supplied for a certain fixed time.
- When disconnecting the 12V battery terminal, turn off the ACC power before disconnecting the 12V battery terminal, observing "How to disconnect 12V battery terminal" described below.

NOTE:

Some ECUs operate for a certain fixed time even after ignition switch is turned OFF and ignition power supply is stopped. If the battery terminal is disconnected before ECU stops, accidental DTC detection or ECU data damage may occur.

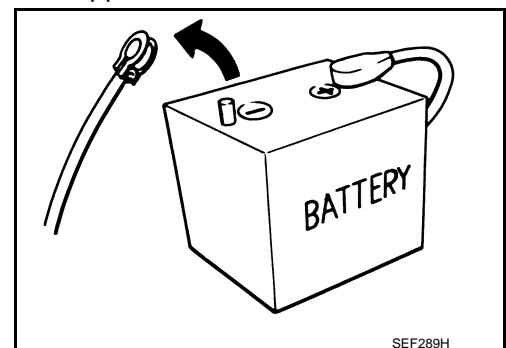
- For vehicles with the 2-batteries, be sure to connect the main battery and the sub battery before turning ON the ignition switch.

NOTE:

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

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

NOTE:



PRECAUTIONS

[QR25DE]

< PRECAUTION >

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

HOW TO DISCONNECT 12V BATTERY TERMINAL

Disconnect 12V battery terminal according to Instruction 1 or Instruction 2 described below.

For vehicles parked by ignition switch OFF, refer to Instruction 2.

INSTRUCTION 1

1. Open the hood.
2. Turn key switch to the OFF position with the driver side door opened.
3. Get out of the vehicle and close the driver side door.
4. Wait at least 3 minutes. For vehicle with the engine listed below, remove the battery terminal after a lapse of the specified time.

D4D engine : 20 minutes

HRA2DDT : 12 minutes

K9K engine : 4 minutes

M9R engine : 4 minutes

R9M engine : 4 minutes

V9X engine : 4 minutes

CAUTION:

While waiting, never operate the vehicle such as locking, opening, and closing doors. Violation of this caution results in the activation of ACC power supply according to the Auto ACC function.

5. Remove 12V battery terminal.

CAUTION:

After installing 12V battery, always check self-diagnosis results of all ECUs and erase DTC.

INSTRUCTION 2 (FOR VEHICLES PARKED BY IGNITION SWITCH OFF)

1. Unlock the door with intelligent key or remote keyless entry.

NOTE:

At this moment, ACC power is supplied.

2. Open the driver side door.
3. Open the hood.
4. Close the driver side door.
5. Wait at least 3 minutes.

CAUTION:

While waiting, never operate the vehicle such as locking, opening, and closing doors. Violation of this caution results in the activation of ACC power supply according to the Auto ACC function.

6. Remove 12V battery terminal.

CAUTION:

After installing 12V battery, always check self-diagnosis results of all ECUs and erase DTC.

PREPARATION

< PREPARATION >

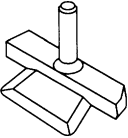
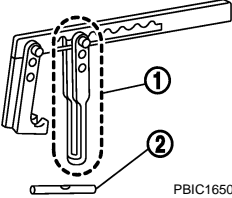
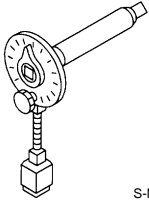
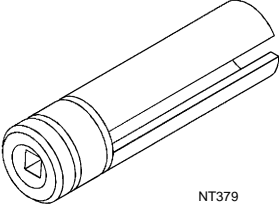
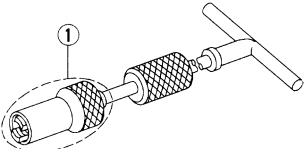
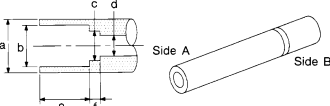
[QR25DE]

PREPARATION

PREPARATION

Special Service Tools

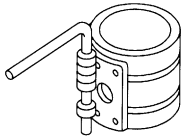
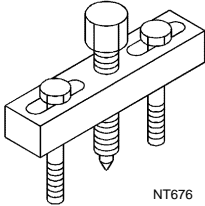
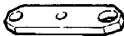
INFOID:0000000010783756

Tool number Tool name		Description
KV10111100 Seal cutter	 S-NT046	Removing oil pan and timing chain case
KV10116200 Valve spring compressor 1. KV10115900 Attachment 2. KV10109220 Adapter	 PBIC1650E	Disassembling and assembling valve mechanism Part (1) is a component of KV10116200, but Part (2) is not so.
KV10112100 Angle wrench	 S-NT014	Tightening bolts for bearing cap, cylinder head, etc.
KV10117100 Heated oxygen sensor wrench	 NT379	Loosening or tightening heated oxygen sensors with 22 mm (0.87 in) hexagon nut
KV10107902 Valve oil seal puller 1. KV10116100 Valve oil seal puller adapter	 S-NT605	Removing valve oil seal
KV10115600 Valve oil seal drift	 S-NT603	Installing valve oil seal Use side A. a: 20 (0.79) dia. d: 8 (0.31) dia. b: 13 (0.51) dia. e: 10.7 (0.421) dia. c: 10.3 (0.406) dia. f: 5 (0.20) dia. Unit: mm (in)

PREPARATION

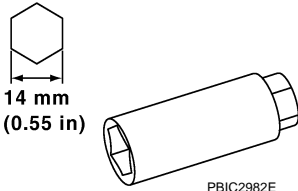

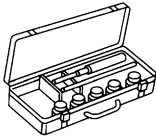
< PREPARATION >

[QR25DE]

Tool number Tool name	Description	
EM03470000 Piston ring compressor	Installing piston assembly into cylinder bore	A
 S-NT044		EM
KV11103000 Pulley puller	Removing crankshaft pulley	C
 NT676		D
KV11105210 Stopper plate	Fixing drive plate	E
 ZZA0009D		F
		G
		H

Commercial Service Tools

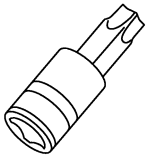
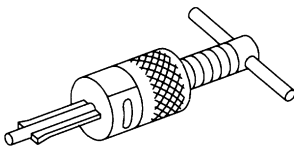
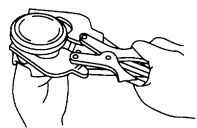
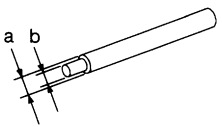
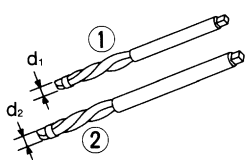
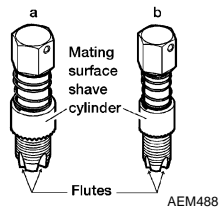
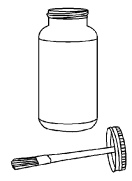
INFOID:0000000010783757

Tool name	Description	
Spark plug wrench	Removing and installing spark plug	I
 PBIC2982E		J
Pulley holder	Crankshaft pulley removing and installing	K
 ZZA1010D		L
Valve seat cutter set	Finishing valve seat dimensions	M
 S-NT048		N
		O
		P

PREPARATION

< PREPARATION >

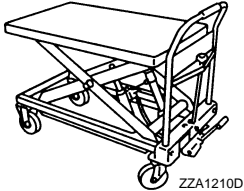
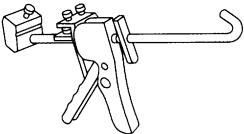
[QR25DE]

Tool name	Description
<p>TORX socket</p>  <p>PBIC1113E</p>	<p>Removing and installing flywheel Size: T55</p>
<p>Pilot bushing puller</p>  <p>S-NT045</p>	<p>Removing pilot converter</p>
<p>Piston ring expander</p>  <p>S-NT030</p>	<p>Removing and installing piston ring</p>
<p>Valve guide drift</p>  <p>S-NT015</p>	<p>Removing and installing valve guide Intake & Exhaust: a: 9.5 mm (0.374 in) dia. b: 5.5 mm (0.217 in) dia.</p>
<p>Valve guide reamer</p>  <p>S-NT016</p>	<p>1: Reaming valve guide inner hole 2: Reaming hole for oversize valve guide Intake & Exhaust: d1: 6.0 mm (0.236 in) dia. d2: 10.2 mm (0.402 in) dia.</p>
<p>Oxygen sensor thread cleaner</p>  <p>AEM488</p>	<p>Reconditioning the exhaust system threads before installing a new air fuel ratio sensor and heated oxygen sensor (Use with anti-seize lubricant shown below.) a = 18 mm (0.71 in) dia. for zirconia heated oxygen sensor and air fuel ratio sensor b = 12 mm (0.47 in) dia. for titania heated oxygen sensor</p>
<p>Anti-seize lubricant i.e.: (Permatex™ 133AR or equivalent meeting MIL specification MIL-A-907)</p>  <p>AEM489</p>	<p>Lubricating oxygen sensor thread cleaning tool when reconditioning exhaust system threads</p>

PREPARATION

< PREPARATION >

[QR25DE]

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

Lubricant or/and Sealant

INFOID:0000000010783758

Name	Description	Note
Three bond 1215	Cylinder block	Water drain plug
Three bond 1217H	<ul style="list-style-type: none"> • Oil pan (lower) • Oil pan (upper) • Rocker cover • VTC cover • Timing chain • Camshaft bracket • Cylinder block 	—
Three bond 1386G or 1211	Cylinder block	Plug

SYSTEM DESCRIPTION

COMPONENT PARTS

Intake Camshaft Sprocket

INFOID:0000000010783759

OUTLINE

The adoption of the intake valve timing intermediate lock control allows the fixing of valve timing in the intermediate phase when starting the engine.

The intake valve timing intermediate lock control improves the cleaning ability of exhaust gas at cold starting by fixing the camshaft sprocket (INT) with two lock keys and bringing the cam phase into intermediate phase.

OPERATION

The rotor and housing of the intake camshaft sprocket are fixed by the lock key when the engine is stopped. After the engine is started, the lock key is released by oil pressure and ECM performs the spark advance/retard control according to driving conditions.

For details of intake valve timing intermediate lock control, refer to [EC-466, "INTAKE VALVE TIMING CONTROL : System Description"](#).

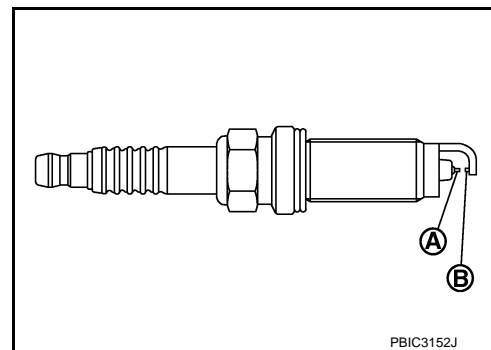
Spark Plug

INFOID:0000000010783760

OUTLINE

- The adoption of a durable and high-performance iridium plug improves the reduction in discharge voltage.

- Ⓐ : Iridium alloy
- Ⓑ : Platinum



STRUCTURE AND OPERATION

Major Kinetic System

INFOID:0000000010783761

DESCRIPTION

- The adoption of the following items enables high-compression by controlling the knocking without increasing the temperature in the combustion chamber:
 - Sodium-filled exhaust valves: Releases heat from the combustion chamber. For details, refer to [EM-155, "Valve System"](#).
- The coating of hydrogen-free DLC to the valve lifter and the piston ring enables low friction.

NOTE:

Hydrogen-free DLC (Diamond-like Carbon) coating: Coating by the Ion-plating method without using carbon-free graphite as the evaporation source. This improves the adherence with engine oil and significantly reduces the friction coefficient.

STRUCTURE

A

EM

C

D

E

F

G

H

I

J

K

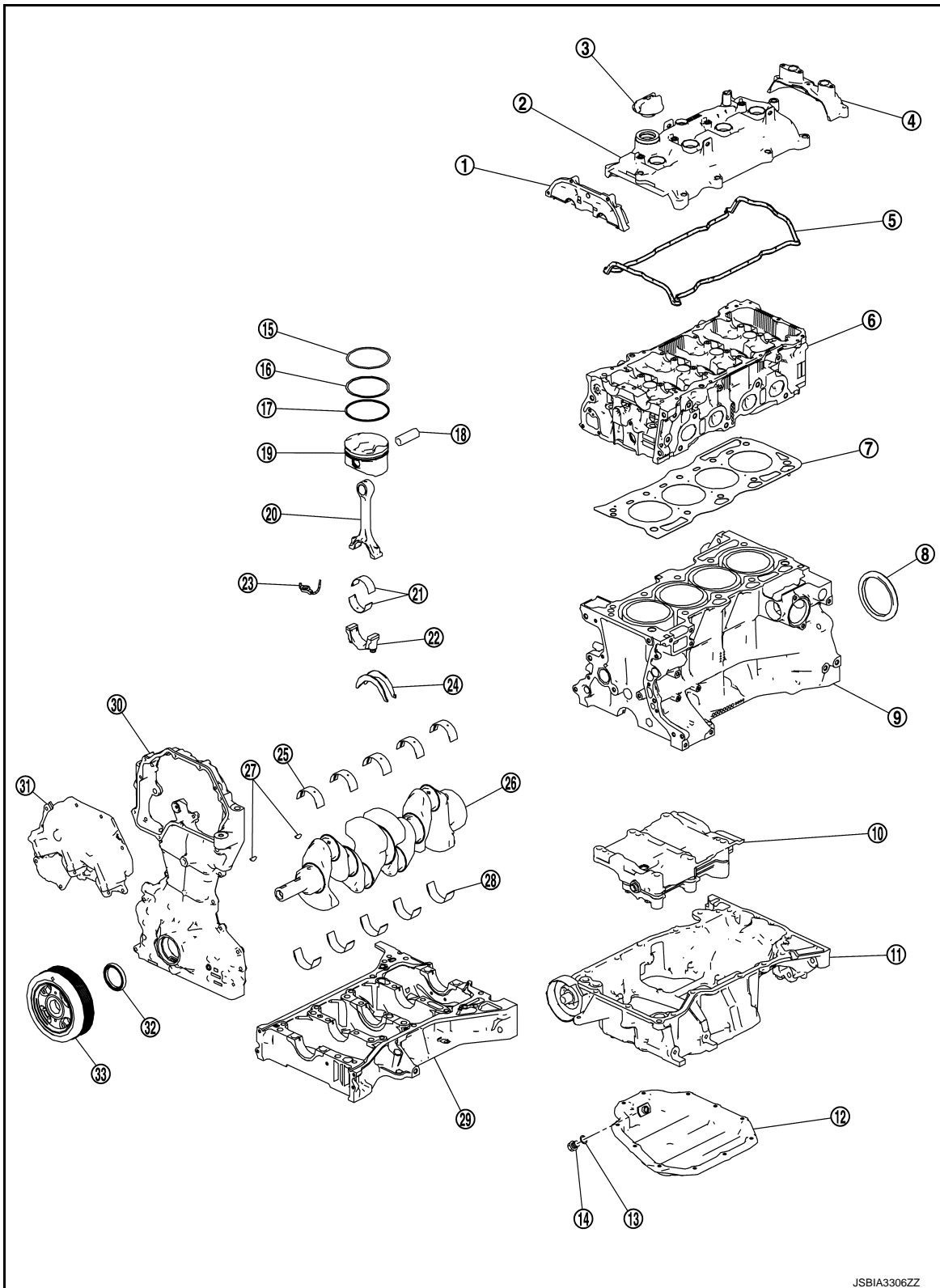
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- | | | |
|------------------------------------|-----------------------|-------------------|
| ① Camshaft bracket (No.1) | ② Rocker cover | ③ Oil filler cap |
| ④ Camshaft position sensor bracket | ⑤ Rocker cover gasket | ⑥ Cylinder head |
| ⑦ Gasket | ⑧ Rear oil seal | ⑨ Cylinder block |
| ⑩ Balancer unit | ⑪ Oil pan (upper) | ⑫ Oil pan (lower) |
| ⑬ Drain plug washer | ⑭ Drain plug | ⑮ Top ring |

< SYSTEM DESCRIPTION >

①⑥ Second ring	①⑦ Oil ring	①⑧ Piston pin
①⑨ Piston	②⑩ Connecting rod	②① Connecting rod bearing
②② Connecting rod cap	②③ Oil jet	②④ Thrust bearing
②⑤ Main bearing (upper)	②⑥ Crankshaft	②⑦ Crankshaft key
②⑧ Main bearing (lower)	②⑨ Lower cylinder block	③⑩ Front cover
③① Valve timing control cover	③② Front oil seal	③③ Crankshaft pulley

Valve System

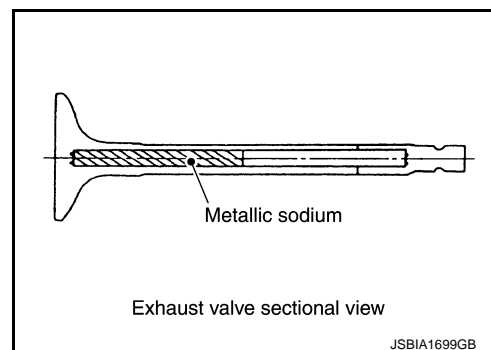
INFOID:0000000010783762

DESCRIPTION

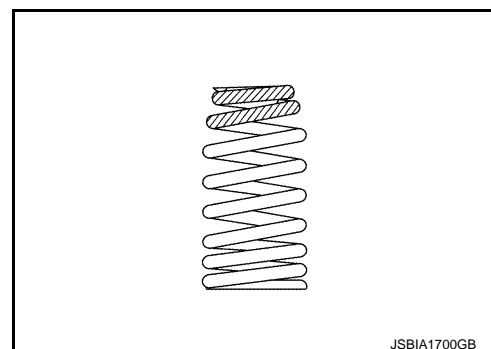
- The valve system has the DOHC mechanism with the V-shaped valve layout and the cam shaft is driven by the single-stage chain system.
- The adoption of a small-pitch silent chain with a lighter and more compact cam shaft drive system (e.g. use of smaller sprocket) reduces noise generated from the drive system.
- The adoption of sodium-filled exhaust valves reduces the valve temperature and improves the intake efficiency. The stem of this valve is hollow and includes metallic sodium with larger specific heat (large absorbed duty). Metallic sodium is liquefied at temperatures while the vehicle is traveling.

NOTE:

With the sodium-filled exhaust valves, metallic sodium is agitated by the open-close motion of the valve, and the heat generated in the combustion chamber and exhaust port is released to the valve guide to reduce the temperature of the valve umbrella.



- The adoption of the single beehive spring for the valve spring reduces friction and prevents spring surge.

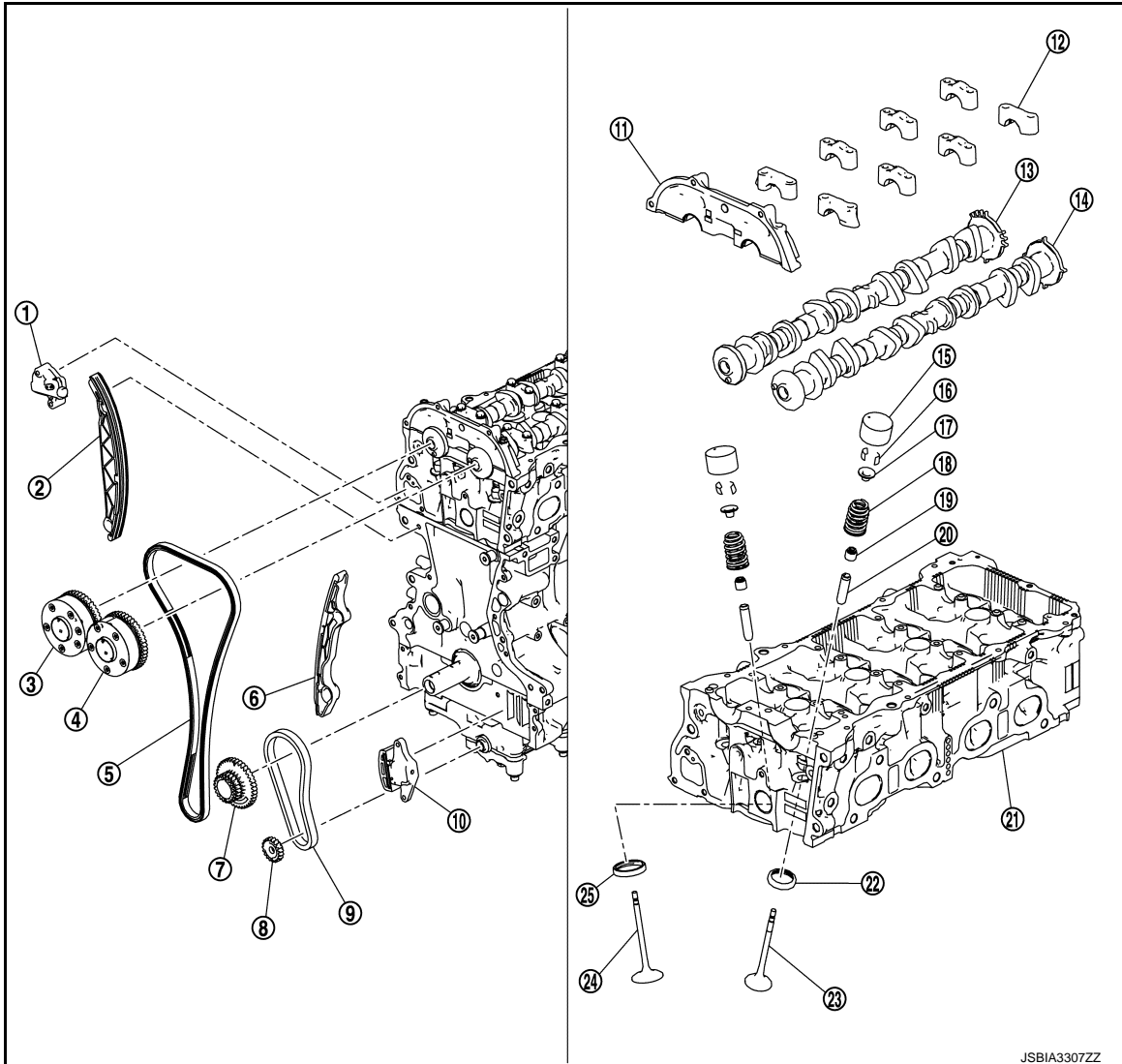


- The adoption of the intake valve timing control and the exhaust valve timing control enables the continuous adjustment of the valve timing within the movable range by oil pressure. This can control the optimum valve timing according to engine speeds and load, allowing significant improvement in low/intermediate torque.
- The adoption of the intake manifold intermediate lock control reduces HC at a cold start.

For details on control, refer to the following information:

- Intake valve timing control: [EC-466, "INTAKE VALVE TIMING CONTROL : System Description"](#)
- Exhaust valve timing control: [EC-469, "EXHAUST VALVE TIMING CONTROL : System Description"](#)

STRUCTURE

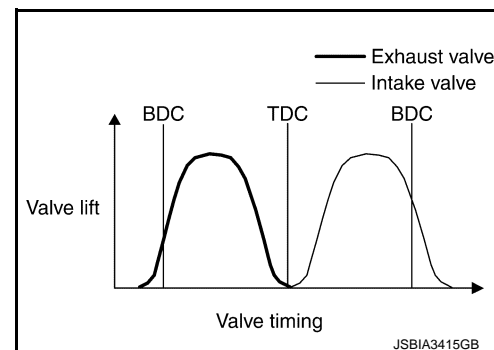


- | | | |
|--|----------------------------|------------------------------|
| ① Chain tensioner (for timing chain) | ② Timing chain slack guide | ③ Camshaft sprocket (INT) |
| ④ Camshaft sprocket (EXH) | ⑤ Timing chain | ⑥ Timing chain tension guide |
| ⑦ Crankshaft sprocket | ⑧ Oil pump sprocket | ⑨ Oil pump drive chain |
| ⑩ Chain tensioner (for oil pump drive chain) | ⑪ Camshaft bracket (No.1) | ⑫ Camshaft bracket |
| ⑬ Camshaft (INT) | ⑭ Camshaft (EXH) | ⑮ Valve lifter |
| ⑯ Valve collet | ⑰ Valve spring retainer | ⑱ Valve spring |
| ⑲ Valve oil seal | ⑳ Valve guide | ㉑ Cylinder head |
| ㉒ Valve seat (EXH) | ㉓ Valve (EXH) | ㉔ Valve (INT) |
| ㉕ Valve seat (INT) | | |

OPERATION

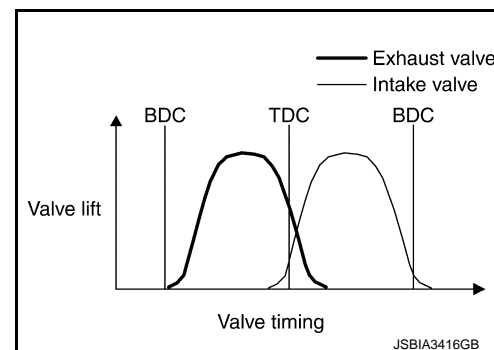
VTC minimum phase (mechanical)

- The valve timing of the intake valve is set in the retarded angle.
- The valve timing of the exhaust valve is set in the advance angle.



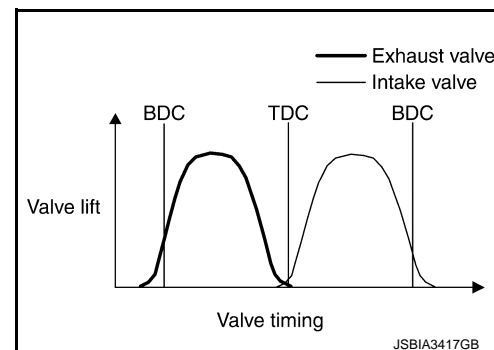
VTC maximum phase (mechanical)

- The valve timing of the intake valve is set in the advance angle.
- The valve timing of the exhaust valve is set in the retarded angle.



VTC intermediate lock phase [engine start (mechanical)]

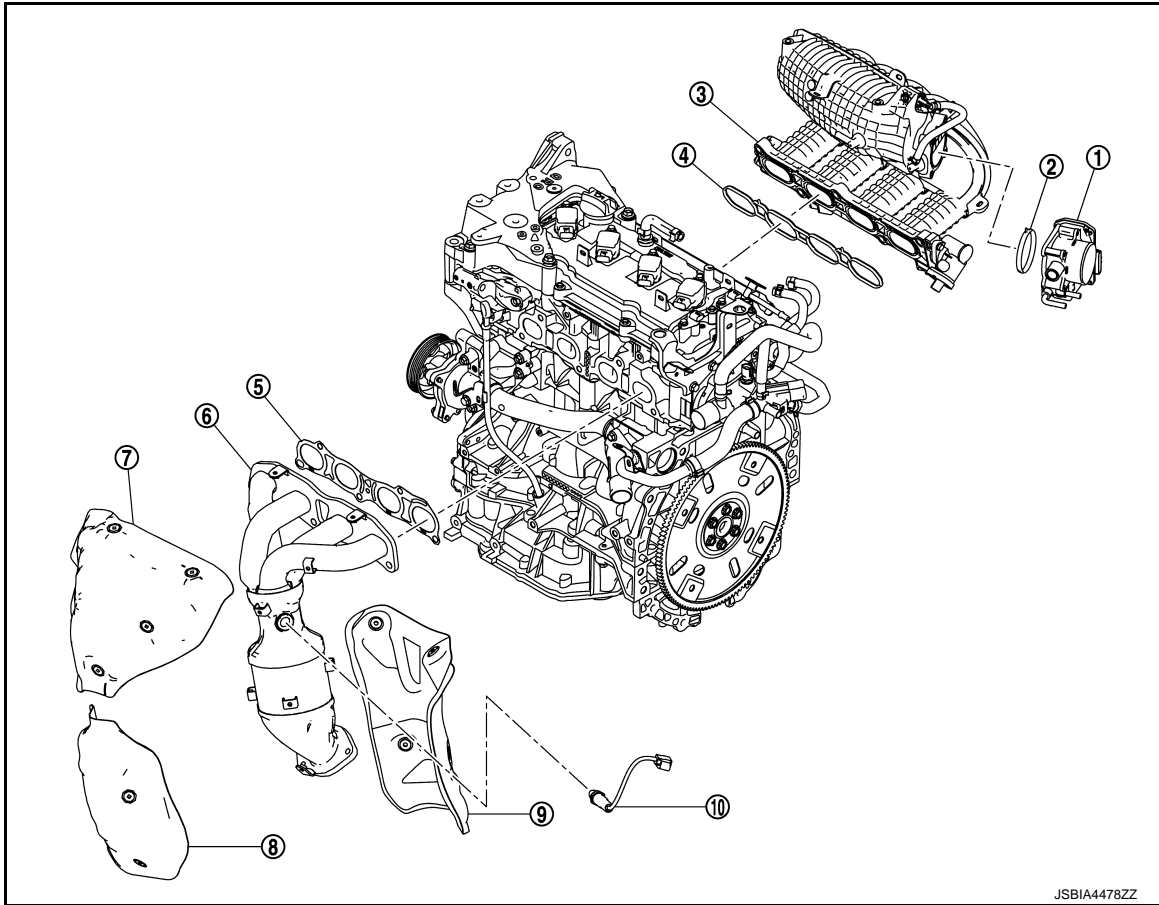
- The valve timing of the intake valve is set in the intermediate lock angle.
- The valve timing of the exhaust valve is set in the most advance angle.
- Locking in the intermediate phase secures the cold startability and reduces HC.



Intake and Exhaust System

INFOID:0000000010783763

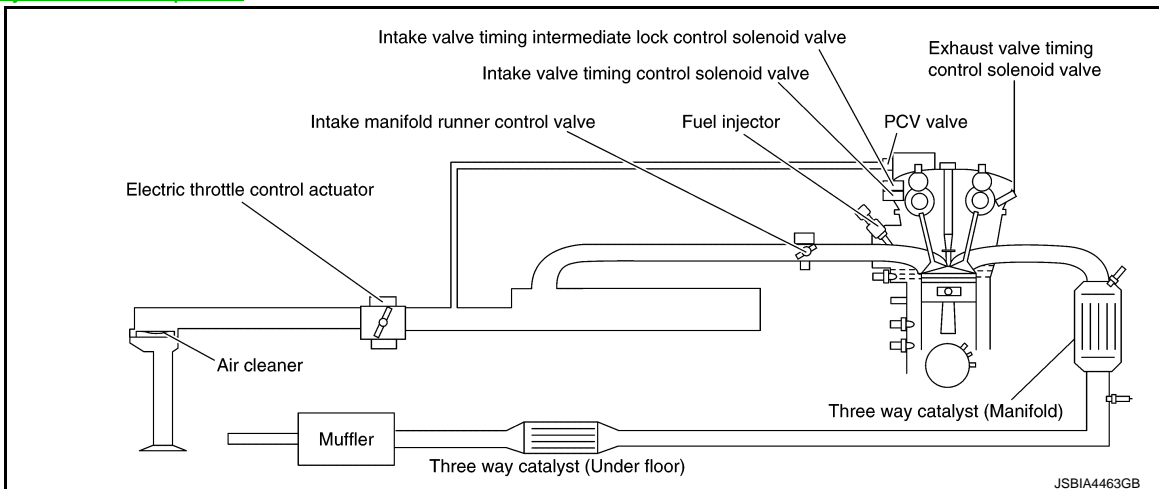
STRUCTURE



- | | | |
|--------------------------------------|----------------------------------|----------------------------|
| ① Electric throttle control actuator | ② Gasket | ③ Intake manifold |
| ④ Gasket | ⑤ Gasket | ⑥ Exhaust manifold |
| ⑦ Exhaust manifold cover (upper) | ⑧ Exhaust manifold cover (lower) | ⑨ Three way catalyst cover |

OPERATION

The intake valve timing control and exhaust valve timing control are controlled to the optimum combination by the integrated engine control. For the integrated engine control, refer to [EC-455. "ENGINE CONTROL SYSTEM : System Description"](#).



BASIC INSPECTION

CAMSHAFT VALVE CLEARANCE

Inspection and Adjustment

INFOID:0000000010783764

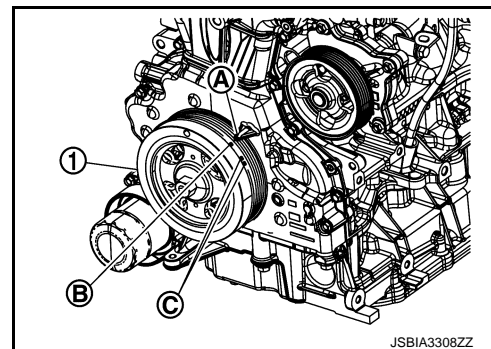
EM

INSPECTION

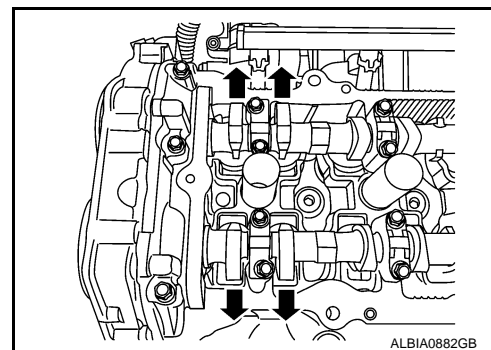
Perform inspection as follows after removal, installation or replacement of camshaft or valve-related parts, or if there is unusual engine conditions regarding valve clearance.

1. Remove rocker cover. Refer to [EM-189, "Exploded View"](#).
2. Measure the valve clearance with the following procedure:
 - a. Set No. 1 cylinder at TDC of its compression stroke.
 - Rotate crankshaft pulley ① clockwise and align TDC mark (no paint) ② to timing indicator ③ on front cover.

③ : Paint marks

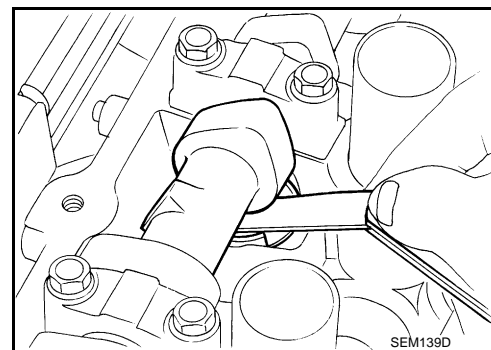


- At the same time, check that both intake and exhaust cam noses of No. 1 cylinder face outside as shown in the figure.
- If they do not face outside, rotate crankshaft pulley once more (360 degrees) and align as shown in the figure.



- b. Use a feeler gauge, measure the clearance between valve lifter and camshaft.

Valve clearance : Refer to [EM-275, "Camshaft"](#).



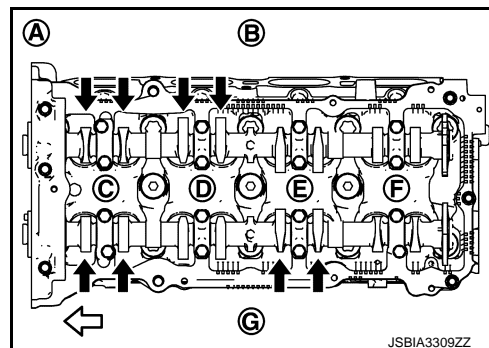
CAMSHAFT VALVE CLEARANCE

[QR25DE]

< BASIC INSPECTION >

- By referring to the figure, measure the valve clearances at locations marked "x" as shown in the table below [locations indicated with black arrow (↖) in the figure] with a feeler gauge.

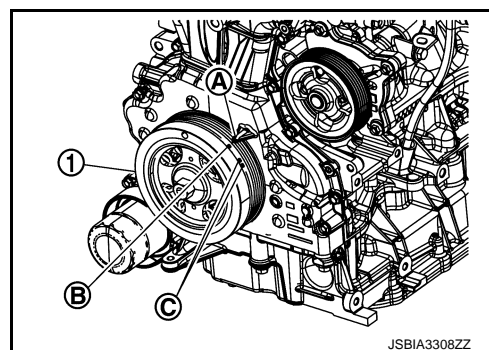
- (A) : No. 1 cylinder at compression TDC
- (B) : Intake side
- (C) : No. 1 cylinder
- (D) : No. 2 cylinder
- (E) : No. 3 cylinder
- (F) : No. 4 cylinder
- (G) : Exhaust side
- ↖ : Engine front



Measuring position		No. 1 CYL.	No. 2 CYL.	No. 3 CYL.	No. 4 CYL.
No. 1 cylinder at compression TDC	INT	x	x		
	EXH	x		x	

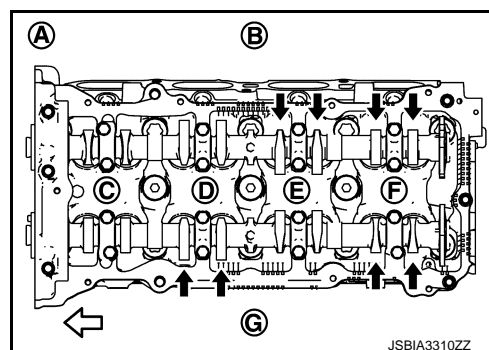
- c. Rotate crankshaft pulley ① one revolution (360 degrees) and align TDC mark (no paint) ② to timing indicator ③ on front cover.

- (C) : Paint marks



- By referring to the figure, measure the valve clearance at locations marked "x" as shown in the table below [locations indicated with black arrow (↖) in the figure] with a feeler gauge.

- (A) : No. 4 cylinder at compression TDC
- (B) : Intake side
- (C) : No. 1 cylinder
- (D) : No. 2 cylinder
- (E) : No. 3 cylinder
- (F) : No. 4 cylinder
- (G) : Exhaust side
- ↖ : Engine front



Measuring position		No. 1 CYL.	No. 2 CYL.	No. 3 CYL.	No. 4 CYL.
No. 4 cylinder at compression TDC	INT			x	x
	EXH		x		x

3. If out of standard, perform adjustment. Refer to "ADJUSTMENT".

ADJUSTMENT

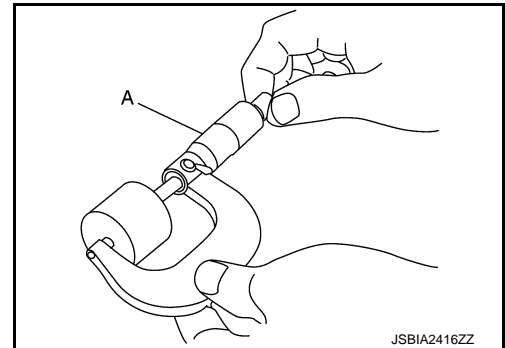
- Perform adjustment depending on selected head thickness of valve lifter.

CAMSHAFT VALVE CLEARANCE

[QR25DE]

< BASIC INSPECTION >

1. Remove camshaft. Refer to [EM-221, "Exploded View"](#).
2. Remove valve lifters at the locations that are out of the standard.
3. Measure the center thickness of the removed valve lifters with a micrometer (A).



4. 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

t₁ = Removed valve lifter thickness

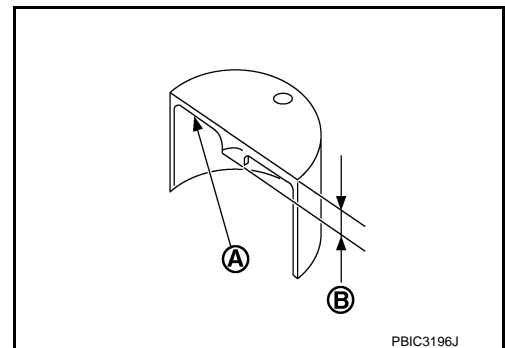
C₁ = Measured valve clearance

C₂ = Standard valve clearance:

Intake : 0.28 mm (0.011 in)

Exhaust : 0.30 mm (0.012 in)

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



NOTE:

Available thickness of valve lifter: 26 sizes 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-275, "Camshaft"](#).

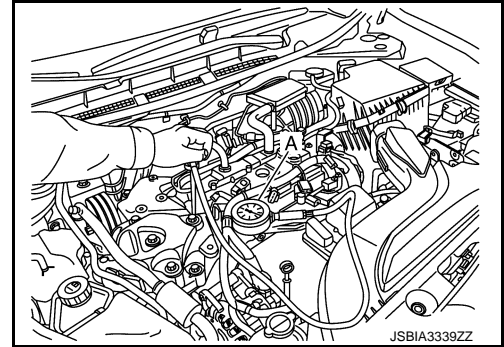
5. Install the selected valve lifter.
6. Install camshaft. Refer to [EM-221, "Exploded View"](#).
7. Install timing chain and related parts. Refer to [EM-210, "Exploded View"](#).
8. Manually rotate crankshaft pulley a few rotations.
9. Check that the valve clearances is within the standard. Refer to "INSPECTION".
10. Install remaining parts in the reverse order of removal.
11. Warm up the engine, and check for unusual noise and vibration.

COMPRESSION PRESSURE

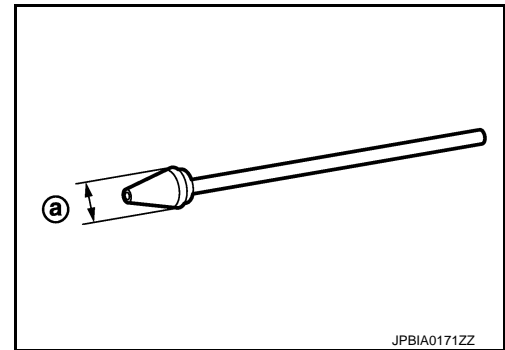
Inspection

INFOID:000000010783765

1. Warm up engine thoroughly. Then, stop it.
2. Release fuel pressure. Refer to [EC-558, "Work Procedure"](#).
3. Disconnect fuel pump fuse to avoid fuel injection during measurement. Refer to [PG-84, "Fuse, Connector and Terminal Arrangement"](#).
4. Remove ignition coil and spark plug from each cylinder. Refer to [EM-189, "Exploded View"](#).
5. Connect engine tachometer (not required in use of CONSULT).
6. Install compression tester (A) with adapter onto spark plug hole.



- Use compression tester whose end ① (rubber portion) is smaller than 20 mm (0.79 in) in diameter. Otherwise, it may be caught by cylinder head during removal.



7. 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-274, "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.
 - 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.
8. After inspection is completed, install removed parts.
 9. Start engine, and confirm that engine runs smoothly.

COMPRESSION PRESSURE

< BASIC INSPECTION >

[QR25DE]

10. Perform trouble diagnosis. If DTC appears, erase it. Refer to [EC-491, "CONSULT Function"](#).

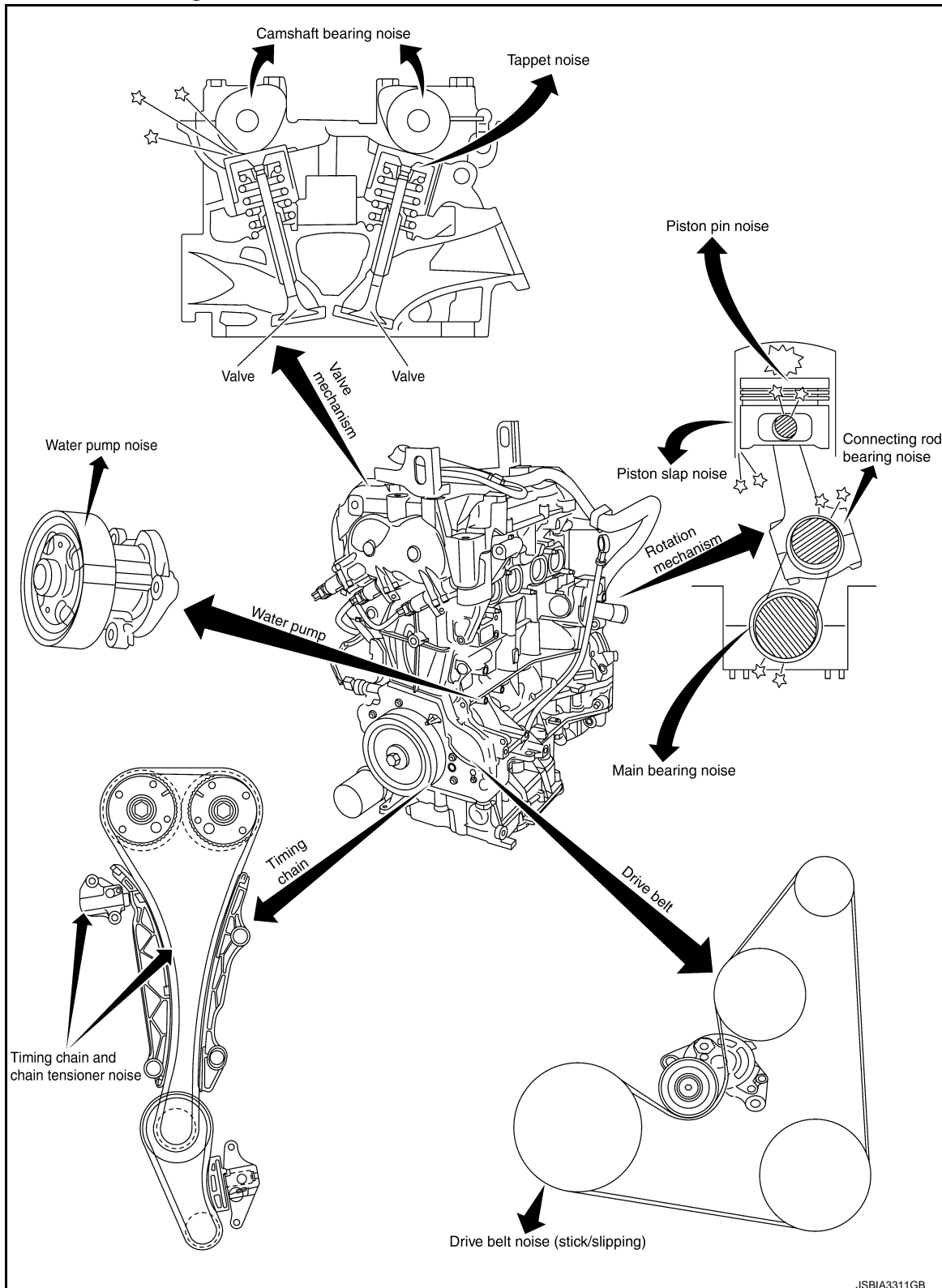
- A
- EM
- C
- D
- E
- F
- G
- H
- I
- J
- K
- L
- M
- N
- O
- P

SYMPTOM DIAGNOSIS

NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING

NVH Troubleshooting Chart

INFOID:000000010783766



1. Locate the area where noise occurs.
2. Confirm the type of noise.
3. Specify the operating condition of engine.

NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING

< SYMPTOM DIAGNOSIS >

[QR25DE]

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	EM-159
	Rattle	C	A	—	A	B	C	Camshaft bearing noise	Camshaft journal oil clearance Camshaft runout	EM-228
Crank-shaft 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	EM-256
	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	EM-280 EM-280 EM-280 EM-280
	Knock	B	A	C	B	B	B	Connecting rod bearing noise	Connecting rod bushing oil clearance Connecting rod bearing oil clearance	EM-280 EM-284
	Knock	B	A	—	A	B	C	Main bearing noise	Main bearing oil clearance Crankshaft runout	EM-283 EM-280
Front of engine Front cover	Tapping or ticking	A	A	—	B	B	B	Timing chain and chain tensioner noise	Timing chain cracks and wear Timing chain tensioner operation	EM-219 EM-211
Front of engine	Squeaking or fizzing	A	B	—	B	B	B	Drive belt (Sticking or slipping)	Drive belt deflection	EM-166
	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	CO-50

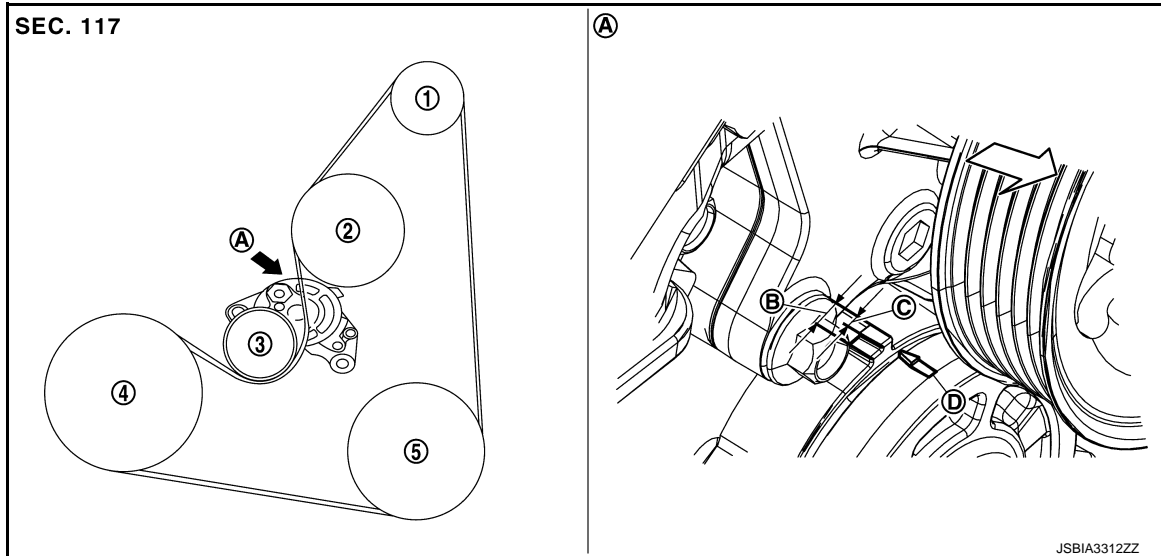
A: Closely related B: Related C: Sometimes related —: Not related

PERIODIC MAINTENANCE

DRIVE BELTS

Exploded View

INFOID:0000000010783767



- | | | |
|---------------------------------------|----------------------|--|
| ① Alternator | ② Water pump | ③ Drive belt auto tensioner |
| ④ Crankshaft pulley | ⑤ A/C compressor | |
| Ⓐ View A | Ⓑ Possible use range | Ⓒ Range when new drive belt is installed |
| Ⓓ Indicator (notch on the fixed side) | | |
| ⇐ : Engine front | | |

Removal and Installation

INFOID:0000000010783768

REMOVAL

1. Turn the steering wheel to the right.
2. Remove the splash guard (RH). Refer to [EXT-35, "FENDER PROTECTOR : Exploded View"](#).
3. Securely hold the hexagonal part Ⓐ of drive belt auto-tensioner ① using suitable tool, and move in the direction of arrow (➡) (loosening direction of tensioner).

CAUTION:

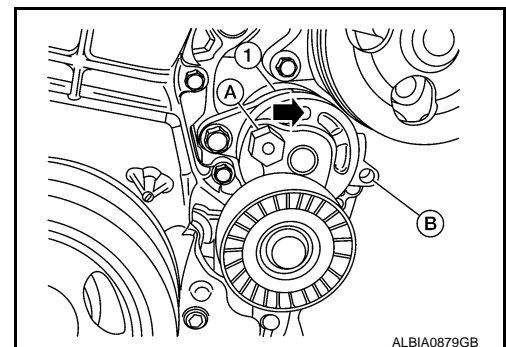
Avoid placing hand in a location where pinching may occur if the holding tool accidentally comes off.

4. Insert a rod approximately 6.0 mm (0.24 in) in diameter through the rear of the drive belt auto-tensioner into retaining boss Ⓑ to lock drive belt auto-tensioner pulley.

NOTE:

Leave drive belt auto-tensioner pulley arm locked until drive belt is installed again.

5. Loosen drive belt from drive belt auto-tensioner and then remove it from the other pulleys.



INSTALLATION

1. Install the drive belt onto all of the pulleys except for the drive belt auto-tensioner. Then install the drive belt onto drive belt auto-tensioner last.

CAUTION:

Confirm belts are completely set on the pulleys.

DRIVE BELTS

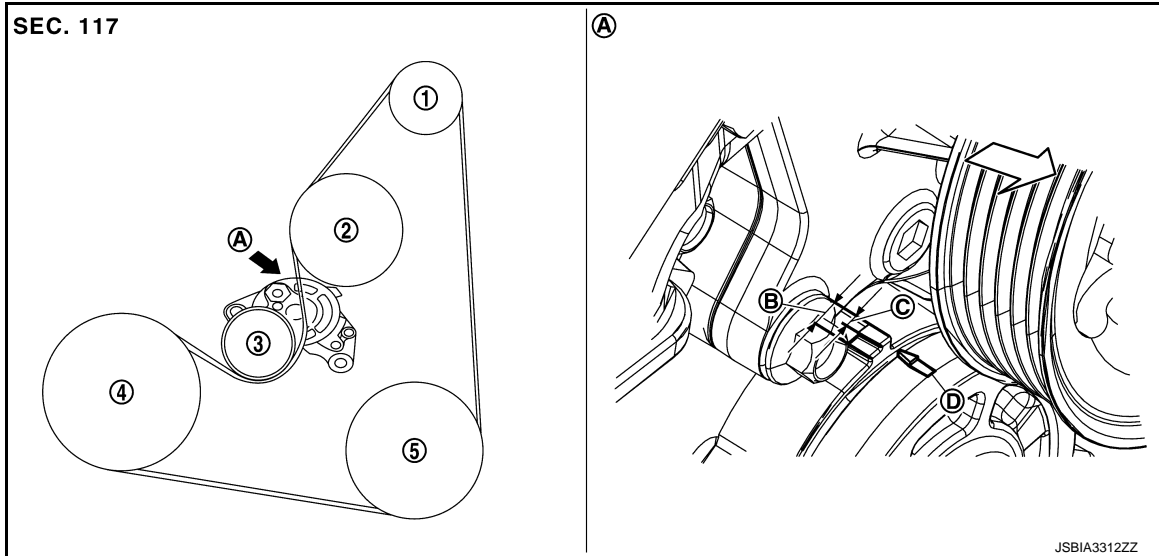
< PERIODIC MAINTENANCE >

[QR25DE]

2. Release drive belt auto-tensioner, and apply tension to drive belt.
3. Turn crankshaft pulley clockwise several times to equalize tension between each pulley.
4. Confirm the indicator is within the possible use range. Refer to [EM-167. "Inspection"](#).
5. Install the splash guard (RH). Refer to [EXT-35. "FENDER PROTECTOR : Exploded View"](#).

Inspection

INFOID:0000000010783769



- | | | |
|---------------------------------------|----------------------|--|
| ① Alternator | ② Water pump | ③ Drive belt auto tensioner |
| ④ Crankshaft pulley | ⑤ A/C compressor | |
| Ⓐ View A | Ⓑ Possible use range | Ⓒ Range when new drive belt is installed |
| Ⓓ Indicator (notch on the fixed side) | | |
| ↶ : Engine front | | |

WARNING:

Perform this step when engine is stopped.

- Check that the indicator ⑨ (notch on fixed side) of drive belt auto-tensioner is within the possible use range ⑦ in the figure.

NOTE:

- Check the drive belt auto-tensioner indication when the engine is cold.
- When new drive belt is installed, the indicator (notch on fixed side) should be within the range ⑧ in the figure.
- Visually check entire drive belt for wear, damage or cracks.
- If the indicator (notch on fixed side) is out of the possible use range or belt is damaged, replace drive belt.

Adjustment

INFOID:0000000010783770

Refer to : [EM-275. "Drive belt"](#).

AIR CLEANER FILTER

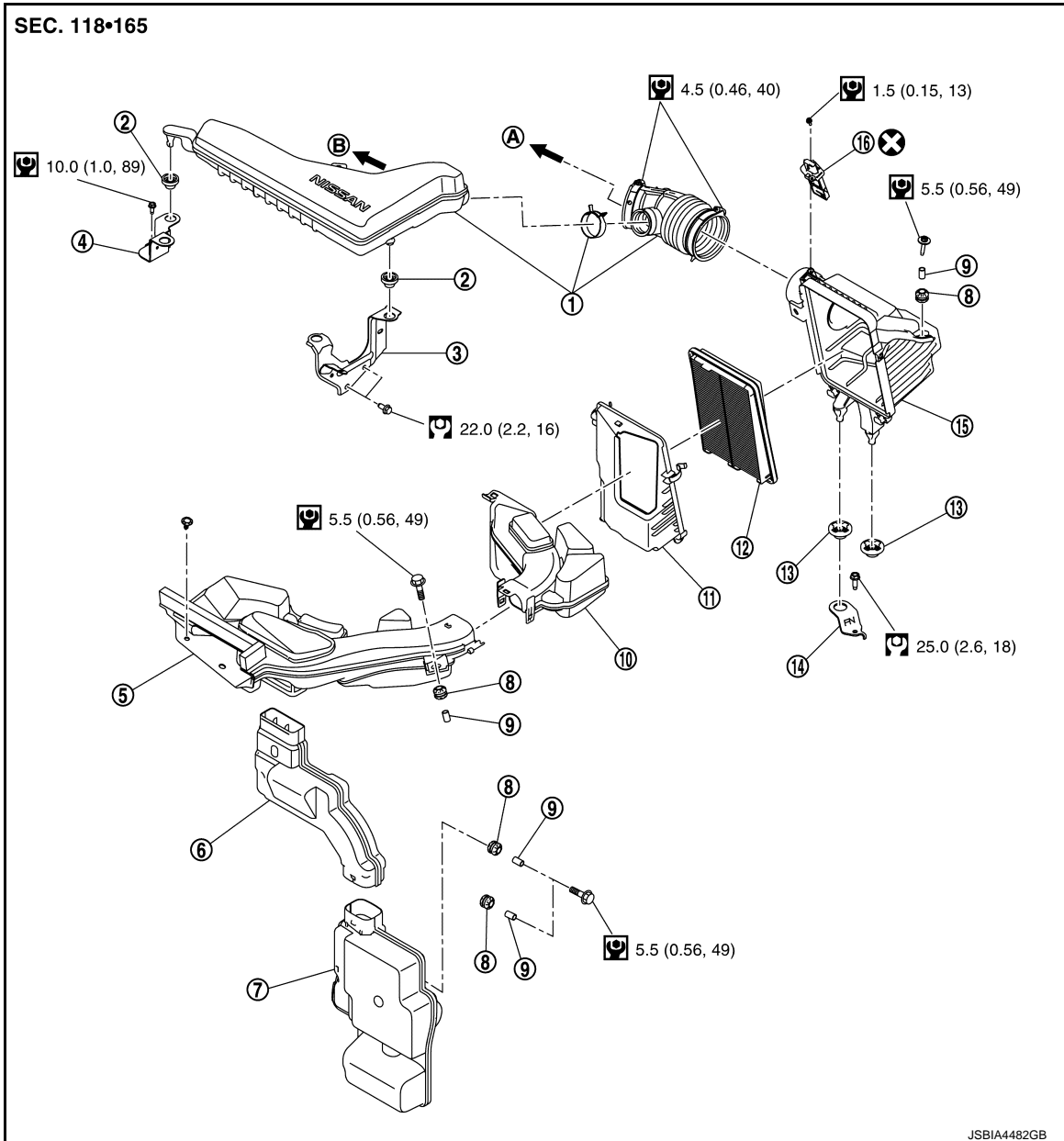
< PERIODIC MAINTENANCE >

[QR25DE]

AIR CLEANER FILTER

Exploded View

INFOID:000000010783771



- | | | |
|---|---------------------|-----------------------|
| ① Air duct assembly | ② Mounting rubber | ③ Bracket |
| ④ Bracket | ⑤ Air duct 1 | ⑥ Resonator Duct |
| ⑦ Resonator | ⑧ Mounting rubber | ⑨ Color |
| ⑩ Air duct 2 | ⑪ Air cleaner cover | ⑫ Air cleaner element |
| ⑬ Mounting rubber | ⑭ Bracket | ⑮ Air cleaner body |
| ⑯ Mass air flow sensor | | |
| (A) To electric throttle control actuator | (B) To rocker cover | |
| ⊗ : Always replace after every disassembly. | | |
| ⊙ : N·m (kg-m, in-lb) | | |
| ⊕ : N·m (kg-m, ft-lb) | | |

AIR CLEANER FILTER

< PERIODIC MAINTENANCE >

[QR25DE]

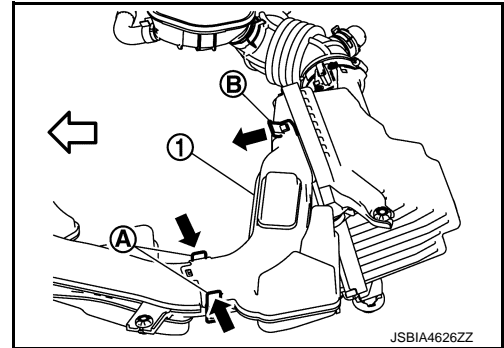
Removal and Installation

INFOID:000000010783772

REMOVAL

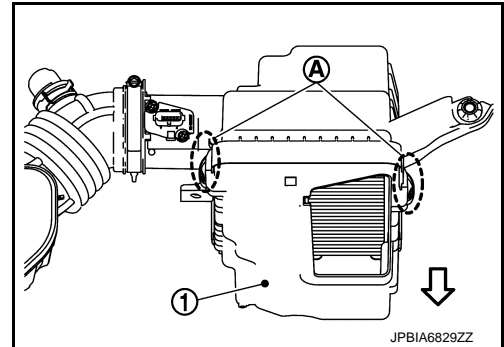
1. To remove air duct 2 ①, pinch pawl A to unlock, move pawl B frontward, and remove air duct 2 upward.

↩ : Vehicle front



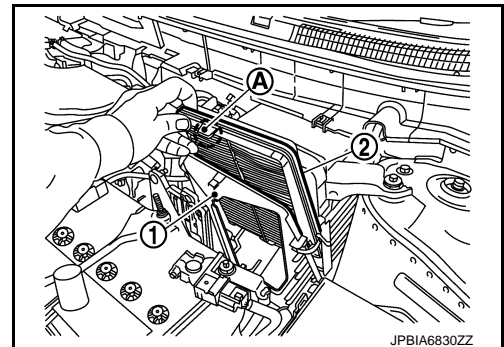
2. Remove the clips A of air cleaner cover ①.

↩ : Vehicle front



3. Shift air cleaner cover ① to car front side and remove air cleaner element ②.

A : Projection

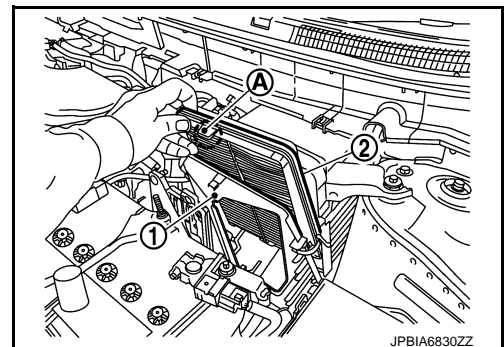


INSTALLATION

Install in the reverse order of removal.

- Insert the projection A of air cleaner element ② in such a way so that it becomes the position (upper front side of car) of illustration.

A : Projection



- Verify that there is no looseness in air cleaner cover and has been fixed accurately.

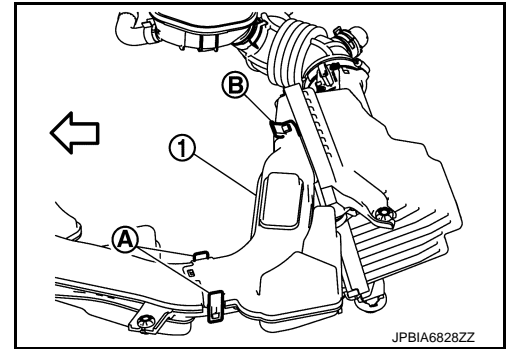
AIR CLEANER FILTER

< PERIODIC MAINTENANCE >

[QR25DE]

- Check that pawls (A) and (B) (3 in total) of air duct 2 (1) are engaged.

⇐ : Vehicle front



Inspection (Dry Paper Type)

INFOID:000000010783773

INSPECTION AFTER REMOVAL

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

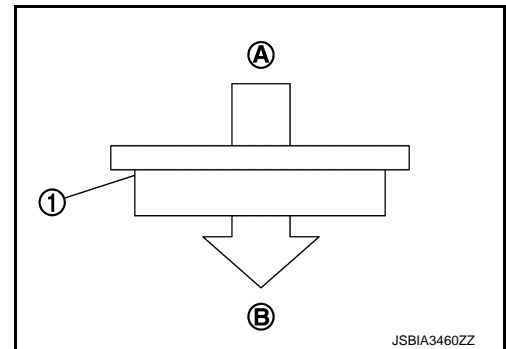
- Remove dusts (such as dead leaves) on air cleaner element surface and inside cleaner case.
- To clean air cleaner element (1), blow air on it from the air intake manifold side (A) to remove trash or dust.

(B) Ambient air side

⇐ Air blow direction

CAUTION:

- When blowing air on the air cleaner element, attach the cover to the air cleaner case and stay away from the vehicle as much as possible to prevent the entry of dirt into the air cleaner case.
- Never blow air from the ambient air side to prevent clogging. When the ambient air side needs to be cleaned, attach the cover to the intake manifold side and lightly dust by hand.



- If clogging or damage is observed, replace the air cleaner element.

MAINTENANCE INTERVAL

Refer to [MA-42, "AIR CLEANER FILTER : Inspection \(Dry Paper Type\)"](#).

SPARK PLUG

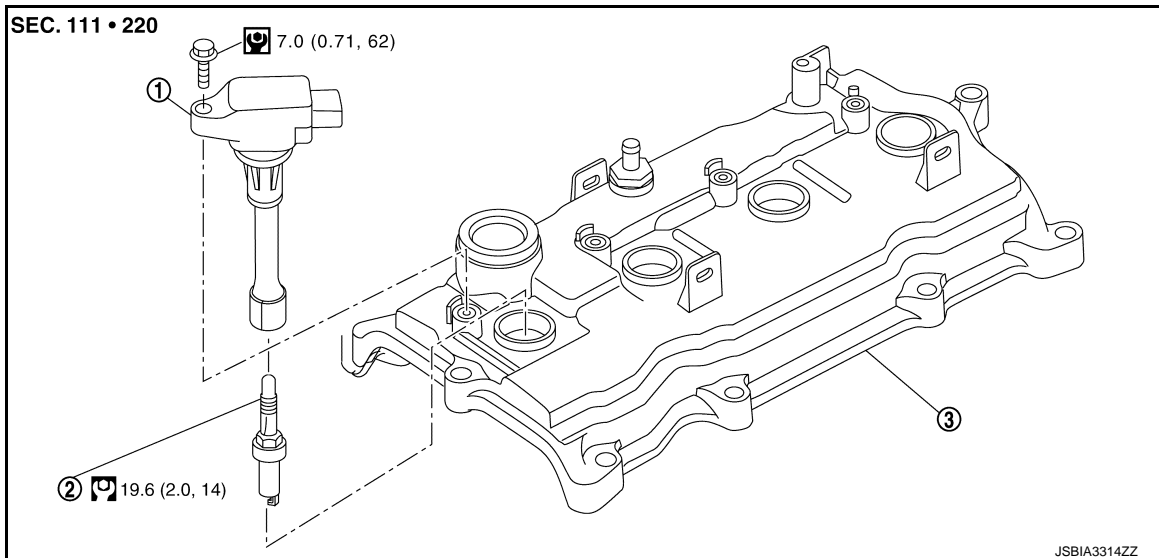
< PERIODIC MAINTENANCE >

[QR25DE]

SPARK PLUG

Exploded View

INFOID:0000000010783775



① Ignition coil

② Spark plug

③ Rocker cover

: N·m (kg-m, ft-lb)

: N·m (kg-m, in-lb)

Removal and Installation

INFOID:0000000010783776

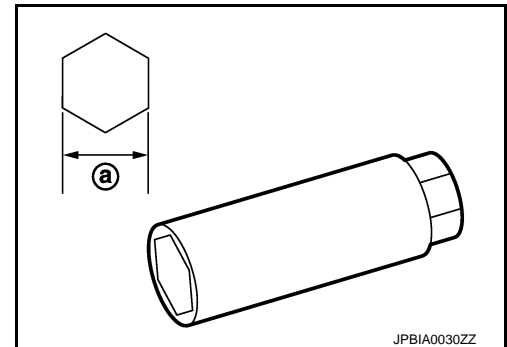
REMOVAL

1. Remove air duct assembly. Refer to [EM-174, "Exploded View"](#).
2. Remove ignition coil.
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

Install in the reverse order of removal.

Inspection

INFOID:0000000010783777

INSPECTION AFTER REMOVAL

Use standard type spark plug for normal condition.

Spark plug (standard) : Refer to [EM-275, "Spark Plug"](#).

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

SPARK PLUG

< PERIODIC MAINTENANCE >

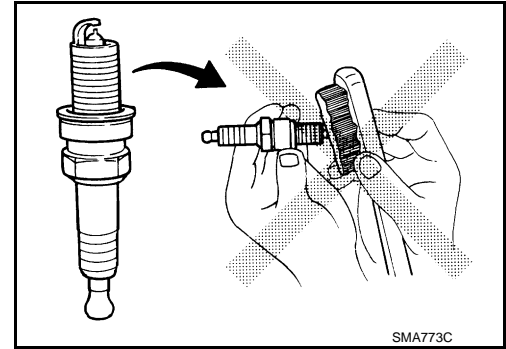
[QR25DE]

CAUTION:

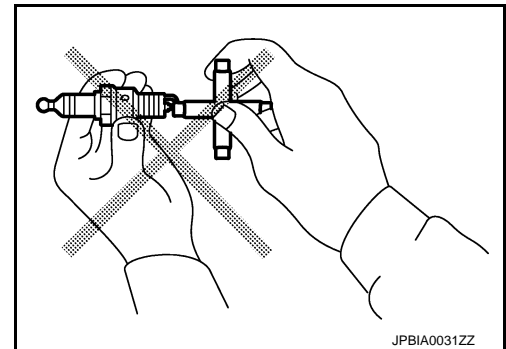
- Never drop or shock spark plug.
- Never use wire brush for cleaning.
- If plug tip is covered with carbon, spark plug cleaner may be used.

Cleaner air pressure: Less than 588 kPa (5.9 bar , 6 kg/
cm², 85 psi)

Cleaning time: Less than 20 seconds



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



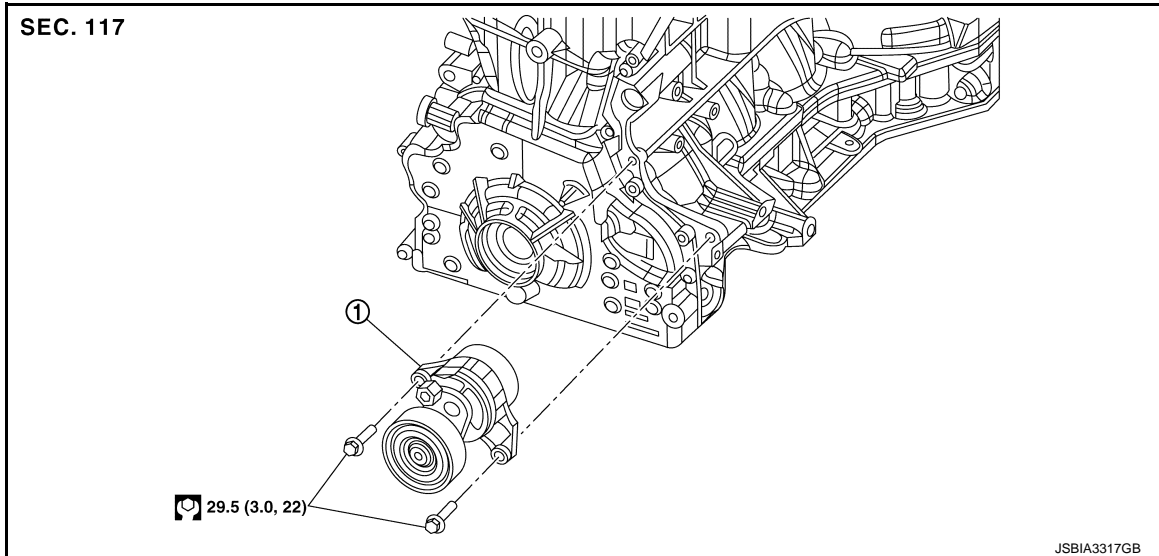
REMOVAL AND INSTALLATION

DRIVE BELT AUTO-TENSIONER

Exploded View

INFOID:0000000010783780

EM



① Drive belt auto-tensioner

: N·m (kg-m, ft-lb)

Removal and Installation

INFOID:0000000010783781

Removal

CAUTION:

The complete drive belt auto-tensioner must be replaced as a unit, including the pulley.

1. Turn the steering wheel to the right.
2. Remove the splash guard (RH). Refer to [EXT-35, "FENDER PROTECTOR : Exploded View"](#).
3. Remove the drive belt. Refer to [EM-166, "Removal and Installation"](#).
4. Remove the drive belt auto-tensioner using power tool.

Installation

Installation is in the reverse order of removal.

CAUTION:

- When installing drive belt auto-tensioner, be careful not to interfere with water pump pulley.
- Never swap the pulley between new and old drive belt auto-tensioner.

AIR CLEANER AND AIR DUCT

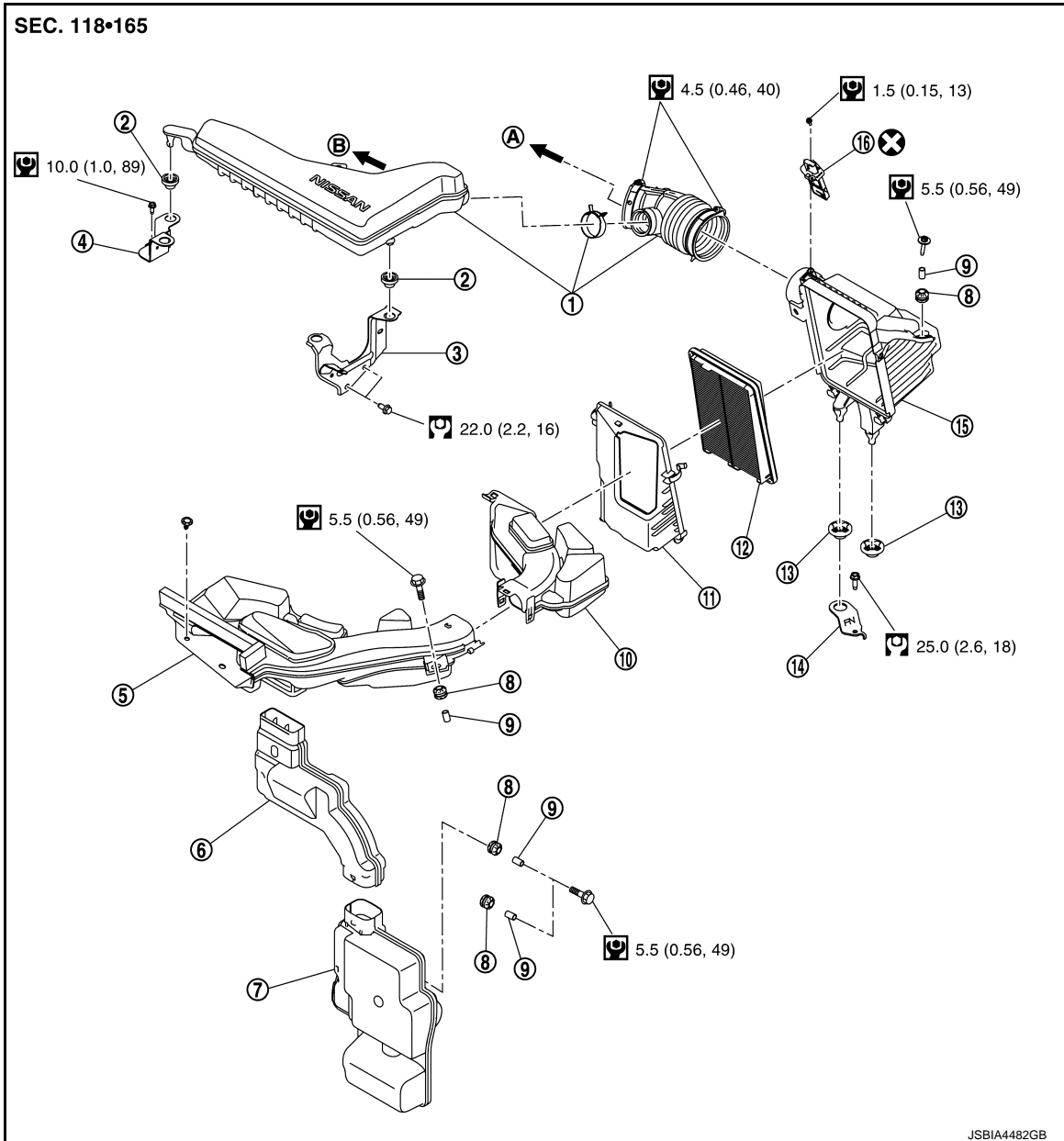
< REMOVAL AND INSTALLATION >

[QR25DE]

AIR CLEANER AND AIR DUCT

Exploded View

INFOID:000000010783782



- | | | |
|---|---------------------|-----------------------|
| ① Air duct assembly | ② Mounting rubber | ③ Bracket |
| ④ Bracket | ⑤ Air duct 1 | ⑥ Resonator Duct |
| ⑦ Resonator | ⑧ Mounting rubber | ⑨ Color |
| ⑩ Air duct 2 | ⑪ Air cleaner cover | ⑫ Air cleaner element |
| ⑬ Mounting rubber | ⑭ Bracket | ⑮ Air cleaner body |
| ⑯ Mass air flow sensor | | |
| (A) To electric throttle control actuator | (B) To rocker cover | |

⊗ : Always replace after every disassembly.

⊙ : N·m (kg-m, in-lb)

⊙ : N·m (kg-m, ft-lb)

AIR CLEANER AND AIR DUCT

< REMOVAL AND INSTALLATION >

[QR25DE]

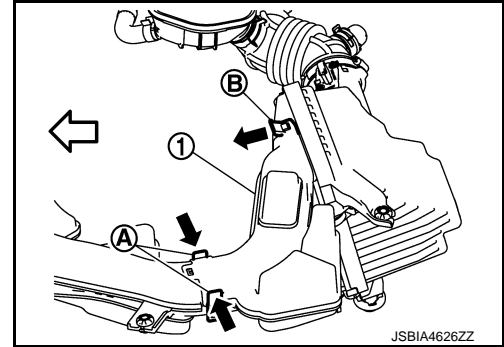
Removal and Installation

INFOID:0000000010783783

REMOVAL

1. Remove air duct 1 and 2.
 - To remove air duct 2 ①, pinch pawl (A) to unlock, move pawl (B) frontward, and remove air duct 2 ① upward.

← : Vehicle front



2. Remove battery. Refer to [PG-142, "EXCEPT FOR R9M : Removal and Installation"](#).
3. Remove battery tray. Refer to [PG-148, "EXCEPT FOR R9M : Removal and Installation"](#).
4. Disconnect air flow sensor harness connector.
5. Loosen clamp of air duct assembly.
 - During installation do paint marking.
6. Remove mass air flow sensor from air cleaner body, if necessary.
CAUTION:
Handle the mass air flow sensor with care:
 - Do not shock it.
 - Do not disassemble it.
 - Do not touch the internal sensor.
7. Remove air cleaner body with air cleaner cover.
8. Remove PCV hose.
9. Remove air duct assembly.

INSTALLATION

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

- Align marks. Attach each joint. Screw clamps firmly.

Inspection

INFOID:0000000010783784

INSPECTION AFTER REMOVAL

Inspect air duct and resonator assembly for crack or tear.

- If anything found, replace air duct assembly.

INTAKE MANIFOLD

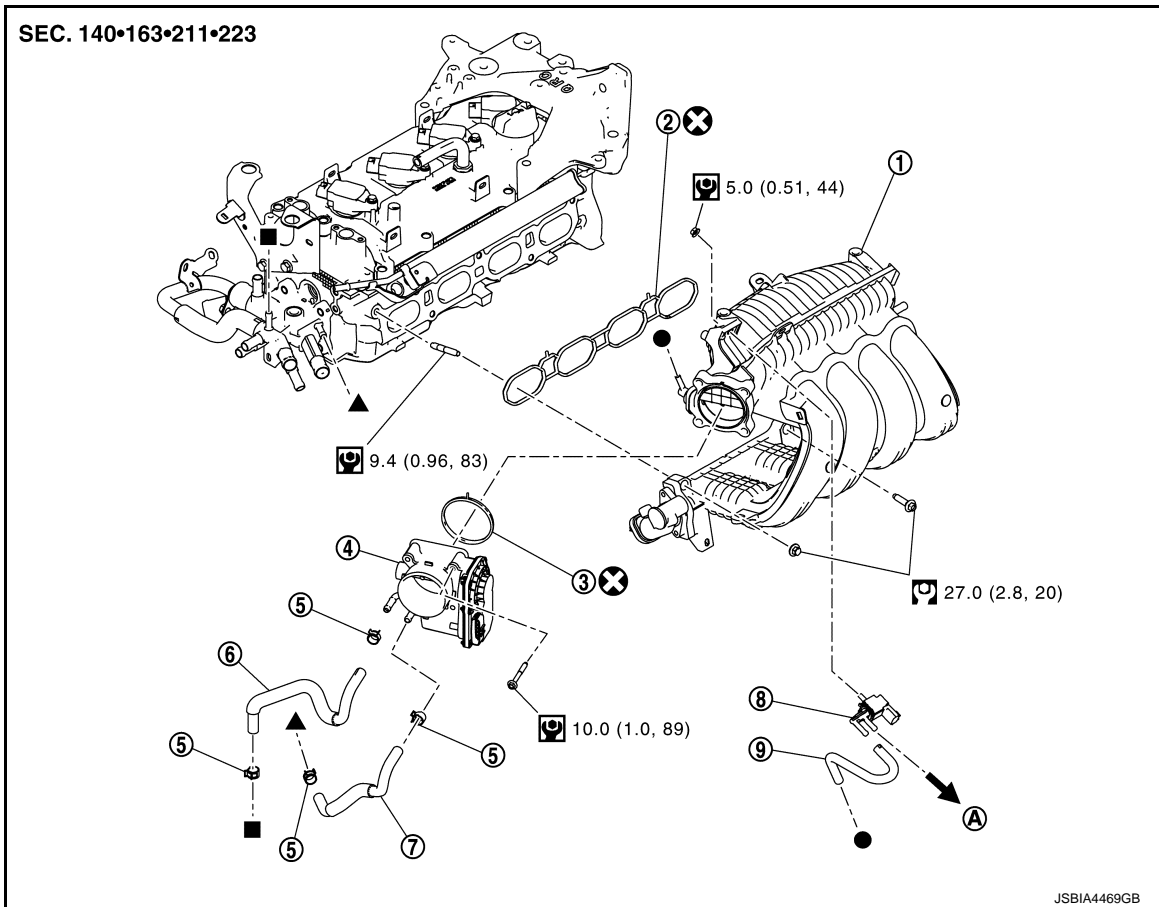
< REMOVAL AND INSTALLATION >

[QR25DE]

INTAKE MANIFOLD

Exploded View

INFOID:000000010783785



- | | | |
|--------------------------------------|---|--------------|
| ① Intake manifold | ② Gasket | ③ Gasket |
| ④ Electric throttle control actuator | ⑤ Clamp | ⑥ Water hose |
| ⑦ Water hose | ⑧ EVAP canister purge volume control solenoid valve | ⑨ EVAP hose |
| Ⓐ To vacuum pipe (canister) | Ⓑ To water outlet | |

Ⓐ : N·m (kg-m, ft-lb)

Ⓑ : N·m (kg-m, in-lb)

ⓧ : Always replace after every disassembly.

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

Removal and Installation

INFOID:000000010783786

REMOVAL

WARNING:

To avoid the danger of being scalded, never drain the coolant when the engine is hot.

NOTE:

When removing components such as hoses, tubes/lines, etc., cap or plug openings to prevent fluid from spilling.

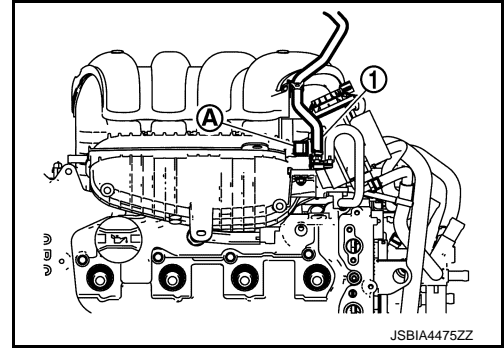
1. Remove cowl top cover and cowl top extension. Refer to [EXT-25, "Removal and Installation"](#).
2. Partially drain engine coolant. Refer to [CO-39, "Draining"](#).
3. Remove the air duct assembly. Refer to [EM-174, "Exploded View"](#).

INTAKE MANIFOLD

< REMOVAL AND INSTALLATION >

[QR25DE]

4. Disconnect the PCV hose from the intake manifold.
5. Disconnect the EVAP hose ① and EVAP canister purge volume control solenoid connector (A).



6. Disconnect the brake booster vacuum hose from the intake manifold.
7. Disconnect the water hoses from the electric throttle control actuator.

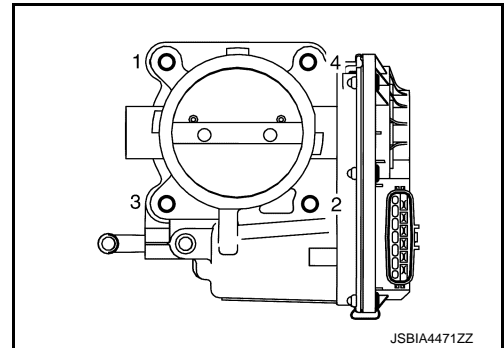
NOTE:

When removing only intake manifold, position electric throttle control actuator aside without disconnecting the water hose.

8. Loosen bolts in reverse order as shown, then remove electric throttle control actuator and gasket.

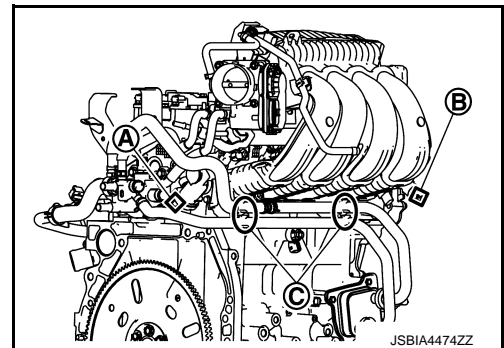
CAUTION:

Handle carefully to avoid any damage.



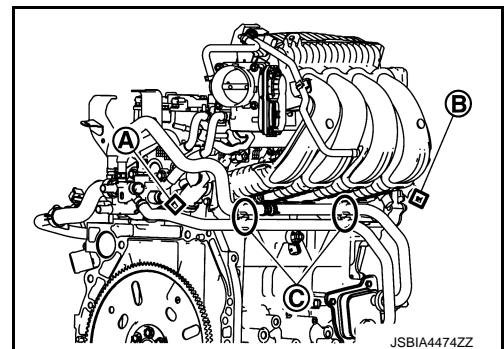
9. Disconnect electrical harness clip and harness connectors from the intake manifold runner control valve actuator (A), intake manifold runner control valve position sensor (B).

Ⓒ : Clamp



10. Disconnect oil cooler hose clamp ①.

- (A) : Intake manifold runner control valve actuator
(B) : Intake manifold runner control valve position sensor



INTAKE MANIFOLD

[QR25DE]

< REMOVAL AND INSTALLATION >

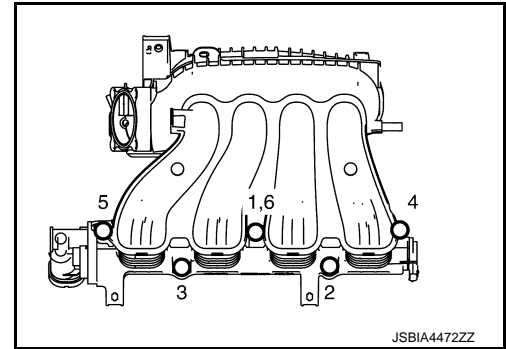
11. Remove the bolts and nuts in the reverse order shown using power tools and remove the intake manifold assembly with gasket.

CAUTION:

Cover engine openings to prevent entry of foreign materials.

NOTE:

Disregard No. 6 when loosening.



INSTALLATION

Installation is in the reverse order of removal. Follow the tightening sequences and specifications below and perform the following:

- Perform the "Throttle Valve Closed Position Learning" when harness connector of electric throttle control actuator is disconnected. Refer to [EC-554, "Work Procedure"](#).
- Perform the "Idle Air Volume Learning" and "Throttle Valve Closed Position Learning" when electric throttle control actuator is replaced. Refer to [EC-555, "Work Procedure"](#) or [EC-554, "Work Procedure"](#).

Intake Manifold

1. Securely install gasket to the mounting groove.

CAUTION:

Do not reuse gasket.

2. If studs were removed, install them and tighten to specification.

Studs : 9.4 N·m (0.96 kg-m, 83 in-lb)

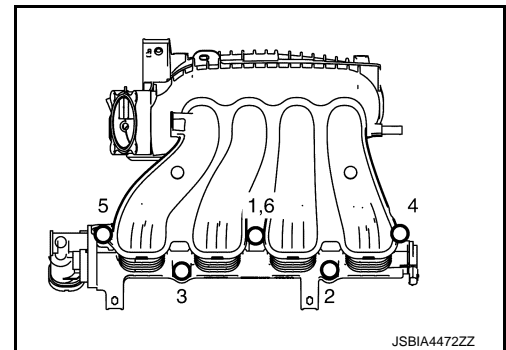
3. Tighten in numerical order as shown.

CAUTION:

After tightening the five bolts in the order shown, the 1, 6 position designates that the first bolt tightened is to be retightened to specification.

Bolts 1, 2, 3, 6 : 25.0 N·m (2.6 kg-m, 18 ft-lb)

Nuts 4, 5 : 25.0 N·m (2.6 kg-m, 18 ft-lb)



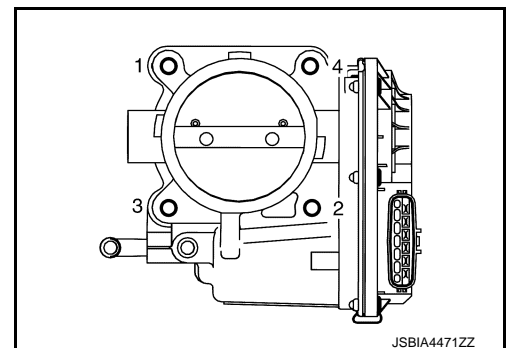
Electric Throttle Control Actuator

1. Install a new gasket on the electric throttle control actuator.

CAUTION:

Do not reuse gasket.

2. Tighten the bolts of electric throttle control actuator equally and diagonally in several steps in numerical order as shown.



Inspection

INFOID:0000000010783787

A

INSPECTION AFTER REMOVAL

1. Make sure there are no fuel leaks at connections as follows:
 - a. Apply fuel pressure to fuel lines by turning ignition switch ON (with engine stopped).Then check for fuel leaks at connections.

NOTE:

Use mirrors for checking on connections out of the direct line of sight.

- b. Start the engine and rev it up and check for fuel leaks at connections.

WARNING:

Do not touch engine immediately after stopping as engine is extremely hot.

EM

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EXHAUST MANIFOLD AND THREE WAY CATALYST

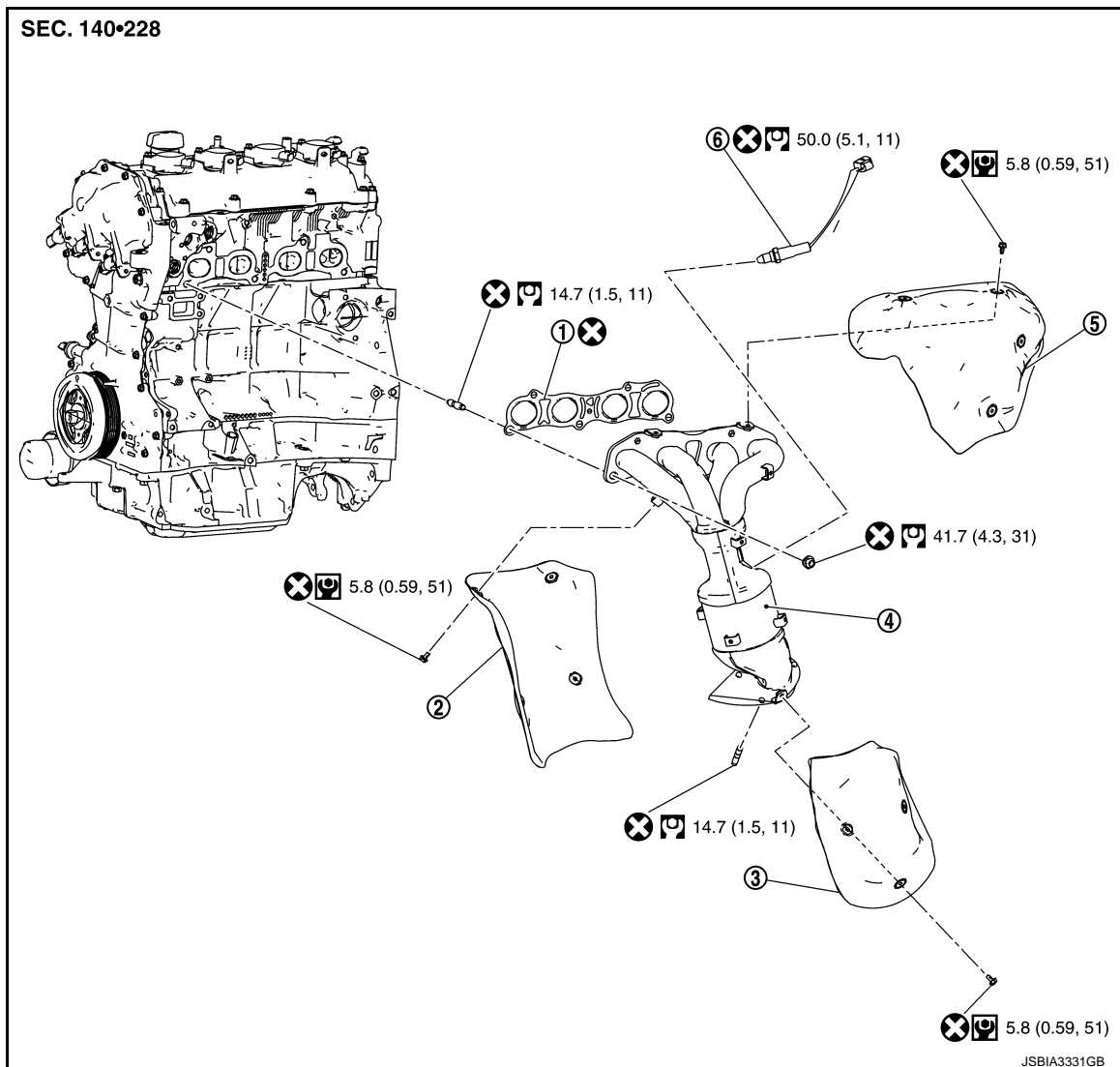
< REMOVAL AND INSTALLATION >

[QR25DE]

EXHAUST MANIFOLD AND THREE WAY CATALYST

Exploded View

INFOID:000000010783788



- | | | |
|--|----------------------------------|----------------------------------|
| ① Gasket | ② Three way catalyst cover | ③ Exhaust manifold cover (lower) |
| ④ Exhaust manifold and three way catalyst assembly | ⑤ Exhaust manifold cover (upper) | ⑥ Air fuel ratio sensor 1 |

: N·m (kg-m, ft-lb)

: N·m (kg-m, in-lb)

: Always replace after every disassembly.

Removal and Installation

INFOID:000000010783789

REMOVAL

1. Remove the engine under cover. Refer to [EXT-39, "ENGINE UNDER COVER : Exploded View"](#).
2. Remove the exhaust front tube 1. Refer to [EX-12, "Exploded View"](#).
3. Remove the air duct 1. Refer to [EM-175, "Removal and Installation"](#).
4. Remove the drive belt. Refer to [EM-166, "Removal and Installation"](#).
5. Remove the alternator. Refer to [CHG-46, "QR25DE : Removal and Installation"](#).

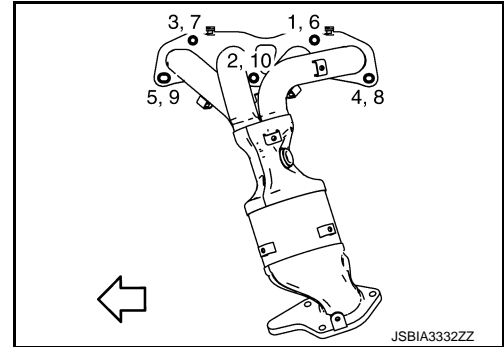
EXHAUST MANIFOLD AND THREE WAY CATALYST

[QR25DE]

< REMOVAL AND INSTALLATION >

6. Disconnect the air fuel ratio sensor 1 harness connector.
7. Remove the oil level gauge and oil level gauge guide. Refer to [EM-247, "Exploded View"](#).
8. Move the resonator of air duct assembly, set it aside.
9. Remove the exhaust manifold cover (upper).
10. Loosen the exhaust manifold and three way catalyst nuts in the reverse order as shown.

← :Engine front

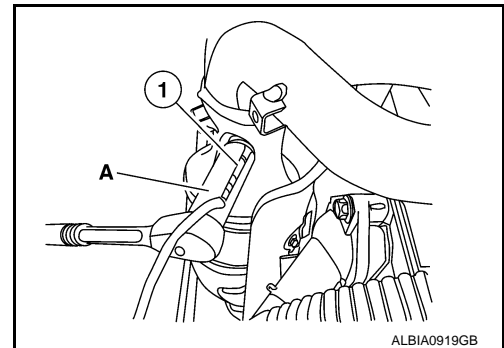


11. Remove the exhaust manifold and three way catalyst assembly and gasket. Discard the gasket.
12. Remove the exhaust manifold covers (lower) and three way catalyst cover.
13. Remove the air fuel ratio sensor 1 ① using SST (A), (if necessary).

SST numbers : KV10117100

CAUTION:

- Be careful not to damage air fuel ratio sensor.
- Discard any air fuel ratio 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; replace with a new one.



INSTALLATION

Exhaust Manifold

1. Install studs in cylinder head and exhaust manifold (if removed). Then tighten to specification.

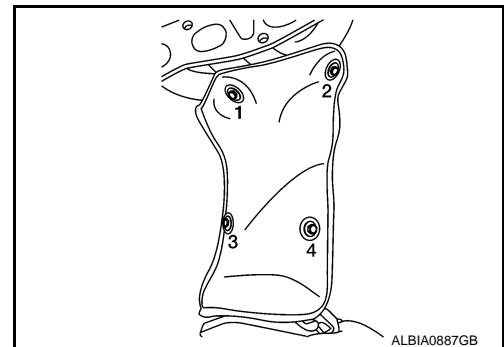
CAUTION:

Do not reuse cylinder head or exhaust manifold studs.

2. Install three way catalyst cover (if removed) and bolts. Then tighten the bolts to specification in the numerical order shown.

CAUTION:

Do not reuse bolts.



EXHAUST MANIFOLD AND THREE WAY CATALYST

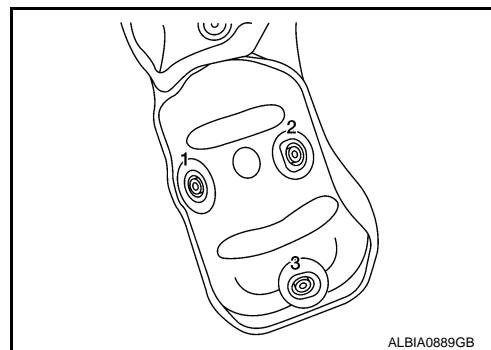
[QR25DE]

< REMOVAL AND INSTALLATION >

3. Install the exhaust manifold cover (lower) and bolts. Then tighten the bolts to specification in the numerical order shown.

CAUTION:

Do not reuse bolts.

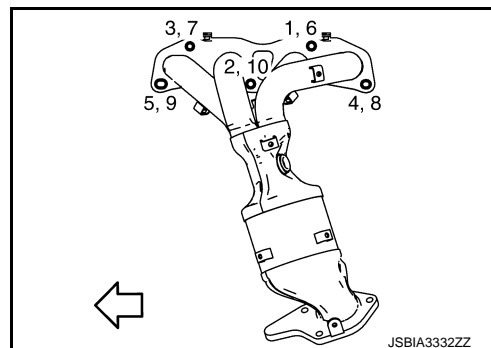


4. Install the exhaust manifold and gasket. Then tighten the nuts to specification in the numerical order shown.

CAUTION:

- Do not reuse gasket.
- Do not reuse nuts.

⇐ :Engine front

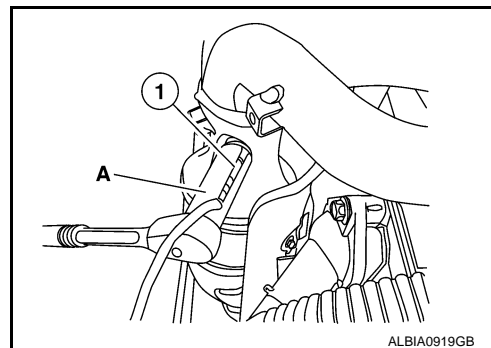


5. Install the air fuel ratio sensor 1 ① using SST (A) and tighten to specification.

SST numbers : KV10117100

CAUTION:

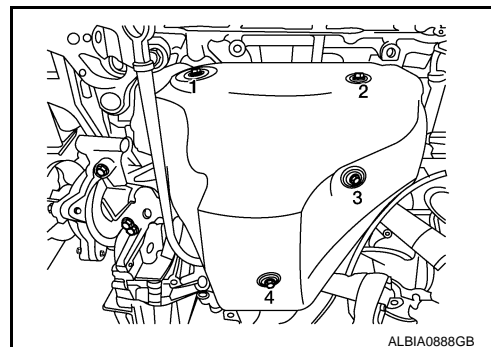
- Be careful not to damage air fuel ratio sensor.
- Discard any air fuel ratio sensor which has been dropped from a height of more than 0.5 m (19.7 in) onto a hard surface such as a concrete floor; replace with a new one.
- Do not over-tighten the air fuel ratio sensor 1. Doing so may cause damage to the air fuel ratio sensor 1, resulting in a malfunction and the MIL coming on.



6. Install the exhaust manifold cover (upper). Then tighten the bolts to specification in the numerical order shown.

CAUTION:

Do not reuse bolts.



Inspection

INFOID:000000010783790

INSPECTION AFTER REMOVAL

Surface Distortion

EXHAUST MANIFOLD AND THREE WAY CATALYST

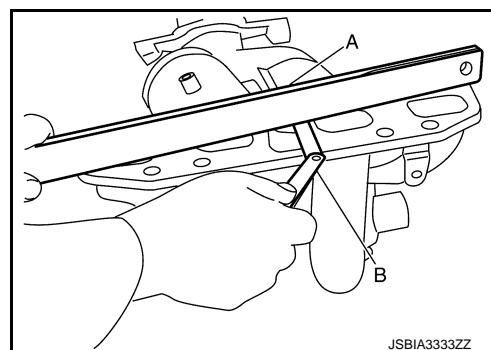
< REMOVAL AND INSTALLATION >

[QR25DE]

- Check the surface distortion of the exhaust manifold mating surface with a straightedge (A) and a feeler gauge (B).

Limit : Refer to [EM-275. "Exhaust Manifold"](#).

- If it exceeds the limit, replace exhaust manifold.



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FUEL INJECTOR AND FUEL TUBE

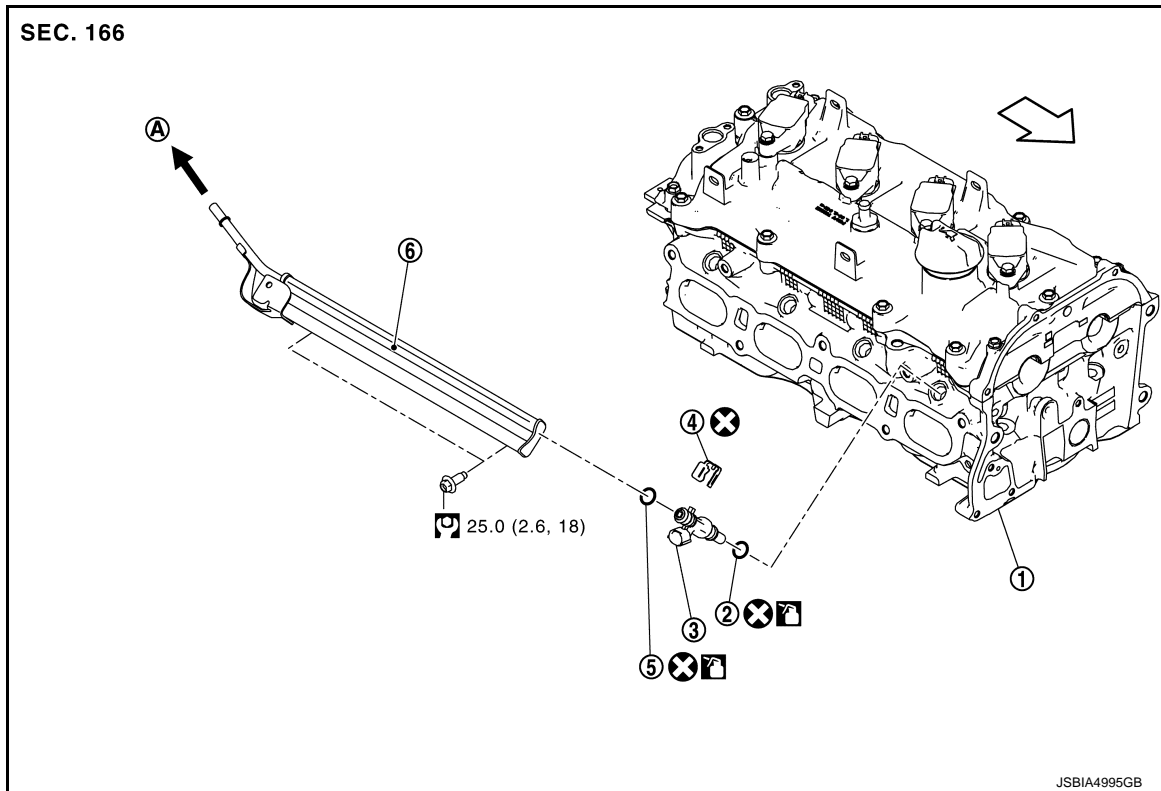
< REMOVAL AND INSTALLATION >

[QR25DE]

FUEL INJECTOR AND FUEL TUBE

Exploded View

INFOID:000000010783791



- | | | |
|-----------------|------------------|-----------------|
| ① Cylinder head | ② O-ring (green) | ③ Fuel injector |
| ④ Clip | ⑤ O-ring (black) | ⑥ Fuel tube |

Ⓐ To under floor piping

⇐ : Engine front

: N·m (kg-m, ft-lb)

: Always replace after every disassembly.

: Should be lubricated with oil.

CAUTION:

Never remove or disassemble parts unless instructed in the figure.

Removal and Installation

INFOID:000000010783792

WARNING:

- 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

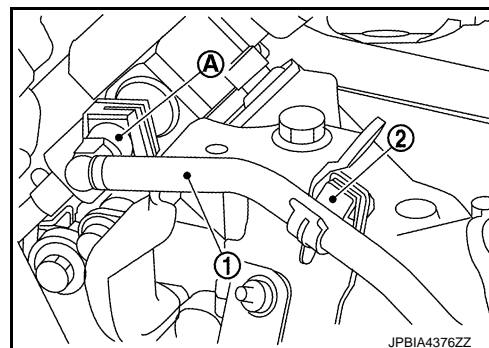
1. Release the fuel pressure. Refer to [EC-558, "Work Procedure"](#).
2. Disconnect the battery negative terminal. Refer to [PG-142, "EXCEPT FOR R9M : Removal and Installation"](#).
3. Remove intake manifold. Refer to [EM-176, "Removal and Installation"](#).

FUEL INJECTOR AND FUEL TUBE

< REMOVAL AND INSTALLATION >

[QR25DE]

4. Disconnect quick connector ① with the following procedure.
 - a. Disconnect fuel feed hose ① from bracket hose clamp ②.



- b. 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.

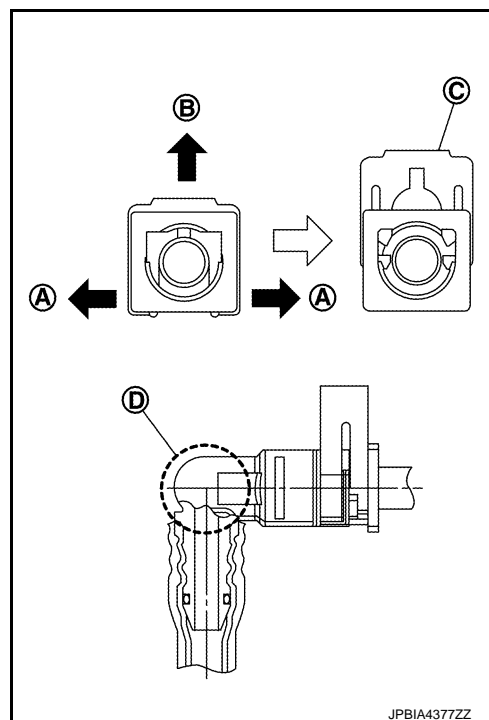
NOTE:

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

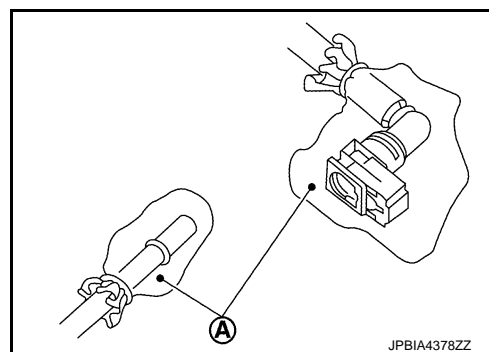
CAUTION:

- 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.

Retainer color : Red



- 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.



5. Disconnect harness connector from fuel injector.
6. Remove fuel tube and fuel injector assembly.

FUEL INJECTOR AND FUEL TUBE

< REMOVAL AND INSTALLATION >

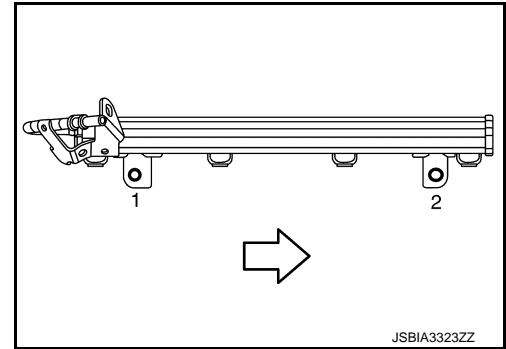
[QR25DE]

- Loosen mounting bolts in the order of 2, 1 as shown in the figure.

⇐ : Engine front

CAUTION:

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



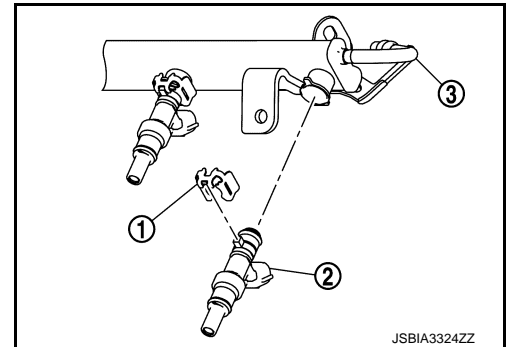
7. Remove fuel injector from fuel tube with the following procedure:

- Open and remove clip ①.
- Remove fuel injector ② from fuel tube ③ by pulling straight.

CAUTION:

- Be careful with remaining fuel that may go out from fuel tube.
- Be careful not to damage fuel injector nozzle during removal.
- Never bump or drop fuel injector.
- Never disassemble fuel injector.

- Remove O-ring.



INSTALLATION

CAUTION:

Do not reuse O-rings.

- Note the following, and install O-rings to fuel injector.

CAUTION:

- Do not reuse O-ring.
- Upper and lower O-rings are different. Be careful not to confuse them.

Fuel tube side : Black

Nozzle side : Green

- 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.
- When installing O-ring, be careful not to scratch it with tool or fingernails. Also be careful not to twist or stretch O-ring. If O-ring is stretched while installing, never insert it quickly into fuel tube.
- Insert O-ring straight into fuel tube. Never decenter or twist it.

- Install fuel injector to fuel tube with the following procedure:

FUEL INJECTOR AND FUEL TUBE

< REMOVAL AND INSTALLATION >

[QR25DE]

- a. Insert clip ② into clip mounting groove ① on fuel injector ①.

③ : O-ring (Black)

④ : O-ring (Green)

- Insert clip so that protrusion ② of fuel injector matches cut-out ③ of clip.

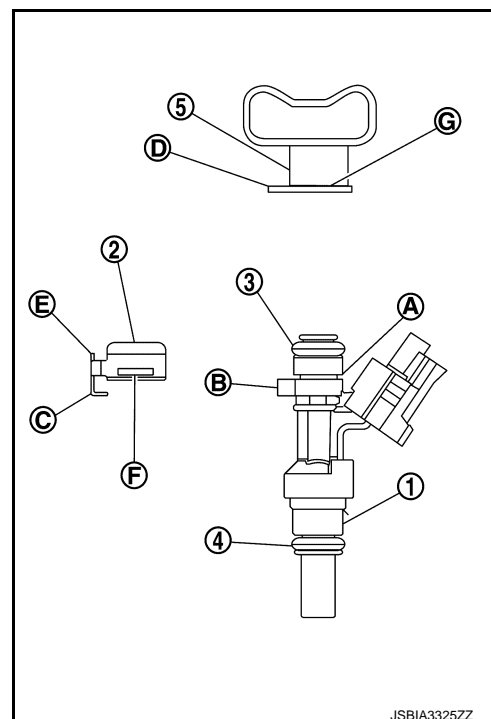
CAUTION:

- **Never reuse clip. Replace it with a new one.**
- **Be careful to keep clip from interfering with O-ring. If interference occurs, replace O-ring.**

- b. Insert fuel injector into fuel tube ⑤ with clip attached.

- Insert it while matching it to the axial center.
- Insert fuel injector so that protrusion ④ of fuel tube matches cut-out ⑤ of clip.
- Check that fuel tube flange ⑥ is securely fixed in flange fixing groove ⑦ on clip.

- c. Check that installation is complete by checking that fuel injector does not rotate or come off.



3. Set fuel tube and fuel injector assembly at its position for installation on cylinder head.

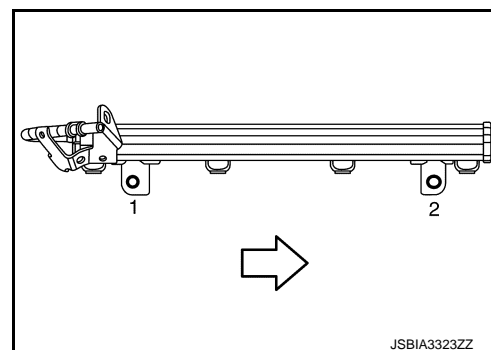
CAUTION:

For installation, be careful not to interfere with fuel injector nozzle.

4. Install fuel tube and injector assembly onto cylinder.

- Tighten mounting bolts in the order of 1, 2 as shown in the figure.

↩ : Engine front



5. Connect harness connector to fuel injector.

6. Connect fuel feed hose with the following procedure, and then install the fuel feed hose.

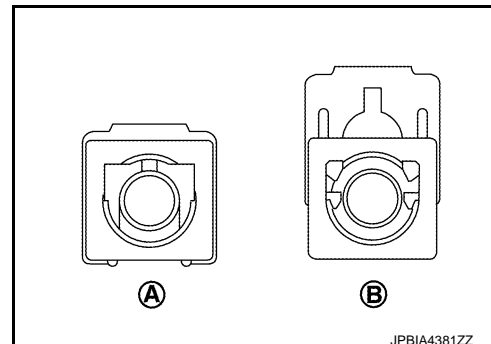
- Check no foreign substances are deposited in and around matching pipe and quick connector, and no damage on them.
- Quick connector shall be inserted gradually, aligning with the axis of the matching pipe.
- Insert the retainer until it clicks and check the retainer is locked. After insertion, pull the connector and check that the connector is locked.

① : Lock position

② : 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.

7. Install intake manifold. Refer to [EM-176, "Exploded View"](#).

Inspection

INFOID:0000000010783793

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 leaks 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 leaks at connection points.

CAUTION:

Never touch the engine immediately after stopped, as the engine becomes extremely hot.

IGNITION COIL, SPARK PLUG AND ROCKER COVER

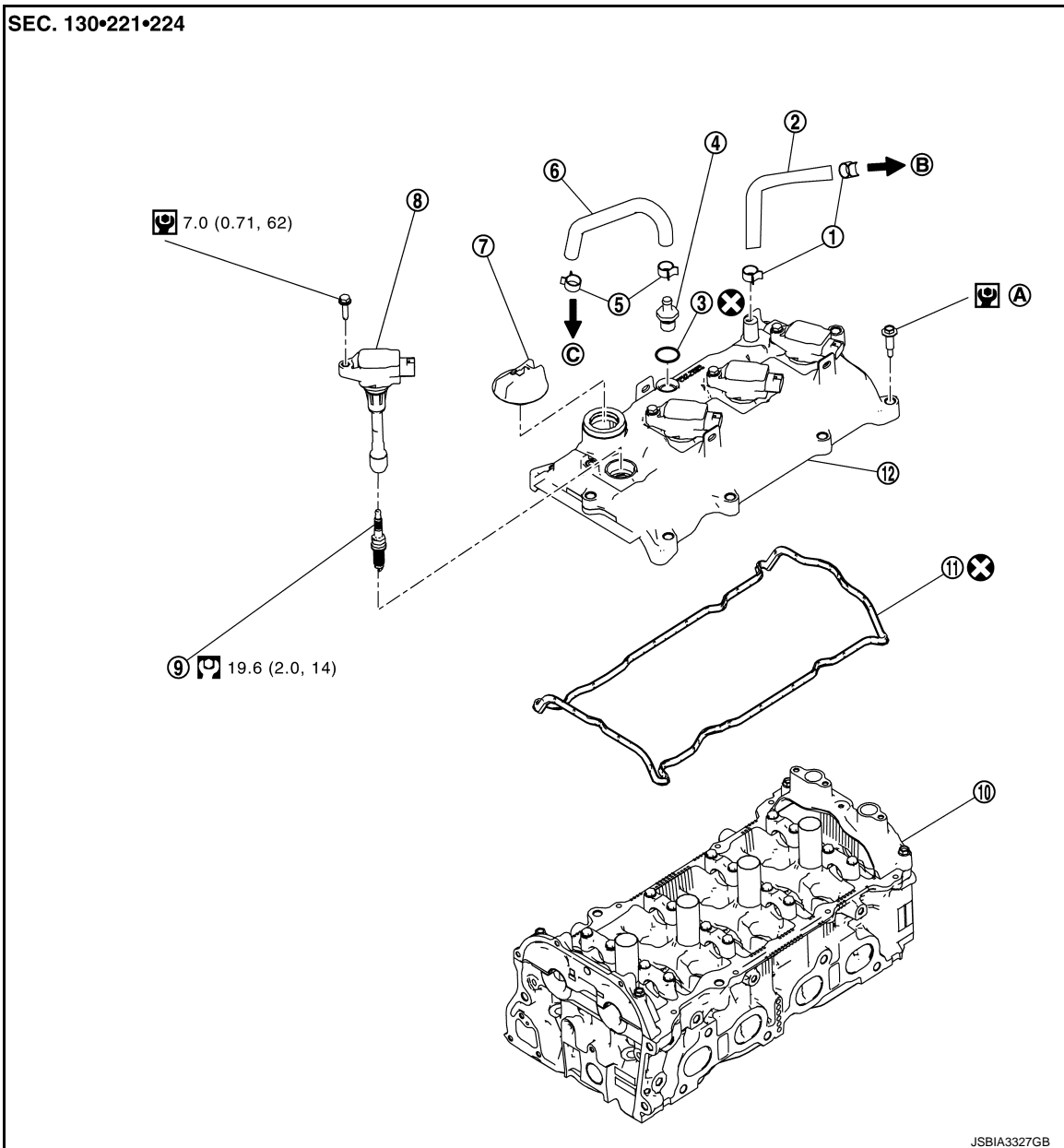
< REMOVAL AND INSTALLATION >

[QR25DE]

IGNITION COIL, SPARK PLUG AND ROCKER COVER

Exploded View

INFOID:000000010783794



- | | | |
|---|--------------------------|------------------------|
| ① Clamp | ② Blow-by hose | ③ O-ring |
| ④ PCV valve | ⑤ Clamp | ⑥ PCV valve hose |
| ⑦ Oil filler cap | ⑧ Ignition coil | ⑨ Spark plug |
| ⑩ Camshaft position sensor bracket | ⑪ Rocker cover gasket | ⑫ Rocker cover |
| (A) Comply with the assembly procedure when tightening. Refer to EM-190 | (B) To air duct assembly | (C) To intake manifold |

: N·m (kg-m, ft-lb)

: N·m (kg-m, in-lb)

: Always replace after every disassembly.

IGNITION COIL, SPARK PLUG AND ROCKER COVER

< REMOVAL AND INSTALLATION >

[QR25DE]

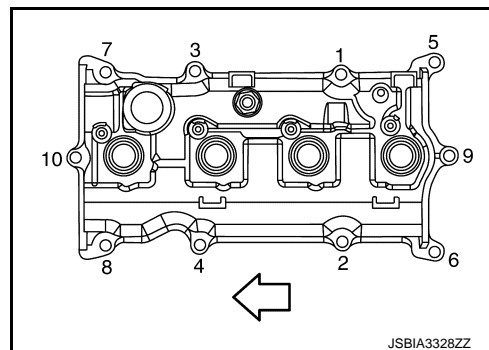
Removal and Installation

INFOID:000000010783795

REMOVAL

1. Disconnect the battery negative terminal. Refer to [PG-142, "EXCEPT FOR R9M : Removal and Installation"](#).
2. Remove the engine under cover. Refer to [EXT-39, "ENGINE UNDER COVER : Exploded View"](#).
3. Remove the air duct assembly. Refer to [EM-174, "Exploded View"](#).
4. Remove the intake manifold. Refer to [EM-176, "Removal and Installation"](#).
5. Support the engine using a suitable jack.
6. Remove harness grounds from the top of the engine mount block bracket.
7. Remove engine mounting parts. Refer to [EM-200, "Exploded View"](#).
 - Torque rod (RH)
 - Engine mounting insulator (RH)
 - Engine mounting block bracket
8. Disconnect the PCV hose.
9. Remove the ignition coils. Refer to [EM-189, "Exploded View"](#).
10. Loosen the bolts in the numerical order as shown using power tool.

⇐ : Engine front



11. Remove the rocker cover and the rocker cover gasket. Discard the rocker cover gasket.

CAUTION:

Do not reuse the rocker cover gasket.

12. Remove the oil filler cap, (if necessary).

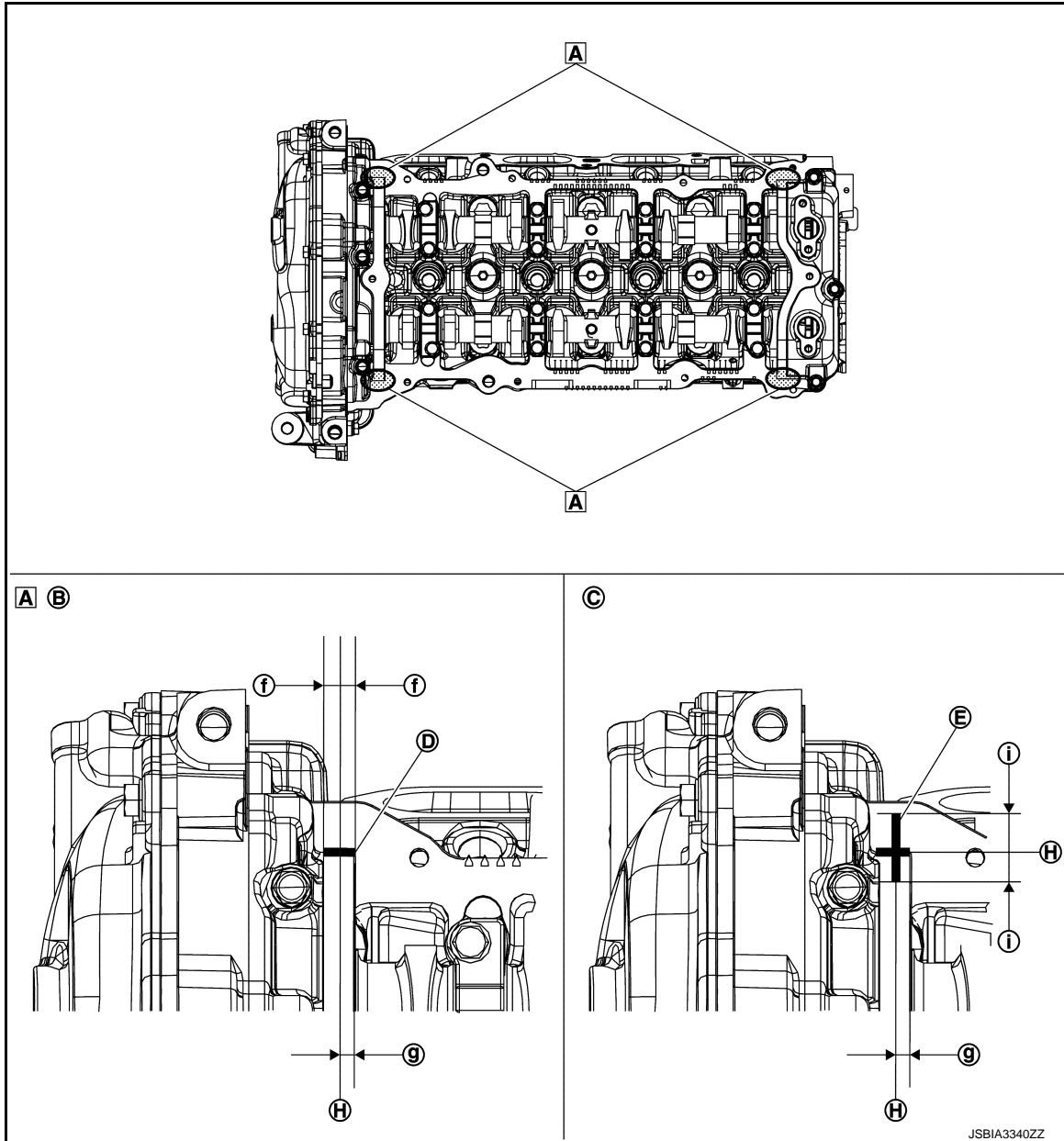
INSTALLATION

IGNITION COIL, SPARK PLUG AND ROCKER COVER

< REMOVAL AND INSTALLATION >

[QR25DE]

1. Apply liquid gasket to the position shown **A** with the following procedure:



- a. Refer to figure **B** to apply liquid gasket **D** to joint part of camshaft bracket (No. 1) and cylinder head.
- b. Refer to figure **C** to apply liquid gasket **E** in 90 degrees to figure **B**.

Use Genuine Liquid Gasket (Three Bond 1217H) or equivalent.

CAUTION:

Attaching should be done within 5 minutes after liquid gasket application.

- f** : {5 mm (0.39 in), ϕ 3 mm (0.12 in)} from the liquid gasket application center point.
- g** : Liquid gasket application center point is 4 mm (0.16 in) from the edge of camshaft bracket surface.
- H** : Liquid gasket application center point
- i** : {10 mm (0.20 in), ϕ 3 mm (0.12 in)} from the liquid gasket application center point.

- c. Apply liquid gasket to joint part of camshaft position sensor bracket and cylinder head, same as step (a) and (b).

2. Install rocker cover gasket to rocker cover.

NOTE:

The rocker cover gasket must be securely installed in the groove in the rocker cover.

IGNITION COIL, SPARK PLUG AND ROCKER COVER

< REMOVAL AND INSTALLATION >

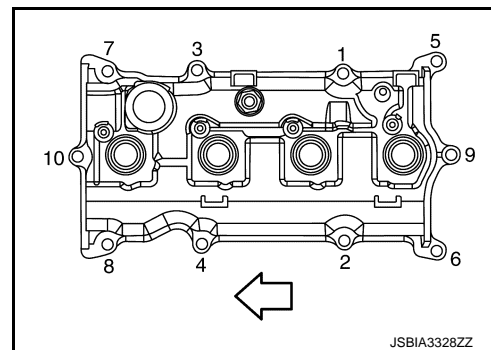
[QR25DE]

3. Install the rocker cover and rocker cover gasket onto the cylinder head.
4. Tighten the rocker cover bolts to specification in two steps in the order shown.

⇐ :Engine front

Step 1 : 1.96 N·m (0.20 kg-m, 17 in-lb)

Step 2 : 8.33 N·m (0.85 kg-m, 74 in-lb)



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

OIL PAN (LOWER)

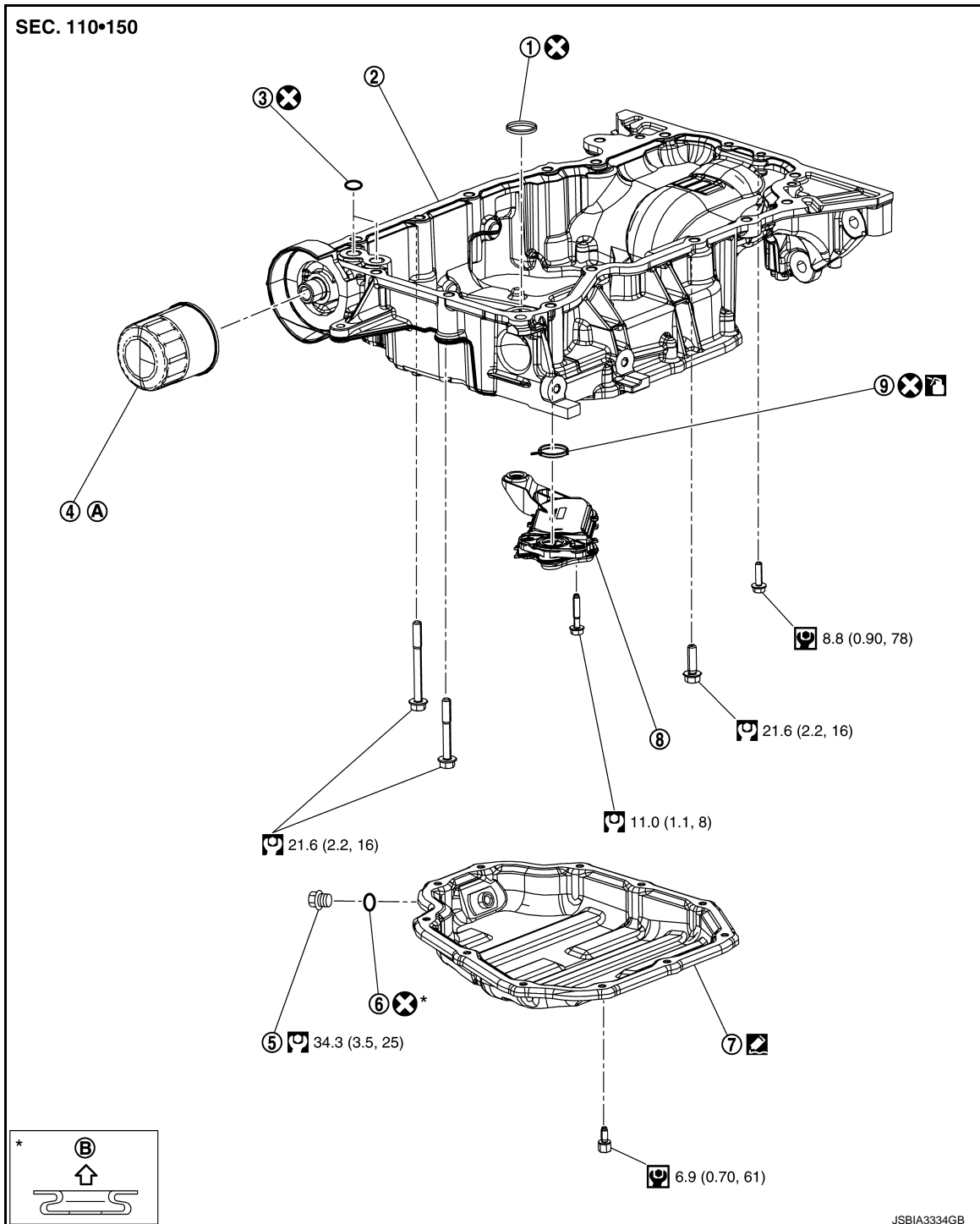
< REMOVAL AND INSTALLATION >

[QR25DE]

OIL PAN (LOWER)

Exploded View

INFOID:0000000010783796



- | | | |
|-------------------|-------------------|---------------------|
| ① O-ring | ② Oil pan (upper) | ③ O-ring |
| ④ Oil filter | ⑤ Drain plug | ⑥ Drain plug washer |
| ⑦ Oil pan (lower) | ⑧ Oil strainer | ⑨ O-ring |

Comply with the installation procedure when tightening. Refer to [EM-194](#).
"Removal and Installation"

(B) Oil pan side

OIL PAN (LOWER)

< REMOVAL AND INSTALLATION >

[QR25DE]



: 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:0000000010783797

REMOVAL

WARNING:

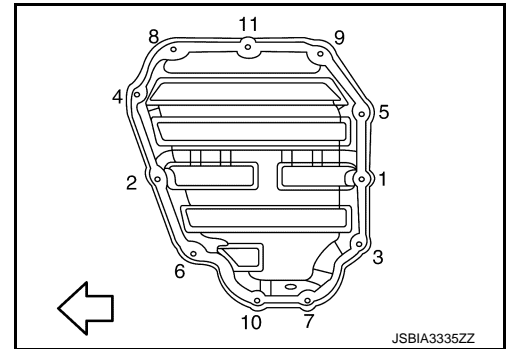
To avoid the danger of being scalded, never drain the engine oil when the engine is hot.

NOTE:

When removing oil pan (lower) only, take step 2 and 3.

1. Remove under cover.
2. Drain engine oil. Refer to [LU-26, "Draining"](#).
3. Remove oil pan (lower) with the following procedure:
 - a. Loosen mounting bolts in reverse order as shown in the figure.

← : Engine front

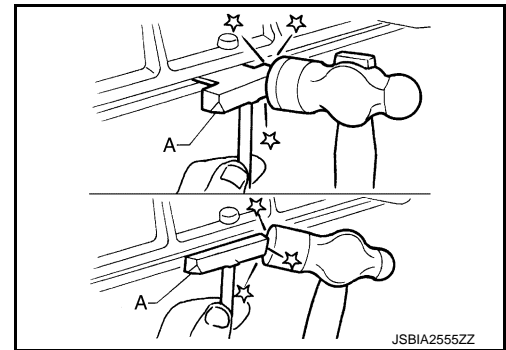


JSBIA3335ZZ

- b. Insert seal cutter [SST:KV10111100] (A) between oil pan (upper) and oil pan (lower).

CAUTION:

Be careful not to damage the mating surface.



JSBIA2555ZZ

INSTALLATION

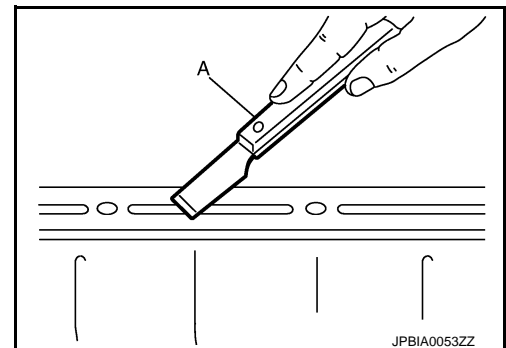
CAUTION:

Do not reuse drain plug washer.

1. Install oil pan (lower) with the following procedure:
 - a. Use a scraper (A) to remove old liquid gasket from mating surfaces.
 - Also remove old liquid gasket from mating surface of oil pan (upper).
 - Remove old liquid gasket from the bolt holes and threads.

CAUTION:

Never scratch or damage the mating surface when cleaning off liquid gasket.



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OIL PAN (LOWER)

< REMOVAL AND INSTALLATION >

[QR25DE]

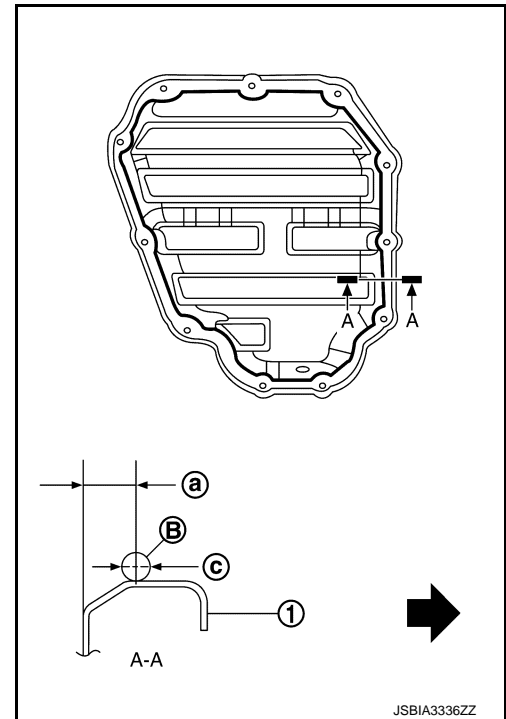
- b. Apply a continuous bead of liquid gasket (B) with a tube presser (commercial service tool) as shown in the figure.

- ① : Oil pan (lower)
- (a) : 7.5 - 9.5 mm (0.295 - 0.374 in)
- (C) : ϕ 4.0 - 5.0 mm (0.157 - 0.197 in)
- ← : Engine outside

Use Genuine Liquid Gasket or equivalent.

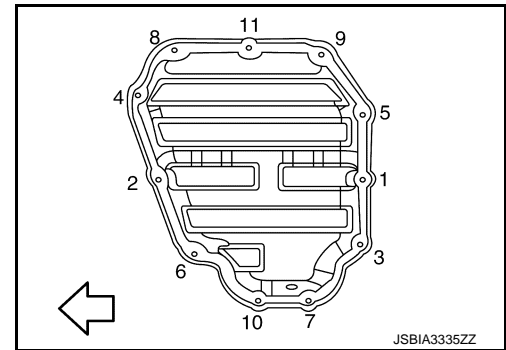
CAUTION:

Attaching should be done within 5 minutes after liquid gasket application.



- c. Tighten bolts in numerical order as shown in the figure.

- ← : Engine front



2. Install oil pan drain plug.
- Refer to the figure of components of former page for installation direction of washer. Refer to [EM-193](#), "[Exploded View](#)".

CAUTION:

Do not reuse drain plug washer.

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

NOTE:

Pour engine oil at least 30 minutes after oil pan is installed.

Inspection

INFOID:0000000010783798

INSPECTION AFTER INSTALLATION

1. Check engine oil level and adjust engine oil. Refer to [LU-25](#), "[Inspection](#)".
2. Start engine, and check there is no leaks of engine oil.
3. Stop engine and wait for 10 minutes.
4. Check engine oil level again. Refer to [LU-25](#), "[Inspection](#)".

OIL SEAL

VALVE OIL SEAL

VALVE OIL SEAL : Removal and Installation

INFOID:0000000010783799

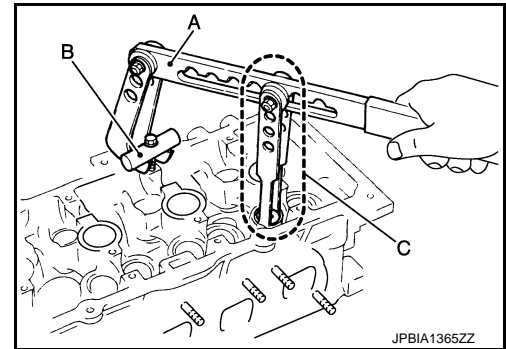
REMOVAL

1. Remove camshafts. Refer to [EM-221, "Exploded View"](#).
2. Remove valve lifters. Refer to [EM-221, "Exploded View"](#).
3. Rotate crankshaft, and set piston whose valve oil seal is to be removed to TDC. This will prevent valve from dropping into cylinder.

CAUTION:

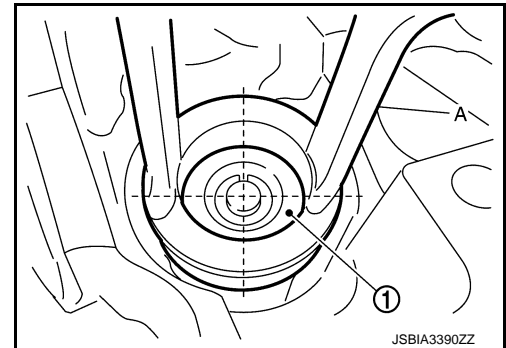
When rotating crankshaft, be careful to avoid scarring front cover with timing chain.

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

**CAUTION:**

- Be careful not to damage valve lifter holes.
- Install Tool (A) in the center of valve spring retainer to press it.

① : Valve spring retainer

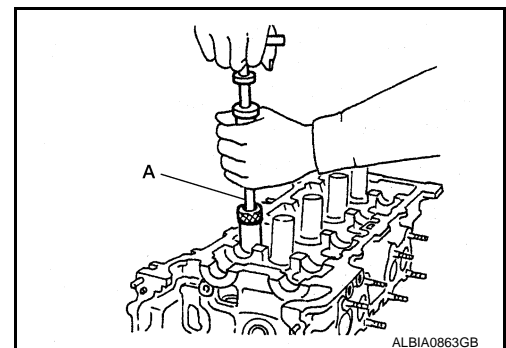


5. Remove valve spring retainer and valve spring (with valve spring seat).

CAUTION:

Never remove valve spring seat from valve spring.

6. Remove valve oil seal with a valve oil seal puller [SST: KV10107902] (A).



INSTALLATION

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

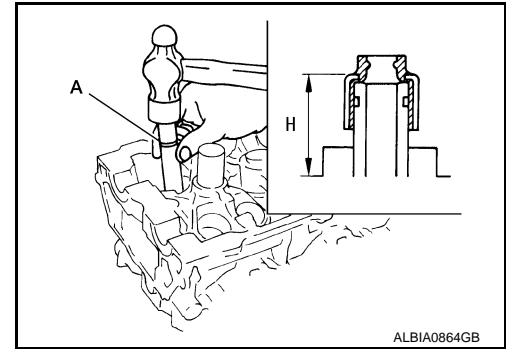
OIL SEAL

< REMOVAL AND INSTALLATION >

[QR25DE]

- Press in valve oil seal to the height "H" shown in the figure with a valve oil seal drift [SST: KV10115600] (A).

Height "H" : 11.8 - 12.4 mm (0.465 - 0.488 in)



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

FRONT OIL SEAL

FRONT OIL SEAL : Removal and Installation

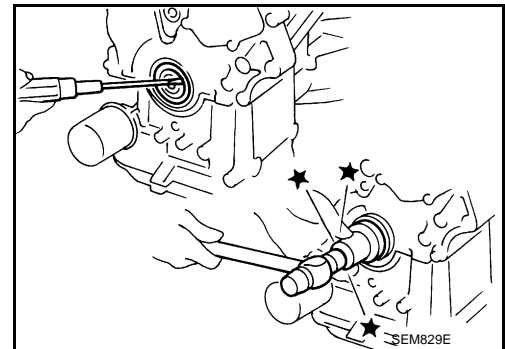
INFOID:0000000010783800

REMOVAL

- Remove the following parts.
 - Front fender protector: Refer to [EXT-35, "FENDER PROTECTOR : Exploded View"](#).
 - Drive belt: Refer to [EM-166, "Removal and Installation"](#).
 - Crankshaft pulley: Refer to [EM-210, "Exploded View"](#).
- Remove front oil seal with a suitable tool.

CAUTION:

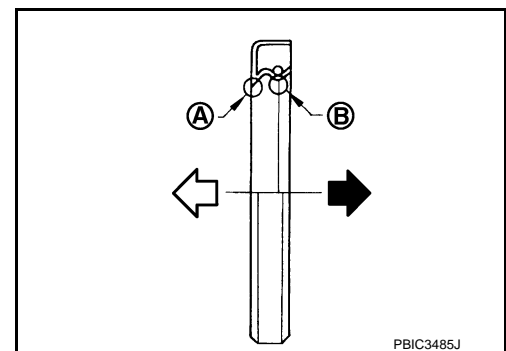
Be careful not to damage front cover and crankshaft.



INSTALLATION

- Apply new engine oil to seal lip.
- Install front oil seal so that each seal lip is oriented as shown in the figure.

- Ⓐ : Dust seal lip
Ⓑ : Oil seal lip
⇐ : Engine outside
➡ : Engine inside



OIL SEAL

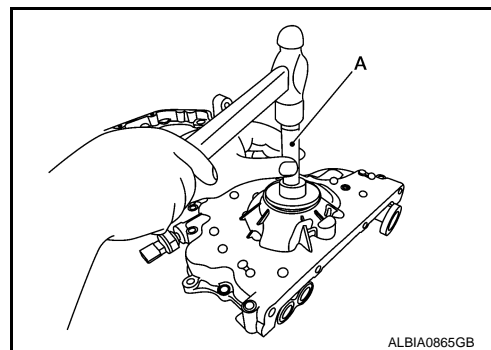
< REMOVAL AND INSTALLATION >

[QR25DE]

- Press-fit front oil seal until it is flush with front end surface of front cover using a suitable drift (A) with outer diameter 56 mm (2.20 in) and inner diameter 48 mm (1.89 in).

CAUTION:

- **Be careful not to damage front cover and crankshaft.**
- **Press-fit oil seal straight to avoid causing burrs or tilting.**
- **Never touch the grease applied to the oil seal lip.**



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

REAR OIL SEAL

REAR OIL SEAL : Removal and Installation

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REMOVAL

1. Remove the engine and transaxle. Refer to [EM-200, "Removal and Installation"](#).
2. Separate engine from transaxle.
3. Remove drive plate. Refer to [EM-208, "Exploded View"](#).
4. Remove rear oil seal with a suitable tool.

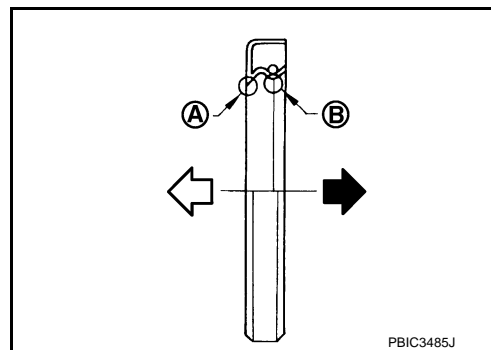
CAUTION:

Be careful not to damage crankshaft and cylinder block.

INSTALLATION

1. Apply new engine oil to seal lip.
2. Install rear oil seal so that each seal lip is oriented as shown in the figure.

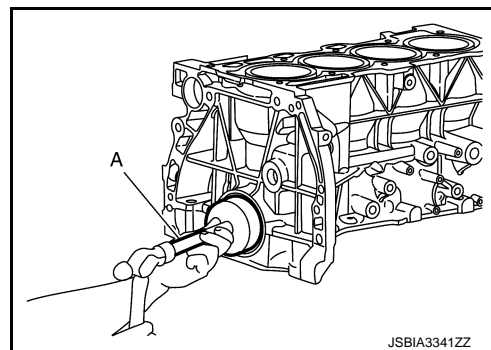
- Ⓐ : Dust seal lip
Ⓑ : Oil seal lip
⇐ : Drive plate side
➡ : Engine front



- Press-fit rear oil seal with a suitable drift (A) [outer diameter 102 mm (4.02 in), inner diameter 86 mm (3.39 in)].

CAUTION:

- **Be careful not to damage crankshaft and cylinder block.**
- **Press-fit oil seal straight to avoid causing burrs or tilting.**



OIL SEAL

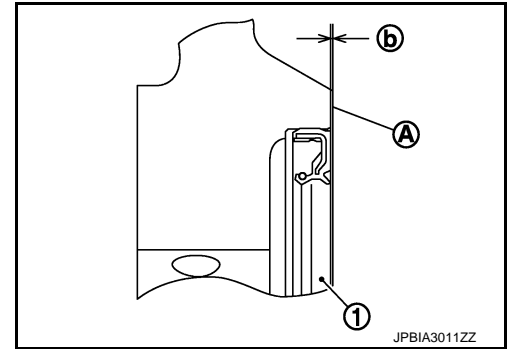
< REMOVAL AND INSTALLATION >

[QR25DE]

- Press in the new rear oil seal ① to the position ② shown in the figure.

Ⓐ : Rear surface of cylinder block

② : **0 - 0.5 mm (0 - 0.020 in)**



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

A

EM

C

D

E

F

G

H

I

J

K

L

M

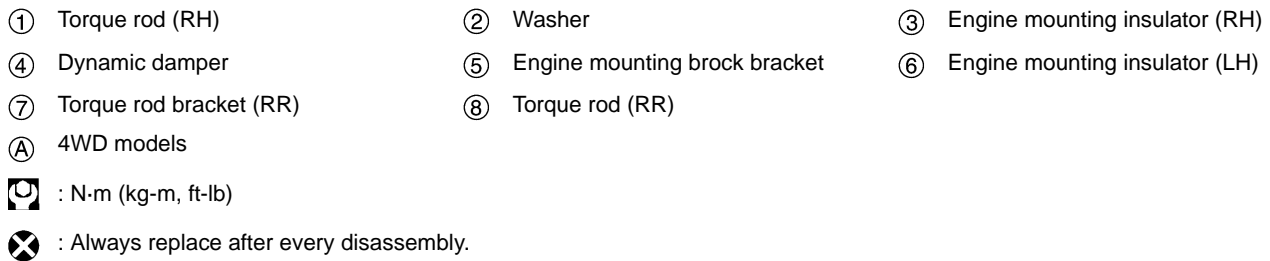
N

O

P

Exploded View

INFOID:0000000010783802



INFOID:0000000010783803

- **Situate the vehicle on a flat and solid surface.**
- **Place chocks at front and back of rear wheels.**
- **Attach proper slingers and bolts described in PARTS CATALOG if engine slingers are not equipped.**

CAUTION:

ENGINE ASSEMBLY

< UNIT REMOVAL AND INSTALLATION >

[QR25DE]

- Always be careful to work safely, avoid forceful or uninstructed operations.
- Never start working until exhaust system and 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 best you can. If board-on type is used for unavoidable reasons, support at the rear axle jacking point with a 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-31, "Garage Jack and Safety Stand and 2-Pole Lift"](#).

NOTE:

When removing components such as hoses, tubes/lines, etc., cap or plug openings to prevent fluid from spilling.

REMOVAL

Outline

Remove the engine and the transaxle assembly from the vehicle downward. Separate the engine and the transaxle.

Preparation

1. Release fuel pressure. Refer to [EC-558, "Work Procedure"](#).
2. Drain engine coolant from radiator. Refer to [CO-39, "Draining"](#).
CAUTION:
 - Perform this step when the engine is cold.
 - Never spill engine coolant on drive belt.
3. Remove the following parts.
 - Battery and battery tray: Refer to [PG-142, "EXCEPT FOR R9M : Removal and Installation"](#).
 - Air duct and air cleaner assembly: Refer to [EM-174, "Exploded View"](#).
 - Engine under cover: Refer to [EXT-39, "ENGINE UNDER COVER : Exploded View"](#).
 - Radiator hose (upper and lower): Refer to [CO-43, "Exploded View"](#).
 - Front road wheels and tires: Refer to [WT-61, "Exploded View"](#).
 - Front fender protector (RH and LH): Refer to [EXT-35, "FENDER PROTECTOR : Exploded View"](#).
 - Exhaust front tube 1 and 2: Refer to [EX-12, "Exploded View"](#).
4. Discharge refrigerant from A/C circuit. Refer to [HA-111, "Recycle Refrigerant"](#).

Engine Room LH

1. Disconnect all connections of engine harness around the engine mounting insulator (LH), and then temporarily secure the engine harness into the engine side.
CAUTION:
Protect connectors using a resin bag against foreign materials during the operation.
2. Disconnect fuel feed hose at engine side. Refer to [EM-184, "Removal and Installation"](#).
3. Disconnect heater hoses.
4. Disconnect control cable from transaxle. Refer to [TM-409, "QR25DE : Exploded View"](#).
5. Remove ground cable at transaxle side.
6. Disconnect CVT fluid cooler hose. Refer to [TM-441, "QR25DE : Exploded View"](#).

Engine Room RH

1. Disconnect vacuum hose from intake manifold. Refer to [EM-176, "Exploded View"](#).
2. Disconnect A/C piping from A/C compressor, and temporarily fasten it on vehicle with a rope. Refer to [HA-123, "Exploded View"](#).
3. Disconnect brake booster vacuum hose.

Vehicle inside

Disconnect intermediate shaft at steering gear assembly side. Refer to [ST-17, "Exploded View"](#).

Vehicle Underbody

1. Remove front wheel sensor (LH and RH) for ABS from steering knuckle. Refer to [BRC-212, "FRONT WHEEL SENSOR : Exploded View"](#).
2. Remove brake caliper assembly with piping connected from steering knuckle. Temporarily secure it on the vehicle side with a rope to avoid load on it. Refer to the following table:

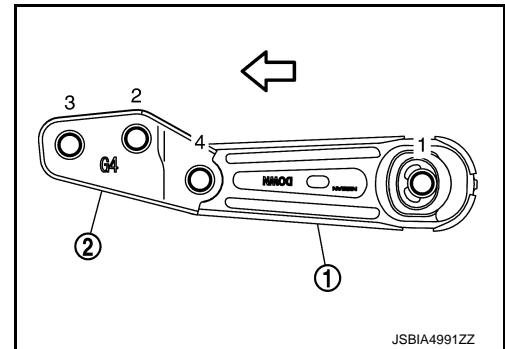
ENGINE ASSEMBLY

< UNIT REMOVAL AND INSTALLATION >

[QR25DE]

TYPE		Reference
LHD models		BR-50. "BRAKE CALIPER ASSEMBLY (1 PISTON TYPE) : Exploded View"
RHD models	1 piston type	BR-110. "BRAKE CALIPER ASSEMBLY (1 PISTON TYPE) : Exploded View"
	2 piston type	BR-115. "BRAKE CALIPER ASSEMBLY (2 PISTON TYPE) : Exploded View"

- Disconnect steering outer sockets from steering knuckle. Refer to [ST-20, "LHD : Exploded View"](#) (LHD models) or [ST-21, "RHD : Exploded View"](#) (RHD models).
 - Remove transverse link from steering knuckle. Refer to [FSU-17, "Exploded View"](#).
 - Remove front drive shafts (RH and LH). Refer to [FAX-112, "QR25DE : Exploded View"](#).
- NOTE:**
Cap or plug openings to prevent fluid from spilling.
- Remove propeller shaft. Refer to [DLN-214, "Exploded View"](#).
 - Remove stabilizer connecting rod. Refer to [FSU-19, "Exploded View"](#).
 - Remove rear torque rod.



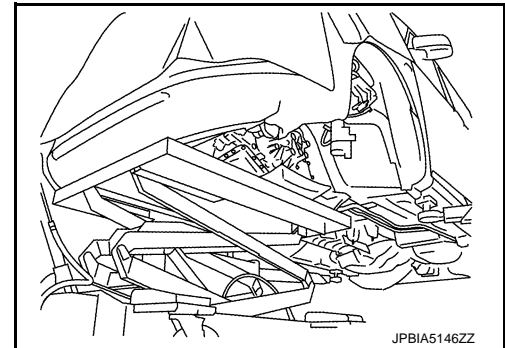
- Remove front suspension member. Refer to [FSU-22, "Exploded View"](#).
- Preparation for the separation work of transaxle is as follows:
 - Remove transaxle joint bolts which pierce at oil pan (upper) lower rear side. Refer to [EM-242, "Exploded View"](#).

Removal

- Use a manual lift table caddy (commercial service tool) or equivalently rigid tool such as a transmission jack. Securely support bottom of the engine and the transaxle assembly.

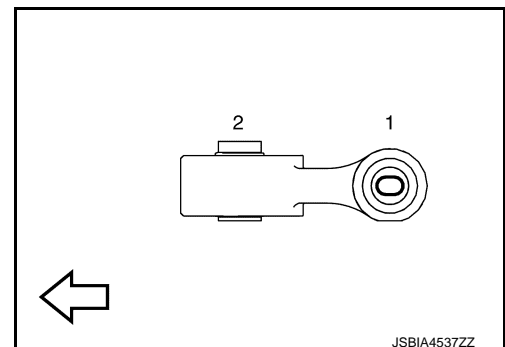
CAUTION:

Put a piece of wood or an equivalent as the supporting surface, secure a completely stable condition.



- Remove upper torque rod bolt (RH).
 - Loosen the mounting bolt as shown in the figure.

← : Engine front



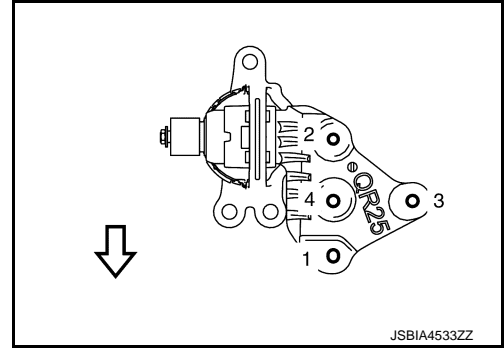
ENGINE ASSEMBLY

< UNIT REMOVAL AND INSTALLATION >

[QR25DE]

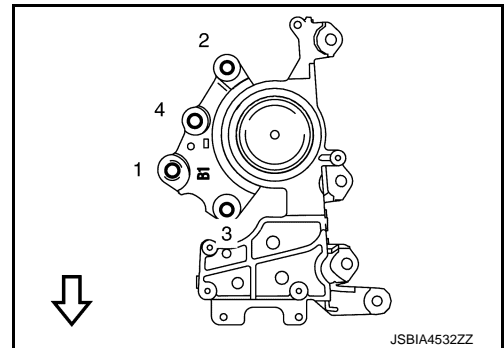
3. Remove engine mounting insulator bolts (RH).
 - Loosen the mounting bolts in the reverse order as shown in the figure.

⇐ : Engine front



4. Remove engine mounting insulator bolts (LH).
 - Loosen the mounting bolts in the reverse order as shown in the figure.

⇐ : Engine front



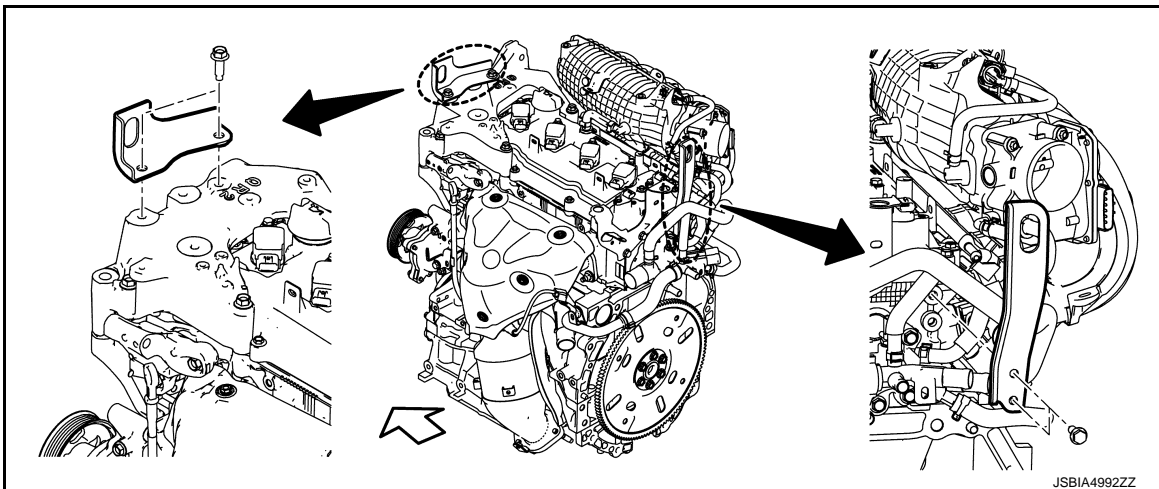
5. Remove engine and transaxle assembly from the vehicle by lowering (or raising the lift) a bottom supporting tool, such as manual lift table caddy [SST: GW86490800] or mission jack.

CAUTION:

- Check that no part interferes with the vehicle side.
- Before and during this lifting, always check if any harnesses are left connected.
- During the removal, always be careful to prevent the vehicle from falling off the lift due to changes in the center of gravity.
- If necessary, support the vehicle by setting jack or suitable tool at the rear.

Separation

1. Install engine slingers into front left of engine mount bracket (RH) and rear right of cylinder head.



⇐ : Engine front

Slinger bolts

ENGINE ASSEMBLY

< UNIT REMOVAL AND INSTALLATION >

[QR25DE]

Cylinder head side : : 22.0 N-m (2.2 kg-m, 16 ft-lb)

Engine mount bracket side : : 48.0 N-m (4.9 kg-m, 35 ft-lb)

2. Remove starter motor. Refer to [STR-31, "QR25DE : Exploded View"](#).
3. Lift with a hoist and separate the engine from the transaxle assembly. Refer to [TM-449, "Exploded View"](#).

INSTALLATION

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

CAUTION:

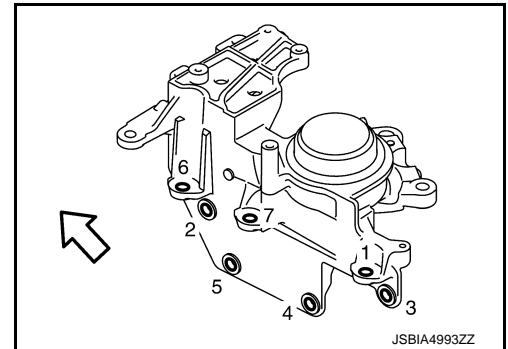
- **Never allow engine oil to get on engine mounting insulator. Be careful not to damage engine mounting insulator.**
- **Check that each mounting insulator is seated properly, and tighten mounting nuts and bolts.**

Preparation

1. Install the engine mounting insulator bolts (LH) as follows:
 - a. Tighten the bolt in order of No. 1, No. 2 to shown in the figure (temporarily).

 : Vehicle front

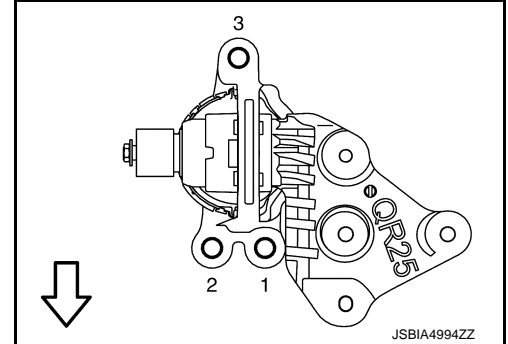
- b. Tighten the bolt shown in the figure (specified torque).



2. Install the engine mounting insulator bolts (RH) as follows:
 - a. Tighten the bolt No. 2 as shown in the figure (temporarily).

 : Vehicle front

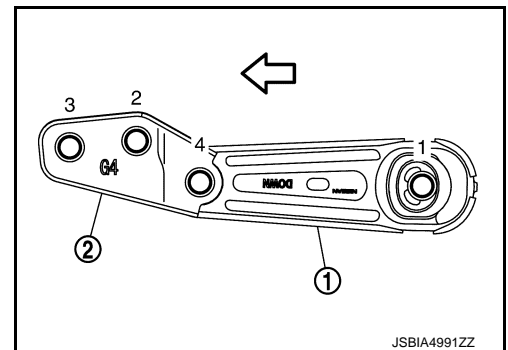
- b. Tighten the bolt shown in the figure (specified torque).



3. Install the rear torque rod bracket bolts as follows:
 - a. Tighten the bolt No. 2 and 3 as shown in the figure (temporarily).

Tightening procedure : 3 → 2

 : Vehicle front



Installation

1. Install the engine mounting insulator bolts (LH) as follows:

ENGINE ASSEMBLY

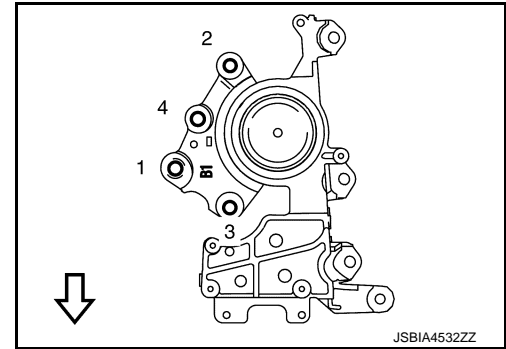
< UNIT REMOVAL AND INSTALLATION >

[QR25DE]

- a. Tighten the bolt in order of No. 1, No. 2 to shown in the figure (specified torque).

↩ : Vehicle front

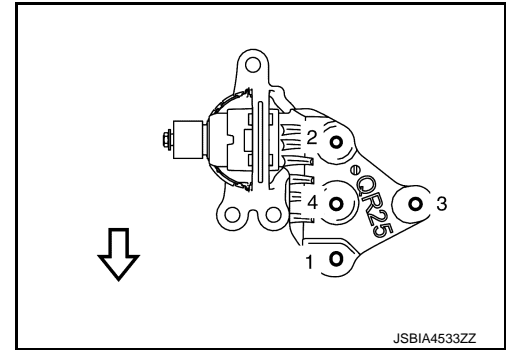
- b. Tighten the bolt shown in the figure (specified torque).



2. Install the engine mounting insulator bolts (RH) as follows:
a. Tighten the bolt No. 2 as shown in the figure (specified torque).

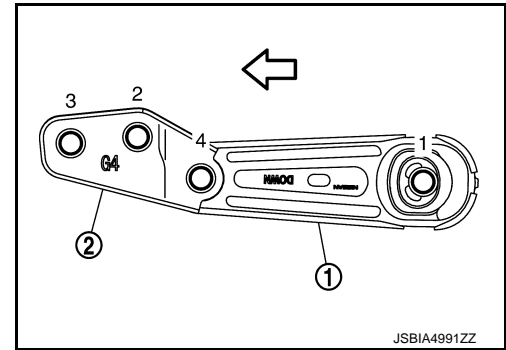
↩ : Vehicle front

- b. Tighten the bolt shown in the figure (specified torque).



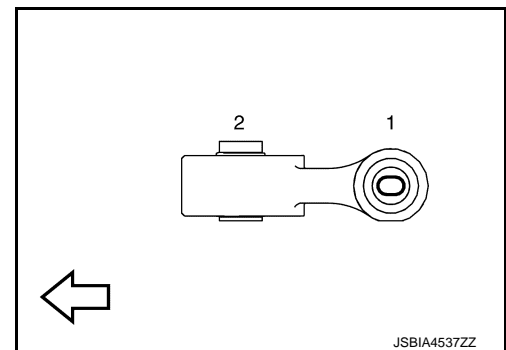
3. Install the rear torque bolts as follows:
a. Tighten the bolts as shown in the figure (specified torque).

↩ : Vehicle front



4. Install the upper torque rod bolt (RH).
• Tighten the bolt as shown in the figure (specified torque).

↩ : Engine front



Inspection

INFOID:0000000010783804

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 less than required quantity, fill to the specified level. Refer to [MA-23. "Fluids and Lubricants"](#).

ENGINE ASSEMBLY

< UNIT REMOVAL AND INSTALLATION >

[QR25DE]

- 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.
- Warm up engine thoroughly to check there is no leakage of fuel, exhaust gases, 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 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:0000000010783805

EM

NOTE:

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

1. Remove the engine and the transaxle assembly from the vehicle, and separate the transaxle from the engine. Refer to [EM-200, "Exploded View"](#).
2. Remove drive plate. Remove to [EM-208, "Removal and Installation"](#).
3. Lift the engine with a hoist to install it onto widely use engine stand.

CAUTION:

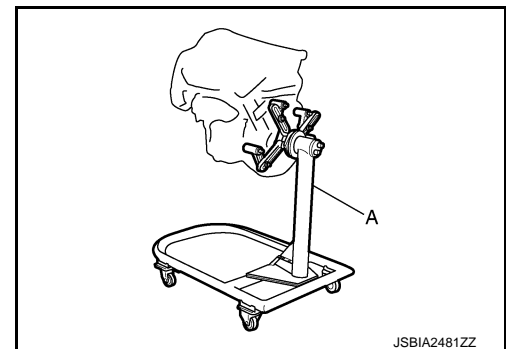
- Use the engine stand that has a load capacity [approximately 135 kg (298 lb) or more] large enough for supporting the engine weight.
- If the load capacity of stand is not adequate, remove the following parts beforehand to reduce the potential risk of overturning stand.
 - Intake manifold: Refer to [EM-176, "Exploded View"](#).
 - Exhaust manifold: Refer to [EM-180, "Exploded View"](#).
 - Rocker cover: Refer to [EM-189, "Exploded View"](#).

NOTE:

The figure shows an example of widely used engine stand (A) that can support mating surface of transaxle.

CAUTION:

Before removing the hanging chains, check the engine stand is stable and there is no risk of overturning.



4. Drain engine oil. Refer to [LU-26, "Draining"](#).

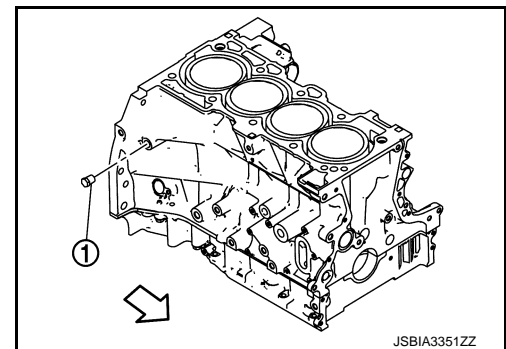
CAUTION:

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

5. Drain engine coolant by removing water drain plug ① from inside of the engine.

↩ : Engine front

Tightening torque : Refer to [EM-247, "Exploded View"](#).



DRIVE PLATE

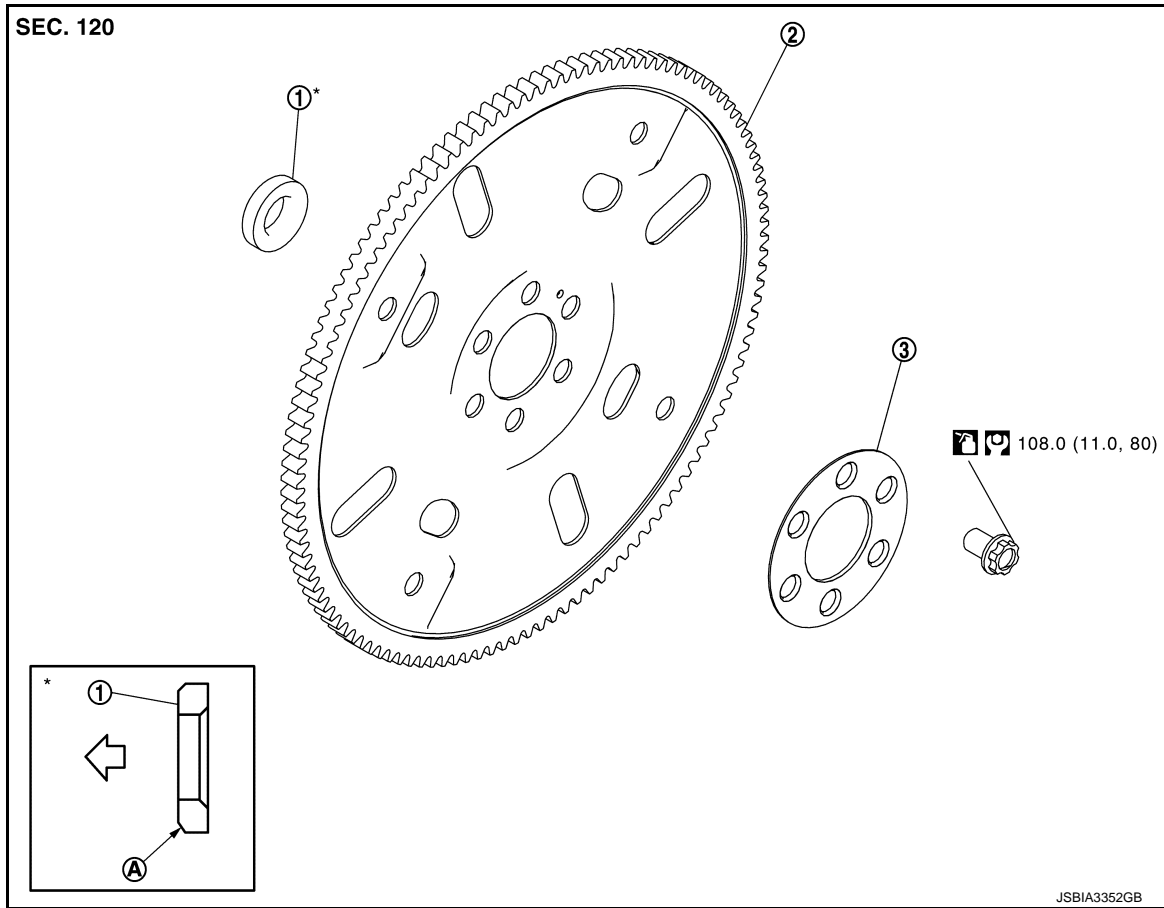
< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

DRIVE PLATE

Exploded View

INFOID:0000000010783806



① Pilot converter

② Drive plate

③ Reinforcement plate

A Chamfered

← : Crankshaft side

U : N·m (kg-m, ft-lb)

🔧 : Should be lubricated with oil.

Removal and Installation

INFOID:0000000010783807

REMOVAL

1. Remove the engine and the transaxle assembly from the vehicle, and separate the transaxle from the engine. Refer to [EM-200, "Exploded View"](#).
2. Remove drive plate.

DRIVE PLATE

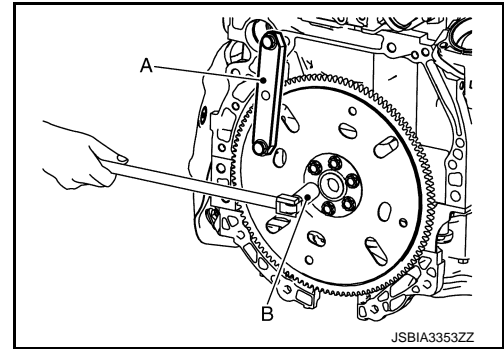
< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

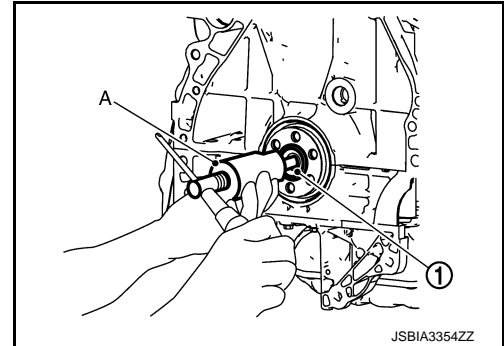
- Secure drive plate with a stopper plate [SST: KV11105210] (A), and remove mounting bolts.
- Using TORX socket (size E20) (B), loosen mounting bolts.
- loosen mounting bolts in diagonal order.

CAUTION:

- **Never disassemble them.**



3. Remove pilot converter ①, from the rear end of the crankshaft. Use a pilot bushing puller (commercial service tool) (A), if necessary.

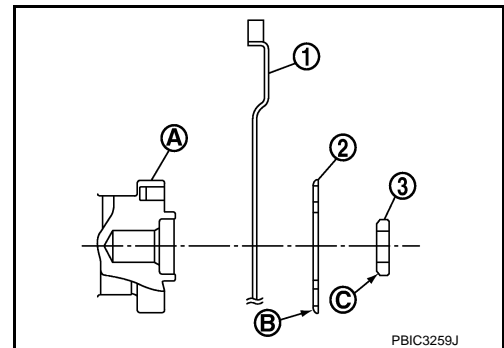


INSTALLATION

1. Install pilot converter.
2. Install drive plate in the reverse order of removal.
 - Install drive plate ①, reinforcement plate ② and pilot converter ③ as shown in figure.

- (A) : Crankshaft rear end
- (B) : Rounded
- (C) : Chamfered

- Using a drift of 33 mm (1.30 in) in diameter, press-fit pilot converter into the end of crankshaft until it stops.



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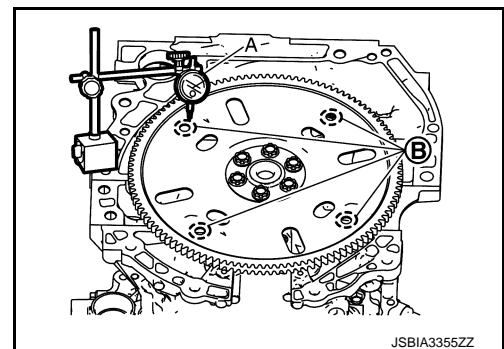
Inspection

DRIVE PLATE DEFLECTION

- Measure the deflection of drive plate contact surface to torque converter with a dial indicator (A).
- Measure the deflection at the area limited 20.6 mm (0.811 in) dia around hole (B).

Limit : 0.35 mm (0.0138 in) or less.

- If measured value is out of the standard, replace drive plate.



TIMING CHAIN

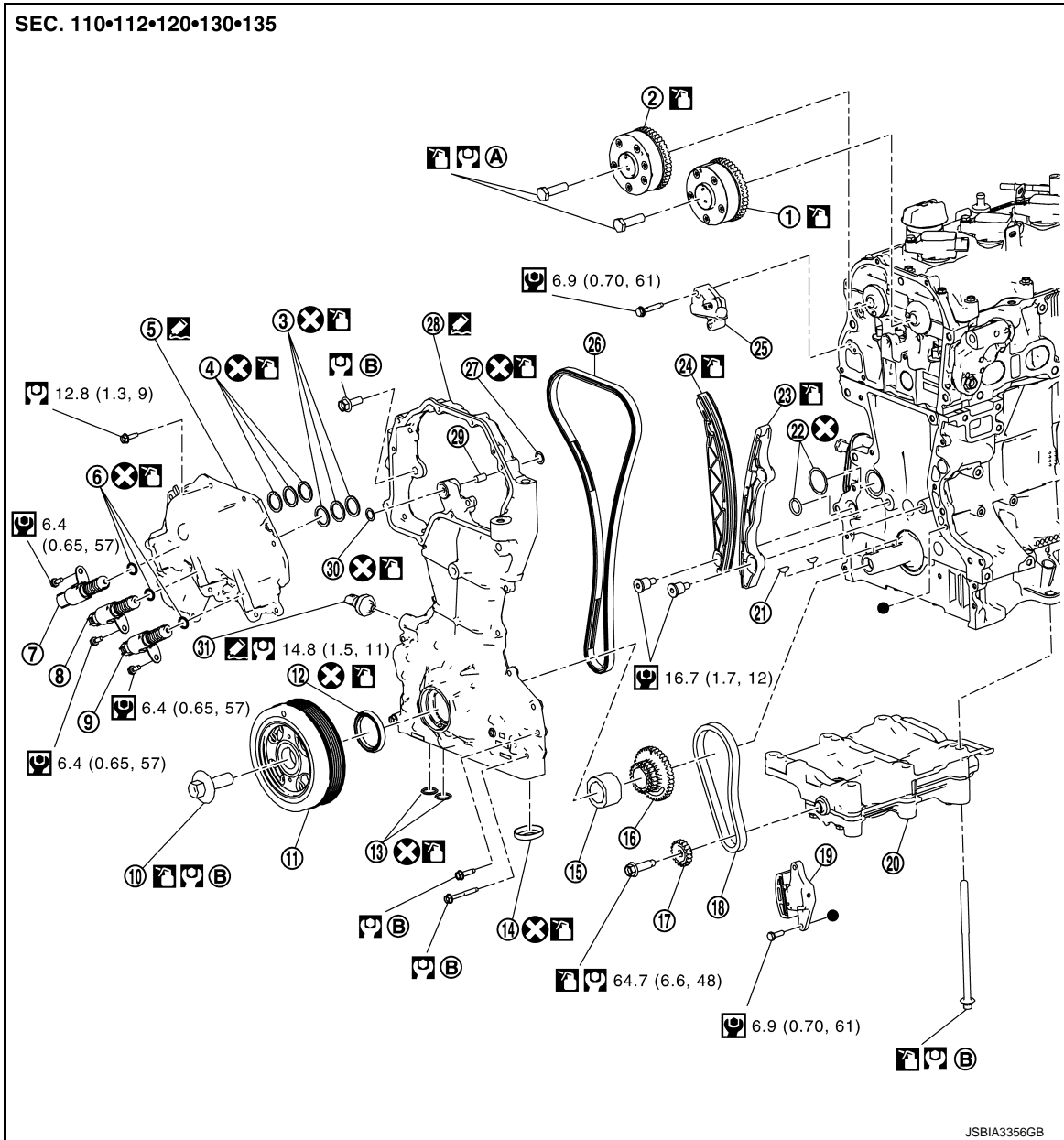
< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]






TIMING CHAIN

Exploded View

INFOID:000000010783809



- | | | |
|--|--|---|
| ① Camshaft sprocket (EXH) | ② Camshaft sprocket (INT) | ③ O-ring |
| ④ O-ring | ⑤ Valve timing control cover | ⑥ O-ring |
| ⑦ Intermediate valve timing control solenoid valve | ⑧ Intake valve timing control solenoid valve | ⑨ Exhaust valve timing control solenoid valve |
| ⑩ Crankshaft pulley bolt | ⑪ Crankshaft pulley | ⑫ Front oil seal |
| ⑬ O-ring | ⑭ O-ring | ⑮ Oil pump drive spacer |
| ⑯ Crankshaft sprocket | ⑰ Balancer unit sprocket | ⑱ Balancer unit timing chain |
| ⑲ Balancer unit timing chain tensioner | ⑳ Balancer unit | ㉑ Crankshaft key |
| ㉒ O-ring | ㉓ Timing chain tension guide | ㉔ Timing chain slack guide |
| ㉕ Chain tensioner | ㉖ Timing chain | ㉗ O-ring |
| ㉘ Front cover | ㉙ Oil filter | ㉚ O-ring |

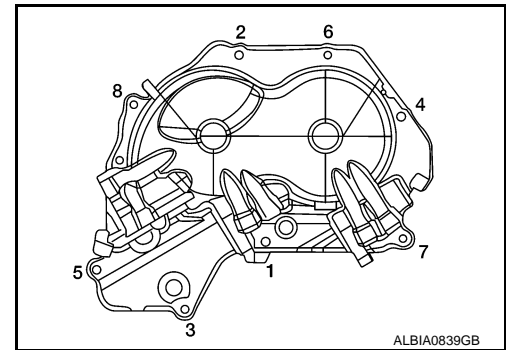
- ③① Oil pressure sensor
- Ⓐ Comply with the assembly procedure when tightening. Refer to [EM-222](#)
- Ⓑ Comply with the assembly procedure when tightening. Refer to [EM-211](#)
-  : N·m (kg-m, ft-lb)
-  : N·m (kg-m, in-lb)
-  : Always replace after every disassembly.
-  : Should be lubricated with oil.
-  : Sealing point
- : Indicates that the part is connected at points with same symbol in actual vehicle.

Removal and Installation

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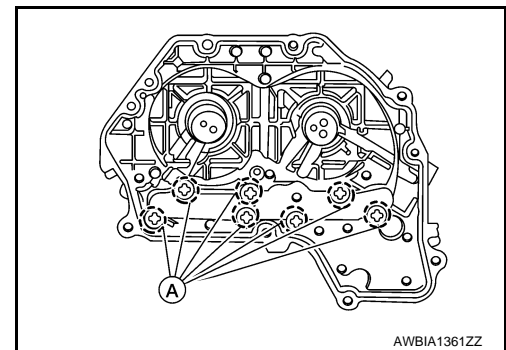
REMOVAL

1. Remove the following parts.
 - PCV hose: Refer to [EM-176, "Exploded View"](#).
 - Intake manifold: Refer to [EM-176, "Exploded View"](#).
 - Ignition coil: Refer to [EM-189, "Exploded View"](#).
 - Drive belt: Refer to [EM-166, "Removal and Installation"](#).
 - Drive belt auto-tensioner: Refer to [EM-173, "Exploded View"](#).
2. Remove engine mounting bracket (RH).
3. Remove rocker cover. Refer to [EM-190, "Removal and Installation"](#).
4. Remove oil pan (lower). Refer to [EM-193, "Exploded View"](#).
5. Remove oil pan (upper), and oil strainer. Refer to [EM-242, "Exploded View"](#).
6. Remove valve timing control cover.
 - Loosen bolts in reverse order as shown in the figure.



NOTE:

Do not loosen screws Ⓐ on the back of the valve timing control cover.



7. Pull chain guide between camshaft sprockets out through front cover.
8. Set No. 1 cylinder at TDC on its compression stroke with the following procedure:

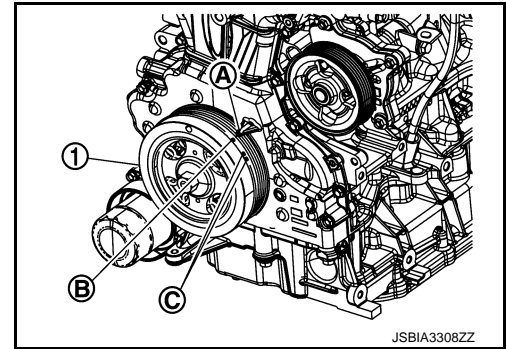
TIMING CHAIN

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

- a. Rotate crankshaft pulley ① clockwise and align TDC mark (no paint) ② to timing indicator ③ on front cover.

③ : Paint mark (Not use for service)

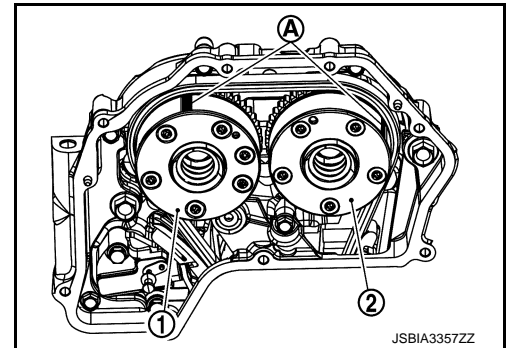


- b. At the same time, check that the mating marks ④ on camshaft sprockets are located as shown in the figure.

① : Camshaft sprocket (INT)

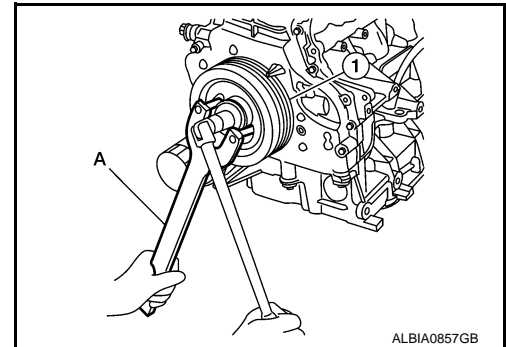
② : Camshaft sprocket (EXH)

- If not, rotate crankshaft pulley one more turn to align mating marks to the positions in the figure.

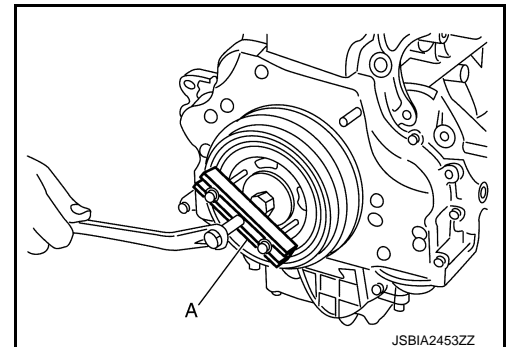


9. Remove crankshaft pulley with the following procedure:

- a. Fix crankshaft pulley ① with a pulley holder (commercial service tool) (A), loosen crankshaft pulley bolt, and locate bolt seating surface at 10 mm (0.39 in) from its original position.



- b. Attach a pulley puller [SST:KV11103000] (A) in the M6 thread hole on crankshaft pulley, and remove crankshaft pulley.



10. Remove front cover with the following procedure:

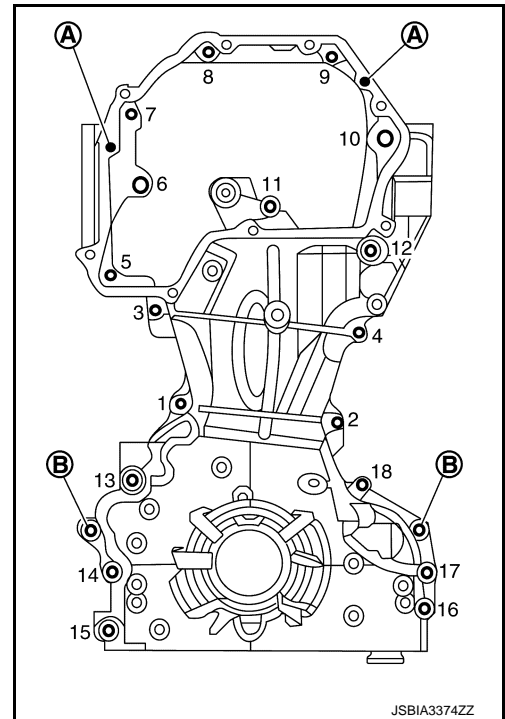
TIMING CHAIN

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

- a. Loosen mounting bolts in reverse order as shown in the figure, and remove them.

- Ⓐ : Dowel pin
Ⓑ : Dowel pin hole



11. If front oil seal needs to be replaced, lift it with a suitable tool, and remove it.

CAUTION:

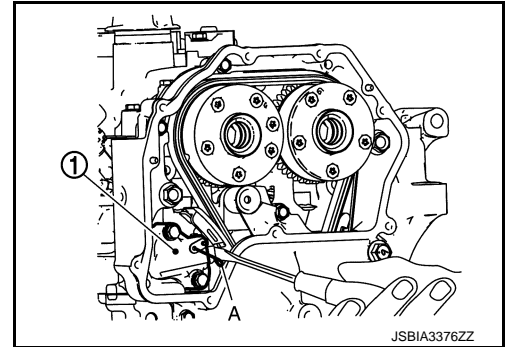
Be careful not to damage front cover.

12. Remove timing chain and camshaft sprockets with the following procedure:

- a. Push in chain tensioner plunger. Insert a stopper pin (A) into hole on chain tensioner body to secure chain tensioner plunger and remove chain tensioner ①.

NOTE:

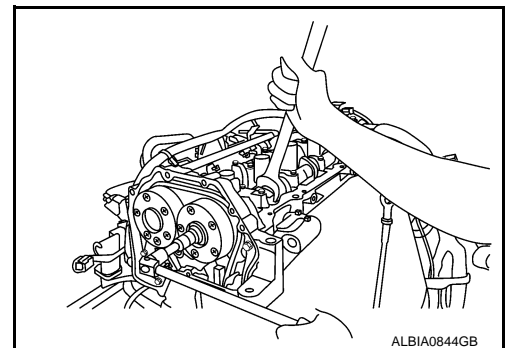
Use approx. 0.5 mm (0.02 in) dia. hard metal pin as a stopper pin.



- b. Secure hexagonal part of camshaft with a wrench. Loosen camshaft sprocket mounting bolts and remove timing chain and camshaft sprockets.

CAUTION:

Never rotate crankshaft or camshaft while timing chain is removed. It causes interference between valve and piston.



13. Remove timing chain slack guide, timing chain tension guide and oil pump drive spacer.

14. Remove balancer unit timing chain tensioner with the following procedure:

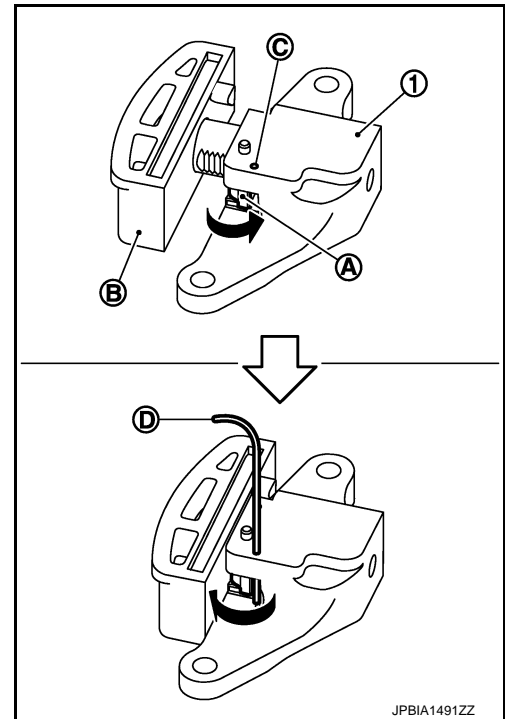
TIMING CHAIN

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

- a. Press stopper tab (A) in the direction shown in the figure to push the timing chain slack guide (B) toward timing chain tensioner (for oil pump) (1).
 - The slack guide is released by pressing the stopper tab. As the result, the slack guide can be moved.
- b. Insert a stopper pin (D) into tensioner body hole (C) to secure the timing chain slack guide.

NOTE:
Use a hard metal pin with the diameter of approximately 1.2 mm (0.047 in) as a stopper pin.
- c. Remove balancer unit timing chain tensioner.
 - When the holes on lever and tensioner body cannot be aligned, align these holes by slightly moving the slack guide.



15. Remove balancer unit timing chain and crankshaft sprocket.
16. Loosen mounting bolts in reverse order as shown in the figure, and remove balancer unit.

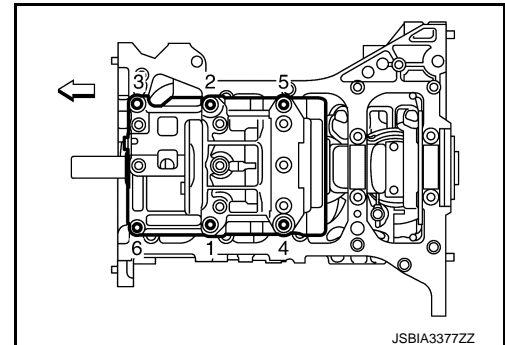
← : Engine front

CAUTION:

Never disassemble balancer unit.

NOTE:

Use TORX socket (size E14).



INSTALLATION

CAUTION:

Do not reuse O-rings.

NOTE:

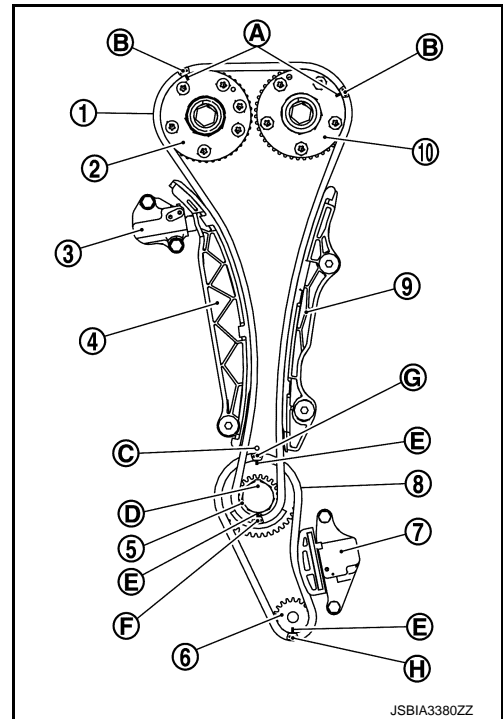
TIMING CHAIN

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

The figure shows the relationship between the mating mark on each timing chain and that on the corresponding sprocket, with the components installed.

- ① : Timing chain
- ② : Camshaft sprocket (INT)
- ③ : Chain tensioner
- ④ : Timing chain slack guide
- ⑤ : Crankshaft sprocket
- ⑥ : Balancer unit sprocket
- ⑦ : Balancer unit chain tensioner
- ⑧ : Balancer unit timing chain
- ⑨ : Timing chain tension guide
- ⑩ : Camshaft sprocket (EXH)
- A : Mating mark (peripheral stamp line)
- B : Pink link
- C : Mating mark (lug)
- D : Crankshaft key
- E : Mating mark (stamp)
- F : Orange link
- G : Yellow link
- H : Blue link



1. Check that crankshaft key points straight up.
2. Tighten mounting bolts in numerical order as shown in figure with the following procedure, and install balancer unit.

← : Engine front

CAUTION:

If mounting bolts are re-used, check their outer diameter before installation. Refer to [EM-219, "Inspection"](#).

- a. Apply new engine oil to threads and seat surfaces of mounting bolts.
- b. Tighten No. 1 to 5 bolts.

: 42.0 N·m (4.3 kg-m, 35 ft-lb)

- c. Tighten No. 6 bolt.

: 36.0 N·m (3.7 kg-m, 27 ft-lb)

- d. Turn No. 1 to 5 bolts 120 degrees clockwise (angle tightening).

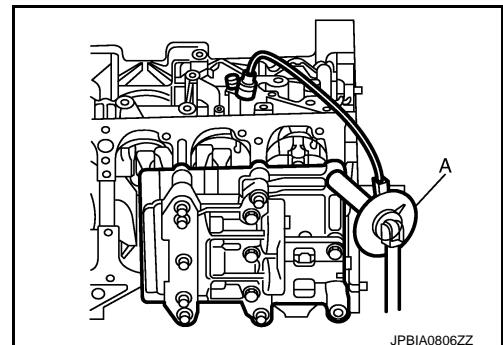
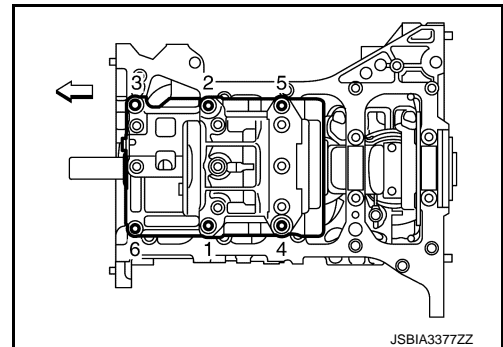
CAUTION:

Use the angle wrench [SST: KV10112100] (A) to check tightening angle. Never make judgment by visual inspection.

- e. Turn No. 6 bolt 90 degrees clockwise (angle tightening).
- f. Completely loosen all bolts.

: 0 N·m (0 kg-m, 0 ft-lb)

CAUTION:



TIMING CHAIN

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

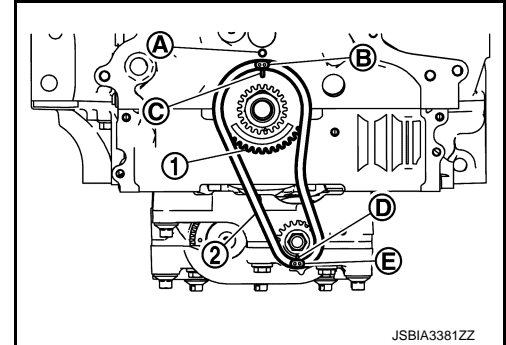
In this step, loosen bolts in reverse order as shown in the figure.

g. Repeat step "b" to "e".

3. Install crankshaft sprocket ① and balancer unit timing chain ②.

- Ⓑ : Mating mark (yellow)
- Ⓓ : Mating mark
- Ⓔ : Mating mark (Blue)

- Check that crankshaft sprocket is positioned with mating marks Ⓐ on cylinder block and crankshaft sprocket meeting Ⓒ at the top.
- Install it by aligning mating marks on each sprocket and balancer unit timing chain.



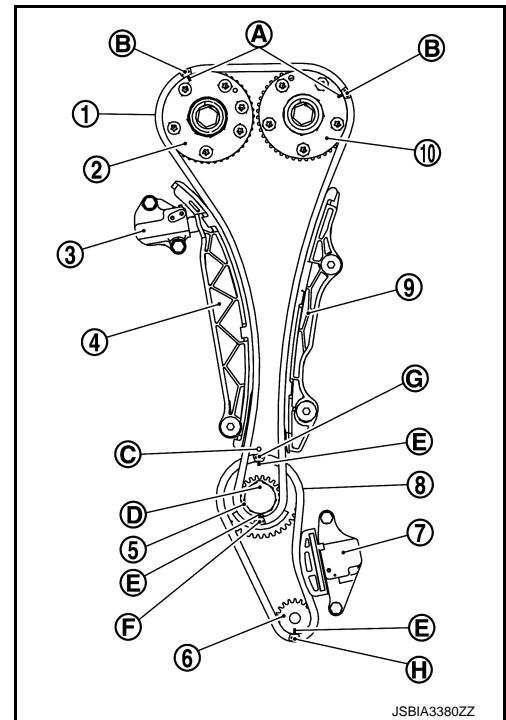
4. Install balancer unit timing chain tensioner.

- Be careful not to let mating marks of each sprocket and timing chain slip.
- After installation, check the mating marks have not slipped, then remove stopper pin and release tensioner sleeve.

5. Install timing chain and related parts.

- Install by aligning mating marks on each sprocket and timing chain.

- ① : Timing chain
- ② : Camshaft sprocket (INT)
- ③ : Chain tensioner
- ④ : Timing chain slack guide
- ⑤ : Crankshaft sprocket
- ⑥ : Balancer unit sprocket
- ⑦ : Balancer unit chain tensioner
- ⑧ : Balancer unit timing chain
- ⑨ : Timing chain tension guide
- ⑩ : Camshaft sprocket (EXH)
- Ⓐ : Mating mark (peripheral stamp line)
- Ⓑ : Pink link
- Ⓒ : Mating mark (lug)
- Ⓓ : Crankshaft key
- Ⓔ : Mating mark (stamp)
- Ⓕ : Orange link
- Ⓖ : Yellow link
- Ⓗ : Blue link



- Before and after installing chain tensioner, check again to check that mating marks have not slipped.
- After installing chain tensioner, remove stopper pin, and check that tensioner moves freely.

CAUTION:

- For the following note, after the mating marks are aligned, keep them aligned by holding them with a hand.
- To avoid skipped teeth, never rotate crankshaft and camshaft until front cover is installed.

NOTE:

Before installing chain tensioner, it is possible to change the position of mating mark on timing chain for that on each sprocket for alignment.

TIMING CHAIN

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

6. Install front oil seal to front cover. Refer to [EM-197. "FRONT OIL SEAL : Removal and Installation"](#).
7. Install front cover with the following procedure:

CAUTION:

Do not reuse O-rings.

- a. Install O-rings to cylinder head and cylinder block.
- b. Apply a continuous bead of liquid gasket with the tube presser (commercial service tool) to front cover as shown in the figure.

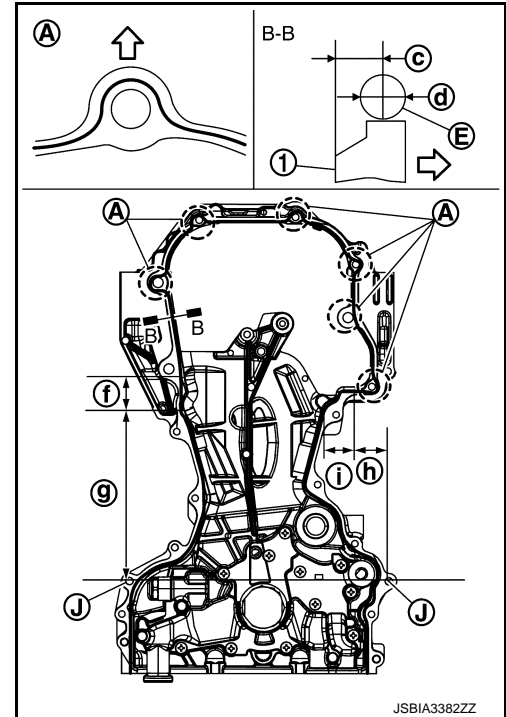
- ① : Front cover
- (A) : Apply liquid gasket outside the bolt holes
- (E) : Liquid gasket
- (J) : Dowel pin hole
- ⇐ : Engine outside

Use Genuine Liquid Gasket or equivalent.

NOTE:

Application instruction differs depending on the position.

- (c) : 4.0 - 5.6 mm (0.157 - 0.220 in)
- (d) : ϕ 3.4 - 4.4 mm (0.134 - 0.173 in)
- (f) : 35.7 mm (1.406 in) Apply liquid gasket ϕ 6.0 - 7.0 mm (0.236 - 0.275 in) between this area.
- (g) : 179.6 mm (7.07 in)
- (h) : 35.5 mm (1.398 in)
- (i) : 31.3 mm (1.232 in) Apply liquid gasket ϕ 6.0 - 7.0 mm (0.236 - 0.275 in) between this area.



- c. Check that mating marks of timing chain and each sprocket are still aligned. Then install front cover.

CAUTION:

Be careful not to damage front oil seal by interference with front end of crankshaft.

- d. Tighten mounting bolts in numerical order as shown in the figure.
- e. After all bolts are tightened, retighten them to specified torque in numerical order as shown in the figure.

- (A) : Dowel pin
- (B) : Dowel pin hole

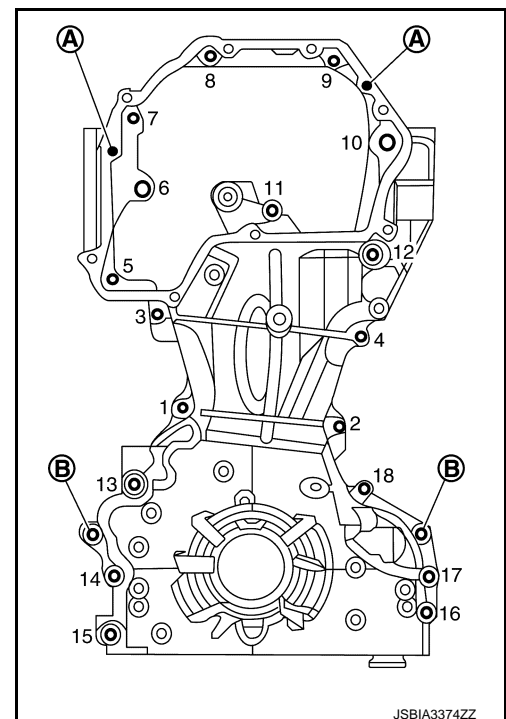
CAUTION:

Be sure to wipe off any excessive liquid gasket leaking to surface for fitting oil pan.

Tightening torque

M10 bolt : 49.0 N·m (5.0 kg-m, 36 ft-lb)

M6 bolt : 12.7 N·m (1.3 kg-m, 9 ft-lb)



8. Install chain guide between camshaft sprockets.
9. Install valve timing control cover with the following procedure:

TIMING CHAIN

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

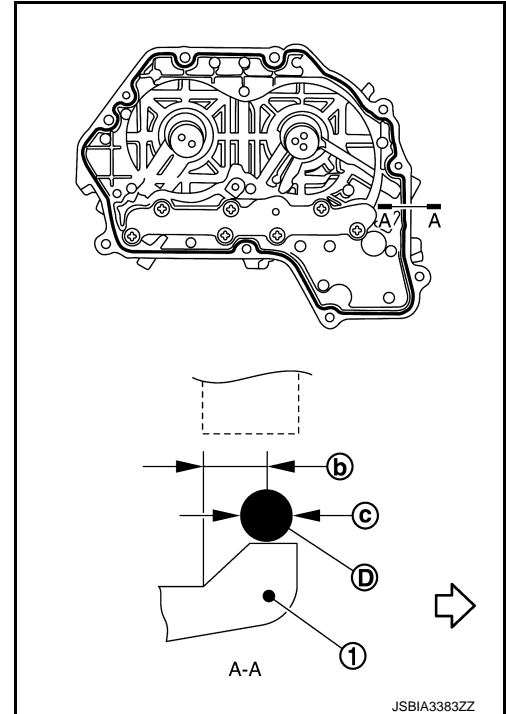
- Install valve timing control solenoid valves to valve timing control cover if removed.
- Install new oil rings to the camshaft sprocket (INT) insertion points on backside of valve timing control cover.
- Install new O-ring to front cover.
- Apply a continuous bead of liquid gasket ① with a tube presser (commercial service tool) to valve timing control cover as shown in the figure.

- ① : Valve timing control cover
 (b) : 4.3 - 5.3 mm (0.169 - 0.208 in)
 (c) : ϕ 3.4 - 4.4 mm (0.134 - 0.173 in)
 ⇐ : Engine outside

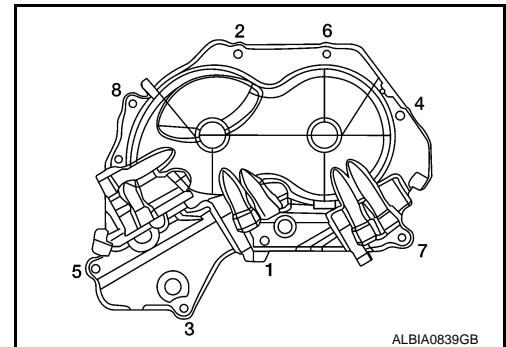
Use Genuine Liquid Gasket or equivalent.

CAUTION:

- Attaching should be done within 5 minutes after liquid gasket application.
- Do not reuse O-ring.



- Tighten mounting bolts in numerical order as shown in the figure.



- Insert crankshaft pulley by aligning with crankshaft key.
 - When inserting crankshaft pulley with a plastic hammer, tap on its center portion (not circumference).

CAUTION:
Install protecting front oil seal lip section from any damage.
- Tighten crankshaft pulley bolt.
 - Secure crankshaft pulley with a pulley holder (commercial service tool), and tighten crankshaft pulley bolt.
 - Perform angle tightening with the following procedure:
 - Apply new engine oil to thread and seat surfaces of crankshaft pulley bolt.
 - Tighten crankshaft pulley bolt.

: 42.1 N·m (4.3 kg-m, 31 ft-lb)

TIMING CHAIN

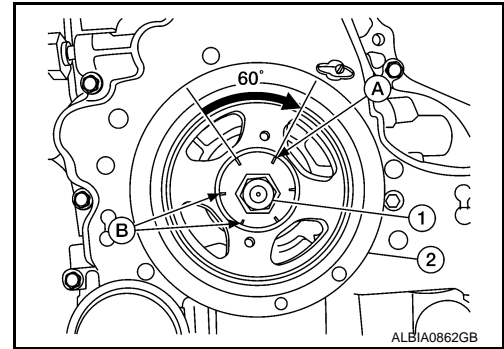
< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

- c. Put a paint mark (A) on crankshaft pulley (2), mating with any one of six easy to recognize angle marks on bolt flange.

① : Crankshaft pulley bolt

- d. Turn another 60 degrees clockwise (angle tightening).
• Check the tightening angle with movement of one angle mark (B).



12. Install all removed parts in the reverse order of removal.

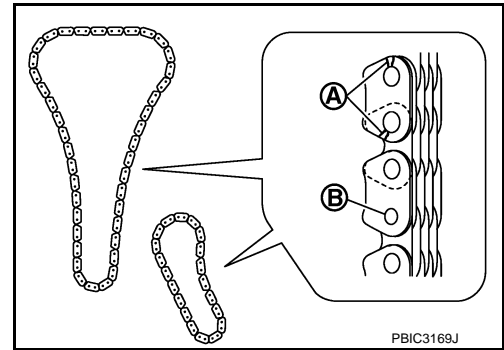
Inspection

INFOID:0000000010783811

INSPECTION AFTER REMOVAL

Timing Chain

- Check timing chain for cracks (A) and any excessive wear (B) at the roller links of timing chain. Replace timing chain if necessary.

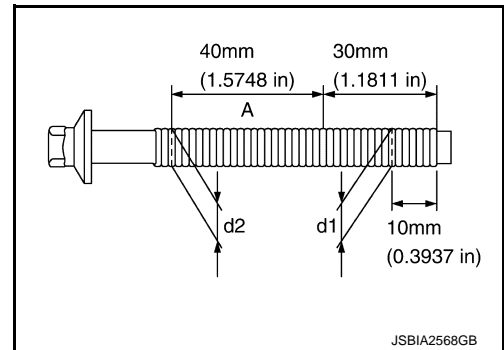


Balancer Unit Mounting Bolt Outer Diameter

- Measure the outer diameters ("d1", "d2") at two positions as shown in the figure.
• If reduction appears in "A" range, regard it as "d2".

Limit ("d1"–"d2") : 0.15 mm (0.0059 in)

- If it exceeds the limit (large difference in dimensions), replace it with a new one.



INSPECTION AFTER INSTALLATION

Inspection for Leaks

The following are procedures for checking fluids leak, lubricates leak.

- 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-23. "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.
- 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 to the specified level, if necessary.

TIMING CHAIN

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

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

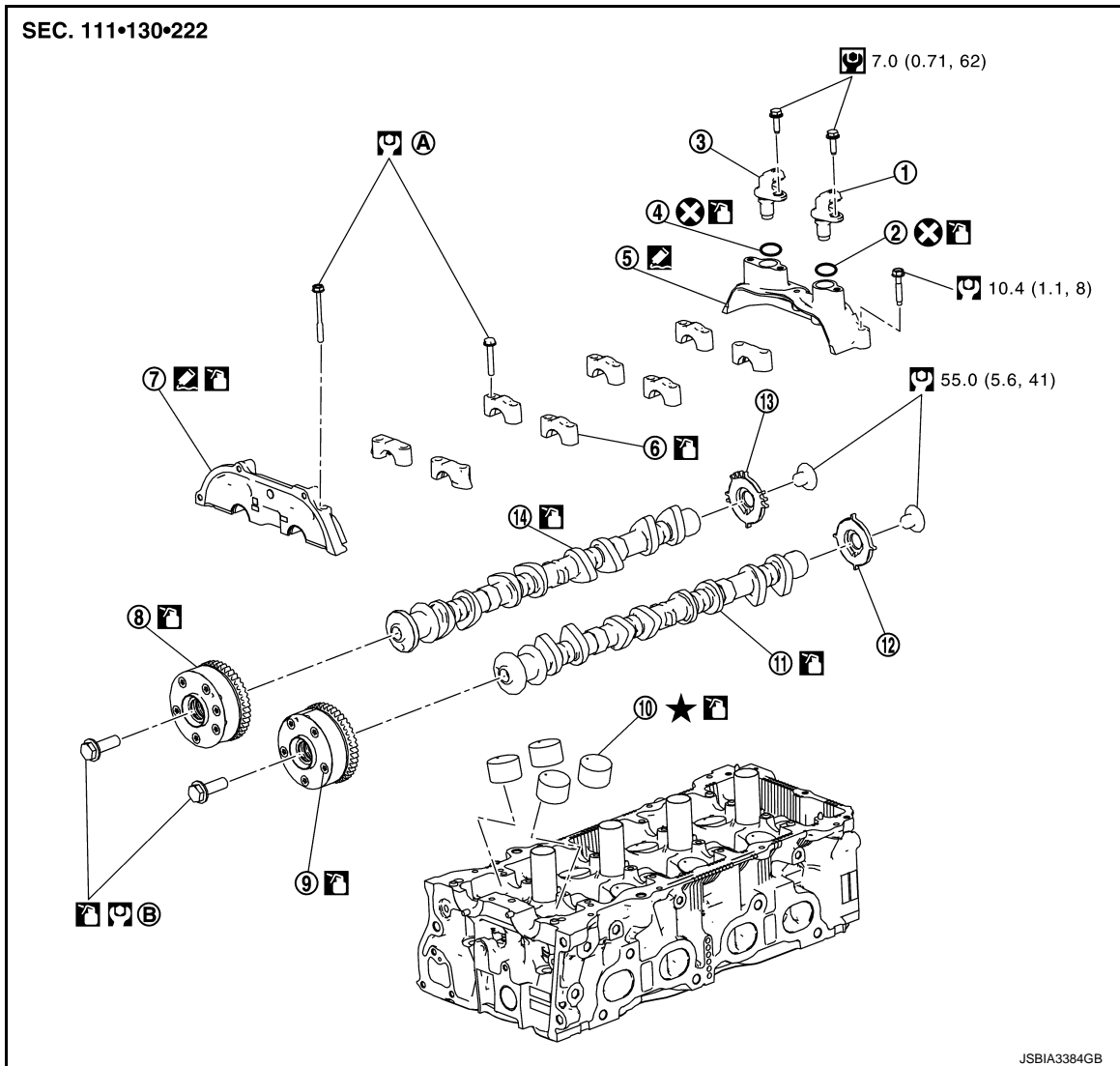
< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

CAMSHAFT

Exploded View

INFOID:0000000010783812



- | | | |
|---|---|------------------------------------|
| ① Exhaust valve timing control position sensor | ② O-ring | ③ Camshaft position sensor (PHASE) |
| ④ O-ring | ⑤ Camshaft position sensor bracket | ⑥ Camshaft bracket (No. 2 to 5) |
| ⑦ Camshaft bracket (No. 1) | ⑧ Camshaft sprocket (INT) | ⑨ Camshaft sprocket (EXH) |
| ⑩ Valve lifter | ⑪ Camshaft (EXH) | ⑫ Signal plate (EXH) |
| ⑬ Signal plate (INT) | ⑭ Camshaft (INT) | |
| (A) Comply with the installation procedure when tightening. Refer to EM-222 | (B) Comply with the installation procedure when tightening. Refer to EM-222 | |

: 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.

Removal and Installation

REMOVAL

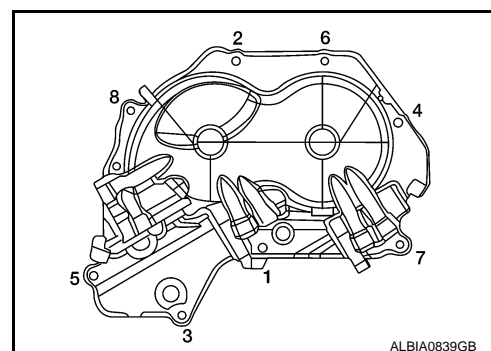
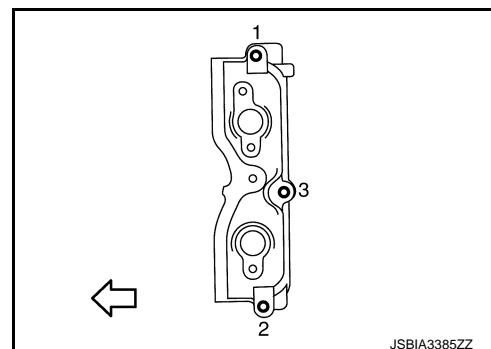
NOTE:

This section describes removal/installation procedure of camshaft without removing front cover. If front cover is removed or installed, removal of camshaft bracket (No. 1) is easier before step 9 and installation is easier after step 4. Regarding removal and installation of front cover, refer to [EM-210. "Exploded View"](#).

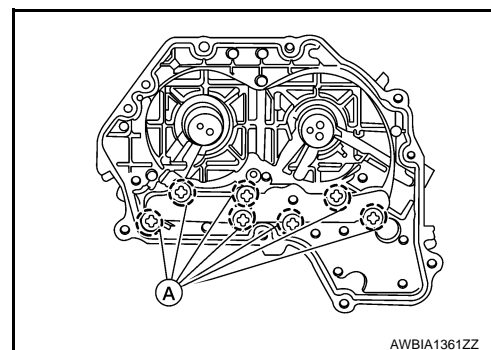
1. Release fuel pressure. Refer to [EC-558. "Work Procedure"](#).
2. Remove rocker cover. Refer to [EM-190. "Removal and Installation"](#).
3. Remove camshaft position sensor bracket.
 - Loosen mounting bolts in reverse order as shown in the figure.

⇐ : Engine front

4. Remove intake valve timing control cover with the following procedure:
 - a. Disconnect intake valve timing control solenoid valve harness connector.
 - b. Remove intake valve timing control solenoid valve, if necessary.
 - c. Loosen bolts in reverse order as shown in the figure.

**NOTE:**

Do not loosen screws (A) on the back of the valve timing control cover.



5. Pull chain guide between camshaft sprockets out through front cover.
6. Set No. 1 cylinder at TDC on its compression stroke with the following procedure:
 - a. Open front splash guard on RH undercover.

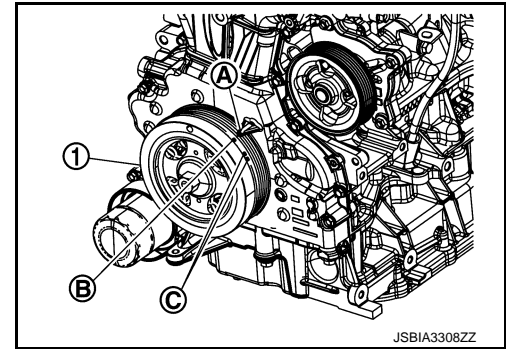
CAMSHAFT

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

- b. Rotate crankshaft pulley ① clockwise and align TDC mark (no paint) ② to timing indicator ③ on front cover.

③ : Paint mark (Not use for service)



- c. At the same time, check that the mating marks ④ on camshaft sprockets are located as shown in the figure.

① : Camshaft sprocket (INT)

② : Camshaft sprocket (EXH)

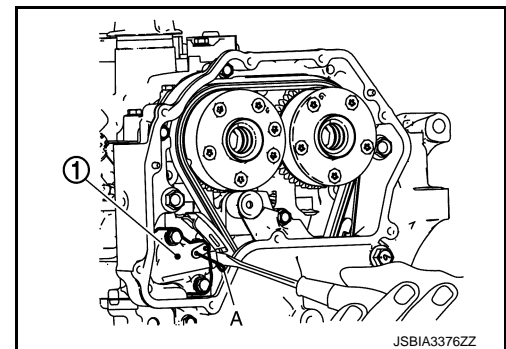
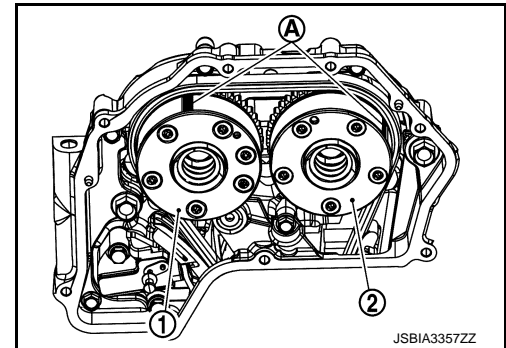
- If not, rotate crankshaft pulley one more turn to align mating marks to the positions in the figure.

7. Remove camshaft sprockets with the following procedure:

- a. Line up the mating marks on camshaft sprockets, and paint indelible mating marks on timing chain link plate.
- b. Push in chain tensioner plunger. Insert a stopper pin (A) into hole on chain tensioner body to secure chain tensioner plunger and remove chain tensioner ①.

NOTE:

Use approx. 0.5 mm (0.02 in) dia. hard metal pin as a stopper pin.



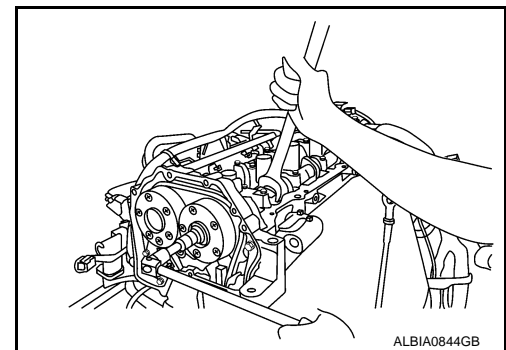
- c. Secure hexagonal part of camshaft with a wrench. Loosen camshaft sprocket mounting bolts and remove camshaft sprockets.

CAUTION:

Never rotate crankshaft or camshaft while timing chain is removed. It causes interference between valve and piston.

NOTE:

Chain tension holding work is not necessary. Crankshaft sprocket and timing chain do not disconnect structurally while front cover is attached.



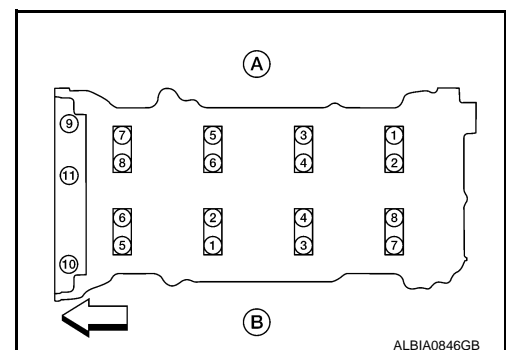
8. Loosen mounting bolts in reverse order as shown in the figure, and remove camshaft brackets and camshafts.

④ : Intake side

⑤ : Exhaust side

⇐ : Engine front

- Remove camshaft bracket (No. 1) by slightly tapping it with a plastic hammer.



CAMSHAFT

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

9. Remove valve lifters.
 - Identify installation positions, and store them without mixing them up.

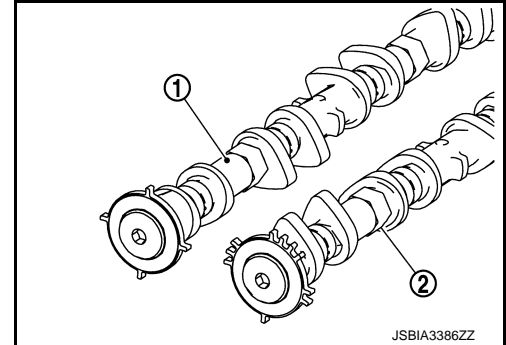
INSTALLATION

CAUTION:

Do not reuse O-rings.

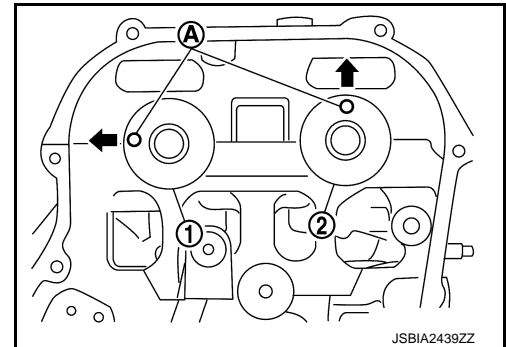
1. Install valve lifters.
 - Install them in the original positions.
2. Install camshafts.
 - Distinction between intake and exhaust camshafts is performed with the different shapes of rear end.

- ① : Camshaft (EXH)
② : Camshaft (INT)



- Install camshafts so that camshaft dowel pins ① on the front side are positioned (←) as shown in the figure.

- ① : Camshaft (INT)
② : Camshaft (EXH)

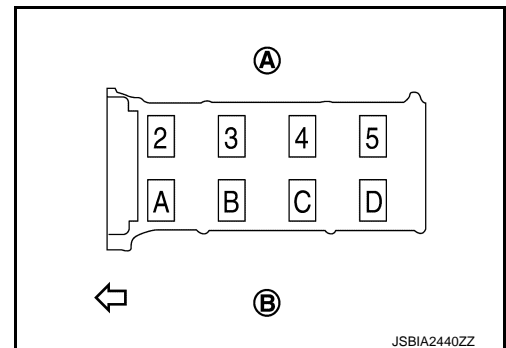


3. Install camshaft brackets with the following procedure:
 - a. Remove foreign material completely from camshaft bracket backside and from cylinder head installation face.
 - b. Install camshaft brackets aligning the identification marks on upper surface as shown in the figure.

- Ⓐ : Intake side
Ⓑ : Exhaust side
← : Engine front

NOTE:

Install so that identification mark can be correctly read when viewed from the exhaust side.



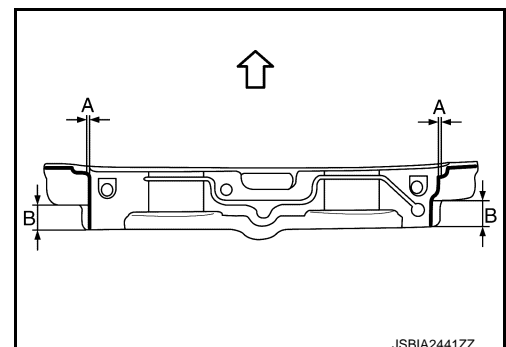
- c. Install camshaft bracket (No. 1) with the following procedure:
 - i. Apply liquid gasket to camshaft bracket (No. 1) as shown in the figure.

- ← : Engine front

- A : ϕ 2.0 - 3.0 mm**
B : 10.5 mm

Use Genuine Liquid Gasket or equivalent.

CAUTION:



CAMSHAFT

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

After installation, be sure to wipe off any excessive liquid gasket leaking.

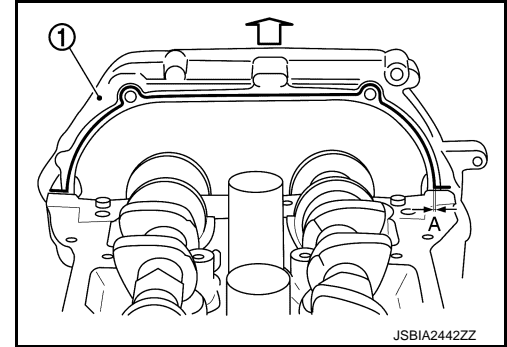
- ii. Apply liquid gasket to camshaft bracket (No. 1) contact surface on the front cover ① backside.

↶ : Engine front

A : $\phi 2.6 - 3.6$ mm

Use Genuine Liquid Gasket or equivalent.

- Apply liquid gasket to the outside of bolt hole on front cover.

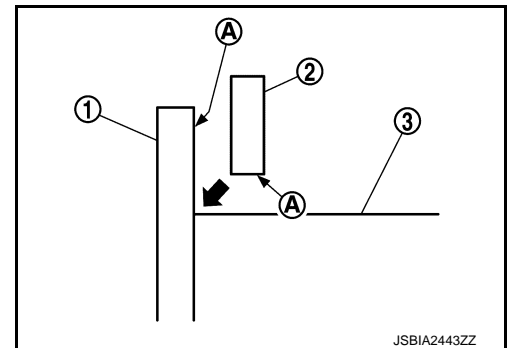


- iii. Locate camshaft bracket (No. 1) ② near installation position, and install (↶) it without disturbing the liquid gasket applied to the surfaces.

① : Front cover

③ : Cylinder head

Ⓐ : Liquid gasket application face



4. Tighten mounting bolts of camshaft brackets in the following steps, in numerical order as shown in the figure.

Ⓐ : Intake side

Ⓑ : Exhaust side

↶ : Engine front

- a. Tighten No. 9 to 11 in numerical order.

: **1.96 N·m (0.2 kg-m, 17 in-lb)**

- b. Tighten No. 1 to 8 in numerical order.

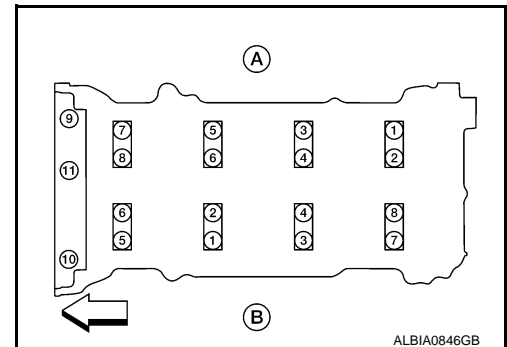
: **1.96 N·m (0.2 kg-m, 17 in-lb)**

- c. Tighten all bolts in numerical order.

: **5.88 N·m (0.6 kg-m, 52 in-lb)**

- d. Tighten all bolts in numerical order.

: **10.5 N·m (1.1 kg-m, 8 ft-lb)**



CAUTION:

After tightening mounting bolts of camshaft brackets, be sure to wipe off excessive liquid gasket from the parts listed below.

- Mating surface of rocker cover.
- Mating surface of front cover. (When installed without front cover)

5. Install the camshaft sprocket to the camshaft with the following procedure.

CAMSHAFT

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

- a. Install them by aligning the mating marks (A) on each camshaft sprocket with the ones painted on timing chain link plate during removal.

- ① : Camshaft sprocket (INT)
② : Camshaft sprocket (EXH)

CAUTION:

- Aligned mating marks could slip. Therefore, after matching them, hold the timing chain in place by hand.
- Before and after installing chain tensioner, check again that mating marks have not slipped.

NOTE:

Before installation of chain tensioner, it is possible to re-match the marks on timing chain with the ones on each sprocket.

- b. Tighten bolts in the following steps.
- Secure the hexagonal part of camshaft using wrench to tighten mounting bolt.
- i. Tighten camshaft mounting bolt.

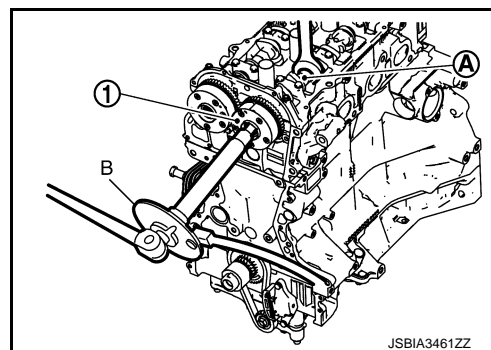
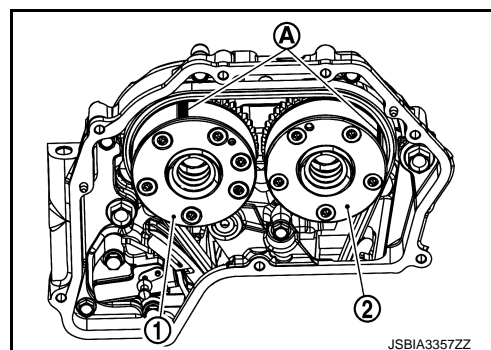
: 50.0 N·m (5.1 kg-m, 36.8 ft-lb)

- ii. Turn 45 degrees clockwise (angle tightening).

CAUTION:

Check the tightening angle by using an angle wrench [SST: KV10112100](B) or protractor. Never judge by visual inspection without an angle wrench.

- ① : Camshaft sprocket
(A) : Camshaft hexagonal part



6. Install chain tensioner.

CAUTION:

After installation, pull the stopper pin off completely, and check that chain tensioner plunger is released.

7. Install chain guide.
8. Install intake valve timing control cover with the following procedure:
- Install intake valve timing control solenoid valve to intake valve timing control cover if removed.
 - Install new O-rings to the camshaft sprocket (INT) insertion points on backside of intake valve timing control cover.
 - Install new O-ring to front cover.

CAMSHAFT

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

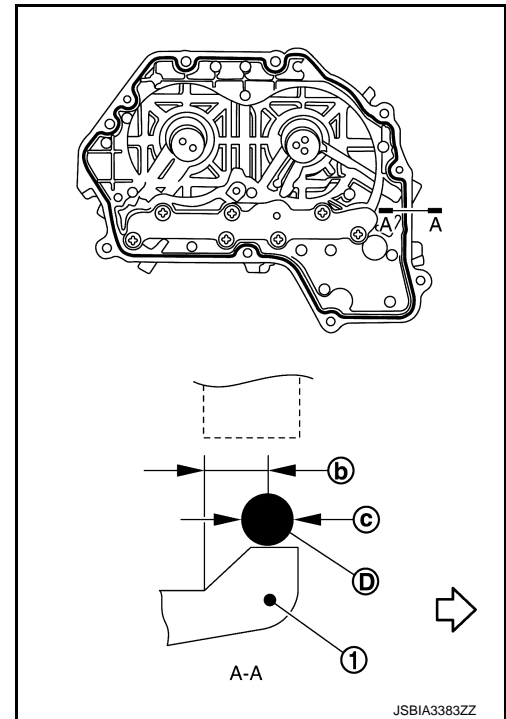
- d. Apply liquid gasket ④ with a tube presser (Commercial Service Tool) to intake valve timing control cover as shown in the figure.

- ① : Valve timing control cover
 (b) : 4.3 - 5.3 mm (0.169 - 0.208 in)
 (c) : ϕ 3.4 - 4.4 mm (0.134 - 0.173 in)
 ⇐ : Engine outside

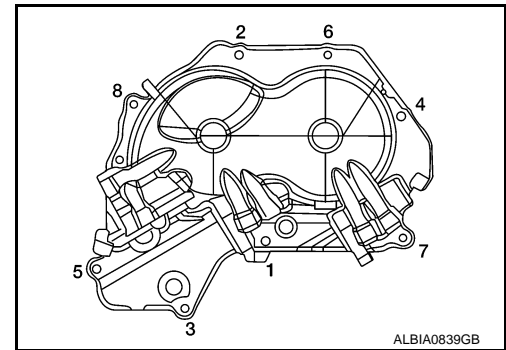
Use Genuine Liquid Gasket or equivalent.

CAUTION:

Attaching should be done within 5 minutes after liquid gasket application.



- e. Tighten mounting bolts in numerical order as shown in the figure.



9. Install camshaft position sensor bracket.
 a. Apply liquid gasket with a tube presser (commercial service tool) to camshaft position sensor bracket as shown in the figure.

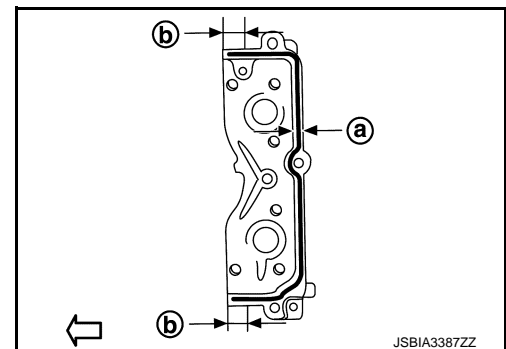
- ⇐ : Engine front

- (a) : 2.0 - 3.0 mm (0.079 - 0.118 in)
 (b) : 10.5 mm (0.413 in)

Use Genuine Liquid Gasket or equivalent.

CAUTION:

- After installation, be sure to wipe off any excessive liquid gasket leaking from part "b"
- Attaching should be done within 5 minutes after liquid gasket application.



CAMSHAFT

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

- b. Tighten mounting bolts in numerical order as shown in the figure.

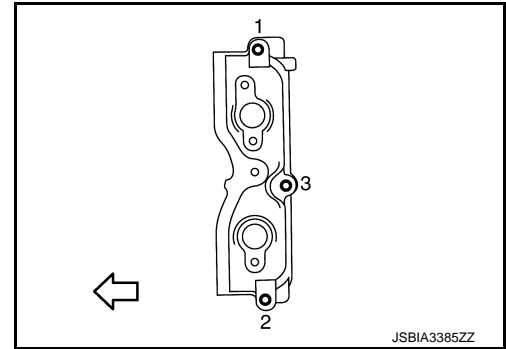
⇐ : Engine front

10. Install camshaft position sensor (PHASE) and exhaust valve timing cont position sensor.

CAUTION:

Do not reuse O-ring.

11. Inspect and adjust valve clearance. Refer to [EM-159. "Inspection and Adjustment"](#).
12. Install in the reverse order of removal after this step.



INFOID:000000010783814

Inspection

INSPECTION AFTER REMOVAL

Camshaft Runout

1. Put V-block on a precise flat table, and support No. 2 and 5 journal of camshaft.

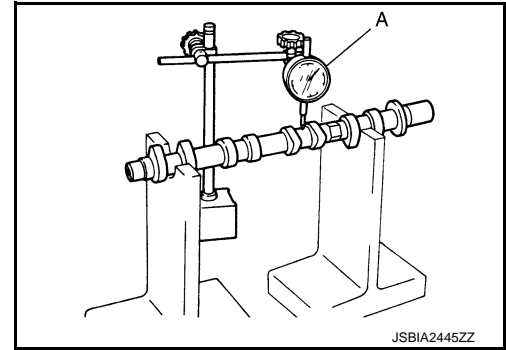
CAUTION:

Never support No. 1 journal (on the side of camshaft sprocket) because it has a different diameter from the other four locations.

2. Set dial indicator (A) vertically to No. 3 journal.
3. Turn camshaft to one direction with hands, and measure the camshaft runout on dial indicator. (Total indicator reading)

Standard: Refer to [EM-275. "Camshaft"](#).

4. If out of the standard, replace camshaft.

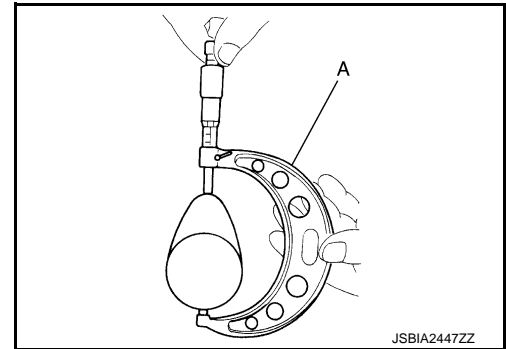


Camshaft Cam Height

1. Measure the camshaft cam height with a micrometer (A).

Standard and Limit : Refer to [EM-275. "Camshaft"](#).

2. If it exceeds the limit, replace camshaft.

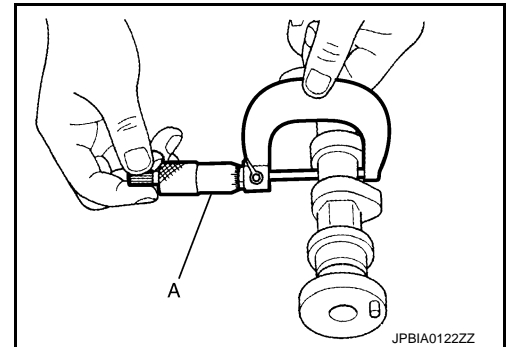


Camshaft Journal Oil Clearance

CAMSHAFT JOURNAL DIAMETER

Measure the outer diameter of camshaft journal with a micrometer (A).

Standard: Refer to [EM-275. "Camshaft"](#).



CAMSHAFT BRACKET INNER DIAMETER

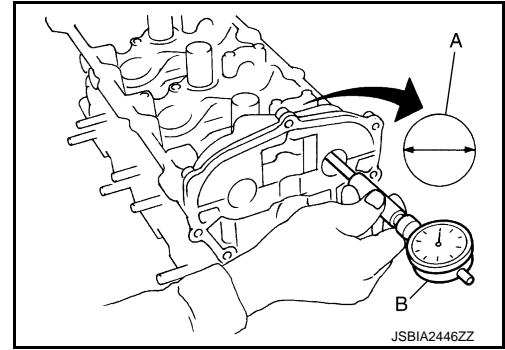
CAMSHAFT

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

- Tighten camshaft bracket bolts with specified torque. Refer to [EM-222, "Removal and Installation"](#).
- Measure the inner diameter (A) of camshaft bracket with an cylinder gauge (B).

Standard: Refer to [EM-275, "Camshaft"](#).



CAMSHAFT JOURNAL OIL CLEARANCE

- (Oil clearance) = (Camshaft bracket inner diameter) – (Camshaft journal diameter)

Standard : Refer to [EM-275, "Camshaft"](#).

- If out of the standard, replace either or both camshaft and cylinder head.

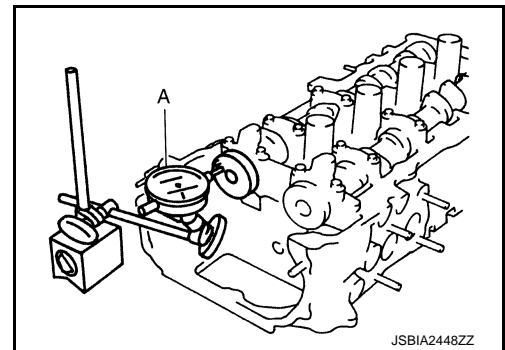
NOTE:

Camshaft bracket cannot be replaced as a single part, because it is machined together with cylinder head. Replace whole cylinder head assembly.

Camshaft End Play

1. Install camshaft in cylinder head. Refer to [EM-222, "Removal and Installation"](#).
2. 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-275, "Camshaft"](#).



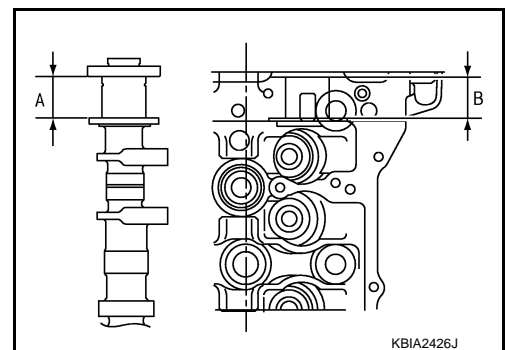
- Measure the following parts if out of the standard.
 - Dimension "A" for camshaft No. 1 journal

Standard : 25.800 - 25.848 mm (1.0157 - 1.0176 in)

- Dimension "B" for cylinder head No. 1 journal

Standard : 25.660 - 25.685 mm (1.0102 - 1.0112 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 5 journals of camshaft.

CAUTION:

Never support No. 1 journal (on the side of camshaft sprocket) because it has a different diameter from the other four locations.

CAMSHAFT

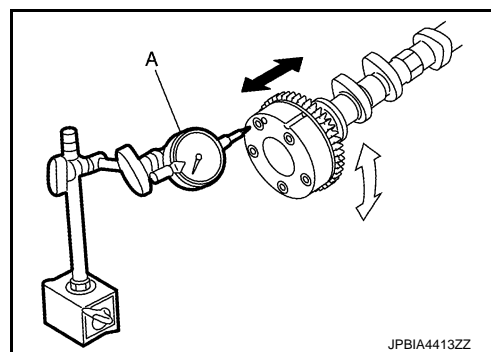
< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

2. Measure the camshaft sprocket runout with a dial indicator (A).
(Total indicator reading)

Limit : Refer to [EM-275, "Camshaft"](#).

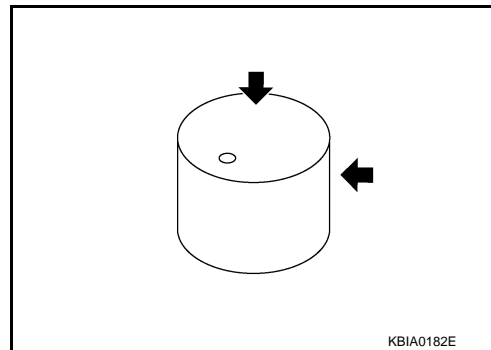
- If it exceeds the limit, replace camshaft sprocket.



Valve Lifter

Check if surface of valve lifter has any wear or cracks.

- If anything above is found, replace valve lifter. Refer to [EM-275, "Camshaft"](#).

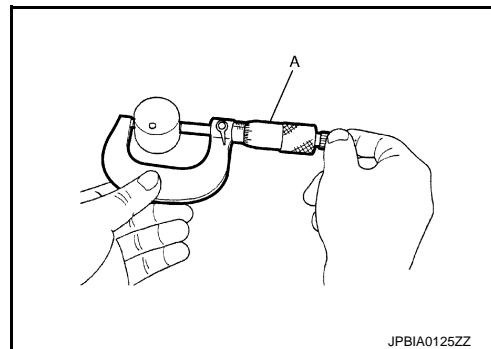


Valve Lifter Clearance

VALVE LIFTER OUTER DIAMETER

- Measure the outer diameter of valve lifter with a micrometer (A).

Standard: Refer to [EM-275, "Camshaft"](#).



VALVE LIFTER HOLE DIAMETER

Measure the diameter of valve lifter hole of cylinder head with an inside micrometer (A).

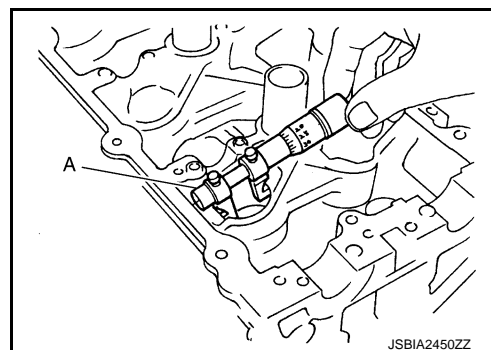
Standard: Refer to [EM-275, "Camshaft"](#).

VALVE LIFTER CLEARANCE

- (Valve lifter clearance) = (Valve lifter hole diameter) – (Valve lifter outer diameter)

Standard: Refer to [EM-275, "Camshaft"](#).

- If out of the standard, referring to the 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 Oil Groove.

CAUTION:

- Perform this inspection only when DTC P0011 and DTC P0014 is detected in self-diagnostic results of CONSULT and it is directed according to inspection procedure of EC section. Refer to [EC-585, "Diagnosis Procedure"](#) (P0011), (P0014).

CAMSHAFT

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

- Check when the engine is cold so as to prevent burns from any splashing engine oil.

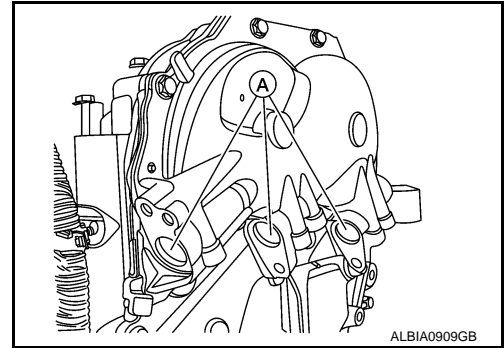
1. Check the engine oil level. Refer to [LU-25, "Inspection"](#).
2. Perform the following procedure so as to prevent the engine from being unintentionally started while checking.
 - a. Release fuel pressure. Refer to [EC-558, "Work Procedure"](#).
 - b. Disconnect ignition coil and injector harness connectors.
3. Remove intake valve timing control solenoid valve. Refer to [EM-210, "Exploded View"](#).
4. Crank the engine, and then check that engine oil comes out from intake valve timing control cover oil hole ①. End crank after checking.

WARNING:

Be careful not to touch rotating parts (drive belt, idler pulley, and crankshaft pulley, etc.).

CAUTION:

Engine oil may squirt from intake valve timing control solenoid valve installation hole during cranking. Use a shop cloth to prevent the engine components and the vehicle. Do not allow engine oil to get on rubber components such as drive belt or engine mount insulators. Immediately wipe off any splashed engine oil.



- Clean oil groove between oil strainer and intake valve timing control solenoid valve if engine oil does not come out from intake valve timing control cover oil hole. Refer to [LU-23, "Engine Lubrication System"](#).
5. Remove components between intake valve timing control solenoid valve and camshaft sprocket (INT), and then check each oil groove for clogging.
 - Clean oil groove if necessary. Refer to [LU-23, "Engine Lubrication System"](#).
 6. After inspection, install removed parts.

CYLINDER HEAD

< UNIT DISASSEMBLY AND ASSEMBLY >

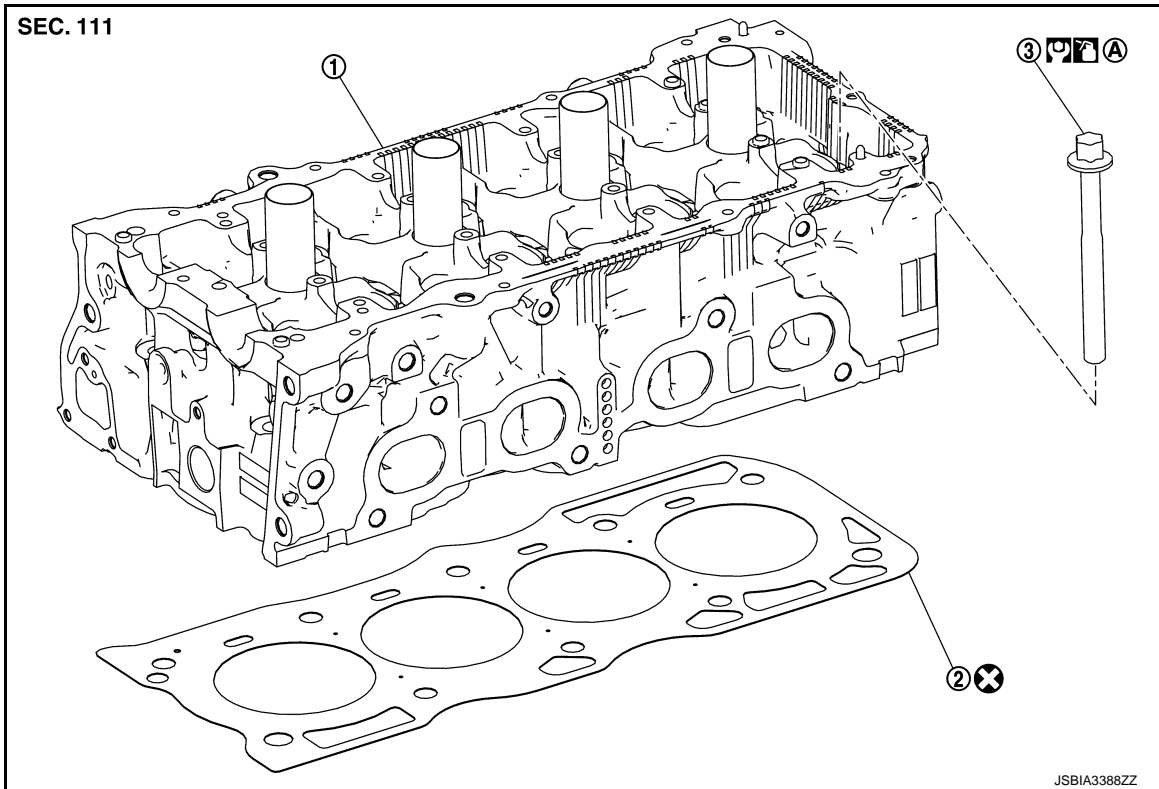
[QR25DE]

CYLINDER HEAD

Exploded View

INFOID:000000010783815

REMOVAL



① Cylinder head assembly

② Cylinder head gasket

③ Cylinder head bolt

ⓐ :Comply with the assembly procedure
when tightening. Refer to [EM-233](#)

: N·m (kg-m, ft-lb)

: Always replace after every disassembly.

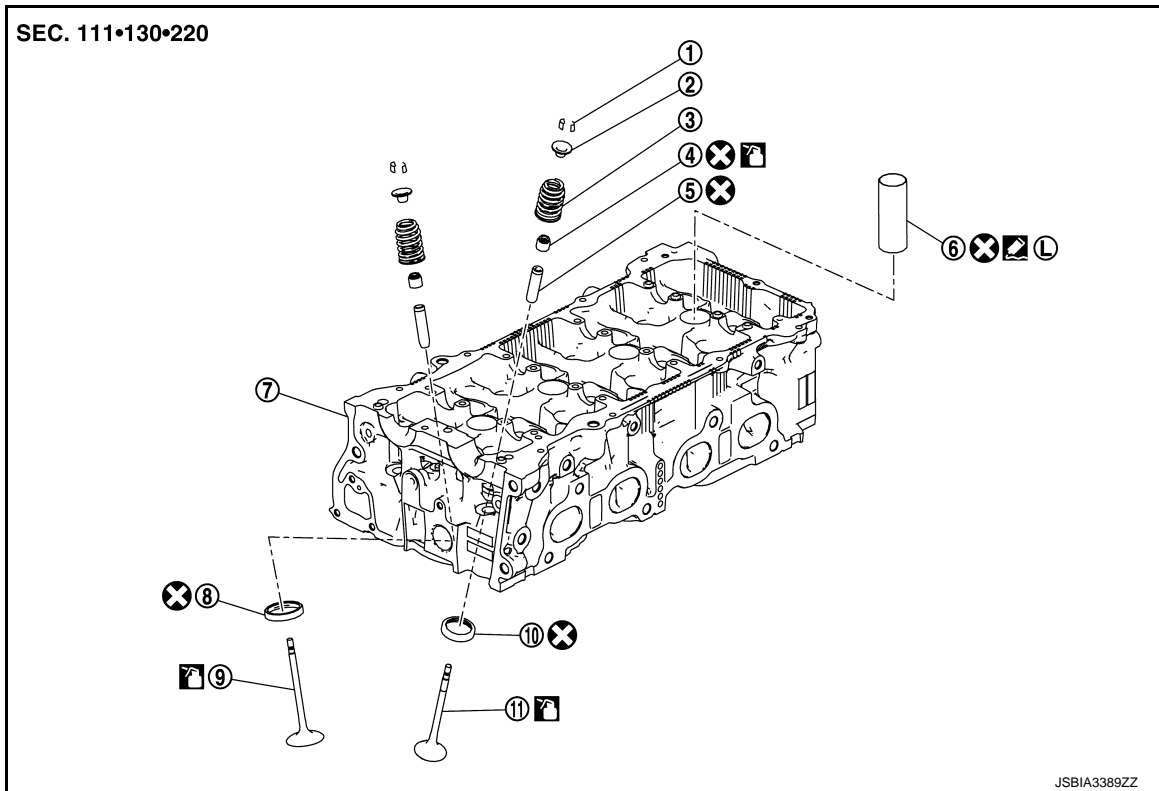
: Should be lubricated with oil.

DISASSEMBLY

CYLINDER HEAD

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]



- | | | |
|--------------------|-------------------------|---|
| ① Valve collet | ② Valve spring retainer | ③ Valve spring (with valve spring seat) |
| ④ Valve oil seal | ⑤ Valve guide | ⑥ Spark plug tube |
| ⑦ Cylinder head | ⑧ Valve seat (INT) | ⑨ Valve (INT) |
| ⑩ Valve seat (EXH) | ⑪ Valve (EXH) | |

L : Apply thread locking sealant.

: Always replace after every disassembly.

: Should be lubricated with oil.

Removal and Installation

INFOID:0000000010783816

REMOVAL

1. Drain engine oil. Refer to [LU-26, "Draining"](#).
 2. Remove the following components and related parts.
 - Exhaust manifold and three way catalyst assembly: Refer to [EM-180, "Removal and Installation"](#).
 - Intake manifold and fuel tube assembly: Refer to [EM-176, "Removal and Installation"](#).
 - Water control valve and water control valve housing (water outlet): Refer to [CO-52, "Exploded View"](#).
- NOTE:**
Can be removed and installed even when assembled with cylinder head.
3. Remove front cover and timing chain. Refer to [EM-210, "Exploded View"](#).
 4. Remove camshafts. Refer to [EM-222, "Removal and Installation"](#).
 5. Securely support bottom of cylinder block with a jack or equivalent tool, and release the hoist that was supporting it.

CYLINDER HEAD

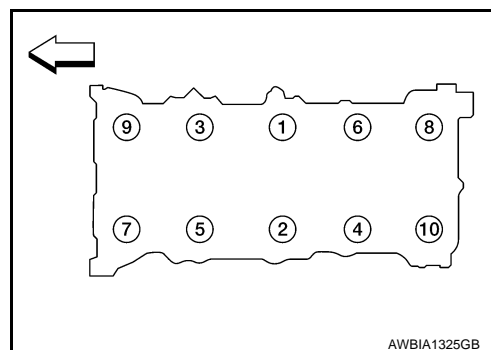
< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

6. Remove cylinder head loosening bolts in reverse order as shown in the figure.

⇐ : Engine front

- Using TORX socket (size E20), loosen cylinder head bolts.



7. Remove cylinder head gasket.

INSTALLATION

1. Install cylinder head gasket.
2. Tighten cylinder head bolts in numerical order as shown in figure with the following procedure, and install cylinder head.

⇐ : Engine front

CAUTION:

If cylinder head bolts are re-used, check their outer diameters before installation. Refer to [EM-239, "Inspection"](#).

- a. Apply new engine oil to threads and seating surface of mounting bolts.
- b. Tighten all bolts.

: 50.0 N·m (5.1 kg-m, 37 ft-lb)

- c. Turn all bolts 60 degrees clockwise (angle tightening).
- d. Completely loosen.

: 0 N·m (0 kg-m, 0 ft-lb)

CAUTION:

In this step, loosen bolts in reverse order of that indicated in the figure.

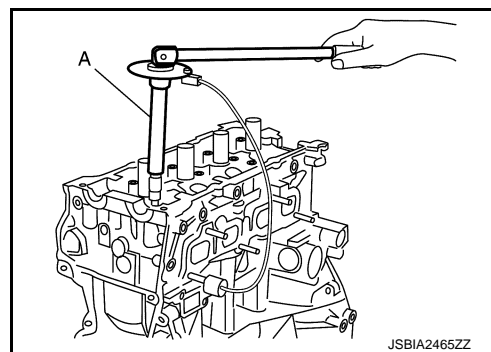
- e. Tighten all bolts.

: 39.2 N·m (4.0 kg-m, 29 ft-lb)

- f. Turn all bolts 75 degrees clockwise (angle tightening).
- g. Turn all bolts 75 degrees clockwise again (angle tightening).

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.



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

Disassembly and Assembly

DISASSEMBLY

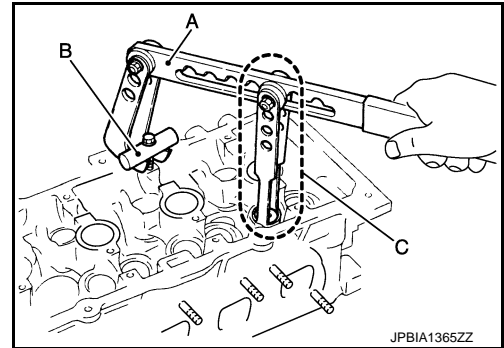
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CYLINDER HEAD

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

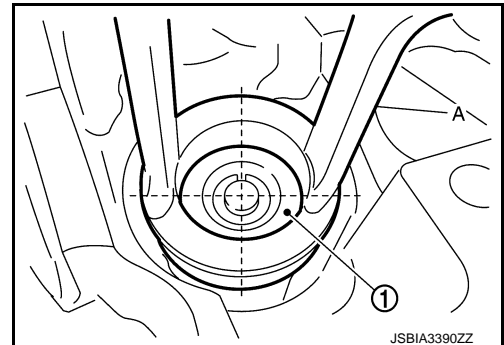
1. Remove spark plug with spark plug wrench (commercial service tool).
2. Remove spark plug tube, if necessary.
 - Using pliers, remove it from cylinder head.**CAUTION:**
 - Be careful not to damage cylinder head.
 - Never remove spark plug tube if not necessary. Once removed, spark plug tube cannot be reused because of deformation.
3. Remove valve lifter.
 - Identify installation positions, and store them without mixing them up.
4. Remove valve collet.
 - Compress valve spring with valve spring compressor [SST: KV10116200] (A), adapter [SST: KV10109220] (B) and attachment [SST: KV10115900] (C).



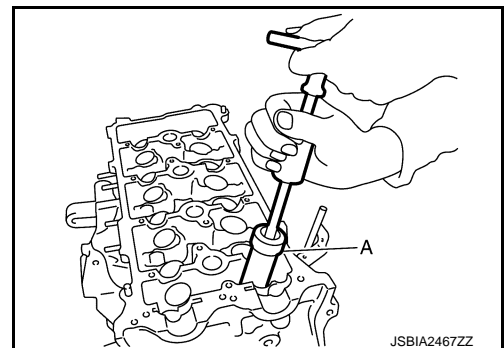
CAUTION:

- Never damage valve lifter holes.
- Fit the attachment [SST: KV10115900] (A) in the center of valve spring retainer to press it.

① : Valve spring retainer



5. Remove valve spring retainer and valve spring (with valve spring seat).**CAUTION:**
Never remove valve spring seat from valve spring.
6. Push valve stem to combustion chamber side, and remove valve.
 - Identify installation positions, and store them without mixing them up.
7. Remove valve oil seal with a valve oil seal puller [SST: KV10107902] (A).



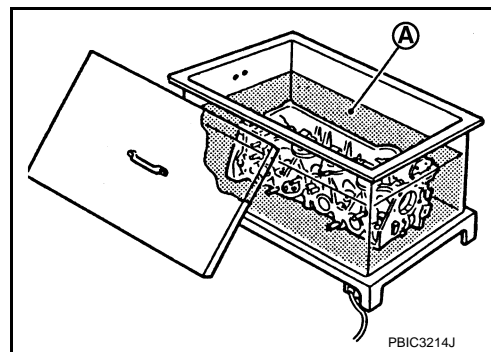
8. Remove valve seat, if valve seat must be replaced.
 - Bore out old seat until it collapses. Boring should not continue beyond the bottom face of the seat recess in cylinder head. Set the machine depth stop to ensure this. Refer to [EM-277, "Cylinder Head"](#).**CAUTION:**
Prevent to scratch cylinder head by excessive boring.

CYLINDER HEAD

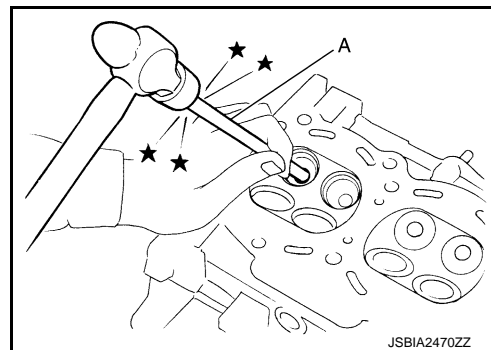
< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

9. 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).



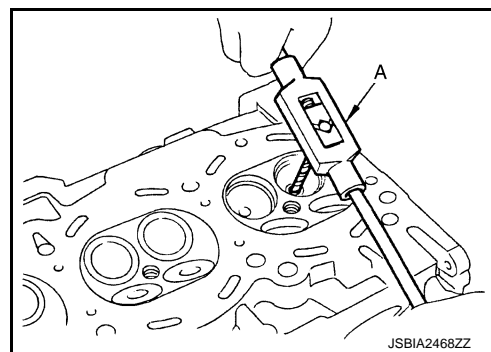
- b. Drive out valve guide with a press [under a 20 kN (2 ton, 2.2 US ton, 2.0 Imp ton) pressure] or hammer and suitable tool (A).
CAUTION:
Cylinder head contains heat, when working, wear protective equipment to avoid getting burned.



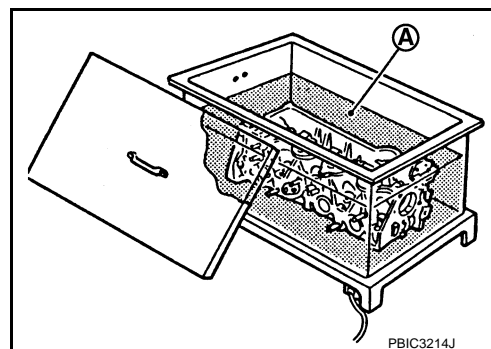
ASSEMBLY

1. Install valve guide if removed.
CAUTION:
Replace with oversize [0.2 mm (0.008 in)] valve guide.
 - a. Ream cylinder head valve guide hole with a valve guide reamer (commercial service tool) (A).

For service parts : Oversize [0.2 mm (0.008 in)]
Refer to [EM-277, "Cylinder Head"](#).



- b. Heat cylinder head to 110 to 130°C (230 to 266°F) by soaking in heated oil (A).



CYLINDER HEAD

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

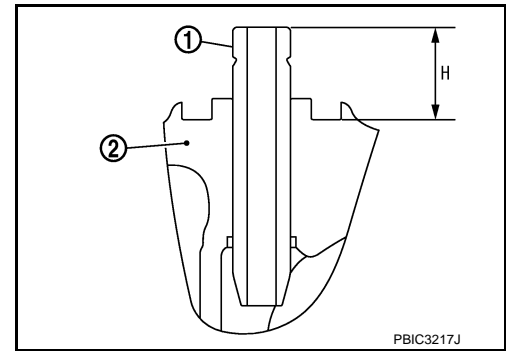
- c. Press valve guide ① from camshaft side to dimensions as shown in the figure.

② : Cylinder head

Projection "H" : Refer to [EM-277, "Cylinder Head"](#).

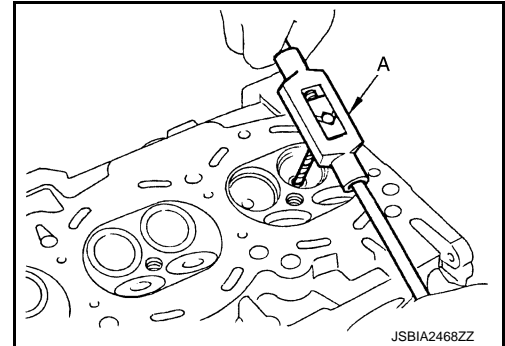
CAUTION:

Cylinder head contains heat, when working, wear protective equipment to avoid getting burned.



- d. Apply reamer finish to valve guide with a valve guide reamer (commercial service tool) (A).

Standard : Refer to [EM-277, "Cylinder Head"](#).



2. Install valve seat if removed.

CAUTION:

Replace with oversize [0.5 mm (0.020 in)] valve seat.

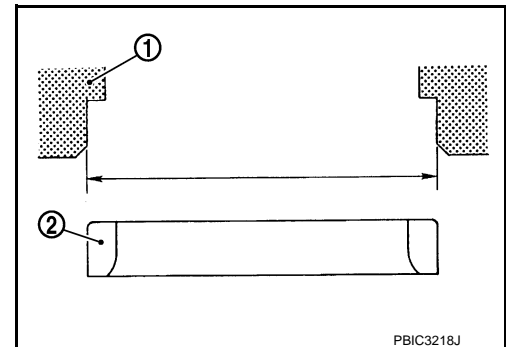
- a. Ream cylinder head ① recess diameter for service valve seat.

② : Valve seat

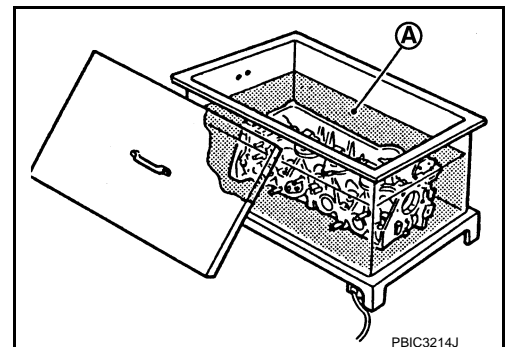
For service parts : Oversize [0.5 mm (0.020 in)]

Refer to [EM-277, "Cylinder Head"](#).

- Be sure to ream in circles concentric to the valve guide center. This will enable valve seat to fit correctly.



- b. Heat cylinder head to 110 to 130°C (230 to 266°F) by soaking in heated oil (A).



- c. Provide valve seats cooled well with dry ice. Press-fit valve seat into cylinder head.

CAUTION:

- Avoid directly touching cold valve seats.
- Cylinder head contains heat, when working, wear protective equipment to avoid getting burned.

CYLINDER HEAD

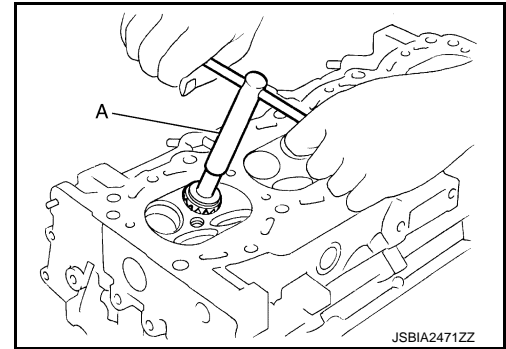
< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

- d. Using valve seat cutter set (commercial service tool) (A) or valve seat grinder, finish valve seat to the specified dimensions. For dimensions, refer to [EM-277, "Cylinder Head"](#).

CAUTION:

When using valve seat cutter, firmly grip the cutter handle with both hands. Then, press on the contacting surface all around the circumference to cut in a single drive. Improper pressure on with the cutter or cutting many different times may result in stage valve seat.

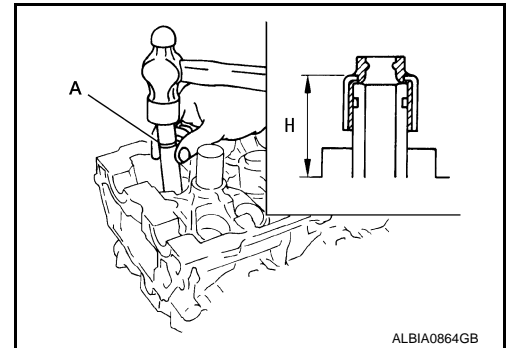


- e. Using compound, grind to adjust valve fitting.
f. Check again for normal contact. Refer to [EM-239, "Inspection"](#).
3. Install valve oil seal.
• Install with a valve oil seal drift [SST: KV10115600] (A) to match dimension in the figure.

NOTE:

Dimension "H" is height that measured before installing valve spring (with valve spring seat).

Height "H" : 11.8 - 12.4 mm (0.465 - 0.488 in)



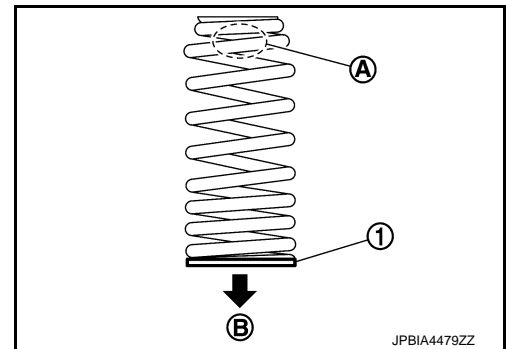
4. Install valve.
• Install larger diameter to intake side.
5. Install valve spring (with valve spring seat).
• Install smaller pitch (valve spring seat side) to cylinder head side (B).

① : Valve spring seat

- Confirm identification color (A) of valve spring.

Intake : White

Exhaust : Light blue

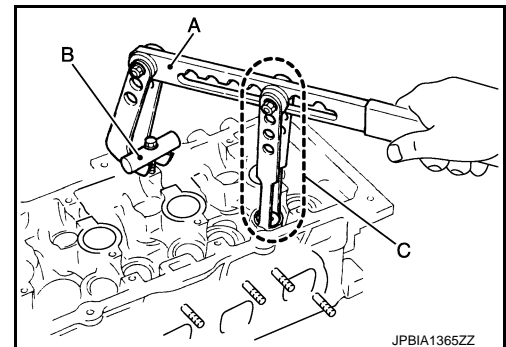


6. Install valve spring retainer.
7. Install valve collet.
• Compress valve spring with valve spring compressor [SST: KV10116200] (A), adapter [SST: KV10109220] (B) and attachment [SST: KV10115900] (C).

CAUTION:

When working, be careful not to damage valve lifter holes.

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



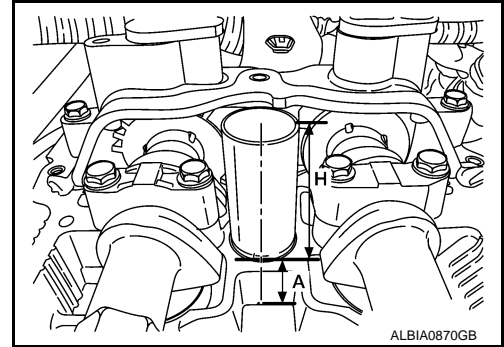
8. Install valve lifter.
• Install it in the original position.

CYLINDER HEAD

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

9. Install spark plug tube if removed.
 - Press-fit it into cylinder head with the following procedure:
- a. Remove old thread locking sealant from cylinder head side installation hole.
- b. Apply thread locking sealant all round on spark plug tube within approximately 12 mm (0.47 in) (A) width from edge of spark plug tube on the press-fit side.
Use Genuine Thread Locking Sealant or equivalent.
- c. Using a drift, press-fit spark plug tube so that height is as same as "H" shown in figure.



Standard press-fit height "H":

41.2 - 42.2 mm (1.622 - 1.661 in)

CAUTION:

- When press-fitting, be careful not to deform spark plug tube.
- After press-fitting, wipe off any protruding thread locking sealant on top surface of cylinder head.

10. Install spark plug with spark plug wrench (commercial service tool).

Inspection

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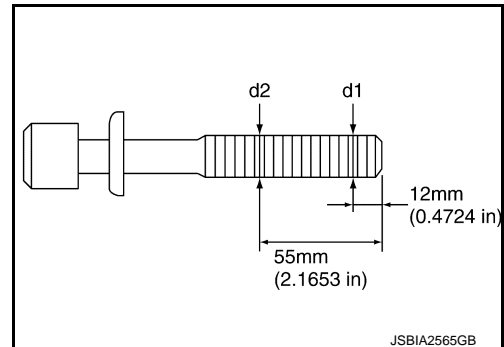
INSPECTION AFTER REMOVAL

Cylinder Head Bolts Outer Diameter

- Cylinder head bolts are tightened by plastic zone tightening method. Whenever the size difference between "d1" and "d2" exceeds the limit, replace them with a new one.

Limit ("d1" – "d2"): 0.23 mm (0.0091 in)

- If reduction of outer diameter appears in a position other than "d2", use it as "d2" point.



Cylinder Head Distortion

NOTE:

When performing this inspection, cylinder block distortion should be also checking. Refer to [EM-256, "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.

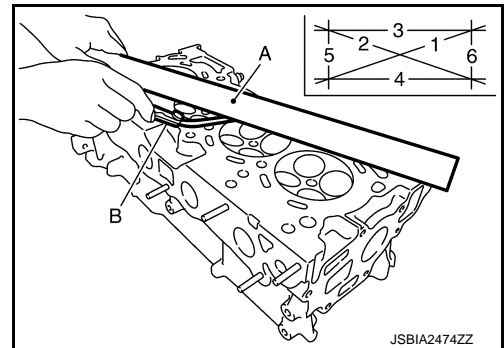
2. At each of several locations on bottom surface of cylinder head, measure the distortion in six directions.

A : Straightedge

B : Feeler gauge

Limit : Refer to [EM-277, "Cylinder Head"](#).

- If it exceeds the limit, replace cylinder head.



VALVE DIMENSIONS

- Check dimensions of each valve. For dimensions, refer to [EM-277, "Cylinder Head"](#).
- If dimensions are out of the standard, replace valve.

CYLINDER HEAD

< UNIT DISASSEMBLY AND ASSEMBLY >

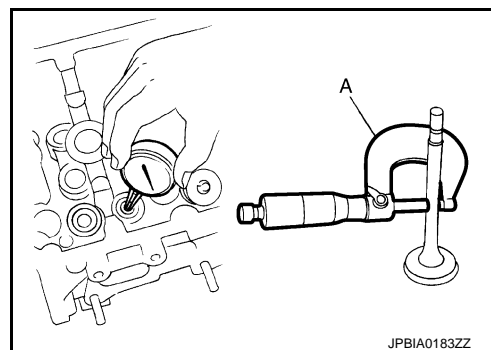
[QR25DE]

VALVE GUIDE CLEARANCE

Valve Stem Diameter

Measure the diameter of valve stem with a micrometer (A).

Standard : Refer to [EM-277, "Cylinder Head"](#).



Valve Guide Inner Diameter

Measure the inner diameter of valve guide with a bore gauge.

Standard : Refer to [EM-277, "Cylinder Head"](#).

Valve Guide Clearance

(Valve guide clearance) = (Valve guide inner diameter) – (Valve stem diameter).

Standard and Limit : Refer to [EM-277, "Cylinder Head"](#).

- If it exceeds the limit, replace valve guide and/or valve. When valve guide must be replaced. Refer to [EM-234, "Disassembly and Assembly"](#).

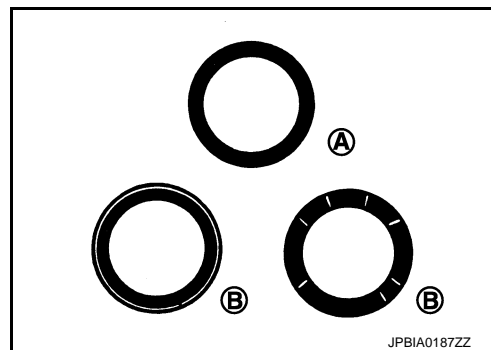
VALVE SEAT CONTACT

- After confirming that the dimensions of valve guides and valves are within 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 re-check, replace valve seat. Refer to [EM-234, "Disassembly and Assembly"](#).



VALVE SPRING SQUARENESS

- Set try square (A) along the side of valve spring and rotate the spring. Measure the maximum clearance ⓓ between the top of valve spring and try square.

Ⓑ : Contact

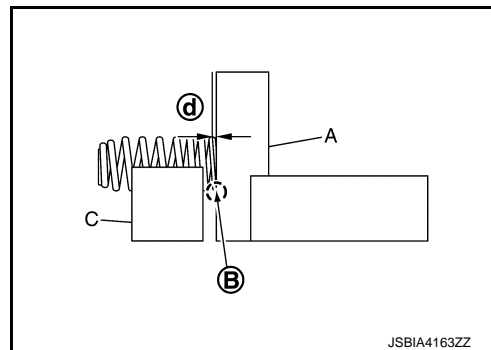
C : V-block

CAUTION:

Never remove valve spring seat from valve spring.

Limit : Refer to [EM-277, "Cylinder Head"](#).

- If it exceeds the limit, replace valve spring (with valve spring seat).



VALVE SPRING DIMENSIONS AND VALVE SPRING PRESSURE LOAD

CYLINDER HEAD

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

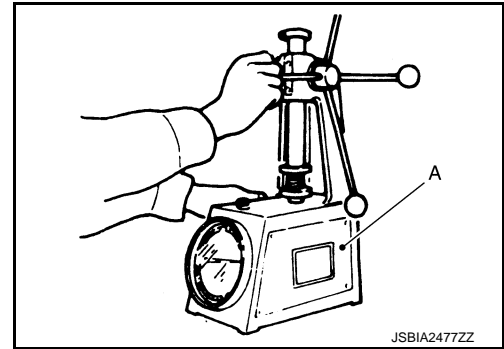
- Check valve spring pressure with valve spring seat installed at the specified spring height.

A : Valve spring tester

CAUTION:

Never remove valve spring seat from valve spring.

Standard : Refer to [EM-277, "Cylinder Head"](#).



- If the installation load or load with valve open is out of the standard, replace valve spring (with valve spring seat).

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 less than required quantity, fill to the specified level. Refer to [MA-23, "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.
- Warm up engine thoroughly to check there is no leakage of fuel, exhaust gases, 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 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.

OIL PAN (UPPER) AND OIL STRAINER

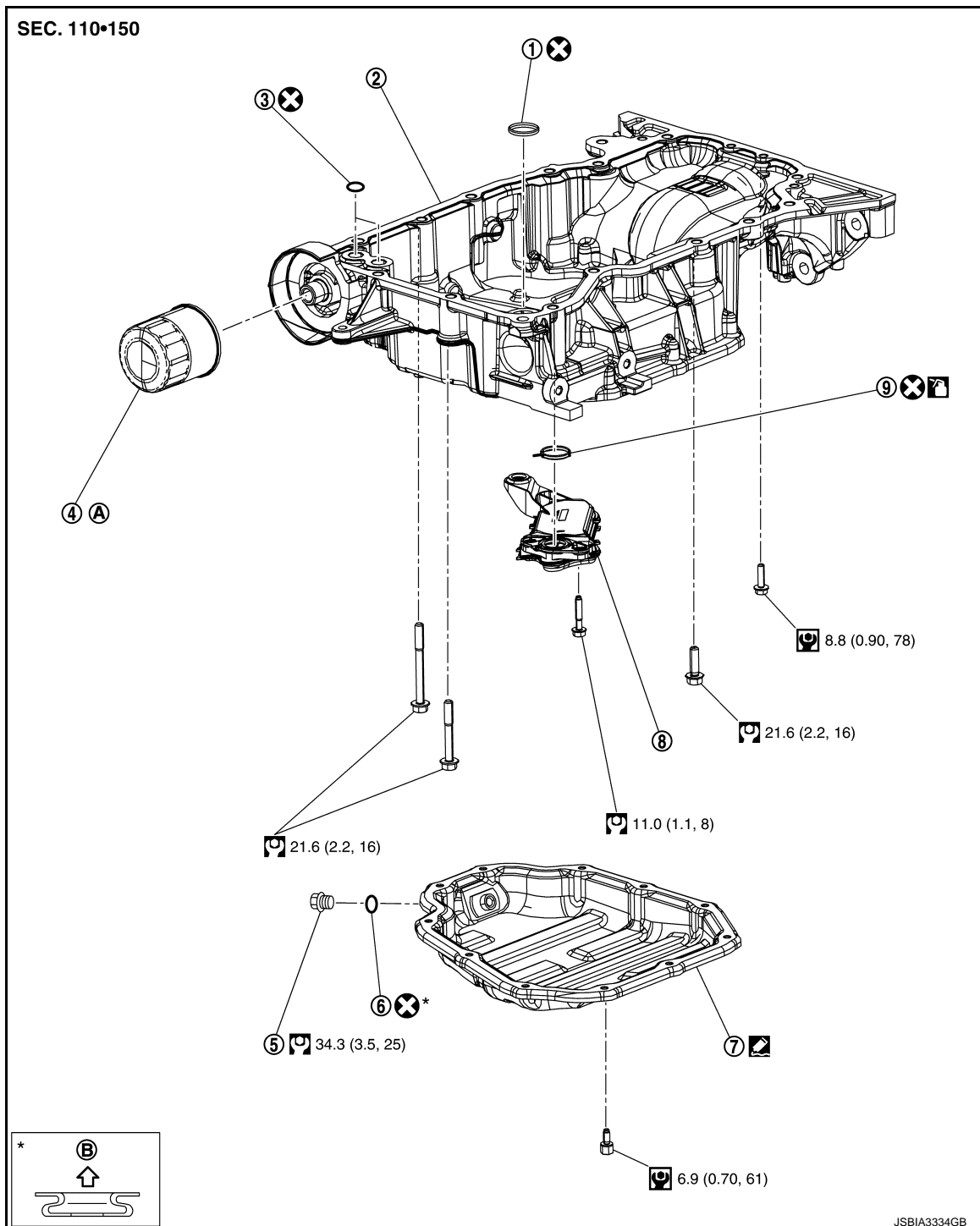
< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

OIL PAN (UPPER) AND OIL STRAINER

Exploded View

INFOID:000000010783819



- | | | |
|---|-------------------|---------------------|
| ① O-ring | ② Oil pan (upper) | ③ O-ring |
| ④ Oil filter | ⑤ Drain plug | ⑥ Drain plug washer |
| ⑦ Oil pan (lower) | ⑧ Oil strainer | ⑨ O-ring |
| (A) Comply with the installation procedure when tightening. Refer to EM-243 | (B) Oil pan side | |
- * : N·m (kg-m, ft-lb)

OIL PAN (UPPER) AND OIL STRAINER

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]



: N·m (kg-m, in-lb)



: Always replace after every disassembly.



: Should be lubricated with oil.



: Sealing point

Removal and Installation

INFOID:000000010783820

REMOVAL

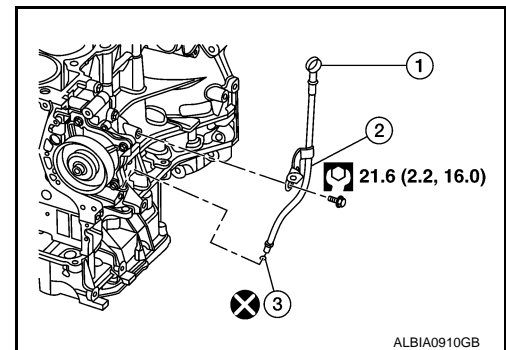
WARNING:

To avoid the danger of being scalded, never drain the engine oil when the engine is hot.

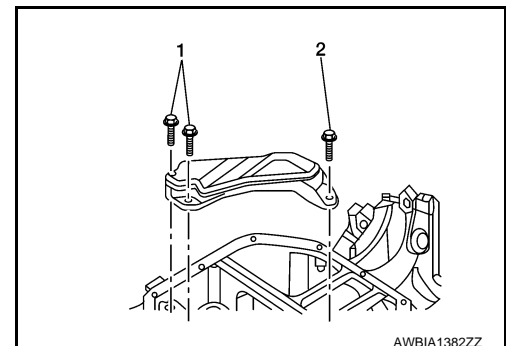
1. Remove under cover.
2. Drain engine oil. Refer to [LU-26, "Draining"](#).
3. Remove oil pan (lower). [EM-194, "Removal and Installation"](#).
4. Remove oil level gauge ①, oil level gauge guide ② and O-ring ③.

CAUTION:

Do not reuse O-ring.



5. Disconnect the air fuel ratio sensor 1 electrical harness connector.
6. Remove the front driveshaft (LH) and front driveshaft (RH). Refer to [FAX-113, "QR25DE : Removal and Installation"](#).
7. Remove the connecting rod (LH) and the connecting rod (RH). Refer to [FSU-19, "Exploded View"](#).
8. Remove the tie rod end from the steering knuckle (RH) and the tie rod end from the steering knuckle (LH). Refer to [ST-20, "LHD : Exploded View"](#) (LHD models) or [ST-21, "RHD : Exploded View"](#) (RHD models).
9. Remove the steering gear bolts and support the steering gear. Refer to [ST-22, "Removal and Installation"](#).
10. Remove the torque rod bracket (RR). Refer to [EM-200, "Removal and Installation"](#).
11. Remove the front suspension member for clearance to remove the oil pan.
12. Disconnect the A/C compressor electrical harness connector.
13. Remove the drive belt. Refer to [EM-166, "Removal and Installation"](#).
14. Remove the A/C compressor bolts, position the A/C compressor aside and support. Refer to [HA-121, "Exploded View"](#).
15. Remove rear propeller shaft. Refer to [DLN-214, "Exploded View"](#). (4WD models)
16. Remove transfer assembly. Refer to [DLN-81, "QR25DE : Exploded View"](#). (4WD models)
17. Remove the oil strainer bolts in the reverse order as shown then remove the oil strainer.



18. Remove rear cover plate, and four engine-to transaxle bolts, using power tool.

OIL PAN (UPPER) AND OIL STRAINER

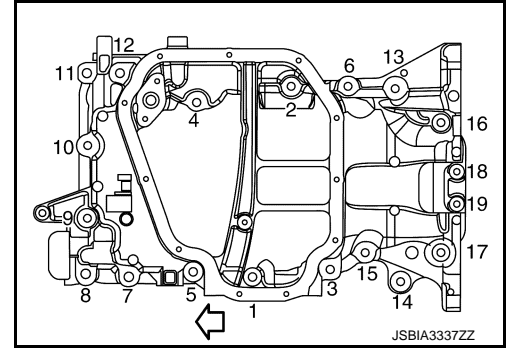
< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

19. Remove oil pan (upper) with the following procedure:

- a. Loosen bolts in reverse order as shown in the figure.

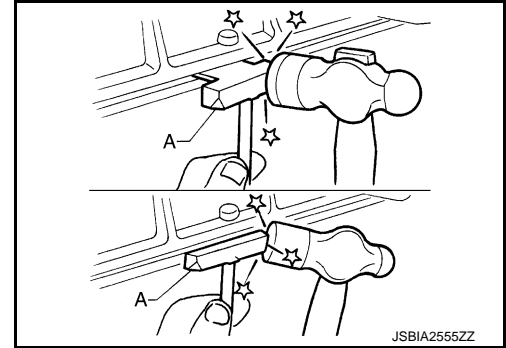
⇐ : Engine front



- b. Insert seal cutter [SST:KV10111100] (A) between oil pan (upper) and lower cylinder block, and slide it by tapping on the side of the tool with a hammer.

CAUTION:

Be careful not to damage the mating surface.



20. Remove O-rings at front cover side.

INSTALLATION

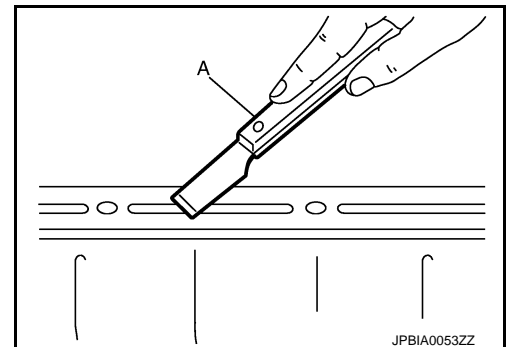
CAUTION:

Do not reuse O-ring.

1. Install oil pan (upper) with the following procedure:
- a. Use a scraper (A) to remove old liquid gasket from mating surfaces.
- Also remove the old liquid gasket from mating surface of cylinder block.
 - Remove old liquid gasket from the bolt holes and threads.

CAUTION:

Never scratch or damage the mating surfaces when cleaning off old liquid gasket.



OIL PAN (UPPER) AND OIL STRAINER

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

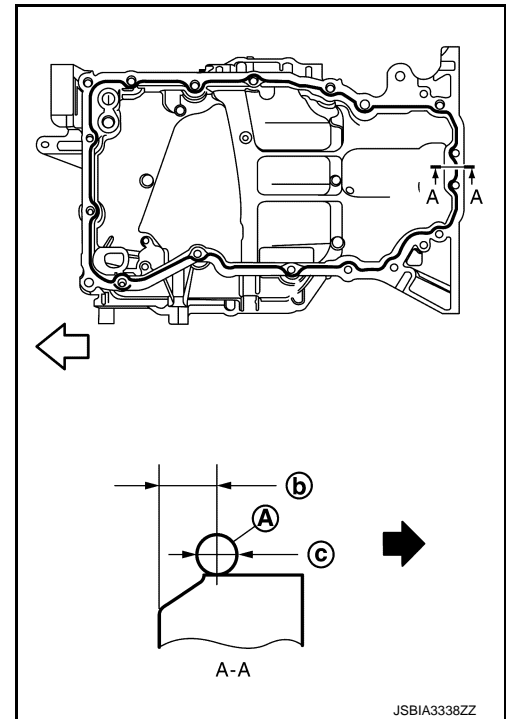
- b. Apply a continuous bead of liquid gasket (A) with a tube presser (commercial service tool) as shown in the figure.

- (b) : 5.5 - 7.5mm (0.216 - 0.295 in)
 (c) : ϕ 4.0 - 5.0 mm (0.157 - 0.197 in)
 ← : Engine outside
 ⇐ : Engine front

Use Genuine Liquid Gasket or equivalent.

CAUTION:

- Attaching should be done within 5 minutes after liquid gasket application.



- c. Install new O-rings at front cover side.

CAUTION:

Do not reuse O-rings.

- d. Tighten bolts in numerical order as shown in the figure.

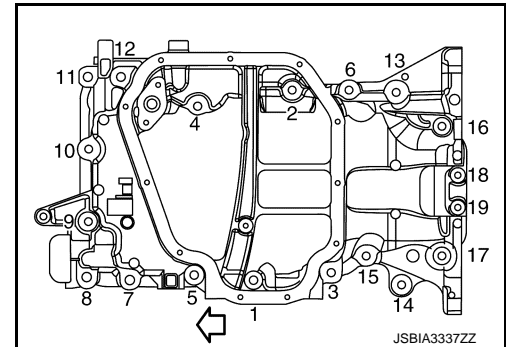
- ⇐ : Engine front

NOTE:

Refer to the following for locating bolts.

- | | |
|-----------------------|-------------------------------|
| M6 × 22 mm (0.87 in) | : No. 18, 19 |
| M8 × 27 mm (1.06 in) | : No. 2, 4, 6, 11, 15, 16, 17 |
| M8 × 58 mm (2.28 in) | : No. 7, 8, 9, 10 |
| M8 × 77 mm (3.03 in) | : No. 1, 3, 5, 12 |
| M8 × 100 mm (3.94 in) | : No. 13, 14 |

Tightening torque : Refer to [EM-242, "Exploded View"](#).



- Install oil strainer.
- Install front suspension member. Refer to [FSU-22, "Exploded View"](#).
- Install oil pan (lower). Refer to [EM-194, "Removal and Installation"](#).
- Install oil pan drain plug.
 - Refer to the figure of components of former page for installation direction of washer. Refer to [EM-242, "Exploded View"](#).
- Install in the reverse order of removal after this step.

NOTE:
 Pour engine oil at least 30 minutes after oil pan is installed.

Inspection

INFOID:000000010783821

INSPECTION AFTER INSTALLATION

- Check engine oil level and adjust engine oil. Refer to [LU-25, "Inspection"](#).
- Start engine, and check there is no leaks of engine oil.

OIL PAN (UPPER) AND OIL STRAINER

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

3. Stop engine and wait for 10 minutes.
4. Check engine oil level again. Refer to [LU-25, "Inspection"](#).

CYLINDER BLOCK

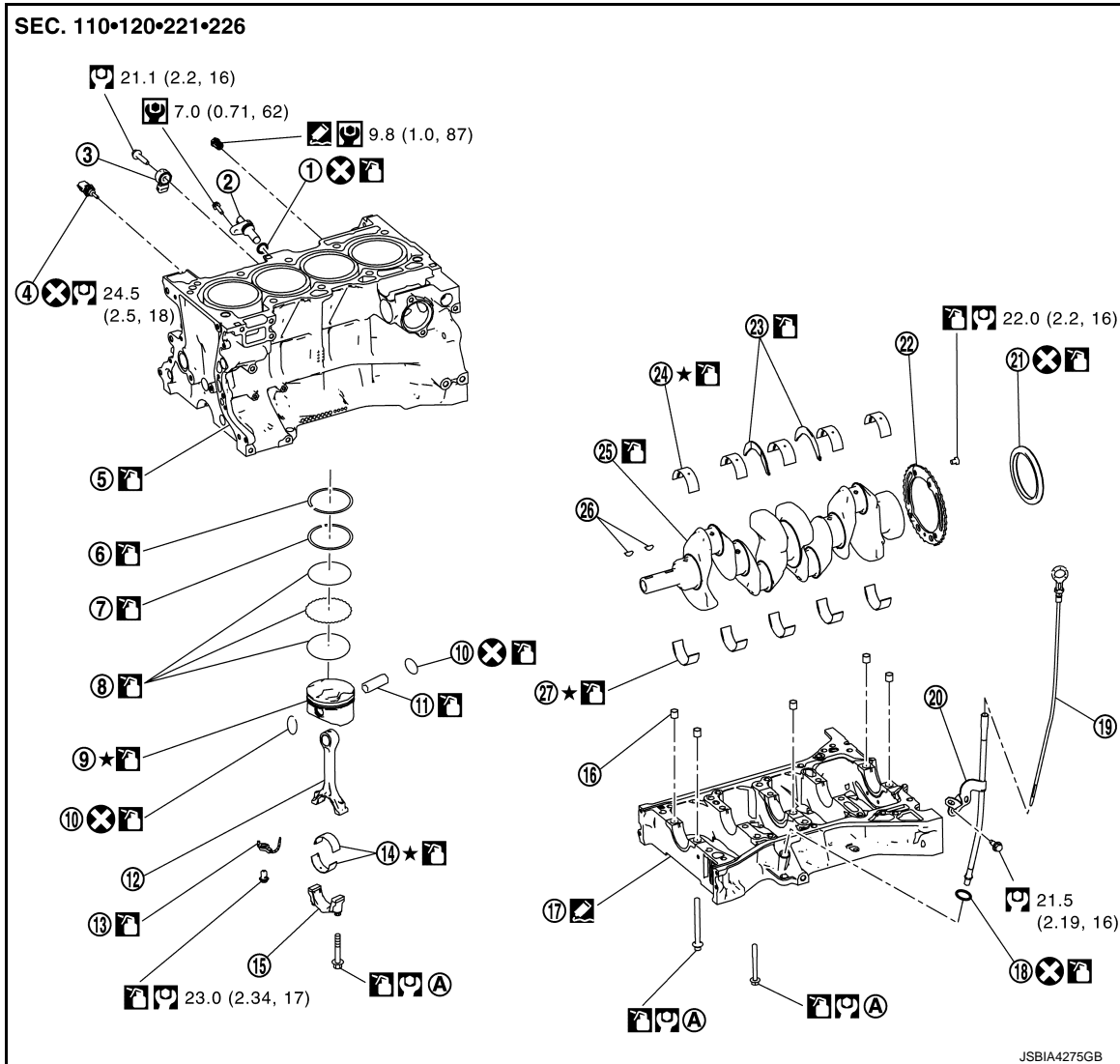
< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

CYLINDER BLOCK

Exploded View

INFOID:000000010783822




- | | | |
|--------------------------|------------------------------------|------------------------------|
| ① O-ring | ② Crankshaft position sensor (POS) | ③ Knock sensor |
| ④ Oil temperature sensor | ⑤ Cylinder block | ⑥ Top ring |
| ⑦ Second ring | ⑧ Oil ring | ⑨ Piston |
| ⑩ Snap ring | ⑪ Piston pin | ⑫ Connecting rod |
| ⑬ Oil jet | ⑭ Connecting rod bearing | ⑮ Connecting rod bearing cap |
| ⑯ Dowel pin | ⑰ Lower cylinder block | ⑱ O-ring |
| ⑲ Oil level gauge | ⑳ Oil level gauge guide | ㉑ Rear oil seal |
| ㉒ Signal plate | ㉓ Thrust bearing | ㉔ Main bearing upper |
| ㉕ Crankshaft | ㉖ Crankshaft key | ㉗ Main bearing lower |


Ⓐ : Comply with the assembly procedure when tightening. Refer to [EM-248](#)

Ⓐ : 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:000000010783823

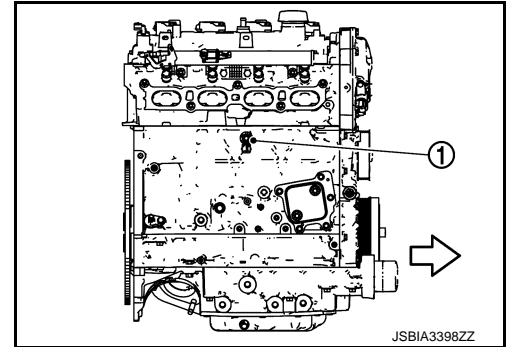
DISASSEMBLY

1. Remove cylinder head. Refer to [EM-232, "Exploded View"](#).
2. Remove knock sensor ①.

 : Engine front


CAUTION:

Carefully handle knock sensor avoiding shocks.



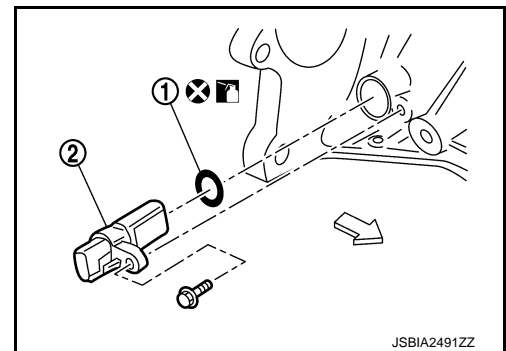
3. Remove crankshaft position sensor (POS) ②.

① : O-ring

 : Engine front

CAUTION:

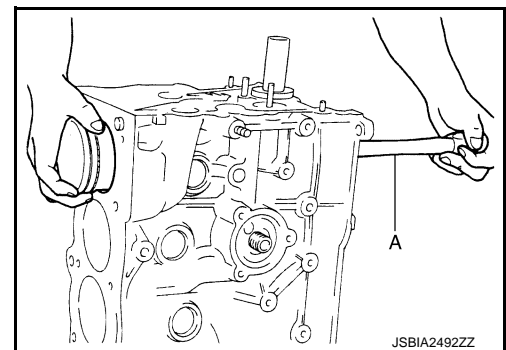
- Avoid impacts such as a dropping.
- Never disassemble.
- Keep it away from metal particles.
- Never place the sensor in a location where it is exposed to magnetism.



4. 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-256, "Inspection"](#).
- a. Position crankshaft pin corresponding to connecting rod to be removed onto the bottom dead center.
- b. Remove connecting rod cap.
- c. Using a hammer handle or similar tool (A), push piston and connecting rod assembly out to the cylinder head side.

CAUTION:

Be careful not to damage the cylinder wall, resulting from an interference of the connecting rod big end.



5. Remove connecting rod bearings.

CAUTION:

When removing them, note the installation position. Keep them in the correct order.

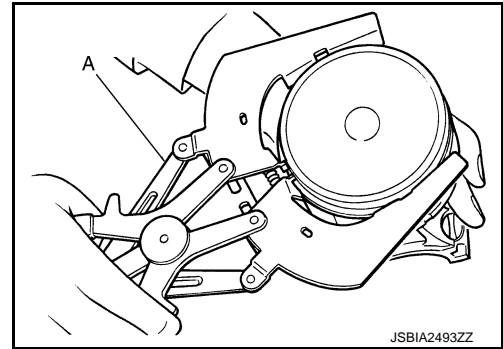
6. Remove piston rings from piston.

CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

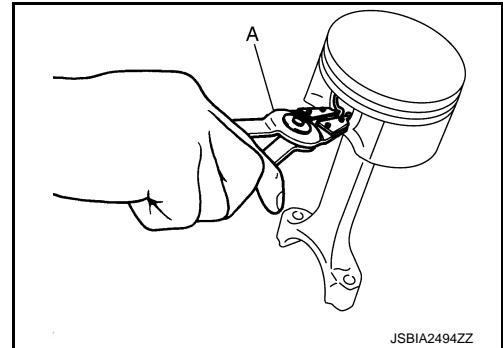
[QR25DE]

- Use a piston ring expander (commercial service tool) (A).
- CAUTION:**
- When removing piston rings, be careful not to damage the piston.
 - Be careful not to damage piston rings by expanding them excessively.

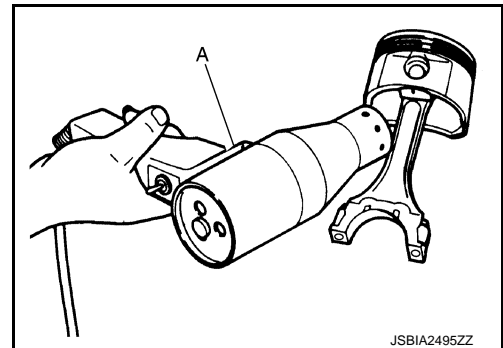


7. Remove piston from connecting rod with the following procedure:

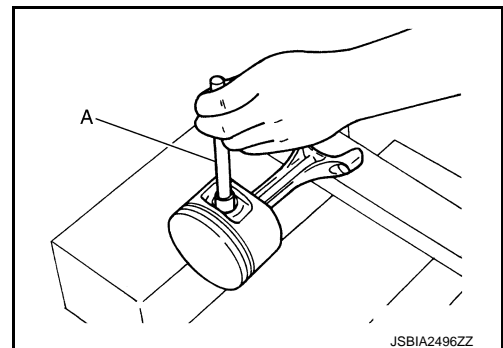
a. Using snap ring pliers (A), remove snap ring.



b. Heat piston to 60 to 70°C (140 to 158°F) with an industrial use drier (A) or equivalent.



c. Push out piston pin with stick (A) of outer diameter approximately 19 mm (0.75 in).



8. Remove lower cylinder block mounting bolts.

CYLINDER BLOCK

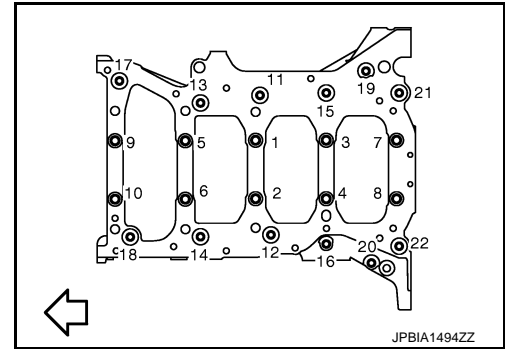
[QR25DE]

< UNIT DISASSEMBLY AND ASSEMBLY >

- Loosen them in reverse order as shown in the figure, and remove them.

⇐ : Engine front

- Use TORX socket (size E14) for bolts No. 1 to 10.
- Before loosening lower cylinder block mounting bolts, measure crankshaft end play. Refer to [EM-256, "Inspection"](#).



9. Remove lower cylinder block.

- Use a seal cutter [SST: KV10111100] or equivalent tool to cut liquid gasket for removal.

CAUTION:

Be careful not to damage the mounting surface.

10. Remove crankshaft.

CAUTION:

- Be careful not damage or deform signal plate mounted on crankshaft.
- When setting crankshaft ① on a flat floor surface, use a block of wood to avoid interference between signal plate and the floor surface.
- Never remove signal plate unless it is necessary to do so.

NOTE:

When removing or installing signal plate ②, use TORX socket (size T30).

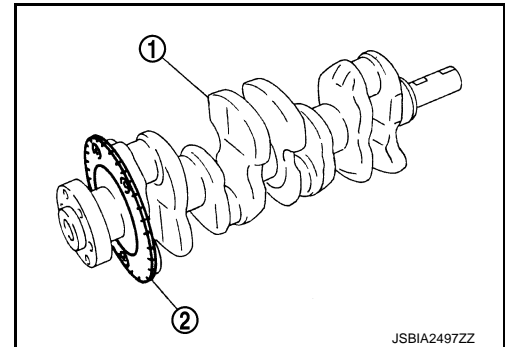
11. Pull rear oil seal out from rear end of crankshaft.

NOTE:

When replacing rear oil seal without removing lower cylinder block, use a screwdriver to pull it out from between crankshaft and cylinder block.

CAUTION:

Be careful not to damage crankshaft and cylinder block.



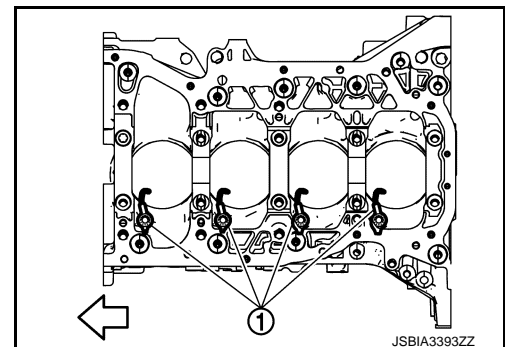
12. Remove main bearings and thrust bearings from cylinder block and lower cylinder block.

CAUTION:

Identify installation positions, and store them without mixing them up.

13. Remove oil jets ① if necessary.

⇐ : Engine front



ASSEMBLY

CAUTION:

Do not reuse O-rings or washers.

1. Fully air-blow engine coolant and engine oil passages in cylinder block, cylinder bore and crankcase to remove any foreign material.

CAUTION:

Use a goggles to protect your eye.

CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

2. Install each plug to cylinder block as shown in the figure.

- ③ : Washer
 ⇐ : Engine front

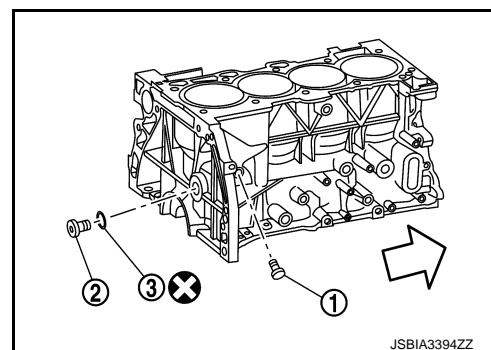
- Apply liquid gasket to the thread of water drain plug ①.
Use Genuine Liquid Gasket or equivalent.

NOTE:

Do not apply liquid gasket to the thread of plug ②.

CAUTION:

Do not reuse washers.



JSBIA3394ZZ

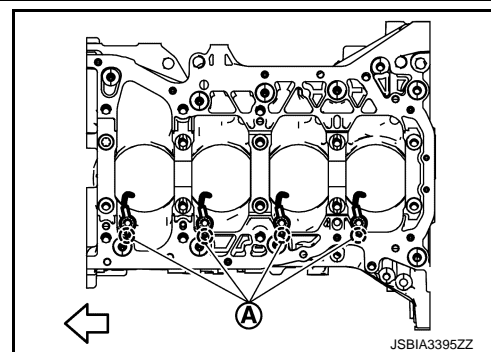
- Tighten each plug as specified below.

Part	Washer	Tightening torque
①	No	53.9 N·m (5.5 kg-m, 40 ft-lb)
②	Yes	9.8 N·m (1.0 kg-m, 87 in-lb)

3. Install oil jet.

- Insert oil jet dowel pin ① into cylinder block dowel pin hole, and tighten mounting bolts.

⇐ : Engine front



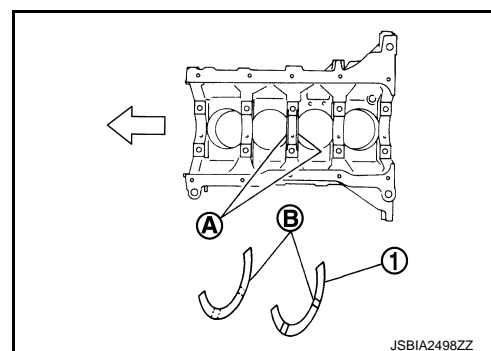
JSBIA3395ZZ

4. Install main bearings and thrust bearings with the following procedure:

- Remove dust, dirt, and engine oil on the bearing mating surfaces of cylinder block and lower cylinder block.
- Install thrust bearings to the both sides of the No. 3 journal housing ① on cylinder block.

⇐ : Engine front

- Install thrust bearings ① with the oil groove ② facing crankshaft arm (outside).



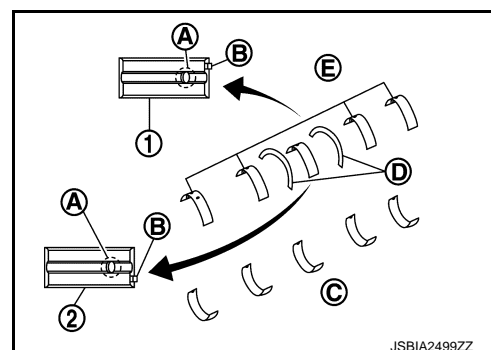
JSBIA2498ZZ

c. Install the main bearings paying attention to the direction.

- Main bearing with an oil hole and groove goes on cylinder block. The one without them goes on lower cylinder block.

- ① : Journal other than No.3
 ② : Lower cylinder block side
 ③ : Thrust bearing

- Only main bearing (on cylinder block) ④ for No. 3 journal ② has different specifications.
- Before installing main bearings, apply new engine oil to the bearing surface (inside). Do not apply engine oil to the back surface, but thoroughly clean it.



JSBIA2499ZZ

CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

- When installing, align main bearing stopper (B) to the notch.
- Ensure the oil holes (A) on cylinder block and those on the corresponding bearing are aligned.

5. Install signal plate to crankshaft if removed.

- ① : Signal plate
- ② : Crank shaft
- ③ : Dowel pin (used to position the signal plate)

a. Position crankshaft and signal plate using dowel pin, and tighten mounting bolts.

NOTE:

Dowel pin of crankshaft and signal plate is provided as a set for each. If dowel pin is not available (when reusing crankshaft and signal plate), use M8 bolt [length 10 mm (0.39 in) or more] as a substitute.

b. Remove dowel pin.

CAUTION:

Be sure to remove dowel pin.

6. Install crankshaft to cylinder block.

- While turning crankshaft by hand, check that it turns smoothly.

7. Install lower cylinder block with the following procedure:

a. Apply liquid gasket with a tube presser (commercial service tool) to lower cylinder block as shown in the figure.

- ① : Lower cylinder block
- (B) : Apply liquid gasket to an end
- (C) : 6.5 mm (0.255 in)
- (d) : ϕ 4.5 mm (0.177 in)
- ← : Engine front

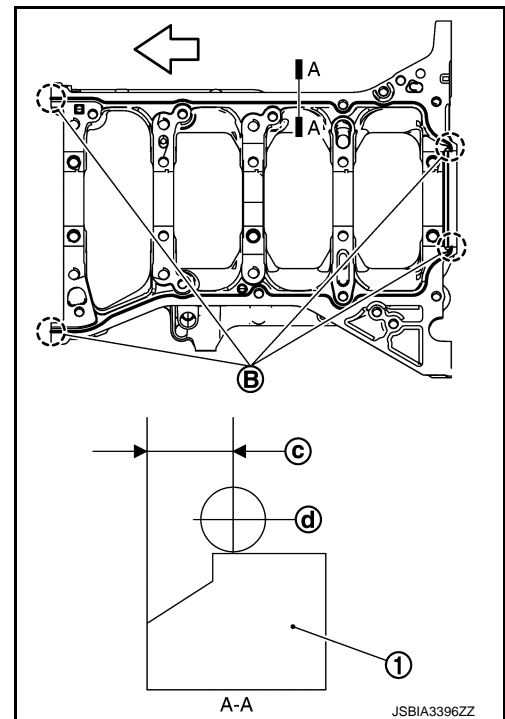
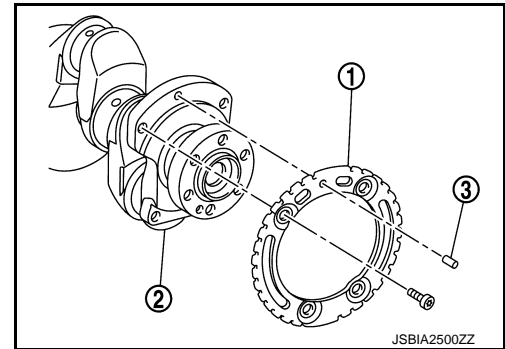
Use Genuine Liquid Gasket or equivalent.

CAUTION:

After liquid gasket is applied, rear oil seal installation must be finished within 5 minutes. Therefore, the following procedure must be performed quickly.

NOTE:

Lower cylinder block cannot be replaced as a single part, because it is machined together with cylinder block.



b. Tighten lower cylinder block mounting bolts with the following procedure:

i. Apply new engine oil to threads and seat surfaces of mounting bolts.

CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

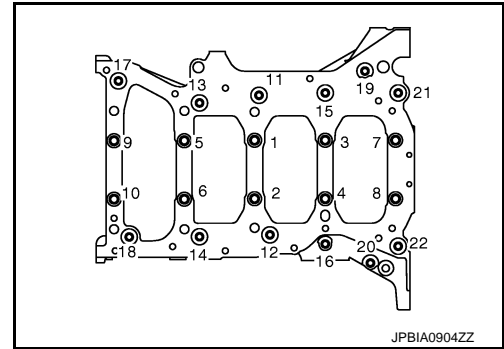
[QR25DE]

- ii. Tighten M8 bolts in numerical order from No. 11 to 22 in the figure.

 : 25.1 N·m (2.6 kg-m, 19 ft-lb)

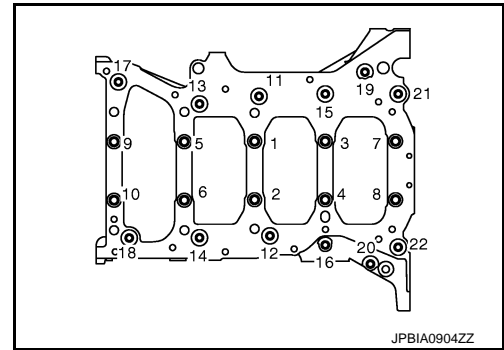
NOTE:

There are more processes to complete the tightening of mounting bolts. However stop procedure here to install rear oil seal.



- c. Install rear oil seal. Refer to [EM-198. "REAR OIL SEAL : Removal and Installation"](#).
d. Restart tightening of lower cylinder block mounting bolts with the following procedure:
i. Tighten M10 bolts in numerical order from No. 1 to 10.

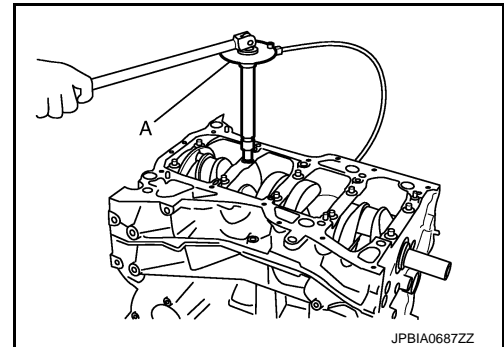
 : 39.2 N·m (4.0 kg-m, 29 ft-lb)




- ii. Turn M10 bolts 60 degrees clockwise (angle tightening) in order from No. 1 to 10 in the figure.

CAUTION:

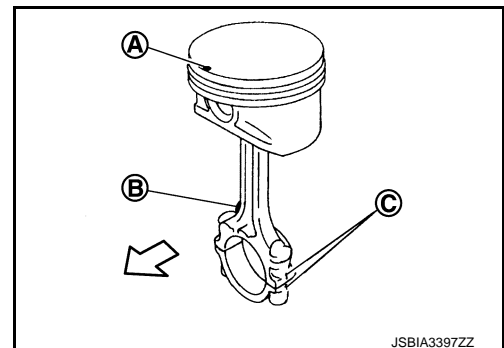
Check and confirm the tightening angle by using an angle wrench [SST: KV10112100] (A) or protractor. Avoid judgment by visual inspection without the tool.



- After installing mounting bolts, check that crankshaft can be rotated smoothly by hand.
 - Wipe off completely any protruding liquid gasket on front side of engine.
 - Check the crankshaft end play. refer to [EM-280. "Cylinder Block"](#)
8. Install piston to connecting rod with the following procedure:
- Using snap ring pliers, install new snap ring to the groove of the piston rear side.
 - Insert it fully into groove to install.
 - Assemble piston to connecting rod.
 - Using an industrial drier 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 (A) on the piston head and the oil splash (B) and the cylinder number (C) on connecting rod are positioned as shown in the figure.

 : Engine front

- c. Install new snap ring to the groove of the piston front side.
- Insert it fully into groove to install.
 - After installing, check that connecting rod moves smoothly.



CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

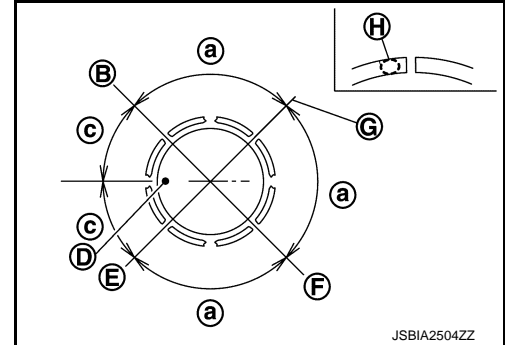
[QR25DE]

9. Using a piston ring expander (commercial service tool), install piston rings.

CAUTION:

- Be careful not to damage piston.
- Be careful not to damage piston rings by expanding them excessively.
- Position each ring with the gap as shown in the figure referring to the piston front mark ㉔.

- ㉔ : 90°
- ㉕ : Top ring gap
- ㉖ : 45°
- ㉗ : Oil ring upper or lower rail gap (either of them)
- ㉘ : Second ring and oil ring spacer gap
- ㉙ : Oil ring upper or lower rail gap (either of them)



- Install second ring with the stamped ㉚ surface facing upward.

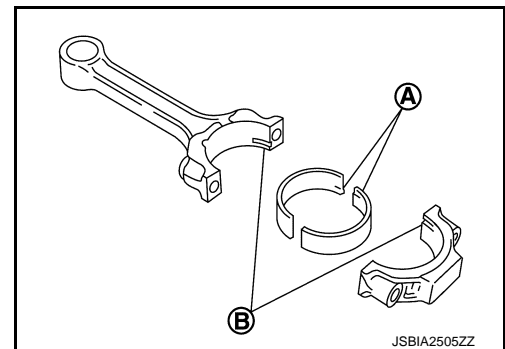
Stamped mark:

- Top ring : —
- Second ring : 2 ND

NOTE:

If there is no stamped mark on piston ring, no specific orientation is required for installation.

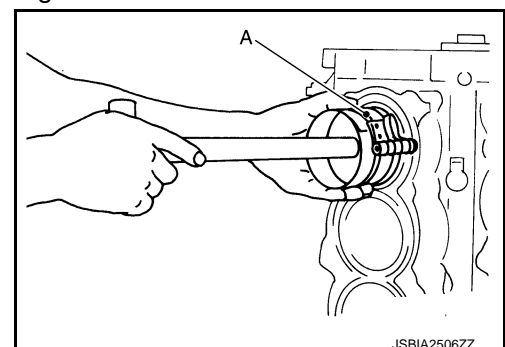
10. Inspect outer diameter of connecting rod bolts. Refer to [EM-256, "Inspection"](#).
11. Install connecting rod bearings to connecting rod and connecting rod cap.
- When installing connecting rod bearings, apply new engine oil to the bearing surface (inside). Do not apply engine oil to the back surface, but thoroughly clean it.
 - When installing, align the connecting rod bearing stopper protrusion ㉓ with the cutout ㉔ of connecting rod and connecting rod cap to install.
 - Ensure the oil hole on connecting rod and that on the corresponding bearing are aligned.



12. Install piston and connecting rod assembly to crankshaft.
- Position crankshaft pin corresponding to connecting rod to be installed onto the bottom dead center.
 - Apply new engine oil sufficiently to the cylinder bore, piston and crankshaft pin.
 - Match the cylinder position with the cylinder number on connecting rod to install.
 - Using the piston ring compressor [SST:EM03470000] (A) or suitable tool, install piston with the front mark on the piston head facing the front of the engine.

CAUTION:

Be careful not to damage the cylinder wall and crankshaft pin, resulting from an interference of the connecting rod big end.



CYLINDER BLOCK

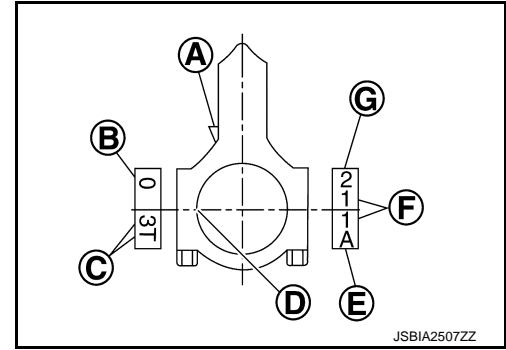
< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

13. Install connecting rod cap.

- Match the stamped cylinder number marks on connecting rod with those on connecting rod cap to install.

- (A) : Oil splash
- (B) : Small end diameter grade
- (C) : Management code
- (D) : Bearing stopper groove
- (E) : Management code
- (F) : Cylinder number
- (G) : Big end diameter grade



14. Tighten connecting rod bolt with the following procedure:

- Apply new engine oil to the threads and seats of connecting rod bolts.
- Tighten bolts.

 : 27.4 N·m (2.8 kg-m, 20 ft-lb)

- Completely loosen bolts.

 : 0 N·m (0 kg-m, 0 ft-lb)

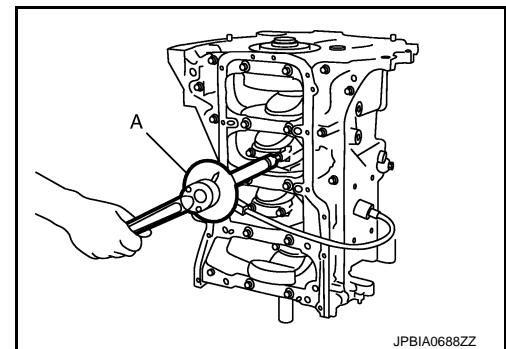
- Tighten bolts.

 : 19.6 N·m (2.0 kg-m, 14 ft-lb)

- Then turn all bolts 90 degrees clockwise (Angle tightening).

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.



- After tightening connecting rod bolt, check that crankshaft rotates smoothly.
- Check the connecting rod side clearance. Refer to [EM-256, "Inspection"](#).

15. Install drive plate.

CAUTION:

Check that dowel pin is installed at the rear end of crankshaft.

- When installing drive plate to crankshaft, check that align crankshaft side dowel pin with drive-plate side dowel pin hole correctly.

CAUTION:

If these are not aligned correctly, engine runs roughly and "MIL" turns on.

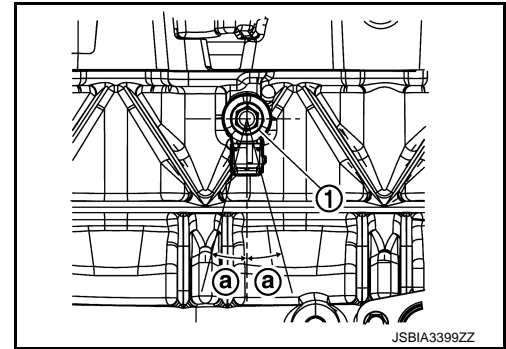
- Secure crankshaft with a stopper plate, and tighten mounting bolts crosswise over several times.

CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

16. Install knock sensor ①.
- Install knock sensor with connector facing lower left by 15 degrees ② as shown in the figure.
- CAUTION:**
- **Never tighten mounting bolt while holding the connector.**
 - **If any impact by dropping is applied to knock sensor, replace it with a 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 crankshaft position sensor (POS).
18. Assemble in the reverse order of disassembly after this step.



Inspection

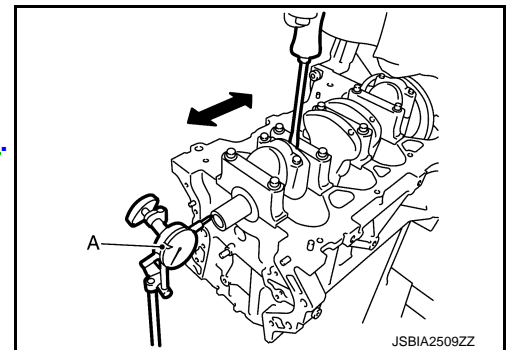
INFOID:000000010783824

CRANKSHAFT END PLAY

- Measure the clearance between thrust bearings and crankshaft arm when crankshaft is moved fully forward or backward with a dial indicator (A).

Standard and Limit : Refer to [EM-280, "Cylinder Block"](#).

- If the measured value exceeds the limit, replace thrust bearings, and measure again. If it still exceeds the limit, replace crankshaft also.

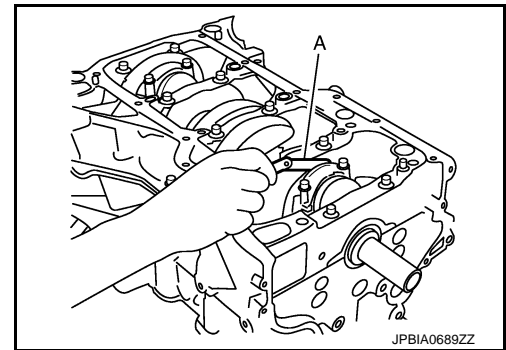


CONNECTING ROD SIDE CLEARANCE

- Measure the side clearance between connecting rod and crankshaft arm with a feeler gauge (A).

Standard and Limit : Refer to [EM-280, "Cylinder Block"](#).

- If the measured value exceeds the limit, replace connecting rod, and measure again. If it still exceeds the limit, replace crankshaft also.

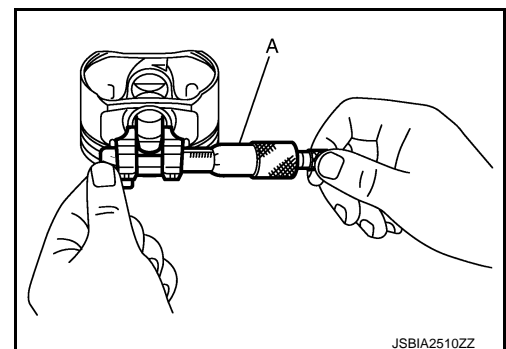


PISTON TO PISTON PIN OIL CLEARANCE

Piston Pin Hole Diameter

Measure the inner diameter of piston pin hole with an inside micrometer (A).

Standard : Refer to [EM-280, "Cylinder Block"](#).



Piston Pin Outer Diameter

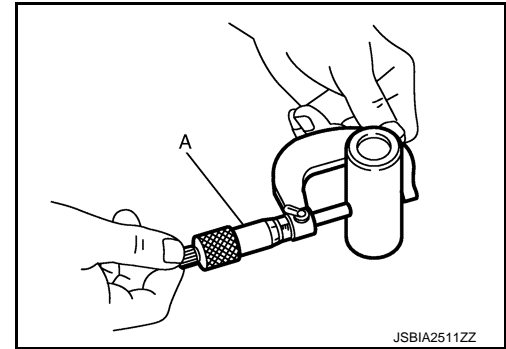
CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

Measure the outer diameter of piston pin with a micrometer (A).

Standard : Refer to [EM-280, "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-280, "Cylinder Block"](#).

- If oil clearance is out of the standard, replace piston and piston pin assembly.
- When replacing piston and piston pin assembly, refer to "PISTON TO CYLINDER BORE CLEARANCE".

NOTE:

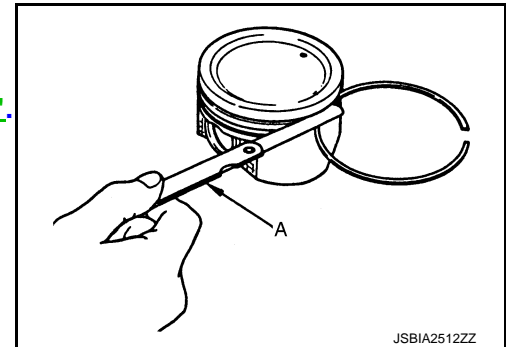
- Piston is available together with piston pin as assembly.
- Piston pin (piston pin hole) grade is provided only for the parts installed at the plant. For service parts, no grades can be selected. (Only grade "0" is available.)

PISTON RING SIDE CLEARANCE

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

Standard and Limit : Refer to [EM-280, "Cylinder Block"](#).

- If the measured value exceeds the limit, replace piston ring, and measure again. If it still exceeds the limit, replace piston also.

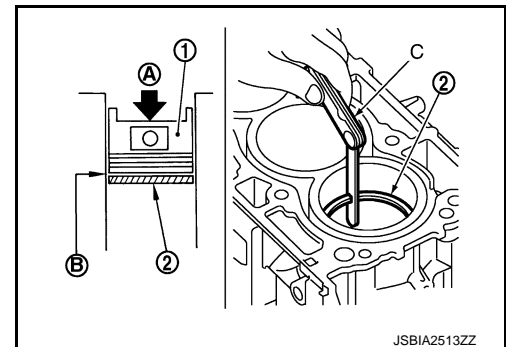


PISTON RING END GAP

- Check that cylinder bore inner diameter is within specification. Refer to "PISTON TO CYLINDER BORE CLEARANCE".
- Lubricate with new engine oil to piston ① and piston ring ②, and then insert (A) piston ring until middle of cylinder (B) with piston, and measure piston ring end gap with a feeler gauge (C).

Standard and Limit : Refer to [EM-280, "Cylinder Block"](#).

- If the measured value exceeds the limit, replace piston ring, and measure again. If it still exceeds the limit, replace cylinder block.



CONNECTING ROD BEND AND TORSION

CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

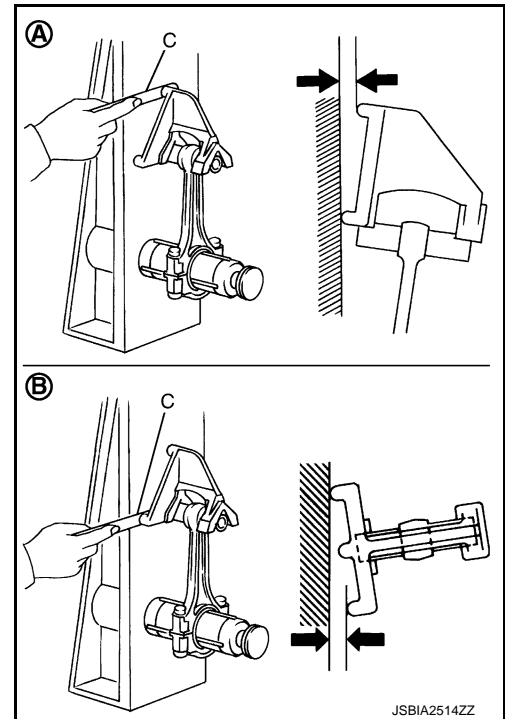
[QR25DE]

- Check with a connecting rod aligner.

- (A) : Bend
(B) : Torsion
C : Feeler gauge

Limit : Refer to [EM-280, "Cylinder Block"](#).

- If it exceeds the limit, replace connecting rod assembly.



CONNECTING ROD BIG END DIAMETER

- Install connecting rod cap ① without connecting rod bearing installed, and tightening connecting rod bolts to the specified torque. Refer to [EM-247, "Exploded View"](#).

- ② : Connecting rod
(A) : Example
B : Measuring direction of inner diameter

- Measure the inner diameter of connecting rod big end with an inside micrometer.

Standard : Refer to [EM-280, "Cylinder Block"](#).

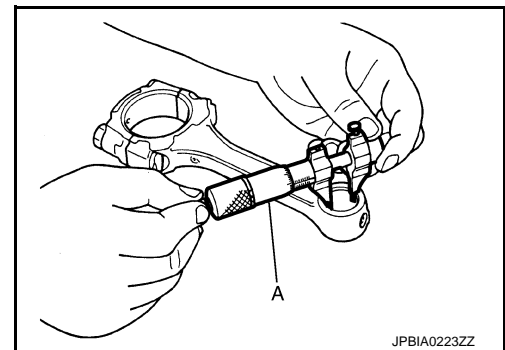
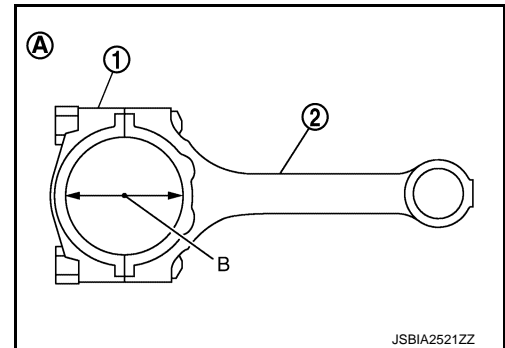
- If out of the standard, replace connecting rod assembly.

CONNECTING ROD BUSHING OIL CLEARANCE

Connecting Rod Bushing Inner Diameter

Measure the inner diameter of connecting rod bushing with an inside micrometer (A).

Standard : Refer to [EM-280, "Cylinder Block"](#).



Piston Pin Outer Diameter

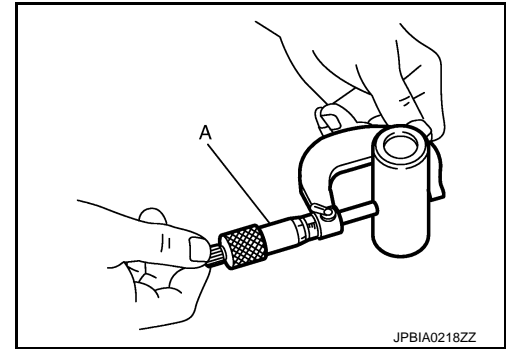
CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

Measure the outer diameter of piston pin with a micrometer (A).

Standard : Refer to [EM-280, "Cylinder Block"](#).



Connecting Rod Bushing Oil Clearance

(Connecting rod bushing oil clearance) = (Connecting rod bushing inner diameter) – (Piston pin outer diameter)

Standard : Refer to [EM-280, "Cylinder Block"](#).

- If the measured value is out of the standard. Replace connecting rod assembly and/or piston and piston pin assembly.
- If replacing piston and piston pin assembly. Refer to [EM-265, "Piston"](#).
- If replacing connecting rod assembly. Refer to [EM-266, "Connecting Rod Bearing"](#) to select connecting rod bearing.

CYLINDER BLOCK DISTORTION

- Using a scraper, remove gasket on the cylinder block surface, and also remove engine oil, scale, carbon, or other contamination.

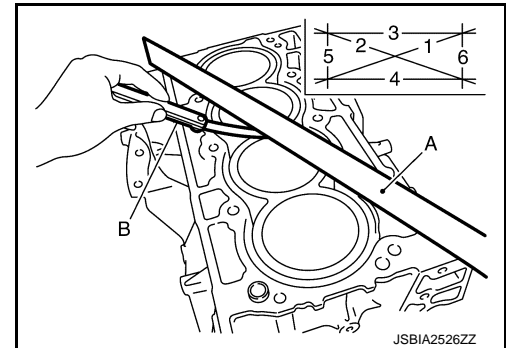
CAUTION:

Be careful not to 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 with a straight edge (A) and a feeler gauge (B).

Limit : Refer to [EM-280, "Cylinder Block"](#).

- If it exceeds the limit, replace cylinder block.



MAIN BEARING HOUSING INNER DIAMETER

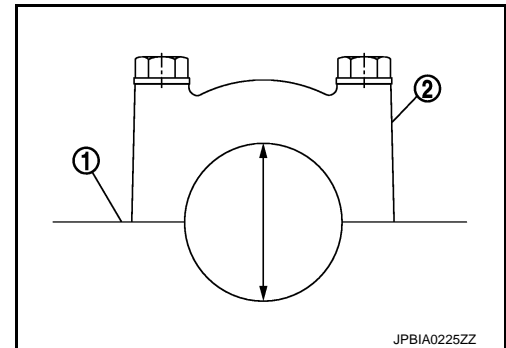
- Install lower cylinder block ② without main bearings installed, and tighten lower cylinder block mounting bolts to the specified torque. Refer to [EM-248, "Disassembly and Assembly"](#) for the tightening procedure.
- Measure the inner diameter of main bearing housing with a bore gauge.

Standard : Refer to [EM-280, "Cylinder Block"](#).

- If out of the standard, replace cylinder block ① and lower cylinder block assembly.

NOTE:

Cylinder block cannot be replaced as a single, because it is machined together with lower cylinder block.



PISTON TO CYLINDER BORE CLEARANCE

Cylinder Bore Inner Diameter

CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

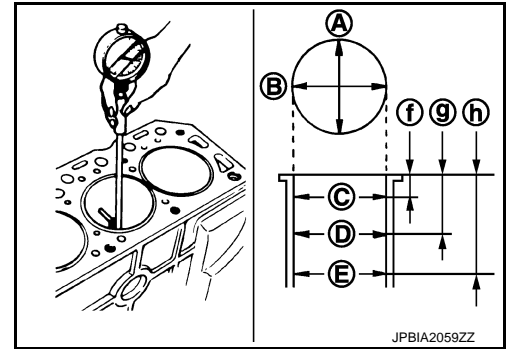
[QR25DE]

- Using a cylinder gauge, measure the 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) (A is in longitudinal direction of engine)

- (f) : 10 mm (0.39 in)
 (g) : 60 mm (2.36 in)
 (h) : 120 mm (4.72 in)

NOTE:

When determining cylinder bore grade, measure the cylinder bore (B) direction at (D) position.



Standard:

Cylinder bore inner diameter

: Refer to [EM-280, "Cylinder Block"](#).

Limit:

Out-of-round (Difference between A and B)

Taper (Difference between C and E)

: Refer to [EM-280, "Cylinder Block"](#).

- If the measured value exceeds the limit, or if there are scratches and/or seizure on the cylinder inner wall, replace cylinder block.

CAUTION:

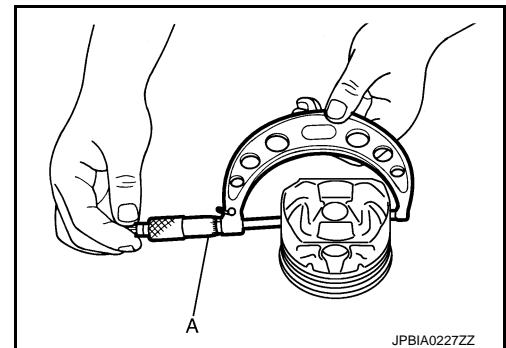
When using an oversize piston, use oversize pistons for all cylinders with oversize piston rings.

Oversize (O/S): 0.2 mm (0.008 in)

Piston Skirt Diameter

Measure the outer diameter of piston skirt with a micrometer (A).

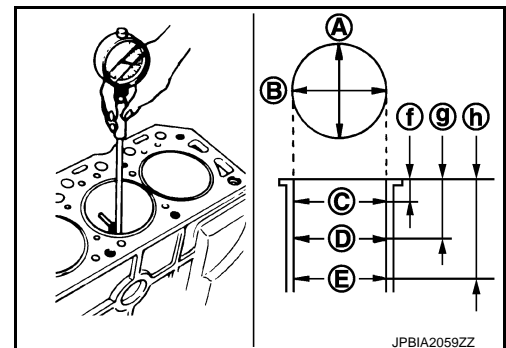
Standard : Refer to [EM-280, "Cylinder Block"](#).



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) : 120 mm (4.72 in)



(Clearance) = (Cylinder bore inner diameter) – (Piston skirt diameter)

Standard and Limit : Refer to [EM-280, "Cylinder Block"](#).

CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

- If it exceeds the limit, replace piston and piston pin assembly and/or cylinder block. Refer to [EM-280, "Cylinder Block"](#).

Re-boring 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 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 mounting bolts to the specified torque. Otherwise, cylinder bores may be distorted in final assembly. Refer to [EM-248, "Disassembly and Assembly"](#) for the tightening procedure.

3. Cut cylinder bores.

NOTE:

- 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 the finished cylinder bore for out-of-round and taper.

NOTE:

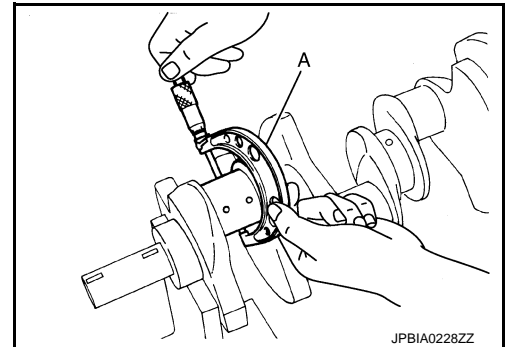
Measurement should be done after cylinder bore cools down.

CRANKSHAFT MAIN JOURNAL DIAMETER

- Measure the outer diameter of crankshaft main journals with a micrometer (A).

Standard : Refer to [EM-280, "Cylinder Block"](#).

- If out of the standard, measure the main bearing oil clearance. Then use undersize bearing. Refer to [EM-283, "Main Bearing"](#).



CRANKSHAFT PIN JOURNAL DIAMETER

- Measure the outer diameter of crankshaft pin journal with a micrometer.

Standard : Refer to [EM-280, "Cylinder Block"](#).

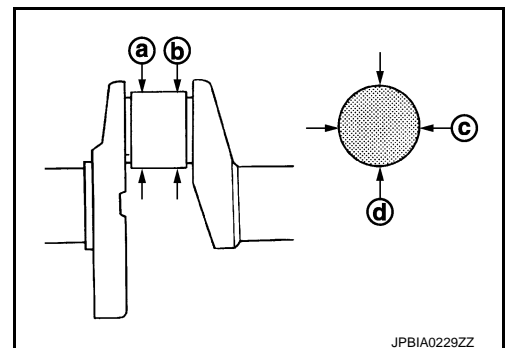
- If out of the standard, measure the connecting rod bearing oil clearance. Then use undersize bearing. Refer to [EM-284, "Connecting Rod Bearing"](#).

OUT-OF-ROUND AND TAPER OF CRANKSHAFT

- 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 dimensions between (a) and (b) at (c) and (d).
- Taper is indicated by the difference in dimension between (c) and (d) at (a) and (b).

Limit:

Out-of-round [Difference between (c) and (d)]



CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

Taper [Difference between ① and ②]

: Refer to [EM-280, "Cylinder Block"](#).

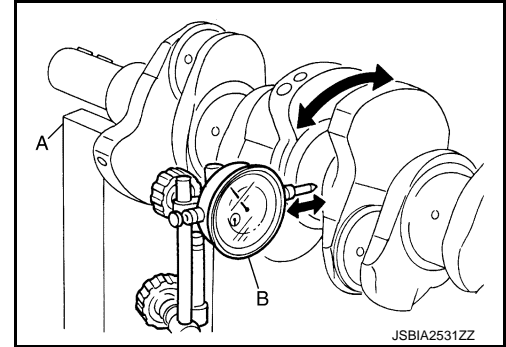
- If the measured value exceeds the limit, correct or replace crankshaft.
- If corrected, measure the bearing oil clearance of the corrected main journal and/or pin journal. Then select main bearing and/or connecting rod bearing. Refer to [EM-284, "Connecting Rod Bearing"](#) and/or [EM-283, "Main Bearing"](#).

CRANKSHAFT RUNOUT

- Place a V-block (A) on a precise flat table to support the journals on the both end of the crankshaft.
- Place a dial indicator (B) straight up on the No. 3 journal.
- While rotating crankshaft, read the movement of the pointer on the dial indicator. (Total indicator reading)

Standard and Limit : Refer to [EM-280, "Cylinder Block"](#).

- If it exceeds the limit, replace crankshaft.

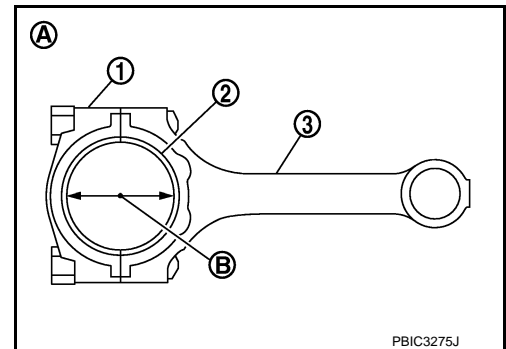


CONNECTING ROD BEARING OIL CLEARANCE

Method by Calculation

- Install connecting rod bearings ② to connecting rod ③ and cap, and tighten connecting rod bolts to the specified torque. Refer to [EM-248, "Disassembly and Assembly"](#) for tightening procedure.

- ① : Connecting rod bearing cap
- ② : Example
- ③ : Inner diameter measuring direction



- Measure the inner diameter of connecting rod bearing with an inside micrometer.
(Bearing oil clearance) = (Connecting rod bearing inner diameter) – (Crankshaft pin journal diameter)

Standard and Limit : Refer to [EM-280, "Cylinder Block"](#).

- If clearance exceeds the limit, select proper connecting rod bearing according to connecting rod big end diameter and crankshaft pin journal diameter to obtain specified bearing oil clearance. Refer to [EM-266, "Connecting Rod Bearing"](#).

Method of Using Plastigage

- Remove engine oil and dust on crankshaft pin 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 cap, and tighten connecting rod bolts to the specified torque. Refer to [EM-248, "Disassembly and Assembly"](#) for the tightening procedure.

CAUTION:

Never rotate crankshaft.

CYLINDER BLOCK

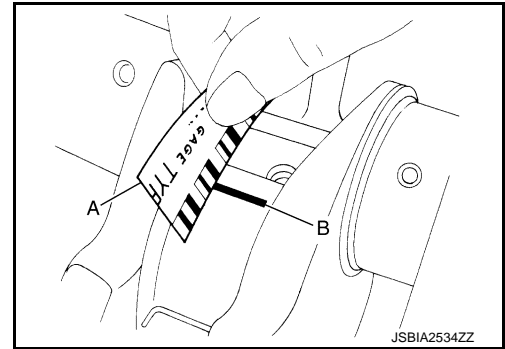
< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

- Remove connecting rod cap and bearing, and using the scale (A) on the plastigage bag, measure the plastigage (B) width.

NOTE:

The procedure when the measured value exceeds the limit is same as that described in the "Method by Calculation".



MAIN BEARING OIL CLEARANCE

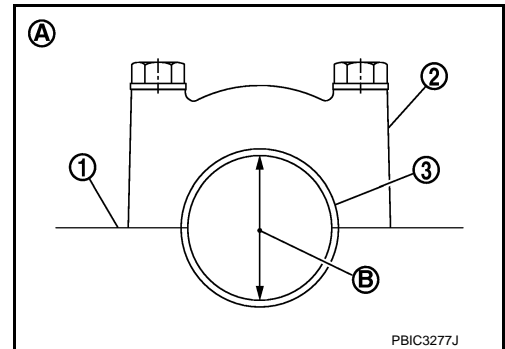
Method by Calculation

- Install main bearings ③ to cylinder block ① and lower cylinder block ②, and tighten lower cylinder block mounting bolts to the specified torque. Refer to [EM-248, "Disassembly and Assembly"](#) for the tightening procedure.

Ⓐ : Example

Ⓑ : Inner diameter measuring direction

- Measure the inner diameter of main bearing with a bore gauge.
 $(\text{Bearing oil clearance}) = (\text{Main bearing inner diameter}) - (\text{Crankshaft main journal diameter})$



Standard and Limit : Refer to [EM-280, "Cylinder Block"](#).

- If clearance exceeds the limit, select proper main bearing according to main bearing inner diameter and crankshaft main journal diameter to obtain specified bearing oil clearance. Refer to [EM-248, "Disassembly and Assembly"](#).

Method of Using Plastigage

- Remove engine oil and dust on crankshaft main 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 main bearings to cylinder block and lower cylinder block, and tighten lower cylinder block mounting bolts to the specified torque. Refer to [EM-248, "Disassembly and Assembly"](#) for the tightening procedure.

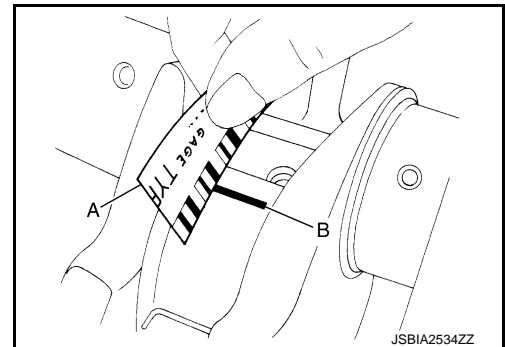
CAUTION:

Never rotate crankshaft.

- Remove main bearing cap and bearings, and using the scale (A) on the plastigage bag, measure the plastigage (B) width.

NOTE:

The procedure when the measured value exceeds the limit is same as that described in the "Method by Calculation".



MAIN BEARING CRUSH HEIGHT

CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

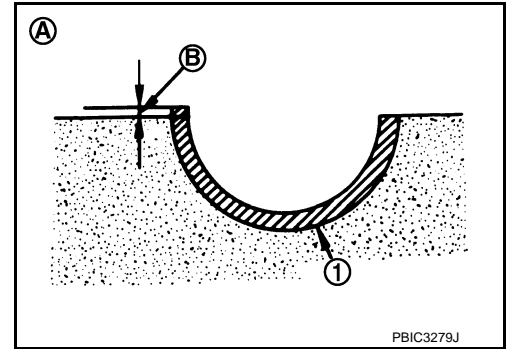
[QR25DE]

- When main bearing cap is removed after being tightened to the specified torque with main bearings① installed, the tip end of bearing must protrudeⒷ. Refer to [EM-248, "Disassembly and Assembly"](#).

Ⓐ : Example

Standard : There must be crush height.

- If the standard is not met, replace main bearings.



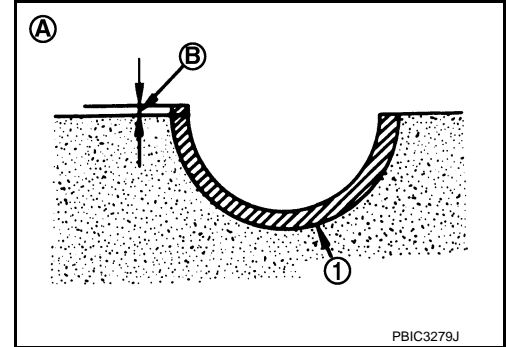
CONNECTING ROD BEARING CRUSH HEIGHT

- When connecting rod cap is removed after being tightened to the specified torque with connecting rod bearings① installed, the tip end of bearing must protrudeⒷ. Refer to [EM-248, "Disassembly and Assembly"](#).

Ⓐ : Example

Standard : There must be crush height.

- If the standard is not met, replace connecting rod bearings.

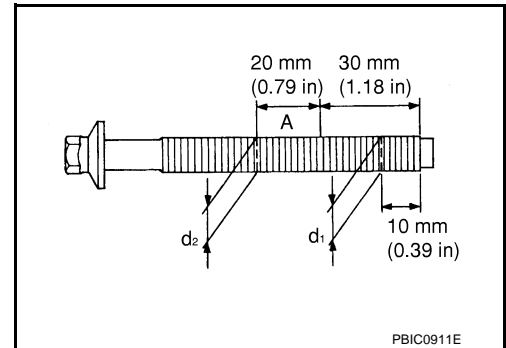


LOWER CYLINDER BLOCK MOUNTING BOLT OUTER DIAMETER

- Perform only with M10 bolts.
- Measure the outer diameters ("d1", "d2") at two positions as shown in the figure.
- If reduction appears in "A" range, regard it as "d2".

Limit ("d1"–"d2"): 0.13 mm (0.0051 in)

- If it exceeds the limit (a large difference in dimensions), replace lower cylinder block mounting bolt with a new one.

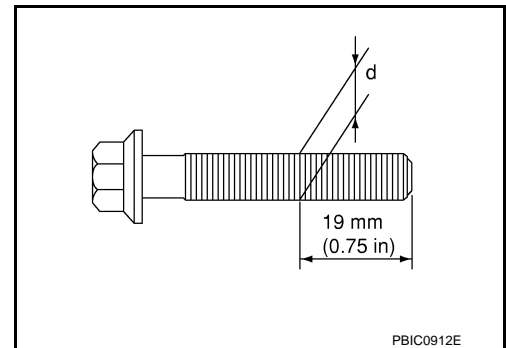


CONNECTING ROD BOLT OUTER DIAMETER

- Measure the outer diameter "d" at position as shown in the figure.
- If reduction appears in a position other than "d", regard it as "d".

Limit: 7.75 mm (0.3051 in)

- When "d" exceeds the limit (when it becomes thinner), replace connecting rod bolt with a new one.



HOW TO SELECT PISTON AND BEARING

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

HOW TO SELECT PISTON AND BEARING

Description

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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 an assembly.)	Piston grade (piston outer diameter)	Piston grade = cylinder bore grade (inner diameter of bore)
Between piston and connecting rod*	—	—	—

*For the service parts, the grade for fitting cannot be selected between piston pin and connecting rod. (Only grade "0" is available.) The information at the shipment from the plant is described as a reference.

- 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.

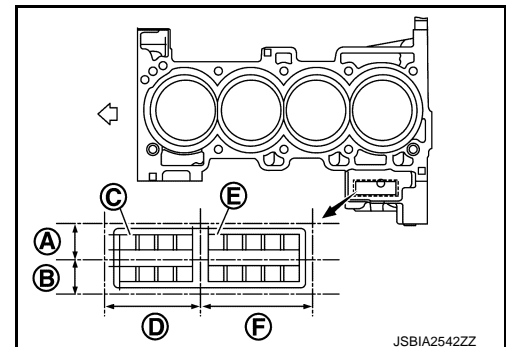
Piston

INFOID:0000000010783826

WHEN NEW CYLINDER BLOCK IS USED

- Check the cylinder bore grade on rear left side of cylinder block, and select piston of the same grade.

- (A) : Corrected stamping position
- (B) : Basic stamping position
- (C) : No.1 - 4 from left
- (D) : Cylinder bore grade
- (E) : No.1 - 5 from left
- (F) : Main bearing housing grade
- ↙ : Engine front



- If there is a corrected stamp mark on the cylinder block, use it as a correct reference.

WHEN CYLINDER BLOCK IS REUSED

1. Measure the cylinder bore inner diameter. Refer to [EM-256, "Inspection"](#).
2. Determine the bore grade by comparing the measurement with the values under the cylinder bore inner diameter of the "Piston Selection Table".

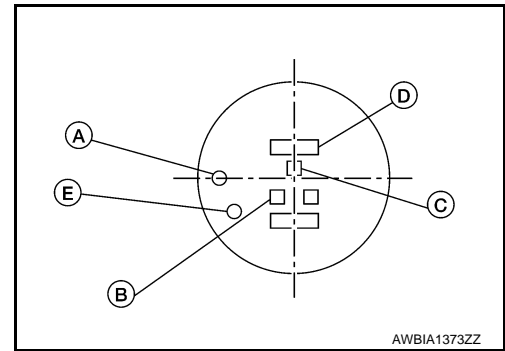
HOW TO SELECT PISTON AND BEARING

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

3. Select piston of the same grade.

- (A) : Front mark
- (B) : Piston pin bore grade number
- (C) : Piston grade identification stamp number
- (D) : Piston upper surface identification code stamp
- (E) : Identification code



PISTON SELECTION TABLE

Unit: mm (in)

Grade number (Mark)	2	3
Cylinder bore Inner diameter	89.010 - 89.020 (3.5043 - 3.5047)	89.020 - 89.030 (3.5047 - 3.5051)
Piston skirt diameter	88.990 - 89.000 (3.5035 - 3.5039)	89.000 - 89.010 (3.5039 - 3.5043)

NOTE:

- There is no piston grade “1”.
- Piston is available together with piston pin as an assembly.
- The piston pin (piston pin hole) grade is provided only for the parts installed at the plant. For service parts, no grades can be selected. (Only grade “0” is available.)

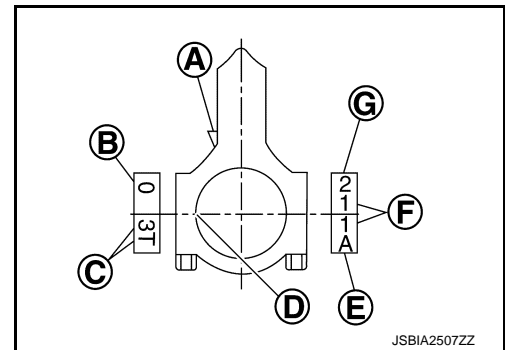
Connecting Rod Bearing

INFOID:0000000010783827

WHEN NEW CONNECTING ROD AND CRANKSHAFT ARE USED

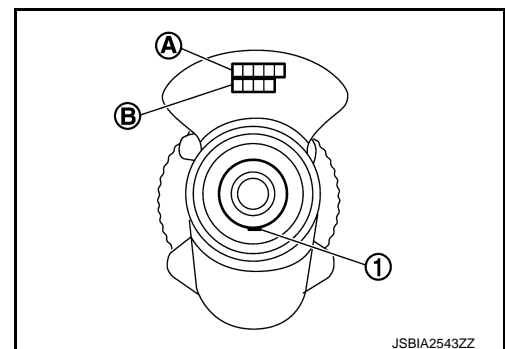
1. Apply connecting rod big end diameter grade stamped on connecting rod side face to the row in the “Connecting Rod Bearing Selection Table”.

- (A) : Oil splash
- (B) : Small end diameter grade
- (C) : Management code
- (D) : Bearing stopper groove
- (E) : Management code
- (F) : Cylinder number
- (G) : Big end diameter grade



2. Apply crankshaft pin journal diameter grade stamped on crankshaft front side to the column in the “Connecting Rod Bearing Selection Table”.

- ① : Key
- (A) : Main journal diameter grade (No.1 - 5 from left)
- (B) : Pin journal diameter grade (No.1 - 4 from left)



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

HOW TO SELECT PISTON AND BEARING

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

1. Measure the dimensions of the connecting rod big end diameter and crankshaft pin journal diameter individually. Refer to [EM-256, "Inspection"](#).
2. Apply the measured dimension to the "Connecting Rod Bearing Selection Table".
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.

Connecting Rod Bearing Grade Table

Connecting Rod Bearing Grade Table : Refer to [EM-284, "Connecting Rod Bearing"](#).

Undersize Bearings Usage Guide

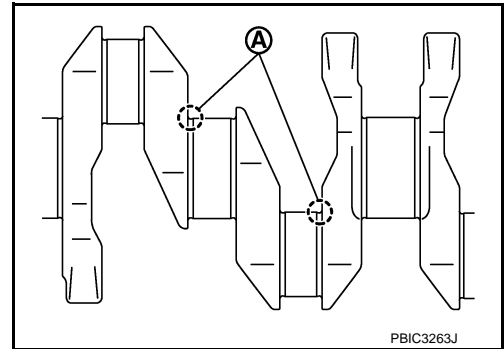
- When the specified connecting rod bearing oil clearance is not obtained with standard size connecting rod bearings, use undersize (US) bearings.
- When using undersize (US) bearing, measure the connecting rod bearing inner diameter with bearing installed, and grind the crankshaft pin so that the connecting 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)] (A).

Bearing undersize table:

Refer to [EM-284, "Connecting Rod Bearing"](#).



HOW TO SELECT PISTON AND BEARING

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

CONNECTING ROD BEARING SELECTION TABLE

<div> <div>Connecting rod big end diameter</div> <div>Crankshaft pin journal diameter</div> </div>		Mark	0	1	2	3	4	5	6	7	8	9	A	B	C
		Inner diameter Unit: mm (in)													
Mark	Outer diameter Unit: mm (in)		48.000 - 48.001 (1.8898 - 1.8898)	48.001 - 48.002 (1.8898 - 1.8898)	48.002 - 48.003 (1.8898 - 1.8899)	48.003 - 48.004 (1.8899 - 1.8899)	48.004 - 48.005 (1.8899 - 1.8900)	48.005 - 48.006 (1.8900 - 1.8900)	48.006 - 48.007 (1.8900 - 1.8900)	48.007 - 48.008 (1.8900 - 1.8901)	48.008 - 48.009 (1.8901 - 1.8901)	48.009 - 48.010 (1.8901 - 1.8902)	48.010 - 48.011 (1.8902 - 1.8902)	48.011 - 48.012 (1.8902 - 1.8902)	48.012 - 48.013 (1.8902 - 1.8903)
A	44.974 - 44.973 (1.7706 - 1.7706)		0	0	0	0	01	01	01	1	1	1	12	12	12
B	44.973 - 44.972 (1.7706 - 1.7705)		0	0	0	01	01	01	1	1	1	12	12	12	2
C	44.972 - 44.971 (1.7705 - 1.7705)		0	0	01	01	01	1	1	1	12	12	12	2	2
D	44.971 - 44.970 (1.7705 - 1.7705)		0	01	01	01	1	1	1	12	12	12	2	2	2
E	44.970 - 44.969 (1.7705 - 1.7704)		01	01	01	1	1	1	12	12	12	2	2	2	23
F	44.969 - 44.968 (1.7704 - 1.7704)		01	01	1	1	1	12	12	12	2	2	2	23	23
G	44.968 - 44.967 (1.7704 - 1.7704)		01	1	1	1	12	12	12	2	2	2	23	23	23
H	44.967 - 44.966 (1.7704 - 1.7703)		1	1	1	12	12	12	2	2	2	23	23	23	3
J	44.966 - 44.965 (1.7703 - 1.7703)		1	1	12	12	12	2	2	2	23	23	23	3	3
K	44.965 - 44.964 (1.7703 - 1.7702)		1	12	12	12	2	2	2	23	23	23	3	3	3
L	44.964 - 44.963 (1.7702 - 1.7702)		12	12	12	2	2	2	23	23	23	3	3	3	34
M	44.963 - 44.962 (1.7702 - 1.7702)		12	12	2	2	2	23	23	23	3	3	3	34	34
N	44.962 - 44.961 (1.7702 - 1.7701)		12	2	2	2	23	23	23	3	3	3	34	34	34
P	44.961 - 44.960 (1.7701 - 1.7701)		2	2	2	23	23	23	3	3	3	34	34	34	4
R	44.960 - 44.959 (1.7701 - 1.7700)		2	2	23	23	23	3	3	3	34	34	34	4	4
S	44.959 - 44.958 (1.7700 - 1.7700)		2	23	23	23	3	3	3	34	34	34	4	4	4
T	44.958 - 44.957 (1.7700 - 1.7700)		23	23	23	3	3	3	34	34	34	4	4	4	4
U	44.957 - 44.956 (1.7700 - 1.7699)		23	23	3	3	3	34	34	34	4	4	4	4	4

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CONNECTING ROD BEARING GRADE TABLE

Connecting rod bearing grade table : Refer to [EM-284, "Connecting Rod Bearing"](#).

UNDERSIZE BEARINGS USAGE GUIDE

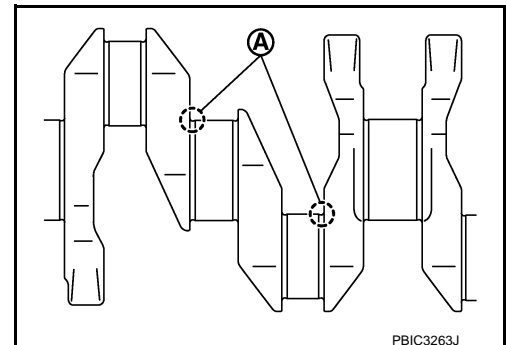
- When the specified connecting rod bearing oil clearance is not obtained with standard size connecting rod bearings, use undersize (US) bearings.
- When using undersize (US) bearing, measure the connecting rod bearing inner diameter with bearing installed, and grind the crankshaft pin so that the connecting 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)] (A).

Bearing undersize table:

Refer to [EM-284, "Connecting Rod Bearing"](#).



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HOW TO SELECT PISTON AND BEARING

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

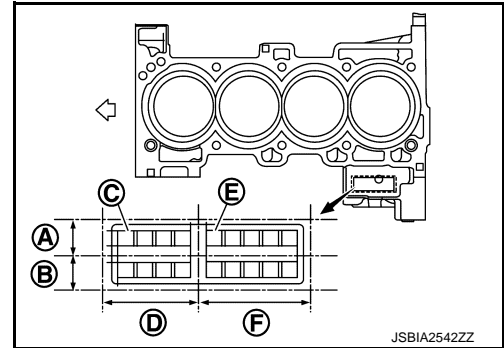
Main Bearing

INFOID:000000010783828

WHEN NEW CYLINDER BLOCK AND CRANKSHAFT ARE USED

1. "Main Bearing Selection Table" rows correspond to main bearing housing grade on rear-left side of cylinder block.

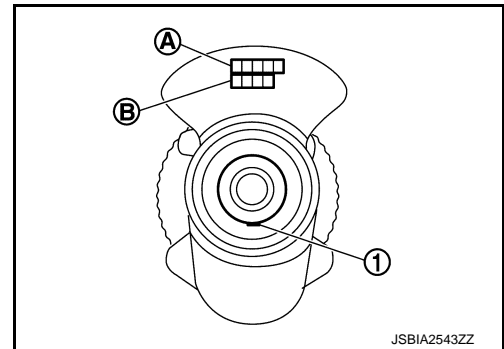
- (A) : Corrected stamping position
- (B) : Basic stamping position
- (C) : No.1 - 4 from left
- (D) : Cylinder bore grade
- (E) : No.1 - 5 from left
- (F) : Main bearing housing grade
- ↶ : Engine front



- If there is a corrected stamp mark on cylinder block, use it as a correct reference.

2. Apply main journal diameter grade stamped on crankshaft front side to column in the "Main Bearing Selection Table".

- ① : key
- (A) : Main journal diameter grade (No.1 - 5 from left)
- (B) : Pin journal diameter grade (No.1 - 4 from left)



3. Read the symbol at the cross point of selected row and column in the "Main Bearing Selection Table".

CAUTION:

There are three main bearing selection tables. Make certain to use the appropriate table. This is due to differences in the specified clearances.

4. Apply the symbol obtained to the "Main Bearing Grade Table" to select main bearing.

NOTE:

Service part is available as a set of both upper and lower.

WHEN CYLINDER BLOCK AND CRANKSHAFT ARE REUSED

1. Measure the dimensions of the cylinder block main bearing housing inner diameter and crankshaft main journal diameter individually. Refer to [EM-256, "Inspection"](#).
2. Apply the measured dimension to the "Main Bearing Selection Table".
3. Read the symbol at the cross point of selected row and column in the "Main Bearing Selection Table".

CAUTION:

There are three main bearing selection tables. Make certain to use the appropriate table. This is due to differences in the specified clearances.

4. Apply the symbol obtained to the "Main Bearing Grade Table" to select main bearing.

NOTE:

Service part is available as a set of both upper and lower.

HOW TO SELECT PISTON AND BEARING

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

MAIN BEARING SELECTION TABLE (No. 1 and 5 journals)

<div> <div>Cylinder block main bearing housing inner diameter</div> <div>Crankshaft main journal diameter</div> </div>		Mark	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V	W	X	Y	4	7
		Inner diameter Unit: mm (in)	58.944 - 58.945 (2.3206 - 2.3207)	58.945 - 58.946 (2.3207 - 2.3207)	58.946 - 58.947 (2.3207 - 2.3207)	58.947 - 58.948 (2.3207 - 2.3208)	58.948 - 58.949 (2.3208 - 2.3208)	58.949 - 58.950 (2.3208 - 2.3209)	58.950 - 58.951 (2.3209 - 2.3209)	58.951 - 58.952 (2.3209 - 2.3209)	58.952 - 58.953 (2.3209 - 2.3210)	58.953 - 58.954 (2.3210 - 2.3210)	58.954 - 58.955 (2.3210 - 2.3211)	58.955 - 58.956 (2.3211 - 2.3211)	58.956 - 58.957 (2.3211 - 2.3211)	58.957 - 58.958 (2.3211 - 2.3212)	58.958 - 58.959 (2.3212 - 2.3212)	58.959 - 58.960 (2.3212 - 2.3213)	58.960 - 58.961 (2.3213 - 2.3213)	58.961 - 58.962 (2.3213 - 2.3213)	58.962 - 58.963 (2.3213 - 2.3214)	58.963 - 58.964 (2.3214 - 2.3214)	58.964 - 58.965 (2.3214 - 2.3215)	58.965 - 58.966 (2.3215 - 2.3215)	58.966 - 58.967 (2.3215 - 2.3215)	58.967 - 58.968 (2.3215 - 2.3216)
Mark	Outer diameter Unit: mm (in)																									
A	54.979 - 54.978 (2.1645 - 2.1645)	0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	3	34	34	34	4
B	54.978 - 54.977 (2.1645 - 2.1644)	0	01	01	01	1	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	3	34	34	34	4
C	54.977 - 54.976 (2.1644 - 2.1644)	01	01	01	1	1	1	12	12	12	12	2	2	2	23	23	23	3	3	3	3	34	34	34	4	4
D	54.976 - 54.975 (2.1644 - 2.1644)	01	01	1	1	1	12	12	12	12	2	2	2	23	23	23	3	3	3	3	34	34	34	4	4	45
E	54.975 - 54.974 (2.1644 - 2.1643)	01	1	1	1	12	12	12	2	2	2	2	23	23	23	3	3	3	3	34	34	34	4	4	4	45
F	54.974 - 54.973 (2.1643 - 2.1643)	1	1	1	12	12	12	2	2	2	2	23	23	23	3	3	3	3	34	34	34	4	4	4	45	45
G	54.973 - 54.972 (2.1643 - 2.1642)	1	1	12	12	12	2	2	2	2	23	23	23	3	3	3	3	34	34	34	4	4	4	45	45	45
H	54.972 - 54.971 (2.1642 - 2.1642)	1	12	12	12	2	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	4	45	45	45	5
J	54.971 - 54.970 (2.1642 - 2.1642)	12	12	12	2	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	4	45	45	45	5	5
K	54.970 - 54.969 (2.1642 - 2.1641)	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	4	45	45	45	5	5	5	56
L	54.969 - 54.968 (2.1641 - 2.1641)	12	2	2	2	23	23	23	3	3	3	3	34	34	34	4	4	4	4	45	45	45	5	5	5	56
M	54.968 - 54.967 (2.1641 - 2.1641)	2	2	2	23	23	23	3	3	3	3	34	34	34	4	4	4	4	45	45	45	5	5	5	56	56
N	54.967 - 54.966 (2.1641 - 2.1640)	2	2	23	23	23	3	3	3	3	34	34	34	4	4	4	4	45	45	45	5	5	5	56	56	6
P	54.966 - 54.965 (2.1640 - 2.1640)	2	23	23	23	3	3	3	3	34	34	34	4	4	4	4	45	45	45	5	5	5	56	56	6	6
R	54.965 - 54.964 (2.1640 - 2.1639)	23	23	23	3	3	3	3	34	34	34	4	4	4	4	45	45	45	5	5	5	56	56	6	6	6
S	54.964 - 54.963 (2.1639 - 2.1639)	23	23	3	3	3	3	34	34	34	4	4	4	4	45	45	45	5	5	5	56	56	6	6	6	67
T	54.963 - 54.962 (2.1639 - 2.1639)	23	3	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	5	56	56	56	6	6	6	67
U	54.962 - 54.961 (2.1639 - 2.1638)	3	3	3	34	34	34	4	4	4	4	45	45	45	5	5	5	5	56	56	56	6	6	6	67	67
V	54.961 - 54.960 (2.1638 - 2.1638)	3	3	34	34	34	4	4	4	4	45	45	45	5	5	5	5	56	56	56	6	6	6	67	67	7
W	54.960 - 54.959 (2.1638 - 2.1637)	3	34	34	34	4	4	4	4	45	45	45	5	5	5	5	56	56	56	6	6	6	67	67	7	7
X	54.959 - 54.958 (2.1637 - 2.1637)	34	34	34	4	4	4	4	4	45	45	45	5	5	5	5	56	56	56	6	6	6	67	67	7	7
Y	54.958 - 54.957 (2.1637 - 2.1637)	34	34	4	4	4	4	45	45	45	5	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7
4	54.957 - 54.956 (2.1637 - 2.1636)	34	4	4	4	4	45	45	45	5	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	7
7	54.956 - 54.955 (2.1636 - 2.1636)	4	4	4	4	45	45	45	5	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	7	7

PBIC2201E

HOW TO SELECT PISTON AND BEARING

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

MAIN BEARING SELECTION TABLE (No. 2 and 4 journals)

<div> <div>Cylinder block main bearing housing inner diameter</div> <div>Crankshaft main journal diameter</div> </div>		Mark	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V	W	X	Y	4	7
		Inner diameter Unit: mm (in)	58.944 - 58.945 (2.3206 - 2.3207)	58.945 - 58.946 (2.3207 - 2.3207)	58.946 - 58.947 (2.3207 - 2.3207)	58.947 - 58.948 (2.3207 - 2.3208)	58.948 - 58.949 (2.3208 - 2.3208)	58.949 - 58.950 (2.3208 - 2.3209)	58.950 - 58.951 (2.3209 - 2.3209)	58.951 - 58.952 (2.3209 - 2.3209)	58.952 - 58.953 (2.3209 - 2.3210)	58.953 - 58.954 (2.3210 - 2.3210)	58.954 - 58.955 (2.3210 - 2.3211)	58.955 - 58.956 (2.3211 - 2.3211)	58.956 - 58.957 (2.3211 - 2.3212)	58.957 - 58.958 (2.3212 - 2.3212)	58.958 - 58.959 (2.3212 - 2.3212)	58.959 - 58.960 (2.3212 - 2.3213)	58.960 - 58.961 (2.3213 - 2.3213)	58.961 - 58.962 (2.3213 - 2.3213)	58.962 - 58.963 (2.3213 - 2.3214)	58.963 - 58.964 (2.3214 - 2.3214)	58.964 - 58.965 (2.3214 - 2.3215)	58.965 - 58.966 (2.3215 - 2.3215)	58.966 - 58.967 (2.3215 - 2.3215)	58.967 - 58.968 (2.3215 - 2.3216)
Mark	Outer diameter Unit: mm (in)																									
A	54.979 - 54.978 (2.1645 - 2.1645)		0	0	0	0	0	0	0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3
B	54.978 - 54.977 (2.1645 - 2.1644)		0	0	0	0	0	0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3
C	54.977 - 54.976 (2.1644 - 2.1644)		0	0	0	0	0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3
D	54.976 - 54.975 (2.1644 - 2.1644)		0	0	0	0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34
E	54.975 - 54.974 (2.1644 - 2.1643)		0	0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	3	34	34
F	54.974 - 54.973 (2.1643 - 2.1643)		0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4
G	54.973 - 54.972 (2.1643 - 2.1642)		0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4
H	54.972 - 54.971 (2.1642 - 2.1642)		01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4
J	54.971 - 54.970 (2.1642 - 2.1642)		01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4
K	54.970 - 54.969 (2.1642 - 2.1641)		01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45
L	54.969 - 54.968 (2.1641 - 2.1641)		01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45
M	54.968 - 54.967 (2.1641 - 2.1641)		1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45
N	54.967 - 54.966 (2.1641 - 2.1640)		1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5
P	54.966 - 54.965 (2.1640 - 2.1640)		1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5
R	54.965 - 54.964 (2.1640 - 2.1639)		12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5
S	54.964 - 54.963 (2.1639 - 2.1639)		12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56
T	54.963 - 54.962 (2.1639 - 2.1639)		12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56
U	54.962 - 54.961 (2.1639 - 2.1638)		2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56
V	54.961 - 54.960 (2.1638 - 2.1638)		2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6
W	54.960 - 54.959 (2.1638 - 2.1637)		2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6
X	54.959 - 54.958 (2.1637 - 2.1637)		23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6
Y	54.958 - 54.957 (2.1637 - 2.1637)		23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67
4	54.957 - 54.956 (2.1637 - 2.1636)		23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67
7	54.956 - 54.955 (2.1636 - 2.1636)		3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67

PBIC2202E

HOW TO SELECT PISTON AND BEARING

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

MAIN BEARING SELECTION TABLE (No. 3 journals)

<div> <div>Cylinder block main bearing housing inner diameter</div> <div>Crankshaft main journal diameter</div> </div>		Mark	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V	W	X	Y	4	7
		Inner diameter Unit: mm (in)	58.944 - 58.945 (2.3206 - 2.3207)	58.945 - 58.946 (2.3207 - 2.3207)	58.946 - 58.947 (2.3207 - 2.3207)	58.947 - 58.948 (2.3207 - 2.3208)	58.948 - 58.949 (2.3208 - 2.3208)	58.949 - 58.950 (2.3208 - 2.3209)	58.950 - 58.951 (2.3209 - 2.3209)	58.951 - 58.952 (2.3209 - 2.3209)	58.952 - 58.953 (2.3209 - 2.3210)	58.953 - 58.954 (2.3210 - 2.3210)	58.954 - 58.955 (2.3210 - 2.3211)	58.955 - 58.956 (2.3211 - 2.3211)	58.956 - 58.957 (2.3211 - 2.3211)	58.957 - 58.958 (2.3211 - 2.3212)	58.958 - 58.959 (2.3212 - 2.3212)	58.959 - 58.960 (2.3212 - 2.3213)	58.960 - 58.961 (2.3213 - 2.3213)	58.961 - 58.962 (2.3213 - 2.3213)	58.962 - 58.963 (2.3213 - 2.3214)	58.963 - 58.964 (2.3214 - 2.3214)	58.964 - 58.965 (2.3214 - 2.3215)	58.965 - 58.966 (2.3215 - 2.3215)	58.966 - 58.967 (2.3215 - 2.3215)	58.967 - 58.968 (2.3215 - 2.3216)
Mark	Outer diameter Unit: mm (in)																									
A	54.979 - 54.978 (2.1645 - 2.1645)	-1	-1	-1	-1	-1	-10	-10	-10	0	0	0	0	01	01	01	1	1	1	12	12	12	2	2	2	23
B	54.978 - 54.977 (2.1645 - 2.1644)	-1	-1	-1	-1	-1	-10	-10	-10	0	0	0	0	01	01	01	1	1	1	12	12	12	2	2	2	23
C	54.977 - 54.976 (2.1644 - 2.1644)	-1	-1	-1	-1	-10	-10	-10	0	0	0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23
D	54.976 - 54.975 (2.1644 - 2.1644)	-1	-1	-10	-10	-10	0	0	0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3
E	54.975 - 54.974 (2.1644 - 2.1643)	-1	-10	-10	-10	0	0	0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3
F	54.974 - 54.973 (2.1643 - 2.1643)	-10	-10	-10	0	0	0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3
G	54.973 - 54.972 (2.1643 - 2.1642)	-10	-10	0	0	0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34
H	54.972 - 54.971 (2.1642 - 2.1642)	-10	0	0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	3	34	34
J	54.971 - 54.970 (2.1642 - 2.1642)	0	0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	3	3	34	34
K	54.970 - 54.969 (2.1642 - 2.1641)	0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	3	34	34	34	4
L	54.969 - 54.968 (2.1641 - 2.1641)	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	3	34	34	34	4	4
M	54.968 - 54.967 (2.1641 - 2.1641)	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	3	34	34	34	4	4	4
N	54.967 - 54.966 (2.1641 - 2.1640)	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	3	34	34	34	4	4	4	45
P	54.966 - 54.965 (2.1640 - 2.1640)	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	3	34	34	34	4	4	4	4	45
R	54.965 - 54.964 (2.1640 - 2.1639)	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	4	4	45	45
S	54.964 - 54.963 (2.1639 - 2.1639)	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	4	4	45	45	5
T	54.963 - 54.962 (2.1639 - 2.1639)	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5
U	54.962 - 54.961 (2.1639 - 2.1638)	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	5
V	54.961 - 54.960 (2.1638 - 2.1638)	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	5	56
W	54.960 - 54.959 (2.1638 - 2.1637)	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	5	56	56
X	54.959 - 54.958 (2.1637 - 2.1637)	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	5	56	56	56
Y	54.958 - 54.957 (2.1637 - 2.1637)	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	5	56	56	56	6
4	54.957 - 54.956 (2.1637 - 2.1636)	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6
7	54.956 - 54.955 (2.1636 - 2.1636)	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	6

JSBIA3794GB

MAIN BEARING GRADE TABLE (ALL JOURNALS)

Main bearing grade table (All journals) : Refer to [EM-283, "Main Bearing"](#).

USE UNDERSIZE BEARING USAGE GUIDE

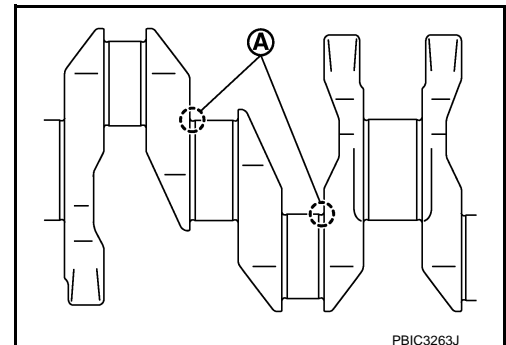
- When the specified main bearing oil clearance is not obtained with standard size main bearings, use under-size (US) bearing.
- When using undersize (US) bearing, measure the main bearing inner diameter with bearing installed, and grind main journal so that the main bearing oil clearance satisfies the standard.

CAUTION:

In grinding crankshaft main journal to use undersize bearings, keep fillet R [1.5 - 1.7 mm (0.059 - 0.067 in)] (A).

Bearing undersize table:

Refer to [EM-283, "Main Bearing"](#).



HOW TO SELECT PISTON AND BEARING

< UNIT DISASSEMBLY AND ASSEMBLY >

[QR25DE]

Bearing undersize table : Refer to [EM-283, "Main Bearing"](#).

A
EM

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

SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[QR25DE]

SERVICE DATA AND SPECIFICATIONS (SDS)

SERVICE DATA AND SPECIFICATIONS (SDS)

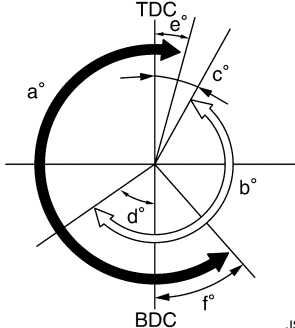
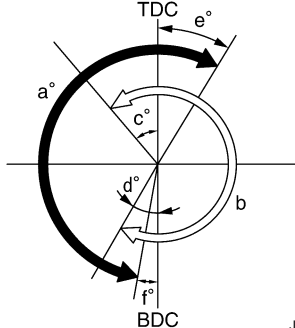
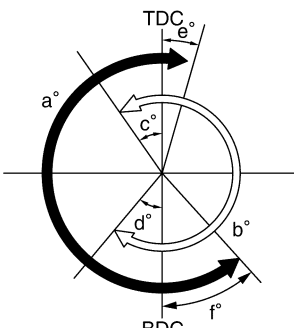
General Specification

INFOID:0000000010783829

GENERAL SPECIFICATIONS

Engine type		QR25DE
Cylinder arrangement		In-line 4
Displacement	cm ³ (cu in)	2,488 (151.82)
Bore and stroke	mm (in)	89.0 x 100.0 (3.504 x 3.937)
Valve arrangement		DOHC
Firing order		1-3-4-2
Number of piston rings	Compression	2
	Oil	1
Compression ratio		10.0
Compression pressure kPa (bar, kg/cm ² , psi)/250 rpm	Standard	1,410 (14.1, 14.4, 204.7)
	Minimum	1,220 (12.2, 12.1, 176.3)
	Differential limit between cylinders	100 (1.0, 1.0, 14)

Unit: degree

Valve timing ⇐ : Intake valve ⇐ : Exhaust valve	VTC Minimum phasing (Mechanical)		VTC Maximum phasing (Mechanical)			
						
	JSBIA3409ZZ		JSBIA3410ZZ			
	Engine start (Mechanical)					
						
JSBIA3411ZZ						
	a EXH valve opening angle	b INT valve opening angle	c INT open	d INT close	e EXH close	f EXH open

SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[QR25DE]

VTC Minimum phasing (Mechanical) *1	224	244	5 ATDC	69 ABDC	3 ATDC	41 BBDC
VTC Maximum phasing (Mechanical) *2			35 BTDC	29 ABDC	48 ATDC	4 ABDC
Intermediate lock phasing (Mechanical) *3			5 BTDC	59 ABDC	3 ATDC	41 BBDC

*1: When running at idle with engine coolant temperature more than 60°C (140°F).

*2: When the intake or exhaust valve opening angle is at the maximum.

*3: When starting the engine with engine coolant temperature 60°C (140°F) or less.

Drive belt

INFOID:0000000010783830

DRIVE BELT

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

Spark Plug

INFOID:0000000010783831

SPARK PLUG

Unit: mm (in)

Make	DENSO
Standard type	FXE20HE11
Spark plug gap (Nominal)	1.1 (0.043)

Exhaust Manifold

INFOID:0000000010783832

EXHAUST MANIFOLD

Unit: mm (in)

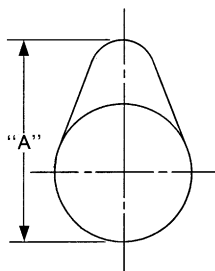
Items		Limit
Surface distortion	Exhaust manifold	0.3 (0.012)

Camshaft

INFOID:0000000010783833

CAMSHAFT

Unit: mm (in)



SEM671

Items		Standard	Limit
Camshaft journal oil clearance		0.045 - 0.086 (0.0018 - 0.0034)	—
Camshaft bracket inner diameter	No. 1	28.000 - 28.021 (1.1024 - 1.1032)	—
	No. 2, 3, 4, 5	23.500 - 23.521 (0.9252 - 0.9260)	—
Camshaft journal diameter	No. 1	27.935 - 27.955 (1.0998 - 1.1006)	—
	No. 2, 3, 4, 5	23.435 - 23.455 (0.9226 - 0.9234)	—

SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[QR25DE]

Camshaft end play		0.115 - 0.188 (0.0045 - 0.0074)	—
Camshaft cam height "A"	Intake	45.865 - 46.055 (1.8057 - 1.8132)	0.2 (0.008)* ¹
	Exhaust	44.175 - 44.365 (1.7392 - 1.7467)	
Camshaft runout [TIR* ²]		Less than 0.02 mm (0.0008)	—
Camshaft sprocket runout [TIR* ²]		—	0.15 (0.0059)

*1: Cam wear limit

*2: Total indicator reading

VALVE LIFTER

Unit: mm (in)

Items		Standard
Valve lifter outer diameter	CHINA production model	33.977 - 33.987 (1.3377 - 1.3381)
	THAILAND production model	33.980 - 33.990 (1.3378 - 1.3382)
Valve lifter hole diameter		34.000 - 34.021 (1.3386 - 1.3394)
Valve lifter clearance	CHINA production model	0.013 - 0.044 (0.0005 - 0.0017)
	THAILAND production model	0.010 - 0.041 (0.0004 - 0.0016)

VALVE CLEARANCE

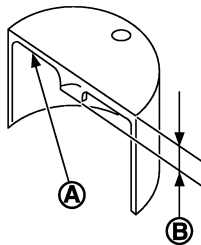
Unit: mm (in)

Items	Cold	Hot* (reference data)
Intake	0.24 - 0.32 (0.094 - 0.0126)	0.304 - 0.416 (0.0120 - 0.0164)
Exhaust	0.26 - 0.34 (0.0102 - 0.0134)	0.308 - 0.432 (0.0121 - 0.0170)

*: Approximately 80°C (176°F)

AVAILABLE VALVE LIFTER

Unit: mm (in)



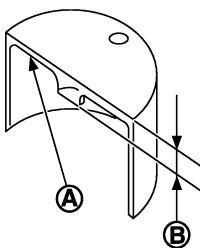
JPBIA0170ZZ

Thickness (B)	Identification (stamped)* mark (A)	
	CHINA production model	THAILAND production model
3.00 (0.1181)	300	300N or 300n
3.02 (0.1189)	302	302N or 302n
3.04 (0.1197)	304	304N or 304n
3.06 (0.1205)	306	306N or 306n
3.08 (0.1213)	308	308N or 308n
3.10 (0.1220)	310	310N or 310n
3.12 (0.1228)	312	312N or 312n
3.14 (0.1236)	314	314N or 314n
3.16 (0.1244)	316	316N or 316n
3.18 (0.1252)	318	318N or 318n

SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[QR25DE]



JPBIA0170ZZ

Thickness (B)	Identification (stamped)* mark (A)	
	CHINA production model	THAILAND production model
3.20 (0.1260)	320	320N or 320n
3.22 (0.1268)	322	322N or 322n
3.24 (0.1276)	324	324N or 324n
3.26 (0.1283)	326	326N or 326n
3.28 (0.1291)	328	328N or 328n
3.30 (0.1299)	330	330N or 330n
3.32 (0.1307)	332	332N or 332n
3.34 (0.1315)	334	334N or 334n
3.36 (0.1323)	336	336N or 336n
3.38 (0.1331)	338	338N or 338n
3.40 (0.1339)	340	340N or 340n
3.42 (0.1346)	342	342N or 342n
3.44 (0.1354)	344	344N or 344n
3.46 (0.1362)	346	346N or 346n
3.48 (0.1370)	348	348N or 348n
3.50 (0.1378)	350	350N or 350n

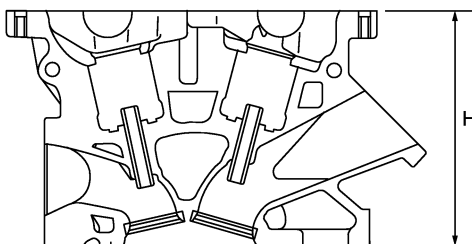
*: Always check with the Parts Department for the latest parts information.

Cylinder Head

INFOID:0000000010783834

CYLINDER HEAD

Unit: mm (in)



PBIC0924E

Items	Standard	Limit
Head surface distortion	Less than 0.03 (0.0012)	0.1 (0.004)
Normal cylinder head height "H"	129.4 (5.09)	—

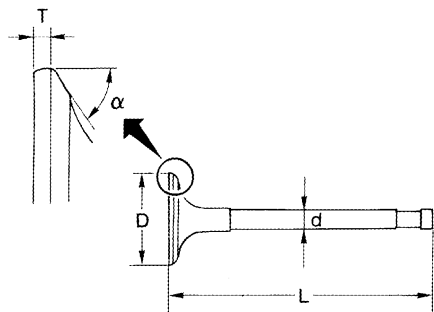
SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[QR25DE]

VALVE DIMENSIONS

Unit: mm (in)

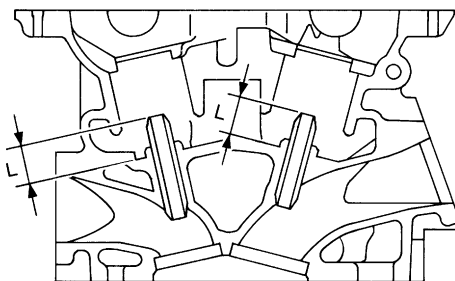


JSBIA1166ZZ

Valve head diameter "D"	Intake	35.5 - 35.8 (1.398 - 1.409)
	Exhaust	30.3 - 30.6 (1.193 - 1.205)
Valve length "L"	Intake	101.72 (4.0074)
	Exhaust	102.78 (4.0464)
Valve stem diameter "d"	Intake	5.965 - 5.980 (0.2348 - 0.2354)
	Exhaust	5.955 - 5.970 (0.2344 - 0.2350)
Valve seat angle "α"	Intake	45°15' - 45°45'
	Exhaust	
Valve margin "T"	Intake	1.08 (0.0425)
	Exhaust	1.38 (0.0543)
Valve margin "T" limit		0.5 (0.020)
Valve stem end surface grinding limit		0.2 (0.008)

VALVE GUIDE

Unit: mm (in)



SEM950E

Items		Standard	Oversize (Service) [0.2 (0.008)]
Valve guide	Outer diameter	10.023 - 10.034 (0.3946 - 0.3950)	10.223 - 10.234 (0.4025 - 0.4029)
	Inner diameter (Finished size)	6.000 - 6.018 (0.2362 - 0.2369)	
Cylinder head valve guide hole diameter		9.975 - 9.996 (0.3927 - 0.3935)	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 (0.003)
	Exhaust	0.030 - 0.063 (0.0012 - 0.0025)	0.09 (0.0035)
Projection length "L"	Intake	10.1 - 10.3 (0.398 - 0.405)	
	Exhaust	10.0 - 10.4 (0.394 - 0.409)	

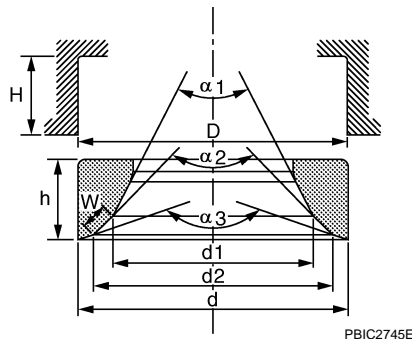
SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[QR25DE]

VALVE SEAT

Unit: mm (in)



Items		Standard	Oversize (Service) [0.5 (0.02)]
Cylinder head seat recess diameter "D"	Intake	36.500 - 36.516 (1.4370 - 1.4376)	37.000 - 37.016 (1.4567 - 1.4573)
	Exhaust	31.500 - 31.516 (1.2402 - 1.2408)	32.000 - 32.016 (1.2598 - 1.2408)
Valve seat outer diameter "d"	Intake	36.597 - 36.613 (1.4408 - 1.4415)	37.097 - 37.113 (1.4605 - 1.4611)
	Exhaust	31.600 - 31.616 (1.2441 - 1.2447)	32.100 - 32.116 (1.2638 - 1.2644)
Valve seat interference fit	Intake	0.081 - 0.113 (0.0032 - 0.0044)	
	Exhaust	0.084 - 0.116 (0.0034 - 0.0046)	
Diameter "d1"*1	Intake	33.5 (1.319)	
	Exhaust	28.0 (1.102)	
Diameter "d2"*2	Intake	34.8 - 35.3 (1.370 - 1.390)	
	Exhaust	29.6 - 30.1 (1.165 - 1.185)	
Angle "α1"	Intake	60°	
	Exhaust	60°	
Angle "α2"	Intake	88°45' - 90°15'	
	Exhaust	88°45' - 90°15'	
Angle "α3"	Intake	120°	
	Exhaust	120°	
Contacting width "W"*3	Intake	0.99 - 1.35 (0.0390 - 0.0531)	
	Exhaust	1.19 - 1.55 (0.0469 - 0.0610)	
Height "h"	Intake	5.9 - 6.0 (0.232 - 0.236)	5.0 - 5.1 (0.197 - 0.201)
	Exhaust	5.9 - 6.0 (0.232 - 0.236)	4.91 - 5.01 (0.1933 - 0.1972)
Depth "H"		6.0 (0.236)	

*1: Diameter made by intersection point of conic angles "α1" and "α2"

*2: Diameter made by intersection point of conic angles "α2" and "α3"

*3: Machining data

VALVE SPRING

Items	Intake	Exhaust
Free height	47.92 - 48.12 (1.8866 - 1.8945)	48.65 - 48.85 (1.9154 - 1.9232)
Installation height	36.96 mm (1.4551 in)	36.96 mm (1.455 in)
Installation load	151 - 175 N (15.4 - 17.8 kg, 34 - 39 lb)	151 - 175 N (15.4 - 17.8 kg, 34 - 39 lb)
Height during valve open	26.76 mm (1.0535 in)	28.46 mm (1.1205 in)
Load with valve open	335 - 383 N (34.2 - 39.1 kg, 75.3 - 86.1 lb)	300 - 342 N (30.6 - 34.9 kg, 67.4 - 76.9 lb)

SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[QR25DE]

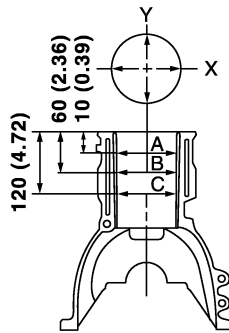
Items	Intake	Exhaust
Identification color	White	Ligte blue
Out- of- Square	1.0 mm (0.0394 in)	

Cylinder Block

INFOID:000000010783835

CYLINDER BLOCK

Unit: mm (in)



PBIC0281E

Surface distortion		Limit		0.1 (0.004)
Cylinder bore	Inner diameter	Standard	Grade No. 2	89.010 - 89.020 (3.5043 - 3.5047)
			Grade No. 3	89.020 - 89.030 (3.5047 - 3.5051)
		Wear limit		0.2 (0.008)
Out-of-round (Difference between “X” and “Y”)		Limit		0.015 (0.0006)
Taper (Difference between “A” and “C”)				0.01 (0.0004)
Main bearing housing inner diameter grade			Grade No. A	58.944 - 58.945 (2.3206 - 2.3207)
			Grade No. B	58.945 - 58.946 (2.3207 - 2.3207)
			Grade No. C	58.946 - 58.947 (2.3207 - 2.3207)
			Grade No. D	58.947 - 58.948 (2.3207 - 2.3208)
			Grade No. E	58.948 - 58.949 (2.3208 - 2.3208)
			Grade No. F	58.949 - 58.950 (2.3208 - 2.3209)
			Grade No. G	58.950 - 58.951 (2.3209 - 2.3209)
			Grade No. H	58.951 - 58.952 (2.3209 - 2.3209)
			Grade No. J	58.952 - 58.953 (2.3209 - 2.3210)
			Grade No. K	58.953 - 58.954 (2.3210 - 2.3210)
			Grade No. L	58.954 - 58.955 (2.3210 - 2.3211)
			Grade No. M	58.955 - 58.956 (2.3211 - 2.3211)
			Grade No. N	58.956 - 58.957 (2.3211 - 2.3211)
			Grade No. P	58.957 - 58.958 (2.3211 - 2.3212)
			Grade No. R	58.958 - 58.959 (2.3212 - 2.3212)
			Grade No. S	58.959 - 58.960 (2.3212 - 2.3213)
			Grade No. T	58.960 - 58.961 (2.3213 - 2.3213)
			Grade No. U	58.961 - 58.962 (2.3213 - 2.3213)
			Grade No. V	58.962 - 58.963 (2.3213 - 2.3214)
			Grade No. W	58.963 - 58.964 (2.3214 - 2.3214)
			Grade No. X	58.964 - 58.965 (2.3214 - 2.3215)
			Grade No. Y	58.965 - 58.966 (2.3215 - 2.3215)
Grade No. 4	58.966 - 58.967 (2.3215 - 2.3215)			
Grade No. 7	58.967 - 58.968 (2.3215 - 2.3216)			
Difference in inner diameter between cylinders		Standard		Less than 0.03 (0.0012)

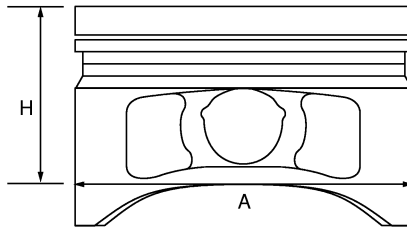
AVAILABLE PISTON

SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[QR25DE]

Unit: mm (in)



PBIC0188E

Piston skirt diameter “A”	Standard	Grade No. 2	88.990 - 89.000 (3.5035 - 3.5039)
		Grade No. 3	89.000 - 89.010 (3.5039 - 3.5043)
		Oversize (Service) [0.20 (0.008)]	89.180 - 89.210 (3.5110 - 3.5122)
Piston height “H” dimension			37.5 (1.476)
Piston pin hole diameter	Grade No. 0		19.993 - 19.999 (0.7871 - 0.7874)
	Grade No. 1		19.999 - 20.005 (0.7874 - 0.7876)
Piston to cylinder bore clearance	Standard		0.010 - 0.030 (0.0004 - 0.0012)
	Limit		0.08 (0.0031)

PISTON RING

Unit: mm (in)

Items		Standard	Limit
Side clearance	Top	0.040 - 0.080 (0.0016 - 0.0031)	0.11 (0.0043)
	2nd	0.030 - 0.070 (0.0012 - 0.0028)	0.1 (0.004)
	Oil ring	0.045 - 0.125 (0.0018 - 0.0049)	—
End gap	Top	0.21 - 0.31 (0.0083 - 0.0122)	0.53 (0.0209)
	2nd	0.37 - 0.52 (0.0146 - 0.0205)	0.71 (0.0280)
	Oil (rail ring)	0.20 - 0.45 (0.008 - 0.0177)	0.80 (0.0314)

PISTON PIN

Unit: mm (in)

Items		Standard	Limit
Piston pin outer diameter	Grade No. 0	19.989 - 19.995 (0.7870 - 0.7872)	—
	Grade No. 1	19.995 - 20.001 (0.7872 - 0.7874)	—
Piston to piston pin oil clearance		0.002 - 0.006 (0.0001 - 0.0002)	—
Connecting rod bushing oil clearance		0.005 - 0.017 (0.0002 - 0.0007)	0.030 (0.0012)

CONNECTING ROD

Unit: mm (in)

Center distance		143.00 - 143.10 (5.63 - 5.63)
Bend [per 100 (3.94)]	Limit	0.15 (0.0059)
Torsion [per 100 (3.94)]	Limit	0.3 (0.012)
Connecting rod small end inner diameter		22.000 - 22.012 (0.7874 - 0.7879)
Connecting rod bushing inner diameter*	Grade No. 0	20.000 - 20.006 (0.7874 - 0.7876)
	Grade No. 1	20.006 - 20.012 (0.7876 - 0.7879)
Connecting rod big end inner diameter		48.000 - 48.013 (1.8898 - 1.8903)

SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

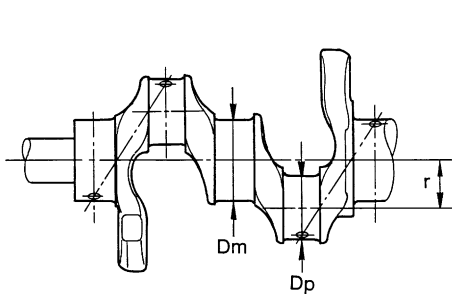
[QR25DE]

Side clearance	Standard	0.20 – 0.35 (0.008 – 0.0138)
	Limit	0.5 (0.020)
Connecting rod big end diameter	Grade No. 0	48.000 – 48.001 (1.8898 – 1.8898)
	Grade No. 1	48.001 – 48.002 (1.8898 – 1.8898)
	Grade No. 2	48.002 – 48.003 (1.8898 – 1.8899)
	Grade No. 3	48.003 – 48.004 (1.8899 – 1.8899)
	Grade No. 4	48.004 – 48.005 (1.8899 – 1.8900)
	Grade No. 5	48.005 – 48.006 (1.8900 – 1.8900)
	Grade No. 6	48.006 – 48.007 (1.8900 – 1.8900)
	Grade No. 7	48.007 – 48.008 (1.8900 – 1.8901)
	Grade No. 8	48.008 – 48.009 (1.8901 – 1.8901)
	Grade No. 9	48.009 – 48.010 (1.8901 – 1.8902)
	Grade No. A	48.010 – 48.011 (1.8902 – 1.8902)
	Grade No. B	48.011 – 48.012 (1.8902 – 1.8902)
	Grade No. C	48.012 – 48.013 (1.8902 – 1.8903)

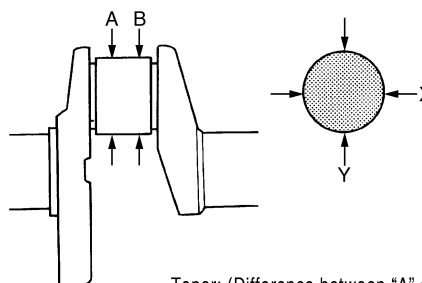
*: After installing in connecting rod

CRANKSHAFT

Unit: mm (in)



SEM645



Taper: (Difference between "A" and "B")
Out-of-round: (Difference between "X" and "Y")

SBIA0535E

Center distance "r"		49.96 - 50.04 (1.9669 - 1.9701)
Out-of-round (Difference between "X" and "Y")	Limit	0.005 (0.0002)
Taper (Difference between "A" and "B")	Limit	0.005 (0.0002)
Runout [TIR*]	Limit	0.05 (0.0020)
Crankshaft end play	Standard	0.10 - 0.26 (0.004 - 0.0102)
	Limit	0.3 (0.012)

SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[QR25DE]

Pin journal diameter grade. "Dp"	Grade No. A	44.974 - 44.973 (1.7706 - 1.7706)
	Grade No. B	44.973 - 44.972 (1.7706 - 1.7705)
	Grade No. C	44.972 - 44.971 (1.7705 - 1.7705)
	Grade No. D	44.971 - 44.970 (1.7705 - 1.7705)
	Grade No. E	44.970 - 44.969 (1.7705 - 1.7704)
	Grade No. F	44.969 - 44.968 (1.7704 - 1.7704)
	Grade No. G	44.968 - 44.967 (1.7704 - 1.7704)
	Grade No. H	44.967 - 44.966 (1.7704 - 1.7703)
	Grade No. J	44.966 - 44.965 (1.7703 - 1.7703)
	Grade No. K	44.965 - 44.964 (1.7703 - 1.7702)
	Grade No. L	44.964 - 44.963 (1.7702 - 1.7702)
	Grade No. M	44.963 - 44.962 (1.7702 - 1.7702)
	Grade No. N	44.962 - 44.961 (1.7702 - 1.7701)
	Grade No. P	44.961 - 44.960 (1.7701 - 1.7701)
	Grade No. R	44.960 - 44.959 (1.7701 - 1.7700)
	Grade No. S	44.959 - 44.958 (1.7700 - 1.7700)
	Grade No. T	44.958 - 44.957 (1.7700 - 1.7700)
	Grade No. U	44.957 - 44.956 (1.7700 - 1.7699)
Main journal diameter grade. "Dm"	Grade No. A	54.979 - 54.978 (2.1645 - 2.1645)
	Grade No. B	54.978 - 54.977 (2.1645 - 2.1644)
	Grade No. C	54.977 - 54.976 (2.1644 - 2.1644)
	Grade No. D	54.976 - 54.975 (2.1644 - 2.1644)
	Grade No. E	54.975 - 54.974 (2.1644 - 2.1643)
	Grade No. F	54.974 - 54.973 (2.1643 - 2.1643)
	Grade No. G	54.973 - 54.972 (2.1643 - 2.1642)
	Grade No. H	54.972 - 54.971 (2.1642 - 2.1642)
	Grade No. J	54.971 - 54.970 (2.1642 - 2.1642)
	Grade No. K	54.970 - 54.969 (2.1642 - 2.1641)
	Grade No. L	54.969 - 54.968 (2.1641 - 2.1641)
	Grade No. M	54.968 - 54.967 (2.1641 - 2.1641)
	Grade No. N	54.967 - 54.966 (2.1641 - 2.1640)
	Grade No. P	54.966 - 54.965 (2.1640 - 2.1640)
	Grade No. R	54.965 - 54.964 (2.1640 - 2.1639)
	Grade No. S	54.964 - 54.963 (2.1639 - 2.1639)
	Grade No. T	54.963 - 54.962 (2.1639 - 2.1639)
	Grade No. U	54.962 - 54.961 (2.1639 - 2.1638)
	Grade No. V	54.961 - 54.960 (2.1638 - 2.1638)
	Grade No. W	54.960 - 54.959 (2.1638 - 2.1637)
	Grade No. X	54.959 - 54.958 (2.1637 - 2.1637)
	Grade No. Y	54.958 - 54.957 (2.1637 - 2.1637)
	Grade No. 4	54.957 - 54.956 (2.1637 - 2.1636)
	Grade No. 7	54.956 - 54.955 (2.1636 - 2.1636)

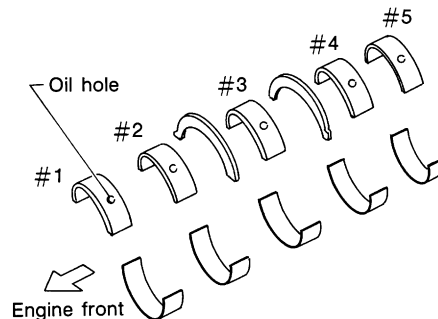
*: Total indicator reading

Main Bearing

INFOID:0000000010783836

MAIN BEARING

Unit: mm (in)



SEM685D

Grade number	Thickness	Identification color	Remarks
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SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[QR25DE]

-1		1.970 - 1.973 (0.0776 - 0.0777)	Green - Brown	Grade and color are the same for upper and lower bearings.
0		1.973 - 1.976 (0.0777 - 0.0778)	Black	
1		1.976 - 1.979 (0.0778 - 0.0779)	Brown	
2		1.979 - 1.982 (0.0779 - 0.0780)	Green	
3		1.982 - 1.985 (0.0780 - 0.0781)	Yellow	
4		1.985 - 1.988 (0.0781 - 0.0783)	Blue	
5		1.988 - 1.991 (0.0783 - 0.0784)	Pink	
6		1.991 - 1.994 (0.0784 - 0.0785)	Purple	
7		1.994 - 1.997 (0.0785 - 0.0786)	White	
-10	UPR	1.970 - 1.973 (0.0776 - 0.0777)	Green - Brown	Grade and color are different for upper and lower bearings.
	LWR	1.973 - 1.976 (0.0777 - 0.0778)	Black	
01	UPR	1.973 - 1.976 (0.0777 - 0.0778)	Black	
	LWR	1.976 - 1.979 (0.0778 - 0.0779)	Brown	
12	UPR	1.976 - 1.979 (0.0778 - 0.0779)	Brown	
	LWR	1.979 - 1.982 (0.0779 - 0.0780)	Green	
23	UPR	1.979 - 1.982 (0.0779 - 0.0780)	Green	
	LWR	1.982 - 1.985 (0.0780 - 0.0781)	Yellow	
34	UPR	1.982 - 1.985 (0.0780 - 0.0781)	Yellow	
	LWR	1.985 - 1.988 (0.0781 - 0.0783)	Blue	
45	UPR	1.985 - 1.988 (0.0781 - 0.0783)	Blue	
	LWR	1.988 - 1.991 (0.0783 - 0.0784)	Pink	
56	UPR	1.988 - 1.991 (0.0783 - 0.0784)	Pink	
	LWR	1.991 - 1.994 (0.0784 - 0.0785)	Purple	
67	UPR	1.991 - 1.994 (0.0784 - 0.0785)	Purple	
	LWR	1.994 - 1.997 (0.0785 - 0.0786)	White	

UNDERSIZE

Unit: mm (in)

Items	Thickness	Main journal diameter
0.25 (0.0098)	2.106 - 2.114 (0.0829 - 0.0832)	Grind so that bearing clearance is the specified value.

MAIN BEARING OIL CLEARANCE

Unit: mm (in)

Main bearing oil clearance	Standard	No. 1 and 5	0.012 - 0.022 (0.0005 - 0.0009)
		No. 2 and 4	0.018 - 0.028 (0.0007 - 0.0011)
		No. 3	0.021 - 0.031 (0.0008 - 0.0012)
	Limit		0.1 (0.004)

Connecting Rod Bearing

INFOID:0000000010783837

CONNECTING ROD BEARING

Unit: mm (in)

Grade number	Thickness	Identification color	Remarks
0	1.493 - 1.496 (0.0588 - 0.0589)	Black - Black	Grade and color are the same for upper and lower bearings.
1	1.496 - 1.499 (0.0589 - 0.0590)	Brown - Brown	
2	1.499 - 1.502 (0.0590 - 0.0591)	Green - Green	
3	1.502 - 1.505 (0.0591 - 0.0593)	Yellow - Yellow	
4	1.505 - 1.508 (0.0593 - 0.0594)	Blue - Blue	

SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[QR25DE]

01	UPR	1.493 - 1.496 (0.0588 - 0.0589)	Black - Black	Grade and color are different for upper and lower bearings.
	LWR	1.496 - 1.499 (0.0589 - 0.0590)	Brown - Brown	
12	UPR	1.496 - 1.499 (0.0589 - 0.0590)	Brown - Brown	
	LWR	1.499 - 1.502 (0.0590 - 0.0591)	Green - Green	
23	UPR	1.499 - 1.502 (0.0590 - 0.0591)	Green - Green	
	LWR	1.502 - 1.505 (0.0591 - 0.0593)	Yellow - Yellow	
34	UPR	1.502 - 1.505 (0.0591 - 0.0593)	Yellow - Yellow	
	LWR	1.505 - 1.508 (0.0593 - 0.0594)	Blue - Blue	

UNDERSIZE

Unit: mm (in)

Items	Thickness	Crank pin journal diameter
0.25 (0.0098)	1.622 - 1.630 (0.0639 - 0.0642)	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	0.035 - 0.045 (0.0014 - 0.0018)	0.1 (0.004)

PRECAUTION

PRECAUTIONS

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

INFOID:0000000010784294

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. 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, all maintenance must be performed by an authorized NISSAN/INFINITI dealer.
- Improper maintenance, 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, and wait at least 3 minutes before performing any service.

Precaution Necessary for Steering Wheel Rotation After Battery Disconnect

INFOID:0000000010784542

CAUTION:

Comply with the following cautions to prevent any error and malfunction.

- Before removing and installing any control units, first turn the ignition power source and accessory power source to the OFF, then disconnect both battery cables.
- After finishing work, confirm that all control unit connectors are connected properly, then re-connect both battery cables.
- Always use CONSULT to perform self-diagnosis as a part of each function inspection after finishing work. If a DTC is detected, perform trouble diagnosis according to self-diagnosis results.

For vehicle with steering lock unit, if the battery is disconnected or discharged, the steering wheel will lock and cannot be turned.

If turning the steering wheel is required with the battery disconnected or discharged, follow the operation procedure below before starting the repair operation.

OPERATION PROCEDURE

1. Connect both battery cables.

NOTE:

Supply power using jumper cables if battery is discharged.

2. Open driver door.
3. Turn the ignition switch to the ON position.
(At this time, the steering lock will be released.)
4. Turn the ignition switch to OFF position with driver door open.
5. Wait for 3 minutes or longer with driver door open.

NOTE:

- Do not close driver door because the steering wheel locks when driver door is closed.

PRECAUTIONS

[R9M]

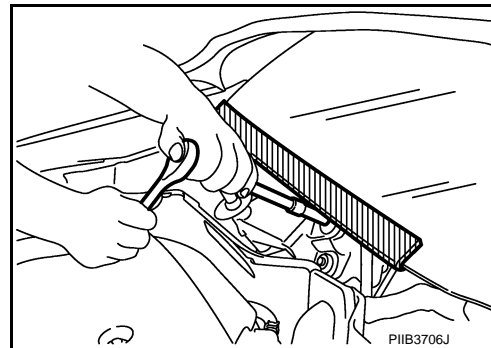
< PRECAUTION >

- The auto acc function is adapted to this vehicle. For this reason, even when the ignition switch is turned to OFF position, the accessory power source does not turned OFF and continues to be supplied for a certain amount of time.
6. Disconnect both battery cables. The steering lock will remain released with both battery cables disconnected and the steering wheel can be turned.
 7. Perform the necessary repair operation.
 8. When the repair work is completed, re-connect both battery cables. With the brake pedal released, turn the ignition switch from OFF position to ON position, then to LOCK position. (The steering wheel will lock when the ignition switch is turned to LOCK position.)
 9. Perform self-diagnosis check of all control units using CONSULT.

Precaution for Procedure without Cowl Top Cover

INFOID:0000000010784296

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:0000000010784301

DISCONNECTING FUEL PIPING

- Before starting work, check no fire or spark producing items are in the work area.
- Release fuel pressure before disconnecting and disassembly.
- After disconnecting pipes, plug openings to stop fuel leakage.

DRAINING ENGINE COOLANT

Drain engine coolant and engine oil when the engine is cooled.

INSPECTION, REPAIR AND REPLACEMENT

Before repairing or replacing, thoroughly inspect parts. Inspect new replacement parts in the same way, and replace if necessary.

REMOVAL AND DISASSEMBLY

- When instructed to use SST, use specified tools. Always be careful to work safely, avoid forceful or uninstructed operations.
- Exercise maximum care to avoid damage to mating or sliding surfaces.
- Dowel pins are used for several parts alignment. When replacing and reassembling parts with dowel pins, check that dowel pins are installed in the original position.
- Must cover openings of engine system with a tape or equivalent, to seal out foreign materials.
- Mark and arrange disassembly parts in an organized way for easy troubleshooting and reassembly.
- When loosening nuts and bolts, as a basic rule, start with the one furthest outside, then the one diagonally opposite, and so on. If the order of loosening is specified, do exactly as specified. Power tools may be used in the step.

ASSEMBLY AND INSTALLATION

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

PRECAUTIONS

[R9M]

< PRECAUTION >

- 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:000000010784543

- 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.

Liquid Gasket

INFOID:000000010784544

REMOVAL OF LIQUID GASKET SEALING

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

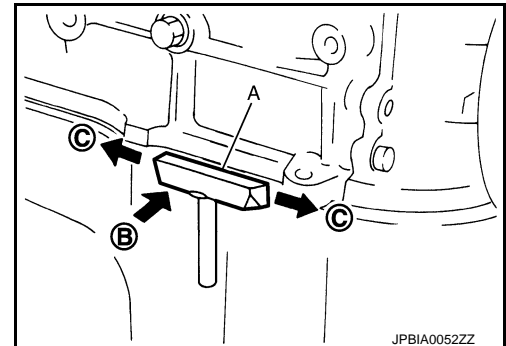
CAUTION:

Never damage the mating surfaces.

- Tap the seal cutter [SST: KV10111100] to insert it (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.

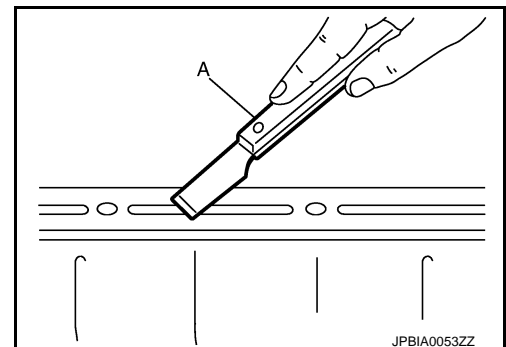
CAUTION:

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



LIQUID GASKET APPLICATION PROCEDURE

1. Using a scraper (A), remove old liquid gasket adhering to the liquid gasket application surface and the mating surface.
 - Remove liquid gasket completely from the groove of the liquid gasket application surface, mounting bolts, and bolt holes.
2. Wipe the liquid gasket application surface and the mating surface with white gasoline (lighting and heating use) to remove adhering moisture, grease and foreign materials.

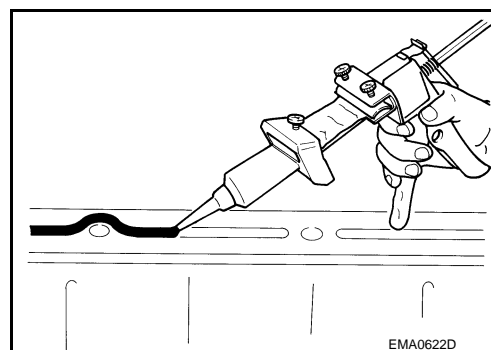


PRECAUTIONS

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< PRECAUTION >

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

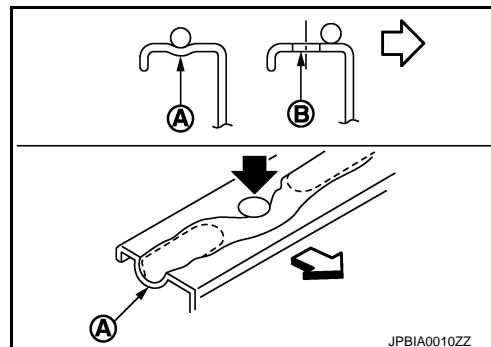


- As for bolt holes (B), normally apply liquid gasket inside the holes. Occasionally, it should be applied outside the holes. Check to read the text of this manual.

(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.

Precaution for Diesel Equipment

INFOID:0000000010784545

CLEANLINESS

CLEANLINESS INSTRUCTIONS WHICH MUST BE FOLLOWED WHEN WORKING ON THE HIGH PRESSURE DIRECT INJECTION SYSTEM

Risks relating to contamination

The system is very sensitive to contamination. The risks caused by the introduction of contamination are:

- Damage or destruction of the high pressure injection system and the engine
- Seizing or leaking of a component

All After-Sales operations must be performed under very clean conditions. This means that no impurities (particles a few microns in size) get into the system during dismantling or into the circuits via the fuel unions.

The cleanliness principle must be applied from the fuel filter to the fuel injectors.

WHAT ARE THE SOURCES OF CONTAMINATION?

Contamination is caused by:

- Metal or plastic chips
- Paint
- Fibers:
 - Boxes
 - Brushes
 - Paper
 - Clothing
 - Cloths
- Foreign bodies such as hair
- Ambient air
- Etc.

WARNING:

It is not possible to clean the engine using a high pressure fuel pump because of the risk of damaging connections. In addition, moisture may collect in the connectors and create electrical connection malfunctions

PRECAUTIONS

< PRECAUTION >

[R9M]

INSTRUCTIONS TO BE FOLLOWED BEFORE ANY WORK IS CARRIED OUT ON THE INJECTION SYSTEM

- Check that you have the plugs for the unions to be opened (bag of plugs sold at the Parts Stores - Nissan part No. 16609 00Q0A, Renault part No. 77 01 209 062). Plugs are to be used once only. After use, they must be thrown away (once used they are soiled and cleaning is not sufficient to make them reusable). Unused plugs must be thrown away.
- Check that you have hermetically resealable plastic bags for storing removed parts. Stored parts will therefore be less subject to the risk of impurities. The bags must be used only once, and after use they must be thrown away.
- Lint-free towelettes to be used for fuel pump related service purpose. The use of a normal cloth or paper for cleaning purposes is forbidden. These are not lint-free and may contaminate the fuel circuit of the system. Each lint-free cloth should only be used once.

INSTRUCTIONS TO BE FOLLOWED BEFORE OPENING THE FUEL CIRCUIT

- For each operation, use new thinner (used thinner contains impurities). Pour it into a clean receptacle.
- For each operation, use a clean brush which is in good condition (the brush must not shed its bristles).
- Use a brush and thinners to clean the connections to be opened.
- Blow compressed air over the cleaned parts (tools, cleaned the same way as the parts, connections and injection system zone). Check that no bristles remain adhered.
- Wash your hands before and during the operation if necessary.
- When wearing leather protective gloves, cover these with latex gloves.

INSTRUCTIONS TO BE FOLLOWED DURING THE OPERATION

- As soon as the circuit is open, all openings must be plugged to prevent impurities from entering the system. The plugs to be used are available from the Parts Stores - Nissan part No. 16609 00Q0A, Renault part No. 77 01 209 062. They must not, under any circumstances, be reused.
- Close the hermetically sealed bag, even if it has to be reopened shortly afterwards. Ambient air carries contamination.
- All components of the injection system that are removed must be stored in a hermetically sealed plastic bag once the plugs have been inserted.
- The use of a brush, thinner, bellows, sponge or normal cloth is strictly forbidden once the circuit has been opened. These items are likely to allow impurities to enter the system.
- A new component replacing an old one must not be removed from its packaging until it is to be fitted to the vehicle.

Instructions for Fitting the Plugs

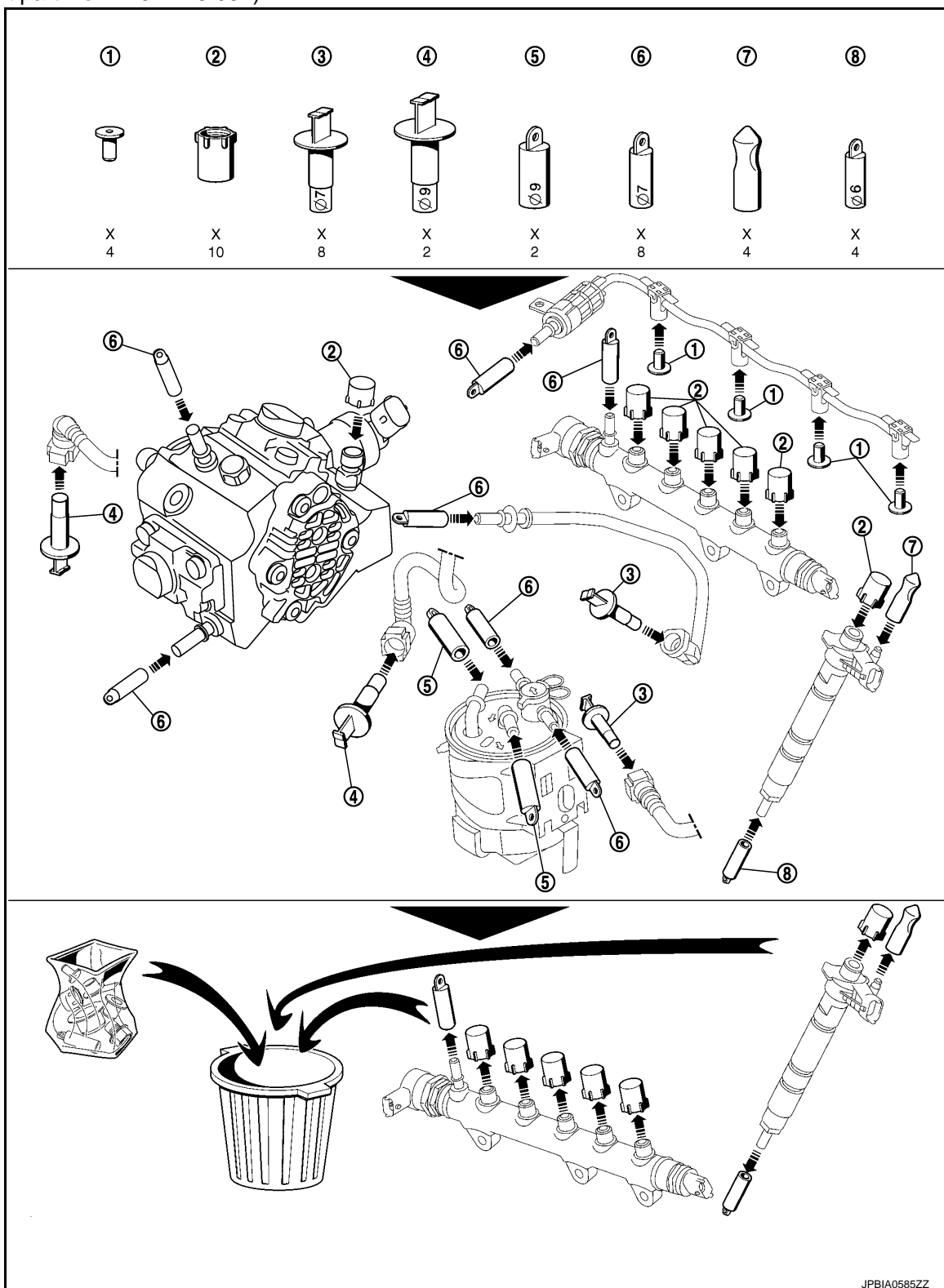
Nissan part No. 16609 00Q0C

PRECAUTIONS

< PRECAUTION >

[R9M]

(Renault part No. 77 01 479 091)



SPECIAL FEATURES

CAUTION:

- The engine must not operate with:
 - Use diesel fuel required by the regulations for cetane number. Refer to [GI-30. "Fuel"](#).
 - Petrol, even in tiny quantities
- Before carrying out any work, check that the fuel rail is not under pressure and that the fuel temperature is not too high. [The system can inject the diesel into the engine at a pressure up to 160,000 kPa (1,600 bar, 1,632 kg/cm², 23,200 psi)].

PRECAUTIONS

[R9M]

< PRECAUTION >

- Respect the cleaning and safety advice specified in this document for any work on the high pressure injection system.
- Remove of the interior of the fuel pump and fuel injectors is prohibited.
- For safety reasons, it is strictly forbidden to slacken an injection tube union when the engine is running.
- It is not possible to remove the fuel pressure sensor from the fuel rail because this may cause circuit contamination malfunctions. If the fuel pressure sensor fails, the fuel pressure sensor, the fuel rail and the fuel injection tubes must be replaced.
- It is strictly forbidden to remove the fuel pump pulley.
- Applying 12 volts directly to any component in the system is prohibited.
- Ultrasonic carbon removal and cleaning are prohibited.
- Never start the engine without the battery being connected correctly.

CHECKING SEALING AFTER REPAIR

CAUTION:

After any operation, check that there is no diesel leakage.

- Start the engine and check for fuel leak for one minute after starting.
- Apply tracing fluid around the high pressure connections of the pipe that has been replaced.
- Once the engine coolant temperature is above 50°C (122°F) and provided there are no malfunctions present, carry out a road test, taking the engine speed up to 4,000 rpm at least once to check that there is no leakage.
- Perform a visual inspection after the road test to check that there is no high pressure leakage.
- Clean off the tracing fluid.

Precautions for Removing Battery Terminal

INFOID:000000010784540

- With the adoption of Auto ACC function, ACC power is automatically supplied by operating the intelligent key or remote keyless entry or by opening/closing the driver side door. In addition, ACC power is supplied even after the ignition switch is turned to the OFF position, i.e. ACC power is supplied for a certain fixed time.
- When disconnecting the 12V battery terminal, turn off the ACC power before disconnecting the 12V battery terminal, observing "How to disconnect 12V battery terminal" described below.

NOTE:

Some ECUs operate for a certain fixed time even after ignition switch is turned OFF and ignition power supply is stopped. If the battery terminal is disconnected before ECU stops, accidental DTC detection or ECU data damage may occur.

- For vehicles with the 2-batteries, be sure to connect the main battery and the sub battery before turning ON the ignition switch.

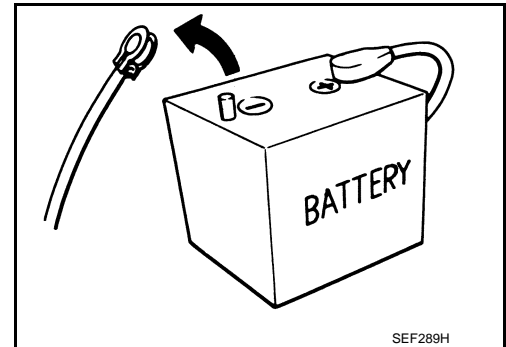
NOTE:

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

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

NOTE:

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



SEF289H

HOW TO DISCONNECT 12V BATTERY TERMINAL

Disconnect 12V battery terminal according to Instruction 1 or Instruction 2 described below.

For vehicles parked by ignition switch OFF, refer to Instruction 2.

INSTRUCTION 1

1. Open the hood.
2. Turn key switch to the OFF position with the driver side door opened.
3. Get out of the vehicle and close the driver side door.
4. Wait at least 3 minutes. For vehicle with the engine listed below, remove the battery terminal after a lapse of the specified time.

D4D engine	: 20 minutes
HRA2DDT	: 12 minutes
K9K engine	: 4 minutes
M9R engine	: 4 minutes

PRECAUTIONS

< PRECAUTION >

[R9M]

R9M engine : 4 minutes

V9X engine : 4 minutes

A

CAUTION:

While waiting, never operate the vehicle such as locking, opening, and closing doors. Violation of this caution results in the activation of ACC power supply according to the Auto ACC function.

EM

5. Remove 12V battery terminal.

CAUTION:

After installing 12V battery, always check self-diagnosis results of all ECUs and erase DTC.

C

INSTRUCTION 2 (FOR VEHICLES PARKED BY IGNITION SWITCH OFF)

1. Unlock the door with intelligent key or remote keyless entry.

NOTE:

At this moment, ACC power is supplied.

D

2. Open the driver side door.
3. Open the hood.
4. Close the driver side door.
5. Wait at least 3 minutes.

E

CAUTION:

While waiting, never operate the vehicle such as locking, opening, and closing doors. Violation of this caution results in the activation of ACC power supply according to the Auto ACC function.

F

6. Remove 12V battery terminal.

G

CAUTION:

After installing 12V battery, always check self-diagnosis results of all ECUs and erase DTC.

H

I

J

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PREPARATION

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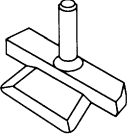
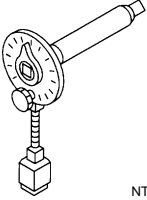
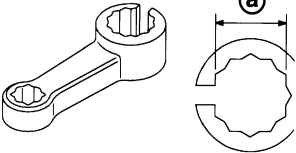
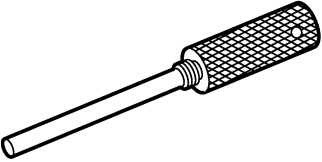
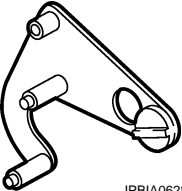
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PREPARATION

PREPARATION

Special Service Tools

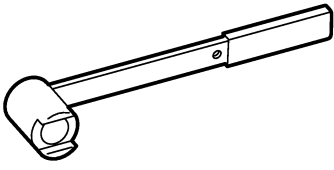
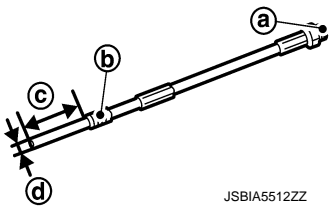
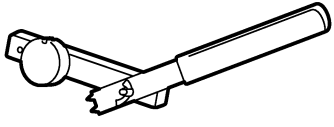
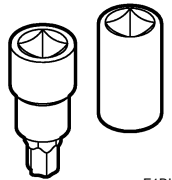
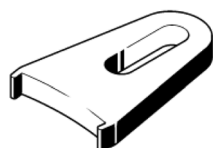
INFOID:0000000010784302

NISSAN tool number (RENAULT tool No.) Tool name	Description
— (Mot. 1979) Piston ring compressor	Installing piston assembly into cylinder bore
KV10111100 (—) Seal cutter	Removing oil pan and front cover, etc
	 NT046
KV10112100 (—) Angle wrench	Tightening bolts for bearing cap, cylinder head, etc. in angle
	 NT014
KV10114400 (—) Heated oxygen sensor wrench	Loosening or tightening air fuel ratio sensor a: 22 mm (0.87 in)
	 JP8IA0397ZZ
— (Mot. 1970) TDC set pin	To lock engine at TDC
	 JP8IA0629ZZ
— (Mot. 1969) Camshaft timing tool	To lock camshaft when changing timing chain
	 JP8IA0628ZZ

PREPARATION

< PREPARATION >

[R9M]

NISSAN tool number (RENAULT tool No.) Tool name	Description	
— (Mot. 1770) Crankshaft pulley locking tool	To lock crankshaft pulley	EM
 JPBIA0630ZZ		C
— (Mot. 1772) Compression gauge adapter	Connecting compression gauge and glow plug hole • (a) : G1/4 • (b) : M10×1.0 • (c) : 64 mm • (d) : φ8.5 mm	D
 JSBIA5512ZZ		E
— (Mot. 1773) Positioning tool	To position the gear and apply for the right clearance (wear compensation gear)	F
 JPBIA0625ZZ		G
— (Mot. 1959) TORX Socket	Removing and installing drive plate or fly-wheel Size: T55+	H
 E1BIA0349ZZ		I
— (Mot. 1972) Piston cooler fitting tool	Installing oil jet (9.5 degree orientation)	J
— (Mot. 1485-01) Piston cooler removing tool	Removing oil jet	K
— (Mot. 1431) Flywheel locking tool	To lock flywheel	L
 JMAIA0431ZZ		M
— (Emb. 880) Piston cooler fitting tool	Pin extractor tool	N
		O
		P

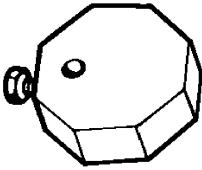
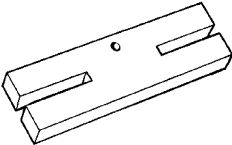
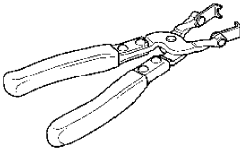
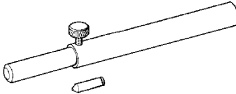
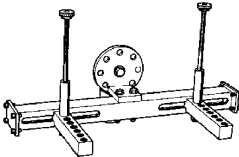
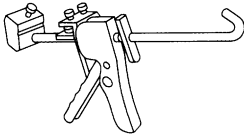
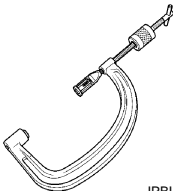
Commercial Service Tools

INFOID:0000000010784303

PREPARATION

< PREPARATION >

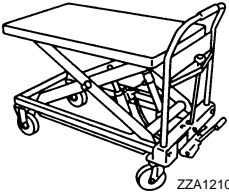
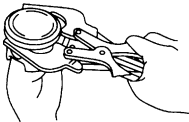
[R9M]

NISSAN tool number (RENAULT tool No.) Tool name		Description
KV113B0040 (Mot. 251-01) Dial indicator stand set	 MBIB0360E	Gauge stand used with KV113B0050 (Mot. 252-01)
KV113B0050 (Mot. 252-01) Dial indicator stand set	 MBIB0361E	Thrust plate for measuring the protrusion of piston used with KV113B0040 (Mot. 251-01)
KV113B0090 (Mot. 1335) Valve seal remover	 MBIB0370E	Tool for removing valve oil seals
KV113B0180 (Mot. 1511-01) Valve seal drift	 MBIB0378E	Tool for installing valve oil seals
KV113B0200 (Mot. 1573) Cylinder head stand	 MBIB0380E	Cylinder head and cylinder head housing support
Tube presser	 NT052	Pressing the tube of liquid gasket
Valve spring compressor	 JPBIA0770ZZ	Disassembling valve mechanism

PREPARATION

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[R9M]

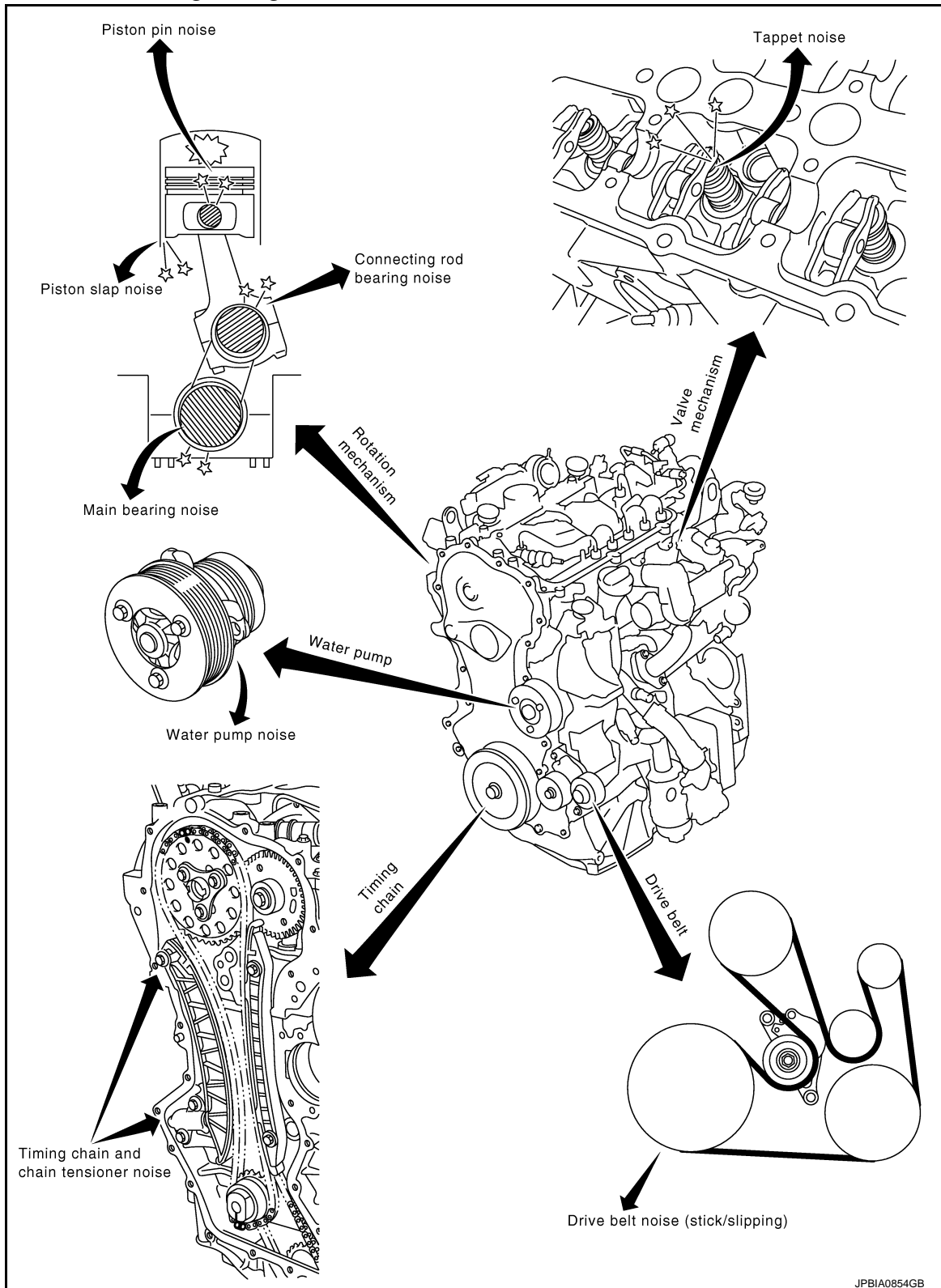
NISSAN tool number (RENAULT tool No.) Tool name	Description	
Manual lift table caddy  ZZA1210D	Removing and installing engine	EM
Piston ring expander  NT030	Removing and installing piston ring	

SYMPTOM DIAGNOSIS

NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING

NVH Troubleshooting - Engine Noise

INFOID:0000000010784292



NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING

< SYMPTOM DIAGNOSIS >

[R9M]

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

INFOID:000000010784293

1. Locate the area where noise occurs.
2. Confirm the type of noise.
3. Specify the operating condition of 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 Cylinder head	Ticking or clicking	A	C	—	B	B	—	Hydraulic tappet noise	Out of oil	EM-338
	Rattle	C	A	—	A	B	C	Camshaft bearing noise	Camshaft journal oil clearance	EM-357
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	EM-401
	Slap or rap	A	—	—	B	B	A	Piston slap noise	Piston ring side clearance Piston ring end gap	EM-401
	Knock	A	B	C	B	B	B	Connecting rod bearing noise	Connecting rod bushing oil clearance Connecting rod bearing oil clearance	EM-401
	Knock	A	B	—	A	B	C	Main bearing noise	Main bearing oil clearance	EM-401
Front of engine Front cover	Tapping or ticking	A	A	—	B	B	B	Timing chain and chain tensioner noise	Timing chain cracks and wear Timing chain tensioner operation	EM-351
Front of engine	Squeaking or fizzing	A	B	—	B	—	C	Drive belt (Sticking or slipping)	Drive belt deflection	EM-307
	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	CO-84, "Inspection"

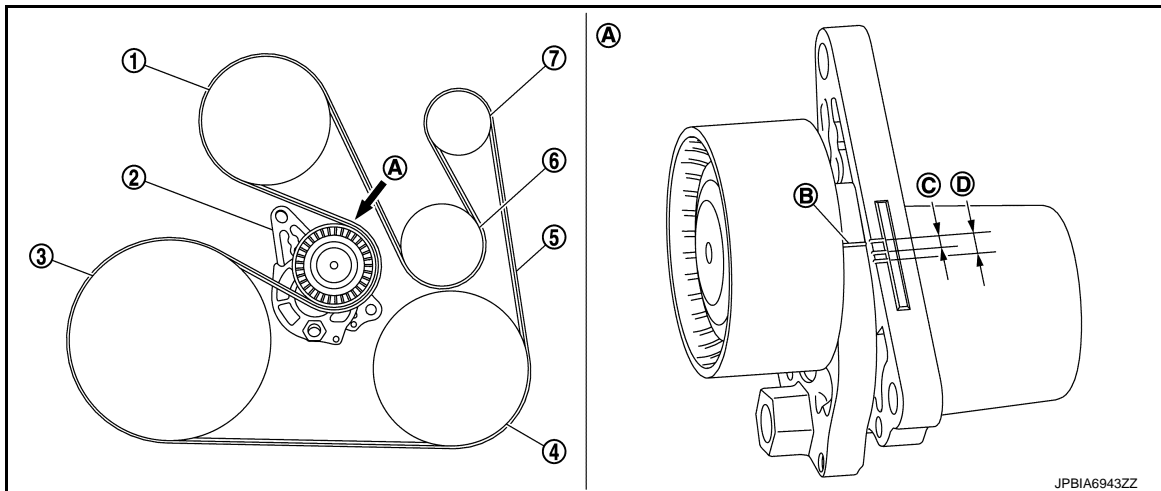
A: Closely related B: Related C: Sometimes related —: Not related

PERIODIC MAINTENANCE

DRIVE BELT

Exploded View

INFOID:0000000010784304



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

Removal and Installation

INFOID:0000000010784307

CAUTION:

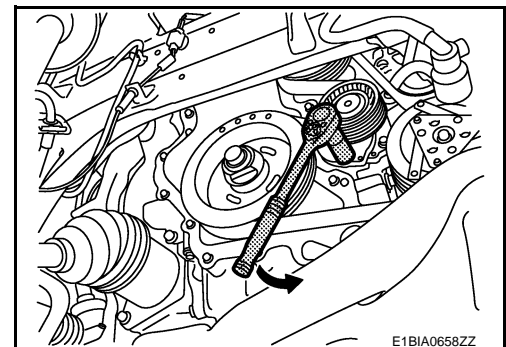
- Replace the drive belt that has been removed with a new one.
- Drive belt auto-tensioner and idler pulley must be replaced with new ones when the drive belt is replaced.
- Never run the engine without the drive belt to avoid damaging the crankshaft pulley.

REMOVAL

1. Remove front fender protector (RH). Refer to [EXT-35, "FENDER PROTECTOR : Exploded View"](#).
2. Hold the hexagonal part of drive belt auto-tensioner with a hexagonal socket securely. Then move the wrench handle in the direction of arrow (loosening direction of tensioner).

CAUTION:

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



E1BIA0658ZZ

DRIVE BELT

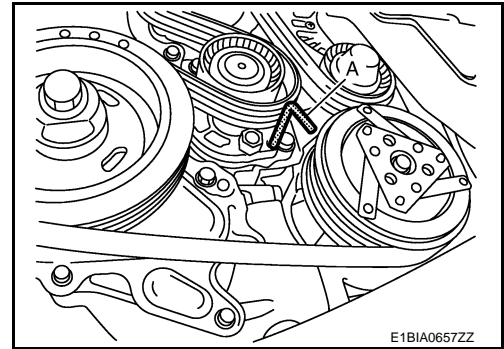
< PERIODIC MAINTENANCE >

[R9M]

3. Insert a stopper pin (A) in diameter such as short-length screw-driver into the hole of the retaining boss to fix drive belt auto-tensioner pulley.
 - Keep drive belt auto-tensioner pulley arm locked after drive belt is removed.

NOTE:

Use approximately 3.0 mm (0.118 in) dia. hard metal pin as a stopper pin.



4. Remove drive belt.

INSTALLATION

1. Install drive belt.

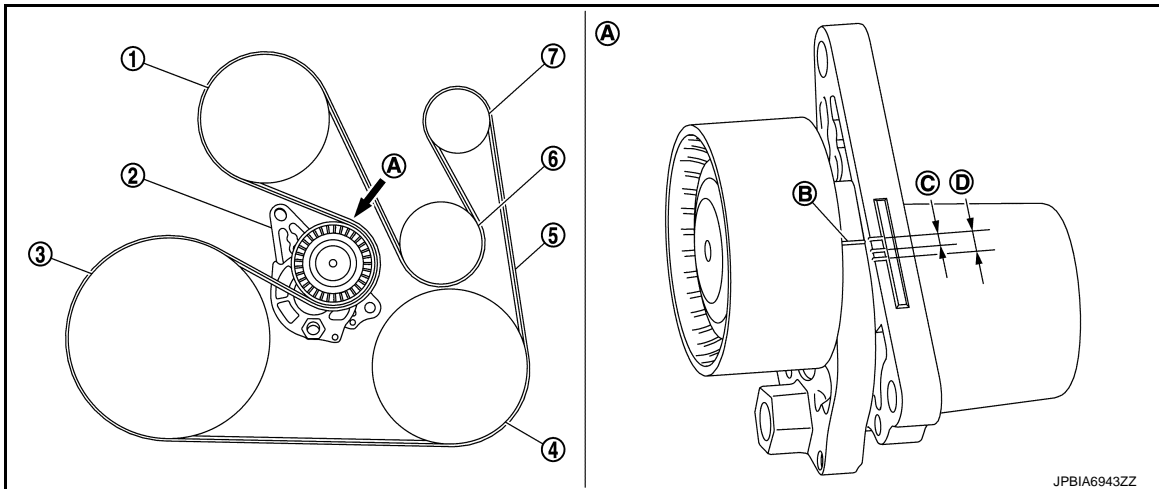
CAUTION:

- Check that drive belt is completely set to pulleys.
- 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.
3. Turn crankshaft pulley clockwise several times to equalize tension between each pulley.
4. Check that the indicator (notch on fixed side) of drive belt auto-tensioner is within the range when new drive belt is installed. Refer to [EM-301, "Inspection"](#).

Inspection

INFOID:000000010784305



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

WARNING:

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

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

NOTE:

- Check the drive belt auto-tensioner indication when the engine is cold.
- When new drive belt is installed, the indicator (notch on fixed side) should be within the range (Ⓒ) in the figure.
- Visually check entire drive belt for wear, damage or cracks.

DRIVE BELT

< PERIODIC MAINTENANCE >

[R9M]

- If the indicator (notch on fixed side) is out of the possible use range or belt is damaged, replace drive belt.

CAUTION:

Drive belt auto-tensioner and idler pulley must be replaced with new ones when the drive belt is replaced.

Adjustment

INFOID:0000000010784306

Refer to [EM-414, "Drive Belts"](#).

AIR CLEANER FILTER

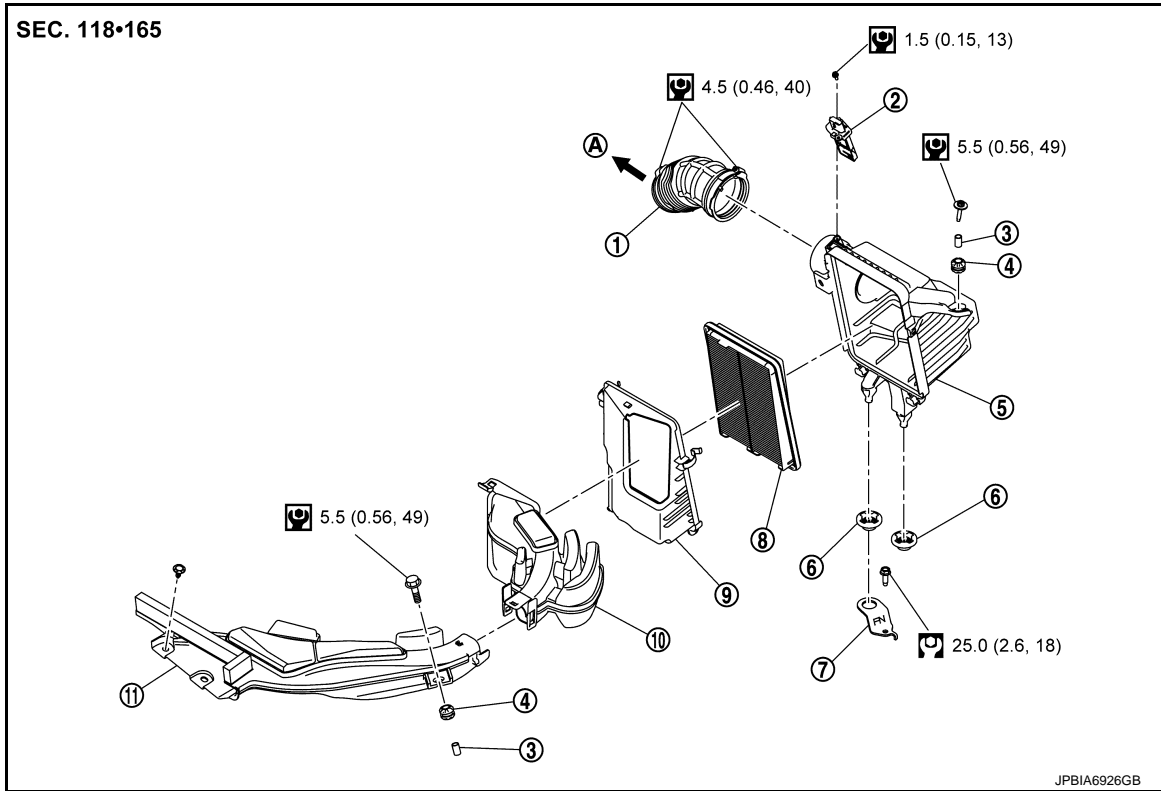
< PERIODIC MAINTENANCE >

[R9M]

AIR CLEANER FILTER

Exploded View

INFOID:0000000011004806



- | | | |
|--------------|------------------------|---------------------|
| ① Air duct | ② Mass air flow sensor | ③ Collar |
| ④ Grommet | ⑤ Air cleaner body | ⑥ Mounting rubber |
| ⑦ Bracket | ⑧ Air cleaner filter | ⑨ Air cleaner cover |
| ⑩ Air duct 2 | ⑪ Air duct 1 | |

Ⓐ To turbochager

: N·m (kg-m, ft-lb)

: N·m (kg-m, in-lb)

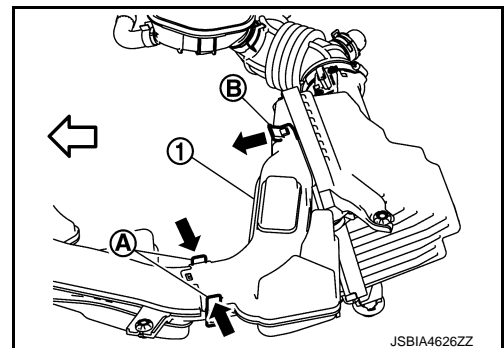
Removal and Installation

INFOID:0000000010784308

REMOVAL

- To remove air duct 2 ①, pinch pawl Ⓐ to unlock, move pawl Ⓑ frontward, and remove air duct 2 upward.

← : Vehicle front



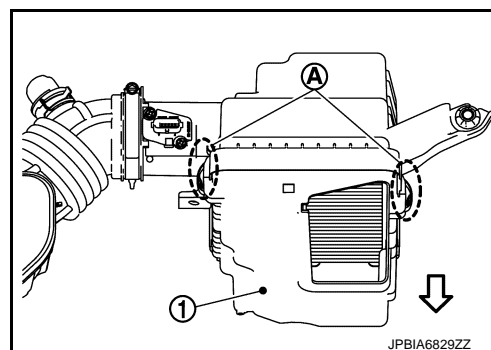
AIR CLEANER FILTER

[R9M]

< PERIODIC MAINTENANCE >

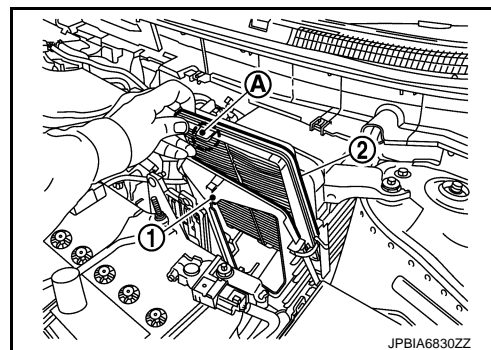
2. Remove the clips ① of air cleaner cover ①.

⇐ : Vehicle front



3. Shift air cleaner cover ① to vehicle front side and remove air cleaner filter ②.

Ⓐ : Projection

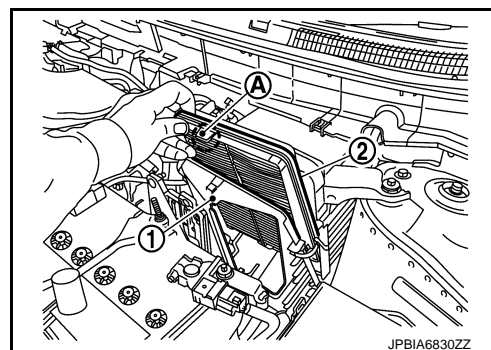


INSTALLATION

Install in the reverse order of removal.

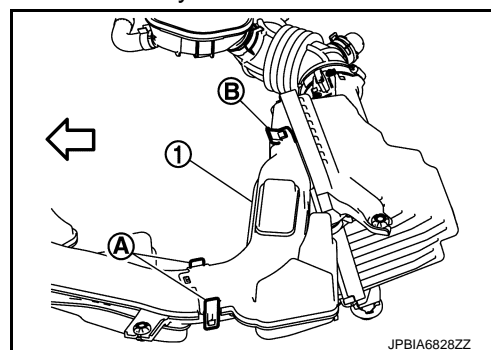
- Insert the projection Ⓐ of air cleaner filter ② in such a way so that it becomes the position (upper front side of car) of illustration.

① : Air cleaner cover



- Verify that there is no looseness in air cleaner cover and has been fixed accurately.
- Check that pawls Ⓐ and Ⓑ (3 in total) of air duct 2 ① are engaged.

⇐ : Vehicle front



Inspection (Dry Paper Type)

INFOID:000000011004807

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.
- To clean air cleaner element, blow it from intake manifold side towards air intake side to remove trash or dust.
- If clogging or damage is observed, replace the air cleaner element.

AIR CLEANER FILTER

[R9M]

< PERIODIC MAINTENANCE >

MAINTENANCE INTERVAL

Refer to [MA-8, "Periodic Maintenance"](#).

Inspection (Viscous Paper Type)

INFOID:0000000011004808

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-8, "Periodic Maintenance"](#).

A

EM

C

D

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P

ENGINE COVER

< REMOVAL AND INSTALLATION >

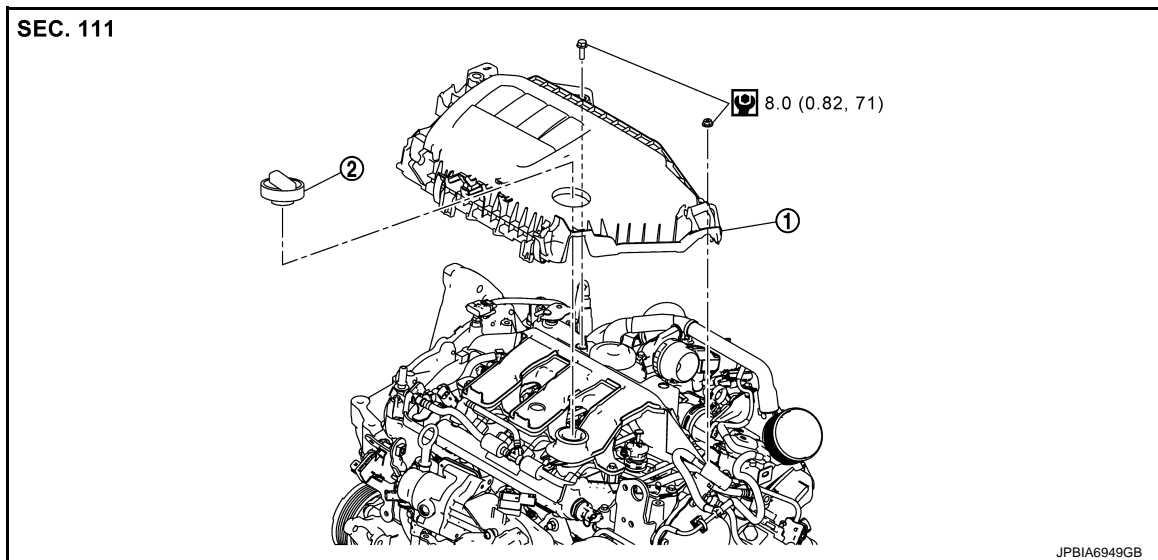
[R9M]

REMOVAL AND INSTALLATION

ENGINE COVER

Exploded View

INFOID:0000000011004823



① Engine cover

② Oil filler cap

: N·m (kg-m, in-lb)

Removal and Installation

INFOID:0000000011004824

REMOVAL

1. Remove Oil filter cap.
2. Move harness.
3. Remove engine cover.

CAUTION:

- Never damage or scratch engine cover when installing or removing.

INSTALLATION

Install in the reverse order of removal.

DRIVE BELT AUTO TENSIONER AND IDLER PULLEY

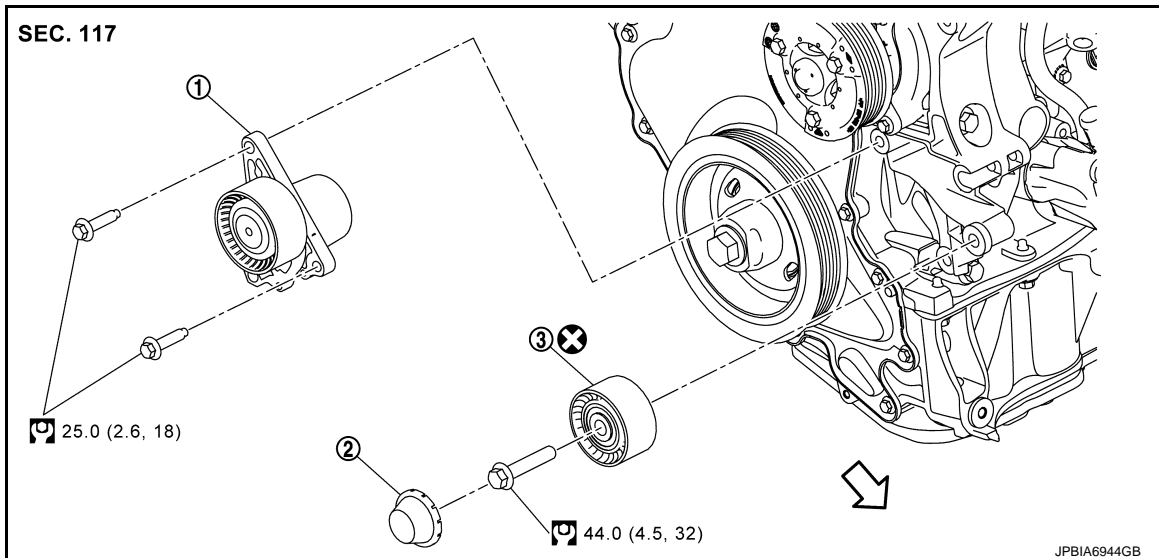
< REMOVAL AND INSTALLATION >

[R9M]

DRIVE BELT AUTO TENSIONER AND IDLER PULLEY

Exploded View

INFOID:0000000010784309



① Drive belt auto-tensioner

② Cover

③ Idler pulley

⇐ : Vehicle front

Ⓐ : N·m (kg-m, ft-lb)

⊗ : Always replace after every disassembly.

Removal and Installation

INFOID:0000000010784310

CAUTION:

- Replace the drive belt that has been removed with a new one.
- Drive belt auto-tensioner and idler pulley must be replaced with new ones when the drive belt is replaced.
- Never run the engine without the drive belt to avoid damaging the crankshaft pulley.

REMOVAL

1. Remove drive belt. Refer to [EM-300. "Removal and Installation"](#).
 - Keep drive belt auto-tensioner pulley arm locked after drive belt is removed.
2. Remove drive belt auto-tensioner.
3. Remove rear torque rod mounting bolt.
4. Move engine, and remove cover and idler pulley.

INSTALLATION

Install in the reverse order of removal.

AIR CLEANER AND AIR DUCT

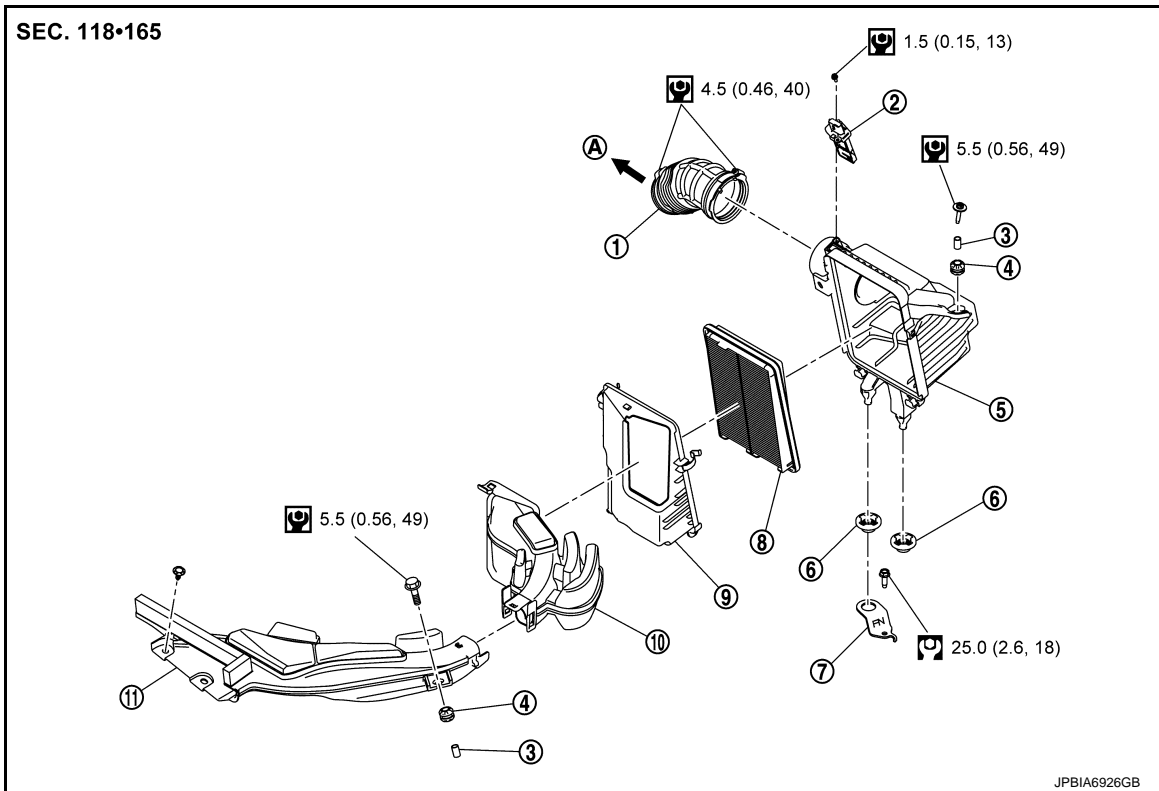
< REMOVAL AND INSTALLATION >

[R9M]

AIR CLEANER AND AIR DUCT

Exploded View

INFOID:0000000010784311



- | | | |
|---------------------|------------------------|---------------------|
| ① Air duct | ② Mass air flow sensor | ③ Collar |
| ④ Grommet | ⑤ Air cleaner body | ⑥ Mounting rubber |
| ⑦ Bracket | ⑧ Air cleaner filter | ⑨ Air cleaner cover |
| ⑩ Air duct 2 | ⑪ Air duct 1 | |
| Ⓐ To turbochager | | |
| : N·m (kg-m, ft-lb) | | |
| : N·m (kg-m, in-lb) | | |

Removal and Installation

INFOID:0000000010784312

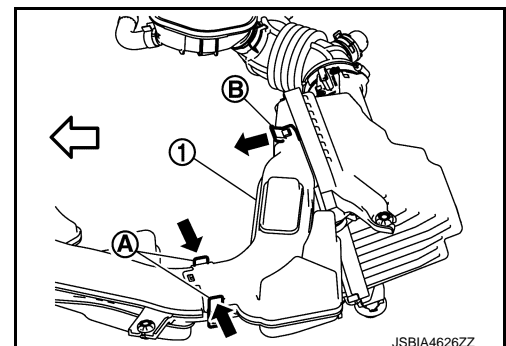
REMOVAL

NOTE:

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

- Remove air duct 1 and air duct 2.
 - To remove air duct 2 ①, pinch pawl Ⓐ to unlock, move pawl Ⓑ frontward, and remove air duct 2 upward.

← : Vehicle front



AIR CLEANER AND AIR DUCT

[R9M]

< REMOVAL AND INSTALLATION >

2. Remove battery. Refer to [PG-138, "R9M : Exploded View"](#).
3. Remove battery tray. Refer to [PG-143, "R9M : Exploded View"](#).
4. Disconnect mass air flow sensor harness connector.
5. Loosen clamps of air duct.
 - Add mating marks if necessary for easier installation.
6. Remove air cleaner assembly (cover and body).
7. Remove mass air flow sensor from air cleaner body, if necessary.
CAUTION:
Handle the mass air flow sensor with following cares.
 - **Never shock the mass air flow sensor.**
 - **Never disassemble the mass air flow sensor.**
 - **Never touch the sensor of the mass air flow sensor.**
8. Remove air duct.
9. Remove bracket, if necessary.

INSTALLATION

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

Air cleaner body

CAUTION:

Check that mounting rubber is positioned in the mounting location and be careful not to allow it to be dislocated when installing air cleaner body.

Air duct assembly

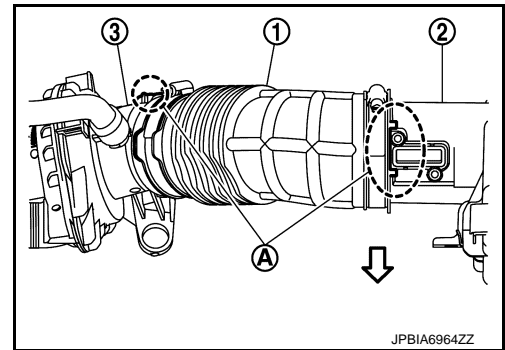
- To install air duct ①, align the matching marks ④ on both ends with the others.

- ② : Air cleaner body
- ③ : Turbocharger air inlet pipe
- ⇐ : Vehicle front

CAUTION:

Never allow foreign materials (i.e. lint) to adhere to the mounting part of air duct assembly and each mating part.

- Install hose clamps and tighten to the specified torque.



INFOID:0000000010784313

Inspection

INSPECTION AFTER REMOVAL

Inspect air duct assembly for crack or tear.

- If anything found, replace air duct assembly.

CHARGE AIR COOLER

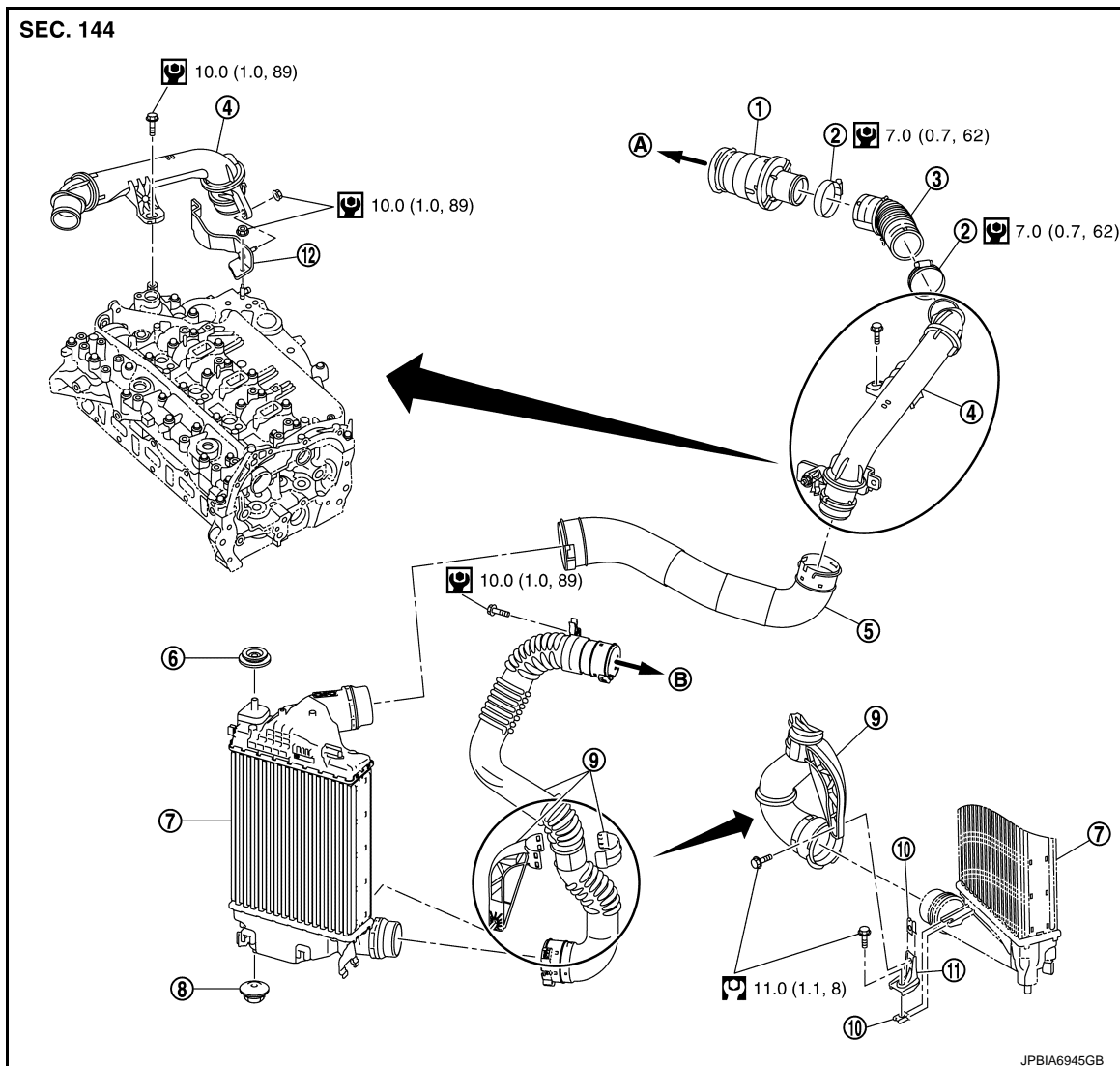
< REMOVAL AND INSTALLATION >

[R9M]

CHARGE AIR COOLER

Exploded View

INFOID:000000010784314



- | | | |
|---------------------|---|----------------------------|
| ① Silencer | ② Clamp | ③ Air inlet hose 1 |
| ④ Air inlet tube 1 | ⑤ Air inlet hose 2 | ⑥ Mounting rubber |
| ⑦ Charge air cooler | ⑧ Mounting rubber | ⑨ Air inlet tube 2 |
| ⑩ Metal clip | ⑪ Air inlet tube 2 bracket | ⑫ Air inlet tube 1 bracket |
| (A) To turbocharger | (B) To electric throttle control actuator | |

: N·m (kg-m, ft-lb)

: N·m (kg-m, in-lb)

Removal and Installation

INFOID:000000010784315

REMOVAL

Air inlet hose 1 and tube 1

1. Remove harness bracket and air inlet tube 1 bracket.
2. Disconnect air inlet hose 2.

CHARGE AIR COOLER

[R9M]

< REMOVAL AND INSTALLATION >

3. Remove air inlet tube 1.
4. Remove silencer with air inlet hose 1.
5. Remove air inlet hose 1, if necessary.

Air inlet hose 2 and tube 2

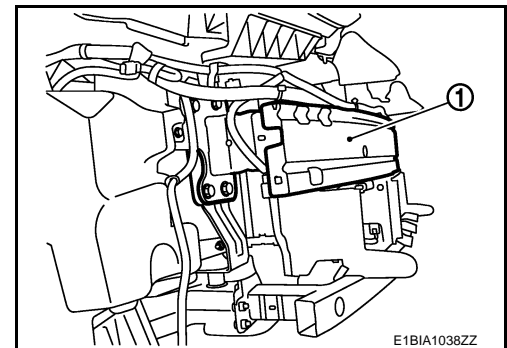
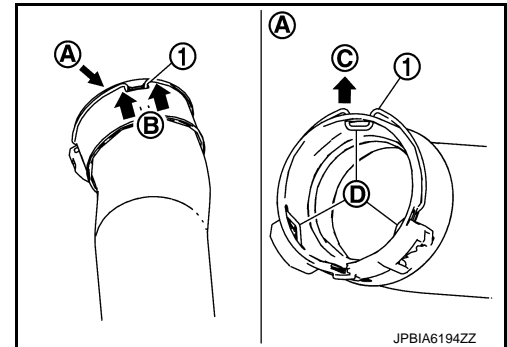
1. Drain engine coolant. Refer to [CO-64, "Draining"](#).
2. Remove harness clamp from bracket.
3. Remove air inlet hose 2 with the following procedure:
 - a. Insert suitable tool between air inlet hose 2 and retainer ①.

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

- b. Unlock the retainer and pull out air inlet hose 2.
4. Separate air inlet tube 2 from mounting part.
5. Disconnect air inlet tube 2. (Charge air cooler side)
6. Disconnect radiator hose (upper). (Radiator side)
7. Remove water pipe from clamp.
8. Disconnect air inlet tube 2. (Electric throttle control actuator side)
9. Remove air inlet tube 2.

Charge air cooler

1. Remove engine under cover. Refer to [EXT-39, "ENGINE UNDER COVER : Exploded View"](#).
2. Remove front bumper. Refer to [EXT-14, "Exploded View"](#).
3. Remove headlamp (RH). Refer to [EXL-190, "Exploded View"](#) (LED headlamp) or [EXL-375, "Exploded View"](#) (Halogen headlamp).
4. Remove distance sensor. Refer to [BRC-304, "Exploded View"](#). (With forward emergency braking)
5. Remove front bumper reinforcement ①.

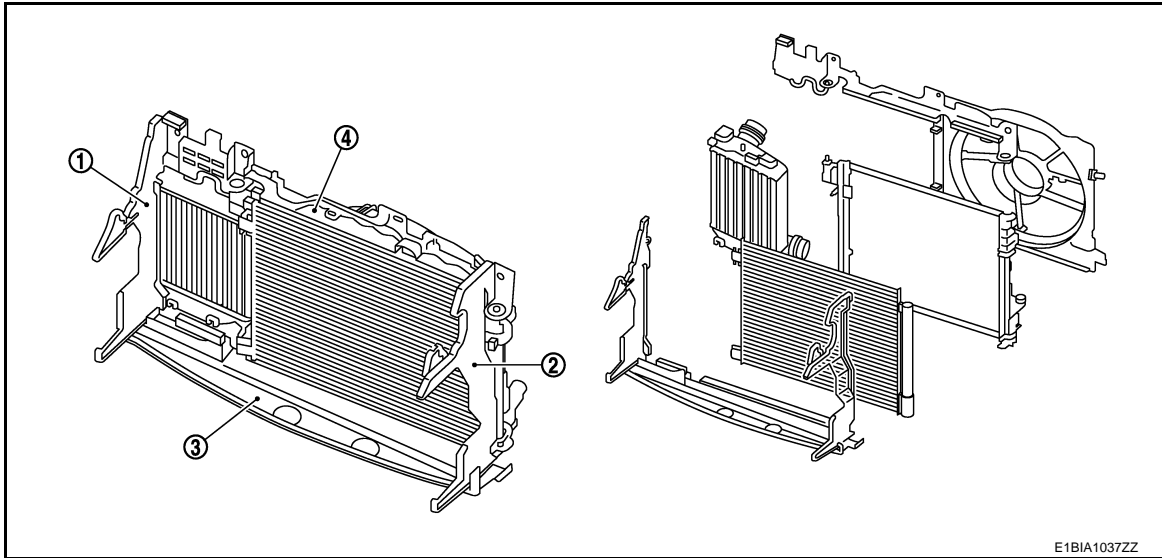


6. Remove air guides and mounting bracket.

CHARGE AIR COOLER

< REMOVAL AND INSTALLATION >

[R9M]

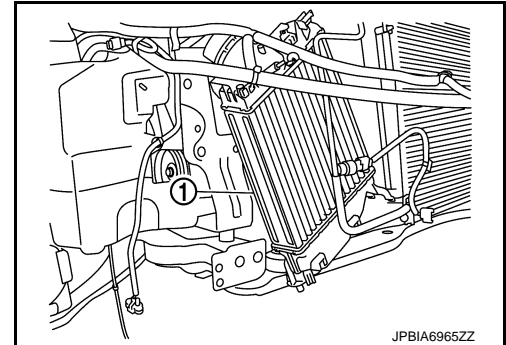


- ① Radiator air guide RH ② Radiator air guide LH ③ Radiator air guide lower
④ Mounting bracket

7. Remove air inlet tube 2 from charge air cooler.
8. Remove A/C piping bracket mounting bolt.
9. Disconnect air inlet hose 2 from charge air cooler side.
10. Remove charge air cooler ①.

CAUTION:

- Be careful not to damage charge air cooler core.
- Avoid interference between the charge air cooler and radiator.
- When removing charge air cooler, close opening on turbo charger and intake manifold with shop cloth or other suitable material.



INSTALLATION

Install in the reverse order of removal paying attention to the following points:

- Apply a neutral detergent (fluid) to the joint between hoses and pipes (oil is not permissible).
- Pay attention to identification mark and direction.
- When installing air inlet hoses and tubes. Refer to [EM-310. "Exploded View"](#).

Inspection

INFOID:0000000010784316

INSPECTION AFTER REMOVAL

1. Check that the charge air cooler is not full of oil. In that case, clean it with cleaning agent and then let it dry.
2. Check air passages of charge air cooler core and fins for clogging, leaks or deformation. Clean or replace charge air cooler if necessary.
 - Do not deform core fins.

INTAKE MANIFOLD

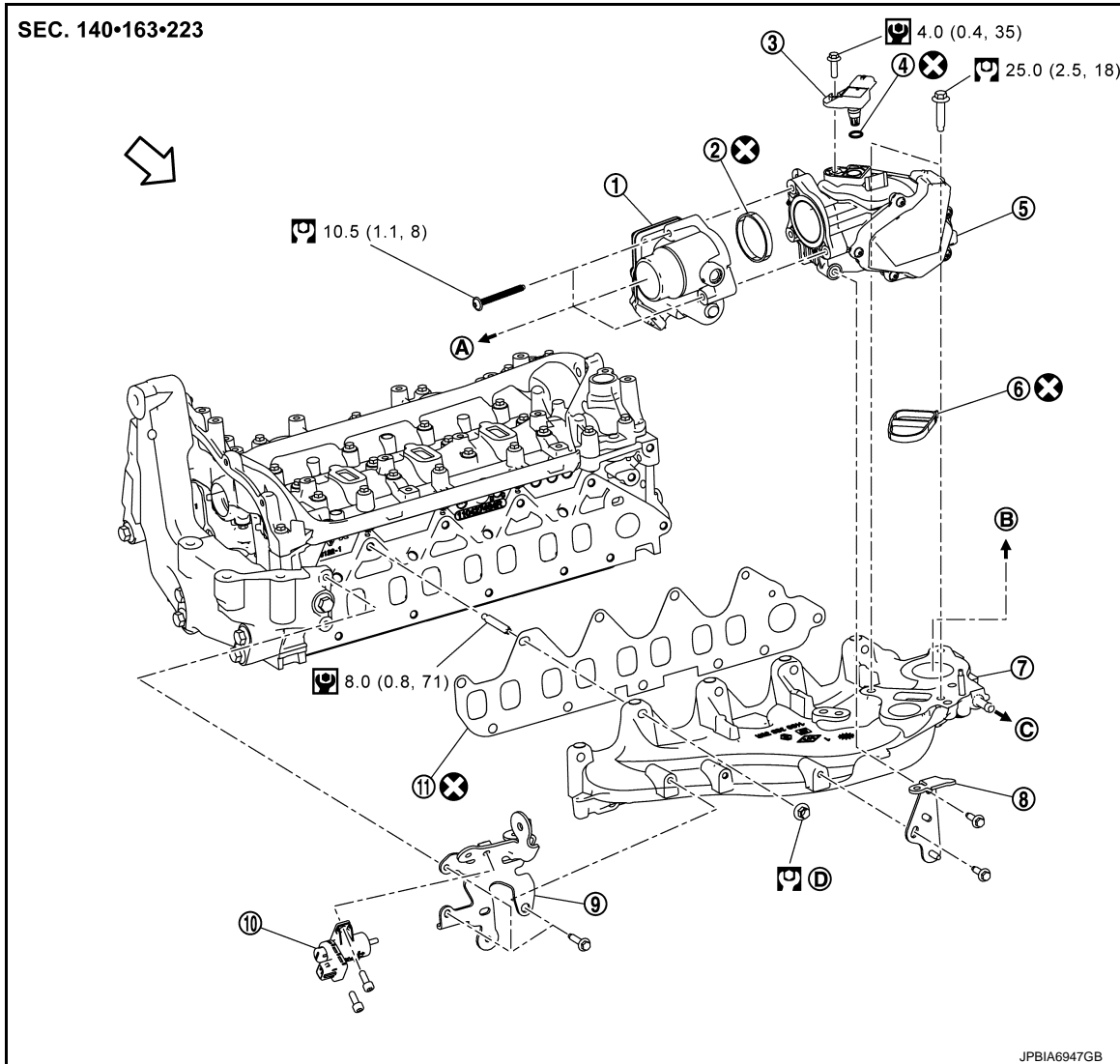
< REMOVAL AND INSTALLATION >

[R9M]

INTAKE MANIFOLD

Exploded View

INFOID:0000000010784319



- | | | |
|--|--|--|
| ① Electric throttle control actuator | ② Gasket | ③ Turbocharger boost sensor (with intake air temperature sensor 2) |
| ④ O-ring | ⑤ Intake manifold runner control valve | ⑥ Gasket |
| ⑦ Intake manifold | ⑧ Bracket | ⑨ Bracket |
| ⑩ Engine coolant bypass control solenoid valve | ⑪ Gasket | |
| Ⓐ To charge air cooler | Ⓑ To EGR volume control valve | Ⓒ To water outlet |

Ⓓ Comply with the installation procedure when tightening. Refer to [EM-314. "Removal and Installation"](#)

← : Vehicle front

Ⓐ : N-m (kg-m, ft-lb)

Ⓑ : N-m (kg-m, in-lb)

ⓧ : Always replace after every disassembly.

INTAKE MANIFOLD

< REMOVAL AND INSTALLATION >

[R9M]

Removal and Installation

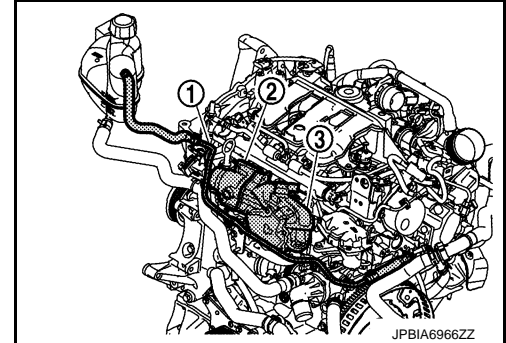
INFOID:000000010784320

REMOVAL

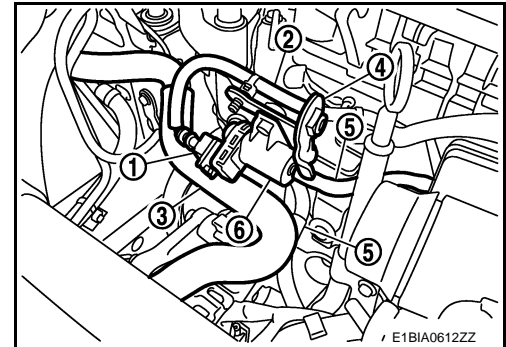
1. Drain engine coolant. Refer to [CO-64, "Draining"](#).
2. Remove air inlet hose 2, air inlet tube 1 and 2. Refer to [EM-310, "Exploded View"](#).
3. Remove water pipe ①.
4. Remove electric throttle control actuator ② from intake manifold.
5. Remove intake manifold runner control valve ③ from intake manifold.
6. Remove EGR volume control valve from intake manifold. Refer to [EM-317, "Exploded View"](#).

CAUTION:

- Handle carefully to avoid any shock to EGR volume control valve.
- Never disassemble EGR volume control valve.



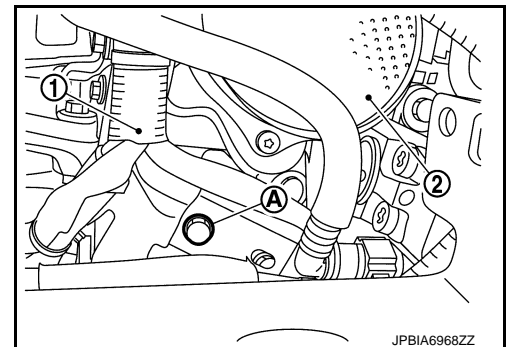
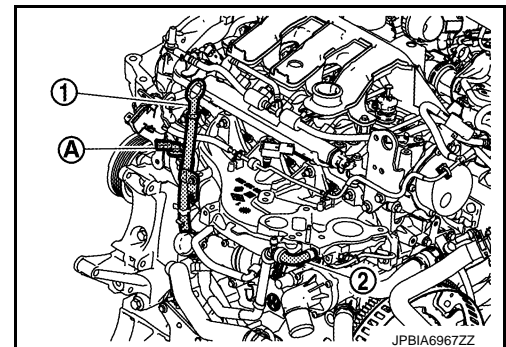
7. Remove engine coolant bypass control solenoid valve ⑥ and bracket ④ assembly.
 - a. Disconnect engine coolant bypass control solenoid valve connector ①.
 - b. Unclip engine coolant bypass control solenoid valve connector harness ② and put aside.
 - c. Unclip water hose ③ from engine coolant bypass control solenoid valve bracket ④.
 - d. Disconnect vacuum hoses ⑤ from engine coolant bypass control solenoid valve.
8. Unclip engine coolant temperature sensor harness connector ①A.
9. Remove oil level gauge ① and oil level gauge guide.
10. Remove water hose ② from intake manifold.
11. Disconnect harness connectors from A/C compressor.
12. Disconnect terminal nut and connector from the alternator. Refer to [CHG-26, "R9M : Exploded View"](#).



13. Remove bolt ①A.

② : Vacuum pump

14. Put aside engine harness ①.

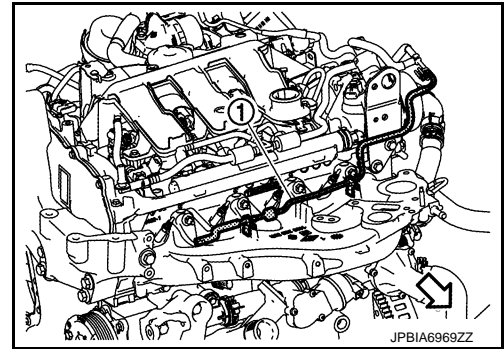


INTAKE MANIFOLD

< REMOVAL AND INSTALLATION >

[R9M]

15. Unclip vacuum hose ① on the intake manifold and put aside.

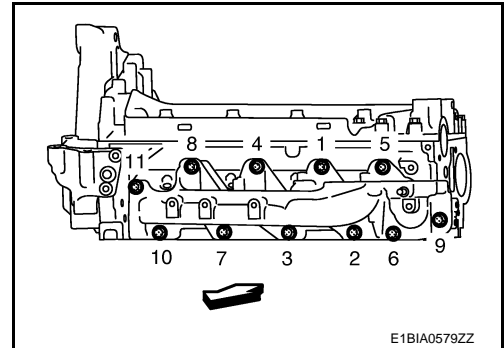


16. Remove intake manifold with the following procedure:
 - a. Loosen mounting nuts in reverse order as shown in the figure.

← : Vehicle front

- b. Remove intake manifold and gasket.

CAUTION:
Cover engine openings to avoid entry of foreign materials.



INSTALLATION

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

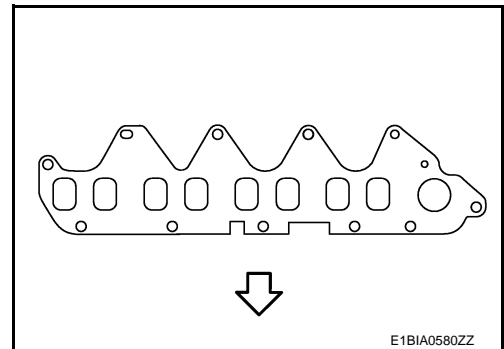
CAUTION:

- Clean each joint surface before installation.
- Replace intake manifold stud if loosened.

Intake Manifold

1. Install gasket to cylinder head as shown in the figure.

← : Engine lower

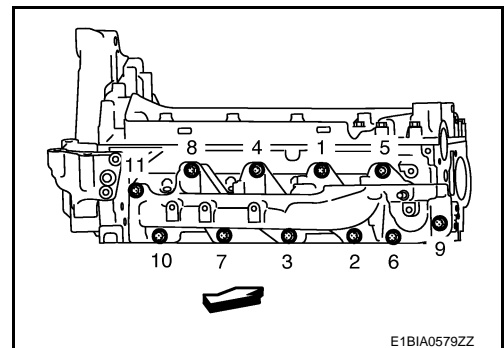


2. Install intake manifold.
 - Tighten mounting nuts in two steps separately.

← : Vehicle front

 **1st step: 10 N·m (1.0 kg-m, 89 in-lb)**

 **2nd step: 25 N·m (2.6 kg-m, 18 ft-lb)**



3. Perform "Throttle valve position learning". Refer to [EC-949. "Work Procedure"](#). and "Intakemanifold runner control valve position learning". Refer to [EC-953. "Work Procedure"](#). when removing or replacing throttle valve or swirl valve.

INTAKE MANIFOLD

< REMOVAL AND INSTALLATION >

[R9M]

4. Perform "EGR volume control valve position learning". Refer to [EC-951, "Work Procedure"](#). when removing or replacing EGR volume control valve.
5. When replacing EGR volume control valve, throttle valve or swirl valve, this procedure must be performed. Refer to [EC-943, "Special Repair Requirement List"](#)

Inspection

INFOID:0000000010784321

INSPECTION AFTER REMOVAL

Surface Distortion

- Check the surface distortion of the intake manifold mating surface with a straightedge and a feeler gauge.

Standard : Refer to [EM-414, "Intake Manifold"](#).

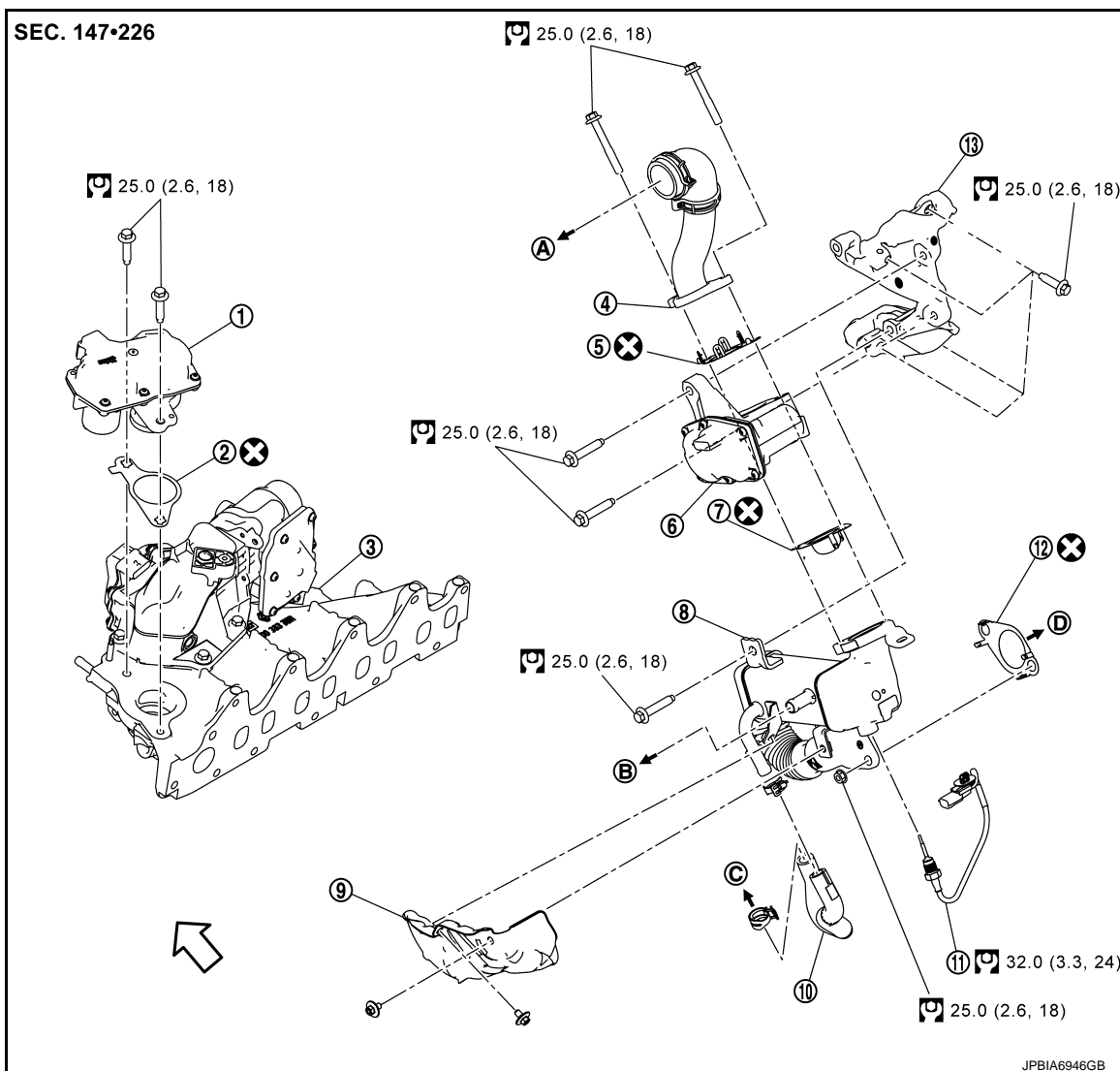
- If it exceeds the standard, replace intake manifold.




[R9M]

EGR SYSTEM

Exploded View

INFOID:0000000010784317



- | | | |
|--------------------------------------|---------------------------------------|---|
| ① EGR volume control valve | ② Gasket | ③ Intake manifold |
| ④ EGR tube assembly | ⑤ Gasket | ⑥ Low pressure EGR volume control valve |
| ⑦ Gasket | ⑧ EGR cooler | ⑨ EGR heat shield |
| ⑩ Water hose | ⑪ Low pressure EGR temperature sensor | ⑫ Gasket |
| ⑬ EGR valve bracket | | |
| Ⓐ To turbocharger air inlet pipe | Ⓑ To water connector | Ⓒ To cylinder block |
| Ⓓ To DPF (Diesel particulate filter) | | |
-  : Vehicle front
-  : N·m (kg-m, ft-lb)
-  : Always replace after every disassembly.

Removal and Installation

INFID:0000000010784318

NOTE:

EGR SYSTEM

< REMOVAL AND INSTALLATION >

[R9M]

When remove EGR cooler for 4WD models, perform it after removing engine and transaxle assembly. Refer to [EM-366, "Removal and Installation"](#).

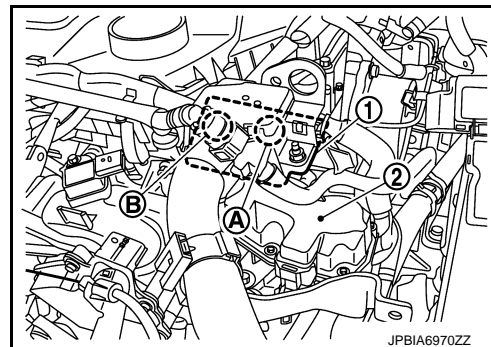
REMOVAL

EGR volume control valve

1. Remove air inlet tube 1. Refer to [EM-310, "Exploded View"](#).
2. Remove bolt (A). (For EGI harness bracket)
3. Disconnect fuel rail pressure sensor harness connector (B).
4. Remove bracket (1).
5. Remove EGR volume control valve (2) on the intake manifold.

CAUTION:

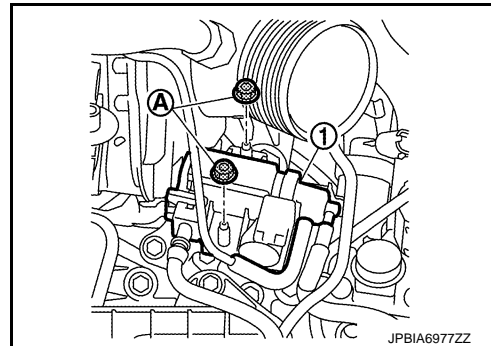
- Handle carefully to avoid any shock to EGR volume control valve.
- Never disassemble EGR volume control valve.
- Cover engine openings to avoid entry of foreign materials.



EGR cooler

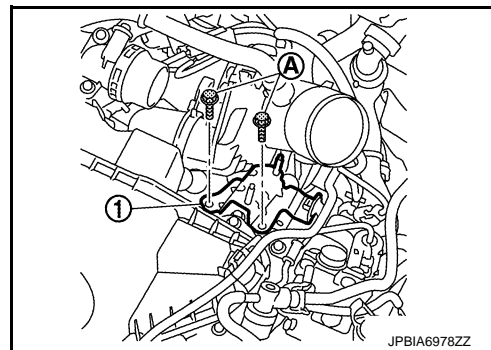
1. Drain engine coolant. Refer to [CO-64, "Draining"](#).
- #### CAUTION:
- Perform this step when the engine is cold.
2. Remove cowl top cover and extension cowl top. Refer to [EXT-24, "Exploded View"](#).
 3. Remove air inlet tube 1, air inlet hose 1, and silencer. Refer to [EM-310, "Exploded View"](#).
 4. Remove air cleaner assembly and air duct. Refer to [EM-308, "Exploded View"](#).
 5. Remove PCV hose. Refer to [EM-336, "Exploded View"](#).
 6. Move DPF differential pressure sensor with bracket and set it aside. Refer to [EM-321, "Exploded View"](#).
 7. Remove TC boost control solenoid valve (1).

(A) : Nuts



8. Remove TC boost control solenoid valve bracket (1).

(A) : Bolts



9. Remove turbocharger air inlet pipe. Refer to [EM-325, "Exploded View"](#).

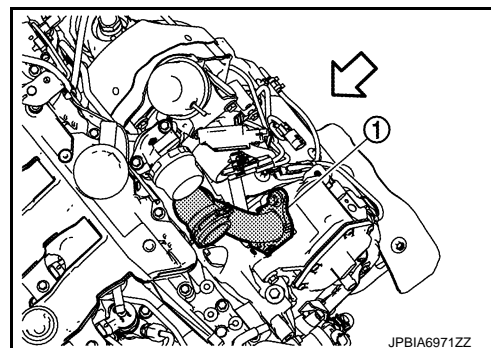
EGR SYSTEM

< REMOVAL AND INSTALLATION >

[R9M]

10. Remove EGR tube assembly ①.

← : Vehicle front



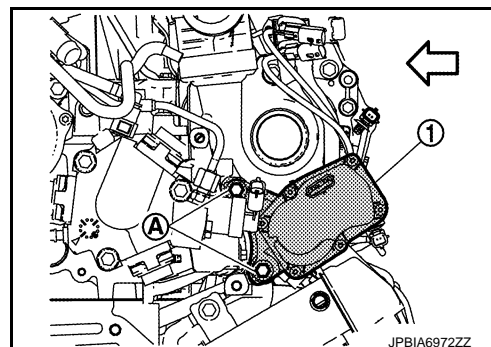
11. Remove low pressure EGR volume control valve ① on the EGR cooler.

Ⓐ : Bolts

← : Vehicle front

CAUTION:

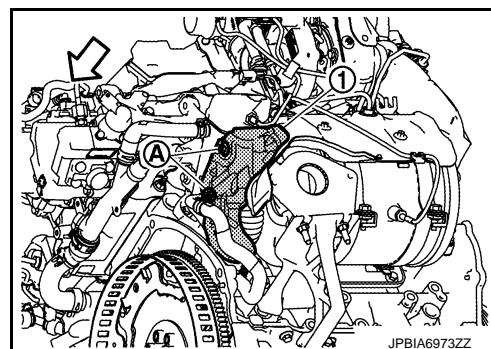
- Handle carefully to avoid any shock to EGR volume control valve.
- Never disassemble EGR volume control valve.
- Cover engine openings to avoid entry of foreign materials.



12. Remove EGR heat shield ①.

Ⓐ : Bolts

← : Vehicle front



13. Disconnect water hoses on the EGR cooler.

14. Remove exhaust front tube. Refer to [EX-17, "Exploded View"](#).

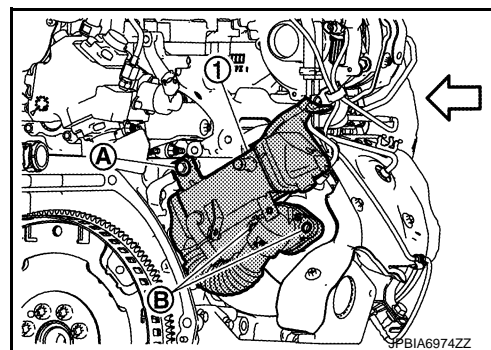
15. Remove low pressure EGR temperature sensor.

16. Remove EGR cooler ①.

Ⓐ : Bolt

Ⓑ : Nuts

← : Vehicle front



INSTALLATION

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

CAUTION:

Clean each joint surface before installation.

EGR SYSTEM

< REMOVAL AND INSTALLATION >

[R9M]

1. Perform “EGR volume control valve position learning”. Refer to [EC-951, "Work Procedure"](#). when removing or replacing EGR volume control valve.
2. Perform “Low pressure EGR volume control valve position learning”. Refer to [EC-952, "Work Procedure"](#). when removing or replacing low pressure EGR volume control.

DPF (DIESEL PARTICULATE FILTER)

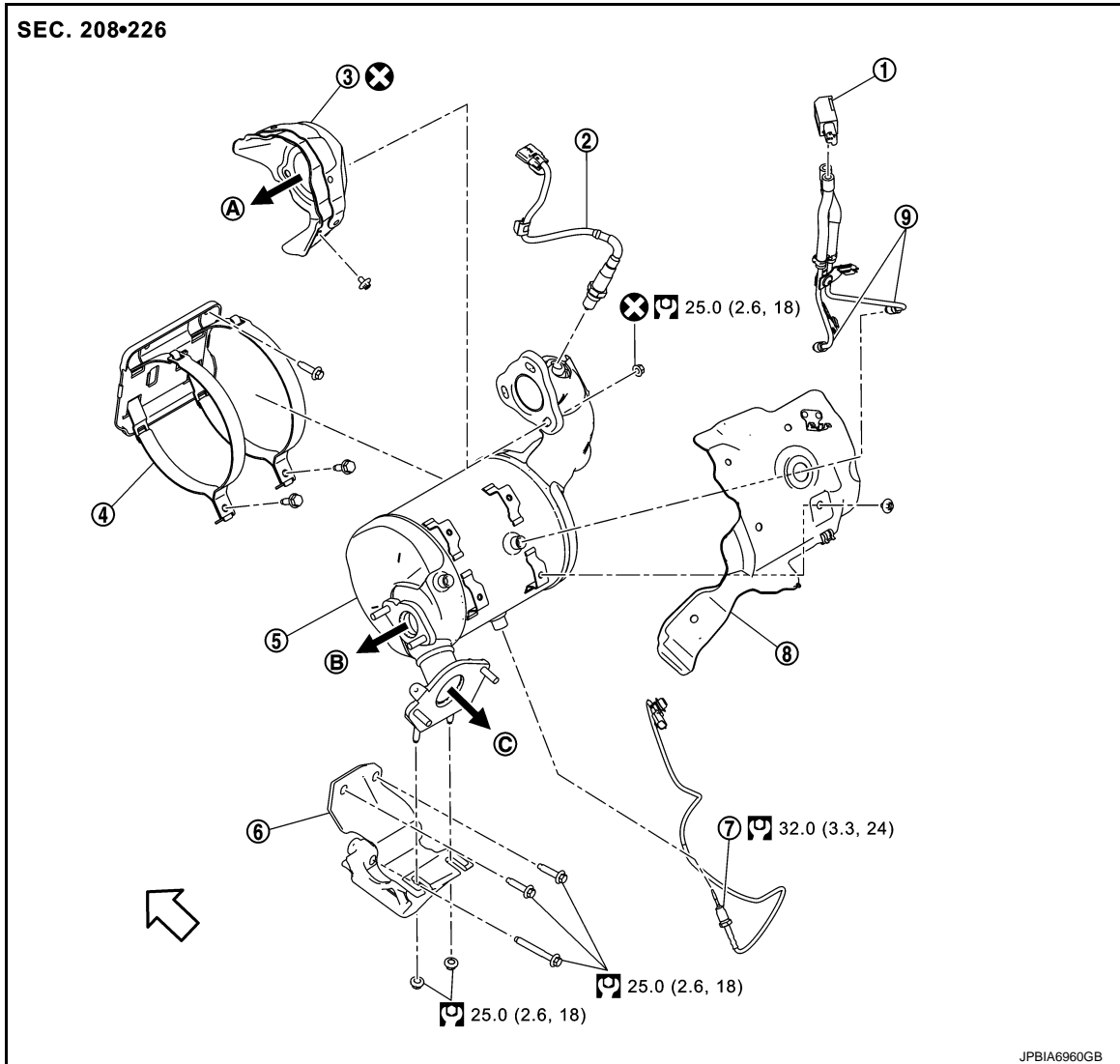
< REMOVAL AND INSTALLATION >

[R9M]

DPF (DIESEL PARTICULATE FILTER)

Exploded View

INFOID:0000000011006844



- | | | |
|--|-----------------------------------|---|
| ① DPF (diesel particulate filter) differential pressure sensor | ② A/F sensor 1 | ③ Turbocharger heat shield gasket |
| ④ Particle filter mounting | ⑤ DPF (diesel particulate filter) | ⑥ Particle filter bracket |
| ⑦ Exhaust gas temperature sensor 2 | ⑧ Heat insulator | ⑨ DPF (diesel particulate filter) differential pressure tube assembly |
| Ⓐ To turbocharger | Ⓑ To EGR cooler | Ⓒ To exhaust front tube |

↩ : Vehicle front

Ⓐ : N·m (kg·m, ft·lb)

ⓧ : Always replace after every disassembly.

Removal and installation

INFOID:0000000011006845

CAUTION:

- Perform the operation with the exhaust system fully cooled down because the system is still hot just after engine stops.
- Be careful not to cut your hand on the insulator edge.

NOTE:

DPF (DIESEL PARTICULATE FILTER)

[R9M]

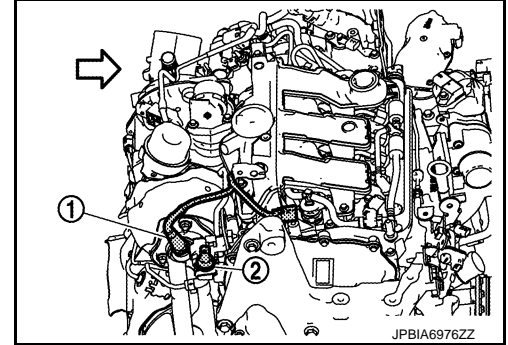
< REMOVAL AND INSTALLATION >

When remove DPF for 4WD models, perform it after removing engine and transaxle assembly. Refer to [EM-366, "Removal and Installation"](#).

REMOVAL

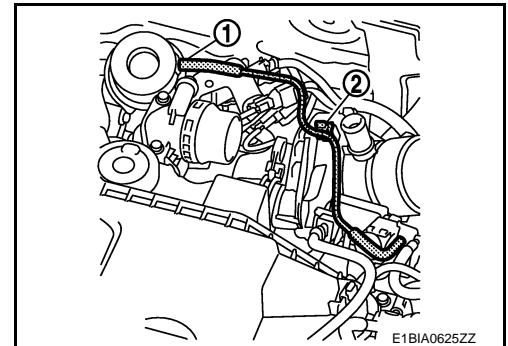
1. Remove cowl top cover and extension cowl top. Refer to [EXT-24, "Exploded View"](#)
2. Remove the silencer. Refer to [EM-310, "Exploded View"](#).
3. Remove the air inlet pipe. Refer to [EM-325, "Exploded View"](#).
4. Remove the A/F sensor 1 ① and exhaust gas pressure sensor ②.

⇐ : Vehicle front

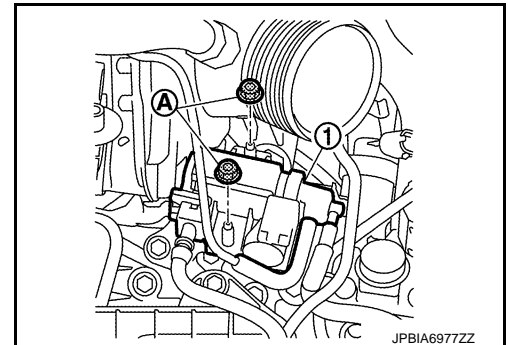


5. Remove the turbocharger boost control vacuum hose ① from turbocharger.

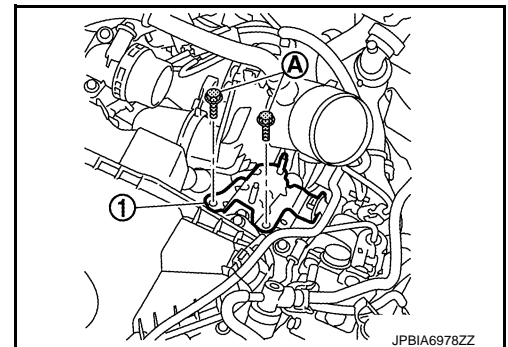
② : Clip



6. Remove the turbocharger boost control solenoid valve nuts (A).
7. Move aside the turbocharger boost control solenoid valve ①.



8. Remove the turbocharger boost control solenoid valve bracket bolts (A).
9. Remove the turbocharger boost control solenoid valve bracket ①.

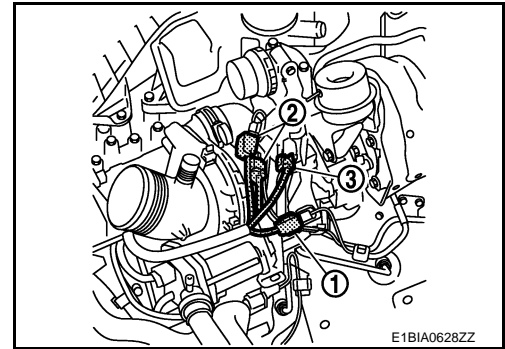


DPF (DIESEL PARTICULATE FILTER)

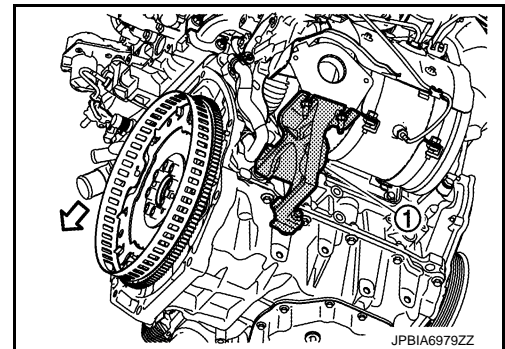
< REMOVAL AND INSTALLATION >

[R9M]

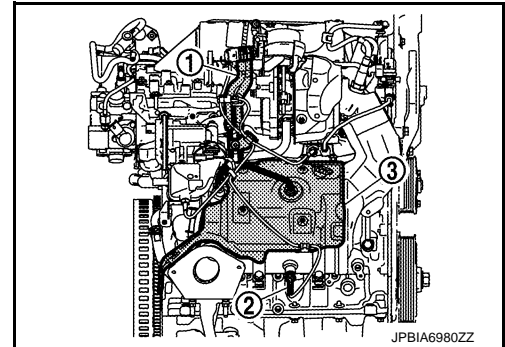
10. Disconnect the harness connectors ①, ② and ③.
11. Remove the particle sensor connector bracket.



12. Remove the front wheels. Refer to [WT-61. "Exploded View"](#).
13. Remove the rear torque rod and rear torque rod bracket. Refer to [EM-365. "Exploded View"](#).
14. Remove front suspension member. Refer to [FSU-22. "Exploded View"](#).
15. Remove exhaust front tube. Refer to [EX-17. "Exploded View"](#).
16. Remove the particle filter bracket ①.

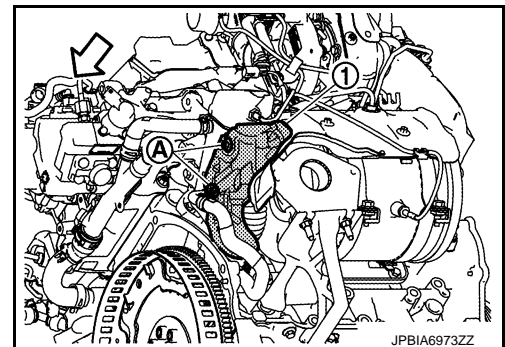


17. Remove DPF (diesel particulate filter) differential pressure tube assembly ①.
CAUTION:
Be careful not to impact or damage DPF (diesel particulate filter) differential pressure sensor.
18. Remove exhaust gas temperature sensor 2 ②.
CAUTION:
Be careful not to impact or damage exhaust gas temperature sensor 2.
19. Remove heat insulator ③.



20. Remove EGR heat shield ①.

- Ⓐ : Bolts
⇐ : Vehicle front



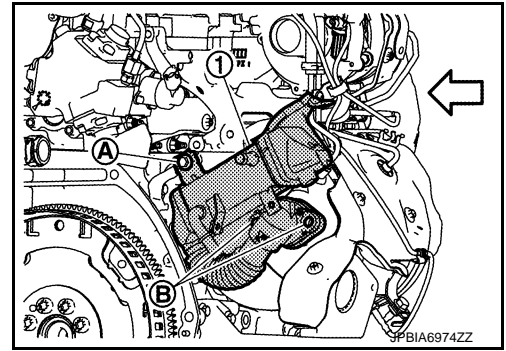
DPF (DIESEL PARTICULATE FILTER)

< REMOVAL AND INSTALLATION >

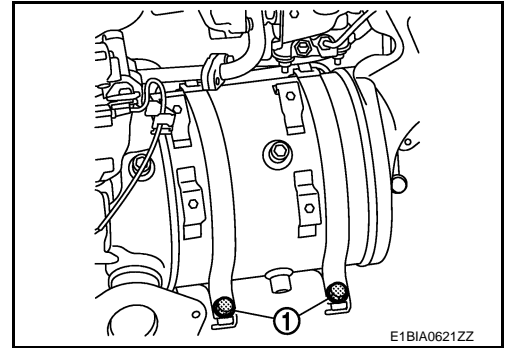
[R9M]

21. Remove EGR cooler nuts ②.

- ① : EGR cooler
- Ⓐ : Bolt
- ⇐ : Vehicle front



22. Remove the bolts ① of the particle filter straps and the straps.



23. Remove the particle filter nuts.

24. Move the engine lower side forward and remove the particle filter.

CAUTION:

Be careful not to impact or damage particle filter pressure sensor.

INSTALLATION

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

CAUTION:

- **Be careful not to impact or damage particle filter sensor.**
- **When installing never use such tools as an air impact wrench.**

1. Perform "Diesel particulate filter data clear". Refer to [EC-957, "Description"](#). when replacing diesel particulate filter. Refer to [EC-943, "Special Repair Requirement List"](#)

TURBOCHARGER

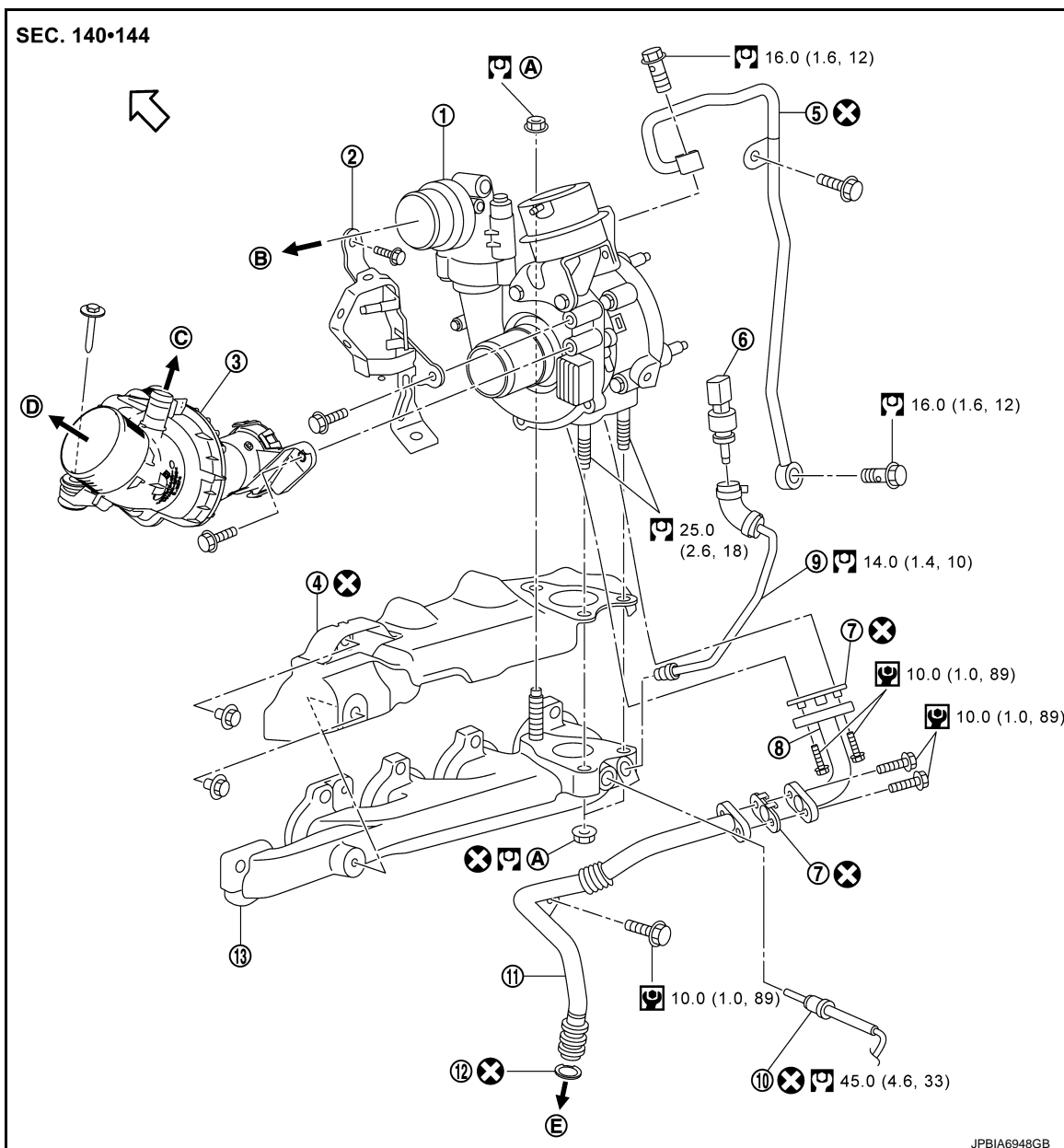
< REMOVAL AND INSTALLATION >

[R9M]

TURBOCHARGER

Exploded View


INFOID:000000010784322




- | | | |
|---------------------------------------|-------------------------------------|------------------------------------|
| ① Turbocharger | ② Particle sensor connector bracket | ③ Turbocharger air inlet pipe |
| ④ Exhaust manifold heat shield gasket | ⑤ Oil tube | ⑥ Exhaust gas pressure sensor |
| ⑦ Gasket | ⑧ Oil tube | ⑨ Exhaust gas pressure sensor tube |
| ⑩ Exhaust gas temperature sensor 1 | ⑪ Oil tube | ⑫ O-ring |
| ⑬ Exhaust manifold | | |
- Comply with the installation procedure when tightening. Refer to [EM-326. "Removal and Installation"](#)
- | | | |
|---------------------|---------------|---------------|
| Ⓐ To air duct | Ⓑ To silencer | Ⓒ To PCV hose |
| Ⓓ To cylinder block | | |

↖ : Vehicle front

Ⓐ : N·m (kg·m, ft·lb)

 : N·m (kg-m, in-lb)

 : Always replace after every disassembly.

Removal and Installation

INFOID:0000000010784323

NOTE:

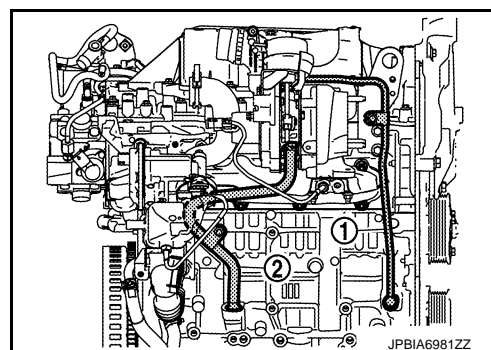
When remove turbocharger for 4WD models, perform it after removing engine and transaxle assembly. Refer to [EM-366, "Removal and Installation"](#).

REMOVAL

1. Remove cowl top cover and extension cowl top. Refer to [EXT-24, "Exploded View"](#).
2. Remove silencer. Refer to [EM-310, "Exploded View"](#).
3. Remove air duct. Refer to [EM-308, "Exploded View"](#).
4. Remove exhaust front tube. Refer to [EX-18, "Removal and Installation"](#).
5. Remove DPF (diesel particulate filter). Refer to [EM-321, "Removal and installation"](#).
6. Remove oil tube ① and ② from turbocharger.
7. Remove turbocharger from exhaust manifold.

CAUTION:

Never disassemble or adjust the turbocharger body.



INSTALLATION

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

CAUTION:

- Clean each joint surface before installation.
- Replace turbocharger stud if loosened.

1. Install turbocharger.
 - Tighten the mounting nuts in two steps separately.

 **1st step: 15.0 N·m (1.5 kg-m, 11 ft-lb)**

 **2nd step: 25.0 N·m (2.6 kg-m, 18 ft-lb)**

Inspection

INFOID:0000000010784324

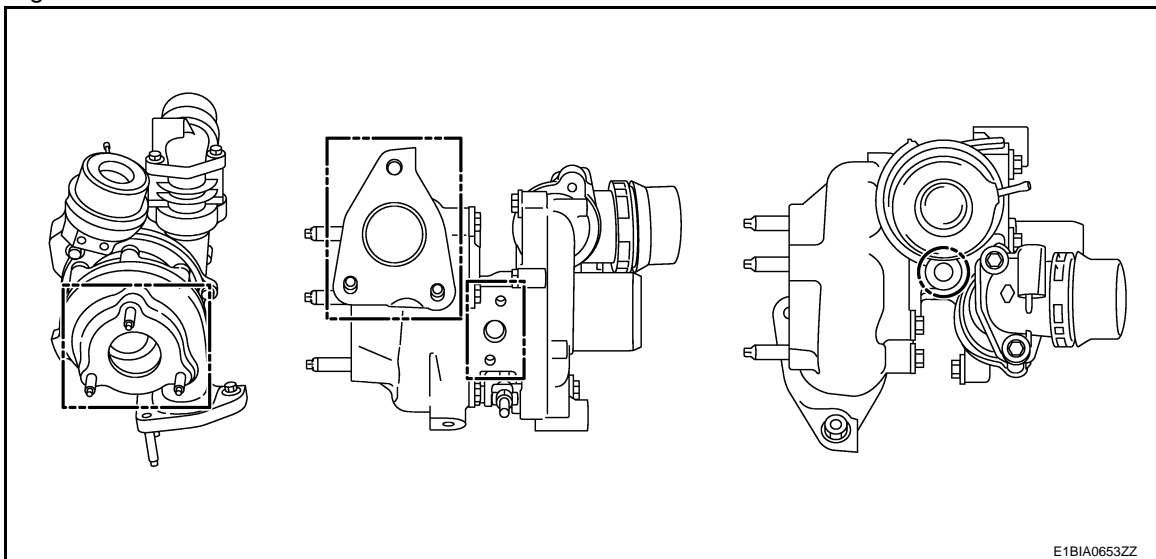
INSPECTION AFTER REMOVAL

TURBOCHARGER

< REMOVAL AND INSTALLATION >

[R9M]

Turbocharger



Check there is no leakage on the different side of the turbocharger (exhaust gas and oil)

CAUTION:

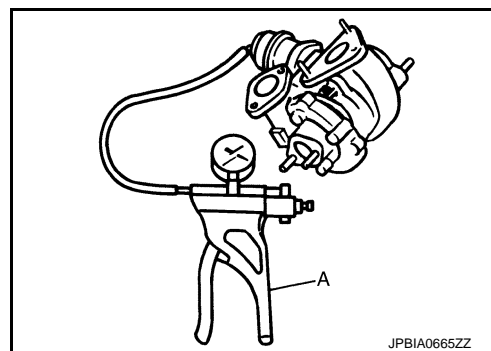
When the compressor wheel, turbine wheel or rotor shaft is damaged, remove all the fragments and foreign matter left in the following passages in order to prevent a secondary malfunction:

- Suction side:** Between turbocharger and air cleaner
- Between turbocharger and charge air cleaner
- Exhaust side:** Between turbocharger and diesel particle filter
- Between turbocharger and exhaust manifold

Turbocharger Boost Control

- Connect the handy vacuum pump (A) to the actuator, and check that the rod strokes smoothly in compliance with the following pressure.

Standard (value of vacuum/value of rod moving):
Refer to [EM-415, "Turbocharger"](#).



INSPECTION AFTER INSTALLATION

Start engine and raise engine speed to check no exhaust emission leaks.

EXHAUST MANIFOLD

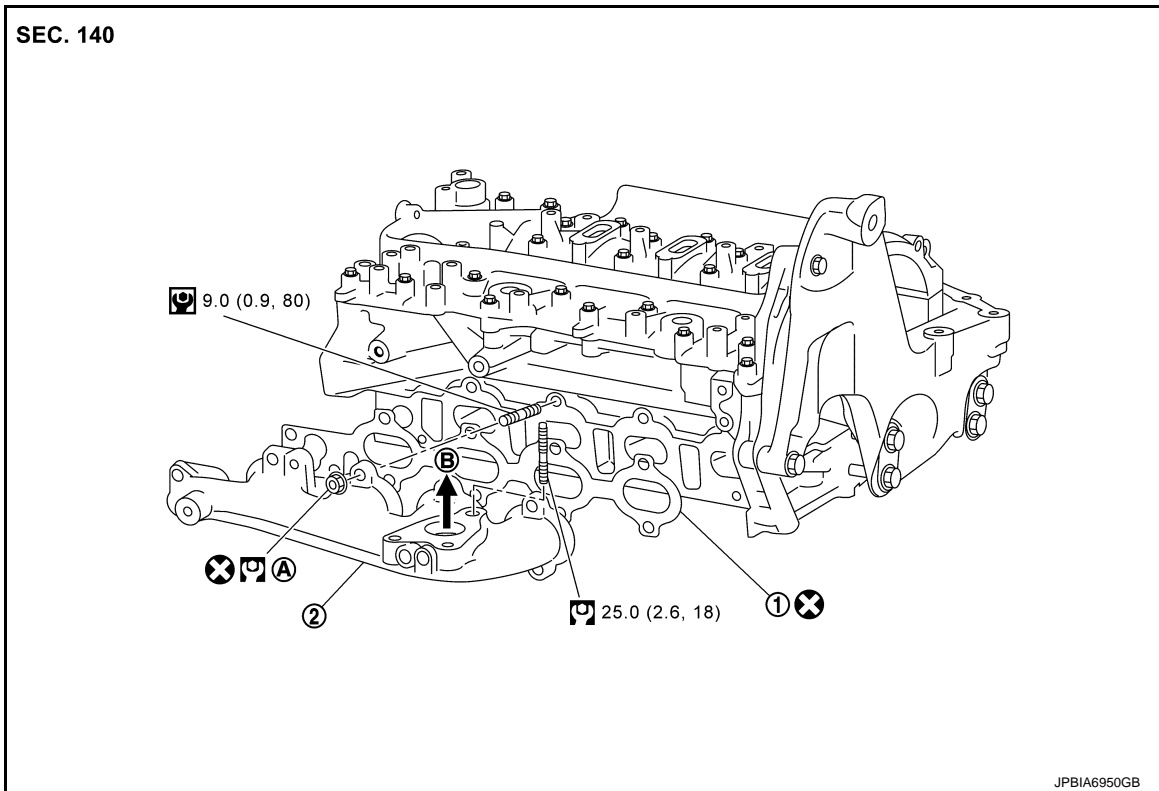
< REMOVAL AND INSTALLATION >

[R9M]

EXHAUST MANIFOLD

Exploded View

INFOID:000000010784325



- ① Exhaust manifold gasket ② Exhaust manifold

Comply with the installation procedure when tightening. Refer to [EM-328, "Removal and Installation"](#)

- Ⓐ To turbocharger Ⓑ To turbocharger

: N·m (kg-m, ft-lb)

: N·m (kg-m, in-lb)

: Always replace after every disassembly.

Removal and Installation

INFOID:000000010784326

REMOVAL

1. Remove DPF (diesel particle filter). Refer to [EM-321, "Removal and installation"](#).
2. Remove turbocharger. Refer to [EM-326, "Removal and Installation"](#).
3. Remove exhaust gas pressure sensor. Refer to [EM-325, "Exploded View"](#)
4. Remove exhaust gas temperature sensor 1. Refer to [EM-325, "Exploded View"](#)
5. Remove exhaust manifold.

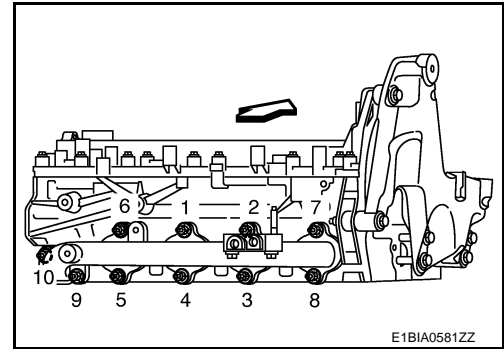
EXHAUST MANIFOLD

[R9M]

< REMOVAL AND INSTALLATION >

- Loosen mounting nuts in the reverse order as shown in the figure.

← : Vehicle front



- Remove exhaust manifold gasket.

CAUTION:

Cover engine openings to avoid entry of foreign materials.

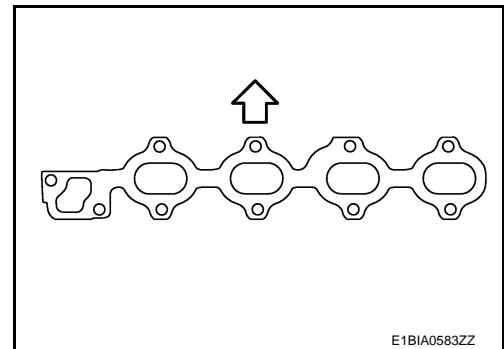
INSTALLATION

CAUTION:

- Clean each joint surface before installation.
- Replace exhaust manifold stud if loosened.

- Install gasket to cylinder head as shown in the figure.

← : Engine upper



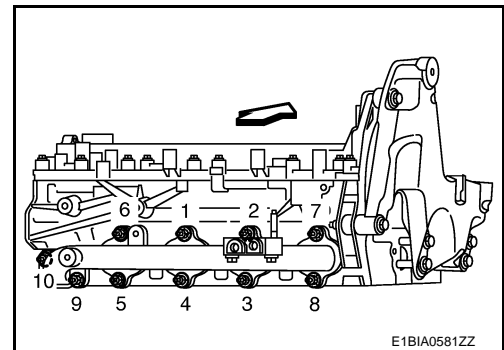
- Install exhaust manifold.

- Tighten the mounting nuts in two steps separately in numerical order as shown in the figure.

← : Vehicle front

 **1st step: 15.0 N·m (1.5 kg-m, 11 ft-lb)**

 **2nd step: 30.0 N·m (3.1 kg-m, 22 ft-lb)**



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

Inspection

INFOID:0000000010784327

INSPECTION AFTER REMOVAL

Surface Distortion

- Check the surface distortion of the exhaust manifold mating surface with a straightedge and a feeler gauge.

Standard : Refer to [EM-414, "Exhaust Manifold"](#).

- If it exceeds the standard, replace exhaust manifold.

INSPECTION AFTER INSTALLATION

Start engine and raise engine speed to check no exhaust emission leaks.

OIL PAN (LOWER)

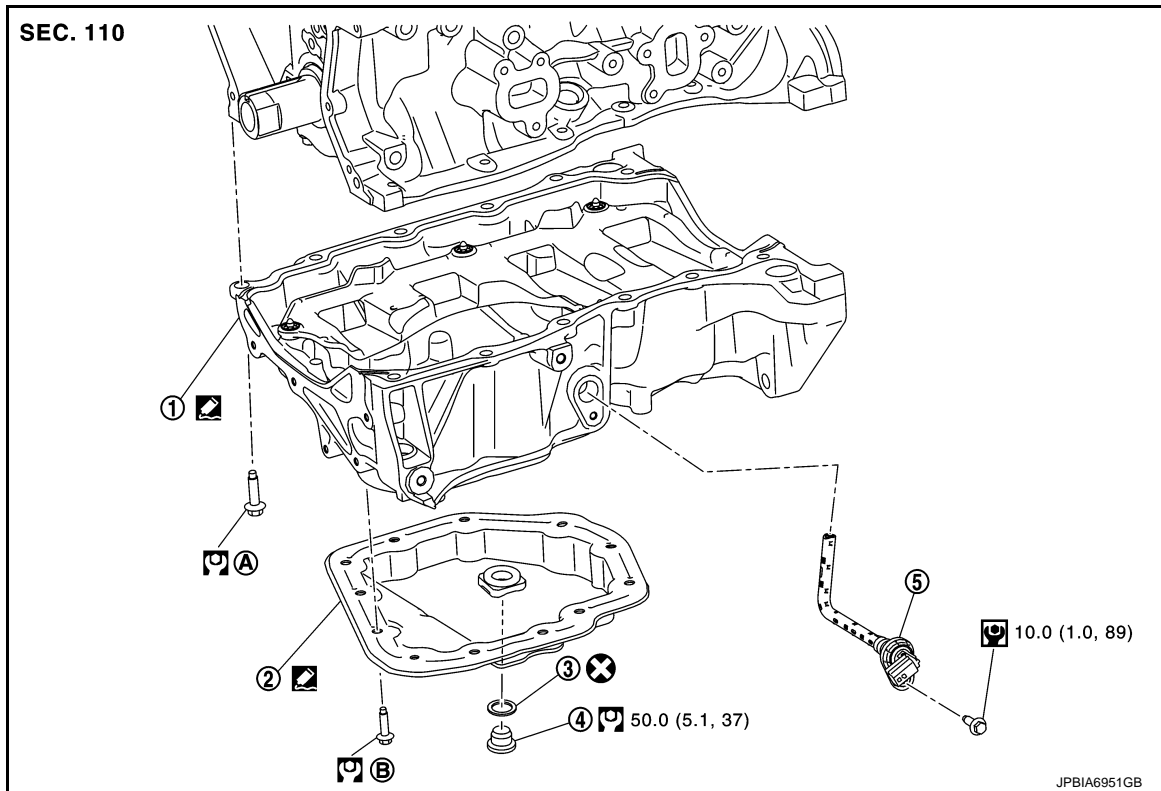
< REMOVAL AND INSTALLATION >

[R9M]

OIL PAN (LOWER)

Exploded View

INFOID:000000010784328



- | | | |
|---|---|---------------------|
| ① Oil pan (upper) | ② Oil pan (lower) | ③ Drain plug washer |
| ④ Oil pan drain plug | ⑤ Oil level sensor | |
| Ⓐ Comply with the installation procedure when tightening. Refer to EM-380. "Removal and Installation" | Ⓑ Comply with the installation procedure when tightening. Refer to EM-330. "Removal and Installation" | |

: N·m (kg-m, ft-lb)

: N·m (kg-m, in-lb)

: Always replace after every disassembly.

: Sealing point

Removal and Installation

INFOID:000000010784329

REMOVAL

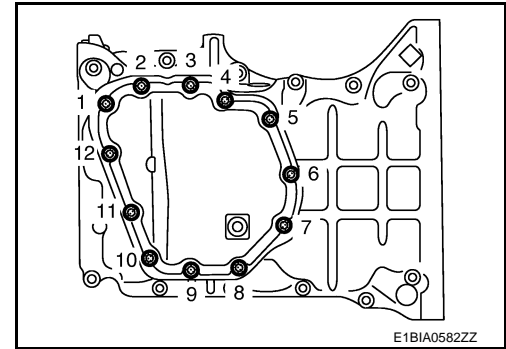
1. Remove engine under cover. Refer to [EXT-39, "ENGINE UNDER COVER : Exploded View"](#).
2. Drain engine oil. Refer to [LU-39. "Draining"](#).
CAUTION:
Perform this step when engine is cold.
3. Remove oil pan (lower) with the following procedure:

OIL PAN (LOWER)

< REMOVAL AND INSTALLATION >

[R9M]

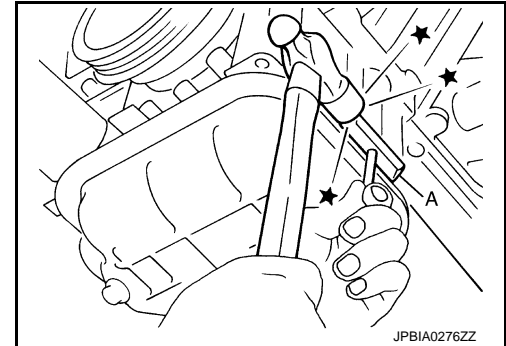
- a. Loosen mounting bolts in reverse order shown in the figure.



- b. Insert the seal cutter [SST:KV10111100 (—)] (A) between oil pan (upper) and oil pan (lower). Slide tool by tapping on the side of the tool with a hammer.

CAUTION:

- Be careful not to damage mating surface.
- Never insert screwdriver, or oil pan flange will be deformed.



- c. Remove oil pan (lower).
4. Remove oil strainer. Refer to [LU-44. "Exploded View"](#).

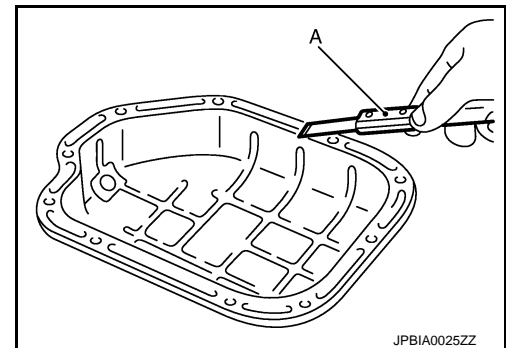
INSTALLATION

1. Install oil strainer. Refer to [LU-44. "Exploded View"](#).
2. Install oil pan (lower) with the following procedure:
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.

- Remove old liquid gasket from the bolt holes and threads.



- b. Apply a continuous bead of liquid gasket with the tube presser (commercial service tool) as shown in the figure.

① : Oil pan (lower)

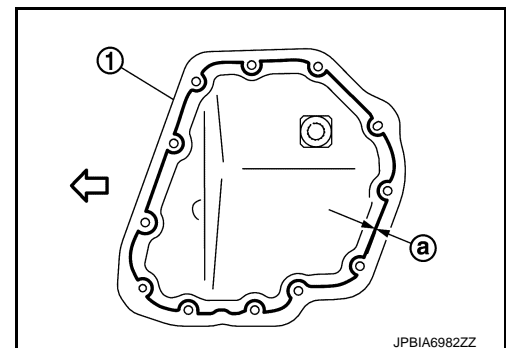
Ⓐ : 3.0 - 7.0 mm (0.118 - 0.276 in)

⇐ : Engine front

Use Genuine Liquid Gasket or equivalent

CAUTION:

Attaching should be done within 5 minutes after coating.



OIL PAN (LOWER)

[R9M]

< REMOVAL AND INSTALLATION >

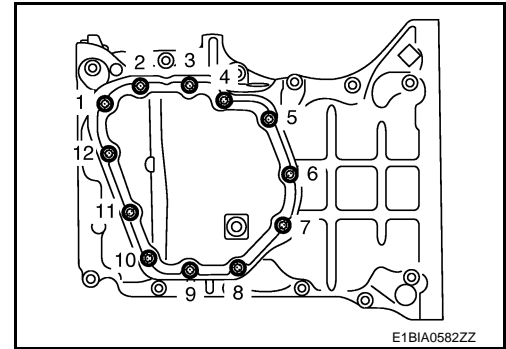
- c. Tighten mounting bolts in two steps separately in numerical order as shown in the figure.



1st step: 5.0 N·m (0.51 kg-m, 44 in-lb)



2nd step: 12.0 N·m (1.2 kg-m, 9 ft-lb)



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

NOTE:

At least 30 minutes after oil pan is installed, pour engine oil.

Inspection

INFOID:0000000010784330

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-38. "Inspection"](#).
2. Start engine, and check there is no leak of engine oil.
3. Stop engine and wait for 10 minutes.
4. Check the engine oil level again. Refer to [LU-38. "Inspection"](#).

GLOW PLUG

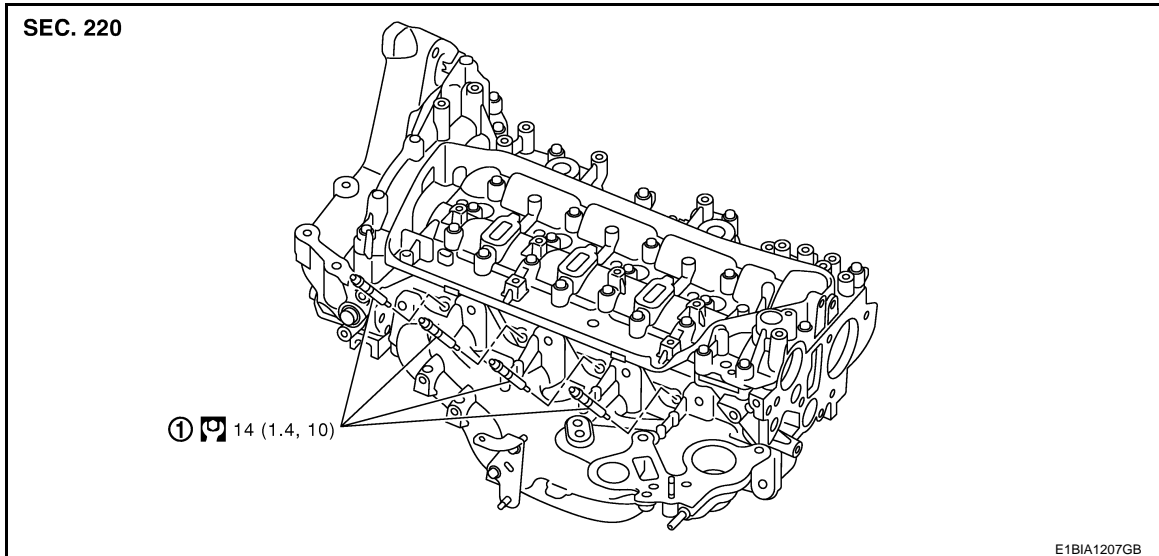
< REMOVAL AND INSTALLATION >

[R9M]


GLOW PLUG

Exploded View

INFOID:0000000010784331



① Glow plug

 : N·m (kg·m, ft·lb)

Removal and Installation

INFOID:0000000010784332

REMOVAL

CAUTION:

Remove glow plug only if necessary. If carbon adheres, it may be stuck and broken.

1. Disconnect harness connector from glow plug.
2. Remove glow plug.

CAUTION:

- When removing or installing, never use such tools as an air impact wrench.
- Handle it carefully without giving any impact, even after removal.

INSTALLATION

1. Remove adhered carbon from glow plug installation hole with a reamer.
2. Install glow plug.
3. Install in the reverse order of removal, for the rest of parts.

VACUUM PUMP

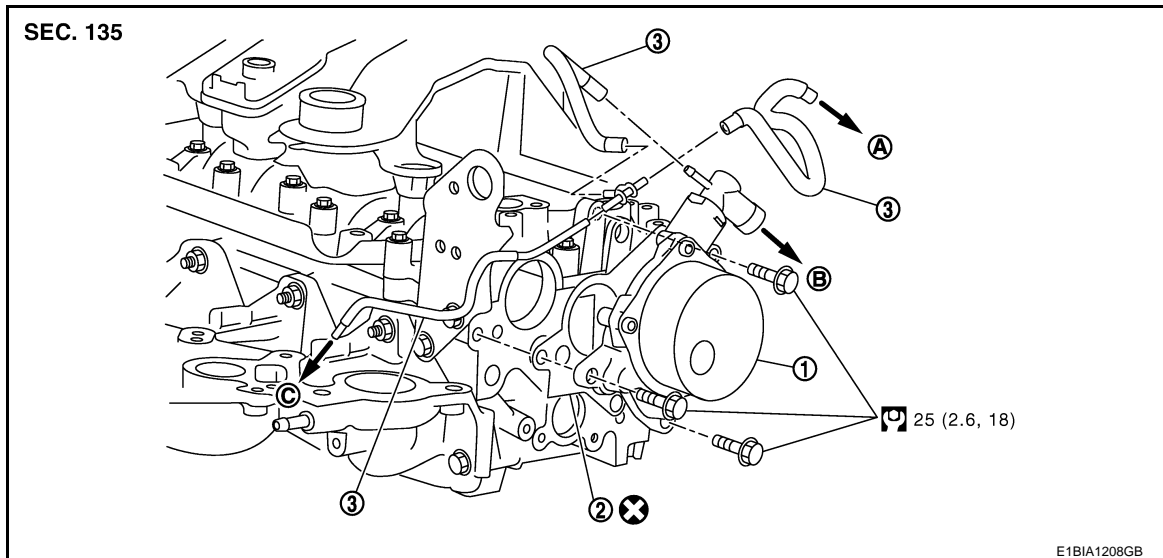
< REMOVAL AND INSTALLATION >

[R9M]

VACUUM PUMP

Exploded View

INFOID:0000000010784333



- | | | |
|--|--------------------|--|
| ① Vacuum pump | ② Gasket | ③ Vacuum hose |
| Ⓐ To turbocharger boost control solenoid valve | Ⓑ To brake booster | Ⓒ To coolant outlet unit regulation solenoid valve |

: N·m (kg-m, ft-lb)

: Always replace after every disassembly.

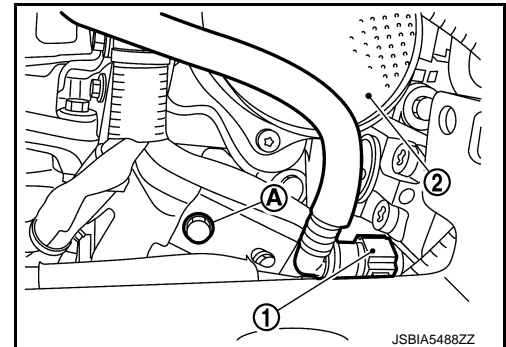
Removal and Installation

INFOID:0000000010784334

REMOVAL

1. Remove battery. Refer to [PG-138. "R9M : Exploded View"](#).
2. Remove air inlet tube 1. Refer to [EM-310. "Exploded View"](#).
3. Disconnect vacuum hoses.
4. Disconnect fuel hose quick connector ① from fuel pump. (Feed side)
5. Remove bracket bolt Ⓐ.

② : Vacuum pump



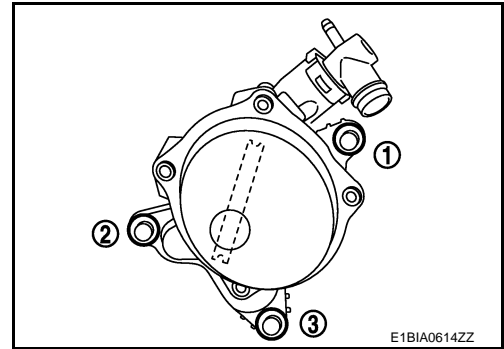
6. Remove vacuum pump.

VACUUM PUMP

< REMOVAL AND INSTALLATION >

[R9M]

- Loosen mounting bolts in reverse order as shown in the figure.



INSTALLATION

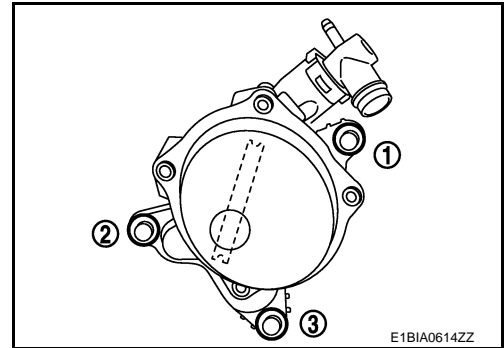
Note the following, and install in the reverse order of removal.

Vacuum pump

- Tighten mounting bolts in numerical order as shown in the figure.

CAUTION:

Be sure to check that the vacuum pump is in contact with the cylinder head before tightening the mounting bolts.



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OIL SEPARATOR

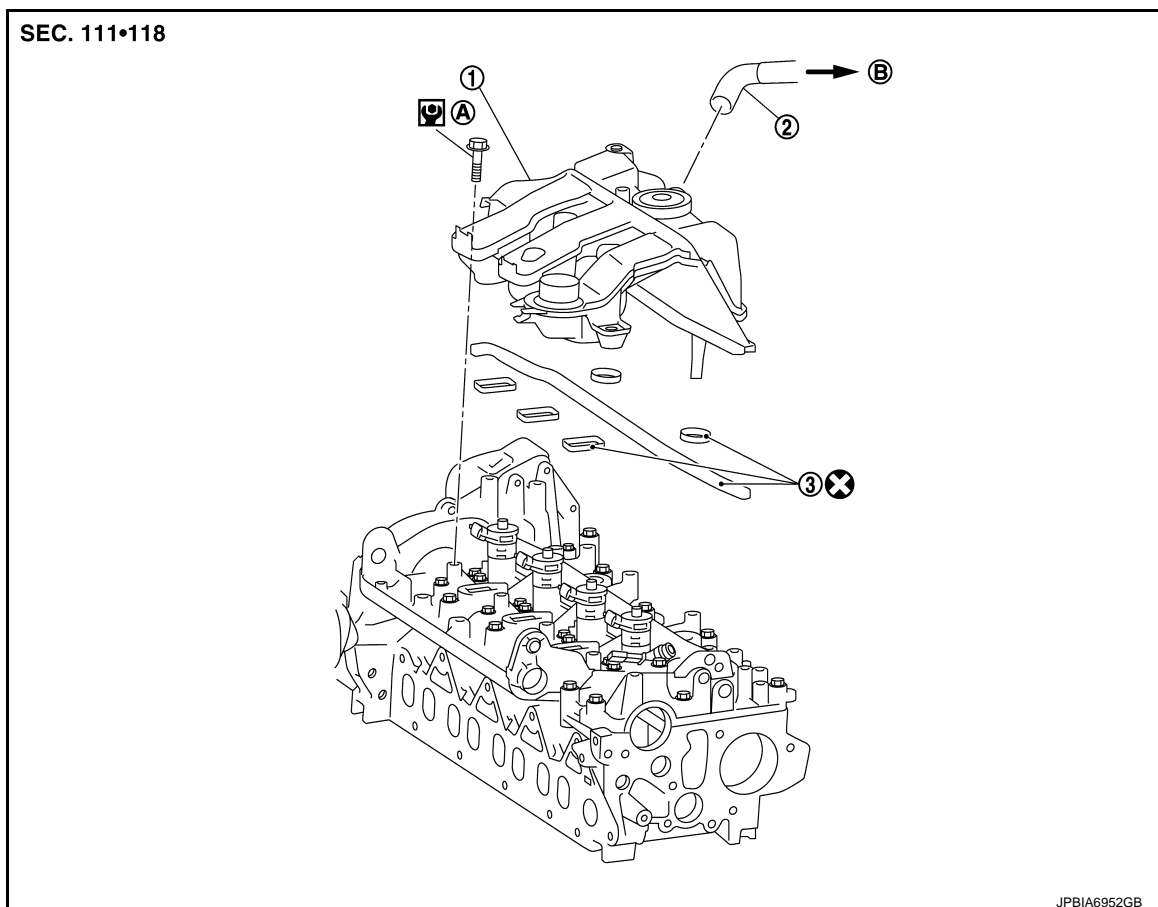
< REMOVAL AND INSTALLATION >

[R9M]

OIL SEPARATOR

Exploded View

INFOID:000000010784335



- ① Oil separator ② PCV hose ③ Gasket

- Ⓐ Comply with the installation procedure when tightening. Refer to [EM-336, "Removal and Installation"](#) Ⓑ To turbocharger air inlet pipe

Ⓐ : N·m (kg-m, in-lb)

ⓧ : Always replace after every disassembly.

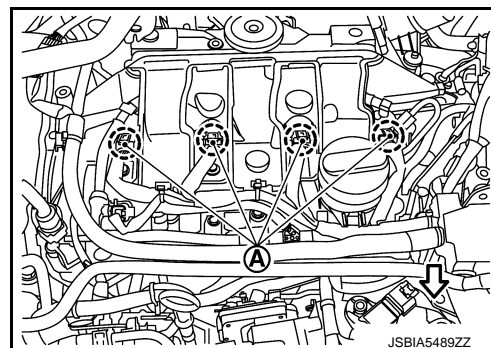
Removal and Installation

INFOID:000000010784336

REMOVAL

1. Remove engine cover. Refer to [EM-306, "Exploded View"](#).
2. Remove PCV hose.
3. Disconnect harness connector Ⓐ of fuel injector.

⇐ : Vehicle front



OIL SEPARATOR

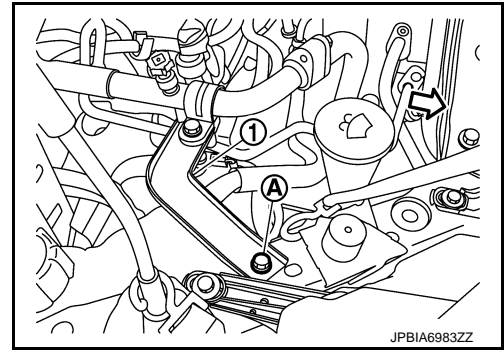
< REMOVAL AND INSTALLATION >

[R9M]

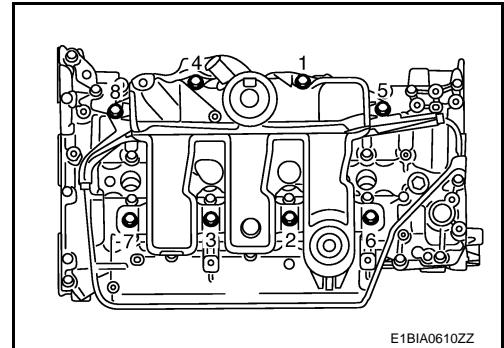
4. Remove A/C pipe bracket bolt (A).

① : A/C pipe bracket

← : Vehicle front



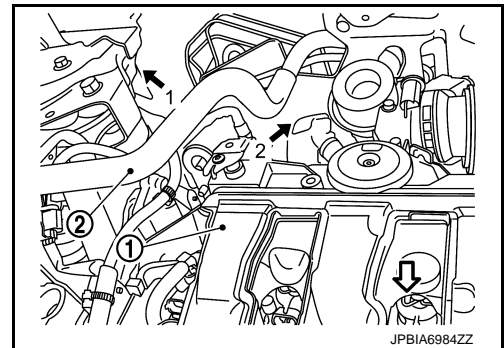
5. Disconnect harness connectors from injectors.
6. Loosen oil separator mounting bolts in the reverse order as shown in the figure.



7. Lift the A/C pipe (2) to the top left side, and remove oil separator (1).

← : Vehicle front

8. Remove gaskets.

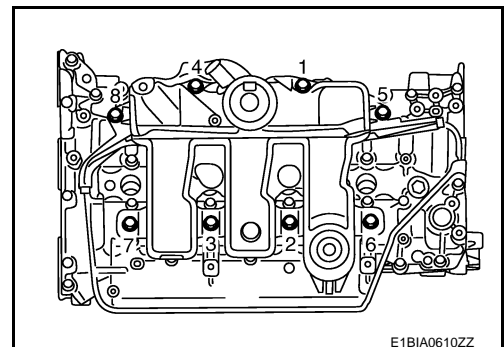


INSTALLATION

1. Install gaskets to oil separator.
CAUTION:
Check the gasket is not dropped.
2. Install oil separator.
• Tighten mounting bolts in two steps separately in numerical order as shown in the figure.

 **1st step: 5.0 N·m (0.51 kg-m, 44 in-lb)**

 **2nd step: 10.0 N·m (1.0 kg-m, 89 in-lb)**



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

INJECTION TUBE AND FUEL INJECTOR

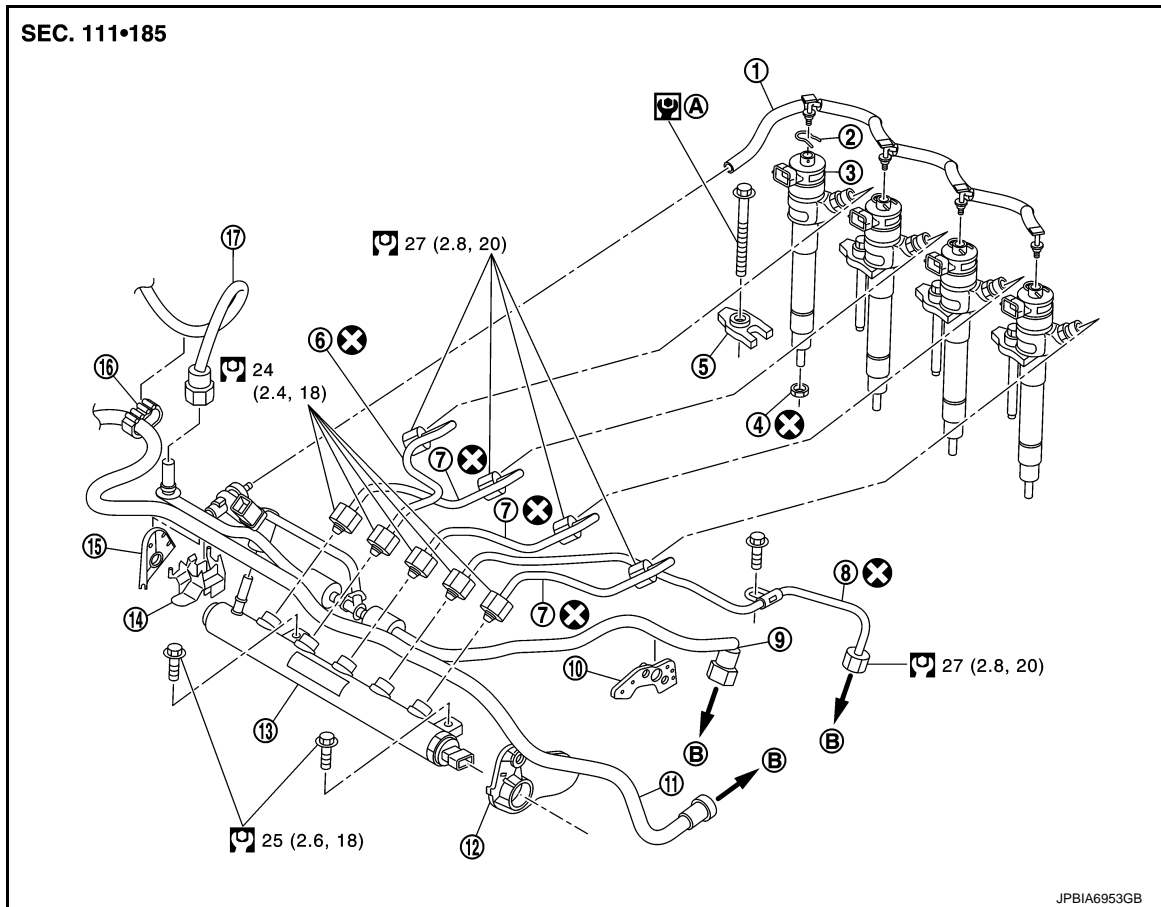
< REMOVAL AND INSTALLATION >

[R9M]

INJECTION TUBE AND FUEL INJECTOR

Exploded View

INFOID:000000010784337



- | | | |
|--|---------------------------|---------------------------------|
| ① Fuel return hose | ② Clip | ③ Fuel injector |
| ④ Fuel injector spacer | ⑤ Fuel injector support | ⑥ Injection tube (No.1) |
| ⑦ Injection tube (No.2 - 4) | ⑧ Injection tube (center) | ⑨ Fuel hose |
| ⑩ Injection rail protector seal | ⑪ Fuel hose | ⑫ Injection rail protector seal |
| ⑬ Injection rail (with fuel rail pressure sensor)* | ⑭ Bracket | ⑮ Injection rail protector seal |
| ⑯ Clip | ⑰ Fuel hose | |

Ⓐ Comply with the installation procedure when tightening. Refer to [EM-339, "Removal and Installation"](#)

Ⓑ To fuel pump

: N·m (kg-m, ft-lb)

: N·m (kg-m, in-lb)

: Always replace after every disassembly.

*: 2 types of injection rail

- Fuel rail pressure sensor with color ring:

CAUTION:

Do not disassemble fuel rail pressure sensor.

- Fuel rail pressure sensor without color ring: Tighten the sensor (specified torque).

: 130 N·m (13.3 kg-m, 96 ft-lb)

INJECTION TUBE AND FUEL INJECTOR

< REMOVAL AND INSTALLATION >

[R9M]

Removal and Installation

INFOID:000000010784338

REMOVAL

CAUTION:

- Be sure to read "Precautions for Diesel Equipment". Refer to [EM-289, "Precaution for Diesel Equipment"](#).
- Wait until the fuel temperature drops before carrying out any work.
- Order the special high pressure injection circuit plug kit.
- It is forbidden to open an fuel injector. If you open an fuel injector by mistake, you will have to change it.

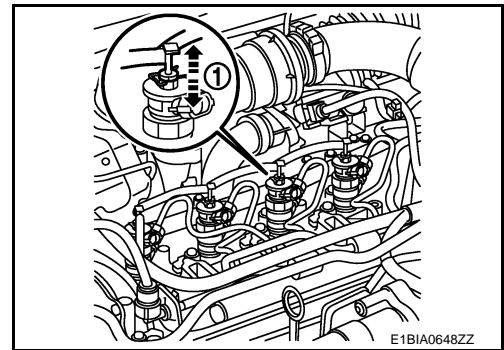
NOTE:

It is possible to replace a single injection tube.

1. Remove the battery. Refer to [PG-138, "R9M : Exploded View"](#).
2. Remove oil separator. Refer to [EM-336, "Exploded View"](#).
3. Remove fuel return hose.
 - Move without removing the fuel return hose clip using a flat bade screwdriver.

① : Moving direction

4. Disconnect and remove fuel hose.



5. Remove fuel collector and injection tube (center).
6. Remove injection tube (No. 1, 2, 3, 4).
7. Remove fuel injector. While rotating it to left and right, raise it to remove.
 - If fuel injector spacer remains in cylinder head, hook it with tip of a flat-bladed screwdriver and pull it out.

CAUTION:

- Handle fuel injector carefully without giving an impact.
- Never disassemble fuel injector.

8. Remove injection rail and injection rail protector seal.

CAUTION:

In case of fuel rail pressure sensor fitted with a color ring:

- replacing the sensor is forbidden
- the injector rail must be completely replaced if the fuel rail pressure sensor fails.

9. Plug all the holes in the injection circuit. Refer to [EM-289, "Precaution for Diesel Equipment"](#).

INSTALLATION

1. If an injector is replaced, not the IMA code and the corresponding cylinder number and perform "injector adjustment value registration". Refer to [EC-947, "Work Procedure"](#).

2. Install fuel injector, injection tubes and fuel rail with the following procedure:

- a. Install fuel injector spacer to fuel injector, and insert them into cylinder head.

CAUTION:

- Completely remove any foreign material among fuel injector and cylinder head.

- b. Install injection rail, injection tube (center).
 - Finger tighten until contact the injection tube nuts.

- c. Install fuel injector support.

CAUTION:

Be sure to fit fuel injector support without looseness.

- d. Tighten fuel injector support bolt.

Fuel injector support bolt 7 N·m (0.7 kg-m, 62 in-lb)

INJECTION TUBE AND FUEL INJECTOR

< REMOVAL AND INSTALLATION >

[R9M]

NOTE:

In case of cylinder head replacement, pre-tighten the fuel injector support bolt and after loosen the fuel injector support bolt.

Pre-tightening fuel injector support bolt (in case of cylinder head replacement) **20 N·m (2.0 kg-m, 15 ft-lb)**

- e. Turn 180 degrees clockwise (angle tightening).
- f. Install injection tube (No. 1, 2, 3, 4) in the original position (temporarily).
 - Finger tighten until contact the injection tube nuts.

CAUTION:

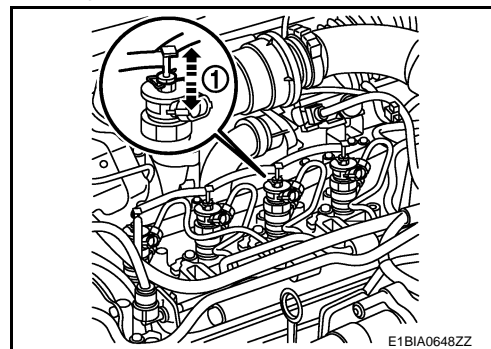
Never put injection tubes under stress.

- g. Tighten injection rail mounting bolts and all injection tube nuts (specified torque).
- 3. Install fuel return hose onto fuel injectors with the following procedure.

• NOTE:

Failure to observe the following procedure may lead to an immobilizing default.

- Fit the clip on the fuel return hose.
- Install fuel return hose onto fuel injectors.
- Always carry out a “push-pull” test ①, to check that the fuel return hose is correctly fitted onto fuel injector.
- Always carry out a “push-pull” test, to check that the fuel return hose is correctly fitted onto fuel hose.



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

Inspection

INFOID:0000000010784339

INSPECTION AFTER INSTALLATION

- When replacing fuel injector, this procedure must be performed. Refer to [EC-943, "Special Repair Requirement List"](#)
- Start the engine and check for fuel leak for one minute after starting.

CAUTION:

After any operation, check that there are no diesel leaks. Refer to [EM-289, "Precaution for Diesel Equipment"](#).

FUEL PUMP

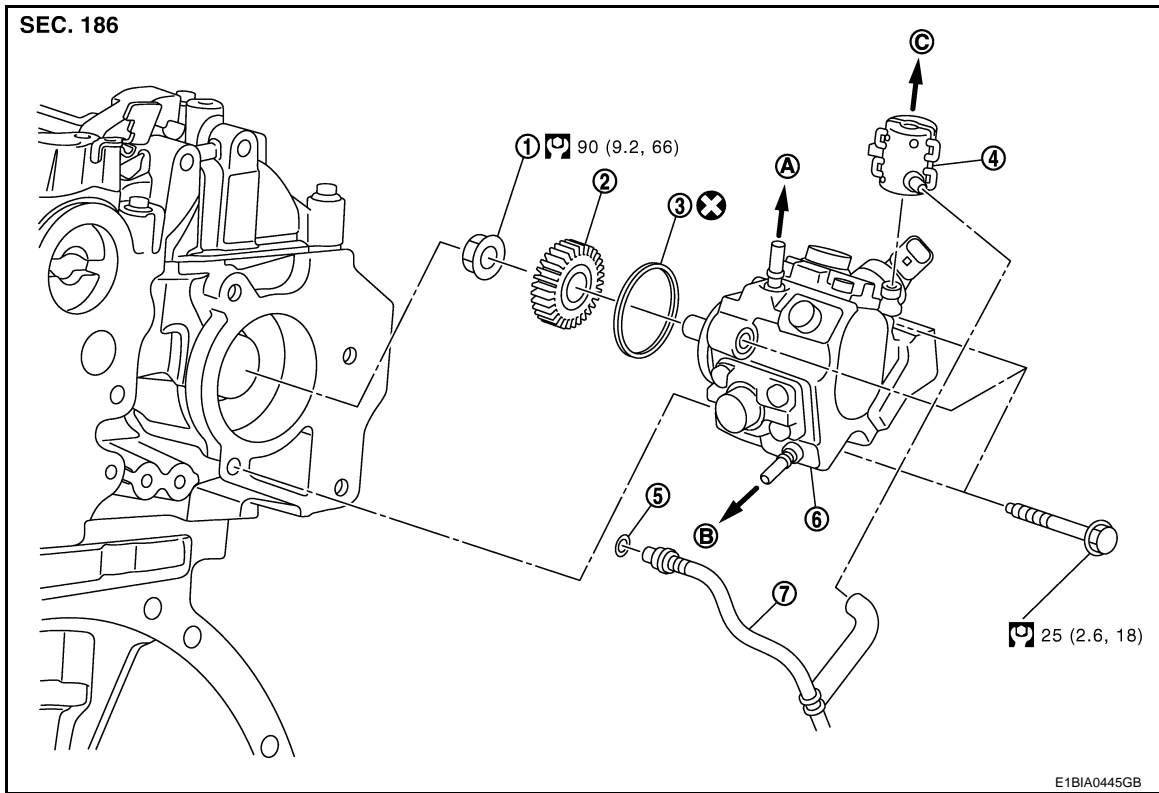
< REMOVAL AND INSTALLATION >

[R9M]

FUEL PUMP

Exploded View

INFOID:000000010784340



- | | | |
|------------------|--------------------|--------------------------------|
| ① Nut | ② Fuel pump gear | ③ Fuel pump gasket |
| ④ Fuel collector | ⑤ Gasket | ⑥ Fuel pump |
| ⑦ Drain hose | | |
| (A) To fuel tank | (B) To fuel filter | (C) To injection tube (center) |

: N·m (kg-m, ft-lb)

: Always replace after every disassembly.

Removal and Installation

INFOID:000000010784341

REMOVAL

CAUTION:

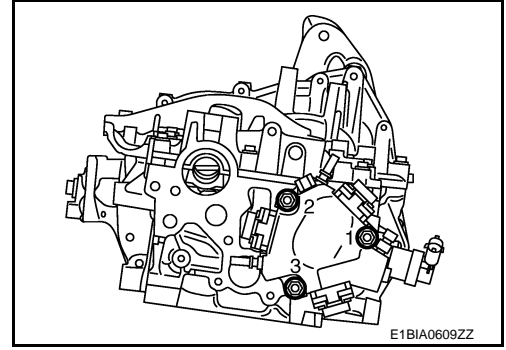
- Be sure to read "Precautions for Diesel Equipment". Refer to [EM-289, "Precaution for Diesel Equipment"](#).
 - Wait until the fuel temperature drops before carrying out any work.
 - Order the special high pressure injection circuit plug kit.
 - Never disassemble or adjust the fuel pump body.
1. Remove the battery. Refer to [PG-138, "R9M : Exploded View"](#).
 2. Remove engine cover. Refer to [EM-306, "Exploded View"](#).
 3. Remove air inlet tube. Refer to [EM-310, "Exploded View"](#).
 4. Remove drain hose.
 5. Remove fuel collector.
 6. Disconnect fuel hoses from fuel pump. Refer to [EM-338, "Exploded View"](#).
 7. Remove the injection tube (center). Refer to [EM-338, "Exploded View"](#).
 8. Plug all the holes of the injection circuit. Refer to [EM-289, "Precaution for Diesel Equipment"](#).

FUEL PUMP

[R9M]

< REMOVAL AND INSTALLATION >

9. Remove the fuel pump.
 - Loosen mounting bolts in the reverse order as shown in the figure.



10. In case of replacement of the fuel pump you need to install the old fuel pump sprocket on the new fuel pump. Refer to [EM-343, "Removal and Installation"](#).

INSTALLATION

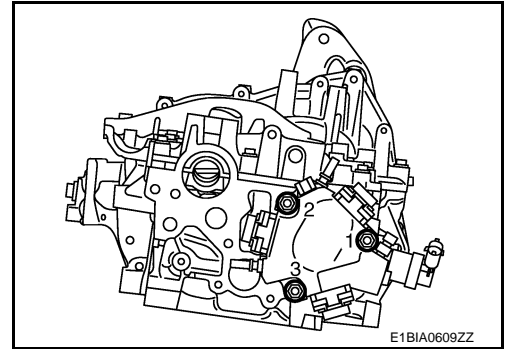
1. Install fuel pump.

CAUTION:

Be sure to check that the fuel pump is in contact with the cylinder head before tightening the mounting bolts.

- Tighten mounting bolts in two steps separately in numerical order as shown in the figure.

 : 25.0 N·m (2.6 kg-m, 18 ft-lb)



2. Install the injection tube (center). Refer to [EM-338, "Exploded View"](#).
 - Finger tighten until contact the injection tube nuts.
3. Install in the reverse order of removal, for the rest of parts.
4. Perform "Fuel pump learning value clearing". Refer to [EC-958, "Description"](#). when replacing fuel pump.
5. When replacing or removing fuel pump, this procedure must be performed. Refer to [EC-943, "Special Repair Requirement List"](#).

Inspection

INFOID:0000000010784342

INSPECTION AFTER INSTALLATION

- Start the engine and check for fuel leak for one minute after starting.

CAUTION:

After any operation, check that there are no diesel leaks. Refer to [EM-289, "Precaution for Diesel Equipment"](#).

FUEL PUMP SPROCKET

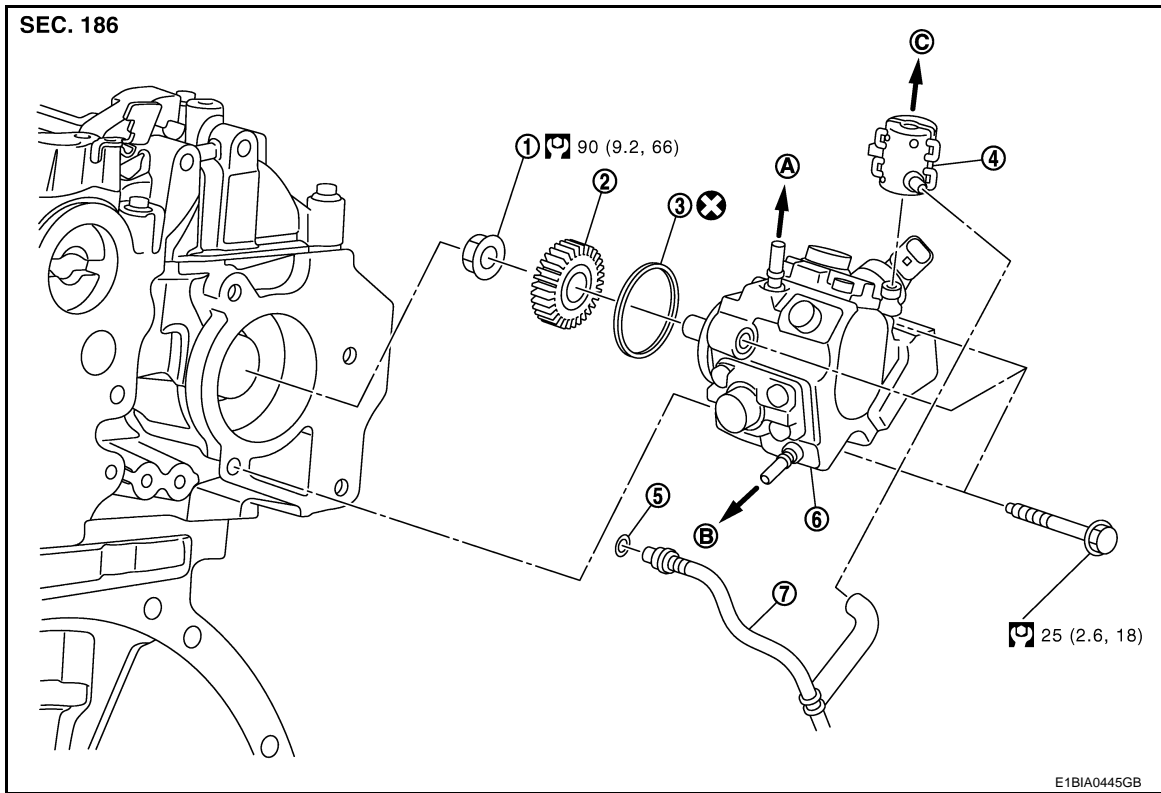
< REMOVAL AND INSTALLATION >

[R9M]

FUEL PUMP SPROCKET

Exploded View

INFOID:0000000011006149



- | | | |
|------------------|--------------------|--------------------------------|
| ① Nut | ② Fuel pump gear | ③ Fuel pump gasket |
| ④ Fuel collector | ⑤ Gasket | ⑥ Fuel pump |
| ⑦ Drain hose | | |
| (A) To fuel tank | (B) To fuel filter | (C) To injection tube (center) |

: N·m (kg-m, ft-lb)

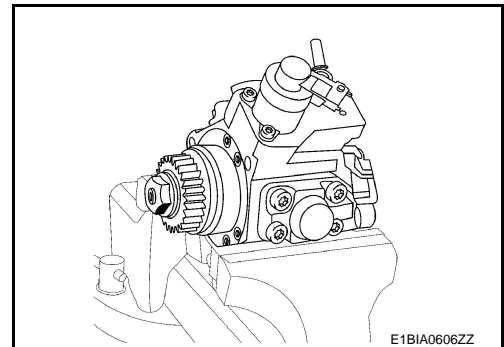
: Always replace after every disassembly.

Removal and Installation

INFOID:0000000010784343

REMOVAL

1. Lock the fuel pump on the work-bench in a vice with protective jaws.

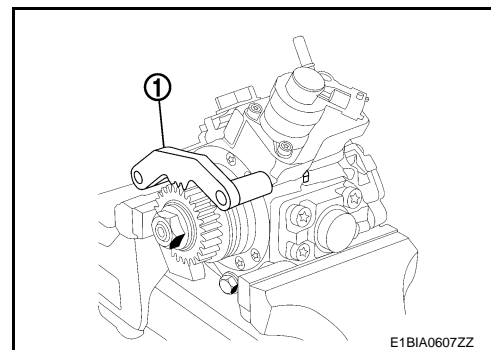


FUEL PUMP SPROCKET

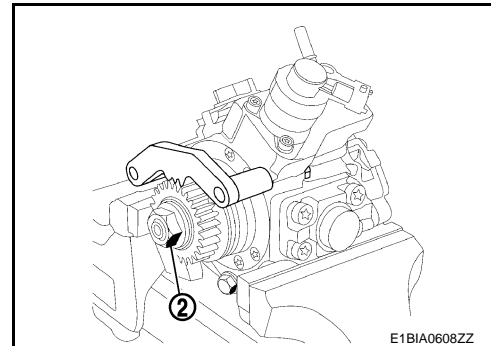
< REMOVAL AND INSTALLATION >

[R9M]

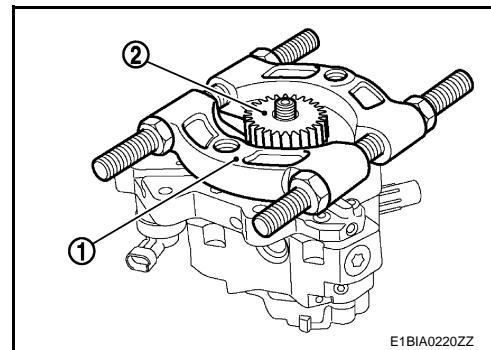
2. Using the tool [SST (Mot.1906)] ①, lock the fuel pump gear.



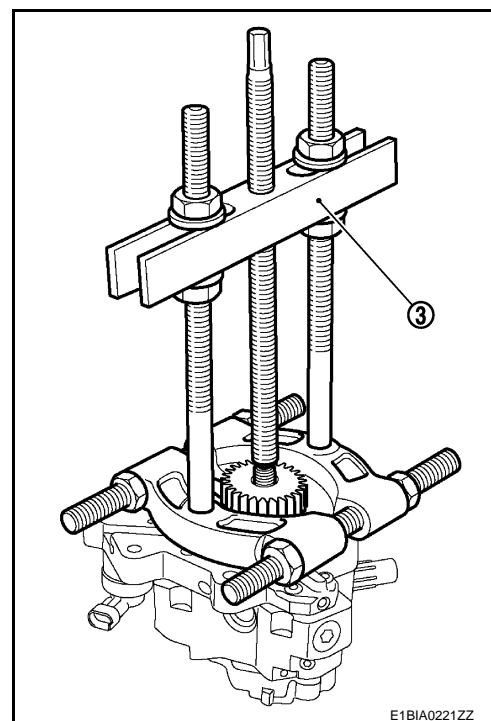
3. Remove the nut ②.



4. Fit a separator ① from the puller kit under the fuel pump gear ②.



5. Put the bracket ③ on the separator.



FUEL PUMP SPROCKET

< REMOVAL AND INSTALLATION >

[R9M]

6. Remove the fuel pump gear.

INSTALLATION

- 1. Refit the fuel pump gear to the new fuel pump.
- 2. Screw in the new fuel pump gear on the work-bench, without tightening it.
- 3. Lock the fuel pump on the workbench in a vice with protective jaws.
- 4. Torque tighten the nut.

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TIMING CHAIN

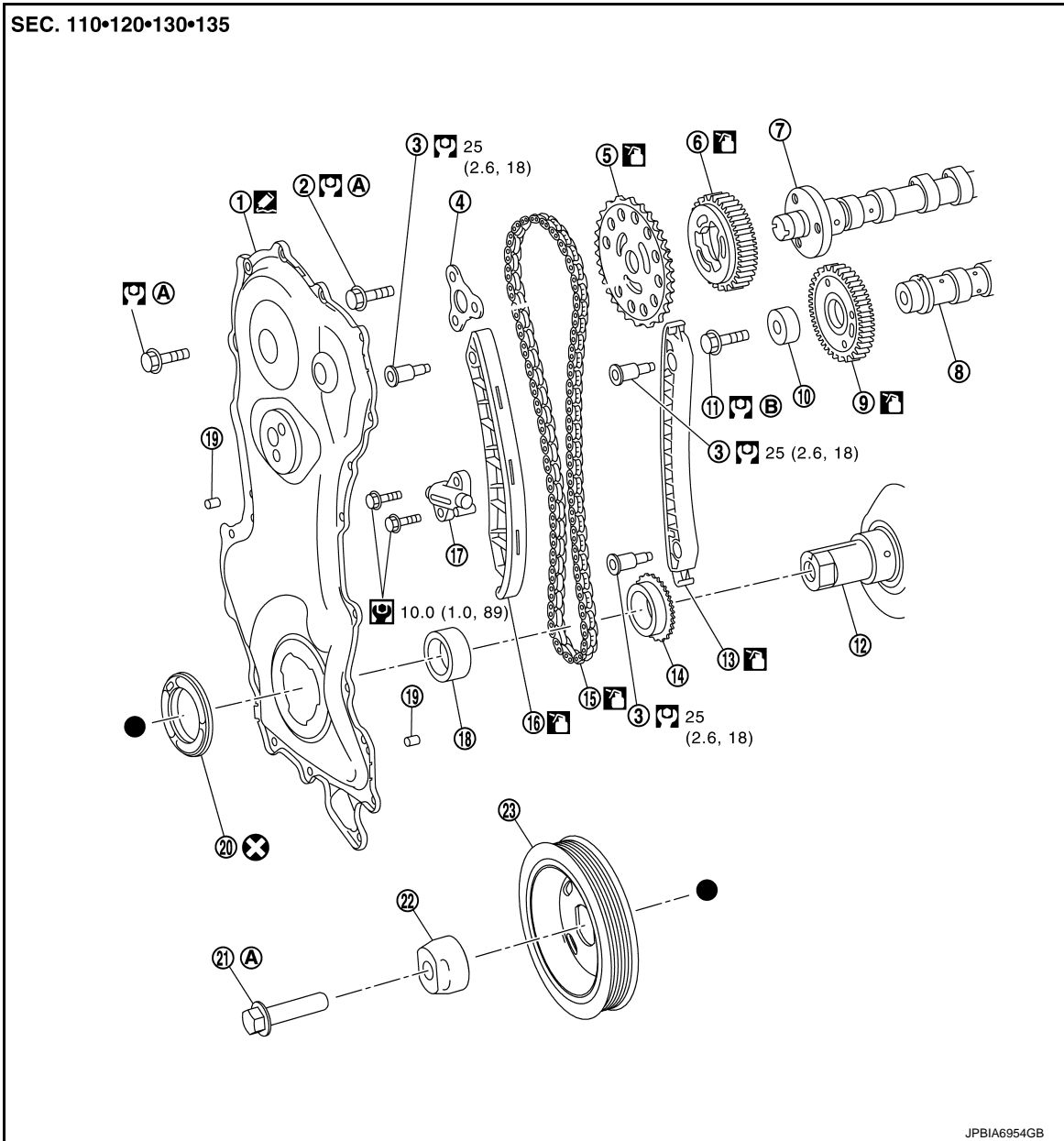
< REMOVAL AND INSTALLATION >

[R9M]

TIMING CHAIN







Exploded View

INFOID:000000010784344



- | | | |
|--|--|---|
| ① Front cover | ② Exhaust camshaft timing sprocket bolt | ③ Guide bolt |
| ④ Timing sprocket spacer | ⑤ Exhaust camshaft timing sprocket (front) | ⑥ Exhaust camshaft timing sprocket (rear) |
| ⑦ Exhaust camshaft | ⑧ Intake camshaft | ⑨ Intake camshaft timing sprocket |
| ⑩ Intake camshaft timing sprocket spacer | ⑪ Intake camshaft timing sprocket bolt | ⑫ Crankshaft |
| ⑬ Tension guide | ⑭ Crankshaft sprocket | ⑮ Timing chain |
| ⑯ Slack guide | ⑰ Timing chain tensioner | ⑱ Crankshaft spacer |
| ⑲ Timing chain cover pin | ⑳ Front oil seal | ㉑ Crankshaft pulley bolt |
| ㉒ Crankshaft spacer | ㉓ Crankshaft pulley | |

< REMOVAL AND INSTALLATION >

- Comply with the installation procedure when tightening. Refer to [EM-347, "Removal and Installation"](#). (A)
- Comply with the installation procedure when tightening. Refer to [EM-354, "Removal and installation"](#). (B)
-  : N·m (kg-m, ft-lb)
-  : N·m (kg-m, in-lb)
-  : Always replace after every disassembly.
-  : Should be lubricated with oil.
-  : Sealing point
-  : Indicates that the part is connected at points with same symbol in actual vehicle.

Removal and Installation

INFOID:000000010784345

REMOVAL

1. Drain engine oil. Refer to [LU-39, "Draining"](#).
CAUTION:
Perform this step when the engine is cold.
 2. Disconnect the battery cable from the negative terminal.
 3. Remove the following parts:
 - Engine under cover: Refer to [EXT-39, "ENGINE UNDER COVER : Exploded View"](#).
 - Load wheel tire (RH): Refer to [WT-61, "Exploded View"](#).
 - Fender protector (RH): Refer to [EXT-35, "FENDER PROTECTOR : Exploded View"](#).
 - Drive belt: Refer to [EM-300, "Removal and Installation"](#).
 - Drive belt auto-tensioner: Refer to [EM-300, "Exploded View"](#).
 - Engine coolant bypass control solenoid valve: Refer to [EM-313, "Exploded View"](#).
 - Fuel filter: Refer to [FL-37, "Removal and Installation"](#).
 4. Remove crankshaft pulley with the following procedure:
 - a. Set the crankshaft pulley locking tool [SST: — (Mot. 1770)] (A) and loosen crankshaft pulley bolt.
 - b. Remove crankshaft pulley and spacer.
 - Pull crankshaft pulley with both hands to remove it.
 - CAUTION:**
Be careful not to damage front oil seal lip.
-
5. Remove front oil seal. Refer to [EM-363, "FRONT OIL SEAL : Removal and Installation"](#).
 6. Remove the through bolt between rear torque rod and rear torque rod bracket, and hold the rear torque rod bracket with a transmission jack. Refer to [EM-365, "Exploded View"](#).
CAUTION:
Never hold the oil pan (lower).
 7. Remove the upper torque rod and the engine mounting insulator (RH). Refer to [EM-365, "Exploded View"](#).
 8. Remove engine mounting bracket (RH).
 9. Remove water pump pulley bolts. Refer to [CO-83, "Exploded View"](#).
 10. Remove front cover with the following procedure:
 - a. Loosen front cover mounting bolts.
 - b. Use the seal cutter [SST: KV10111100 (—)] to cut liquid gasket for removal.
CAUTION:
Never use a screwdriver or something similar.
NOTE:
Unstick the front cover by hand, using a jerking motion to ensure it is not damaged.

TIMING CHAIN

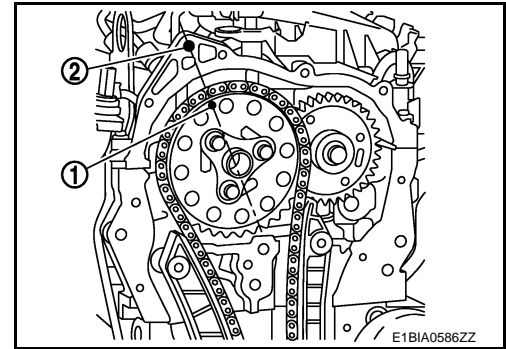
< REMOVAL AND INSTALLATION >

[R9M]

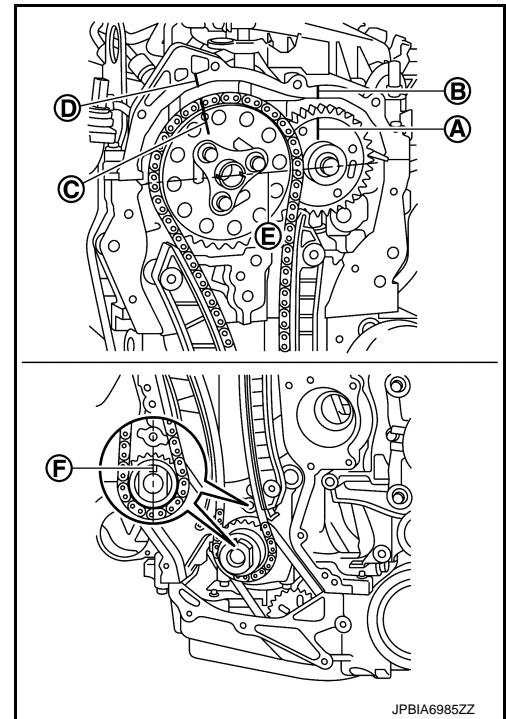
11. Align the hole ① on the exhaust camshaft timing sprocket (front) with the hole ② on the cylinder head housing.

• **NOTE:**

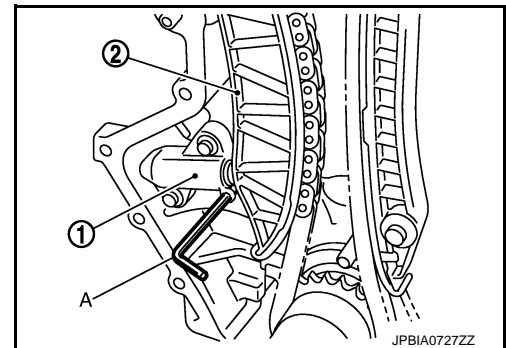
Turn the crankshaft clockwise using the tool [SST: — (Mot.1770)].



12. Remove the TDC pin plug. Refer to [EM-389. "Exploded View"](#).
13. In place of plug, manually tighten the tool [SST: — (Mot.1970)].
14. Turn the crankshaft clockwise until it makes contact with the pin.
15. Make a mark:
• on the intake camshaft timing sprocket ① and the rocker cover ② (vertically).
• on the hole ③ on the exhaust camshaft timing sprocket (front) and on the rocker cover ④.
• Check the mark alignment ⑤ and ⑥.



16. Loosen the exhaust camshaft timing sprocket bolts (front).
17. Compress the timing chain tensioner ① with slack guide ②, and then insert a stopper pin (A) into hole on timing chain tensioner.
NOTE:
Use approximately 3.0 mm (0.118 in) dia. hard metal pin as a stopper pin



18. Remove the timing chain with the following procedure:
a. the timing chain tensioner,
b. the slack guide,
c. the exhaust camshaft timing sprocket bolts,
d. the timing sprocket spacer,

TIMING CHAIN

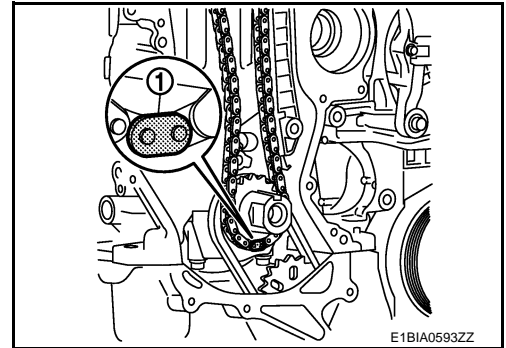
[R9M]

< REMOVAL AND INSTALLATION >

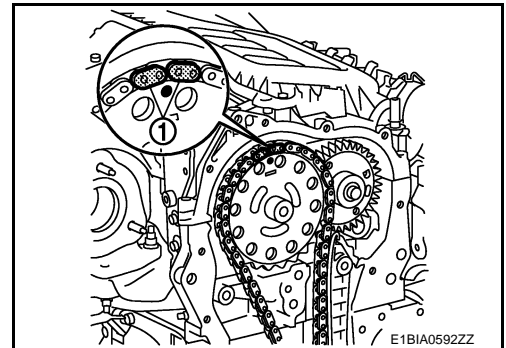
- e. the crankshaft spacer,
- f. the "Exhaust camshaft timing sprocket (front) - timing chain - crankshaft sprocket" assembly,
- g. the tension guide,
- h. the tool [SST: — (Mot.1970)].

INSTALLATION

- 1. Set the engine at TDC.
- 2. Install the tool [SST: — (Mot.1970)].
- 3. Install tension guide.
- 4. Tighten timing chain guide bolts.
- 5. Install the crankshaft sprocket onto the crankshaft.
- 6. Install timing chain.
- a. The timing chain on the crankshaft sprocket (align the sprocket mark with the cooper chain link ①).



- b. The timing chain on the exhaust camshaft timing sprocket (front) (align the sprocket mark with the cooper chain link ①).



- 7. Install the exhaust camshaft timing sprocket (front) onto the exhaust camshaft.
- 8. Place the timing sprocket spacer on the exhaust camshaft timing sprocket (front).
- 9. Finger tighten the exhaust camshaft timing sprocket bolts.

NOTE:

Allow the timing sprocket to rotate freely.

- 10. Install the crankshaft spacer.
- 11. Install the slack guide.
- 12. Tighten the bolt of the slack guide.
- 13. Install the timing chain tensioner with its locking pin.

NOTE:

Check that the hydraulic tensioner is in contact with the cylinder block before tightening the bolts.

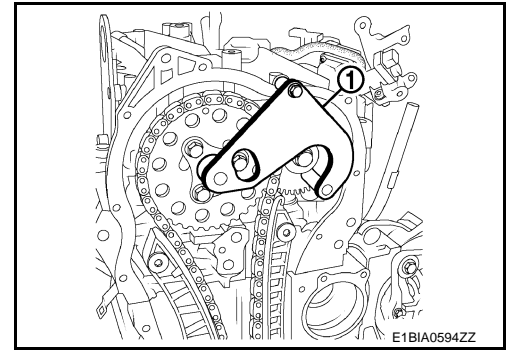
- 14. Tighten the bolts of the timing chain tensioner.
- 15. Remove the locking pin.

TIMING CHAIN

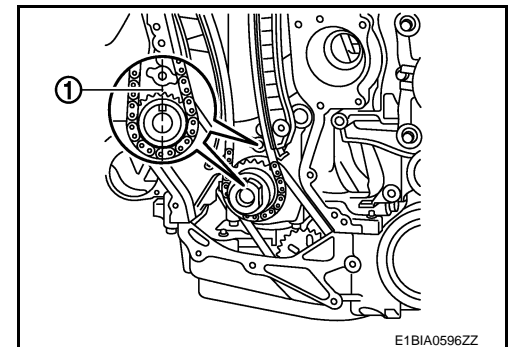
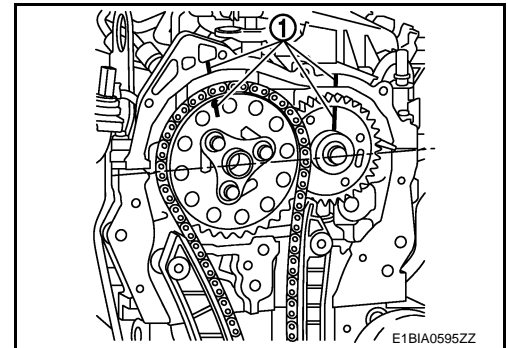
< REMOVAL AND INSTALLATION >

[R9M]

16. Engage the collet of the tool [SST: — (Mot.1969)] ① into the exhaust camshaft groove.



17. Turn the tool to align the shafts on the spacer and the hole of the rocker cover.
18. Detach the collet of the tool from the exhaust camshaft groove.
19. Engage the pins of the tool in the holes in the intake camshaft timing sprocket.
NOTE:
Do not install the collet of the tool into the groove on the exhaust side of the camshaft.
20. Turn the tool to align the shafts on the spacer and the hole of the rocker cover.
21. Install the collet of the tool into the groove on the exhaust camshaft without forcing it (if necessary, start the previous operation again).
22. Install the rocker cover onto the tool [SST: — (Mot.1969)].
23. Tighten the exhaust camshaft timing sprocket bolts.
24. Turn 40 degrees clockwise (angle tightening).
25. Remove the tools.
 - The bolts from the tool [SST: — (Mot.1969)]
 - The tool [SST: — (Mot.1969)]
 - The tool [SST: — (Mot.1970)]26. Tighten the TDC hole plug. Refer to [EM-389. "Exploded View"](#).
27. Check the marks ① (if necessary, start the previous operation again).



28. Install front cover with the following procedure:

TIMING CHAIN

< REMOVAL AND INSTALLATION >

[R9M]

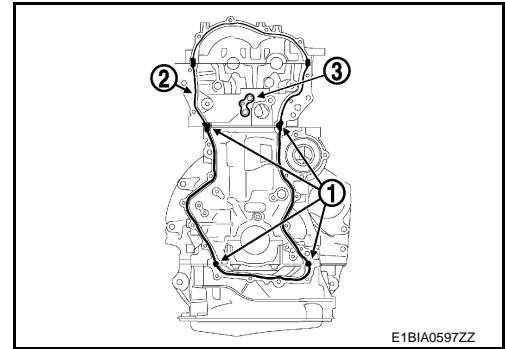
- a. Apply liquid gasket to the front cover side, referring to the application point shown in the figure.

- ① **lower side:**
5.0 - 9.0 mm (0.098 - 0.177 in) in diameter
- ② **upper side:**
4.0 - 8.0 mm (0.118 - 0.276 in) in diameter
- ③ **center:**
1.5 - 3.5 mm (0.394 - 0.591 in) long

Use Genuine Liquid Gasket or equivalent.

NOTE:


Liquid gasket should be applied to the front cover side because the workspace is narrow.

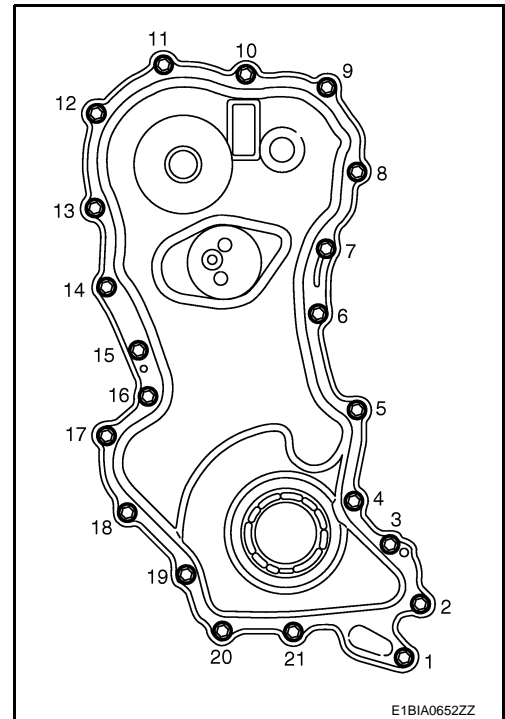


- b. Install the front cover.
i. Pre-tighten the front cover bolts.

 : **5.0 N·m (0.51 kg-m, 44 in-lb)**


- ii. Tighten the front cover bolts.

 : **15 N·m (1.6 kg-m, 12 ft-lb)**



29. Install crankshaft pulley with the following procedure:

- a. Tighten crankshaft pulley bolt.

 : **50 N·m (5.1 kg-m, 37 ft-lb)**

- b. Turn 150 degrees clockwise (angle tightening).

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

Inspection

INFOID:0000000010784346

INSPECTION AFTER INSTALLATION

Inspection for Leaks

- 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-23. "Fluids and Lubricants"](#).
- Use procedure below to check for fuel leakage.
 - 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 there is no leakage of fuel, exhaust gases, or any oil/fluids including engine oil and engine coolant.

TIMING CHAIN

< REMOVAL AND INSTALLATION >

[R9M]

- 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 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.

TIMING SPROCKET

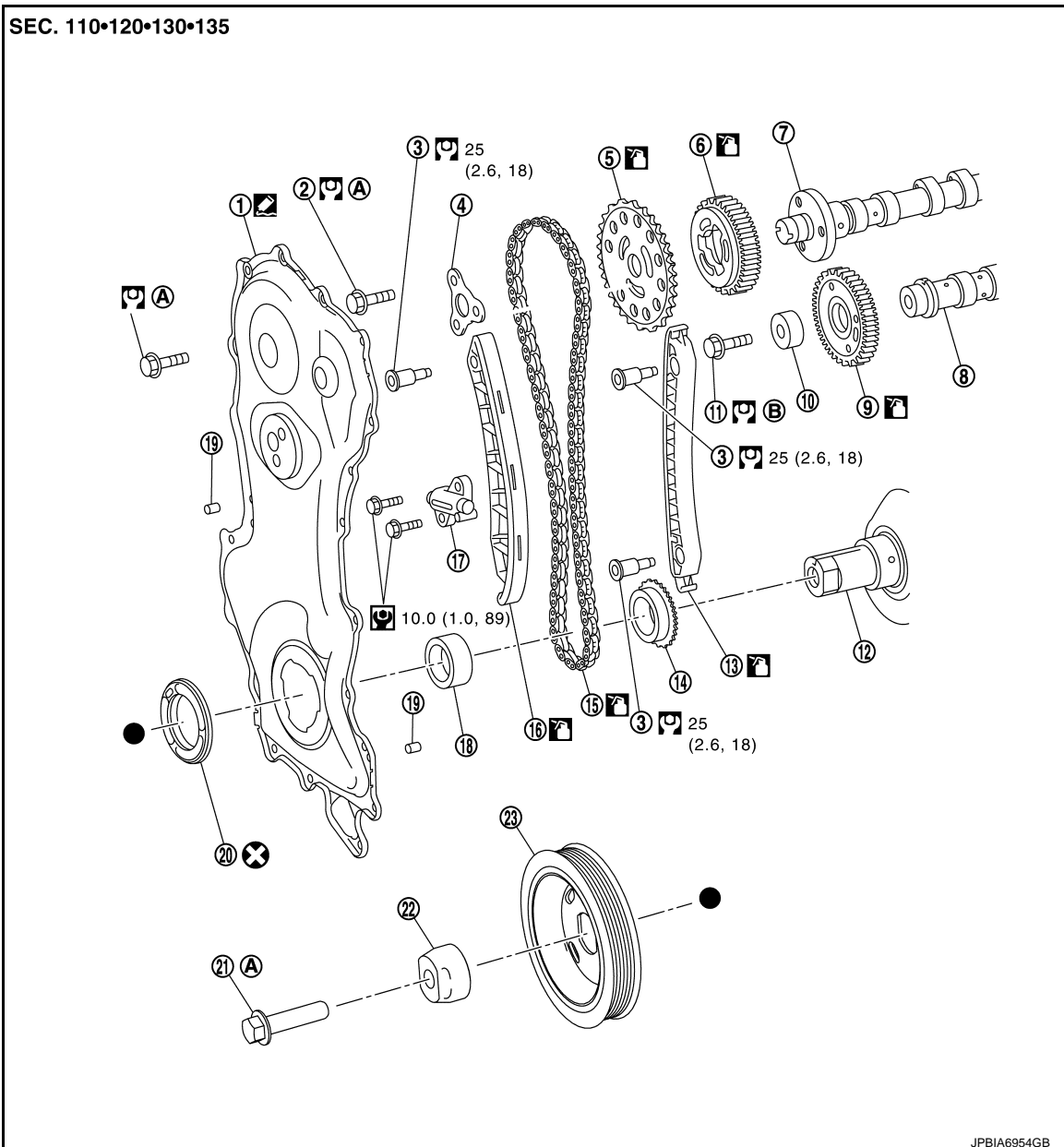
< REMOVAL AND INSTALLATION >

[R9M]

TIMING SPROCKET

Exploded View

INFOID:0000000011006364



- | | | |
|--|--|---|
| ① Front cover | ② Exhaust camshaft timing sprocket bolt | ③ Guide bolt |
| ④ Timing sprocket spacer | ⑤ Exhaust camshaft timing sprocket (front) | ⑥ Exhaust camshaft timing sprocket (rear) |
| ⑦ Exhaust camshaft | ⑧ Intake camshaft | ⑨ Intake camshaft timing sprocket |
| ⑩ Intake camshaft timing sprocket spacer | ⑪ Intake camshaft timing sprocket bolt | ⑫ Crankshaft |
| ⑬ Tension guide | ⑭ Crankshaft sprocket | ⑮ Timing chain |
| ⑯ Slack guide | ⑰ Timing chain tensioner | ⑱ Crankshaft spacer |
| ⑲ Timing chain cover pin | ⑳ Front oil seal | ㉑ Crankshaft pulley bolt |
| ㉒ Crankshaft spacer | ㉓ Crankshaft pulley | |

TIMING SPROCKET

< REMOVAL AND INSTALLATION >

[R9M]

- Comply with the installation procedure when tightening. Refer to [EM-347. "Removal and Installation"](#). Comply with the installation procedure when tightening. Refer to [EM-354. "Removal and installation"](#).



: N·m (kg-m, ft-lb)



: N·m (kg-m, in-lb)



: Always replace after every disassembly.



: Should be lubricated with oil.



: Sealing point



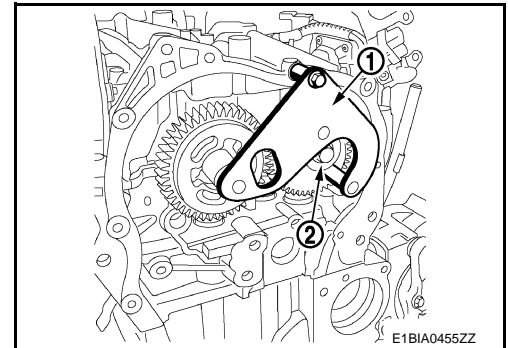
: Indicates that the part is connected at points with same symbol in actual vehicle.

Removal and installation

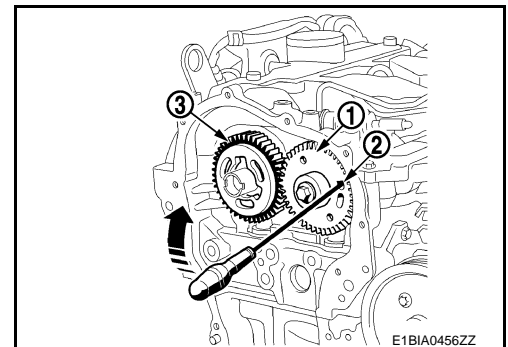
INFOID:0000000010784347

REMOVAL

1. Remove the timing chain. Refer to [EM-346. "Exploded View"](#).
2. Immobilize the intake camshaft timing sprocket using the tool [SST: — (Mot.1969)] ①
3. Loosen the intake camshaft timing sprocket bolt ②.
4. Remove the tool [SST: — (Mot.1969)].



5. Place a screw driver in the hole ②, compress the spring of the intake camshaft timing sprocket ① and remove the exhaust camshaft timing sprocket (rear) ③.



6. Remove the intake camshaft timing sprocket with the following procedure:
 - a. Remove the screwdriver.
 - b. Remove the intake camshaft timing sprocket bolt.
 - c. Remove the intake camshaft timing sprocket spacer.
 - d. Remove the intake camshaft timing sprocket.

INSTALLATION

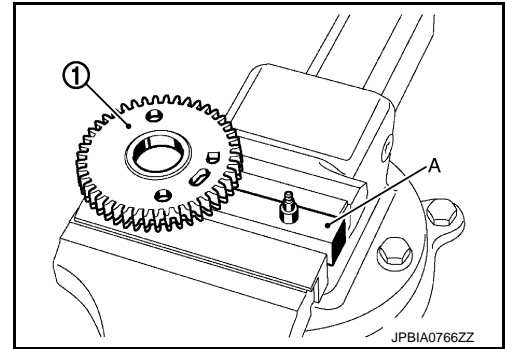
1. Install the intake camshaft timing sprocket with the following procedure:

TIMING SPROCKET

< REMOVAL AND INSTALLATION >

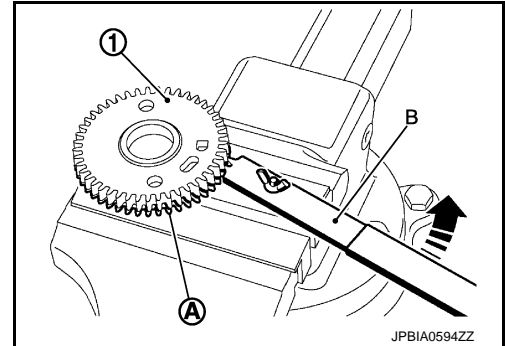
[R9M]

- a. Set the intake camshaft timing sprocket ① on base plate of positioning tool [SST: — (Mot. 1773)] (A).



- b. Set the lever (B) in the lower gear teeth ①. Pivot the lever counterclockwise until the two gear teeth are aligned.

① : Wear compensation gear

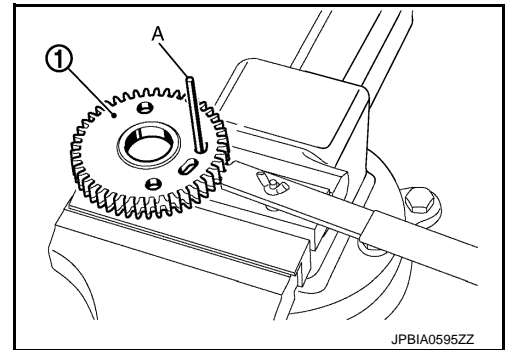


- c. Set a stopper pin (A) in the gear hole.

① : Wear compensation gear

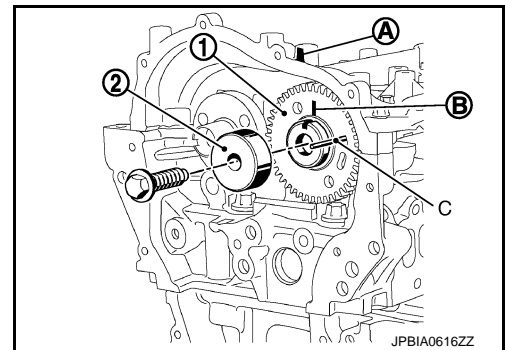
NOTE:

- Use approximately 4.0 mm (0.157 in) dia. hard metal pin as a stopper pin



- d. Install intake camshaft timing sprocket ① and intake camshaft timing sprocket spacer ② to the camshaft.
- e. Align matching mark ② on intake camshaft timing sprocket and mark ① of cylinder head housing.

C : Stopper pin



- f. Temporarily tighten mounting bolt.

2. Install exhaust camshaft timing sprocket (rear) with the following procedure:

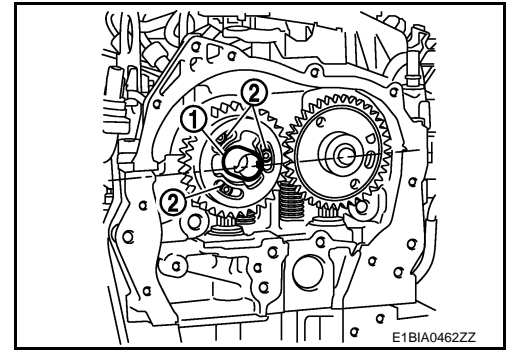
- a. Check that the exhaust camshaft groove ① is horizontal (large ring facing upwards).

TIMING SPROCKET

[R9M]

< REMOVAL AND INSTALLATION >

- b. Center the exhaust camshaft timing sprocket (rear) openings on the camshaft hub mounting holes ②.
- c. Set the exhaust camshaft timing sprocket (rear) fully onto the camshaft (right side) hub.
- d. Remove stopper pin.



3. Re-install the tool [SST: — (Mot.1969)] to immobilize the intake camshaft timing sprocket.
4. Tighten the intake camshaft timing sprocket bolt

**Intake camshaft timing
sprocket bolt:**

20 N·m (2.0 kg-m, 15 ft-lb)

5. Turn 35 degrees clockwise (angle tightening).
6. Install in the reverse order of removal.

CAMSHAFT

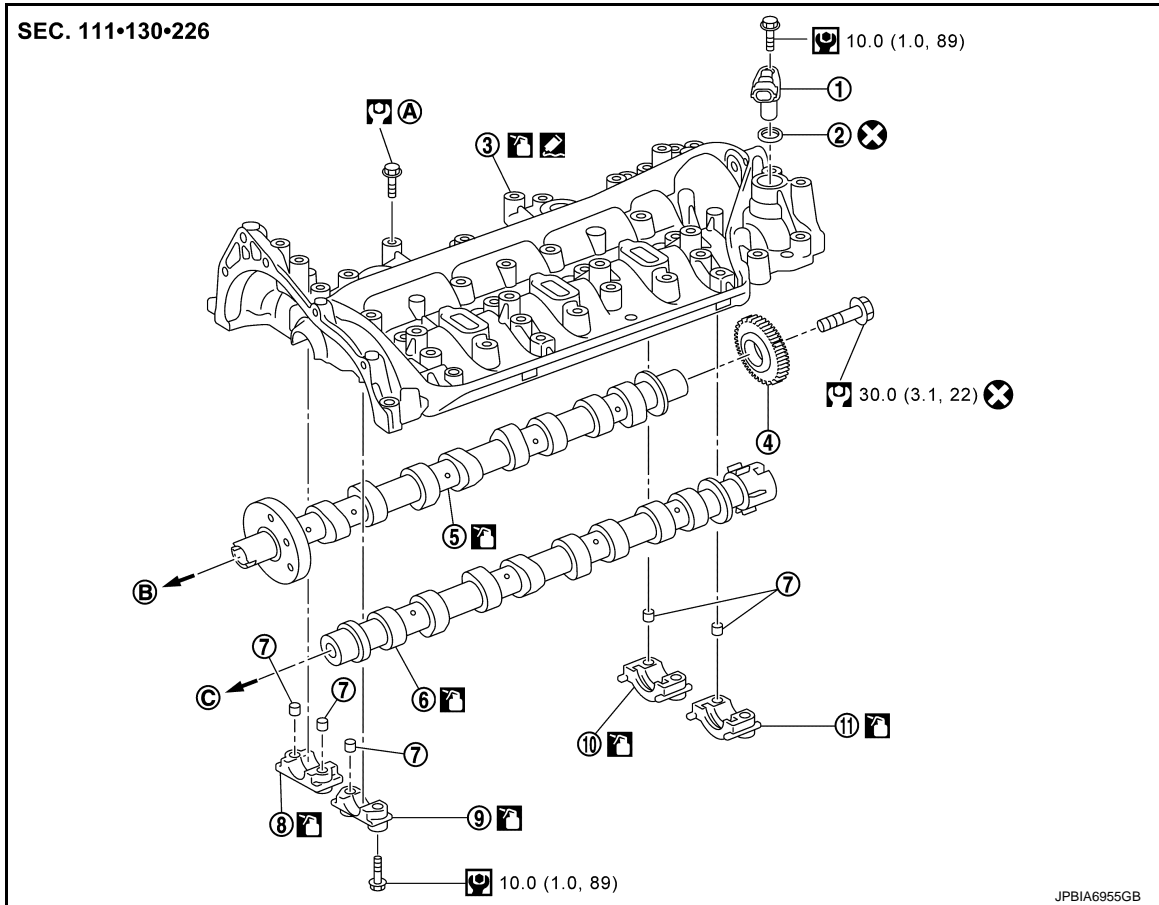
< REMOVAL AND INSTALLATION >

[R9M]

CAMSHAFT

Exploded View

INFOID:0000000010784348



- | | | |
|----------------------------|--------------------|-------------------------|
| ① Camshaft position sensor | ② O-ring | ③ Cylinder head housing |
| ④ Fuel pump gear | ⑤ Exhaust camshaft | ⑥ Intake camshaft |
| ⑦ Camshaft bracket pin | ⑧ Camshaft bracket | ⑨ Camshaft bracket |
| ⑩ Camshaft bracket | ⑪ Camshaft bracket | |

Comply with the installation procedure when tightening. Refer to [EM-347. "Removal and Installation"](#).

- | | |
|----------------------------------|---------------------------------|
| (A) To exhaust camshaft sprocket | (B) To intake camshaft sprocket |
|----------------------------------|---------------------------------|

: 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:0000000010784349

REMOVAL

- Remove the following parts.
 - Oil separator: Refer to [EM-336. "Exploded View"](#).
 - Fuel injector: Refer to [EM-338. "Exploded View"](#).
 - Engine slinger (front side): Refer to [EM-383. "Exploded View"](#).

CAMSHAFT

[R9M]

< REMOVAL AND INSTALLATION >

- Front cover and timing chain related parts: Refer to [EM-346, "Exploded View"](#).
- Fuel pump: Refer to [EM-341, "Exploded View"](#).
- Vacuum pump: Refer to [EM-334, "Exploded View"](#).

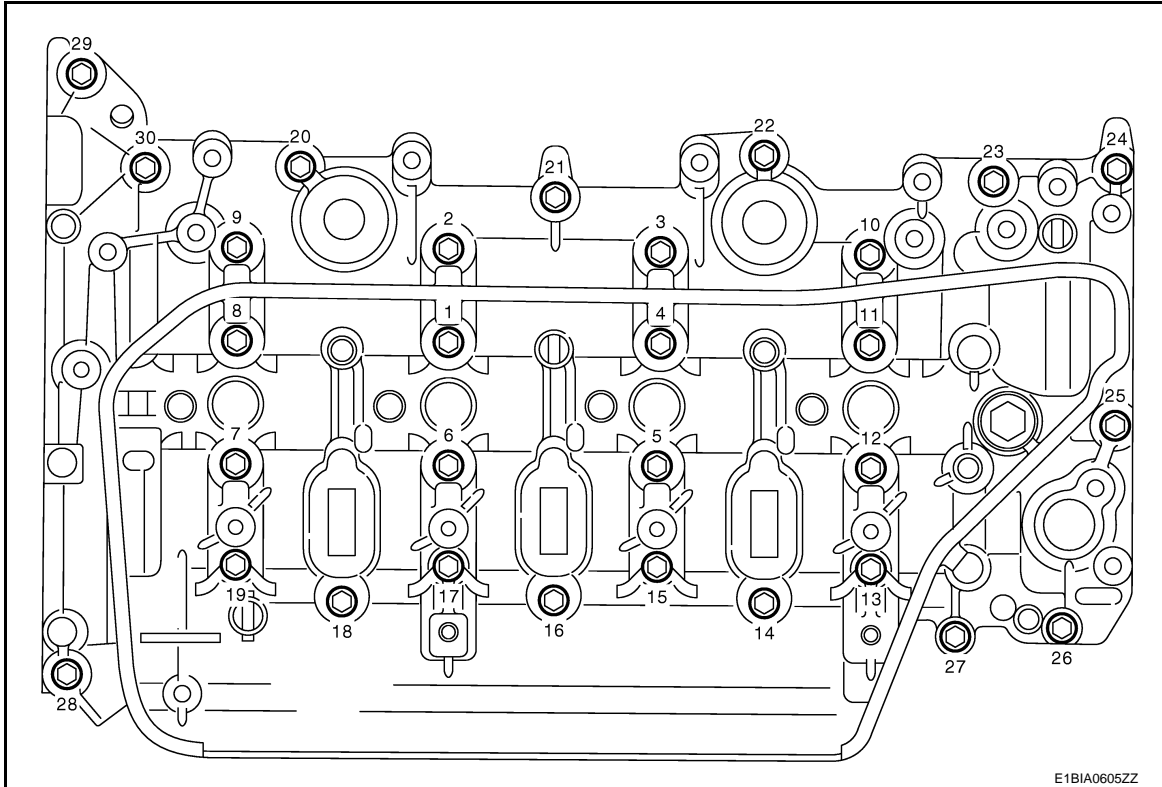
2. Remove camshaft position sensor.

CAUTION:

- **Handle camshaft position sensor carefully and avoid impacts.**
- **Never disassemble camshaft position sensor.**
- **Never place sensor where it is exposed to magnetism.**

3. Remove cylinder head housing with the following procedure:

a. Loosen mounting bolts in reverse order as shown in the figure.

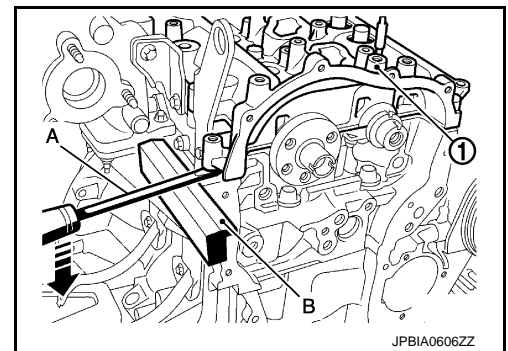


b. Remove the cylinder head housing ① using a flat-blade screwdriver (A).

B : Protective shim (suitable tool)

CAUTION:

Be careful not to damage the mating surface.



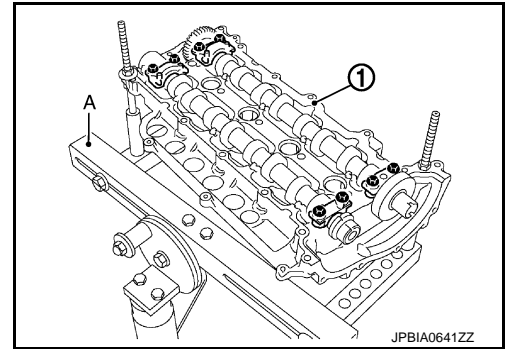
4. Remove camshafts with the following procedure:

CAMSHAFT

< REMOVAL AND INSTALLATION >

[R9M]

- a. Install cylinder head housing ① to cylinder head stand [commercial service tool: KV113B0200 (Mot.1573)] (A).
- b. Loosen mounting bolts, and remove camshaft brackets and camshafts.
 - Mark camshafts and camshaft brackets so they are placed in the same position and direction for installation.

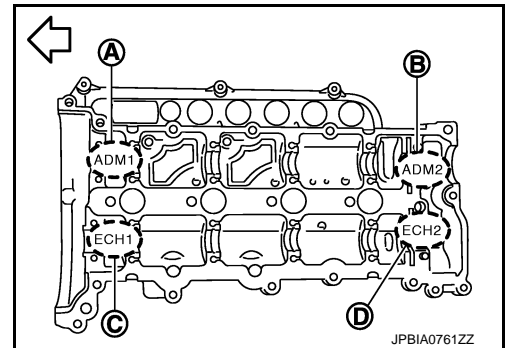


5. Remove camshaft sprocket (for fuel pump) from camshaft (right side), if necessary.

INSTALLATION

1. When camshaft sprocket (for fuel pump) is removed, install it.
2. Install camshaft to cylinder head housing with the following procedure:
 - a. Clean camshaft journal to remove any foreign material.
 - b. Install camshafts.
 - c. Refer to the figure to install camshaft bracket in its original.

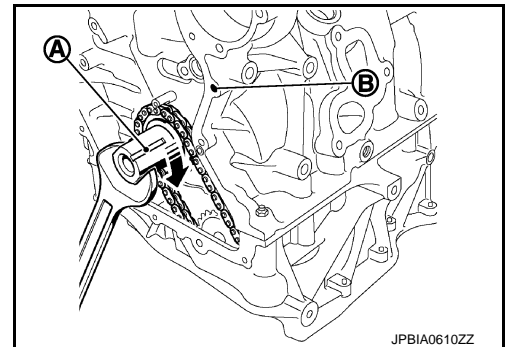
- (A) : Part marking ADM1
- (B) : Part marking ADM2
- (C) : Part marking ECH1
- (D) : Part marking ECH2
- ← : Engine front



- d. Tighten camshaft bracket mounting bolts.
 - Finger tighten the camshaft bracket mounting bolts, until they just make contact.
3. Install cylinder head housing with the following procedure:
 - a. Align the crankshaft groove (A) with the cylinder block hole (B).

NOTE:

This is for the purpose of preventing interferences of valve and piston head.



- b. Remove foreign material completely from cylinder head housing backside and cylinder head installation face.

CAMSHAFT

< REMOVAL AND INSTALLATION >

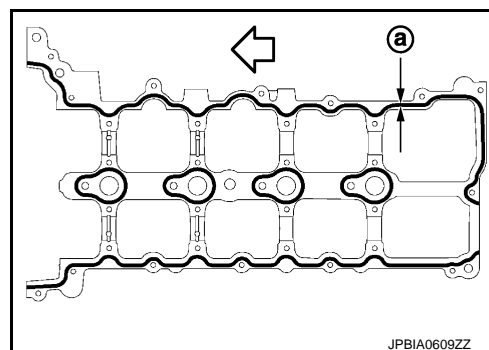
[R9M]

c. Apply liquid gasket to cylinder head as shown in the figure.

Ⓐ : 0.5 - 2.5 mm (0.020 - 0.098 in)

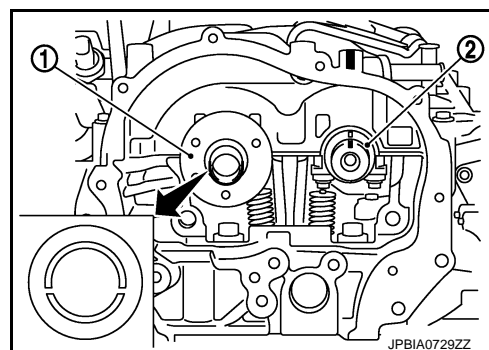
⇐ : Engine front

Use Genuine Liquid Gasket or equivalent.

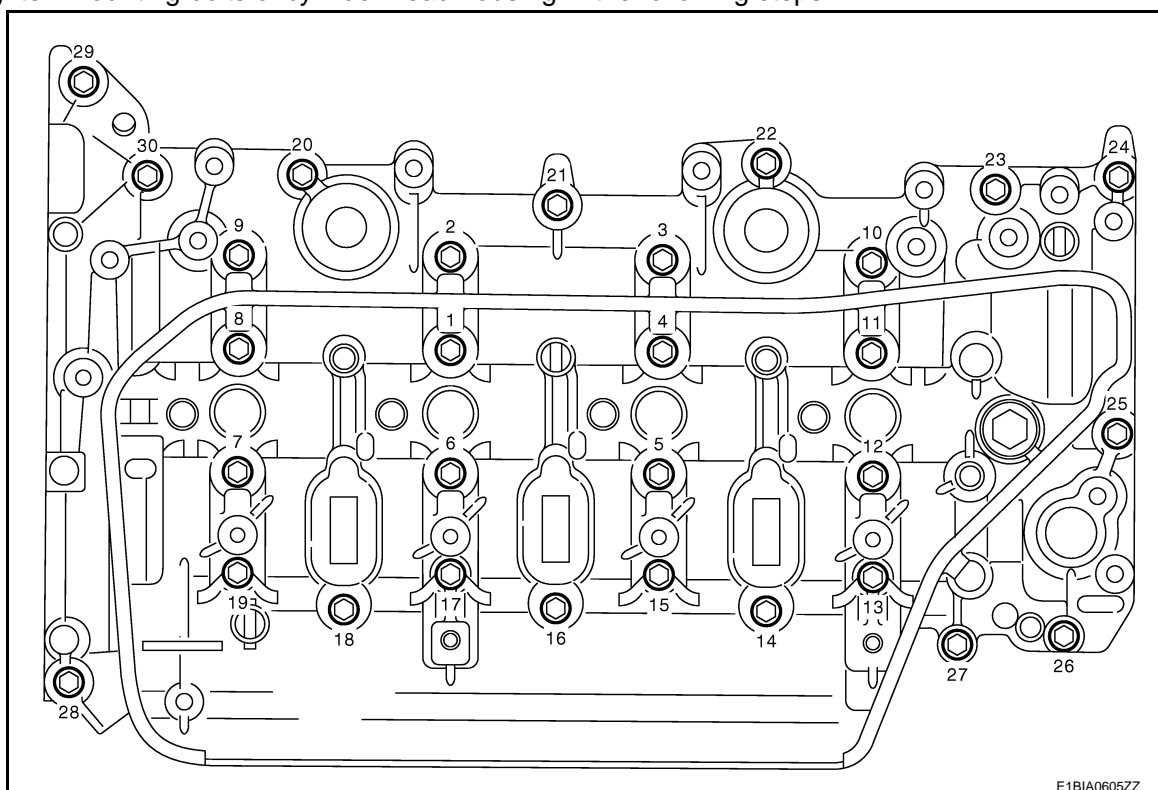


d. Install so that camshafts are positioned in the directions shown in the figure.

- Parallelize the groove of camshaft (right side) ① to face the offset side upward.
- Fit the groove of camshaft (left side) ② and boss of cylinder head housing.




e. Tighten mounting bolts of cylinder head housing in the following steps.



- Tighten in order and successively, the cylinder head housing bolts No. 6, 4, 8 and 12 to gradually fit the cylinder head housing on the cylinder head.
- Tighten the remaining bolts (temporarily).
- Loosen bolts No. 6, 4, 8 and 12.
- Tighten the bolts No. 6, 4, 8 and 12 (temporarily).
- Tighten bolts in numerical order.

 : 5.0 N·m (0.51 kg-m, 44 in-lb)

vi. Tighten bolts in numerical order.

 : 12.0 N·m (1.2 kg-m, 9 ft-lb)

CAUTION:

After tightening mounting bolts of cylinder head housing, be sure to wipe off excessive liquid gasket from the mating surface of cylinder head.

4. Install timing chain and related parts. Refer to [EM-346, "Exploded View"](#).
5. Install in the reverse order of removal, for the rest of parts

Inspection

INFOID:000000010784350

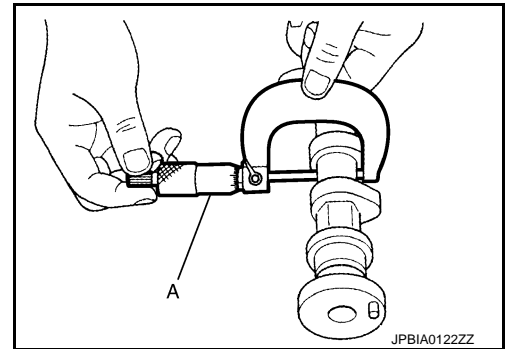
INSPECTION AFTER REMOVAL

Camshaft Journal oil clearance

CAMSHAFT JOURNAL

- Measure the camshaft journal with a micrometer (A).

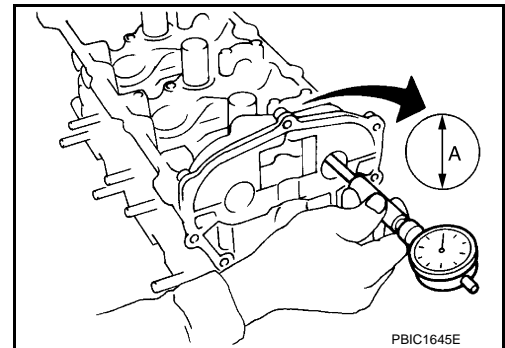
Standard : Refer to [EM-415, "Camshaft"](#).



CYLINDER HEAD HOUSING AND CAMSHAFT BRACKET INNER DIAMETER

- Measure the inner diameter (A) of cylinder head housing and camshaft bracket with a bore gauge.

Standard : Refer to [EM-415, "Camshaft"](#).



CAMSHAFT JOURNAL OIL CLEARANCE

- (Oil clearance) = (Bracket inner diameter) – (Camshaft journal diameter)

Standard : Refer to [EM-415, "Camshaft"](#).

- If it exceeds the standard, replace camshaft or/and cylinder head housing and cylinder head assembly.

INSPECTION AFTER INSTALLATION

Inspection for Leaks

- 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-23, "Fluids and Lubricants"](#).
- Use procedure below to check for fuel leakage.
 - 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 there is no leakage of fuel, exhaust gases, or any oil/fluids including engine oil and engine coolant.

CAMSHAFT

< REMOVAL AND INSTALLATION >

[R9M]

- 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 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.

OIL SEAL

FRONT OIL SEAL

FRONT OIL SEAL : Removal and Installation

INFOID:000000010784351

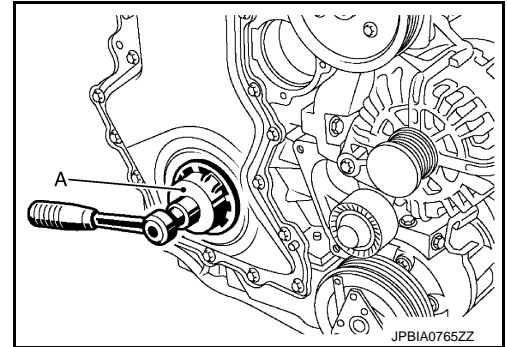
EM

REMOVAL

1. Remove the following parts.
 - Front fender protector (RH): Refer to [EXT-35. "FENDER PROTECTOR : Exploded View"](#).
 - Drive belt: Refer to [EM-300. "Removal and Installation"](#).
 - Crankshaft pulley: Refer to [EM-307. "Exploded View"](#).
2. Remove front oil seal using service tool (A).

NOTE:

The service tool is supplied in the new seal parts kit.

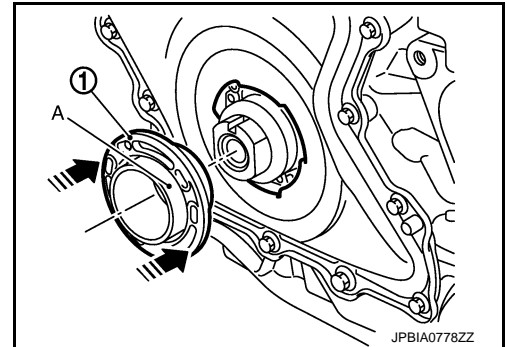


INSTALLATION

1. Install front oil seal with the following procedure:
 - a. Fit the protector (A) to front oil seal ①.
 - Align the front oil seal notches with front cover notches.

NOTE:

The protector is supplied in the new seal parts kit.

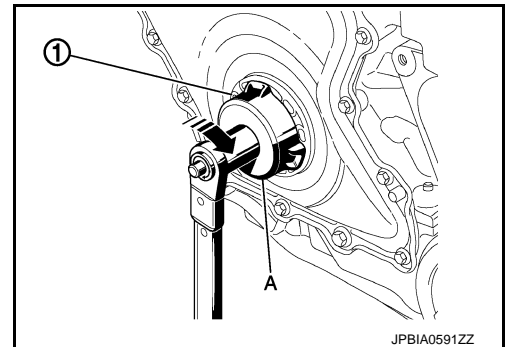


- b. Tighten to front oil seal ① using service tool (A).

 : 47 N·m (4.8 kg-m, 35 ft-lb)

NOTE:

The service tool is supplied in the new seal parts kit.



- c. Remove the protector.
 2. Install in the reverse order of removal, for the rest of parts.

REAR OIL SEAL

REAR OIL SEAL : Removal and Installation

INFOID:000000010784352

REMOVAL

OIL SEAL

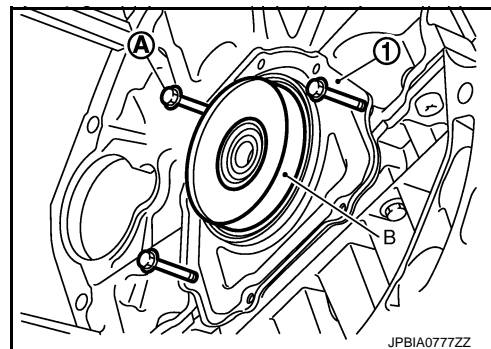
[R9M]

< REMOVAL AND INSTALLATION >

1. Remove transaxle assembly. Refer to [TM-122. "Exploded View"](#) (M/T models) or [TM-704. "Exploded View"](#) (CVT models).
2. Remove clutch cover and clutch disk. Refer to [CL-35. "R9M : Exploded View"](#) (M/T models).
3. Remove flywheel or drive plate. Refer to [EM-376. "Exploded View"](#) (flywheel) or [EM-378. "Exploded View"](#) (drive plate).
4. Remove rear oil seal retainer.

INSTALLATION


1. Install rear oil seal retainer with the following procedure:
 - a. Set guide bolt (A) and protector (B) to rear oil seal retainer ①.
NOTE:
The protector is supplied in the new seal parts kit.
 - b. Move the rear oil seal retainer evenly by hand until it makes contact with the cylinder block.

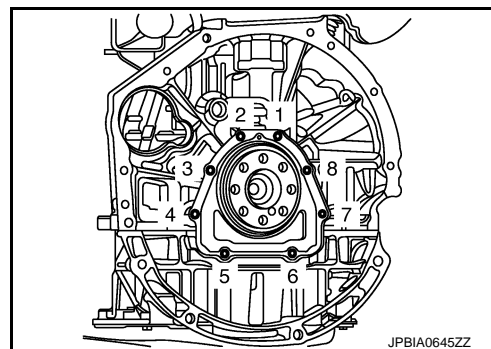


- c. Remove guide bolts and protector.
- d. Tighten mounting bolts in two steps separately in numerical order as shown in the figure.
 - i. Tighten bolts No. 1 and 5.

 : 5.0 N·m (0.51 kg-m, 44 in-lb)

- ii. Tighten No. 1 to 8 in numerical order as shown.

 : 12.0 N·m (1.2 kg-m, 9 ft-lb)



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

UNIT REMOVAL AND INSTALLATION

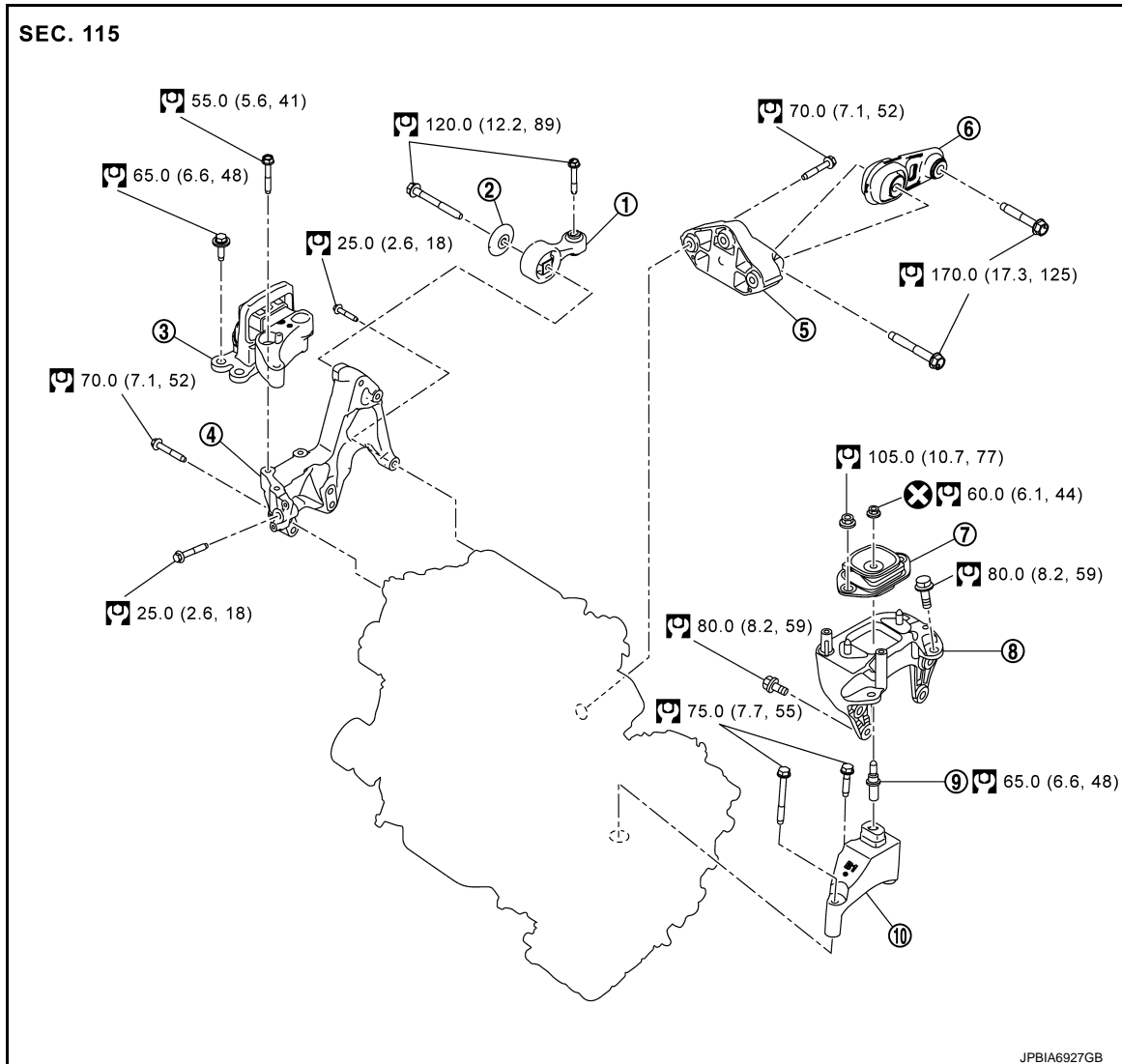
ENGINE ASSEMBLY

Exploded View

INFOID:0000000010784353

EM

M/T models



- | | | |
|----------------------------------|--------------------------------------|----------------------------------|
| ① Upper torque rod | ② Mass damper | ③ Engine mounting insulator (RH) |
| ④ Engine mounting bracket (RH) | ⑤ Rear torque rod bracket | ⑥ Rear torque rod |
| ⑦ Engine mounting insulator (LH) | ⑧ Engine mounting frame support (LH) | ⑨ Stud bolt |
| ⑩ Engine mounting bracket (LH) | | |

: N·m (kg-m, ft-lb)

: Always replace after every disassembly.

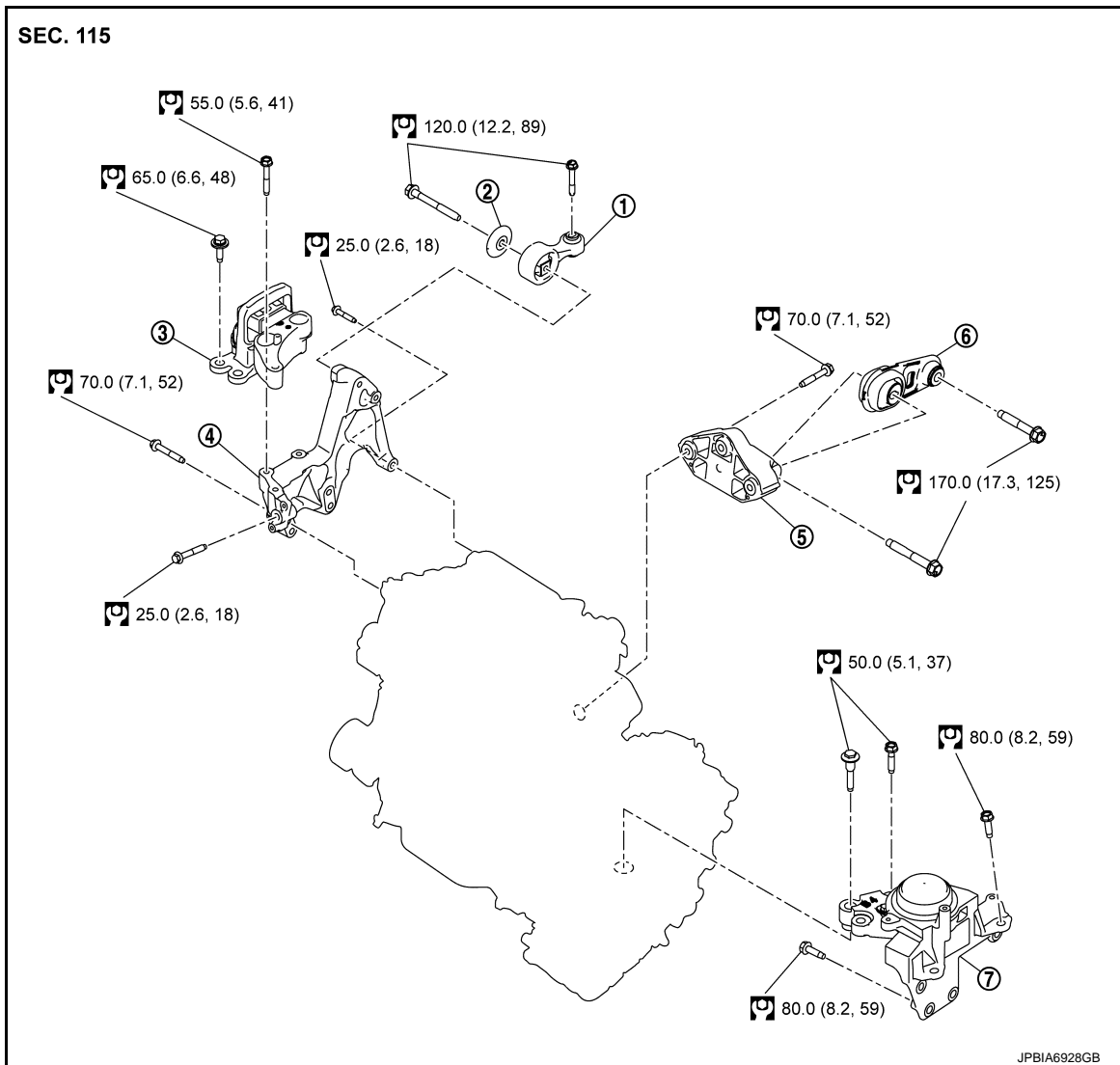
ENGINE ASSEMBLY

< UNIT REMOVAL AND INSTALLATION >

[R9M]


CVT models

SEC. 115



JPBIA6928GB

- | | | |
|----------------------------------|---------------------------|----------------------------------|
| ① Upper torque rod | ② Mass damper | ③ Engine mounting insulator (RH) |
| ④ Engine mounting bracket (RH) | ⑤ Rear torque rod bracket | ⑥ Rear torque rod |
| ⑦ Engine mounting insulator (LH) | | |

 : N·m (kg-m, ft-lb)

Removal and Installation

INFOID:000000010784354

WARNING:

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

CAUTION:

- Always be careful to work safely, avoid forceful or uninstructed operations.
- Never start working until exhaust system and 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 best you can. If board-on type is used for unavoidable reasons, support at the rear axle jacking point with a 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-31, "Garage Jack and Safety Stand and 2-Pole Lift"](#).

ENGINE ASSEMBLY

< UNIT REMOVAL AND INSTALLATION >

[R9M]

NOTE:

When removing components such as hoses, tubes / lines, etc., cap or plug openings to prevent fluid from spilling.

REMOVAL

Outline

Remove the engine and the transaxle assembly from the vehicle downward. Separate the engine and the transaxle.

Preparation

1. Drain engine coolant from radiator. Refer to [CO-64, "Draining"](#).

CAUTION:

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

2. Remove the following parts.

- Engine under cover: Refer to [EXT-39, "ENGINE UNDER COVER : Exploded View"](#).
- Road wheels tire (RH and LH): Refer to [WT-61, "Exploded View"](#).
- Front fender protector (RH and LH): Refer to [EXT-35, "FENDER PROTECTOR : Exploded View"](#).
- Cowl top cover and cowl top extension: Refer to [EXT-24, "Exploded View"](#).
- Drive belt: Refer to [EM-300, "Exploded View"](#).
- Battery and battery tray: Refer to [PG-138, "R9M : Exploded View"](#) (Battery) and [PG-143, "R9M : Exploded View"](#) (Battery tray).
- Air inlet tubes and air inlet hoses: Refer to [EM-310, "Exploded View"](#).
- Air duct (inlet) and air duct/air cleaner case assembly: Refer to [EM-308, "Exploded View"](#).
- Radiator hose (upper and lower): Refer to [CO-70, "Exploded View"](#).
- Exhaust front tube: Refer to [EX-17, "Exploded View"](#).

Engine Room LH

1. Remove ECM and bracket. Refer to [EC-1226, "Removal and Installation"](#).
2. Remove harness bracket from engine mounting insulator (LH).
3. Disconnect all connections of engine harness around the engine mounting insulator (LH), and then temporarily secure the engine harness into the engine side.

CAUTION:

Protect connectors using a resin bag against foreign materials during the operation.

4. Disconnect fuel hoses from fuel pump. Refer to [EM-338, "Exploded View"](#).
5. Disconnect heater hoses, and install plugs them to prevent engine coolant from draining.
6. Disconnect shift cable/select cable from transaxle. Refer to [TM-109, "Exploded View"](#) (M/T models) or [TM-670, "Exploded View"](#) (CVT models).
7. Remove ground cable from transaxle side.
8. Disconnect vacuum hose from brake booster.

Engine Room RH

1. Remove ground cable.
2. Disconnect reservoir tank hose (lower).
3. Remove alternator. Refer to [CHG-26, "R9M : Exploded View"](#).
4. Remove A/C compressor with piping connected from the engine. Temporarily secure it on the vehicle side with a rope to avoid putting load on it. Refer to [HA-167, "Exploded View"](#) (For RUSSIA) or [HA-30, "Exploded View"](#) (Except for RUSSIA).

Vehicle Underbody

1. Disconnect water hoses (to thermoplunger). Refer to [CO-79, "Exploded View"](#).
2. Remove front wheel sensor (LH and RH) for ABS from steering knuckle. Refer to [BRC-212, "FRONT WHEEL SENSOR : Exploded View"](#).
3. Remove brake caliper assembly with piping connected from steering knuckle. Temporarily secure it on the vehicle side with a rope to avoid load on it. Refer to the following table.

ENGINE ASSEMBLY

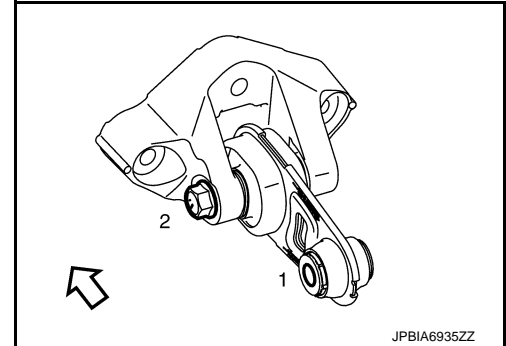
< UNIT REMOVAL AND INSTALLATION >

[R9M]

Handle	Brake caliper assembly	Reference
LHD	1 piston type	BR-50, "BRAKE CALIPER ASSEMBLY (1 PISTON TYPE) : Exploded View"
	2 piston type	BR-55, "BRAKE CALIPER ASSEMBLY (2 PISTON TYPE) : Exploded View"
RHD	1 piston type	BR-110, "BRAKE CALIPER ASSEMBLY (1 PISTON TYPE) : Exploded View"
	2 piston type	BR-115, "BRAKE CALIPER ASSEMBLY (2 PISTON TYPE) : Exploded View"

- Remove rear torque rod.
 - Loosen the mounting bolts as shown in the figure.

↩ : Vehicle front



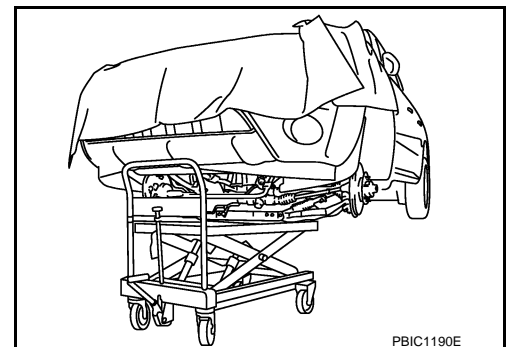
- Remove propeller shaft (4WD models). Refer to [DLN-214, "Exploded View"](#).
- Remove drive shaft (LH and RH). Refer to [FAX-48, "R9M : Exploded View"](#) (2WD models) or [FAX-124, "R9M : Exploded View"](#) (4WD models).
- Remove stabilizer connecting rod mounting nut and cap at strut side (RH and LH). Refer to [FSU-19, "Exploded View"](#).
- Disconnect steering shaft to steering gear assembly. Refer to [ST-17, "Exploded View"](#).
- Disconnect clutch pipe. Refer to [CL-26, "Exploded View"](#). (M/T models)
- Remove front suspension member. Refer to [FSU-22, "Exploded View"](#).
- Preparation for the separation work of transaxle is as follows:
 - Remove transaxle joint bolts which pierce at oil pan (upper) lower rear side.

Removal

- Use a manual lift table caddy (commercial service tool) or equivalently rigid tool such as a transmission jack. Securely support bottom of the engine and the transaxle assembly.

CAUTION:

When using the jack, apply a piece of wood to the oil pan (lower) mounting bolt to protect the bottom of engine from being scratched.



- Remove upper torque rod bolt (RH).

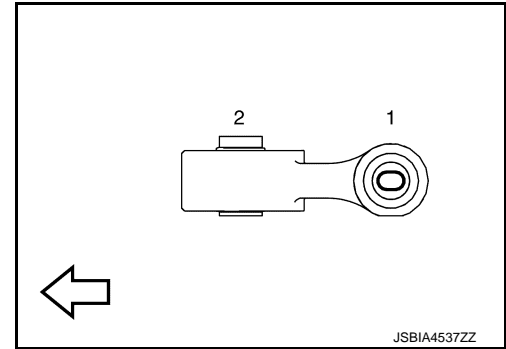
ENGINE ASSEMBLY

< UNIT REMOVAL AND INSTALLATION >

[R9M]

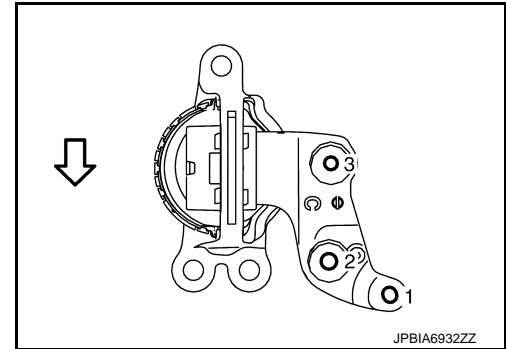
- Loosen the mounting bolt as shown in the figure.

← : Vehicle front



- Remove engine mounting insulator bolts (RH).
 - Loosen the mounting bolts in the reverse order as shown in the figure.

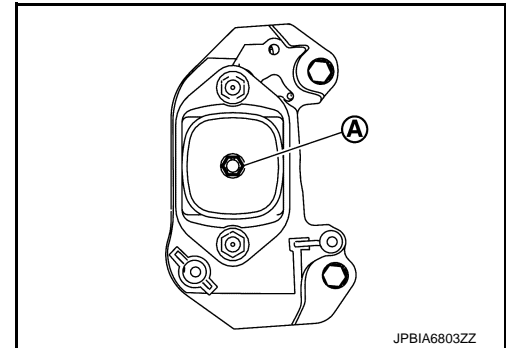
← : Vehicle front



- Separate engine mount (LH).

M/T models

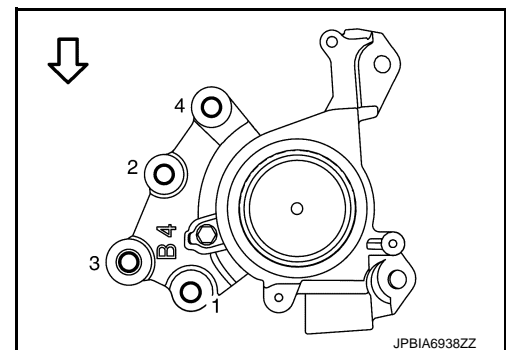
- Remove mounting nut ① on engine mounting insulator (LH).



CVT models

- Remove mounting bolts on engine mounting insulator (LH).
- Loosen the mounting bolts in the reverse order as shown in the figure.

← : Vehicle front



- Carefully lower jack, or raise lift to remove the engine and the transaxle assembly. When performing work, observe the following caution.

CAUTION:

- Check that no part interferes with the vehicle side.
- Before and during this lifting, always check if any harnesses are left connected.

ENGINE ASSEMBLY

< UNIT REMOVAL AND INSTALLATION >

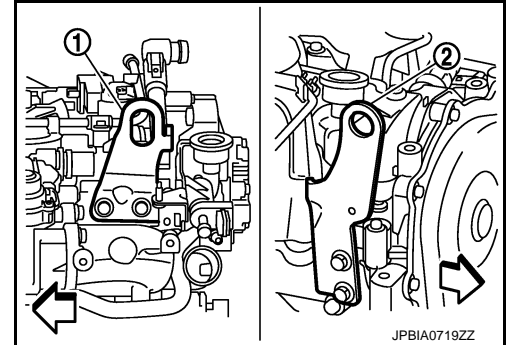
[R9M]

- During the removal, always be careful to prevent the vehicle from falling off the lift due to changes in the center of gravity.
- If necessary, support the vehicle by setting jack or suitable tool at the rear.

Separation

1. Set a hoist to engine slinger (rear side) ① and engine slinger (front side) ②.

⇐ : Engine front



2. Remove starter motor. Refer to [STR-39, "R9M : Exploded View"](#).
3. Lift with a hoist and separate the engine from the transaxle assembly. Refer to [TM-122, "Exploded View"](#) (M/T models) or [TM-704, "Exploded View"](#) (CVT models).

INSTALLATION

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

CAUTION:

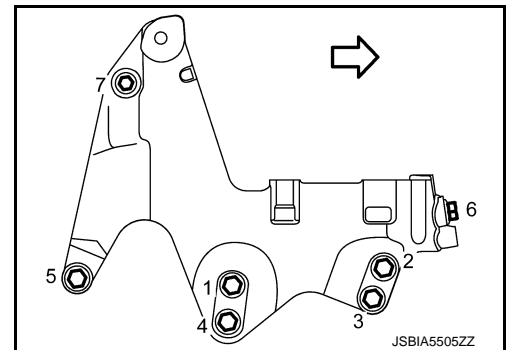
- Never allow engine oil to get on engine mounting insulator. Be careful not to damage engine mounting insulator.
- Check that each mounting insulator is seated properly, and tighten mounting nuts and bolts.

Preparation

Engine mounting bracket (RH)

1. Tighten the bolts No. 1 to 7 as shown in the figure. (specified torque)

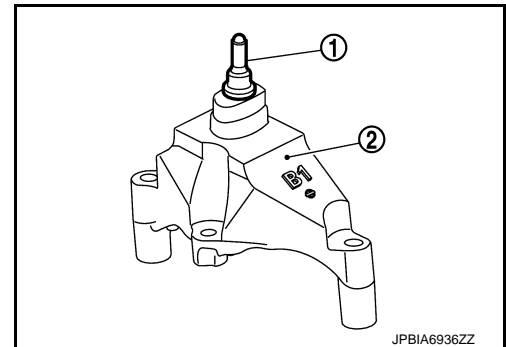
⇐ : Vehicle front



Engine mounting bracket (LH) for M/T models

1. Check that stud bolt ① shown in the figure is tightened to the specified torque.

② : Engine mounting bracket (LH)



Engine mounting bracket support (LH) for M/T models

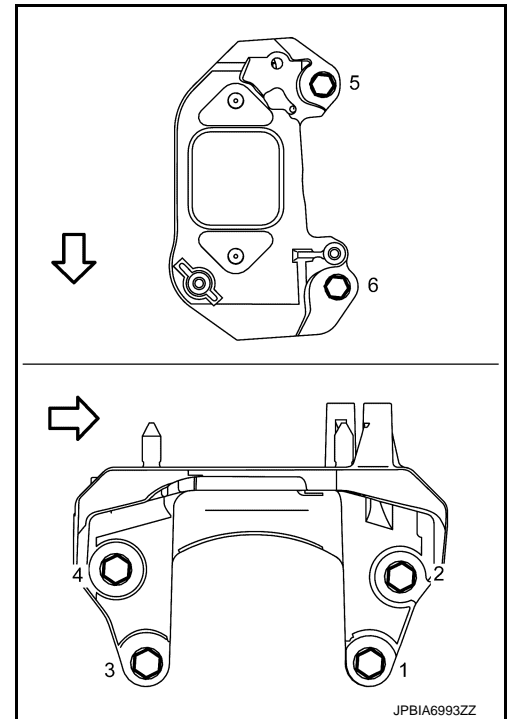
ENGINE ASSEMBLY

< UNIT REMOVAL AND INSTALLATION >

[R9M]

1. Tighten the bolts in order of No. 6 and No. 4 as shown in the figure. (temporarily)
2. Tighten the bolts No. 1 to 6 as shown in the figure. (specified torque)

← : Vehicle front

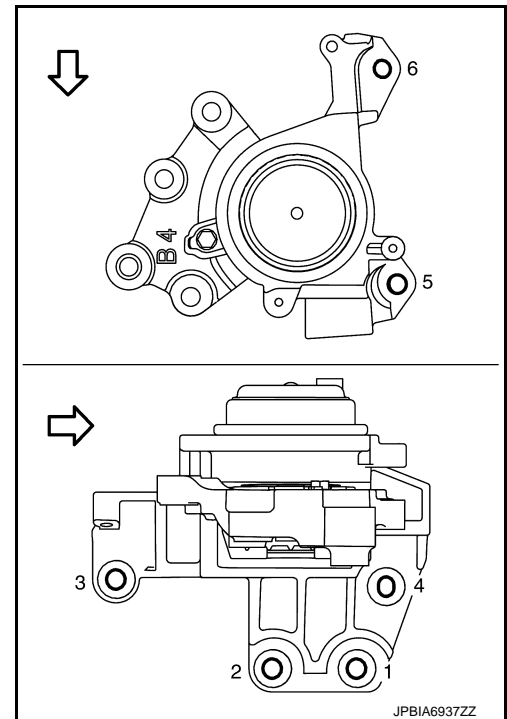


Engine mounting insulator (LH) for CVT models

1. Tighten the bolt in order of No. 6 and No. 3 as shown in the figure. (temporarily)

← : Vehicle front

2. Tighten the bolts in order of No. 1 to 6 as shown in the figure. (specified torque)



Engine mounting insulator (RH)

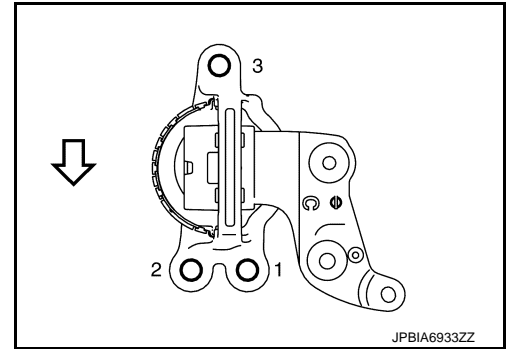
ENGINE ASSEMBLY

< UNIT REMOVAL AND INSTALLATION >

[R9M]

1. Tighten the bolt as shown in the figure. (temporarily)

↩ : Vehicle front

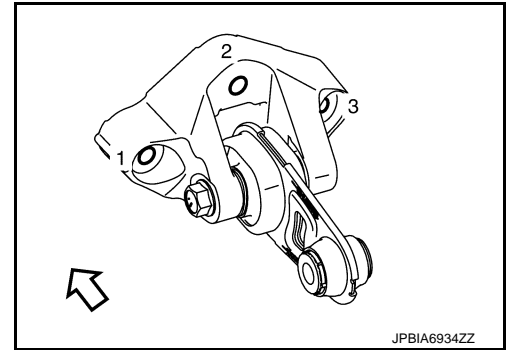


Rear torque rod bracket

1. Tighten the bolts in order of No. 1 to 3 as shown in the figure. (temporarily)

↩ : Vehicle front

2. Tighten the bolt as shown in the figure. (specified torque)

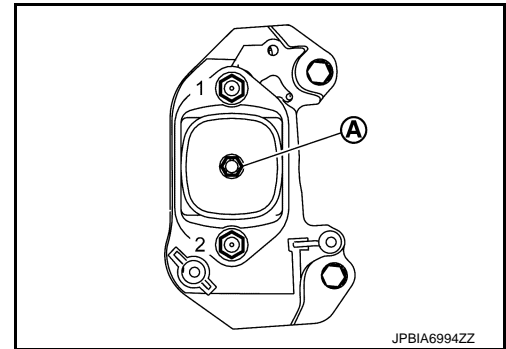


Installation

1. Install engine mount (LH).

M/T models

1. Tighten the nuts in order of No. 1 to 2 as shown in the figure. (temporarily)
2. Tighten the nut ① on engine mounting insulator (LH). (specified torque)
3. Tighten the nuts in order of No. 1 to 2 as shown in the figure after removing the jack. (specified torque)

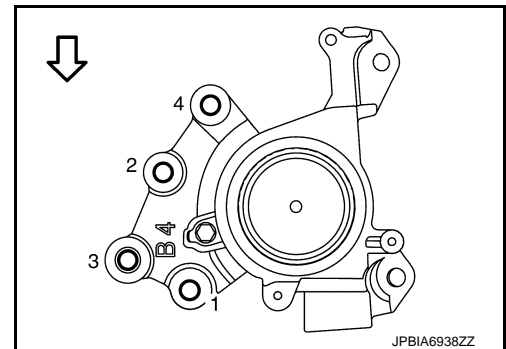


CVT models

1. Tighten the bolt in order of No. 3 and 4 to shown in the figure (temporarily).

↩ : Vehicle front

2. Tighten the bolt shown in the figure (specified torque).



2. Install the engine mounting insulator bolts (RH) as follows:

ENGINE ASSEMBLY

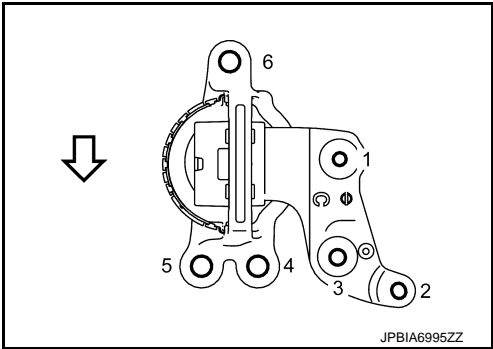
< UNIT REMOVAL AND INSTALLATION >

[R9M]

- a. Tighten the bolts in order of No. 1 to 3 as shown in the figure.
(specified torque)

← : Vehicle front

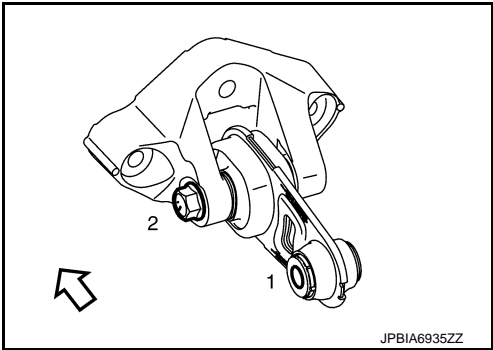
- b. Tighten the bolts in order of No. 4 to 6 as shown in the figure
after removing the jack. (specified torque)



3. Install the rear torque bolts as follows:

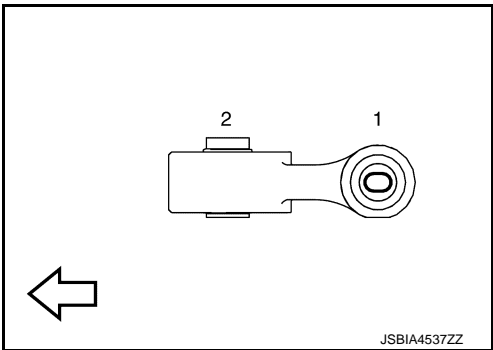
- a. Tighten the bolts as shown in the figure (specified torque).

← : Vehicle front



4. Install the upper torque rod bolt (RH).
• Tighten the bolts in order of No. 2 to 1 as shown in the figure.
(specified torque)

← : Vehicle front



Inspection

INFOID:0000000010784355

INSPECTION AFTER INSTALLATION

Inspection for Leaks

- 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-23. "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.
- Warm up engine thoroughly to make sure there is no leakage of fuel, exhaust gases, 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 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

ENGINE ASSEMBLY

< UNIT REMOVAL AND INSTALLATION >

[R9M]

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:0000000010784356

EM

NOTE:

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

1. Remove the engine and the transaxle assembly from the vehicle, and separate the transaxle from the engine. Refer to [EM-365, "Exploded View"](#).
2. Install engine to engine stand with the following procedure:
 - a. Remove flywheel or drive plate. Refer to [EM-376, "Exploded View"](#) (M/T models) or [EM-378, "Exploded View"](#) (CVT models).
 - b. Lift the engine with a hoist to install it onto widely use engine stand.

CAUTION:

Use the engine stand that has a load capacity [approximately 225 kg (496 lb) or more] large enough for supporting the engine weight.

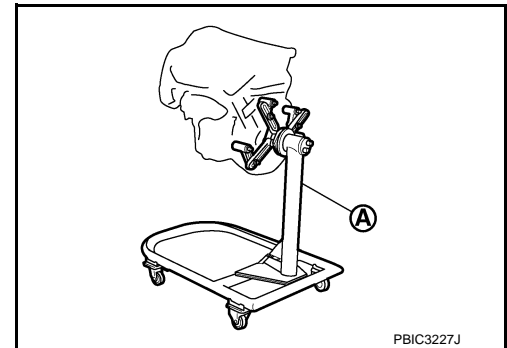
- If the load capacity of stand is not adequate, remove the following parts beforehand to reduce the potential risk of overturning stand.
 - Intake manifold: Refer to [EM-313, "Exploded View"](#).
 - Exhaust manifold: Refer to [EM-328, "Exploded View"](#).
 - Oil separator: Refer to [EM-336, "Exploded View"](#).

NOTE:

The figure shows an example of widely used engine stand (A) that can support mating surface of transaxle with flywheel removed.

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-39, "Draining"](#).

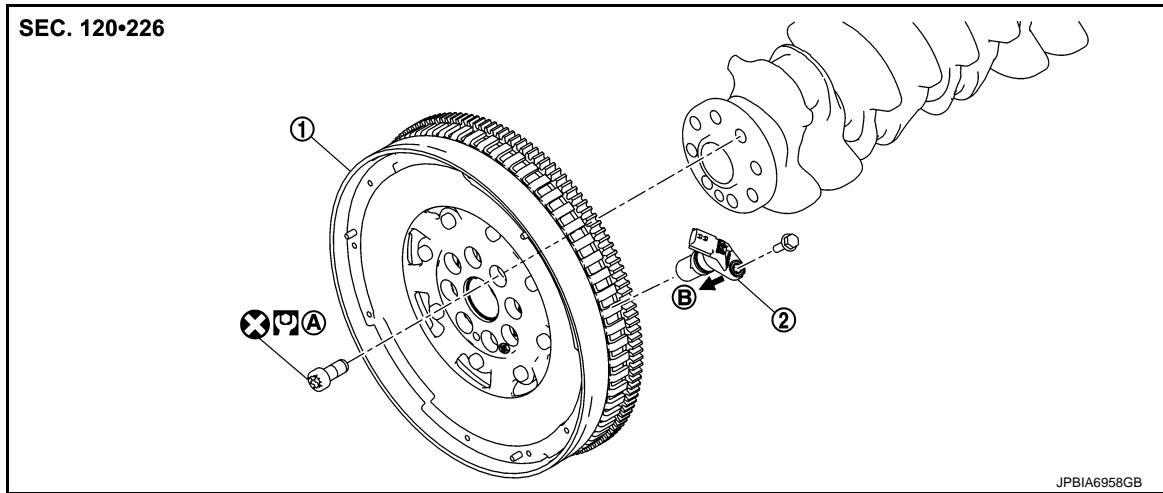
CAUTION:

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

FLYWHEEL

Exploded View

INFOID:0000000011006377



- ① Flywheel ② Crankshaft position sensor
Ⓐ Comply with the installation proce- Ⓑ To M/T

 : N·m (kg-m, ft-lb)

 : Always replace after every disassembly.

Removal and Installation

INFOID:0000000011006378

REMOVAL

1. Remove the engine and the transaxle assembly from the vehicle, and separate the transaxle from the engine. Refer to [EM-365, "Exploded View"](#).
2. Remove clutch cover and clutch disk. Refer to [CL-35, "R9M : Exploded View"](#).
3. Remove flywheel.
 - Secure crankshaft using a crankshaft pulley locking tool [SST: — (Mot.1770)], and remove mounting bolts.

CAUTION:

- **Never disassemble them.**
- **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.**

INSTALLATION

CAUTION:

Never damage or scratch and contact surface for clutch disc of flywheel.

FLYWHEEL

< UNIT DISASSEMBLY AND ASSEMBLY >

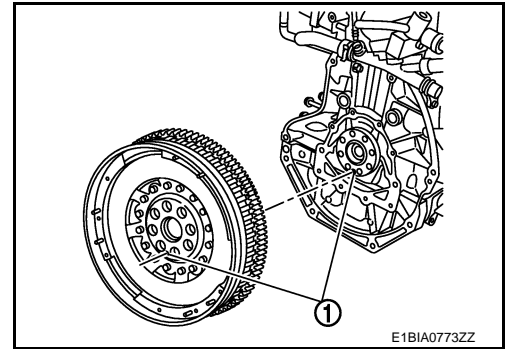
[R9M]

1. Install flywheel by aligning the mark ①.

NOTE:

The openings of the flywheel bolts must be aligned.

- a. Install bolts without tightening them.
- b. Fix flywheel using flywheel locking tool [SST: — (Mot.1431)].

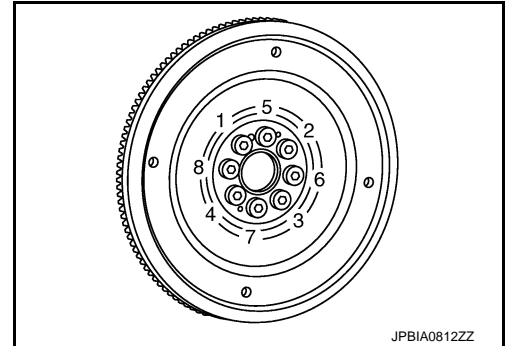


- c. Tighten bolts in numerical order as shown in the figure with the following procedure:
 - i. Tighten mounting bolts.



: 40.0 N·m (4.1 kg-m, 30 ft-lb)

- ii. Turn 50 degrees clockwise (angle tightening).



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DRIVE PLATE

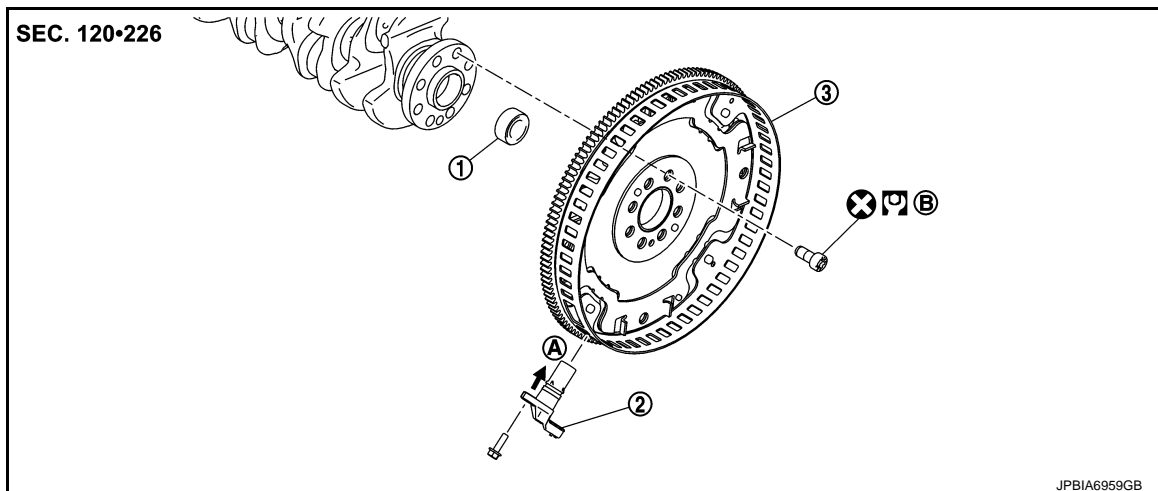
< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

DRIVE PLATE

Exploded View

INFOID:0000000011006380



- ① Pilot bushing ② Crankshaft position sensor ③ Drive plate

Ⓐ To CVT

Ⓑ Comply with the installation procedure when tightening. Refer to [EM-378, "Removal and Installation"](#).

⊗ : Always replace after every disassembly.

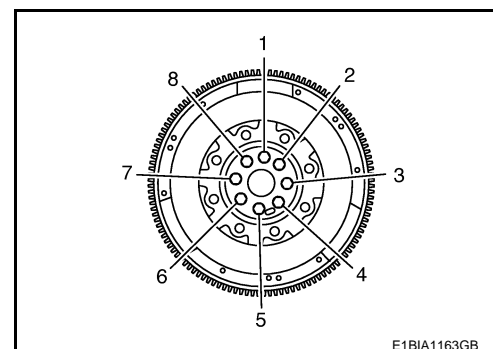
Ⓢ : N·m (kg-m, ft-lb)

Removal and Installation

INFOID:0000000011006381

REMOVAL

1. Remove the engine and the transaxle assembly from the vehicle, and separate the transaxle from the engine. Refer to [EM-365, "Exploded View"](#).
2. Remove drive plate.
CAUTION:
 - **Never disassemble them.**
- a. Fix drive plate using flywheel locking tool [SST: — (Mot.1431)].
- b. Loosen bolts in reverse order as shown in the figure with the following procedure:
3. Remove pilot bushing using the pilot bushing puller (commercial service tool), if necessary.



INSTALLATION

1. Install pilot bushing.
 - Using the drift, force fit the pilot bushing until its front end contacts crankshaft.
2. Install drive plate.
 - a. Install bolts without tightening them.
 - b. Fix drive plate using flywheel locking tool [SST: — (Mot.1431)].

DRIVE PLATE

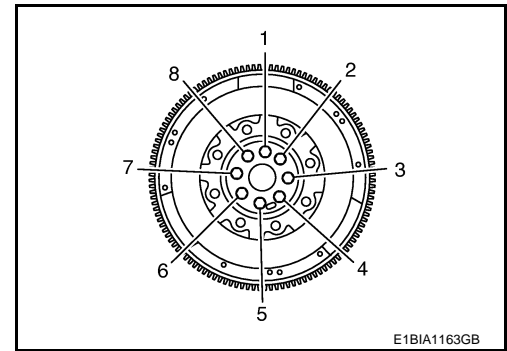
< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

- c. Tighten bolts in numerical order as shown in the figure with the following procedure:
- i. Tighten mounting bolts.



: 50.0 N·m (5.1 kg-m, 37 ft-lb)



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OIL PAN (UPPER)

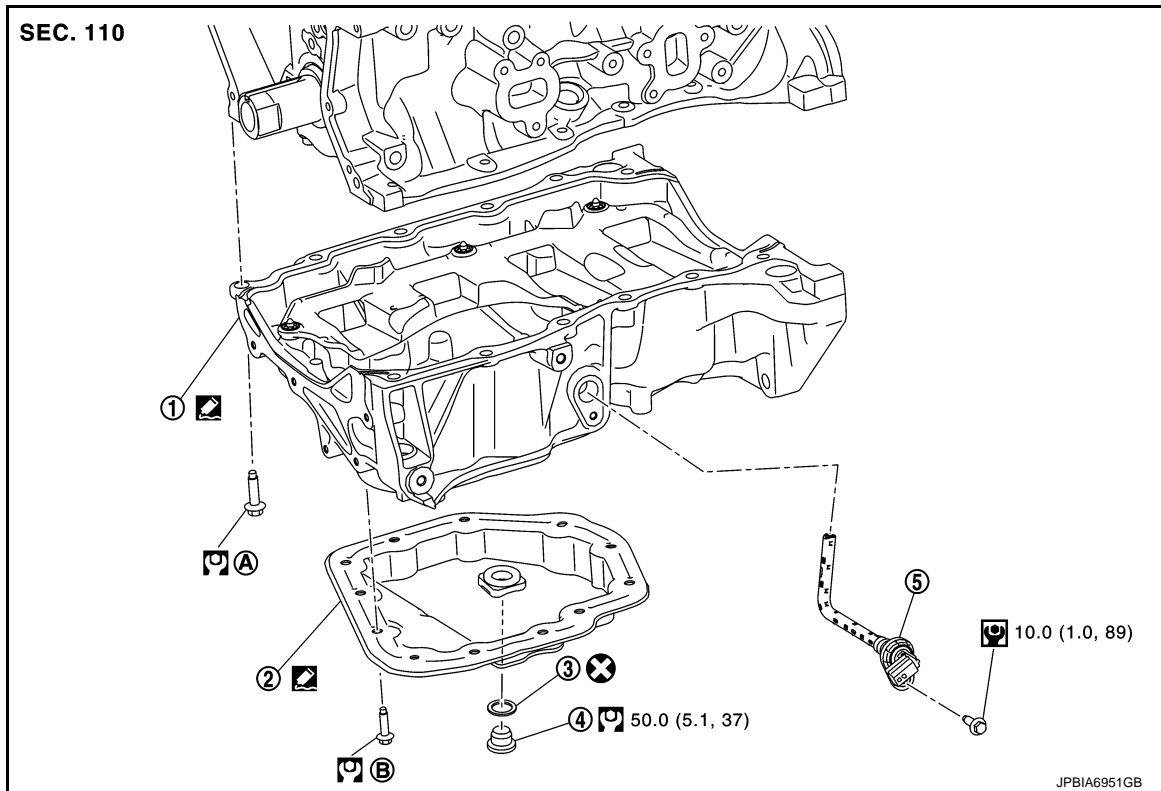
< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

OIL PAN (UPPER)

Exploded View

INFOID:0000000011006384



- | | | |
|---|---|---------------------|
| ① Oil pan (upper) | ② Oil pan (lower) | ③ Drain plug washer |
| ④ Oil pan drain plug | ⑤ Oil level sensor | |
| Ⓐ Comply with the installation procedure when tightening. Refer to EM-380. "Removal and Installation" | Ⓑ Comply with the installation procedure when tightening. Refer to EM-330. "Removal and Installation" | |

: N·m (kg-m, ft-lb)

: N·m (kg-m, in-lb)

: Always replace after every disassembly.

: Sealing point

Removal and Installation

INFOID:0000000010784360

REMOVAL

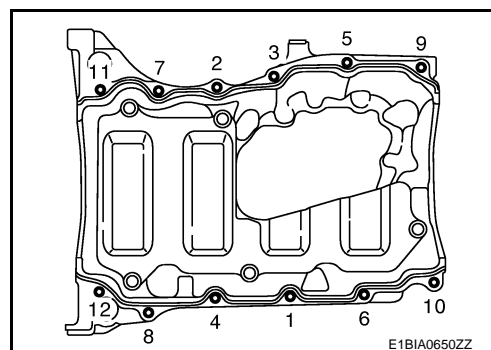
1. Remove oil pan (lower). Refer to [EM-330. "Exploded View"](#).
2. Remove oil strainer and oil pump. Refer to [LU-44. "Exploded View"](#).
3. Remove rear oil seal retainer. Refer to [EM-389. "Exploded View"](#).
4. Remove oil pan (upper) with the following procedure:

OIL PAN (UPPER)

< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

- a. Loosen mounting bolts in reverse order as shown in the figure.



- b. Set two stud bolts (A), two washers (B) and two nuts (C) in place of the oil pan (upper) mounting bolts.

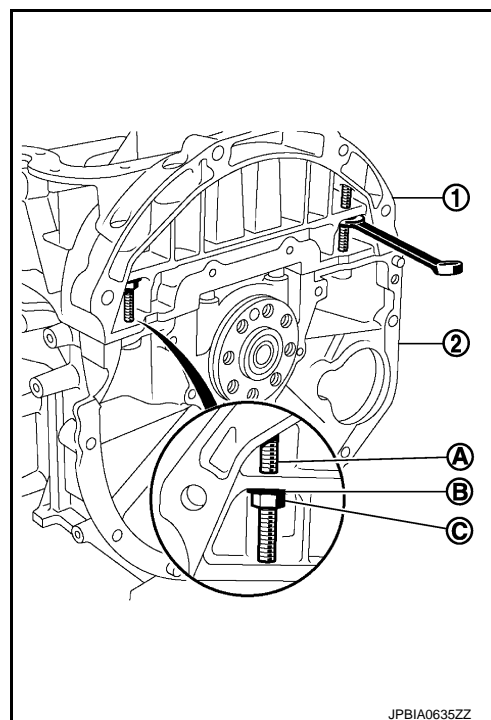
① : Oil pan (upper)

② : Cylinder block

NOTE:

Use M8 × 90 mm (3.54 in) long stud bolt.

- c. Detach the oil pan (upper) from the cylinder block by gradually tightening the nuts. Remove oil pan (upper).



5. Remove oil pump related parts.

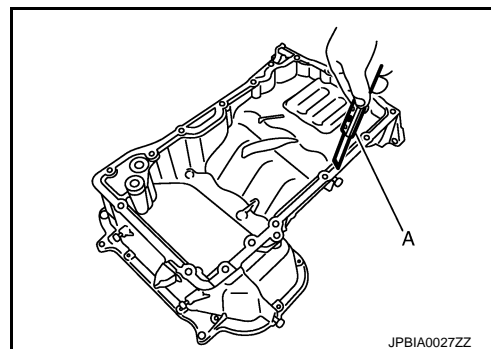
INSTALLATION

1. Install oil pump. Refer to [LU-44, "Exploded View"](#).
2. Install oil pan (upper) with the following procedure:
 - 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 cylinder block.
- Remove old liquid gasket from the bolt holes and threads.



OIL PAN (UPPER)

< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

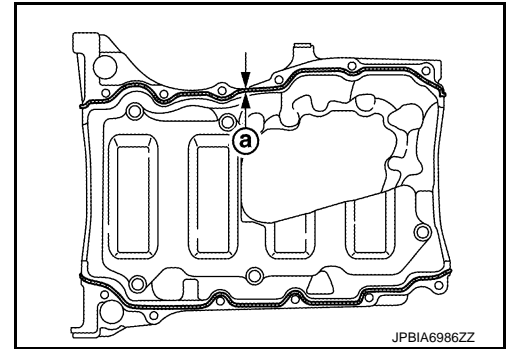
- b. Apply a continuous bead of liquid gasket with the tube presser (commercial service tool) to areas shown in the figure.

(a) : $\phi 3.0 - 7.0$ mm (0.118 - 0.276 in)

Use Genuine Liquid Gasket or equivalent

CAUTION:

- At the bolt holes marked, liquid gasket should be applied inside holes.
- Attaching should be done within 5 minutes after coating.



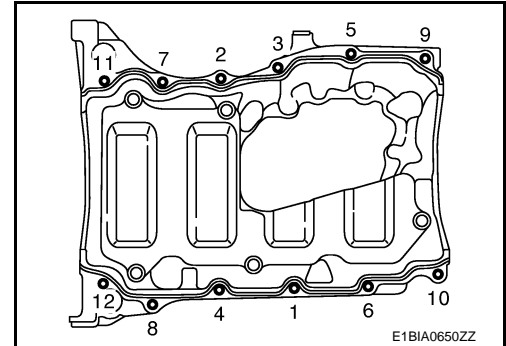
- c. Tighten mounting bolts in two steps separately in numerical order as shown in the figure.



1st step: 10.0 N·m (1.0 kg-m, 89 in-lb)



2nd step: 25.0 N·m (2.6 kg-m, 18 ft-lb)



3. Install rear oil seal retainer. Refer to [EM-389, "Exploded View"](#).
4. Install in the reverse order of removal, for the rest of parts.

NOTE:

At least 30 minutes after oil pan is installed, pour engine oil.

CYLINDER HEAD

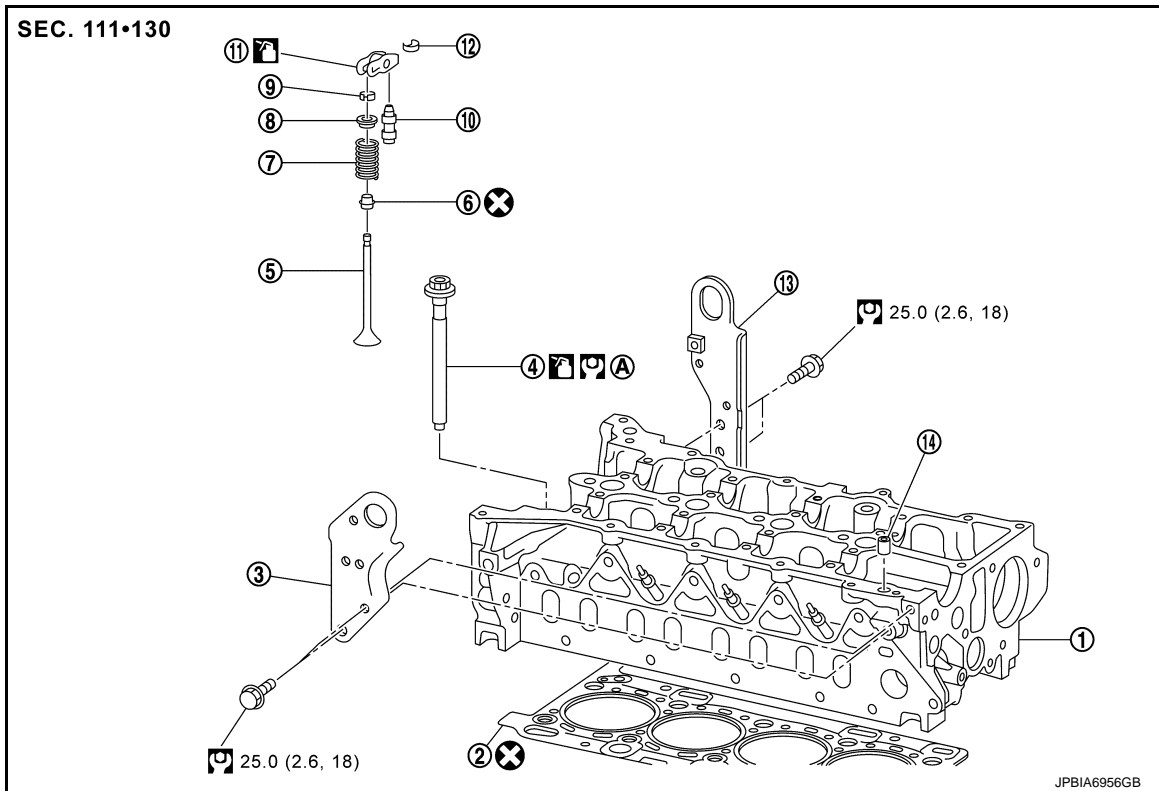
< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

CYLINDER HEAD

Exploded View

INFOID:0000000010784361



- | | | |
|----------------------|-------------------------|----------------------|
| ① Cylinder head | ② Cylinder head gasket | ③ Engine slinger |
| ④ Cylinder head bolt | ⑤ Valve | ⑥ Valve oil seal |
| ⑦ Valve spring | ⑧ Valve spring retainer | ⑨ Valve collet |
| ⑩ Tappet | ⑪ Hydraulic tappet | ⑫ Valve rocker clips |
| ⑬ Engine slinger | ⑭ Bush | |

Comply with the assembly procedure when tightening. Refer to [EM-390, "Disassembly and Assembly"](#)

: N·m (kg-m, ft-lb)

: Always replace after every disassembly.

: Should be lubricated with oil.

Removal and Installation

INFOID:0000000011006818

REMOVAL

1. Remove the following components and related parts.
 - Intake manifold: Refer to [EM-313, "Exploded View"](#).
 - Turbocharger: Refer to [EM-325, "Exploded View"](#).
 - Exhaust manifold: Refer to [EM-328, "Exploded View"](#).
 - Water inlet and water outlet: Refer to [CO-81, "Exploded View"](#).
 - Front cover, timing chain: Refer to [EM-346, "Exploded View"](#).
 - Camshaft: Refer to [EM-357, "Exploded View"](#)

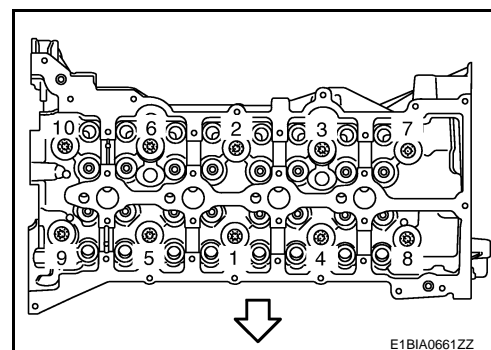
CYLINDER HEAD

[R9M]

< UNIT DISASSEMBLY AND ASSEMBLY >

2. Remove cylinder head.
 - Loosen mounting bolts in reverse order as shown in the figure.

⇐ : Vehicle front



3. Remove cylinder head gasket.

INSTALLATION

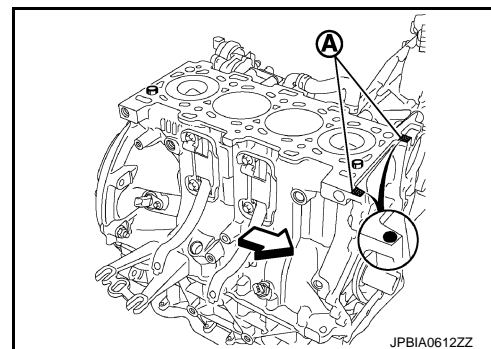
1. Install cylinder head gasket with the following procedure:

CAUTION:
Before installing cylinder head, inspect piston protrusion.

 - a. Apply liquid gasket to position ① shown in the figure.

⇐ : Engine front

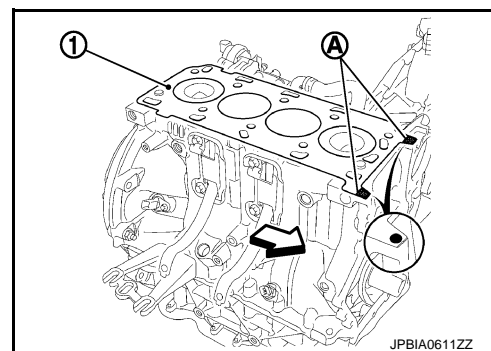
Use Genuine Liquid Gasket or equivalent.



- b. Install cylinder head gasket ①, and apply liquid gasket to position ① shown in the figure.

⇐ : Engine front

Use Genuine Liquid Gasket or equivalent.



2. Install cylinder head, and tighten mounting bolts in numerical order as shown in figure with the following procedure:

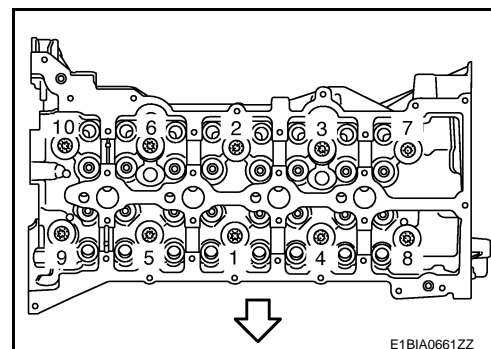
⇐ : Vehicle front

- a. Tighten all bolts.

 : 5.0 N·m (0.51 kg-m, 44 in-lb)

- b. Tighten all bolts.

 : 30.0 N·m (3.1 kg-m, 22 ft-lb)



CYLINDER HEAD

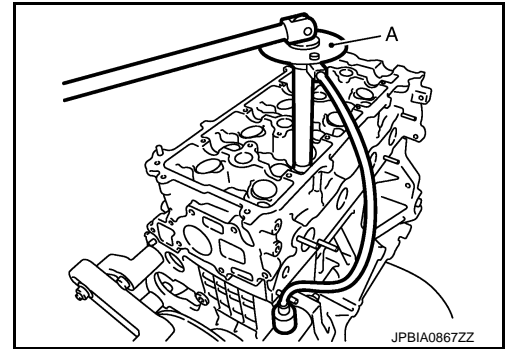
< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

- c. Turn all bolts 300 degrees clockwise (angle tightening).

CAUTION:

Check and confirm the tightening angle by using an angle wrench [SST: KV10112100 (—)] (A) or protractor. Never judge by visual inspection without the tool.



3. Assemble in the reverse order of disassembly, for the rest of parts.

Disassembly and Assembly

INFOID:000000010784362

DISASSEMBLY

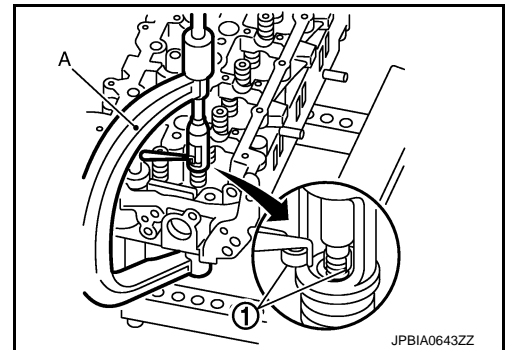
1. Set the cylinder head assembly to the cylinder head support [commercial service tool: KV113B0200 (Mot.1573)].

2. Remove hydraulic tappet.

CAUTION:

Be sure to immerse the hydraulic tappets in a bath of engine oil to ensure no air enters.

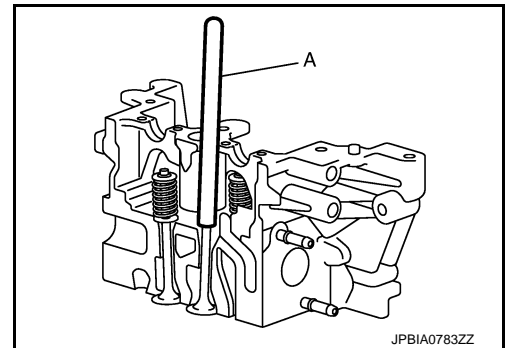
3. Remove valve collet ①.
• Compress valve spring with valve spring compressor (commercial service too) (A).



4. Remove valve spring retainer and valve spring.
5. Check dimension of valve oil seal mounting position before removing valve and valve oil seal with the following procedure:
a. Install the push rod (A) of valve seal drift [commercial service tool: KV113B0180 (Mot.1511-01)] on the valve oil seal.

NOTE:

The inner diameter of the push rod must be identical to that of the valve. In addition, the bottom of the push rod must come into contact with the metal upper section of the valve oil seal.

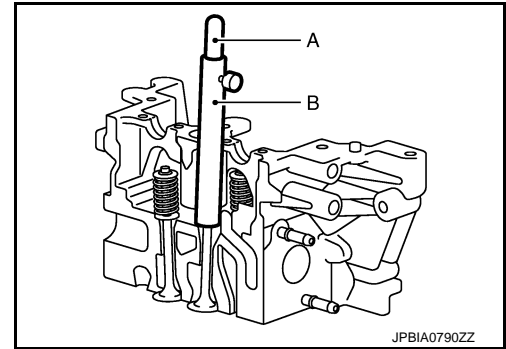


CYLINDER HEAD

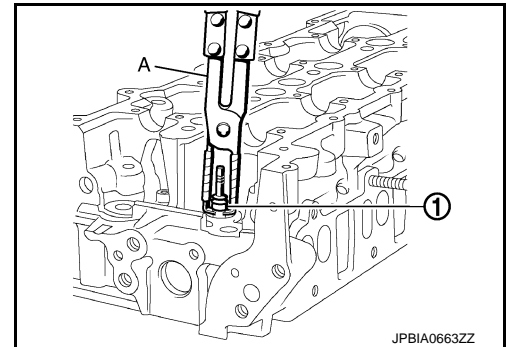
< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

- b. Install the guide tube (B) over the push rod (A) until the guide tube comes into contact with the cylinder head, locking the push rod with the knurled wheel.
- Remove the guide tube assembly plus push rod, being careful not to loosen the knurled wheel.

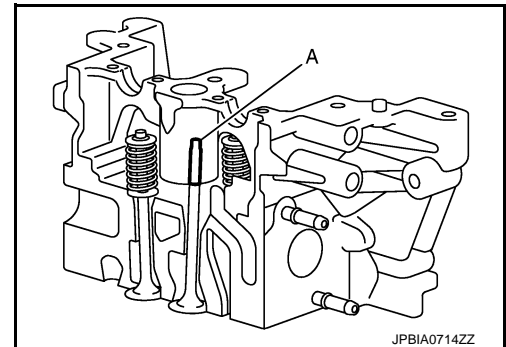


6. Push valve stem to combustion chamber side, and remove valve.
- Identify installation positions, and store them without mixing them up.
7. Remove valve oil seal ① with a valve oil seal puller [commercial service tool: KV113B0090 (Mot.1335)] (A).



ASSEMBLY

1. Install valve.
- NOTE:**
Install larger diameter to intake side.
2. Install valve oil seal with the following procedure:
- a. Position the protector (A) of valve seal drift [commercial service tool: KV113B0180 (Mot.1511-01)] on the valve.

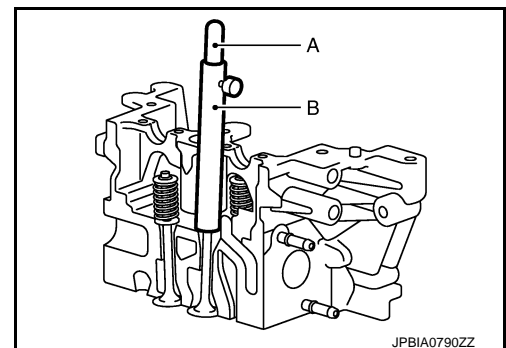


- b. Position a valve oil seal on the protector. Move the valve oil seal past the protector.

CAUTION:

Never lubricate valve oil seal.

- c. Remove the protector.
- d. Push in the push rod (A) of valve seal drift [commercial service tool: KV113B0180 (Mot. 1511-01)] with palm of the hand until the guide tube (B) makes contact with the cylinder head.

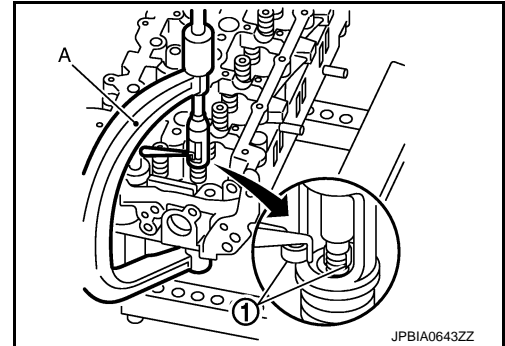


CYLINDER HEAD

< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

3. Install valve spring.
NOTE:
The intake and exhaust valve springs are identical.
4. Install valve spring retainer.
5. Install valve collet ①.
 - Compress valve spring with a valve spring compressor (commercial service tool) (A).
 - Tap valve stem edge lightly with a plastic hammer after installation to check its installed condition.



6. Install hydraulic tappet.
 - Check that the tappets are filled with oil before refitting them.

Inspection

INFOID:0000000010784363

INSPECTION AFTER DISASSEMBLY

Cylinder Head Distortion

NOTE:

When performing this inspection, cylinder block distortion should be also checked.

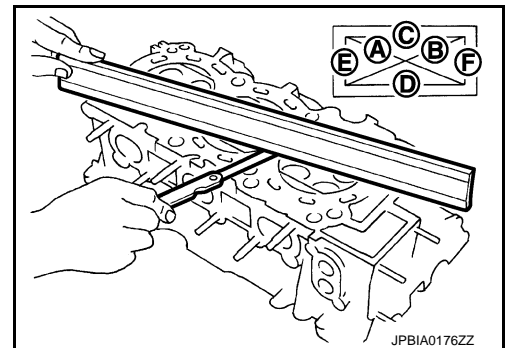
1. Wipe off engine oil and remove water scale (like deposit), gasket, sealant, carbon, etc. with a scraper.
CAUTION:
Never allow gasket debris to enter passages for engine oil or water.
2. At each of several locations on bottom surface of cylinder head, measure the distortion in six directions (A - F).

Standard: Refer to [EM-415, "Cylinder Head"](#).

- If it exceeds the standard, replace cylinder head and cylinder head housing.

NOTE:

Cylinder head cannot be replaced as a single part, because it is machined together with cylinder head housing. Replace whole cylinder head housing and cylinder head assembly.



VALVE DIMENSIONS

- Check the dimensions of each valve. For the dimensions, refer to [EM-415, "Cylinder Head"](#).
- If dimensions are out of the standard, replace valve and check valve seat contact.

VALVE GUIDE CLEARANCE

Valve Stem Diameter

CYLINDER HEAD

< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

- Measure the diameter of valve stem with micrometer (A).

Standard : Refer to [EM-415, "Cylinder Head"](#).

Valve Guide Inner Diameter

- Measure the inner diameter of valve guide with bore gauge.

Standard : Refer to [EM-415, "Cylinder Head"](#).

Valve Guide Clearance

- (Valve guide clearance) = (Valve guide inner diameter) – (Valve stem diameter)

Standard : Refer to [EM-415, "Cylinder Head"](#).

- If it exceeds the standard, replace valve and/or cylinder head and cylinder head housing.

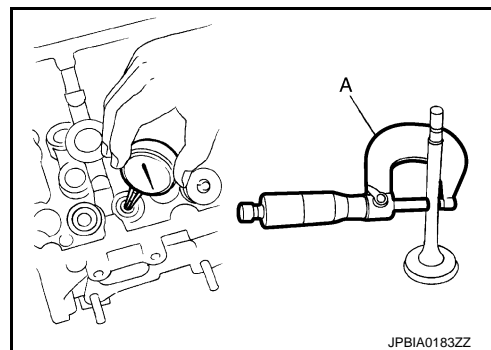
VALVE SEAT CONTACT

- 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.

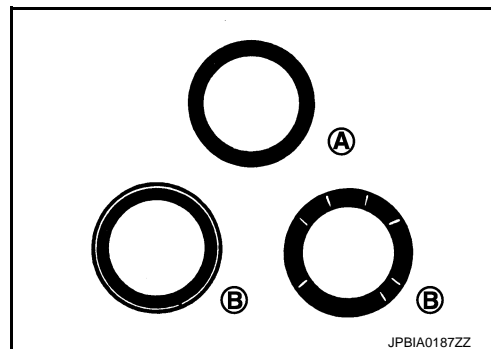
Ⓐ : OK

Ⓑ : NG

- If not, grind to adjust valve fitting and check again. If the contacting surface still has "NG" conditions even after the re-check, replace cylinder head and cylinder head housing.



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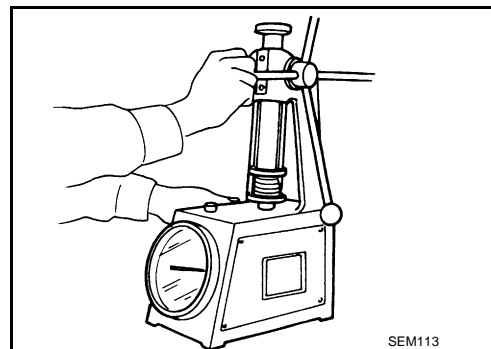
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VALVE SPRING DIMENSIONS AND VALVE SPRING PRESSURE LOAD

- Check valve spring pressure with valve spring seat installed at the specified spring height.

Standard : Refer to [EM-415, "Cylinder Head"](#).

- If the pressure height is out of the standard, replace valve spring.



SEM113

CYLINDER BLOCK

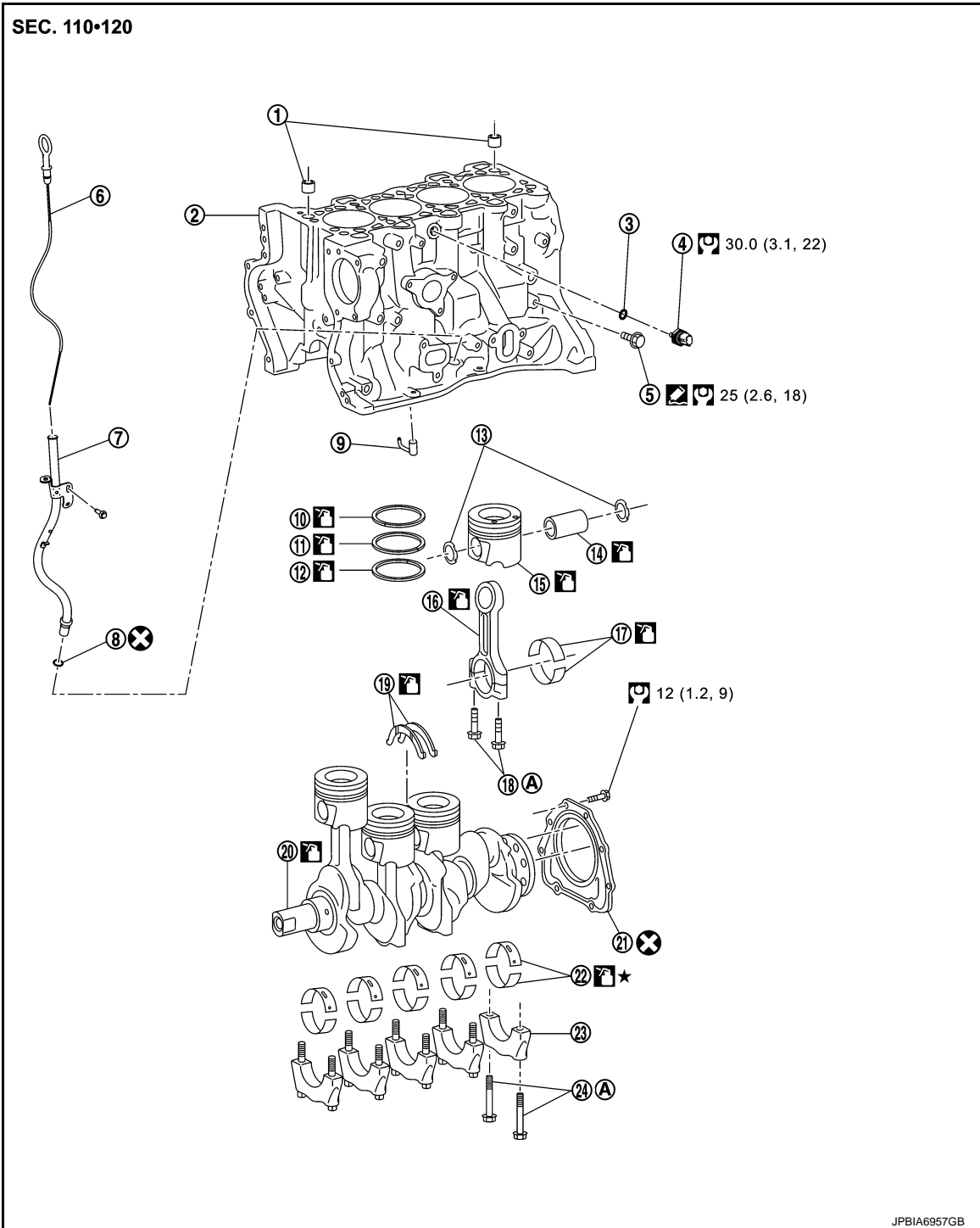
< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

CYLINDER BLOCK

Exploded View

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- | | | |
|-------------------------------------|--------------------------------|-----------------------|
| ① Centering dowel | ② Cylinder block | ③ O-ring |
| ④ Engine coolant temperature sensor | ⑤ TDC hole plug | ⑥ Oil level gauge |
| ⑦ Oil level gauge guide | ⑧ O-ring | ⑨ Oil jet |
| ⑩ Compression ring | ⑪ Sealing ring | ⑫ Scraper ring |
| ⑬ Snap ring | ⑭ Piston pin | ⑮ Piston |
| ⑯ Connecting rod | ⑰ Connecting rod bearing shell | ⑱ Connecting rod bolt |


CYLINDER BLOCK


< UNIT DISASSEMBLY AND ASSEMBLY >


[R9M]


- | | | |
|--|---------------------------|-----------------------------------|
| ①9 Crankshaft thrust washer | ②0 Crankshaft | ②1 Crankshaft seal on gearbox end |
| ②2 Crankshaft bearing shell | ②3 Crankshaft bearing cap | ②4 Crankshaft bearing cap bolt |
| ②5 Engine coolant temperature sensor harness | | |

Comply with the assembly procedure when tightening. Refer to [EM-390, "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

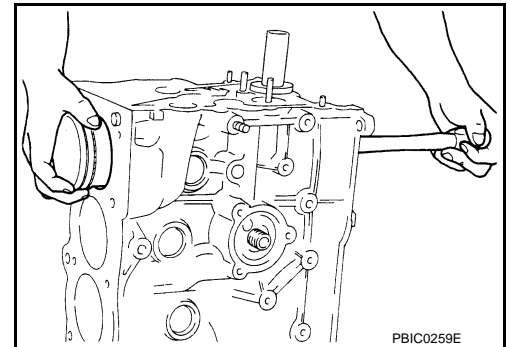
★ : Select with proper thickness.

Disassembly and Assembly

INFOID:0000000010784365

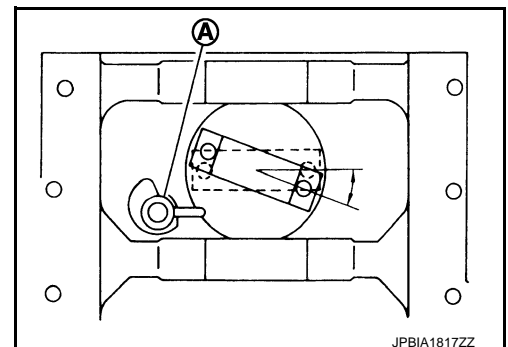
Disassembly

1. Remove rear oil seal retainer. Refer to [EM-363, "REAR OIL SEAL : Removal and Installation"](#).
2. Remove oil pan (upper). Refer to [EM-380, "Exploded View"](#).
3. Remove oil pump related parts. Refer to [LU-44, "Exploded View"](#).
4. 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-401, "Inspection"](#).
- a. Position crankshaft pin corresponding to connecting rod to be removed onto the bottom dead center.
- b. Remove connecting rod cap.
 - Put a paint mark on cap to identify each cylinder.
- c. Using a hammer handle or similar tool, push piston and connecting rod assembly out to the cylinder head side.



CAUTION:

- Be careful not to damage oil jets ①, cylinder wall and crankshaft pin, resulting from an interference of the connecting rod big end.
- Never disassemble oil jets.



5. Remove connecting rod bearing shells.

CAUTION:

CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

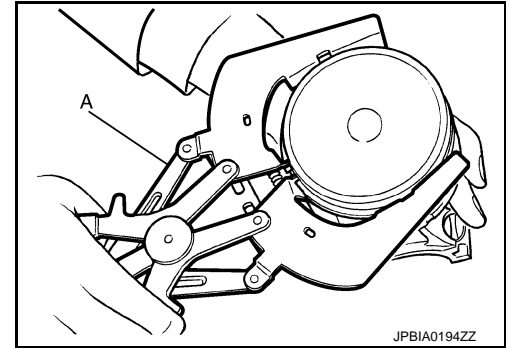
[R9M]

When removing them, note the installation position. Keep them in the correct.

6. Remove piston rings from piston.
- Before removing piston rings, check the piston ring side clearance. Refer to [EM-401. "Inspection"](#).
 - Use a piston ring expander (commercial service tool) (A).

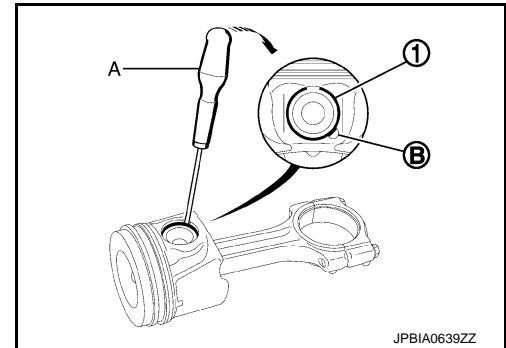
CAUTION:

- When removing piston rings, be careful not to damage the piston.
- Be careful not to damage piston rings by expanding them excessively.



7. Remove the snap rings ① using a screwdriver (A), and then release the piston pin.

Ⓑ : Channel



8. Remove main bearing cap mounting bolts with the following procedure:
- Measure crankshaft end play before loosening main bearing cap mounting bolts. Refer to [EM-401. "Inspection"](#).

a. **NOTE:**

Always mark the position of each crankshaft bearing shell using an indelible marker pen, in relation to the crankshaft bearing number

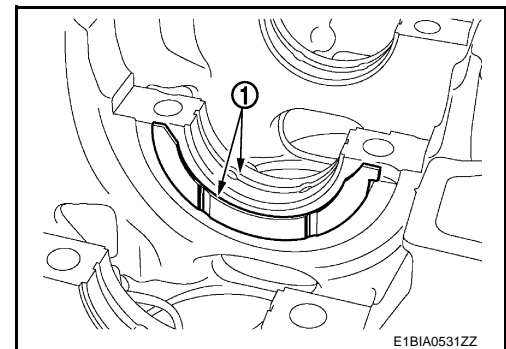
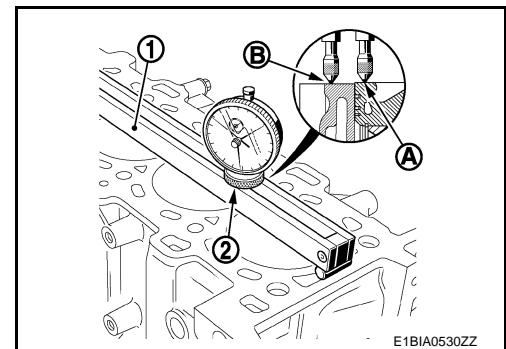
Remove:

- the crankshaft bearing cap bolts,
- the crankshaft bearing caps,
- the crankshaft,
- the crankshaft bearing shells.

NOTE:

Always mark the position of each crankshaft bearing shell using an indelible marker pen, in relation to the crankshaft bearing number

9. Remove the crankshaft thrust washer ①



CYLINDER BLOCK

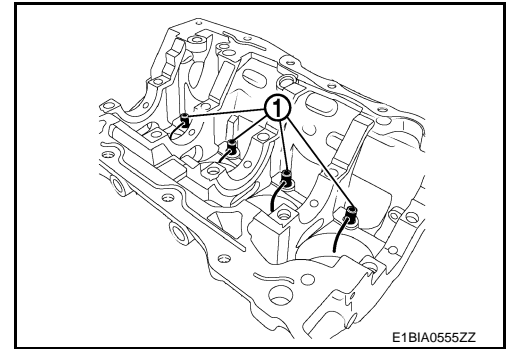
< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

10. Remove oil jets ① following this procedure:

CAUTION:

Wear goggles with side protectors for this operation.

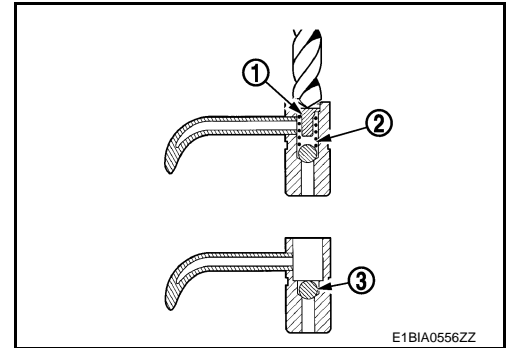


- a. Drill the oil jets using a [7 mm (0.3in)] diameter drill bit.

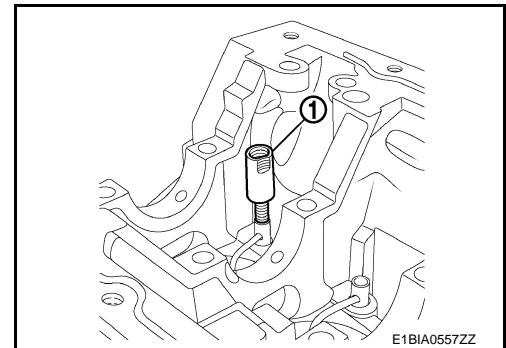
NOTE:

Do not take out the ball from the oil jet, otherwise swarf may enter the lubrication circuit.

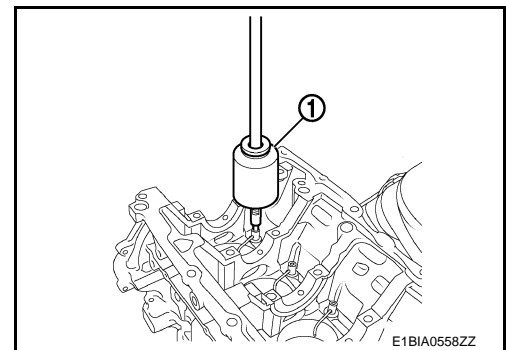
- Remove the spring tappet ① and the springs ② without taking out the ball ③.
- Remove any swarf present with a brush with non abrasive bristles and a compressed air nozzle.



- b. Screw the tool [SST: — (Mot. 1485-01)] ① into the drilled oil jets using a [6 mm (0.2 in)] Allen key, which slides into the tool [SST: — Mot. 1485-01)].



- c. Screw the tool [SST: — (Emb. 880)] ① on the tool [SST: — (Mot. 1485-01)].
- d. Remove the oil jets.
- e. Fit a blanking plug whenever a oil jet is removed.



Assembly

1. Fully air-blow engine coolant and engine oil passages in the cylinder block, cylinder bore and crankcase to remove any foreign matter.

CAUTION:

Use a goggles to protect your eye.

2. Install the new oil jet following procedure:

- a. Remove the blanking plugs.
- b. Use pressurized air and clean cloths to clean the oil circuit, the cylinders and the joint faces to ensure there is no swarf present.

CYLINDER BLOCK

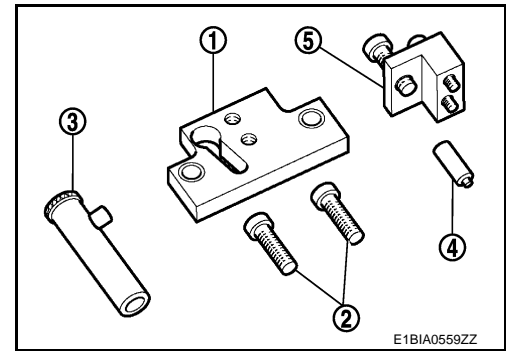
< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

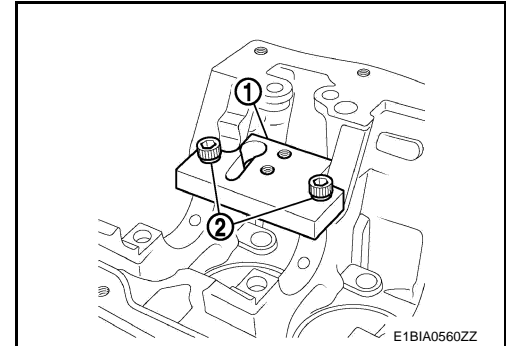
c. Description of the tool [SST: — (Mot. 1972)]

The tool [SST: — (Mot. 1972)] consists of:

- a plate ①,
- a plate bolt ②,
- a pushrod ③,
- an end piece ④,
- a system nut-screw ⑤.

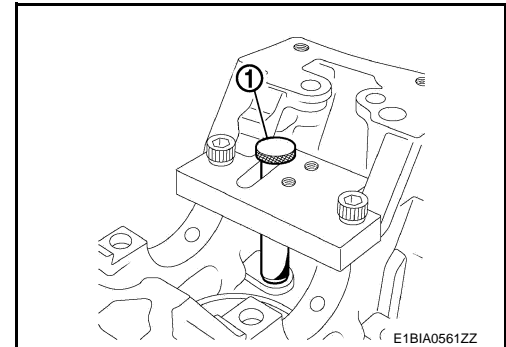


d. Fit the plate ① of the tool [SST: — (Mot. 1972)] on the cylinder block without tighten the bolts ②



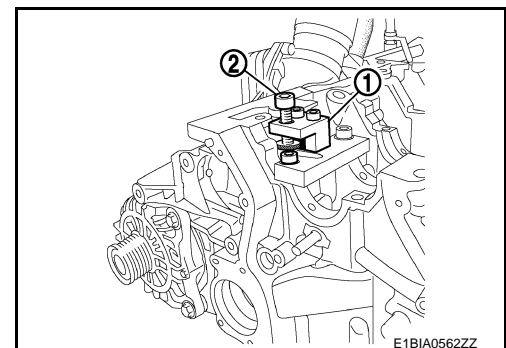
e. Fit the piece of the tool [SST: — (Mot. 1972)] in the push-rod of the tool [SST: — (Mot. 1972)].

- Place the “end piece - pushrod” ① assembly of the tool [SST: — (Mot. 1972)] in the plate to centre the plate above the opening of the oil jet.
- Tighten the plate bolts.
- Remove the “end piece - pushrod” assembly from the plate.



f. Insert the oil jet in the pushrod.

- Place the “pushrod - oil jet” assembly in the plate by presenting the jet in front of its opening.
- Fit the system nut-screw ① on the plate.
- Tighten the bolt ② to has retaining wall of the pushrod on the plate.
- Remove the tool [SST: — (Mot. 1972)].



3. Install main bearings and thrust bearings with the following procedure:

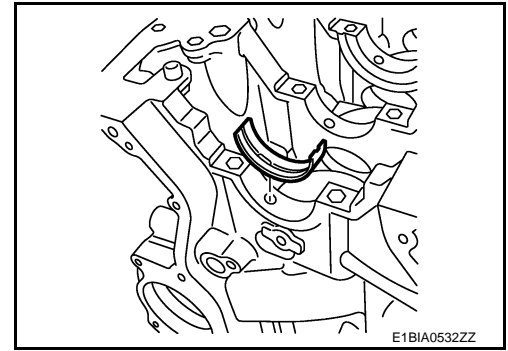
- Remove dust, dirt, and engine oil from the bearing mating surfaces of the cylinder block and main bearing cap.
- Center the grooved bearing shell on bearing No.1 of the cylinder block while aligning the groove of the bearing shell with the hole of the bearing.

CYLINDER BLOCK

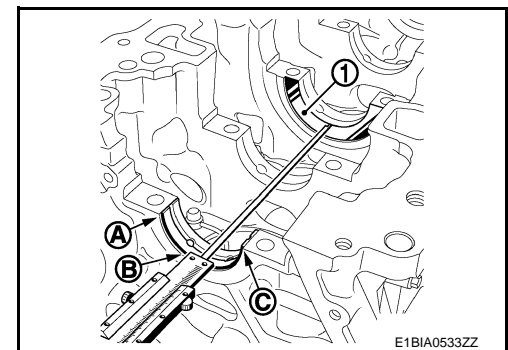
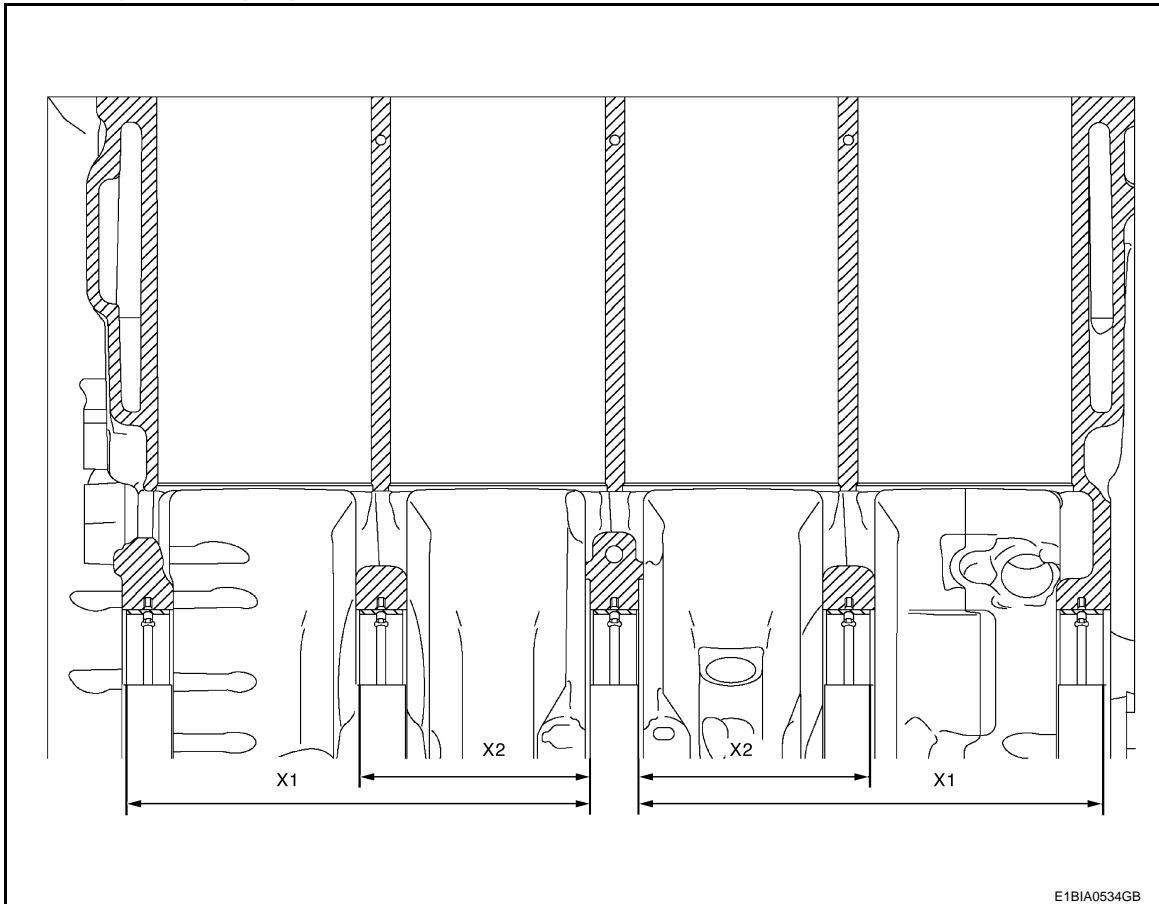
< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

- Secure the flush bearing shell and push from the opposite side the position of the bearing shell flush with the bearing.



- c. Measure the distance (X1) between the bearing face ① and the edge of the bearing shell at points (A), (B) and (C) using a depth gauge.



- d. If necessary, adjust the position of the bearing shell to the value (X1) = [179 mm (7.0 in)].
- e. Repeat the previous operations for the bearing shells of the bearings No 2, 4 and 5.
- f. If necessary, adjust the position of the bearing shells:
- of bearings No. 2 and 4 to the value (X2) = [88 mm (3.5 in)].

CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

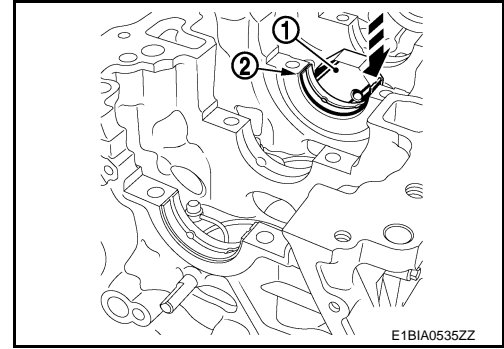
[R9M]

- of the bearing No. 5 to the value (X1) = [176 mm (6.9 in)].

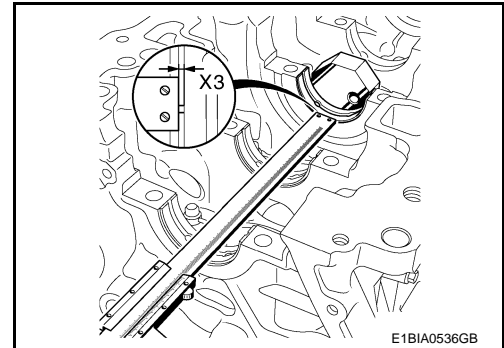
- g. Secure the flush bearing shell against the rectified shimat ② and push from the opposite side to position the bearing shell flush with the bearing.

Place:

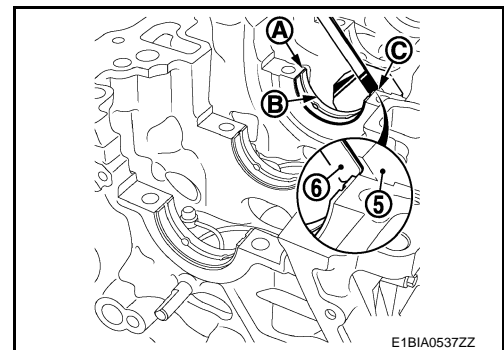
- a rectified shim ① against the mating face of the crankshaft thrust washer on bearing No.3
- the grooved bearing shell against the rectified shim.



- h. Measure the distance (X3) between the bearing face of the thrust washer and the bearing shell edge using a depth gauge.



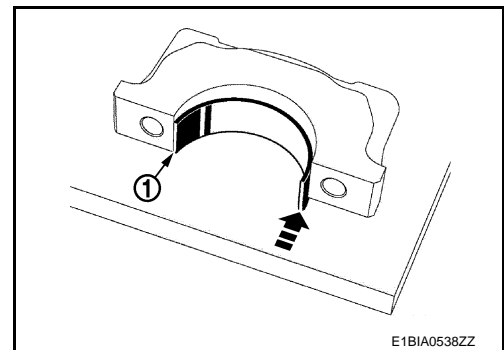
- i. Center the grooved bearing shell on the bearing, aligning the shell with the hole groove.
- Adjust the position of the bearing shell at points (A), (B) and (C) using the rectified shim ① and a set of feeler gauges (thickness of the shim ② = (X3): [2 mm (0.1 in)]).



- j. Secure the flush bearing shell with the bearing cap at ① and push from the opposite side to bring the bearing shell flush with the bearing cap.

Place:

- the bearing cap on a bench,
- a non-grooved bearing shell against the bench.

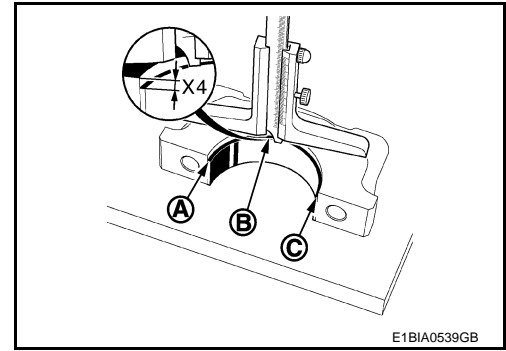


CYLINDER BLOCK

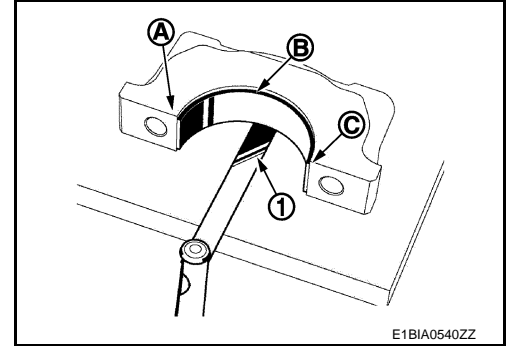
< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

- k. Measure the distance (X4) between the edge of the bearing shell and the wall of the bearing cap at points (A), (B) and (C) using a depth gauge.



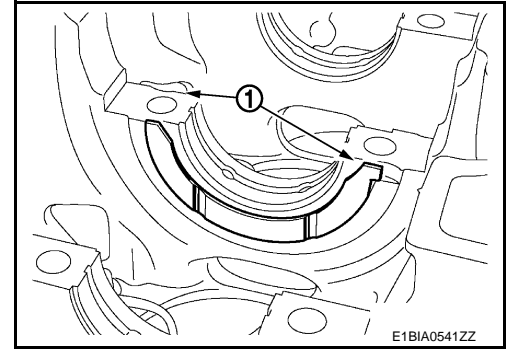
- l. Adjust the position of the bearing shell at point (A), (B) and using a set of feeler gauges (feeler gauges (thickness of the shim ① = X4: [2 mm (0.1 in)])
- Repeat the previous operations for the other bearing caps.



- m. Position the crankshaft thrust washers on the cylinder block (washer plug ① in the cylinder block notch)
- Use engine oil to lubricate the crankshaft journal bearing shells and thrust washers (only the face making contact with the crankshaft).

NOTE:

Ensure the bearing shells and the thrust washers do not move when refitting the crankshaft and bearing caps.



4. Install crankshaft, the bearing caps and the crankshaft bearing bolts.

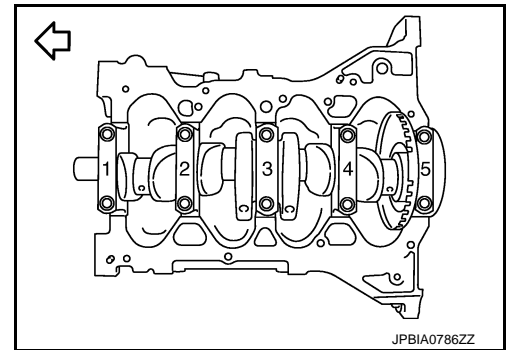
NOTE:

Check that the bearing caps are in contact with the cylinder block before tightening the bearing cap bolts.

5. Install main bearing caps with the following procedure:

- a. Align the identification number to the journal position to install as shown in the figure.

← : Engine front



CYLINDER BLOCK


< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]


- b. Tighten new main bearing cap bolts in numerical order as shown in the figure with the following procedure:

↩ : Engine front

- i. Pre-tighten main bearing cap bolts.

 : 25.0 N·m (2.6 kg-m, 18 ft-lb)

Tighten main bearing cap bolts.

 : 25.0 N·m (2.6 kg-m, 18 ft-lb)

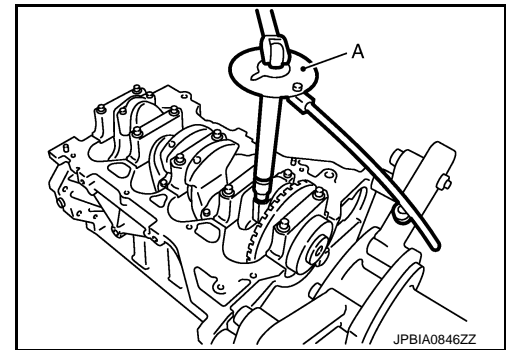
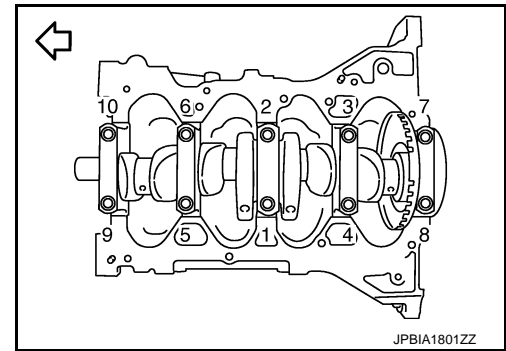
CAUTION:

Be sure to check that the main bearing cap is in contact with the cylinder block before tightening the bolts.

- ii. Turn bolts 110 degrees clockwise (angle tightening).

CAUTION:

Confirm the tightening angle by using an angle wrench [SST: KV10112100 (—)] (A) or protractor. Never judge by visual inspection without the tool.



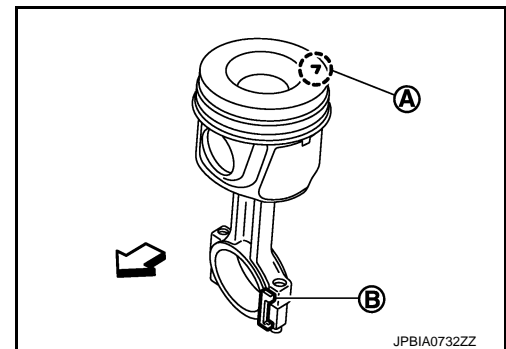
- After installing mounting bolts, check that crankshaft can be rotated smoothly by hand.
- Check crankshaft end play. Refer to [EM-401. "Inspection"](#).
- If replacing the crankshaft, always identify the piston height category to refit in each cylinder to guarantee that the piston protrusion in relation to the cylinder block remains within the tolerance, before refitting the connecting rod - piston assemblies. Refer to [EM-401. "Inspection"](#).

6. Install piston to connecting rod with the following procedure:

- a. Install snap ring to the groove of the piston rear side.
- Insert it fully into the groove.
- b. Assemble piston to connecting rod.
- Point the mark engraved (A) on the piston head facing and the bosses (B) of the big end as shown in the figure.

↩ : Engine front

- Piston pin can be pushed in by hand without excessive force. From the front to the rear, insert piston pin into piston and connecting rod.



- c. Install snap ring to the groove of the piston front side.
- Insert it fully into the groove.
 - After installing, check that connecting rod moves smoothly.
7. Using a piston ring expander (commercial service tool), install piston rings.

CAUTION:

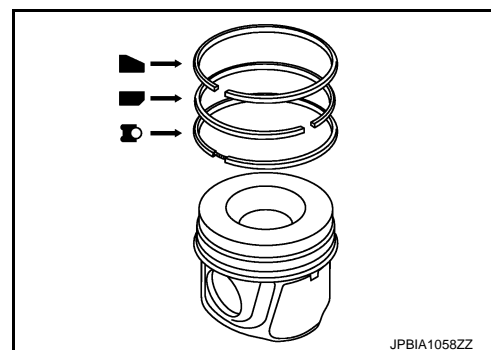
- Be careful not to damage piston.
- Be careful not to damage piston rings by expanding them excessively.

CYLINDER BLOCK

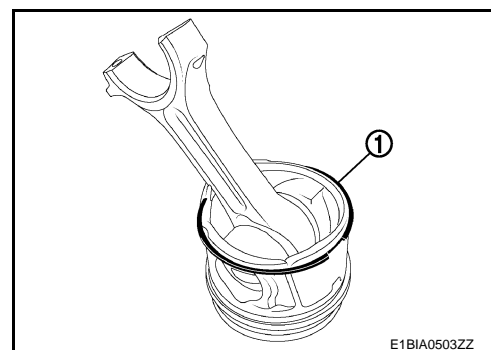
< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

- Position each ring with the gap as shown in the figure referring to the piston front mark.



8. Fit the scraper ring ① with the hand by way of the connecting rod.

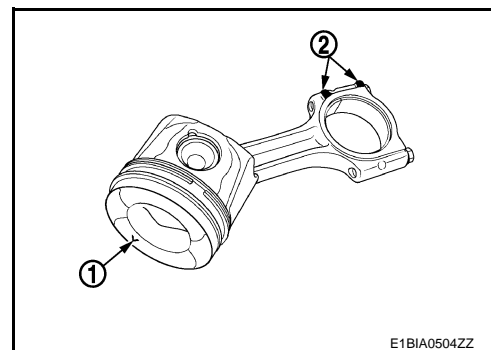


9. Lubricate piston pin with engine oil.

- Position the connecting rod in relation to the piston (piston marking ① "V" is opposite the machined bosses ② on the big end)

NOTE:

Piston marking V engine flywheel end, connecting rod marking (machined bosses) timing end.



10. Engage the pin in the piston and in the small end.

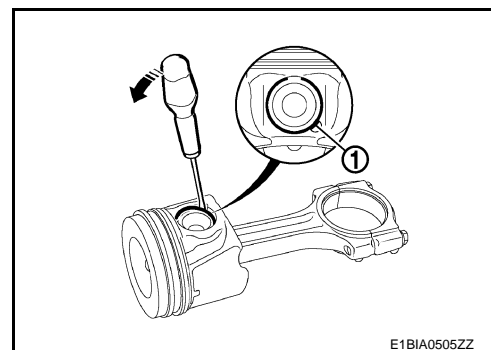
NOTE:

Check that the piston pin slides and rotates easily in the piston and the small end.

11. Refit the snap ring to the piston pin using a flat screwdriver (apply pressure in the groove ①).

NOTE:

Position the opening in the snap ring towards the piston crown.



CYLINDER BLOCK

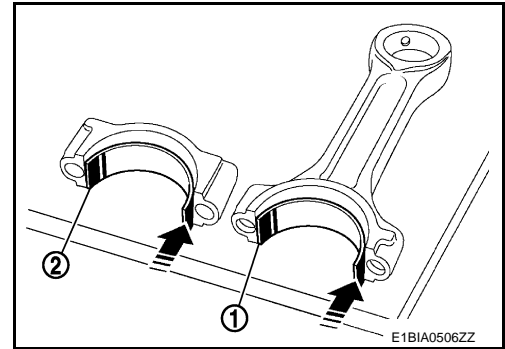
< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

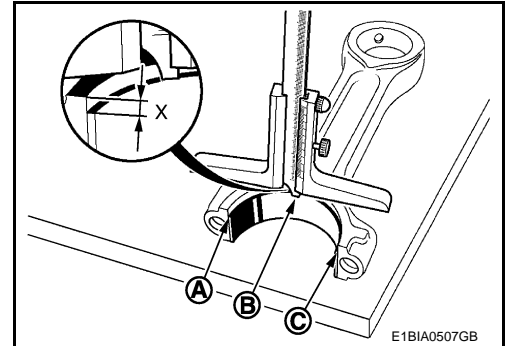
12. Secure the flush bearing shell of the connecting rod body mating face on side ① and push from the opposite side ② until the connecting rod body mating face is flush.

Place:

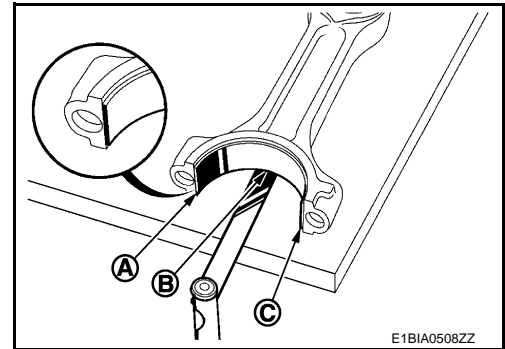
- the connecting rod body on the bench,
- the connecting rod upper bearing shell (width = [18.2 mm (0.7 in)])



13. Measure the distance (X) between the edge of the bearing shell and the wall of the connecting rod body at points (A), (B) and (C) .



14. Center the bearing shell on the connecting rod body.
- Adjust the position of the bearing shell at points (A), (B) and (C) using a set of feeler gauges = X: [2 mm (0.1 in)].
 - Repeat the previous operations on the remaining connecting rod bodies and caps



Lubricate with engine oils:

- the cylinder block barrels,
- the piston rings
- the piston skirts,
- the crankshaft crank pins

- Orient the piston rings on the piston pin axis.

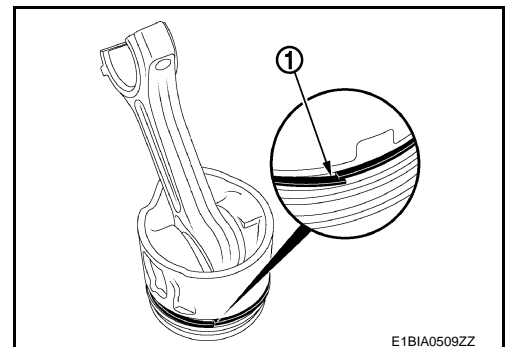
15. Lubricate the tool [SST: — (Mot.1979)].

16. Check that the piston rings are correctly engaged in the piston grooves

- Put the piston on a plane and clean surface.
- Verify the absence of over lap ① of the tips of the scraper ring.

NOTE:

Manipulate the piston exclusively by the skirt or the connecting rod, without touching the scraper ring.



17. Insert the tool [SST: — (Mot.1979)] ① on the piston, conical part the first one, by the connecting rod.

NOTE:

CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

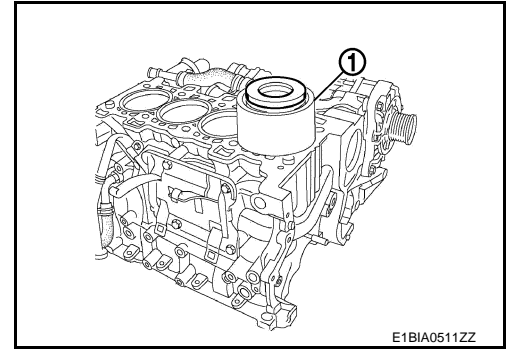
The engagement of the tool [SST: — (Mot.1979)] on the piston has to be made without forcing. If resistance during the engagement occurs, put off the tool and to re-engage it.

18. Check that the pistons correspond to the cylinder block barrels (No. 1 timing end)

- Place the “connecting rod - piston - tool” ① assembly in the cylinder.

NOTE:

Position the point of the “V” engaged on the piston towards the flywheel end.



19. WARNING:

Failure to observe the following procedure may result in destruction of the engine.

- Gradually insert the “connecting rod - piston” assembly in the cylinder (avoid any contact between the connecting rod and the oil jet) using only of the hand.
- Position the big end on the crankshaft crank pin.
- Refit the connecting rod cap, ensuring that the connecting rod caps and bodies correspond. Refer to [EM-401. "Inspection"](#).

20. Install connecting rod cap bolts.

- a. Tighten new connecting rod cap bolts.



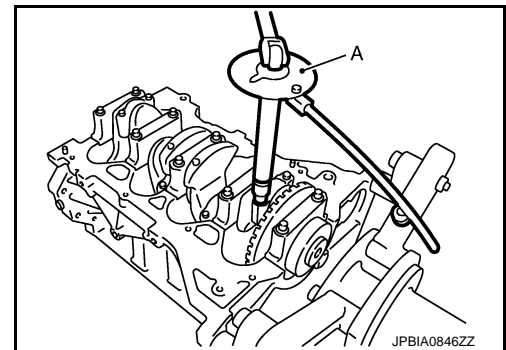
: 25.0 N·m (2.6 kg-m, 18 ft-lb)

- b. Turn bolts 110 degrees clockwise (angle tightening).

CAUTION:

Confirm the tightening angle by using an angle wrench [SST: KV10112100 (—)] (A) or protractor. Never judge by visual inspection without the tool.

- After tightening connecting rod cap bolt, check that crankshaft rotates smoothly.
- Check the connecting rod side clearance. Refer to [EM-401. "Inspection"](#).
- Check the piston protrusion. Refer to [EM-401. "Inspection"](#).



21. Install oil pump and related parts. Refer to [LU-44. "Exploded View"](#).

22. Install oil pan (upper). Refer to [EM-380. "Exploded View"](#).

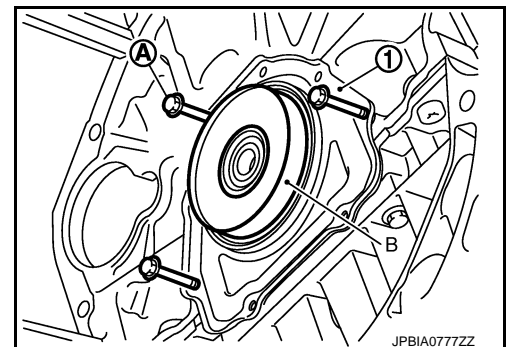
23. Install rear oil seal retainer with the following procedure:

- a. Set guide bolt (A) and protector (B) to rear oil seal retainer ①.

NOTE:

The protector is supplied in the new oil seal parts kit.

- b. Move the rear oil seal retainer evenly by hand until it makes contact with the cylinder block.



CYLINDER BLOCK


[R9M]

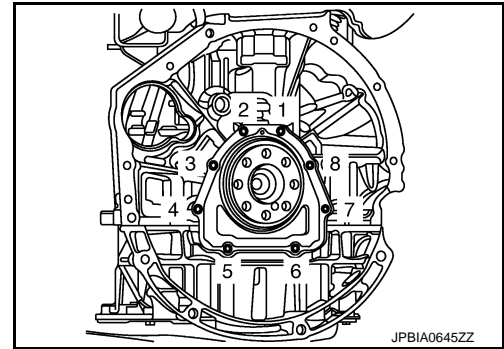
< UNIT DISASSEMBLY AND ASSEMBLY >

- c. Tighten mounting bolts in two steps separately in numerical order as shown in the figure.
- i. Tighten mounting bolts No.1 and 5.

 : 5.0 N·m (0.51 kg-m, 44 in-lb)

- ii. Tighten mounting bolts No. 1 to 8 in numerical order as shown.

 : 12.0 N·m (1.2 kg-m, 9 ft-lb)



24. Assemble in the reverse order of disassembly.

Inspection

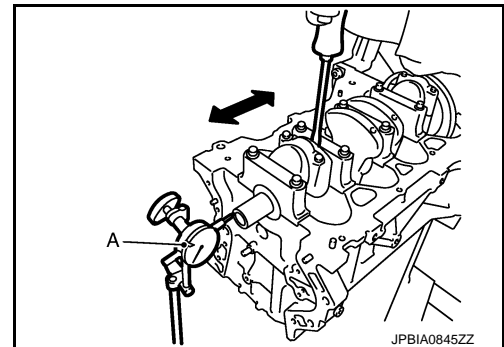
INFOID:000000010784366

CRANKSHAFT END PLAY

- Measure the clearance between thrust bearings and crankshaft arm when crankshaft is moved fully forward or backward with a dial indicator (A).

Standard : Refer to [EM-417, "Cylinder Block"](#).

- If it exceeds the standard, replace thrust bearings, and measure again. If it still exceeds the standard, also replace crankshaft.

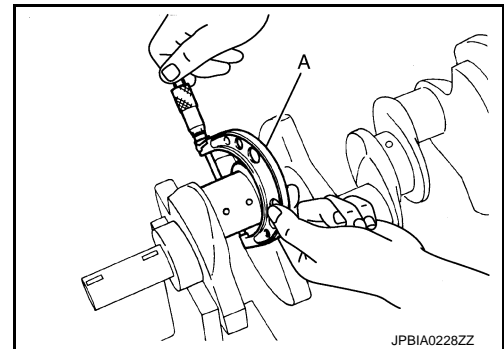


CRANKSHAFT PIN JOURNAL DIAMETER

- Measure the outer diameter of crankshaft pin journal with a micrometer (A).

Standard : Refer to [EM-417, "Cylinder Block"](#).

- If it exceeds the standard, measure the connecting rod bearing oil clearance. Refer to "CONNECTING ROD BEARING OIL CLEARANCE".



CRANKSHAFT MAIN JOURNAL DIAMETER

- Measure the outer diameter of crankshaft main journals with a micrometer.

Standard : Refer to [EM-417, "Cylinder Block"](#).

- If it exceeds the standard, measure the main bearing oil clearance. Refer to "MAIN BEARING OIL CLEARANCE".

CONNECTING ROD SIDE CLEARANCE

CYLINDER BLOCK

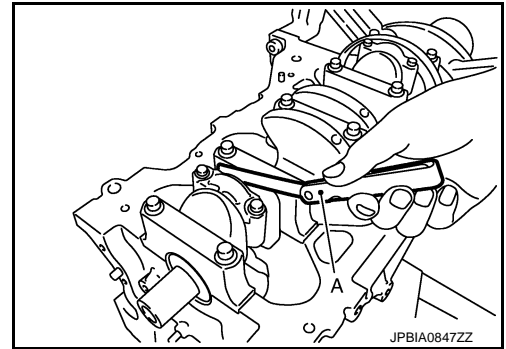
[R9M]

< UNIT DISASSEMBLY AND ASSEMBLY >

- Measure the side clearance between connecting rod and crankshaft arm with a feeler gauge (A).

Standard : Refer to [EM-417, "Cylinder Block"](#).

- If it exceeds the standard, replace connecting rod, and measure again. If it still exceeds the standard, also replace crankshaft.



CONNECTING ROD BIG END DIAMETER

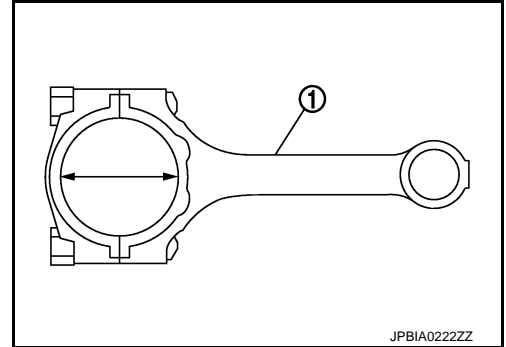
- Install connecting rod cap without connecting rod bearing installed, and tightening connecting rod cap bolts to the specified torque. Refer to [EM-390, "Disassembly and Assembly"](#).

① : Connecting rod

- Measure the inner diameter of connecting rod big end with an inside micrometer.

Standard : Refer to [EM-417, "Cylinder Block"](#).

- If it exceeds the standard, replace connecting rod assembly.

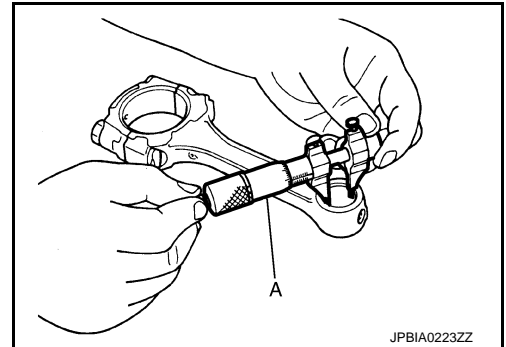


CONNECTING ROD BUSHING OIL CLEARANCE

Connecting Rod Bushing Inner Diameter

Measure the inner diameter of connecting rod bushing with an inside micrometer (A).

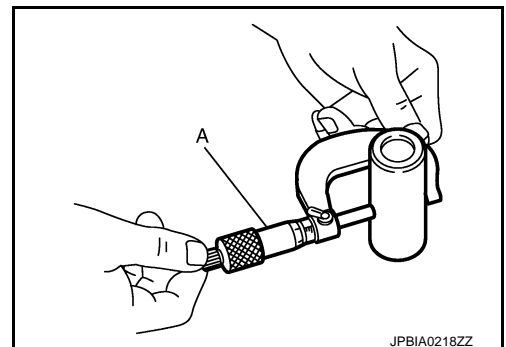
Standard : Refer to [EM-417, "Cylinder Block"](#).



Piston Pin Outer Diameter

Measure the outer diameter of piston pin with a micrometer (A).

Standard : Refer to [EM-417, "Cylinder Block"](#).



Connecting Rod Bushing Oil Clearance

(Connecting rod bushing oil clearance) = (Connecting rod bushing inner diameter) – (Piston pin outer diameter)

Standard : Refer to [EM-417, "Cylinder Block"](#).

- If it exceeds the standard, replace connecting rod assembly and/or piston and piston pin assembly.
- If replacing piston and piston pin assembly. Refer to "PISTON PROTRUSION".

CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

PISTON PROTRUSION

Measure the protrusion of piston with the following procedure:

1. Set piston at a point close to the TDC.
2. Set the dial indicator stand set [commercial service tool: KV113B0040 (Mot.251-01)] (B) and [commercial service tool: KV113B0050 (Mot.252-01)] (A) at the location as shown in the figure.
3. Set the indicator scale to "0" where the piston protrusion is maximized.
4. Move the dial indicator stand so that the tip of dial indicator can contact the cylinder block. Read the difference.

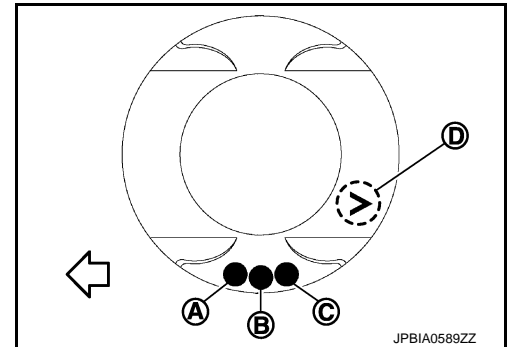
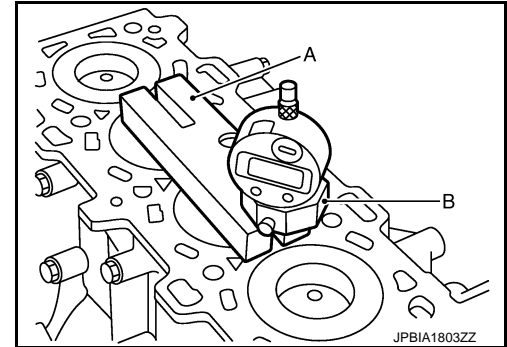
Standard : Refer to [EM-417, "Cylinder Block"](#).

5. If measured value is out of the standard, replace piston. Select a piston in "Piston Protrusion Grade".

- (A) : Date of manufacture
- (B) : Piston grade
- (C) : Modification in production suffix
- (D) : Mark engraved
- ← : Engine front

Piston Protrusion Grade:

Refer to [EM-417, "Cylinder Block"](#).

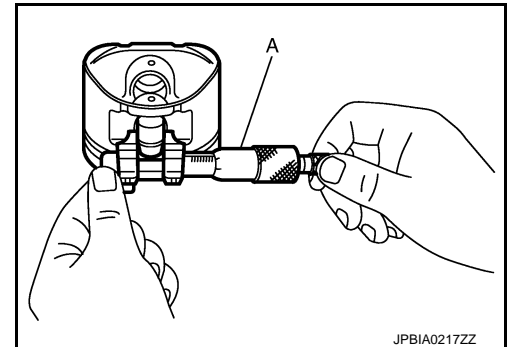


PISTON TO PISTON PIN OIL CLEARANCE

Piston Pin Hole Diameter

Measure the inner diameter of piston pin hole with an inside micrometer (A).

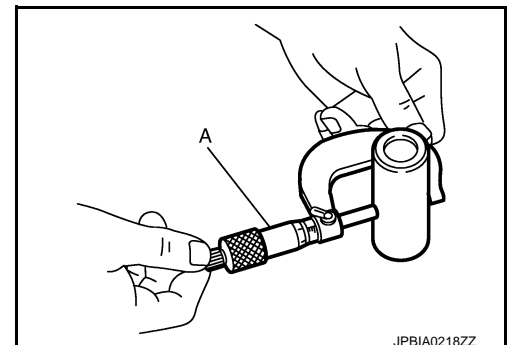
Standard : Refer to [EM-417, "Cylinder Block"](#).



Piston Pin Outer Diameter

Measure the outer diameter of piston pin with a micrometer (A).

Standard : Refer to [EM-417, "Cylinder Block"](#).



Piston to Piston Pin Oil Clearance

(Piston to piston pin oil clearance) = (Piston pin hole diameter) – (Piston pin outer diameter)

CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

Standard : Refer to [EM-417, "Cylinder Block"](#).

- If it exceeds the standard, replace piston and piston pin an assembly.

NOTE:

Piston is available together with piston pin as assembly.

PISTON RING SIDE CLEARANCE

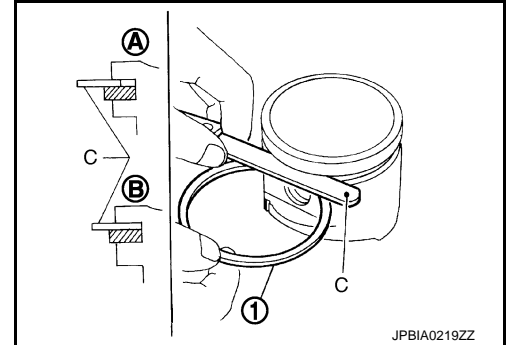
- Measure the side clearance of piston ring ① and piston ring groove with a feeler gauge (C).

Ⓐ : OK

Ⓑ : NG

Standard : Refer to [EM-417, "Cylinder Block"](#).

- If it exceeds the standard, replace piston ring, and measure again.
If it still exceeds the standard, also replace piston.



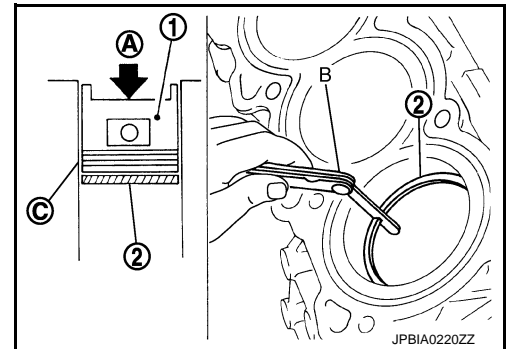
PISTON RING END GAP

- Check that cylinder bore inner diameter is within specification. Refer to "PISTON TO CYLINDER BORE CLEARANCE".
- 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 piston ring end gap with a feeler gauge (B).

Ⓒ : Measuring point

Standard : Refer to [EM-417, "Cylinder Block"](#).

- If it exceeds the standard, replace piston ring, and measure again.
If it still exceeds the standard, replace cylinder block and piston rings.



CYLINDER BLOCK TOP SURFACE DISTORTION

- Using a scraper, remove gasket on the cylinder block surface, and also remove engine oil, scale, carbon, or other contamination.

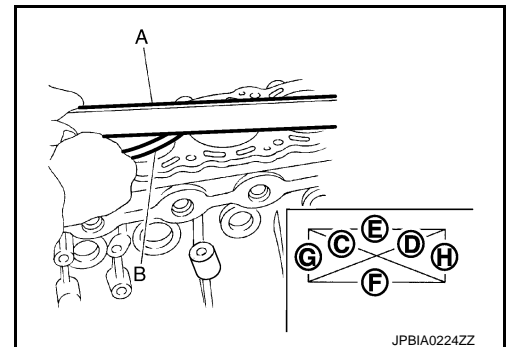
CAUTION:

Be careful not to allow gasket flakes to enter engine oil or engine coolant passages.

- Measure the distortion on the cylinder block upper face at different points in six directions (Ⓒ, Ⓓ, Ⓔ, Ⓕ, Ⓖ and Ⓗ) with a straight edge (A) and feeler gauge (B).

Standard : Refer to [EM-417, "Cylinder Block"](#).

- If it exceeds the standard, replace cylinder block.



MAIN BEARING HOUSING INNER DIAMETER

- Install main bearing cap without main bearings installed, and tighten main bearing cap mounting bolts to the specified torque. Refer to [EM-390, "Disassembly and Assembly"](#).

CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

- Measure the inner diameter of main bearing housing with a bore gauge.

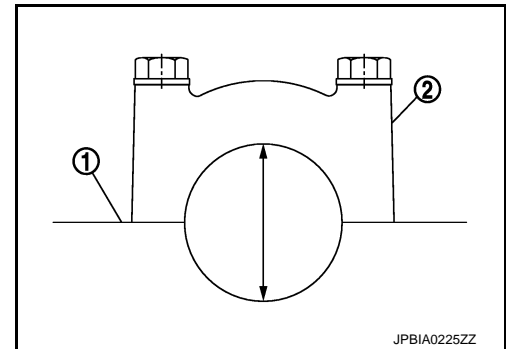
- ① : Cylinder block
② : Main bearing cap

Standard : Refer to [EM-417, "Cylinder Block"](#).

- If it exceeds the standard, replace cylinder block and main bearing caps assembly.

NOTE:

Main bearing caps cannot be replaced individually, because it is machined together with the cylinder block.



PISTON TO CYLINDER BORE CLEARANCE

Cylinder Bore Inner Diameter

- Using a bore gauge, measure the cylinder bore for wear, out-of-round and taper at six different points on each cylinder.

Standard:

Cylinder bore inner diameter

: Refer to [EM-417, "Cylinder Block"](#).

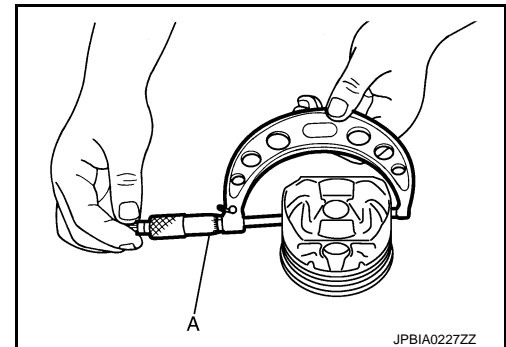
- If it exceeds the standard, or if there are scratches and/or seizure on the cylinder inner wall, replace cylinder block.

Piston Skirt Diameter

Measure the outer diameter of piston skirt with a micrometer (A).

Standard : Refer to [EM-417, "Cylinder Block"](#).

Measurepoint : Refer to [EM-417, "Cylinder Block"](#).



Piston to Cylinder Bore Clearance

Calculate by piston skirt diameter and cylinder bore inner diameter.

(Clearance) = (Cylinder bore inner diameter) – (Piston skirt diameter)

Standard : Refer to [EM-417, "Cylinder Block"](#).

- If it exceeds the standard, replace piston and piston pin assembly and/or cylinder block.

CONNECTING ROD BEARING OIL CLEARANCE

Method by Calculation

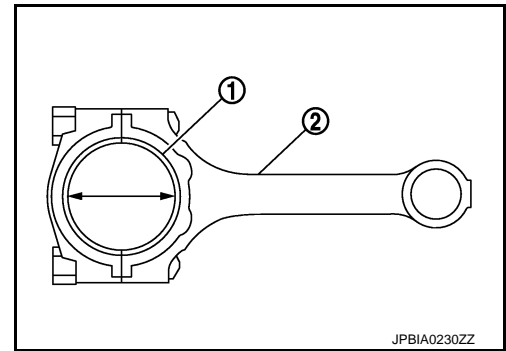
CYLINDER BLOCK

< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

- Install connecting rod bearings ① to connecting rod ② and connecting rod bearing cap, and tighten connecting rod cap bolts to the specified torque. Refer to [EM-390, "Disassembly and Assembly"](#).
- Measure the inner diameter of connecting rod bearing with an inside micrometer.
(Bearing oil clearance) = (Connecting rod bearing inner diameter) – (Crankshaft pin journal diameter)

Standard : Refer to [EM-421, "Connecting Rod Bearing"](#).



- If it exceeds the standard. Replace connecting rod bearing or/and connecting rod.

Method of Using Plastigage

- Remove engine oil and dust on crankshaft pin 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 cap, and tighten connecting rod cap bolts to the specified torque. Refer to [EM-390, "Disassembly and Assembly"](#).

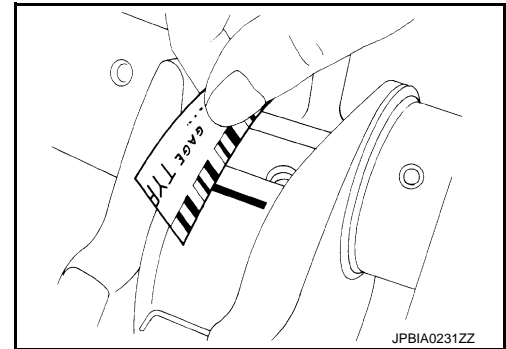
CAUTION:

Never rotate crankshaft.

- Remove connecting rod cap and bearing, and using the scale on the plastigage bag, measure the plastigage width.

NOTE:

The procedure when the measured value exceeds the standard is the same as that described in "Method by Calculation".



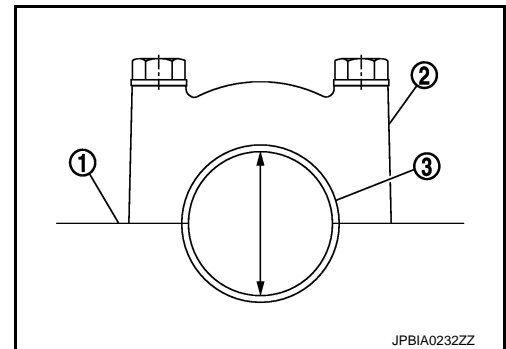
MAIN BEARING OIL CLEARANCE

Method by Calculation

- Install main bearings ③ to cylinder block ① and main bearing cap ②, and tighten main bearing cap mounting bolts to the specified torque. Refer to [EM-390, "Disassembly and Assembly"](#).
- Measure the inner diameter of main bearing with a bore gauge.
(Bearing oil clearance) = (Main bearing inner diameter) – (Crankshaft main journal diameter)

Standard : Refer to [EM-421, "Main Bearing"](#).

- If it exceeds the standard, select proper main bearing according to main bearing inner diameter and crankshaft main journal diameter to obtain specified bearing oil clearance. Refer to [EM-421, "Main Bearing"](#).



Method of Using Plastigage

- Remove engine oil and dust on crankshaft main journal and the surfaces of each bearing completely.
- Cut a plastigage slightly shorter than the bearing width, and place it in the crankshaft axial direction, avoiding oil holes.
- Install main bearings to cylinder block and main bearing cap, and tighten main bearing cap mounting bolts to the specified torque. Refer to [EM-390, "Disassembly and Assembly"](#).

CAUTION:

Never rotate crankshaft.

CYLINDER BLOCK

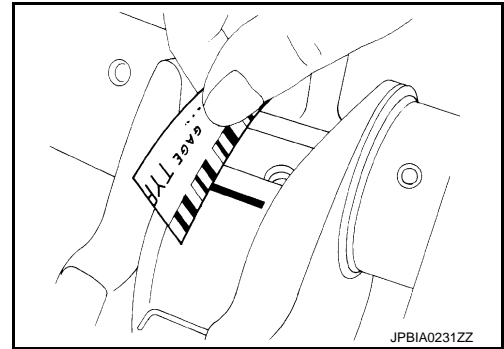
< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

- Remove main 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 standard is the same as that described in "Method by Calculation".



FLYWHEEL INSPECTION

For a dual mass flywheel which has worked: presence of a free rotation angle. This angle is measured by fixing the primary flywheel and turning the secondary flywheel. The dual mass flywheel free rotation angle must not exceed 15° or 30mm (1.2 in) in linear movement measured on the edge.

A

EM

C

D

E

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L

M

N

O

P

HOW TO SELECT PISTON AND BEARING

< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

HOW TO SELECT PISTON AND BEARING

Description

INFOID:0000000010784367

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)
Piston protrusion	Piston	Piston grade (piston height)	Refer to EM-401, "Inspection" .

- 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.

Main Bearing

INFOID:0000000010784368

WHEN NEW CYLINDER BLOCK AND CRANKSHAFT ARE USED

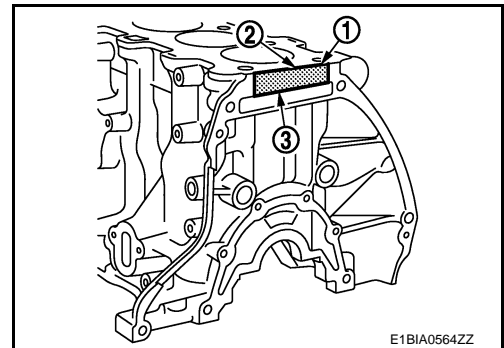
1. "Main Bearing Selection Table" rows correspond to main bearing housing grade on rear side of cylinder block.

NOTE:

This engine only has one cylinder bore grade.

① : Cylinder block bearing diameter category:

- Identification by letter of the crankshaft bearing diameter,
- the order of the marking letters goes from the bearing on the timing end to the bearing on the flywheel end.
- ② : cylinder diameter category.
- ③ : marking only for factory use.



WORKING OUT THE CLASS OF MAIN BEARING (ORIGINAL FITMENT)

Marking On The Crankshaft

Identify the category of crankshaft main journal diameter with checking the marking of crankshaft as shown in the figures.

NOTE:

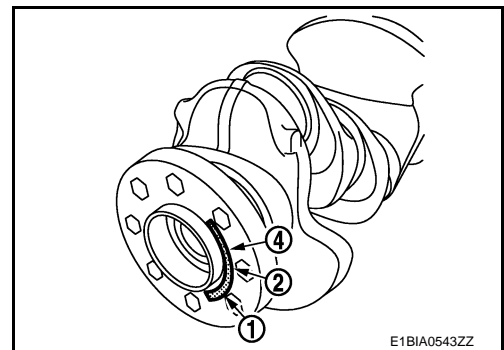
The marking has 5 digits. Left end is the diameter category of No. 1 bearing (flywheel side) and right end is the diameter category of No. 5 bearing (sprocket side).

Detail of the marking:

① : Line indicating the diameter category of the journal.

- identification by letters corresponding to the diameter of the journal
- the order of the marking letters goes from the bearing on the timing end to the bearing on the flywheel end,

② :Line indicating the diameter class of the crankpins,



HOW TO SELECT PISTON AND BEARING

< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

- ③, ④ : Last five numbers of the crankshaft part number,
⑤: Line reserved for the factory.

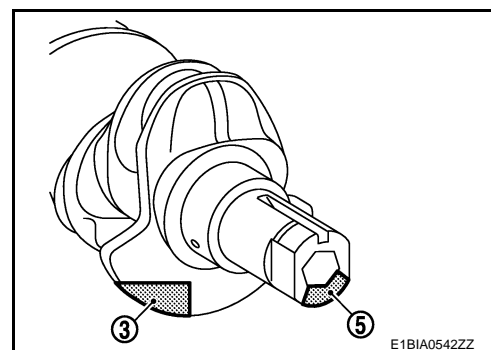


Table Of Journal Diameter Classes

Unit: mm (in)

Journal class mark on the crankshaft	Journal diameter
A,B,C	51.485 - 51.487 (2.0270)
D, E	51.488 - 51.489 (2.0271)
F, G, H	51.490 - 51.492 (2.0272)
K, L, M	51.495 - 51.497 (2.0274)
N, O	51.498 - 51.499 (2.0275)
P, Q, R	51.500 - 51.502 (2.0276)
S, T	51.503 - 51.504 (2.0277)
U	51.505 (2.0278)

WHEN CYLINDER BLOCK AND CRANKSHAFT ARE REUSED

1. Measure the dimensions of the cylinder block main bearing housing inner diameter and crankshaft main journal diameter individually. Refer to [EM-401, "Inspection"](#).
2. Apply the measured dimension to "Main Bearing Selection Table".
3. Read the symbol at the cross point of selected row and column in "Main Bearing Selection Table".
4. Apply the symbol obtained from "Main Bearing Grade Table" to select main bearing.

MAIN BEARING SELECTION TABLE

B* = Blue (bearing shell color mark)
N** = Black (bearing shell color mark)
J*** = Yellow (bearing shell color mark)

Table of distribution of upper journals 1, 2, 4 and 5

HOW TO SELECT PISTON AND BEARING

< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

	Cylinder block bearing diameter class mark														
		A	B	C	E	H	J	K	L	M	P	S	T	U	Z
Crank shaft journal diameter class mark	A	B*													
	B	B													
	C	N**	B												
	D	N		B											
	E	N			B										
	F	N					B								
	G	N						B							
	H	N							B						
	I	N								B					
	J	N									B				
	K	N											B		
	L	N												B	
	M	J***	N										B		
	N	J		N											
	O	J			N										
	P	J					N								
	Q	J						N							
	R	J							N						
	S	J								N					
	T	J									N				
	U	J											N		

Table of the distribution of lower journals 1, 2, 4 and 5

B* = Blue (bearing shell color mark)

N** = Black (bearing shell color mark)

J*** = Yellow (bearing shell color mark)

HOW TO SELECT PISTON AND BEARING

< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

	Cylinder block bearing diameter class mark														
		A	B	C	E	H	J	K	L	M	P	S	T	U	Z
Crank shaft journal diameter class mark	A	N**					B*								
	B	N						B							
	C	N							B						
	D	N								B					
	E	N									B				
	F	N										B			
	G	N												B	
	H	J***	N												B
	I	J	N												
	J	J	N												
	K	J					N								
	L	J						N							
	M	J							N						
	N	J								N					
	O	J									N				
	P	J										N			
	Q	J												N	
	R	J												N	
	S	J													
	T	J													
	U	J													

Table of the distribution of upper journal 3

W* = White (bearing shell color mark)

N** = Black (bearing shell color mark)

J*** = Yellow (bearing shell color mark)

HOW TO SELECT PISTON AND BEARING

< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

	Cylinder block bearing diameter class mark															
		A	B	C	E	H	J	K	L	M	P	S	T	U	Z	
Crank shaft journal diameter class mark	A	N**														
	B	N														
	C	J***	N													
	D	J		N												
	E	J			N											
	F	J					N									
	G	J						N								
	H	J							N							
	I	J								N						
	J	J									N					
	K	J											N			
	L	J												N		
	M	W***	J												N	
	N	W		J												
	O	W			J											
	P	W					J									
	Q	W						J								
	R	W							J							
	S	W								J						
	T	W									J					
	U	W											J			

Table of the distribution of lower journals 3

W* = White (bearing shell color mark)

N** = Black (bearing shell color mark)

J*** = Yellow (bearing shell color mark)

HOW TO SELECT PISTON AND BEARING

< UNIT DISASSEMBLY AND ASSEMBLY >

[R9M]

	Cylinder block bearing diameter class mark															
		A	B	C	E	H	J	K	L	M	P	S	T	U	Z	
Crank shaft journal diameter class mark	A	J***					N**									
	B	J						B								
	C	J							B							
	D	J								B						
	E	J									B					
	F	J										B				
	G	J											B			
	H	W*	J										B			
	I	W		J												
	J	W			J											
	K	W					J									
	L	W						J								
	M	W							J							
	N	W								J						
	O	W									J					
	P	W											J			
	Q	W												J		
	R	W													J	
	S	W														
	T	W														
	U	W														

Example:

- diameter category of journal No. 1 marked on the crankshaft = N,
- diameter category of crankshaft bearing No.1 marked on the cylinder block = M,
- thickness class to of the upper and lower bearing shells of bearing No. 1 to refit = Black Mark.

Identification of the crankshaft bearing shells

	Marking	color Mark	Thickness mm (in)
Lower shell bearing	33281R or 4	Blue	1.989 (0.0783)
	3875R or 3	Black	1.985 (0.0781)
	37686R or 2	Yellow	1.981 (0.0780)
	31153R or 1	White	1.977 (0.0787)
Upper bearing shell bearing	53785R or 4	Blue	1.989 (0.0783)
	54889R or 3	Black	1.985 (0.0781)
	56848R or 2	Yellow	1.981 (0.0780)
	53368R or 1	White	1.977 (0.0787)

SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[R9M]

SERVICE DATA AND SPECIFICATIONS (SDS)

SERVICE DATA AND SPECIFICATIONS (SDS)

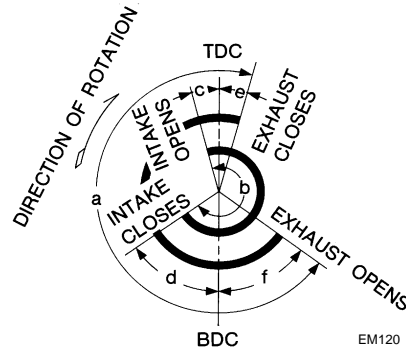
General Specification

INFOID:0000000010784369

GENERAL SPECIFICATIONS

Engine type		R9M
Cylinder arrangement		In-line 4
Displacement	cm ³ (cu in)	1,598 (97.51)
Bore and stroke	mm (in)	80.0 x 79.5 (3.1496 x 3.1299)
Valve arrangement		DOHC
Firing order		1-3-4-2
Number of piston rings	Compression	2
	Oil	1
Compression ratio		15.4

Valve timing



Unit: degree

a	b	c	d	e	f
198	187	- 11	18	- 17	35

Drive Belts

INFOID:0000000010784370

DRIVE BELT

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

INFOID:0000000010784371

INTAKE MANIFOLD

Unit: mm (in)

Items	Standard
Surface distortion	0.05 (0.0020)

Exhaust Manifold

INFOID:0000000010784372

EXHAUST MANIFOLD

Unit: mm (in)

Items	Standard
Surface distortion	0.7 (0.028)

SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[R9M]

Turbocharger

INFOID:0000000010784373

		Valve rod moving length
Value of vacuum	25 kPa (250 mbar, 187.525 mmHg, 7.3825 inHg)	2.95 - 5.95 mm (0.1161 - 0.2343 in)
	More than 60 kPa (600 mbar, 450.06 mmHg, 17.718 inHg)	The rod should not move

Camshaft

INFOID:0000000010784374

CAMSHAFT

Unit: mm (in)

Items	Standard
Camshaft journal diameter	24.979 - 25.000 (0.9834 - 0.9843)
Cylinder head housing and camshaft bracket inner diameter	25.040 - 25.061 (0.9858 - 0.9867)
Camshaft journal oil clearance	0.060 (0.0024)

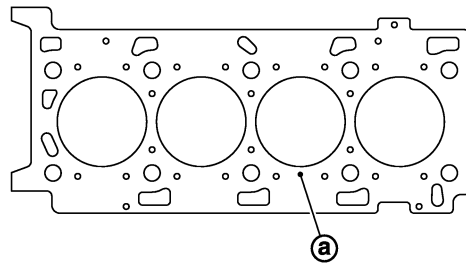
Cylinder Head

INFOID:0000000010784375

CYLINDER HEAD

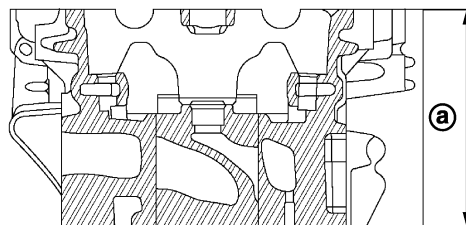
Unit: mm (in)

Items	Standard
Head surface distortion	0.05 (0.0020)



JPBIA0791ZZ

Cylinder head gasket thickness "a"	1.116 - 1.184 (0.0439 - 0.0466)
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JPBIA0792ZZ

Normal cylinder head height "a"	131.5 (5.18)
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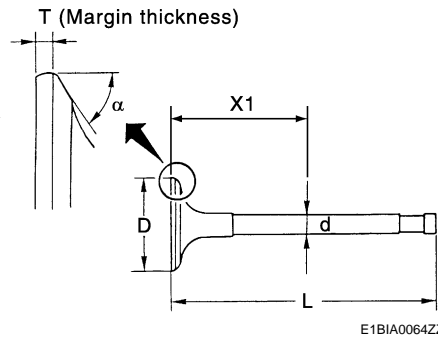
VALVE DIMENSIONS

SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[R9M]

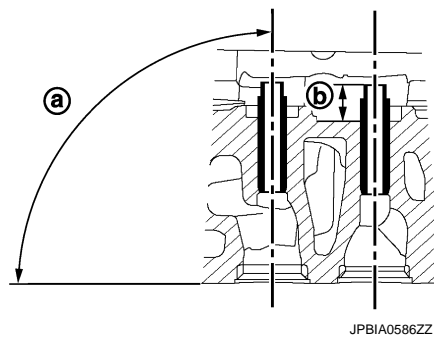
Unit: mm (in)



Item		Standard
Valve head diameter "D"	Intake	23.38 - 23.62 (0.9205 - 0.9299)
	Exhaust	23.28 - 23.62 (0.9165 - 0.9260)
Valve length "L"	Intake	104.17 (4.1)
	Exhaust	104.06 (4.097)
Valve stem diameter "d"	Intake	5.970 - 5.985 (0.2350 - 0.2356)
	Exhaust	5.955 - 5.970 (0.2344 - 0.2350)
Measuring point "X1"		35.0 (1.378)
Valve seat angle "α"		45° - 45°15'
Valve margin "T"	Intake	1.84 (0.072)
	Exhaust	1.35 (0.531)
Valve lift amount		8.0 (0.315)

VALVE GUIDE

Unit: mm (in)



Items		Standard
Valve guide	Outer diameter	11.033 - 11.044 (0.4344 - 0.4348)
	Inner diameter (Finished size)	6.000 - 6.018 (0.2362 - 0.2369)
Cylinder head valve guide hole diameter		10.987 - 11.013 (0.4326 - 0.4336)
Interference fit of valve guide		0.020 - 0.057 (0.0008 - 0.0022)
Valve guide clearance	Intake	0.015 - 0.048 (0.0006 - 0.0019)
	Exhaust	0.030 - 0.063 (0.0012 - 0.0025)
Valve guide angle "(a)"		90°
Projection length "(b)"		14.0 (0.551)

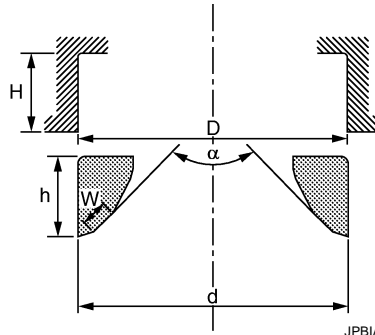
VALVE SEAT

SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[R9M]

Unit: mm (in)



Items		Standard
Cylinder head seat recess diameter "D"	Intake	28.163 - 28.191 (1.1088 - 1.1099)
	Exhaust	26.986 - 27.014 (1.0624 - 1.0635)
Valve seat outer diameter "d"	Intake	28.276 - 28.292 (1.1132 - 1.1139)
	Exhaust	27.076 - 27.092 (1.0660 - 1.0666)
Valve seat interference fit	Intake	0.085 - 0.129 (0.0033 - 0.0051)
	Exhaust	0.062 - 0.106 (0.0024 - 0.0042)
Angle "α"		89°30'
Contacting width "W"*1	Intake	1.40 (0.0551)
	Exhaust	1.544 (0.0608)
Height "h"	Intake	4.56 - 4.64 (0.1795 - 0.1827)
	Exhaust	4.905 - 4.985 (0.1931 - 0.1963)
Depth "H"	Intake	6.95 (0.2736)
	Exhaust	7.25 (0.2854)

*1: Machining data

VALVE SPRING

Free height		46.90 mm (1.8465 in)
Pressure height	200 - 220 N (20.4 - 22.4 kg, 45 - 49 lb)	34.90 mm (1.3740 in)
	353 - 387 N (36.0 - 39.5 kg, 79 - 87 lb)	26.90 mm (1.0591 in)
Full pressed height		24.40 mm (0.9606 in)
Diameter of the wire		2.78 - 2.82 mm (0.1094 - 0.1110 in)
Inner diameter		13.90 - 14.30 mm (0.5472 - 0.5630 in)
Outer diameter		19.50 - 19.90 mm (0.7677 - 0.7835 in)
Valve spring squareness		1.4 mm (0.055 in)

Cylinder Block

INFOID:0000000010784376

CRANKSHAFT

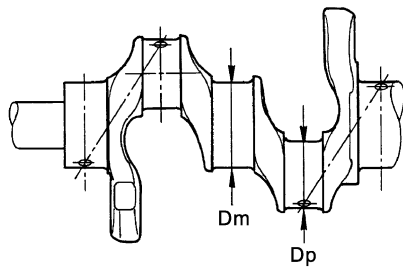
SERVICE DATA AND SPECIFICATIONS (SDS)

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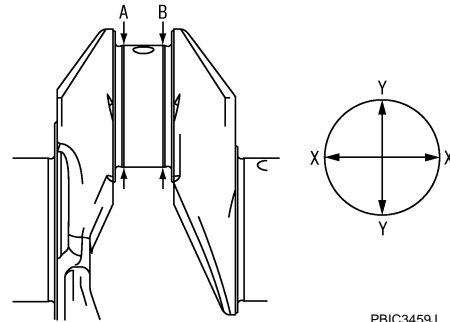
[R9M]

Unit: mm (in)

Item	Standard
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E1BIA0067ZZ



PBIC3459J

Crankshaft main journal diameter "Dm"	GRADE mark A	51.485 (2.0270)
	GRADE mark B	51.486 (2.0270)
	GRADE mark C	51.487 (2.0270)
	GRADE mark D	51.488 (2.0271)
	GRADE mark E	51.489 (2.0271)
	GRADE mark F	51.490 (2.0272)
	GRADE mark G	51.491 (2.0272)
	GRADE mark H	51.492 (2.0272)
	GRADE mark I	51.493 (2.0273)
	GRADE mark J	51.494 (2.0273)
	GRADE mark K	51.495 (2.0274)
	GRADE mark L	51.496 (2.0274)
	GRADE mark M	51.497 (2.0274)
	GRADE mark N	51.498 (2.0275)
	GRADE mark O	51.499 (2.0275)
	GRADE mark P	51.500 (2.0276)
	GRADE mark Q	51.501 (2.0276)
	GRADE mark R	51.502 (2.2048)
	GRADE mark S	51.503 (2.2048)
	GRADE mark T	51.504 (2.2049)
	GRADE mark U	51.505 (2.2049)
Crankshaft pin journal diameter "Dp"		48.000 - 48.020 (1.8898 - 1.8905)
Crankshaft end play		0.112 - 0.438 (0.004 - 0.0172)

CONNECTING ROD

Unit: mm (in)

Item	Standard
Center distance (big end and small end)	Grade 1 127.17 - 127.185 (5.0067 - 5.0073)
	Grade 2 127.185 - 127.2 (5.0073 - 5.0079)
	Grade 3 127.2 - 127.215 (5.0079 - 5.0098)
	Grade 4 127.215 - 127.23 (5.0098 - 5.001)
Connecting rod big end diameter	51.58 - 51.600 (2.0307 - 2.0315)
Connecting rod bushing end diameter	32.02 - 32.04 (1.1819 - 1.1827)
Connecting rod bushing end oil clearance	0.020 - 0.038 (0.0008 - 0.0015)
Connecting rod side clearance	0.021 - 0.48 (0.0083 - 0.0189)

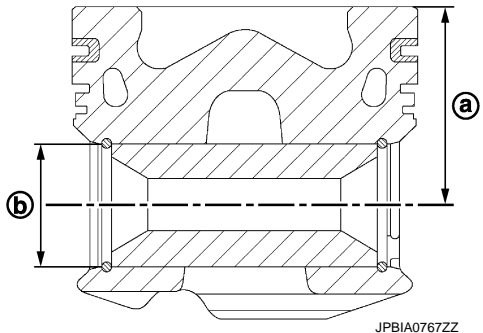
SERVICE DATA AND SPECIFICATIONS (SDS)

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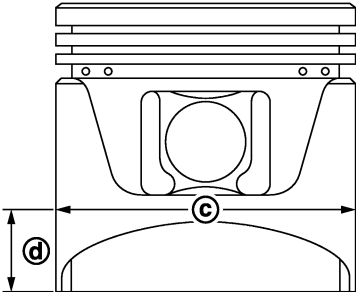
[R9M]

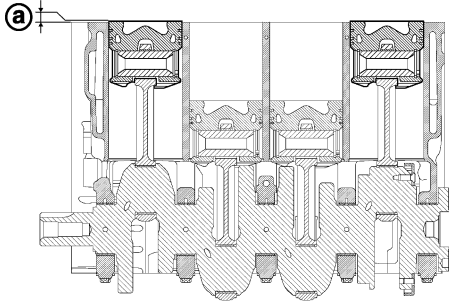
PISTON PROTRUSION GRADE

Unit: mm (in)

Item	Standard	
<div></div>		
Piston height “a”	Grade R	45.911 (1.8075)
	Grade S	45.946 (1.8089)
	Grade T	45.981 (1.8103)
	Grade U	46.016 (1.8116)
	Grade X	46.031 (1.8130)
Piston pin hole diameter “b”		32.012 - 32.017 (1.2603 - 1.2605)
Piston to cylinder bore clearance		0.192 - 0.236 (0.0076 - 0.0093)

AVAILABLE PISTON

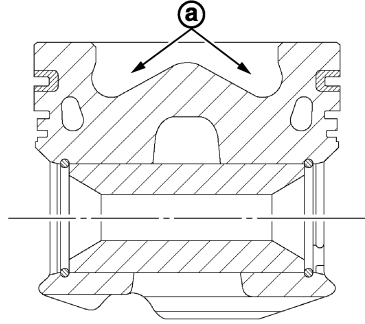
Item	Standard
<div><p>JPBIA0784ZZ</p></div>	
Piston skirt diameter “c”	79.835 mm (3.1431 in)
Measure point “d”	42 mm (1.6535 in)

		
Piston protrusion "a"	0.387 - 0.551 mm (0.0159 - 0.0217 in)	

SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[R9M]



JPBIA0633ZZ

Capacity of combustion chamber "a"

24.65 - 25.35 cm³ (1.5041 - 1.546 cu in)

PISTON RING

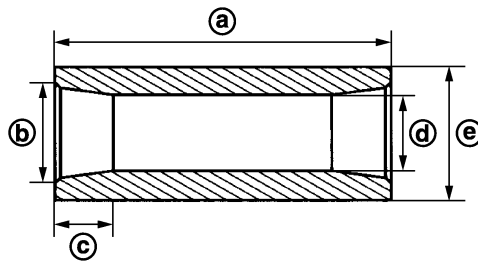
Unit: mm (in)

Items		Standard
Piston ring side clearance	Top	0.09 - 0.13 (0.0035 - 0.0051)
	2nd	0.08 - 0.12 (0.0031 - 0.0047)
	Oil ring	0.05 (0.002)
Piston ring end gap	Top	0.2 - 0.35 (0.0079 - 0.0138)
	2nd	0.7 - 0.9 (0.0276 - 0.0354)
	Oil ring	0.25 - 0.50 (0.0098 - 0.0197)

PISTON PIN

Unit: mm (in)

Items	Standard
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JPBIA0768ZZ

Length "a"	59.85 (2.3563)
Diameter of chamfer "b"	23.85 - 24.15 (0.9390 - 0.9508)
Length of the chamfer "c"	8.7 (0.343)
Piston pin inner diameter "d"	13.8 - 14.1 (0.543 - 0.555)
Piston pin outer diameter "e"	29.995 - 30.005 (1.1809 - 1.1813)
Piston to piston pin oil clearance	0.012 - 0.023 (0.0005 - 0.0009)

CYLINDER BLOCK

Unit: mm (in)

Item	Standard
Cylinder block top surface distortion	0.05 (0.0020)
Cylinder bore inner diameter	80.004 - 84.034 (3.1498 - 3.1509)

SERVICE DATA AND SPECIFICATIONS (SDS)

< SERVICE DATA AND SPECIFICATIONS (SDS)

[R9M]

Cylinder block main bearing housing inner diameter	Grade mark A	55.4975 - 55.4985 (2.1849 - 2.185)
	Grade mark B	55.4985 - 55.4995 (2.185)
	Grade mark C	55.4995 - 55.5005 (2.185 - 2.1851)
	Grade mark E	55.5005 - 55.5015 (2.1851)
	Grade mark H	55.5015 - 55.5025 (2.1851)
	Grade mark J	55.5025 - 55.5035 (2.1851 - 2.1852)
	Grade mark K	55.5035 - 55.5045 (2.1852)
	Grade mark L	55.5045 - 55.5055 (2.1852 - 2.1853)
	Grade mark M	55.5055 - 55.5065 (2.1853)
	Grade mark P	55.5065 - 55.5075 (2.1853)
	Grade mark S	55.5075 - 55.5085 (2.1853 - 2.1854)
	Grade mark T	55.5085 - 55.5095 (2.1854)
	Grade mark U	55.5095 - 55.5105 (2.1854)
	Grade mark Z	55.5105 - 55.5115 (2.1854 - 2.1855)

Main Bearing

INFOID:0000000010784377

MAIN BEARING GRADE TABLE

	Marking	Thickness	Identification color
Lower shell bearing	33281R or 4	1.989 mm (0.0783 in)	Blue
	38751R or 3	1.985 mm (0.0781 in)	Black
	37686R or 2	1.981 mm (0.0780 in)	Yellow
	31153R or 1	1.977 mm (0.0778 in)	White
Upper shell bearing	53785R or 4	1.989 mm (0.0783 in)	Blue
	54889 or 3	1.985 mm (0.0781 in)	Black
	7527 (upper)	1.981 mm (0.0780 in)	Yellow
	7521 (lower)	1.977 mm (0.0778 in)	White

MAIN BEARING OIL CLEARANCE

Unit: mm (in)

Main bearing oil clearance	Standard	0.035 - 0.065 (0.0014 - 0.0026)
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Connecting Rod Bearing

INFOID:0000000010784378

CONNECTING ROD BEARING OIL CLEARANCE

Unit: mm (in)

Connecting rod bearing oil clearance	Standard	0.053 - 0.093 (0.0021 - 0.0037)
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