

## 2012 ENGINE

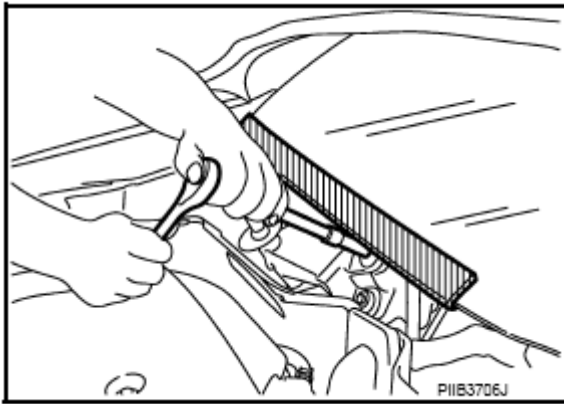
## Engine Mechanical (VQ37VHR) - M

## PRECAUTION

## PRECAUTIONS

## PRECAUTION FOR PROCEDURE WITHOUT COWL TOP COVER

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



**Fig. 1: Identifying Windshield Precaution When Removing Cowl Top Cover**  
Courtesy of NISSAN NORTH AMERICA, INC.

**PRECAUTION FOR SUPPLEMENTAL RESTRAINT SYSTEM (SRS) "AIR BAG" AND "SEAT BELT PRE-TENSIONER"**

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

Information necessary to service the system safely is included in the "SRS AIRBAG " and "SEAT BELT " articles of this Service Information.

**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 AIRBAG".**
- **Never use electrical test equipment on any circuit related to the SRS unless instructed to in this Service Information. 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.**

#### **PRECAUTIONS FOR ENGINE SERVICE**

##### **DISCONNECTING FUEL PIPING**

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

##### **DRAINING ENGINE COOLANT**

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

##### **INSPECTION, REPAIR AND REPLACEMENT**

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

##### **REMOVAL AND DISASSEMBLY**

- When instructed to use SST, use specified tools. Always be careful to work safely, avoid forceful or uninstructed operations.
- Exercise maximum care to avoid damage to mating or sliding surfaces.
- Dowel pins are used for several parts alignment. When replacing and reassembling parts with dowel pins,

check that dowel pins are installed in the original position.

- Must cover openings of engine system with a tape or equivalent, to seal out foreign materials.
- Mark and arrange disassembly parts in an organized way for easy troubleshooting and reassembly.
- When loosening nuts and bolts, as a basic rule, start with the one furthest outside, then the one diagonally opposite, and so on. If the order of loosening is specified, do exactly as specified. Power tools may be used in the step.

#### **ASSEMBLY AND INSTALLATION**

- Use torque wrench to tighten bolts or nuts to specification.
- When tightening nuts and bolts, as a basic rule, equally tighten in several different steps starting with the ones in center, then ones on inside and outside diagonally in this order. If the order of tightening is specified, do exactly as specified.
- Replace with new gasket, packing, oil seal or O-ring.
- Thoroughly wash, clean, and air-blow each part. Carefully check engine oil or engine coolant passages for any restriction and blockage.
- Avoid damaging sliding or mating surfaces. Completely remove foreign materials such as cloth lint or dust. Before assembly, oil sliding surfaces well.
- After disassembling and opening the engine, change engine oil and replace oil filter with a new one.
- Release air within route when refilling after draining engine coolant.
- After repairing, start the engine and increase engine speed to check engine coolant, fuel, engine oil, and exhaust gases for leakage.

#### **PRECAUTIONS NECESSARY FOR STEERING WHEEL ROTATION AFTER BATTERY DISCONNECTION**

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

- **Before removing and installing any control units, first turn the ignition switch to the LOCK position, then disconnect both battery cables.**
- **After finishing work, confirm that all control unit connectors are connected properly, then reconnect 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. Turn the ignition switch to ACC position.

(At this time, the steering lock will be released.)

3. Disconnect both battery cables. The steering lock will remain released with both battery cables disconnected and the steering wheel can be turned.
4. Perform the necessary repair operation.
5. When the repair work is completed, reconnect both battery cables. With the brake pedal released, turn the ignition switch from ACC position to ON position, then to LOCK position. (The steering wheel will lock when the ignition switch is turned to LOCK position.)
6. Perform self-diagnosis check of all control units using CONSULT.

## PARTS REQUIRING ANGLE TIGHTENING

- Use the angle wrench [SST: KV10112100 (BT8653-A)] for the final tightening of the following engine parts:
  - Cylinder head bolts
  - Lower cylinder block bolts
  - Connecting rod cap bolts
- 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.

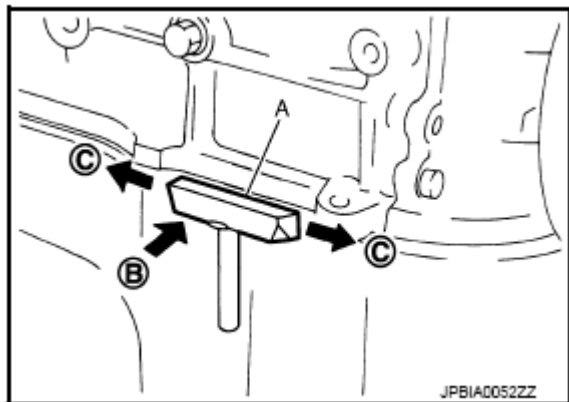
## LIQUID GASKET

### REMOVAL OF LIQUID GASKET SEALING

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

**CAUTION: Be careful not to damage the mating surfaces.**

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



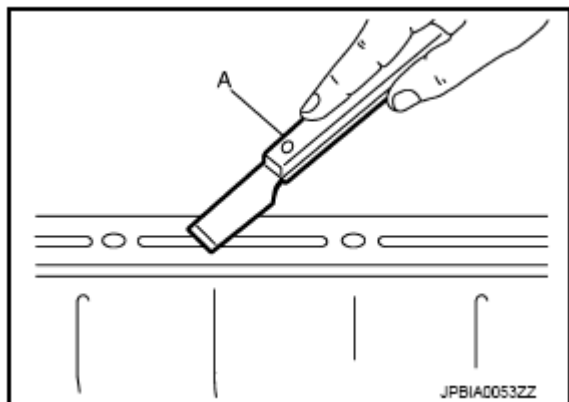
**Fig. 2: Tapping Seal Cutter**

Courtesy of NISSAN NORTH AMERICA, INC.

**CAUTION:** If for some unavoidable reason a 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 stuck 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.



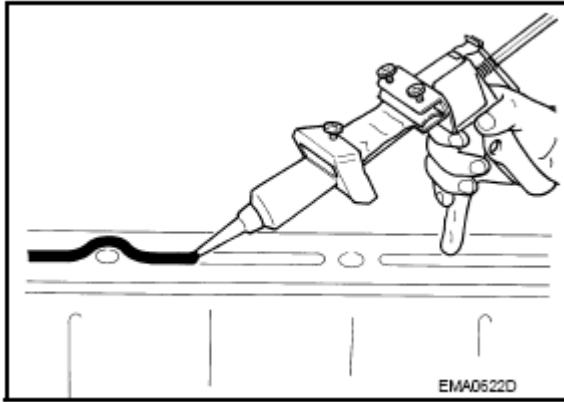
**Fig. 3: Removing Liquid Gasket**

Courtesy of NISSAN NORTH AMERICA, INC.

3. Attach liquid gasket tube to the tube presser (commercial service tool).

**Use Genuine RTV Silicone Sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS".**

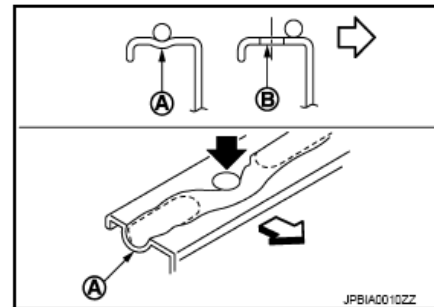
4. Apply liquid gasket without gaps to the specified location according to the specified dimensions.
  - If there is a groove for liquid gasket application, apply liquid gasket to the groove.



**Fig. 4: Applying Liquid Gasket**  
 Courtesy of NISSAN NORTH AMERICA, INC.

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

A : Groove  
 ⇐ : Inside



**Fig. 5: Identifying Liquid Gasket Application Areas**  
 Courtesy of NISSAN NORTH AMERICA, INC.

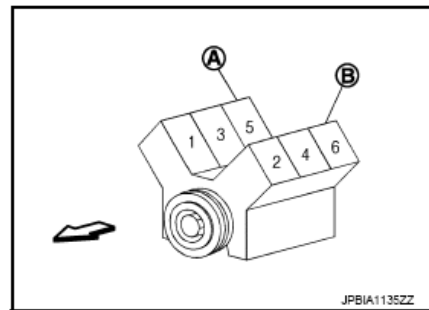
- Within five minutes of liquid gasket application, install the mating component.
- If liquid gasket protrudes, wipe it off immediately.
- Do not retighten mounting bolts or nuts after the installation.
- After 30 minutes or more have passed from the installation, fill engine oil and engine coolant.

**CAUTION: If there are specific instructions in this Service Information, observe them.**

## DEFINITIONS OF BANK NAMES

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

- A : Bank 1 (The conventional right bank)  
 B : Bank 2 (The conventional left bank)  
 ⇐ : Engine front



**Fig. 6: Identifying Right And Left Banks**  
 Courtesy of NISSAN NORTH AMERICA, INC.

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

**Bank 1: The bank side including cylinder No. 1**

**(odd-numbered cylinder side)**

**Bank 2: The other bank side of the above**

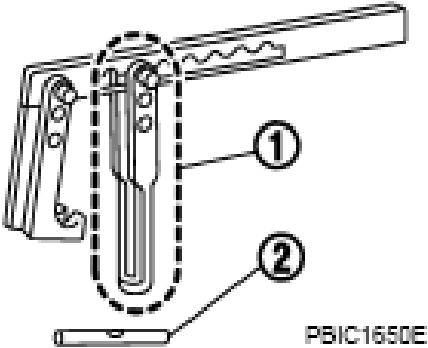
**(even-numbered cylinder side)**

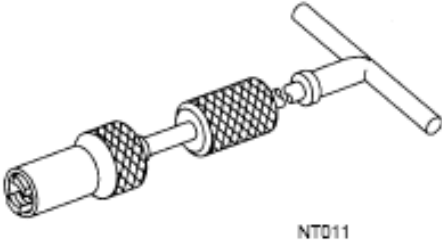
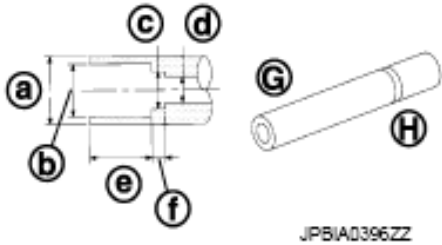
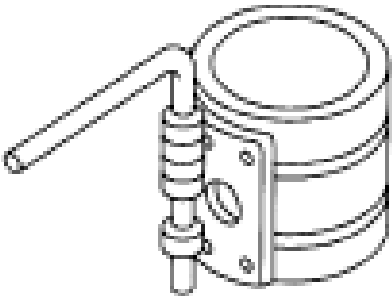
## PREPARATION

### PREPARATION

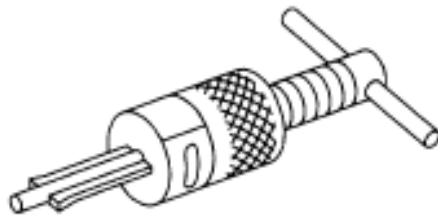
#### Special Service Tools

The actual shapes of Kent-Moore tools may differ from those of special service tools illustrated here.

Tool number (Kent-Moore No.) Tool name	Description
KV10116200 (J-26336-A) Valve spring compressor  1. KV10115900  (J-26336-20)  Attachment  2. KV10109220	 <p>Disassembling valve mechanism Part (1) is a component of KV10116200 (J-26336-A), but Part (2) is not so.</p>

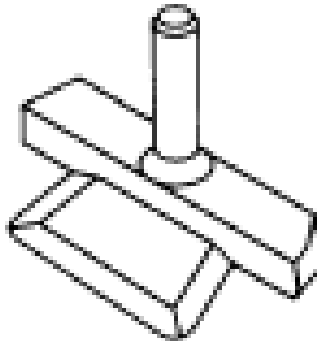
<p>(-)</p> <p>Adapter</p>	
<p>KV10107902 (J-38959) Valve oil seal puller</p>  <p>NT011</p>	<p>Replacing valve oil seal</p>
<p>KV10115600 (J-38958) Valve oil seal drift</p>  <p>JPBA0396ZZ</p>	<p>Installing valve oil seal Use side A (G).</p> <p>a. 20 (0.79) dia. b. 13 (0.51) dia. c. 10.3 (0.406) dia. d. 8 (0.31) dia. e. 10.7 (0.421) f. 5 (0.20)</p> <p><b>H: side B</b></p> <p>Unit: mm (in)</p>
<p>EM03470000 (J-8037) Piston ring compressor</p>  <p>NT044</p>	<p>Installing piston assembly into cylinder bore</p>
<p>ST16610001 (J-23907) Pilot bushing puller</p>	<p>Removing pilot converter</p>





NT045

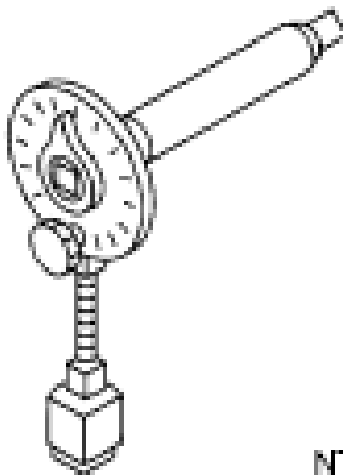
KV10111100  
(J-37228)  
Seal cutter



NT046

Removing oil pan (lower and upper), front and rear timing chain case, etc.

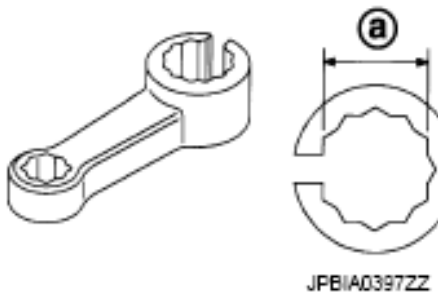
KV10112100  
(BT8653-A)  
Angle wrench



NT014

Tightening bolts for connecting rod bearing cap, cylinder head, etc. at an angle

KV10114400  
(J-38365)  
Heated oxygen sensor wrench

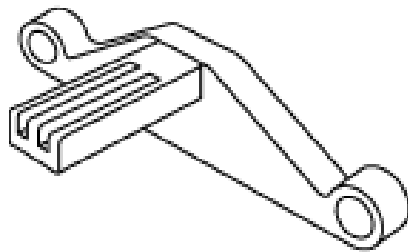


JFBI/A0397ZZ

Loosening or tightening air fuel ratio sensor 1

a. **22 mm (0.87 in)**

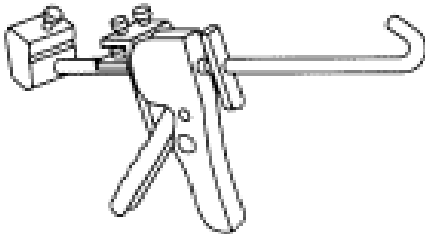
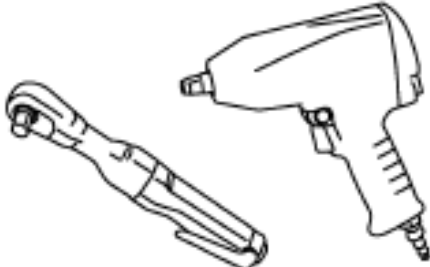
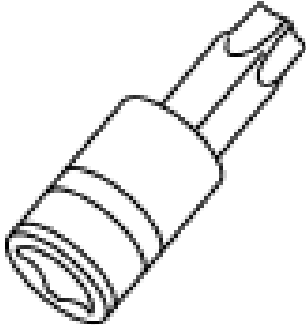
KV10118600  
(J-48641)  
Ring gear stopper



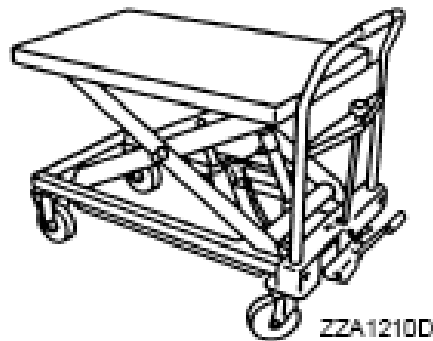
JFBIAD409ZZ

Removing and installing crankshaft pulley

Commercial Service Tools

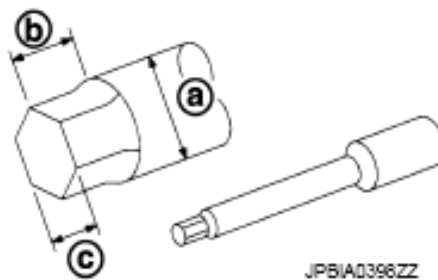
(Kent-Moore No.) Tool name	Description
(-) Tube presser	 NT052 Pressing the tube of liquid gasket
(-) Power tool	 PBIC0190E Loosening nuts and bolts
(-) TORX socket	 PBIC1113E Removing and installing drive plate

(-)  
Manual lift table caddy



Removing and installing engine

(J-24239-01)  
Cylinder head bolt wrench

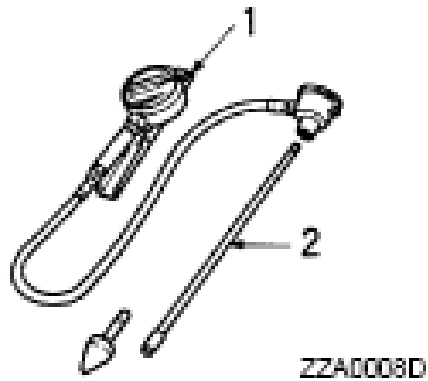


Loosening and tightening cylinder head bolt, and used with the angle wrench [SST: KV10112100 (BT8653-A)]

- a. **13 (0.51) dia.**
- b. **12 (0.47)**
- c. **10 (0.39)**

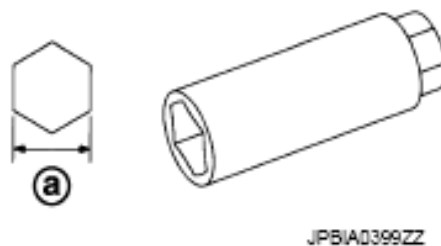
Unit: mm (in)

(-)  
1. Compression gauge  
2. Adapter



Checking compression pressure

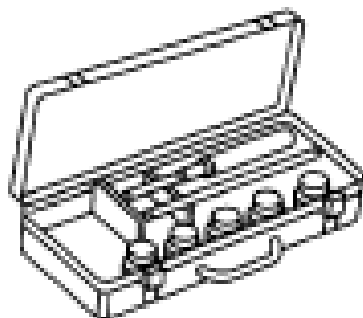
(-)  
Spark plug wrench



Removing and installing spark plug

- a. **14 mm (0.55 in)**

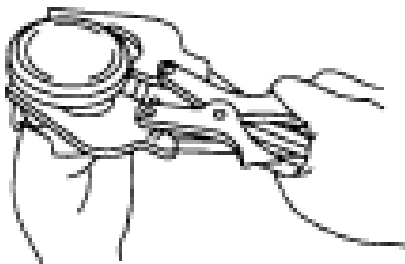
(-)  
Valve seat cutter set



NT048

Finishing valve seat (EXH)  
dimensions

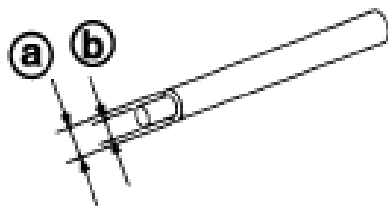
(-)  
Piston ring expander



NT030

Removing and installing piston ring

(-)  
Valve guide drift

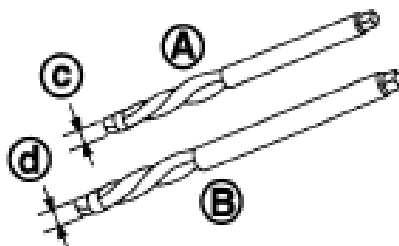


JPBIA0400ZZ

Removing and installing valve guide  
(EXH) Exhaust:

- a. **9.5 mm (0.374 in) dia.**
- b. **5.5 mm (0.217 in) dia.**

(-)  
Valve guide reamer



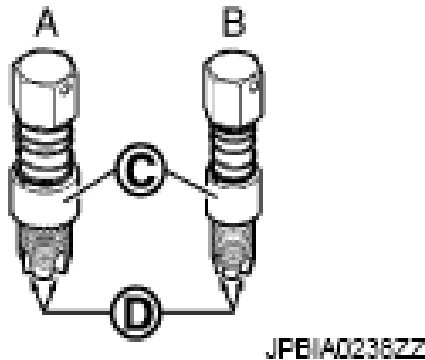


JPBIA0401ZZ

- A. Reaming valve guide (EXH)  
inner hole
- B. Reaming hole for oversize  
valve guide (EXH)

**Exhaust:**

- c: **6.0 mm (0.236 in) dia.**
- d: **10.2 mm (0.402 in) dia.**

Reconditioning the exhaust system  
threads before installing a new air  
fuel ratio sensor and heated oxygen

<p>(J-43897-18) (J-43897-12) Oxygen sensor thread cleaner</p>	 <p>JPBIA0236ZZ</p>	<p>sensor (Use with anti-seize lubricant shown below.)</p> <p>A. <b>J-43897-18 [18 mm (0.71 in) dia.] for zirconia heated oxygen sensor and air fuel ratio sensor</b></p> <p>B. <b>J-43897-12 [12 mm (0.47 in) dia.] for titania heated oxygen sensor</b></p> <p>C. Mating surface shave cylinder</p> <p>D. Flutes</p>
<p>(-) Anti-seize lubricant (Permatex 133AR or equivalent meeting MIL specification MIL-A-907)</p>	 <p>JEM489</p>	<p>Lubricating oxygen sensor thread cleaning tool when reconditioning exhaust system threads</p>
<p>(-) Feeler gauge</p>	 <p>JPBIA1362ZZ</p>	<p>Inspection valve clearance (Use a curved-tip gauge)</p>

## BASIC INSPECTION

### CAMSHAFT VALVE CLEARANCE

#### Inspection and Adjustment

#### INSPECTION

Check valve clearance if applicable to the following cases:

Intake side:

- At the removal and installation of VVEL ladder assembly or valve-related parts, or at the occurrence of malfunction (poor starting, idle malfunction, unusual noise) due to aged deterioration in valve clearance.

**CAUTION:** Valve clearance check on the intake side is not required after replacing the VVEL ladder assembly and cylinder head assembly with a new one. (Install new VVEL ladder assembly and cylinder head assembly in factory-shipped condition because it is factory-adjusted and inspected.)

**NOTE:** VVEL ladder assembly cannot be replaced as a single part, because it is machined together with cylinder head assembly.

Exhaust side:

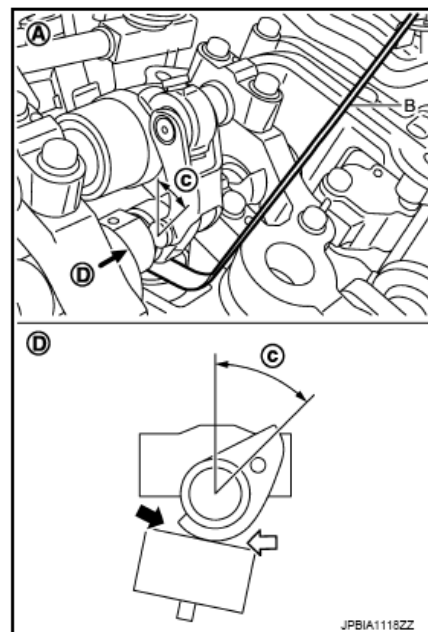
- At the removal, installation, and replacement of camshaft (EXH) or valve-related parts, or at the occurrence of malfunction (poor starting, idle malfunction, unusual noise) due to aged deterioration in valve clearance.
1. Remove rocker covers (bank 1 and bank 2). Refer to "**EXPLODED VIEW**".
  2. Measure the valve clearance as follows:
    - Use the feeler gauge (commercial service tool) of curved-tip. This allows the feeler gauge to access the clearance between camshaft and valve lifter with ease.

**Valve clearance:** Refer to "**CAMSHAFT**".

**NOTE:** Be sure to note the following points when measuring valve clearance on the intake side.

- Before measuring, check that the position of drive shaft nose is within the angle shown in the figure below.

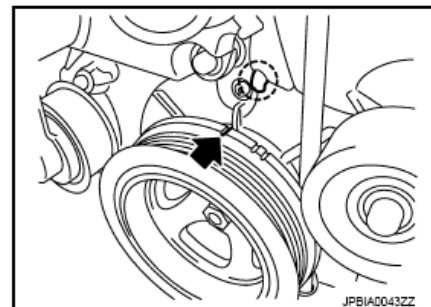
- A : Bank 1
- B : Feeler gauge (commercial service tool)
- D : View D
- c : 45 degrees (drive shaft nose angle)
- ↖ : Insertion direction of feeler gauge on the bank 1
- ↙ : Insertion direction of feeler gauge on the bank 2



**Fig. 7: Measuring Camshaft Valve Clearance**  
Courtesy of NISSAN NORTH AMERICA, INC.

- Refer to the illustration for the insertion direction of the feeler gauge since the direction depends on the bank.
- a. Set No. 1 cylinder at TDC of its compression stroke.
  - Rotate crankshaft pulley clockwise to align timing mark (grooved line without color) with timing indicator.

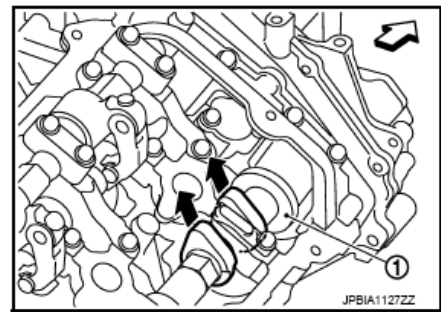
- ↖ : Timing mark (grooved line without color)



**Fig. 8: Locating Timing Marks**  
Courtesy of NISSAN NORTH AMERICA, INC.

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

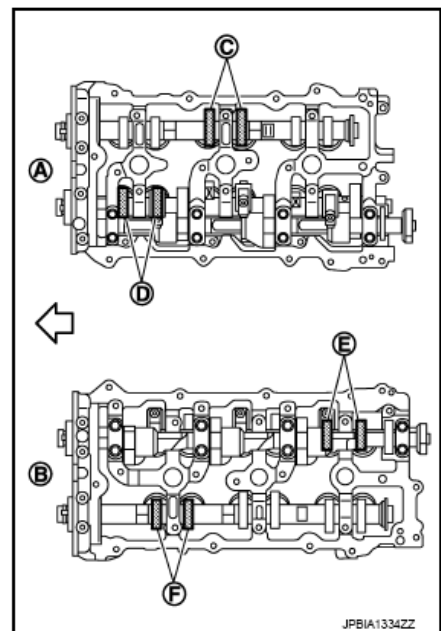
1 : Camshaft (EXH) (bank 1)  
 ⇐ : Engine front



**Fig. 9: Locating No. 1 Cylinder Exhaust Cam Nose**  
 Courtesy of NISSAN NORTH AMERICA, INC.

- If not, turn crankshaft one revolution (360 degrees) and align as shown in the figure below.
- By referring to the figure, measure the valve clearances at locations marked "x" as shown in the table below (locations indicated in the figure).
- No. 1 cylinder at compression TDC

⇐ : Engine front



**Fig. 10: Locating Valve Clearance Measuring Area**  
 Courtesy of NISSAN NORTH AMERICA, INC.

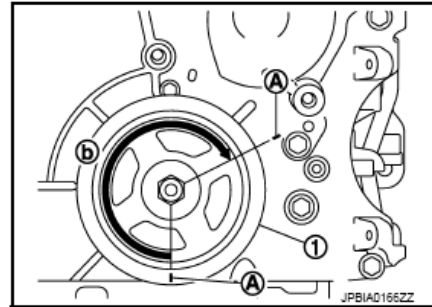
Measuring position [bank 1 (A)]		No. 1 CYL.	No. 3 CYL.	No. 5 CYL.
No. 1 cylinder at compression TDC	EXH		x (C)	
	INT	x (D)		
Measuring position [bank 2 (B)]		No. 2 CYL.	No. 4 CYL.	No. 6 CYL.
No. 1 cylinder at compression TDC	INT			x (E)
	EXH	x (F)		



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

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

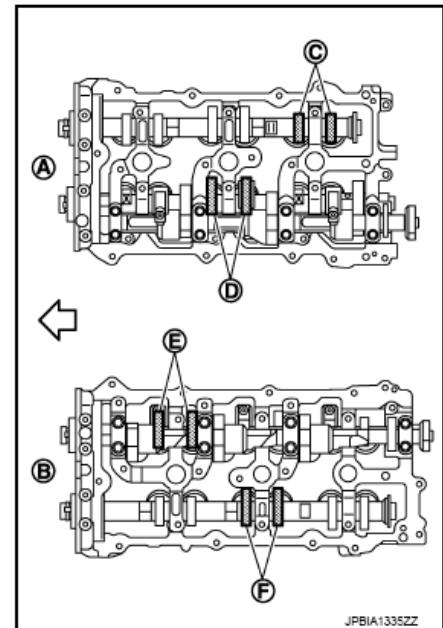
1 : Crankshaft pulley  
A : Paint mark



**Fig. 11: Rotating Crankshaft 240 Degrees Clockwise**  
Courtesy of NISSAN NORTH AMERICA, INC.

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

↔ : Engine front



**Fig. 12: Locating Valve Clearance Measuring Area**  
Courtesy of NISSAN NORTH AMERICA, INC.

- No. 3 cylinder at compression TDC

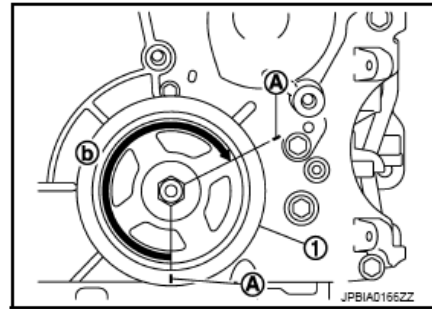
Measuring position [bank 1 (A)]	No. 1 CYL.	No. 3 CYL.	No. 5 CYL.
---------------------------------	------------	------------	------------

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

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

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

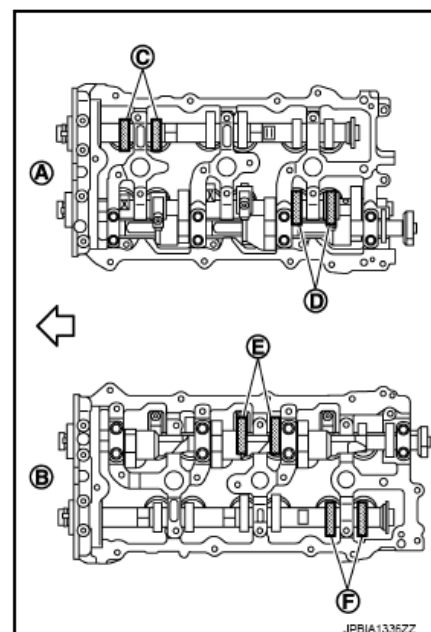
- 1 : Crankshaft pulley  
A : Paint mark



**Fig. 13: Rotating Crankshaft 240 Degrees Clockwise**  
Courtesy of NISSAN NORTH AMERICA, INC.

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

↩ : Engine front



**Fig. 14: Locating Valve Clearance Measuring Area**  
Courtesy of NISSAN NORTH AMERICA, INC.

- No. 5 cylinder at compression TDC

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

3. Perform adjustment or replacement if the measured value is out of the standard.

- If a valve clearance on the exhaust side is out of specification, adjust the valve clearance.
- If a valve clearance on the intake side is out of specification, replace VVEL ladder assembly and cylinder head assembly. Refer to "**EXPLODED VIEW**".

**CAUTION:** Never adjust valve clearance on the intake side.

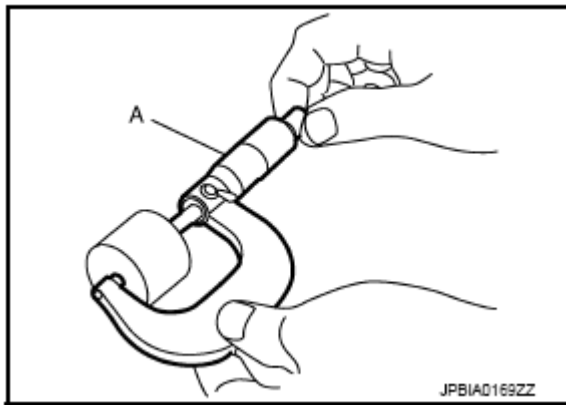
**NOTE:** Since the valve lifter (INT) cannot be replaced by the piece, VVEL ladder assembly and cylinder head assembly replacement are required.

#### CAMSHAFT (EXH) VALVE CLEARANCE ADJUSTMENT

- Perform adjustment depending on selected head thickness of valve lifter (EXH).
1. Measure the valve clearance. Refer to "**INSPECTION**".
  2. Remove VVEL ladder assembly and camshaft (EXH). Refer to "**DISASSEMBLY AND ASSEMBLY**".

**CAUTION: Never loosen adjusting bolts and mounting bolts (black color) of VVEL ladder assembly.**

3. Remove valve lifter (EXH) at the locations that are out of the standard.
4. Measure the center thickness of the removed valve lifters (EXH) with a micrometer (A).



**Fig. 15: Measuring Valve Lifter Center Thickness**  
Courtesy of NISSAN NORTH AMERICA, INC.

5. Use the equation below to calculate valve lifter (EXH) thickness for replacement.

**Valve lifter (EXH) thickness calculation:  $t = t1 + (C1 - C2)$**

**$t$  = Valve lifter (EXH) thickness to be replaced**

**$t1$  = Removed valve lifter (EXH) thickness**

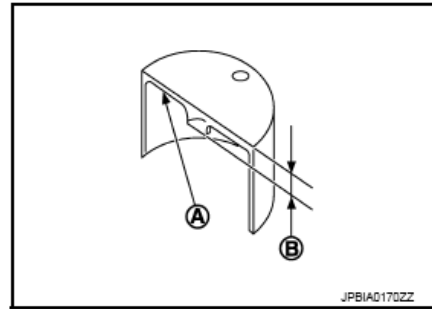
**$C1$  = Measured valve clearance**

**$C2$  = Standard valve clearance:**

**Exhaust: 0.33 mm (0.013 in)**

- Thickness of new valve lifter (EXH) can be identified by stamp marks on the reverse side (inside the cylinder). Stamp mark 788 indicates 7.88 mm (0.3102 in) in thickness.

- A : Stamp  
B : Thickness of valve lifter (EXH)



**Fig. 16: Identifying Valve Lifter Thickness**  
Courtesy of NISSAN NORTH AMERICA, INC.

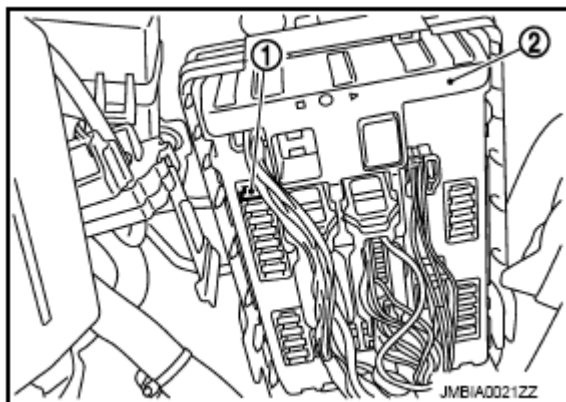
Available thickness of valve lifter (EXH): 27 sizes with range 7.88 to 8.40 mm (0.3102 to 0.3307 in) in steps of 0.02 mm (0.0008 in) (when manufactured at factory). Refer to "CAMSHAFT".

6. Install selected valve lifter (EXH).
7. Install VVEL ladder assembly and camshaft (EXH). Refer to "DISASSEMBLY AND ASSEMBLY".
8. Manually turn crankshaft pulley a few turns.
9. Check that the valve clearances for cold engine are within the specifications by referring to the specified values.
10. Install all removed parts in the reverse order of removal.
11. Warm up the engine, and check for unusual noise and vibration.

## COMPRESSION PRESSURE

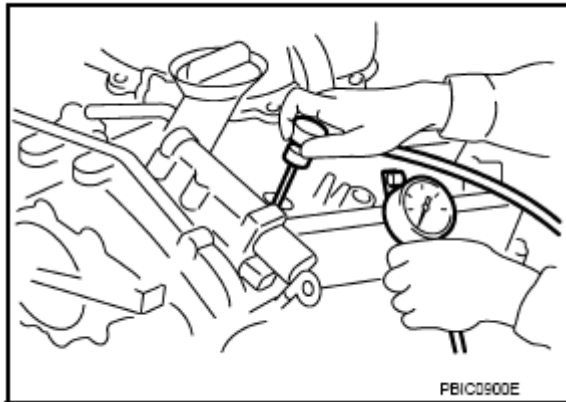
### Inspection

1. Warm up engine thoroughly. Then, stop it.
2. Release fuel pressure. Refer to "WORK PROCEDURE" (FOR USA AND CANADA) .
3. Disconnect fuel pump fuse (1) from IPDM E/R (2) to avoid fuel injection during measurement.



**Fig. 17: Identifying Fuel Pump Fuse And IPDM E/R**  
Courtesy of NISSAN NORTH AMERICA, INC.

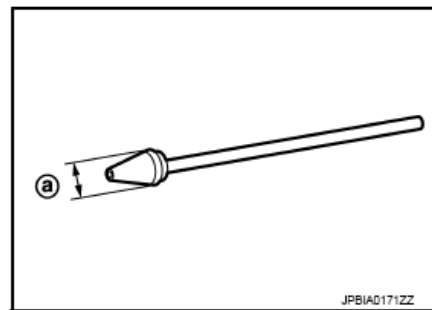
4. Remove engine cover with power tool. Refer to "**EXPLODED VIEW**".
5. Remove ignition coil and spark plug from each cylinder. Refer to "**EXPLODED VIEW**".
6. Connect engine tachometer (not required in use of CONSULT).
7. Install compression gauge with an adapter (commercial service tool) onto spark plug hole.



**Fig. 18: Installing Compression Tester & Adapter**  
Courtesy of NISSAN NORTH AMERICA, INC.

- 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)



**Fig. 19: Identifying Adapter End Diameter**  
Courtesy of NISSAN NORTH AMERICA, INC.

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

**Compression pressure:** Refer to "**GENERAL SPECIFICATION**".

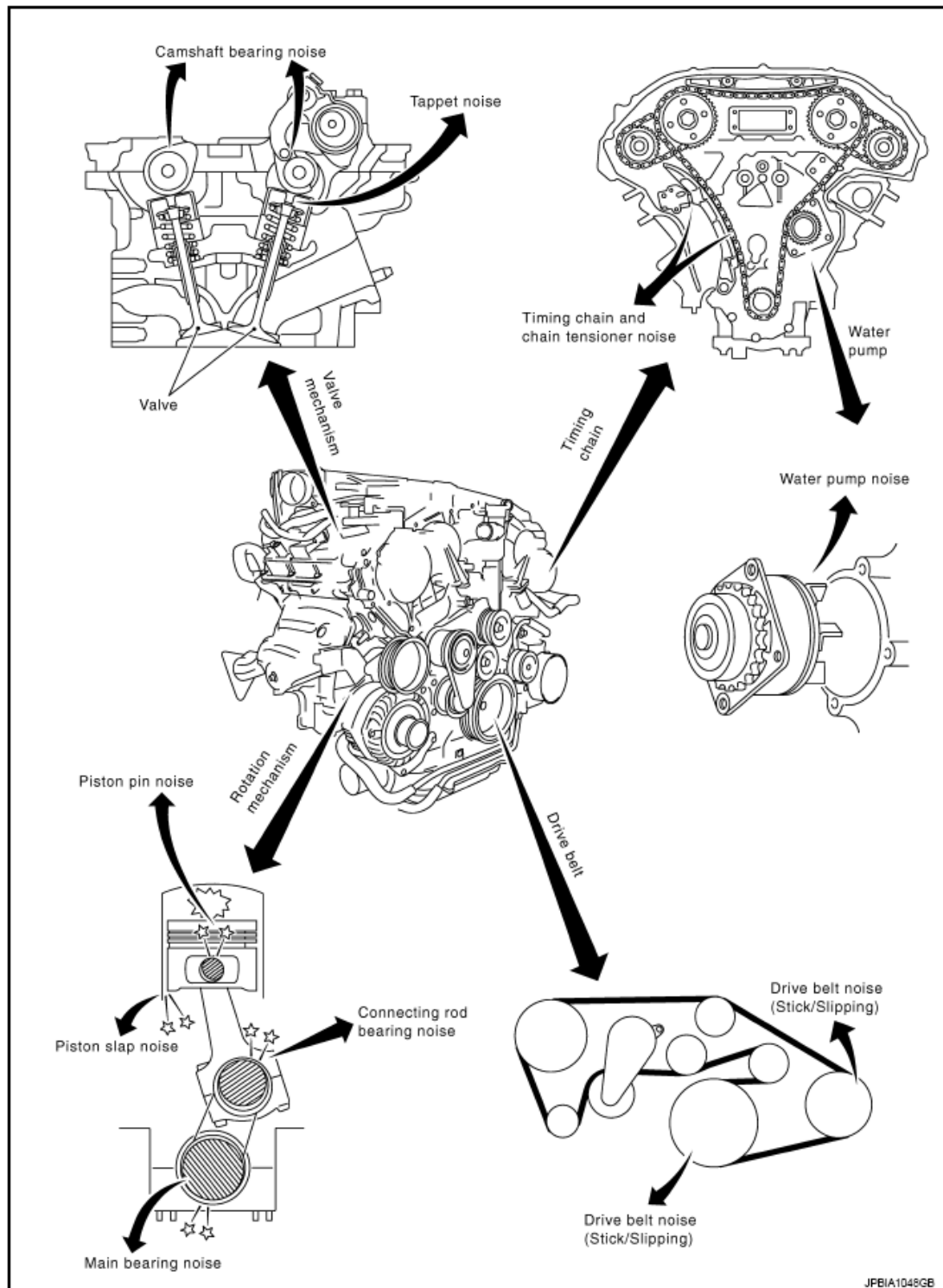
**CAUTION:**

- **Measure a six-cylinder under the same conditions since a measurement depends on measurement conditions (engine water temperature, etc.).**
- **Always use a fully charged battery to obtain the specified**

**engine speed.**

- If the engine speed is out of the specified range, check battery liquid for proper gravity. Check the engine speed again with normal battery gravity.
  - If compression pressure is below the minimum value, check valve clearances and parts associated with combustion chamber (valve, valve seat, piston, piston ring, cylinder bore, cylinder head, cylinder head gasket). After checking, measure compression pressure again.
  - If a cylinder has low compression pressure, pour a small amount of engine oil into the spark plug hole of the cylinder to recheck it for compression.
    - 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.
9. After inspection is completed, install removed parts.
  10. Start the engine, and check that the engine runs smoothly.
  11. Perform trouble diagnosis. If DTC appears, erase it. Refer to "**DESCRIPTION**" (FOR USA AND CANADA).

**SYMPTOM DIAGNOSIS****NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING****NVH Troubleshooting - Engine Noise**



**Fig. 20: Identifying Engine Noise, Vibration And Harshness Components**  
 Courtesy of NISSAN NORTH AMERICA, INC.

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



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

If necessary, repair or replace these parts.

Location of noise	Type of noise	Operating condition of engine						Source of noise	Check item	Refer
		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	<u>VALVE CLEARANCE</u>	
	Rattle	C	A	-	A	B	C	Camshaft bearing noise	<u>CAMSHAFT RUNOUT</u> <u>CAMSHAFT JOURNAL OIL CLEARANCE</u>	
Crankshaft pulley Cylinder block (Side of engine) Oil pan	Slap or knock	-	A	-	B	B	-	Piston pin noise	<u>PISTON TO PISTON PIN OIL CLEARANCE</u> <u>CONNECTING ROD BUSHING OIL CLEARANCE</u>	
	Slap or rap	A	-	-	B	B	A	Piston slap noise	<u>PISTON TO CYLINDER BORE CLEARANCE</u> <u>PISTON RING SIDE CLEARANCE</u> <u>PISTON RING END GAP</u> <u>CONNECTING ROD BEND AND TORSION</u>	
	Knock	A	B	C	B	B	B	Connecting rod bearing noise	<u>CONNECTING ROD BUSHING OIL CLEARANCE</u> <u>CONNECTING ROD BEARING OIL</u>	

## 2012 Infiniti M37

2012 ENGINE Engine Mechanical (VQ37VHR) - M

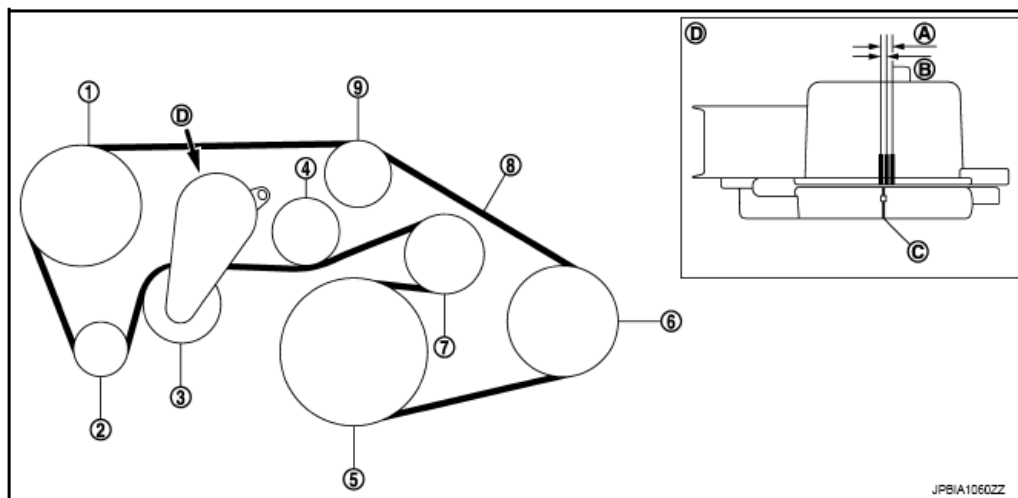
									<u>CLEARANCE</u>	
	Knock	A	B	-	A	B	C	Main bearing noise	<u>MAIN BEARING OIL CLEARANCE</u> <u>CRANKSHAFT RUNOUT</u>	
Front of engine Timing chain case	Tapping or ticking	A	A	-	B	B	B	Timing chain and timing chain tensioner noise	<u>TIMING CHAIN CRACKS AND WEAR</u> <u>TIMING CHAIN TENSIONER OPERATION</u>	
Front of engine	Squeaking or fizzing	A	B	-	B	-	C	Drive belt (Sticking or slipping)	<u>DRIVE BELT DEFLECTION</u>	
	Creaking	A	B	A	B	A	B	Drive belt (Slipping)	<u>IDLER PULLEY BEARING OPERATION</u>	
	Squall Creak	A	B	-	B	A	B	Water pump noise	Water pump operation	<u>WATER PUMP</u>

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

## PERIODIC MAINTENANCE

### DRIVE BELT

Exploded View



JPB/A1060ZZ

- |                            |   |                              |
|----------------------------|---|------------------------------|
| 1. Power steering oil pump | 2. Alternator                             | 3. Drive belt auto-tensioner |
| 4. Idler pulley            | 5. Crankshaft pulley                      | 6. A/C compressor            |
| 7. Idler pulley            | 8. Drive belt                             | 9. Idler pulley              |
| A. Possible use range      | B. Range when new drive belt is installed | C. Indicator                 |
| D. View D                  |   |                              |

**Fig. 21: Drive Belt Routing Diagram**

Courtesy of NISSAN NORTH AMERICA, INC.

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

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

**NOTE:**

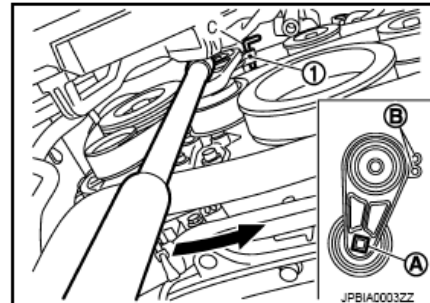
- Check the drive belt auto-tensioner indication when the engine is cold.
- When new drive belt is installed, the indicator (notch on fixed side) should be within the range (B) in the figure.
- Visually check the entire drive belt for wear, damage or crack.
- If the indicator (notch on fixed side) is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

**Tension Adjustment**Refer to "**DRIVE BELT**".**Removal and Installation****REMOVAL**

1. Remove radiator reservoir tank. Refer to "**EXPLODED VIEW**".
2. Remove engine undercover with power tool.
3. Remove radiator cooling fan assembly. Refer to "**EXPLODED VIEW**".
4. While securely holding the square hole (A) in pulley center of auto tensioner (1) with a spinner handle, move spinner handle in the direction of arrow (loosening direction of drive belt).

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

← : Loosening direction of drive belt



**Fig. 22: Loosening Drive Belt**

Courtesy of NISSAN NORTH AMERICA, INC.

5. Under the above condition, insert a metallic bar of approximately 6 mm (0.24 in) in diameter [hexagonal wrench (C) shown as example in the figure below] through the holding boss (B) to lock auto-tensioner pulley arm.
6. Remove drive belt.

## INSTALLATION

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

- CAUTION:**
- Check drive belt is securely installed around all pulleys.
  - Check drive belt is correctly engaged with the pulley groove.
  - Check for engine oil and engine coolant on drive belt and pulleys.

## Inspection

### INSPECTION AFTER INSTALLATION

- Turn crankshaft pulley clockwise several times to equalize tension between each pulley, and then confirm tension of drive belt at indicator (notch on fixed side) is within the possible use range. Refer to "**EXPLODED VIEW**".

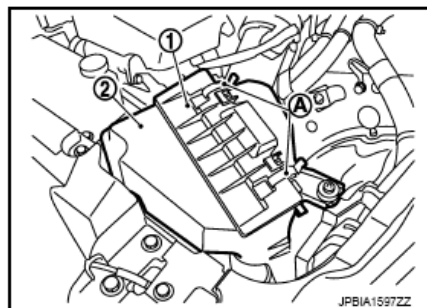
## AIR CLEANER FILTER

## Removal and Installation

### REMOVAL

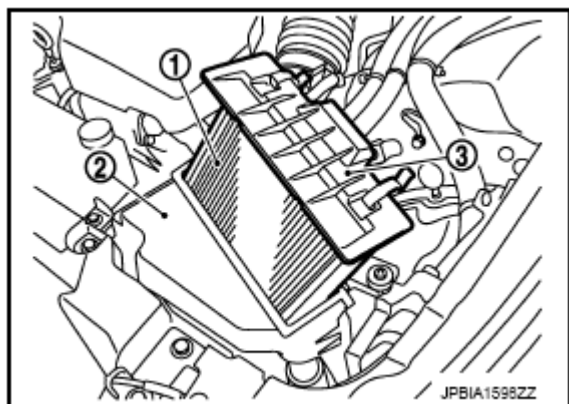
1. Unhook clips (A).

- 1 : Holder  
2 : Air cleaner case



**Fig. 23: Identifying Air Cleaner Case, Holder And Clips**  
Courtesy of NISSAN NORTH AMERICA, INC.

2. Remove holder (3) from air cleaner case (2), and then remove air cleaner filter (1) from holder.



**Fig. 24: Identifying Holder, Air Cleaner Case And Filter**  
Courtesy of NISSAN NORTH AMERICA, INC.

### INSTALLATION

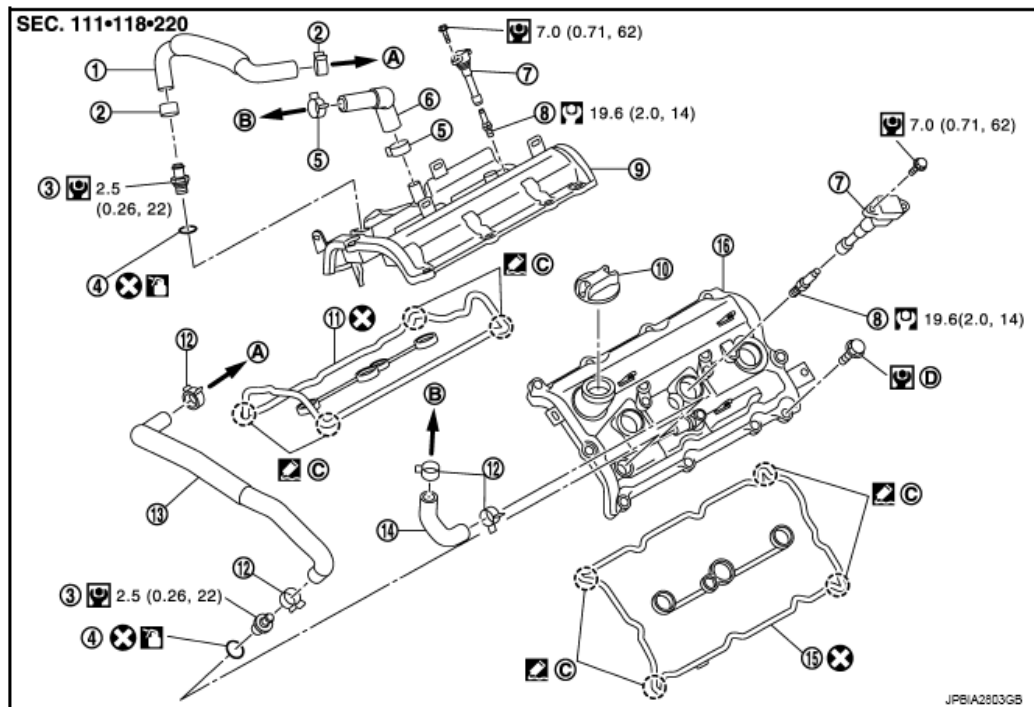
Note the following, and install in the reverse order of removal.

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

### SPARK PLUG

#### Exploded View

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.



- |  |                                  |                                  |
|--|----------------------------------|----------------------------------|
| 1. PCV hose  | 2. Clamp                         | 3. PCV valve                     |
| 4. O-ring  | 5. Clamp                         | 6. PCV hose                      |
| 7. Ignition coil   | 8. Spark plug                    | 9. Rocker cover (bank 1)         |
| 10. Oil filler cap   | 11. Rocker cover gasket (bank 1) | 12. Clamp                        |
| 13. PCV hose   | 14. PCV hose                     | 15. Rocker cover gasket (bank 2) |
| 16. Rocker cover (bank 2)                                  |                                  |                                  |
| A. To intake manifold collector                            | B. To air duct                   | C. VVEL ladder assembly side     |
| D. Comply with the installation procedure when tightening. |                                  |                                  |

**Fig. 25: Exploded View Of Spark Plug With Torque Specifications**

Courtesy of NISSAN NORTH AMERICA, INC.

Refer to "**COMPONENTS**" for symbols in the figure.

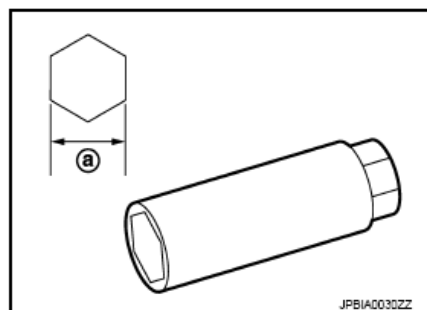
## Removal and Installation

### REMOVAL

1. Remove engine cover with power tool. Refer to "**EXPLODED VIEW**".
2. Remove air cleaner case and air duct (RH and LH). Refer to "**EXPLODED VIEW**".
3. Remove electric throttle control actuator. Refer to "**EXPLODED VIEW**".
4. Remove ignition coil. Refer to "**REMOVAL AND INSTALLATION**".

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

a : 14 mm (0.55 in)



**Fig. 26: Identifying Spark Plug Wrench Dimension**  
Courtesy of NISSAN NORTH AMERICA, INC.

#### INSTALLATION

Installation is the reverse order of removal.

#### Inspection

#### INSPECTION AFTER REMOVAL

Use the standard type spark plug for normal condition.

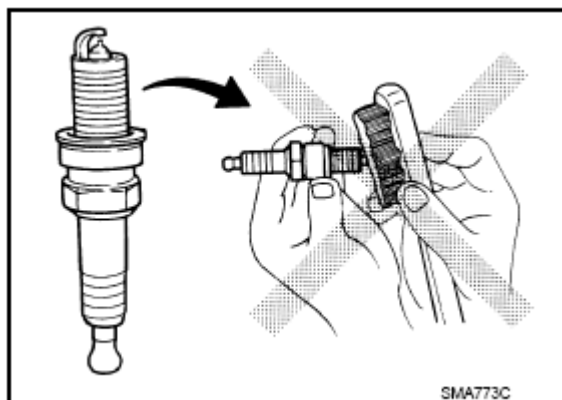
Spark plug (Standard type): Refer to "SPARK PLUG".

#### CAUTION:

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

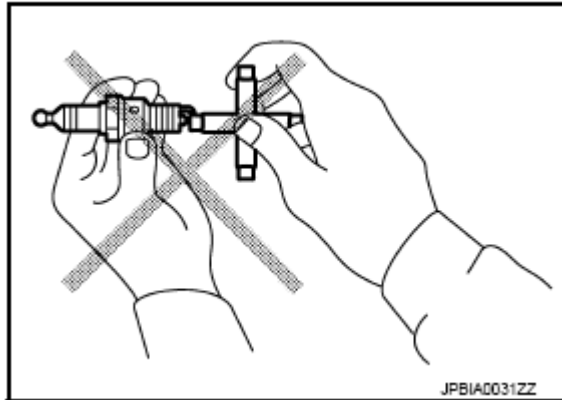
Cleaner air pressure: Less than 588 kPa (6 kg/cm<sup>2</sup> , 85 psi)

Cleaning time: Less than 20 seconds



**Fig. 27: Caution - Do Not Clean Spark Plug Using Wire Brush**  
Courtesy of NISSAN NORTH AMERICA, INC.

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



**Fig. 28: Caution - Do Not Adjust Spark Plug Gap**  
Courtesy of NISSAN NORTH AMERICA, INC.




## REMOVAL AND INSTALLATION

### ENGINE COVER

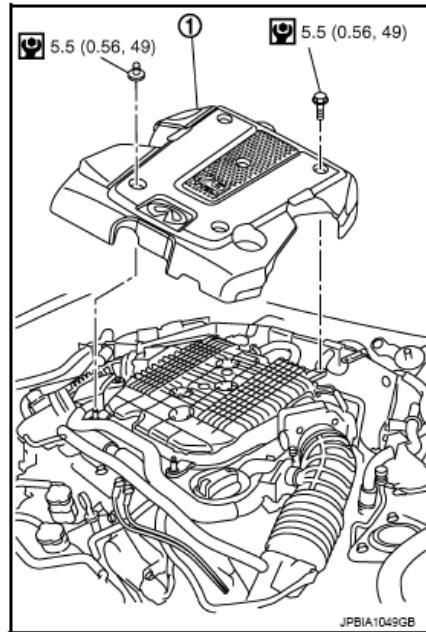
#### Exploded View

Refer to "**COMPONENTS**" for symbols in the figure.



Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.

1 : Engine cover



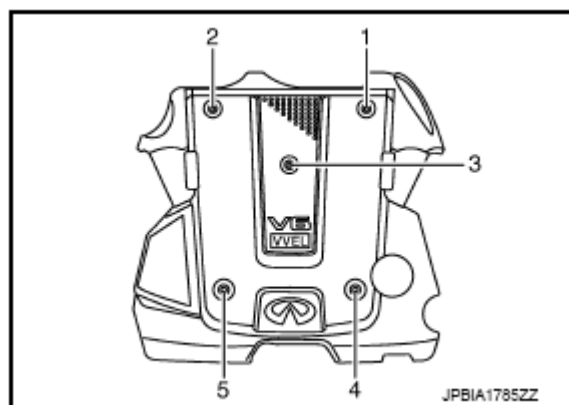
**Fig. 29: Exploded View Of Engine Cover Mounting Bolts With Torque Specifications**  
 Courtesy of NISSAN NORTH AMERICA, INC.

## Removal and Installation

### REMOVAL

Loosen mounting bolts and nuts in reverse of the order shown in the figure below, and then remove engine cover.

**CAUTION:** Never damage or scratch engine cover when installing or removing.

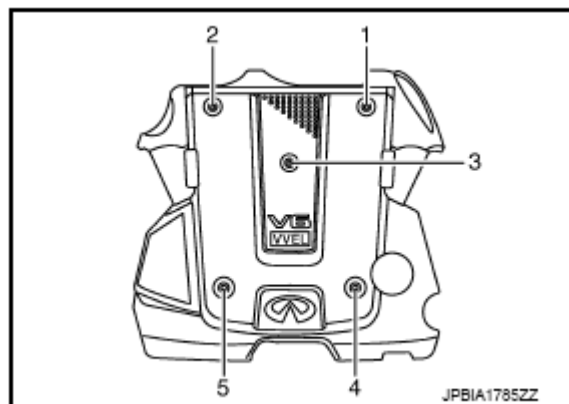


**Fig. 30: Engine Cover Bolt Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

#### INSTALLATION

Install engine cover, and then tighten mounting bolts and nuts in numerical order as shown in the figure below.




**CAUTION: Never damage or scratch engine cover when installing or removing.**

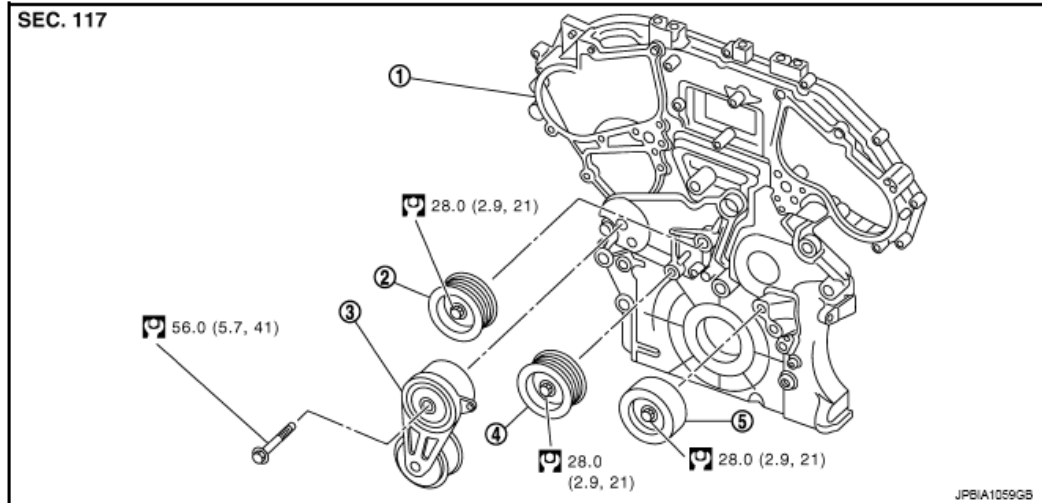


**Fig. 31: Engine Cover Bolt Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

#### DRIVE BELT AUTO TENSIONER AND IDLER PULLEY

Exploded View

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.



- |                            |                 |                              |
|----------------------------|-----------------|------------------------------|
| 1. Front timing chain case | 2. Idler pulley | 3. Drive belt auto-tensioner |
| 4. Idler pulley            | 5. Idler pulley |                              |

**Fig. 32: Exploded View Of Drive Belt Auto Tensioner And Idler Pulley With Torque Specifications**  
 Courtesy of NISSAN NORTH AMERICA, INC.

Refer to "**COMPONENTS**" for symbols in the figure.

## Removal and Installation

### REMOVAL

1. Remove drive belt. Refer to "**EXPLODED VIEW**".
  - Keep auto-tensioner pulley arm locked after drive belt is removed.
2. Remove auto-tensioner and idler pulley.
  - Keep auto-tensioner pulley arm locked to install or remove auto-tensioner.

### INSTALLATION

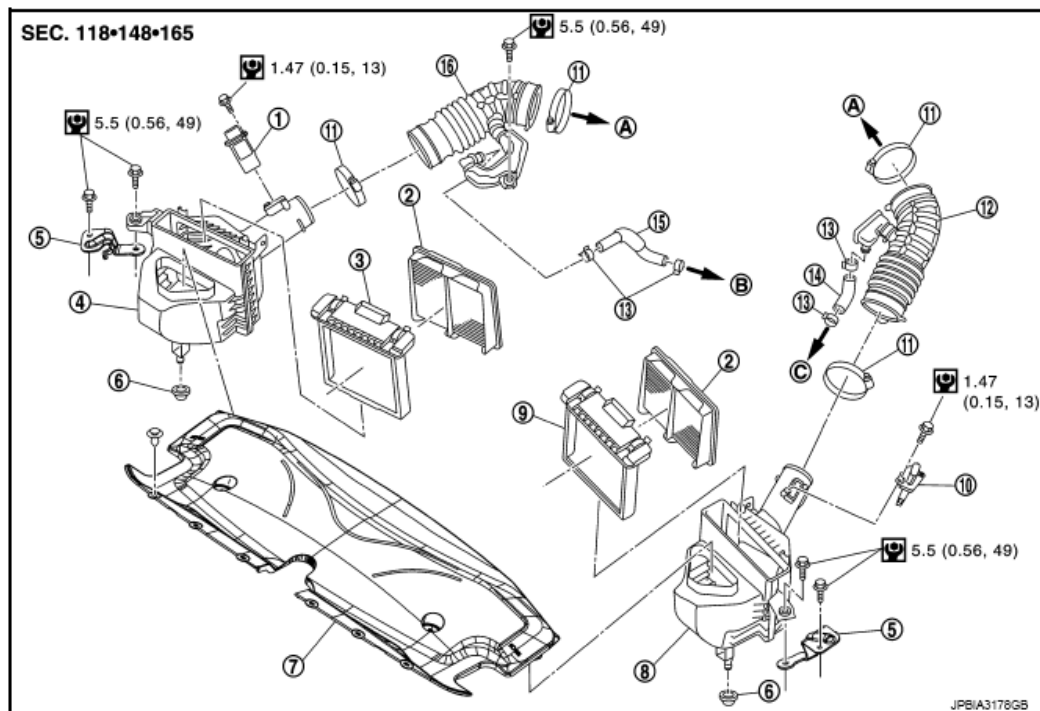
Installation is the reverse order of removal.

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

## AIR CLEANER AND AIR DUCT

### Exploded View

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.



- |  |                             |                             |
|--|-----------------------------|-----------------------------|
| 1. Mass air flow sensor (bank 1)         | 2. Air cleaner filter       | 3. Holder (RH)              |
| 4. Air cleaner case (RH)                 | 5. Bracket                  | 6. Grommet                  |
| 7. Air duct (inlet)                      | 8. Air cleaner case (LH)    | 9. Holder (LH)              |
| 10. Mass air flow sensor (bank 2)        | 11. Clamp                   | 12. Air duct (LH)           |
| 13. Clamp                                | 14. PCV hose                | 15. PCV hose                |
| 16. Air duct (RH)                        |                             |                             |
| A. To electric throttle control actuator | B. To rocker cover (bank 1) | C. To rocker cover (bank 2) |

**Fig. 33: Exploded View Of Air Cleaner And Air Duct With Torque Specifications**  
 Courtesy of NISSAN NORTH AMERICA, INC.

Refer to "COMPONENTS" for symbols in the figure.

## Removal and Installation

### REMOVAL

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

1. Remove Air duct (inlet).
2. Disconnect mass air flow sensor harness connector.
3. Disconnect PCV hose.
4. Remove air cleaner case & mass air flow sensor assembly and air duct by disconnecting their joints.

- Add marks if necessary for easier installation.
5. Remove mass air flow sensor from air cleaner case, if necessary.

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

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

## **INSTALLATION**

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

- Align marks. Attach each joint. Screw clamps firmly.

## **Inspection**

### **INSPECTION AFTER REMOVAL**

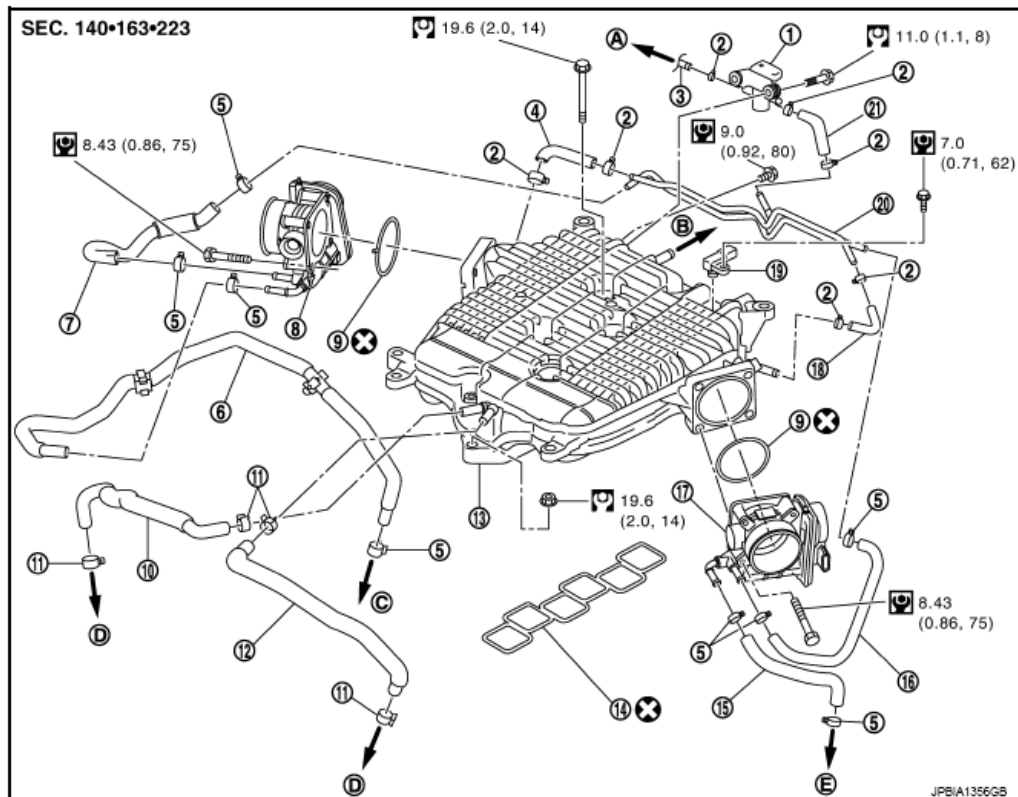
Inspect air duct for crack or tear.

- If anything is found, replace air duct.

## **INTAKE MANIFOLD COLLECTOR**

### **Exploded View**

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.



- |   |   |                           |
|---|---|---------------------------|
| 1. EVAP canister purge control solenoid valve | 2. Clamp  | 3. EVAP hose              |
| 4. EVAP hose                                  | 5. Clamp  | 6. Water hose             |
| 7. Water hose                                 | 8. Electric throttle control actuator (bank 1)  | 9. Gasket                 |
| 10. PCV hose                                  | 11. Clamp                                       | 12. PCV hose              |
| 13. Intake manifold collector                 | 14. Gasket                                      | 15. Water hose            |
| 16. Water hose                                | 17. Electric throttle control actuator (bank 2) | 18. EVAP hose             |
| 19. Manifold absolute Pressure (MAP) sensor   | 20. EVAP tube assembly                          | 21. EVAP hose             |
| A. To vacuum pipe                             | B. To brake booster                             | C. To water outlet (rear) |
| D. To PCV valve                               | E. To heater pipe                               |                           |

**Fig. 34: Exploded View Of Intake Manifold Collector With Torque Specifications**  
 Courtesy of NISSAN NORTH AMERICA, INC.

Refer to "COMPONENTS" for symbols in the figure.

## Removal and Installation

### REMOVAL

**WARNING:** Never drain engine coolant when the engine is hot to avoid the danger of being scalded.

1. Remove engine cover with power tool. Refer to "**EXPLODED VIEW**".
2. Remove air cleaner case and air duct (RH and LH). Refer to "**EXPLODED VIEW**".
3. Remove electric throttle control actuator as follows:
  - a. Drain engine coolant. When water hoses are disconnected, attach plug to prevent engine coolant leakage.

**CAUTION:**

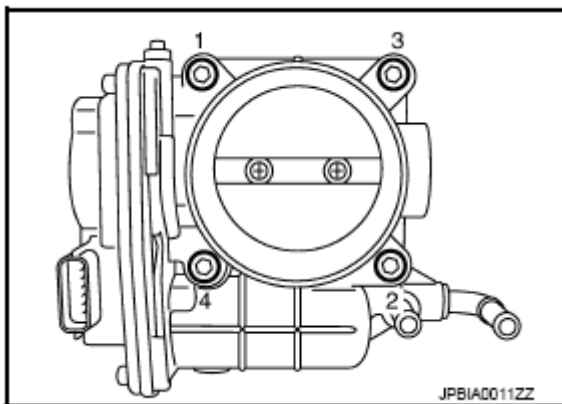
- Perform this step when engine is cold.
- Never spill engine coolant on drive belt.

- b. Disconnect water hoses from electric throttle control actuator. When engine coolant is not drained from radiator, attach plug to water hoses to prevent engine coolant leakage.
- c. Disconnect harness connector.
- d. Loosen mounting bolts in reverse order as shown in the figure below.

**NOTE:**

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

**CAUTION:** Handle carefully to avoid any shock to electric throttle control actuator.

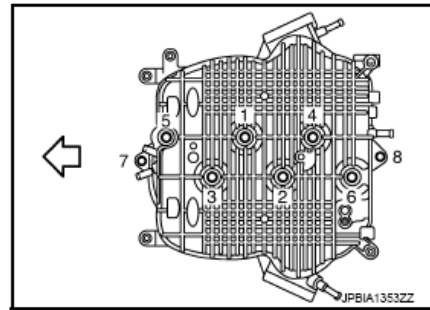


**Fig. 35: Electric Throttle Control Actuator Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

4. Disconnect vacuum hose, PCV hose and EVAP hose from intake manifold collector.

5. Remove EVAP canister purge volume control solenoid valve and EVAP tube assembly from intake manifold collector.
6. Loosen mounting bolts and nuts with power tool in the reverse order as shown in the figure below to remove intake manifold collector.

← : Engine front



**Fig. 36: Intake Manifold Collector Tightening Sequence**  
 Courtesy of NISSAN NORTH AMERICA, INC.

#### INSTALLATION

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

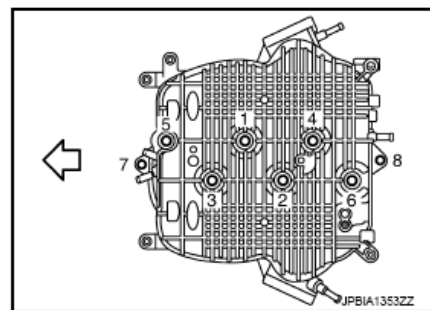
#### INTAKE MANIFOLD COLLECTOR

- If stud bolts were removed, install them and tighten to the torque specified below.

**Torque: 10.8 N.m (1.1 kg-m, 8 ft-lb)**

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

← : Engine front



**Fig. 37: Intake Manifold Collector Tightening Sequence**  
 Courtesy of NISSAN NORTH AMERICA, INC.

#### WATER HOSE

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

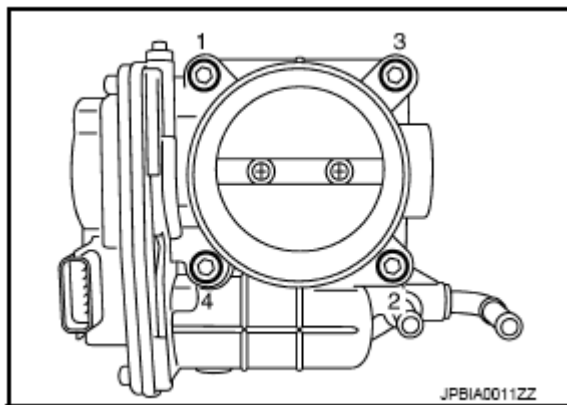


**ELECTRIC THROTTLE CONTROL ACTUATOR (BANK 1 AND BANK 2)**

- Tighten in numerical order as shown in the figure below.




**NOTE:**

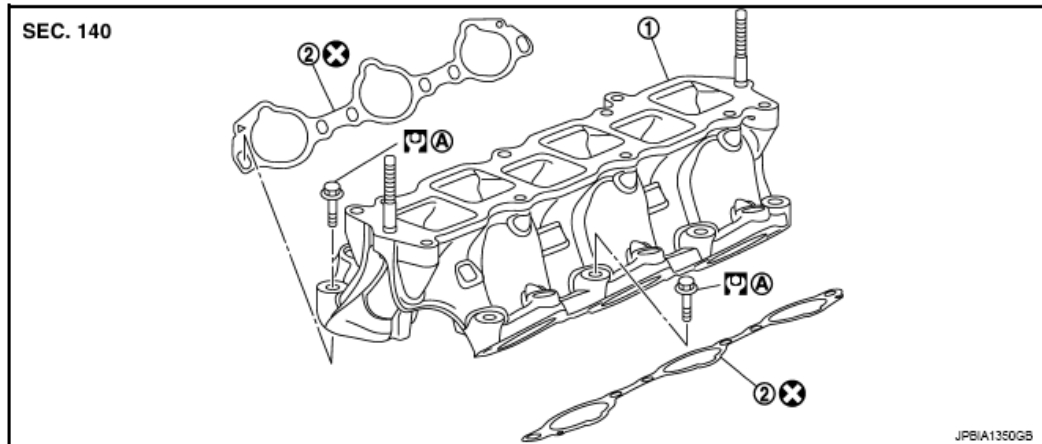
- The figure shows the electric throttle control actuator (bank 1) viewed from the air duct side.
- Viewed from the air duct side, the order of tightening mounting bolts of electric throttle control actuator (bank 2) is the same as that of the electric throttle control actuator (bank 1).
- Perform the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



**Fig. 38: Electric Throttle Control Actuator Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

**INTAKE MANIFOLD****Exploded View**

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.



1. Intake manifold
  2. Gasket
- A. Comply with the installation procedure when tightening.

**Fig. 39: Exploded View Of Intake Manifold And Gasket**  
 Courtesy of NISSAN NORTH AMERICA, INC.

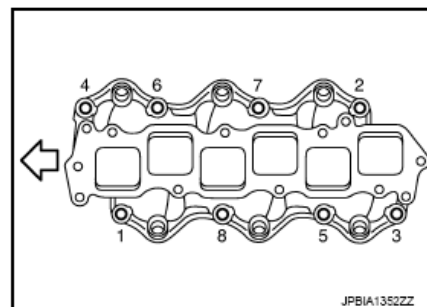
Refer to "**COMPONENTS**" for symbols in the figure.

## Removal and Installation

### REMOVAL

1. Release fuel pressure. Refer to "**WORK PROCEDURE**" (FOR USA AND CANADA) .
2. Remove intake manifold collector. Refer to "**EXPLODED VIEW**".
3. Remove fuel tube and fuel injector assembly. Refer to "**EXPLODED VIEW**".
4. Loosen mounting bolts in reverse order as shown in the figure below to remove intake manifold with power tool.

← : Engine front



**Fig. 40: Intake Manifold Mounting Bolt Tightening Sequence**

Courtesy of NISSAN NORTH AMERICA, INC.

**CAUTION:**

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

5. Remove gaskets.

**INSTALLATION**

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

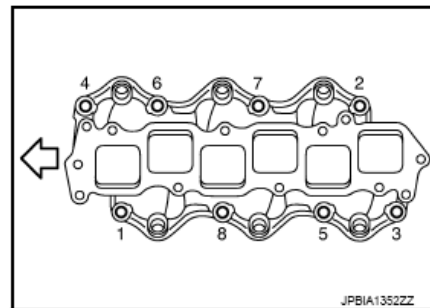
**INTAKE MANIFOLD**

- If stud bolts were removed, install them and tighten to the torque specified below.

**Torque: 10.8 N.m (1.1 kg-m, 8 ft-lb)**

- Tighten all mounting bolts to the specified torque in two or more steps in numerical order as shown in the figure below.

↔ : Engine front



**Fig. 41: Intake Manifold Mounting Bolt Tightening Sequence**

Courtesy of NISSAN NORTH AMERICA, INC.

**CAUTION:**

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

**1st step:**

**Torque: 7.4 N.m (0.75 kg-m, 5 ft-lb)**

**2nd step and after:**

**Torque: 25.5 N.m (2.6 kg-m, 19 ft-lb)**

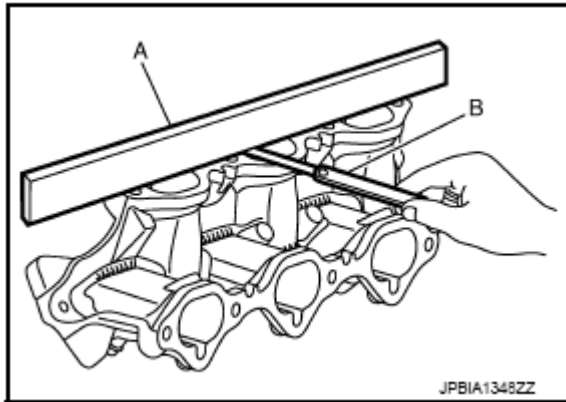
**Inspection**

**INSPECTION AFTER REMOVAL****Surface Distortion**

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

**Limit: Refer to "INTAKE MANIFOLD".**

- If it exceeds the limit, replace intake manifold.

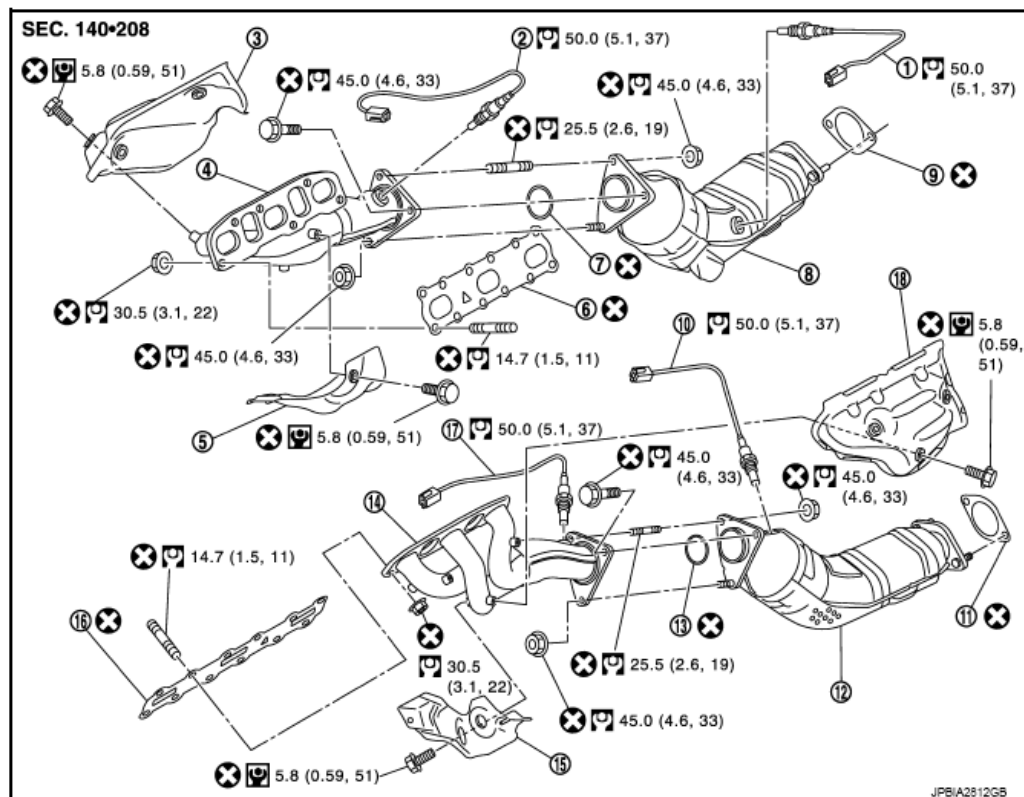


**Fig. 42: Checking Surface Distortion Of Intake Manifold Mating Surface Using Straightedge And Feeler Gauge**

Courtesy of NISSAN NORTH AMERICA, INC.

**EXHAUST MANIFOLD****Exploded View**

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.



- |                                     |                                      |                                    |
|-------------------------------------|--------------------------------------|------------------------------------|
| 1. Heated oxygen sensor 2 (bank 1)  | 2. Air fuel ratio sensor 1 (bank 1)  | 3. Exhaust manifold cover (upper)  |
| 4. Exhaust manifold (bank 1)        | 5. Exhaust manifold cover (lower)    | 6. Gasket                          |
| 7. Ring gasket                      | 8. Three way catalyst (bank 1)       | 9. Gasket                          |
| 10. Heated oxygen sensor 2 (bank 2) | 11. Gasket                           | 12. Three way catalyst (bank 2)    |
| 13. Ring gasket                     | 14. Exhaust manifold (bank 2)        | 15. Exhaust manifold cover (lower) |
| 16. Gasket                          | 17. Air fuel ratio sensor 1 (bank 2) | 18. Exhaust manifold cover (upper) |

**Fig. 43: Exploded View Of Exhaust Manifold With Torque Specifications**  
 Courtesy of NISSAN NORTH AMERICA, INC.

Refer to "**COMPONENTS**" for symbols in the figure.

## Removal and Installation

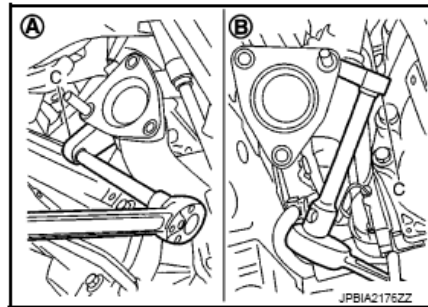
### REMOVAL

**WARNING:** Perform the work when the exhaust and cooling system have completely cooled down.

**NOTE:** When removing bank 1 side parts only, steps 1, 4 and 7 are unnecessary.

1. Drain engine coolant. Refer to "**DRAINING**".
2. Remove engine cover with power tool. Refer to "**EXPLODED VIEW**".
3. Remove air cleaner case and air duct (RH and LH). Refer to "**EXPLODED VIEW**".
4. Remove water pipe and water hose. Refer to "**EXPLODED VIEW**".
5. Remove engine undercover with power tool.
6. Remove exhaust front tube and three way catalysts (bank 1 and bank 2). Refer to "**VQ37VHR: EXPLODED VIEW**".
7. Disconnect steering lower joint at power steering gear assembly side, and release steering lower shaft.
8. Disconnect air fuel ratio sensor 1 (bank 1 and bank 2) harness connectors and remove harness clip.
9. Using the heated oxygen sensor wrench [SST: KV10114400 (J-38365)] (C), remove air fuel ratio sensor 1 (bank 1 and bank 2).

A : Bank 1  
B : Bank 2



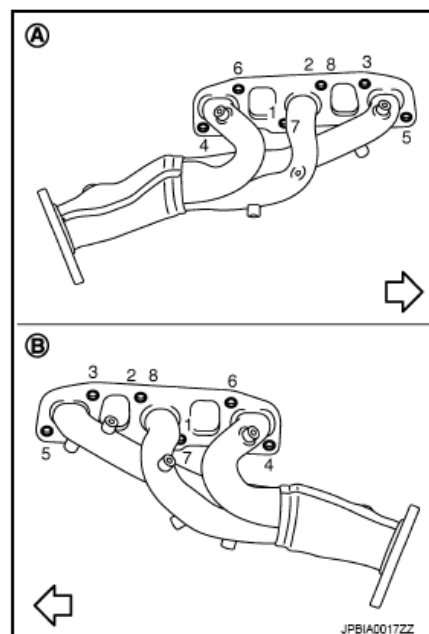
**Fig. 44: Removing Air Fuel Ratio Sensor 1 Using Heated Oxygen Sensor Wrench**  
Courtesy of NISSAN NORTH AMERICA, INC.

**CAUTION:**

- Be careful not to damage air fuel ratio sensor 1.
- Discard any air fuel ratio sensor 1 that has been dropped onto a hard surface such as a concrete floor. Replace with a new sensor.

10. Remove exhaust manifold cover (upper) (bank 1 and bank 2).
11. Loosen mounting nuts in the reverse order as shown in the figure below to remove exhaust manifold.

A : Bank 1  
B : Bank 2  
⇐ : Engine front



**Fig. 45: Exhaust Manifold Mounting Bolt Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

**NOTE:** Disregard the numerical order No. 7 and 8 in removal.

12. Remove gaskets.

**CAUTION:** Cover engine openings to avoid entry of foreign materials.

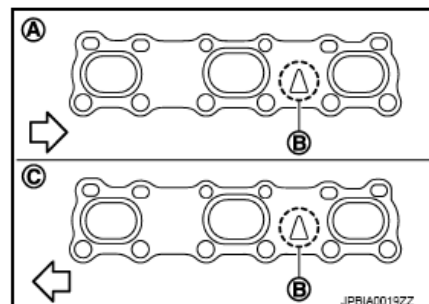
## INSTALLATION

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

### EXHAUST MANIFOLD GASKET

- Install exhaust manifold gasket in direction shown in the figure below. (Follow the same procedure for both banks.)

A : Bank 1  
B : Triangle press  
C : Bank 2  
⇐ : Engine front



**Fig. 46: Identifying Exhaust Manifold Gasket Orientation**  
 Courtesy of NISSAN NORTH AMERICA, INC.

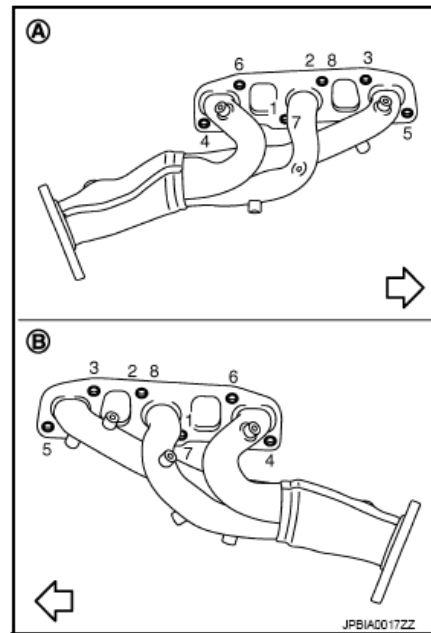
#### EXHAUST MANIFOLD

- If stud bolts were removed, install them and tighten to the torque specified below.

**Tightening torque: Refer to "EXPLODED VIEW".**

- Install exhaust manifold and tighten mounting bolts in numerical order as shown in the figure below.

A : Bank 1  
 B : Bank 2  
 ⇐ : Engine front



**Fig. 47: Exhaust Manifold Mounting Bolt Tightening Sequence**  
 Courtesy of NISSAN NORTH AMERICA, INC.

**NOTE:** Tighten nuts the No. 1 and 2 in two steps. The numerical order No. 7 and 8 shows the second step.

#### AIR FUEL RATIO SENSOR 1

##### CAUTION:

- Before installing a new air fuel ratio sensor 1, clean exhaust system threads using heated oxygen sensor thread cleaner tool (Commercial Service Tool: J-43897-18 or J-43897-12) and apply anti-seize lubricant.
- Never apply excessive torque to air fuel ratio sensor 1. Doing so may cause damage to air fuel ratio sensor 1, resulting in the "MIL" illuminating.
- Prevent rust inhibitors from adhering to the sensor body.

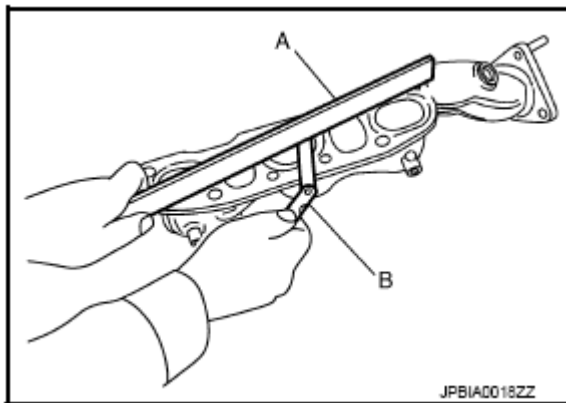


**Inspection****INSPECTION AFTER REMOVAL****Surface Distortion**

- Check the surface distortion of the exhaust manifold mating surface with a straightedge (A) and a feeler gauge (B).

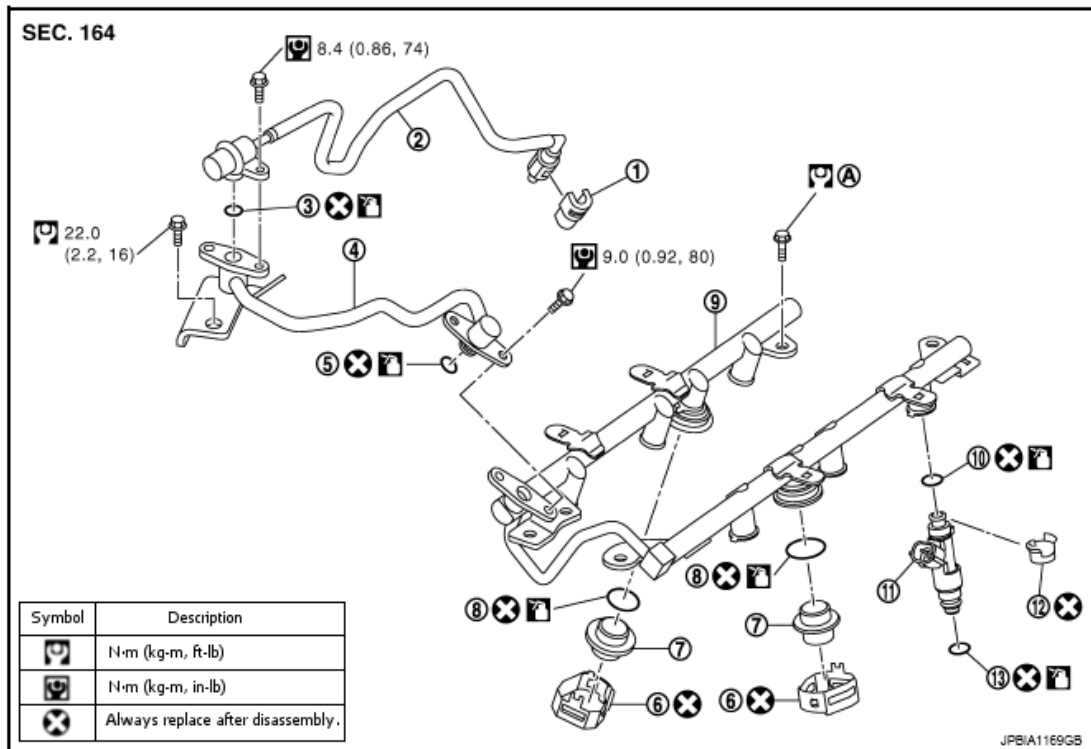
**Limit: Refer to "EXHAUST MANIFOLD".**

- If it exceeds the limit, replace exhaust manifold.



**Fig. 48: Checking Surface Distortion Of Exhaust Manifold Mating Surface**  
Courtesy of NISSAN NORTH AMERICA, INC.

**FUEL INJECTOR AND FUEL TUBE****Exploded View**



- |  |                                 |              |
|--|---------------------------------|--------------|
| 1. Quick connector cap                                     | 2. Fuel feed hose (with damper) | 3. O-ring    |
| 4. Fuel sub tube   | 5. O-ring                       | 6. Clip      |
| 7. Fuel damper   | 8. O-ring                       | 9. Fuel tube |
| 10. O-ring (black)   | 11. Fuel injector               | 12. Clip     |
| 13. O-ring (green)   |                                 |              |
| A. Comply with the installation procedure when tightening. |                                 |              |

**Fig. 49: Exploded View Of Fuel Injector And Fuel Tube With Torque Specifications**  
 Courtesy of NISSAN NORTH AMERICA, INC.

Refer to "COMPONENTS" for symbols in the figure.

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

#### Removal and Installation

##### REMOVAL

##### WARNING:

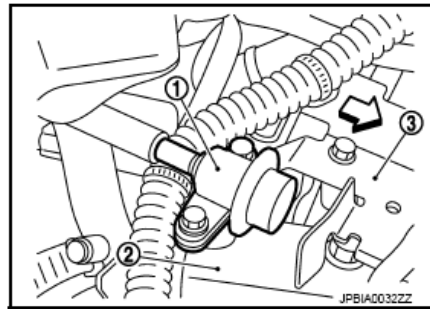
- Put a "CAUTION: FLAMMABLE" sign in the workshop.
- Be sure to work in a well ventilated area and furnish workshop with a CO<sub>2</sub> fire extinguisher.
- Never smoke while servicing fuel system. Keep open flames and

sparks away from the work area.

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

1. Release fuel pressure. Refer to "**WORK PROCEDURE**" (FOR USA AND CANADA) .
2. Disconnect battery cable from the negative terminal. Refer to "**EXPLODED VIEW**".
3. Remove engine cover with power tool. Refer to "**EXPLODED VIEW**".
4. Remove air cleaner case and air duct (RH and LH). Refer to "**EXPLODED VIEW**".
5. Remove intake manifold collector. Refer to "**EXPLODED VIEW**".
6. Remove fuel feed hose (with damper) (1) from fuel sub-tube (2) and remove harness bracket (3).

⇐ : Engine front



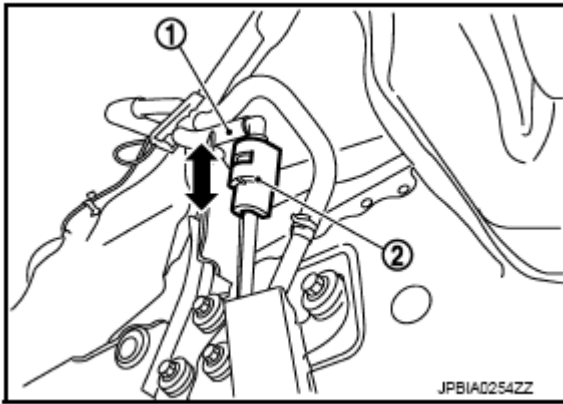
**Fig. 50: Identifying Fuel Feed Hose, Fuel Sub-Tube And Harness Bracket**  
 Courtesy of NISSAN NORTH AMERICA, INC.

**NOTE:**        There is no fuel return route.

**CAUTION:**

- While hoses are disconnected, plug them to prevent fuel from draining.
- Never separate damper and hose.

7. When separating fuel feed hose (with damper) and centralized under-floor piping connection, disconnect quick connector as follows:
  - a. Remove quick connector cap (2) from quick connector connection on right member side.
  - b. Disconnect fuel feed hose (with damper) (1) from bracket hose clamp.

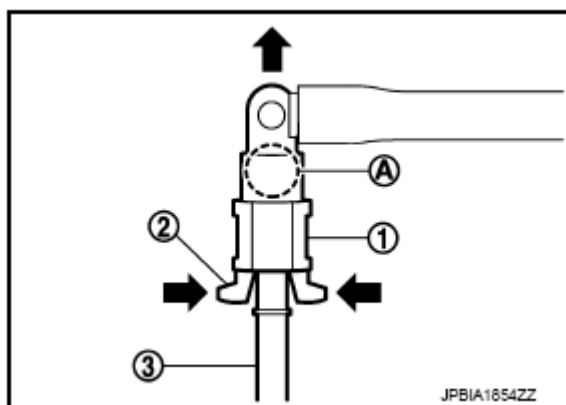


**Fig. 51: Disconnecting Fuel Feed Hose From Bracket Hose Clamp**  
Courtesy of NISSAN NORTH AMERICA, INC.

- c. Push in retainer tabs (2).
- d. Draw and pull out quick connector (1) straight from centralized under-floor piping (3).

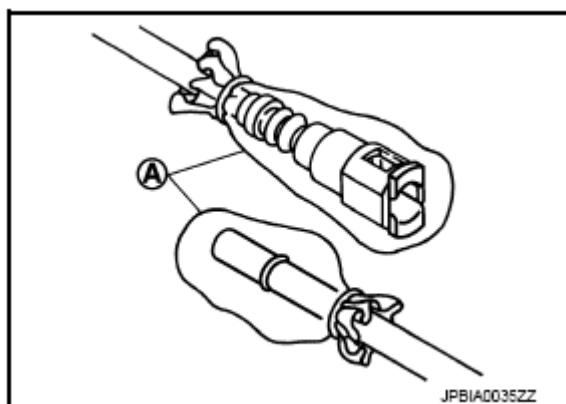
**CAUTION:**

- Pull quick connector holding (A) position as shown in the figure below.
- Never pull with lateral force applied. O-ring inside quick connector may be damaged.
- Prepare container and cloth beforehand because fuel will leak out.
- Avoid fire and sparks.
- 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 bend or twist connection between quick connector and fuel feed hose (with damper) during installation/removal.
- To keep the connecting portion clean and to avoid damage and foreign materials, cover them completely with plastic bags, etc. (A) or a similar item.



**Fig. 52: Removing Quick Connector**

Courtesy of NISSAN NORTH AMERICA, INC.

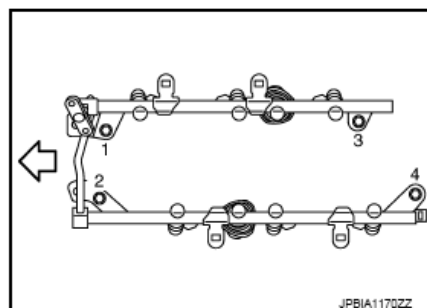


**Fig. 53: Covering Quick Connector Using Plastic Bags**

Courtesy of NISSAN NORTH AMERICA, INC.

8. Remove fuel sub tube mounting bolt.
9. Disconnect harness connector from fuel injector.
10. Loosen mounting bolts in reverse order as shown in the figure below, and remove fuel tube and fuel injector assembly.

← : Engine front






**Fig. 54: Fuel Injector Assembly Mounting Bolt Tightening Sequence**

Courtesy of NISSAN NORTH AMERICA, INC.

**CAUTION:** Never tilt it, or remaining fuel in pipes may flow out from pipes.

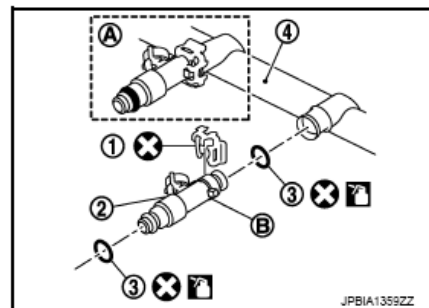
11. Remove fuel injector (2) from fuel tube (4) as follows:

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.

3 : O-ring

A : Installed condition

B : Clip mounting groove



**Fig. 55: Removing Fuel Injector From Fuel Tube**  
Courtesy of NISSAN NORTH AMERICA, INC.

- Open and remove clip (1).
- Remove fuel injector from fuel tube by pulling straight.

**CAUTION:**

- Be careful with remaining fuel that may go out from fuel tube.
- Be careful not to damage injector nozzles during removal.
- Never bump or drop fuel injector.
- Never disassemble fuel injector.

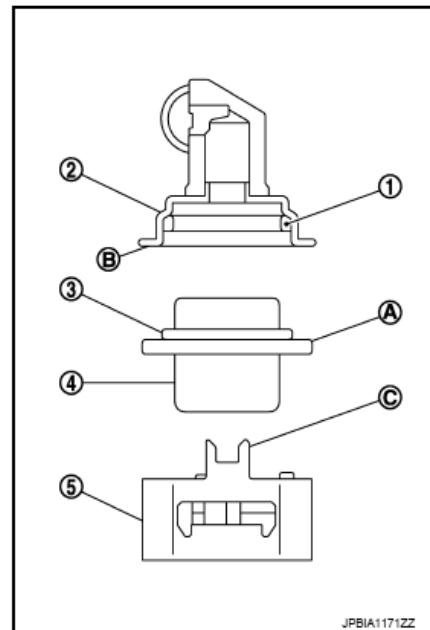
12. Remove fuel sub-tube and fuel damper, if necessary.

**INSTALLATION**

**CAUTION:** Do not reuse O-rings.

1. Install fuel damper (4) as follows:

- 2 : Cup  
 5 : Clip  
 C : Cut-out



**Fig. 56: Identifying Fuel Damper, Cup, Clip, Cut-Out, O-Ring And Spacer**  
 Courtesy of NISSAN NORTH AMERICA, INC.

- a. Install new O-ring (1) to fuel tube as shown in the figure above. When handling new O-ring, pay attention to the following caution items:

**CAUTION:**

- 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, do not insert it quickly into fuel tube.
- Insert new O-ring straight into fuel tube. Never twist it.

- b. Install spacer (3) to fuel damper.  
 c. Insert fuel damper straight into fuel tube.

**CAUTION:**

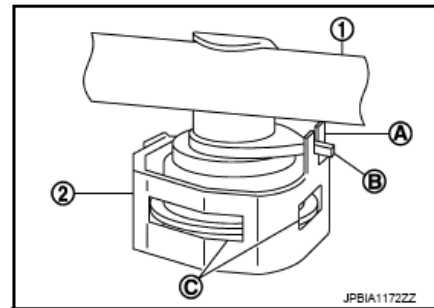
- Insert straight, checking that the axis is lined up.
- Never pressure-fit with excessive force.

Reference value: 130 N (13.3 kg, 29.2 lb)

- Insert fuel damper until (A) is touching (B) of fuel tube.

- d. Install the cut-out (A) of the clip (2) to the projection (B), which ensures that the fuel tube does not move or rotate.

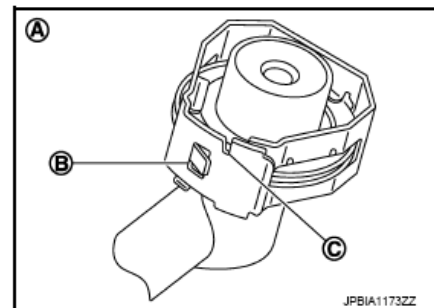
1 : Fuel tube



**Fig. 57: Installing Cut-Out Of Clip To Projection**  
Courtesy of NISSAN NORTH AMERICA, INC.

- e. Unlock the clip after making sure that the rib of the cup and the brim of the fuel damper are mated each other and positioned in the holes (C) of the clip.
- f. Check that the opening (B) and the slit (C) of the clip are positioned and fixed properly so it does not rotate or pull out.

A : Under view



**Fig. 58: Identifying Clip Opening And Slit**  
Courtesy of NISSAN NORTH AMERICA, INC.

2. Install fuel sub-tube.

- When handling new O-rings, be careful of the following caution items:

**CAUTION:**

- 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.



- **Insert new O-ring straight into fuel tube. Never install off center or twist it.**

- Insert fuel sub-tube straight into fuel tube.
- Tighten mounting bolts evenly in turn.
- After tightening mounting bolts, Check that there is no gap between flange and fuel tube.

3. Install new O-rings to fuel injector, paying attention to the following items.

**CAUTION:**




- **Upper and lower O-ring are different. Be careful not to confuse them.**

**Fuel tube side: Black**

**Nozzle side: Green**

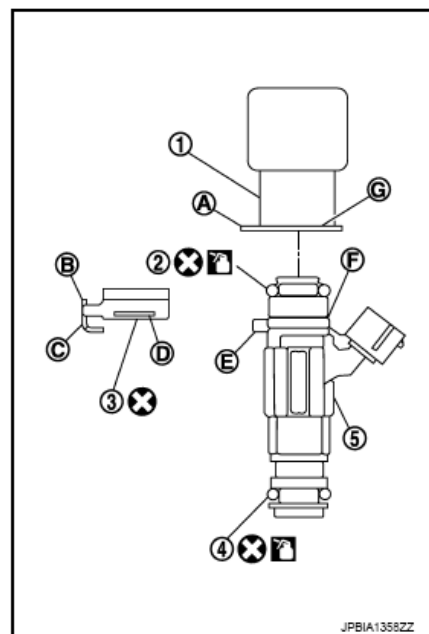
- **Handle O-ring with bare hands. Never wear gloves.**
- **Lubricate O-ring with new engine oil.**
- **Never clean O-ring with solvent.**
- **Check that O-ring and its mating part are free of foreign material.**
- **When installing O-ring, be careful not to scratch it with tool or fingernails. Also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

4. Install fuel injector to fuel tube as follows:

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.

2 : O-ring (Black)

4 : O-ring (Green)



**Fig. 59: Identifying Fuel Injector, Fuel Tube And Related Components**  
Courtesy of NISSAN NORTH AMERICA, INC.

- a. Insert clip (3) into clip mounting groove (F) on fuel injector (5).

**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.
- Insert clip so that protrusion (E) of fuel injector matches cut-out (C) of clip.

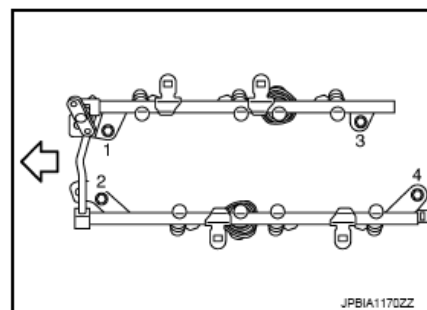
- b. Insert fuel injector into fuel tube (1) with clip attached.
  - Insert it while matching it to the axial center.
  - Insert fuel injector so that protrusion (A) of fuel tube matches cutout (B) of clip.
  - Check that fuel tube flange (G) is securely fixed in flange fixing groove (D) on clip.
- c. Check that installation is complete by checking that fuel injector does not rotate or come off.
  - Check that protrusions of fuel injectors and fuel tube are aligned with cutouts of clips after installation.

5. Install fuel tube and fuel injector assembly to intake manifold.

**CAUTION:** Be careful not to let tip of injector nozzle come in contact with other parts.

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

← : Engine front



**Fig. 60: Fuel Injector Assembly Mounting Bolt Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

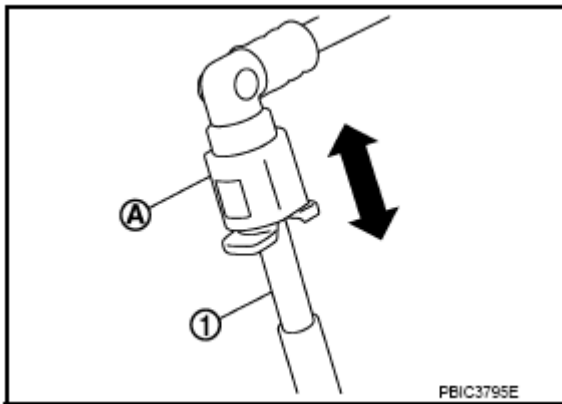
**Torque 1st step: 10.1 N.m (1.0 kg-m, 7 ft-lb)**

**Torque 2nd step: 23.6 N.m (2.4 kg-m, 17 ft-lb)**

6. Connect injector sub-harness.
7. Install fuel sub tube mounting bolt.
8. Connect fuel feed hose (with damper).
  - Handling procedure of O-ring is the same as that of fuel damper and fuel sub-tube.
  - Insert fuel damper straight into fuel sub-tube.
  - Tighten mounting bolts evenly in turn.
  - After tightening mounting bolts, check that there is no gap between flange and fuel sub-tube.
9. Connect quick connector between fuel feed hose (with damper) and centralized under-floor piping connection as follows:
  - a. Check that no foreign substances are deposited in and around centralized under-floor piping and quick connector, and that there is no damage to them.
  - b. Thinly apply new engine oil around centralized under-floor piping from tip end to spool end.
  - c. Align center to insert quick connector straightly into centralized under-floor piping.
    - Insert quick connector to centralized under-floor piping until top spool is completely inside quick connector and 2nd level spool exposes right below quick connector.

**CAUTION:**

- **Hold align center to avoid inclined insertion to prevent damage to O-ring inside quick connector.**
  - **Insert until you hear a "click" sound and actually feel the engagement.**
  - **To avoid misidentification of engagement with a similar sound, be sure to perform the next step.**
- d. Pull quick connector by hand holding position (A). Check it is completely engaged (connected) so that it does not come out from centralized under-floor piping (1).

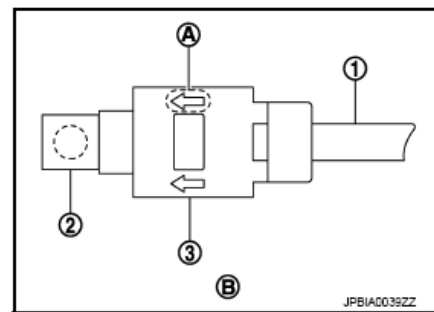


**Fig. 61: Pulling Quick Connector**

Courtesy of NISSAN NORTH AMERICA, INC.

- e. Install quick connector cap (3) to quick connector connection.

- 1 : Centralized under-floor piping  
 2 : Fuel feed hose  
 B : Under view



**Fig. 62: Identifying Quick Connector Cap, Centralized Under-Floor Piping And Fuel Feed Hose**

Courtesy of NISSAN NORTH AMERICA, INC.

- Install quick connector cap with arrow (A) on surface facing in direction of quick connector (fuel feed hose side).

**CAUTION:** If quick connector cap cannot be installed smoothly, quick connector may have not been installed correctly. Check the connection again.

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

## Inspection

### 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 that again that there is no fuel leakage at connection points.

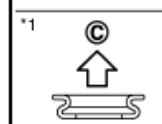
**CAUTION:** Never touch the engine immediately after it is stopped because the engine is extremely hot.

## **OIL PAN (LOWER)**

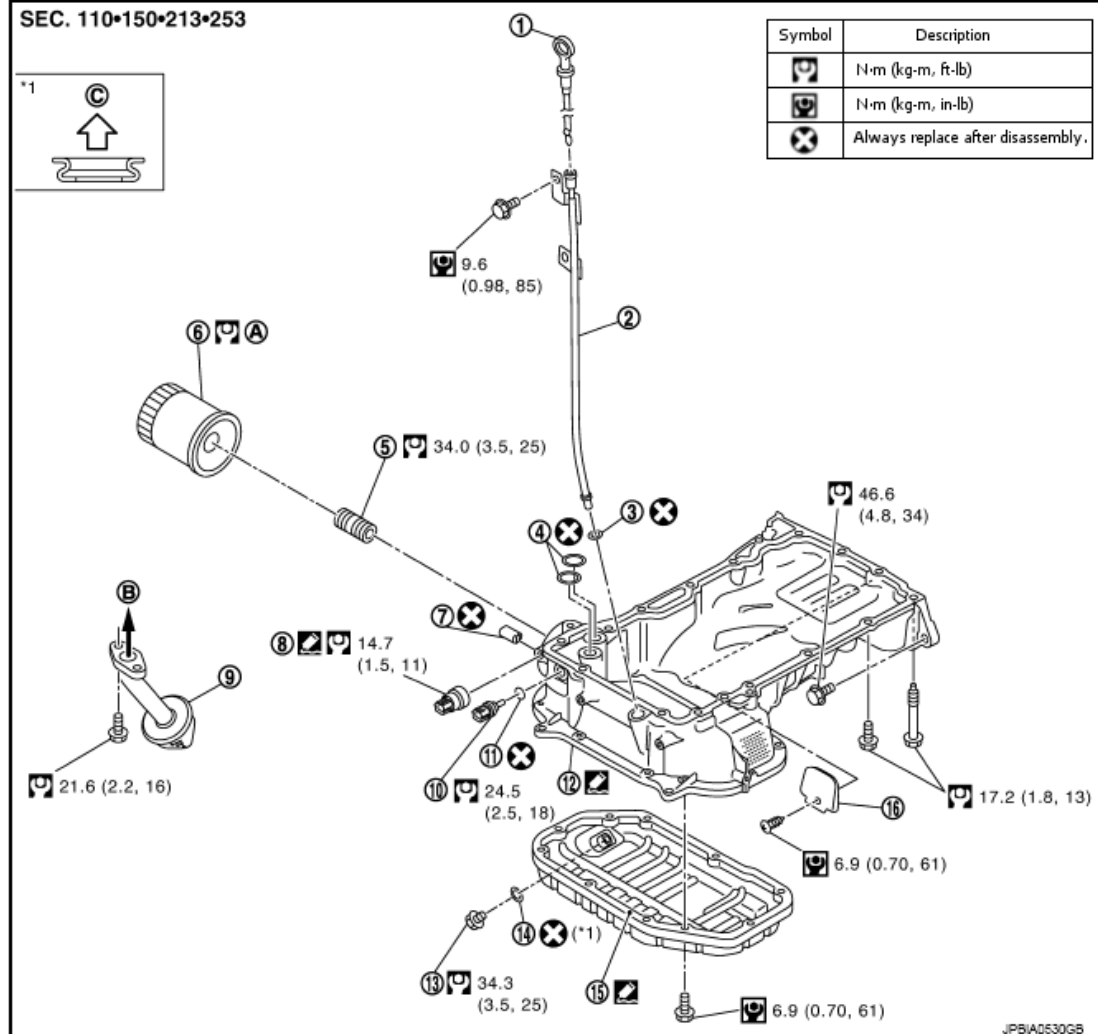
### **Exploded View**

## 2WD models

SEC. 110•150•213•253



Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.



JPBIA0530GB

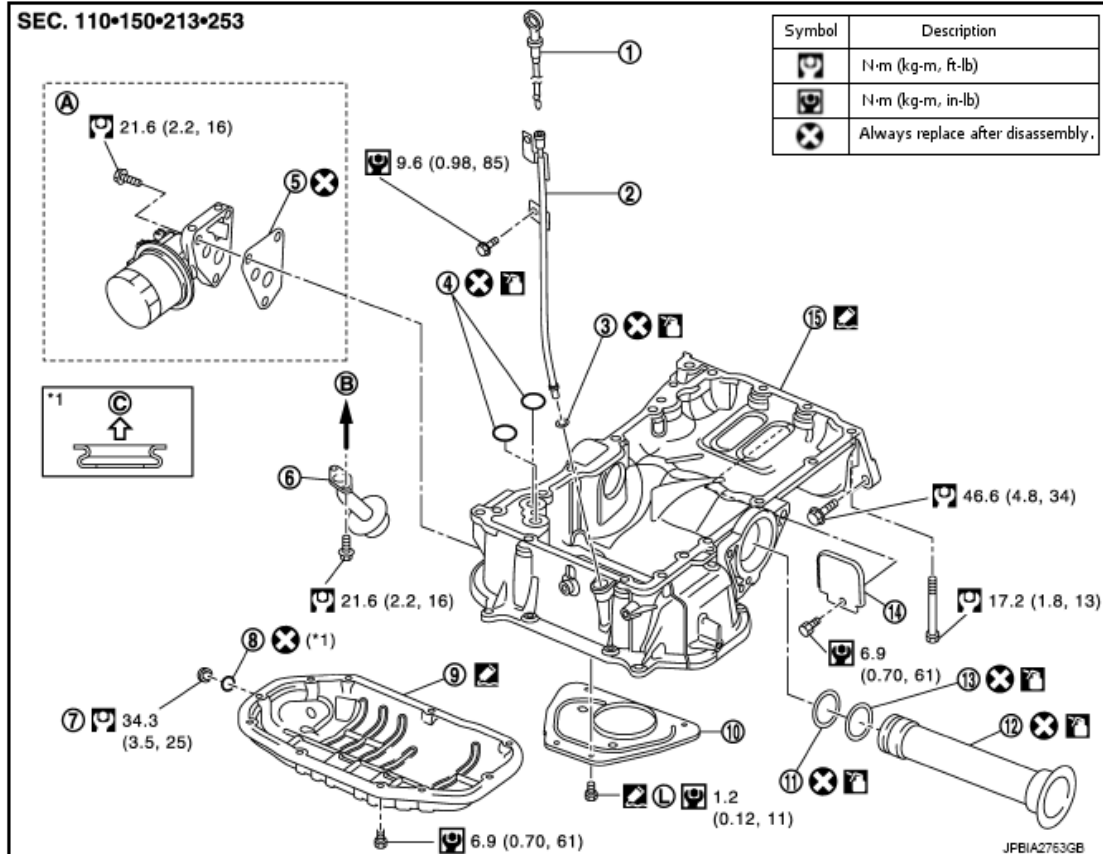
- |                                  |                          |                     |
|----------------------------------|--------------------------|---------------------|
| 1. Oil level gauge               | 2. Oil level gauge guide | 3. O-ring           |
| 4. O-ring                        | 5. Connector bolt        | 6. Oil filter       |
| 7. Relief valve                  | 8. Oil pressure switch   | 9. Oil strainer     |
| 10. Oil temperature sensor       | 11. Washer               | 12. Oil pan (upper) |
| 13. Drain plug                   | 14. Drain plug washer    | 15. Oil pan (lower) |
| 16. Rear plate cover             |                          |                     |
| A. Refer to "Lubrication System" | B. To oil pump           | C. Oil pan side     |

**Fig. 63: Exploded View Of Lower Oil Pan With Torque Specifications (2WD Models)**  
 Courtesy of NISSAN NORTH AMERICA, INC.

Refer to "COMPONENTS" for symbols in the figure.

## AWD models

SEC. 110•150•213•253



- |                                  |                          |                     |
|----------------------------------|--------------------------|---------------------|
| 1. Oil level gauge               | 2. Oil level gauge guide | 3. O-ring           |
| 4. O-ring                        | 5. Gasket                | 6. Oil strainer     |
| 7. Drain plug                    | 8. Drain plug washer     | 9. Oil pan (lower)  |
| 10. Baffle plate                 | 11. O-ring (small)       | 12. Axle pipe       |
| 13. O-ring (large)               | 14. Rear plate cover     | 15. Oil pan (upper) |
| A. Refer to "Lubrication System" | B. To oil pump           | C. Oil pan side     |

**Fig. 64: Exploded View Of Lower Oil Pan With Torque Specifications (AWD Models)**  
 Courtesy of NISSAN NORTH AMERICA, INC.

Refer to "**COMPONENTS**" for symbols in the figure.

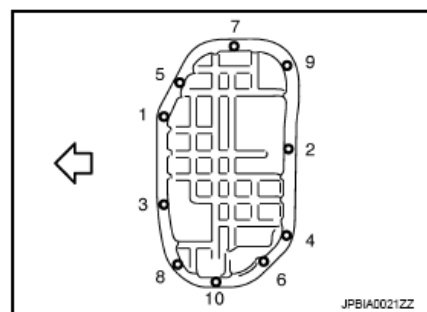
### Removal and Installation

#### REMOVAL

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

1. Remove engine undercover with power tool.
2. Remove oil pan (lower) as follows:
  - a. Loosen mounting bolts in reverse of the order shown in the figure below to remove.

↩ : Engine front



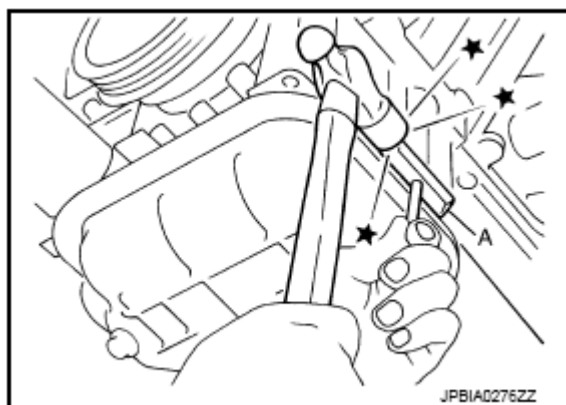
**Fig. 65: Lower Oil Pan Bolt Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

- b. Insert the seal cutter [SST: KV10111100 (J-37228)] (A) between oil pan (upper) and oil pan (lower).

**CAUTION:**

- Be careful not to damage the mating surfaces.
- Never insert a screwdriver. This damages the mating surfaces.

- c. Slide the seal cutter by tapping on the side of tool with a hammer. Remove oil pan (lower).



**Fig. 66: Inserting Seal Cutter Between Upper Oil Pan And Lower Oil Pan**  
Courtesy of NISSAN NORTH AMERICA, INC.

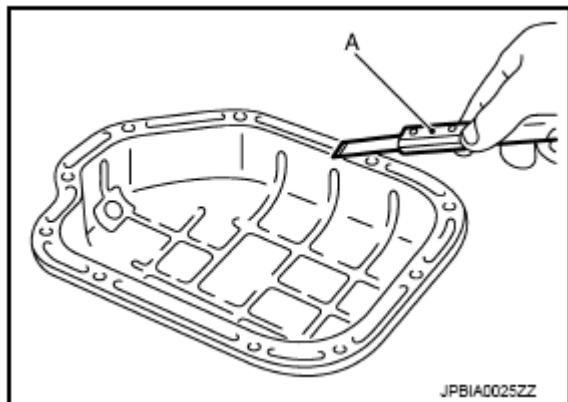
**INSTALLATION**

**CAUTION: Do not reuse drain plug washers.**

1. Install oil pan (lower) as follows:
  - a. Use scraper (A) to remove old liquid gasket from mating surfaces.
    - Remove old liquid gasket from the bolt holes and thread.



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

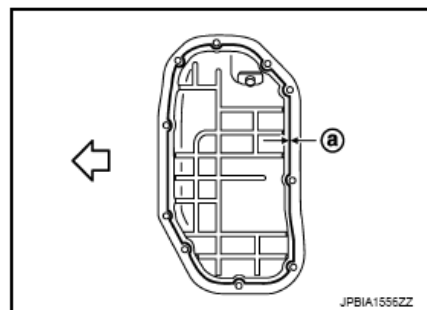


**Fig. 67: Removing Liquid Gasket**

Courtesy of NISSAN NORTH AMERICA, INC.

- b. Apply a continuous bead of liquid gasket with the tube presser (commercial service tool) to the oil pan (lower) as shown in the figure below.

a :  $\phi 4.0 - 5.0$  mm (0.157 - 0.197 in)  
 ⇐ : Engine front



**Fig. 68: Identifying Liquid Gasket**

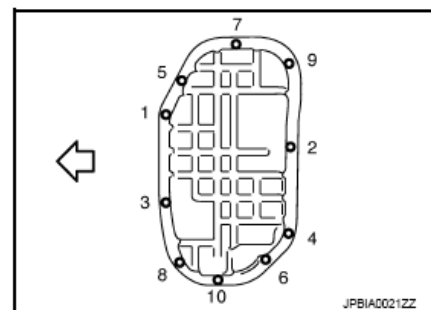
Courtesy of NISSAN NORTH AMERICA, INC.

Use Genuine RTV Silicone Sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS".

**CAUTION:** Attaching should be done within 5 minutes after coating.

- c. Install oil pan (lower).
- Tighten mounting bolts in numerical order as shown in the figure below.

⇐ : Engine front



**Fig. 69: Lower Oil Pan Mounting Bolt Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

2. Install oil pan drain plug.

**CAUTION: Do not reuse drain plug washer.**

- Refer to the figure of the components above for installation direction of drain plug washer. Refer to "EXPLODED VIEW".

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

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

### Inspection

#### INSPECTION AFTER REMOVAL

Clean oil strainer if any object is attached.

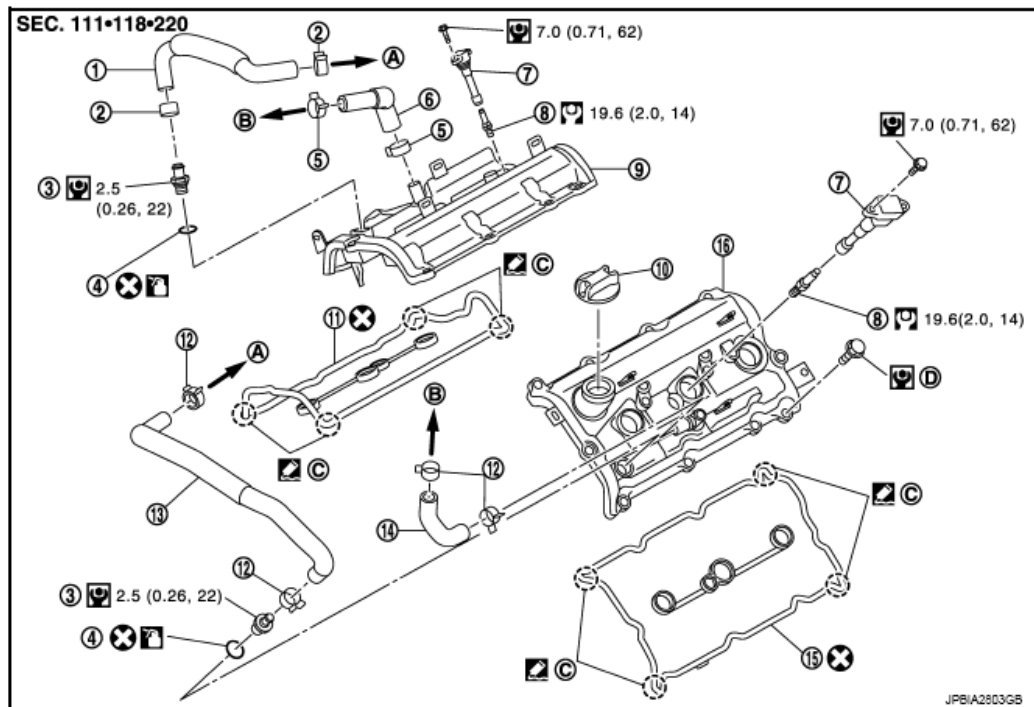
#### INSPECTION AFTER INSTALLATION

1. Check the engine oil level and adjust engine oil. Refer to "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 "INSPECTION".

### IGNITION COIL, SPARK PLUG AND ROCKER COVER

#### Exploded View

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.



- |  |                                  |                                  |
|--|----------------------------------|----------------------------------|
| 1. PCV hose  | 2. Clamp                         | 3. PCV valve                     |
| 4. O-ring  | 5. Clamp                         | 6. PCV hose                      |
| 7. Ignition coil   | 8. Spark plug                    | 9. Rocker cover (bank 1)         |
| 10. Oil filler cap   | 11. Rocker cover gasket (bank 1) | 12. Clamp                        |
| 13. PCV hose   | 14. PCV hose                     | 15. Rocker cover gasket (bank 2) |
| 16. Rocker cover (bank 2)                                  |                                  |                                  |
| A. To intake manifold collector                            | B. To air duct                   | C. VVEL ladder assembly side     |
| D. Comply with the installation procedure when tightening. |                                  |                                  |

**Fig. 70: Exploded View Of Ignition Coil, Spark Plug And Rocker Cover With Torque Specifications**  
 Courtesy of NISSAN NORTH AMERICA, INC.

Refer to "**COMPONENTS**" for symbols in the figure.

## Removal and Installation

### REMOVAL

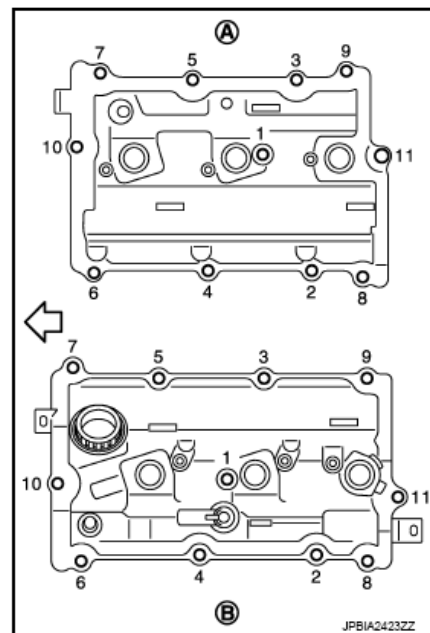
- Remove the following parts:
  - Engine cover: Refer to "**EXPLODED VIEW**".
  - Air cleaner case and air duct (RH and LH): Refer to "**EXPLODED VIEW**".
  - Intake manifold collector: Refer to "**EXPLODED VIEW**".

2. Disconnect PCV hose from rocker cover.
3. Remove PCV valve and O-ring from rocker cover, if necessary.
4. Remove oil filler cap from rocker cover, if necessary.
5. Remove ignition coil.

**CAUTION: Never shock ignition coil.**

6. Remove harness clips on the rocker cover.
7. Loosen mounting bolts with power tool in reverse order as shown in the figure below.

A : Bank 1  
 B : Bank 2  
 ⇐ : Engine front



**Fig. 71: Rocker Cover Bolt Tightening Sequence**  
 Courtesy of NISSAN NORTH AMERICA, INC.

8. Remove rocker cover gasket from rocker cover.
9. Use scraper to remove all traces of liquid gasket from cylinder head and VVEL ladder assembly.

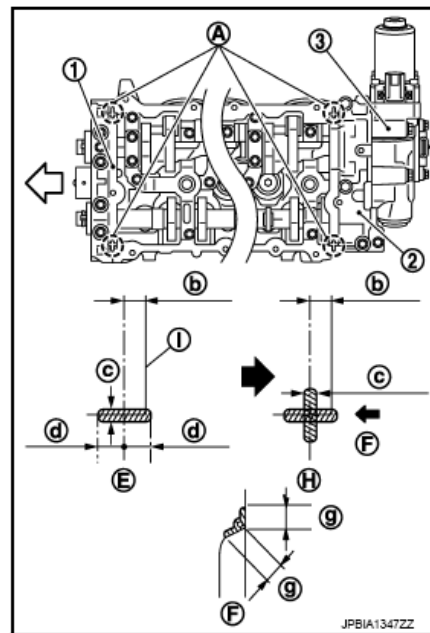
**CAUTION: Never scratch or damage the mating surface when cleaning off old liquid gasket.**

## INSTALLATION

**CAUTION: Do not reuse O-rings.**

1. Apply liquid gasket to the position shown in the figure below with the following procedure:

- 2 : Actuator bracket (rear)  
 3 : VVEL actuator sub assembly  
 A : Liquid gasket application point  
 F : View F  
 I : End surface of VVEL ladder assembly  
 b : 4 mm (0.16 in)  
 c :  $\phi 2.5 - 3.5$  mm (0.098 - 0.138 in)  
 d : 5 mm (0.20 in)  
 g : 10 mm (0.39 in)  
 ⇐ : Engine front

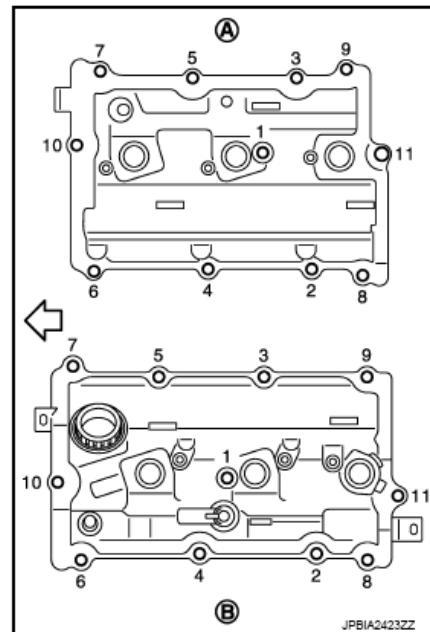


**Fig. 72: Identifying Liquid Gasket**

Courtesy of NISSAN NORTH AMERICA, INC.

- a. Refer to figure (E) above to apply liquid gasket to joint part of VVEL ladder assembly (1) and cylinder head.
  - b. Refer to figure above (H) to apply liquid gasket in 90 degrees to figure. **Use Genuine RTV Silicone Sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS".**
2. Install rocker cover gasket to rocker cover.
  3. Install rocker cover.
    - Check that rocker cover gasket does not drop from the installation groove of rocker cover.
  4. Tighten bolts in two steps separately in numerical order as shown in the figure below.

A : Bank 1  
 B : Bank 2  
 ⇐ : Engine front



**Fig. 73: Rocker Cover Bolt Tightening Sequence**  
 Courtesy of NISSAN NORTH AMERICA, INC.

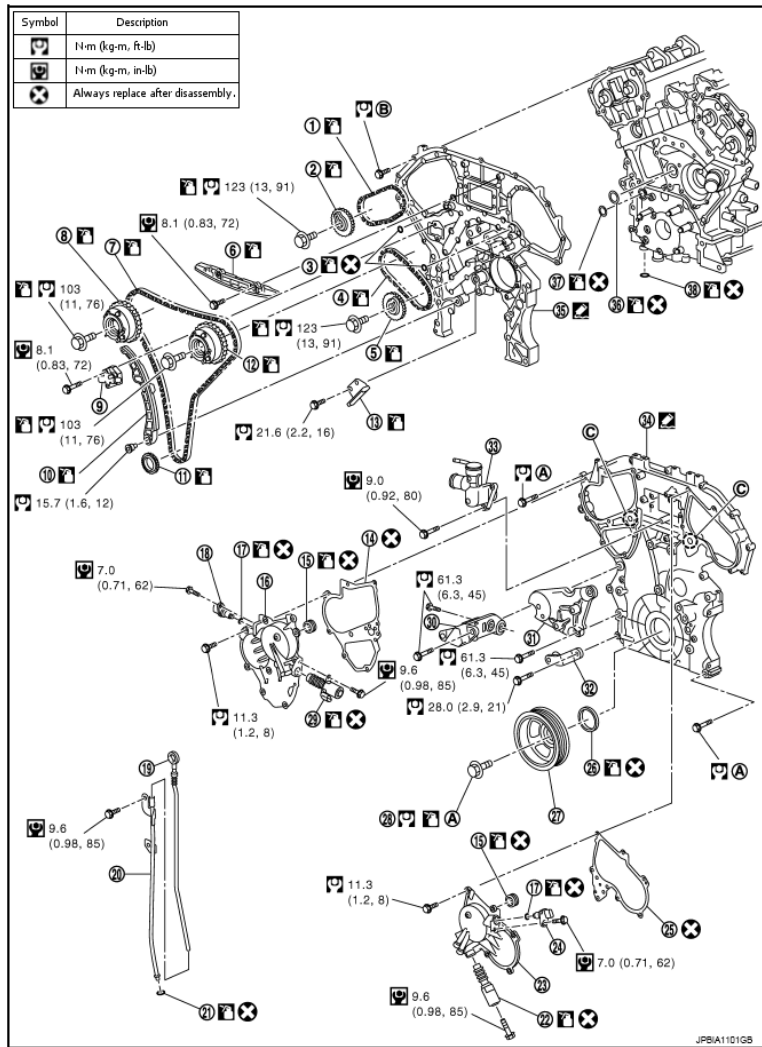
**Torque 1st step: 2.0 N.m (0.2 kg-m, 18 in-lb)**

**Torque 2nd step: 8.3 N.m (0.85 kg-m, 73 in-lb)**

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

## TIMING CHAIN

### Exploded View



**Fig. 74: Exploded View Of Timing Chain With Torque Specifications**  
 Courtesy of NISSAN NORTH AMERICA, INC.

Refer to "COMPONENTS" for symbol marks in the figure.

**Removal and Installation****REMOVAL**

1. Release the fuel pressure. Refer to "**WORK PROCEDURE**" (FOR USA AND CANADA) .
2. Disconnect the battery cable from the negative terminal.
3. Remove engine cover with power tool. Refer to "**EXPLODED VIEW**".
4. Remove radiator reservoir tank. Refer to "**EXPLODED VIEW**".
5. Remove air duct and air cleaner case assembly (RH and LH). Refer to "**EXPLODED VIEW**".
6. Remove engine undercover with power tool.
7. Drain engine coolant from radiator. Refer to "**DRAINING**".

**CAUTION:**

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

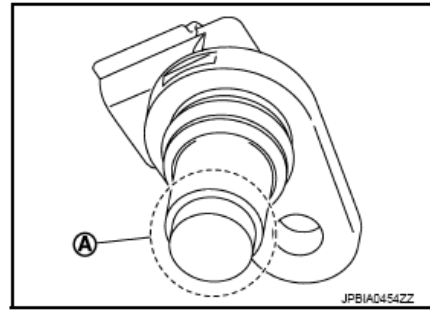
8. Remove radiator hose (upper and lower). Refer to "**EXPLODED VIEW**".
9. Drain engine oil. Refer to "**DRAINING**".

**CAUTION: Perform this step when the engine is cold.**

10. Remove radiator cooling fan assembly. Refer to "**EXPLODED VIEW**".
11. Remove drive belt. Refer to "**REMOVAL AND INSTALLATION**".
12. Separate engine harnesses by removing their brackets from front timing chain case.
13. Remove intake manifold collector. Refer to "**EXPLODED VIEW**".
14. Remove fuel sub tube mounting bolt. Refer to "**EXPLODED VIEW**".
15. Remove oil level gauge and oil level gauge guide.
16. Remove A/C compressor from bracket with piping connected, and temporarily secure it aside. Refer to "**EXPLODED VIEW**".
17. Remove power steering oil pump from bracket with piping connected, and temporarily secure it aside. Refer to "**VQ37VHR: EXPLODED VIEW**".
18. Remove power steering oil pump bracket.
19. Remove idler pulley, drive belt auto-tensioner and bracket. Refer to "**EXPLODED VIEW**".
20. Remove alternator and alternator bracket. Refer to "**VQ37VHR: EXPLODED VIEW**".
21. Remove water pipe. Refer to "**EXPLODED VIEW**".
22. Remove camshaft position sensor (PHASE).



A : Keep free from magnetic materials



**Fig. 75: Identifying Camshaft Position Sensor Magnetic Area**

Courtesy of NISSAN NORTH AMERICA, INC.

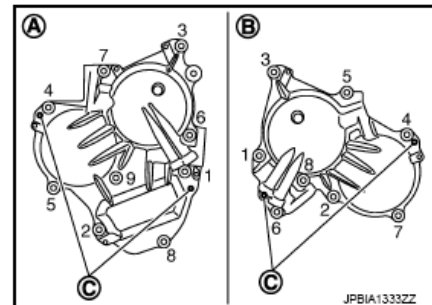
**CAUTION:**

- Handle carefully to avoid dropping and shocks.
- Never disassemble.
- Never allow metal powder to contact magnetic part at sensor tip.
- Never place sensors in a location where they are exposed to magnetism.

23. Remove intake valve timing control covers and gasket as follows:

- a. Disconnect intake valve timing control solenoid valve harness connector.
- b. Loosen mounting bolts in reverse order as shown in the figure below.

A : Bank 1  
B : Bank 2  
C : Dowel pin hole



**Fig. 76: Intake Valve Timing Control Cover Bolt Tightening Sequence**

Courtesy of NISSAN NORTH AMERICA, INC.

**CAUTION:** Shaft is internally jointed with camshaft sprocket (INT) center hole. When removing, keep it horizontal until it is completely disconnected.

- c. Shaft is engaged with camshaft sprocket (INT) center hole on inside. Pull straight out so that it does not tilt until the joint is disengaged.

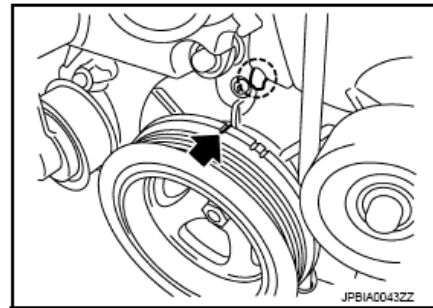
24. Remove intake valve timing control solenoid valve, if necessary.

**CAUTION:** Intake valve timing control solenoid valve is nonreusable. Never

**remove it unless required.**

25. Remove rocker covers (bank 1 and bank 2). Refer to "**EXPLODED VIEW**".
26. Obtain No. 1 cylinder at TDC of its compression stroke as follows:
  - a. Rotate crankshaft pulley clockwise to align timing mark (grooved line without color) with timing indicator.

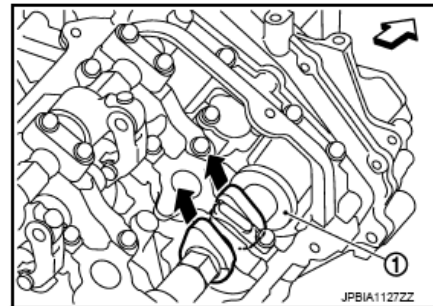
← : Timing mark (grooved line without color)



**Fig. 77: Locating Timing Marks**  
 Courtesy of NISSAN NORTH AMERICA, INC.

- b. Check that exhaust cam noses on No. 1 cylinder (engine front side of bank 1) is located as shown in the figure below.

1 : Camshaft (EXH) (bank 1)  
 ⇨ : Engine front

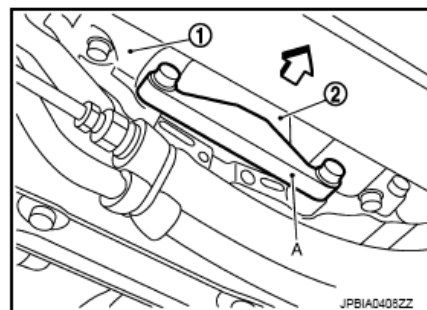


**Fig. 78: Locating No. 1 Cylinder Exhaust Cam Noses**  
 Courtesy of NISSAN NORTH AMERICA, INC.

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

27. Remove crankshaft pulley as follows:
  - a. Remove rear cover plate and set the ring gear stopper [SST: KV10118600 (J-48641)] (A) as shown in the figure below.

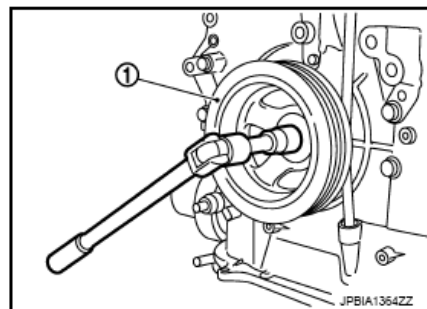
- 1 : Oil pan (upper)  
 2 : Drive plate  
 ⇐ : Vehicle front



**Fig. 79: Identifying Upper Oil Pan And Ring Gear Stopper**  
 Courtesy of NISSAN NORTH AMERICA, INC.

- b. Loosen crankshaft pulley bolt and rotate bolt seating surface at 10 mm (0.39 in) from its original position.

- 1 : Crankshaft pulley

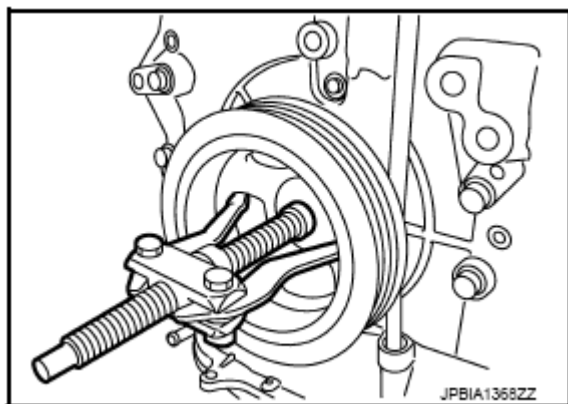


**Fig. 80: Loosening Crankshaft Pulley Bolt**  
 Courtesy of NISSAN NORTH AMERICA, INC.

**CAUTION:** Do not remove crankshaft pulley bolt because it is used as a supporting point for suitable puller.

- c. Place suitable puller tab on holes of crankshaft pulley, and pull crankshaft pulley using center section.

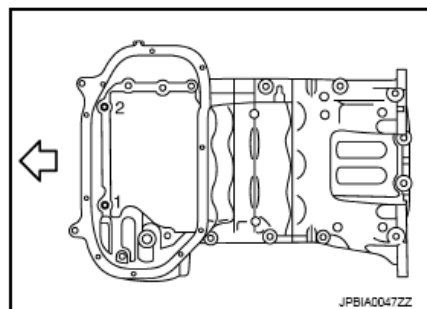
**CAUTION:** Never put suitable puller tab on crankshaft pulley periphery, because this damages internal damper.



**Fig. 81: Removing Crankshaft Pulley**  
 Courtesy of NISSAN NORTH AMERICA, INC.

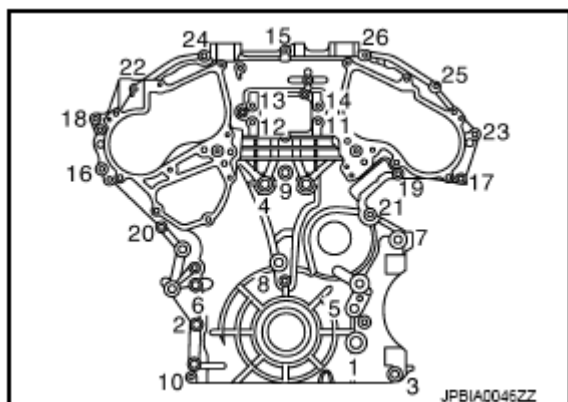
28. Remove oil pan (lower). Refer to "**EXPLODED VIEW**".
29. Loosen two mounting bolts in front of oil pan (upper) with power tool in reverse order as shown in the figure below.

← : Engine front



**Fig. 82: Front Upper Oil Pan Bolt Tightening Sequence**  
 Courtesy of NISSAN NORTH AMERICA, INC.

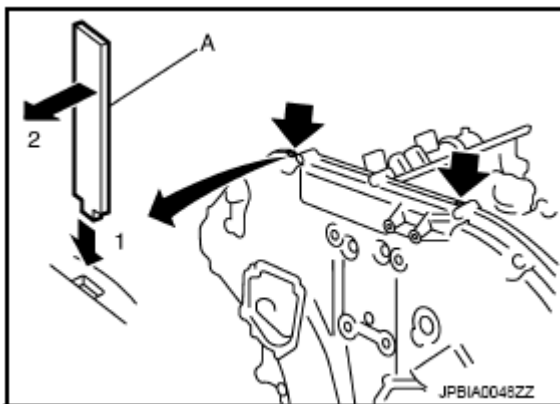
30. Remove front timing chain case as follows:
  - a. Loosen mounting bolts in reverse order as shown in the figure below.



**Fig. 83: Front Timing Chain Case Bolt Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

- b. Insert a suitable tool (A) into the notch at the top of front timing chain case as shown below.
- c. Pry off case by moving the suitable tool as shown below.
  - Use the seal cutter [SST: KV10111100 (J-37228)] to cut liquid gasket for removal.

**CAUTION:**      • **Never use a screwdriver or a similar item.**

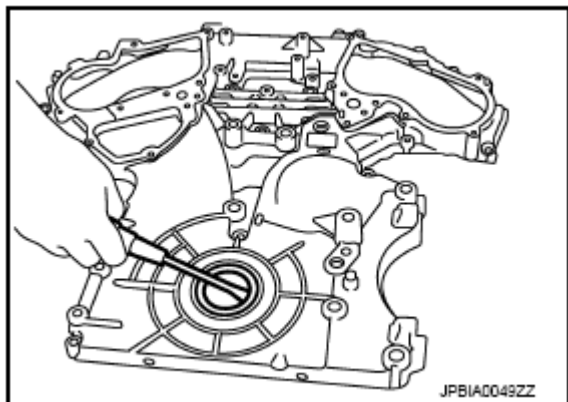


**Fig. 84: Prying Off Case**  
Courtesy of NISSAN NORTH AMERICA, INC.

- **After removal, handle front timing chain case carefully so it does not tilt, cant, or warp under a load.**

31. Remove front oil seal from front timing chain case using a suitable tool.
  - Use a screwdriver for removal.

**CAUTION:** Be careful not to damage front timing chain case.

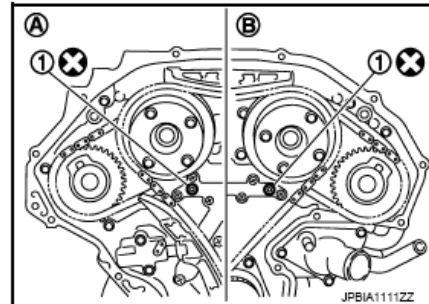


**Fig. 85: Removing Front Timing Chain Case Oil Seal**  
 Courtesy of NISSAN NORTH AMERICA, INC.

32. Remove O-ring (1) from rear timing chain case.

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.

A : Bank 1  
 B : Bank 2

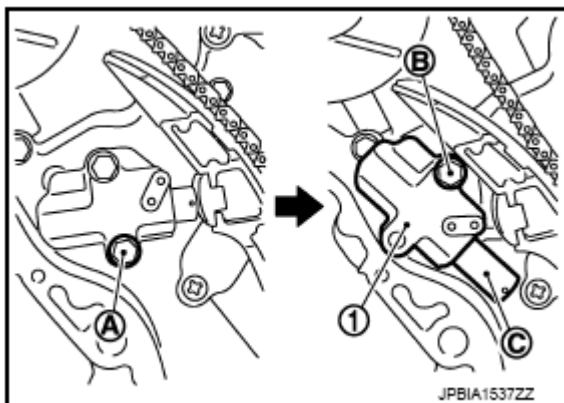


**Fig. 86: Identifying Rear Timing Chain Case O-Ring**  
 Courtesy of NISSAN NORTH AMERICA, INC.

33. Remove timing chain tensioner (primary) (1) as follows:
- Remove lower mounting bolt (A).
  - Loosen upper mounting bolt (B) slowly, and then turn timing chain tensioner (primary) on the upper mounting bolt so that plunger (C) is fully expanded.

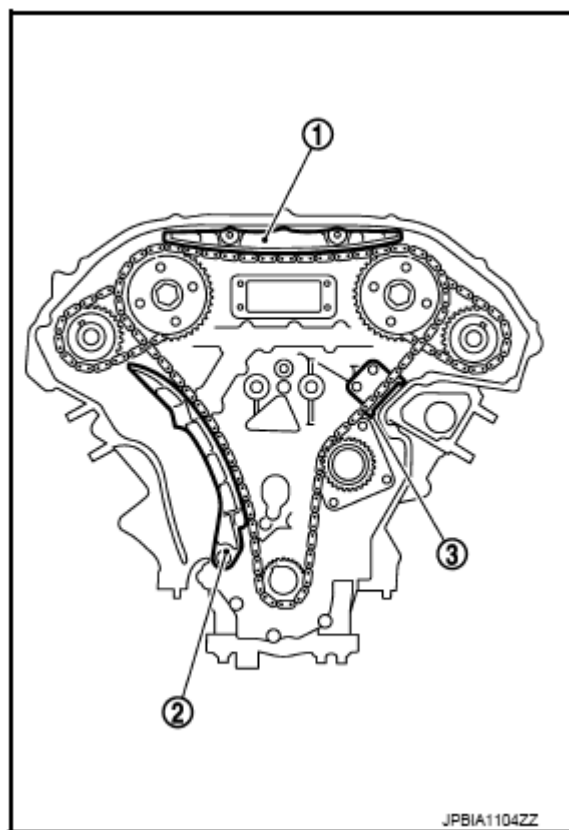
**NOTE:** Even if plunger is fully expanded, it does not drop from the body of timing chain tensioner (primary).

- Remove upper mounting bolt, and then remove timing chain tensioner (primary).



**Fig. 87: Removing Primary Timing Chain Tensioner**  
 Courtesy of NISSAN NORTH AMERICA, INC.

34. Remove internal chain guide (1), slack guide (2) and tension guide (3).



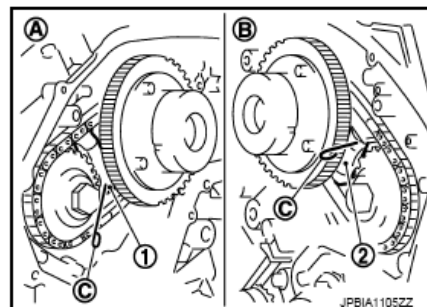
**Fig. 88: Identifying Internal Chain Guide, Slack Guide And Tension Guide**  
 Courtesy of NISSAN NORTH AMERICA, INC.

35. Remove timing chain (primary) and crankshaft sprocket.

**CAUTION:** After removing timing chain (primary), never turn crankshaft and camshaft separately, or valves strike the piston heads.

36. Remove timing chain (secondary) and camshaft sprockets as follows:
- Attach suitable stopper pin (C) to the timing chain tensioners (secondary) (1), (2).

A : Bank 1  
 B : Bank 2



**Fig. 89: Inserting Stopper Pin Into Secondary Timing Chain Tensioners**  
Courtesy of NISSAN NORTH AMERICA, INC.

**NOTE:**

- Use approximately 0.5 mm (0.02 in) dia. hard metal pin as a stopper pin.
- For removal of timing chain tensioners (secondary), refer to "EXPLODED VIEW". (Removing VVEL ladder assembly is required.)

b. Remove camshaft sprocket (EXH) mounting bolt.

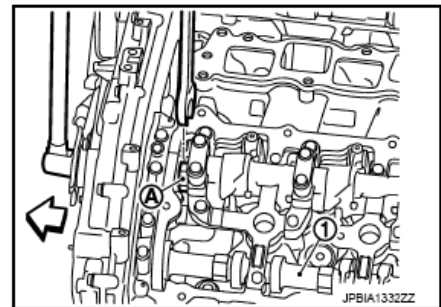
- Secure the hexagonal portion of camshaft (EXH) using a wrench to loosen mounting bolt.

**CAUTION:** Never loosen the mounting bolt by securing anything other than the camshaft (EXH) hexagonal portion or with tensioning the timing chain.

c. Remove camshaft sprocket (INT) mounting bolt.

- Secure the hexagonal portion (located in between journal No. 1 and journal No. 2) of drive shaft (A) using a wrench to loosen mounting bolt.

1 : Camshaft (EXH) (bank 2)  
⇐ : Engine front

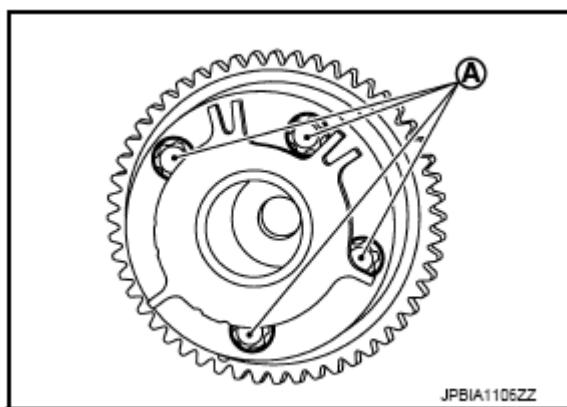


**Fig. 90: Identifying Exhaust Camshaft And Drive Shaft**  
Courtesy of NISSAN NORTH AMERICA, INC.

**CAUTION:**

- Never loosen the mounting bolt by securing anything other than the drive shaft hexagonal portion or with tensioning the timing chain.
- When holding the hexagonal part of drive shaft on the intake side with a wrench, be careful not to allow the wrench to cause interference with other parts.
- Never disassemble camshaft sprocket (INT). [Never loosen bolts (A) as shown in the figure below.]

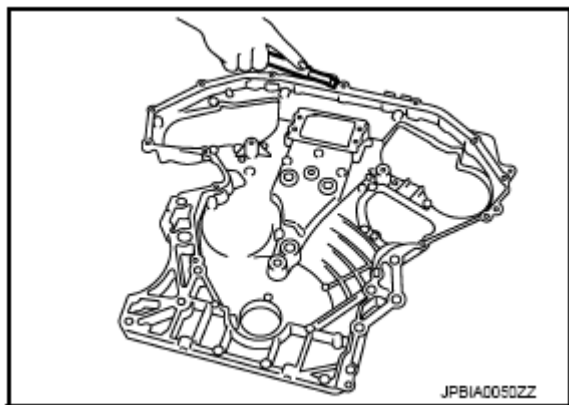




**Fig. 91: Identifying Camshaft Sprocket Bolts**  
Courtesy of NISSAN NORTH AMERICA, INC.

- d. Remove timing chain (secondary) together with camshaft sprockets.
37. Use a scraper to remove all traces of old liquid gasket from front and rear timing chain cases and oil pan (upper), and liquid gasket mating surfaces.

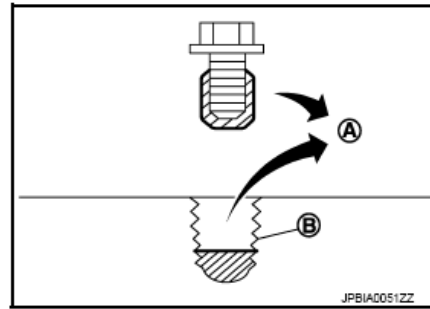
**CAUTION: Be careful not to allow gasket fragments to enter oil pan.**



**Fig. 92: Removing Liquid Gasket**  
Courtesy of NISSAN NORTH AMERICA, INC.

38. Remove old liquid gasket from bolt hole and thread.

- A : Remove old liquid gasket that is stuck  
B : Bolt hole



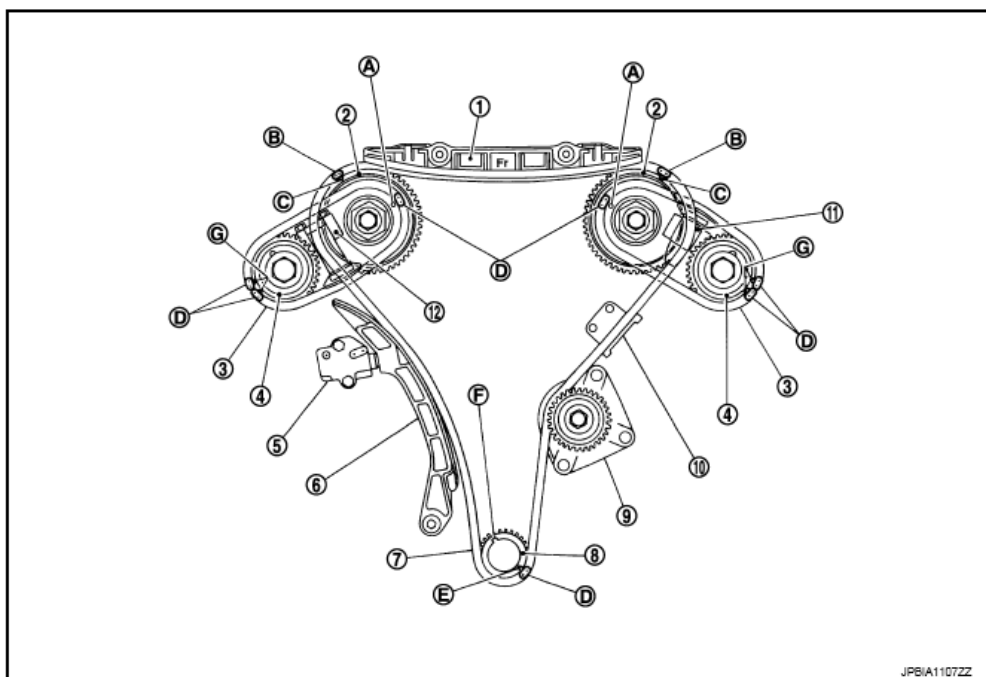
**Fig. 93: Removing Liquid Gasket**

Courtesy of NISSAN NORTH AMERICA, INC.

#### INSTALLATION

**CAUTION:** Do not reuse O-rings.

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



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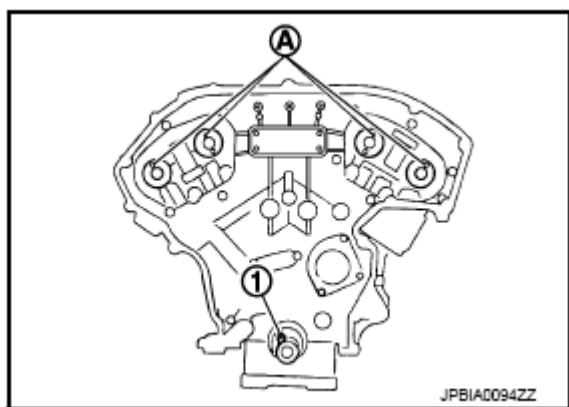
- |  |   |   |
|--|---|---|
| 1. Internal chain guide                | 2. Camshaft sprocket (INT)                      | 3. Timing chain (secondary)                     |
| 4. Camshaft sprocket (EXH)             | 5. Timing chain tensioner (primary)             | 6. Slack guide                                  |
| 7. Timing chain (primary)              | 8. Crankshaft sprocket                          | 9. Water pump                                   |
| 10. Tension guide                      | 11. Timing chain tensioner (secondary) (bank 2) | 12. Timing chain tensioner (secondary) (bank 1) |
| A. Matching mark [punched (back side)] | B. Matching mark (yellow link)                  | C. Matching mark (punched)                      |
| D. Matching mark (orange link)         | E. Matching mark (notched)                      | F. Crankshaft key                               |
| G. Matching mark [punched]             |   |   |

**Fig. 94: Camshaft Sprocket, Timing Chain And Related Components**

Courtesy of NISSAN NORTH AMERICA, INC.

1. Check that dowel pin (A) and crankshaft key (1) are located as shown in the figure below. (No. 1 cylinder at compression TDC)

**NOTE:** Though camshaft does not stop at the position as shown in the figure below, for the placement of cam noses, it is generally accepted that camshaft is placed in the same direction as that of the figure.



**Fig. 95: Identifying Crankshaft Key And Dowel Pin**  
 Courtesy of NISSAN NORTH AMERICA, INC.

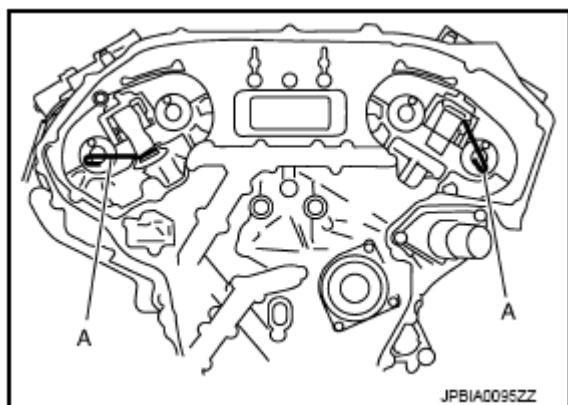
**Camshaft dowel pin:** At cylinder head upper face side in each bank.

**Crankshaft key:** At cylinder head side of bank 1.

2. Install timing chains (secondary) and camshaft sprockets as follows:

**CAUTION:** Matching marks between timing chain and sprockets slip easily.  
 Confirm all matching mark positions repeatedly during the installation process.

- a. Push plunger of timing chain tensioner (secondary) and keep it pressed in with a stopper pin (A).

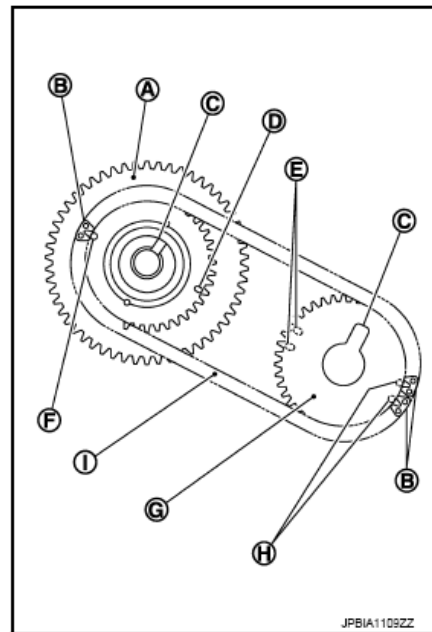


**Fig. 96: Identifying Secondary Timing Chain Tensioner Stopper Pin**  
 Courtesy of NISSAN NORTH AMERICA, INC.

- b. Install timing chains (secondary) and camshaft sprockets.

**NOTE:** Figure shows bank 1 (rear view).

- A : Camshaft sprocket (INT) back face
- B : Orange link
- C : Dowel groove
- D : Matching mark (oval)
- E : Matching mark (2 oval: on front face)
- F : Matching mark (circle)
- G : Camshaft sprocket (EXH) back face
- H : Matching mark (2 circle: on front face)
- I : Timing chain (secondary)



**Fig. 97: Aligning Secondary Timing Chains & Camshaft Sprockets**  
 Courtesy of NISSAN NORTH AMERICA, INC.

- Align the matching marks on timing chain (secondary) (orange link) with the ones on intake and exhaust camshaft sprockets (punched), and install them.

**NOTE:**

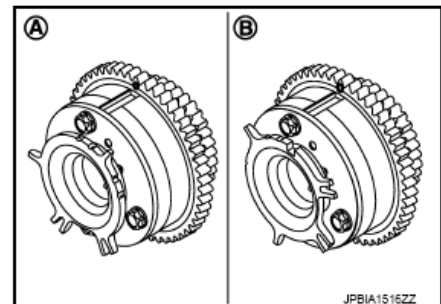
- **Matching marks for camshaft sprockets (INT) are on the back side of camshaft sprockets (secondary).**
- **There are two types of matching marks, the circle and oval types. They should be used for the bank 1 and bank 2, respectively.**

**Bank 1: Use circle type**

**Bank 2: Use oval type**

- Shape (orientation of signal plate) of camshaft sprocket (INT) varies depending on the bank position. See the figure below.

- A : Bank 1
- B : Bank 2

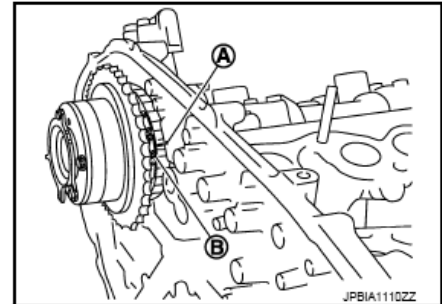


**Fig. 98: Identifying Camshaft Sprockets**

Courtesy of NISSAN NORTH AMERICA, INC.

- Align dowel pin camshafts with the pin groove on sprockets, and install them.
- In case that positions of each matching mark and each dowel pin do not fit with matching parts, make fine adjustment to the position holding the hexagonal portion on camshaft (EXH) or drive shaft with wrench or equivalent tool.
- Mounting bolts for camshaft sprockets must be tightened in the next step. Tightening them by hand is sufficient to prevent the dislocation of dowel pins.
- It may be difficult to visually check the dislocation of matching marks during and after installation. To make the matching easier, make a matching mark on the top of sprocket teeth and its extended line in advance with paint.

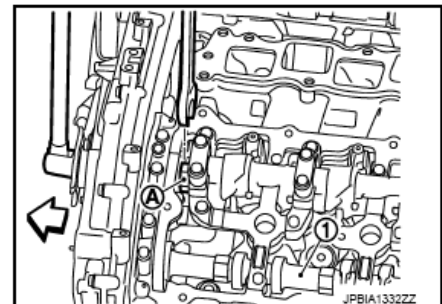
- A : Matching mark (painted)  
B : Matching mark (orange link)

**Fig. 99: Identifying Matching Marks On Top Of Sprocket Teeth**

Courtesy of NISSAN NORTH AMERICA, INC.

- c. Tighten camshaft sprocket (EXH) mounting bolt.
  - Secure camshaft (EXH) using a wrench at the hexagonal portion to tighten mounting bolt.
- d. After confirming the matching marks are aligned, tighten camshaft sprocket (INT) mounting bolt.
  - Secure the hexagonal portion (located in between journal No. 1 and journal No. 2) of drive shaft (A) using a wrench to tighten mounting bolt.

- 1 : Camshaft (EXH) (bank 2)  
↔ : Engine front

**Fig. 100: Identifying Exhaust Camshaft Sprocket And Drive Shaft**

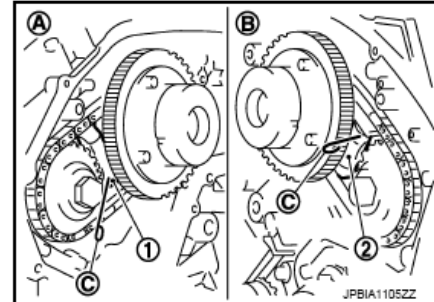
Courtesy of NISSAN NORTH AMERICA, INC.

**CAUTION:** When holding the hexagonal part of drive shaft on the intake side with a wrench, be careful not to allow the wrench to cause

**interference with other parts.**

- e. Pull stopper pins (C) out from timing chain tensioners (secondary) (1), (2).

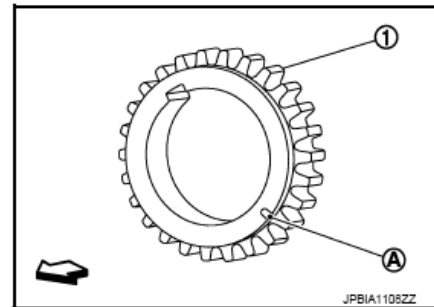
A : Bank 1  
B : Bank 2



**Fig. 101: Identifying Secondary Timing Chain Tensioner Stopper Pins**  
Courtesy of NISSAN NORTH AMERICA, INC.

3. Install timing chain (primary) as follows:
  - a. Install crankshaft sprocket (1).

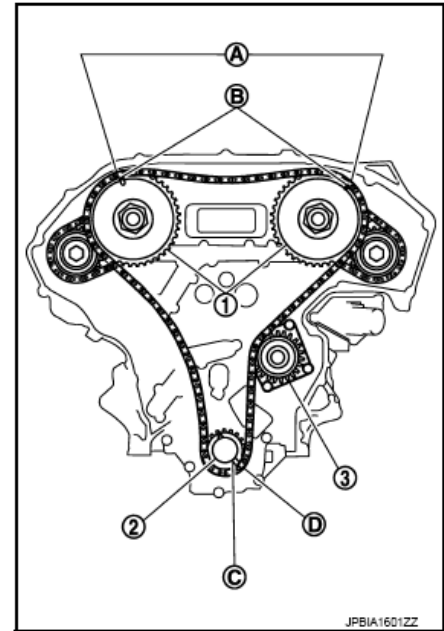
A : Matching mark (front side)  
↔ : Engine front



**Fig. 102: Identifying Crankshaft Sprocket And Matching Mark**  
Courtesy of NISSAN NORTH AMERICA, INC.

- Check that the matching marks on crankshaft sprocket face the front of the engine.
- b. Install timing chain (primary).
    - Install timing chain (primary) so that the matching mark (punched) (B) on camshaft sprocket (INT) (1) is aligned with the yellow link (A) on timing chain, while the matching mark (notched) (C) on crankshaft sprocket (2) is aligned with the orange link (D) one on timing chain, as shown in the figure below.

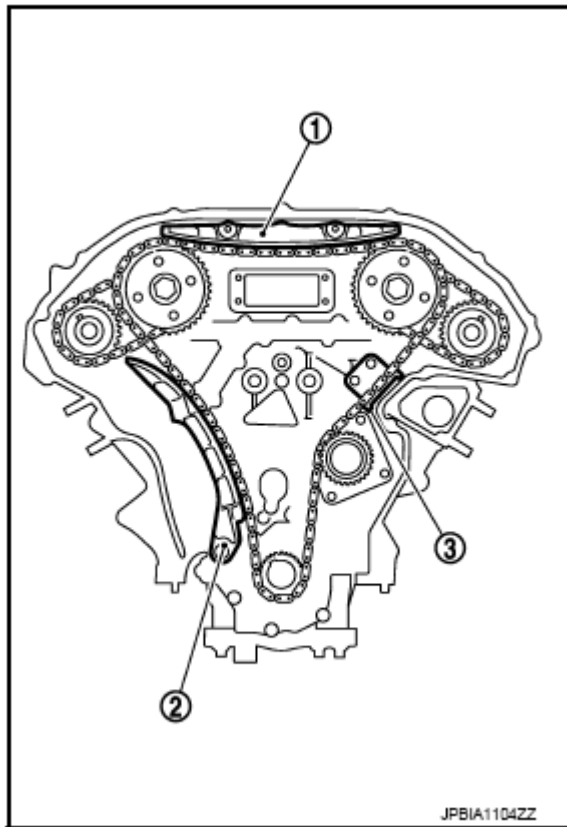
3 : Water pump



**Fig. 103: Aligning Primary Timing Chain Marks**  
 Courtesy of NISSAN NORTH AMERICA, INC.

- When it is difficult to align matching marks of timing chain (primary) with each sprocket, gradually turn drive shaft using wrench on the hexagonal portion to align it with the matching marks.
4. Install internal chain guide (1), slack guide (2), and tension guide (3).

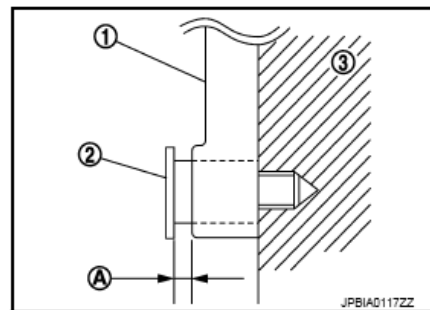




**Fig. 104: Identifying Internal Chain Guide, Slack Guide And Tension Guide**  
 Courtesy of NISSAN NORTH AMERICA, INC.

**CAUTION:** Never overtighten slack guide mounting bolt (2). It is normal for a gap (A) to exist under the bolt seats when mounting bolt are tightened to the specification.

- 1 : Slack guide
- 3 : Cylinder block



**Fig. 105: Identifying Slack Guide Mounting Bolt End Gap**  
 Courtesy of NISSAN NORTH AMERICA, INC.

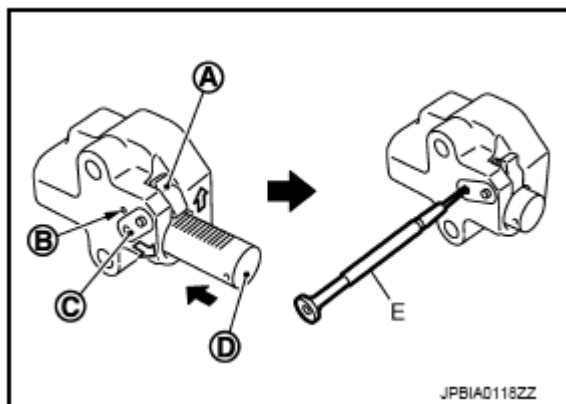
5. Install the timing chain tensioner (primary) with the following procedure:
  - a. Pull plunger stopper tab (A) up (or turn lever downward) so as to remove plunger stopper tab from the ratchet of plunger (D).

**NOTE:** Plunger stopper tab and lever (C) are synchronized.

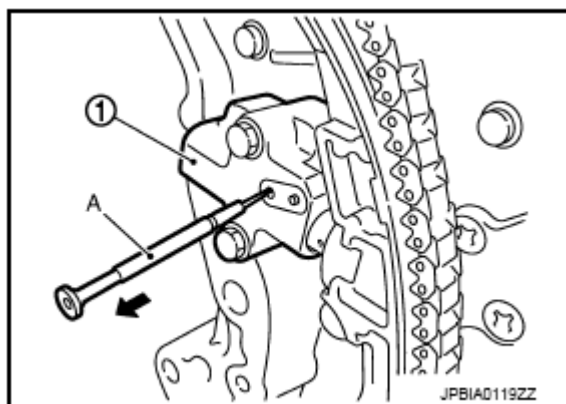
- b. Push plunger into the inside of tensioner body.
- c. Hold plunger in the fully compressed position by engaging plunger stopper tab with the tip of ratchet.
- d. To secure lever, insert stopper pin (E) through hole of lever into tensioner body hole (B).
  - The lever parts and the plunger stopper tab are synchronized. Therefore, the plunger is secured under this condition.

**NOTE:** Figure shows the example of 1.2 mm (0.047 in) diameter thin screwdriver being used as the stopper pin.

- e. Install timing chain tensioner (primary) (1).
  - Remove any dirt and foreign materials completely from the back and the mounting surfaces of timing chain tensioner (primary).
- f. Pull out stopper pin (A) after installing, and then release plunger.



**Fig. 106: Inserting Stopper Pin**  
Courtesy of NISSAN NORTH AMERICA, INC.






**Fig. 107: Pulling Out Stopper Pin**

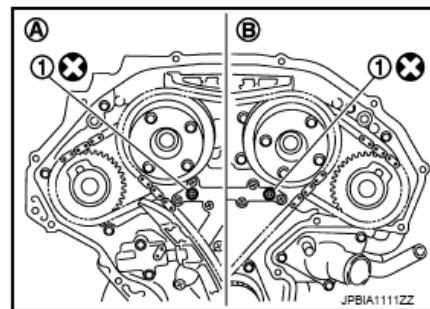
Courtesy of NISSAN NORTH AMERICA, INC.

6. Check again that the matching marks on sprockets and timing chain have not slipped out of alignment.
7. Install new O-rings (1) on rear timing chain case.

**CAUTION: Do not reuse O-rings.**

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.

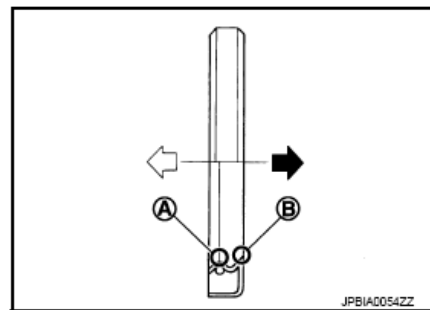
A : Bank 1  
B : Bank 2



**Fig. 108: Identifying Rear Timing Chain Case O-Rings**  
Courtesy of NISSAN NORTH AMERICA, INC.

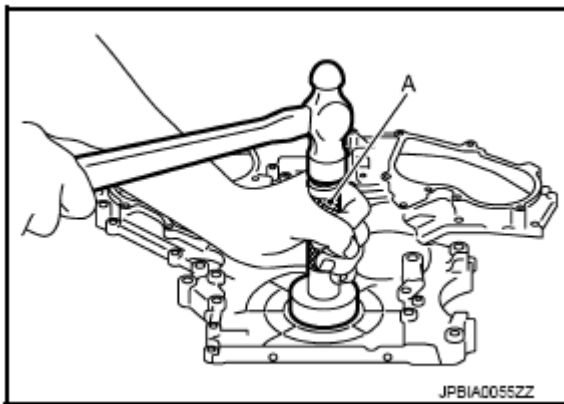
8. Install new front oil seal on front timing chain case.

⇐ : Engine inside  
➡ : Engine outside



**Fig. 109: Identifying Front Timing Chain Case Oil Seal Orientation**  
Courtesy of NISSAN NORTH AMERICA, INC.

- Apply new engine oil to both oil seal lip (A) and dust seal lip (B).
- Install it so that each seal lip is oriented as shown in the figure below.
- Using a suitable drift [outer diameter: 60 mm (2.36 in)] (A), press-fit oil seal until it becomes flush with front timing chain case end face.
- Check that the garter spring is in position and seal lip is not inverted.



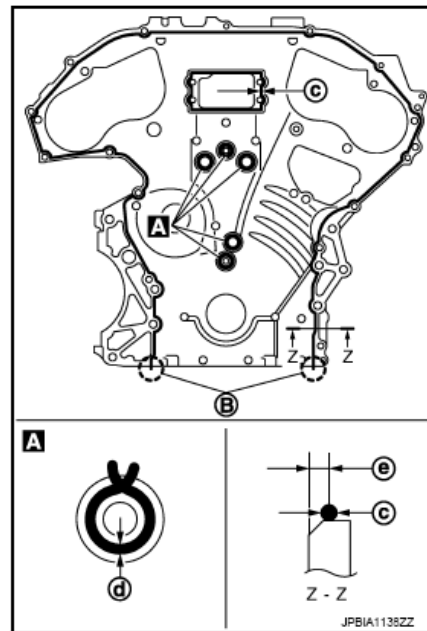
**Fig. 110: Installing Oil Seal**

Courtesy of NISSAN NORTH AMERICA, INC.

9. Install front timing chain case as follows:

- Check that O-rings stay in place during installation to rear timing chain case.
- a. Apply a continuous bead of liquid gasket with the tube presser (commercial service tool) to front timing chain case back side as shown in the figure below.

- B : Protrusion  
 c :  $\phi 3.4 - 4.4$  mm (0.134 - 0.173 in)  
 d :  $\phi 2.6 - 3.6$  mm (0.102 - 0.142 in)  
 e : 4.0 - 5.6 mm (0.157 - 0.220 in)



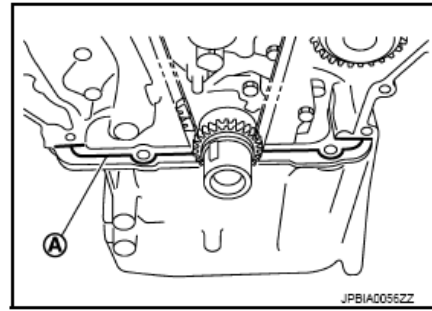
**Fig. 111: Identifying Liquid Gasket**

Courtesy of NISSAN NORTH AMERICA, INC.

Use Genuine RTV Silicone Sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS".

- b. Apply liquid gasket to top surface of oil pan (upper) as shown in the figure below.

A :  $\phi 4.0 - 5.0$  mm (0.157 - 0.197 in)

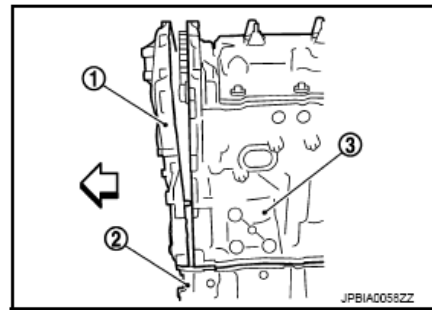


**Fig. 112: Identifying Liquid Gasket**  
Courtesy of NISSAN NORTH AMERICA, INC.

Use Genuine RTV Silicone Sealant or equivalent. Refer to "**RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS**".

- c. Assemble front timing chain case.

- 1 : Front timing chain case  
2 : Oil pan (upper)  
3 : Cylinder block  
↔ : Engine front

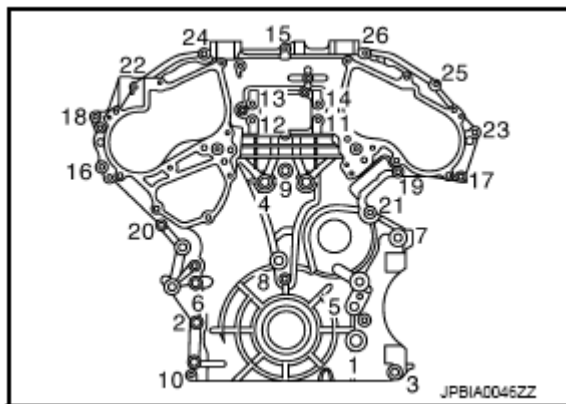


**Fig. 113: Identifying Front Timing Chain Case, Upper Oil Pan And Cylinder Block**  
Courtesy of NISSAN NORTH AMERICA, INC.

**CAUTION:**

- Be careful not to damage front oil seal by interference with front end of crankshaft.
- Attaching should be done within 5 minutes after liquid gasket application.

- d. Install front timing chain case fitting its dowel pin hole together with dowel pin on rear timing chain case.
- e. Tighten mounting bolts to the specified torque in numerical order as shown in the figure below.
- There are two types of mounting bolts. Refer to **the following** for locating bolts.



**Fig. 114: Front Timing Chain Case Bolt Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

**M10 bolts: 1, 2, 3, 4, 5, 6, 7**

**Torque: 55.0 N.m (5.6 kg-m, 41 ft-lb)**

**M6 bolts: Except the above**

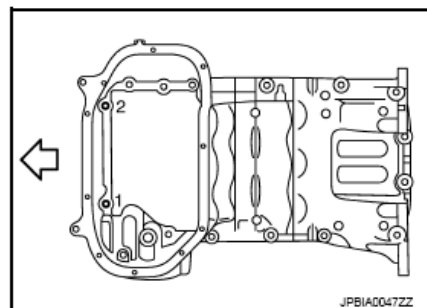
**Torque: 12.7 N.m (1.3 kg-m, 9 ft-lb)**

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

**CAUTION: Be sure to wipe off any excessive liquid gasket leaking on surface mating with oil pan (upper).**

- g. Install two mounting bolts in front of oil pan (upper) in numerical order shown in the figure below.

↩ : Engine front



**Fig. 115: Front Upper Oil Pan Bolt Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

**Tightening torque**

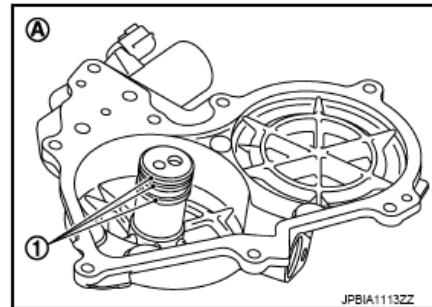
**2WD models: Refer to "2WD: EXPLODED VIEW".**

**AWD models: Refer to "AWD: EXPLODED VIEW".**

10. Install intake valve timing control covers as follows:

- a. Install new seal rings (1) in shaft grooves.

A : Bank 2



**Fig. 116: Identifying Shaft Grooves Seal Rings**  
Courtesy of NISSAN NORTH AMERICA, INC.

**CAUTION:** When replacing seal ring, replace all rings with new ones.

**NOTE:** The figure shows an example of bank 2.

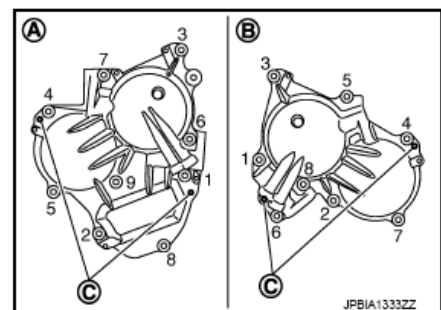
- b. Install intake valve timing control cover with new gasket to front timing chain case.

**CAUTION:**

- Align the center of both shaft holes of the shaft and the intake side camshaft sprocket, and then insert them.
- Be careful not to drop the seal ring from the shaft groove.

- c. Being careful not to move seal ring from the installation groove, align dowel pins on front timing chain case with dowel pin holes (C) to install intake valve timing control covers.
- d. Tighten mounting bolts in numerical order as shown in the figure below.
  - After all bolts are tightened, tighten No. 1 bolt to the specified torque again.

A : Bank 1  
B : Bank 2

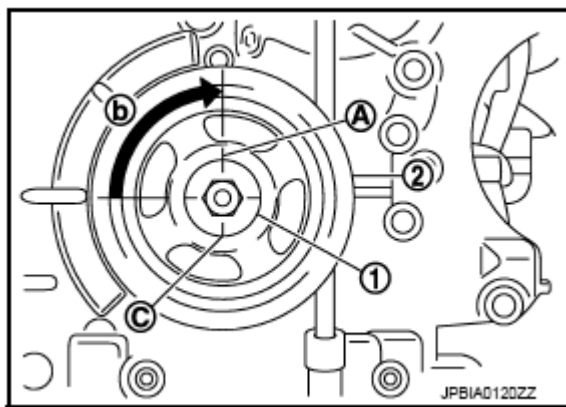


**Fig. 117: Front Timing Chain Case Mounting Bolt Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

11. Install oil pan (lower). Refer to "**EXPLODED VIEW**".
12. Install rocker covers (bank 1 and bank 2). Refer to "**EXPLODED VIEW**".
13. Install crankshaft pulley as follows:
  - a. Fix crankshaft using the ring gear stopper [SST: KV10118600 (J-48641)].
  - b. Install crankshaft pulley, taking care not to damage front oil seal.
    - When press-fitting crankshaft pulley with plastic hammer, tap on its center portion (not circumference).
  - c. Tighten crankshaft pulley bolt.

**Torque: 44.1 N.m (4.5 kg-m, 33 ft-lb)**

- d. Tighten the bolt 90 degrees (one mark) (b).
  - Place a matching mark (A) on crankshaft pulley (2) aligning with the matching (C) of crankshaft pulley bolt (1).

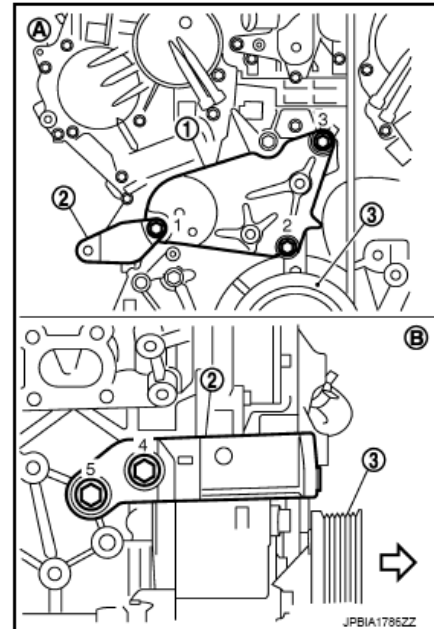


**Fig. 118: Tightening Crankshaft Pulley Bolt**  
**Courtesy of NISSAN NORTH AMERICA, INC.**

- e. Rotate crankshaft pulley in normal direction (clockwise when viewed from front) to confirm it turns smoothly.
14. Install power steering oil pump bracket and idler pulley bracket as follows:
  - a. Tighten mounting bolts in numerical order as shown in the figure below. (temporarily)
  - b. Tighten mounting bolts to specified torque in numerical order as shown in the figure below.



- 1 : Idler pulley bracket
- 2 : Power steering oil pump bracket
- 3 : Crankshaft pulley
- A : Engine front side
- B : Engine right side
- ⇐ : Engine front



**Fig. 119: Idler Pulley Bracket Mounting Bolt Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

15. For the following operations, perform steps in the reverse order of removal.

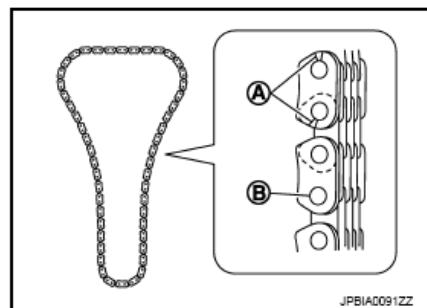
### Inspection

#### INSPECTION AFTER REMOVAL

#### Timing Chain

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

- A : Crack
- B : Wear



**Fig. 120: Inspecting Timing Chain For Crack & Wear**  
Courtesy of NISSAN NORTH AMERICA, INC.

#### INSPECTION AFTER INSTALLATION

#### Inspection for Leakage

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

- Before starting engine, check oil/fluid levels including engine coolant and engine oil. If any are less than the required quantity, fill them to the specified level. Refer to "**FOR NORTH AMERICA: FLUIDS AND LUBRICANTS**".
- Follow the procedure below to check for fuel leakage.
  - Turn ignition switch to the "ON" position (with engine stopped). With fuel pressure applied to fuel piping, check for fuel leakage at connection points.
  - Start engine. With engine speed increased, check again for fuel leakage at connection points.
- Run engine to check for unusual noise and vibration.

**NOTE:** If hydraulic pressure inside chain tensioner drops after removal/installation, slack in guide may generate a pounding noise during and just after the engine start. However, this does not indicate a malfunction. The noise will stop after hydraulic pressure rises.

- Warm up engine thoroughly to check that there is no leakage of fuel, or any oil/fluids including engine oil and engine coolant.
- Bleed air from lines and hoses of applicable lines, such as in cooling system.
- After cooling down engine, again check oil/fluid levels including engine oil and engine coolant. Refill them to the specified level, if necessary.

#### SUMMARY OF 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 <sup>(1)</sup>		Level	Leakage	Level
Fuel		Leakage	Leakage	Leakage
Exhaust gases		-	Leakage	-
(1) Power steering fluid, brake fluid, etc.				

## OIL SEAL

### FRONT OIL SEAL

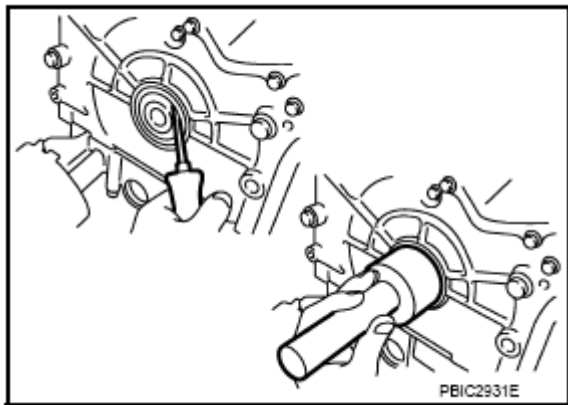
#### FRONT OIL SEAL: Removal and Installation

#### REMOVAL

1. Remove the following parts:

- Engine undercover with power tool.
  - Drive belt: Refer to "**EXPLODED VIEW**".
  - Crankshaft pulley: Refer to "**EXPLODED VIEW**".
2. Remove front oil seal using a suitable tool.

**CAUTION:** Be careful not to damage front timing chain case and crankshaft.

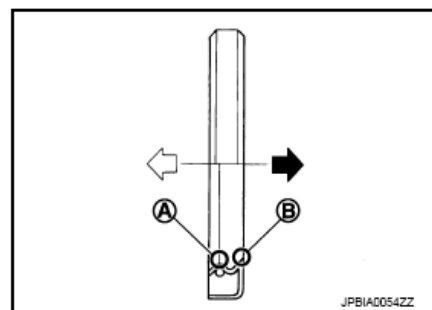


**Fig. 121: Removing/Installing Front Oil Seal**  
Courtesy of NISSAN NORTH AMERICA, INC.

#### INSTALLATION

1. Apply new engine oil to both oil seal lip and dust seal lip of new front oil seal.
  2. Install front oil seal.
- Install front oil seal so that each seal lip is oriented as shown in the figure below.

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



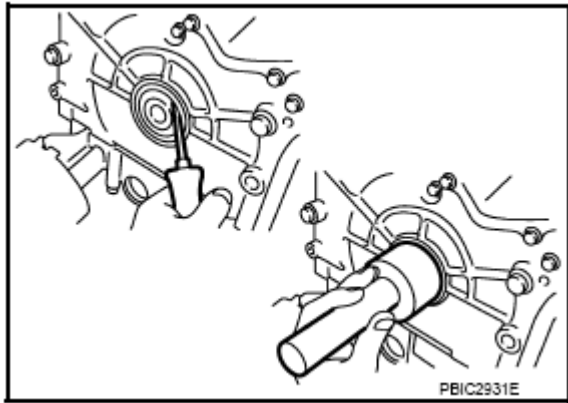
**Fig. 122: Identifying Front Oil Seal Orientation**  
Courtesy of NISSAN NORTH AMERICA, INC.

- Using a suitable drift, press-fit until the height of front oil seal is level with the mounting surface.
  - Suitable drift: outer diameter 60 mm (2.36 in), inner diameter 50 mm (1.97 in).
- Check that the garter spring is in position and seal lips are not inverted.

**CAUTION:**

- Be careful not to damage front timing chain case and crankshaft.
- Press-fit straight and avoid causing burrs or tilting oil seal.

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

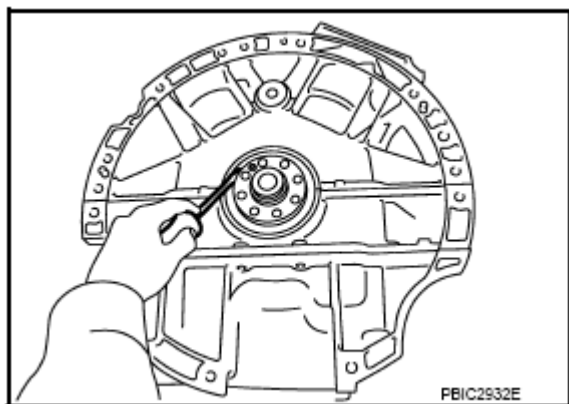


**Fig. 123: Removing/Installing Front Oil Seal**  
Courtesy of NISSAN NORTH AMERICA, INC.

**REAR OIL SEAL****REAR OIL SEAL: Removal and Installation****REMOVAL**

1. Remove transmission assembly. Refer to "**VQ37VHR (2WD): EXPLODED VIEW** " (2WD models) or "**VQ37VHR (AWD): EXPLODED VIEW** " (AWD models).
2. Remove drive plate. Refer to "**EXPLODED VIEW**".
3. Remove rear oil seal with a suitable tool.

**CAUTION: Be careful not to damage crankshaft and cylinder block.**



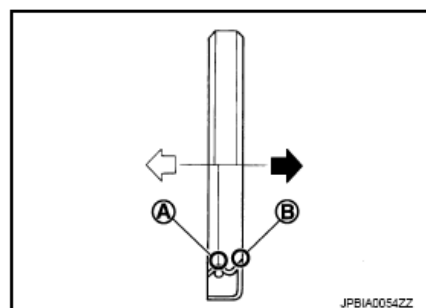
**Fig. 124: Removing Rear Oil Seal**

Courtesy of NISSAN NORTH AMERICA, INC.

#### INSTALLATION

1. Install rear oil seal.
  - Install rear oil seal so that each seal lip is oriented as shown in the figure below.

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

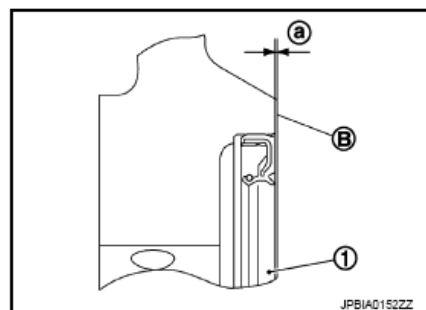


**Fig. 125: Identifying Rear Oil Seal Orientation**

Courtesy of NISSAN NORTH AMERICA, INC.

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

- B : Cylinder block rear end face  
 a : 0 - 0.5 mm (0 - 0.020 in)



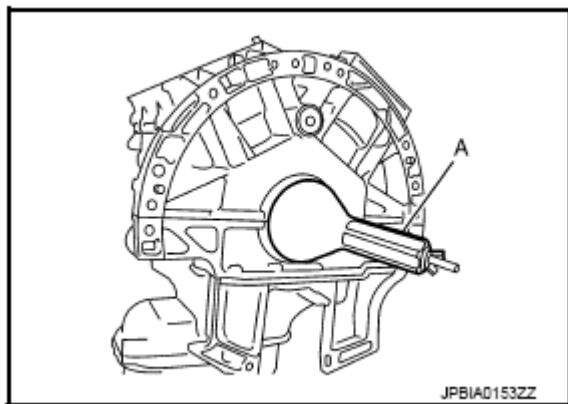
**Fig. 126: Identifying Rear Oil Seal Installation Dimensions**

Courtesy of NISSAN NORTH AMERICA, INC.

- Using a suitable drift (A), press-fit until the height of rear oil seal is level with the mounting surface.
  - Suitable drift: outer diameter 100 mm (3.94 in), inner diameter 85 mm (3.35 in).

**CAUTION:**

- Be careful not to damage crankshaft and cylinder block.
- Press-fit straight and avoid causing burrs or tilting oil seal.



**Fig. 127: Installing Rear Oil Seal**

Courtesy of NISSAN NORTH AMERICA, INC.




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

## UNIT REMOVAL AND INSTALLATION

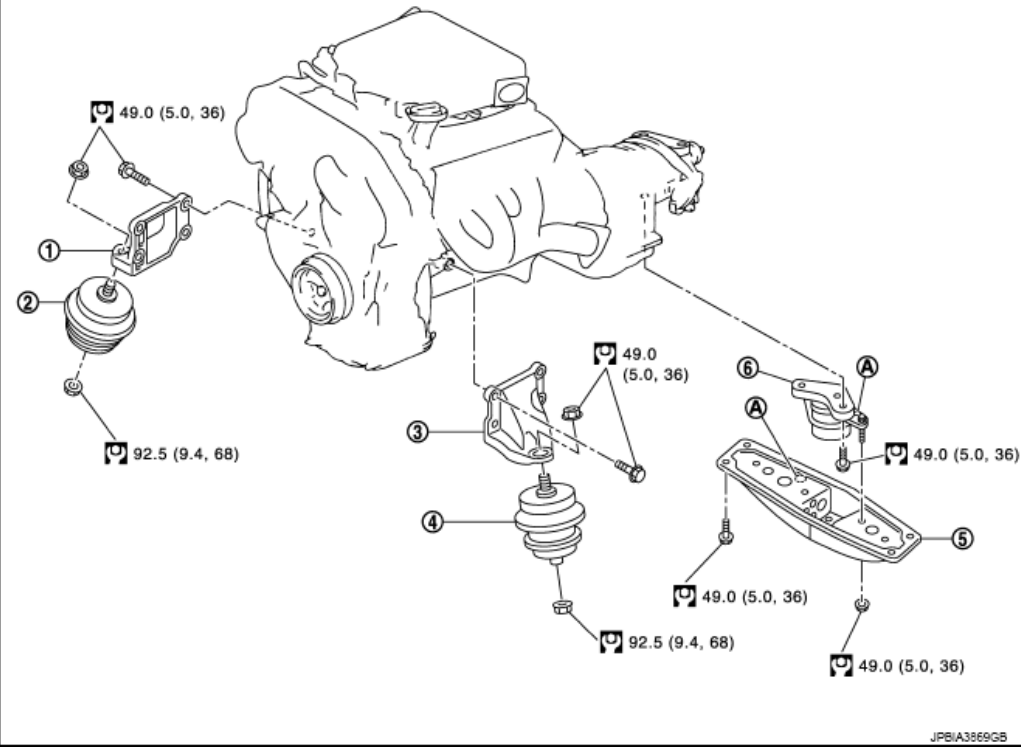
### ENGINE ASSEMBLY

#### 2WD

#### 2WD: Exploded View

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.

SEC. 112



- |                                   |                                   |                                     |
|-----------------------------------|-----------------------------------|-------------------------------------|
| 1. Engine mounting bracket (RH)   | 2. Engine mounting insulator (RH) | 3. Engine mounting bracket (LH)     |
| 4. Engine mounting insulator (LH) | 5. Rear engine mounting member    | 6. Engine mounting insulator (rear) |
| A. Front mark                     |                                   |                                     |

**Fig. 128: Exploded View Of Engine Assembly With Torque Specifications (2WD)**  
 Courtesy of NISSAN NORTH AMERICA, INC.

Refer to "**COMPONENTS**" for symbols in the figure.

**2WD: Removal and Installation**

**WARNING:**

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

**CAUTION:**

- Always be careful to work safely, and avoid forceful or uninstructed operations.
- Never start working until exhaust system and engine coolant are cool

enough.

- If items or work required are not covered by this article, refer to the applicable Service Information.
- Always use the support point specified for lifting.
- Use either 2-pole lift type or separate type lift as much as possible. If board-on type is used for unavoidable reasons, support at rear axle jacking point with transmission jack or similar tool before starting work, in preparation for the backward shift of the center of gravity.
- For supporting points for lifting and jacking point at rear axle, refer to "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

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

### Preparation

1. Release fuel pressure. Refer to "WORK PROCEDURE" (FOR USA AND CANADA).
2. Disconnect both battery cables. Refer to "EXPLODED VIEW".
3. Drain engine coolant from radiator. Refer to "DRAINING".

**CAUTION:**

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

4. Remove the following parts:
  - Radiator reservoir tank: Refer to "EXPLODED VIEW".
  - Engine cover: Refer to "EXPLODED VIEW".
  - Front road wheel and tires (power tool)
  - Engine under cover (power tool): Refer to "EXPLODED VIEW".
  - Cowl top cover: Refer to "EXPLODED VIEW".
  - Air duct and air cleaner case assembly (RH and LH): Refer to "EXPLODED VIEW".
  - Cooling fan assembly: Refer to "EXPLODED VIEW".
5. Discharge refrigerant from A/C circuit. Refer to "RECYCLE REFRIGERANT".
6. Remove radiator hoses (upper and lower). Refer to "EXPLODED VIEW".

### Engine Room LH



1. Disconnect heater hose at vehicle side, and fit a plug onto hose end to prevent engine coolant leakage.
2. Disconnect A/C piping from A/C compressor, and temporarily fasten it on vehicle with a rope. Refer to "**EXPLODED VIEW**".
3. Disconnect brake booster vacuum hose.
4. Disconnect ground cable.

#### Engine Room RH

1. Disconnect battery positive cable at vehicle side and temporarily fasten it on engine.
2. Disconnect all clips and connectors of the engine room harness from engine back side.
3. Disconnect fuel feed hose (with damper) and EVAP hose. Refer to "**EXPLODED VIEW**".

**CAUTION: Fit plugs onto disconnected hoses to prevent fuel leakage.**

4. Remove reservoir tank of power steering oil pump and piping from vehicle, and temporarily secure them on engine. Refer to "**2WD: EXPLODED VIEW**".

**CAUTION: When temporarily securing, keep the reservoir tank upright to avoid fluid leakage.**

#### Vehicle Inside

Follow the procedure below to disconnect engine room harness connectors at passenger room side, and temporarily secure them on engine.

1. Remove passenger-side kicking plate and dash side finisher. Refer to "**EXPLODED VIEW**".
2. Disconnect engine room harness connectors at unit sides TCM, ECM and other locations.
3. Disengage intermediate fixing point. Pull out engine room harnesses to engine room side, and temporarily secure them on engine.

**CAUTION:**

- When pulling out harnesses, take care not to damage harnesses and connectors.
- After temporarily securing, cover connectors with vinyl or similar material to protect against adhesion of foreign materials.

#### Vehicle Underbody

1. Remove A/T fluid cooler hoses and power steering oil pump oil cooler hoses.
2. Disconnect heated oxygen sensor 2 harness. Refer to "**VQ37VHR: EXPLODED VIEW**".
3. Remove three way catalyst and exhaust front tube. Refer to "**VQ37VHR: EXPLODED VIEW**".
4. Disconnect steering lower joint at power steering gear assembly side, and release steering lower shaft.

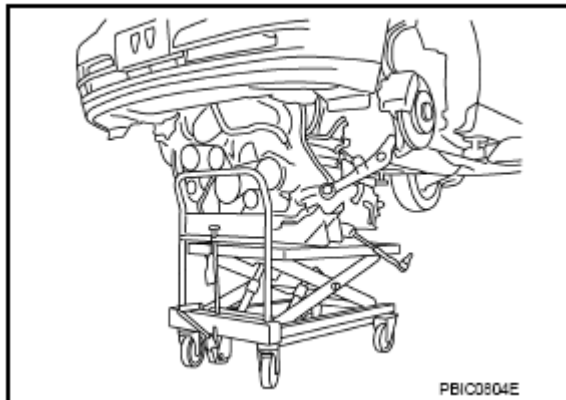
Refer to "**WITHOUT 4WAS: EXPLODED VIEW** " (without 4WAS models) or "**WITH 4WAS: EXPLODED VIEW** " (with 4WAS models).

5. Remove rear propeller shaft. Refer to "**EXPLODED VIEW** ".
6. Disengage A/T control rod at A/T shift selector side. Then, temporarily secure it on the transmission assembly, so that it does not sag. Refer to "**EXPLODED VIEW** ".
7. Remove rear plate cover from oil pan (upper). Then remove bolts fixing drive plate to torque converter. Refer to "**EXPLODED VIEW**".
8. Remove transmission joint bolts that pierce at oil pan (upper) lower rear side. Refer to "**2WD: EXPLODED VIEW**".
9. Remove front stabilizer connecting rod from transverse link. Refer to "**EXPLODED VIEW** ".
10. Remove lower ends of left and right steering knuckle from transverse link. Refer to "**EXPLODED VIEW** ".
11. Separate steering outer sockets from steering knuckle. Refer to "**2WD: EXPLODED VIEW** ".
12. Remove transverse links mounting bolts at suspension member side. Refer to "**EXPLODED VIEW** ".

#### Removal Work

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

**CAUTION:** Use a piece of wood or a similar item as the supporting surface to secure a completely stable condition.



**Fig. 129: Supporting Transmission Assembly Suspension Member Using Lift Caddy**  
Courtesy of NISSAN NORTH AMERICA, INC.

2. Remove rear engine mounting member bolts.
3. Remove front suspension member mounting bolts and nuts. Refer to "**EXPLODED VIEW** ".
4. Carefully lower jack, or raise lift, to remove the engine, the transmission assembly and front suspension member. When performing work, observe the following caution items:

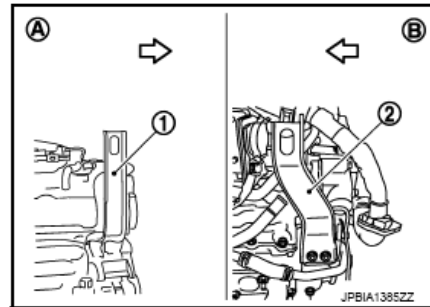
**CAUTION:**

- Confirm there is no interference with the vehicle.
- Check that all connection points have been disconnected.
- Keep in mind that the center of gravity of the vehicle changes. If necessary, use jack(s) to support the vehicle at rear jacking point(s) to prevent it from falling off the lift.

## Separation Work

1. Install engine slingers into front of cylinder head (bank 1) and rear of cylinder head (bank 2).

- 1 : Engine front slinger  
 2 : Engine rear slinger  
 A : Bank 1  
 B : Bank 2  
 ⇐ : Engine front



**Fig. 130: Identifying Front And Rear Engine Slingers**  
 Courtesy of NISSAN NORTH AMERICA, INC.

**Slinger bolts:**

**Torque: 28.0 N.m (2.9 kg-m, 21 ft-lb)**

2. Remove power steering oil pump from engine side. Refer to "VQ37VHR: EXPLODED VIEW".
3. Remove engine mounting insulators (RH and LH) under side nuts with power tool.
4. Lift with hoist and separate the engine and the transmission assembly from front suspension member.

**CAUTION:**

- Before and during this lifting, always check that any harnesses are left connected.
- Never damage engine mounting insulator and avoid oil/grease smearing or spills onto engine mounting insulator.

5. Remove alternator. Refer to "VQ37VHR: EXPLODED VIEW".
6. Remove starter motor. Refer to "VQ37VHR: EXPLODED VIEW".
7. Remove crankshaft position sensor.

**CAUTION:**

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

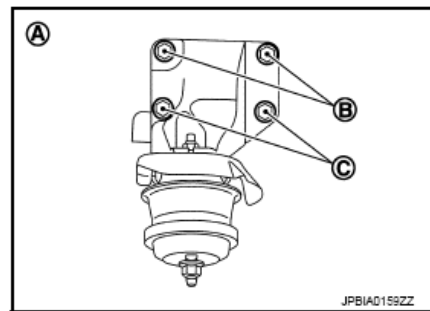
8. Separate the engine from the transmission assembly. Refer to "**VQ37VHR (2WD): EXPLODED VIEW**".
9. Remove each engine mounting insulator and each engine mounting bracket from the engine with power tool.

## INSTALLATION

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

- Do not damage engine mounting insulator and do not spill oil on it.
- For a location with a positioning pin, insert it securely into hole of mating part.
- For a part with a specified installation orientation, refer to component figure in "**2WD: EXPLODED VIEW**".
- When installing engine mounting bracket (RH and LH) on cylinder block, tighten two upper bolts [shown as (B) in the figure below] first. Then tighten two lower bolts [shown as (C) in the figure below].

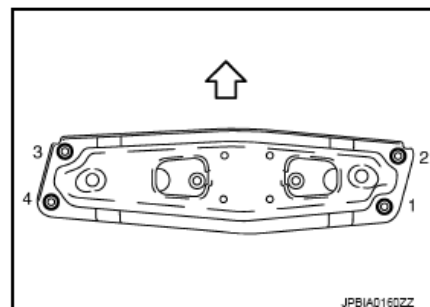
A : Example Left



**Fig. 131: Identifying Engine Mounting Bracket Upper And Lower Mounting Bolts**  
Courtesy of NISSAN NORTH AMERICA, INC.

- Check that all engine mounting insulators are seated properly, then tighten mounting nuts.
- Tighten rear engine mounting member bolts in numerical order as shown in the figure below.

↶ : Vehicle front



**Fig. 132: Rear Engine Member Bolt Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

## 2WD: Inspection

## INSPECTION AFTER INSTALLATION

## Inspection for Leakage

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

- Before starting engine, check oil/fluid levels including engine coolant and engine oil. If any are less than the required quantity, fill them to the specified level. Refer to "**FOR NORTH AMERICA: FLUIDS AND LUBRICANTS**".
- Follow the procedure below to check for fuel leakage.
  - Turn ignition switch to the "ON" position (with engine stopped). With fuel pressure applied to fuel piping, check for fuel leakage at connection points.
  - Start engine. With engine speed increased, check again for fuel leakage at connection points.
- Run engine to check for unusual noise and vibration.

**NOTE:** If hydraulic pressure inside chain tensioner drops after removal/installation, slack in guide may generate a pounding noise during and just after the engine start. However, this does not indicate a malfunction. The noise will stop after hydraulic pressure rises.




- Warm up engine thoroughly to check that there is no leakage of fuel, or any oil/fluids including engine oil and engine coolant.
- Bleed air from lines and hoses of applicable lines, such as in cooling system.
- After cooling down engine, again check oil/fluid levels including engine oil and engine coolant. Refill them to the specified level, if necessary.

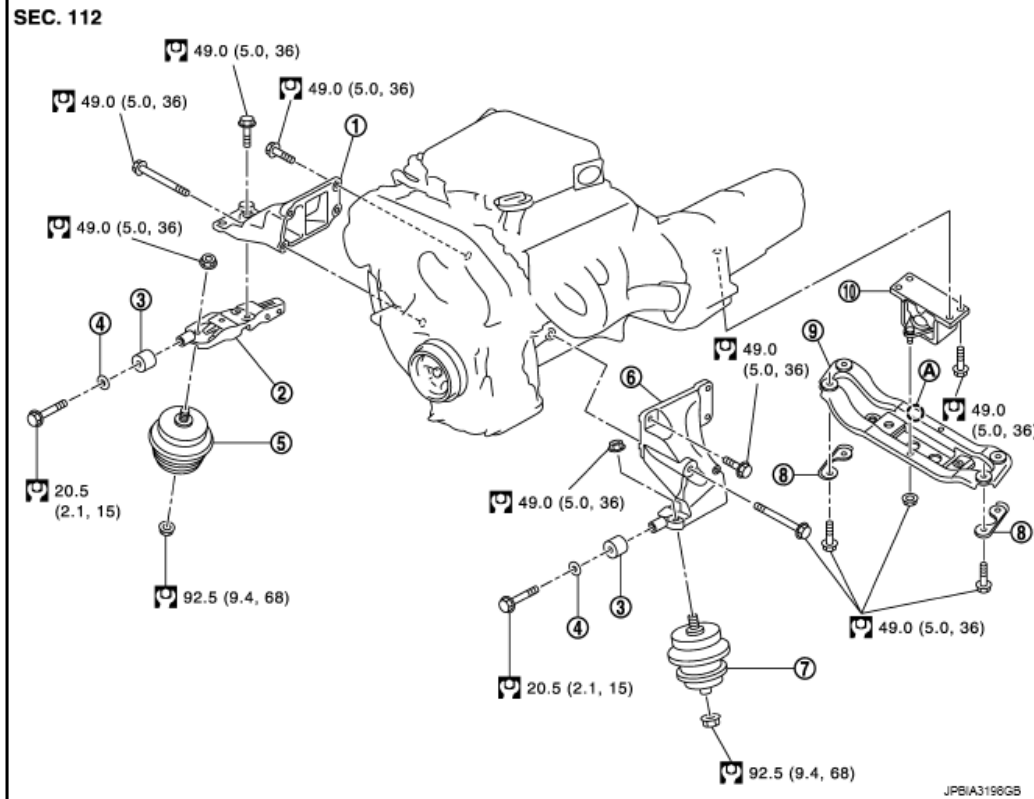
## SUMMARY OF INSPECTION ITEMS

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 <sup>(1)</sup>		Level	Leakage	Level
Fuel		Leakage	Leakage	Leakage
Exhaust gases		-	Leakage	-
(1) Power steering fluid, brake fluid, etc.				

## AWD

### AWD: Exploded View

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.



- |                                      |   |                                 |
|--------------------------------------|---|---------------------------------|
| 1. Engine mounting bracket (RH)      | 2. Engine mounting bracket (RH) (lower) | 3. Dynamic damper               |
| 4. Washer                            | 5. Engine mounting insulator (RH)       | 6. Engine mounting bracket (LH) |
| 7. Engine mounting insulator (LH)    | 8. Heat insulator                       | 9. Rear engine mounting member  |
| 10. Engine mounting insulator (rear) |   |                                 |
| A. Front mark                        |   |                                 |

**Fig. 133: Exploded View Of Engine Assembly With Torque Specifications (AWD)**  
 Courtesy of NISSAN NORTH AMERICA, INC.

Refer to "**COMPONENTS**" for symbols in the figure.

**AWD: Removal and Installation**

**WARNING:**

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

**CAUTION:**

- Always be careful to work safely, avoid forceful or uninstructed

operations.

- **Never start working until exhaust system and engine coolant are cool enough.**
- **If items or work required are not covered by this article, refer to the applicable Service Information.**
- **Always use the support point specified for lifting.**
- **Use either 2-pole lift type or separate type lift as much as possible. If board-on type is used for unavoidable reasons, support at rear axle jacking point with transmission jack or similar tool before starting work, in preparation for the backward shift of center of gravity.**
- **For supporting points for lifting and jacking point at rear axle, refer to "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

At first, remove the engine, the transmission assembly, the transfer assembly and the front final drive assembly with front suspension member downward. Then separate the engine, the transmission assembly, the transfer and the front final drive assembly.

### Preparation

1. Release fuel pressure. Refer to "WORK PROCEDURE".
2. Drain engine coolant from radiator. Refer to "DRAINING".

**CAUTION:**

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

3. Disconnect both battery terminals. Refer to "EXPLODED VIEW".
4. Remove the following parts:
  - Radiator reservoir tank: Refer to "EXPLODED VIEW".
  - Engine cover: Refer to "EXPLODED VIEW".
  - Front road wheel and tires (power tool)
  - Engine under cover (power tool): Refer to "EXPLODED VIEW".
  - Front cross bar: Refer to "EXPLODED VIEW".
  - Cowl top cover: Refer to "EXPLODED VIEW".
  - Air duct and air cleaner case assembly (RH and LH): Refer to "EXPLODED VIEW".
  - Cooling fan assembly: Refer to "EXPLODED VIEW".

5. Discharge refrigerant from A/C circuit. Refer to "**RECYCLE REFRIGERANT**".
6. Remove radiator hoses (upper and lower). Refer to "**EXPLODED VIEW**".

#### Engine Room LH

1. Disconnect heater hose from vehicle side, and fit a plug onto hose end to prevent engine coolant leak.
2. Disconnect A/C piping from A/C compressor, and temporarily fasten it on vehicle with a rope. Refer to "**EXPLODED VIEW**".
3. Disconnect brake booster vacuum hose.
4. Disconnect ground cables.

#### Engine Room RH

1. Disconnect battery positive cable vehicle side and temporarily fasten it on engine.
2. Disconnect all clips and connectors of the engine room harness from engine back side.
3. Disconnect fuel feed hose (with damper) and EVAP hose. Refer to "**EXPLODED VIEW**".

**CAUTION: Fit plugs onto disconnected hoses to prevent fuel leakage.**

4. Remove reservoir tank of power steering oil pump and piping from vehicle, and temporarily secure them on engine. Refer to "**AWD: EXPLODED VIEW**".

**CAUTION: When temporarily securing, keep the reservoir tank upright to avoid a fluid leakage.**

#### Vehicle Inside

Follow procedure below to disconnect engine room harness connectors at passenger room side, and temporarily secure them on engine.

1. Remove passenger-side kicking plate and dash side finisher. Refer to "**EXPLODED VIEW**".
2. Disconnect engine room harness connectors at unit sides TCM, ECM and other.
3. Disengage intermediate fixing point. Pull out engine room harnesses to engine room side, and temporarily secure them on engine.

**CAUTION:**

- When pulling out harnesses, take care not to damage harnesses and connectors.
- After temporarily securing, cover connectors with vinyl or similar material to protect against adhesion of foreign materials.

#### Vehicle Underbody

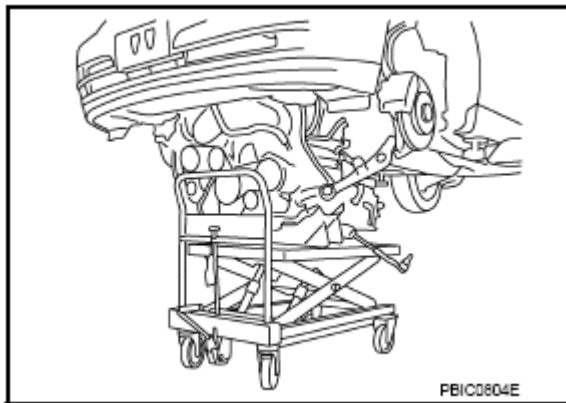


1. Remove A/T fluid cooler hoses and power steering oil pump oil cooler hoses.
2. Disconnect heated oxygen sensor 2 harness. Refer to "**VQ37VHR: EXPLODED VIEW**".
3. Remove three way catalyst and exhaust front tube. Refer to "**VQ37VHR: EXPLODED VIEW**".
4. Disconnect steering lower joint at power steering gear assembly side, and release steering lower shaft. Refer to "**WITHOUT 4WAS: EXPLODED VIEW**".
5. Remove rear propeller shaft. Refer to "**EXPLODED VIEW**".
6. Remove front drive shaft (both side). Refer to "**EXPLODED VIEW**".
7. Disconnect harness connector from transmission assembly and transfer assembly.
8. Disengage A/T control rod at A/T shift selector side. Then, temporarily secure it on the transmission assembly, so that it does not sag. Refer to "**EXPLODED VIEW**".
9. Remove rear plate cover from oil pan (upper). Then remove bolts fixing drive plate to torque converter. Refer to "**AWD: EXPLODED VIEW**".
10. Remove transmission joint bolts that pierce at oil pan (upper) lower rear side. Refer to "**AWD: EXPLODED VIEW**".
11. Remove front stabilizer connecting rod from transverse link. Refer to "**EXPLODED VIEW**".
12. Remove lower ends of left and right steering knuckle from transverse link. Refer to "**EXPLODED VIEW**".
13. Separate steering outer sockets from steering knuckle. Refer to "**AWD: EXPLODED VIEW**".
14. Remove transverse links mounting bolts at suspension member side. Refer to "**EXPLODED VIEW**".

#### Removal Work

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

**CAUTION: Use a piece of wood or a similar item as the supporting surface to secure a completely stable condition.**



**Fig. 134: Supporting Transmission Assembly Suspension Member Using Lift Caddy**  
 Courtesy of NISSAN NORTH AMERICA, INC.

2. Remove rear engine mounting member bolts.
3. Remove front suspension member mounting bolts and nuts. Refer to "**EXPLODED VIEW**".
4. Carefully lower jack, or raise lift to remove the engine, transmission assembly, transfer, front final drive assembly and front suspension member. When performing work, observe the following caution:

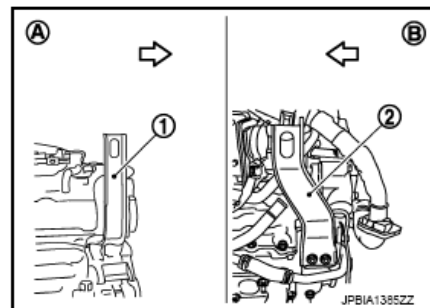
**CAUTION:**

- Confirm there is no interference with the vehicle.
- Check that all connection points have been disconnected.
- Keep in mind that the center of gravity of the vehicle changes. If necessary, use jack(s) to support the vehicle at rear jacking point(s) to prevent it from falling off the lift.

## Separation Work

1. Install engine slingers into front of cylinder head (bank 1) and rear of cylinder head (bank 2).

- 1 : Engine front slinger  
 2 : Engine rear slinger  
 A : Bank 1  
 B : Bank 2  
 ⇐ : Engine front



**Fig. 135: Identifying Front And Rear Engine Slingers**  
 Courtesy of NISSAN NORTH AMERICA, INC.

**Slinger bolts:**

**Torque: 28.0 N.m (2.9 kg-m, 21 ft-lb)**

2. Remove power steering oil pump from engine side. Refer to "**VQ37VHR: EXPLODED VIEW**".
3. Remove engine mounting insulators (RH and LH) under side nuts with power tool.
4. Lift with hoist and separate the engine, transmission assembly, transfer, front final drive assembly and front suspension member.

**CAUTION:**

- Before and during this lifting, always check any harnesses are left connected.
- Never damage engine mounting insulator and avoid oil/grease smearing or spills onto engine mounting insulator.

5. Remove alternator. Refer to "**VQ37VHR: EXPLODED VIEW**".
6. Remove starter motor. Refer to "**VQ37VHR: EXPLODED VIEW**".

7. Remove crankshaft position sensor.

**CAUTION:**

- **Handle it carefully and avoid impacts.**
- **Never disassemble.**
- **Never place sensor in a location where it is exposed to magnetism.**

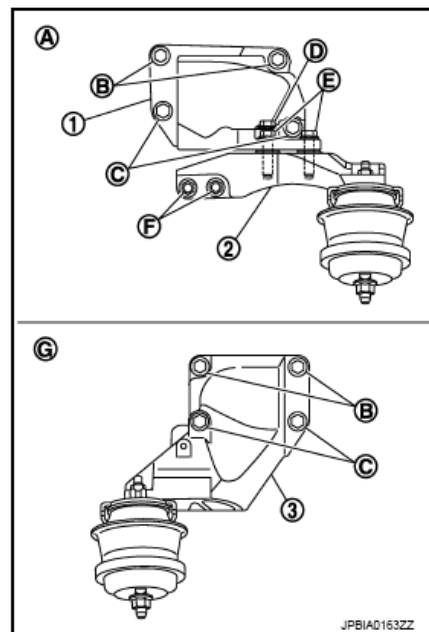
8. Remove front propeller shaft from the front final drive assembly side. Refer to "**VQ37VHR: EXPLODED VIEW**".
9. Separate the engine from the transmission assembly. Refer to "**VQ37VHR (AWD): EXPLODED VIEW**".
10. Remove the front final drive assembly from oil pan (upper). Refer to "**VQ37VHR: EXPLODED VIEW**".
11. Remove each engine mounting insulator and each engine mounting bracket from the engine with power tool.

**INSTALLATION**

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

- Do not damage engine mounting insulator and do not spill oil on it.
- For a location with a positioning pin, insert it securely into hole of mating part.
- For a part with a specified installation orientation, refer to component figure in "**AWD: EXPLODED VIEW**".
- When installing engine mounting bracket (RH and LH) on cylinder block, tighten two upper bolts [shown as (B) in the figure below] first. Then tighten two lower bolts [shown as (C) in the figure below].

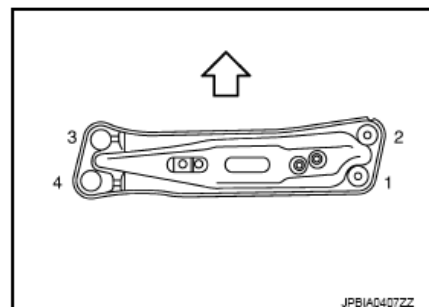
3 : Engine mounting bracket (LH)  
A : Right side  
G : Left side



**Fig. 136: Identifying Engine Mounting Bracket Upper And Lower Bolts**  
Courtesy of NISSAN NORTH AMERICA, INC.

- Install engine mounting bracket (RH) (lower) (2) as follows:
  - Temporarily tighten mounting bolts [shown as (D), (E) and (F) in the figure below].
  - Tighten mounting bolts to the specified torque with following mounting surfaces touched.
- Engine mounting bracket (RH) (1) to engine mounting bracket (RH) (lower) [shown as and in figure below].
- Front final drive to engine mounting bracket (RH) (lower) [shown as in figure below].
- Check all engine mounting insulators are seated properly, then tighten mounting nuts.
- Tighten rear engine mounting member bolts in numerical order as shown in the figure below.

← : Vehicle front



**Fig. 137: Rear Engine Member Bolt Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

AWD: Inspection

INSPECTION AFTER INSTALLATION

## Inspection for Leaks

The following are procedures for checking fluids leak, lubricates leak and exhaust gases leak.

- Before starting engine, check oil/fluid levels including engine coolant and engine oil. If any are less than the required quantity, fill to the specified level. Refer to "**FOR NORTH AMERICA: FLUIDS AND LUBRICANTS**".
- Follow the procedure below to check for fuel leakage.
  - Turn ignition switch to the "ON" (with engine stopped). With fuel pressure applied to fuel piping, check for fuel leakage at connection points.
  - Start engine. With engine speed increased, check again for fuel leakage at connection points.
- Run engine to check for unusual noise and vibration.

**NOTE:** If hydraulic pressure inside chain tensioner drops after removal/installation, slack in guide may generate a pounding noise during and just after the engine start. However, this does not indicate a malfunction. The noise will stop after hydraulic pressure rises.

- Warm up engine thoroughly to check that there is no leakage of fuel, or any oil/fluids including engine oil and engine coolant.
- Bleed air from lines and hoses of applicable lines, such as in cooling system.
- After cooling down engine, again check oil/fluid levels including engine oil and engine coolant. Refill them to the specified level, if necessary.

## SUMMARY OF 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 <sup>(1)</sup>		Level	Leakage	Level
Fuel		Leakage	Leakage	Leakage
Exhaust gases		-	Leakage	-
(1) Power steering fluid, brake fluid, etc.				

## UNIT DISASSEMBLY AND ASSEMBLY

### ENGINE STAND SETTING

#### Setting

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

1. Remove the engine assembly from the vehicle. Refer to "**2WD: EXPLODED VIEW**" (2WD models) or "**AWD: EXPLODED VIEW**" (AWD models).
2. Remove the parts that may restrict installation of engine to a widely use engine stand.

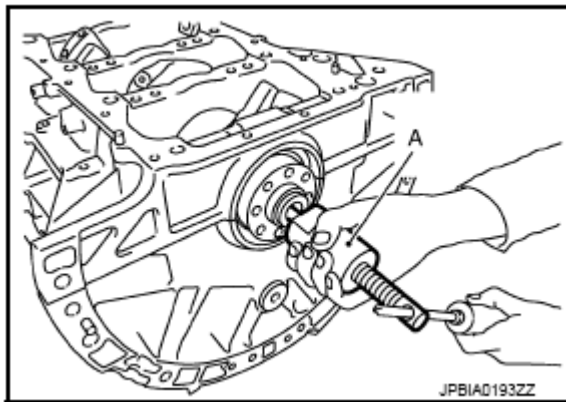
**NOTE:** The procedure is described assuming that you use a widely use engine stand holding the surface, to which transmission is installed.

- Remove drive plate with power tool. Fix crankshaft with a ring gear stopper [SST: KV10118600 (J-48641)], and remove mounting bolts.
- Loosen mounting bolts in diagonal order.
- Check for deformation or damage of drive plate.

**CAUTION:**

- Never disassemble drive plate.
- Never place drive plate with signal plate facing down.
- When handling signal plate, take care not to damage or scratch it.
- Handle signal plate in a manner that prevents it from becoming magnetized.

3. Remove pilot converter using the pilot bushing puller [SST: ST16610001 (J-23907)] (A) if necessary.



**Fig. 138: Removing Pilot Converter**  
Courtesy of NISSAN NORTH AMERICA, INC.

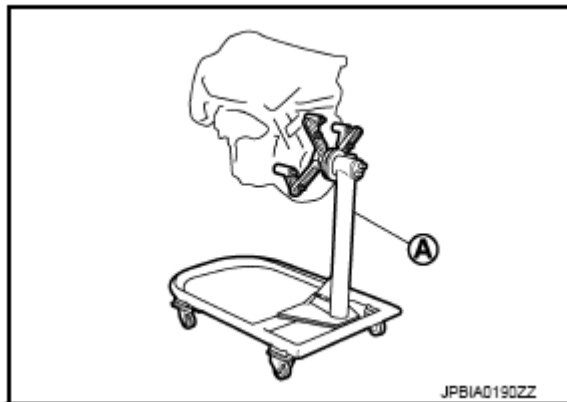
4. Lift the engine with hoist to install it onto the widely use engine stand.

**CAUTION:** Use an engine stand that has a load capacity [220 kg (485 lb) or more] large enough for supporting the engine weight.

- If the load capacity of the stand is not adequate, remove the following parts beforehand to reduce the potential risk of overturning the stand.
  - Remove intake manifold collector. Refer to "**EXPLODED VIEW**".
  - Remove intake manifold. Refer to "**EXPLODED VIEW**".
  - Remove fuel injector and fuel tube assembly. Refer to "**EXPLODED VIEW**".
  - Remove ignition coil. Refer to "**EXPLODED VIEW**".
  - Remove rocker cover. Refer to "**EXPLODED VIEW**".
  - Remove exhaust manifold. Refer to "**EXPLODED VIEW**".
  - Other removable brackets.

**NOTE:** The figure shows an example of widely use engine stand (A) that can hold mating surface of transmission with drive plate removed.

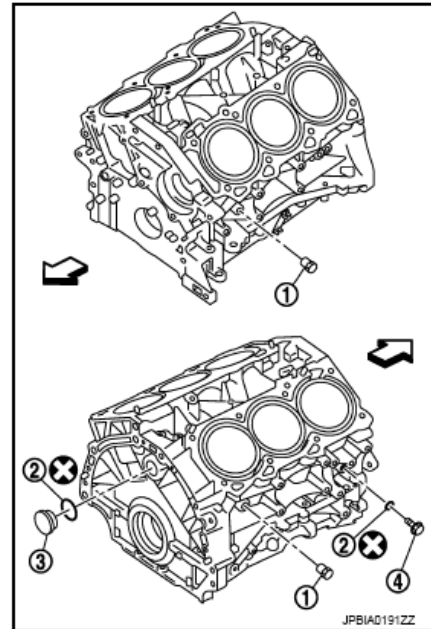
**CAUTION:** Before removing the hanging chains, check the engine stand is stable and there is no risk of overturning.



**Fig. 139: Holding Transmission Using Engine Stand**  
Courtesy of NISSAN NORTH AMERICA, INC.

5. Drain engine oil. Refer to "**DRAINING**".
6. Drain engine coolant by removing water drain plug (1) from both sides of the cylinder block as shown in the figure below.

- 2 : Washer
- 3 : Plug
- 4 : Drain plug
- ⇐ : Engine front



**Fig. 140: Identifying Drain Plug, Washer And Plug**  
 Courtesy of NISSAN NORTH AMERICA, INC.

## ENGINE UNIT

### Disassembly

1. Remove intake manifold collector. Refer to "**EXPLODED VIEW**".
2. Remove fuel injector and fuel tube. Refer to "**EXPLODED VIEW**".
3. Remove intake manifold. Refer to "**EXPLODED VIEW**".
4. Remove exhaust manifold. Refer to "**EXPLODED VIEW**".
5. Remove ignition coil, spark plug and rocker cover. Refer to "**EXPLODED VIEW**".
6. Remove oil pan (lower). Refer to "**EXPLODED VIEW**".
7. Remove oil pan (upper). Refer to "**2WD: EXPLODED VIEW**" (2WD models) or "**AWD: EXPLODED VIEW**" (AWD models).
8. Remove timing chain. Refer to "**EXPLODED VIEW**".
9. Remove rear timing chain case. Refer to "**EXPLODED VIEW**".
10. Remove camshaft (EXH) and VVEL ladder assembly. Refer to "**EXPLODED VIEW**".
11. Remove cylinder head. Refer to "**EXPLODED VIEW**".

### Assembly

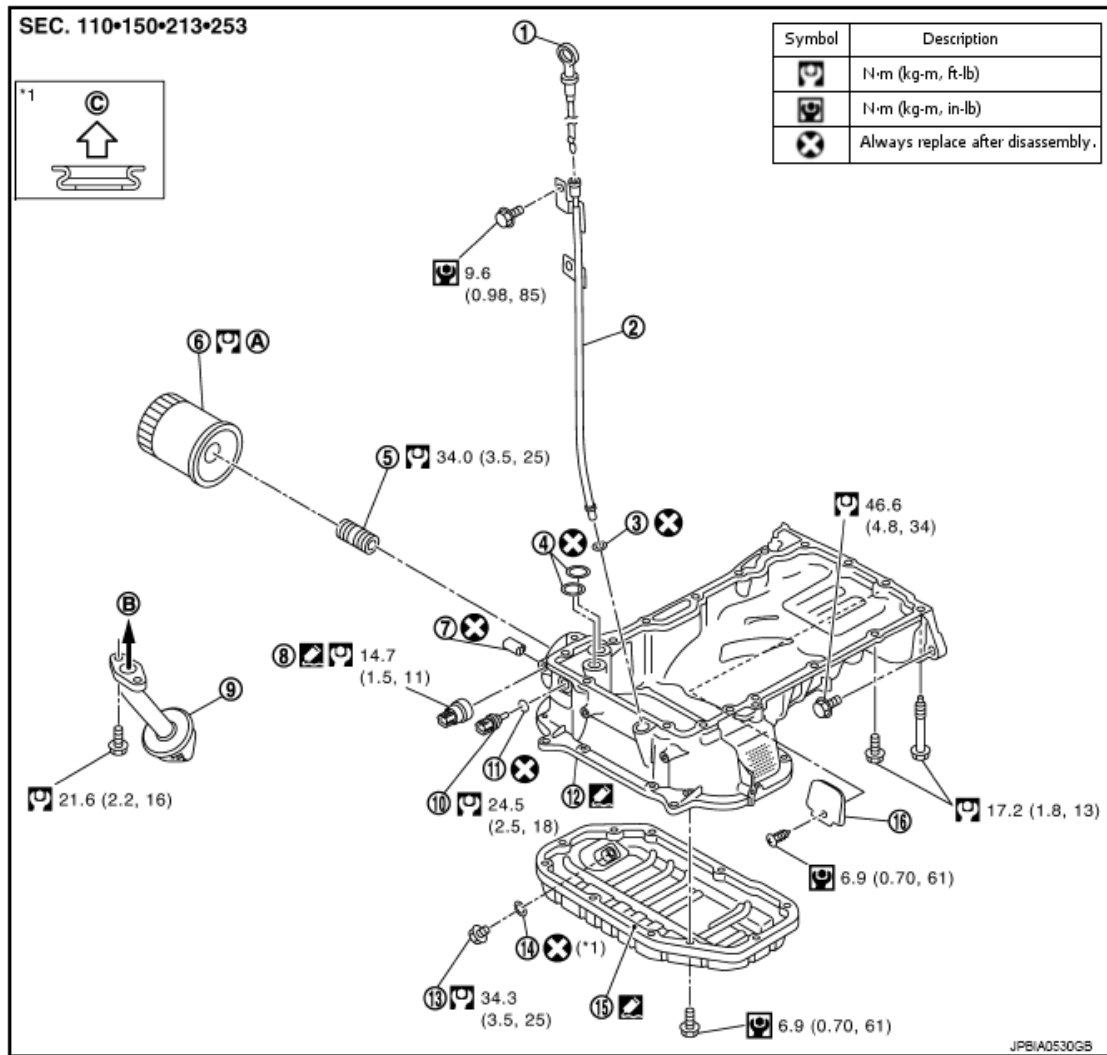
Assemble in the reverse order of disassembly.

## OIL PAN (UPPER) AND OIL STRAINER

### 2WD



## 2WD: Exploded View



- |                                  |                          |                     |
|----------------------------------|--------------------------|---------------------|
| 1. Oil level gauge               | 2. Oil level gauge guide | 3. O-ring           |
| 4. O-ring                        | 5. Connector bolt        | 6. Oil filter       |
| 7. Relief valve                  | 8. Oil pressure switch   | 9. Oil strainer     |
| 10. Oil temperature sensor       | 11. Washer               | 12. Oil pan (upper) |
| 13. Drain plug                   | 14. Drain plug washer    | 15. Oil pan (lower) |
| 16. Rear plate cover             |                          |                     |
| A. Refer to "Lubrication System" | B. To oil pump           | C. Oil pan side     |

**Fig. 141: Exploded View Of Upper Oil Pan And Oil Strainer With Torque Specifications (2WD)**  
 Courtesy of NISSAN NORTH AMERICA, INC.

Refer to "COMPONENTS" for symbols in the figure.

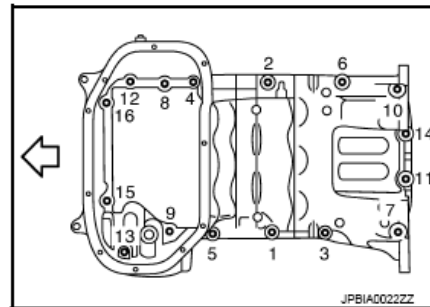
## 2WD: Disassembly and Assembly

## REMOVAL

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

1. Remove oil level gauge, oil pressure switch and oil temperature sensor.
2. Remove oil pan (lower). Refer to "**EXPLODED VIEW**".
3. Remove oil strainer.
4. Loosen mounting bolts in the reverse order as shown in the figure below with power tool to remove.

⇐ : Engine front



**Fig. 142: Oil Pan & Oil Strainer Bolt Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

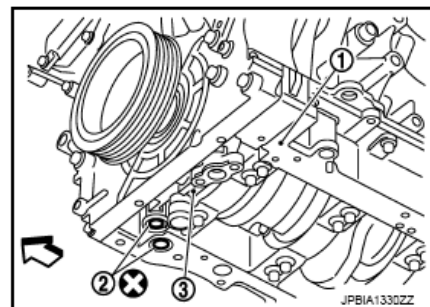
- Insert the seal cutter [SST: KV10111100 (J-37228)] between oil pan (upper) and lower cylinder block. Slide seal cutter by tapping on the side of tool with a hammer. Remove oil pan (upper).

**CAUTION:**

- Be careful not to damage the mating surfaces.
- Never insert a screwdriver, because this damages the mating surfaces.

5. Remove O-rings (2) from bottom of lower cylinder block (1) and oil pump (3).

⇐ : Engine front



**Fig. 143: Identifying Lower Cylinder Block, Oil Pump And O-Ring**  
Courtesy of NISSAN NORTH AMERICA, INC.

## INSTALLATION

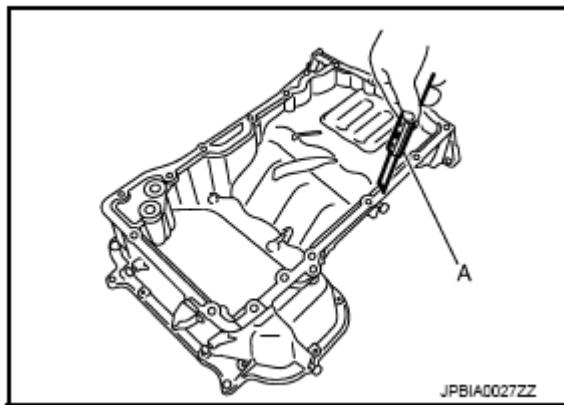
**CAUTION:** Do not reuse O-rings.

## 1. Install oil pan (upper) as follows:

- a. Use a scraper (A) to remove old liquid gasket from mating surfaces.

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

- Also remove old liquid gasket from mating surface of lower cylinder block.
- Remove old liquid gasket from the bolt holes and threads.

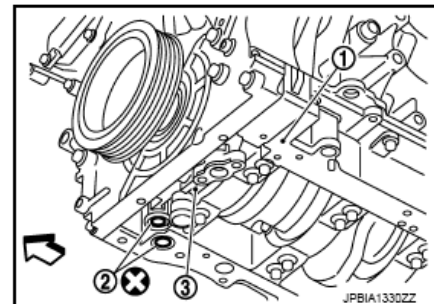


**Fig. 144: Removing Liquid Gasket**  
Courtesy of NISSAN NORTH AMERICA, INC.

- b. Install new O-rings (2) on the bottom of lower cylinder block (1) and oil pump (3).

**CAUTION: Do not reuse O-rings.**

↔ : Engine front



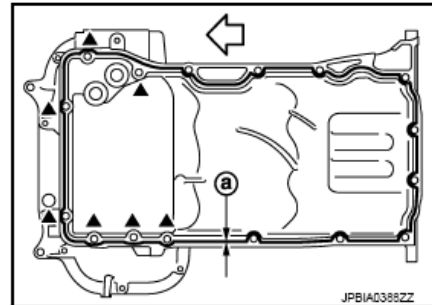
**Fig. 145: Identifying Lower Cylinder Block, Oil Pump And O-Rings**  
Courtesy of NISSAN NORTH AMERICA, INC.

- c. Apply a continuous bead of liquid gasket with the tube presser (commercial service tool) to the

cylinder block mating surface of oil pan (upper) to a limited portion as shown in the figure below.

a :  $\phi 4.0 - 5.0$  mm (0.157 - 0.197 in)

↩ : Engine front



**Fig. 146: Identifying Liquid Gasket**

Courtesy of NISSAN NORTH AMERICA, INC.

Use Genuine RTV Silicone Sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS".

**CAUTION:**

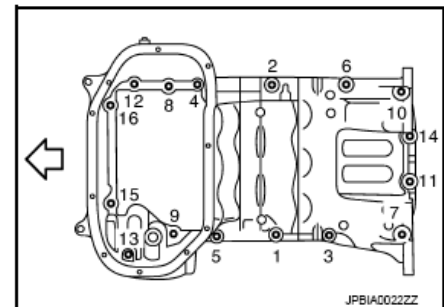
- For bolt holes with delta marks (7 locations), apply liquid gasket outside the holes.
- Attaching should be done within 5 minutes after coating.

d. Install oil pan (upper).

**CAUTION: Never misalign O-rings during installation.**

- Tighten mounting bolts in numerical order as shown in the figure below.

↩ : Engine front



**Fig. 147: Upper Oil Pan Bolt Tightening Sequence**

Courtesy of NISSAN NORTH AMERICA, INC.

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

**M8 x 90 mm (3.54 in): 7, 10, 13**

**M8 x 25 mm (0.98 in): Except the above**

2. Install oil strainer to oil pump.
3. Install oil pan (lower). Refer to "**EXPLODED VIEW**".
4. Install oil pan drain plug.
  - Refer to the figure of components above for installation direction of drain plug washer. Refer to "**EXPLODED VIEW**".
5. Install in the reverse order of removal after this step.

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

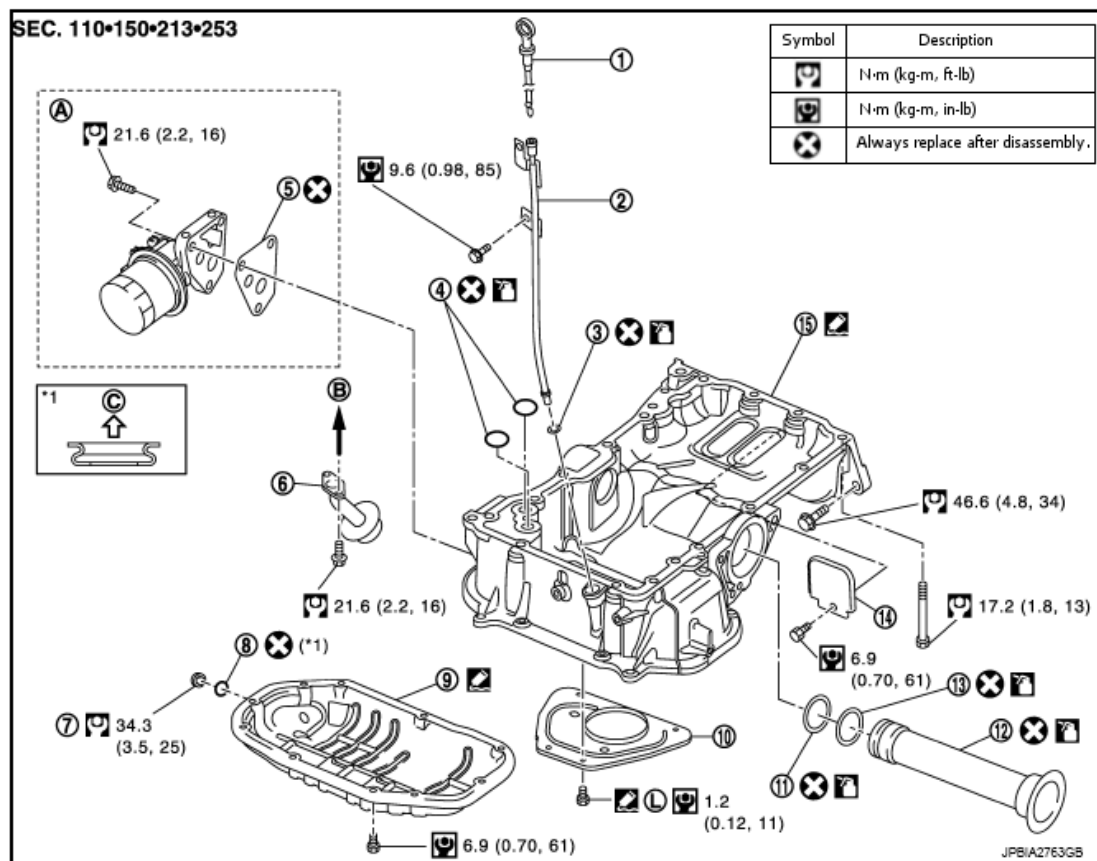
**2WD: Inspection****INSPECTION AFTER REMOVAL**

Clean oil strainer if any object is attached.

**INSPECTION AFTER INSTALLATION**

1. Check the engine oil level and adjust engine oil. Refer to "**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 "**INSPECTION**".

**AWD****AWD: Exploded View**



- |                                  |                          |                     |
|----------------------------------|--------------------------|---------------------|
| 1. Oil level gauge               | 2. Oil level gauge guide | 3. O-ring           |
| 4. O-ring                        | 5. Gasket                | 6. Oil strainer     |
| 7. Drain plug                    | 8. Drain plug washer     | 9. Oil pan (lower)  |
| 10. Baffle plate                 | 11. O-ring (small)       | 12. Axle pipe       |
| 13. O-ring (large)               | 14. Rear plate cover     | 15. Oil pan (upper) |
| A. Refer to "Lubrication System" | B. To oil pump           | C. Oil pan side     |

**Fig. 148: Exploded View Of Upper Oil Pan And Oil Strainer With Torque Specifications (AWD)**  
 Courtesy of NISSAN NORTH AMERICA, INC.

Refer to "**COMPONENTS**" for symbols in the figure.

**AWD: Disassembly and Assembly**

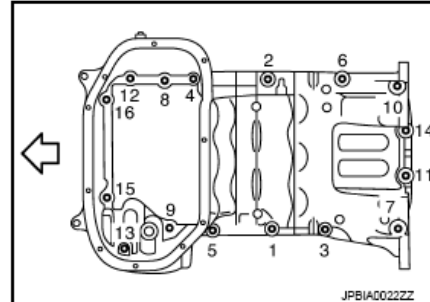
#### REMOVAL

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

1. Remove oil level gauge, oil pressure switch and oil temperature sensor.
2. Remove oil filter bracket. Refer to "**EXPLODED VIEW**".
3. Remove oil pan (lower). Refer to "**EXPLODED VIEW**".

4. Remove oil strainer.
5. Loosen mounting bolts in the reverse order as shown in the figure below with power tool to remove.

← : Engine front



**Fig. 149: Oil Strainer Bolt Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

- Insert the seal cutter [SST: KV10111100 (J-37228)] between oil pan (upper) and lower cylinder block. Slide seal cutter by tapping on the side of tool with a hammer. Remove oil pan (upper).

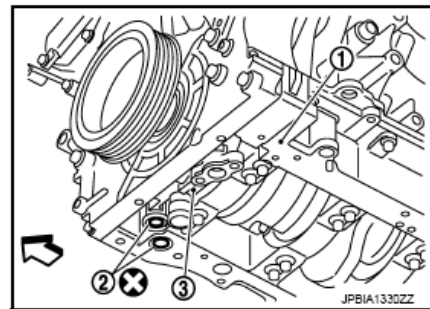
**CAUTION:**

- Be careful not to damage the mating surfaces.
- Never insert a screwdriver, because this will damage the mating surfaces.

6. Remove O-rings (2) from bottom of lower cylinder block (1) and oil pump (3).

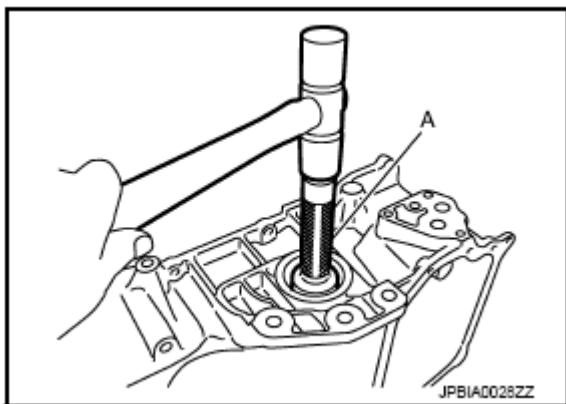
Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.

← : Engine front



**Fig. 150: Identifying O-Rings, Lower Cylinder Block And Oil Pump**  
Courtesy of NISSAN NORTH AMERICA, INC.

7. Remove axle pipe, if necessary.
  - Remove axle pipe from oil pan (upper) using a suitable drift (A) [outer diameter: 37 mm (1.46 in)].



**Fig. 151: Removing Axle Pipe From Upper Oil Pan**  
Courtesy of NISSAN NORTH AMERICA, INC.

#### INSTALLATION

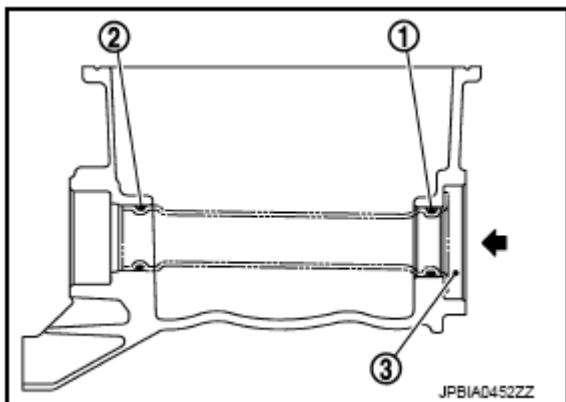
**CAUTION: Do not reuse O-rings.**

1. Install axle pipe (3) to oil pan (upper), if removed.

**CAUTION: Do not reuse O-rings.**

- Lubricate O-ring groove of axle pipe, O-rings (1), (2), and O-ring joint of oil pan with new engine oil.

Unit: mm (in)	
Items	O-ring inner diameter
Final drive side	(right side) 31.4 (1.236)
Axle pipe flange side	(left side) 33.6 (1.323)

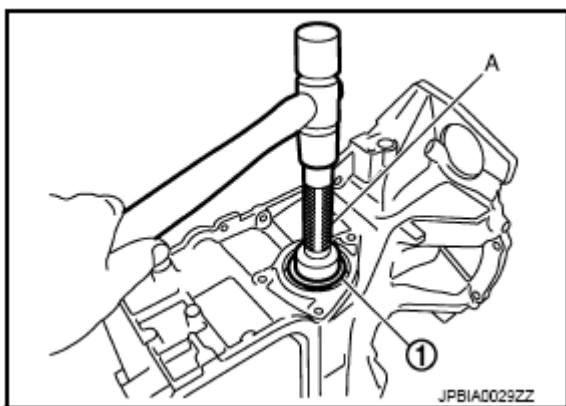




**Fig. 152: Identifying Axle Pipe And O-Rings**  
Courtesy of NISSAN NORTH AMERICA, INC.

- Install axle pipe (1) to oil pan (upper) from axle pipe flange side (left side) using a suitable drift (A) [outer diameter: 43 to 57 mm (1.69 to 2.24 in)].

**CAUTION:** Insert it with care to prevent O-ring from sliding.

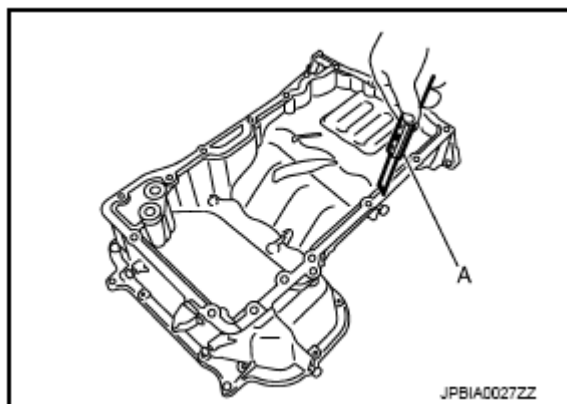


**Fig. 153: Installing Axle Pipe To Upper Oil Pan**  
Courtesy of NISSAN NORTH AMERICA, INC.

2. Install oil pan (upper) as follows:
  - a. Use a scraper (A) to remove old liquid gasket from mating surfaces.

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




- Also remove old liquid gasket from mating surface of lower cylinder block.
- Remove old liquid gasket from the bolt holes and threads.



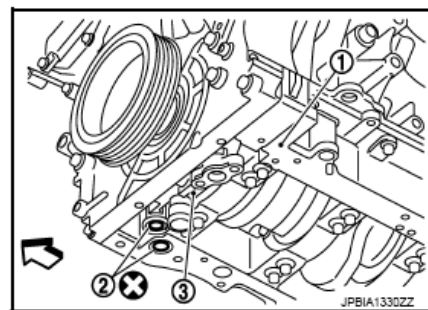
**Fig. 154: Removing Liquid Gasket**  
 Courtesy of NISSAN NORTH AMERICA, INC.

- b. Install new O-rings (2) on the bottom of lower cylinder block (1) and oil pump (3).

**CAUTION: Do not reuse O-rings.**

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.

↔ : Engine front

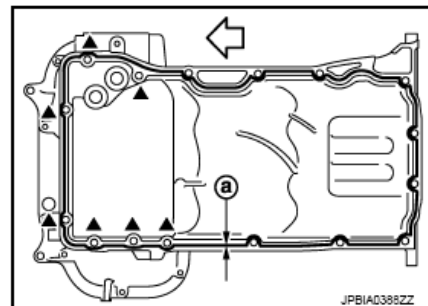


**Fig. 155: Identifying O-Rings, Lower Cylinder Block And Oil Pump**  
 Courtesy of NISSAN NORTH AMERICA, INC.

- c. Apply a continuous bead of liquid gasket with the tube presser (commercial service tool) to the cylinder block mating surface of oil pan (upper) to a limited portion as shown in the figure below.

a :  $\phi 4.0 - 5.0$  mm (0.157 - 0.197 in)

↔ : Engine front



**Fig. 156: Identifying Liquid Gasket**  
 Courtesy of NISSAN NORTH AMERICA, INC.

Use Genuine RTV Silicone Sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS".

**CAUTION:**

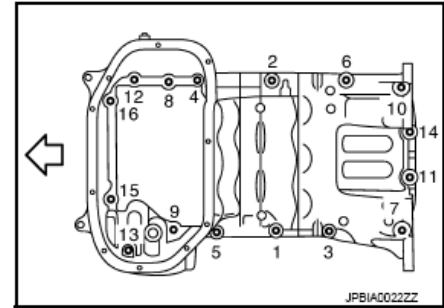
- For bolt holes with delta marks (7 locations), apply liquid gasket outside the holes.
- Attaching should be done within 5 minutes after coating.

- d. Install oil pan (upper).

**CAUTION: Never misalign O-rings during installation.**

- Tighten mounting bolts in numerical order as shown in the figure below.

← : Engine front



**Fig. 157: Upper Oil Pan Bolt Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

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

**M8 x 25 mm (0.98 in): 3, 6, 8, 9, 11, 12, 14, 15, 16**

**M8 x 50 mm (1.97 in): 2**

**M8 x 90 mm (3.54 in): 1, 4, 5, 7, 10, 13**

3. Install oil strainer to oil pump.
4. Install oil pan (lower). Refer to "**EXPLODED VIEW**".
5. Install oil pan drain plug.
  - Refer to the figure of components above for installation direction of drain plug washer. Refer to "**EXPLODED VIEW**".
6. Install in the reverse order of removal after this step.

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

**AWD: Inspection**

**INSPECTION AFTER REMOVAL**

Clean oil strainer if any object attached.

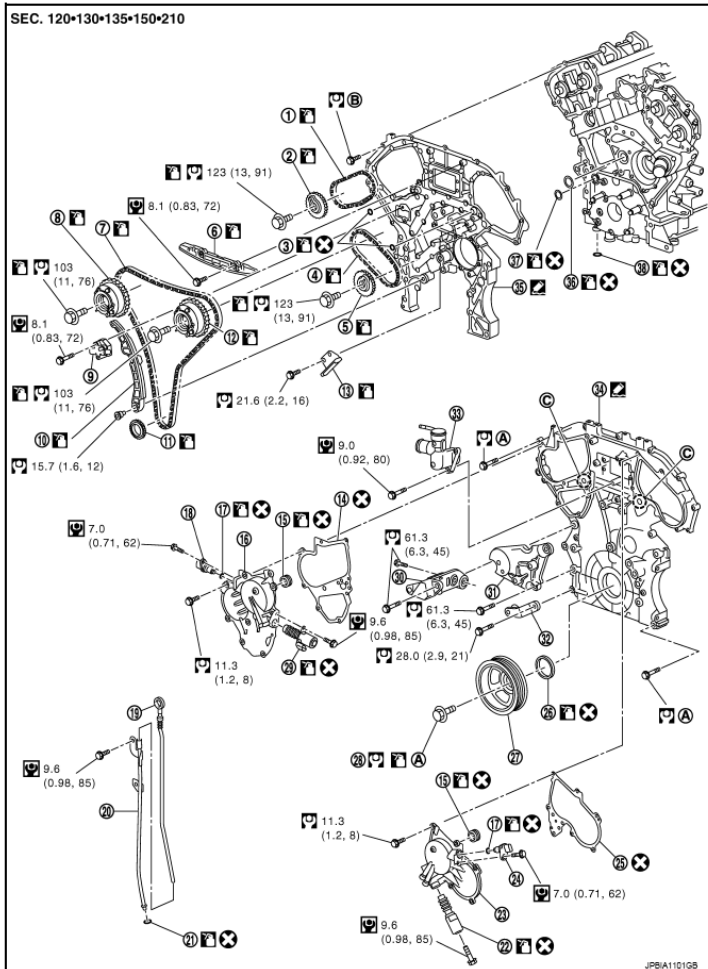
**INSPECTION AFTER INSTALLATION**

1. Check the engine oil level and adjust engine oil. Refer to "**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 "**INSPECTION**".

**REAR TIMING CHAIN CASE****Exploded View**

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.



- |   |   |   |
|---|---|---|
| 1. Timing chain (secondary)   | 2. Camshaft sprocket (EXH)  | 3. O-ring                                     |
| 4. Timing chain (secondary)   | 5. Camshaft sprocket (EXH)  | 6. Internal chain guide                       |
| 7. Timing chain (primary)   | 8. Camshaft sprocket (INT) (bank 1)   | 9. Timing chain tensioner (primary)           |
| 10. Slack guide   | 11. Crankshaft sprocket   | 12. Camshaft sprocket (INT) (bank 2)          |
| 13. Tension guide   | 14. Intake valve timing control cover gasket (bank 1)                                   | 15. Seal ring                                 |
| 16. Intake valve timing control cover (bank 1)  | 17. O-ring  | 18. Camshaft position sensor (PHASE) (bank 1) |
| 19. Oil level gauge   | 20. Oil level gauge guide   | 21. O-ring                                    |
| 22. Intake valve timing control solenoid valve (bank 2)                                 | 23. Intake valve timing control cover (bank 2)  | 24. Camshaft position sensor (PHASE) (bank 2) |
| 25. Intake valve timing control cover gasket (bank 2)                                   | 26. Front oil seal  | 27. Crankshaft pulley                         |
| 28. Crankshaft pulley bolt  | 29. Intake valve timing control solenoid valve (bank 1)                                 | 30. Power steering oil pump bracket           |
| 31. Idler pulley bracket  | 32. Alternator bracket  | 33. Water outlet (front)                      |
| 34. Front timing chain case   | 35. Rear timing chain case  | 36. O-ring                                    |
| 37. O-ring  | 38. O-ring  |   |
| A. Comply with the assembly procedure when tightening. Refer to <a href="#">EM-53</a> . | B. Comply with the assembly procedure when tightening. Refer to <a href="#">EM-92</a> . | C. Oil filter                                 |

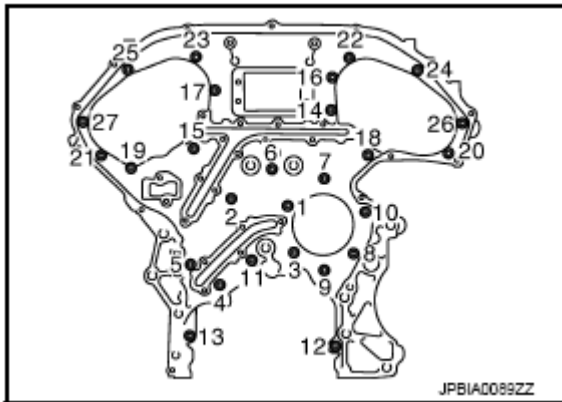
**Fig. 158: Exploded View Of Rear Timing Chain Case With Torque Specifications**  
Courtesy of NISSAN NORTH AMERICA, INC.

Refer to "[COMPONENTS](#)" for symbol marks in the figure.

## Disassembly and Assembly

### DISASSEMBLY

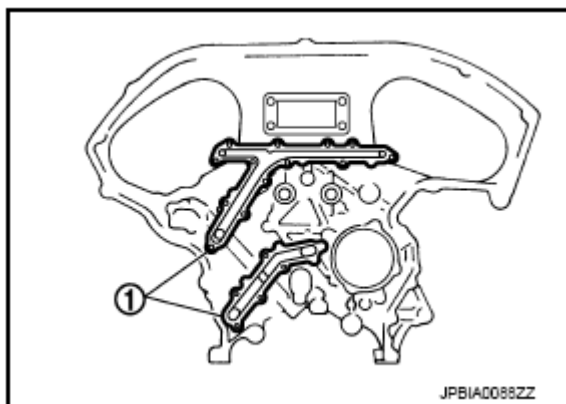
1. Remove front timing chain case and timing chain. Refer to "**REMOVAL AND INSTALLATION**".
2. Remove water pump. Refer to "**EXPLODED VIEW**".
3. Remove oil pan (upper). Refer to "**2WD: EXPLODED VIEW**" (2WD models) or "**AWD: EXPLODED VIEW**" (AWD models).
4. Remove rear timing chain case as follows:
  - a. Loosen mounting bolts in reverse order as shown in the figure below.
  - b. Cut liquid gasket using the seal cutter [SST: KV10111100 (J-37228)] and remove rear timing chain case.



**Fig. 159: Rear Timing Chain Case Bolt Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

### CAUTION:




- Never remove plate metal cover (1) of oil passage.
- After removal, handle rear timing chain case carefully so it does not tilt, cant, or warp under a load.




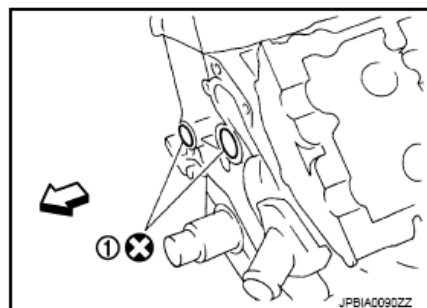
**Fig. 160: Identifying Oil Passage Plate Metal Cover**

Courtesy of NISSAN NORTH AMERICA, INC.

5. Remove O-rings (1) from cylinder block.

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.

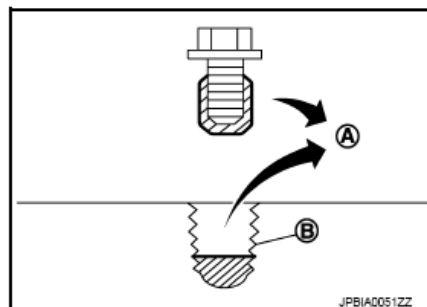
 : Engine front



**Fig. 161: Identifying Cylinder Block O-Rings**  
Courtesy of NISSAN NORTH AMERICA, INC.

6. Use a scraper to remove all traces of liquid gasket from rear timing chain cases and opposite mating surfaces.
7. Remove old liquid gasket from bolt hole and thread.

A : Remove old liquid gasket that is stuck  
B : Bolt hole






**Fig. 162: Removing Liquid Gasket**  
Courtesy of NISSAN NORTH AMERICA, INC.

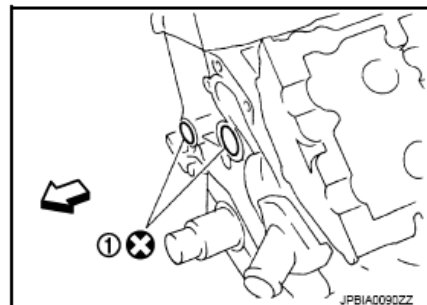
#### ASSEMBLY

**CAUTION: Do not reuse O-rings.**

1. Install rear timing chain case as follows:
  - a. Install new O-rings (1) onto cylinder block.

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.

↩ : Engine front



**Fig. 163: Identifying O-Rings**  
Courtesy of NISSAN NORTH AMERICA, INC.

**CAUTION: Do not reuse O-rings.**

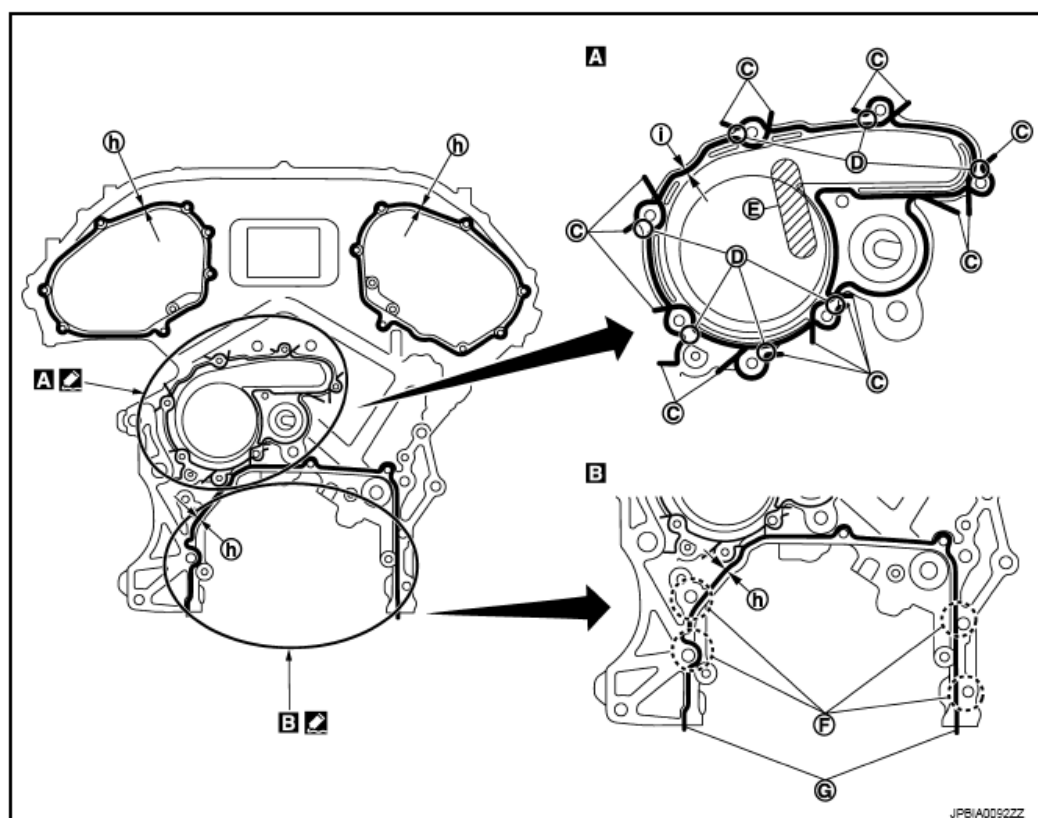
- b. Apply liquid gasket with the tube presser (commercial service tool) to rear timing chain case back side as shown in the figure below.

**Use Genuine RTV Silicone Sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS".**

**CAUTION:**

- For [A] in the figure, completely wipe off liquid gasket extended on a portion touching at engine coolant.
- Apply liquid gasket on installation position of water pump and cylinder head completely.



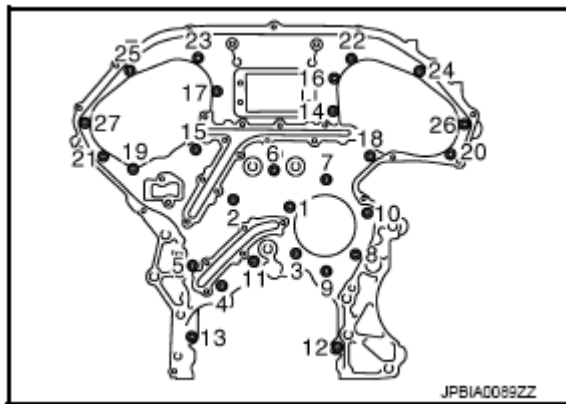


- |   |   |                                 |
|---|---|---------------------------------|
| C. Protrusion                             | D. Clearance 1 mm (0.04 in)                   | E. Do not protrude in this area |
| F. Run along bolt hole inner side         | G. Protrusions at beginning and end of gasket |                                 |
| h. $\phi 3.4 - 4.4$ mm (0.134 - 0.173 in) | i. $\phi 2.6 - 2.8$ mm (0.102 - 0.110 in)     |                                 |

**Fig. 164: Identifying Liquid Gasket**  
 Courtesy of NISSAN NORTH AMERICA, INC.

Refer to "**COMPONENTS**" for symbol marks in the figure.

- c. Align rear timing chain case with dowel pins (bank 1 and bank 2) on cylinder block and install rear timing chain case.
  - Check that O-rings stay in place during installation to cylinder block.
- d. Tighten mounting bolts in numerical order as shown in the figure below.
  - There are three types of mounting bolts. Refer to **the following** for locating bolts.



**Fig. 165: Rear Timing Chain Case Bolt Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

**Bolt length: Bolt position**

**20 mm (0.79 in): 1, 2, 3, 6, 7, 8, 9, 10**

**16 mm (0.63 in): 4, 5, 11, 12, 13**

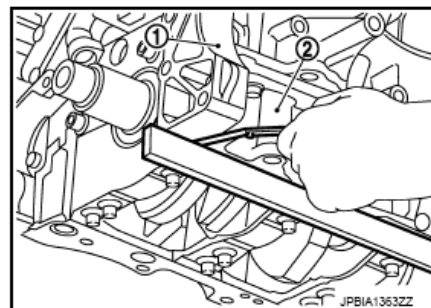
**Torque: 12.7 N.m (1.3 kg-m, 9 ft-lb)**

**16 mm (0.63 in): Except the above**

**Torque: 15.0 N.m (1.5 kg-m, 11 ft-lb)**

- e. After all bolts are tightened, retighten them to the specified torque in numerical order shown in the figure below.
  - If liquid gasket protrudes, wipe it off immediately.
- f. After installing rear timing chain case, check the surface height difference between the following parts on the oil pan (upper) mounting surface.

- 1 : Rear timing chain case
- 2 : Lower cylinder block



**Fig. 166: Checking Surface Height Difference Between Rear Timing Chain Case To Lower Cylinder Block**  
Courtesy of NISSAN NORTH AMERICA, INC.

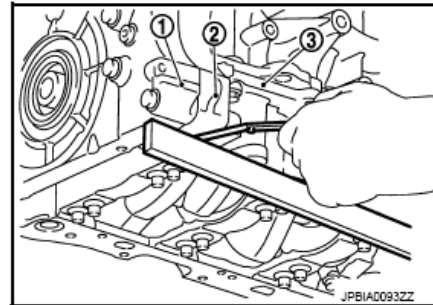
## Standard

### Rear timing chain case to lower cylinder block:

**-0.24 to 0.14 mm (-0.0094 to 0.0055 in)**

- If not within the standard, repeat the **INSTALLATION** procedure.
2. Install water pump with new O-rings. Refer to "**EXPLODED VIEW**".
  3. Install timing chains, camshaft sprockets and front timing chain case. Refer to "**REMOVAL AND INSTALLATION**".
    - After installing front timing chain case, check the surface height difference between the following parts on the oil pan (upper) mounting surface.

- 1 : Front timing chain case
- 2 : Rear timing chain case
- 3 : Lower cylinder block



**Fig. 167: Checking Surface Height Difference Between Front Timing Chain Case To Lower Cylinder Block**

Courtesy of NISSAN NORTH AMERICA, INC.

## Standard

### Front timing chain case to rear timing chain case:

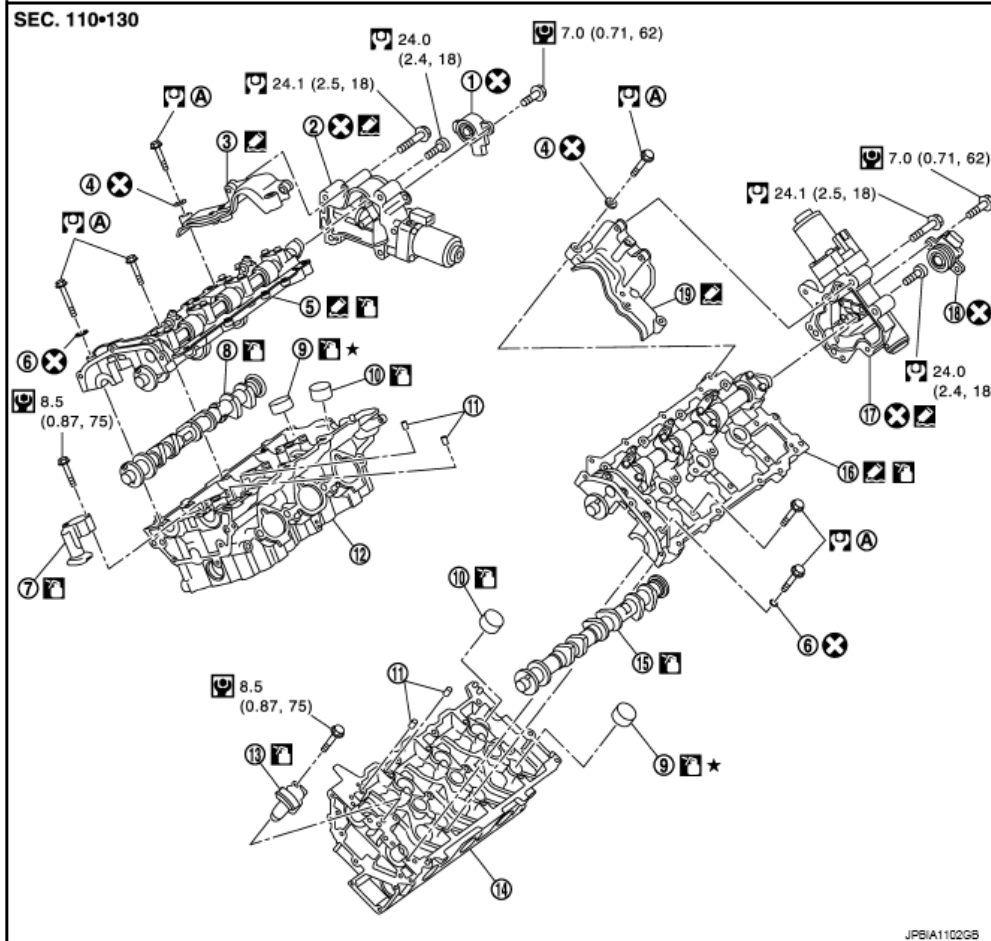
**-0.14 to 0.14 mm (-0.0055 to 0.0055 in)**

- If not within the standard, repeat the **INSTALLATION** procedure.
4. Install oil pan (upper). Refer to "**2WD: EXPLODED VIEW**" (2WD models) or "**AWD: EXPLODED VIEW**" (AWD models).
  5. Install in the reverse order of removal after this step.

## CAMSHAFT

### Exploded View

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.



- |   |   |   |
|---|---|---|
| 1. VVEL control shaft position sensor (bank 1)  | 2. VVEL actuator sub assembly (bank 1)  | 3. Actuator bracket (rear) (bank 1)             |
| 4. Washer                                       | 5. VVEL ladder assembly (bank 1)        | 6. Washer                                       |
| 7. Timing chain tensioner (secondary) (bank 1)  | 8. Camshaft (EXH) (bank 1)              | 9. Valve lifter (EXH)                           |
| 10. Valve lifter (INT)                          | 11. Oil filter                          | 12. Cylinder head (bank 1)                      |
| 13. Timing chain tensioner (secondary) (bank 2) | 14. Cylinder head (bank 2)              | 15. Camshaft (EXH) (bank 2)                     |
| 16. VVEL ladder assembly (bank 2)               | 17. VVEL actuator sub assembly (bank 2) | 18. VVEL control shaft position sensor (bank 2) |
| 19. Actuator bracket (rear) (bank 2)            |   |   |
- A. Comply with the assembly procedure when tightening.

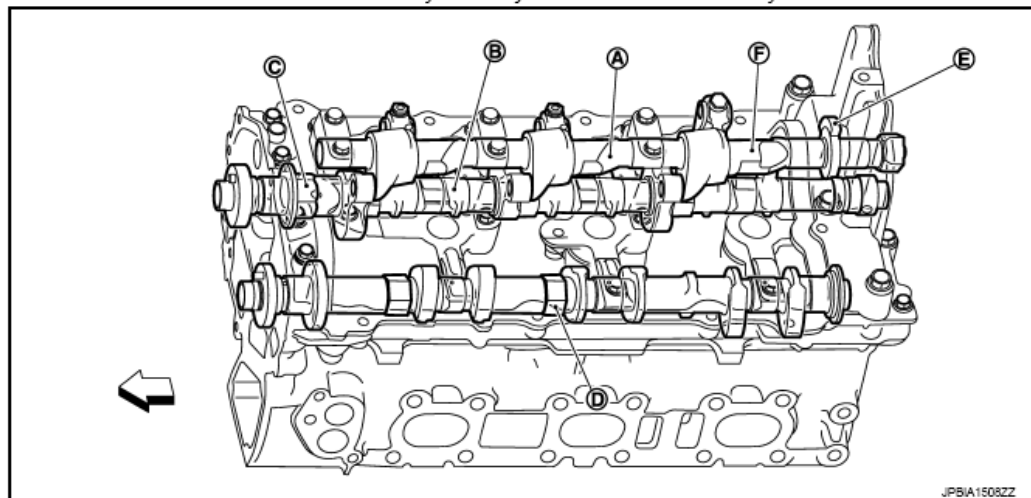
**Fig. 168: Exploded View Of Camshaft With Torque Specifications**  
 Courtesy of NISSAN NORTH AMERICA, INC.

Refer to "COMPONENTS" for symbol marks in the figure.

**CAUTION:** As for replacement of parts on the intake side as shown in the exploded view above, replace VVEL ladder assembly and cylinder head assembly.

**NOTE:** VVEL ladder assembly cannot be replaced as a single part, because it is machined together with cylinder head assembly.

VVEL Ladder Assembly and Cylinder Head Assembly Features



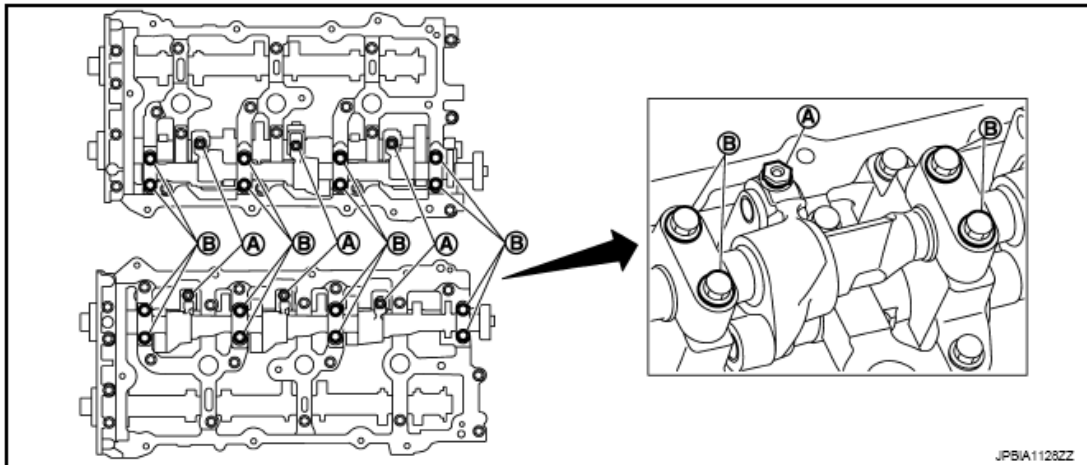
- |   |                             |   |
|---|-----------------------------|---|
| A. Control shaft                                  | B. Drive shaft              | C. Hexagonal part of drive shaft (for holding)  |
| D. Hexagonal part of camshaft (EXH) (for holding) | E. Stopper of control shaft | F. Two flat area of control shaft (for holding) |
- ← : Engine front

**Fig. 169: Identifying VVEL Ladder Assembly And Cylinder Head Assembly**  
Courtesy of NISSAN NORTH AMERICA, INC.

**NOTE:** The figure shows an example of bank 2.

#### Disassembly and Assembly

#### DISASSEMBLY



**Fig. 170: Identifying VVEL Ladder Assembly, Adjusting Bolts & Mounting Bolts**  
 Courtesy of NISSAN NORTH AMERICA, INC.

**CAUTION:** Never loosen adjusting bolts (A) and mounting bolts (black color) (B) of VVEL ladder assembly. If loosened, the stroke of cam lift becomes out of adjustment. In such case, replacement of VVEL ladder assembly and cylinder head assembly is required.

**NOTE:** VVEL ladder assembly cannot be replaced as a single part, because it is machined together with cylinder head assembly.

1. Remove rocker covers (bank 1 and bank 2). Refer to "EXPLODED VIEW".
2. Remove VVEL actuator sub assembly as follows:

**CAUTION:** VVEL actuator sub assembly and VVEL control shaft position sensor are not reusable. Never remove them unless required.

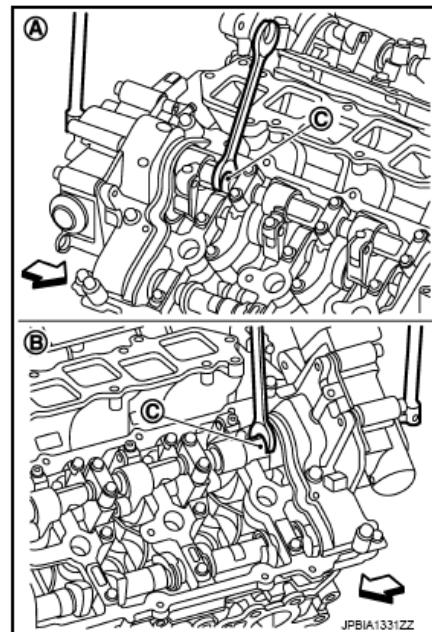
- a. Remove VVEL control shaft position sensor.
- b. Turn control shaft to the large lift side and fix it in order to prevent the interference of the stopper surface.
  - If control shaft cannot be moved, set crankshaft in position referring to the information below. (To displace cam nose)

**Bank 1: Turn 120 degrees from no. 1 cylinder at TDC**

**Bank 2: No. 1 cylinder at TDC**

- c. Fix two flat areas (C) of control shaft with a wrench to remove mounting bolts of control shaft.

A : Bank 1  
 B : Bank 2  
 ⇐ : Engine front



**Fig. 171: Removing Control Shaft Mounting Bolt**  
 Courtesy of NISSAN NORTH AMERICA, INC.

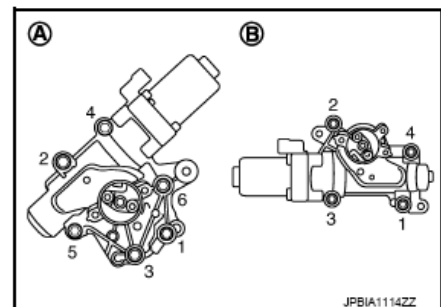
**CAUTION:**

- During the operation, never allow a wrench to interfere with other parts.
- Fix control shaft to prevent the interference of the stopper surface.

d. Remove VVEL actuator sub assembly.

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

A : Bank 2  
 B : Bank 1



**Fig. 172: VVEL Actuator Sub Assembly Bolt Tightening Sequence**  
 Courtesy of NISSAN NORTH AMERICA, INC.

**CAUTION:**

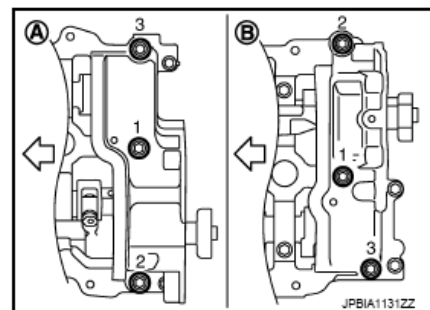
- When removing, prepare wastes because oil spills.
- When installing, be careful with VVEL actuator sub assembly (bank 2) mounting bolt No. 1 because its length

is different.

e. Remove actuator bracket (rear).

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

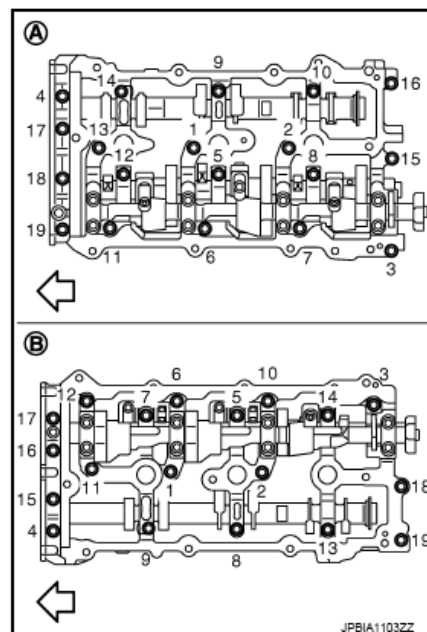
A : Bank 1  
B : Bank 2  
⇐ : Engine front



**Fig. 173: Rear Actuator Bracket Bolt Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

- Remove front timing chain case, camshaft sprockets, and timing chain. Refer to "EXPLODED VIEW".
- Remove rear timing chain case. Refer to "EXPLODED VIEW".
- Remove VVEL ladder assembly.
  - Loosen mounting bolts (gold color) in the reverse order as shown in the figure below.

A : Bank 1  
B : Bank 2  
⇐ : Engine front



**Fig. 174: VVEL Ladder Assembly Bolt Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

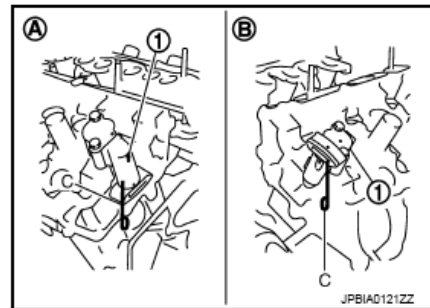
**CAUTION:** • Never loosen adjusting bolts and mounting bolts (black color).



- When removing VVEL ladder assembly, hold the drive shaft from below so as not to drop it.

6. Remove camshaft (EXH).
7. Remove valve lifter.
  - Identify installation positions, and store them without mixing them up.
8. Remove timing chain tensioners (secondary) (1) from cylinder head.

A : Bank 1  
B : Bank 2



**Fig. 175: Identifying Secondary Timing Chain Tensioners And Stopper Pin**  
Courtesy of NISSAN NORTH AMERICA, INC.

- Remove timing chain tensioners (secondary) with its stopper pin (C) attached.

**NOTE:** Stopper pin should be attached when timing chain (secondary) is removed.

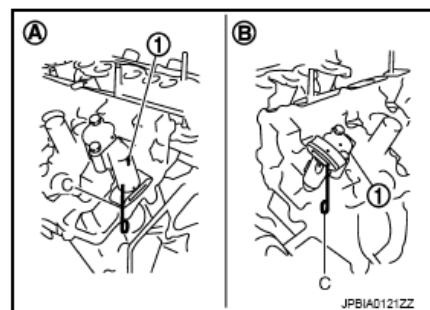
9. Remove oil filter from cylinder head, if necessary.

#### ASSEMBLY

**CAUTION:** Do not reuse washers.

1. Install timing chain tensioners (secondary) (1) on both sides of cylinder head.

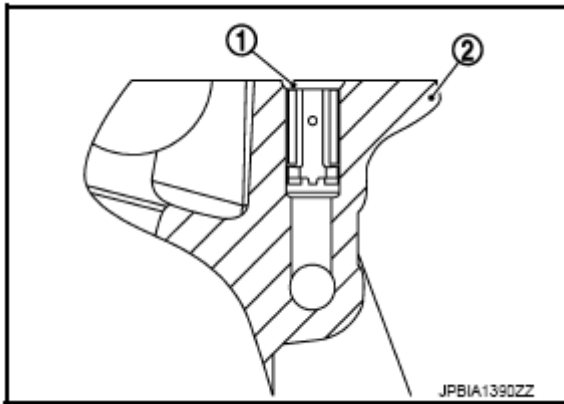
A : Bank 1  
B : Bank 2



**Fig. 176: Identifying Secondary Timing Chain Tensioners And Stopper Pin**

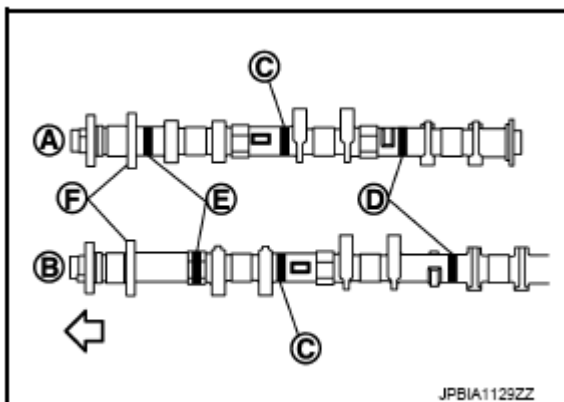
Courtesy of NISSAN NORTH AMERICA, INC.

- Install timing chain tensioner with its stopper pin (C) attached.
  - Install timing chain tensioner with sliding part facing downward on cylinder head (bank 1), and with sliding part facing upward on cylinder head (bank 2).
2. Install oil filter (1), if removed.
- Do not project from the cylinder head (2) surface.



**Fig. 177: Identifying Cylinder Head And VVEL Oil Filter**  
Courtesy of NISSAN NORTH AMERICA, INC.

3. Install valve lifter.
- Install it in the original position.
4. Install camshaft (EXH).
- Distinction between camshaft (EXH) (bank 1 and bank 2) is performed with the identification mark.




**Fig. 178: Identifying Exhaust Camshaft Identification Marks**  
Courtesy of NISSAN NORTH AMERICA, INC.

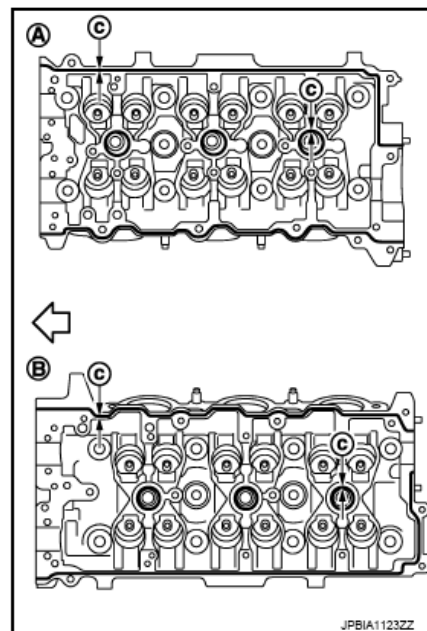
	<b>Paint marks</b>	
--	--------------------	--

Bank	M1 (C)	M2 (D)	M3 (E)	Identification mark (F)
Bank 1 (A)	No	Blue	Light blue	1 N
Bank 2 (B)	No	Blue	Light blue	1 P

5. Install VVEL ladder assembly as follows:

- a. Apply a continuous bead of liquid gasket with tube presser (commercial service tool) to the cylinder head as shown in the figure below.

A : Bank 1  
 B : Bank 2  
 c :  $\phi 3.4 - 4.4$  mm (0.134 - 0.173 in)  
 : Engine front

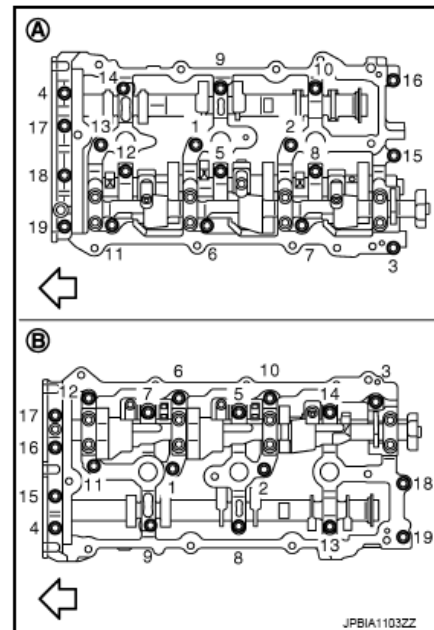


**Fig. 179: Identifying Liquid Gasket**  
 Courtesy of NISSAN NORTH AMERICA, INC.

**Use Genuine RTV Silicone Sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS".**

- b. Tighten mounting bolts in the following step, in numerical order as shown in the figure below.

A : Bank 1  
 B : Bank 2  
 ← : Engine front



**Fig. 180: VVEL Ladder Assembly Bolt Tightening Sequence**  
 Courtesy of NISSAN NORTH AMERICA, INC.

**CAUTION: Do not reuse washers.**

- i. Tighten bolts in numerical order as shown in the figure below.

**Torque: 1.96 N.m (0.20 kg-m, 1 ft-lb)**

- ii. Tighten bolts in numerical order as shown in the figure below.

**Torque: 5.88 N.m (0.60 kg-m, 4 ft-lb)**

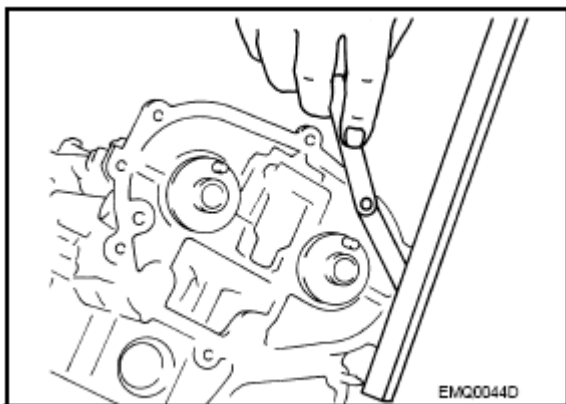
- iii. Tighten bolts in numerical order as shown in the figure below.

**Torque: 10.4 N.m (1.1 kg-m, 8 ft-lb)**

6. Measure difference in levels between front end faces of VVEL ladder assembly and cylinder head.

**Standard: -0.14 to 0.14 mm (-0.0055 to 0.0055 in)**

- Measure two positions (both intake and exhaust side) for a single bank.
- If the measured value is out of the standard, reinstall VVEL ladder assembly.

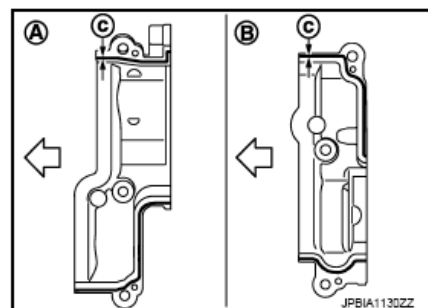


**Fig. 181: Measuring Difference Between VVEL Ladder Assembly Front End Faces And Cylinder Head**

Courtesy of NISSAN NORTH AMERICA, INC.

7. Install rear timing chain case. Refer to "**EXPLODED VIEW**".
8. Install camshaft sprockets and timing chains. Refer to "**EXPLODED VIEW**".
9. Install actuator bracket (rear) as follows:
  - a. Apply a continuous bead of liquid gasket with tube presser (commercial service tool) to the actuator bracket (rear) as shown in the figure below.

A : Bank 1  
 B : Bank 2  
 c :  $\phi 3.4 - 4.4$  mm (0.134 - 0.173 in)  
 ⇐ : Engine front



**Fig. 182: Identifying Liquid Gasket**

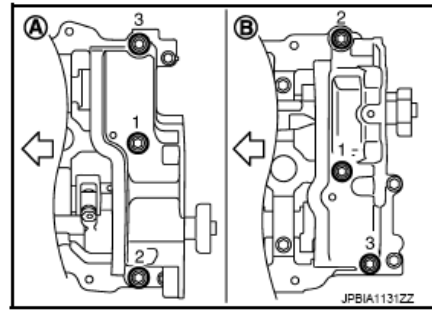
Courtesy of NISSAN NORTH AMERICA, INC.

Use Genuine RTV Silicone Sealant or equivalent. Refer to "**RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS**".

**CAUTION: Never apply gasket to the oil passage.**

- b. Tighten mounting bolts in the following steps, in numerical order as shown in the figure below.

A : Bank 1  
B : Bank 2  
← : Engine front



**Fig. 183: Rear Actuator Bracket Bolt Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

**CAUTION: Do not reuse washers.**

- i. Tighten bolts in numerical order as shown in the figure below.

**Torque: 1.96 N.m (0.20 kg-m, 1 ft-lb)**

- ii. Tighten bolts in numerical order as shown in the figure below.

**Torque: 5.88 N.m (0.60 kg-m, 4 ft-lb)**

- iii. Tighten bolts in numerical order as shown in the figure below.

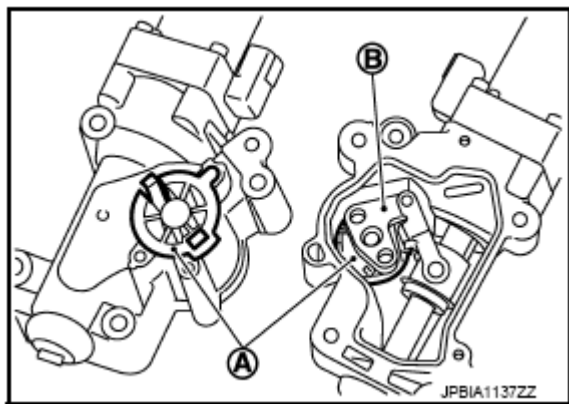
**Torque: 31.4 N.m (3.2 kg-m, 23 ft-lb)**

10. Install new VVEL actuator sub assembly as follows:

**CAUTION: Regarding replacement, because VVEL actuator sub assembly and VVEL control shaft position sensor are controlled on a one-on-one basis, replace them as a set.**

**NOTE:**

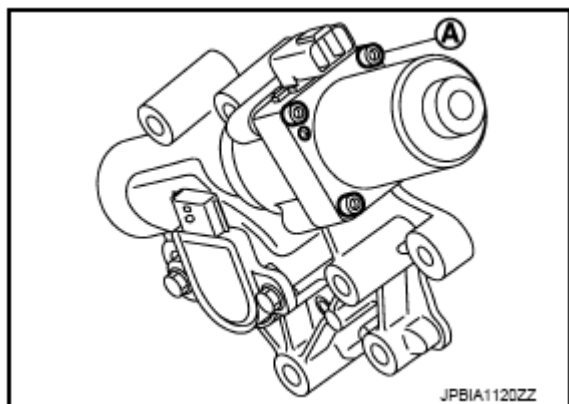
- VVEL actuator arm (B) is factory-fixed at 5.5 degrees from the small lift with a holding jig (A).
- The holding jig is supplied in the new VVEL actuator sub assembly.



**Fig. 184: Identifying VVEL Actuator Arm And Holding Jig**  
Courtesy of NISSAN NORTH AMERICA, INC.

**CAUTION:**

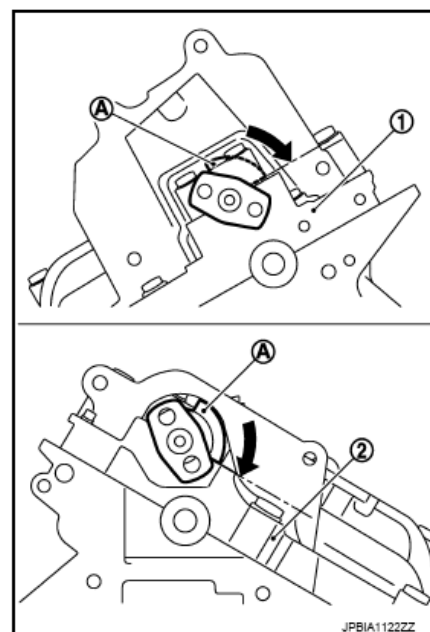
- Never disassemble VVEL actuator sub assembly. [Never loosen actuator motor mounting bolts (A) shown in the figure below]
- Never shock VVEL actuator sub assembly.



**Fig. 185: Identifying Actuator Motor Mounting Bolts**  
Courtesy of NISSAN NORTH AMERICA, INC.

- Move control shaft to the position of small lift stopper.
  - The position where a part of the stopper of control shaft contacts VVEL ladder bracket.

- 1 : VVEL ladder assembly (bank 2)  
 2 : VVEL ladder assembly (bank 1)  
 A : Stopper of control shaft  
 ← : Small lift side



**Fig. 186: Positioning Of Control Shaft Contacts VVEL Ladder Bracket Stopper**  
 Courtesy of NISSAN NORTH AMERICA, INC.

**CAUTION:** Be careful not to damage the stopper surface.

- If control shaft cannot be moved, set crankshaft in position referring to the information below. (To displace cam nose)

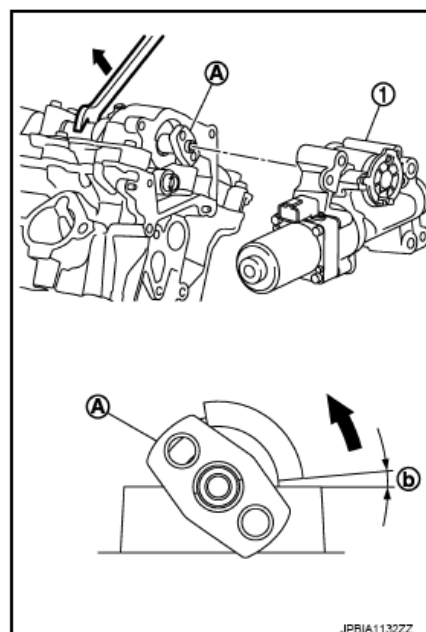
**Bank 1: Turn 120 degrees from No. 1 cylinder at TDC**

**Bank 2: No. 1 cylinder at TDC**

- Hold two flat areas of control shaft with a wrench, and rotate the control shaft (5.5 degrees from the stopper) to the large lift side. (This is for aligning the bolt hole of control shaft and the hole of VVEL actuator arm.)



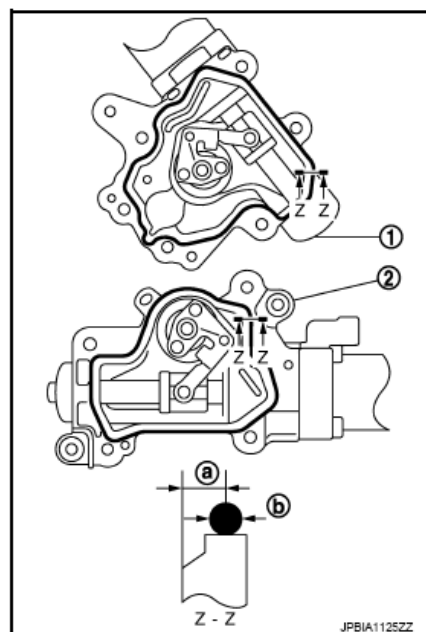
- 1 : VVEL actuator sub assembly (bank 1)  
A : Control shaft  
b : 5.5 degrees  
← : Large lift side



**Fig. 187: Aligning Control Shaft Bolt Hole And VVEL Actuator Arm Hole**  
Courtesy of NISSAN NORTH AMERICA, INC.

- c. Apply a continuous bead of liquid gasket with tube presser (commercial service tool) to the VVEL actuator sub assembly as shown in the figure below.

- 1 : VVEL actuator sub assembly (bank 2)  
2 : VVEL actuator sub assembly (bank 1)  
a : 4.0 - 5.6 mm (0.157 - 0.220 in)  
b :  $\phi$ 3.4 - 4.4 mm (0.134 - 0.173 in)



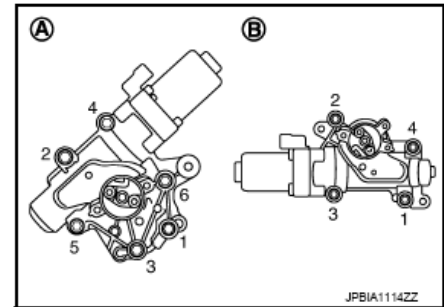
**Fig. 188: Identifying Liquid Gasket**  
Courtesy of NISSAN NORTH AMERICA, INC.

Use Genuine RTV Silicone Sealant or equivalent. Refer to "**RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS**".

**CAUTION:** Never apply gasket to the oil passage.

- d. Install new VVEL actuator sub assembly.
- Tighten mounting bolts in the following step, in numerical order as shown below.

A : Bank 2  
B : Bank 1

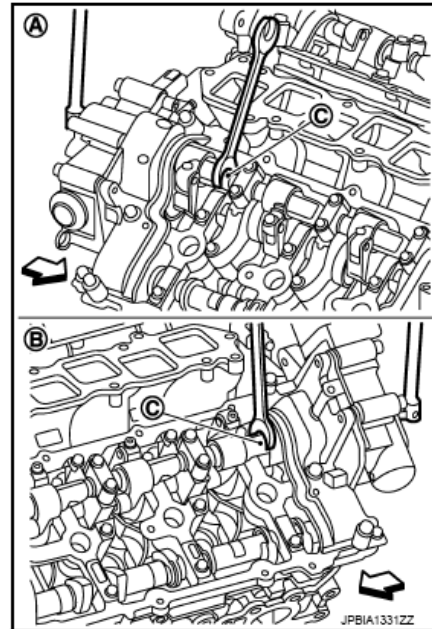


**Fig. 189: VVEL Actuator Sub Assembly Bolt Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

- CAUTION:**
- When installing, be careful with VVEL actuator sub assembly (bank 2) mounting bolt No. 1 because its length is different.
  - Be sure to check that the VVEL actuator sub assembly is in contact with the cylinder head before tightening the mounting bolts.

- e. Remove holding jig.
- f. Check that VVEL actuator arm bolt hole is aligned with control shaft tapped hole. If it is not aligned, turn control shaft for alignment.
- g. Fix two flat areas (C) of control shaft with a wrench to install mounting bolts of control shaft.

A : Bank 1  
 B : Bank 2  
 ⇐ : Engine front



**Fig. 190: Installing Control Shaft Mounting Bolts**  
 Courtesy of NISSAN NORTH AMERICA, INC.

**CAUTION:**

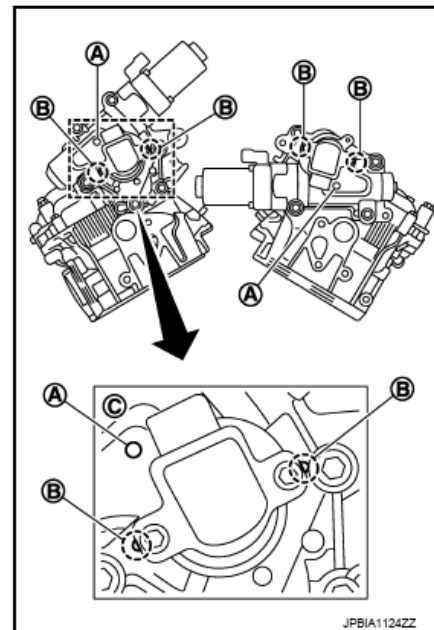
- During the operation, never allow a wrench to interfere with other parts.
- Fix control shaft to prevent the interference of the stopper surface.

11. Install new VVEL control shaft position sensor as follows:

**CAUTION:** Regarding replacement, because VVEL actuator sub assembly and VVEL control shaft position sensor are controlled on a one-on-one basis, replace them as a set.

- a. Apply engine oil to O-ring or contact surface of O-ring.
- b. Align matching marks (B) of VVEL control shaft position sensor and upper housing.

C : Bank 2



**Fig. 191: Identifying Alignment Matching Marks Of VVEL Control Shaft Position Sensor And Upper Housing**

Courtesy of NISSAN NORTH AMERICA, INC.

- Face connector toward matching mark (A).
- c. Temporarily tighten bolt.
- d. Adjust VVEL control shaft position sensor after setting the engine assembly in the vehicle. Refer to "**DESCRIPTION**" (FOR USA AND CANADA) .

**CAUTION: Be sure to adjust VVEL control shaft position sensor.**

- e. After adjusting VVEL control shaft position sensor, tighten bolts to the specified torque.
- 12. Inspect the valve clearance. Refer to "**INSPECTION AND ADJUSTMENT**".
- 13. Install in the reverse order of removal after this step.

## Inspection

### INSPECTION AFTER REMOVAL (EXHAUST SIDE)

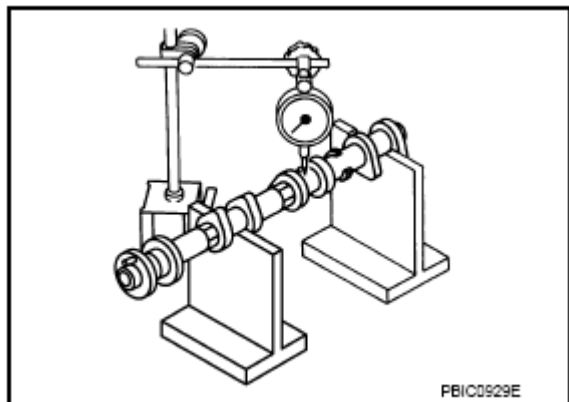
#### Camshaft (EXH) Runout

1. Put V-block on precise flat table, and support No. 2 and 4 journals of camshaft.

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

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

**Standard and limit: Refer to "CAMSHAFT".**



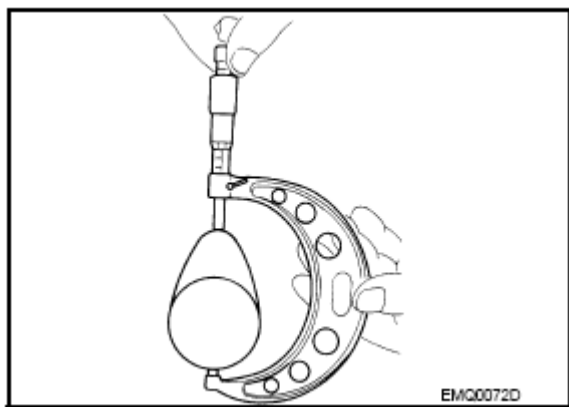
**Fig. 192: Checking Exhaust Camshaft Runout Using Dial Indicator**  
Courtesy of NISSAN NORTH AMERICA, INC.

4. If it exceeds the limit, replace camshaft (EXH).

#### Camshaft (EXH) Cam Height

- Measure the camshaft (EXH) cam height with a micrometer.

**Standard: Refer to "CAMSHAFT".**



**Fig. 193: Measuring Exhaust Camshaft Cam Height**  
Courtesy of NISSAN NORTH AMERICA, INC.

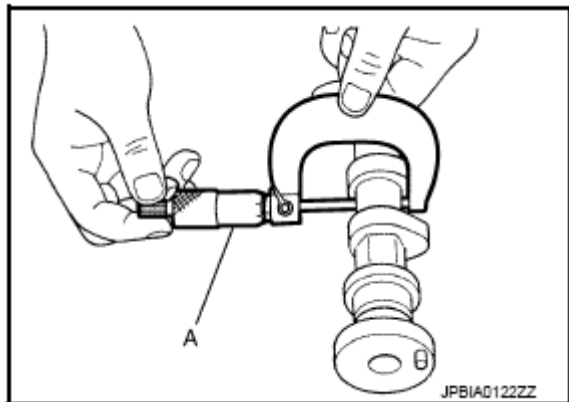
- If wear exceeds the limit, replace camshaft (EXH).

#### Camshaft (EXH) Journal Oil Clearance

**CAMSHAFT (EXH) JOURNAL DIAMETER**

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

**Standard:** Refer to "CAMSHAFT".

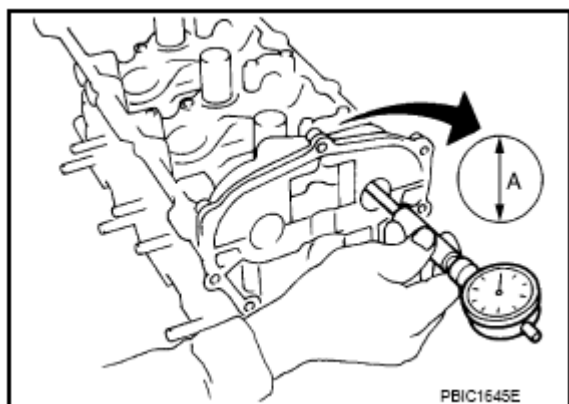


**Fig. 194: Measuring Exhaust Camshaft Journal**  
Courtesy of NISSAN NORTH AMERICA, INC.

**VVEL LADDER ASSEMBLY (EXHAUST SIDE) INNER DIAMETER**

- Tighten VVEL ladder assembly bolts to the specified torque. Refer to "ASSEMBLY" for the tightening procedure.
- Measure inner diameter (A) of VVEL ladder assembly (Exhaust side) with a bore gauge.

**Standard:** Refer to "CAMSHAFT".



**Fig. 195: Measuring Inner Diameter Of VVEL Ladder Assembly Using Bore Gauge**  
Courtesy of NISSAN NORTH AMERICA, INC.

**CAMSHAFT (EXH) JOURNAL OIL CLEARANCE**

- (Oil clearance) = [VVEL ladder assembly (Exhaust side) inner diameter] - [Camshaft (EXH) journal diameter].

**Standard and limit: Refer to "CAMSHAFT".**

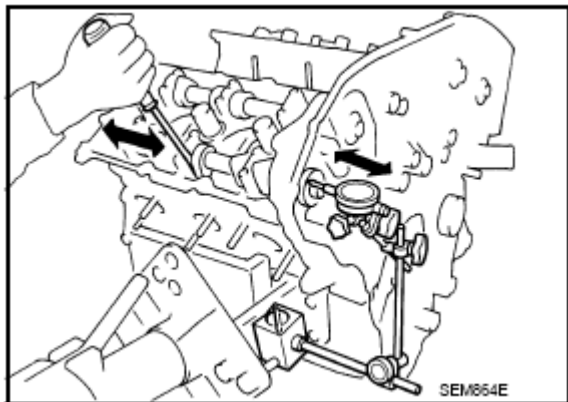
- If the calculated value exceeds the limit, replace either or both camshaft (EXH) and VVEL ladder assembly and cylinder head assembly.

**NOTE: VVEL ladder assembly cannot be replaced as a single part, because it is machined together with cylinder head assembly.**

#### Camshaft (EXH) End Play

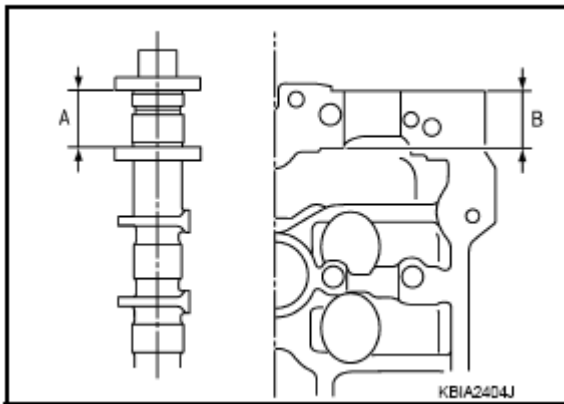
- Install a dial indicator in thrust direction on front end of camshaft. Measure the end play of a dial indicator when camshaft (EXH) is moved forward/backward (in direction of axis).

**Standard and limit: Refer to "CAMSHAFT".**



**Fig. 196: Measuring Camshaft End Play**  
Courtesy of NISSAN NORTH AMERICA, INC.

- Measure the following parts if out of the limit.
  - Dimension "A" for camshaft (EXH) No. 1 journal  
**Standard: 27.500 - 27.548 mm (1.0827 - 1.0846 in)**
  - Dimension "B" for cylinder head No. 1 journal bearing  
**Standard: 27.360 - 27.385 mm (1.0772 - 1.0781 in)**



**Fig. 197: Identifying Camshaft And Cylinder Head Journal Dimensions**  
 Courtesy of NISSAN NORTH AMERICA, INC.

- Refer to the standards above, and then replace camshaft (EXH) and/or VVEL ladder assembly and cylinder head assembly.

**NOTE:**        **Cylinder head assembly cannot be replaced as a single part, because it is machined together with VVEL ladder assembly.**

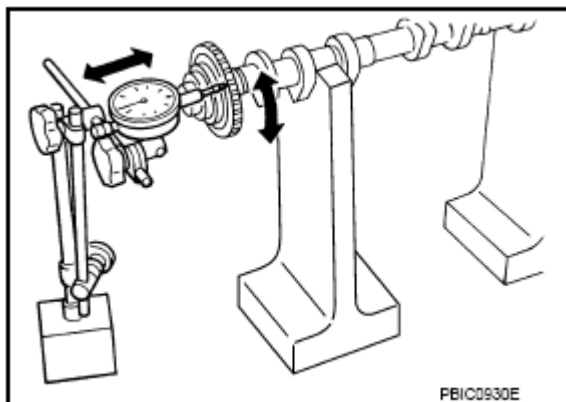
#### Camshaft Sprocket (EXH) Runout

1. Put V-block on precise flat table, and support No. 2 and 4 journals of camshaft (EXH).

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

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

**Limit: Refer to "CAMSHAFT".**



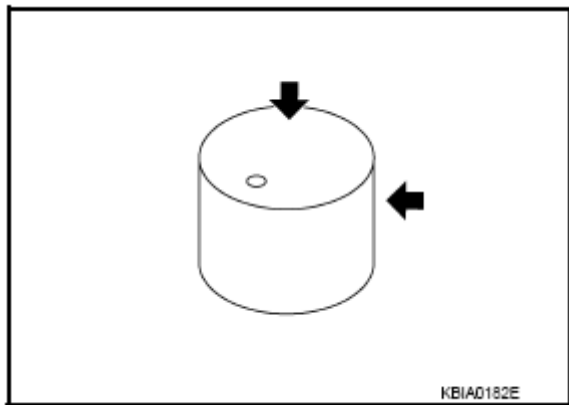
**Fig. 198: Measuring Exhaust Camshaft Sprocket Runout**  
 Courtesy of NISSAN NORTH AMERICA, INC.



3. If it exceeds the limit, replace camshaft sprocket (EXH).

#### Valve Lifter (EXH)

- Check if surface of valve lifter has any wear or crack.
- If wear or crack is found, replace valve lifter (EXH). Refer to "CAMSHAFT".



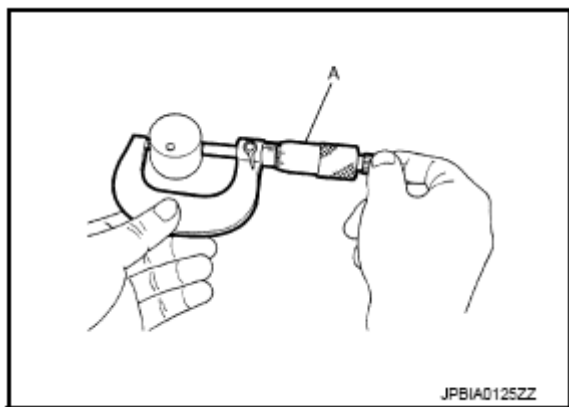
**Fig. 199: Identifying Valve Lifter Surface**  
Courtesy of NISSAN NORTH AMERICA, INC.

#### Valve Lifter Clearance (EXH)

#### VALVE LIFTER OUTER DIAMETER

- Measure the outer diameter at 1/2 height of valve lifter with a micrometer (A) since valve lifter is in barrel shape.

**Standard: Refer to "CAMSHAFT".**

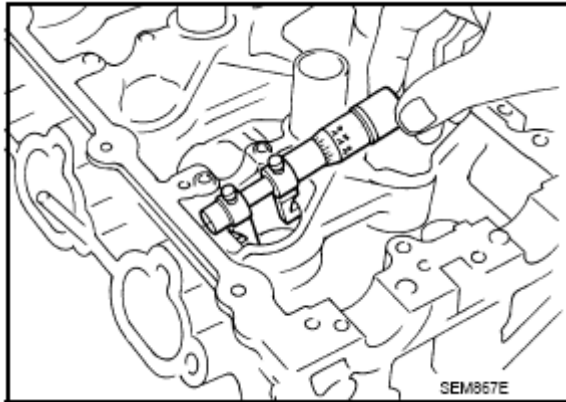


**Fig. 200: Measuring Valve Lifter Outer Diameter**  
Courtesy of NISSAN NORTH AMERICA, INC.

## VALVE LIFTER HOLE DIAMETER

- Measure the inner diameter of valve lifter hole of cylinder head with an inside micrometer.

**Standard:** Refer to "CAMSHAFT".



**Fig. 201: Measuring Valve Lifter Hole Inner Diameter**  
Courtesy of NISSAN NORTH AMERICA, INC.

## VALVE LIFTER CLEARANCE

- $(\text{Valve lifter clearance}) = (\text{Valve lifter hole diameter}) - (\text{Valve lifter outer diameter})$

**Standard:** Refer to "CAMSHAFT".

- If the calculated value is out of the standard, referring to each standard of valve lifter outer diameter and valve lifter hole diameter, replace either or both valve lifter and VVEL ladder assembly and cylinder head assembly.

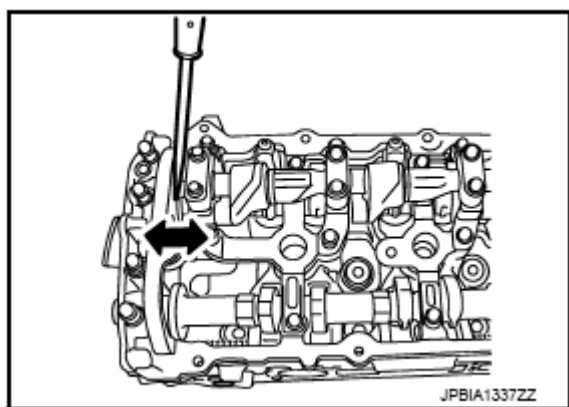
**NOTE:**      **Cylinder head assembly cannot be replaced as a single part, because it is machined together with VVEL ladder assembly.**

## INSPECTION AFTER REMOVAL (INTAKE SIDE)

### Drive Shaft End Play

- Install a dial indicator in thrust direction on front end of drive shaft. Measure the end play of a dial indicator when drive shaft is moved forward/backward (in direction of axis).

**Standard and limit:** Refer to "CAMSHAFT".

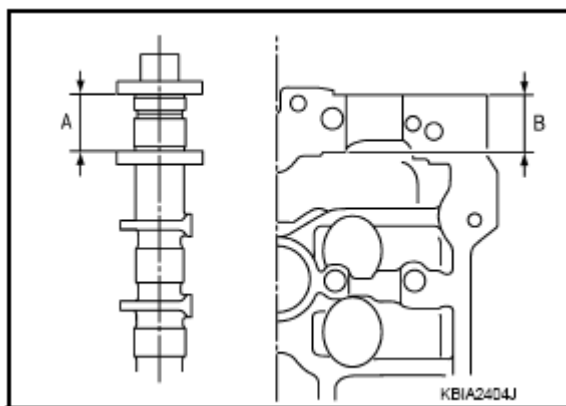


**Fig. 202: Measuring Drive Shaft End Play**  
 Courtesy of NISSAN NORTH AMERICA, INC.

- Measure the following parts if out of the limit.
    - Dimension "A" for drive shaft No. 1 journal

**Standard: 27.500 - 27.548 mm (1.0827 - 1.0846 in)**

  - Dimension "B" for cylinder head No. 1 journal bearing
- Standard: 27.360 - 27.385 mm (1.0772 - 1.0781 in)**



**Fig. 203: Identifying Camshaft And Cylinder Head Journal Dimensions**  
 Courtesy of NISSAN NORTH AMERICA, INC.

- If it exceeds the limit, replace VVEL ladder assembly and cylinder head assembly.

**NOTE:**      **Cylinder head assembly cannot be replaced as a single part, because it is machined together with VVEL ladder assembly.**

Camshaft Sprocket (INT) Runout

1. Put V-block on precise flat table, and support No. 2 and 4 journals of drive shaft.

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

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

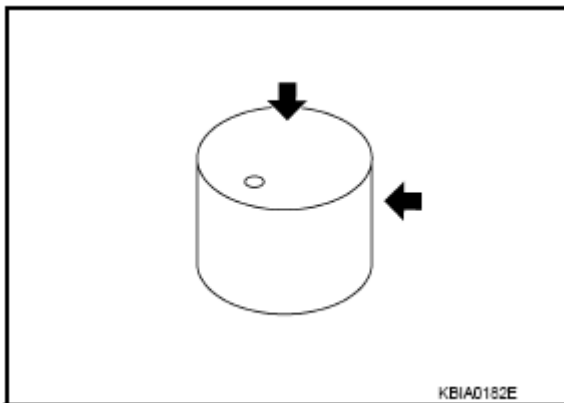
**Limit: Refer to "CAMSHAFT".**

3. If it exceeds the limit, replace camshaft sprocket (INT).

#### Valve Lifter (INT)

- Check if surface of valve lifter has any wear or crack.
- If wear or crack is found, replace VVEL ladder assembly and cylinder head assembly. Refer to "CAMSHAFT".

**NOTE: Since the valve lifter (INT) cannot be replaced by the piece, VVEL ladder assembly and cylinder head assembly replacement are required.**



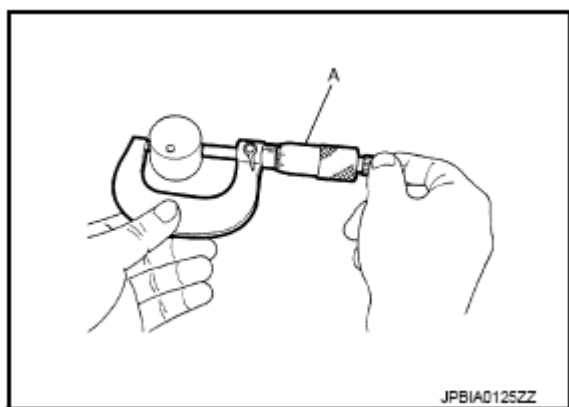
**Fig. 204: Identifying Valve Lifter Surface**  
Courtesy of NISSAN NORTH AMERICA, INC.

#### Valve Lifter Clearance (INT)

#### VALVE LIFTER OUTER DIAMETER

- Measure the outer diameter at 1/2 height of valve lifter (INT) with a micrometer (A) since valve lifter is in barrel shape.

**Standard: Refer to "CAMSHAFT".**

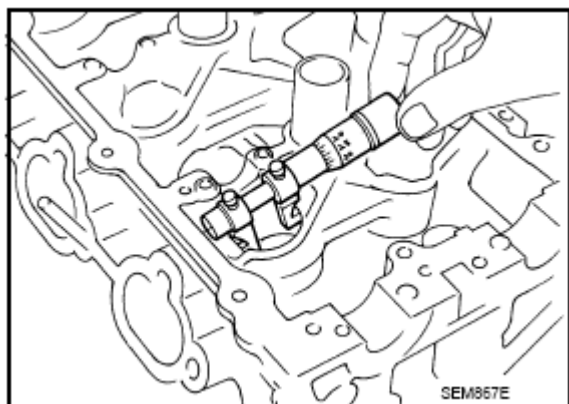


**Fig. 205: Measuring Valve Lifter Outer Diameter**  
Courtesy of NISSAN NORTH AMERICA, INC.

### VALVE LIFTER HOLE DIAMETER

- Measure the inner diameter of valve lifter hole of cylinder head with an inside micrometer.

**Standard:** Refer to "CAMSHAFT".



**Fig. 206: Measuring Valve Lifter Hole Inner Diameter**  
Courtesy of NISSAN NORTH AMERICA, INC.

### VALVE LIFTER CLEARANCE

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

**Standard:** Refer to "CAMSHAFT".

- If the calculated value is out of the standard, replace VVEL ladder assembly and cylinder head assembly.

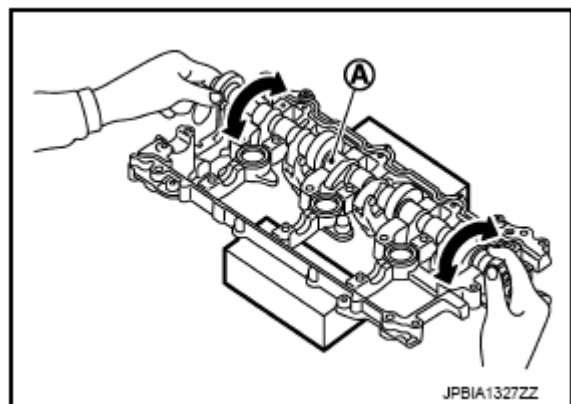
**NOTE:** Since the valve lifter (INT) cannot be replaced by the piece, VVEL ladder assembly and cylinder head assembly replacement are required.

## VVEL Ladder Assembly

## DRIVE SHAFT OPERATIONAL CHECK

- Hold the both ends of the drive shaft (A) and rotate it to check that it rotates smoothly.

**CAUTION:** Turn VVEL ladder assembly upside down to prevent the drive shaft from dropping off.



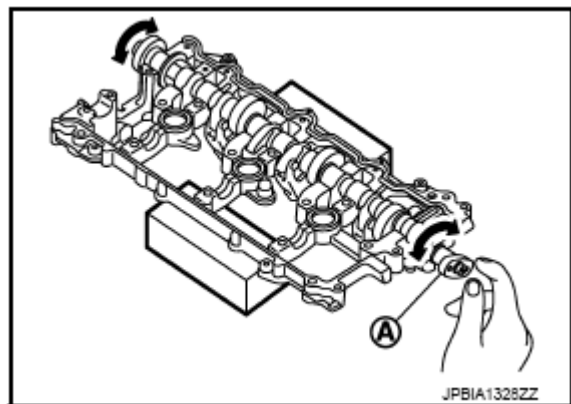
**Fig. 207: Rotating Drive Shaft Ends**

Courtesy of NISSAN NORTH AMERICA, INC.

## CONTROL SHAFT OPERATIONAL CHECK

- Move control shaft (A) to the small stopper and large stopper to check that the control shaft functions smoothly.

**CAUTION:** Turn VVEL ladder assembly upside down to prevent the drive shaft from dropping off.

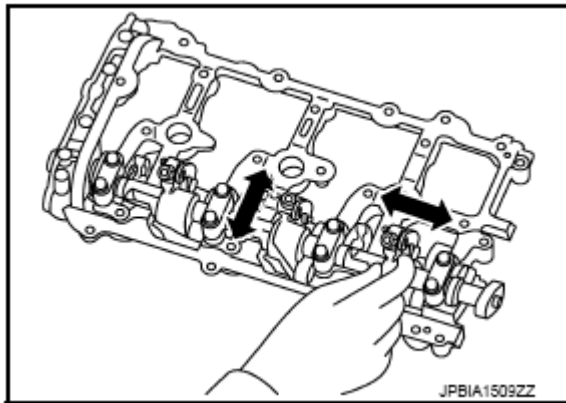


**Fig. 208: Checking Control Shaft Operation**

Courtesy of NISSAN NORTH AMERICA, INC.

### LINK CHECK FOR BACKLASH (BONDING)

- Check that the link and the shaft of drive shaft and control shaft are not fixed.
- Check this by moving drive shaft and control shaft in the axial and rotation directions.



**Fig. 209: Moving Drive Shaft And Control Shaft In Axial And Rotation Directions**  
Courtesy of NISSAN NORTH AMERICA, INC.

- If there is an unusualness related to the above three, replace VVEL ladder assembly and cylinder head assembly.

**NOTE:** VVEL ladder assembly cannot be replaced as a single part, because it is machined together with cylinder head assembly.

### INSPECTION AFTER INSTALLATION

#### Inspection of Camshaft Sprocket (INT) Oil Groove

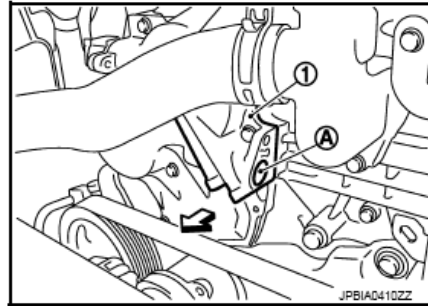
**CAUTION:**

- Perform this inspection only when DTC P0011, P0021 is detected in self-diagnostic results of CONSULT and it is directed according to inspection procedure of the "ENGINE CONTROL" article. Refer to "DTC LOGIC" (FOR USA AND CANADA) .
- Check when engine is cold to prevent burns from the splashing engine oil.

1. Check engine oil level. Refer to "INSPECTION".
2. Perform the following procedure to prevent the engine from being unintentionally started while checking.
  - a. Release the fuel pressure. Refer to "WORK PROCEDURE" (FOR USA AND CANADA) .
  - b. Disconnect ignition coil and injector harness connectors. Refer to "EXPLODED VIEW".
3. Remove intake valve timing control solenoid valve. Refer to "EXPLODED VIEW".
4. Crank engine, and then check that engine oil comes out from intake valve timing control solenoid valve

hole (A). End crank after checking.

- 1 : Intake valve timing control cover (bank 1)  
 ⇐ : Engine front



**Fig. 210: Identifying Intake Valve Timing Control Cover And Solenoid Valve Hole**  
 Courtesy of NISSAN NORTH AMERICA, INC.

**WARNING:** Be careful not to touch rotating parts (drive belt, idler pulley, and crankshaft pulley, etc.).

**CAUTION:**

- Prevent splashing by using a shop cloth to prevent the worker from injury from engine oil and to prevent engine oil contamination.
- Prevent splashing by using a shop cloth to prevent engine oil from being splashed to engine and vehicle. Especially, be careful no to apply engine oil to rubber parts of drive belt, engine mounting insulator, etc. Wipe engine oil off immediately if it is splashed.

5. Perform the following inspection if engine oil does not come out from intake valve timing control solenoid valve oil hole of the cylinder head.
  - Remove oil filter, and then clean it. Refer to "**EXPLODED VIEW**".
  - Clean oil groove between oil strainer and intake valve timing control solenoid valve. Refer to "**ENGINE LUBRICATION SYSTEM**".
6. 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 "**ENGINE LUBRICATION SYSTEM**".
7. After inspection, install removed parts in the reverse order.

**Inspection for Leakage**

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

- Before starting engine, check oil/fluid levels including engine coolant and engine oil. If any are less than the required quantity, fill them to the specified level. Refer to "**FOR NORTH AMERICA: FLUIDS AND LUBRICANTS**".
- Follow the procedure below to check for fuel leakage.



- Turn ignition switch to the "ON" position (with engine stopped). With fuel pressure applied to fuel piping, check for fuel leakage at connection points.
- Start engine. With engine speed increased, check again for fuel leakage at connection points.
- Run engine to check for unusual noise and vibration.

**NOTE:** If hydraulic pressure inside chain tensioner drops after removal/installation, slack in guide may generate a pounding noise during and just after the engine start. However, this does not indicate a malfunction. The noise will stop after hydraulic pressure rises.

- Warm up engine thoroughly to check that there is no leakage of fuel, or any oil/fluids including engine oil and engine coolant.
- Bleed air from lines and hoses of applicable lines, such as in cooling system.
- After cooling down engine, again check oil/fluid levels including engine oil and engine coolant. Refill them to the specified level, if necessary.

#### SUMMARY OF INSPECTION ITEMS

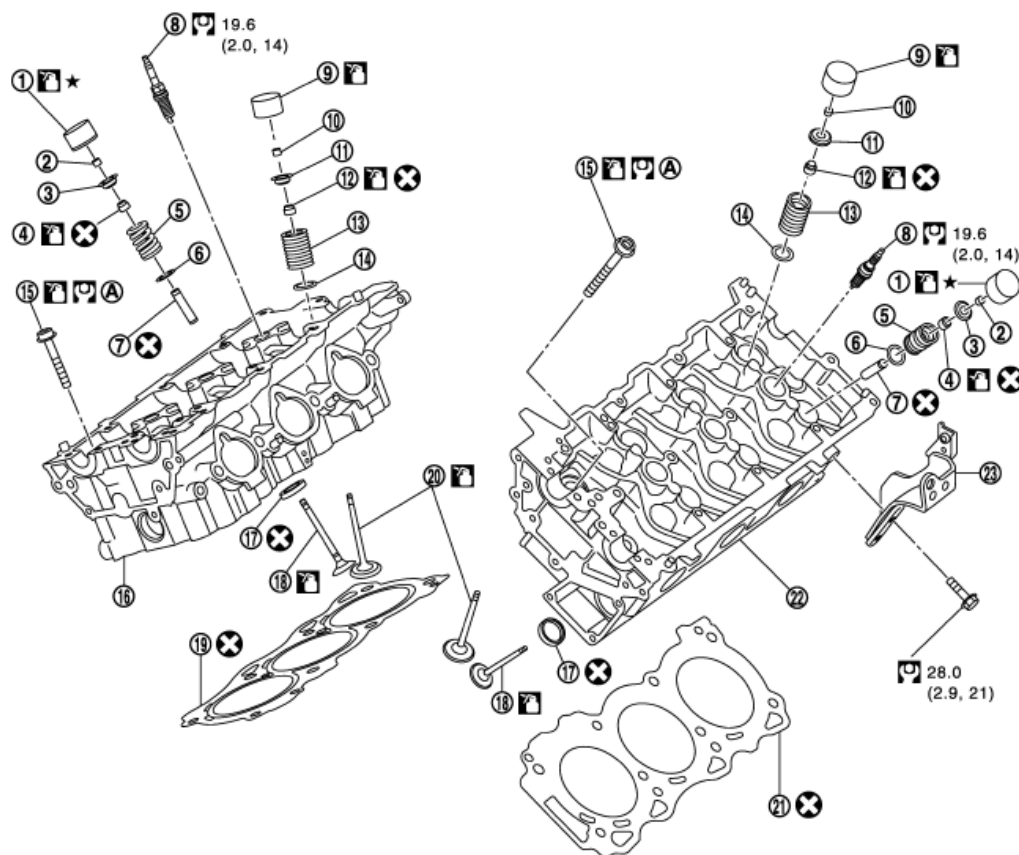
Items		Before starting engine	Engine running	After engine stopped
Engine coolant		Level	Leakage	Level
Engine oil		Level	Leakage	Level
Transmission/transaxle fluid	AT & CVT Models	Leakage	Level/Leakage	Leakage
	MT Models	Level/Leakage	Leakage	Level/Leakage
Other oils and fluids <sup>(1)</sup>		Level	Leakage	Level
Fuel		Leakage	Leakage	Leakage
Exhaust gases		-	Leakage	-
(1) Power steering fluid, brake fluid, etc.				

#### CYLINDER HEAD

##### Exploded View

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.

# SEC. 111•130•220



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- |                                   |                                 |                                   |
|-----------------------------------|---------------------------------|-----------------------------------|
| 1. Valve lifter (EXH)             | 2. Valve collet (EXH)           | 3. Valve spring retainer (EXH)    |
| 4. Valve oil seal (EXH)           | 5. Valve spring (EXH)           | 6. Valve spring seat (EXH)        |
| 7. Valve guide (EXH)              | 8. Spark plug                   | 9. Valve lifter (INT)             |
| 10. Valve collet (INT)            | 11. Valve spring retainer (INT) | 12. Valve oil seal (INT)          |
| 13. Valve spring (INT)            | 14. Valve spring seat (INT)     | 15. Cylinder head bolt            |
| 16. Cylinder head (bank 1)        | 17. Valve seat (EXH)            | 18. Valve (EXH)                   |
| 19. Cylinder head gasket (bank 1) | 20. Valve (INT)                 | 21. Cylinder head gasket (bank 2) |
| 22. Cylinder head (bank 2)        | 23. Engine rear lower slinger   |                                   |

A. Comply with the assembly procedure when tightening.

**Fig. 211: Exploded View Of Cylinder Head With Torque Specifications**  
**Courtesy of NISSAN NORTH AMERICA, INC.**

Refer to "**COMPONENTS**" for symbol marks in the figure.

**CAUTION:** As for replacement of parts on the intake side as shown in the exploded view above, replace VVEL ladder assembly and cylinder head assembly. (Only valve oil seals are replaceable as a single part.)

**NOTE:** VVEL ladder assembly cannot be replaced as a single part, because it is machined together with cylinder head assembly.

## Disassembly and Assembly

### DISASSEMBLY

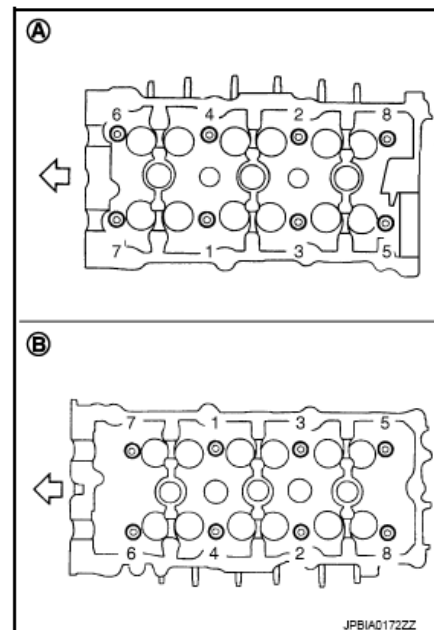
#### 1. Remove the following parts:

- Intake manifold collector: Refer to "EXPLODED VIEW".
- Rocker cover: Refer to "EXPLODED VIEW".
- Fuel tube and fuel injector assembly: Refer to "EXPLODED VIEW".
- Intake manifold: Refer to "EXPLODED VIEW".
- Exhaust manifold: Refer to "EXPLODED VIEW".
- Water inlet and thermostat assembly: Refer to "EXPLODED VIEW".
- Water outlet, water pipe and heater pipe: Refer to "EXPLODED VIEW".
- Timing chain: Refer to "EXPLODED VIEW".
- Rear timing chain case: Refer to "EXPLODED VIEW".
- Camshaft (EXH) and VVEL ladder assembly: Refer to "EXPLODED VIEW".

#### 2. Remove cylinder head.

- Loosen mounting bolts in reverse of the order shown in the figure below.

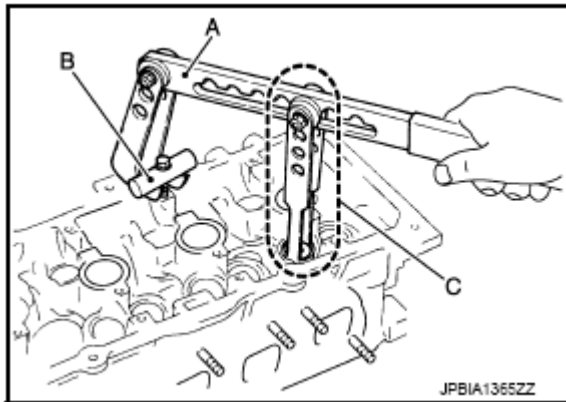
A : Bank 1  
B : Bank 2  
⇐ : Engine front



**Fig. 212: Cylinder Head Bolt Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

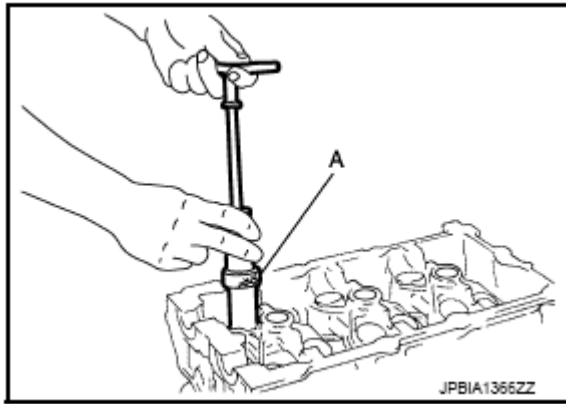
- Use the cylinder head bolt wrench [commercial service tool: - (J-24239-01)] and power tool.
3. Remove cylinder head gaskets.
  4. Remove spark plug with spark plug wrench (commercial service tool).
  5. Remove valve lifter.
    - Identify installation positions, and store them without mixing them up.
  6. Remove valve collet.
    - Compress valve spring with the valve spring compressor [SST: KV10116200 (J-26336-A)] (A), the attachment [SST: KV10115900 (J-26336-20)] (C) and the adapter [SST: KV10109220 (-)] (B).  
Remove valve collet with a magnet hand.

**CAUTION:** When working, take care not to damage valve lifter holes.



**Fig. 213: Compressing Valve Spring**  
Courtesy of NISSAN NORTH AMERICA, INC.

7. Remove valve spring retainer, valve spring and valve spring seat.
8. Push valve stem to combustion chamber side, and remove valve.
  - Identify installation positions, and store them without mixing them up.
9. Remove valve oil seal using the valve oil seal puller [SST: KV10107902 (J-38959)] (A).



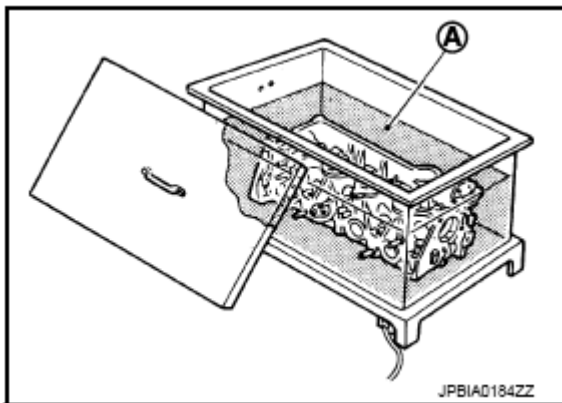
**Fig. 214: Removing Valve Oil Seal**

Courtesy of NISSAN NORTH AMERICA, INC.

10. Remove valve seat (EXH), if valve seat (EXH) 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 "CYLINDER HEAD".

**CAUTION: Prevent to scratch cylinder head by excessive boring.**

11. Remove valve guide (EXH), if valve guide (EXH) must be replaced.
  - a. To remove valve guide (EXH), heat cylinder head to 110 to 130°C (230 to 266°F) by soaking in heated oil (A).



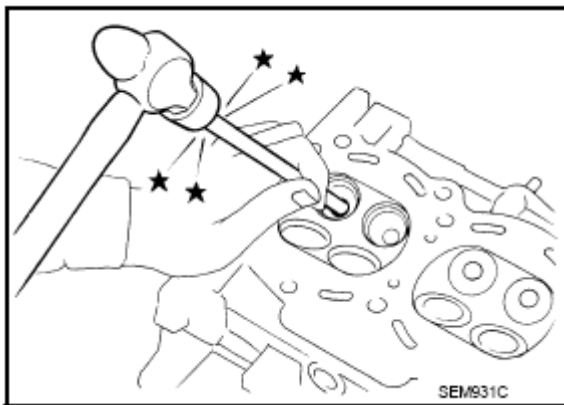
**Fig. 215: Heating Cylinder Head**

Courtesy of NISSAN NORTH AMERICA, INC.

- b. Drive out valve guide (EXH) with a press [under a 20 kN (2 ton, 2.2 US ton, 2.0 Imp ton) pressure] or a hammer and the valve guide drift (commercial service tool).

**WARNING: Cylinder head contains heat. When working, wear protective**

equipment to avoid getting burned.



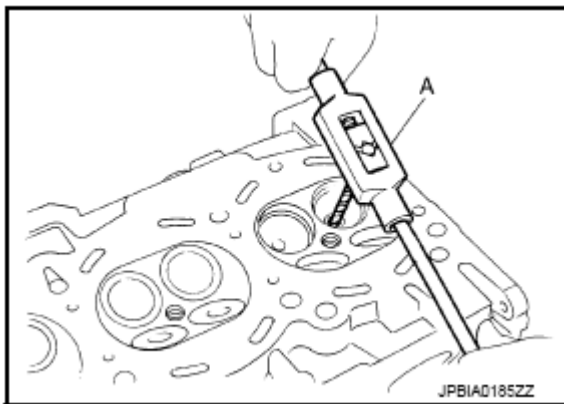
**Fig. 216: Driving Out Valve Guide**  
Courtesy of NISSAN NORTH AMERICA, INC.

#### ASSEMBLY

1. If valve guide (EXH) is removed in step 11 (DISASSEMBLY), install it. Replace with oversized [0.2 mm (0.008 in)] valve guide (EXH).
  - a. Using the valve guide reamer (commercial service tool) (A), ream cylinder head valve guide (EXH) hole.

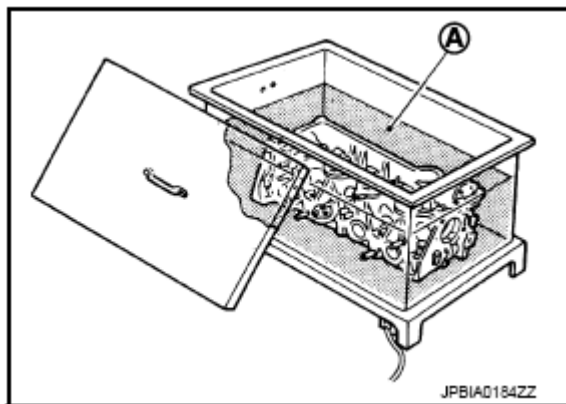
**Oversize (service) [0.2 mm (0.008 in)]:**

**: Refer to "CYLINDER HEAD".**



**Fig. 217: Reaming Cylinder Head Valve Guide Hole**  
Courtesy of NISSAN NORTH AMERICA, INC.

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

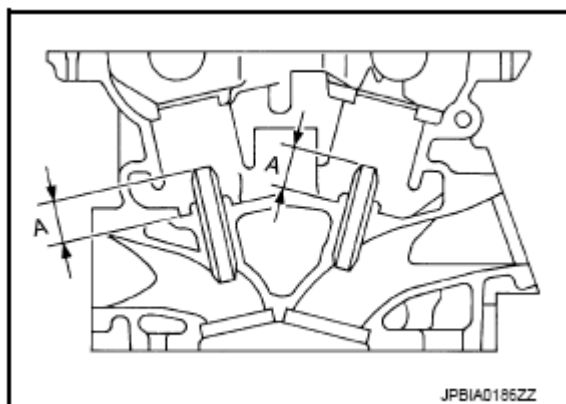


**Fig. 218: Heating Cylinder Head**

Courtesy of NISSAN NORTH AMERICA, INC.

- c. Using the valve guide drift (commercial service tool), press valve guide (EXH) from camshaft side to the dimensions as shown in the figure below.

**Projection (A):** Refer to "CYLINDER HEAD".



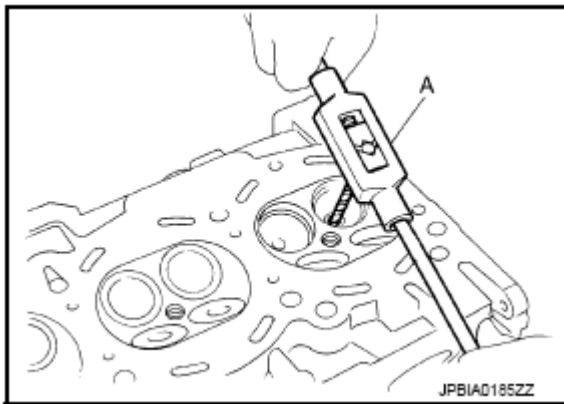
**Fig. 219: Identifying Valve Guide Installation Dimensions**

Courtesy of NISSAN NORTH AMERICA, INC.

**WARNING:** Cylinder head contains heat. When working, wear protective equipment to avoid getting burned.

- d. Using the valve guide reamer (commercial service tool) (A), apply reamer finish to valve guide (EXH).

**Standard:** Refer to "CYLINDER HEAD".

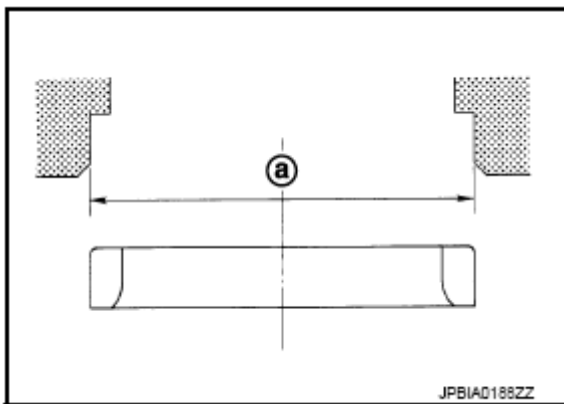


**Fig. 220: Reaming Cylinder Head Valve Guide Hole**  
Courtesy of NISSAN NORTH AMERICA, INC.

2. If valve seat (EXH) is removed in step 10 (DISASSEMBLY), install it. Replace with oversize [0.5 mm (0.020 in)] valve seat (EXH).
  - a. Ream cylinder head recess diameter (a) for service valve seat (EXH).

**Oversize (service) [0.5 mm (0.020 in)]:**

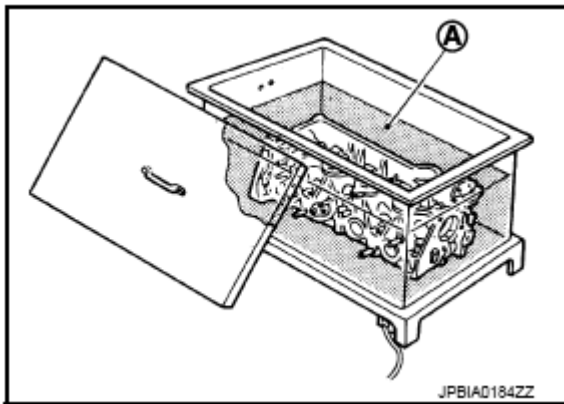
**: Refer to "CYLINDER HEAD".**



**Fig. 221: Identifying Cylinder Head Recess Diameter**  
Courtesy of NISSAN NORTH AMERICA, INC.

- Be sure to ream in circles concentric to valve guide center. This will enable valve to fit correctly.
- b. Heat cylinder head to 110 to 130°C (230 to 266°F) by soaking in heated oil (A).





**Fig. 222: Heating Cylinder Head**

Courtesy of NISSAN NORTH AMERICA, INC.

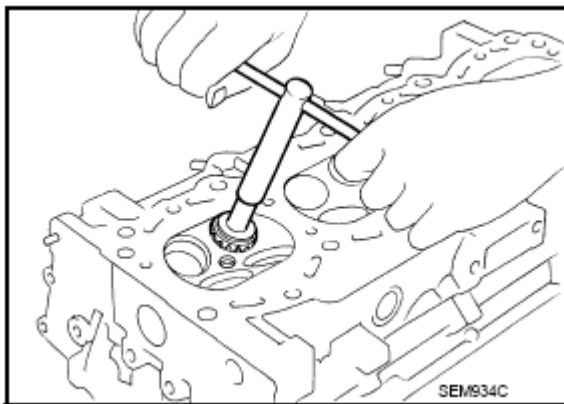
- c. Provide valve seats (EXH) cooled well with dry ice. Force fit valve seat (EXH) into cylinder head.

**WARNING:** Cylinder head contains heat. When working, wear protective equipment to avoid getting burned.

**CAUTION:** Avoid directly touching cold valve seats.

- d. Using the valve seat cutter set (commercial service tool) or valve seat grinder, finish seat to the specified dimensions. Refer to "**CYLINDER HEAD**".

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



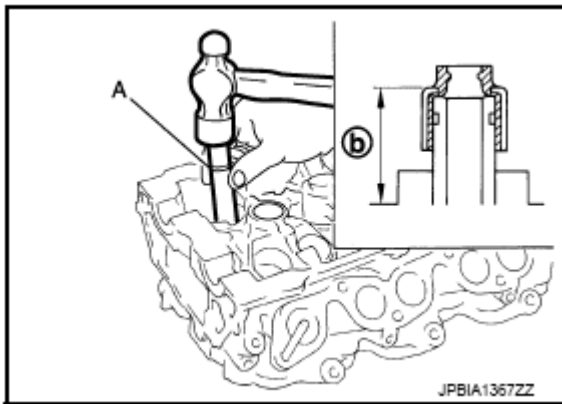
**Fig. 223: Cutting Valve Seat**

**Courtesy of NISSAN NORTH AMERICA, INC.**

- e. Using compound, grind to adjust valve fitting.
  - f. Check again for normal contact. Refer to "Valve Seat Contact".
3. Install new valve oil seals as follows.
- a. Apply new engine oil on new valve oil seal joint and seal lip.
  - b. Using the valve oil seal drift [SST: KV10115600 (J-38958)] (A), press fit valve seal to height (b) shown in figure below.

**NOTE:**      **Dimension: Height measured before valve spring seat installation**

**Height (b): 14.3 - 14.9 mm (0.563 - 0.587 in)**



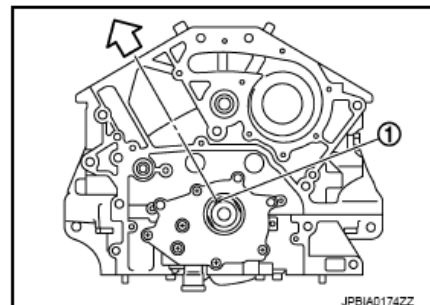
**Fig. 224: Installing Valve Oil Seal**  
**Courtesy of NISSAN NORTH AMERICA, INC.**

- 4. Install valve spring seat.
- 5. Install valve.

**NOTE:**      **Larger diameter valves are for intake side.**

- 6. Install new cylinder head gaskets.
- 7. Turn crankshaft until No. 1 piston is set at TDC.

- 1 : Crankshaft key
- ↶ : Bank 1 side

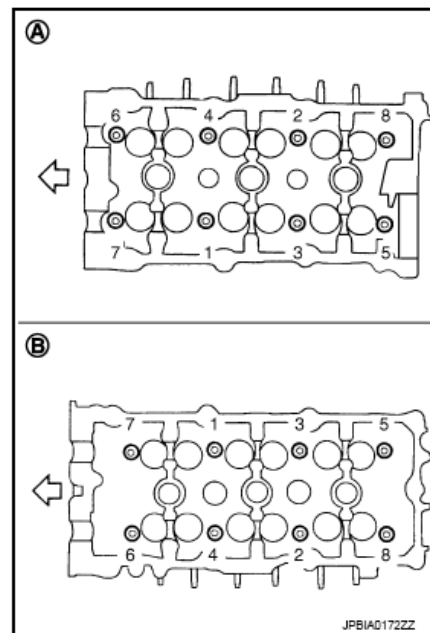


**Fig. 225: Identifying Crankshaft Key**

Courtesy of NISSAN NORTH AMERICA, INC.

- Crankshaft key should line up with the cylinder center line (bank 1) as shown in the figure below.
8. Install cylinder head, and tighten cylinder head bolts in numerical order (as shown in figure below) as follows:

A : Bank 1  
 B : Bank 2  
 ⇐ : Engine front

**Fig. 226: Cylinder Head Bolt Tightening Sequence**

Courtesy of NISSAN NORTH AMERICA, INC.

- Use the cylinder head bolt wrench [commercial service tool: - (J-24239-01)] and power tool.

**CAUTION:**

- If cylinder head bolts are reused, check their outer diameters before installation. Refer to "INSPECTION".
- Before installing cylinder head, inspect cylinder head distortion. Refer to "INSPECTION".

- Apply new engine oil to threads and seat surfaces of cylinder head bolts.
- Tighten all cylinder head bolts.

**Torque: 105 N.m (11 kg-m, 77 ft-lb)**

- Completely loosen all cylinder head bolts.

**Torque: 0 N.m (0 kg-m, 0 ft-lb)**

**CAUTION:** In step "c", loosen bolts in the reverse order of that indicated in

the figure.

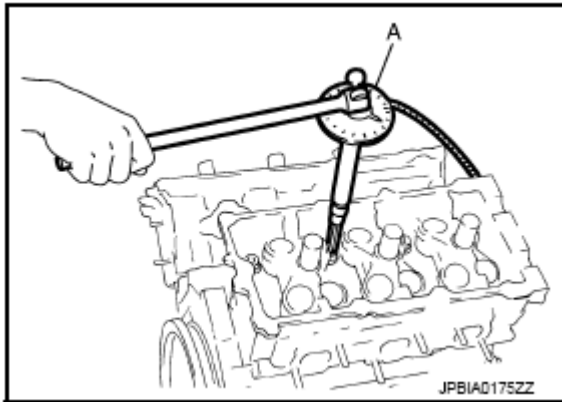
- d. Tighten all cylinder head bolts.

**Torque: 40.0 N.m (4.1 kg-m, 30 ft-lb)**

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

**CAUTION: Check the tightening angle using the angle wrench [SST: KV10112100 (BT8653-A)] (A). Never make judgment by visual inspection.**

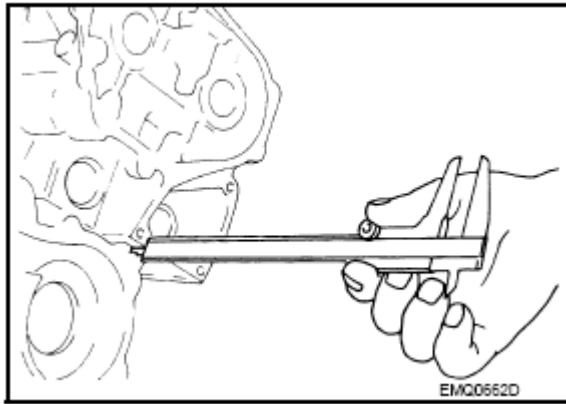
- Check tightening angle indicated on the angle wrench indicator plate.
- f. Turn all cylinder head bolts 95 degrees clockwise again (angle tightening).



**Fig. 227: Checking Cylinder Head Bolts Tightening Angle Using Angle Wrench**  
Courtesy of NISSAN NORTH AMERICA, INC.

9. After installing cylinder head, measure distance between front end faces of cylinder block and cylinder head (bank 1 and bank 2).

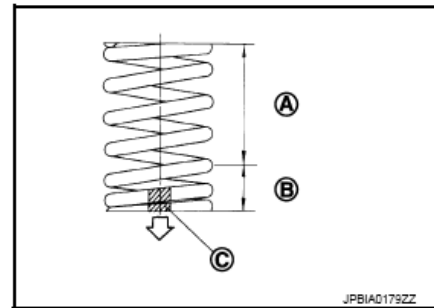
**Standard: 14.1 - 14.9 mm (0.555 - 0.587 in)**



**Fig. 228: Measuring Distance Between Cylinder Block Front End Face And Cylinder Head**  
Courtesy of NISSAN NORTH AMERICA, INC.

- If measured value is out of the standard, reinstall cylinder head.
10. Install valve spring (uneven pitch type).
- Install narrow pitch (B) end [paint mark (C)] to cylinder head side (valve spring seat side).

A : Wide pitch  
⇐ : Cylinder head side



**Fig. 229: Identifying Valve Spring Narrow Pitch End & Paint Mark**  
Courtesy of NISSAN NORTH AMERICA, INC.

#### Paint mark color

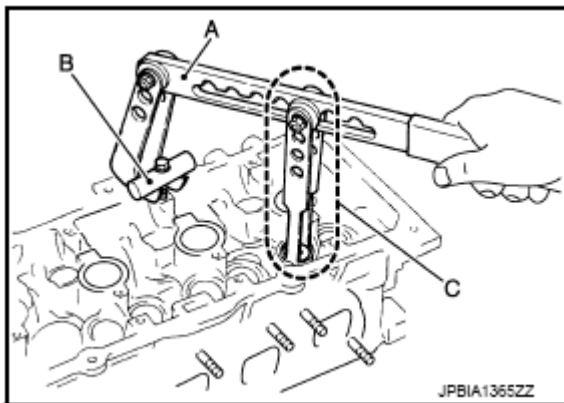
**Intake: Purple**

**Exhaust: Yellowish green**

11. Install valve spring retainer.
12. Install valve collet.
- Compress valve spring with the valve spring compressor [SST: KV10116200 (J-26336-A)] (A), the attachment [SST: KV10115900 (J-26336-20)] (C) and the adapter [SST: KV10109220 (-)] (B). Install valve collet with a magnet hand.

**CAUTION: When working, take care not to damage valve lifter holes.**

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



**Fig. 230: Compressing Valve Spring**  
Courtesy of NISSAN NORTH AMERICA, INC.

13. Install valve lifter.
  - Install it in the original position.
14. Install spark plug with spark plug wrench (commercial service tool).
15. Install in the reverse order of removal after this step.

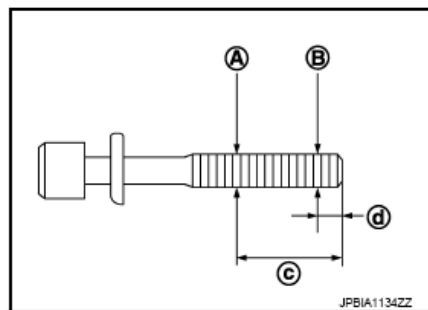
### Inspection

#### INSPECTION AFTER DISASSEMBLY

#### Cylinder Head Bolts Outer Diameter

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

c : 48 mm (1.89 in)  
d : 11 mm (0.43 in)



**Fig. 231: Identifying Cylinder Head Bolt Dimensions**  
Courtesy of NISSAN NORTH AMERICA, INC.

**Limit [(B) - (A)]: 0.18 mm (0.0071 in)**

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

**Cylinder Head Distortion**

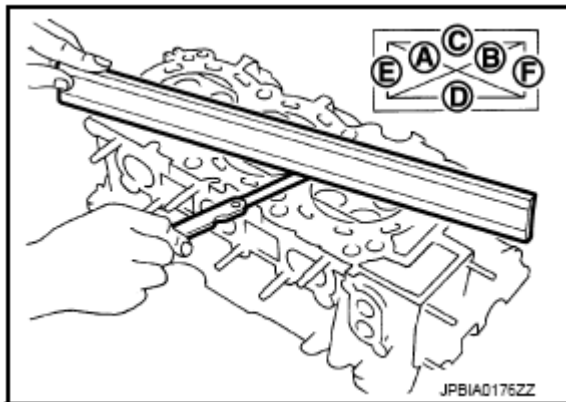
**NOTE:** When performing this inspection, cylinder block distortion should be also checked. Refer to "INSPECTION".

1. Using a scraper, wipe off oil, scale, gasket, sealant and carbon deposits from surface of cylinder head.

**CAUTION:** Never allow gasket fragments to enter engine oil or engine coolant passages.

2. At each of several locations on bottom surface of cylinder head, measure the distortion in six directions (A), (B), (C), (D), (E), and (F).

**Limit:** Refer to "CYLINDER HEAD".



**Fig. 232: Measuring Cylinder Head Distortion**  
Courtesy of NISSAN NORTH AMERICA, INC.

- If it exceeds the limit, replace VVEL ladder assembly and cylinder head assembly.

**NOTE:** Cylinder head assembly cannot be replaced as a single part, because it is machined together with VVEL ladder assembly.

**Valve Dimensions**

- Check the dimensions of each valve. For the dimensions, refer to "CYLINDER HEAD".
- If dimensions are out of the standard.
  - Replace valve (EXH) and check valve seat contact. Refer to "Valve Seat Contact". (Exhaust side)
  - Replace VVEL ladder assembly and cylinder head assembly. Refer to "EXPLODED VIEW". (Intake side)

**NOTE:** Since the valve (INT) cannot be replaced by the piece, VVEL ladder

**assembly and cylinder head assembly replacement are required.**

#### Valve Guide Clearance

#### Valve Stem Diameter

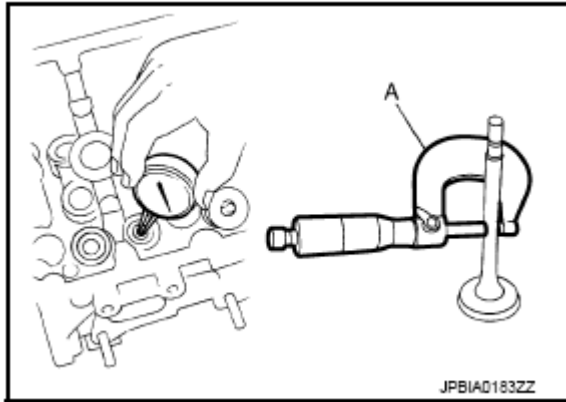
- Measure the diameter of valve stem with micrometer (A).

**Standard: Refer to "CYLINDER HEAD".**

#### Valve Guide Inner Diameter

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

**Standard: Refer to "CYLINDER HEAD".**



**Fig. 233: Measuring Inner Diameter Of Valve Guide Using Bore Gauge**  
Courtesy of NISSAN NORTH AMERICA, INC.

#### Valve Guide Clearance

- $(\text{Valve guide clearance}) = (\text{Valve guide inner diameter}) - (\text{Valve stem diameter})$

**Standard: Refer to "CYLINDER HEAD".**

- If the calculated value exceeds the limit.
  - Replace valve (EXH) and/or valve guide (EXH). Refer to "EXPLODED VIEW". (Exhaust side)
  - Replace VVEL ladder assembly and cylinder head assembly. Refer to "EXPLODED VIEW". (Intake side)

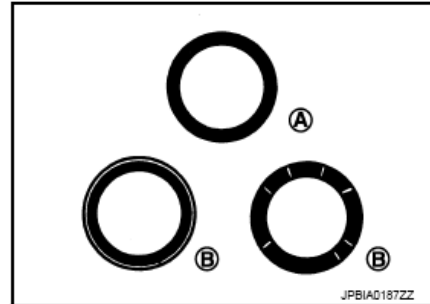
**NOTE:** Since the valve (INT) and valve guide (INT) cannot be replaced by the piece, VVEL ladder assembly and cylinder head assembly replacement are required.



**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.

A : OK  
B : NG



**Fig. 234: Checking Valve Seat Contact**  
Courtesy of NISSAN NORTH AMERICA, INC.

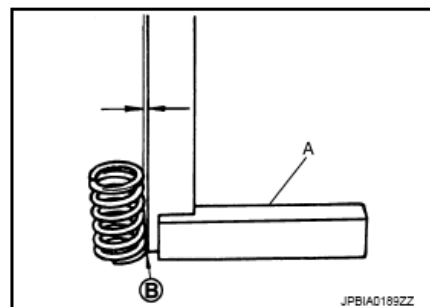
- If not, grind to adjust valve fitting and check again. If the contacting surface still has "NG" conditions even after the recheck, replace valve seat (EXH). Refer to "**EXPLODED VIEW**". (Exhaust side)
- If not, replace VVEL ladder assembly and cylinder head assembly. Refer to "**EXPLODED VIEW**". (Intake side)

**NOTE:** Since the valve seat (INT) cannot be replaced by the piece, VVEL ladder assembly and cylinder head assembly replacement are required.

**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.

B : Contact



**Fig. 235: Checking Valve Spring Squareness**  
Courtesy of NISSAN NORTH AMERICA, INC.

**Limit:** Refer to "**CYLINDER HEAD**".

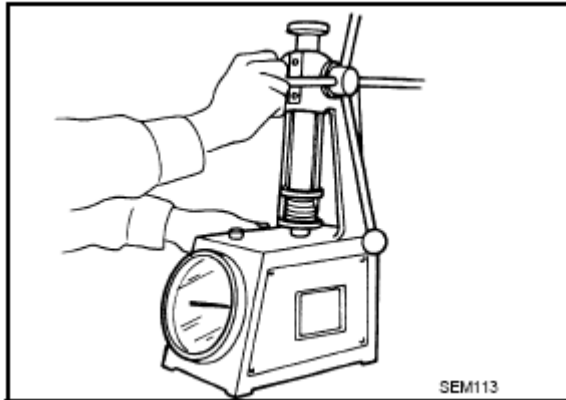
- If it exceeds the limit.
- Replace valve spring (EXH). Refer to "**EXPLODED VIEW**". (Exhaust side)
- Replace VVEL ladder assembly and cylinder head assembly. Refer to "**EXPLODED VIEW**". (Intake side)

**NOTE:** Since the valve spring (INT) cannot be replaced by the piece, VVEL ladder assembly and cylinder head assembly replacement are required.

#### Valve Spring Dimensions and Valve Spring Pressure Load

- Check the valve spring pressure at specified spring height.

**Standard:** Refer to "**CYLINDER HEAD**".



**Fig. 236: Checking Valve Spring Pressure**  
Courtesy of NISSAN NORTH AMERICA, INC.

- If the installation load or load with valve open is out of the standard.
- Replace valve spring (EXH). Refer to "**EXPLODED VIEW**". (Exhaust side)
- Replace VVEL ladder assembly and cylinder head assembly. Refer to "**EXPLODED VIEW**". (Intake side)

**NOTE:** Since the valve spring (INT) cannot be replaced by the piece, VVEL ladder assembly and cylinder head assembly replacement are required.

#### INSPECTION AFTER INSTALLATION

##### Inspection for Leakage

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

- Before starting engine, check oil/fluid levels including engine coolant and engine oil. If any are less than

the required quantity, fill them to the specified level. Refer to "**FOR NORTH AMERICA: FLUIDS AND LUBRICANTS**".

- Follow the procedure below to check for fuel leakage.
  - Turn ignition switch to the "ON" position (with engine stopped). With fuel pressure applied to fuel piping, check for fuel leakage at connection points.
  - Start engine. With engine speed increased, check again for fuel leakage at connection points.
- Run engine to check for unusual noise and vibration.

**NOTE:** If hydraulic pressure inside chain tensioner drops after removal/installation, slack in guide may generate a pounding noise during and just after the engine start. However, this does not indicate a malfunction. The noise will stop after hydraulic pressure rises.

- Warm up engine thoroughly to check that there is no leakage of fuel, or any oil/fluids including engine oil and engine coolant.
- Bleed air from lines and hoses of applicable lines, such as in cooling system.
- After cooling down engine, again check oil/fluid levels including engine oil and engine coolant. Refill them to the specified level, if necessary.

#### SUMMARY OF INSPECTION ITEMS

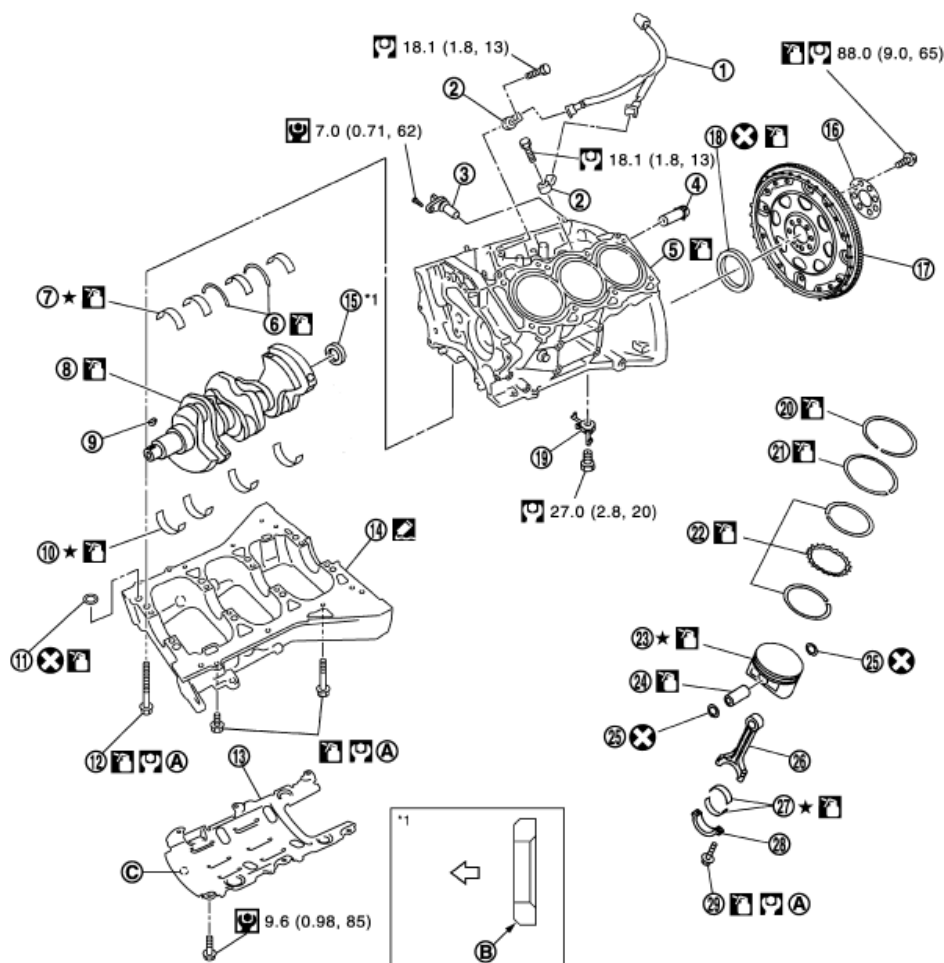
Items		Before starting engine	Engine running	After engine stopped
Engine coolant		Level	Leakage	Level
Engine oil		Level	Leakage	Level
Transmission/transaxle fluid	AT & CVT Models	Leakage	Level/Leakage	Leakage
	MT Models	Level/Leakage	Leakage	Level/Leakage
Other oils and fluids <sup>(1)</sup>		Level	Leakage	Level
Fuel		Leakage	Leakage	Leakage
Exhaust gases		-	Leakage	-

(1) Power steering fluid, brake fluid, etc.

## CYLINDER BLOCK

### Exploded View

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.

**SEC. 110•120•226**


JPB/A1827GB

- |                                       |                          |                               |
|---------------------------------------|--------------------------|-------------------------------|
| 1. Sub harness                        | 2. Knock sensor          | 3. Crankshaft position sensor |
| 4. Cylinder block heater (for Canada) | 5. Cylinder block        | 6. Thrust bearing             |
| 7. Main bearing (upper)               | 8. Crankshaft            | 9. Crankshaft key             |
| 10. Main bearing (lower)              | 11. O-ring               | 12. Lower cylinder block bolt |
| 13. Baffle plate                      | 14. Lower cylinder block | 15. Pilot converter           |
| 16. Reinforcement plate               | 17. Drive plate          | 18. Rear oil seal             |
| 19. Oil jet                           | 20. Top ring             | 21. Second ring               |
| 22. Oil ring                          | 23. Piston               | 24. Piston pin                |
| 25. Snap ring                         | 26. Connecting rod       | 27. Connecting rod bearing    |
| 28. Connecting rod bearing cap        | 29. Connecting rod bolt  |                               |

A. Comply with the assembly procedure when tightening. Refer to [EM-124](#).

B. Chamfered

C. Front mark

: Crankshaft side

**Fig. 237: Exploded View Of Cylinder Block With Torque Specifications**  
Courtesy of NISSAN NORTH AMERICA, INC.

### Disassembly and Assembly

#### DISASSEMBLY

1. Remove the following parts:
  - Oil pan (lower): Refer to "**EXPLODED VIEW**".
  - Oil pan (upper): Refer to "**2WD: EXPLODED VIEW**" (2WD models) or "**AWD: EXPLODED VIEW**" (AWD models).
  - Front and rear timing chain case: Refer to "**EXPLODED VIEW**" and "**EXPLODED VIEW**".
  - Cylinder head: Refer to "**EXPLODED VIEW**".
2. Remove knock sensor.

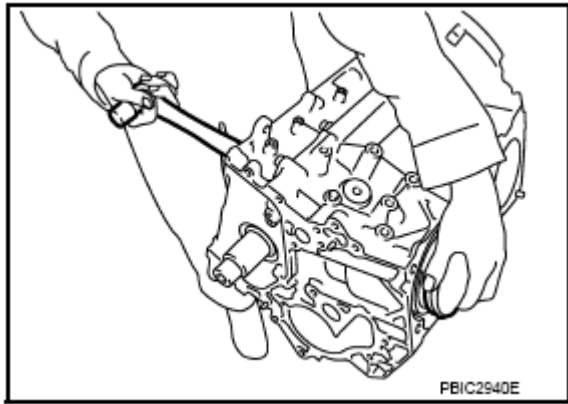
**CAUTION: Carefully handle sensor avoiding shocks.**

3. Remove baffle plate from lower cylinder block.
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 "**INSPECTION**".

**CAUTION: Be careful not to drop connecting rod bearing, and to scratch the surface.**

- a. Position crankshaft pin corresponding to connecting rod to be removed onto the bottom dead center.
- b. Remove connecting rod bearing cap.
- c. Using a hammer handle or similar tool, push piston and connecting rod assembly out to the cylinder head side.

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



**Fig. 238: Removing Piston And Connecting Rod Assembly**  
Courtesy of NISSAN NORTH AMERICA, INC.

5. Remove connecting rod bearings from connecting rod and connecting rod bearing cap.

**CAUTION:**

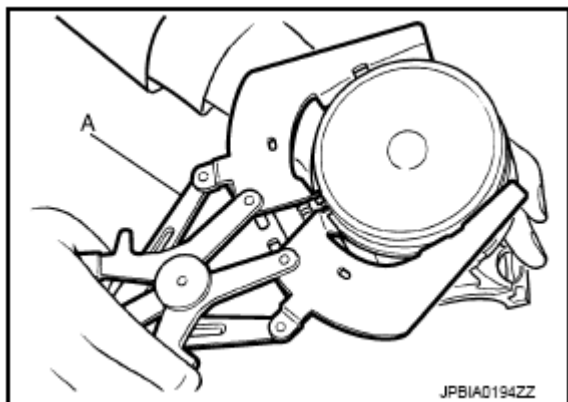
- Be careful not to drop connecting rod bearing, and to scratch the surface.
- Identify installation positions, and store them without mixing them up.

6. Remove piston rings from piston.

- Before removing piston rings, check the piston ring side clearance. Refer to "INSPECTION".
- Use a piston ring expander (commercial service tool) (A).

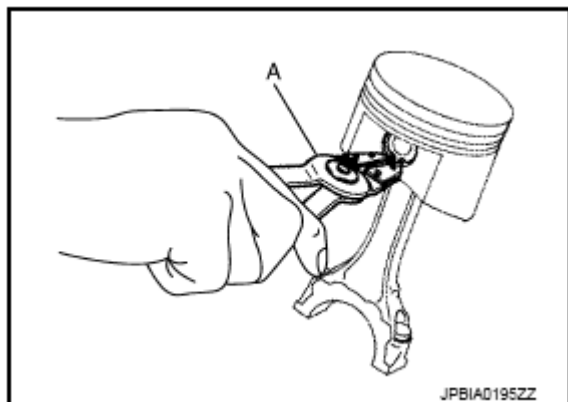
**CAUTION:**

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



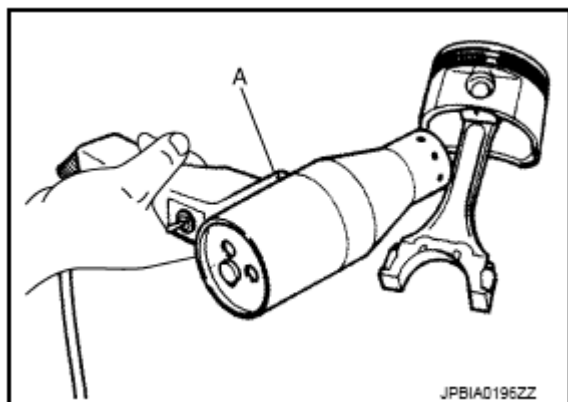
**Fig. 239: Removing/Installing Piston Rings**  
Courtesy of NISSAN NORTH AMERICA, INC.

7. Remove piston from connecting rod as follows:
- Using snap ring pliers (A), remove snap rings.



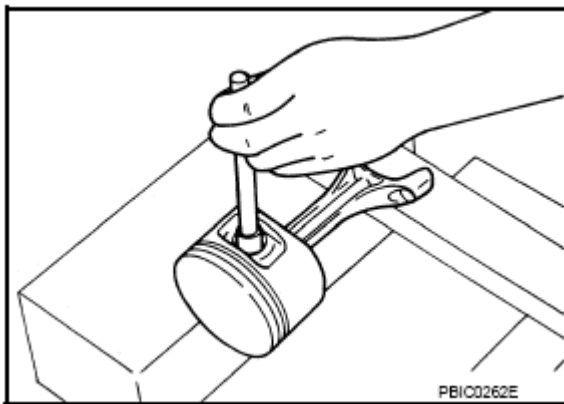
**Fig. 240: Removing Snap Rings**  
Courtesy of NISSAN NORTH AMERICA, INC.

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



**Fig. 241: Heating Piston**  
Courtesy of NISSAN NORTH AMERICA, INC.

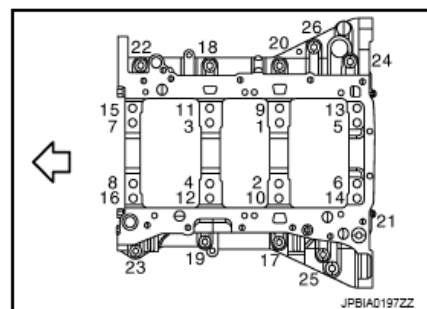
- Push out piston pin using a stick than has an outer diameter of approximately 20 mm (0.79 in).



**Fig. 242: Removing Piston Pin**  
Courtesy of NISSAN NORTH AMERICA, INC.

8. Remove lower cylinder block bolts.
  - Before loosening lower cylinder block bolts, measure the crankshaft end play. Refer to "INSPECTION".
  - Loosen lower cylinder block bolts in reverse of the order shown in the figure below in several different steps.

← : Engine front



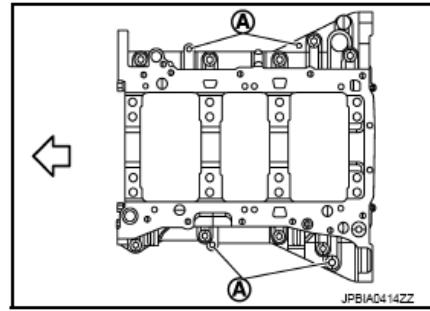
**Fig. 243: Lower Cylinder Block Bolt Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

9. Remove lower cylinder block as follows:

Screw M8 bolt [pitch: 1.25 mm (0.049 in) length: approximately 50 mm (1.97 in)] into bolt holes (A). Then equally tighten each bolt, and remove lower cylinder block.



← : Engine front



**Fig. 244: Removing Lower Cylinder Block Using Bolts**

Courtesy of NISSAN NORTH AMERICA, INC.

**CAUTION:**

- Be careful not to damage the mounting surfaces.
- Never tighten bolts excessively.
- Never insert screwdriver, this will damage the mating surface.

10. Remove crankshaft.
11. Pull rear oil seal out from rear end of crankshaft.
12. Remove main bearings and thrust bearings from cylinder block and lower cylinder block.

**CAUTION:**

- Be careful not to drop main bearing, and to scratch the surface.
- Identify installation positions, and store them without mixing them up.

13. Remove oil jet.




**ASSEMBLY**


**CAUTION: Do not reuse O-rings or washers.**

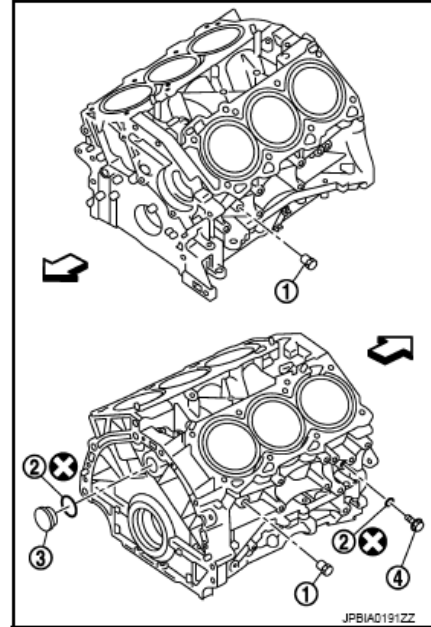
1. Fully air-blow engine coolant and engine oil passages in cylinder block, cylinder bore and crankcase to remove any foreign material.

**CAUTION: Use goggles to protect your eyes.**

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

Symbol	Description
	N·m (kg-m, ft-lb)
	N·m (kg-m, in-lb)
	Always replace after disassembly.

- 3 : Plug  
 : Engine front



**Fig. 245: Identifying Water Drain Plug & Washer**  
 Courtesy of NISSAN NORTH AMERICA, INC.

- Apply sealant to the thread of water drain plug (1).

**Use Genuine RTV Silicone Sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS".**

- Apply sealant to the thread of plug (4).

**Use Genuine High Strength Thread Locking Sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS".**

- Replace washers (2) with new ones.

**CAUTION: Do not reuse washers.**

- Tighten each plug as specified below.

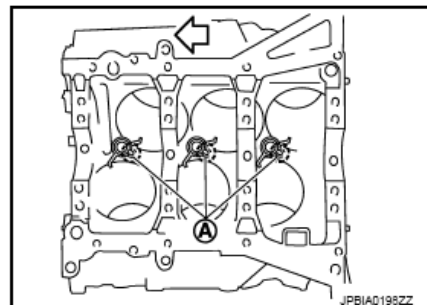
Unit: N.m (kg-m, ft-lb)		
Part	Washer	Tightening torque
1	No	19.6 (2.0, 14)

3	Yes	78.0 (8.0, 58)
4	Yes	12.3 (1.3, 9)

3. Install oil jet.

- Insert oil jet dowel pin (A) into cylinder block dowel pin hole, and tighten mounting bolts.

↔ : Engine front



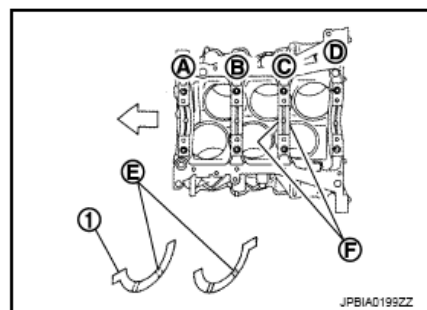
**Fig. 246: Identifying Oil Jet Dowel Pin**  
Courtesy of NISSAN NORTH AMERICA, INC.

4. Install main bearings and thrust bearings as follows:

**CAUTION: Be careful not to drop main bearing, and to scratch the surface.**


- Remove dust, dirt, and engine oil on bearing mating surfaces of cylinder block and lower cylinder block.
- Install thrust bearings (1) to both sides of the No. 3 journal housing on cylinder block.

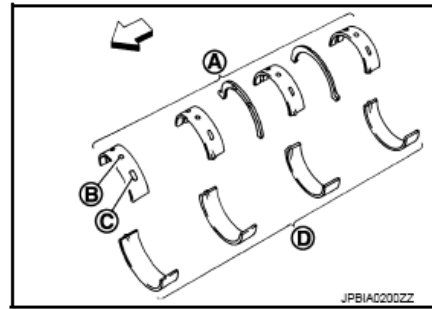
A : No. 1  
B : No. 2  
C : No. 3  
D : No. 4  
F : Thrust bearing installation position  
↔ : Engine front



**Fig. 247: Identifying Thrust Bearing Installation Positions**  
Courtesy of NISSAN NORTH AMERICA, INC.

- Install thrust bearings with the oil groove (E) facing crankshaft arm (outside).
- Install main bearings paying attention to the direction.

- A : Cylinder block side  
 D : Lower cylinder block side  
 : Engine front



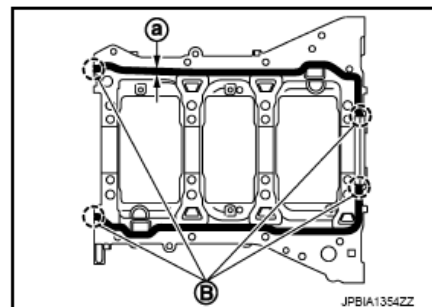
**Fig. 248: Identifying Main Bearing Oil Hole And Groove**  
 Courtesy of NISSAN NORTH AMERICA, INC.

- Main bearing with oil hole (B) and groove (C) goes on cylinder block. The one without them goes on lower cylinder block.
  - Before installing main bearings, apply engine oil to the bearing surface (inside). Do not apply engine oil to the back surface, but thoroughly clean it.
  - When installing, align main bearing stopper protrusion to cutout of cylinder block and lower cylinder block.
  - Ensure the oil holes on cylinder block and those on the corresponding bearing are aligned.
5. Install crankshaft to cylinder block.
    - While turning crankshaft by hand, check that it turns smoothly.
  6. Install lower cylinder block.

**NOTE:** Lower cylinder block cannot be replaced as a single part, because it is machined together with cylinder block.

- Apply a continuous bead of liquid gasket with the tube presser (commercial service tool) to lower cylinder block as shown in the figure below.

- B : Apply to end  
 a :  $\phi 4.0 - 5.0$  mm (0.157 - 0.197 in)



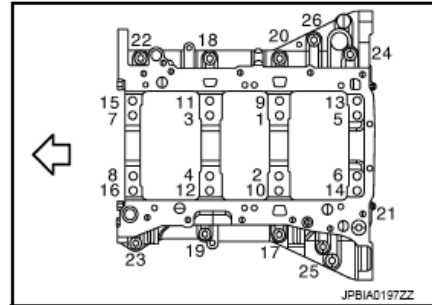
**Fig. 249: Identifying Liquid Gasket**  
 Courtesy of NISSAN NORTH AMERICA, INC.

**Use Genuine RTV Silicone Sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS".**

7. Inspect the outer diameter of lower cylinder block bolt. Refer to "INSPECTION".

8. Install lower cylinder block bolts in numerical order (as shown in the figure below) as follows:
  - a. Apply new engine oil to threads and seat surfaces of lower cylinder block bolts.
  - b. Tighten bolts (No. 17 to 26) in numerical order as shown in the figure below.

← : Engine front



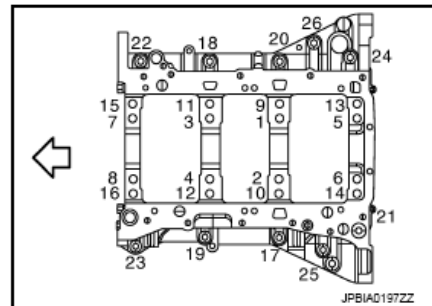
**Fig. 250: Lower Cylinder Block Bolt Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

**Torque: 25.0 N.m (2.6 kg-m, 18 ft-lb)**

**CAUTION: Do not reuse O-rings.**

- c. Repeat step b.
- d. Tighten bolts (No. 1 to 16) in numerical order as shown in the figure below.

← : Engine front



**Fig. 251: Lower Cylinder Block Bolt Tightening Sequence**  
Courtesy of NISSAN NORTH AMERICA, INC.

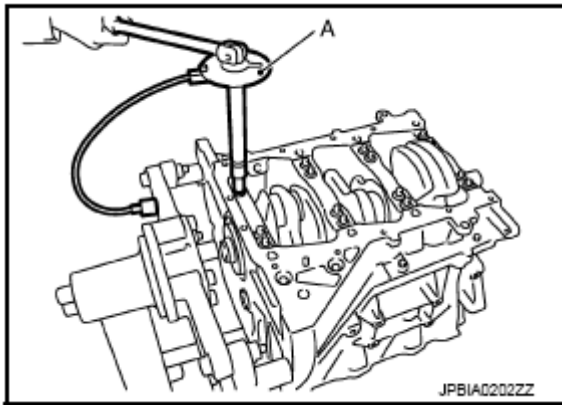
**NOTE: Use TORX socket for bolts No. 1 to 16.**

**Torque: 35.3 N.m (3.6 kg-m, 26 ft-lb)**

- e. Turn bolts (No. 1 to 16) 90 degrees clockwise (angle tightening).

**CAUTION: Use the angle wrench [SST: KV10112100 (BT8653-A)] (A) to check tightening angle. Never make judgment by visual**

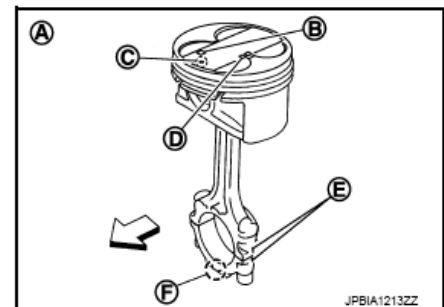
inspection.



**Fig. 252: Checking Cylinder Head Bolts Tightening Angle Using Angle Wrench**  
Courtesy of NISSAN NORTH AMERICA, INC.

- After installing lower cylinder block bolts, check that crankshaft can be rotated smoothly by hand.
  - Check the crankshaft end play. Refer to "INSPECTION".
9. Install piston to connecting rod as follows:
- a. Using snap ring pliers, install new snap ring to the groove of piston rear side.
    - Insert it fully into groove to install.
  - b. Install piston to connecting rod.
    - Using an industrial use dryer or similar tool, heat piston until piston pin can be pushed in by hand without excess force [approximately 60 to 70°C (140 to 158°F)]. From the front to the rear, insert piston pin into piston and connecting rod.
    - Assemble so that the front mark on the piston head and the cylinder number on connecting rod are positioned as shown in the figure below.

- A : Example RH  
 B : Piston grade number  
 C : Front mark  
 D : Pin grade number  
 E : Cylinder number  
 F : Front mark  
 ⇐ : Engine front



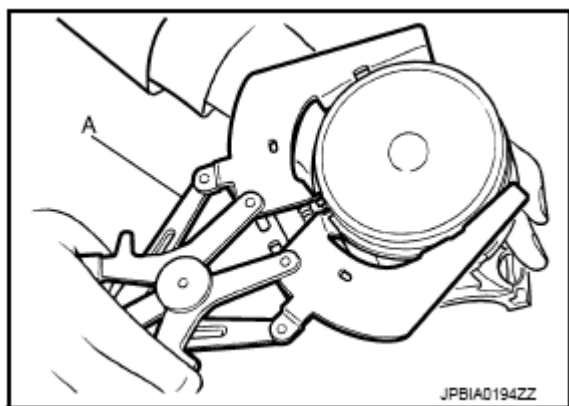
**Fig. 253: Identifying Piston Grade Number, Front Mark, Pin Grade Number, Cylinder Number And Front Mark**  
Courtesy of NISSAN NORTH AMERICA, INC.

- 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.
10. Using a piston ring expander (commercial service tool) (A), install piston rings.

**CAUTION:**

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



**Fig. 254: Removing/Installing Piston Rings**

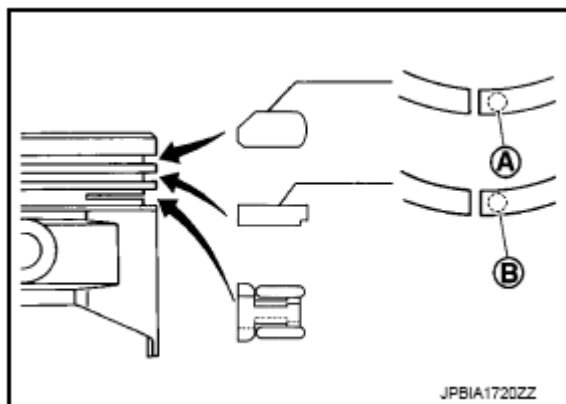
Courtesy of NISSAN NORTH AMERICA, INC.

- If there is stamped mark on ring, mount it with marked side up.

**Stamped mark:**

**Top ring (A): 1 N**

**Second ring (B): 2 N**

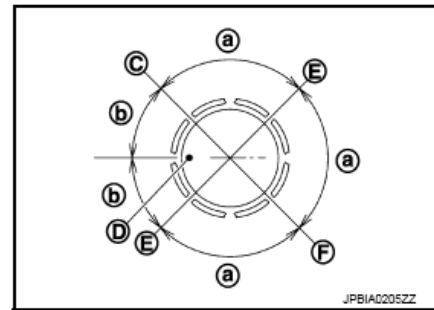


**Fig. 255: Identifying Stamped Marks On Top And Second Ring**

Courtesy of NISSAN NORTH AMERICA, INC.

- Position each ring with the gap as shown in the figure below referring to the piston front mark (D).

- C : Top ring gap  
 E : Oil ring upper or lower rail gap (either of them)  
 F : Second ring and oil ring spacer gap  
 a : 90 degrees  
 b : 45 degrees

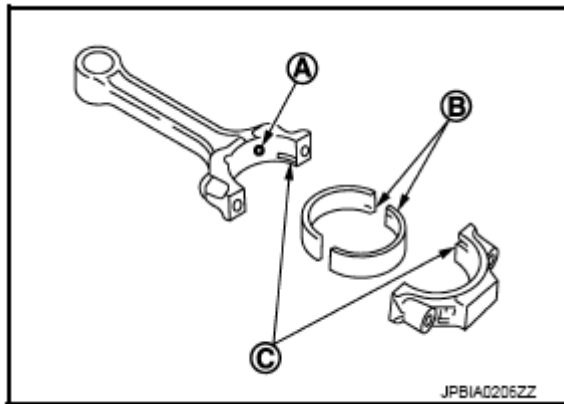


**Fig. 256: Identifying Gap Between Piston Rings**  
 Courtesy of NISSAN NORTH AMERICA, INC.

- Check the piston ring side clearance. Refer to "INSPECTION".
11. Install connecting rod bearings to connecting rod and connecting rod bearing cap.

**CAUTION: Be careful not to drop connecting rod bearing, and to scratch the surface.**

- Before installing connecting rod bearings, apply engine oil to the bearing surface (inside). Do not apply engine oil to the back surface, but thoroughly clean it.
- When installing, align connecting rod bearing stopper protrusion (B) with cutout (C) of connecting rods and connecting rod bearing caps to install.
- Ensure the oil hole (A) on connecting rod and that on the corresponding bearing are aligned.



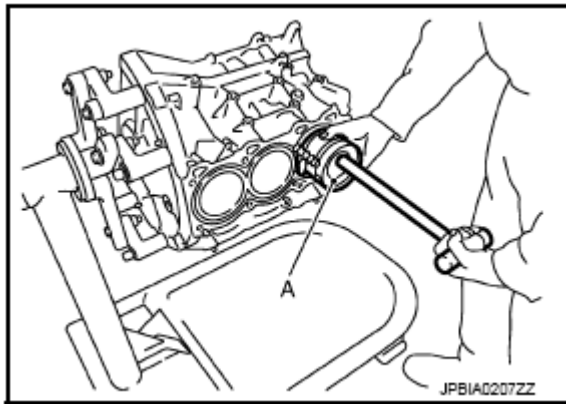
**Fig. 257: Identifying Connecting Rod Bearing Stopper Protrusion, Cutout And Oil Hole**  
 Courtesy of NISSAN NORTH AMERICA, INC.

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 engine oil sufficiently to the cylinder bore, piston and crankshaft pin journal.



- Match the cylinder position with the cylinder number on connecting rod to install.
- Be sure that front mark on piston crown is facing the front of the engine.
- Using a piston ring compressor [SST: EM03470000 (J-8037)] (A) or suitable tool, install piston with the front mark on the piston crown facing the front of the engine.

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

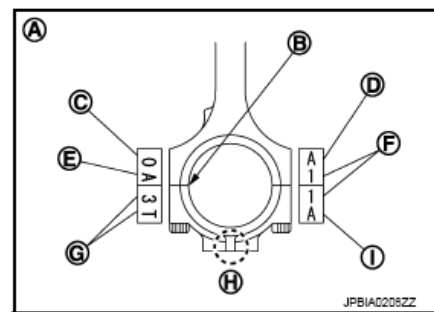


**Fig. 258: Installing Crankshaft Piston And Connecting Rod Assembly**  
Courtesy of NISSAN NORTH AMERICA, INC.

13. Install connecting rod bearing cap.

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

- A : Sample codes
- B : Bearing stopper groove
- C : Small-end diameter grade
- D : Big-end diameter grade
- E : Weight grade
- F : Cylinder No.
- G : Management code
- I : Management code



**Fig. 259: Identifying Stamped Cylinder Number Marks On Connecting Rod**  
Courtesy of NISSAN NORTH AMERICA, INC.

- Be sure that front mark (H) on connecting rod bearing cap is facing the front of the engine.

14. Tighten connecting rod bolt as follows:

- Inspect the outer diameter of connecting rod bolt. Refer to "**INSPECTION**".
- Apply engine oil to the threads and seats of connecting rod bolts.

- c. Tighten connecting rod bolts.

**Torque: 28.4 N.m (2.9 kg-m, 21 ft-lb)**

- d. Completely loosen connecting rod bolts.

**Torque: 0 N.m (0 kg-m, 0 ft-lb)**

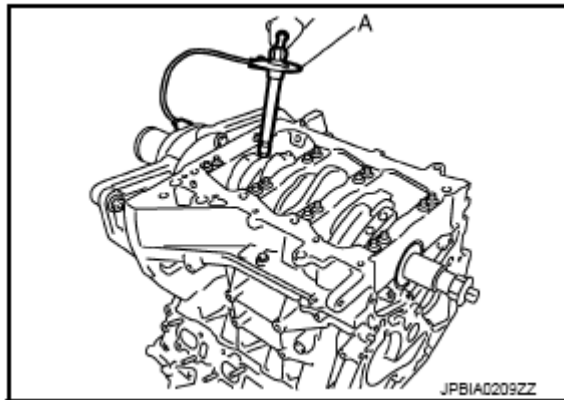
- e. Tighten connecting rod bolts.

**Torque: 24.5 N.m (2.5 kg-m, 18 ft-lb)**

- f. Then turn connecting rod bolts 90 degrees clockwise (angle tightening).

**CAUTION: Always use the angle wrench [SST: KV10112100 (BT8653-A)] (A). Never make judgment by visual inspection.**

- After tightening connecting rod bolts, check that crankshaft rotates smoothly.
- Check the connecting rod side clearance. Refer to "INSPECTION".

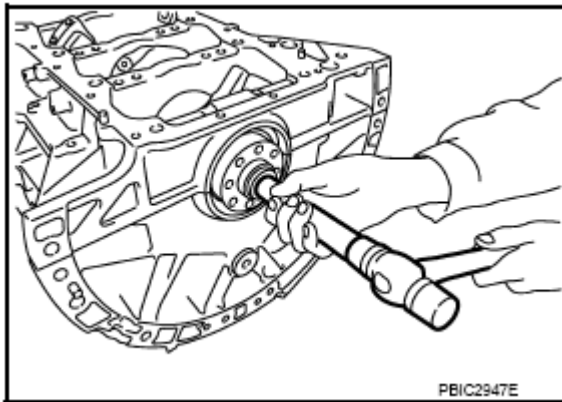


**Fig. 260: Checking Connecting Rod Bolt Tightening Angle Using Angle Wrench**  
**Courtesy of NISSAN NORTH AMERICA, INC.**

15. Install baffle plate.
16. Install new rear oil seal. Refer to "REAR OIL SEAL: REMOVAL AND INSTALLATION".
  - Apply new engine oil to both oil seal lip and dust seal lip.
17. Install pilot converter.
  - With a drift of the following outer diameter, press-fit as far as it will go.

**Pilot bushing: Approx. 17 mm (0.67 in)**

**Pilot converter: Approx. 33 mm (1.30 in)**

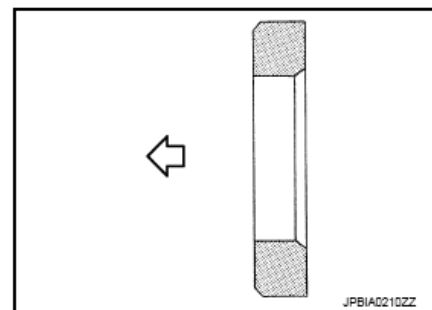


**Fig. 261: Installing Pilot Converter**

Courtesy of NISSAN NORTH AMERICA, INC.

- Press-fit pilot converter with its chamfer facing crankshaft as shown in the figure below.

← : Crankshaft side

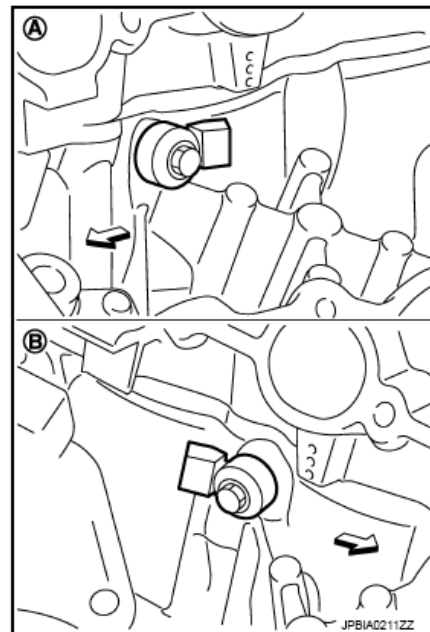


**Fig. 262: Identifying Pilot Converter Orientation**

Courtesy of NISSAN NORTH AMERICA, INC.

18. Install knock sensors.

A : Bank 1  
 B : Bank 2  
 ⇐ : Engine front



**Fig. 263: Identifying Knock Sensors**

Courtesy of NISSAN NORTH AMERICA, INC.

- Install knock sensor so that connector faces the rear of the engine.
- After installing knock sensor, connect harness connector, and lay it out to rear of the engine.

**CAUTION:**

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

**NOTE:**

- Check that there is no foreign material on the cylinder block mating surface and the back surface of knock sensor.
- Check that knock sensor does not interfere with other parts.

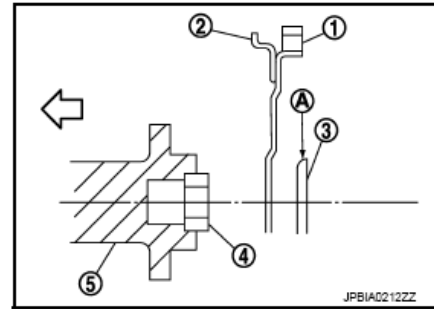
19. Note the following, assemble in the reverse order of disassembly after this step.

- When installing drive plate to crankshaft, be sure to correctly align crankshaft side dowel pin and drive plate side dowel pin hole.

**CAUTION:** If these are not aligned correctly, engine runs roughly and "MIL" illuminates.

- Install drive plate (2) and reinforcement plate (3) as shown in the figure below.

- 1 : Ring gear
- 4 : Pilot converter
- 5 : Crankshaft
- A : Rounded
- ⇐ : Engine front



**Fig. 264: Identifying Ring Gear, Pilot Converter, Crankshaft, Drive Plate And Reinforcement Plate**  
 Courtesy of NISSAN NORTH AMERICA, INC.

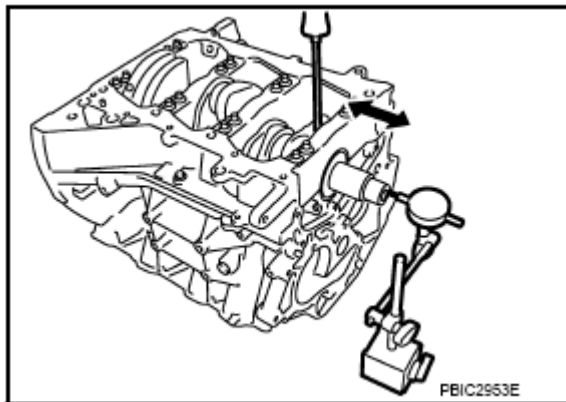
- Holding ring gear with the ring gear stopper [SST: KV10118600 (J-48641)].
- Tighten the mounting bolts crosswise over several times.

## Inspection

### CRANKSHAFT END PLAY

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

**Standard and limit: Refer to "CYLINDER BLOCK".**



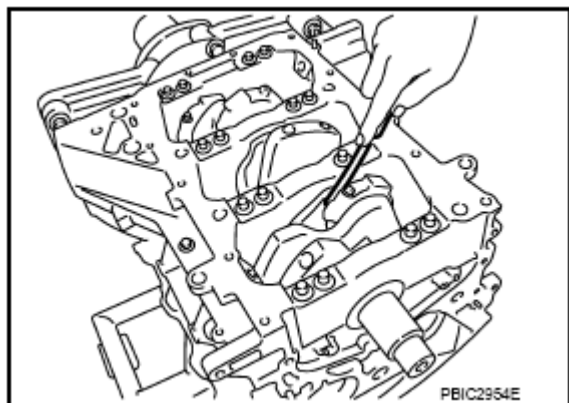
**Fig. 265: Measuring Crankshaft End Play**  
 Courtesy of NISSAN NORTH AMERICA, INC.

- 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.

**Standard and limit: Refer to "CYLINDER BLOCK".**



**Fig. 266: Measuring Connecting Rod Side Clearance**  
Courtesy of NISSAN NORTH AMERICA, INC.

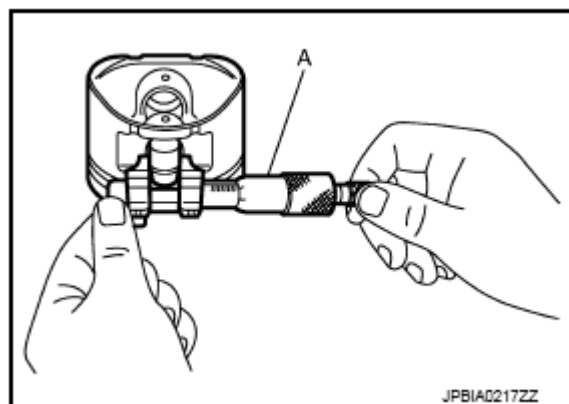
- If the measured value exceeds the limit, replace connecting rod, and measure again. If it still exceeds the limit, replace crankshaft also.

#### 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 "CYLINDER BLOCK".**

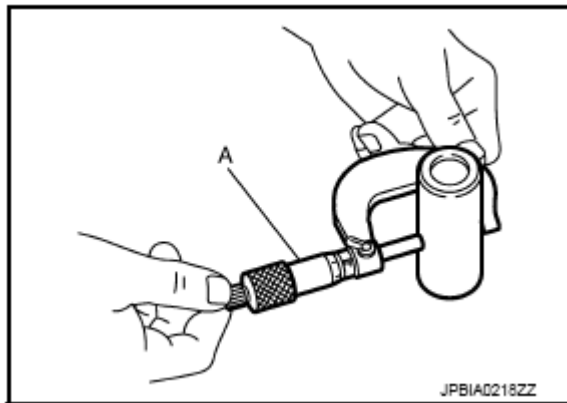


**Fig. 267: Measuring Piston Pin Hole Inner Diameter**  
Courtesy of NISSAN NORTH AMERICA, INC.

##### Piston Pin Outer Diameter

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

**Standard:** Refer to "CYLINDER BLOCK".



**Fig. 268: Measuring Piston Pin Outer Diameter**  
Courtesy of NISSAN NORTH AMERICA, INC.

#### Piston to Piston Pin Oil Clearance

(Piston to piston pin oil clearance) = (Piston pin hole diameter) - (Piston pin outer diameter)

**Standard:** Refer to "CYLINDER BLOCK".

- If the calculated value is out of the standard, replace piston and piston pin assembly.
- When replacing piston and piston pin assembly, refer to "DESCRIPTION".

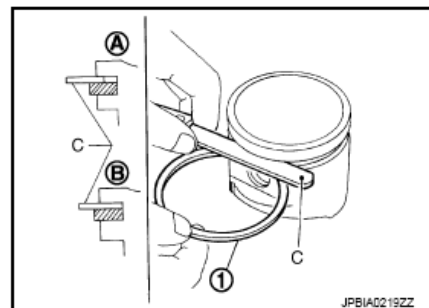
#### NOTE:

- 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 piston pin grades can be selected. (Only "0" grade is available.)

#### PISTON RING SIDE CLEARANCE

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

A : NG  
B : OK



**Fig. 269: Measuring Piston Ring Side Clearance**  
Courtesy of NISSAN NORTH AMERICA, INC.

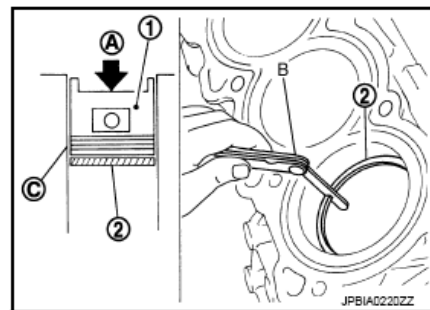
**Standard and limit: Refer to "CYLINDER BLOCK".**

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

A : Press-fit  
C : Measuring point



**Fig. 270: Measuring Piston Ring End Gap**  
Courtesy of NISSAN NORTH AMERICA, INC.

**Standard and limit: Refer to "CYLINDER BLOCK".**

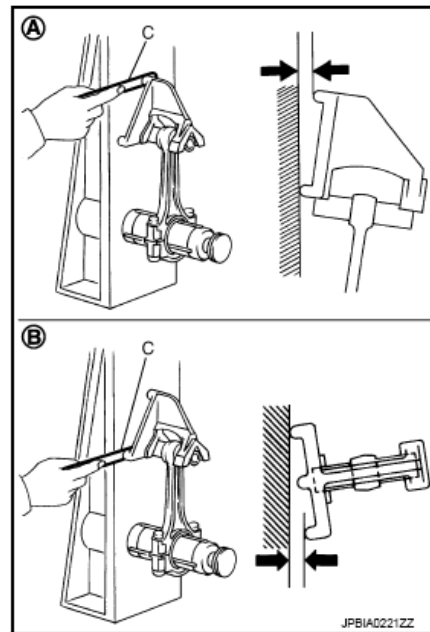
- If the measured value exceeds the limit, replace piston ring, and measure again. If it still exceeds the limit, rebore cylinder and use oversize piston and piston rings.

#### CONNECTING ROD BEND AND TORSION

- Check with a connecting rod aligner.



- A : Bend  
B : Torsion  
C : Feeler gauge



**Fig. 271: Checking Connecting Rod Using Connecting Rod Aligner**  
Courtesy of NISSAN NORTH AMERICA, INC.

#### Bend limit

: Refer to "CYLINDER BLOCK".

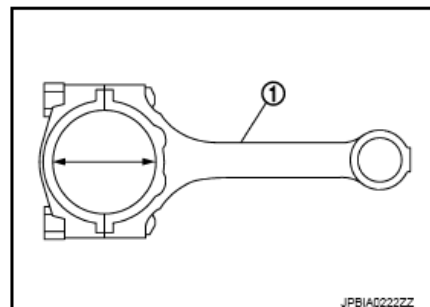
#### Torsion limit

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

#### CONNECTING ROD BIG END DIAMETER

- Install connecting rod bearing cap without installing connecting rod bearing, and tighten connecting rod bolts to the specified torque. Refer to "DISASSEMBLY AND ASSEMBLY" for the tightening procedure.

- 1 : Connecting rod



**Fig. 272: Identifying Connecting Rod Big End Diameter**  
Courtesy of NISSAN NORTH AMERICA, INC.

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

**Standard:** Refer to "CYLINDER BLOCK".

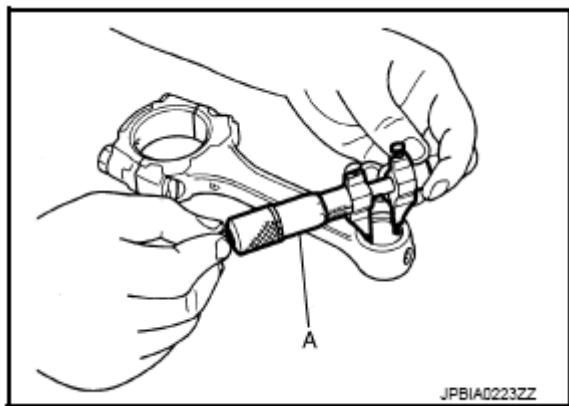
- If out of the standard, replace connecting rod assembly.

#### 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 "CYLINDER BLOCK".

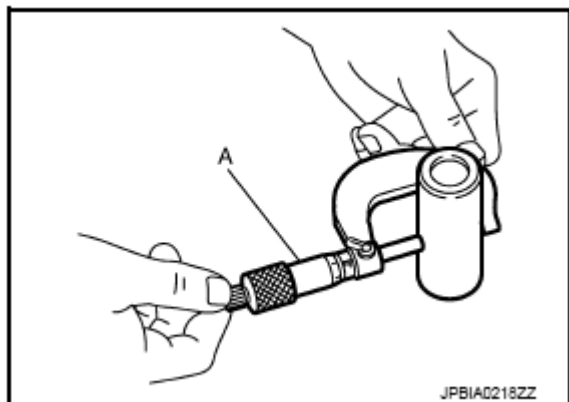


**Fig. 273: Measuring Connecting Rod Bushing Inner Diameter**  
Courtesy of NISSAN NORTH AMERICA, INC.

##### Piston Pin Outer Diameter

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

**Standard:** Refer to "CYLINDER BLOCK".



**Fig. 274: Measuring Piston Pin Outer Diameter**  
 Courtesy of NISSAN NORTH AMERICA, INC.

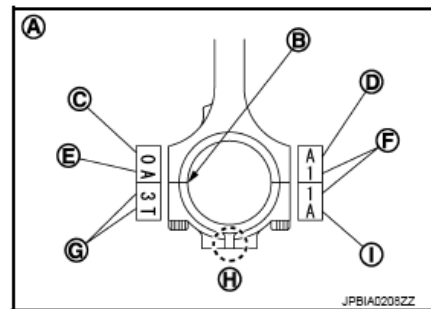
#### Connecting Rod Bushing Oil Clearance

(Connecting rod bushing oil clearance) = (Connecting rod bushing inner diameter) - (Piston pin outer diameter)

**Standard and limit: Refer to "CYLINDER BLOCK".**

- If the calculated value exceeds the limit, replace connecting rod assembly and/or piston and piston pin assembly.
- If replacing piston and piston pin assembly, refer to "**DESCRIPTION**".
- If replacing connecting rod assembly, refer to "**CONNECTING ROD BEARING**" to select the connecting rod bearing.

- A : Sample codes  
 B : Bearing stopper groove  
 C : Small-end diameter grade  
 D : Big-end diameter grade  
 E : Weight grade  
 F : Cylinder No.  
 G : Management code  
 H : Front mark  
 I : Management code



**Fig. 275: Identifying Connecting Rod Bearing Grade, Codes And Number**  
 Courtesy of NISSAN NORTH AMERICA, INC.

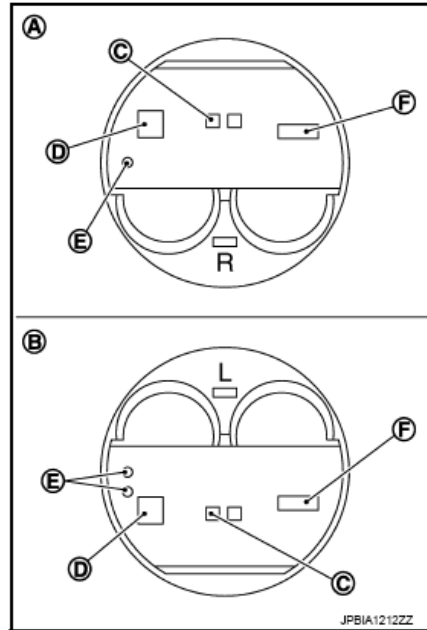
#### Factory installed parts grading:

- Service parts apply only to grade "0".
  - A. RH
  - B. LH
  - C. Piston pin grade number
  - D. Piston grade number
  - E. Front mark
  - F. Identification code

Unit: mm (in)		
Grade	0	1
Connecting rod bushing inner diameter <sup>(1)</sup>	22.000 - 22.006 (0.8661 - 0.8664)	22.006 - 22.012 (0.8664 - 0.8666)
Piston pin hole diameter	21.993 - 21.999 (0.8659 - 0.8661)	21.999 - 22.005 (0.8661 - 0.8663)

Piston pin outer diameter	21.989 - 21.995 (0.8657 - 0.8659)	21.995 - 22.001 (0.8659 - 0.8662)
(1) After installing in connecting rod		

- A : RH  
 B : LH  
 C : Piston pin grade number  
 D : Piston grade number  
 E : Front mark  
 F : Identification code



**Fig. 276: Identifying Piston Pin Grade Number, Piston Grade Number, Front Mark And Identification Code**

Courtesy of NISSAN NORTH AMERICA, INC.

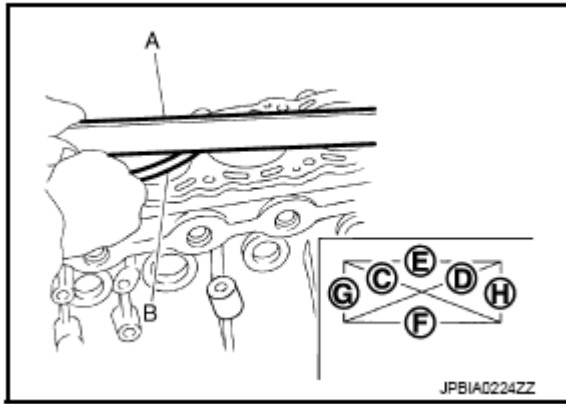
#### CYLINDER BLOCK DISTORTION

- 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 (C), (D), (E), (F), (G), and (H) with a straightedge (A) and a feeler gauge (B).

**Limit: Refer to "CYLINDER BLOCK".**



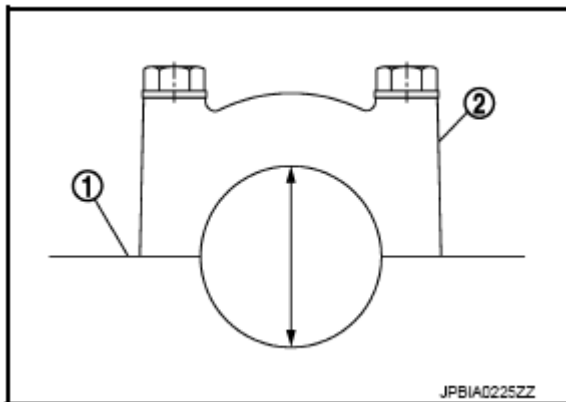
**Fig. 277: Measuring Cylinder Block Upper Face Distortion Using Straightedge And Feeler Gauge**  
 Courtesy of NISSAN NORTH AMERICA, INC.

- If it exceeds the limit, replace cylinder block.

#### MAIN BEARING HOUSING INNER DIAMETER

- Install lower cylinder block (2) without installing main bearings, and tighten lower cylinder block bolts to the specified torque. Refer to "**DISASSEMBLY AND ASSEMBLY**" for the tightening procedure.
- Measure the inner diameter of main bearing housing with a bore gauge.

**Standard: Refer to "CYLINDER BLOCK".**



**Fig. 278: Identifying Main Bearing Housing Inner Diameter**  
 Courtesy of NISSAN NORTH AMERICA, INC.

- If out of the standard, replace cylinder block (1) and lower cylinder block as assembly.

**NOTE:**      **Cylinder block cannot be replaced as a single part, because it is machined together with lower cylinder block.**

#### PISTON TO CYLINDER BORE CLEARANCE

**Cylinder Bore inner Diameter**

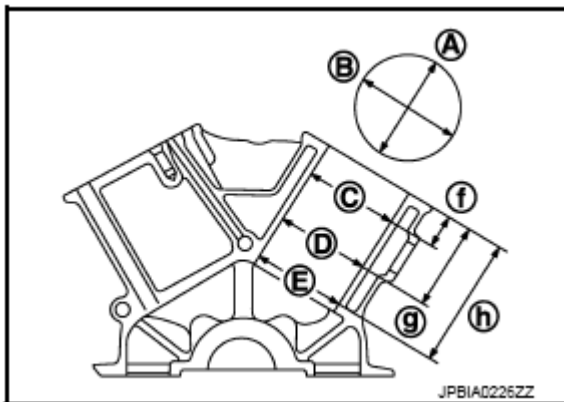
- Using a bore gauge, measure cylinder bore for wear, out-of-round and taper at six different points on each cylinder. [(A) and (B) directions at (C), (D) and (E)] is in longitudinal direction of engine.

**f: 10 mm (0.39 in)**

**g: 60 mm (2.36 in)**

**h: 125 mm (4.92 in)**

**Standard and limit: Refer to "CYLINDER BLOCK".**



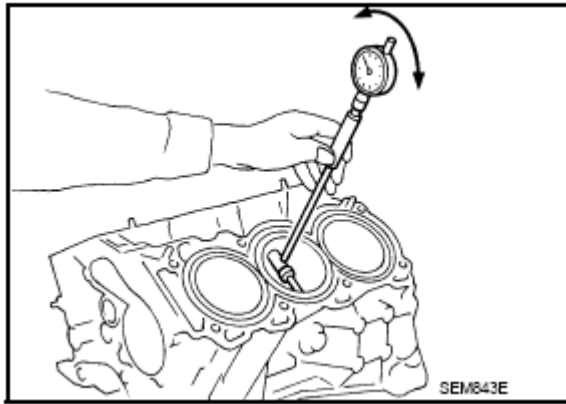
**Fig. 279: Identifying Cylinder Bore Inner Diameter**

**Courtesy of NISSAN NORTH AMERICA, INC.**

- If the measured value exceeds the limit, or if there are scratches and/or seizure on the cylinder inner wall, hone or rebore the inner wall.
- Oversize piston is provided. When using oversize piston, rebore cylinder so that the clearance of the piston-to-cylinder bore satisfies the standard.

**CAUTION: When using oversize piston, use oversize pistons for all cylinders with oversize piston rings.**

**Oversize (O/S): 0.2 mm (0.008 in)**



**Fig. 280: Measuring Bore Diameter**

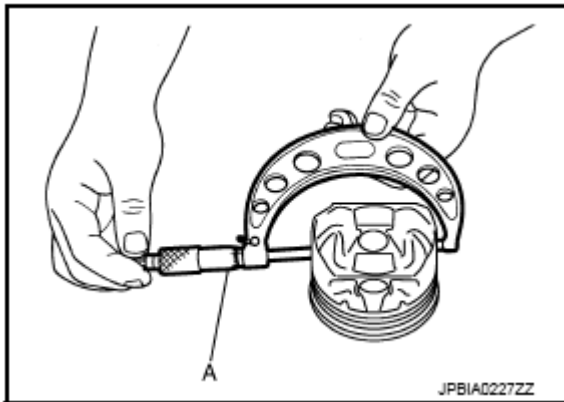
Courtesy of NISSAN NORTH AMERICA, INC.

#### **Piston Skirt Diameter**

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

**Measure point:** Refer to "CYLINDER BLOCK".

#### **Standard**



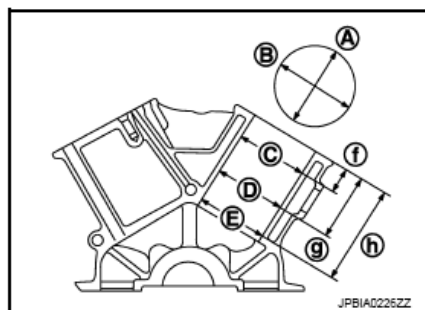
**Fig. 281: Measuring Outer Diameter Of Piston Skirt**

Courtesy of NISSAN NORTH AMERICA, INC.

#### **Piston-to-Cylinder Bore Clearance**

Calculate by piston skirt diameter and cylinder bore inner diameter [direction (B), position (D)].

- A** : Direction A  
**C** : Position C  
**E** : Position E  
**f** : 10 mm (0.39 in)  
**g** : 60 mm (2.36 in)  
**h** : 125 mm (4.92 in)



**Fig. 282: Measuring Piston-To-Cylinder Bore Clearance**

Courtesy of NISSAN NORTH AMERICA, INC.

(Clearance) = (Cylinder bore inner diameter) - (Piston skirt diameter).

**Standard and limit:** Refer to "CYLINDER BLOCK".

- If the calculated value exceeds the limit, replace piston and piston pin assembly. Refer to "CYLINDER BLOCK".

#### Reboring Cylinder Bore

1. Cylinder bore size is determined by adding piston to cylinder bore clearance to piston skirt diameter.

**Rebored size calculation:**  $D = A + B - C$

where,

- A. Piston skirt diameter as measured
  - B. Piston to cylinder bore clearance (standard value)
  - C. Honing allowance 0.02 mm (0.0008 in)
  - D. Bored diameter
2. Install lower cylinder block, and tighten to the specified torque. Otherwise, cylinder bores may be distorted in final assembly.
  3. Cut cylinder bores.

#### NOTE:

- When any cylinder needs boring, all other cylinders must also be bored.
- Do not cut too much out of cylinder bore at a time. Cut only 0.05 mm (0.0020 in) or so in diameter at a time.

4. Hone cylinders to obtain the specified piston to cylinder bore clearance.
5. Measure finished cylinder bore for the out-of-round and taper.

#### NOTE:

**Perform measurement after cylinder bore cools down.**



**CRANKSHAFT MAIN JOURNAL DIAMETER**

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

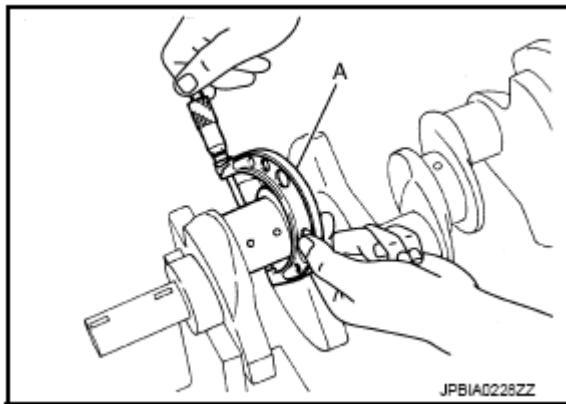
**Standard:** Refer to "CYLINDER BLOCK".

- If out of the standard, measure the main bearing oil clearance. Then use undersize bearing. Refer to "MAIN BEARING".

**CRANKSHAFT PIN JOURNAL DIAMETER**

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

**Standard:** Refer to "CYLINDER BLOCK".



**Fig. 283: Measuring Outer Diameter Of Crankshaft Pin Journal**

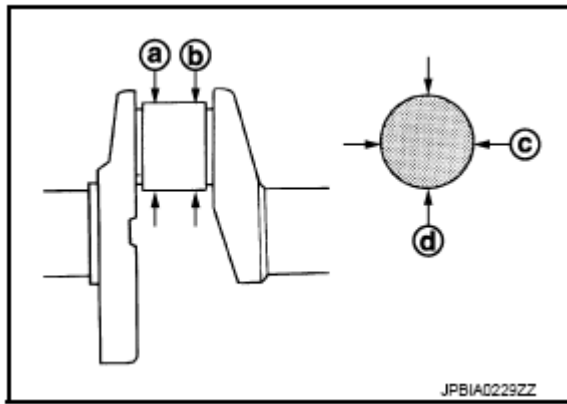
Courtesy of NISSAN NORTH AMERICA, INC.

- If out of the standard, measure the connecting rod bearing oil clearance. Then use undersize bearing. Refer to "CONNECTING ROD BEARING".

**CRANKSHAFT OUT-OF-ROUND AND TAPER**

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

**Limit:** Refer to "CYLINDER BLOCK".



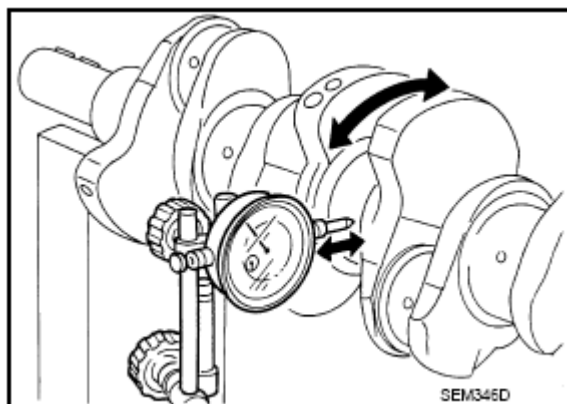
**Fig. 284: Checking Crankshaft For Out-Of-Round & Taper**  
 Courtesy of NISSAN NORTH AMERICA, INC.

- If the measured value exceeds the limit, correct or replace crankshaft.
- If corrected, measure the bearing oil clearance of the corrected main journal and/or pin journal. Then select the main bearing and/or connecting rod bearing. Refer to "**MAIN BEARING**" and/or "**CONNECTING ROD BEARING**".

#### CRANKSHAFT RUNOUT

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

**Standard and limit: Refer to "CYLINDER BLOCK".**



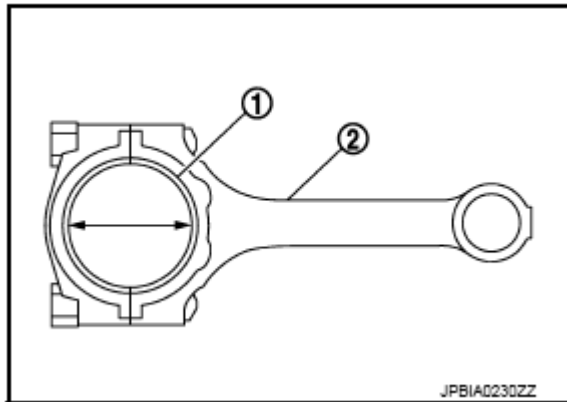
**Fig. 285: Checking Crankshaft Runout**  
 Courtesy of NISSAN NORTH AMERICA, INC.

- If it exceeds the limit, replace crankshaft.

#### CONNECTING ROD BEARING OIL CLEARANCE

**Method by Calculation**

- Install connecting rod bearings (1) to connecting rod (2) and connecting rod cap, and tighten connecting rod bolts to the specified torque. Refer to "**DISASSEMBLY AND ASSEMBLY**" for the tightening procedure.



**Fig. 286: Identifying Connecting Rod & Bearings**  
Courtesy of NISSAN NORTH AMERICA, INC.

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

(Oil clearance) = (Connecting rod bearing inner diameter) - (Crankshaft pin journal diameter)

**Standard and limit:** Refer to "**CONNECTING ROD BEARING**".

- If the calculated value exceeds the limit, select proper connecting rod bearing according to connecting rod big end diameter and crankshaft pin journal diameter to obtain the specified bearing oil clearance. Refer to "**DESCRIPTION**".

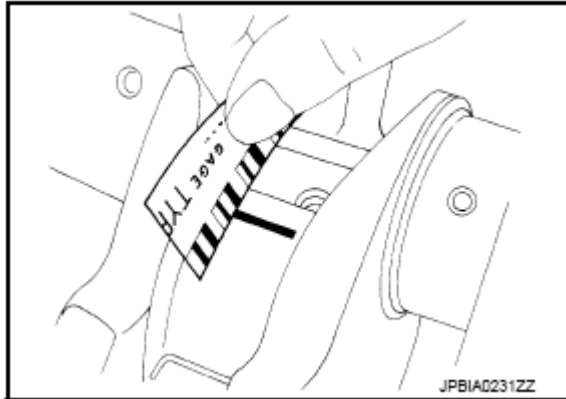
**Method of Using Plastigage**

- Remove oil and dust on crankshaft pin journal and the surfaces of each bearing completely.
- Cut a plastigage slightly shorter than the bearing width, and place it in crankshaft axial direction, avoiding oil holes.
- Install connecting rod bearings to connecting rod and connecting rod bearing cap, and tighten connecting rod bolts to the specified torque. Refer to "**DISASSEMBLY AND ASSEMBLY**" for the tightening procedure.

**CAUTION: Never rotate crankshaft.**

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

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



**Fig. 287: Measuring Rod Bearing Oil Clearance Using Plastigage**  
Courtesy of NISSAN NORTH AMERICA, INC.

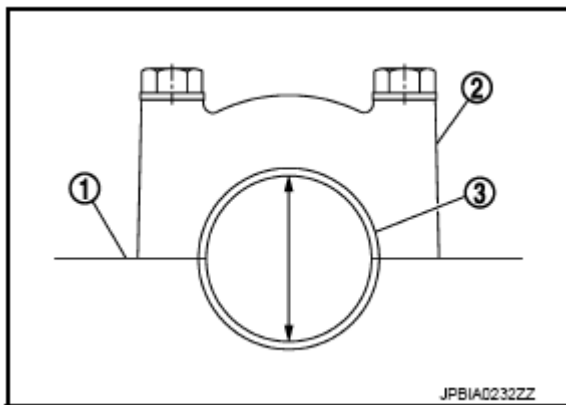
#### MAIN BEARING OIL CLEARANCE

##### Method by Calculation

- Install main bearings (3) to cylinder block (1) and lower cylinder block (2), and tighten lower cylinder block bolts to the specified torque. Refer to "**DISASSEMBLY AND ASSEMBLY**" for the tightening procedure.
- Measure the inner diameter of main bearing with a bore gauge.

(Oil clearance) = (Main bearing inner diameter) - (Crankshaft main journal diameter)

**Standard and limit:** Refer to "**MAIN BEARING**".



**Fig. 288: Identifying Main Bearing Inner Diameter**  
Courtesy of NISSAN NORTH AMERICA, INC.

- If the calculated value exceeds the limit, select proper main bearing according to main bearing inner

diameter and crankshaft main journal diameter to obtain the specified bearing oil clearance. Refer to "**DESCRIPTION**".

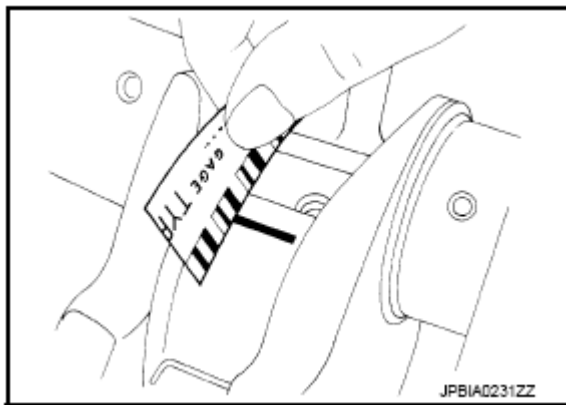
#### Method of Using Plastigage

- Remove engine oil and dust on crankshaft 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 bearing to cylinder block and lower cylinder block, and tighten lower cylinder block bolts with lower cylinder block to the specified torque. Refer to "**DISASSEMBLY AND ASSEMBLY**" for the tightening procedure.

**CAUTION: Never rotate crankshaft.**

- Remove lower cylinder block and bearings, and using the scale on the plastigage bag, measure the plastigage width.

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

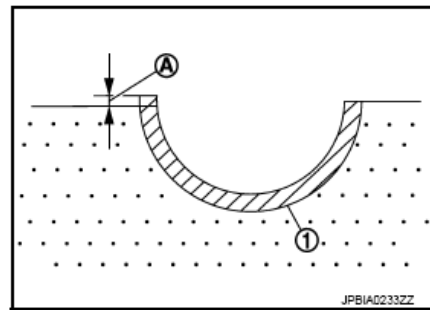


**Fig. 289: Measuring Main Bearing Oil Clearance Using Plastigage**  
Courtesy of NISSAN NORTH AMERICA, INC.

#### MAIN BEARING CRUSH HEIGHT

- When lower cylinder block is removed after being tightened to the specified torque with main bearings (1) installed, the tip end of bearing must protrude. Refer to "**DISASSEMBLY AND ASSEMBLY**" for the tightening procedure.

A : Crush height



**Fig. 290: Identifying Main Bearing Crush Height**  
Courtesy of NISSAN NORTH AMERICA, INC.

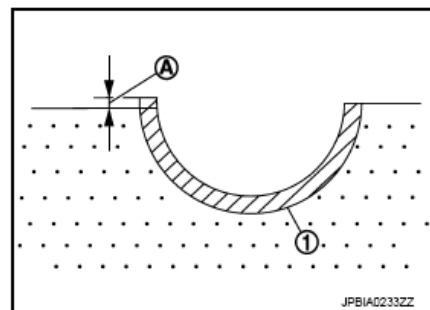
**Standard: There must be crush height.**

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

#### CONNECTING ROD BEARING CRUSH HEIGHT

- When connecting rod bearing cap is removed after being tightened to the specified torque with connecting rod bearings (1) installed, the tip end of bearing must protrude. Refer to "**DISASSEMBLY AND ASSEMBLY**" for the tightening procedure.

A : Crush height



**Fig. 291: Identifying Connecting Rod Bearing Crush Height**  
Courtesy of NISSAN NORTH AMERICA, INC.

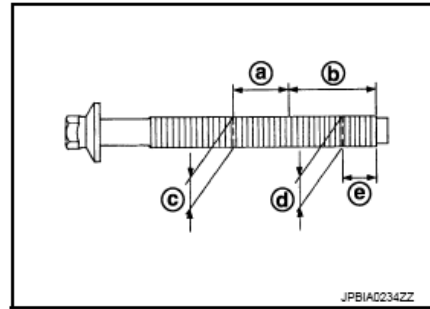
**Standard: There must be crush height.**

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

#### LOWER CYLINDER BLOCK BOLT OUTER DIAMETER

- Measure the outer diameters (c), (d) at two positions as shown in the figure below.

- a : 20 mm (0.79 in)
- b : 30 mm (1.18 in)
- e : 10 mm (0.39 in)



**Fig. 292: Identifying Lower Cylinder Block Bolt Dimensions**

Courtesy of NISSAN NORTH AMERICA, INC.

- If reduction appears in (a) range, regard it (c).

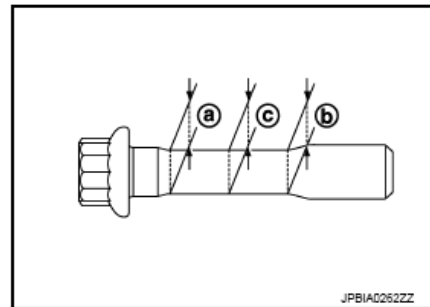
**Limit [(d) - (c)]: 0.11 mm (0.0043 in)**

- If it exceeds the limit (large difference in dimensions), replace lower cylinder block bolt with new one.

#### CONNECTING ROD BOLT OUTER DIAMETER

1. Measure the outer diameters [(a), (b) and (c)] at the position shown in the figure below.

- a : Value at the end of the smaller diameter of the bolt
- b : Value at the end of the smaller diameter of the bolt [opposite side of (a)]
- c : Value of the smallest diameter of the smaller of the bolt



**Fig. 293: Identifying Connecting Rod Bolt Dimensions**

Courtesy of NISSAN NORTH AMERICA, INC.

2. Obtain a mean value (d) of (a) and (b).
3. Subtract (c) from (d).

**Limit [(d) - (c)]: 0.09 mm (0.0035 in)**

4. If it exceeds the limit (large difference in dimensions), replace the bolt with new one.

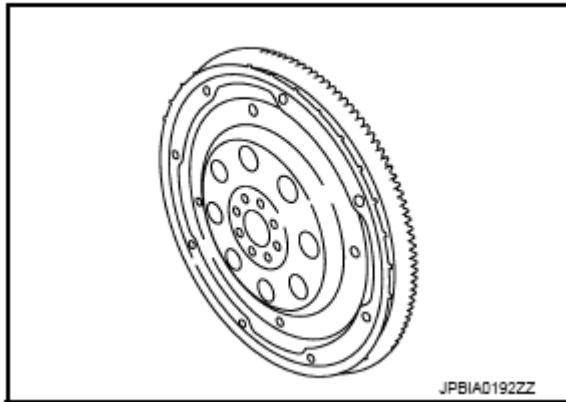
#### DRIVE PLATE

- Check drive plate and signal plate for deformation or damage.

#### CAUTION:

- Never disassemble drive plate.

- **Never place drive plate with signal plate facing down.**
  - **When handling signal plate, take care not to damage or scratch it.**
  - **Handle signal plate in a manner that prevents it from becoming magnetized.**
- 
- If anything is found, replace drive plate.



**Fig. 294: Identifying Drive Plate**  
**Courtesy of NISSAN NORTH AMERICA, INC.**

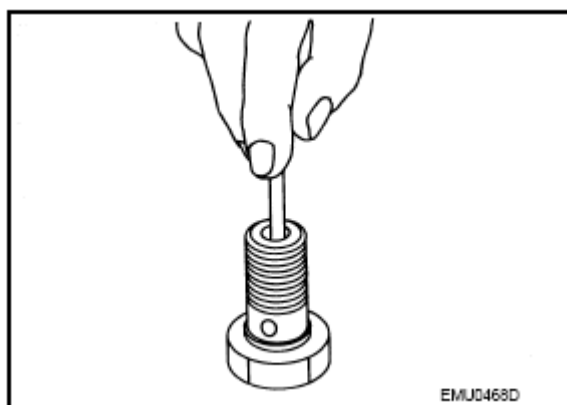
#### **OIL JET**

- Check nozzle for deformation and damage.
- Blow compressed air from nozzle, and check for clogs.
- If it is not satisfied, clean or replace oil jet.

#### **OIL JET RELIEF VALVE**

- Using a clean plastic stick, press check valve in oil jet relief valve. Check that valve moves smoothly with proper reaction force.
- If it is not satisfied, replace oil jet relief valve.





**Fig. 295: Checking Oil Jet Relief Valve Using Plastic Stick**  
 Courtesy of NISSAN NORTH AMERICA, INC.

## HOW TO SELECT PISTON AND BEARING

### Description

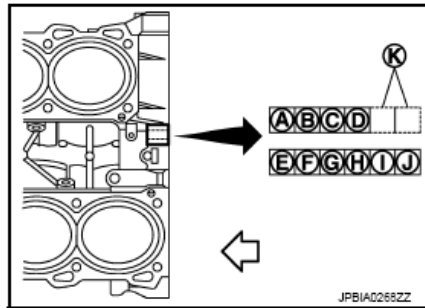
Selection points	Selection parts	Selection items	Selection methods
Between cylinder block and crankshaft	Main bearing	Main bearing grade (bearing thickness)	Determined by match of cylinder block bearing housing grade (inner diameter of housing) and crankshaft journal grade (outer diameter of journal)
Between crankshaft and connecting rod	Connecting rod bearing	Connecting rod bearing grade (bearing thickness)	Combining service grades for connecting rod big end diameter and crankshaft pin outer diameter determine connecting rod bearing selection.
Between cylinder block and piston	Piston and piston pin assembly (Piston is available together with piston pin as assembly.)	Piston grade (piston skirt diameter)	Piston grade = cylinder bore grade (inner diameter of bore)
Between piston and connecting rod <sup>(1)</sup>	-	-	-
(1) For the service parts, the grade for fitting cannot be selected between piston pin and connecting rod. (Only "0" grade 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****WHEN NEW CYLINDER BLOCK IS USED**

Check the cylinder bore grade ("1", "2" or "3") on rear side of cylinder block, and select piston of the same grade.

- A : Bearing housing grade No. 1
- B : Bearing housing grade No. 2
- C : Bearing housing grade No. 3
- D : Bearing housing grade No. 4
- E : Cylinder bore grade No. 1
- F : Cylinder bore grade No. 2
- G : Cylinder bore grade No. 3
- H : Cylinder bore grade No. 4
- I : Cylinder bore grade No. 5
- J : Cylinder bore grade No. 6
- K : Identification
- ↶ : Engine front



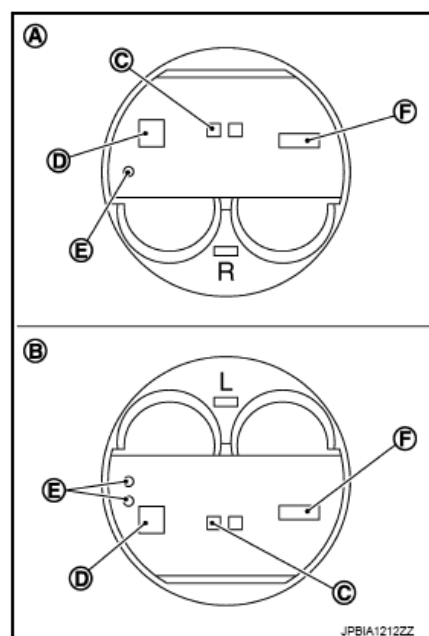
**Fig. 296: Identifying Piston Identification, Bearing Housing And Cylinder Bore Grade No.**  
**Courtesy of NISSAN NORTH AMERICA, INC.**

**NOTE:**        **Piston is available with piston pin as a set for the service part. (Only "0" grade piston pin is available.)**

**WHEN CYLINDER BLOCK IS REUSED**

1. Measure the cylinder bore inner diameter. Refer to "**INSPECTION**".
2. Determine the bore grade by comparing the measurement with the values under the cylinder bore inner diameter of the "PISTON SELECTION TABLE".

- A : RH  
 B : LH  
 C : Piston pin grade number  
 D : Piston grade number  
 E : Front mark  
 F : Identification code



**Fig. 297: Identifying Piston Pin Grade Number, Piston Grade Number, Front Mark And Identification Code**

Courtesy of NISSAN NORTH AMERICA, INC.

3. Select piston of the same grade.

#### PISTON SELECTION TABLE

Grade	Unit: mm (in)		
	1	2	3
Cylinder bore inner diameter	95.500 - 95.510 (3.7598 - 3.7602)	95.510 - 95.520 (3.7602 - 3.7606)	95.520 - 95.530 (3.7606 - 3.7610)
Piston skirt diameter	95.480 - 95.490 (3.7590 - 3.7594)	95.490 - 95.500 (3.7594 - 3.7598)	95.500 - 95.510 (3.7598 - 3.7602)

#### NOTE:

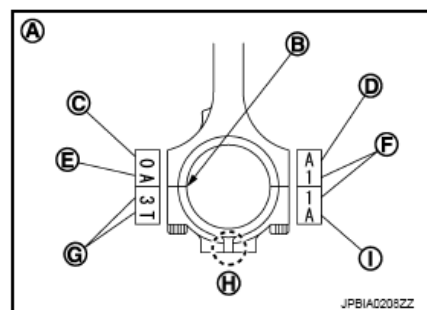
- Piston is available together with piston pin as assembly.
- Piston pin (piston pin hole) grade is provided only for the parts installed at the plant. For service parts, no piston pin grades can be selected. (Only "0" grade is available.)
- No second grade mark is available on piston.

#### Connecting Rod Bearing

#### WHEN NEW CONNECTING ROD AND CRANKSHAFT ARE USED

1. Apply connecting rod big end diameter grade stamped (D) on connecting rod side face to the row in the "CONNECTING ROD BEARING SELECTION TABLE".

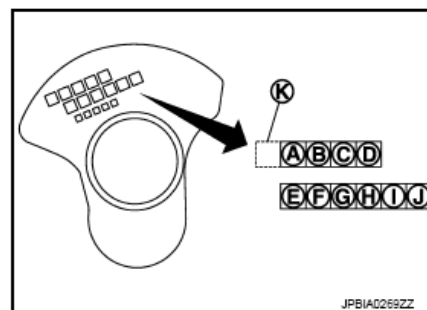
- A : Sample codes
- B : Bearing stopper groove
- C : Small-end diameter grade
- E : Weight grade
- F : Cylinder No.
- G : Management code
- H : Front mark
- I : Management code



**Fig. 298: Identifying Grade Stamp Mark On Connecting Rod Big End Diameter**  
 Courtesy of NISSAN NORTH AMERICA, INC.

2. Apply crankshaft pin journal diameter grade stamped on crankshaft front side to the column in the "CONNECTING ROD BEARING SELECTION TABLE"

- A : Journal diameter grade No. 1
- B : Journal diameter grade No. 2
- C : Journal diameter grade No. 3
- D : Journal diameter grade No. 4
- E : Pin diameter grade No. 1
- F : Pin diameter grade No. 2
- G : Pin diameter grade No. 3
- H : Pin diameter grade No. 4
- I : Pin diameter grade No. 5
- J : Pin diameter grade No. 6
- K : Identification



**Fig. 299: Identifying Grade Stamp Mark On Crankshaft Pin Journal Diameter**  
 Courtesy of NISSAN NORTH AMERICA, INC.

3. Read the symbol at the cross point of selected row and column in the "CONNECTING ROD BEARING SELECTION TABLE".
4. Apply the symbol obtained to the "CONNECTING ROD BEARING GRADE TABLE" to select connecting rod bearing.

#### WHEN CONNECTING ROD AND CRANKSHAFT ARE REUSED

1. Measure connecting rod big end diameter and crankshaft pin journal diameter. Refer to "**INSPECTION**".
2. Correspond the measured dimension in "connecting rod big end diameter" row of "CONNECTING ROD BEARING SELECTION TABLE".
3. Correspond the measured dimension in "crankshaft pin diameter" column of "CONNECTING ROD BEARING SELECTION TABLE".
4. Follow step 3 and later in "WHEN NEW CONNECTING ROD AND CRANKSHAFT ARE USED".

## CONNECTING ROD BEARING SELECTION TABLE

<div> <div>Connecting rod big end diameter Unit: mm (in)</div> <div>Crankshaft pin journal diameter Unit: mm (in)</div> </div>		Mark	A	B	C	D	E	F	G	H	J	K	L	M	N
		Hole diameter	57.000 - 57.001 (2.2441 - 2.2441)	57.001 - 57.002 (2.2441 - 2.2442)	57.002 - 57.003 (2.2442 - 2.2442)	57.003 - 57.004 (2.2442 - 2.2442)	57.004 - 57.005 (2.2442 - 2.2443)	57.005 - 57.006 (2.2443 - 2.2443)	57.006 - 57.007 (2.2443 - 2.2444)	57.007 - 57.008 (2.2444 - 2.2444)	57.008 - 57.009 (2.2444 - 2.2444)	57.009 - 57.010 (2.2444 - 2.2445)	57.010 - 57.011 (2.2445 - 2.2445)	57.011 - 57.012 (2.2445 - 2.2446)	57.012 - 57.013 (2.2446 - 2.2446)
Mark	Axle diameter														
A	53.974 - 53.973 (2.1250 - 2.1249)		0	0	0	0	0	0	1	1	1	1	1	1	2
B	53.973 - 53.972 (2.1249 - 2.1249)		0	0	0	0	0	1	1	1	1	1	1	2	2
C	53.972 - 53.971 (2.1249 - 2.1248)		0	0	0	0	1	1	1	1	1	1	2	2	2
D	53.971 - 53.970 (2.1248 - 2.1248)		0	0	0	1	1	1	1	1	1	2	2	2	2
E	53.970 - 53.969 (2.1248 - 2.1248)		0	0	1	1	1	1	1	1	2	2	2	2	2
F	53.969 - 53.968 (2.1248 - 2.1247)		0	1	1	1	1	1	1	2	2	2	2	2	2
G	53.968 - 53.967 (2.1247 - 2.1247)		1	1	1	1	1	1	2	2	2	2	2	2	3
H	53.967 - 53.966 (2.1247 - 2.1246)		1	1	1	1	1	2	2	2	2	2	2	3	3
J	53.966 - 53.965 (2.1246 - 2.1246)		1	1	1	1	2	2	2	2	2	2	3	3	3
K	53.965 - 53.964 (2.1246 - 2.1246)		1	1	1	2	2	2	2	2	2	3	3	3	3
L	53.964 - 53.963 (2.1246 - 2.1245)		1	1	2	2	2	2	2	2	3	3	3	3	3
M	53.963 - 53.962 (2.1245 - 2.1245)		1	2	2	2	2	2	2	3	3	3	3	3	3
N	53.962 - 53.961 (2.1245 - 2.1244)		2	2	2	2	2	2	3	3	3	3	3	3	4
P	53.961 - 53.960 (2.1244 - 2.1244)		2	2	2	2	2	3	3	3	3	3	3	4	4
R	53.960 - 53.959 (2.1244 - 2.1244)		2	2	2	2	3	3	3	3	3	3	4	4	4
S	53.959 - 53.958 (2.1244 - 2.1243)		2	2	2	3	3	3	3	3	3	4	4	4	4
T	53.958 - 53.957 (2.1243 - 2.1243)		2	2	3	3	3	3	3	3	4	4	4	4	4
U	53.957 - 53.956 (2.1243 - 2.1242)		2	3	3	3	3	3	3	4	4	4	4	4	4

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**Fig. 300: Connecting Rod Bearing Selection Chart**  
 Courtesy of NISSAN NORTH AMERICA, INC.

## CONNECTING ROD BEARING GRADE TABLE

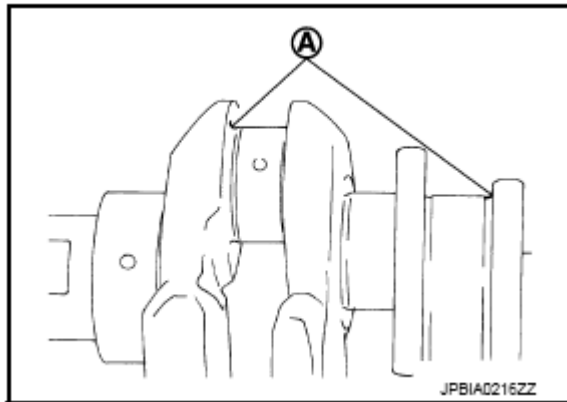
Connecting rod bearing grade table: Refer to "CONNECTING ROD BEARING".

## UNDERSIZE BEARING 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 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 (A) [1.5 - 1.7 mm (0.059 - 0.067 in)].



**Fig. 301: Identifying Fillet Area On Crankshaft**  
Courtesy of NISSAN NORTH AMERICA, INC.

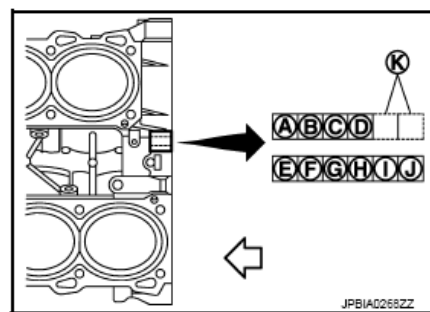
**Bearing undersize table:** Refer to "CONNECTING ROD BEARING".

#### Main Bearing

#### WHEN NEW CYLINDER BLOCK AND CRANKSHAFT ARE USED

1. "MAIN BEARING SELECTION TABLE" rows correspond to bearing housing grade on rear side of cylinder block.

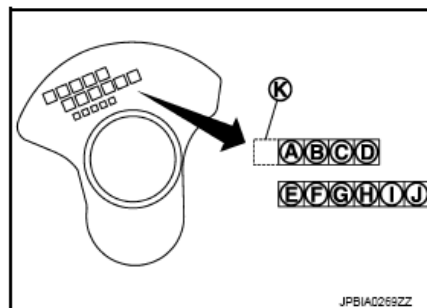
- A : Bearing housing grade No. 1
- B : Bearing housing grade No. 2
- C : Bearing housing grade No. 3
- D : Bearing housing grade No. 4
- E : Cylinder bore grade No. 1
- F : Cylinder bore grade No. 2
- G : Cylinder bore grade No. 3
- H : Cylinder bore grade No. 4
- I : Cylinder bore grade No. 5
- J : Cylinder bore grade No. 6
- K : Identification code
- ↔ : Engine front



**Fig. 302: Identifying Main Bearing Housing Grade Number, Cylinder Bore Grade Number And Identification Code**  
Courtesy of NISSAN NORTH AMERICA, INC.

2. "MAIN BEARING SELECTION TABLE" columns correspond to journal diameter grade on front side of crankshaft.

- A : Journal diameter grade No. 1  
 B : Journal diameter grade No. 2  
 C : Journal diameter grade No. 3  
 D : Journal diameter grade No. 4  
 E : Pin diameter grade No. 1  
 F : Pin diameter grade No. 2  
 G : Pin diameter grade No. 3  
 H : Pin diameter grade No. 4  
 I : Pin diameter grade No. 5  
 J : Pin diameter grade No. 6  
 K : Identification code



**Fig. 303: Identifying Main Bearing Journal Diameter Grade Number, Pin Diameter Grade Number And Identification Code**

Courtesy of NISSAN NORTH AMERICA, INC.

3. Select main bearing grade at the point where selected row and column meet in "MAIN BEARING SELECTION TABLE".
4. Apply sign at crossing in above step 3 to "MAIN BEARING GRADE TABLE".

**NOTE:**

- "MAIN BEARING GRADE TABLE" applies to all journals.
- Service parts are available as a set of both upper and lower.

**WHEN CYLINDER BLOCK AND CRANKSHAFT ARE REUSED**

1. Measure cylinder block main bearing housing inner diameter and crankshaft main journal diameter. Refer to "**INSPECTION**".
2. Correspond the measured dimension in "Cylinder block main bearing housing inner diameter" row of "MAIN BEARING SELECTION TABLE".
3. Correspond the measured dimension in "Crankshaft main journal diameter" column of "MAIN BEARING SELECTION TABLE".
4. Follow step 3 and later in "When New Cylinder Block and Crankshaft are Used".

**MAIN BEARING SELECTION TABLE**

<div> <div> Cylinder block main bearing housing inner diameter Unit: mm (in) </div> <div> Crankshaft main journal diameter Unit: mm (in) </div> </div>		Mark		Hole diameter		Axle diameter	
		A	B	C	D	E	F
A	64.975 - 64.974 (2.5581 - 2.5580)	0 0	0 01	01 01	01 1	1 1	1 1
B	64.974 - 64.973 (2.5580 - 2.5580)	0 0	0 01	01 01	1 1	1 1	1 1
C	64.973 - 64.972 (2.5580 - 2.5579)	0 01	01 01	01 1	1 1	1 1	1 1
D	64.972 - 64.971 (2.5579 - 2.5579)	01 01	01 1	1 1	1 1	1 1	1 1
E	64.971 - 64.970 (2.5579 - 2.5579)	01 01	1 1	1 1	1 1	1 1	1 1
F	64.970 - 64.969 (2.5579 - 2.5578)	01 1	1 1	1 1	1 1	1 1	1 1
G	64.969 - 64.968 (2.5578 - 2.5578)	1 1	1 1	1 1	1 1	1 1	1 1
H	64.968 - 64.967 (2.5578 - 2.5578)	1 1	1 1	1 1	1 1	1 1	1 1
J	64.967 - 64.966 (2.5578 - 2.5577)	1 12	12 12	2 2	2 2	2 2	2 2
K	64.966 - 64.965 (2.5577 - 2.5577)	12 12	12 2	2 2	2 2	2 2	2 2
L	64.965 - 64.964 (2.5577 - 2.5576)	12 12	2 2	2 2	2 2	2 2	2 2
M	64.964 - 64.963 (2.5576 - 2.5576)	12 2	2 2	2 2	2 2	2 2	2 2
N	64.963 - 64.962 (2.5576 - 2.5576)	2 2	2 2	2 2	2 2	2 2	2 2
P	64.962 - 64.961 (2.5576 - 2.5575)	2 2	2 2	2 2	2 2	2 2	2 2
R	64.961 - 64.960 (2.5575 - 2.5575)	2 23	23 23	3 3	3 3	3 3	3 3
S	64.960 - 64.959 (2.5575 - 2.5574)	23 23	23 3	3 3	3 3	3 3	3 3
T	64.959 - 64.958 (2.5574 - 2.5574)	23 23	3 3	3 3	3 3	3 3	3 3
U	64.958 - 64.957 (2.5574 - 2.5574)	23 3	3 3	3 3	3 3	3 3	3 3
V	64.957 - 64.956 (2.5574 - 2.5573)	3 3	3 3	3 3	3 3	3 3	3 3
W	64.956 - 64.955 (2.5573 - 2.5573)	3 3	3 3	3 3	3 3	3 3	3 3
X	64.955 - 64.954 (2.5573 - 2.5572)	3 34	34 34	4 4	4 4	4 4	4 4
Y	64.954 - 64.953 (2.5572 - 2.5572)	34 34	34 4	4 4	4 4	4 4	4 4
4	64.953 - 64.952 (2.5572 - 2.5572)	34 34	4 4	4 4	4 4	4 4	4 4
7	64.952 - 64.951 (2.5572 - 2.5571)	34 4	4 4	4 4	4 4	4 4	4 4

JPB/A0264ZZ

**Fig. 304: Main Bearing Selection Chart**  
Courtesy of NISSAN NORTH AMERICA, INC.

#### MAIN BEARING GRADE TABLE (ALL JOURNALS)

Main bearing grade table (All journals): Refer to "MAIN BEARING".

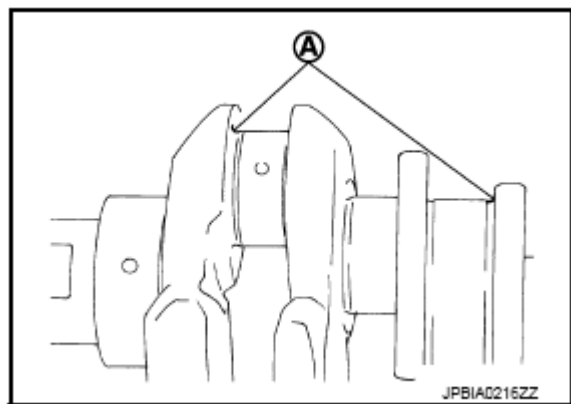
#### UNDERSIZE BEARING USAGE GUIDE

- When the specified main bearing oil clearance is not obtained with standard size main bearings, use undersize (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 the fillet R (A) [1.5 - 1.7 mm (0.059 - 0.067 in)].



**Bearing undersize table: Refer to "MAIN BEARING".**



**Fig. 305: Identifying Fillet Area On Crankshaft**  
 Courtesy of NISSAN NORTH AMERICA, INC.

## SERVICE DATA AND SPECIFICATIONS (SDS)

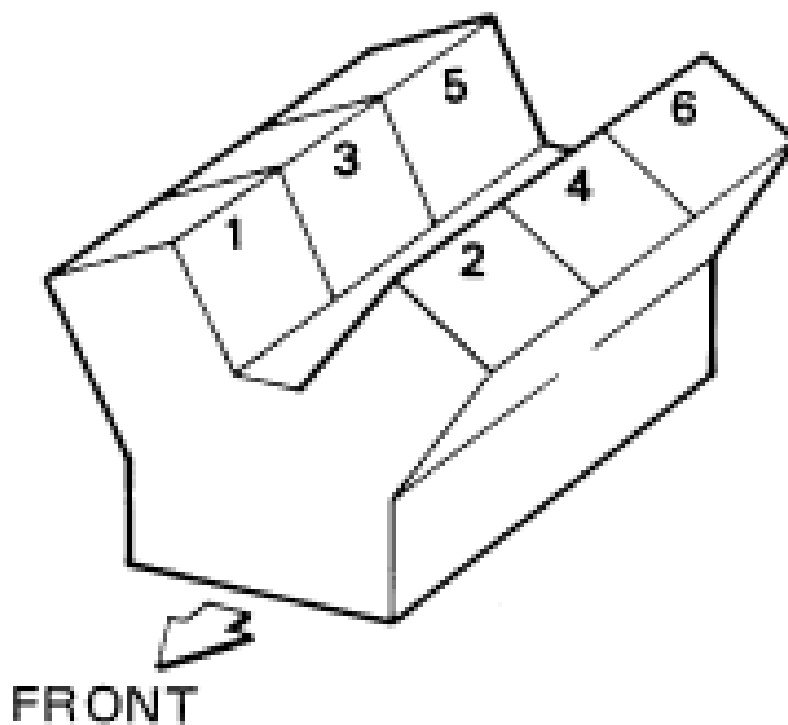
### SERVICE DATA AND SPECIFICATIONS (SDS)

#### General Specification

#### GENERAL SPECIFICATIONS

Cylinder arrangement		V-6
Displacement cm <sup>3</sup> (cu in)		3, 696 (225.53)
Bore and stroke mm (in)		95.5 x 86.0 (3.76 x 3.386)
Valve arrangement		DOHC
Firing order		1-2-3-4-5-6
Number of piston rings	Compression	2
	Oil	1
Number of main bearings		4
Compression ratio		11
Compression pressure kPa (kg/cm <sup>2</sup> , psi)/200 RPM	Standard	1, 667 - 2, 354 (17 - 24, 242 - 341)
	Minimum	1, 226 (12.5, 178)
	Differential limit between cylinders	98 (1.0, 14)

Cylinder number



SEM713A

		Unit: degree
Valve timing	Intake valve open (BTDC)	63 - -64
	Intake valve close (ABDC)	-73 - 82
	Exhaust valve open (BBDC)	64
	Exhaust valve close (ATDC)	12

**Drive Belt****DRIVE BELT**

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

**Spark Plug****SPARK PLUG**

		Unit: mm (in)
Make	DENSO	
Standard type	FXE24HR11	
Gap (Nominal)	1.1 (0.043)	

**2012 Infiniti M37**

2012 ENGINE Engine Mechanical (VQ37VHR) - M

**Intake Manifold****INTAKE MANIFOLD**

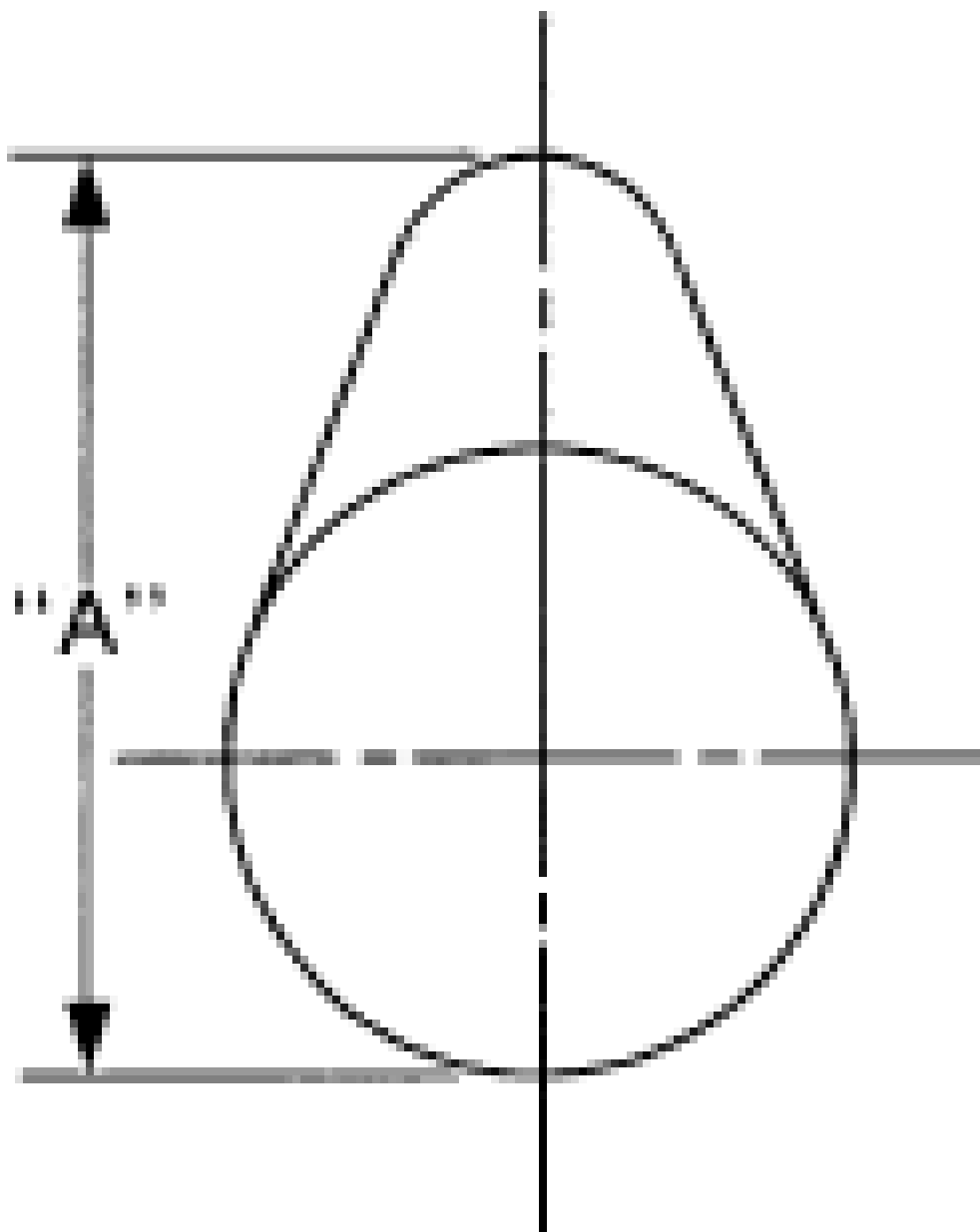
		Unit: mm (in)
Items		Limit
Surface distortion	Intake manifold	0.1 (0.004)

**Exhaust Manifold****EXHAUST MANIFOLD**

		Unit: mm (in)
Items		Limit
Surface distortion	Exhaust manifold	0.7 (0.028)

**Camshaft****CAMSHAFT (EXH)**

			Unit: mm (in)
Items		Standard	Limit
Camshaft (EXH) journal oil clearance	No. 1	0.045 - 0.086 (0.0018 - 0.0034)	0.150 (0.0059)
	No. 2, 3, 4	0.035 - 0.076 (0.0014 - 0.0030)	
VVEL ladder assembly bracket inner diameter (EXH)	No. 1	26.000 - 26.021 (1.0236 - 1.0244)	-
	No. 2, 3, 4	23.500 - 23.521 (0.9252 - 0.9260)	-
Camshaft (EXH) journal diameter	No. 1	25.935 - 25.955 (1.0211 - 1.0218)	-
	No. 2, 3, 4	23.445 - 23.465 (0.9230 - 0.9238)	-
Camshaft (EXH) end play		0.115 - 0.188 (0.0045 - 0.0074)	0.24 (0.0094)
Camshaft (EXH) cam height "A"	Bank 1	45.015 - 45.205 (1.7722 - 1.7797)	0.2 (0.008) <sup>(1)</sup>
	Bank 2	46.735 - 46.925 (1.8400 - 1.8474)	
Camshaft (EXH) runout [TIR <sup>(2)</sup> ]		Less than 0.02 (0.001)	0.05 (0.002)
Camshaft sprocket (EXH) runout [TIR <sup>(2)</sup> ]		-	0.15 (0.0059)



**SEN1571**

- (1) Cam wear limit
- (2) Total indicator reading

**CAMSHAFT (INT)**

**2012 Infiniti M37****2012 ENGINE Engine Mechanical (VQ37VHR) - M**

		Unit: mm (in)
Items	Standard	Limit
Drive shaft end play	0.115 - 0.188 (0.0045 - 0.0074)	0.24 (0.0094)
Camshaft sprocket (INT) runout [TIR <sup>(1)</sup> ]	-	0.15 (0.0059)
(1) Total indicator reading		

**VALVE LIFTER**

		Unit: mm (in)
Items	Standard	
Valve lifter outer diameter	33.980 - 33.990 (1.3378 - 1.3382)	
Valve lifter hole diameter	34.000 - 34.016 (1.3386 - 1.3392)	
Valve lifter clearance	0.010 - 0.036 (0.0004 - 0.0014)	

**VALVE CLEARANCE**

			Unit: mm (in)
Items	Cold	Hot <sup>(1)</sup> (reference data)	
Intake	0.26 - 0.34 (0.010 - 0.013)	0.304 - 0.416 (0.012 - 0.016)	
Exhaust	0.29 - 0.37 (0.011 - 0.015)	0.308 - 0.432 (0.012 - 0.017)	
(1) Approximately 80°C (176°F)			

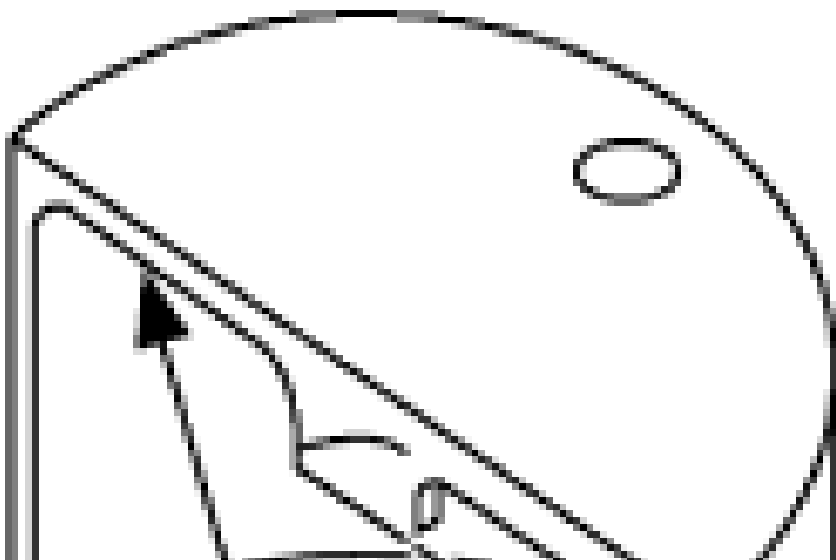
**AVAILABLE VALVE LIFTER**

		Unit: mm (in)
Identification (stamped) mark	Thickness	
788	7.88 (0.3102)	
790	7.90 (0.3110)	
792	7.92 (0.3118)	
794	7.94 (0.3126)	
796	7.96 (0.3134)	
798	7.98 (0.3142)	
800	8.00 (0.3150)	
802	8.02 (0.3157)	
804	8.04 (0.3165)	
806	8.06 (0.3173)	
808	8.08 (0.3181)	
810	8.10 (0.3189)	
812	8.12 (0.3197)	
814	8.14 (0.3205)	
816	8.16 (0.3213)	

**2012 Infiniti M37**

2012 ENGINE Engine Mechanical (VQ37VHR) - M

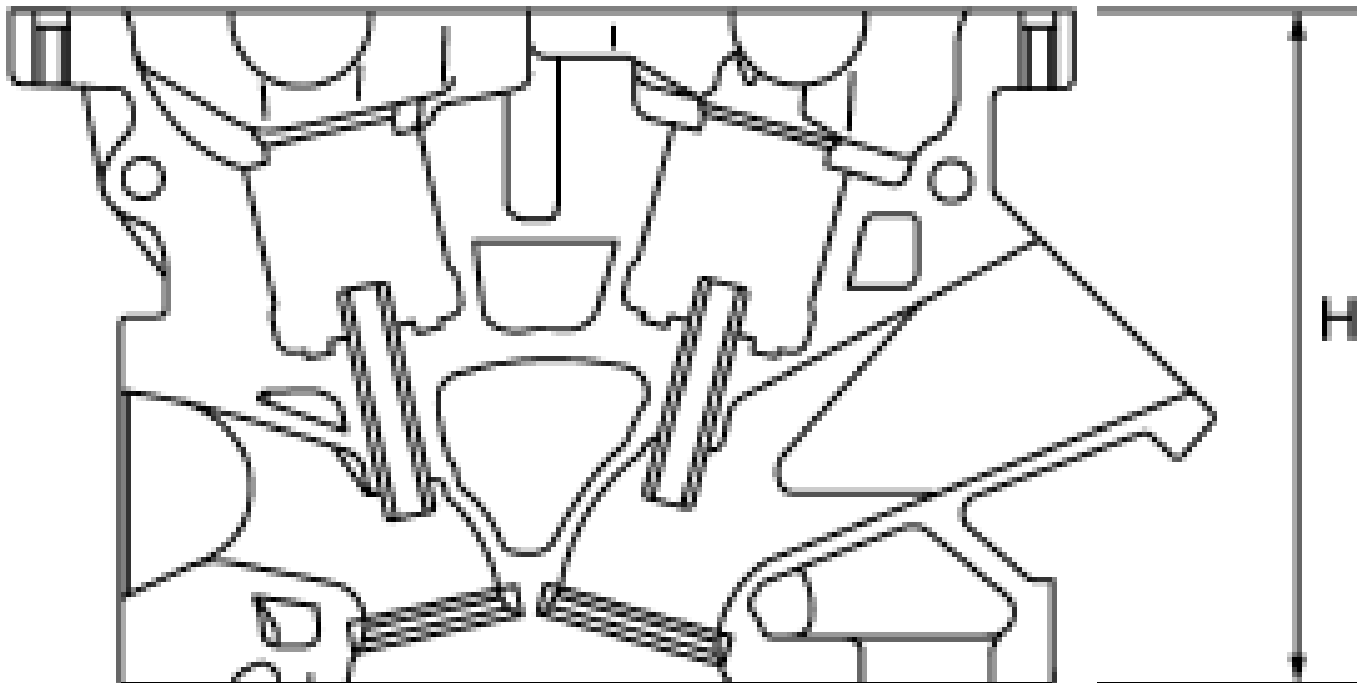
818	8.18 (0.3220)
820	8.20 (0.3228)
822	8.22 (0.3236)
824	8.24 (0.3244)
826	8.26 (0.3252)
828	8.28 (0.3260)
830	8.30 (0.3268)
832	8.32 (0.3276)
834	8.34 (0.3283)
836	8.36 (0.3291)
838	8.38 (0.3299)
840	8.40 (0.3307)



## Cylinder Head

## CYLINDER HEAD

Unit: mm (in)		
Items	Standard	Limit
Head surface distortion	Less than 0.03 (0.0012)	0.1 (0.004)
Normal cylinder head height "H"	126.4 (4.98)	-

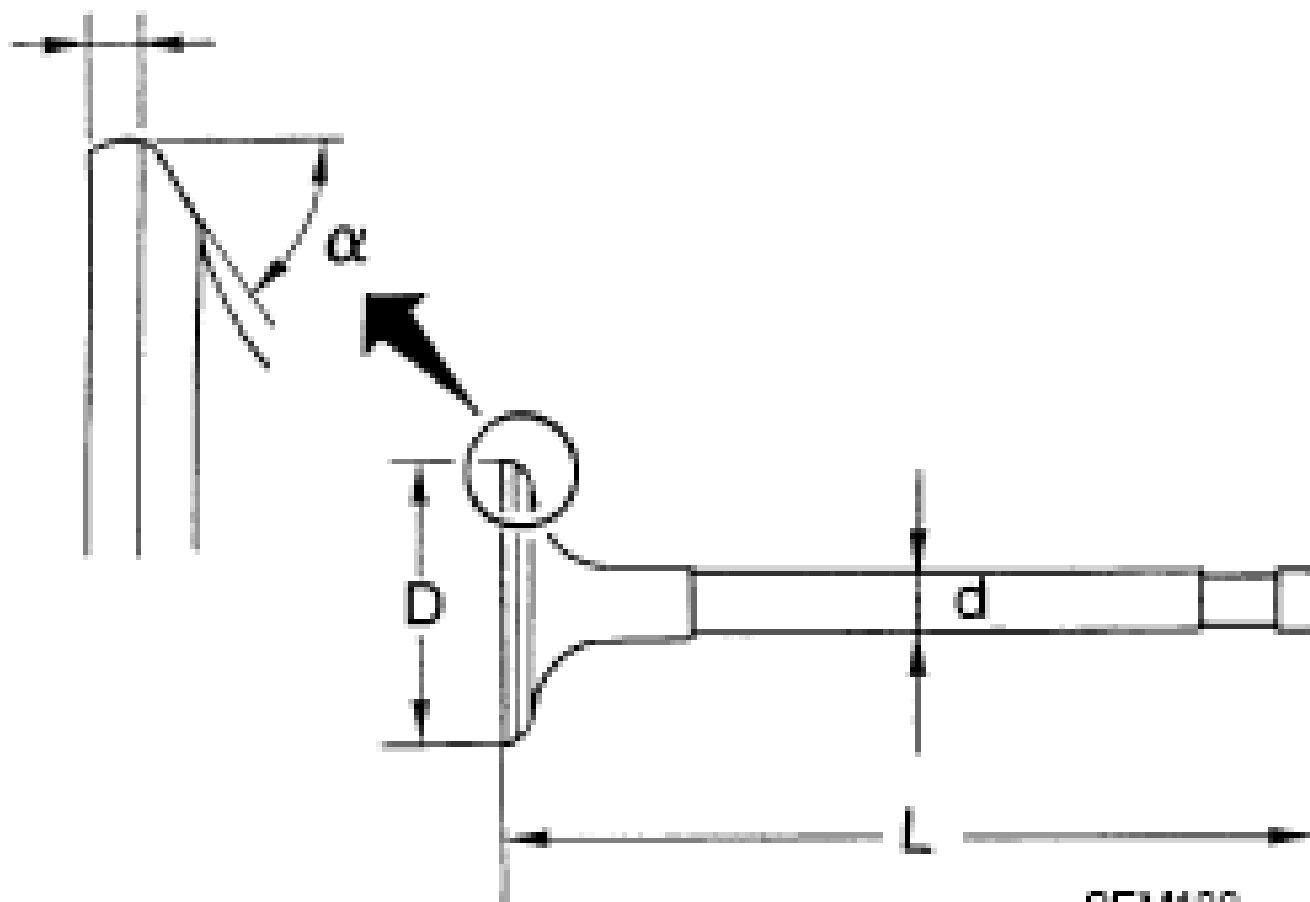


PBIC0924E

## VALVE DIMENSIONS

Unit: mm (in)

## T (Margin thickness)



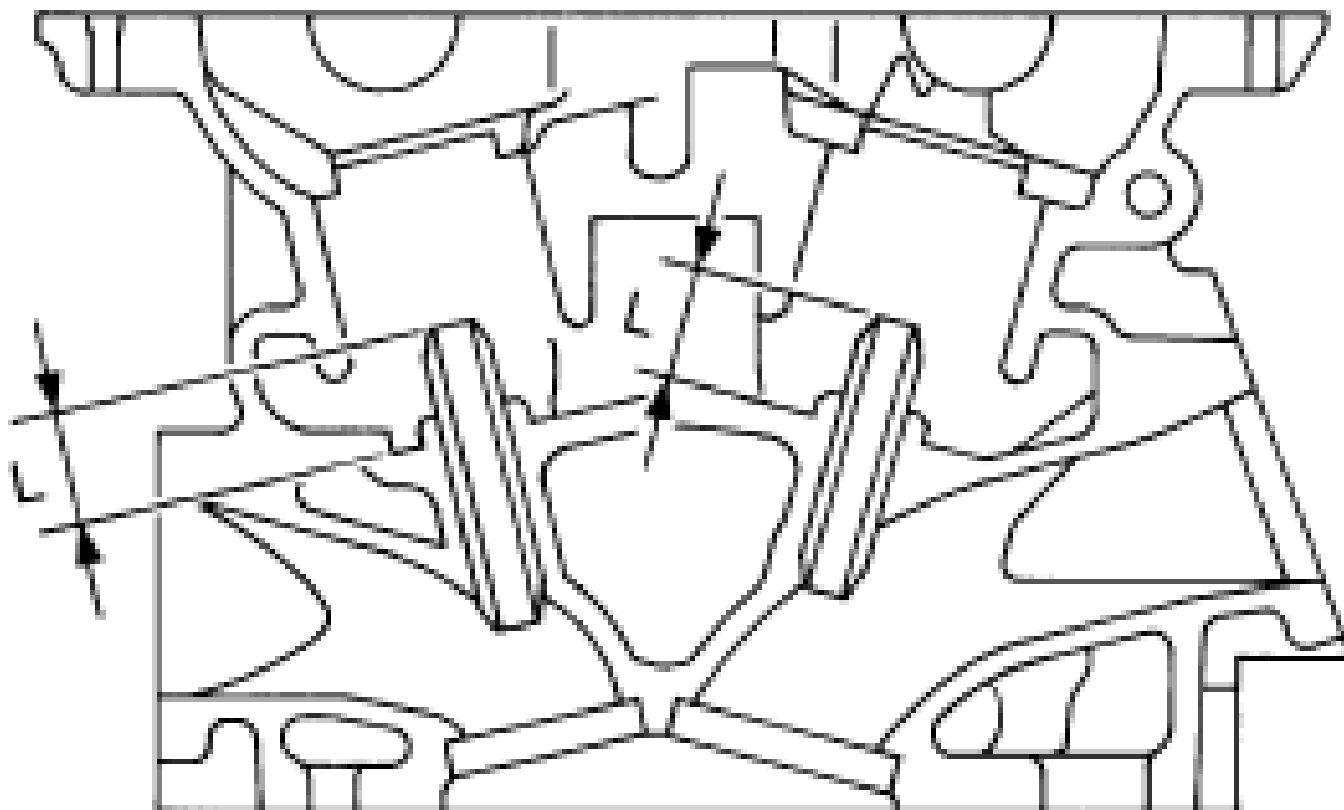
SEM188

Valve head diameter "D"	Intake	36.6 - 36.9 (1.441 - 1.453)
	Exhaust	30.2 - 30.5 (1.189 - 1.201)
Valve length "L"	Intake	100.11 (3.94)
	Exhaust	94.67 (3.7272)
Valve stem diameter "d"	Intake	5.965 - 5.980 (0.2348 - 0.2354)
	Exhaust	5.962 - 5.970 (0.2347 - 0.2350)
Valve seat angle "a"	Intake	45°15' - 45°45'
	Exhaust	
Valve margin "T"	Intake	1.1 (0.043)
	Exhaust	1.3 (0.051)
Valve margin "T" limit		0.5 (0.020)
Valve stem end surface grinding limit		0.2 (0.008)

### VALVE GUIDE



Unit: mm (in)

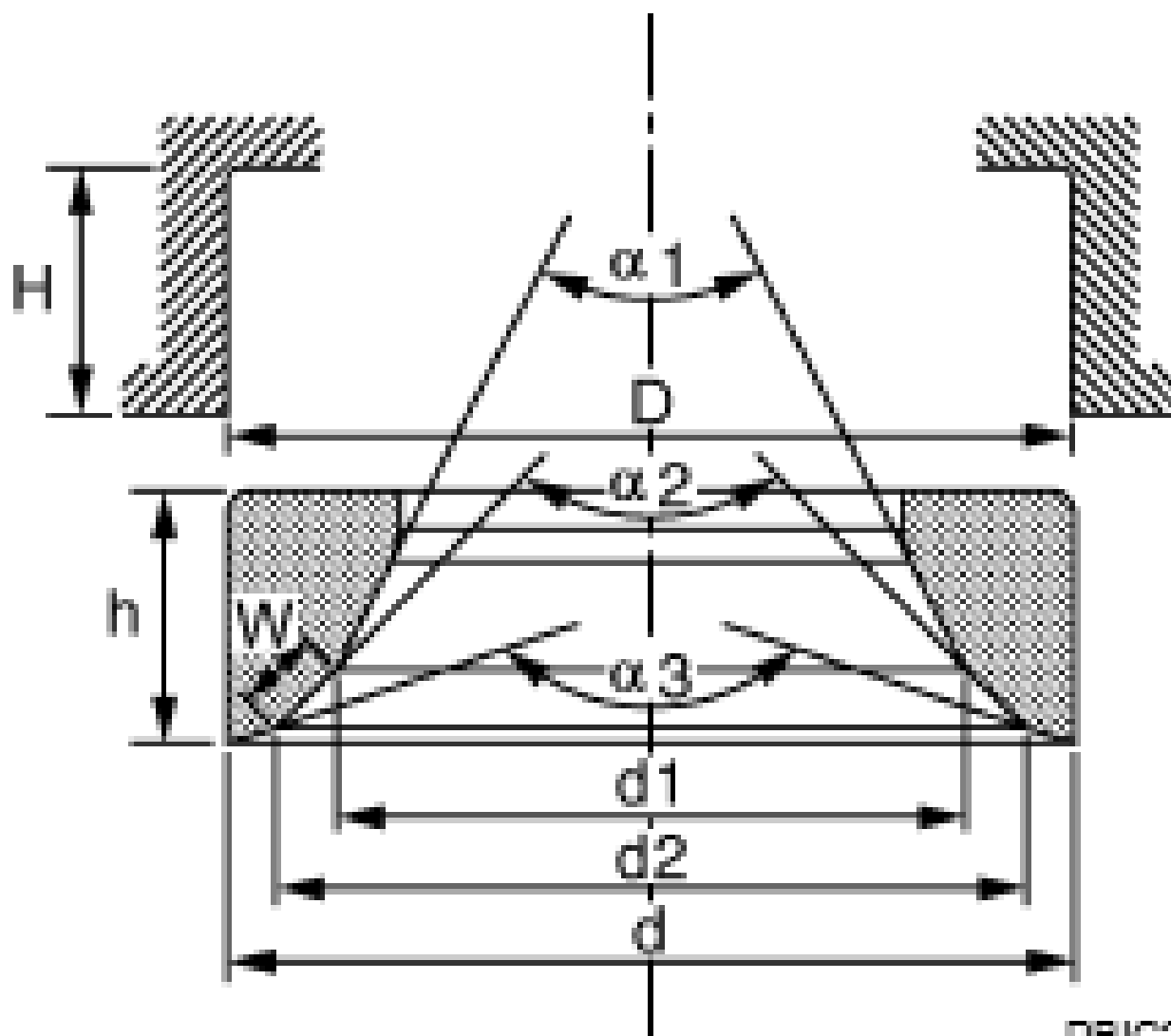
**SEM950E**

Items		Standard	Oversize (Service) [0.2 (0.008)] (1)
Valve guide	Outer diameter	10.023 - 10.034 (0.3946 - 0.3950)	10.223 - 10.234 (0.4025 - 0.4029) <sup>(1)</sup>
	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) <sup>(1)</sup>
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 - 0.056 (0.0012 - 0.0022)	0.09 (0.004)
Projection length "L"		12.6 - 12.8 (0.496 - 0.504)	

(1) Parts settings are for exhaust side only

## VALVE SEAT

Unit: mm (in)



PBIC2745E

Items		Standard	Oversize (Service) [0.5 (0.02)] <sup>(4)</sup>
Cylinder head seat recess diameter "D"	Intake	38.000 - 38.016 (1.4961 - 1.4967)	-
	Exhaust	31.600 - 31.616 (1.2441 - 1.2447)	32.100 - 32.116 (1.2638 - 1.2644) <sup>(4)</sup>
Valve seat outer diameter "d"	Intake	38.097 - 38.113 (1.4999 - 1.5005)	-
	Exhaust	31.680 - 31.696 (1.2472 - 1.2479)	32.180 - 32.196 (1.2669 - 1.2676) <sup>(4)</sup>

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### 2012 ENGINE Engine Mechanical (VQ37VHR) - M

Valve seat interference fit	Intake	0.081 - 0.113 (0.0032 - 0.0044)	
	Exhaust	0.064 - 0.096 (0.0025 - 0.0038)	
Diameter "d1" <sup>(1)</sup>	Intake	34.6 (1.362)	
	Exhaust	27.7 (1.091)	
Diameter "d2" <sup>(2)</sup>	Intake	35.9 - 36.4 (1.413 - 1.433)	
	Exhaust	29.3 - 29.8 (1.154 - 1.173)	
Angle "a1"	Intake	60°	
	Exhaust	60°	
Angle "a2"	Intake	88°45' - 90°15'	
	Exhaust	88°45' - 90°15'	
Angle "a3"	Intake	120°	
	Exhaust	120°	
Contacting width "W" <sup>(3)</sup>	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)	-
	Exhaust	5.9 - 6.0 (0.232 - 0.236)	4.95 - 5.05 (0.1949 - 0.1988) <sup>(4)</sup>
Depth "H"		6.0 (0.236)	

(1) Diameter made by intersection point of conic angles "a1" and "a2"

(2) Diameter made by intersection point of conic angles "a2" and "a3"

(3) Machining data

(4) Parts settings are for exhaust side only

#### VALVE SPRING

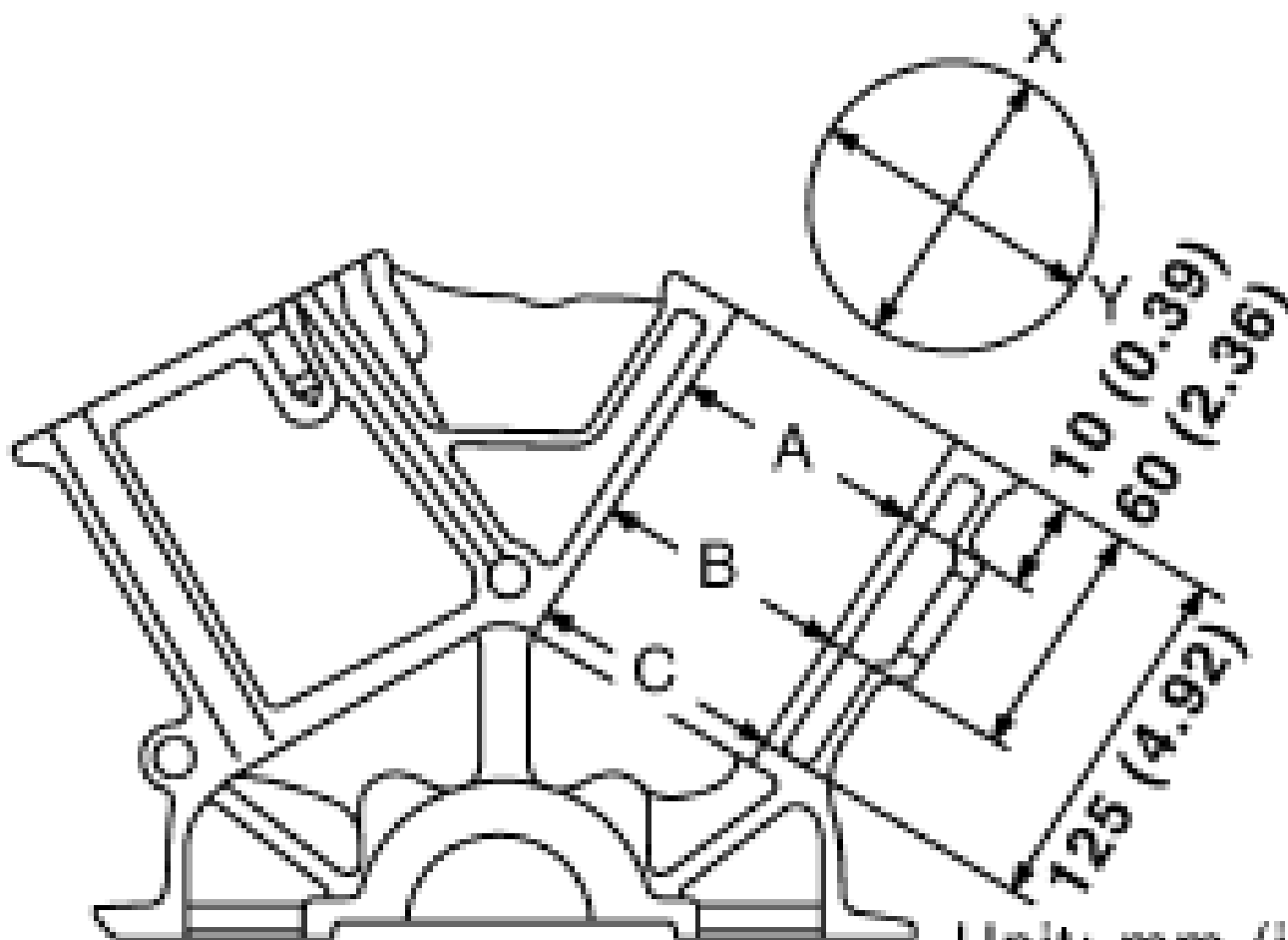
Items		Standard	
		Intake	Exhaust
Free height		45.66 mm (1.7976 in)	43.85 mm (1.7264 in)
Pressure	Installation	191.1 - 215.5 N (19.5 - 22 kg, 43 - 48 lb) at 40.90 mm (1.6102 in)	166 - 188 N (16.9 - 19.2 kg, 37 - 42 lb) at 37.00 mm (1.4567 in)
	Valve open	830.9 - 936.9 N (84.8 - 95.6 kg, 187 - 211 lb) at 28.07 mm (1.1051 in)	502 - 566 N (51.2 - 57.7 kg, 113 - 127 lb) at 26.80 mm (1.0551 in)
Identification color		Purple	Yellowish green

Items	Limit	
	Intake	Exhaust
Out-of-square	2.0 mm (0.079 in)	1.9 mm (0.075 in)

#### Cylinder Block

#### CYLINDER BLOCK

Unit: mm (in)



Unit: mm (in)

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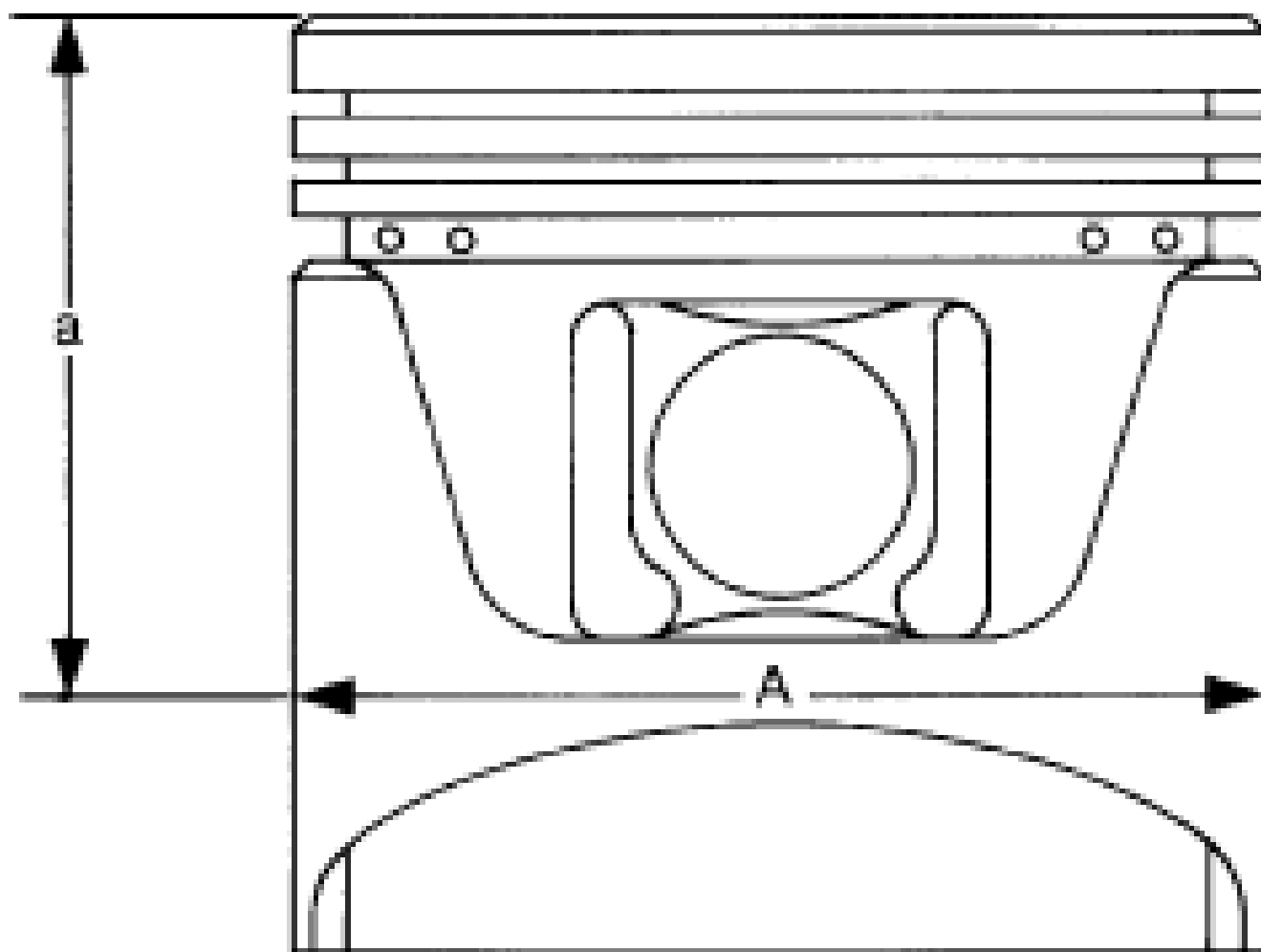
Surface flatness		Standard		Less than 0.03 (0.0012)
		Limit		0.1 (0.004)
Main bearing housing inner diameter		Standard		69.993 - 70.017 (2.7556 - 2.7566)
Cylinder bore	Inner diameter	Standard	Grade No. 1	95.500 - 95.510 (3.7598 - 3.7602)
			Grade No. 2	95.510 - 95.520 (3.7602 - 3.7606)
			Grade No. 3	95.520 - 95.530 (3.7606 - 3.7610)
		Wear limit		0.2 (0.008)
Out-of-round		Limit		0.015 (0.0006)
Taper				0.010 (0.0004)
			Grade No. A	69.993 - 69.994 (2.7556 - 2.7557)
			Grade No. B	69.994 - 69.995 (2.7557 - 2.7557)
			Grade No. C	69.995 - 69.996 (2.7557 - 2.7557)
			Grade No. D	69.996 - 69.997 (2.7557 - 2.7558)

**2012 Infiniti M37****2012 ENGINE Engine Mechanical (VQ37VHR) - M**

Main bearing housing inner diameter grade (Without bearing)	Grade No. E	69.997 - 69.998 (2.7558 - 2.7558)
	Grade No. F	69.998 - 69.999 (2.7558 - 2.7559)
	Grade No. G	69.999 - 70.000 (2.7559 - 2.7559)
	Grade No. H	70.000 - 70.001 (2.7559 - 2.7559)
	Grade No. J	70.001 - 70.002 (2.7559 - 2.7560)
	Grade No. K	70.002 - 70.003 (2.7560 - 2.7560)
	Grade No. L	70.003 - 70.004 (2.7560 - 2.7561)
	Grade No. M	70.004 - 70.005 (2.7561 - 2.7561)
	Grade No. N	70.005 - 70.006 (2.7561 - 2.7561)
	Grade No. P	70.006 - 70.007 (2.7561 - 2.7562)
	Grade No. R	70.007 - 70.008 (2.7562 - 2.7562)
	Grade No. S	70.008 - 70.009 (2.7562 - 2.7563)
	Grade No. T	70.009 - 70.010 (2.7563 - 2.7563)
	Grade No. U	70.010 - 70.011 (2.7563 - 2.7563)
	Grade No. V	70.011 - 70.012 (2.7563 - 2.7564)
	Grade No. W	70.012 - 70.013 (2.7564 - 2.7564)
	Grade No. X	70.013 - 70.014 (2.7564 - 2.7565)
	Grade No. Y	70.014 - 70.015 (2.7565 - 2.7565)
	Grade No. 4	70.015 - 70.016 (2.7565 - 2.7565)
	Grade No. 7	70.016 - 70.017 (2.7565 - 2.7566)
Difference in inner diameter between cylinders	Standard	Less than 0.03 (0.0012)

**AVAILABLE PISTON**

Unit: mm (in)



SEM882E

Items		Standard	Oversize (Service) [0.2 (0.008)]
Piston skirt diameter "A"	Grade No. 1	95.480 - 95.490 (3.7590 - 3.7594)	-
	Grade No. 2	95.490 - 95.500 (3.7594 - 3.7598)	-
	Grade No. 3	95.500 - 95.510 (3.7598 - 3.7602)	-
	Service	-	95.680 - 95.710 (3.7669 - 3.7681)
Items		Standard	Limit
"a" dimension		38.8 (1.528)	-
Piston pin hole diameter	Grade No. 0	21.993 - 21.999 (0.8659 - 0.8661)	-
		21.999 - 22.005 (0.8661 -	

## 2012 Infiniti M37

### 2012 ENGINE Engine Mechanical (VQ37VHR) - M

	Grade No. 1	0.8663)	-
Piston to cylinder bore clearance		0.010 - 0.030 (0.0004 - 0.0012)	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)	0.10 (0.0039)
	Oil ring	0.055 - 0.155 (0.0022 - 0.0061)	0.19 (0.0075)
End gap	Top	0.23 - 0.33 (0.0091 - 0.0130)	0.42 (0.0169)
	2nd	0.23 - 0.33 (0.0091 - 0.0130)	0.57 (0.0224)
	Oil (rail ring)	0.17 - 0.47 (0.0067 - 0.0185)	0.63 (0.0248)

#### PISTON PIN

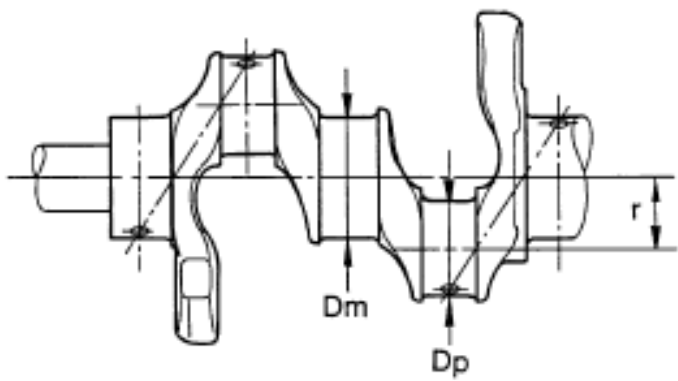
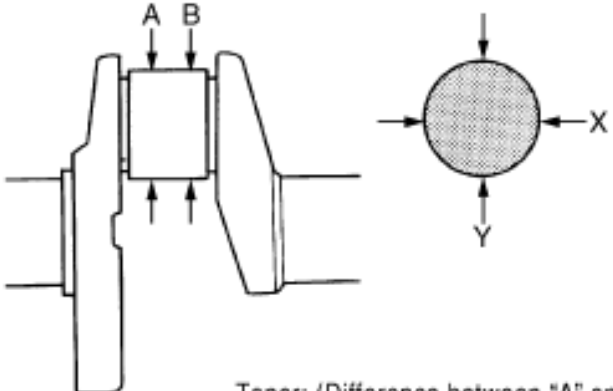
		Unit: mm (in)	
Items		Standard	Limit
Piston pin outer diameter	Grade No. 0	21.989 - 21.995 (0.8657 - 0.8659)	-
	Grade No. 1	21.995 - 22.001 (0.8659 - 0.8662)	-
Piston to piston pin oil clearance		0.002 - 0.006 (0.0001 - 0.0002)	-
Connecting rod bushing oil clearance		0.005 - 0.017 (0.0002 - 0.0007)	0.030 (0.0012)

#### CONNECTING ROD

		Unit: mm (in)	
Items		Standard	Limit
Center distance		149.45 - 149.55 (5.88 - 5.89)	-
Bend [per 100 (3.94)]		-	0.15 (0.0059)
Torsion [per 100 (3.94)]		-	0.30 (0.0118)
Connecting rod bushing inner diameter <sup>(1)</sup>	Grade No. 0	22.000 - 22.006 (0.8661 - 0.8664)	-
	Grade No. 1	22.006 - 22.012 (0.8664 - 0.8666)	-
	Grade No.	A 57.000 - 57.001 (2.2441 - 2.2441)	-
	Grade No. B	57.001 - 57.002 (2.2441 - 2.2442)	-
	Grade No. C	57.002 - 57.003 (2.2442 - 2.2442)	-
	Grade No.	57.003 - 57.004 (2.2442 -	-

Connecting rod big end diameter (Without bearing)	D	2.2442)	
	Grade No. E	57.004 - 57.005 (2.2442 - 2.2443)	-
	Grade No. F	57.005 - 57.006 (2.2443 - 2.2443)	-
	Grade No. G	57.006 - 57.007 (2.2443 - 2.2444)	-
	Grade No. H	57.007 - 57.008 (2.2444 - 2.2444)	-
	Grade No. J	57.008 - 57.009 (2.2444 - 2.2444)	-
	Grade No. K	57.009 - 57.010 (2.2444 - 2.2445)	-
	Grade No. L	57.010 - 57.011 (2.2445 - 2.2445)	-
	Grade No. M	57.011 - 57.012 (2.2445 - 2.2446)	-
	Grade No. N	57.012 - 57.013 (2.2446 - 2.2446)	-
Items		Standard	Limit
Side clearance		0.20 - 0.35 (0.0079 - 0.0138)	0.40 (0.0157)
(1) After installing in connecting rod			

**CRANKSHAFT**

Unit: mm (in)			
 <p style="text-align: center;">SEM645</p>		 <p style="text-align: center;">Taper: (Difference between "A" and "B") Out-of-round: (Difference between "X" and "Y")</p> <p style="text-align: right;">SBIAD535E</p>	
		Grade No. A	64.975 - 64.974 (2.5581 - 2.5580)
		Grade No. B	64.974 - 64.973 (2.5580 - 2.5580)
		Grade No. C	64.973 - 64.972 (2.5580 - 2.5579)



# 2012 Infiniti M37

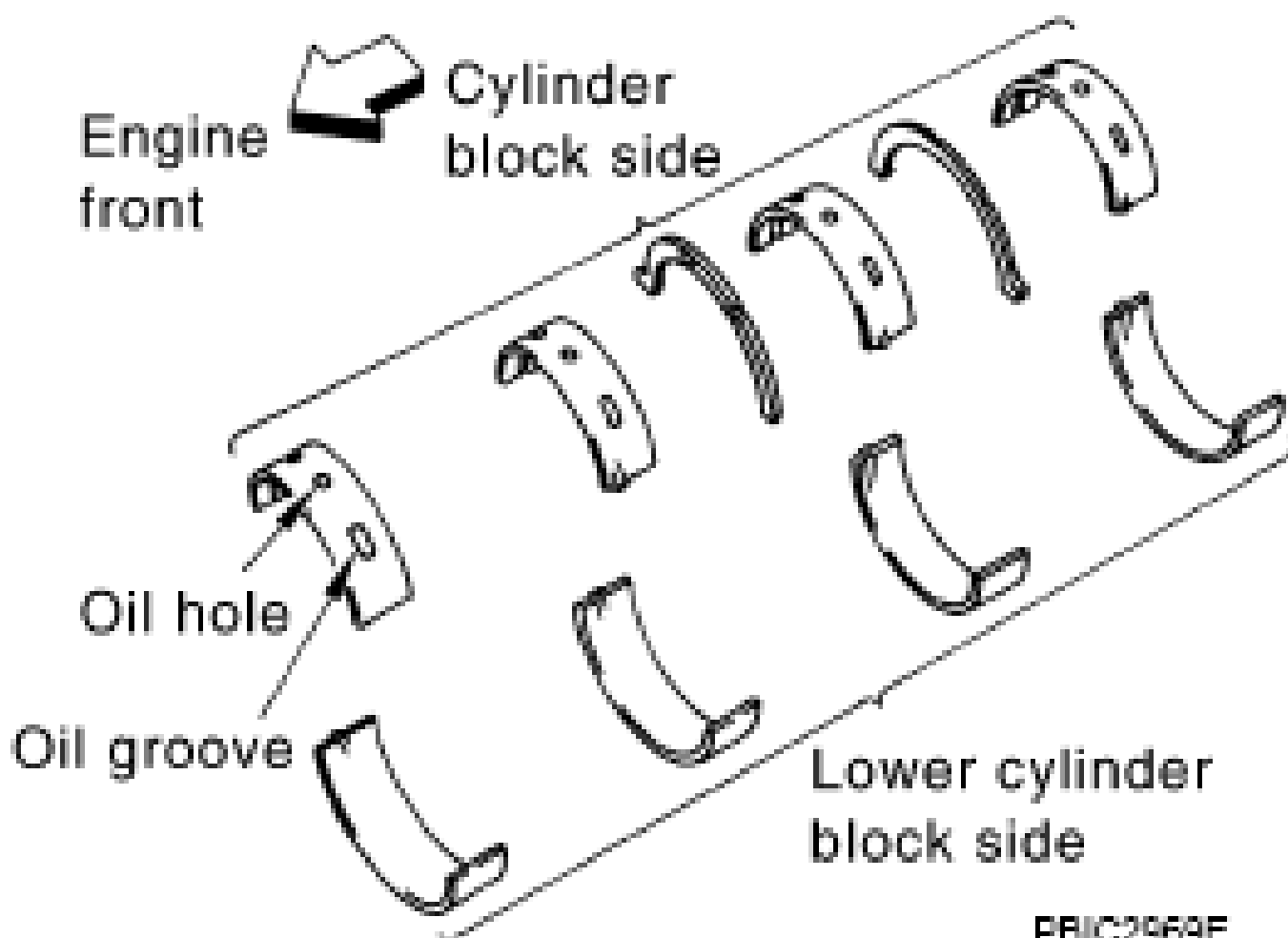
2012 ENGINE Engine Mechanical (VQ37VHR) - M

Main journal diameter. "Dm" grade	Standard	Grade No. D	64.972 - 64.971 (2.5579 - 2.5579)
		Grade No. E	64.971 - 64.970 (2.5579 - 2.5579)
		Grade No. F	64.970 - 64.969 (2.5579 - 2.5578)
		Grade No. G	64.969 - 64.968 (2.5578 - 2.5578)
		Grade No. H	64.968 - 64.967 (2.5578 - 2.5578)
		Grade No. J	64.967 - 64.966 (2.5578 - 2.5577)
		Grade No. K	64.966 - 64.965 (2.5577 - 2.5577)
		Grade No. L	64.965 - 64.964 (2.5577 - 2.5576)
		Grade No. M	64.964 - 64.963 (2.5576 - 2.5576)
		Grade No. N	64.963 - 64.962 (2.5576 - 2.5576)
		Grade No. P	64.962 - 64.961 (2.5576 - 2.5575)
		Grade No. R	64.961 - 64.960 (2.5575 - 2.5575)
		Grade No. S	64.960 - 64.959 (2.5575 - 2.5574)
		Grade No. T	64.959 - 64.958 (2.5574 - 2.5574)
		Grade No. U	64.958 - 64.957 (2.5574 - 2.5574)
		Grade No. V	64.957 - 64.956 (2.5574 - 2.5573)
		Pin journal diameter. "Dp" grade	Standard
Grade No. X	64.955 - 64.954 (2.5573 - 2.5572)		
Grade No. Y	64.954 - 64.953 (2.5572 - 2.5572)		
Grade No. 4	64.953 - 64.952 (2.5572 - 2.5572)		
Grade No. 7	64.952 - 64.951 (2.5572 - 2.5571)		
Grade No. A	53.974 - 53.973 (2.1250 - 2.1249)		
Grade No. B	53.973 - 53.972 (2.1249 - 2.1249)		
Grade No. C	53.972 - 53.971 (2.1249 - 2.1248)		
Grade No. D	53.971 - 53.970 (2.1248 - 2.1248)		
Grade No. E	53.970 - 53.969 (2.1248 - 2.1248)		
Grade No. F	53.969 - 53.968 (2.1248 - 2.1247)		
Grade No. G	53.968 - 53.967 (2.1247 - 2.1247)		
Grade No. H	53.967 - 53.966 (2.1247 - 2.1246)		
Grade No. J	53.966 - 53.965 (2.1246 - 2.1246)		
Grade No. K	53.965 - 53.964 (2.1246 - 2.1246)		
Grade No. L	53.964 - 53.963 (2.1246 - 2.1245)		
Grade No. M	53.963 - 53.962 (2.1245 - 2.1245)		
Grade No. N	53.962 - 53.961 (2.1245 - 2.1244)		
Grade No. P	53.961 - 53.960 (2.1244 - 2.1244)		
Grade No. R	53.960 - 53.959 (2.1244 - 2.1244)		
Grade No. S	53.959 - 53.958 (2.1244 - 2.1243)		
Grade No. T	53.958 - 53.957 (2.1243 - 2.1243)		
Grade No. U	53.957 - 53.956 (2.1243 - 2.1242)		
Center distance "r"			42.96 - 43.04 (1.6913 - 1.6945)
Taper (Difference between "A" and "B")	Limit	0.0025 (0.0001)	
Out-of-round (Difference between "X" and		0.0025 (0.0001)	

"Y")		
Crankshaft runout [TIR <sup>(1)</sup> ]	Standard	Less than 0.05 (0.002)
	Limit	0.10 (0.0039)
Crankshaft end play	Standard	0.10 - 0.25 (0.0039 - 0.0098)
	Limit	0.30 (0.0118)
(1) Total indicator reading		

**Main Bearing****MAIN BEARING**

Unit: mm (in)

**FBIC2969E**

Grade number	Thickness	Width	Identification color	Remarks
0	2.500 - 2.503 (0.0984 - 0.0985)		Black	

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1		2.503 - 2.506 (0.0985 - 0.0987)		Brown	
2		2.506 - 2.509 (0.0987 - 0.0988)		Green	
3		2.509 - 2.512 (0.0988 - 0.0989)		Yellow	
4		2.512 - 2.515 (0.0989 - 0.0990)		Blue	Grade is the same for upper and lower bearings.
5		2.515 - 2.518 (0.0990 - 0.0991)		Pink	
6		2.518 - 2.521 (0.0991 - 0.0993)		Purple	
7		2.521 - 2.524 (0.0993 - 0.0994)		White	
01	UPR	2.503 - 2.506 (0.0985 - 0.0987)		Brown	
	LWR	2.500 - 2.503 (0.0984 - 0.0985)		Black	
12	UPR	2.506 - 2.509 (0.0987 - 0.0988)		Green	Grade and color are different for upper and lower bearings.
	LWR	2.503 - 2.506 (0.0985 - 0.0987)	19.9 - 20.1 (0.783 - 0.791)	Brown	
23	UPR	2.509 - 2.512 (0.0988 - 0.0989)		Yellow	
	LWR	2.506 - 2.509 (0.0987 - 0.0988)		Green	
34	UPR	2.512 - 2.515 (0.0989 - 0.0990)		Blue	
	LWR	2.509 - 2.512 (0.0988 - 0.0989)		Yellow	
45	UPR	2.515 - 2.518 (0.0990 - 0.0991)		Pink	
	LWR	2.512 - 2.515 (0.0989 - 0.0990)		Blue	
56	UPR	2.518 - 2.521 (0.0991 - 0.0993)		Purple	
	LWR	2.515 - 2.518 (0.0990 - 0.0991)		Pink	
67	UPR	2.521 - 2.524 (0.0993 - 0.0994)		White	
	LWR	2.518 - 2.521 (0.0991 - 0.0993)		Purple	

## UNDERSIZE

**2012 Infiniti M37**

2012 ENGINE Engine Mechanical (VQ37VHR) - M

**Unit: mm (in)**

Items	Thickness	Main journal diameter
0.25 (0.0098)	2.633 - 2.641 (0.1037 - 0.1040)	Grind so that bearing clearance is the specified value.

**MAIN BEARING OIL CLEARANCE****Unit: mm (in)**

Items	Standard	Limit
Main bearing oil clearance	0.035 - 0.045 (0.0014 - 0.0018) <sup>(1)</sup>	0.065 (0.0026)

<sup>(1)</sup> Actual clearance**Connecting Rod Bearing****CONNECTING ROD BEARING****Unit: mm (in)**

Grade number	Thickness	Identification color (mark)
0	1.497 - 1.500 (0.0589 - 0.0591)	Black
1	1.500 - 1.503 (0.0591 - 0.0592)	Brown
2	1.503 - 1.506 (0.0592 - 0.0593)	Green
3	1.506 - 1.509 (0.0593 - 0.0594)	Yellow
4	1.509 - 1.512 (0.0594 - 0.0595)	Blue

**UNDERSIZE****Unit: mm (in)**

Items	Thickness	Crank pin journal diameter
0.25 (0.0098)	1.626 - 1.634 (0.0640 - 0.0643)	Grind so that bearing clearance is the specified value.

**CONNECTING ROD BEARING OIL CLEARANCE****Unit: mm (in)**

Items	Standard	Limit
Connecting rod bearing oil clearance	0.040 - 0.053 (0.0016 - 0.0021) <sup>(1)</sup>	0.070 (0.0028)

<sup>(1)</sup> Actual clearance