

2012 ENGINE

Engine Mechanical - QX56

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.

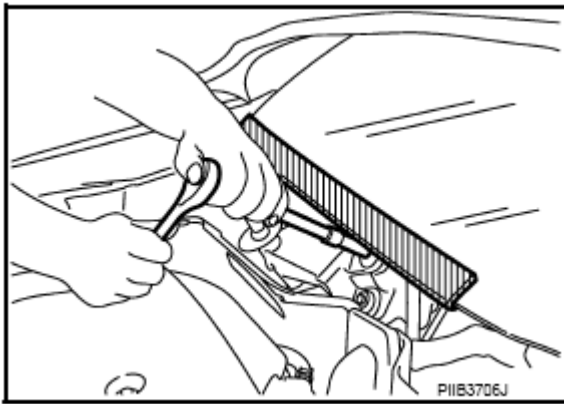


Fig. 1: Removing Cowl Top Cover

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 "SRS AIRBAG" and "SEAT BELT".

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.**

Precaution for Handling High Pressure Fuel System

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

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.

Parts Requiring Angle Tightening

- Use angle wrench [SST: KV10112100 (BT8653-A)] for the final tightening of the following engine parts:
 - Cylinder head bolts
 - Main bearing cap bolts
 - Main bearing cap sub bolts
 - Connecting rod cap bolts
 - Crankshaft pulley bolt (No angle wrench is required as the bolt flange is provided with notches for angle tightening)
- Ensure thread and seat surfaces are clean and coated with engine oil.

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

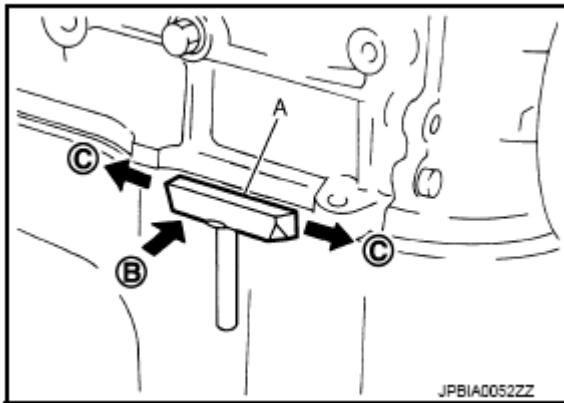


Fig. 2: Separating Mating Surface Using The Seal Cutter
Courtesy of NISSAN NORTH AMERICA, INC.

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 adhering to the liquid gasket application surface and the mating surface.
 - Remove liquid gasket completely from the groove of the liquid gasket application surface, mounting bolts and bolt holes.
2. Wipe the liquid gasket application surface and the mating surface with white gasoline (lighting and heating use) to remove adhering moisture, grease and foreign materials.

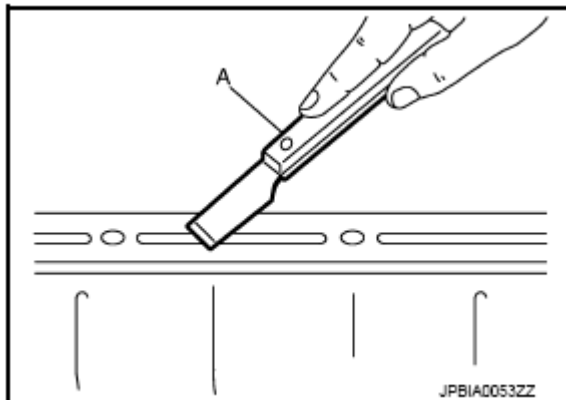


Fig. 3: Removing Liquid Gasket Using Scraper
 Courtesy of NISSAN NORTH AMERICA, INC.

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.

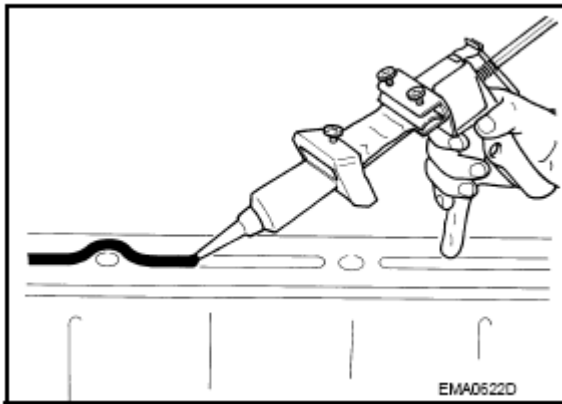


Fig. 4: Applying Liquid Gasket Using Tool
 Courtesy of NISSAN NORTH AMERICA, INC.

- As for bolt holes (B), normally apply liquid gasket inside the holes. Occasionally, it should be applied outside the holes. Check to read the text of this Service Information.
- Within 5 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.

A : Groove
 ⇐ : Inside

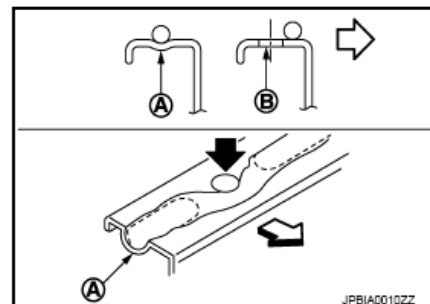


Fig. 5: Identifying Bolt Hole And Groove
 Courtesy of NISSAN NORTH AMERICA, INC.

Definitions of Bank Names

- In this Service Information, each bank name is defined as per the following:

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

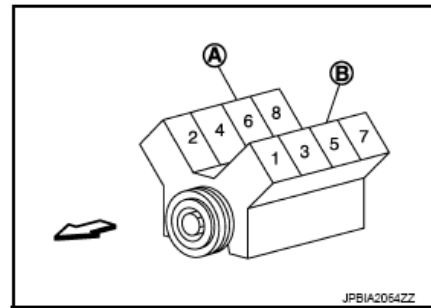


Fig. 6: Identifying Cylinder Numbers And Bank Layout
 Courtesy of NISSAN NORTH AMERICA, INC.

- For cylinder numbers and bank layout, Refer to the figure.

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

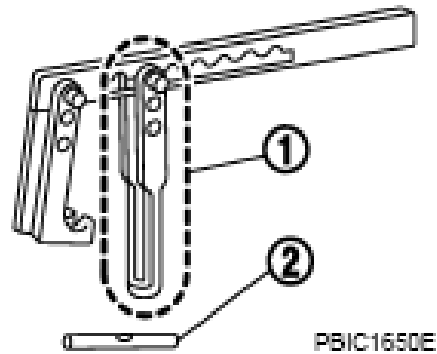
PREPARATION

Special Service Tool

Tool number (Kent-Moore No.) Tool name	Description
KV10116200 (J-26336-A) Valve spring compressor 1. KV10115900 (J-26336-20) Attachment 2. KV10109220	Disassembling valve mechanism Part (1) is a component of KV10116200 (J26336-A), but part (2) is not so.

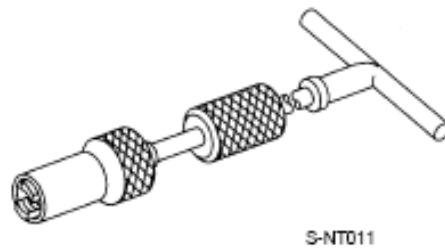
(-)

Adapter



PBIC1650E

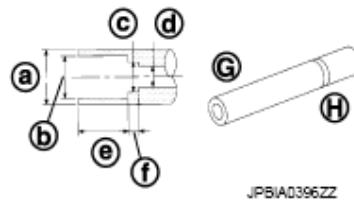
KV10107902
(J-38959)
Valve oil seal puller



S-NT011

Removing valve oil seal

KV10115600
(J-38958)
Valve oil seal drift



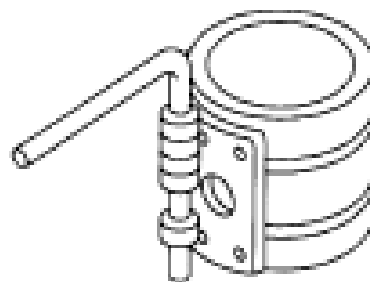
JPBIA0396ZZ

Installing valve oil seal
Use side A (G)

- 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)
- H: Side B

Unit: mm (in)

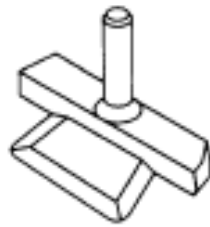
EM03470000
(J-8037)
Piston ring compressor



S-NT044

Installing piston assembly into cylinder bore

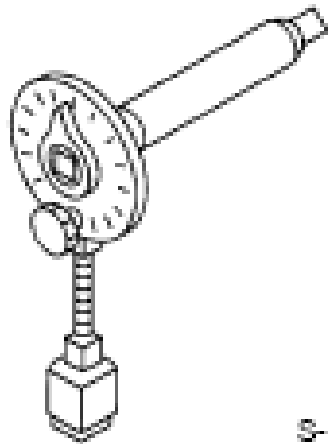
KV10111100
(J-37228)
Seal cutter



S-NT046

Removing steel oil pan and front cover

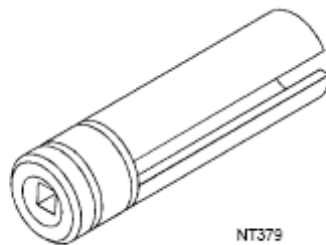
KV10112100
(BT8653-A)
Angle wrench



S-NT014

Tightening bolts for bearing cap,
cylinder head, etc.

KV10117100
(J-44626)
Heated oxygen sensor
wrench

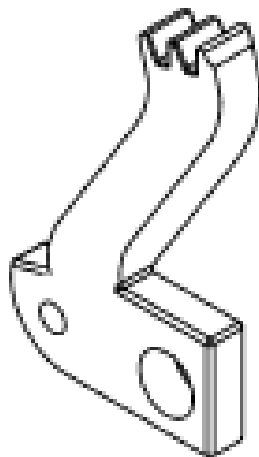


NT379

Loosening or tightening air fuel ratio
sensor 1

a. 22 mm (0.87 in)

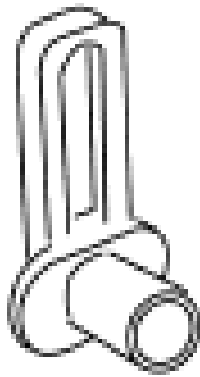
KV10120100
(J-47245)
Ring gear stopper



LBIA0451E

Removing and installing crankshaft
pulley

(J-45488)
Quick connector release



PB/C0198E

Removing fuel tube quick connectors in engine room
(Available in SEC. 164 of PARTS CATALOG: Part No. 16441 6N210)

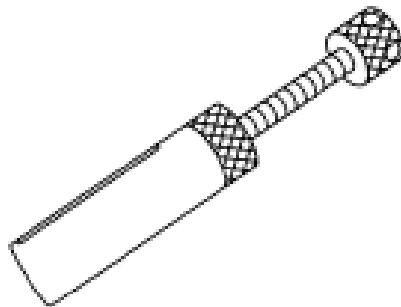
KV10119300
(-)
Adapter and torque wrench assembly



JPBIA2623ZZ

Tightening rocker cover mounting bolts. (specified torque)

KV10119600
(-)
Injector remover

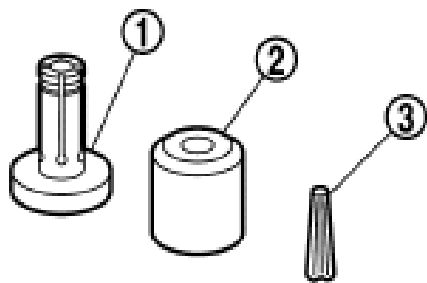


JPBIA3746ZZ

Removing fuel injector

KV101197S0
(-) Injector seal drift set

1. KV10119730
(-) Seal installer
2. KV10119710 (-)
Drift
3. KV10119720
(-)

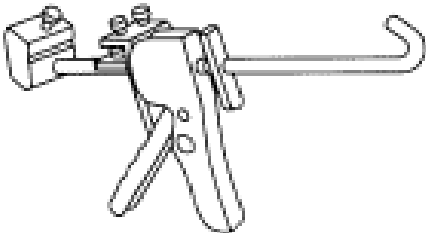
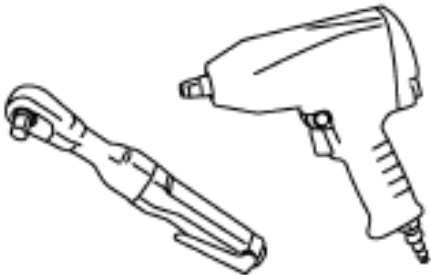
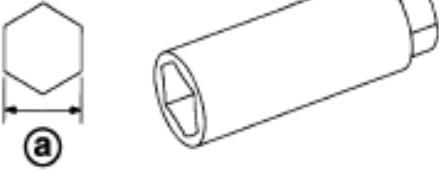


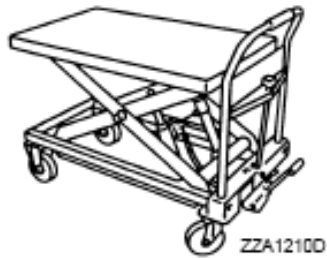
JPBIA5653ZZ

Installing fuel injector seal ring

Seal guide		
EG15050500 (J-45402) Compression gauge adapter		Checking compression pressure

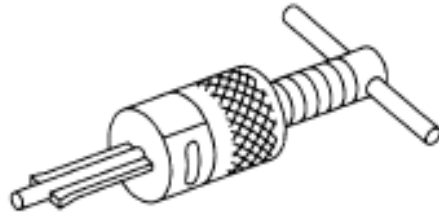
Commercial Service Tool

(Kent-Moore No.) Tool name	Description
(-) Tube presser  S-NT052	Pressing the tube of liquid gasket
(-) Power tool  PBIC0190E	Loosening nuts and bolts
(-) Spark plug wrench  JPBIA0399ZZ	Removing and installing spark plug a. 14 mm (0.55 in)
(-) Manual lift table caddy	Removing and installing engine



ZZA12100

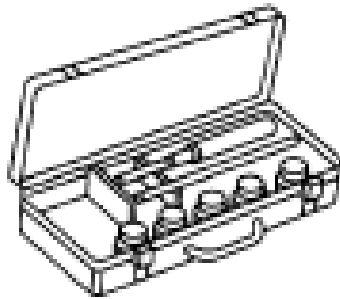
(-)
Pilot bushing puller



NT045

Removing pilot converter

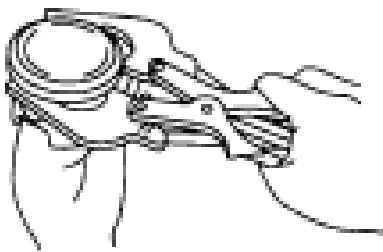
(-)
Valve seat cutter set



S-NT048

Finishing valve seat (EXH) dimensions

(-)
Piston ring expander



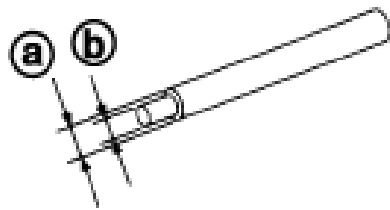
S-NT030

Removing and installing piston ring

(-)
Valve guide drift

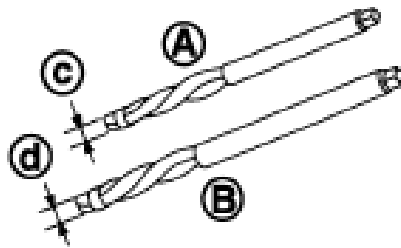
Removing and installing valve guide (EXH)

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



JPBIA0400ZZ

(-)
Valve guide reamer



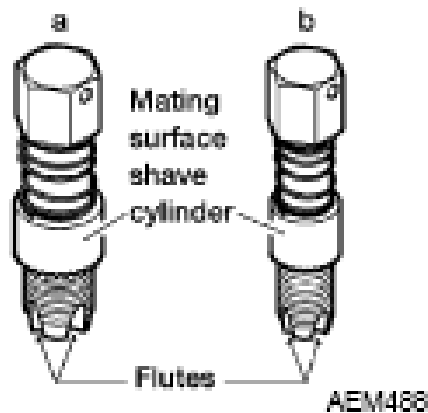
JPBIA0401ZZ

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

c: 6.0 mm (0.236 in) Dia.

d: 10.2 mm (0.402 in) Dia.

(J-43897-18)
(J-43897-12)
Oxygen sensor
thread cleaner



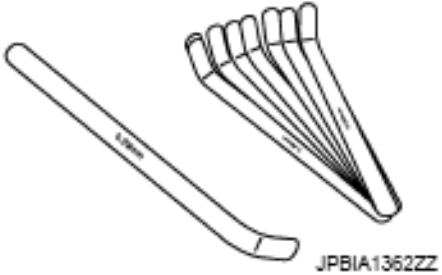
Reconditioning the exhaust system threads
before installing a new heated oxygen sensor
(use with anti-seize lubricant shown below):

- J-43897-18 (18 mm Dia.) for zirconia heated oxygen sensor and air fuel ratio sensor**
- J-43897-12 (12 mm dial.) for Titania heated oxygen sensor and air fuel ratio sensor**

(-)
Anti-seize lubricant
(Permatex 133AR
or equivalent
meeting MIL
specification
MIL-A-907)



Lubricating oxygen sensor thread cleaning tool
when reconditioning exhaust system threads

(-) Feeler gauge 	Inspection valve clearance (use a curved-tip gauge)
(-) Compression gauge with flexible type adapter	Checking compression pressure

BASIC INSPECTION

CAMSHAFT VALVE CLEARANCE

Inspection

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 & cylinder head assembly with a new one. (Install new VVEL ladder assembly & 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 exhaust camshaft or valve-related parts, or at the occurrence of malfunction (poor starting, idle malfunction, unusual noise) due to aged deterioration in valve clearance.
- Remove VVEL actuator motor assembly. Refer to "**REMOVAL AND INSTALLATION**".
 - Remove rocker covers (bank 1 and bank 2). Refer to "**REMOVAL AND INSTALLATION**".
 - Remove VVEL actuator housing assembly. Refer to "**REMOVAL AND INSTALLATION**".
 - Measure the valve clearance as per the following:

- Use the feeler gauge (commercial service tool) of curved-tip. This allows the feeler gauge to access the clearance between camshaft (drive shaft) nose 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 angle shown in the figure.
- Refer to the figure for the insertion direction of the feeler gauge since the direction depends on the bank.

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

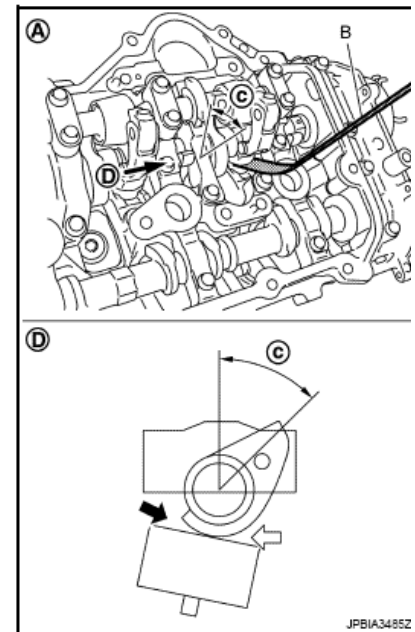


Fig. 7: Measuring Valve Clearance On Intake Side Using Feeler Gauge
Courtesy of NISSAN NORTH AMERICA, INC.

- Set No. 1 cylinder at TDC of its compression stroke.
 - Rotate crankshaft pulley clockwise to align timing mark (grooved line without color) (B) with timing indicator (A).

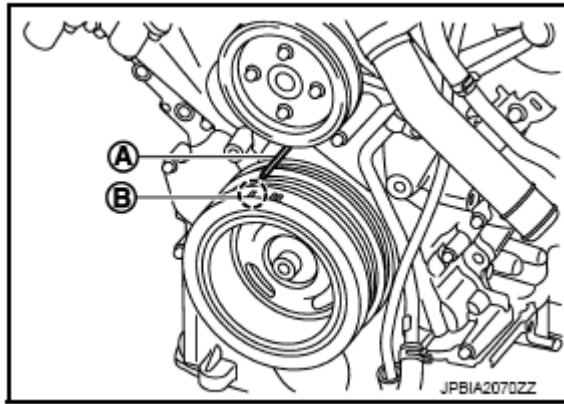


Fig. 8: Identifying Crankshaft Pulley With Timing Indicator
 Courtesy of NISSAN NORTH AMERICA, INC.

- Check that exhaust cam nose on No. 1 cylinder (engine front side of bank 1) is located as shown in the figure.
- If not, turn crankshaft one revolution (360 degrees) and align as shown in the figure.

1 : Exhaust camshaft (bank 1)
 ⇐ : Engine front

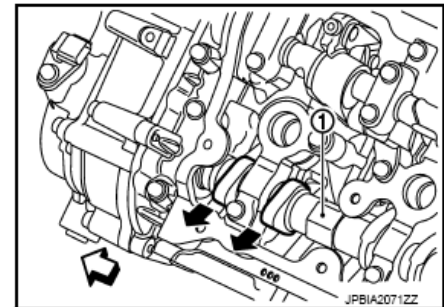


Fig. 9: Locating Intake And Exhaust Cam Nose On No. 1 Cylinder
 Courtesy of NISSAN NORTH AMERICA, INC.

- By referring to the figure, measure the valve clearances at locations marked "x" as shown in the table below (locations indicated in the figure):
- No. 1 cylinder at compression TDC

↩ : Engine front

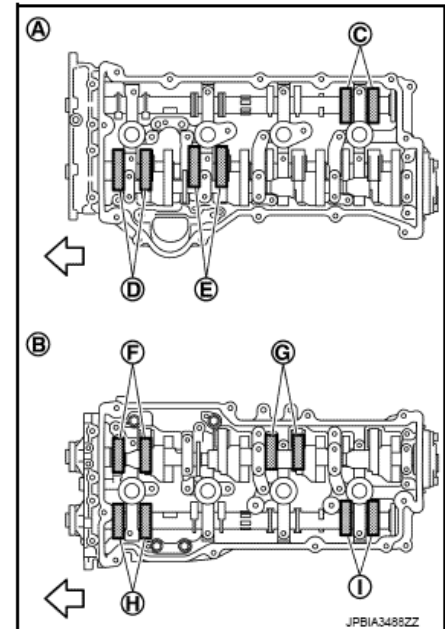


Fig. 10: Identifying Valve Clearances Measuring Position (No. 1)
Courtesy of NISSAN NORTH AMERICA, INC.

Measuring position [bank 2 (A)]		No. 2 CYL.	No. 4 CYL.	No. 6 CYL.	No. 8 CYL.
No. 1 cylinder at compression TDC	EXH				x (C)
	INT	x (D)	x (E)		
Measuring position [bank 1 (B)]		No. 1 CYL.	No. 3 CYL.	No. 5 CYL.	No. 7 CYL.
No. 1 cylinder at compression TDC	INT	x (F)		x (G)	
	EXH	x (H)			x (I)

NOTE: To measure valve clearance of No. 1 cylinder INT valve (front side), insert feeler gauge (A) (commercial service tool) as shown in the figure.

↩ : Engine front

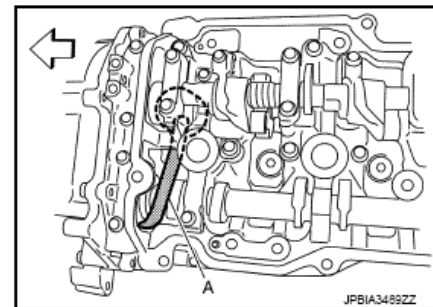


Fig. 11: Measuring Valve Clearance Of No. 1 Cylinder INT Valve Using Feeler Gauge
Courtesy of NISSAN NORTH AMERICA, INC.

A : Paint mark

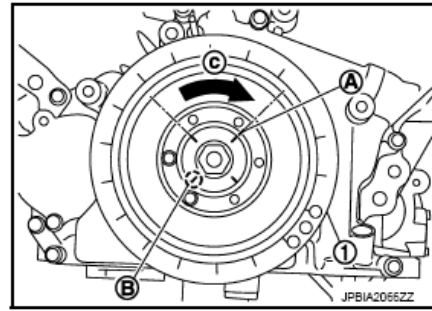


Fig. 12: Identifying Crankshaft Pulley Mounting Bolt Tightening Turn

Courtesy of NISSAN NORTH AMERICA, INC.

- b. Rotate crankshaft 270 degrees clockwise (when viewed from engine front) to align No. 3 cylinder at TDC its compression stroke.

NOTE: Crankshaft pulley mounting bolt flange has an angle mark (B) every 90 degrees (c). They can be used as a guide to rotation angle.

- 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

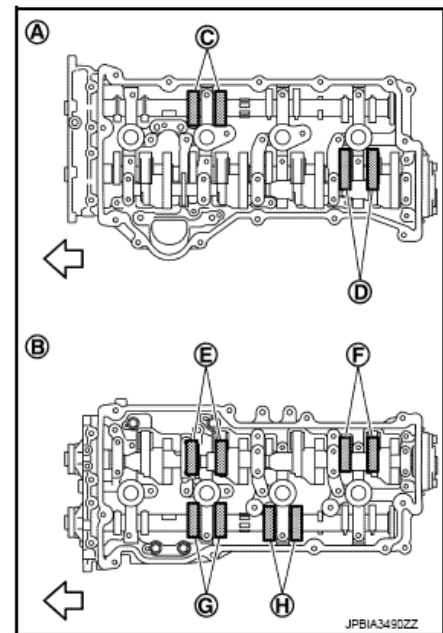


Fig. 13: Identifying Valve Clearances Measuring Position (No. 3)

Courtesy of NISSAN NORTH AMERICA, INC.

- No. 3 cylinder at compression TDC

Measuring position [bank 2 (A)]	No. 2 CYL.	No. 4 CYL.	No. 6 CYL.	No. 8 CYL.
EXH		x (C)		

No. 3 cylinder at compression TDC	INT				x (D)
Measuring position [bank 1 (B)]		No. 1 CYL.	No. 3 CYL.	No. 5 CYL.	No. 7 CYL.
No. 3 cylinder at compression TDC	INT		x (E)		x (F)
	EXH		x (G)	x (H)	

- c. Rotate crankshaft 90 degrees clockwise (when viewed from engine front) to align No. 6 cylinder at TDC of compression stroke.

NOTE: Crankshaft pulley mounting bolt flange has an angle mark (B) every 90 degrees (c). They can be used as a guide to rotation angle.

A : Paint mark

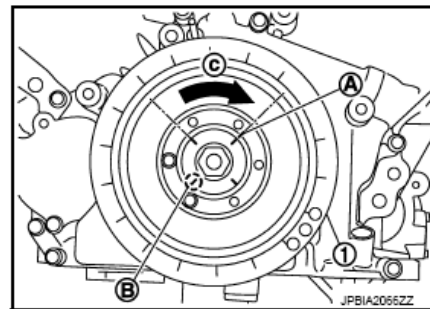


Fig. 14: Identifying Crankshaft Pulley Mounting Bolt Tightening Turn
Courtesy of NISSAN NORTH AMERICA, INC.

- 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

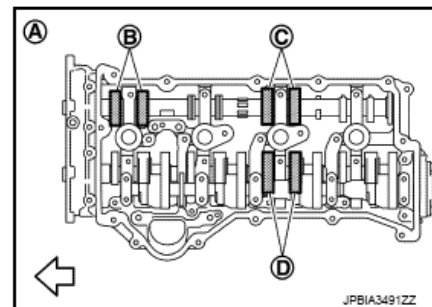


Fig. 15: Identifying Valve Clearances Measuring Position (No. 5)
Courtesy of NISSAN NORTH AMERICA, INC.

- No. 6 cylinder at compression TDC

Measuring position [bank 2 (A)]		No. 2 CYL.	No. 4 CYL.	No. 6 CYL.	No. 8 CYL.
No. 6 cylinder at compression TDC	EXH	x (B)		x (C)	
	INT			x (D)	

5. 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. Refer to "INSPECTION".
- If a valve clearance on the intake side is out of specification, replace VVEL ladder assembly & 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 & cylinder head assembly replacement are required.

COMPRESSION PRESSURE

Inspection

1. Warm up engine thoroughly. Then, stop it.
2. Release fuel pressure. Refer to the following table:

ENGINE	Reference
VK56VD FOR USA AND CANADA	" <u>WORK PROCEDURE</u> "
VK56VD FOR MEXICO	" <u>WORK PROCEDURE</u> "

CAUTION: If CONSULT is not used to release fuel pressure leave the fuel pump fuse disconnected until step 7.

3. Remove fuel pump fuse in IPDM E/R.

NOTE:

- For the fuse number, Refer to the following table:

ENGINE	Reference
VK56VD FOR USA AND CANADA	" <u>WIRING DIAGRAM</u> "
VK56VD FOR MEXICO	" <u>WIRING DIAGRAM</u> "

- For the fuse arrangement, Refer to "FUSE, CONNECTOR AND TERMINAL ARRANGEMENT".

4. Remove engine cover. 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 the compression tester with Tool [SST: EG15050500 (J-45402)] into the spark plug hole.

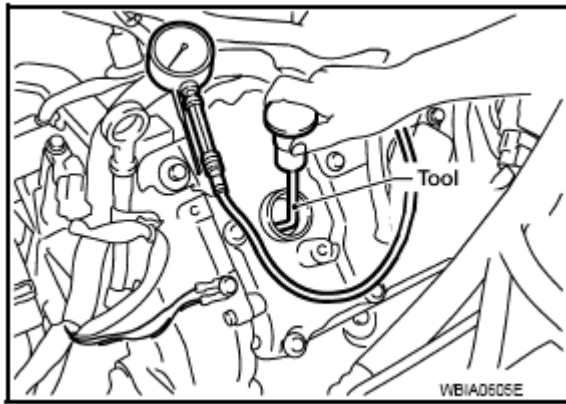


Fig. 16: Installing Compression Tester With Tool Into Spark Plug Hole
 Courtesy of NISSAN NORTH AMERICA, INC.

8. Measure compression pressure using compression gauge connected with flexible type adapter (commercial service tool).
9. 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. Refer to "HOW TO HANDLE BATTERY".
- 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 re-check it for compression.
 - If the added engine oil improves the compression, piston rings may be worn out or damaged. Check piston rings and replace if necessary. Refer to "DISASSEMBLY AND ASSEMBLY".
 - 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. Refer to "DISASSEMBLY AND ASSEMBLY".
- 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. Refer to "REMOVAL AND INSTALLATION".

10. After inspection is completed, install removed parts.
11. Start the engine, and check that the engine runs smoothly.
12. Perform trouble diagnosis. If DTC appears, erase it. Refer to the following table:

ENGINE	Reference
VK56VD FOR USA AND CANADA	<u>"VALUE DESCRIPTION "</u>
VK56VD FOR MEXICO	<u>"DESCRIPTION "</u>

SYMPTOM DIAGNOSIS

NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING

NVH Troubleshooting - Engine Noise

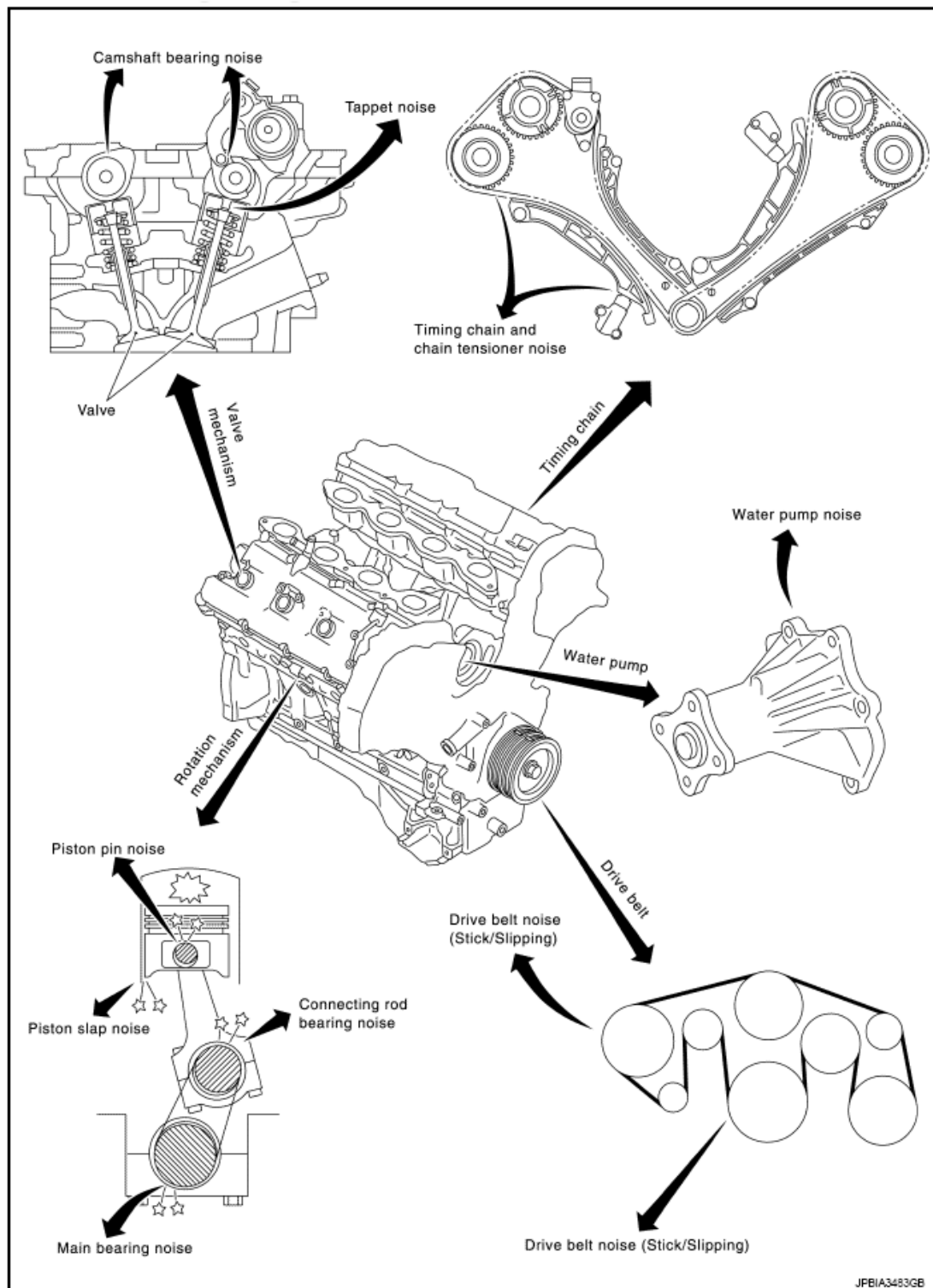


Fig. 17: Identifying Noise, Vibration And Harshness (NVH) Troubleshooting Components
 Courtesy of NISSAN NORTH AMERICA, INC.

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	Reference
		Before warm-up	After warm-up	When starting	When idling	When racing	While driving			
Top of engine Rocker cover Cylinder head	Ticking or clicking	C	A	-	A	B	-	Tappet noise	Valve clearance	<u>CAMSHAFT VALVE CLEARANCE</u>
	Rattle	C	A	-	A	B	C	Camshaft bearing noise	Camshaft runout Camshaft journal oil clearance	<u>CAMSHAFT</u>
Crankshaft pulley Cylinder block (Side of engine) Oil pan	Slap or knock	-	A	-	B	B	-	Piston pin noise	Piston to piston pin oil clearance Connecting rod bushing oil clearance	<u>PISTON TO PISTON PIN OIL CLEARANCE</u>
	Slap or rap	A	-	-	B	B	A	Piston slap noise	Piston to cylinder bore clearance Piston ring side clearance Piston ring end gap Connecting rod bend and torsion	<u>PISTON TO CYLINDER BORE CLEARANCE</u>
	Knock	A	B	C	B	B	B	Connecting rod bearing noise	Connecting rod bushing oil clearance Connecting rod bearing oil	<u>CONNECTING ROD BUSHING OIL CLEARANCE</u>

2012 Infiniti QX56

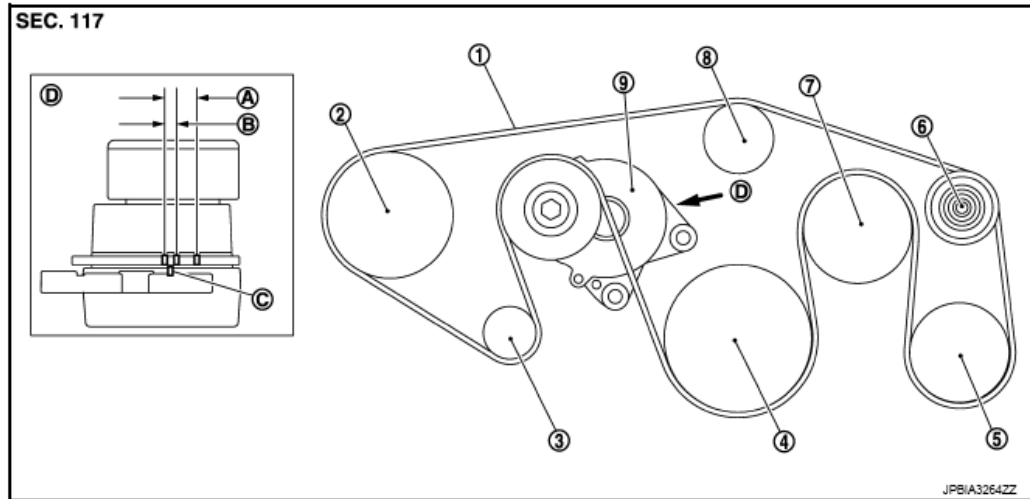
2012 ENGINE Engine Mechanical - QX56

									clearance	
	Knock	A	B	-	A	B	C	Main bearing noise	Main bearing oil clearance Crankshaft runout	<u>MAIN BEARING OIL CLEARANCE</u>
Front of engine Timing chain case	Tapping or ticking	A	A	-	B	B	B	Timing chain and timing chain tensioner noise	Timing chain cracks and wears Timing chain tensioner operation	<u>TIMING CHAIN</u>
Front of engine	Squeaking or fizzing	A	B	-	B	-	C	Drive belts (Sticking or slipping)	Drive belts deflection	<u>DRIVE BELTS</u>
	Creaking	A	B	A	B	A	B	Drive belts (Slipping)	Idler pulley bearing operation	
	Squall Creak	A	B	-	B	A	B	Water pump noise	Water pump operation	<u>INSPECTION</u>
A: Closely related B: Related C: Sometimes related -: Not related										

PERIODIC MAINTENANCE

DRIVE BELTS

Exploded View



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

Fig. 18: Identifying Drive Belt And Related Components
 Courtesy of NISSAN NORTH AMERICA, INC.

Checking

WARNING: Be sure to perform the these steps when engine is stopped.

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

NOTE:

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

Tension Adjustment

Refer to "**DRIVE BELTS**".

Removal and Installation

REMOVAL

1. Move reservoir tank to the position without the hindrance for work. Refer to "**EXPLODED VIEW**".
2. Install wrench (A) on drive belt auto tensioner pulley bolt, move in the direction of arrow (loosening direction of tensioner) as shown in the figure.

CAUTION:

- Never place hand in a location where pinching may occur if the holding tool accidentally comes off.
 - Never loosen the hexagonal part in center of auto tensioner pulley (1) (Never turn it clockwise). If turned clockwise, the complete auto tensioner must be replaced as a unit, including the pulley.
3. Under the above condition, insert a metallic bar (B) of approximately 6 mm (0.24 in) in diameter (hexagonal bar wrench shown as example in the figure) through the holding boss to lock auto tensioner pulley arm.
 4. Remove drive belt.

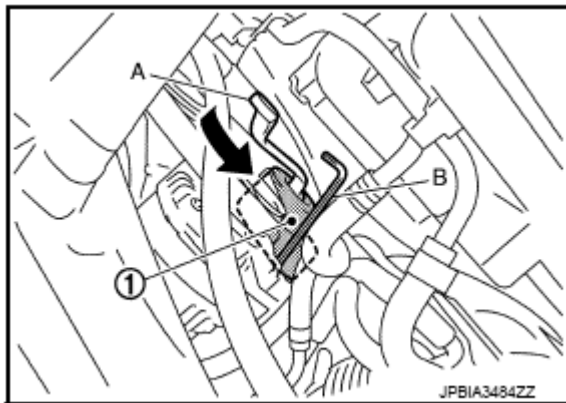


Fig. 19: Loosening Drive Belt Auto Tensioner Pulley Bolt Using Wrench
Courtesy of NISSAN NORTH AMERICA, INC.

INSTALLATION

Note the following item, and install in the reverse order of removal:

CAUTION:

- Check drive belts are securely installed around all pulleys.
- Check drive belts are correctly engaged with the pulley groove.
- Check for engine oil and engine coolant are not adhered drive belts and pulley groove.

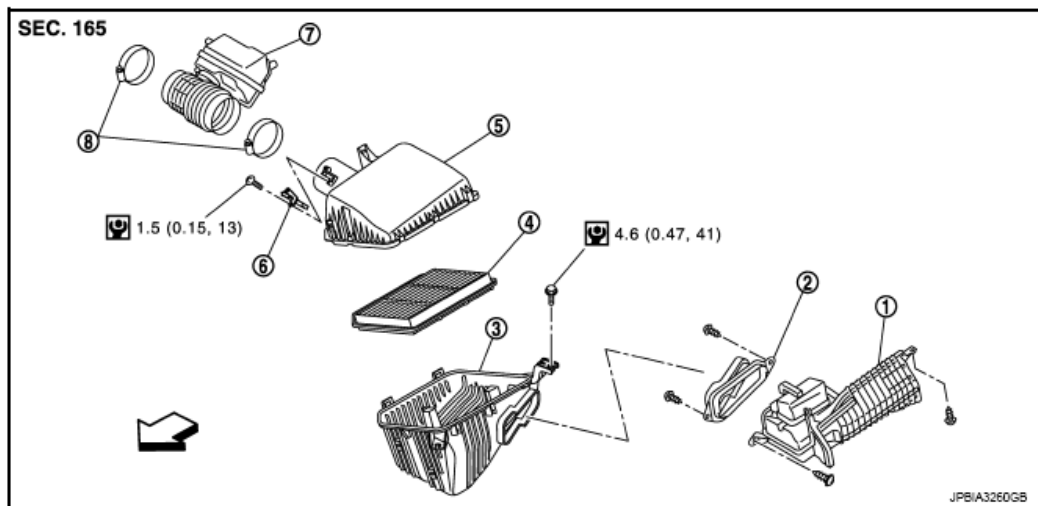
Inspection**INSPECTION AFTER INSTALLATION**

- Turn crankshaft pulley clockwise several times to equalize tension between each pulley, and then confirm

tension of drive belts at indicator (notch on fixed side) is within the possible use range. Refer to **"EXPLODED VIEW"**.

AIR CLEANER FILTER

Exploded View



- | | | |
|-----------------------|-----------------------------|-----------------------------|
| 1. Resonator | 2. Adapter | 3. Air cleaner case (lower) |
| 4. Air cleaner filter | 5. Air cleaner case (upper) | 6. Mass air flow sensor |
| 7. Air duct | 8. Clamp | |

↶ Vehicle front

Fig. 20: Identifying Air Cleaner Filter And Components With Torque Specifications
Courtesy of NISSAN NORTH AMERICA, INC.

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

Removal and Installation

REMOVAL

NOTE:

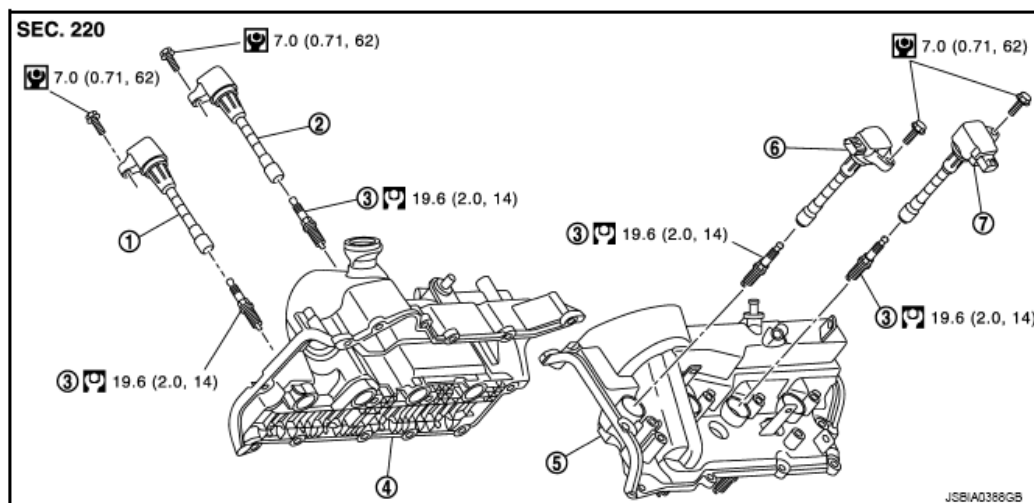
- The viscous paper type filter does not need cleaning between replacement intervals.
- Replace the air filter as necessary for periodic maintenance. Refer to the following table:

For NORTH AMERICA	<u>"FOR NORTH AMERICA: INTRODUCTION OF PERIODIC MAINTENANCE"</u>
For MEXICO	<u>"FOR MEXICO: INTRODUCTION OF PERIODIC MAINTENANCE"</u>

1. Unhook clips, and lift air cleaner case (upper).
2. Remove air cleaner filter from air cleaner case.

INSTALLATION

Install is the reverse order of removal.

SPARK PLUG**Exploded View**

- | | | |
|-----------------------------|-----------------------------|-----------------------------|
| 1. Ignition coil (No. 2, 4) | 2. Ignition coil (No. 6, 8) | 3. Spark plug |
| 4. Rocker cover (bank 2) | 5. Rocker cover (bank 1) | 6. Ignition coil (No. 1, 3) |
| 7. Ignition coil (No. 5, 7) | | |

Fig. 21: 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. Refer to "**EXPLODED VIEW**".
2. Remove ignition coil. Refer to "**EXPLODED VIEW**".
3. Remove spark plug with a spark plug wrench (commercial service tool).

a : 14 mm (0.55 in)

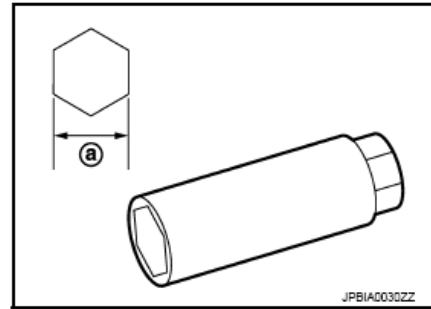


Fig. 22: Identifying Spark Plug Wrench Dimension
Courtesy of NISSAN NORTH AMERICA, INC.

INSTALLATION

Note the following item, installation is the reverse order of removal:

CAUTION: Install ignition coil marked with an identification mark (A) on cylinder No. 5, 6, 7 and 8.

↶ : Engine front

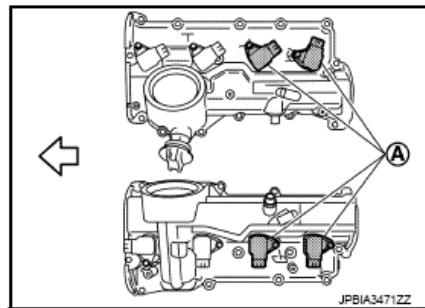


Fig. 23: Installing Ignition Coils
Courtesy of NISSAN NORTH AMERICA, INC.

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 impact 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/cm² , 85 psi)

Cleaning time: Less than 20 seconds

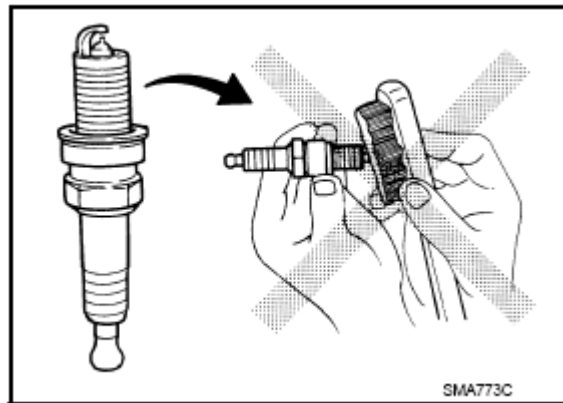


Fig. 24: Caution For Cleaning Spark Plug Using Wire Brush
Courtesy of NISSAN NORTH AMERICA, INC.

- Measure spark plug gap. When it exceeds the limit, replace spark plug even if it is within the specified replacement mileage. Refer to "**SPARK PLUG**".
- Spark plug gap adjustment is not required between replacement intervals.

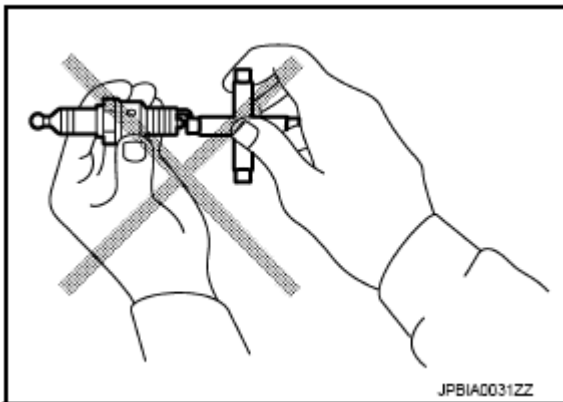
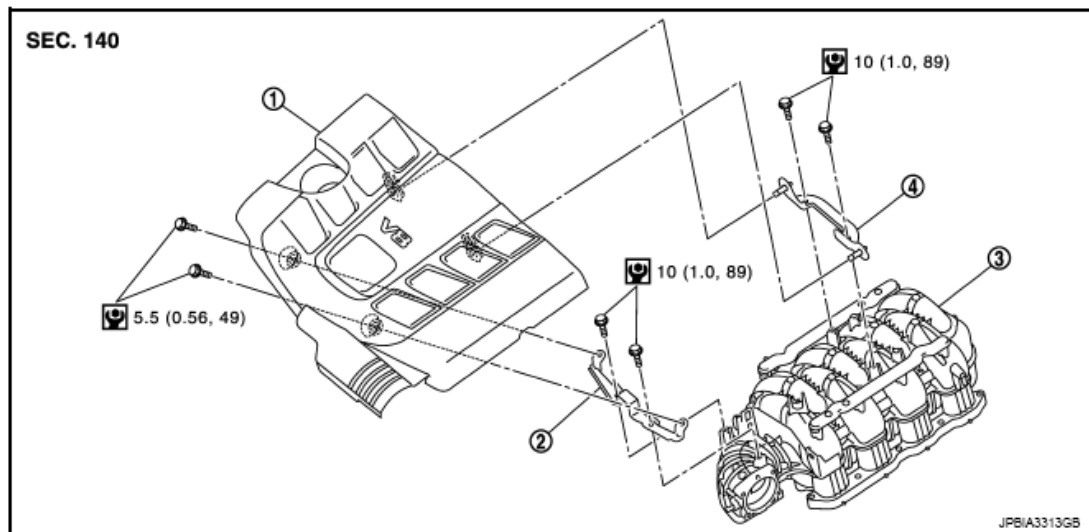


Fig. 25: Caution For Measuring Spark Plug Gap
Courtesy of NISSAN NORTH AMERICA, INC.

REMOVAL AND INSTALLATION

ENGINE COVER

Exploded View



- | | | |
|-------------------|--------------------|--------------------|
| 1. Engine cover | 2. Bracket (front) | 3. Intake manifold |
| 4. Bracket (rear) | | |

Fig. 26: Identifying Engine Cover And Screws With Torque Specifications
 Courtesy of NISSAN NORTH AMERICA, INC.

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

Removal and Installation

REMOVAL

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

1. Remove mounting bolts.
2. Pull forward and remove engine cover.
3. Remove bracket (front) and bracket (rear).

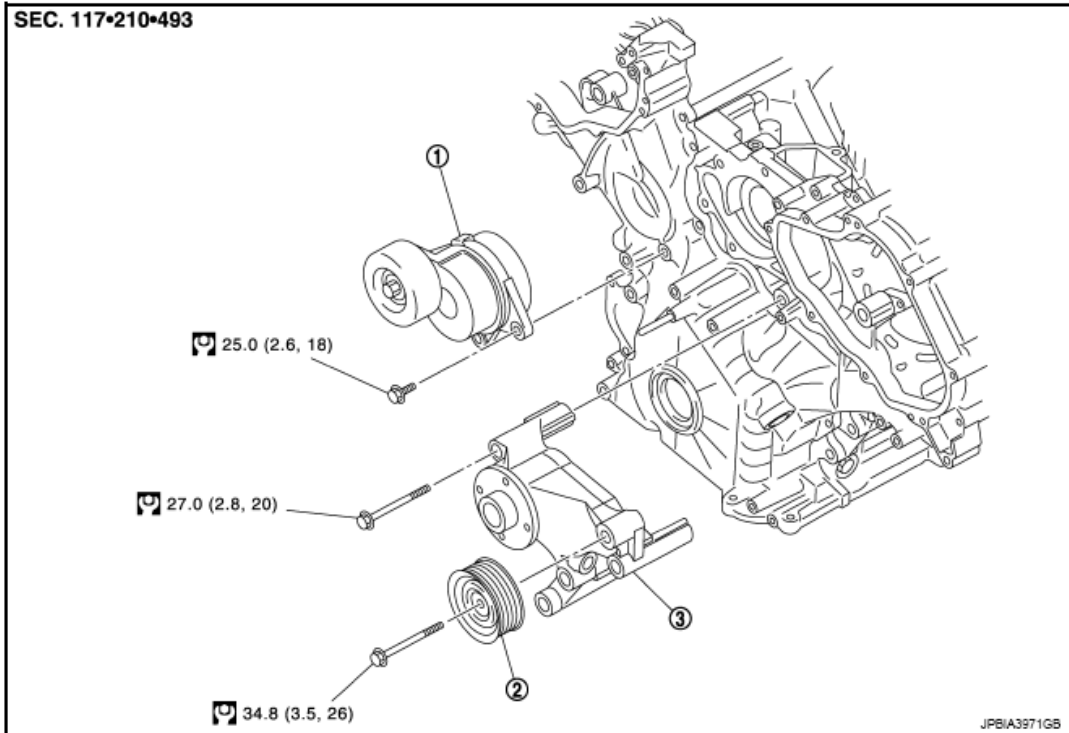
INSTALLATION

Installation is the reverse order of removal.

DRIVE BELT AUTO TENSIONER AND IDLER PULLEY

Exploded View

SEC. 117•210•493



1. Drive belt auto-tensioner

2. Idler pulley

3. Fan bracket

Fig. 27: Identifying Drive Belt Auto-Tensioner, Idler Pulley And Fan Bracket With Torque Specifications
 Courtesy of NISSAN NORTH AMERICA, INC.

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

Removal and Installation

Removal

CAUTION: The complete drive belt auto-tensioner must be replaced as a unit, including the pulley.

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

CAUTION: Never loosen the hexagonal part in center of drive belt auto tensioner pulley (Never turn it clockwise). If turned clockwise, the complete drive belt auto tensioner must be replaced as a unit, including the pulley.

3. Remove idler pulley.

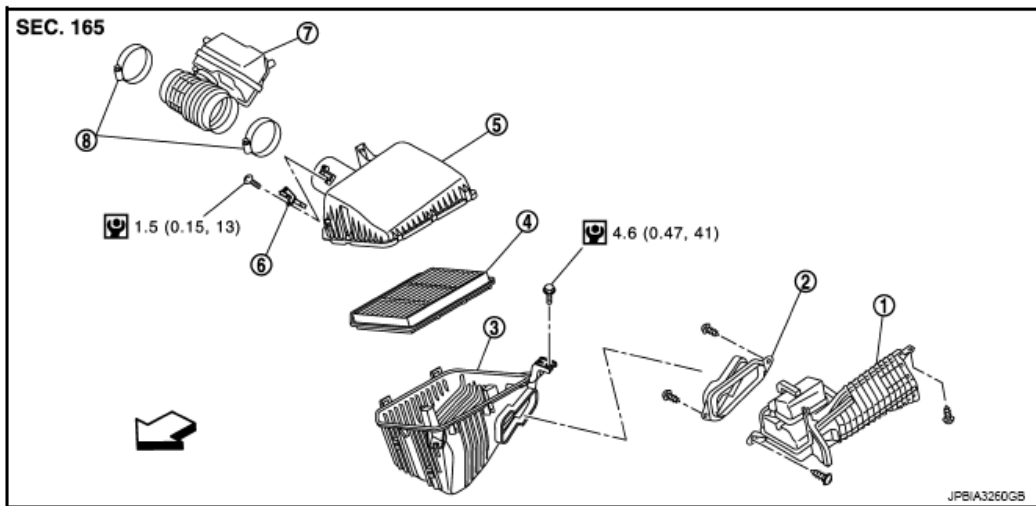
Installation

Installation is the reverse order of removal.

CAUTION: Never swap the pulley between new and old drive belt auto tensioner.

AIR CLEANER AND AIR DUCT

Exploded View



- | | | |
|-----------------------|-----------------------------|-----------------------------|
| 1. Resonator | 2. Adapter | 3. Air cleaner case (lower) |
| 4. Air cleaner filter | 5. Air cleaner case (upper) | 6. Mass air flow sensor |
| 7. Air duct | 8. Clamp | |
- ↶ Vehicle front

Fig. 28: 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 engine cover. Refer to "**EXPLODED VIEW**".
2. Disconnect mass air flow sensor harness connector.
3. Remove air cleaner case and mass air flow sensor assembly and air duct by disconnecting their joints.
 - Add matching marks, if necessary for easier installation.
4. Remove mass air flow sensor from air cleaner case, if necessary.

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

- **Never impact it.**
- **Never disassemble it.**
- **Never touch its sensor.**

5. Disconnect PCV hose from air duct.
6. Remove air duct.
7. Remove air cleaner filter.
8. Remove air cleaner case (lower).
9. Remove adapter.
10. If remove resonator (location in wheel house), refer to following:
 - a. Remove LH front wheel and tire.
 - b. Remove fender protector. Refer to "**FENDER PROTECTOR: EXPLODED VIEW**".
 - c. Remove resonator.

INSTALLATION

Note the following item, and install in the reverse order of removal:

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

Clamp tightening Torque: 4.5 N.m (0.46 kg-m, 40 in-lb)

Inspection

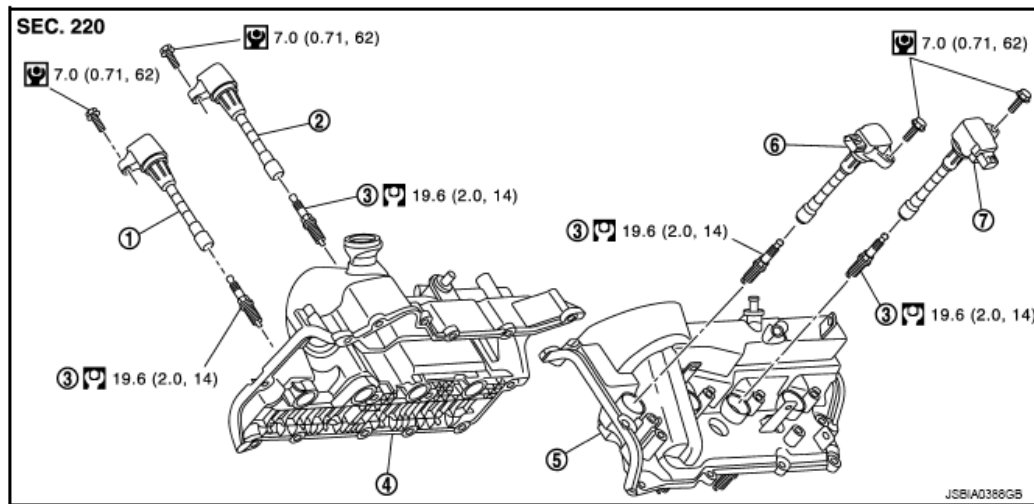
INSPECTION AFTER REMOVAL

Inspect air duct assembly for crack or tear.

- If damage is found, replace air duct assembly

IGNITION COIL

Exploded View



- | | | |
|-----------------------------|-----------------------------|-----------------------------|
| 1. Ignition coil (No. 2, 4) | 2. Ignition coil (No. 6, 8) | 3. Spark plug |
| 4. Rocker cover (bank 2) | 5. Rocker cover (bank 1) | 6. Ignition coil (No. 1, 3) |
| 7. Ignition coil (No. 5, 7) | | |

Fig. 29: Exploded View Of Ignition Coil 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. Refer to "EXPLODED VIEW".
2. Remove ignition coil.

CAUTION: Never impact it.

NOTE: Installation position of ignition coil depends on cylinder position.

INSTALLATION

1. Install ignition coil.

CAUTION:

- Install Ignition coil marked with an identification mark (A) on cylinder No. 5, 6, 7 and 8.

↔ : Engine front

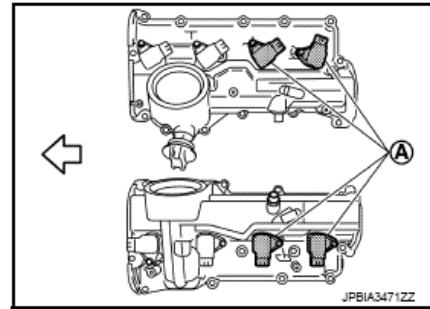
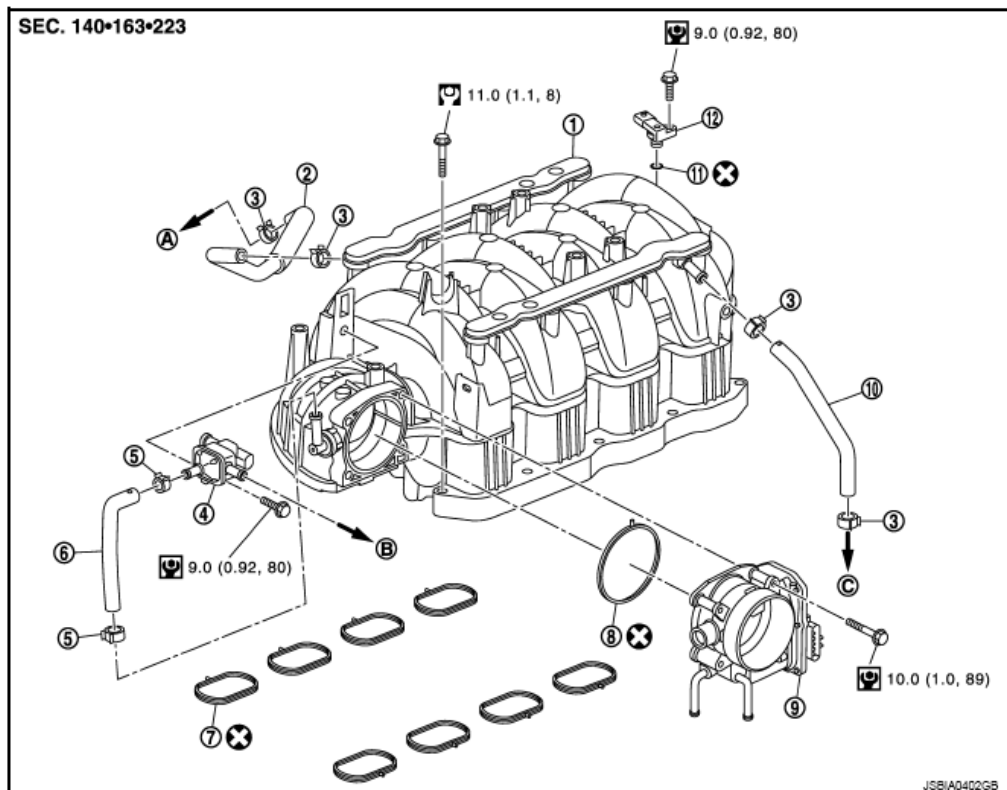


Fig. 30: Identifying Ignition Coil With Identification Mark
Courtesy of NISSAN NORTH AMERICA, INC.

2. Install engine cover.

INTAKE MANIFOLD

Exploded View



- | | | |
|---|--------------------------------------|---|
| 1. Intake manifold | 2. PCV hose | 3. Clamp |
| 4. EVAP canister purge control solenoid valve | 5. Clamp | 6. EVAP hose |
| 7. Gasket | 8. Gasket | 9. Electric throttle control actuator |
| 10. PCV hose | 11. O-ring | 12. Manifold absolute pressure (MAP) sensor |
| A. To rocker cover (bank 2) | B. To centralized under-floor piping | C. To rocker cover (bank 1) |

Fig. 31: 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: To avoid the danger of being scalded, never drain the engine coolant when the engine is hot.

1. Remove engine cover and bracket. Refer to "**EXPLODED VIEW**".
2. Remove air cleaner case (upper) and air duct. Refer to "**EXPLODED VIEW**".
3. Disconnect manifold absolute pressure (MAP) sensor harness connector.
4. Remove EVAP canister purge control solenoid valve.
5. Disconnect PCV hoses from intake manifold.
 - Add matching marks as necessary for easier installation.
6. Drain engine coolant from radiator. Refer to "**DRAINING**".

CAUTION:

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

NOTE: When removing only intake manifold, move electric throttle control actuator without disconnecting the water hoses.

7. Remove electric throttle control actuator.
 - Loosen mounting bolts in reverse order as shown in the figure.

NOTE: The figure shows the electric throttle control actuator viewed from the air duct side.

CAUTION:

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

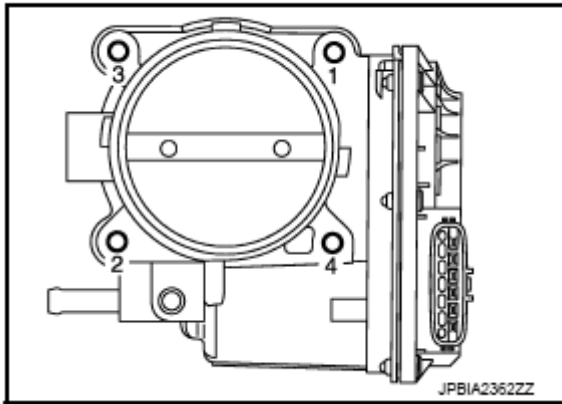


Fig. 32: Identifying Electric Throttle Control Actuator Mounting Bolts Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

8. Remove intake manifold, using a power tool.
 - Loosen mounting bolts in reverse order as shown in the figure.

← : Engine front

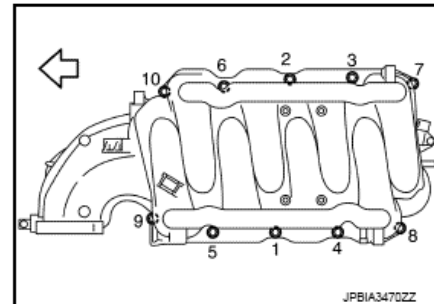


Fig. 33: Identifying Intake Manifold Collector Mounting Bolts Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

9. Remove intake manifold gaskets.

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

10. Remove manifold absolute pressure (MAP) sensor, if necessary.

CAUTION: Handle carefully to avoid any impact to manifold absolute pressure (MAP) sensor.

INSTALLATION

Note the following item, and install in the reverse order of removal:

CAUTION: Do not reuse O-rings.

Intake Manifold

Tighten in numerical order as shown in the figure.

← : Engine front

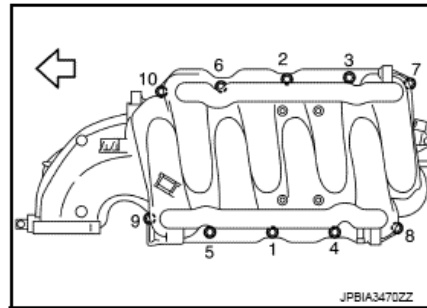


Fig. 34: Identifying Intake Manifold Collector Mounting Bolts Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

Electric Throttle Control Actuator

- Tighten in numerical order as shown in the figure.

NOTE: The figure shows the electric throttle control actuator viewed from the air duct side.

- Perform the "Throttle Valve Closed Position Learning" when harness connector of electric throttle control actuator is disconnected. Refer to the following table:

ENGINE	Reference
VK56VD FOR USA AND CANADA	" <u>DESCRIPTION</u> "
VK56VD FOR MEXICO	" <u>DESCRIPTION</u> "

- Perform the "Idle Air Volume Learning" and "Throttle Valve Closed Position Learning" when electric throttle control actuator is replaced. Refer to the following table:

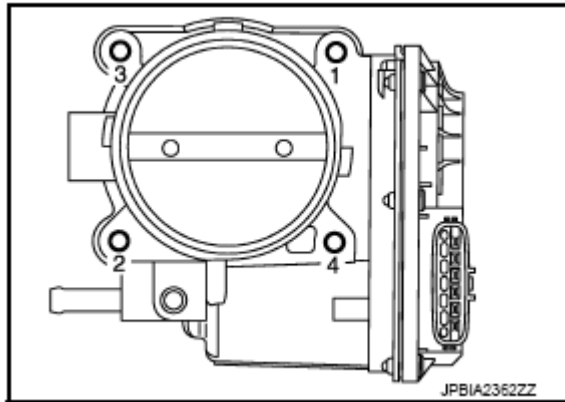


Fig. 35: Identifying Electric Throttle Control Actuator Mounting Bolts Tightening Sequence
 Courtesy of NISSAN NORTH AMERICA, INC.

ENGINE	Reference	
	Idle Air Volume Learning	Throttle Valve Closed Position Learning
VK56VD FOR USA AND CANADA	" <u>DESCRIPTION</u> "	" <u>DESCRIPTION</u> "
VK56VD FOR MEXICO	" <u>DESCRIPTION</u> "	" <u>DESCRIPTION</u> "

ROCKER COVER

Exploded View

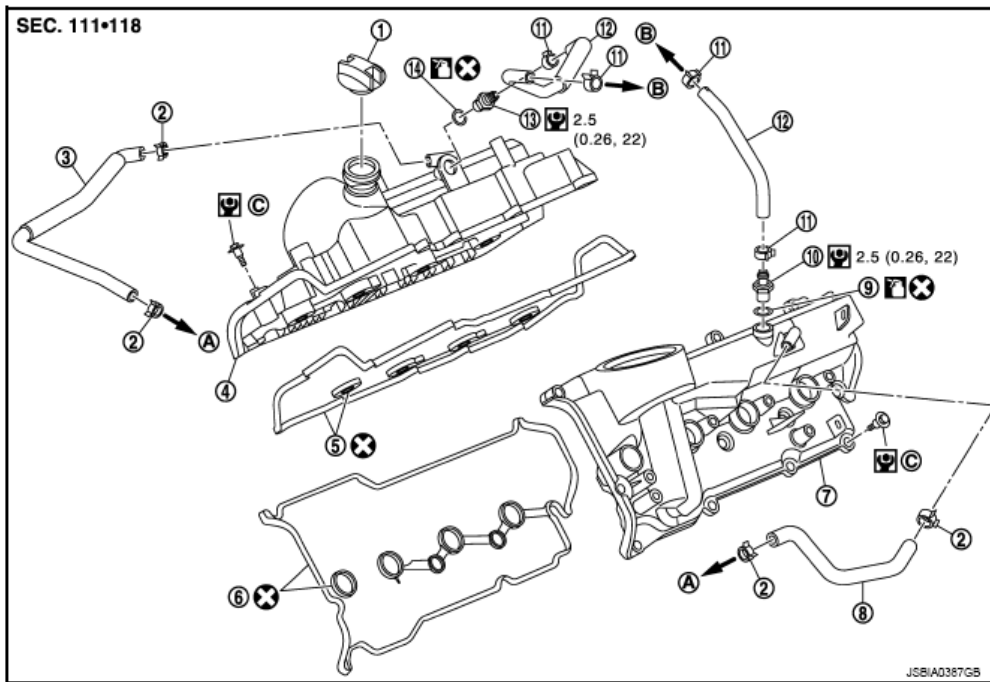


Fig. 36: Exploded View Of Rocker Cover With Torque Specifications
Courtesy of NISSAN NORTH AMERICA, INC.

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

Removal and Installation

REMOVAL

1. Remove engine cover and bracket (rear). Refer to "**EXPLODED VIEW**".
2. Disconnect PCV hose from rocker cover.
3. Remove air cleaner case (upper) and air duct. Refer to "**EXPLODED VIEW**".
4. Move the following parts to the position without the hindrance for work:
 - Oil level gauge guide. Refer to "**EXPLODED VIEW**".
 - Power steering fluid reservoir tank bracket. Refer to "**EXPLODED VIEW**".
 - EVAP canister purge control solenoid valve. "**EXPLODED VIEW**".
 - Fuel feed hose. Refer to "**EXPLODED VIEW**".
5. Remove VVEL actuator motor assembly. Refer to "**EXPLODED VIEW**".
6. Remove ignition coil. Refer to "**EXPLODED VIEW**".

CAUTION: Never impact it.

7. Remove rocker cover.
 - Loosen bolts in reverse order shown in the figure.

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

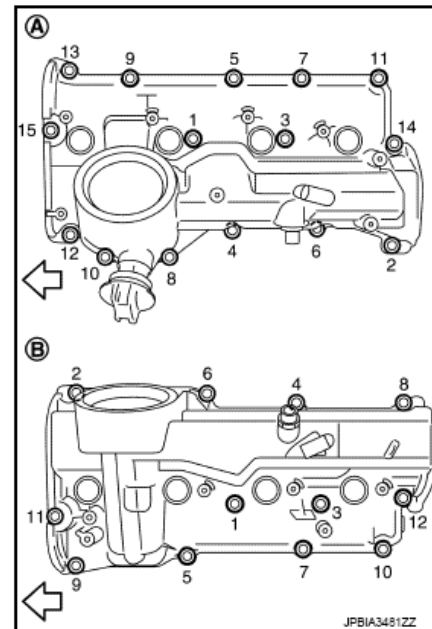


Fig. 37: Identifying Rocker Cover Bolts Tightening Sequence
 Courtesy of NISSAN NORTH AMERICA, INC.

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

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

10. Remove PCV valve from rocker cover, if necessary.
11. Remove oil filler cap from rocker cover, if necessary.

INSTALLATION

CAUTION: Do not reuse O-rings.

1. Apply liquid gasket with the tube presser (commercial service tool) to VVEL ladder assembly (1).

Use Genuine RTV silicone sealant or equivalent. Refer to "**RECOMMENDED CHEMICAL**

PRODUCTS AND SEALANTS "

NOTE: The figure shows an example of bank 1 side.

- A : Liquid gasket application point
 F : End surface of VVEL ladder assembly
 b : 4.0 mm (0.16 in)
 c : 2.5 - 3.5 mm (0.098 - 0.138 in)
 d : 5.0 mm (0.20 in)
 e : 10.0 mm (0.39 in)
 ⇐ : Engine front

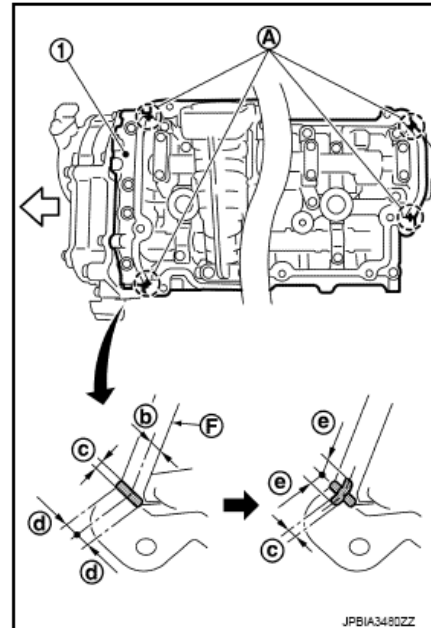


Fig. 38: Identifying Liquid Gasket Applying Area
 Courtesy of NISSAN NORTH AMERICA, INC.

- Apply liquid gasket on the front and rear side of engine first. [5 mm (0.20 in) + 5 mm (0.20 in) side as shown in the figure]
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.

1st step Torque: 20 N.m (0.2 kg-m, 18 in-lb)

2nd step: Torque: 8 3 N.m (0.85 kg-m, 73 in-lb)

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

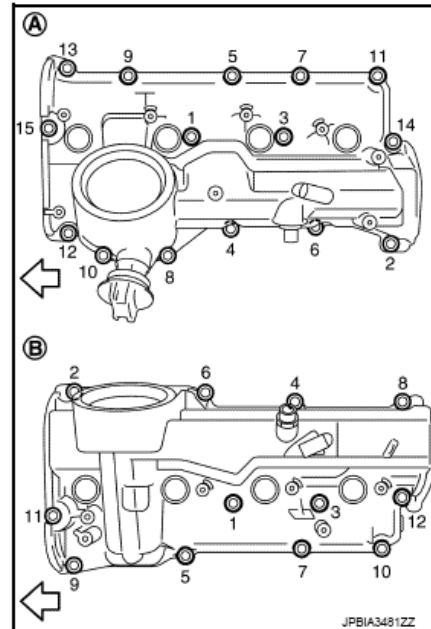


Fig. 39: Identifying Rocker Cover Bolts Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

- Because of the limited working space, use adapter and torque wrench assembly [SST: KV10119300 (-)] (A) to tighten bolts (on the No. 7 and No. 8 cylinders) to the specified torque.

↔ : Engine front

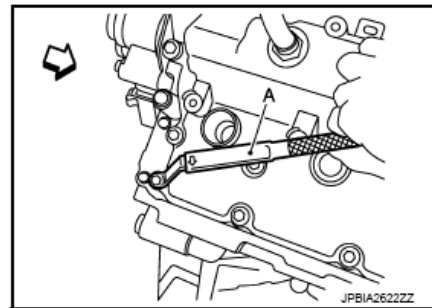


Fig. 40: Tightening Rocker Cover Bolts Using Adapter And Torque Wrench
Courtesy of NISSAN NORTH AMERICA, INC.

- Install ignition coil. Refer to "**EXPLODED VIEW**".

CAUTION:

- Install Ignition coil marked with an identification mark (A) on cylinder No. 5, 6, 7 and 8.

← : Engine front

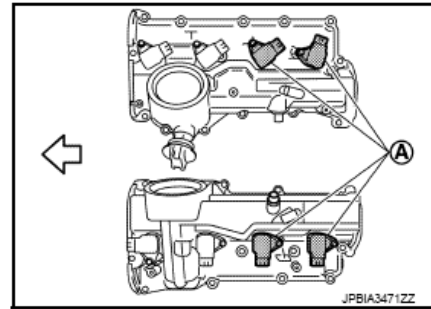
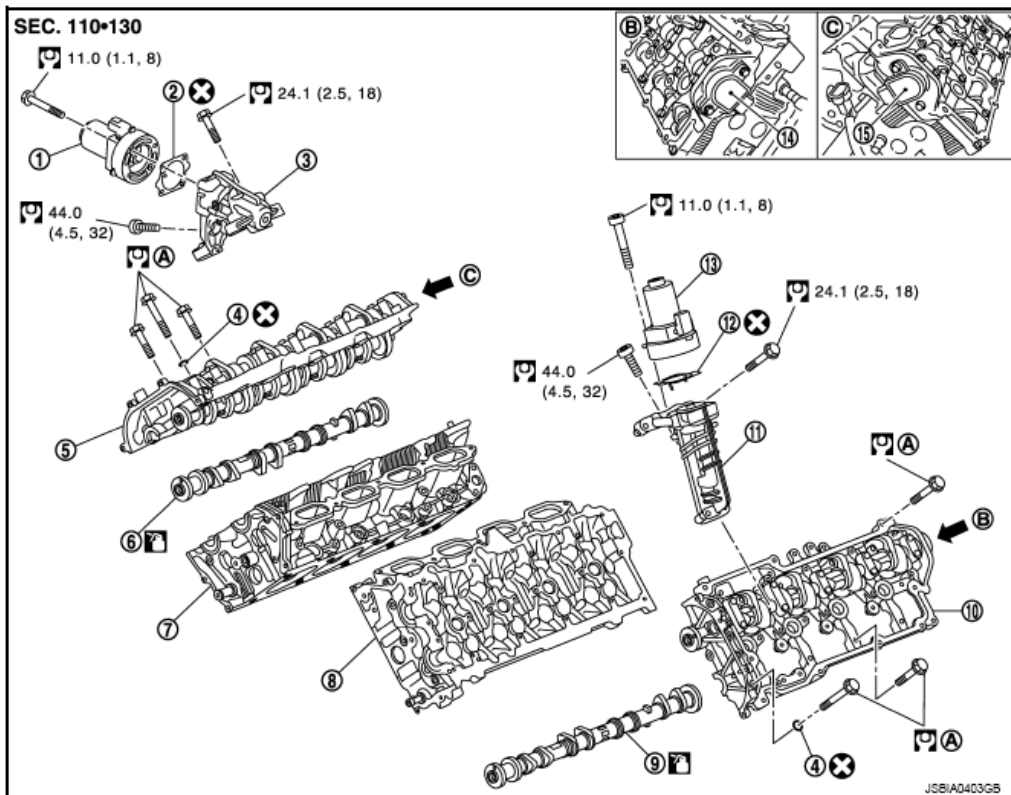


Fig. 41: Identifying Ignition Coil With Identification Mark
 Courtesy of NISSAN NORTH AMERICA, INC.

6. Install VVEL actuator motor assembly. Refer to "**EXPLODED VIEW**".
7. Install in the reverse order of removal.

VVEL ACTUATOR ASSEMBLY

Exploded View



- | | | |
|--|---|---|
| 1. VVEL actuator motor assembly (bank 2) | 2. Gasket | 3. VVEL actuator housing assembly (bank 2) |
| 4. Washer | 5. VVEL ladder assembly (bank 2) | 6. Exhaust camshaft (bank 2) |
| 7. Cylinder head (bank 2) | 8. Cylinder head (bank 1) | 9. Exhaust camshaft (bank 1) |
| 10. VVEL ladder assembly (bank 1) | 11. VVEL actuator housing assembly (bank 1) | 12. Gasket |
| 13. VVEL actuator motor assembly (bank 1) | 14. VVEL control shaft position sensor (bank 1) | 15. VVEL control shaft position sensor (bank 2) |
| A. Comply with the installation procedure when tightening. | | |
| B. View B | | |
| C. View C | | |

Fig. 42: Exploded View Of VVEL Actuator Assembly 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. Refer to "**EXPLODED VIEW**".
2. Loosen mounting bolts (C), and then remove VVEL actuator motor assembly (1).

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

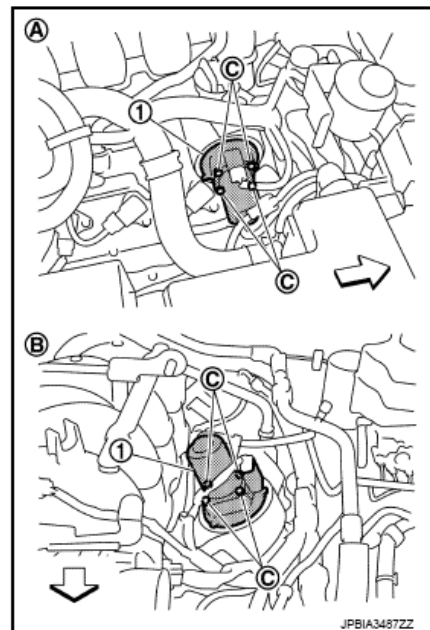


Fig. 43: Identifying VVEL Actuator Assembly And Mounting Bolts
 Courtesy of NISSAN NORTH AMERICA, INC.

CAUTION: Never loosen screws (A) of VVEL actuator motor assembly.

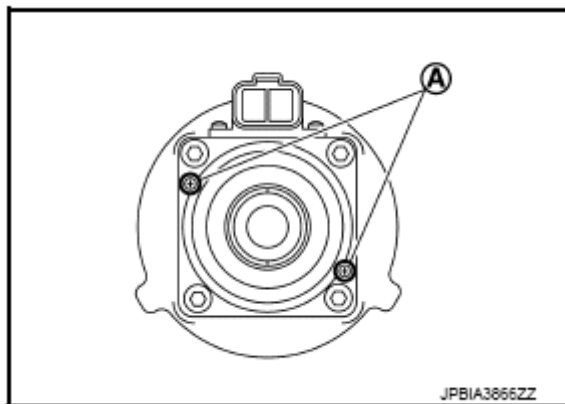


Fig. 44: Identifying VVEL Actuator Motor Assembly Screws
 Courtesy of NISSAN NORTH AMERICA, INC.

3. Remove rocker cover. Refer to "**EXPLODED VIEW**".
4. Insert mounting bolt (A) removed at step 2 into VVEL actuator housing assembly.

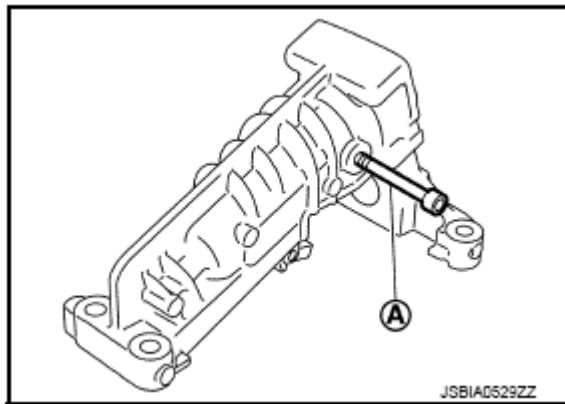
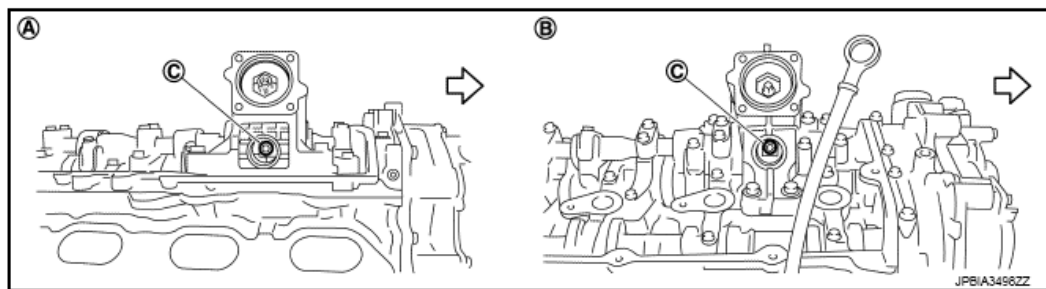


Fig. 45: Identifying VVEL Actuator Housing Assembly Mounting Bolt
Courtesy of NISSAN NORTH AMERICA, INC.

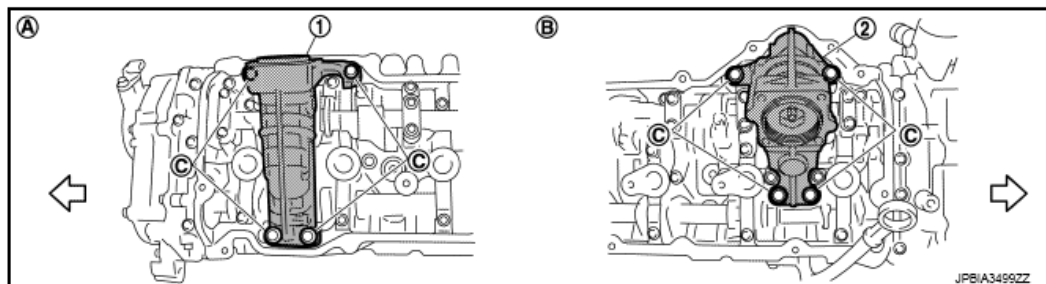
5. Loosen mounting bolt (C) to disengage the control shaft and the actuator arm.



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

Fig. 46: Identifying Control Shaft And Actuator Arm Mounting Bolts
Courtesy of NISSAN NORTH AMERICA, INC.

6. Loosen mounting bolts (C), and then remove VVEL actuator housing assembly.



1. VVEL actuator housing assembly (bank 1) 2. VVEL actuator housing assembly (bank 2)
 A. Bank 1 B. Bank 2
 ⇐ : Engine front

Fig. 47: Identifying VVEL Actuator Housing Assembly Mounting Bolts

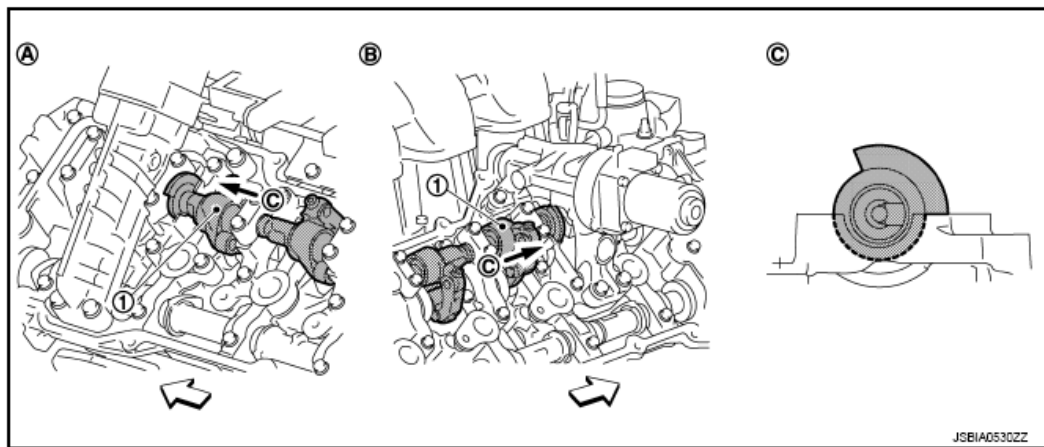
Courtesy of NISSAN NORTH AMERICA, INC.

INSTALLATION

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

CAUTION: Do not reuse washers.

- When disengaging the control shaft (1) and the actuator arm, hold the stopper of the control shaft in the position shown in the figure.



A. Bank 1

B. Bank 2

C. View C

↙ : Engine front

Fig. 48: Identifying Control Shaft

Courtesy of NISSAN NORTH AMERICA, INC.

Inspection

INSPECTION AFTER REMOVAL

VVEL actuator housing assembly

- Move the ball nut (A) in the axial direction to check the smooth rotation.

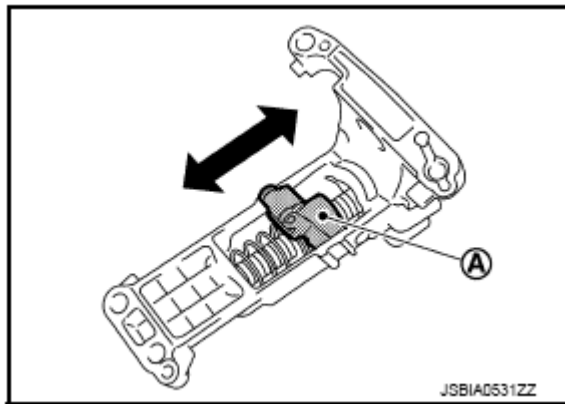
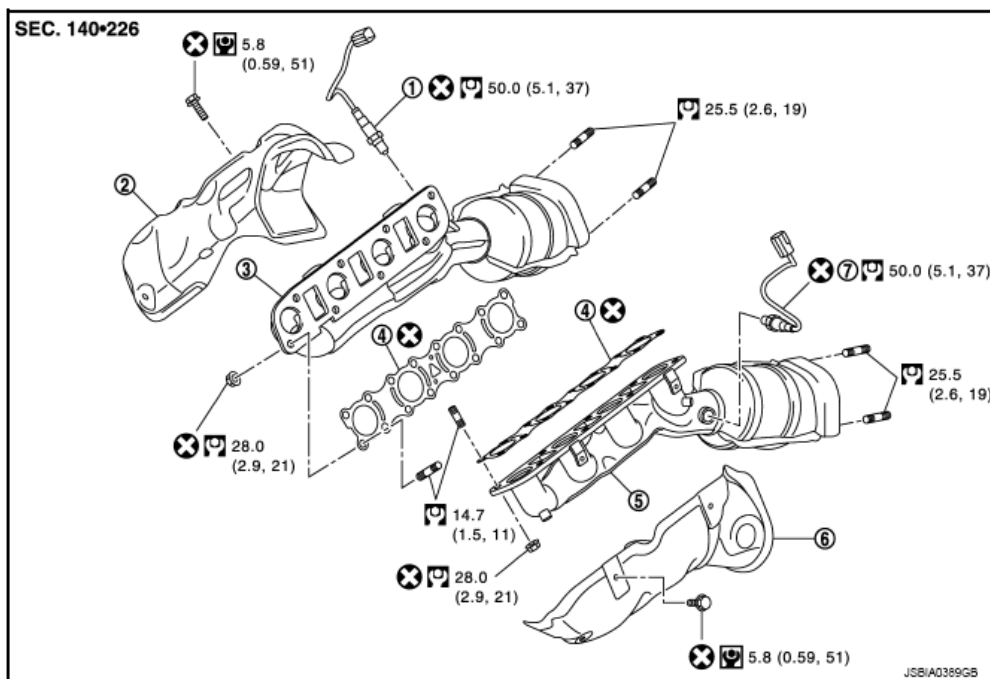


Fig. 49: Moving VVEL Actuator Housing Assembly Ball Nut Axially
Courtesy of NISSAN NORTH AMERICA, INC.

EXHAUST MANIFOLD AND THREE WAY CATALYST

Exploded View



- | | | |
|-------------------------------------|---|---|
| 1. Air fuel ratio sensor 1 (bank 2) | 2. Exhaust manifold cover (bank 2) | 3. Exhaust manifold and three way catalyst (bank 2) |
| 4. Gasket | 5. Exhaust manifold and three way catalyst (bank 1) | 6. Exhaust manifold cover (bank 1) |
| 7. Air fuel ratio sensor 1 (bank 1) | | |

Fig. 50: Exploded View Of Exhaust Manifold And Three Way Catalyst 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 cooled sufficiently.

1. Drain engine coolant from radiator. Refer to "**DRAINING**".

CAUTION:

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

2. Remove reservoir tank. Refer to "**EXPLODED VIEW**".
3. Remove drive belt. Refer to "**REMOVAL AND INSTALLATION**".
4. Remove power steering oil pump. Refer to "**EXPLODED VIEW**".
5. Remove radiator. Refer to "**EXPLODED VIEW**".
6. Remove front under cover. Refer to "**EXPLODED VIEW**".
7. Remove front wheels and tires. Refer to "**EXPLODED VIEW**".
8. Remove A/C compressor. Refer to "**EXPLODED VIEW**".
9. Remove alternator and alternator bracket. Refer to "**EXPLODED VIEW**".
10. Remove exhaust front tube (bank 1 and bank 2). Refer to "**EXPLODED VIEW**".
11. Remove front propeller shaft. Refer to "**EXPLODED VIEW**".
12. Disconnect steering lower joint. Refer to "**EXPLODED VIEW**".
13. Remove air fuel ratio sensor 1 as per the following:

CAUTION: Air fuel ratio sensor 1 is not reusable. Never remove air fuel ratio sensor 1 unless this is required.

- Using the heated oxygen sensor wrench [SST: KV10117100 (J-44626)] (A), remove air fuel ratio sensor 1 (1).

↶ : Vehicle front

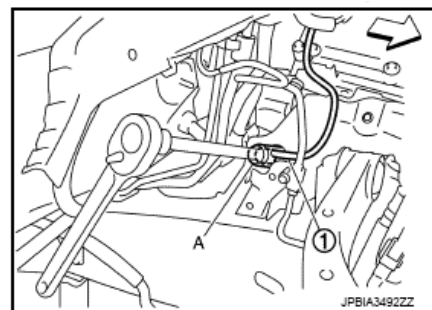


Fig. 51: Removing Air Fuel Ratio Sensor 1 Using Wrench
Courtesy of NISSAN NORTH AMERICA, INC.

14. Remove exhaust manifold cover.
15. Remove oil level gauge guide. Refer to "**EXPLODED VIEW**".
16. Remove exhaust manifold.
 - Loosen nuts in the reverse order of figure to remove exhaust manifold with a power tool.

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

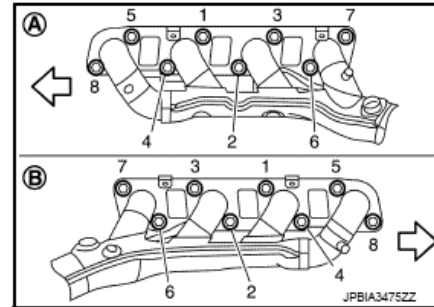


Fig. 52: Identifying Exhaust Manifold Nuts Tightening Sequence
 Courtesy of NISSAN NORTH AMERICA, INC.

17. Remove exhaust manifold gaskets.

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

INSTALLATION

Note the following item, and install in the reverse order of removal:

Exhaust Manifold Gasket

- Install exhaust manifold gasket in directional shown in the figure.

A : Triangle press
 ⇐ : Above

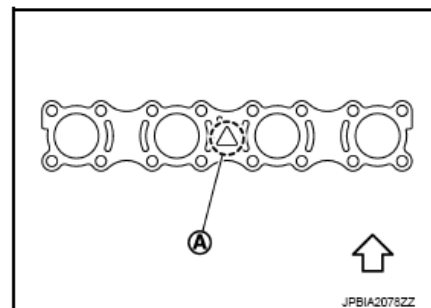


Fig. 53: Identifying Exhaust Manifold Gasket Triangle Press
 Courtesy of NISSAN NORTH AMERICA, INC.

NOTE: When install exhaust manifold gasket, coating surface (black) shall be located on the exhaust manifold side.

Exhaust Manifold

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

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

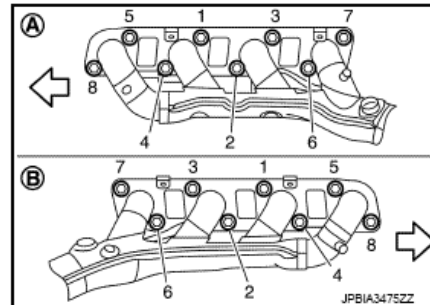


Fig. 54: Identifying Exhaust Manifold And Three Way Catalyst Mounting Nuts Tightening Sequence

Courtesy of NISSAN NORTH AMERICA, INC.

CAUTION: All exhaust manifold nuts are tightened at twice.

Air Fuel Ratio Sensor 1

CAUTION:

- Before installing a new air fuel ratio sensor 1, clean exhaust system threads using oxygen sensor thread cleaner (commercial service tool: J-43897-18 or J-43897-12), and apply anti-seize lubricant (commercial service tool).
- Air fuel ratio sensor 1 is not reusable. Replace them with a new one after removal. When replacing them, handle with care not to impact on them.
- When installing the new air fuel ratio sensors 1 (1), set the heated oxygen sensor wrench [SST: KV10117100(J-44626)] (A) in the hexagonal part to tighten the them.

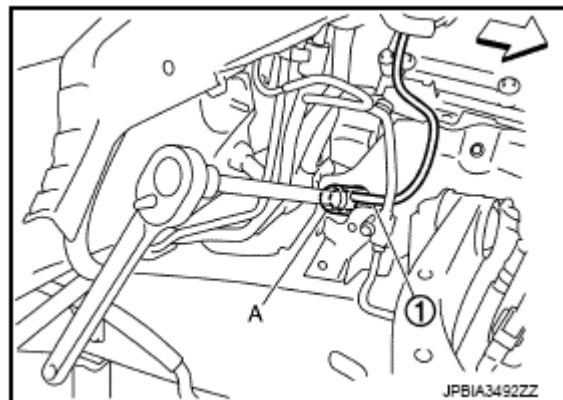


Fig. 55: Tightening Air Fuel Ratio Sensor 1 Using Wrench
Courtesy of NISSAN NORTH AMERICA, INC.

- Never over torque sensors. Doing so may cause damage to the sensors, resulting in "MIL" coming on.
- Prevent rust preventives from adhering to the sensor body.

Inspection

INSPECTION AFTER DISASSEMBLY

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.

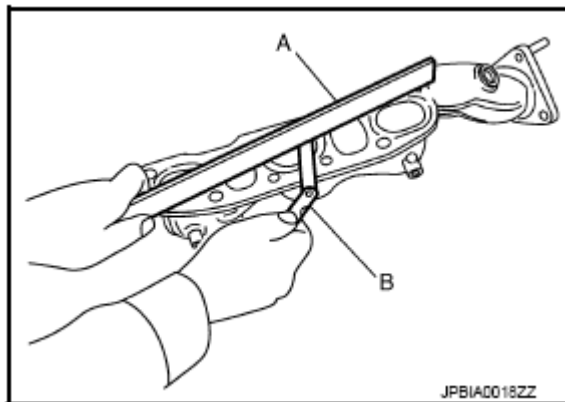
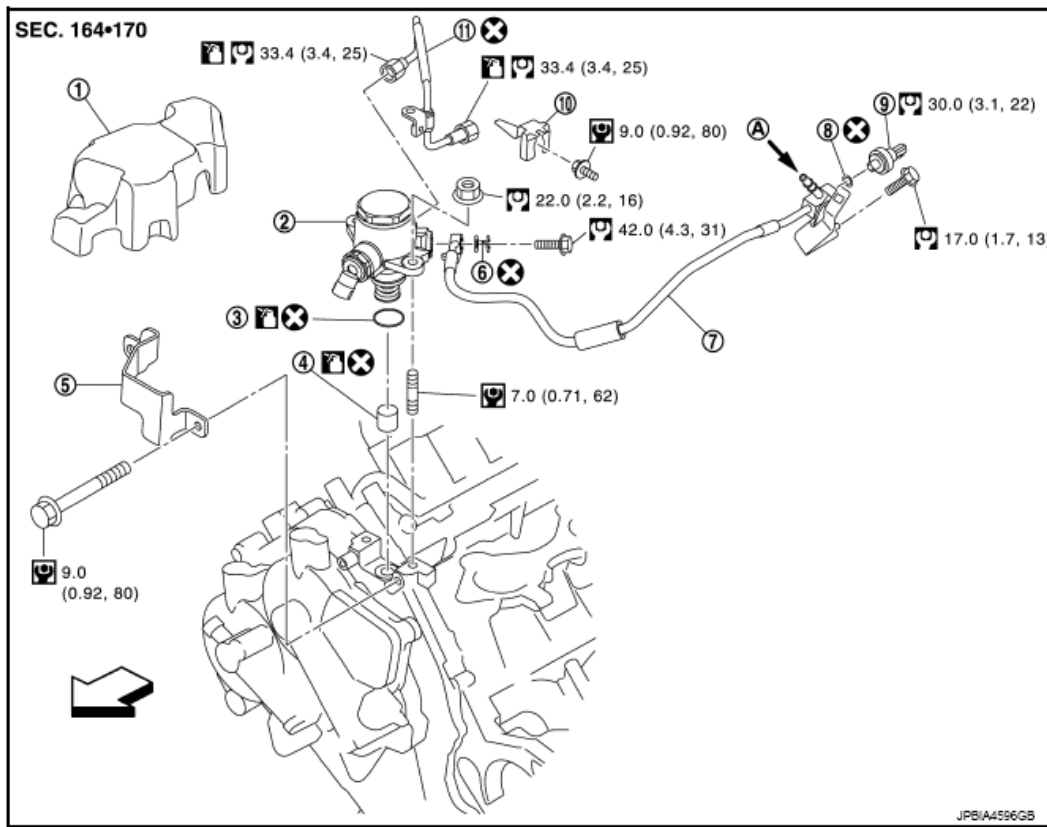


Fig. 56: Checking Surface Distortion Of Exhaust Manifold Mating Surface Using Straightedge And Feeler Gauge
Courtesy of NISSAN NORTH AMERICA, INC.

HIGH PRESSURE FUEL PUMP AND FUEL HOSE

Exploded View

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



- | | | |
|--------------------------------------|----------------------------------|-----------------------------|
| 1. High pressure fuel pump insulator | 2. High pressure fuel pump | 3. O-ring |
| 4. Lifter | 5. Fuel pump connector protector | 6. Copper washer |
| 7. Fuel feed hose | 8. Copper washer | 9. Low fuel pressure sensor |
| 10. Bracket | 11. Fuel feed tube (pump side) | |
| A. From fuel tank | | |
| ↔ : Engine front | | |

Fig. 57: Exploded View Of High Pressure Fuel Pump And Fuel Hose With Torque Specifications
Courtesy of NISSAN NORTH AMERICA, INC.

Refer to "COMPONENTS" for symbols in the figure.

Removal and Installation

REMOVAL

WARNING:

- Be sure to read "PRECAUTION FOR HANDLING HIGH PRESSURE FUEL SYSTEM" when working on the high pressure fuel system.
- Put a "CAUTION: FLAMMABLE" sign in the workshop.
- Be sure to work in a well ventilated area and furnish workshop with a CO2 fire extinguisher.
- Never smoke while servicing fuel system. Keep open flames and sparks away from the work area.

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

1. Release fuel pressure. Refer to the following table:

ENGINE	Reference
VK56VD FOR USA AND CANADA	" <u>WORK PROCEDURE</u> "
VK56VD FOR MEXICO	" <u>WORK PROCEDURE</u> "

2. Remove intake manifold. Refer to "REMOVAL AND INSTALLATION".
3. Disconnect harness connector from high pressure fuel pump.
4. Remove fuel feed tube (pump side) (1).
5. Disconnect fuel hose (2) from high pressure fuel pump.

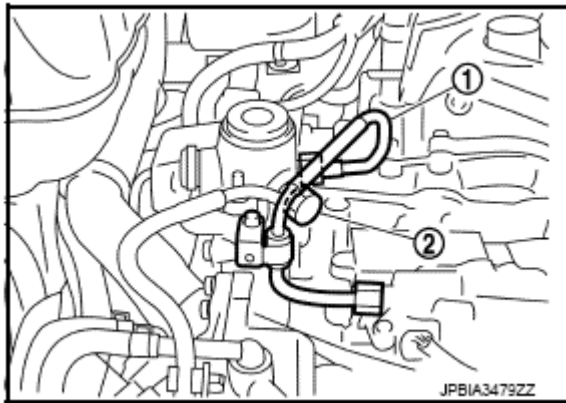


Fig. 58: Identifying Fuel Feed Tube (Pump Side) And Fuel Hose
Courtesy of NISSAN NORTH AMERICA, INC.

6. Remove high pressure fuel pump and lifter.

CAUTION: After removing lifter, replace lifter with a new one.

7. Disconnect quick connector (A) with the following procedure:

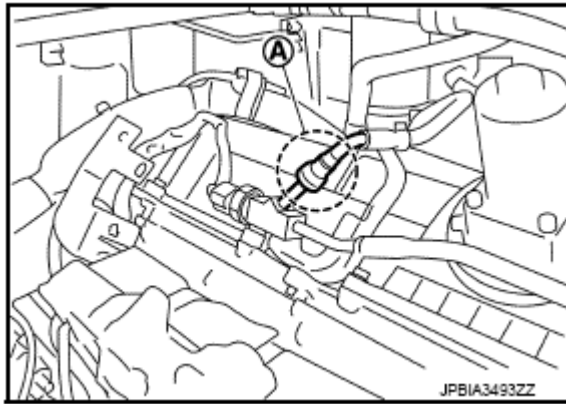


Fig. 59: Identifying Quick Connector
Courtesy of NISSAN NORTH AMERICA, INC.

- a. Remove quick connector cap from quick connector connection.
- b. With the sleeve side of quick connector release facing quick connector, install quick connector release onto fuel tube.
- c. Insert quick connector release into quick connector until sleeve contacts and goes no further. Hold quick connector release on that position.

CAUTION: Inserting quick connector release hard will not disconnect quick connector. Hold quick connector release where it contacts and goes no further.

- d. Draw and pull out quick connector straight from fuel tube.

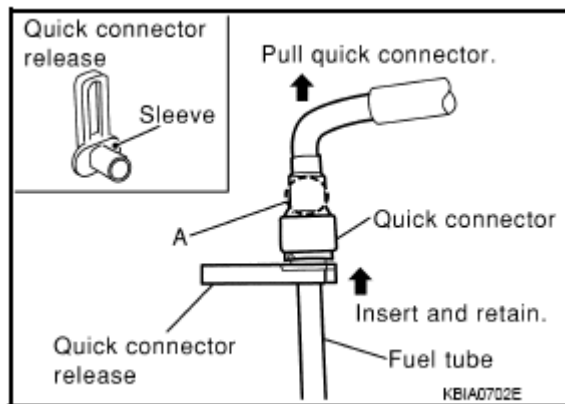


Fig. 60: Inserting Quick Connector Release Into Quick Connector
Courtesy of NISSAN NORTH AMERICA, INC.

- CAUTION:**
- Pull quick connector holding (A) position as shown in the figure.
 - 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 clean the connecting portion and to avoid damage and foreign materials, cover them completely with plastic bags, etc. or a similar item.

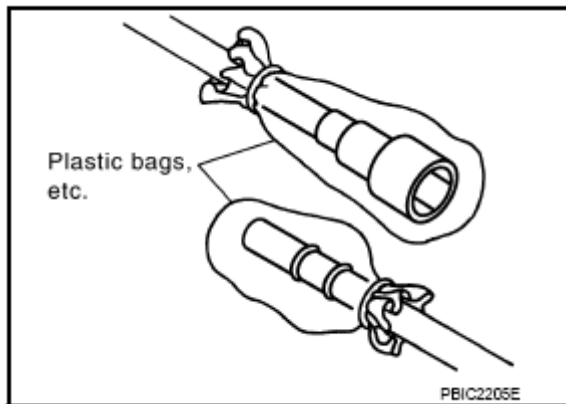


Fig. 61: Securing Quick Connector In Plastic Bags
Courtesy of NISSAN NORTH AMERICA, INC.

8. Disconnect harness connector from low fuel pressure sensor.
9. Remove fuel hose assembly.
10. Remove low fuel pressure sensor.

CAUTION:

- Never allow water and foreign materials enter into the connector.
- Never reuse the dropped sensor.
- Carefully handle sensor avoiding shocks.
- Use hex head support installation for removal and installation of sensor.
- The contact surface of gasket must not have any stain or scoring by dust etc.

INSTALLATION

CAUTION: Do not reuse O-rings or washers.

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

CAUTION:

- Do not reuse O-ring.
- Handle O-ring with bare hands. Never wear gloves.
- Lubricate O-ring with new engine oil.
- Never clean O-ring with solvent.
- Check that O-ring and its mating part are free of foreign material.
- 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 rail. Never decenter or twist it.

2. Install low fuel pressure sensor.

CAUTION: Do not reuse copper washer.

← : Engine front

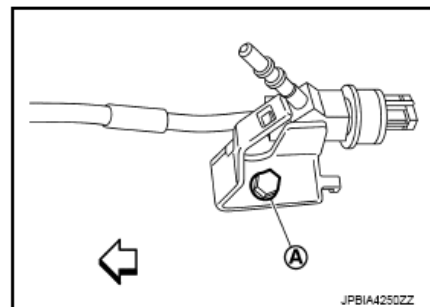


Fig. 62: Identifying Fuel Hose Assembly Mounting Bolts
Courtesy of NISSAN NORTH AMERICA, INC.

3. Install fuel hose assembly.
 - Temporarily tighten mounting bolt (A) as shown in the figure.
4. Install high pressure fuel pump to front cover.

CAUTION: After removing lifter, replace lifter with a new one.

5. Connect fuel feed hose to high pressure fuel pump.

NOTE:

- Never allow the machined edge of the high pressure fuel pump to contact with gasket.
- The gasket contact area must be free of dust and scratches.
- Check that rotation stopper (A) of fuel feed hose contact high f pressure fuel pump.

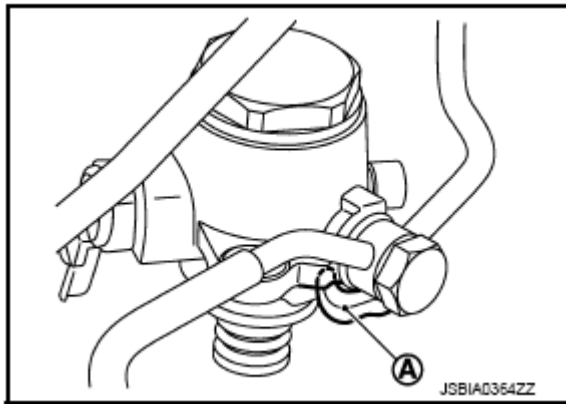


Fig. 63: Identifying Fuel Pump Rotation Stopper
Courtesy of NISSAN NORTH AMERICA, INC.

6. Tighten mounting bolts that are temporarily tightened in step 3.
7. Connect harness connector to high pressure fuel pump.
8. Install fuel pump connector protector.
9. Connect harness connector to low fuel pressure sensor.
10. Note the following, and connect quick connector to install fuel feed hose:
 - a. Check the connection for foreign material and damage.
 - b. Align center to insert quick connector straightly into fuel tube.

NOTE:

The figure shows engine side as an example.

- Insert fuel tube into quick connector until the top spool on fuel tube is inserted completely and the second level spool is positioned slightly below quick connector bottom end.

CAUTION:

- Hold "A" position in the figure when inserting fuel tube into quick connector.
- Carefully 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.

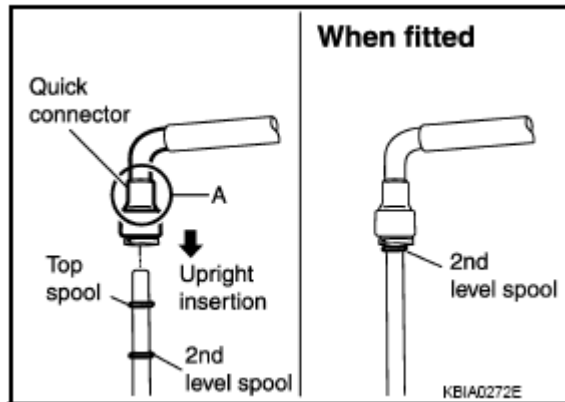


Fig. 64: Inserting Fuel Tube Into Quick Connector
Courtesy of NISSAN NORTH AMERICA, INC.

- Before clamping fuel feed hose with hose clamps, pull quick connector hard by hand holding "A" position. Check it is completely engaged (connected) so that it does not come out from fuel feed tube.
- Install quick connector cap to quick connector connection.
 - Install so that the arrow mark on the side faces up.

CAUTION:

- Check that quick connector and fuel tube are securely fit into quick connector cap installation groove.
- If quick connector cap cannot be installed smoothly, quick connector may have not been installed correctly. Check connection again.

- Install in the reverse order of removal.

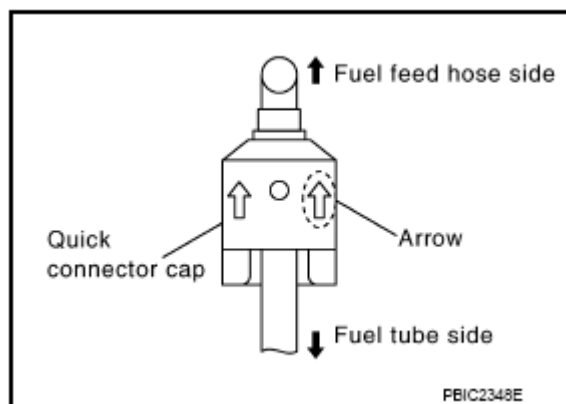


Fig. 65: Position For Removing/Installing Quick Connector Cap

Courtesy of NISSAN NORTH AMERICA, INC.

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.

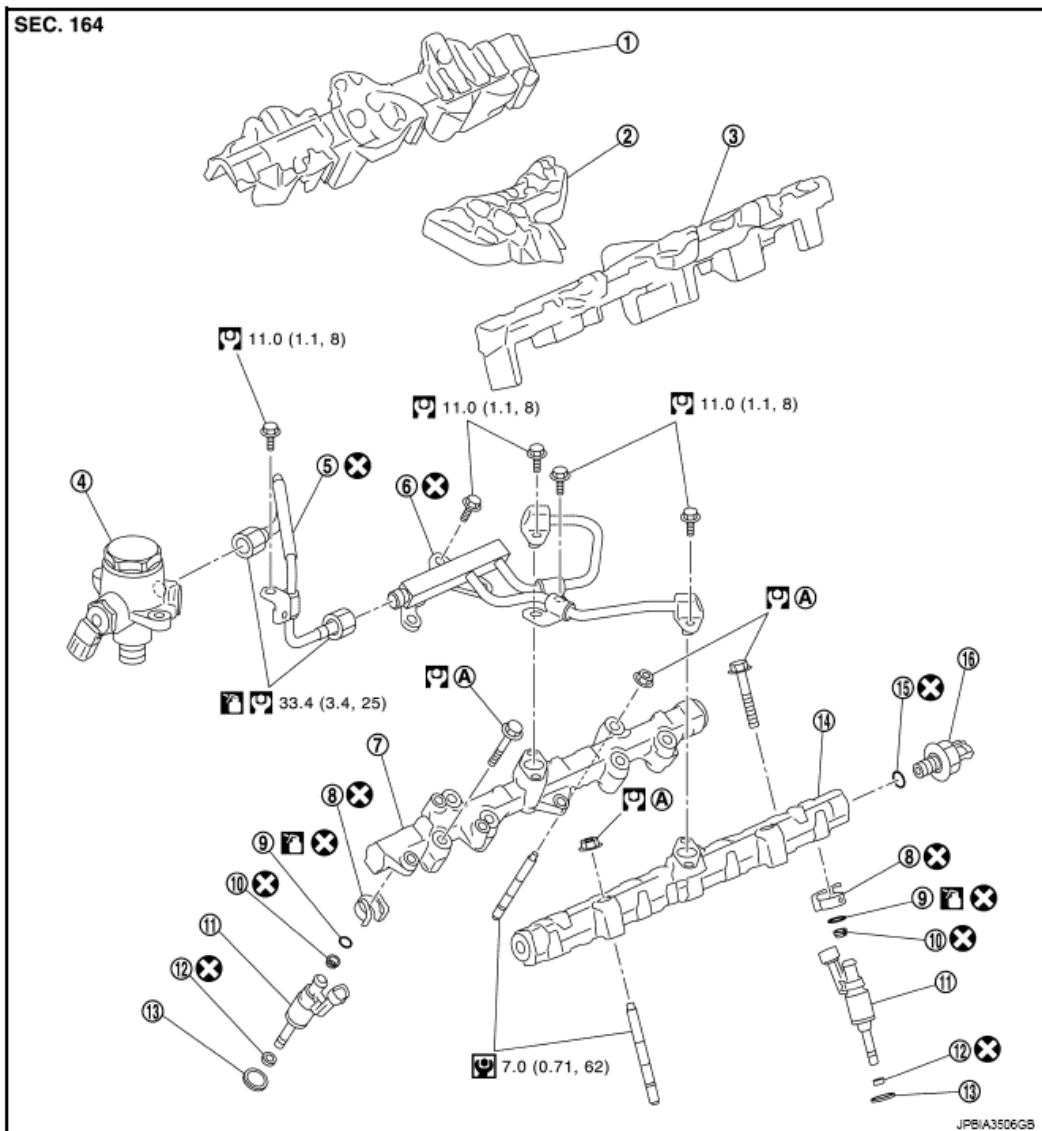
2. Start the engine. With engine speed increased, check again that there is no fuel leakage at connection points.

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

FUEL INJECTOR AND FUEL TUBE

Exploded View

SEC. 164



- | | | |
|---------------------------------|---------------------------------|---------------------------------|
| 1. Fuel tube insulator (bank 2) | 2. Fuel tube insulator (center) | 3. Fuel tube insulator (bank 1) |
| 4. High pressure fuel pump | 5. Fuel feed tube (pump side) | 6. Fuel feed tube (bank side) |
| 7. Fuel rail (bank 2) | 8. Injector holder | 9. O-ring (blue) |
| 10. Backup ring | 11. Fuel injector | 12. Seal ring |
| 13. Insulator | 14. Fuel rail (bank 1) | 15. Gasket |
| 16. Fuel rail pressure sensor | | |

Comply with the installation procedure when tightening.
A.

Fig. 66: 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.

- Be sure to follow the tightening instruction to avoid fuel leakage.

Removal and Installation

REMOVAL

WARNING:

- Be sure to read "**PRECAUTION FOR HANDLING HIGH PRESSURE FUEL SYSTEM**" when working on the high pressure fuel system.
- Put a "**CAUTION: FLAMMABLE**" sign in the workshop.
- Be sure to work in a well ventilated area and furnish workshop with a CO2 fire extinguisher.
- Never smoke while servicing fuel system. Keep open flames and sparks away from the work area.
- To avoid the danger of being scalded, never drain engine coolant when engine is hot.

1. Release fuel pressure. Refer to the following table:

ENGINE	Reference
VK56VD FOR USA AND CANADA	" <u>WORK PROCEDURE</u> "
VK56VD FOR MEXICO	" <u>WORK PROCEDURE</u> "

2. Remove intake manifold. Refer to "**REMOVAL AND INSTALLATION**".
3. Remove fuel feed tube (pump side) and fuel feed tube (bank side).

CAUTION: Never reuse fuel feed tube.

4. Remove fuel rail (bank 1) and fuel rail (bank 2).
5. Disconnect harness connector from fuel injectors.
6. Remove fuel injector from cylinder head as per the following:

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.

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

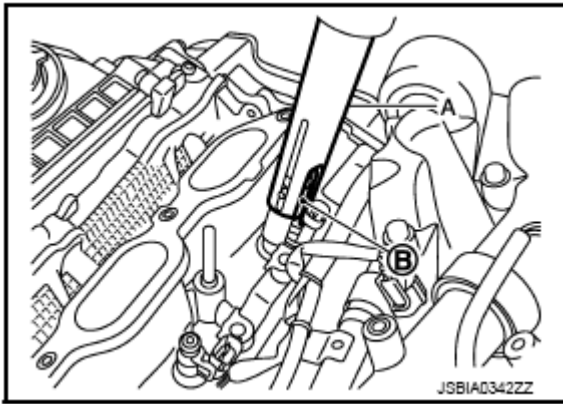


Fig. 67: Installing Injector Remover To Injector Connector
Courtesy of NISSAN NORTH AMERICA, INC.

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

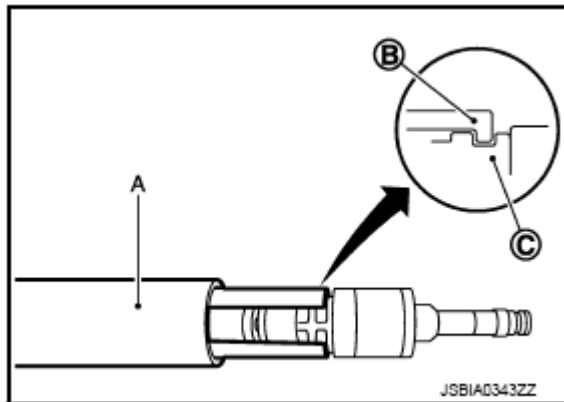


Fig. 68: Identifying Injector Remover Pawl Portion And Groove Portion
Courtesy of NISSAN NORTH AMERICA, INC.

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

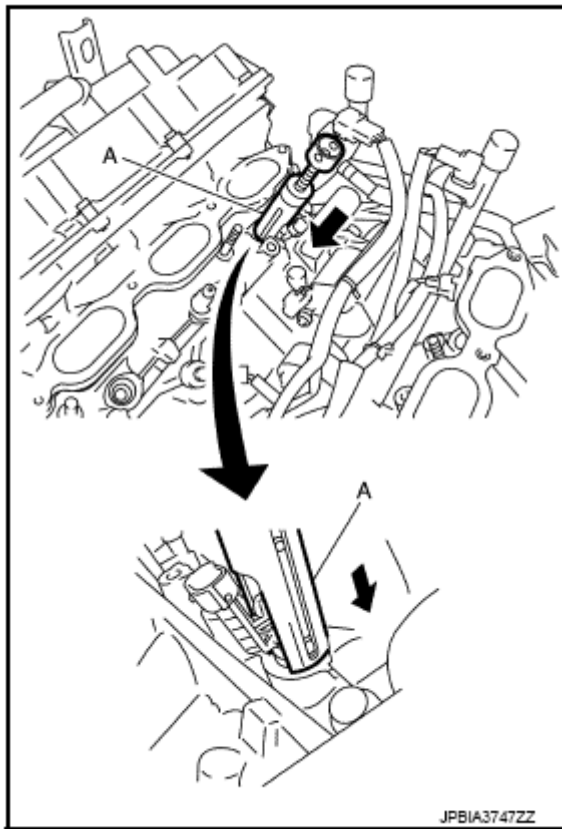


Fig. 69: Pressing Down Body Portion Of Injector Remover To Cylinder Head
Courtesy of NISSAN NORTH AMERICA, INC.

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

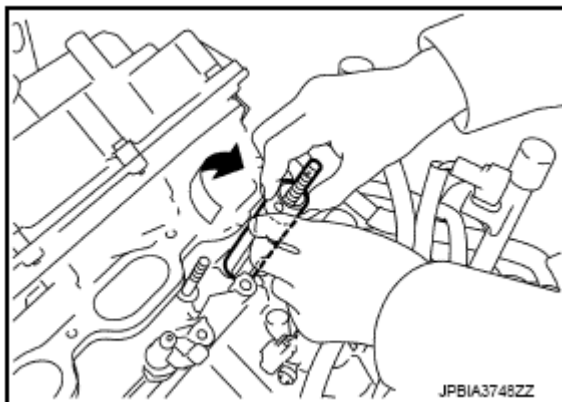


Fig. 70: Removing Injector From Cylinder Head Using Injector Remover
Courtesy of NISSAN NORTH AMERICA, INC.

- e. Cut Teflon seal (1) while pinching it. Be careful not to damage injector.

- f. Remove insulator from mounting hole of fuel injector of cylinder head.

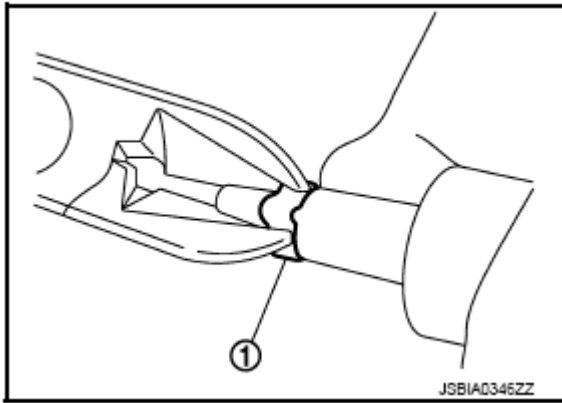


Fig. 71: Cutting Seal Ring
Courtesy of NISSAN NORTH AMERICA, INC.

INSTALLATION

CAUTION: Do not reuse O-rings.

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

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

- a. Install a seal guide [SST: KV10119720 (-)] (A) to fuel injector (1).

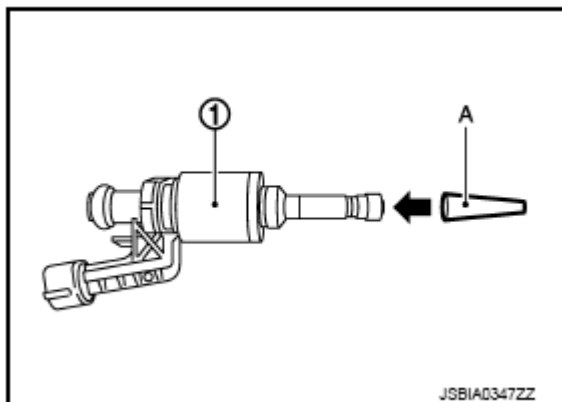


Fig. 72: Installing Seal Guide To Fuel Injector
Courtesy of NISSAN NORTH AMERICA, INC.

- b. Set seal ring (1) to seal installer [SST: KV10119730 (-)] (A).

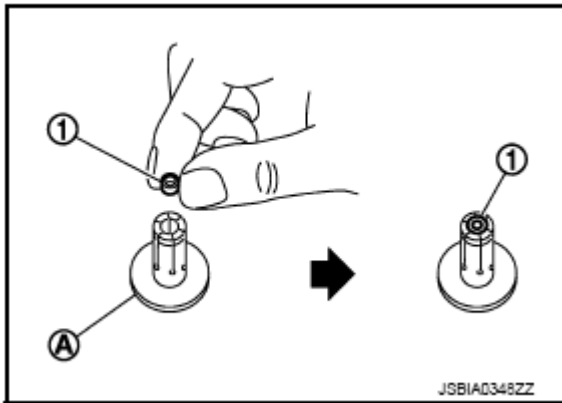


Fig. 73: Setting Seal Ring To Injector Seal Drift Set
Courtesy of NISSAN NORTH AMERICA, INC.

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

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

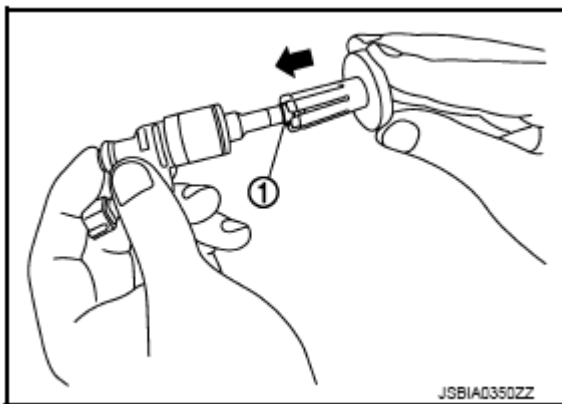


Fig. 74: Inserting Seal Ring To Fuel Injector
Courtesy of NISSAN NORTH AMERICA, INC.

- d. Insert drift [SST: KV10119710 (-)] (A) to injector and rotate clockwise and counterclockwise by 90° while pressing seal ring to fit it.

B : Chamfering
 ⇐ : Injector side

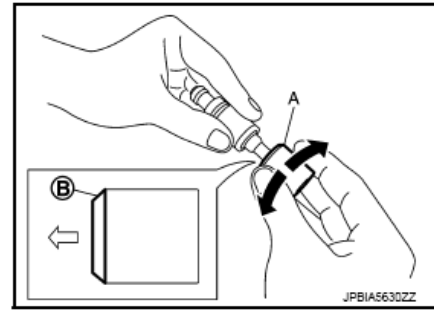


Fig. 75: Fitting Seal Ring By Rotating Drift
 Courtesy of NISSAN NORTH AMERICA, INC.

CAUTION: Be careful to a direction of the tool.

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

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

CAUTION:

- Do not reuse O-ring.
- Handle O-ring with bare hands. Never wear gloves.
- Lubricate O-ring with new engine oil.
- Never clean O-ring with solvent.
- Check that O-ring and its mating part are free of foreign material.
- When installing O-ring, be careful not to scratch it with tool or fingernails. Also be careful not to twist or stretch O-ring. If O-ring was stretched while it was being attached, never insert it quickly into fuel tube.
- Insert new O-ring straight into fuel rail. Never decenter or twist it.
- Always install the back up ring (1) in the right direction as instructed.

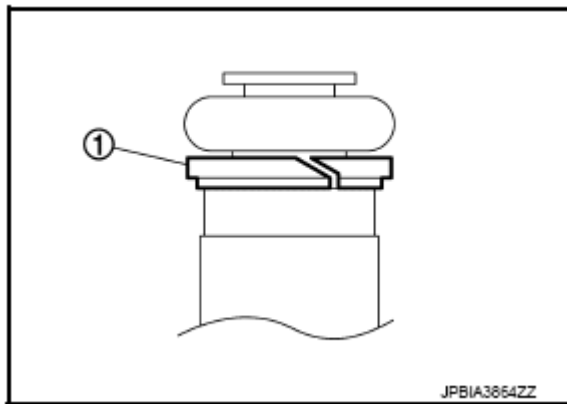


Fig. 76: Identifying Fuel Injector Back Up Ring
 Courtesy of NISSAN NORTH AMERICA, INC.

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

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

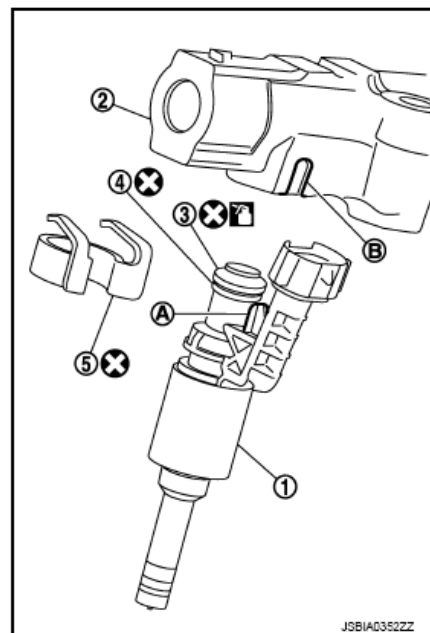


Fig. 77: Identifying Fuel Injector, Holder, Fuel Rail, O-Rings And Backup Ring
 Courtesy of NISSAN NORTH AMERICA, INC.

- a. Install fuel injector holder (5) to fuel injector.

CAUTION:

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

- b. Insert fuel injector into fuel rail with fuel injector holder attached.

- Insert it while matching it to the axial center.
 - Insert so that protrusion (A) of fuel injector is aligned to cutout (B).
- c. Check that installation is complete by checking that fuel injector does not rotate or come off.
- Check that protrusions of fuel injectors and fuel rail are aligned with cutouts of clips after installation.
4. Insert insulator into mounting hole of fuel injector of cylinder head.
5. Install fuel rail and fuel injector assembly to cylinder head.
- Tighten mounting bolts and nuts in two steps in numerical order as shown in the figure.

← : Engine front

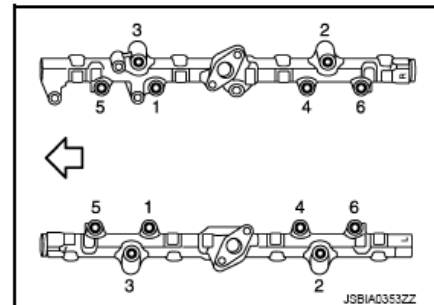


Fig. 78: Identifying Fuel Rail And Fuel Injector Assembly Mounting Bolts Tightening Sequence

Courtesy of NISSAN NORTH AMERICA, INC.

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

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

6. Connect injector harness connector.
7. Install fuel feed tube (bank side) to fuel rail.

CAUTION:

- When inserting fuel feed tube (bank side) to fuel rail, press the flange part to install the tube.
 - Never use O-ring with any scoring.
 - Never reuse fuel feed tube (bank side), O-ring and back up ring.
- Apply engine oil to O-ring.

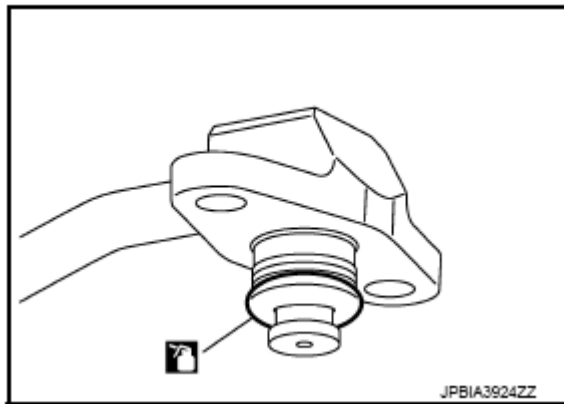


Fig. 79: Identifying Fuel Feed Tube O-Ring
 Courtesy of NISSAN NORTH AMERICA, INC.

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

↩ : Engine front

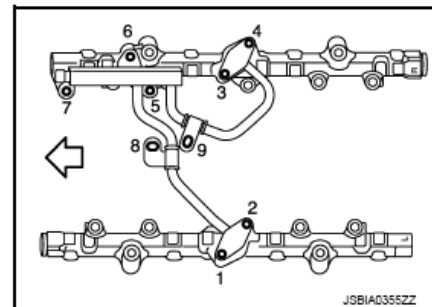


Fig. 80: Identifying Fuel Injector And Fuel Tube Mounting Bolts Tightening Sequence
 Courtesy of NISSAN NORTH AMERICA, INC.

8. Install fuel feed tube (pump side) to fuel feed tube (bank side) as per the following:

CAUTION: Never reuse fuel feed tube (pump side).

- Apply engine oil to flare screw parts of high pressure pump side and fuel feed tube (bank side) side.
- Manually tighten 2 flare nuts without using a tool until they are seated to screw thread.
- Tighten mounting bolt (A).

B :To high pressure fuel pump
 ⇐ : Engine front

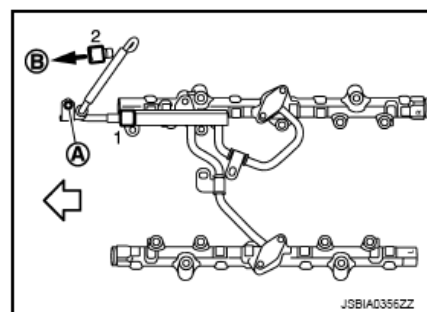


Fig. 81: Identifying High Pressure Pump Side And Fuel Feed Tube Flare Nuts And Mounting Bolts
 Courtesy of NISSAN NORTH AMERICA, INC.

- d. Tighten flare nuts in numerical order as shown in the figure.
9. Install in the reverse order of removal.

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.

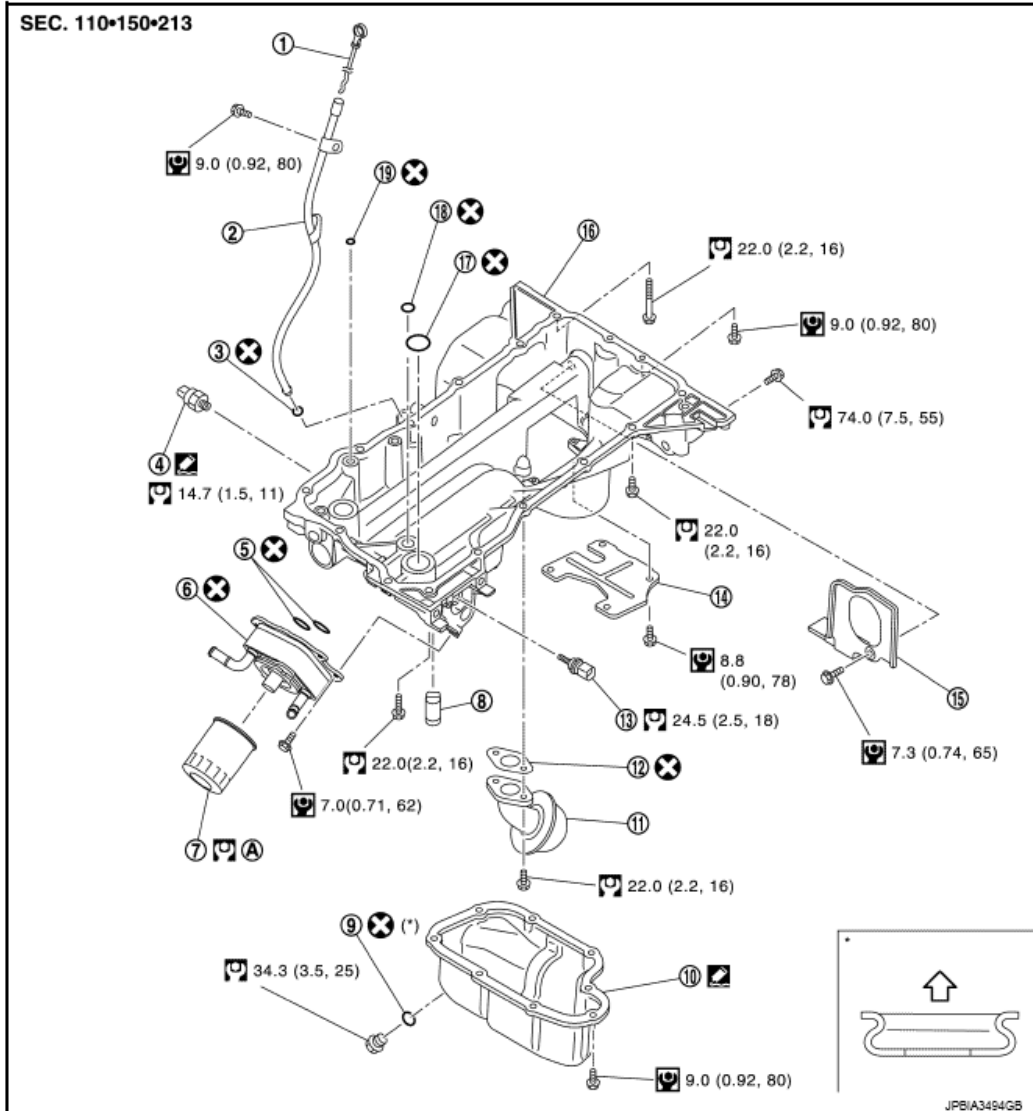
NOTE: Use mirrors for checking at points out of clear sight.

2. Start the engine. With engine speed increased, check 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) AND OIL STRAINER

Exploded View



- | | | |
|----------------------------|--------------------------|----------------------|
| 1. Oil level gauge | 2. Oil level gauge guide | 3. O-ring |
| 4. Oil pressure switch | 5. O-ring | 6. Oil cooler |
| 7. Oil filter | 8. Relief valve | 9. Drain plug washer |
| 10. Oil pan (lower) | 11. Oil strainer | 12. Gasket |
| 13. Oil temperature sensor | 14. Baffle plate | 15. Rear plate cover |
| 16. Oil pan (upper) | 17. O-ring | 18. O-ring |
| 19. O-ring | | |

A. Comply with the installation procedure when tightening.

← : Oil pan side

Fig. 82: Exploded View Of Oil Pan (Lower) And Oil Strainer With Torque Specifications
Courtesy of NISSAN NORTH AMERICA, INC.

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

Removal and Installation

REMOVAL

WARNING: To avoid the danger of being scalded, never drain engine oil when engine is hot.

1. Drain engine oil. Refer to "**DRAINING**".
2. Remove protector A and protector B. Refer to "**FRONT TUBE ASSEMBLY : EXPLODED VIEW**".
3. Remove front suspension rear cross member. Refer to "**2WD: EXPLODED VIEW**" (2WD models) or "**4WD: EXPLODED VIEW**" (4WD models).
4. Remove oil pan (lower) as per the following:
 - a. Loosen mounting bolts in reverse order as shown in the figure to remove.

↔ : Engine front

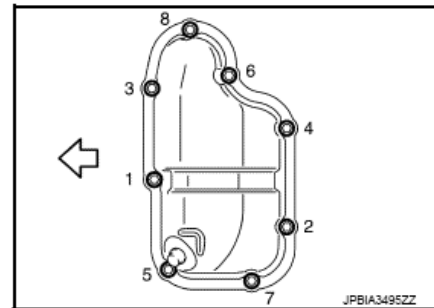


Fig. 83: Identifying Oil Pan (Lower) Mounting Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

- 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.

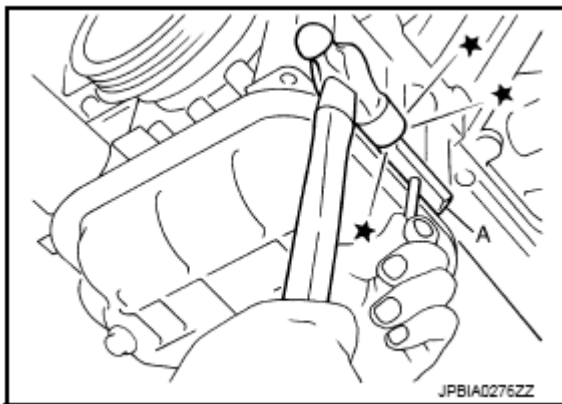


Fig. 84: Inserting Seal Cutter Between Oil Pan (Upper) And Oil Pan (Lower)

Courtesy of NISSAN NORTH AMERICA, INC.

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

INSTALLATION

CAUTION: Do not reuse drain plug washer.

1. Install oil strainer.
2. Install oil pan (lower) as per the following:
 - 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.

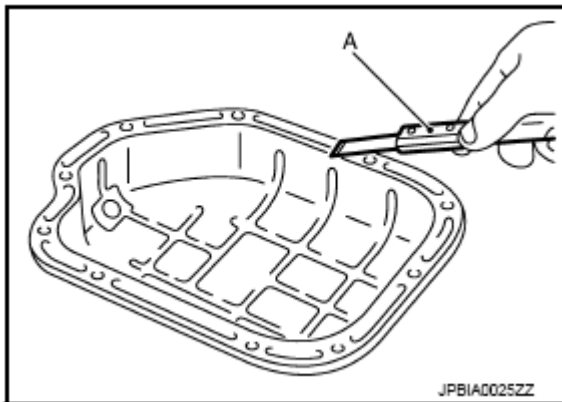


Fig. 85: Removing Liquid Gasket From Mating Surfaces Using Scraper
Courtesy of NISSAN NORTH AMERICA, INC.

- 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.

- a : 7.5 - 9.5 mm (0.295 - 0.374 in)
 b : ϕ 4.0 - 5.0 mm (0.157 - 0.197 in)
 ⇐ : Engine front

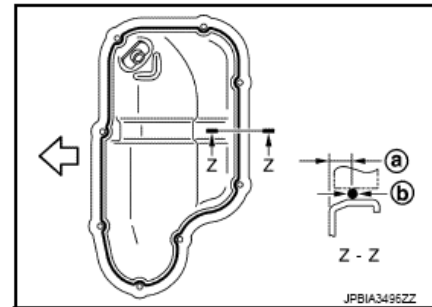


Fig. 86: Identifying Liquid Gasket Applying Area
 Courtesy of NISSAN NORTH AMERICA, INC.

Use Genuine RTV silicone sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS".

CAUTION: Attaching must be done within 5 minutes after coating.

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

⇐ : Engine front

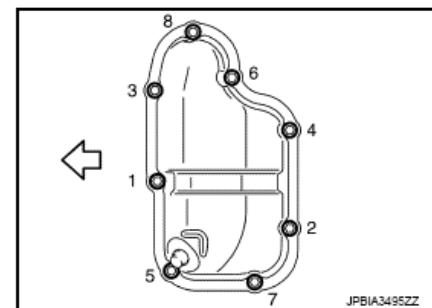


Fig. 87: Identifying Oil Pan (Lower) Mounting Bolts Tightening Sequence
 Courtesy of NISSAN NORTH AMERICA, INC.

3. 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".
4. 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.

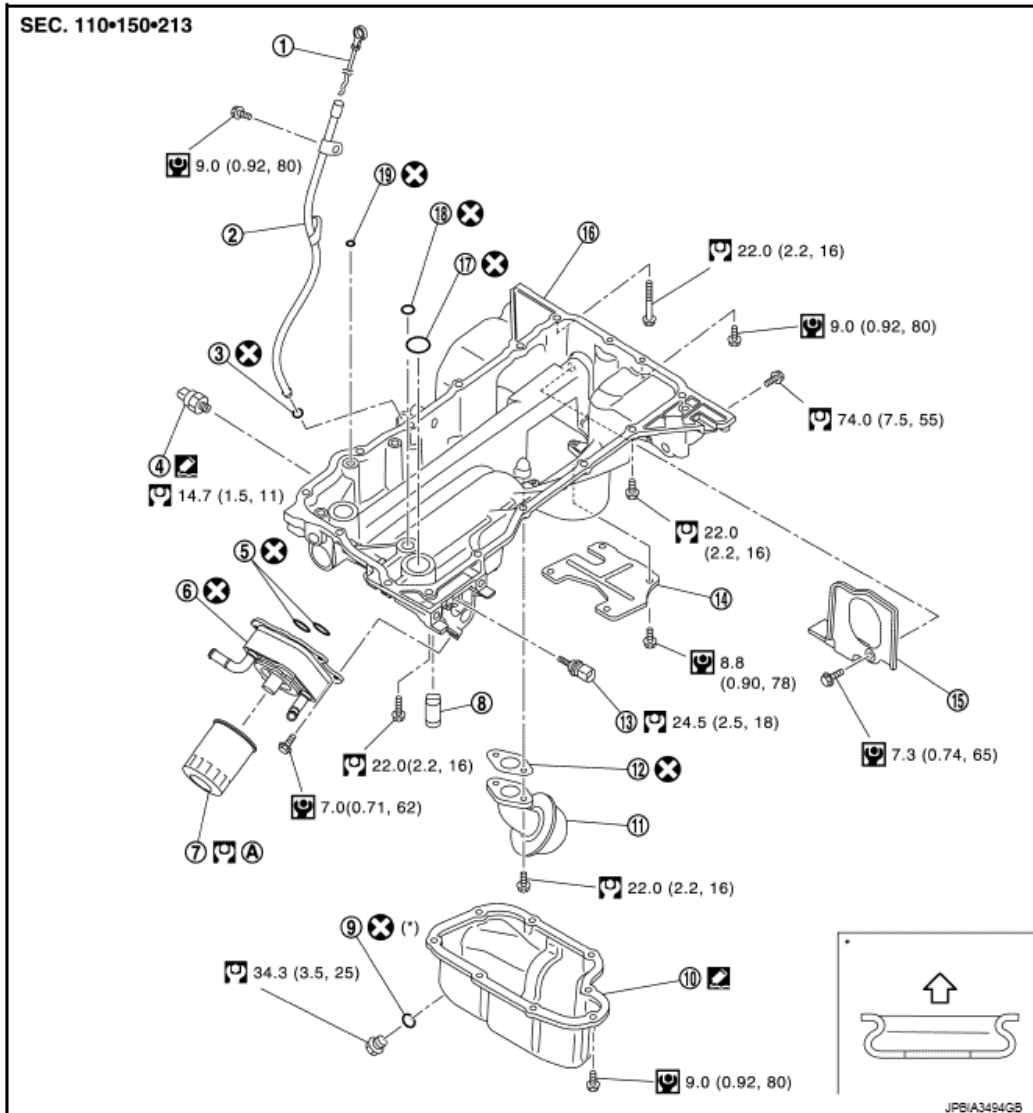
Inspection**INSPECTION AFTER REMOVAL**

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 15 minutes.
4. Check the engine oil level again. Refer to "**INSPECTION**".

OIL PAN (UPPER)**Exploded View**



- | | | |
|----------------------------|--------------------------|----------------------|
| 1. Oil level gauge | 2. Oil level gauge guide | 3. O-ring |
| 4. Oil pressure switch | 5. O-ring | 6. Oil cooler |
| 7. Oil filter | 8. Relief valve | 9. Drain plug washer |
| 10. Oil pan (lower) | 11. Oil strainer | 12. Gasket |
| 13. Oil temperature sensor | 14. Baffle plate | 15. Rear plate cover |
| 16. Oil pan (upper) | 17. O-ring | 18. O-ring |
| 19. O-ring | | |

Comply with the installation procedure when tightening.

A.

↶ : Oil pan side

Fig. 88: Exploded View Of Oil Pan (Upper) With Torque Specifications
 Courtesy of NISSAN NORTH AMERICA, INC.

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

Removal and Installation

REMOVAL

WARNING: To avoid the danger of being scalded, never drain engine oil when engine is hot.

1. Remove oil filter. Refer to "REMOVAL AND INSTALLATION".
2. Remove oil cooler. Refer to "EXPLODED VIEW".
3. Move A/C compressor to the position without the hindrance for work. Refer to "EXPLODED VIEW".
4. Remove oil level gauge and oil level gauge guide.
5. Remove oil pressure switch and oil temperature sensor if necessary.
6. Remove rear plate cover.
7. Remove protector A and protector B. Refer to "FRONT TUBE ASSEMBLY : EXPLODED VIEW".
8. Remove front suspension rear cross member. Refer to "2WD: EXPLODED VIEW" (2WD models) or "4WD: EXPLODED VIEW" (4WD models).
9. Remove steering gear assembly. Refer to "EXPLODED VIEW".
10. Remove front final drive assembly. Refer to "EXPLODED VIEW".
11. Remove oil pan (lower). Refer to "EXPLODED VIEW".
12. Remove oil strainer. Refer to "EXPLODED VIEW".
13. Remove bolts fixing oil pan (upper) to transmission assembly.
14. Remove oil pan (upper) as per the following:
 - a. Loosen mounting bolts in the reverse order as shown in the figure with power tool to remove.

NOTE: Disregard No. 9, 16 when loosening.

- b. Insert a suitable tool into the notch at oil pan (upper) (1) as shown in the figure.
 - Pry off case by moving a suitable tool.

↩ : Engine front

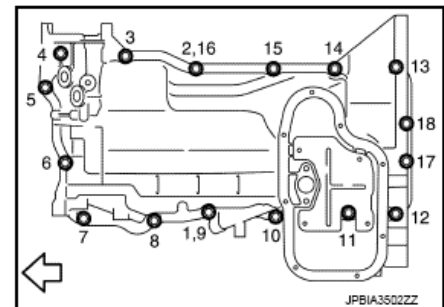


Fig. 89: Identifying Oil Pan (Upper) Mounting Bolts Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

CAUTION: Be careful not to damage the mating surfaces.

← : Engine front

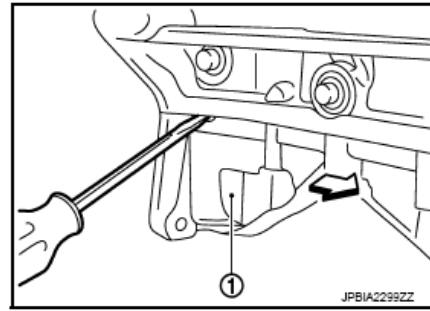


Fig. 90: Inserting Screwdriver Into Notch At Oil Pan (Upper)

Courtesy of NISSAN NORTH AMERICA, INC.

15. Remove O-ring from bottom of cylinder block and oil pump.
16. Remove oil pressure switch and oil temperature sensor, if necessary.

INSTALLATION

CAUTION: Do not reuse O-rings.

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

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

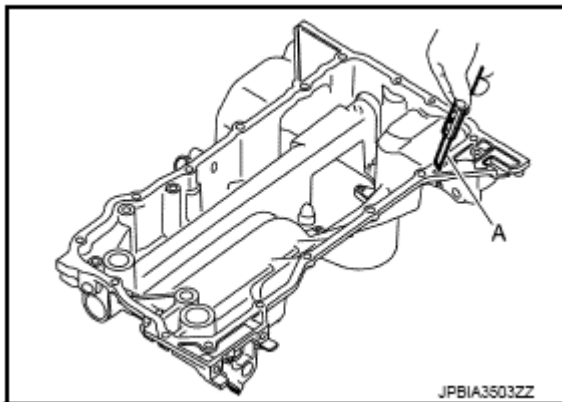


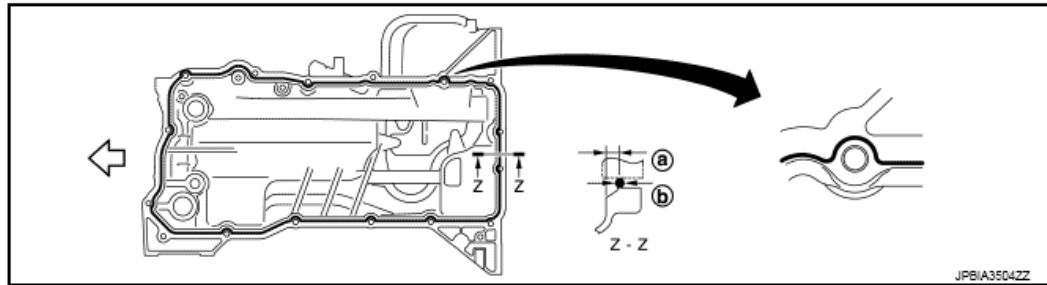
Fig. 91: Removing Liquid Gasket From Mating Surfaces Using Scraper

Courtesy of NISSAN NORTH AMERICA, INC.

- b. Install new O-rings on the bottom of cylinder block and oil pump.

CAUTION: Do not reuse O-rings.

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



a. : 5.5 - 7.5 mm (0.217 - 0.295 in) b. : ϕ 4.0 - 5.0 mm (0.157 - 0.197 in)

↔ : Engine front

Fig. 92: Identifying Liquid Gasket Applying Area
Courtesy of NISSAN NORTH AMERICA, INC.

Use Genuine RTV silicone sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS".

CAUTION: Attaching must be done within 5 minutes after coating.

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

CAUTION: Install avoiding misalignment of O-rings.

NOTE: Tighten mounting bolts No. 1 and 2 in two steps. The numerical order No. 9 and 16 shown in the figure second steps.

- There are four types of mounting bolts. Refer to the following figure for locating bolts:

← : Engine front

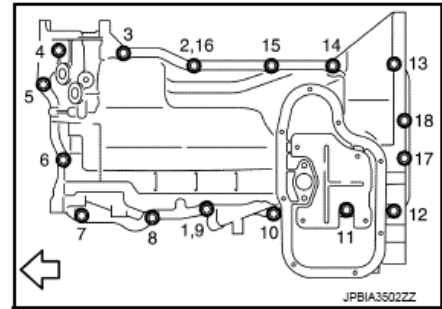


Fig. 93: Identifying Oil Pan (Upper) Mounting Bolts Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

Order number for tightening	17, 18	2 (16), 3, 5, 6, 7, 8, 10, 11, 14, 15	1(9), 4	12, 13
Bolt size	M6	M8		
Bolt length (threaded area)	45 mm (1.77 in)	25 mm (0.98 in)	30.0 mm (1.18 in)	120 mm (4.72 in)
Tightening torque	9.0 N. (0.92 kg-m, 80 in-lb)	22.0 N.m (2.2 kg-m, 16 ft-lb)		

- e. Tighten transmission joint bolts.
- f. Install rear plate cover.
2. Install oil strainer.
3. Install oil pan (lower). Refer to "**REMOVAL AND INSTALLATION**".
4. Install in the reverse order of removal.

NOTE: At least 30 minutes after oil pan is installed, pour engine oil.

Inspection

INSPECTION AFTER DISASSEMBLY

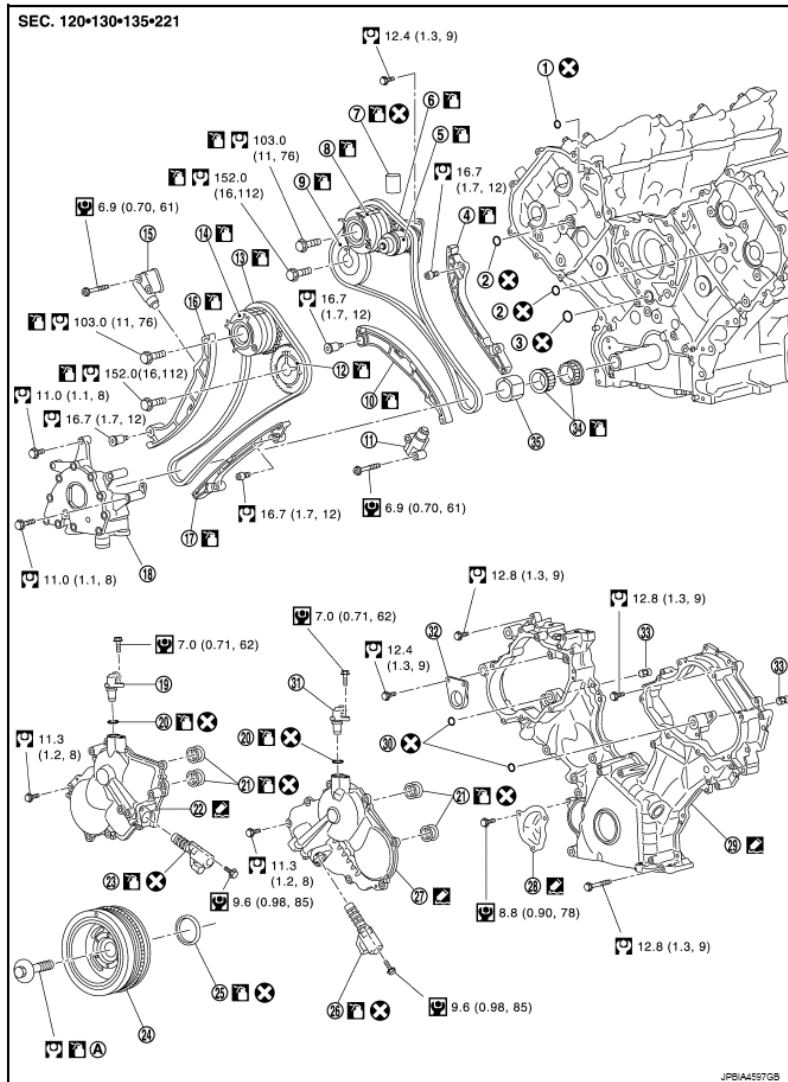
Clean oil strainer if any object is attached.

INSPECTION AFTER ASSEMBLY

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 15 minutes.
4. Check the engine oil level again. Refer to "**INSPECTION**".

TIMING CHAIN

Exploded View



- | | | |
|---|---|--|
| 1. O-ring | 2. O-ring | 3. O-ring |
| 4. Tension guide (bank 2) | 5. High pressure fuel pump camshaft | 6. Timing chain (bank 2) |
| 7. Lifter | 8. Intake camshaft sprocket (bank 2) | 9. Exhaust camshaft sprocket (bank 2) |
| 10. Slack guide (bank 2) | 11. Timing chain tensioner (bank 2) | 12. Exhaust camshaft sprocket (bank 1) |
| 13. Timing chain (bank 1) | 14. Intake camshaft sprocket (bank 1) | 15. Timing chain tensioner (bank 1) |
| 16. Slack guide (bank 1) | 17. Tension guide (bank 1) | 18. Oil pump |
| 19. Camshaft position sensor (bank 2) | 20. O-ring | 21. Seal ring |
| 22. Valve timing control cover (bank 2) | 23. Intake valve timing control solenoid valve (bank 2) | 24. Crankshaft pulley |
| 25. Front oil seal | 26. Intake valve timing control solenoid valve (bank 1) | 27. Valve timing control cover (bank 1) |
| 28. Timing chain tensioner cover | 29. Front cover | 30. O-ring |
| 31. Camshaft position sensor (bank 1) | 32. Camshaft bracket | 33. Oil filter (for valve timing control solenoid valve) |
| 34. Crankshaft sprocket | 35. Oil pump drive spacer | |
- A. Comply with the installation procedure when tightening.

Fig. 94: 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 fuel pressure. Refer to the following table:

ENGINE	Reference
VK56VD FOR USA AND CANADA	" <u>WORK PROCEDURE</u> "
VK56VD FOR MEXICO	" <u>WORK PROCEDURE</u> "

2. Drain engine coolant from radiator. Refer to "**DRAINING**".
3. Remove fan shroud (lower). Refer to "**EXPLODED VIEW**".
4. Remove fan bracket. Refer to "**EXPLODED VIEW**".
5. Remove drive belt auto-tensioner. Refer to "**EXPLODED VIEW**".
6. Remove oil level gauge and oil level gauge guide. Refer to "**EXPLODED VIEW**".
7. Move power steering oil pump to the position without the hindrance for work. Refer to "**EXPLODED VIEW**".
8. Remove alternator, alternator bracket and alternator stay. Refer to "**EXPLODED VIEW**".
9. Move power steering reservoir tank to the position without the hindrance for work, and then remove Reservoir tank bracket. Refer to "**EXPLODED VIEW**".
10. Remove camshaft position sensors.

CAUTION:

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

A : Keep free from magnetic materials

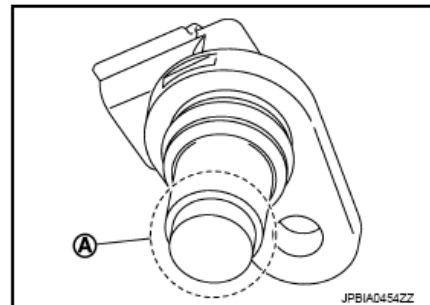


Fig. 95: Caution For Camshaft Position Sensors With Magnetic Material
 Courtesy of NISSAN NORTH AMERICA, INC.

11. Remove high pressure fuel pump and lifter. Refer to "**EXPLODED VIEW**".

CAUTION: After removing lifter, replace lifter with a new one.

12. Remove radiator hose (upper) and radiator hose (lower). Refer to "**EXPLODED VIEW**".
13. Remove water suction pipe. Refer to "**EXPLODED VIEW**".
14. Remove valve timing control cover as per the following:
- Disconnect valve timing control solenoid valve harness connector.
 - Loosen mounting bolts in the reverse order as shown in the figure.

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

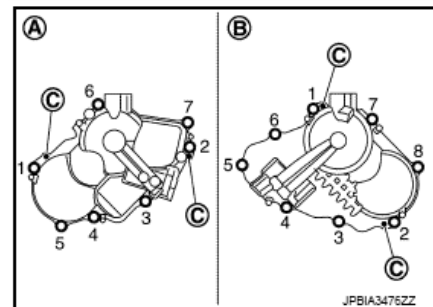


Fig. 96: Identifying Timing Chain Cover Mounting Bolts Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

- CAUTION:**
- Exercise care not to damage mating surfaces.
 - Shaft is internally jointed with camshaft sprocket center hole. When removing, keep it horizontal until it is completely disconnected.

15. Remove intake valve timing control solenoid valve (bank 1 and bank 2), if necessary.

CAUTION: Valve timing control solenoid valve is not reusable. Never remove it unless required.

16. Remove O-rings (1) from front cover.

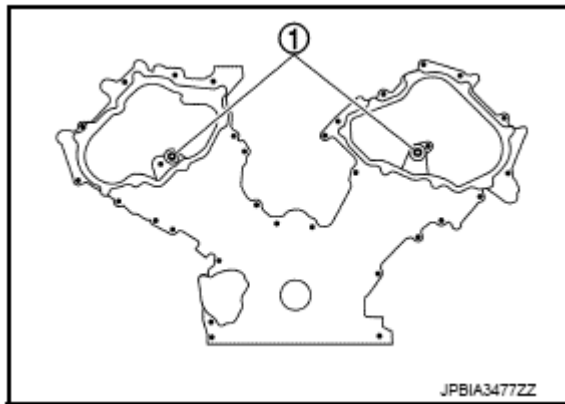


Fig. 97: Identifying Timing Chain Front Cover O-Rings
 Courtesy of NISSAN NORTH AMERICA, INC.

17. Remove rocker cover. Refer to "**EXPLODED VIEW**".
18. Obtain No. 1 cylinder at TDC of its compression stroke. Refer to "**INSPECTION**".
19. Remove crankshaft pulley. Refer to "**FRONT OIL SEAL: REMOVAL AND INSTALLATION**".
20. Remove water pump pulley. Refer to "**EXPLODED VIEW**".
21. Remove oil pan (lower) and oil strainer. Refer to "**EXPLODED VIEW**".
22. Remove oil pan (upper). Refer to "**EXPLODED VIEW**".
23. Remove front cover as per the following:
 - a. Loosen mounting bolts (A), and then remove camshaft bracket (1).

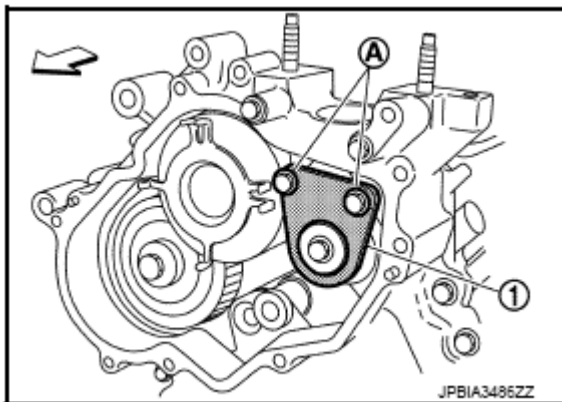


Fig. 98: Identifying Camshaft Bracket And Mounting Bolts
 Courtesy of NISSAN NORTH AMERICA, INC.

- b. Loosen mounting bolts in reverse order as shown in the figure.
- c. Insert a suitable tool into the notch at front cover.
 - Pry off case by moving a suitable tool.

CAUTION: • Exercise care not to damage mating surfaces.

- After removal, handle front cover carefully so it does not tilt, cant, or warp under a load.

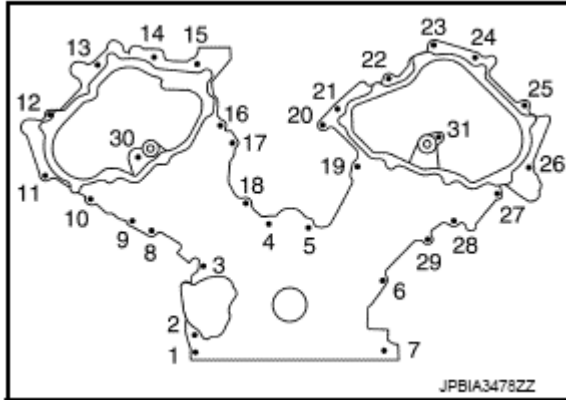


Fig. 99: Identifying Timing Chain Front Cover Mounting Bolts Tightening Sequence
 Courtesy of NISSAN NORTH AMERICA, INC.

24. Remove oil pump and oil pump drive spacer.
25. Remove front oil seal from front cover using suitable tool.
 - Use screwdriver for removal.

CAUTION: Be careful not to damage front cover.

26. Remove O-rings (1), (2), (3) from cylinder heads and cylinder block.

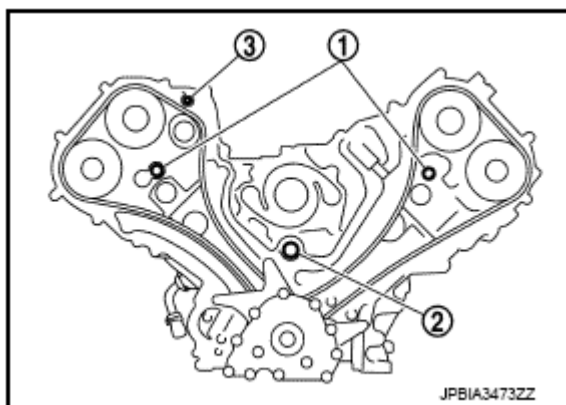


Fig. 100: Identifying Cylinder Heads And Cylinder Block O-Rings
 Courtesy of NISSAN NORTH AMERICA, INC.

27. Remove oil filter (for valve timing control solenoid valve), if necessary.
28. Remove timing chain tensioner cover from front cover, if necessary.

- Use seal cutter [SST: KV10111100 (J-37228)] to cut liquid gasket for removal.

29. Remove timing chain tensioner (bank 1) as per the following:

NOTE: To remove timing chain and related parts, start with those on bank 1. The procedure for removing parts on bank 2 is omitted because it is the same as that for bank 1.

- Push both sides of spring (A) against spring tension, and then press in plunger with a slack guide (2).

1 : Timing chain tensioner (bank 1)

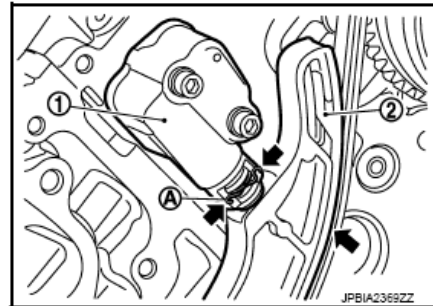


Fig. 101: Identifying Timing Chain Tensioner And Slack Guide
Courtesy of NISSAN NORTH AMERICA, INC.

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

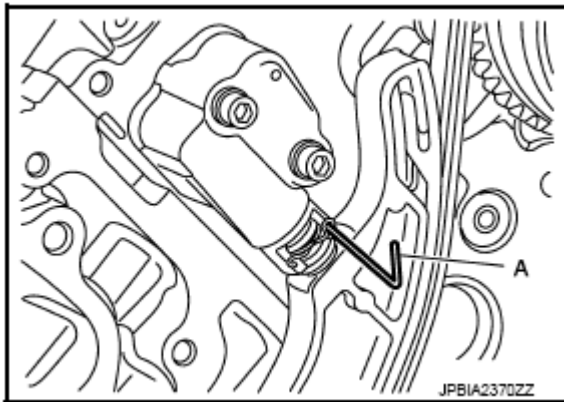


Fig. 102: Identifying Stopper Pin
Courtesy of NISSAN NORTH AMERICA, INC.

- Remove high pressure fuel pump camshaft.
- Remove tension guide and slack guide.
- Remove exhaust camshaft sprocket as per the following:
 - Secure the hexagonal portion of exhaust camshaft using a wrench to loosen mounting bolt.
- Remove timing chain and crankshaft sprocket.

CAUTION: After removing timing chain, never turn crankshaft and camshaft separately, or valves will strike the piston head.

34. Remove intake camshaft sprocket as per the following:

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

NOTE: The figure shows an example of bank 2.

⇐ : Engine front

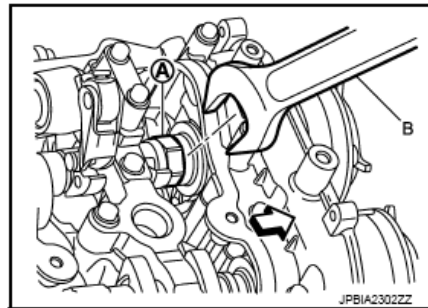


Fig. 103: Loosening Drive Shaft Mounting Bolts Using Wrench
Courtesy of NISSAN NORTH AMERICA, INC.

CAUTION:

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

A : Intake

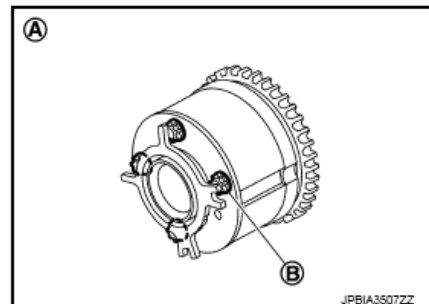


Fig. 104: Identifying Camshaft Sprocket Bolts
Courtesy of NISSAN NORTH AMERICA, INC.

35. Use scraper to remove all traces of old liquid gasket from front cover and opposite mating surfaces.
- Remove old liquid gasket from bolt hole and thread.

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

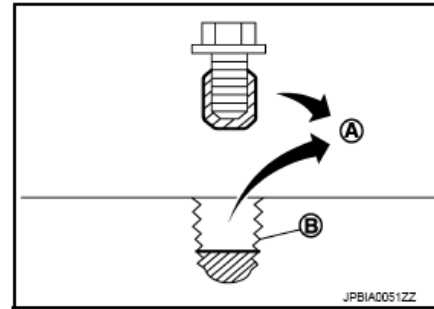
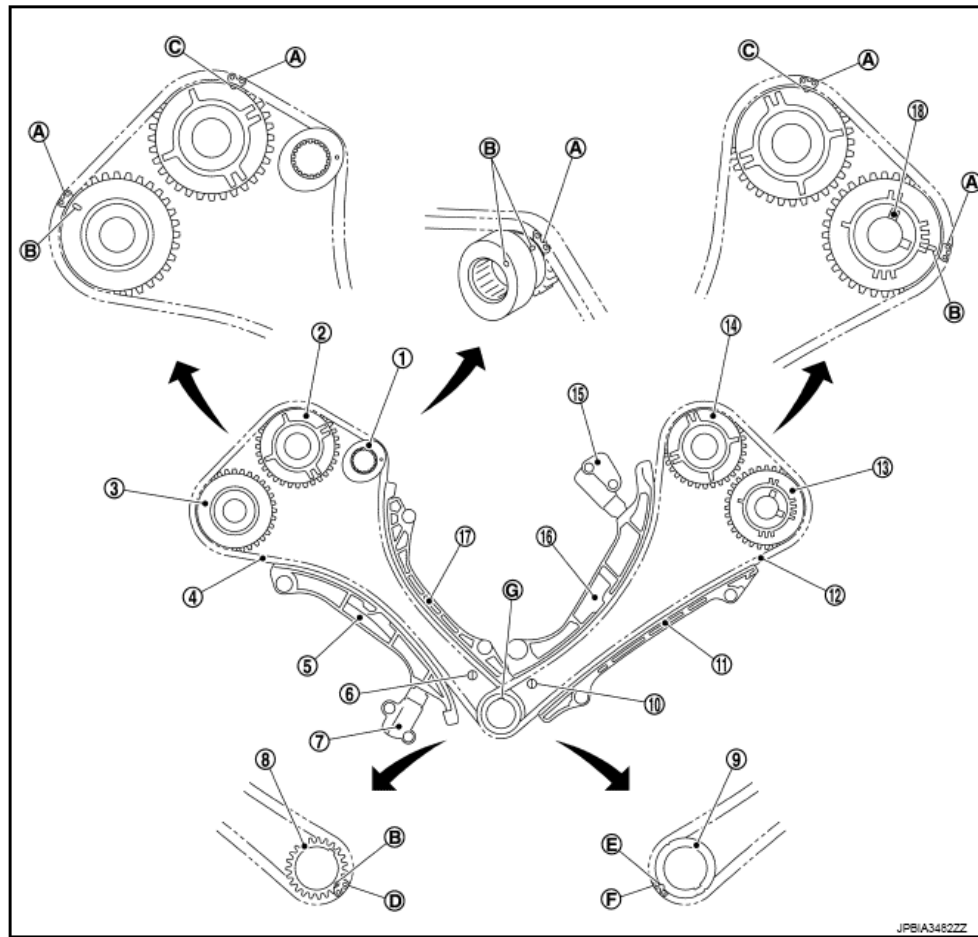


Fig. 105: Removing Old Liquid Gasket From Bolt Hole And Thread
Courtesy of NISSAN NORTH AMERICA, INC.

INSTALLATION

CAUTION: Do not reuse O-rings.



JPB/A3482ZZ

- | | | |
|--|---------------------------------------|---------------------------------------|
| 1. High pressure fuel pump camshaft | 2. Intake camshaft sprocket (bank 2) | 3. Exhaust camshaft sprocket (bank 2) |
| 4. Timing chain (bank 2) | 5. Slack guide (bank 2) | 6. Chain oil jet (bank 2) |
| 7. Timing chain tensioner (bank 2) | 8. Crankshaft sprocket (bank 2 side) | 9. Crankshaft sprocket (bank 1 side) |
| 10. Chain oil jet (bank 1) | 11. Tension guide (bank 1) | 12. Timing chain (bank 1) |
| 13. Exhaust camshaft sprocket (bank 1) | 14. Intake camshaft sprocket (bank 1) | 15. Timing chain tensioner (bank 1) |
| 16. Slack guide (bank 1) | 17. Tension guide (bank 2) | 18. Dowel pin |
| A: Matching mark (copper link) | B: Matching mark (punched) | C: Matching mark (outer groove) |
| D: Matching mark (white link) | E: Matching mark (notched) | F: Matching mark (yellow link) |
| G: Crankshaft key | | |

Fig. 106: Identifying Timing Chain Components With Matching Marks
 Courtesy of NISSAN NORTH AMERICA, INC.

NOTE:

- The above figure shows the relationship between the matching mark on each timing chain and that on the corresponding sprocket, with the components installed.
- Parts with an identification mark (R or L) should be installed on the corresponding bank according to the mark.
 - Intake camshaft sprocket, exhaust camshaft sprocket
 - Tension guide
 - Slack guide

- To install timing chain and related parts, start with those on bank 2. The procedure for installing parts on bank 1 is omitted because it is the same as that for installation on bank 2.

1. Check that crankshaft key (1) and dowel pin (A) of each camshaft are located as shown in the figure.

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

Crankshaft key: Straight up

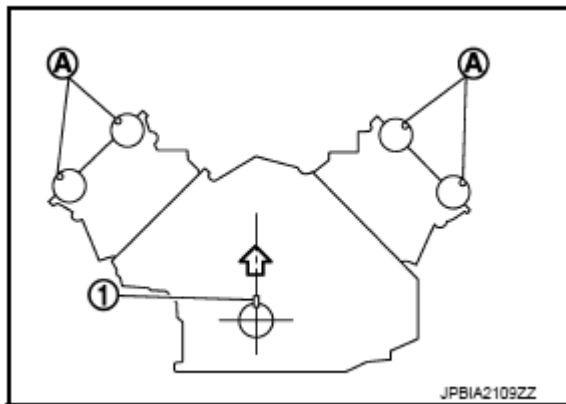


Fig. 107: Identifying Crankshaft Key And Dowel Pin
Courtesy of NISSAN NORTH AMERICA, INC.

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

2. Install camshaft sprockets (INT and EXH).
 - Install onto correct side by checking with identification mark (A) on surface.

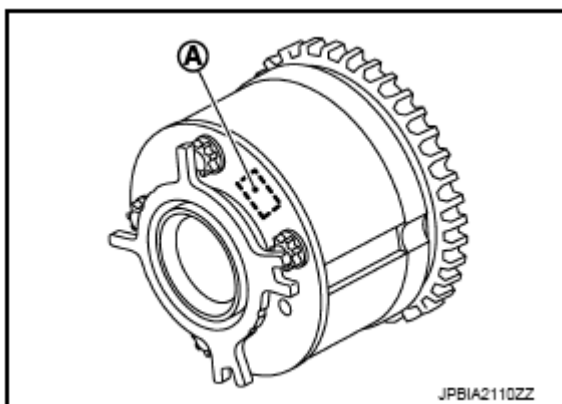


Fig. 108: Identifying Camshaft Sprockets With Identification Mark

Courtesy of NISSAN NORTH AMERICA, INC.

Exhaust side:

- Secure the hexagonal portion of exhaust camshaft using a wrench to tighten mounting bolt. Refer to "**EXPLODED VIEW**".

Intake side:

- Secure the hexagonal portion (located in between journal No. 1 and journal No. 2) of drive shaft (A) using a wrench (B) to tighten mounting bolt. Refer to "**EXPLODED VIEW**".

↔ : Engine front

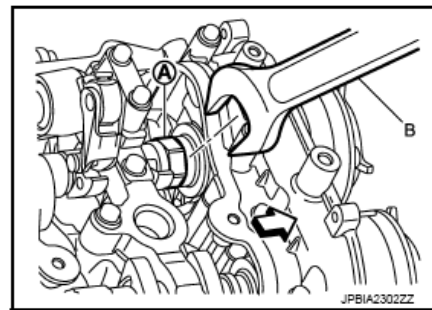


Fig. 109: Tightening Exhaust Camshaft Mounting Bolts Using Wrench
Courtesy of NISSAN NORTH AMERICA, INC.

NOTE: The figure shows an example of bank 2.

3. Install high pressure fuel pump camshaft.
4. Install timing chains as per the following:
 - a. Install crankshaft sprockets for both banks.
 - Install each crankshaft sprocket so that its flange side (the larger diameter side without teeth) (A) faces in the direction shown in the figure.

NOTE: The same parts are used but facing directions are different.

- 1 : Crankshaft sprocket (bank 1 side)
2 : Crankshaft sprocket (bank 2 side)

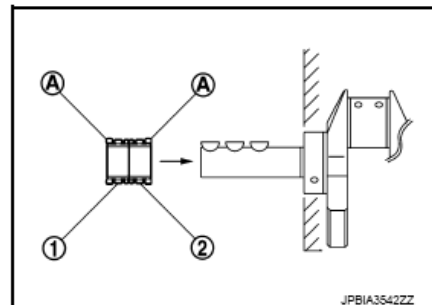


Fig. 110: Identifying Crankshaft Sprockets
Courtesy of NISSAN NORTH AMERICA, INC.

b. Install timing chains.

Bank 2 (F):

- Install timing chain so that the matching mark (punched) (B) and the matching mark (outer groove) (C) on camshaft sprocket is aligned with the copper link (A) on timing chain, while the matching mark (punched) (B) on crankshaft sprocket is aligned with the yellow link (D) one on timing chain, as shown in the figure.

Bank 1 (G):

- Install timing chain so that the matching mark (punched) (B) and the matching mark (outer groove) (C) on camshaft sprocket is aligned with the copper link (A) on timing chain, while the matching mark (notched) (E) on crankshaft sprocket is aligned with the yellow link (D) one on timing chain, as shown in the figure.

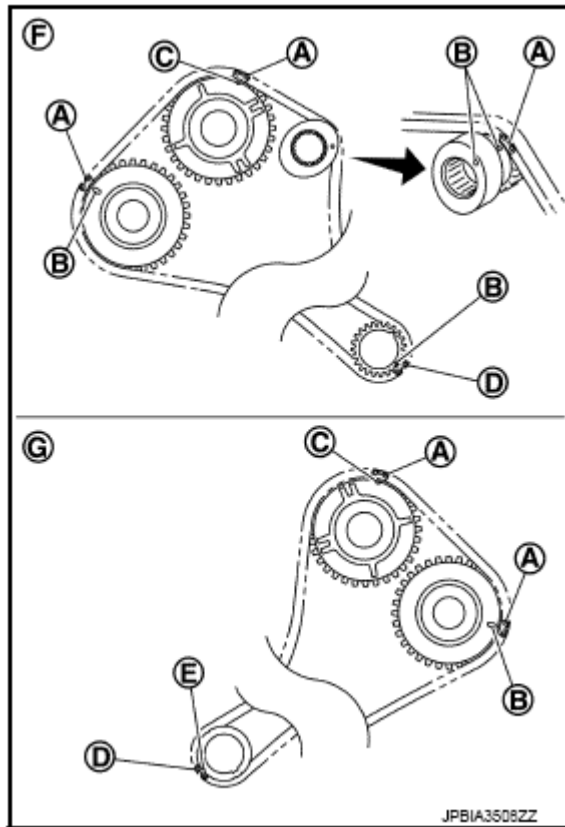


Fig. 111: Identifying Timing Chain And Related Components With Marks
Courtesy of NISSAN NORTH AMERICA, INC.

5. Install slack guides and tension guides onto correct side by checking with identification mark (A) on surface.

- 1 : Slack guide (bank 2)
- 2 : Tension guide (bank 2)
- 3 : Slack guide (bank 1)
- 4 : Tension guide (bank 1)

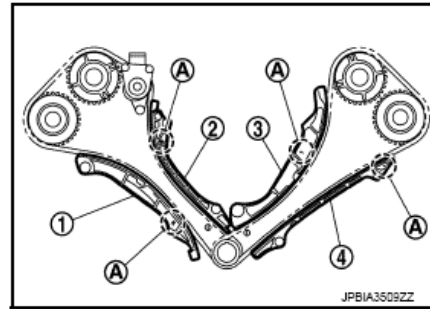


Fig. 112: Identifying Slack Guides And Tension Guides With Identification Mark

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

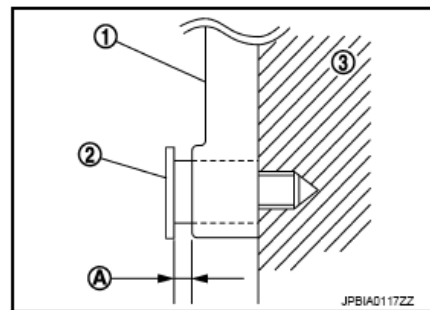


Fig. 113: Identifying Slack Guide And Mounting Bolt

Courtesy of NISSAN NORTH AMERICA, INC.

6. Install timing chain tensioner as per the following:
 - a. Fix the plunger at the most compressed position using a stopper pin (A).
 - Remove any dirt and foreign materials completely from the back and the mounting surfaces of timing chain tensioner.
 - b. Pull out stopper pin after installing, and then release plunger.

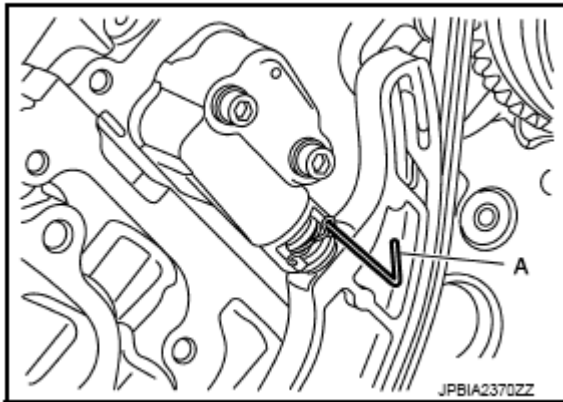


Fig. 114: Identifying Stopper Pin
Courtesy of NISSAN NORTH AMERICA, INC.

7. Check again that the matching marks on sprockets and timing chain have not slipped out of alignment.
8. Install oil pump and oil pump drive spacer. Refer to "**EXPLODED VIEW**".
9. Install front oil seal on front cover. Refer to "**FRONT OIL SEAL: REMOVAL AND INSTALLATION**".
10. Install timing chain tensioner cover (2) to front cover (1).

a : $\phi 3.4 - 4.4$ mm (0.134 - 0.173 in)

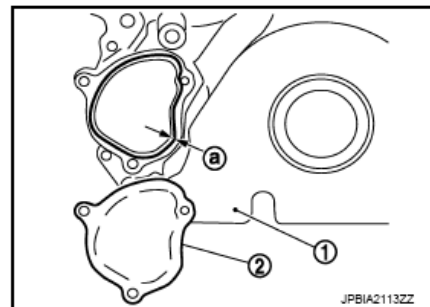


Fig. 115: Identifying Liquid Gasket Applying Area
Courtesy of NISSAN NORTH AMERICA, INC.

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

Use Genuine RTV silicone sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS**".**

11. Install oil filter (for valve timing control solenoid valve) (1) in the direction shown in the figure, if removed.
 - Check that the oil filter does not protrude from the upper surface of front cover (2) after installation.

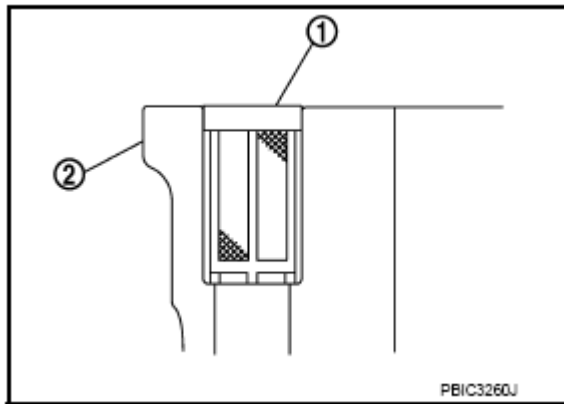


Fig. 116: Identifying Oil Filter And Front Cover
Courtesy of NISSAN NORTH AMERICA, INC.

12. Install front cover as per the following:
- Install new O-ring (1), (2), (3) onto cylinder heads and cylinder block.

CAUTION: Do not reuse O-rings.

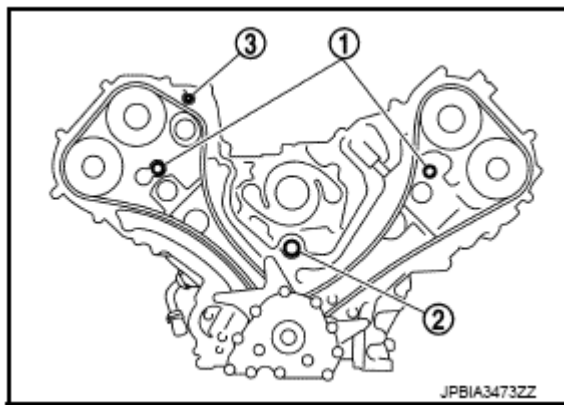


Fig. 117: Identifying Cylinder Heads And Cylinder Block O-Rings
Courtesy of NISSAN NORTH AMERICA, INC.

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

Use Genuine RTV silicone sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS".

- Check again that the matching marks on timing chain and that on each sprocket are aligned. Then, install front cover.

CAUTION: Be careful not to damage front oil seal by interference with front end of crankshaft.

- A : Junction between cylinder block and cylinder head
 B : Protrusion
 c : 4.3 - 5.3 mm (0.169 - 0.209 in)
 d : $\phi 3.4 - 4.4$ mm (0.134 - 0.173 in)
 e : $\phi 4.0 - 5.6$ mm (0.157 - 0.220 in)
 f : $\phi 4.8 - 5.8$ mm (0.189 - 0.228 in)

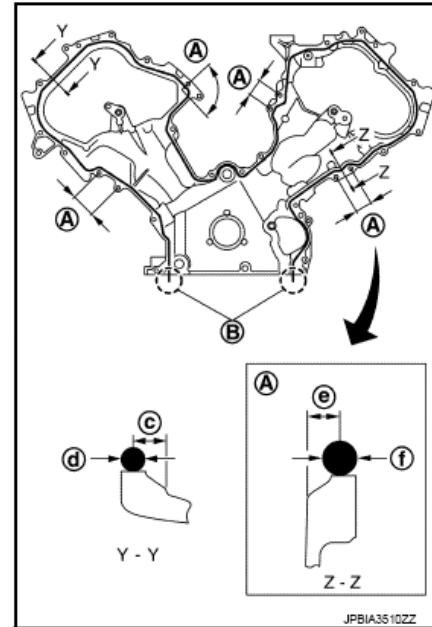


Fig. 118: Identifying Liquid Gasket Applying Area
 Courtesy of NISSAN NORTH AMERICA, INC.

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

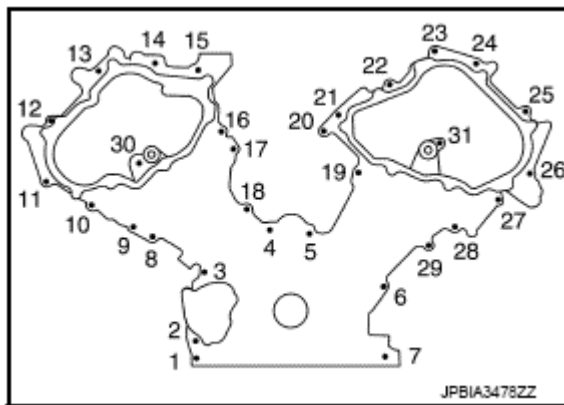


Fig. 119: Identifying Timing Chain Front Cover Mounting Bolts Tightening Sequence
 Courtesy of NISSAN NORTH AMERICA, INC.

- There are three types of mounting bolts.

A: 20 mm (0.79 in)

B: 50 mm (1.97 in)

C: 80 mm (3.15 in)

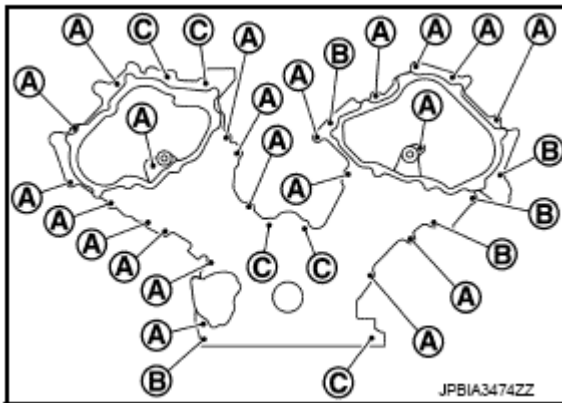


Fig. 120: Identifying Timing Chain Front Cover Mounting Bolts
Courtesy of NISSAN NORTH AMERICA, INC.

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

CAUTION: Be sure to wipe out any excessive liquid gasket leaking onto surface mating with oil pan.

13. Install valve timing control cover as per the following:

- Bolt (A) of fuel pump connector protector (1) cannot be installed after installing valve timing control cover. Therefore, install fuel pump connector protector in advance, if it is being removed.

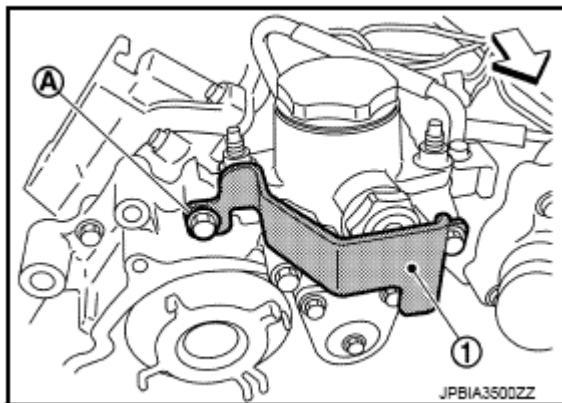


Fig. 121: Identifying Fuel Pump Connector Protector And Bolt
Courtesy of NISSAN NORTH AMERICA, INC.

- a. Install new O-rings (1) on front cover.

CAUTION: Do not reuse O-rings.

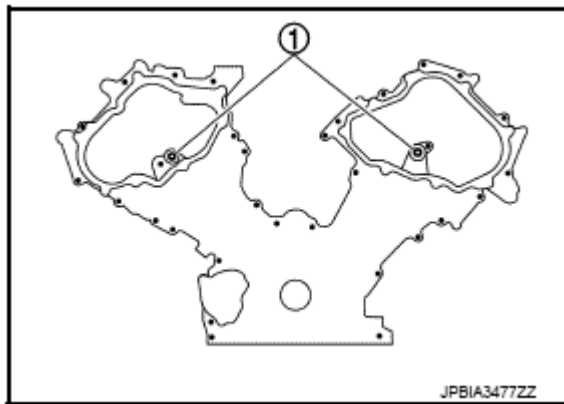


Fig. 122: Identifying Timing Chain Front Cover O-Rings
Courtesy of NISSAN NORTH AMERICA, INC.

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

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

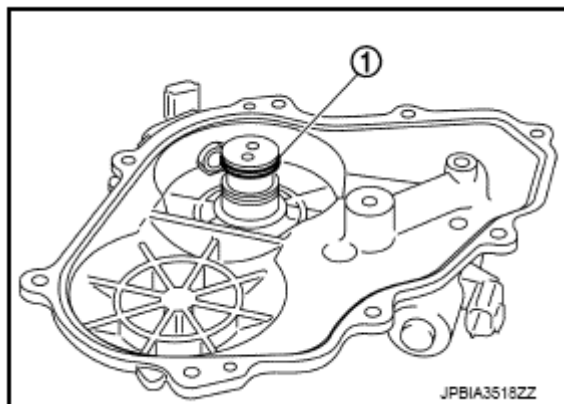


Fig. 123: Identifying Seal Rings In Shaft Grooves
Courtesy of NISSAN NORTH AMERICA, INC.

- c. Apply a continuous bead of liquid gasket with tube presser (commercial service tool) to valve timing control covers as shown in the figure.

Use Genuine RTV silicone sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS".

- d. Put a paint mark (A) on crankshaft pulley (1) aligning with angle f mark (B) on crankshaft pulley bolt.

A : Bank 2
B : Bank 1

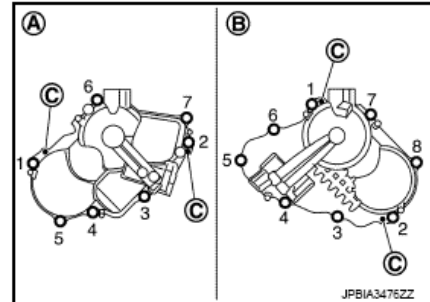


Fig. 125: Identifying Timing Chain Front Cover Mounting Bolts Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

- e. Tighten crankshaft pulley bolt (clockwise).

Angle tightening: 90 degrees (c)

- Check the tightening angle by referencing to the notches. The angle between two notches is 90 degrees.

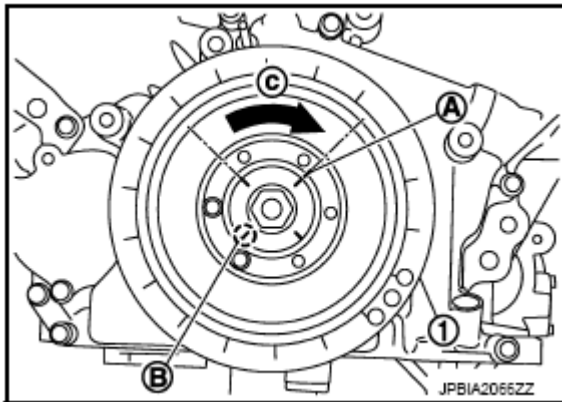


Fig. 126: Identifying Crankshaft Pulley Bolt Tightening Angle
Courtesy of NISSAN NORTH AMERICA, INC.

19. Rotate crankshaft pulley in normal direction (clockwise when viewed from engine front) to confirm it turns smoothly.
20. Install in the reverse order of removal.

Inspection

INSPECTION AFTER DISASSEMBLY 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

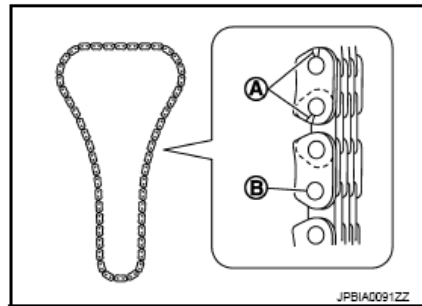


Fig. 127: Checking Timing Chain For Crack And Wear
Courtesy of NISSAN NORTH AMERICA, INC.

INSPECTION AFTER ASSEMBLY

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 the following table:

For NORTH AMERICA	"FOR NORTH AMERICA: FLUIDS AND LUBRICANTS "
For MEXICO	"FOR MEXICO: 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.

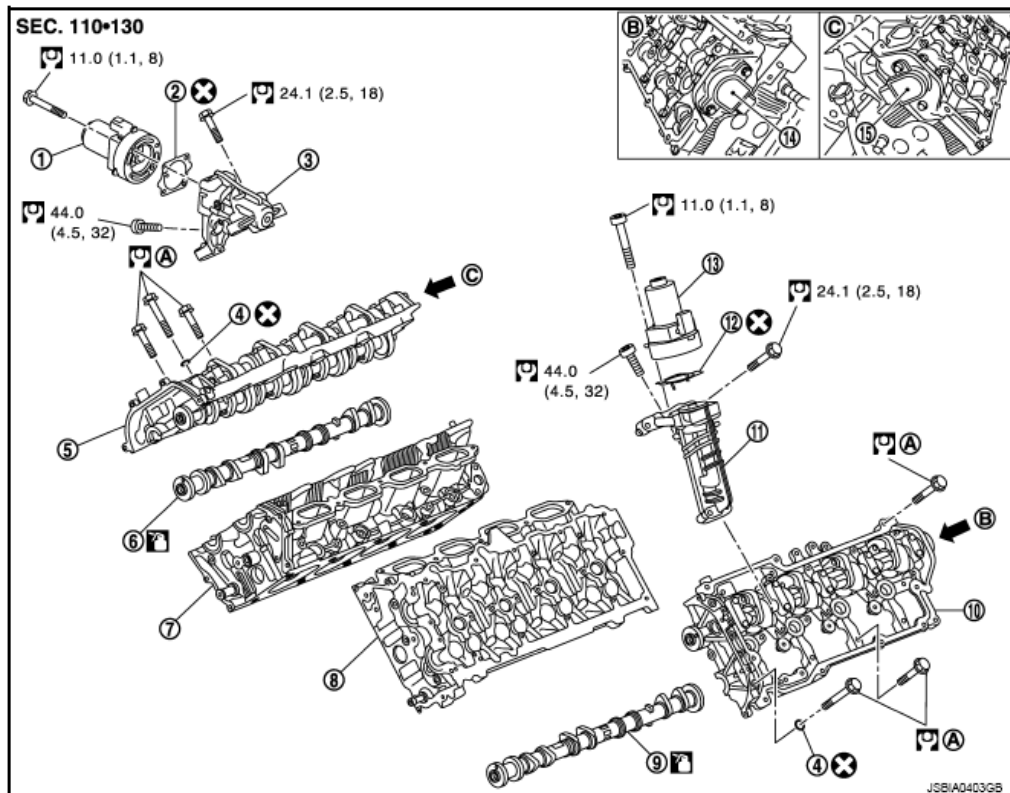
SUMMARY OF INSPECTION ITEMS

	Before starting	Engine	After engine
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Items		engine	running	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 ⁽¹⁾		Level	Leakage	Level
Fuel		Leakage	Leakage	Leakage
(1) Power steering fluid, brake fluid, etc.				

CAMSHAFT

Exploded View



- | | | |
|--|---|---|
| 1. VVEL actuator motor assembly (bank 2) | 2. Gasket | 3. VVEL actuator housing assembly (bank 2) |
| 4. Washer | 5. VVEL ladder assembly (bank 2) | 6. Exhaust camshaft (bank 2) |
| 7. Cylinder head (bank 2) | 8. Cylinder head (bank 1) | 9. Exhaust camshaft (bank 1) |
| 10. VVEL ladder assembly (bank 1) | 11. VVEL actuator housing assembly (bank 1) | 12. Gasket |
| 13. VVEL actuator motor assembly (bank 1) | 14. VVEL control shaft position sensor (bank 1) | 15. VVEL control shaft position sensor (bank 2) |
| A. Comply with the installation procedure when tightening. | B. View B | C. View C |

Fig. 128: Exploded View Of Camshaft With Torque Specifications
 Courtesy of NISSAN NORTH AMERICA, INC.

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

Removal and Installation

REMOVAL

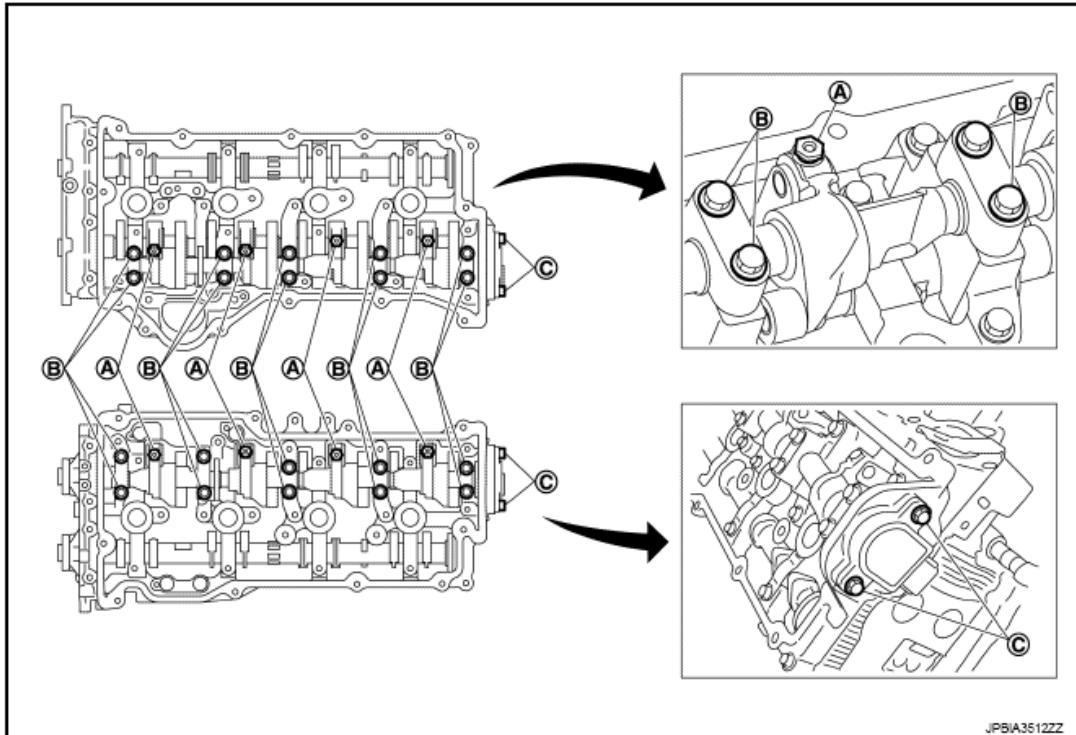


Fig. 129: Identifying VVEL Ladder Assembly Adjusting Bolts And Mounting Bolts
 Courtesy of NISSAN NORTH AMERICA, INC.

CAUTION:

- Never loosen adjusting bolts (A), mounting bolts (black color) (B) of VVEL ladder assembly and mounting bolts (C) of VVEL control shaft position sensor. 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.
- Never loosen the mounting bolts (C) of the VVEL control shaft position sensor. VVEL control shaft position sensor mounting bolts are required to be loosened for adjustment only when using a new VVEL ladder assembly. Refer to the following table:

ENGINE	Reference
VK56VD FOR USA AND CANADA	" WORK PROCEDURE "
VK56VD FOR MEXICO	" WORK PROCEDURE "

VVEL control shaft position sensor mounting bolt**Torque: 7.0 N.m (0.71 kg-m, 62 in-lb)**

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

1. Remove VVEL actuator motor assembly. Refer to "EXPLODED VIEW".
2. Remove rocker covers (bank 1 and bank 2). Refer to "EXPLODED VIEW".
3. Remove VVEL actuator housing assembly. Refer to "EXPLODED VIEW".
4. Remove front cover, camshaft sprockets, and timing chains. Refer to "EXPLODED VIEW".
5. Remove VVEL ladder assembly.
 - Loosen mounting bolts (gold color) in the reverse order as shown in the figure.

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.

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

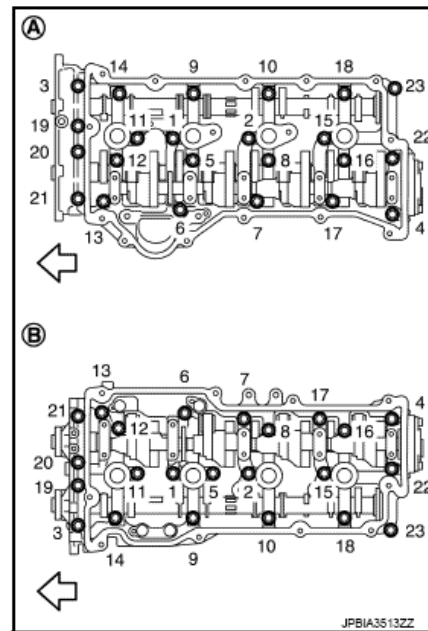


Fig. 130: Identifying VVEL Ladder Assembly Mounting Bolts Tightening Sequence
 Courtesy of NISSAN NORTH AMERICA, INC.

6. Remove exhaust camshaft.
7. Remove valve lifter, if necessary.
 - Identify installation positions, and store them without mixing them up.

INSTALLATION

CAUTION: Do not reuse washers.

1. Install valve lifter.
 - Install it in the original position.
2. Install exhaust camshaft.
 - Distinction between exhaust camshaft is performed with the identification mark.

Bank	Paint marks		Identification rib (E)
	M1 (C)	M2 (D)	
Bank 1 (A)	No	Purple	Yes
Bank 2 (B)	No	Purple	No

3. Install VVEL ladder assembly as per the following:

↶ : Engine front

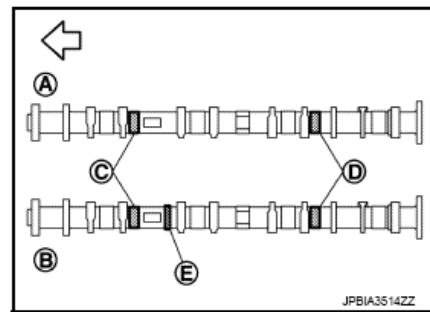


Fig. 131: Identifying Exhaust Camshaft With Identification Marks
 Courtesy of NISSAN NORTH AMERICA, INC.

- a. Apply a continuous bead of liquid gasket with tube presser (commercial service tool) to the VVEL ladder assembly as shown in the figure.

Use Genuine RTV silicone sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS".

A : Bank 1
 B : Bank 2
 c : $\phi 3.4 - 4.4$ mm (0.134 - 0.173 in)
 ← : Engine front

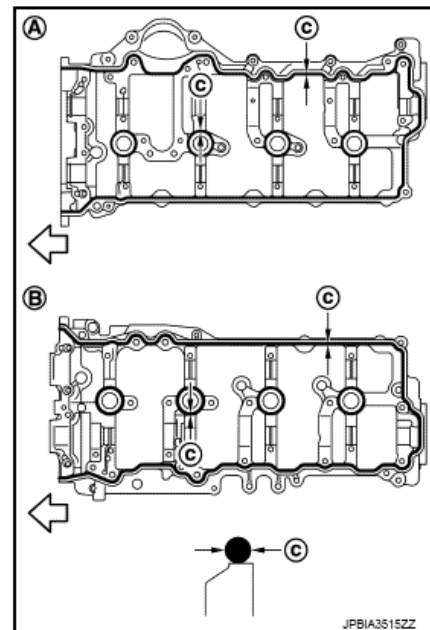


Fig. 132: Identifying Liquid Gasket Applying Area
 Courtesy of NISSAN NORTH AMERICA, INC.

- b. Tighten mounting bolts in the following step, in numerical order as shown in the figure:

CAUTION: Do not reuse washers.

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

Torque: 1.96 N.m (0.20 kg-m, 1 ft-lb)

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

Torque: 5.88 N.m (0.60 kg-m, 4 ft-lb)

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

Torque: 10.4 N.m (1.1 kg-m, 8 ft-lb)

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

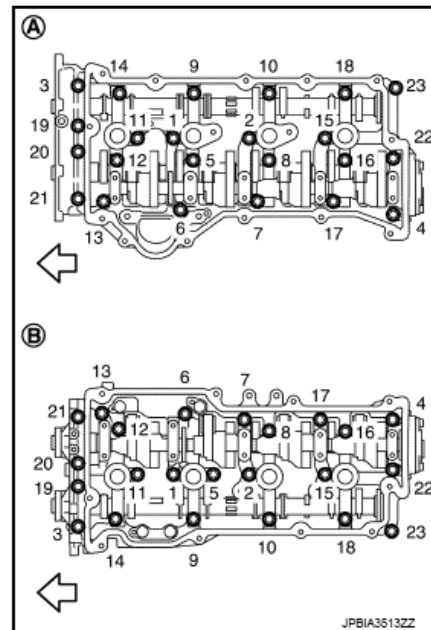


Fig. 133: Identifying VVEL Ladder Assembly Mounting Bolts Tightening Sequence
 Courtesy of NISSAN NORTH AMERICA, INC.

4. Install camshaft sprockets and timing chains. Refer to "**EXPLODED VIEW**".
5. Install VVEL actuator housing assembly. Refer to "**REMOVAL AND INSTALLATION**".
6. Inspect the valve clearance. Refer to "**INSPECTION**".
7. Install in the reverse order of removal.
8. When New VVEL ladder assembly used. Adjust VVEL control shaft position sensor. Refer to the following table:

ENGINE	Reference
VK56VD FOR USA AND CANADA	" <u>WORK PROCEDURE</u> "
VK56VD FOR MEXICO	" <u>WORK PROCEDURE</u> "

Inspection

EXHAUST CAMSHAFT 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 exhaust camshaft. Refer to "**REMOVAL AND INSTALLATION**".

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).

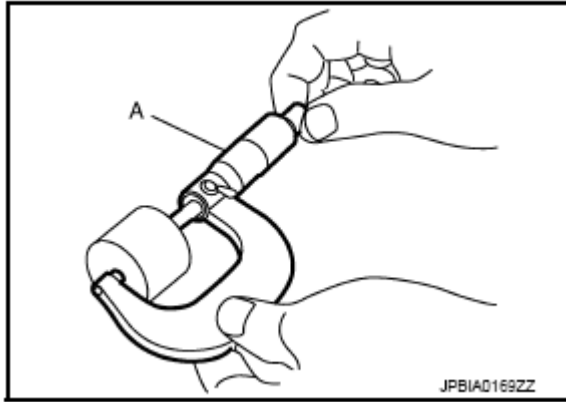


Fig. 134: Measuring Center Thickness Of Valve Lifters (EXH) Using Micrometer
 Courtesy of NISSAN NORTH AMERICA, INC.

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.

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**".

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

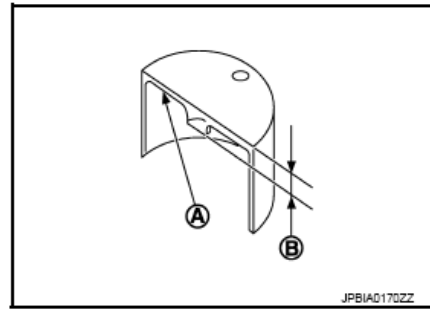


Fig. 135: Checking Camshaft Runout Using Dial Indicator
Courtesy of NISSAN NORTH AMERICA, INC.

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

INSPECTION AFTER DISASSEMBLY (EXHAUST SIDE)

Exhaust Camshaft Runout

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

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

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

Standard and limit

: Refer to "**CAMSHAFT**".

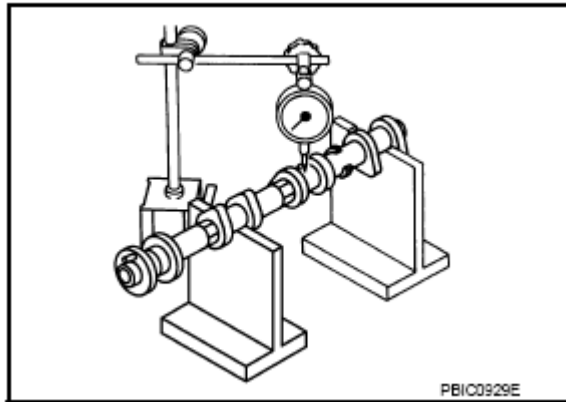


Fig. 136: Checking Camshaft Runout Using Dial Indicator
Courtesy of NISSAN NORTH AMERICA, INC.

4. If it exceeds the limit, replace exhaust camshaft.

Exhaust Camshaft Cam Height

- Measure the exhaust camshaft cam height with a micrometer.

Standard and limit

: Refer to "CAMSHAFT".

- If wear exceeds the limit, replace exhaust camshaft.

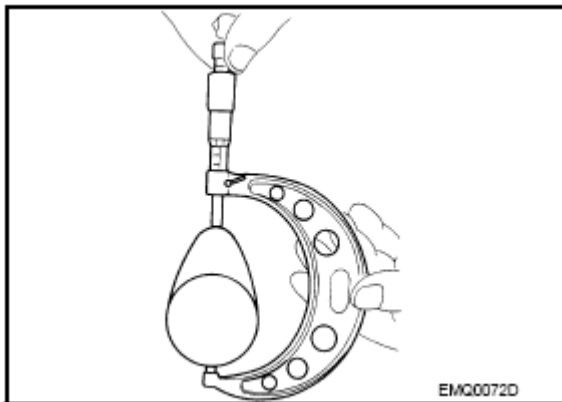


Fig. 137: Measuring Camshaft Cam Height Using Micrometer
Courtesy of NISSAN NORTH AMERICA, INC.

Exhaust Camshaft Journal Oil Clearance

EXHAUST CAMSHAFT JOURNAL DIAMETER

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

Standard: Refer to "CAMSHAFT".

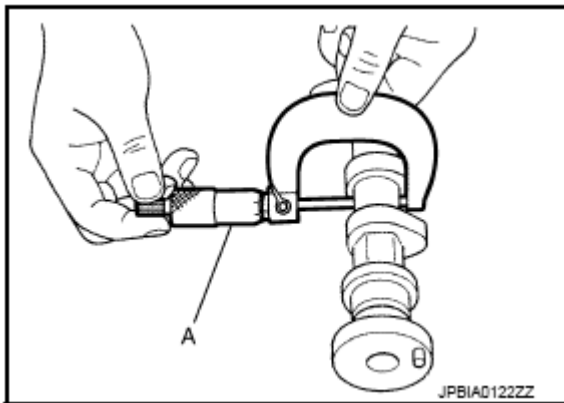


Fig. 138: Measuring Outer Diameter Of Camshaft (EXH) Journal Using Micrometer
Courtesy of NISSAN NORTH AMERICA, INC.

VVEL LADDER ASSEMBLY (EXH 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".

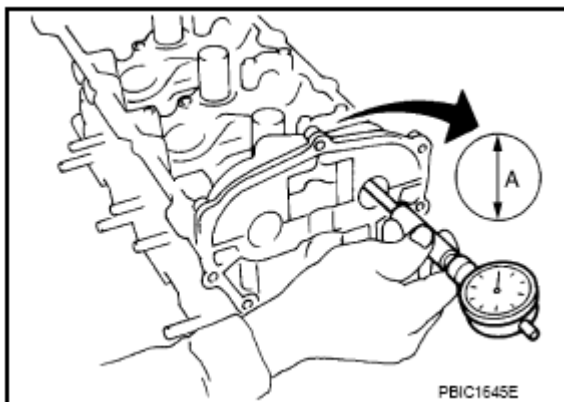


Fig. 139: Measuring Inner Diameter Of VVEL Ladder Assembly Using Bore Gauge
Courtesy of NISSAN NORTH AMERICA, INC.

EXHAUST CAMSHAFT JOURNAL OIL CLEARANCE

- (Oil clearance) = [VVEL ladder assembly (exhaust side) inner diameter] - [Exhaust camshaft journal diameter].

Standard and limit: Refer to "CAMSHAFT".

- If the calculated value exceeds the limit, replace either or both exhaust camshaft and VVEL ladder assembly & cylinder head assembly.

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

Exhaust Camshaft End Play

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

Standard and limit: Refer to "CAMSHAFT".

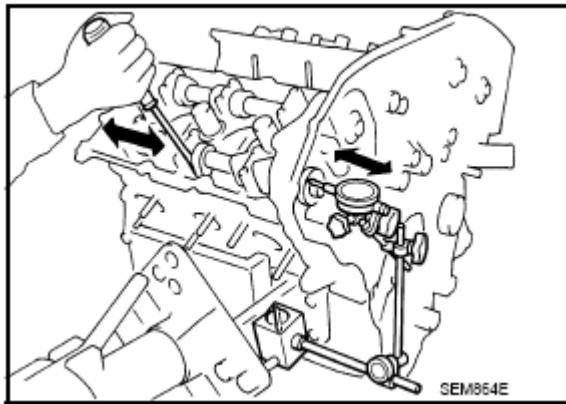


Fig. 140: Measuring Camshaft End Play Using Dial Indicator
Courtesy of NISSAN NORTH AMERICA, INC.

- Measure the following parts if out of the limit:
 - Dimension "A" for exhaust camshaft No. 1 journal
- Standard: 30.500 - 30.548 mm (1.2008 - 1.2027 in)**
- Dimension "B" for cylinder head No. 1 journal bearing

Standard: 30.360 - 30.385 mm (1.1953 - 1.1963 in)

- Refer to the standards above, and then replace exhaust camshaft and/or VVEL ladder assembly & cylinder head assembly.

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

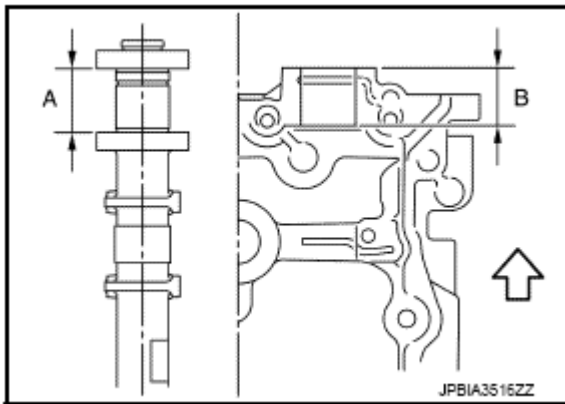


Fig. 141: Identifying Exhaust Camshaft Journal Dimension
 Courtesy of NISSAN NORTH AMERICA, INC.

Exhaust Camshaft Sprocket Runout

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

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

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

Limit: Refer to "CAMSHAFT".

3. If it exceeds the limit, replace exhaust camshaft sprocket.

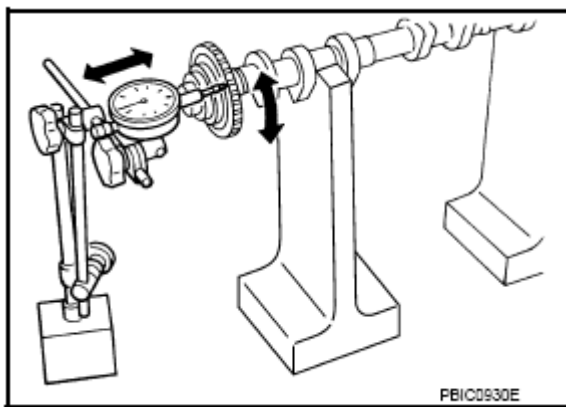


Fig. 142: Measuring Exhaust Camshaft Sprocket Runout Using Dial Indicator
 Courtesy of NISSAN NORTH AMERICA, INC.

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".

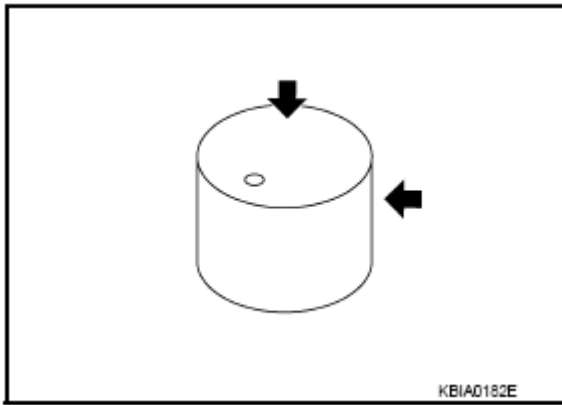


Fig. 143: Locating Valve Lifter Surfaces
Courtesy of NISSAN NORTH AMERICA, INC.

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".

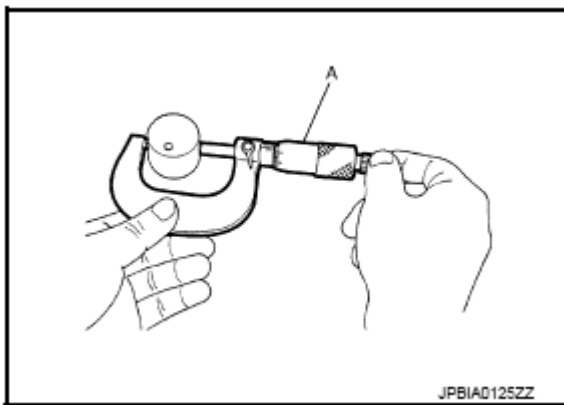


Fig. 144: Measuring Outer Diameter Of Valve Lifter Using Micrometer
Courtesy of NISSAN NORTH AMERICA, INC.

VALVE LIFTER HOLE DIAMETER

- Measure the inner diameter of valve lifter hole of cylinder head with an inside micrometer.

Standard: Refer to "CAMSHAFT".

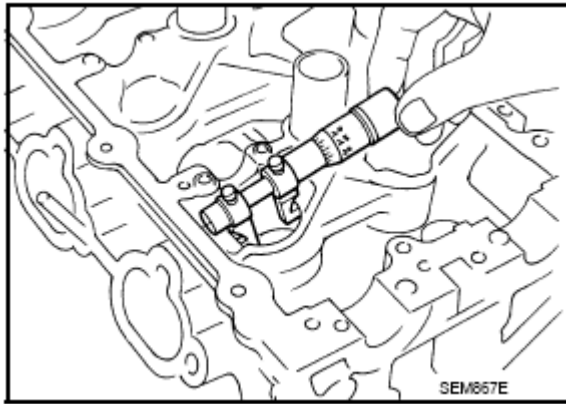


Fig. 145: Measuring Inner Diameter Of Valve Lifter Hole Of Cylinder Head Using Micrometer
 Courtesy of NISSAN NORTH AMERICA, INC.

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 & 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 DISASSEMBLY (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 direct on of axis).

Standard and limit: Refer to "CAMSHAFT".

↔ : Engine front

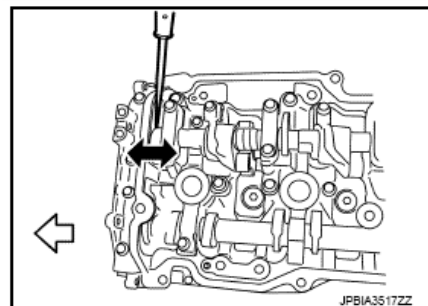


Fig. 146: Measuring End Play Of Drive Shaft Using Dial Indicator
 Courtesy of NISSAN NORTH AMERICA, INC.

- Measure the following parts if out of the limit:
 - Dimension "A" for drive shaft No. 1 journal

Standard: 30.500 - 30.548 mm (1.2008 - 1.2027 in)

- Dimension "B" for cylinder head No. 1 journal bearing

Standard: 30.360 - 30.385 mm (1.1953 - 1.1963 in)

- If it exceeds the limit, replace VVEL ladder assembly & cylinder head assembly.

← : Engine front

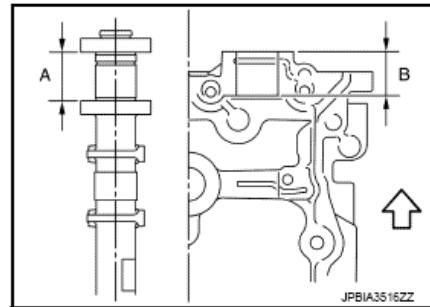


Fig. 147: Identifying Drive Shaft Journal Dimension
 Courtesy of NISSAN NORTH AMERICA, INC.

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 5 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 four 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 & cylinder head assembly. Refer to "CAMSHAFT".

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

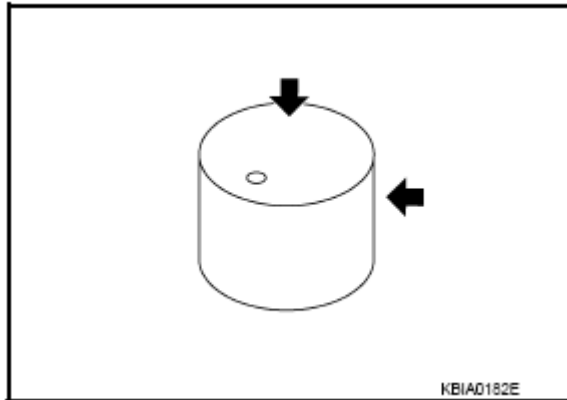


Fig. 148: Locating Valve Lifter Surfaces
Courtesy of NISSAN NORTH AMERICA, INC.

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".

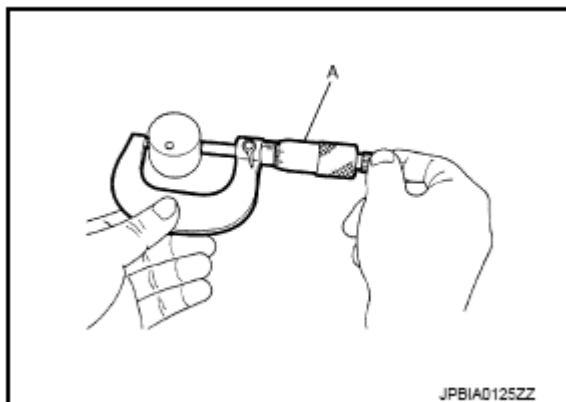


Fig. 149: Measuring Outer Diameter Of Valve Lifter Using Micrometer
Courtesy of NISSAN NORTH AMERICA, INC.

VALVE LIFTER HOLE DIAMETER

- Measure the inner diameter of valve lifter hole of cylinder head with an inside micrometer.

Standard: Refer to "CAMSHAFT".

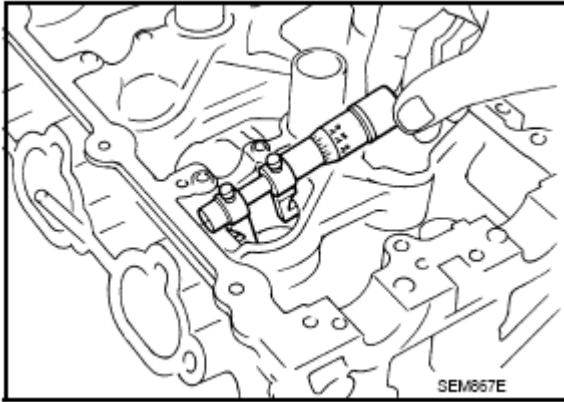


Fig. 150: Measuring Inner Diameter Of Valve Lifter Hole Of Cylinder Head Using Micrometer
Courtesy of NISSAN NORTH AMERICA, INC.

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 & cylinder head assembly.

NOTE: Since the valve lifter (INT) cannot be replaced by the piece, VVEL ladder assembly & 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.

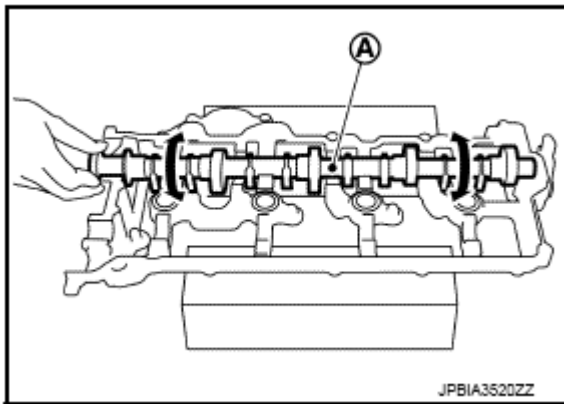


Fig. 151: Inspecting Drive Shaft For Smooth Functioning
 Courtesy of NISSAN NORTH AMERICA, INC.

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

⇐ : Engine front

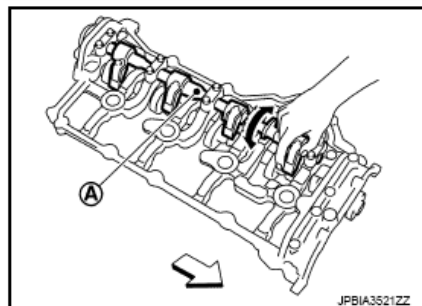


Fig. 152: Inspecting Control Shaft For Smooth Functioning
 Courtesy of NISSAN NORTH AMERICA, INC.

RINK CHECK FOR BACK-LASH (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.

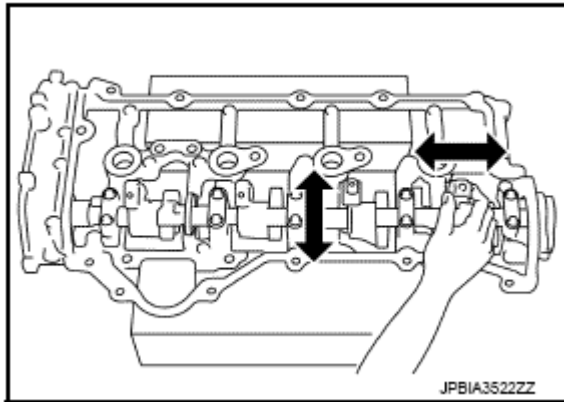


Fig. 153: Checking Backlash By Moving Drive Shaft And Control Shaft In Axial And Rotation
Directions

Courtesy of NISSAN NORTH AMERICA, INC.

- If there is an unusualness related to the above three items, replace VVEL ladder assembly & 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 ASSEMBLY

Inspection of Camshaft Sprocket (INT) Oil Groove

- CAUTION:**
- Perform this inspection only when DTC P0011, P0021 are detected in self-diagnostic results of CONSULT and it is directed according to inspection procedure of ENGINE CONTROL SYSTEM (FOR USA AND CANADA) or ENGINE CONTROL SYSTEM (FOR MEXICO) . Refer to the following table:

ENGINE	Reference
VK56VD FOR USA AND CANADA	" <u>DTC LOGIC</u> "
VK56VD FOR MEXICO	" <u>DTC LOGIC</u> "

- 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 the following table:

ENGINE	Reference
--------	-----------

VK56VD FOR USA AND CANADA	<u>"WORK PROCEDURE "</u>
VK56VD FOR MEXICO	<u>"WORK PROCEDURE "</u>

- b. Disconnect ignition coil and injector harness connectors.
3. Release fuel pressure. Refer to the following table:
4. Remove valve timing control solenoid valve. Refer to **"EXPLODED VIEW"**.
5. Crank engine, and then check that engine oil comes out from valve timing control solenoid valve hole (A). End crank after checking.

1 : Valve timing control cover (bank 2)

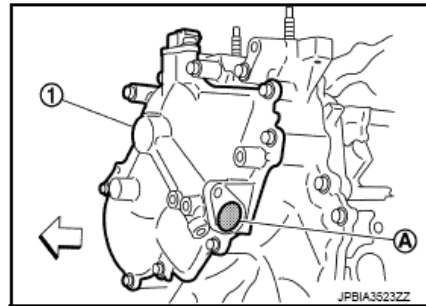


Fig. 154: Identifying Valve Timing Control Cover And Solenoid Valve Hole
Courtesy of NISSAN NORTH AMERICA, INC.

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 not to apply engine oil to rubber parts of drive belt, engine mounting insulator, etc. Wipe engine oil out immediately if it is splashed.

6. Perform the following inspection if engine oil does not come out from valve timing control solenoid valve oil hole of the valve timing control cover:
 - Remove oil filter, and then clean it. Refer to **"EXPLODED VIEW"**.
 - Clean oil groove between oil strainer and valve timing control solenoid valve. Refer to **"ENGINE LUBRICATION SYSTEM "** and **"ENGINE LUBRICATION SYSTEM SCHEMATIC "**.
7. Remove components between valve timing control solenoid valve and camshaft sprocket, and then check each oil groove for clogging.
 - Clean oil groove if necessary. Refer to **"ENGINE LUBRICATION SYSTEM "** and **"ENGINE LUBRICATION SYSTEM SCHEMATIC "**.

8. 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 the following table:

For NORTH AMERICA	"FOR NORTH AMERICA: FLUIDS AND LUBRICANTS "
For MEXICO	"FOR MEXICO: 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.

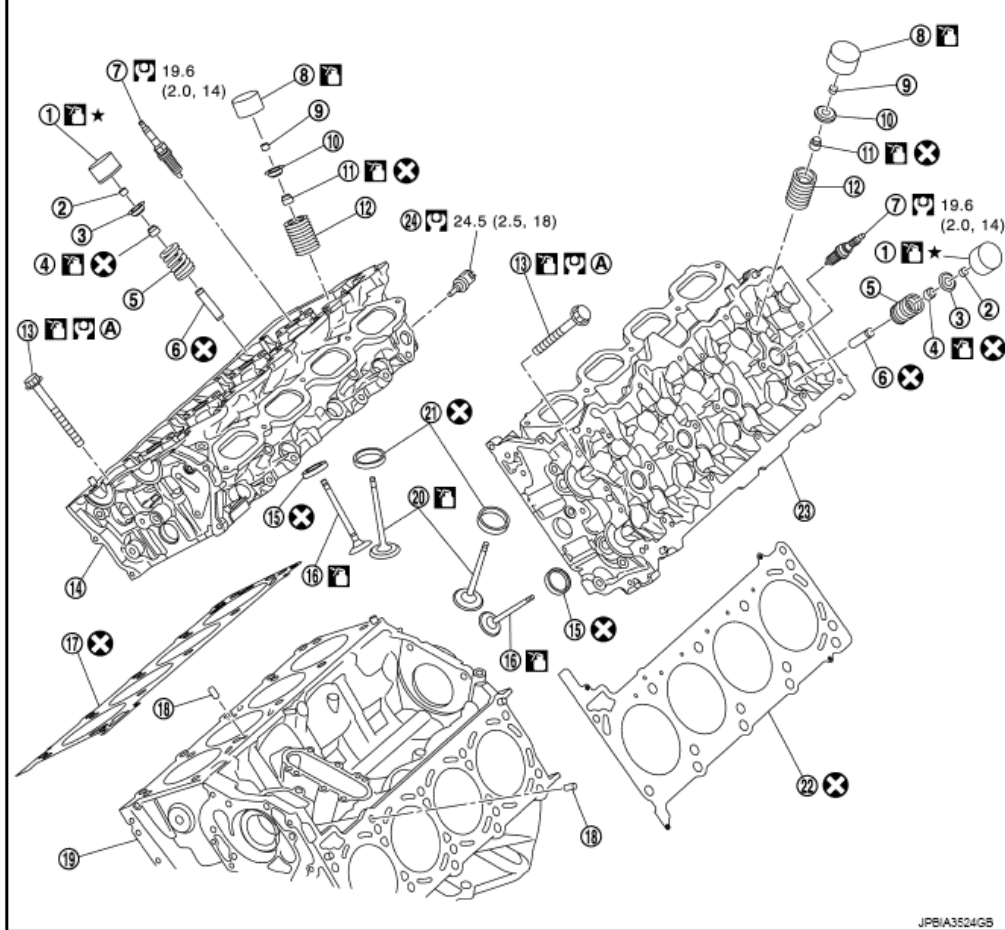
SUMMARY OF INSPECTION ITEMS

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 ⁽¹⁾	Level	Leakage	Level
Fuel	Leakage	Leakage	Leakage
(1) Power steering fluid, brake fluid, etc.			

CYLINDER HEAD**Exploded View**

SEC. 111•130•220



JPBIA3524GB

- | | | |
|-----------------------------------|--|---|
| 1. Valve lifter (EXH) | 2. Valve collet (EXH) | 3. Valve spring retainer (EXH) |
| 4. Valve oil seal (EXH) | 5. Valve spring (with valve spring seat) (EXH) | 6. Valve guide (EXH) |
| 7. Spark plug | 8. Valve lifter (INT) | 9. Valve collet (INT) |
| 10. Valve spring retainer (INT) | 11. Valve oil seal (INT) | 12. Valve spring (with valve spring seat) (INT) |
| 13. Cylinder head bolt | 14. Cylinder head (bank 2) | 15. Valve seat (EXH) |
| 16. Valve (EXH) | 17. Cylinder head gasket (bank 2) | 18. Oil filter (for VVEL ladder assembly) |
| 19. Cylinder block | 20. Valve (INT) | 21. Valve seat (INT) |
| 22. Cylinder head gasket (bank 1) | 23. Cylinder head (bank 1) | 24. Engine coolant temperature sensor |

Comply with the installation procedure when tightening.
A.

Fig. 155: Exploded View Of Cylinder Head With Torque Specifications
Courtesy of NISSAN NORTH AMERICA, INC.

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

CAUTION: A high degree of precision is required for a valve on the intake side. Never remove the valve related parts unless necessary.

NOTE:

- As for replacement of parts on the intake side as shown in the exploded view figure, replace VVEL ladder assembly & cylinder head assembly. (Only valve oil seals are replaceable as a single part.)
- VVEL ladder assembly cannot be replaced as a single part, because it is machined together with cylinder head assembly.

Removal and Installation**REMOVAL**

1. Remove the following parts:

- Rocker cover and spark plug: Refer to "EXPLODED VIEW".
- Intake manifold: Refer to "EXPLODED VIEW".
- Exhaust manifold: Refer to "EXPLODED VIEW".
- Water inlet and thermostat housing: Refer to "EXPLODED VIEW".
- Water pipe and heater pipe: Refer to "EXPLODED VIEW".
- Timing chain: Refer to "EXPLODED VIEW".
- Camshaft (EXH) and VVEL ladder assembly: Refer to "EXPLODED VIEW".

2. Remove cylinder head.

- Loosen mounting bolts in reverse order as shown in the figure.
- Use TORX socket and power tool.

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

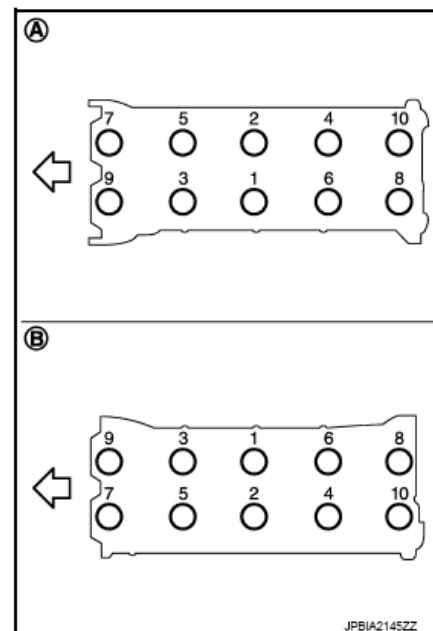


Fig. 156: Identifying Cylinder Head Mounting Bolts Tightening Sequence
 Courtesy of NISSAN NORTH AMERICA, INC.

3. Remove cylinder head gaskets.

4. Remove oil filter (for VVEL ladder assembly) from cylinder block, if necessary.
5. Remove valve lifter.
 - Identify installation positions, and store them without mixing them up.

INSTALLATION

1. Install oil filter (for VVEL ladder assembly) (1) in the direction shown in the figure, if removed.
 - Check that the oil filter does not protrude from the upper surface of cylinder block (2) after installation.

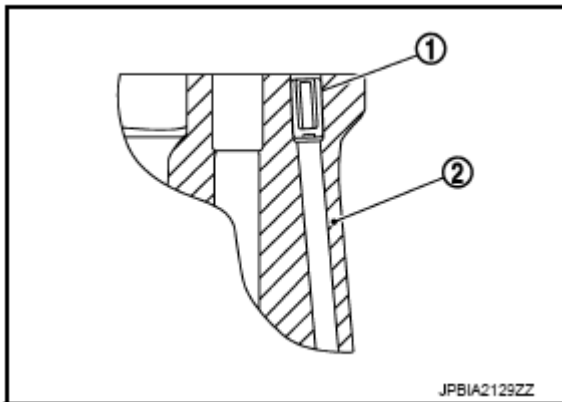


Fig. 157: Identifying Oil Filter And Cylinder Block
Courtesy of NISSAN NORTH AMERICA, INC.

2. Install new cylinder head gaskets.
3. Install cylinder head as per the following:

CAUTION:

- If cylinder head bolts are re-used, check their outer diameters before installation. Refer to "INSPECTION".
- Before installing cylinder head, inspect cylinder head distortion. Refer to "INSPECTION".
- Tighten cylinder head bolts in numerical order as shown in figure.

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

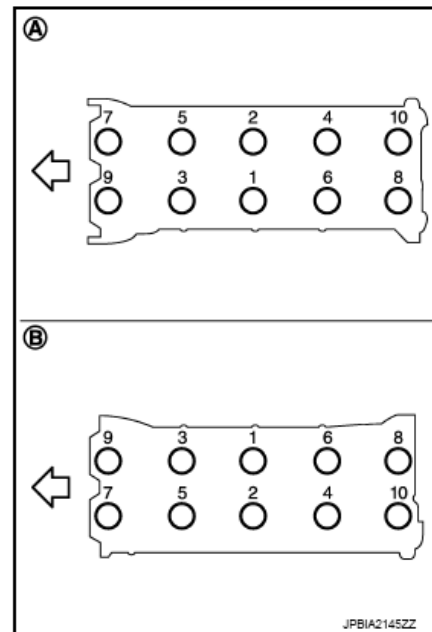


Fig. 158: Identifying Cylinder Head Bolts Tightening Sequence
 Courtesy of NISSAN NORTH AMERICA, INC.

- Use TORX socket.
- a. Apply new engine oil to threads and seat surfaces of cylinder head bolts.
- b. Tighten all cylinder head bolts.

Torque: 40.0 N.m (4.1 kg-m, 30 ft-lb)

- c. Tighten all cylinder head bolts (clockwise).

Angle tightening: 75 degrees

- d. Completely loosen all cylinder head bolts.

Torque: 0 N.m (0 kg-m, 0 ft-lb)

CAUTION: In step "d", loosen bolts in the reverse order of that indicated in the figure.

- e. Tighten all cylinder head bolts.

Torque: 40.0 N.m (4.1 kg-m, 30 ft-lb)

- f. Tighten all cylinder head bolts (clockwise).

Angle tightening: 90 degrees

- g. Tighten all cylinder head bolts again (clockwise).

Angle tightening: 90 degrees

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.

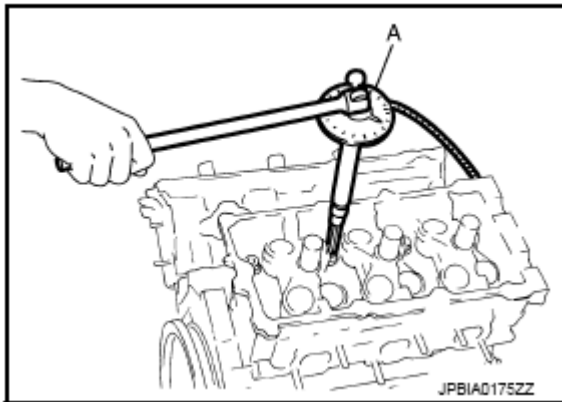


Fig. 159: Checking Tightening Angle Using Angle Wrench
Courtesy of NISSAN NORTH AMERICA, INC.

4. Install valve lifter.
 - Install it in the original position.
5. Install in the reverse order of removal.

Disassembly and Assembly

DISASSEMBLY

1. 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.

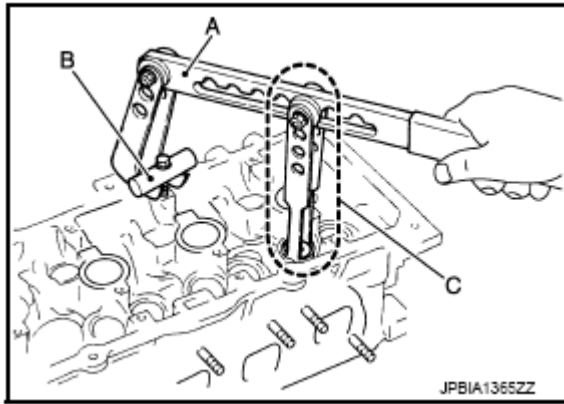


Fig. 160: Compressing Valve Spring Using Valve Spring Compressor
 Courtesy of NISSAN NORTH AMERICA, INC.

2. Remove valve spring retainer and valve spring (with valve spring seat).
3. Push valve stem to combustion chamber side, and remove valve.
 - Identify installation positions, and store them without mixing them up.
4. Remove valve oil seal using the valve oil seal puller [SST: KV10107902 (J38959)] (A).

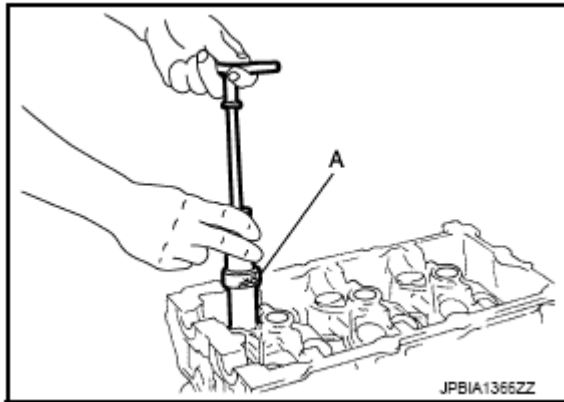


Fig. 161: Removing Valve Oil Seal Using Valve Oil Seal Puller
 Courtesy of NISSAN NORTH AMERICA, INC.

5. 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.

6. 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).

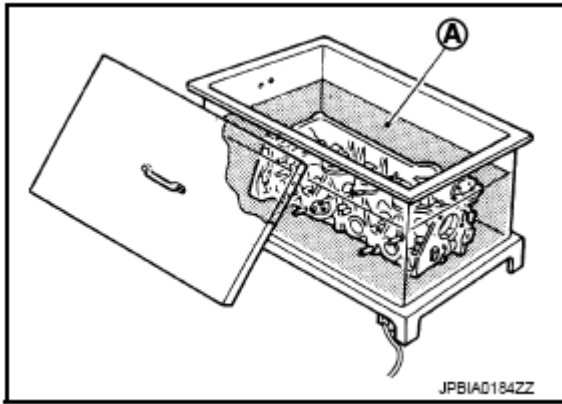


Fig. 162: Heating Cylinder Head In Heated Oil
 Courtesy of NISSAN NORTH AMERICA, INC.

- 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.

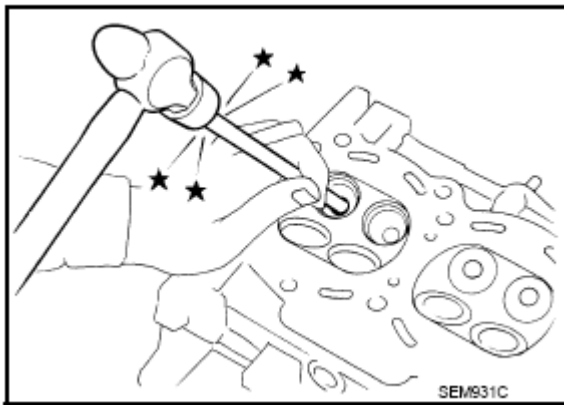


Fig. 163: Driving Out Valve Guide Using Hammer And Valve Guide Drift
 Courtesy of NISSAN NORTH AMERICA, INC.

ASSEMBLY

1. Install valve guide (EXH), if removed.

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".

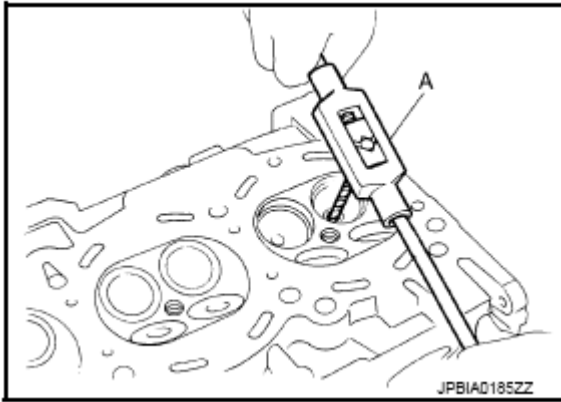


Fig. 164: Reaming Cylinder Head Valve Guide (EXH) Hole Using Valve Guide Reamer
Courtesy of NISSAN NORTH AMERICA, INC.

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

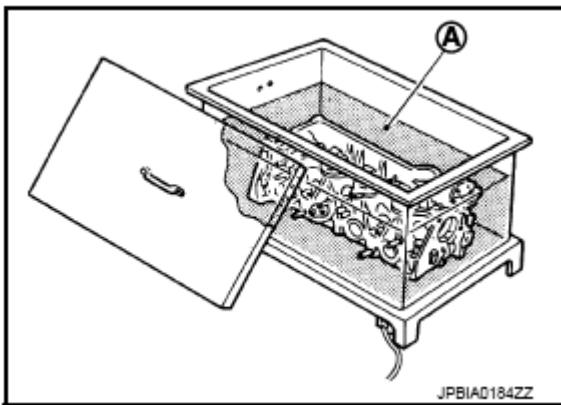


Fig. 165: Heating Cylinder Head In Heated Oil
Courtesy of NISSAN NORTH AMERICA, INC.

- c. Using the valve guide drift (commercial service tool), press valve guide (EXH) from camshaft side to the dimensions as shown in the figure.

Projection (A)

: Refer to "CYLINDER HEAD".

WARNING: Cylinder head contains heat. When working, wear protective equipment to avoid getting burned.

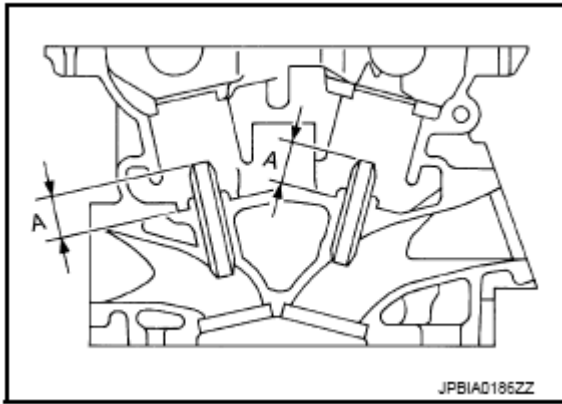


Fig. 166: Identifying Valve Guide Press Dimensions
 Courtesy of NISSAN NORTH AMERICA, INC.

- d. Using the valve guide reamer (commercial service tool) (A), apply reamer finish to valve guide (EXH).

Standard: Refer to "CYLINDER HEAD".

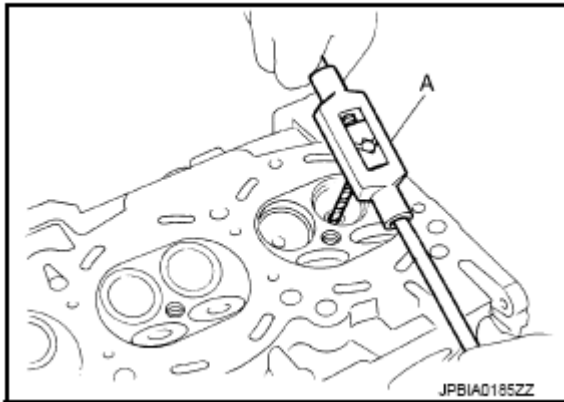


Fig. 167: Reaming Cylinder Head Valve Guide (EXH) Hole Using Valve Guide Reamer
 Courtesy of NISSAN NORTH AMERICA, INC.

2. Install valve seat (EXH), if removed.

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".

- Be sure to ream in circles concentric to valve guide center. This enables valve to fit correctly.

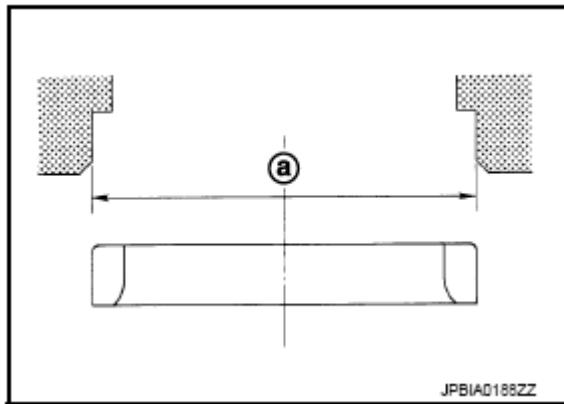


Fig. 168: Identifying Cylinder Head Recess Diameter
Courtesy of NISSAN NORTH AMERICA, INC.

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

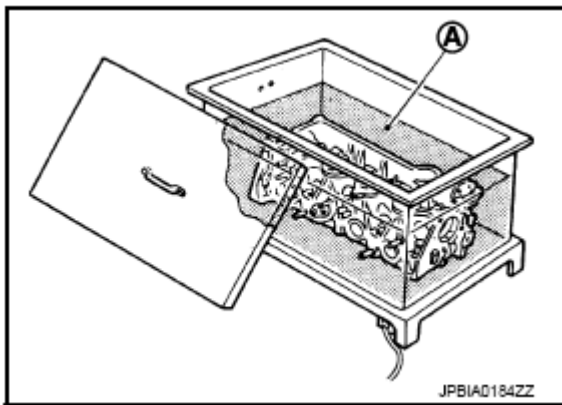


Fig. 169: Heating Cylinder Head In Heated Oil
Courtesy of NISSAN NORTH AMERICA, INC.

- 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.

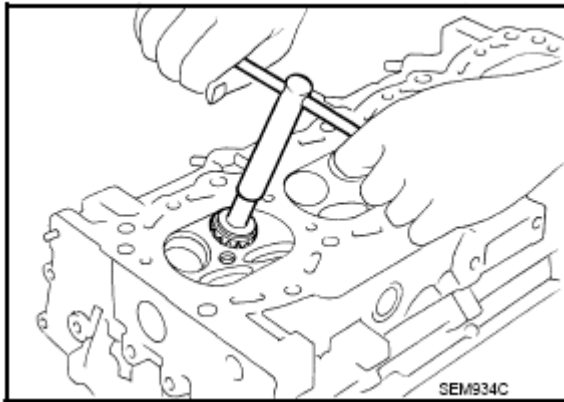


Fig. 170: Finishing Seat Using Valve Seat Cutter Set
Courtesy of NISSAN NORTH AMERICA, INC.

- e. Using compound, grind to adjust valve fitting.
 - f. Check again for normal contact. Refer to "INSPECTION".
3. Install new valve oil seals as per the following:
- 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 the figure.

Height (b)

Intake, Exhaust: 14.3 - 14.9 mm (0.563 - 0.587 in)

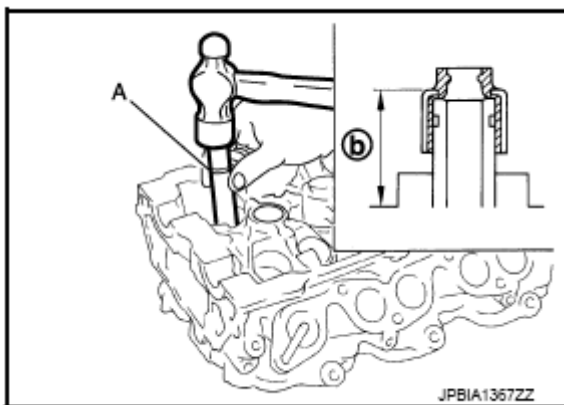


Fig. 171: Pressing To Fit Valve Seal Using Valve Oil Seal Drift
Courtesy of NISSAN NORTH AMERICA, INC.

4. Install valve.

NOTE: Larger diameter valves are for intake side.

5. Install valve spring (with valve spring seat).

- Install narrow pitch (B) end [paint mark (C)] to cylinder head side (valve spring seat side).

A : Wide pitch
⇐ : Cylinder head side

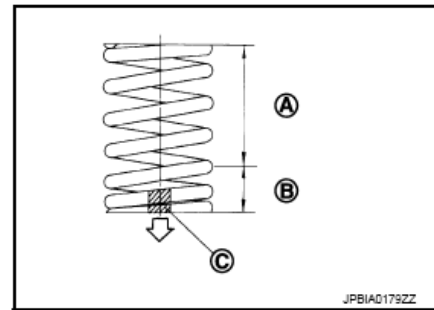


Fig. 172: Identifying Narrow Pitch And Wide Pitch Dimensions
Courtesy of NISSAN NORTH AMERICA, INC.

Paint mark color

Intake: Light green

Exhaust: Light blue

6. Install valve spring retainer.

7. Install valve collet.

- Compress valve spring with the valve spring compressor [SST: KV10116200 (J26336-A)] (A), the attachment [SST: KV10115900 (J26336-20)] (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.

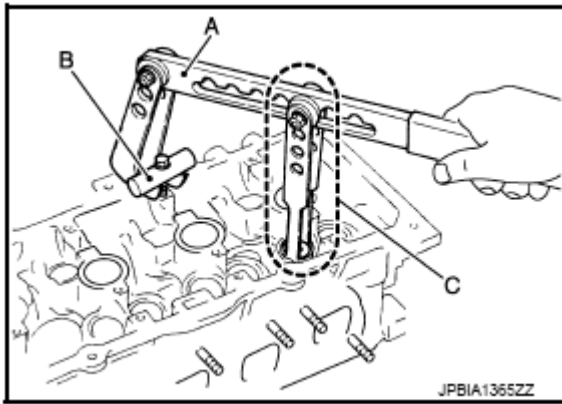


Fig. 173: Compressing Valve Spring Using Valve Spring Compressor
 Courtesy of NISSAN NORTH AMERICA, INC.

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.

Limit [(B) - (A)]: 0.18 mm (0.0071 in)

c : 55 mm (2.17 in)
 d : 12 mm (0.47 in)

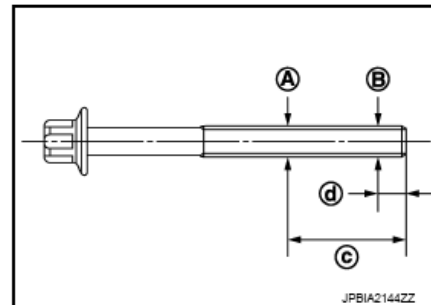


Fig. 174: Identifying Cylinder Head Bolts Outer Diameter
 Courtesy of NISSAN NORTH AMERICA, INC.

- 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 out 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, f measure the distortion in six directions (A), (B), (C), (D), (E), and (F).

Limit: Refer to "CYLINDER HEAD".

- If it exceeds the limit, replace VVEL ladder assembly & cylinder head assembly.

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

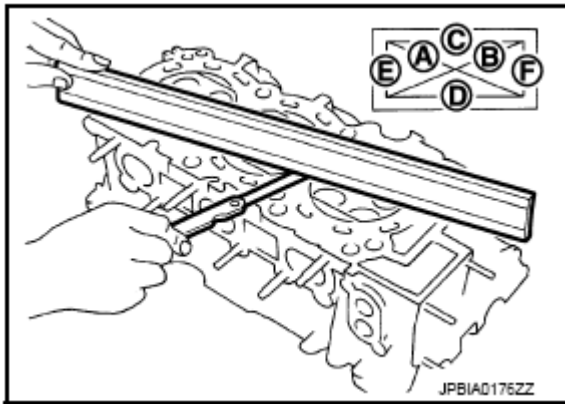


Fig. 175: Measuring Distortion Of Cylinder Head Using Feeler Gauge And Straightedge
Courtesy of NISSAN NORTH AMERICA, INC.

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) below:
 - Replace VVEL ladder assembly & cylinder head assembly. Refer to "EXPLODED VIEW". (Intake side)

NOTE: Since the valve (INT) cannot be replaced by the piece, VVEL ladder assembly & 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".

Valve Guide Clearance

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

Standard: Refer to "CYLINDER HEAD".

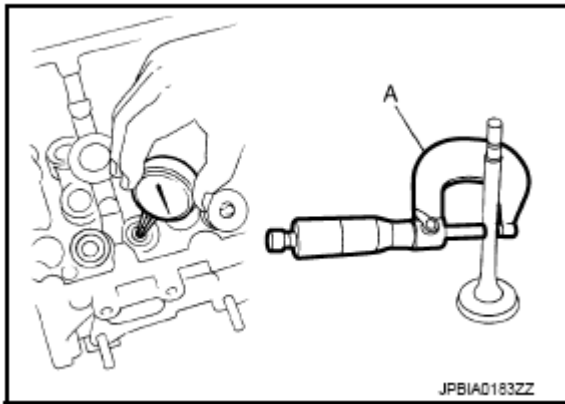


Fig. 176: Measuring Inner Diameter Of Valve Guide Using Bore Gauge
Courtesy of NISSAN NORTH AMERICA, INC.

- 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 & 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 & 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.
 - If not, grind to adjust valve fitting and check again. If the contacting surface still has "NG" conditions

- even after the re-check, replace valve seat (EXH). Refer to "**EXPLODED VIEW**". (Exhaust side)
- If not, replace VVEL ladder assembly & cylinder head assembly. Refer to "**EXPLODED VIEW**". (Intake side)

A : OK
B : NG

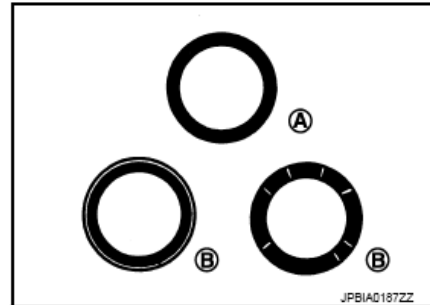


Fig. 177: Identifying Valve Seat NG And OK Conditions
Courtesy of NISSAN NORTH AMERICA, INC.

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

Valve Spring (with valve spring seat) Squareness

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

Limit: Refer to "**CYLINDER HEAD**".

- If it exceeds the limit.
- Replace valve spring (with valve spring seat) (EXH). Refer to "**EXPLODED VIEW**". (Exhaust side)
- Replace VVEL ladder assembly & cylinder head assembly. Refer ' to "**EXPLODED VIEW**". (Intake side)

B : Contact

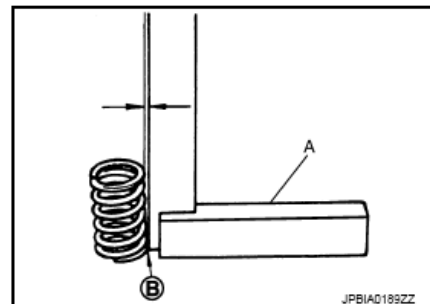


Fig. 178: Measuring Maximum Clearance Between Top Of Spring And Try Square
Courtesy of NISSAN NORTH AMERICA, INC.

NOTE: Since the valve spring (with valve spring seat) (INT) cannot be replaced by the

piece, VVEL ladder assembly & cylinder head assembly replacement are required.

Valve Spring Dimensions and Valve Spring Pressure Load

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

Standard

: Refer to "CYLINDER HEAD".

- If the installation load or load with valve open is out of the standard.
 - Replace valve spring (with valve spring seat) (EXH). Refer to "EXPLODED VIEW". (Exhaust side)
 - Replace VVEL ladder assembly & cylinder head assembly. Refer to "EXPLODED VIEW". (Intake side)

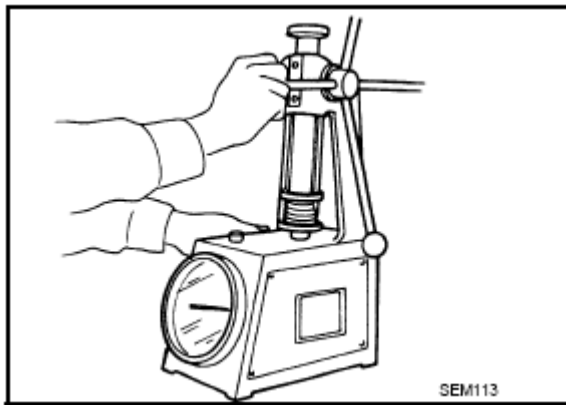


Fig. 179: Checking Valve Spring Dimensions And Valve Spring Pressure Load
Courtesy of NISSAN NORTH AMERICA, INC.

NOTE: Since the valve spring (with valve spring seat) (INT) cannot be replaced by the piece, VVEL ladder assembly & cylinder head assembly replacement are required.

INSPECTION AFTER ASSEMBLY

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 the following table:

For NORTH AMERICA	"FOR NORTH AMERICA: FLUIDS AND LUBRICANTS "
For MEXICO	"FOR MEXICO: 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 ⁽¹⁾		Level	Leakage	Level
Fuel		Leakage	Leakage	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:
 - Front under cover, using a power tool. Refer to "**EXPLODED VIEW**".
 - Drive belt: Refer to "**EXPLODED VIEW**".
 - Cooling fan: Refer to "**EXPLODED VIEW**".
2. Remove crankshaft pulley as per the following:
 - a. Remove rear plate cover. Refer to "**EXPLODED VIEW**".

- b. Set the ring gear stopper [SST: KV10120100 (J-47245)] (A) as shown in the figure.
- c. Loosen crankshaft pulley bolt, and then pull crankshaft pulley with both hands to remove it.

CAUTION: Never remove crankshaft pulley bolt. Keep loosened crankshaft pulley bolt in place to protect removed crankshaft pulley from dropping.

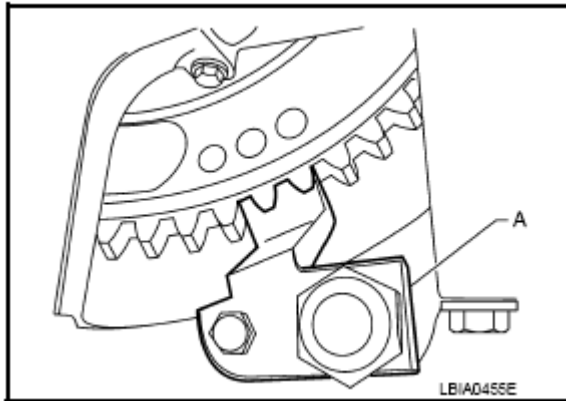


Fig. 180: Identifying Crankshaft Pulley Bolts
Courtesy of NISSAN NORTH AMERICA, INC.

3. Remove front oil seal using a suitable tool.

CAUTION: Be careful not to damage front cover and crankshaft.

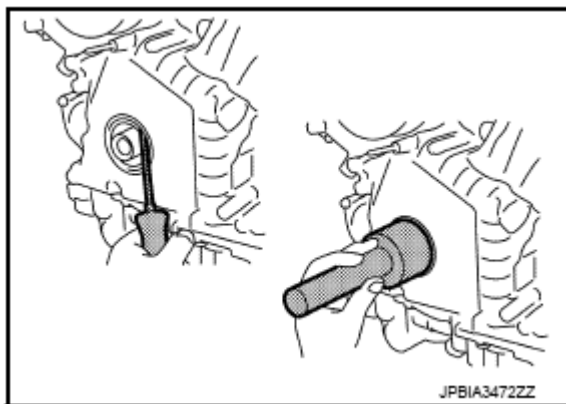


Fig. 181: Removing Front Oil Seal Using Suitable Tool
Courtesy of NISSAN NORTH AMERICA, INC.

INSTALLATION

1. Install front oil seal on front cover.

- 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.

CAUTION: Be careful not to scratch or make burrs on circumference of oil seal.

↩ : Engine inside
 ➡ : Engine outside

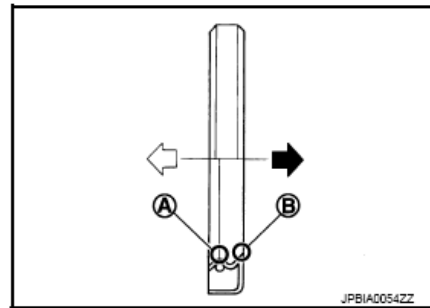


Fig. 182: Identifying Oil Seal Lip And Dust Seal Lip
 Courtesy of NISSAN NORTH AMERICA, INC.

- Using a suitable drift [outer diameter: 56 mm (2.20 in)], press-fit oil seal until it becomes flush with front cover end face.
 - Check the garter spring is in position and seal lips are not inverted.
2. Install in the reverse order of removal.

REAR OIL SEAL

REAR OIL SEAL: Removal and Installation

REMOVAL

1. Remove transmission assembly. Refer to "**2WD: EXPLODED VIEW**" (2WD models) or "**4WD: EXPLODED VIEW**" (4WD 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.

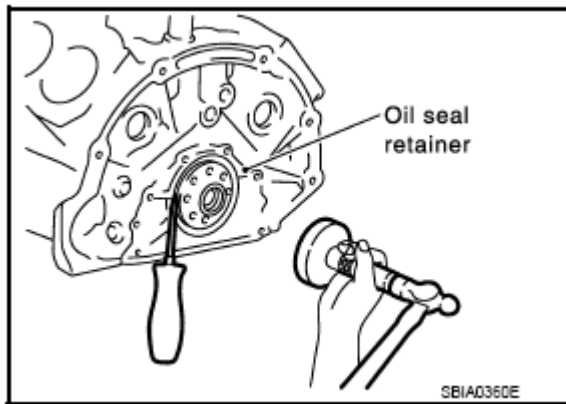


Fig. 183: Removing Rear Oil Seal Using Suitable Tool
 Courtesy of NISSAN NORTH AMERICA, INC.

INSTALLATION

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

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

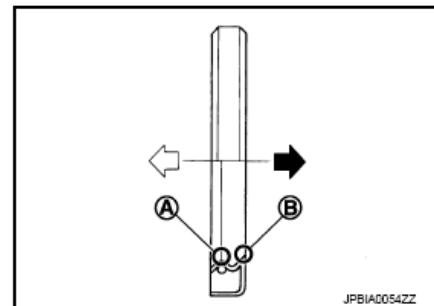


Fig. 184: Identifying Oil Seal Lip And Dust Seal Lip
 Courtesy of NISSAN NORTH AMERICA, INC.

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

- B : Rear oil seal retainer rear end face
 a : 0 - 0.5 mm (0 - 0.020 in)

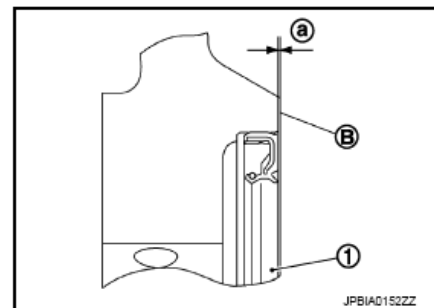


Fig. 185: Identifying Rear Oil Seal
 Courtesy of NISSAN NORTH AMERICA, INC.

- Using a suitable drift [outer diameter 101 mm (3.98 in)], press-fit until the height of rear oil seal is level with the mounting surface.
- Check the garter spring is in position and seal lips are not inverted.

CAUTION:

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

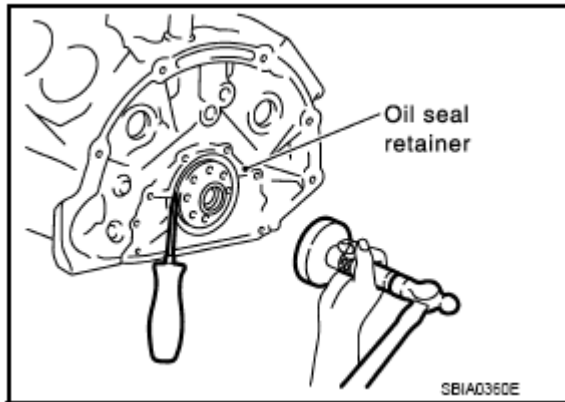


Fig. 186: Pressing To Fit Rear Oil Seal Using Drift
Courtesy of NISSAN NORTH AMERICA, INC.

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

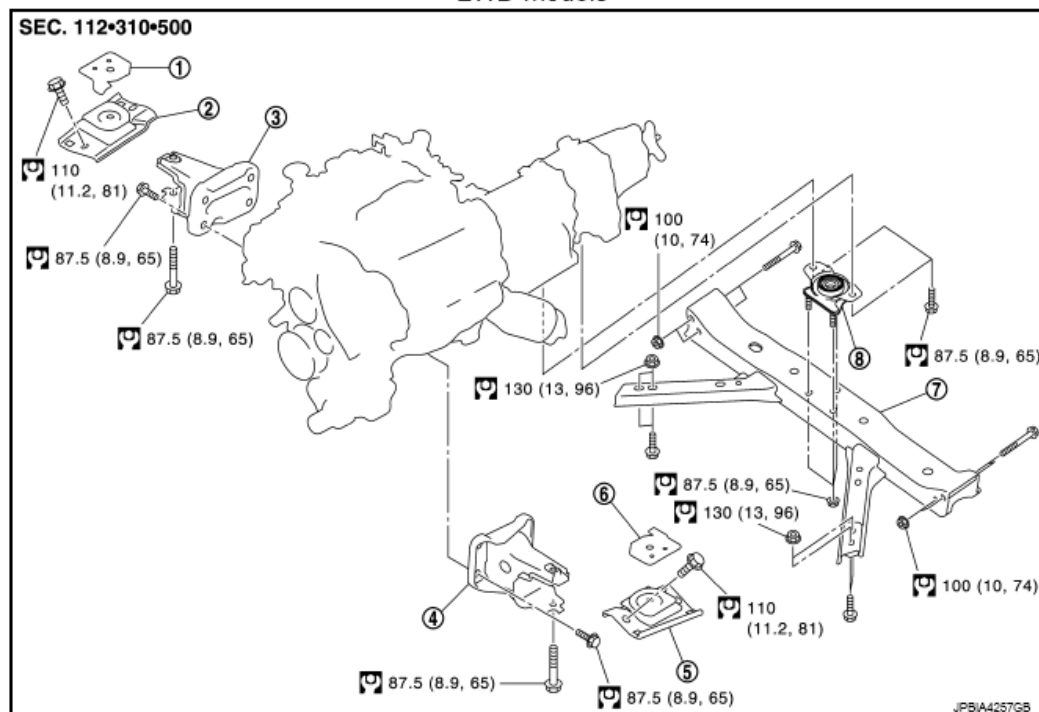
UNIT REMOVAL AND INSTALLATION

ENGINE ASSEMBLY

Exploded View

2WD models

2WD models

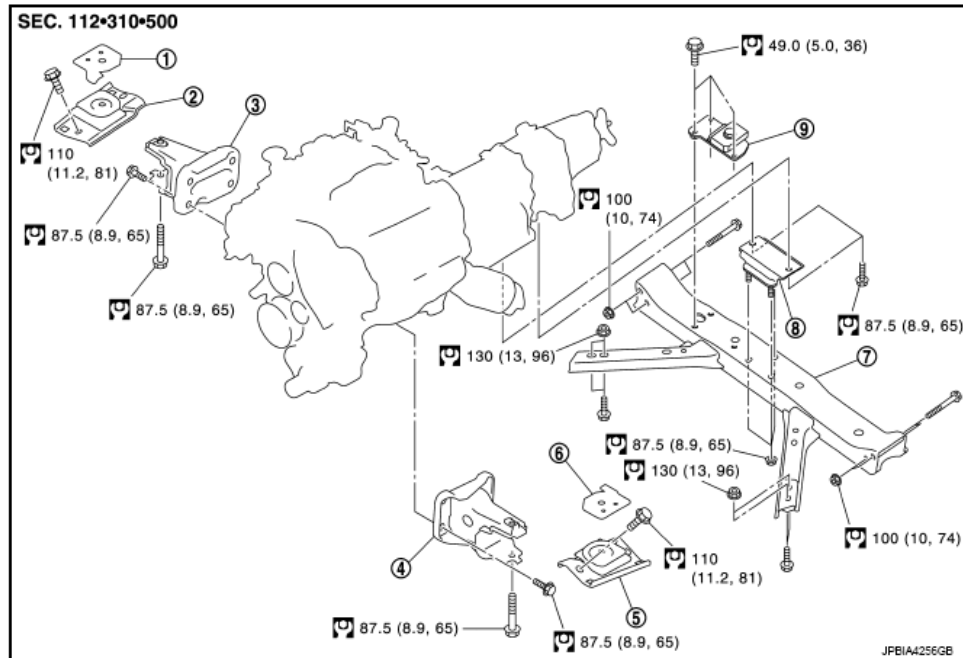


- | | | |
|--------------------------------------|-----------------------------------|---------------------------------|
| 1. Heat shield plate (RH) | 2. Engine mounting insulator (RH) | 3. Engine mounting bracket (RH) |
| 4. Engine mounting bracket (LH) | 5. Engine mounting insulator (LH) | 6. Heat shield plate (LH) |
| 7. Rear engine mounting cross member | 8. Rear engine mounting insulator | |

Fig. 187: Exploded View Of Engine Assembly With Torque Specifications (2WD Models)
 Courtesy of NISSAN NORTH AMERICA, INC.

Refer to "COMPONENTS" for symbols in the figure.

4WD models



- | | | |
|--------------------------------------|-----------------------------------|---------------------------------|
| 1. Heat shield plate (RH) | 2. Engine mounting insulator (RH) | 3. Engine mounting bracket (RH) |
| 4. Engine mounting bracket (LH) | 5. Engine mounting insulator (LH) | 6. Heat shield plate (LH) |
| 7. Rear engine mounting cross member | 8. Rear engine mounting insulator | 9. Dynamic damper |

Fig. 188: Exploded View Of Engine Assembly With Torque Specifications (AWD Models)
 Courtesy of NISSAN NORTH AMERICA, INC.

Refer to "**COMPONENTS**" for symbols in the figure. 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 ENGINE MECHANICAL article, refer to the applicable article(s).
- 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".

NOTE: When removing/installing only the engine mounting, the hold engine assembly as instructed bellow:

1. Remove hood assembly. Refer to "EXPLODED VIEW".
2. Remove the following components and related parts:
 - Battery. Refer to "EXPLODED VIEW".
 - Battery tray.
 - Power steering reservoir tank bracket. Refer to "EXPLODED VIEW".
 - Air cleaner case assembly and air duct. Refer to "EXPLODED VIEW".
3. Install engine slinger on both front right and front left sides of the engine.

Slinger bolts: Torque: 45.0 N.m (4.6 kg-m, 33 ft-lb)

- A : Engine front slinger (bank 2)
B : Engine front slinger (bank 1)

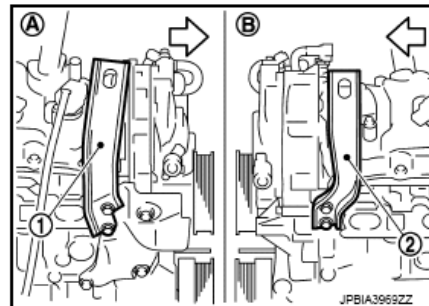


Fig. 189: Identifying Engine Slingers
Courtesy of NISSAN NORTH AMERICA, INC.

4. Hoist the slinger to obtain room for engine assembly.

CAUTION: Use an engine lifter to prevent the engine slinger from falling and damaging the rocker cover.

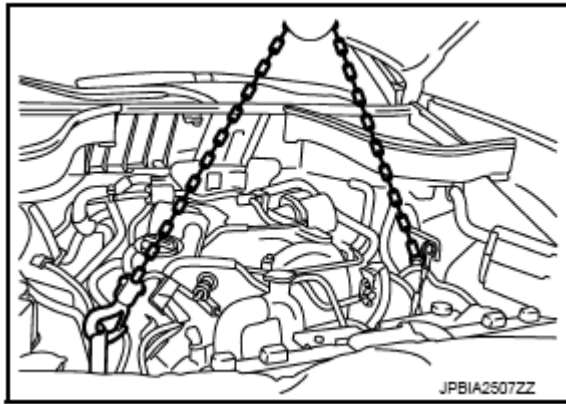


Fig. 190: Lifting Engine Using Engine Lifter
 Courtesy of NISSAN NORTH AMERICA, INC.

REMOVAL

Outline

At first, remove the transmission and transfer assembly, steering gear and front final drive facing downward. Then remove the engine.

Preparation

1. Remove engine cover. Refer to "**EXPLODED VIEW**".
2. Release fuel pressure. Refer to the following table:

ENGINE	Reference
VK56VD FOR USA AND CANADA	" <u>WORK PROCEDURE</u> "
VK56VD FOR MEXICO	" <u>WORK PROCEDURE</u> "

3. Remove battery and tray. Refer to "**EXPLODED VIEW** ".
4. Remove the following components and related parts:
 - Hood assembly. Refer to "**EXPLODED VIEW** ".
 - Front under cover. Refer to "**EXPLODED VIEW** ".
 - Front road wheel and tires. Refer to "**EXPLODED VIEW** ".
5. Drain engine oil. Refer to "**DRAINING** ".
6. Drain engine coolant. Refer to "**DRAINING** ".

CAUTION:

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

7. Drain power steering fluid. Refer to "**EXPLODED VIEW** ".

Engine Room Front

1. Remove drive belt. Refer to "**EXPLODED VIEW**".
2. Remove fan shroud. Refer to "**EXPLODED VIEW**".
3. Remove cooling fan and fan coupling. Refer to "**EXPLODED VIEW**".
4. Remove radiator hoses (upper and lower).
5. Remove radiator.

Vehicle Underbody

1. Remove exhaust front tube. Refer to "**EXPLODED VIEW**".
2. Remove protector A and B. Refer to "**FRONT TUBE ASSEMBLY : EXPLODED VIEW**".
3. Remove front suspension rear cross member. Refer to "**2WD: EXPLODED VIEW**" (2WD models) or "**4WD: EXPLODED VIEW**" (4WD models).
4. Remove oil cooler. Refer to "**EXPLODED VIEW**".
5. Remove A/T assembly. Refer to "**2WD: EXPLODED VIEW**" (2WD models) or "**4WD: EXPLODED VIEW**" (4WD models).
6. Remove steering gear assembly. Refer to "**EXPLODED VIEW**".
7. Remove front final drive assembly. Refer to "**EXPLODED VIEW**".
8. Remove exhaust manifold. Refer to "**EXPLODED VIEW**".
9. Remove alternator. Refer to "**EXPLODED VIEW**".

Engine Room LH

1. Remove air cleaner and air duct. Refer to "**EXPLODED VIEW**".
2. Remove A/C compressor. Refer to "**EXPLODED VIEW**".
3. Disconnect fuel feed hose and EVAP hose. Refer to "**EXPLODED VIEW**".

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

Engine Room RH

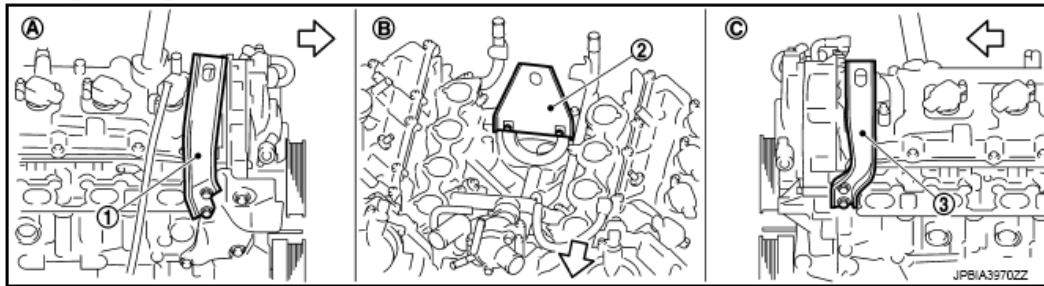
1. Remove power steering oil pump and reservoir tank. Refer to "**EXPLODED VIEW**".
2. Disconnect heater hose at heater core side, and fit a plug onto hose end to prevent engine coolant leakage.
3. Disconnect ground cable.
4. Disconnect all clips and connectors of the engine harness from vehicle side.

Removal Work

1. Install alternator bracket. Refer to "**EXPLODED VIEW**".
 - Temporarily tighten mounting bolts.

2. Remove intake manifold. Refer to "**EXPLODED VIEW**".
3. Remove starter motor. Refer to "**EXPLODED VIEW**".
4. Install engine slingers.

Slinger bolts: Torque: 45.0 N.m (4.6 kg-m, 33 ft-lb)



A Engine front slinger (bank 2)

B Engine rear slinger

C Engine front slinger (bank 1)

Fig. 191: Identifying Engine Slingers

Courtesy of NISSAN NORTH AMERICA, INC.

5. Lift using a hoist and secure the engine in position.
6. Remove engine mounting bracket (LH, RH) and engine mounting insulator (LH, RH). Refer to "**EXPLODED VIEW**".
7. Remove the engine from the vehicle, avoid interference with the f vehicle body.

CAUTION:

- Before and during 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.

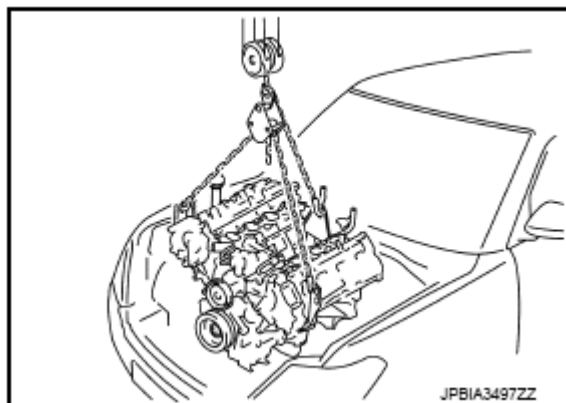


Fig. 192: Removing Engine From Vehicle Using Engine Lifter

Courtesy of NISSAN NORTH AMERICA, INC.

INSTALLATION

Install in the reverse order of removal.

CAUTION:

- When replacing an engine or transmission you must make sure the dowels are installed correctly during re-assembly. Improper alignment caused by missing dowels may cause vibration, oil leaks or breakage of drivetrain components.

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 the following table:

For NORTH AMERICA	"FOR NORTH AMERICA: FLUIDS AND LUBRICANTS "
For MEXICO	"FOR MEXICO: 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 ⁽¹⁾		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 "**EXPLODED VIEW**".
2. Remove crankshaft pulley. Refer to "**FRONT OIL SEAL: REMOVAL AND INSTALLATION**".

NOTE: The drive plate is fixed with a ring gear stopper [SST: KV10120100 (J-47245)]. Loosen the crankshaft pulley mounting bolts before installing the engine stand.

3. Remove the parts that may restrict installation of engine to a widely used engine stand.
 - Drive plate: Refer to "**EXPLODED VIEW**".
4. Lift the engine with hoist to install it onto the widely used engine stand.

CAUTION: Use an engine stand that has a load capacity [240 kg (529 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. 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 used 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.

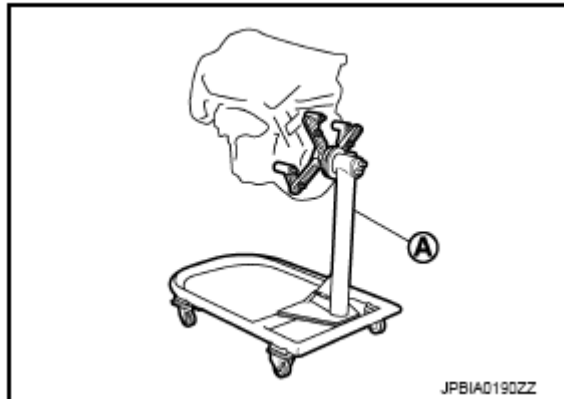


Fig. 193: Holding Transmission On Engine Stand
Courtesy of NISSAN NORTH AMERICA, INC.

5. Drain engine oil. Refer to "**DRAINING**".
6. Drain engine coolant by removing water drain plug (3) from both sides of the cylinder block as shown in the figure.

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

Water drain plug torque

Torque: 19.6 N.m (2.0 kg/m, 14 ft-lb)

- 1 : Washer
- 2 : Plug (engine coolant)
- 4 : Plug (engine oil)
- 5 : Washer
- ⇐ : Engine front

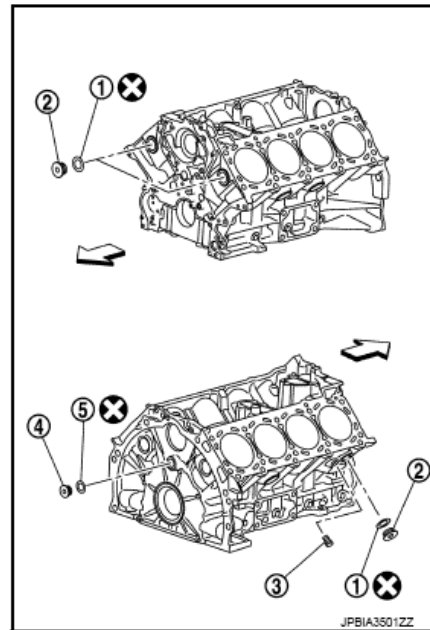


Fig. 194: Identifying Water Drain Plug, Drain Plug And Washer
 Courtesy of NISSAN NORTH AMERICA, INC.

ENGINE UNIT

Disassembly

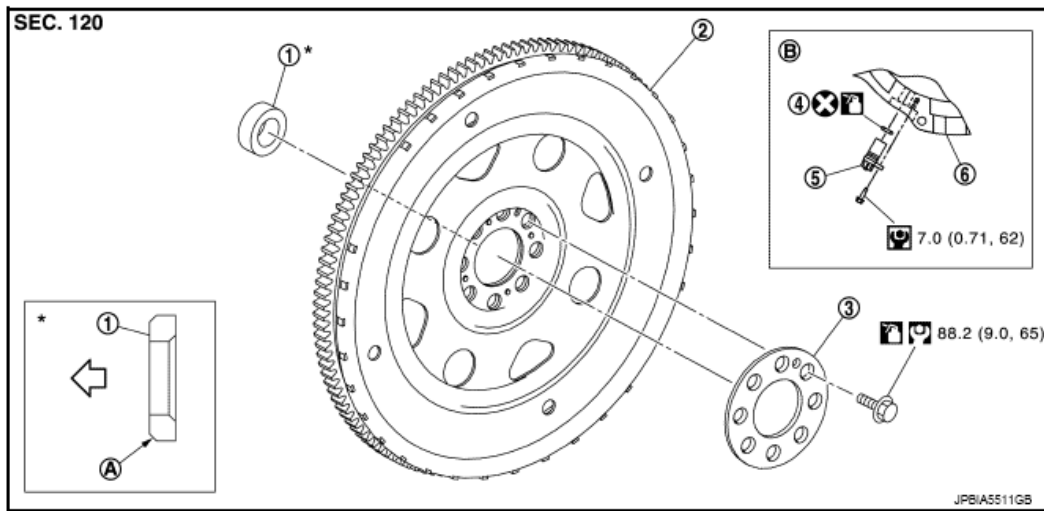
1. Remove intake manifold. Refer to "**EXPLODED VIEW**".
2. Remove exhaust manifold. Refer to "**EXPLODED VIEW**".
3. Remove oil pan (lower). Refer to "**EXPLODED VIEW**".
4. Remove ignition coil and spark plug. Refer to "**EXPLODED VIEW**".
5. Remove rocker cover. Refer to "**EXPLODED VIEW**".
6. Remove timing chain. Refer to "**EXPLODED VIEW**".
7. Remove exhaust camshaft and VVEL ladder assembly. Refer to "**EXPLODED VIEW**".
8. Remove cylinder head. Refer to "**EXPLODED VIEW**".

Assembly

Assemble in the reverse order of disassembly.

DRIVE PLATE

Exploded View



- | | | |
|--------------------|-------------------------------------|------------------------|
| 1. Pilot converter | 2. Drive plate | 3. Reinforcement plate |
| 4. O-ring | 5. Crankshaft position sensor (POS) | 6. Transmission |
| A. Chamfered | B. Installed on transmission | |

← :Crankshaft side

: N·m (kg-m, in-lb)

: N·m (kg-m, ft-lb)

: Always replace after every disassembly.

: Should be lubricated with oil.

Fig. 195: Exploded View Of Drive Plate With Torque Specifications
 Courtesy of NISSAN NORTH AMERICA, INC.

Removal and Installation

REMOVAL

1. Remove transmission assembly. Refer to "**2WD: EXPLODED VIEW** " (2WD models) or "**4WD: EXPLODED VIEW** " (4WD models).
2. Before removing the drive plate, put a match mark (A) on the crankshaft and drive plate for alignment during installation.

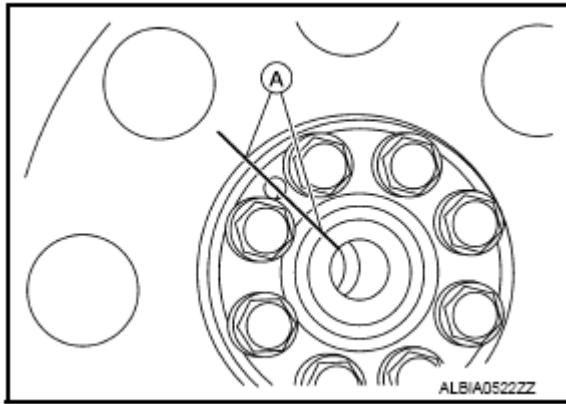


Fig. 196: Identifying Drive Plate (CVT) And Match Mark
Courtesy of NISSAN NORTH AMERICA, INC.

3. Remove drive plate as per the following procedure:
 - a. Set the ring gear stopper [SST: KV10120100 (J-47245)] (A) as shown in the figure.
 - b. Loosen the bolts diagonally, and then pull drive plate with both hands to remove it.

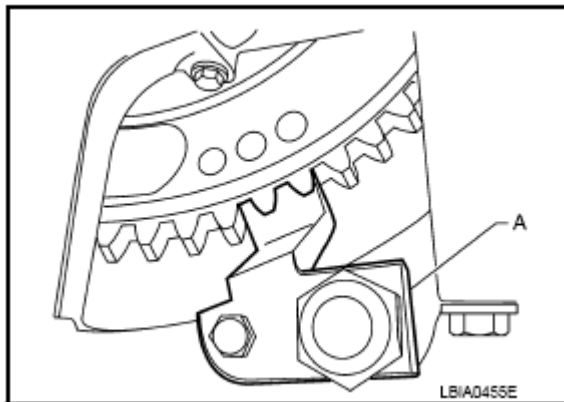


Fig. 197: Identifying Crankshaft Pulley Bolts
Courtesy of NISSAN NORTH AMERICA, INC.

CAUTION:

- Never disassemble them.
- Never place them with signal plate facing down.
- When handling signal plate, take care not to damage or scratch them.
- Handle signal plate in a manner that prevents them from becoming magnetized.
- Take care not to damage the periphery of the sensing area.
- Any dropped drive plate shall not be used. (The drive plate to which the sensing area shall not be placed on the floor.)
- Never touch drive plate with bare hands. Always use

urethane coating gloves or skin gloves when removing these parts.

- Never use torn glove.

4. Remove pilot converter (1) using the pilot bushing puller (commercial service tool) (A), if necessary.

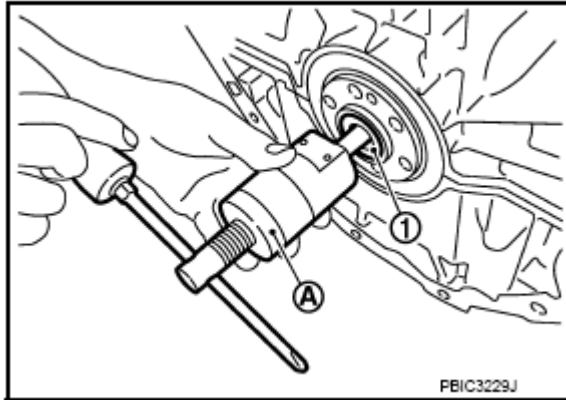


Fig. 198: Removing Pilot Converter (CVT Models) Using Pilot Bushing Puller
Courtesy of NISSAN NORTH AMERICA, INC.

INSTALLATION

1. Install pilot converter to the crankshaft using suitable tool, if removed.
 - With a drift of the following outer diameter, press-fit as far as it will go:

Pilot converter: Approx. 35 mm (1.38 in)

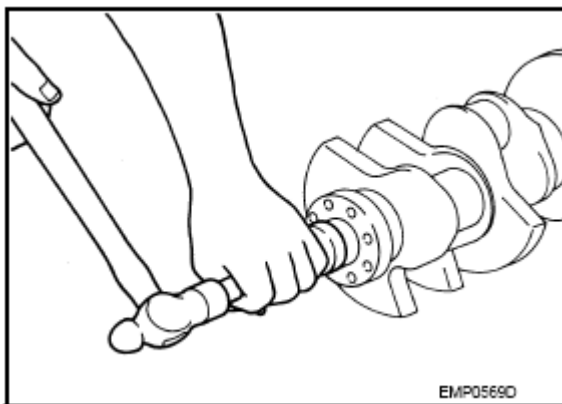


Fig. 199: Installing Pilot Converter To Crankshaft Using Drift
Courtesy of NISSAN NORTH AMERICA, INC.

- Press-fit pilot converter with its chamfering side facing crankshafts shown in the figure.

↩ : Crankshaft side

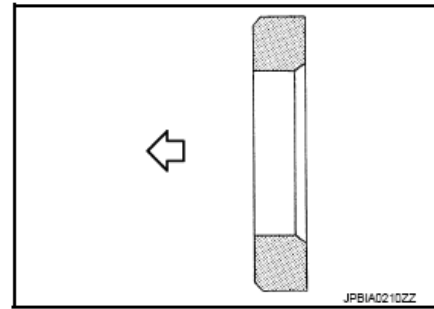


Fig. 200: Identifying Chamfered Pilot Converter
Courtesy of NISSAN NORTH AMERICA, INC.

2. Install drive plate in the reverse order of removal.
 - Install drive plate (4) and reinforcement plate (3) as shown in the figure.

2 : Pilot converter
A : Rounded
↩ : Engine front

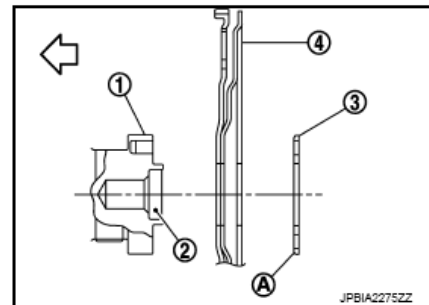


Fig. 201: Identifying Drive Plate And Reinforcement Plate
Courtesy of NISSAN NORTH AMERICA, INC.

- When installing drive plate to crankshaft (1), be sure to correctly align crankshaft side dowel pin and drive plate side dowel pin hole.

CAUTION: If these are not aligned correctly, engine runs roughly and "MIL" illuminates.

- Holding ring gear with the ring gear stopper [SST: KV10120100 (J-47245)].
- Tighten the mounting bolts crosswise over several times.

Inspection

DRIVE PLATE DEFLECTION

- Check drive plate and signal plate (A) for deformation or damage.

B : Ring gear
 ⇐ : Engine front

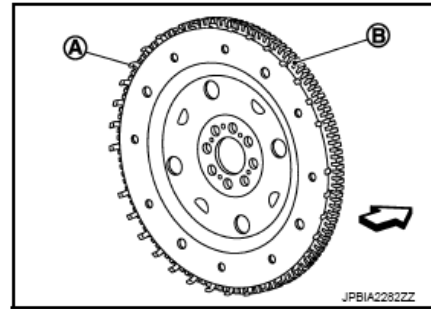


Fig. 202: Identifying Signal Plate

Courtesy of NISSAN NORTH AMERICA, INC.

CAUTION:

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

- If damage is found, replace drive plate.
- Measure the deflection of drive plate contact surface to torque converter with a dial indicator (A).
- Measure the deflection at the area (B).

Limit: 0.35 mm (0.0138 in) or less .

C : Hole of torque converter bolt
 d : 34 mm (1.34 in)
 e : 21 mm (0.83 in)

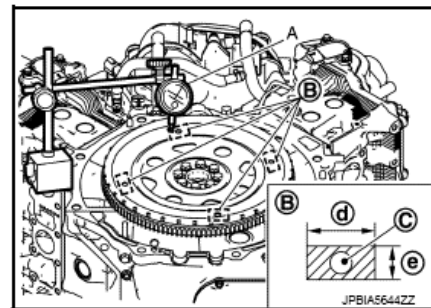


Fig. 203: Measuring Deflection Of Drive Plate Contact Surface Using Dial Indicator

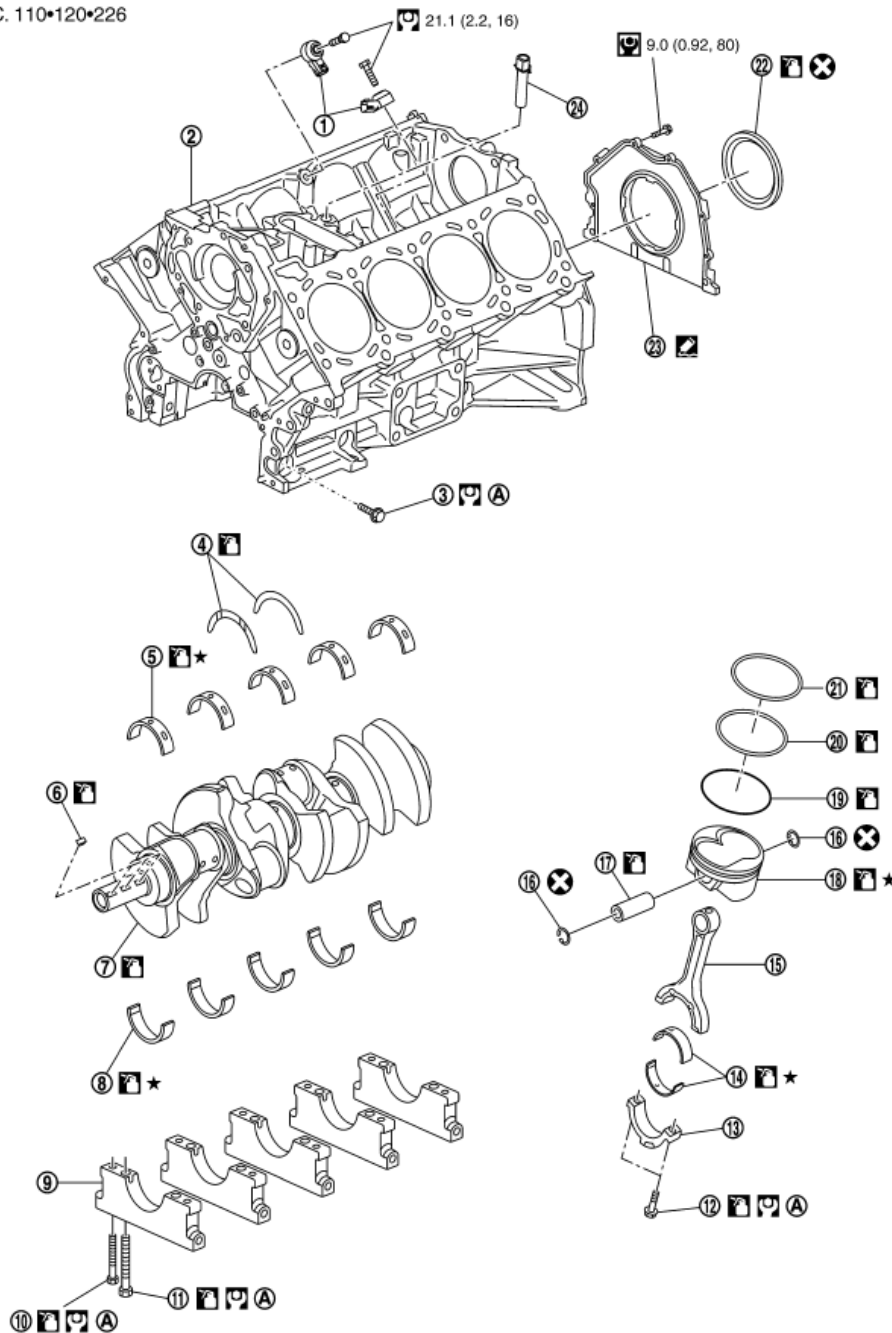
Courtesy of NISSAN NORTH AMERICA, INC.

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

CYLINDER BLOCK

Exploded View

SEC. 110•120•226



JPB/A5668/GB

- | | | |
|-------------------------------|----------------------------|--|
| 1. Knock sensor | 2. Cylinder block | 3. Side bolt |
| 4. Thrust bearing | 5. Main bearing (upper) | 6. Crankshaft key |
| 7. Crankshaft | 8. Main bearing (lower) | 9. Main bearing cap |
| 10. Main bearing cap sub bolt | 11. Main bearing cap bolt | 12. Connecting rod cap bolt |
| 13. Connecting rod cap | 14. Connecting rod bearing | 15. Connecting rod |
| 16. Snap ring | 17. Piston pin | 18. Piston |
| 19. Oil ring | 20. Second ring | 21. Top ring |
| 22. Rear oil seal | 23. Rear oil seal retainer | 24. Cylinder block heater (for Canada) |
- A. Comply with the assembly procedure when tightening.

Fig. 204: Exploded View Of Cylinder Block With Torque Specifications
Courtesy of NISSAN NORTH AMERICA, INC.

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

Disassembly and Assembly

DISASSEMBLY

1. Remove the following parts:
 - Oil pans (lower and upper): Refer to "EXPLODED VIEW" and "EXPLODED VIEW".
 - Front cover and timing chain: Refer to "EXPLODED VIEW".
 - Cylinder head: Refer to "EXPLODED VIEW".
2. Remove knock sensor.

CAUTION: Carefully handle knock sensor avoiding shocks.

3. Remove oil filter (for VVEL ladder assembly) from cylinder block, if necessary. Refer to "EXPLODED VIEW".
4. Remove piston and connecting rod assembly as per the following:
 - 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. Loosen mounting bolts, and remove connecting rod bearing cap.
- c. Using a hammer handle (A) 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.

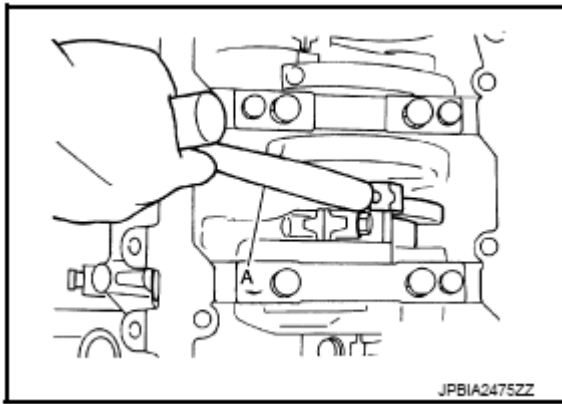


Fig. 205: Pushing Piston And Connecting Rod Assembly Using Hammer Handle
Courtesy of NISSAN NORTH AMERICA, INC.

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.

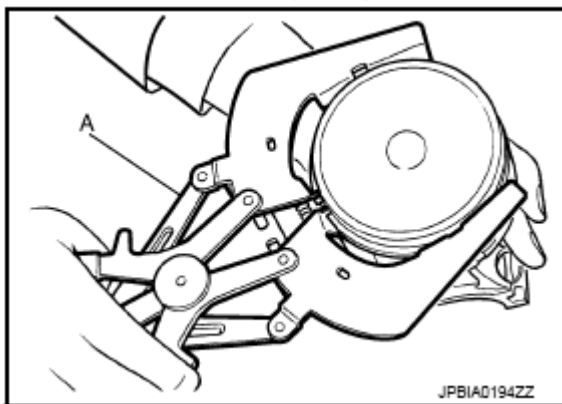


Fig. 206: Checking Piston Ring Clearance Using Piston Ring Expander

Courtesy of NISSAN NORTH AMERICA, INC.

7. Remove piston from connecting rod as per the following:
 - a. Using snap ring pliers (A), remove snap rings.

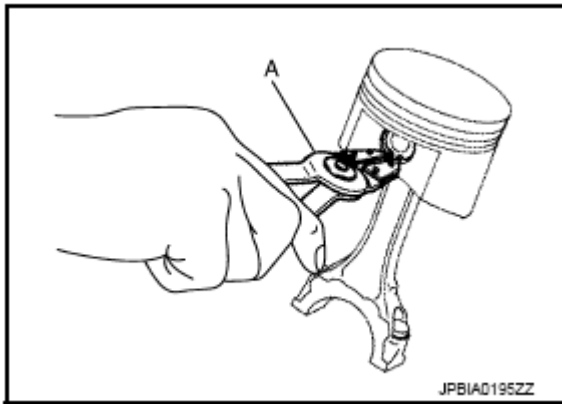


Fig. 207: Removing Snap Rings Using Snap Ring Plier
Courtesy of NISSAN NORTH AMERICA, INC.

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

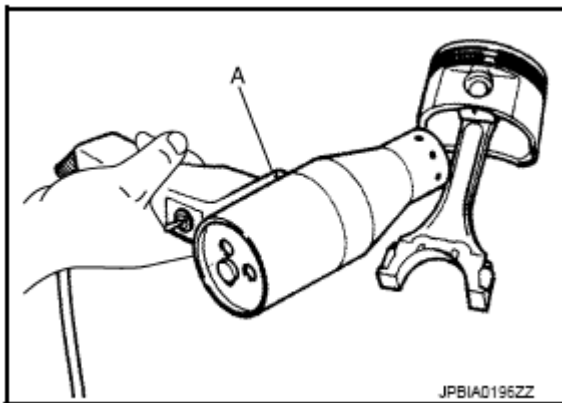


Fig. 208: Heating Piston Using Dryer
Courtesy of NISSAN NORTH AMERICA, INC.

- c. Push out piston pin using a stick that has an outer diameter of approximately 20 mm (0.79 in).

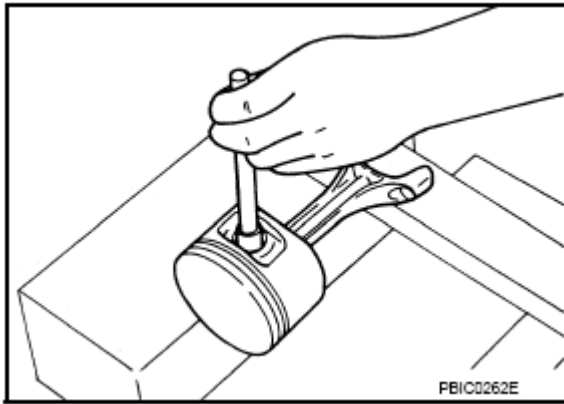


Fig. 209: Pushing Out Piston Pin Using Stick
Courtesy of NISSAN NORTH AMERICA, INC.

8. Remove rear oil seal and rear oil seal retainer assembly from cylinder block.
 - Insert screwdriver or similar tool between rear end of crankshaft counter weight and rear oil seal retainer, and separate liquid gasket to remove.

CAUTION: Be careful not to damage the mating surfaces.

9. Using screwdriver or similar tool, and lever off rear oil seal from rear oil seal retainer.
10. Remove main bearing cap as per the following:
 - Before loosening cylinder block bolts, measure the crankshaft end play. Refer to "**INSPECTION**".
 - a. Loosen side bolts starting from No. 30 to 21 to remove.

← : Engine front

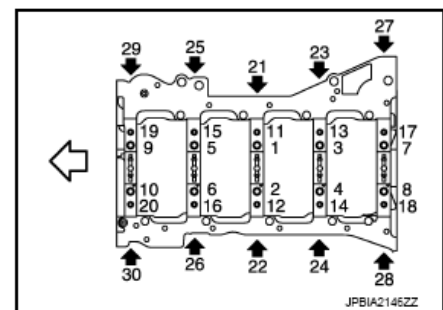


Fig. 210: Loosening Cylinder Block Bolts
Courtesy of NISSAN NORTH AMERICA, INC.

- b. Loosen main bearing cap sub bolts starting from No. 20 to 11 to remove.
- c. Loosen main bearing cap bolts starting from No. 10 to 1 to remove.
- d. Remove the main bearing cap.
- Insert bolts (1) into bolt holes, and then remove main bearing cap (2) by lifting up and shaking forward and backward.

CAUTION: Be careful not to damage the mounting surface.

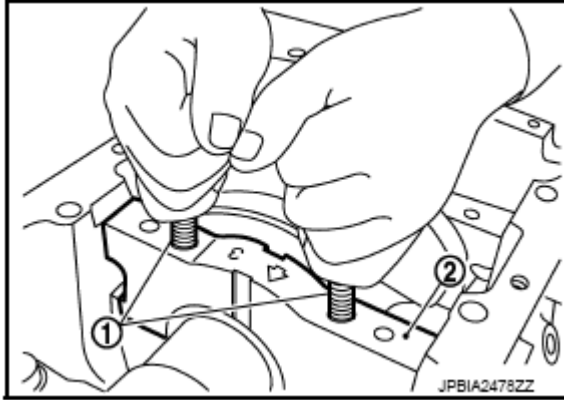


Fig. 211: Inserting Bolts Into Bolt Holes
Courtesy of NISSAN NORTH AMERICA, INC.

11. Remove crankshaft.
12. Remove main bearings and thrust bearings from main bearing cap and 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 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.

← : Engine front

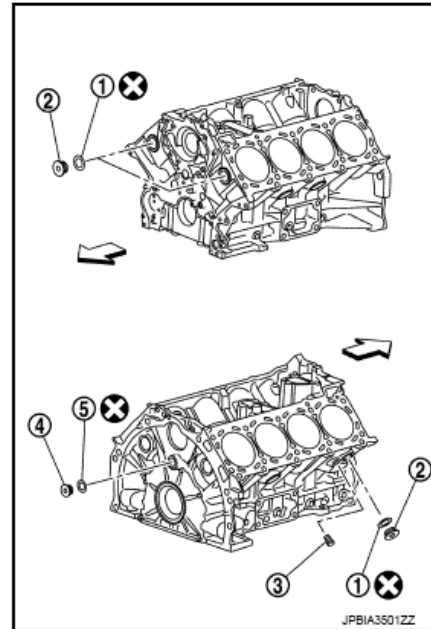


Fig. 212: Identifying Water Drain Plug And Washers
Courtesy of NISSAN NORTH AMERICA, INC.

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

- Tighten each plug as specified below:

Part	Tightening torque
Plug (2)	78.0 Nm (8.0 kg-m, 58 ft-lb)
Water drain plug (3)	19.6 Nm (2.0 kg-m, 14 ft-lb)
Plug (4)	53.9 Nm (5.5 kg-m, 40 ft-lb)

- Replace washers (1), (5) with new ones.

CAUTION: Do not reuse washers.

- Apply sealant to the thread of water drain plug (3).

Use Genuine RTV silicone sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS**".**

- Apply sealant to the thread of plug (4).

Use high strength thread locking sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS**".**

3. Install main bearings and thrust bearings as per the following:

CAUTION: Be careful not to drop main bearing, and to scratch the surface.

- a. Remove dust, dirt, and engine oil on bearing mating surfaces of cylinder block and main bearing caps.
- b. Install thrust bearings (2) to both sides of the No. 3 journal housing on cylinder block (1).

- 3 : Main bearing (upper) (cylinder block side)
 4 : Crankshaft
 5 : Main bearing (lower) (main bearing cap side)
 ⇐ : Engine front

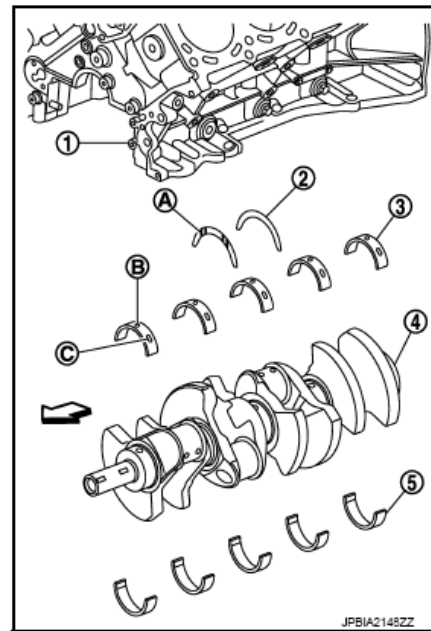


Fig. 213: Identifying Thrust Bearings And Main Bearings
 Courtesy of NISSAN NORTH AMERICA, INC.

- Install thrust bearings with the oil groove (A) facing crankshaft arm (outside).
- c. Install main bearings paying attention to the direction.
 - Main bearing with oil hole (B) and groove (C) goes on cylinder block. The one without them goes on main bearing cap.
 - 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 main bearing.
 - Ensure the oil holes on cylinder block and those on the corresponding bearing are aligned.
4. Install crankshaft to cylinder block.
- While turning crankshaft by hand, check that it turns smoothly.
5. Install main bearing caps as per the following:
- Align the identification number to the journal position to install.

↩ : Engine front

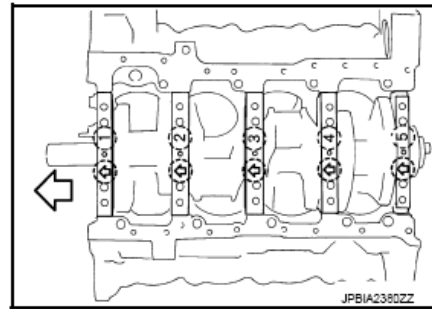


Fig. 214: Identifying Main Bearing Caps With Identification Number

Courtesy of NISSAN NORTH AMERICA, INC.

- Install it with the front mark (indicated by stamping) facing the front of engine.
- Using plastic hammer or similar tool, tap them lightly to seat them on the installation position.

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

6. Install each main bearing cap bolts as per the following:

CAUTION: If main bearing cap bolts and sub bolts are re-used, check their outer diameters before installation. Refer to "INSPECTION".

- a. Apply new engine oil to threads and seat surfaces of main bearing cap bolts and sub bolts.
- b. Tighten all bolts in order of (No. 1 - 30) temporarily.

↩ : Engine front

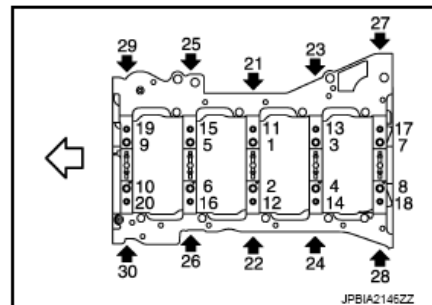


Fig. 215: Installing Main Bearing Cap Bolts And Sub Bolts

Courtesy of NISSAN NORTH AMERICA, INC.

- c. Tighten main bearing cap bolts (M12) in order of No. 1 - 10.

Torque: 39.2 N.m (4.0 kg-m, 29 ft-lb)

- d. Tighten main bearing cap sub bolts (M9) in order of No. 11 - 20.

Torque: 29.4 N.m (3.0 kg-m, 22 ft-lb)

- e. Tighten main bearing cap bolts (M12) in order of No. 1 - 10 (clockwise).

Angle tightening: 40 degrees

CAUTION: Use the angle wrench [SST: KV10112100 (BT8653-A)] (A) to check tightening angle. Never make judgment by visual inspection.

- f. Tighten main bearing cap sub bolts (M9) in order of No. 11 - 20. (clockwise)

Angle tightening: 30 degrees

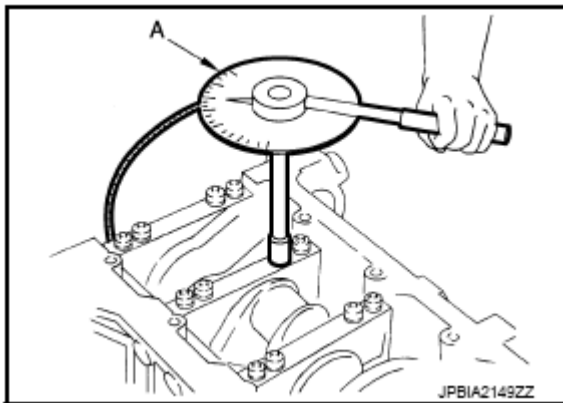


Fig. 216: Tightening Main Bearing Cap Bolts Using Angle Wrench
Courtesy of NISSAN NORTH AMERICA, INC.

- g. Tighten side bolts (M10) in order of No. 21 - 30.

Torque: 49.0 N.m (5.0 kg-m, 36 ft-lb)

- After installing bolts, check that crankshaft can be rotated smoothly by hand.
- Check the crankshaft end play. Refer to "CYLINDER BLOCK".

7. Install rear oil seal retainer.

- Apply a continuous bead of liquid gasket with tube presser (commercial service tool) to rear oil seal retainer as shown in the figure.

Use Genuine RTV silicone sealant or equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS".

- A : Protrusion
b : 4.0 - 5.6 mm (0.157 - 0.220 in)
c : ϕ 3.4 - 4.4 mm (0.134 - 0.173 in)

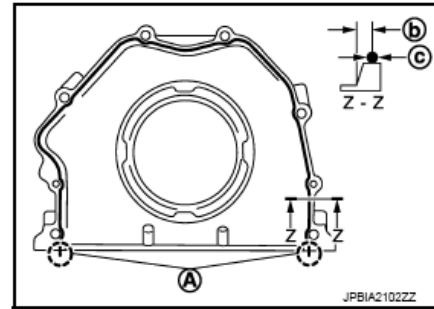


Fig. 217: Identifying Liquid Gasket Applying Area
Courtesy of NISSAN NORTH AMERICA, INC.

8. Install rear oil seal on rear oil seal retainer.
- 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.

CAUTION: Be careful not to scratch or make burrs on circumference of oil seal.

- ↔ : Engine inside
← : Engine outside

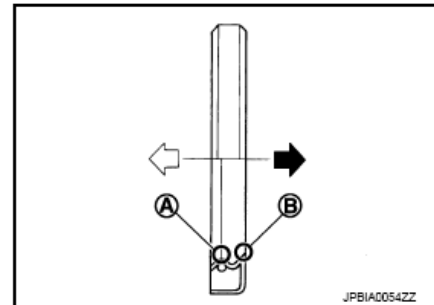


Fig. 218: Identifying Oil Seal Lip And Dust Seal Lip
Courtesy of NISSAN NORTH AMERICA, INC.

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

- B : Rear oil seal retainer rear end face
a : 0 - 0.5 mm (0 - 0.020 in)

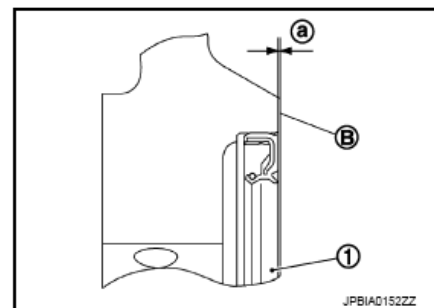


Fig. 219: Identifying Rear Oil Seal
Courtesy of NISSAN NORTH AMERICA, INC.

- Using a suitable drift [outer diameter: 101 mm (3.98 in)].
 - Check the garter spring is in position and seal lips are not inverted.
9. Install piston to connecting rod as per the following:
- Assemble so that the front mark (A) on the piston head and the cylinder number (D) on connecting rod are positioned as shown in the figure.

B : Oil hole
 C : Front mark
 ⇐ : Engine front

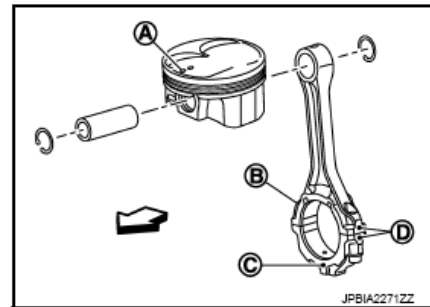


Fig. 220: Identifying Piston Head And Connecting Rod With Oil Hole And Front Mark
 Courtesy of NISSAN NORTH AMERICA, INC.

- Using snap ring pliers, install new snap ring to the groove of piston rear side.
 - Insert it fully into groove to install.
 - 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.
 - 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 expending them excessively.

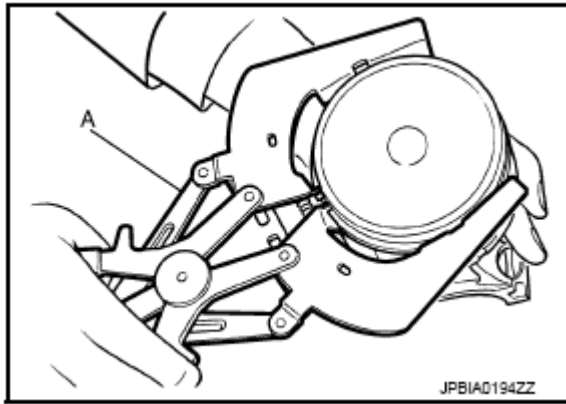


Fig. 221: Checking Piston Ring Clearance Using Piston Ring Expander
Courtesy of NISSAN NORTH AMERICA, INC.

- If there is stamped mark on ring, mount it with marked side up.

Stamped mark:

Top ring (A): 1 K

Second ring (B): 2 K

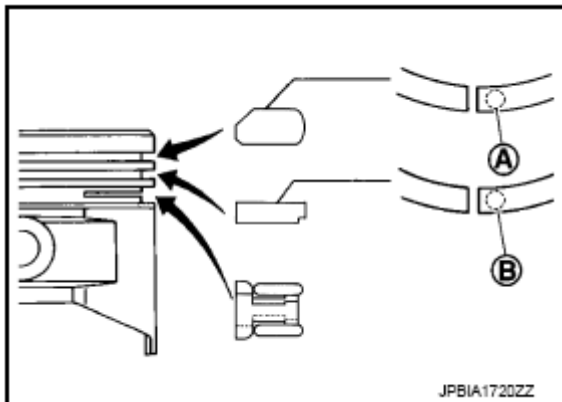


Fig. 222: Identifying Rings Installation Position
Courtesy of NISSAN NORTH AMERICA, INC.

- Position each ring with the gap as shown in the figure referring to the piston front mark (D).

- C : Top ring gap
- E : Oil ring upper or lower rail gap (either of them)
- F : Second ring and oil ring spacer gap
- a : 90 degrees
- b : 45 degrees

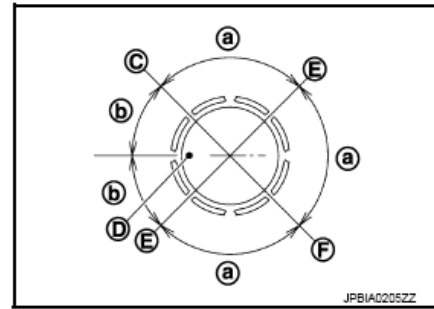


Fig. 223: Identifying Rings Gaps

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 (A) of connecting rods and connecting rod bearing caps to install.
- Ensure the oil hole (C) on connecting rod and that on the corresponding bearing are aligned.

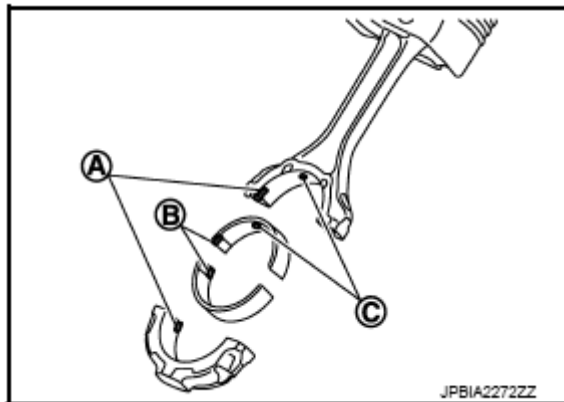


Fig. 224: Identifying Connecting Rod, Bearings With Protrusion, Cutout And Oil Hole
Courtesy of NISSAN NORTH AMERICA, INC.

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.

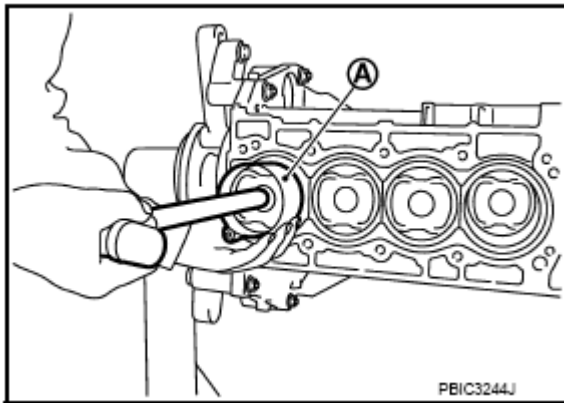


Fig. 225: Installing Piston Ring Using Piston Ring Compressor
Courtesy of NISSAN NORTH AMERICA, INC.

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

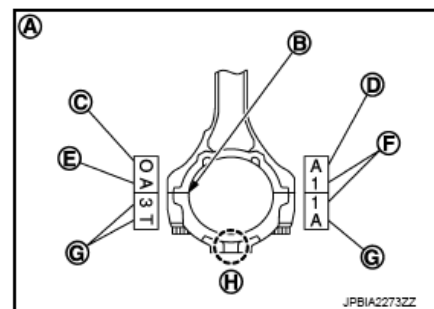


Fig. 226: Identifying Grades And Codes
Courtesy of NISSAN NORTH AMERICA, INC.

- Be sure that front mark (H) on connecting rod bearing cap is facing the front of the engine.

14. Tighten connecting rod bolts as per the following:

- Inspect the outer diameter of connecting rod bolt. Refer to "**INSPECTION**".
- Apply engine oil to the threads and seats of connecting rod bolts.
- Tighten connecting rod bolts.

Torque: 29.4 N.m (3.0 kg-m, 21.7 ft-lb)

- d. Completely loosen connecting rod bolts.

Torque: 0 N.m (0 kg-m, 0 ft-lb)

- e. Tighten connecting rod bolts.

Torque: 19.6 N.m (2.0 kg-m, 14.5 ft-lb)

- f. Tighten connecting rod bolts. (clockwise)

Angle tightening: 90 degrees

**CAUTION: Always use the angle wrench [SST: KV10112100 (BT8653-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".

15. Install knock sensors (1).

- Install knock sensors in the direction shown in the figure.

⇐ : Engine front

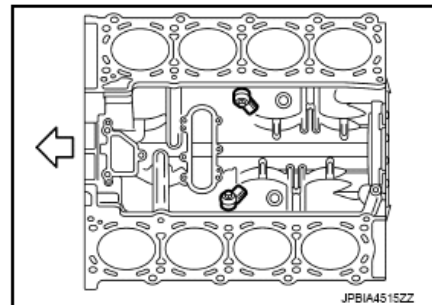


Fig. 227: Identifying Knock Sensors
Courtesy of NISSAN NORTH AMERICA, INC.

- After installing knock sensor, connect harness connector, and lay it out to front 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.

16. Install oil filter (for VVEL ladder assembly).

17. Assemble in the reverse order of disassembly.

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 (A).

Standard and limit: Refer to "CYLINDER BLOCK".

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

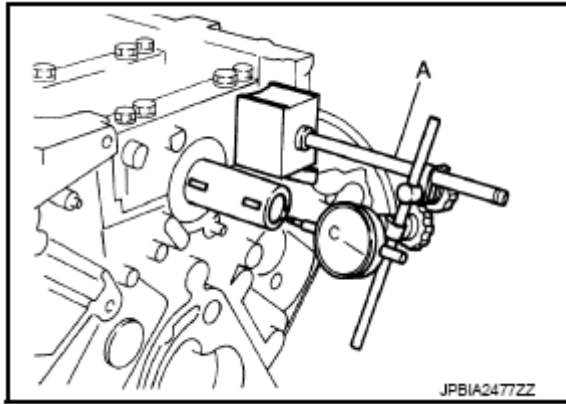


Fig. 228: Checking Crankshaft End Play Using Dial Gauge
Courtesy of NISSAN NORTH AMERICA, INC.

CONNECTING ROD SIDE CLEARANCE

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

Standard and limit: Refer to "CYLINDER BLOCK".

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

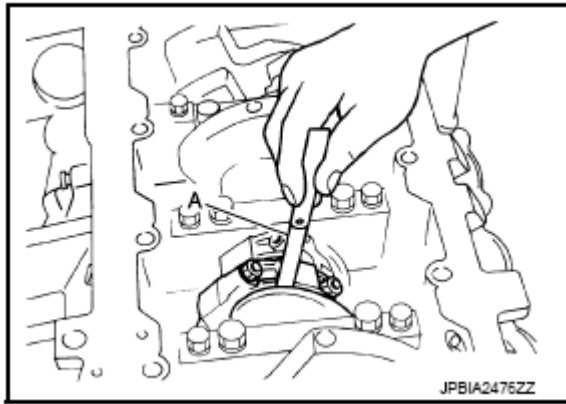


Fig. 229: Measuring Side Clearance Between Connecting Rod And Crankshaft Arm Using Feeler Gauge

Courtesy of NISSAN NORTH AMERICA, INC.

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".

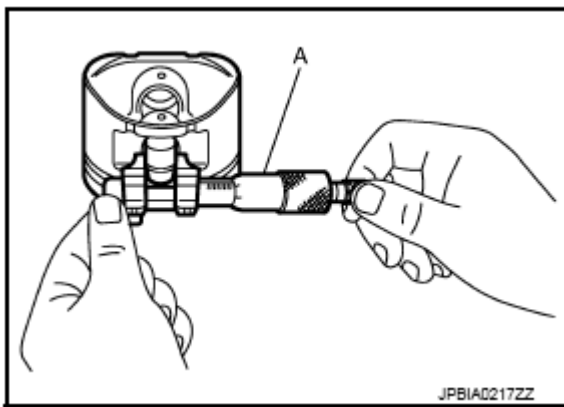


Fig. 230: Measuring Inner Diameter Of Piston Pin Hole Using Inside Micrometer

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".

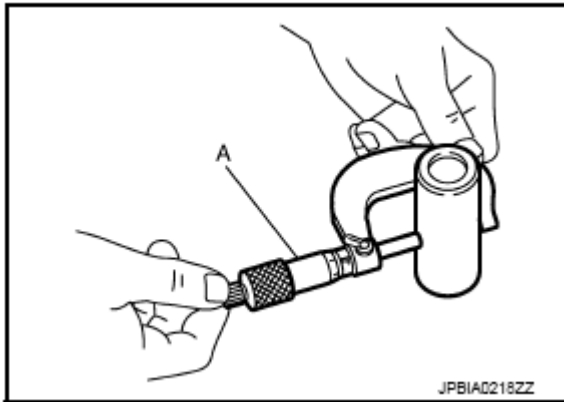


Fig. 231: Measuring Outer Diameter Of Piston Pin Using Micrometer
 Courtesy of NISSAN NORTH AMERICA, INC.

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 RING SIDE CLEARANCE

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

Standard and limit: Refer to "CYLINDER BLOCK".

A : OK
 B : NG

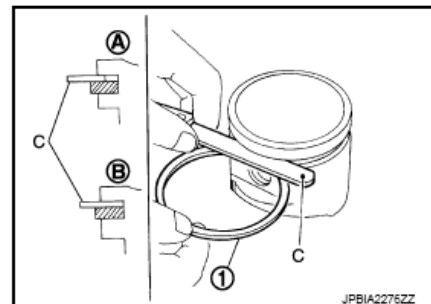


Fig. 232: Measuring Side Clearance Of Piston Ring And Piston Ring Groove Using Feeler Gauge
 Courtesy of NISSAN NORTH AMERICA, INC.

- 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.
- 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).

Standard and limit: Refer to "CYLINDER BLOCK".

A : Press-fit

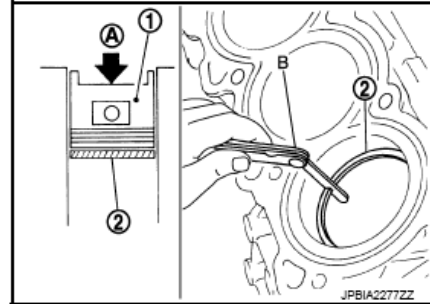


Fig. 233: Measuring Piston Ring End Gap Using Feeler Gauge
 Courtesy of NISSAN NORTH AMERICA, INC.

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

CONNECTING ROD BEND AND TORSION

- Check with a connecting rod aligner.

Bend limit Torsion limit: Refer to "CYLINDER BLOCK".

A : Bend
 B : Torsion
 C : Feeler gauge

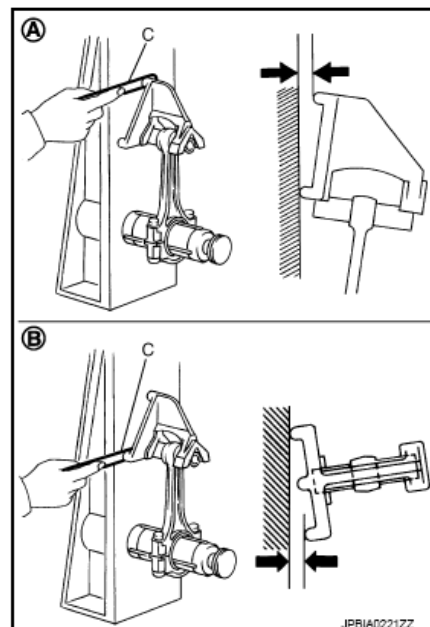


Fig. 234: Checking Bend And Torsion Using Feeler Gauge
Courtesy of NISSAN NORTH AMERICA, INC.

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

Standard: Refer to "**CYLINDER BLOCK**".

1 : Connecting rod

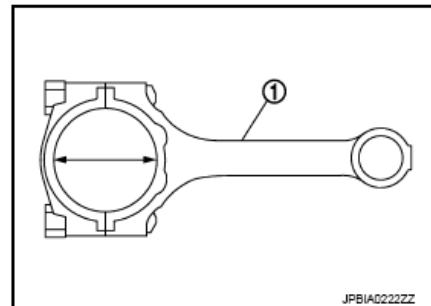


Fig. 235: Identifying Connecting Rod Big End Diameter
Courtesy of NISSAN NORTH AMERICA, INC.

- 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**".

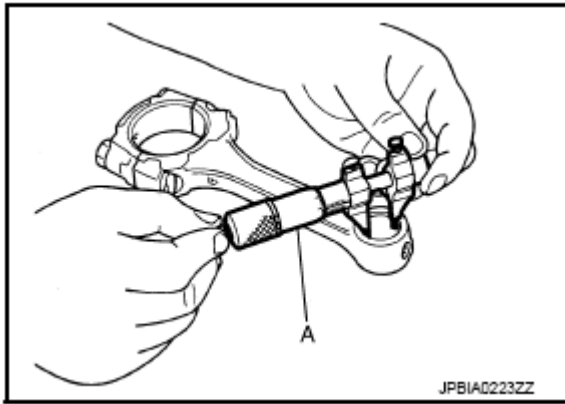


Fig. 236: Measuring Inner Diameter Of Connecting Rod Bushing Using Inside Micrometer
 Courtesy of NISSAN NORTH AMERICA, INC.

Piston Pin Outer Diameter

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

Standard: Refer to "CYLINDER BLOCK".

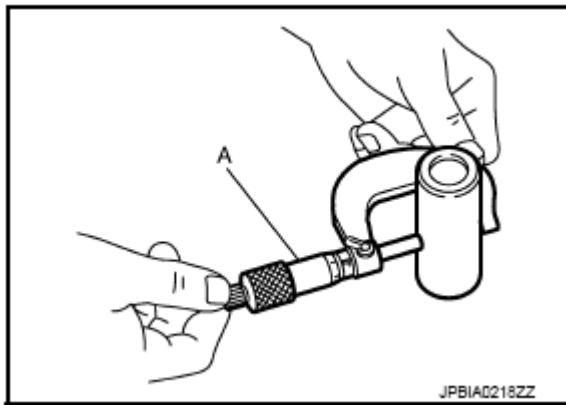


Fig. 237: Measuring Outer Diameter Of Piston Pin Using Micrometer
 Courtesy of NISSAN NORTH AMERICA, INC.

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.

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".

- If it exceeds the limit, replace cylinder block.

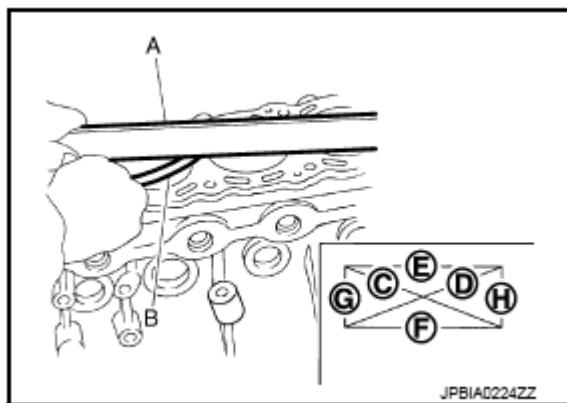


Fig. 238: Measuring Distortion On Cylinder Block Upper Face Using Straightedge And Feeler Gauge

Courtesy of NISSAN NORTH AMERICA, INC.

MAIN BEARING HOUSING INNER DIAMETER

- Install main bearing cap (2) without installing main bearings, and tighten main bearing cap 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".

- If out of the standard, replace cylinder block (1) and main bearing cap as assembly.

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

PISTON TO CYLINDER BORE CLEARANCE

Cylinder Bore inner Diameter

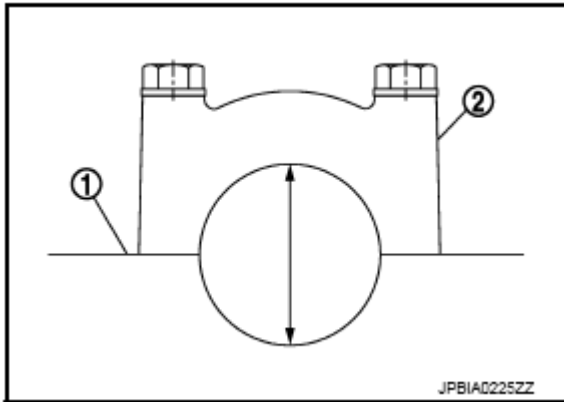


Fig. 239: Identifying Main Bearing Housing Inner Diameter
 Courtesy of NISSAN NORTH AMERICA, INC.

- 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: 120 mm (4.72 in)

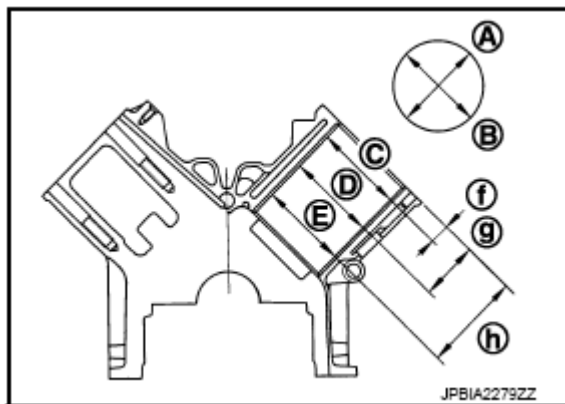


Fig. 240: Identifying Cylinder Bore Inner Diameter
 Courtesy of NISSAN NORTH AMERICA, INC.

Wear limit:

Out-of-round (Difference between "A" and "B"): Refer to "CYLINDER BLOCK".

Taper limit (Difference between "C" and "E"):

- If the measured value exceeds the limit, or if there are scratches and/or seizure on the cylinder inner wall, hone or re-bore the inner wall.
- Oversize piston is provided. When using oversize piston, re-bore 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)**Piston Skirt Diameter**

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

Measure point Standard: Refer to "CYLINDER BLOCK".

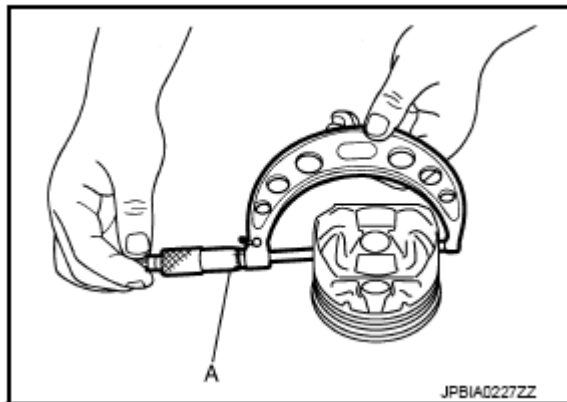


Fig. 241: Measuring Outer Diameter Of Piston Skirt Using Micrometer
Courtesy of NISSAN NORTH AMERICA, INC.

Piston-to-Cylinder Bore Clearance

Calculate by piston skirt diameter and cylinder bore inner diameter [direction (B), position (D)].

(Clearance) = (Cylinder bore inner diameter) - (Piston skirt diameter).

Standard and limit: Refer to "CYLINDER BLOCK".

- A : Longitudinal direction
 C : Top position
 E : Bottom position
 f : 10 mm (0.39 in)
 g : 60 mm (2.36 in)
 h : 120 mm (4.72 in)

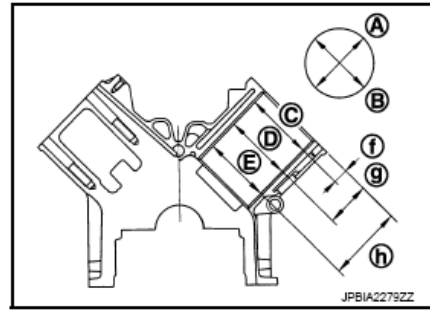


Fig. 242: Identifying Cylinder Bore Inner Diameter

Courtesy of NISSAN NORTH AMERICA, INC.

- If the calculated value exceeds the limit, replace piston and piston pin assembly. Refer to "**CYLINDER BLOCK**".

Re-boring Cylinder Bore

1. Cylinder bore size is determined by adding piston to cylinder bore clearance to piston skirt diameter.

Re-bored size calculation: $D = A + B - C$ where,

D: Bored diameter

A: Piston skirt diameter as measured

B: Piston to cylinder bore clearance (standard value)

C: Honing allowance 0.02 mm (0.0008 in)

2. Install main bearing cap, 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".

- If out of the standard, measure the connecting rod bearing oil clearance. Then use undersize bearing. Refer to "CONNECTING ROD BEARING".

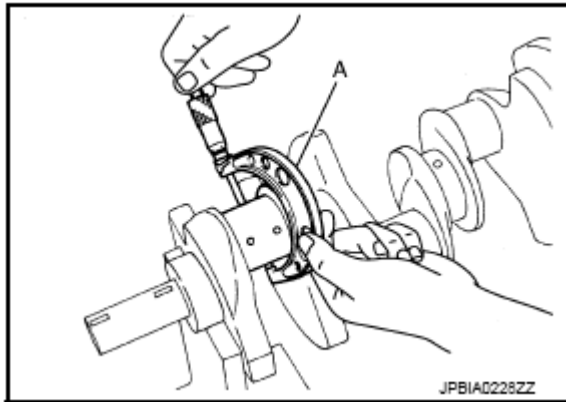


Fig. 243: Measuring Outer Diameter Of Crankshaft Pin Journal Using Micrometer
Courtesy of NISSAN NORTH AMERICA, INC.

CRANKSHAFT OUT-OF-ROUND AND TAPER

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

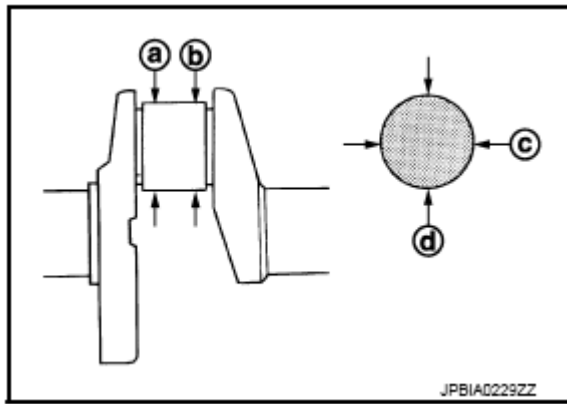


Fig. 244: Identifying Connecting Rod Main Bearing
Courtesy of NISSAN NORTH AMERICA, INC.

Out-of-round (Difference between "c" and "d") Taper (Difference between "a" and "b"): Refer to **"CYLINDER BLOCK"**.

- If the measured value exceeds the limit, correct or replace crankshaft.
- If corrected, measure the bearing oil clearance of the corrected main journal and/or pin journal. Then select the main bearing and/or connecting rod bearing. Refer to **"MAIN BEARING"** and/or **"CONNECTING ROD BEARING"**.

CRANKSHAFT RUNOUT

- Place V-block on precise flat table, and support the journals on f 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"**.

- If it exceeds the limit, replace crankshaft.

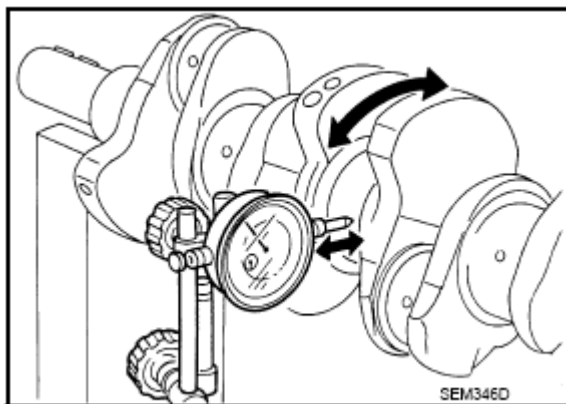


Fig. 245: Checking Crankshaft Runout Using Dial Indicator

Courtesy of NISSAN NORTH AMERICA, INC.

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.

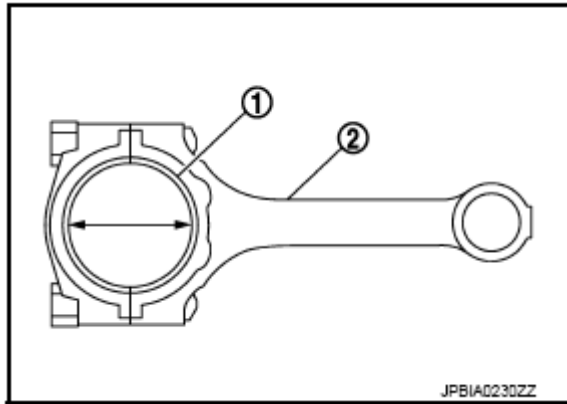


Fig. 246: Identifying Connecting Rod Bearings And Connecting Rod
Courtesy of NISSAN NORTH AMERICA, INC.

- 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 f 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".

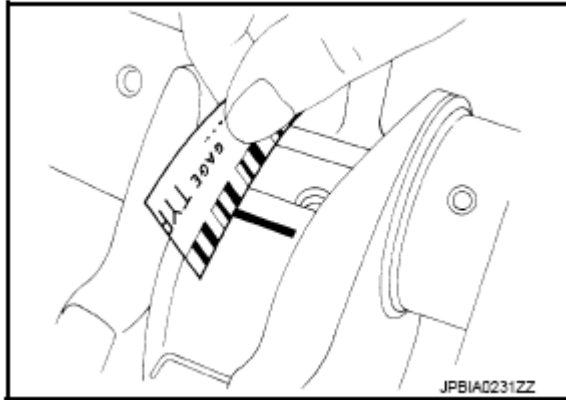


Fig. 247: Measuring Plastigage Width Using Scale On Plastigage Bag
Courtesy of NISSAN NORTH AMERICA, INC.

MAIN BEARING OIL CLEARANCE

Method by Calculation

- Install main bearings (3) to cylinder block (1) and main bearing cap (2), and tighten main bearing cap 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**".

- 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**".

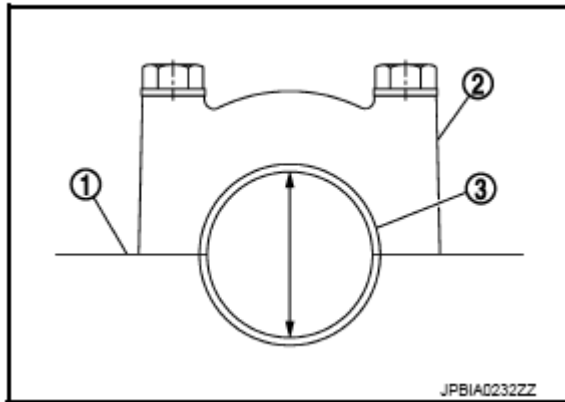


Fig. 248: Identifying Main Bearing, Inner Diameter And Cylinder Block
 Courtesy of NISSAN NORTH AMERICA, INC.

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 main bearing cap, and tighten main bearing cap bolts with main bearing cap to the specified torque. Refer to "**DISASSEMBLY AND ASSEMBLY**" for the tightening procedure.

CAUTION: Never rotate crankshaft.

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

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

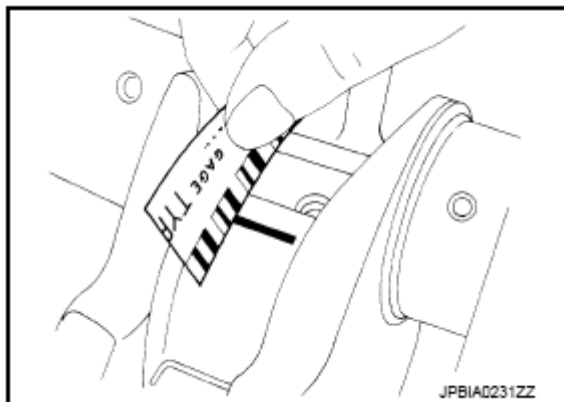


Fig. 249: Measuring Plastigage Width Using Scale On Plastigage Bag
 Courtesy of NISSAN NORTH AMERICA, INC.

MAIN BEARING CRUSH HEIGHT

- When main bearing cap is removed after being tightened to the specified torque with main bearings (1) installed, the tip end of bearing must protrude. Refer to "**DISASSEMBLY AND ASSEMBLY**" for the tightening procedure.

Standard: There must be crush height .

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

A : Crush height

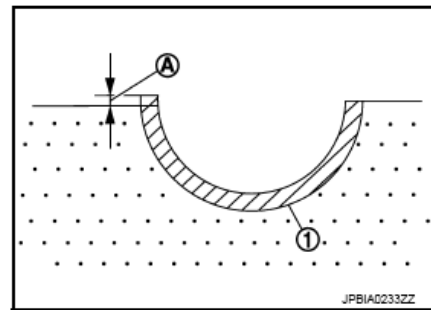


Fig. 250: Identifying Main Bearing And Crush Height
 Courtesy of NISSAN NORTH AMERICA, INC.

CONNECTING ROD BEARING CRUSH HEIGHT

- When connecting rod bearing cap is removed after being tightened f 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

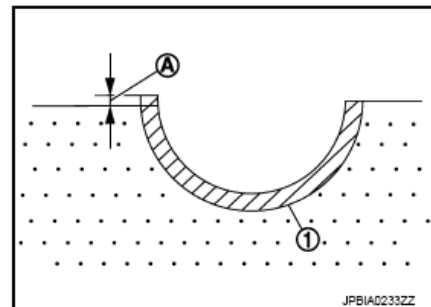


Fig. 251: Identifying Connecting Rod Bearing And Crush Height
 Courtesy of NISSAN NORTH AMERICA, INC.

Standard: There must be crush height .

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

MAIN BEARING CAP BOLT OUTER DIAMETER

- Measure the outer diameters (A), (B) at two positions as shown in the figure.

c : 20 mm (0.79 in)
 d : 55 mm (2.17 in)
 e : 12 mm (0.47 in)

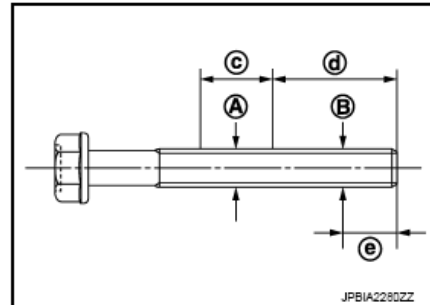


Fig. 252: Identifying Main Bearing Cap Bolt Outer Diameter
 Courtesy of NISSAN NORTH AMERICA, INC.

- If reduction appears in (A) range, regard it (B).

Limit [(B) - (A)]: 0.15 mm (0.0059 in)

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

MAIN BEARING CAP SUB BOLT OUTER DIAMETER

- Measure the outer diameters (A), (B) at two positions as shown in the figure.

c : 20 mm (0.79 in)
 d : 15 mm (0.59 in)
 e : 9 mm (0.35 in)

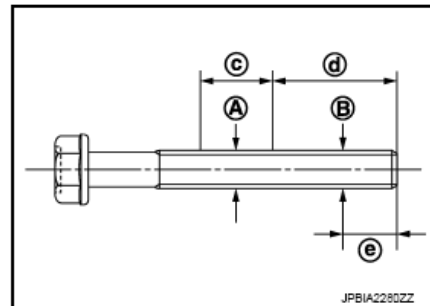


Fig. 253: Identifying Main Bearing Cap Sub Bolt Outer Diameter
 Courtesy of NISSAN NORTH AMERICA, INC.

- If reduction appears in (A) range, regard it (B).

Limit [(B) - (A)]: 0.10 mm (0.0039 in)

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

CONNECTING ROD BOLT OUTER DIAMETER

1. Measure the outer diameters [(a), (b) and (c)] at the position shown in the figure.

- a : Value at the end of the smaller diameter of the bolt
 b : Value at the end of the smaller diameter of the bolt [opposite side of (a)]
 c : Value of the smallest diameter of the smaller of the bolt

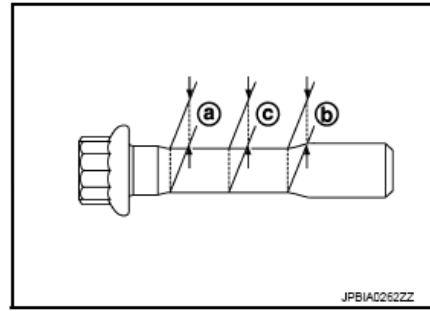


Fig. 254: Identifying Connecting Rod Bolt Outer Diameter

Courtesy of NISSAN NORTH AMERICA, INC.

2. Obtain a mean value (d) of (a) and (b).
3. Subtract (c) from (d).

Limit [(d) - (c)]: 0.08 mm (0.0032 in)

4. If it exceeds the limit (large difference in dimensions), replace the bolt with new one.

OIL JET

- Check nozzle for deformation and damage.
- Blow compressed air from nozzle, and check for clogs.
- 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, clean or replace oil jet.

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)	Determined by match of connecting rod big end diameter grade (inner diameter of housing) and crankshaft pin outer diameter.
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)

- 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 on the bottom face of the cylinder block, and select the piston of the same grade.

NOTE: Piston is available with piston pin as a set for the service part.

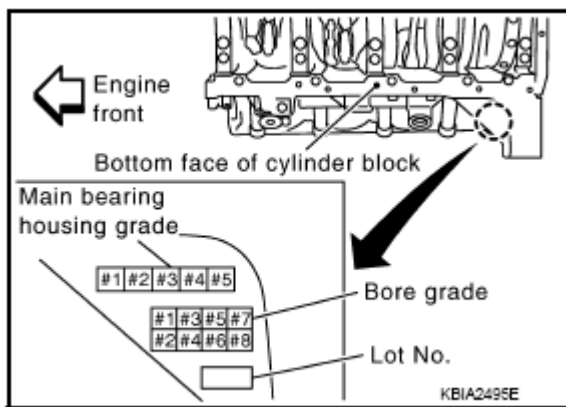


Fig. 255: Identifying Main Bearing Housing Grade Label
Courtesy of NISSAN NORTH AMERICA, INC.

WHEN CYLINDER BLOCK IS REUSED

1. Measure the cylinder bore inner diameter. Refer to "CYLINDER BLOCK".
2. Determine the bore grade by comparing the measurement with the values under the cylinder bore inner diameter of the "PISTON SELECTION TABLE".

- A : Bank 2
 B : Bank 1
 C : Front mark
 D : Piston grade number
 E : Piston pin grade number
 F : Identification code

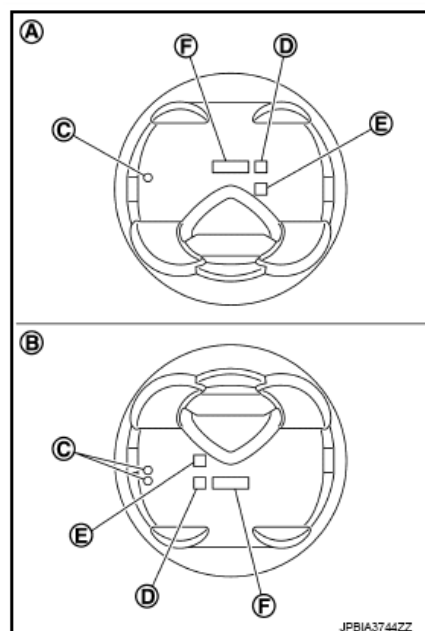


Fig. 256: Identifying Piston And Pin Grade Number With Identification Code
 Courtesy of NISSAN NORTH AMERICA, INC.

3. Select piston of the same grade.

PISTON SELECTION TABLE

			Unit: mm (in)
Grade	1	2	3
Cylinder bore inner diameter	98.000 - 98.010 (3.8583 - 3.8587)	98.010 - 98.020 (3.8587 - 3.8590)	98.020 - 98.030 (3.8590 - 3.8594)
Piston skirt diameter	97.980 - 97.990 (3.8575 - 3.8579)	97.990 - 98.000 (3.8579 - 3.8583)	98.000 - 98.010 (3.8583 - 3.8587)

NOTE: Piston is available together with piston pin as assembly.

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

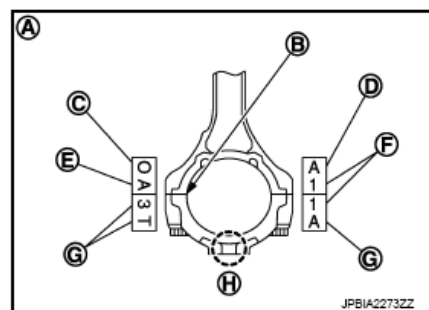


Fig. 257: Identifying Connecting Rod Bearing Grades And Codes
 Courtesy of NISSAN NORTH AMERICA, INC.

2. Apply crankshaft pin journal diameter grade stamped on crankshaft front side to the column in the "CONNECTING ROD BEARING SELECTION TABLE".

- A : Pin diameter grade No. 1
- B : Pin diameter grade No. 2
- C : Pin diameter grade No. 3
- D : Pin diameter grade No. 4
- E : Journal diameter grade No. 1
- F : Journal diameter grade No. 2
- G : Journal diameter grade No. 3
- H : Journal diameter grade No. 4
- I : Journal diameter grade No. 5

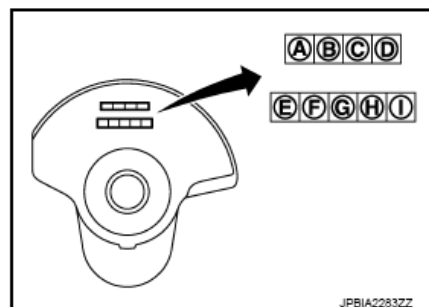


Fig. 258: Identifying Journal Diameter Grades And Pin Diameter Grades
 Courtesy of NISSAN NORTH AMERICA, INC.

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 journal diameter column of "CONNECTING ROD BEARING SELECTION TABLE".
4. Follow from step 3 in "WHEN NEW CONNECTING ROD AND CRANKSHAFT ARE USED".

CONNECTING ROD BEARING GRADE TABLE

Connecting rod big end. inner diameter Crankshaft pin outer diameter		Mark	A	B	C	D	E	F	G	H	J	K	L	M	N
		Inner diameter Unit: mm (in)	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 – 2.2443)	57.004 – 57.005 (2.2443 – 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	Outer diameter Unit: mm (in)		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 – 2.2443)	57.004 – 57.005 (2.2443 – 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)
0	53.968 – 53.974 (2.1247 – 2.1250)	1	1	1	1	1	1	1	2	2	2	2	2	2	3
1	53.962 – 53.968 (2.1245 – 2.1247)	2	2	2	2	2	2	2	3	3	3	3	3	3	4
2	53.956 – 53.962 (2.1243 – 2.1245)	3	3	3	3	3	3	3	4	4	4	4	4	4	4

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Fig. 259: 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)].

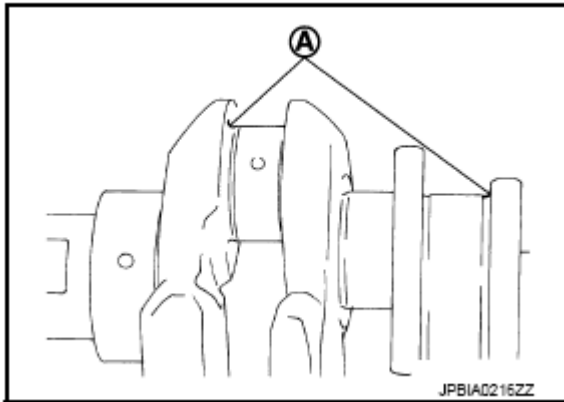


Fig. 260: Identifying Crankshaft Fillet Area
 Courtesy of NISSAN NORTH AMERICA, INC.

Bearing undersize table: Refer to "CONNECTING ROD BEARING".

Main Bearing

WHEN NEW CYLINDER BLOCK AND CRANKSHAFT ARE USED

1. Apply the main bearing housing grade on the bottom face of the cylinder block to the row in "MAIN BEARING SELECTION TABLE".

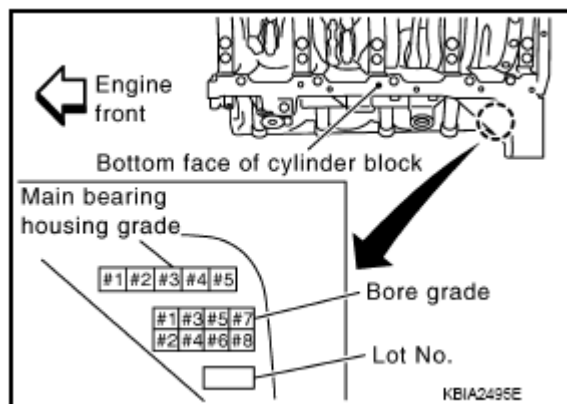


Fig. 261: Identifying Main Bearing Housing Grade Label
 Courtesy of NISSAN NORTH AMERICA, INC.

2. "MAIN BEARING SELECTION TABLE" columns correspond to journal diameter grade on front side of crankshaft.

- A : Pin diameter grade No. 1
 B : Pin diameter grade No. 2
 C : Pin diameter grade No. 3
 D : Pin diameter grade No. 4
 E : Journal diameter grade No. 1
 F : Journal diameter grade No. 2
 G : Journal diameter grade No. 3
 H : Journal diameter grade No. 4
 I : Journal diameter grade No. 5

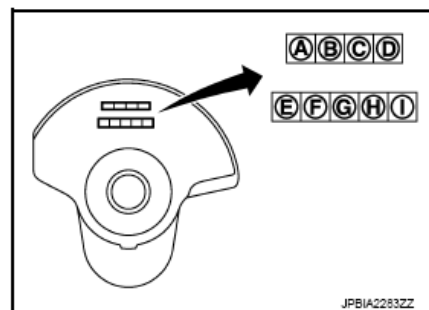


Fig. 262: Identifying Journal Diameter Grades And Pin Diameter Grades
 Courtesy of NISSAN NORTH AMERICA, INC.

3. Select main bearing grade at the point where selected row and column meet in "MAIN BEARING SELECTION TABLE".

CAUTION:

- Initial clearance for No. 1, 5 journal and No. 2, 3, 4 journal is different. Use two different selection table for each part.
- No. 1, 5 journal and No. 2, 3, 4 journal have the same signs but different measures. Never confuse.

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 from step 3 in "When New Cylinder Block and Crankshaft are Used".

MAIN BEARING SELECTION TABLE (No. 1 and 5 Journal)

Cylinder block main bearing housing inner diameter		I.D. mark	Hole diameter Unit: mm (in)																											
			A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V	W	X	Y	4	7				
Crankshaft main journal diameter	I.D. mark	Axle diameter Unit: mm (in)	68.944 - 68.945 (2.7143 - 2.7144)	68.945 - 68.946 (2.7144 - 2.7144)	68.946 - 68.947 (2.7144 - 2.7144)	68.947 - 68.948 (2.7144 - 2.7145)	68.948 - 68.949 (2.7145 - 2.7145)	68.949 - 68.950 (2.7145 - 2.7146)	68.950 - 68.951 (2.7146 - 2.7146)	68.951 - 68.952 (2.7146 - 2.7146)	68.952 - 68.953 (2.7146 - 2.7147)	68.953 - 68.954 (2.7147 - 2.7147)	68.954 - 68.955 (2.7147 - 2.7148)	68.955 - 68.956 (2.7148 - 2.7148)	68.956 - 68.957 (2.7148 - 2.7148)	68.957 - 68.958 (2.7148 - 2.7149)	68.958 - 68.959 (2.7149 - 2.7149)	68.959 - 68.960 (2.7149 - 2.7150)	68.960 - 68.961 (2.7150 - 2.7150)	68.961 - 68.962 (2.7150 - 2.7151)	68.962 - 68.963 (2.7151 - 2.7151)	68.963 - 68.964 (2.7151 - 2.7151)	68.964 - 68.965 (2.7151 - 2.7152)	68.965 - 68.966 (2.7152 - 2.7152)	68.966 - 68.967 (2.7152 - 2.7152)	68.967 - 68.968 (2.7152 - 2.7153)				
			1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5		
G	63.964 - 63.963 (2.5183 - 2.5182)		1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5			
H	63.963 - 63.962 (2.5182 - 2.5182)		12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5				
J	63.962 - 63.961 (2.5182 - 2.5181)		12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5				
K	63.961 - 63.960 (2.5181 - 2.5181)		12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56				
L	63.960 - 63.959 (2.5181 - 2.5181)		12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56				
M	63.959 - 63.958 (2.5181 - 2.5180)		2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56				
N	63.958 - 63.957 (2.5180 - 2.5180)		2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6				
P	63.957 - 63.956 (2.5180 - 2.5179)		2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6				
R	63.956 - 63.955 (2.5179 - 2.5179)		23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6				
S	63.955 - 63.954 (2.5179 - 2.5179)		23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67				
T	63.954 - 63.953 (2.5179 - 2.5178)		23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67				
U	63.953 - 63.952 (2.5178 - 2.5178)		3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67				
V	63.952 - 63.951 (2.5178 - 2.5178)		3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7				
W	63.951 - 63.950 (2.5178 - 2.5177)		3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7				
X	63.950 - 63.949 (2.5177 - 2.5177)		34	34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7				
Y	63.949 - 63.948 (2.5177 - 2.5176)		34	34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	78				
1	63.948 - 63.947 (2.5176 - 2.5176)		34	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	78	78				
2	63.947 - 63.946 (2.5176 - 2.5176)		4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	78	78	78				
3	63.946 - 63.945 (2.5176 - 2.5175)		4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	78	78	78	8				
4	63.945 - 63.944 (2.5175 - 2.5175)		4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	78	78	78	8	8				
5	63.944 - 63.943 (2.5175 - 2.5174)		45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	78	78	78	8	8	8				
6	63.943 - 63.942 (2.5174 - 2.5174)		45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	78	78	78	8	8	8	X				
7	63.942 - 63.941 (2.5174 - 2.5174)		45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	78	78	78	8	8	8	X	X				
9	63.941 - 63.940 (2.5174 - 2.5173)		5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	78	78	78	8	8	8	X	X	X				

JPB/A2265GB

Fig. 263: Main Bearing Selection Chart (No. 1 And 5 Journal)

Courtesy of NISSAN NORTH AMERICA, INC.

MAIN BEARING SELECTION TABLE (No. 2, 3 and 4 Journal)

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)].

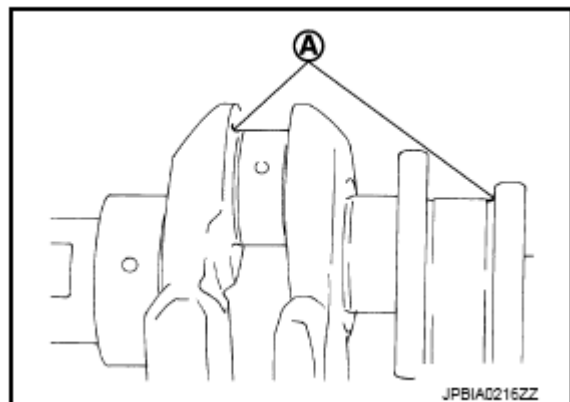


Fig. 265: Identifying Crankshaft Fillet Area
Courtesy of NISSAN NORTH AMERICA, INC.

Bearing undersize table: Refer to "MAIN BEARING".

SERVICE DATA AND SPECIFICATIONS (SDS)

SERVICE DATA AND SPECIFICATIONS (SDS)

General Specification

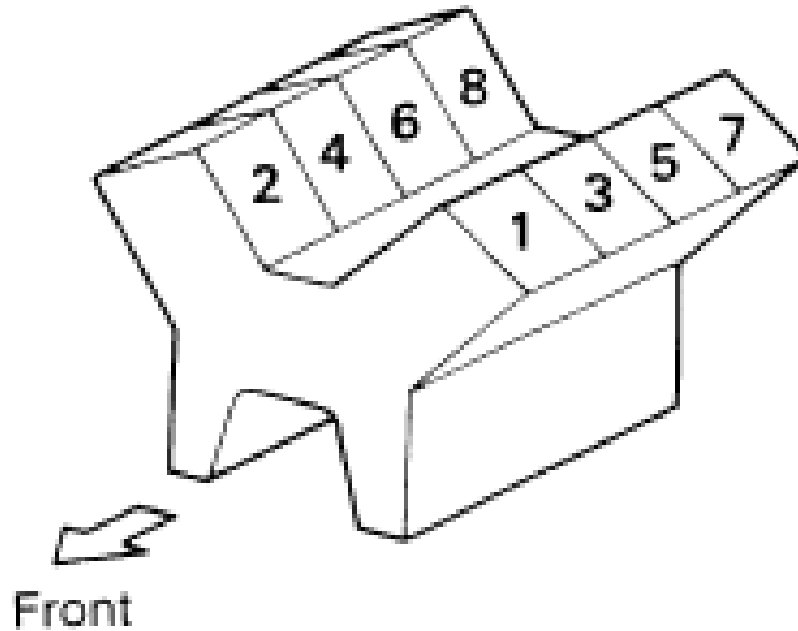
GENERAL SPECIFICATIONS

Cylinder arrangement		V-8
Displacement cm ³ (cu in)		5, 552 (338.80)
Bore and stroke mm (in)		98.0 x 92.0 (3.86 x 3.62)
Valve arrangement		DOHC
Firing order		1-8-7-3-6-5-4-2
Number of piston rings	Compression	2
	Oil	1
Number of main bearings		5
Compression ratio		10.8
Compression pressure kPa (kg/cm ² , psi)/200rpm	Standard	1, 667 (17, 242)
	Minimum	1, 226 (12.5, 178)
	Differential limit between cylinders	98 (1.0, 14)

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Cylinder number



SEM957C

Unit: degree

Valve timing	Intake valve open (BTDC)	(-61) - (+ 58)
	Intake valve close (ABDC)	(-76) - (+ 69)
	Exhaust valve open (BBDC)	56
	Exhaust valve close (ATDC)	8

Drive Belts**DRIVE BELT**

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

Spark Plug**SPARK PLUG**

Unit: mm (in)		
Make		NGK
Standard type		DILKAR7B11
Gap	Standard	1.1 (0.043)
	Limit	1.25 (0.049)

Exhaust Manifold

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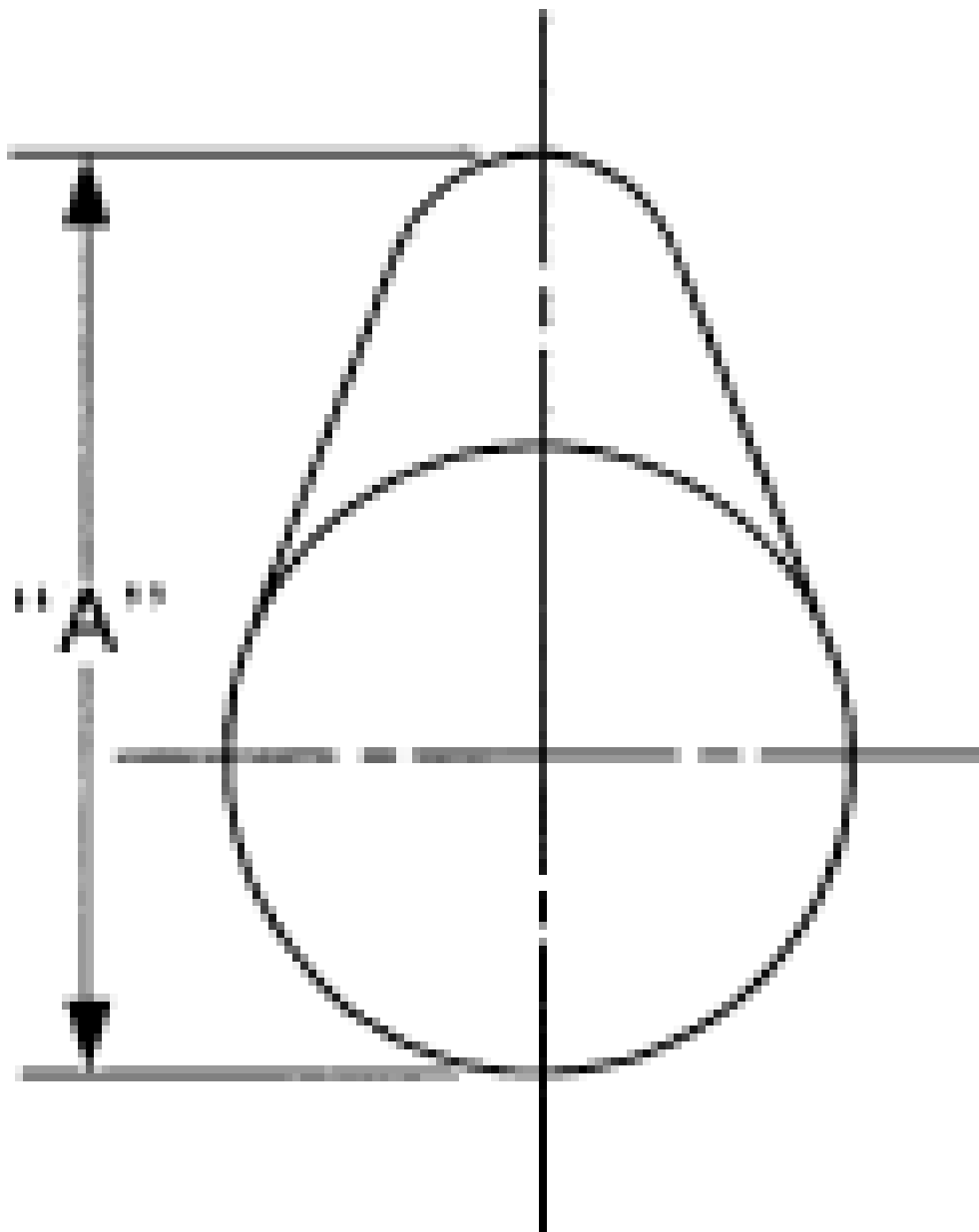
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EXHAUST MANIFOLD

		Unit: mm (in)
Items		Limit
Surface distortion	Exhaust manifold	0.7 (0.028)

Camshaft**EXHAUST CAMSHAFT**

			Unit: mm (in)
Items	Standard	Limit	
Exhaust camshaft journal oil clearance	0.030 - 0.071 (0.0012 - 0.0028)	0.150 (0.0059)	
VVEL ladder assembly bracket inner diameter (EXH side)	26.000 - 26.021 (1.0236 - 1.0244)	-	
Exhaust camshaft journal diameter	25.935 - 25.955 (1.0211 - 1.0218)	-	
Exhaust camshaft end play	0.115 - 0.188 (0.0045 - 0.0074)	0.24 (0.0094)	
Exhaust camshaft cam height "A"	45.475 - 45.665 (1.7904 - 1.7978)	45.275 (1.7825)	
Exhaust camshaft runout [TIR ⁽¹⁾]	Less than 0.02 (0.0008)	0.05 (0.002)	
Exhaust camshaft sprocket runout [TIR ⁽¹⁾]	-	0.2 (0.0079)	



SEM571

(1) Total indicator reading

INTAKE CAMSHAFT

Unit: mm (in)

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Items	Standard	Limit
Drive shaft end play	0.115 - 0.188 (0.0045 - 0.0074)	0.24 (0.0094)
Intake camshaft sprocket runout [TIR ⁽¹⁾]	-	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 ⁽¹⁾ (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)		

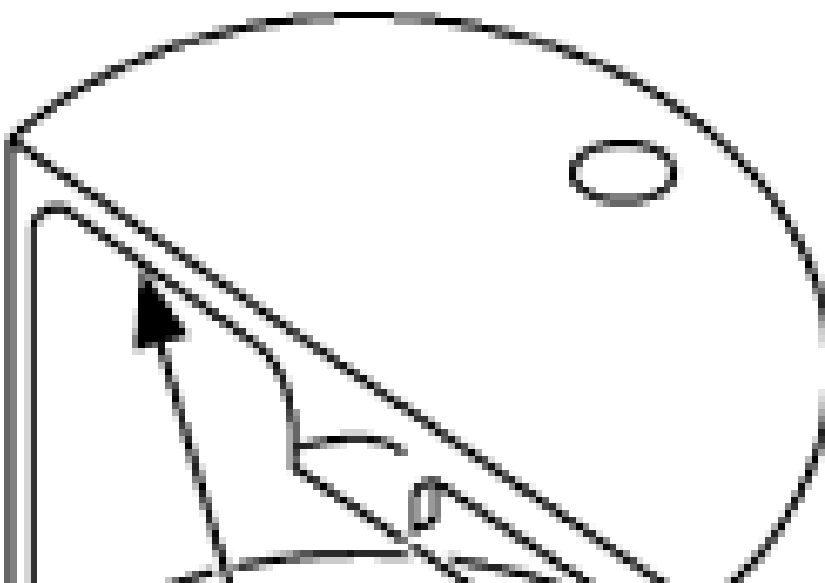
AVAILABLE VALVE LIFTER

Unit: mm (in)	
Identification (stamped) mark	Thickness
788P	7.88 (0.3102)
790P	7.90 (0.3110)
792P	7.92 (0.3118)
794P	7.94 (0.3126)
796P	7.96 (0.3134)
798P	7.98 (0.3142)
800P	8.00 (0.3150)
802P	8.02 (0.3157)
804P	8.04 (0.3165)
806P	8.06 (0.3173)
808P	8.08 (0.3181)
810P	8.10 (0.3189)
812P	8.12 (0.3197)
814P	8.14 (0.3205)
816P	8.16 (0.3213)
818P	8.18 (0.3220)

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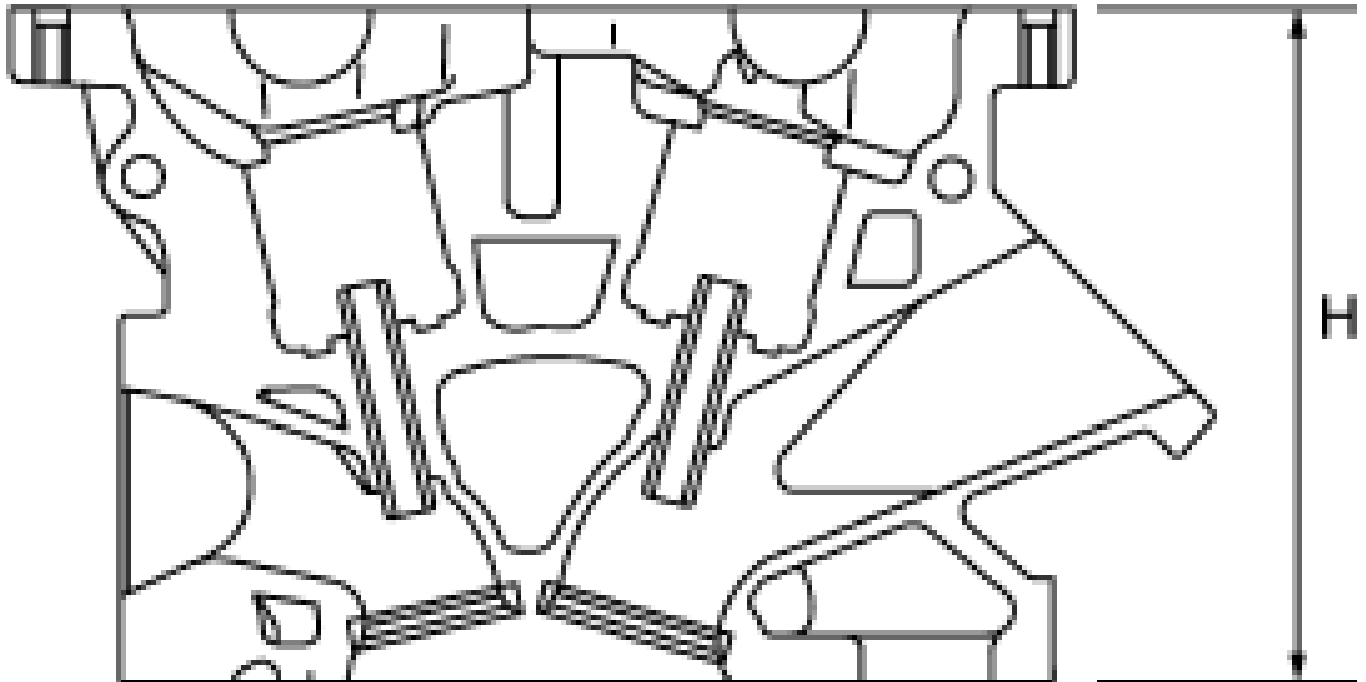
820P	8.20 (0.3228)
822P	8.22 (0.3236)
824P	8.24 (0.3244)
826P	8.26 (0.3252)
828P	8.28 (0.3260)
830P	8.30 (0.3268)
832P	8.32 (0.3276)
834P	8.34 (0.3283)
836P	8.36 (0.3291)
838P	8.38 (0.3299)
840P	8.40 (0.3307)



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"	126.3 (4.97)	-

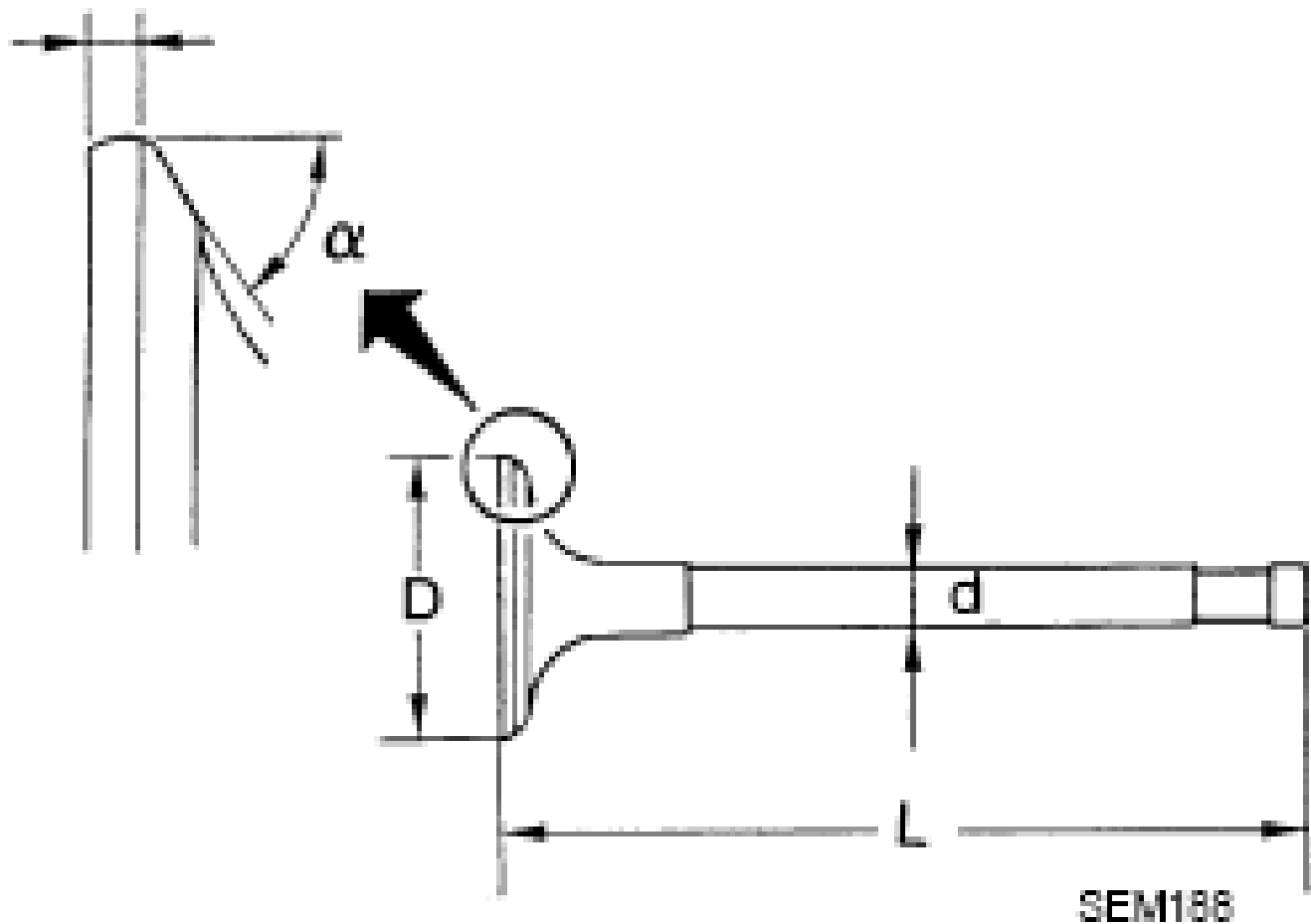


PBIC0924E

VALVE DIMENSIONS

Unit: mm (in)

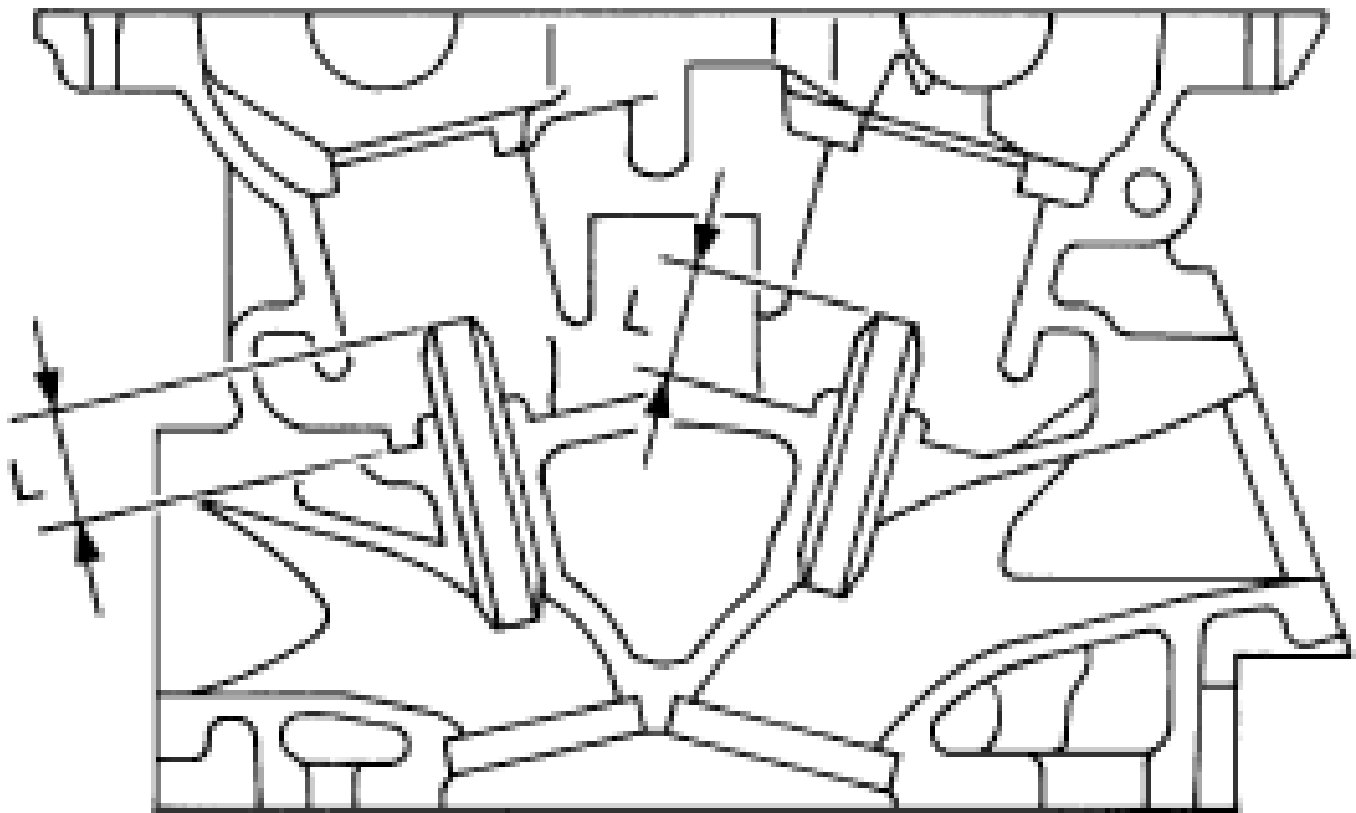
T (Margin thickness)



Valve head diameter "D"	Intake	36.6 - 36.9 (1.441 - 1.453)
	Exhaust	31.2 - 31.5 (1.228 - 1.240)
Valve length "L"	Intake	99.19 - 99.69 (3.9051 - 3.9248)
	Exhaust	93.74 - 94.24 (3.6905 - 3.7102)
Valve stem diameter "d"	Intake	5.965 - 5.980 (0.2348 - 0.2354)
	Exhaust	5.955 - 5.970 (0.2344 - 0.2350)
Valve seat angle "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)

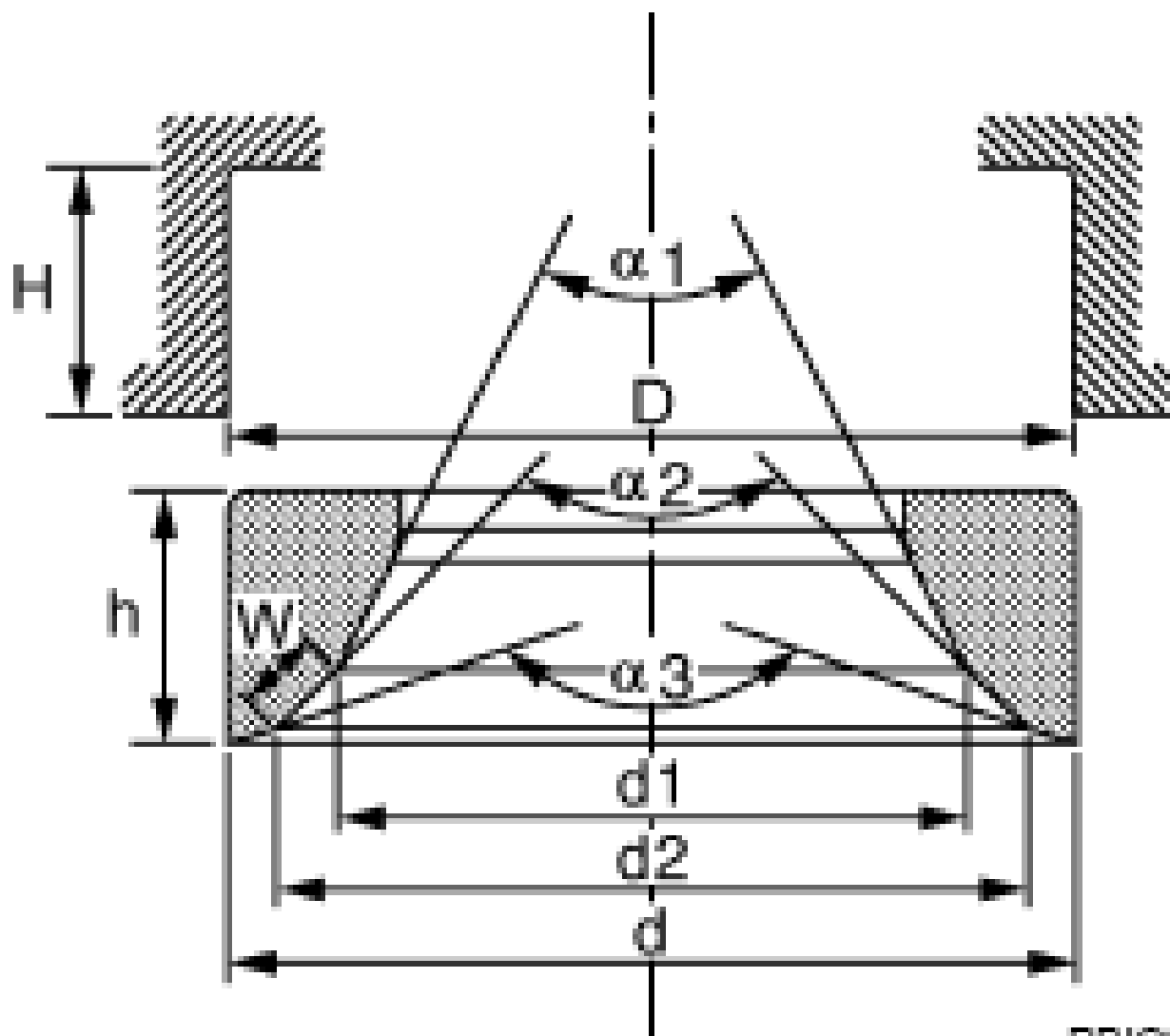
**SEM950E**

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)*
	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) ⁽¹⁾
Interference fit of valve guide		0.027 - 0.059 (0.0011 - 0.0023)	
Items		Standard	Limit
Valve guide clearance	Intake	0.020 - 0.053 (0.0008 - 0.0021)	0.08 (0.003)
	Exhaust	0.030 - 0.063 (0.0012 - 0.0025)	0.09 (0.004)
Projection length "L"	Intake	12.6 - 12.8 (0.496 - 0.504)	
	Exhaust	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)] (4)
Cylinder head seat recess diameter "D"	Intake	38.000 - 38.016 (1.4961 - 1.4967)	-
	Exhaust	32.200 - 32.216 (1.2677 - 1.2683)	32.700 - 32.716 (1.2874 - 1.2880) (4)
		38.097 - 38.113 (1.4999 -	

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Valve seat outer diameter "d"	Intake	1.5005)	-
	Exhaust	32.280 - 32.296 (1.2709 - 1.2715)	32.780 - 32.796 (1.2906 - 1.2912) (4)
Valve seat interference fit	Intake	0.081 - 0.113 (0.0032 - 0.0044)	
	Exhaust	0.064 - 0.096 (0.0025 - 0.0038)	
Diameter "d1"(1)	Intake	34.6 (1.362)	
	Exhaust	28.7 (1.130)	
Diameter "d2"(2)	Intake	35.9 - 36.4 (1.413 - 1.433)	
	Exhaust	30.3 - 30.8 (1.193 - 1.213)	
Angle "a1"		59 - 61°	
Angle "a2"		88°75' - 90°25'	
Angle "a3"		119 - 1 2 1°	
Contacting width "W"(3)	Intake	1.0 - 1.4 (0.039 - 0.055)	
	Exhaust	1.2 - 1.6 (0.047 - 0.063)	
Height "h"	Intake	5.9 - 6.0 (0.232 - 0.236)	-
	Exhaust	5.9 - 6.0 (0.232 - 0.236)	4.95 - 5.05 (0.1949 - 0.1988)*4
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

Item		Standard	
		Intake	Exhaust
Free height		47.28 mm (1.8614 in)	48.06 mm (1.8921 in)
Pressure	Installation	166 - 188 N (16.9 - 19.2 kg, 37 - 42 lb) at 41.0 mm (1.614 in)	166 - 188 N (16.9 - 19.2 kg, 37 - 42 lb) at 34.45 mm (1.3563 in)
	Valve open	541 - 611 N (55.2 - 62.3 kg, 122 - 137 lb) at 29.6 mm (1.165 in)	320.1 - 360.1 N (32.7 - 36.7 kg, 72 - 81 lb) at 24.65 mm (0.9705 in)
Identification color		Light green	Light blue

Item	Limit	
	Intake	Exhaust
Out-of-square	2.1 mm (0.083 in)	2.0 mm (0.079 in)

Cylinder Block

CYLINDER BLOCK

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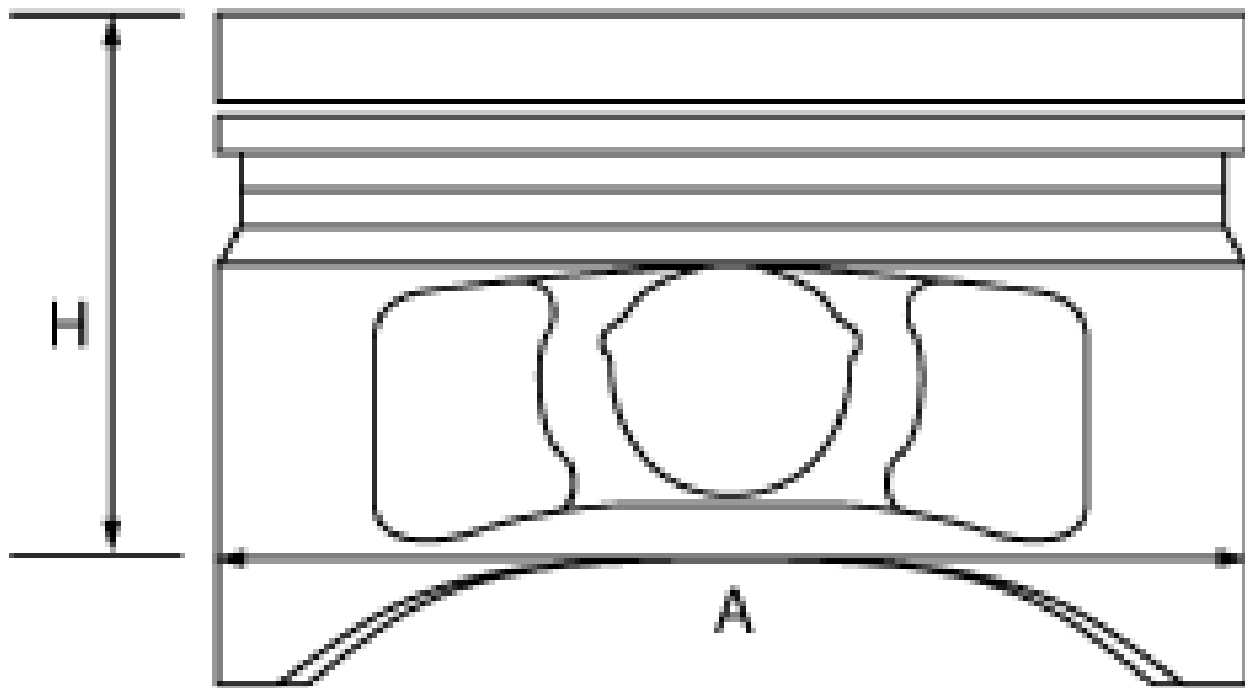
Unit: mm (in)				
Surface flatness		Limit		0.1 (0.004)
Main bearing housing inner diameter		Standard		68.944 - 68.968 (2.7143 - 2.7153)
Cylinder bore	Inner diameter	Standard	Grade No. 1	98.000 - 98.010 (3.8583 - 3.8587)
			Grade No. 2	98.010 - 98.020 (3.8587 - 3.8590)
			Grade No. 3	98.020 - 98.030 (3.8590 - 3.8594)
		Wear limit		0.2 (0.008)
Out-of-round		Limit		0.015 (0.0006)
Taper				0.010 (0.0004)
Main bearing housing inner diameter grade (Without bearing)			Grade No. A	68.944 - 68.945 (2.7143 - 2.7144)
			Grade No. B	68.945 - 68.946 (2.7144 - 2.7144)
			Grade No. C	68.946 - 68.947 (2.7144 - 2.7144)
			Grade No. D	68.947 - 68.948 (2.7144 - 2.7145)
			Grade No. E	68.948 - 68.949 (2.7145 - 2.7145)
			Grade No. F	68.949 - 68.950 (2.7145 - 2.7146)
			Grade No. G	68.950 - 68.951 (2.7146 - 2.7146)
			Grade No. H	68.951 - 68.952 (2.7146 - 2.7146)
			Grade No. J	68.952 - 68.953 (2.7146 - 2.7147)
			Grade No. K	68.953 - 68.954 (2.7147 - 2.7147)
			Grade No. L	68.955 (2.7147 - 2.7148)
			Grade No. M	68.955 - 68.956 (2.7148 - 2.7148)
			Grade No. N	68.956 - 68.957 (2.7148 - 2.7148)
			Grade No. P	68.957 - 68.958 (2.7148 - 2.7149)
			Grade No. R	68.958 - 68.959 (2.7149 - 2.7149)
			Grade No. S	68.959 - 68.960 (2.7149 - 2.7150)
				68.960 - 68.961 (2.7150 -

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	Grade No. T	2.7150)
	Grade No. U	68.962 - 68.963 (2.7150 - 2.7151)
	Grade No. V	68.961 - 68.962 (2.7150 - 2.7150)
	Grade No. W	68.963 - 68.964 (2.7151 - 2.7151)
	Grade No. X	68.964 - 68.965 (2.7151 - 2.7152)
	Grade No. Y	68.965 - 68.966 (2.7152 - 2.7152)
	Grade No. 4	68.966 - 68.967 (2.7152 - 2.7152)
	Grade No. 7	68.967 - 68.968 (2.7152 - 2.7153)
Difference in inner diameter between cylinders	Standard	Less than 0.03 (0.0012)

AVAILABLE PISTON

Unit: mm (in)

**PBIC0188E**

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Items		Standard	Oversize (Service) [0.2 (0.008)]
Piston skirt diameter "A"	Grade No. 1	97.980 - 97.990 (3.8575 - 3.8579)	-
	Grade No. 2	97.990 - 98.000 (3.8579 - 3.8583)	-
	Grade No. 3	98.000 - 98.010 (3.8583 - 3.8587)	-
	Service	-	95.680 - 95.710 (3.7669 - 3.7681)
Items		Standard	Limit
"H" dimension		40.0 (1.5748)	-
Piston pin hole diameter		21.993 - 21.999 (0.8659 - 0.8661)	-
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	0.015 - 0.185 (0.0006 - 0.00728)	0.22 (0.0087)
End gap	Top	0.23 - 0.28 (0.0091 - 0.0110)	0.50 (0.0197)
	2nd	0.50 - 0.65 (0.0197 - 0.0256)	0.84 (0.0331)
	Oil (rail ring)	0.20 - 0.60 (0.0079 - 0.0236)	0.95 (0.0374)

PISTON PIN

			Unit: mm (in)
Items		Standard	Limit
Piston pin outer diameter		21.989 - 21.995 (0.8657 - 0.8659)	-
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

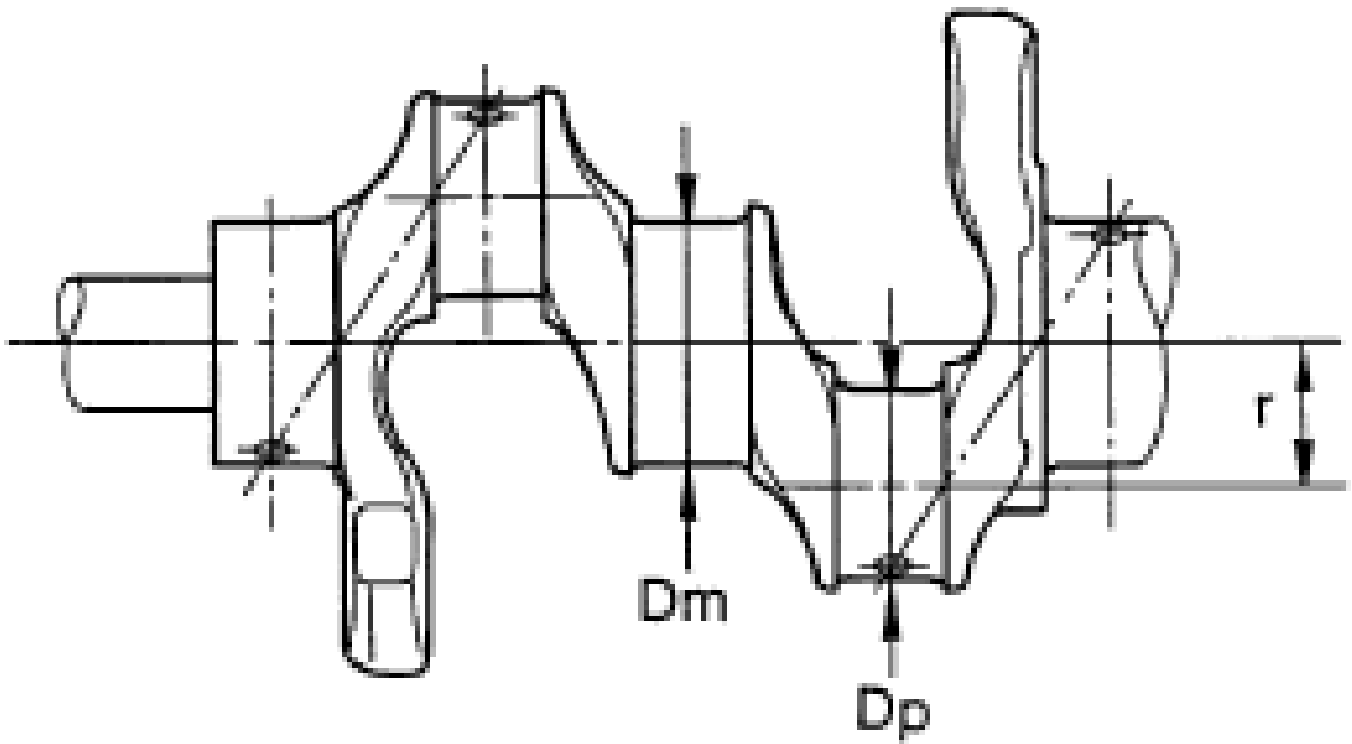
			Unit: mm (in)
Items		Standard	Limit
Center distance		154.45 - 154.55 (6.08 - 6.08)	-
Bend [per 100 (3.94)]		-	0.15 (0.0059)
Torsion [per 100 (3.94)]		-	0.30 (0.0118)
Connecting rod bushing inner diameter ⁽¹⁾		22.000 - 22.006 (0.8661 - 0.8664)	-

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Connecting rod big end diameter (Without bearing)	Grade No. A	57.000 - 57.001 (2.2441 - 2.2441)
	Grade No. B	57.001 - 57.002 (2.2441 - 2.2442)
	Grade No. C	57.002 - 57.003 (2.2442 - 2.2442)
	Grade No. D	57.003 - 57.004 (2.2442 - 2.2442)
	Grade No. E	57.004 - 57.005 (2.2442 - 2.2443)
	Grade No. F	57.005 - 57.006 (2.2443 - 2.2443)
	Grade No. G	57.006 - 57.007 (2.2443 - 2.2444)
	Grade No. H	57.007 - 57.008 (2.2444 - 2.2444)
	Grade No. J	57.008 - 57.009 (2.2444 - 2.2444)
	Grade No. K	57.009 - 57.010 (2.2444 - 2.2445)
	Grade No. L	57.010 - 57.011 (2.2445 - 2.2445)
Side clearance	Grade No. M	57.011 - 57.012 (2.2445 - 2.2446)
	Grade No. N	57.012 - 57.013 (2.2446 - 2.2446)
(1) After installing in connecting rod		

CRANKSHAFT

Unit: mm (in)



SEM645

Grade No. G	63.964 - 63.963 (2.5183 - 2.5182)
Grade No. H	63.963 - 63.962 (2.5182 - 2.5182)
Grade No. J	63.962 - 63.961 (2.5182 - 2.5181)
Grade No. K	63.961 - 63.960 (2.5181 - 2.5181)
Grade No. L	63.960 - 63.959 (2.5181 - 2.5181)
Grade No. M	63.959 - 63.958 (2.5181 - 2.5180)
Grade No. N	63.958 - 63.957 (2.5180 - 2.5180)
Grade No. P	63.957 - 63.956 (2.5180 - 2.5179)
Grade No. R	63.956 - 63.955 (2.5179 - 2.5179)
Grade No. S	63.955 - 63.954 (2.5179 -

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Main journal diameter. "Dm" grade (No. 1 and 5 journal)	Standard	Grade No. T	2.5179) 63.954 - 63.953 (2.5179 - 2.5178)
		Grade No. U	63.953 - 63.952 (2.5178 - 2.5178)
		Grade No. V	63.952 - 63.951 (2.5178 - 2.5178)
		Grade No. W	63.951 - 63.950 (2.5178 - 2.5177)
		Grade No. X	63.950 - 63.949 (2.5177 - 2.5177)
		Grade No. Y	63.949 - 63.948 (2.5177 - 2.5176)
		Grade No. 1	63.948 - 63.947 (2.5176 - 2.5176)
		Grade No. 2	63.947 - 63.946 (2.5176 - 2.5176)
		Grade No. 3	63.946 - 63.945 (2.5176 - 2.5175)
		Grade No. 4	63.945 - 63.944 (2.5175 - 2.5175)
		Grade No. 5	63.944 - 63.943 (2.5175 - 2.5174)
		Grade No. 6	63.943 - 63.942 (2.5174 - 2.5174)
		Grade No. 7	63.942 - 63.941 (2.5174 - 2.5174)
		Grade No. 9	63.941 - 63.940 (2.5174 - 2.5173)
		Grade No. A	63.963 - 63.964 (2.5182 - 2.5183)
		Grade No. B	63.962 - 63.963 (2.5182 - 2.5182)
		Grade No. C	63.961 - 63.962 (2.5181 - 2.5182)
		Grade No. D	63.960 - 63.961 (2.5181 - 2.5181)
		Grade No. E	63.959 - 63.960 (2.5181 - 2.5181)
		Grade No. F	63.958 - 63.959 (2.5180 - 2.5181)
		Grade No. G	63.957 - 63.958 (2.5180 - 2.5180)
		Grade No. H	63.956 - 63.957 (2.5179 - 2.5180)

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Main journal diameter. "Dm" grade (No. 2, 3 and 4 journal)	Standard	Grade No. J	63.955 - 63.956 (2.5179 - 2.5179)
		Grade No. K	63.954 - 63.955 (2.5179 - 2.5179)
		Grade No. L	63.953 - 63.954 (2.5178 - 2.5179)
		Grade No. M	63.952 - 63.953 (2.5178 - 2.5178)
		Grade No. N	63.951 - 63.952 (2.5178 - 2.5178)
		Grade No. P	63.950 - 63.951 (2.5177 - 2.5178)
		Grade No. R	63.949 - 63.950 (2.5177 - 2.5177)
		Grade No. S	63.948 - 63.949 (2.5176 - 2.5177)
		Grade No. T	63.947 - 63.948 (2.5176 - 2.5176)
		Grade No. U	63.946 - 63.947 (2.5176 - 2.5176)
		Grade No. V	63.945 - 63.946 (2.5175 - 2.5176)
		Grade No. W	63.944 - 63.945 (2.5175 - 2.5175)
		Grade No. X	63.943 - 63.944 (2.5174 - 2.5175)
		Grade No. Y	63.942 - 63.943 (2.5174 - 2.5174)
		Grade No. 1	63.941 - 63.942 (2.5174 - 2.5174)
		Grade No. 2	63.940 - 63.941 (2.5173 - 2.5174)
Pin journal diameter. "Dp" grade	Standard	Grade No. 0	53.968 - 53.974 (2.1247 - 2.1250)
		Grade No. 1	53.962 - 53.968 (2.1245 - 2.1247)
		Grade No. 2	53.956 - 53.962 (2.1243 - 2.1245)
Center distance "r"			45.96 - 46.04 (1.8095 - 1.8126)
Taper	Limit	0.0025 (0.0001)	
Out-of-round		0.0025 (0.0001)	
Crankshaft runout [TIR ⁽¹⁾]	Standard	Less than 0.05 (0.002)	
	Limit	0.10 (0.0039)	
Crankshaft end play	Standard	0.10 - 0.26 (0.0039 - 0.0102)	
	Limit	0.30 (0.012)	

(1) Total indicator reading

Main Bearing**MAIN BEARING**

Grade number		Thickness mm (in)	Width mm (in)	Identification color	Remarks
0		2.483 - 2.486 (0.0978 - 0.0979)	19.9 - 20.1 (0.783 - 0.791)	Black	Grade is the same for upper and lower bearings.
1		2.486 - 2.489 (0.0979 - 0.0980)		Brown	
2		2.489 - 2.492 (0.0980 - 0.0981)		Green	
3		2.492 - 2.495 (0.0981 - 0.0982)		Yellow	
4		2.495 - 2.498 (0.0982 - 0.0983)		Blue	
5		2.498 - 2.501 (0.0983 - 0.0985)		Pink	
6		2.501 - 2.504 (0.0985 - 0.0986)		Purple	
7		2.504 - 2.507 (0.0986 - 0.0987)		White	
8		2.507 - 2.510 (0.0987 - 0.0988)		Red	
01	UPR	2.483 - 2.486 (0.0978 - 0.0979)		Black	Grade and color are different for upper and lower bearings.
	LWR	2.486 - 2.489 (0.0979 - 0.0980)		Brown	
12	UPR	2.486 - 2.489 (0.0979 - 0.0980)		Brown	
	LWR	2.489 - 2.492 (0.0980 - 0.0981)		Green	
23	UPR	2.489 - 2.492 (0.0980 - 0.0981)		Green	
	LWR	2.492 - 2.495 (0.0981 - 0.0982)		Yellow	
34	UPR	2.492 - 2.495 (0.0981 - 0.0982)		Yellow	
	LWR	2.495 - 2.498 (0.0982 - 0.0983)		Blue	
45	UPR	2.495 - 2.498 (0.0982 - 0.0983)		Blue	

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	LWR	2.498 - 2.501 (0.0983 - 0.0985)		Pink	
56	UPR	2.498 - 2.501 (0.0983 - 0.0985)		Pink	
	LWR	2.501 - 2.504 (0.0985 - 0.0986)		Purple	
67	UPR	2.501 - 2.504 (0.0985 - 0.0986)		Purple	
	LWR	2.504 - 2.507 (0.0986 - 0.0987)		White	
78	UPR	2.504 - 2.507 (0.0986 - 0.0987)		White	
	LWR	2.507 - 2.510 (0.0987 - 0.0988)		Red	

UNDERSIZE

Unit: mm (in)		
Items	Thickness	Main journal diameter
0.25 (0.0098)	2.618 - 2.626 (0.1031 - 0.1034)	Grind so that bearing clearance is the specified value.

MAIN BEARING OIL CLEARANCE

Unit: mm (in)			
Items		Standard	Limit
Main bearing oil clearance	No. 1 and 5	0.001 - 0.011 (0.00004 - 0.00043) ⁽¹⁾	0.065 (0.0026)
	No. 2, 3 and 4	0.007 - 0.017 (0.0003 - 0.0007) ⁽¹⁾	
(1) Actual clearance			

Connecting Rod Bearing

CONNECTING ROD BEARING

Grade number	Thickness mm (in)	Width mm (in)	Identification color (mark)
1	1.500 - 1.503 (0.0591 - 0.0592)	18.1 - 18.3 (0.713 - 0.720)	Black
2	1.503 - 1.506 (0.0592 - 0.0593)		Brown
3	1.506 - 1.509 (0.0593 - 0.0594)		Green
4	1.509 - 1.512 (0.0594 - 0.0595)		Yellow

UNDERSIZE

Unit: mm (in)		
Items	Thickness	Pin journal diameter

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0.25 (0.0098)	1.627 - 1.635 (0.0641 - 0.0644)	Grind so that bearing clearance is the specified value.
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CONNECTING ROD BEARING OIL CLEARANCE

		Unit: mm (in)
Items	Standard	Limit
Connecting rod bearing oil clearance	0.020 - 0.039 (0.0008 - 0.0015) ⁽¹⁾	0.070 (0.0028)
(1) Actual clearance		