2012 ENGINE

Engine Mechanical (VK56VD) - M

PRECAUTION

PRECAUTIONS

Precaution for Procedure without Cowl Top Cover

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

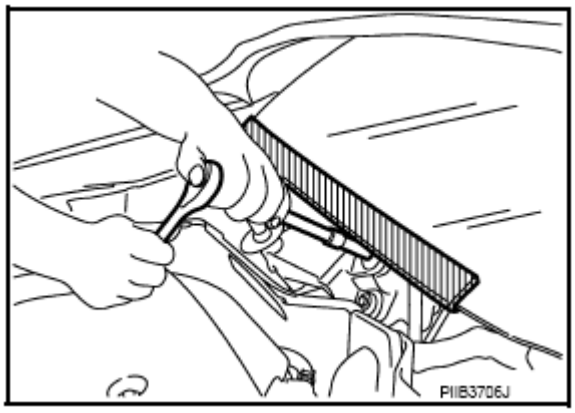


Fig. 1: Identifying Windshield Precaution When Removing Cowl Top Cover
Courtesy of NISSAN NORTH AMERICA, INC.

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

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

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

WARNING: Always observe the following items for preventing accidental activation.

- **To avoid rendering the SRS inoperative, which could increase the risk of personal injury or death in the event of a collision that would result in air bag inflation, all maintenance must be performed by an authorized NISSAN/INFINITI dealer.**
- **Improper maintenance, including incorrect removal and installation**

of the SRS, can lead to personal injury caused by unintentional activation of the system. For removal of Spiral Cable and Air Bag Module, see "SRS AIRBAG ".

- **Never use electrical test equipment on any circuit related to the SRS unless instructed to in this Service Information. SRS wiring harnesses can be identified by yellow and/or orange harnesses or harness connectors.**

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

WARNING: Always observe the following items for preventing accidental activation.

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

Precautions Necessary for Steering Wheel Rotation After Battery Disconnection

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

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

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

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

OPERATION PROCEDURE

1. Connect both battery cables.

NOTE: Supply power using jumper cables if battery is discharged.

2. Turn the ignition switch to ACC position.

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

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

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.

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.

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.

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 below.
- In areas where the seal cutter is difficult to use, lightly tap the parts using a plastic hammer to remove it.

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

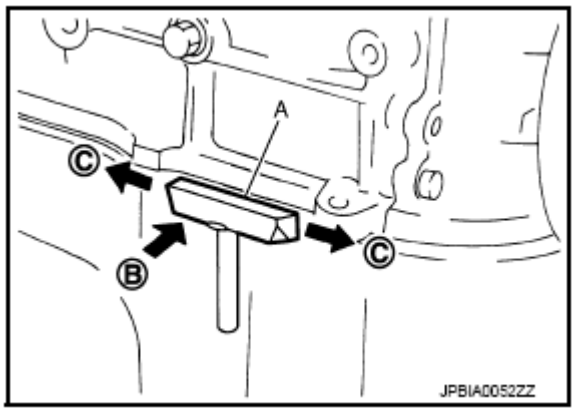


Fig. 2: Sliding Cutter By Tapping On Side
Courtesy of NISSAN NORTH AMERICA, INC.

LIQUID GASKET APPLICATION PROCEDURE

1. Using a scraper (A), remove old liquid gasket sticking 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 any moisture, grease and foreign materials.

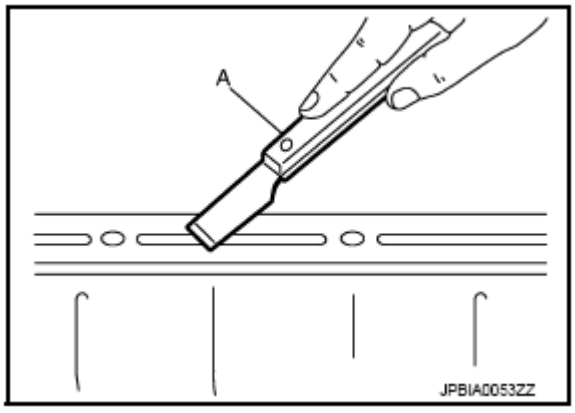


Fig. 3: Removing Liquid Gasket
Courtesy of NISSAN NORTH AMERICA, INC.

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

   Use Genuine RTV Silicone Sealant or an equivalent.

Refer to "**RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS** "

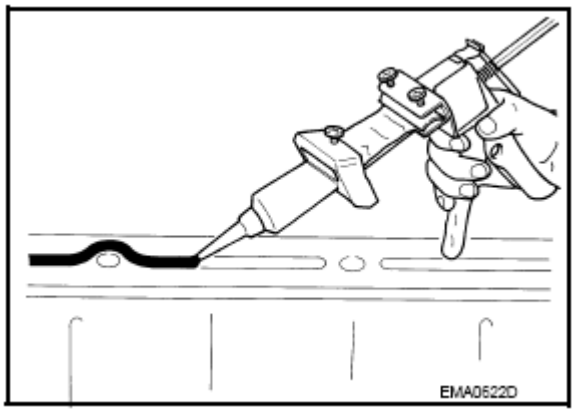


Fig. 4: Applying Liquid Gasket
Courtesy of NISSAN NORTH AMERICA, INC.

4. Apply liquid gasket without gaps to the specified location according to the specified dimensions.
   - If there is a groove for liquid gasket application, apply liquid gasket to the groove.
   - As for bolt holes (B), normally apply liquid gasket inside the holes. Occasionally, it should be applied outside the holes. Follow the instructions found in the Service Information.

A : Groove
⇦ : Inside

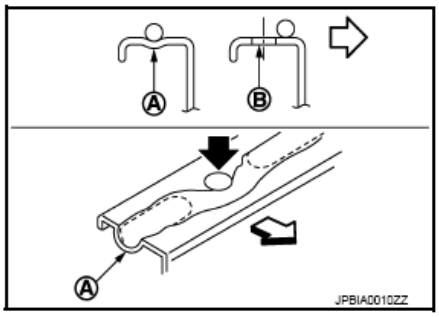


Fig. 5: Identifying Liquid Gasket Applying Area
Courtesy of NISSAN NORTH AMERICA, INC.

- 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.

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

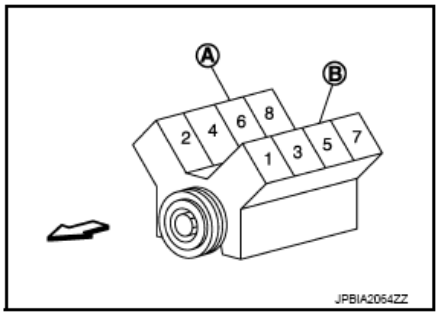


Fig. 6: Identifying Cylinder Orientation
Courtesy of NISSAN NORTH AMERICA, INC.

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

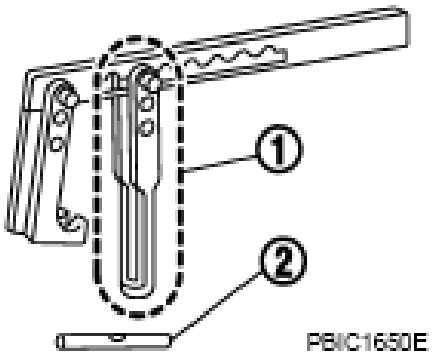
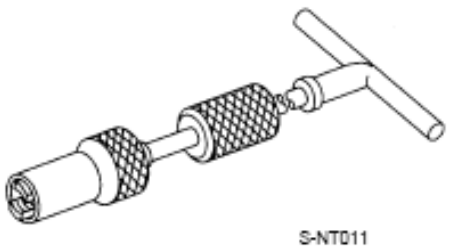
  Bank 1: The bank side including cylinder No. 1 (odd-numbered cylinder side)

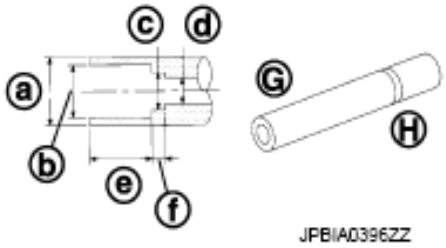
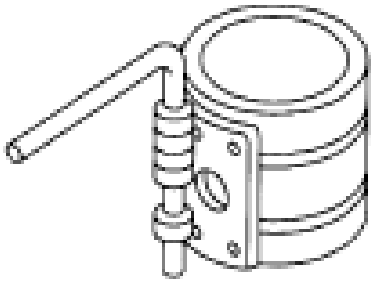
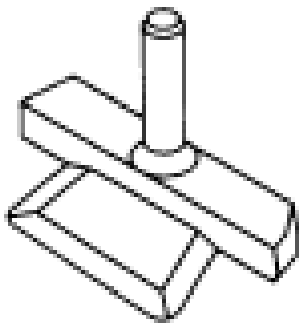
  Bank 2: The other bank side of the above (even-numbered cylinder side)

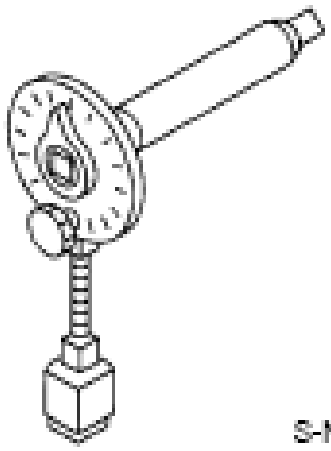
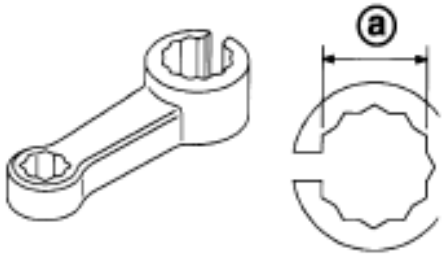
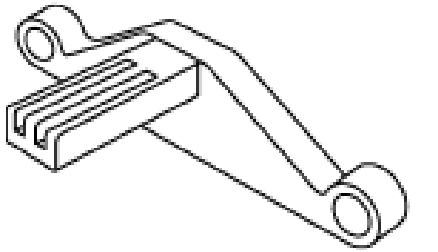
PREPARATION

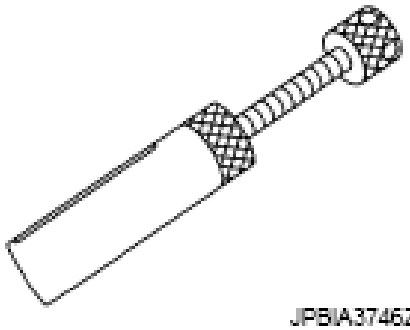
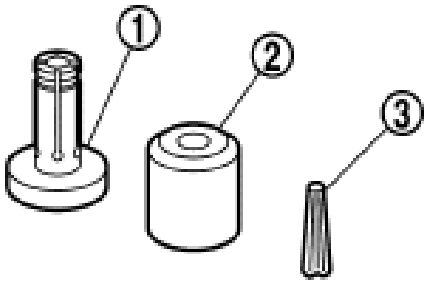
PREPARATION

Special Service Tool

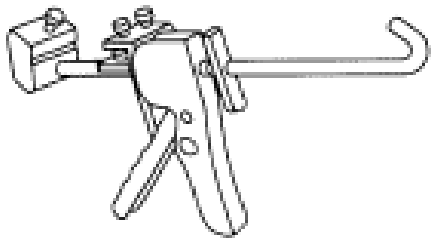
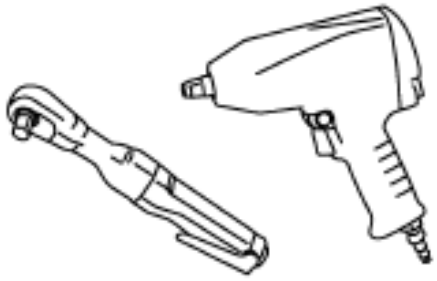
Tool number (Kent-Moore No.) Tool name		Description
KV10116200 (J-26336-A) Valve spring compressor 1. KV10115900 (J-26336-20) Attachment 2. KV10109220 (-) Adapter		Disassembling valve mechanism Part (1) is a component of KV10116200 (J26336-A), but part (2) is not so.
KV10107902 (J-38959) Valve oil seal puller		Removing valve oil seal

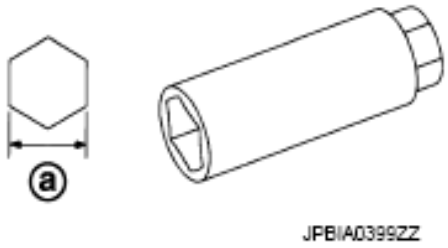
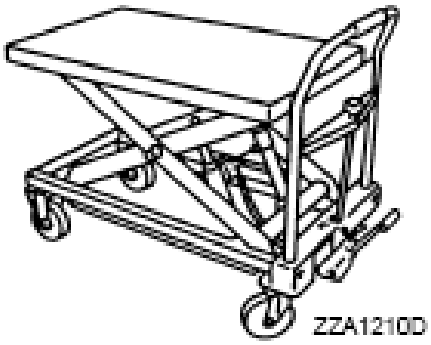
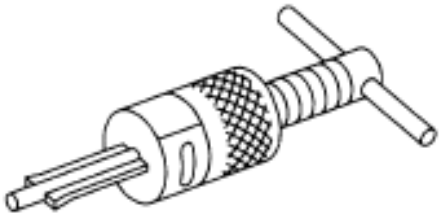
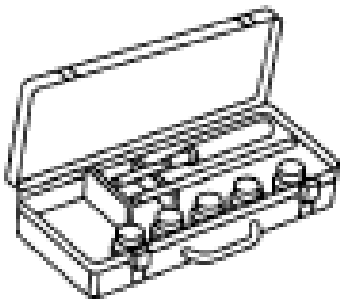
KV10115600 (J-38958) Valve oil seal drift	 JPBIA0396ZZ	Installing valve oil seal **Use side A (G)** a. **20 (0.79) dia.** b. **13 (0.51) dia.** c. **10.3 (0.406) dia.** d. **8 (0.31) dia.** e. **10.7 (0.421)** f. **5 (0.20)** **H: Side B** Unit: mm (in)
EM03470000 (J-8037) Piston ring compressor	 S-NT044	Installing piston assembly into cylinder bore
KV10111100 (J-37228) Seal cutter	 S-NT045	Removing steel oil pan and front cover
KV10112100 (BT8653-A)		Tightening bolts for bearing cap,

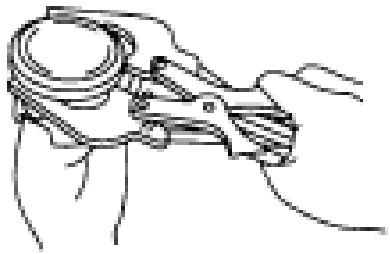
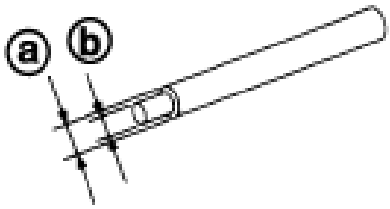
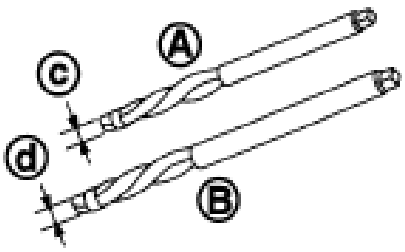
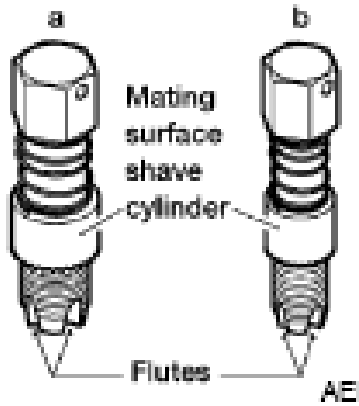
Angle wrench	 S-NT014	cylinder head, etc.
KV10114400 (J-38365) Heated oxygen sensor wrench	 JPBIA0397ZZ	Loosening or tightening air fuel ratio sensor 1 and heated oxygen sensor 2 a. **22 mm (0.87 in)**
KV10119200 (J-49277) Ring gear stopper	 JPBIA0409ZZ	Removing and installing crankshaft pulley
KV10119300 (-) Adapter and torque wrench assembly	 JPBIA2623ZZ	Tightening rocker cover mounting bolts (specified torque)
KV10119600 (-) Injector remover		Removing fuel injector

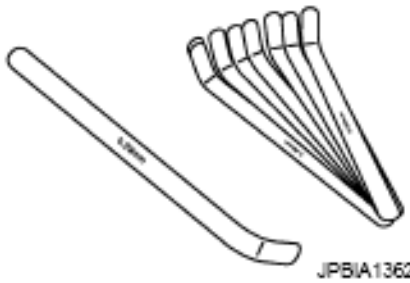
 JPBIA3746ZZ	
KV101197S0 (-) Injector seal drift set 1. KV10119730 (-) Seal installer 2. KV10119710 (-) Drift 3. KV10119720 (-) Seal guide  JPBIA5653ZZ	Installing fuel injector seal ring
KV10119300 (-) Adapter and torque wrench assembly	Tightening rocker cover mounting bolts. (specified torque)

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		Removing and installing spark plug a. **14 mm (0.55 in)**
(-) Manual lift table caddy		Removing and installing engine
(-) Pilot bushing puller		Removing pilot converter
(-) Valve seat cutter set		Finishing valve seat (EXH) dimensions
(-) Piston ring expander		Removing and installing piston ring

	 S-NT030	
(-) Valve guide drift	 JPBIA0400ZZ	Removing and installing valve guide (EXH) a. **9.5 mm (0.374 in) dia.** b. **5.5 mm (0.217 in) dia.**
(-) Valve guide reamer	 JPBIA0401ZZ	1. Reaming valve guide (EXH) inner hole 2. 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	 AEM488	Reconditioning the exhaust system threads before installing a new heated oxygen sensor (Use with anti-seize lubricant shown below.) a. **J-43897-18 (18 mm dia.) for zirconia heated oxygen sensor and air fuel ratio sensor** b. **J-43897-12 (12 mm dia.) 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 camshaft (EXH) or valve-related parts, or at the occurrence of malfunction (poor starting, idle malfunction, unusual noise) due to aged deterioration in valve clearance.

1. Remove rocker covers (bank 1 and bank 2). Refer to "**REMOVAL AND INSTALLATION**".
2. 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 the angle shown in the figure below.

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

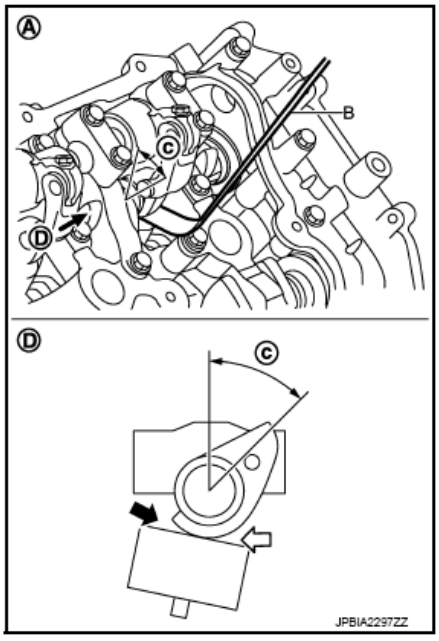


Fig. 7: Identifying Insertion Direction Of Feeler Gauge
Courtesy of NISSAN NORTH AMERICA, INC.

3. Refer to the figure for the insertion direction of the feeler gauge since the direction depends on the bank.

a. Set No. 1 cylinder at TDC of its compression stroke.

- Rotate crankshaft pulley clockwise to align timing mark (grooved line without color) (B) with timing indicator (A).

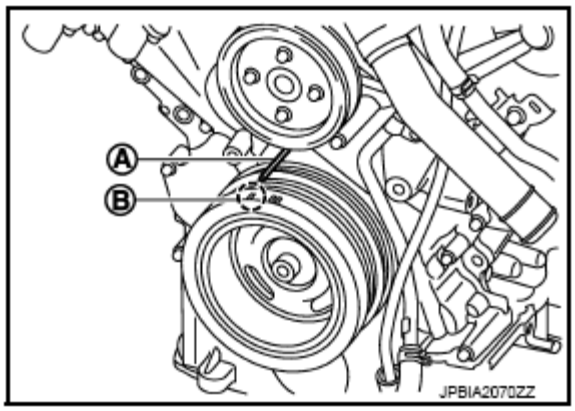


Fig. 8: Identifying Timing Marks
Courtesy of NISSAN NORTH AMERICA, INC.

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

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

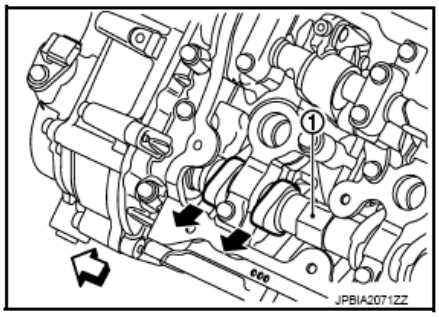


Fig. 9: Checking Exhaust Cam Nose On No. 1 Cylinder (Engine Front Side Of Bank 1) Location
Courtesy of NISSAN NORTH AMERICA, INC.

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

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)

⇦ : Engine front

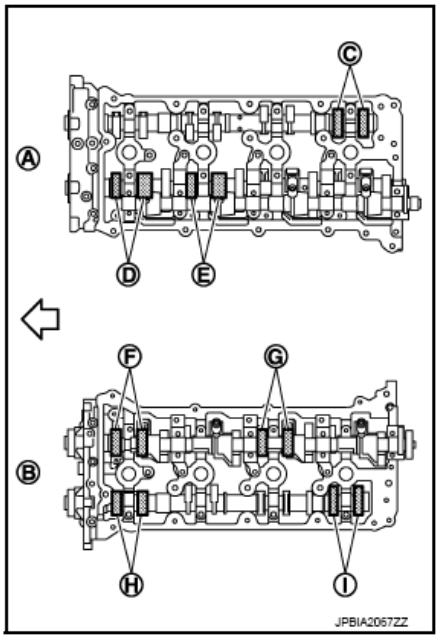


Fig. 10: Identifying Locations For Measuring Valve Clearance
Courtesy of NISSAN NORTH AMERICA, INC.

NOTE: To measure valve clearance of No. 1 cylinder INT valve (front side), insert feeler gauge (commercial service tool) from the front side (A) of the control shaft bracket or camshaft (EXH) side (B).

1 : Valve lifter

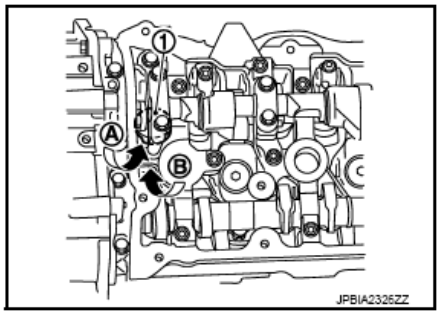


Fig. 11: Identifying Valve Clearance Measuring Location For No. 1 Cylinder INT Valve
Courtesy of NISSAN NORTH AMERICA, INC.

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.

A : Paint mark

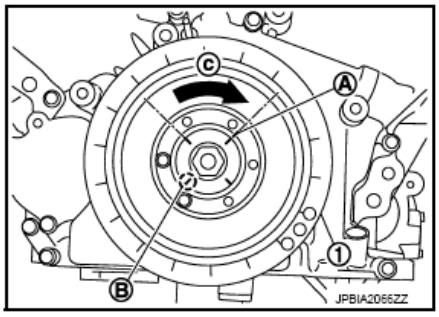


Fig. 12: Rotating Crankshaft 270 Degrees Clockwise
Courtesy of NISSAN NORTH AMERICA, INC.

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

⇦ : Engine front

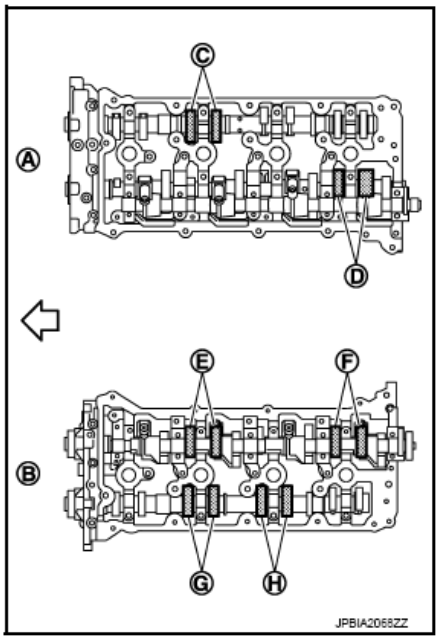


Fig. 13: Identifying Valve Clearance Measuring Locations
Courtesy of NISSAN NORTH AMERICA, INC.

- No. 3 cylinder at compression TDC

Measuring position [bank 2 (A)]		No. 2 CYL.	No. 4 CYL.	No. 6 CYL.	No. 8 CYL.
No. 3 cylinder at compression TDC	EXH		x (C)		
	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

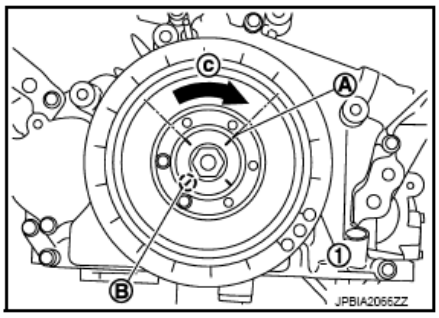


Fig. 14: Rotating Crankshaft 90 Degrees Clockwise
Courtesy of NISSAN NORTH AMERICA, INC.

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

⇦ : Engine front

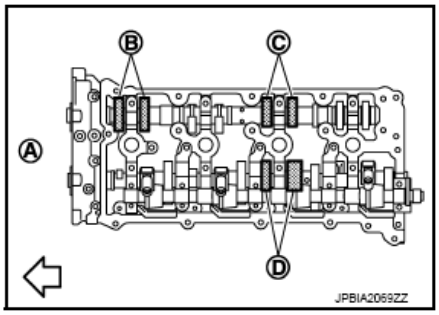


Fig. 15: Identifying Valve Clearance Measuring Locations
Courtesy of NISSAN NORTH AMERICA, INC.

- 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)	

d. 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 "**WORK PROCEDURE** ".
3. Disconnect fuel pump fuse (No. 41, located in IPDM E/R) from IPDM E/R to avoid fuel injection during measurement.
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. Measure compression pressure using compression gauge connected with flexible type adapter (commercial service tool).
8. With accelerator pedal fully depressed, turn ignition switch to "START" for cranking. When the gauge pointer stabilizes, read the compression pressure and the engine rpm. Perform these steps to check each cylinder.

   Compression pressure: Refer to "GENERAL SPECIFICATION".

   CAUTION:
   - **Measure a six-cylinder under the same conditions since a measurement depends on measurement conditions (engine water temperature, etc.).**
   - **Always use a fully changed 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 recheck it for compression.
  - If the added engine oil improves the compression, piston rings may be worn out or damaged. Check piston rings and replace if necessary. Refer to "**INSPECTION**".
  - 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 "**INSPECTION**".

- 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 "**DISASSEMBLY AND ASSEMBLY**".

9. After inspection is completed, install removed parts.
10. Start the engine, and check that the engine runs smoothly.
11. Perform trouble diagnosis. If DTC appears, erase it. Refer to "**DESCRIPTION** ".

SYMPTOM DIAGNOSIS

NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING

NVH Troubleshooting - Engine Noise

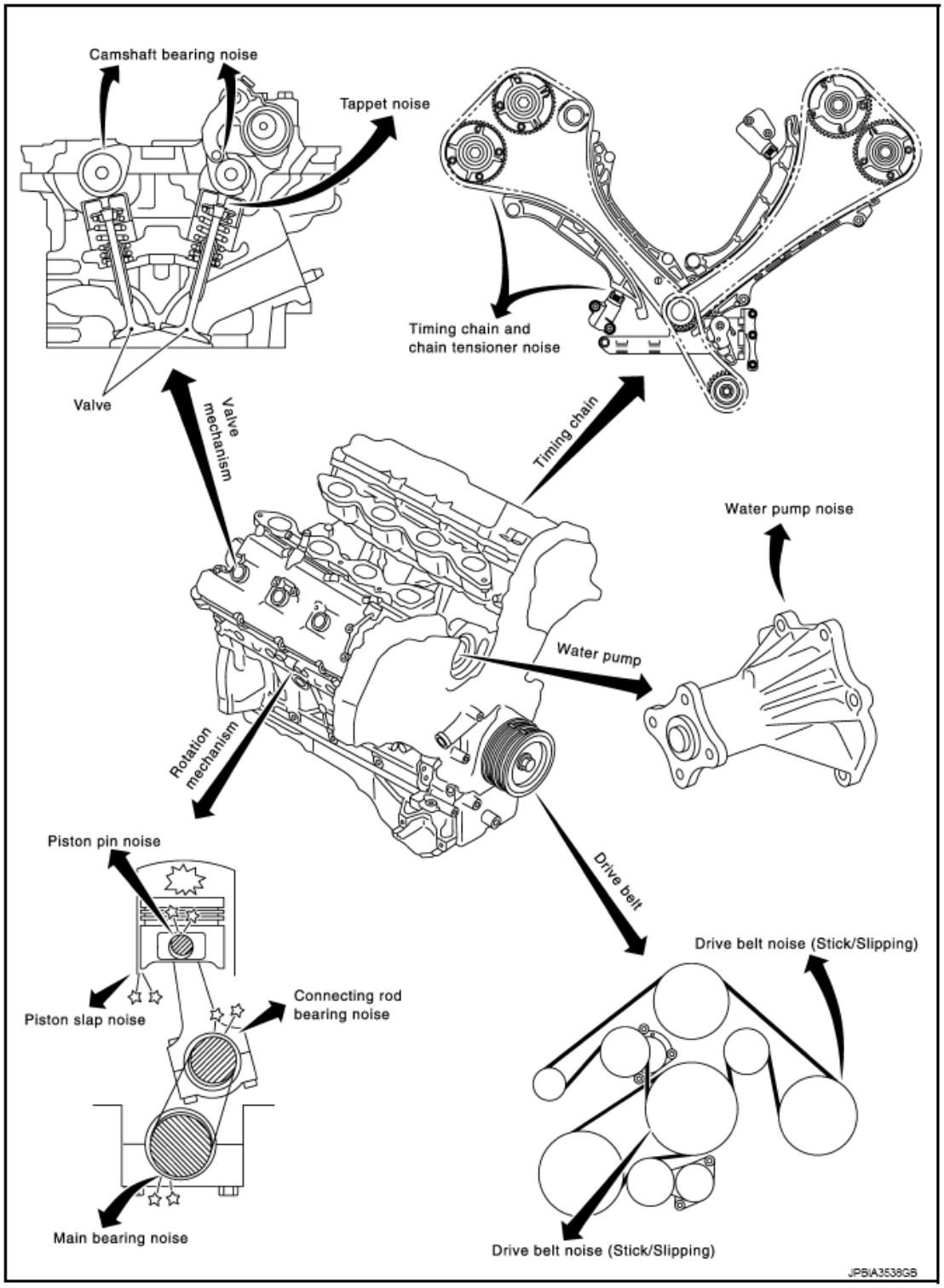


Fig. 16: Identifying Noise, Vibration And Harshness Components
Courtesy of NISSAN NORTH AMERICA, INC.

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

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

   If necessary, repair or replace these parts.

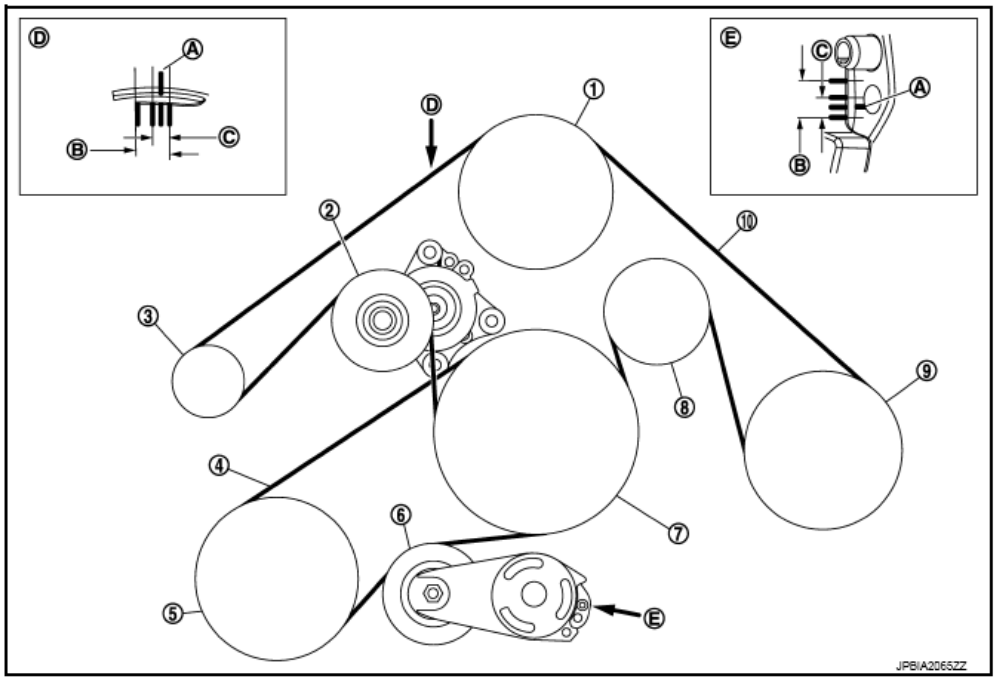
Location of noise	Type of noise	Operating condition of engine						Source of noise	Check item	Refer to
		Before warm-up	After warm-up	When starting	When idling	When racing	While driving			
Top of engine Rocker cover Cylinder head	Ticking or clicking	C	A	-	A	B	-	Tappet noise	Valve clearance	**CAMSHAFT VALVE CLEARANCE**
	Rattle	C	A	-	A	B	C	Camshaft bearing noise	Camshaft runout Camshaft journal oil clearance	**CAMSHAFT**
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	**PISTON TO PISTON PIN OIL CLEARANCE**
	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	**PISTON TO CYLINDER BORE CLEARANCE**
	Knock	A	B	C	B	B	B	Connecting rod bearing noise	Connecting rod bushing oil clearance Connecting rod bearing oil	**CONNECTING ROD BUSHING OIL CLEARANCE**

									clearance	
	Knock	A	B	-	A	B	C	Main bearing noise	Main bearing oil clearance Crankshaft runout	**MAIN BEARING OIL CLEARANCE**
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	**TIMING CHAIN**
Front of engine	Squeaking or fizzing	A	B	-	B	-	C	Drive belts (Sticking or slipping)	Drive belts deflection	**DRIVE BELT**
	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	**WATER PUMP**
A: Closely related B: Related C: Sometimes related -: Not related										

PERIODIC MAINTENANCE

DRIVE BELTS

Exploded View



1.	Water pump	2.	Auto-tensioner (for alternator, water pump and A/C compressor belt)	3.	Alternator
4.	Power steering oil pump belt	5.	Power steering oil pump	6.	Auto-tensioner (for power steering oil pump belt)
7.	Crankshaft pulley	8.	Idler pulley	9.	A/C compressor
10.	Alternator, water pump and A/C compressor belt				
A.	Indicator	B.	Possible use range	C.	Range when new drive belt is installed
D.	View D	E.	View E		

Fig. 17: Drive Belt Routing Diagram
Courtesy of NISSAN NORTH AMERICA, INC.

Checking

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

- Remove air duct (inlet) when inspecting alternator, water pump and A/C compressor belt.
- Remove engine undercover with power tool when inspecting power steering oil pump belt.
- Check that the indicator (A) (notch on fixed side) of each auto-tensioner is within the possible use range (B).

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 (C) 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

Alternator, Water Pump and A/C Compressor Belt

1. Remove air duct (inlet). Refer to "**EXPLODED VIEW**".
2. Remove reservoir tank. Refer to "**EXPLODED VIEW** ".
3. With box wrench, and while securely holding the hexagonal part in pulley center of auto tensioner (1), move wrench handle in the direction of arrow (loosening direction of belt tensioner).

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 (Never turn it clockwise). If turned clockwise, the complete auto tensioner must be replaced as a unit, including the pulley.**

4. Under the above condition, insert a metallic bar (A) of approximately 6 mm (0.24 in) in diameter (hexagonal bar wrench shown as example in the figure below) through the holding boss to lock auto tensioner pulley arm.
   - Leave auto tensioner pulley arm locked until belt is installed again.

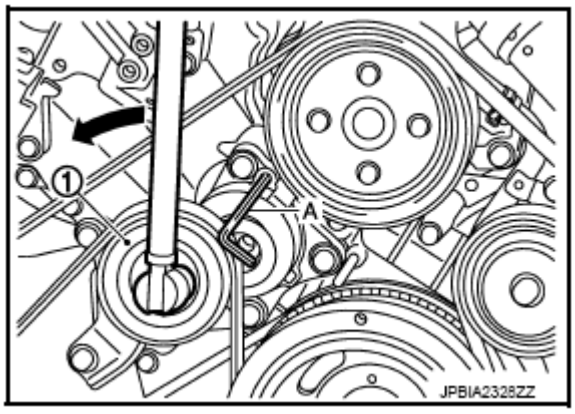


Fig. 18: Locking Auto Tensioner Pulley Arm
Courtesy of NISSAN NORTH AMERICA, INC.

5. Remove alternator, water pump and A/C compressor belt.

Power Steering Oil Pump Belt

1. Remove engine undercover with power tool.
2. Remove alternator, water pump and A/C compressor belt. Refer to "**ALTERNATOR, WATER PUMP AND A/C COMPRESSOR BELT**".
3. With box wrench, and while securely holding the hexagonal part in pulley center of auto tensioner (1), move wrench handle in the direction of arrow (loosening direction of tensioner).

CAUTION:
- **Never place hand in a location where pinching may occur if the holding tool accidentally comes off.**
- **Never loosen the hexagonal part in center of auto tensioner pulley (Never turn it clockwise). If turned clockwise, the complete auto tensioner must be replaced as a unit, including the pulley.**

4. Under the above condition, insert a metallic bar (A) of approximately 6 mm (0.24 in) in diameter (hexagonal bar wrench shown as example in the figure below) through the holding boss to lock auto tensioner pulley arm.
   - Leave auto tensioner pulley arm locked until belt is installed again.
5. Remove power steering oil pump belt.

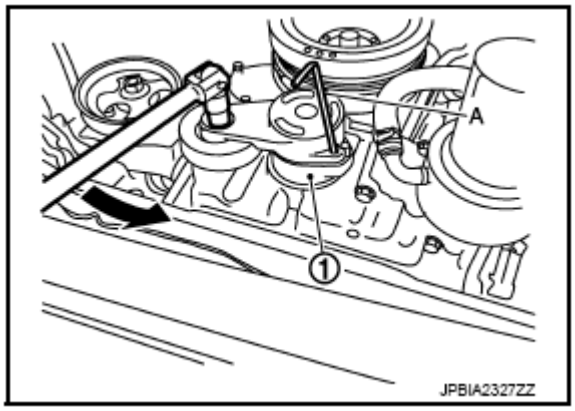


Fig. 19: Locking Auto Tensioner Pulley Arm
Courtesy of NISSAN NORTH AMERICA, INC.

INSTALLATION

Note the following items, 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 on drive belts and pulley groove.**

Inspection

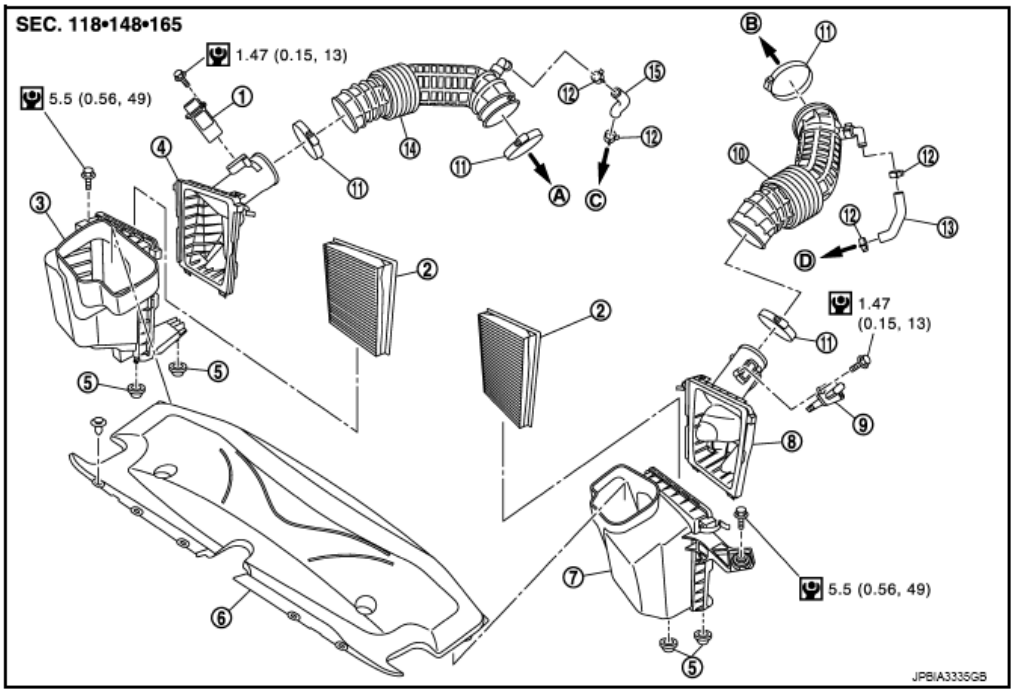
INSPECTION AFTER INSTALLATION

- 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

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



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

Fig. 20: Exploded View Of Air Cleaner Filter With Torque Specifications
Courtesy of NISSAN NORTH AMERICA, INC.

Removal and Installation

REMOVAL

1. Unhook clips (A), and move the air cleaner cover assembly (1).

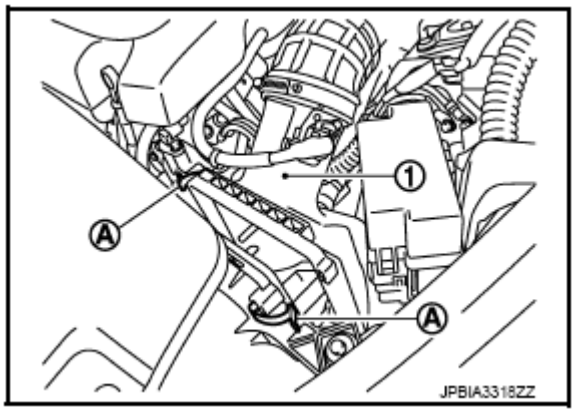


Fig. 21: Identifying Air Cleaner Cover Assembly & Clips
Courtesy of NISSAN NORTH AMERICA, INC.

2. Remove air cleaner filter (1).

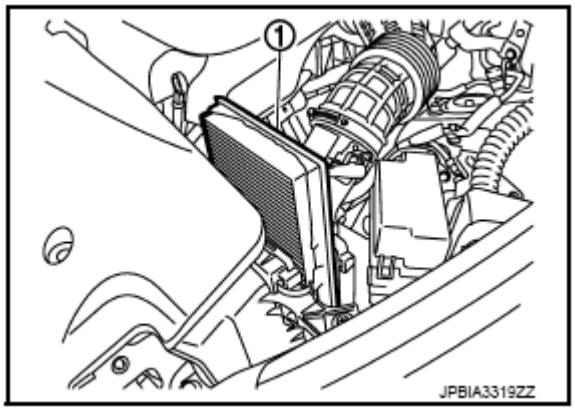


Fig. 22: Identifying Air Cleaner Filter
Courtesy of NISSAN NORTH AMERICA, INC.

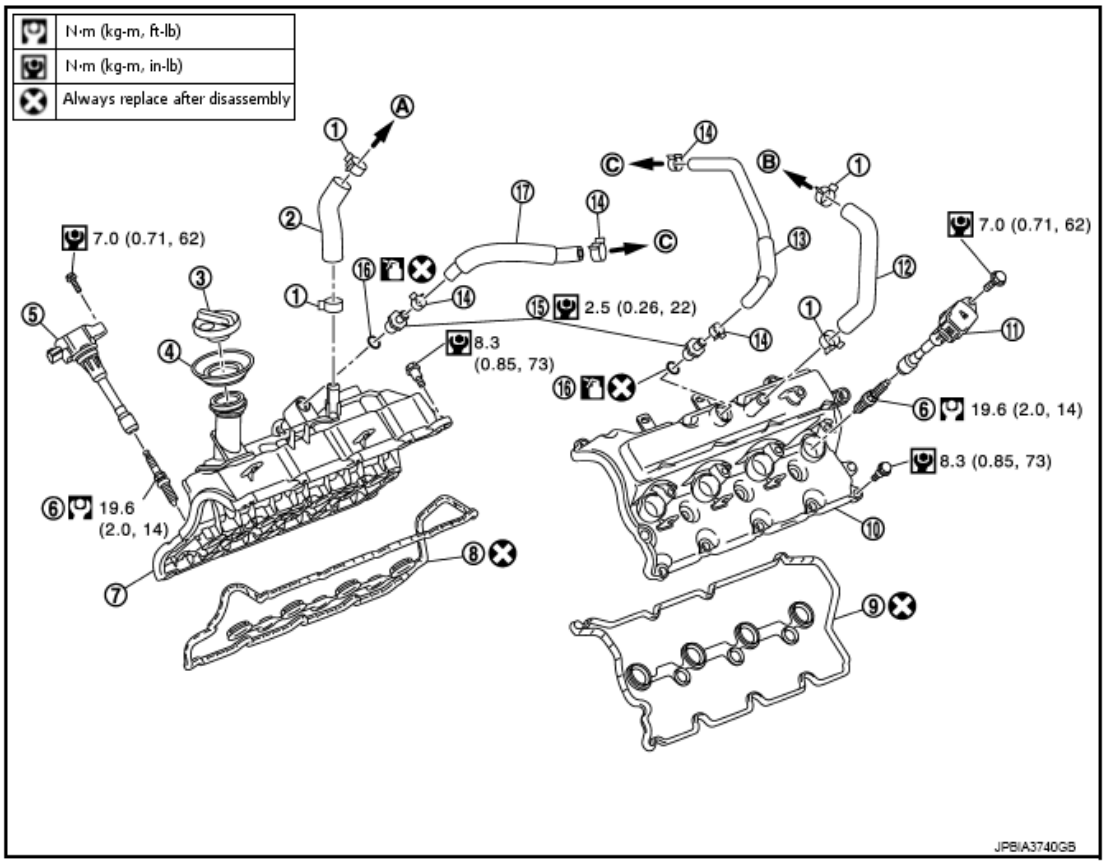
INSTALLATION

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

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

SPARK PLUG

Exploded View



1.	Clamp	2.	PCV hose	3.	Oil filler cap
4.	Oil catcher	5.	Ignition coil (No. 1 - 6)	6.	Spark plug
7.	Rocker cover (bank 2)	8.	Rocker cover gasket (bank 2)	9.	Rocker cover gasket (bank 1)
10.	Rocker cover (bank 1)	11.	Ignition coil (No. 7, 8)	12.	PCV hose
13.	PCV hose	14.	Clamp	15.	PCV valve
16.	O-ring	17.	PCV hose		
A.	To air duct (bank 2)	B.	To air duct (bank 1)	C.	To intake manifold

Fig. 23: 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 air duct.
3. Remove the harness bracket. (bank 2 side)
4. Remove ignition coil. Refer to "**EXPLODED VIEW**".
5. Remove spark plug with a spark plug wrench (commercial service tool).

a : 14 mm (0.55 in)

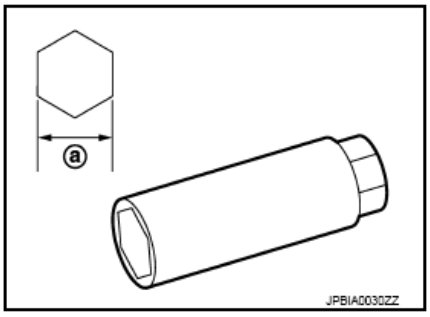


Fig. 24: Identifying Spark Plug Wrench Dimension
Courtesy of NISSAN NORTH AMERICA, INC.

INSTALLATION

Installation is the reverse order of removal.

Inspection

INSPECTION AFTER REMOVAL

Use the standard type spark plug for normal condition.

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

CAUTION:

- **Never drop or 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/cm^2 , 85 psi)

Cleaning time: Less than 20 seconds

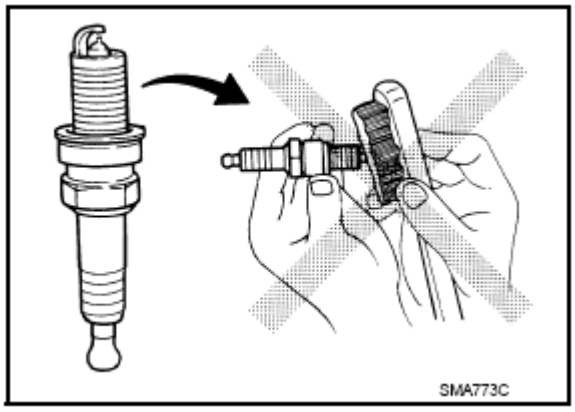


Fig. 25: Caution - Do Not Clean Spark Plug Using Wire Brush
Courtesy of NISSAN NORTH AMERICA, INC.

- **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.**

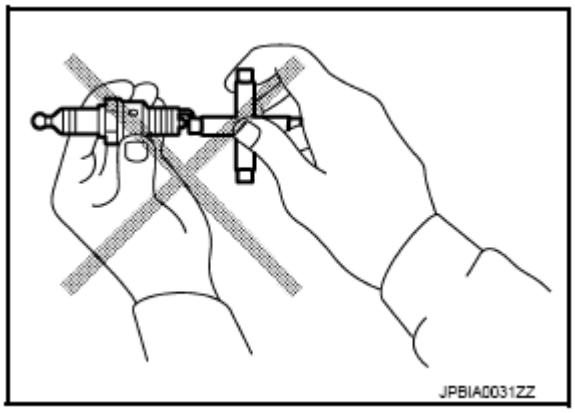


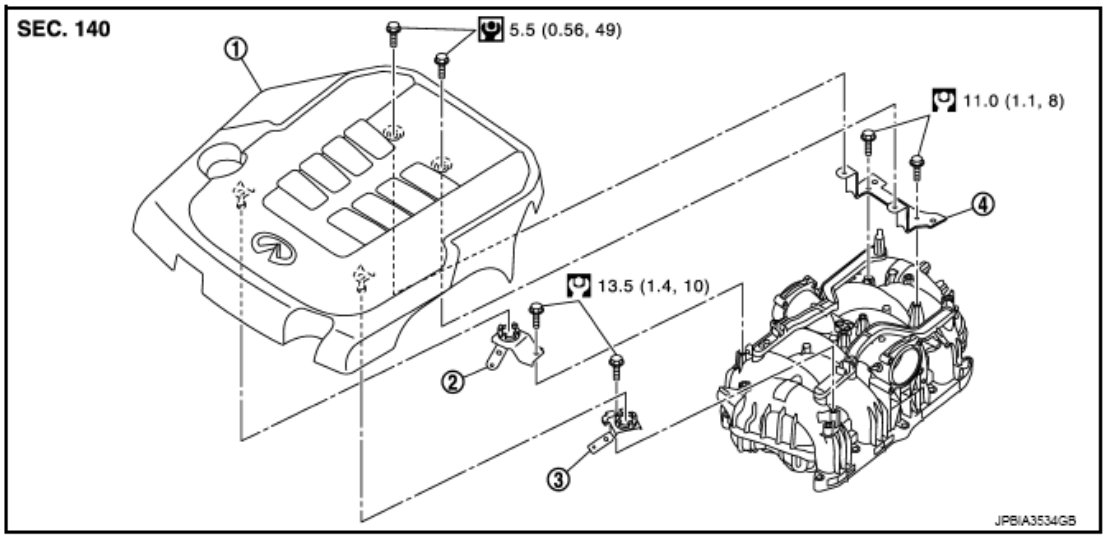
Fig. 26: Caution - Do Not Adjust Spark Plug Gap
Courtesy of NISSAN NORTH AMERICA, INC.

REMOVAL AND INSTALLATION

ENGINE COVER

Exploded View

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



1. Engine cover
2. Bracket (right)
3. Bracket (left)
4. Bracket (rear)

Fig. 27: Exploded View Of Engine Cover 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 engine cover mounting bolts.
2. Remove engine cover.
3. Remove bracket (rear), refer to following.
   - Remove engine harness mounting bolt, and disconnect engine harness clip.
   - Disconnect MAP sensor harness connector and EVAP canister purge control solenoid valve harness connector.
   - Move engine harness, and remove bracket (rear) mounting bolt.
   - Remove bracket (rear).

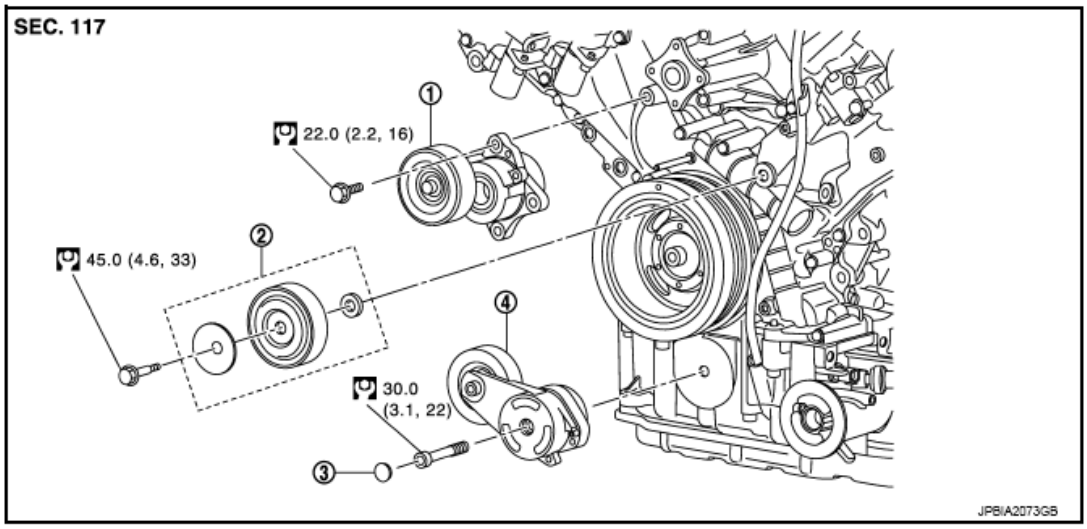
INSTALLATION

Installation is the reverse order of removal.

DRIVE BELT AUTO TENSIONER AND IDLER PULLEY

Exploded View

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



1. Auto-tensioner (for alternator, water pump and A/C compressor belt)
2. Idler pulley
3. Cover
4. Auto-tensioner (for power steering oil pump belt)

Fig. 28: Exploded View Of Drive Belt Auto Tensioner And Idler Pulley With Torque Specifications
Courtesy of NISSAN NORTH AMERICA, INC.

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

Removal and Installation

Removal

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-tensioners.
   - 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

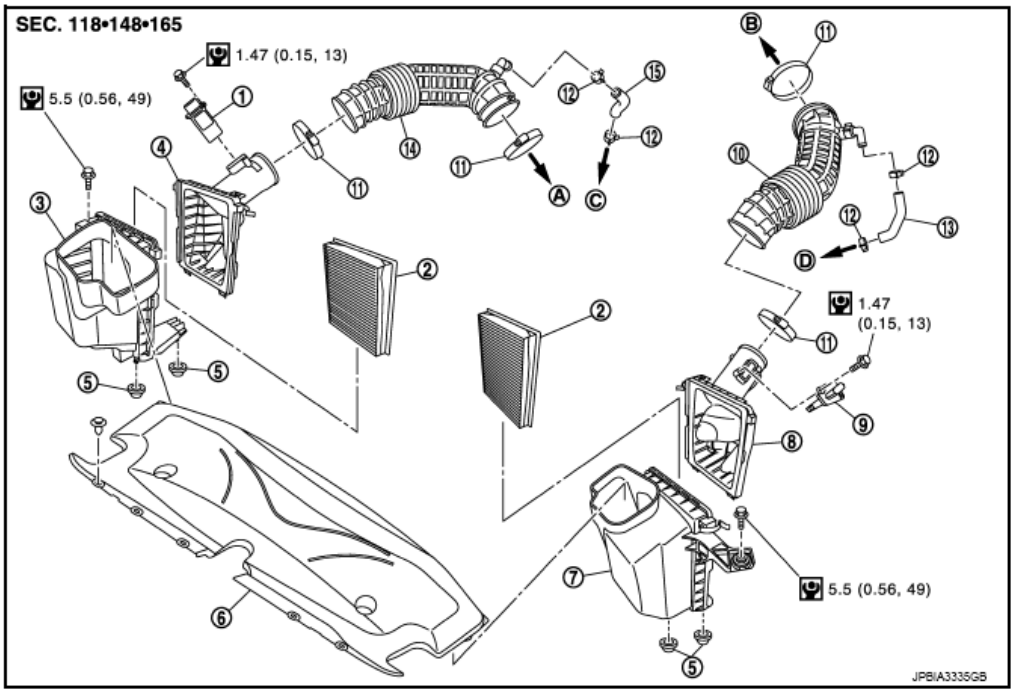
Installation is the reverse order of removal.

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

AIR CLEANER AND AIR DUCT

Exploded View

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



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

Fig. 29: Exploded View Of Air Cleaner And Duct 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 air duct (inlet).
3. Disconnect mass air flow sensor harness connector.
4. Disconnect PCV hose.
5. Remove air cleaner cover assembly & mass air flow sensor assembly and air duct by disconnecting their joints.

- Add matching marks, if necessary for easier installation.

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

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

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

INSTALLATION

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

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

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

Inspection

INSPECTION AFTER REMOVAL

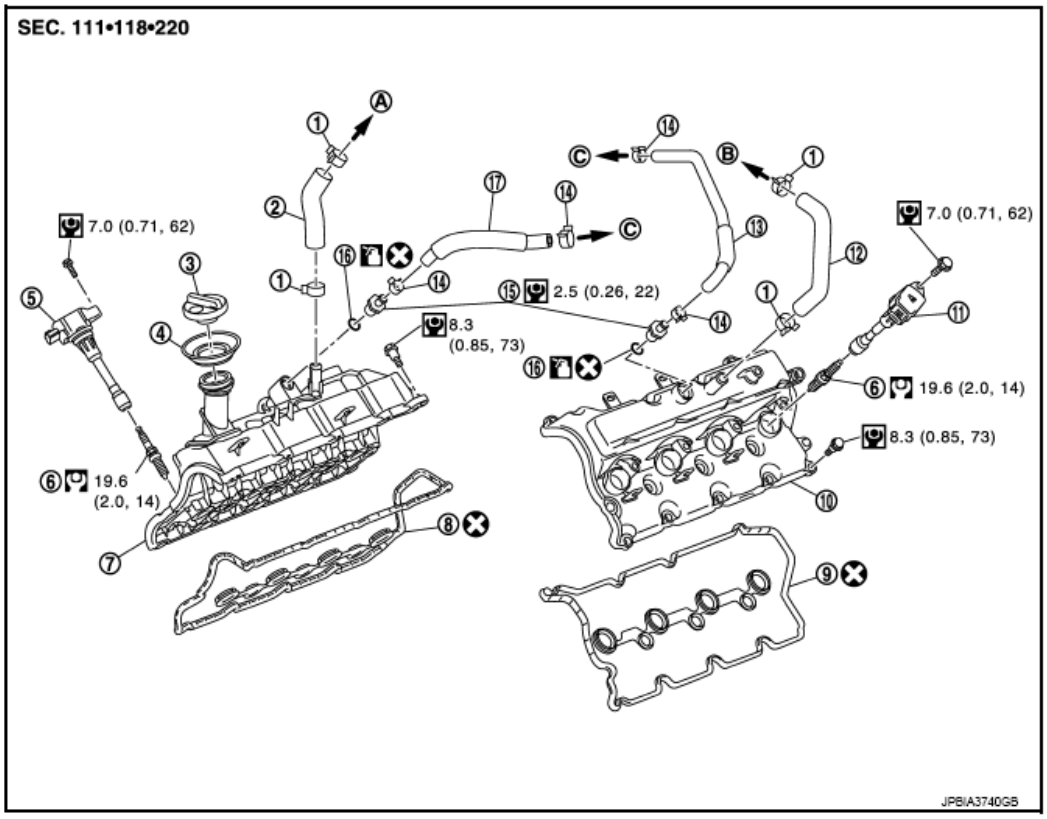
Inspect air duct assembly for crack or tear.

- If damage is found, replace air duct assembly

IGNITION COIL, SPARK PLUG AND ROCKER COVER

Exploded View

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



1.	Clamp	2.	PCV hose	3.	Oil filler cap
4.	Oil catcher	5.	Ignition coil (No. 1 - 6)	6.	Spark plug
7.	Rocker cover (bank 2)	8.	Rocker cover gasket (bank 2)	9.	Rocker cover gasket (bank 1)
10.	Rocker cover (bank 1)	11.	Ignition coil (No. 7, 8)	12.	PCV hose
13.	PCV hose	14.	Clamp	15.	PCV valve
16.	O-ring	17.	PCV hose		
A.	To air duct (bank 2)	B.	To air duct (bank 1)	C.	To intake manifold

Fig. 30: Exploded View Of Ignition Coil, Spark Plug And Rocker Cover With Torque Specifications
Courtesy of NISSAN NORTH AMERICA, INC.

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

Removal and Installation

REMOVAL

1. Remove the following parts:
   - Engine cover: Refer to "**EXPLODED VIEW**".
   - Air duct (inlet), air cleaner case assembly and air duct: Refer to "**EXPLODED VIEW**".
   - Remove harness clip and harness bracket, and move engine harness.

2. Remove ignition coil.

CAUTION: Never impact it.

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

3. Disconnect PCV hose from rocker cover.
4. Remove spark plugs. Refer to "**REMOVAL AND INSTALLATION**".

CAUTION: Never impact it.

5. Remove the rocker cover, refer to following.
   a. Bank 1
      - Discharge refrigerant from A/C circuit. Refer to "**RECYCLE REFRIGERANT** ".
      - Remove low pressure flexible hose compressor side. Refer to "**EXPLODED VIEW** ".

   Bank 2

      - Remove EVAP hose.
      - Release fuel pressure. Refer to "**WORK PROCEDURE** ".
      - Disconnect battery cable from the negative terminal.
      - Remove water hose. Refer to "**EXPLODED VIEW**".
      - Disconnect low fuel pressure sensor harness connector and quick connector. Refer to "**REMOVAL AND INSTALLATION**".
      - Remove fuel feed hose mounting bolt. Refer to "**EXPLODED VIEW**".
      - Move the fuel feed hose.

   b. Loosen rocker cover bolts in reverse order shown in the figure below.

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

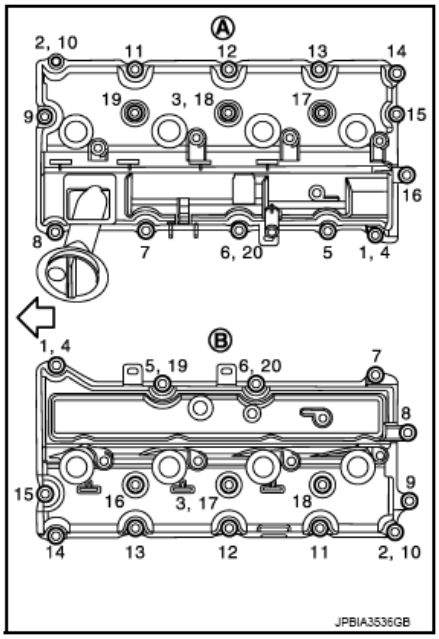


Fig. 31: Rocker Cover Bolt Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

c. Remove rocker cover.

6. Remove rocker cover gasket from rocker cover.
7. 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.

8. Remove PCV valve from rocker cover, if necessary.
9. Remove oil filler cap and oil catcher 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) and actuator bracket (rear) (2).

3 : VVEL actuator sub assembly
A : Liquid gasket application point
b : 4 mm (0.16 in)
c : 2.5 - 3.5 mm (0.098 - 0.138 in)
d : 5 mm (0.20 in)
e : 10 mm (0.39 in)
F : End surface of VVEL ladder assembly
⇦ : Engine front

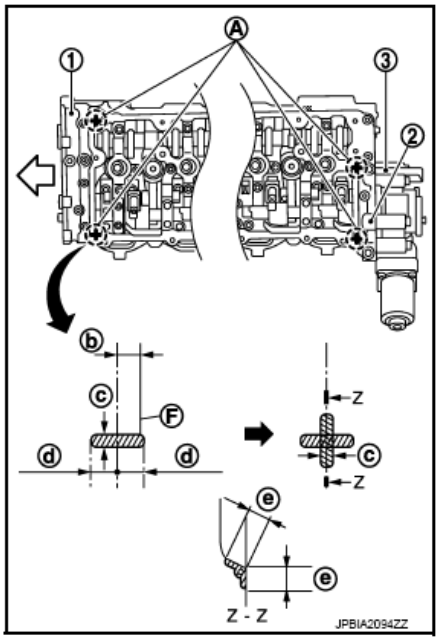


Fig. 32: Identifying Liquid Gasket Applying Area
Courtesy of NISSAN NORTH AMERICA, INC.

Use Genuine RTV Silicone Sealant or an equivalent.

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

- 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 above]

2. Install rocker cover gasket to rocker cover.
3. Install rocker cover.
   - Check that rocker cover gasket does not drop from the installation groove of rocker cover.
4. Tighten bolts in two steps separately in numerical order as shown in the figure below.

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

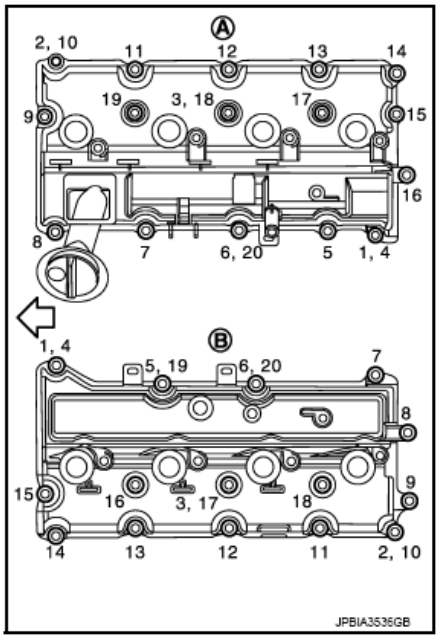


Fig. 33: Rocker Cover Bolt Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

Torque: 8.3 N.m (0.85 kg-m, 73 in-lb)

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

⇦ : Engine front

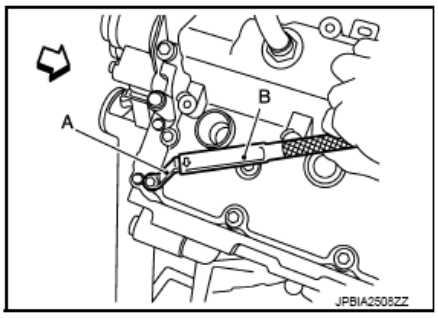


Fig. 34: Tightening Rocker Cover Bolts Using Adapter And Torque Wrench
Courtesy of NISSAN NORTH AMERICA, INC.

5. Install spark plug. Refer to "**REMOVAL AND INSTALLATION**".
6. Install ignition coil.
   - Install ignition coil marked with an identification mark (A) on cylinder No. 7 and 8.

⇦ : Engine front

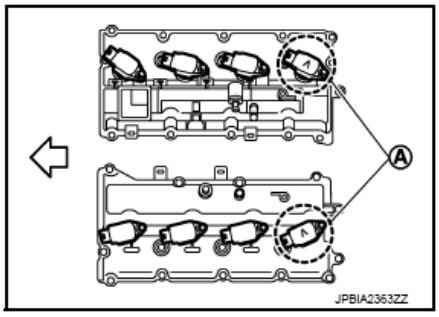


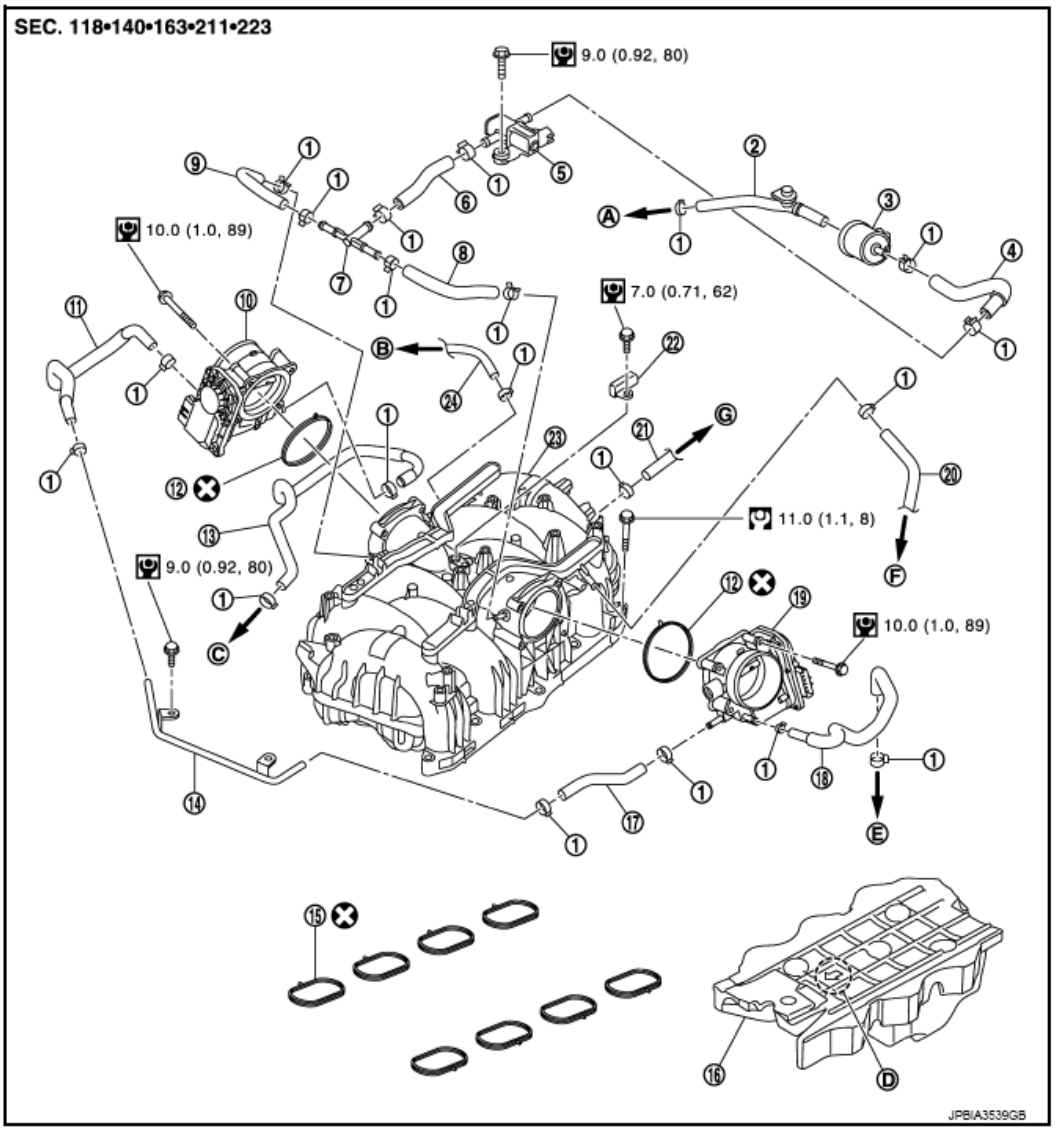
Fig. 35: Identifying Identification Marks On Cylinder No. 7 And 8
Courtesy of NISSAN NORTH AMERICA, INC.

7. Install in the reverse order of removal.

INTAKE MANIFOLD

Exploded View

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



1.	Clamp	2.	EVAP service port hose	3.	Vacuum tank
4.	EVAP hose	5.	EVAP canister purge control solenoid valve	6.	EVAP hose
7.	EVAP tube	8.	EVAP hose	9.	EVAP hose
10.	Electric throttle control actuator (bank 2)	11.	Water hose	12.	Gasket
13.	Water hose	14.	Water pipe	15.	Gasket
16.	Acoustic absorbent	17.	Water hose	18.	Water hose
19.	Electric throttle control actuator (bank 1)	20.	PCV hose	21.	Vacuum hose
22.	Manifold absolute pressure (MAP) sensor	23.	Intake manifold	24.	PCV hose
A.	To centralized under-floor piping	B.	To rocker cover (bank 2)	C.	To water outlet
D.	Front mark	E.	To cylinder head	F.	To rocker cover (bank 1)

Fig. 36: Exploded View Of Intake Manifold 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. Refer to "**EXPLODED VIEW**".
2. Remove air duct (inlet) and air duct. Refer to "**EXPLODED VIEW**".
3. Disconnect harness connector and harness bracket (bank 2 rear side).
4. Remove engine cover bracket. Refer to "**EXPLODED VIEW**".
5. Disconnect air flow sensor harness connector.
6. Remove air flow sensor harness connector clip from intake manifold.
7. Remove vacuum tank, EVAP service port hose and EVAP canister purge control solenoid valve.
8. Disconnect PCV hoses and vacuum hose from intake manifold.
   - Add matching marks as necessary for easier installation.
9. 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.

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

NOTE:
- **The figure shows the electric throttle control actuator (bank 1) viewed from the air duct side.**
- **Viewed from the air duct side, the order of loosening mounting bolts of electric throttle control actuator (bank 1) is the same as that of the electric throttle control actuator (bank 2).**

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

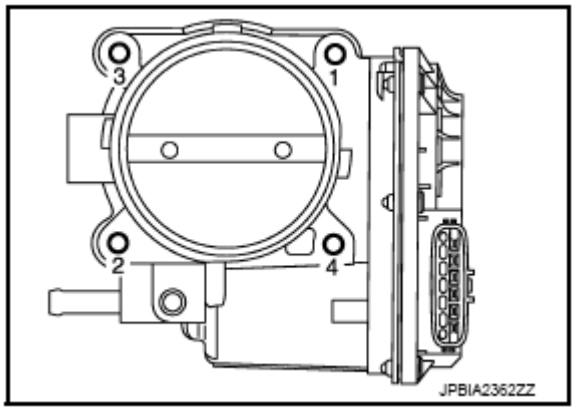


Fig. 37: Identifying Electric Throttle Control Actuator Mounting Bolts Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

11. Remove engine harness clip on rocker cover.
12. Remove water pipe mounting bolts. Refer "**EXPLODED VIEW**".
13. Remove water pipe mounting bolts (intake manifold back side). Refer "**EXPLODED VIEW** ".
14. Remove high pressure fuel pump insulator. Refer to "**EXPLODED VIEW**".
15. Remove harness bracket (intake manifold back side).
16. Remove intake manifold.
    - Loosen mounting bolts in reverse order as shown in the figure below.

⇦ : Engine front

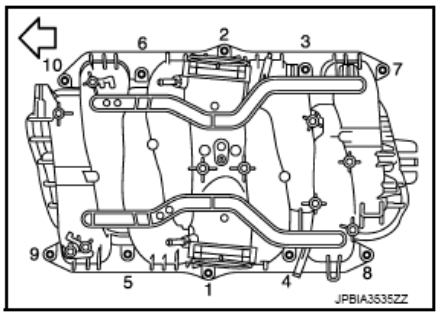


Fig. 38: Identifying Intake Manifold Mounting Bolts Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

17. Remove intake manifold gaskets.

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

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

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

19. Remove acoustic absorbent.

INSTALLATION

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

Intake Manifold

Tighten in numerical order as shown in the figure below.

⇦ : Engine front

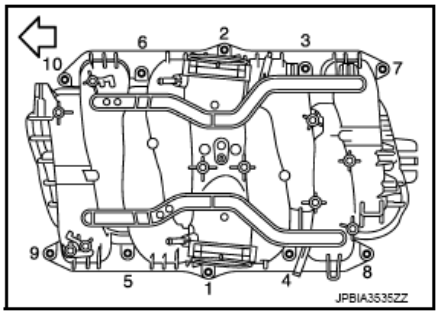


Fig. 39: Identifying Intake Manifold Mounting Bolts Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

Electric Throttle Control Actuator

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

NOTE:

- **The figure shows the electric throttle control actuator (bank 1) viewed from the air duct side.**
- **Viewed from the air duct side, the order of tightening mounting bolts of electric throttle control actuator (bank 1) is the same as that of the electric throttle control actuator (bank 2).**

- Perform the "Throttle Valve Closed Position Learning" when harness connector of electric throttle control actuator is disconnected. Refer to "**DESCRIPTION** ".
- Perform the "Idle Air Volume Learning" and "Throttle Valve Closed Position Learning" when electric throttle control actuator is replaced. Refer to "**DESCRIPTION** " (FOR USA AND CANADA), and "**DESCRIPTION** " (FOR USA AND CANADA), .

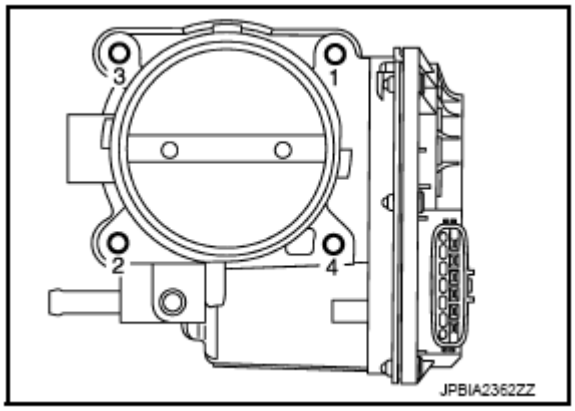


Fig. 40: Identifying Electric Throttle Control Actuator Mounting Bolts Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

Water Hose

Insert hose by 27 to 32 mm (1.06 to 1.26 in) from connector end.

Vacuum Hose

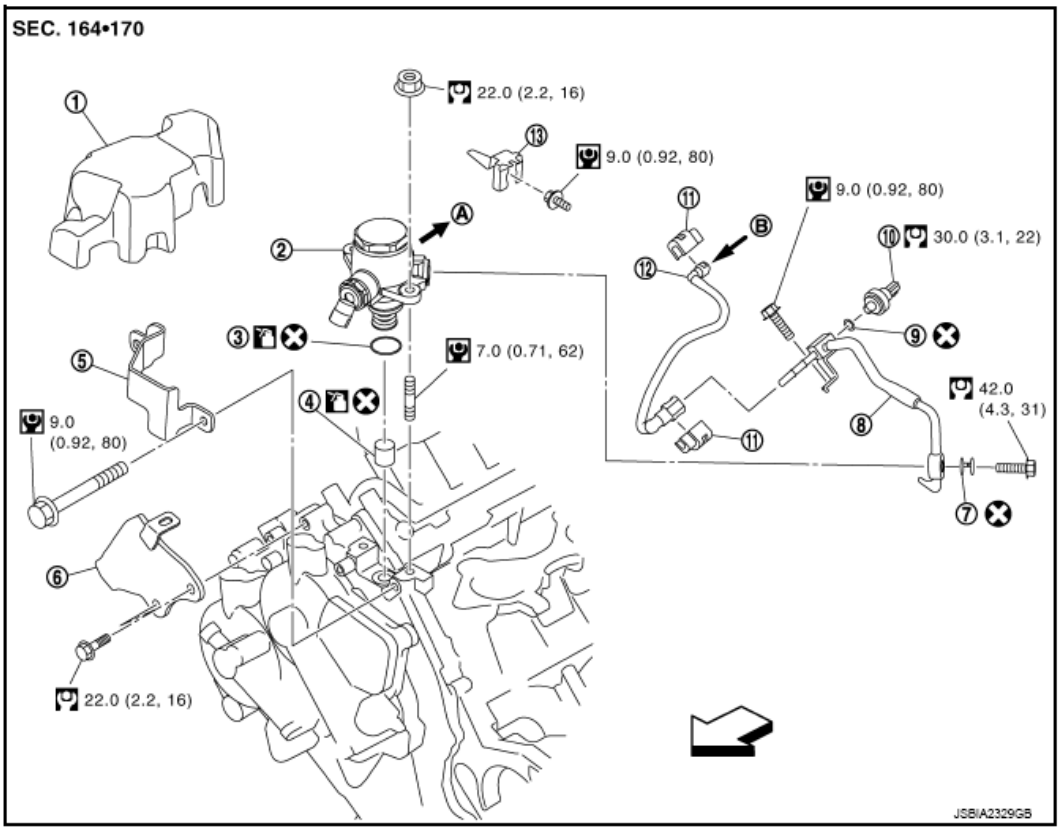
Refer to "**INSPECTION** ".

HIGH PRESSURE FUEL PUMP AND FUEL HOSE

Exploded View

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

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



1. High pressure fuel pump insulator
2. High pressure fuel pump
3. O-ring
4. Lifter
5. Fuel pump connector protector
6. Fuel hose connector protector
7. Copper washer
8. Fuel feed hose
9. Washer
10. Low fuel pressure sensor
11. Quick connector cap
12. Fuel hose
13. Bracket

A. To fuel feed tube (pump side)
B. From fuel tank

⇦ Engine front

Fig. 41: 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 CO_2 fire extinguisher.**
- **Never smoke while servicing fuel system. Keep open flames and sparks away from the work area.**
- **To avoid the danger of being scalded, never drain engine coolant when engine is hot.**

1. Release fuel pressure. Refer to "**WORK PROCEDURE** ".
2. Remove intake manifold. Refer to "**EXPLODED VIEW**".
3. Disconnect harness connector from high pressure fuel pump.
4. Remove acoustic absorbent. Refer to "**EXPLODED VIEW**".
5. Remove fuel feed tube (pump side) (1) and fuel feed hose (2) from high pressure fuel pump. Refer to "**EXPLODED VIEW**".

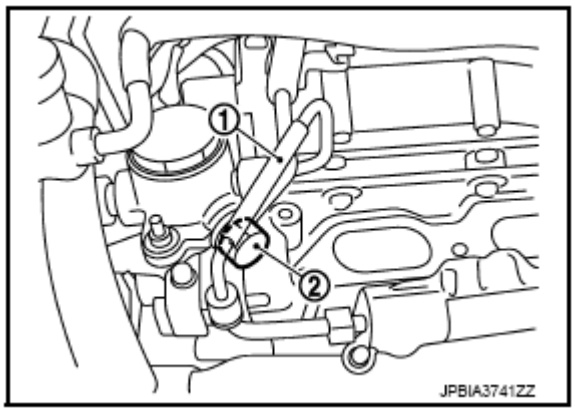


Fig. 42: Identifying High Pressure Fuel Pump Tube And Feed Hose
Courtesy of NISSAN NORTH AMERICA, INC.

6. Remove high pressure fuel pump and lifter.

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

7. Remove fuel hose protector.
8. Disconnect low pressure sensor harness connector (B).
9. Remove quick connector cap from quick connector.
10. Remove fuel hose assembly from fuel hose clamp.
11. Disconnect quick connector (A) with the following procedure.

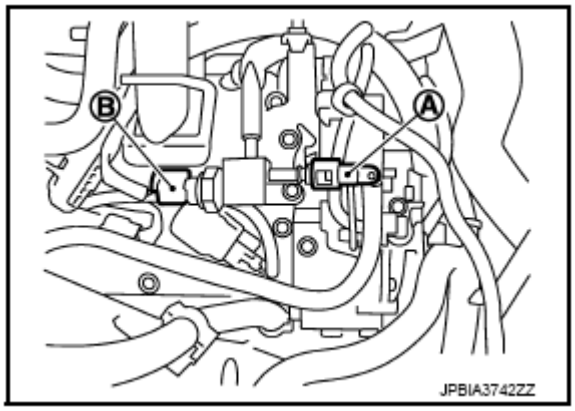


Fig. 43: Identifying Low Pressure Sensor Harness Connector And Quick Connector
Courtesy of NISSAN NORTH AMERICA, INC.

a. Quick connector (1) can be disconnected when the tabs (F) are completely depressed. Never twist it more than necessary.

B : Connection (Cross-section)
C : Fuel hose
D : To under floor fuel line
E : To fuel tank
G : Disconnection

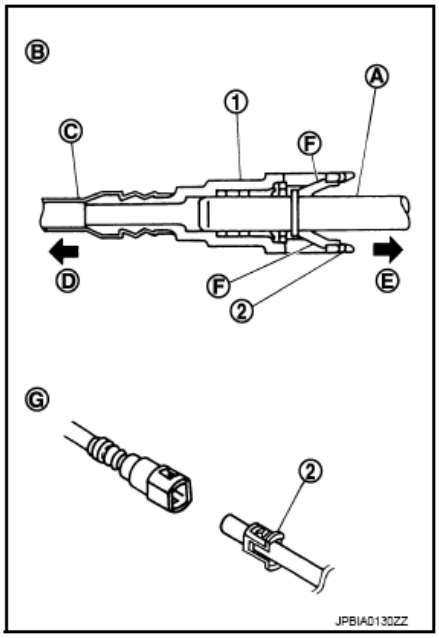


Fig. 44: Disconnecting Quick Connector
Courtesy of NISSAN NORTH AMERICA, INC.

b. If quick connector and fuel tube on sender unit are stuck, push and pull several times until they move, and pull out.

CAUTION:

- **Keep resin tube away from heat. Be especially careful when welding near the resin tube.**
- **Keep parts away from heat source. Especially, be careful when welding is performed around them.**

- **Never bend or twist resin tube during installation and disconnection.**
- **Prevent acid liquid such as battery electrolyte, etc. from getting on resin tube.**
- **Never remove the remaining retainer (2) on hard tube (or the equivalent) (A) except when resin tube or retainer is replaced.**
- **When resin tube or hard tube (or the equivalent) is replaced, also replace retainer with new one.**

  Retainer color: Green

- **To keep the connecting portion clean and to avoid damage and foreign materials, cover them completely with plastic bags, etc. (A) or a similar item.**

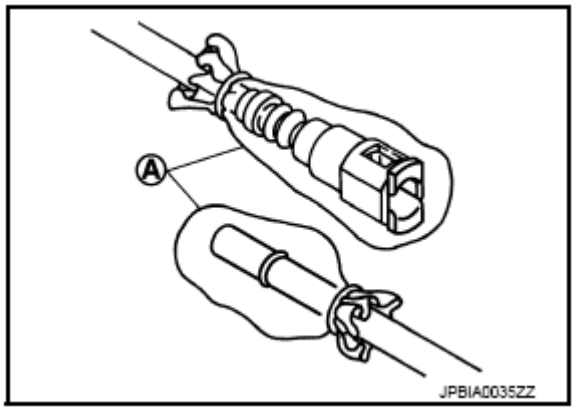


Fig. 45: Cover Quick Connector Using Plastic Bag
Courtesy of NISSAN NORTH AMERICA, INC.

12. 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.**

13. Remove fuel feed hose.
14. Remove harness clip and bracket mounting bolt.

INSTALLATION

CAUTION: Do not reuse O-rings or washers.

1. Install O-ring to high pressure fuel pump. When handing 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 front cover.**
- **Insert new O-ring straight into front cover. Never install off center or twist it.**

2. Install low fuel pressure sensor.

CAUTION: Do not reuse washer.

3. Install fuel feed hose.
   - Temporarily tighten mounting bolts (A) as shown in the figure below.

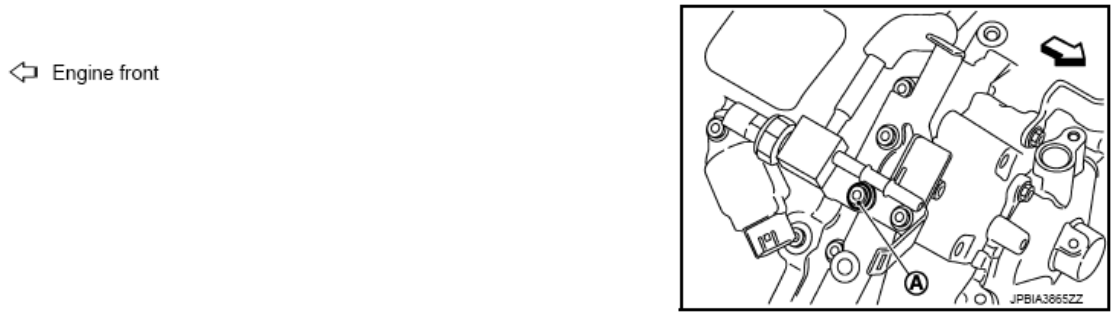


Fig. 46: Identifying Fuel Feed Hose Mounting Bolt
Courtesy of NISSAN NORTH AMERICA, INC.

4. Install high pressure fuel pump and lifter to front cover.

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

5. Connect fuel hose and fuel feed tube (pump side) to high pressure fuel pump. Refer to "**EXPLODED VIEW**".

CAUTION: When removing fuel feed tube (pump side), always replace fuel feed tube (bank side) together with fuel feed tube (pump side).

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 hose contact fuel pump.**

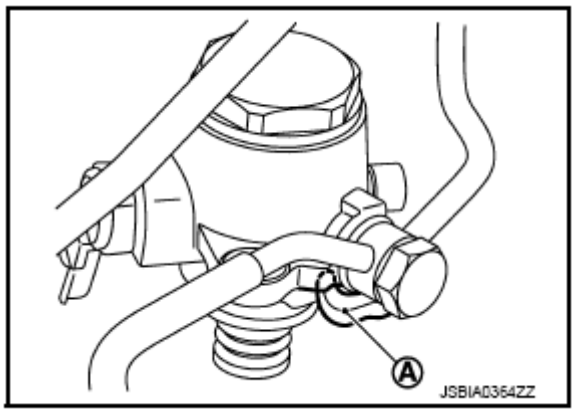


Fig. 47: Identifying Fuel Hose Contact Fuel Pump Rotation Stopper
Courtesy of NISSAN NORTH AMERICA, INC.

6. Install acoustic absorbent. Refer to "**EXPLODED VIEW**".
7. Tighten mounting bolts that are temporarily tightened in step 2.
8. Connect harness connector to high pressure fuel pump.
9. Install connector protector.
10. Note the following, and connect quick connector to install fuel feed hose.
    a. Align the connector with the tube, then insert the connector straight into the tube until a click sound is heard.
    b. After connecting, check that the connection is secure by following method.
        - Visually confirm that the two retainer tabs are connected to the connector.
        - Pull the tube and the connector to check they are securely connected.
    c. Install quick connector cap (3) to quick connector connection.

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

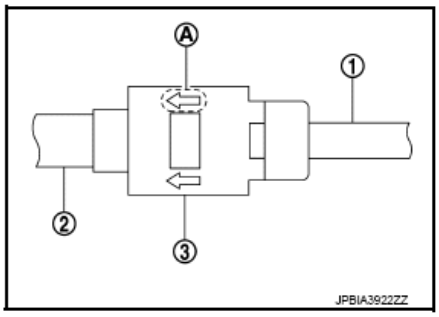


Fig. 48: Installing Quick Connector Cap To Quick Connector Connection
Courtesy of NISSAN NORTH AMERICA, INC.

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

CAUTION:
- **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.**

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

CAUTION: After checking fuel leakage, maintain ten minutes of idling to bleed the fuel line.

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.

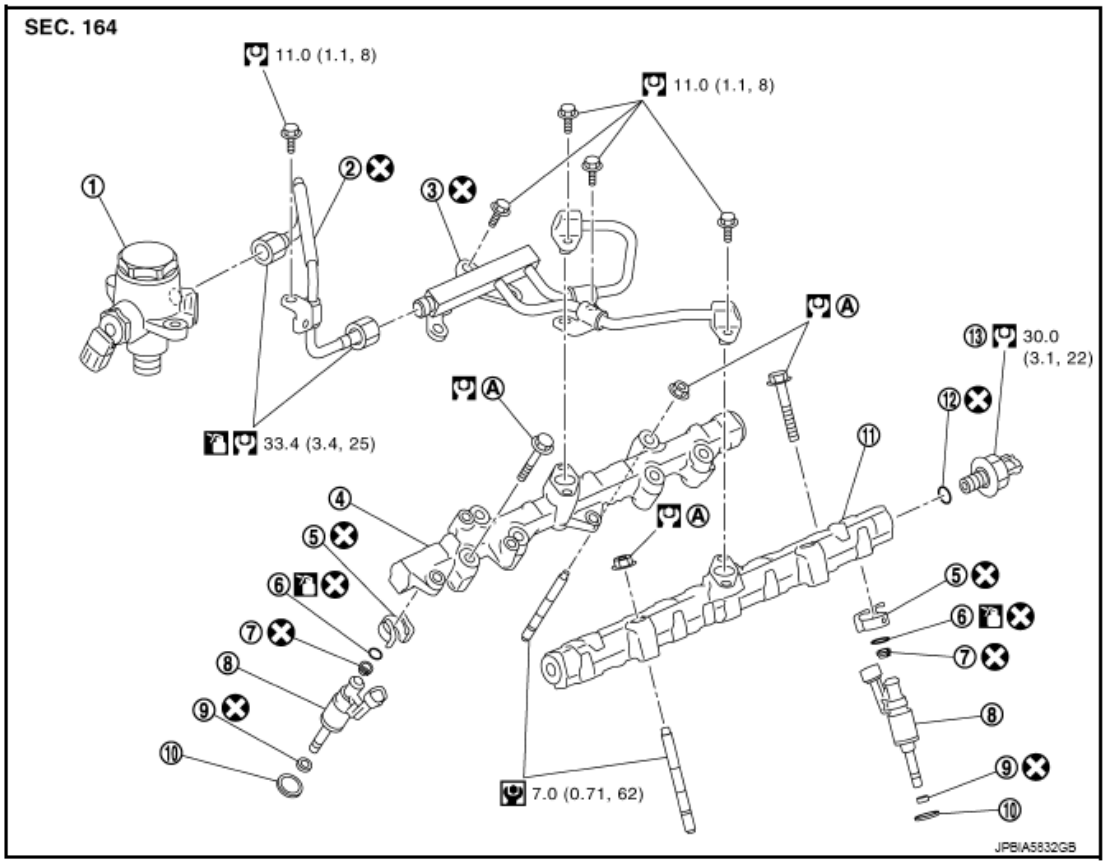
2. Start the engine. With engine speed increased, check again that there is no fuel leakage at connection points.

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

FUEL INJECTOR AND FUEL TUBE

Exploded View

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



1. High pressure fuel pump
2. Fuel feed tube (pump side)
3. Fuel feed tube (bank side)
4. Fuel rail (bank 2)
5. Injector holder
6. O-ring (blue)
7. Back up ring
8. Fuel injector
9. Seal ring
10. Insulator
11. Fuel rail (bank 1)
12. Gasket
13. Fuel rail pressure sensor
A. Comply with the installation procedure when tightening.

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

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

CAUTION:

- **Never remove or disassemble parts unless instructed as shown in the figure below.**
- **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 "**WORK PROCEDURE** ".
2. Remove intake manifold. Refer to "**EXPLODED VIEW**".
3. Remove acoustic absorbent. Refer to "**EXPLODED VIEW**".
4. Remove fuel feed tube (pump side) and fuel feed tube (bank side).

CAUTION: Never reuse fuel feed tube.

5. Remove fuel rail (bank 1) and fuel rail (bank 2).
6. Disconnect harness connector from fuel injectors.
7. 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.

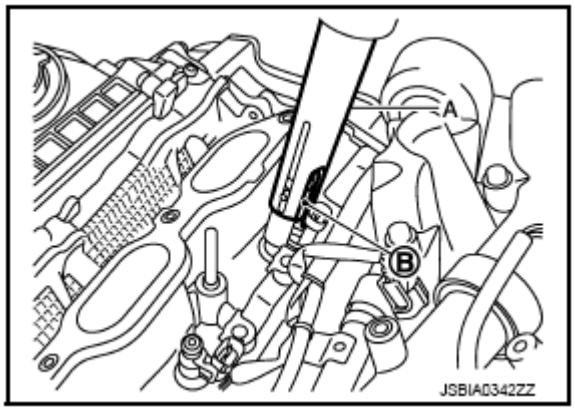


Fig. 50: Installing Injector Remover
Courtesy of NISSAN NORTH AMERICA, INC.

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

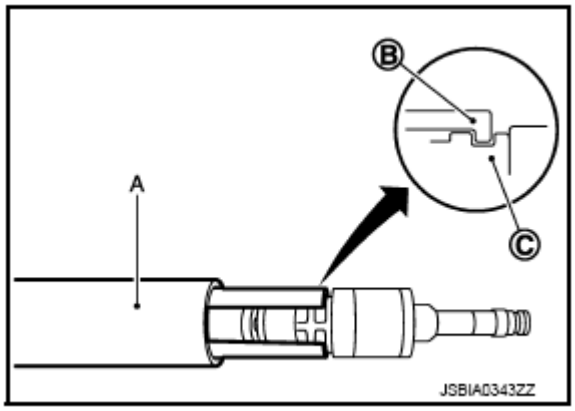


Fig. 51: Hooking Pawl Portion Of Injector Remover To Groove Portion Of Injector
Courtesy of NISSAN NORTH AMERICA, INC.

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

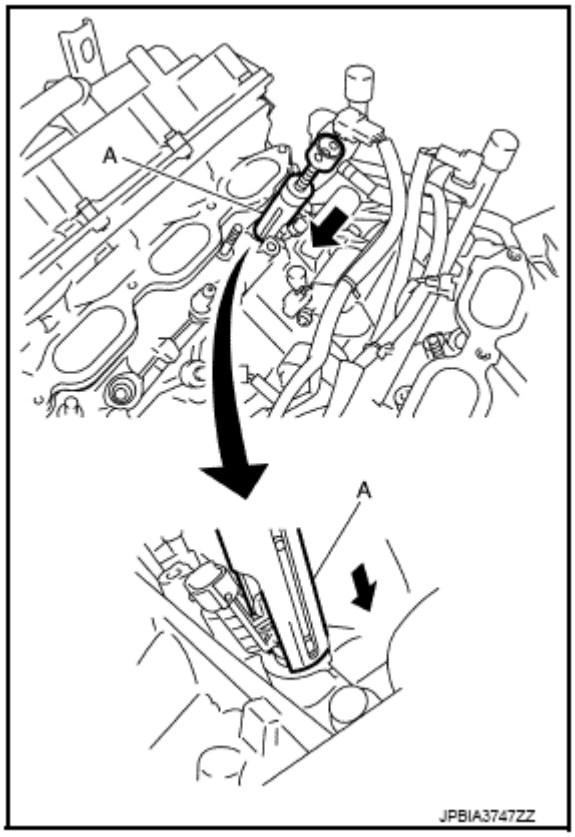


Fig. 52: Pressing Down Body Portion Of Injector Remover
Courtesy of NISSAN NORTH AMERICA, INC.

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

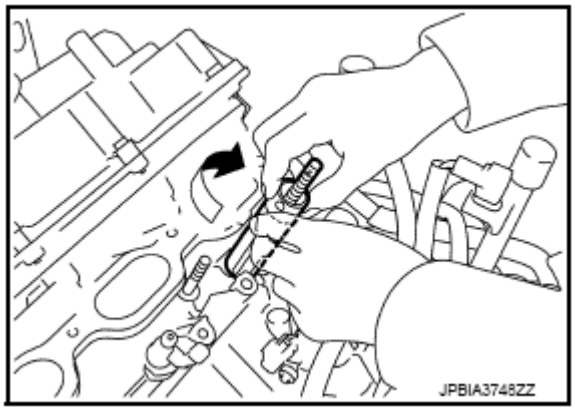


Fig. 53: Removing Injector From Cylinder Head
Courtesy of NISSAN NORTH AMERICA, INC.

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.

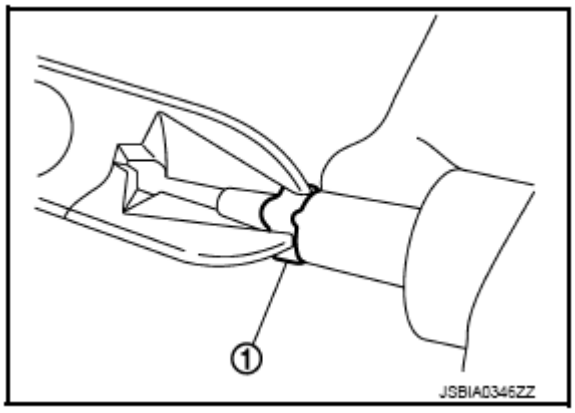


Fig. 54: Cutting Teflon Seal
Courtesy of NISSAN NORTH AMERICA, INC.

8. Remove fuel rail pressure sensor from fuel rail (bank 1), if necessary.

INSTALLATION

CAUTION: Do not reuse O-rings.

1. Install fuel rail pressure sensor to fuel rail (bank 1), if removed.

CAUTION:
- **Use a hexagon support tool to install fuel rail pressure sensor. Do not use open end tool such as a spanner.**
- **Never use fuel rail pressure sensor, if dropped.**

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

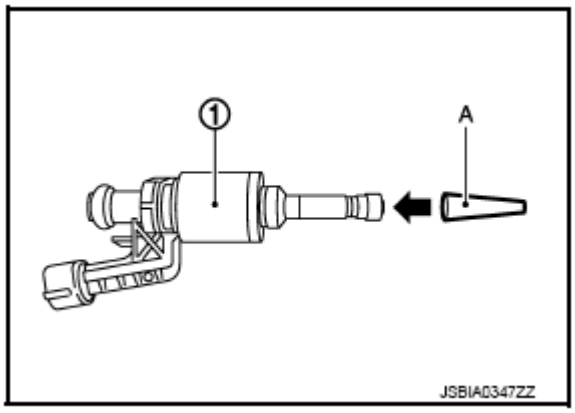


Fig. 55: Installing Seal Guide To Fuel Injector
Courtesy of NISSAN NORTH AMERICA, INC.

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

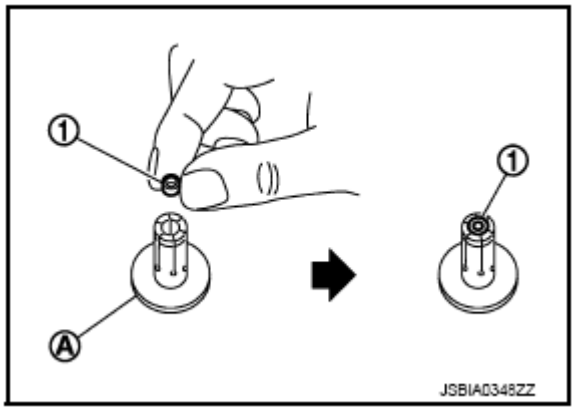


Fig. 56: Placing Seal Ring In Seal Installer
Courtesy of NISSAN NORTH AMERICA, INC.

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

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

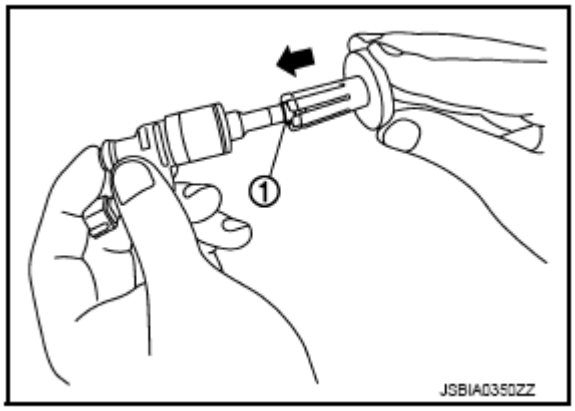


Fig. 57: Installing Seal Ring On Fuel Injector
Courtesy of NISSAN NORTH AMERICA, INC.

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

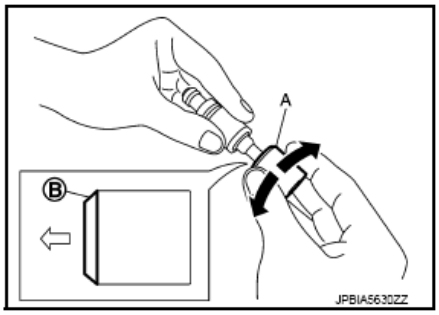


Fig. 58: Rotating Drift
Courtesy of NISSAN NORTH AMERICA, INC.

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.

3. Install O-ring and back up ring to fuel injector. When handing new O-ring and back up 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 rail.**
- **Insert new O-ring straight into fuel rail. Never install off center or twist it.**
- **Always install the back up ring (1) in the right direction as instructed.**

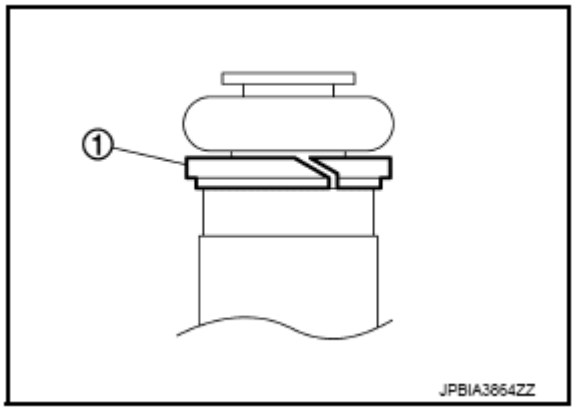


Fig. 59: Identifying Back Up Ring
Courtesy of NISSAN NORTH AMERICA, INC.

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

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

3 : O-ring (blue)
4 : Back up ring

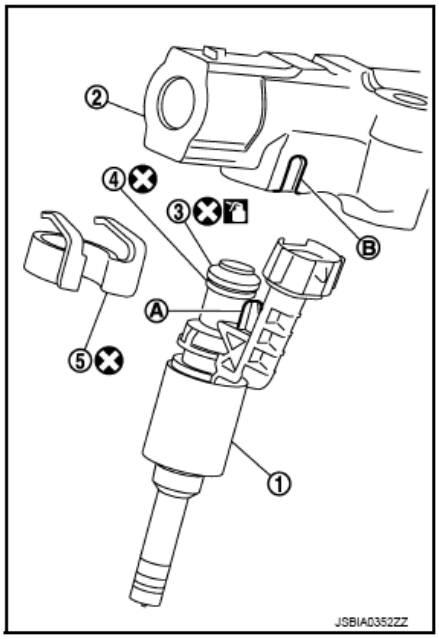


Fig. 60: Identifying Fuel Injector & Related Components
Courtesy of NISSAN NORTH AMERICA, INC.

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

CAUTION:
- **Never reuse 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.

5. Insert insulator into mounting hole of fuel injector of cylinder head.
6. 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 below.

⇦ : Engine front

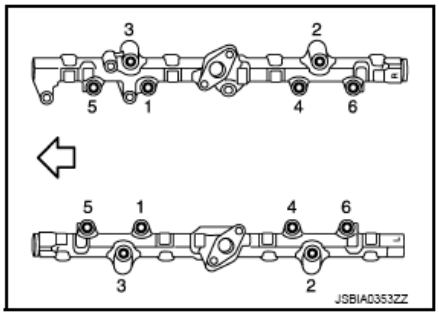


Fig. 61: Fuel Rail And Injector Assembly Mounting Bolts And Nuts Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

1st step Torque: 10.0 N.m (1.0 kg-m, 7.4 ft-lb)

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

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

CAUTION:

- **Never reuse fuel feed tube (bank side).**
- **When installing fuel feed tube (bank side) to fuel rail, press the flange part to install the tube.**
- **Handle O-ring with bare hands. Never wear gloves.**
- **Lubricate O-ring with new engine oil.**
- **Never clean O-ring with solvent.**
- **Check that O-ring and its mating part are free of foreign material.**
- **Never scratch O-ring with tools or fingernails when installing fuel feed tube (bank side).**
- **Insert new fuel feed tube (bank side) straight into fuel rail. Never install off center or twist the fuel feed tube (bank side) during insertion.**

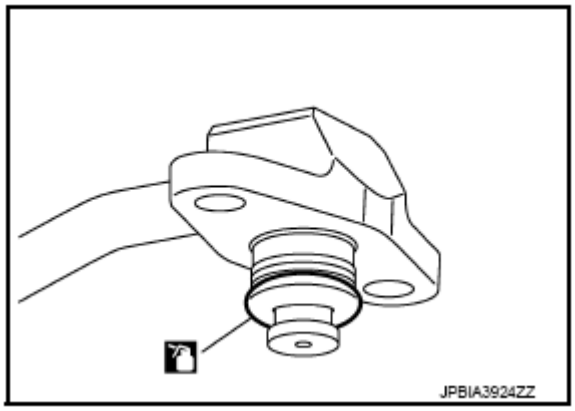


Fig. 62: Lubricating O-Ring With Engine Oil
Courtesy of NISSAN NORTH AMERICA, INC.

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

⇦ : Engine front

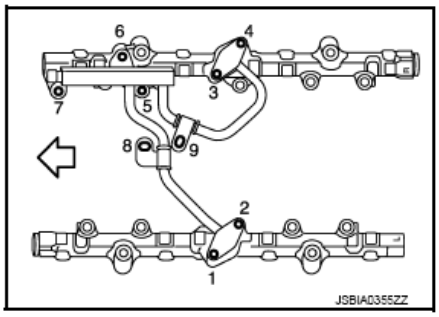


Fig. 63: Fuel Tube Mounting Bolt Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

9. Install fuel feed tube (pump side) (1) to fuel feed tube (bank side) (2) as per the following:

⇦ : Engine front

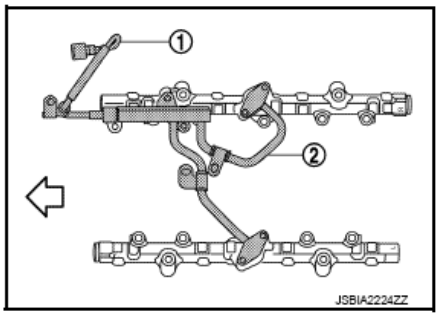


Fig. 64: Identifying Fuel Feed Tubes
Courtesy of NISSAN NORTH AMERICA, INC.

CAUTION:

- **When removing fuel feed tube (pump side), always replace fuel feed tube (bank side) together with fuel feed tube (pump side).**

- **Never reuse fuel feed tube (pump side).**
- **Never use fuel feed tube (pump side) if its terminal tip is damaged.**
- **Observe the tightening order and the tightening torque.**

a. Apply engine oil to flare screw parts of high pressure pump and tube between banks.
b. Manually tighten 2 flare nuts without using a tool until they are seated to screw thread.

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

c. Tighten mounting bolt (A).

B :To high pressure fuel pump
⇦ : Engine front

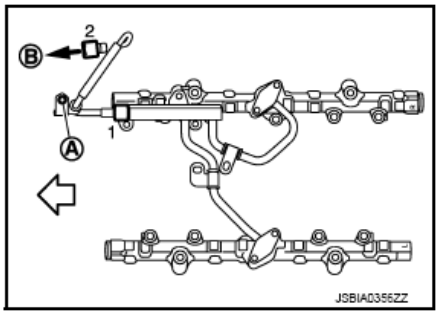


Fig. 65: Fuel Feed Tube Flare Nut Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

d. Tighten flare nuts in numerical order as shown in the figure below.

CAUTION: Always fit the tool completely with the nut.

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

CAUTION: After checking fuel leakage, maintain ten minutes of idling to bleed the fuel line.

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.

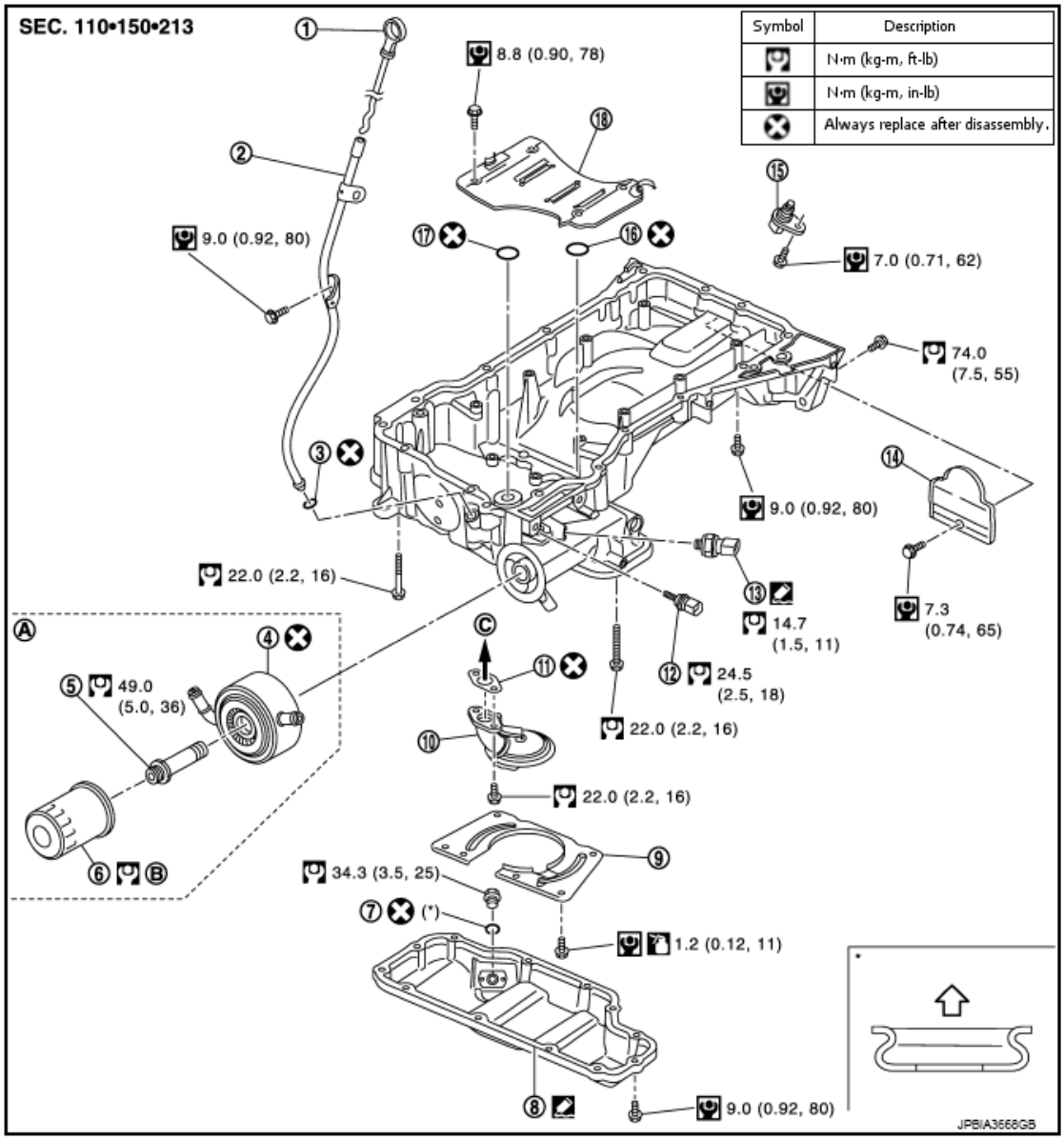
2. Start the engine. With engine speed increased, check again that there is no fuel leakage at connection points.

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

OIL PAN (LOWER) AND OIL STRAINER

2WD

2WD: Exploded View



1. Oil level gauge
2. Oil level gauge guide
3. O-ring
4. Oil cooler
5. Connector bolt
6. Oil filter
7. Drain plug washer
8. Oil pan (lower)
9. Baffle plate
10. Oil strainer
11. Gasket
12. Engine oil temperature sensor
13. Engine oil pressure sensor
14. Rear plate cover
15. Crankshaft position sensor (POS)
16. O-ring
17. O-ring
18. Baffle plate
A. Refer to "Engine Lubrication"
B. Refer to "Engine Lubrication"
C. Oil pump side
⇦ : Oil pan side

Fig. 66: Exploded View Of Lower Oil Pan & Oil Strainer With Torque Specifications (2WD)
Courtesy of NISSAN NORTH AMERICA, INC.

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

2WD: Removal and Installation

REMOVAL

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

1. Remove engine under cover.
2. Drain engine oil. Refer to "**DRAINING** ".
3. Remove oil pan (lower) as per the following:
   a. Loosen mounting bolts in reverse order as shown in the figure below to remove.

⇦ : Engine front

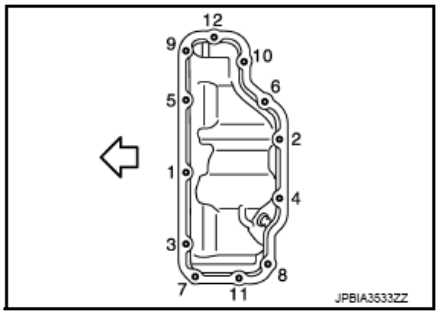


Fig. 67: Oil Pan Mounting Bolt Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

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

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

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

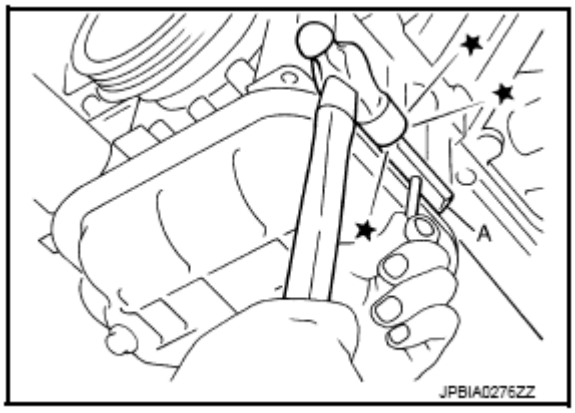


Fig. 68: Inserting Seal Cutter Between Upper And Lower Oil Pan

Courtesy of NISSAN NORTH AMERICA, INC.

4. Remove oil strainer.

INSTALLATION

CAUTION: Do not reuse drain plug washers.

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.

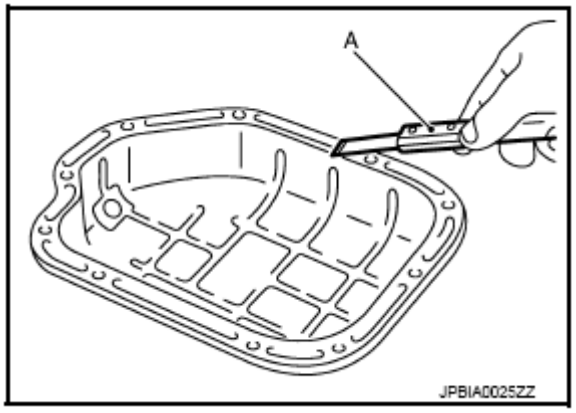


Fig. 69: Removing Old Liquid Gasket
Courtesy of NISSAN NORTH AMERICA, INC.

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

a : 7.5 - 9.5 mm (0.295 - 0.374 in)
b : ϕ4.0 - 5.0 mm (0.157 - 0.197 in)
⇦ : Engine front

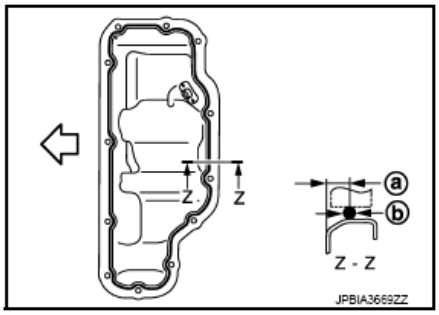


Fig. 70: Identifying Liquid Gasket
Courtesy of NISSAN NORTH AMERICA, INC.

Use Genuine RTV Silicone Sealant or an 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 below.

⇦ : Engine front

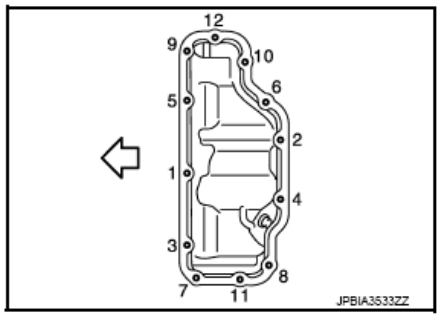


Fig. 71: Lower Oil Pan Bolt Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

3. Install oil pan drain plug.

CAUTION: Do not reuse drain plug washers.

   - Refer to the figure for installation direction of drain plug washer. See **2WD: Exploded View**.

     Refer to "**2WD: 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.

2WD: Inspection

INSPECTION AFTER REMOVAL

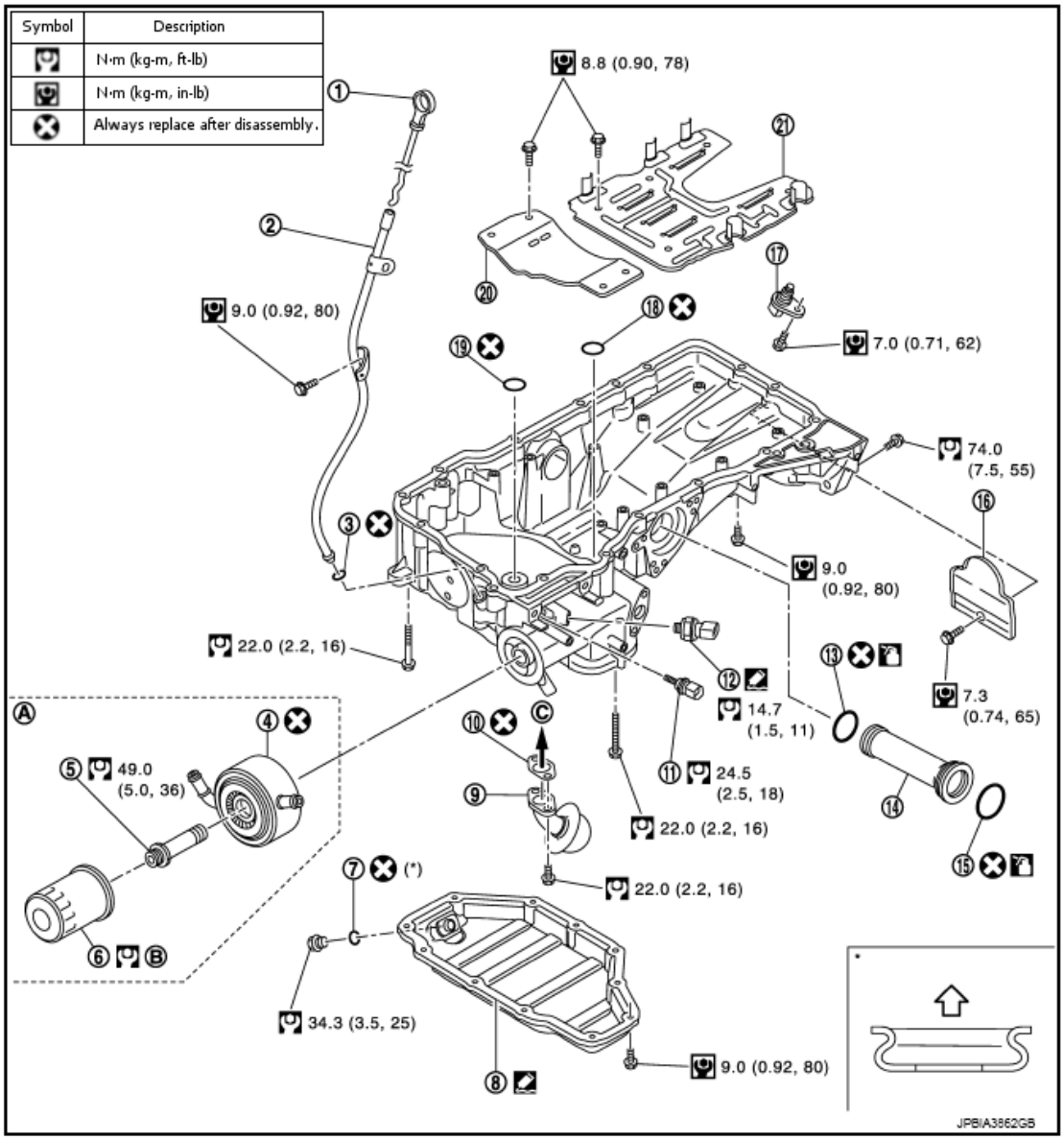
Clean oil strainer if any object is attached.

INSPECTION AFTER INSTALLATION

1. Check the engine oil level and adjust engine oil. Refer to "**INSPECTION** ".
2. Start engine, and check there is no leakage of engine oil.
3. Stop engine and wait for 15 minutes.
4. Check the engine oil level again. Refer to "**INSPECTION** ".

AWD

AWD: Exploded View



1. Oil level gauge
2. Oil level gauge guide
3. O-ring
4. Oil cooler
5. Connector bolt
6. Oil filter
7. Drain plug washer
8. Oil pan (lower)
9. Oil strainer
10. Gasket
11. Engine oil temperature sensor
12. Engine oil pressure sensor
13. O-ring
14. Axle pipe
15. O-ring
16. Rear plate cover
17. Crankshaft position sensor (POS)
18. O-ring
19. O-ring
20. Baffle plate
21. Baffle plate

A. Refer to "Engine Lubrication"
B. Refer to "Engine Lubrication"
C. Oil pump side
⇦ : Oil pan side

Fig. 72: Exploded View Of Lower Oil Pan & Oil Strainer With Torque Specifications
Courtesy of NISSAN NORTH AMERICA, INC.

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

AWD: Removal and Installation

REMOVAL

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

1. Remove engine under cover.
2. Drain engine oil. Refer to "**DRAINING** ".
3. Remove oil pan (lower) as per the following:
   a. Loosen mounting bolts in reverse order as shown in the figure below to remove.

⇦ : Engine front

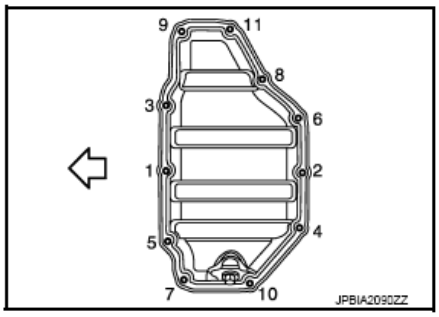


Fig. 73: Oil Pan Mounting Bolt Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

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

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

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

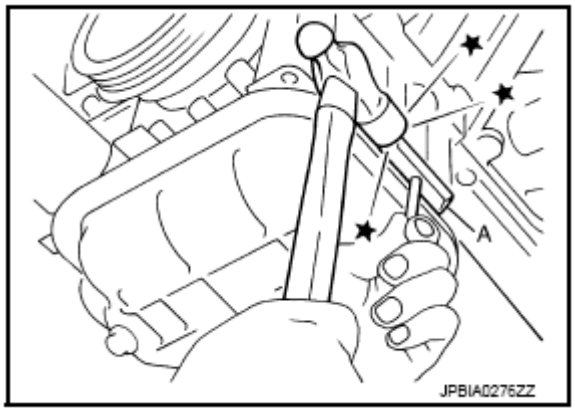


Fig. 74: Inserting Seal Cutter Between Upper & Lower Oil Pan
Courtesy of NISSAN NORTH AMERICA, INC.

4. Remove oil strainer.

INSTALLATION

CAUTION: Do not reuse drain plug washers.

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.

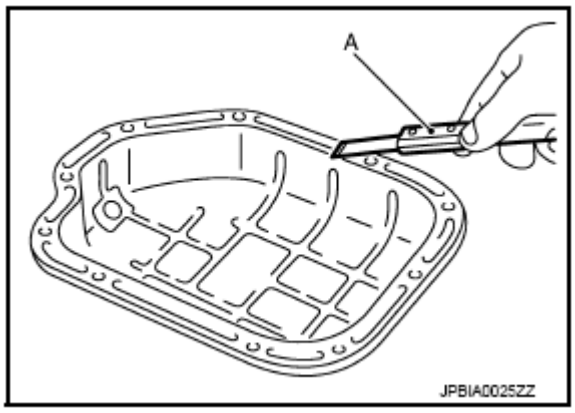


Fig. 75: Removing Old Liquid Gasket
Courtesy of NISSAN NORTH AMERICA, INC.

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

a : 7.5 - 9.5 mm (0.295 - 0.374 in)
b : ϕ4.0 - 5.0 mm (0.157 - 0.197 in)
⇦ : Engine front

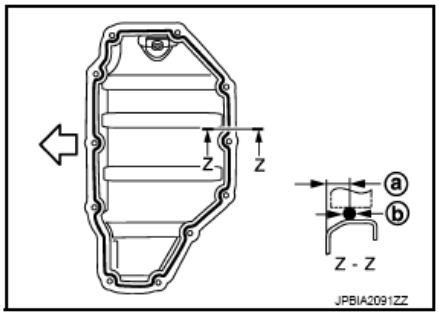


Fig. 76: Identifying Liquid Gasket
Courtesy of NISSAN NORTH AMERICA, INC.

Use Genuine RTV Silicone Sealant or an 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 below.

⇦ : Engine front

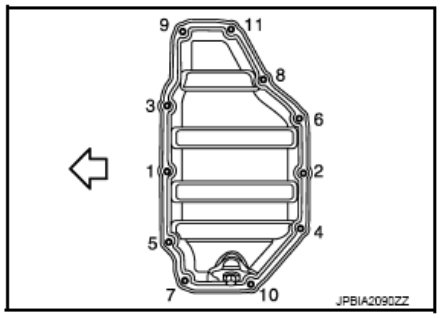


Fig. 77: Lower Oil Pan Mounting Bolt Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

3. Install oil pan drain plug.

CAUTION: Do not reuse drain plug washer.

   - Refer to **AWD: Exploded View** for installation direction of drain plug washer.

     Refer to "**AWD: 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.

AWD: 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 SEAL

FRONT OIL SEAL

FRONT OIL SEAL: Removal and Installation

REMOVAL

1. Remove the following parts:
   - Engine undercover with power tool.
   - Drive belts: Refer to "**EXPLODED VIEW**".
   - Cooling fan assembly: Refer to "**EXPLODED VIEW** ".
   - Suspension member stay (2WD models): Refer to "**EXPLODED VIEW** ".
   - Front cross bar (AWD models): Refer to "**EXPLODED VIEW** ".
2. Remove crankshaft pulley as per the following:
   a. Remove rear plate cover. Refer to "**2WD: EXPLODED VIEW**" (2WD models) or "**AWD: EXPLODED VIEW**" (AWD models).
   b. Set the ring gear stopper [SST: KV10119200 (J-49277)] (A) as shown in the figure below.

⇦ : Engine front

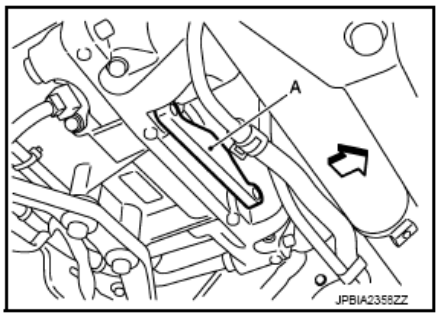


Fig. 78: Installing Ring Gear Stopper
Courtesy of NISSAN NORTH AMERICA, INC.

   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.

3. Remove front oil seal using a suitable tool.

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

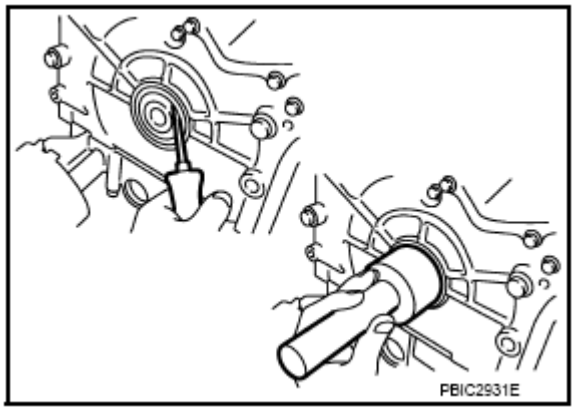


Fig. 79: Replacing Front Oil Seal
Courtesy of NISSAN NORTH AMERICA, INC.

INSTALLATION

1. Install front oil seal on front cover.

⇦ : Engine inside
⬅ : Engine outside

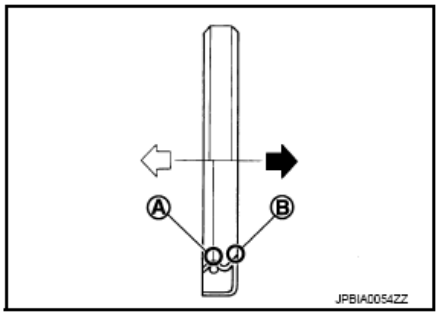


Fig. 80: Identifying Oil And Dust Seal Orientation
Courtesy of NISSAN NORTH AMERICA, INC.

- Apply new engine oil to both oil seal lip (A) and dust seal lip (B).
- Install it so that each seal lip is oriented as shown in the figure below.

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

- 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 "**VK56VD (2WD): EXPLODED VIEW** " (2WD models) or "**VK56VD (AWD): EXPLODED VIEW** " (AWD models).
2. Remove drive plate. Refer to "**EXPLODED VIEW**".
3. Remove rear oil seal with a suitable tool.

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

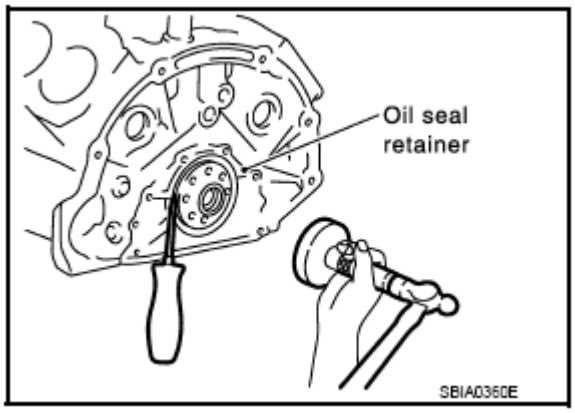


Fig. 81: Replacing Rear Oil Seal
Courtesy of NISSAN NORTH AMERICA, INC.

INSTALLATION

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

A : Oil seal lip
B : Dust seal lip
⇦ : Engine inside
⬅ : Engine outside

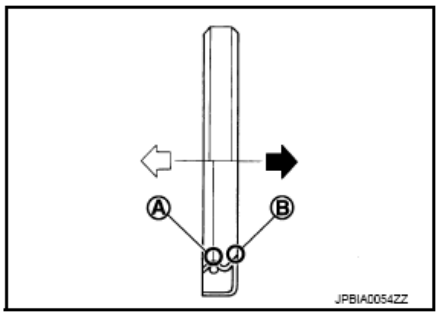


Fig. 82: Identifying Oil And Dust Seal Orientation
Courtesy of NISSAN NORTH AMERICA, INC.

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

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

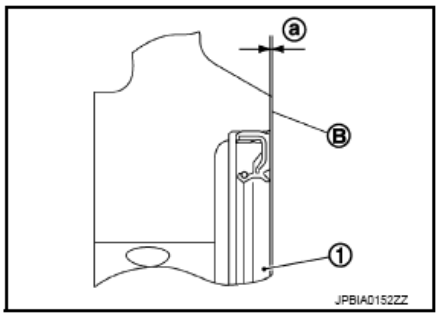


Fig. 83: Identifying Rear Oil Seal Installation Dimensions
Courtesy of NISSAN NORTH AMERICA, INC.

- 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.**

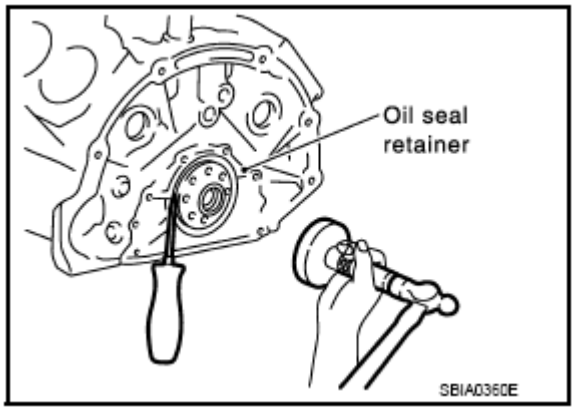


Fig. 84: Replacing Rear Oil Seal
Courtesy of NISSAN NORTH AMERICA, INC.

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

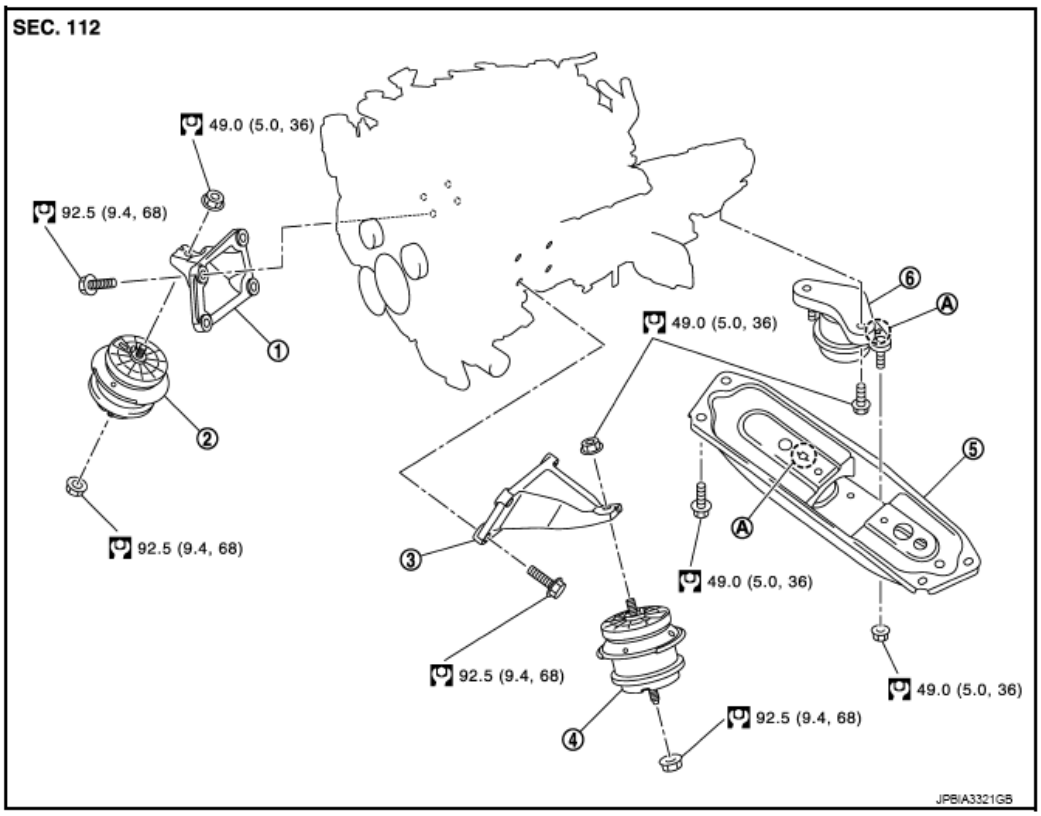
UNIT REMOVAL AND INSTALLATION

ENGINE ASSEMBLY

2WD

2WD: Exploded View

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



1. Engine mounting bracket (RH)
2. Engine mounting insulator (RH)
3. Engine mounting bracket (LH)
4. Engine mounting insulator (LH)
5. Rear engine mounting member
6. Engine mounting insulator (rear)

A. Front mark

Fig. 85: Exploded View Of Engine Assembly With Torque Specifications (2WD)
Courtesy of NISSAN NORTH AMERICA, INC.

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

2WD: Removal and Installation

WARNING:

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

CAUTION:

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

enough.

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

NOTE:

- **When removing components such as hoses, tubes/lines, etc., cap or plug openings to prevent fluid from spilling.**
- **When removing/installing only the engine mounting, the hold engine assembly as instructed bellow:**

1. Remove food assembly. Refer to "**EXPLODED VIEW** ".
2. Install engine slinger on both front right and front left sides of the engine.
3. 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.

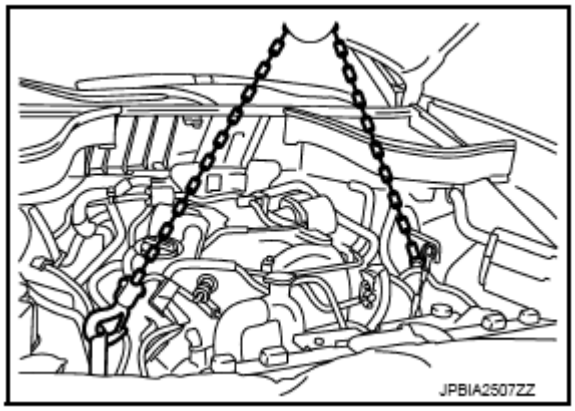


Fig. 86: Lifting Engine
Courtesy of NISSAN NORTH AMERICA, INC.

REMOVAL

Outline

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

Preparation

1. Remove engine cover. Refer to "**EXPLODED VIEW**".
2. Release fuel pressure. Refer to "**WORK PROCEDURE** ".
3. Remove the following parts:
   - Engine undercover (power tool)
   - Front road wheel and tires (power tool)
   - Cowl top cover: Refer to "**EXPLODED VIEW** ".
   - Air duct (inlet), air cleaner case assembly, air duct and PCV hose: Refer to "**EXPLODED VIEW**".
   - Drive belts: Refer to "**REMOVAL AND INSTALLATION**".
4. Drain power steering fluid.
5. Remove battery. Refer to "**EXPLODED VIEW** ".
6. Drain engine coolant from radiator. Refer to "**DRAINING** ".

CAUTION: Perform this step when engine is cold.

7. Discharge refrigerant from A/C circuit. Refer to "**DESCRIPTION** ".
8. Remove radiator hoses (upper and lower). Refer to "**EXPLODED VIEW** ".

Engine Room LH

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

Engine Room RH

1. Remove air intake cover.
2. Disconnect all clips and connectors of the engine room harness from vehicle side.
3. Disconnect fuel feed hose and EVAP service port hose. Refer to "**EXPLODED VIEW**" and "**EXPLODED VIEW**".

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

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

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

Vehicle Inside

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

1. Remove glove box assembly and instrument assist lower panel. Refer to "**EXPLODED VIEW** ".
2. Disconnect engine room harness connectors at unit sides and other locations.
3. Disengage intermediate fixing point. Pull out engine room harnesses to engine room side, and temporarily secure them on engine.

CAUTION:

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

Vehicle Underbody

1. Remove A/T fluid cooler hoses and power steering oil piping.
2. Disconnect ground cable from exhaust manifold cover (bank 2).
3. Disconnect heated oxygen sensor 2 harness.
4. Remove mounting bracket. Refer to "**VK56VD: EXPLODED VIEW** ".
5. Remove three way catalyst and exhaust front tube. Refer to "**EXPLODED VIEW**" and "**VK56VD: EXPLODED VIEW** ".
6. Remove rear propeller shaft. Refer to "**EXPLODED VIEW** ".
7. Disconnect lower joint at power steering gear assembly side, and release lower shaft. Refer to "**WITHOUT 4WAS: EXPLODED VIEW** " (WITHOUT 4WAS) or "**WITH 4WAS: EXPLODED VIEW** " (WITH 4WAS).
8. Disengage A/T control rod at control device assembly side. Then, temporarily secure it on the transmission assembly, so that it does not sag. Refer to "**EXPLODED VIEW** ".
9. Preparation for the separation work of transaxle is as per the following:
   - Remove suspension member stay. Refer to "**EXPLODED VIEW** ".
   - Remove rear plate cover from oil pan (upper). Then remove bolts fixing drive plate to torque converter. Refer to "**2WD: EXPLODED VIEW**".
   - Remove transmission joint bolts that pierce at oil pan (upper) lower rear side. Refer to "**2WD: EXPLODED VIEW**".
10. Remove front stabilizer connecting rod. Refer to "**EXPLODED VIEW** ".
11. Remove front wheel sensor for ABS from steering knuckle. Refer to "**FRONT WHEEL SENSOR: EXPLODED VIEW** ".
12. Remove steering gear outer socket from steering knuckle. Refer to "**2WD: EXPLODED VIEW** ".

13. Separate shock absorber from transverse link. Refer to "**EXPLODED VIEW** ".
14. Remove transverse link from steering knuckle. Refer to "**EXPLODED VIEW** ".

Removal Work

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

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

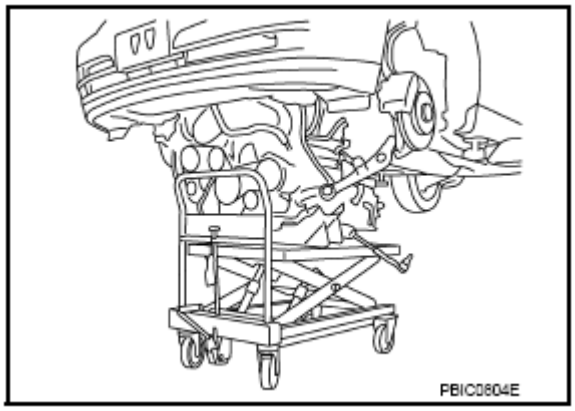


Fig. 87: Supporting Bottom Of Suspension Member Using Manual Lift Table Caddy
Courtesy of NISSAN NORTH AMERICA, INC.

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

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

Separation Work

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

1 : Engine front slinger (bank 1)
2 : Engine rear slinger (bank 2)
⇦: Engine front

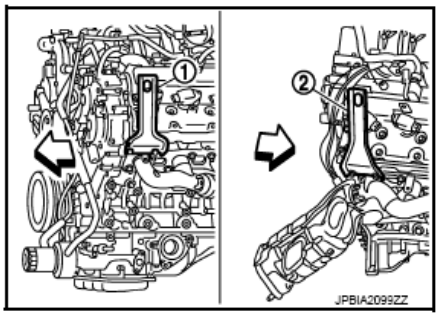


Fig. 88: Identifying Engine Slingers
Courtesy of NISSAN NORTH AMERICA, INC.

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

2. Hang the lifting hook of a two-point engine lifter (commercial service tool) (A) from the front and rear engine slingers to hoist engine and flywheel housing assembly.
   - For the flywheel housing side, use a webbing slinger (B) or an equivalent to hoist the assembly horizontally.

CAUTION: Always hoist the engine by using a two-point engine lifter (i.e. hoisting the front and rear slingers from one point in the air), or the rocker cover and parts around the engine may be damaged due to the fall of the engine slinger.

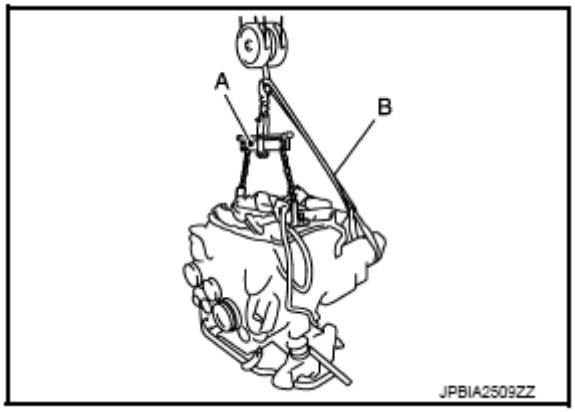


Fig. 89: Identifying Two-Point Engine Lifter & Webbing Slinger
Courtesy of NISSAN NORTH AMERICA, INC.

3. Remove power steering oil pump from engine side. Refer to "**VK56VD: EXPLODED VIEW** ".
4. Remove engine mounting insulators (RH and LH) under side nuts with power tool.
5. Lift with hoist and separate the engine, transmission, transfer and front final drive assembly from front suspension member.

CAUTION:
- **Before and during this lifting, always check that any harnesses**

are left connected.

- **Never damage engine mounting insulator and avoid oil/grease smearing or spills onto engine mounting insulator.**

6. Remove alternator. Refer to "**VK56VD: EXPLODED VIEW** ".
7. Remove crankshaft position sensor. Refer to "**2WD: EXPLODED VIEW**".
8. Remove engine harness from transmission.
9. Remove A/T fluid cooler tube. Refer to "**VK56VD (2WD): EXPLODED VIEW** ".
10. Separate the engine from the transmission assembly. Refer to "**VK56VD (2WD): EXPLODED VIEW** ".
11. Remove each engine mounting insulator and each engine mounting bracket from the engine with power tool.

INSTALLATION

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

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

A : Example right

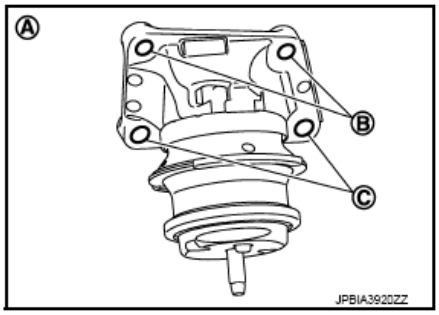


Fig. 90: Identifying Engine Mounting Bracket Upper And Lower Bolts
Courtesy of NISSAN NORTH AMERICA, INC.

NOTE: This figure shows an example of bank 2.

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

⇦: Vehicle front

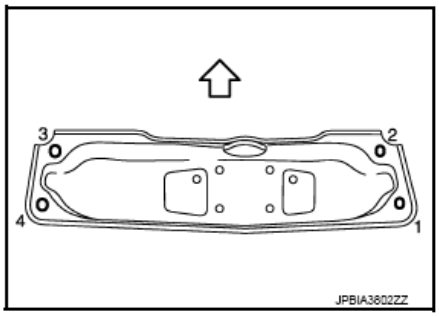


Fig. 91: Rear Engine Mounting Member Bolt Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

- Check that all engine mounting insulators are seated properly, then tighten mounting nuts and bolts.

2WD: Inspection

INSPECTION AFTER INSTALLATION

Inspection for Leakage

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

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

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

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

SUMMARY OF INSPECTION ITEMS

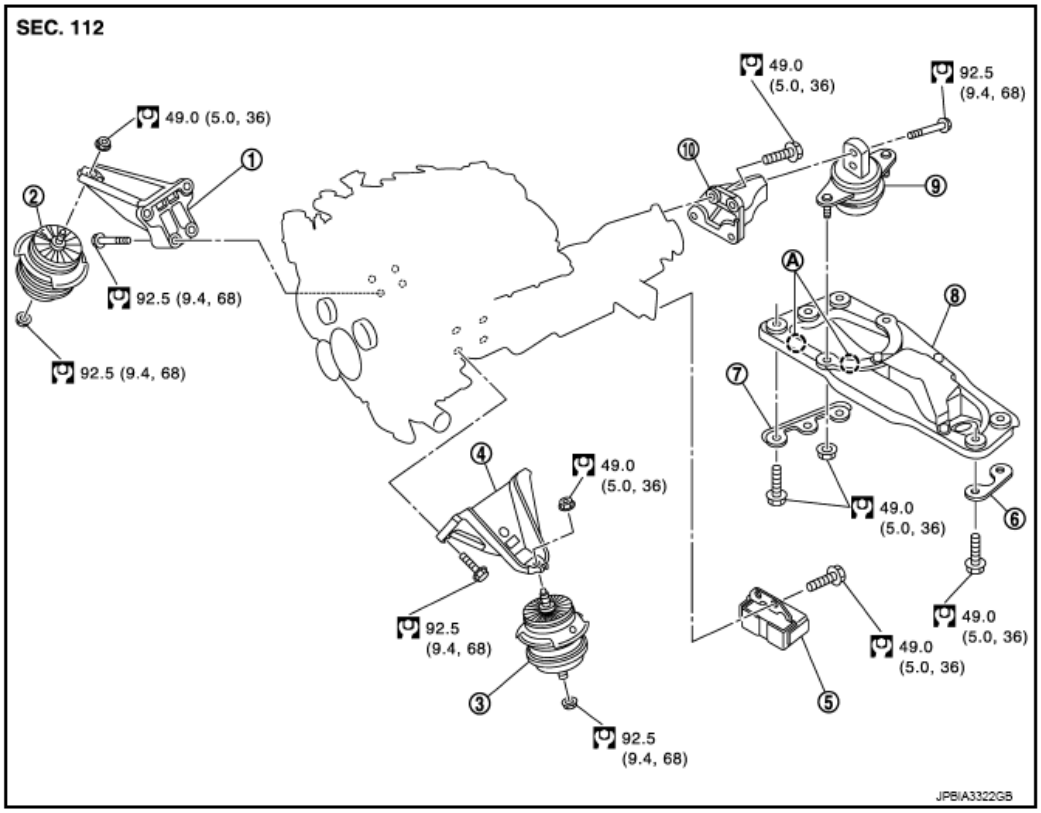
Items	Before starting engine	Engine running	After engine stopped

Engine coolant		Level	Leakage	Level
Engine oil		Level	Leakage	Level
Transmission/transaxle fluid	AT & CVT Models	Leakage	Level/Leakage	Leakage
	MT Models	Level/Leakage	Leakage	Level/Leakage
Other oils and fluids(1)		Level	Leakage	Level
Fuel		Leakage	Leakage	Leakage
Exhaust gases		-	Leakage	-
(1) Power steering fluid, brake fluid, etc.				

AWD

AWD: Exploded View

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



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

Fig. 92: Exploded View Of Engine Assembly (AWD) With Torque Specifications
Courtesy of NISSAN NORTH AMERICA, INC.

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

AWD: Removal and Installation

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

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

NOTE:
- **When removing components such as hoses, tubes/lines, etc., cap or plug openings to prevent fluid from spilling.**
- **When removing/installing only the engine mounting, the hold engine assembly as instructed bellow:**

1. Remove food assembly. Refer to "**EXPLODED VIEW** ".
2. Install engine slinger on both front right and front left sides of the engine.
3. 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.

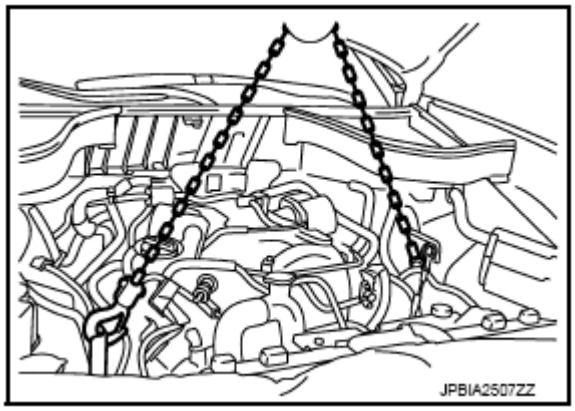


Fig. 93: Lifting Engine
Courtesy of NISSAN NORTH AMERICA, INC.

REMOVAL

Outline

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

Preparation

1. Remove engine cover. Refer to "**EXPLODED VIEW**".
2. Release fuel pressure. Refer to "**WORK PROCEDURE** ".
3. Remove the following parts:
   - Engine undercover (power tool)
   - Front road wheel and tires (power tool)
   - Cowl top cover: Refer to "**EXPLODED VIEW** ".
   - Air duct (inlet), air cleaner case assembly, air duct and PCV hose: Refer to "**EXPLODED VIEW**".
   - Drive belts: Refer to "**REMOVAL AND INSTALLATION**".
   - Front cross bar: Refer to "**EXPLODED VIEW** ".
4. Remove battery. Refer to "**EXPLODED VIEW** ".
5. Drain engine coolant from radiator. Refer to "**DRAINING** ".

CAUTION: Perform this step when engine is cold.

6. Drain power steering fluid.
7. Discharge refrigerant from A/C circuit. Refer to "**DESCRIPTION** ".
8. Remove radiator hoses (upper and lower). Refer to "**EXPLODED VIEW** ".

Engine Room LH

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

Engine Room RH

1. Remove air intake duct.
2. Disconnect all clips and connectors of the engine room harness from vehicle side.
3. Disconnect fuel feed hose and EVAP service port hose. Refer to "**EXPLODED VIEW**" and "**EXPLODED VIEW**".

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

4. Remove reservoir tank of power steering oil pump and piping from vehicle, and temporarily secure them on engine. Refer to "**VK56VD: EXPLODED VIEW** ".

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

Vehicle Inside

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

1. Remove glove box assembly and instrument assist lower panel. Refer to "**EXPLODED VIEW** ".
2. Disconnect engine room harness connectors at unit sides and other locations.
3. Disengage intermediate fixing point. Pull out engine room harnesses to engine room side, and temporarily secure them on engine.

CAUTION:

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

Vehicle Underbody

1. Remove A/T fluid cooler hoses and power steering oil pump oil piping.
2. Disconnect ground cable from exhaust manifold cover (bank 2).

3. Disconnect heated oxygen sensor 2 harness.
4. Remove mounting bracket and exhaust front tube. Refer to "**VK56VD: EXPLODED VIEW** ".
5. Disconnect lower joint at power steering gear assembly side, and release lower shaft. Refer to "**WITHOUT 4WAS: EXPLODED VIEW** " (WITHOUT 4WS) or "**WITH 4WAS: EXPLODED VIEW** " (WITH 4WS).
6. Remove rear propeller shaft. Refer to "**EXPLODED VIEW** ".
7. Disengage A/T control rod at control device assembly side. Then, temporarily secure it on the transmission assembly, so that it does not sag. Refer to "**EXPLODED VIEW** ".
8. Preparation for the separation work of transaxle is as per the following:
   - Remove rear plate cover from oil pan (upper). Then remove bolts fixing drive plate to torque converter. Refer to "**AWD: EXPLODED VIEW**".
   - Remove transmission joint bolts that pierce at oil pan (upper) lower rear side. Refer to "**AWD: EXPLODED VIEW**".
9. Separate steering outer sockets from steering knuckle. Refer to "**AWD: EXPLODED VIEW** ".
10. Remove stabilizer connecting rod. Refer to "**EXPLODED VIEW** ".
11. Remove shock absorber. Refer to "**EXPLODED VIEW** ".
12. Remove front drive shaft (both side). Refer to "**EXPLODED VIEW** ".
13. Remove transverse links mounting bolts at suspension member side. Refer to "**EXPLODED VIEW** ".

Removal Work

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

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

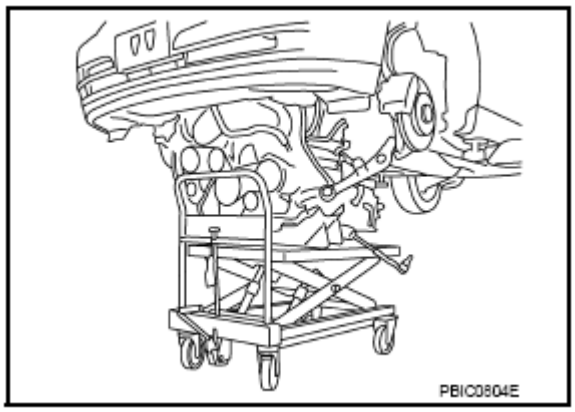


Fig. 94: Supporting Bottom Of Suspension Member Using Manual Lift Table Caddy
Courtesy of NISSAN NORTH AMERICA, INC.

2. Loosen rear engine mounting member mounting bolts.

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

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

Separation Work

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

1 : Engine front slinger (bank 1)
2 : Engine rear slinger (bank 2)
⇦: Engine front

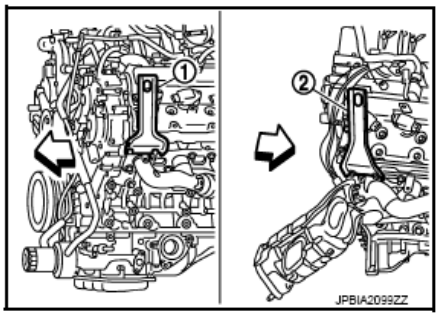


Fig. 95: Identifying Engine Slingers
Courtesy of NISSAN NORTH AMERICA, INC.

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

2. Hang the lifting hook of a two-point engine lifter (commercial service tool) (A) from the front and rear engine slingers to hoist engine and flywheel housing assembly.
   - For the flywheel housing side, use a webbing slinger (B) or an equivalent to hoist the assembly horizontally.

CAUTION: Always hoist the engine by using a two-point engine lifter (i.e. hoisting the front and rear slingers from one point in the air), or the rocker cover and parts around the engine may be damaged due to the fall of the engine slinger.

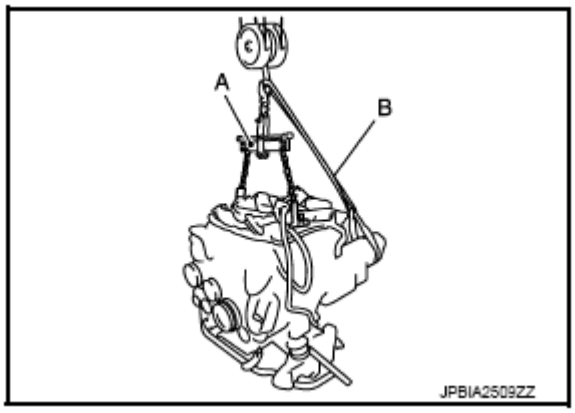


Fig. 96: Identifying Two-Point Engine Lifter & Webbing Slinger
Courtesy of NISSAN NORTH AMERICA, INC.

3. Remove power steering oil pump from engine side. Refer to "**VK56VD: EXPLODED VIEW** ".
4. Remove engine mounting insulators (RH and LH) under side nuts with power tool.
5. Lift with hoist and separate the engine, transmission, transfer and front final drive assembly from front suspension member.

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

6. Remove alternator. Refer to "**VK56VD: EXPLODED VIEW** ".
7. Disconnect harness connector from transmission assembly and transfer assembly.
8. Remove crankshaft position sensor. Refer to "**AWD: EXPLODED VIEW**".
9. Remove A/T fluid cooler tube. Refer to "**VK56VD (AWD): EXPLODED VIEW** ".
10. Separate the engine from the transmission assembly. Refer to "**VK56VD (AWD): EXPLODED VIEW** ".
11. Remove front propeller shaft. Refer to "**VK56VD: EXPLODED VIEW** ".
12. Remove the front final drive assembly from oil pan (upper). Refer to "**VK56VD: EXPLODED VIEW** ".
13. Remove each engine mounting insulator and each engine mounting bracket from the engine with power tool.

INSTALLATION

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

- Do not allow engine mounting insulator to be damage and careful no engine oil gets on it.
- For a location with a positioning pin, insert it securely into hole of matching part.
- For a part with a specified installation orientation, refer to component figure in "**AWD: EXPLODED VIEW**".

- When installing engine mounting bracket (RH and LH) on cylinder block, tighten two upper bolts (A) first. Then tighten two lower bolts (B).

⇦: Engine front

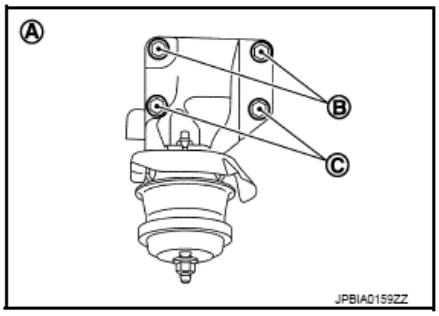


Fig. 97: Identifying Engine Mounting Bracket Upper And Lower Bolts
Courtesy of NISSAN NORTH AMERICA, INC.

NOTE: This figure shows an example of bank 2.

- When installing engine mounting bracket (rear) on transfer, tighten two upper bolts (B) first. Then tighten two lower bolts (C).

A : Rear view

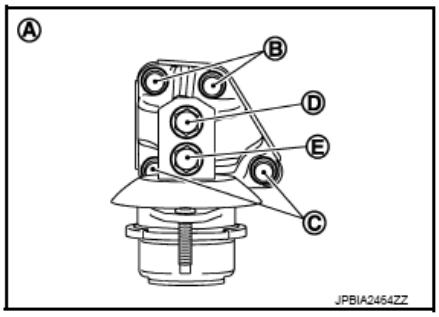


Fig. 98: Engine Mounting Bracket Bolt Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

- When installing engine mounting insulator (rear) on engine mounting bracket (rear), tighten upper bolts (D) first. Then tighten lower bolts (E).
- Tighten rear engine mounting member bolts in numerical order as shown in the figure below.

⇦: Vehicle front

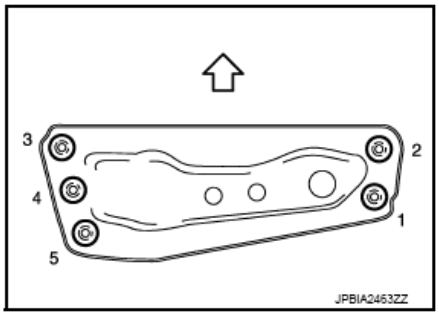


Fig. 99: Rear Engine Mounting Member Bolt Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

- Check that all engine mounting insulators are seated properly, then tighten mounting nuts and bolts.

AWD: Inspection

INSPECTION AFTER INSTALLATION

Inspection for Leakage

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

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

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

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

SUMMARY OF INSPECTION ITEMS

Items		Before starting engine	Engine running	After engine stopped
Engine coolant		Level	Leakage	Level
Engine oil		Level	Leakage	Level
Transmission/transaxle fluid	AT & CVT Models	Leakage	Level/Leakage	Leakage
	MT Models	Level/Leakage	Leakage	Level/Leakage
Other oils and fluids(1)		Level	Leakage	Level
Fuel		Leakage	Leakage	Leakage
Exhaust gases		-	Leakage	-

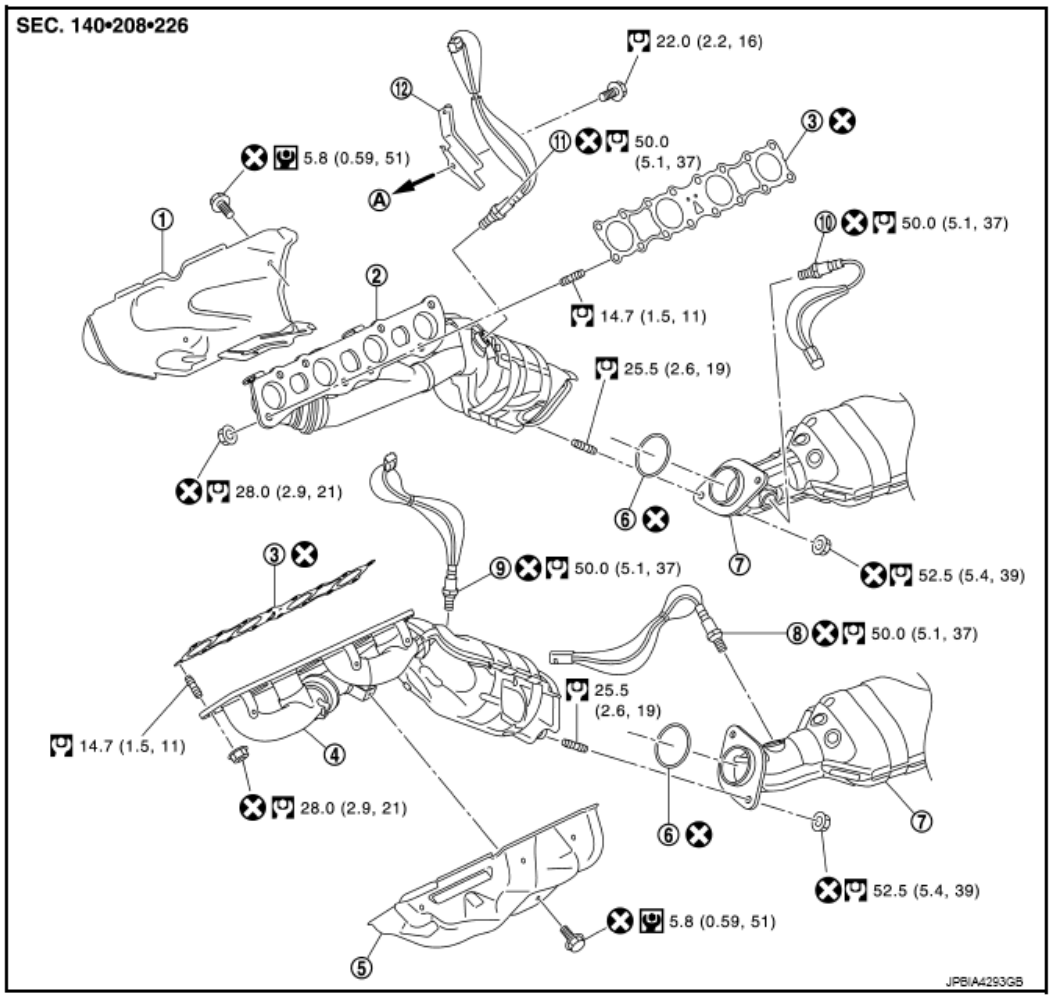
(1) Power steering fluid, brake fluid, etc.

UNIT DISASSEMBLY AND ASSEMBLY

EXHAUST MANIFOLD AND THREE WAY CATALYST

Exploded View

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



1. Exhaust manifold cover (bank 2)
2. Exhaust manifold (bank 2)
3. Gasket
4. Exhaust manifold (bank 1)
5. Exhaust manifold cover (bank 1)
6. Gasket
7. Exhaust front tube
8. Heated oxygen sensor 2 (bank 1)
9. Air fuel ratio sensor 1 (bank 1)
10. Heated oxygen sensor 2 (bank 2)
11. Air fuel ratio sensor 1 (bank 2)
12. Harness bracket

A. To cylinder head (bank 2)

Fig. 100: 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.

Disassembly and Assembly

DISASSEMBLY

NOTE: For 2WD models, the exhaust manifold on the bank 2 side can be removed without removing the engine.

1. Remove heated oxygen sensor 2.

CAUTION: Heated oxygen sensor 2 is not reusable. Never remove heated oxygen sensor 2 unless this is required.

- Using the heated oxygen sensor wrench [SST: KV10114400 (J-38365)] (A), remove heated oxygen sensor 2 (1).

NOTE:
- **The heated oxygen sensor 2 is removable under vehicle-mounted condition.**
- **The figure shows an example of bank 1.**

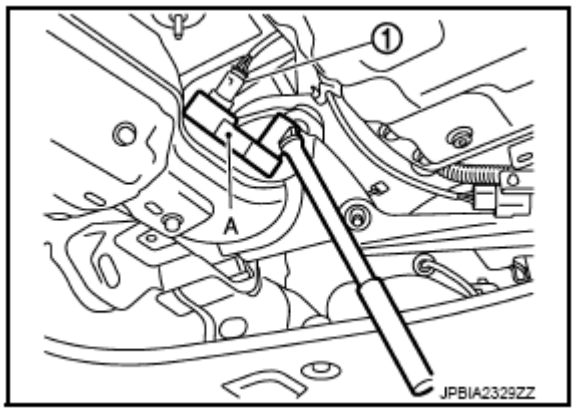


Fig. 101: Identifying Heated Oxygen Sensor & Wrench
Courtesy of NISSAN NORTH AMERICA, INC.

2. Remove three way catalyst (bank 1 and bank 2).
3. 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: KV10114400 (J-38365)], remove air fuel ratio sensor 1.

NOTE: The air fuel ration sensor 1 is removable under vehicle-mounted condition.

4. Remove exhaust manifold cover.
5. Remove exhaust manifold.
   - Loosen nuts in the reverse order of figure to remove exhaust manifold with power tool.

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

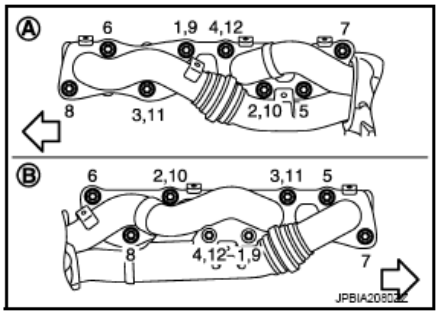


Fig. 102: Exhaust Manifold Mounting Nut Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

NOTE: Disregard No. 9 to No. 12 when loosening.

6. Remove exhaust manifold gaskets.

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

ASSEMBLY

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 below.

A : Triangle press
⇦ : Above

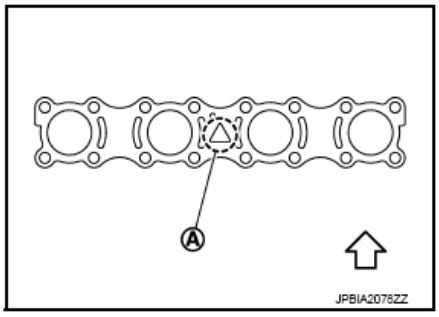


Fig. 103: Identifying Exhaust Manifold Gasket Orientation
Courtesy of NISSAN NORTH AMERICA, INC.

Exhaust Manifold

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

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

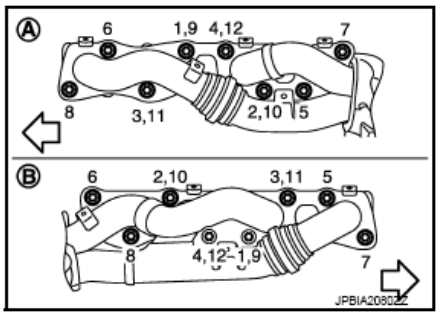


Fig. 104: Exhaust Manifold Nut Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

NOTE: Tighten mounting nuts No. 1 to 4 in two steps. The numerical order No. 9 to 12 shows second steps.

Air Fuel Ratio Sensor 1, Heated Oxygen Sensor 2

CAUTION:

- **Before installing a new sensors, clean exhaust system threads using oxygen sensor thread cleaner (commercial service tool: J-43897-18 or 43897-12), and apply anti-seize lubricant (commercial service tool).**
- **Sensors are 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 sensors, set the heated oxygen sensor wrenc [SST: KV10114400 (J-38365)] (A) in the hexagonal part to tighten the th**

1 : Heated oxygen sensor 2 (bank 1)

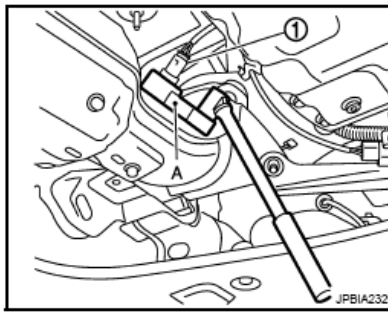


Fig. 105: Identifying Heated Oxygen Sensor & Wrench
Courtesy of NISSAN NORTH AMERICA, INC.

- **Never over torque sensors. Doing so may cause damage to the sensor resulting in "MIL" coming on.**
- **Prevent rust preventative from contacting 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.

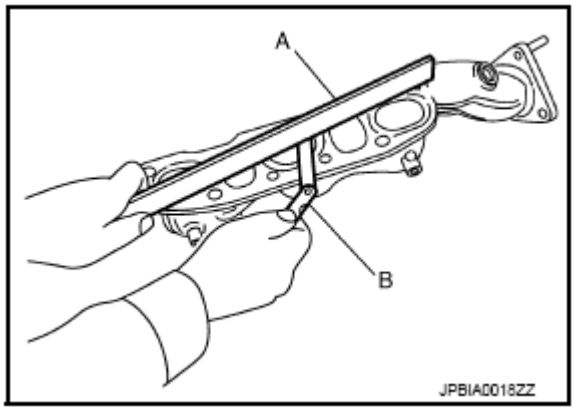
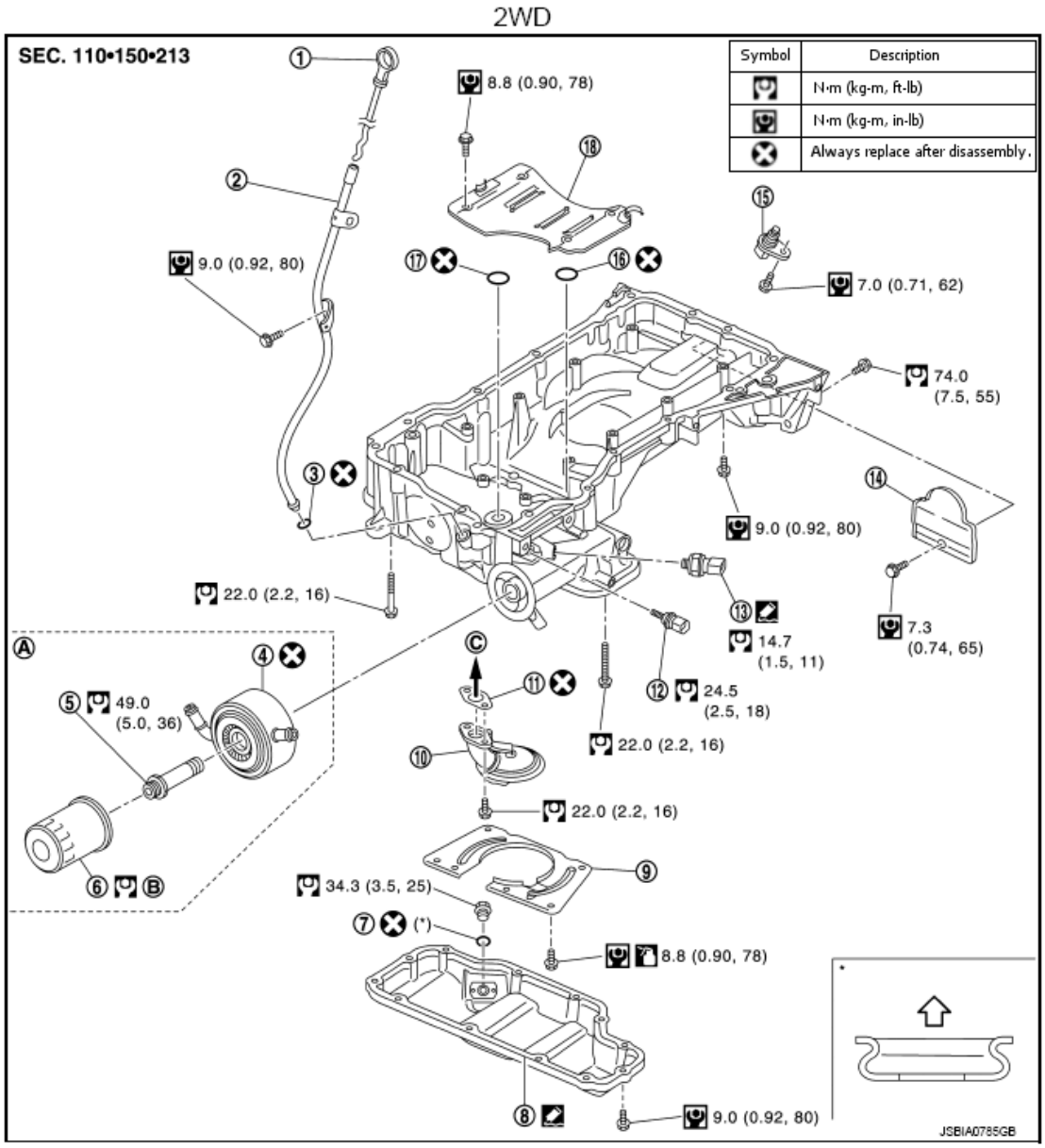


Fig. 106: Checking Surface Distortion Of Exhaust Manifold Mating Surface
Courtesy of NISSAN NORTH AMERICA, INC.

OIL PAN (UPPER)

Exploded View



1. Oil level gauge
2. Oil level gauge guide
3. O-ring
4. Oil cooler
5. Connector bolt
6. Oil filter
7. Drain plug washer
8. Oil pan (lower)
9. Baffle plate
10. Oil strainer
11. Gasket
12. Engine oil temperature sensor
13. Engine oil pressure sensor
14. Rear plate cover
15. Crankshaft position sensor (POS)
16. O-ring
17. O-ring
18. Baffle plate

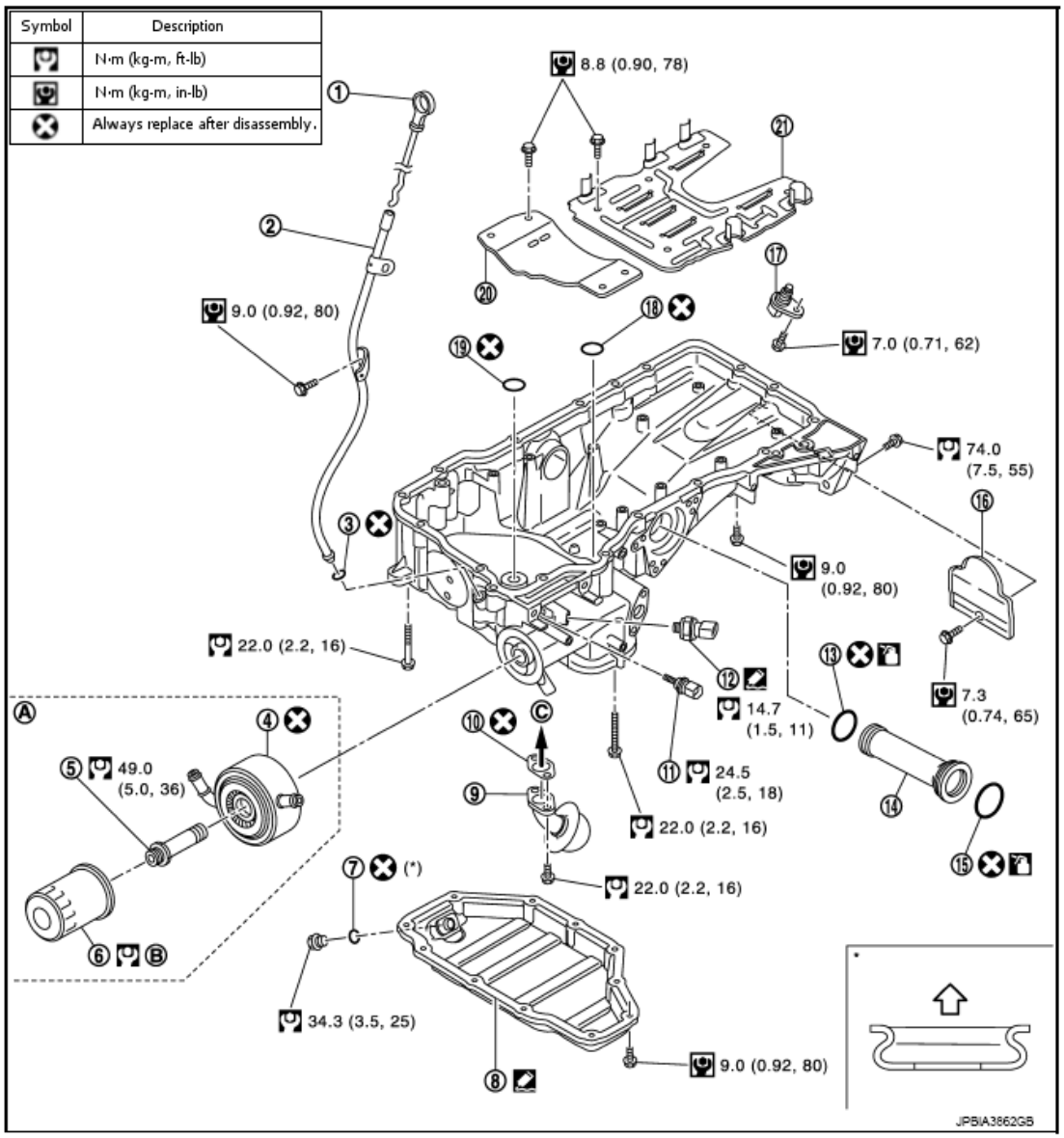
A. Refer to "Engine Lubrication"
B. Refer to "Engine Lubrication"
C. Oil pump side

⇦ : Oil pan side

Fig. 107: Exploded View Of Upper Oil Pan With Torque Specifications (2WD)
Courtesy of NISSAN NORTH AMERICA, INC.

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

AWD



1. Oil level gauge
2. Oil level gauge guide
3. O-ring
4. Oil cooler
5. Connector bolt
6. Oil filter
7. Drain plug washer
8. Oil pan (lower)
9. Oil strainer
10. Gasket
11. Engine oil temperature sensor
12. Engine oil pressure sensor
13. O-ring
14. Axle pipe
15. O-ring
16. Rear plate cover
17. Crankshaft position sensor (POS)
18. O-ring
19. O-ring
20. Baffle plate
21. Baffle plate

A. Refer to "Engine Lubrication"
B. Refer to "Engine Lubrication"
C. Oil pump side

⇦ : Oil pan side

Fig. 108: Exploded View Of Upper Oil Pan With Torque Specifications (AWD)
Courtesy of NISSAN NORTH AMERICA, INC.

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

Disassembly and Assembly

DISASSEMBLY

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 oil filter. Refer to "**REMOVAL AND INSTALLATION** ".
3. Remove oil cooler. Refer to "**EXPLODED VIEW** ".
4. Remove A/C compressor. Refer to "**EXPLODED VIEW** ".
5. Remove engine oil level gauge and engine oil level gauge guide.
6. Remove engine oil pressure sensor and engine oil temperature sensor if necessary.
7. Remove rear plate cover.
8. Remove power steering oil pump bracket. Refer to "**VK56VD: EXPLODED VIEW** ".
9. Remove power steering belt tensioner pulley. Refer to "**EXPLODED VIEW**".
10. Remove front final drive assembly (AWD models). Refer to "**VK56VD: EXPLODED VIEW** ".
11. Remove oil pan (lower). Refer to "**2WD: EXPLODED VIEW**" (2WD models) or "**AWD: EXPLODED VIEW**" (AWD models).
12. Remove oil strainer. Refer to "**2WD: EXPLODED VIEW**" (2WD models) or "**AWD: EXPLODED VIEW**" (AWD models).
13. Remove oil pan (upper) as per the following:
    a. Remove transmission mounting bolts.
    b. Loosen mounting bolts in reverse of the order shown in the figure below with power tool to remove.

NOTE:

- **The above exploded view shows 2WD models as an example.**
- **The oil pan (upper) removal order for AWD models is the same as the one for 2WD models.**
- **Disregard No. 7, 17 when loosening.**

⇦ : Engine front

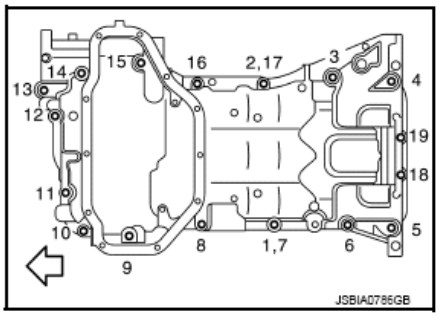


Fig. 109: Upper Oil Pan Bolt Tightening Sequence (AWD)
Courtesy of NISSAN NORTH AMERICA, INC.

c. Insert a suitable tool into the notch at oil pan (upper) (1) as shown below.

⇦ : Engine front

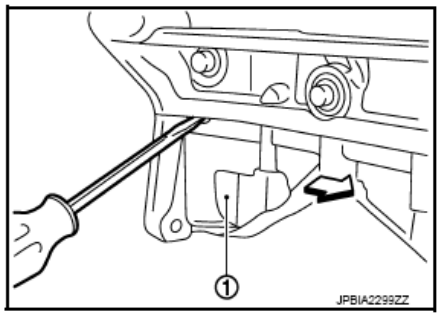


Fig. 110: Prying Off Case
Courtesy of NISSAN NORTH AMERICA, INC.

- Pry off case by moving a suitable tool.

CAUTION: Be careful not to damage the mating surfaces.

14. Remove O-ring from bottom of cylinder block and oil pump.
15. Remove baffle plate, if necessary.
16. Remove axle pipe from oil pan (upper), if necessary (AWD models).
    - Pull axle pipe from oil pan (upper) using a suitable drift.

ASSEMBLY

CAUTION: Do not reuse O-rings.

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

CAUTION: Do not reuse O-rings.

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

2 : O-ring
3 : O-ring (with identification paint)
A : Front final drive side
B : Drive shaft (LH) side

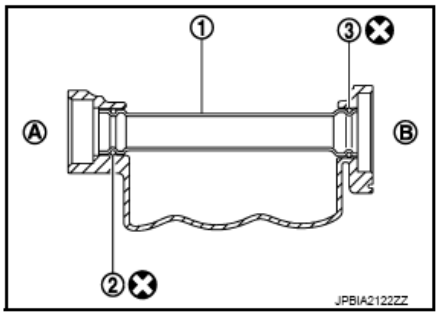


Fig. 111: Identifying Axle Pipe Orientation
Courtesy of NISSAN NORTH AMERICA, INC.

- Lubricate O-ring groove of axle pipe, O-ring, and O-ring joint of oil pan with new engine oil.
- Install axle pipe to oil pan (upper) from drive shaft (LH) side.

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

2. Install baffle plate, if removed.
3. 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.

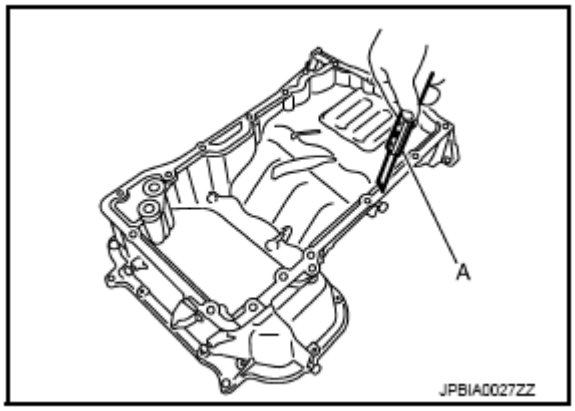


Fig. 112: Removing Old Liquid Gasket

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 below.

a : 5.5 - 7.5 mm (0.217 - 0.295 in)
b : ϕ4.0 - 5.0 mm (0.157 - 0.197 in)
⇦ : Engine front

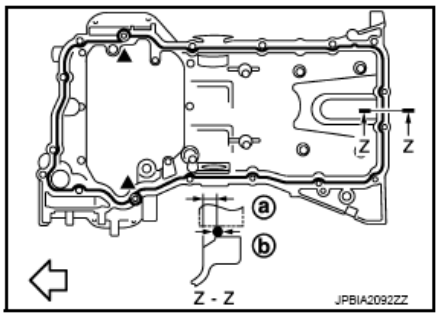


Fig. 113: Identifying Liquid Gasket
Courtesy of NISSAN NORTH AMERICA, INC.

NOTE:

- **The above exploded view shows AWD models as an example.**
- **The oil pan (upper) removal order for 2WD models is the same as the one for AWD models.**

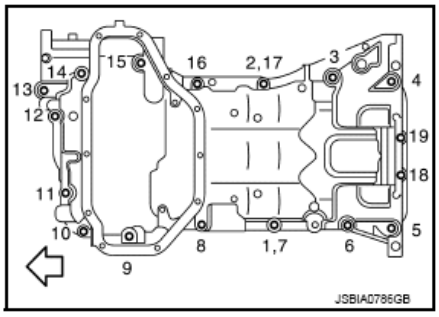
Use Genuine RTV Silicone Sealant or an equivalent. Refer to "RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS ".

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

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

NOTE:

- **The above exploded view shows 2WD models as an example.**
- **The oil pan (upper) removal order for AWD models is the same as the one for 2WD models.**
- **Tighten mounting bolts No. 1 and 2 in two steps. The numerical order No. 7 and 17 shows second steps.**



⇦ : Engine front

Fig. 114: Oil Pan Mounting Bolt Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

CAUTION: Install avoiding misalignment of O-rings.

- There are three types of mounting bolts. Refer to **the following for locating bolts** .
  - 2WD models

    M6 x 30 mm. (1.18 in): 18, 19

    M8 x 100 mm (3.94 in): 4, 5, 9, 12, 14, 15

    M8 x 45 mm (1.77 in): Except the above

  - AWD models

    M6 x 30 mm. (1.18 in): 18, 19

    M8 x 100 mm (3.94 in): 4, 5, 8, 9, 12, 14, 15, 16

    M8 x 45 mm (1.77 in): Except the above

e. Tighten transmission joint bolts.
f. Install rear plate cover.

4. Install oil strainer.
5. Install oil pan (lower). Refer to "**2WD: EXPLODED VIEW**" (2WD models) or "**AWD: EXPLODED VIEW**" (AWD models).
6. Install in the reverse order of removal.

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

Inspection

INSPECTION AFTER DISASSEMBLY

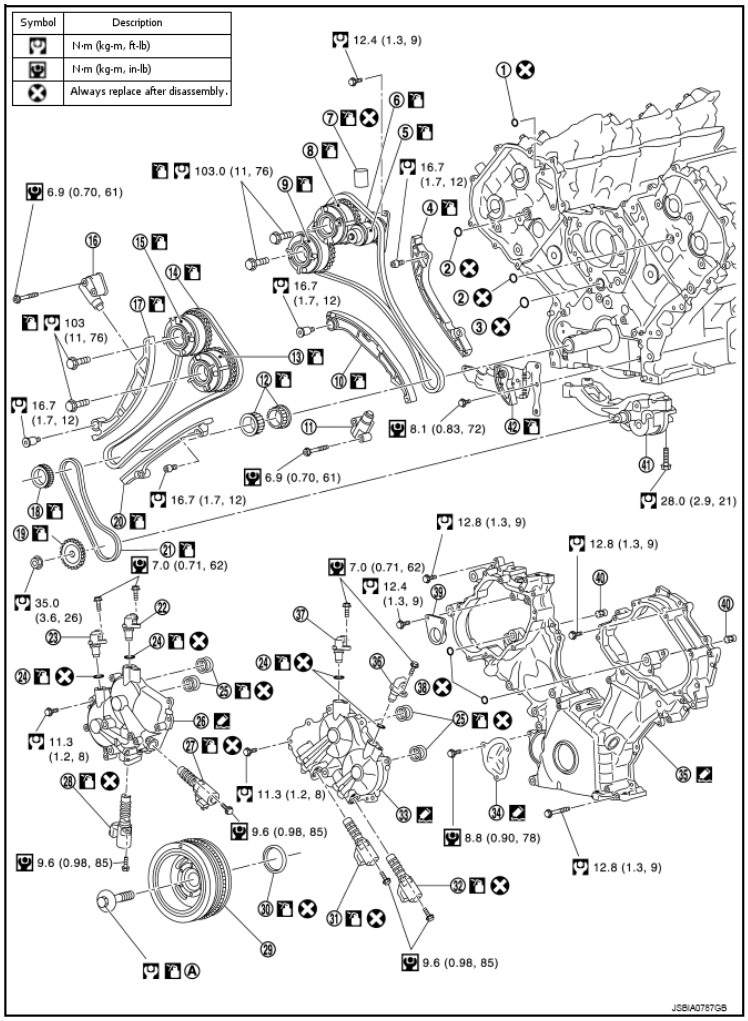
Clean oil strainer if any object is attached.

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

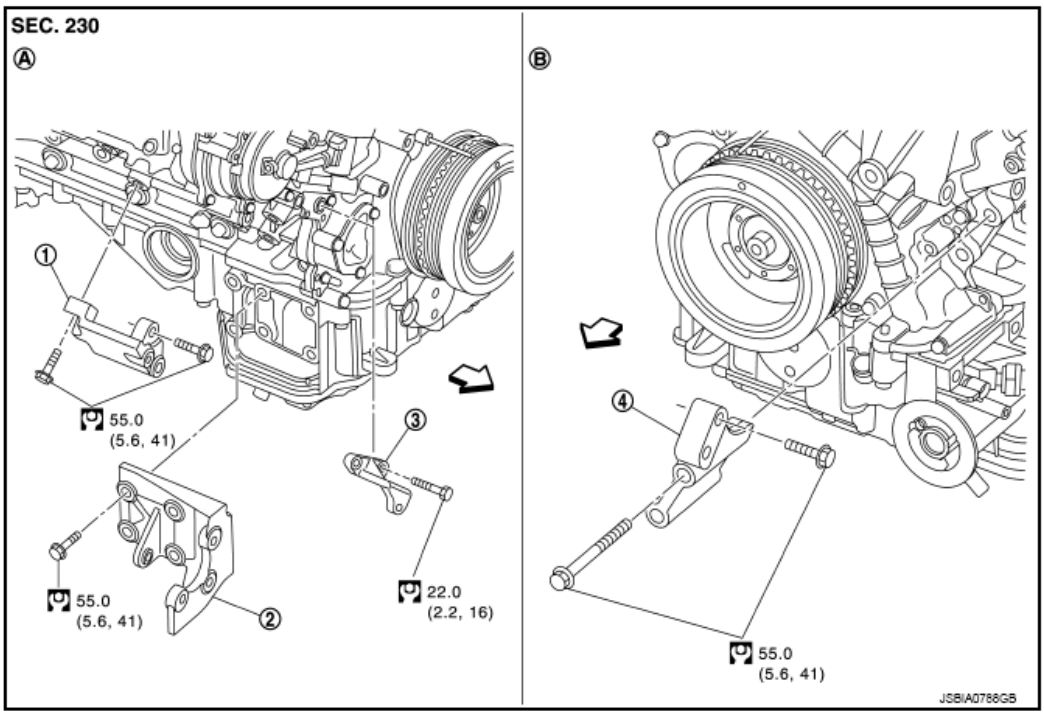


1.	O-ring	2.	O-ring	3.	O-ring
4.	Tension guide (bank 2)	5.	High pressure fuel pump camshaft	6.	Timing chain (bank 2)
7.	Lifter	8.	Intake camshaft sprocket (bank 2)	9.	Exhaust camshaft sprocket (bank 2)
10.	Slack guide (bank 2)	11.	Timing chain tensioner (bank 2)	12.	Crankshaft sprocket
13.	Exhaust camshaft sprocket (bank 1)	14.	Timing chain (bank 1)	15.	Intake camshaft sprocket (bank 1)
16.	Timing chain tensioner (bank 1)	17.	Slack guide (bank 1)	18.	Oil pump sprocket (crankshaft side)
19.	Oil pump sprocket (oil pump side)	20.	Tension guide (bank 1)	21.	Oil pump drive chain
22.	Camshaft position sensor (INT) (bank 2)	23.	Camshaft position sensor (EXH) (bank 2)	24.	O-ring
25.	Seal ring	26.	Valve timing control cover (bank 2)	27.	Intake valve timing control solenoid valve (bank 2)
28.	Exhaust valve timing control solenoid valve (bank 2)	29.	Crankshaft pulley	30.	Front oil seal
31.	Intake valve timing control solenoid valve (bank 1)	32.	Exhaust valve timing control solenoid valve (bank 1)	33.	Valve timing control cover (bank 1)
34.	Timing chain tensioner cover	35.	Front cover	36.	Camshaft position sensor (EXH) (bank 1)
37.	Camshaft position sensor (INT) (bank 1)	38.	O-ring	39.	Camshaft bracket
40.	Oil filter (for valve timing control solenoid valve)	41.	Oil pump	42.	Oil pump drive chain tensioner
A.	Comply with the installation procedure when tightening.				

Fig. 115: Exploded View Of Timing Chain With Torque Specifications
Courtesy of NISSAN NORTH AMERICA, INC.

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

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



1. Alternator bracket
2. Power steering pump bracket
3. Alternator support
4. A/C compressor bracket
A. Right side
B. Left side
⇦ : Engine front

Fig. 116: Identifying Accessory Brackets With Torque Specifications
Courtesy of NISSAN NORTH AMERICA, INC.

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

Disassembly and Assembly

DISASSEMBLY

1. Remove auto tensioners and idler pulley. Refer to "**EXPLODED VIEW**".
2. Remove oil level gauge and oil level gauge guide. Refer to "**EXPLODED VIEW**".
3. Remove alternator bracket and alternator stay.
4. Remove camshaft position sensors.

CAUTION:
- **Handle carefully to avoid dropping and shocks.**
- **Never disassemble.**
- **Never allow metal powder to contact magnetic part at sensor tip.**

- **Never place sensors in a location where they are exposed to mag**

A : Keep free from magnetic materials

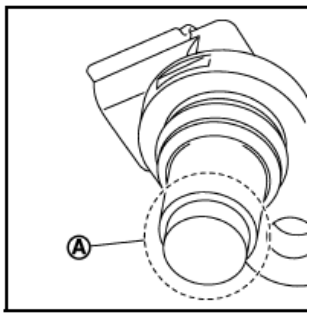


Fig. 117: Identifying Camshaft Position Sensor Magnet Area
Courtesy of NISSAN NORTH AMERICA, INC.

5. Remove high pressure fuel pump and lifter. "**EXPLODED VIEW**".

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

6. Remove water suction hose and water suction pipe. Refer to "**EXPLODED VIEW** ".
7. Remove valve timing control cover as per the following:
   a. Disconnect valve timing control solenoid valve harness connector.
   b. Loosen mounting bolts in the reverse order as shown in the figure below.

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

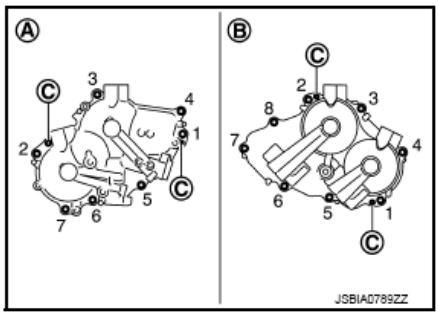


Fig. 118: Identifying High Pressure Fuel Pump & Filter Bolt Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

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.**

8. Remove valve timing control solenoid valve (INT and EXH), if necessary.

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

9. Remove fuel pump connector protector. Refer to "**EXPLODED VIEW**".
10. Remove O-rings (1) from front cover.

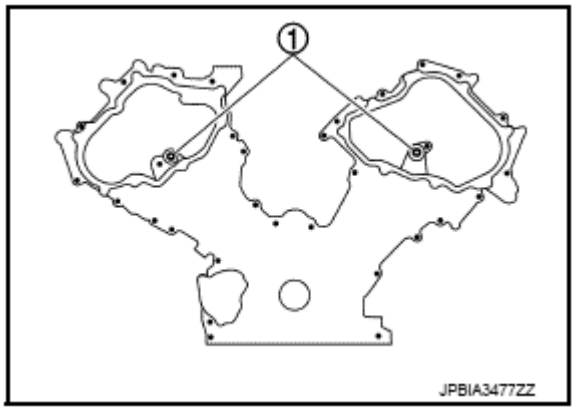


Fig. 119: Identifying Front Cover O-Rings
Courtesy of NISSAN NORTH AMERICA, INC.

11. Remove rocker cover. Refer to "**EXPLODED VIEW**".
12. Obtain No. 1 cylinder at TDC of its compression stroke. Refer to "**INSPECTION**".
13. Remove oil cooler tube and hose. Refer to "**EXPLODED VIEW** ".
14. Remove air compressor bracket.
15. Remove crankshaft pulley. Refer to "**FRONT OIL SEAL: REMOVAL AND INSTALLATION**".
16. Remove water pump pulley. Refer to "**EXPLODED VIEW** ".
17. Remove oil pan (lower) and oil strainer. Refer to "**2WD: EXPLODED VIEW**" (2WD models) or "**AWD: EXPLODED VIEW**" (AWD models).
18. Remove oil pan (upper). Refer to "**EXPLODED VIEW**".
19. Remove front cover as per the following:
    a. Loosen mounting bolts (A), and then remove camshaft bracket (1).

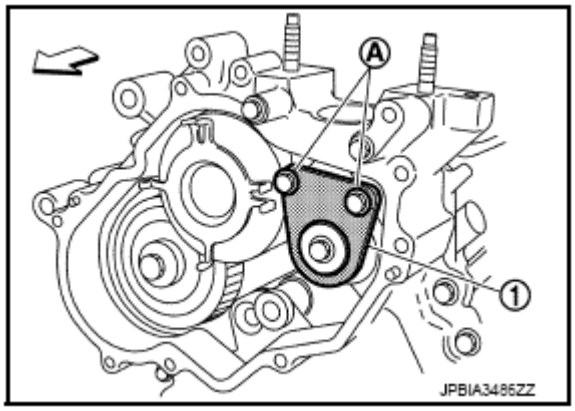


Fig. 120: Identifying Camshaft Bracket And Mounting Bolts
Courtesy of NISSAN NORTH AMERICA, INC.

b. Loosen mounting bolts in reverse of the order shown in the figure below.

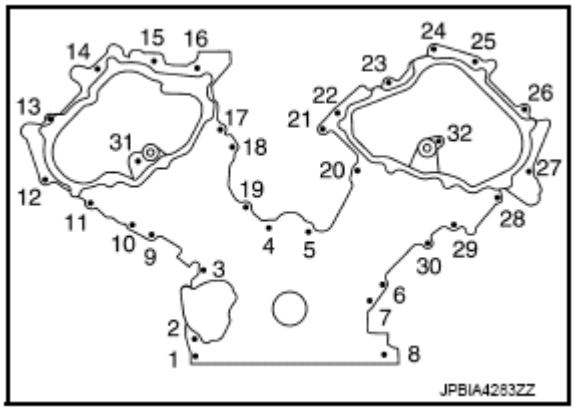


Fig. 121: Timing Chain Cover Bolt Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

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.**

20. Remove front oil seal from front cover using suitable tool.
    - Use screwdriver for removal.

CAUTION: Be careful not to damage front cover.

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

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

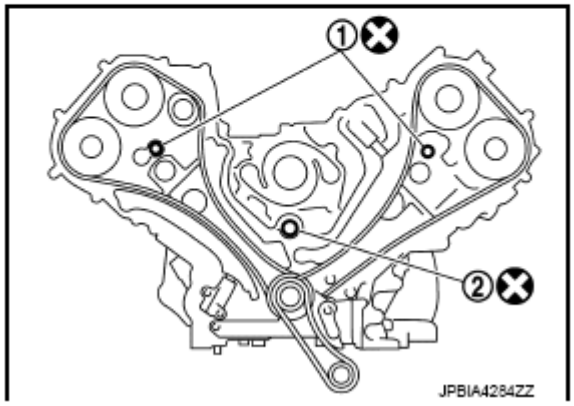


Fig. 122: Identifying O-Rings
Courtesy of NISSAN NORTH AMERICA, INC.

22. Remove oil filter (for valve timing control solenoid valve), if necessary.
23. Remove timing chain tensioner cover from front cover, if necessary.
    - Use seal cutter [SST: KV10111100 (J-37228)] to cut liquid gasket for removal.
24. Remove oil pump drive chain as per the following:
    a. Push oil pump drive chain tensioner (1).
    b. Insert a stopper pin (A) into the body hole.

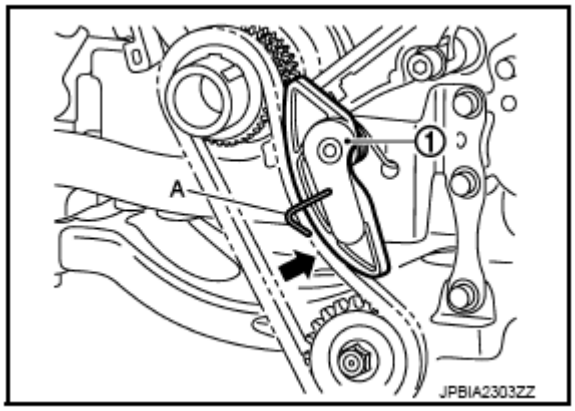


Fig. 123: Identifying Oil Pump Drive Chain Tensioner & Stopper Pin
Courtesy of NISSAN NORTH AMERICA, INC.

    c. Hold the two flat parts of oil pump shaft, and then loosen the oil pump sprocket (oil pump side) nut.

1 : Oil pump sprocket (oil pump side)

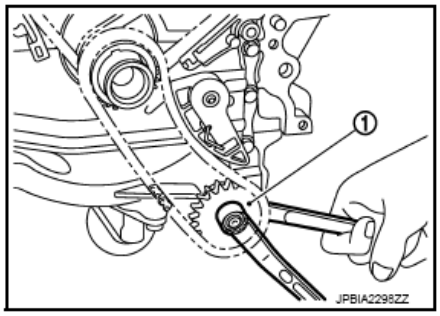


Fig. 124: Loosening Oil Pump Sprocket Nut (Oil Pump Side)
Courtesy of NISSAN NORTH AMERICA, INC.

CAUTION: Secure the oil pump unit shaft with the two flat parts.

25. Remove oil pump drive chain tensioner.
26. 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.

a. 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)

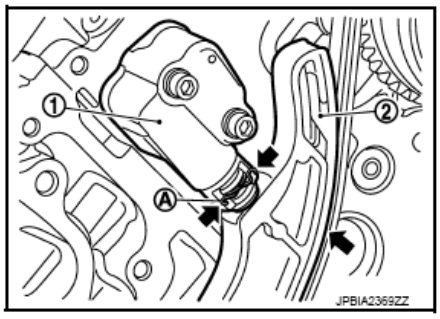


Fig. 125: Compressing Plunger Using Slack Guide
Courtesy of NISSAN NORTH AMERICA, INC.

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

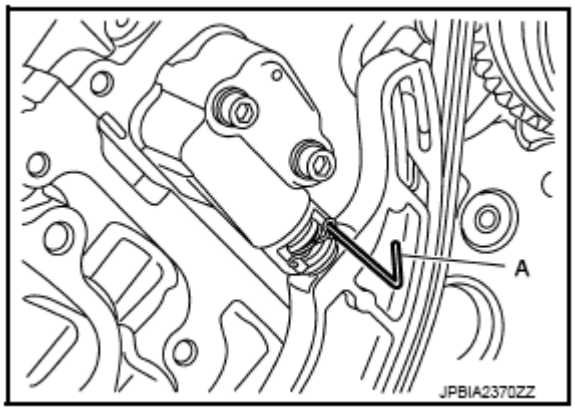


Fig. 126: Identifying Stopper Pin
Courtesy of NISSAN NORTH AMERICA, INC.

27. Remove high pressure fuel pump camshaft.
28. Remove tension guide and slack guide.
29. Remove timing chain and crankshaft sprocket.

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

30. Remove intake and exhaust 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. Refer to "**EXPLODED VIEW**".

⇦ : Engine front

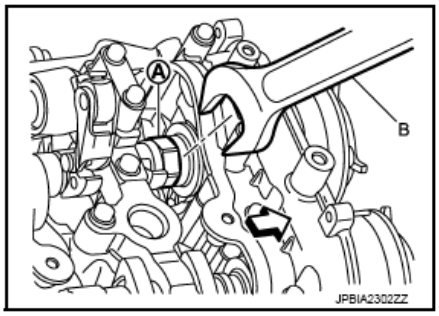


Fig. 127: Removing Intake And Exhaust Camshaft Sprocket
Courtesy of NISSAN NORTH AMERICA, INC.

NOTE: The figure shows an example of bank 2.

CAUTION:
- **Never loosen the mounting bolt by securing anything other camshaft (drive shaft) hexagonal portion or with tensioning chain.**
- **When holding the hexagonal part of camshaft (drive shaft) v**

be careful not to allow the wrench to cause interference witl

- **Never disassemble camshaft sprocket. [Never loosen bolts in the figure below.]**

A : Intake
B : Exhaust

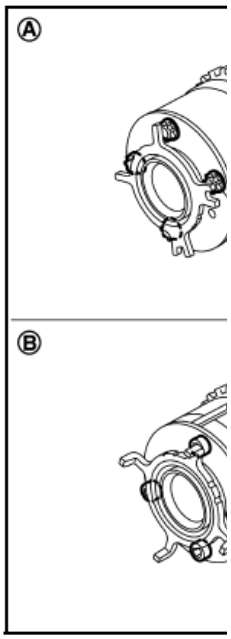


Fig. 128: Identifying Camshaft Sprocket Assembly Bolts
Courtesy of NISSAN NORTH AMERICA, INC.

31. 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

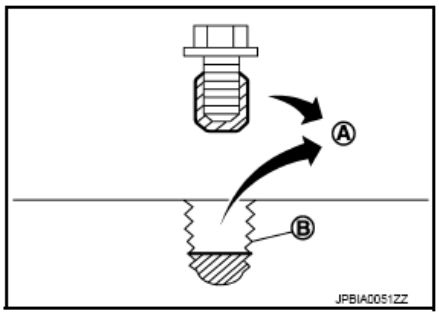
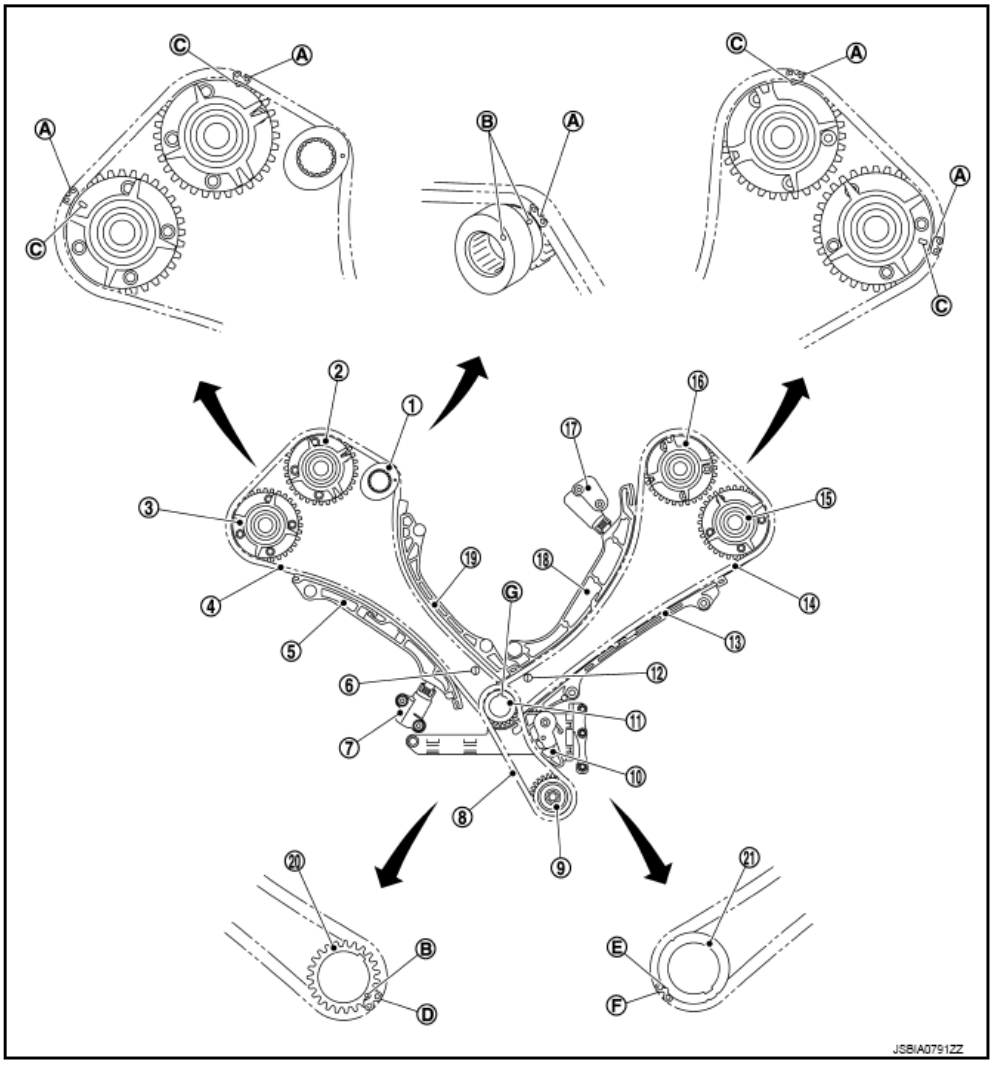


Fig. 129: Removing Old Liquid Gasket
Courtesy of NISSAN NORTH AMERICA, INC.

ASSEMBLY

CAUTION: Do not reuse O-rings.



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. Oil pump drive chain
9. Oil pump sprocket (oil pump side)
10. Oil pump drive chain tensioner
11. Oil pump sprocket (crankshaft side)
12. Chain oil jet (bank 1)
13. Tension guide (bank 1)
14. Timing chain (bank 1)
15. Exhaust camshaft sprocket (bank 1)
16. Intake camshaft sprocket (bank 1)
17. Timing chain tensioner (bank 1)
18. Slack guide (bank 1)
19. Tension guide (bank 2)
20. Crankshaft sprocket (bank 2 side)
21. Crankshaft sprocket (bank 1 side)
- 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. 130: Identifying Timing Chain Components
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.**
- **There is no matching mark in the oil pump related parts.**

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

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

   Crankshaft key: Straight up

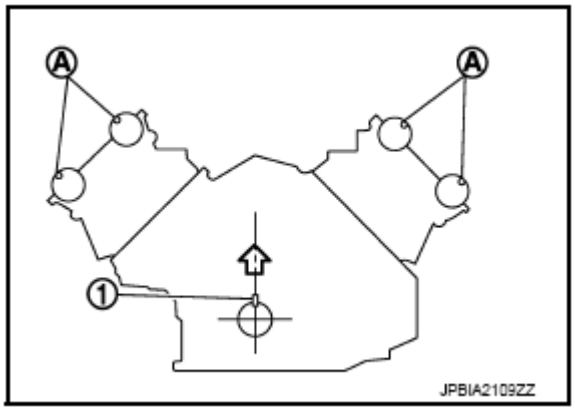


Fig. 131: Identifying Crankshaft Key And Dowel Pins
Courtesy of NISSAN NORTH AMERICA, INC.

NOTE: **Though camshaft does not stop at the position as shown in the figure below, 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.

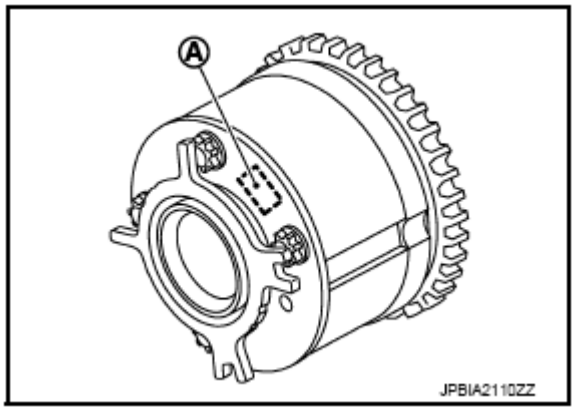


Fig. 132: Identifying Identification Mark On Camshaft Sprockets
Courtesy of NISSAN NORTH AMERICA, INC.

Exhaust side:

- Secure the hexagonal portion of camshaft (EXH) 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

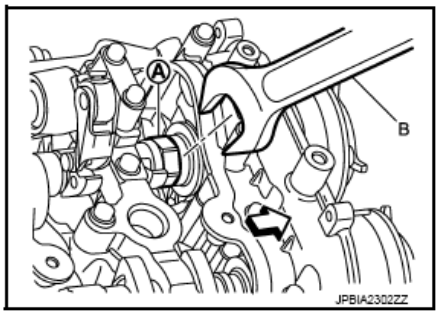


Fig. 133: Securing Hexagonal Portion Of Drive Shaft Using Wrench
Courtesy of NISSAN NORTH AMERICA, INC.

NOTE: The figure shows an example of bank 2.

3. Install high pressure fuel pump camshaft.

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

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 below.

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

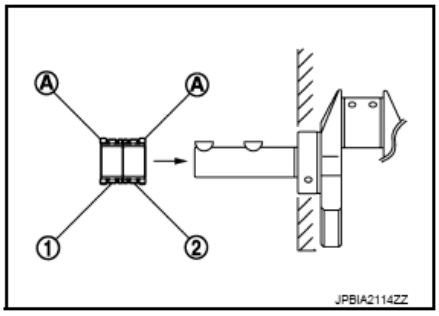


Fig. 134: Identifying Crankshaft Sprocket Orientation
Courtesy of NISSAN NORTH AMERICA, INC.

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

b. Install timing chains.

Bank 2 (F):

- Install timing chain so that the matching mark (punched) (B) on high pressure fuel pump camshaft 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 white link (D) one on timing chain, as shown in the figure below.

Bank 1 (G):

- Install timing chain so that 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 below.

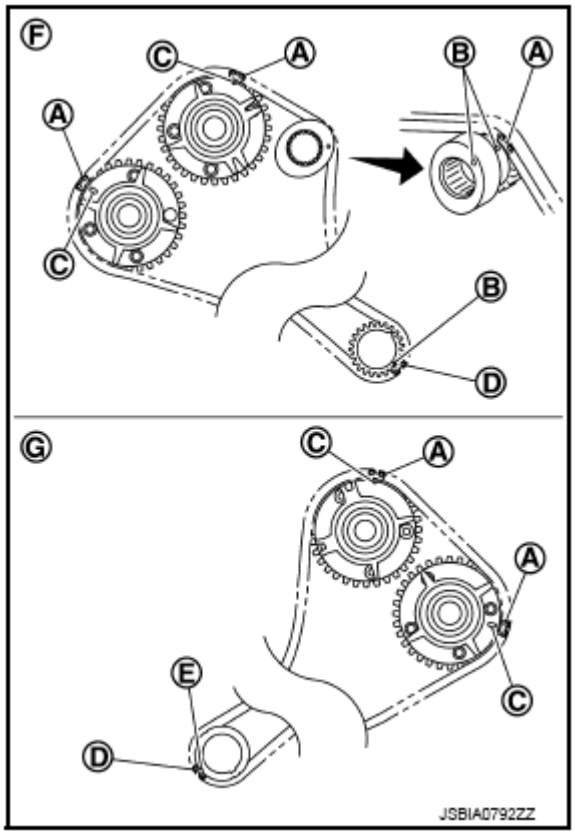


Fig. 135: Aligning Timing Chain Marks
Courtesy of NISSAN NORTH AMERICA, INC.

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)

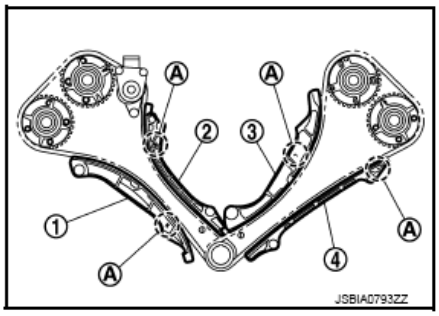


Fig. 136: Identifying Slack And Tension Guides
Courtesy of NISSAN NORTH AMERICA, INC.

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

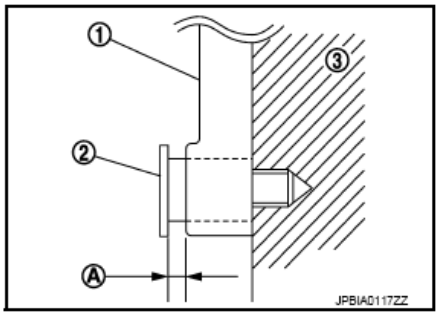


Fig. 137: Identifying Slack Guide Mounting Bolt Gap
Courtesy of NISSAN NORTH AMERICA, INC.

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.

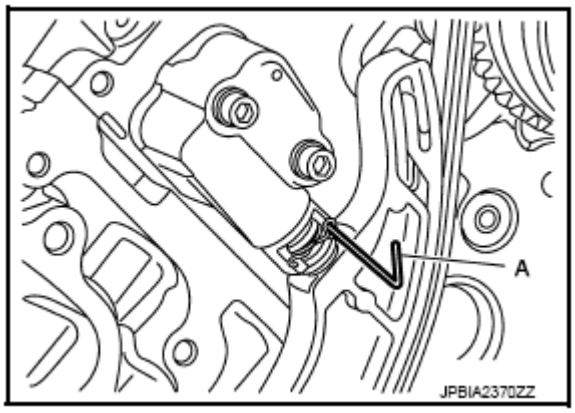


Fig. 138: Identifying Stopper Pin
Courtesy of NISSAN NORTH AMERICA, INC.

7. Check again that the matching marks on sprockets and timing chain have not slipped out of alignment.
8. Install oil pump drive chain as per the following:
   a. Install oil pump drive chain tensioner.
      - Fix the tensioner at the most compressed position using a stopper pin. and then install it.
   b. Install the oil pump sprocket (crankshaft side), oil pump sprocket (oil pump side) and oil pump drive chain at the same time.
      - Install each oil pump sprocket so that its flange side (the larger diameter side without teeth) (A) faces in the direction shown in the figure below.

1 : Oil pump sprocket (crankshaft side)
2 : Oil pump sprocket (oil pump side)
3 : Oil pump
4 : Crankshaft

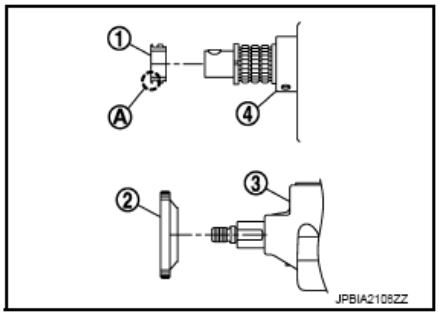


Fig. 139: Oil Pump Sprocket Orientation
Courtesy of NISSAN NORTH AMERICA, INC.

NOTE: There is no matching mark in the oil pump related parts.

c. Hold the two flat parts of oil pump shaft, and then tighten the oil pump sprocket (oil pump side) nut.

CAUTION: Secure the oil pump shaft with the two flat parts.

1 : Oil pump sprocket (oil pump side)

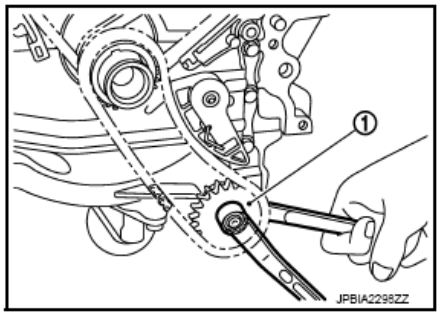


Fig. 140: Tightening Oil Pump Sprocket Nut (Oil Pump Side)
Courtesy of NISSAN NORTH AMERICA, INC.

d. Securely pull out the stopper pin (A) after installing the oil pump drive chain.
   - Check that the tension is applied to the oil pump drive chain (1) after installing.

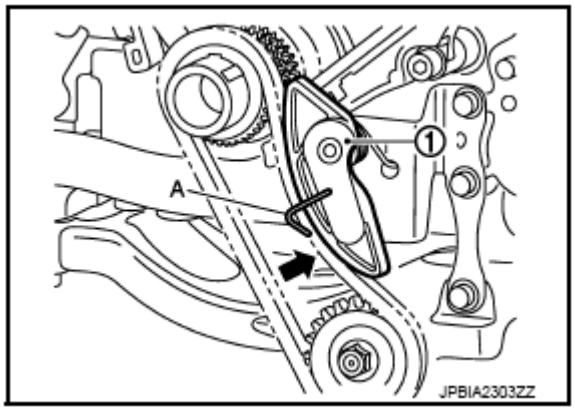


Fig. 141: Identifying Oil Pump Drive Chain Stopper Pin
Courtesy of NISSAN NORTH AMERICA, INC.

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 : ϕ3.4 - 4.4 mm (0.134 - 0.173 in)

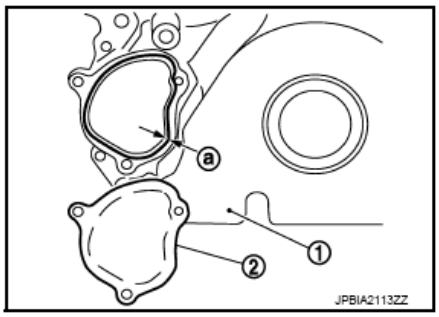


Fig. 142: Identifying Timing Chain Tensioner Cover And Front Cover
Courtesy of NISSAN NORTH AMERICA, INC.

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

  Use Genuine RTV Silicone Sealant or an 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 below, if removed.
    - Check that the oil filter does not protrude from the upper surface of front cover (2) after installation.

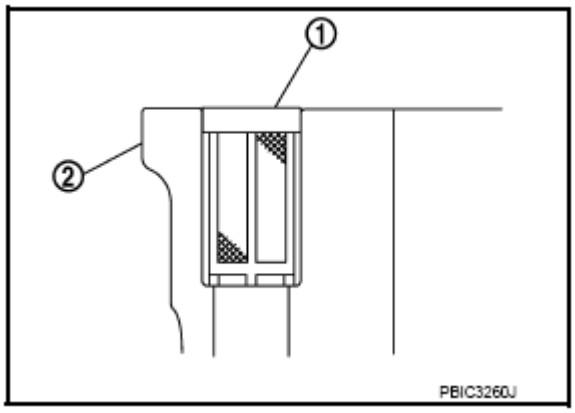


Fig. 143: Valve Timing Control Solenoid Valve Oil Filter
Courtesy of NISSAN NORTH AMERICA, INC.

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

CAUTION: Do not reuse O-rings.

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

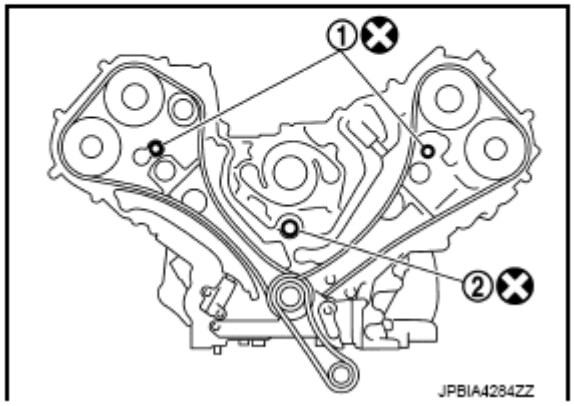


Fig. 144: Identifying O-Rings On Cylinder Head And Block
Courtesy of NISSAN NORTH AMERICA, INC.

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

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

A : Junction between cylinder block and cylinder head
B : Protrusion
c : 4.3 - 5.3 mm (0.169 - 0.209 in)
d : ϕ3.4 - 4.4 mm (0.134 - 0.173 in)
e : 4.0 - 5.6 mm (0.157 - 0.220 in)
f : ϕ4.8 - 5.8 mm (0.189 - 0.228 in)

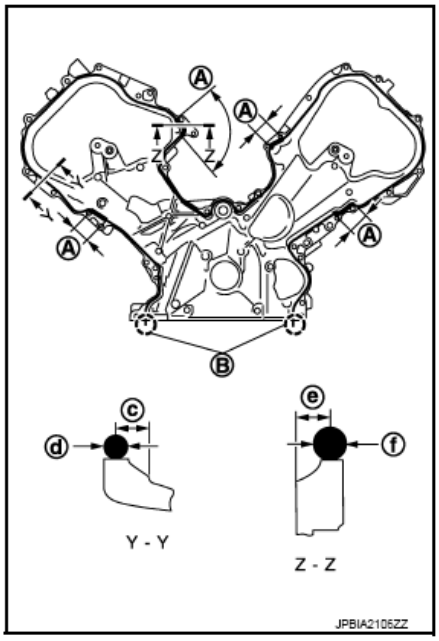


Fig. 145: Identifying Liquid Gasket
Courtesy of NISSAN NORTH AMERICA, INC.

c. 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.

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

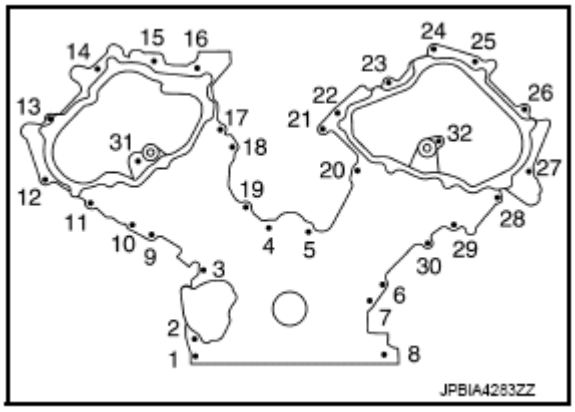


Fig. 146: Timing Chain Cover Bolt Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

- There are three types of mounting bolts.

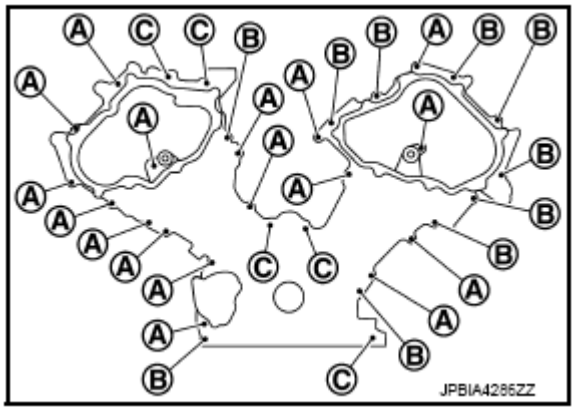


Fig. 147: Timing Cover Bolt Location
Courtesy of NISSAN NORTH AMERICA, INC.

A: 20 mm (0.79 in)

B: 50 mm (1.97 in)

C: 80 mm (3.15 in)

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

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:
    - Both (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.

⇦ : Engine front

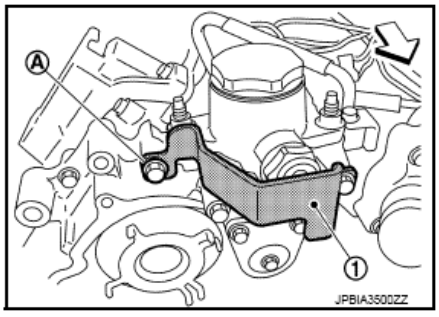


Fig. 148: Fuel Pump Connector Protector
Courtesy of NISSAN NORTH AMERICA, INC.

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

CAUTION: Do not reuse O-rings.

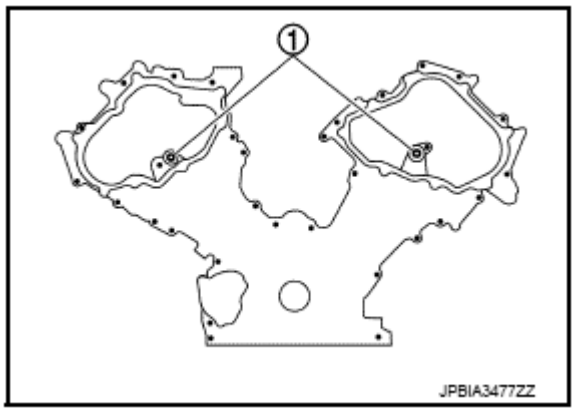


Fig. 149: Identifying Front Cover O-Rings
Courtesy of NISSAN NORTH AMERICA, INC.

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

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

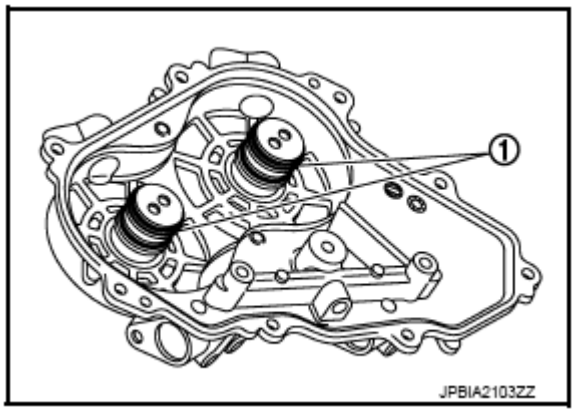


Fig. 150: Identifying Seal Rings
Courtesy of NISSAN NORTH AMERICA, INC.

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

A : Bank 1
B : Bank 2
c : ϕ3.4 - 4.4 mm (0.134 - 0.173 in)

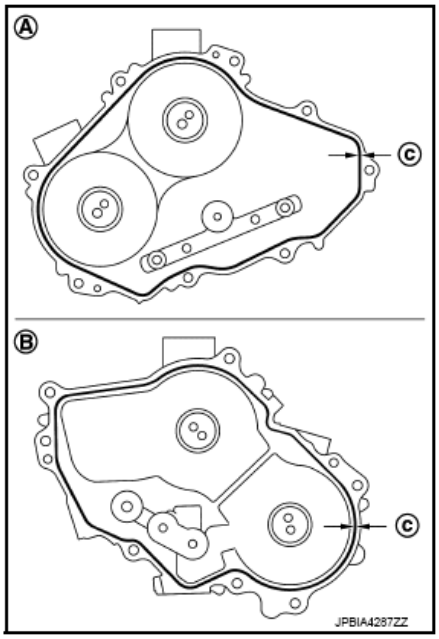


Fig. 151: Identifying Liquid Gasket
Courtesy of NISSAN NORTH AMERICA, INC.

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

d. Being careful not to move seal ring from the installation groove, align dowel pins on front cover with dowel pin holes (C) to install valve timing control covers.

A : Bank 2
B : Bank 1

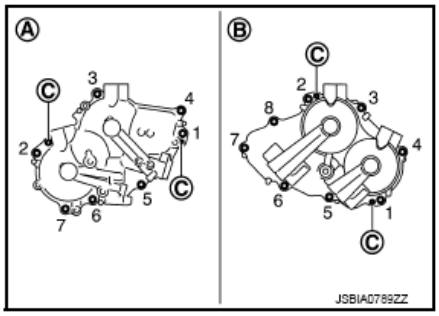


Fig. 152: Timing Control Cover Bolt Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

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

14. Install camshaft position sensor and valve timing control solenoid valve (RH and LH) to valve timing control cover, if removed.
    - Be sure to tighten mounting bolts with flanges completely seated.
15. Install oil pan (lower) and oil strainer. Refer to "**2WD: EXPLODED VIEW**" (2WD models) or "**AWD: EXPLODED VIEW**" (AWD models).
16. Install oil pan (upper). Refer to "**EXPLODED VIEW**".

17. Install water pump pulley. Refer to "**EXPLODED VIEW** ".
18. Install crankshaft pulley.
    - Fix the crankshaft as instructed in the removal procedure. Refer to "**FRONT OIL SEAL: REMOVAL AND INSTALLATION**".
    a. Install crankshaft pulley, taking care not to damage front oil seal.
    b. Apply engine oil onto threaded parts of crankshaft pulley bolt and seating area.
        - Lightly tapping its center with plastic hammer, insert crankshaft pulley.

CAUTION: Never tap crankshaft pulley on the side surface where belt is installed (outer circumference).

    c. Tighten crankshaft pulley bolt.

Torque: 157 N.m (16 kg-m, 116 ft-lb)

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

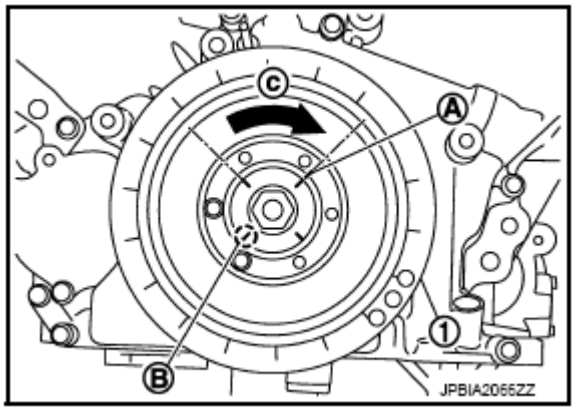


Fig. 153: Tightening Crankshaft Pulley Bolt
Courtesy of NISSAN NORTH AMERICA, INC.

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

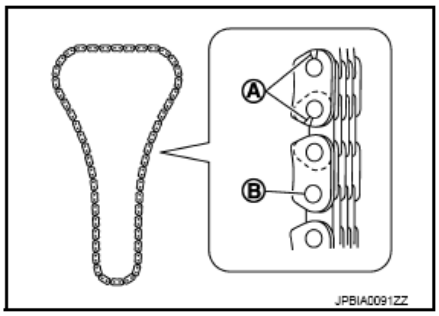


Fig. 154: Identifying Crack And Wear Areas On Timing Chain Link Plates
Courtesy of NISSAN NORTH AMERICA, INC.

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 "**FOR NORTH AMERICA: FLUIDS AND LUBRICANTS** ".
- Follow the procedure below to check for fuel leakage.
  - Turn ignition switch to the "ON" position (with engine stopped). With fuel pressure applied to fuel piping, check for fuel leakage at connection points.
  - Start engine. With engine speed increased, check again for fuel leakage at connection points.
- Run engine to check for unusual noise and vibration.

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

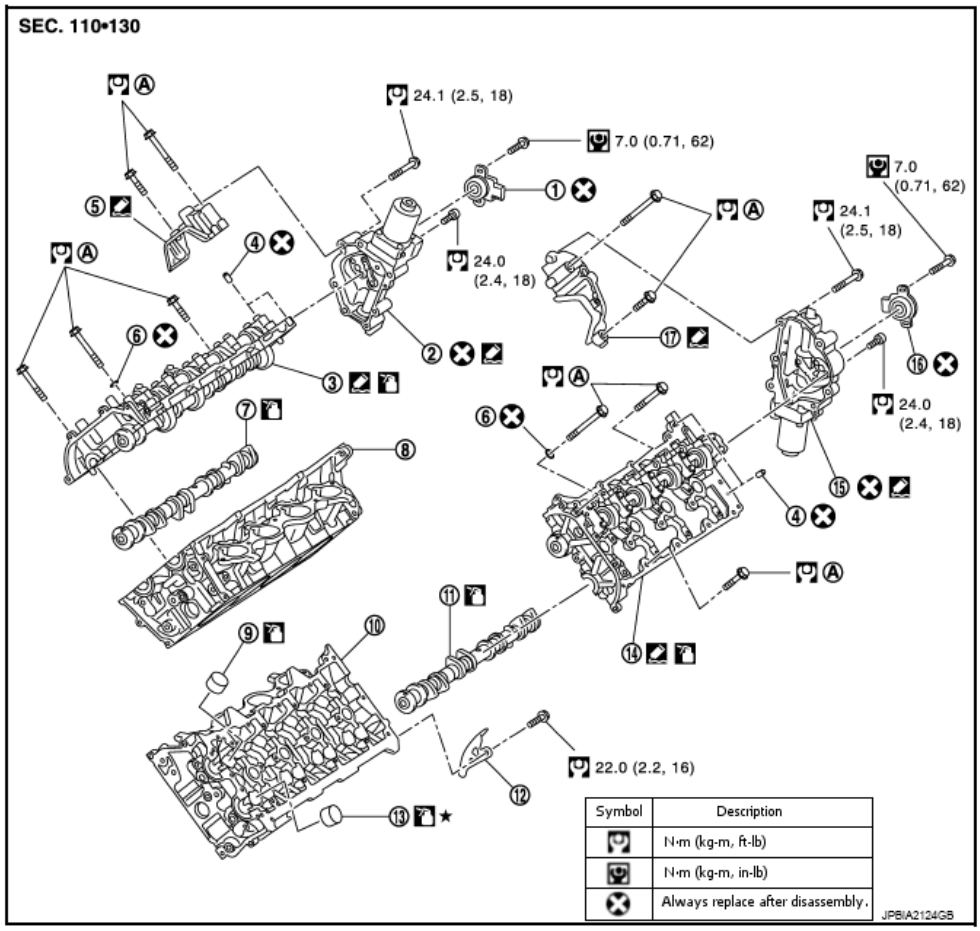
- Warm up engine thoroughly to check that there is no leakage of fuel, or any oil/fluids including engine oil and engine coolant.
- Bleed air from lines and hoses of applicable lines, such as in cooling system.
- After cooling down engine, again check oil/fluid levels including engine oil and engine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

SUMMARY OF INSPECTION ITEMS

Items		Before starting engine	Engine running	After engine stopped
Engine coolant		Level	Leakage	Level
Engine oil		Level	Leakage	Level
Transmission/transaxle fluid	AT & CVT Models	Leakage	Level/Leakage	Leakage
	MT Models	Level/Leakage	Leakage	Level/Leakage
Other oils and fluids(1)		Level	Leakage	Level
Fuel		Leakage	Leakage	Leakage
Exhaust gases		-	Leakage	-
(1) Power steering fluid, brake fluid, etc.				

CAMSHAFT

Exploded View



1. VVEL control shaft position sensor (bank 2)
2. VVEL actuator sub assembly (bank 2)
3. VVEL ladder assembly (bank 2)
4. Dowel pin
5. Actuator bracket (rear) (bank 2)
6. Washer
7. Camshaft (EXH) (bank 2)
8. Cylinder head (bank 2)
9. Valve lifter (INT)
10. Cylinder head (bank 1)
11. Camshaft (EXH) (bank 1)
12. Actuator cover
13. Valve lifter (EXH)
14. VVEL ladder assembly (bank 1)
15. VVEL actuator sub assembly (bank 1)
16. VVEL control shaft position sensor (bank 1)
17. Actuator bracket (rear) (bank 1)

A. Comply with the installation procedure when tightening.

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

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

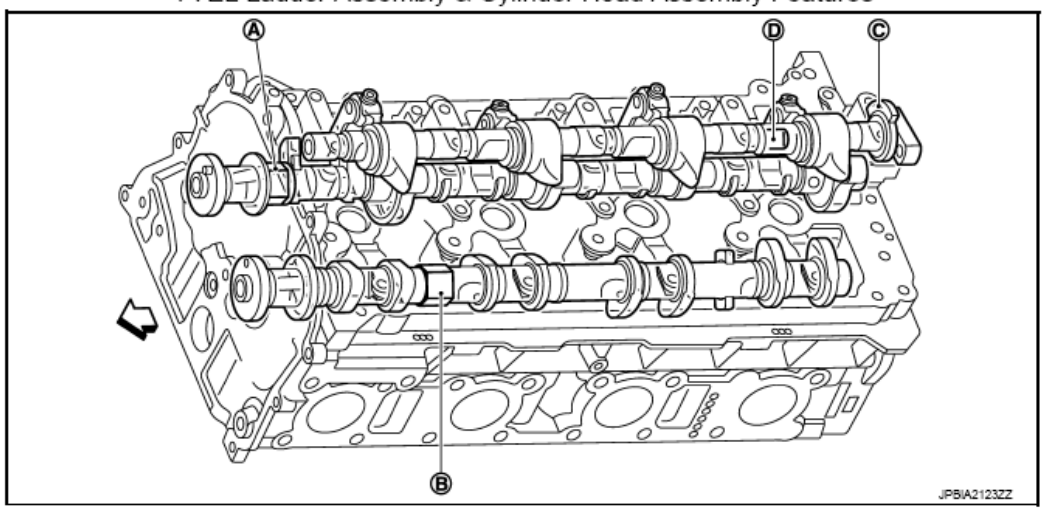
CAUTION: A high degree of precision is required for a valve on the intake side. Never remove the valve related parts unless necessary.

NOTE:

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

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

VVEL Ladder Assembly & Cylinder Head Assembly Features



A. Hexagonal part of drive shaft (for holding)
B. Hexagonal part of camshaft (EXH) (for holding)
C. Stopper of control shaft
D. Two flat areas of control shaft (for holding)
⇦ : Engine front

Fig. 156: Identifying VVEL Ladder Assembly And Cylinder Head Assembly Features
Courtesy of NISSAN NORTH AMERICA, INC.

NOTE: The figure shows an example of bank 1.

Disassembly and Assembly

DISASSEMBLY

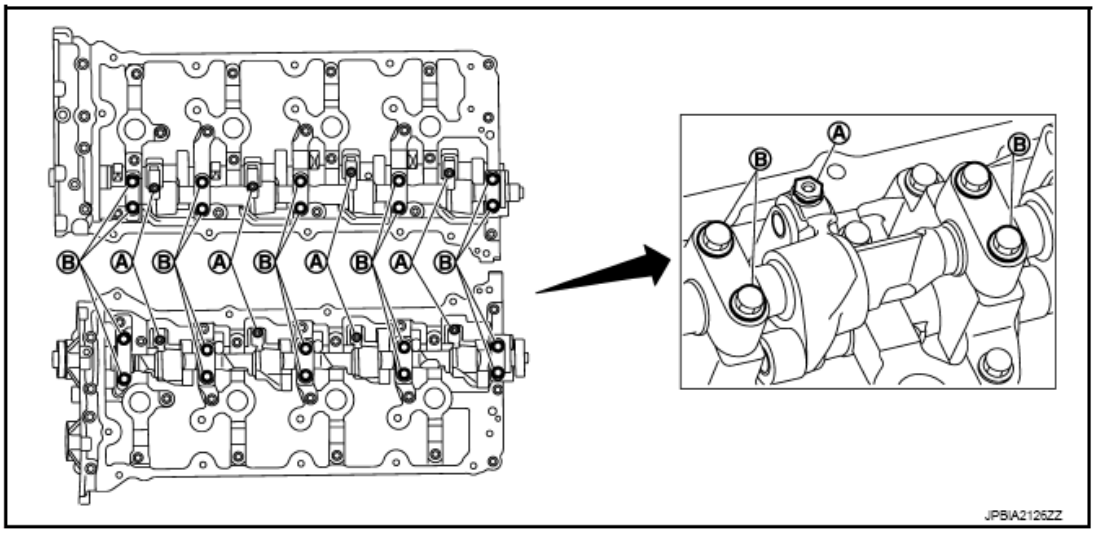


Fig. 157: VVEL Ladder Assembly Bolt & Nut Location
Courtesy of NISSAN NORTH AMERICA, INC.

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

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

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

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

a. Remove VVEL control shaft position sensor.
b. Fix two flat areas (C) of control shaft with a wrench to remove mounting bolts of control shaft.

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

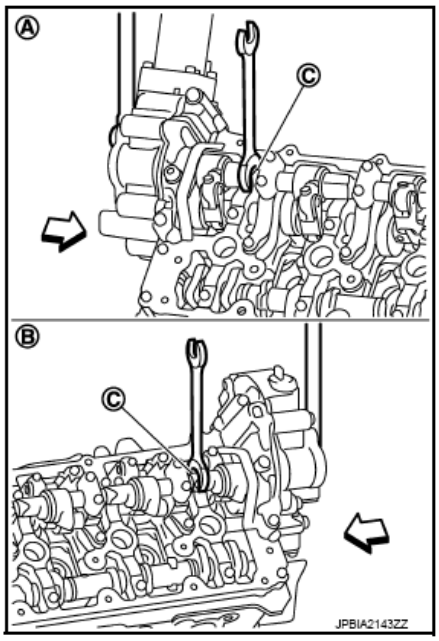


Fig. 158: Removing Control Shaft Mounting Bolts
Courtesy of NISSAN NORTH AMERICA, INC.

CAUTION:
- **During the operation, never allow a wrench to interfere with other parts.**
- **Fix control shaft to prevent the interference of the stopper**

surface.

c. Remove VVEL actuator sub assembly.
- Loosen mounting bolts in the reverse order as shown in the figure below.

A : Bank 1
B : Bank 2

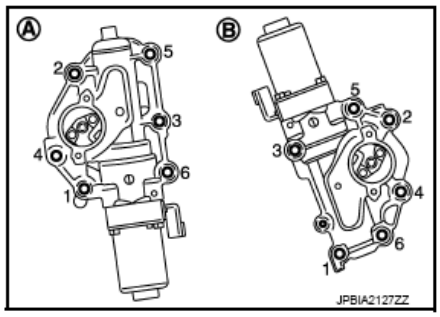


Fig. 159: VVEL Actuator Sub Assembly Bolt Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

CAUTION:
- **When removing, prepare wastes because oil spills.**
- **When installing, be careful with VVEL actuator sub assembly (bank 1) mounting bolt No. 4 because its length is different.**

d. Remove actuator bracket (rear).
- Loosen mounting bolts in the reverse order as shown in the figure below.

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

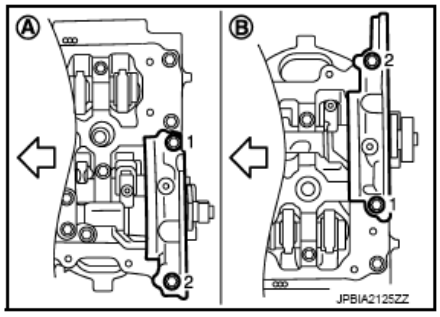


Fig. 160: Rear Actuator Bracket Bolt Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

3. Remove front cover, camshaft sprockets, and timing chains. Refer to "**EXPLODED VIEW**".
4. Remove VVEL ladder assembly.
- Loosen mounting bolts (gold color) in the reverse order as shown in the figure below.

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

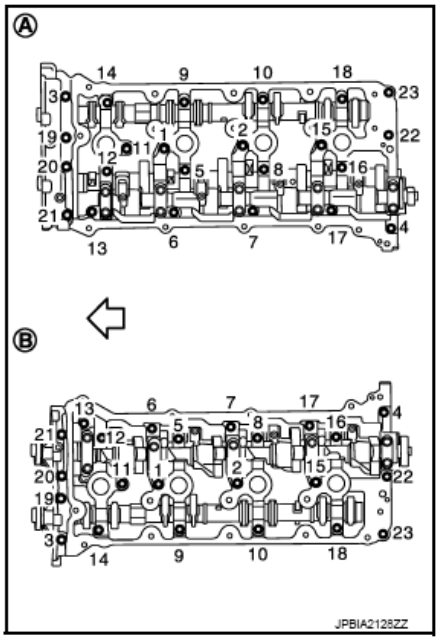


Fig. 161: VVEL Ladder Assembly Bolt Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

CAUTION:
- **Never loosen adjusting bolts and mounting bolts (black color).**
- **When removing VVEL ladder assembly, hold the drive shaft from below so as not to drop it.**

5. Remove camshaft (EXH).
6. Remove valve lifter, if necessary.
   - Identify installation positions, and store them without mixing them up.

ASSEMBLY

CAUTION: Do not reuse washers.

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

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

Bank 1 (B)	No	Brown	No

⇦ : Engine front

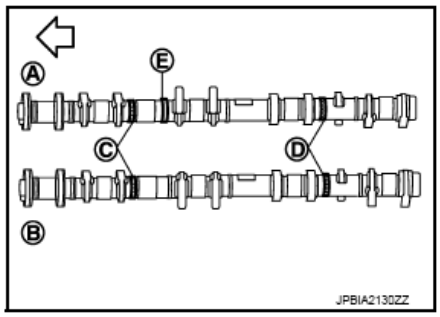


Fig. 162: Locating Identification Mark On Camshaft (EXH)
Courtesy of NISSAN NORTH AMERICA, INC.

3. Install VVEL ladder assembly as per the following:
   a. Apply a continuous bead of liquid gasket with tube presser (commercial service tool) to the cylinder head as shown in the figure below.

A : Bank 1
B : Bank 2
c : ϕ3.4 - 4.4 mm (0.134 - 0.173 in)
⇦ : Engine front

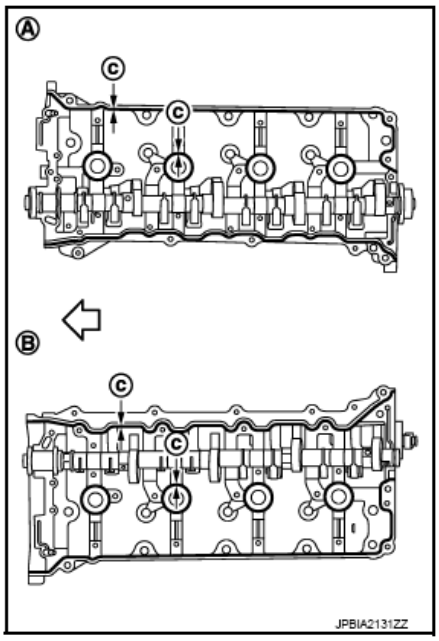


Fig. 163: Identifying Liquid Gasket
Courtesy of NISSAN NORTH AMERICA, INC.

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

   b. Tighten mounting bolts in the following step, in numerical order as shown below.

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

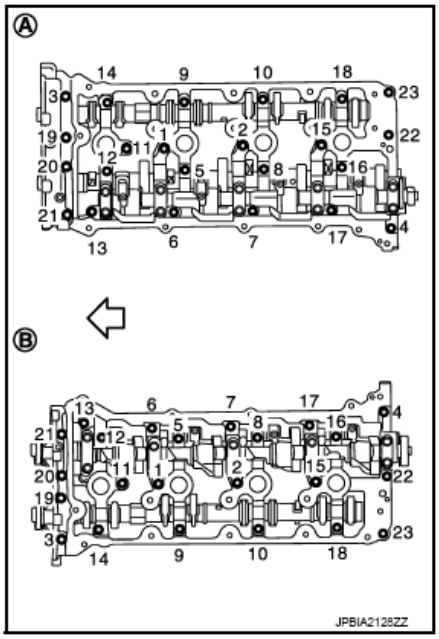


Fig. 164: VVEL Ladder Assembly Bolt Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

CAUTION: Do not reuse washers.

i. Tighten bolts in numerical order as shown above.

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

ii. Tighten bolts in numerical order as shown above.

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

iii. Tighten bolts in numerical order as shown above.

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

4. Install camshaft sprockets and timing chains. Refer to "**EXPLODED VIEW**".
5. Install actuator bracket (rear) as per the following:
   a. Refer to the figure below to replace new dowel pins (2), if removed.

1 : Actuator bracket
3 : VVEL ladder assembly
a : 4.0 - 6.0 mm(0.157 - 0.236 in)

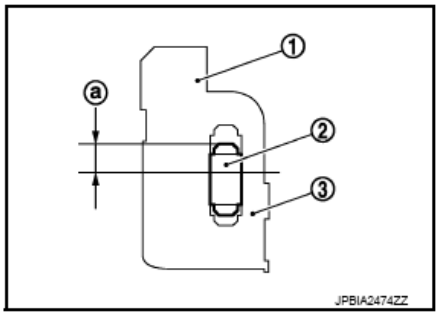


Fig. 165: Identifying Actuator Bracket, Dowel Pins And VVEL Ladder Assembly
Courtesy of NISSAN NORTH AMERICA, INC.

b. Apply a continuous bead of liquid gasket with tube presser (commercial service tool) to the actuator bracket (rear) as shown in the figure below.

A : Bank 2
B : Bank 1
c : ϕ3.4 - 4.4 mm (0.134 - 0.173 in)
⇦ : Engine front

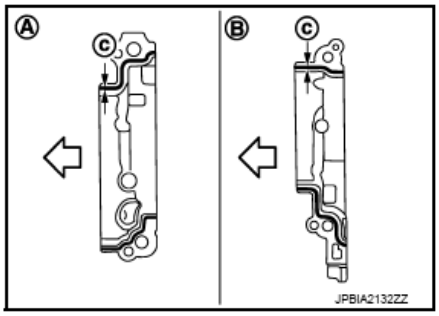


Fig. 166: Identifying Liquid Gasket
Courtesy of NISSAN NORTH AMERICA, INC.

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

CAUTION: Never apply gasket to the oil passage.

c. Tighten mounting bolts in the following steps, in numerical order as shown below.

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

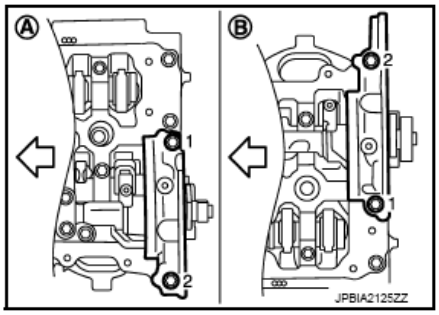


Fig. 167: Actuator Bracket Bolt Tightening Sequence

Courtesy of NISSAN NORTH AMERICA, INC.

i. Tighten bolts in numerical order as shown above.

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

ii. Tighten bolts in numerical order as shown above.

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

iii. Tighten bolts in numerical order as shown above.

Torque: 31.4 N.m (3.2 kg-m, 23 ft-lb)

6. Install new VVEL actuator sub assembly as per the following:

CAUTION: Regarding replacement, because VVEL actuator sub assembly and VVEL control shaft position sensor are controlled on a one-on-one basis, replace them as a set.

NOTE:

- **VVEL actuator arm (B) is factory-fixed at 10 degrees from the small lift with a holding jig (A).**
- **The holding jig is supplied in the new VVEL actuator sub assembly.**

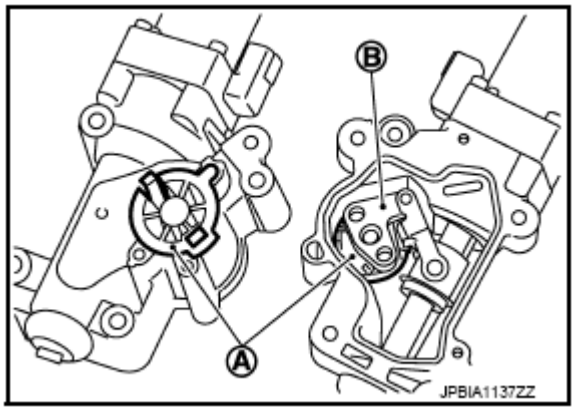


Fig. 168: Identifying VVEL Actuator Arm And Holding Jig
Courtesy of NISSAN NORTH AMERICA, INC.

CAUTION:

- **Never disassemble VVEL actuator sub assembly. [Never loosen actuator motor mounting bolts (A) shown in the figure below]**
- **Never impact VVEL actuator sub assembly.**

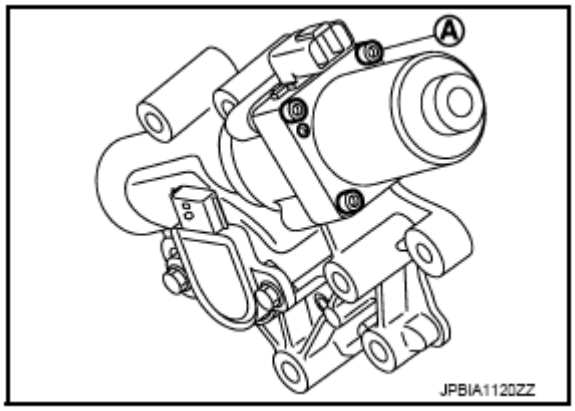


Fig. 169: Identifying Actuator Motor Mounting Bolts
Courtesy of NISSAN NORTH AMERICA, INC.

a. Move control shaft to the position of small lift stopper.
   - The position where a part of the stopper of control shaft contacts VVEL ladder bracket.

1 : VVEL ladder assembly (bank 2)
2 : VVEL ladder assembly (bank 1)
A : Stopper of control shaft
⬅ : Small lift side

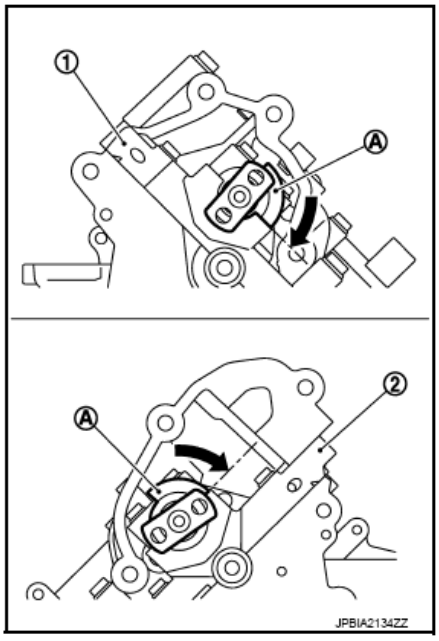


Fig. 170: Moving Control Shaft To Position Of Small Lift Stopper
Courtesy of NISSAN NORTH AMERICA, INC.

CAUTION: Be careful not to damage the stopper surface.

- If control shaft cannot be moved, set crankshaft in position referring to the information below. (To displace cam nose)

Bank 1: Turn 360 degrees from No. 1 cylinder at TDC

Bank 2: No. 1 cylinder at TDC

b. Hold two flat areas of control shaft with a wrench, and rotate the control shaft (10 degrees from the stopper) to the large lift side. (This is for aligning the bolt hole of control shaft and the hole of VVEL actuator arm.)

1 : VVEL actuator sub assembly (bank 2)
A : Control shaft
B : View B
C : Holding jig
d : 10 degrees
⬅ : Large lift side

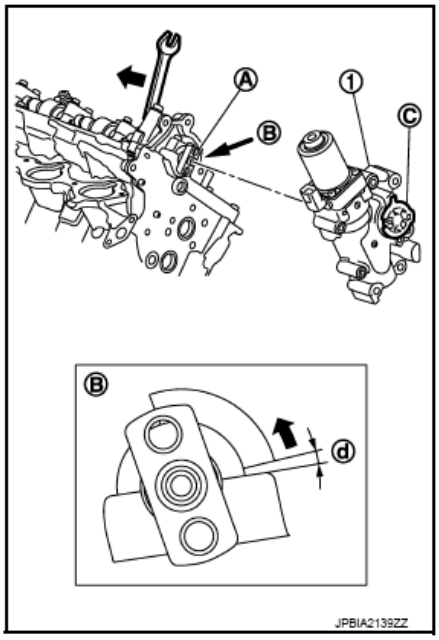


Fig. 171: Rotating Control Shaft
Courtesy of NISSAN NORTH AMERICA, INC.

NOTE: The figure shows an example of bank 2.

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

1 : VVEL actuator sub assembly (bank 2)
2 : VVEL actuator sub assembly (bank 1)
a : 4.0 - 5.6 mm (0.157 - 0.220 in)
b : ϕ3.4 - 4.4 mm (0.134 - 0.173 in)

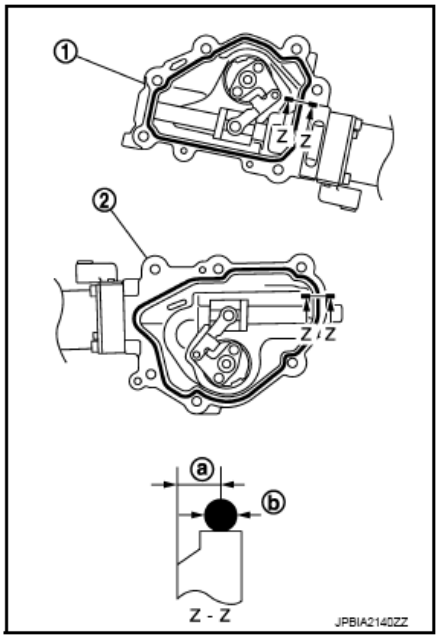


Fig. 172: Identifying Liquid Gasket
Courtesy of NISSAN NORTH AMERICA, INC.

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

CAUTION: Never apply gasket to the oil passage.

d. Install new VVEL actuator sub assembly.
- Tighten mounting bolts in the following step, in numerical order as shown below.

A : Bank 1
B : Bank 2

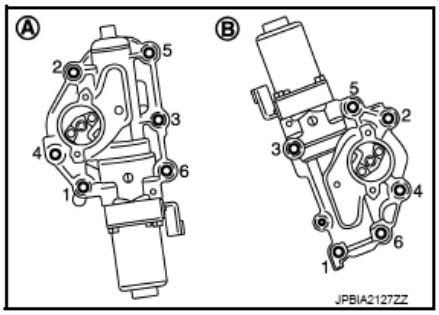


Fig. 173: VVEL Actuator Sub Assembly Bolt Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

CAUTION:
- **When installing, be careful with VVEL actuator sub assembly (bank 1) mounting bolt No. 4 because its length is different.**

- **Be sure to check that the VVEL actuator sub assembly is in contact with the cylinder head before tightening the mounting bolts.**

e. Remove holding jig.

f. Check that VVEL actuator arm bolt hole is aligned with control shaft tapped hole. If it is not aligned, turn control shaft for alignment.

CAUTION: Never impact the magnet part. (A)

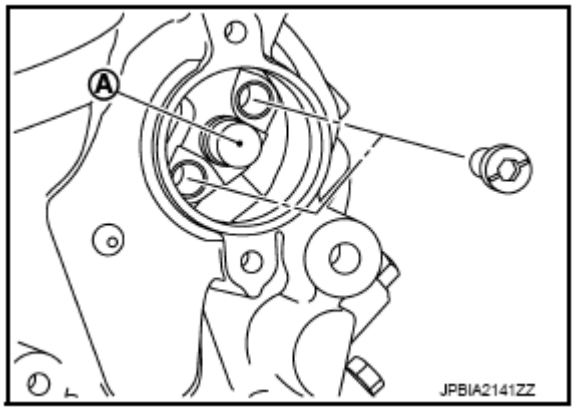


Fig. 174: Identifying VVEL Actuator Arm Bolt, Hole & Magnet
Courtesy of NISSAN NORTH AMERICA, INC.

g. Fix two flat areas (C) of control shaft with a wrench to tighten mounting bolts of control shaft.

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

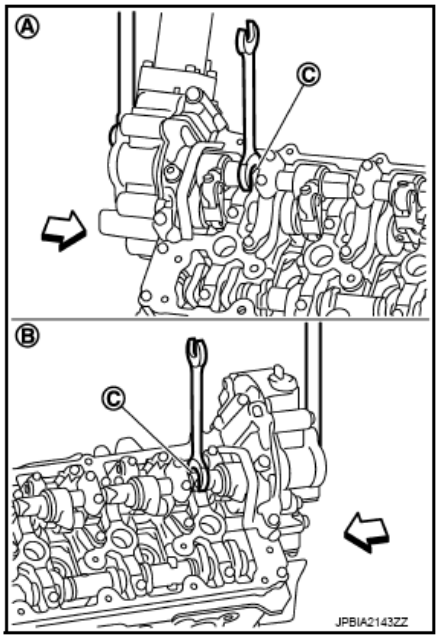


Fig. 175: Tightening Control Shaft Mounting Bolts
Courtesy of NISSAN NORTH AMERICA, INC.

CAUTION:
- **During the operation, never allow a wrench to interfere with other parts.**
- **Fix control shaft to prevent the interference of the stopper surface.**

7. Install new VVEL control shaft position sensor as per the following:

CAUTION: Regarding replacement, because VVEL actuator sub assembly and VVEL control shaft position sensor are controlled on a one-on-one basis, replace them as a set.

a. Apply engine oil to O-ring or contact surface of O-ring.
b. Align matching marks (B) of VVEL control shaft position sensor and upper housing.
   - Face connector toward matching mark (A).

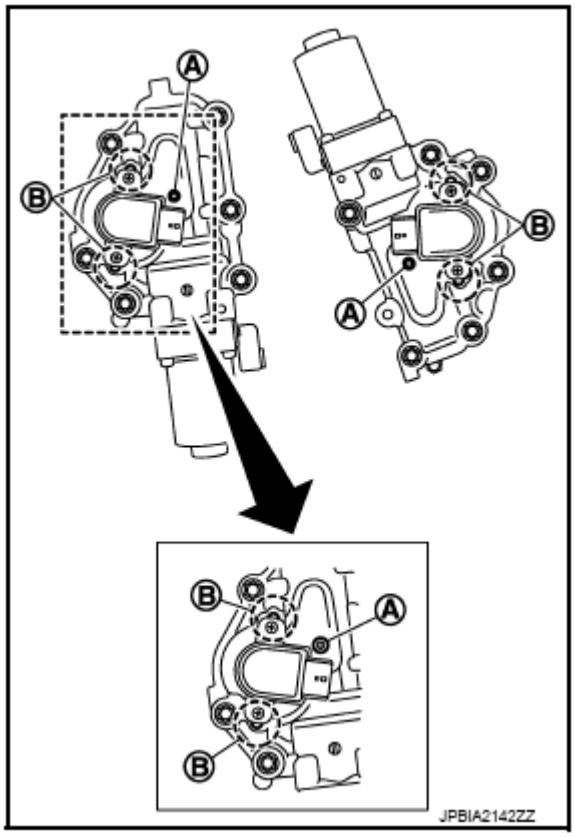


Fig. 176: Aligning Matching Marks Of VVEL Control Shaft Position Sensor And Upper Housing
Courtesy of NISSAN NORTH AMERICA, INC.

c. Temporarily tighten bolt.
d. Adjust VVEL control shaft position sensor after setting the engine assembly in the vehicle. Refer to "**DESCRIPTION** ".

CAUTION: Be sure to adjust VVEL control shaft position sensor.

e. After adjusting VVEL control shaft position sensor, tighten bolts to the specified torque.

8. Install actuator cover.
9. Inspect the valve clearance. Refer to "**INSPECTION**".
10. Install in the reverse order of removal.

Inspection

CAMSHAFT (EXH) VALVE CLEARANCE ADJUSTMENT

- Perform adjustment depending on selected head thickness of valve lifter (EXH).

1. Measure the valve clearance. Refer to "**INSPECTION**".
2. Remove VVEL ladder assembly and camshaft (EXH). Refer to "**DISASSEMBLY AND ASSEMBLY**".

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

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

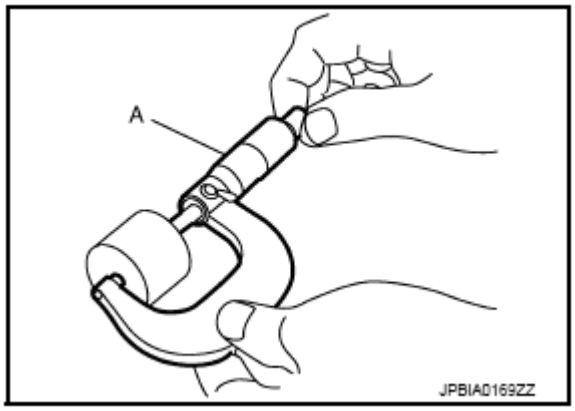


Fig. 177: Measuring Valve Lifter Center Thickness
Courtesy of NISSAN NORTH AMERICA, INC.

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

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

t = Valve lifter (EXH) thickness to be replaced

t1 = Removed valve lifter (EXH) thickness

C1 = Measured valve clearance

C2 = Standard valve clearance:

Exhaust: 0.33 mm (0.013 in)

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

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

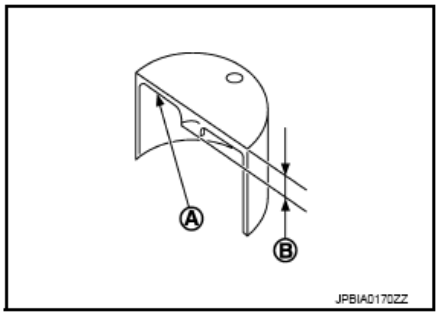


Fig. 178: Identifying Valve Lifter Thickness
Courtesy of NISSAN NORTH AMERICA, INC.

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

6. Install selected valve lifter (EXH).
7. Install VVEL ladder assembly and camshaft (EXH). Refer to "**DISASSEMBLY AND ASSEMBLY**".
8. Manually turn crankshaft pulley a few turns.
9. Check that the valve clearances for cold engine are within the specifications by referring to the specified values. 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)

Camshaft (EXH) 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 camshaft (EXH) to one direction with hands, and measure the camshaft runout on a dial indicator. (Total indicator reading)

Standard and limit: Refer to "CAMSHAFT".

4. If it exceeds the limit, replace camshaft (EXH).

Camshaft (EXH) Cam Height

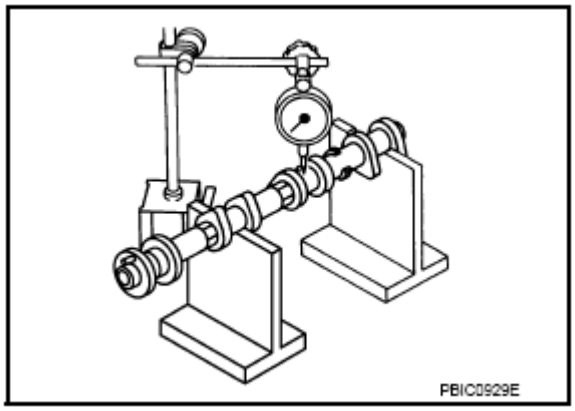


Fig. 179: Measuring Camshaft Runout
Courtesy of NISSAN NORTH AMERICA, INC.

- Measure the camshaft (EXH) cam height with a micrometer.

  Standard and limit: Refer to "CAMSHAFT".

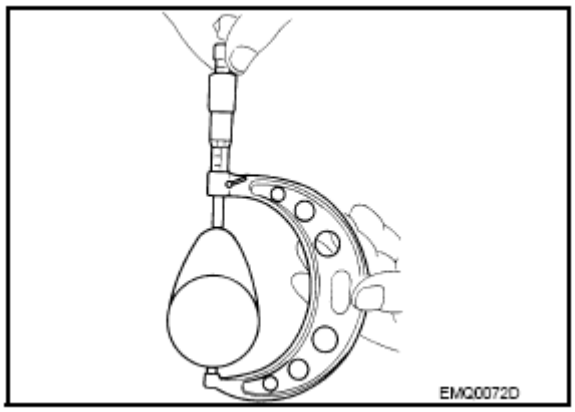


Fig. 180: Measuring Camshaft Cam Height
Courtesy of NISSAN NORTH AMERICA, INC.

- If wear exceeds the limit, replace camshaft (EXH).

Camshaft (EXH) Journal Oil Clearance

CAMSHAFT (EXH) JOURNAL DIAMETER

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

  Standard: Refer to "CAMSHAFT".

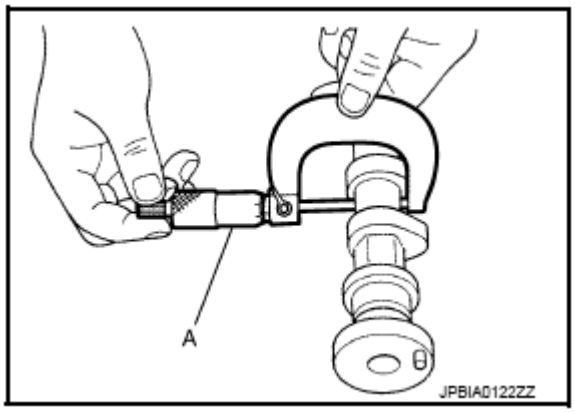


Fig. 181: Measuring Camshaft Journal Outer Diameter
Courtesy of NISSAN NORTH AMERICA, INC.

VVEL LADDER ASSEMBLY (EXH SIDE) INNER DIAMETER

- Tighten VVEL ladder assembly bolts to the specified torque. Refer to text and figures under "**Disassembly and Assembly**" for the tightening procedure.
- Measure inner diameter (A) of VVEL ladder assembly (EXH side) with a bore gauge.

  Standard: Refer to "CAMSHAFT".

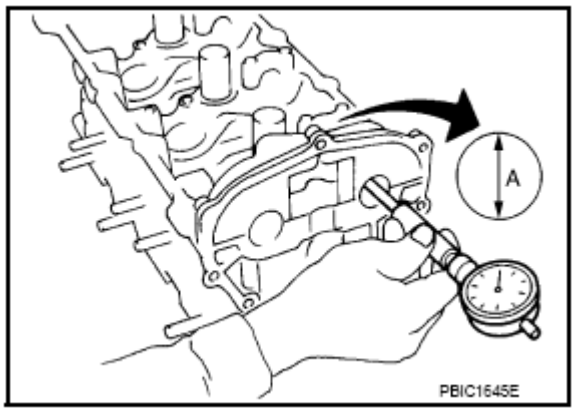


Fig. 182: Measuring VVEL Ladder Assembly Inner Diameter
Courtesy of NISSAN NORTH AMERICA, INC.

CAMSHAFT (EXH) JOURNAL OIL CLEARANCE

- (Oil clearance) = [VVEL ladder assembly (EXH side) inner diameter] - [Camshaft (EXH) journal diameter].

  Standard and limit: Refer to "CAMSHAFT".

- If the calculated value exceeds the limit, replace either or both camshaft (EXH) and VVEL ladder

assembly & cylinder head assembly.

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

Camshaft (EXH) End Play

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

  Standard and limit: Refer to "CAMSHAFT".

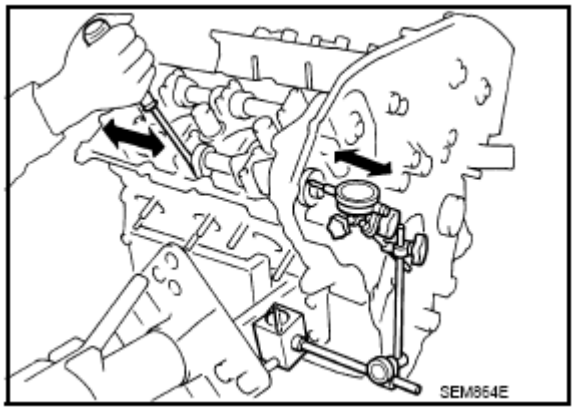


Fig. 183: Measuring Camshaft End Play
Courtesy of NISSAN NORTH AMERICA, INC.

- Measure the following parts if out of the limit.
  - Dimension "A" for camshaft (EXH) No. 1 journal

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

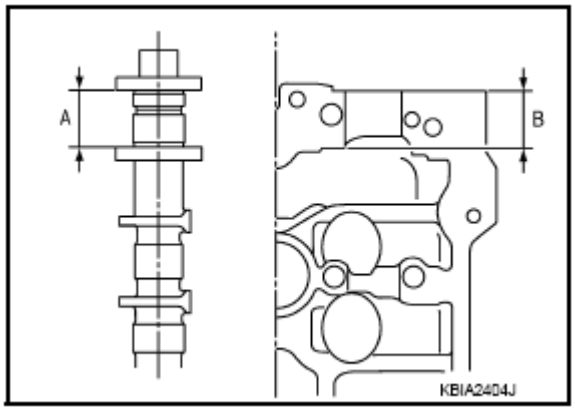


Fig. 184: Identifying Camshaft Journal Dimensions
Courtesy of NISSAN NORTH AMERICA, INC.

- 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 camshaft (EXH) 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.

Camshaft Sprocket (EXH) Runout

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

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

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

   Limit: Refer to "CAMSHAFT".

3. If it exceeds the limit, replace camshaft sprocket (EXH).

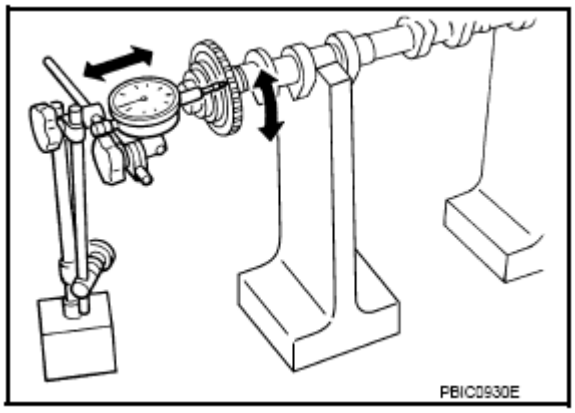


Fig. 185: Measuring Camshaft Sprocket Runout
Courtesy of NISSAN NORTH AMERICA, INC.

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".

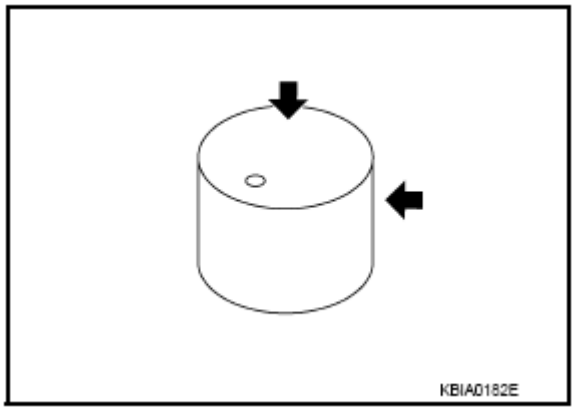


Fig. 186: Locating Wear Or Crack Area On Valve Lifter
Courtesy of NISSAN NORTH AMERICA, INC.

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".

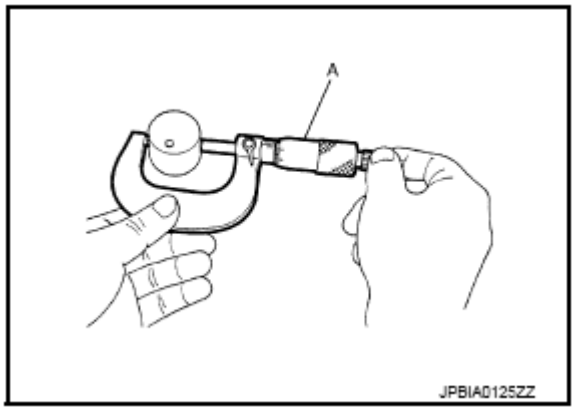


Fig. 187: Measuring Valve Lifter Outer Diameter At 1/2 Height
Courtesy of NISSAN NORTH AMERICA, INC.

VALVE LIFTER HOLE DIAMETER

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

  Standard: Refer to "CAMSHAFT".

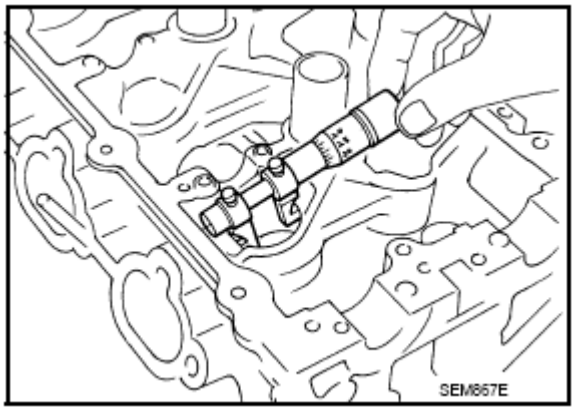


Fig. 188: Measuring Valve Lifter Hole Inner Diameter
Courtesy of NISSAN NORTH AMERICA, INC.

VALVE LIFTER CLEARANCE

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

  Standard: Refer to "CAMSHAFT".

- If the calculated value is out of the standard, 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 direction of axis).

  Standard and limit: Refer to "CAMSHAFT".

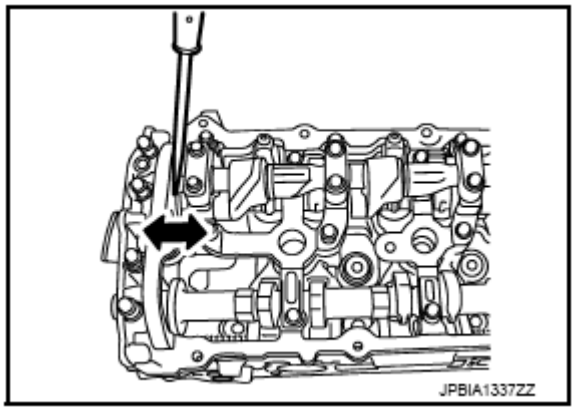


Fig. 189: Measuring Camshaft End Play
Courtesy of NISSAN NORTH AMERICA, INC.

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

    Standard: 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)

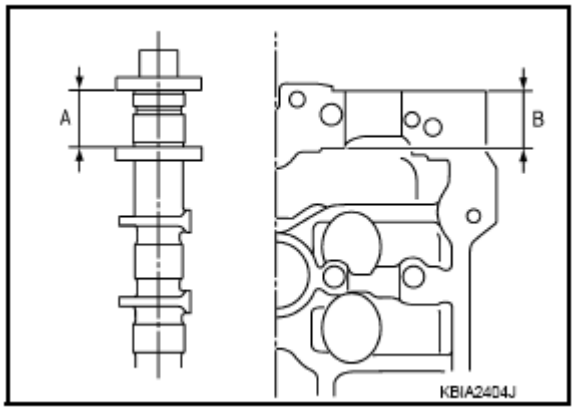


Fig. 190: Identifying Camshaft Journal Dimensions
Courtesy of NISSAN NORTH AMERICA, INC.

- 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.

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.

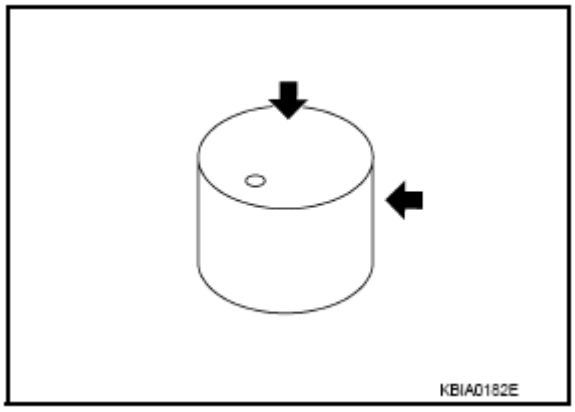


Fig. 191: Locating Wear Or Crack Area On Valve Lifter
Courtesy of NISSAN NORTH AMERICA, INC.

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".

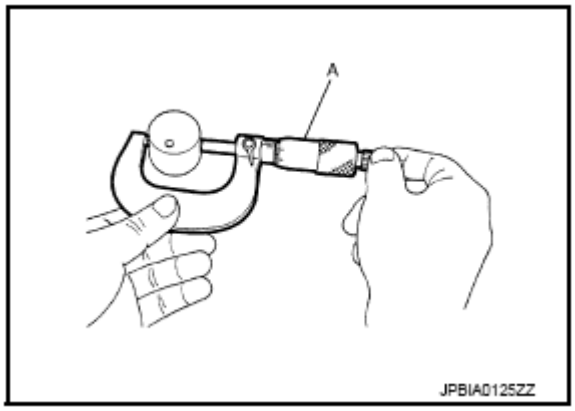


Fig. 192: Measuring Valve Lifter Outer Diameter At 1/2 Height
Courtesy of NISSAN NORTH AMERICA, INC.

VALVE LIFTER HOLE DIAMETER

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

  Standard: Refer to "CAMSHAFT".

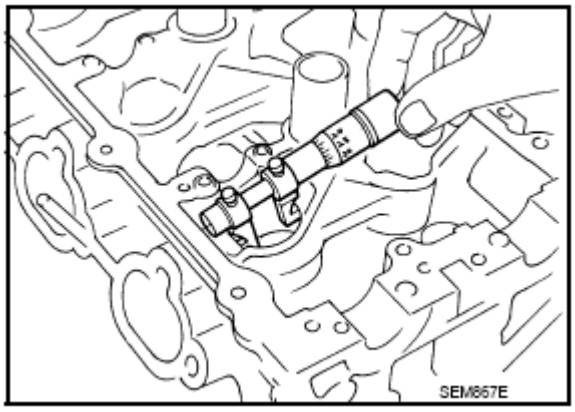


Fig. 193: Measuring Valve Lifter Hole Inner Diameter
Courtesy of NISSAN NORTH AMERICA, INC.

VALVE LIFTER CLEARANCE

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

  Standard: Refer to "CAMSHAFT".

- If the calculated value is out of the standard, replace VVEL ladder assembly & 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.

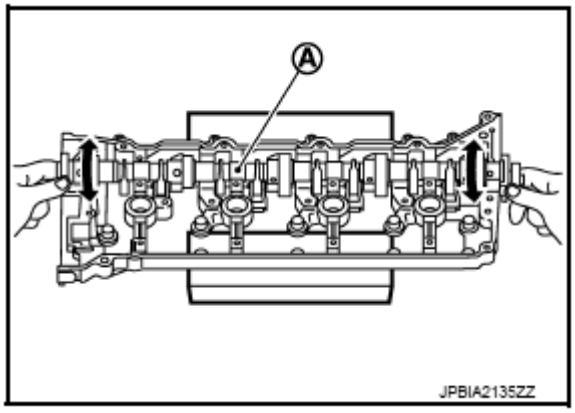


Fig. 194: Checking Drive Shaft Rotation
Courtesy of NISSAN NORTH AMERICA, INC.

CONTROL SHAFT OPERATIONAL CHECK

- Move control shaft (A) to the small stopper and large stopper to check that the control shaft functions smoothly.

CAUTION: Turn VVEL ladder assembly upside down to prevent the drive shaft from dropping off.

RINK CHECK FOR BACK-LASH (BONDING)

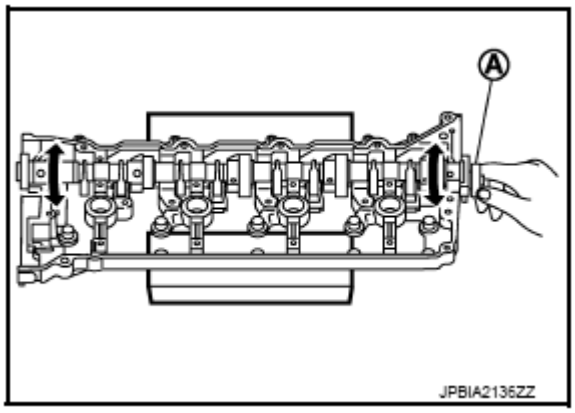


Fig. 195: Moving Control Shaft To Small And Large Stopper
Courtesy of NISSAN NORTH AMERICA, INC.

- 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.

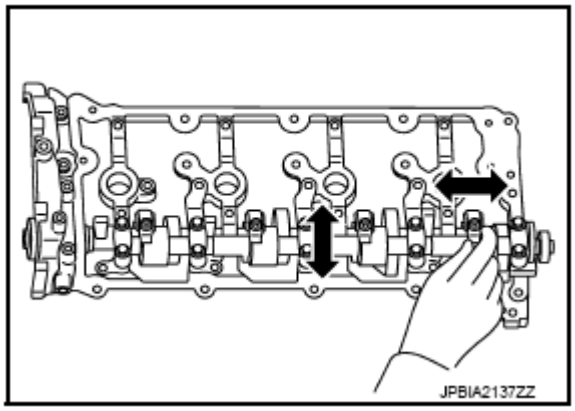


Fig. 196: Checking Control Shaft Movement In Axial And Rotation Directions
Courtesy of NISSAN NORTH AMERICA, INC.

- 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/EXH) Oil Groove

CAUTION:
- **Perform this inspection only when DTC P0011, P0021, P0014, P0024 is detected in self-diagnostic results of CONSULT and it is directed according to inspection procedure of "ENGINE CONTROL" article.**

Refer to "DIAGNOSIS DESCRIPTION ".

- **Check when engine is cold to prevent burns from the splashing engine oil.**

1. Check engine oil level. Refer to "**INSPECTION** ".
2. Perform the following procedure to prevent the engine from being unintentionally started while checking.
   a. Release the fuel pressure. Refer to "**WORK PROCEDURE** ".
   b. Disconnect ignition coil and injector harness connectors. Refer to "**EXPLODED VIEW**".
3. Remove valve timing control solenoid valve. Refer to "**EXPLODED VIEW**".
4. 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)

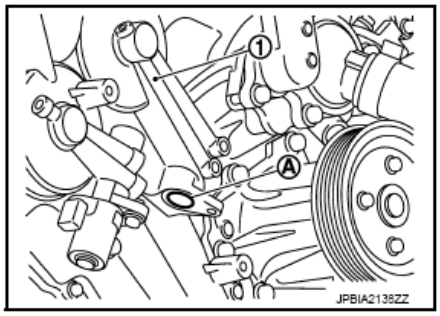


Fig. 197: Identifying Valve Timing Control Cover And Valve Timing Control Solenoid Valve Hole
Courtesy of NISSAN NORTH AMERICA, INC.

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.**

5. 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** ".
6. 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** ".

7. After inspection, install removed parts in the reverse order.

Inspection for Leakage

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

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

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

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

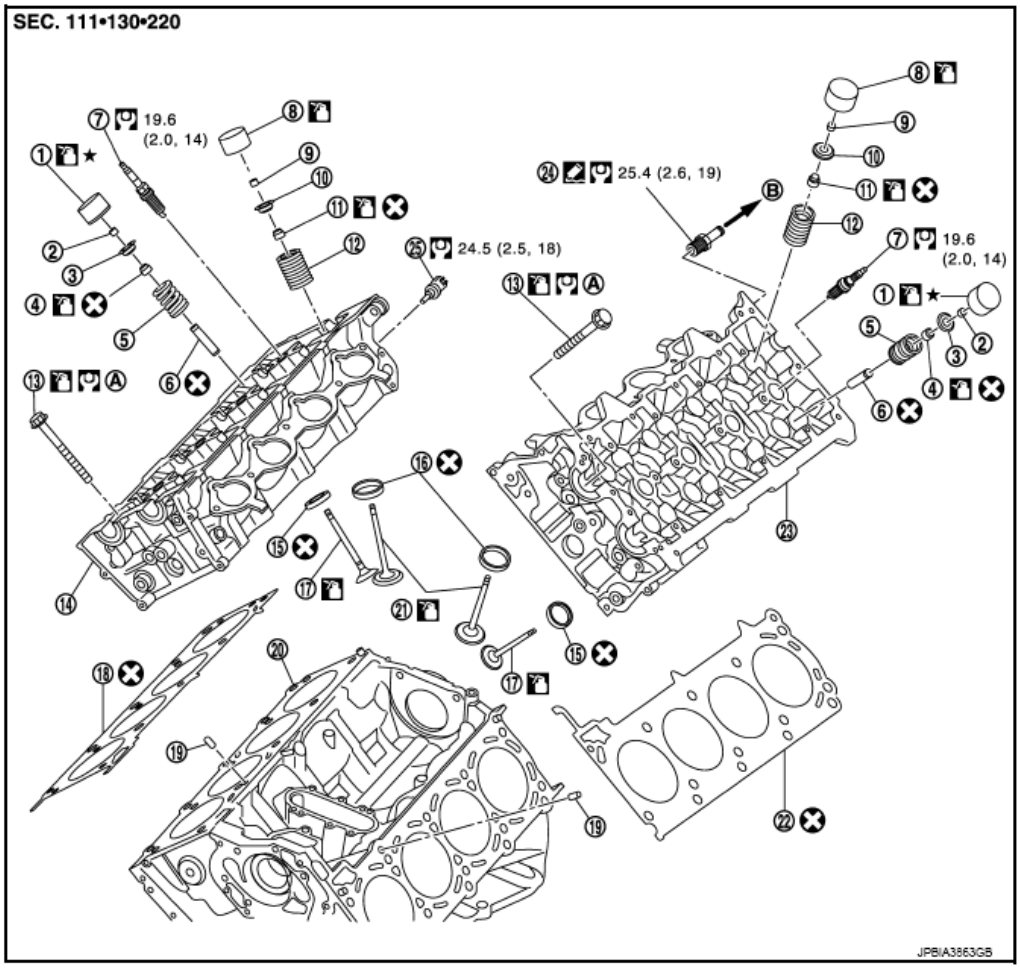
SUMMARY OF INSPECTION ITEMS

Items		Before starting engine	Engine running	After engine stopped
Engine coolant		Level	Leakage	Level
Engine oil		Level	Leakage	Level
Transmission/transaxle fluid	AT & CVT Models	Leakage	Level/Leakage	Leakage
	MT Models	Level/Leakage	Leakage	Level/Leakage
Other oils and fluids(1)		Level	Leakage	Level
Fuel		Leakage	Leakage	Leakage
Exhaust gases		-	Leakage	-
(1) Power steering fluid, brake fluid, etc.				

CYLINDER HEAD

Exploded View

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



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 (EXT)
16.	Valve seat (INT)	17.	Valve (EXH)	18.	Cylinder head gasket (bank 2)
19.	Oil filter (for VVEL ladder assembly)	20.	Cylinder block	21.	Valve (INT)
22.	Cylinder head gasket (bank 1)	23.	Cylinder head (bank 1)	24.	Water connector
25.	Engine coolant temperature sensor				
A.	Refer to installation procedure.	B.	To Electric throttle control actuator (bank 1)		

Fig. 198: Exploded View Of Cylinder Head With Torque Specifications
Courtesy of NISSAN NORTH AMERICA, INC.

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 above, 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.**

Disassembly and Assembly

DISASSEMBLY

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 below.

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

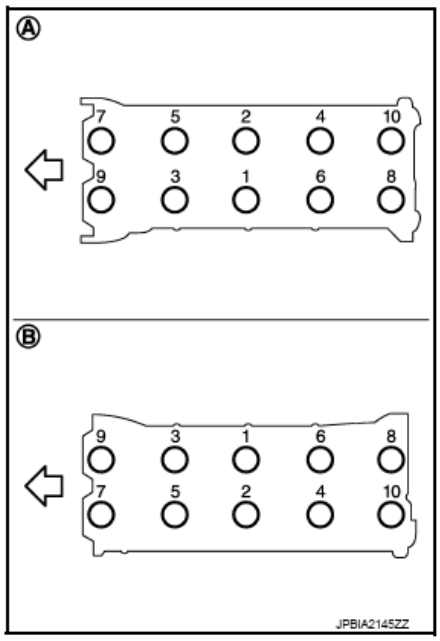


Fig. 199: Cylinder Head Bolt Tightening Sequence

Courtesy of NISSAN NORTH AMERICA, INC.

- Use TORX socket and power tool.

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.
6. Remove valve collet.
   - Compress valve spring with the valve spring compressor [SST: KV10116200 (J-26336-A)] (A), the attachment [SST: KV10115900 (J-26336-20)] (C) and the adapter [SST: KV10109220 (-)] (B). Remove valve collet with a magnet hand.

CAUTION: When working, take care not to damage valve lifter holes.

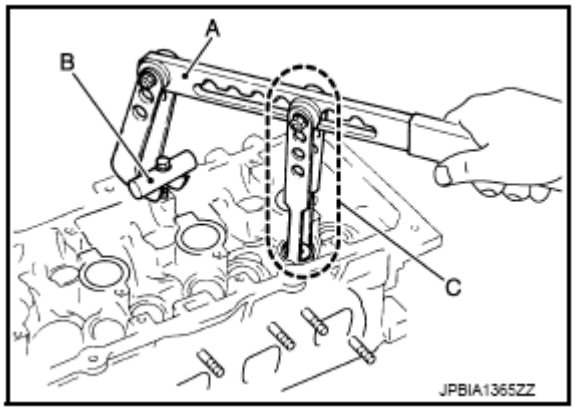


Fig. 200: Compressing Valve Spring
Courtesy of NISSAN NORTH AMERICA, INC.

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

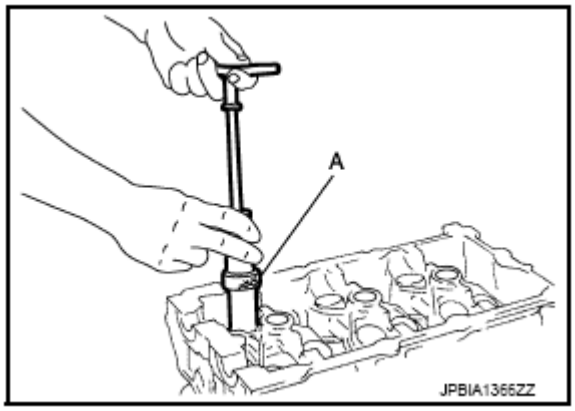


Fig. 201: Removing Valve Oil Seal
Courtesy of NISSAN NORTH AMERICA, INC.

10. Remove valve seat (EXH), if valve seat (EXH) must be replaced.
    - Bore out old seat until it collapses. Boring should not continue beyond the bottom face of the seat recess in cylinder head. Set the machine depth stop to ensure this. Refer to "**CYLINDER HEAD**".

CAUTION: Prevent to scratch cylinder head by excessive boring.

11. Remove valve guide (EXH), if valve guide (EXH) must be replaced.
    a. To remove valve guide (EXH), heat cylinder head to 110 to 130°C (230 to 266°F) by soaking in heated oil (A).

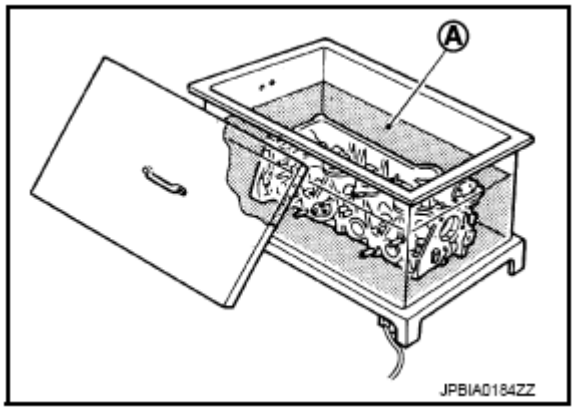


Fig. 202: Heating Cylinder Head
Courtesy of NISSAN NORTH AMERICA, INC.

    b. Drive out valve guide (EXH) with a press [under a 20 kN (2 ton, 2.2 US ton, 2.0 lmp 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.

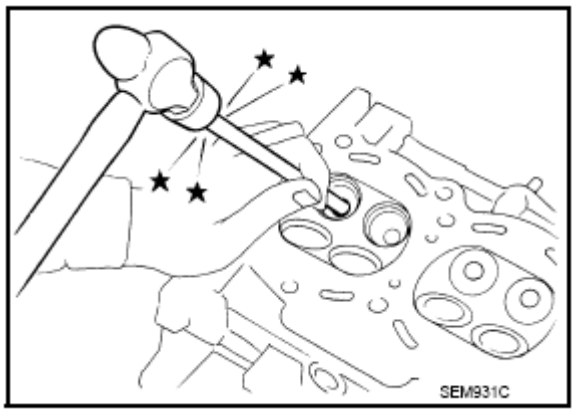


Fig. 203: Removing Valve Guide
Courtesy of NISSAN NORTH AMERICA, INC.

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".

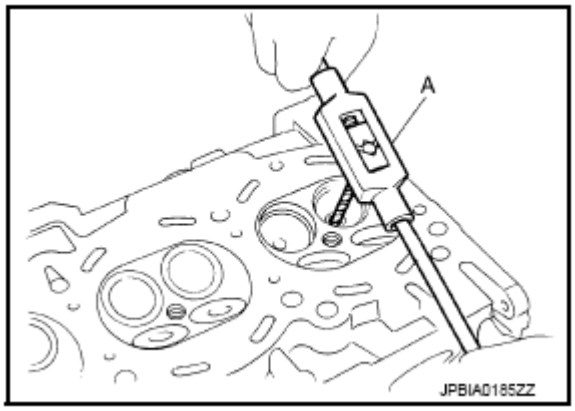


Fig. 204: Reaming Cylinder Head Valve Guide
Courtesy of NISSAN NORTH AMERICA, INC.

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

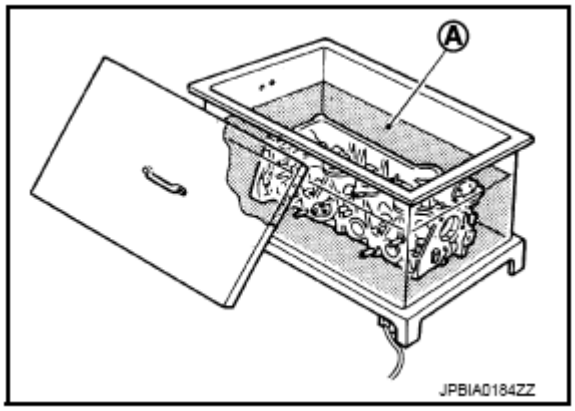


Fig. 205: Heating Cylinder Head
Courtesy of NISSAN NORTH AMERICA, INC.

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

Projection (A): Refer to "CYLINDER HEAD".

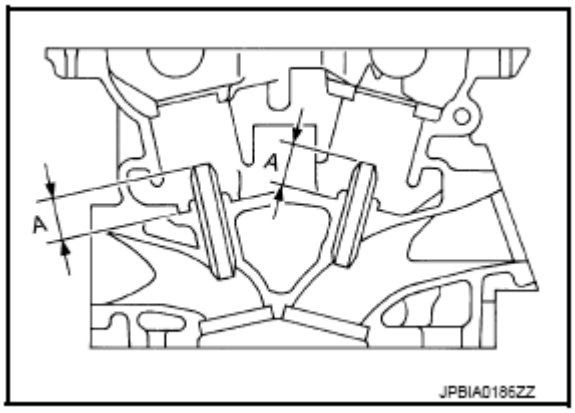


Fig. 206: Valve Guide Installation Dimensions
Courtesy of NISSAN NORTH AMERICA, INC.

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

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

Standard: Refer to "CYLINDER HEAD".

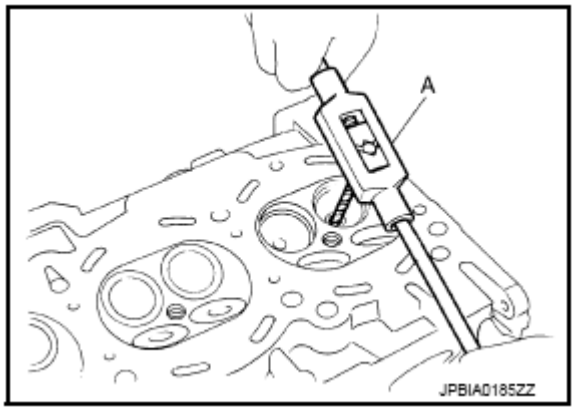


Fig. 207: Reaming Cylinder Head Valve Guide
Courtesy of NISSAN NORTH AMERICA, INC.

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".

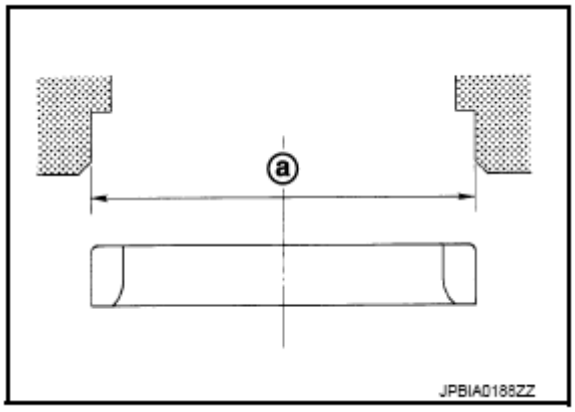


Fig. 208: Identifying Valve Seat Recess Diameter
Courtesy of NISSAN NORTH AMERICA, INC.

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

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

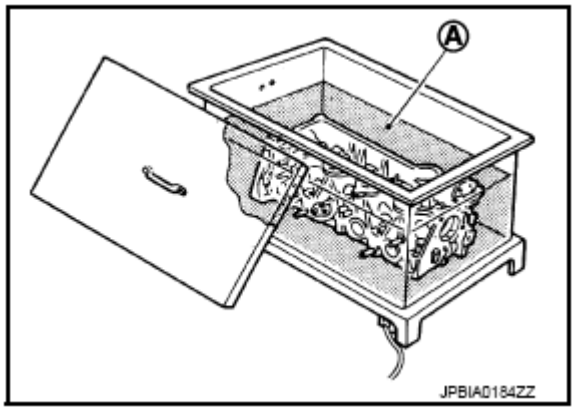


Fig. 209: Heating Cylinder Head
Courtesy of NISSAN NORTH AMERICA, INC.

c. Provide valve seats (EXH) cooled well with dry ice. Force fit valve seat (EXH) into cylinder head.

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

CAUTION: Avoid directly touching cold valve seats.

d. Using the valve seat cutter set (commercial service tool) or valve seat grinder, finish seat to the specified dimensions. Refer to " "**CYLINDER HEAD**"."

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

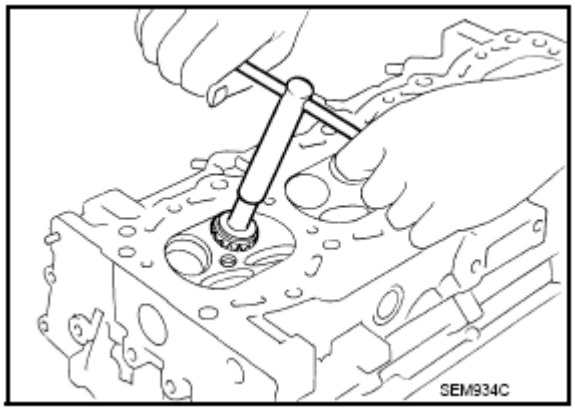


Fig. 210: Cutting Valve Seat

Courtesy of NISSAN NORTH AMERICA, INC.

e. Using compound, grind to adjust valve fitting.
f. Check again for normal contact. Refer to "**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 figure below.

Height (b)

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

Exhaust: 13.6 - 14.2 mm (0.535 - 0.559 in)

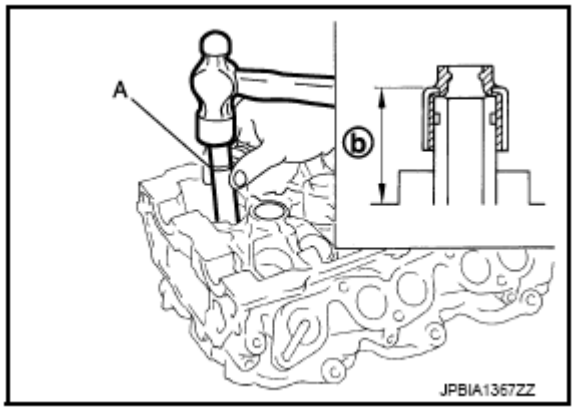


Fig. 211: Installing Valve Seal
Courtesy of NISSAN NORTH AMERICA, INC.

4. Install valve.

NOTE: Larger diameter valves are for intake side.

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

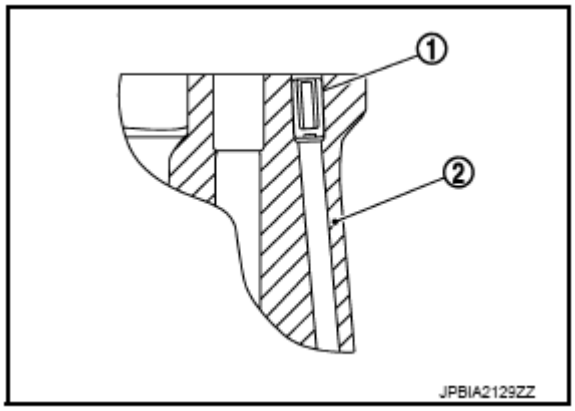


Fig. 212: Identifying Cylinder Block & VVEL Ladder Assembly Oil Filter
Courtesy of NISSAN NORTH AMERICA, INC.

6. Install new cylinder head gaskets.
7. 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 below.

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

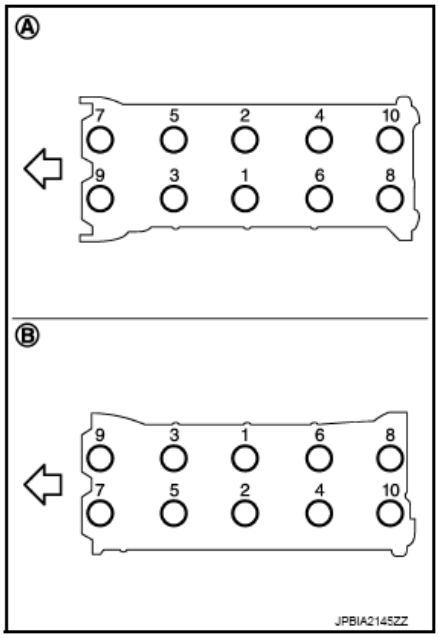


Fig. 213: Cylinder Head Bolt Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

- 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 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

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.

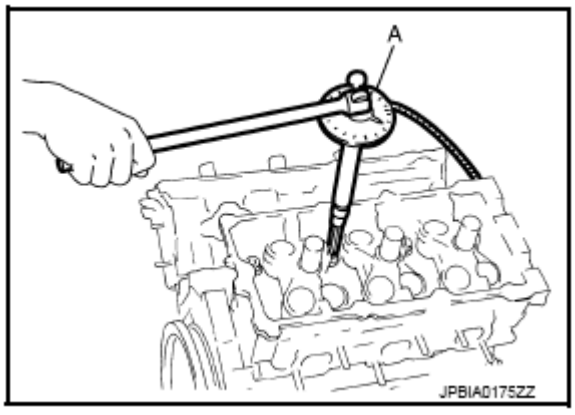


Fig. 214: Checking Tightening Angle Using Angle Wrench
Courtesy of NISSAN NORTH AMERICA, INC.

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

Angle tightening: 90 degrees

8. 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

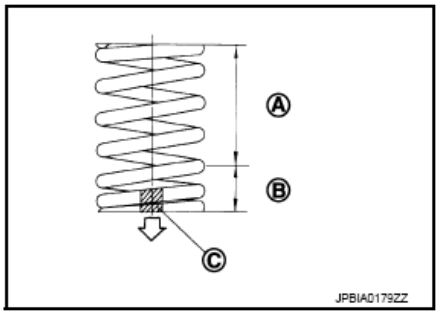


Fig. 215: Installing Valve Spring Paint Mark
Courtesy of NISSAN NORTH AMERICA, INC.

Paint mark color

Intake: Yellow

Exhaust: Pink

9. Install valve spring retainer.
10. 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.

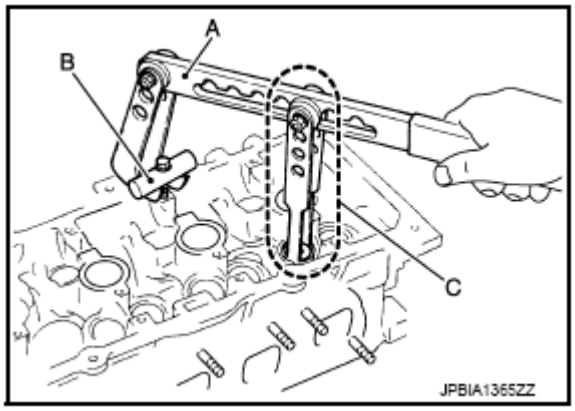


Fig. 216: Compressing Valve Spring
Courtesy of NISSAN NORTH AMERICA, INC.

11. Install valve lifter.
    - Install it in the original position.
12. Install in the reverse order of removal.

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)

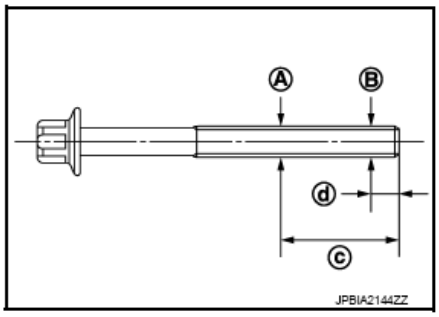


Fig. 217: Cylinder Head Bolt Dimension
Courtesy of NISSAN NORTH AMERICA, INC.

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

   Limit: Refer to "CYLINDER HEAD".

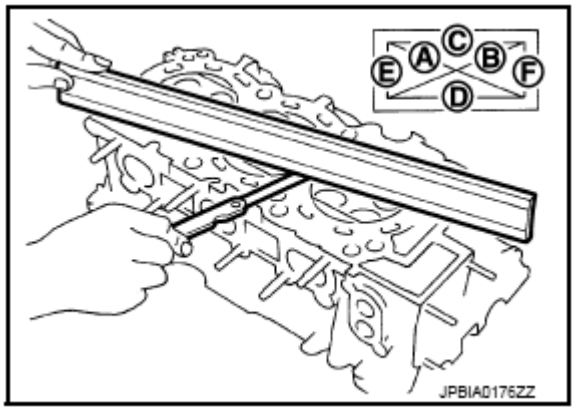


Fig. 218: Measuring Cylinder Head Distortion
Courtesy of NISSAN NORTH AMERICA, INC.

- 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.

Valve Dimensions

- Check the dimensions of each valve. For the dimensions, refer to "CYLINDER HEAD".
- If dimensions are out of the standard.
  - Replace valve (EXH) and check valve seat contact. Refer to "Valve Seat Contact". (Exhaust side)
  - Replace VVEL ladder assembly & 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".

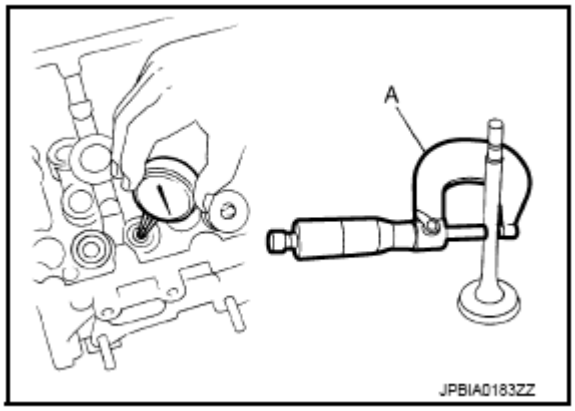


Fig. 219: Measuring Valve Guide Clearance
Courtesy of NISSAN NORTH AMERICA, INC.

- 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.

A : OK
B : NG

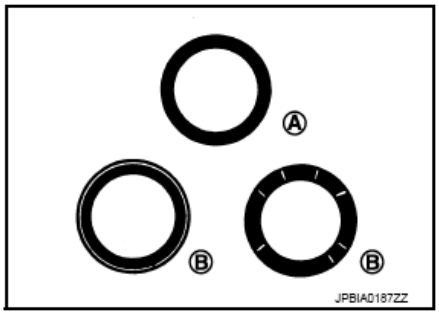


Fig. 220: Checking Valve Seat Contact
Courtesy of NISSAN NORTH AMERICA, INC.

- If not, grind to adjust valve fitting and check again. If the contacting surface still has "NG" conditions even after the recheck, replace valve seat (EXH). Refer to "**EXPLODED VIEW**". (Exhaust side)
- If not, replace VVEL ladder assembly & cylinder head assembly. Refer to "**EXPLODED VIEW**". (Intake side)

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.

B : Contact

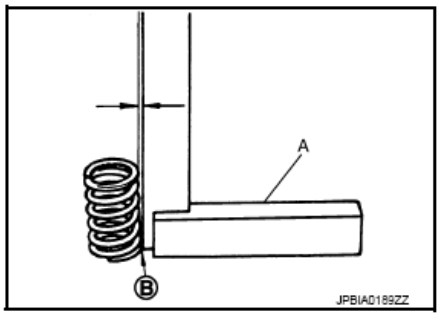


Fig. 221: Measuring Valve Spring Squareness
Courtesy of NISSAN NORTH AMERICA, INC.

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)

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".

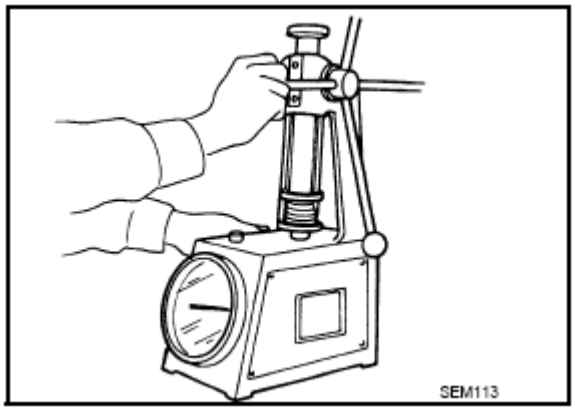


Fig. 222: Checking Valve Spring Pressure
Courtesy of NISSAN NORTH AMERICA, INC.

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

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 "**FOR NORTH AMERICA: FLUIDS AND LUBRICANTS** ".
- Follow the procedure below to check for fuel leakage.
  - Turn ignition switch to the "ON" position (with engine stopped). With fuel pressure applied to fuel piping, check for fuel leakage at connection points.
  - Start engine. With engine speed increased, check again for fuel leakage at connection points.
- Run engine to check for unusual noise and vibration.

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

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

SUMMARY OF INSPECTION ITEMS

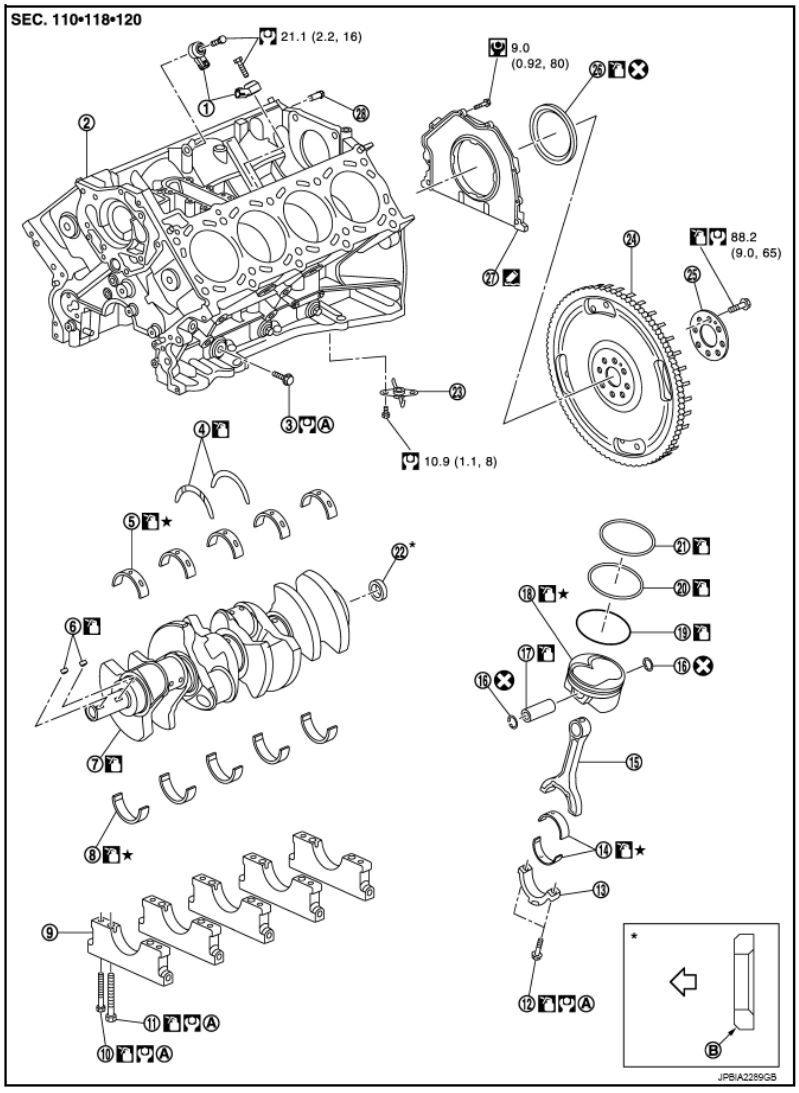
Items		Before starting engine	Engine running	After engine stopped
Engine coolant		Level	Leakage	Level
Engine oil		Level	Leakage	Level
Transmission/transaxle fluid	AT & CVT Models	Leakage	Level/Leakage	Leakage
	MT Models	Level/Leakage	Leakage	Level/Leakage
Other oils and fluids(1)		Level	Leakage	Level
Fuel		Leakage	Leakage	Leakage
Exhaust gases		-	Leakage	-

(1) Power steering fluid, brake fluid, etc.

CYLINDER BLOCK

Exploded View

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



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. Pilot converter
23. Piston oil jet
24. Drive plate
25. Reinforcement plate
26. Rear oil seal
27. Rear oil seal retainer
28. Cylinder block heater (for Canada)

A. Follow installation procedure
B. Chamfered

⇦ : Crankshaft side

Fig. 223: 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 "**2WD: EXPLODED VIEW**"(2WD models) or "**AWD: EXPLODED VIEW**" (AWD models) 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.

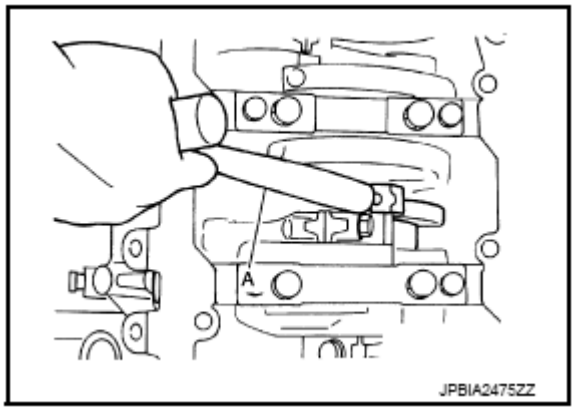


Fig. 224: Removing Piston & Connecting Rod Assembly
Courtesy of NISSAN NORTH AMERICA, INC.

5. Remove connecting rod bearings from connecting rod and connecting rod bearing cap.

CAUTION:
- **Be careful not to drop connecting rod bearing, and to scratch the surface.**
- **Identify installation positions, and store them without mixing them up.**

6. Remove piston rings from piston.
   - Before removing piston rings, check the piston ring side clearance. Refer to "**INSPECTION**".
   - Use a piston ring expander (commercial service tool) (A).

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

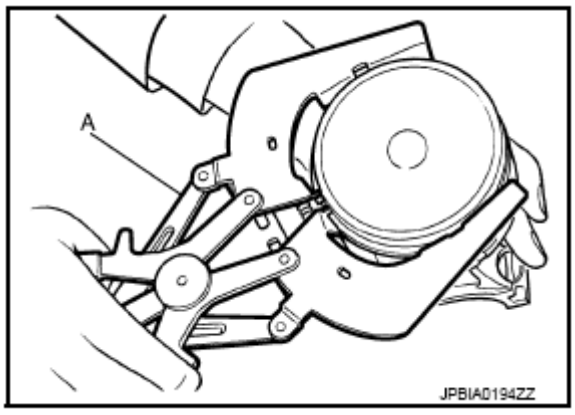


Fig. 225: Removing Piston Rings
Courtesy of NISSAN NORTH AMERICA, INC.

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

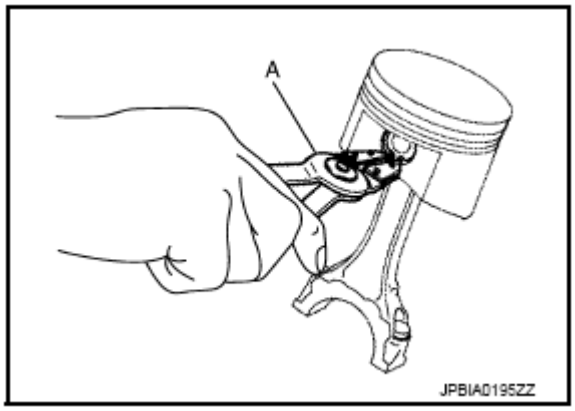


Fig. 226: Removing Snap Ring
Courtesy of NISSAN NORTH AMERICA, INC.

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

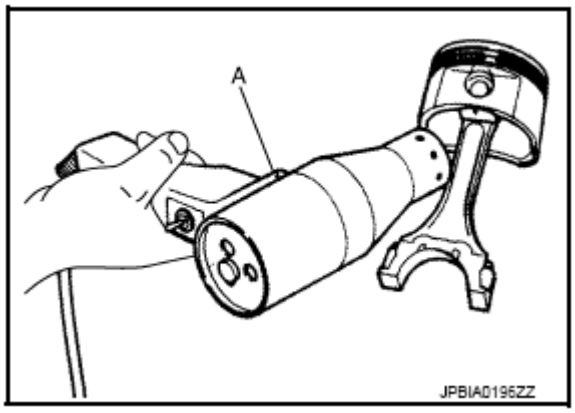


Fig. 227: Heating Piston
Courtesy of NISSAN NORTH AMERICA, INC.

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

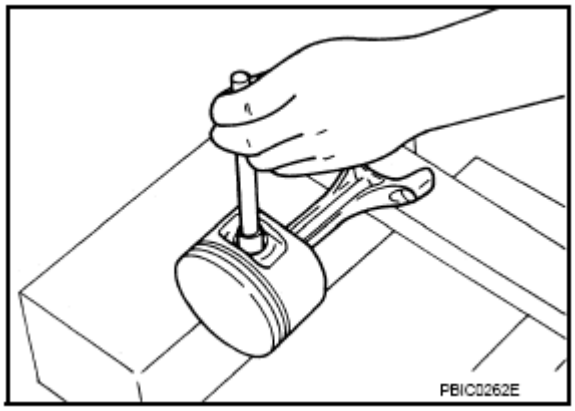


Fig. 228: Removing Piston Pin
Courtesy of NISSAN NORTH AMERICA, INC.

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

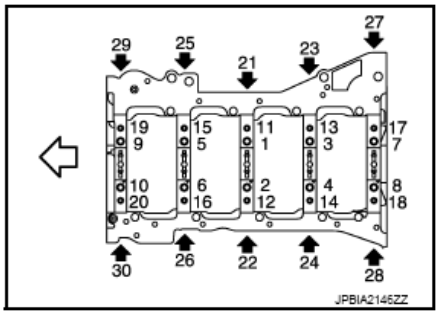


Fig. 229: Cylinder Block Side Bolt Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

    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.

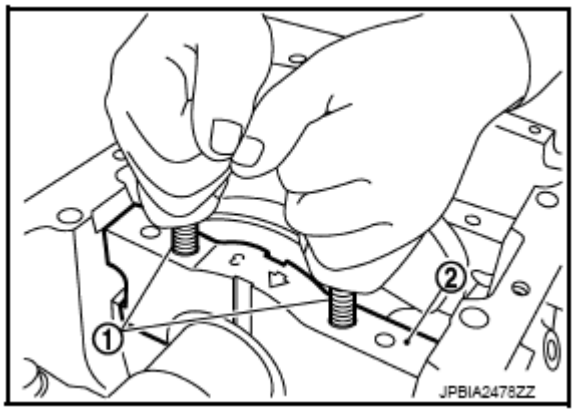


Fig. 230: Removing Main Bearing Cap
Courtesy of NISSAN NORTH AMERICA, INC.

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 pilot converter using the pilot bushing puller (commercial service tool), if necessary.
14. 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 below.

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

⇦ : Engine front

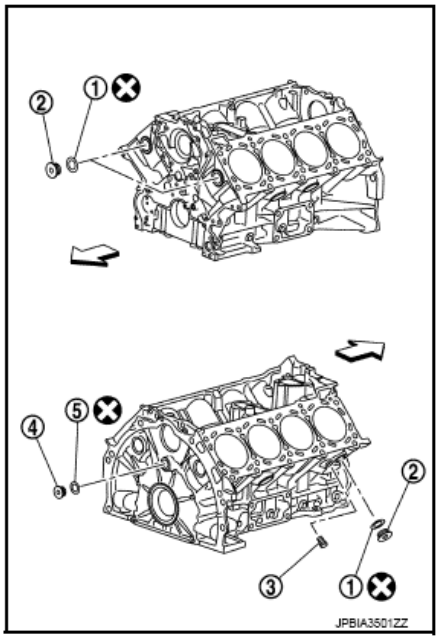


Fig. 231: Locating Cylinder Block Plugs
Courtesy of NISSAN NORTH AMERICA, INC.

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

- Tighten each plug as specified below.

Part	Tightening torque
Plug (2)	78.0 N.m (8.0 kg-m, 58 ft-lb)
Water drain plug (3)	19.6 N.m (2.0 kg-m, 14 ft-lb)
Plug (4)	65 N.m (6.5 kg-m, 48 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 Liquid Gasket or equivalent.

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

Use high strength thread locking sealant or equivalent.

3. Install oil jet.
   - Insert oil jet into cylinder block hole, and tighten the mounting bolt on the corner side (A) first.

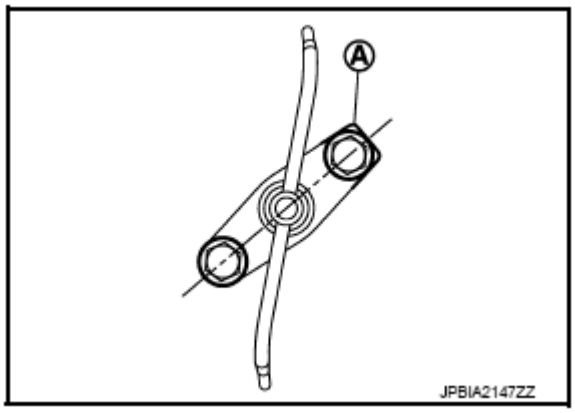


Fig. 232: Locating Oil Jet Corner Side Bolt
Courtesy of NISSAN NORTH AMERICA, INC.

4. Install pilot converter to crankshaft, if removed.
   - With drift [outer diameter: approx. 35 mm (1.38 in)], press-fit as far as it will go.

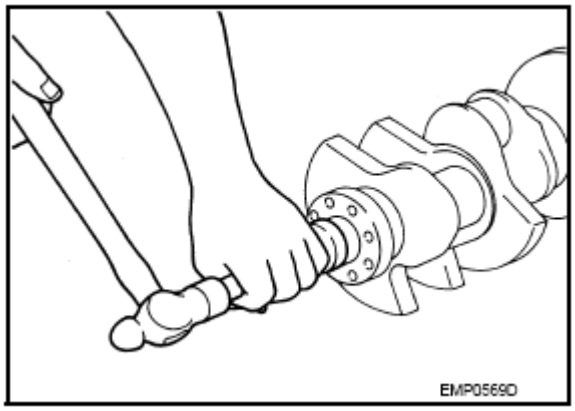


Fig. 233: Installing Pilot Converter
Courtesy of NISSAN NORTH AMERICA, INC.

   - Press-fit pilot converter with its chamfering side facing crankshaft as shown in the figure below.

⇦ : Crankshaft side

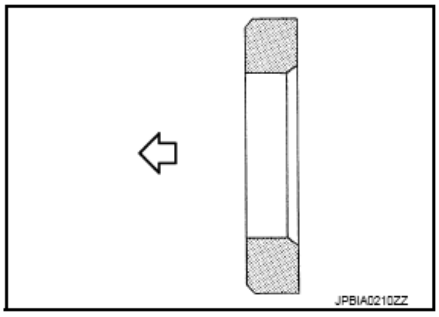


Fig. 234: Identifying Pilot Converter Orientation
Courtesy of NISSAN NORTH AMERICA, INC.

5. 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

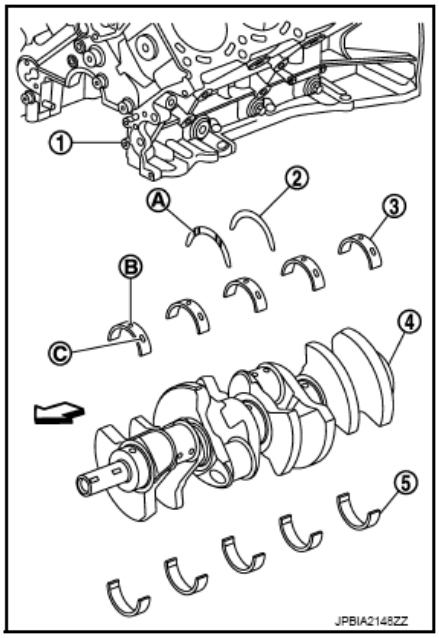


Fig. 235: Identifying Main Bearings
Courtesy of NISSAN NORTH AMERICA, INC.

- 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.

6. Install crankshaft to cylinder block.
   - While turning crankshaft by hand, check that it turns smoothly.
7. Install main bearing caps as per the following:
   - Align the identification number to the journal position to install.

⇦ : Engine front

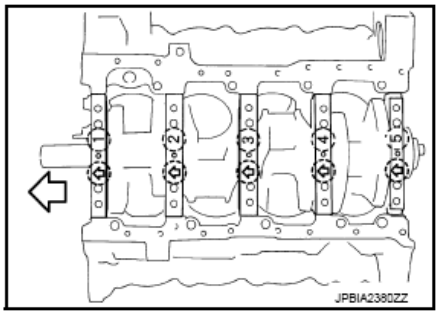


Fig. 236: Aligning Identification Number To Journal Position
Courtesy of NISSAN NORTH AMERICA, INC.

   - 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.

8. 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

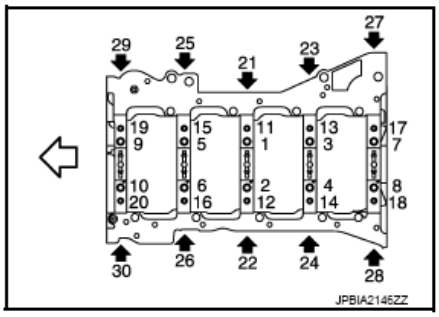


Fig. 237: Main Bearing Cap Bolt Tightening Sequence
Courtesy of NISSAN NORTH AMERICA, INC.

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

Torque: 53.9 N.m (5.5 kg-m, 40 ft-lb)

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

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

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

Angle tightening: 90 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: 90 degrees

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

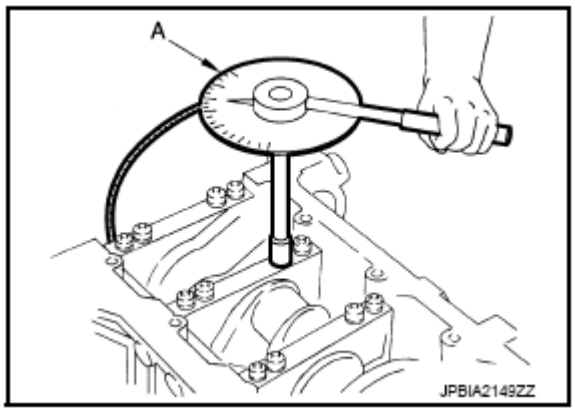


Fig. 238: Check Tightening Angle Using Angle Wrench
Courtesy of NISSAN NORTH AMERICA, INC.

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**".

9. 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 below.

A : Protrusion
b : 4.0 - 5.6 mm (0.157 - 0.220 in)
c : ϕ3.4 - 4.4 mm (0.134 - 0.173 in)

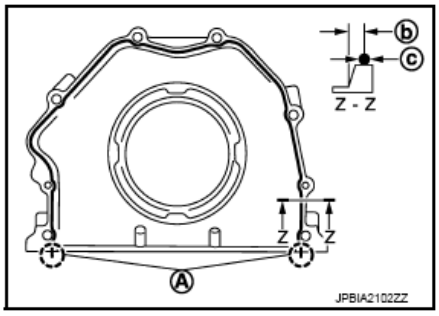


Fig. 239: Identifying Liquid Gasket
Courtesy of NISSAN NORTH AMERICA, INC.

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

10. Install rear oil seal on rear oil seal retainer.

⇦ : Engine inside
⬅ : Engine outside

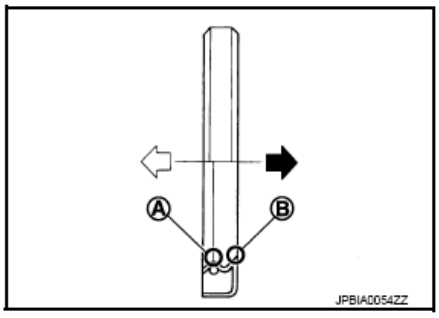


Fig. 240: Identifying Oil & Dust Seal Orientation
Courtesy of NISSAN NORTH AMERICA, INC.

- Apply new engine oil to both oil seal lip (A) and dust seal lip (B).
- Install it so that each seal lip is oriented as shown in the figure below.

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

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

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

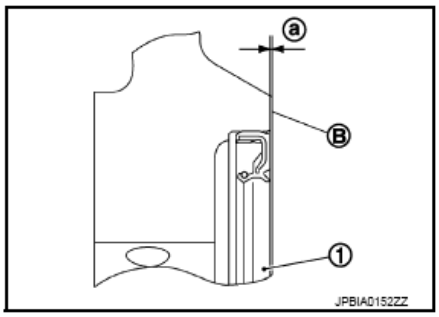


Fig. 241: Identifying Rear Oil Seal Installation Dimension
Courtesy of NISSAN NORTH AMERICA, INC.

- Using a suitable drift [outer diameter: 101 mm (3.98 in)].
- Check the garter spring is in position and seal lips are not inverted.

11. 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 below.

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

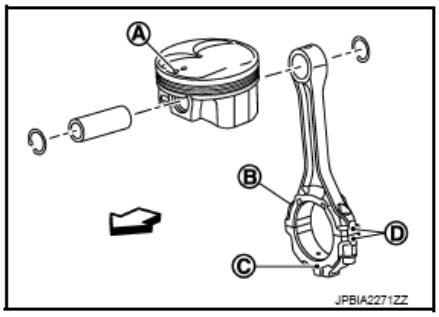


Fig. 242: Identifying Piston Head Front Mark And Cylinder Number
Courtesy of NISSAN NORTH AMERICA, INC.

a. Using snap ring pliers, install new snap ring to the groove of piston rear side.
    - Insert it fully into groove to install.
b. Install piston to connecting rod.
    - Using an industrial use dryer or similar tool, heat piston until piston pin can be pushed in by hand without excess force [approximately 60 to 70°C (140 to 158°F)]. From the front to the rear, insert piston pin into piston and connecting rod.
c. Install new snap ring to the groove of the piston front side.
    - Insert it fully into groove to install.
    - After installing, check that connecting rod moves smoothly.

12. 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.**

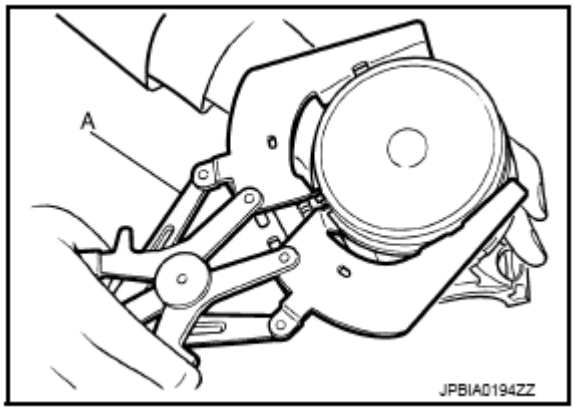


Fig. 243: Installing Piston Rings
Courtesy of NISSAN NORTH AMERICA, INC.

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

  Stamped mark:

  Top ring (A): 1 K

  Second ring (B): 2 K

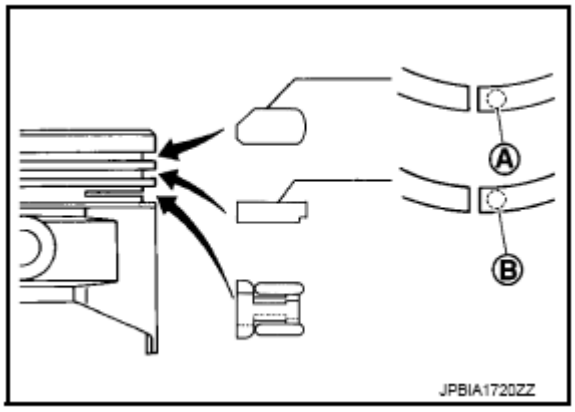


Fig. 244: Identifying Top & Second Ring Stamped Marks
Courtesy of NISSAN NORTH AMERICA, INC.

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

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

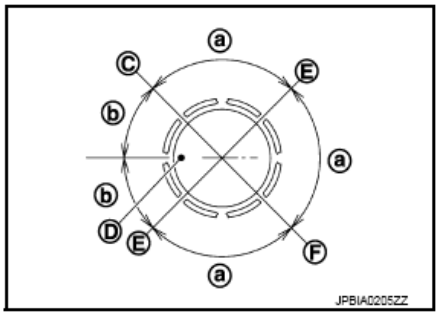


Fig. 245: Identifying Piston Ring Orientation
Courtesy of NISSAN NORTH AMERICA, INC.

- Check the piston ring side clearance. Refer to "**INSPECTION**".

13. 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.

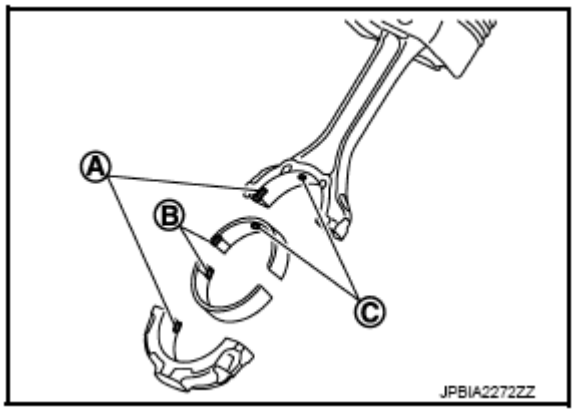


Fig. 246: Identifying Connecting Rod Bearing Stopper Protrusion, Connecting Rods Cutout And Oil Hole
Courtesy of NISSAN NORTH AMERICA, INC.

14. 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.

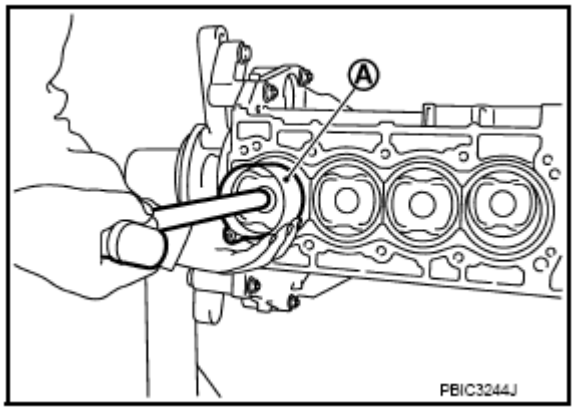


Fig. 247: Installing Piston
Courtesy of NISSAN NORTH AMERICA, INC.

15. 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

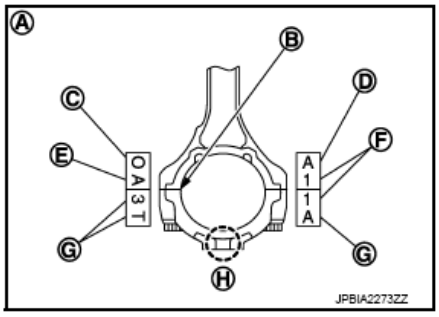


Fig. 248: Identifying Stamped Marks On Connecting Rod Bearing Caps
Courtesy of NISSAN NORTH AMERICA, INC.

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

16. Tighten connecting rod bolts as per the following:
    a. Inspect the outer diameter of connecting rod bolt. Refer to "**INSPECTION**".
    b. Apply engine oil to the threads and seats of connecting rod bolts.
    c. Tighten connecting rod bolts.

Torque: 28.4 N.m (2.9 kg-m, 21.0 ft-lb)

d. Completely loosen connecting rod bolts.

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

e. Tighten connecting rod bolts.

Torque: 24.5 N.m (2.5 kg-m, 18.0 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**".

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

⇦ : Engine front

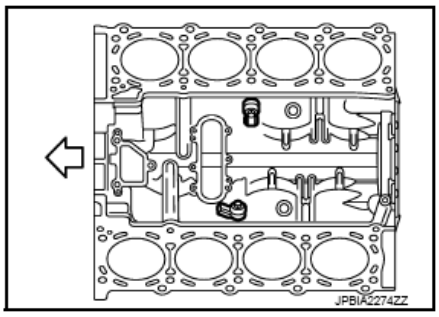


Fig. 249: Identifying Knock Sensors
Courtesy of NISSAN NORTH AMERICA, INC.

- 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.**

18. Install oil filter (for VVEL ladder assembly).
19. Install drive plate.
    - Install drive plate (4) and reinforcement plate (3) as shown in the figure below.

2 : Pilot converter
A : Rounded
⇦ : Engine front

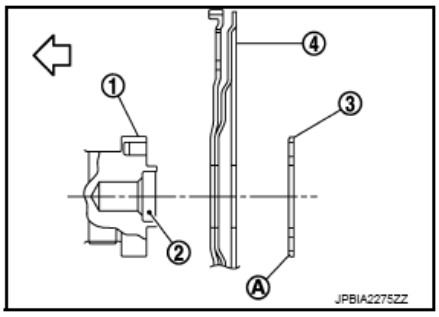


Fig. 250: Identifying Drive Plate & Reinforcement Plate
Courtesy of NISSAN NORTH AMERICA, INC.

- 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 "MI" illuminates.

- Holding ring gear with the ring gear stopper [SST: KV10119200 (J-49277)].
- Tighten the mounting bolts crosswise over several times.

20. 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).

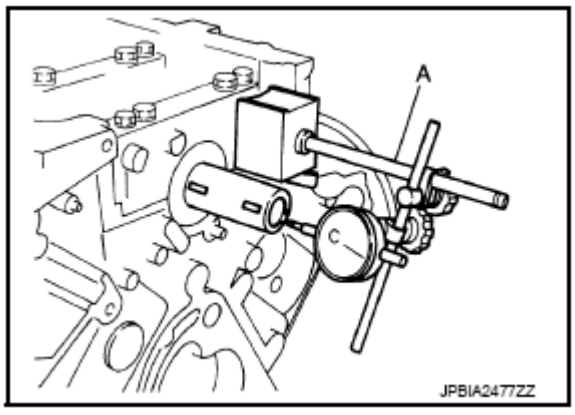


Fig. 251: Measuring Crankshaft End Play
Courtesy of NISSAN NORTH AMERICA, INC.

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.

CONNECTING ROD SIDE CLEARANCE

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

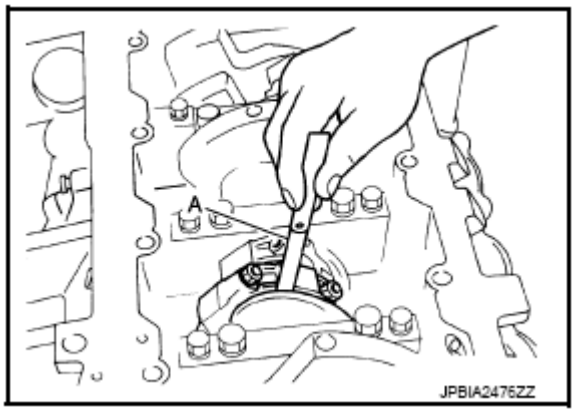


Fig. 252: Measuring Side Clearance Between Connecting Rod & Crankshaft Arm
Courtesy of NISSAN NORTH AMERICA, INC.

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.

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".

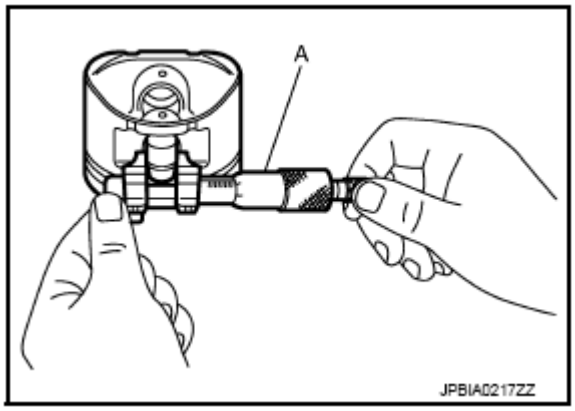


Fig. 253: Measuring Inner Diameter Of Piston Pin Hole
Courtesy of NISSAN NORTH AMERICA, INC.

Piston Pin Outer Diameter

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

Standard: Refer to "CYLINDER BLOCK".

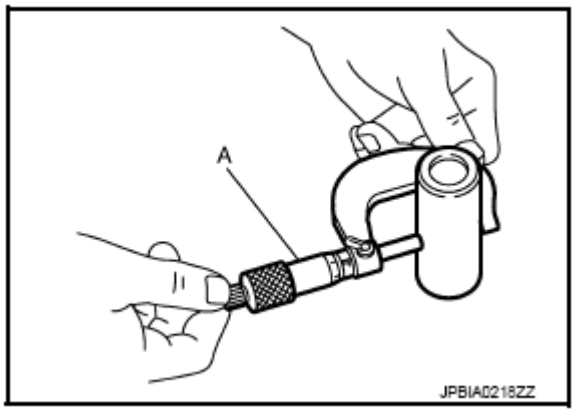


Fig. 254: Measuring Outer Diameter Of Piston Pin
Courtesy of NISSAN NORTH AMERICA, INC.

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).

A : OK
B : NG

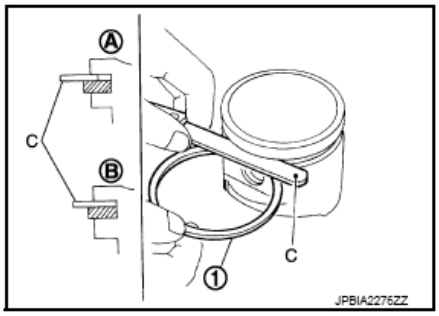


Fig. 255: Measuring Piston Ring Side Clearance
Courtesy of NISSAN NORTH AMERICA, INC.

Standard and limit: Refer to "CYLINDER BLOCK".

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

PISTON RING END GAP

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

A : Press-fit

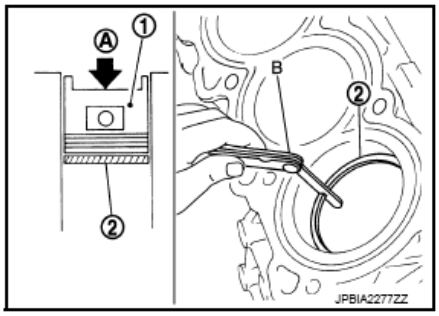


Fig. 256: Measuring Piston Ring End Gap
Courtesy of NISSAN NORTH AMERICA, INC.

Standard and limit: Refer to "CYLINDER BLOCK".

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

CONNECTING ROD BEND AND TORSION

- Check with a connecting rod aligner.

A : Bend
B : Torsion
C : Feeler gauge

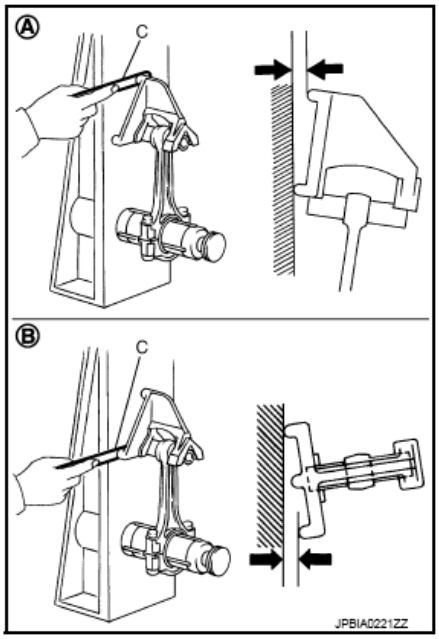


Fig. 257: Checking Connecting Rod
Courtesy of NISSAN NORTH AMERICA, INC.

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

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

CONNECTING ROD BIG END DIAMETER

- Install connecting rod bearing cap without installing connecting rod bearing, and tighten connecting rod bolts to the specified torque. Refer to "**DISASSEMBLY AND ASSEMBLY**" for the tightening procedure.

1 : Connecting rod

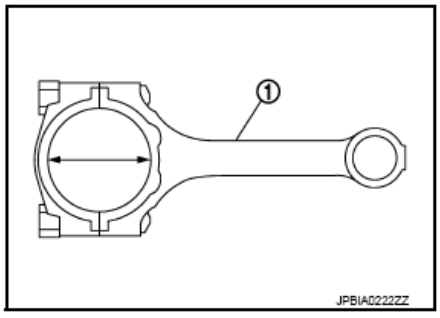


Fig. 258: Identifying Connecting Rod
Courtesy of NISSAN NORTH AMERICA, INC.

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

Standard: Refer to "CYLINDER BLOCK".

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

CONNECTING ROD BUSHING OIL CLEARANCE

Connecting Rod Bushing Inner Diameter

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

Standard: Refer to "CYLINDER BLOCK".

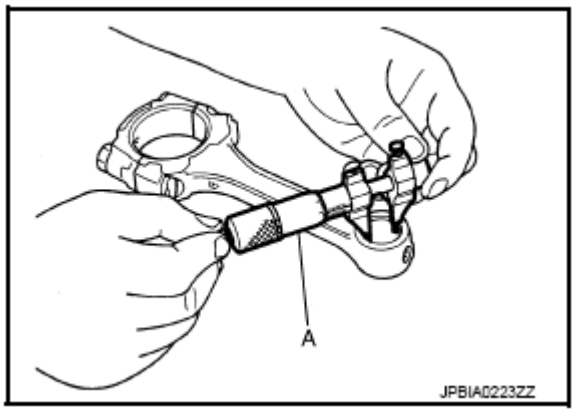


Fig. 259: Measuring Inner Diameter Of Connecting Rod Bushing
Courtesy of NISSAN NORTH AMERICA, INC.

Piston Pin Outer Diameter

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

Standard: Refer to "CYLINDER BLOCK".

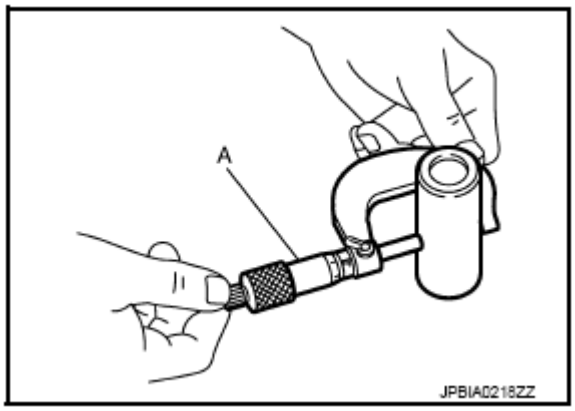


Fig. 260: Measuring Outer Diameter Of Piston Pin
Courtesy of NISSAN NORTH AMERICA, INC.

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".

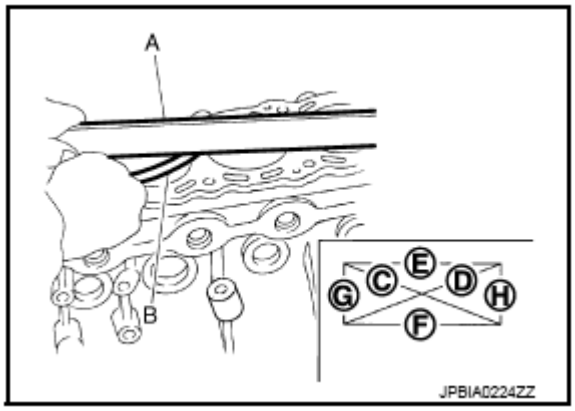


Fig. 261: Measuring Cylinder Block Upper Face Distortion
Courtesy of NISSAN NORTH AMERICA, INC.

- If it exceeds the limit, replace cylinder block.

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".

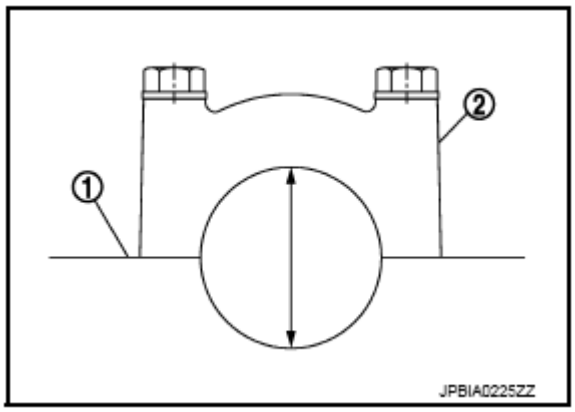


Fig. 262: Identifying Main Bearing Housing Inner Diameter
Courtesy of NISSAN NORTH AMERICA, INC.

- 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

- 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)

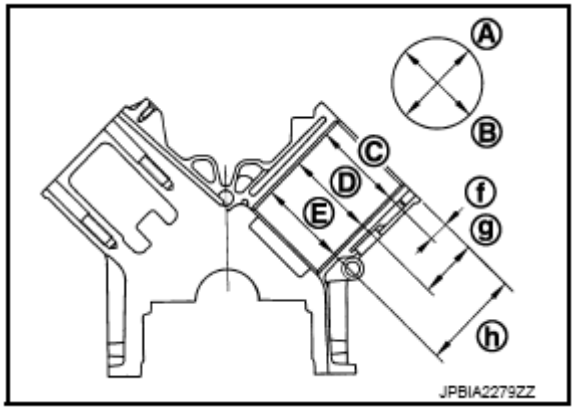


Fig. 263: Identifying Piston To Cylinder Bore Clearances
Courtesy of NISSAN NORTH AMERICA, INC.

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 rebore the inner wall.
- Oversize piston is provided. When using oversize piston, rebore cylinder so that the clearance of the piston-to-cylinder bore satisfies the standard.

CAUTION: When using oversize piston, use oversize pistons for all cylinders with oversize piston rings.

Oversize (O/S): 0.2 mm (0.008 in)

Piston Skirt Diameter

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

Measure point: Refer to "CYLINDER BLOCK".

Standard

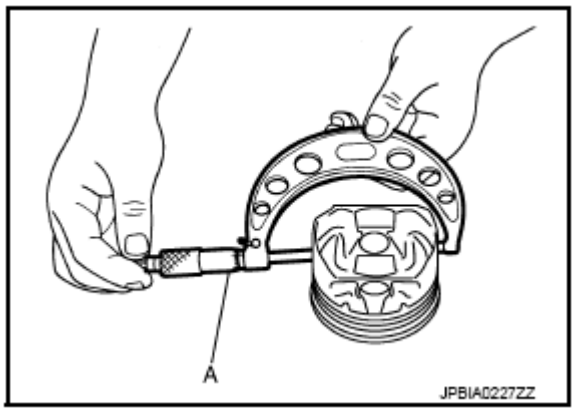


Fig. 264: Measuring Piston Skirt Outer Diameter
Courtesy of NISSAN NORTH AMERICA, INC.

Piston-to-Cylinder Bore Clearance

Calculate by piston skirt diameter and cylinder bore inner diameter [direction (B), position (D)].

A : 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)

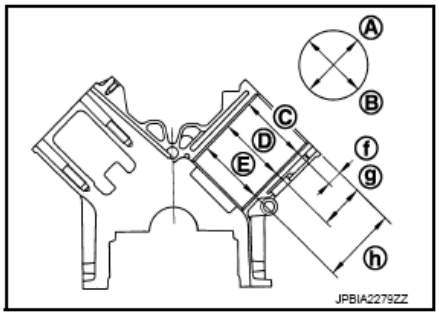


Fig. 265: Identifying Piston-To-Cylinder Bore Clearances
Courtesy of NISSAN NORTH AMERICA, INC.

(Clearance) = (Cylinder bore inner diameter) - (Piston skirt diameter).

Standard and limit: Refer to "CYLINDER BLOCK".

- If the calculated value exceeds the limit, replace piston and piston pin assembly. Refer to "**CYLINDER BLOCK**".

Re-boring Cylinder Bore

1. Cylinder bore size is determined by adding piston to cylinder bore clearance to piston skirt diameter.

   Rebored size calculation: D = A + B - C

   where,

   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".

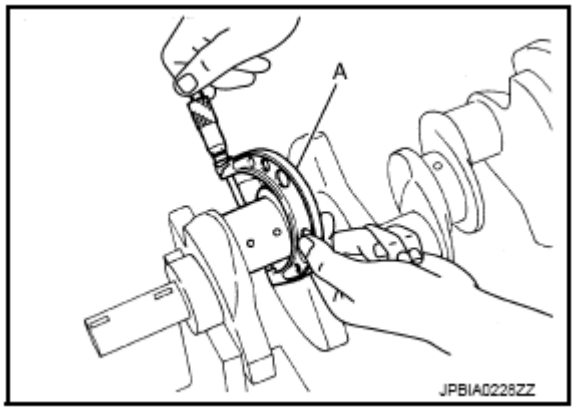


Fig. 266: Measuring Outer Diameter Of Crankshaft Pin Journal
Courtesy of NISSAN NORTH AMERICA, INC.

- If out of the standard, measure the connecting rod bearing oil clearance. Then use undersize bearing. Refer to "**CONNECTING ROD BEARING**".

CRANKSHAFT OUT-OF-ROUND AND TAPER

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

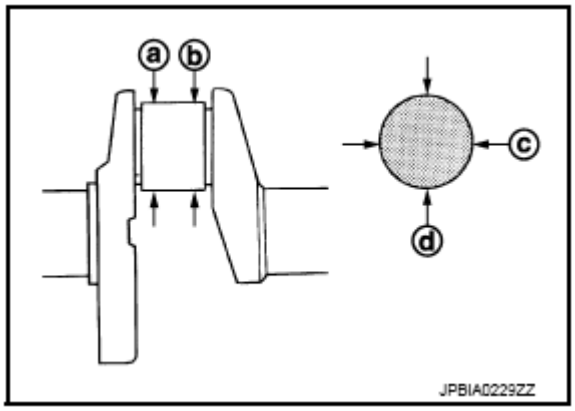


Fig. 267: Measuring Crankshaft Journal Out-Of-Round & Taper
Courtesy of NISSAN NORTH AMERICA, INC.

Out-of-round (Difference between "c" and "d")

: Refer to "CYLINDER BLOCK".

Taper (Difference between "a" and "b")

- If the measured value exceeds the limit, correct or replace crankshaft.
- If corrected, measure the bearing oil clearance of the corrected main journal and/or pin journal. Then select the main bearing and/or connecting rod bearing. Refer to "**MAIN BEARING**" and/or "**CONNECTING ROD BEARING**".

CRANKSHAFT RUNOUT

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

Standard and limit: Refer to "CYLINDER BLOCK".

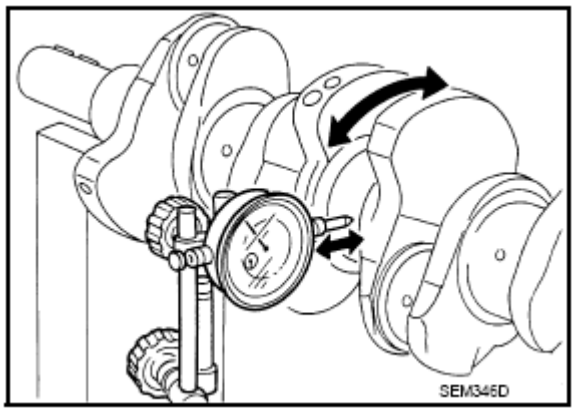


Fig. 268: Checking Crankshaft Runout
Courtesy of NISSAN NORTH AMERICA, INC.

- If it exceeds the limit, replace crankshaft.

CONNECTING ROD BEARING OIL CLEARANCE

Method by Calculation

- Install connecting rod bearings (1) to connecting rod (2) and connecting rod cap, and tighten connecting rod bolts to the specified torque. Refer to "**DISASSEMBLY AND ASSEMBLY**" for the tightening procedure.

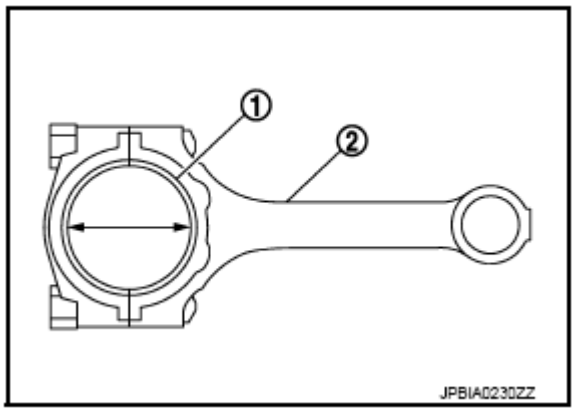


Fig. 269: Identifying Connecting Rod Bearings And Connecting Rod
Courtesy of NISSAN NORTH AMERICA, INC.

- 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 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".

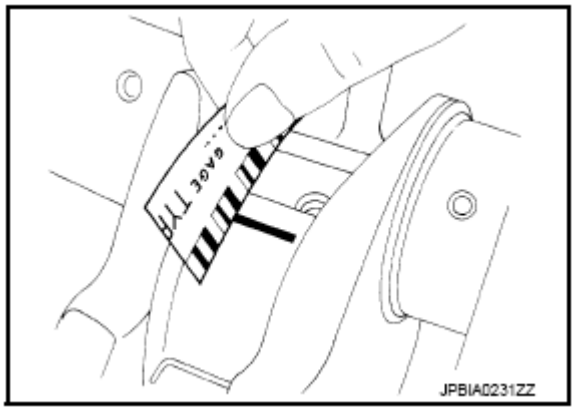


Fig. 270: Measuring Rod Bearing Clearance
Courtesy of NISSAN NORTH AMERICA, INC.

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".

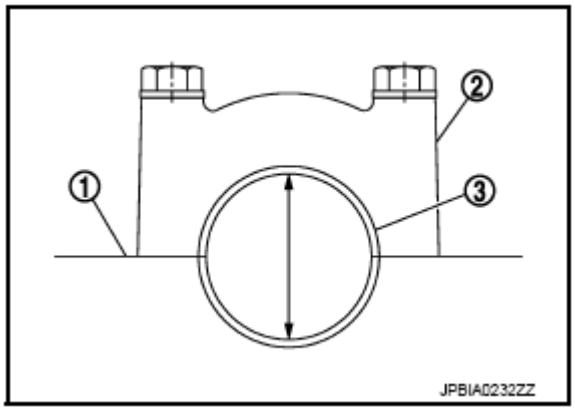


Fig. 271: Identifying Main Bearing Inner Diameter
Courtesy of NISSAN NORTH AMERICA, INC.

- If the calculated value exceeds the limit, select proper main bearing according to main bearing inner diameter and crankshaft main journal diameter to obtain the specified bearing oil clearance. Refer to "**DESCRIPTION**".

Method of Using Plastigage

- Remove engine oil and dust on crankshaft journal and the surfaces of each bearing completely.
- Cut a plastigage slightly shorter than the bearing width, and place it in crankshaft axial direction, avoiding oil holes.
- Install main bearing to cylinder block and 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".

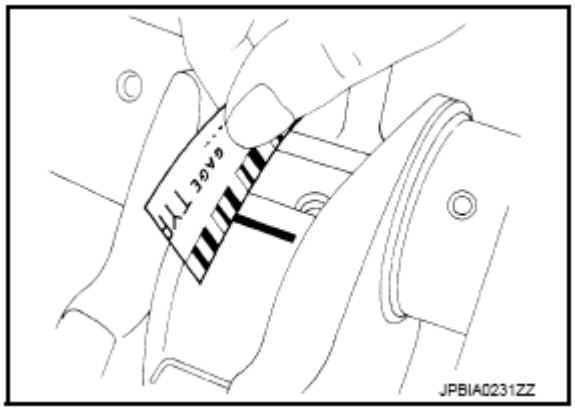


Fig. 272: Measuring Rod Bearing Clearance
Courtesy of NISSAN NORTH AMERICA, INC.

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.

A : Crush height

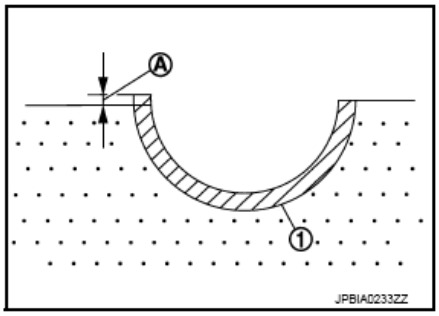


Fig. 273: Identifying Main Bearing Crush Height
Courtesy of NISSAN NORTH AMERICA, INC.

Standard: There must be crush height.

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

CONNECTING ROD BEARING CRUSH HEIGHT

- When connecting rod bearing cap is removed after being tightened to the specified torque with connecting rod bearings (1) installed, the tip end of bearing must protrude. Refer to "**DISASSEMBLY AND ASSEMBLY**" for the tightening procedure.

A : Crush height

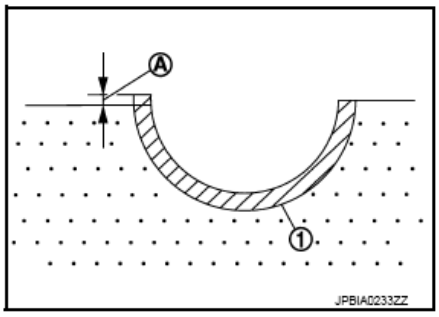


Fig. 274: Identifying Connecting Rod Bearing Crush Height
Courtesy of NISSAN NORTH AMERICA, INC.

Standard: There must be crush height.

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

MAIN BEARING CAP BOLT OUTER DIAMETER

- Measure the outer diameters (A), (B) at two positions as shown in the figure below.

c : 20 mm (0.79 in)
d : 50 mm (1.97 in)
e : 22 mm (0.87 in)

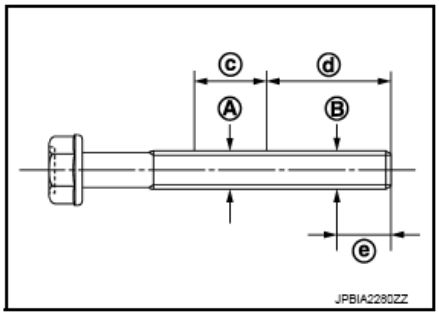


Fig. 275: Main Bearing Cap Bolt Dimensions
Courtesy of NISSAN NORTH AMERICA, INC.

- If reduction appears in (A) range, regard it (B).

Limit [(B) - (A)]: 0.2 mm (0.0078 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 below.

c : 20 mm (0.79 in)
d : 50 mm (1.97 in)
e : 9 mm (0.35 in)

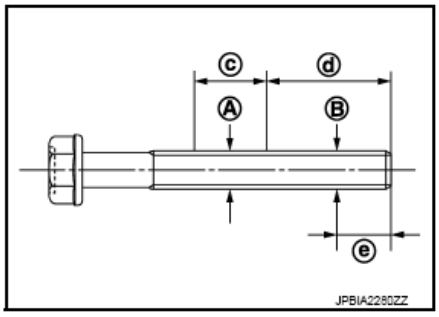


Fig. 276: Main Bearing Cap Bolt Dimensions
Courtesy of NISSAN NORTH AMERICA, INC.

- If reduction appears in (A) range, regard it (B).

  Limit [(d) - (c)]: 0.07 mm (0.0027 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 below.

a : Value at the end of the smaller diameter of the bolt
b : Value at the end of the smaller diameter of the bolt [opposite side of (a)]
c : Value of the smallest diameter of the smaller of the bolt

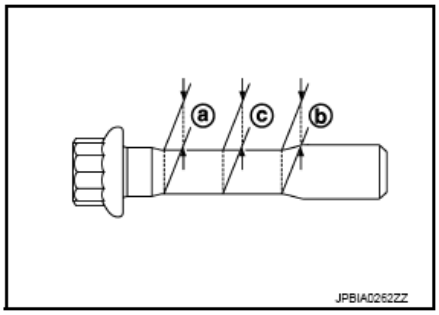


Fig. 277: Identifying Connecting Rod Bolt Dimensions
Courtesy of NISSAN NORTH AMERICA, INC.

2. Obtain a mean value (d) of (a) and (b).
3. Subtract (c) from (d).

   Limit [(B) - (A)]: 0.13 mm (0.0051 in)

4. If it exceeds the limit (large difference in dimensions), replace the bolt with new one.

DRIVE PLATE

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

B : Ring gear
⇦ : Engine front

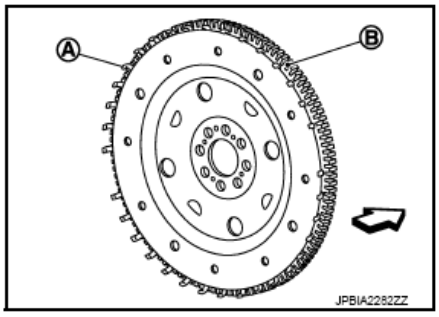


Fig. 278: Identifying Drive Plate, Signal Plate & Ring Gear
Courtesy of NISSAN NORTH AMERICA, INC.

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.

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	Piston and piston pin assembly (Piston is	Piston grade (piston skirt	Piston grade = cylinder bore grade

and piston	available together with piston pin as assembly.)	diameter)	(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 ("1", "2" or "3") on rear side of cylinder block, and select piston of the same grade.

A : Bearing housing grade No. 1
B : Bearing housing grade No. 2
C : Bearing housing grade No. 3
D : Bearing housing grade No. 4
E : Bearing housing grade No. 5
F : Cylinder bore grade No. 1
G : Cylinder bore grade No. 2
H : Cylinder bore grade No. 3
I : Cylinder bore grade No. 4
J : Cylinder bore grade No. 5
K : Cylinder bore grade No. 6
L : Cylinder bore grade No. 7
M : Cylinder bore grade No. 8
⇦ : Engine front

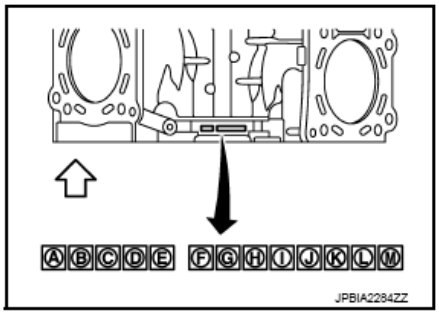


Fig. 279: Identifying Cylinder Bore Grades
Courtesy of NISSAN NORTH AMERICA, INC.

NOTE: Piston is available with piston pin as a set for the service part.

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

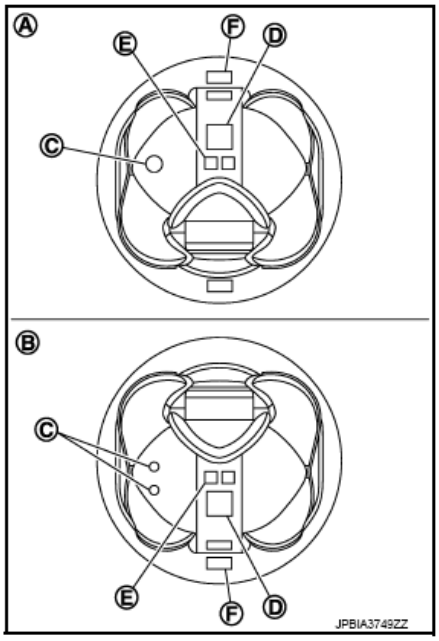


Fig. 280: Identifying Cylinder Bore Grade
Courtesy of NISSAN NORTH AMERICA, INC.

3. Select piston of the same grade.

PISTON SELECTION TABLE

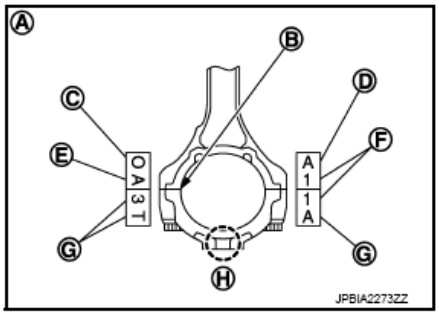
			Unit: mm (in)
Grade	**1**	**2**	**3**
Cylinder bore inner diameter	98.000 - 98.010 (3.8583 - 3.8587)	98.010 - 98.020 (3.8587 - 3.8590)	98.020 - 98.030 (3.8590 - 3.8594)
Piston skirt diameter	97.970 - 97.980 (3.8571 - 3.8575)	97.980 - 97.990 (3.8575 - 3.8579)	97.990 - 98.000 (3.8579 - 3.8583)

NOTE: Piston is available together with piston pin as assembly.

Connecting Rod Bearing

WHEN NEW CONNECTING ROD AND CRANKSHAFT ARE USED

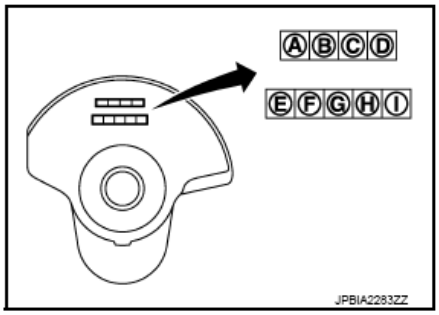
1. Apply connecting rod big end diameter grade stamped (D) on connecting rod side face to the row in the "CONNECTING ROD BEARING SELECTION TABLE".



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. 281: Identifying Connecting Rod Big End Diameter Grade
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. 282: Identifying Crankshaft Pin Journal Diameter Grade
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" below.
3. Correspond the measured dimension in crankshaft pin journal diameter column of "CONNECTING ROD BEARING SELECTION TABLE" below.
4. Follow from step 3 in "WHEN NEW CONNECTING ROD AND CRANKSHAFT ARE USED".

CONNECTING ROD BEARING SELECTION TABLE

Crankshaft pin journal diameter Unit: mm (in) / Connecting rod big end diameter Unit: mm (in)		Mark	A	B	C	D	E	F	G	H	J	K	L	M	N
Mark	Axle diameter	Hole diameter	57.000 - 57.001 (2.2441 - 2.2441)	57.001 - 57.002 (2.2441 - 2.2442)	57.002 - 57.003 (2.2442 - 2.2442)	57.003 - 57.004 (2.2442 - 2.2442)	57.004 - 57.005 (2.2442 - 2.2443)	57.005 - 57.006 (2.2443 - 2.2443)	57.006 - 57.007 (2.2443 - 2.2444)	57.007 - 57.008 (2.2444 - 2.2444)	57.008 - 57.009 (2.2444 - 2.2444)	57.009 - 57.010 (2.2444 - 2.2445)	57.010 - 57.011 (2.2445 - 2.2445)	57.011 - 57.012 (2.2445 - 2.2446)	57.012 - 57.013 (2.2446 - 2.2446)
A	53.974 - 53.973 (2.1250 - 2.1249)		0	0	0	0	0	0	1	1	1	1	1	1	2
B	53.973 - 53.972 (2.1249 - 2.1249)		0	0	0	0	0	1	1	1	1	1	1	2	2
C	53.972 - 53.971 (2.1249 - 2.1248)		0	0	0	0	1	1	1	1	1	1	2	2	2
D	53.971 - 53.970 (2.1248 - 2.1248)		0	0	0	1	1	1	1	1	1	2	2	2	2
E	53.970 - 53.969 (2.1248 - 2.1248)		0	0	1	1	1	1	1	1	2	2	2	2	2
F	53.969 - 53.968 (2.1248 - 2.1247)		0	1	1	1	1	1	1	2	2	2	2	2	2
G	53.968 - 53.967 (2.1247 - 2.1247)		1	1	1	1	1	1	2	2	2	2	2	2	3
H	53.967 - 53.966 (2.1247 - 2.1246)		1	1	1	1	1	2	2	2	2	2	2	3	3
J	53.966 - 53.965 (2.1246 - 2.1246)		1	1	1	1	2	2	2	2	2	2	3	3	3
K	53.965 - 53.964 (2.1246 - 2.1246)		1	1	1	2	2	2	2	2	2	3	3	3	3
L	53.964 - 53.963 (2.1246 - 2.1245)		1	1	2	2	2	2	2	2	3	3	3	3	3
M	53.963 - 53.962 (2.1245 - 2.1245)		1	2	2	2	2	2	2	3	3	3	3	3	3
N	53.962 - 53.961 (2.1245 - 2.1244)		2	2	2	2	2	2	3	3	3	3	3	3	4
P	53.961 - 53.960 (2.1244 - 2.1244)		2	2	2	2	2	3	3	3	3	3	3	4	4
R	53.960 - 53.959 (2.1244 - 2.1244)		2	2	2	2	3	3	3	3	3	3	4	4	4
S	53.959 - 53.958 (2.1244 - 2.1243)		2	2	2	3	3	3	3	3	3	4	4	4	4
T	53.958 - 53.957 (2.1243 - 2.1243)		2	2	3	3	3	3	3	3	4	4	4	4	4
U	53.957 - 53.956 (2.1243 - 2.1242)		2	3	3	3	3	3	3	4	4	4	4	4	4

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Fig. 283: 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)].

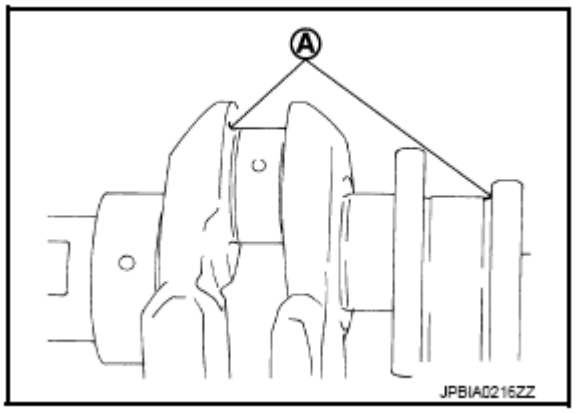


Fig. 284: Identifying Crankshaft Fillet Area
Courtesy of NISSAN NORTH AMERICA, INC.

Bearing undersize table: Refer to "CONNECTING ROD BEARING".

Main Bearing

WHEN NEW CYLINDER BLOCK AND CRANKSHAFT ARE USED

1. "MAIN BEARING SELECTION TABLE" rows correspond to bearing housing grade on rear side of cylinder block.

A : Bearing housing grade No. 1
B : Bearing housing grade No. 2
C : Bearing housing grade No. 3
D : Bearing housing grade No. 4
E : Bearing housing grade No. 5
F : Cylinder bore grade No. 1
G : Cylinder bore grade No. 2
H : Cylinder bore grade No. 3
I : Cylinder bore grade No. 4
J : Cylinder bore grade No. 5
K : Cylinder bore grade No. 6
L : Cylinder bore grade No. 7
M : Cylinder bore grade No. 8
⇦ : Engine front

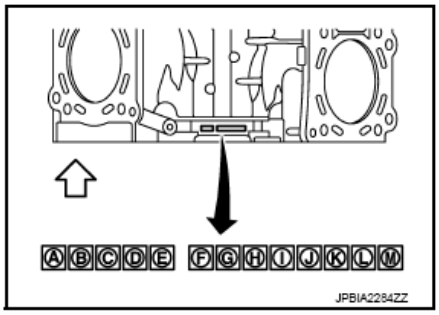
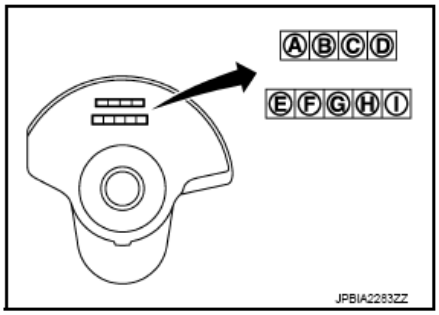


Fig. 285: Identifying Bearing Housing Grade
Courtesy of NISSAN NORTH AMERICA, INC.

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. 286: Identifying Journal Diameter Grade
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 / Crankshaft main journal diameter		I.D. mark	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V	W	X	Y	4	7
		Hole 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 - 2.7150)	68.962 - 68.963 (2.7150 - 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)
I.D. mark	Axle diameter Unit: mm (in)																									
G	63.964 - 63.963 (2.5183 - 2.5182)		1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5
H	63.963 - 63.962 (2.5182 - 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
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

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Fig. 287: 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)

Cylinder block main bearing housing inner diameter / Crankshaft main journal diameter		I.D. mark	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V	W	X	Y	4	7
		Hole 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 - 2.7150)	68.962 - 68.963 (2.7150 - 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)
I.D. mark	Axle diameter Unit: mm (in)																									
A	63.964 - 63.963 (2.5183 - 2.5182)		0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4
B	63.963 - 63.962 (2.5182 - 2.5182)		0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4
C	63.962 - 63.961 (2.5182 - 2.5181)		01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4
D	63.961 - 63.960 (2.5181 - 2.5181)		01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45
E	63.960 - 63.959 (2.5181 - 2.5181)		01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45
F	63.959 - 63.958 (2.5181 - 2.5180)		1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45
G	63.958 - 63.957 (2.5180 - 2.5180)		1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5
H	63.957 - 63.956 (2.5180 - 2.5179)		1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5
J	63.956 - 63.955 (2.5179 - 2.5179)		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	63.955 - 63.954 (2.5179 - 2.5179)		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	63.954 - 63.953 (2.5179 - 2.5178)		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	63.953 - 63.952 (2.5178 - 2.5178)		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	63.952 - 63.951 (2.5178 - 2.5178)		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	63.951 - 63.950 (2.5178 - 2.5177)		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	63.950 - 63.949 (2.5177 - 2.5177)		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	63.949 - 63.948 (2.5177 - 2.5176)		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	63.948 - 63.947 (2.5176 - 2.5176)		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	63.947 - 63.946 (2.5176 - 2.5176)		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	63.946 - 63.945 (2.5176 - 2.5175)		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	63.945 - 63.944 (2.5175 - 2.5175)		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	63.944 - 63.943 (2.5175 - 2.5174)		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	63.943 - 63.942 (2.5174 - 2.5174)		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	63.942 - 63.941 (2.5174 - 2.5174)		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	63.941 - 63.940 (2.5174 - 2.5173)		4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	78	78	78

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Fig. 288: Main Bearing Selection Chart (No. 2, 3 And 4 Journal)
Courtesy of NISSAN NORTH AMERICA, INC.

MAIN BEARING GRADE TABLE (ALL JOURNALS)

Main bearing grade table (All journals): Refer to "MAIN BEARING".

UNDERSIZE BEARING USAGE GUIDE

- When the specified main bearing oil clearance is not obtained with standard size main bearings, use underside (US) bearing.
- When using undersize (US) bearing, measure the main bearing inner diameter with bearing installed, and grind main journal so that the main bearing oil clearance satisfies the standard.

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

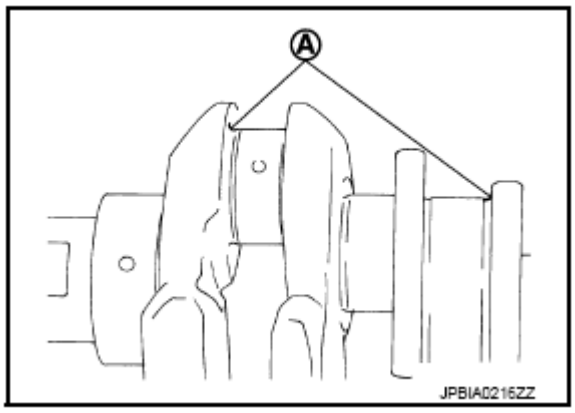


Fig. 289: Identifying Crankshaft Fillet Area
Courtesy of NISSAN NORTH AMERICA, INC.

Bearing undersize table: Refer to "MAIN BEARING".

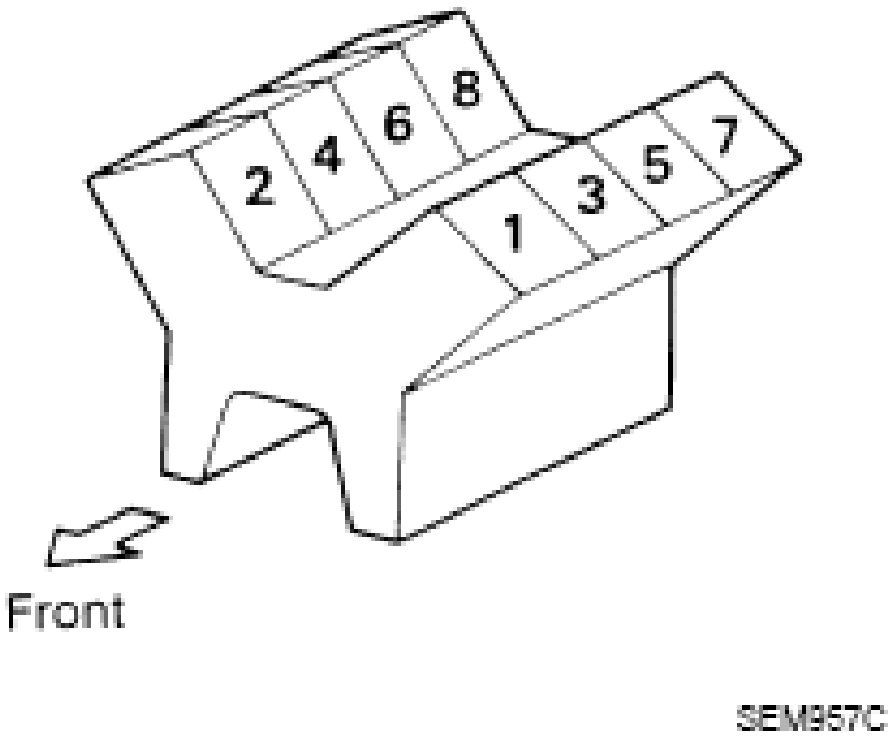
SERVICE DATA AND SPECIFICATIONS (SDS)

SERVICE DATA AND SPECIFICATIONS (SDS)

General Specification

GENERAL SPECIFICATIONS

Cylinder arrangement		V-8
Displacement cm^3 (cu in)		5, 552 (338.8)
Bore and stroke mm (in)		98 x 92 (3.858 x 3.622)
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		11.5
Compression pressure kPa (kg/cm^2 , psi)/200 rpm	Standard	1, 667 (17, 242)
	Minimum	1, 422 (14.5, 206)
	Differential limit between cylinders	98 (1.0, 14)

Cylinder number	

		Unit: degree
Valve timing	Intake valve open (BTDC)	(-63) - (+ 33)
	Intake valve close (ABDC)	(-55) - (+ 74)
	Exhaust valve open (BBDC)	32 - 62
	Exhaust valve close (ATDC)	2 - 32

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

EXHAUST MANIFOLD

Unit: mm (in)

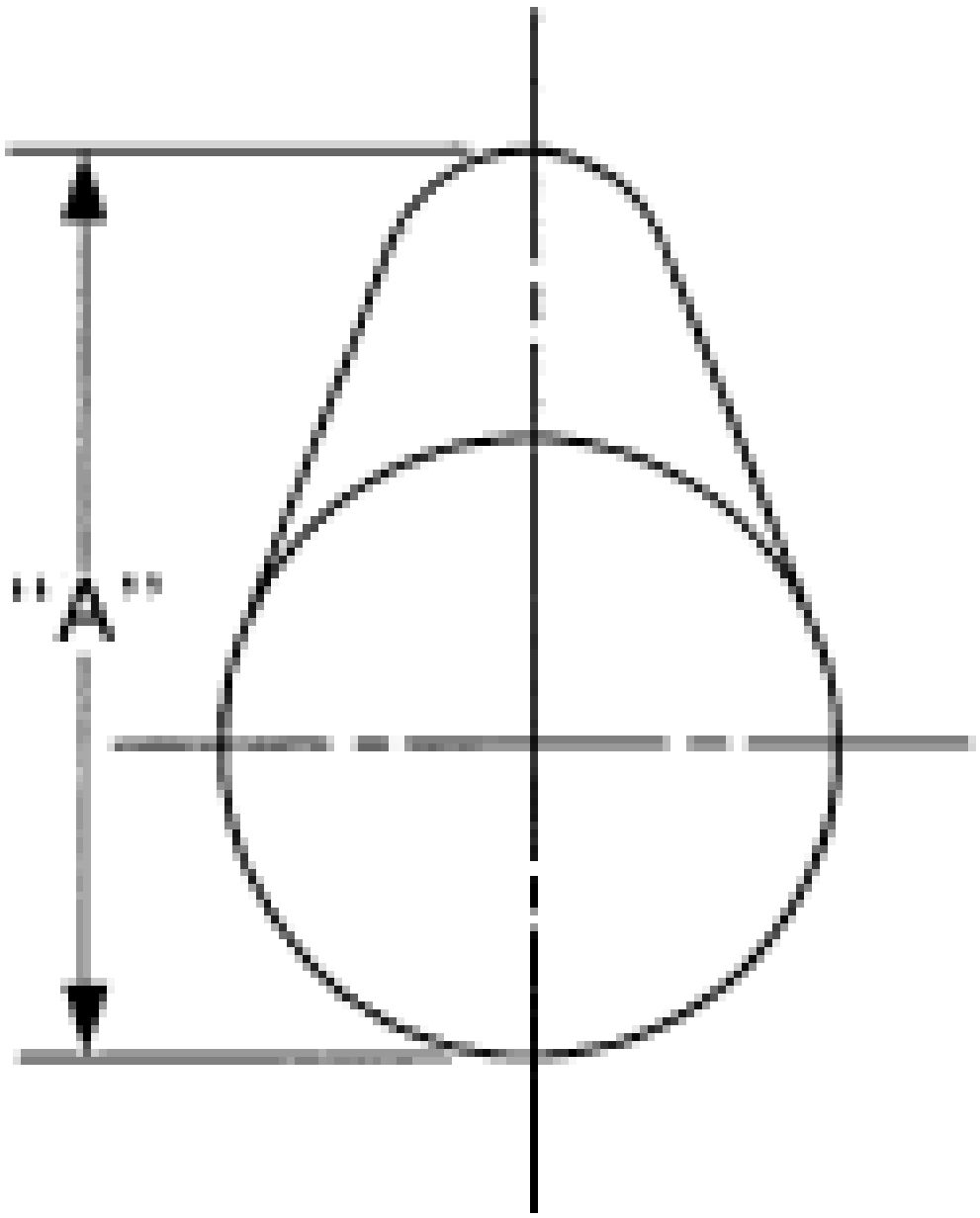
Items		Limit
Surface distortion	Exhaust manifold	0.7 (0.028)

Camshaft

CAMSHAFT (EXH)

Unit: mm (in)

Items		Standard	Limit
Camshaft (EXH) journal oil clearance	No. 1	0.045 - 0.086 (0.0018 - 0.0034)	0.150 (0.0059)
	No. 2, 3, 4, 5	0.030 - 0.071 (0.0012 - 0.0028)	
VVEL ladder assembly bracket inner diameter (EXH side)		26.000 - 26.021 (1.0236 - 1.0244)	-
Camshaft (EXH) journal diameter	No. 1	25.935 - 25.955 (1.0211 - 1.0218)	-
	No. 2, 3, 4, 5	25.950 - 25.970 (1.0217 - 1.0224)	-
Camshaft (EXH) end play		0.115 - 0.188 (0.0045 - 0.0074)	0.24 (0.0094)
Camshaft (EXH) cam height "A"		45.475 - 45.665 (1.7904 - 1.7978)	44.275 (1.7431)
Camshaft (EXH) runout [TIR(1)]		Less than 0.02 mm (0.0008)	0.05 (0.002)
Camshaft sprocket (EXH) runout [TIR(1)]		-	0.2 (0.0079)



(1) Total indicator reading

CAMSHAFT (INT)

			Unit: mm (in)

Items	Standard	Limit
Drive shaft end play	0.115 - 0.188 (0.0045 - 0.0074)	0.24 (0.0094)
Camshaft sprocket (INT) runout [TIR(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)

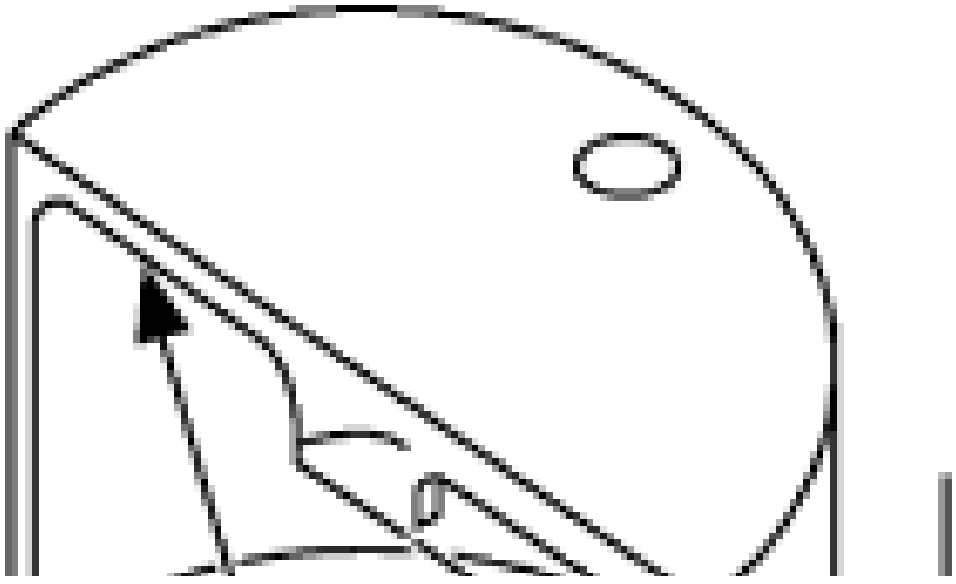
VALVE CLEARANCE

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)

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)

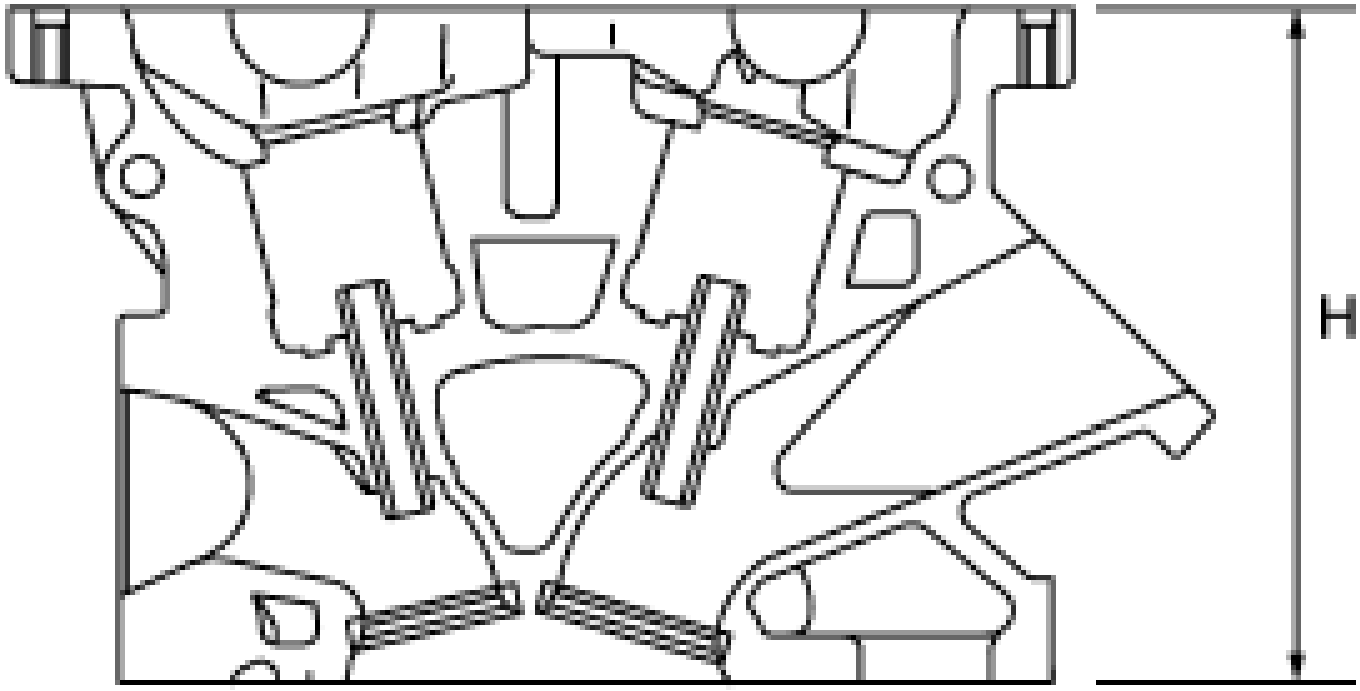


Cylinder Head

CYLINDER HEAD

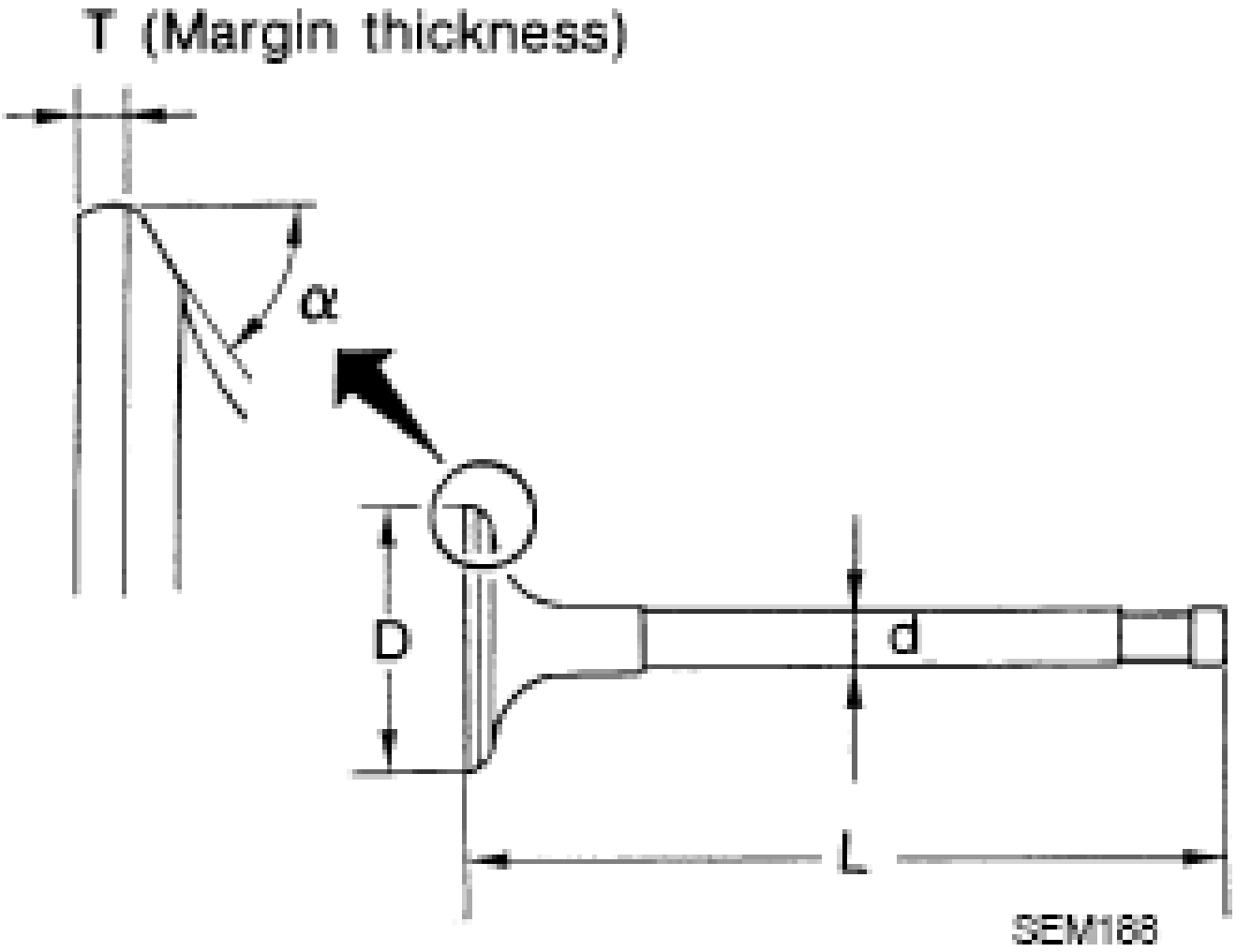
Unit: mm (in)

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)	-



VALVE DIMENSIONS

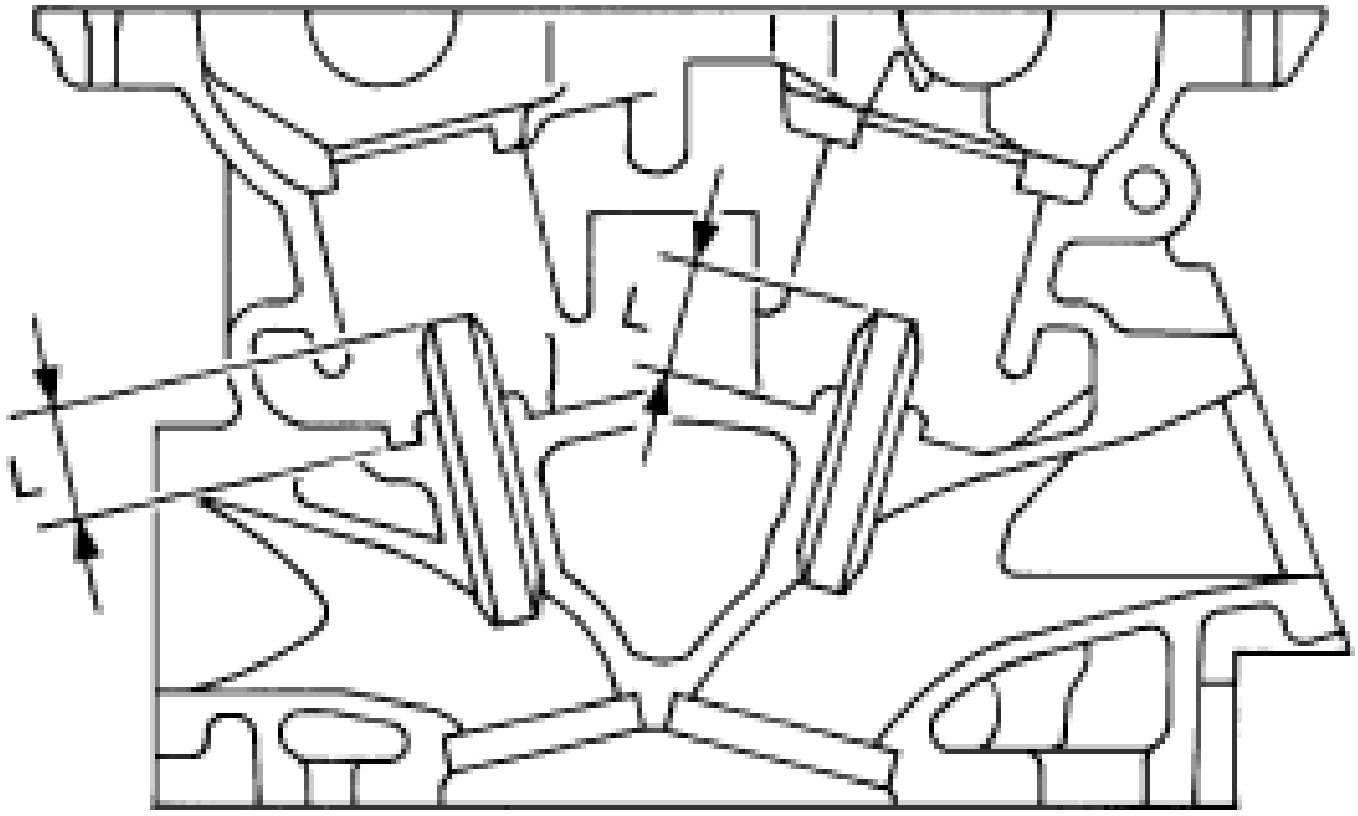
Unit: mm (in)



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	99.44 (3.9150)
	Exhaust	93.99 (3.7004)
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)



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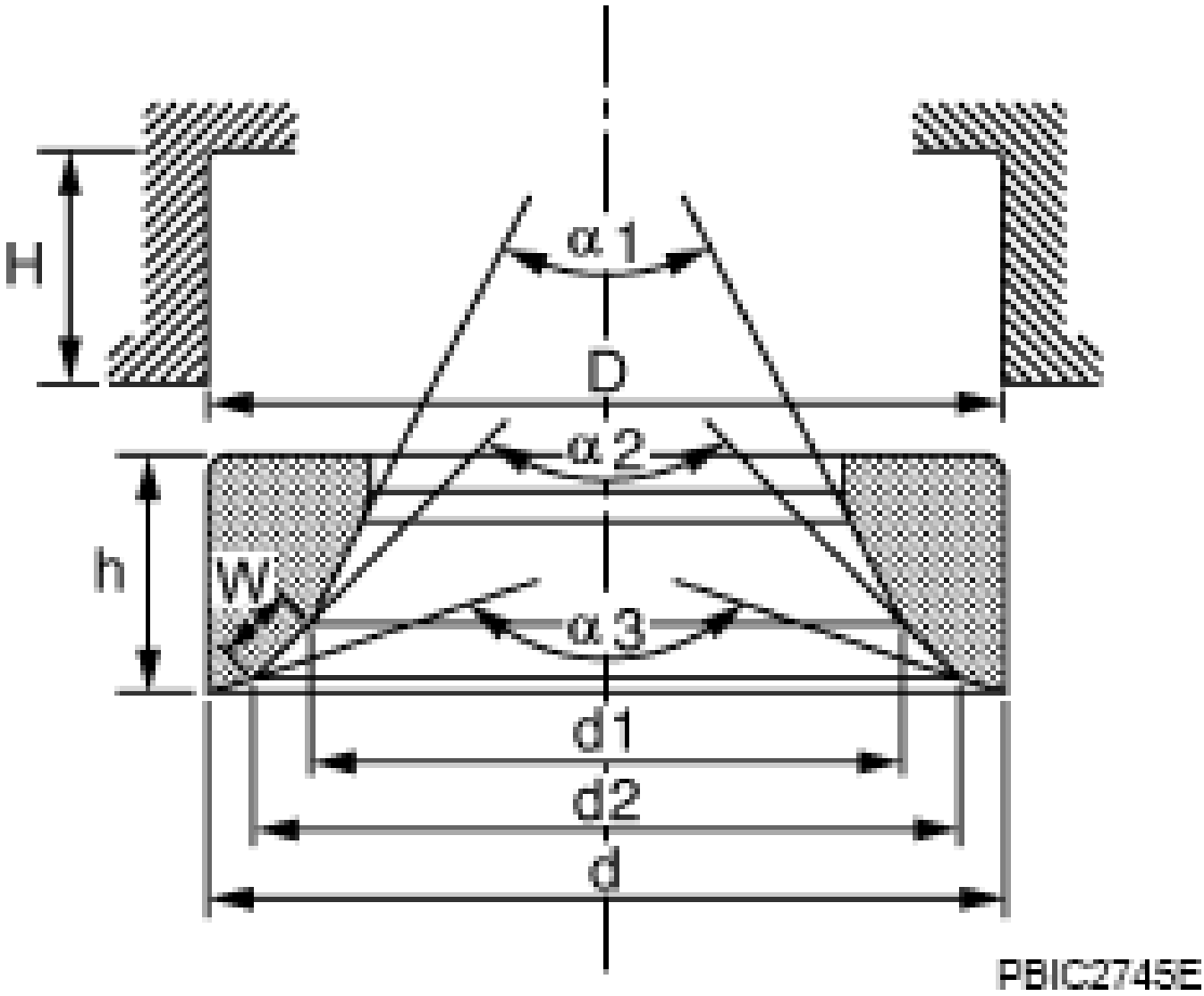
Items		Standard	Oversize (Service) [0.2 (0.008)] (1)
Valve guide	Outer diameter	10.023 - 10.034 (0.3946 - 0.3950)	10.223 - 10.234 (0.4025 - 0.4029)(1)
	Inner diameter (Finished size)	6.000 - 6.018 (0.2362 - 0.2369)	
Cylinder head valve guide hole diameter		9.975 - 9.996 (0.3927 - 0.3935)	10.175 - 10.196 (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	11.9 - 12.1 (0.469 - 0.476)	

(1) Parts settings are for exhaust side only

VALVE SEAT

Unit: mm (in)



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)
	Intake	38.097 - 38.113 (1.4999 - 1.5005)	-

Valve seat outer diameter "d"	Exhaust	32.280 - 32.296 (1.2709 - 1.2715)	32.780 - 32.796 (1.2905 - 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 - 121°	
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		48.69 mm (1.9169 in)	47.35 mm (1.8642 in)
Pressure	Installation	162 - 192 N (16.5 - 19.6 kg, 36 - 43 lb) at 42.40 mm (1.6693 in)	163 - 191 N (16.6 - 19.5 kg, 37 - 43 lb) at 35.45 mm (1.3957 in)
	Valve open	609 - 695 N (62.1 - 70.9 kg, 137 - 156 lb) at 28.83 mm (1.1350 in)	370 - 426 N (37.7 - 43.5 kg, 83 - 96 lb) at 25.65 mm (1.0098 in)
Identification color		Yellow	Pink

Item	Limit	
	Intake	Exhaust
Out-of-square	2.1 mm (0.083 in)	2.0 mm (0.079 in)

Cylinder Block

CYLINDER BLOCK

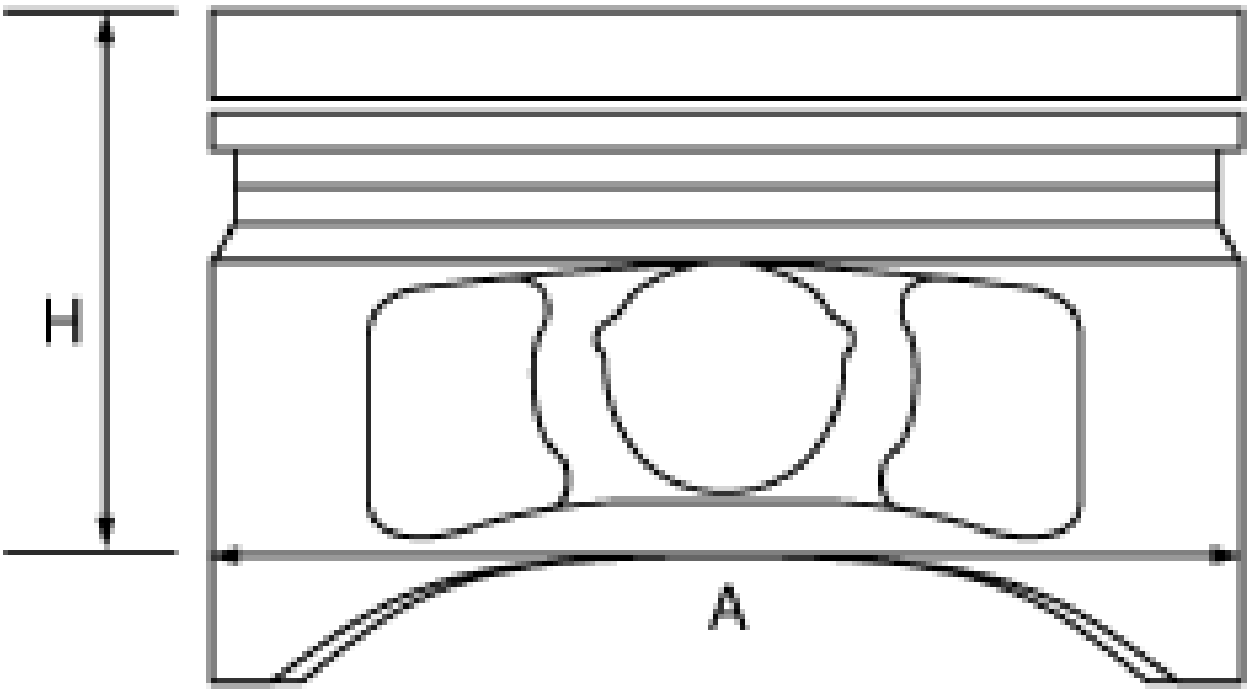
Unit: mm (in)

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	68.954 - 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 -

		Grade No. T	2.7150)
		Grade No. U	68.961 - 68.962 (2.7150 - 2.7150)
		Grade No. V	68.962 - 68.963 (2.7150 - 2.7151)
		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)



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Items		Standard	Oversize (Service) [0.2 (0.008)]
Piston skirt diameter "A"	Grade No. 1	97.970 - 97.980 (3.8571 - 3.8575)	-
	Grade No. 2	97.980 - 97.990 (3.8575 - 3.8579)	-
	Grade No. 3	97.990 - 98.000 (3.8579 - 3.8583)	-
	Service	-	98.170 - 98.200 (3.8650 - 3.8661)
Items		Standard	Limit
"a" dimension		41.5 (1.6339)	-
Piston pin hole diameter		21.993 - 21.999 (0.8659 - 0.8661)	-
Piston to cylinder bore clearance		0.020 - 0.040 (0.0007 - 0.0016)	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 - 0.050 (0.0006 - 0.002)	0.095 (0.0037)
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 - 22.001 (0.8657 - 0.8662)	-
Piston to piston pin oil clearance	0.002 - 0.006 (0.0001 - 0.0002)	-
Connecting rod bushing oil clearance	0.005 - 0.017 (0.0002 - 0.0007)	0.030 (0.0012)

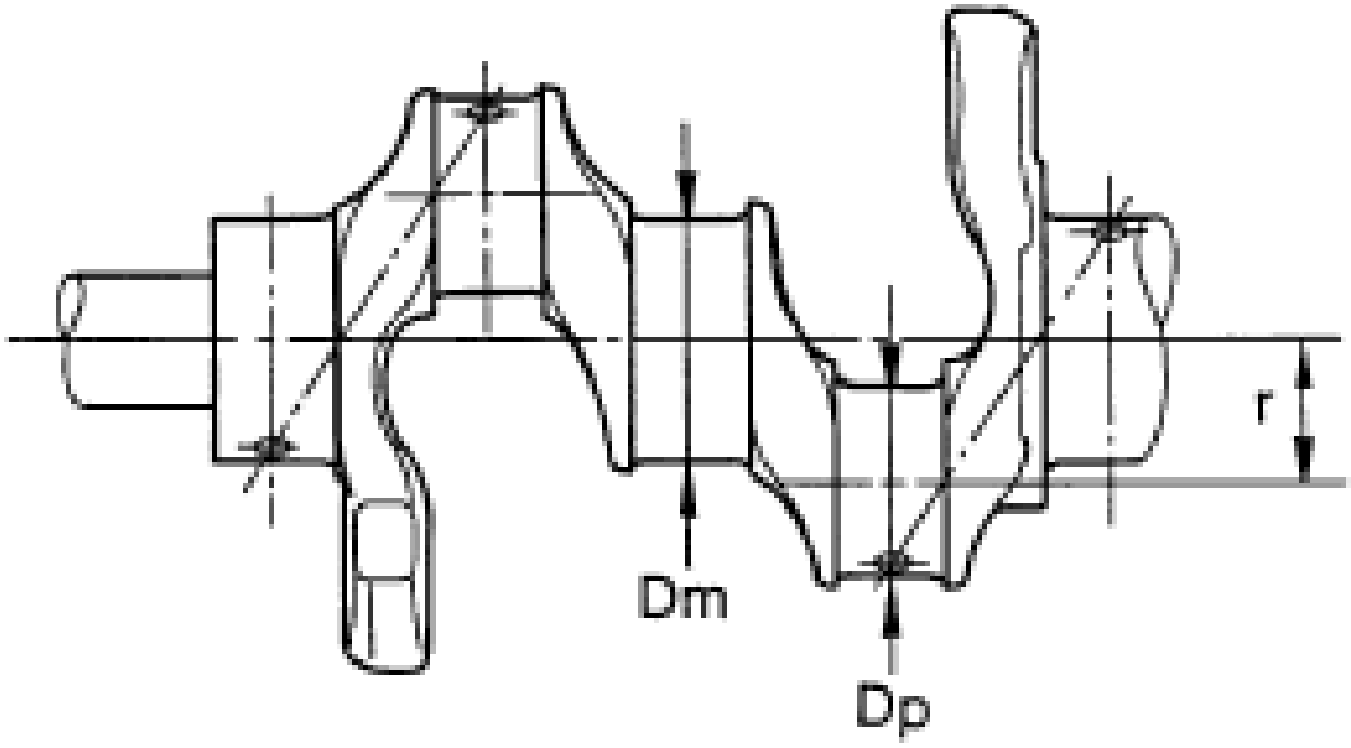
CONNECTING ROD

		Unit: mm (in)
Items	**Standard**	**Limit**
Center distance	153.95 - 154.05 (6.06 - 6.06)	-
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)	-

Connecting rod big end diameter (Without bearing)	Grade No. A	57.000 - 57.001 (2.2441 - 2.2441)
	Grade No. B	57.001 - 57.002 (2.2441 - 2.2442)
	Grade No. C	57.002 - 57.003 (2.2442 - 2.2442)
	Grade No. D	57.003 - 57.004 (2.2442 - 2.2442)
	Grade No. E	57.004 - 57.005 (2.2442 - 2.2443)
	Grade No. F	57.005 - 57.006 (2.2443 - 2.2443)
	Grade No. G	57.006 - 57.007 (2.2443 - 2.2444)
	Grade No. H	57.007 - 57.008 (2.2444 - 2.2444)
	Grade No. J	57.008 - 57.009 (2.2444 - 2.2444)
	Grade No. K	57.009 - 57.010 (2.2444 - 2.2445)
	Grade No. L	57.010 - 57.011 (2.2445 - 2.2445)
	Grade No. M	57.011 - 57.012 (2.2445 - 2.2446)
	Grade No. N	57.012 - 57.013 (2.2446 - 2.2446)
Side clearance	0.20 - 0.40 (0.0079 - 0.0157)	0.40 (0.0157)
(1) After installing in connecting rod		

CRANKSHAFT

Unit: mm (in)



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		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 -

Main journal diameter. "Dm" grade (No. 1 and 5 journal)	Standard		2.5179)
		Grade No. T	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)

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)
		Grade No. A	53.974 - 53.973 (2.1250 - 2.1249)
		Grade No. B	53.973 - 53.972 (2.1249 - 2.1249)
		Grade No. C	53.972 - 53.971 (2.1249 - 2.1248)
		Grade No. D	53.971 - 53.970 (2.1248 - 2.1248)
		Grade No. E	53.970 - 53.969 (2.1248 - 2.1248)
		Grade No. F	53.969 - 53.968 (2.1248 - 2.1247)
		Grade No. G	53.968 - 53.967 (2.1247 - 2.1247)

Pin journal diameter. "Dp" grade	Standard	Grade No. H	53.967 - 53.966 (2.1247 - 2.1246)
		Grade No. J	53.966 - 53.965 (2.1246 - 2.1246)
		Grade No. K	53.965 - 53.964 (2.1246 - 2.1246)
		Grade No. L	53.964 - 53.963 (2.1246 - 2.1245)
		Grade No. M	53.963 - 53.962 (2.1245 - 2.1245)
		Grade No. N	53.962 - 53.961 (2.1245 - 2.1244)
		Grade No. P	53.961 - 53.960 (2.1244 - 2.1244)
		Grade No. R	53.960 - 53.959 (2.1244 - 2.1244)
		Grade No. S	53.959 - 53.958 (2.1244 - 2.1243)
		Grade No. T	53.958 - 53.957 (2.1243 - 2.1243)
		Grade No. U	53.957 - 53.956 (2.1243 - 2.1242)
Center distance "r"			45.96 - 46.04 (1.8094 - 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)		Black	
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		Yellow	

		(0.0981 - 0.0982)	19.9 - 20.1 (0.783 - 0.791)		Grade is the same for upper and lower bearings.
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	
	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 - 0.0004)	0.021 (0.0008)
	No. 2, 3 and 4	0.007 - 0.017 (0.0003 - 0.0007)	0.027 (0.0011)

Connecting Rod Bearing

CONNECTING ROD BEARING

Grade number	Thickness mm (in)	Width mm (in)	Identification color (mark)
0	1.497 - 1.500 (0.0589 - 0.0591)	18.1 - 18.3 (0.713 - 0.720)	Purple
1	1.500 - 1.503 (0.0591 - 0.0592)		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**
0.25 (0.0098)	1.627 - 1.635 (0.0641 - 0.0644)	Grind so that bearing clearance is the specified value.

CONNECTING ROD BEARING OIL CLEARANCE

		Unit: mm (in)
Items	**Standard**	**Limit**
Connecting rod bearing oil clearance	0.026 - 0.039 (0.0010 - 0.0015)	0.070 (0.0028)

