

2004 ENGINES**Engine Mechanical - 4.5L V8****ENGINE IDENTIFICATION**

Engine is identified by fourth character of Vehicle Identification Number (VIN), located on top of dash panel, at lower left corner of windshield. Engine serial number is stamped on right rear (passenger's side) of cylinder block, above flywheel.

ENGINE IDENTIFICATION CODE

Engine	Code
4.5L V8 (VK45DE)	B

PRECAUTIONS**PRECAUTIONS FOR DRAINING ENGINE COOLANT**

Drain engine coolant when engine is cooled.

PRECAUTIONS FOR DISCONNECTING FUEL PIPING

- Before starting work, make sure 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.

PRECAUTIONS FOR REMOVAL AND DISASSEMBLY

- When instructed to use special service tools, use the specified tools. Always be careful to work safely, avoid forceful or uninstructed operations.
- Exercise maximum care to avoid damage to mating or sliding surfaces.
- Cover openings of engine system with tape or the equivalent, if necessary, to seal out foreign materials.
- Mark and arrange disassembly parts in an organized way for easy troubleshooting and re-assembly.
- When loosening nuts and bolts, as a basic rule, start with the one furthest outside, then the one diagonally F opposite, and so on. If the order of loosening is specified, do exactly as specified. Power tools may be used where noted in the step.

PRECAUTIONS FOR INSPECTION, REPAIR AND REPLACEMENT

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

PRECAUTIONS FOR 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 liquid 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, engine oil sliding surfaces well.
- Release air within route when refilling after draining engine coolant.
- After repairing, start engine and increase engine speed to check engine coolant, fuel, engine oil, and exhaust systems for leakage.

PARTS REQUIRING ANGLE TIGHTENING

- Use an angle wrench [SST: KV10112100 (BT8653-A)] for the final tightening of the following engine parts:
 - Cylinder head bolts
 - Main bearing cap bolts
 - Connecting rod cap nuts
 - Crankshaft pulley bolt (No angle wrench is required as the bolt flange is provided with notches for angle tightening)
- Do not use a torque value for final tightening.
- The torque value for these parts are for a preliminary step.
- Ensure thread and seat surfaces are clean and coated with engine oil.

PRECAUTIONS FOR LIQUID GASKET

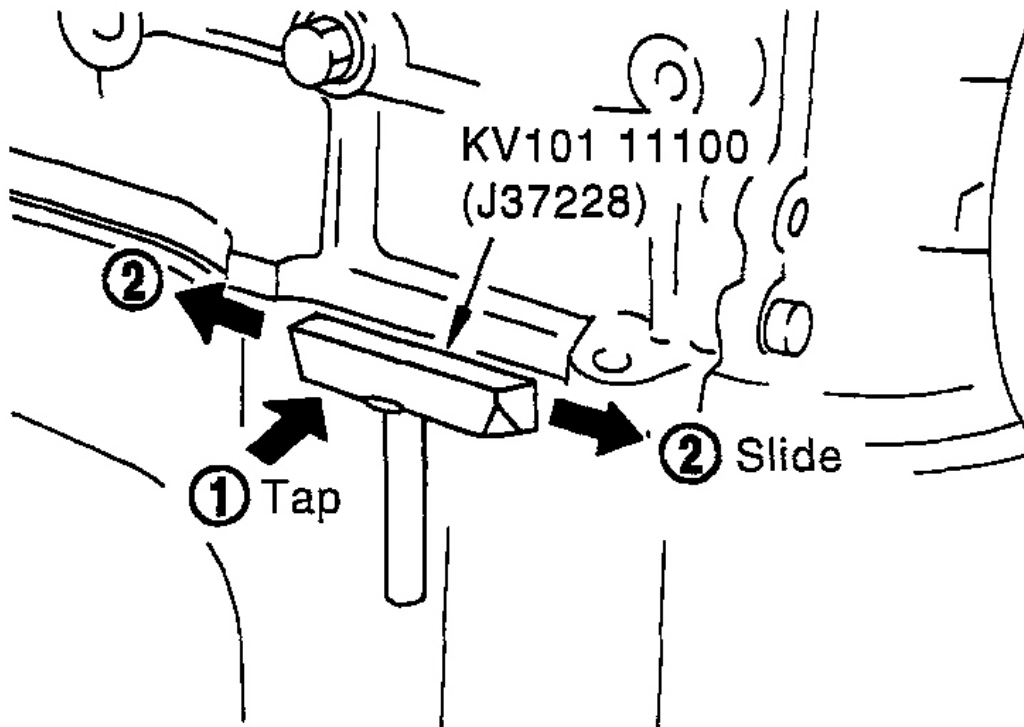
REMOVAL OF LIQUID GASKET SEALING

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

CAUTION: Be careful not to damage the mating surfaces.

- In areas where the seal cutter (SST) is difficult to use, use a plastic hammer to lightly tap (1) the seal cutter where the liquid gasket is applied. Use a plastic hammer to slide the seal cutter (2) by tapping on the side.

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



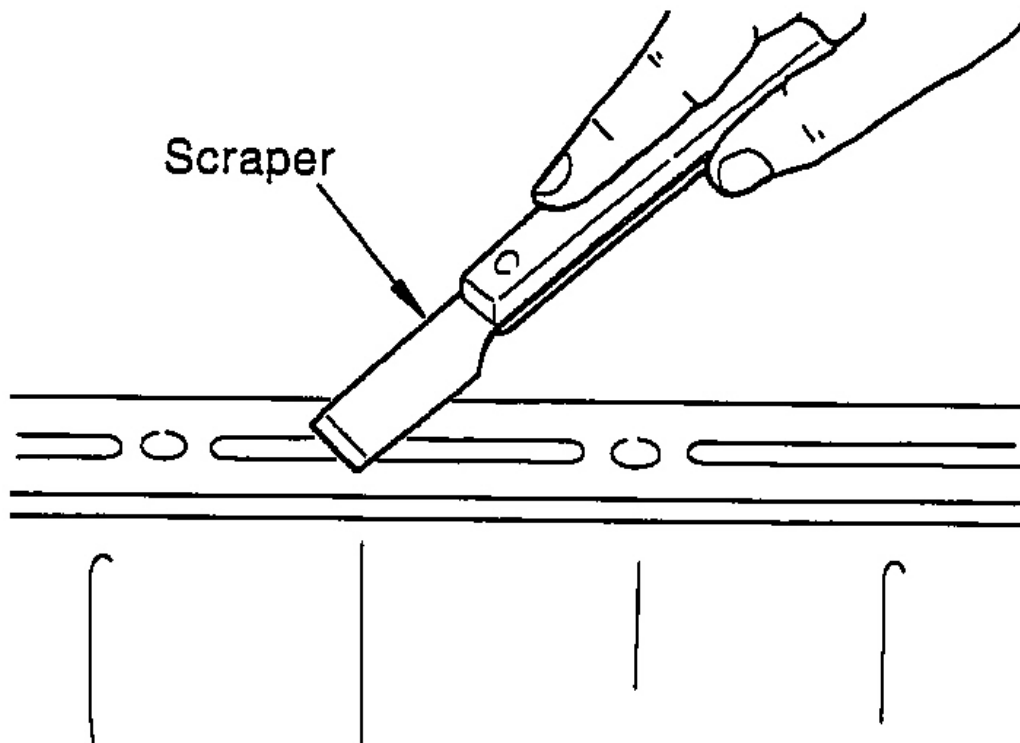
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Fig. 1: View Of Seal Cutter

Courtesy of NISSAN MOTOR CO., U.S.A.

LIQUID GASKET APPLICATION PROCEDURE

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



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Fig. 2: Scraping Old Sealant

Courtesy of NISSAN MOTOR CO., U.S.A.

3. Attach the liquid gasket tube to the tube presser (SST).

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

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

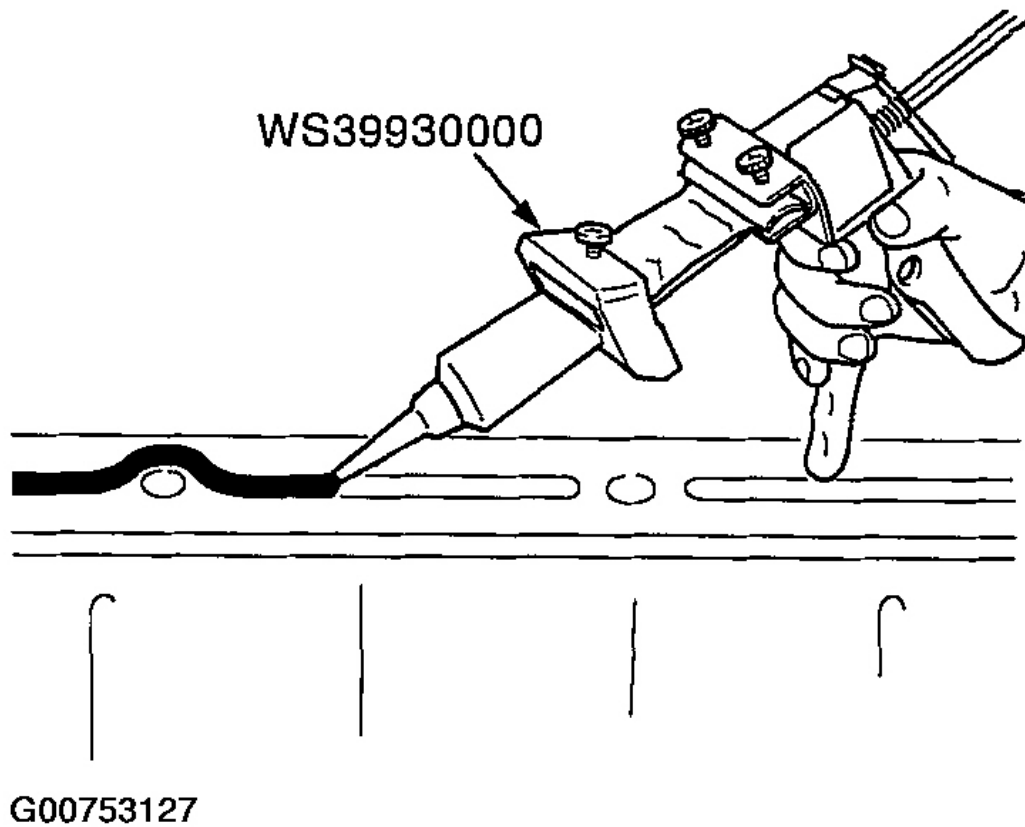
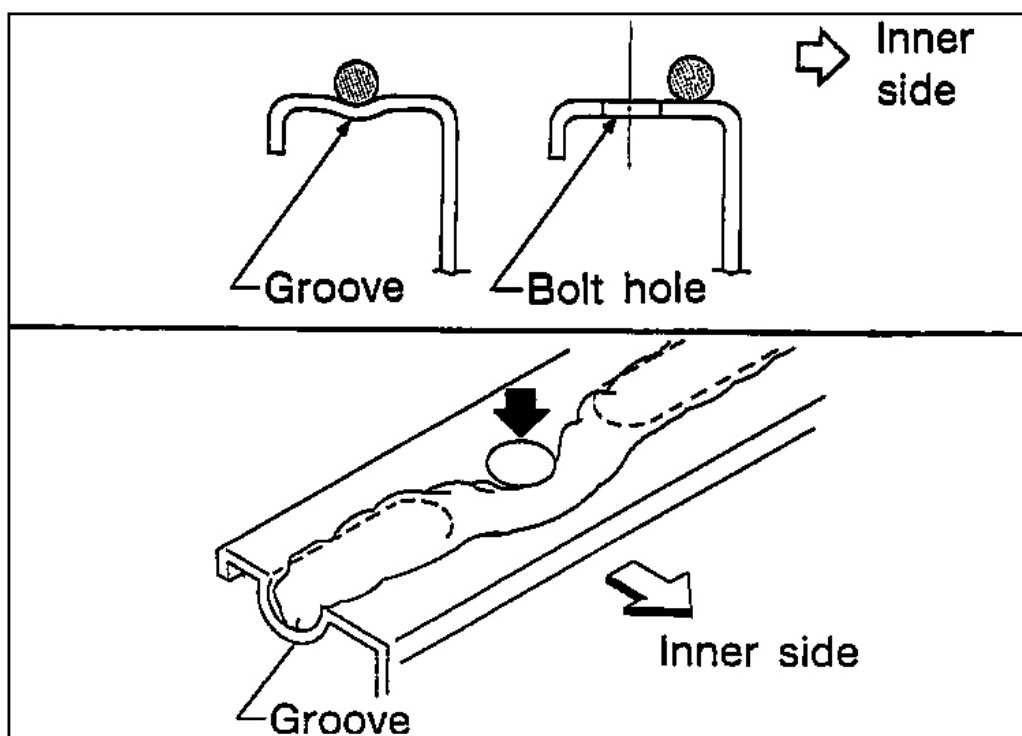


Fig. 3: Applying Sealant
Courtesy of NISSAN MOTOR CO., U.S.A.

- As for the bolt holes, normally apply the liquid gasket inside the holes. Occasionally, it should be applied outside the holes. Make sure to read the text of this manual.
- Within five minutes of liquid gasket application, install the mating component.
- If the liquid gasket protrudes, wipe it off immediately.
- Do not retighten after the installation.
- After 30 minutes or more have passed from the installation, fill the engine oil and engine coolant.

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



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Fig. 4: Sealant Placement

Courtesy of NISSAN MOTOR CO., U.S.A.

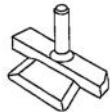
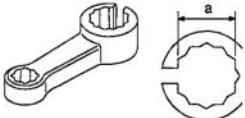
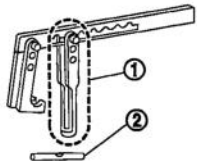
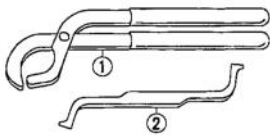
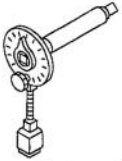
PREPARATION

SPECIAL SERVICE TOOLS

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

2004 Infiniti Q45

2004 ENGINES Engine Mechanical - 4.5L V8

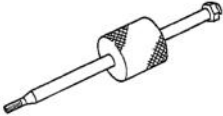
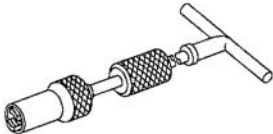
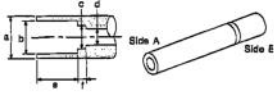
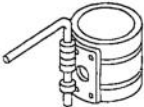
Tool number (Kent-Moore No.) Tool name		Description
KV10111100 (J37228) Seal cutter		Removing steel oil pan and front cover, etc.
KV10114400 (J-38365) Heated oxygen sensor wrench		Loosening or tightening heated oxygen sensors a: 22 mm (0.87 in)
EG15050500 (J45402) Compression gauge adapter		Inspection of compression pressure on No.7 and No.8 cylinders
KV10116200 (J26336-A) Valve spring compressor 1. KV10115900 (J26336-20) Attachment 2. KV10109230 (—) Adapter		Disassembling and assembling valve mechanism Part (1) is a component of KV10116200 (J26336-A), but part (2) is not so.
KV101151S0 (J38972) Lifter stopper set 1. KV10115110 (J38972-1) Camshaft pliers 2. KV10115120 (J38972-2) Lifter stopper		Changing valve lifter shims
KV10112100 (BT8653-A) Angle wrench		Tightening bolts for bearing cap, cylinder head, etc.

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Fig. 5: View Of Special Service Tools (1 Of 3)
Courtesy of NISSAN MOTOR CO., U.S.A.

2004 Infiniti Q45

2004 ENGINES Engine Mechanical - 4.5L V8

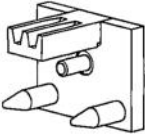
Tool number (Kent-Moore No.) Tool name	Description
KV10114700 (J38139) Main bearing cap remover	Removing crankshaft main bearing cap 
KV10107902 (J38959) Valve oil seal puller	Removing valve oil seal 
KV10115600 (J38958) Valve oil seal drift	Installing valve oil seal Use side A. a: 20 (0.79) dia. d: 8 (0.31) dia. b: 13 (0.51) dia. e: 10.7 (0.421) dia. c: 10.3 (0.406) dia. f: 5 (0.20) dia. Unit: mm (in) 
EM03470000 (J8037) Piston ring compressor	Installing piston assembly into cylinder bore 
ST16610001 (J23907) Pilot bushing puller	Removing crankshaft pilot converter 
WS39930000 (—) Tube presser	Pressing the tube of liquid gasket 

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Fig. 6: View Of Special Service Tools (2 Of 3)
Courtesy of NISSAN MOTOR CO., U.S.A.

2004 Infiniti Q45

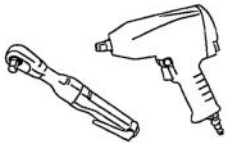
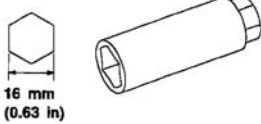
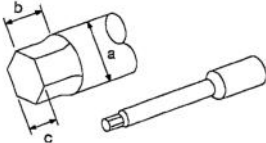
2004 ENGINES Engine Mechanical - 4.5L V8

Tool number (Kent-Moore No.) Tool name		Description
— (J- 45476) Ring gear stopper		Removing and installing crankshaft pulley
— (J-45488) Quick connector release		Removing fuel tube quick connectors in engine room (Available in SEC. 164 of PARTS CATALOG: Part No. 16441 6N210)

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Fig. 7: View Of Special Service Tools (3 Of 3)
Courtesy of NISSAN MOTOR CO., U.S.A.

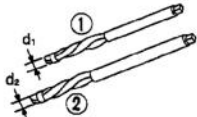
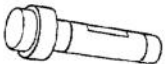
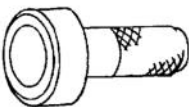
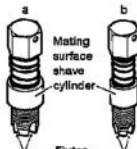
COMMERCIAL SERVICE TOOLS

(Kent-Moore No.) Tool name		Description
Power tool		Loosening bolts and nuts
Spark plug wrench		Removing and installing spark plug
(J24239-01) Cylinder head bolt wrench		Loosening and tightening cylinder head bolt, and used with angle wrench [SST: KV10112100 (BT8653-A)] a: 13 (0.51) dia. b: 12 (0.47) c: 10 (0.39) Unit: mm (in)
Valve seat cutter set		Finishing valve seat dimensions

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Fig. 8: View Of Commercial Service Tools (1 Of 2)

Courtesy of NISSAN MOTOR CO., U.S.A.

(Kent-Moore No.) Tool name		Description
Piston ring expander		Removing and installing piston ring
Valve guide drift		Removing and installing valve guide Intake & Exhaust: a: 9.5 mm (0.374 in) dia. b: 5.5 mm (0.217 in) dia.
Valve guide reamer		1: Reaming valve guide inner hole 2: Reaming hole for oversize valve guide Intake & Exhaust: d1 : 6.0 mm (0.236 in) dia. d2 : 10.2 mm (0.402 in) dia.
Front oil seal drift		Installing front oil seal when front cover is removed
Rear oil seal drift		Installing rear oil seal
(J-43897-18) (J-43897-12) Heated oxygen sensor thread cleaner		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 b: J-43897-12 (12 mm dia.) for titania heated oxygen sensor
Anti-seize lubricant (Permatex 133AR or equivalent meeting MIL specification MIL-A-907)		Lubricating heated oxygen sensor thread cleaning tool when reconditioning exhaust system threads

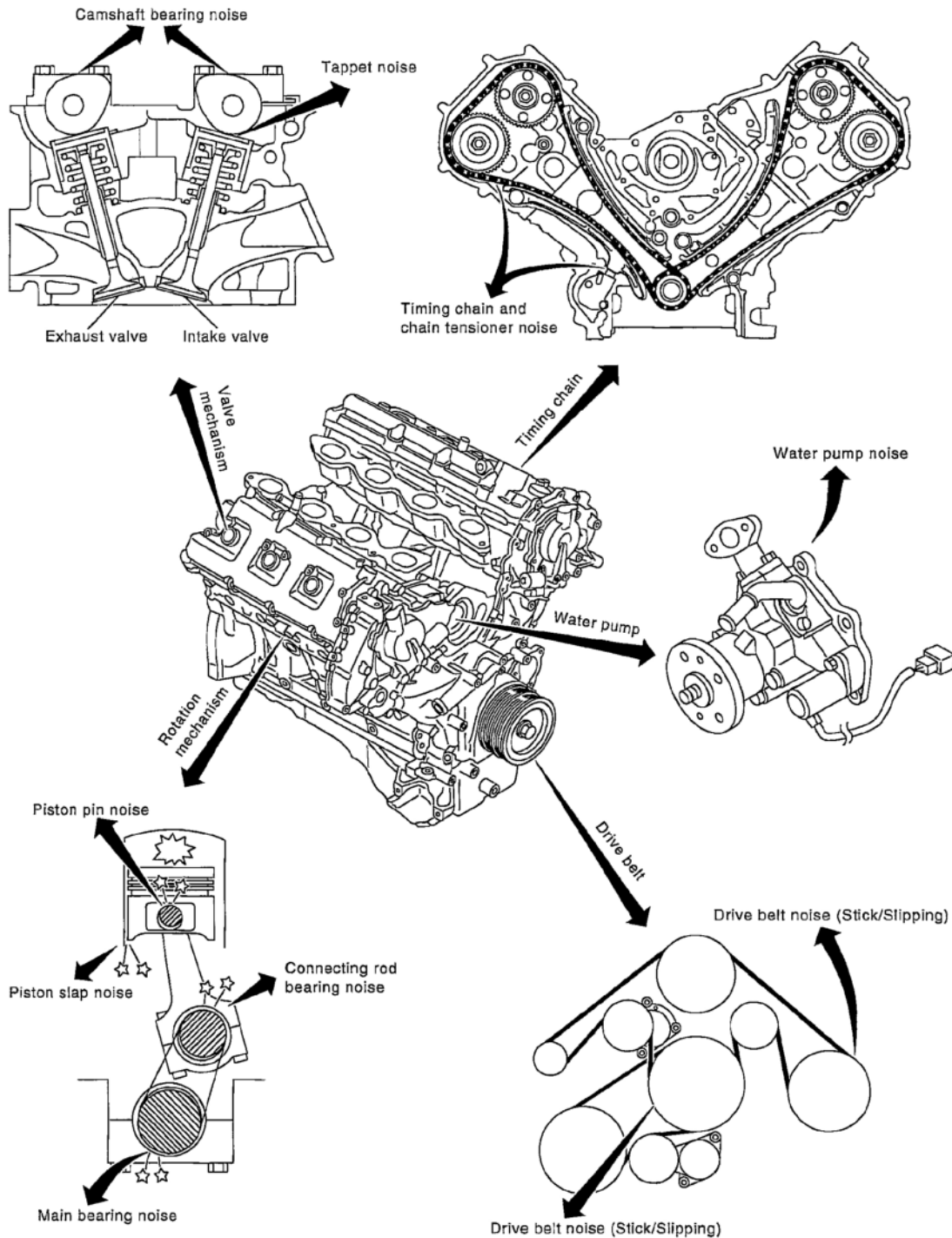
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Fig. 9: View Of Commercial Service Tools (2 Of 2)

Courtesy of NISSAN MOTOR CO., U.S.A.

NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING

NVH TROUBLESHOOTING -ENGINE NOISE



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Fig. 10: Possible Noise Locations

Courtesy of NISSAN MOTOR CO., U.S.A.

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 engine.
4. Check specified noise source.

If necessary, repair or replace these parts.

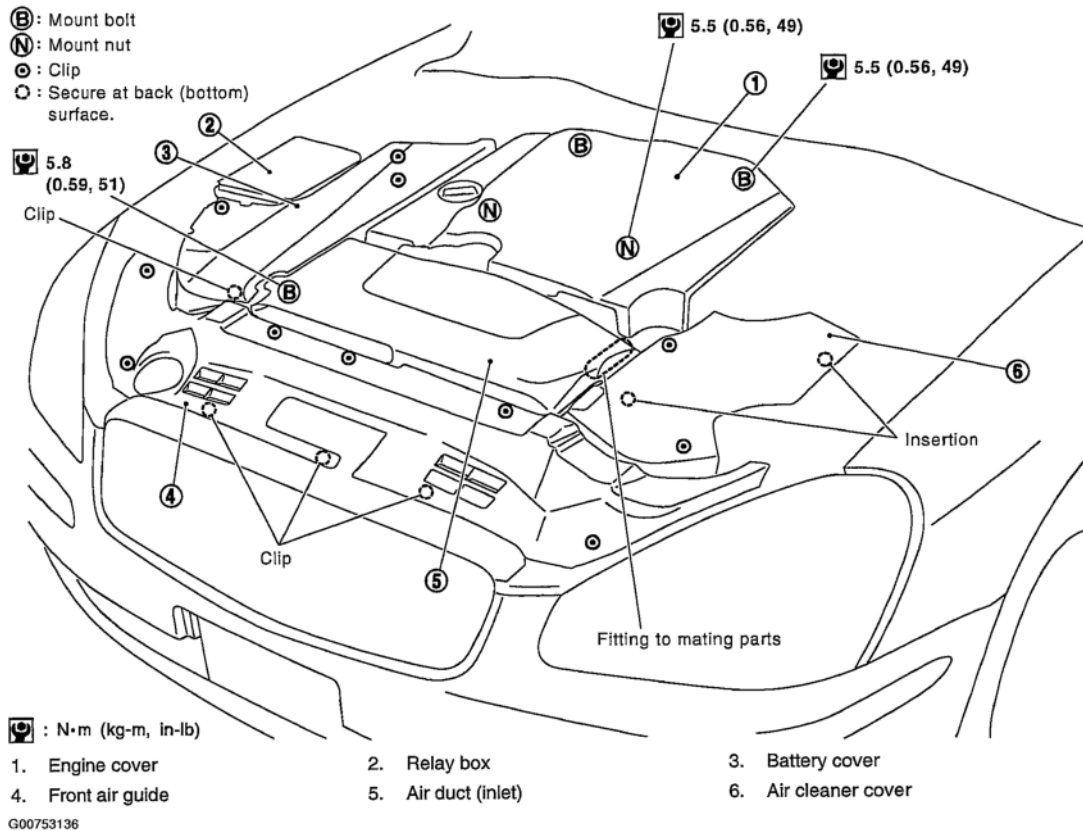
Location of noise	Type of noise	Operating condition of engine						Source of noise	Check item
		Before warm-up	After warm-up	When start-ing	When idling	When racing	While driving		
Top of engine Rocker cover Cylinder head	Ticking or clicking	C	A	—	A	B	—	Tappet noise	Valve clearance
	Rattle	C	A	—	A	B	C	Camshaft bearing noise	Camshaft journal clearance Camshaft runout
Crankshaft pulley Cylinder block (Side of engine) Oil pan	Slap or knock	—	A	—	B	B	—	Piston pin noise	Piston and piston pin clearance Connecting rod bushing 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
	Knock	A	B	C	B	B	B	Connecting rod bearing noise	Connecting rod bushing oil clearance Connecting rod bearing clearance (Big end)
	Knock	A	B	—	A	B	C	Main bearing noise	Main bearing oil clearance Crankshaft runout
Front of engine Timing chain cover	Tapping or ticking	A	A	—	B	B	B	Timing chain and chain tensioner noise	Timing chain cracks and wear Timing chain tensioner operation
Front of engine	Squeaking or fizzing	A	B	—	B	—	C	Drive belts (Sticking or slipping)	Drive belts deflection
	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

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

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Fig. 11: Noise Symptom Chart

Courtesy of NISSAN MOTOR CO., U.S.A.

ENGINE ROOM COVER**REMOVAL AND INSTALLATION****Fig. 12: Engine Room Cover Removal & Installation**

Courtesy of NISSAN MOTOR CO., U.S.A.

REMOVAL

- Remove clips on back with clip driver for each cover.

CAUTION: Do not damage or scratch cover when installing or removing.

- Major parts and inspection points under each cover are as follows; (numbered as in illustration)

1. Upper side of engine assembly, power steering reservoir tank, cooling fan reservoir tank
2. Relay

3. Battery, relay box
4. Cooling fan fluid cooler, power steering fluid cooling tube
5. Engine assembly front side, drive belts, cooling fan
6. Mass air flow sensor, air cleaner case

INSTALLATION

Install in the reverse order of removal.

DRIVE BELTS

CHECKING DRIVE BELTS

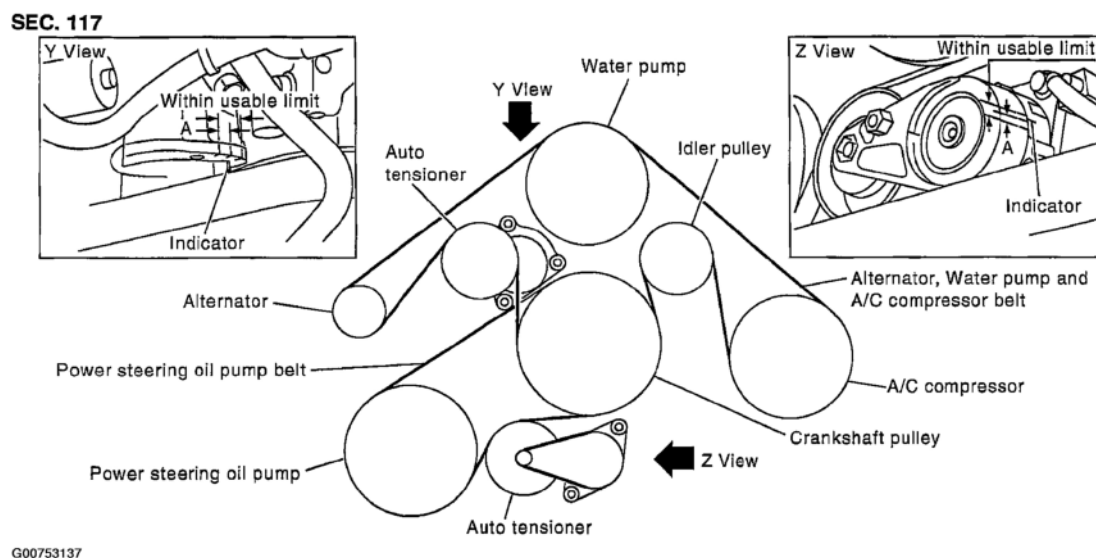


Fig. 13: Checking Drive Belts

Courtesy of NISSAN MOTOR CO., U.S.A.

WARNING: Be sure to perform when engine is stopped.

- Remove air duct (inlet) when inspecting drive belt for alternator, water pump and A/C compressor.
- Remove engine undercover (with power tool) when inspecting power steering oil pump belt.
- Make sure that indicator (single line notch) of each auto tensioner is within the allowable working range (between three line notches). See **Fig. 13**.

NOTE:

- Check auto tensioner indication when engine is cold.
- When new drive belt is installed, the range should be A. See **Fig. 13**.

- The indicator notch is located on the moving side of auto tensioner for alternator, water pump and A/C compressor belt, while it is found on the fixed side for power steering oil pump belt.

- Visually check entire belt for wear, damage or cracks.
- If the indicator is out of allowable working range or belt is damaged, replace the belt.

TENSION ADJUSTMENT

Belt tensioning is not necessary, as it is automatically adjusted by auto tensioner. **DRIVE BELTS**

REMOVAL AND INSTALLATION

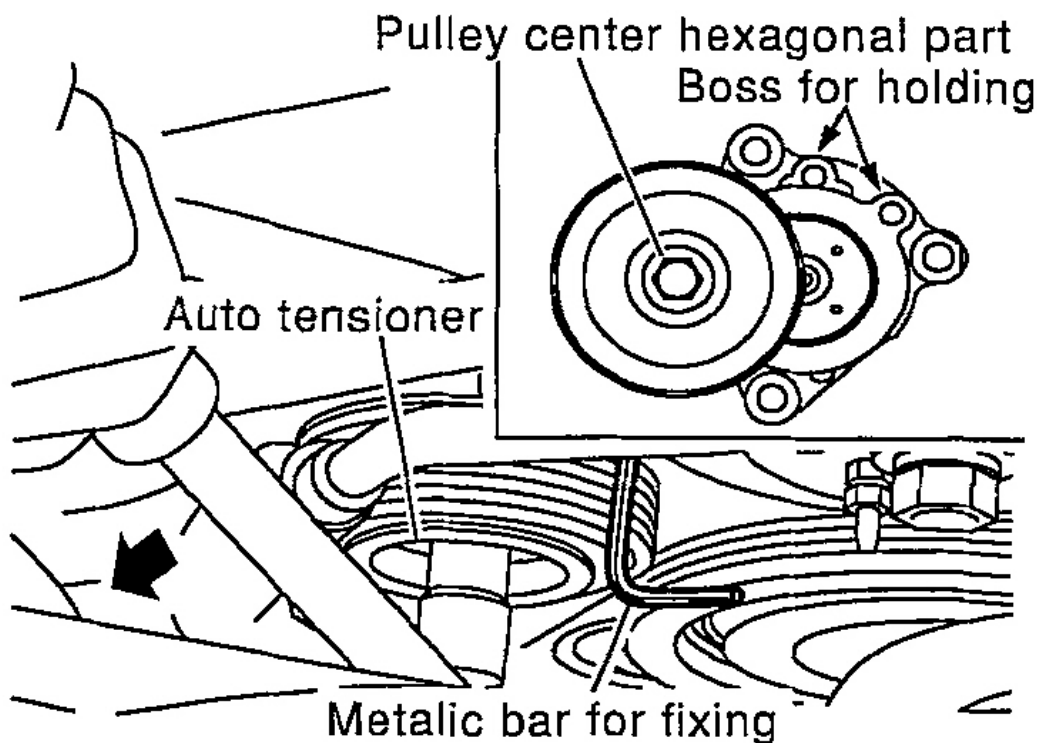
REMOVAL

Alternator, Water Pump and A/C Compressor Belt

1. Remove air duct (inlet). Refer to **AIR CLEANER AND AIR DUCT** .
2. With box wrench, and while securely holding the hexagonal part in pulley center of auto tensioner, move the wrench handle in the direction of arrow (loosening direction of tensioner).

CAUTION: Avoid placing hand in a location where pinching may occur if the holding tool accidentally comes off.

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



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Fig. 14: View Of Belt Tensioner

Courtesy of NISSAN MOTOR CO., U.S.A.

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

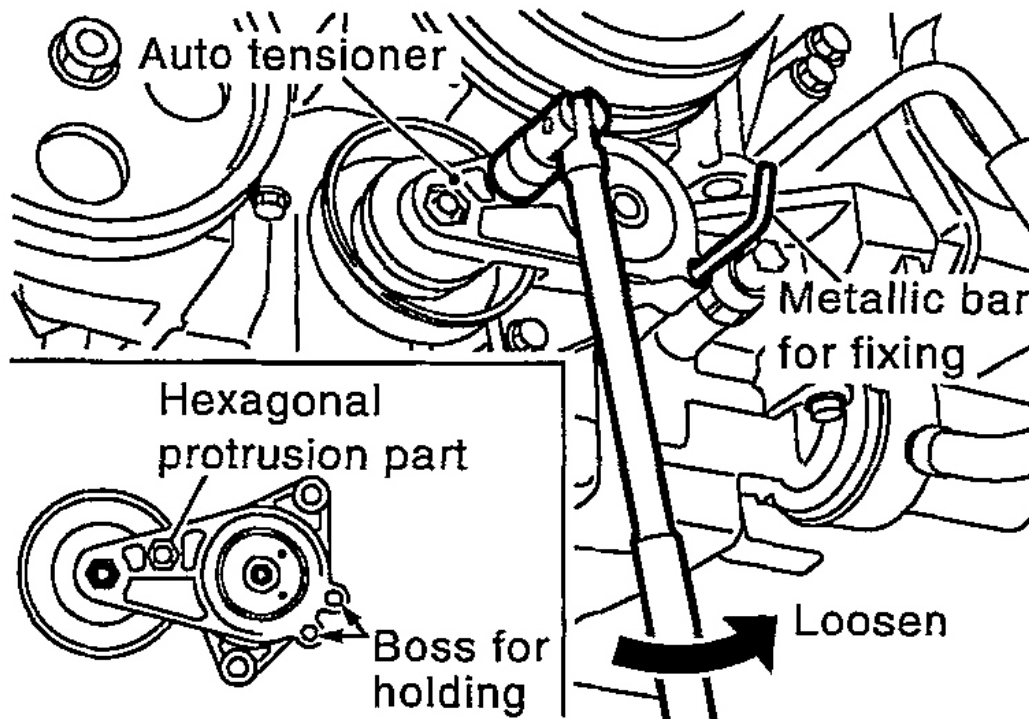
Power Steering Oil Pump Belt

1. Remove air duct (inlet) and engine undercover (with power tool). Refer to **AIR CLEANER AND AIR DUCT**.
2. Remove alternator, water pump and A/C compressor belt. Refer to **REMOVAL**.
3. While securely holding the hexagonal protrusion part of auto tensioner pulley with box wrench, move the wrench handle in the direction of arrow (loosening direction of tensioner).

CAUTION: Avoid placing hand in a location where pinching may occur if the holding tool accidentally comes off.

4. Under the above condition, insert a metal bar of approximately 6 mm (0.24 in) in diameter (hexagonal bar wrench shown as example in the figure) through the holding boss to lock auto tensioner pulley arm.

- Leave auto tensioner pulley arm locked until belt is installed again.



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Fig. 15: Installing Holding Pin

Courtesy of NISSAN MOTOR CO., U.S.A.

5. Remove power steering oil pump belt.

INSTALLATION

Install in the reverse order of removal paying attention to the following.

CAUTION: Make sure belt is securely installed around all pulleys.

- Unlock auto tensioner pulley arm to give tension to belt.
- Rotate crankshaft pulley several turns clockwise to equalize belt tension between pulleys.
- Check that belt tension is within the allowable working range, using indicator notch on auto tensioner. Refer to **Checking Drive Belts**.

DRIVE BELT AUTO TENSIONER AND IDLER PULLEY

SEC. 117

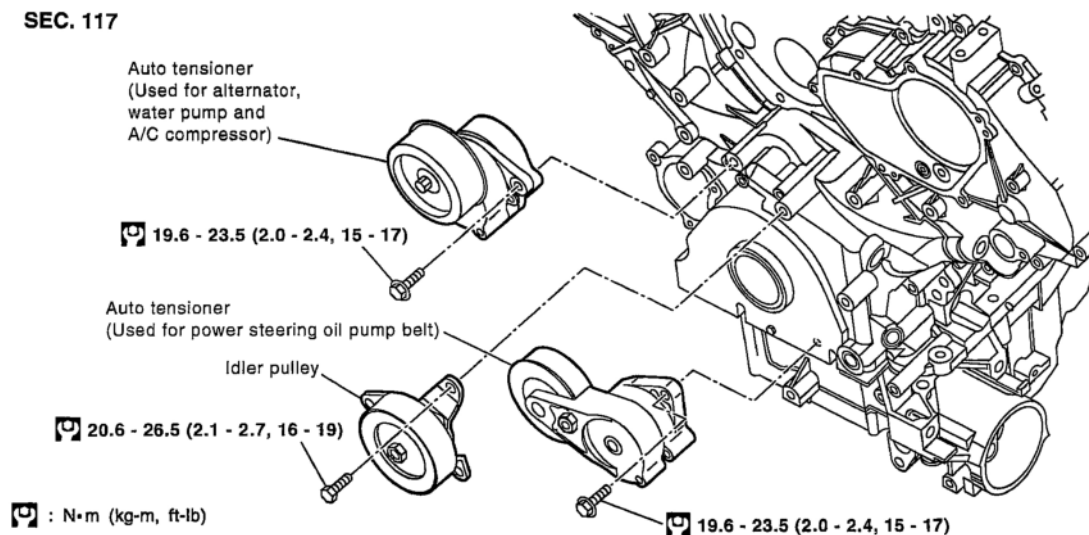


Fig. 16: Removing & Installing Drive Belt Auto Tensioners and Idler Pulley
Courtesy of NISSAN MOTOR CO., U.S.A.

REMOVAL

1. Remove air duct (inlet). Refer to **AIR CLEANER AND AIR DUCT**.
2. Remove engine undercover (with power tool).
3. Remove drive belts. Refer to **DRIVE BELTS**.
 - Keep auto tensioner pulley arm locked after belt is removed.
4. Remove auto tensioner and idler pulley with power tool.
 - Keep auto tensioner pulley arm locked to install or remove auto tensioner.

INSTALLATION

Install in the reverse order of removal.

AIR CLEANER AND AIR DUCT

REMOVAL AND INSTALLATION

SEC. 118•148•165

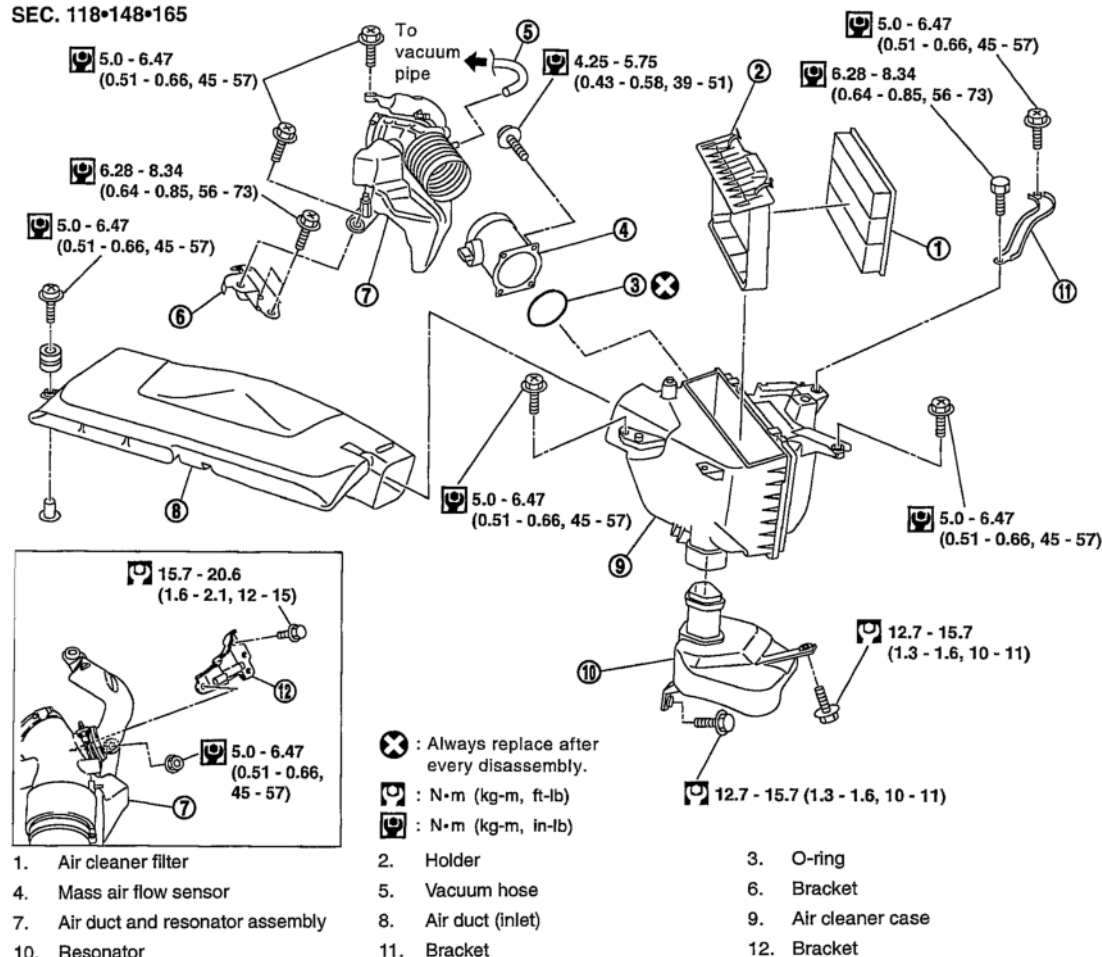


Fig. 17: View Of Air Cleaner And Air Duct
 Courtesy of NISSAN MOTOR CO., U.S.A.

REMOVAL

1. Remove engine cover with power tool. Refer to **ENGINE ROOM COVER**.
2. Remove air cleaner cover. Refer to **ENGINE ROOM COVER**.
3. Disconnect harness connector from mass air flow sensor.
4. Remove air duct (inlet), air cleaner case and mass air flow sensor assembly and air duct and resonator assembly disconnecting their joints.
 - Add marks as necessary for easier installation.
5. Remove mass air flow sensor from air cleaner case.

CAUTION: Handle mass air flow sensor with following cares.

- Do not shock it.

- **Do not disassemble it.**
- **Do not touch its sensor.**

6. Remove resonator in fender lifting left fender protector.

INSTALLATION

Install in the reverse order of removal paying attention to the following.

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

CHANGING AIR CLEANER FILTER

Removal

1. Remove air cleaner cover. Refer to **ENGINE ROOM COVER**
2. Unhook clips and lift up holder with air cleaner filter.
3. Remove air cleaner filter.

Installation

Install in the reverse order of removal.

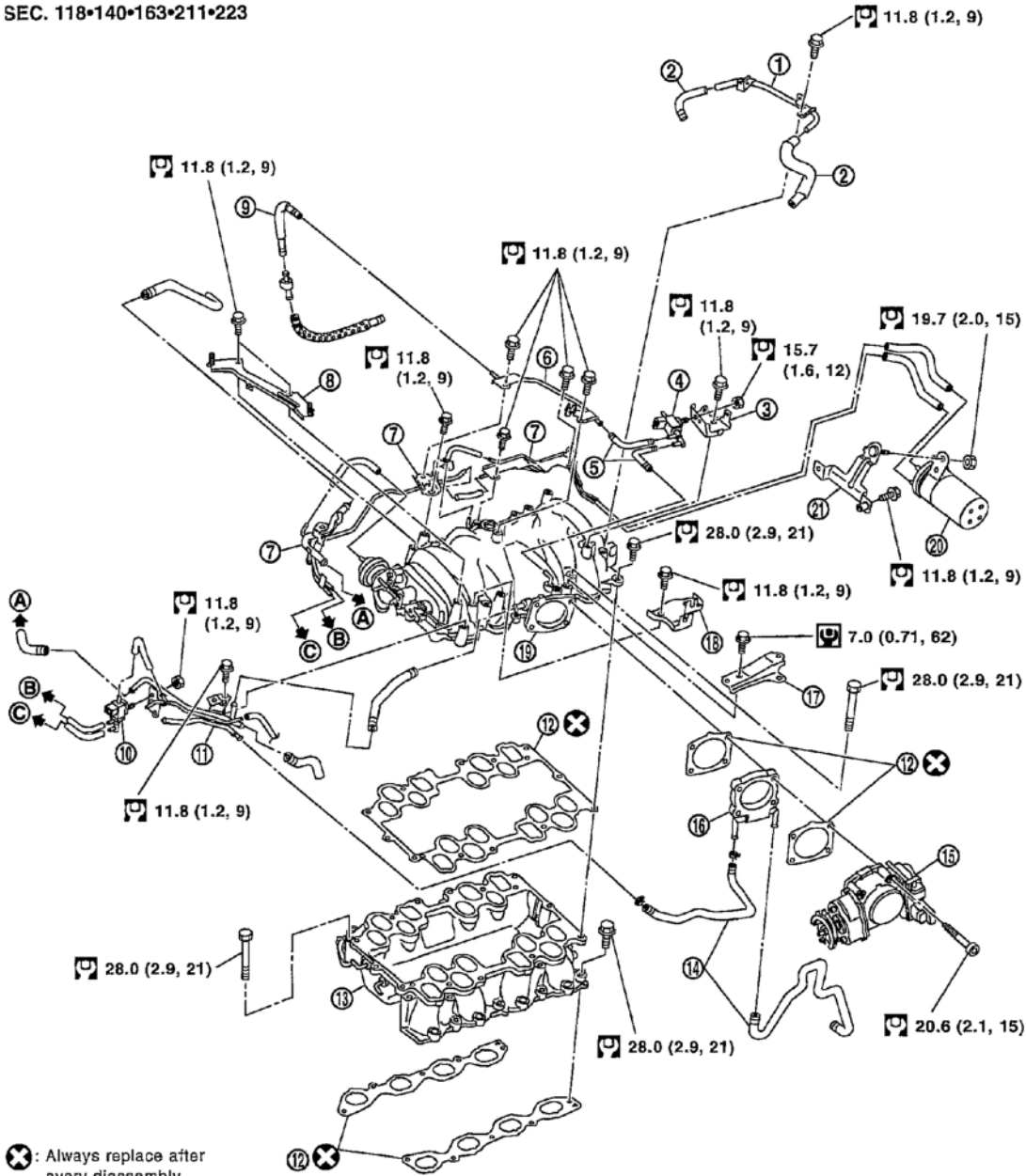
INTAKE MANIFOLD

REMOVAL AND INSTALLATION

2004 Infiniti Q45

2004 ENGINES Engine Mechanical - 4.5L V8

SEC. 118•140•163•211•223



✖: Always replace after every disassembly.

Ⓜ: N•m (kg-m, in-lb)

Ⓜ: N•m (kg-m, ft-lb)

- | | | |
|--|-------------------------------|--|
| 1. PCV tube | 2. PCV hose | 3. EVAP canister purge volume control solenoid valve bracket |
| 4. EVAP canister purge volume control solenoid valve | 5. EVAP hose | 6. EVAP tube |
| 7. Vacuum gallery | 8. Engine cover front bracket | 9. EVAP hose |
| 10. VIAS control solenoid valve | 11. Water gallery | 12. Gasket |
| 13. Intake manifold lower | 14. Water hose | 15. Electric throttle control actuator |
| 16. Intake manifold adapter | 17. Engine cover rear bracket | 18. Accelerator wire bracket |
| 19. Intake manifold upper | 20. Vacuum tank | 21. Vacuum tank bracket |

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Fig. 18: Exploded View Of Intake Manifold
Courtesy of NISSAN MOTOR CO., U.S.A.

REMOVAL

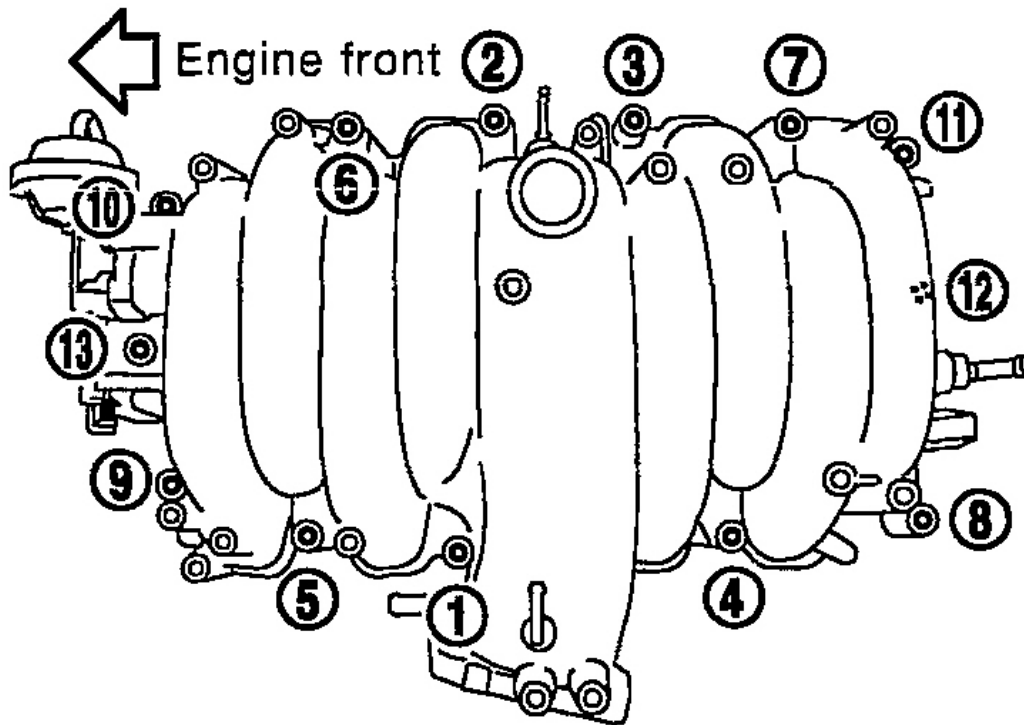
WARNING: To avoid the danger of being scalded, never drain engine coolant when engine is hot.

1. Remove engine cover (with power tool), air cleaner cover and battery cover. Refer to **ENGINE ROOM COVER**.
2. Release fuel pressure. Refer to **FUEL PRESSURE RELEASE**.
3. Remove air cleaner case and air duct assembly. Refer to **AIR CLEANER AND AIR DUCT**.
4. Drain engine coolant when engine is cooled. Refer to **CHANGING ENGINE COOLANT**.
5. Disconnect fuel tube quick connector on engine side. Refer to **FUEL INJECTOR AND FUEL TUBE**.
6. Remove accelerator wire from throttle drum. Refer to **REMOVAL AND INSTALLATION**.
7. Move cooling fan fluid reservoir tank. Refer to **COOLING FAN**.
8. Remove or disconnect intake manifold upper, wiring harnesses, brackets, vacuum hose, vacuum gallery and PCV hose and tube.
9. Remove electric throttle control actuator and intake manifold adapter loosening fixing bolts diagonally.

CAUTION:

- Handle carefully to avoid any shock to electric throttle control actuator.
- Do not disassemble.

10. Disconnect water hoses.
11. Loosen bolts in reverse order of illustration to remove intake manifold upper assembly with power tool.

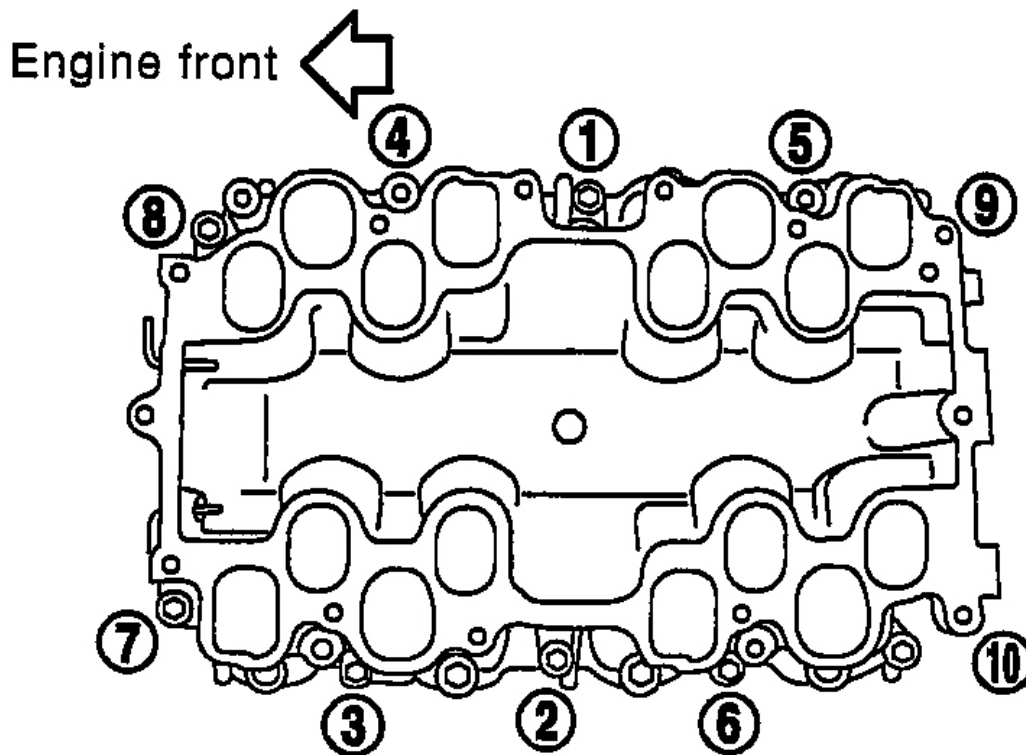


G00753143

Fig. 19: Upper Intake Manifold Torque Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

12. Remove fuel injectors and fuel tube assembly. Refer to **FUEL INJECTOR AND FUEL TUBE..**
13. Loosen bolts in reverse order of illustration to remove intake manifold lower assembly with power tool.

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



G00753144

Fig. 20: Lower Intake Manifold Torque Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

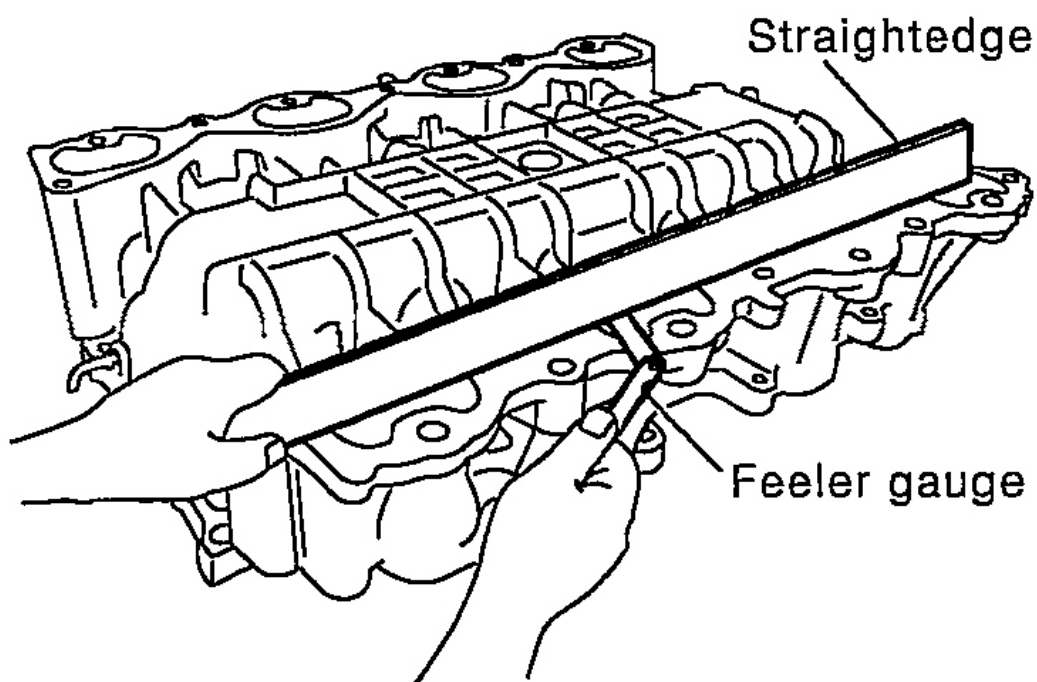
INSPECTION AFTER REMOVAL

Surface Distortion

- Using straightedge and feeler gauge, inspect surface distortion of intake manifold lower and intake manifold upper.

Limit : 0.1 mm (0.004 in)

- If it exceeds the limit, replace intake manifold lower or intake manifold upper.



G00753145

Fig. 21: Inspecting Lower Intake Manifold
Courtesy of NISSAN MOTOR CO., U.S.A.

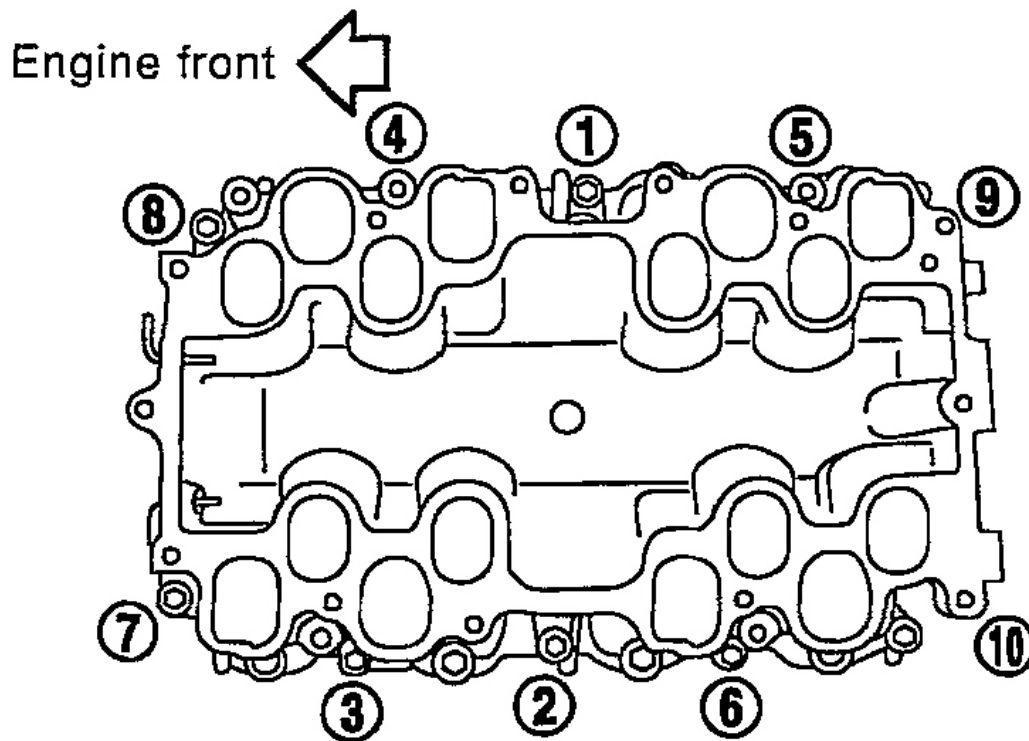
INSTALLATION

Install in the reverse order of removal paying attention to the following.

Tightening Intake Manifold Lower Bolts

Tighten in numerical order as shown in the figure.

NOTE: No.7 and 8 have longer bolt length than others.



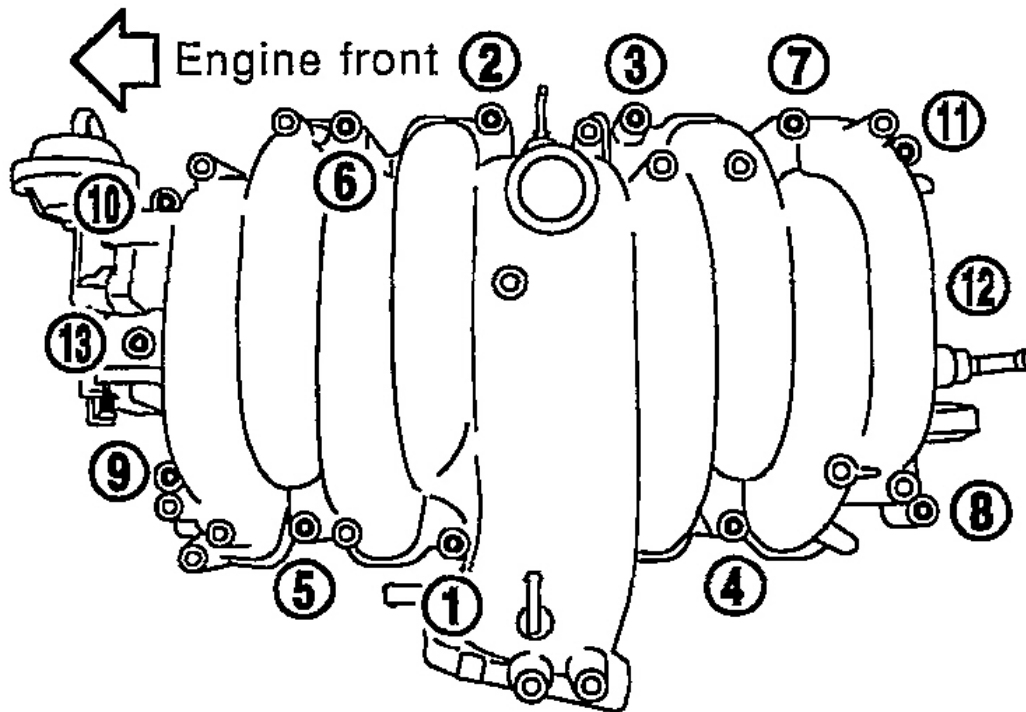
G00753146

Fig. 22: Lower Intake Manifold Torque Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

Tightening Intake Manifold Upper Bolts

Tighten in numerical order as shown in the figure.

NOTE: No.1 to 4 have longer bolt length than others.



G00753147

Fig. 23: Upper Intake Manifold Torque Sequence
 Courtesy of NISSAN MOTOR CO., U.S.A.

Installation of Electric Throttle Control Actuator

- Install intake manifold adapter gasket and electric throttle control actuator gasket so that three protrusions for installation identification do not face downward.
- Tighten fixing bolts of electric throttle control actuator equally and diagonally in several steps.
- After installation perform procedure in **INSPECTION AFTER INSTALLATION** .

Connecting Water Hose

Install water hose so that its overlap width for connection is between 27 mm (1.06 in) and 32 mm (1.26 in) (target: 27 mm, 1.06 in).

Connecting Vacuum Hose

Refer to **VACUUM HOSE DIAGRAM** .

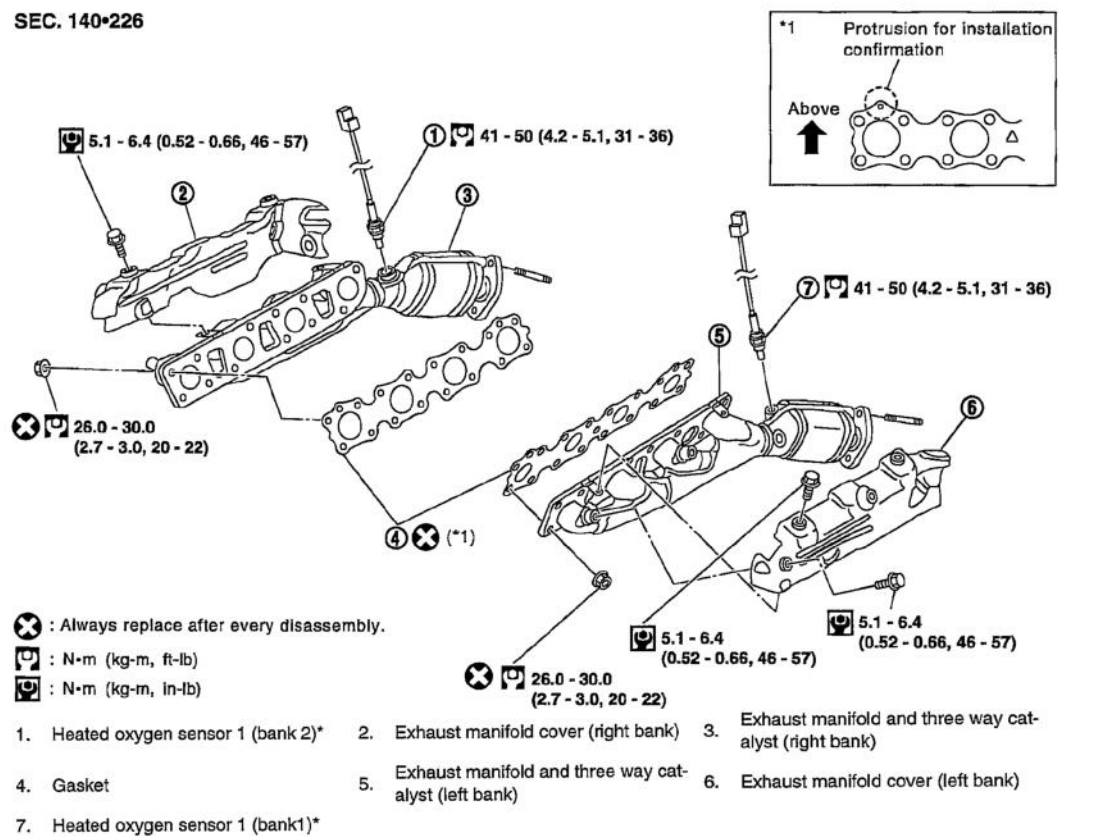
INSPECTION AFTER INSTALLATION

- After installing fuel tubes, make sure there is no fuel leakage at connections in the following steps.
 - Apply fuel pressure to fuel lines with turning ignition switch ON (with engine stopped). Then check for fuel leaks at connections.
 - Start engine and rev it up and check for fuel leaks at connections.
- Perform procedures for "Throttle Valve Closed Position Learning" after finishing repairs. Refer to **THROTTLE VALVE CLOSED POSITION LEARNING**.
- If electric throttle control actuator is replaced, perform procedures for "Idle Air Volume Learning" after finishing repairs. Refer to **IDLE AIR VOLUME LEARNING**.

EXHAUST MANIFOLD AND THREE WAY CATALYST

REMOVAL AND INSTALLATION

SEC. 140•226



* : When using the heated oxygen sensor wrench [SST: KV10114400 (J-38365)], tighten to the middle of specified torque because length of tool may induce slight indication increase. (Do not tighten to the maximum specified torque.)

G00753148

Fig. 24: Exploded View Of Exhaust Manifold And Three Way Catalyst
Courtesy of NISSAN MOTOR CO., U.S.A.

REMOVAL

1. Remove heated oxygen sensors.

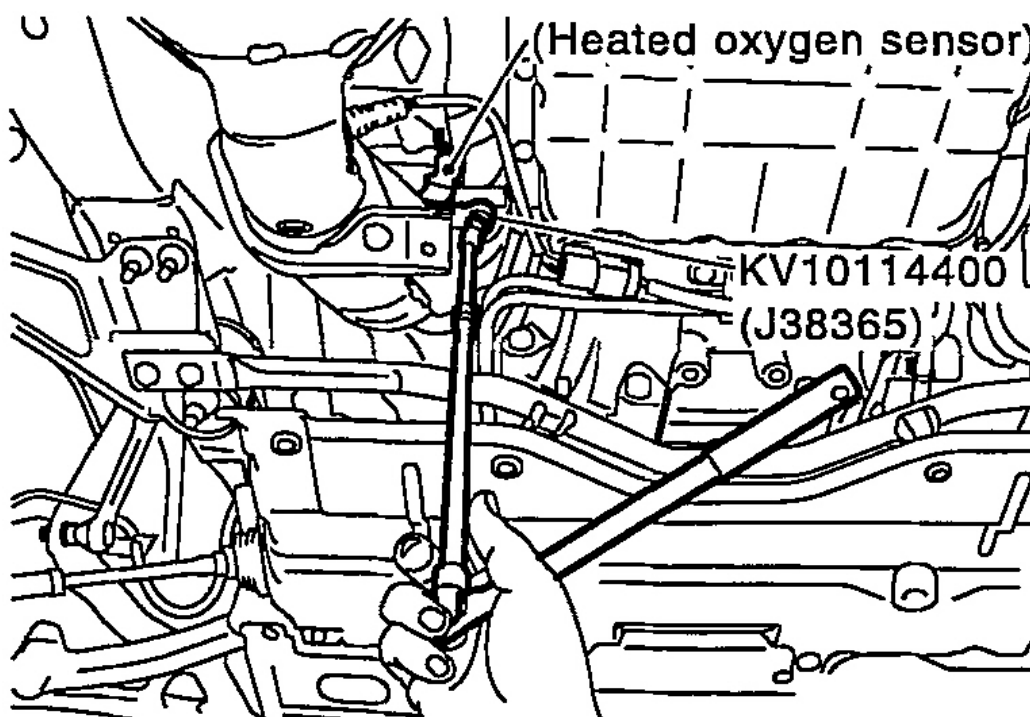
- Follow below steps to remove each heated oxygen sensor.
- a. Remove engine undercover and engine cover with power tool. Refer to **ENGINE ROOM COVER**.
- b. Disconnect harness connector of each heated oxygen sensor, and harness from bracket and middle clamp.
- c. Using the heated oxygen sensor wrench (SST), remove both left and right heated oxygen sensors.

CAUTION:

- Be careful not to damage heated oxygen sensor.
- Discard any heated oxygen sensor which has been dropped from a height of more than 0.5 m (19.7 in) onto a hard surface such as a concrete floor; use a new one.

2. Remove exhaust manifold and three way catalyst (left bank) using the steps below.

- a. Remove A/C compressor with power tool and put aside with piping connected. Refer to **REMOVAL AND INSTALLATION OF COMPRESSOR**.



G00753149

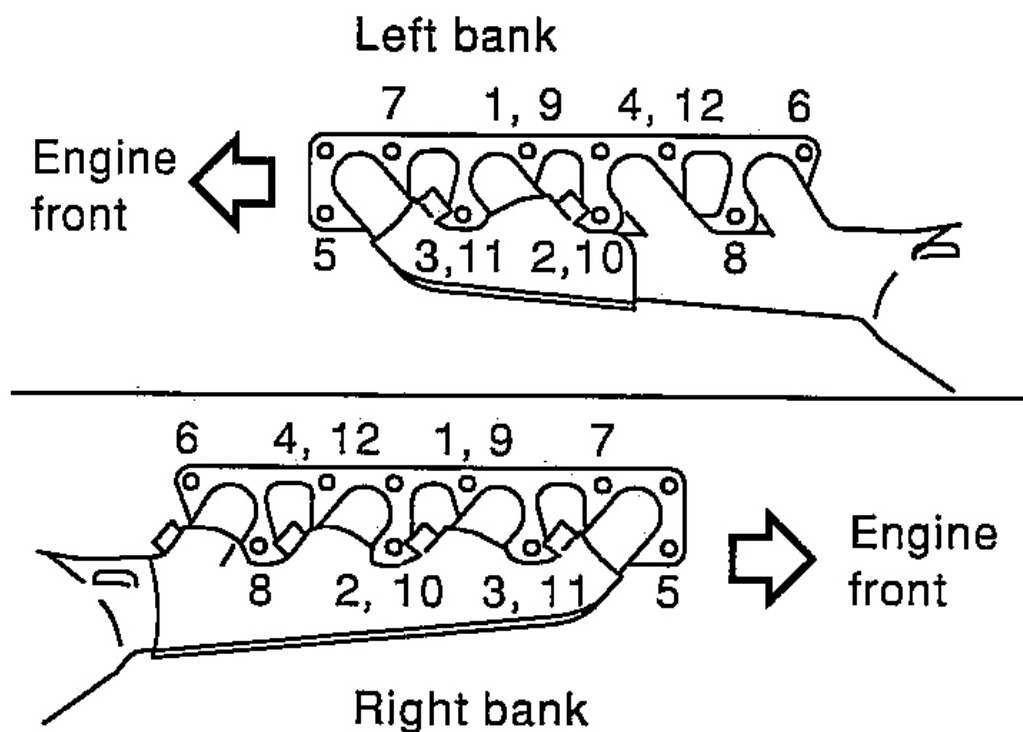
Fig. 25: Removing Oxygen Sensor

Courtesy of NISSAN MOTOR CO., U.S.A.

- b. Remove exhaust front tube with power tool. Refer to **EXHAUST SYSTEM**.
- c. Remove steering lower joint to enable steering shaft to move freely. Refer to **POWER STEERING GEAR AND LINKAGE**.
- d. Support and lift up bottom of engine with transmission jack. Remove left engine mounting insulator along with left engine mounting brackets.
- e. Remove exhaust manifold cover (left bank).
- f. Loosen nuts in reverse order of illustration to remove exhaust manifold and three way catalyst (left bank) with power tool.

NOTE: Exclude No.9 to No.12 in removal.

3. Remove exhaust manifold and three way catalyst (right bank) using the steps below.
 - a. Remove drive belt. Refer to **DRIVE BELTS**.
 - b. Remove alternator. Refer to **REMOVAL & INSTALLATION**.
 - c. Remove exhaust front tube with power tool. Refer to **EXHAUST SYSTEM**.



G00753150

Fig. 26: View Of Exhaust Manifold Torque Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

- d. Remove nuts on bottom of right engine mounting insulator, and lift up right side of engine approximately 3 cm (1.18 in) with transmission jack.
- e. Remove starter motor. Refer to **REMOVAL & INSTALLATION** .
- f. Support and lift up bottom of engine with transmission jack. Remove right engine mounting insulator along with right engine mounting brackets.
- g. Remove exhaust manifold cover (right bank). See **EXHAUST SYSTEM** .
- h. Loosen nuts in reverse order of illustration to remove exhaust manifold and three way catalyst (right bank) with power tool.

NOTE: **Exclude No. 9 to No. 12 in removal.**

INSPECTION AFTER REMOVAL

Surface Distortion

- Use a reliable straightedge and feeler gauge to check the flatness of each exhaust manifold flange surface.
 Limit : 0.3mm (0.012in)
- If it exceeds the limit, replace exhaust manifold and three way catalyst.

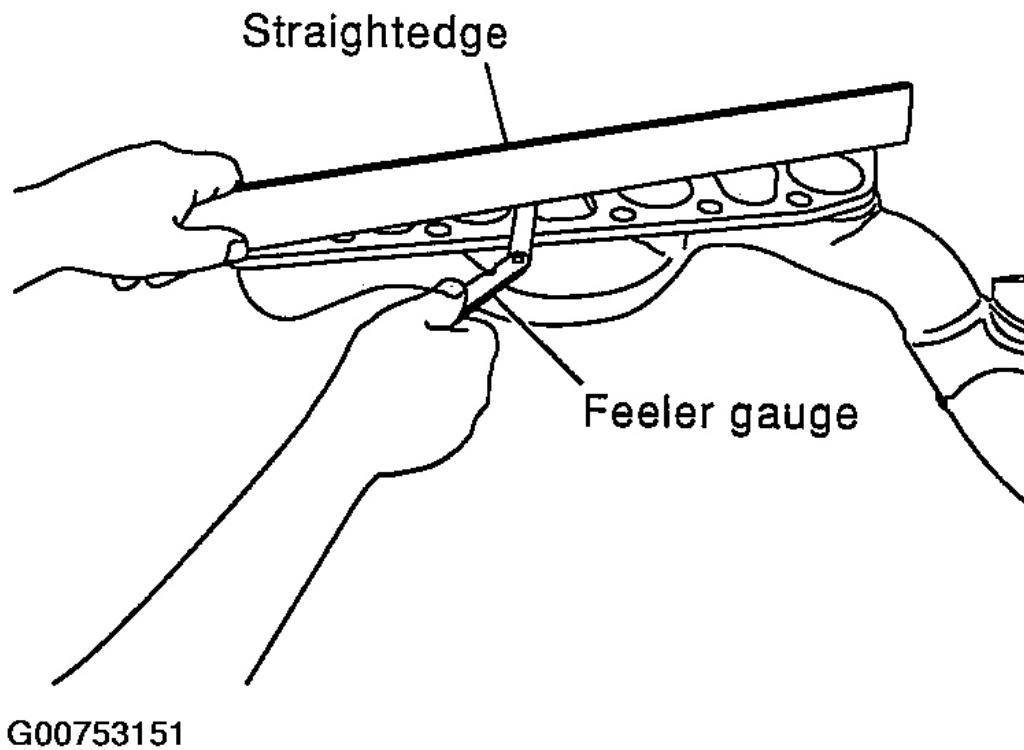


Fig. 27: Checking Exhaust Manifold For Warpage
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

Install in the reverse order of removal paying attention to the following.

Exhaust Manifold Gasket

Install exhaust manifold gasket. See **EXHAUST MANIFOLD AND THREE WAY CATALYST** with its directional protrusion set upward. Refer to removal and installation.

Tightening Exhaust Manifold Nuts

- Install exhaust manifold and three way catalyst in numerical) order shown in the figure.
- Tighten nuts No.1 to No.4 in two steps. Order No.9 to 12 shows second step.

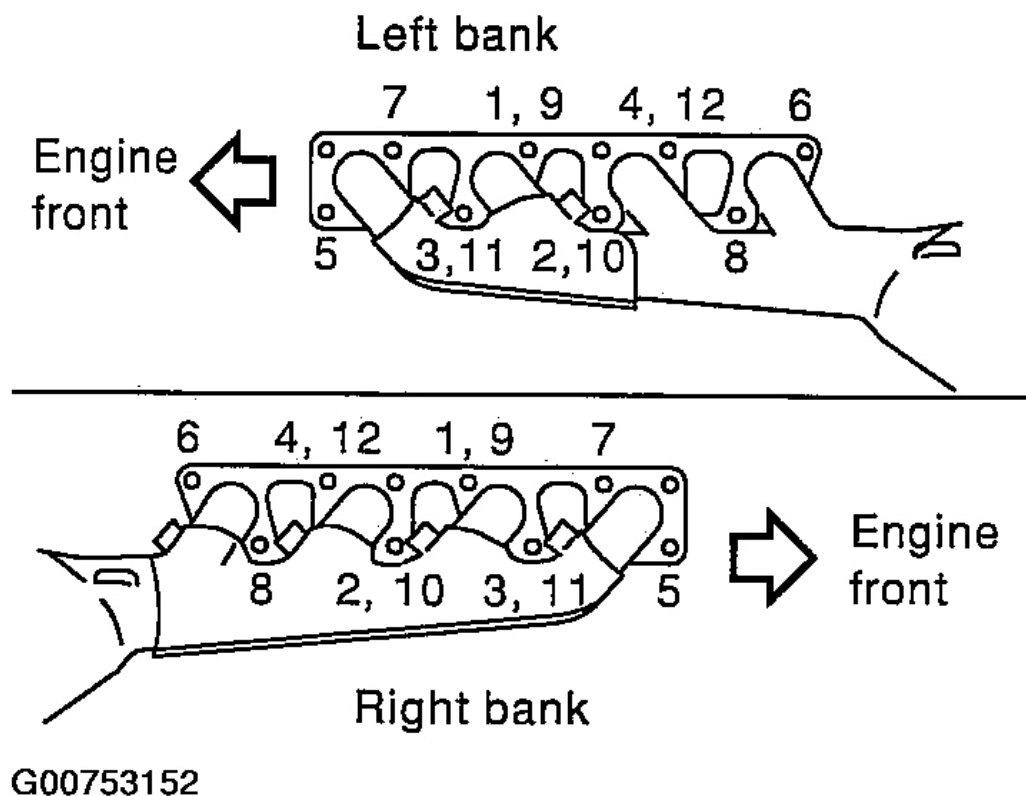


Fig. 28: Exhaust manifold torque sequence
 Courtesy of NISSAN MOTOR CO., U.S.A.

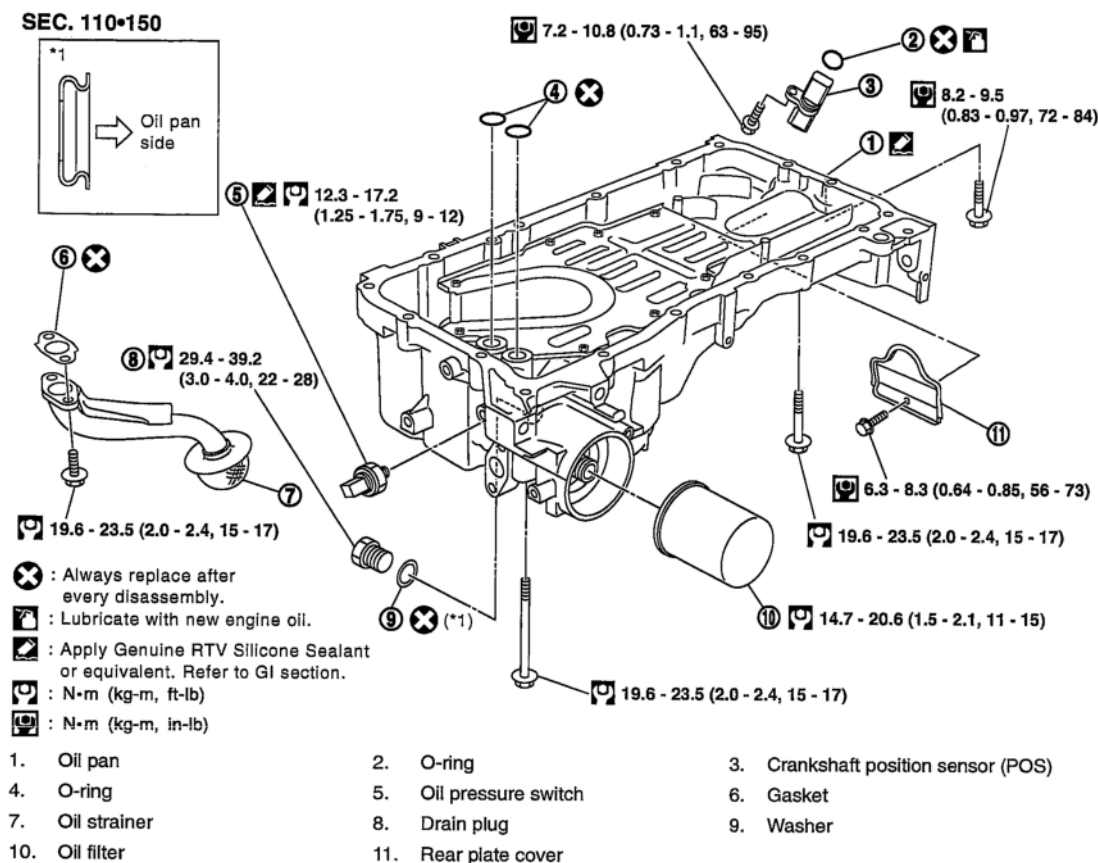
Installation of Heated Oxygen Sensor

CAUTION:

- When using the heated oxygen sensor wrench [SST: KV10114400 (J-38365)], tighten to the middle of specified torque because length of tool may induce slight indication increase. (Do not tighten to the maximum specified torque)
- Before installing a new heated oxygen sensor, clean exhaust system threads using the heated oxygen sensor thread cleaner (commercial service tool: J-43897-18 or J-43897-12), and apply anti-seize lubricant (commercial service tool).
- Do not over torque the heated oxygen sensor. Doing so may cause damage to the heated oxygen sensor, resulting in the MIL coming on.

OIL PAN AND OIL STRAINER

REMOVAL AND INSTALLATION



G00753153

Fig. 29: Exploded view Of Oil Pan And Oil Strainer
 Courtesy of NISSAN MOTOR CO., U.S.A.

REMOVAL

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

1. Remove front tire.
2. Remove hood assembly. Refer to **HOOD**.
3. Remove engine undercover with power tool.
4. Remove engine cover, battery cover, air duct (inlet) and air cleaner cover. Refer to **ENGINE ROOM COVER**.
5. Drain engine oil. Refer to **CHANGING ENGINE OIL**.
6. Remove drive belts. Refer to **DRIVE BELTS**.
7. Remove auto tensioner of power steering oil pump belt. Refer to **Drive Belt Auto Tensioner and Idler**.

Pulley.

8. Move power steering oil pump and remove power steering oil pump bracket.
9. Remove oil filter. Refer to **OIL FILTER** .
10. Remove A/C compressor fitting bolts, and install A/C compressor temporarily on vehicle side with ropes or equivalent. Refer to **REMOVAL AND INSTALLATION OF COMPRESSOR** .
11. Disconnect harness and wires of lower side of oil pan from oil pan.
12. Remove crankshaft position sensor (POS) from transmission.

CAUTION:

- Do not drop or shock it.
- Do not disassemble it.
- Do not let steel powders contact magnetic parts of sensor tips.
- Do not leave where magnetically effected.

13. Install engine slinger and hang engine assembly to secure position. Refer to **ENGINE ASSEMBLY..**
14. Remove front suspension member with power tool. Refer to **FRONT SUSPENSION MEMBER** .
15. Remove oil pan in the order shown below.
 - a. Remove rear plate cover.
 - b. Remove transmission joint bolts (M12: 4 bolts) which pierce oil pan.
 - c. Loosen oil pan bolts with power tool in reverse order of illustration to remove.

NOTE:**Exclude No.11 and No.17 in removal.**

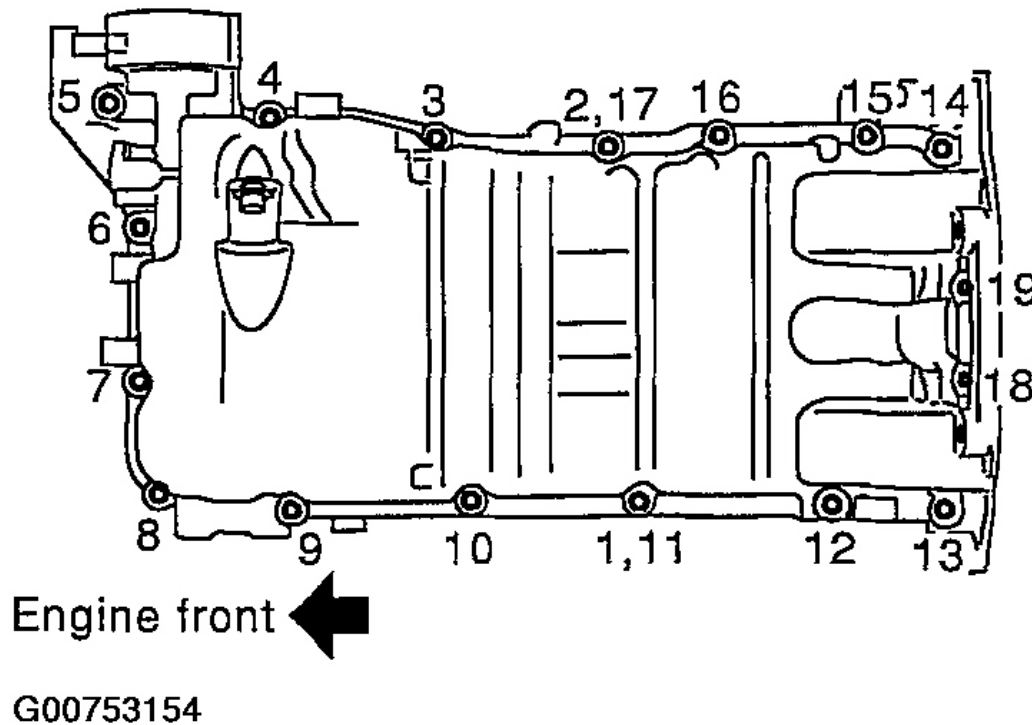


Fig. 30: Oil Pan Bolt Torque Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

- d. Insert the seal cutter (SST) between oil pan and cylinder block. Slide the seal cutter by tapping on side of the seal cutter with a hammer. Remove oil pan.

CAUTION: Exercise care not to damage mating surface.

16. Remove oil strainer.

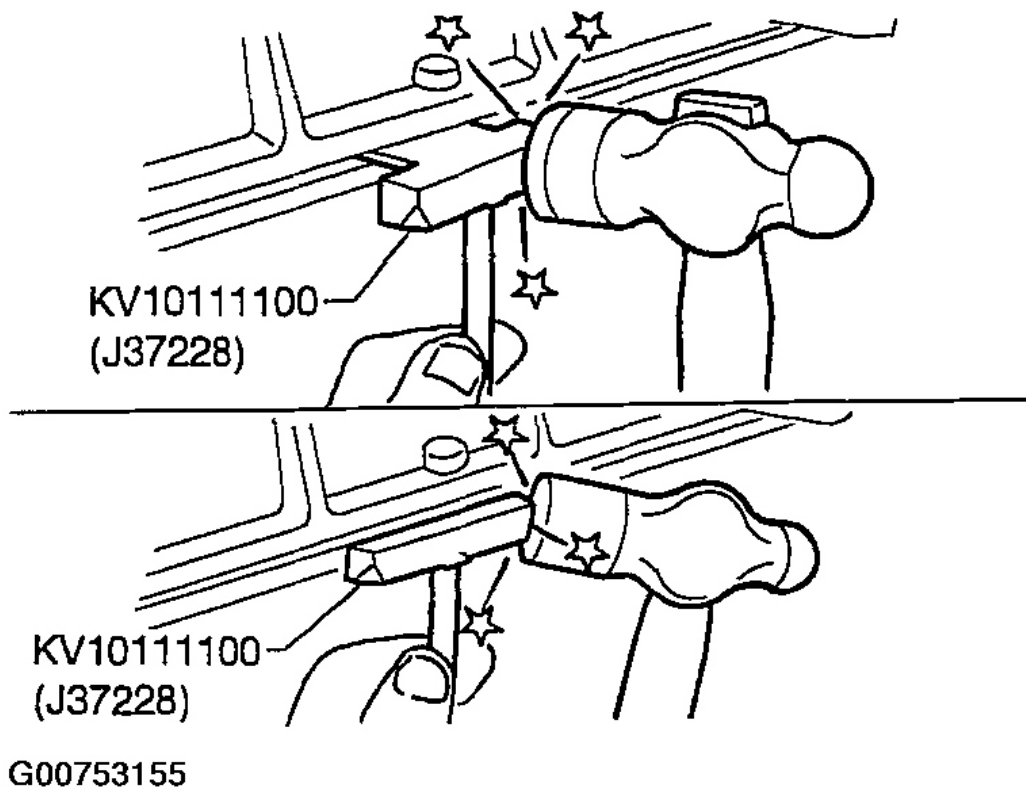


Fig. 31: Using Seal Cutter
Courtesy of NISSAN MOTOR CO., U.S.A.

INSPECTION AFTER REMOVAL

Clean oil strainer if any object attached.

INSTALLATION

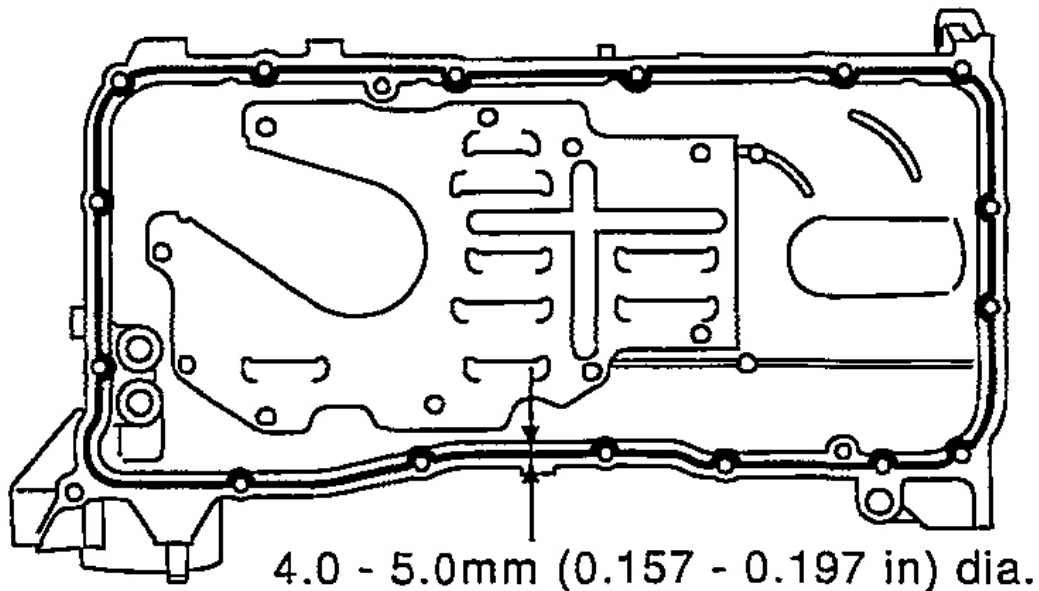
1. Install oil strainer.
2. Install oil pan in the order below.
 - a. Use scraper to remove old liquid gasket from mating surfaces.
 - Also remove the old liquid gasket from mating surface of cylinder block.
 - Remove old liquid gasket from the bolt holes and threads.

CAUTION: Do not scratch or damage the mating surfaces when cleaning off old liquid gasket.

- b. Apply liquid gasket thoroughly as in illustration.

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

- c. Install new O-ring to oil pump and front cover side.



G00753156

Fig. 32: View Of Sealant Placement
Courtesy of NISSAN MOTOR CO., U.S.A.

- d. Tighten bolts in numerical order as shown.
- 11 and 17 indicate double tightening of bolts 1 and 2.

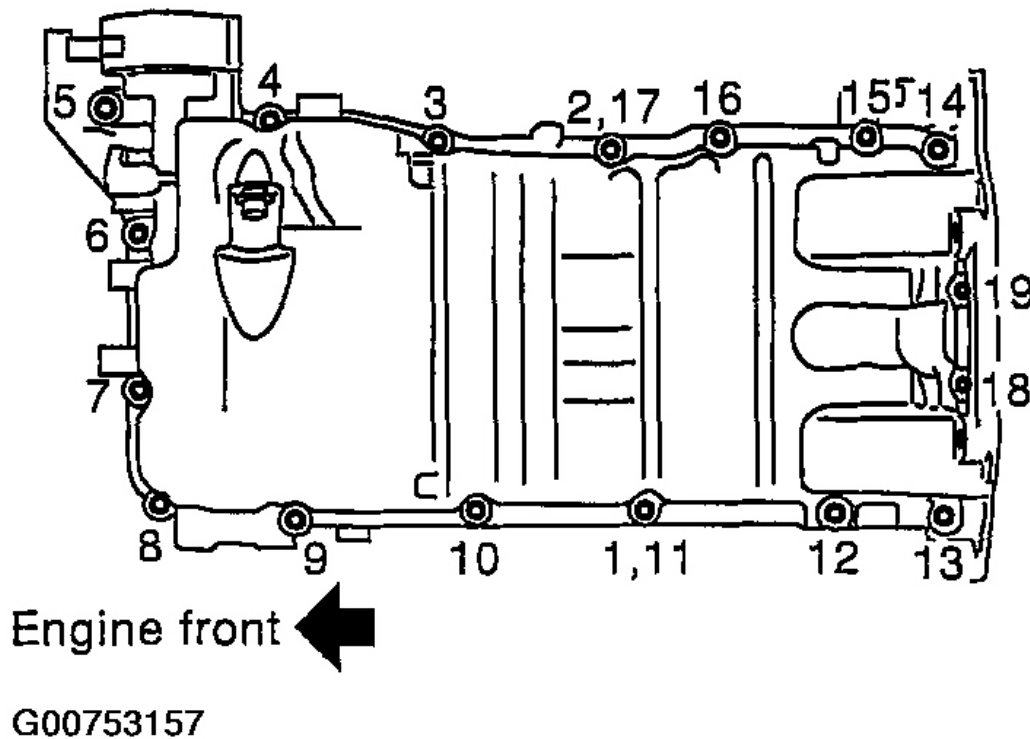
NOTE: Refer to the below for locating bolts.

M6 x 30 mm (1.18 in) :No. 18, 19

M8 x 100 mm (3.97 in) : No. 5, 9

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

- e. Tighten transmission joint bolts. Refer to TRANSMISSION ASSEMBLY .

**Fig. 33: Oil Pan Torque Sequence**

Courtesy of NISSAN MOTOR CO., U.S.A.

- f. Install rear plate cover.
3. Install oil pan drain plug.
 - Refer to **OIL PAN AND OIL STRAINER** for installation direction of washer.
4. Install in the reverse order of removal after this step.

NOTE: Pour engine oil at least 30 minutes after oil pan is installed.

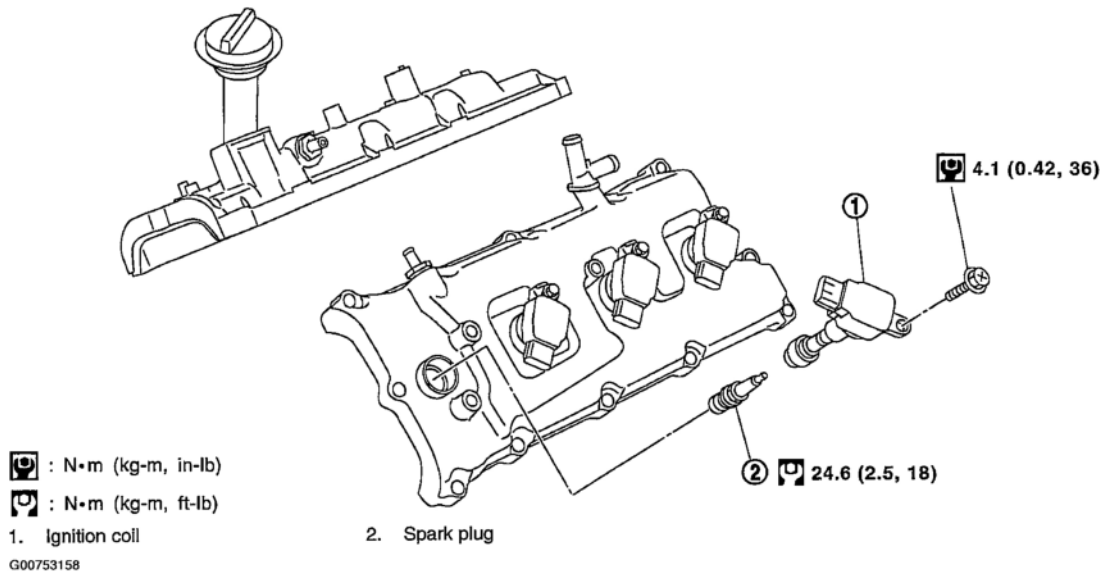
INSPECTION AFTER INSTALLATION

1. Check engine oil level and add engine oil. Refer to **ENGINE OIL** .
2. Start engine, and check there is no leak of engine oil.
3. Stop engine and wait for 15 minutes.
4. Check engine oil level again. Refer to **ENGINE OIL** .

IGNITION COIL

REMOVAL AND INSTALLATION

SEC. 111 • 220

**Fig. 34: Location Of Ignition Coils**

Courtesy of NISSAN MOTOR CO., U.S.A.

REMOVAL

1. Remove engine cover (with power tool), air cleaner cover and battery cover. Refer to **ENGINE ROOM COVER**.
2. Move heater hose and its peripheral parts aside. (No.7 cylinder)
3. Disconnect harness connector from ignition coil.
4. Remove ignition coil.

CAUTION: Do not shock it.

INSTALLATION

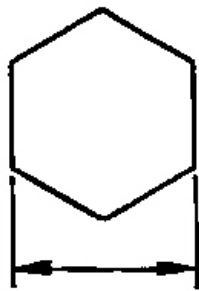
Install in the reverse order of removal.

SPARK PLUG (PLATINUM-TIPPED TYPE)

REMOVAL AND INSTALLATION

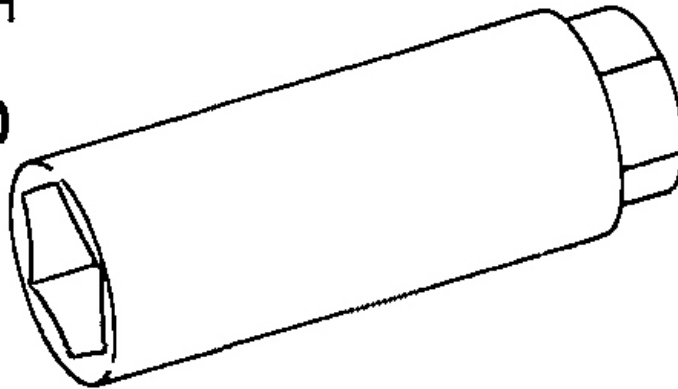
REMOVAL

1. Remove ignition coil. Refer to **IGNITION COIL**.
2. Remove spark plug with the spark plug wrench (commercial service tool).



**16 mm
(0.63 in)**

**Wrench with a magnet
to hold spark plug**



G00753159

Fig. 35: Identifying Spark Plug Wrench
Courtesy of NISSAN MOTOR CO., U.S.A.

INSPECTION AFTER REMOVAL

- Use standard type spark plug for normal condition.

The hot type spark plug is suitable when fouling occurs with the standard type spark plug under conditions such as:

- Frequent engine starts
- Low ambient temperatures

The cold type spark plug is suitable when spark knock occurs with the standard type spark plug under conditions such as:

- Extended highway driving

- Frequent high engine revolution

Make	NGK
Standard type	PLFR5A-11
Hot type	PLFR4A-11
Cold type	PLFR6A-11

G00753160

Fig. 36: Identifying Spark Plug Types

Courtesy of NISSAN MOTOR CO., U.S.A.

Gap (Nominal) : 1.1 mm (0.043 in)

CAUTION:

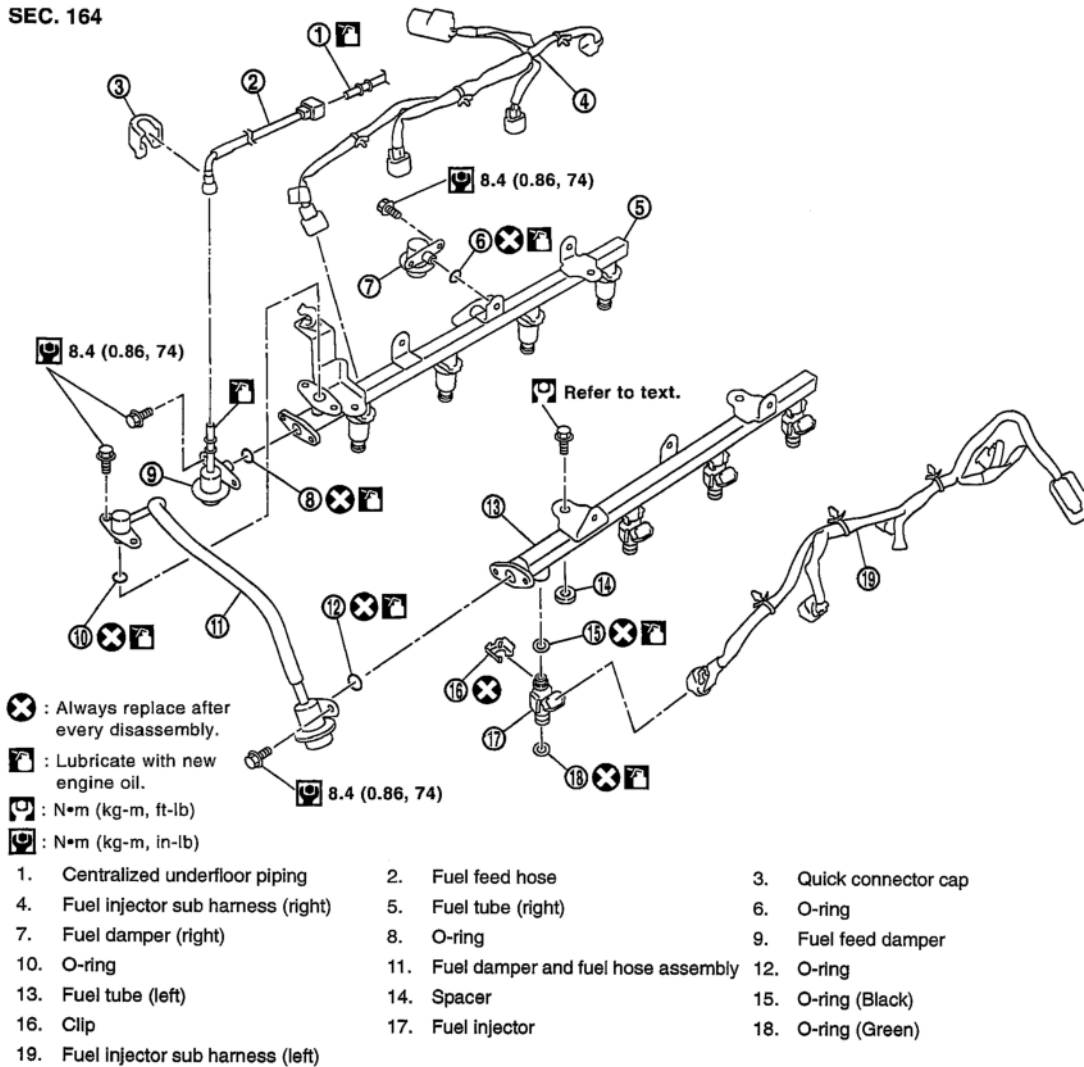
- Do not drop or shock spark plug.
- Do not use a wire brush for cleaning.
- If plug tip is covered with carbon, spark plug cleaner may be used.
Cleaner air pressure: Less than 588 kPa (6 kg/cm², 85 psi)
Cleaning time: Less than 20 seconds
- Checking and adjusting plug gap is not required between change intervals.

INSTALLATION

Install in the reverse order of removal.

Spark plug:**: 24.6 N.m (2.5 kg-m, 18 ft-lb)****FUEL INJECTOR AND FUEL TUBE****REMOVAL AND INSTALLATION**

SEC. 164



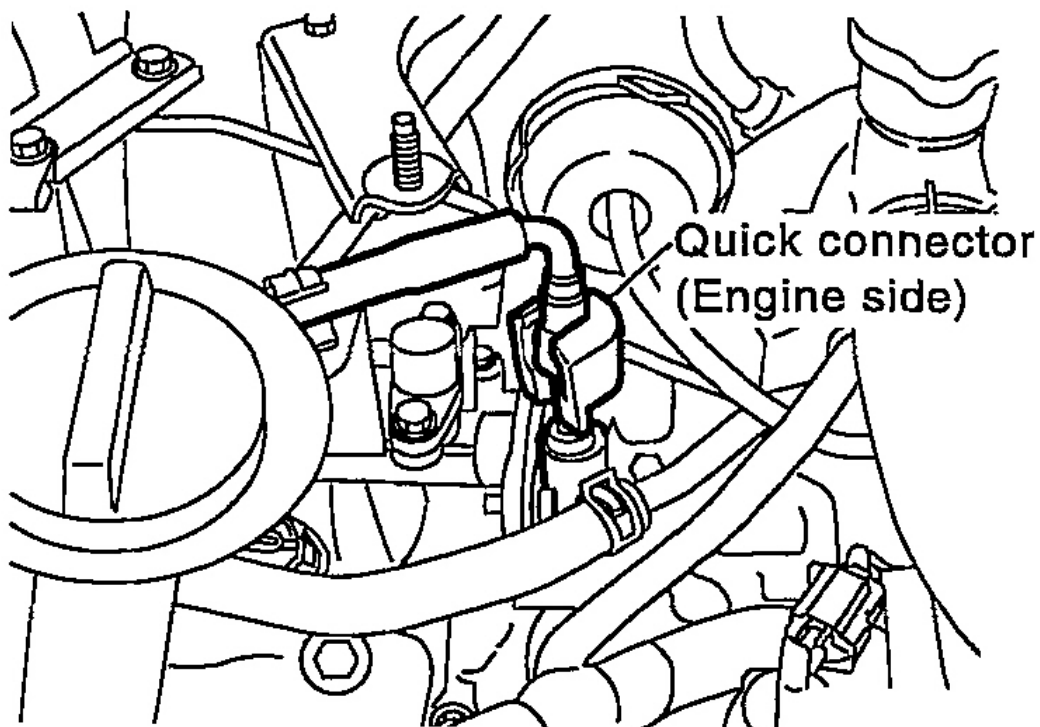
G00753163

Fig. 37: Exploded View Of Fuel Injector And Fuel Tube Assembly
 Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: Do not remove or disassemble parts unless instructed as shown in the figure.

REMOVAL

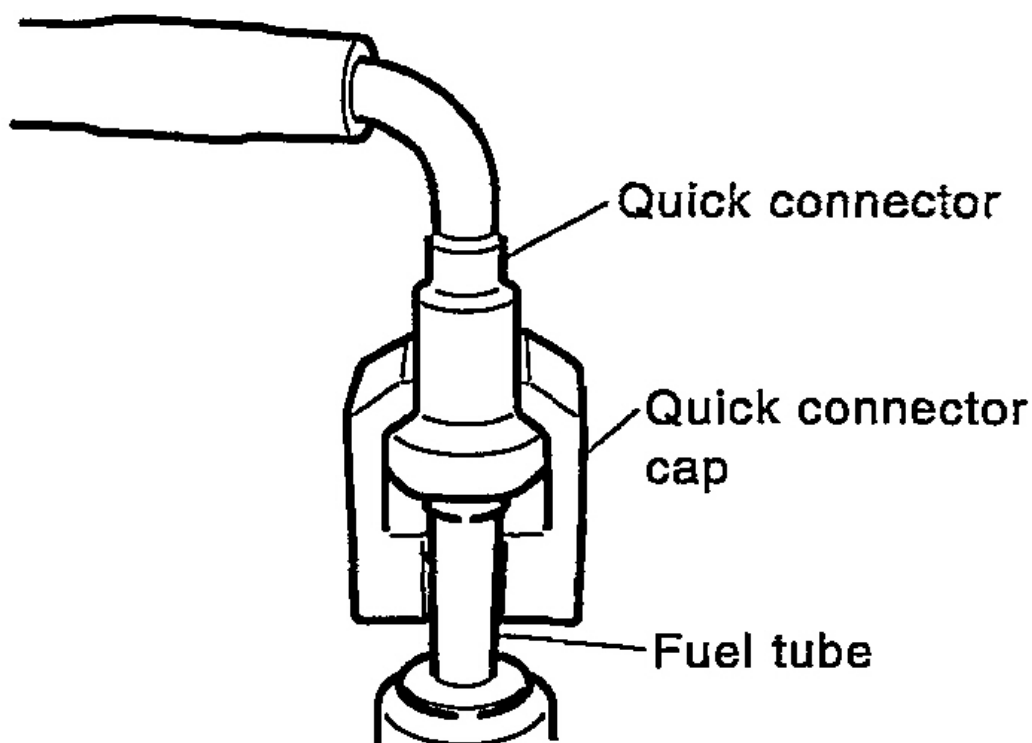
1. Remove engine cover with power tool. Refer to **ENGINE ROOM COVER**.
2. Release fuel pressure. Refer to **FUEL PRESSURE RELEASE**.
3. Disconnect fuel feed hose on engine side as the following: (Excepting to confirm whether or not there is quick connector cap, perform same procedure for the side of centralized under-floor piping as well.)



G00753164

Fig. 38: Disconnecting Fuel Feed Hose On Engine Side
Courtesy of NISSAN MOTOR CO., U.S.A.

- a. Remove quick connector cap from quick connector connection. (engine side only)



G00753165

Fig. 39: Disconnecting Fuel Lines
Courtesy of NISSAN MOTOR CO., U.S.A.

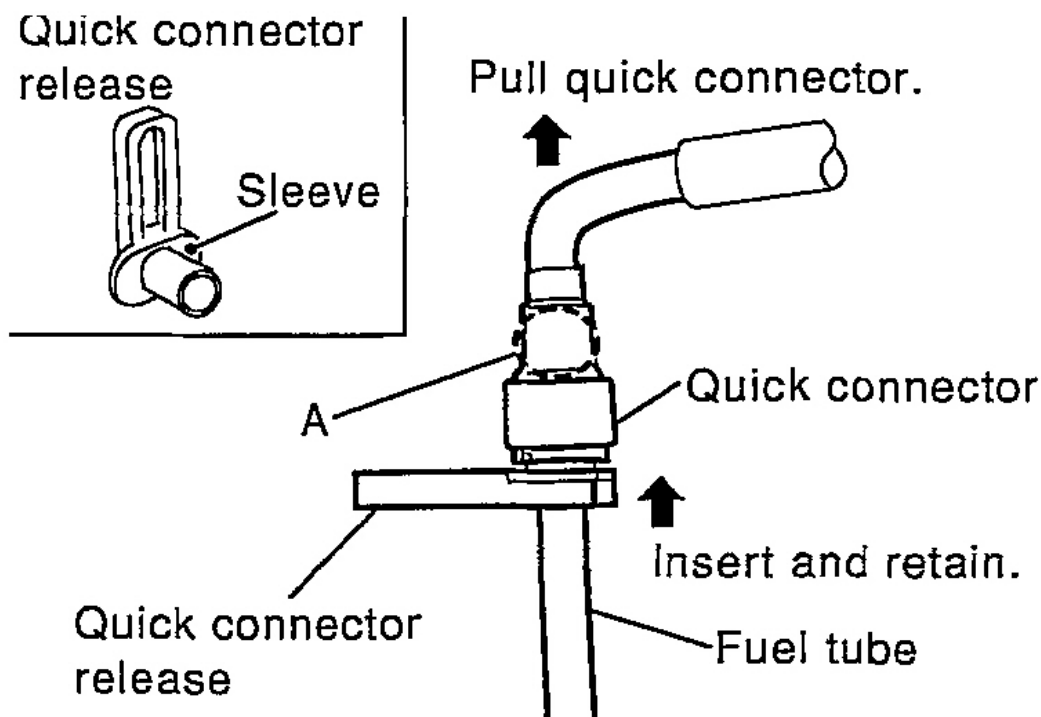
- b. Disconnect quick connector from fuel tube (fuel feed damper) as the following:

CAUTION: Disconnect quick connector by using the quick connector release (SST: J-45488), not by picking out retainer tabs (centralized under-floor piping side).

- I. With the sleeve side of the quick connector release facing quick connector, install the quick connector release onto fuel tube.
- II. Insert the quick connector release into quick connector until sleeve contacts and goes no further. Hold the quick connector release on that position.

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

III. Draw and pull out quick connector straight from fuel tube.



G00753166

Fig. 40: Disconnecting Fuel Lines

Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION:

- Pull quick connector holding "A" position as shown in the figure.
- Do not pull with lateral force applied. O-ring inside quick connector may be damaged.
- Prepare container and cloth beforehand as fuel will leak out.
- Avoid fire and sparks.
- Keep parts away from heat source. Especially, be careful when welding is performed around them.
- Do not expose parts to battery electrolyte or other acids.
- Do not bend or twist connection between quick connector and fuel feed hose during installation/removal.

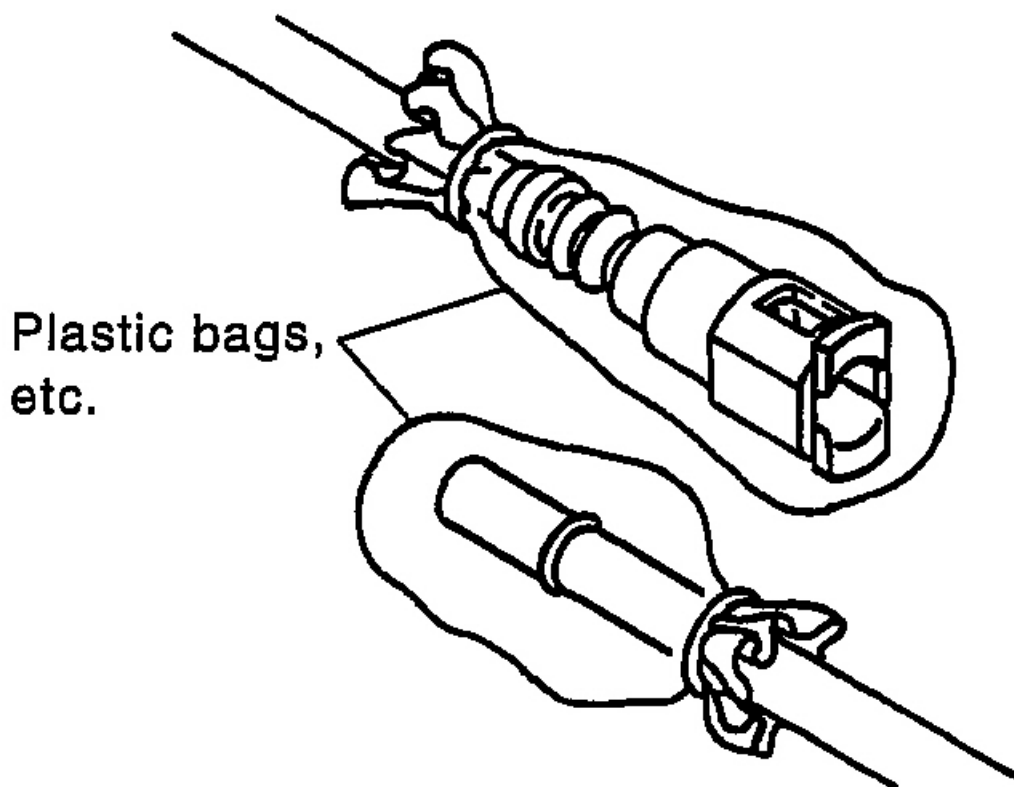
- To keep clean the connecting portion and to avoid damage and foreign materials, cover them completely with plastic bags or something similar.

4. Disconnect fuel damper and fuel hose assembly from fuel tubes (right and left).

CAUTION:

- While hoses are disconnected, plug them to prevent fuel from draining.
- Do not separate fuel damper and fuel hose assembly.

5. Remove intake manifold (upper) with power tool. Refer to INTAKE MANIFOLD.



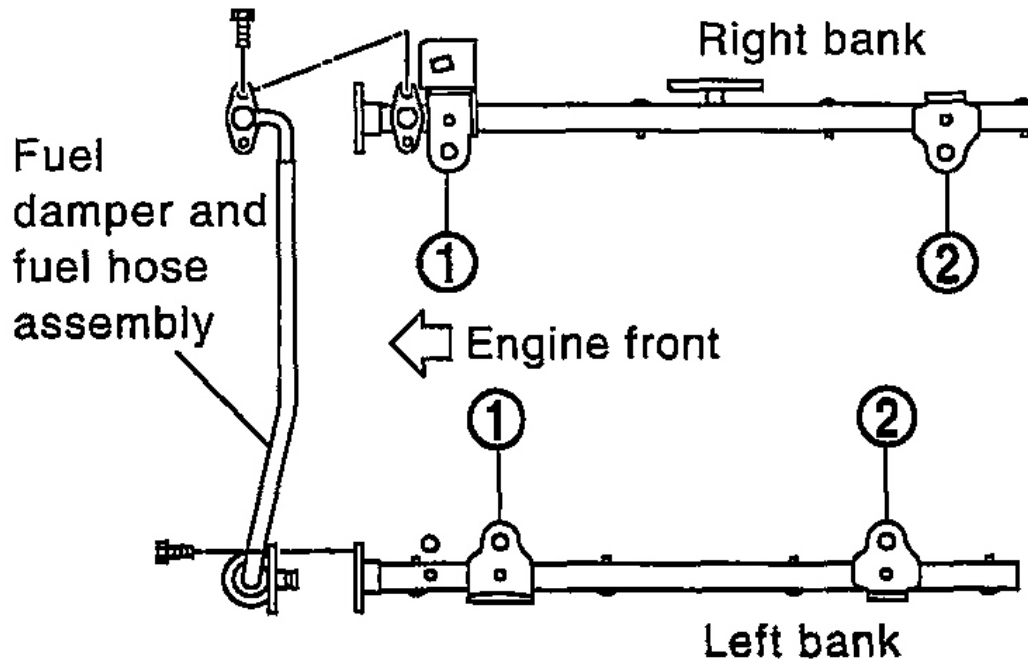
G00753167

Fig. 41: Covering Fuel Line Ends
Courtesy of NISSAN MOTOR CO., U.S.A.

6. Disconnect harness connector from fuel injector.

7. Loosen mounting bolts "2" to "1" as shown in the figure, and remove fuel tube and fuel injector assembly.

CAUTION: Do not tilt it, or remaining fuel in pipes may flow out from pipes.



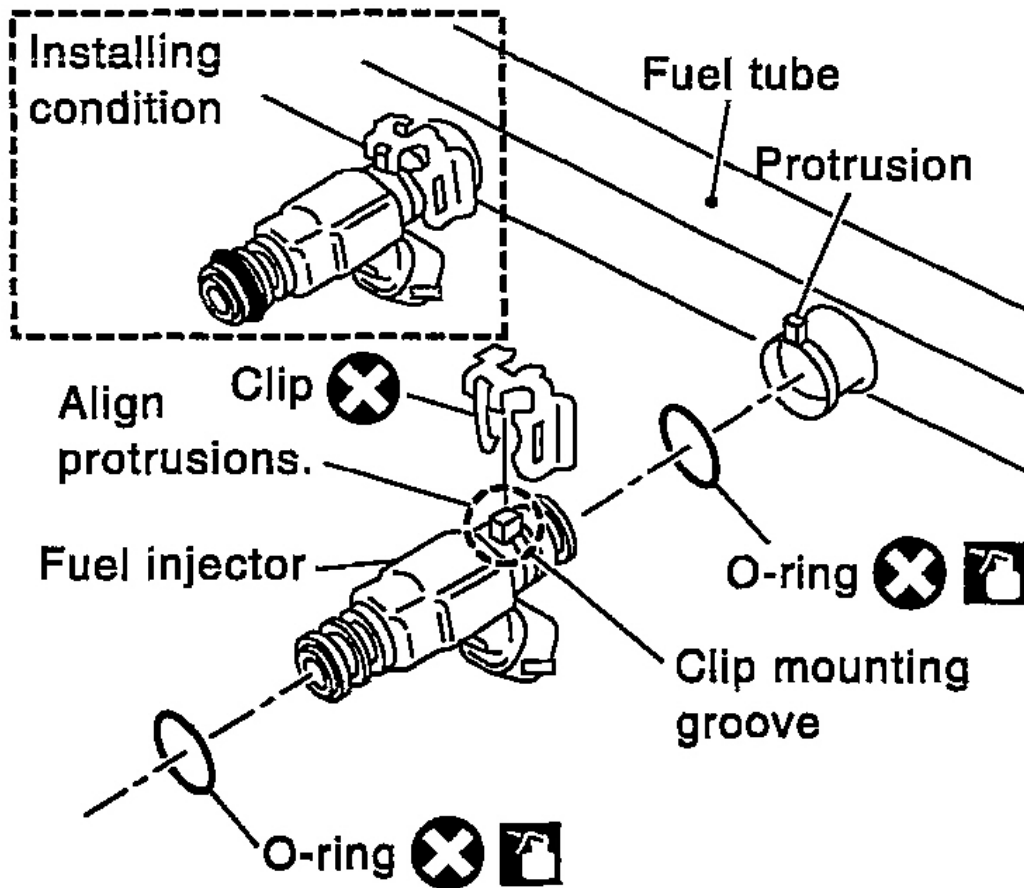
G00753168

Fig. 42: Locating Mounting Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

8. Remove spacers on intake manifold (lower).
9. Remove fuel injector from fuel tube as the following:
 - a. Open and remove clip.
 - b. Remove fuel injector from fuel tube by pulling straight.

CAUTION:

- Be careful with remaining fuel that may go out from fuel tube.
- Be careful not to damage injector nozzles during removal.
- Do not bump or drop fuel injectors.
- Do not disassemble fuel injectors.



 : Always replace after every disassembly.

 : Lubricate with new engine oil.

G00753169

Fig. 43: Removing Injector

Courtesy of NISSAN MOTOR CO., U.S.A.

10. Remove fuel damper (right) and fuel feed damper.

INSTALLATION

1. Install fuel damper (right) and fuel feed damper.

- When handling O-rings, be careful of the following;

CAUTION:

- Handle O-ring with bare hands. Do not wear gloves.
- Lubricate O-ring with new engine oil.
- Do not clean O-ring with solvent.
- Make sure that O-ring and its mating part are free of foreign material.
- When installing O-ring, be careful not to scratch it with tool or fingernails. Also be careful not to twist or stretch O-ring. If O-ring was stretched while it was being attached, do not insert it quickly into fuel tube.
- Insert O-ring straight into fuel tube. Do not decenter or twist it.

- Insert fuel damper (right) and fuel feed damper straight into fuel tube (right).
- Tighten mounting bolts evenly in turn.
- After tightening mounting bolts, make sure that there is no gap between flange and fuel tube (right).

2. Install O-rings to fuel injector paying attention to the items below.

CAUTION:

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

Fuel tube side : Black

Nozzle side : Green

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

3. Install fuel injector to fuel tube as the following:

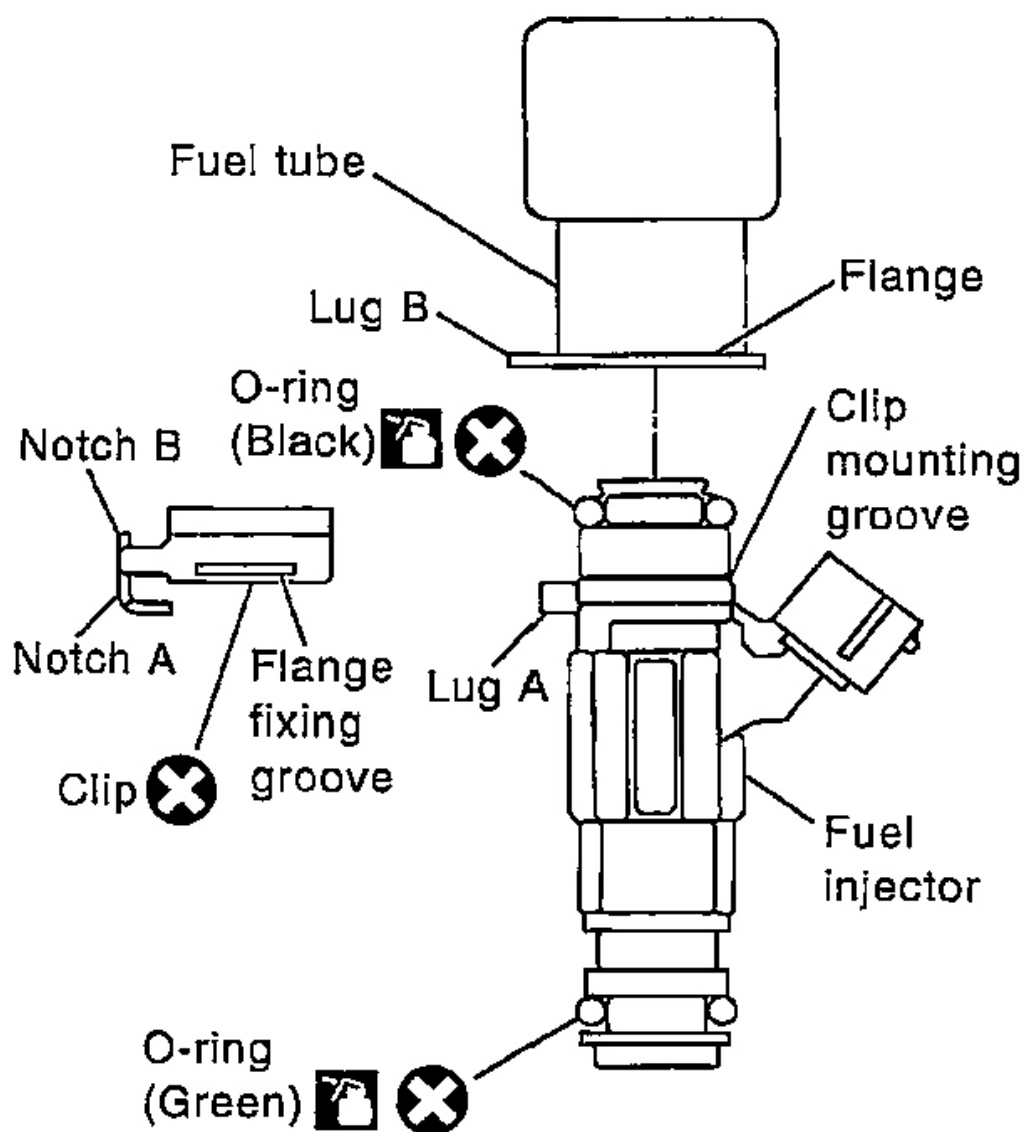
- a. Insert clip into clip mounting groove on fuel injector.
 - Insert clip so that lug "A" of fuel injector matches notch "A" of the clip.

CAUTION:

- Do not reuse clip. Replace it with a new one.
- Be careful to keep clip from interfering with O-ring. If

interference occurs, replace O-ring.

- b. Insert fuel injector into fuel tube with clip attached.
 - Insert it while matching it to the axial center.
 - Insert fuel injector so that lug "B" of fuel tube matches notch "B" of the clip.
 - Make sure that fuel tube flange is securely fixed in flange fixing groove on clip.
- c. Make sure that installation is complete by checking that fuel injector does not rotate or come off.
 - Make sure that protrusions of fuel injectors are aligned with cutouts of clips after installation.



: Lubricate with new engine oil.



: Always replace after every disassembly.

G00753170

Fig. 44: Installing Injector

Courtesy of NISSAN MOTOR CO., U.S.A.

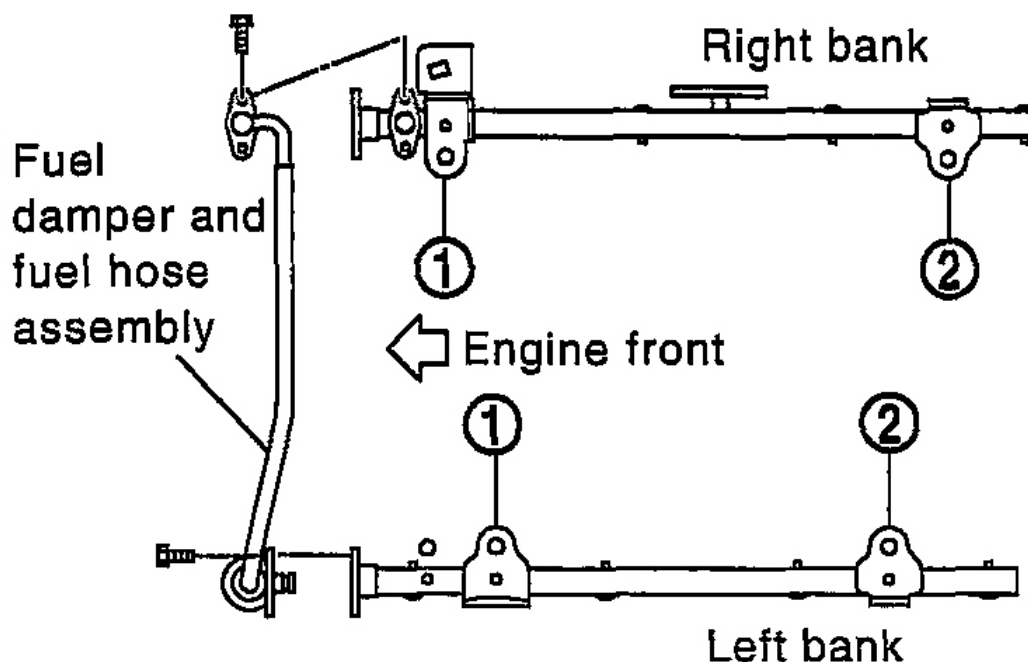
4. Install spacers on intake manifold (lower).
5. Install fuel tube and fuel injector assembly to intake manifold.

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

- Tighten mounting bolts "1" to "2" as shown in the figure and in two steps.

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

2nd step : 23.5 N.m (2.4 kg-m, 17 ft-lb)



G00753171

Fig. 45: Locating Mounting Bolts

Courtesy of NISSAN MOTOR CO., U.S.A.

6. Connect fuel feed hose on engine side as the following: (Excepting to confirm whether or not there is quick connector cap, perform same procedure for the side of centralized under-floor piping as well.)
 - a. Make sure no foreign substances are deposited in and around fuel tube (fuel feed damper) and quick connector, and no damage on them.
 - b. Thinly apply new engine oil around fuel tube from tip end to spool end.

- c. Align center to insert quick connector straightly into fuel tube.
- Insert fuel tube into quick connector until top spool is completely inside quick connector, and 2nd level spool exposes right below quick connector.
 - Hold "A" position as shown in the figure when inserting fuel tube into quick connector.

CAUTION:

- Carefully align center to avoid inclined insertion to prevent damage to O-ring inside quick connector.
- Insert until you hear a "click" sound and actually feel the engagement.
- To avoid misidentification of engagement with a similar sound, be sure to perform the next step.

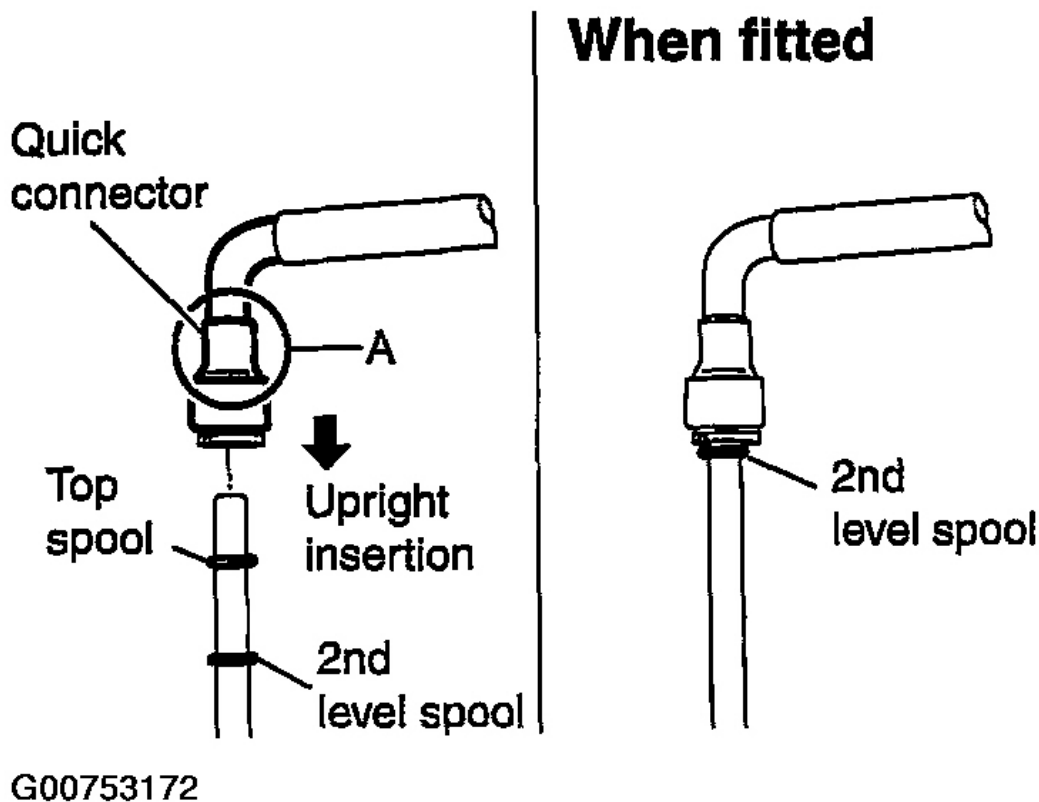
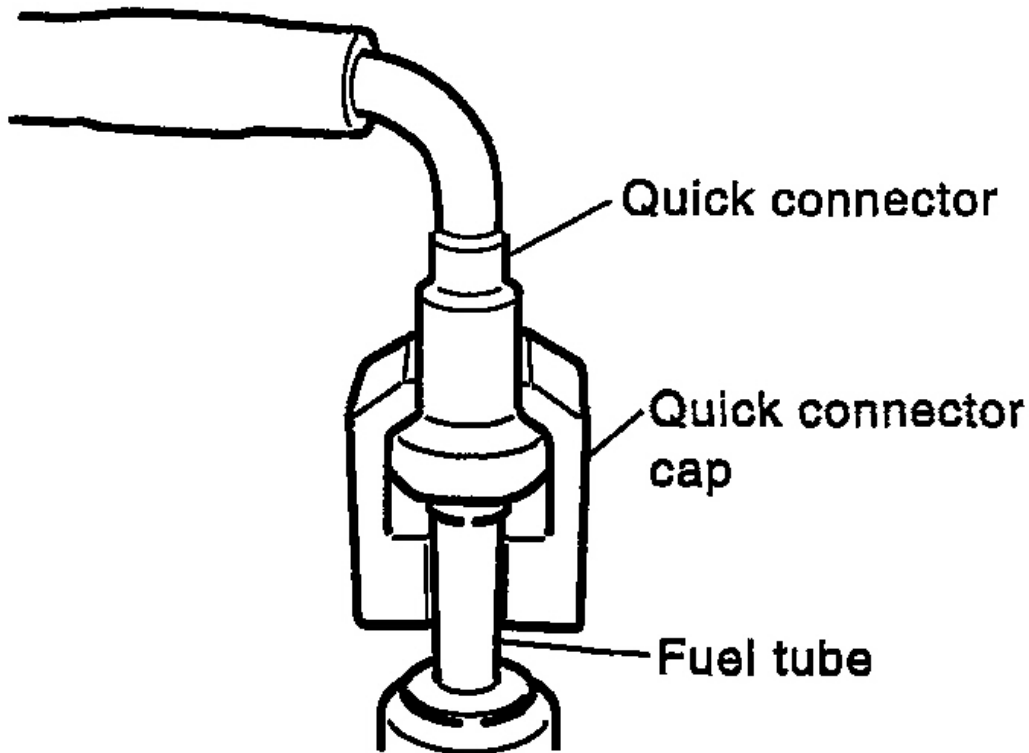


Fig. 46: Connecting Fuel Line (1 Of 2)
 Courtesy of NISSAN MOTOR CO., U.S.A.

- d. Pull quick connector by hand holding "A" position. Make sure it is completely engaged (connected) so that it does not come out from fuel tube.

- e. Install quick connector cap on quick connector connection. (on engine side only).
- f. Install fuel feed hose to hose clamps.



G00753173

Fig. 47: Connecting Fuel Line (2 Of 2)
Courtesy of NISSAN MOTOR CO., U.S.A.

- 7. Install in the reverse order of removal.

INSPECTION AFTER INSTALLATION

Check on Fuel Leakage

- 1. Turn ignition switch "ON" (with engine stopped). With fuel pressure applied to fuel piping, check for fuel leakage at connection points.

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

2. Start engine. With engine speed increased, check again for fuel leakage at connection points.

CAUTION: Do not touch engine immediately after stopped, as engine becomes extremely hot.

ROCKER COVER

REMOVAL AND INSTALLATION

SEC. 111•118

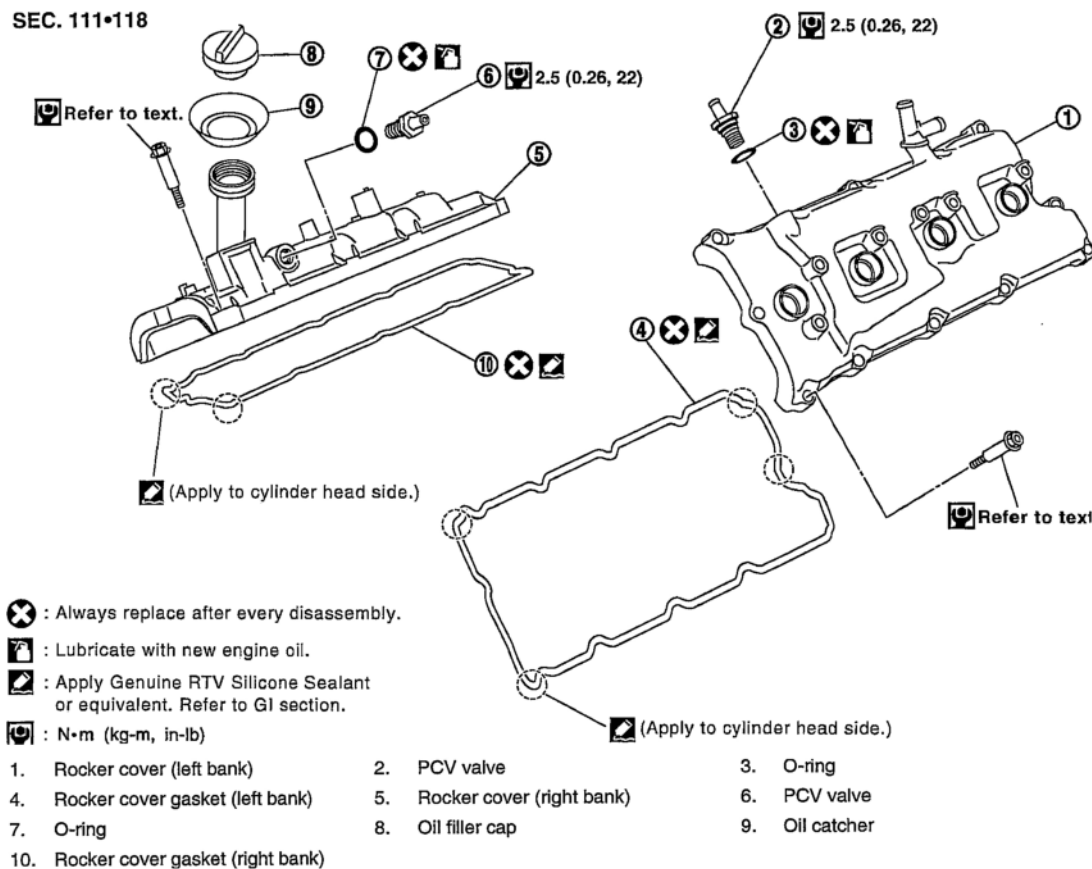


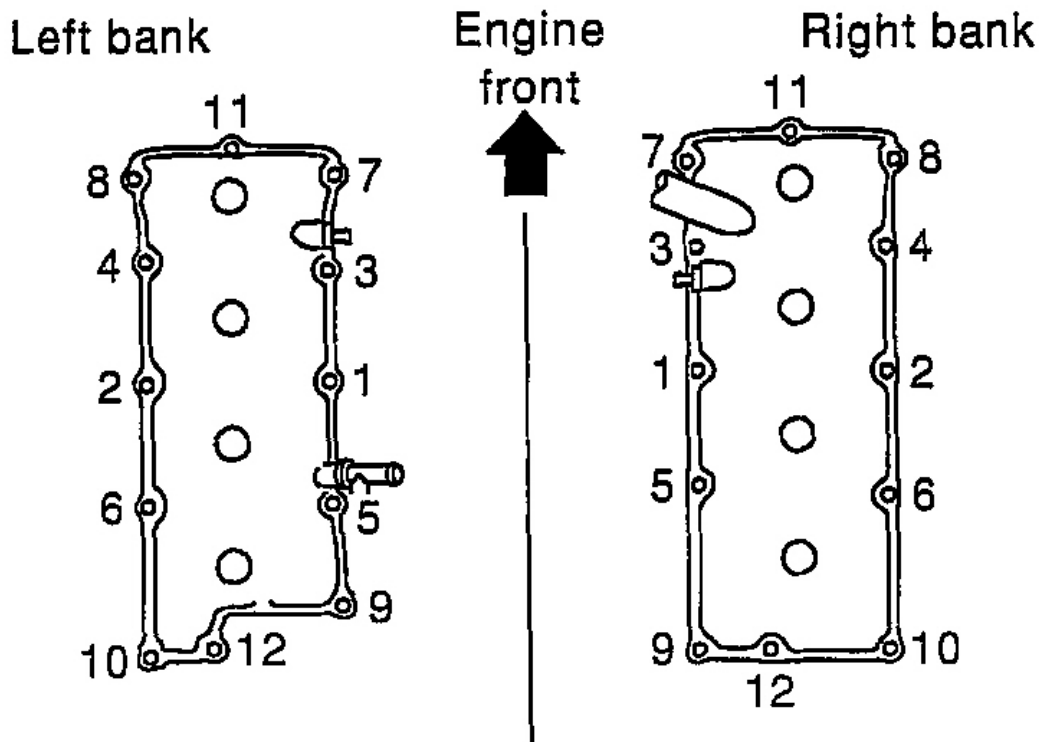
Fig. 48: View Of Rocker Cover Assemblies
 Courtesy of NISSAN MOTOR CO., U.S.A.

REMOVAL

1. Refer to the followings for removal works related to left-bank.
 - a. Remove engine cover (with power tool) and air cleaner cover. Refer to **ENGINE ROOM COVER**.
 - b. Remove air duct and air cleaner case assembly. Refer to **AIR CLEANER AND AIR DUCT**.
 - c. Remove bracket (installation parts for No.6 camshaft bracket).

- d. Move harness on upper rocker cover and its peripheral aside.
 - e. Remove ignition coil. Refer to **IGNITION COIL** .
 - f. Remove PCV valve hose from PCV valve.
2. Refer to the followings for removal works related to right-bank.
 - a. Remove engine cover (with power tool) and battery cover. Refer to **ENGINE ROOM COVER** .
 - b. Move harness on upper rocker cover and its peripheral aside.
 - c. Remove ignition coil. Refer to **IGNITION COIL** .
 - d. Remove PCV valve hose from PCV valve.
 3. Loosen bolts in reverse order shown in the figure (with power tool).

CAUTION: Do not hold oil filler neck (right bank) not to damage it.



G00753175

Fig. 49: Rocker Cover Torque Sequence
 Courtesy of NISSAN MOTOR CO., U.S.A.

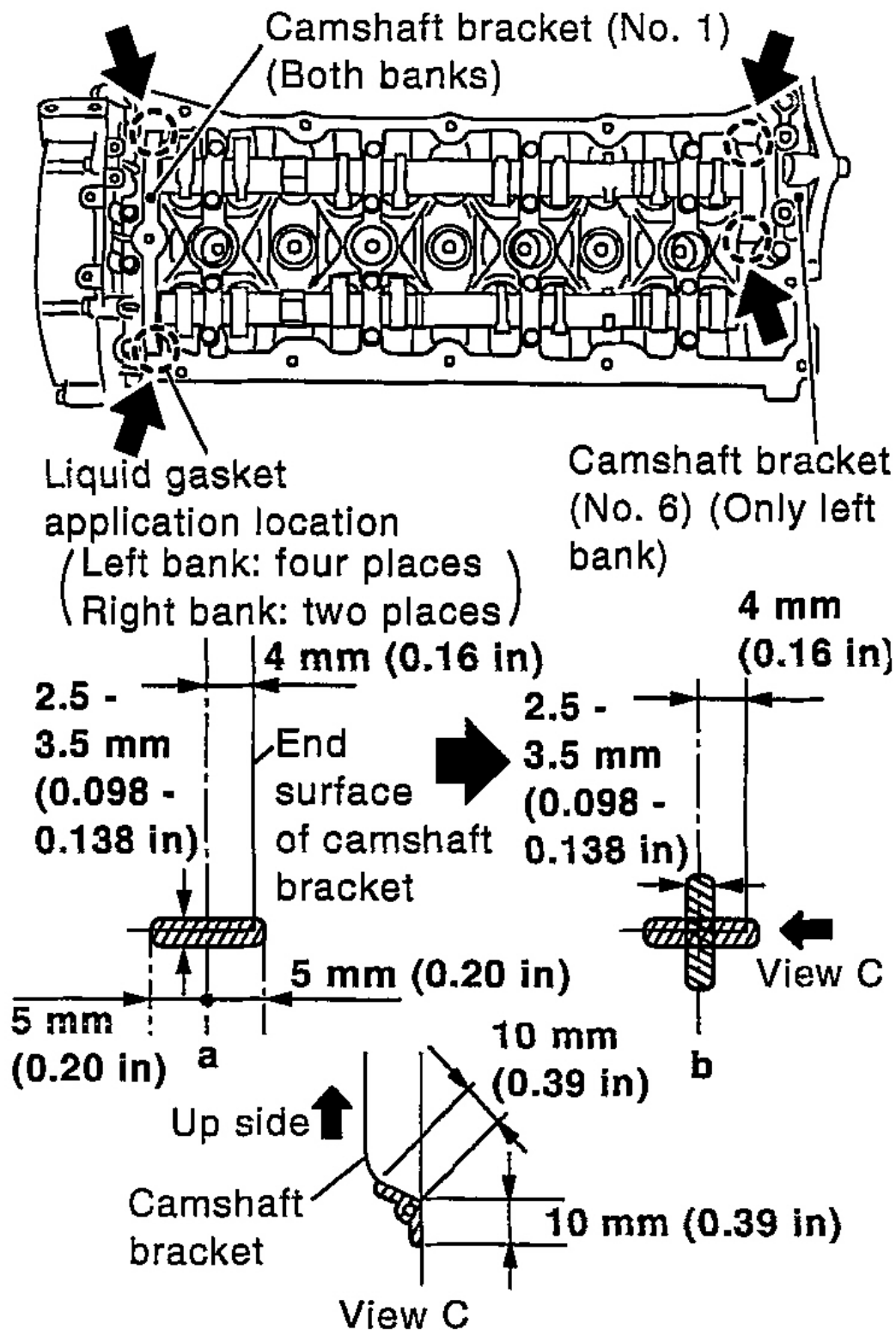
INSTALLATION

1. Apply liquid gasket to joint part of cylinder head and camshaft bracket following the below steps.

NOTE: Illustration shows an example of left-bank side (zoomed in shows No.1 camshaft bracket). Apply only to No.1 camshaft bracket for right-bank side.

- a. Refer to illustration "a" to apply liquid gasket to joint part of No.1 and No.6 camshaft bracket and cylinder head. See **Fig. 48**.
- b. Refer to illustration "b" to apply liquid gasket in 90 degrees to illustration "a". See **Fig. 50**.

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



G00753176

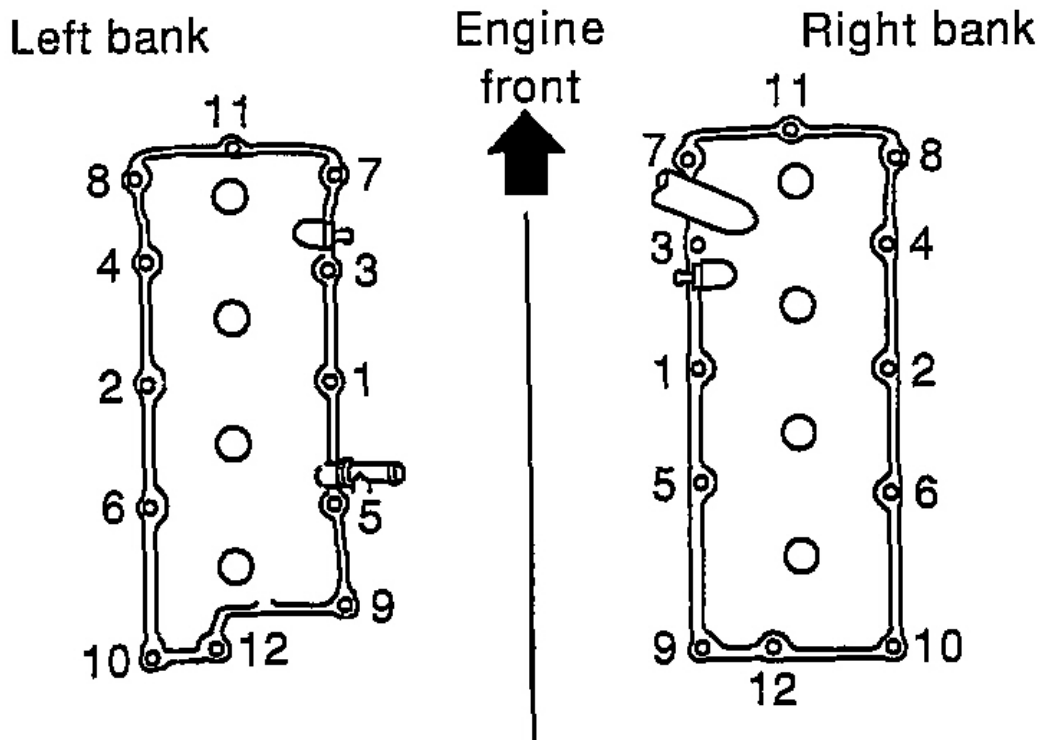
Fig. 50: Example Of Left-Bank Cylinder Head
 Courtesy of NISSAN MOTOR CO., U.S.A.

2. Install rocker cover.
 - Check if rocker cover gasket is not dropped from installation groove of rocker cover.
3. Tighten bolts in two steps separately in order numbers in illustration.

CAUTION: Do not hold oil filler neck (right bank) not to damage it.

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

2nd step: 8.4 N.m (0.85 kg-m, 74 in-lb)



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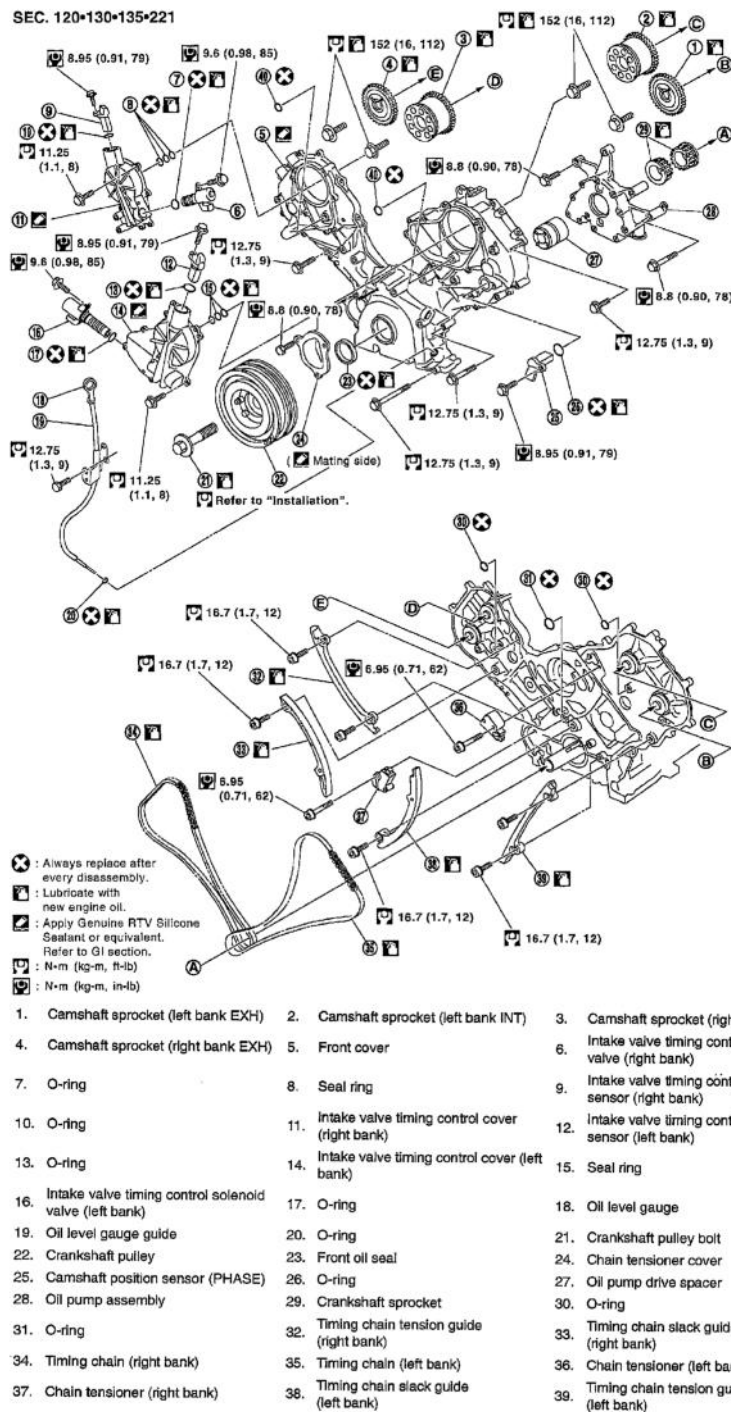
Fig. 51: Rocker Cover Torque Sequence
 Courtesy of NISSAN MOTOR CO., U.S.A.

4. Install in the reverse order of removal.

TIMING CHAIN

REMOVAL AND INSTALLATION

SEC. 120•130•135•221



G00753178

Fig. 52: Exploded View Of Timing Chain
 Courtesy of NISSAN MOTOR CO., U.S.A.

REMOVAL

1. Remove engine assembly from vehicle. Refer to **ENGINE ASSEMBLY**.
2. Remove the following components and related parts:
 - Drive belt auto tensioner and idler pulley; Refer to **Drive Belt Auto Tensioner and Idler Pulley**.
 - Thermostat housing and hose; Refer to **THERMOSTAT AND WATER CONTROL VALVE**.
 - Ignition coil; Refer to **IGNITION COIL**.
 - Rocker cover; Refer to **ROCKER COVER**.
3. If necessary, remove intake valve timing control position sensor (right and left) and camshaft position sensor (PHASE) from intake valve timing control cover and front cover.

CAUTION:

- Handle components and parts carefully to avoid dropping and shocks.
- Do not disassemble.

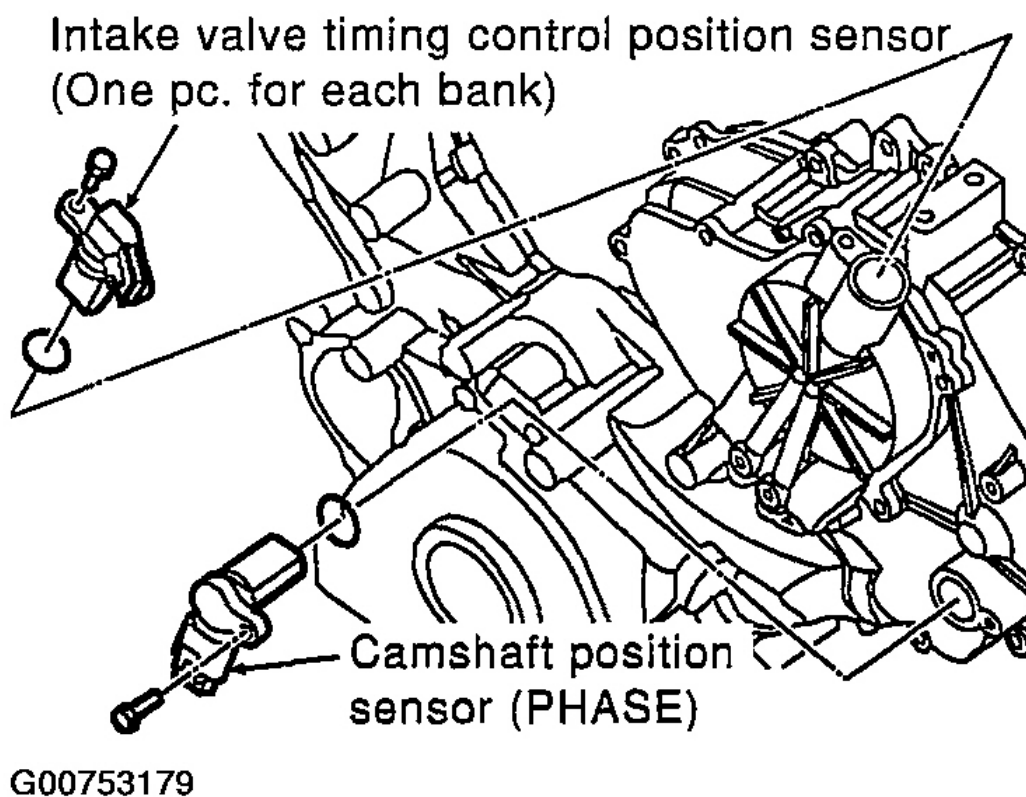


Fig. 53: Locating Intake Valve Timing Control Position Sensor & Camshaft Position Sensor (PHASE)

Courtesy of NISSAN MOTOR CO., U.S.A.

4. If necessary, remove intake valve timing control solenoid valve from intake valve timing control cover.

CAUTION:

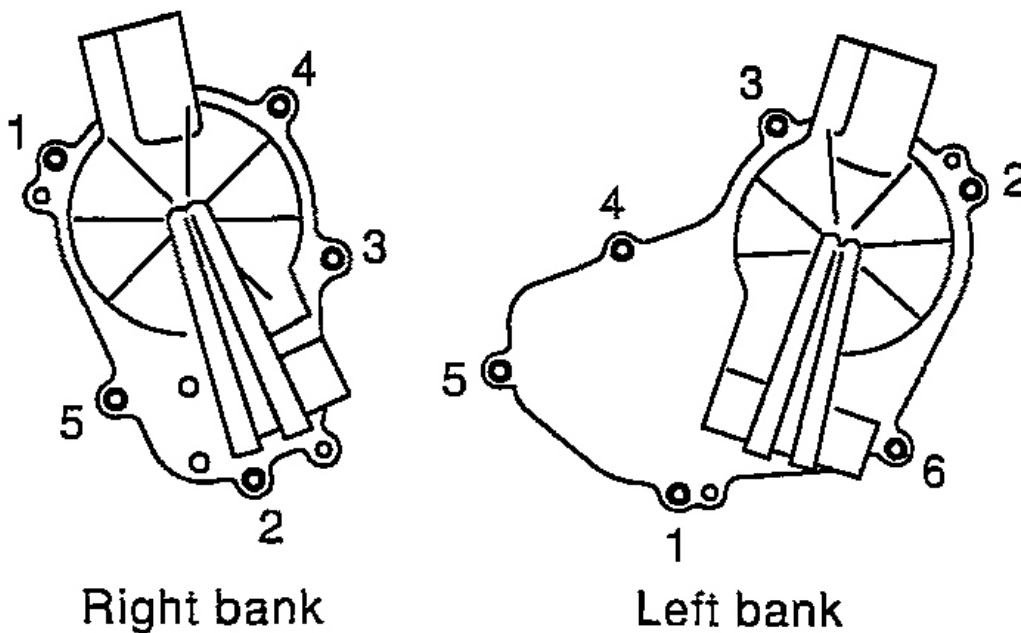
- Handle components and parts carefully to avoid dropping and shocks.
- Do not disassemble.

5. Remove intake valve timing control cover as follows:

- Loosen and remove fixing bolts in reverse order of that shown in figure.
- Use the seal cutter [SST: KV10111100 (J37228)] or the equivalent to cut liquid gasket for removal.

CAUTION:

- Be careful not to damage mating surfaces.
- Pull out cover keeping levelness without an angle, as inner part of cover is engaged with the center of camshaft sprocket (INT).

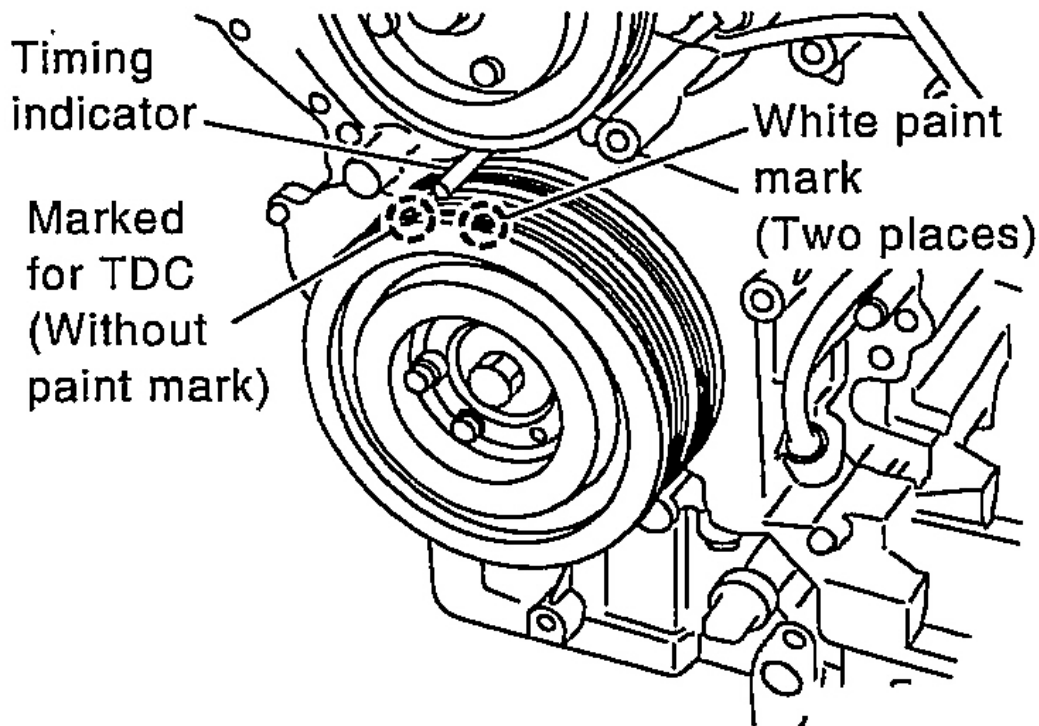


G00753180

Fig. 54: Intake Valve Timing Control Cover Torque Sequences

Courtesy of NISSAN MOTOR CO., U.S.A.

6. Obtain compression TDC of No. 1 cylinder as follows:
 - a. Turn crankshaft pulley clockwise to align the TDC identification notch (without paint mark) with timing indicator on front cover.

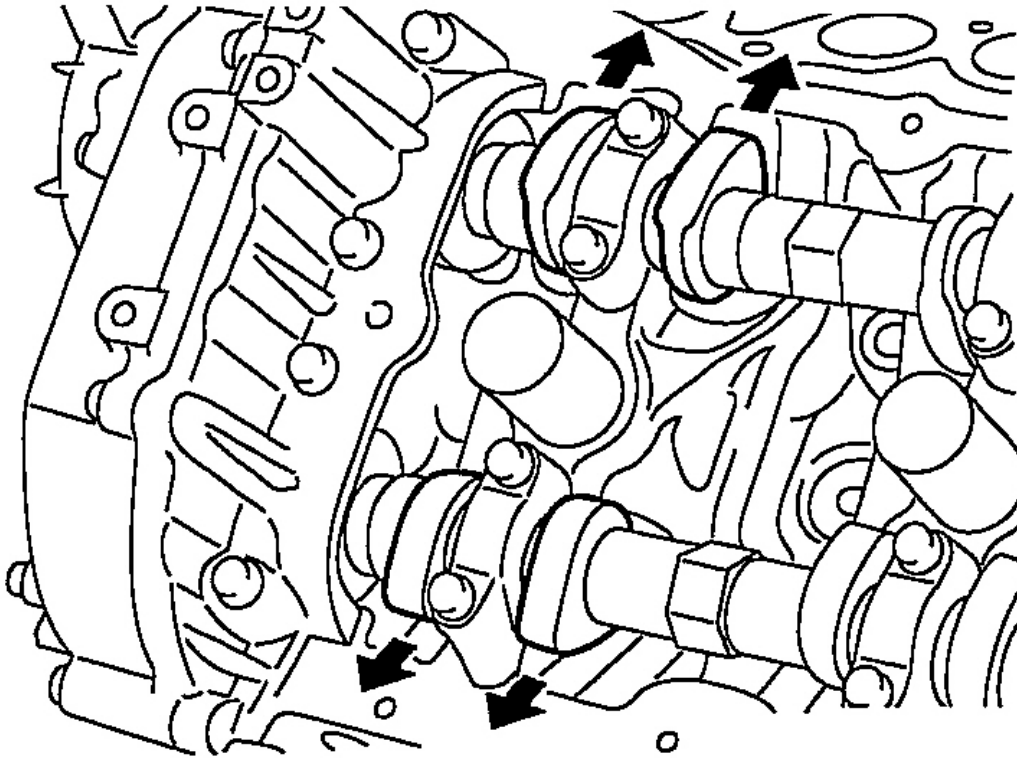


G00753181

Fig. 55: Locating TDC

Courtesy of NISSAN MOTOR CO., U.S.A.

- b. At this time, make sure the both intake and exhaust cam noses of No.1 cylinder (top front on left bank) face outside.
 - If they do not face outside, turn crankshaft pulley by 360 degrees once more.
7. Remove rear plate cover. Refer to **OIL PAN AND OIL STRAINER**.



G00753182

Fig. 56: Positioning Camshafts in TDC Position

Courtesy of NISSAN MOTOR CO., U.S.A.

8. Set the ring gear stopper (SST).
9. Remove crankshaft pulley as follows:
 - a. Loosen crankshaft pulley bolt.
 - b. Pull crankshaft pulley with both hands to remove it.

CAUTION:

- Do not remove fixing bolts. Keep loosened fixing bolts in place to protect removed crankshaft pulley from dropping.
- Do not remove balance weight (inner hexagon bolt) at the front of crankshaft pulley.

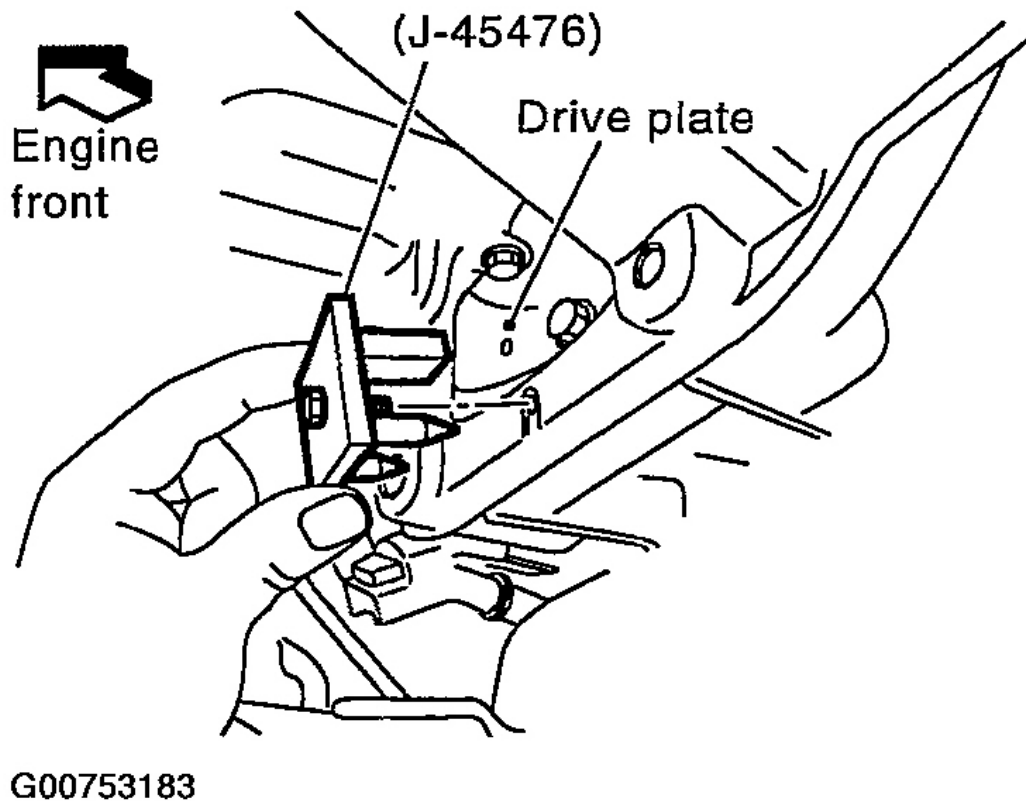


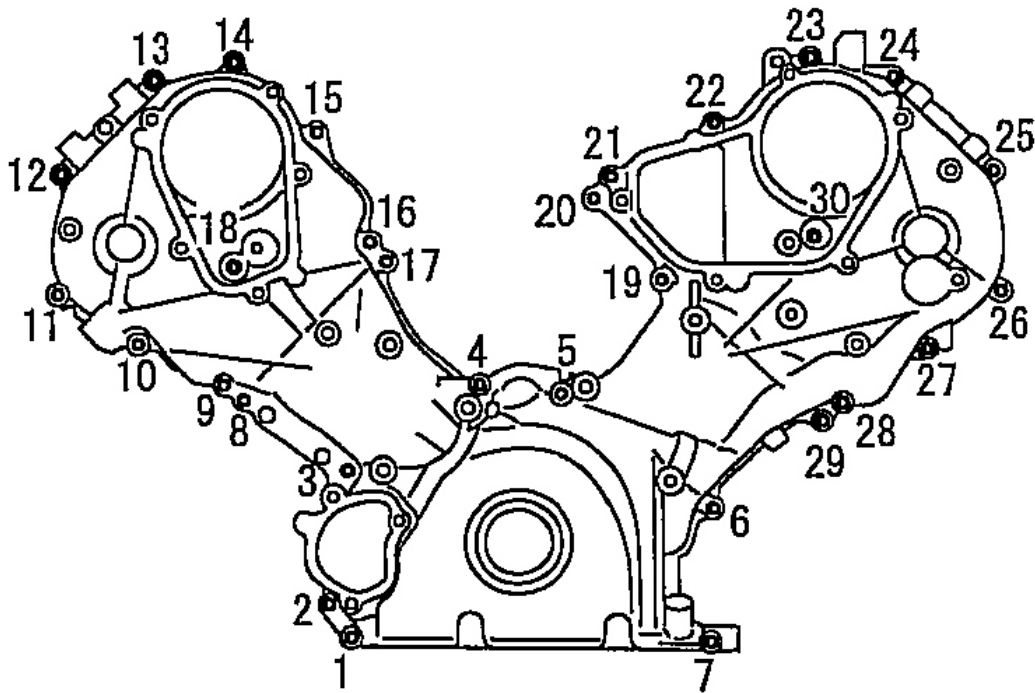
Fig. 57: Identifying Ring Gear Stopper (J-45476)
Courtesy of NISSAN MOTOR CO., U.S.A.

10. Remove oil pan and oil strainer. Refer to **OIL PAN AND OIL STRAINER** .
11. Remove front cover as follows:
 - a. Loosen and remove fixing bolts in reverse order of that shown in figure.
 - b. Use the seal cutter [SST: KV10111100 (J37228)] or the equivalent to cut liquid gasket for removal.

CAUTION: Be careful not to damage mating surfaces.

12. Remove front oil seal from front cover using suitable tool.

CAUTION: Be careful not to damage front cover.



G00753184

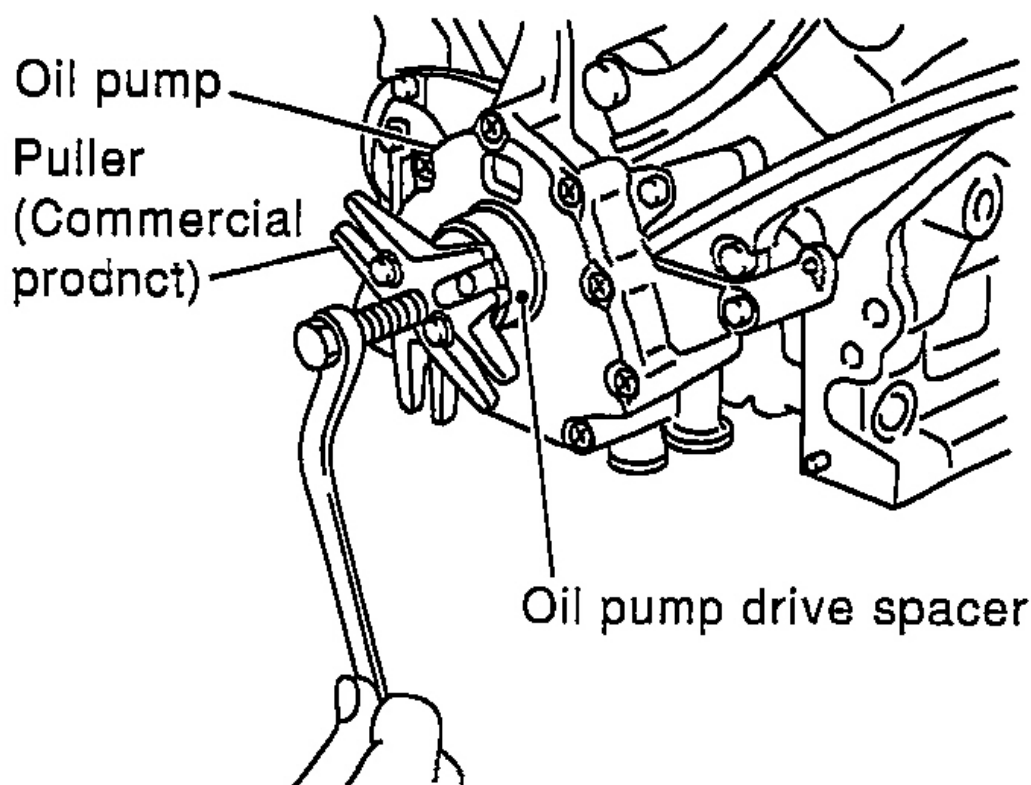
Fig. 58: Front Cover Torque Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

13. Remove oil pump drive spacer.

- Install bolts into two bolt holes [M6 x pitch 1.0 mm (0.04 in)] on front surface. Using a small puller, pull spacer off from crankshaft.

NOTE: The center-to-center dimension between the two bolt holes is 33 mm (1.30 in).

14. Remove oil pump. Refer to **OIL PUMP** .



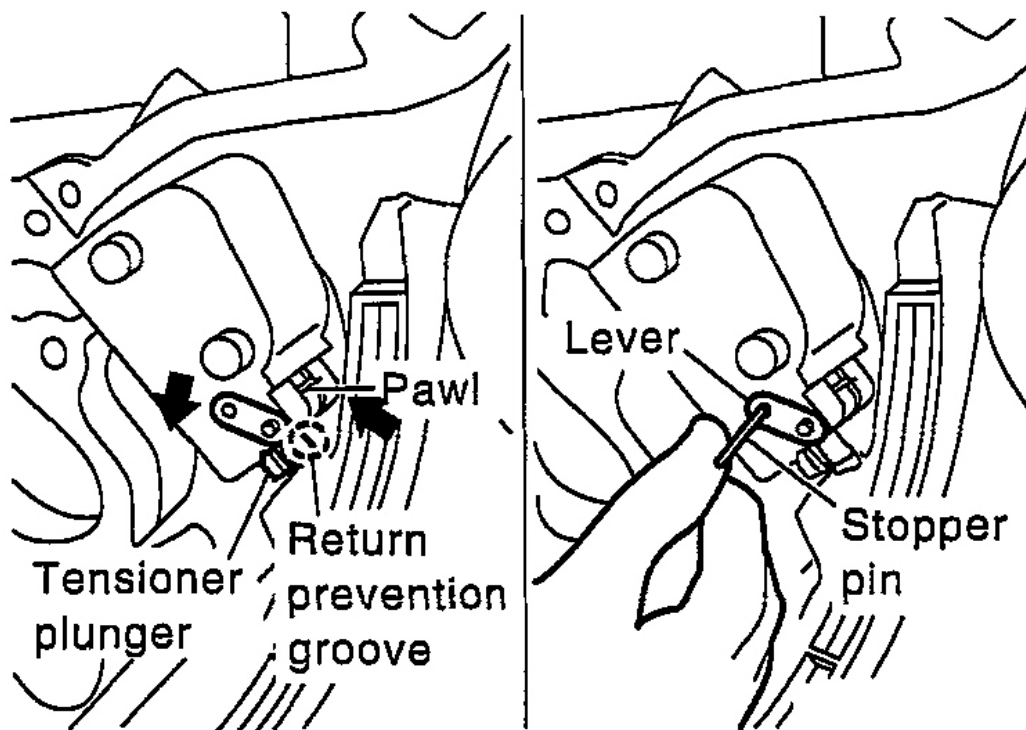
G00753185

Fig. 59: Removing Oil Pump Drive Spacer
Courtesy of NISSAN MOTOR CO., U.S.A.

15. Remove chain tensioner on left bank.

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

- a. Press tab in the direction of arrow (or turn lever in the direction of arrow) to unlock the locking with the groove that stops tensioner plunger from returning.
 - Lightly press tensioner plunger to release the tension of spring for this operation.
- b. Push in tensioner plunger to align the hole on lever and that on pump main body.
 - Pushing in tensioner plunger too far does not allow the holes to align. Therefore, push in the plunger to the degree at which the start of stopper groove and tab engages.



G00753186

Fig. 60: Locking Tensioner

Courtesy of NISSAN MOTOR CO., U.S.A.

- c. Insert a stopper pin [hard wire with approx. 0.5 mm (0.020 in) diameter or a similar tool] to fix plunger. With the plunger fixed, remove chain tensioner.
16. Remove chain tensioner guide and slack guide.
17. Remove timing chain and crankshaft sprocket.
18. With hexagonal part of camshaft locked with wrench, loosen bolts securing camshaft sprocket to remove camshaft sprocket.

CAUTION: To avoid interference between valves and pistons, do not turn crankshaft or camshaft with timing chain is disconnected.

19. Using the same procedure as for left bank, remove timing chain and associated parts on right side.

INSPECTION AFTER REMOVAL

Check for cracks and any excessive wear at link plates. Replace chain if necessary .

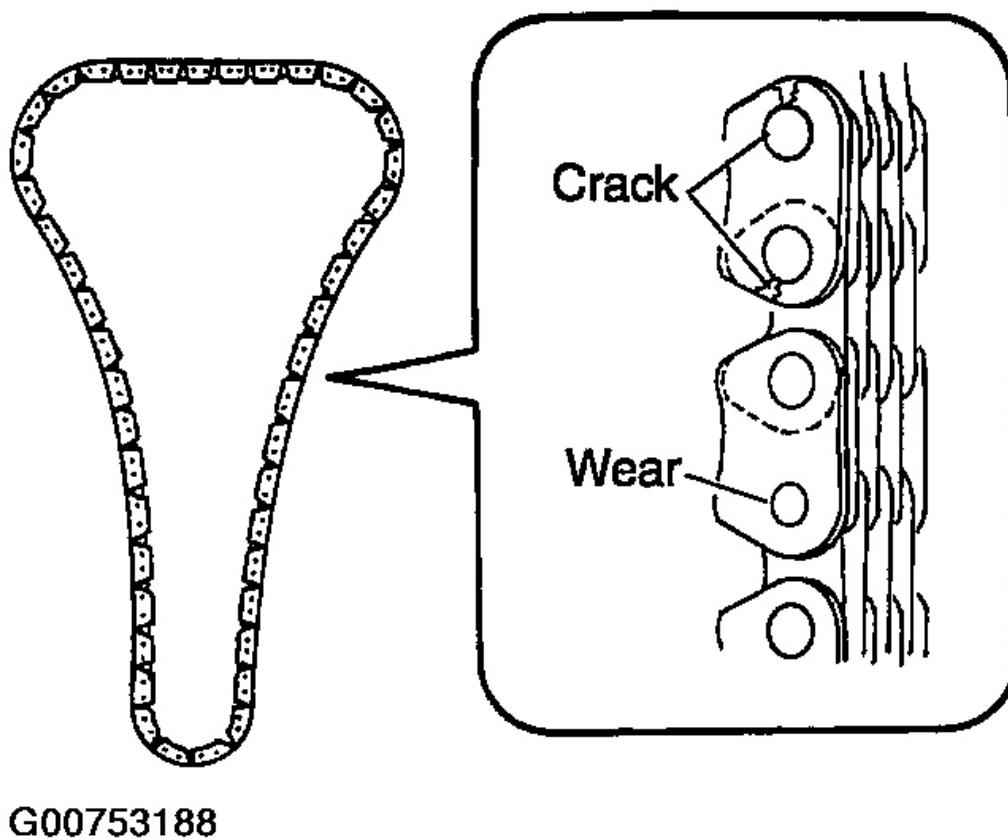
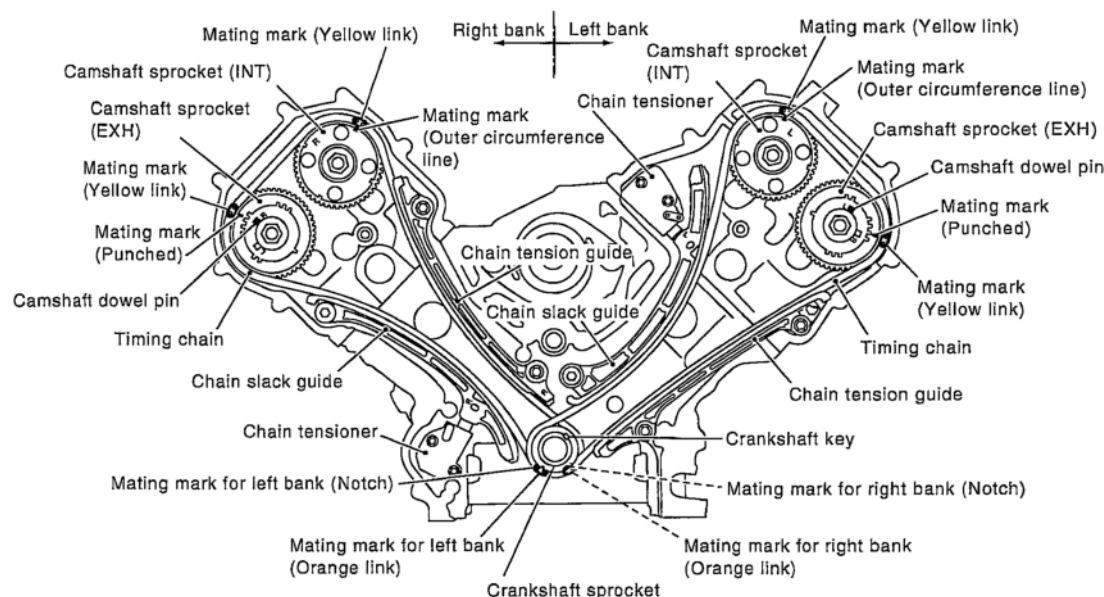


Fig. 61: Checking Timing Chain For Wear
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION



G00753189

Fig. 62: Location Of Mating Marks

Courtesy of NISSAN MOTOR CO., U.S.A.

NOTE:

- The above figure shows the relationship between the mating 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.

Parts with an identification mark:

- Camshaft sprocket (INT)
- Dowel pin groove of camshaft sprocket (EXH) (camshaft sprocket is same part both banks)
- Chain tension guide
- Chain slack guide
- Because of parallel manufacture, there are two types of mark (link colors) for timing chain.
- To install timing chain and associated parts, start with those on right bank. The procedure for installing parts on left bank is omitted because it is the same as that for installation on right bank.

1. Check that crankshaft key and dowel pin of each camshaft are facing in the direction indicated.

NOTE:

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

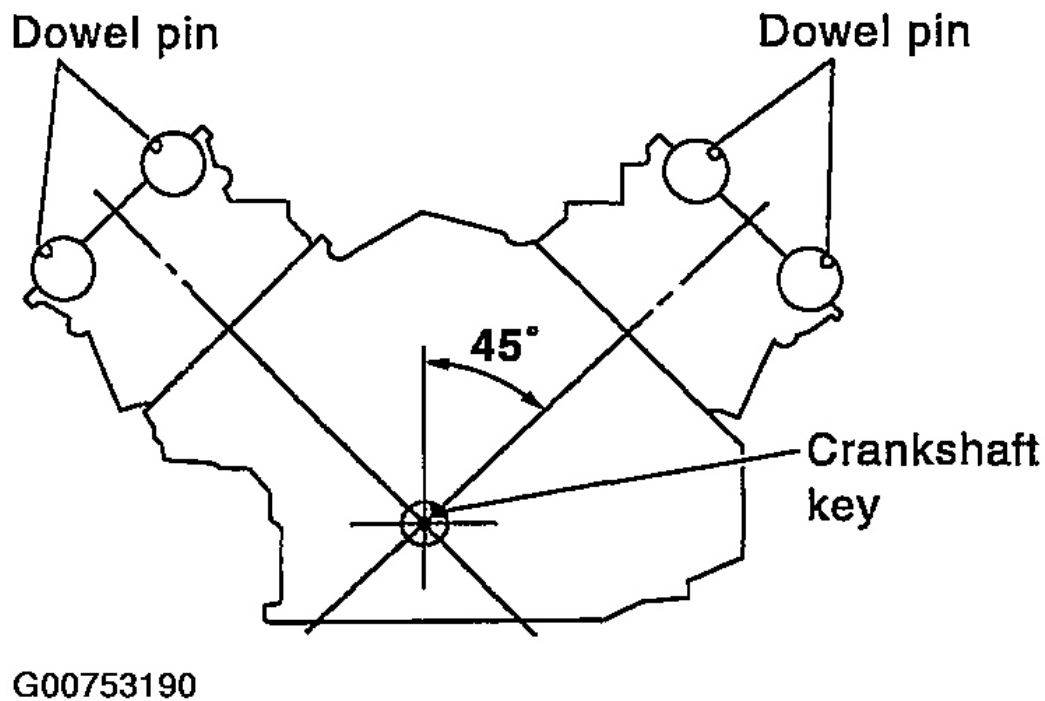


Fig. 63: Checking Crankshaft Key Position
Courtesy of NISSAN MOTOR CO., U.S.A.

2. Install camshaft sprockets.

- Install onto correct side by checking with identification mark on surface.
- Install exhaust-side camshaft sprocket by selectively using the groove of dowel pin according to the bank. (Common part used for both banks.)
- Lock the hexagonal part of camshaft in the same way as for removal, and tighten fixing bolts.

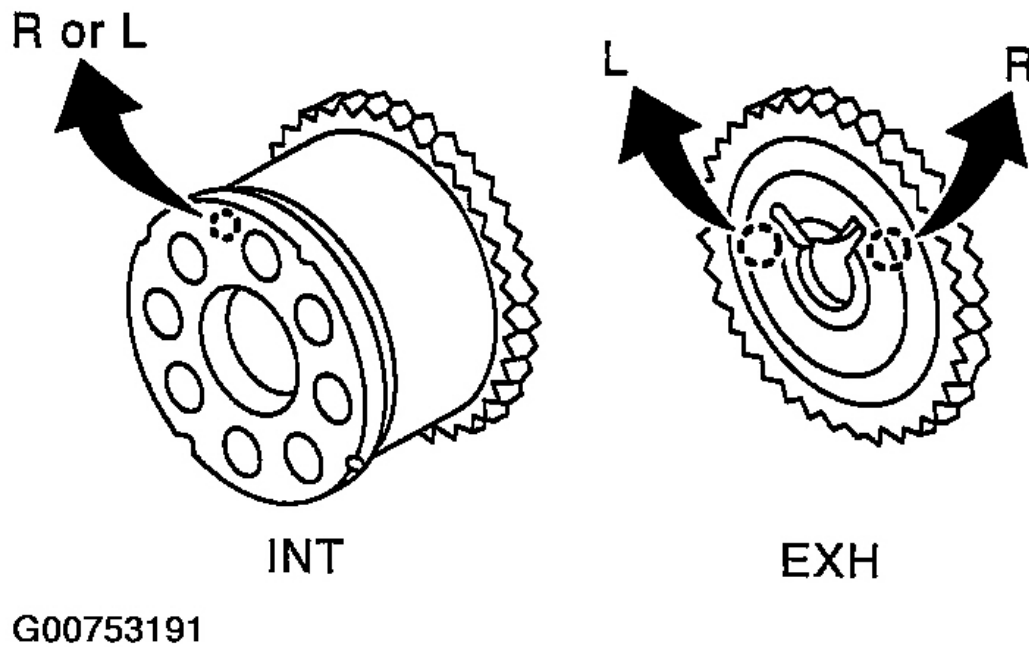


Fig. 64: Placing Camshaft Sprockets

Courtesy of NISSAN MOTOR CO., U.S.A.

3. Install crankshaft sprockets for both banks.
 - Install each crankshaft sprocket so that its flange side (the larger diameter side without teeth) faces in the direction shown in figure.

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

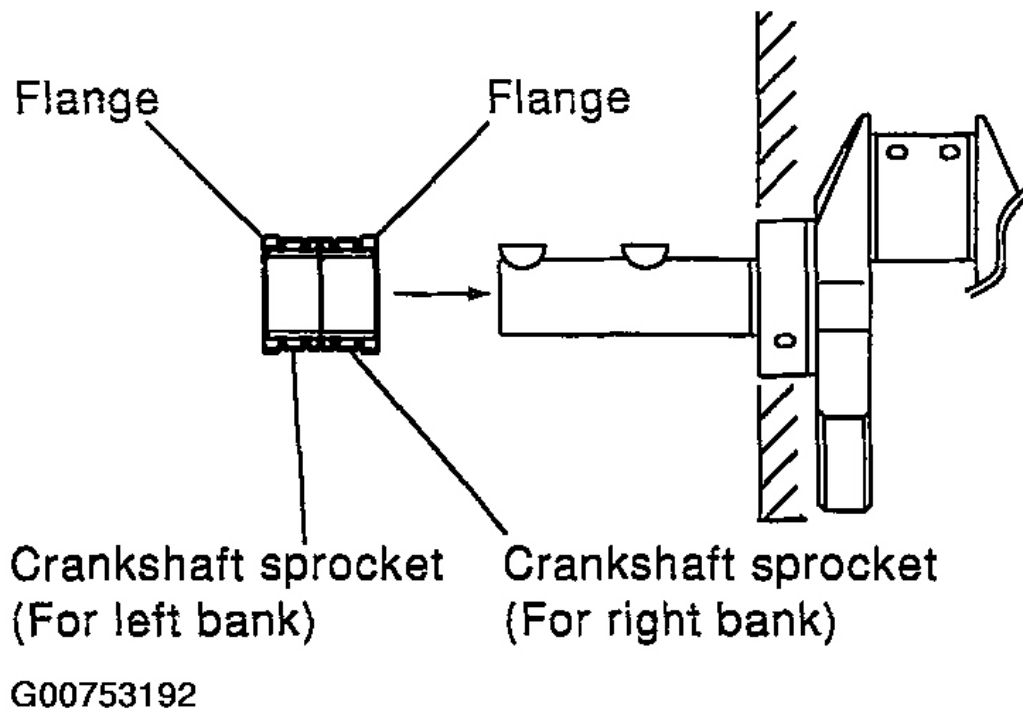


Fig. 65: Installing Crankshaft Sprocket
 Courtesy of NISSAN MOTOR CO., U.S.A.

4. Install timing chains and associated parts.

- Align the mating mark on each sprocket and the timing chain for installation. See **Fig. 62**.

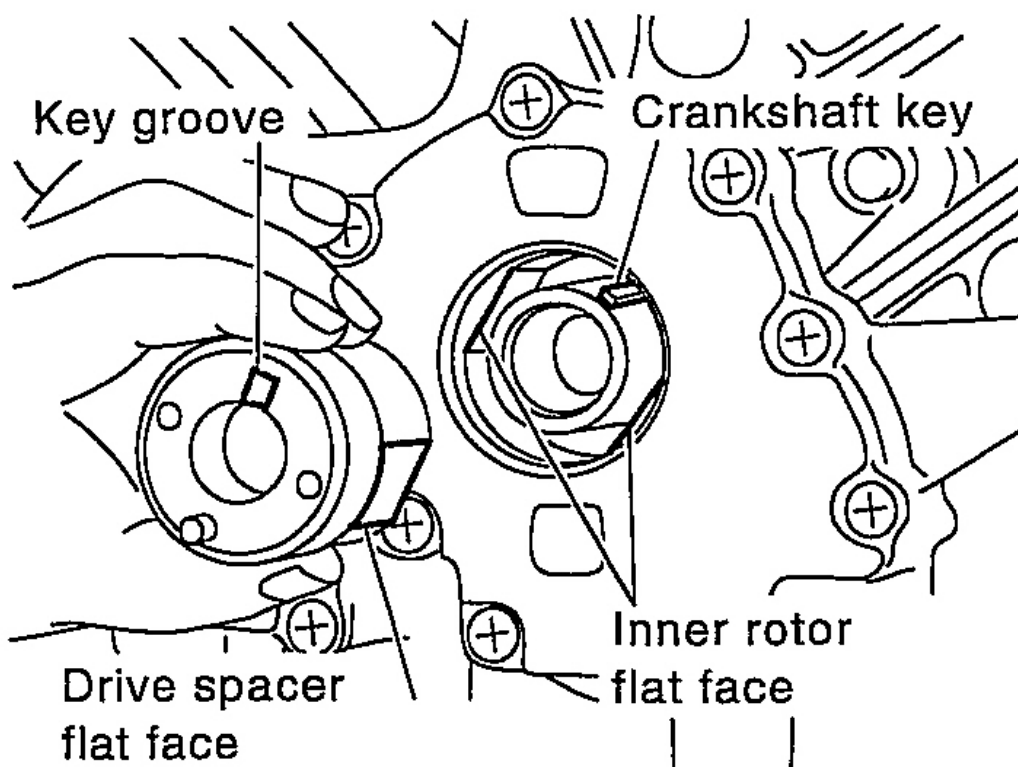
NOTE: Before installing chain tensioner, it is possible to change the position of mating mark on timing chain for that on each sprocket for alignment.

CAUTION: For the above reason, after the mating marks are aligned, keep them aligned by holding them with a hand.

- Install chain slack guides and chain tension guides onto correct side by checking with identification mark on surface.
- Install chain tensioner with plunger fixed as described in its removal.

CAUTION: Before and after the installation of chain tensioner, make sure that the mating mark on timing chain is not out of alignment.

- After installing chain tensioner, remove the stopper pin to release tensioner. Check that tensioner is released.
 - To avoid chain-link skipping of timing chain, never move crankshaft or camshafts until front cover is installed.
5. In the same way as for right bank, install timing chain and associated parts on left side.
 6. Install oil pump assembly.
 7. Install oil pump drive spacer as follows:
 - a. Insert oil pump drive spacer according to the directions of crankshaft key and the two flat surfaces of oil pump inner rotor.
 - If the positional relationship does not allow the insertion, rotate oil pump inner rotor with a finger to allow the spacer.
 - b. After confirming that the position of each part is in correct condition to allow for the spacer, force fit the spacer by lightly tapping with a plastic hammer until it contacts and does not go further.



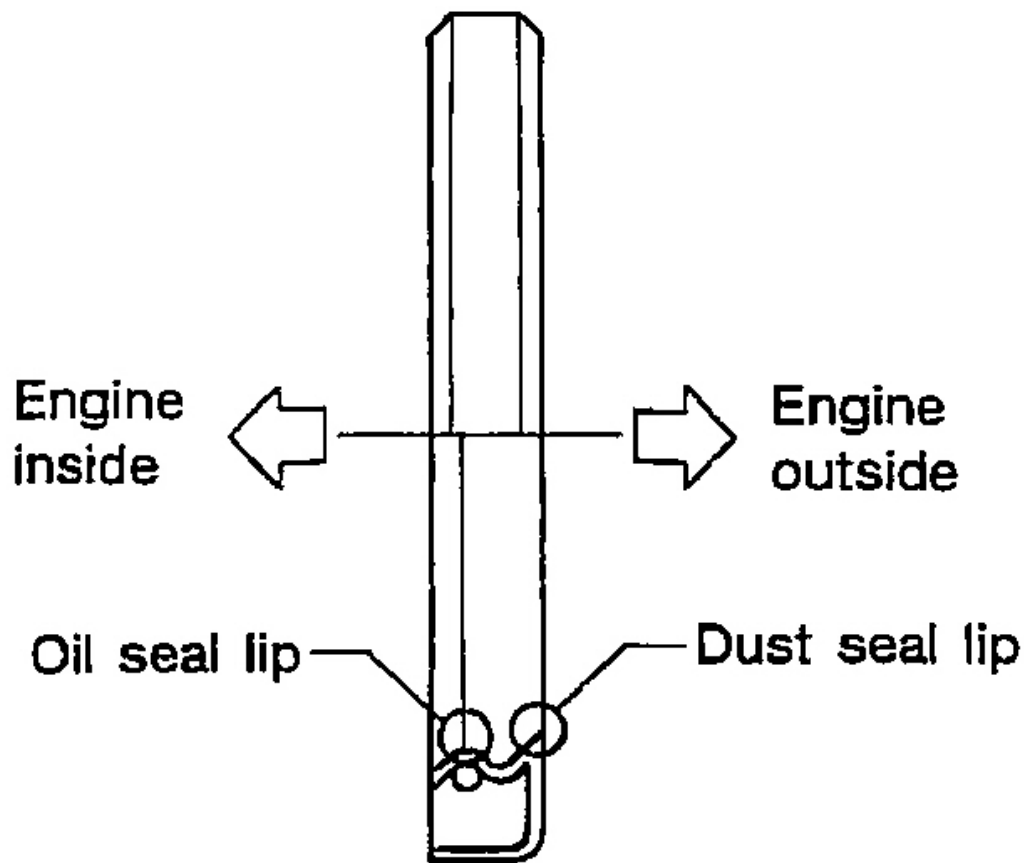
G00753194

Fig. 66: Installing oil pump drive spacer

Courtesy of NISSAN MOTOR CO., U.S.A.

8. Install front oil seal onto front cover.
 - Install new oil seal in the direction shown in the figure.

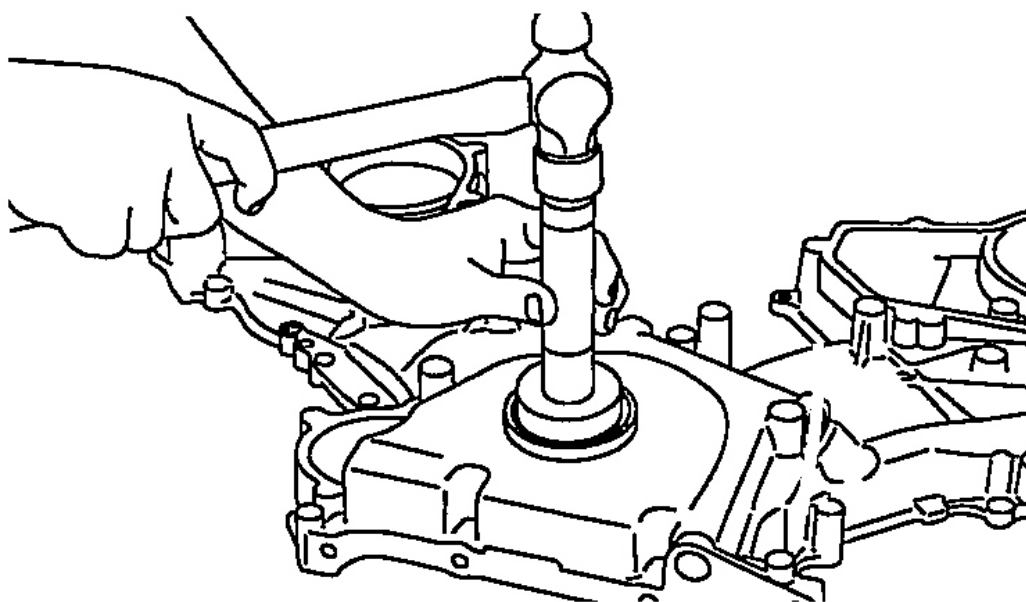
CAUTION: Be careful not to scratch or make burrs on circumference of oil seal.



G00753195

Fig. 67: Install front oil seal
Courtesy of NISSAN MOTOR CO., U.S.A.

- Using the front oil seal drift (commercial service tool) or drift with 54 mm (2.13 in) diameter, force fit the seal until it levels with the front end surface of front cover.

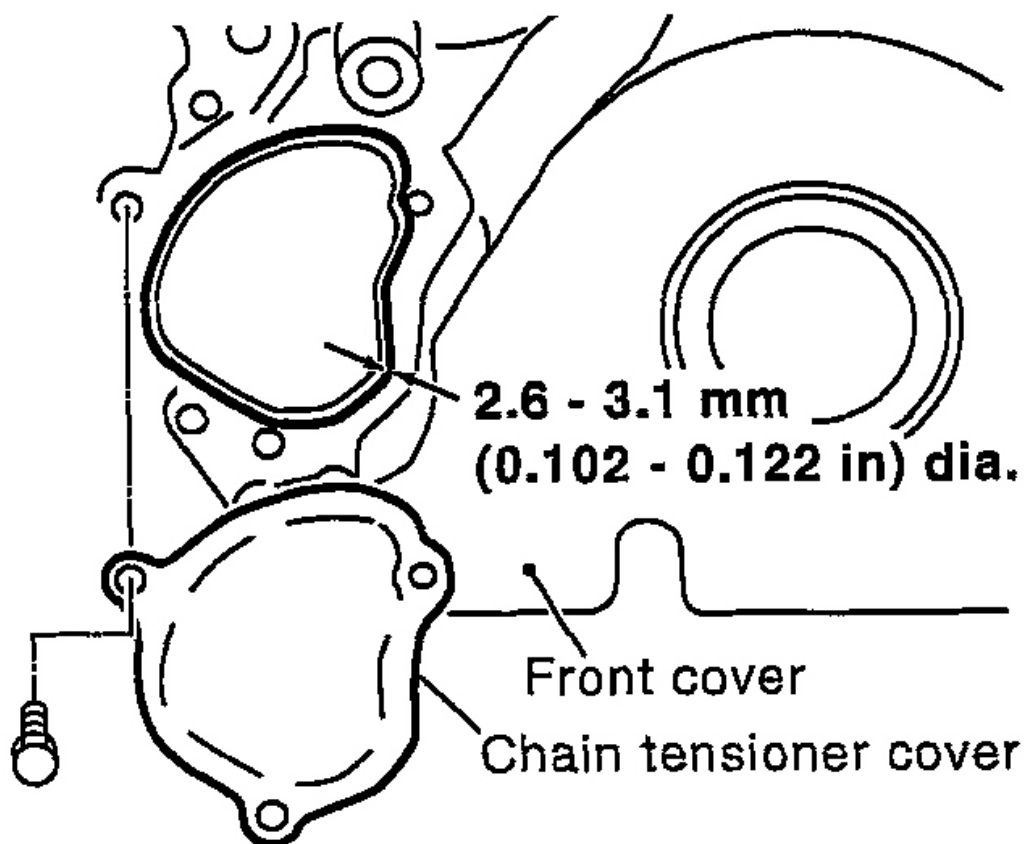


G00753196

Fig. 68: Using the front oil seal drift**Courtesy of NISSAN MOTOR CO., U.S.A.**

9. Install chain tensioner cover onto front cover.
 - Apply liquid gasket as shown in the figure.

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

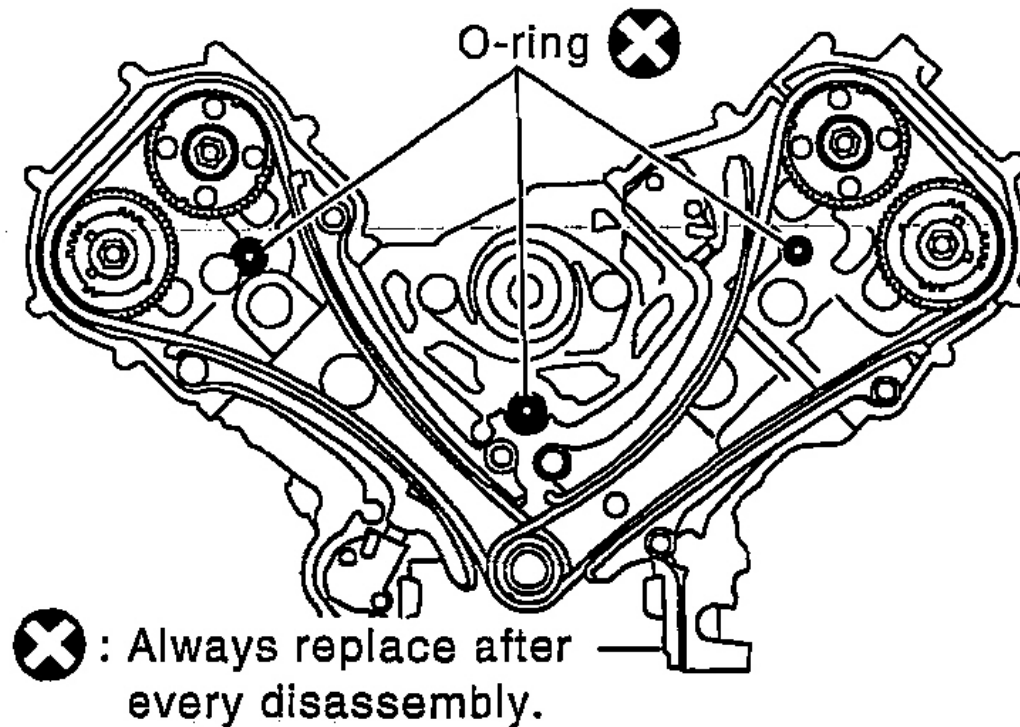


G00753197

Fig. 69: Install chain tensioner cover

Courtesy of NISSAN MOTOR CO., U.S.A.

10. Install front cover as follows:
 - a. Install new O-rings onto right and left cylinder heads and cylinder block.



G00753198

Fig. 70: Install front cover

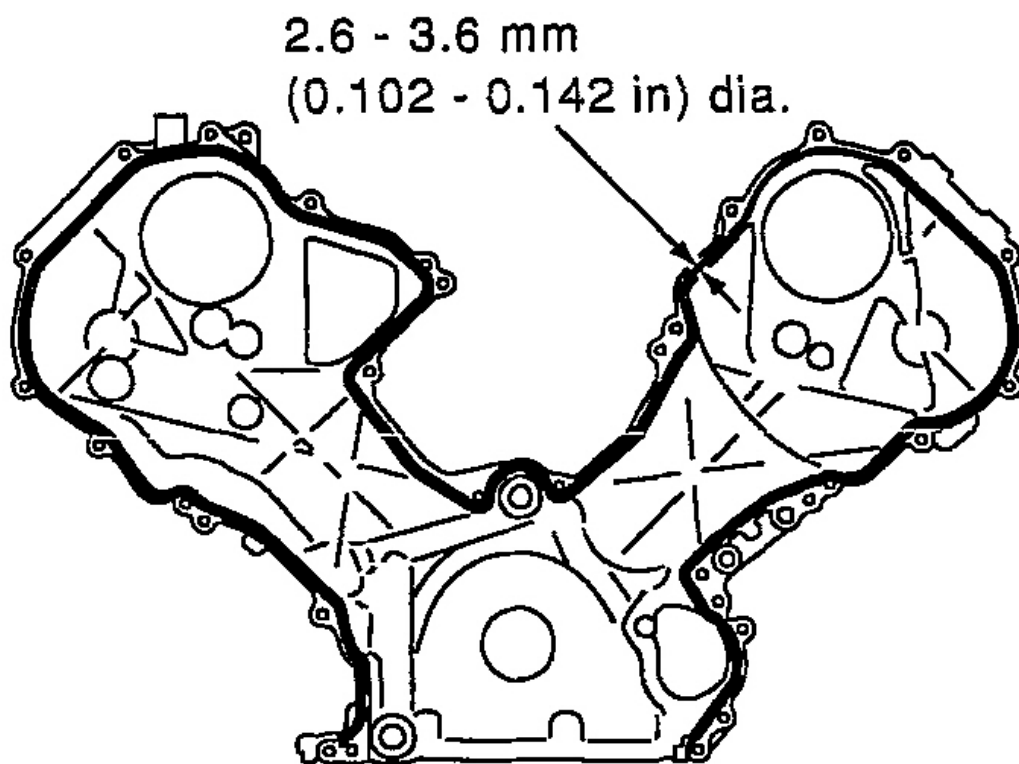
Courtesy of NISSAN MOTOR CO., U.S.A.

- b. Apply liquid gasket as shown in the figure.

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

- c. Check again that the timing mating mark on timing chain and that on each sprocket are aligned. Then, install front cover.

CAUTION: Be careful to avoid interference with the front end of oil pump drive spacer. Such interference may damage front oil seal.



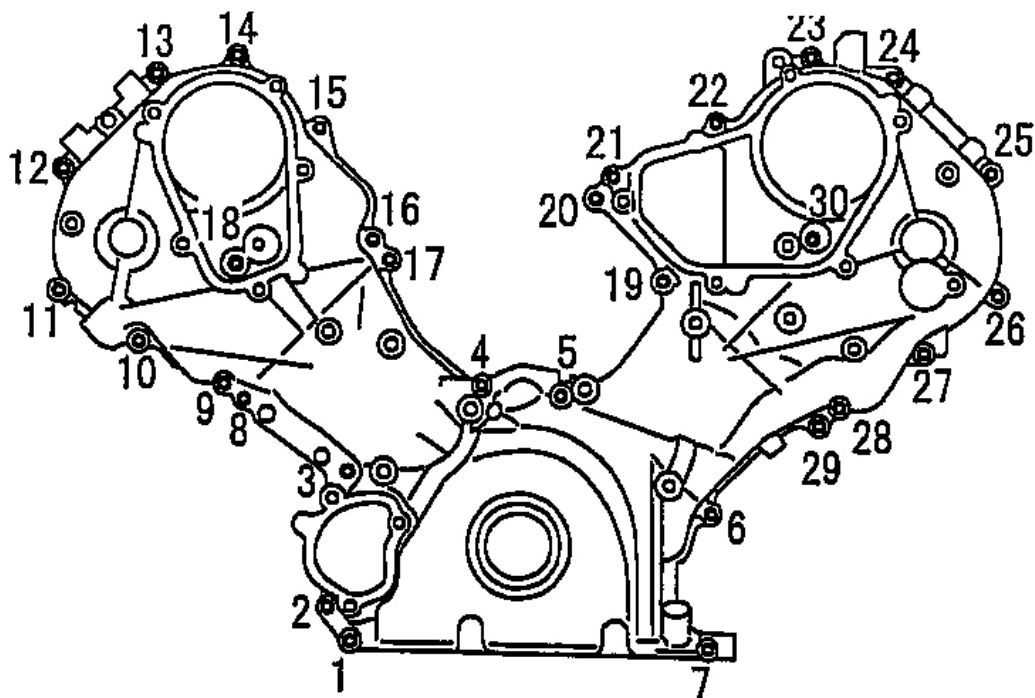
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Fig. 71: Applying liquid gasket

Courtesy of NISSAN MOTOR CO., U.S.A.

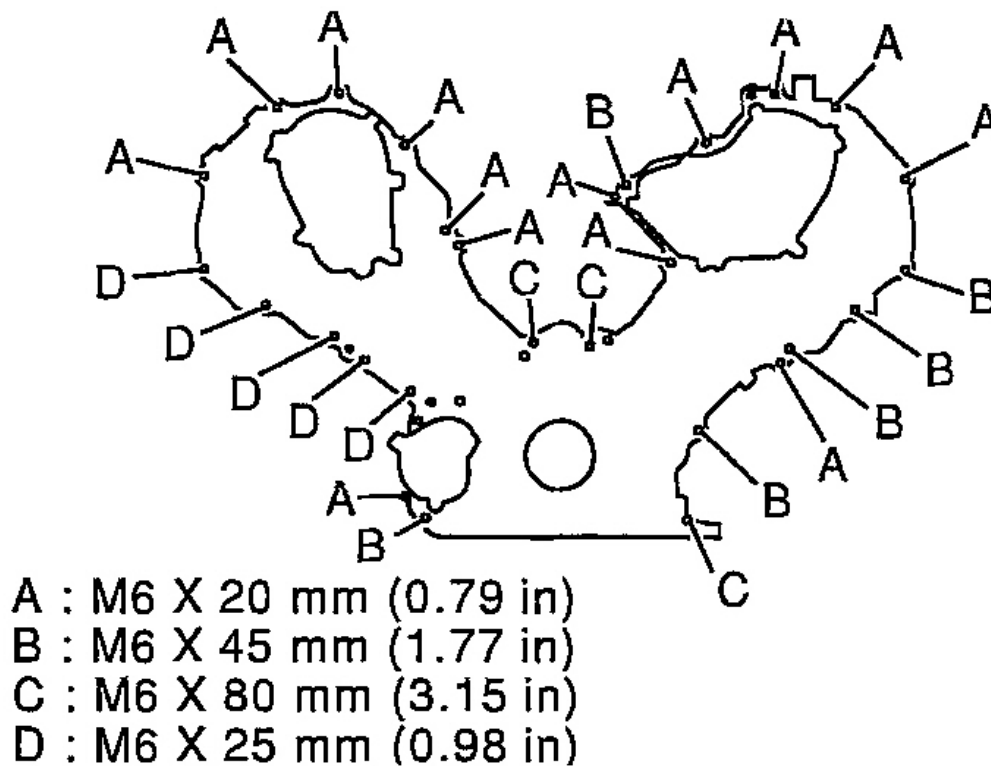
- d. Tighten fixing bolts in the numerical order shown in the figure.
- e. After tightening, re-tighten to the specified torque.

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



G00753200

Fig. 72: Front Cover Torque Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.



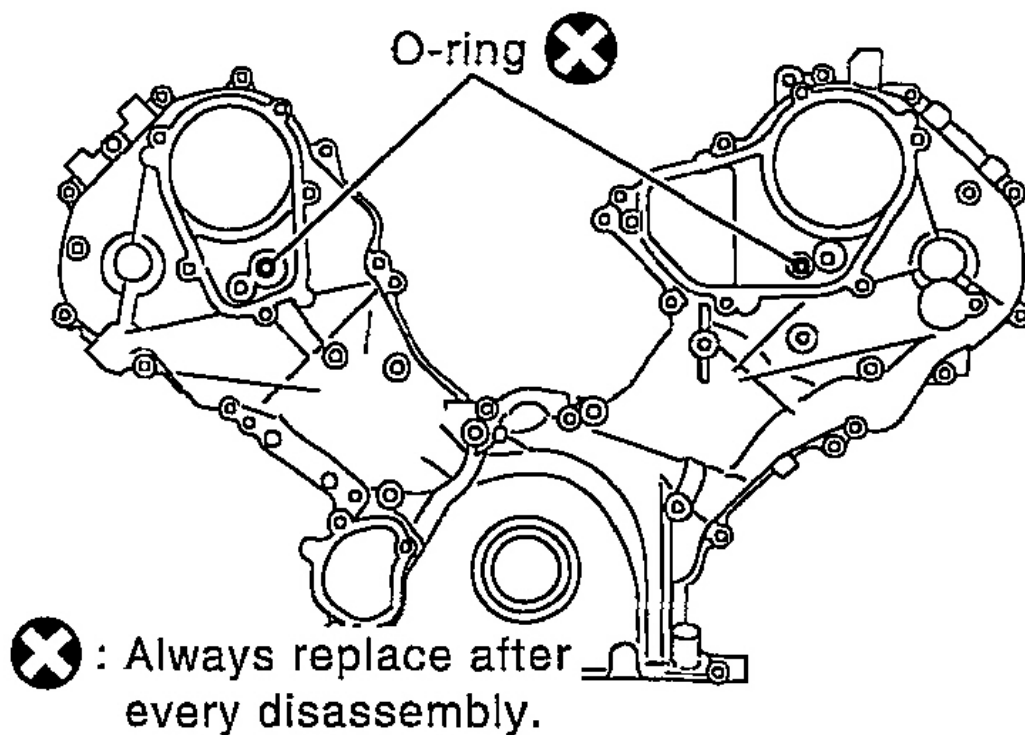
G00753201

Fig. 73: Identifying Bolt Length & Location
Courtesy of NISSAN MOTOR CO., U.S.A.

11. Install intake valve timing control cover as follows:
 - a. At the back of intake valve timing control cover, install new seal rings (three for each) to the area to be inserted into intake camshaft sprocket (INT).

CAUTION: Do not spread seal ring excessively to avoid breaks and deformation.

- b. On the side of front cover, install new O-ring (one for each bank).

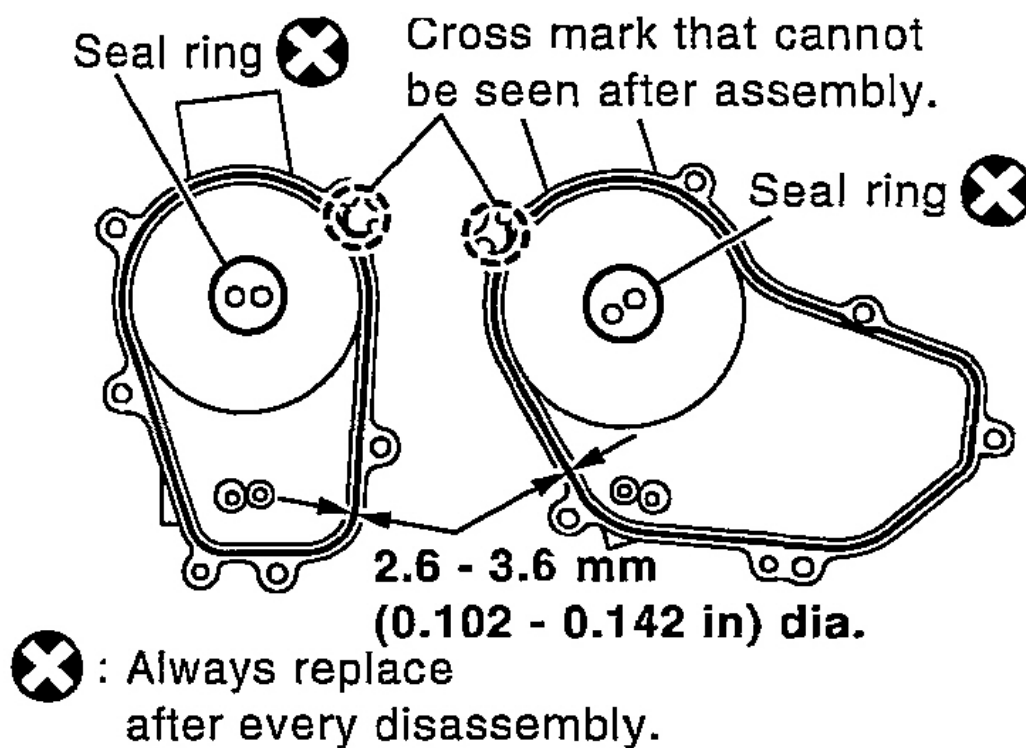


G00753202

Fig. 74: Locating Front Cover O-Rings
Courtesy of NISSAN MOTOR CO., U.S.A.

- c. Apply liquid gasket as shown in the figure.

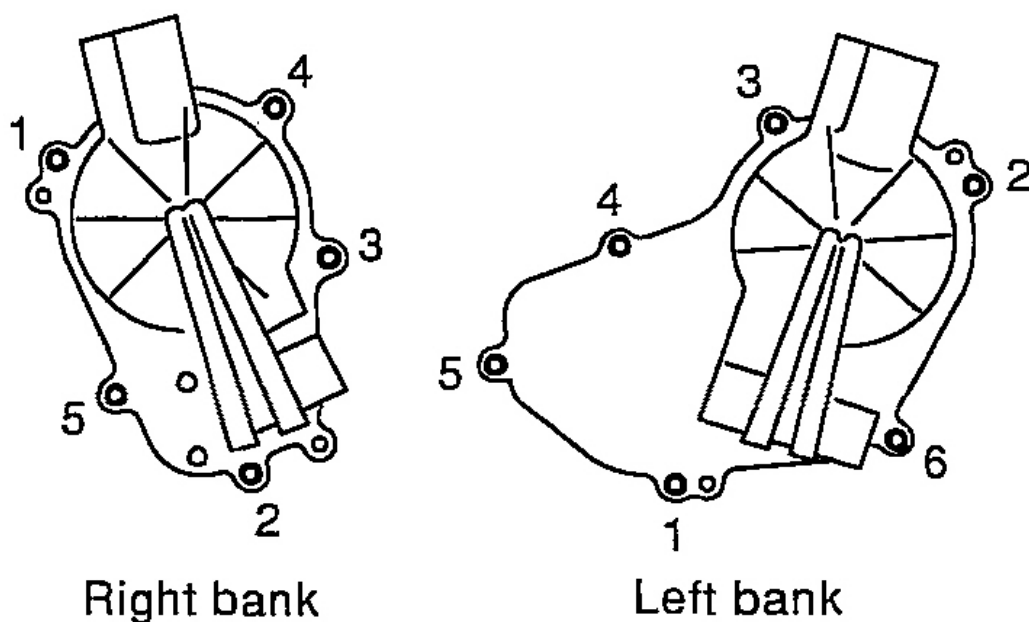
Use Genuine RTV Silicone Sealant or equivalent. Refer to **RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS** .



G00753203

Fig. 75: Applying liquid gasket
Courtesy of NISSAN MOTOR CO., U.S.A.

- d. Tighten fixing bolts in the numerical order shown in the figure.



G00753204

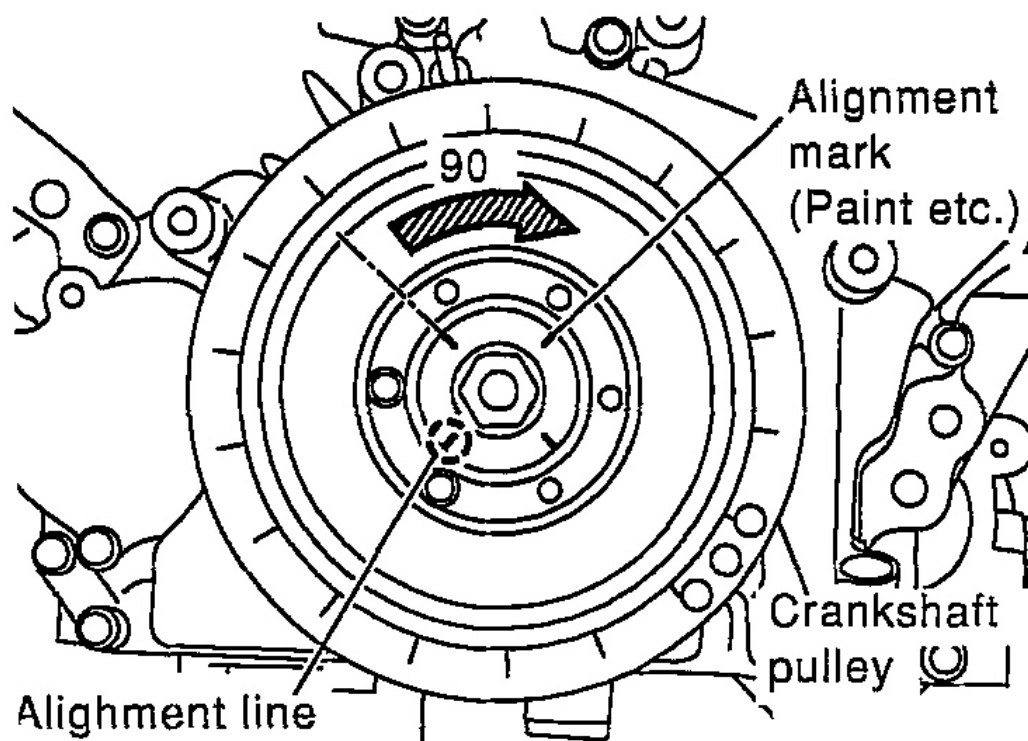
Fig. 76: Intake Valve Timing Control Cover Torque Sequence
 Courtesy of NISSAN MOTOR CO., U.S.A.

12. Install intake valve timing control position sensor, intake valve timing control solenoid valve and camshaft position sensor (PHASE) to intake valve timing control cover and front cover.
 - Be sure to tighten bolts with flanges completely seated.
13. Install crankshaft pulley.
 - Install according to the dowel pin of oil pump drive spacer.
 - Lightly tapping its center with plastic hammer, insert pulley.

CAUTION: Do not tap pulley on the side surface where belt is installed (outer circumference).

14. Tighten fixing bolts of crankshaft pulley.
 - Lock crankshaft with a hammer handle or similar tool to tighten fixing bolts.
 - Perform the following steps for angular tightening:
 - a. Apply engine oil onto threaded parts of bolts and seating areas.
 - b. Tighten bolt 93.1 N.m (9.5 kg-m, 69 ft-lb).
 - c. Select one most visible notch of the four on bolt flange. Corresponding to the selected notch,

- put a mating mark (such as paint) on crankshaft pulley.
- d. Tighten further by 90 degrees. (Angle tightening)
 - Check the tightening angle by referencing to the notches. The angle between two notches is 90 degrees.



G00753205

Fig. 77: Checking Tightening Angle By Referencing To The Notches
Courtesy of NISSAN MOTOR CO., U.S.A.

15. Rotate crankshaft pulley in normal direction (clockwise when viewed from engine front) to check for interference among parts.
16. For the following operations, perform steps in the reverse order of removal.

INSPECTION AFTER INSTALLATION

- Before starting engine, check the levels of engine coolant, engine oil and working fluid. If less than required quantity, fill to the specified level.
- Use procedure below to check for fuel leakage
 - Turn ignition switch "ON" (with engine stopped). With fuel pressure applied to fuel piping, check

for fuel leakage at connection points.

- Start engine. With engine speed increased, check again for fuel leakage at connection points.
- Run engine to check for unusual noise and vibration.
- Warm up engine thoroughly to make sure there is no leakage of engine coolant, engine oil, working fluid, fuel and exhaust gas.
- Bleed air from passages in pipes and tubes of applicable lines, such as in cooling system.
- After cooling down engine, again check amounts of engine coolant, engine oil and working fluid. Refill to specified level, if necessary.

Summary of the inspection items:

Item	Before starting engine	Engine running	After engine stopped
Engine coolant	Level	Leakage	Level
Engine oil	Level	Leakage	Level
Working fluid	Level	Leakage	Level
Fuel	—	Leakage	—
Exhaust gas	—	Leakage	—

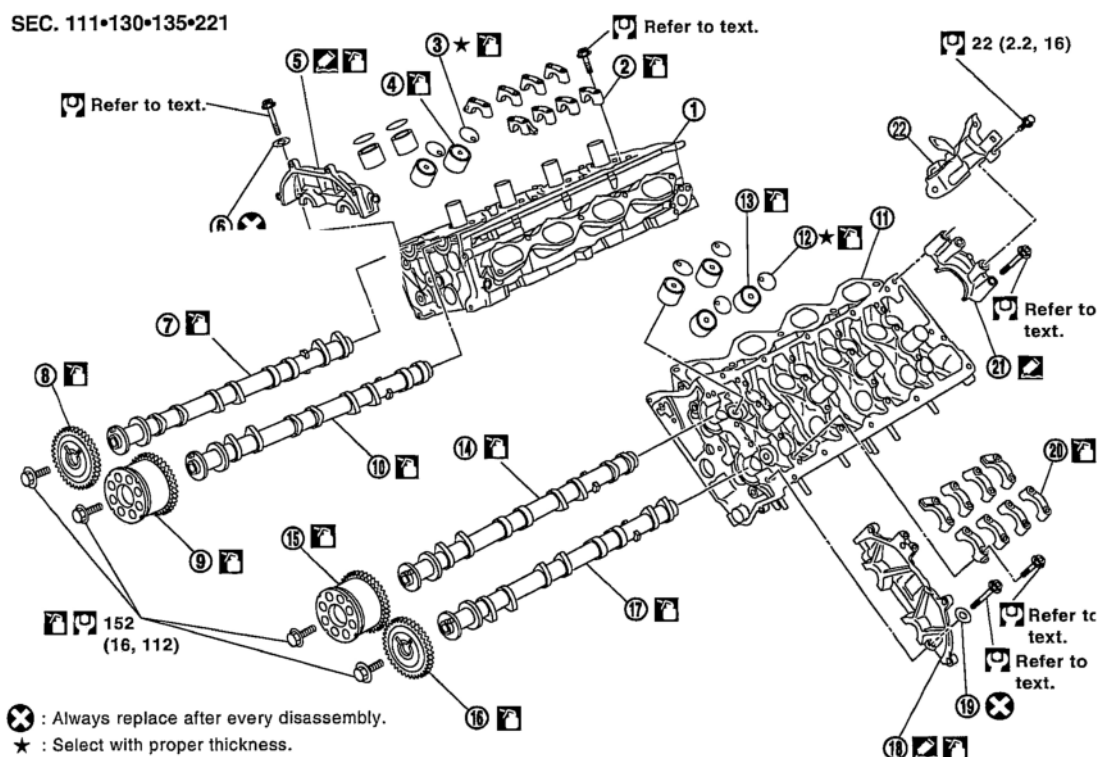
G00753206

Fig. 78: Summary Of Inspection Items
Courtesy of NISSAN MOTOR CO., U.S.A.

CAMSHAFT

REMOVAL AND INSTALLATION

SEC. 111•130•135•221



⊗ : Always replace after every disassembly.

★ : Select with proper thickness.

☒ : Apply Genuine RTV Silicone Sealant or equivalent. Refer to GI section.

🛢 : Lubricate with new engine oil.

⌚ : N•m (kg-m, ft-lb)

1. Cylinder head (right bank)

4. Valve lifter

7. Camshaft (EXH)

10. Camshaft (INT)

13. Valve lifter

16. Camshaft sprocket (EXH)

19. Washer

22. Bracket

2. Camshaft bracket (No.2, 3, 4, 5)

5. Camshaft bracket (No.1)

8. Camshaft sprocket (EXH)

11. Cylinder head (left bank)

14. Camshaft (INT)

17. Camshaft (EXH)

20. Camshaft bracket (No.2, 3, 4, 5)

3. Adjusting shim

6. Washer

9. Camshaft sprocket (INT)

12. Adjusting shim

15. Camshaft sprocket (INT)

18. Camshaft bracket (No.1)

21. Camshaft bracket (INT, No.6)

G00753207

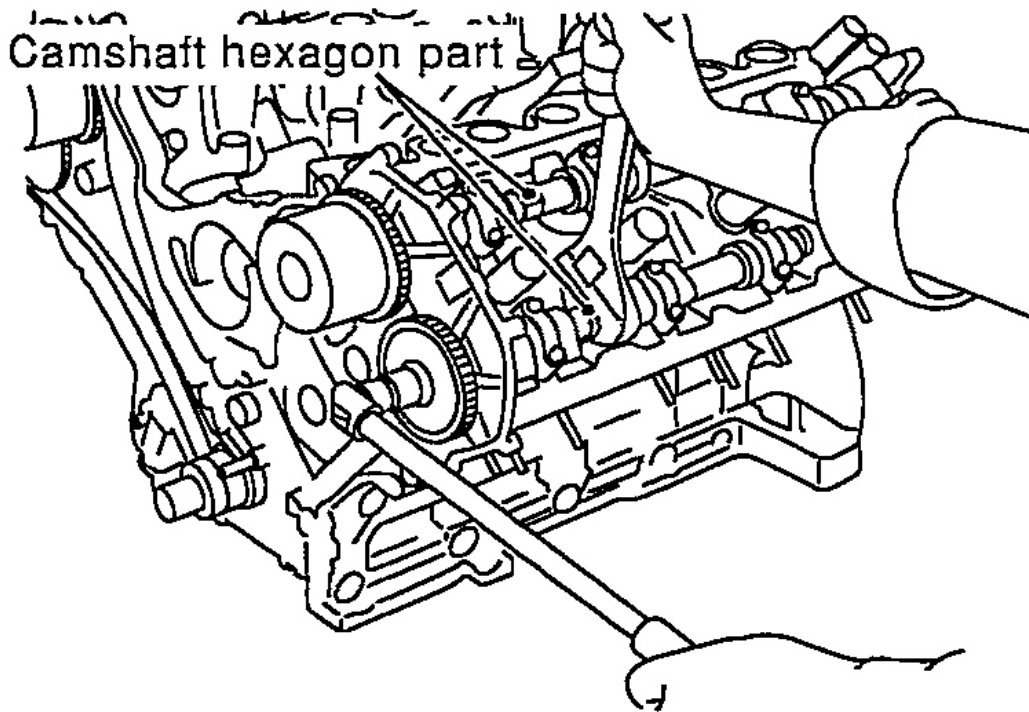
Fig. 79: Exploded View Of Camshaft Assemblies

Courtesy of NISSAN MOTOR CO., U.S.A.

REMOVAL

1. Remove timing chain. Refer to **TIMING CHAIN**.
2. With hexagonal part of camshaft locked with wrench, loosen bolts securing camshaft sprocket to remove camshaft sprocket.

CAUTION: To avoid interference between valves and pistons, do not turn crankshaft or camshaft with timing chain disconnected.



G00753208

Fig. 80: Removing Camshaft Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

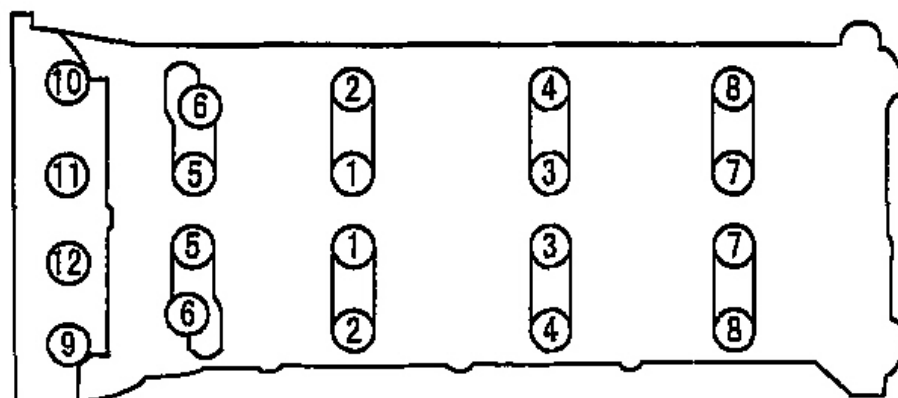
3. Loosen fixing bolts in reverse order of that shown in the figure to remove camshaft brackets.
 - Lightly tapping with plastic hammer, remove No. 1 camshaft bracket and No. 6 camshaft bracket.

NOTE: **The bottom surface of each bracket will be stuck to cylinder head because of liquid gasket.**

4. Remove camshaft.
5. Remove adjusting shims and valve lifters if necessary.
 - Correctly identify location where each part is installed. Keep parts in an organized way to avoid mixing them up.

Right bank

Exhaust

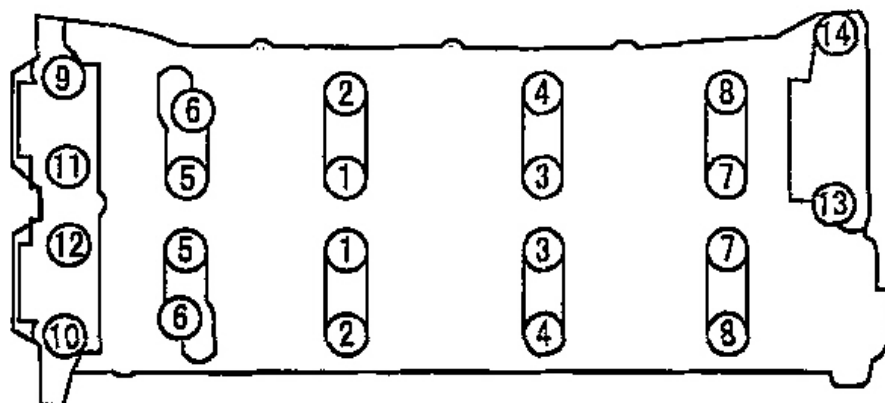


Engine
front



Intake

Left bank



Exhaust

G00753209

Fig. 81: Camshaft Bracket Torque Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

INSPECTION AFTER REMOVAL

Camshaft Runout

1. Put V block on precise flat bed, and support No.2 and No.5 journal of camshaft.
2. Set dial gauge vertically to No.3 journal.
3. Turn camshaft to one direction with hands, and measure camshaft runout on dial gauge. (Total indicator reading)

Limit : 0.02 mm (0.0008 in)

- If it exceeds the limit, replace camshaft.

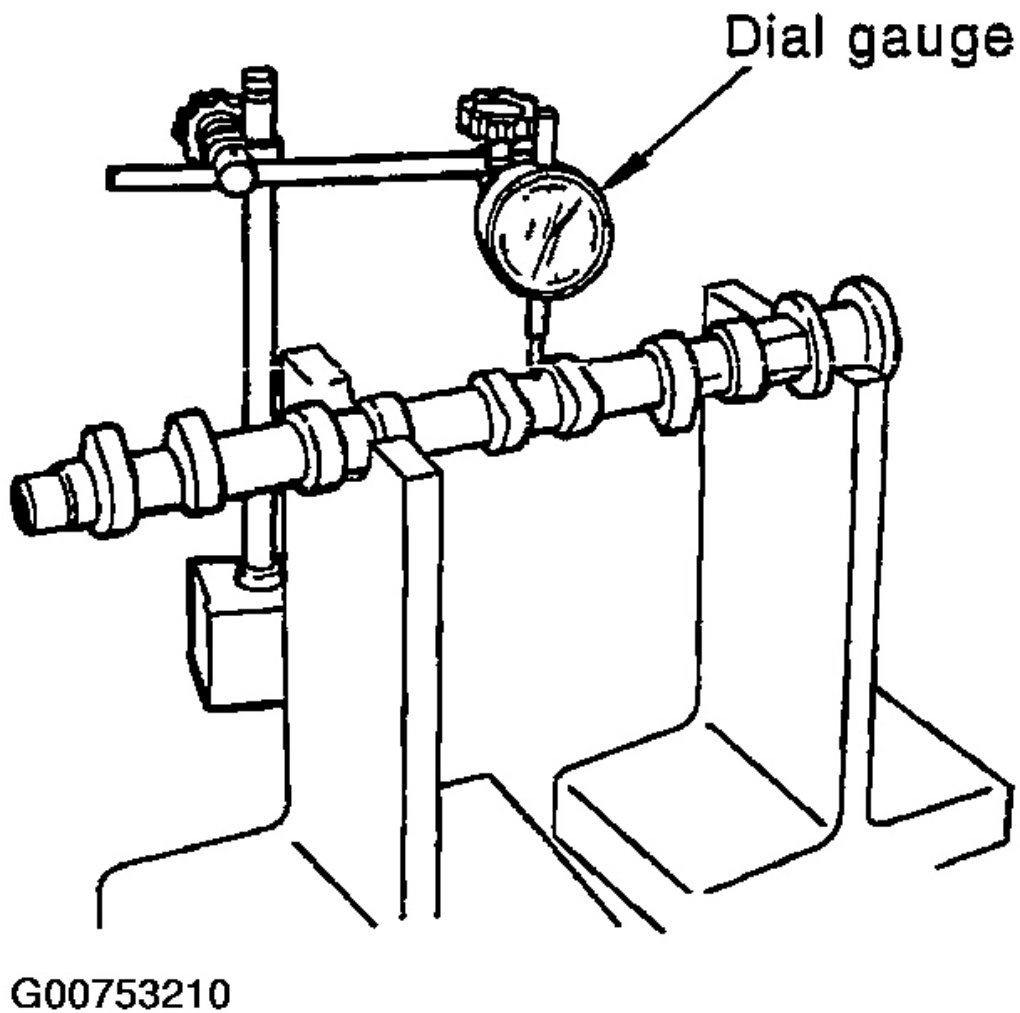
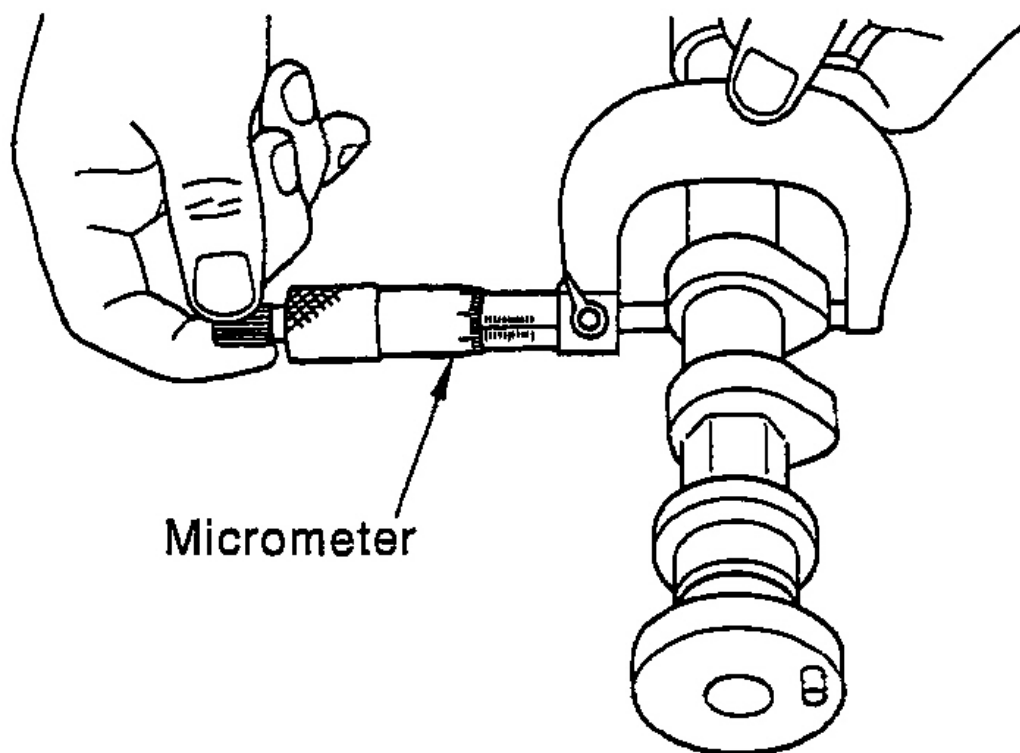


Fig. 82: Checking Camshaft Runout
Courtesy of NISSAN MOTOR CO., U.S.A.

Camshaft Cam Height

- Measure camshaft cam height.
 Standard: Intake : 44.865 - 45.055 mm (1.7663 -1.7738 in)
 Exhaust : 43.925 - 44.115 mm (1.7293 - 1.7368 in)
 Cam wear limit : 0.2 mm (0.008 in)
- If it exceeds the limit, replace camshaft.



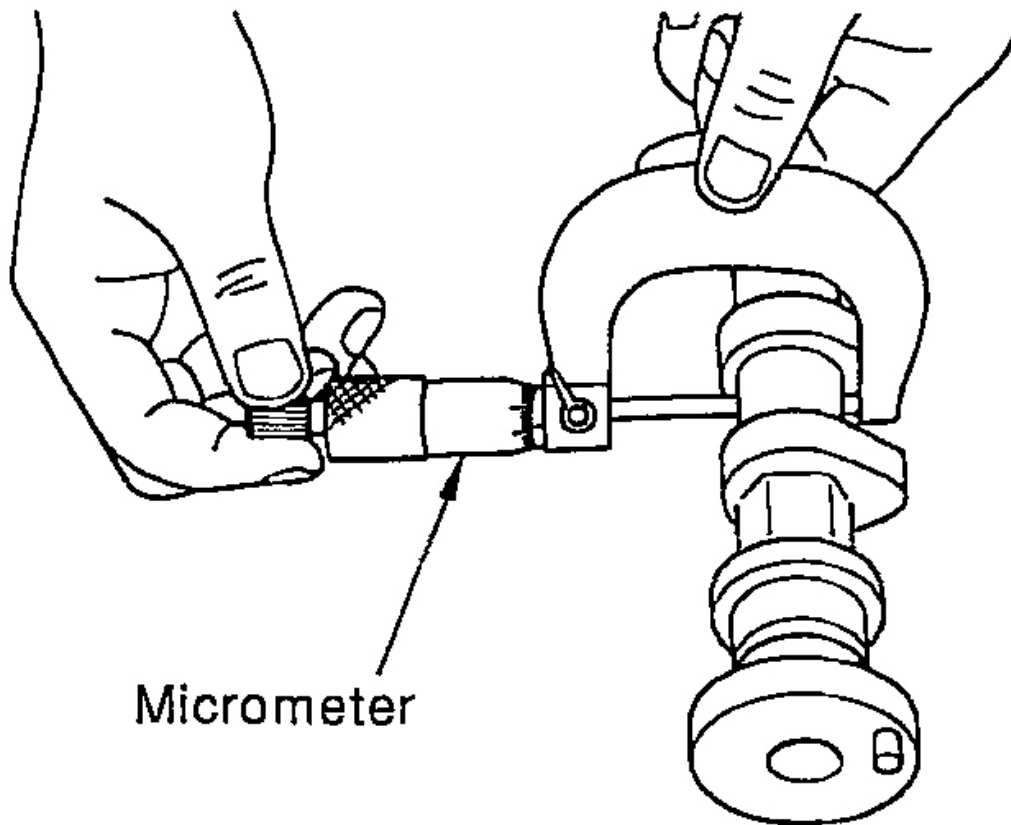
G00753211

Fig. 83: Checking Camshaft Height
Courtesy of NISSAN MOTOR CO., U.S.A.

Camshaft Journal Oil Clearance

Outer Diameter of Camshaft Journal)

- Measure outer diameter of camshaft journal.
Standard: No.1 : 25.938 - 25.955 mm (1.0212 -1.0218 in)
No.2, 3, 4, 5 : 25.953 - 25.970 mm (1.0218 -1.0224 in)



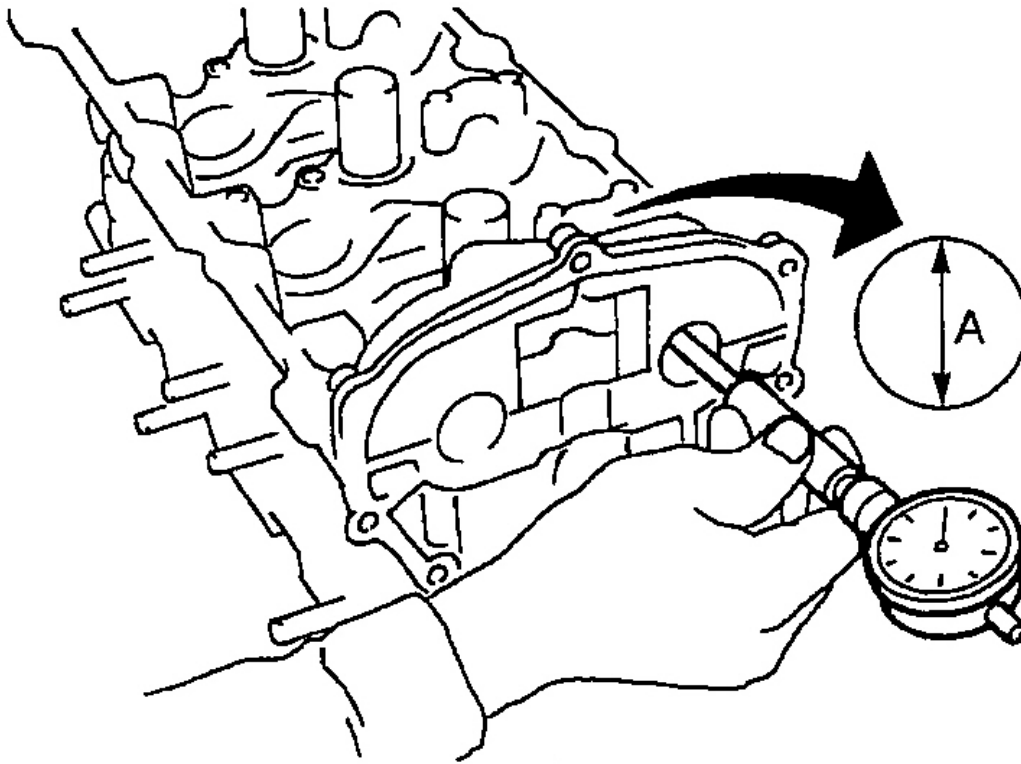
G00753212

Fig. 84: Checking Camshaft Journal Oil Clearance
Courtesy of NISSAN MOTOR CO., U.S.A.

Inner Diameter of Camshaft Bracket

- Tighten camshaft bracket bolt with specified torque. Refer to **INSTALLATION** for the tightening procedure.
- Using inside micrometer, measure inner diameter "A" of camshaft bracket.

Standard: 26.000 - 26.021 mm (1.0236 - 1.0244 in)



G00753213

Fig. 85: Checking Inner Diameter of Camshaft Bracket
 Courtesy of NISSAN MOTOR CO., U.S.A.

Calculation of Camshaft Journal Oil Clearance

- (Journal clearance) = (inner diameter of camshaft bracket) - (outer diameter of camshaft journal)
Standard: No.1 : 0.045 - 0.083 mm (0.0018 - 0.0033 in)
No.2, 3, 4, 5 : 0.030 - 0.068 mm (0.0012 - 0.0027 in)
- If out of the standard, replace either or both camshaft and cylinder head.

NOTICE:

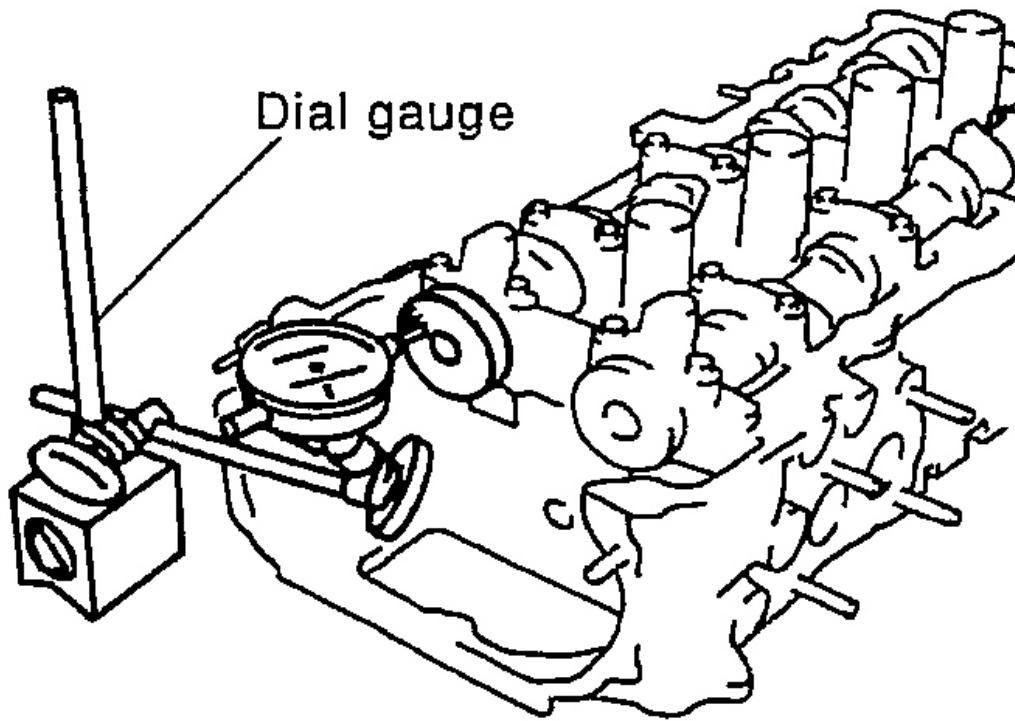
It is impossible to replace only camshaft bracket as camshaft bracket is manufactured with cylinder head. Replace the whole cylinder head assembly.

Camshaft End Play

- Install dial gauge in thrust direction on front end of camshaft. Measure end play when camshaft is moved

forward/backward (in direction to axis).

Standard: 0.115 - 0.188 mm (0.0045 - 0.0074 in)

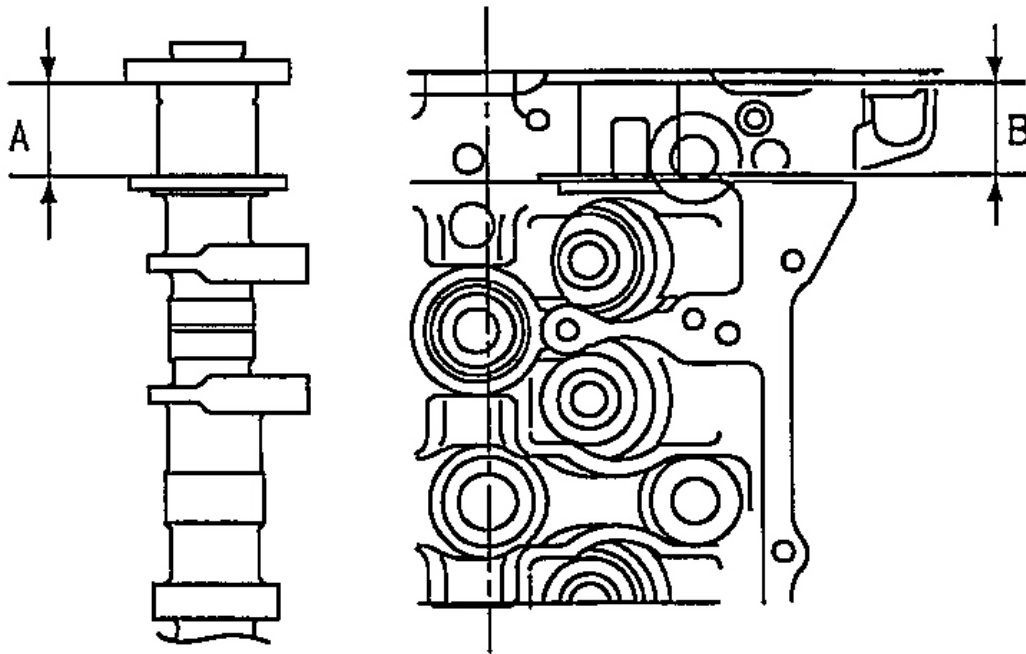


G00753214

Fig. 86: Checking Camshaft End Play

Courtesy of NISSAN MOTOR CO., U.S.A.

- Measure the following parts if out of the standard.
 - Dimension "A" for camshaft No. 1 journal
Standard : 30.500 - 30.548 mm (1.2008 - 1.2027 in)
 - Dimension "B" for cylinder head No. 1 journal
 - **Standard : 30.360 - 30.385 mm (1.1953 - 1.1963 in)**
- Refer to the standards above, and then replace camshaft and/or cylinder head.



G00753215

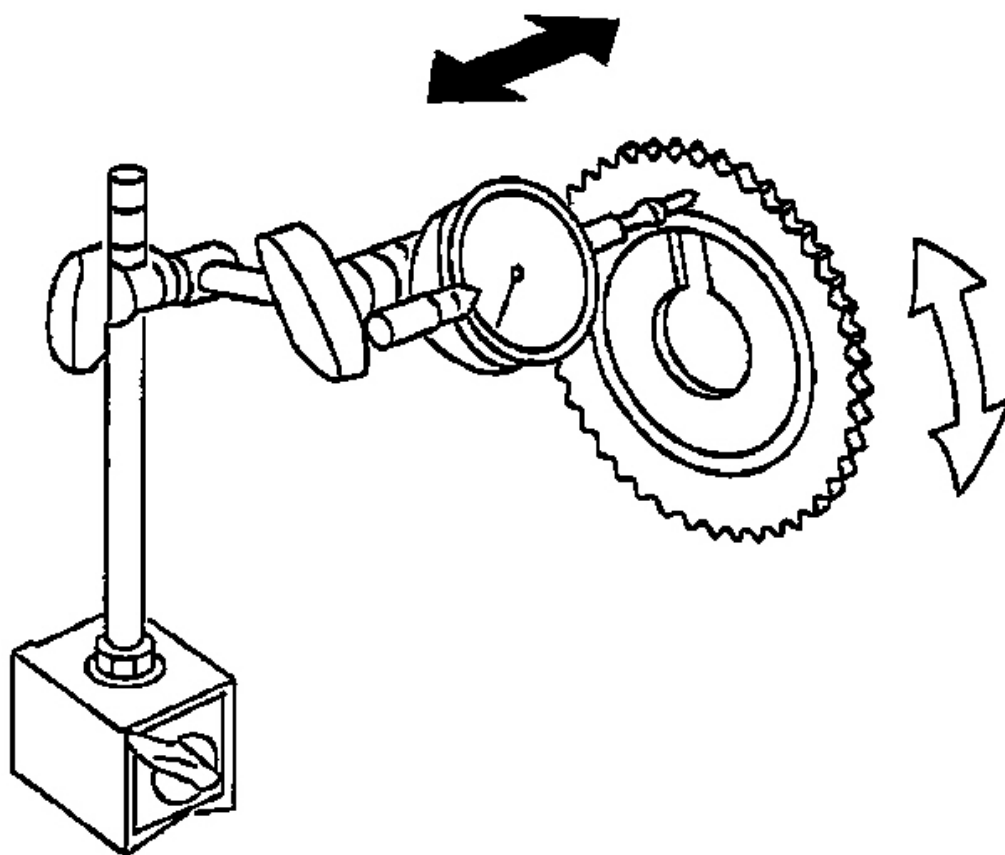
Fig. 87: Checking Camshaft & Cylinder Head Dimensions For Camshaft End Play
Courtesy of NISSAN MOTOR CO., U.S.A.

Camshaft Sprocket Runout

1. Install camshaft in cylinder head. Refer to **INSTALLATION** for tightening procedure.
2. Install camshaft sprocket to camshaft.
3. Measure camshaft sprocket runout (total indicator reading).

Limit: 0.15 mm (0.0059 in)

- If it exceeds the limit, replace camshaft sprocket.



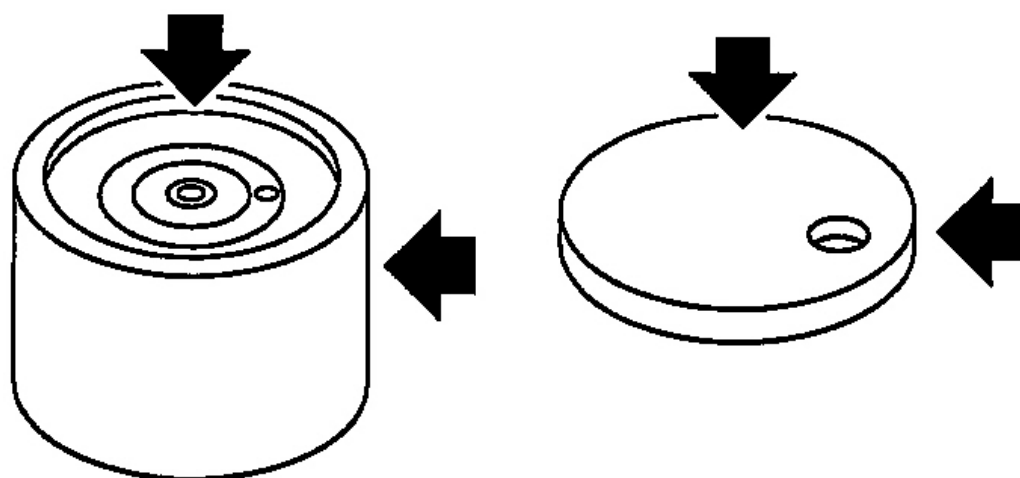
G00753216

Fig. 88: Checking Camshaft Sprocket Runout
Courtesy of NISSAN MOTOR CO., U.S.A.

Valve Lifter and Adjusting Shim

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

- If anything above is found, replace valve lifter or adjusting shim.



G00753217

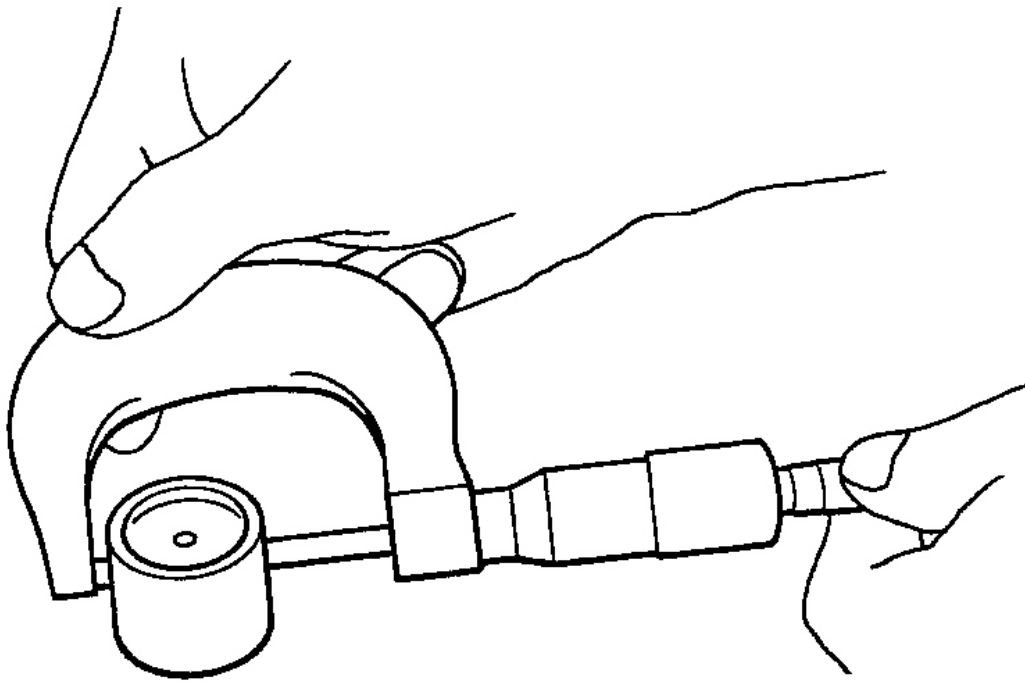
Fig. 89: Identifying Valve Lifter and Adjusting Shim

Courtesy of NISSAN MOTOR CO., U.S.A.

Valve Lifter Clearance**Outer Diameter of Valve Lifter**

- Measure outer diameter of valve lifter.

Standard: 33.965 - 33.975 mm (1.3372 - 1.3376 in)



G00753218

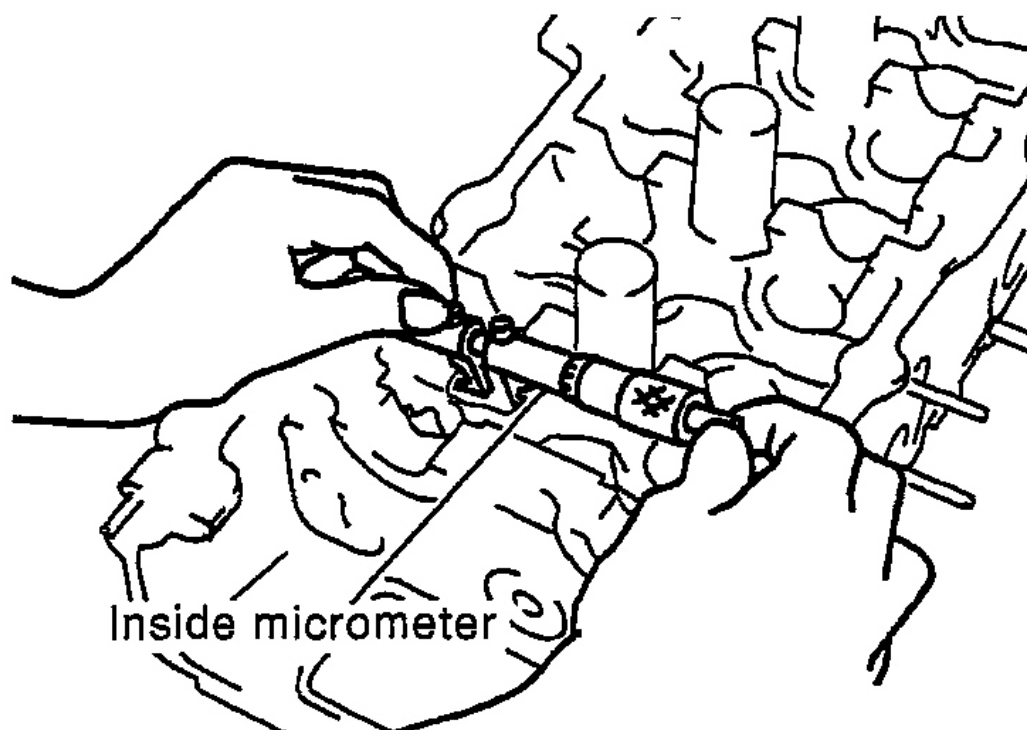
Fig. 90: Checking Valve Lifter Clearance
Courtesy of NISSAN MOTOR CO., U.S.A.

Valve Lifter Hole Diameter

- Using inside micrometer, measure diameter of valve lifter hole of cylinder head.
Standard: 34.000 - 34.016 mm (1.3386 - 1.3392 in)

Calculation of Valve Lifter Clearance

- (Valve lifter clearance) = (hole diameter of valve lifter) - (outer diameter of valve lifter)
Standard: 0.025 - 0.051 mm (0.0010 - 0.0020 in)
- If out of the standard, referring to each specification of outer and inner diameter, replace either or both valve lifter and cylinder head.



G00753219

Fig. 91: Checking Valve Lifter Hole Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

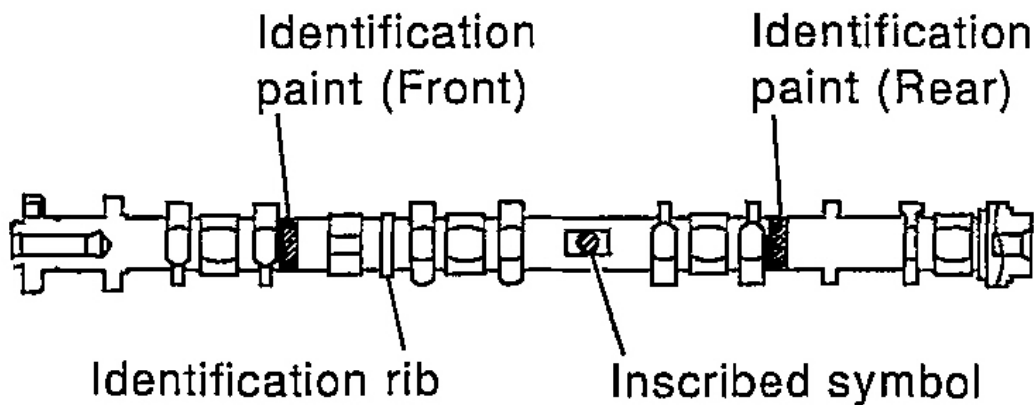
1. Install adjusting shims and valve lifters if necessary.
 - Install removed parts in the same locations as before.
2. Install camshafts. Refer to the table below for identification of right and left bank, and intake and exhaust.

Bank	INT/EXH	Identification paint (front)	Identification paint (rear)	Identification rib	Inscribed symbol
Left	INT	Blue	—	No.	LH
	EXH	—	Orange	No.	LH
Right	INT	Blue	—	Yes.	RH
	EXH	—	Orange	Yes.	RH

G00753220

Fig. 92: Identification Table

Courtesy of NISSAN MOTOR CO., U.S.A.



G00753221

Fig. 93: Locating Identification Marks

Courtesy of NISSAN MOTOR CO., U.S.A.

- Install so that dowel pin at the front of camshaft face is in the direction shown in the figure. (No.1 cylinder at compression TDC)

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

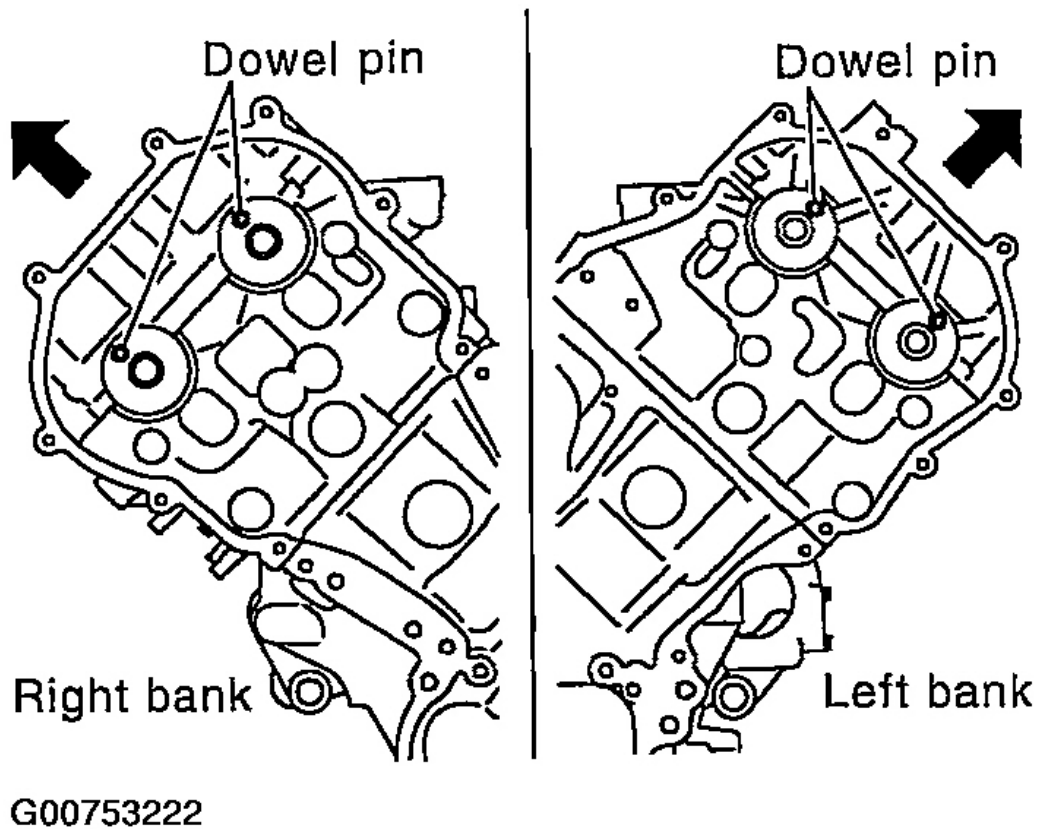
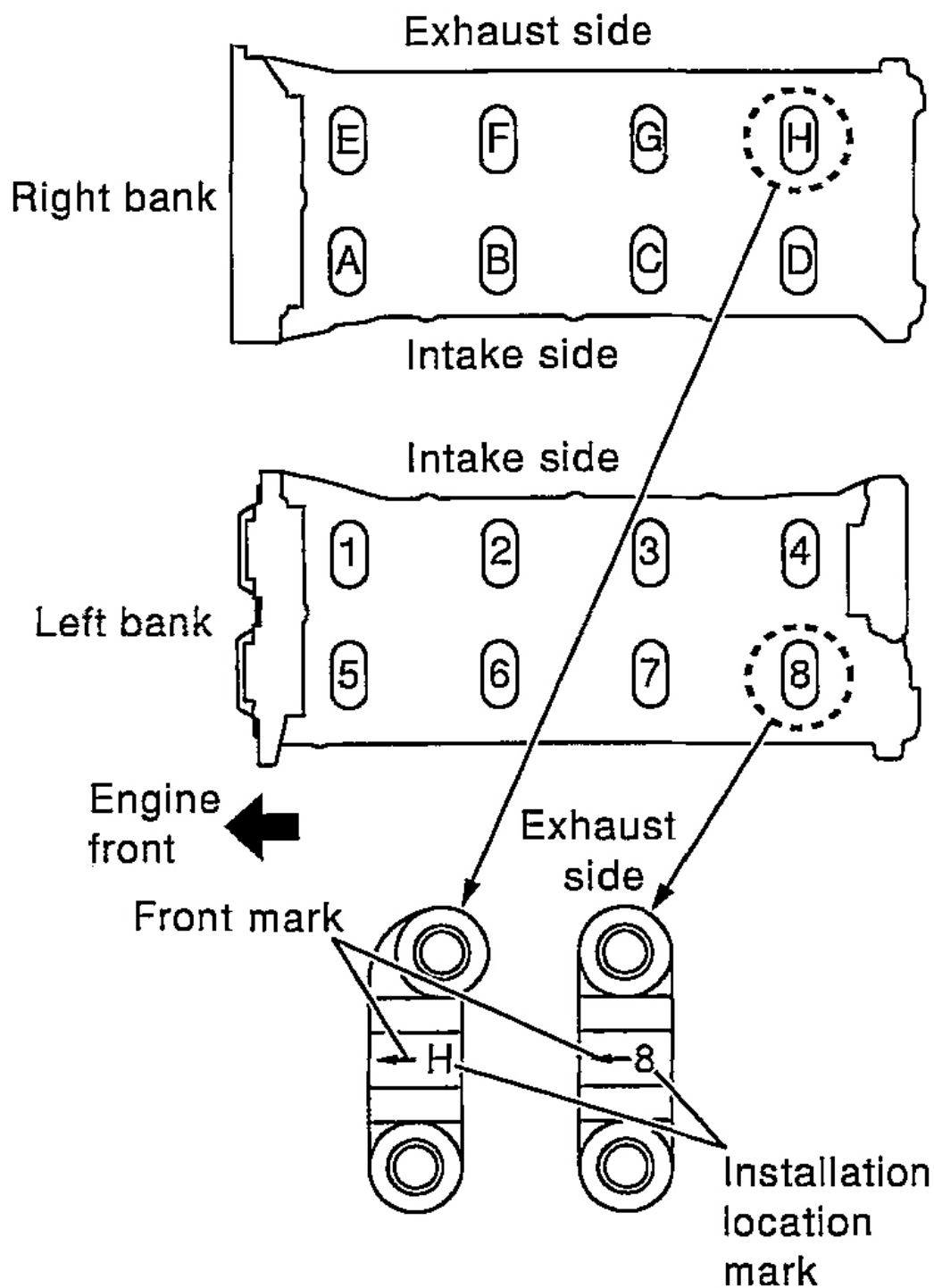


Fig. 94: Positioning Camshafts

Courtesy of NISSAN MOTOR CO., U.S.A.

3. Install camshaft brackets.

- Remove foreign material completely from camshaft bracket backside and from cylinder head installation face.
- Install by referring to installation location mark on upper surface and front mark.
- Install so that installation location mark can be correctly read when viewed from the side of left exhaust bank.



G00753223

Fig. 95: Installing camshaft brackets

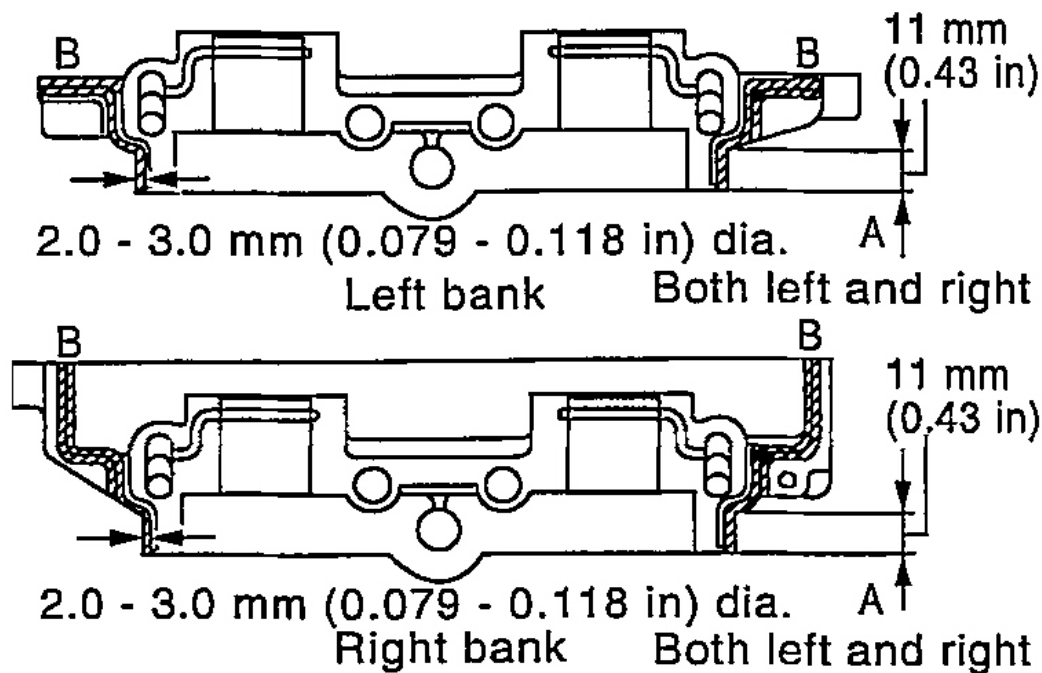
Courtesy of NISSAN MOTOR CO., U.S.A.

- Apply liquid gasket to No.1 camshaft bracket as in the illustration.

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

CAUTION:

- After installation, be sure to wipe off any excessive liquid gasket leaking from part "A" and "B"(both on right and left sides).
- Remove completely any excess of liquid gasket inside bracket.



G00753224

Fig. 96: Applying liquid gasket To No. 1 Camshaft Bracket

Courtesy of NISSAN MOTOR CO., U.S.A.

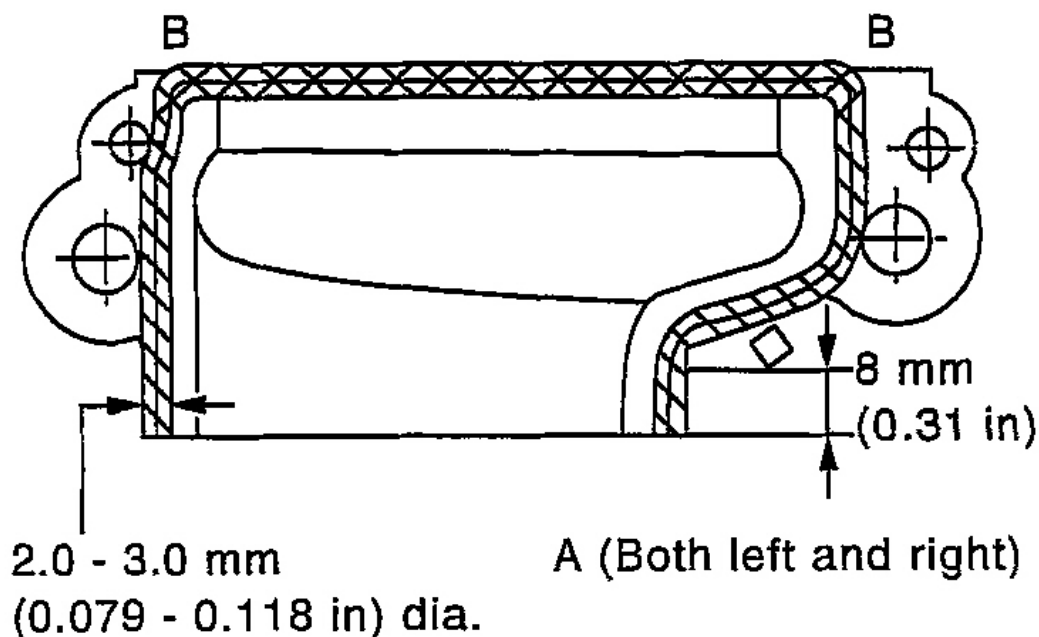
- Apply liquid gasket to No.6 camshaft bracket on left bank intake as in the illustration.

CAUTION:

- After installation, be sure to wipe off any excessive liquid

gasket leaking from part "A", and " B"(both on right and left sides).

- Remove completely any excess of liquid gasket inside bracket.



G00753225

Fig. 97: Apply liquid gasket to No.6 camshaft bracket

Courtesy of NISSAN MOTOR CO., U.S.A.

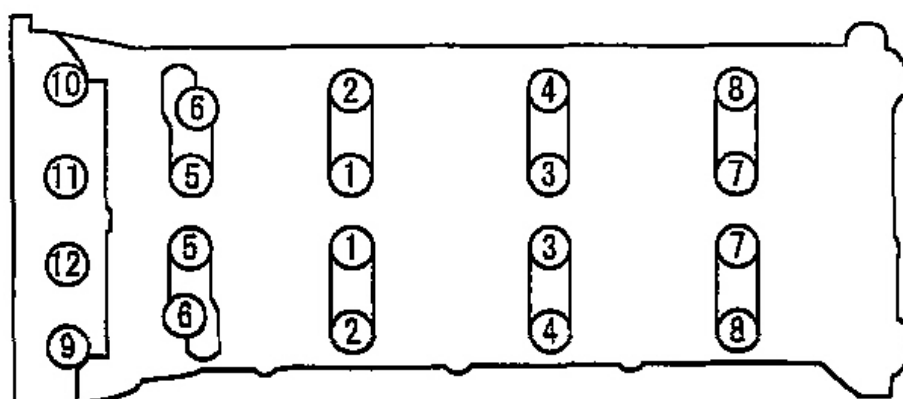
4. Tighten fixing bolts of camshaft brackets as follows:
 - a. Tighten in the order from 9 to 12 with tightening torque 1.96 N.m (0.2kg-m, 17in-lb).
 - b. Tighten in the order from 1 to 8 with tightening torque 1.96 N.m (0.2 kg-m, 17 in-lb).
 - c. Tighten in the order from 13 to 14 with tightening torque 1.96 N.m (0.2 kg-m, 17 in-lb) (Left bank only).
 - d. Tighten all bolts in the specified order with tightening torque 5.88 N.m (0.6 kg-m, 52 in-lb)
 - e. Tighten in the order from 1 to 12 with tightening torque 10.4 N.m (1.1 kg-m, 92 in-lb).
 - f. Tighten in the order from 13 to 14 with tightening torque 31.4 N.m (3.2 kg-m, 23 ft-lb) (left bank only).

CAUTION: After tightening fixing bolts of camshaft brackets, be sure to wipe off excessive liquid gasket from the parts listed below.

- Mating surface of rocker cover
- Mating surface of front cover

Right bank

Exhaust

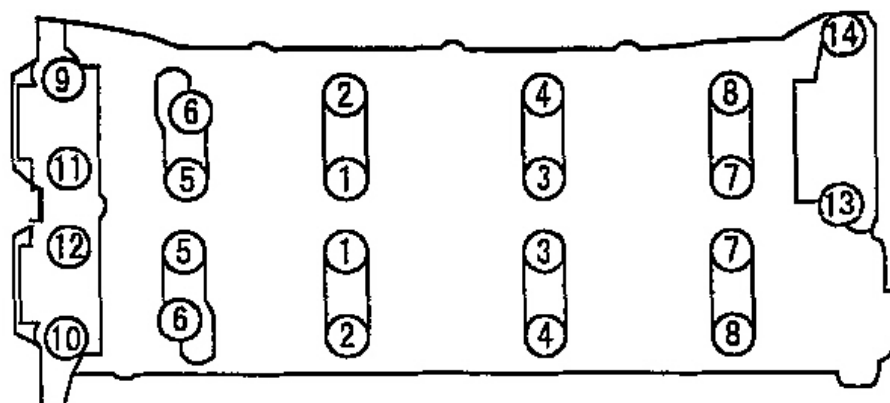


Engine
front



Intake

Left bank



Exhaust

G00753226

Fig. 98: Camshaft Bracket Torque Sequence
 Courtesy of NISSAN MOTOR CO., U.S.A.

5. Install camshaft sprockets.
 - Install by checking with identification mark on surface.
 - Install exhaust-side camshaft sprocket by selectively using the groove of dowel pin according to the bank. (Common part used for both banks.)
 - Lock the hexagonal part of camshaft in the same way as for removal, and tighten fixing bolts.
6. Check and adjust valve clearances. Refer to **Valve Clearance**.
7. Install in the reverse order of removal.

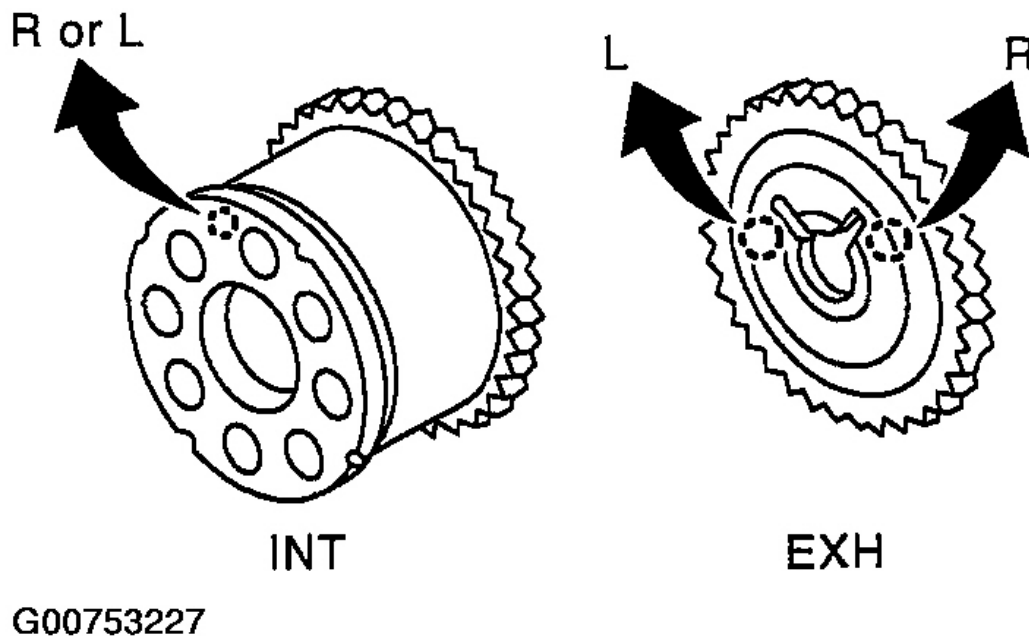


Fig. 99: Install camshaft sprockets
 Courtesy of NISSAN MOTOR CO., U.S.A.

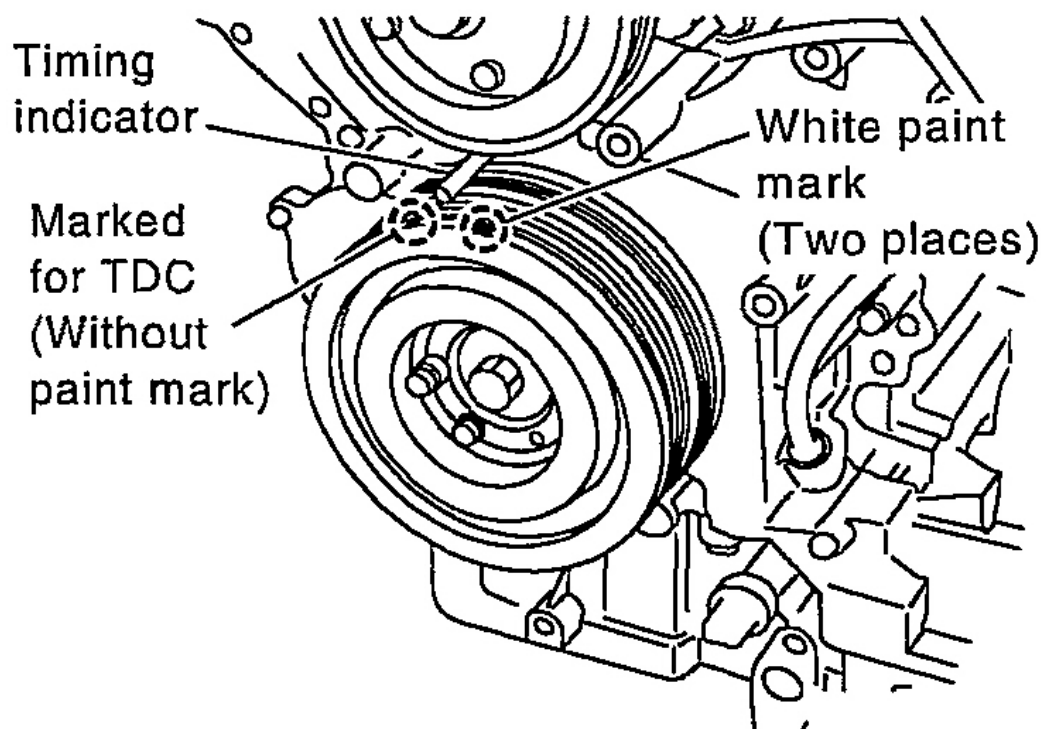
VALVE CLEARANCE

INSPECTION

Perform inspection as follows after removal, installation or replacement of camshaft or valve-related parts, or if there is unusual engine conditions due to changes in valve clearance (engine starting, idling, and/or noise).

1. Warm up engine. Then, stop it.

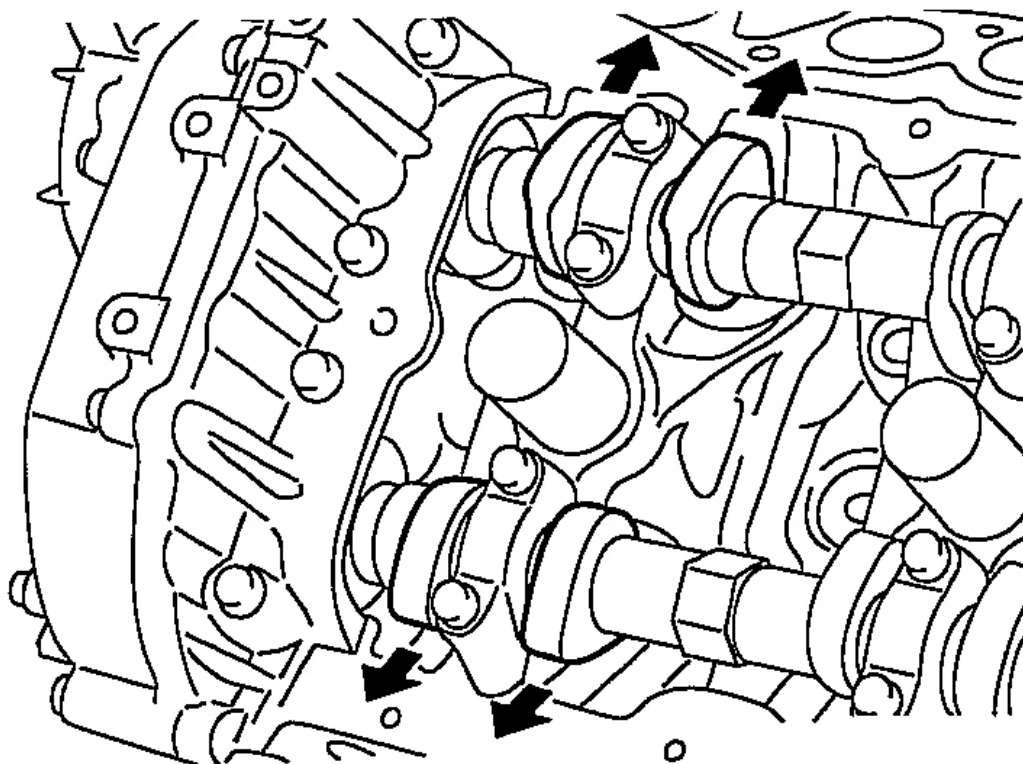
2. Remove engine cover (with power tool) and air duct (inlet). Refer to **ENGINE ROOM COVER**.
3. Remove right and left rocker covers with power tool. Refer to **ROCKER COVER**.
4. Turn crankshaft pulley in normal direction (clockwise when viewed from engine front) to align TDC identification notch (without paint mark) with timing indicator.



G00753228

Fig. 100: Locating TDC On Crankshaft
Courtesy of NISSAN MOTOR CO., U.S.A.

5. At this time, check that the both intake and exhaust cam noses of No. 1 cylinder (top front on left bank) face outside.
 - If they do not face outside, turn crankshaft pulley by 360 degrees once more.



G00753229

Fig. 101: Identifying Camshaft TDC Position
Courtesy of NISSAN MOTOR CO., U.S.A.

6. By referring to the figure, measure valve clearances at locations marked X as shown in the table below (locations indicated with black arrow in figure) with a thickness gauge.

NOTE: Firing order 1-8-7-3-6-5-4-2

- No.1 cylinder compression TDC

2004 Infiniti Q45

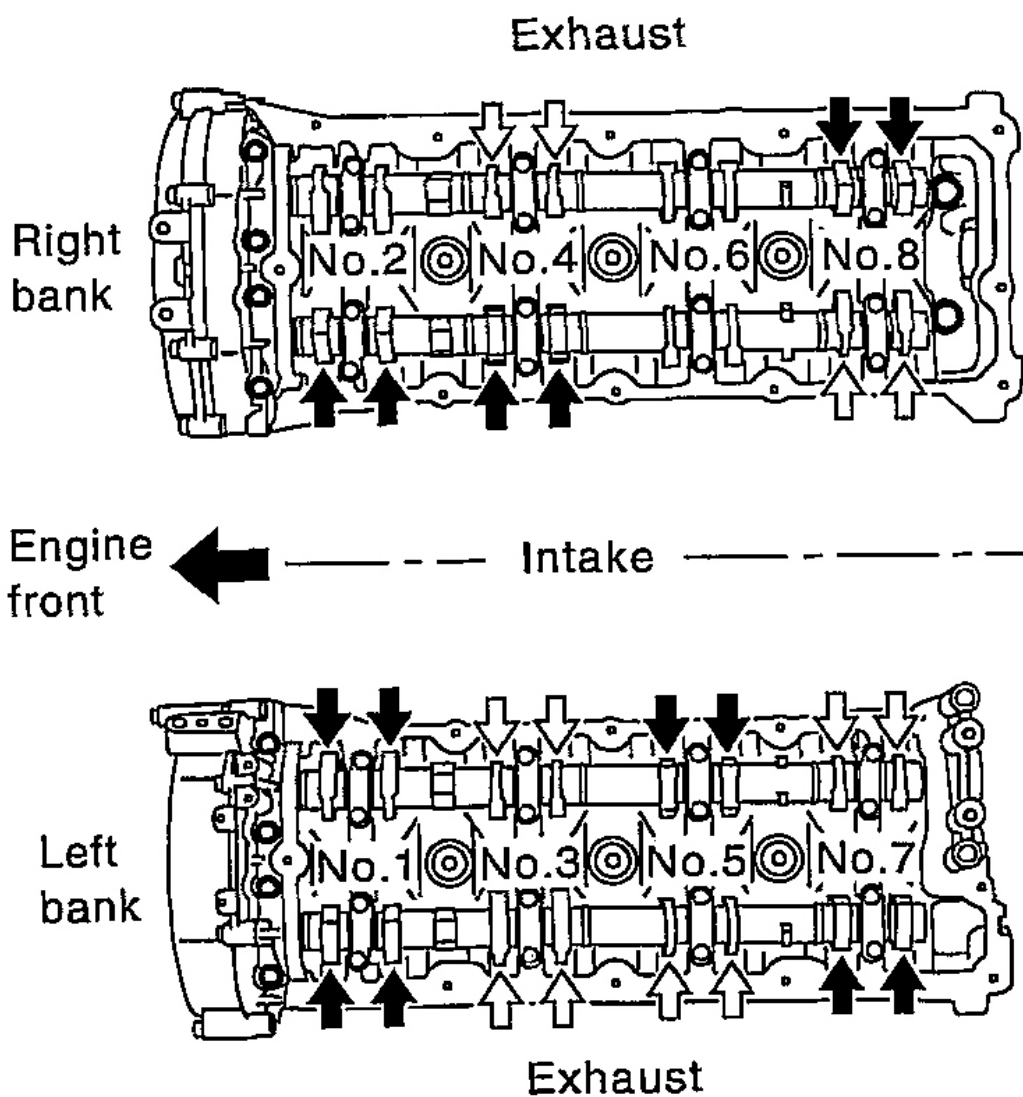
2004 ENGINES Engine Mechanical - 4.5L V8

Measuring position (Right bank)		No.2 CYL	No.4 CYL	No.6 CYL	No. 8 CYL
No. 1 cylinder at TDC	EXH				×
	INT	×	×		
Measuring position (Left bank)		No.1 CYL	No. 3 CYL	No. 5 CYL	No. 7 CYL
No. 1 cylinder at TDC	INT	×		×	
	EXH	×			×

G00753230

Fig. 102: Valve Clearance Table For No. 1 cylinder compression TDC
Courtesy of NISSAN MOTOR CO., U.S.A.

- ↑ : Measurable at No. 1 cylinder
compression top dead center
 ↑ : Measurable at No. 3 cylinder
compression top dead center



G00753231

Fig. 103: Checking Valve Clearance (1 Of 2)

Courtesy of NISSAN MOTOR CO., U.S.A.

- Use a fine thickness gauge.

Valve clearance standard:

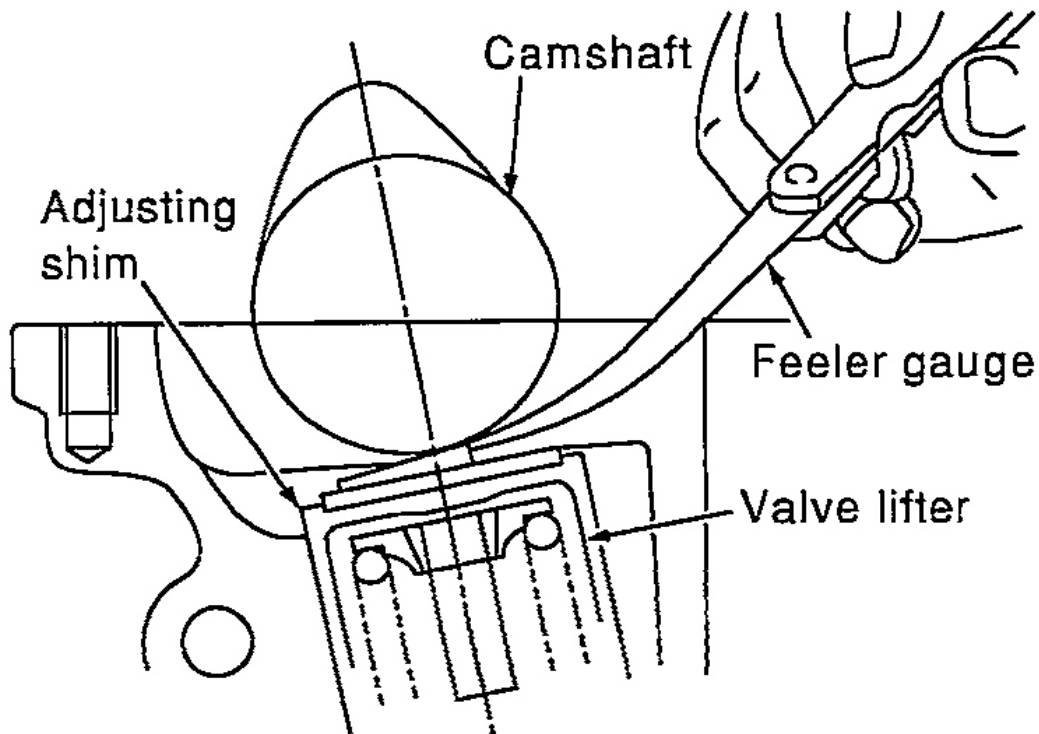
Hot Intake : 0.304 - 0.416 mm (0.012 - 0.016 in)

Exhaust : 0.308 - 0.432 mm (0.012 - 0.017 in)

Cold* Intake : 0.26 - 0.34 mm (0.010 - 0.013 in)

Exhaust : 0.29 - 0.37 mm (0.011 - 0.015 in)

*Reference data at approximately 20°C (68°F)



G00753232

Fig. 104: Checking Valve Clearance (2 Of 2)

Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: If inspection was carried out with cold engine, check that values with fully warmed up engine are still within specifications.

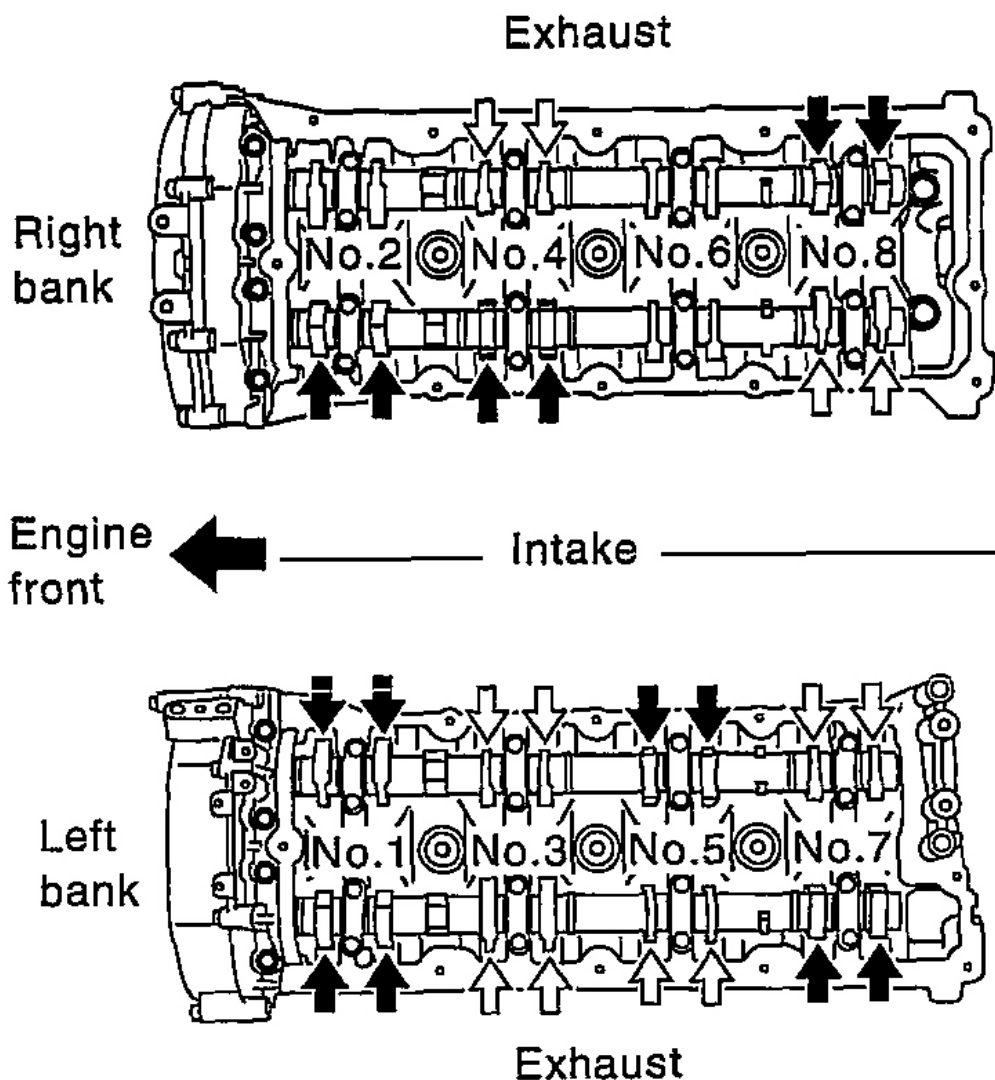
7. Turn crankshaft pulley clockwise by 270 degrees from the position of No. 1 cylinder compression TDC to obtain No. 3 cylinder compression TDC.
8. By referring to the figure, measure valve clearances at locations marked X as shown in the table below (locations indicated with white arrow in figure).
 - No.3 cylinder compression TDC

Measuring position (Right bank)		No.2 CYL	No.4 CYL	No.6 CYL	No. 8 CYL
No. 3 cylinder at TDC	EXH		×		
	INT				×
Measuring position (Left bank)		No.1 CYL	No. 3 CYL	No. 5 CYL	No. 7 CYL
No. 3 cylinder at TDC	INT		×		×
	EXH		×	×	

G00753234

Fig. 105: Valve Clearance Table For No. 3 cylinder compression TDC
 Courtesy of NISSAN MOTOR CO., U.S.A.

- ↑ : Measurable at No. 1 cylinder
compression top dead center
 ↑ : Measurable at No. 3 cylinder
compression top dead center



G00753235

Fig. 106: Checking Valve Clearance (1 Of 2)
 Courtesy of NISSAN MOTOR CO., U.S.A.

9. Turn crankshaft pulley clockwise by 90 degrees from the position of No. 3 cylinder compression TDC (clockwise by 360 degrees from the position of No. 1 cylinder compression TDC) to measure intake and exhaust valve clearances of No. 6 cylinder and exhaust valve clearance of No. 2 cylinder.

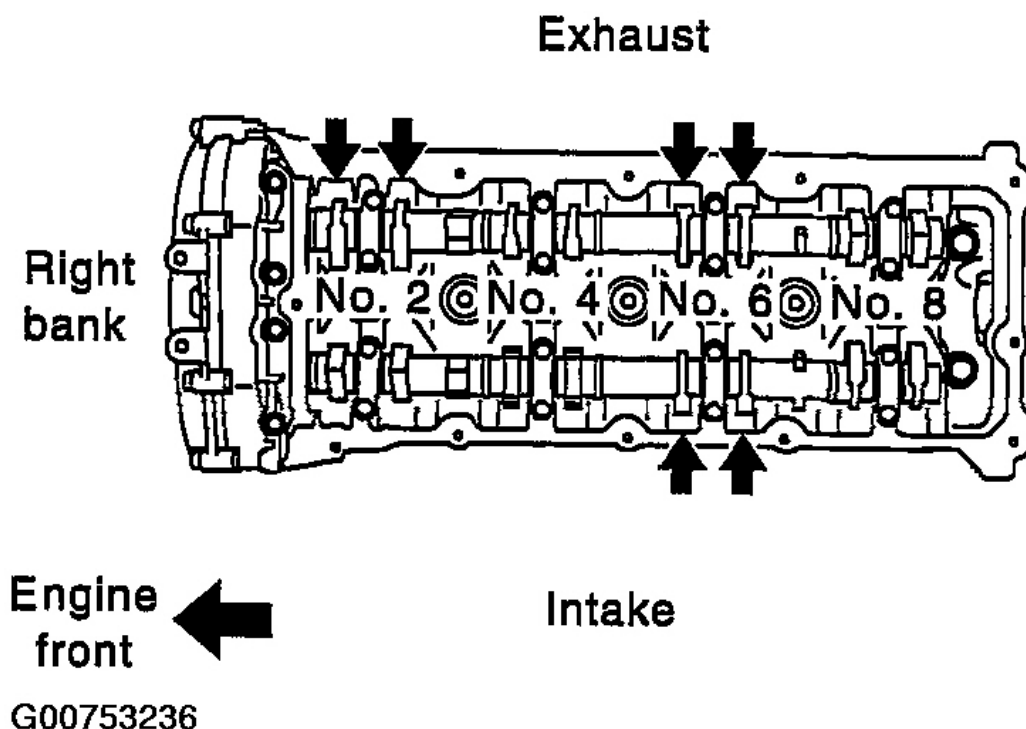


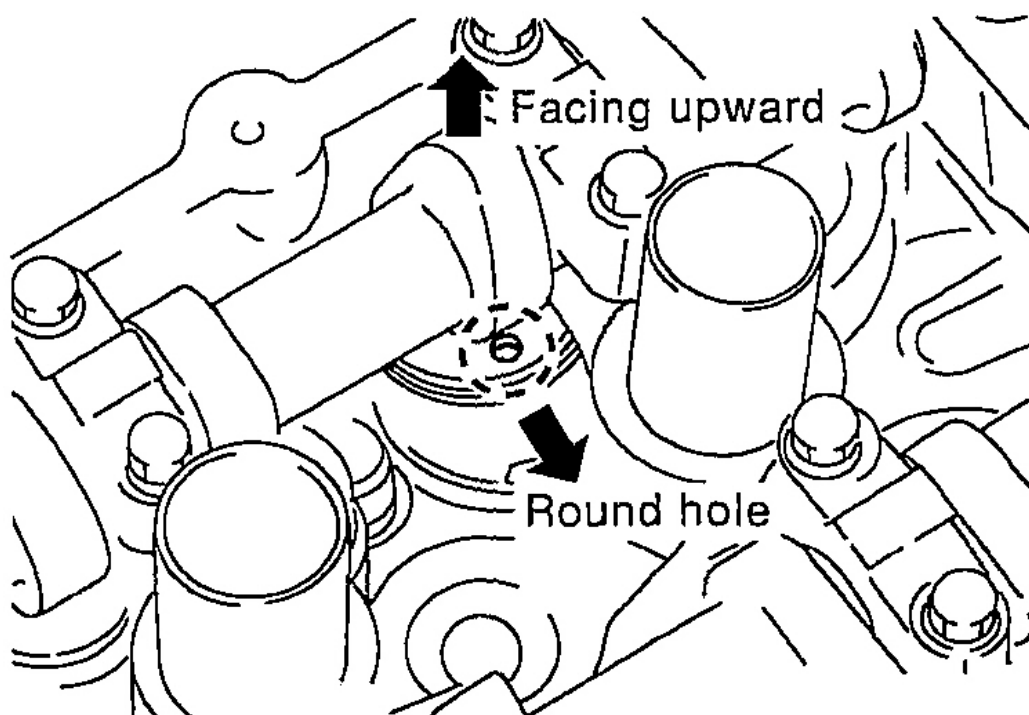
Fig. 107: Checking Valve Clearance (2 Of 2)
Courtesy of NISSAN MOTOR CO., U.S.A.

10. If out of the standard, adjust as follows:

ADJUSTMENT

NOTE: Adjust valve clearance while engine is cold.

1. Turn crankshaft, to position cam nose on camshaft that must be adjusted upward.
2. Thoroughly wipe off engine oil around adjusting shim using a rag.
3. Using a extra-fine screwdriver, turn the round hole of the adjusting shim in the direction of the arrow.



G00753237

Fig. 108: Removing Adjusting Shim

Courtesy of NISSAN MOTOR CO., U.S.A.

4. Compress valve spring by snapping camshaft using the camshaft pliers (SST), by pulling camshaft to the same direction of the arrow and by pushing valve lifter down.

CAUTION: Be careful not to damage cam surface with the camshaft pliers (SST).

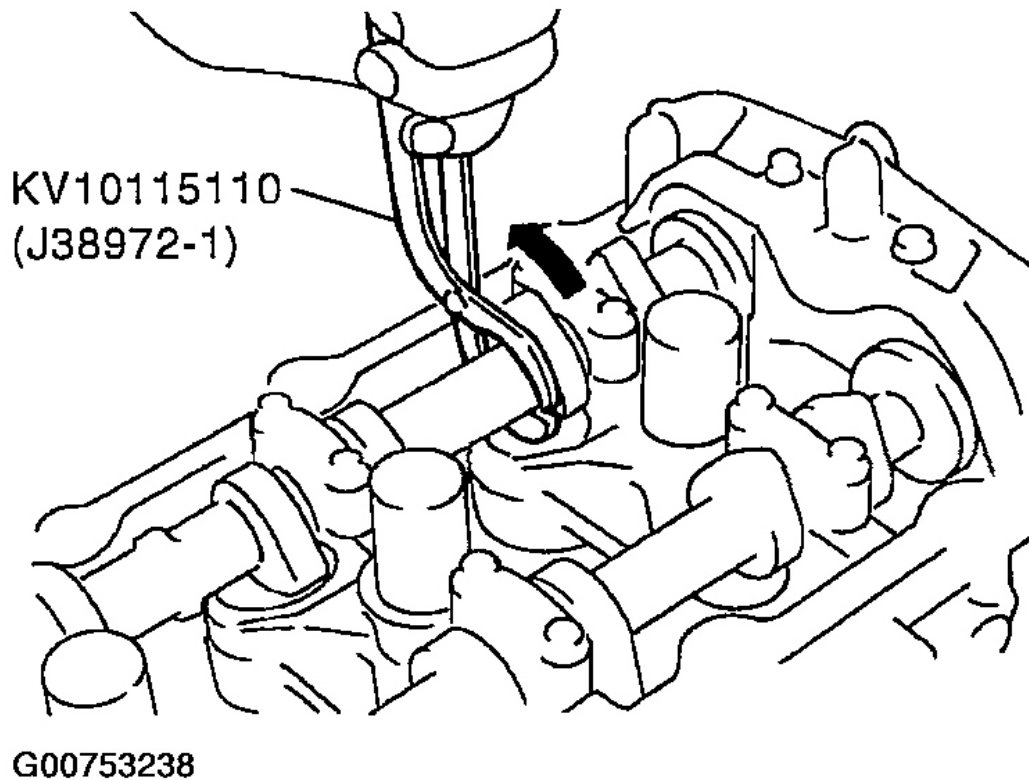


Fig. 109: Identifying Camshaft Pliers
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Place the lifter stopper (SST) between camshaft and the edge of valve lifter to retain valve lifter.

CAUTION:

- The lifter stopper (SST) must be placed as close to camshaft bracket as possible.
- Be careful not to damage cam surface with the lifter stopper.

6. Remove the camshaft pliers (SST).

CAUTION: When returning the camshaft pliers (SST) quickly, the lifter stopper (SST) hit and damages the journal portion of camshaft. Therefore turn the camshaft pliers slowly.

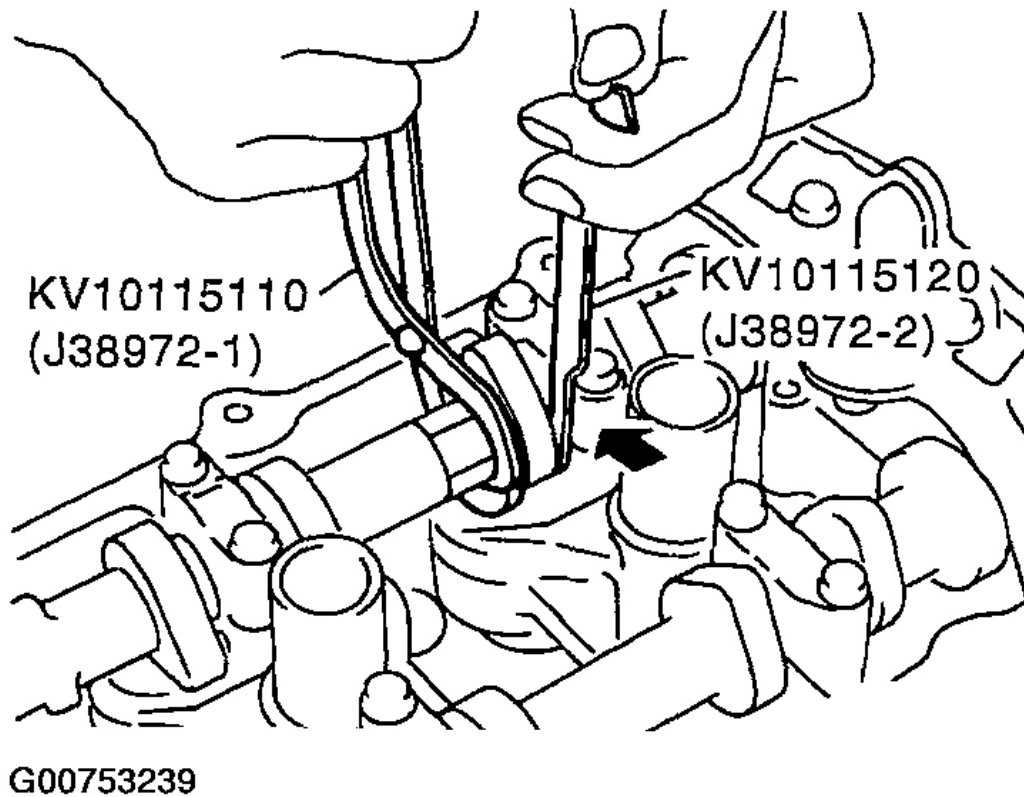
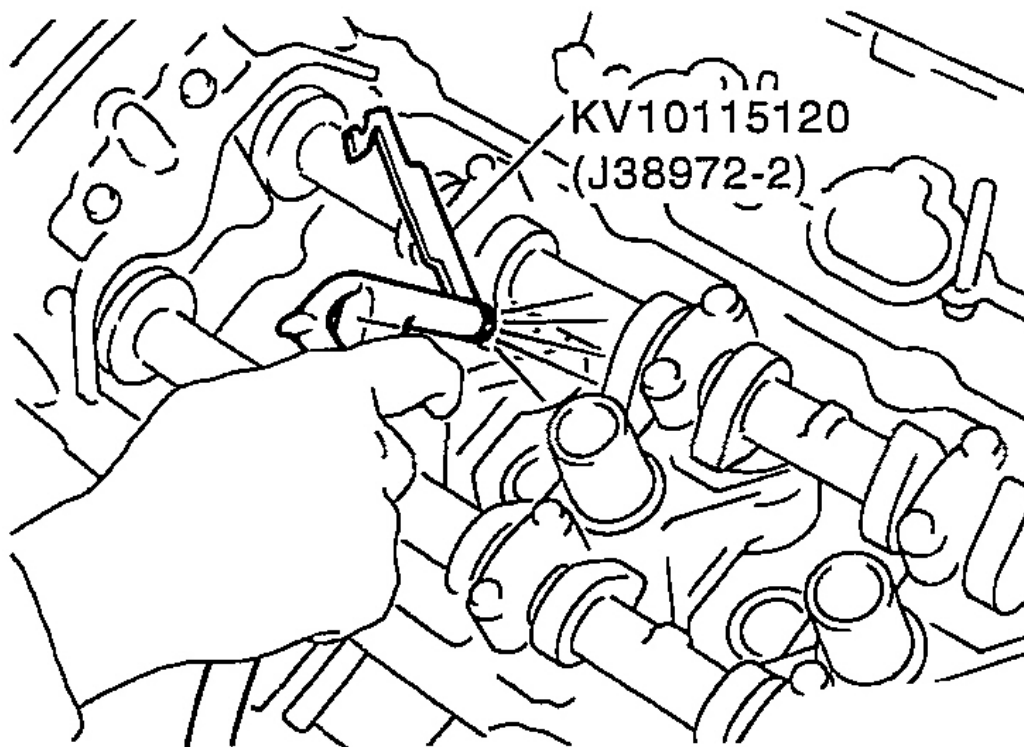


Fig. 110: Installing lifter stopper
Courtesy of NISSAN MOTOR CO., U.S.A.

7. Blow air into the hole to separate adjusting shim from valve lifter.

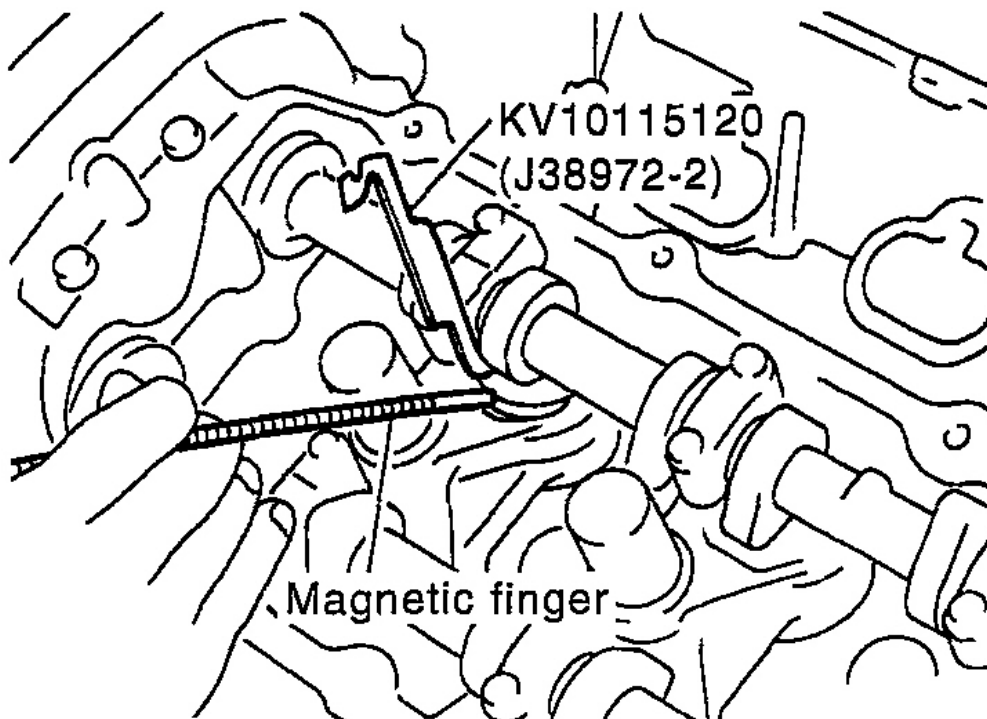
CAUTION: When blowing, use goggles to protect your eye.



G00753240

Fig. 111: Separating adjusting shim from valve lifter
Courtesy of NISSAN MOTOR CO., U.S.A.

8. Remove adjusting shim using a small screwdriver and a magnetic finger.



G00753241

Fig. 112: Removing adjusting shim

Courtesy of NISSAN MOTOR CO., U.S.A.

9. Determine replacement adjusting shim size following formula.
 - Using a micrometer determine thickness of removed shim with measured at center.
 - Calculate thickness of new adjusting shim so valve clearance comes within specified values (Cold value).

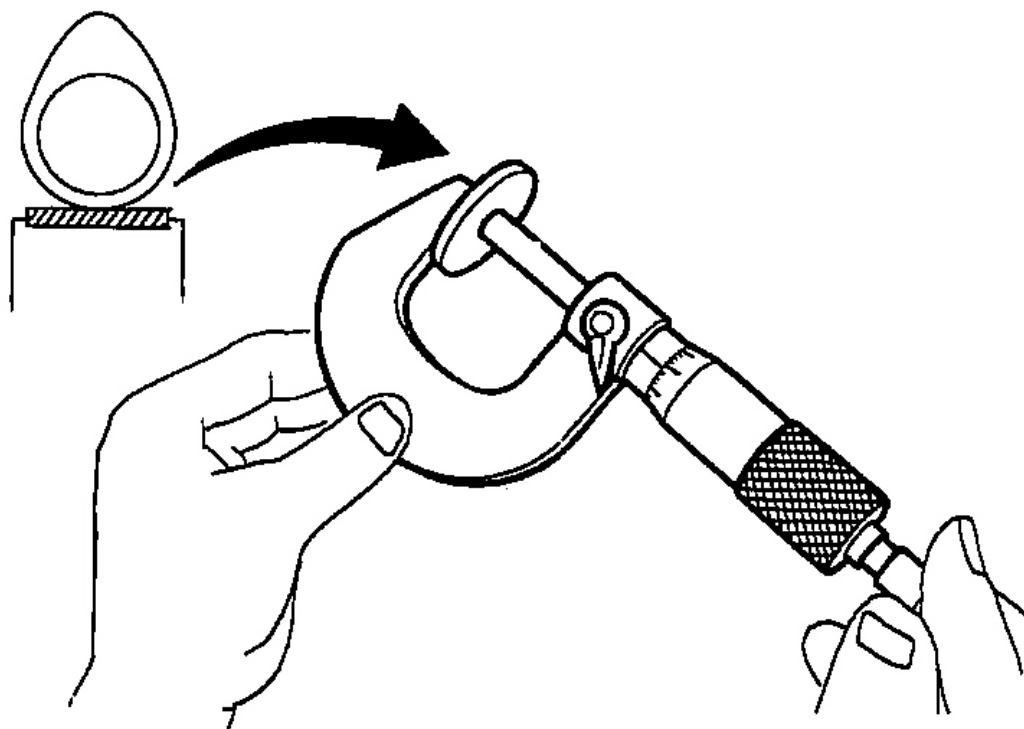
R = Thickness of removed shim

N = Thickness of new shim

M = Measured valve clearance

Intake : $N = R + [M - 0.30 \text{ mm (0.0118 in)}]^*$ **Exhaust : $N = R + [M - 0.33 \text{ mm (0.0130 in)}]^*$** ***: Approximately 20° C (68° F)**

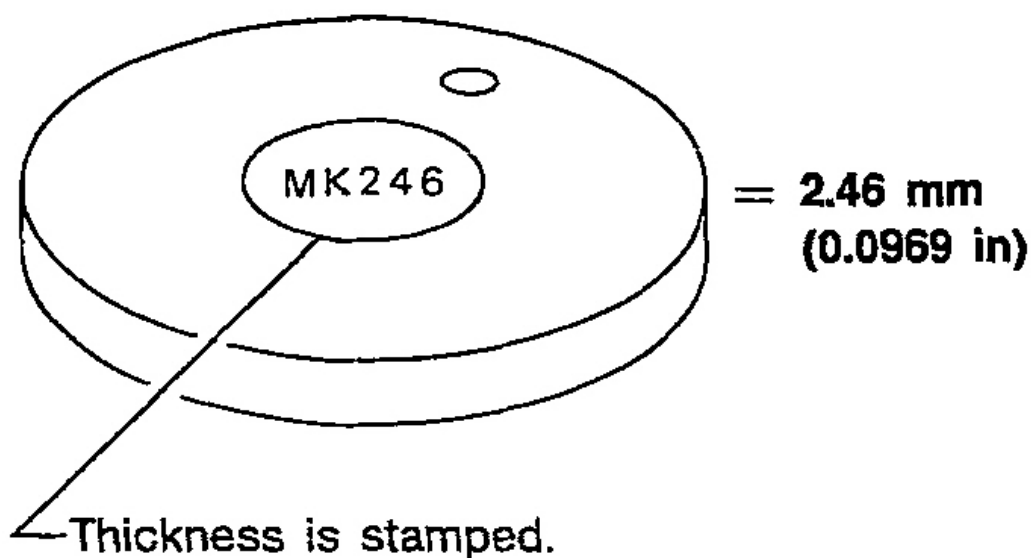
Shims are available in 64 sizes from 2.32 mm (0.0913 in) to 2.95 mm (0.1161 in) in steps of 0.01 mm (0.0004 in) .



G00753242

Fig. 113: Measuring Adjusting Shim
Courtesy of NISSAN MOTOR CO., U.S.A.

- Select new shim with thickness as close as possible to calculated value.

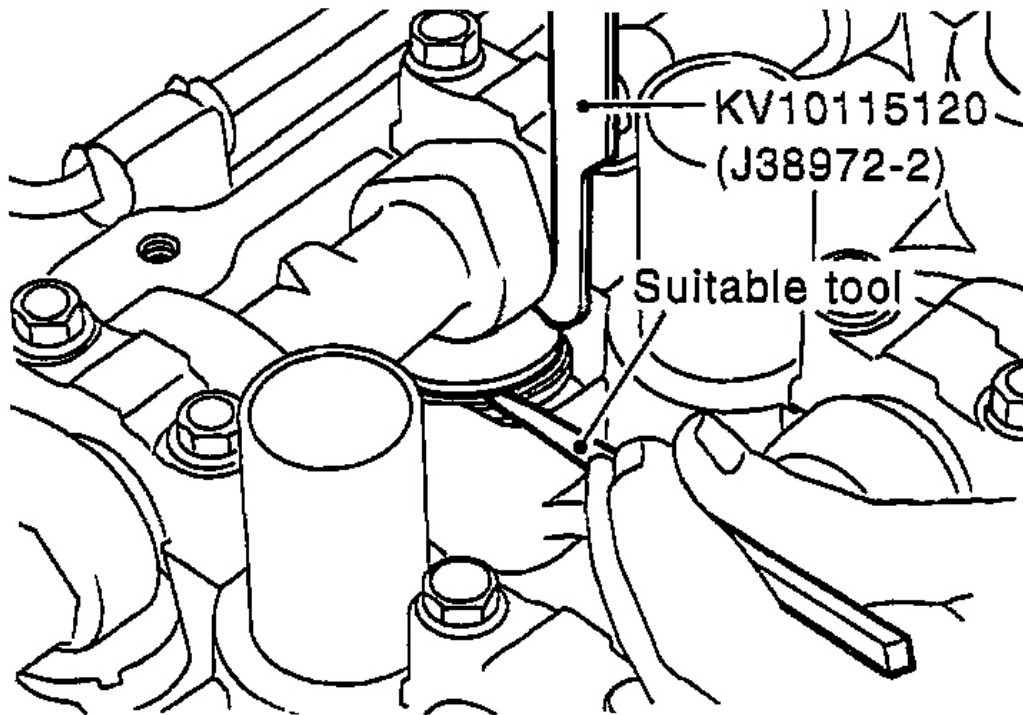


G00753243

Fig. 114: Identifying Adjusting Shim

Courtesy of NISSAN MOTOR CO., U.S.A.

10. Install new shim using a suitable tool.
 - Install with the surface on which the thickness stamped is facing down .



G00753244

Fig. 115: Installing new shim

Courtesy of NISSAN MOTOR CO., U.S.A.

11. Place the camshaft pliers (SST) as mentioned in step 4.
12. Remove the lifter stopper (SST).
13. Remove the camshaft pliers (SST).
14. Rotate crankshaft 2 to 3 turns by hand.
15. Recheck valve clearance. (Cold value)
16. Finally check valve clearance with warmed up engine. (Hot value)

Valve clearance:

Unit: mm (in)		
	Hot	Cold* (reference data)
Intake	0.304 - 0.416 (0.012 - 0.016)	0.26 - 0.34 (0.010 - 0.013)
Exhaust	0.308 - 0.432 (0.012 - 0.017)	0.29 - 0.37 (0.011 - 0.015)

*: Approximately 20°C (68°F)

G00753246

Fig. 116: Valve Clearance Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

OIL SEAL

REMOVAL AND INSTALLATION OF VALVE OIL SEAL

REMOVAL

1. Remove camshaft relating to valve oil seal to be removed. Refer to **CAMSHAFT**.
2. Remove adjusting shims and valve lifters. Refer to **CAMSHAFT**.
 - Correctly identify location where each part is installed. Keep parts in an organized way to avoid mixing them up.
3. Turn crankshaft until the cylinder requiring new oil seals is at TDC. This will prevent the valve from dropping into cylinder.
4. Remove valve collet.
 - Compress valve spring with the valve spring compressor, attachment and adapter (SST). Remove valve collet with magnet driver.

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

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

CAUTION: Do not remove valve spring seat from valve spring.

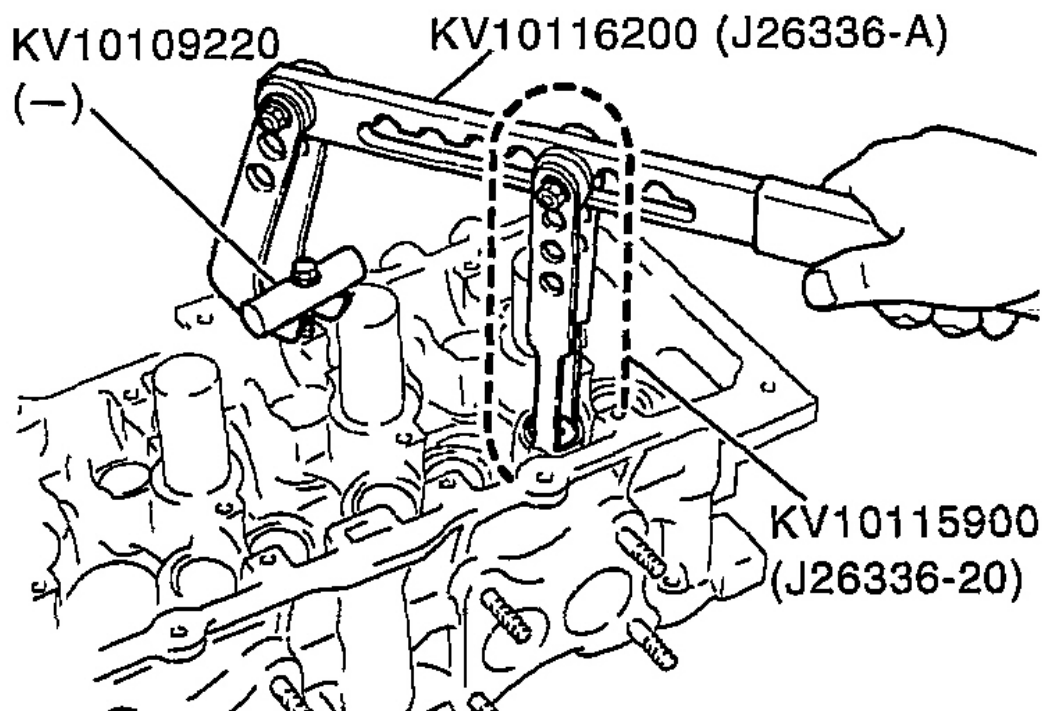


Fig. 117: Identifying Valve Spring Compressor
Courtesy of NISSAN MOTOR CO., U.S.A.

6. Remove valve oil seal using the valve oil seal puller (SST).

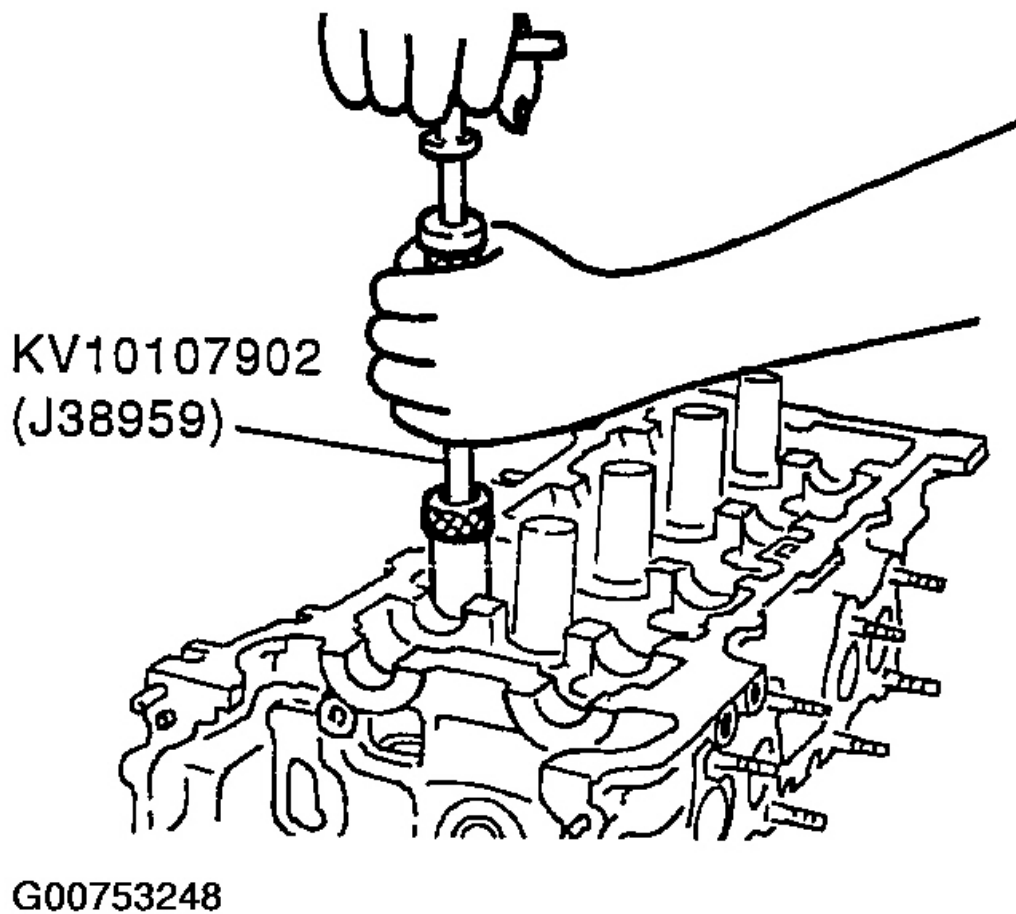
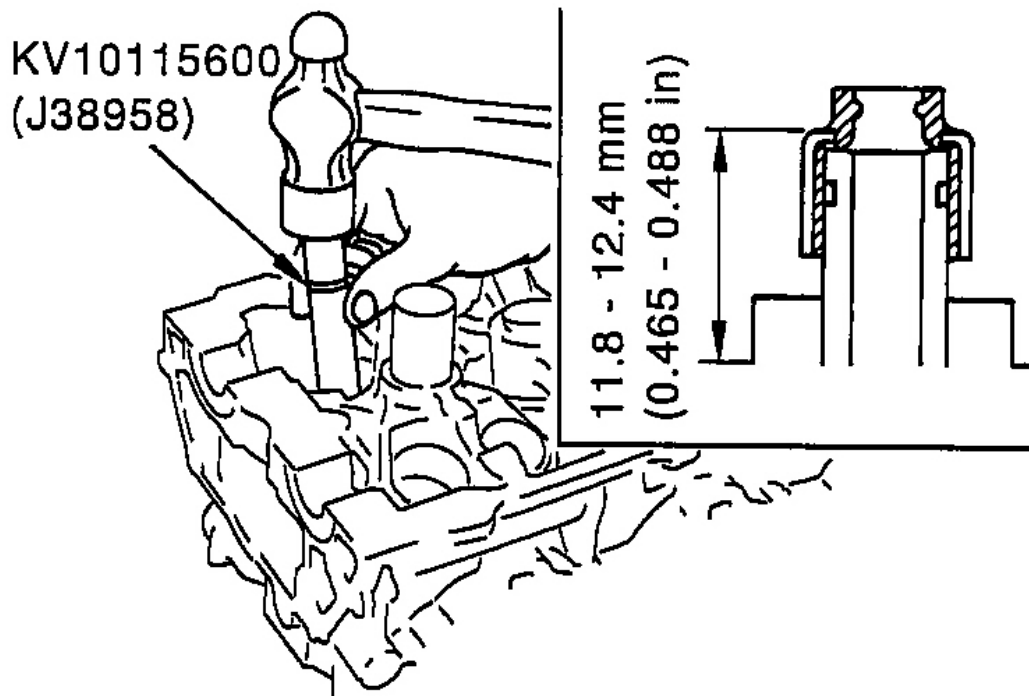


Fig. 118: Identifying valve oil seal puller
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

1. Apply engine oil on new valve oil seal joint and seal lip.
2. Install valve oil seal.
 - Install with the valve oil seal drift (SST) to match dimension in illustration.
3. Perform steps in the reverse order of removal for the following operations.



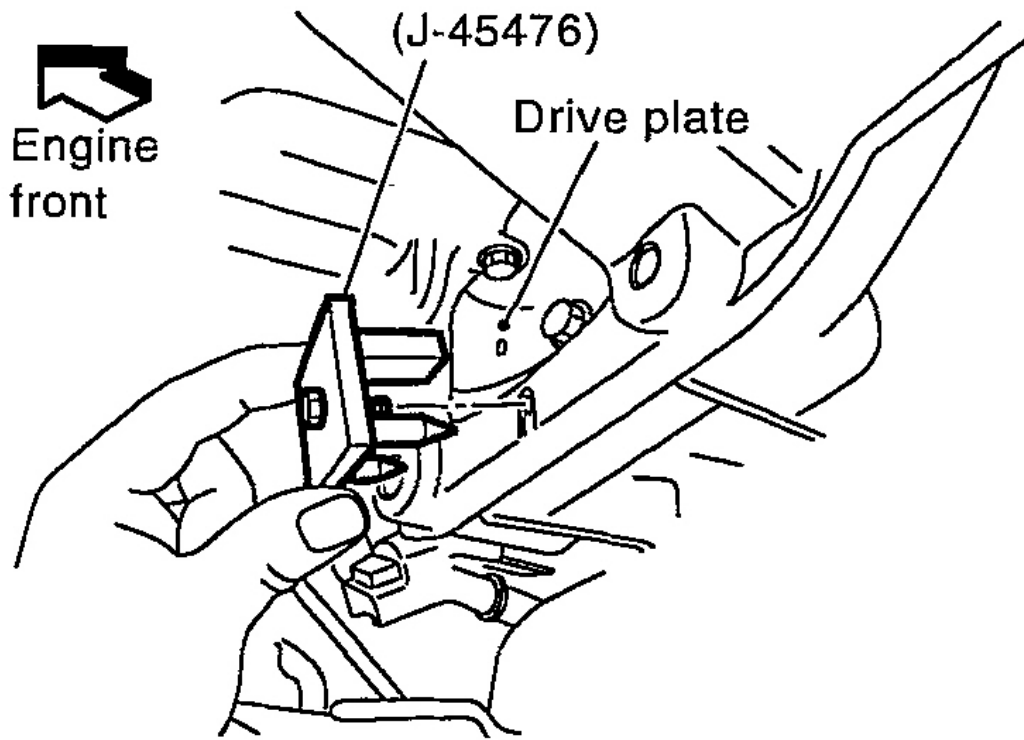
G00753249

Fig. 119: Installing Valve Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

REMOVAL AND INSTALLATION OF FRONT OIL SEAL

REMOVAL

1. Remove the following parts:
 - Engine undercover
 - Drive belt; Refer to **DRIVE BELTS**.
 - Cooling fan; Refer to **COOLING FAN** .
 - Rear plate cover; Refer to **OIL PAN AND OIL STRAINER**.
2. Set the ring gear stopper (SST).



G00753250

Fig. 120: Identifying ring gear stopper (J-45476)
Courtesy of NISSAN MOTOR CO., U.S.A.

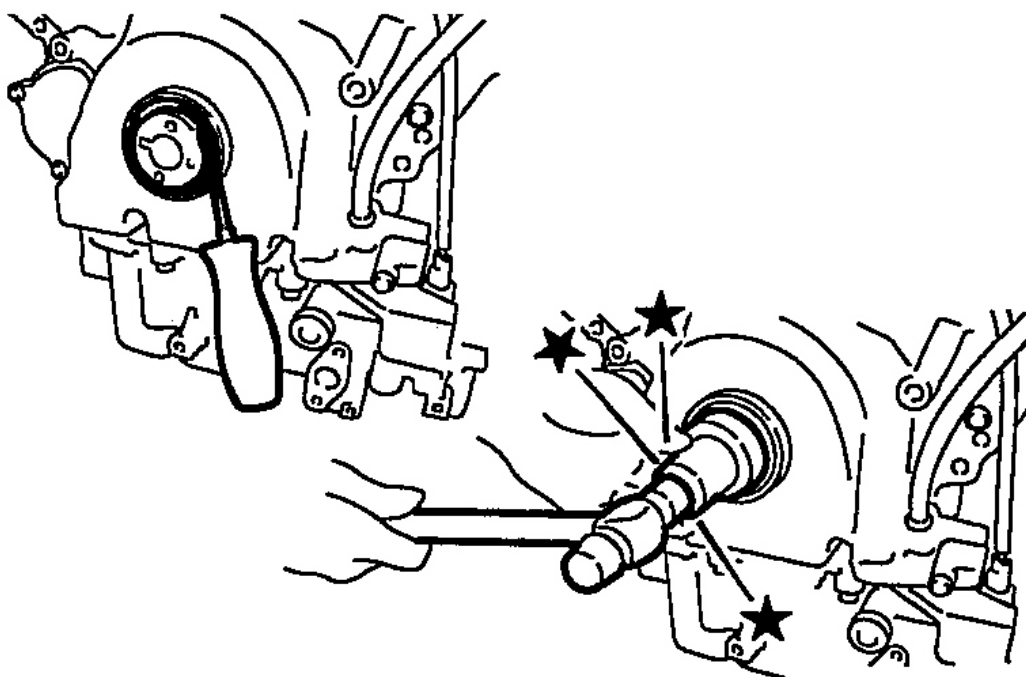
3. Remove crankshaft pulley with the following procedure:
 - a. Loosen crankshaft pulley bolt.
 - b. Pull crankshaft pulley with both hands to remove it.

CAUTION:

- Do not remove fixing bolt. Keep loosened fixing bolt in place to protect removed crankshaft pulley from dropping.
- Do not remove balance weight (inner hexagon bolt) at the front of crankshaft pulley.

4. Remove front oil seal using a suitable tool.

CAUTION: Be careful not to damage front cover and oil pump drive spacer.



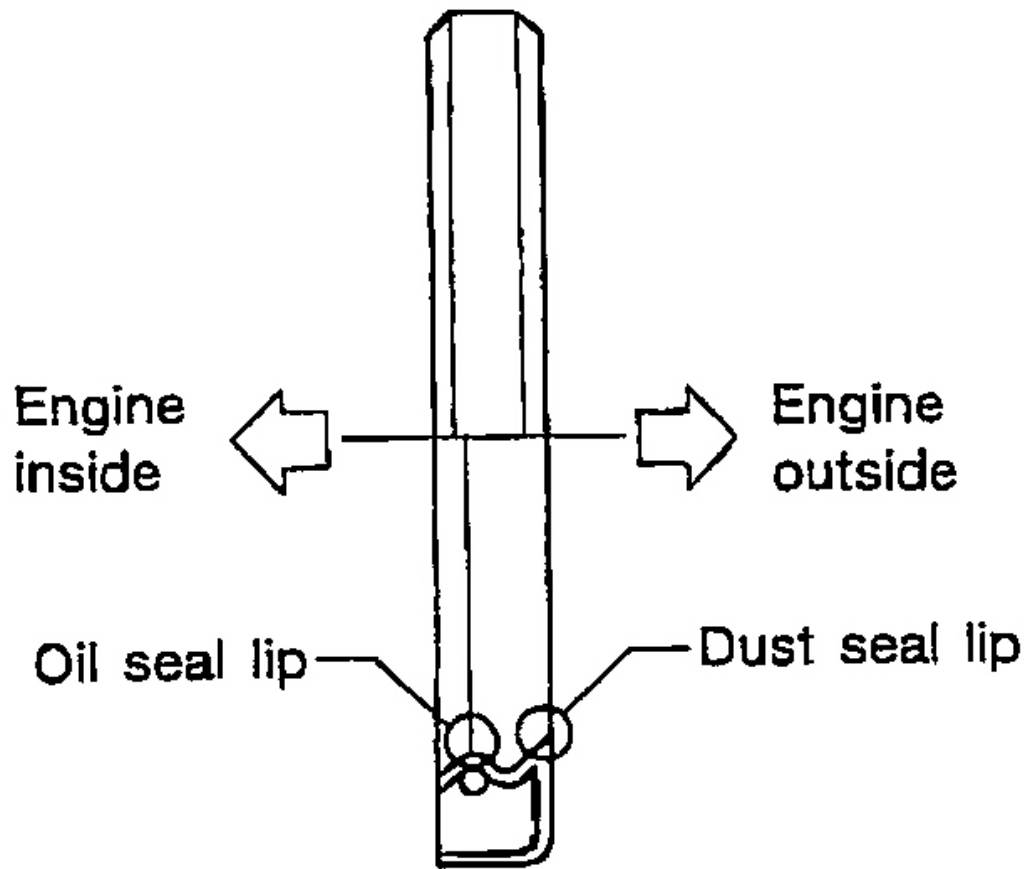
G00753252

Fig. 121: Removing & Installing Front Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

1. Install front oil seal onto front cover.
 - Install new front oil seal in the direction shown in the figure.

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



G00753253

Fig. 122: View Of Front Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

- Apply engine oil on new front oil seal.
 - Using the front oil seal drift (commercial service tool) or drift with 54 mm (2.13 in) diameter, force fit the seal until it levels with the front end surface of front cover.
2. Perform steps in the reverse order of removal for the following operations.

REMOVAL AND INSTALLATION OF REAR OIL SEAL

REMOVAL

1. Remove transmission assembly. Refer to TRANSMISSION ASSEMBLY .
 - a. Remove drive plate.

- Holding crankshaft pulley mounting bolts, lock crankshaft to remove bolts fixing drive plate.
- Loosen fixing bolts diagonally.

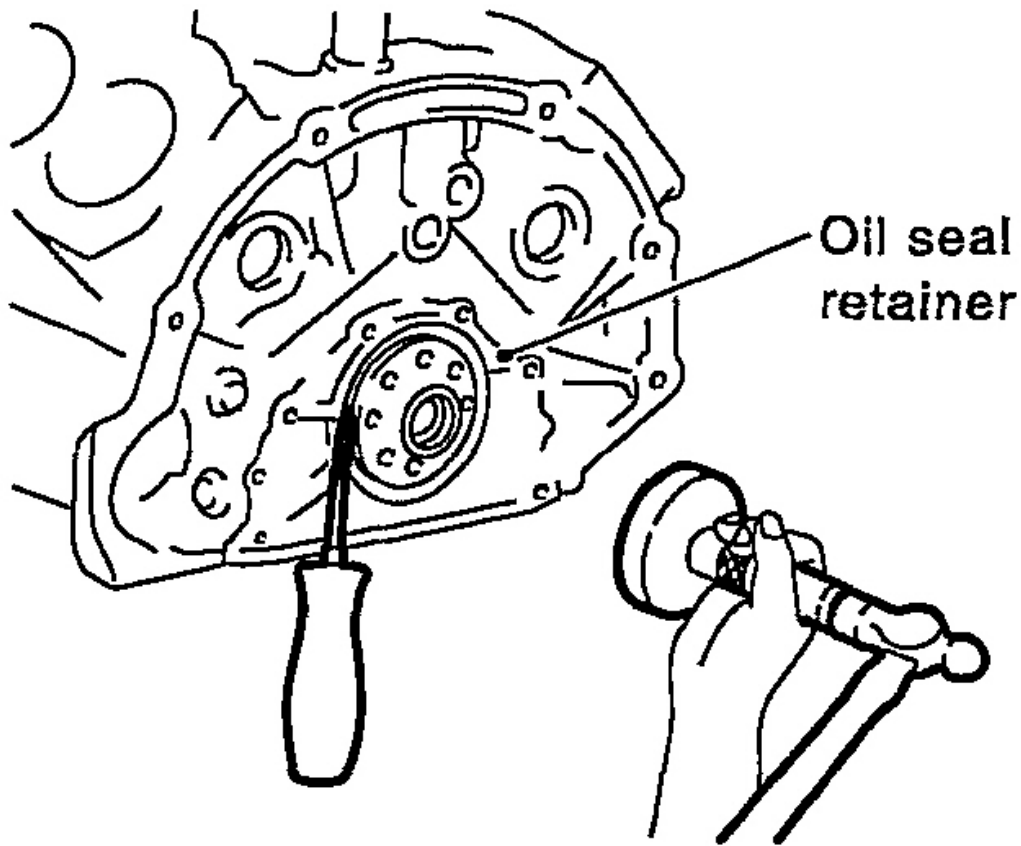
CAUTION:

- Be careful not to damage drive plate. Especially, avoid deforming and damaging of signal plate teeth (circumference position).
- Place drive plate with signal plate surface facing other than downward.
- Keep magnetic materials away from signal plate.

b. Remove engine rear plate.

2. Remove rear oil seal using a suitable tool.

CAUTION: Be careful not to damage crankshaft and oil seal retainer surface.



G00753255

Fig. 123: Removing & Installing Rear Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

1. Install rear oil seal using the rear oil seat drift (commercial service tool).
 - Install new oil seal in the direction shown in the figure.

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

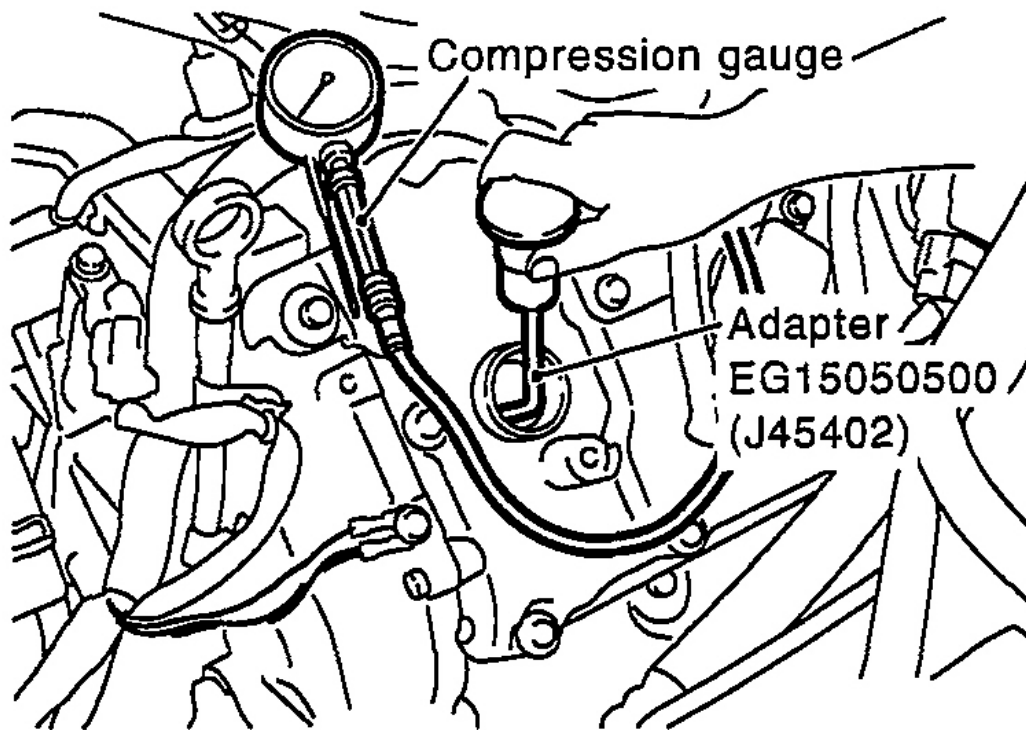
- Tap until flattened with front edge of oil seal retainer. Do not damage or scratch outer circumference of oil seal.
2. Perform steps in the reverse order of removal for the following operations.

CYLINDER HEAD

ON-VEHICLE SERVICE

CHECKING COMPRESSION PRESSURE

1. Warm up engine thoroughly. Then, stop it.
2. Remove engine cover (with power tool), air cleaner cover and battery cover. Refer to **ENGINE ROOM COVER**.
3. Release fuel pressure.
 - a. Remove fuel pump fuse, and start engine. Refer to **FUEL PRESSURE RELEASE** for fuel pump fuse location.
 - b. After engine stalls, crank it two or three times to release all fuel pressure.
 - Let fuel pump fuse removed until the end of step 7.
4. Remove ignition coil and spark plug from each cylinder. Refer to **IGNITION COIL** and **SPARK PLUG (PLATINUM-TIPPED TYPE)**.
5. Connect engine tachometer (not required in use of CONSULT-II).
6. Install the compression gauge with adapter (SST) onto spark plug hole.
 - Use the compression gauge adapter (SST) which is required on No.7 and No.8 cylinders.



G00753258

Fig. 124: Checking Compression
Courtesy of NISSAN MOTOR CO., U.S.A.

- Use the compression gauge adapter (if no SST is used) whose picking up end inserted to spark plug hole is smaller than 20 mm (0.79 in) in diameter. Otherwise, it may be caught by cylinder head during removal.
7. With accelerator pedal fully depressed, turn ignition switch to "START" for cranking. When the gauge pointer stabilizes, read the compression pressure and engine RPM. Perform these steps to check each cylinder.



20 mm (0.79 in) dia.

G00753259

Fig. 125: Identifying compression gauge adapter
Courtesy of NISSAN MOTOR CO., U.S.A.

Compression pressure

Unit: kPa (kg/cm ² , psi) / rpm		
Standard	Minimum	Difference limit between cylinders
1,320 (13.5, 191) / 300	1,130 (11.5, 164) / 300	98 (1.0, 14) / 300

G00753260

Fig. 126: Compression Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

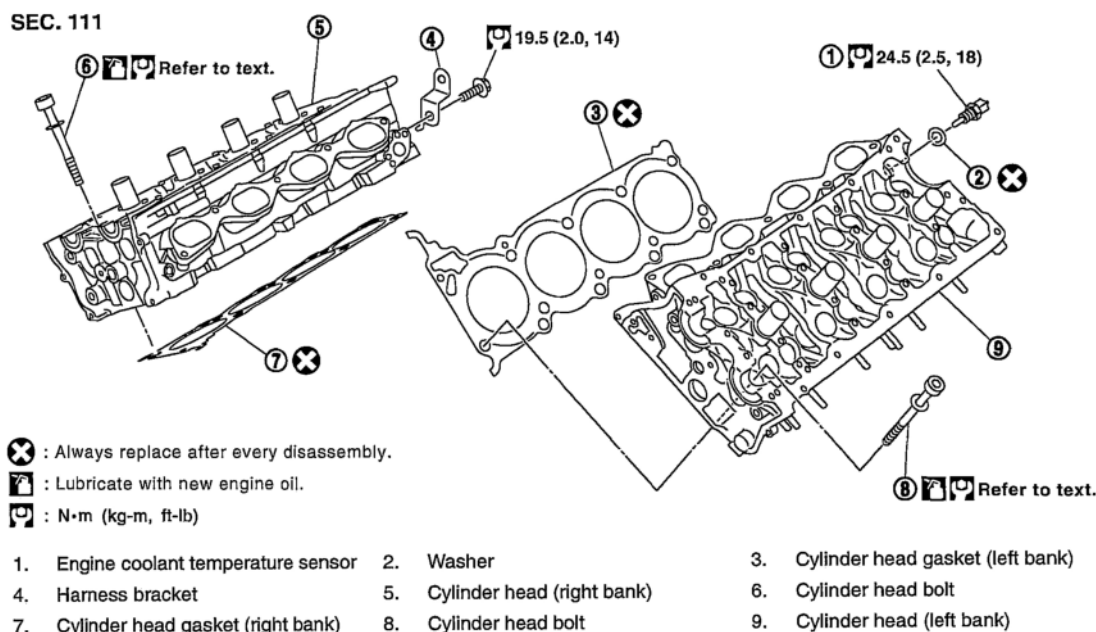
CAUTION: Always use a fully charged battery to obtain specified engine speed.

- If the engine speed is out of specified range, check battery liquid for proper gravity. Check engine speed again with normal battery gravity.
- If compression pressure is below minimum value, check valve clearances and parts associated with combustion chamber (Valve, valve seat, piston, piston ring, cylinder bore, cylinder head, cylinder head gasket). After the checking, measure compression pressure again.
- If some cylinders have low compression pressure, pour small amount of engine oil into the spark plug hole of cylinder to re-check it for compression.
 - If the added engine oil improves the compression, the piston rings may be worn out or damaged. Check piston rings and replace if necessary.
 - If the compression pressure remains at low level despite the addition of engine oil, valves may be malfunctioning. Check valves for damage. Replace valve or valve seat accordingly.
- If two adjacent cylinders have respectively low compression pressure and their compression

remains low even after the addition of engine oil, the gaskets are leaking. In such a case, replace cylinder head gaskets.

8. Install removed parts in the reverse order of removal.
9. Start engine, and confirm that engine runs smoothly.
10. Perform trouble diagnosis. If DTC appears, erase it. Refer to **TROUBLE DIAGNOSIS**.

REMOVAL AND INSTALLATION



G00753261

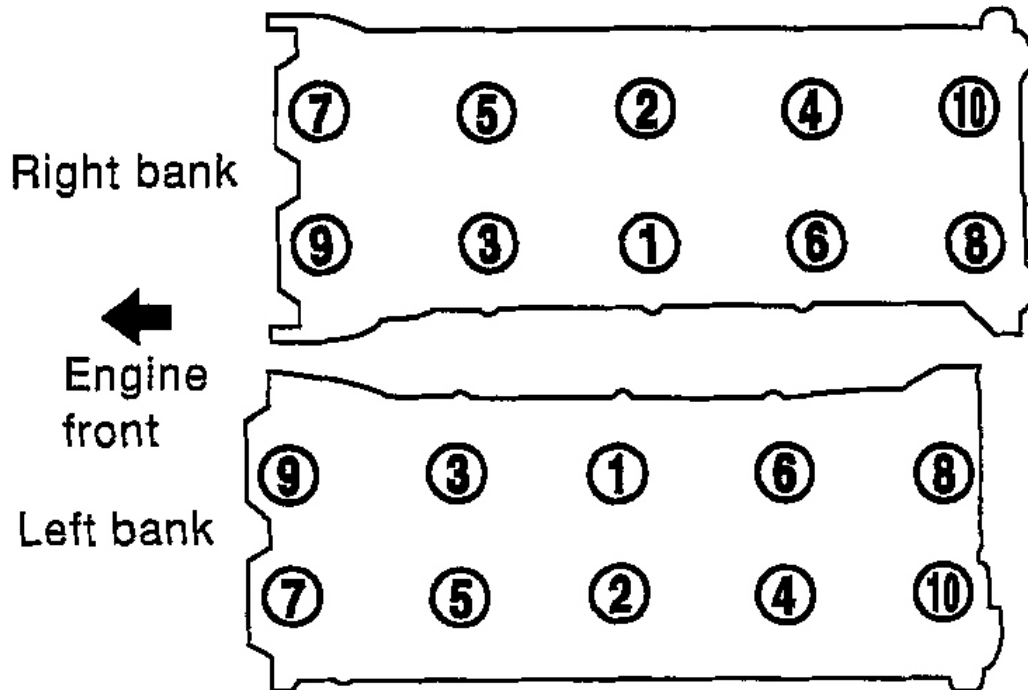
Fig. 127: View Of Cylinder Heads

Courtesy of NISSAN MOTOR CO., U.S.A.

REMOVAL

1. Remove engine assembly from vehicle. Refer to **ENGINE ASSEMBLY**.
2. Remove the following components and related parts:
 - Auto tensioner of drive belts and idler pulley. Refer to **Drive Belt Auto Tensioner and Idler Pulley**.
 - Thermostat housing and hose.
 - Oil pan and oil strainer. Refer to **OIL PAN AND OIL STRAINER**.
 - Intake manifold upper and intake manifold lower. Refer to **INTAKE MANIFOLD**.
 - Fuel tube (right and left), fuel damper and fuel hose assembly and fuel injector. Refer to **FUEL INJECTOR AND FUEL TUBE**.
 - Ignition coil. Refer to **IGNITION COIL**.
 - Rocker cover. Refer to **ROCKER COVER**.

3. Remove crankshaft pulley, front cover, oil pump and timing chain. Refer to **TIMING CHAIN**.
4. Remove camshaft sprockets and camshafts. Refer to **CAMSHAFT**.
5. Remove cylinder head loosening bolts in reverse order shown in the figure and using the cylinder head bolt wrench (Commercial service tool).



G00753262

Fig. 128: Cylinder Head Torque Sequence
 Courtesy of NISSAN MOTOR CO., U.S.A.

6. Remove cylinder head gaskets.

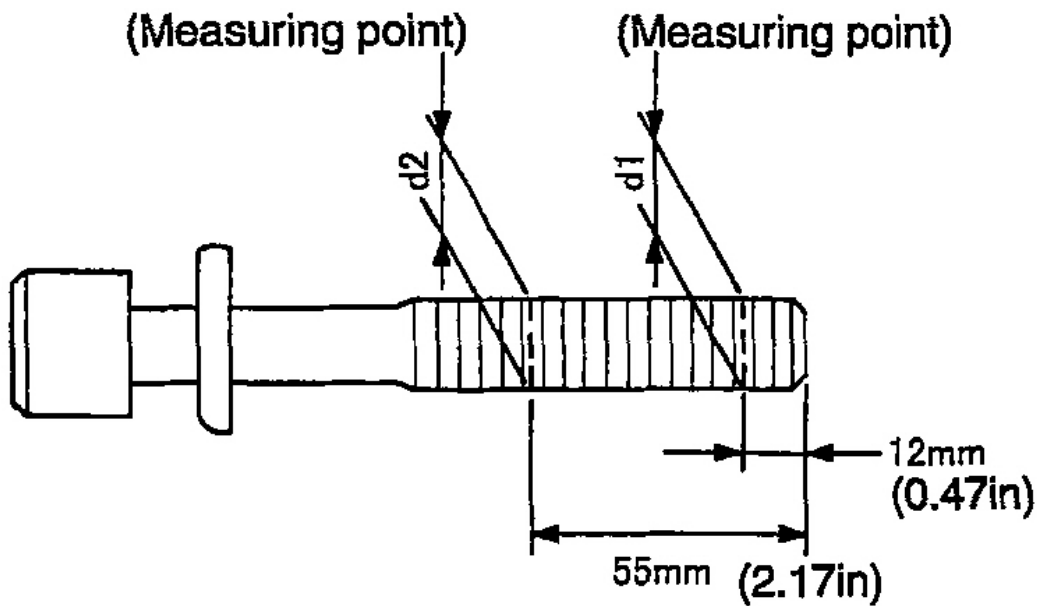
INSPECTION AFTER REMOVAL

Outer Diameter of Cylinder Head Bolts

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

Limit (d1 - d2) : More than 0.18 mm (0.0071 in)

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



G00753263

Fig. 129: Checking For Bolt Stretch
Courtesy of NISSAN MOTOR CO., U.S.A.

CYLINDER HEAD DISTORTION

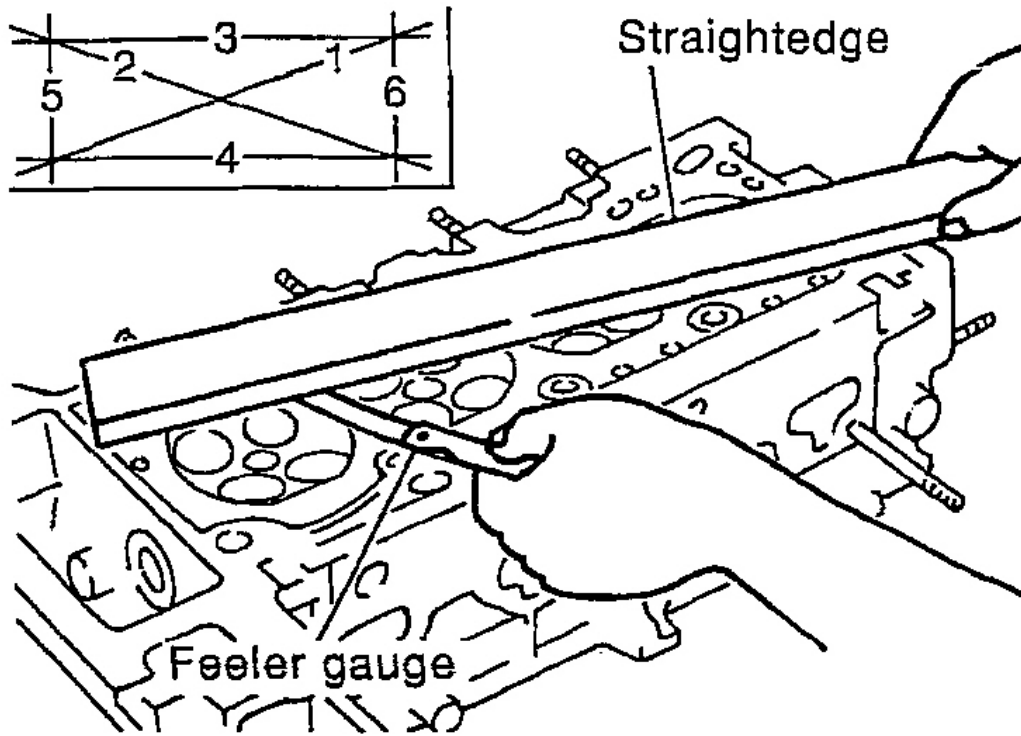
1. Wipe off oil and remove water scale (like deposit), gasket, sealer, carbon, etc. with scraper.

CAUTION: Use utmost care not to allow liquid gasket debris to enter passages for oil or water.

2. At each of several locations on bottom surface of cylinder head, measure distortion in six directions.

Limit: 0.1 mm (0.004 in)

- If it exceeds the limit, replace cylinder head.



G00753264

Fig. 130: Checking Cylinder Head Warpage
 Courtesy of NISSAN MOTOR CO., U.S.A.

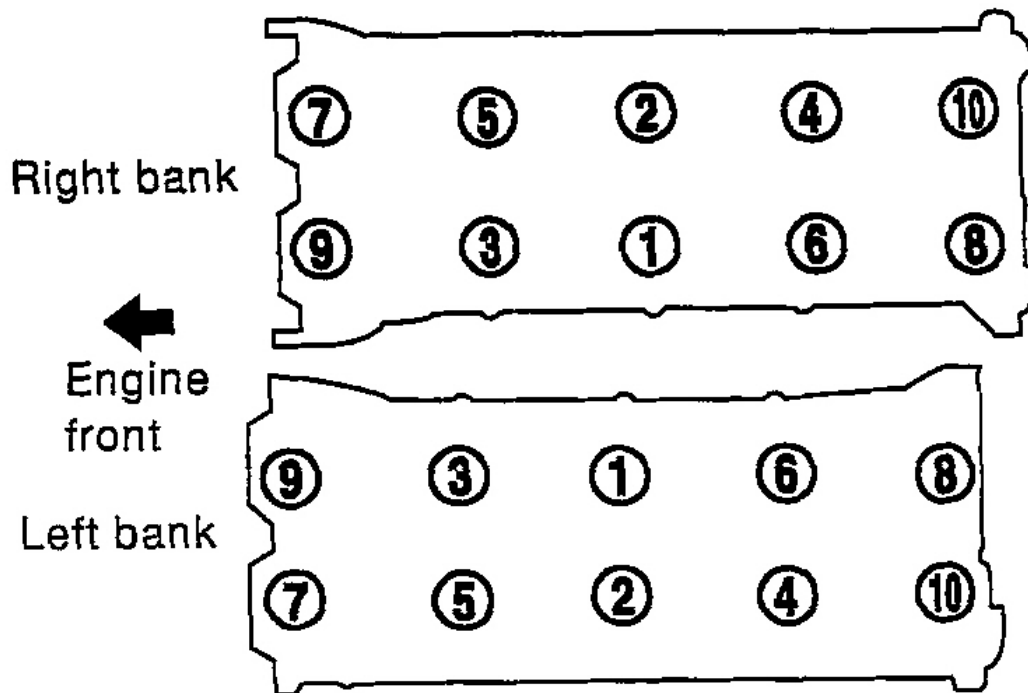
INSTALLATION

1. Install cylinder head gasket.
2. Follow the steps below to tighten fixing bolts in the numerical order shown in figure to install cylinder head.

CAUTION:

- If cylinder head bolts are re-used, check their outer diameters before installation. Refer to above **INSPECTION AFTER REMOVAL**.
- In step "c", loosen bolts in reverse order of that indicated in figure.

- a. Apply engine oil to threads and seating surface of bolts.
- b. Tighten all bolts to 98.1 N.m (10 kg-m, 72 ft-lb).

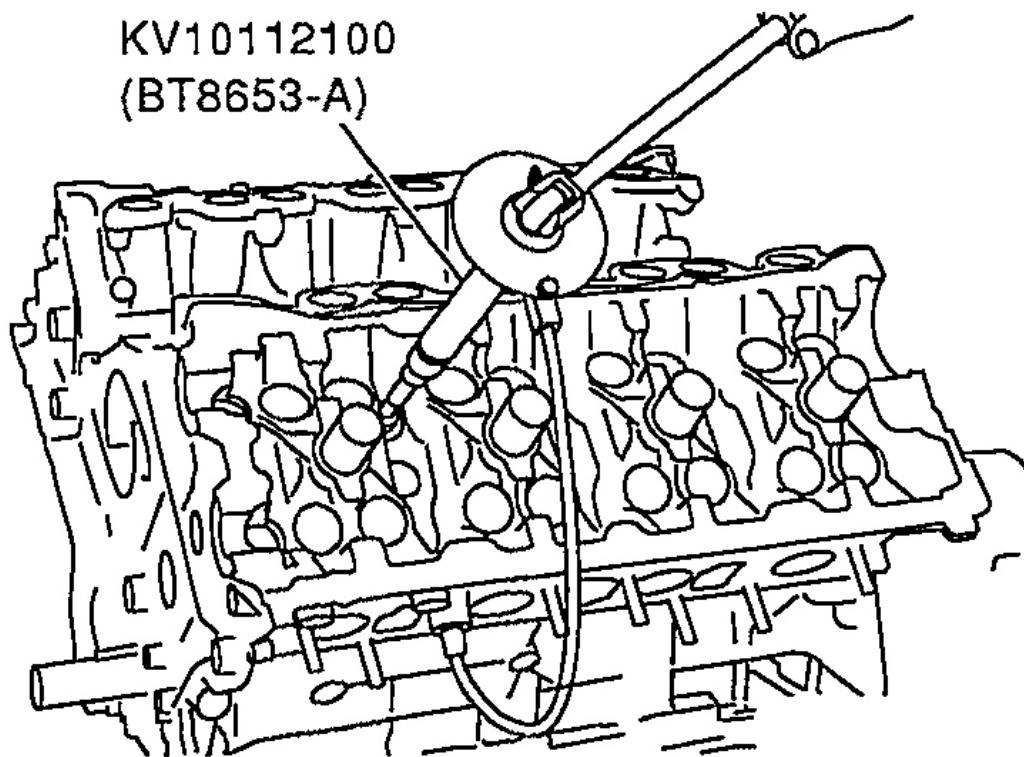


G00753265

Fig. 131: Cylinder Head Torque Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

- c. Completely loosen all bolts.
- d. Tighten all bolts to 44.1 N.m (4.5 kg-m, 33 ft-lb).
- e. Turn all bolts 60 degrees clockwise. (Angle tightening)
- f. Turn all bolts 60 degrees clockwise again. (Angle tightening)

CAUTION: Check and confirm the tightening angle by using the angle wrench (SST) and the cylinder head bolt wrench (commercial service tool). Avoid judgment by visual inspection without the SST.



G00753266

Fig. 132: Using Angle Wrench
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Install in the reverse order of removal.

DISASSEMBLY AND ASSEMBLY

SEC. 111•130•220

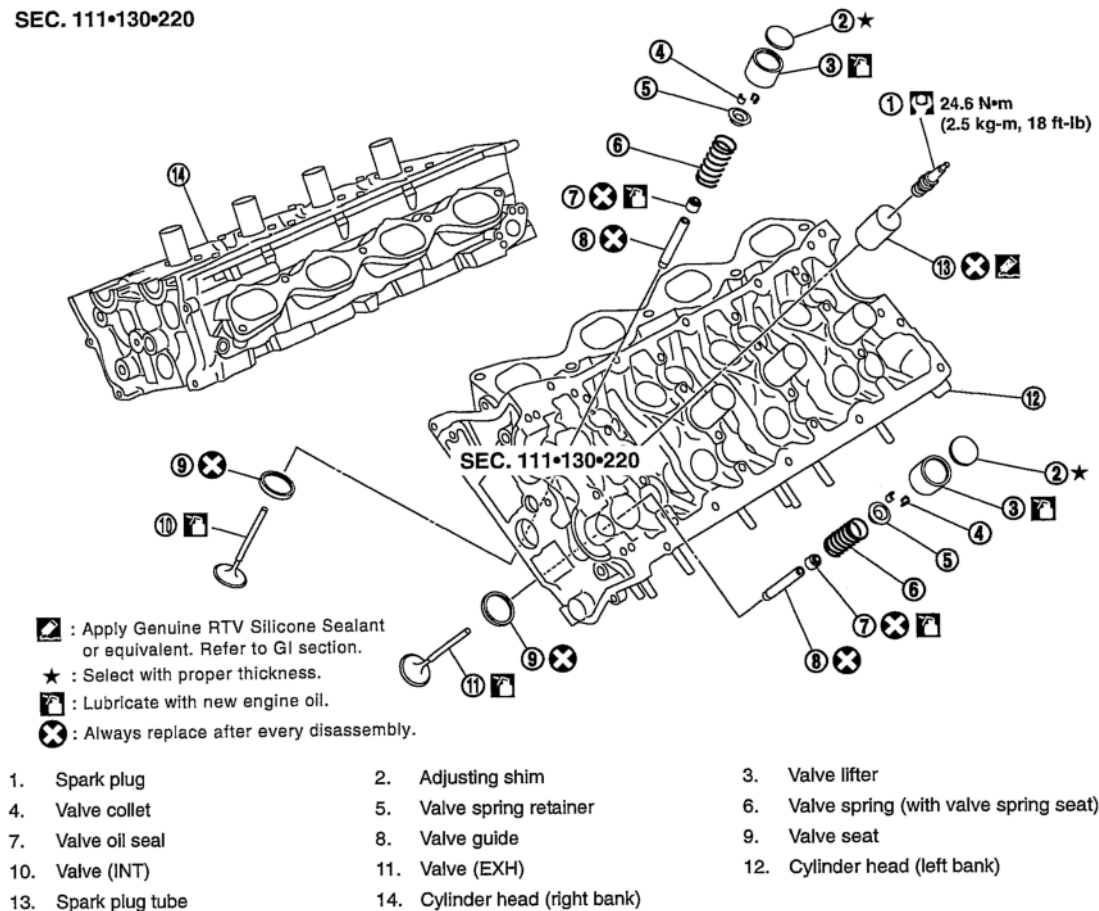


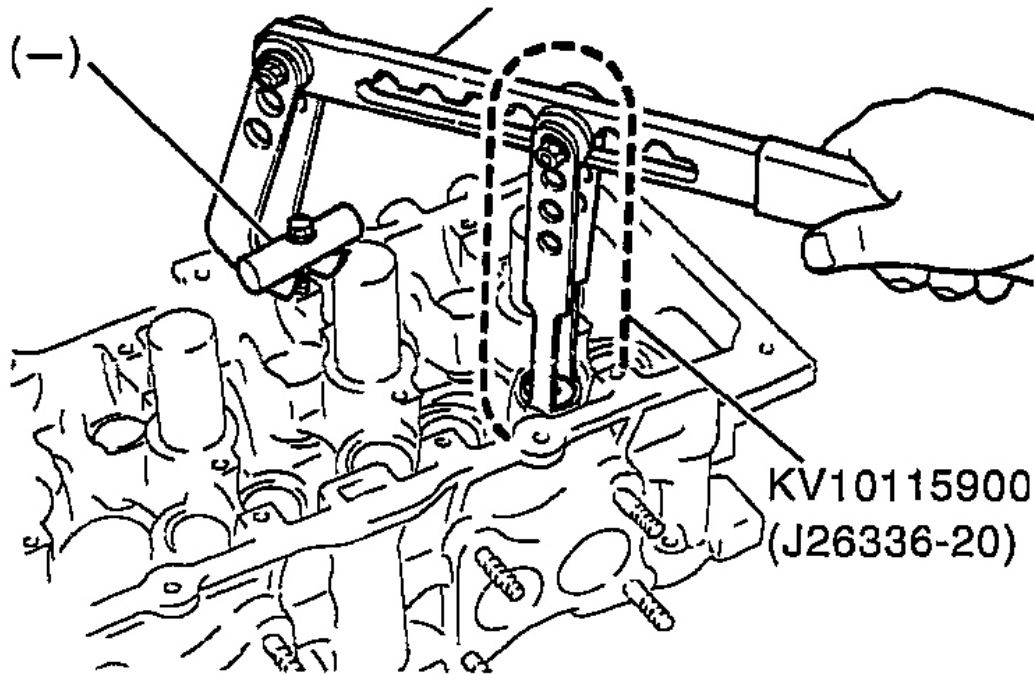
Fig. 133: Exploded View Of Cylinder Head
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: Attach tags to valve lifters so as not to mix them up.

DISASSEMBLY

1. Remove spark plug with the spark plug wrench (commercial service tool).
2. Remove adjusting shim and valve lifter.
 - Confirm installation point and keep parts in an organized way to avoid mixing them up.
3. Remove valve collet.
 - Compress valve spring with the valve spring compressor, attachment and adapter (SST). Remove valve collet with magnetic finger.

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



G00753268

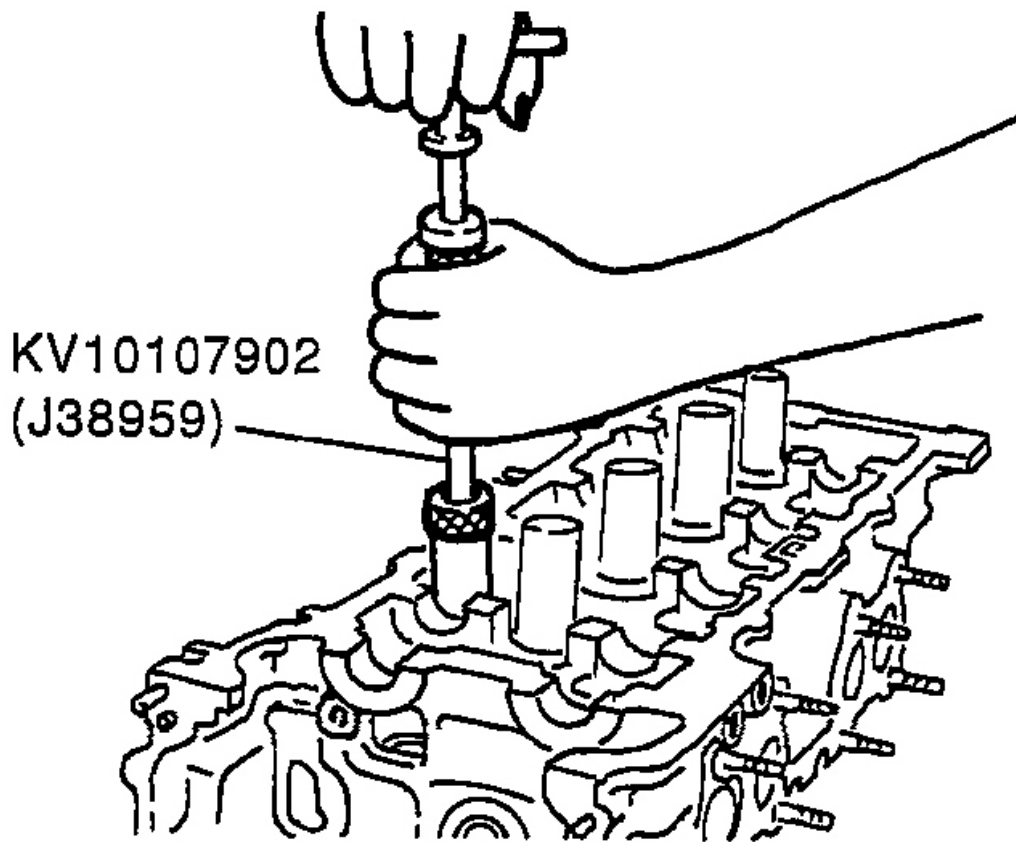
Fig. 134: Removing Valve Spring

Courtesy of NISSAN MOTOR CO., U.S.A.

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

CAUTION: Do not remove valve spring seat from valve spring.

5. Push valve stem to combustion chamber side, and remove valve.
 - Confirm installation point and keep parts in an organized way to avoid mixing then up.
6. Remove valve oil seal with the valve oil seal puller (SST).
7. If valve guide must be replaced, refer to **VALVE GUIDE REPLACEMENT**.
8. If valve seat must be replaced, refer to **VALVE SEAT REPLACEMENT**.



G00753269

Fig. 135: Removing Valve Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

9. Remove spark plug tube, as necessary.
 - Using a pair of pliers, pull spark plug tube out of cylinder head.

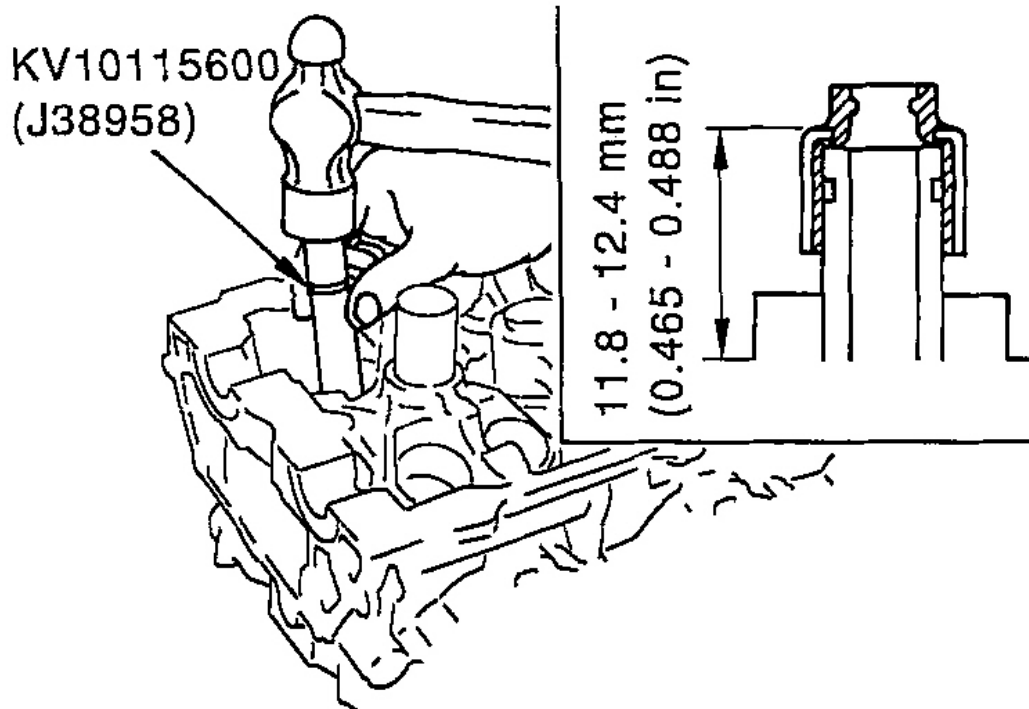
CAUTION:

- Take care not to damage cylinder head.
- Once removed, a spark plug tube will be deformed and cannot be reused. Do not remove it unless absolutely necessary.

ASSEMBLY

1. When valve guide is removed, install it. Refer to VALVE GUIDE REPLACEMENT.
2. When valve seat is removed, install it. Refer to VALVE SEAT REPLACEMENT.

3. Install valve oil seal.
 - Install with the valve oil seal drift (SST) to match dimension in illustration.
4. Install valve.
 - Install larger diameter to intake side.



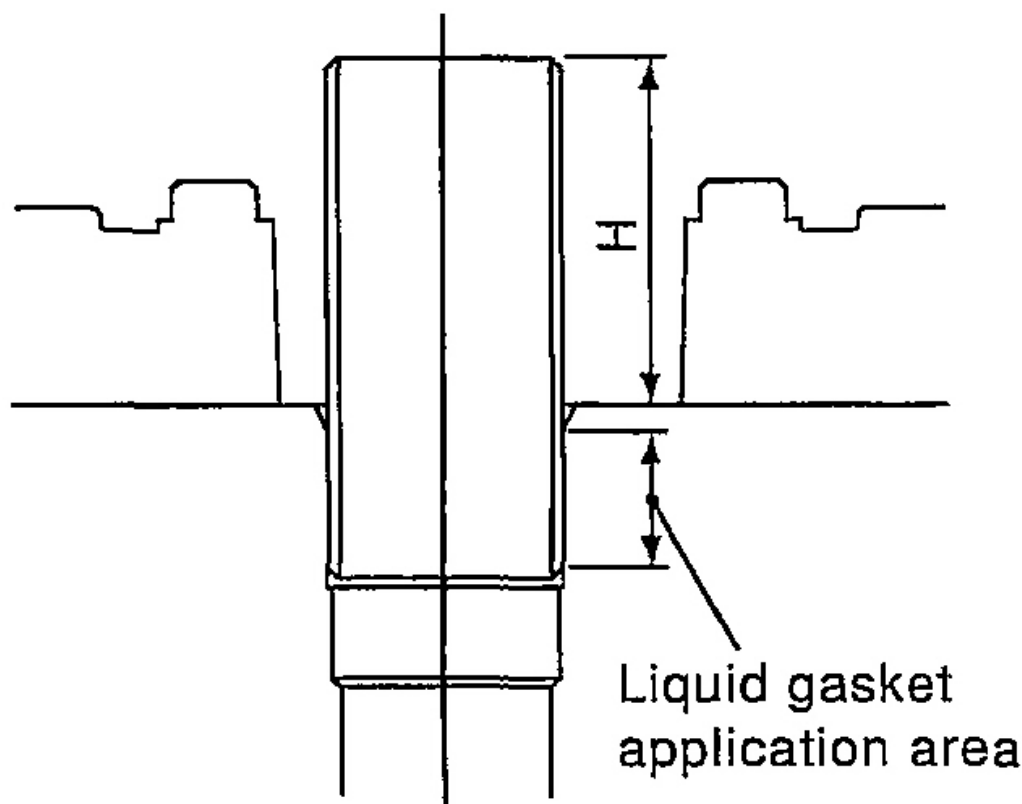
G00753270

Fig. 136: Installing Valve Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Install valve spring (with valve spring seat).
 - Install smaller pitch (valve spring seat side) to cylinder head side.
6. Install valve spring retainer.
7. Install valve collet.
 - Compress valve spring with the valve spring compressor, attachment and adapter (SST). Install valve collet with magnetic finger.

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

- Tap stem edge lightly with plastic hammer after installation to check its installed condition.
8. Install valve lifter and adjusting shim.
 9. Install spark plug tube.
 - Press-fit spark plug tube following procedure below.
 - a. Remove old liquid gasket adhering to cylinder-head mounting hole.
 - b. Apply liquid gasket to area within approximately 12 mm (0.47 in) from edge of spark plug tube press-fit side.
 - Use Genuine RTV Silicone Sealant or equivalent. Refer to **RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS**.
 - c. Using a drift, press-fit spark plug tube so that its height "H" in the figure is as specified.
Standard press-fit height "H": 38.4 - 39.4 mm (1.512 - 1.551 in) .



G00753273

Fig. 137: Applying liquid gasket
Courtesy of NISSAN MOTOR CO., U.S.A.

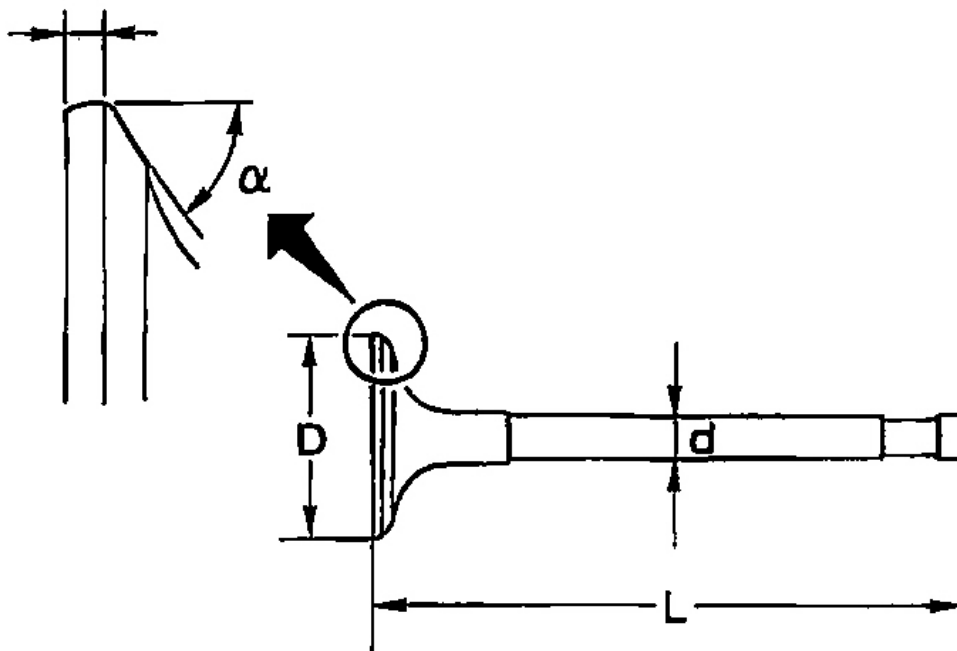
CAUTION:

- When press-fitting spark plug tube, take care not to deform it.
- After press-fitting, wipe off liquid gasket protruding onto cylinder-head upper face.

d. Install spark plug with the spark plug wrench (commercial service tool).

INSPECTION AFTER DISASSEMBLY**VALVE DIMENSIONS**

- Check dimensions of each valve. For dimensions, refer to ENGINE SPECIFICATIONS.
- If dimensions are out of the standard, replace valve.

T (Margin thickness)

G00753274

Fig. 138: Inspecting Valve

Courtesy of NISSAN MOTOR CO., U.S.A.

VALVE GUIDE CLEARANCE

Valve Stem Diameter

Measure diameter of valve stem with micrometer.

Standard Intake : 5.972 - 5.980 mm (0.2351 - 0.2354 in)

Exhaust : 5.962 - 5.970 mm (0.2347 - 0.2350 in)

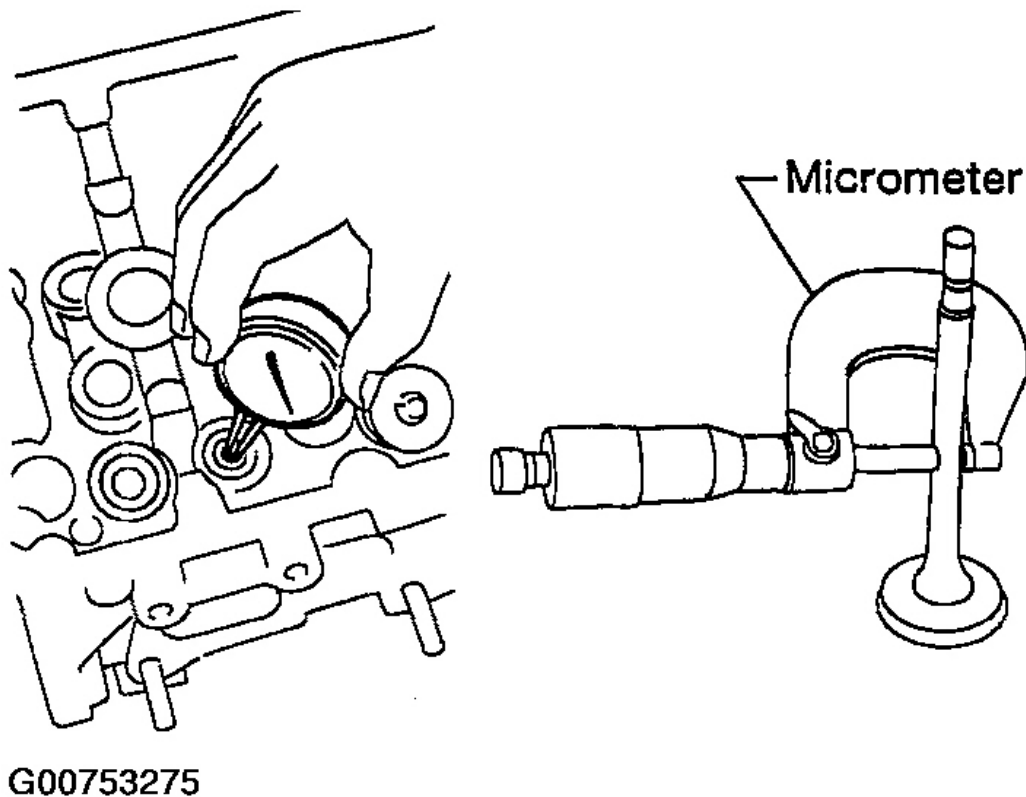


Fig. 139: Checking Valve Guide Clearance
 Courtesy of NISSAN MOTOR CO., U.S.A.

Valve Guide Inner Diameter

Measure inner diameter of valve guide with inside micrometer.

Standard Intake and Exhaust : 6.000 - 6.018 mm (0.2362 - 0.2369 in)

Valve Guide Clearance

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

Valve guide clearance:**Standard Intake : 0.020 - 0.046 mm (0.0008 - 0.0018 in)****Exhaust : 0.030 - 0.056 mm (0.0012 - 0.0022 in)****Limit Intake : 0.08 mm (0.003 in)****Exhaust : 0.10 mm (0.004 in)**

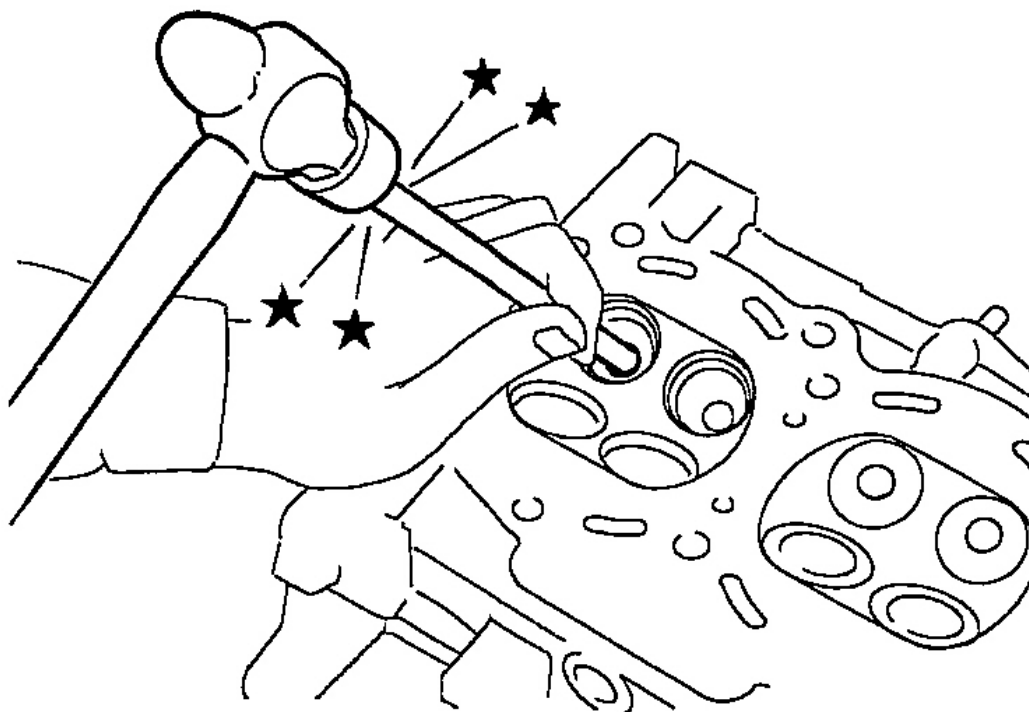
- If it exceeds the limit, replace valve and/or valve guide.

VALVE GUIDE REPLACEMENT

When valve guide is removed, replace with oversized (0.2 mm, 0.008 in) valve guide.

1. To remove valve guide, heat cylinder head to 110 to 130°C (230 to 266°F) by soaking in heated oil.
2. Drive out valve guide with a press [under a 20 kN (2 ton, 2.2 US ton, 2.0 Imp ton) pressure] or hammer and the valve guide drift (commercial service tool).

CAUTION: Cylinder head contains heat, when working wear protective equipment to avoid getting burned.



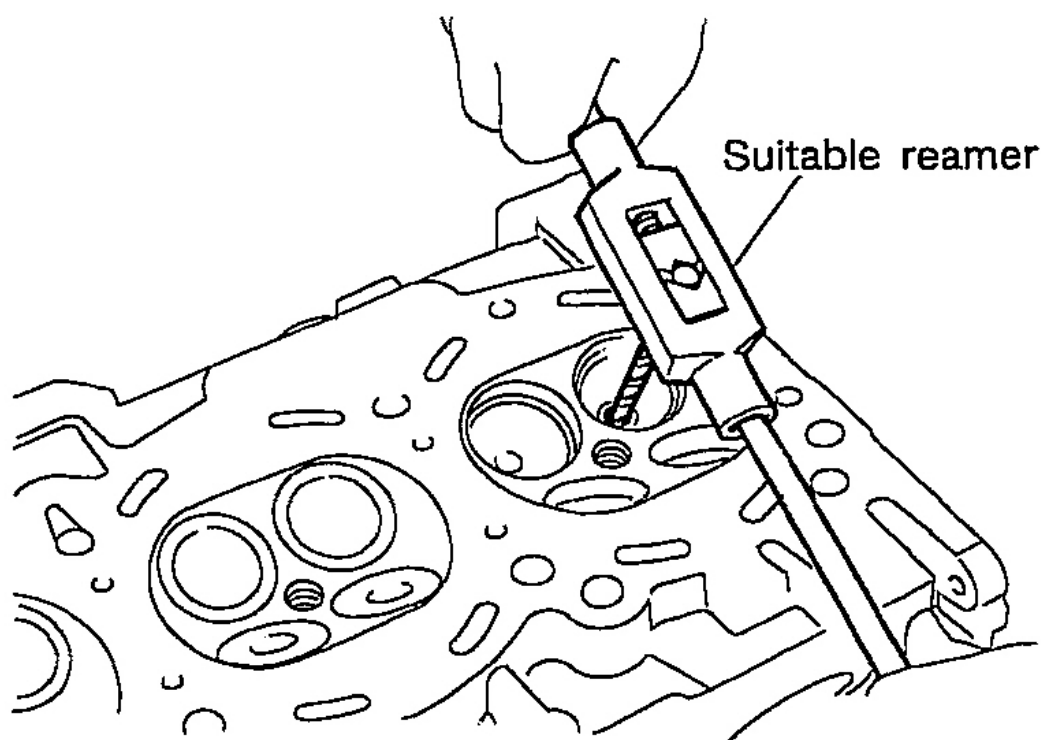
G00753277

Fig. 140: Removing Valve Guide

Courtesy of NISSAN MOTOR CO., U.S.A.

3. Using the valve guide reamer (commercial service tool), ream cylinder head valve guide hole.

Valve guide hole diameter (for service parts)**Intake and exhaust: 10.175 - 10.196 mm (0.4006 - 0.4014 in)**

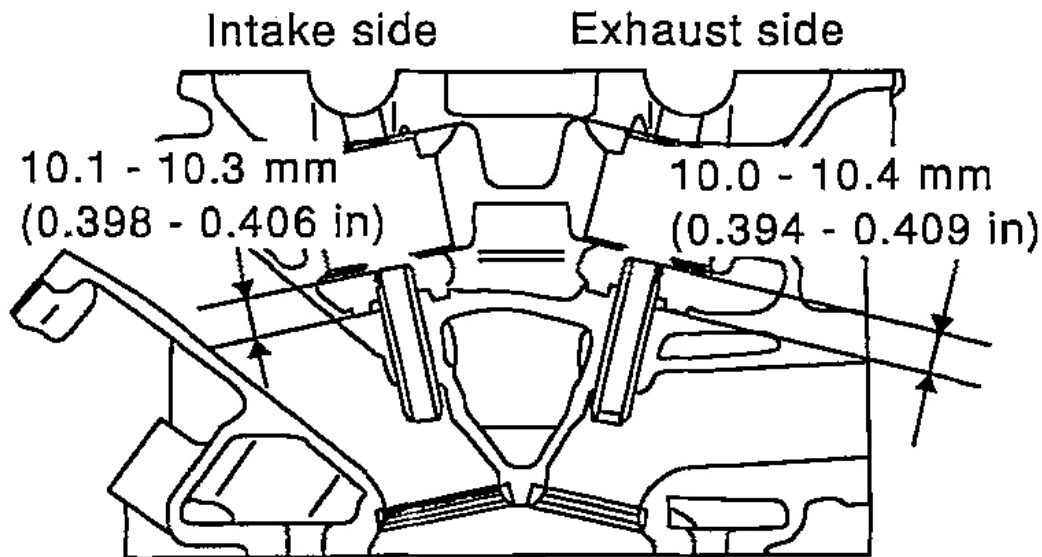


G00753278

Fig. 141: Using the valve guide reamer
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Heat cylinder head to 110 to 130°C (230 to 266°F) by soaking in heated oil.
5. Press valve guide from the camshaft side to dimensions as in the illustration.

CAUTION: Cylinder head contains heat, when working wear protective equipment to avoid getting burned.



G00753280

Fig. 142: Checking Valve Guide Placement
Courtesy of NISSAN MOTOR CO., U.S.A.

6. Using the valve guide reamer (commercial service tool), apply reamer finish to valve guide.
Standard Intake and exhaust: 6.000 - 6.018 mm (0.2362 - 0.2369 in)

VALVE SEAT CONTACT

- After confirming that the dimensions of valve guides and valves are within specifications, perform this procedure.
- Apply prussian blue (or white lead) onto contacting surface of valve seat to check the condition of the valve contact on the surface.
- Check if the contact area band is continuous all around the circumference.
- If not, grind to adjust valve fitting and check again. If the contacting surface still has NG conditions even after the re-check, replace valve seat.

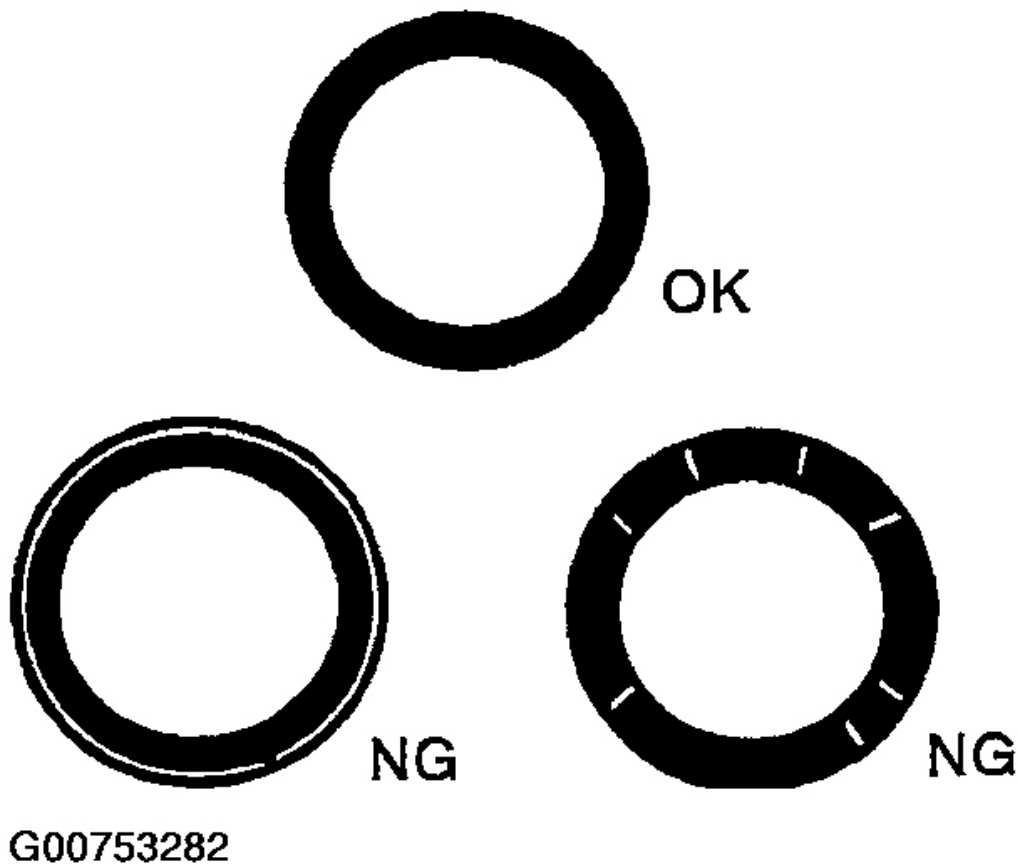


Fig. 143: Checking Valve Seat Contact
Courtesy of NISSAN MOTOR CO., U.S.A.

VALVE SEAT REPLACEMENT

When valve seat is removed, replace with oversized (0.5 mm, 0.020 in) valve seat.

1. 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.

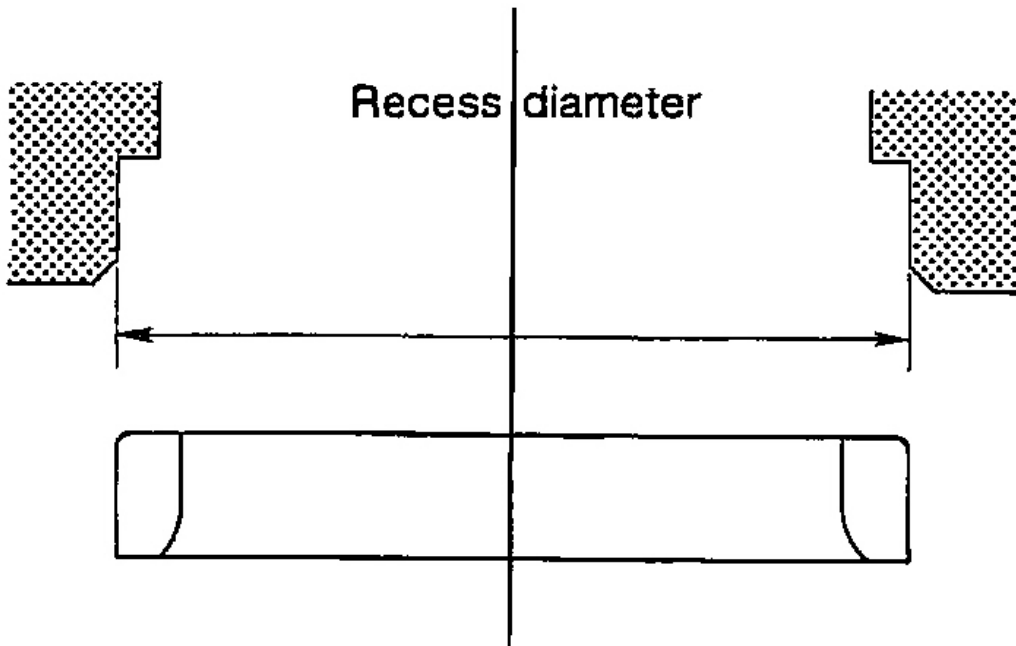
CAUTION: Prevent to scratch cylinder head by excessive boring.

2. Ream cylinder head recess diameter for service valve seat.

Oversize [0.5 mm (0.020 in)]: Intake 37.500 - 37.516 mm (1.4764 - 1.4770 in)

Exhaust 32.700 - 32.716 mm (1.2874 - 1.2880 in)

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



G00753283

Fig. 144: Checking Recess Diameter

Courtesy of NISSAN MOTOR CO., U.S.A.

3. Heat cylinder head to 110 to 130°C (230 to 266°F) by soaking in heated oil.
4. Provide valve seats cooled well with dry ice. Force fit valve seat into cylinder head.

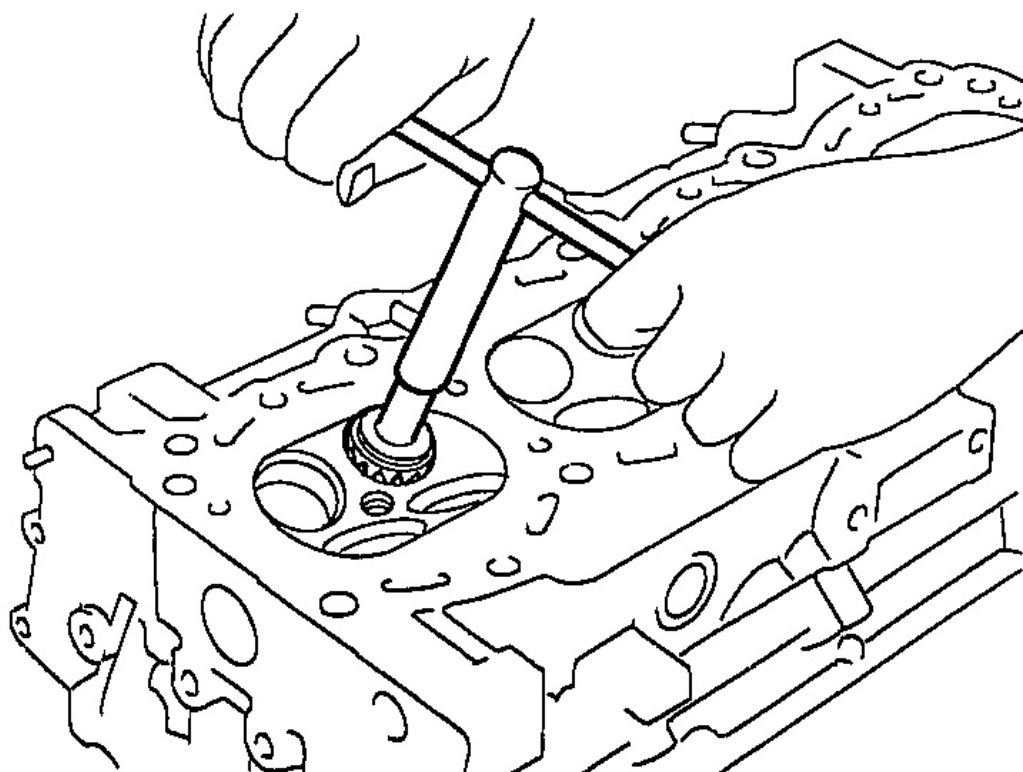
CAUTION:

- Avoid directly touching cold valve seats.
- Cylinder head contains heat, when working wear protective equipment to avoid getting burned.

5. Using the valve seat cutter set (commercial service tool) and valve seat grinder, finish the seat to the specified dimensions.

CAUTION: When using the valve seat cutter, firmly grip the cutter handle with both hands. Then, press on the contacting surface all around the

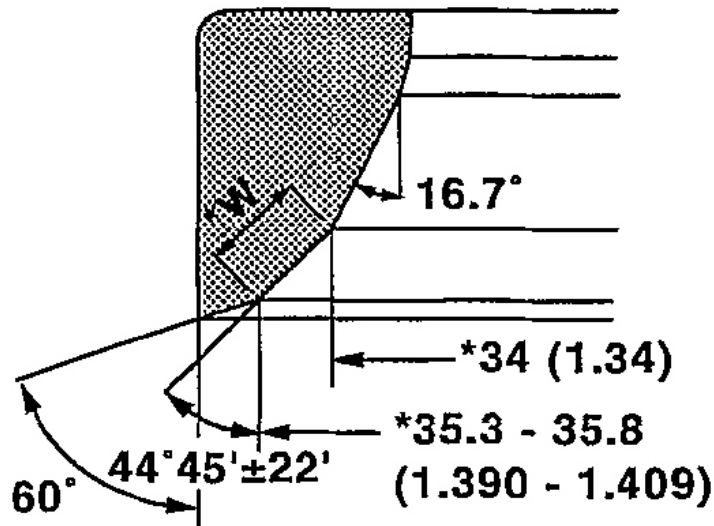
circumference to cut in a single drive. Improper pressure on with the cutter or cutting many different times may result in stage valve seat.



G00753285

Fig. 145: Using the valve seat cutter
Courtesy of NISSAN MOTOR CO., U.S.A.

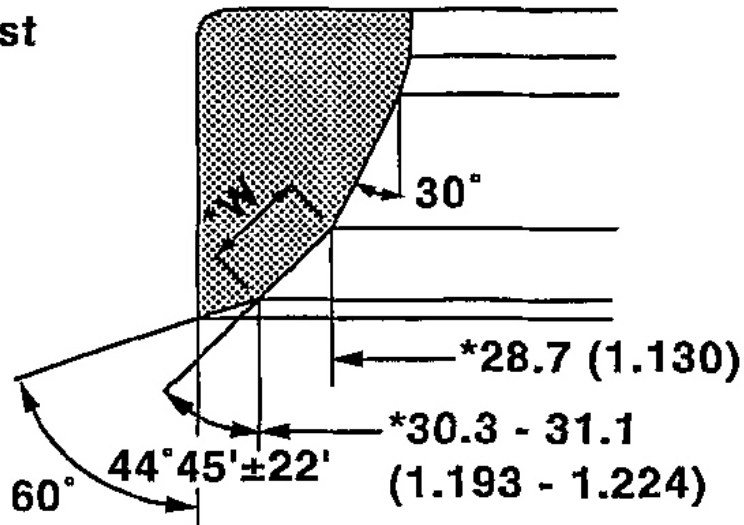
- Grind to obtain the dimensions indicated in the figure.

Intake

* : Machining data

Contacting width (W)

; 1.0 - 1.4 (0.040 - 0.055)

Exhaust

* : Machining data

Contacting width (W)

; 1.2 - 1.6 (0.047 - 0.063)

Unit: mm (in)

G00753286

Fig. 146: Checking Valve Seat Angle
Courtesy of NISSAN MOTOR CO., U.S.A.

6. Using compound, grind to adjust valve fitting.
7. Check again for normal contact.

Valve Spring Squareness

Set try square along the side of valve spring and rotate the spring. Measure the maximum clearance between the top face of spring and try square.

Limit : 2.0 mm (0.079 in)

- If it exceeds the limit, replace valve spring.

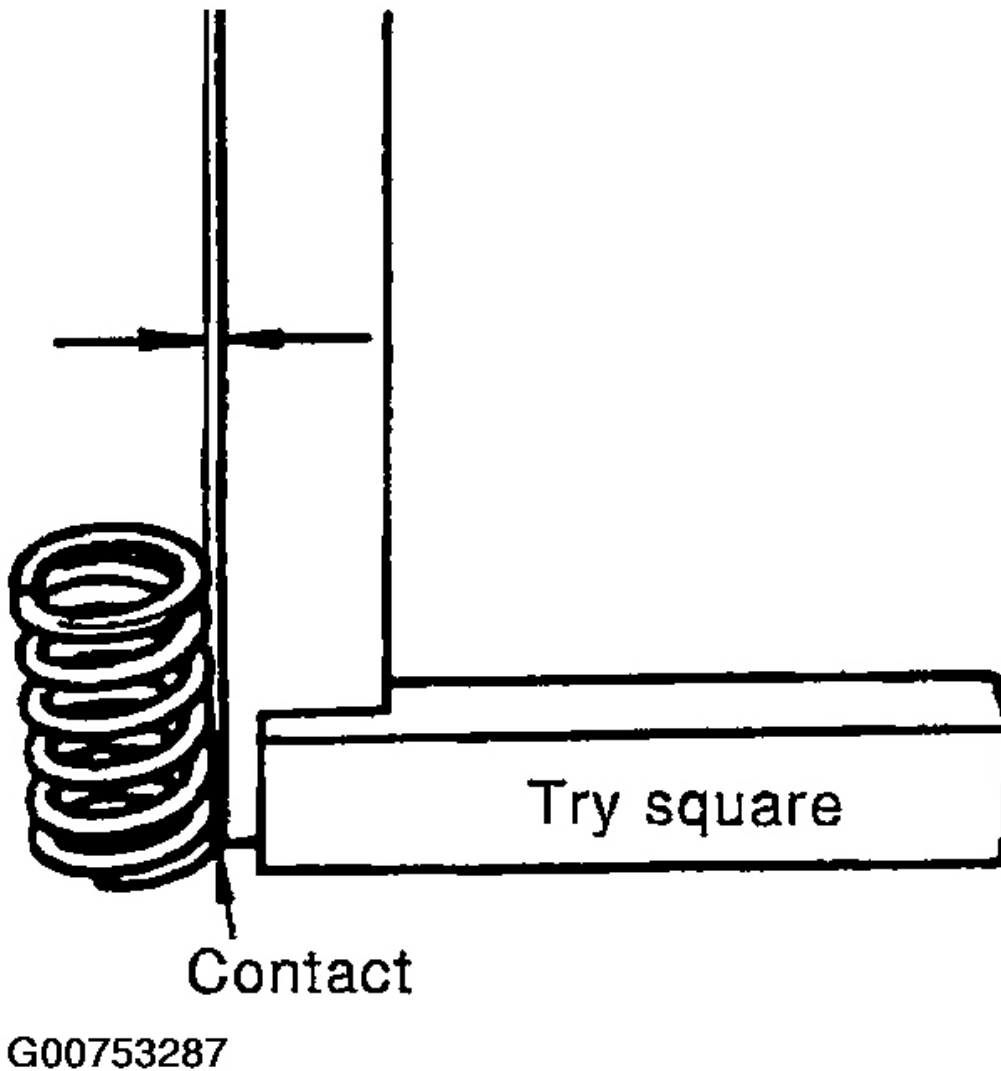


Fig. 147: Checking Valve Spring Squareness
Courtesy of NISSAN MOTOR CO., U.S.A.

VALVE SPRING DIMENSIONS AND VALVE SPRING PRESSURE LOAD

Check valve spring pressure at specified spring height.

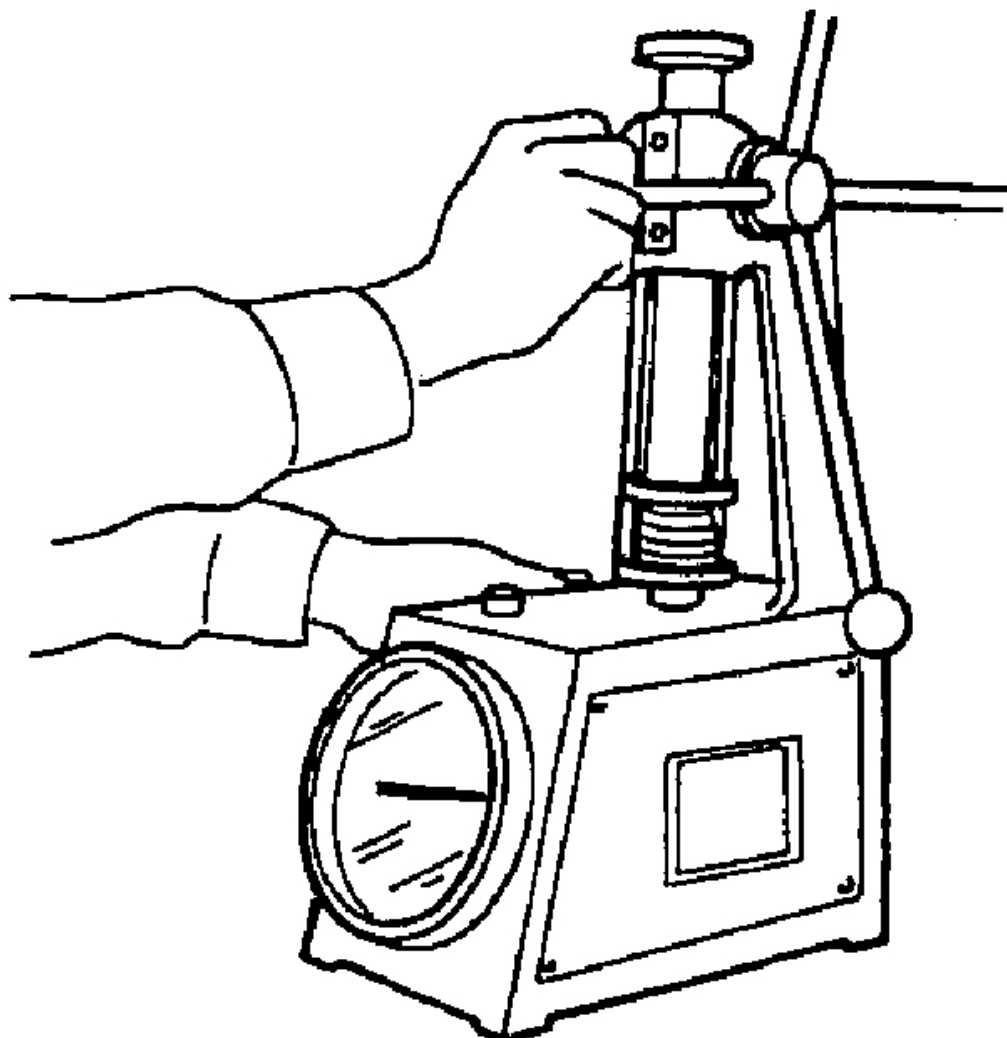
CAUTION: Do not remove valve spring seat from valve spring (parts for assy).

Standard: Free height 46.35 - 46.85 mm (1.8247 - 1.8444 in)

Installation height 33.8 mm (1.331 in)

Installation load 165-189 N (16.8 - 19.3 kg, 37 - 42 lb)

Height during valve open 24.4 mm (0.961 in)



G00753288

Fig. 148: Checking valve spring pressure at specified spring height
Courtesy of NISSAN MOTOR CO., U.S.A.

Load with valve open 290 - 330 N (29.6 - 33.7 kg, 65 - 74 lb)

- If the dimensions exceed the standard, replace the valve spring.

ENGINE ASSEMBLY

REMOVAL AND INSTALLATION

SEC. 112

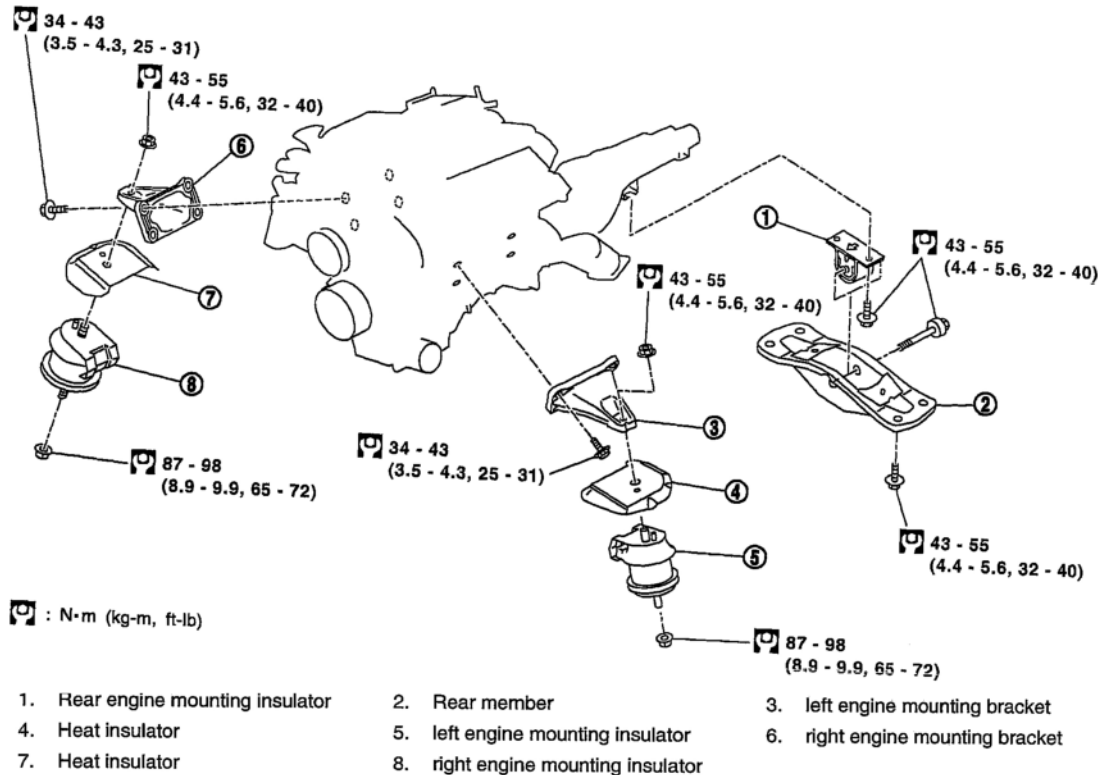


Fig. 149: View Of Engine & Transmission Mounts

Courtesy of NISSAN MOTOR CO., U.S.A.

WARNING:

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

CAUTION:

- Always be careful to work safely, avoid forceful or uninstructed operations.
- Do not start working until exhaust system and engine coolant are cool enough.
- If items or work required are not covered by the engine section, refer

to the applicable sections.

- Always use the support point specified for lifting.
- Use either 2-point lift type or separate type lift as best you can. If board-on type is used for unavoidable reasons, support at the rear axle jacking point with transmission jack or similar tool before starting work, in preparation for the backward shift of center of gravity.

REMOVAL

Outline

After removal of transmission, lift up engine assembly to remove it from vehicle.

Preparation

1. Release fuel pressure. Refer to **FUEL PRESSURE RELEASE** .
2. Remove engine cover. Refer to **ENGINE ROOM COVER**.
3. Remove engine undercover with power tool.
4. Drain engine coolant from radiator drain plug. Refer to **CHANGING ENGINE COOLANT** .
5. Remove the following parts:
 - Hood assembly.
 - Tower bar; Refer to **FRONT SUSPENSION MEMBER** .
 - Battery
 - Air duct and air cleaner case assembly; Refer to **AIR CLEANER AND AIR DUCT**.
 - Drive belts; Refer to **REMOVAL**.
 - Remove accelerator wire. Refer to **REMOVAL AND INSTALLATION** .
 - Cooling fan and tubes; Refer to **COOLING FAN** .
 - Radiator assembly and hoses; Refer to **RADIATOR** .
 - Water suction pipe; Refer to **THERMOSTAT AND WATER CONTROL VALVE** .

Engine Room Left

1. Disconnect engine room harness from the engine side and set it aside for easier work.
2. Disconnect heater hoses, and install plugs to avoid leakage of engine coolant.
3. Disconnect wire bonding exhaust manifold cover to vehicle.
4. Disconnect vacuum hose between vehicle and engine and set it aside.
5. Remove reservoir tank for cooling fan.
6. Remove A/C compressor from brackets, and install A/C compressor temporarily with ropes or equivalent to avoid applying any pressures on piping or disturbing installation or removal of any vehicle parts. Refer to **REMOVAL AND INSTALLATION OF COMPRESSOR** .

Engine Room Right

1. Disconnect fuel hose at the engine side connection.
 - For disconnection/connection of quick connector, refer to **FUEL INJECTOR AND FUEL TUBE**.
2. Disconnect engine room harness from the engine side and set it aside for easier work.
3. Disconnect wire bonding exhaust manifold cover to vehicle.
4. Disconnect vacuum hose between vehicle and engine and set it aside.
5. Disconnect reservoir tank for power steering from engine and move it aside for easier work.
6. Move away relay case.

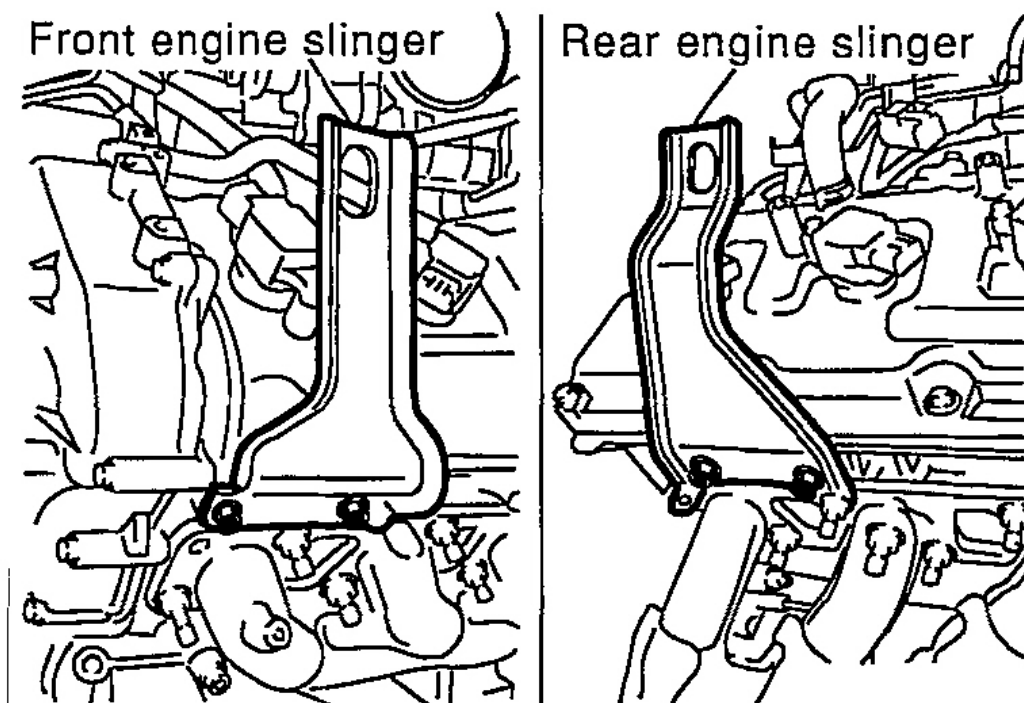
Vehicle Underbody

- Disconnect power steering oil pump from engine. Move it from its location and secure with a rope for easier work. Refer to **POWER STEERING OIL PUMP**.
- Remove pipe of cooler for automatic transmission.
- Remove exhaust front tube with power tool. Refer to **REMOVAL AND INSTALLATION**.
- Disconnect steering lower joint, and release steering shaft. Refer to **POWER STEERING GEAR AND LINKAGE**.
- Disconnect propeller shaft. Refer to **REAR PROPELLER SHAFT**.
 - After disconnection, plug the opening on transmission side.

Removal Work

1. Remove transmission assembly. Refer to **TRANSMISSION ASSEMBLY**.
2. Install engine slingers into front of left bank cylinder head and rear of right bank cylinder head.

Slinger bolts:
: 30.4 - 36.3 N.m (3.1 - 3.7 kg-m, 23 - 26 ft-lb)
3. Lift with hoist and secure engine in position.
4. Remove engine mounting nuts on bottom surface.
5. Carefully lift up engine assembly, avoiding interference with vehicle body, move it away and upward.



G00753290

Fig. 150: Locating Engine Slingers
Courtesy of NISSAN MOTOR CO., U.S.A.

6. With engine assembly lifted up, remove rear end of exhaust manifold to avoid contact with vehicle. Refer to **EXHAUST MANIFOLD AND THREE WAY CATALYST**.
7. Remove engine assembly from vehicle.

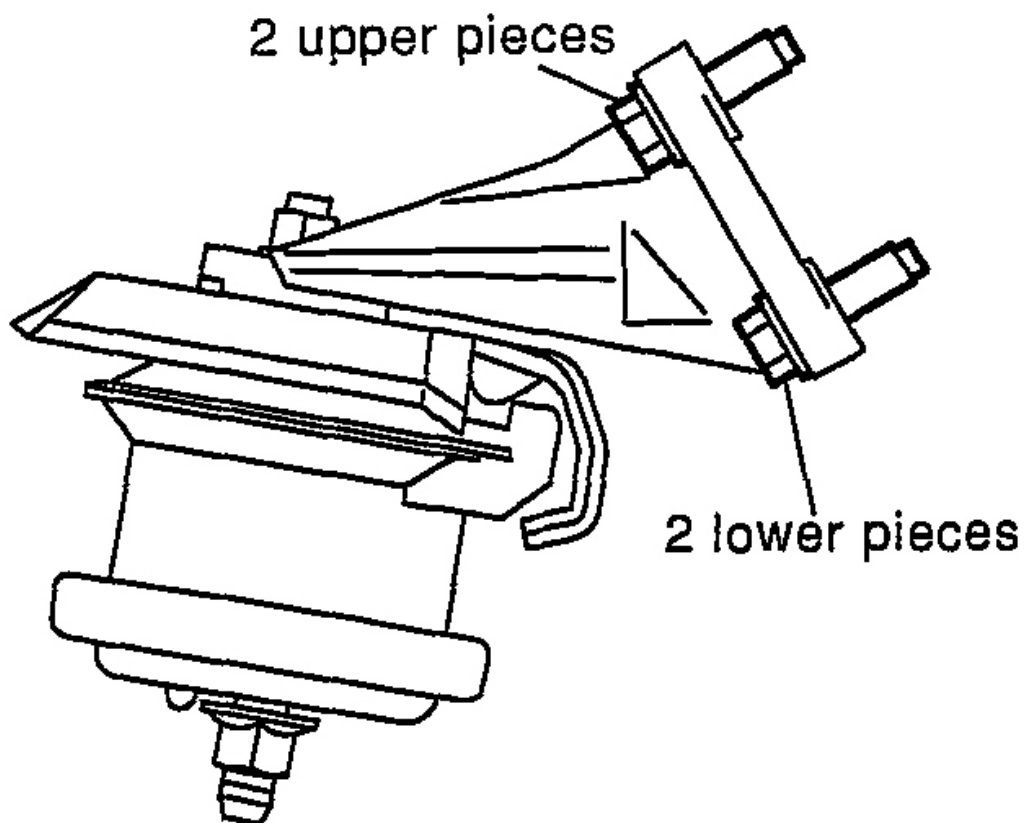
CAUTION:

- Before and during this lifting, always check if any harnesses are left connected.
- Avoid damage to oil/grease smearing or spills onto engine mounting insulator.

INSTALLATION

Install in the reverse order of removal.

- Where positioning pin is used, be sure to securely insert it into the hole of mating part.
- When installing front engine mounting bracket to cylinder block, first tighten two bolts on upper side. Then, tighten two bolts on lower side. (The same applies to both right and left.)



G00753292

Fig. 151: Assembling front engine mounting bracket
Courtesy of NISSAN MOTOR CO., U.S.A.

INSPECTION AFTER INSTALLATION

- Before starting engine, check the levels of engine coolant, engine oil and working fluid. If less than required quantity, fill to the specified level.
- Use procedure below to check for fuel leakage.
 - Turn ignition switch ON (with engine stopped). With fuel pressure applied to fuel piping, check for fuel leakage at connection points.
 - Start engine. With engine speed increased, check again for fuel leakage at connection points.
- Run engine to check for unusual noise and vibration.
- Warm up engine thoroughly to make sure there is no leakage of engine coolant, engine oil, working fluid, fuel and exhaust gas.
- Bleed air from passages in pipes and tubes of applicable lines, such as in cooling system.

- After cooling down engine, again check amounts of engine coolant, engine oil and working fluid. Refill to specified level, if necessary.
- Summary of the inspection items:

Item	Before starting engine	Engine running	After engine stopped
Engine coolant	Level	Leakage	Level
Engine oil	Level	Leakage	Level
Working fluid	Level	Leakage	Level
Fuel	—	Leakage	—
Exhaust gas	—	Leakage	—

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Fig. 152: Summary of the inspection items
 Courtesy of NISSAN MOTOR CO., U.S.A.

CYLINDER BLOCK

DISASSEMBLY AND ASSEMBLY

SEC. 110•120•226

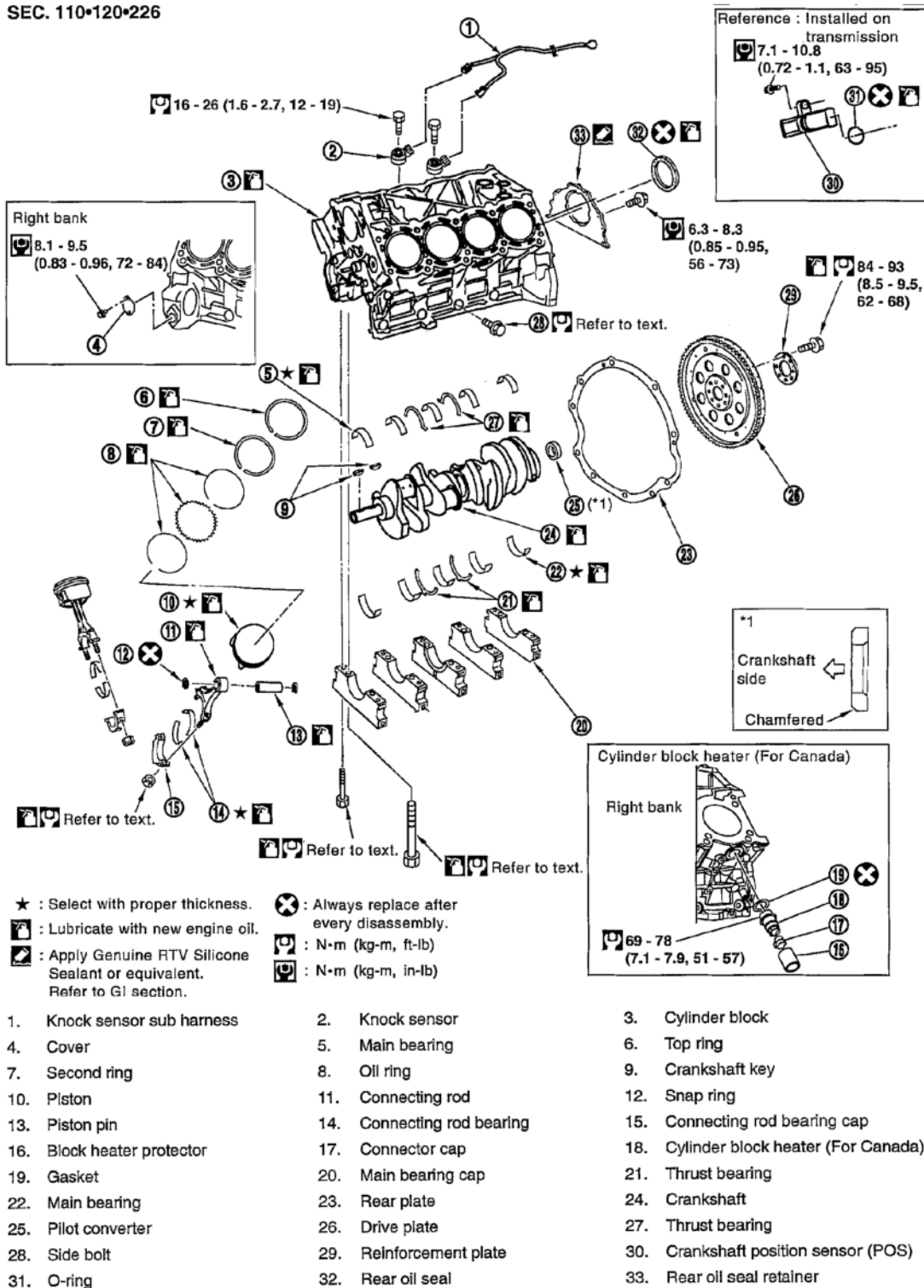


Fig. 153: Exploded View Of Cylinder Block
Courtesy of NISSAN MOTOR CO., U.S.A.

DISASSEMBLY

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

1. Remove engine assembly. Refer to **ENGINE ASSEMBLY**.
2. Remove the parts that may restrict installation of engine to widely use engine stand.

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

- a. Remove drive plate as follows:
 - i. Remove rear plate cover. Refer to **OIL PAN AND OIL STRAINER**.
 - ii. Set the ring gear stopper (SST).
 - iii. Loosen fixing bolts diagonally.

- CAUTION:**
- Be careful not to damage drive plate. Especially, avoid deforming and damaging of signal plate teeth (circumference position).
 - Place drive plate with signal plate surface facing other than downward.
 - Keep magnetic materials away from signal plate.

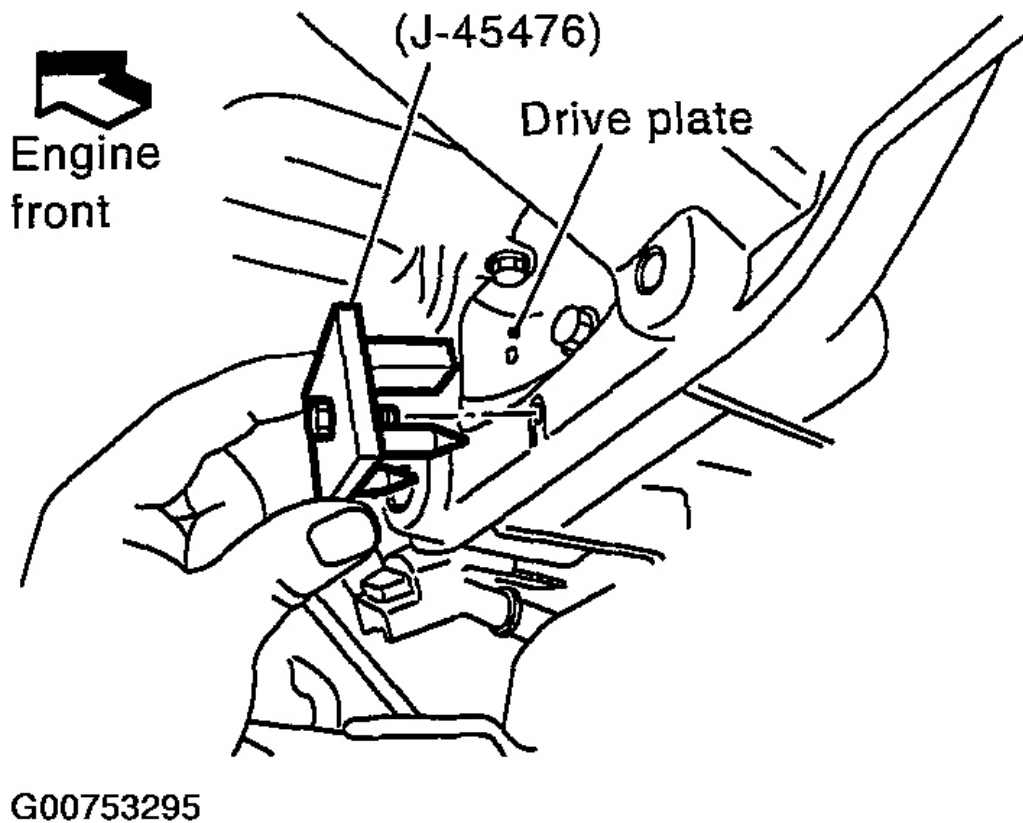


Fig. 154: Identifying ring gear stopper
Courtesy of NISSAN MOTOR CO., U.S.A.

- b. Remove engine rear plate.
3. Lift the engine with hoist to install it onto the widely use engine stand.

CAUTION: Use an engine stand that has a load capacity [240 kg (529 pound) or more] large enough for supporting the engine weight.

- If the load capacity of the stand is not adequate, remove the following parts beforehand to reduce the potential risk of overturning the stand.
 - Remove intake manifold upper and intake manifold lower. Refer to **INTAKE MANIFOLD**.
 - Remove fuel injector and fuel tube assembly. Refer to **FUEL INJECTOR AND FUEL TUBE**.
 - Remove ignition coil. Refer to **IGNITION COIL**.
 - Remove rocker cover. Refer to **ROCKER COVER**.
 - Other removable brackets.

NOTE: The figure shows an example of widely use engine stand that can hold mating surface of transmission with drive plate and rear plate removed.

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

4. Drain engine oil and engine coolant from inside of engine.
5. Remove oil pan and oil strainer. Refer to OIL PAN AND OIL STRAINER.
6. Remove crankshaft pulley as follows:
 - a. Lock crankshaft with a hammer handle or similar tool to loosen fixing bolt.
 - b. Pull crankshaft pulley with both hands to remove it.

CAUTION:

- Do not remove fixing bolts. Keep loosened fixing bolts in place to protect removed crankshaft pulley from dropping.
- Do not remove balance weight (inner hexagon bolt) at the front of crankshaft pulley.

7. Remove the following components and associated parts (The parts listed in step 3 are not included here.)
 - Front cover and timing chain: Refer to TIMING CHAIN.
 - Camshaft: Refer to CAMSHAFT.
 - Cylinder head: Refer to CYLINDER HEAD.
8. Remove knock sensor.

CAUTION: Carefully handle the sensor, avoiding shocks.

9. Remove piston and connecting rod assembly.
 - a. Position crankshaft pin corresponding to connecting rod to be removed onto the bottom dead center.
 - b. Remove connecting rod cap.
 - c. Using a hammer handle or similar tool, push piston and connecting rod assembly out to the cylinder head side.
 - Before removing piston and connecting rod assembly, check the connecting rod side clearance. Refer to CONNECTING ROD SIDE CLEARANCE.
10. Remove connecting rod bearings.

CAUTION:

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

11. Remove piston rings form piston.

- Use the piston ring expander (commercial service tool).

CAUTION:

- When removing piston rings, be careful not to damage piston.
 - Be careful not to damage piston rings by expanding them excessively.
- Before removing piston rings, check the piston ring side clearance. Refer to PISTON RING SIDE CLEARANCE.

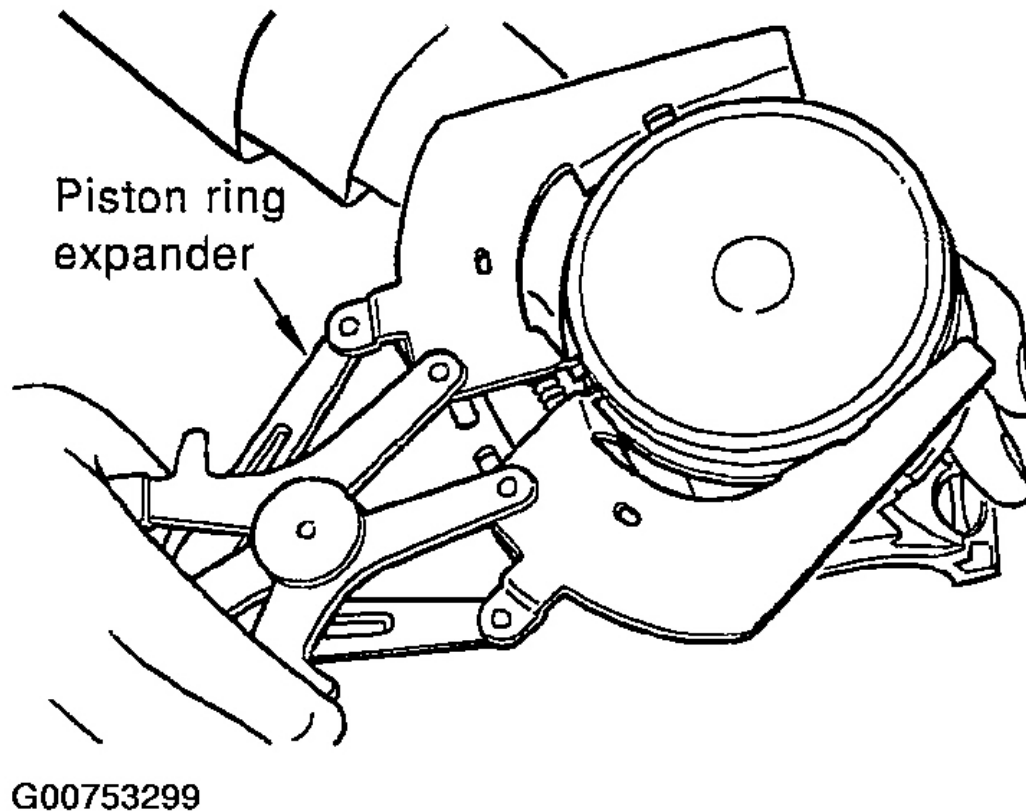
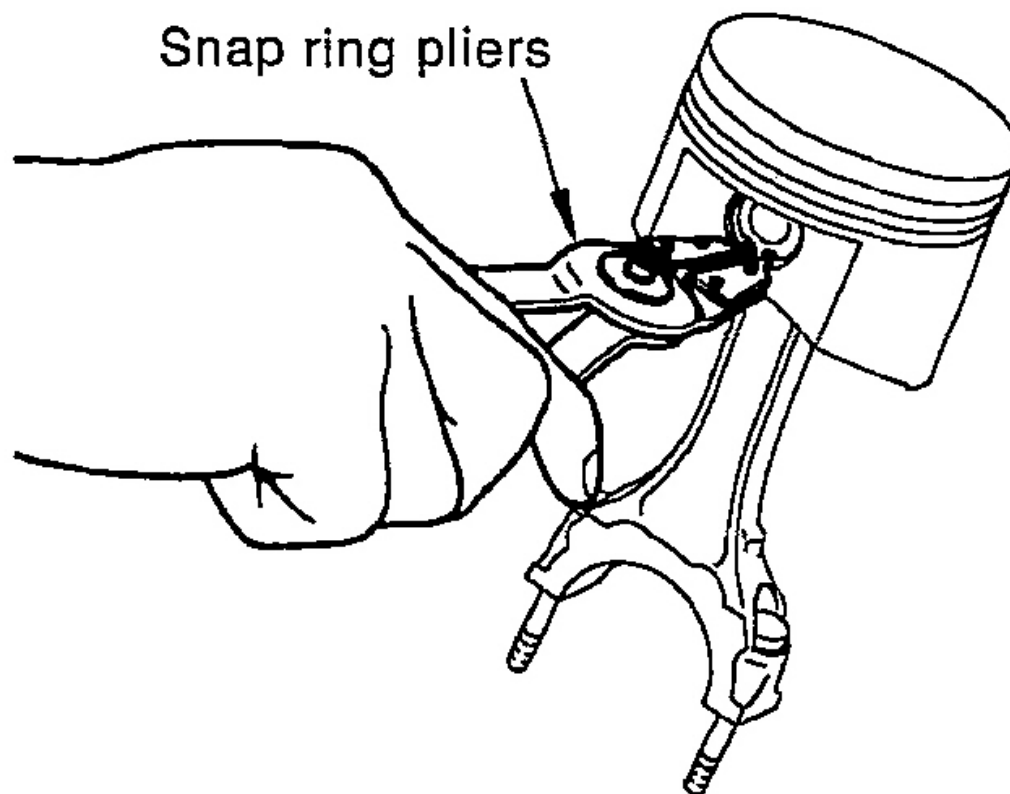


Fig. 155: Removing Piston Rings

Courtesy of NISSAN MOTOR CO., U.S.A.

12. Remove piston from connecting rod as follows.
 - a. Using the snap ring pliers, remove snap ring.



G00753300

Fig. 156: Removing Piston Pin Snap Ring
Courtesy of NISSAN MOTOR CO., U.S.A.

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

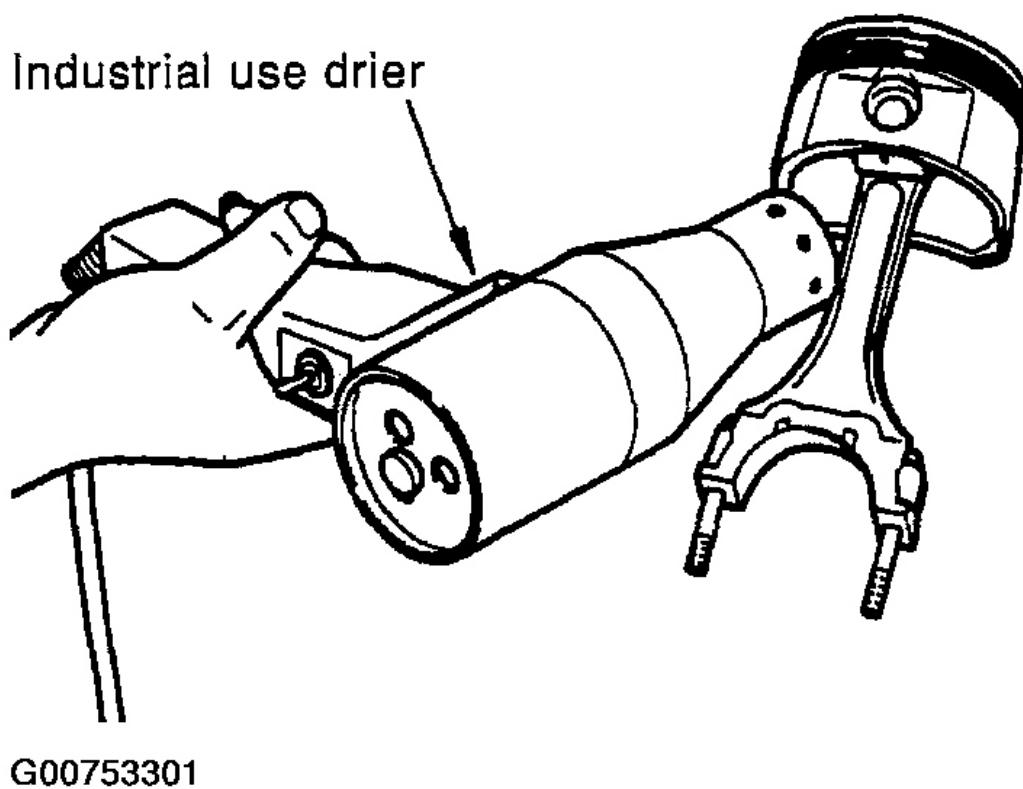
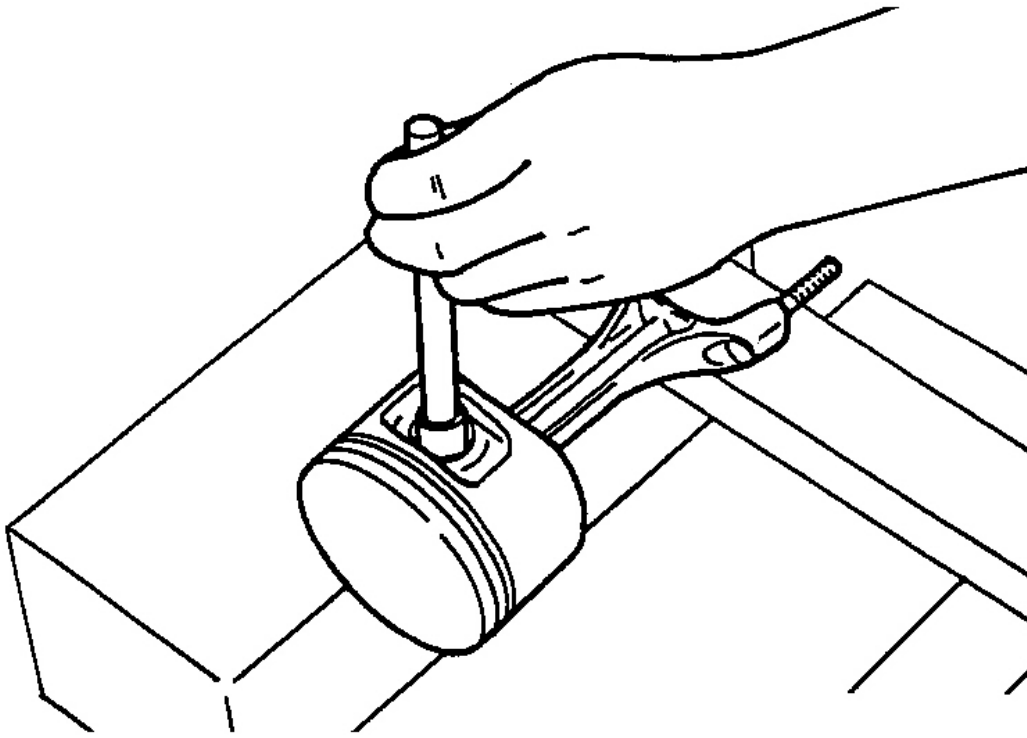


Fig. 157: Heating Piston Pin
Courtesy of NISSAN MOTOR CO., U.S.A.

- c. Push out piston pin with stick of outer diameter approximately 20 mm (0.8 in).



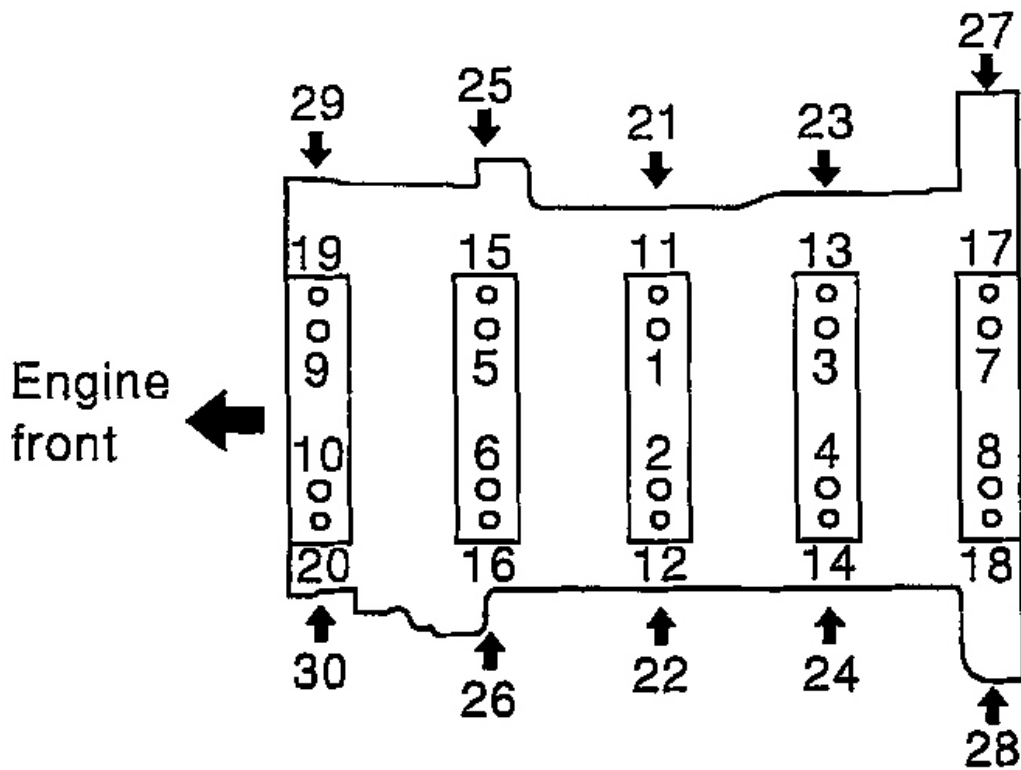
G00753302

Fig. 158: Removing Piston pin
Courtesy of NISSAN MOTOR CO., U.S.A.

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

CAUTION: Be careful not to damage the mating surface.

14. Using a minus-head screwdriver or similar tool, and lever off rear oil seal from rear oil seal retainer.
15. Remove main bearing cap as follows:
 - Before loosening main bearing cap bolts, measure the crankshaft end play. Refer to **CRANKSHAFT END PLAY**.
 - Loosen bolts in several different steps.



G00753303

Fig. 159: Main Cap Torque Sequence
 Courtesy of NISSAN MOTOR CO., U.S.A.

- Remove cover attached to the rear right side of cylinder block (next to the starter motor housing).

NOTE: Bolts (No. 28 shown in the figure) are installed on the inside of cover.

- Loosen the side bolts (M10) starting from 30 to 21 to remove.
- Loosen main bearing cap sub bolts (M9) starting from 20 to 11 to remove.
- Loosen main bearing cap bolts (M12) starting from 10 to 1 to remove.
- Using the main bearing cap remover (SST), remove main bearing cap.

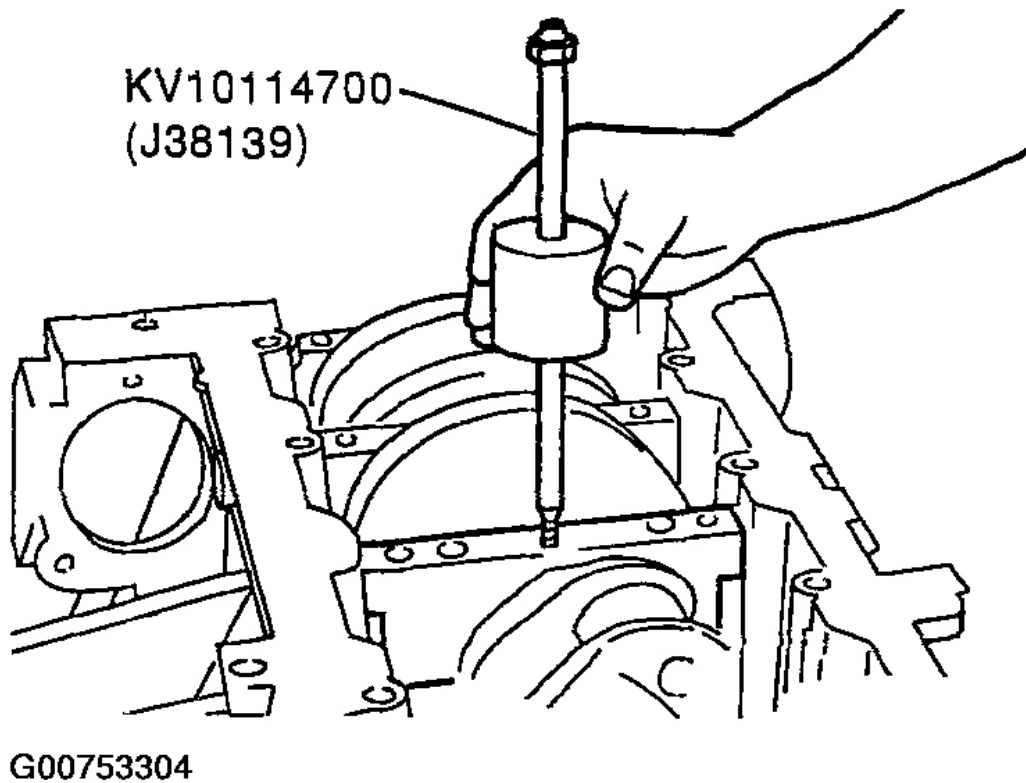


Fig. 160: Using main bearing cap remover
Courtesy of NISSAN MOTOR CO., U.S.A.

16. Remove crankshaft.
17. Remove main bearings and thrust bearings from cylinder block and main bearing caps.
 - When removing them, note the installation position. Keep them in the correct order.
18. If pilot converter must be removed, remove it from the rear end of crankshaft using the pilot bearing puller (SST).
 - Removal and installation without the engine stand is possible.

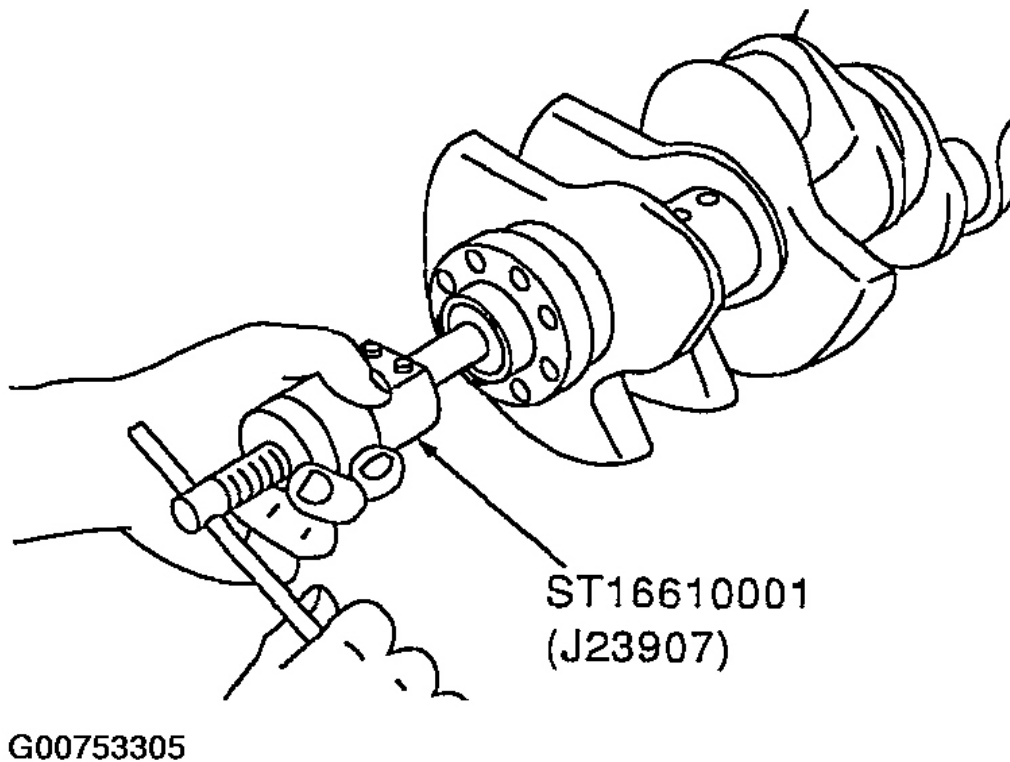


Fig. 161: Identifying pilot bearing puller
Courtesy of NISSAN MOTOR CO., U.S.A.

ASSEMBLY

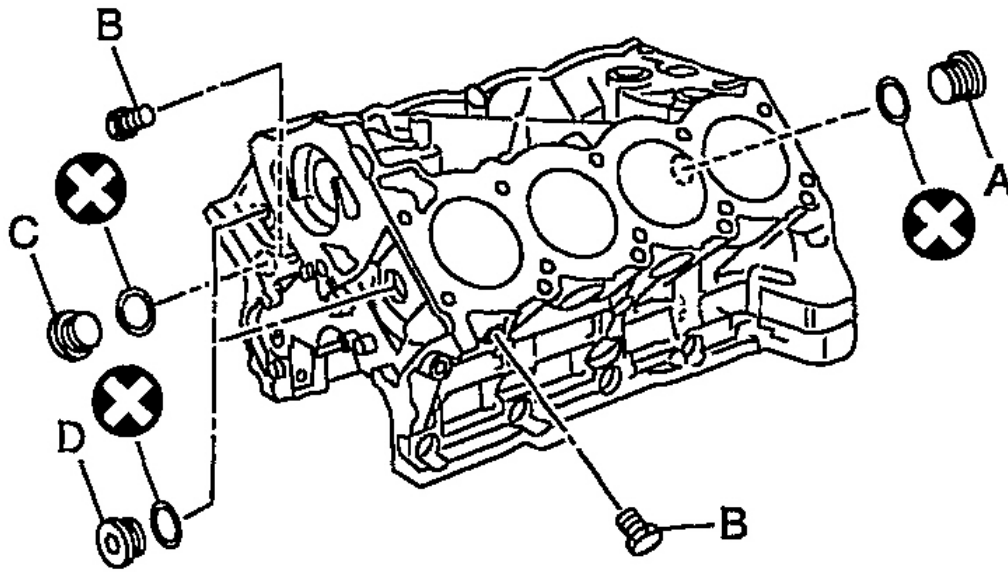
1. Fully air-blow engine coolant and engine oil passages in cylinder block, the cylinder bore, and crankcase to remove any foreign material.

CAUTION: Use a goggles to protect your eye.

2. Install each plug to cylinder block. (Only screwed-type plugs are shown in the figure.)
 - Apply liquid gasket.

Use Genuine Thread Sealant or equivalent. Refer to RECOMMENDED CHEMICAL PRODUCTS AND SEALANTS .

- Replace the copper washers with new ones.
- Tighten them as specified below.



⊗ : Always replace after every disassembly.

G00753306

Fig. 162: Locating Cylinder Block Coolant Plugs
Courtesy of NISSAN MOTOR CO., U.S.A.

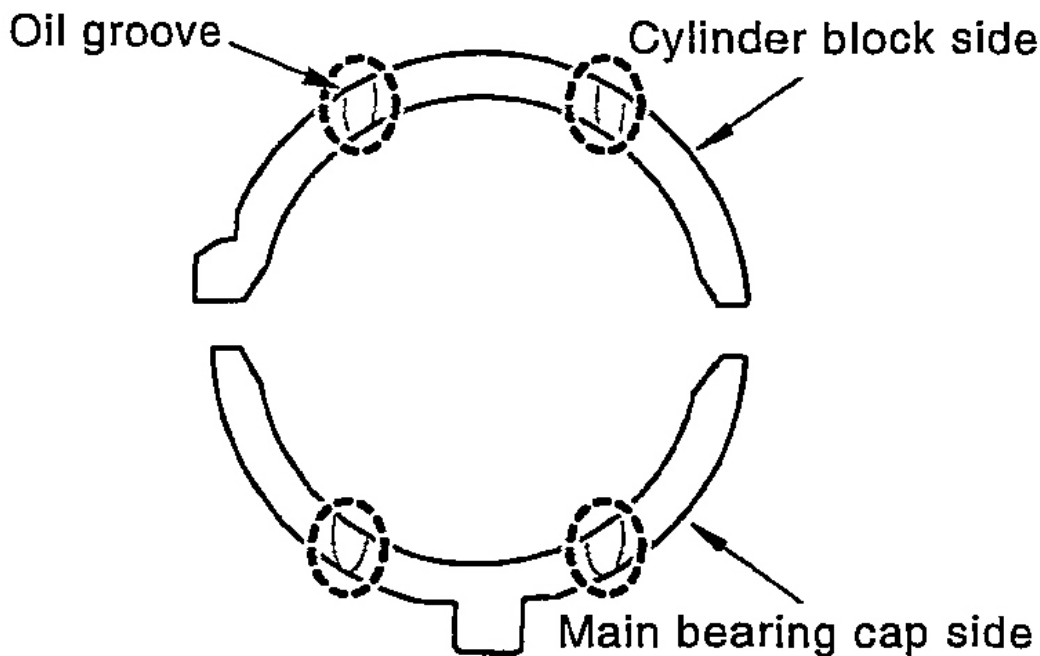
Part	Washer	Tightening torque
A	Yes.	49.0 - 58.8 N·m (5.0 - 6.0 kg-m, 37 - 43 ft-lb)
B	No.	14.7 - 24.5 N·m (1.5 - 2.5 kg-m, 11 - 18 ft-lb)
C	Yes.	57.8 - 67.6 N·m (5.9 - 6.9 kg-m, 43 - 49 ft-lb)
D	Yes.	57.8 - 67.6 N·m (5.9 - 6.9 kg-m, 43 - 49 ft-lb)

G00753307

Fig. 163: Cylinder Block Coolant Plug Torque Specifications
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Install main bearings and thrust bearings.

- a. Remove dust, dirt, and engine oil on the bearing mating surfaces of cylinder block and main bearing caps.
- b. Install thrust bearings to the both sides of the No. 3 journal housing on cylinder block and main bearing caps
 - Install thrust bearings with the engine oil groove facing crankshaft arm (outside).
 - Install thrust bearings with a protrusion in the center on main bearing caps.



G00753308

Fig. 164: Inspecting Thrust Bearing

Courtesy of NISSAN MOTOR CO., U.S.A.

- c. Install main bearings paying attention to the direction.
 - Install the one with oil holes onto cylinder block and the one without oil holes onto main bearing cap.
 - Before installing 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 the bearing stopper to the notch.
 - Insure the oil holes on cylinder block and those on the corresponding bearing are aligned.

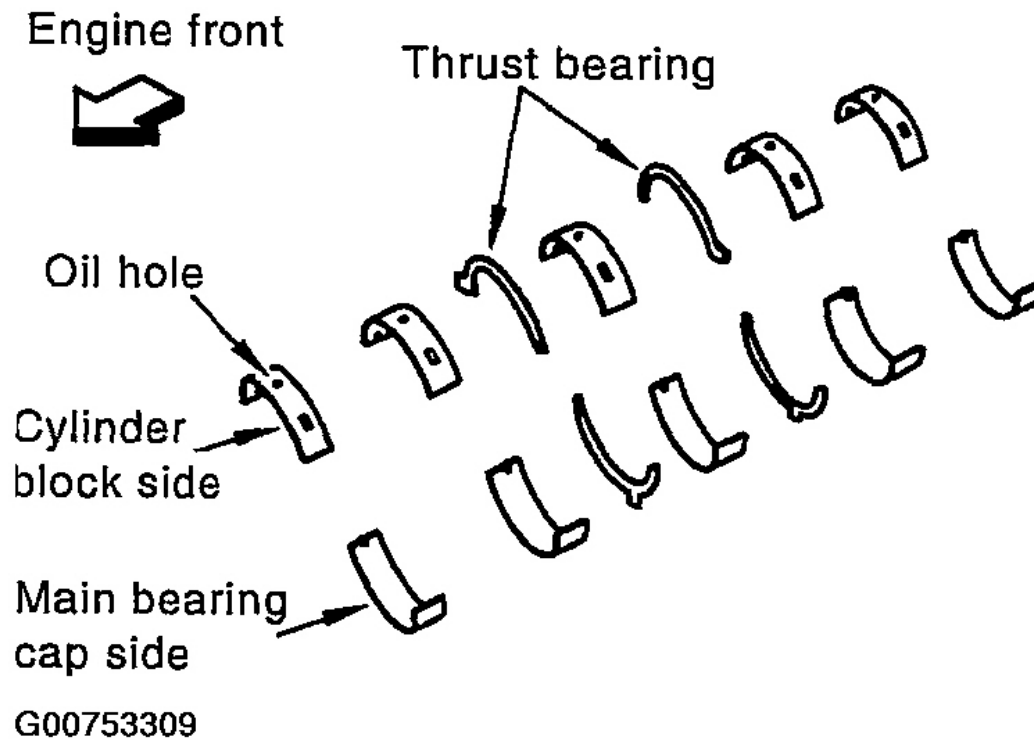
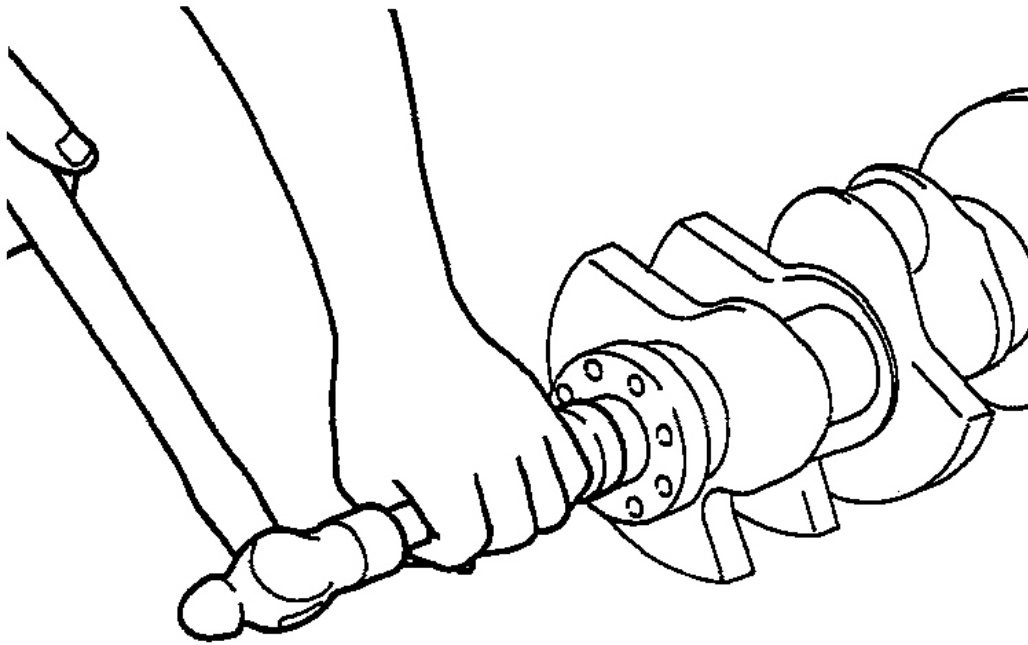


Fig. 165: Identifying Main Bearings
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Install pilot converter to crankshaft.
 - Using a drift approximately 35 mm (1.38 in) in outer diameter, drive pilot converter until its front end contacts crankshaft.
 - Press fit pilot converter with its chamfered side facing crankshaft. (Refer to "Component parts illustration on former page".)
 - It is acceptable to install it without the engine stand.



G00753310

Fig. 166: Installing pilot converter
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Install crankshaft to cylinder block.
 - While turning crankshaft by hand, check that it turns smoothly.
6. Install main bearing caps.
 - Align the identification number to the journal position to install.
 - Install the upper side of the identification number facing the front of engine. (The number shall be read correctly from the rear of engine.)
 - Using a plastic hammer or similar tool, tap them lightly to seat them on the installation position.

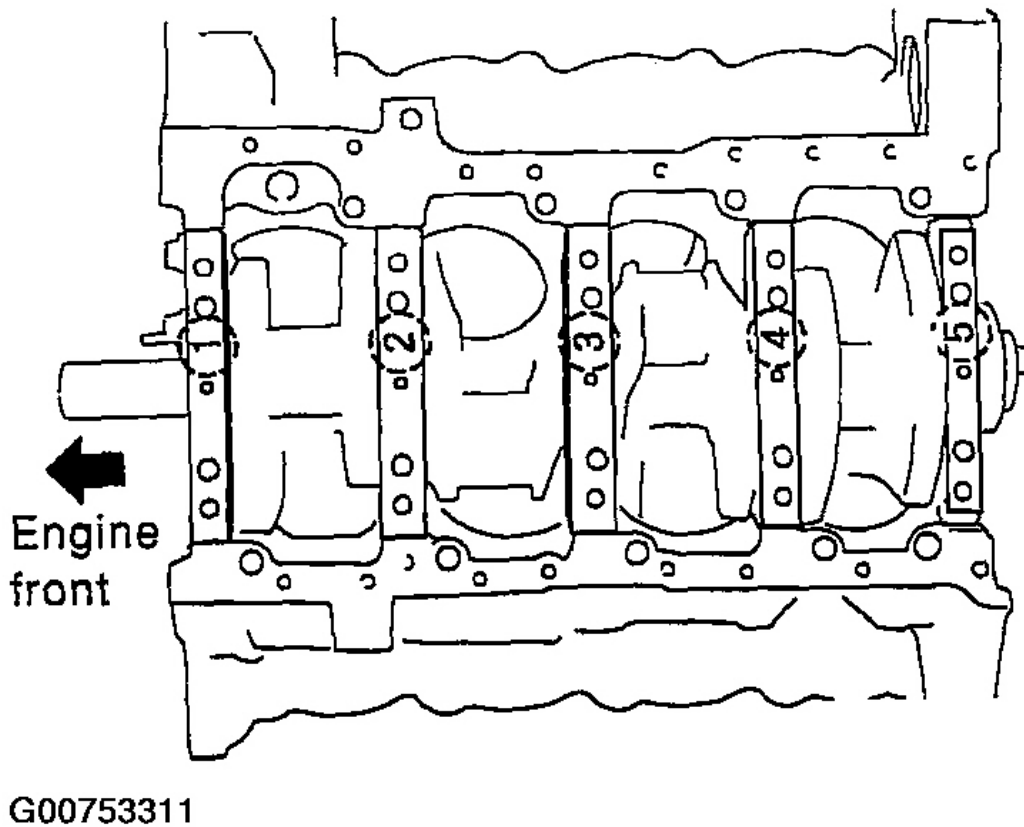
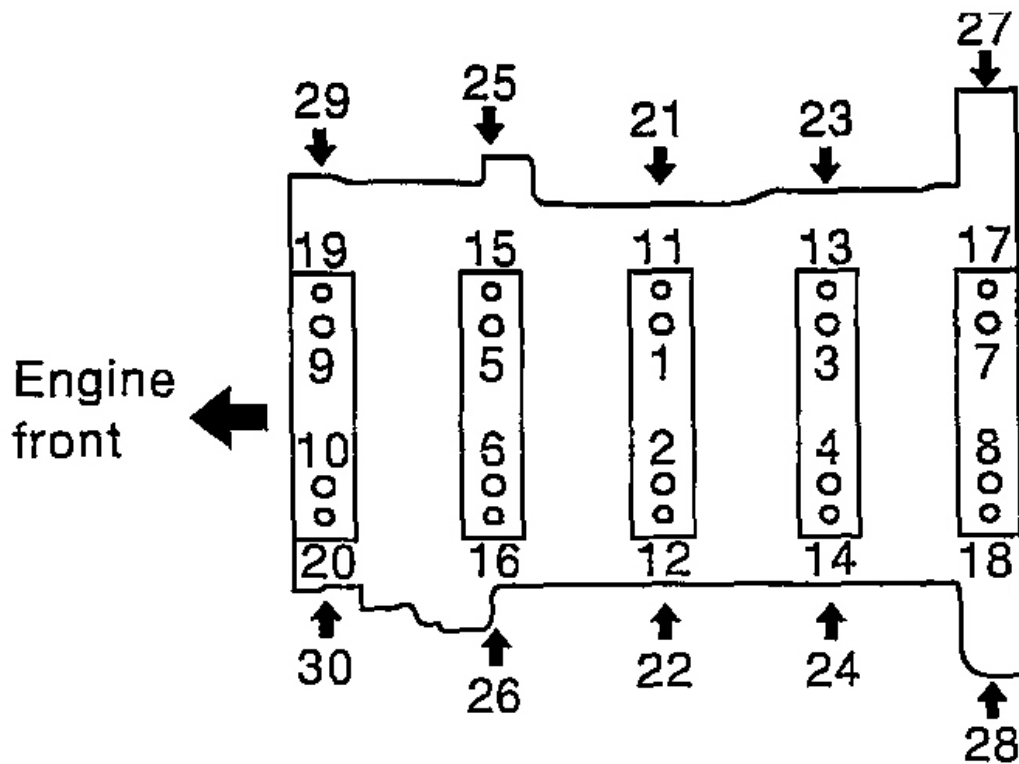


Fig. 167: Identifying Main Cap Placement
Courtesy of NISSAN MOTOR CO., U.S.A.

7. Follow the below steps to tighten each main bearing cap bolts.
 - a. Apply engine oil to threads and seating surface of bolts, and tighten all bolts temporarily.
 - b. Tighten main bearing cap bolt (M12) to 36.3 to 42.1 N.m (3.7 to 4.3 kg-m, 27 to 31 ft-lb) in order of 1 to 10.
 - c. Tighten main bearing cap sub bolt (M9) to 26.5 to 32.3 N.m (2.7 to 3.3 kg-m, 20 to 23 ft-lb) in order of 11 to 20.



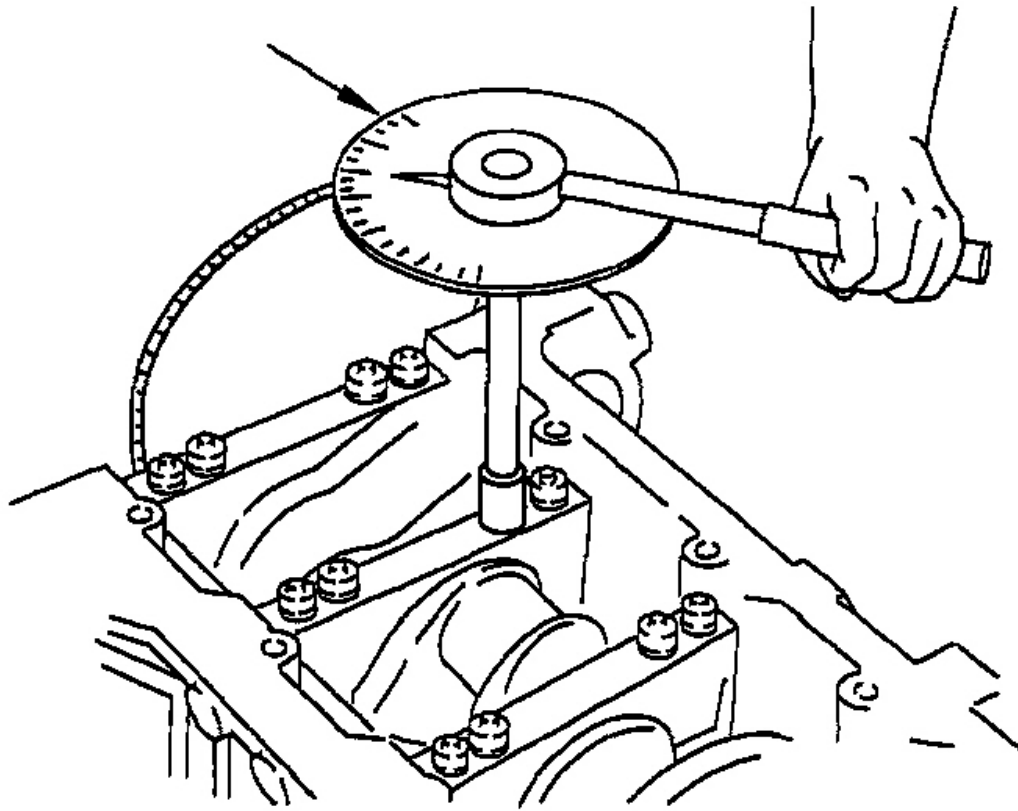
G00753312

Fig. 168: Main Cap Torque Sequence
 Courtesy of NISSAN MOTOR CO., U.S.A.

- d. Tighten main bearing cap bolt (M12) to 40 degrees in order of 1 to 10. (angle tightening)

CAUTION: Measure tighten angle in step "d" and "e" with the angle wrench (SST). Do not measure visually.

- e. Tighten main bearing cap sub bolt (M9) to 30 degrees in order of 11 to 20. (angle tightening)
 f. Tighten side bolt (M10) to 46.1 to 51.9 N.m (4.7 to 5.3 kg-m, 34 to 38 ft-lb) in order of 21 to 30.

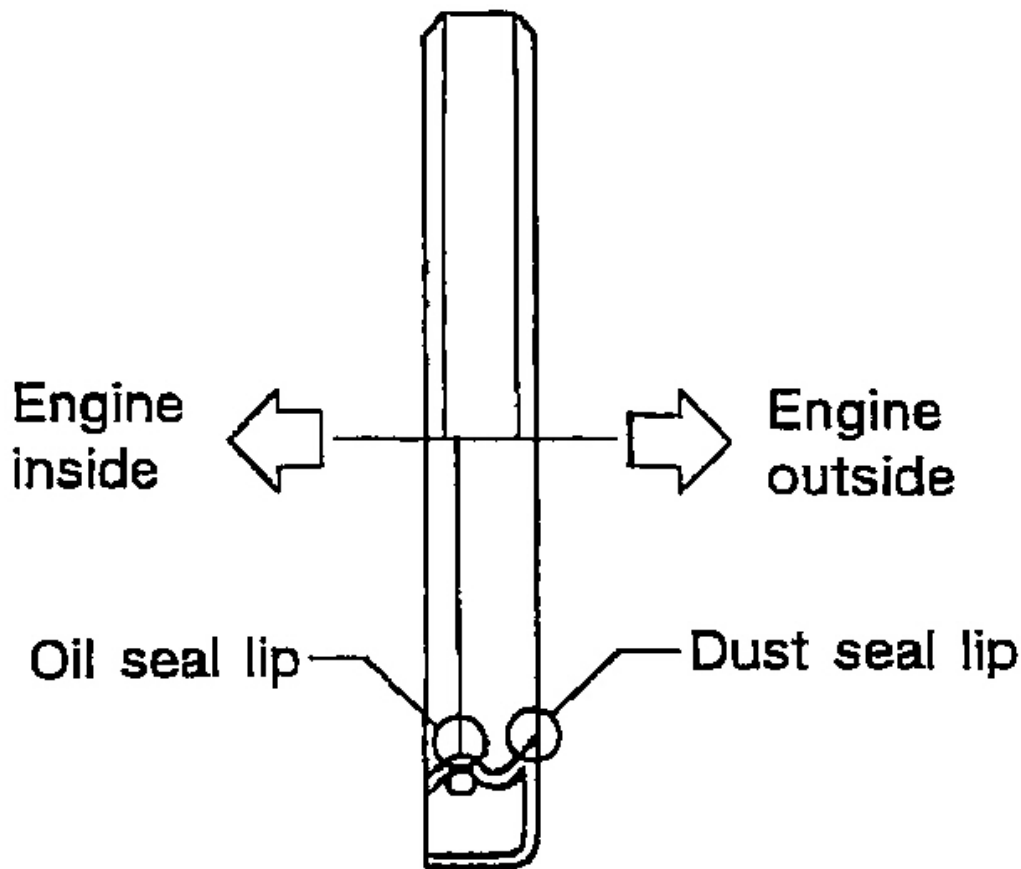


G00753313

Fig. 169: View Of angle wrench

Courtesy of NISSAN MOTOR CO., U.S.A.

- g. Install cover of cylinder block right rear side (next to starter motor housing).
 - Rotate crankshaft by hands after bolts are tightened. Check if it rotates smoothly.
 - Check the crankshaft end play. Refer to **CRANKSHAFT END PLAY**.
8. Install rear oil seal using the rear oil seal drift (commercial service tool).
 - Tap until flattened with front edge of rear oil seal retainer. Do not damage or scratch outer circumference of oil seal.
 - Install new rear oil seal in the direction shown in the figure.



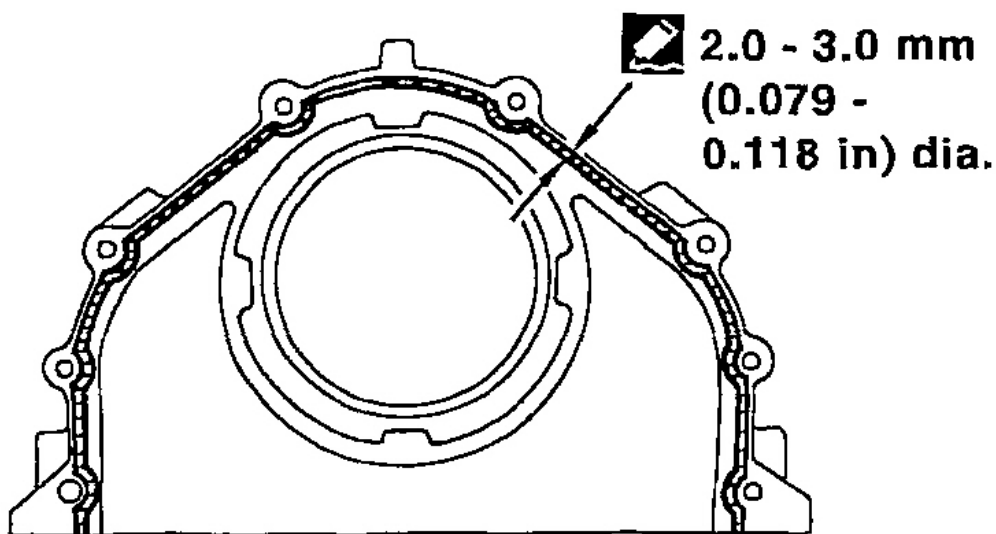
G00753315

Fig. 170: Installing rear oil seal
Courtesy of NISSAN MOTOR CO., U.S.A.

9. Install rear oil seal retainer.
 - Apply liquid gasket thoroughly to rear oil seal retainer.

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

- Apply new engine oil on lips of oil seal. Do not touch.

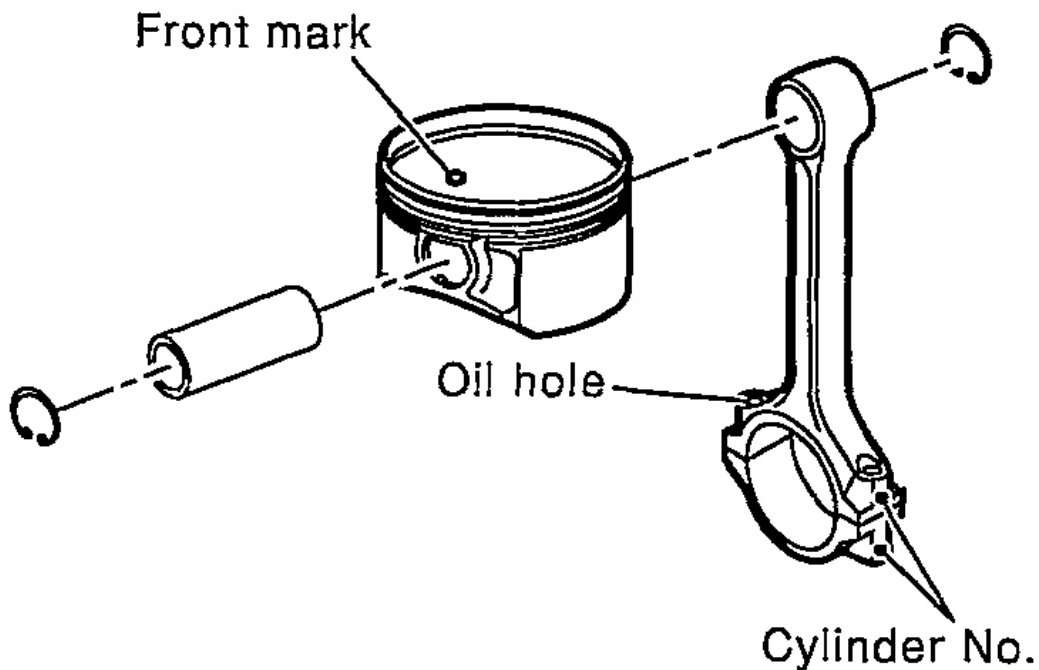


 : Apply Genuine RTV Silicone Sealant or equivalent. Refer to GI section.

G00753316

Fig. 171: Applying liquid gasket
Courtesy of NISSAN MOTOR CO., U.S.A.

10. Install piston to connecting rod.
 - a. Using the snap ring pliers, install snap ring to the grooves of the piston rear side.
 - Insert it fully into groove to install.
 - b. Install piston to connecting rod.
 - Using the industrial use drier or equivalent, heat the piston until piston pin can be pushed in by hand without excess force [approx. 60 to 70 C° (140 to 158 °F)]. From the front to the rear, insert piston pin into piston and connecting rod.
 - Assemble so that the front mark on the piston crown and the oil holes and the cylinder No. on connecting rod are positioned as shown in the figure.
 - c. Install snap rings to the front of piston.
 - After installing, check that connecting rod moves smoothly.



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Fig. 172: Piston And Connecting Rod Assembly
Courtesy of NISSAN MOTOR CO., U.S.A.

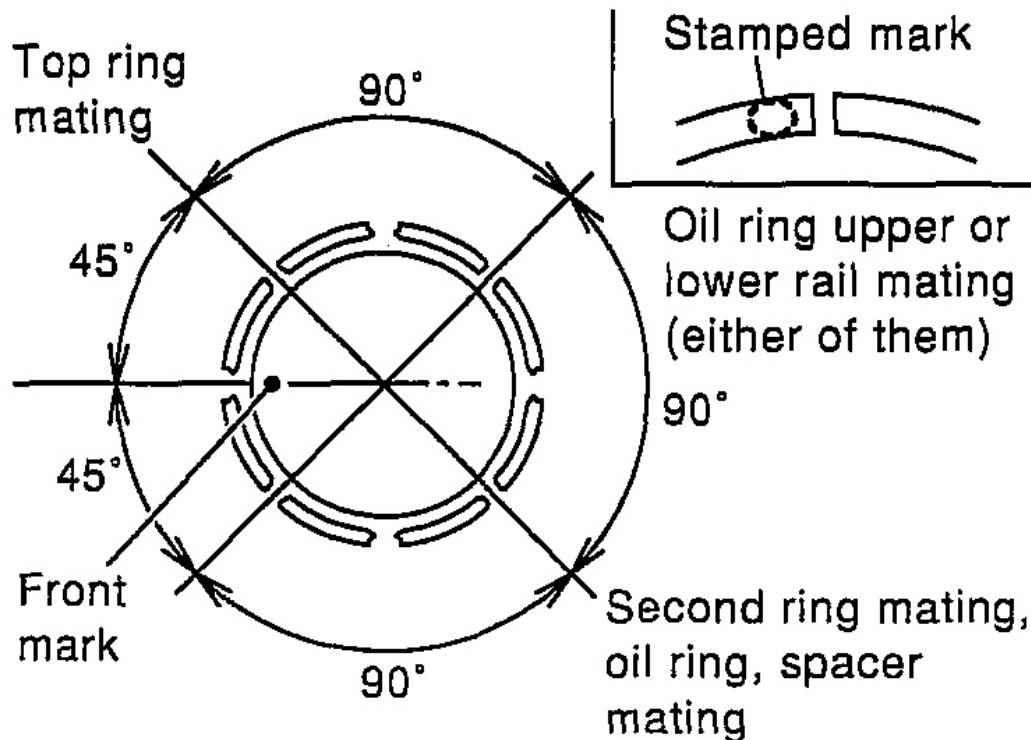
11. Using the piston ring expander (commercial service tool), install piston rings.

CAUTION: Be careful not to damage the piston.

- Position each ring with the gap as shown in the figure, referring to the piston front mark.
- Install top ring and second ring with the stamped surface facing upward.

Stamped mark : R (top ring)

: 2R (second ring)

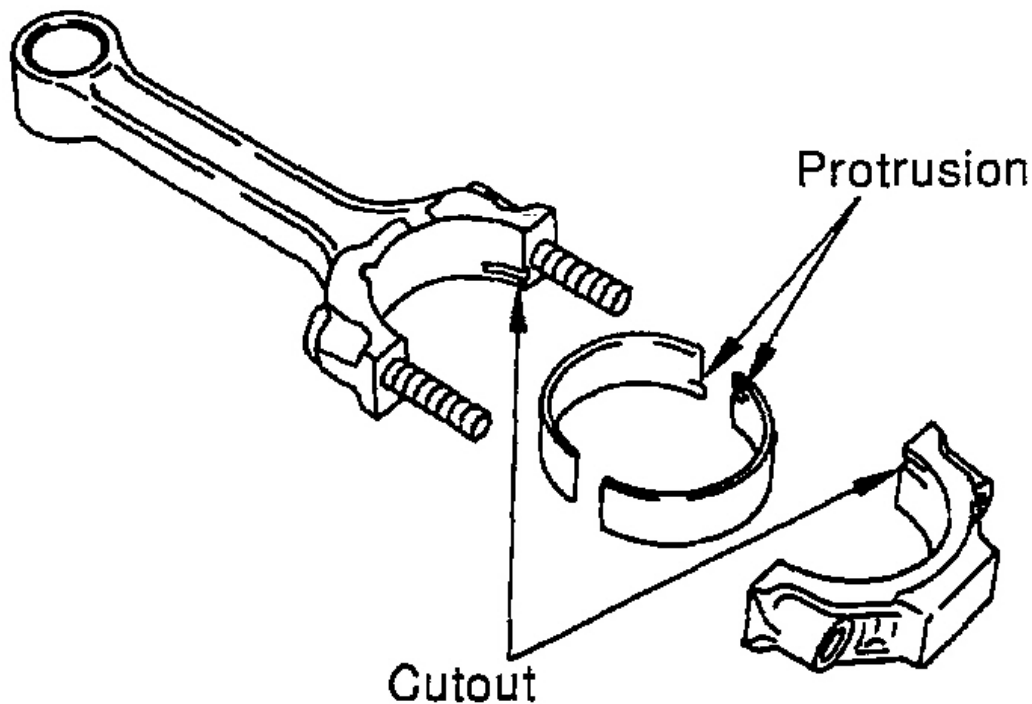


G00753318

Fig. 173: Piston Ring Placement

Courtesy of NISSAN MOTOR CO., U.S.A.

12. Install connecting rod bearings to connecting rod and connecting rod cap.
 - When 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 the connecting rod bearing stopper protrusion with the cutout of connecting rod to install.
 - Check the oil holes on connecting rod and those on the corresponding bearing are aligned.



G00753319

Fig. 174: Installing Connecting Rod Bearings
Courtesy of NISSAN MOTOR CO., U.S.A.

13. 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.
 - Match the cylinder position with the cylinder No. on connecting rod to install.
 - Using the piston ring compressor [SST: EM03470000 (J8037)], install piston with the front mark on the piston crown facing the front of engine.

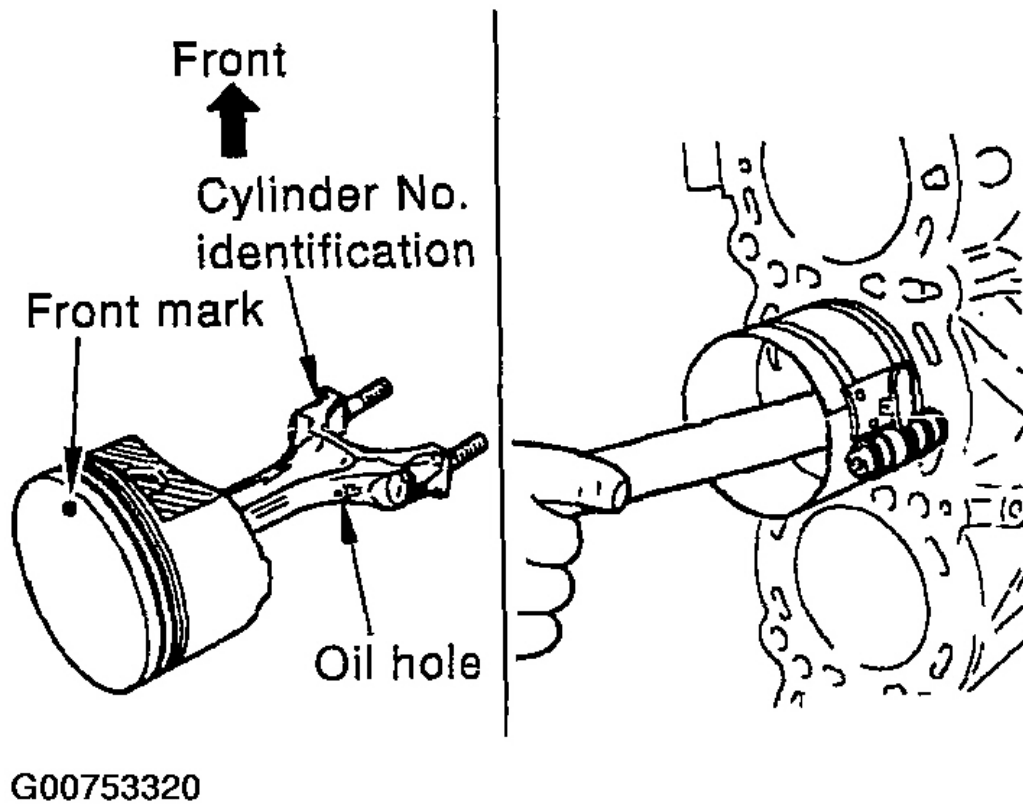


Fig. 175: Installing Piston And Connecting Rod Assembly
Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: Be careful not to damage the crankshaft pin, resulting from an interference of connecting rod big end.

14. Install connecting rod cap.

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

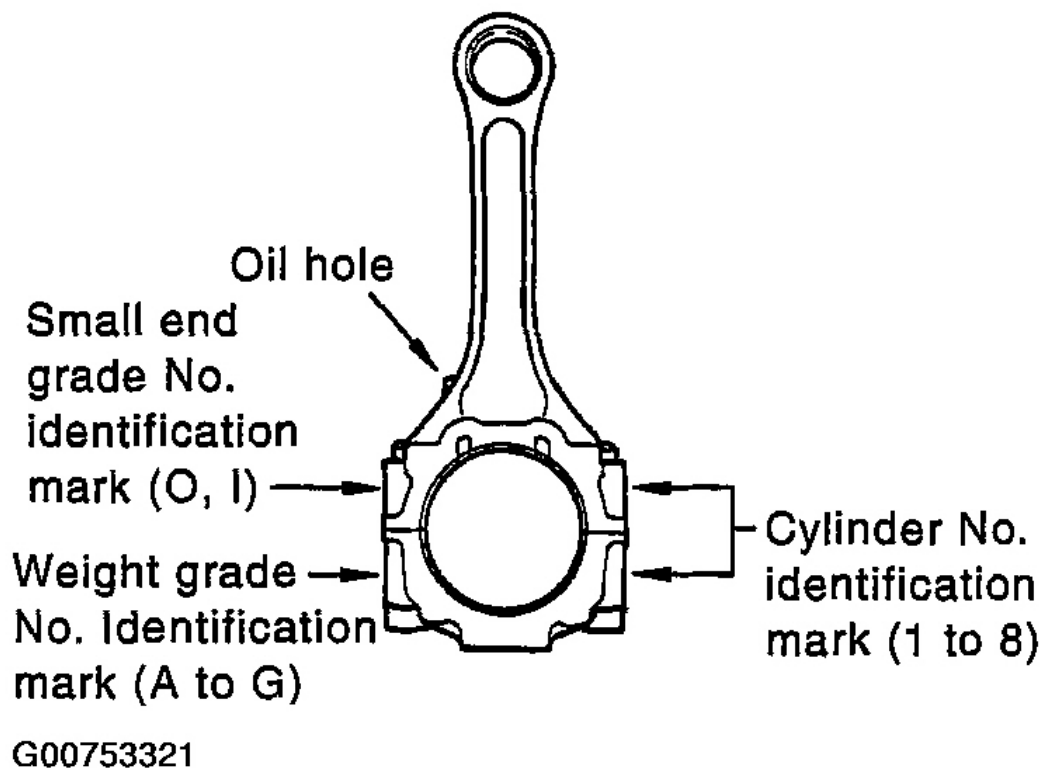


Fig. 176: Installing connecting rod cap
Courtesy of NISSAN MOTOR CO., U.S.A.

15. Tighten the connecting rod nuts as follows:
 - a. Apply engine oil to the threads and seats of the connecting rod bolts and nuts.
 - b. Tighten nuts to 13.7 to 15.7 N.m (1.4 to 1.6 kg-m, 10 to 12 ft-lb).
 - c. Put mating (with paint) on each nut and connecting rod cap, all in the same direction (when using a protractor).
 - d. Then all nuts 60 degrees clockwise (angle tightening).

CAUTION: Always use either the angle wrench (SST) or protractor. Avoid tightening based on visual check alone.

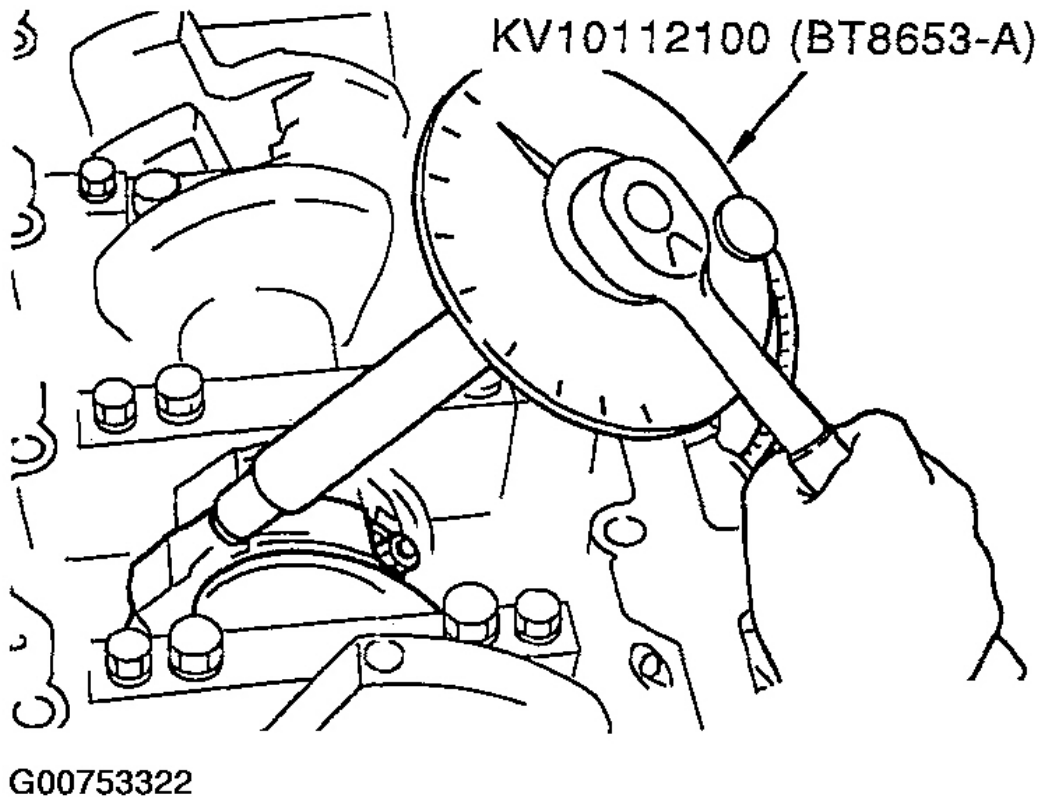


Fig. 177: Using Angle Wrench
Courtesy of NISSAN MOTOR CO., U.S.A.

- After tightening the nuts, make sure that crankshaft rotates smoothly.
- Check the connecting rod side clearance. Refer to **CONNECTING ROD SIDE CLEARANCE**.

16. Install knock sensor.

- Make sure that there is no foreign material on the cylinder block mating surface and the back surface of knock sensor.
- Install it with its connector facing the rear side.
- Do not tighten the mounting bolts while holding the connector.
- Make sure that knock sensor does not interfere with other-parts.
- Install knock sensor sub-harness with its shorter branch line to the right bank.

CAUTION: If any impact by dropping is applied to knock sensor, replace it with new one.

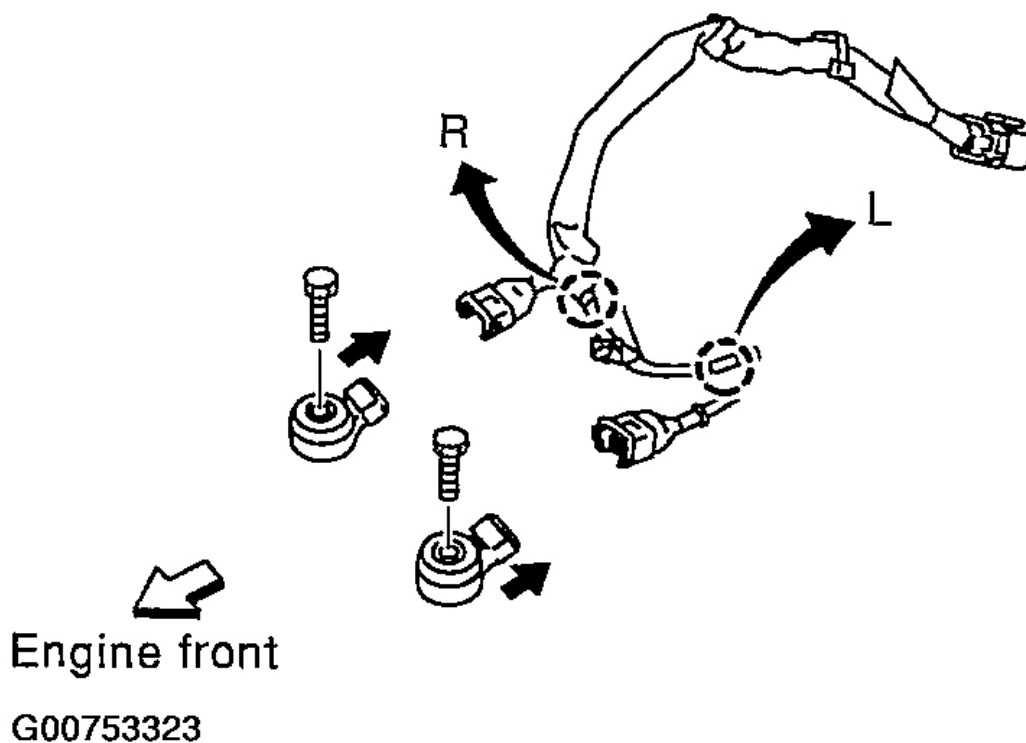
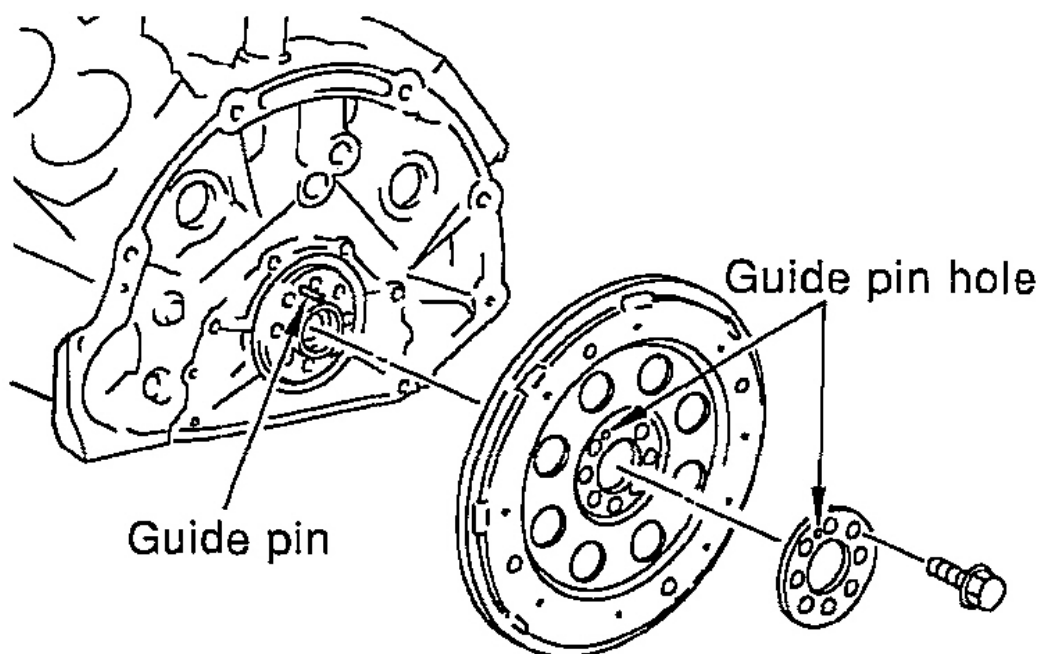


Fig. 178: Installing Knock Sensor
Courtesy of NISSAN MOTOR CO., U.S.A.

17. Install followings in the reverse order of removal.
18. Remove engine assembly from engine stand.
19. Install drive plate.
 - Align guide pin of crankshaft rear end with pin holes of each parts to install.

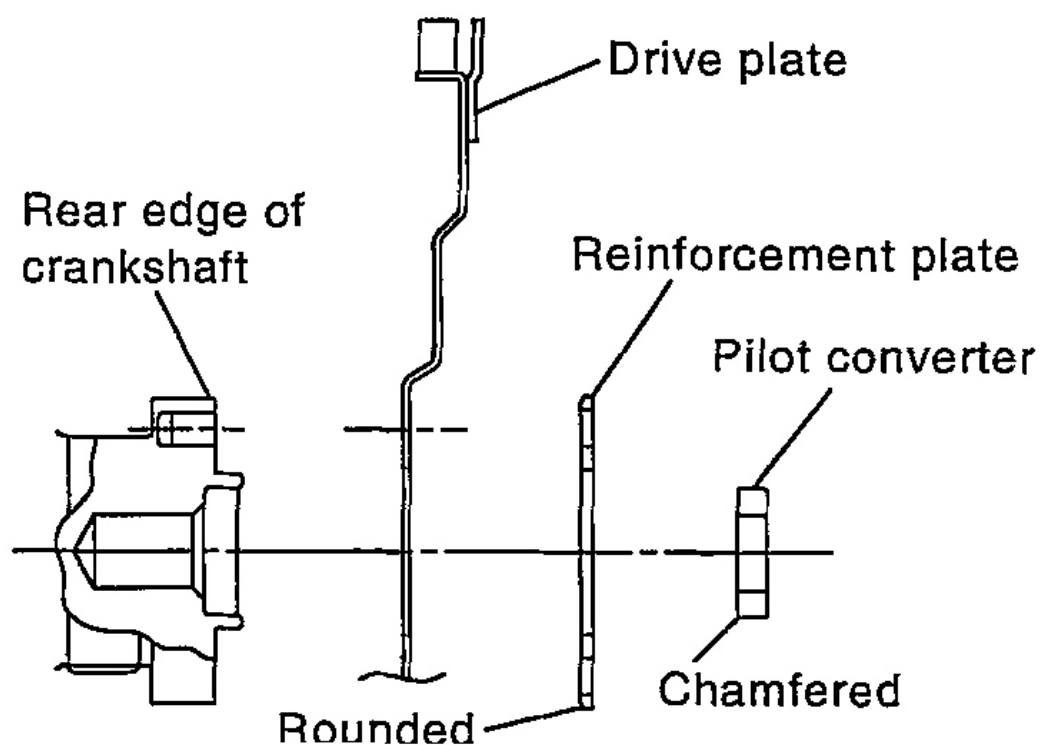


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Fig. 179: Install Drive Plate

Courtesy of NISSAN MOTOR CO., U.S.A.

- Install drive plate, reinforcement plate and pilot converter (if not installed in step 4) as shown in the figure.
- Using drift of 33 mm (1.30 in) dia, push pilot converter into the end.
- Face pilot converter chamfered or rounded edge side to crankshaft.



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Fig. 180: Drive Plate, reinforcement plate and pilot converter Assembly
Courtesy of NISSAN MOTOR CO., U.S.A.

HOW TO SELECT PISTON AND BEARING

DESCRIPTION

Connecting points	Connecting parts	Selection items	Selection methods
Between cylinder block to 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 to connecting rod	Connecting rod bearing	Connecting rod bearing grade (bearing thickness)	Connecting rod bearing grade = crankshaft pin grade (outer diameter of pin). No grade exists for inner diameter of connecting rod large end.
Between cylinder block to piston	Piston and piston pin assembly. The piston is available together with piston pin as an assembly.	Piston grade (piston outer diameter)	Piston grade = cylinder bore grade (inner diameter of bore)
*Between piston to connecting rod	—	—	—

*For the service parts, the grade for fitting cannot be selected between a piston pin and a connecting rod. (Only 0 grade is available.) The information at the shipment from the plant is described as a reference.

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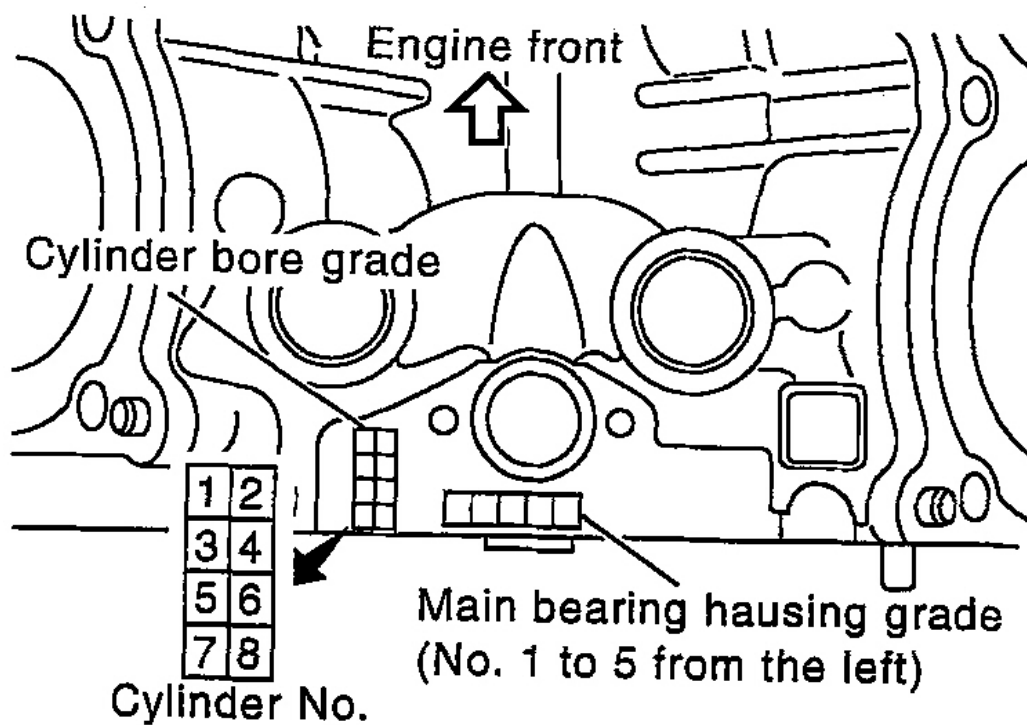
Fig. 181: How to Select Piston and Bearing
Courtesy of NISSAN MOTOR CO., U.S.A.

- 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.

HOW TO SELECT PISTON

Piston Selective Fitting When New Cylinder Block is Used:

Check the cylinder bore grade on the rear upper side between cylinder block banks, and select piston of the same grade.



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Fig. 182: Piston Selective Fitting When New Cylinder Block is Used (1 Of 2)
Courtesy of NISSAN MOTOR CO., U.S.A.

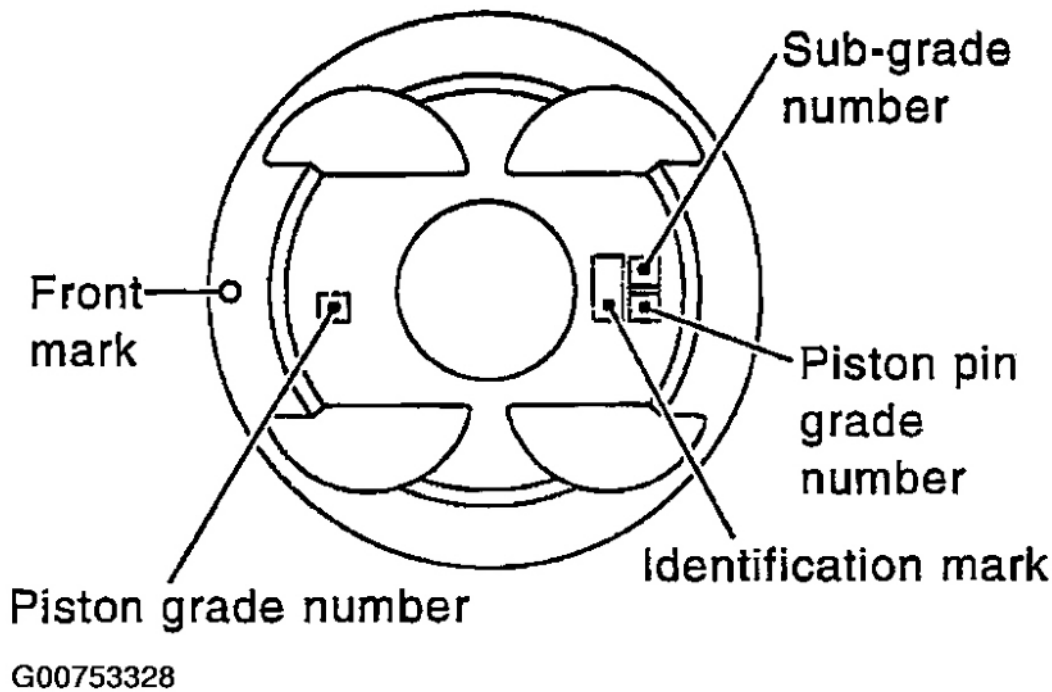


Fig. 183: Piston Selective Fitting When New Cylinder Block is Used (2 Of 2)
 Courtesy of NISSAN MOTOR CO., U.S.A.

When Cylinder Block is Reused:

1. Measure the cylinder block bore inner diameter.
2. Determine the bore grade by comparing the measurement with the values under the "Cylinder bore inner diameter" of the piston selection table. Select piston of the same grade.

Piston Selection Table

Unit: mm (in)

Grade number (Mark)	1	2 (or no mark)	3
Inner diameter of cylinder bore	93.000-93.010 (3.6614-3.6618)	93.010-93.020 (3.6618-3.6622)	93.020-93.030 (3.6622-3.6626)
Outer diameter of piston	92.980-92.990 (3.6606-3.6610)	92.990-93.000 (3.6610-3.6614)	93.000-93.010 (3.6614-3.6618)

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Fig. 184: Piston Selection Table
 Courtesy of NISSAN MOTOR CO., U.S.A.

NOTE:

- The piston is available together with piston pin as an assembly.
- The piston pin (piston pin bore) grade is provided only for the parts

installed at the plant. For the service parts, no grades can be selected (only 0 grade is available).

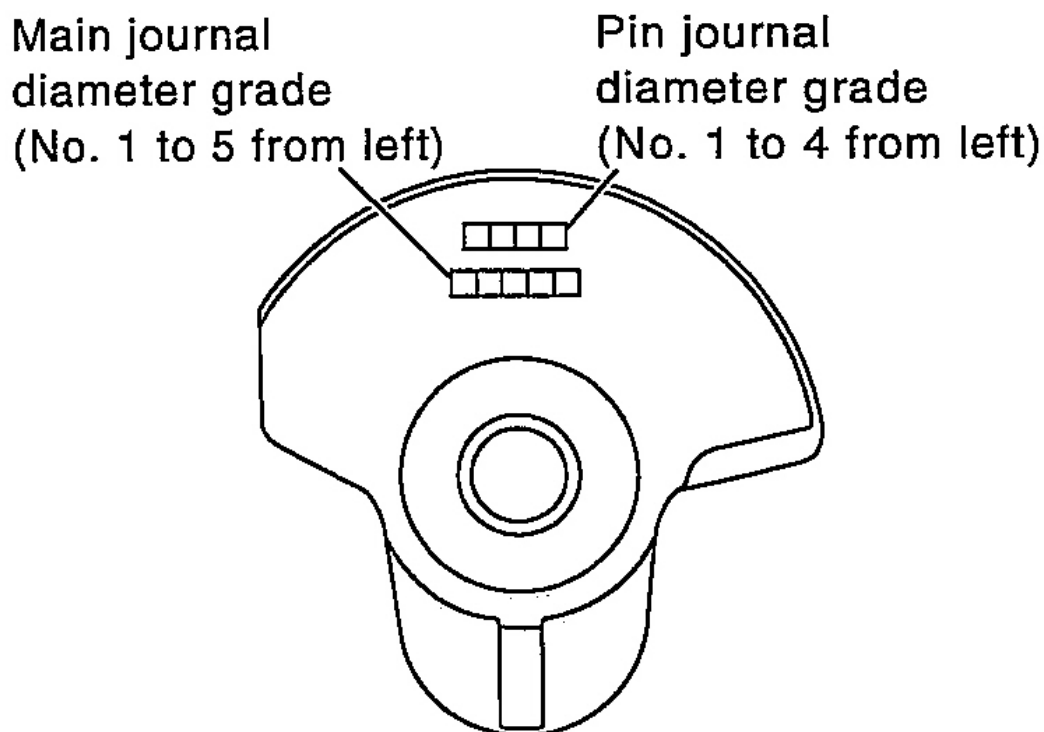
- No second grade mark is available on piston.

HOW TO SELECT CONNECTING ROD BEARING

When New Connecting Rod and Crankshaft are Used:

Compare the pin diameter grade on the crankshaft front surface with the values of the selection table of connecting rod bearing.

NOTE: There is no grading for connecting rod big end.



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Fig. 185: How To Select Connecting Rod Bearing
Courtesy of NISSAN MOTOR CO., U.S.A.

When Crankshaft and Connecting Rod are Reused:

1. Measure the pin outer diameter of crankshaft.

2. Compare the measurement with the values of the selection table of connecting rod bearing.

Selection Table of Connecting Rod Bearing

Unit: mm (in)

Connecting rod big end inner diameter	55.000 - 55.013 (2.1654 - 2.1659)
---------------------------------------	-----------------------------------

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Fig. 186: Selection Table of Connecting Rod Bearing (1 Of 2)
Courtesy of NISSAN MOTOR CO., U.S.A.

Unit: mm (in)

Crankshaft pin outer diameter	Grade (Mark)	Dimension (Bearing thickness range)	Bearing grade No.	Color
51.968 - 51.974 (2.0460 - 2.0462)	0	1.500 - 1.503 (0.0591 - 0.0592)	STD 0	No color
51.962 - 51.968 (2.0457 - 2.0460)	1	1.503 - 1.506 (0.0592 - 0.0593)	STD 1	Brown
51.956 - 51.962 (2.0455 - 2.0457)	2	1.506 - 1.509 (0.0593 - 0.0594)	STD 2	Green

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Fig. 187: Selection Table of Connecting Rod Bearing (2 Of 2)
Courtesy of NISSAN MOTOR CO., U.S.A.

Undersize Bearings Usage Guide

- When the specified oil clearance is not obtained with standard size connecting rod bearings, use undersize (US) bearings.
- When using undersize bearings, measure the bearing inner diameters with bearings installed, and grind crankshaft pin so that the oil clearance satisfies the standard.

Bearing undersize table

CAUTION: In grinding the crankshaft pin to use undersize bearings, do not damage the fillet R [1.5 mm (0.059 in)] (All crankshaft pins).

Unit: mm (in)

Size	Thickness
US 0.25 (0.0098)	1.626 - 1.634 (0.0640 - 0.0643)

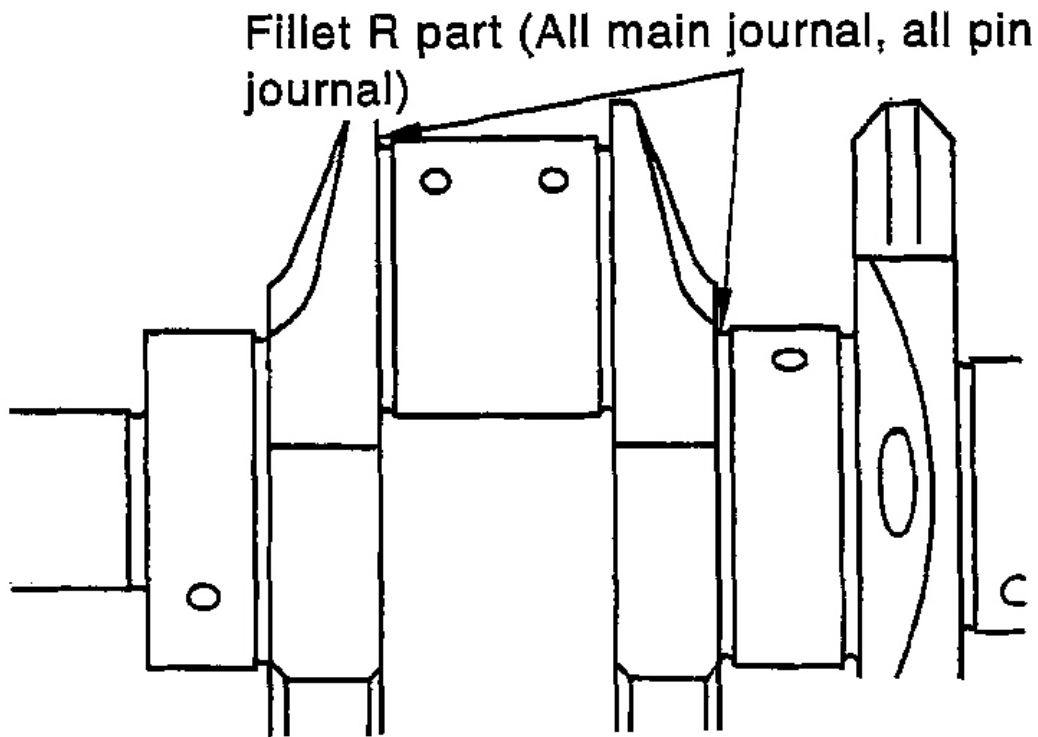
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Fig. 188: Bearing Undersize Table
Courtesy of NISSAN MOTOR CO., U.S.A.

HOW TO SELECT MAIN BEARING

When New Cylinder Block and Crankshaft are Used:

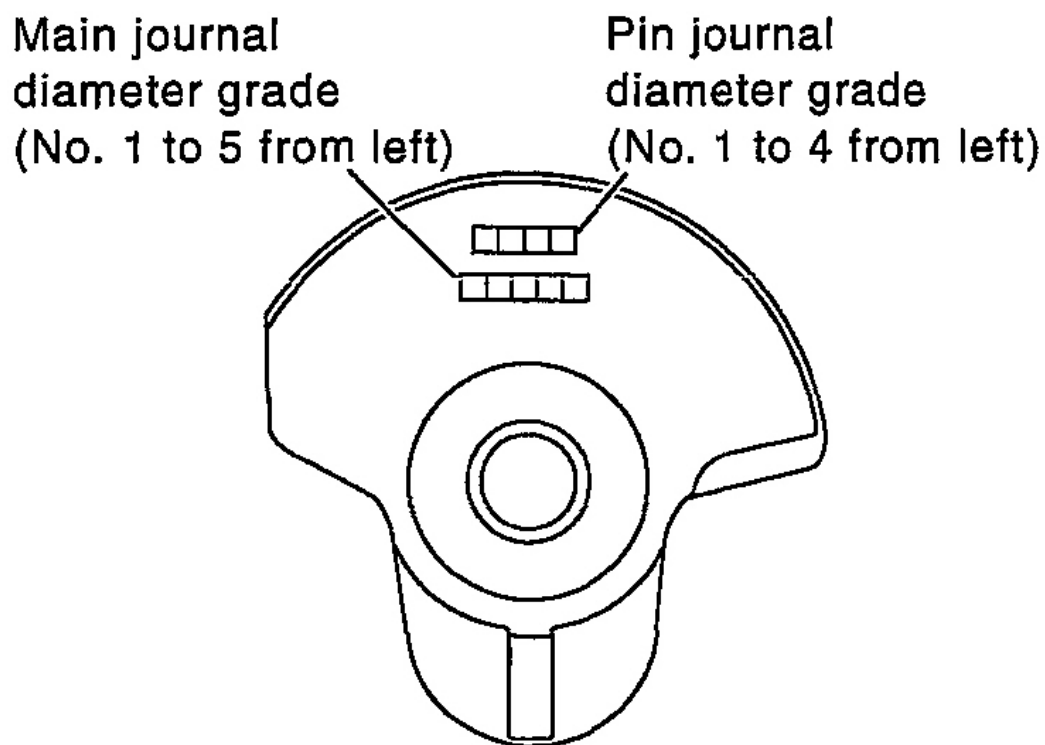
1. Apply main bearing housing grade on upper rear side between cylinder block banks to row in main bearing selection table.



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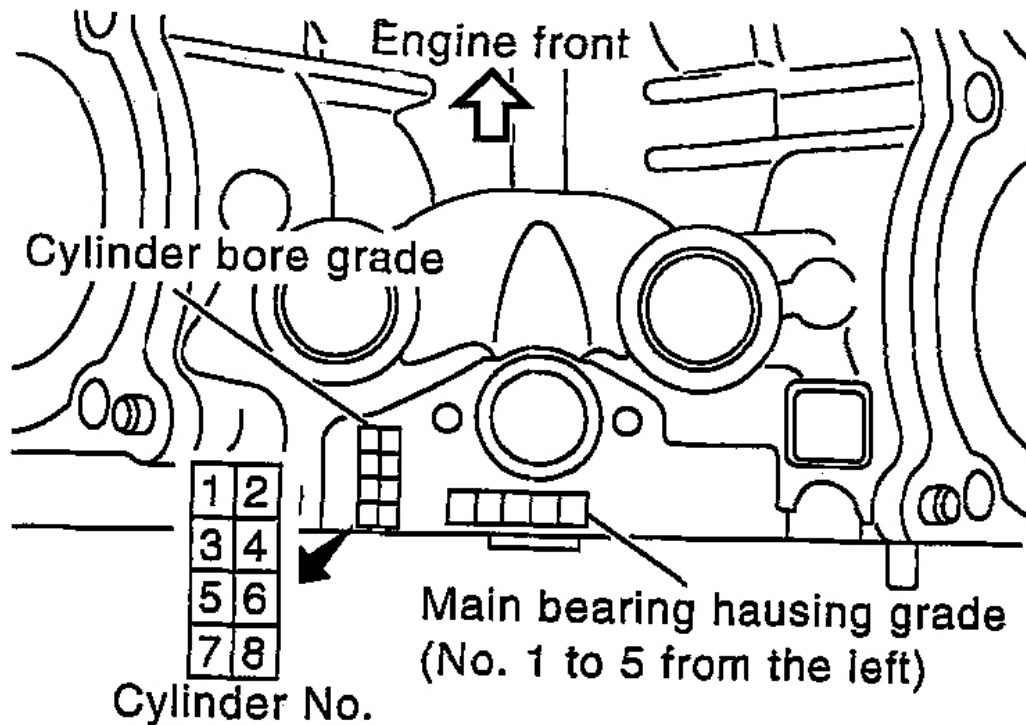
Fig. 189: Checking crankshaft Fillet
Courtesy of NISSAN MOTOR CO., U.S.A.

2. Apply journal diameter grade on the crankshaft front to column in main bearing selection table.



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Fig. 190: How To Select Main Bearing (1 Of 2)
Courtesy of NISSAN MOTOR CO., U.S.A.



G00753335

Fig. 191: How To Select Main Bearing (2 Of 2)

Courtesy of NISSAN MOTOR CO., U.S.A.

- Find sign at crossing of row and column 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 lists for each part.
- No.1, 5 journal and No. 2, 3, 4 journal have the same signs but different measures. Do not confuse.

- Apply sign at crossing in above step 3 to main bearing grade table.

NOTE:

- Grade list applies to all journals.
- Service parts is available as a set of both upper and lower.

When Cylinder Block and Crankshaft are Reused:

- Measure inner diameter of cylinder block main bearing housing and outer diameter of crankshaft journal.

2. Apply measurement in above step 1 to main bearing selection table.
3. Follow step 3 and later in "When new cylinder block and crankshaft are used".

Main Bearings Selection Table (No. 1, and No. 5 Journal)

Cylinder block main bearing hausing inner diameter	Crankshaft journal outer diameter	I.D. mark	I.D. mark		Inner diameter Unit : mm (in)		A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V	W	X	Y	1	2
							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	Outer diameter Unit : mm (in)																													
G	63.964 - 63.963 (2.5183 - 2.5182)	1	1	12	12	12	2	2	2	23	23	23	23	23	23	23	3	3	3	34	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	23	23	23	23	23	3	3	3	34	34	34	34	4	4	4	45	45	45	5
J	63.962 - 63.961 (2.5182 - 2.5181)	12	12	12	2	2	2	23	23	23	23	23	23	23	23	23	3	3	3	34	34	34	34	4	4	4	45	45	45	5
K	63.961 - 63.960 (2.5181 - 2.5181)	12	12	2	2	2	23	23	23	23	23	23	23	23	23	23	3	3	3	34	34	34	34	4	4	4	45	45	45	5
L	63.960 - 63.959 (2.5181 - 2.5181)	12	2	2	2	23	23	23	23	23	23	23	23	23	23	23	3	3	3	34	34	34	34	4	4	4	45	45	45	5
M	63.959 - 63.958 (2.5181 - 2.5180)	2	2	2	23	23	23	23	23	23	23	23	23	23	23	23	3	3	3	34	34	34	34	4	4	4	45	45	45	5
N	63.958 - 63.957 (2.5180 - 2.5180)	2	2	23	23	23	23	23	23	23	23	23	23	23	23	23	3	3	3	34	34	34	34	4	4	4	45	45	45	5
P	63.957 - 63.956 (2.5180 - 2.5179)	2	23	23	23	23	23	23	23	23	23	23	23	23	23	23	3	3	3	34	34	34	34	4	4	4	45	45	45	5
R	63.956 - 63.955 (2.5179 - 2.5179)	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	3	3	3	34	34	34	34	4	4	4	45	45	45	5
S	63.955 - 63.954 (2.5179 - 2.5178)	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	3	3	3	34	34	34	34	4	4	4	45	45	45	5
T	63.954 - 63.953 (2.5179 - 2.5178)	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	3	3	3	34	34	34	34	4	4	4	45	45	45	5
U	63.953 - 63.952 (2.5178 - 2.5178)	3	3	3	34	34	34	4	4	4	4	4	4	4	4	4	45	45	45	5	5	5	5	56	56	56	6	6	6	67
V	63.952 - 63.951 (2.5178 - 2.5178)	3	3	34	34	34	4	4	4	4	4	4	4	4	4	4	45	45	45	5	5	5	5	56	56	56	6	6	6	67
W	63.951 - 63.950 (2.5178 - 2.5177)	3	34	34	34	4	4	4	4	4	4	4	4	4	4	4	45	45	45	5	5	5	5	56	56	56	6	6	6	67
X	63.950 - 63.949 (2.5177 - 2.5177)	34	34	34	4	4	4	4	4	4	4	4	4	4	4	4	45	45	45	5	5	5	5	56	56	56	6	6	6	67
Y	63.949 - 63.948 (2.5177 - 2.5176)	34	34	4	4	4	4	4	4	4	4	4	4	4	4	4	45	45	45	5	5	5	5	56	56	56	6	6	6	67
1	63.948 - 63.947 (2.5176 - 2.5176)	34	4	4	4	4	4	4	4	4	4	4	4	4	4	4	45	45	45	5	5	5	5	56	56	56	6	6	6	67
2	63.947 - 63.946 (2.5176 - 2.5176)	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	45	45	45	5	5	5	5	56	56	56	6	6	6	67
3	63.946 - 63.945 (2.5176 - 2.5175)	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	45	45	45	5	5	5	5	56	56	56	6	6	6	67
4	63.945 - 63.944 (2.5175 - 2.5175)	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	45	45	45	5	5	5	5	56	56	56	6	6	6	67
5	63.944 - 63.943 (2.5175 - 2.5174)	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	45	45	45	5	5	5	5	56	56	56	6	6	6	67
6	63.943 - 63.942 (2.5174 - 2.5174)	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	45	45	45	5	5	5	5	56	56	56	6	6	6	67
7	63.942 - 63.941 (2.5174 - 2.5174)	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	45	45	45	5	5	5	5	56	56	56	6	6	6	67
9	63.941 - 63.940 (2.5174 - 2.5173)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	56	56	56	6	6	6	6	67	67	67	7	7	7	78

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Fig. 192: Main Bearings Selection Table (No. 1, and No. 5 Journal)
 Courtesy of NISSAN MOTOR CO., U.S.A.

Main Bearings Selection Table (No. 2, 3 and 4 Journal)

Crankshaft journal outer diameter		Cylinder block main bearing housing inner 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	1	2	
			Inner 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	Outer 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	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	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	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	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	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	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	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	2	2	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	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	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	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	3	3	34	34	34	4	4	4	45	45	45	5	5	5	56	56	6	
P	63.951 - 63.950 (2.5178 - 2.5177)		2	23	23	23	3	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	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	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	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	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	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	7	
W	63.945 - 63.944 (2.5175 - 2.5175)		3	34	34	34	4	4	4	4	4	45	45	45	5	5	5	56	56	56	6	6	6	67	67	7	7	
X	63.944 - 63.943 (2.5175 - 2.5174)		34	34	34	4	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	4	45	45	45	5	5	5	5	56	56	56	6	6	6	67	67	67	7	7	78	
1	63.942 - 63.941 (2.5174 - 2.5174)		34	4	4	4	4	45	45	45	5	5	5	5	56	56	56	6	6	6	67	67	67	7	7	78	78	
2	63.941 - 63.940 (2.5174 - 2.5173)		4	4	4	45	45	45	5	5	5	5	56	56	56	6	6	6	67	67	67	7	7	7	78	78	78	

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Fig. 193: Main Bearings Selection Table (No. 2, 3 and 4 Journal)
Courtesy of NISSAN MOTOR CO., U.S.A.

Main Bearings Grade Table (All Journals)

2004 Infiniti Q45

2004 ENGINES Engine Mechanical - 4.5L V8

Unit: mm (in)

Grade number		Thickness	Identification color	Remarks
0		2.483 - 2.486 (0.0978 - 0.0979)	Black	Grade and color are the same for upper and lower bearings.
1		2.486 - 2.489 (0.0979 - 0.0980)	Brown	
2		2.489 - 2.492 (0.0980 - 0.0981)	Green	
3		2.492 - 2.495 (0.0981 - 0.0982)	Yellow	
4		2.495 - 2.498 (0.0982 - 0.0983)	Blue	
5		2.498 - 2.501 (0.0983 - 0.0985)	Pink	
6		2.501 - 2.504 (0.0985 - 0.0986)	Purple	
7		2.504 - 2.507 (0.0986 - 0.0987)	White	
8		2.507 - 2.510 (0.0987 - 0.0988)	Red	
01	UPR	2.483 - 2.486 (0.0978 - 0.0979)	Black	Grade and color are different for upper and lower bearings.
	LWR	2.486 - 2.489 (0.0979 - 0.0980)	Brown	
12	UPR	2.486 - 2.489 (0.0979 - 0.0980)	Brown	
	LWR	2.489 - 2.492 (0.0980 - 0.0981)	Green	
23	UPR	2.489 - 2.492 (0.0980 - 0.0981)	Green	
	LWR	2.492 - 2.495 (0.0981 - 0.0982)	Yellow	
34	UPR	2.492 - 2.495 (0.0981 - 0.0982)	Yellow	
	LWR	2.495 - 2.498 (0.0982 - 0.0983)	Blue	
45	UPR	2.495 - 2.498 (0.0982 - 0.0983)	Blue	
	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	

G00753339

Fig. 194: Main Bearings Grade Table (All Journals)

Courtesy of NISSAN MOTOR CO., U.S.A.

Use Undersize Bearing Usage Guide

1. Use undersize (US) bearing when oil clearance with standard size main bearing is not within specification.
2. When using undersize (US) bearing, measure inner diameter of bearing installed and grind journal until oil clearance falls within specification.

Bearing undersize table

Unit: mm (in)

Size		Thickness
US	0.25 (0.0098)	2.618 - 2.626 (0.1031 - 0.1034)

G00753340

Fig. 195: Bearing undersize table

Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION: Do not damage fillet R [1.5 mm (0.059 in)] when grinding crankshaft journal in order to use undersized bearing (All journals).

INSPECTION AFTER DISASSEMBLY

CRANKSHAFT END PLAY

- Using a dial gauge, measure the clearance between the thrust bearings and the crankshaft arm when crankshaft is moved fully forward or backward.

Standard : 0.10 - 0.25 mm (0.0039 - 0.0098 in)

Limit : 0.30 mm (0.0118 in)

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

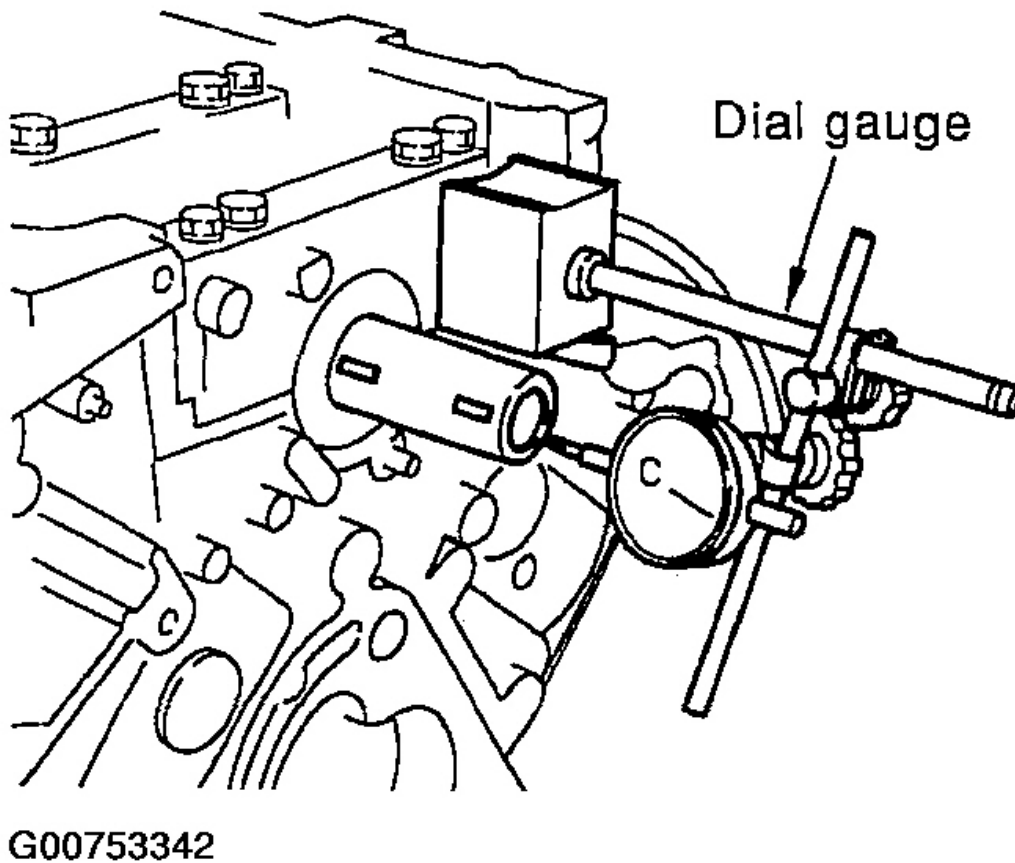
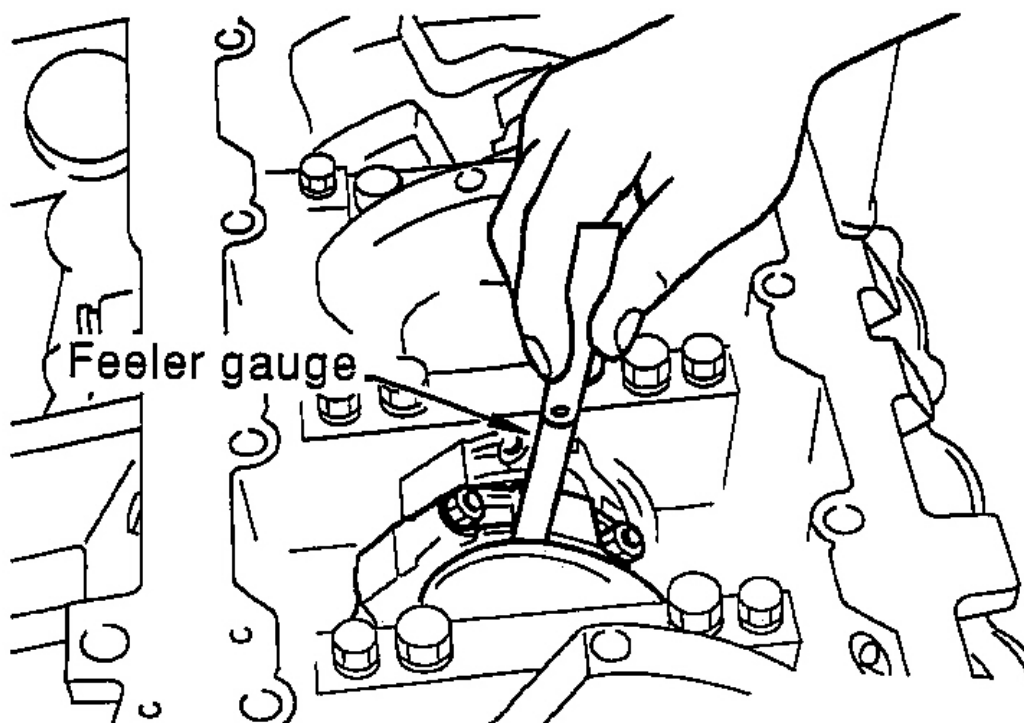


Fig. 196: Checking Crankshaft End Play
Courtesy of NISSAN MOTOR CO., U.S.A.

CONNECTING ROD SIDE CLEARANCE

- Measure the side clearance between connecting rod and crankshaft arm with feeler gauge.
Standard : 0.20 - 0.35 mm (0.0079 - 0.0138 in)
Limit : 0.40 mm (0.0157 in)
- If the measured value exceeds the limit, replace connecting rod, and measure again. If it still exceeds the repair limit, replace crankshaft also.



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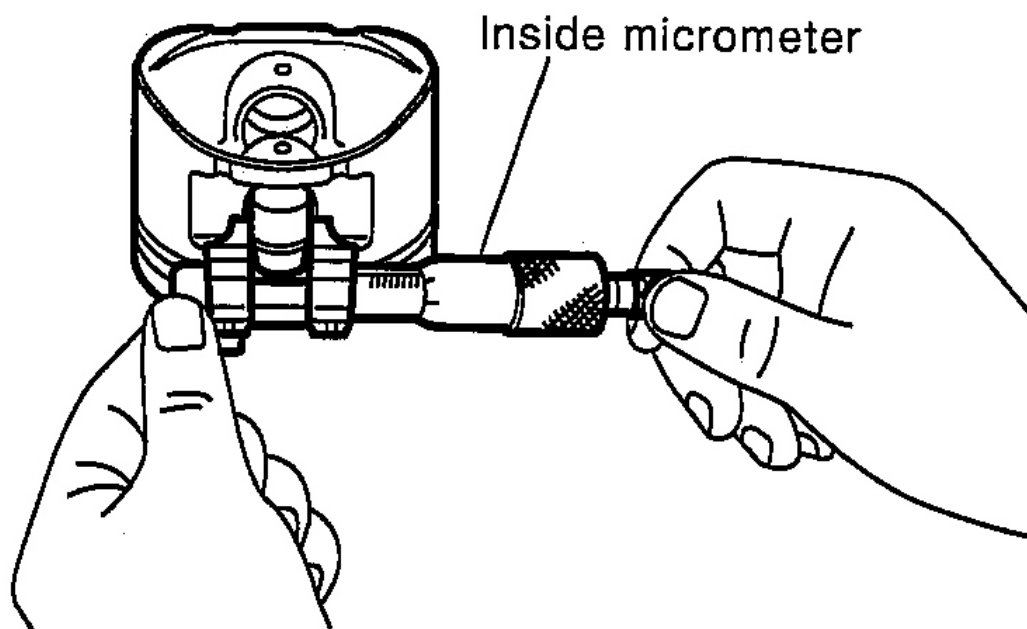
Fig. 197: Checking Connecting Rod Side Clearance
Courtesy of NISSAN MOTOR CO., U.S.A.

PISTON AND PISTON PIN CLEARANCE

Piston Pin Bore Diameter

Measure the inner diameter of piston pin bore with an inside micrometer.

Standard : 21.993 - 22.005 mm (0.8659 - 0.8663 in)



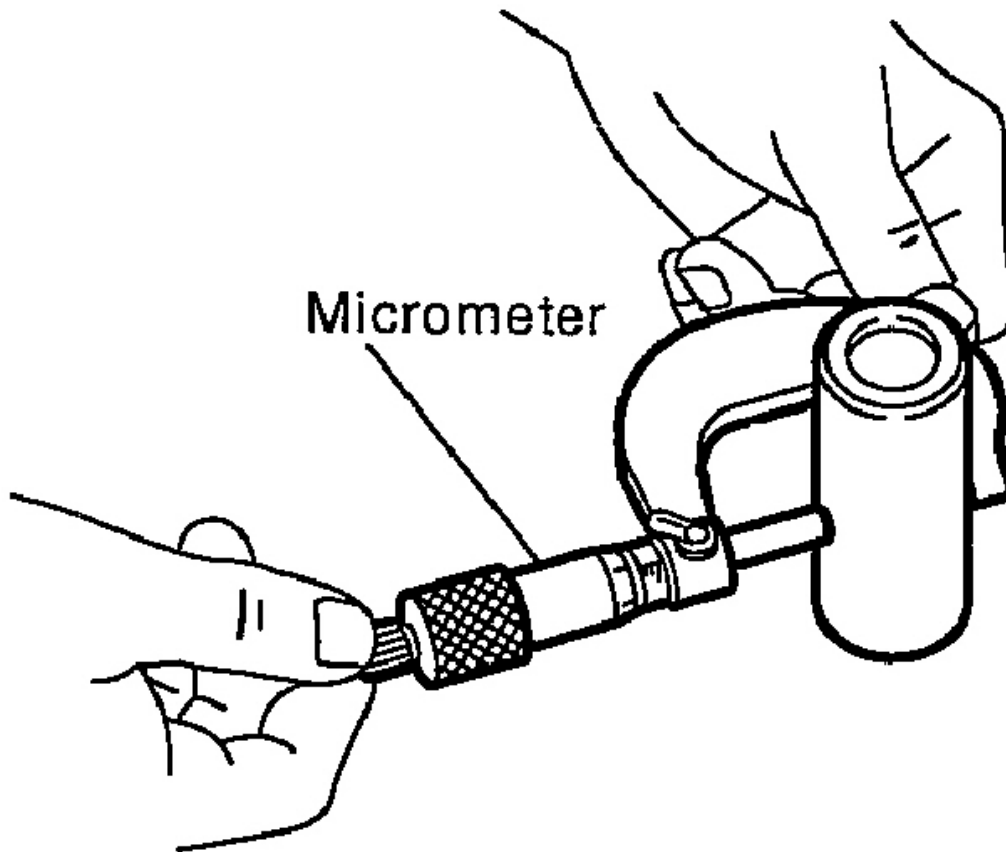
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Fig. 198: Checking Piston Pin Bore Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

Piston Pin Outer Diameter

Measure the outer diameter of piston pin with a micrometer.

Standard : 21.989 - 22.001 mm (0.8657 - 0.8662 in)



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Fig. 199: Checking Piston Pin Outer Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

Piston and Piston Pin Clearance

(Piston pin clearance) = (Piston pin bore diameter) - (Outer diameter of piston pin)

Standard : 0.002 - 0.006 mm (0.0001 - 0.0002 in)

- If the clearance exceeds the standard, replace piston/piston pin assembly.
- Refer to piston selection table to replace piston/piston pin assembly. Refer to **HOW TO SELECT PISTON**.

NOTE:

- **Piston is available together with piston pin as assembly.**

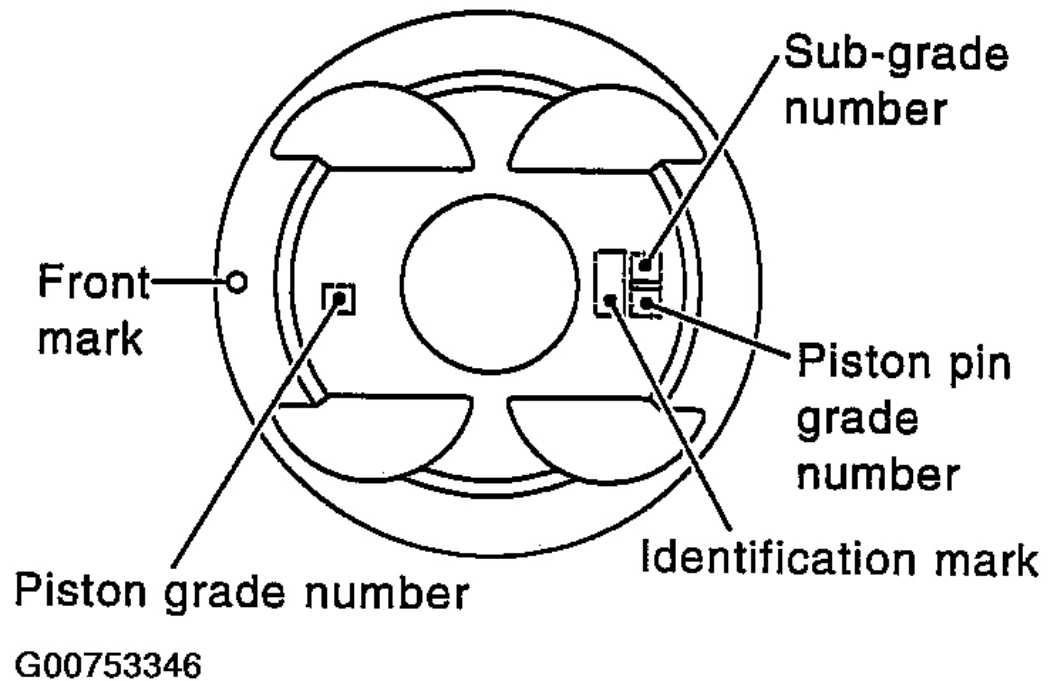
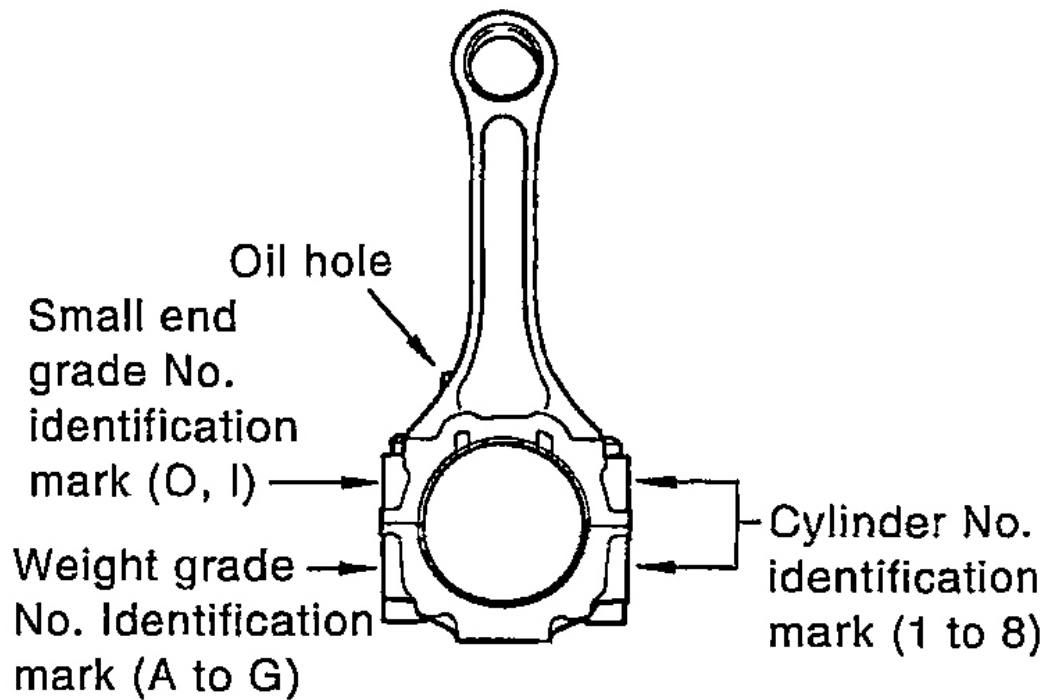


Fig. 200: Identifying Marks On Piston
 Courtesy of NISSAN MOTOR CO., U.S.A.

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



G00753347

Fig. 201: Identifying Marks On Connecting Rod
Courtesy of NISSAN MOTOR CO., U.S.A.

PISTON RING SIDE CLEARANCE

- Measure the side clearance of piston ring and piston ring groove with feeler gauge.

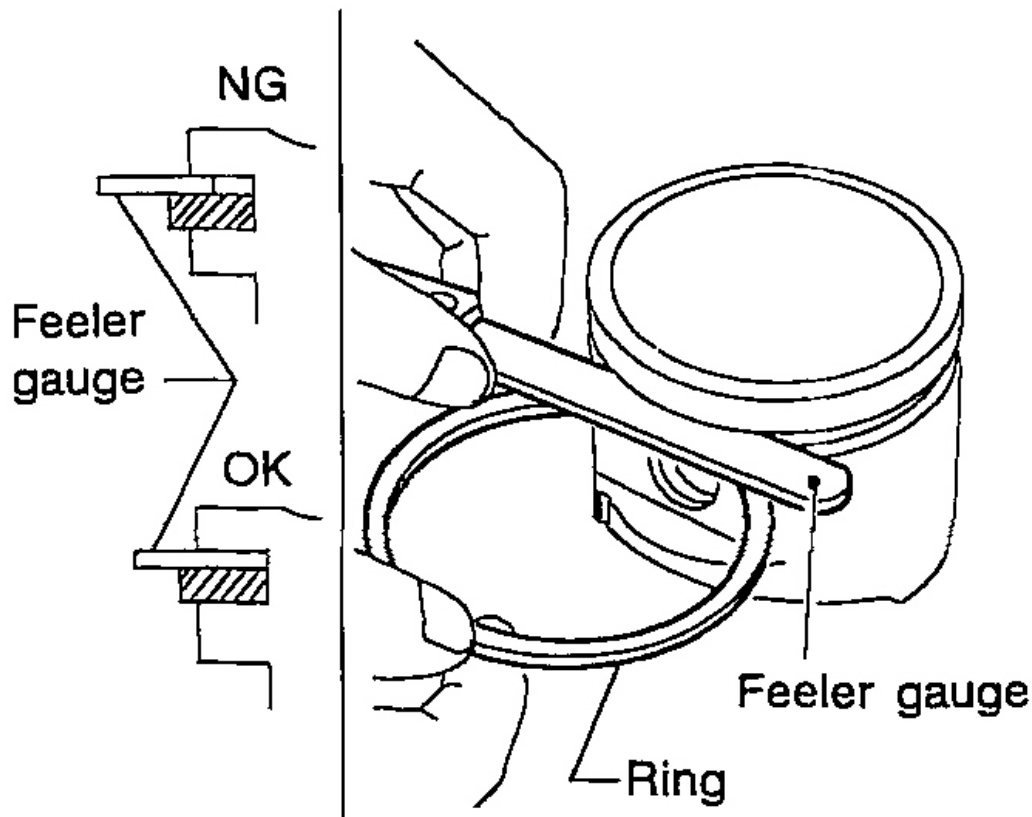
Standard: Top ring 0.045 - 0.080 mm (0.0018 - 0.0031 in)

2nd ring 0.030 - 0.070 mm (0.0012 - 0.0028 in)

Oil ring 0.065 - 0.135 mm (0.0026 - 0.0053 in)

Limit: Top ring 0.11 mm (0.0043 in)

2nd ring 0.10 mm (0.0039 in)



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Fig. 202: Checking Piston Ring Side Clearance
 Courtesy of NISSAN MOTOR CO., U.S.A.

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

PISTON RING END GAP

- Check if the inner diameter of cylinder bore is within the specification. Refer to **PISTON TO CYLINDER BORE CLEARANCE**.
- Lubricate with new engine oil to piston and piston ring, and then insert piston ring until middle of cylinder with piston, and measure piston ring end gap with feeler gauge.

Standard: Top ring 0.22 - 0.32 mm (0.0087 - 0.0126 in)

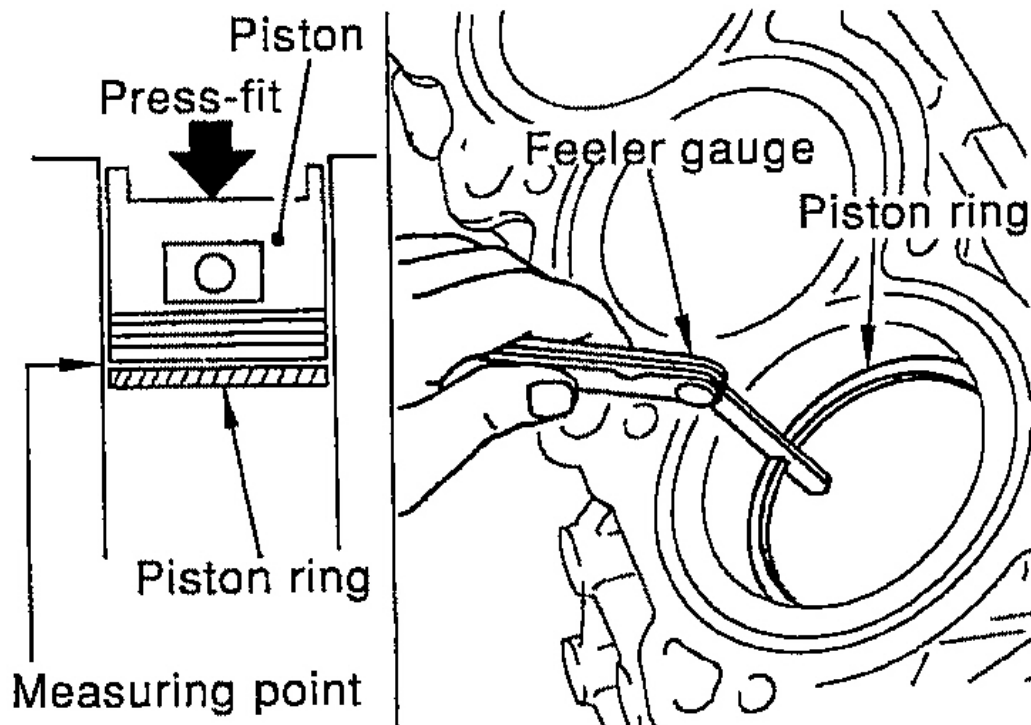
2nd ring 0.22 - 0.32 mm (0.0087 - 0.0126 in)

Oil ring 0.20 - 0.60 mm (0.0079 - 0.0236 in)

Limit: Top ring 0.56 mm (0.0220 in)

2nd ring 0.52 mm (0.0205 in)

Oil ring 0.96 mm (0.0378 in)



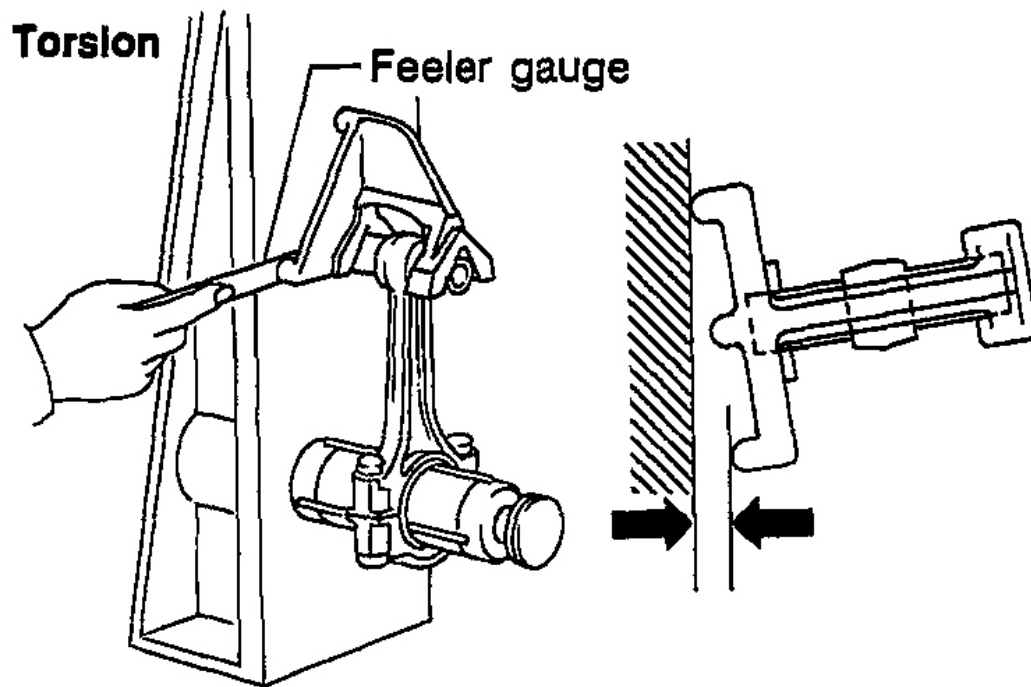
G00753349

Fig. 203: Checking Piston Ring End Gap
Courtesy of NISSAN MOTOR CO., U.S.A.

- If out of the limit, replace piston ring. If the gap still exceeds the limit even with a new ring, re-bore cylinder and use oversized piston and piston ring.

CONNECTING ROD BEND AND TORSION

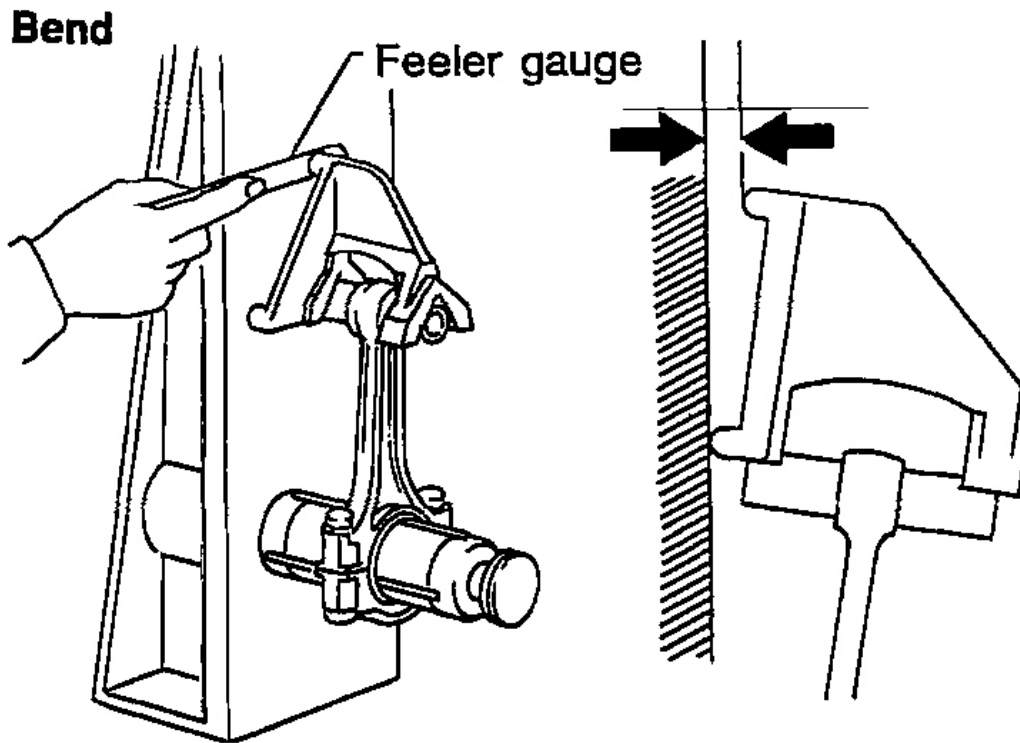
- Check with connecting rod aligner.
Bend: Limit 0.15 mm (0.0059 in) per 100 mm (3.94 in) length
Torsion: Limit 0.30 mm (0.0118 in) per 100 mm (3.94 in) length



G00753350

Fig. 204: Checking Connecting Rod Torsion
Courtesy of NISSAN MOTOR CO., U.S.A.

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



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Fig. 205: Checking Connecting Rod Bend
Courtesy of NISSAN MOTOR CO., U.S.A.

CONNECTING ROD BIG END INNER DIAMETER

- Install connecting rod cap without the connecting rod bearing installed. After tightening the connecting rod nut to the specified torque, measure the connecting rod large end inner diameter using an inside micrometer. Refer to **ASSEMBLY** for the tightening procedure.

Standard : 55.000 - 55.013 mm (2.1654 - 2.1659 in)

- If it exceeds the standard, replace the connecting rod.

Example

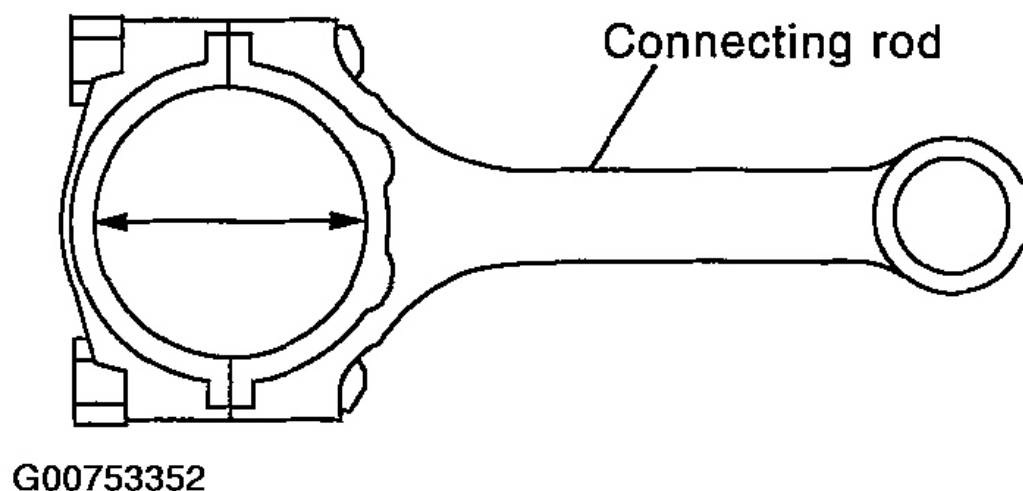


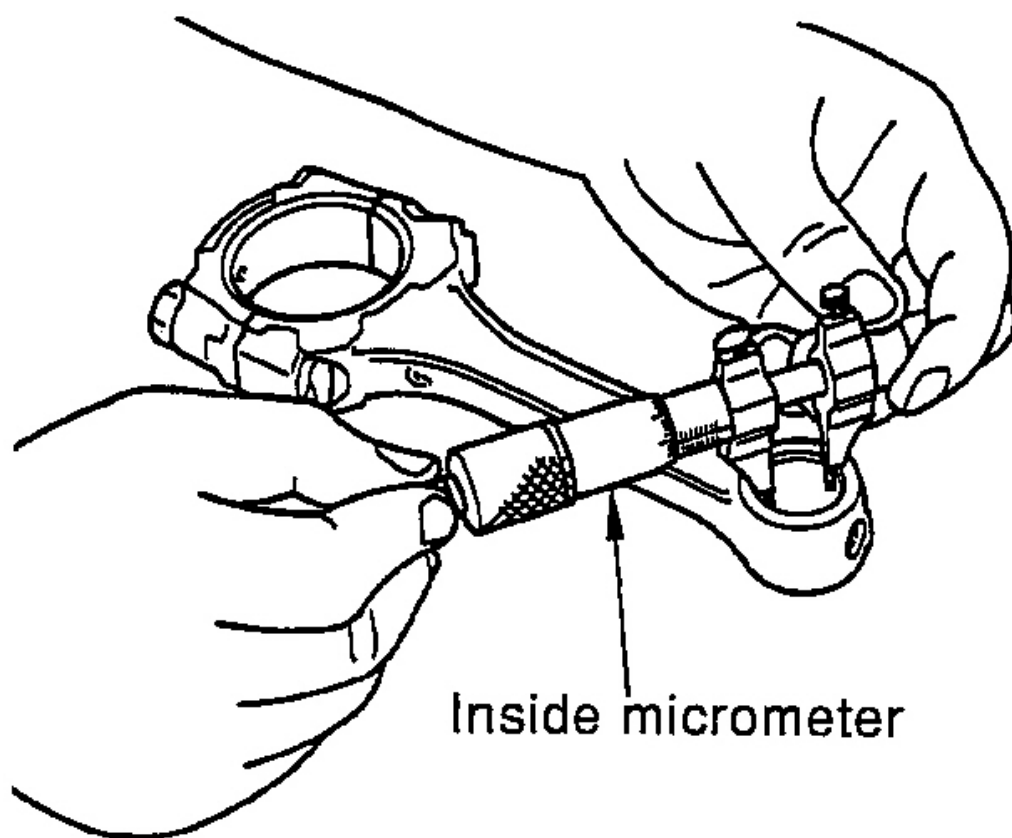
Fig. 206: Checking Connecting Rod Big End Inner Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

CONNECTING ROD BUSHING OIL CLEARANCE

Connecting Rod Bushing Inner Diameter

Measure the inner diameter of bushing.

Standard : 22.000 - 22.012 mm (0.8661 - 0.8666 in)



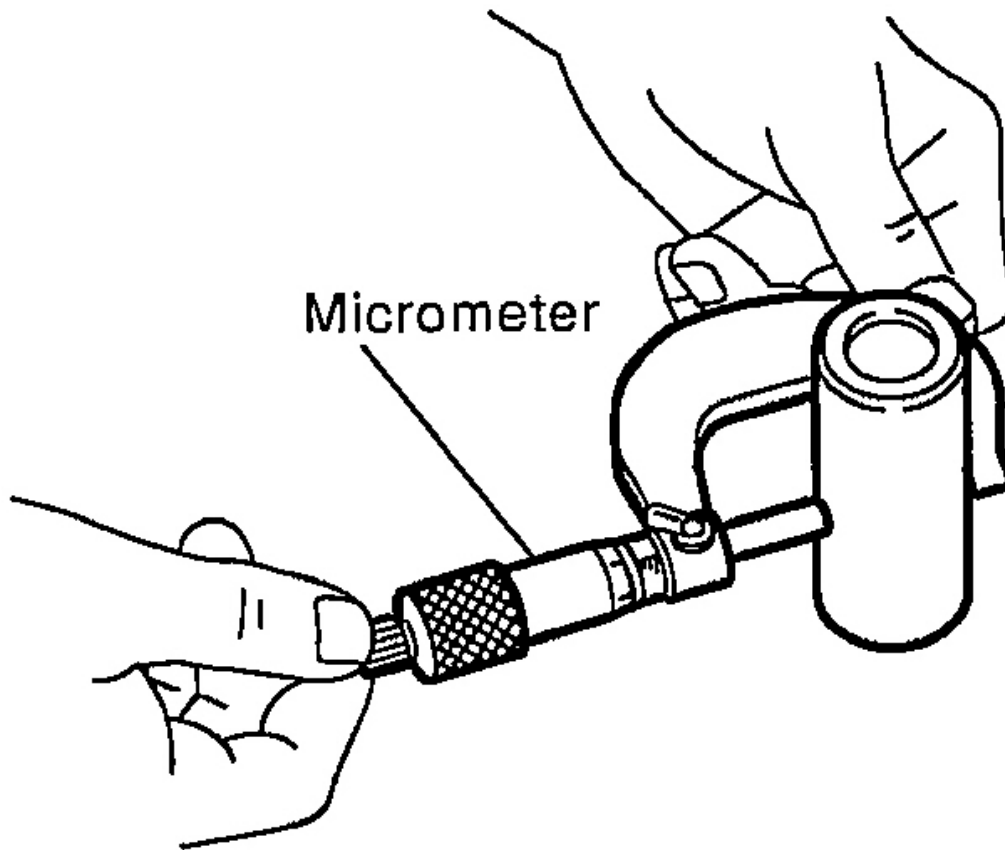
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Fig. 207: Checking Connecting Rod Bushing Inner Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

Piston Pin Outer Diameter

Measure the outer diameter of piston pin.

Standard : 21.989 - 22.001 mm (0.8657 - 0.8662 in)



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Fig. 208: Checking Piston Pin Outer Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

Connecting Rod Bushing Oil Clearance

(Connecting rod bushing oil clearance) = (Inner diameter of connecting rod bushing) - (Outer diameter of piston pin)

Standard : 0.005 - 0.017 mm (0.0002 - 0.007 in)

- If the measured value exceeds the standard, replace the connecting rod assembly and/or the piston and piston pin assembly.
- If replacing piston and piston pin assembly, refer to **PISTON TO CYLINDER BORE CLEARANCE**.
- If replacing connecting rod assembly, refer to **OIL CLEARANCE OF CONNECTING ROD**

BEARING to select the connecting rod bearing.

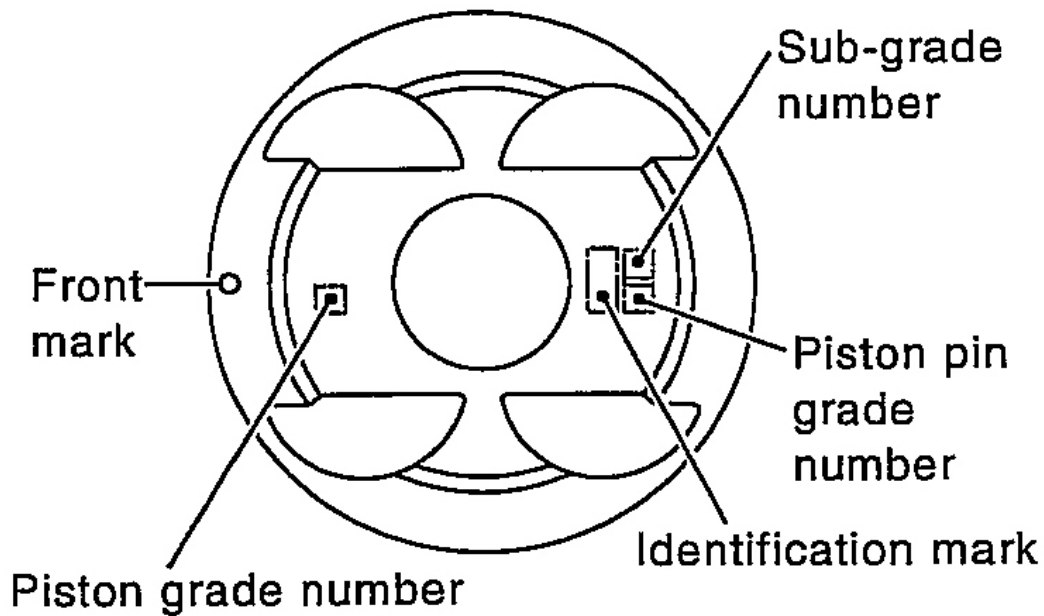
Factory installed parts grading:

Service parts apply only to grade 0.

Unit: mm (in)		
Grade	0	1
Connecting rod bushing inner diameter	22.000 - 22.006 (0.8661 - 0.8664)	22.006 - 22.012 (0.8664 - 0.8666)
Piston pin outer diameter	21.989 - 21.995 (0.8657 - 0.8659)	21.995 - 22.001 (0.8659 - 0.8662)
Piston pin bore diameter	21.993 - 21.999 (0.8659 - 0.8661)	21.999 - 22.005 (0.8661 - 0.8663)

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Fig. 209: Factory Installed Parts Grading
Courtesy of NISSAN MOTOR CO., U.S.A.



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Fig. 210: Identifying Marks On Piston

Courtesy of NISSAN MOTOR CO., U.S.A.

CYLINDER BLOCK DISTORTION

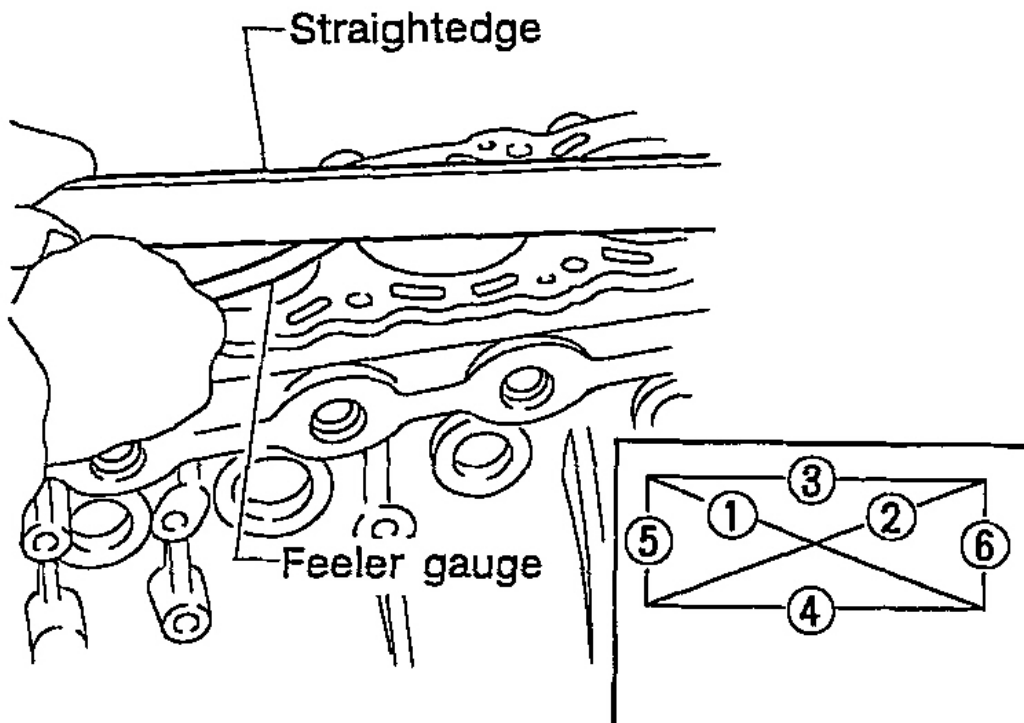
- Using a scraper, remove gasket on the cylinder block surface, and also remove engine oil, scale, carbon, or other contamination.

CAUTION: Be careful not to allow gasket flakes to enter the engine oil or engine coolant passages.

- Measure the distortion on the block upper face at some different points in 6 directions.

Limit : 0.1 mm (0.004 in)

- If out of the limit, replace cylinder block.



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Fig. 211: Checking Cylinder Block Distortion

Courtesy of NISSAN MOTOR CO., U.S.A.

INNER DIAMETER OF MAIN BEARING HOUSING

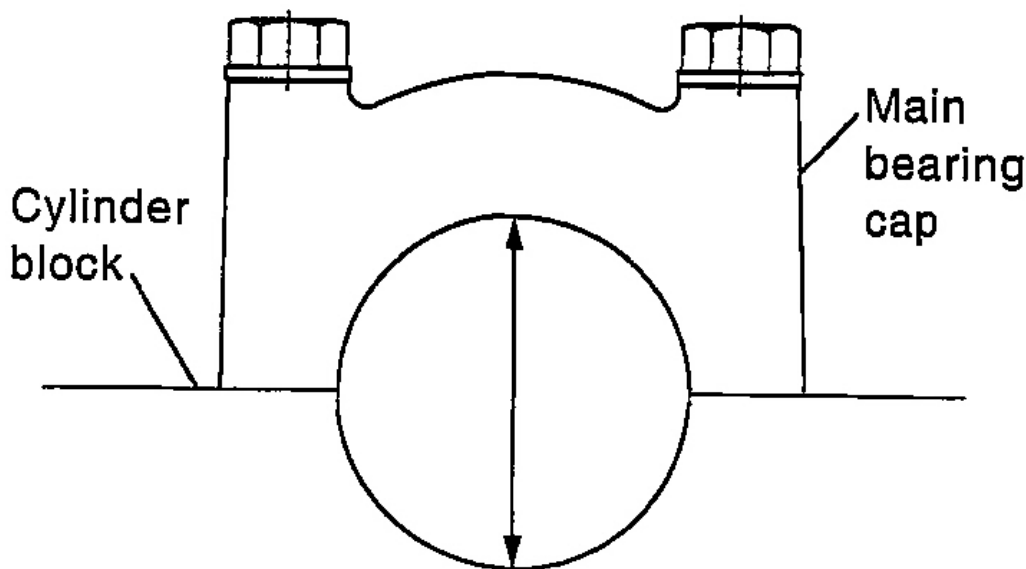
- Install main bearing caps with main bearings removed, and tighten the mounting bolts to the specified torque. Refer to **ASSEMBLY** for the tightening procedure.
- Using a bore gauge, measure the inner diameter of the main bearing housing.

Standard : 68.944 - 68.968 mm (2.7143 - 2.7153 in)

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

NOTE: These components cannot be replaced as a single unit, because they were processed together.

Example



G00753359

Fig. 212: Checking Inner Diameter Of Main Bearing Housing
Courtesy of NISSAN MOTOR CO., U.S.A.

PISTON TO CYLINDER BORE CLEARANCE

Inner Diameter of Cylinder Bore

- Using a bore gauge, measure the cylinder bore diameter for wear, out-of-round and taper at 6 different points on each cylinder. (X and Y directions at A, B and C)

NOTE: When determining cylinder bore grade, measure the cylinder bore at B position.

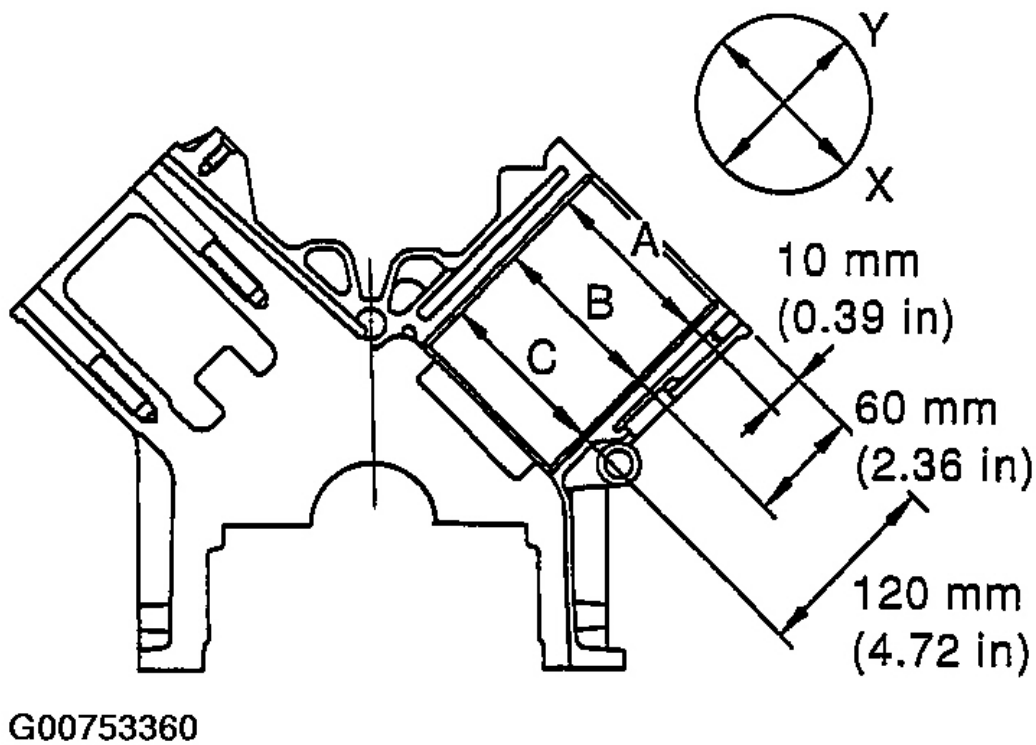


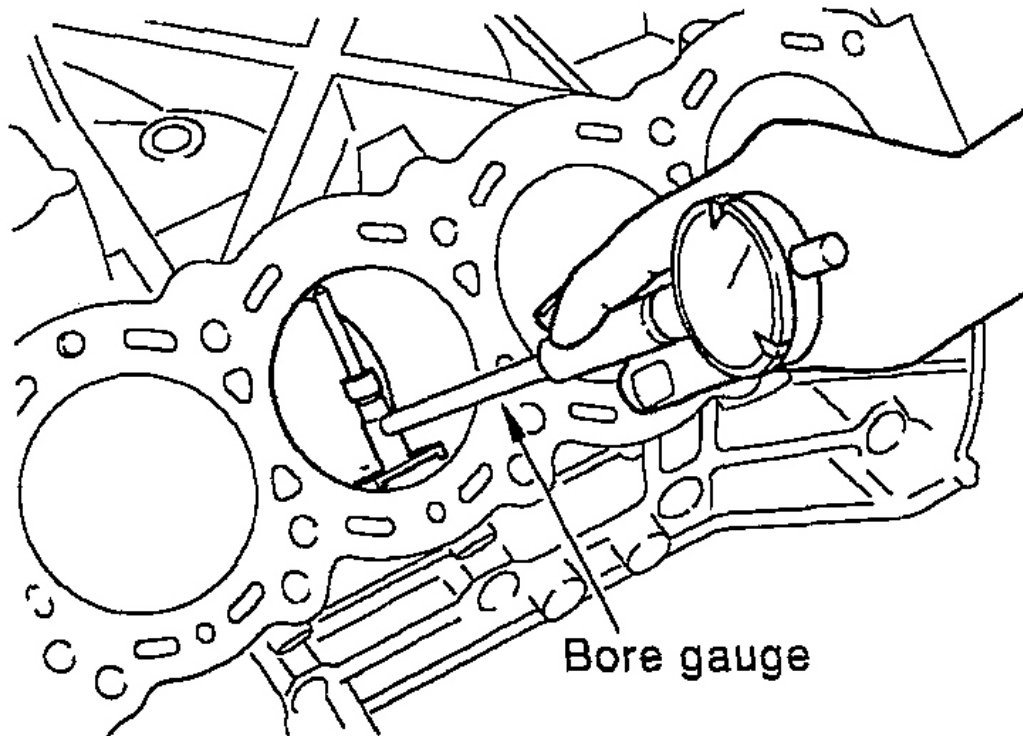
Fig. 213: Checking Inner Diameter of Cylinder Bore (1 Of 2)
Courtesy of NISSAN MOTOR CO., U.S.A.

Standard inner diameter: 93.000 - 93.030 mm (3.6614 - 3.6626 in)

Wear limit: 0.20 mm (0.0079 in)

Out-of-round (Difference between X and Y): 0.015 mm (0.0006 in)

Taper limit (Difference between A and C): 0.010 mm (0.0004 in)



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Fig. 214: Checking Inner Diameter of Cylinder Bore (2 Of 2)

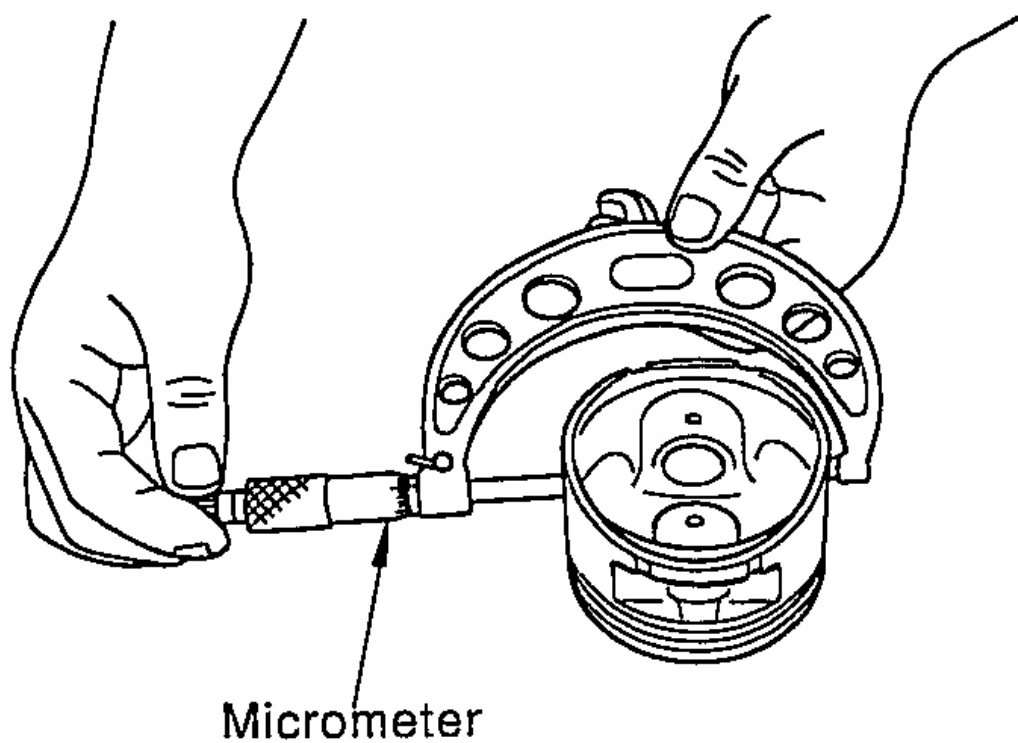
Courtesy of NISSAN MOTOR CO., U.S.A.

- If the measured value exceeds the limit, or if there are scratches or seizure and/or the cylinder inner wall, hone or bore the inner wall.
- Oversize piston is provided. When using oversize piston, hone cylinder so that the clearance between piston and cylinder satisfies the standard.

Oversize (OS) : 0.2 mm (0.008 in)**CAUTION:** If oversize piston is used, use it for all cylinders with oversize piston rings.**Outer Diameter of Piston**

- Measure the piston outer diameter.

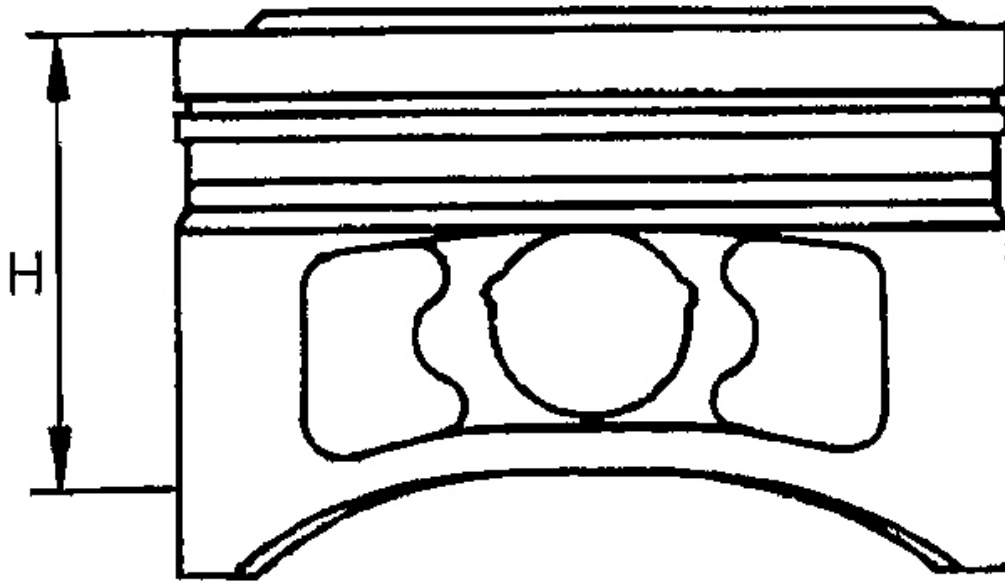
Standard : 92.980 - 93.010 mm (3.6606 - 3.6618 in)



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Fig. 215: Checking piston outer diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

- Measure point "H" (Distance from the top): 42 mm (1.65 in)



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Fig. 216: Measuring For Point "H"

Courtesy of NISSAN MOTOR CO., U.S.A.

Piston to Cylinder Bore Clearance

- Calculate by outer diameter of piston and inner diameter of cylinder (direction X, position B). (Clearance)
= (Inner diameter of cylinder) - (Outer diameter of piston)

Standard : 0.010 - 0.030 mm (0.0004 - 0.0012 in)**Limit : 0.08 mm (0.0031 in)**

- If it exceeds the limit, replace piston/piston pin assembly.

Reboring Cylinder Bore

1. Cylinder bore size is determined by adding piston-to-bore clearance to piston diameter "A".

Rebored size calculation: $D = A + B - C$ where,**D: Bored diameter****A: Piston diameter as measured****B: Piston - to - bore clearance (standard value)****C: Honing allowance 0.02 mm (0.0008 in)**

2. Install main bearing caps, and tighten to the specified torque. Otherwise, cylinder bores may be distorted

in final assembly. Refer to ASSEMBLY .

3. Cut the cylinder bores.

NOTE:

- When any cylinder needs boring, all other cylinders must also be bored.
- Do not cut too much out of the 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-bore clearance.
5. Measure finished the cylinder bore for out-of-round and taper.

NOTE: Measurement should be done after the cylinder bore cools down.

OUTER DIAMETER OF CRANKSHAFT JOURNAL

- Measure the outer diameter of crankshaft journals.

Standard : 63.940 - 63.964 mm (2.5173 - 2.5183 in)

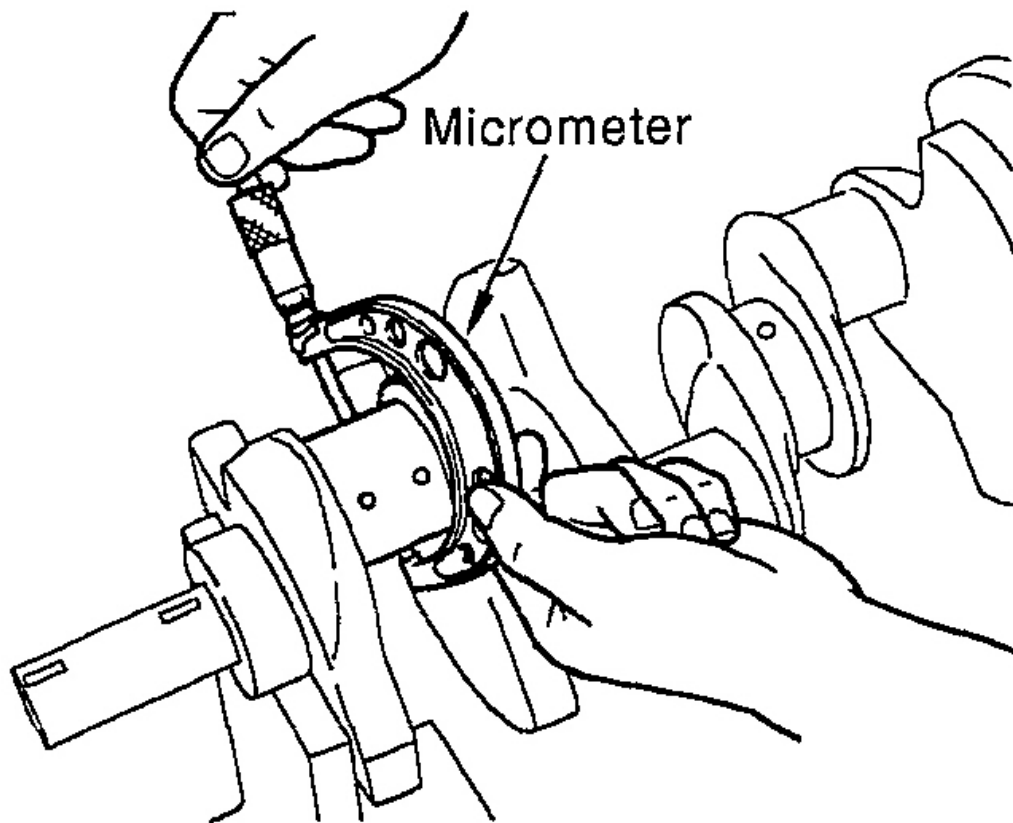
- If out of the standard, measure the main bearing oil clearance. Then use the undersize bearing. Refer to OIL CLEARANCE OF MAIN BEARING .

OUTER DIAMETER OF CRANKSHAFT PIN

- Measure the outer diameter of crankshaft pin.

Standard : 51.956 - 51.974 mm (2.0455-2.0462 in)

- If out of the standard, measure the connecting rod bearing oil clearance. Then use the undersize bearing. Refer to OIL CLEARANCE OF CONNECTING ROD BEARING .



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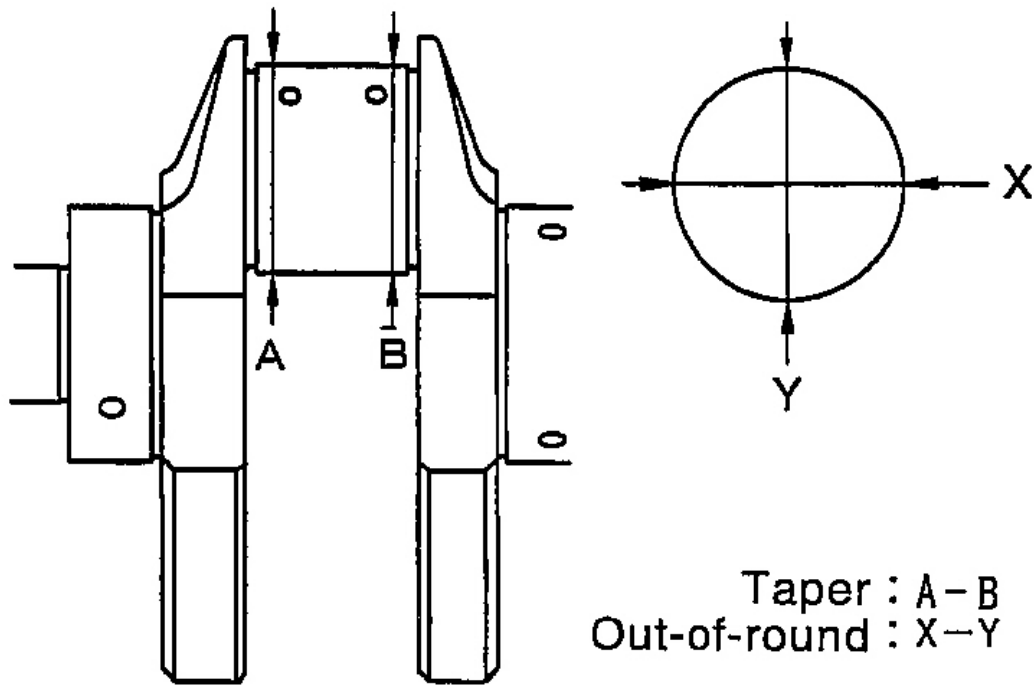
Fig. 217: Measuring outer diameter of crankshaft pin
Courtesy of NISSAN MOTOR CO., U.S.A.

OUT-OF-ROUND AND TAPER OF CRANKSHAFT

- Using a micrometer, measure the dimensions at 4 different points shown in the figure on each journal and pin.
- Out-of-roundness is indicated by the difference in the dimension between X and Y at A and B.
- Taper is indicated by the difference in the dimension between A and B at X and Y.

Limit: Out-of-round (X-Y) : 0.015 mm (0.0006 in)

Taper (A-B) : 0.010 mm (0.0004 in)



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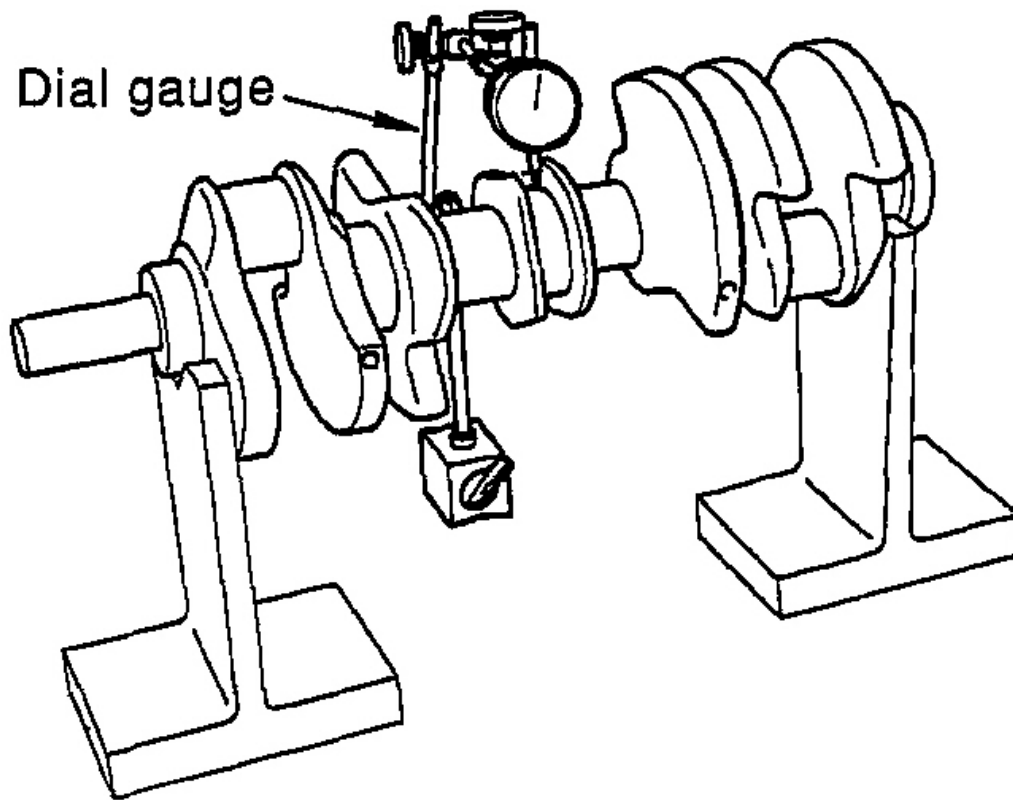
Taper : A-B
Out-of-round : X-Y

Fig. 218: Checking For Taper and Out Of Round
Courtesy of NISSAN MOTOR CO., U.S.A.

- If the measured value exceeds the limit, correct or replace crankshaft.
- If corrected, measure the bearing oil clearance of the corrected journal or pin. Then select main bearing or connecting rod bearing. Refer to **OIL CLEARANCE OF MAIN BEARING** or **OIL CLEARANCE OF CONNECTING ROD BEARING**.

CRANKSHAFT RUNOUT

- Place a V-block on a precise flat table to support the journals on the both end of crankshaft.
- Place a dial gauge straight up on the No. 3 journal.
- While rotating crankshaft, read the movement of the pointer on the dial gauge. (Total indicator reading)
Limit: : 0.10 mm (0.0039 in)
- If it exceeds the limit, replace crankshaft.



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Fig. 219: Checking Crankshaft Runout
Courtesy of NISSAN MOTOR CO., U.S.A.

OIL CLEARANCE OF CONNECTING ROD BEARING

Method of Measurement

- Install connecting rod bearings to connecting rod and cap, and tighten the connecting rod nut to the specified torque. Refer to **ASSEMBLY**. Using an inside micrometer measure the inner diameter of connecting rod bearing.

(Oil clearance) = (Inner diameter of connecting rod bearing) - (Outer diameter of crankshaft pin)

Standard : 0.020 - 0.045 mm (0.0008 - 0.0018 in)

Limit : 0.055 mm (0.0022 in)

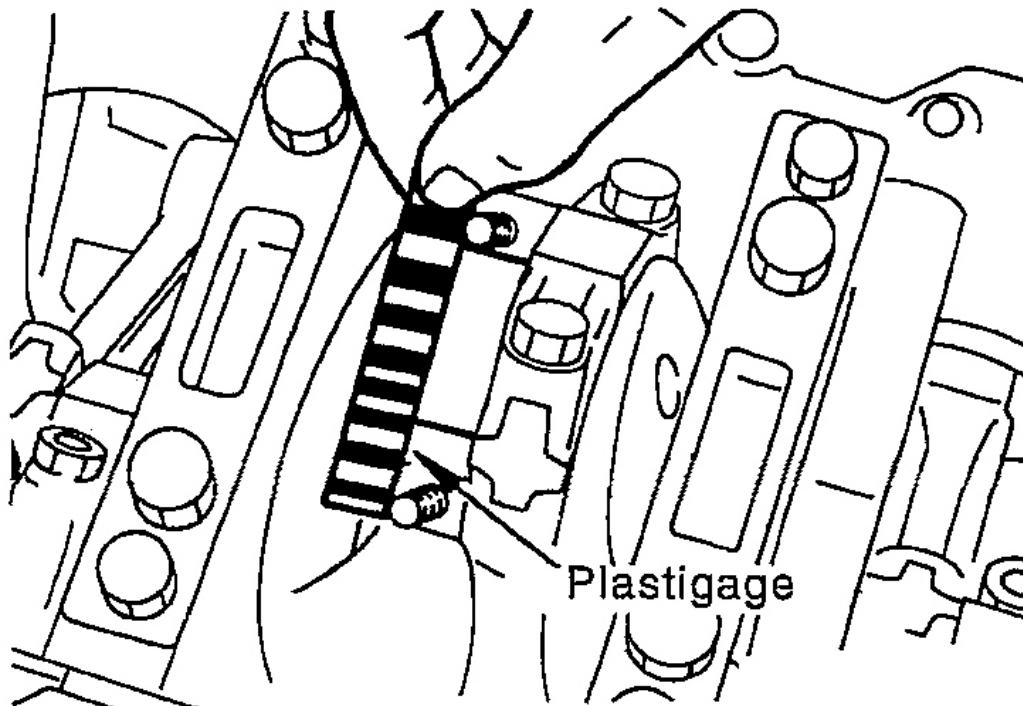
- If clearance exceeds the limit, select proper connecting rod bearing according to connecting rod big end

diameter and crankshaft pin journal diameter to obtain specified bearing oil clearance. Refer to **HOW TO SELECT CONNECTING ROD BEARING** .

Method of Using Plastigage

- Remove oil and dust on the crankshaft pin and the surfaces of each bearing completely.
- Cut a plastigage slightly shorter than the bearing width, and place it in crankshaft axial direction, avoiding oil holes.
- Install connecting rod bearings to connecting rod and connecting rod bearing cap, and tighten the connecting rod nut to the specified torque. Refer to **ASSEMBLY**.

CAUTION: Never rotate crankshaft.



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Fig. 220: Example Of Using Plastigage
Courtesy of NISSAN MOTOR CO., U.S.A.

- Remove connecting rod cap and bearings, and using the scale on the plastigage bag, measure the plastigage width.

NOTE: The procedure when the measured value exceeds the repair limit is same as that described in "Method of Measurement".

OIL CLEARANCE OF MAIN BEARING

Method of Measurement

- Install main bearings to cylinder block and main bearing cap. Measure the main bearing inner diameter with the bearing cap bolt tightened to the specified torque. Refer to ASSEMBLY.

(Oil clearance) = (Inner diameter of main bearing) - (Outer diameter of crankshaft journal)

Standard: No. 1 and 5 journals : 0.001 - 0.011 mm (0.00004 - 0.0004 in)

No. 2,3, and 4 journals : 0.007 - 0.017 mm (0.0003 - 0.0007 in)

Limit: No.1 and 5 journals : 0.021 mm (0.0008 in)

No. 2, 3, and 4 journals : 0.027 mm (0.0011 in)

- If clearance exceeds the limit, select proper main bearing according to main bearing inner diameter and crankshaft main journal diameter to obtain specified bearing oil clearance. Refer to HOW TO SELECT MAIN BEARING.

Method of Using Plastigage

- Remove oil and dust on the 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 bearings to cylinder block and main bearing cap, and tighten the main bearing bolts to the specified torque. Refer to ASSEMBLY.

CAUTION: Never rotate the crankshaft.

- Remove 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 repair limit is same as that described in "Method of Measurement".

CRUSH HEIGHT OF MAIN BEARING

- When the bearing cap is removed after being tightened to the specified torque with main bearings installed, the tip end of bearing must protrude. Refer to ASSEMBLY for the tightening procedure.

Standard : There must be crush height

- If out of the standard, replace main bearings.

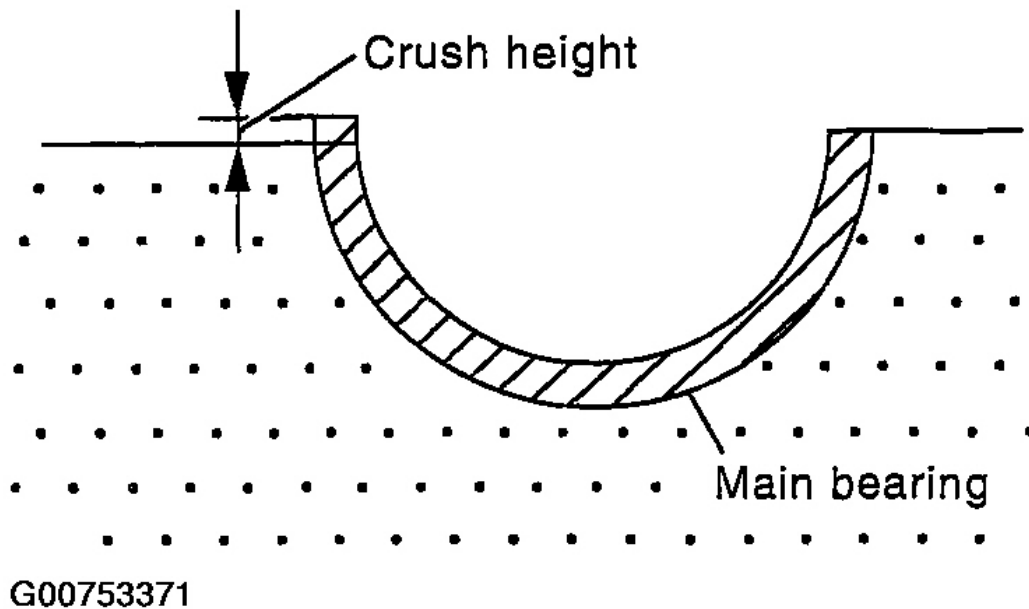


Fig. 221: Crush Height Of Main Bearing
Courtesy of NISSAN MOTOR CO., U.S.A.

CRUSH HEIGHT OF CONNECTING ROD BEARING

- When the connecting rod bearing cap is removed after being tightened to the specified torque with connecting rod bearings installed, the tip end of bearing must protrude. Refer to **ASSEMBLY** for the tightening procedure.

Standard : There must be crush height .

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

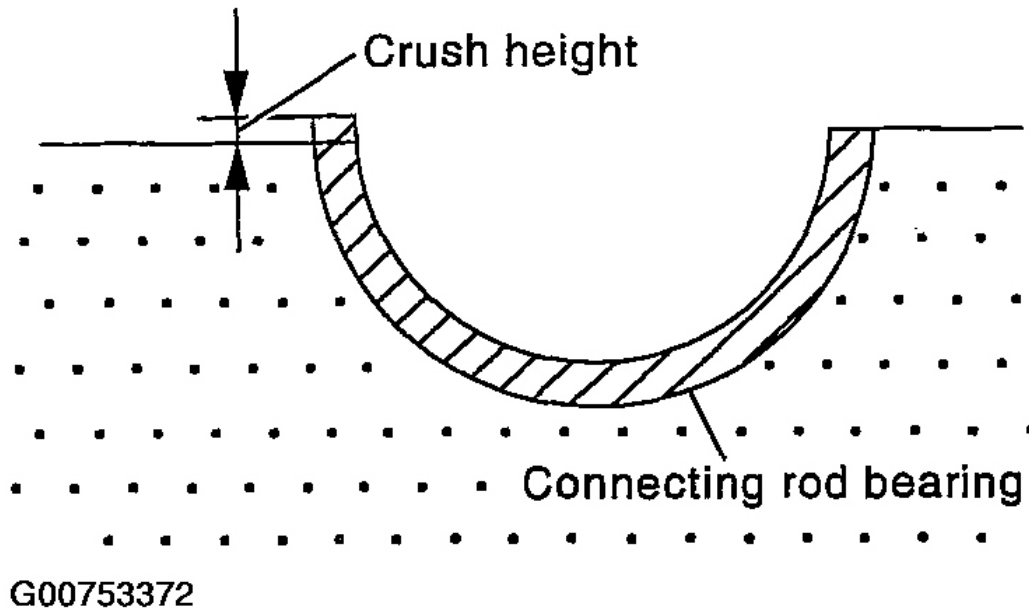


Fig. 222: Crush Height Of Connecting Rod Bearing
 Courtesy of NISSAN MOTOR CO., U.S.A.

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

Application	Specification
Displacement	274.22 Cu. In. (4.5L)
Bore	3.66 in. (93 mm)
Stroke	3.256 in. (82.7 mm)
Compression Pressure	164-191 psi (11.5-13.5 kg/cm ²)
Compression Ratio	10.5:1
Fuel System	SFI

VALVE CLEARANCE SPECIFICATIONS

VALVE CLEARANCE SPECIFICATIONS

Valve	In. (mm)
Exhaust	
Hot	0.012-0.017 (0.308-0.432)
Cold	0.011-0.015 (0.29-0.37)
Intake	

2004 Infiniti Q45

2004 ENGINES Engine Mechanical - 4.5L V8

Hot	0.012-0.016 (0.304-0.416)
Cold	0.010-0.013 (0.26-0.34)

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS**CRANKSHAFT MAIN & CONNECTING ROD BEARINGS**

Application	In. (mm)
Crankshaft	
End Play	
Standard	.0039-.0098 (.10-.25)
Service Limit	.0118 (.30)
Runout	.0039 (.10)
Main Bearings	
Journal Diameter (No. 1 & 5) ⁽¹⁾	
Grade No. G	2.5182-2.5183 (63.963-63.964)
Grade No. H	2.5182-2.5182 (63.962-63.963)
Grade No. J	2.5181-2.5182 (63.961-63.962)
Grade No. K	2.5181-2.5181 (63.960-63.961)
Grade No. L	2.5181-2.5181 (63.959-63.960)
Grade No. M	2.5180-2.5181 (63.958-63.959)
Grade No. N	2.5180-2.5180 (63.957-63.958)
Grade No. P	2.5179-2.5180 (63.956-63.957)
Grade No. R	2.5179-2.5179 (63.955-63.956)
Grade No. S	2.5179-2.5179 (63.954-63.955)
Grade No. T	2.5178-2.5179 (63.953-63.954)
Grade No. U	2.5178-2.5178 (63.952-63.953)
Grade No. V	2.5178-2.5178 (63.951-63.952)
Grade No. W	2.5177-2.5178 (63.950-63.951)
Grade No. X	2.5177-2.5177 (63.949-63.950)
Grade No. Y	2.5176-2.5177 (63.948-63.949)
Grade No. 1	2.5176-2.5177 (63.947-63.948)
Grade No. 2	2.5176-2.5176 (63.946-63.947)
Grade No. 3	2.5175-2.5176 (63.945-63.946)
Grade No. 4	2.5175-2.5175 (63.944-63.945)
Grade No. 5	2.5174-2.5175 (63.943-63.944)
Grade No. 6	2.5174-2.5174 (63.942-63.943)
Grade No. 7	2.5174-2.5174 (63.941-63.942)
Grade No. 9	2.5173-2.5174 (63.940-63.941)
Journal Diameter (No. 2, 3 & 4) ⁽¹⁾	
Grade No. A	2.5182-2.5183 (63.963-63.964)
Grade No. B	2.5182-2.5182 (63.962-63.963)

2004 Infiniti Q45

2004 ENGINES Engine Mechanical - 4.5L V8

Grade No. C	2.5181-2.5182 (63.961-63.962)
Grade No. D	2.5181-2.5181 (63.960-63.961)
Grade No. E	2.5181-2.5181 (63.959-63.960)
Grade No. F	2.5180-2.5181 (63.958-63.959)
Grade No. G	2.5180-2.5180 (63.957-63.958)
Grade No. H	2.5179-2.5180 (63.956-63.957)
Grade No. J	2.5179-2.5179 (63.955-63.956)
Grade No. K	2.5179-2.5179 (63.954-63.955)
Grade No. L	2.5178-2.5179 (63.953-63.954)
Grade No. M	2.5178-2.5178 (63.952-63.953)
Grade No. N	2.5178-2.5178 (63.951-63.952)
Grade No. P	2.5177-2.5178 (63.950-63.951)
Grade No. R	2.5177-2.5177 (63.949-63.950)
Grade No. S	2.5176-2.5177 (63.948-63.949)
Grade No. T	2.5176-2.5177 (63.947-63.948)
Grade No. U	2.5176-2.5176 (63.946-63.947)
Grade No. V	2.5175-2.5176 (63.945-63.946)
Grade No. W	2.5175-2.5175 (63.944-63.945)
Grade No. X	2.5174-2.5175 (63.943-63.944)
Grade No. Y	2.5174-2.5174 (63.942-63.943)
Grade No. 1	2.5174-2.5174 (63.941-63.942)
Grade No. 2	2.5173-2.5174 (63.940-63.941)
Journal Out-Of-Round	.0001 (.002)
Journal Taper	.0001 (.002)
Oil Clearance	
Standard (No. 1 & 5)	.00004-.0004 (.001-.011)
Service Limit	.0008 (.021)
Standard (No. 2, 3 & 4)	.0003-.0007 (.007-.017)
Service Limit	.0011 (.027)
Connecting Rod Bearings	
Journal Diameter ⁽¹⁾	
Grade No. 0	2.0460-2.0462 (51.968-51.974)
Grade No. 1	2.0457-2.0460 (51.962-51.968)
Grade No. 2	2.0455-2.0457 (51.956-51.962)
Journal Out-Of-Round	.0001 (.002)
Journal Taper	.0001 (.002)
Oil Clearance	
Standard	.0008-.0018 (.020-.045)
Service Limit	.0022 (.055)

(1) To locate grade marks, see **Fig. 223**.

2004 Infiniti Q45

2004 ENGINES Engine Mechanical - 4.5L V8

MAIN BEARING SPECIFICATIONS (MATCHED SET)**MAIN BEARING SPECIFICATIONS (MATCHED SET) ⁽¹⁾**

Grade Number	ID Color	Thickness - In. (mm)
0	Black	.0978-.0979 (2.483-2.486)
1	Brown	.0979-.0980 (2.486-2.489)
2	Green	.0980-.0981 (2.489-2.492)
3	Yellow	.0981-.0982 (2.492-2.495)
4	Blue	.0982-.0983 (2.495-2.598)
5	Pink	.0983-.0985 (2.498-2.501)
6	Purple	.0985-.0986 (2.501-2.504)
7	White	.0986-.0987 (2.504-2.507)
8	Red	.0987-.0988 (2.507-2.510)

(1) Grade is the same for lower and upper bearings.

MAIN BEARING SPECIFICATIONS (MISMATCHED SET)**MAIN BEARING SPECIFICATIONS (MISMATCHED SET) ⁽¹⁾**

Grade Number	ID Color	Thickness - In. (mm)
01		
Upper	Black	.0978-.0979 (2.483-2.486)
Lower	Brown	.0979-.0980 (2.486-2.489)
12		
Upper	Brown	.0979-.0980 (2.486-2.489)
Lower	Green	.0980-.0981 (2.489-2.492)
23		
Upper	Green	.0980-.0981 (2.489-2.492)
Lower	Yellow	.0981-.0982 (2.492-2.495)
34		
Upper	Yellow	.0981-.0982 (2.492-2.495)
Lower	Blue	.0982-.0983 (2.495-2.598)
45		
Upper	Blue	.0982-.0983 (2.495-2.598)
Lower	Pink	.0983-.0985 (2.498-2.501)
56		
Upper	Pink	.0983-.0985 (2.498-2.501)
Lower	Purple	.0985-.0986 (2.501-2.504)
67		
Upper	Purple	.0985-.0986 (2.501-2.504)
Lower	White	.0986-.0987 (2.504-2.507)
78		

2004 Infiniti Q45

2004 ENGINES Engine Mechanical - 4.5L V8

Upper	White	.0986-.0987 (2.504-2.507)
Lower	Red	.0987-.0988 (2.507-2.510)

(1) Grade is different for lower and upper bearings.

CONNECTING RODS**CONNECTING RODS**

Application	In. (mm)
Bore Diameter	
Pin Bore ⁽¹⁾	
Grade No. 0	.8661-.8664 (22.000-22.006)
Grade No. 1	.8664-.8666 (22.006-22.012)
Crankpin Bore	2.1654-2.1659 (55.000-55.013)
Center-To-Center Length	5.785-5.789 (146.95-147.05)
Maximum Bend Per 3.94 in. (100 mm)	.006 (.15)
Maximum Twist Per 3.94 in. (100 mm)	.012 (.30)
Side Play	
Standard	.0079-.0138 (.20-.35)
Service Limit	.0157 (.40)
(1) To locate grade marks, see Fig. 223 .	

CONNECTING ROD BEARING SPECIFICATIONS**CONNECTING ROD BEARING SPECIFICATIONS**

Grade Number	ID Color	Thickness - In. (mm)
0	No Color	.0591-.0592 (1.500-1.503)
1	Brown	.0592-.0593 (1.503-1.506)
2	Green	.0593-.0594 (1.506-1.509)

ENGINE PISTONS, ENGINE PISTON PINS & ENGINE PISTON RINGS**ENGINE PISTONS, ENGINE PISTON PINS & ENGINE PISTON RINGS**

Application	In. (mm)
Pistons	
Clearance	.0004-.0012 (.010-.030)
Diameter ⁽¹⁾	
Grade No. 1	3.6606-3.6610 (92.980-92.990)
Grade No. 2	3.6610-3.6614 (92.990-93.000)
Grade No. 3	3.6614-3.6618 (93.000-93.010)
.008 in. (.20 mm) Oversize	3.6685-3.6697 (93.180-93.210)

2004 Infiniti Q45

2004 ENGINES Engine Mechanical - 4.5L V8

Pins

Diameter ⁽¹⁾	
Grade No. 01	.8657-.8659 (21.989-21.995)
Grade No. 02	.8659-.8662 (21.995-22.001)
Piston Interference Fit	.0001-.0002 (.002-.006)
Rod Bushing Clearance	
Standard	.0002-.0007 (.005-.017)
Service Limit	.0012 (.030)

Rings

No. 1	
End Gap	.0087-.0126 (.22-.32)
Limit	.022 (.56)
Side Clearance	.0016-.0031 (.040-.080)
Limit	.0043 (.11)
No. 2	
End Gap	.0087-.0126 (.22-.32)
Limit	.0205 (.52)
Side Clearance	.0012-.0028 (.030-.070)
Limit	.0039 (.10)
No. 3 (Oil Control)	
End Gap	.0079-.0236 (.20-.60)
Limit	.0378 (.96)
Side Clearance	.0006-.0020 (.015-.050)

(1) To locate grade marks, see **Fig. 223**.

CYLINDER BLOCK

CYLINDER BLOCK

Application	In. (mm)
Cylinder Bore	
Standard Diameter ⁽¹⁾	
Grade No. 1	3.6614-3.6618 (93.000-93.010)
Grade No. 2	3.6618-3.6622 (93.010-93.020)
Grade No. 3	3.6622-3.6626 (93.020-93.030)
Main Journal Inner Diameter Grade (Without Bearing)	
Journal Diameter ⁽¹⁾	
Grade No. A	2.7143-2.7144 (68.944-68.945)
Grade No. B	2.7144-2.7144 (68.945-68.946)
Grade No. C	2.7144-2.7144 (68.946-68.947)
Grade No. D	2.7144-2.7145 (68.947-68.948)

2004 Infiniti Q45

2004 ENGINES Engine Mechanical - 4.5L V8

Grade No. E	2.7145-2.7145 (68.948-68.949)
Grade No. F	2.7145-2.7146 (68.949-68.950)
Grade No. G	2.7146-2.7146 (68.950-68.951)
Grade No. H	2.7146-2.7146 (68.951-68.952)
Grade No. J	2.7146-2.7147 (68.952-68.953)
Grade No. K	2.7147-2.7147 (68.953-68.954)
Grade No. L	2.7147-2.7148 (68.954-68.955)
Grade No. M	2.7148-2.7148 (68.955-68.956)
Grade No. N	2.7148-2.7148 (68.956-68.957)
Grade No. P	2.7148-2.7149 (68.957-68.958)
Grade No. R	2.7149-2.7149 (68.958-68.959)
Grade No. S	2.7149-2.7150 (68.959-68.960)
Grade No. T	2.7150-2.7150 (68.960-68.961)
Grade No. U	2.7150-2.7150 (68.961-68.962)
Grade No. V	2.7150-2.7151 (68.962-68.963)
Grade No. W	2.7151-2.7151 (68.963-68.964)
Grade No. X	2.7151-2.7152 (68.964-68.965)
Grade No. Y	2.7152-2.7152 (68.965-68.966)
Grade No. 1	2.7152-2.7152 (68.966-68.967)
Grade No. 2	2.7152-2.7153 (68.967-68.968)
Maximum Taper	.0006 (.015)
Maximum Out-Of-Round	.0006 (.015)
Maximum Deck Warpage ⁽²⁾	.004 (.10)

(1) To locate grade marks, see **Fig. 223**.

(2) Maximum resurfacing limit of cylinder block and cylinder head combined is .008 in. (.20).

OIL PUMP SPECIFICATIONS**OIL PUMP SPECIFICATIONS**

Application	Clearance - In. (mm)
Body-To-Outer Gear	.0045-.0079 (.114-.200)
Inner Gear-To-Outer Gear	Less Than .0071 (.180)
Housing-To-Inner Gear ⁽¹⁾	.0012-.0028 (.030-.070)
Housing-To-Outer Gear ⁽¹⁾	.0012-.0035 (.030-.090)
Inner Gear Shoulder-To-Housing	.0018-.0036 (.045-.091)
Regulator Valve-To-Body Clearance	.0016-.0038 (.040-.097)

(1) Lay straightedge across gears and housing. Insert feeler gauge between straightedge and gear.

VALVES & VALVE SPRINGS

2004 Infiniti Q45

2004 ENGINES Engine Mechanical - 4.5L V8

VALVES & VALVE SPRINGS

Application	In. (mm)
Intake Valves	
Face Angle	45 Degrees 15 Minutes-45 Degrees 45 Minutes
Head Diameter	1.417-1.429 (36.00-36.30)
Valve Margin	.0453-.0571 (1.15-1.45)
Valve Length	3.8020 (96.57)
Stem Diameter	.2351-.2354 (5.972-5.980)
Valve Tip Maximum Refinish	.008 (.20)
Exhaust Valves	
Face Angle	45 Degrees 15 Minutes-45 Degrees 45 Minutes
Head Diameter	1.228-1.240 (31.20-31.50)
Valve Margin	.0728-.0846 (1.85-2.50)
Valve Length	3.720 (94.50)
Stem Diameter	.2347-.2350 (5.962-5.970)
Valve Tip Maximum Refinish	.008 (.20)
Valve Springs	
Free Length	1.8247-1.8444 (46.35-46.85)
Out-Of-Square	.079 (2.00)
Lbs. @ In. (kg @ mm)	
Pressure	
Standard	37-42 @ 1.331 (16.8-19.3 @ 33.8)
Service Limit	65-74 @ .961 (29.6-33.7 @ 24.4)

CYLINDER HEAD**CYLINDER HEAD**

Application	In. (mm)
Cylinder Head Height ⁽¹⁾	4.98 (126.4)
Maximum Warp ⁽²⁾	.004 (.10)
Valve Seats	
Seat Angle	45 Degrees
Seat Width	
Exhaust	.047-.063 (1.20-1.60)
Intake	.040-.055 (1.00-1.40)
Seat Bore (Oversize)	
Exhaust	1.2874-1.2880 (32.700-32.716)
Intake	1.4764-1.4770 (37.500-37.516)
Valve Guides	
Cylinder Head Valve Guide Bore I.D.	

2004 Infiniti Q45

2004 ENGINES Engine Mechanical - 4.5L V8

Standard	.3927-.3935 (9.975-9.996)
Service Limit	.4006-.4014 (10.175-10.196)
Valve Guide I.D.	.2362-.2369 (6.000-6.018)
Valve Guide Installed Height	
Exhaust	.394-.409 (10.0-10.4)
Intake	.398-.406 (10.1-10.3)
Valve Stem-To-Guide Oil Clearance	
Exhaust	
Standard	.0012-.0022 (.030-.056)
Service Limit	.004 (.10)
Intake	
Standard	.0008-.0018 (.020-.046)
Service Limit	.003 (.08)
(1) Measure from cylinder head cover surface to head gasket surface.	
(2) Maximum resurfacing limit of cylinder block and cylinder head combined is .008 (.20).	

CAMSHAFT**CAMSHAFT**

Application	In. (mm)
Bore Diameter	1.0236-1.0244 (26.000-26.021)
End Play	.0045-.0074 (.115-.188)
Journal Diameter	
No. 1	1.0212-1.0218 (25.938-25.955)
No. 2, 3 & 4	1.0218-1.0224 (25.953-25.970)
Camshaft Runout	
Standard	Less Than .0008 (.020)
Service Limit	.002 (.05)
Sprocket Runout	Less Than .006 (.15)
Lobe Height	
Exhaust	
Standard	1.7293-1.7368 (43.925-44.115)
Service Limit	.008 (.20)
Intake	
Standard	1.7663-1.7738 (44.865-45.055)
Service Limit	.008 (.20)
Oil Clearance	
Standard	
Journal No. 1	.0018-.0033 (.045-.083)
Journal No. 2, 3, & 4	.0012-.0027 (.030-.068)

2004 Infiniti Q45

2004 ENGINES Engine Mechanical - 4.5L V8

VALVE LIFTERS**VALVE LIFTERS**

Application	In. (mm)
Bore Diameter	1.3386-1.3392 (34.000-34.016)
Lifter Diameter	1.3372-1.3376 (33.965-33.975)
Oil Clearance	.0010-.0020 (.025-.051)

TORQUE SPECIFICATIONS**TORQUE SPECIFICATIONS**

Application	Ft. Lbs. (N.m)
Auto Tensioner	
Alternator, Water Pump & A/C Compressor	15-17 (20-24)
Power Steering Pump Belt	15-17 (20-24)
Camshaft Sprocket	109-115 (147-157)
Connecting Rod Cap	
Step 1	10-12 (14-16)
Step 2	(1)
Crankshaft Pulley	
Step 1	65-72 (88-98)
Step 2	(2)
Cylinder Head ⁽³⁾	
Step 1	72 (98)
Step 2	Loosen to Zero
Step 3	29-36 (39-49)
Step 4	(1)
Step 5	(1)
Drive Plate	62-68 (84-93)
Electric Throttle Control Actuator	13-17 (18-24)
Engine Coolant Temperature Sensor	15-21 (20-29)
Engine Slinger	23-26 (30-36)
EVAP Canister Purge Volume Control Solenoid Valve	10-13 (13-18)
EVAP Canister Purge Volume Control Solenoid Valve Bracket	8-10 (10-14)
Exhaust Manifold ⁽⁴⁾	19-22 (26-30)
Front Cover ⁽⁵⁾	9-10 (12-14)
Fuel Tube Assembly	
Step 1	6-8 (9-11)
Step 2	16-19 (21-27)

2004 Infiniti Q45

2004 ENGINES Engine Mechanical - 4.5L V8

Heated Oxygen Sensor	30-36 (41-50)
Idler Pulley	16-19 (21-27)
Intake Manifold	
Upper ⁽⁶⁾	18-23 (25-31)
Lower ⁽⁷⁾	18-23 (25-31)
Knock Sensor	12-19 (16-26)
Main Bearing Cap ⁽⁸⁾	
Step 1 (M12 Bolt)	27-31 (36-42)
Step 2 (M9 Bolt)	20-23 (27-32)
Step 3 (M12 Bolt)	(9)
Step 4 (M9 Bolt)	(10)
Step 5 (M10 Side Bolt)	34-38 (46-52)
Oil Filter	11-15 (15-21)
Oil Galley Plugs	
"A" (With Copper Washer) ⁽¹¹⁾	40 (54)
"B" ⁽¹¹⁾	15 (19.6)
"C" & "D" (With Copper Washer) ⁽¹¹⁾	46 (62.7)
Oil Level Gauge Guide	9-10 (12-14)
Oil Pan Drain Plug	22-28 (29-39)
Oil Pressure Switch	9-12 (12-17)
Oil Strainer	15-17 (20-24)
PCV Tube	8-10 (10-14)
Spark Plug	15-21 (20-30)
Timing Chain Slack Guide	12-13 (16-18)
Timing Chain Tensioner Guide	12-13 (16-18)
INCH Lbs. (N.m)	
Camshaft Bracket ⁽¹²⁾	
Step 1 (M6 and M8 Bolts)	17 (1.96)
Step 2 (M6 and M8 Bolts)	52 (5.88)
Step 3 (M6 Bolt)	80-104 (9-12)
Step 4 (M8 Bolt)	22-24 Ft. Lbs. (29-33)
Camshaft Position Sensor (PHASE)	63-95 (7-11)
Chain Tensioner	57-71 (6-8)
Chain Tensioner Cover	71-89 (8-10)
Crankshaft Position Sensor (POS)	63-97 (7-11)
Engine Cover	30-39 (3-4)
Exhaust Manifold Cover	46-57 (5-6)
Fuel Feed Damper	74 (8.4)
Ignition Coil	34-38 (3.8-4.4)

Intake Valve Timing Control Cover	89-112 (10-13)
Intake Valve Timing Control Solenoid Valve	75-97 (9-11)
Intake Valve Timing Control Position Sensor	62-97 (7-11)
Mass Air Flow Sensor	39-51 (4-6)
Oil Pan ⁽¹³⁾	
M6 Bolt	71-89 (8-10)
M8 Bolt	15-17 Ft. Lbs. (20-24)
Oil Pump	71-89 (8-10)
Rear Oil Seal Retainer	56-71 (6-8)
Rear Plate Cover	56-71 (6-8)
Rocker Cover ⁽¹⁴⁾	
Step 1	9-26 (1-3)
Step 2	66-80 (7-9)
(1) Tighten an additional 60-65 degrees. (2) Tighten an additional 90-96 degrees. (3) Tighten in sequence. See Fig. 224. (4) Tighten in sequence. See Fig. 225. (5) Tighten in sequence. See Fig. 226. (6) Tighten in sequence. See Fig. 227. (7) Tighten in sequence. See Fig. 228. (8) Tighten in sequence. See Fig. 229. (9) Tighten an additional 40-45 degrees. (10) Tighten an additional 30-35 degrees. (11) See Fig. 230. (12) Tighten in sequence. See Fig. 231. (13) Tighten in sequence. See Fig. 232. (14) Tighten in sequence. See Fig. 233.	

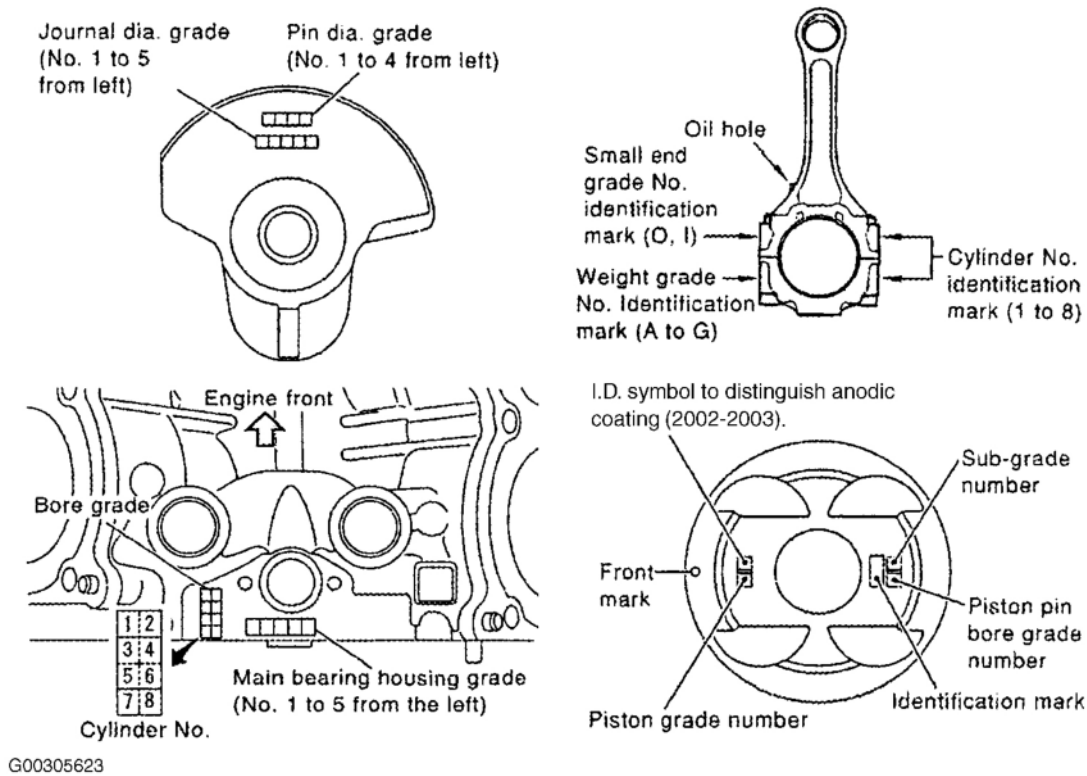
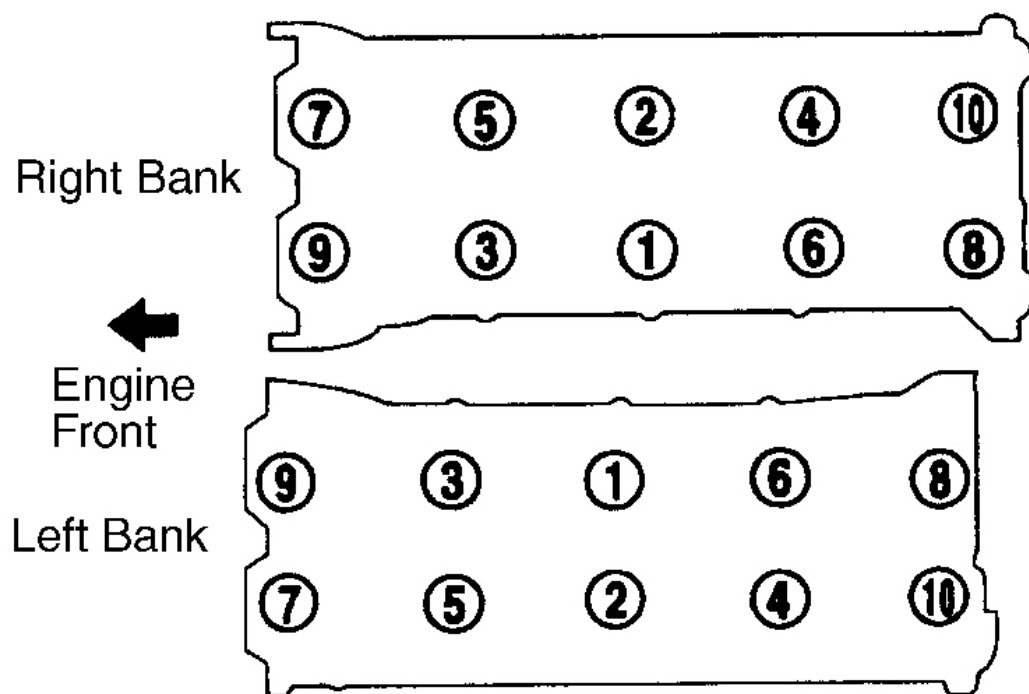
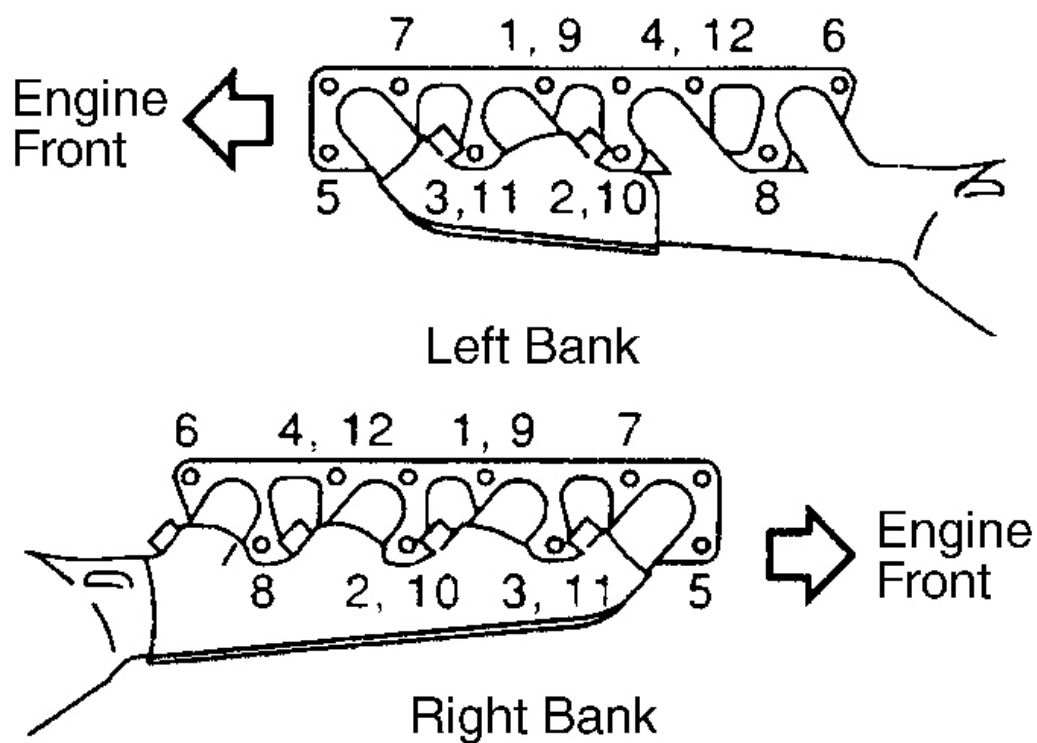


Fig. 223: Locating Engine Component Grade Marks (4.5L V8)
 Courtesy of NISSAN MOTOR CO., U.S.A.



G00241064

Fig. 224: Cylinder Head Bolt Tightening Sequences
Courtesy of NISSAN MOTOR CO., U.S.A.



G00241069

Fig. 225: Exhaust Manifold Nuts Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

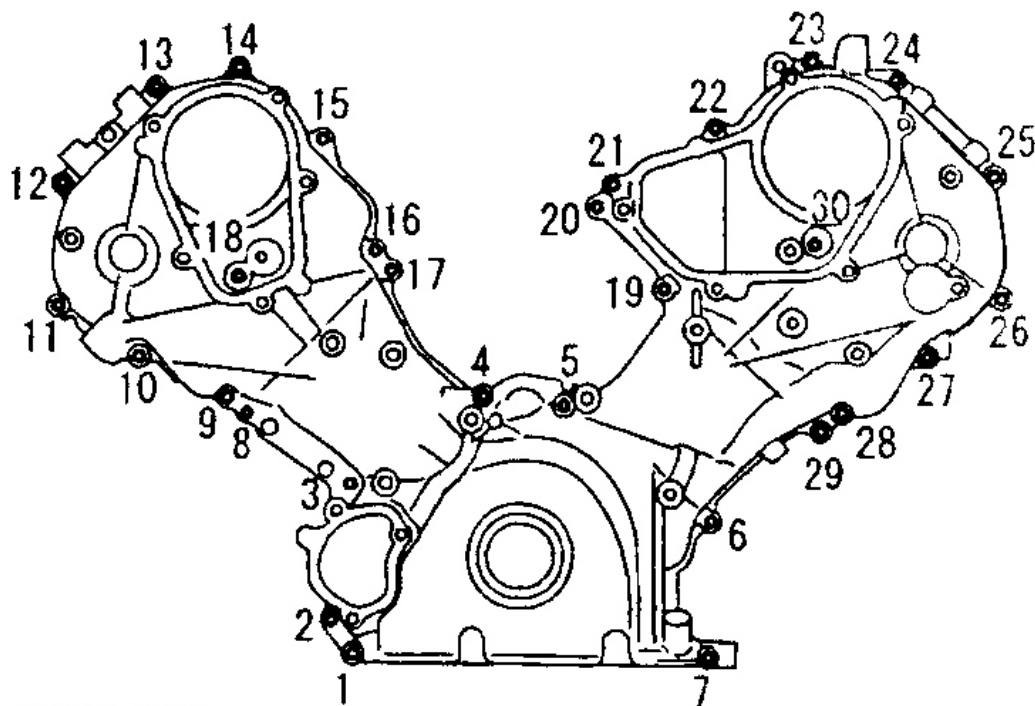
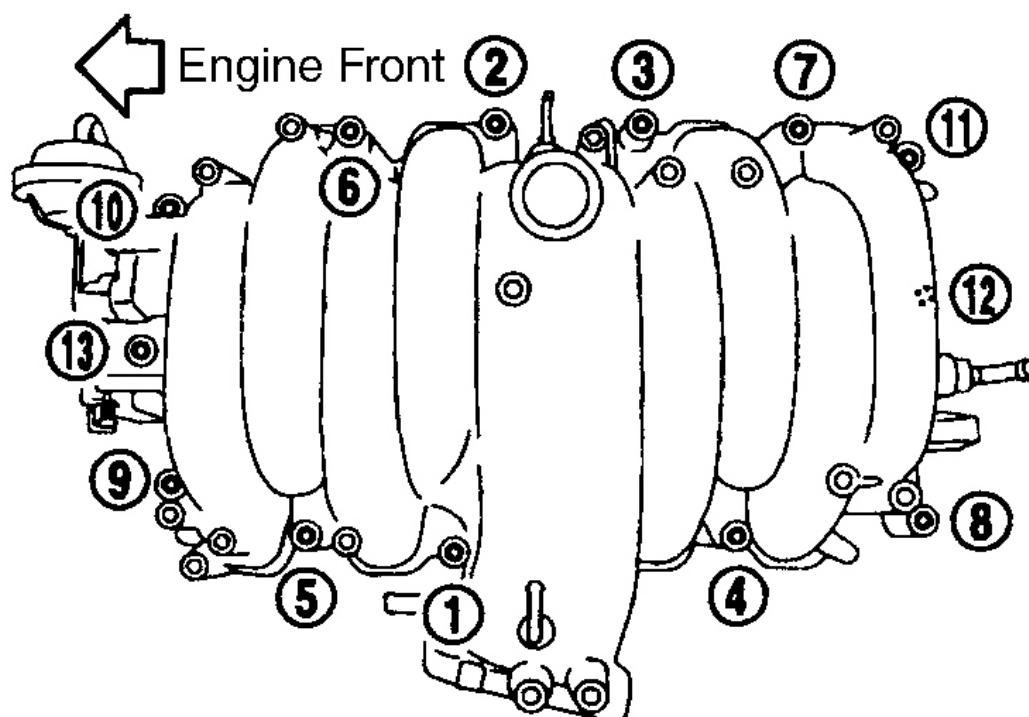


Fig. 226: Front Cover Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.



G00241070

Fig. 227: Upper Intake Manifold Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

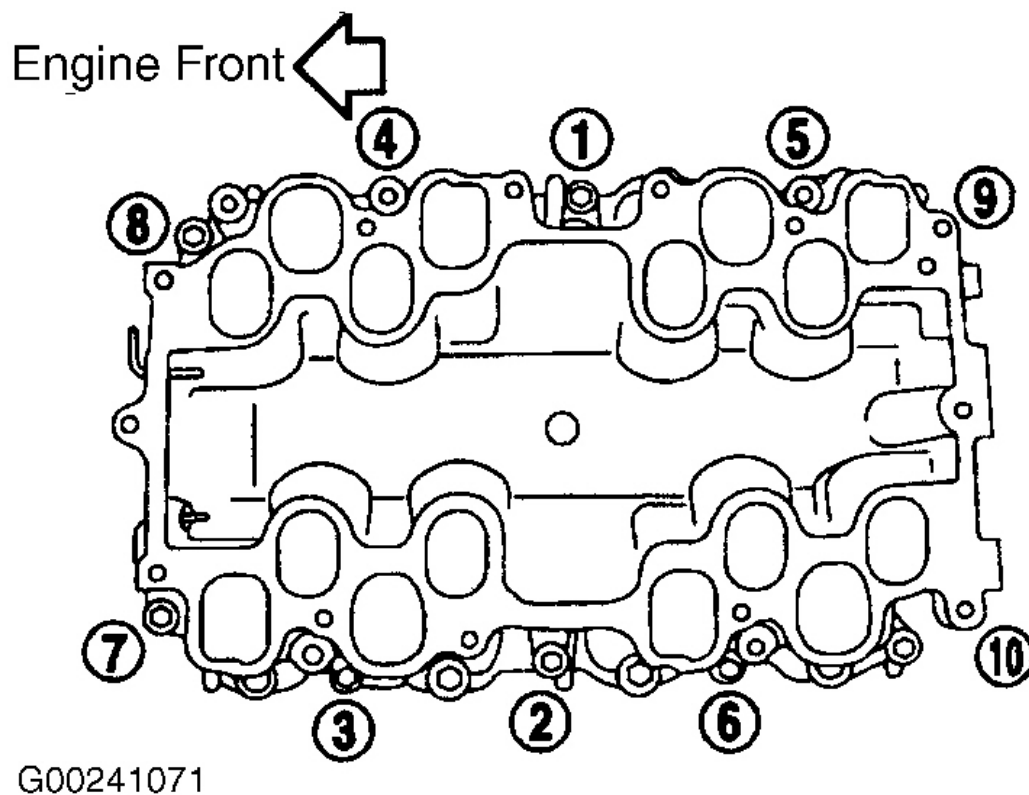


Fig. 228: Lower Intake Manifold Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

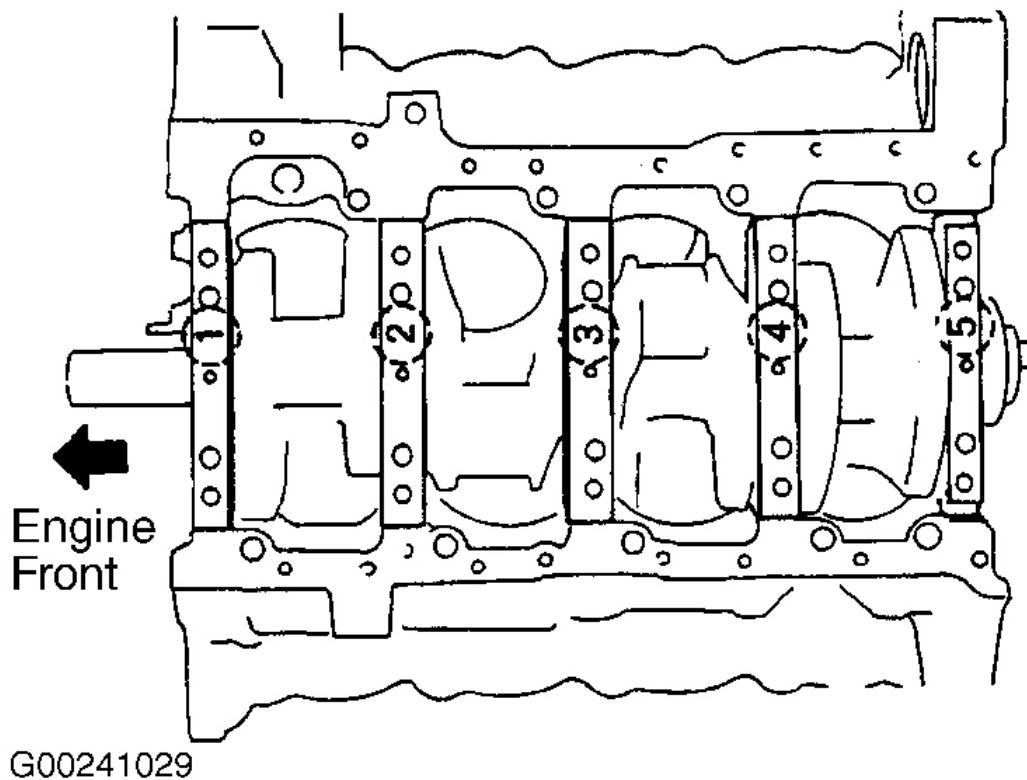
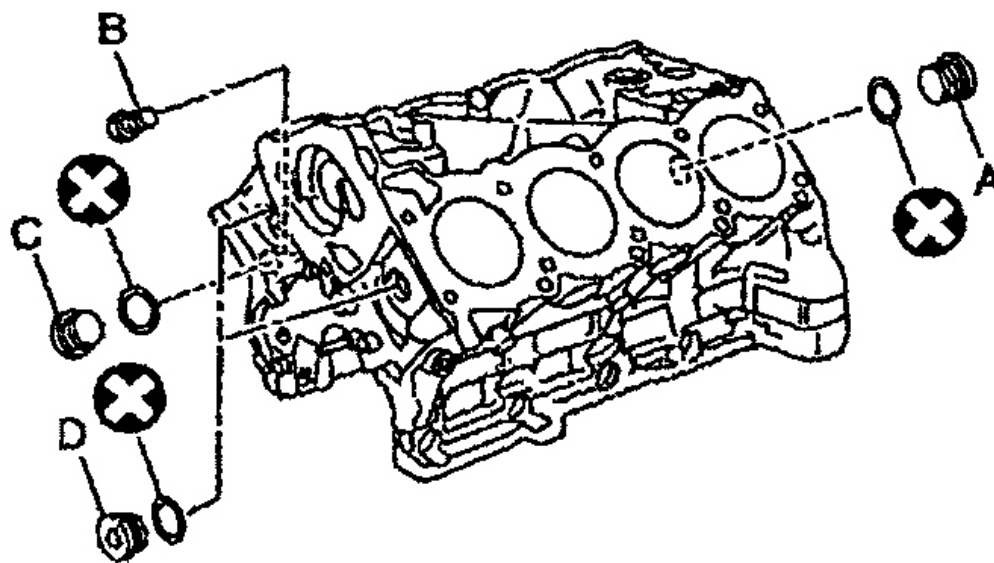


Fig. 229: Main Bearing Cap Identification
Courtesy of NISSAN MOTOR CO., U.S.A.



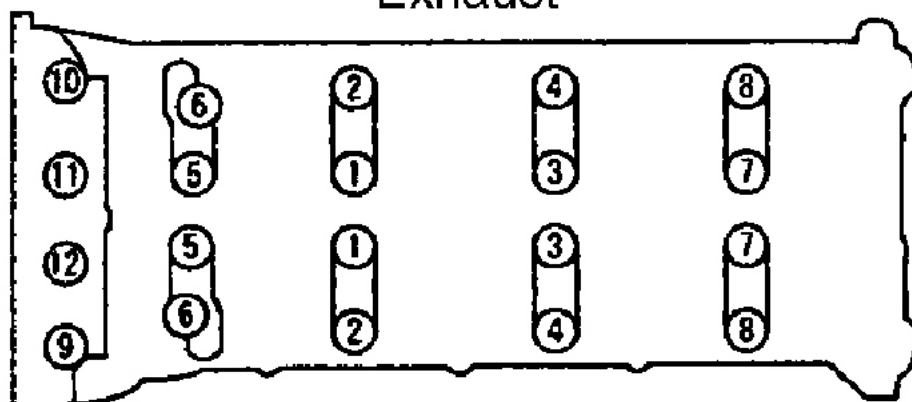
✕ : Always replace after every disassembly.

G00305621

Fig. 230: Locating Oil Galley Plugs
Courtesy of NISSAN MOTOR CO., U.S.A.

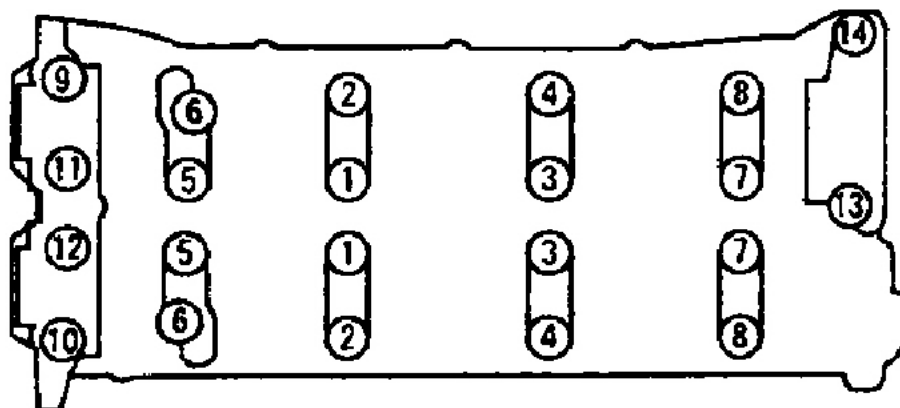
Right Bank

Exhaust

Engine
Front

Intake

Left Bank



Exhaust

G00241065

Fig. 231: Camshaft Bearing Cap Tightening Sequence
 Courtesy of NISSAN MOTOR CO., U.S.A.

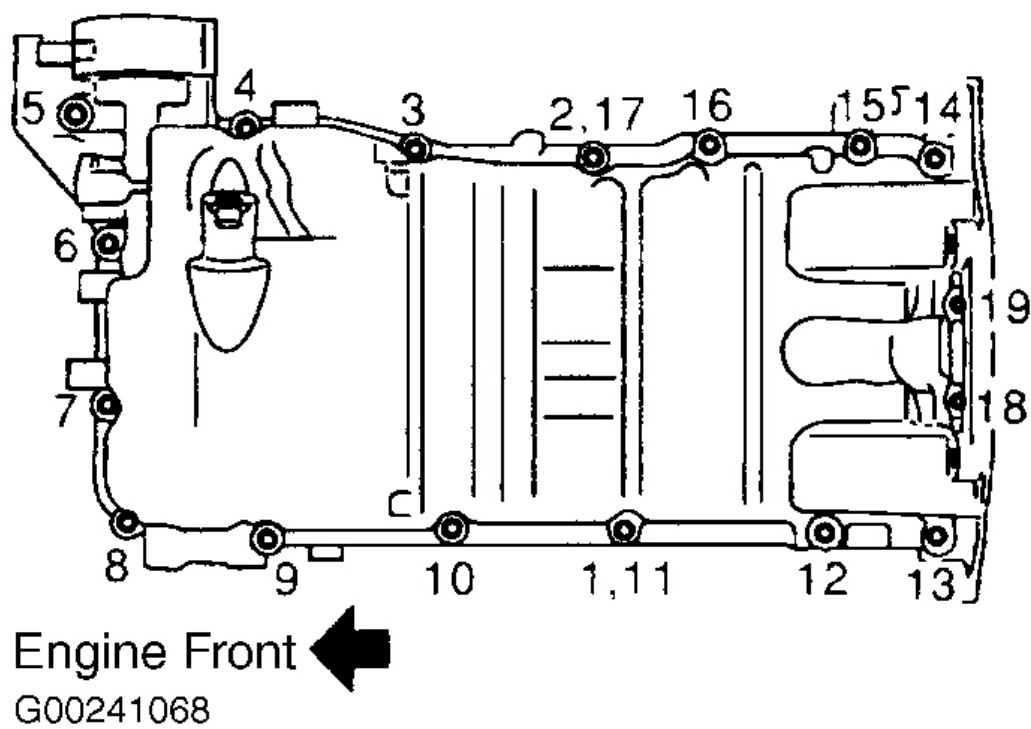
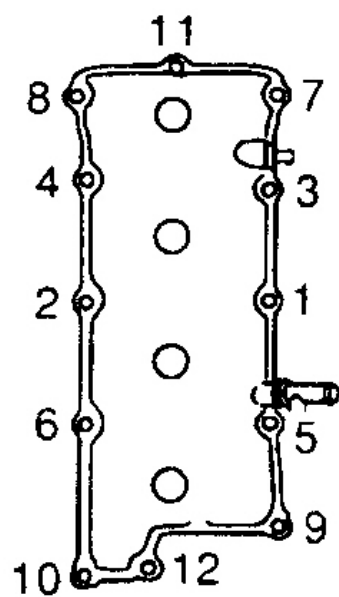


Fig. 232: Oil Pan Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.

Left Bank



G00241067

Engine
Front

Right Bank

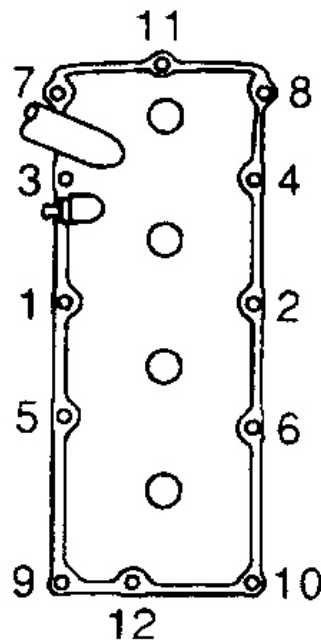


Fig. 233: Rocker Cover Tightening Sequence
Courtesy of NISSAN MOTOR CO., U.S.A.