

2003 ENGINE**Engine Mechanical - I35****PRECAUTIONS****PARTS REQUIRING ANGULAR TIGHTENING**

- Use an angle wrench for the final tightening of the following engine parts:
 - a. Cylinder head bolts
 - b. Main bearing cap bolts
 - c. Connecting rod cap nuts
 - d. Crankshaft pulley bolt
- Do not use a torque value for final tightening.
- The torque value for these parts are for a preliminary step.
- Ensure thread and seat surfaces are clean and coated with engine oil.

LIQUID GASKET APPLICATION PROCEDURE

1. Use a scraper to remove all traces of old liquid gasket from mating surfaces and grooves. Also, completely clean any oil from these areas.
2. Apply a continuous bead of liquid gasket to mating surfaces. Use Genuine RTV silicone sealant or equivalent.
 - Be sure liquid gasket diameter is as specified.

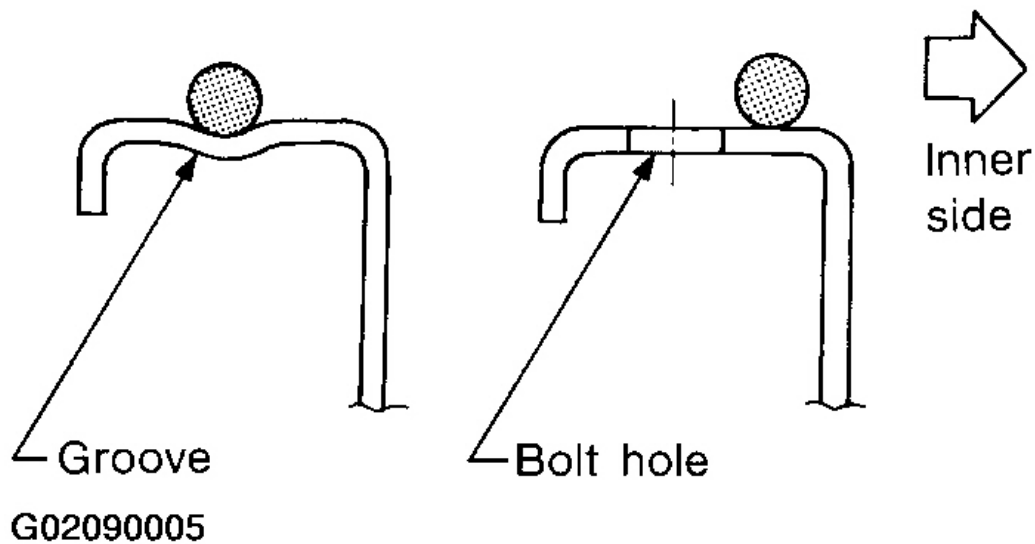


Fig. 1: Identifying Liquid Gasket Diameter

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

3. Apply liquid gasket around the inner side of bolt holes (unless otherwise specified).
4. Assembly should be done within 5 minutes after coating.
5. Wait at least 30 minutes before refilling engine oil and engine coolant.

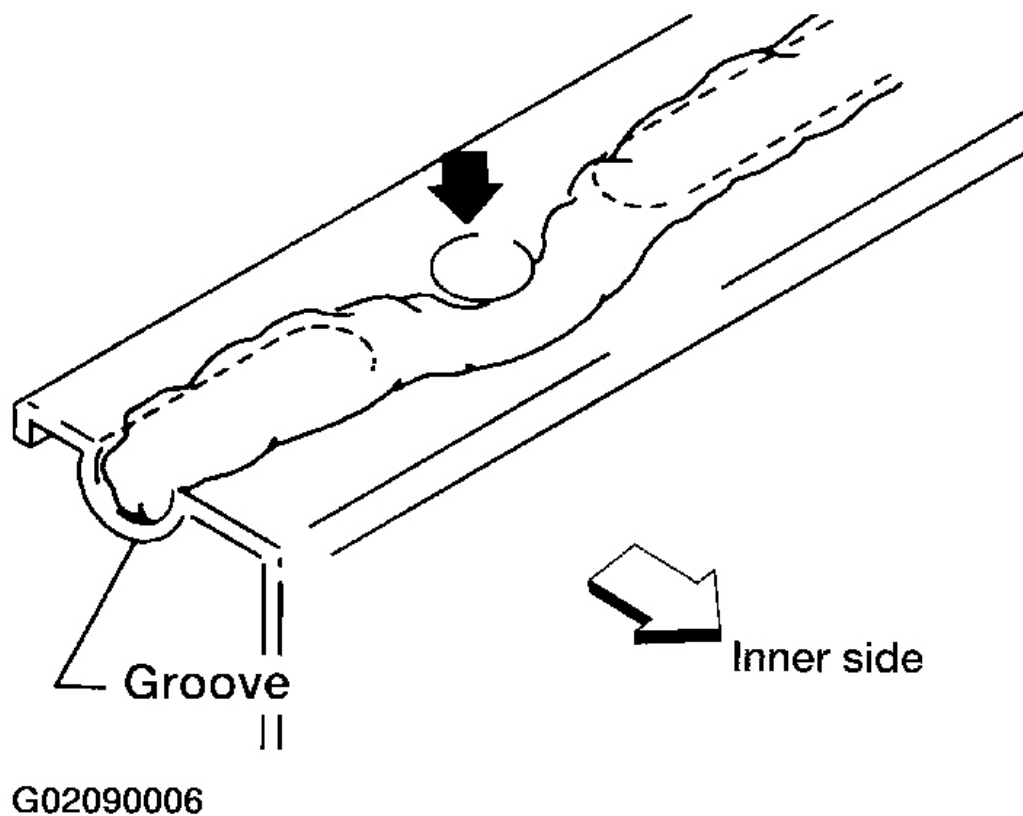
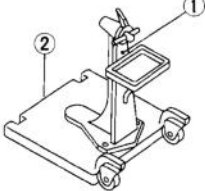
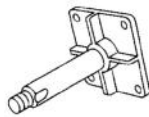
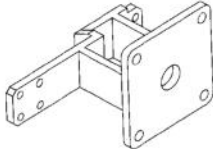
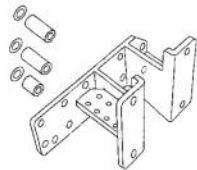
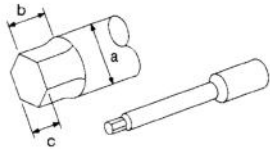
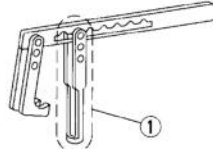


Fig. 2: Applying Liquid Gasket Around Inner Side Of Bolt Holes
Courtesy of NISSAN MOTOR CO., U.S.A.

PREPARATION

SPECIAL SERVICE TOOLS

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

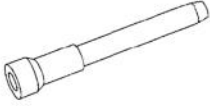
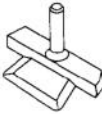
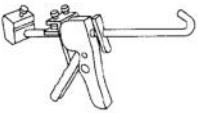
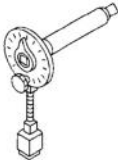
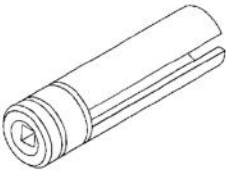
Tool number (Kent-Moore No.) Tool name	Description
ST0501S000 (—) Engine stand assembly 1 ST05011000 (—) Engine stand 2 ST05012000 (—) Base	 Disassembling and assembling
KV10106500 (—) Engine stand shaft	
KV10117000 (J41262) Engine sub-attachment	 KV10117000 has been replaced with KV10117001 (KV10117000 is no longer in production, but it is usable).
KV10117001 (—) Engine sub-attachment	 Installing on the cylinder block
ST10120000 (J24239-01) Cylinder head bolt wrench	 Loosening and tightening cylinder head bolt a: 13 (0.51) dia. b: 12 (0.47) c: 10 (0.39) Unit: mm (in)
KV10116200 (J26336-A) Valve spring compressor 1 KV10115900 (J26336-20) Attachment	 Disassembling valve mechanism

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Fig. 3: Identifying Special Service Tools (1 Of 2)
Courtesy of NISSAN MOTOR CO., U.S.A.

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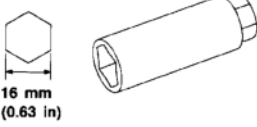
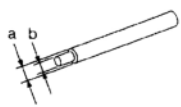
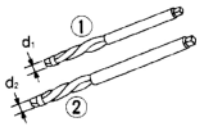
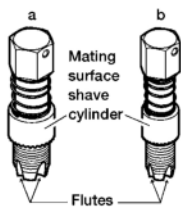
2003 ENGINE Engine Mechanical - I35

Tool number (Kent-Moore No.) Tool name	Description
(J39386) Valve oil seal drift	Installing valve oil seal 
EM03470000 (J8037) Piston ring compressor	Installing piston assembly into cylinder bore 
ST16610001 (J23907) Pilot bushing puller	Removing crankshaft pilot bushing 
KV10111100 (J37228) Seal cutter	Removing steel oil pan and rear timing chain case 
WS39930000 (—) Tube presser	Pressing the tube of liquid gasket 
KV10112100 (BT8653-A) Angle wrench	Tightening bolts for bearing cap, cylinder head, etc. 
KV10117100 (J3647-A) Heated oxygen sensor wrench	Loosening or tightening heated oxygen sensor For 22 mm (0.87 in) hexagon nut 

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Fig. 4: Identifying Special Service Tools (2 Of 2)
Courtesy of NISSAN MOTOR CO., U.S.A.

COMMERCIAL SERVICE TOOLS

Tool number (Kent-Moore No.) Tool name	Description
Spark plug wrench	 16 mm (0.63 in) Removing and installing spark plug
Valve seat cutter set	 Finishing valve seat dimensions
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	 Reaming valve guide 1 or hole for oversize valve guide 2 Intake & Exhaust: d₁ = 6.0 mm (0.236 in) dia. d₂ = 10.2 mm (0.402 in) dia.
(J-43897-18) (J-43897-12) Oxygen sensor thread cleaner	 a b Mating surface shave cylinder Flutes 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. 5: Identifying Commercial Service Tools (1 Of 2)

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

NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING

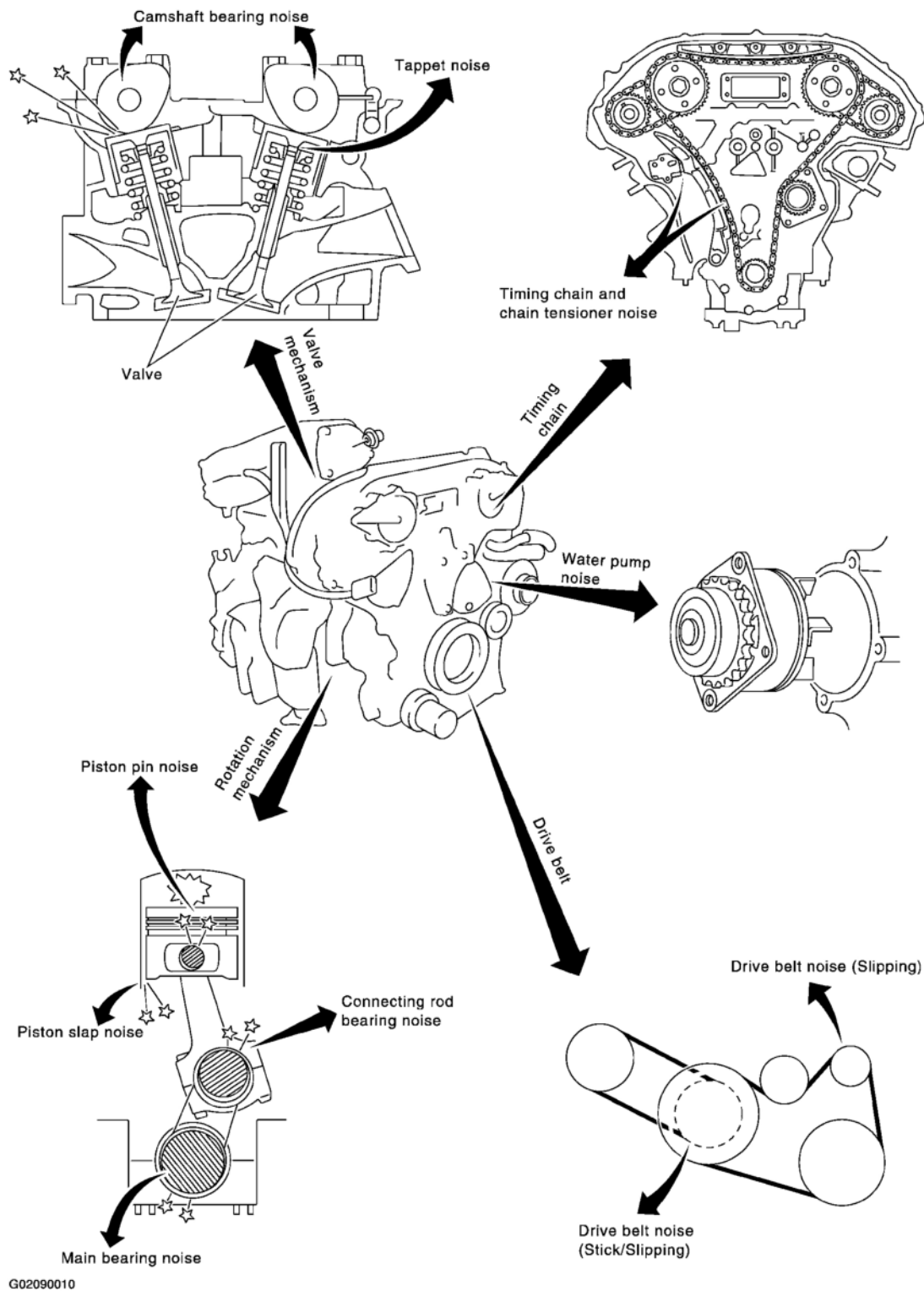


Fig. 6: Identifying Engine Vibration Components Points
 Courtesy of NISSAN MOTOR CO., U.S.A.

NVH TROUBLESHOOTING - ENGINE NOISE

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	Reference page
		Before warm-up	After warm-up	When starting	When idling	When racing	While driving			
Top of engine Rocker cover Cylinder head	Ticking or clicking	C	A	—	A	B	—	Tappet noise	Valve clearance	EM-66
	Rattle	C	A	—	A	B	C	Camshaft bearing noise	Camshaft journal clearance Camshaft runout	EM-56, EM-55
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 clearance	EM-75, EM-81
	Slap or rap	A	—	—	B	B	A	Piston slap noise	Piston-to-bore clearance Piston ring side clearance Piston ring end gap Connecting rod bend and torsion	EM-77, EM-75, EM-75, EM-76
	Knock	A	B	C	B	B	B	Connecting rod bearing noise	Connecting rod bushing clearance (Small end) Connecting rod bearing clearance (Big end)	EM-81, EM-80
	Knock	A	B	—	A	B	C	Main bearing noise	Main bearing oil clearance Crankshaft runout	EM-78, EM-78
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	EM-39, EM-29
Front of engine	Squeaking or fizzing	A	B	—	B	—	C	Drive belts (Sticking or slipping)	Drive belts deflection	MA section ("Checking Drive Belts", "ENGINE MAINTENANCE")
	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	LC section ("Water Pump Inspection", "ENGINE COOLING SYSTEM")

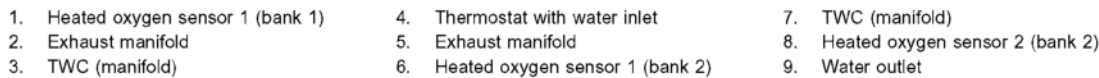
A: Closely related B: Related C: Sometimes related —: Not related

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Fig. 7: Troubleshooting Chart - Engine Noise
 Courtesy of NISSAN MOTOR CO., U.S.A.

OUTER COMPONENT PARTS

REMOVAL AND INSTALLATION

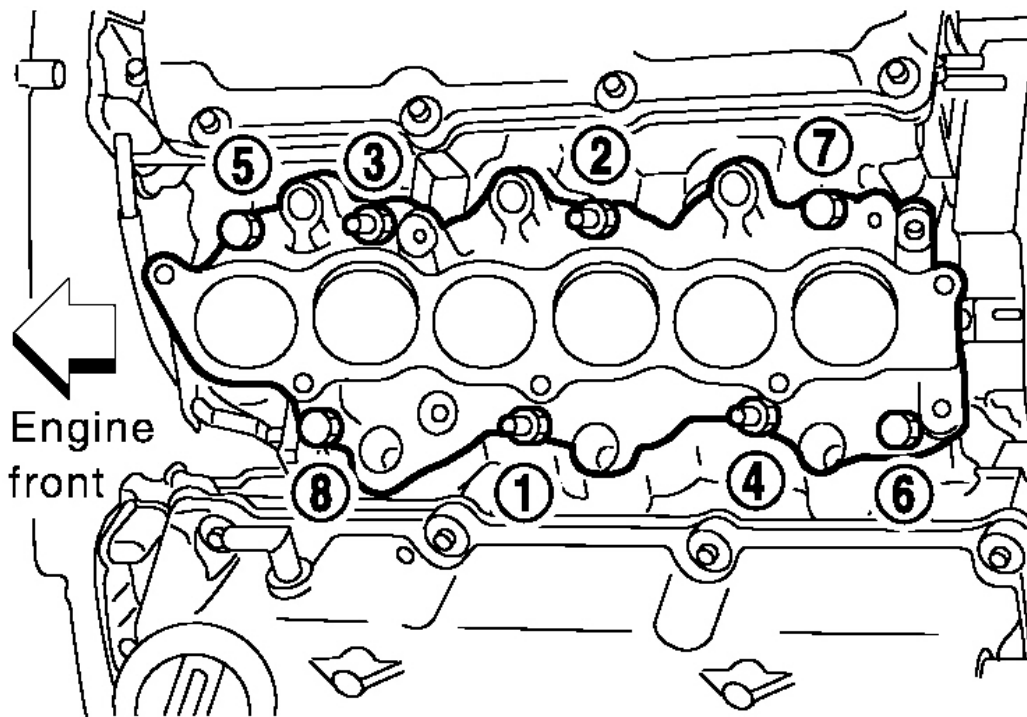


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Courtesy of NISSAN MOTOR CO., U.S.A.

Intake Manifold

- Loosen in reverse order shown in the figure. See **Fig. 10**.
- Tighten in numerical order shown in the figure. See **Fig. 10**.
 1. Tighten all bolts and nuts to 4.9 to 9.8 N.m (0.50 to 0.99 kg-m, 4 to 7 ft-lb).
 2. Finally tighten all bolts and nuts to 26.5 to 31.4 N.m (2.7 to 3.2 kg-m, 20 to 23 ft-lb).
- Tighten all bolts and nuts to the final torque, evenly dividing the tightening into at least three steps.

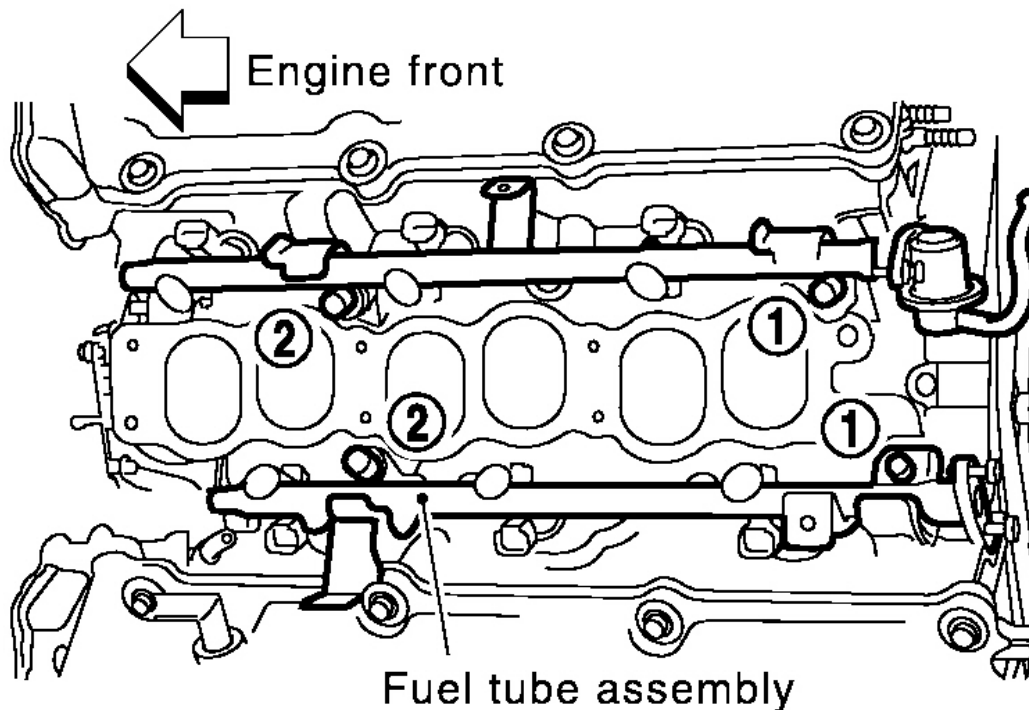


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Fig. 10: Tightening Intake Manifold Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

Fuel Tube

- Tighten in numerical order shown in the figure.



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Fig. 11: Tightening Fuel Tube Bolts

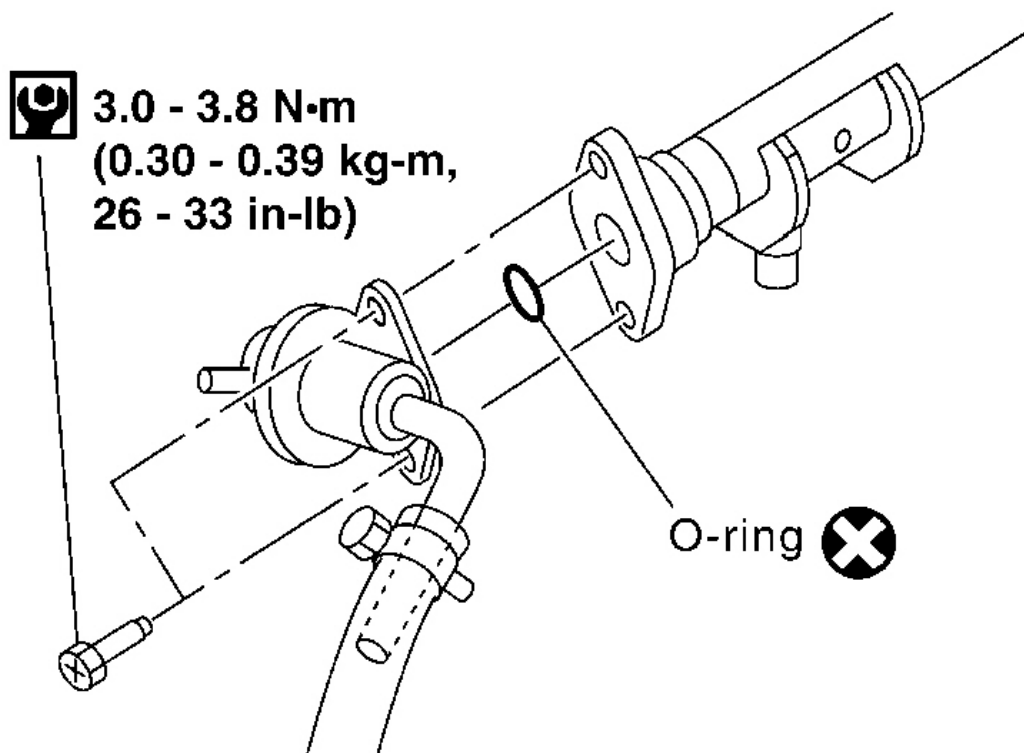
Courtesy of NISSAN MOTOR CO., U.S.A.

1. Tighten all bolts to 9.3 to 10.8 N.m (0.95 to 1.1 kg-m, 6.9 to 7.9 ft-lb).
2. Then tighten all bolts to 20.6 to 26.5 N.m (2.1 to 2.7 kg-m, 16 to 19 ft-lb).

Fuel Damper

Tighten fuel damper to 2.9 to 3.8 N.m (0.3 to 0.39 kg-m, 26.0 to 33.9 in- lb).

- Tighten screws evenly several times to have the fuel damper tightened at the specified torque.
- Always replace O-ring with new ones.
- Lubricate O-ring with new engine oil.

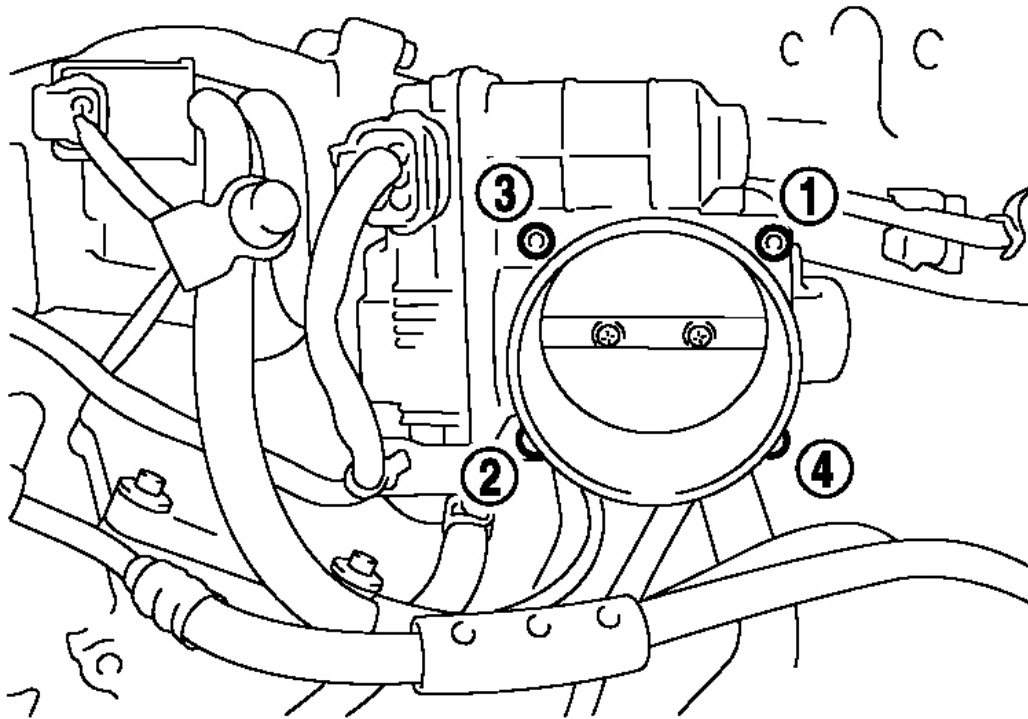


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Fig. 12: Tightening Fuel Damper Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

Electronic Control Throttle Actuator

- Tighten in numerical order shown in the figure.



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Fig. 13: Identifying Electronic Throttle Control Actuator
Courtesy of NISSAN MOTOR CO., U.S.A.

Tighten all bolts to 7.2 to 9.6 N.m (0.74 to 0.97 kg-m, 64 to 84 in-lb).

CAUTION:

- Perform "Throttle Valve Closed Position Learning" when harness connector of electronic throttle control actuator is disconnected.

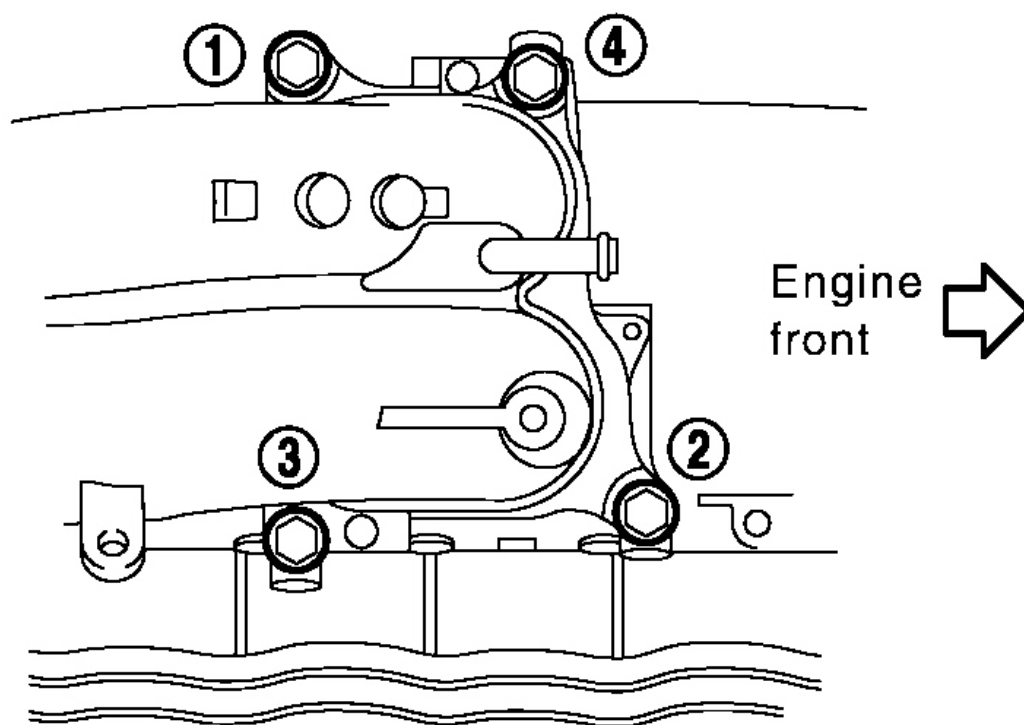
Refer to THROTTLE VALVE CLOSED POSITION LEARNING .

- Perform Idle Air Volume Learning when electronic throttle control actuator is replaced.

Refer to IDLE AIR VOLUME LEARNING .

Intake Manifold Upper Collector

- Loosen in reverse order and tighten in numerical order shown in the figure.



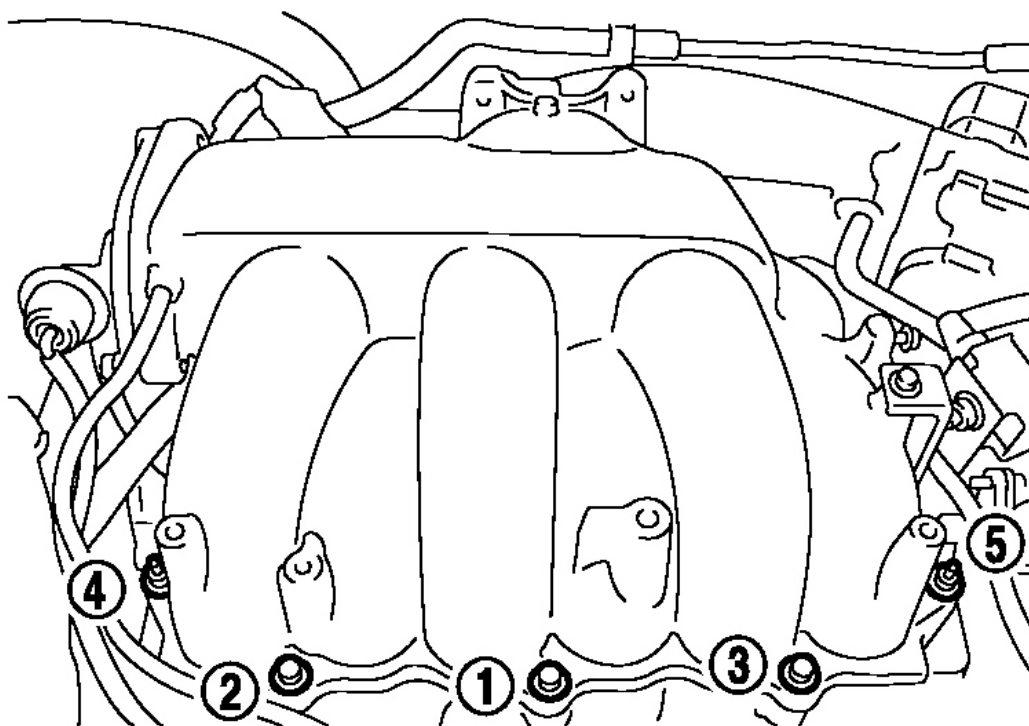
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Fig. 14: Tightening Intake Manifold Upper Collector Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

Tighten all bolts to 17.6 to 21.6 N.m (1.8 to 2.2 kg-m, 13 to 15 ft-lb).

Intake Manifold Lower Collector

- Loosen in reverse order shown in the figure.



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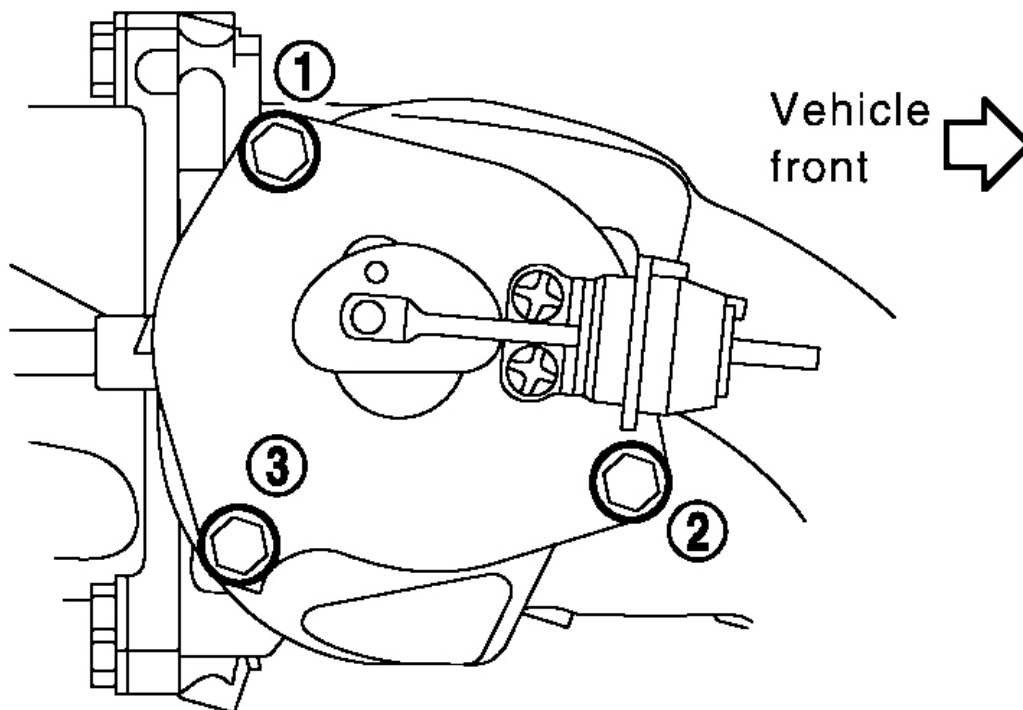
Fig. 15: Tightening Intake Manifold Lower Collector Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

- Tighten in numerical order shown in the figure.

Tighten bolts and nuts to 17.6 to 21.6 N.m (1.8 to 2.2 kg-m, 13 to 15 ft-lb).

Power Valve

- Tighten in numerical order shown in the figure.



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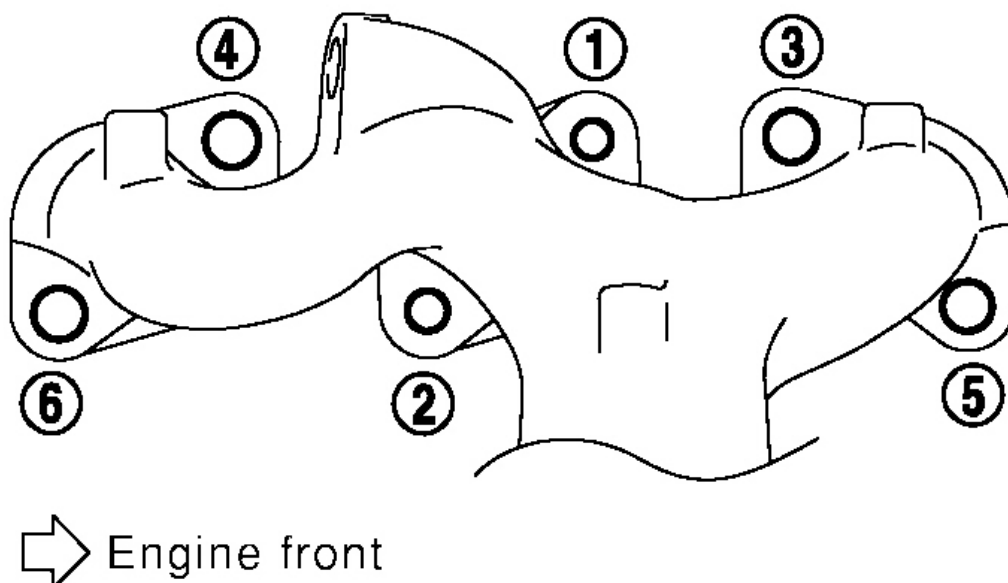
Fig. 16: Tightening Power Valve Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

Tighten all bolts to 17.6 to 21.6 N.m (1.8 to 2.2 kg-m, 13 to 15 ft-lb).

Exhaust Manifold

- Loosen in reverse order shown in the figure.

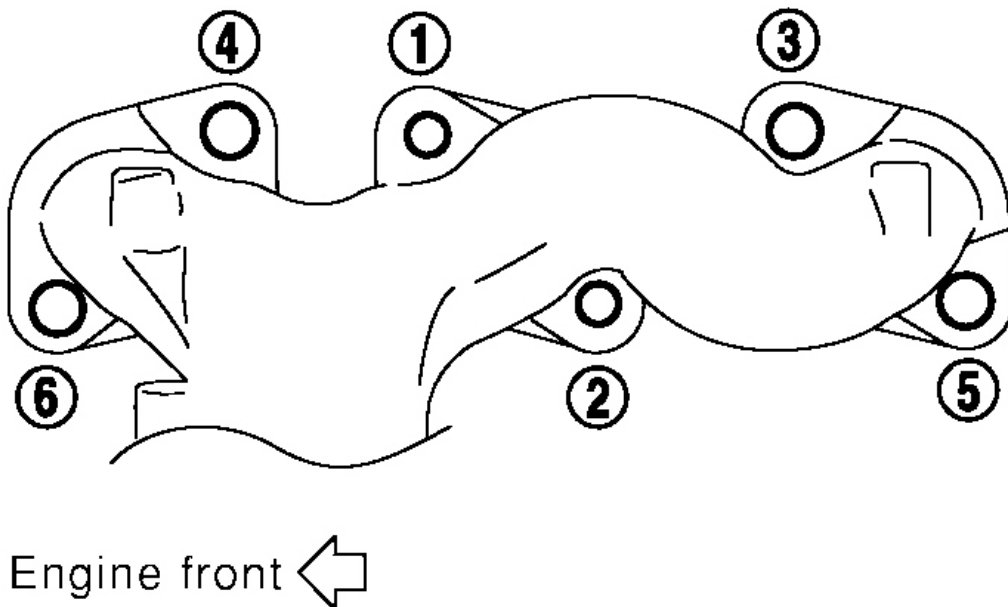
RH bank



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Fig. 17: Tightening Exhaust Manifold Bolts (RH BANK)
Courtesy of NISSAN MOTOR CO., U.S.A.

LH bank



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Fig. 18: Tightening Exhaust Manifold Bolts (LH BANK)
Courtesy of NISSAN MOTOR CO., U.S.A.

- Tighten in numerical order shown in the figure.

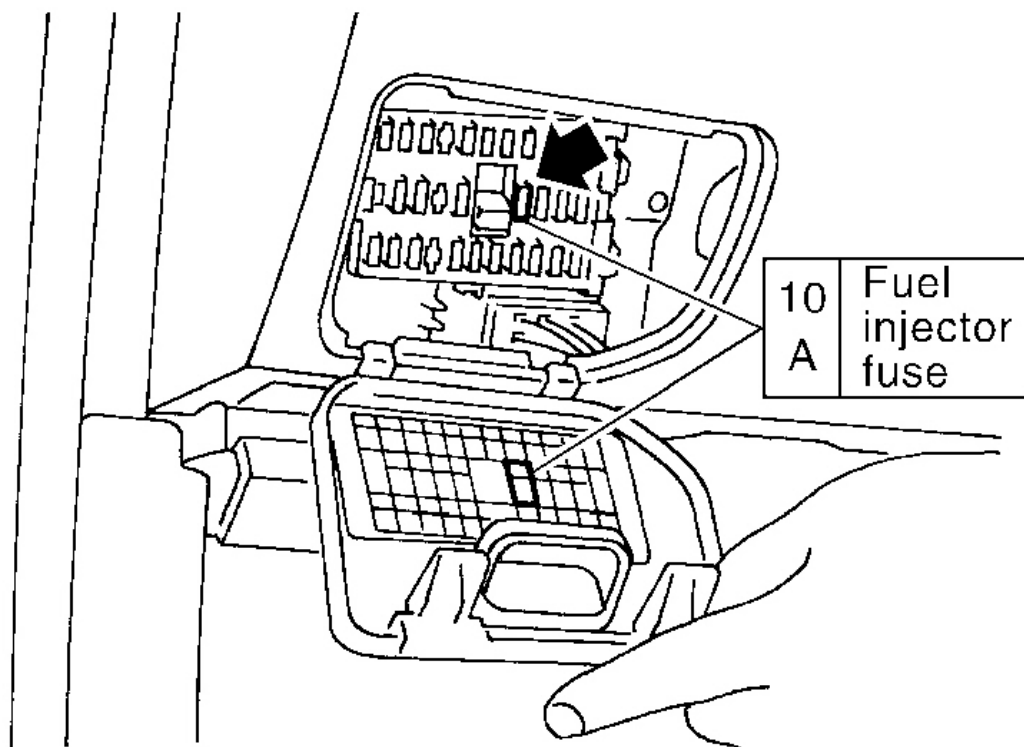
Tighten nuts to 28.4 to 33.3 N.m (2.9 to 3.3 kg-m, 21 to 24 ft-lb).

MEASUREMENT OF COMPRESSION PRESSURE

1. Warm up engine.
2. Turn ignition switch OFF.
3. Release fuel pressure.

Refer to **FUEL PRESSURE RELEASE** .

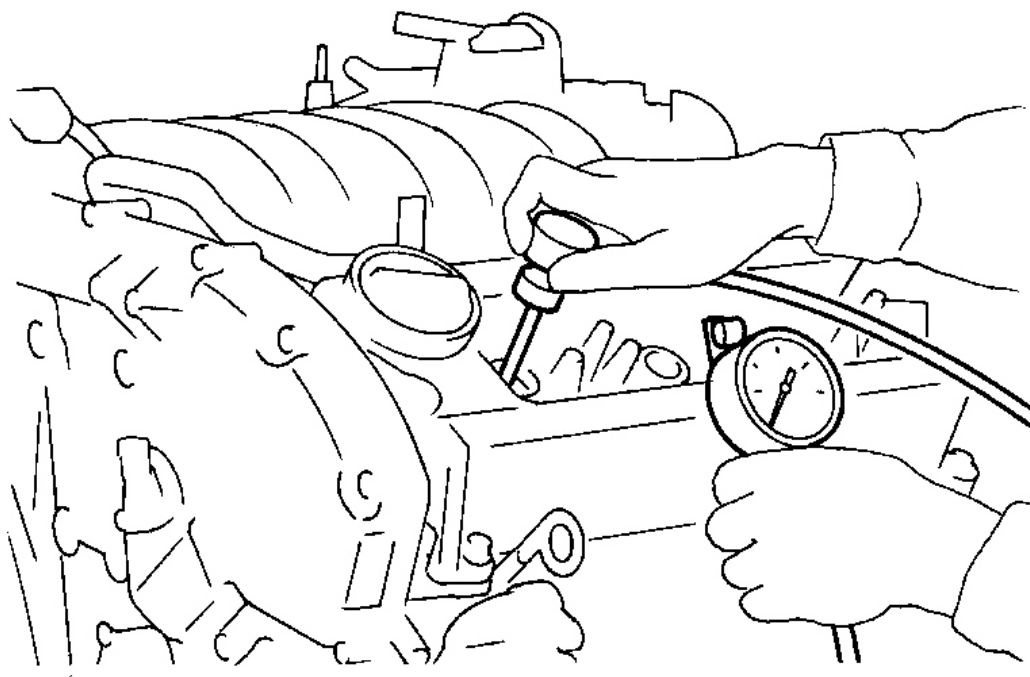
4. Disconnect ignition coil with power transistor harness connectors, then remove ignition coils.
5. Remove all spark plugs.
6. Remove fuse for fuel injector.



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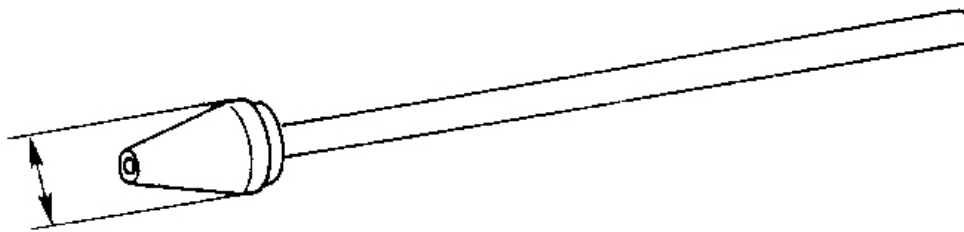
Fig. 19: Identifying Fuse For Fuel Injector
Courtesy of NISSAN MOTOR CO., U.S.A.

7. Attach a compression tester to No. 1 cylinder.
8. Depress accelerator pedal fully to keep throttle valve wide open.
9. Crank engine and record highest gauge indication.
10. Repeat the measurement on each cylinder as shown above.
 - **Always use a fully-charged battery to obtain specified engine speed.**



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Fig. 20: Attaching Compression Tester To No. 1 Cylinder
Courtesy of NISSAN MOTOR CO., U.S.A.



20 mm (0.79 in) dia.

Use compressor tester whose end (rubber portion) is less than 20 mm (0.79 in) dia. Otherwise, it may be caught by cylinder head during removal.

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Fig. 21: Identifying Compression Tester
Courtesy of NISSAN MOTOR CO., U.S.A.

11. If compression in one or more cylinders is low:
 - a. Pour a small amount of engine oil into cylinders through spark plug holes.
 - b. Retest compression.
 - If adding oil helps compression, piston rings may be worn or damaged. If so, replace piston rings after checking piston.
 - If pressure stays low, a valve may be sticking or seating improperly. Inspect and repair valve and valve seat. Refer to VALVE and VALVE SEAT. If valve or valve seat is damaged excessively, replace them.

Unit: kPa (kg/cm², psi)/rpm

Standard	Minimum	Difference limit between cylinders
1,275 (13.0, 185)/300	981 (10.0, 142)/300	98 (1.0, 14)/300

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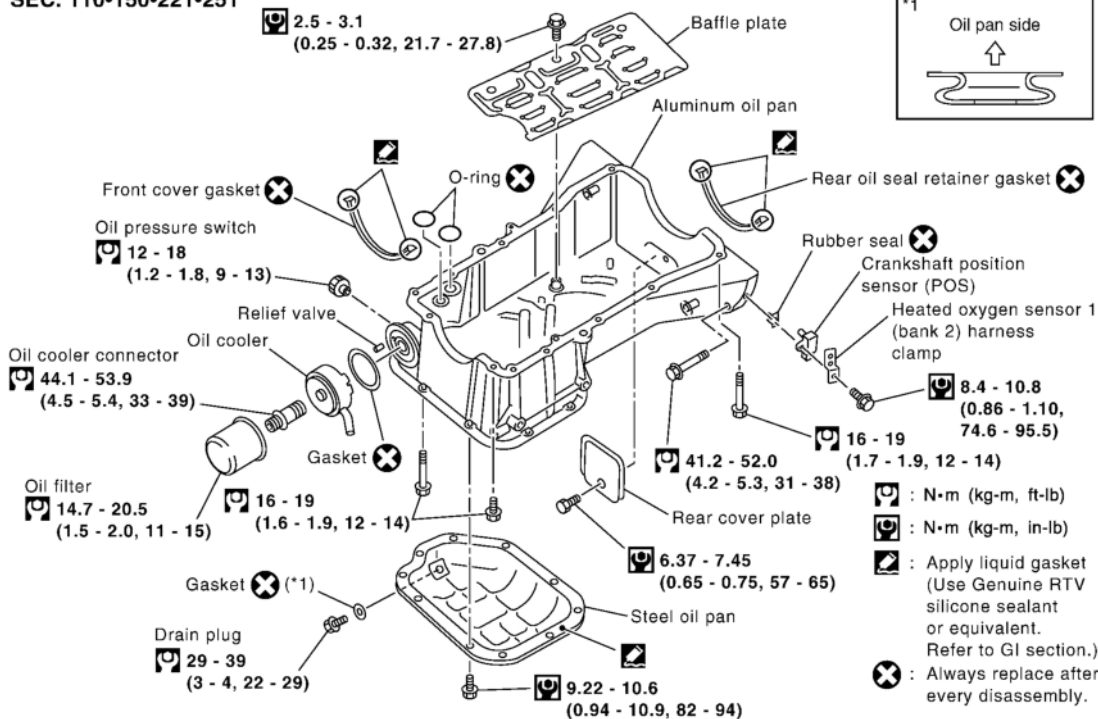
Fig. 22: Cylinders Compression Specification
Courtesy of NISSAN MOTOR CO., U.S.A.

- If compression stays low in two cylinders that are next to each other:
 - a. The cylinder head gasket may be leaking, or
 - b. Both cylinders may have valve component damage. Inspect and repair as necessary.

OIL PAN

COMPONENTS

SEC. 110•150•221•251



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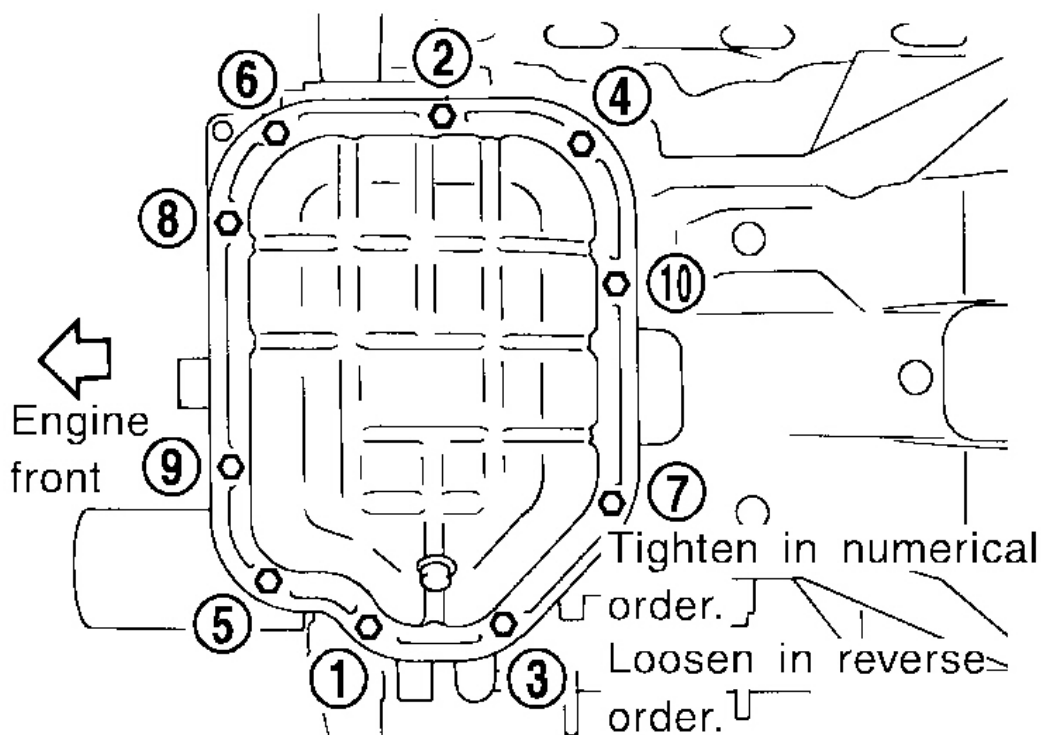
Fig. 23: Exploded View Of Oil Pan Components

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

REMOVAL

CAUTION: When removing the aluminum oil pan from engine, first remove the crankshaft position sensor (POS) from the assembly.
Be careful not to damage sensor edges and signal plate teeth.

1. Remove engine undercover.
2. Drain engine oil.
 - To avoid the danger of being scalded, never drain the engine oil when the engine is hot.
3. Loosen steel oil pan bolts in reverse order shown in the figure.



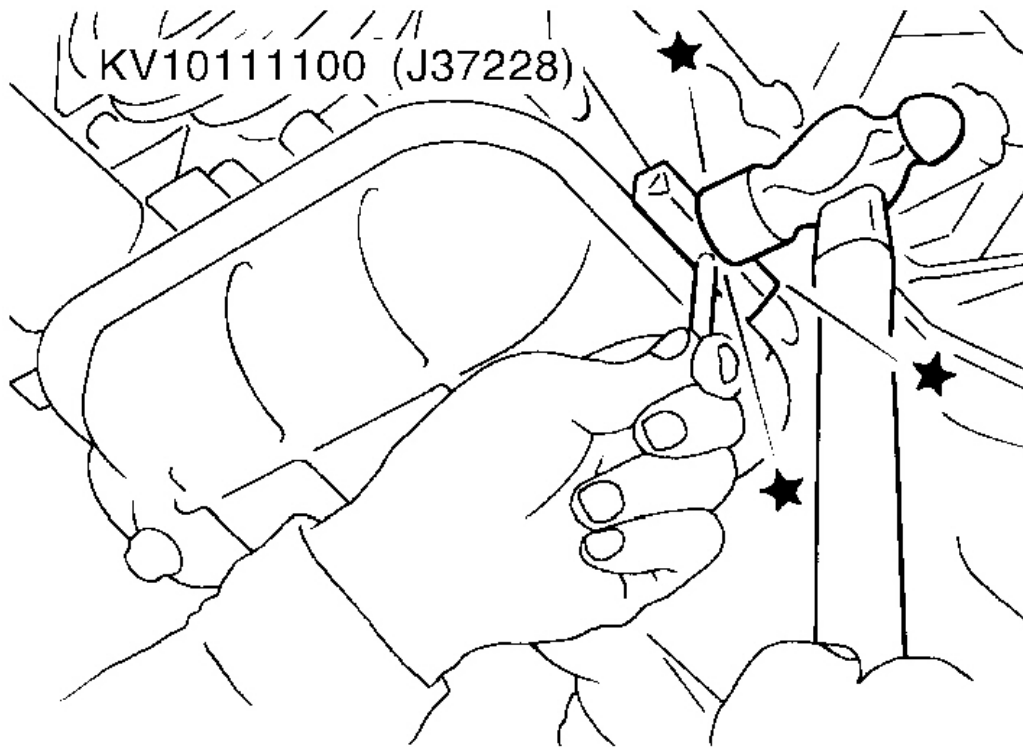
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Fig. 24: Removing Oil Pan Bolts

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

4. Remove steel oil pan.

- a. Insert seal cutter between aluminum oil pan and steel oil pan.
- Be careful not to damage aluminum mating surface.
 - Do not insert screwdriver, or oil pan flange will be deformed.

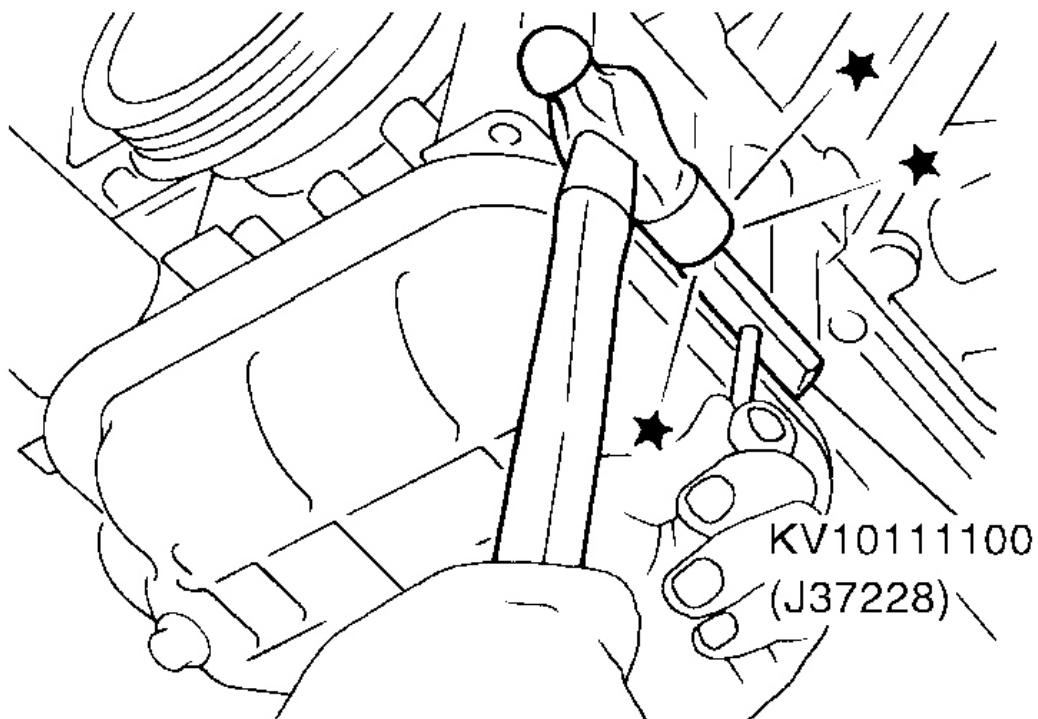


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Fig. 25: Removing Oil Pan

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

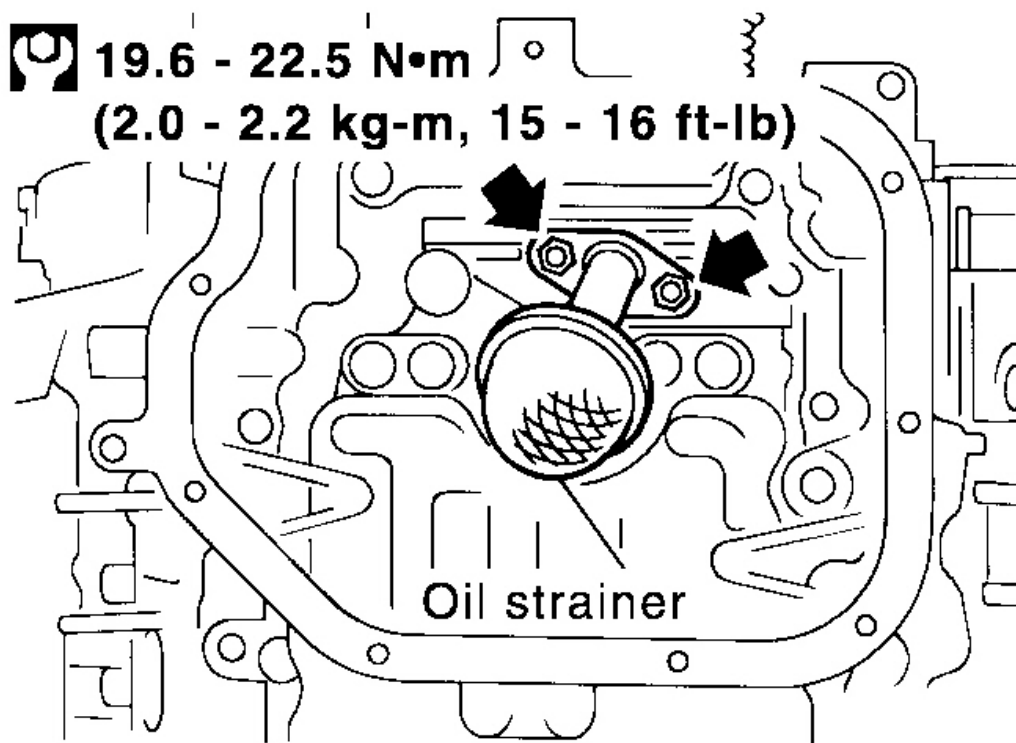
- b. Slide seal cutter by tapping on the side of it with a hammer.
- c. Remove steel oil pan.



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Fig. 26: Tapping On Side Hammer To Oil Pan
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Remove oil strainer.

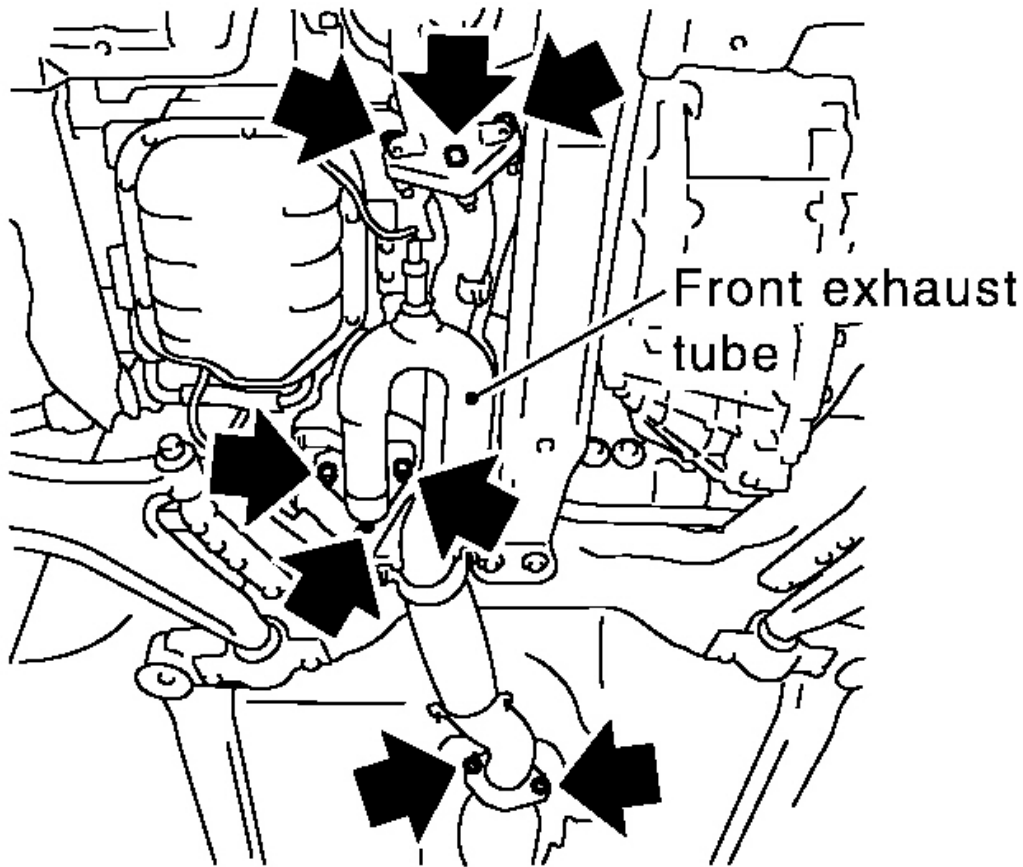


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Fig. 27: Removing Oil Strainer

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

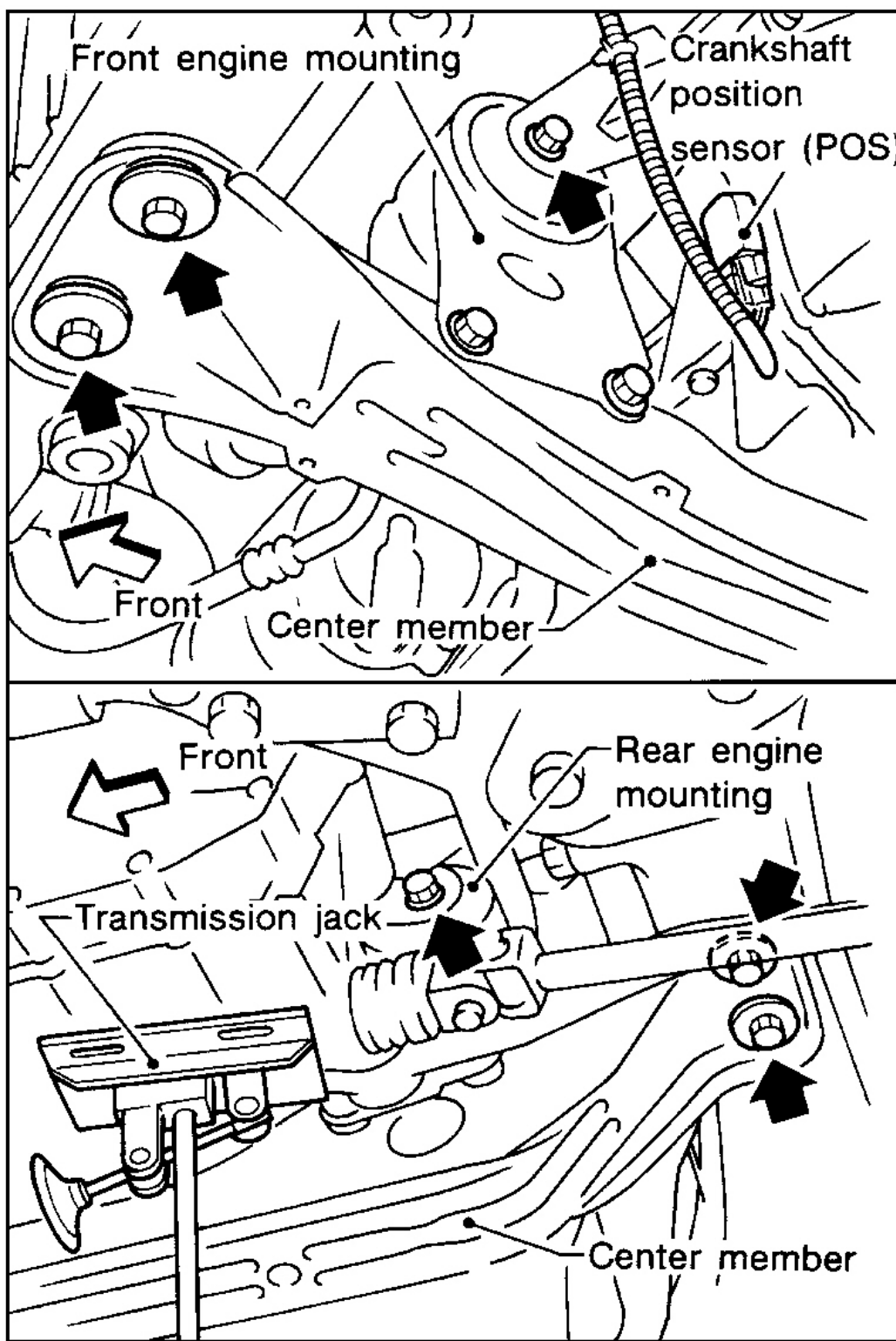
6. Remove front exhaust tube and its support.



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Fig. 28: Removing Front Exhaust Tube
Courtesy of NISSAN MOTOR CO., U.S.A.

7. Set a suitable transmission jack under transaxle and hoist engine with engine slinger.
8. Remove crankshaft position sensor (POS) from oil pan.
9. Loosen front and rear engine mounting nuts and bolts.
10. Remove center member.



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Fig. 29: Removing Front Engine Mounting Nuts And Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

11. Remove drive belts. Refer to **DRIVE BELT ROUTING**.
12. Remove air conditioner compressor.

Refer to **COMPRESSOR**.

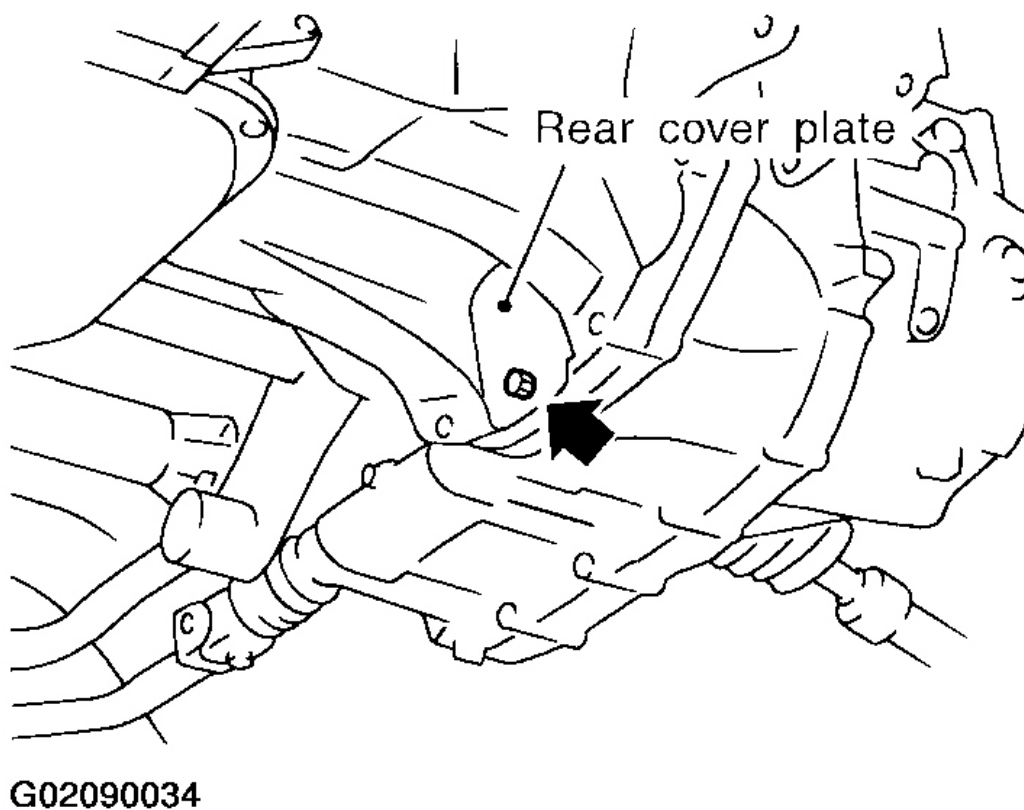
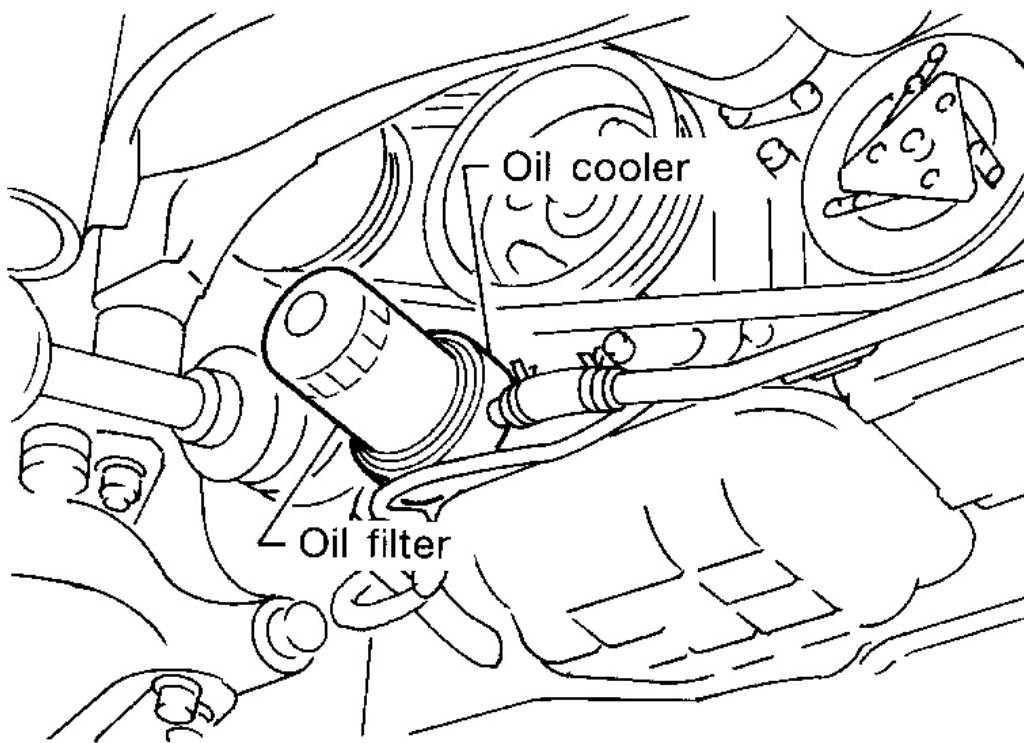


Fig. 30: Removing Air Conditioner Compressor
Courtesy of NISSAN MOTOR CO., U.S.A.

13. Remove rear cover plate.

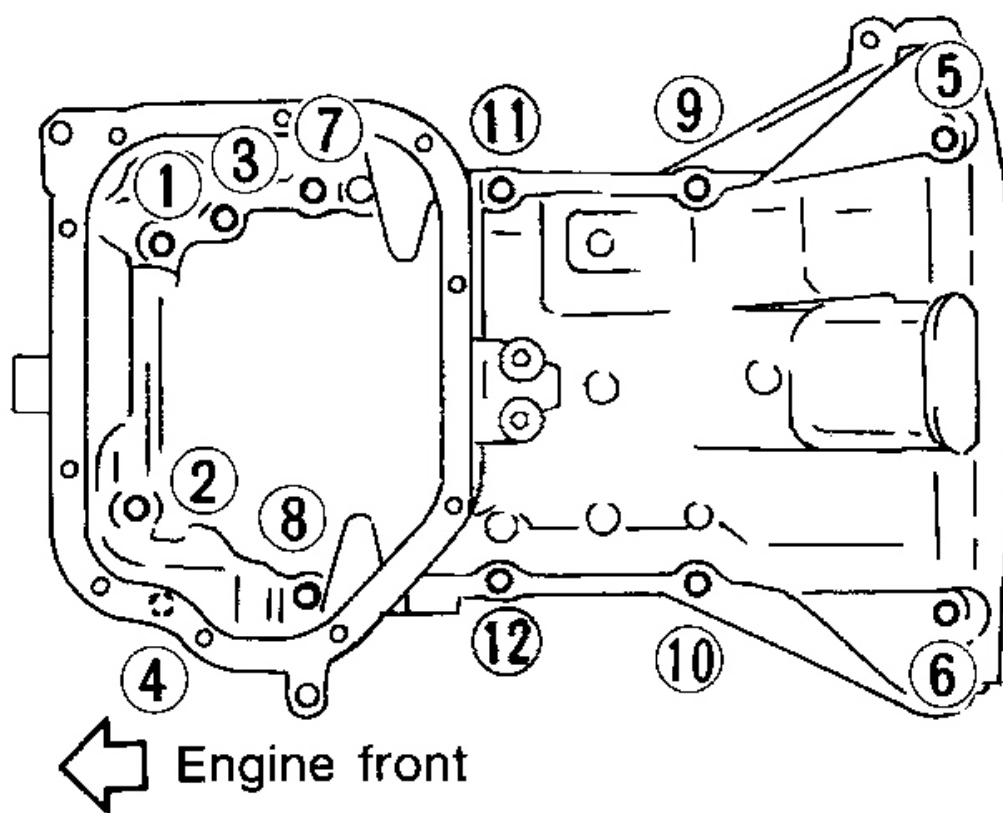


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Fig. 31: Removing rear cover plate

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

14. Remove oil filter, oil cooler fixing bolt and water hoses or pipes as follows.
 - a. Remove oil filter.
 - b. Disconnect water hoses from oil cooler, pinching hose to prevent coolant spill.
 - c. Remove oil cooler.
15. Loosen aluminum oil pan bolts in numerical order.

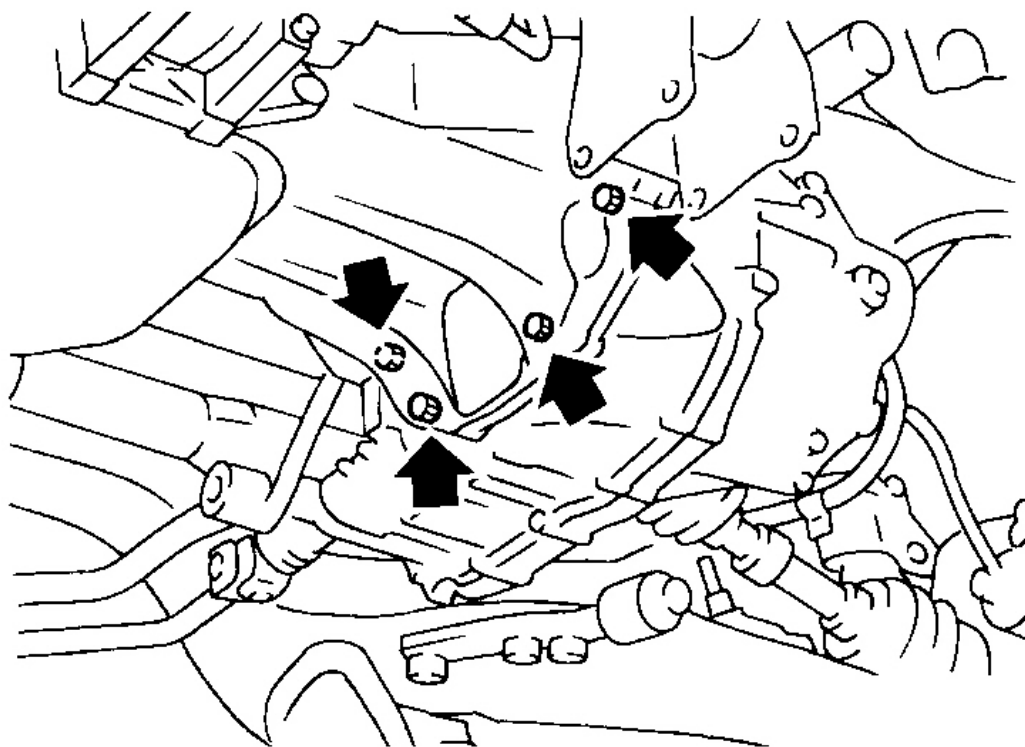


G02090036

Fig. 32: Removing Oil Pan Bolts

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

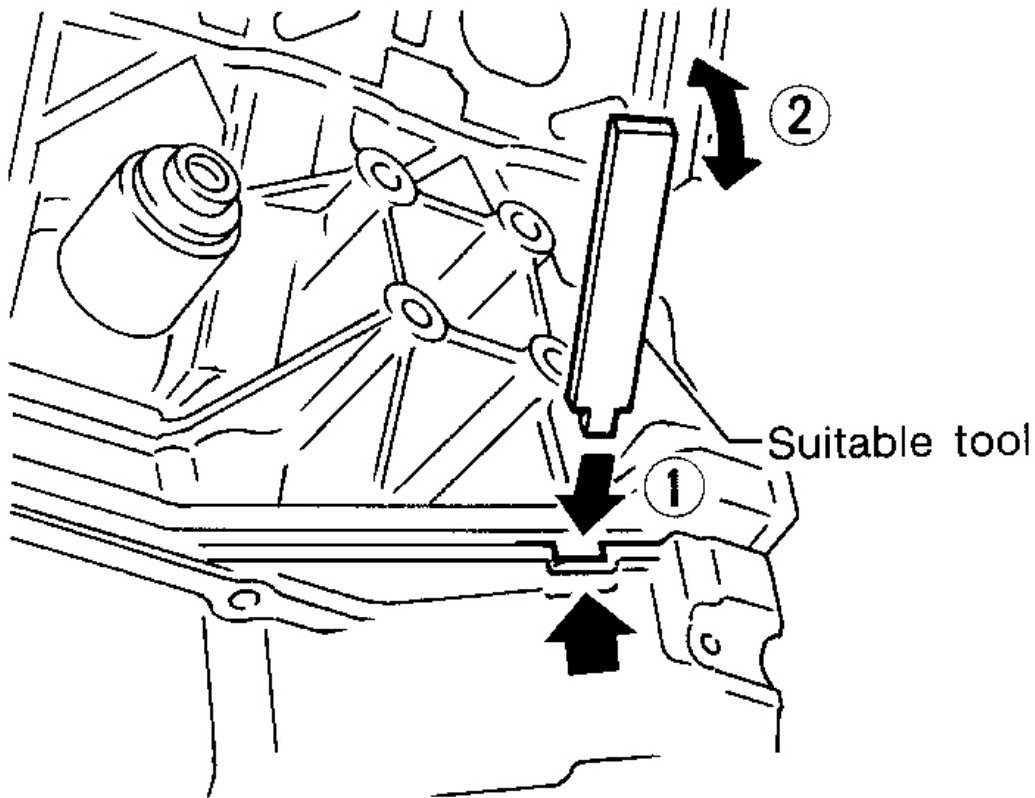
16. Loosen four engine-to-transaxle bolts.



G02090037

Fig. 33: Removing Engine-To-Transaxle Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

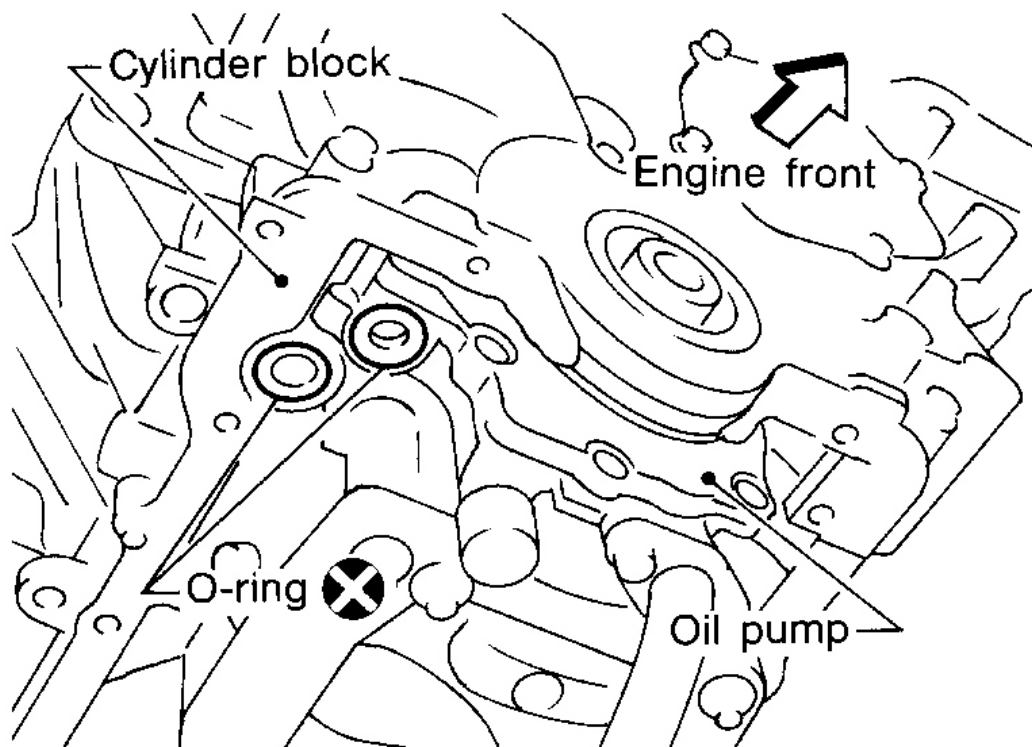
17. Remove aluminum oil pan.
 - a. Insert an appropriate size tool into the notch of aluminum oil pan as shown in the figure.



G02090038

Fig. 34: Removing Aluminum Oil Pan
Courtesy of NISSAN MOTOR CO., U.S.A.

- Be careful not to damage aluminum mating surface.
 - Do not insert screwdriver, or oil pan flange will be deformed.
- b. Pry off aluminum oil pan by moving the tool up and down.
 - c. Remove aluminum oil pan.
18. Remove O-rings from cylinder block and oil pump body.

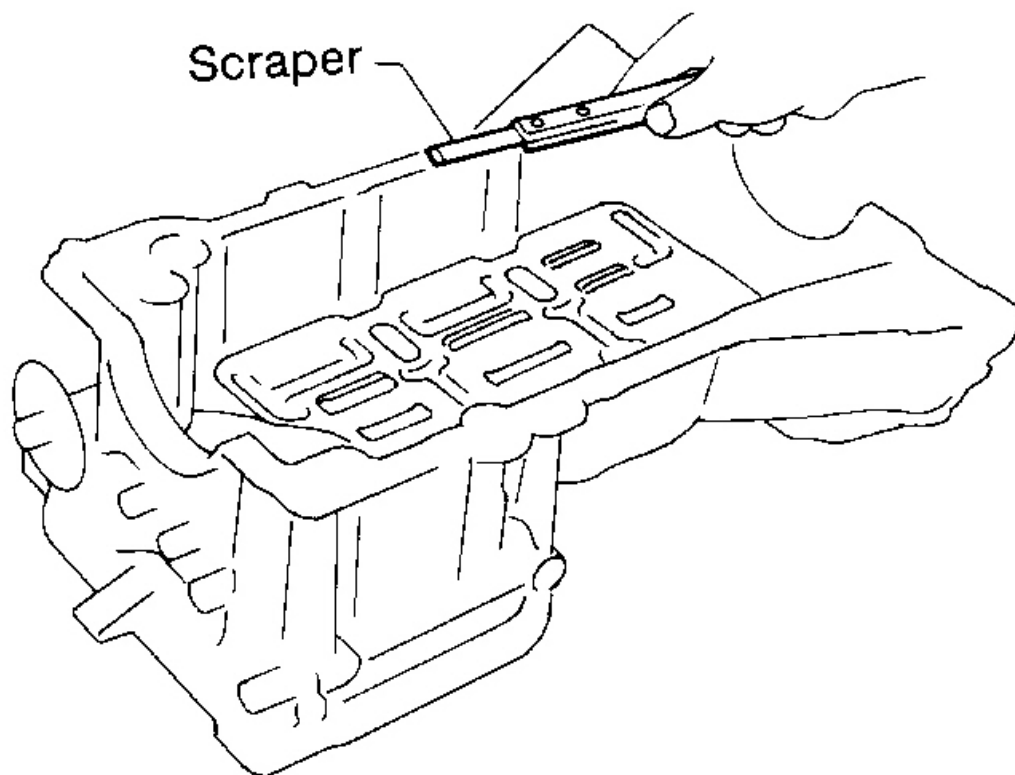


G02090039

Fig. 35: Removing O-Rings From Cylinder Block And Oil Pump Body
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

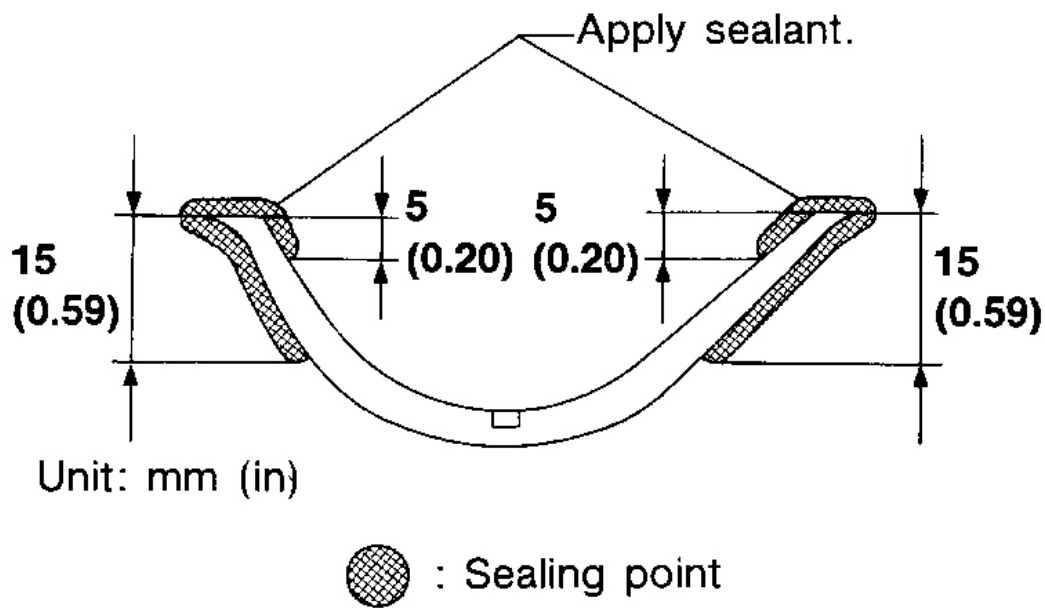
1. Install aluminum oil pan.
 - a. Use a scraper to remove old liquid gasket from mating surfaces.
 - **Also remove old liquid gasket from mating surface of cylinder block, front cover and steel oil pan.**
 - **Remove old liquid gasket from the bolt hole and thread.**



G02090040

Fig. 36: Removing Old Liquid Gasket From Mating Surfaces
Courtesy of NISSAN MOTOR CO., U.S.A.

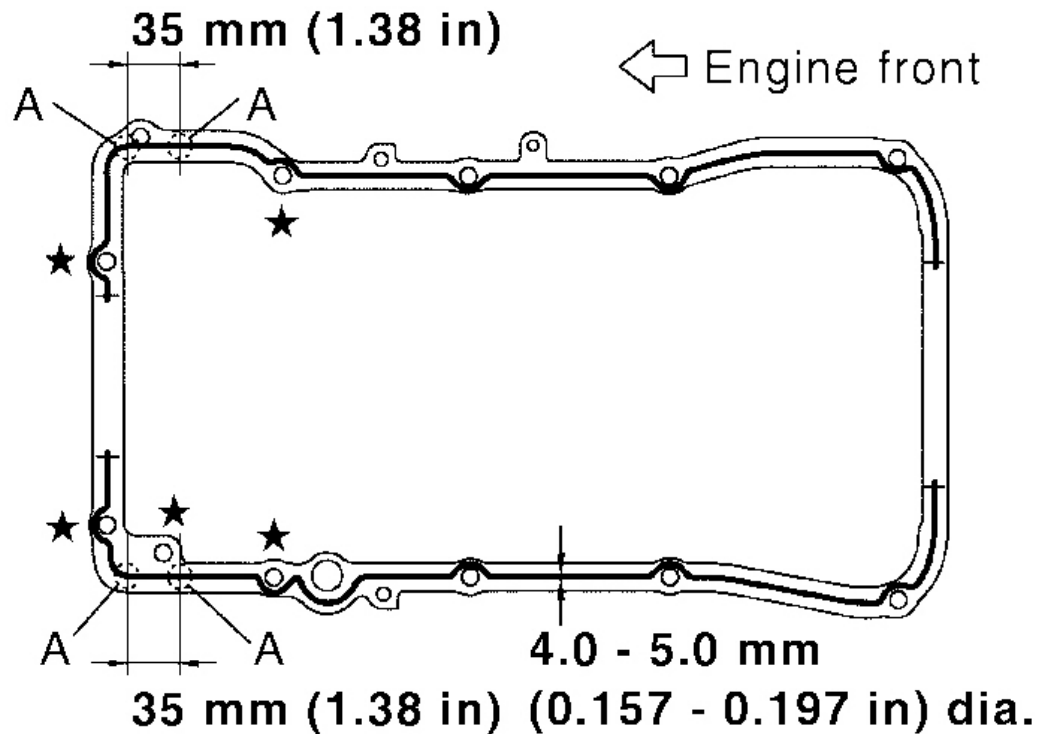
- b. Apply sealant to front cover gasket and rear oil seal retainer gasket.



G02090041

Fig. 37: Applying Sealant To Front Cover Gasket
 Courtesy of NISSAN MOTOR CO., U.S.A.

- c. Apply a continuous bead of liquid gasket to mating surface of aluminum oil pan.
 - **Use Genuine RTV silicone sealant or equivalent.**
- d. Apply liquid gasket to inner sealing surface as shown in figure.
 - **Be sure liquid gasket is 4.0 to 5.0 mm (0.157 to 0.197 in) or 4.5 to 5.5 mm (0.177 to 0.217 in) wide as shown in the figure.**

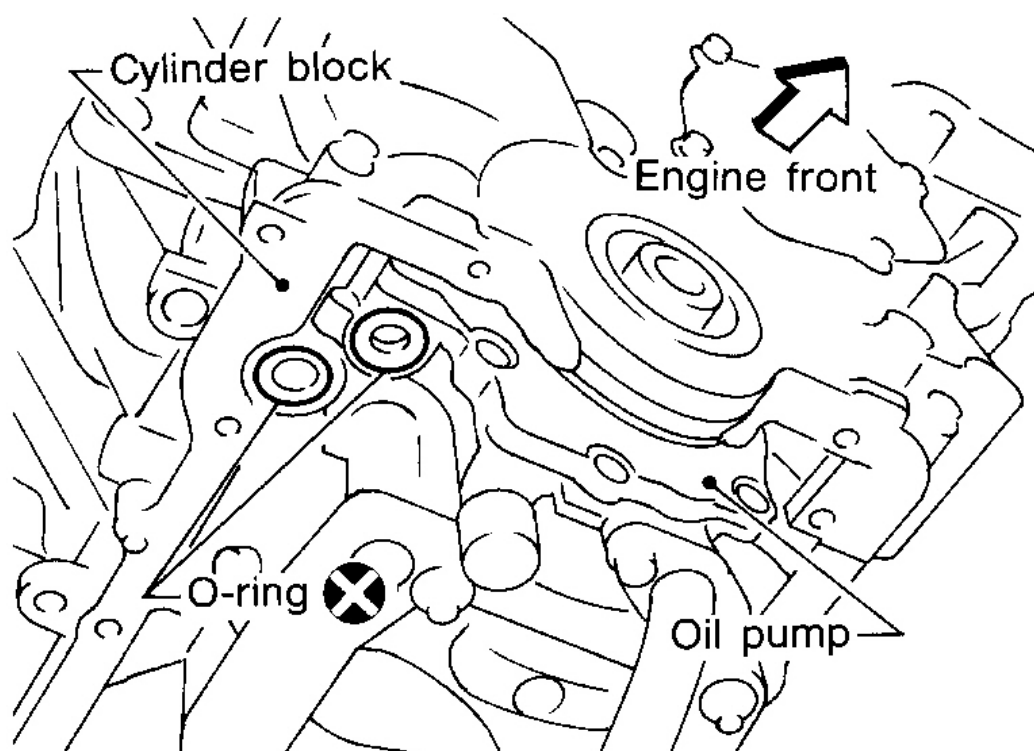


G02090042

Fig. 38: Applying Continuous Bead Of Liquid Gasket To Mating Surface Of Aluminum Oil Pan

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

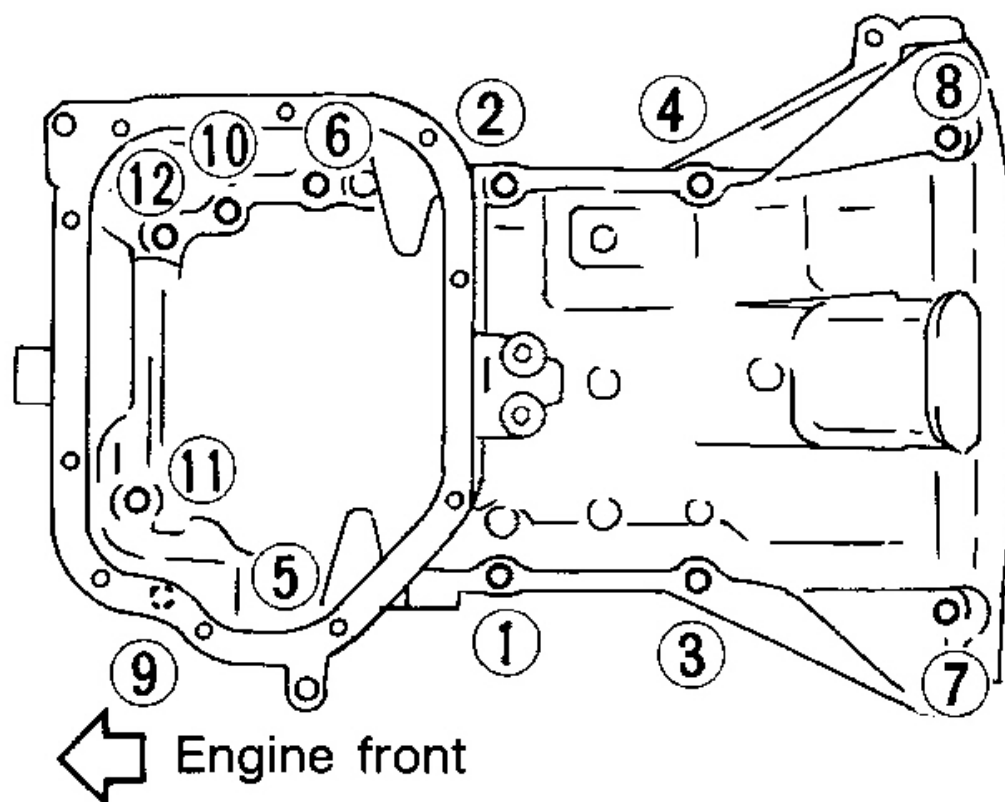
- Apply a bead of 4.5 to 5.5 mm (0.177 to 0.217 in) in diameter to area "A".
 - For bolt holes with * marks (5 locations), apply liquid gasket outside the holes.
 - Assembly should be done within 5 minutes after coating.
- e. Install O-rings, cylinder block and oil pump body.



G02090043

Fig. 39: Installing O-Rings, Cylinder Block And Oil Pump Body
Courtesy of NISSAN MOTOR CO., U.S.A.

- f. Tighten aluminum oil pan.
- Tighten bolts in numerical order.

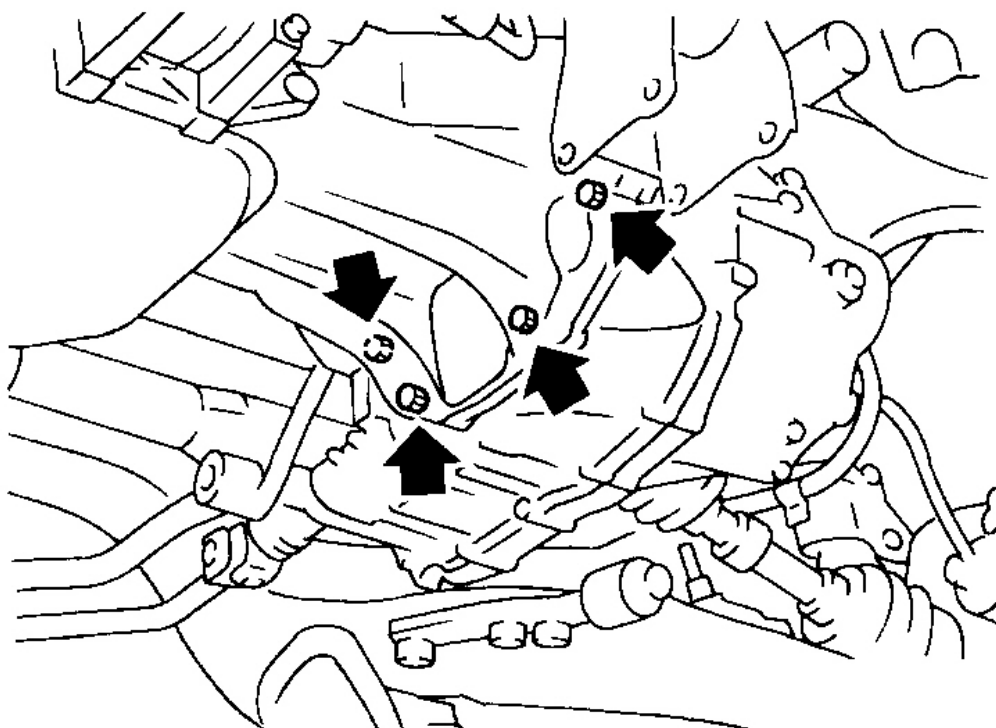


G02090044

Fig. 40: Tightening Bolts

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

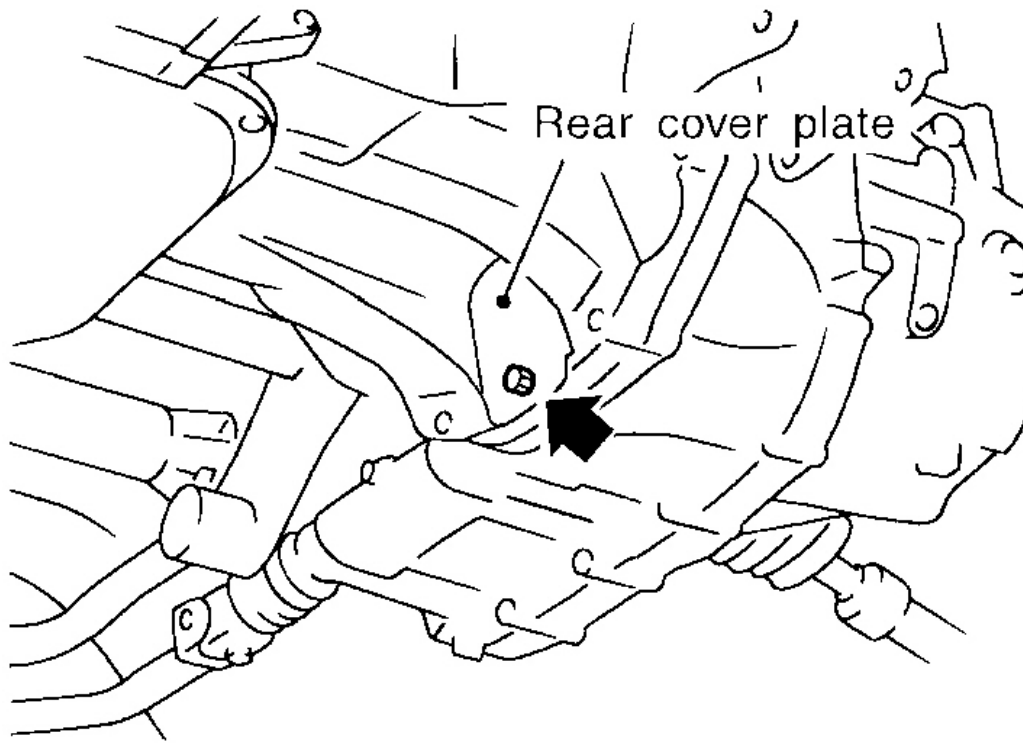
- Wait at least 30 minutes before refilling engine oil.
- g. Install oil cooler, water hoses and pipes.
 2. Install the four engine-to-transaxle bolts. For tightening torque, refer to **INSTALLATION** .



G02090045

Fig. 41: Installing Engine-To-Transaxle Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Install rear cover plate.



G02090046

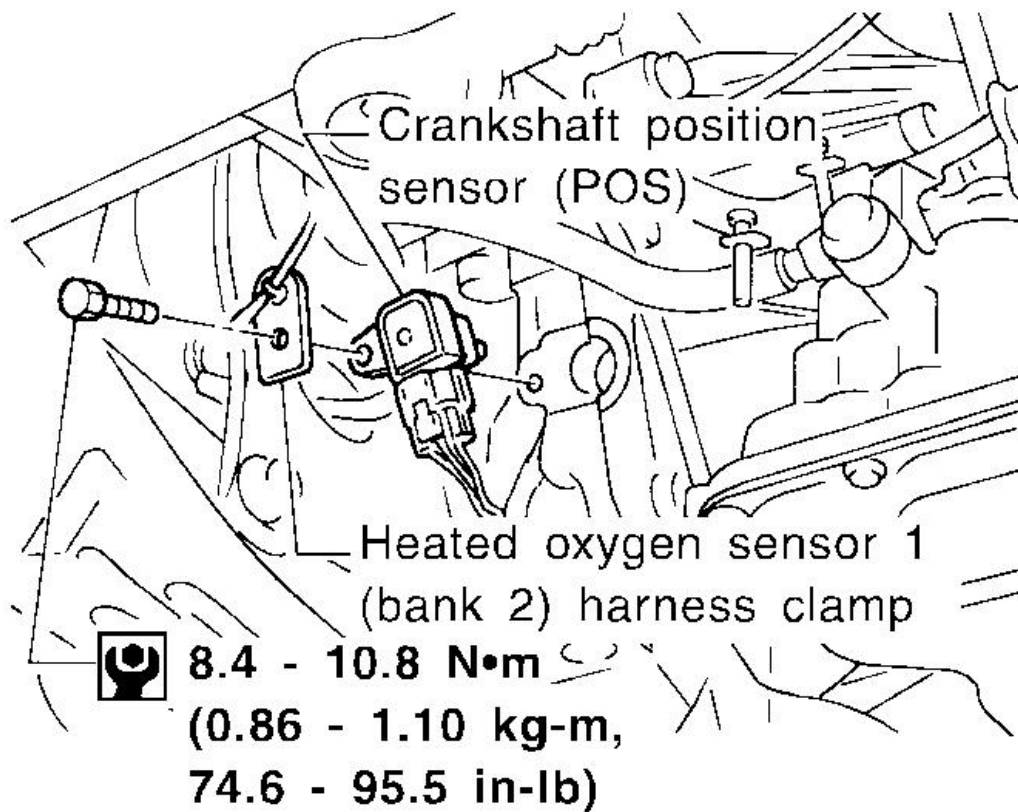
Fig. 42: Installing Rear Cover Plate

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

4. Install air conditioner compressor and bracket.

Refer to **REMOVAL AND INSTALLATION** .

5. Install drive belts.
6. Install center member.
7. Tighten front and rear engine mounting insulator nuts and bolts.
8. Install crankshaft position sensor (POS) with new rubber seal, and heated oxygen sensor 1 (bank 2) harness clamp.
 - **Make sure that crankshaft position sensor (POS) and heated oxygen sensor 1 (bank 2) harness clamp are installed correctly as shown in figure.**
9. Install front exhaust tube and its support.
10. Install oil strainer.

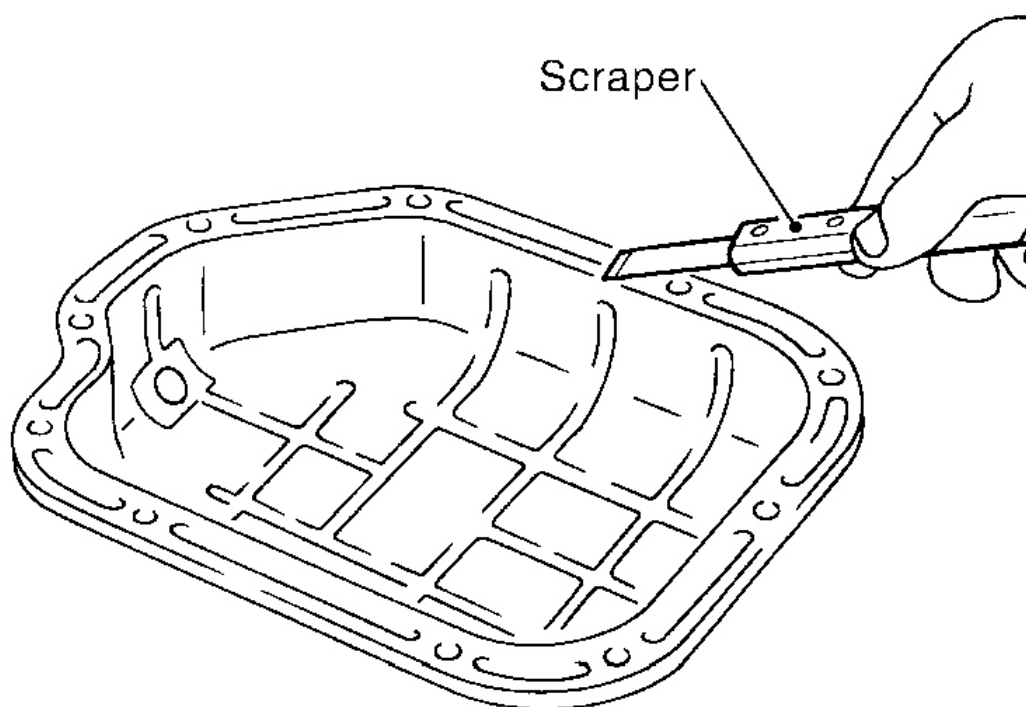


G02090047

Fig. 43: Installing Crankshaft Position Sensor (POS) Rubber Seal, And Heated Oxygen Sensor 1 Harness Clamp (Bank 2)

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

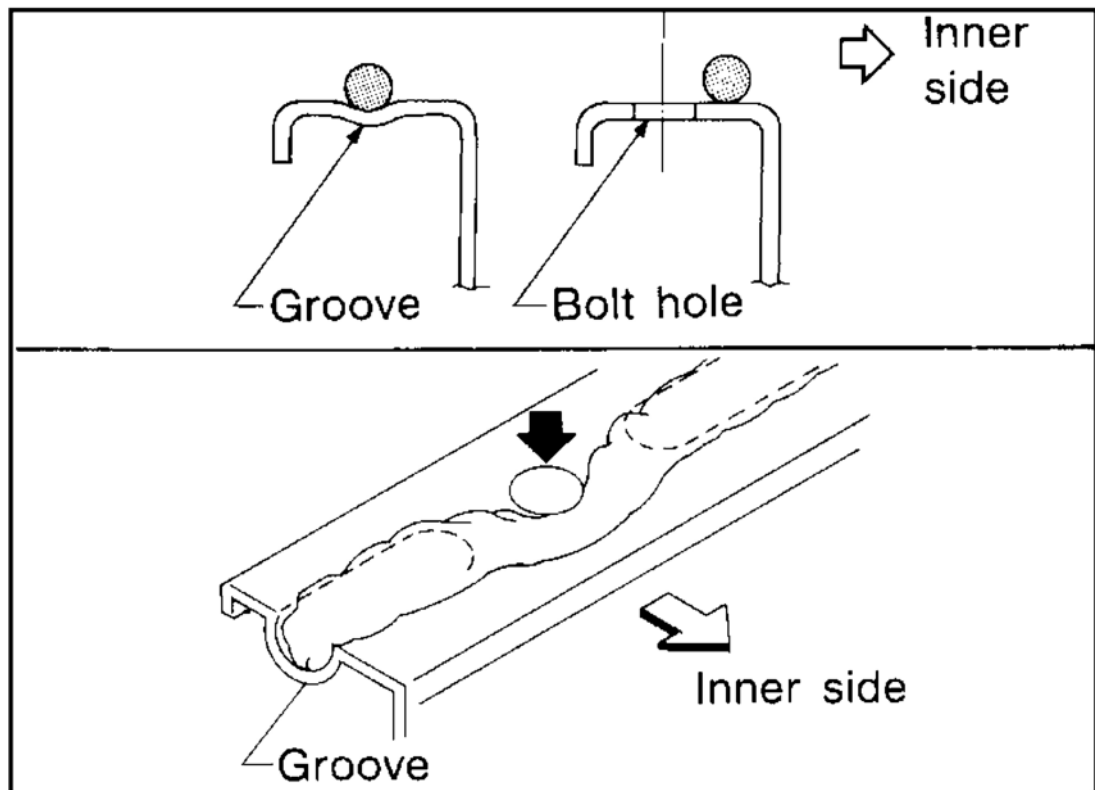
11. Install steel oil pan.
 - a. Use a scraper to remove old liquid gasket from mating surfaces.
 - Also remove old liquid gasket from mating surface of aluminum oil pan.



G02090048

Fig. 44: Removing Old Liquid Gasket
Courtesy of NISSAN MOTOR CO., U.S.A.

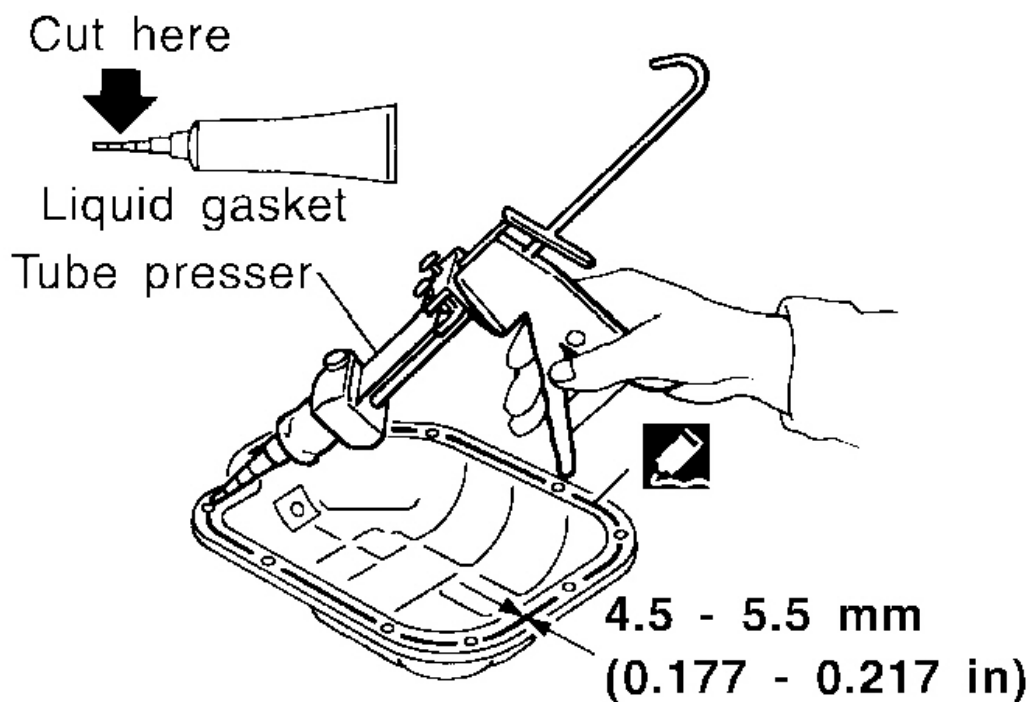
- b. Apply a continuous bead of liquid gasket to mating surface of steel oil pan.
 - Use Genuine RTV silicone sealant or equivalent. .



G02090049

Fig. 45: Applying Continuous Bead
Courtesy of NISSAN MOTOR CO., U.S.A.

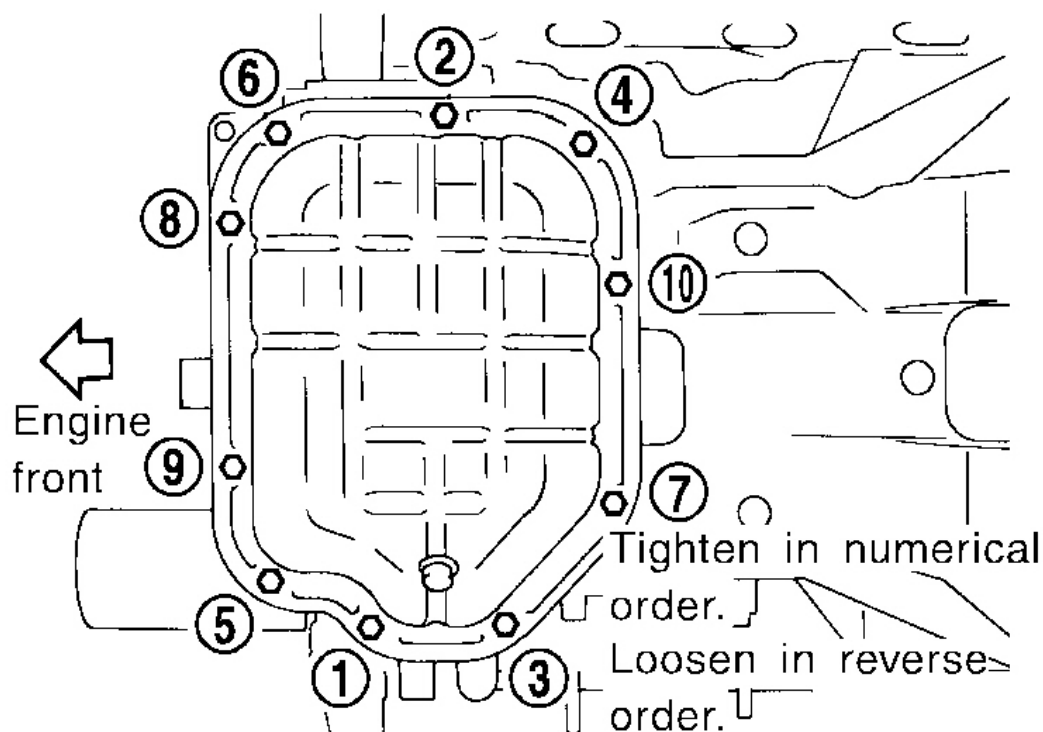
- Be sure liquid gasket is 4.5 to 5.5 mm (0.177 to 0.217 in) wide.
- Assembly should be done within 5 minutes after coating.



G02090050

Fig. 46: Applying Continuous Bead
Courtesy of NISSAN MOTOR CO., U.S.A.

- c. Install steel oil pan.
 - Tighten in numerical order shown in the figure.



G02090051

Fig. 47: Tightening Oil Pan Bolts
 Courtesy of NISSAN MOTOR CO., U.S.A.

- Wait at least 30 minutes before refilling engine oil.
12. Install in the reverse order for steps remain.
- Check oil level after refilling engine oil.
 - Warm engine up and check for oil leakage.

FRONT TIMING CHAIN CASE

REMOVAL

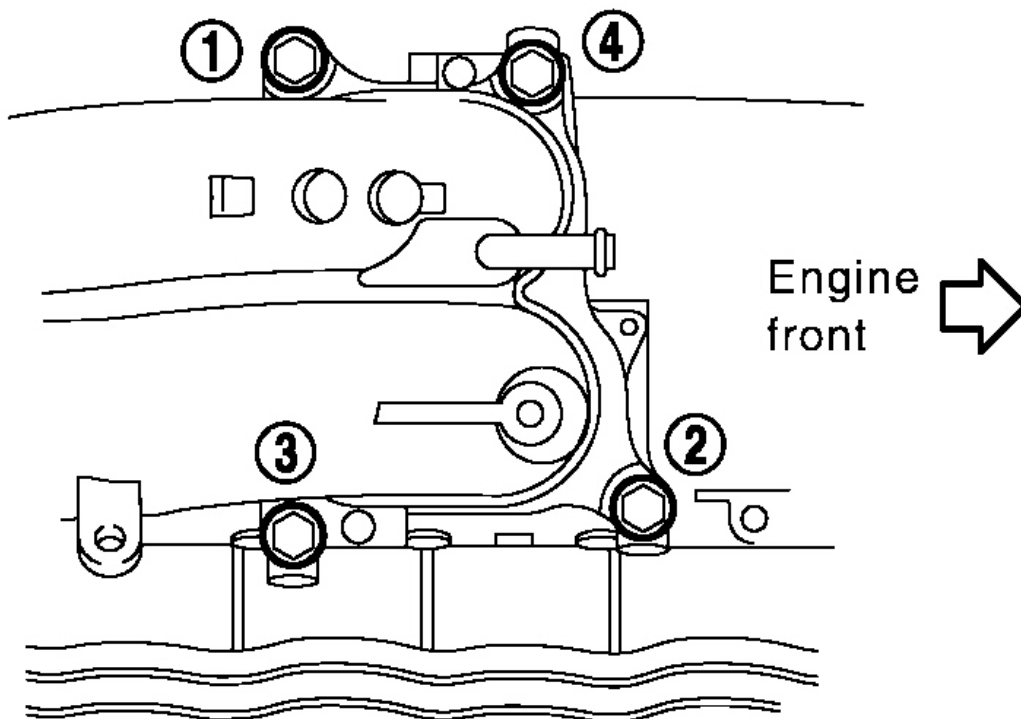
NOTE:

- This section describes removal/installation procedure of front timing chain case and timing-chain-related parts without removing oil pan (upper) on vehicle.
- When oil pan (upper) needs to be removed or installed, or when rear timing chain case is removed or installed, remove oil pans (upper and lower) first. Then remove front timing chain case, timing-chain-related

parts, and rear timing chain case in this order, and install in reverse order of removal. Refer to **TIMING CHAIN**.

- Refer to **TIMING CHAIN** for component parts location.

1. Drain engine oil.
 - To avoid the danger of being scalded, never drain the engine oil when the engine is hot.
2. Drain coolant by removing cylinder block drain plugs.
 - When secondary timing chain is not removed/installed, the steps from 2 to 10 are not required.
3. Remove ornament cover.
4. Remove air duct to intake manifold, collector, PCV hose, vacuum hoses, fuel hoses, harness, connectors and so on.
5. Remove the following.
 - Water hoses
 - EVAP canister purge hose
6. Remove intake manifold upper collectors loosening bolts and nuts in reverse order shown in the figure.

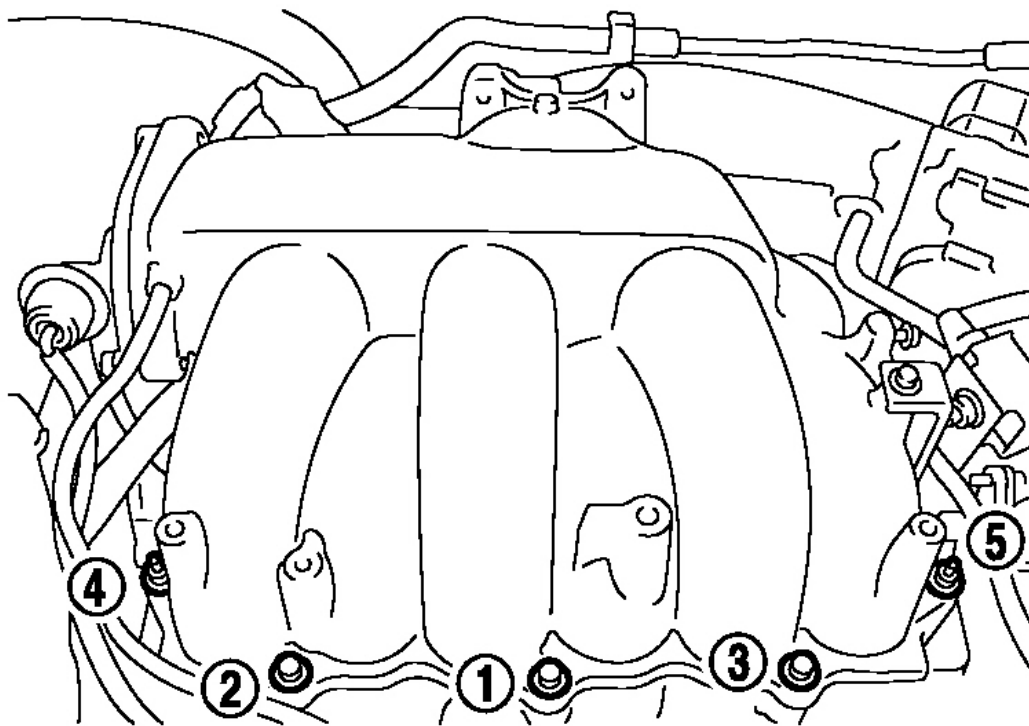


G02090052

Fig. 48: Removing Intake Manifold Upper Collectors

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

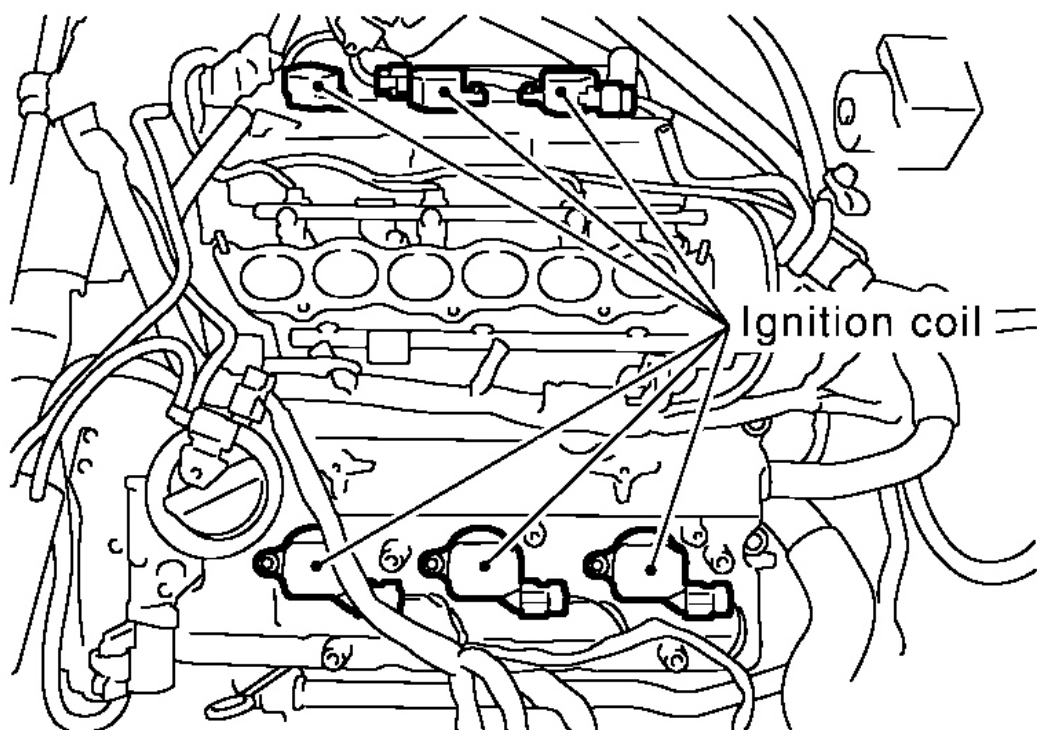
7. Remove intake manifold lower collectors loosening bolts in reverse order shown in the figure.



G02090053

Fig. 49: Removing Intake Manifold Lower Collectors
Courtesy of NISSAN MOTOR CO., U.S.A.

8. Remove RH and LH ignition coils.

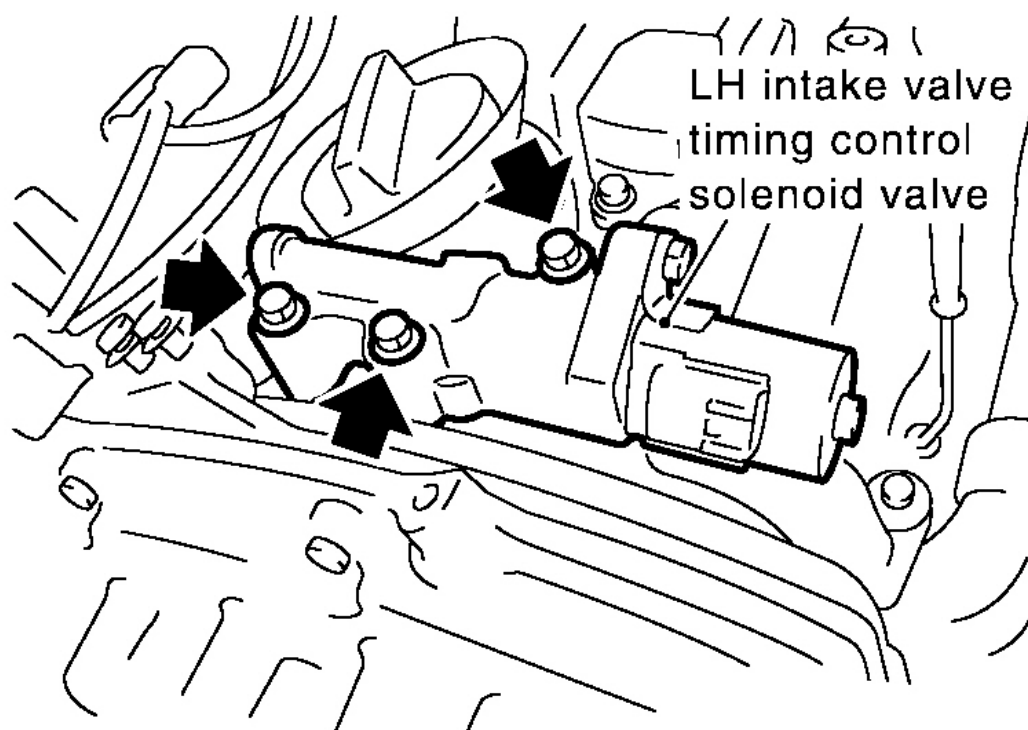


G02090054

Fig. 50: Removing Ignition Coils

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

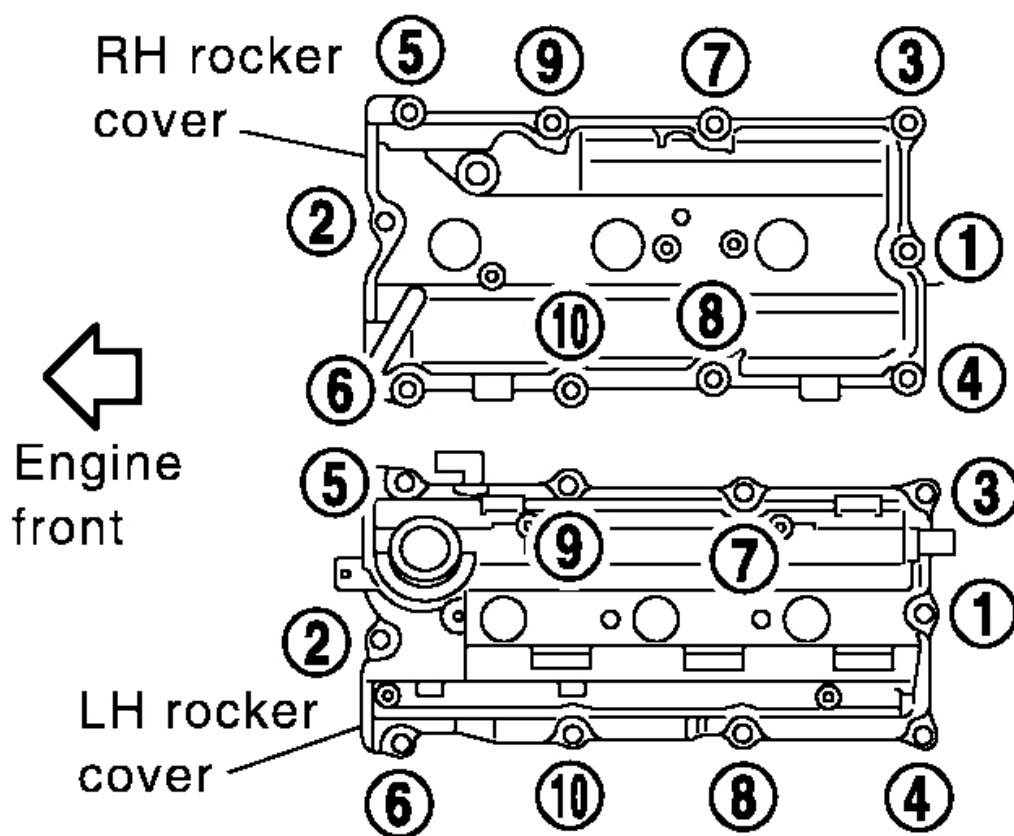
9. Remove RH and LH intake valve timing control solenoid valves.



G02090055

Fig. 51: Removing Bolts And Intake Valve Timing Control Solenoid Valves
Courtesy of NISSAN MOTOR CO., U.S.A.

10. Remove RH and LH rocker covers from cylinder head.
 - Loosen bolts in numerical order shown in the figure.



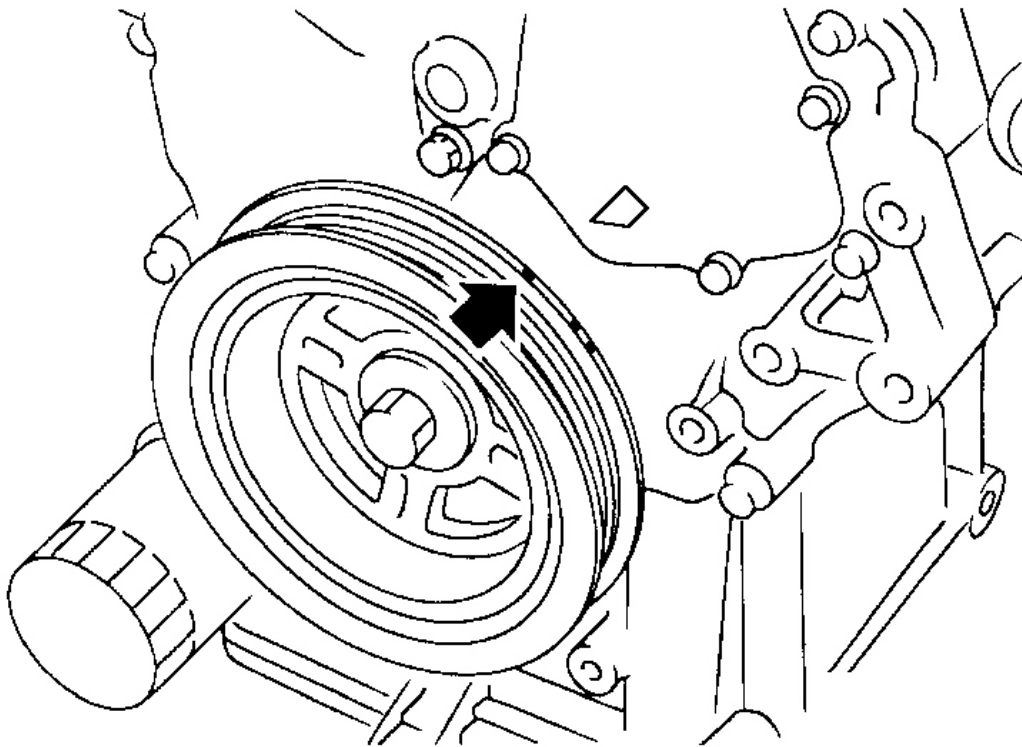
G02090056

Fig. 52: Removing RH And LH Rocker Covers From Cylinder Head
 Courtesy of NISSAN MOTOR CO., U.S.A.

11. Remove engine undercover.
12. Remove front RH wheel and engine side cover.
13. Remove drive belts and idler pulley bracket. See **COMPONENTS**.
14. Remove power steering oil pump assembly.

Refer to **POWER STEERING OIL PUMP** .

15. Remove alternator. Refer to **GENERATOR** .
16. Set No. 1 piston at TDC on the compression stroke by rotating crankshaft.
 - Disregard this step when timing chain removal is not necessary.



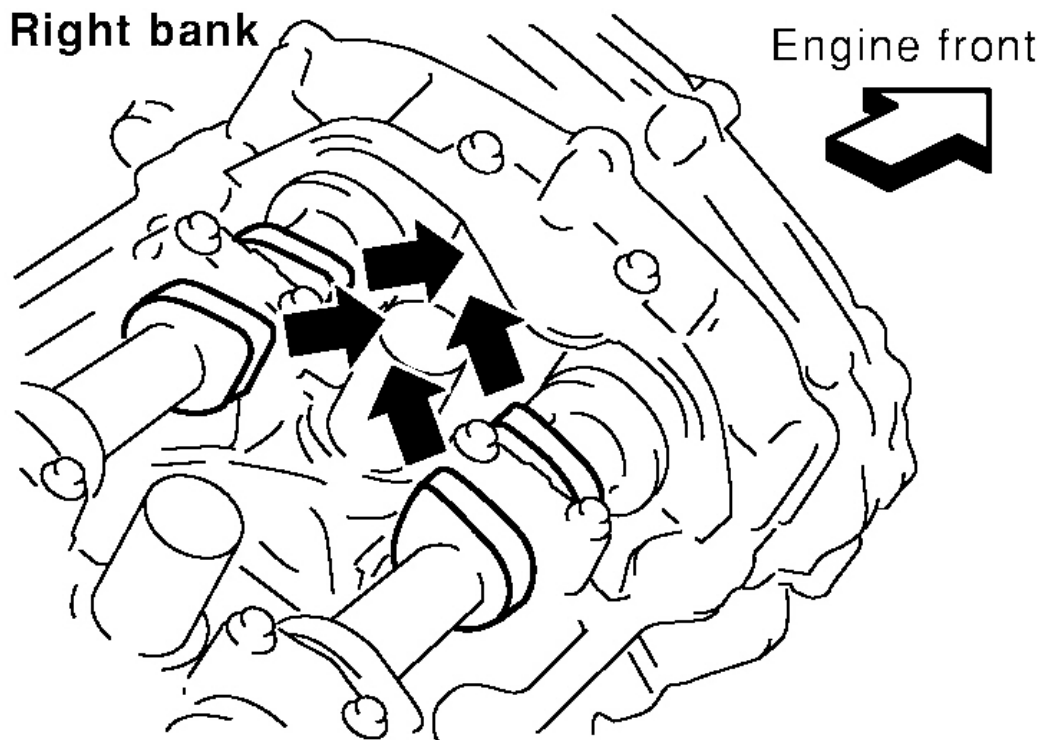
G02090057

Fig. 53: Aligning Piston TDC On Compression Stroke
Courtesy of NISSAN MOTOR CO., U.S.A.

- Check that intake and exhaust cam nose on No. 1 cylinder are located as shown.

If not, turn the crankshaft one revolution (360°) and align as shown.

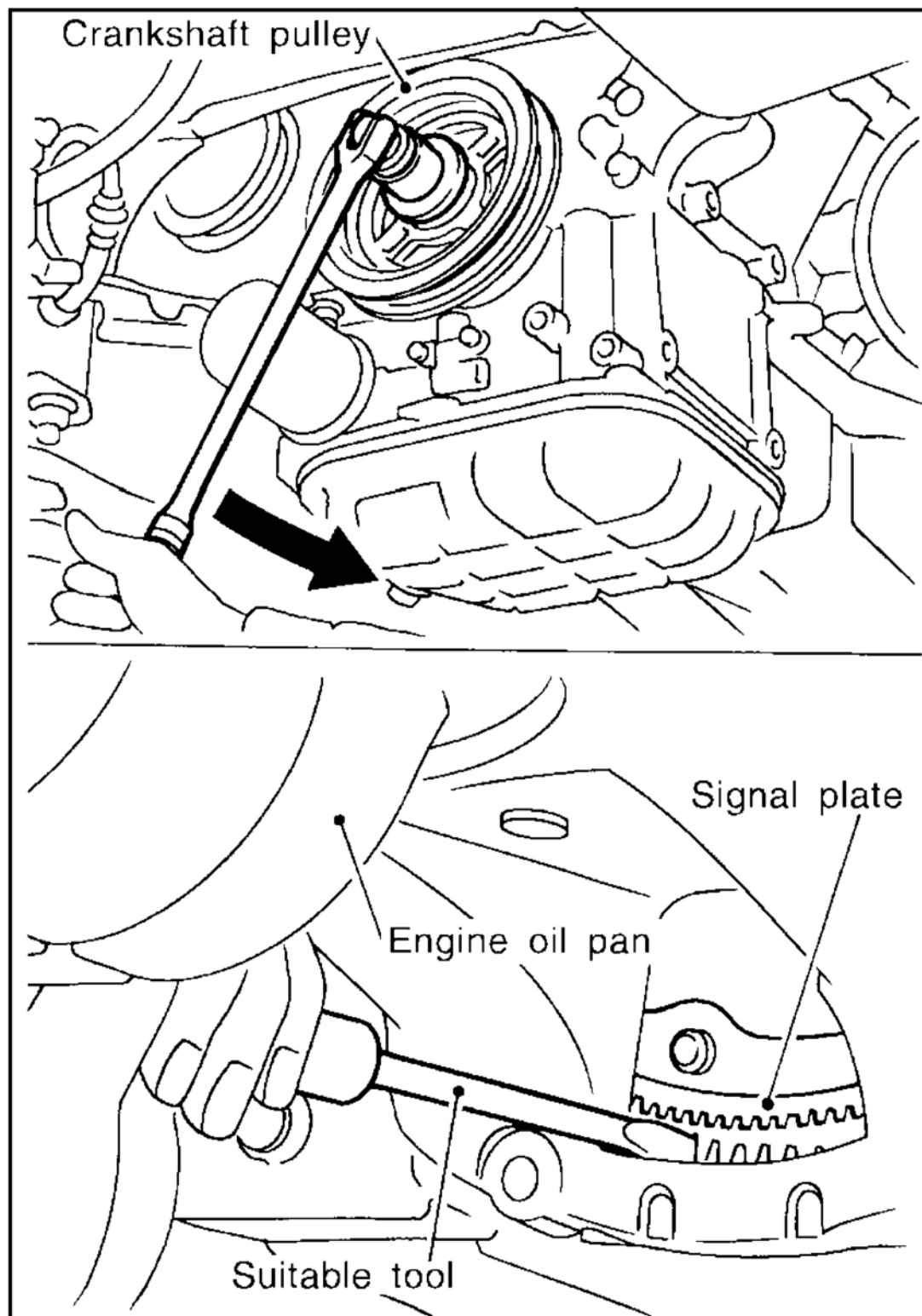
When only primary timing chain is removed, rocker cover does not need to be removed. To confirm that No. 1 cylinder is at its compression TDC, remove front timing chain case first. Then check mating marks on camshaft sprockets. Refer to **INSTALLATION**.



G02090058

Fig. 54: Aligning Intake And Exhaust Cam
Courtesy of NISSAN MOTOR CO., U.S.A.

17. Loosen crankshaft pulley bolt. (At this time remove oil pan rear cover plate and set a suitable tool to ring gear so that crankshaft cannot rotate.)
 - Be careful not to damage the signal plate teeth.

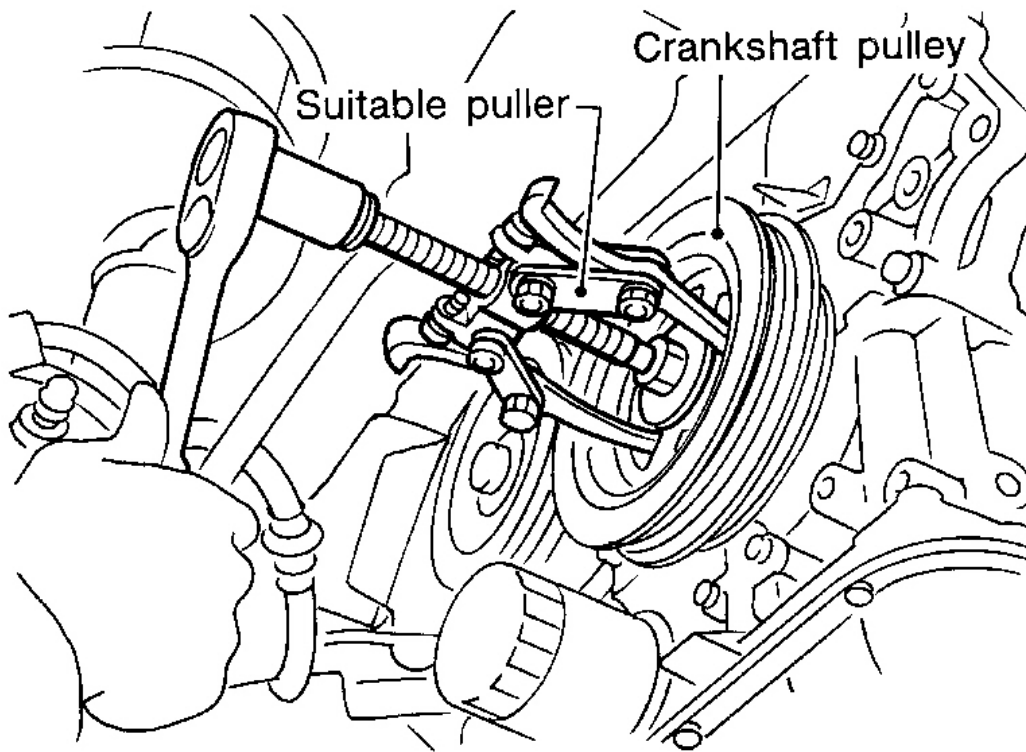


G02090059

Fig. 55: Removing Crankshaft Pulley Bolt Using Suitable Tool

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

18. Remove crankshaft pulley with a suitable puller.
19. Remove steel oil pan. Refer to **REMOVAL**.



G02090060

Fig. 56: Removing Crankshaft Pulley Using Suitable Puller

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

20. Loosen bolts in reverse order shown in figure, and remove installation bolts at the front of aluminum oil pan.
21. Install steel oil pan temporarily.
22. Support steel oil pan bottom with a transmission jack.
 - Perform following operations with engine front-side supported with jack.
23. Remove center member assembly.
24. Remove intake valve timing control covers.
 - Loosen bolts in reverse order shown in the figure.

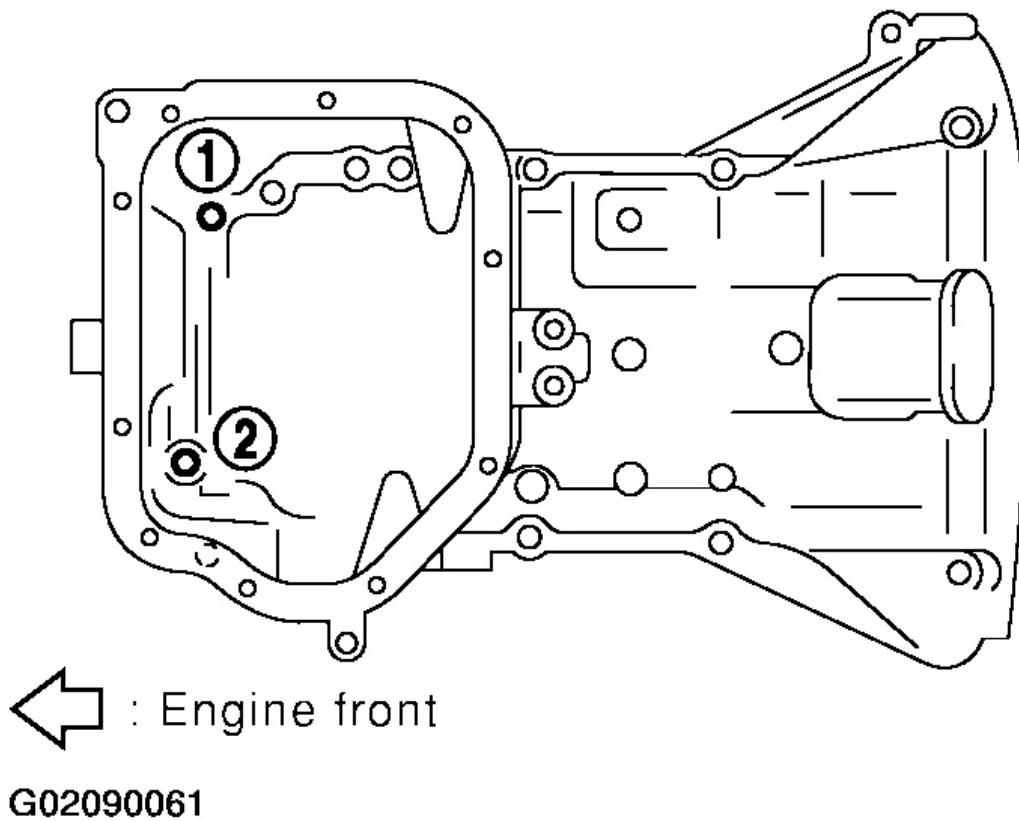
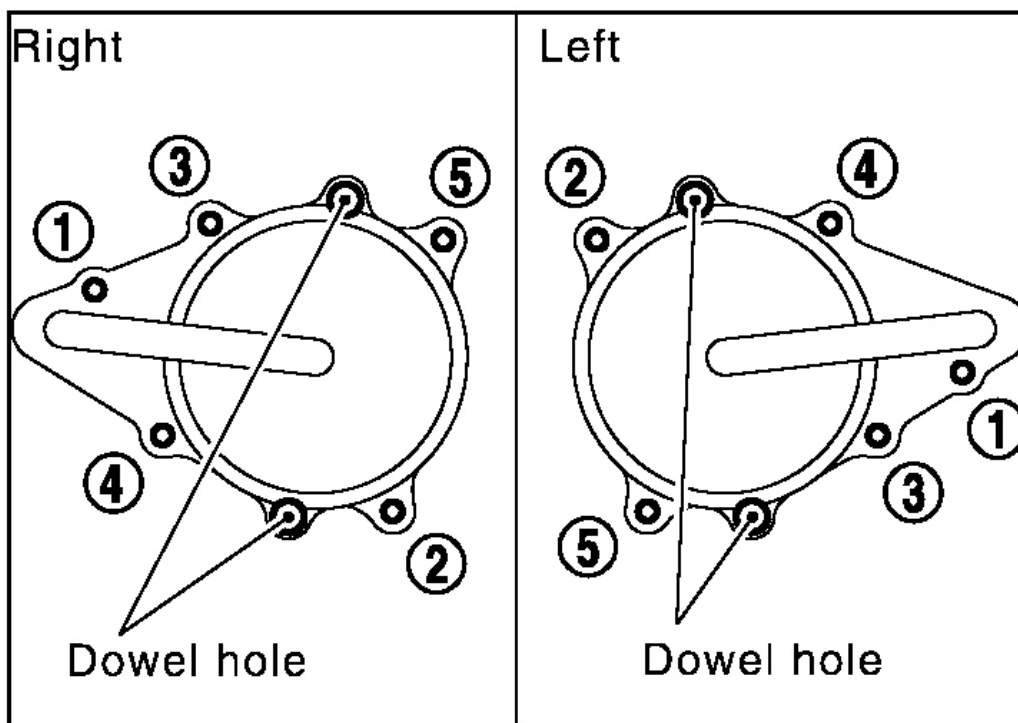


Fig. 57: Removing Bolts

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

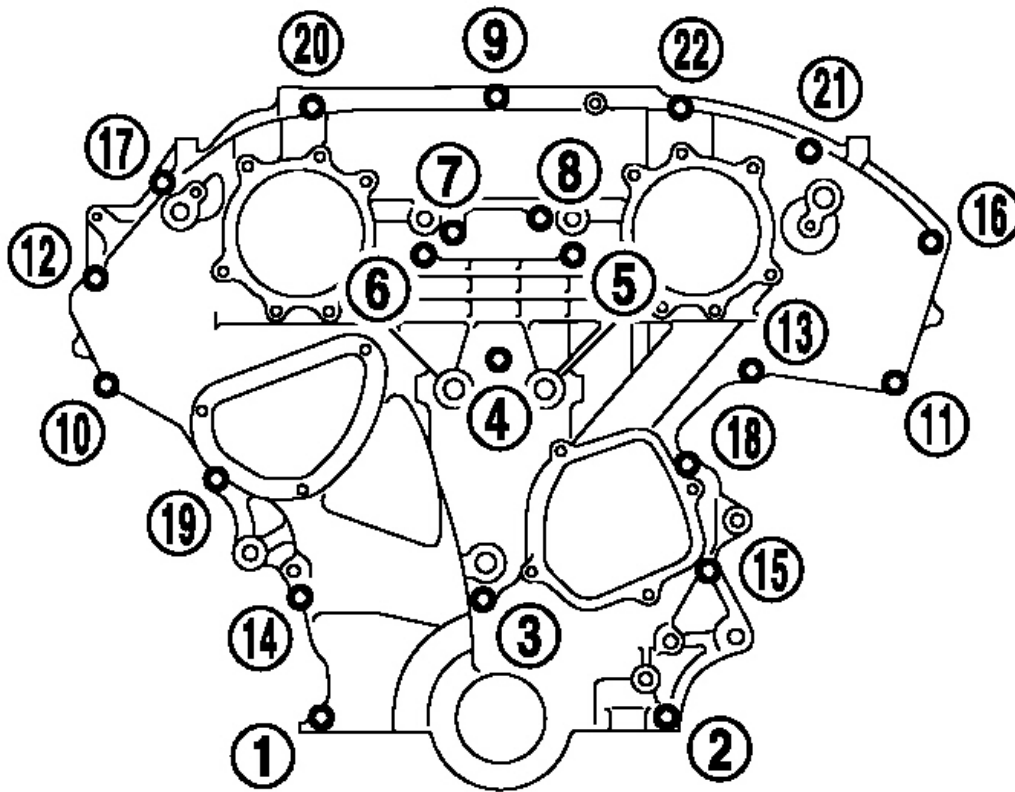
- In the cover, the shaft is engaged with the center hole of the intake camshaft sprocket. Remove it straight out until the engagement comes off.
25. Remove right side engine mounting, mounting bracket and nuts. Refer to **REMOVAL AND INSTALLATION**.
 26. Raise engine front-side with jack. (This secures workspace to remove front timing chain case.)



G02090062

Fig. 58: Identifying Dowel Hole (Right And Left)
Courtesy of NISSAN MOTOR CO., U.S.A.

27. Loosen front timing chain case bolts in reverse order shown in the figure.



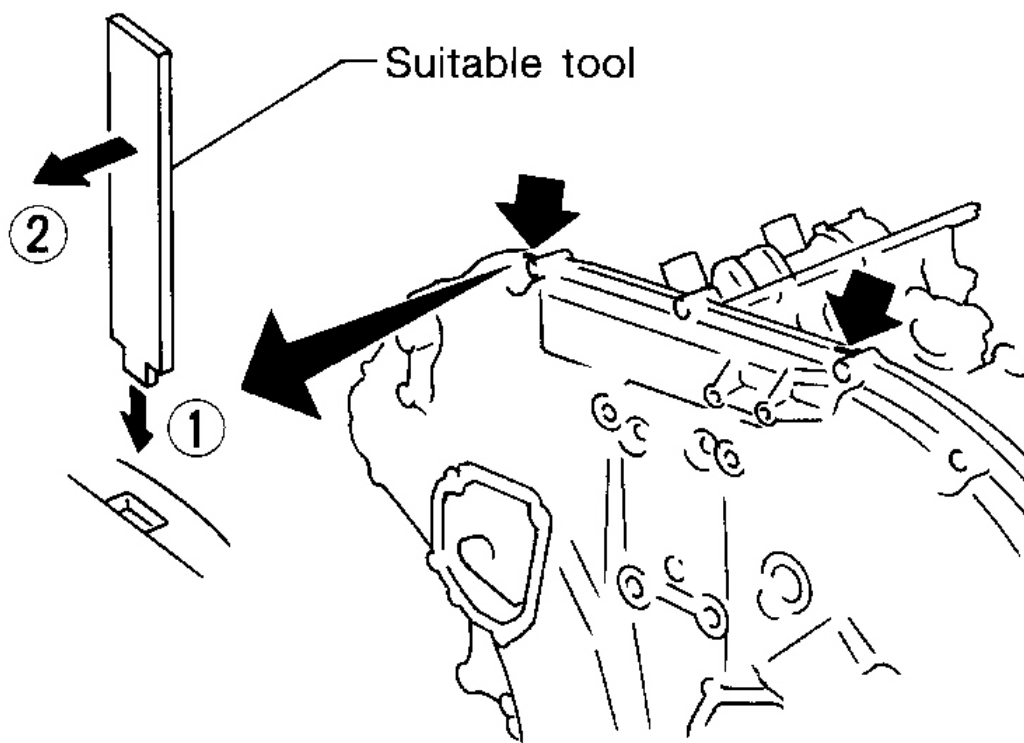
G02090063

Fig. 59: Removing Timing Chain Case Bolts
 Courtesy of NISSAN MOTOR CO., U.S.A.

28. Remove front timing chain case.
 - a. Insert the appropriate size tool into the notch at the top of the front timing chain case as shown (1).
 - b. Pry off the case by moving the tool as shown (2).
 - Use seal cutter (special service tool) or an equivalent tool to cut liquid gasket for removal.

CAUTION:

- Do not use screwdrivers or something similar.
- After removal, handle it carefully so it does not tilt, cant, or warp under a load.



G02090064

Fig. 60: Prying Front Timing Chain Case
 Courtesy of NISSAN MOTOR CO., U.S.A.

29. Remove water pump cover and timing chain tensioner cover from front timing chain case.
 - Use seal cutter (special service tool) or an equivalent tool to cut liquid gasket for removal.
30. Remove front oil seal from front timing chain case.

Refer to **FRONT OIL SEAL**.

31. Remove timing chain and related parts. Refer to **TIMING CHAIN**.

INSTALLATION

1. Install timing chain and related parts. Refer to **TIMING CHAIN**.
2. Remove residual gasket from front timing chain case and liquid-gasket mating surface.

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

3. Hammer dowel pins (right and left) into front timing chain case up to a point close to taper in order to shorten protrusion length.

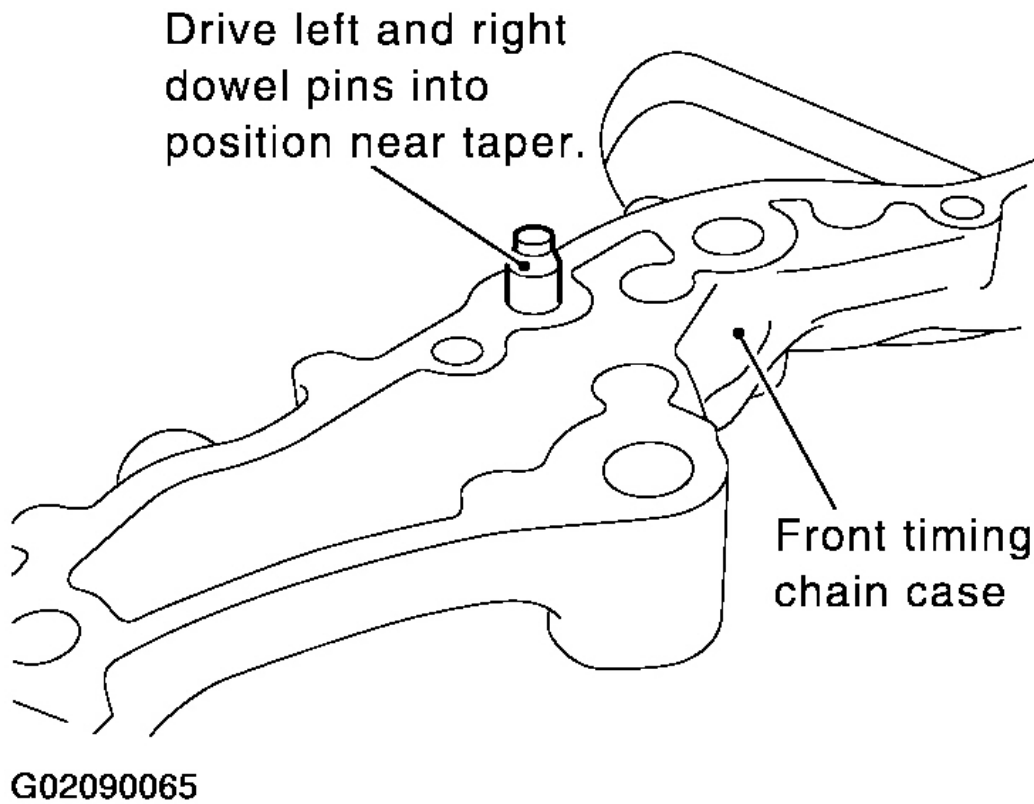
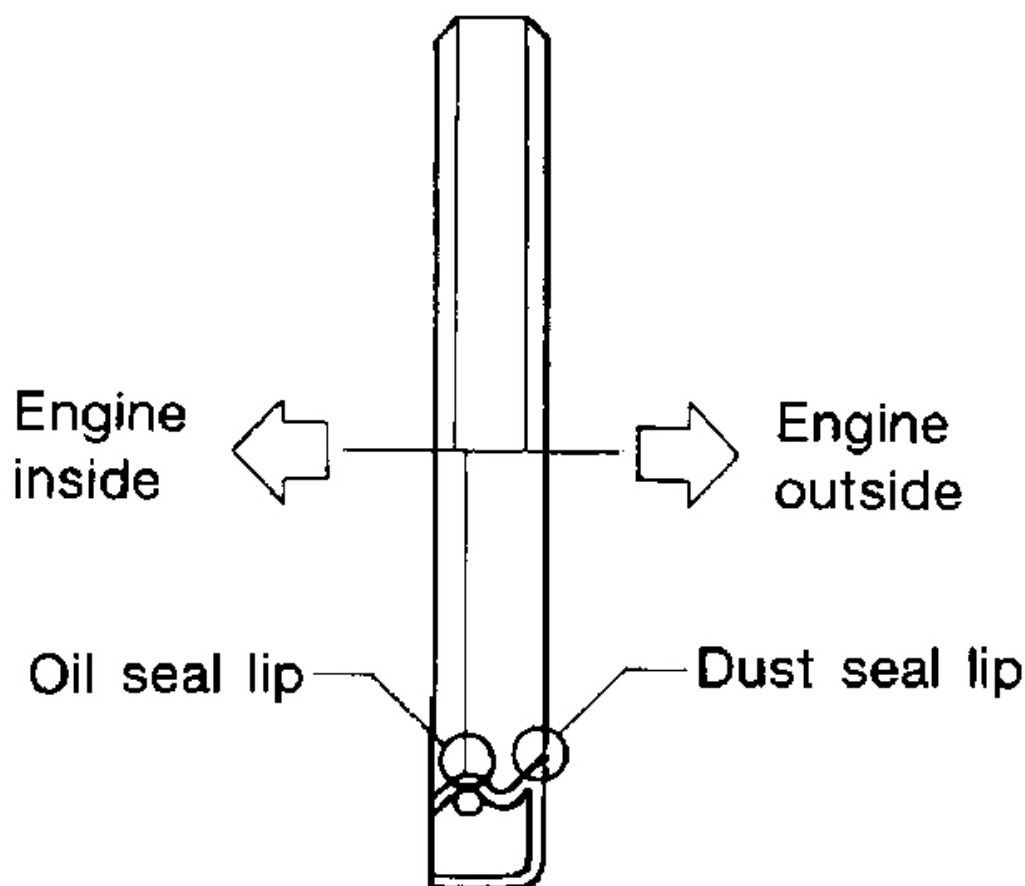


Fig. 61: Identifying Dowel Pins (Right And Left)
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Install the front oil seal on the front timing chain case. Apply new engine oil to the oil seal edges.
 - Install it so that each seal lip is oriented as shown in figure.

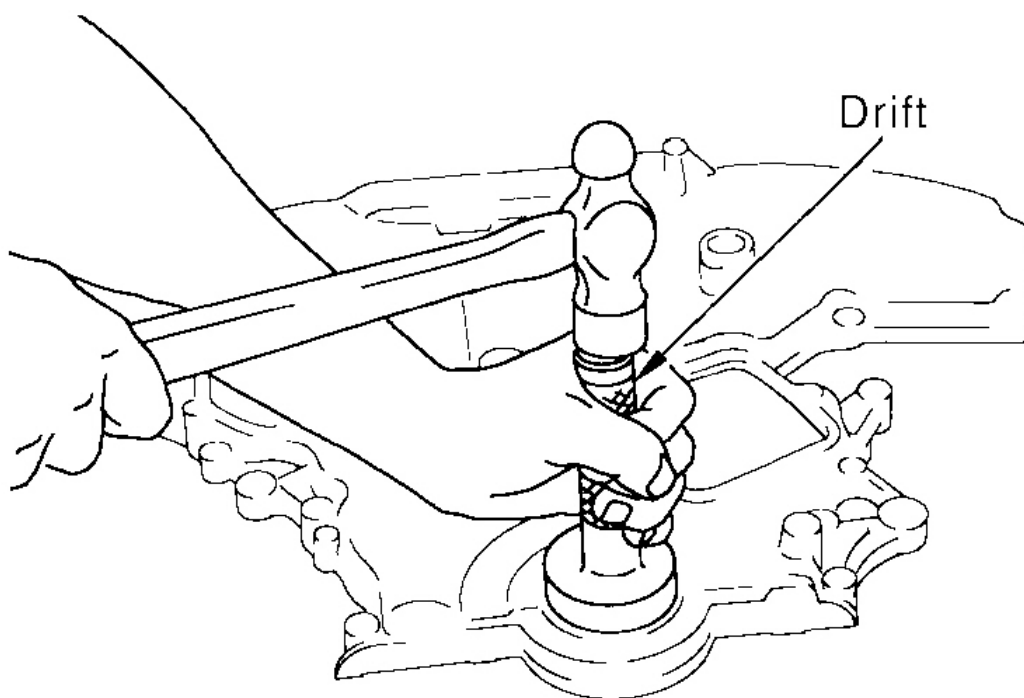


G02090066

Fig. 62: Identifying Front Oil Seal Lip

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

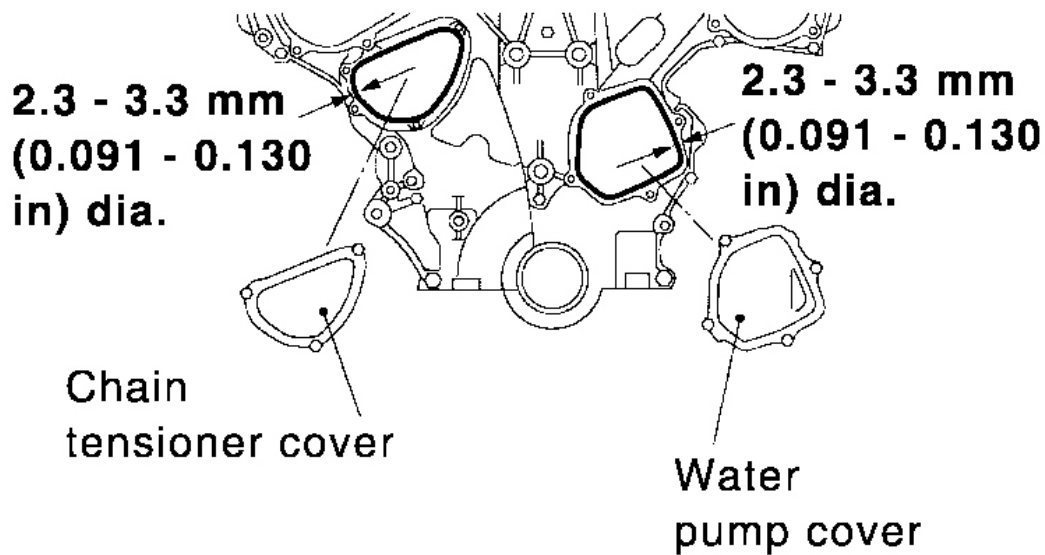
- Using a suitable drift, press-fit oil seal until it becomes flush with front timing chain case end face.
- Make sure the garter spring is in position and seal lip is not inverted.



G02090067

Fig. 63: Pressing Oil Seal Using Suitable Drift
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Install the water pump cover and the chain tensioner cover to front timing chain case cover.
 - Apply RTV Silicone Sealant or equivalent.

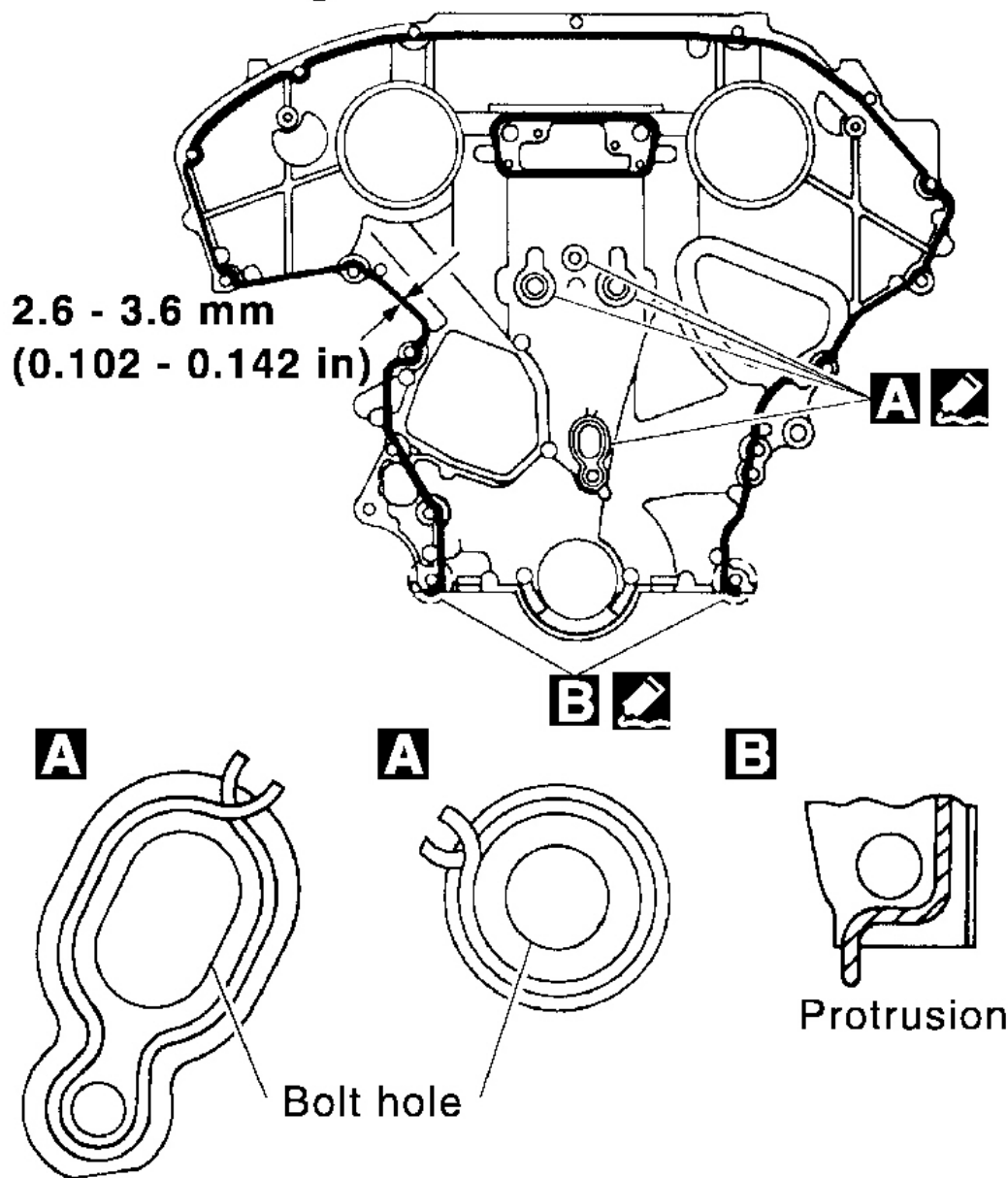


G02090068

Fig. 64: Installing Water Pump Cover And Chain Tensioner Cover
Courtesy of NISSAN MOTOR CO., U.S.A.

6. Install front timing chain case as follows:
 - a. Apply liquid gasket to front timing chain case back side as shown.
 - b. Install dowel pin on the rear timing chain case into dowel pin hole on front timing chain case.

Front timing chain case



Sealant protrusion away from bolt hole

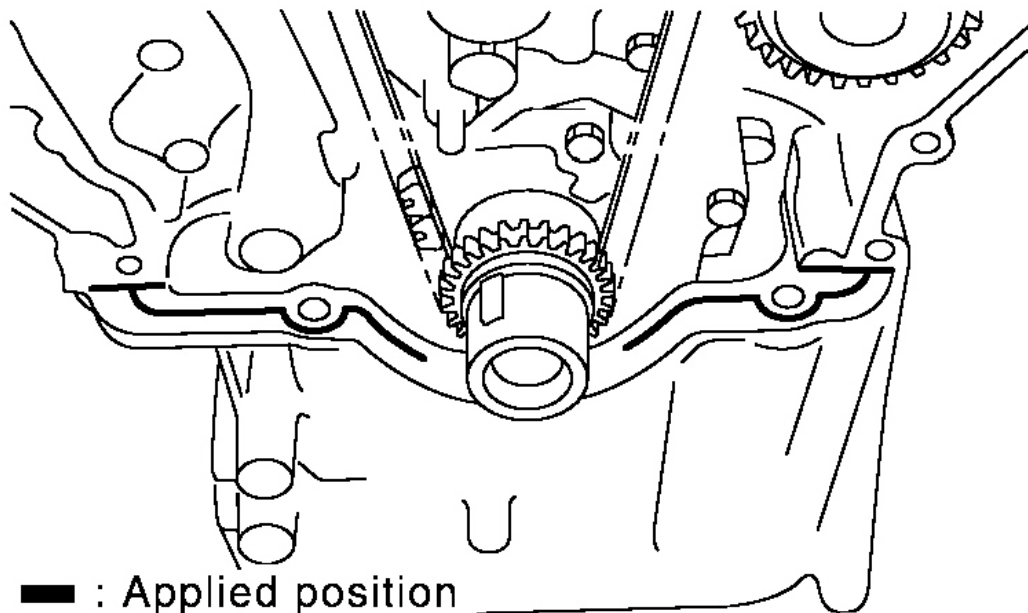


: Apply liquid gasket (Use Genuine RTV silicone sealant or equivalent. Refer to GI section.)

G02090069

Fig. 65: Applying Liquid Gasket To Front Timing Chain Case
Courtesy of NISSAN MOTOR CO., U.S.A.

7. Apply liquid gasket to top surface of oil pan (upper) as shown in figure.
 - Use Genuine RTV Silicone Sealant or equivalent.



3.5 - 4.5 mm

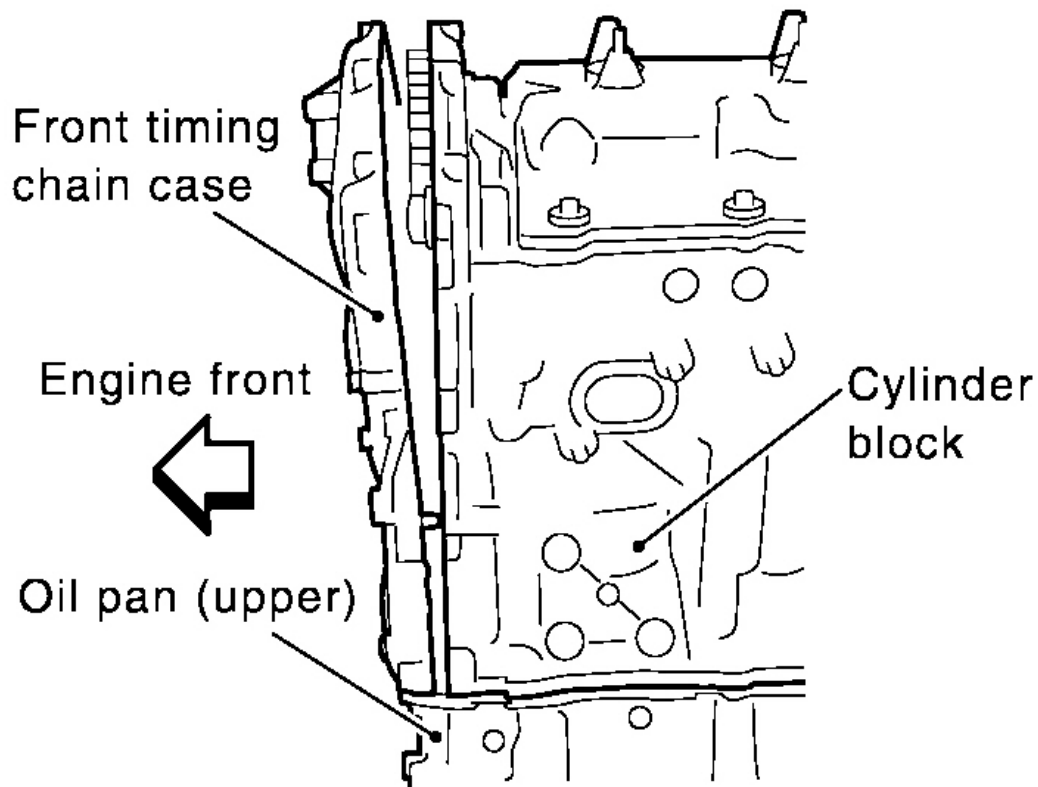
(0.138 - 0.177 in) dia.

G02090070

Fig. 66: Applying Liquid Gasket To Top Surface Of Oil Pan (Upper)
Courtesy of NISSAN MOTOR CO., U.S.A.

8. As shown in figure, assemble front timing chain case.
 - a. Fit lower end of front timing chain case tightly onto top face of oil pan (upper). From the fitting point, make entire front timing chain case contact rear timing chain case completely.

CAUTION: Be careful that oil pan gasket is in place.



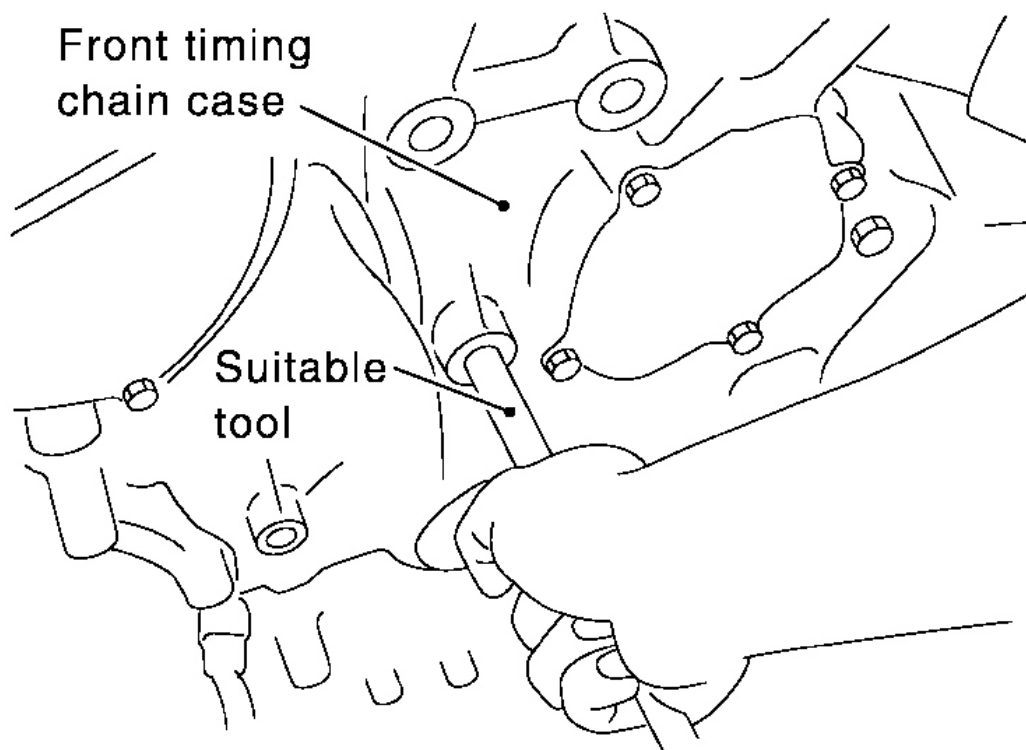
G02090071

Fig. 67: Installing Lower End Of Front Timing Chain Case
Courtesy of NISSAN MOTOR CO., U.S.A.

- b. While pressing front timing chain case from its front and top as shown in figure, install bolts and temporarily tighten them.

For bolt length and positions, refer to the step 9.

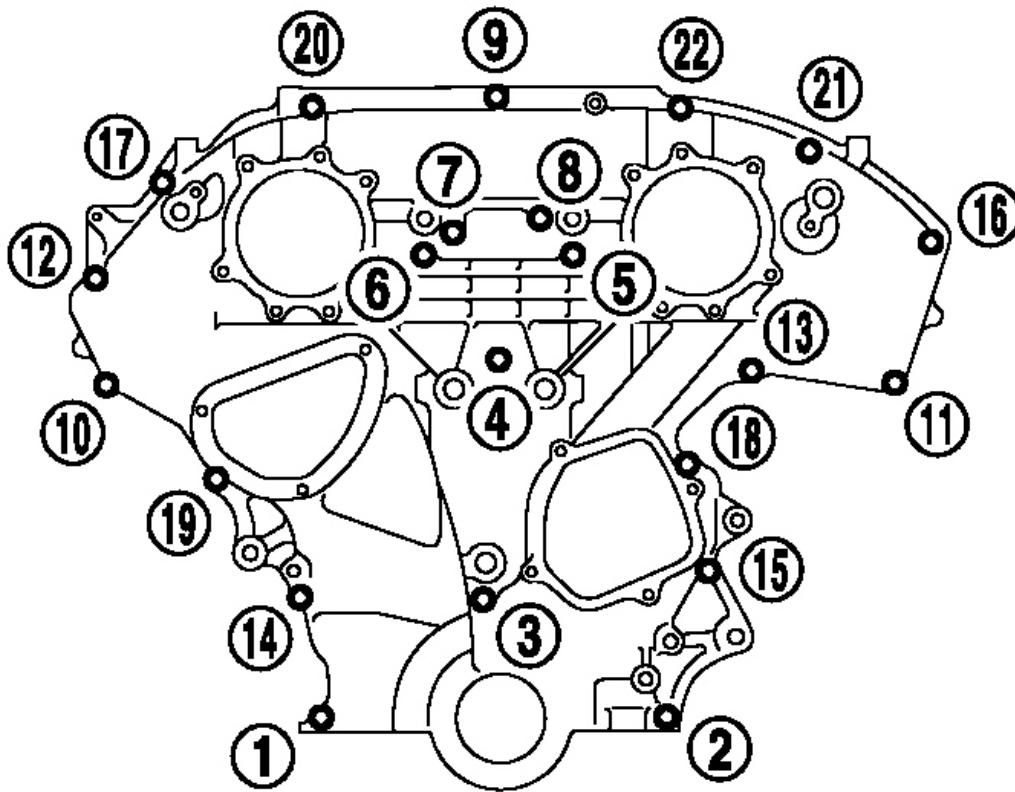
- c. Hammer dowel pin until the outer end becomes flush with surface.



G02090072

Fig. 68: Pressing Front Timing Chain Case
Courtesy of NISSAN MOTOR CO., U.S.A.

9. Tighten bolts to the specified torque in order shown in the figure.
 8 mm (0.31 in) dia. bolts: 1, 2
 6 mm (0.24 in) dia. bolts: Except the above
 - After tightening, retighten them to specified torque in numerical order shown in figure.



G02090073

Fig. 69: Tightening Front Timing Chain Case Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

10. Tighten two mounting bolts in front of oil pan (upper) in numerical order shown in figure.
: 15.7 - 18.6 N.m (1.6 - 1.9 kg-m, 12 - 13 ft-lb)

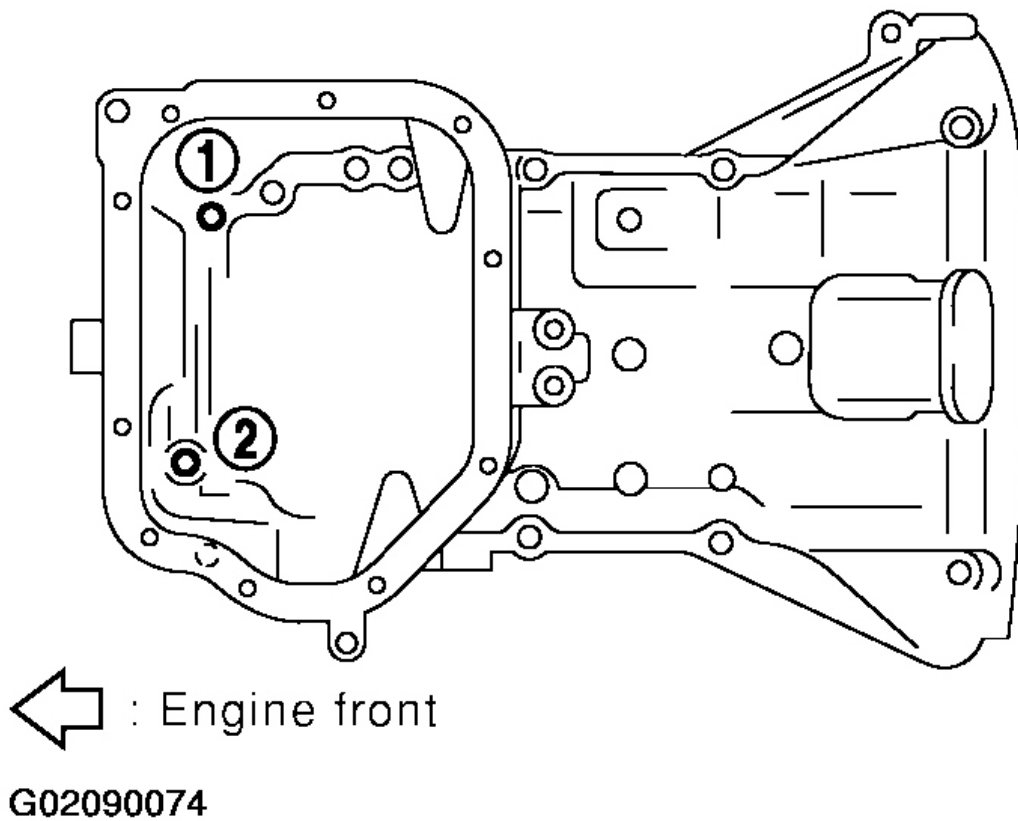
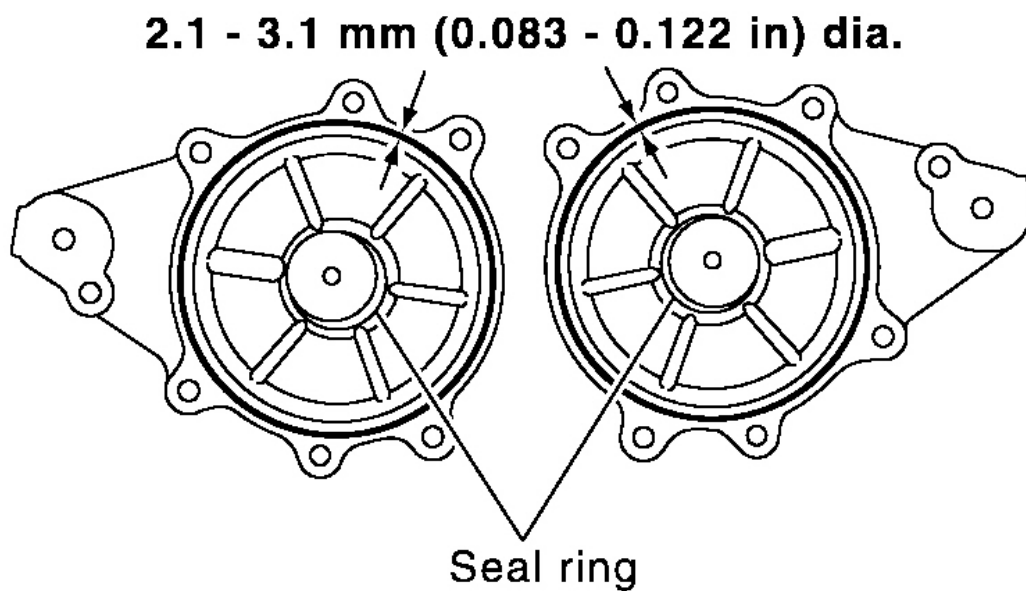


Fig. 70: Tightening Front Of Oil Pan Bolts (Upper)
Courtesy of NISSAN MOTOR CO., U.S.A.

11. Install RH and LH intake valve timing control covers as follows:
 - a. Install seal rings in shaft grooves.
 - b. Apply liquid gasket to the intake valve timing control covers.
 - Use Genuine RTV Silicone Sealant or equivalent.



G02090075

Fig. 71: Identifying Seal Ring

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

- c. Install collared O-ring in front timing chain case oil hole (LH and RH sides).

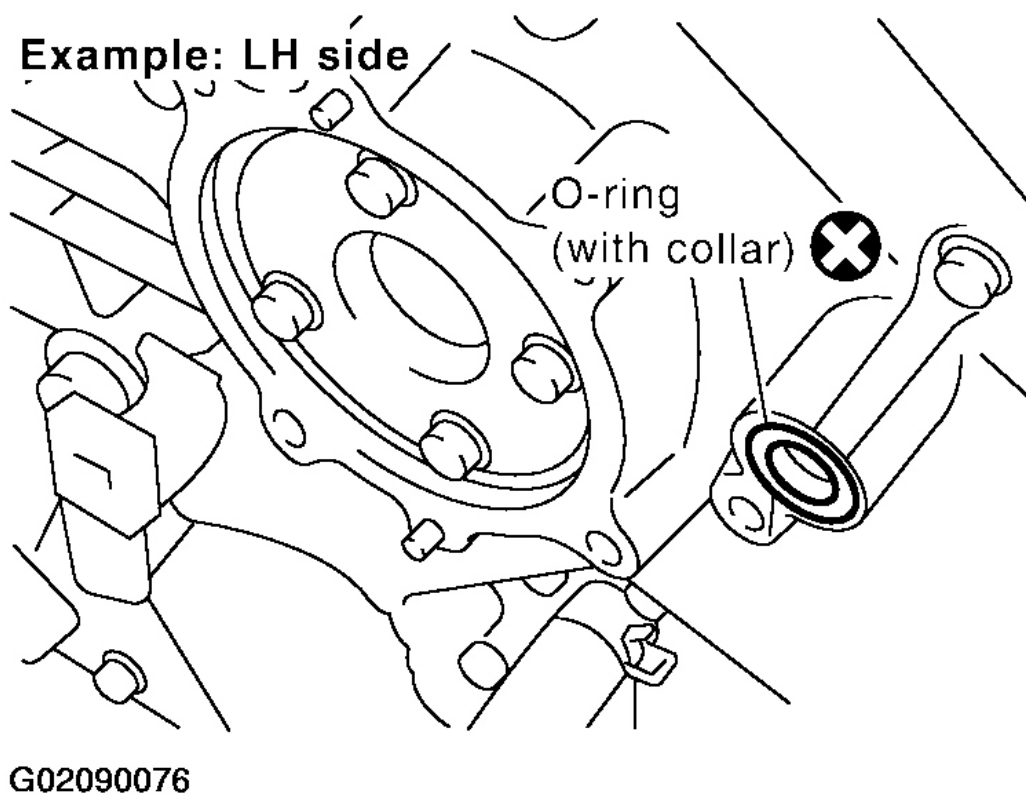
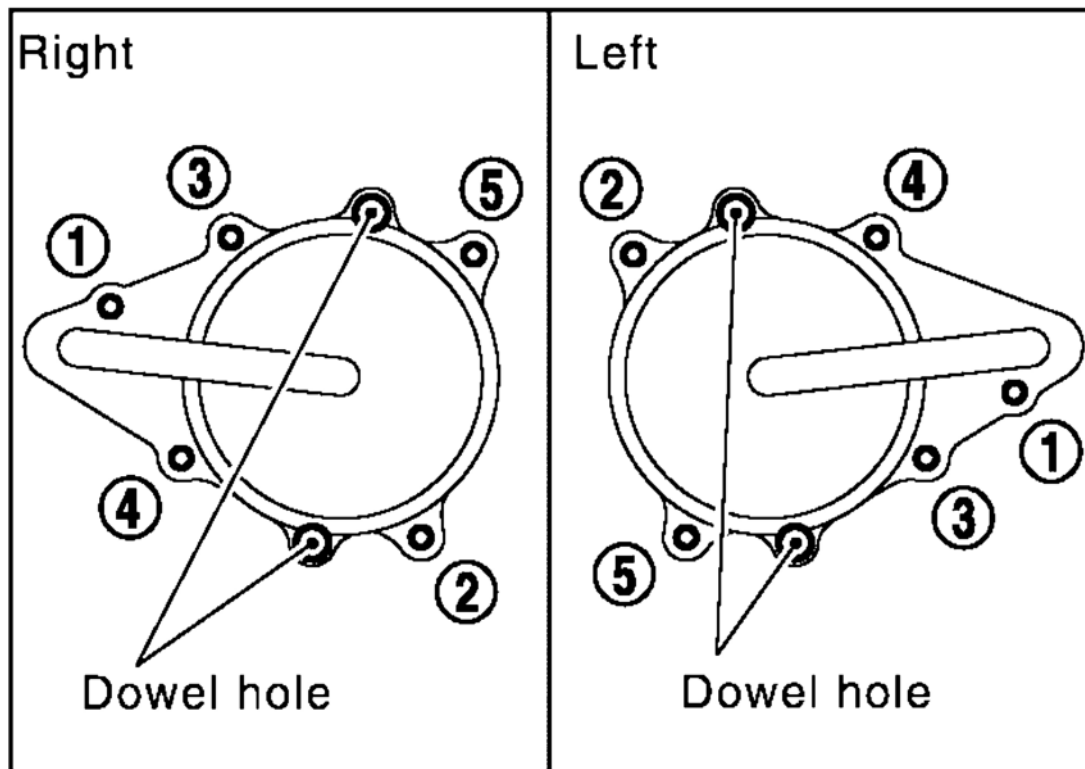


Fig. 72: Installing O-Ring In Front Timing Chain Case
Courtesy of NISSAN MOTOR CO., U.S.A.

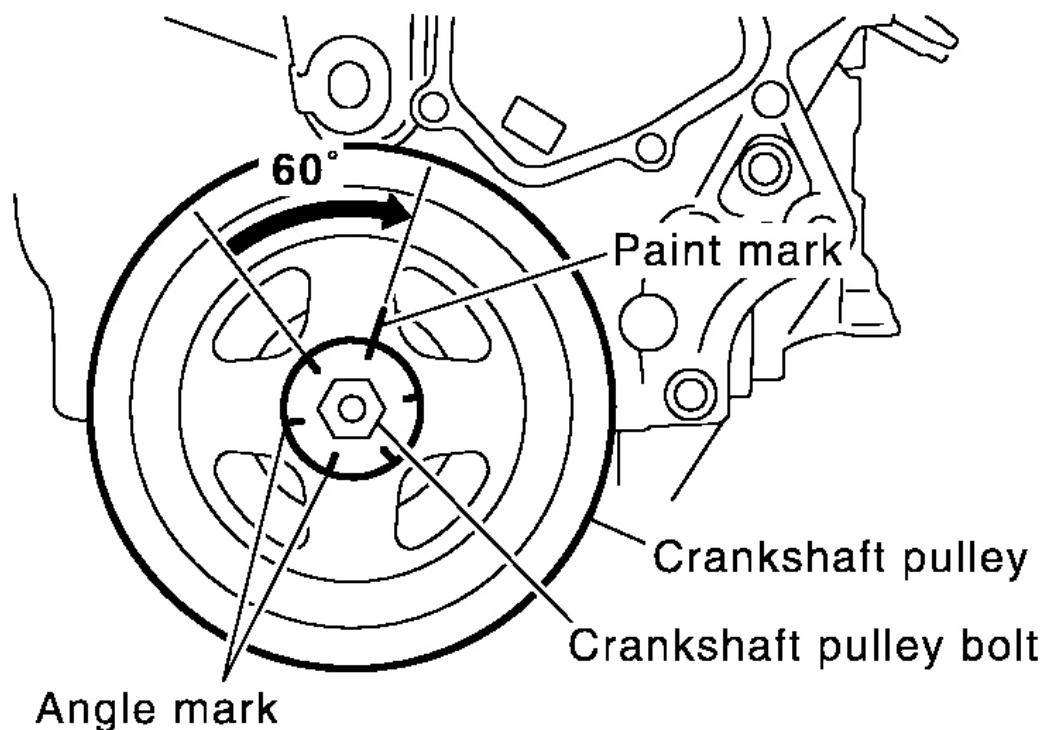
- d. Being careful not to move the seal ring from the installation groove, align the dowel pins on the chain case with the holes to install the intake valve timing control covers.
- e. Tighten bolts in the numerical order as shown.



G02090077

Fig. 73: Aligning Dowel Pins On Chain Case
 Courtesy of NISSAN MOTOR CO., U.S.A.

12. Install crankshaft pulley as follows:
 - a. Fix crankshaft using a suitable tool.
 - b. Install crankshaft pulley, taking care not to damage front oil seal.
 - When press-fitting crankshaft pulley with a plastic hammer, tap on its center portion (not circumference).
 - c. Tighten bolt to 39.2 to 49.0 N.m (4.0 to 5.0 kg-m, 29 to 36 ft-lb).
 - d. Put a paint mark on crankshaft pulley aligning with angle mark on crankshaft pulley bolt. Then, further retighten bolt by 60 to 66 degrees [Target: 60 degrees (equivalent to one graduation)].



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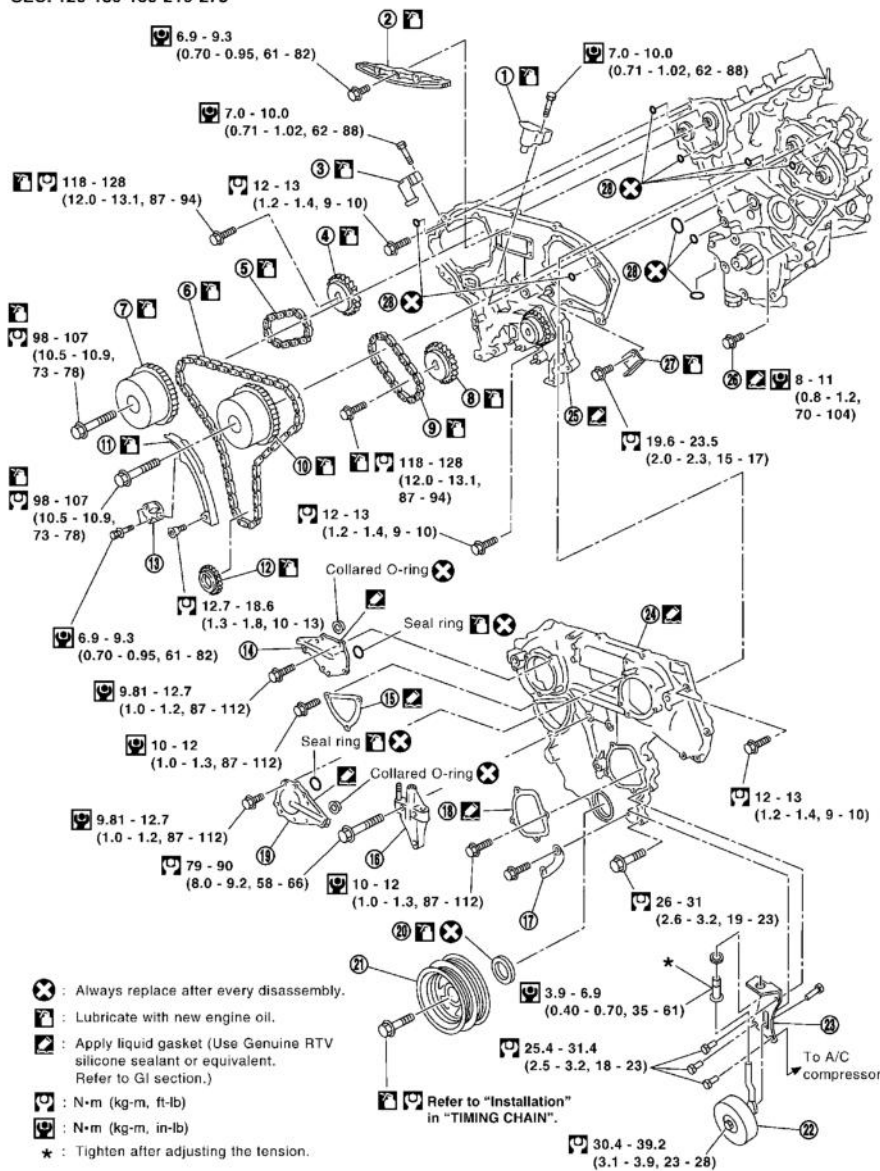
Fig. 74: Aligning Mark On Crankshaft Pulley Bolt
Courtesy of NISSAN MOTOR CO., U.S.A.

13. Rotate crankshaft pulley in normal direction (clockwise when viewed from front) to confirm it turns smoothly.
14. For the following operations, perform steps in the reverse order of removal.
 - If hydraulic pressure inside chain tensioner drops after removal/installation, slack in the guide may generate a pounding noise during and just after engine start. However, this does not indicate an unusualness. Noise will stop after hydraulic pressure rises.

TIMING CHAIN

COMPONENTS

SEC. 120•130•150•210•275



- | | | |
|-----------------------------|---------------------------------------|-----------------------------|
| 1. Timing chain tensioner | 11. Slack guide | 20. Front oil seal |
| 2. Internal chain guide | 12. Crankshaft sprocket | 21. Crankshaft pulley |
| 3. Timing chain tensioner | 13. Timing chain tensioner | 22. Idler pulley |
| 4. Camshaft sprocket (EXH) | 14. Intake valve timing control cover | 23. Idler pulley bracket |
| 5. Timing chain (Secondary) | 15. Chain tensioner cover | 24. Front timing chain case |
| 6. Timing chain (Primary) | 16. Mounting bracket | 25. Rear timing chain case |
| 7. Camshaft sprocket (INT) | 17. Water hose clamp | 26. Water drain plug |
| 8. Camshaft sprocket (EXH) | 18. Water pump cover | 27. Tension guide |
| 9. Timing chain (Secondary) | 19. Intake valve timing control cover | 28. O-ring |
| 10. Camshaft sprocket (INT) | | |

G02090079

Fig. 75: Exploded View Of Timing Chain Components
 Courtesy of NISSAN MOTOR CO., U.S.A.

POSITION FOR APPLYING LIQUID GASKET

- **Before installation, wipe off the protruding sealant.**



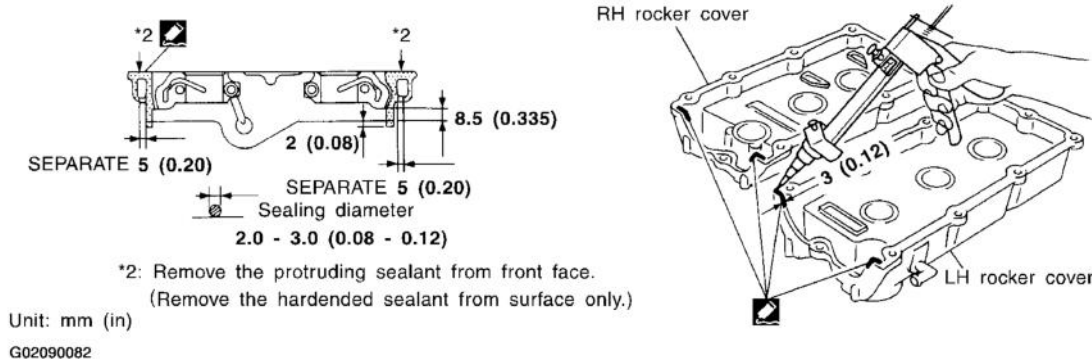


Fig. 78: Applying Liquid Gasket Rocker Cover
 Courtesy of NISSAN MOTOR CO., U.S.A.

CAUTION:

- After removing timing chain, do not turn crankshaft and camshaft separately, or valves will strike piston heads.
- When installing camshafts, chain tensioners, oil seals, or other sliding parts, lubricate contacting surfaces with new engine oil.
- Apply new engine oil to bolt threads and seat surfaces when installing cylinder head, camshaft sprockets, crankshaft pulley and camshaft brackets.
- Before disconnecting fuel hose, release fuel pressure.

Refer to FUEL PRESSURE RELEASE .

- When removing the oil pans, oil pump assembly and timing chain from engine, first remove the crankshaft position sensor (POS) from the assembly.

Be careful not to damage sensor edges.

- Do not spill engine coolant on drive belts.

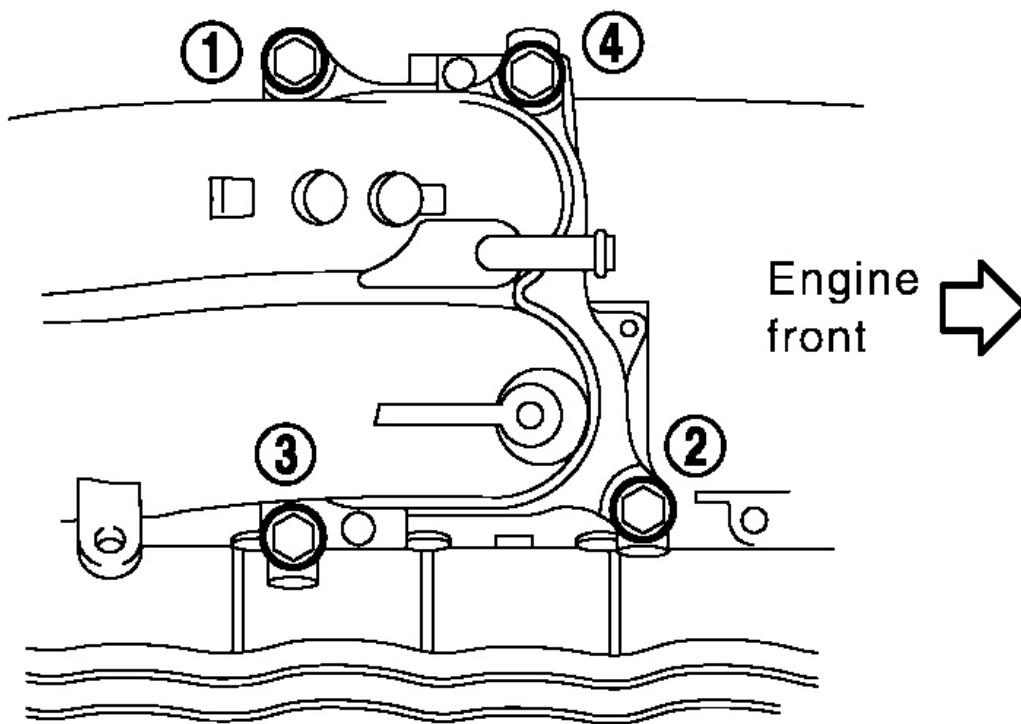
REMOVAL

NOTE:

- This section describes removal and installation procedure for front timing chain, timing-chain-related parts, and rear timing chain case when oil pan (upper) needs to be removed/installed for engine overhaul, etc.
- Refer to FRONT TIMING CHAIN CASE to remove and install front timing chain case, timing chain and its related parts without removing oil pan (upper).

1. Drain engine oil.

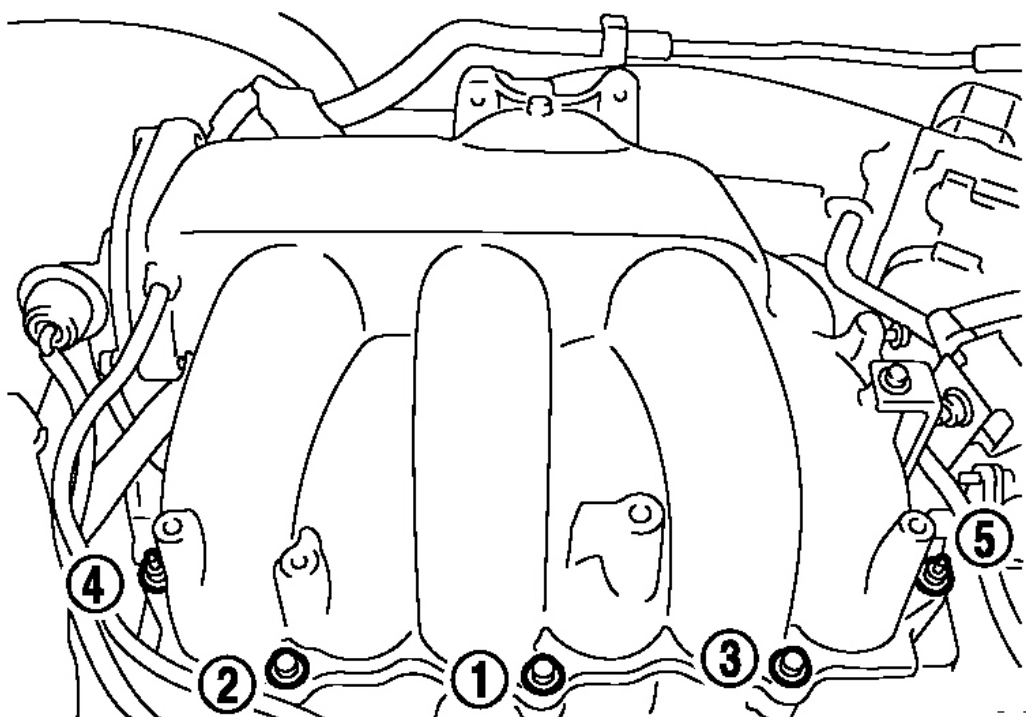
- To avoid the danger of being scalded, never drain the engine oil when the engine is hot.
2. Drain coolant by removing cylinder block drain plugs.
 3. Remove ornament cover.
 4. Remove air duct to intake manifold, collector, PCV hose, vacuum hoses, fuel hoses, wires, harness, connectors and so on.
 5. Remove the following.
 - Water hoses
 - EVAP canister purge hose
 6. Remove intake manifold upper collectors loosening bolts and nuts in reverse order shown in the figure.



G02090083

Fig. 79: Removing Intake Manifold Upper Collectors
Courtesy of NISSAN MOTOR CO., U.S.A.

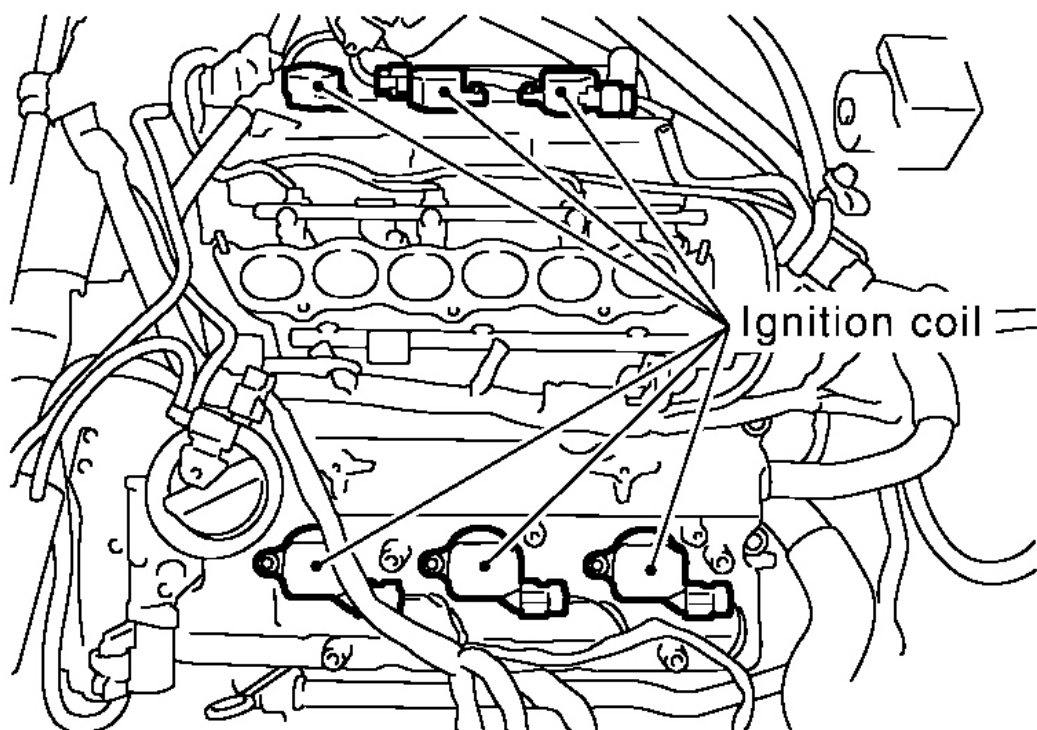
7. Remove intake manifold lower collectors loosening bolts in reverse order shown in the figure.



G02090084

Fig. 80: Removing Intake Manifold Lower Collectors
Courtesy of NISSAN MOTOR CO., U.S.A.

8. Remove RH and LH ignition coils.

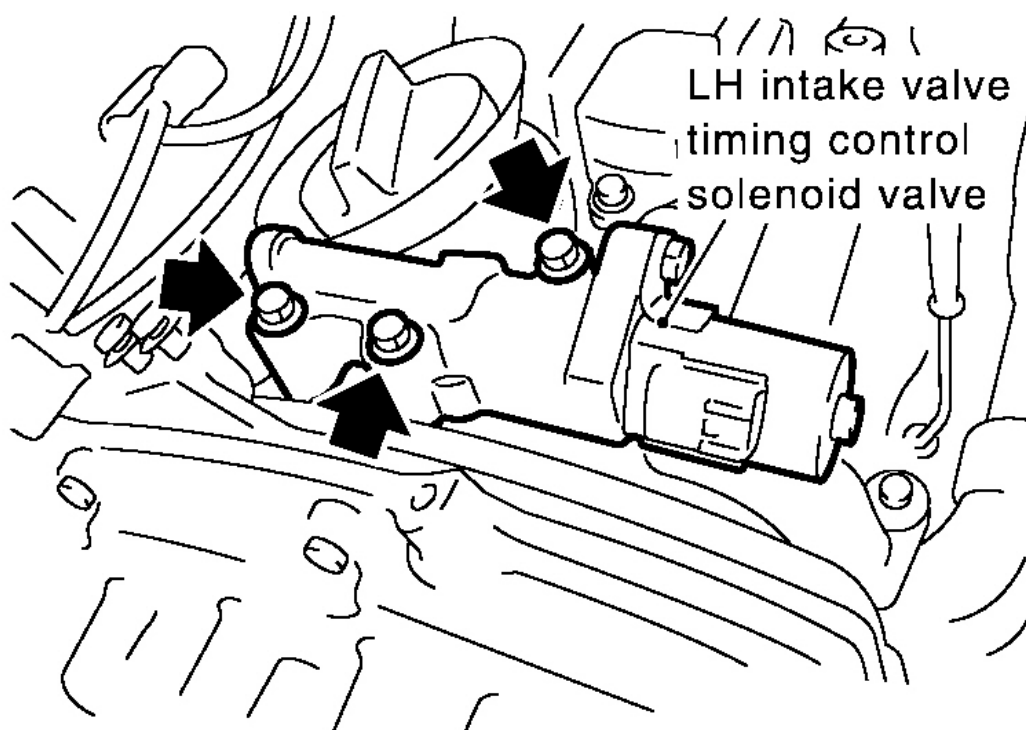


G02090085

Fig. 81: Removing Ignition Coils

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

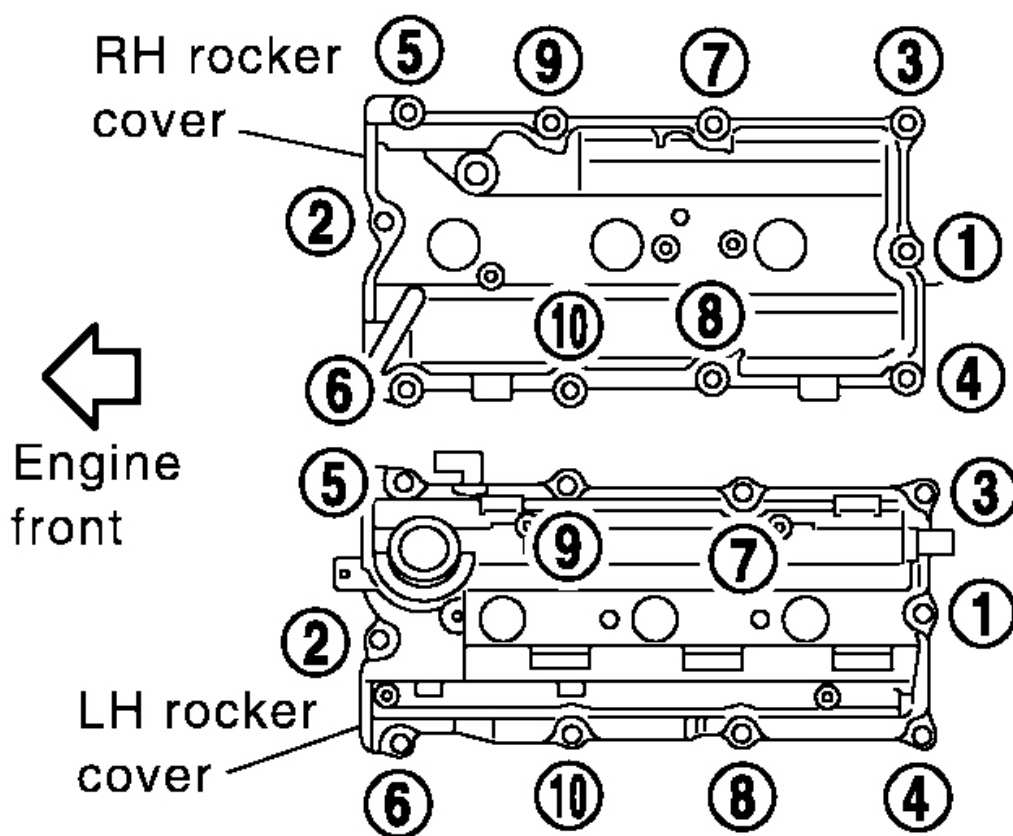
9. Remove RH and LH intake valve timing control solenoid valves.



G02090086

Fig. 82: Removing Bolts And Intake Valve Timing Control Solenoid Valves
Courtesy of NISSAN MOTOR CO., U.S.A.

10. Remove RH and LH rocker covers from cylinder head.
 - Loosen bolts in numerical order shown in the figure.



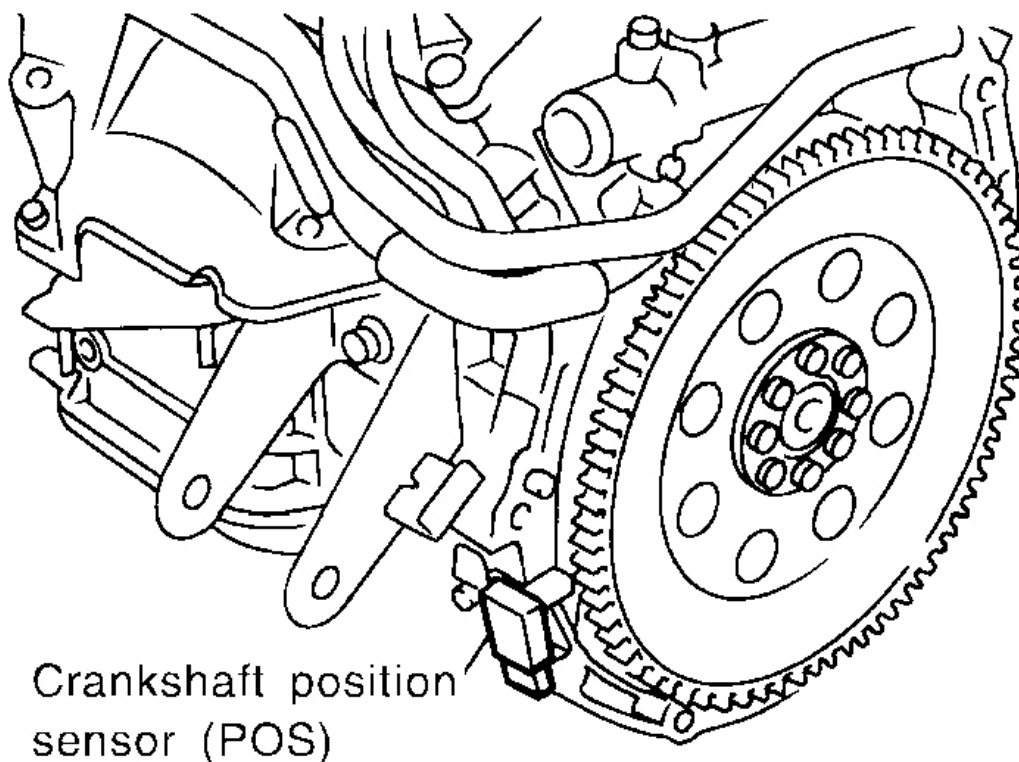
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Fig. 83: Installing RH And LH Rocker Covers From Cylinder Head
 Courtesy of NISSAN MOTOR CO., U.S.A.

11. Remove engine undercover.
12. Remove front RH wheel and engine side cover.
13. Remove drive belts and idler pulley bracket. **COMPONENTS.**
14. Remove power steering oil pump assembly.

Refer to **POWER STEERING OIL PUMP** .

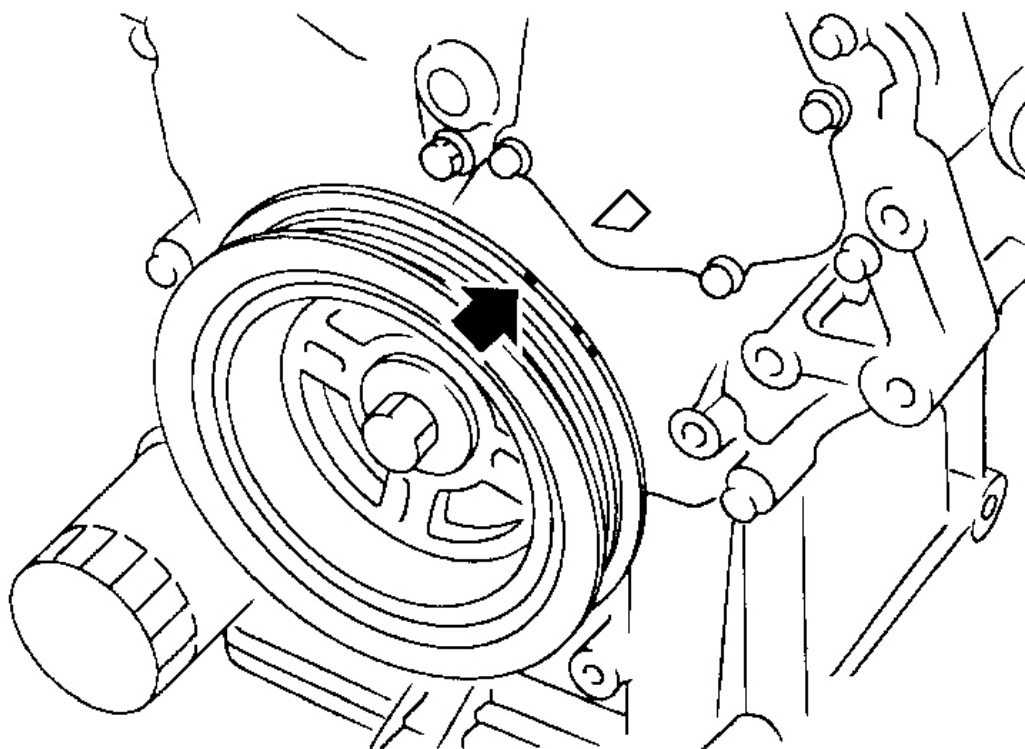
15. Remove alternator. Refer to **GENERATOR** .
16. Remove crankshaft position sensor (POS).



G02090088

Fig. 84: Identifying Crankshaft Position Sensor (POS)
Courtesy of NISSAN MOTOR CO., U.S.A.

17. Set No. 1 piston at TDC on the compression stroke by rotating crankshaft.



G02090089

Fig. 85: Aligning Piston TDC On Compression Stroke
Courtesy of NISSAN MOTOR CO., U.S.A.

- Check that intake and exhaust cam nose on No. 1 cylinder are installed as shown.

If not, turn the crankshaft one revolution (360°) and align as shown.

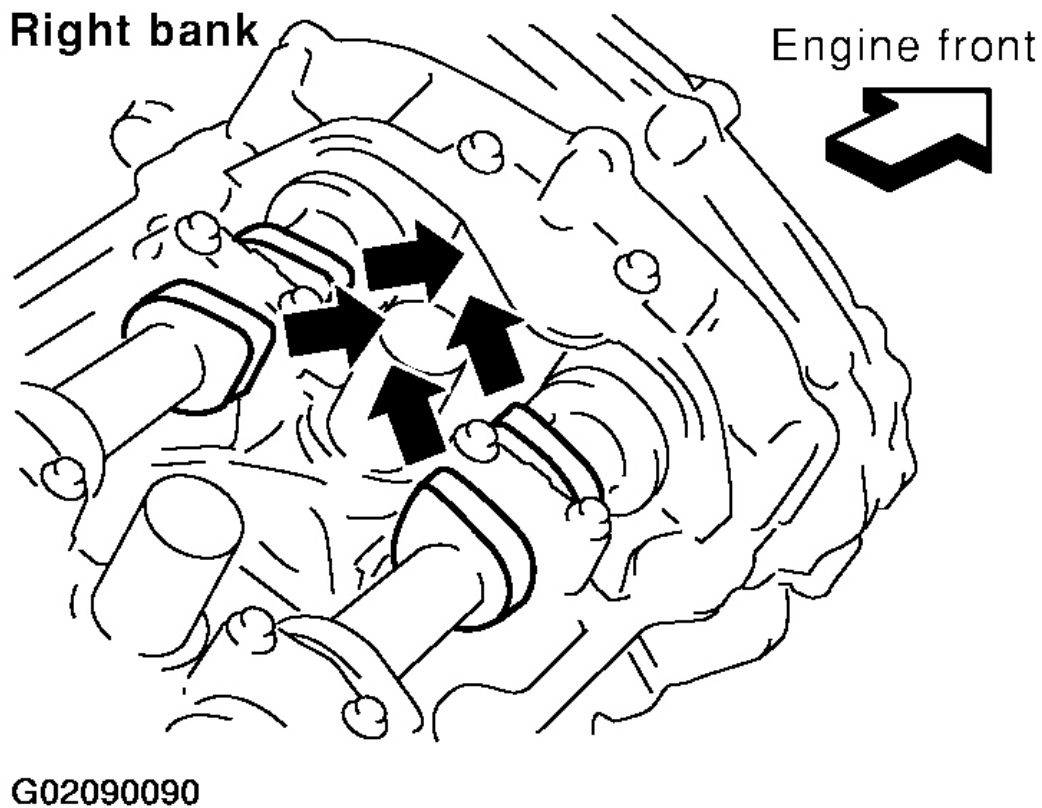
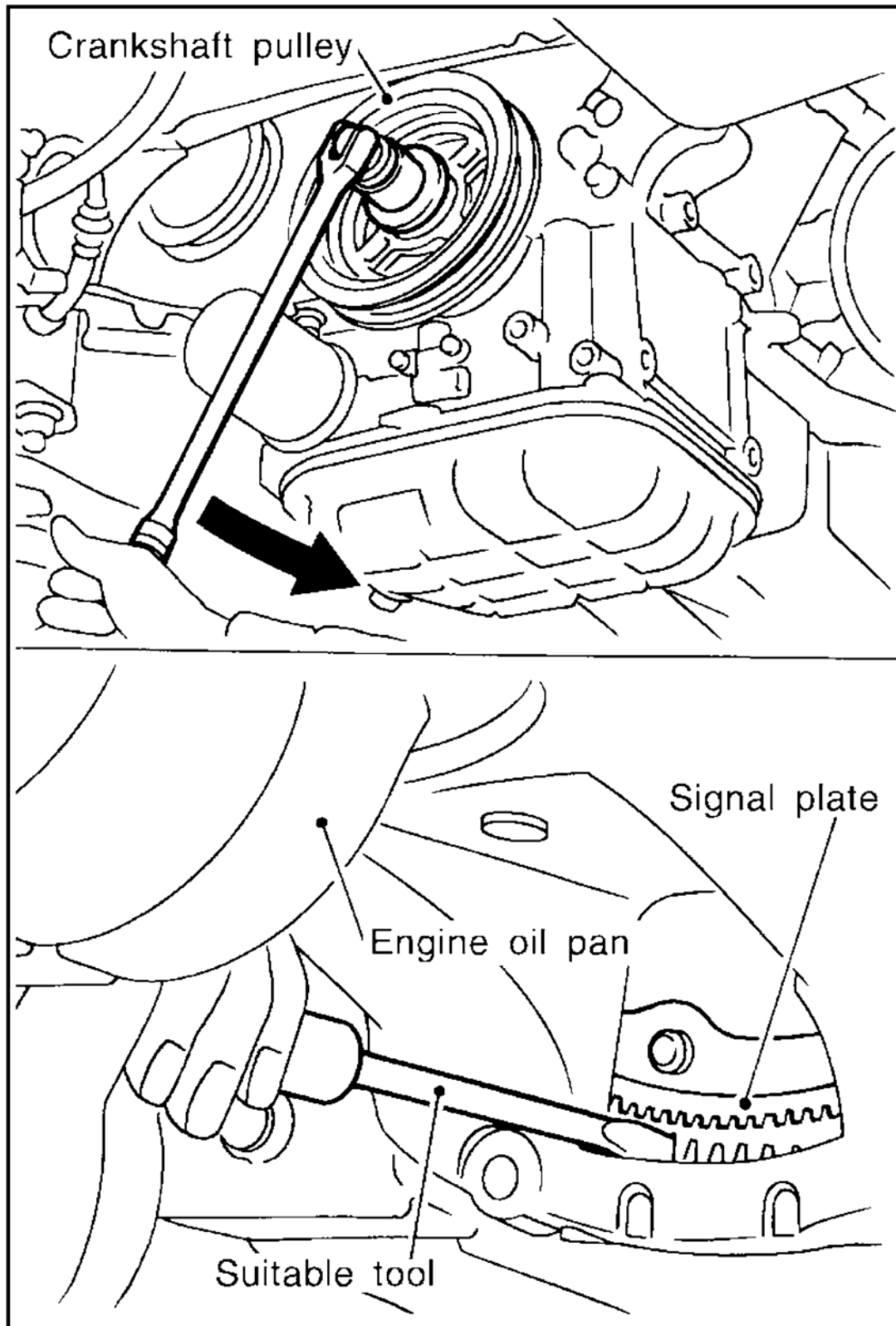


Fig. 86: Checking Intake And Exhaust Cam Nose
Courtesy of NISSAN MOTOR CO., U.S.A.

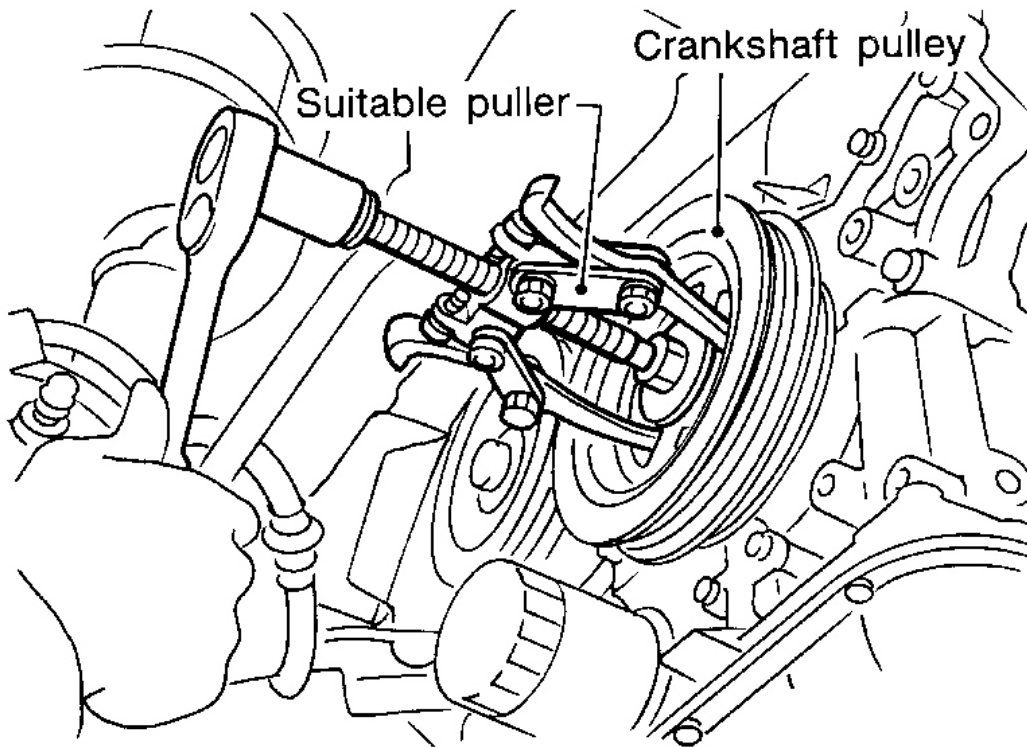
18. Loosen crankshaft pulley bolt. (At this time remove oil pan rear cover plate and set a suitable tool to ring gear so that crankshaft cannot rotate.)
 - Be careful not to damage the signal plate teeth.



G02090091

Fig. 87: Installing Crankshaft Pulley Bolt
Courtesy of NISSAN MOTOR CO., U.S.A.

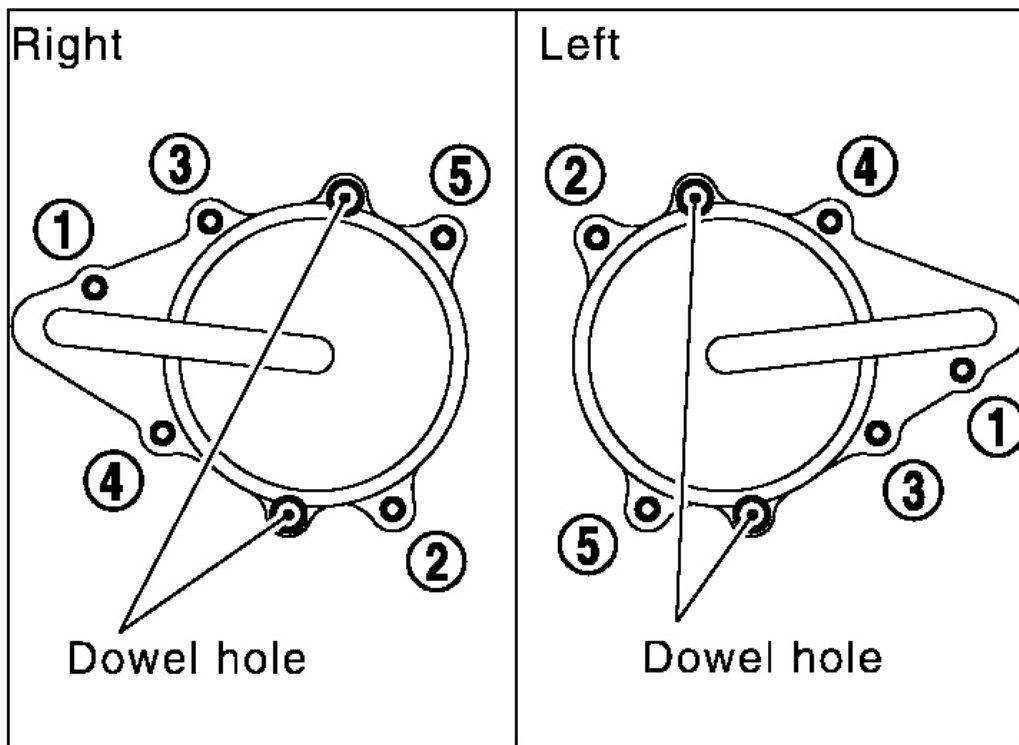
19. Remove crankshaft pulley with a suitable puller.



G02090092

Fig. 88: Installing Crankshaft Pulley With A Suitable Puller
Courtesy of NISSAN MOTOR CO., U.S.A.

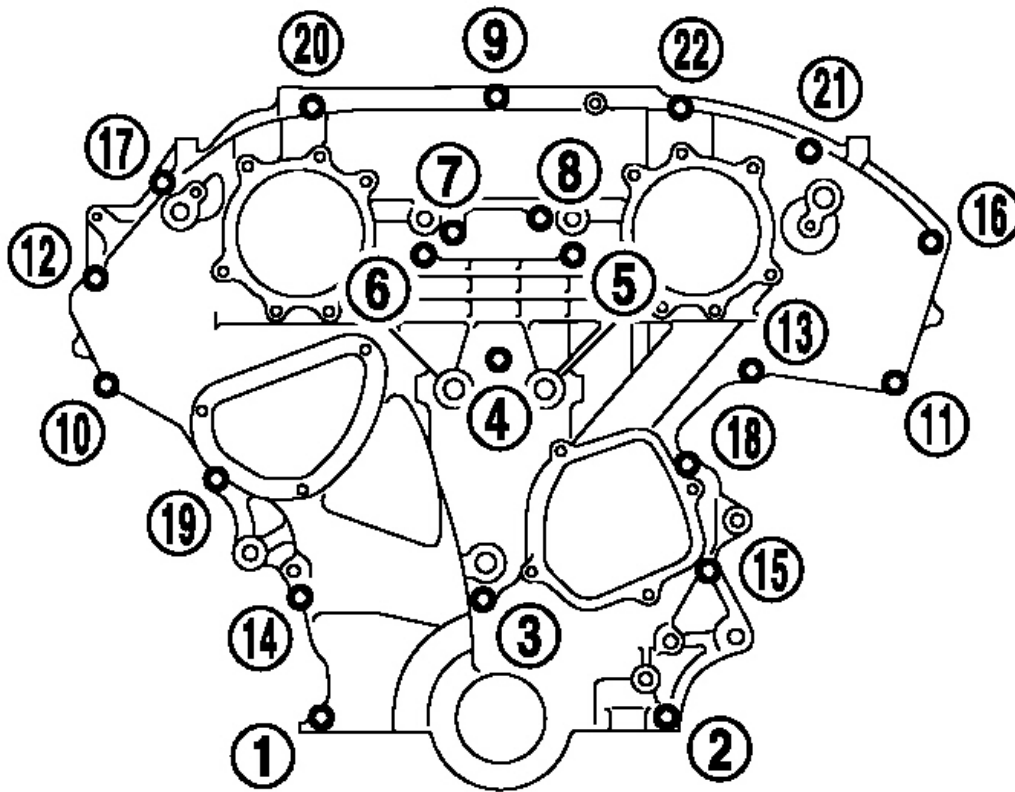
20. Remove intake valve timing control covers.
- Loosen bolts in reverse order shown in the figure.



G02090093

Fig. 89: Aligning Dowel Hole
 Courtesy of NISSAN MOTOR CO., U.S.A.

- In the cover, the shaft is engaged with the center hole of the intake camshaft sprocket. Remove it straight out until the engagement comes off.
21. Remove air conditioner compressor. Refer to **REMOVAL AND INSTALLATION**.
 22. Remove front exhaust tube and its support.
 23. Hang engine at right and left side engine slingers with a suitable hoist. Refer to **REMOVAL AND INSTALLATION**.
 24. Remove right side engine mounting, mounting bracket and nuts. Refer to **REMOVAL AND INSTALLATION**.
 25. Remove center member assembly.
 26. Remove upper and lower oil pans. Refer to **REMOVAL**.
 27. Loosen front timing chain case bolts in reverse order shown in the figure.



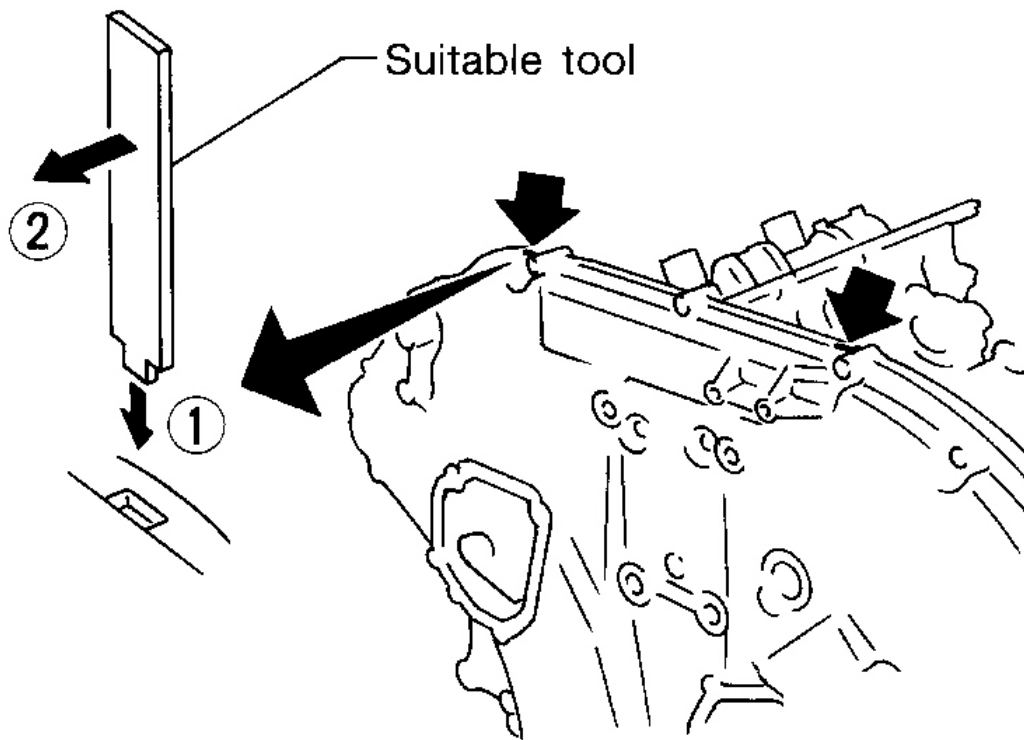
G02090094

Fig. 90: Identifying Front Timing Chain Case Bolts
 Courtesy of NISSAN MOTOR CO., U.S.A.

28. Remove front timing chain case.
 - a. Insert the appropriate size tool into the notch at the top of the front timing chain case as shown (1).
 - b. Pry off the case by moving the tool as shown (2).
 - Use seal cutter (special service tool) or an equivalent tool to cut liquid gasket for removal.

CAUTION:

- Do not use screwdrivers or something similar.
- After removal, handle it carefully so it does not tilt, cant, or warp under a load.



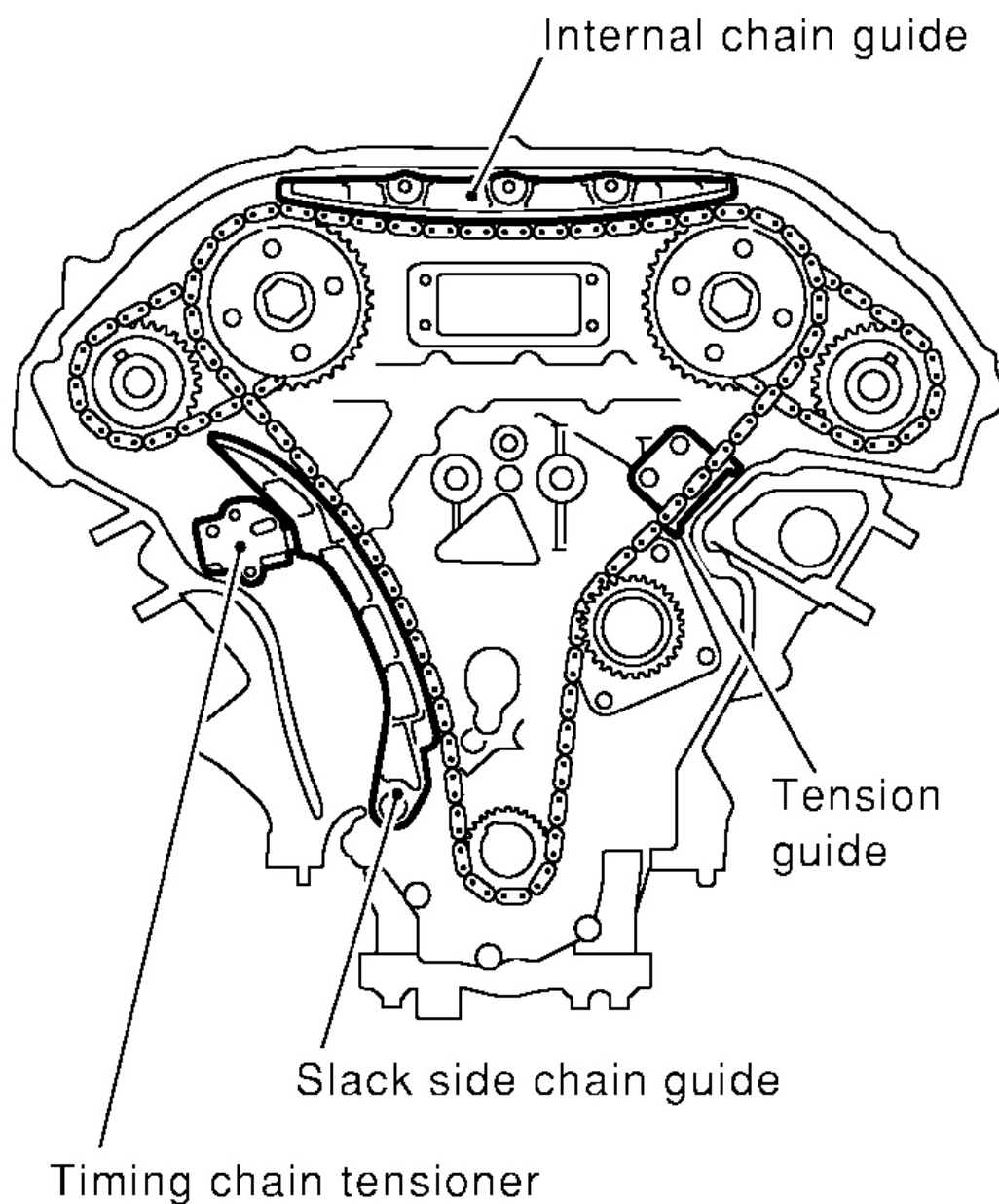
G02090095

Fig. 91: Prying Front Timing Chain Case
Courtesy of NISSAN MOTOR CO., U.S.A.

29. Remove water pump cover and timing chain tensioner cover from front timing chain case.
30. Remove front oil seal from front timing chain case.

Refer to **FRONT OIL SEAL**.

31. Remove internal chain guide.
32. Remove timing chain tensioner and slack side chain guide.



G02090096

Fig. 92: Identifying Timing Chain Tensioner And Slack Side Chain Guide
Courtesy of NISSAN MOTOR CO., U.S.A.

- Remove chain tensioner as follows.
 - a. Pull lever down, and release plunger stopper tab.

- Plunger stopper tab can be pushed up to release (coaxial structure with lever).
- b. Insert stopper pin into tensioner body hole to fix lever, and keep the tab released.
 - In **Fig. 93** Allen wrench [2.5 mm (0.098 in)] is used for stopper pin as an example.
- c. Insert plunger into tensioner body by pressing slack guide.
- d. Keep slack guide pressed, and fix it by pushing stopper pin through lever hole and body hole.
- e. Loosen mounting bolts, and remove chain tensioner.

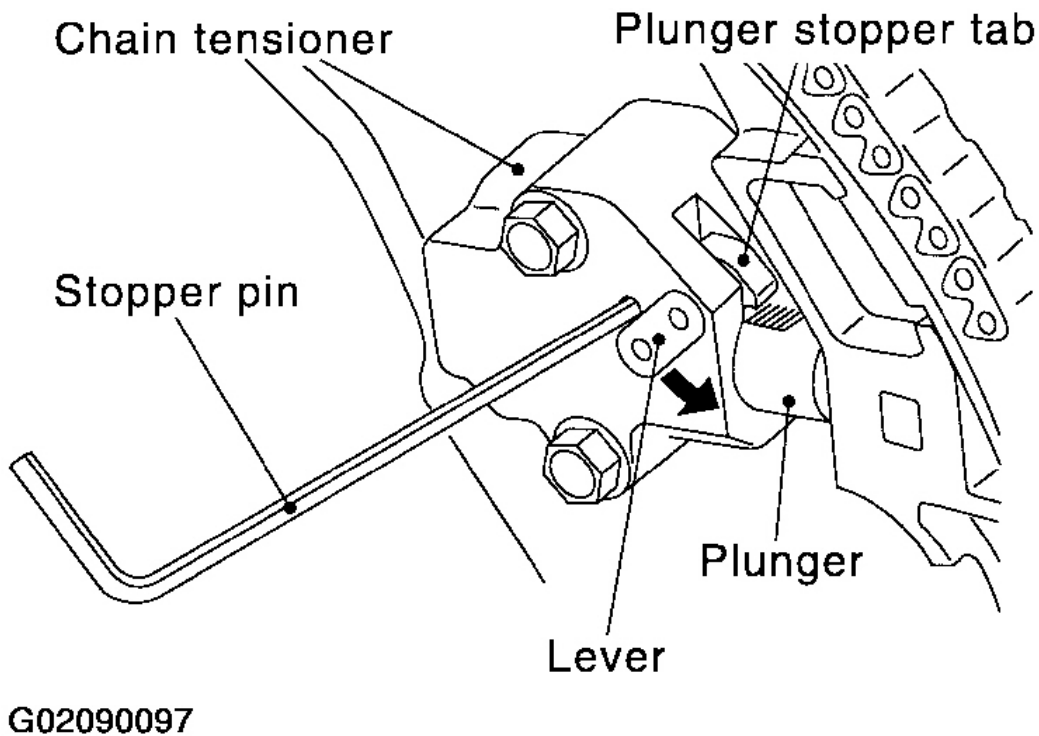
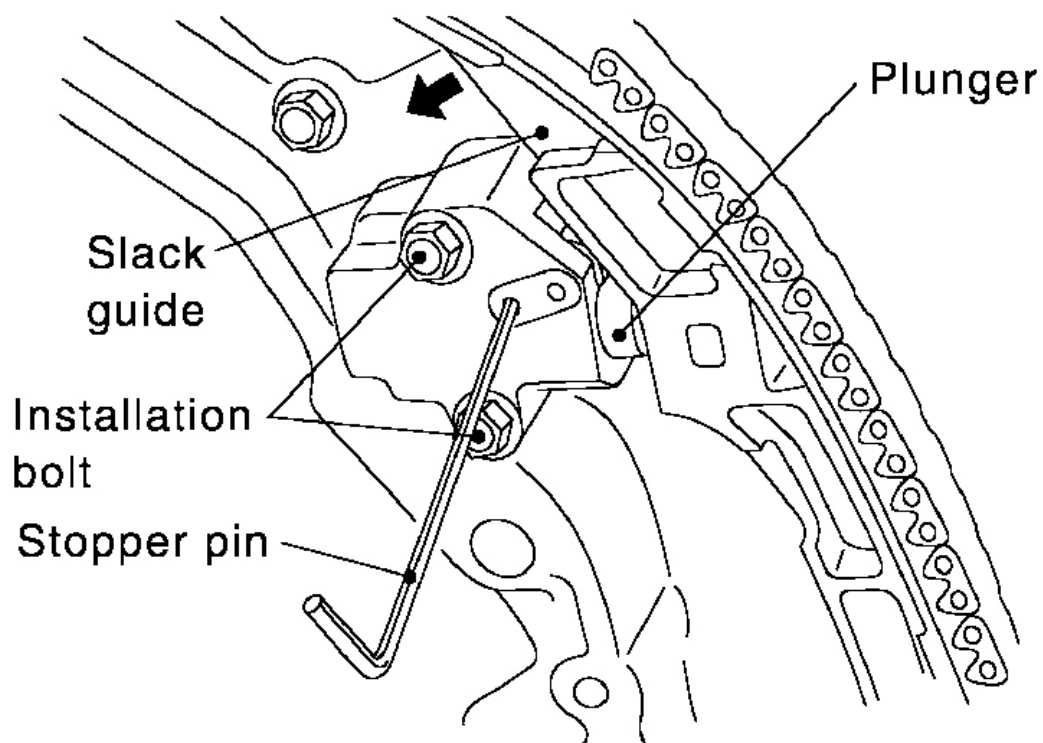


Fig. 93: Removing Chain Tensioner
Courtesy of NISSAN MOTOR CO., U.S.A.

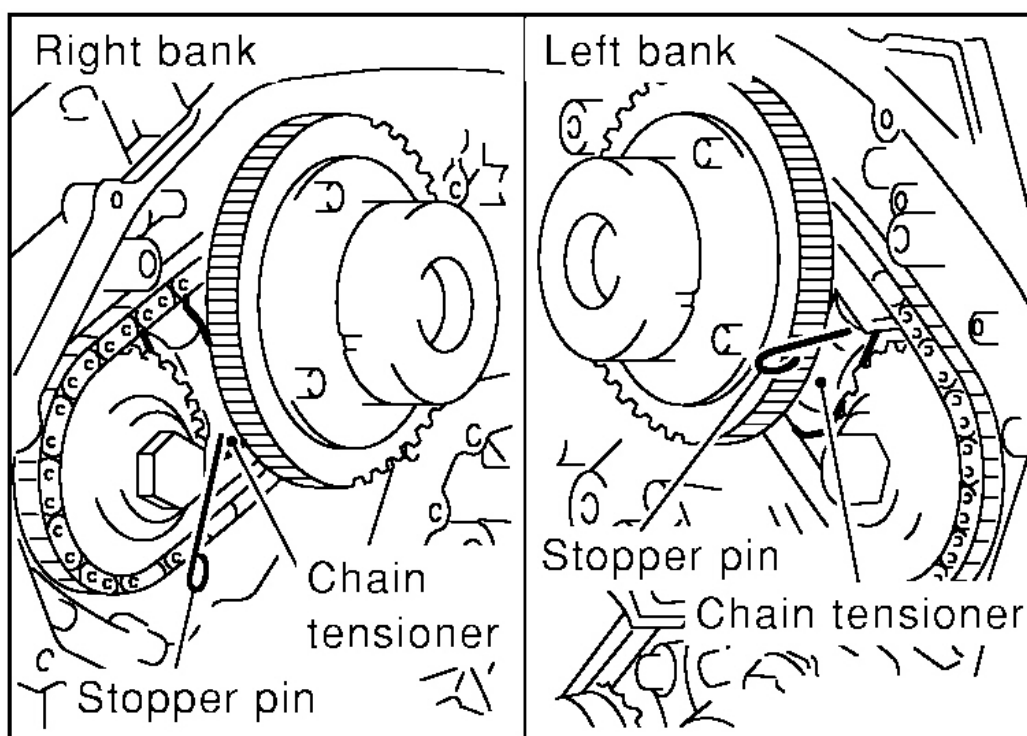
33. Remove primary timing chain and crankshaft sprocket.



G02090098

Fig. 94: Removing Chain And Crankshaft Sprocket
Courtesy of NISSAN MOTOR CO., U.S.A.

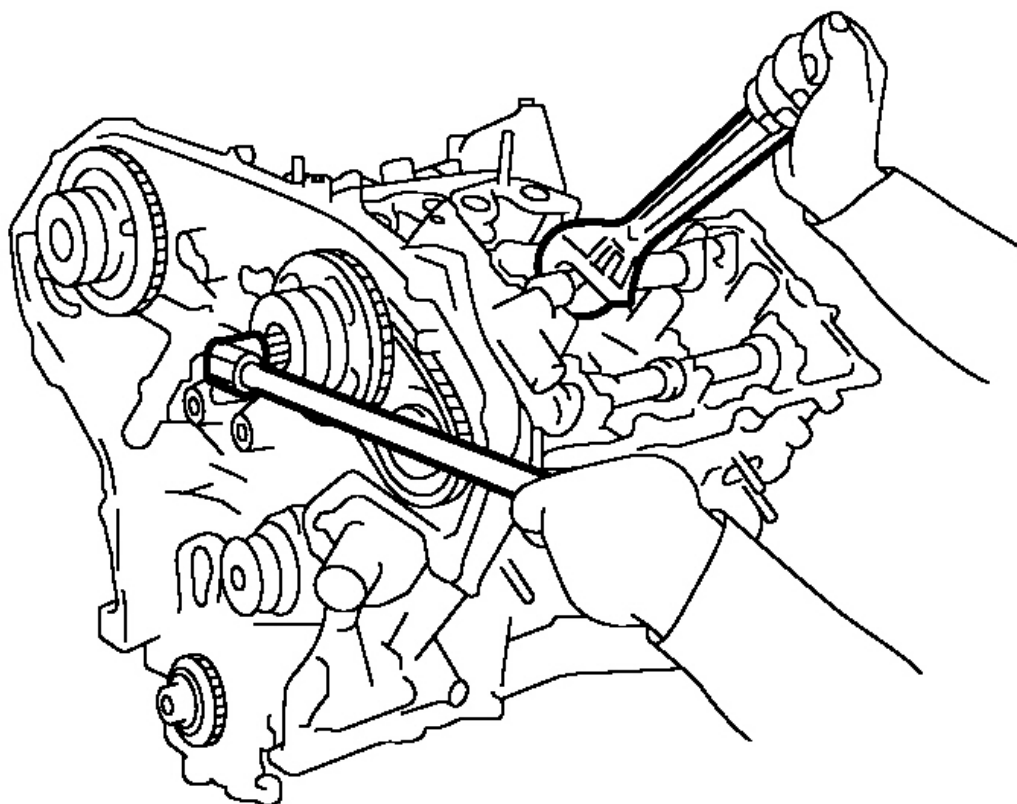
34. Attach a suitable stopper pin to RH and LH camshaft chain tensioners. (For secondary timing chains)



G02090099

Fig. 95: Identifying Stopper Pin And Camshaft Chain Tensioners
Courtesy of NISSAN MOTOR CO., U.S.A.

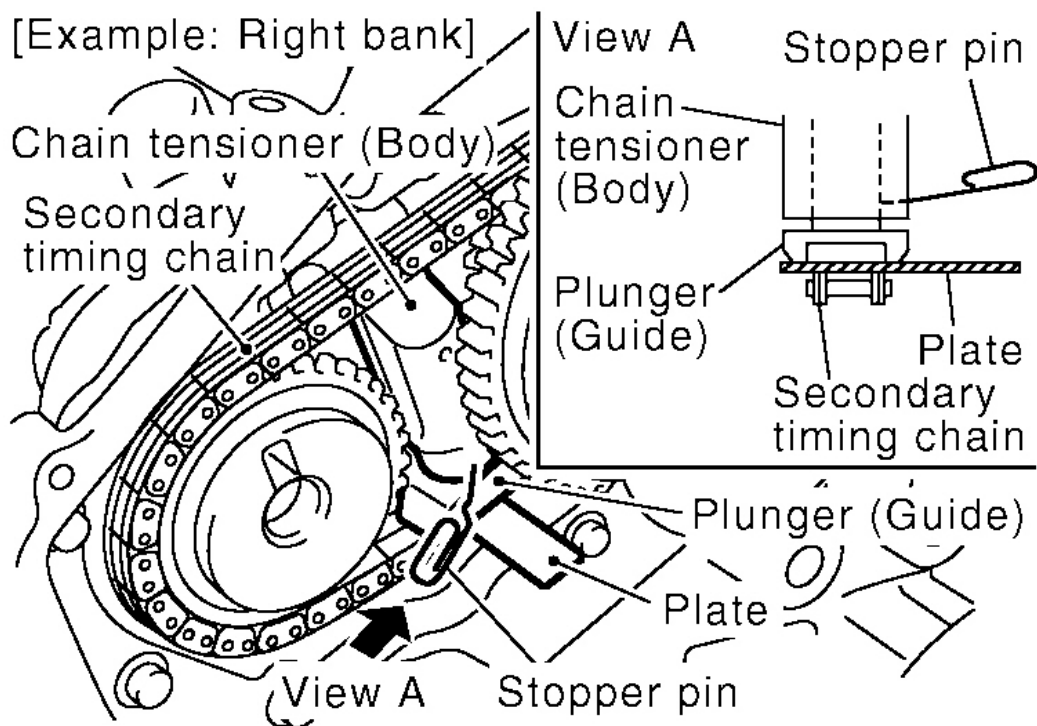
35. Loosen intake and exhaust camshaft sprocket bolts.
- Secure the hexagonal portion of the camshaft using a spanner to loosen mounting bolts.



G02090100

Fig. 96: Removing Intake And Exhaust Camshaft Sprocket Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

36. Remove secondary timing chains with camshaft sprockets.



G02090101

Fig. 97: Identifying Secondary Timing Chains And Camshaft Sprockets

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

- Rotate camshaft lightly, and slacken timing chain of timing chain tensioner- side.
- Insert metal or resin plate [thickness: 0.5 mm (0.020 in)] into guide between timing chain and chain tensioner plunger.

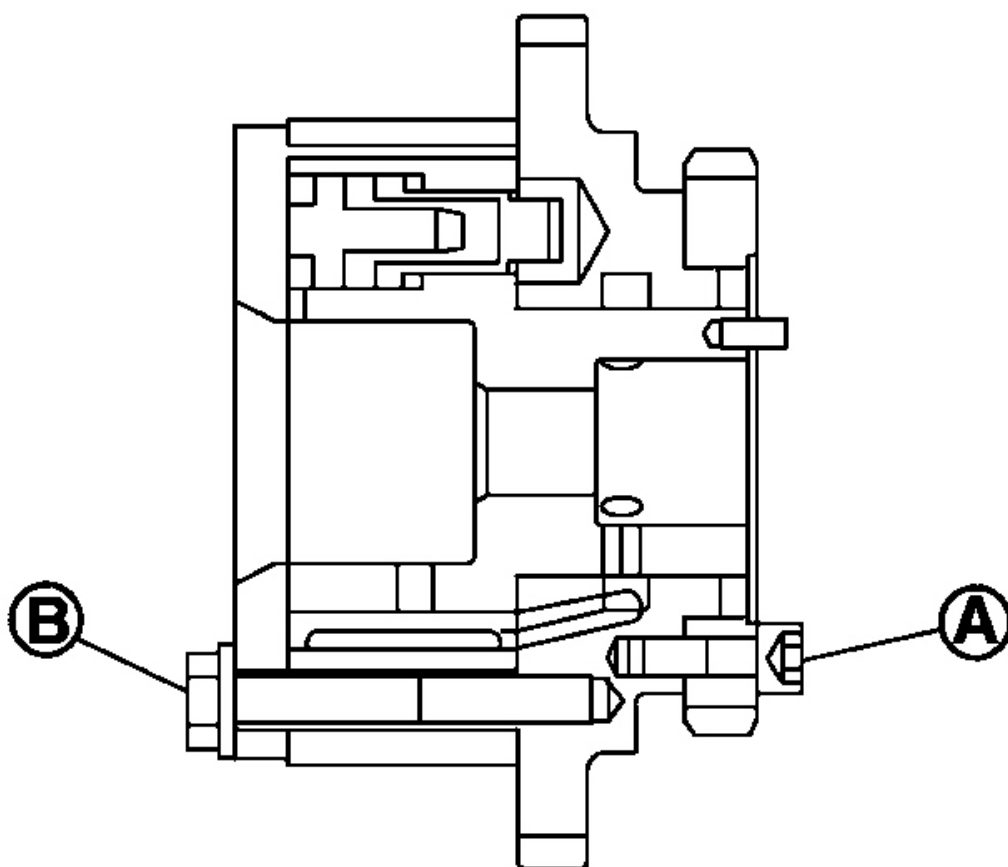
Remove cam sprocket and secondary timing chain with timing chain floated from guide groove.

CAUTION: Chain tensioner plunger may move, while fixed stopper pin and plunger both come off when timing chain is removed. Use caution during removal.

- Intake camshaft sprocket is two-for-one structure of primary and secondary sprockets.
- Handle intake camshaft sprocket, taking care of the following.

CAUTION:

- Avoid impact.
- Do not disassemble (Never loosen bolts A and B).

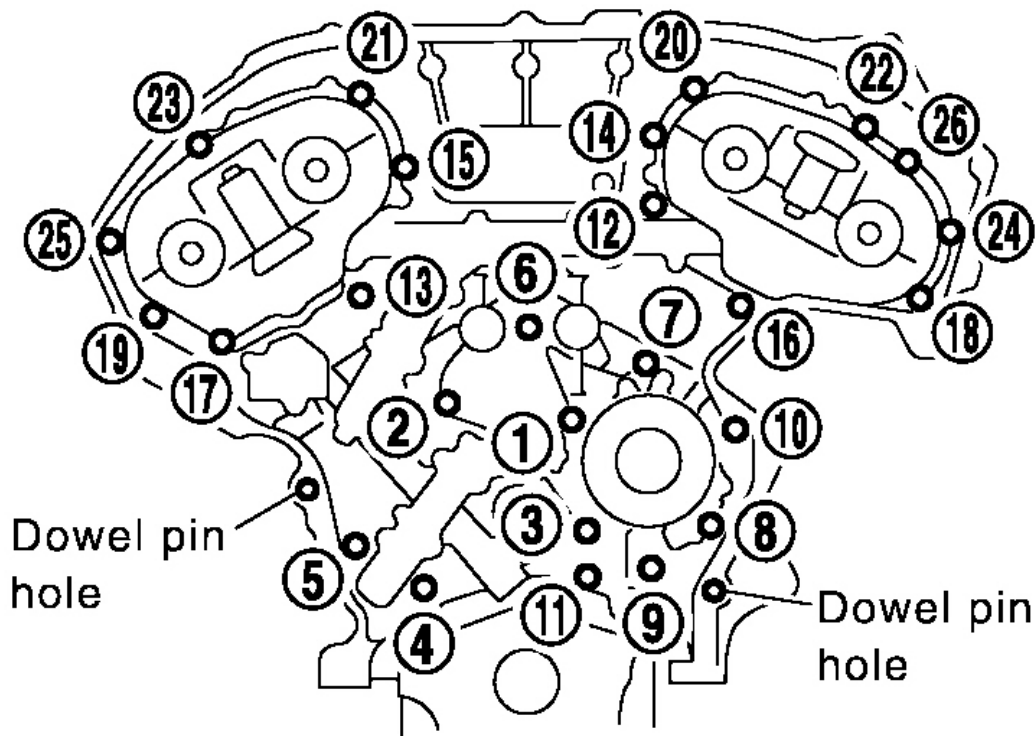


G02090102

Fig. 98: Identifying Bolts (A And B)

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

37. Remove chain tension guide.
38. Remove rear timing chain case as follows.
 - a. Loosen mounting bolts in reverse order shown in figure, and remove them.
 - b. Disconnect liquid gasket applied portion using seal cutter (special service tool: KV10111100) or an equivalent tool. Then remove rear timing chain case.



G02090103

Fig. 99: Identifying Dowel Pin Hole

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

CAUTION:

- Do not remove plate metal cover of oil passage.
- After removing chain case, do not apply any load which affects flatness.

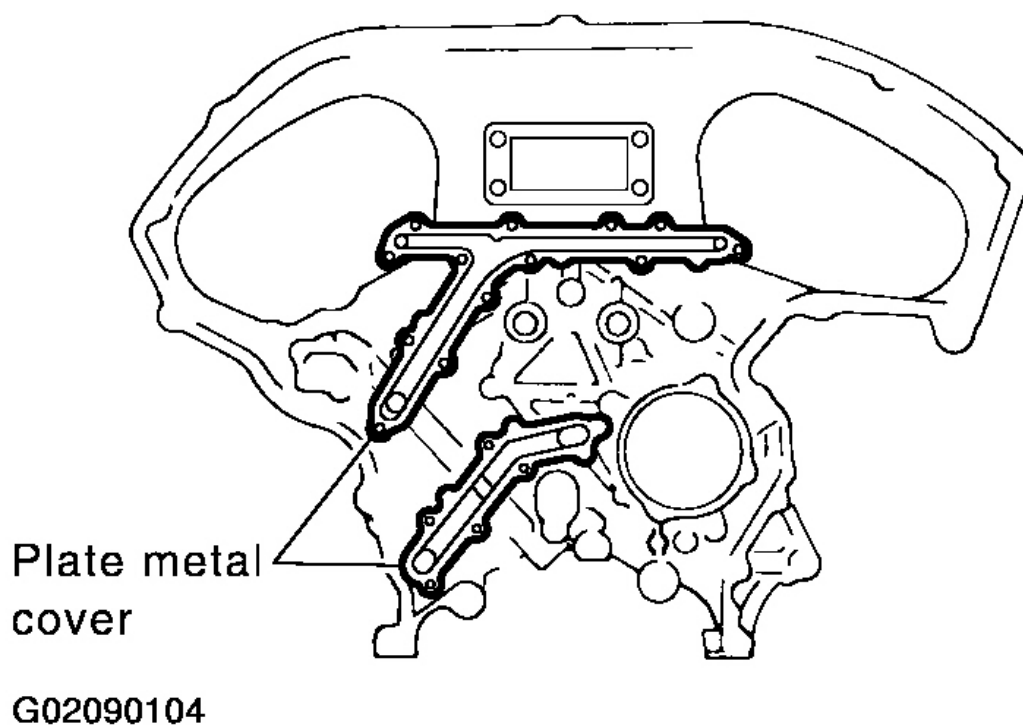
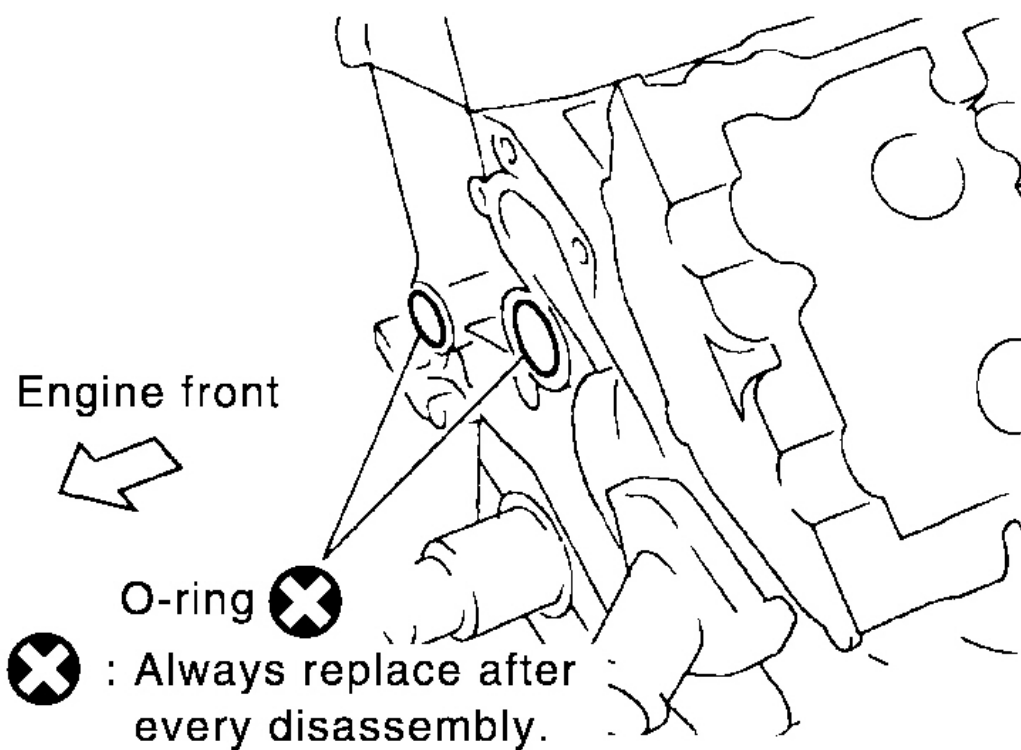


Fig. 100: Identifying Plate Metal Cover
Courtesy of NISSAN MOTOR CO., U.S.A.

39. Remove O-rings from cylinder block.
40. Remove RH and LH camshaft chain tensioners from cylinder head as follows, if necessary.
 - a. Remove No. 1 camshaft brackets.

Refer to **REMOVAL**.

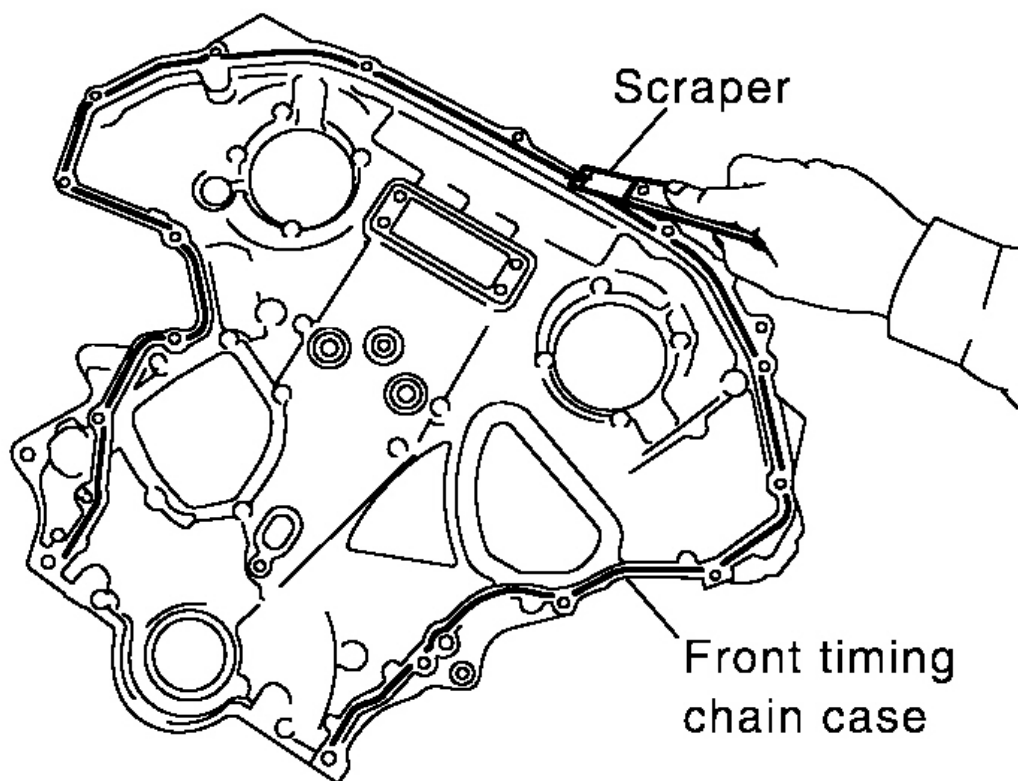
- b. Remove chain tensioners with stopper pin attached.



G02090105

Fig. 101: Removing O-Rings From Cylinder Block
Courtesy of NISSAN MOTOR CO., U.S.A.

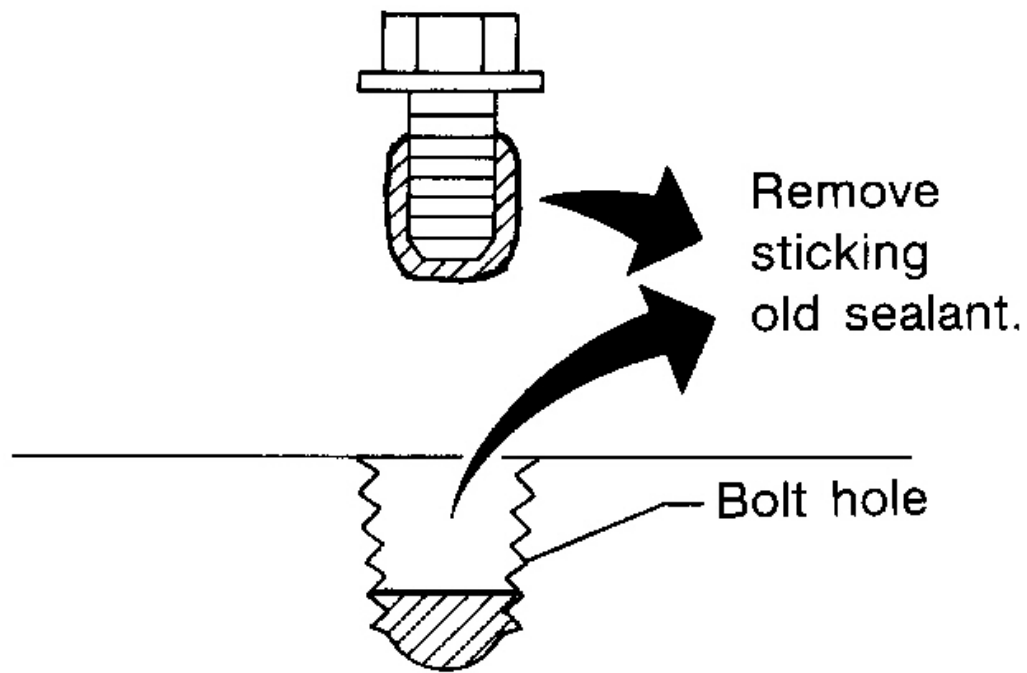
41. Use a scraper to remove all traces of liquid gasket from front and rear timing chain cases, and opposite mating surfaces.



G02090106

Fig. 102: Removing Liquid Gasket From Front Timing Chain Cases
Courtesy of NISSAN MOTOR CO., U.S.A.

- Remove old liquid gasket from the bolt hole and thread.



G02090107

Fig. 103: Removing Old Liquid Gasket From Bolt Hole
Courtesy of NISSAN MOTOR CO., U.S.A.

42. Use a scraper to remove all traces of liquid gasket from water pump cover, chain tensioner cover and intake valve timing control covers.

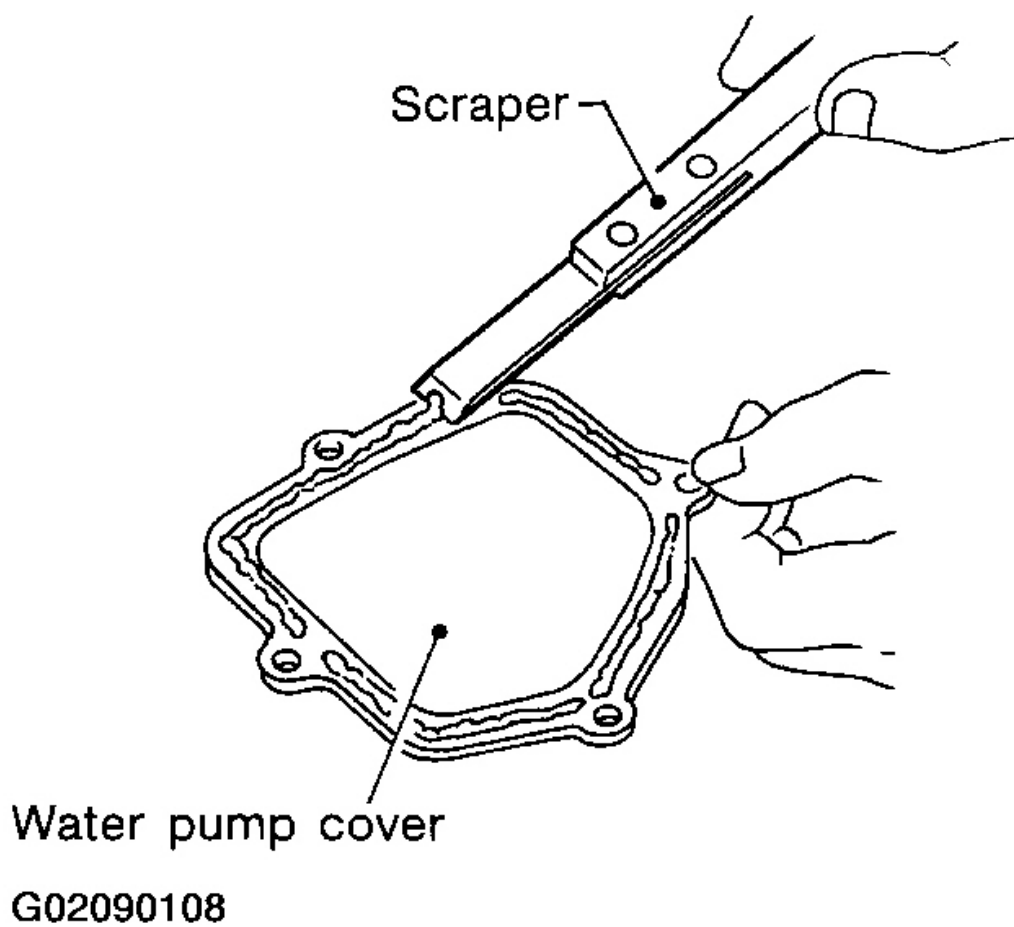


Fig. 104: Removing Liquid Gasket From Water Pump Cover
Courtesy of NISSAN MOTOR CO., U.S.A.

INSPECTION

Check for cracks and excessive wear at roller links. Replace chain if necessary.

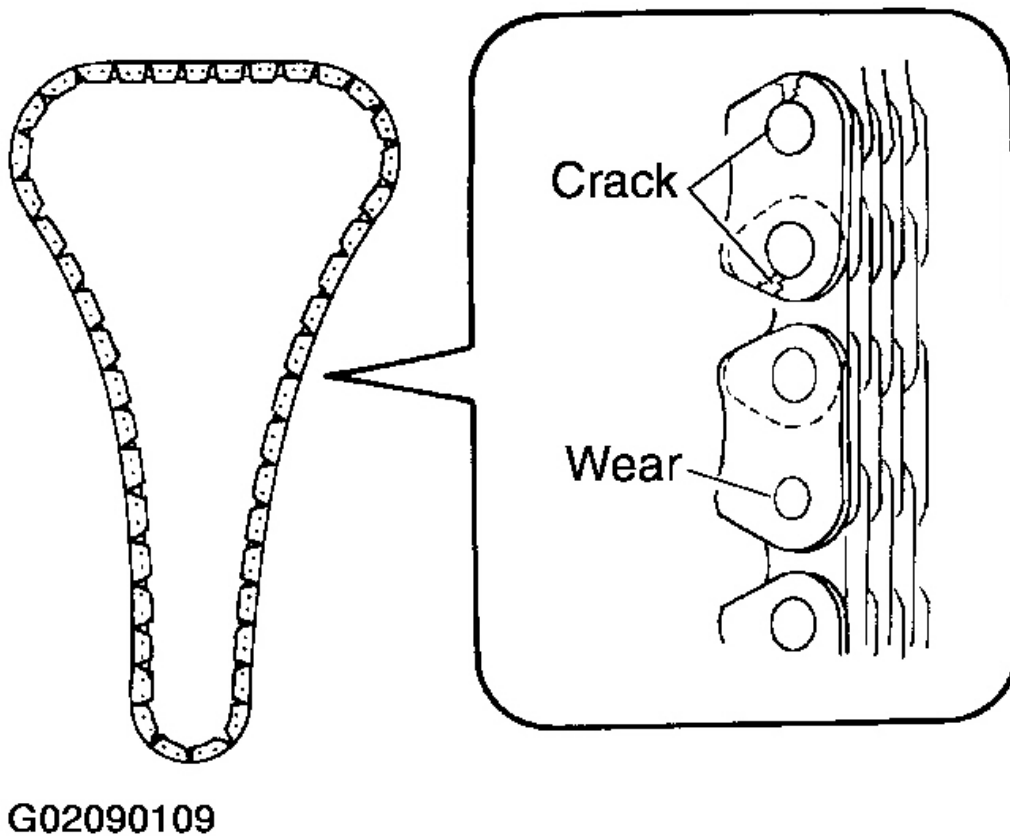
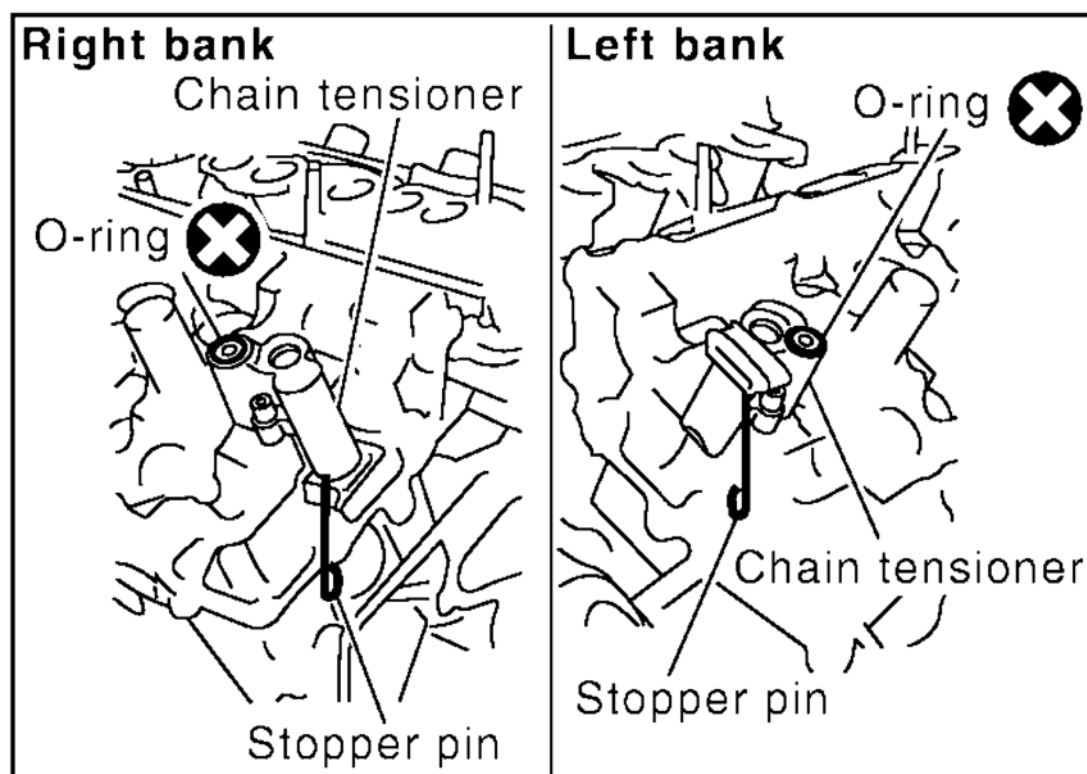


Fig. 105: Checking Roller Links (Timing Chain)
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

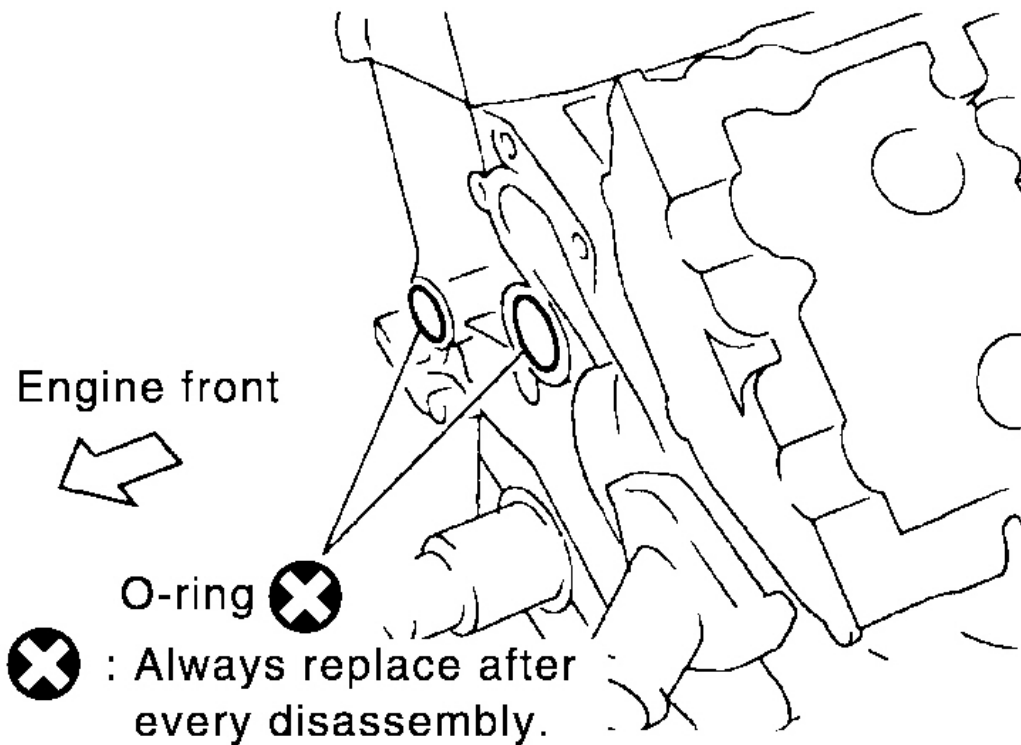
1. Install RH and LH camshaft chain tensioners to cylinder head as follows, if removed.
 - a. Install chain tensioners with stopper pin attached and new O-ring, if removed.
 - b. Install No. 1 camshaft brackets.



G02090110

Fig. 106: Installing Chain Tensioners With Stopper Pin
Courtesy of NISSAN MOTOR CO., U.S.A.

2. Install O-rings onto cylinder block.



G02090111

Fig. 107: Installing O-Rings Onto Cylinder Block
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Install O-rings to cylinder head.
4. Apply liquid gasket to rear timing chain case. Refer to **POSITION FOR APPLYING LIQUID GASKET.**

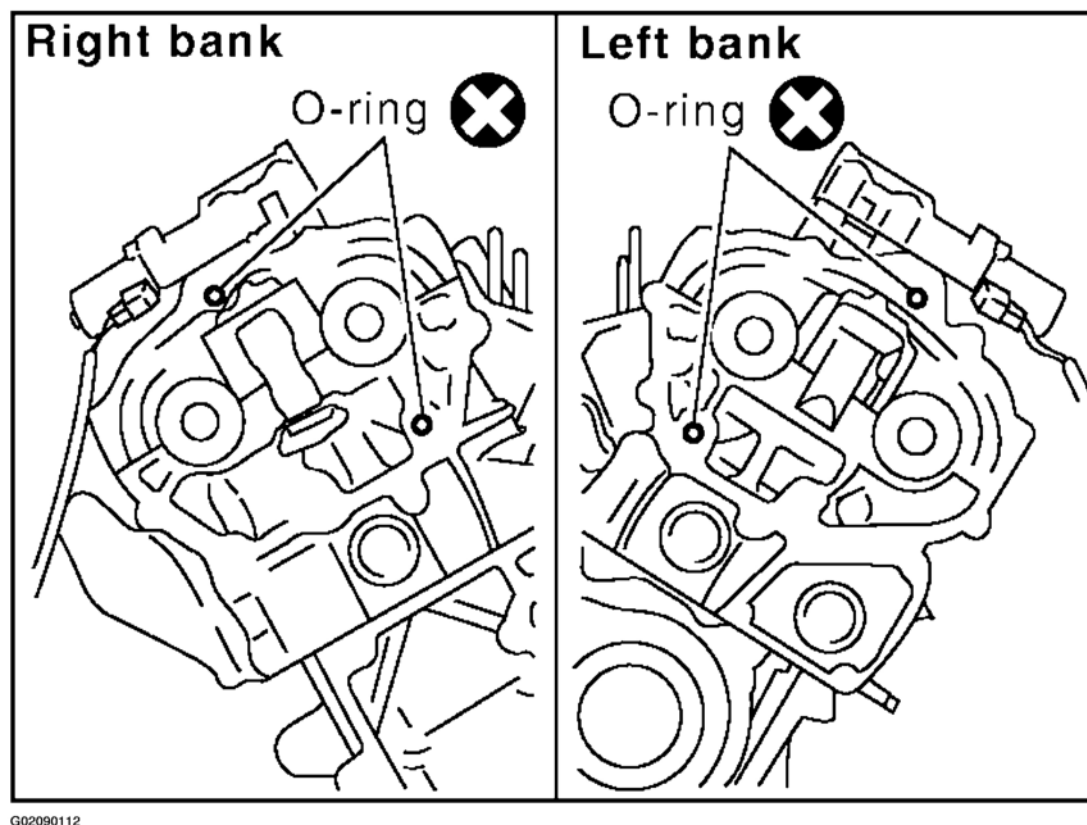


Fig. 108: Installing O-Rings To Cylinder Head
 Courtesy of NISSAN MOTOR CO., U.S.A.

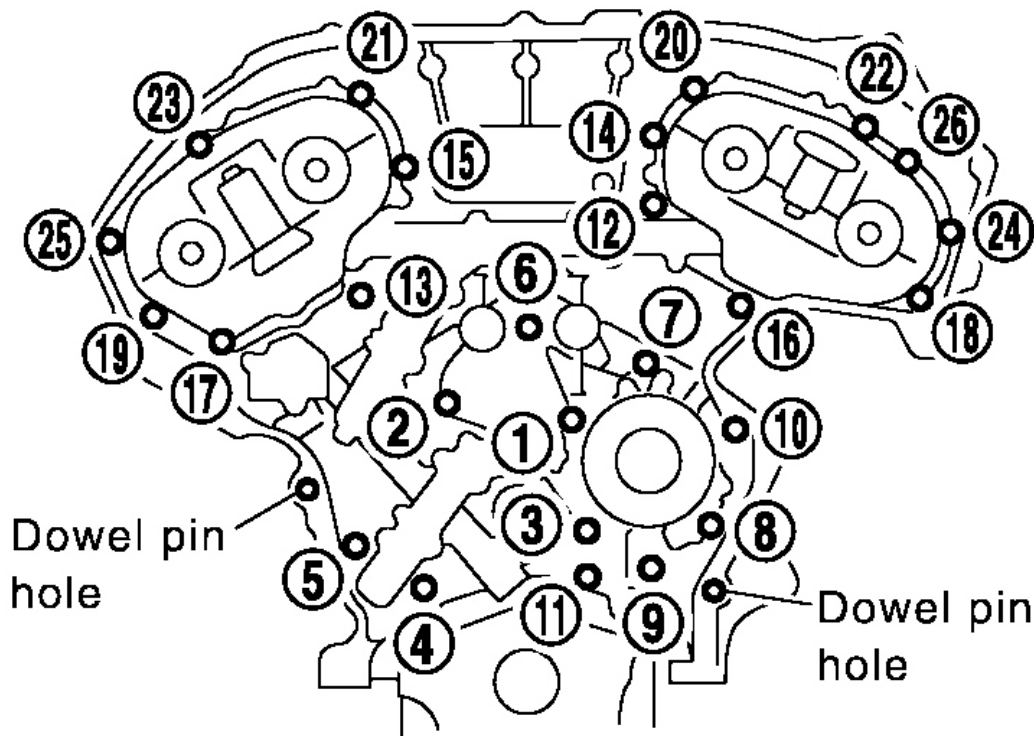
5. Align rear timing chain case and water pump assembly with dowel pins (RH and LH) on cylinder block. Then install it.
 - Do not allow O-ring to drop.
 - a. Tighten mounting bolts in order as shown in the figure. See **Fig. 109**.
 - Install two types of mounting bolts, referring to the following instructions and figure.

Bolt length:

20 mm (0.79 in) (1, 2, 3, 6, 7, 8, 9, and 10 in the figure). See Fig. 109.

16 mm (0.63 in) (other than the above)

12-13 N.m (1.2 -1.4kg-m, 9-10 ft-lb)
 - b. After all bolts are temporarily tightened, retighten them to specified torque in order shown in the figure.



G02090113

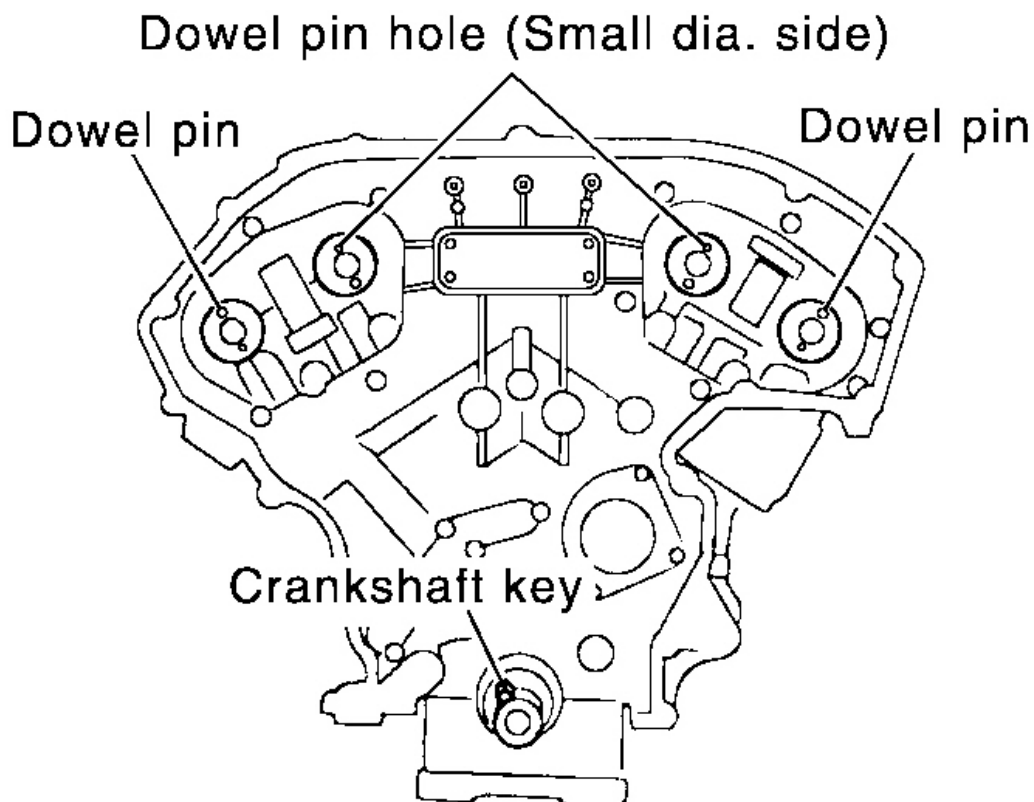
Fig. 109: Identifying Dowel Pin Hole

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

6. After installing rear timing chain case, check surface height difference between following parts on oil pan mounting surface.

Standard**Rear timing chain case to cylinder block:****-0.24 to 0.14 mm (-0.0094 to 0.0055 in)**

- If not within standard, repeat above installation procedure.
7. Install chain tension guide.
 8. Make sure that camshaft and crankshaft are at TDC position of No. 1 cylinder.
 - Make sure that dowel pin hole, dowel pin and crankshaft key are located as shown in the figure.



G02090114

Fig. 110: Locating Dowel Pin Hole And Crankshaft Key
 Courtesy of NISSAN MOTOR CO., U.S.A.

Camshaft dowel pin hole (intake-side): At cylinder head upper face side in each bank

Camshaft dowel pin (exhaust-side): At cylinder head upper face side in each bank

Crankshaft key: At cylinder head side of RH bank

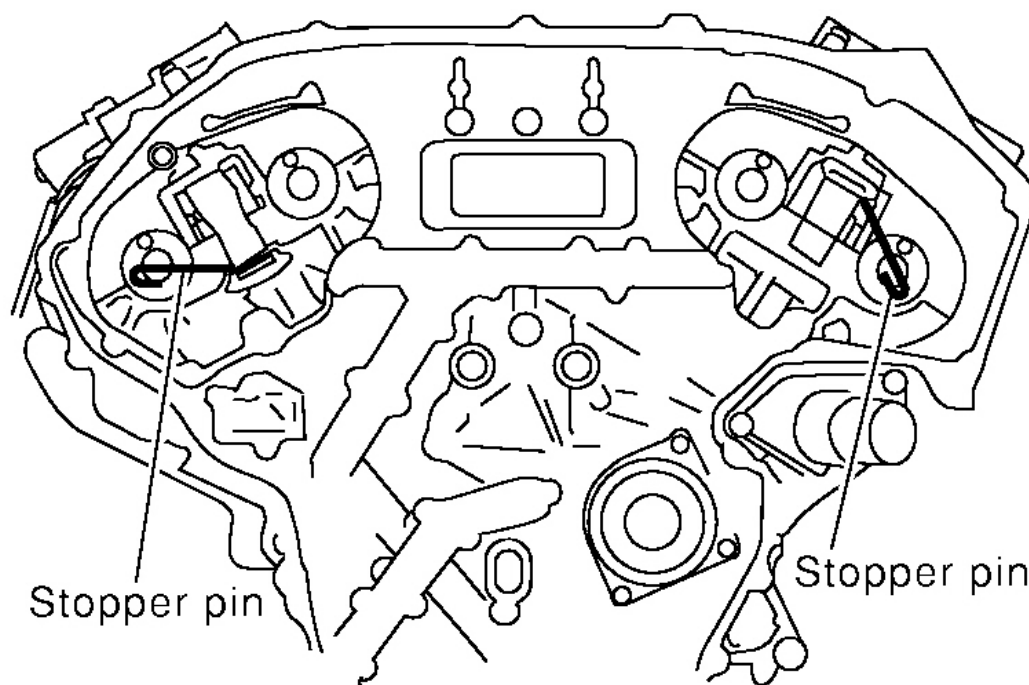
CAUTION: Hole on small diameter side must be used for intake camshaft sprocket dowel pin. Do not misidentify (Ignore big diameter side).

9. Install secondary timing chain and camshaft sprocket.

CAUTION: Matching marks between timing chain, intake and exhaust camshaft sprockets slip easily. Confirm all matching mark positions repeatedly

during the installation process.

- Push sleeve of secondary chain tensioner, and keep it pressed with stopper pin.
- a. Align matching marks on secondary timing chain (gold link) with the ones on intake and exhaust sprockets (stamped) Then install them.
 - Matching marks of intake sprocket are on back side of secondary sprocket.



G02090115

Fig. 111: Identifying Stopper Pin
Courtesy of NISSAN MOTOR CO., U.S.A.

- There are two types of matching marks: round and oval types.

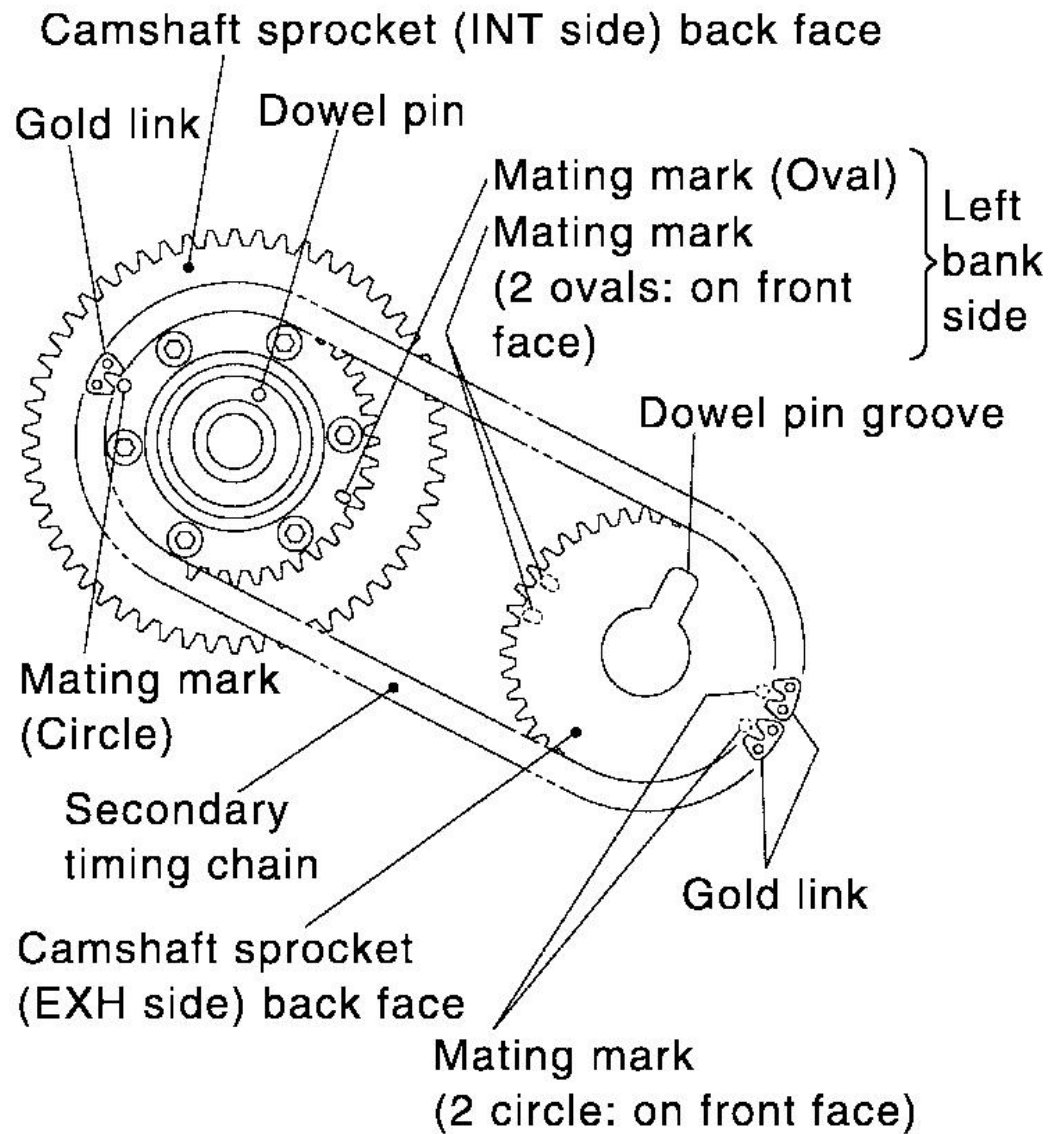
They should be used for RH/LH banks respectively.

RH bank: Use round type.

LH bank: Use oval type.

- b. Align dowel pin and pin hole on camshaft with groove and dowel pin on sprocket. Then install them.

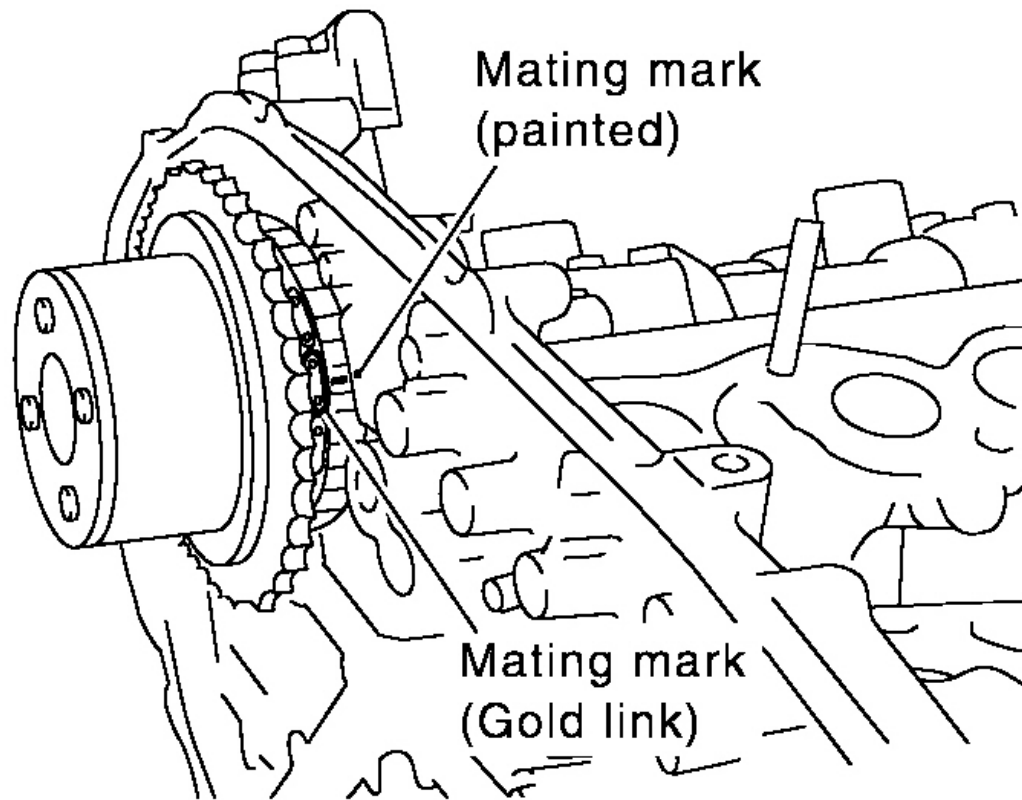
- On intake side, align pin hole on small diameter side of camshaft front end with dowel pin on back side of camshaft sprocket. Then install them.
- On exhaust side, align dowel pin on camshaft front end with pin groove on camshaft sprocket. Then install them.
- Mounting bolts for camshaft sprockets must be tightened in step 10. Tightening them by hand is enough to prevent dislocation of dowel pins.

Example: Right bank side (Rear view)

G02090116

Fig. 112: Aligning Dowel Pin And Pin Hole On Camshaft With Groove And Sprocket
 Courtesy of NISSAN MOTOR CO., U.S.A.

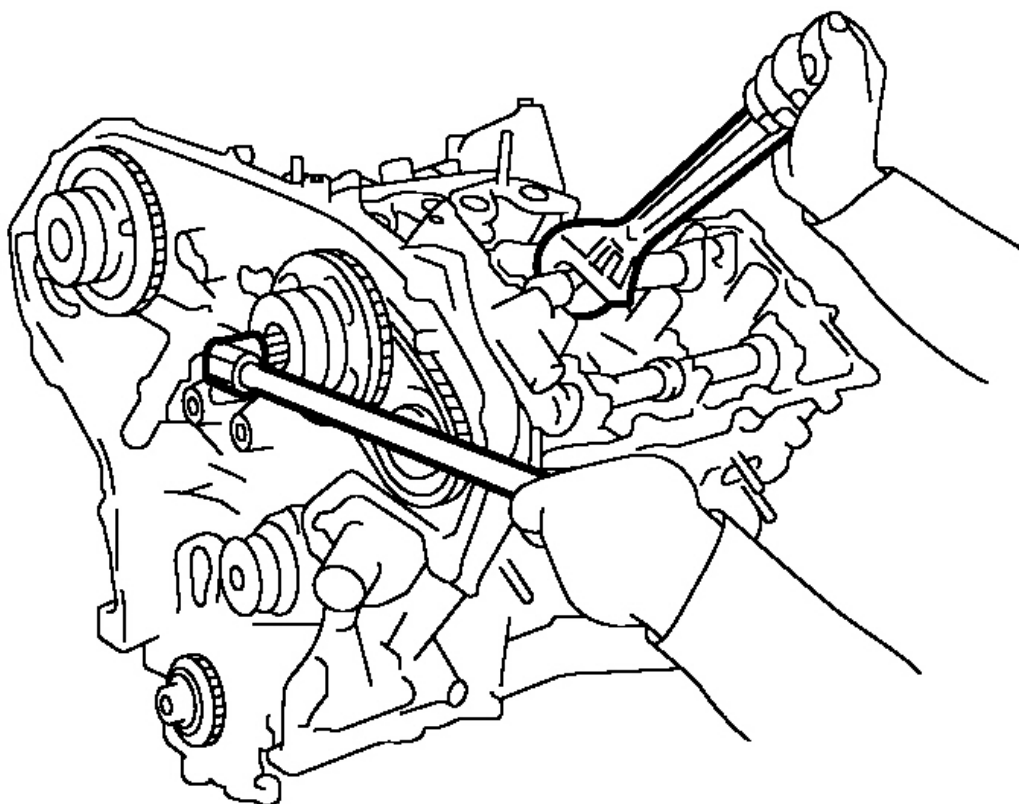
- It may be difficult to visually check the dislocation of mating marks during and after installation. To make the matching easier, make a mating mark on the top of sprocket teeth and its extended line in advance with paint.



G02090117

Fig. 113: Aligning Mating Marks
Courtesy of NISSAN MOTOR CO., U.S.A.

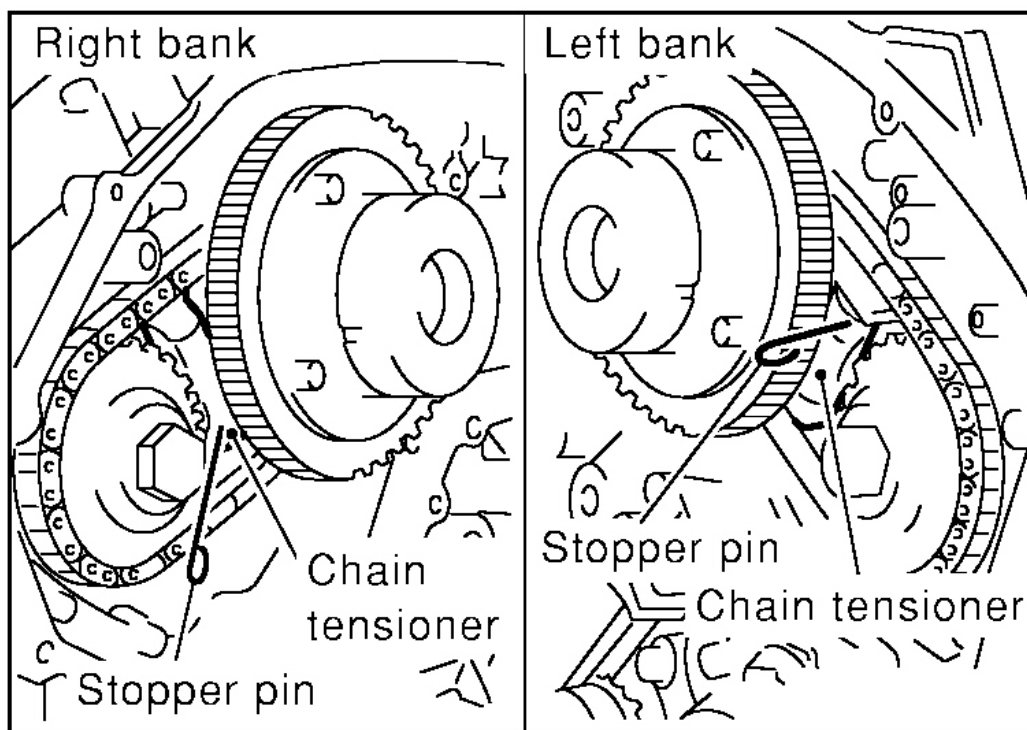
10. After confirming the mating marks are aligned, tighten the camshaft sprocket mounting bolts.
 - Secure the camshaft hexagonal portion using a spanner to tighten mounting bolts.



G02090118

Fig. 114: Tightening Camshaft Sprocket Mounting Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

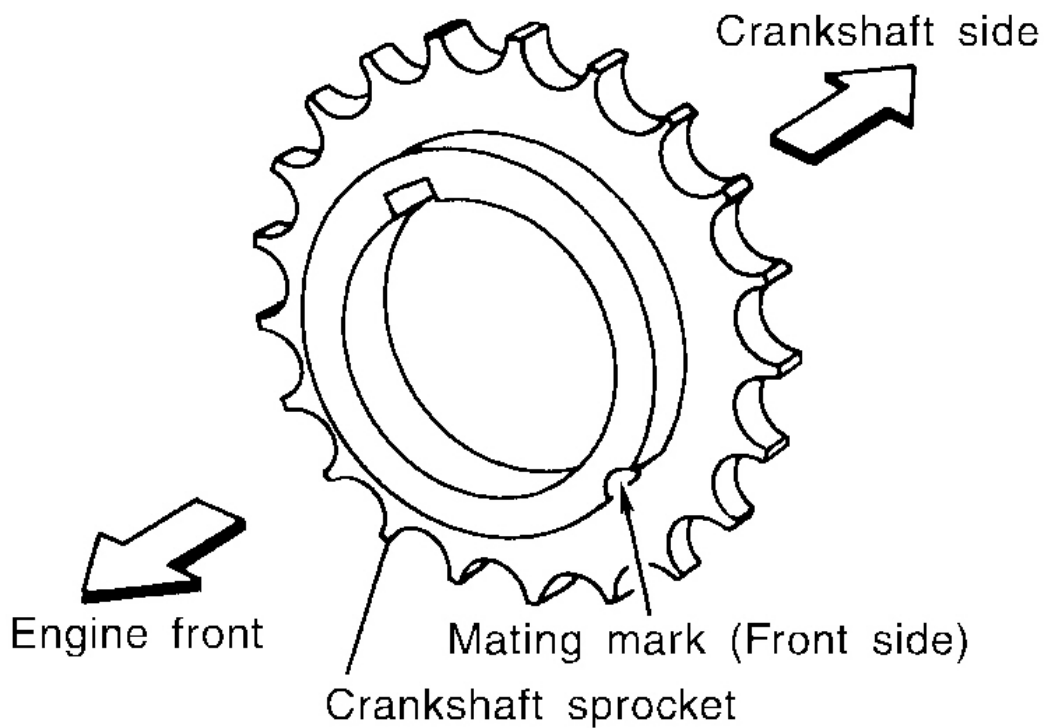
11. Pull out the stopper pin from the secondary timing chain tensioner.



G02090119

Fig. 115: Identifying Stopper Pin And Timing Chain Tensioner
Courtesy of NISSAN MOTOR CO., U.S.A.

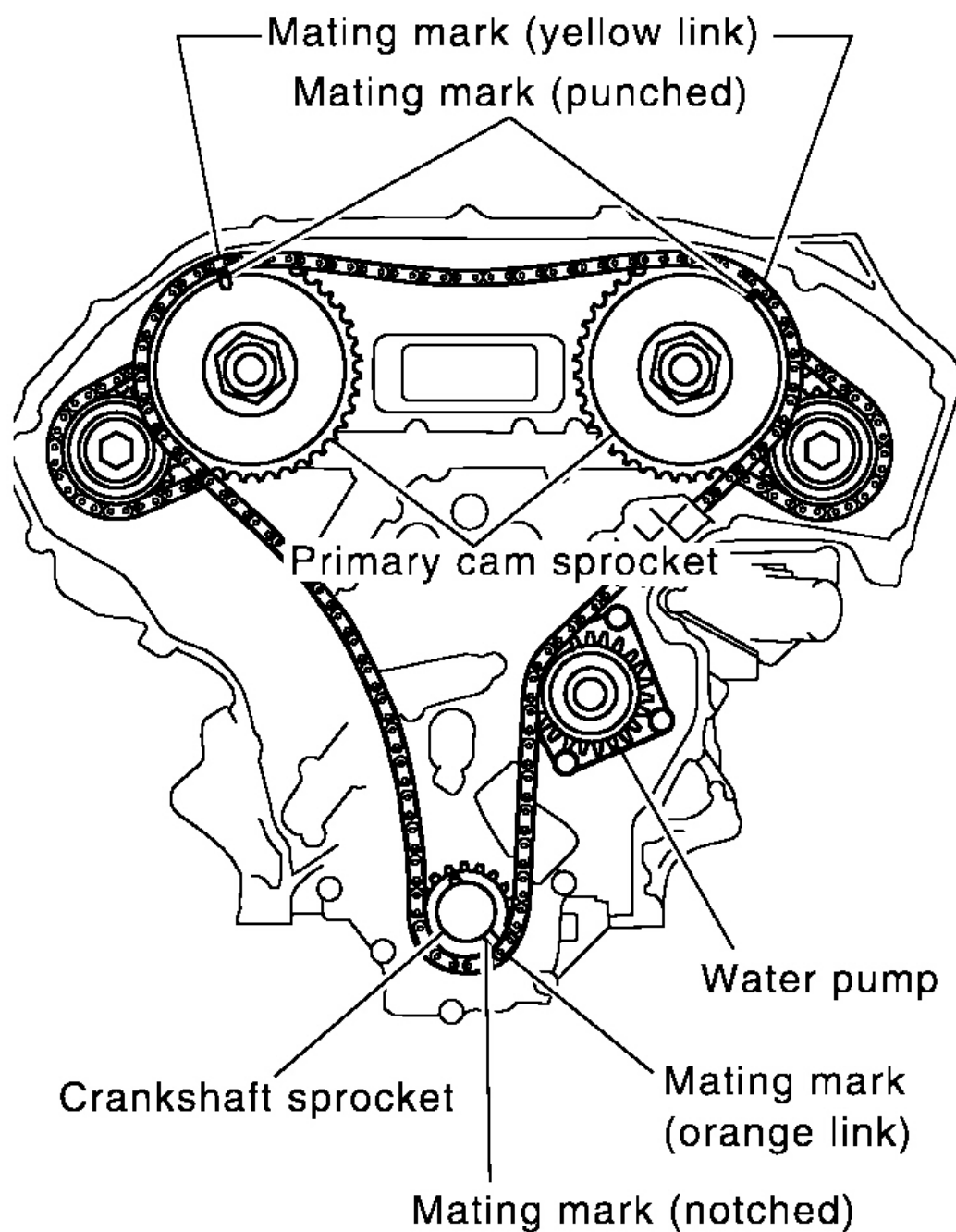
12. Install primary timing chain.
 - Install crankshaft sprocket, with matching mark to timing chain facing front of engine.



G02090120

Fig. 116: Identifying Crankshaft Sprocket Matching Mark
Courtesy of NISSAN MOTOR CO., U.S.A.

- Install primary timing chain so that mating mark (punched) on camshaft sprocket is aligned with that (yellow link) on the timing chain, and mating mark (notched) on crankshaft sprocket is aligned with that orange link on the timing chain, respectively.
- When it is difficult to align mating marks of the primary timing chain with each sprocket, gradually turn the camshaft hexagonal portion using a spanner so it is aligned with the mating mark.



G02090121

Fig. 117: Aligning Timing Chain And Mating Mark Crankshaft Sprocket
Courtesy of NISSAN MOTOR CO., U.S.A.

13. Install internal chain guide.
14. Install slack guide.

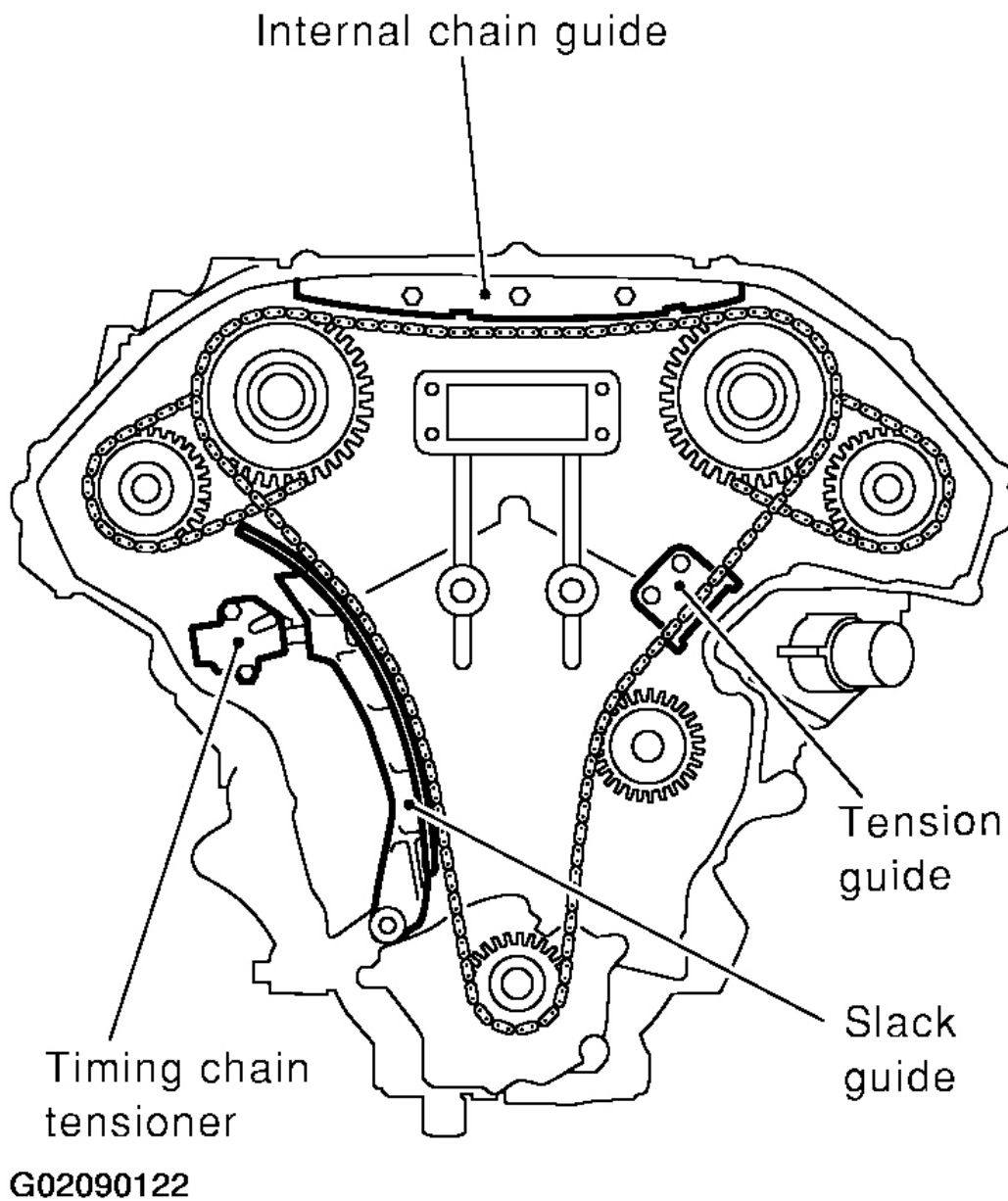
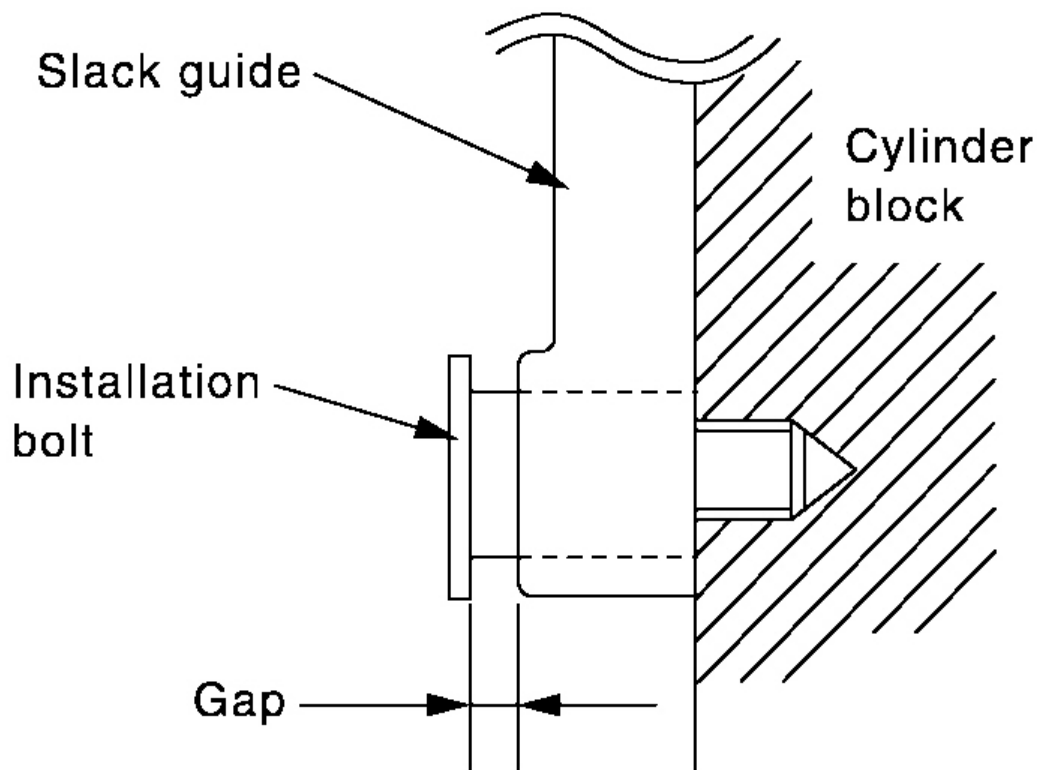


Fig. 118: Identifying Slack Guide

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

- Take care not to overtighten mounting bolts for slack guide. It is normal for a gap to exist under

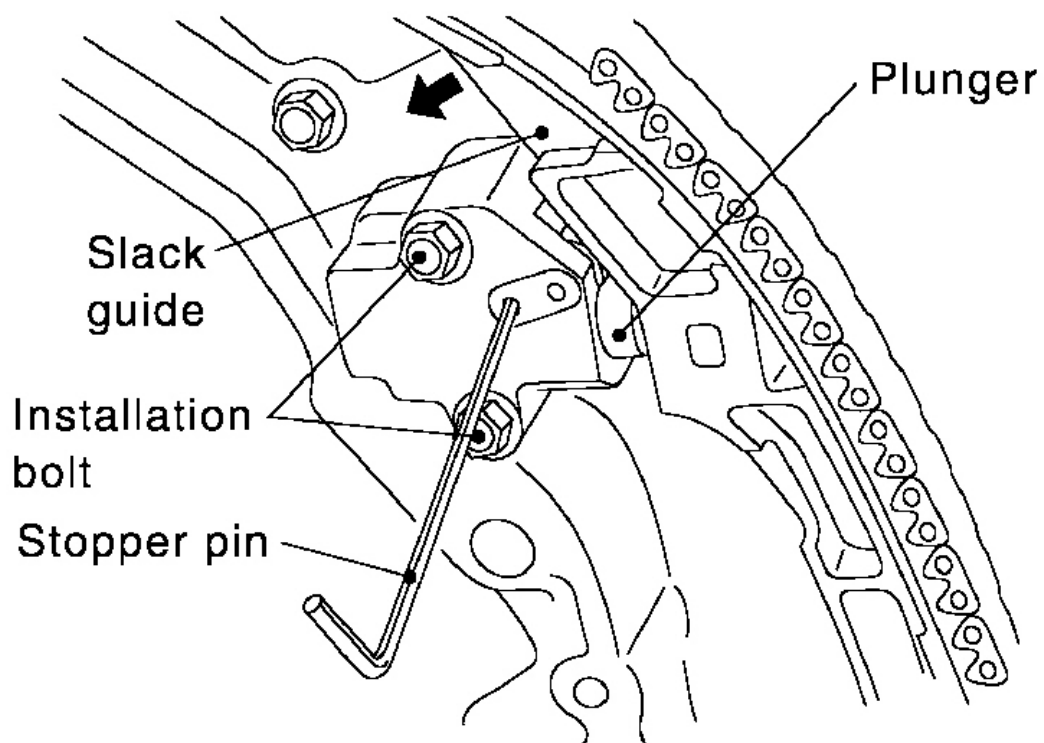
bolt seats when mounting bolts are tightened to specified torque.



G02090123

Fig. 119: Tightening Cylinder Block Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

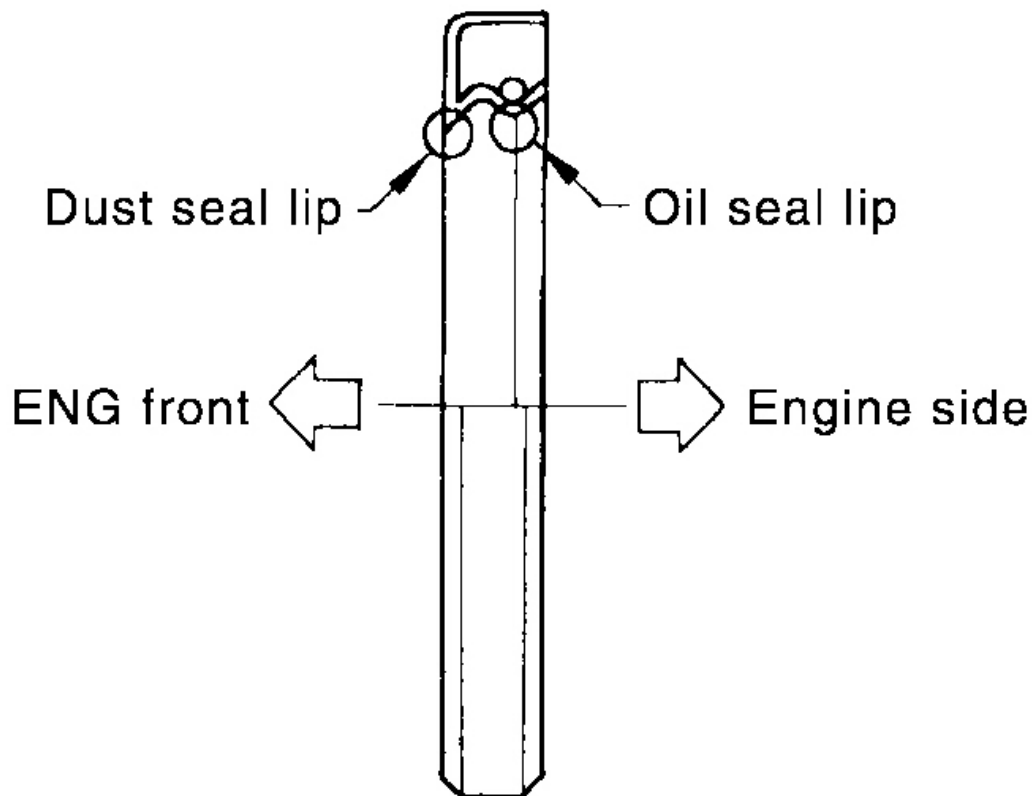
15. Install chain tensioner for slack guide.
 - When installing chain tensioner, push in sleeve and keep it pressed with stopper pin.
 - Remove dirt and foreign materials completely from back and mounting surfaces of chain tensioner.
 - After installing, pull out stopper pin by pressing slack guide.
16. Confirm again that matching marks on sprockets and timing chain have not slipped.



G02090124

Fig. 120: Installing Chain Tensioner For Slack Guide
Courtesy of NISSAN MOTOR CO., U.S.A.

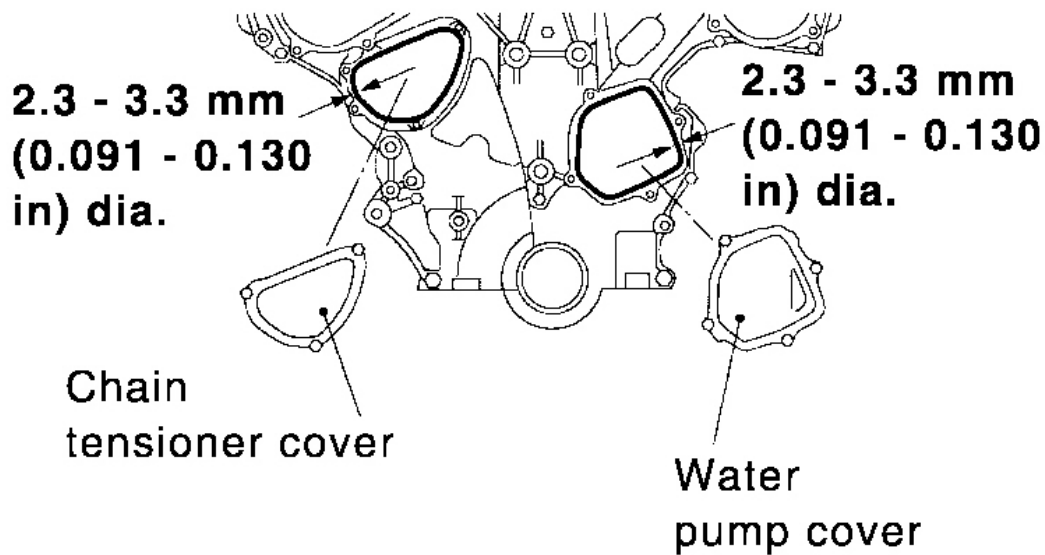
17. Install front oil seal to front timing chain case. Refer to **FRONT OIL SEAL**.



G02090125

Fig. 121: Installing Front Oil Seal To Front Timing Chain Case
Courtesy of NISSAN MOTOR CO., U.S.A.

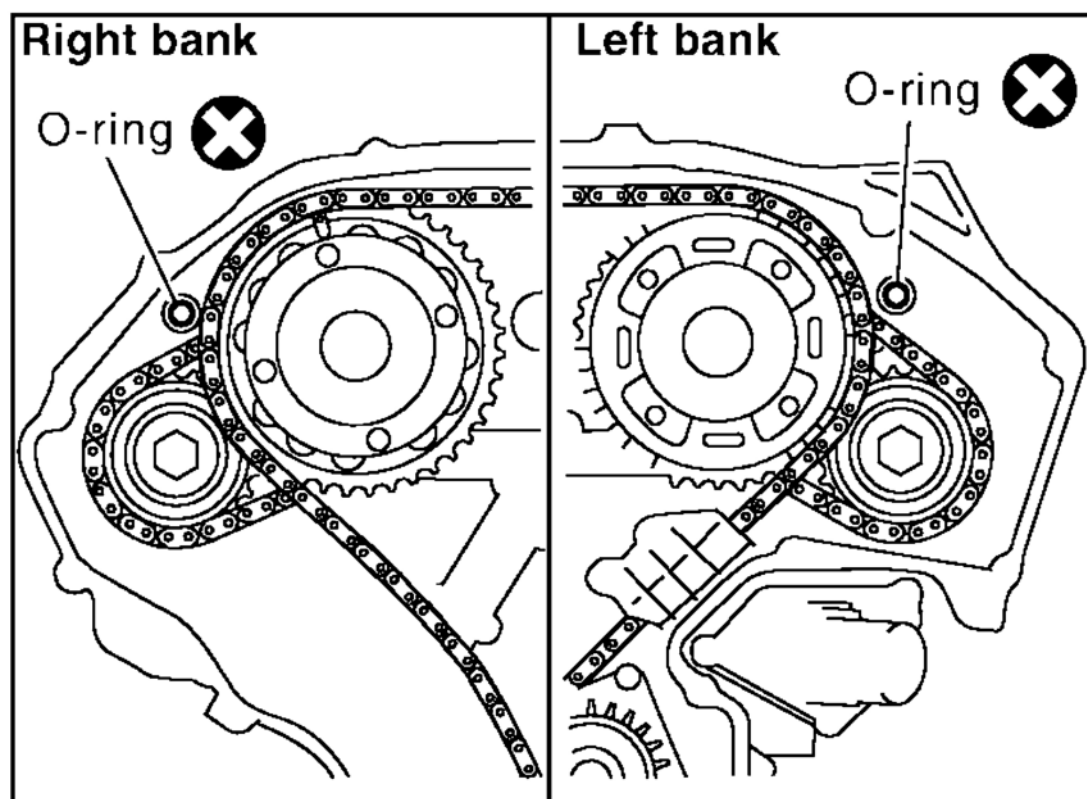
18. Apply liquid gasket to water pump cover and chain tensioner cover. Refer to **INSTALLATION**.
 - **Use Genuine RTV Silicone Sealant or equivalent.**
 - **Before installation, wipe off the protruding sealant.**
19. Install water pump cover and chain tensioner cover.



G02090126

Fig. 122: Applying Liquid Gasket To Water Pump Cover And Chain Tensioner Cover
Courtesy of NISSAN MOTOR CO., U.S.A.

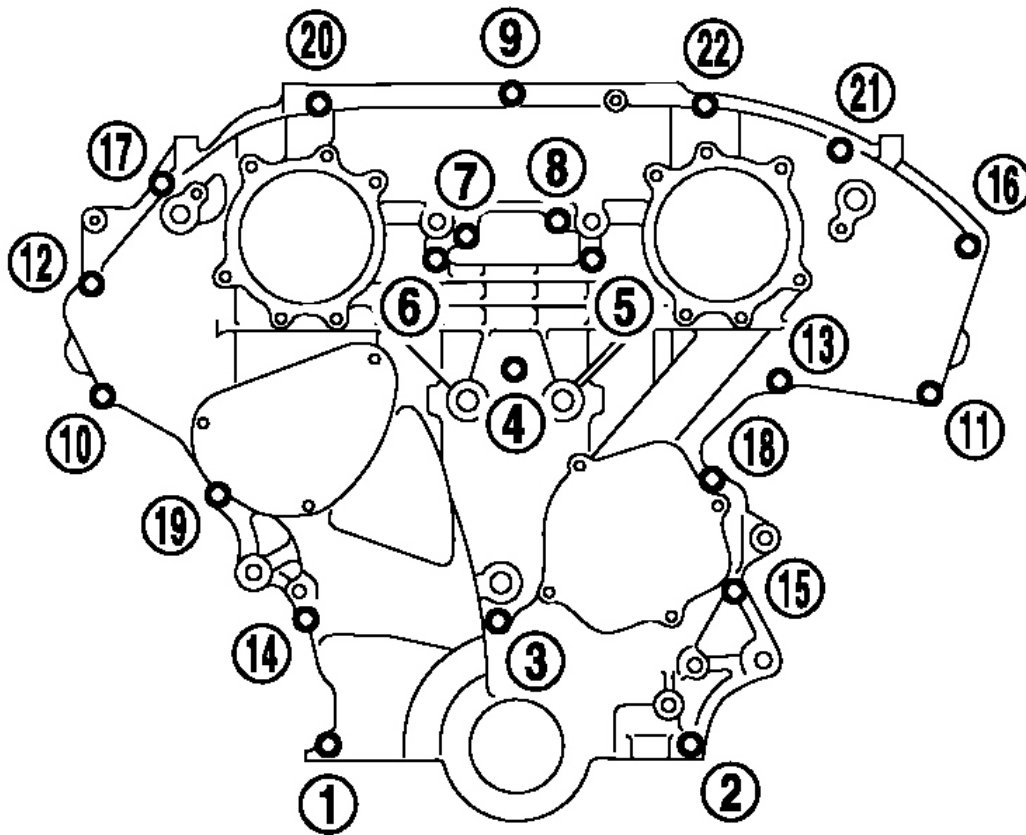
20. Install O-rings on rear timing chain case.
21. Apply liquid gasket to front timing chain case.
 - Refer to **POSITION FOR APPLYING LIQUID GASKET** .
 - Before installation, wipe off the protruding sealant.



G02090127

Fig. 123: Installing O-Rings On Rear Timing Chain Case
Courtesy of NISSAN MOTOR CO., U.S.A.

22. Install front timing chain case.
 - Align dowel pin on rear timing chain case with hole on front timing chain case.
23. Tighten bolts to the specified torque in order shown in the figure.



-  **① - ②** 8 mm (0.31 in) dia. bolts
25.5 - 31.3 N·m
(2.6 - 3.1 kg-m, 19 - 23 ft-lb)
③ - ②② 6 mm (0.24 in) dia. bolts
11.7 - 13.7 N·m
(1.2 - 1.4 kg-m, 9 - 10 ft-lb)

G02090128

Fig. 124: Tightening Front Timing Chain Case Bolts
 Courtesy of NISSAN MOTOR CO., U.S.A.

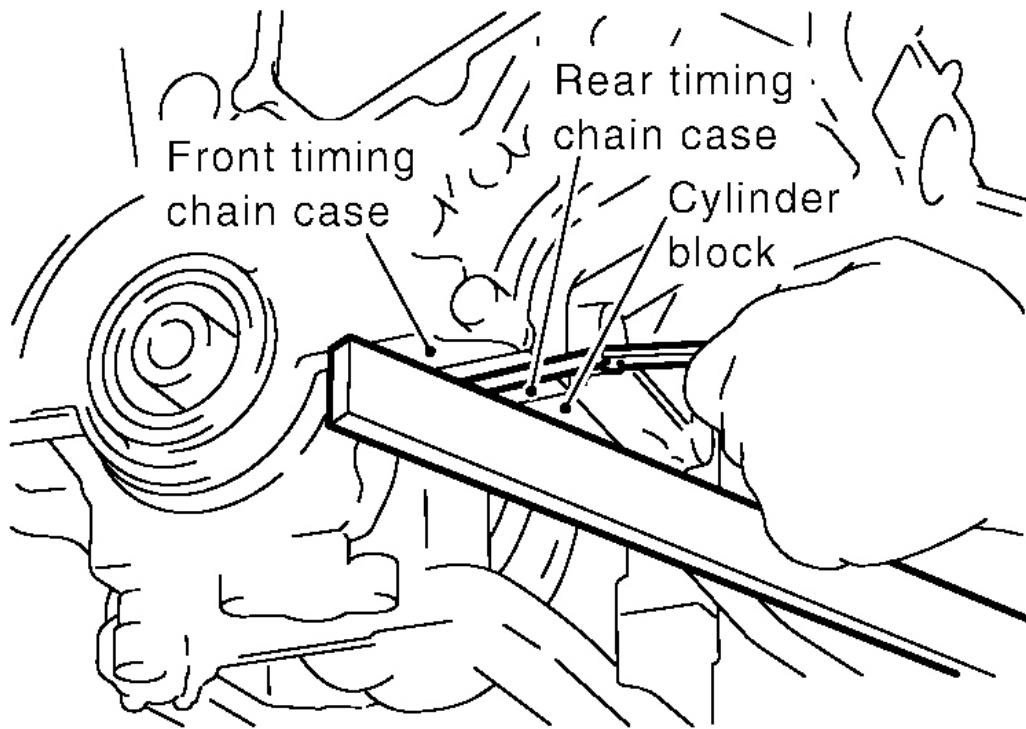
24. After installing front timing chain case, check surface height difference between following parts on oil pan mounting surface.

Standard

Front timing chain case to rear timing chain case:

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

- If not within standard, repeat above installation procedure.

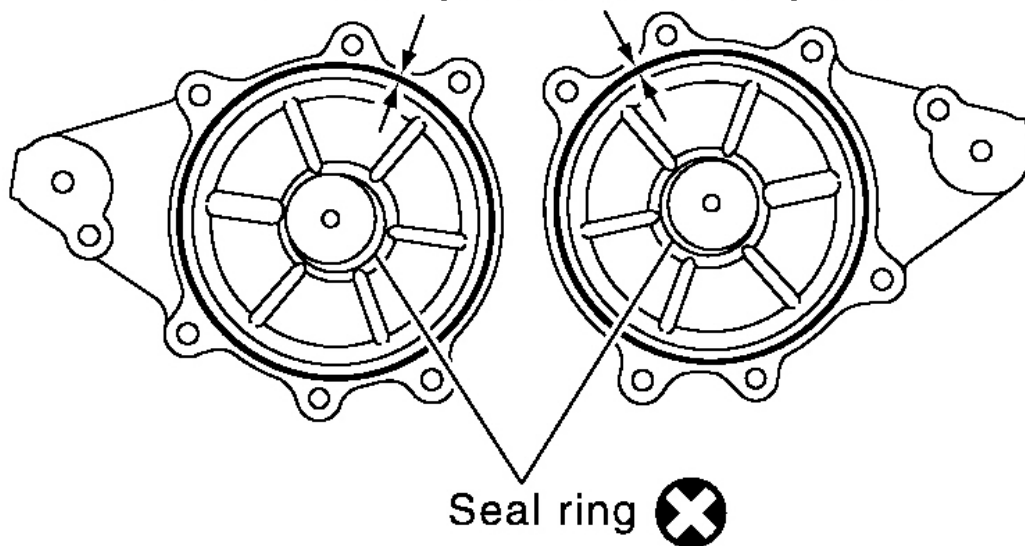


G02090129

Fig. 125: Checking Height Surface Front Timing Chain Case
Courtesy of NISSAN MOTOR CO., U.S.A.

25. Install LH and RH intake valve timing control covers.
- a. Install new seal ring at intake valve timing control cover with new engine oil applied on it.
 - b. Apply liquid gasket to intake valve timing control covers.
 - Use genuine RTV silicone sealant or equivalent.

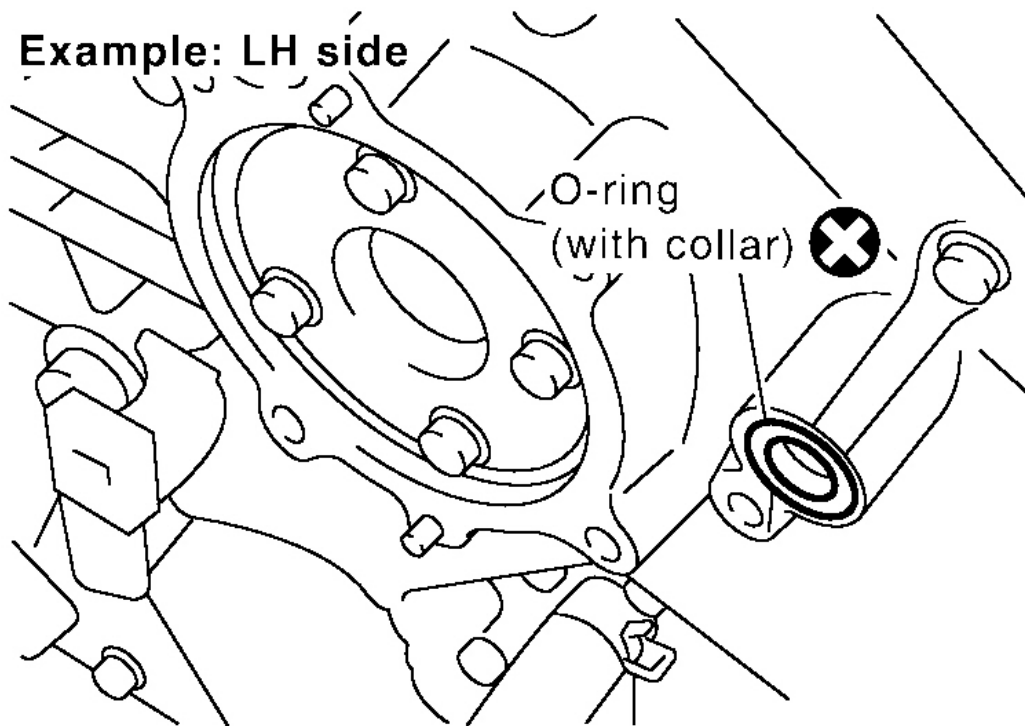
2.1 - 3.1 mm (0.083 - 0.122 in) dia.



G02090130

Fig. 126: Installing Seal Ring Intake Valve Timing Control Cover
Courtesy of NISSAN MOTOR CO., U.S.A.

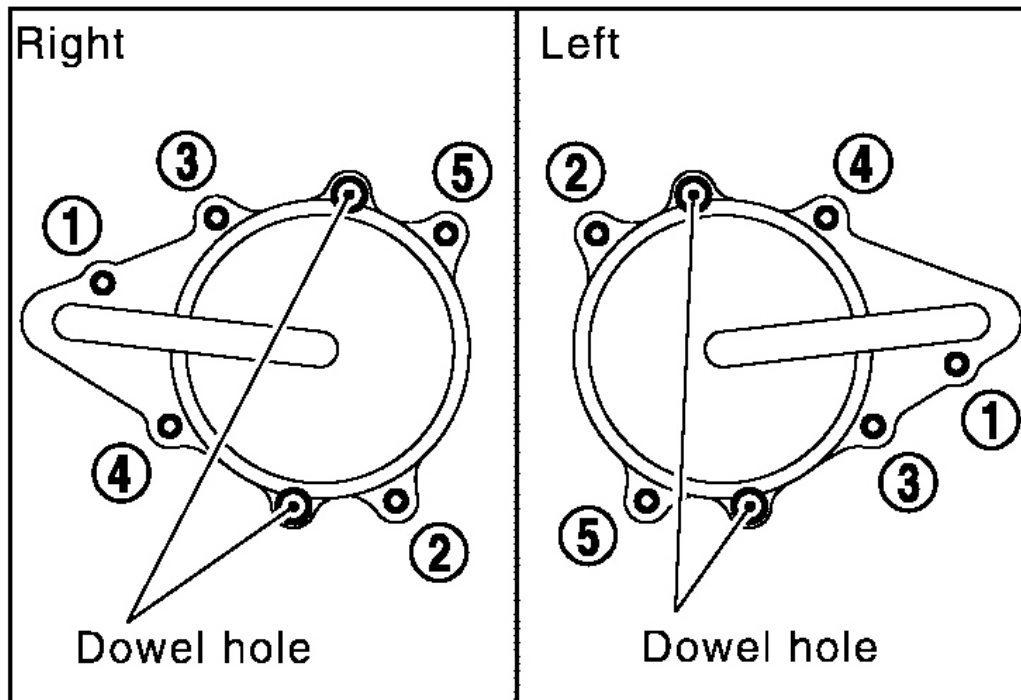
- c. Install collared O-ring in front timing chain case oil hole (LH and RH sides).



G02090131

Fig. 127: Installing O-Ring In Front Timing Chain Case Oil Hole (LH And RH Sides)
Courtesy of NISSAN MOTOR CO., U.S.A.

- d. Being careful not to move the seal ring from the installation groove, align the dowel pins on the chain case with the holes to install the intake valve timing control cover.
- e. Tighten in numerical order as shown in the figure.



G02090132

Fig. 128: Aligning Dowel Pins On Chain Case

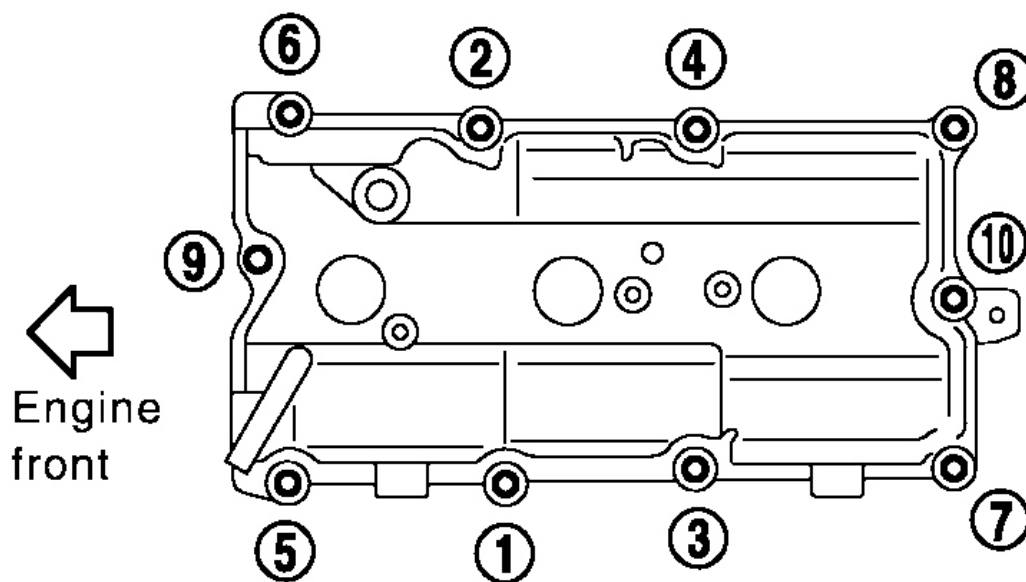
Courtesy of NISSAN MOTOR CO., U.S.A.

26. Install RH and LH rocker covers.

- Check spark plug hole oil seal for cracks and damage on sealing portion. Replace rocker cover if necessary.
- Apply liquid gasket to RH and LH rocker covers. Refer to **POSITION FOR APPLYING LIQUID GASKET**.
- Use Genuine RTV Silicone Sealant or equivalent.

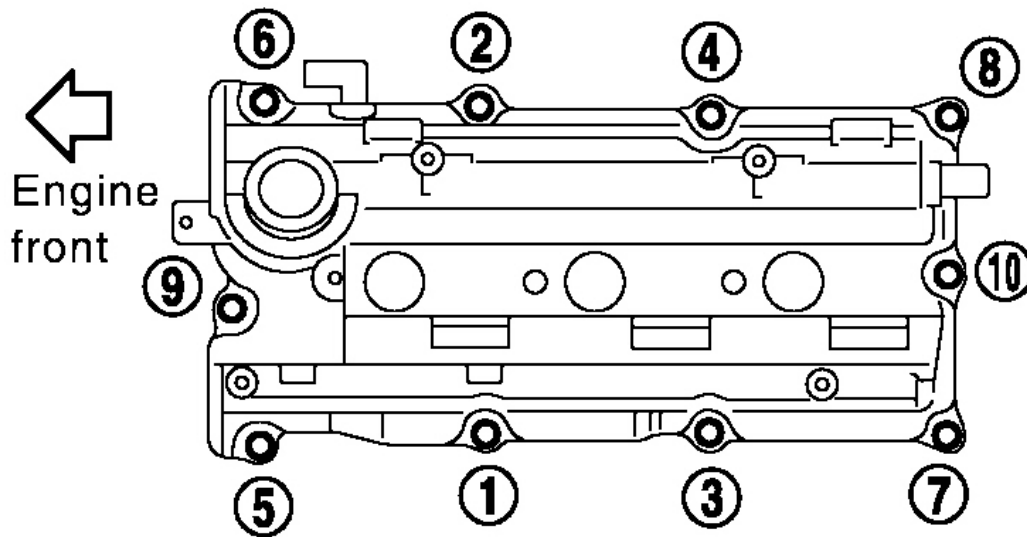
Rocker cover tightening procedure:

- Tighten in numerical order as shown in the figure.



G02090133

Fig. 129: Installing Rocker Covers (RH)
Courtesy of NISSAN MOTOR CO., U.S.A.

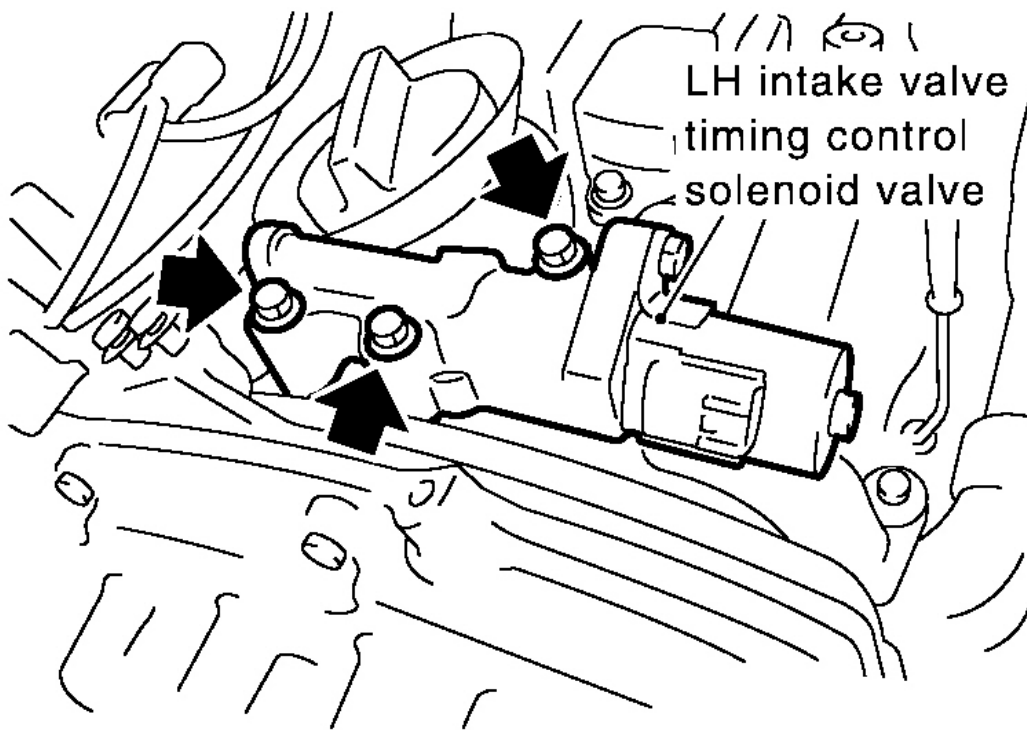


G02090134

Fig. 130: Installing Rocker Covers (LH)
Courtesy of NISSAN MOTOR CO., U.S.A.

- a. Tighten bolts 1 to 10 in that order to 0.96 to 2.96 N.m (0.10 to 0.30 kg-m, 9 to 26 in-lb).
 - b. Then tighten bolts 1 to 10 as indicated in figure to 7.33 to 9.33 N.m (0.75 to 0.95 kg-m, 65 to 82 in-lb).
27. Install RH and LH intake valve timing control solenoid valves.
 28. Install RH and LH ignition coils.
 29. Install intake manifold collector gasket.
 30. Install intake manifold upper and lower collectors.

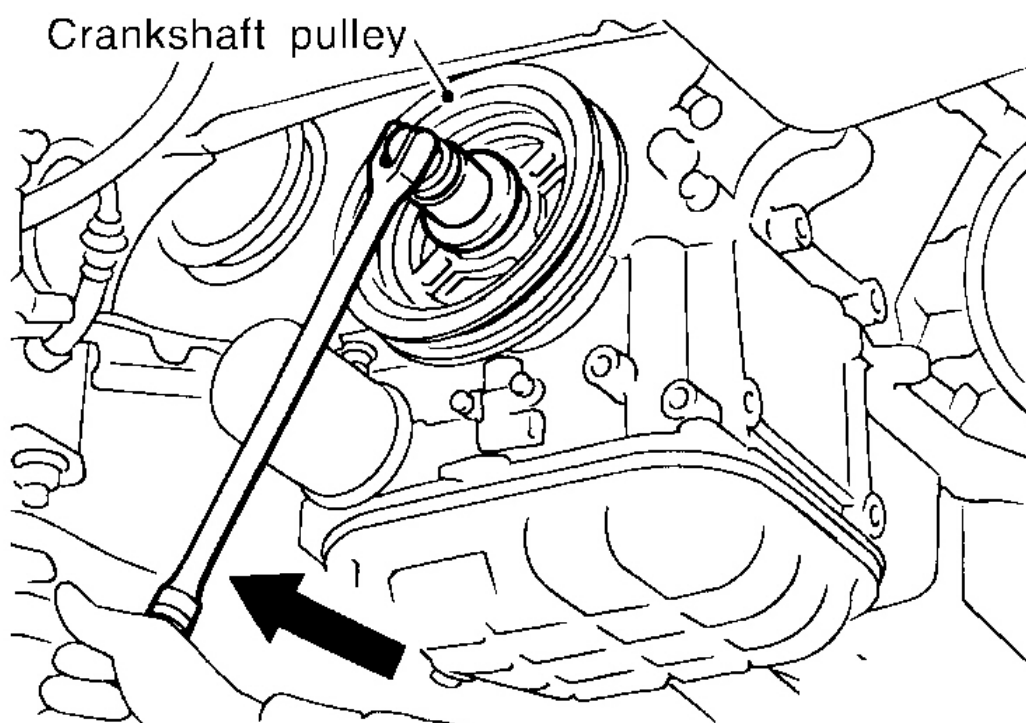
Refer to "**TIGHTENING PROCEDURES.**



G02090135

Fig. 131: Installing Intake Valve Timing Control Solenoid Valves
Courtesy of NISSAN MOTOR CO., U.S.A.

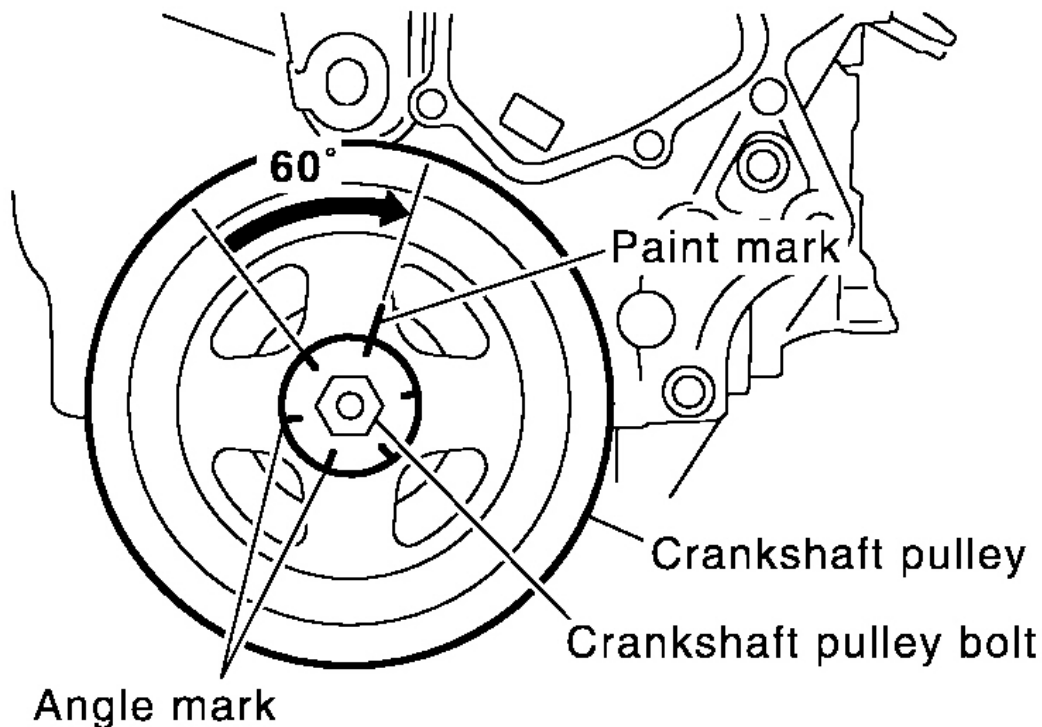
31. Install crankshaft pulley to crankshaft.
 - a. Tighten to 39.2 to 49.0 N.m (4.0 to 5.0 kg-m, 29 to 36 ft-lb).
 - b. Put a paint mark on the crankshaft pulley.



G02090136

Fig. 132: Installing Crankshaft Pulley To Crankshaft
Courtesy of NISSAN MOTOR CO., U.S.A.

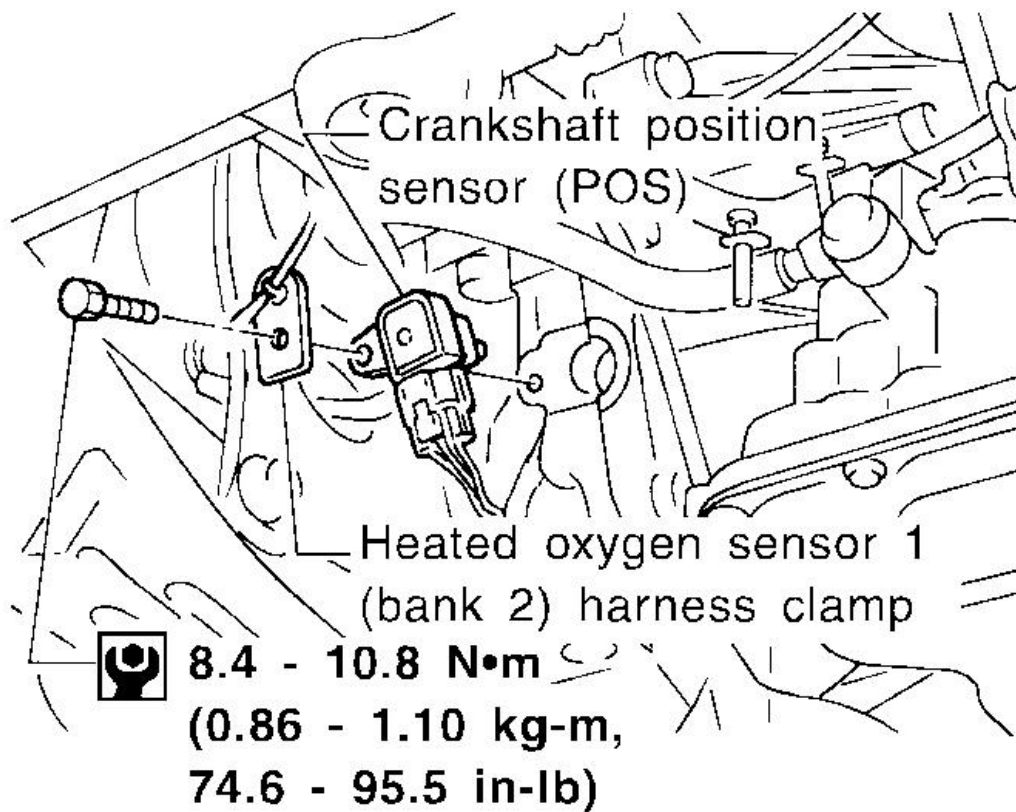
- c. Again tighten by turning 60° to 66° [Target: 60 degrees (equivalent to one graduation)].



G02090137

Fig. 133: Aligning Crankshaft Pulley
Courtesy of NISSAN MOTOR CO., U.S.A.

32. Reinstall removed parts in reverse order of removal.
- Make sure that crankshaft position sensor (POS) and heated oxygen sensor 1 (bank 2) harness clamp are installed correctly as shown in figure.
 - When installing fuel tube assembly. Refer to **FUEL SYSTEMS**.
 - Check oil level after refilling engine oil.
 - After starting engine, keep idling for three minutes. Then rev engine up to 3,000 RPM under no load to purge air from the high-pressure chamber of the chain tensioners. The engine may produce a rattling noise. This indicates that air still remains in the chamber and is not a matter of concern.



G02090138

Fig. 134: Installing Crankshaft Position Sensor
Courtesy of NISSAN MOTOR CO., U.S.A.

OIL SEAL

REPLACEMENT

CAUTION: When removing the oil pans, oil pump assembly and timing chain from engine, first remove the crankshaft position sensor (POS) from the assembly.
Be careful not to damage sensor edges.

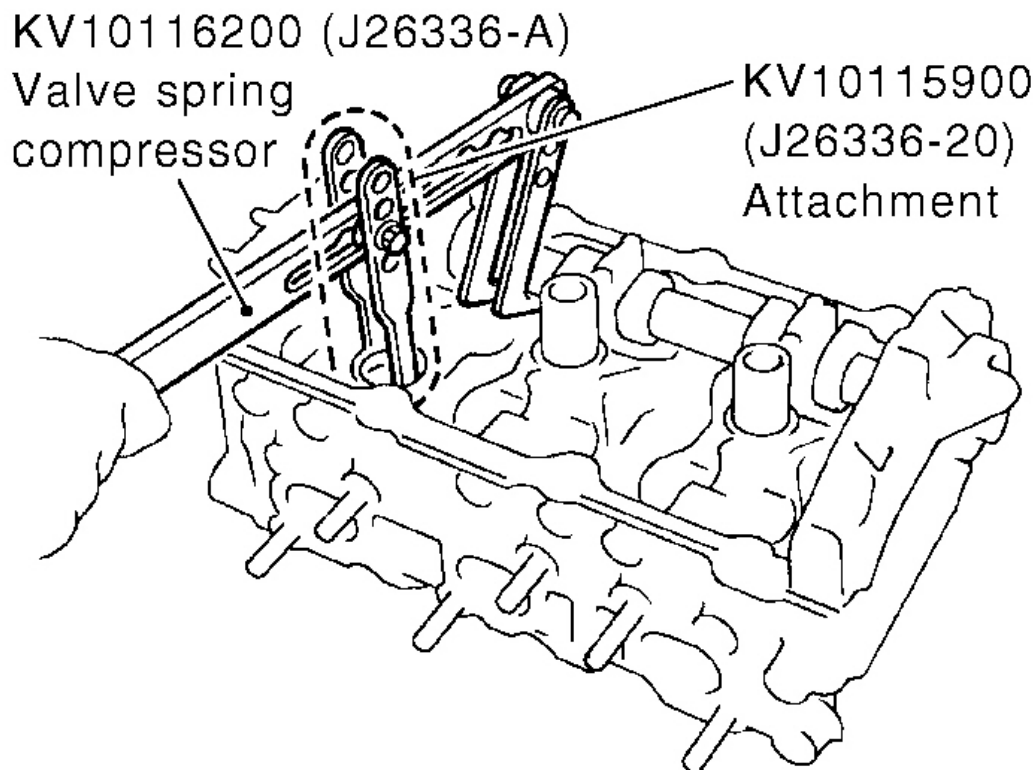
VALVE OIL SEAL

1. Remove ornament cover.
2. Remove intake manifold upper collector and intake manifold lower collector. Refer to **TIGHTENING**

PROCEDURES.

3. Remove RH and LH ignition coils.
4. Remove RH and LH rocker covers from cylinder head. Refer to **REMOVAL**.
5. Remove crankshaft position sensor (POS). Refer to **COMPONENTS**.
6. Remove oil pan. Refer to **REMOVAL**.
7. Remove timing chain. Refer to **REMOVAL**.
8. Remove camshaft brackets and camshaft. Refer to **REMOVAL**.
9. Remove valve lifters. Refer to **REMOVAL**.
10. Remove valve spring with Tool.

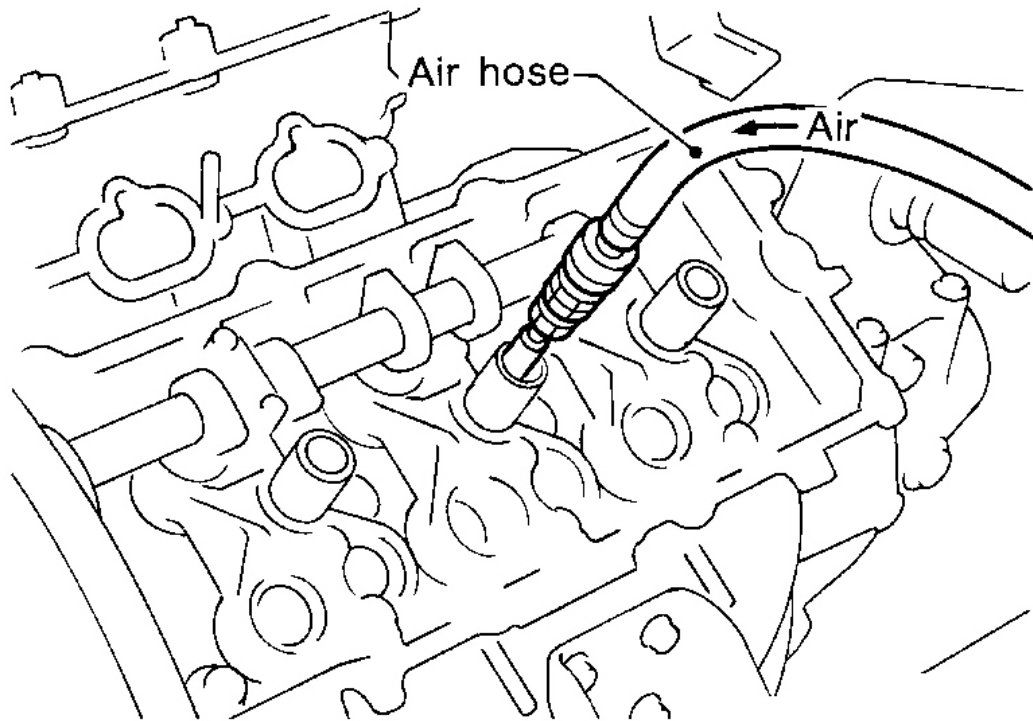
Before removing valve spring, fix valve as follows. Piston concerned should be set at TDC to prevent valve from falling.



G02090139

Fig. 135: Removing Valve Spring Using Tool
Courtesy of NISSAN MOTOR CO., U.S.A.

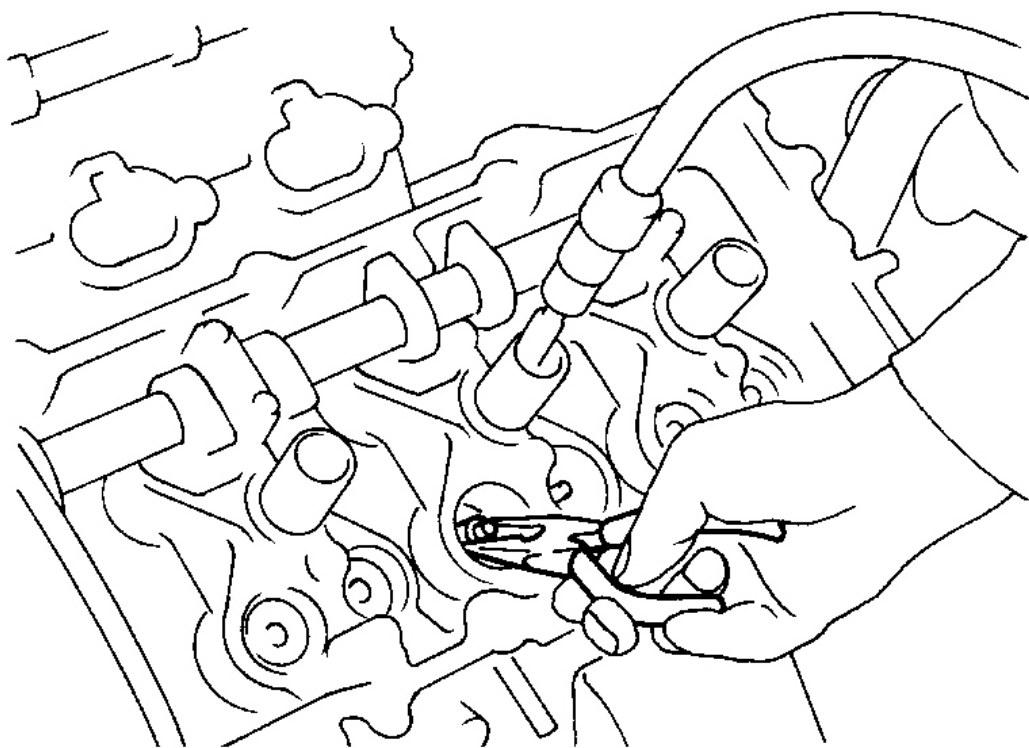
Remove spark plug, then install air hose adapter into spark plug hole and apply air pressure to hold valves in place. Apply a pressure of 490 kPa (5 kg/cm², 71 psi).



G02090140

Fig. 136: Applying Air Pressure To Hold Valves
Courtesy of NISSAN MOTOR CO., U.S.A.

11. Remove valve oil seal.



G02090141

Fig. 137: Removing Valve Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

12. Apply engine oil to new valve oil seal and install it with Tool.
13. Reinstall any parts removed in reverse order of removal.

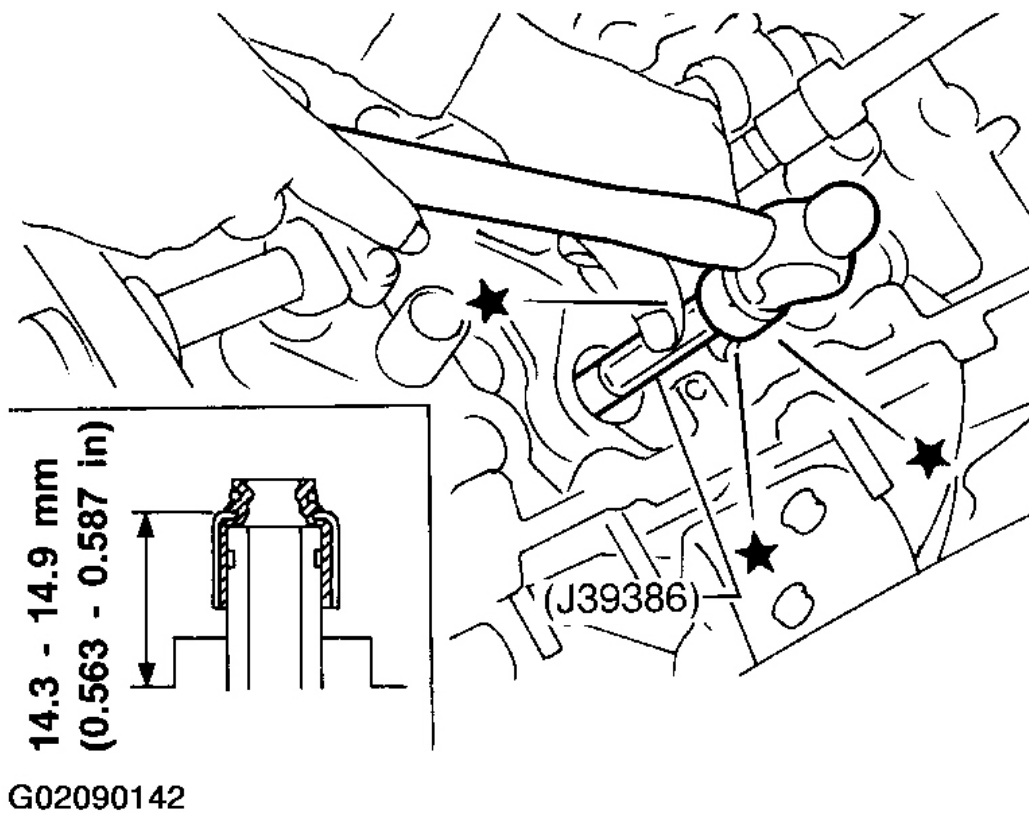


Fig. 138: Installing Valve Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

FRONT OIL SEAL

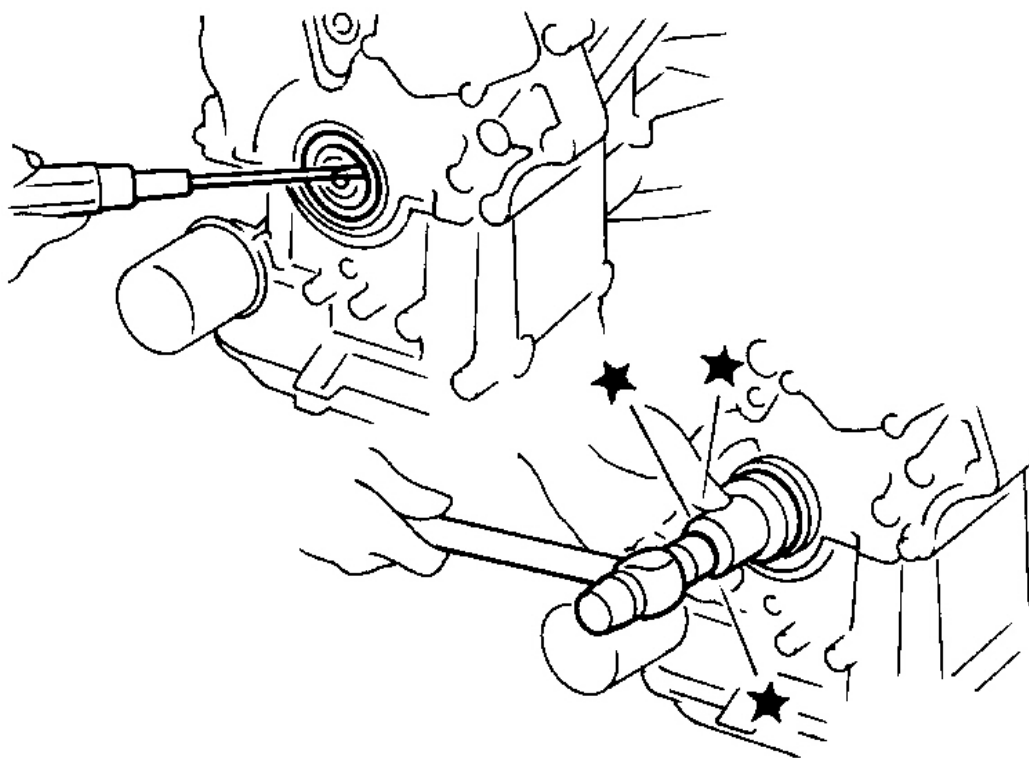
1. Remove the following parts:
 - Engine undercover
 - Front RH wheel and engine side cover
 - Drive belts.
 - Crankshaft pulley. Refer to **REMOVAL**.

Be careful not to damage sensor edge.

2. Remove front oil seal using a suitable tool.

Be careful not to scratch front cover.

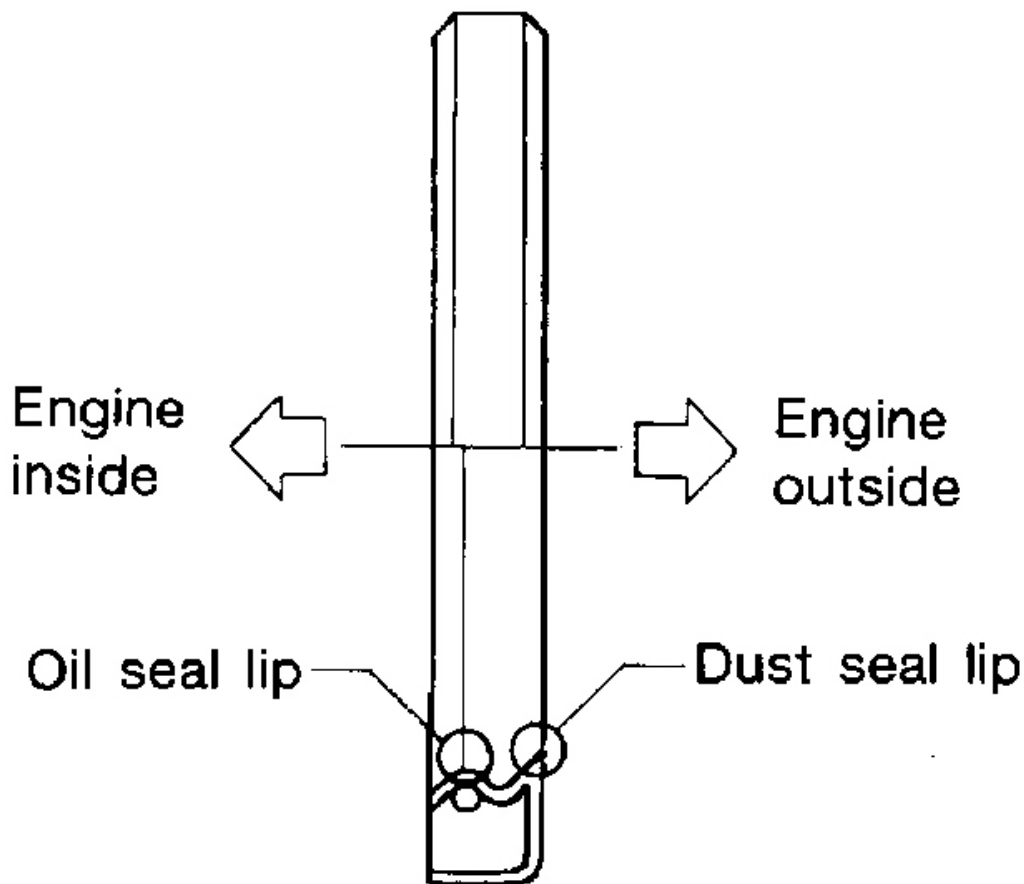
3. Apply engine oil to new oil seal and install it using a suitable tool.



G02090143

Fig. 139: Removing Front Oil Seal Using Suitable Tool
Courtesy of NISSAN MOTOR CO., U.S.A.

- Install new oil seal in the direction shown in the figure.

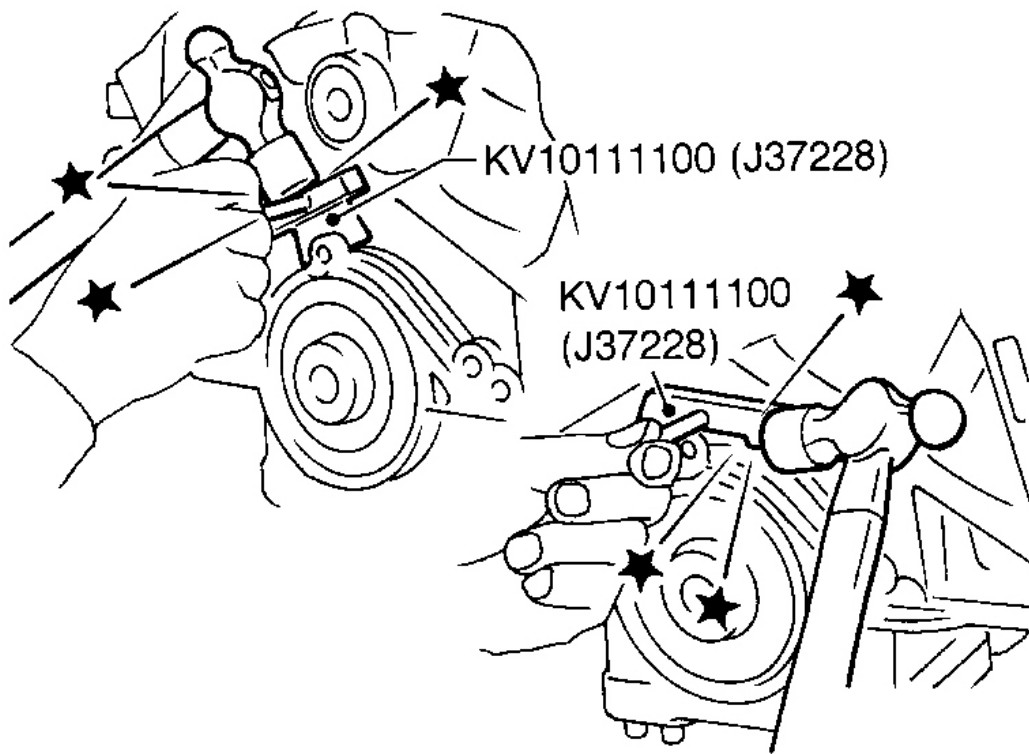


G02090144

Fig. 140: Installing Oil Seal And Dust Seal Lip
Courtesy of NISSAN MOTOR CO., U.S.A.

REAR OIL SEAL

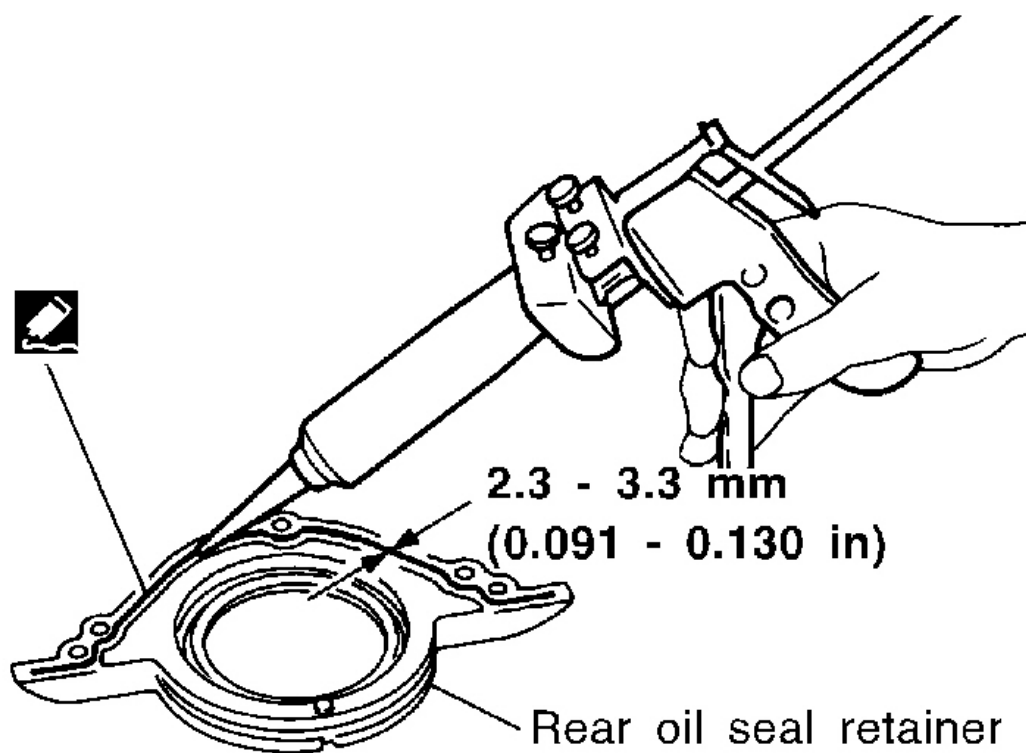
1. Remove transaxle. Refer to **REMOVAL AND INSTALLATION** .
2. Remove drive plate. Refer to **COMPONENTS**.
3. Remove **OIL PAN** .
4. Remove rear oil seal retainer.
 - Use seal cutter (SST) or an equivalent tool to cut liquid gasket for removal.



G02090145

Fig. 141: Removing Rear Oil Seal
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Remove old liquid gasket on mating surface of cylinder block and oil pan using scraper.
 - **Remove old liquid gasket from the bolt hole and thread.**
6. Apply liquid gasket to rear oil seal retainer.
 - Use Genuine RTV Silicone Sealant or equivalent. .
 - Assembly should be done within 5 minutes after coating.
 - Wait at least 30 minutes before refilling engine oil and engine coolant.



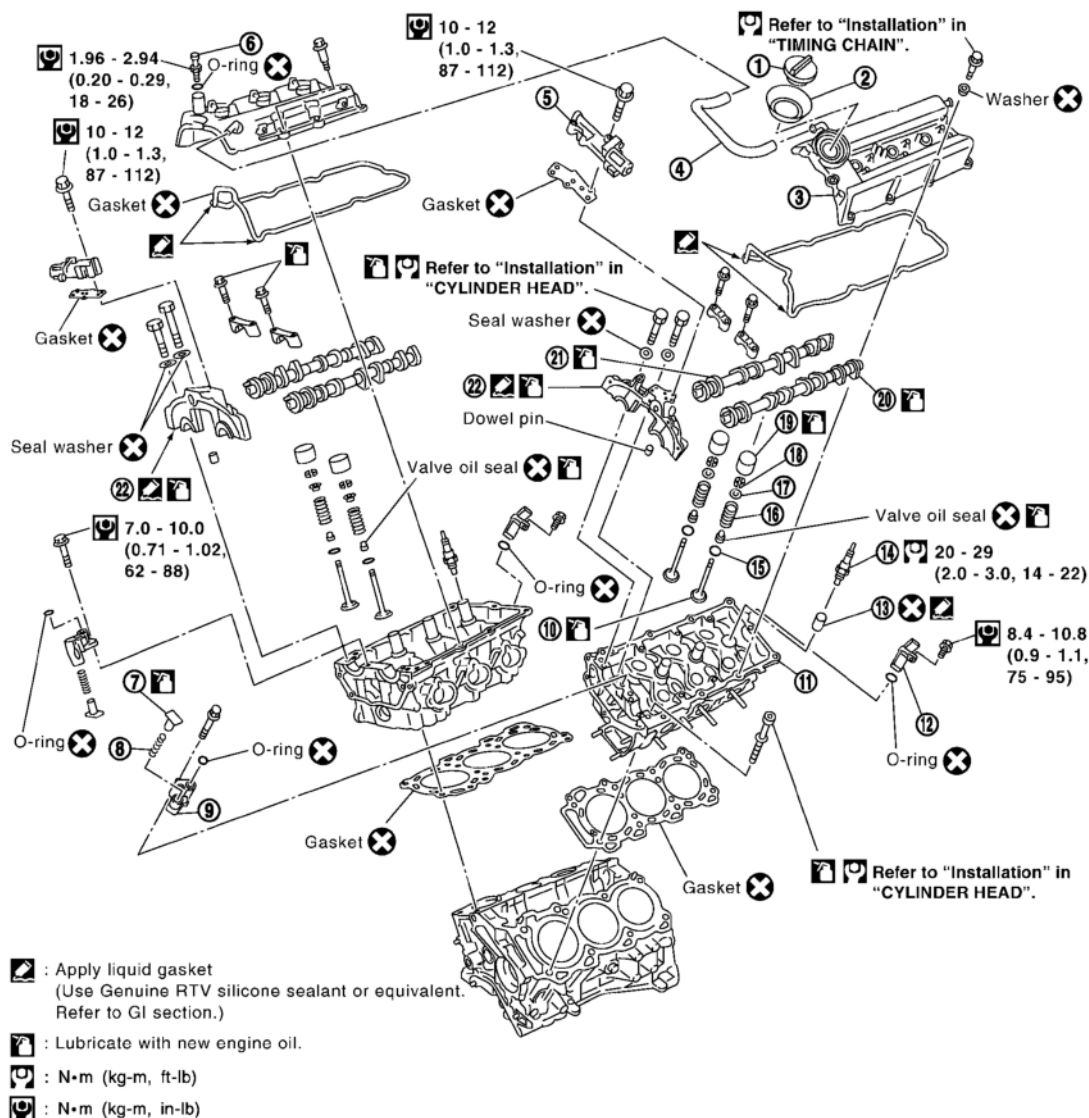
G02090146

Fig. 142: Applying Liquid Gasket To Rear Oil Seal Retainer
Courtesy of NISSAN MOTOR CO., U.S.A.

CYLINDER HEAD

COMPONENTS

SEC. 111•118•130•140•220



- | | | |
|--|---|---------------------------|
| 1. Oil filler cap | 8. Spring | 15. Valve spring seat |
| 2. Oil catcher | 9. Chain tensioner | 16. Valve spring |
| 3. Rocker cover | 10. Valve | 17. Valve spring retainer |
| 4. PCV hose | 11. Cylinder head | 18. Valve collet |
| 5. Intake valve timing control sole-
noid valve | 12. Camshaft position sensor
(PHASE) | 19. Valve lifter |
| 6. PCV valve | 13. Spark plug tube | 20. Camshaft (Exhaust) |
| 7. Tensioner sleeve | 14. Spark plug | 21. Camshaft (Intake) |
| | | 22. Camshaft bracket |

G02090147

Fig. 143: Exploded View Of Cylinder Head Components
 Courtesy of NISSAN MOTOR CO., U.S.A.

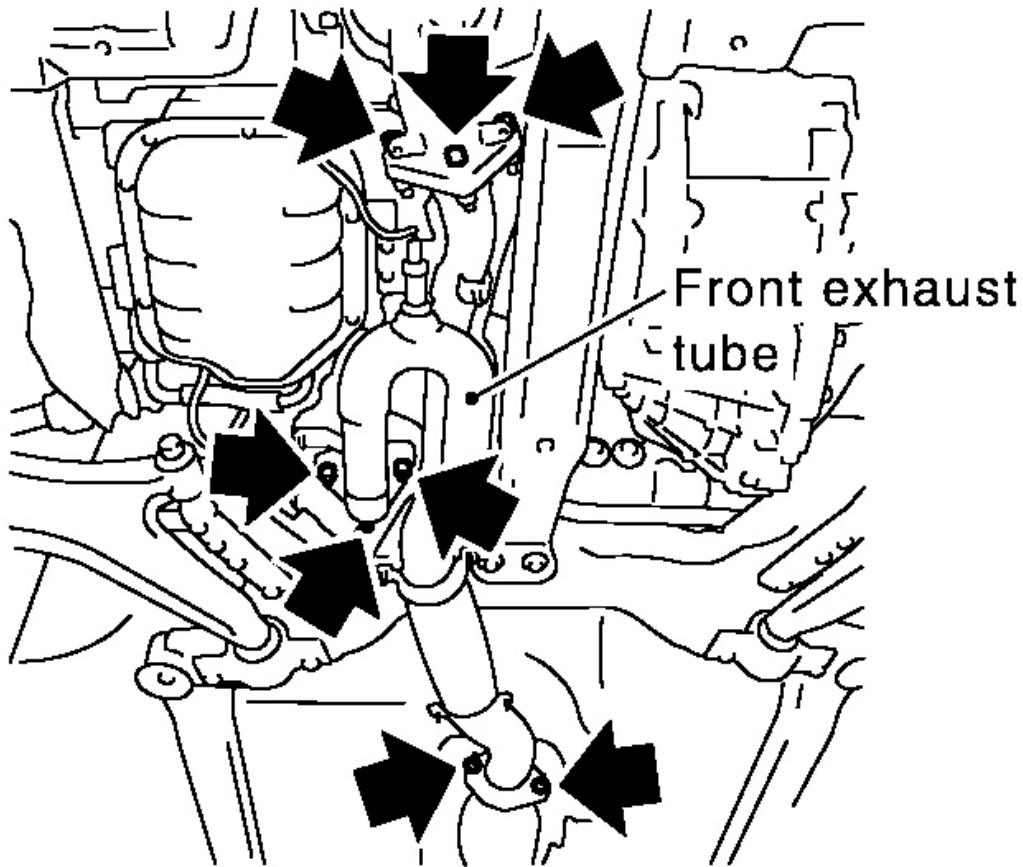
CAUTION:

- When installing camshafts, chain tensioners, oil seals, or other sliding parts, lubricate contacting surfaces with new engine oil.

- **Apply new engine oil to threads and seat surfaces when installing cylinder head, camshaft sprocket, crankshaft pulley, and camshaft bracket.**
- **Attach tags to valve lifters so as not to mix them up.**

REMOVAL

1. Remove engine undercover.
2. Drain engine oil.
 - **To avoid the danger of being scalded, never drain the engine oil when the engine is hot.**
3. Drain engine coolant from radiator.
4. Remove radiator. Refer to **RADIATOR** .
5. Remove front exhaust tube and its support.

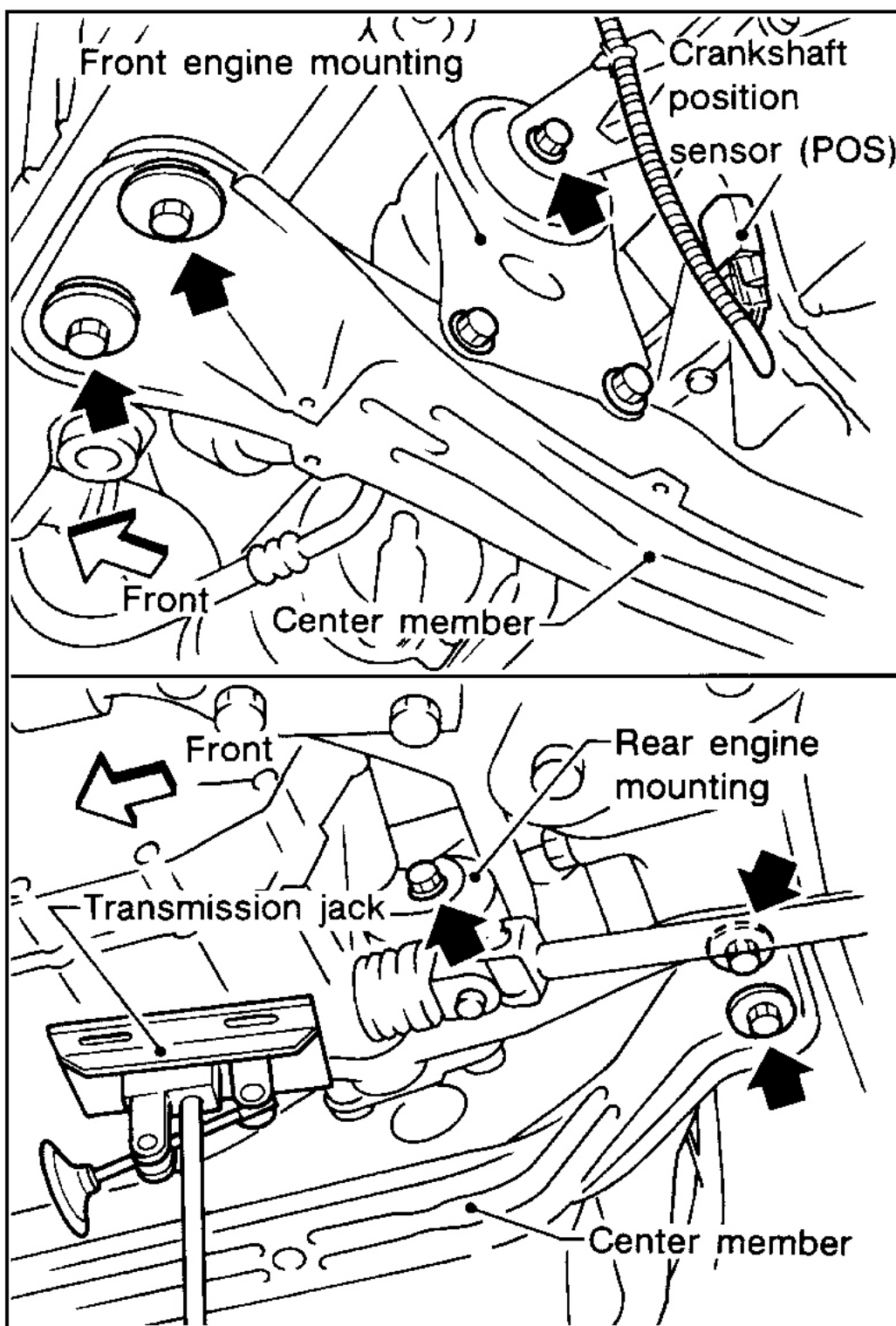


G02090148

Fig. 144: Removing Front Exhaust Tube
Courtesy of NISSAN MOTOR CO., U.S.A.

6. Set a suitable transmission jack under transaxle and hoist engine with engine slinger.
7. Remove crankshaft position sensor (POS) from oil pan.
8. Loosen front and rear engine mounting nuts and bolts.
9. Remove center member.
10. Remove aluminum oil pan. Refer to **REMOVAL**.
11. Remove exhaust manifolds. Refer to **EXHAUST MANIFOLD**.
12. Install center member to support engine temporarily.
13. Tighten front and rear engine mounting nuts and bolts.
14. Remove transmission jack and hoist that were supporting engine.

15. Remove timing chain. Refer to **REMOVAL**.

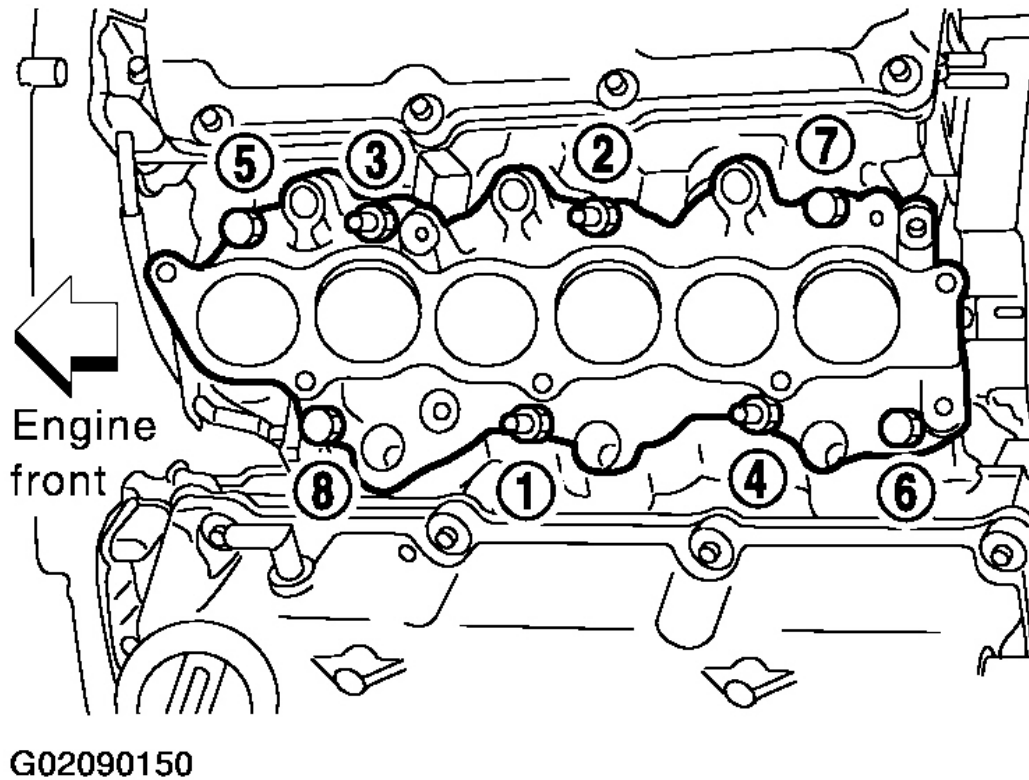


G02090149

Fig. 145: Identifying Front And Rear Engine Mounting Bolts

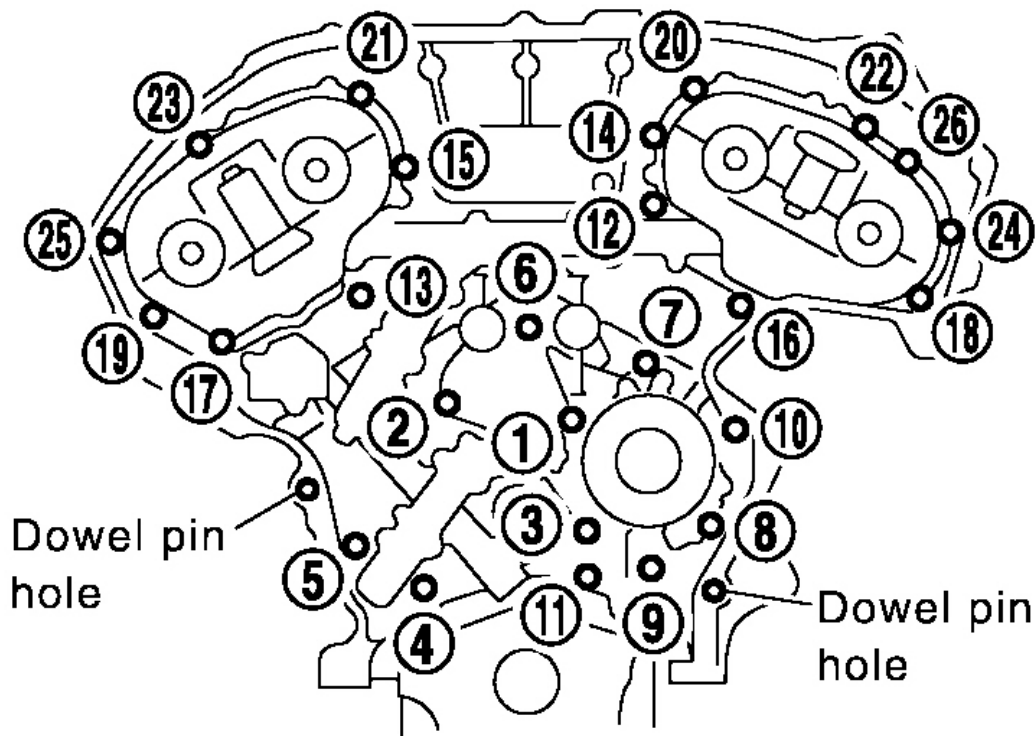
Courtesy of NISSAN MOTOR CO., U.S.A.

16. Remove intake manifold in reverse order of illustration.
17. Remove water outlet.

**Fig. 146: Locating Water Operation**

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

18. Loosen rear timing chain case bolts in reverse order as shown in the figure.



G02090151

Fig. 147: Identifying Dowel Pin Hole

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

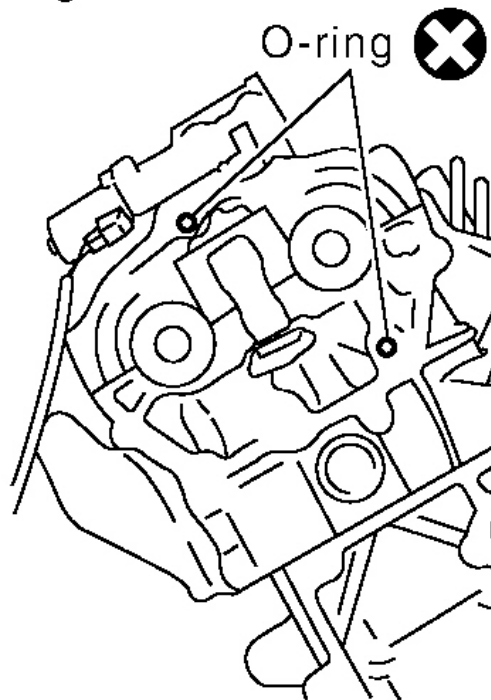
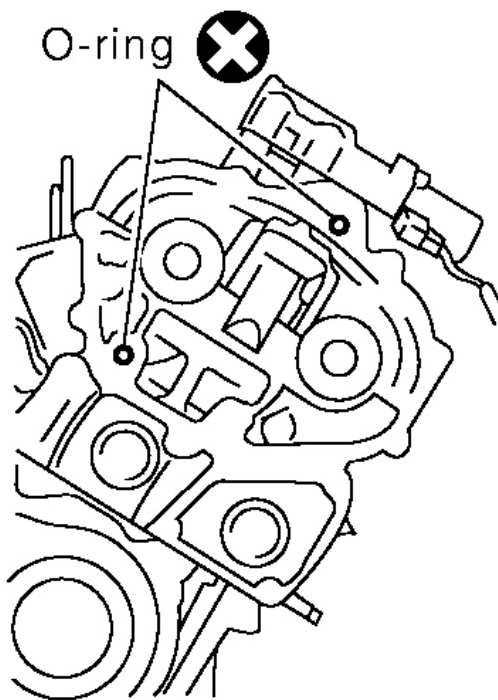
19. Remove rear timing chain case.
 - Use seal cutter (SST) or an equivalent tool to cut liquid gasket for removal.



G02090152

Fig. 148: Removing Rear Timing Chain Case
 Courtesy of NISSAN MOTOR CO., U.S.A.

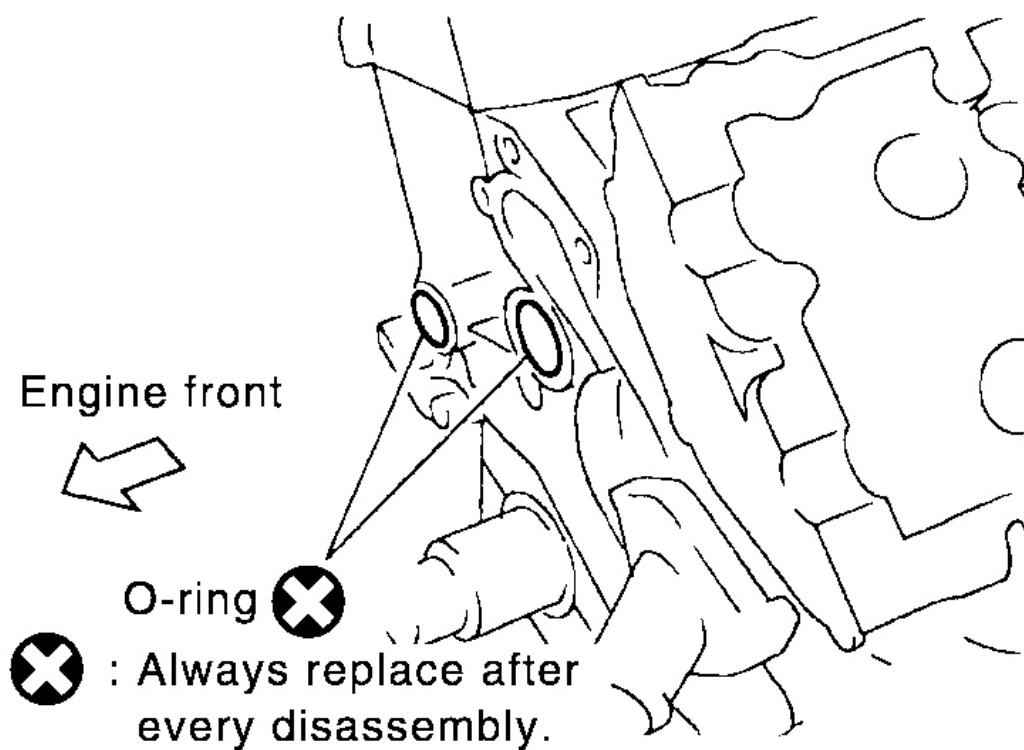
20. Remove O-rings from cylinder head.

Right bank**Left bank**

G02090153

Fig. 149: Removing O-Rings From Cylinder Head
Courtesy of NISSAN MOTOR CO., U.S.A.

21. Remove O-rings from cylinder block.



G02090154

Fig. 150: Removing O-Rings From Cylinder Block
Courtesy of NISSAN MOTOR CO., U.S.A.

22. Remove intake valve timing control solenoid valves.

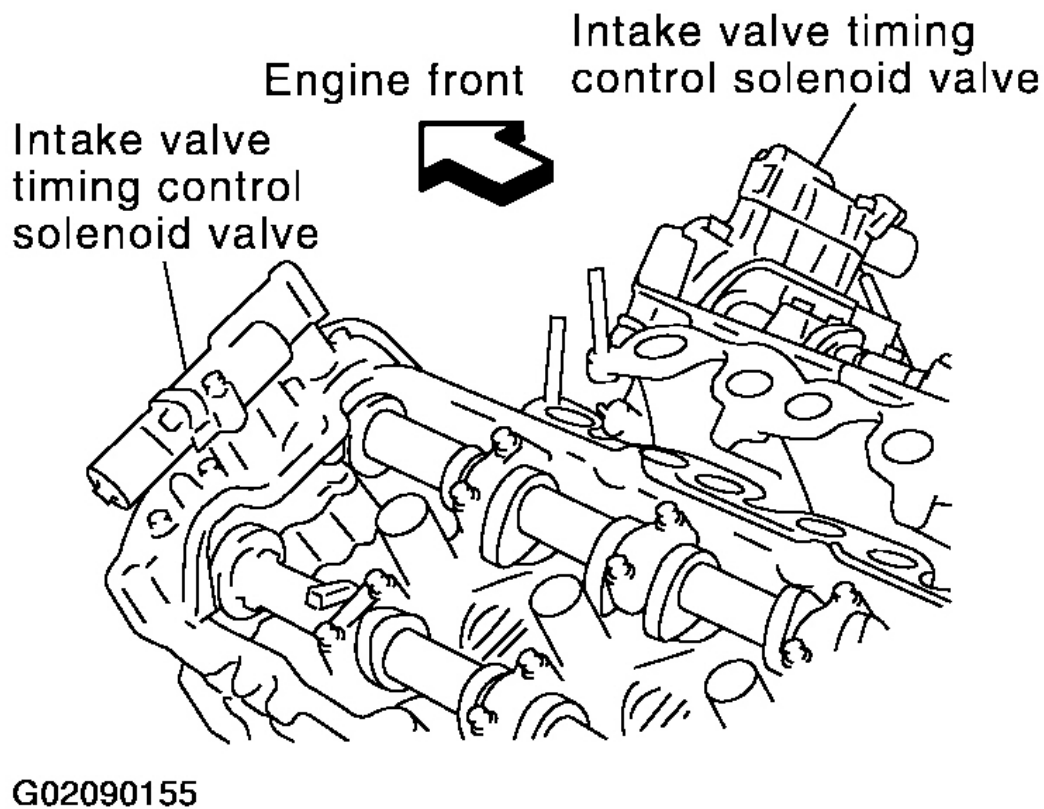
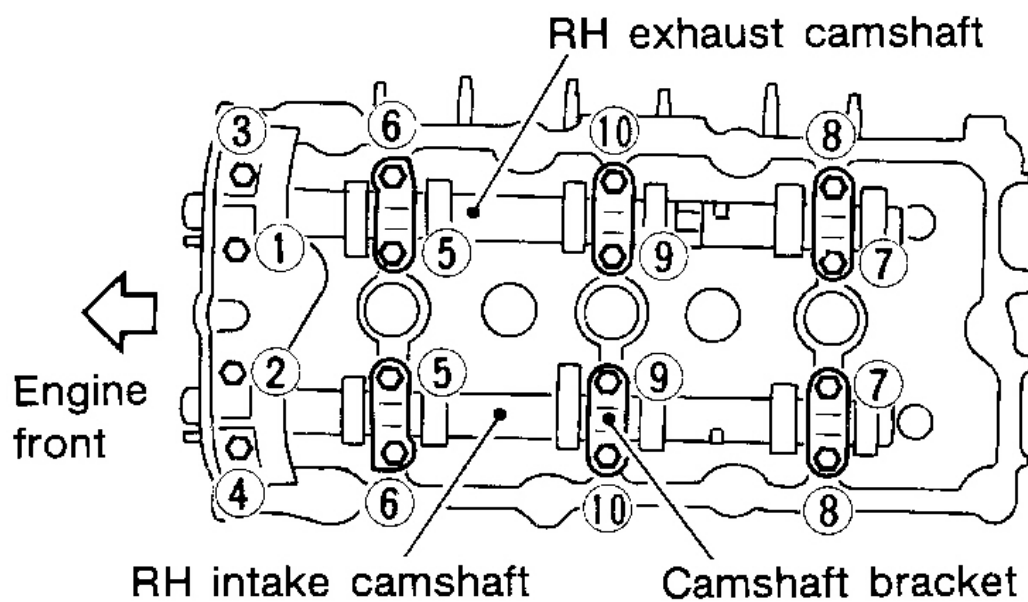


Fig. 151: Removing Intake Valve Timing Control Solenoid Valves
Courtesy of NISSAN MOTOR CO., U.S.A.

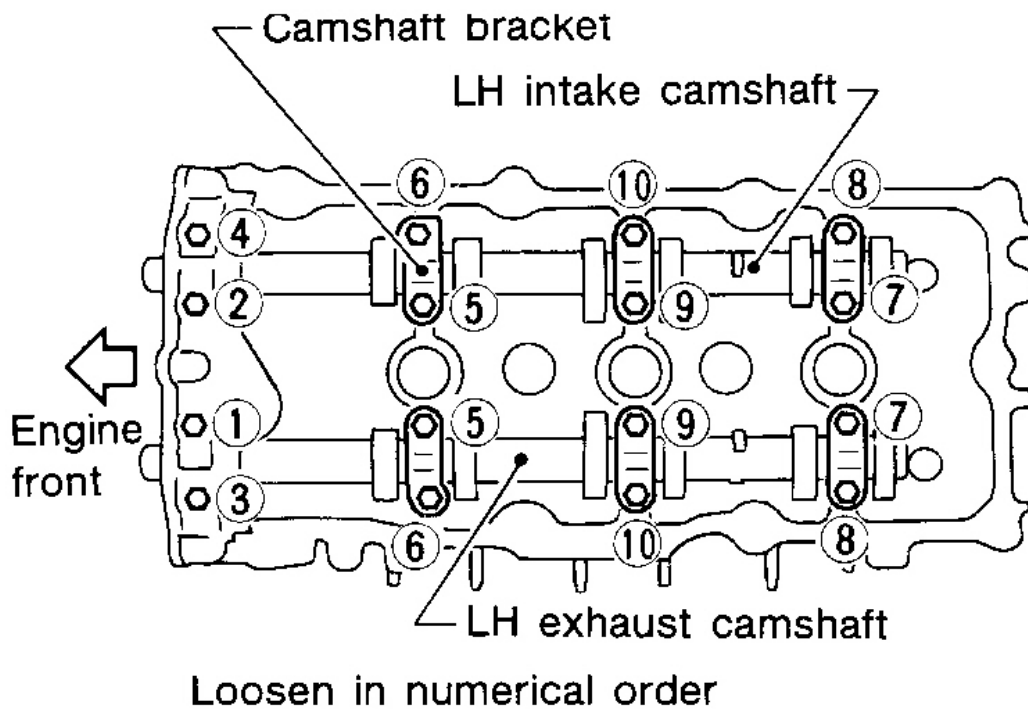
23. Remove intake and exhaust camshafts and camshaft brackets.
 - Equally loosen camshaft bracket bolts in several steps in the numerical order shown in the figure.



Loosen in numerical order

G02090156

Fig. 152: Removing camshaft bracket bolts (RH)
Courtesy of NISSAN MOTOR CO., U.S.A.

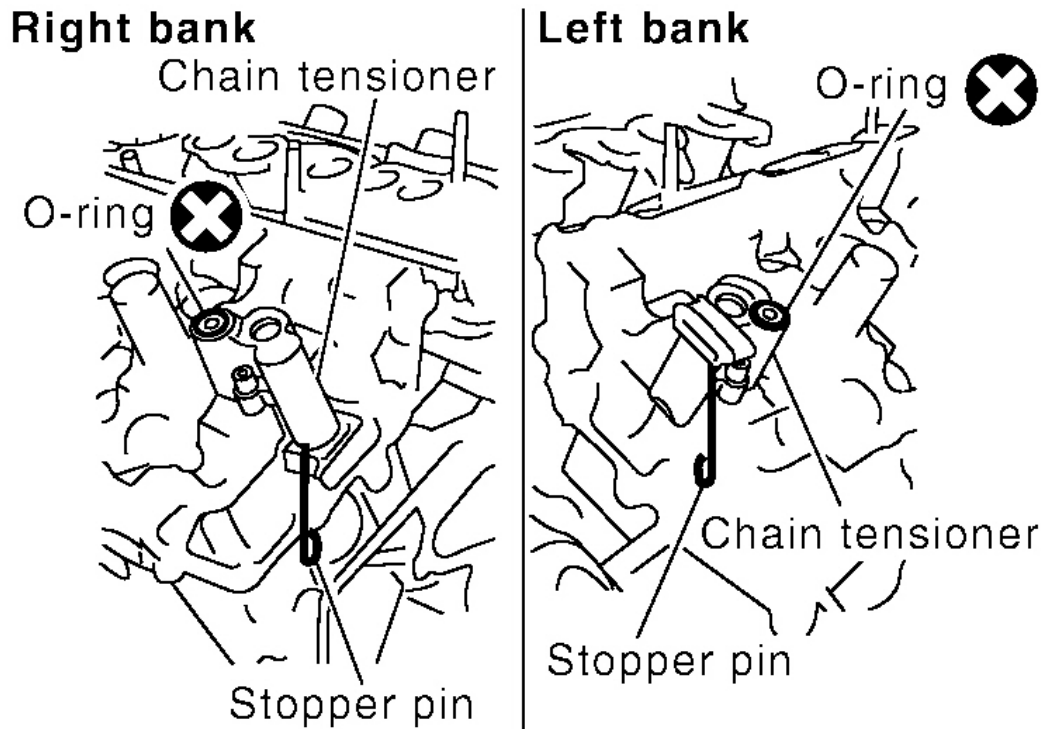


G02090157

Fig. 153: Removing camshaft bracket bolts (LH)
 Courtesy of NISSAN MOTOR CO., U.S.A.

For reinstallation, be sure to put marks on camshaft bracket before removal.

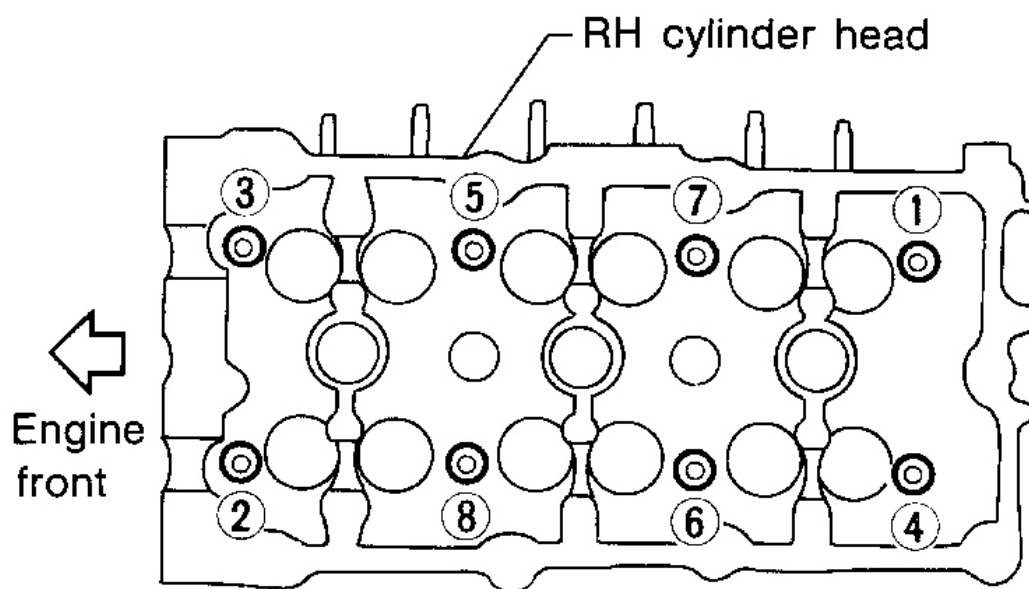
24. Remove valve lifters.
 - Identify installation positions, and store them without mixing them up.
25. Remove RH and LH camshaft chain tensioners from cylinder head.
 - Remove chain tensioner with its stopper pin attached.
 - Stopper pin was attached when secondary timing chain was removed.



G02090158

Fig. 154: Removing Chain Tensioners From Cylinder Head
Courtesy of NISSAN MOTOR CO., U.S.A.

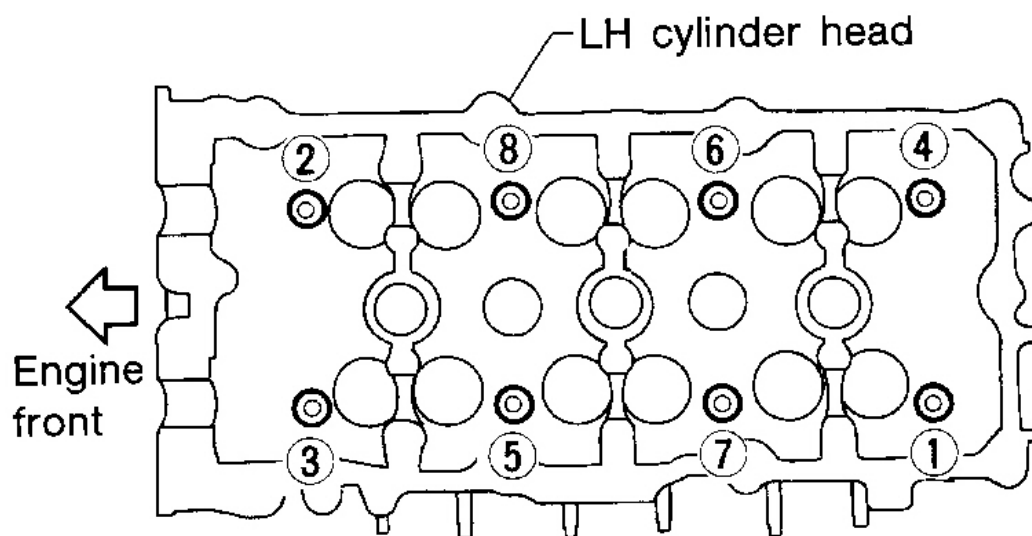
26. Loosen cylinder head bolts.
- Cylinder head bolts should be loosened in two or three steps.
 - A warped or cracked cylinder head could result from removing in incorrect order.



Loosen in numerical order

G02090159

Fig. 155: Identifying Cylinder Head (RH)
Courtesy of NISSAN MOTOR CO., U.S.A.

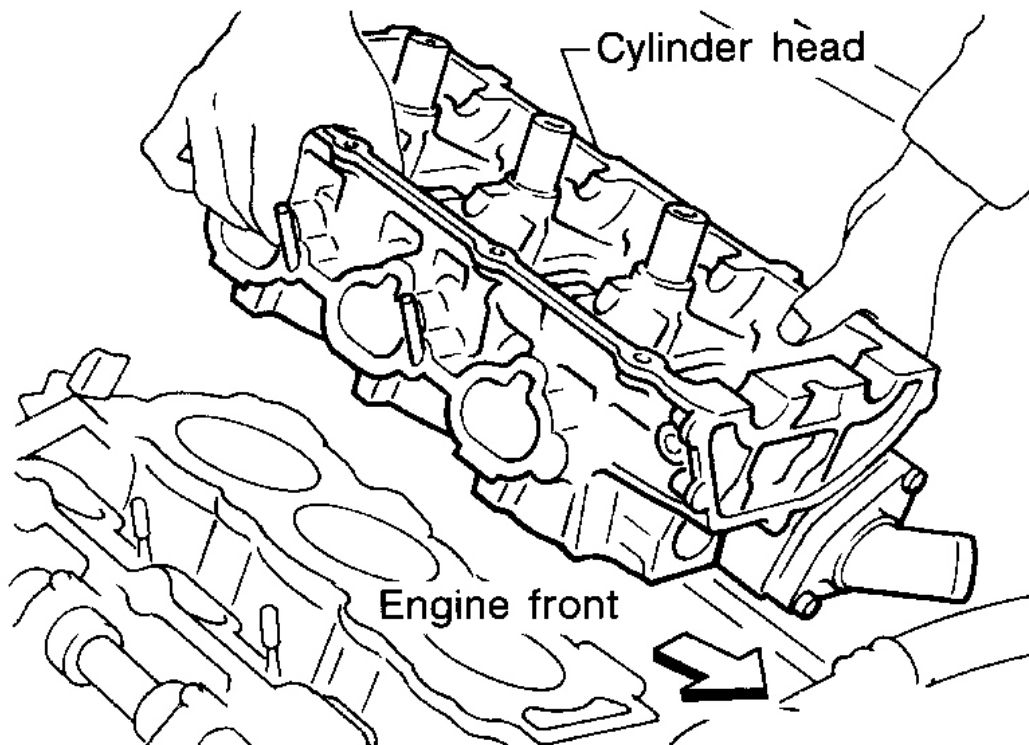


Loosen in numerical order

G02090160

Fig. 156: Identifying Cylinder Head (LH)
Courtesy of NISSAN MOTOR CO., U.S.A.

27. Remove cylinder head.



G02090161

Fig. 157: Removing cylinder head
Courtesy of NISSAN MOTOR CO., U.S.A.

DISASSEMBLY

1. Remove spark plug with spark plug wrench (Commercial service tool).
2. Remove valve component parts.

Refer to **VALVE OIL SEAL**.

- Check the clearance before removing the valve guide. Refer to **VALVE GUIDE CLEARANCE**.
3. Remove spark plug tube, as necessary.
 - Using a pair of pliers, pull spark plug tube out of cylinder head.

CAUTION:

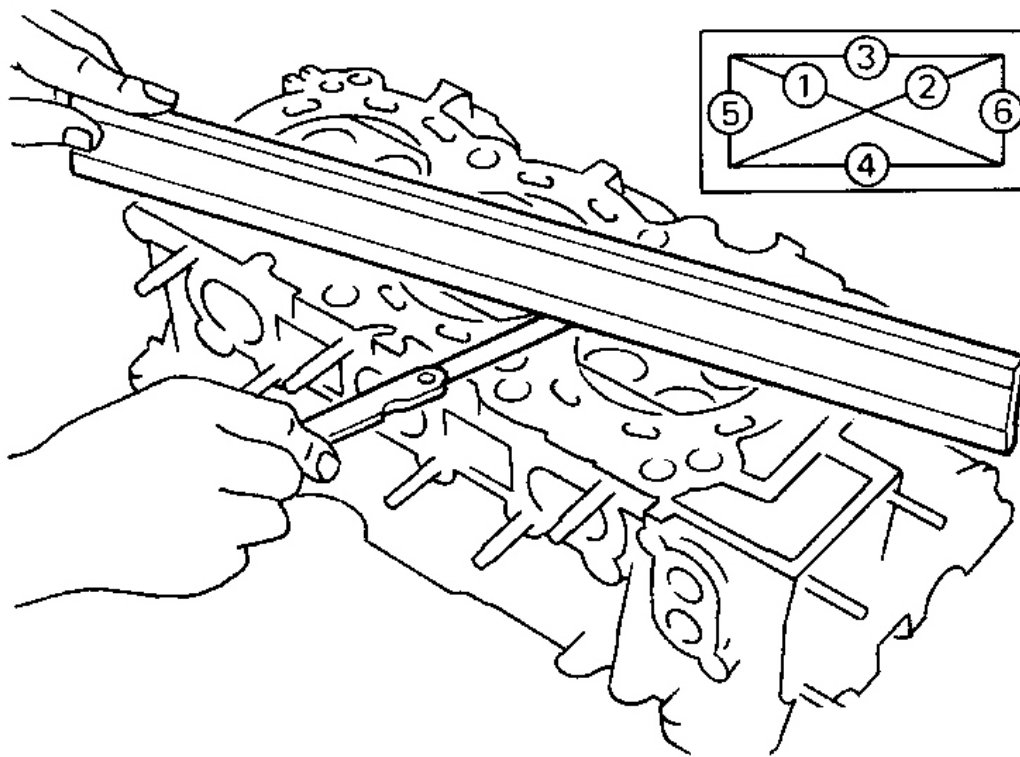
- Take care not to damage cylinder head.
- Once removed, a spark plug tube will be deformed and cannot be reused. Do not remove it unless absolutely necessary.

INSPECTION**CYLINDER HEAD DISTORTION**

Clean surface of cylinder head.

Use a reliable straightedge and feeler gauge to check the flatness of cylinder head surface.

Check along six positions shown in the figure.



G02090162

Fig. 158: Checking Cylinder Head Surface
Courtesy of NISSAN MOTOR CO., U.S.A.

Head surface flatness: Limit 0.1 mm (0.004 in)

If beyond the specified limit, resurface or replace it.

The limit for cylinder head resurfacing is determined by the cylinder block resurfacing.

Resurfacing limit:

Amount of cylinder head resurfacing is "A".

Amount of cylinder block resurfacing is "B".

The maximum limit : $A + B = 0.2 \text{ mm (0.008 in)}$

After resurfacing cylinder head, check that camshaft rotates freely by hand. If resistance is felt, cylinder head must be replaced.

Nominal cylinder head height:

126.3 - 126.5 mm (4.972 - 4.980 in)

CAMSHAFT VISUAL CHECK

Check camshaft for scratches, seizure and wear.

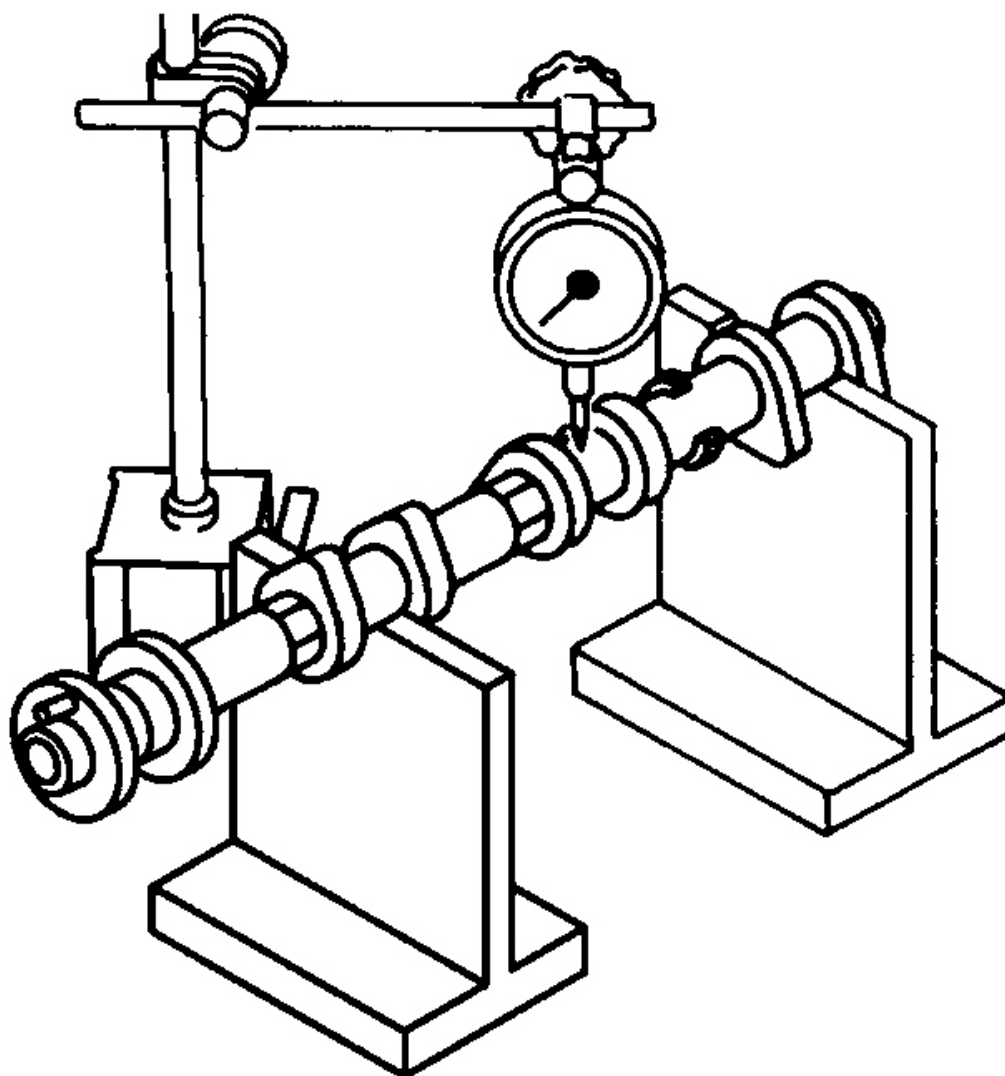
CAMSHAFT RUNOUT

1. Put V block on precise flat bed, and support No. 2 and No. 4 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)

Runout:

Limit (Total indicator reading) 0.05 mm (0.0020 in)

4. If it exceeds the limit, replace camshaft.



G02090163

Fig. 159: Measuring Camshaft Runout Using Dial Gauge
Courtesy of NISSAN MOTOR CO., U.S.A.

CAMSHAFT CAM HEIGHT

1. Measure camshaft cam height.

Standard cam height:

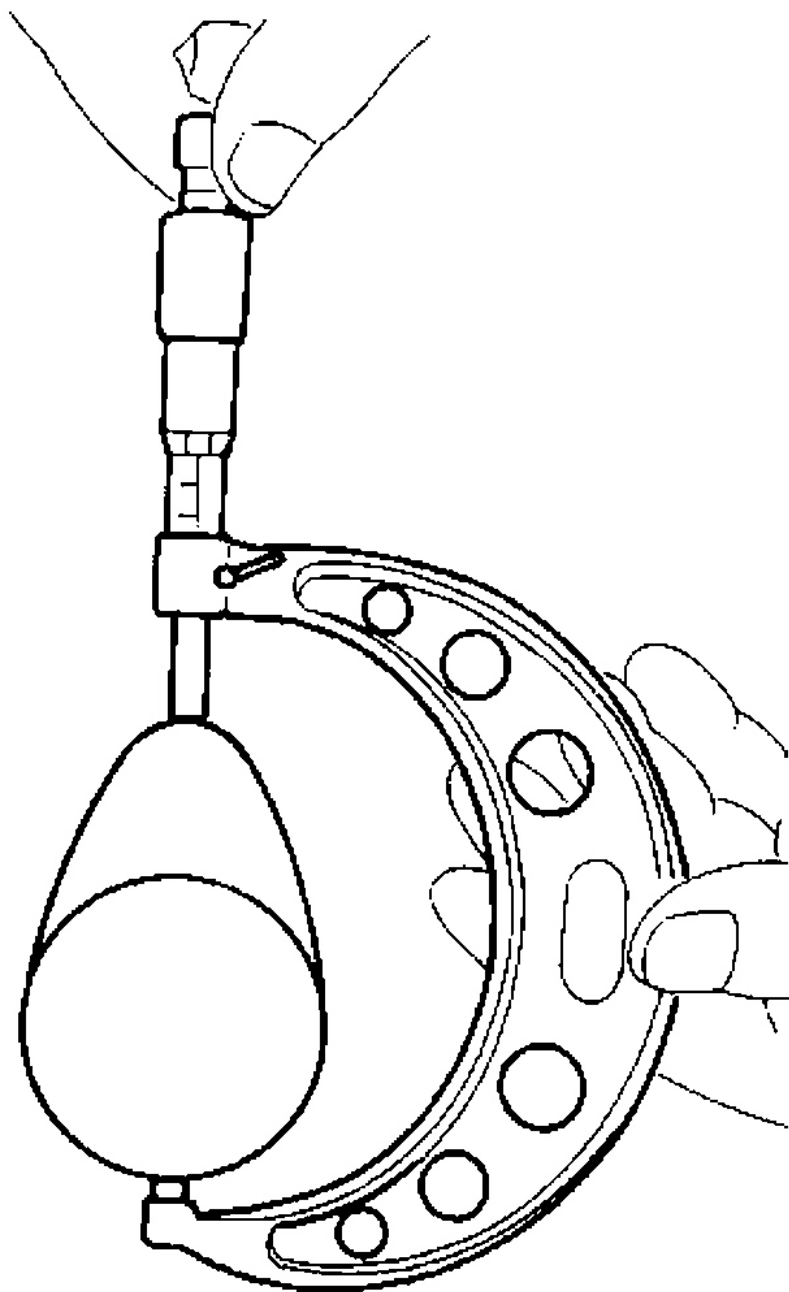
Intake and exhaust

44.865 - 45.055 mm (1.7763 - 1.7738 in)

Cam wear limit:

0.2 mm (0.008 in)

2. If wear is beyond the limit, replace camshaft.



G02090164

Fig. 160: Measuring Camshaft Cam Height
Courtesy of NISSAN MOTOR CO., U.S.A.

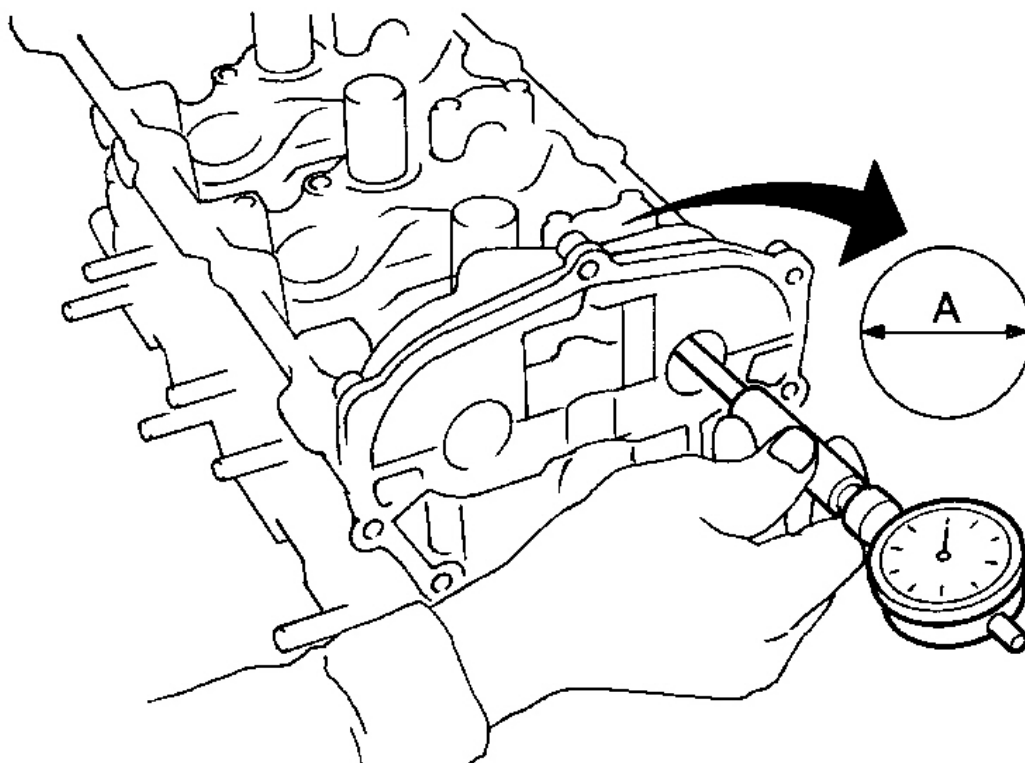
CAMSHAFT JOURNAL CLEARANCE

1. Install camshaft bracket and tighten bolts to the specified torque.
2. Measure inner diameter "A" of camshaft bearing.

Standard inner diameter:

No. 1: 26.000 - 26.021 mm (1.0236 - 1.0244 in)

No. 2, 3, 4: 23.500 - 23.521 mm (0.9252 - 0.9260 in)



G02090165

Fig. 161: Measuring Inner Diameter (A) Of Camshaft Bearing
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Measure outer diameter of camshaft journal.

Standard outer diameter:

No. 1: 25.935 - 25.955 mm (1.0211 - 1.0218 in)

No. 2, 3, 4: 23.445 - 23.465 mm (0.9230 - 0.9238 in)

4. If clearance exceeds the limit, replace camshaft and/or cylinder head.

Camshaft journal clearance:

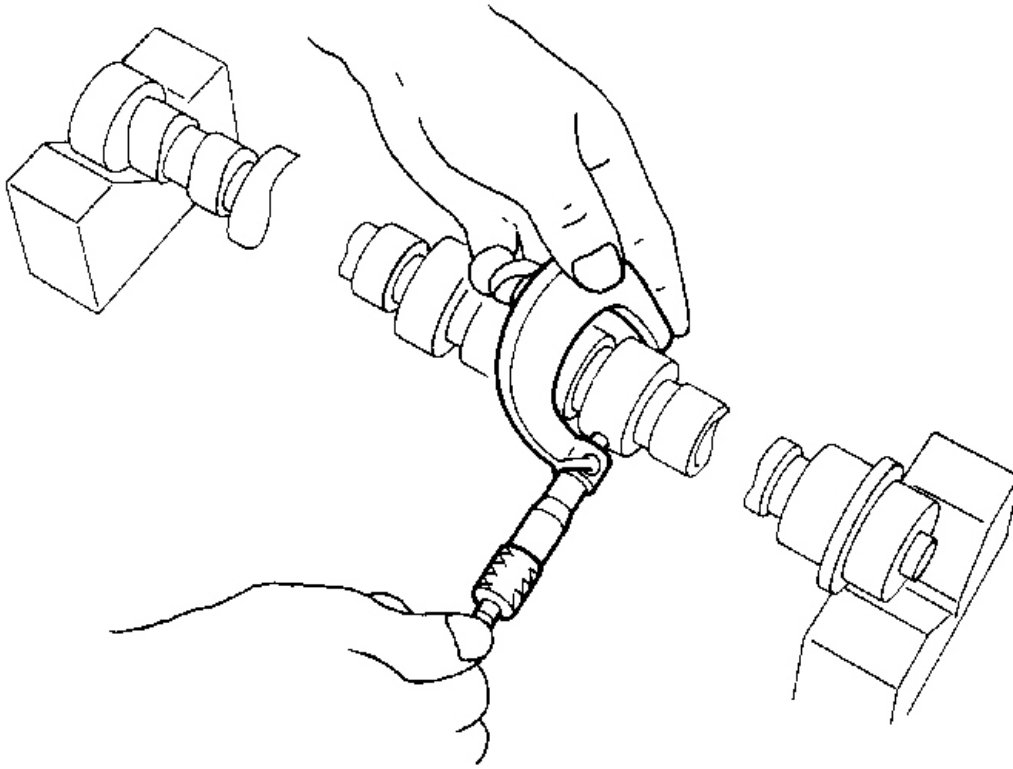
Standard

No. 1: 0.045 - 0.086 mm (0.0018 - 0.0034 in)

No. 2, 3, 4: 0.035 - 0.076 mm (0.0014 - 0.0030 in)

Limit

0.15 mm (0.0059 in)



G02090166

Fig. 162: Measuring Outer Diameter Of Camshaft Journal
Courtesy of NISSAN MOTOR CO., U.S.A.

CAMSHAFT END PLAY

1. Install camshaft in cylinder head. Then install dial gauge in thrust direction on front end of camshaft.
2. Measure end play of dial gauge when camshaft is moved forward/backward (in direction to axis).

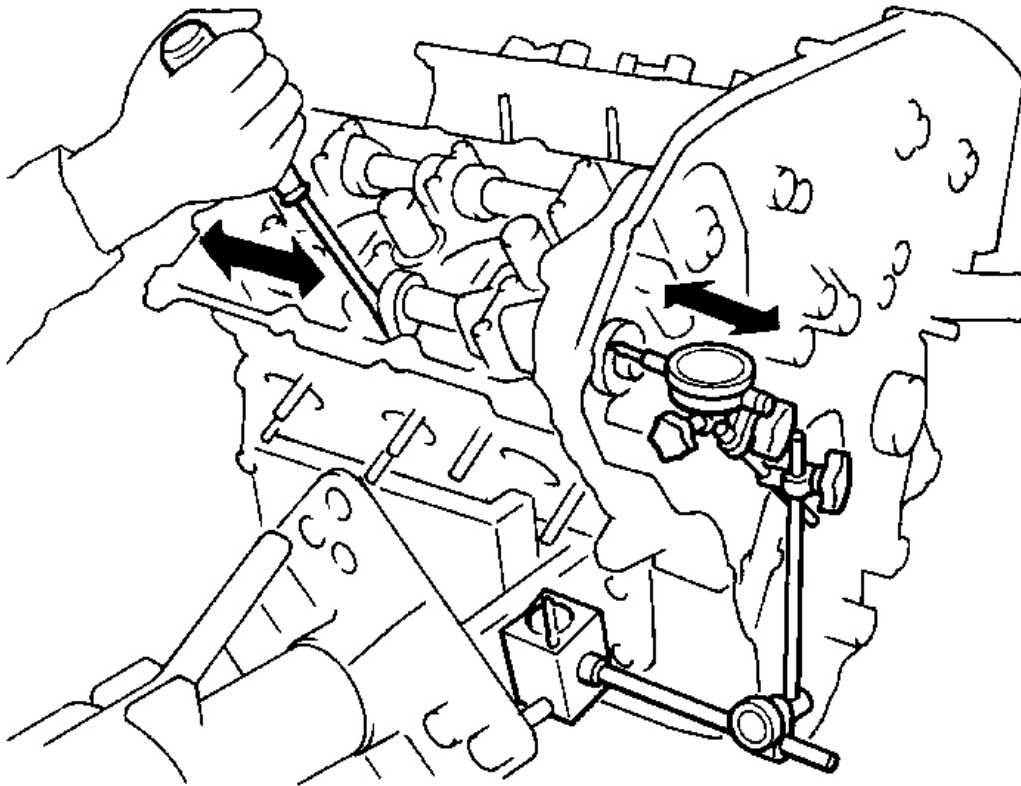
Camshaft end play:

Standard

0.115 - 0.188 mm (0.0045 - 0.0074 in)

Limit

0.24 mm (0.0094 in)



G02090167

Fig. 163: Measuring End Play Of Camshaft Using Dial Gauge
Courtesy of NISSAN MOTOR CO., U.S.A.

- When out of the limit, replace with new camshaft and measure again.
- When out of the limit again, replace with new cylinder head.

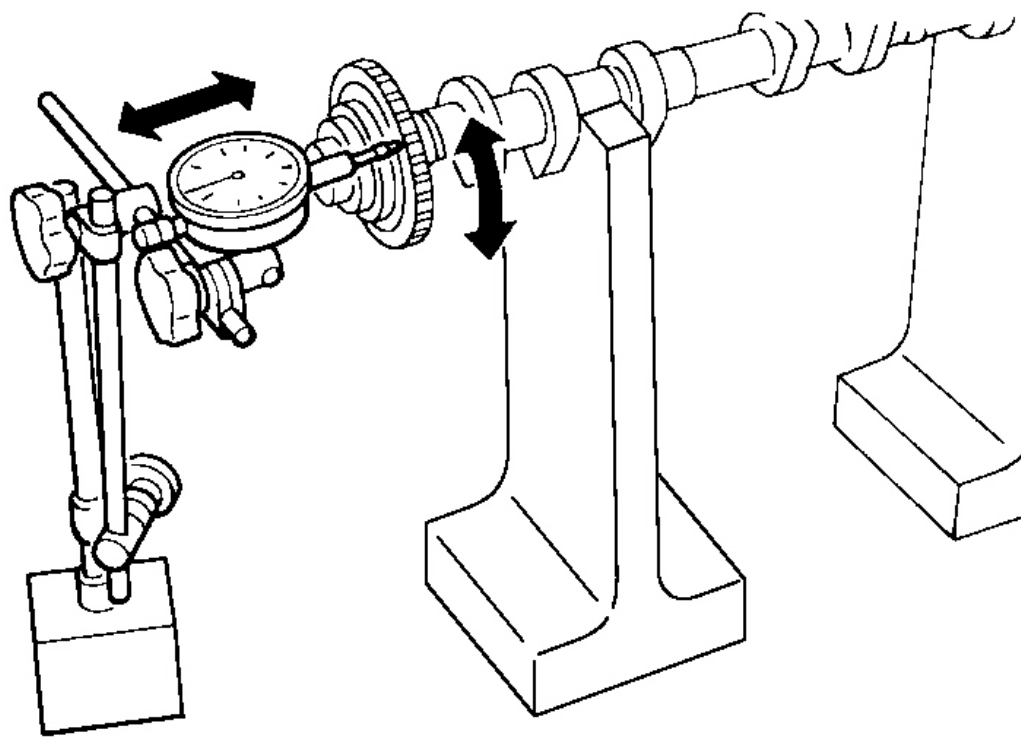
CAMSHAFT SPROCKET RUNOUT

1. Put V block on precise flat bed, and support No. 2 and No. 4 journal of camshaft.
2. Install sprocket on camshaft.
3. Measure camshaft sprocket runout.

Runout (Total indicator reading):

Less than 0.15 mm (0.0059 in)

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



G02090168

Fig. 164: Measuring Camshaft Sprocket Runout
Courtesy of NISSAN MOTOR CO., U.S.A.

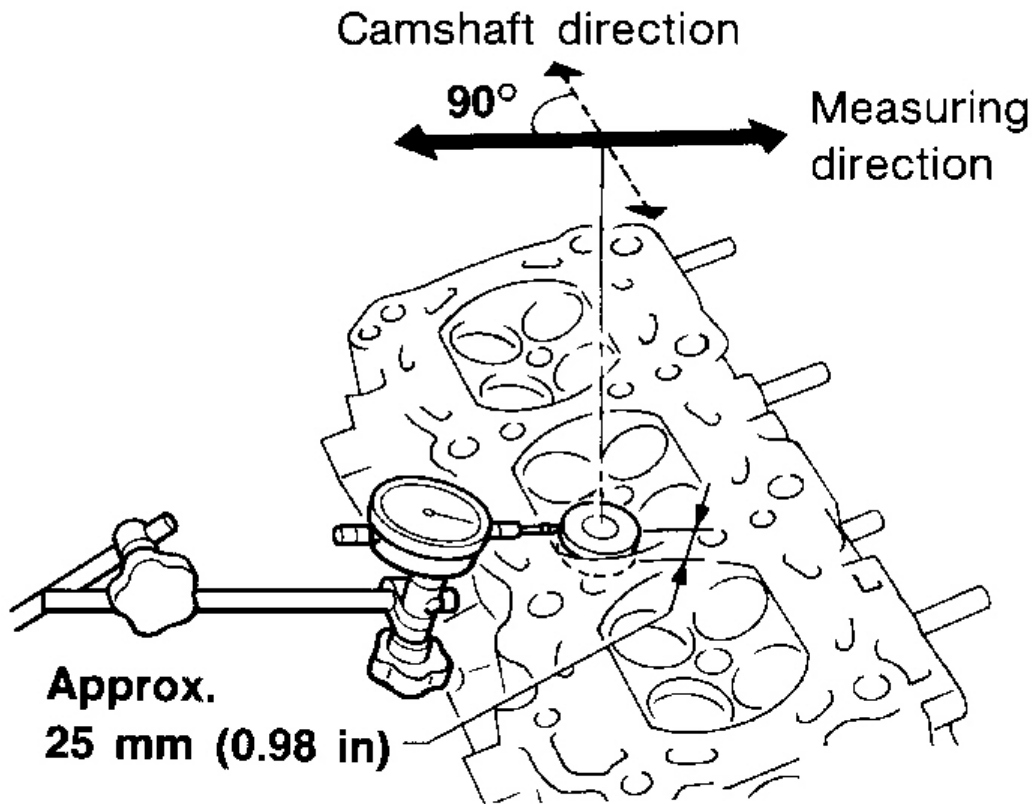
VALVE GUIDE CLEARANCE

1. Measure valve deflection as shown in the figure. (Valve and valve guide mostly wear in this direction.)

Valve deflection limit (Dial gauge reading):

Intake 0.24 mm (0.0094 in)

Exhaust 0.28 mm (0.0110 in)



G02090169

Fig. 165: Measuring Valve Guide Clearance
Courtesy of NISSAN MOTOR CO., U.S.A.

2. If it exceeds the limit, check valve to valve guide clearance.
 - a. Measure valve stem diameter and valve guide inner diameter.
 - b. Check that clearance is within specification.

Valve to valve guide clearance limit:

Intake 0.08 mm (0.0031 in)

Exhaust 0.1 mm (0.004 in)

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

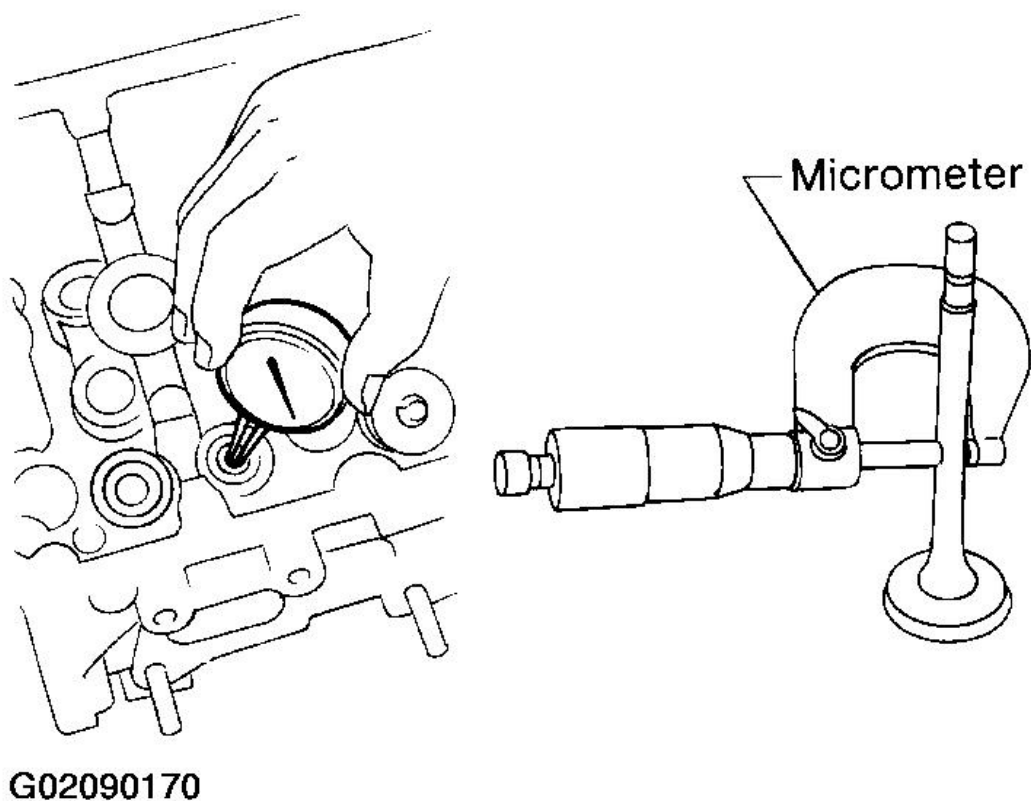
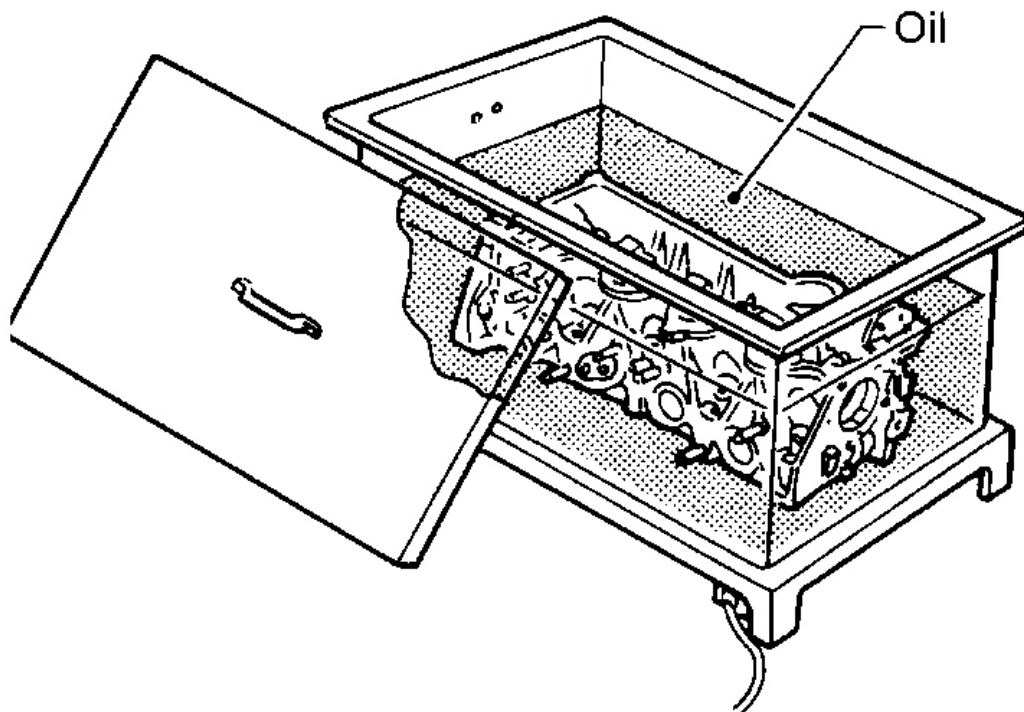


Fig. 166: Measuring Valve Stem Diameter And Valve Guide Inner Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

VALVE GUIDE REPLACEMENT

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

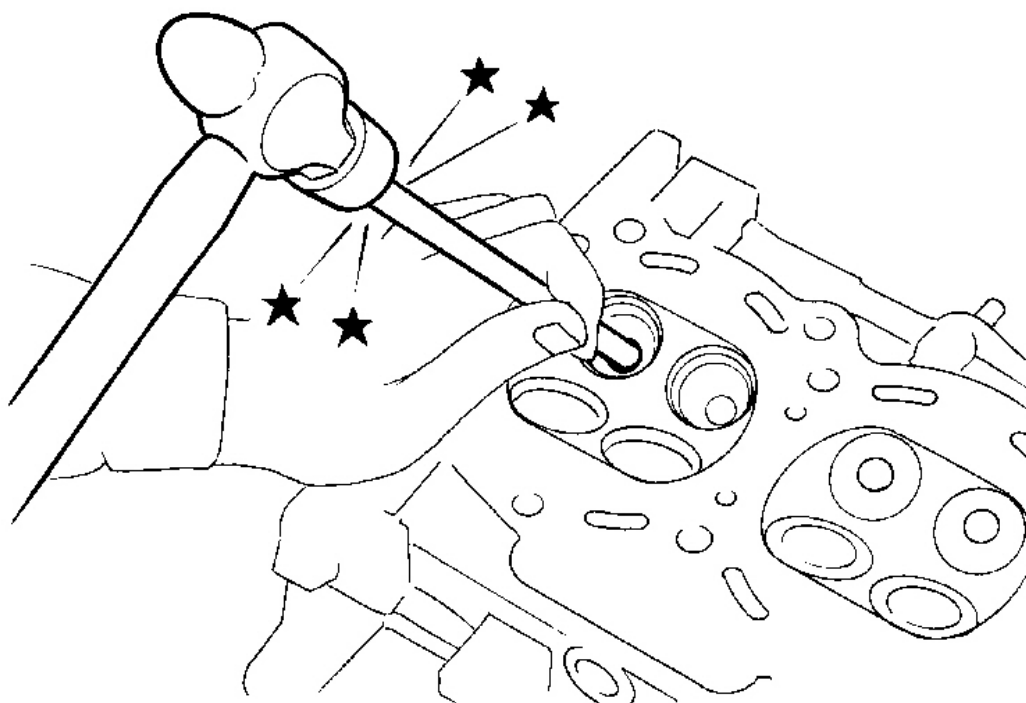


G02090171

Fig. 167: Identifying Heating Cylinder Head
Courtesy of NISSAN MOTOR CO., U.S.A.

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 suitable tool.

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



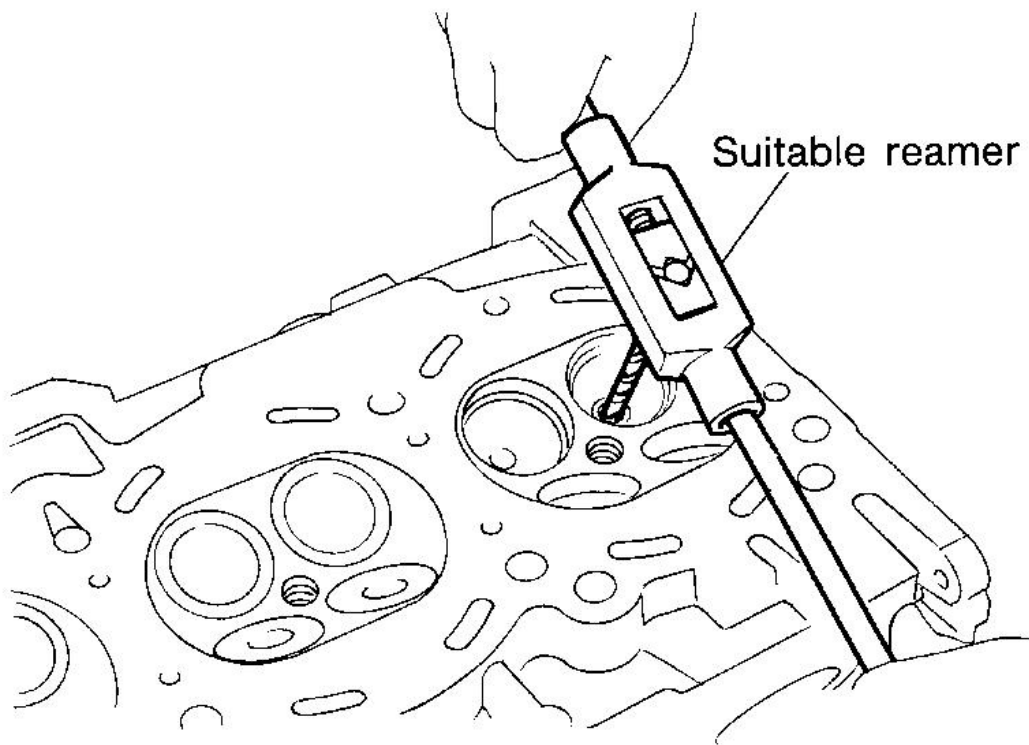
G02090172

Fig. 168: Removing Valve Guide
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Ream cylinder head valve guide hole.

Valve guide hole diameter (for service parts):

10.175 - 10.196 mm (0.4006 - 0.4014 in)



G02090173

Fig. 169: Reaming Cylinder Head Valve Guide Hole
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Heat cylinder head to 110 to 130°C (230 to 266°F) and press service valve guide onto cylinder head.

Projection "L":

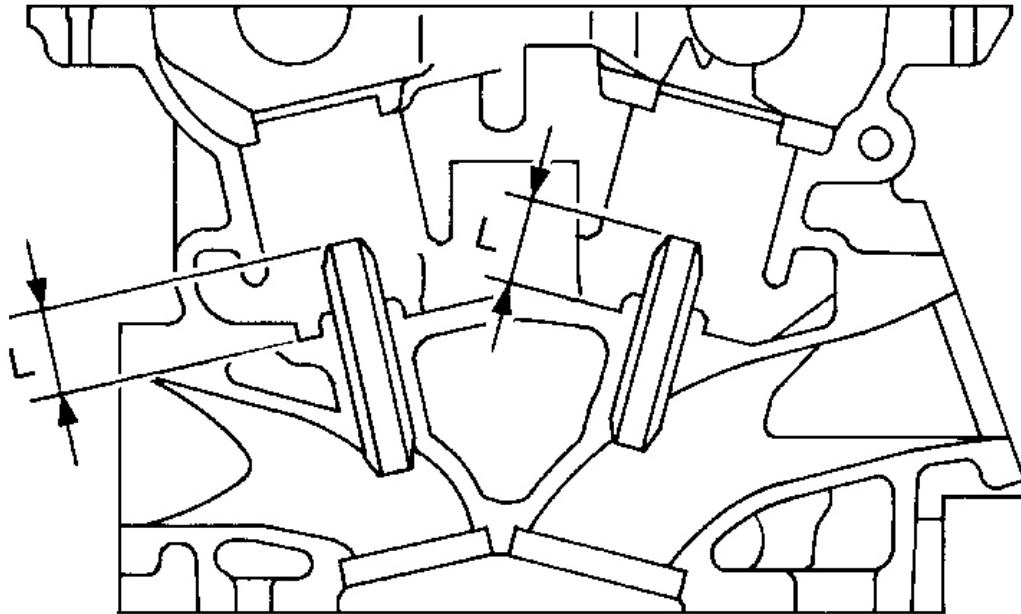
12.6 - 12.8 mm (0.496 - 0.504 in)

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

5. Ream valve guide.

Finished size:

6.000 - 6.018 mm (0.2362 - 0.2369 in)



G02090174

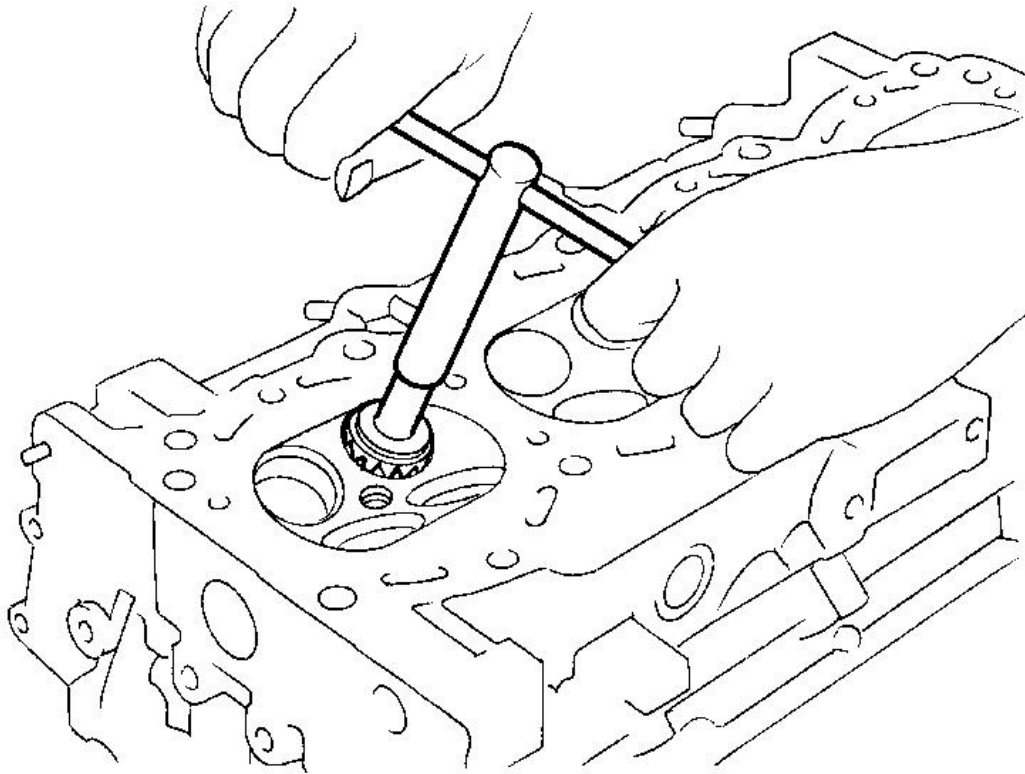
Fig. 170: Measuring Cylinder Head Dimension

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

VALVE SEATS

Check valve seats for any evidence of pitting at valve contact surface, and reseal or replace if it has worn out excessively.

- **Before repairing valve seats, check valve and valve guide for wear. If they have worn, replace them. Then correct valve seat.**
- **Use both hands to cut uniformly.**



G02090175

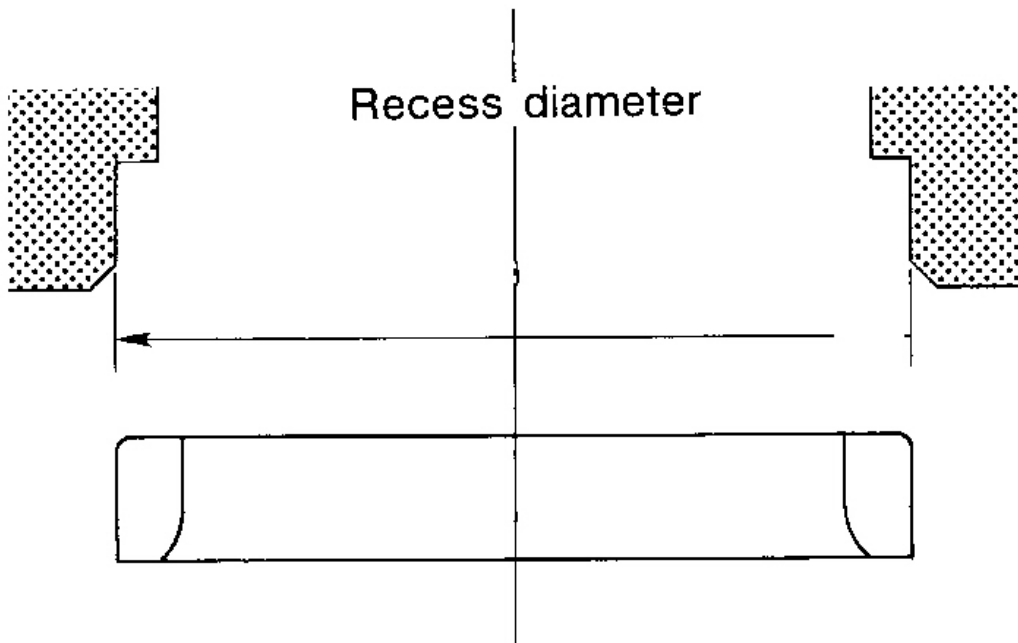
Fig. 171: Checking Valve Seats Surface

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

REPLACING VALVE SEAT FOR SERVICE PARTS

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

Oversize [0.5 mm (0.020 in)]:**Intake 38.500 - 38.516 mm (1.5157 - 1.5164 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.**



G02090176

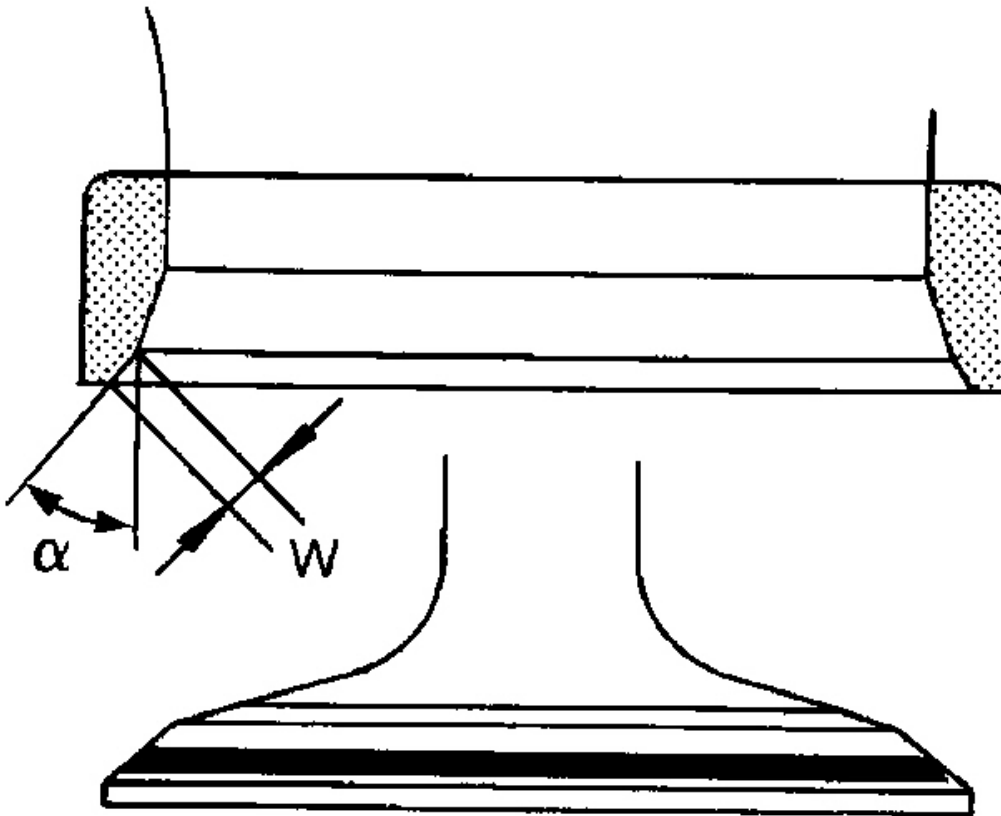
Fig. 172: Identifying Replacing Valve Seat For Service Parts
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Heat cylinder head to 110 to 130°C (230 to 266°F) by soaking in heated oil.
4. Press fit valve seat until it seats on the bottom.

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

5. Cut or grind valve seat using suitable tool to the specified dimensions as shown in **VALVE SEAT**.
6. After cutting, lap valve seat with abrasive compound.
7. Check valve seating condition.

Seat face angle "alpha": 45°15' - 45°45'



G02090177

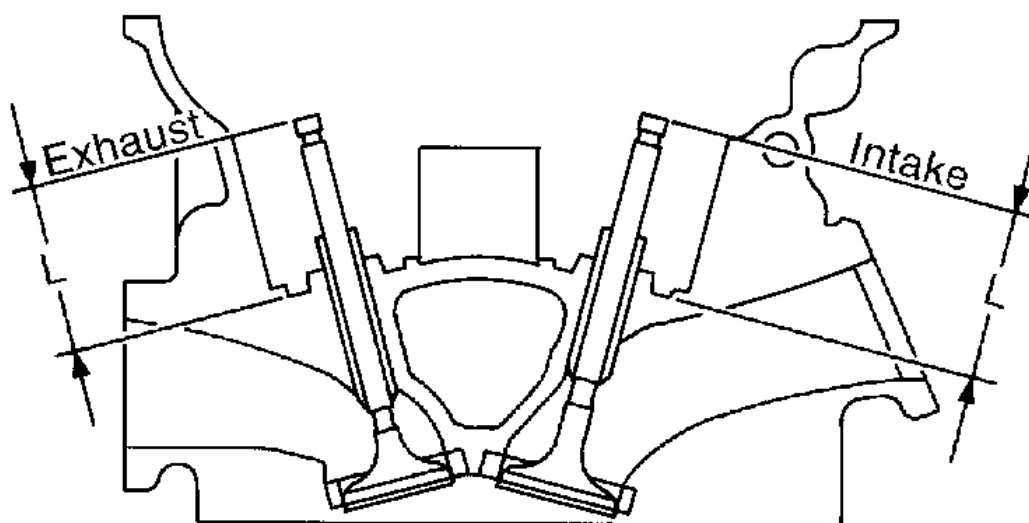
Fig. 173: Identifying Valve Dimensions

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

Contacting width "W":**Intake 1.09 - 1.31 mm (0.0429 - 0.0516 in)****Exhaust 1.29 - 1.51 mm (0.0508 - 0.0594 in)**

8. Use a depth gauge to measure the distance between the mounting surface of the cylinder head spring seat and the valve stem end. If the distance is shorter than specified, repeat step 5 above to adjust it. If it is longer, replace the valve seat with a new one.

Valve seat resurface limit "L":**Intake 41.07 - 41.67 mm (1.6169 - 1.6405 in)****Exhaust 41.00 - 41.60 mm (1.6142 - 1.6378 in)**



G02090178

Fig. 174: Measuring Distance Between Mounting Surface Of Cylinder Head
Courtesy of NISSAN MOTOR CO., U.S.A.

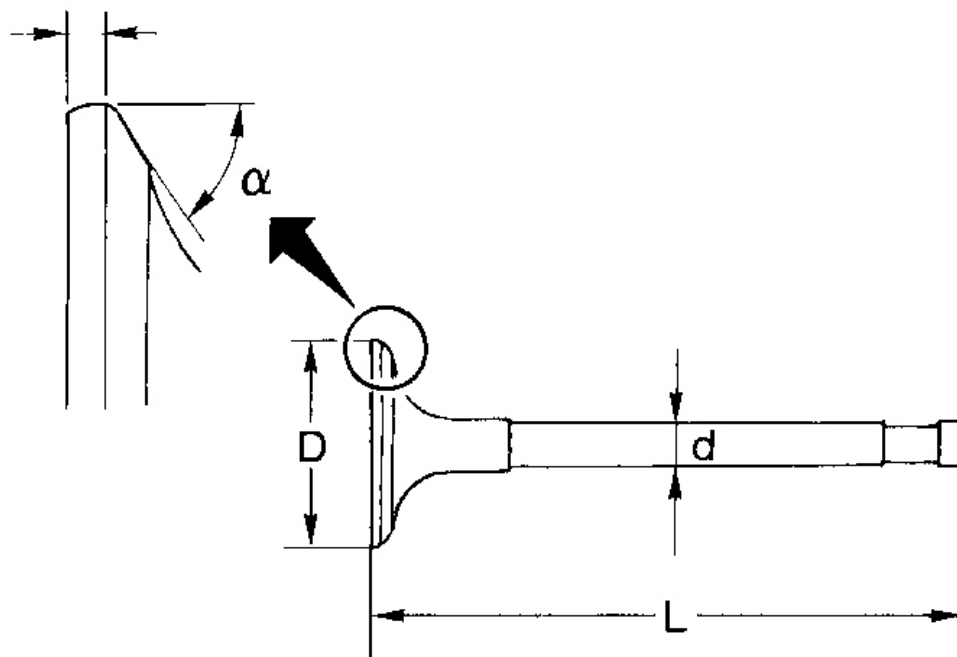
VALVE DIMENSIONS

Check dimensions of each valve. For dimensions, refer to **SDS**, .

When valve head has been worn down to 0.5 mm (0.020 in) in margin thickness, replace valve.

Grinding allowance for valve stem tip is 0.2 mm (0.008 in) or less.

T (Margin thickness)



G02090179

Fig. 175: Checking Valve Dimensions
 Courtesy of NISSAN MOTOR CO., U.S.A.

VALVE SPRING

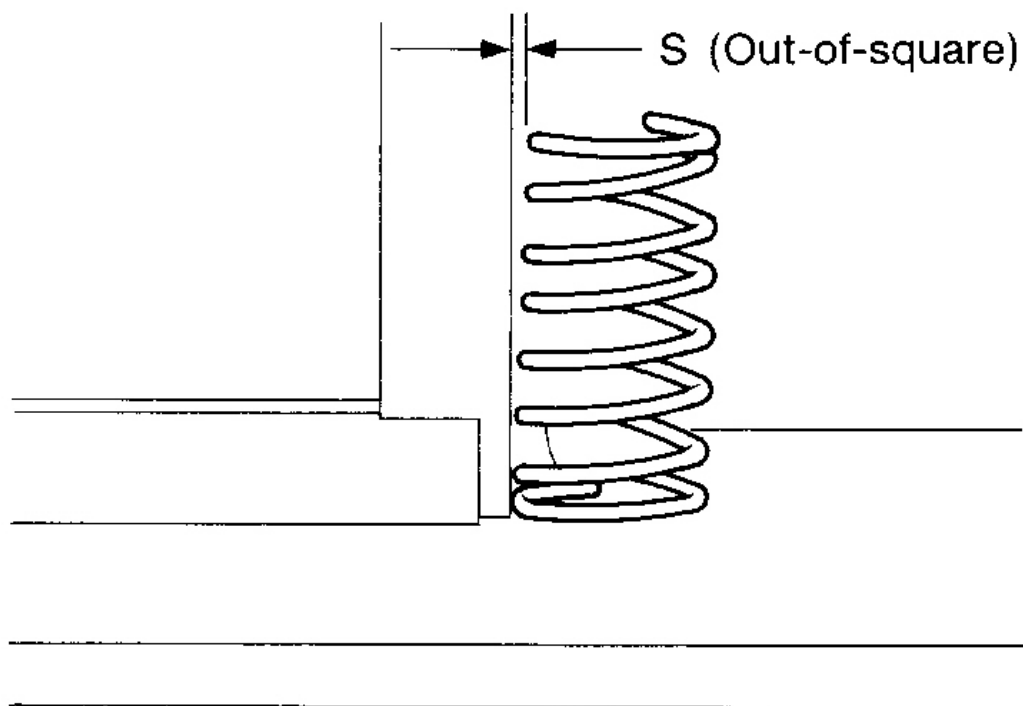
Squareness

1. Measure dimension "S".

Out-of-square "S":

Less than 2.0 mm (0.079 in)

2. If it exceeds the limit, replace spring.



G02090180

Fig. 176: Measuring Valve Spring Dimension
Courtesy of NISSAN MOTOR CO., U.S.A.

Pressure

Check valve spring pressure at specified spring height.

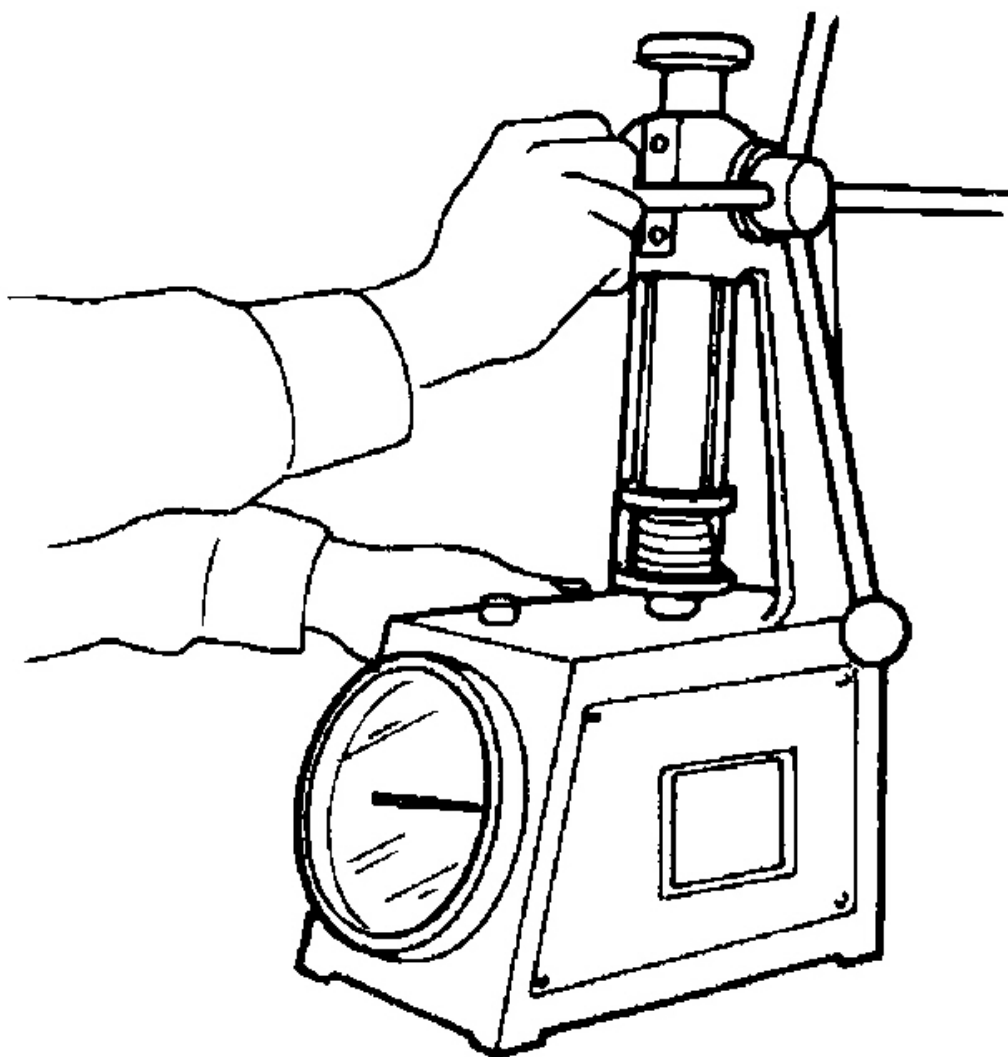
Pressure:**Installation**

196 N (20.0 kg, 44.1 lb) at height 37.0 mm (1.457 in)

Valve open

More than 433 N (44.2 kg, 97.3 lb) at height 27.8 mm (1.094 in)

If it exceeds the limit, replace spring.

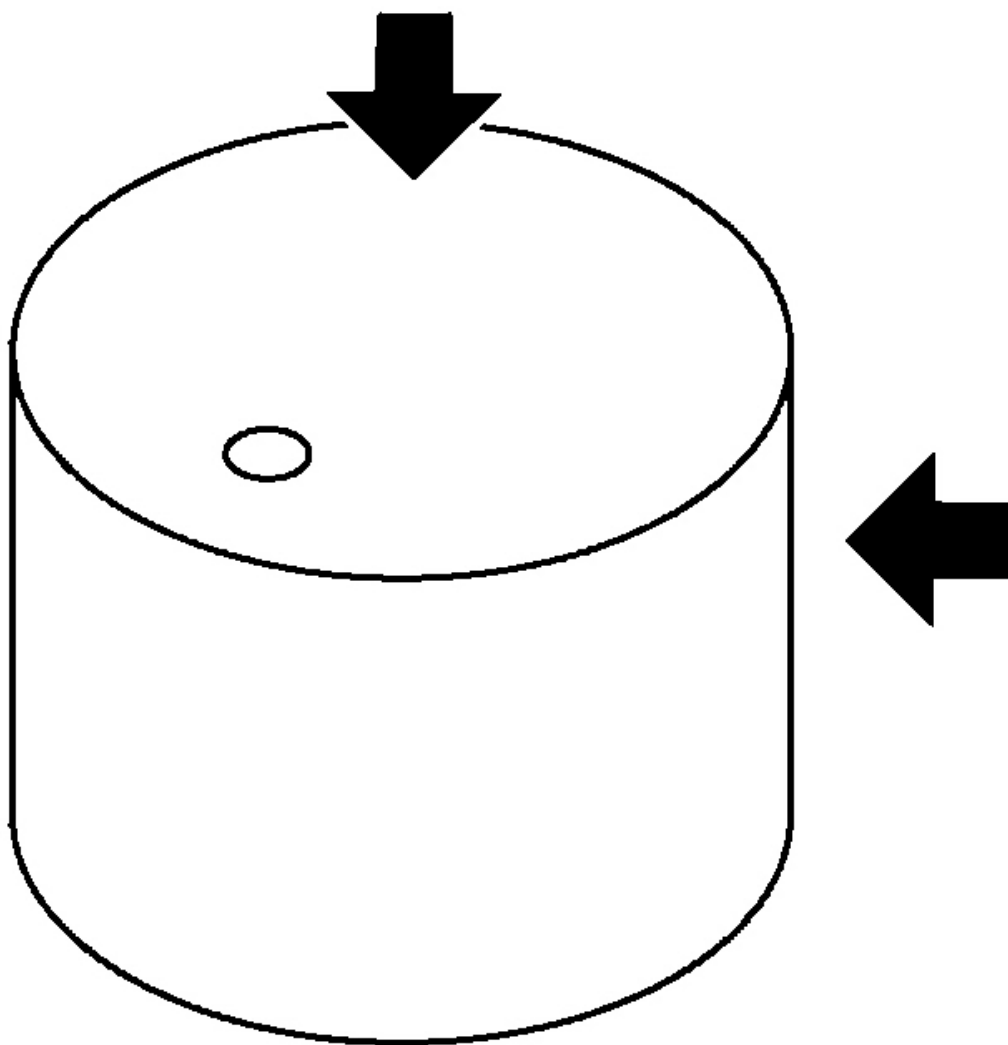


G02090181

Fig. 177: Checking Valve Spring Pressure
Courtesy of NISSAN MOTOR CO., U.S.A.

VALVE LIFTER

1. Check contact and sliding surfaces for wear or scratches.



G02090182

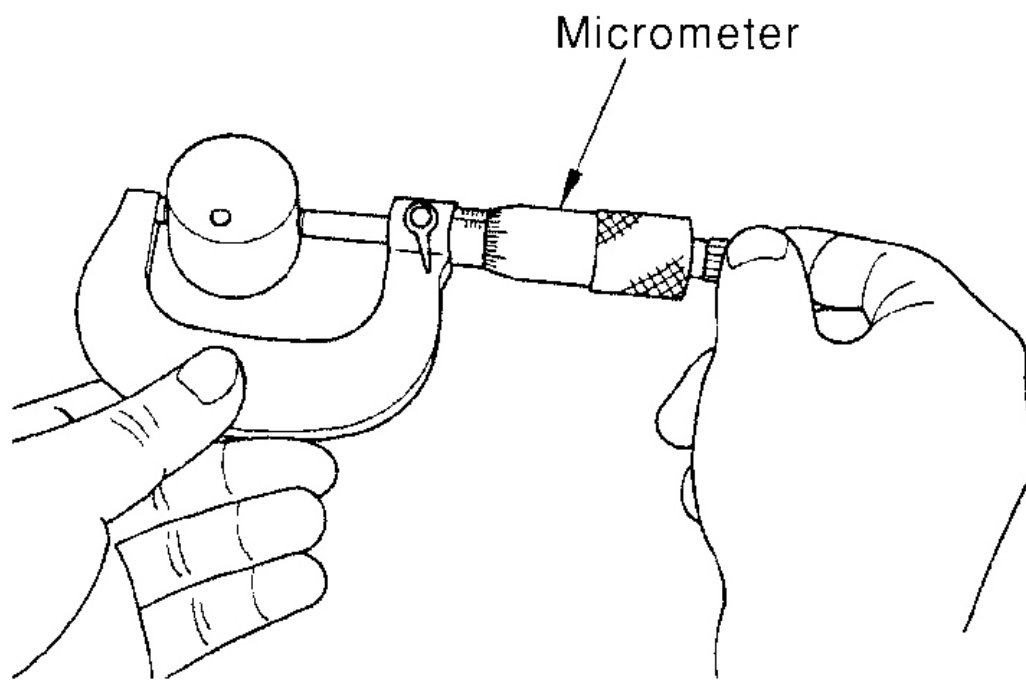
Fig. 178: Identifying Valve Lifter

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

2. Check diameter of valve lifter and valve lifter guide bore.

Valve lifter outer diameter:

33.977 - 33.987 mm (1.3377 - 1.3381 in)



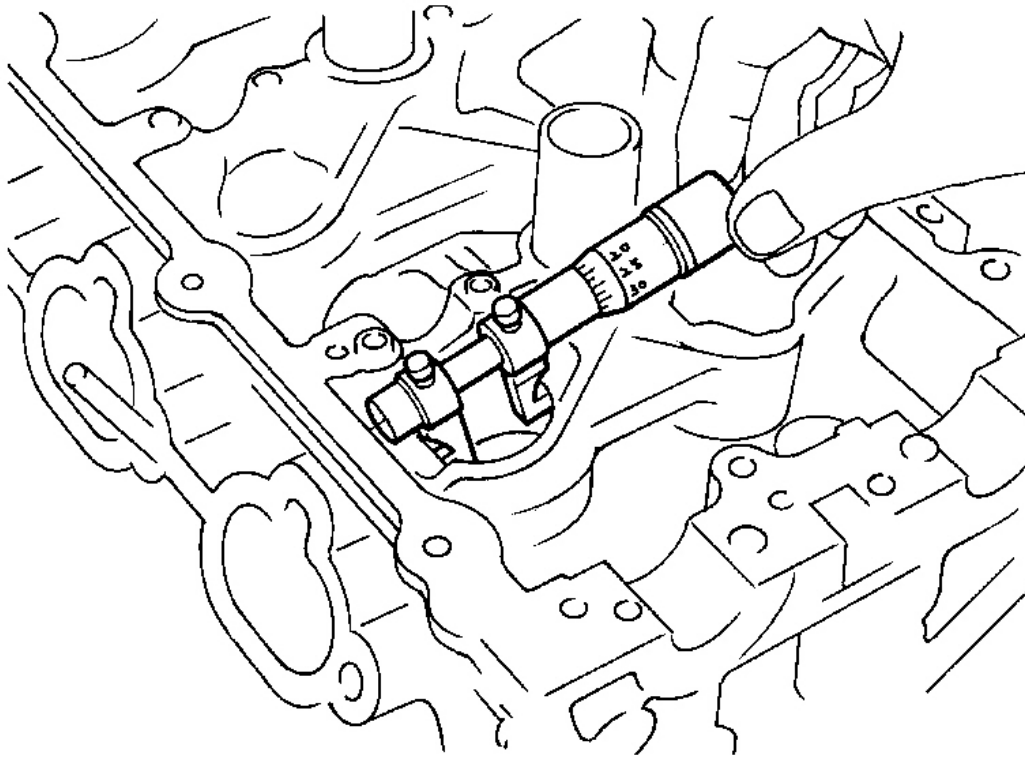
G02090183

Fig. 179: Checking Valve Lifter Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

Lifter guide bore diameter:

34.000 - 34.016 mm (1.3386 - 1.3392 in)

- When out of specified range, refer to each specification of outer and inner diameter. Then replace either or both valve lifter and cylinder head.



G02090184

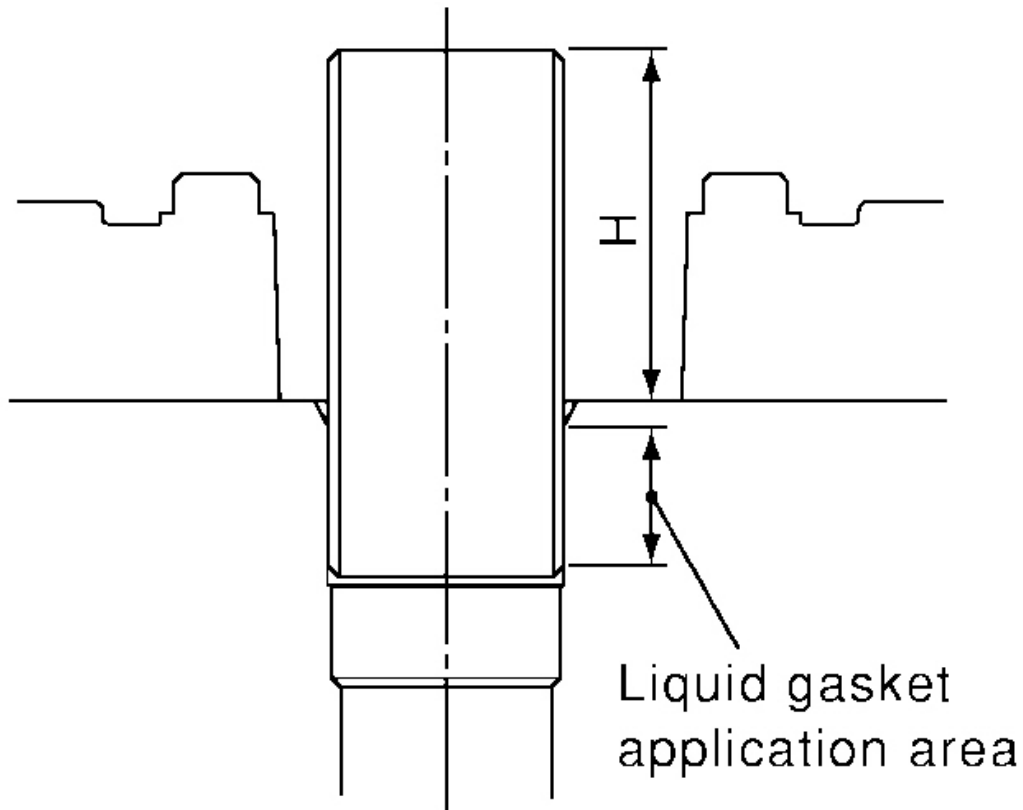
Fig. 180: Checking Outer And Inner Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

ASSEMBLY

1. 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 Liquid Gasket or equivalent.
 - c. Using a drift, press-fit spark plug tube so that its height "H" is as specified in the figure.

Standard press-fit height "H":

: 38.55 - 38.65 mm (1.5177 - 1.5217 in)



G02090185

Fig. 181: Identifying Liquid Gasket To Area
Courtesy of NISSAN MOTOR CO., U.S.A.

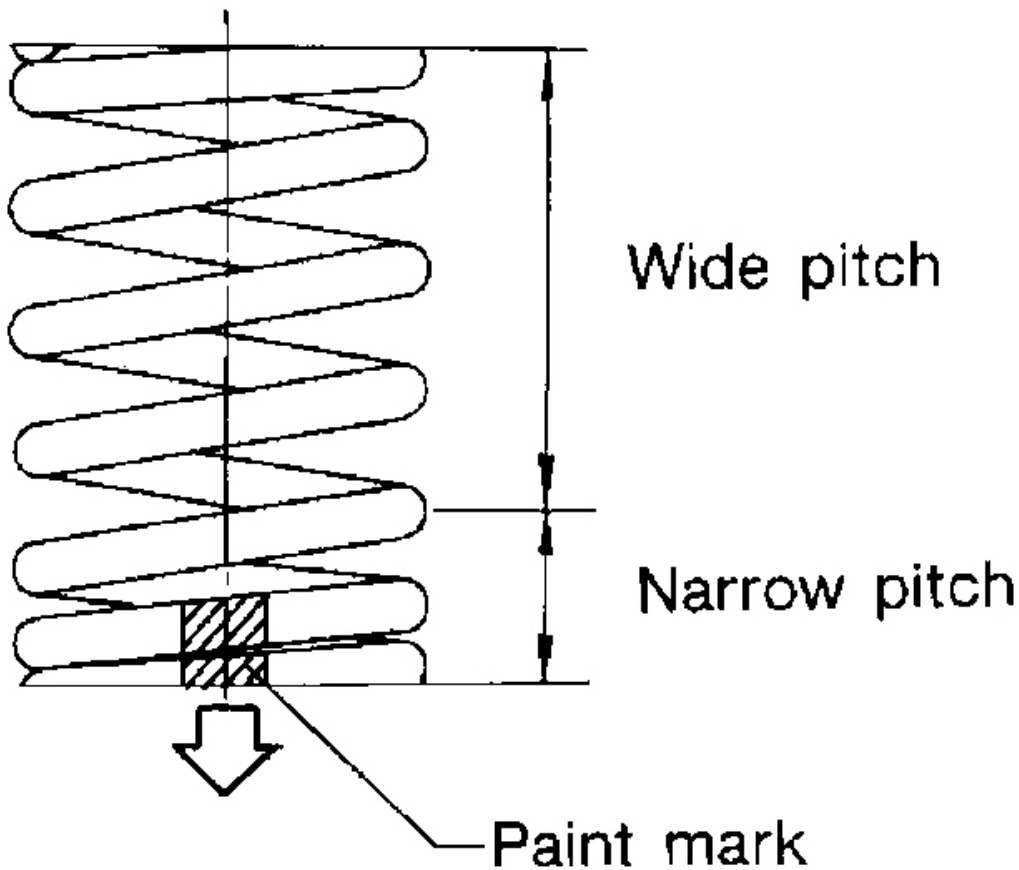
CAUTION:

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

2. Install valve component parts.

- Always use new valve oil seal. Refer to VALVE OIL SEAL.
- Before installing valve oil seal, install valve spring seat.
- Install valve spring (uneven pitch type) with its narrow pitch side toward cylinder head side (paint mark).
- After installing valve component parts, tap valve stem tip with plastic hammer to assure a proper fit.

3. Install spark plug.



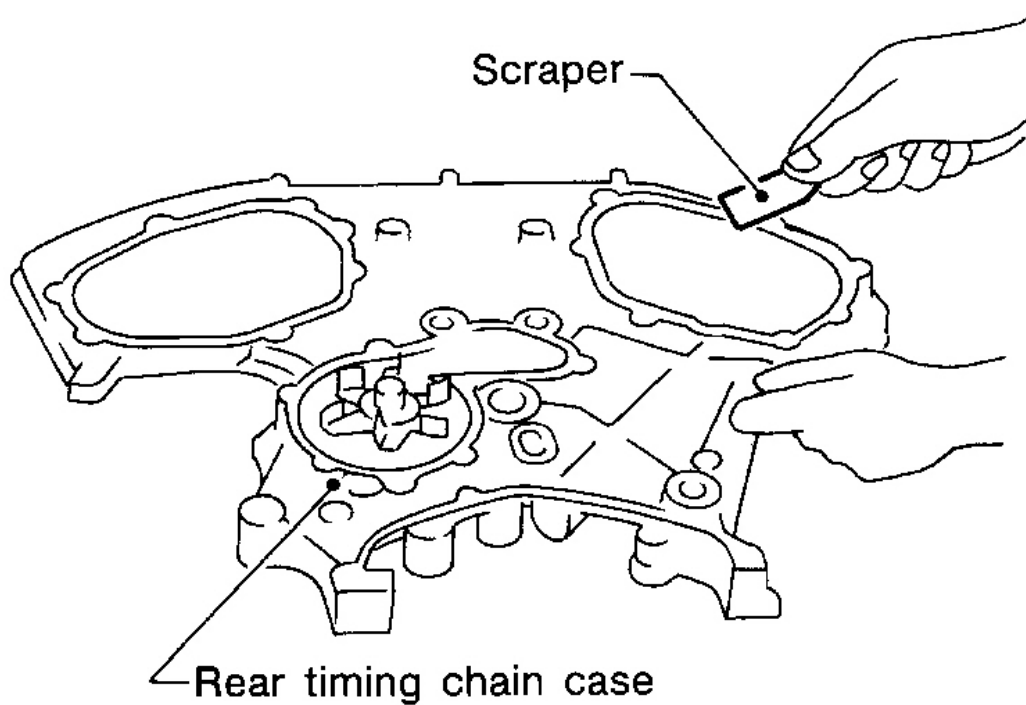
Cylinder head side

G02090186

Fig. 182: Identifying Valve Spring
Courtesy of NISSAN MOTOR CO., U.S.A.

INSTALLATION

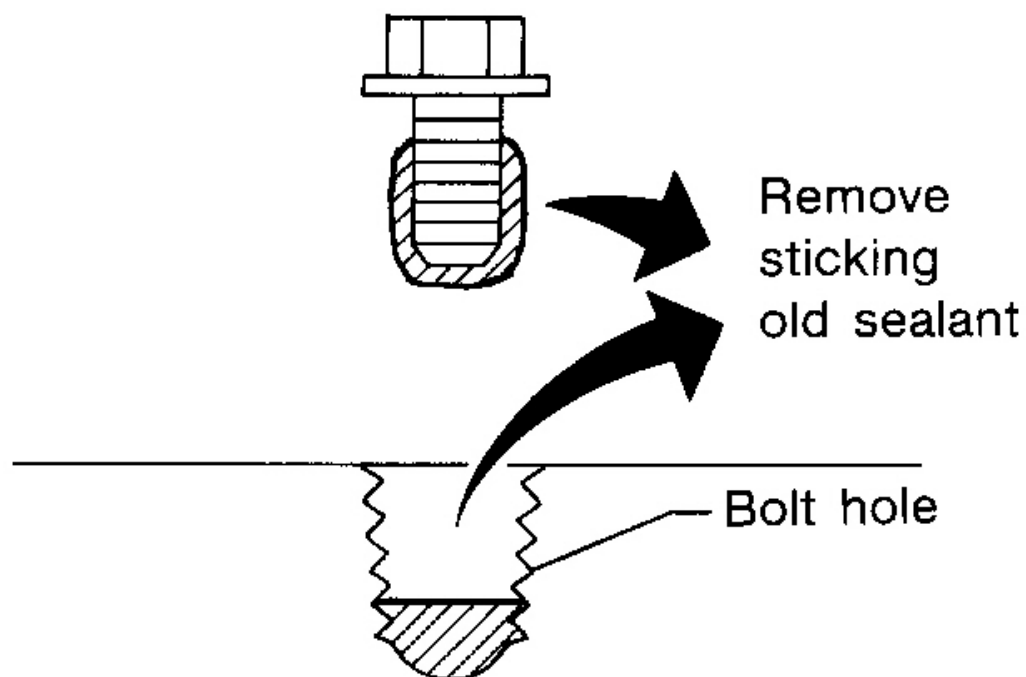
1. Before installing rear timing chain case, remove old liquid gasket from mating surface using a scraper.
 - Also remove old liquid gasket from mating surface of cylinder block.



G02090187

Fig. 183: Removing Old Liquid Gasket
Courtesy of NISSAN MOTOR CO., U.S.A.

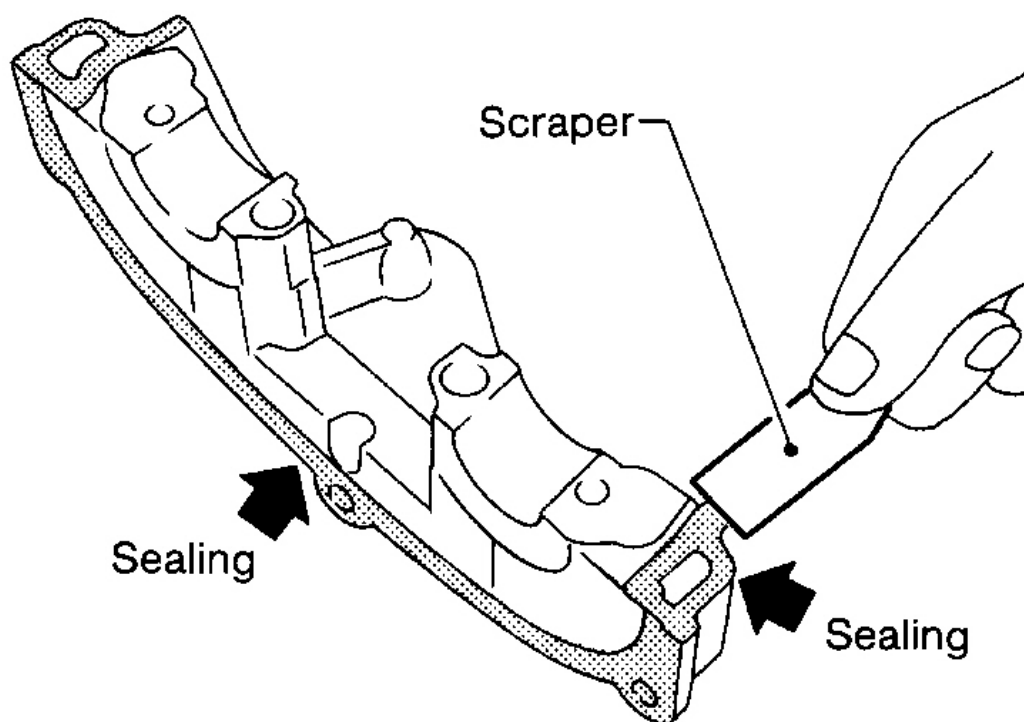
- Remove old liquid gasket from the bolt hole and thread.



G02090188

Fig. 184: Removing Old Liquid Gasket From Bolt Hole
Courtesy of NISSAN MOTOR CO., U.S.A.

2. Before installing cam bracket, remove old liquid gasket from mating surface using a scraper.

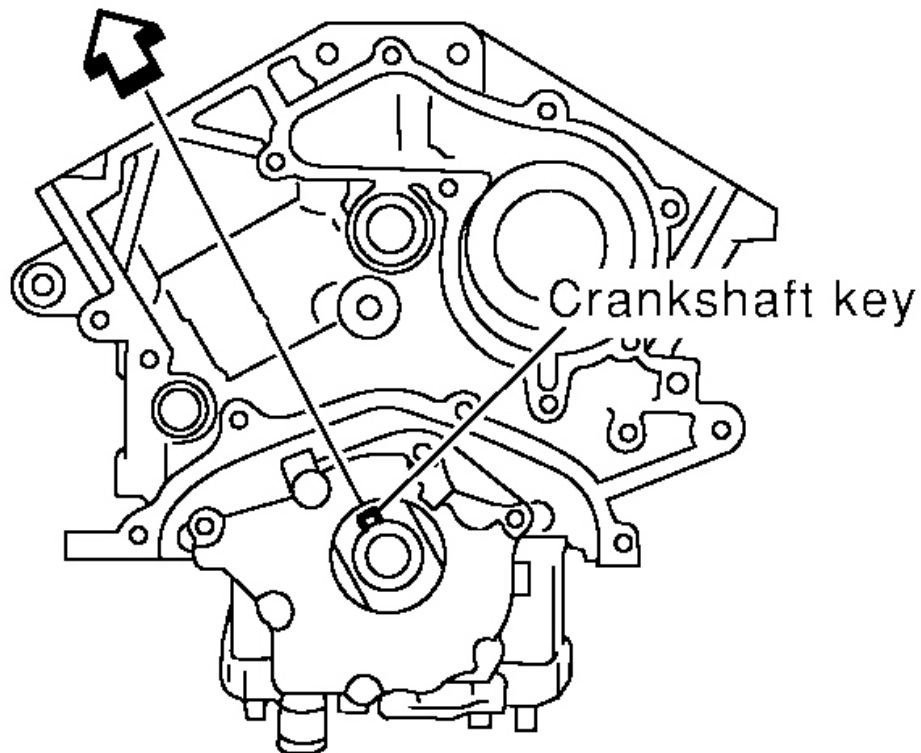


G02090189

Fig. 185: Removing Old Liquid Gasket From Mating Surface Using Scraper
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Before installing the cylinder head gasket, be sure that No. 1 cylinder is at TDC.
 - At this time, the crankshaft key should face toward the right bank.

Right bank side

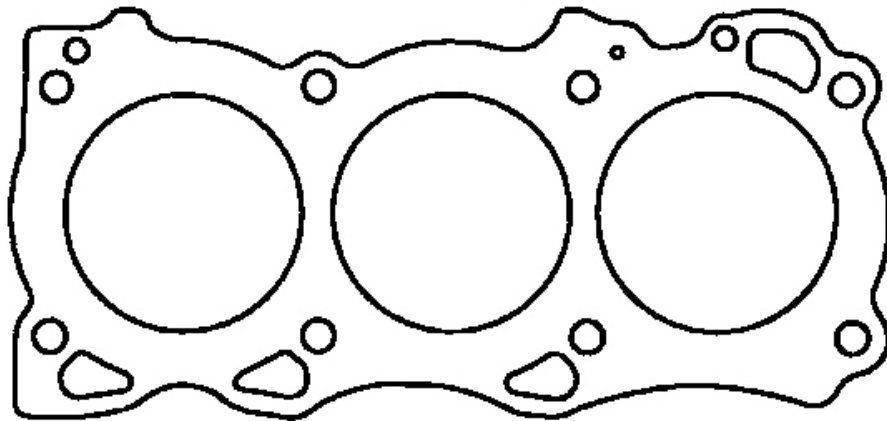


G02090190

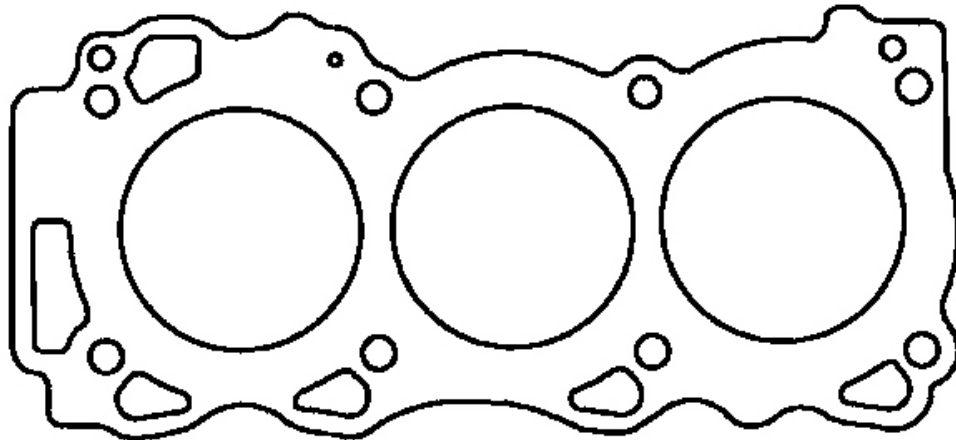
Fig. 186: Identifying Crankshaft Key
Courtesy of NISSAN MOTOR CO., U.S.A.

4. Install cylinder heads with new gaskets.
 - **Do not rotate crankshaft and camshaft separately, or valves will strike piston heads.**

RH cylinder head gasket



LH cylinder head gasket



G02090191

Fig. 187: Identifying Cylinder Heads Gaskets
Courtesy of NISSAN MOTOR CO., U.S.A.

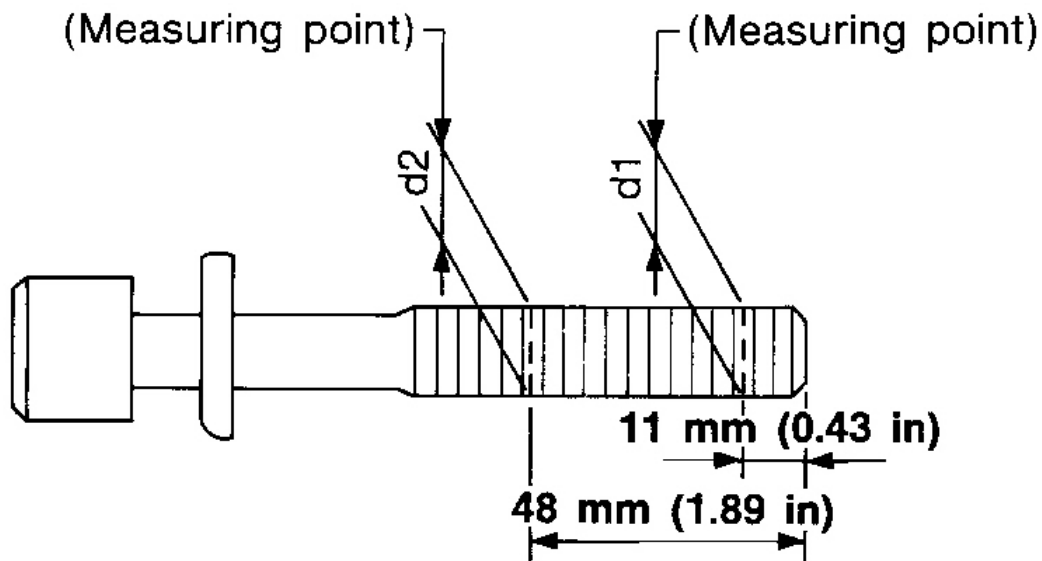
CAUTION: Cylinder head bolts are tightened by plastic zone tightening method. Whenever the size difference between d1 and d2 exceeds the limit, replace them with new ones.

Limit (d1 - d2):

0.11 mm (0.0043 in)

- If reduction of outer diameter appears in a position other than d2, use it as d2 point.
- Lubricate threads and seat surfaces of the bolts with new engine oil.

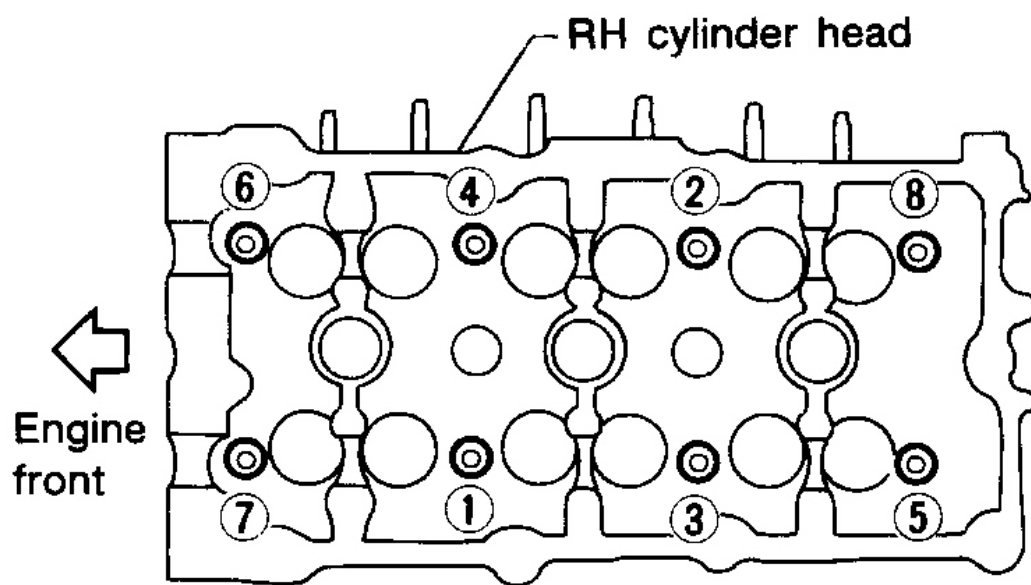
Cylinder head bolt



G02090192

Fig. 188: Measuring Cylinder Head Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

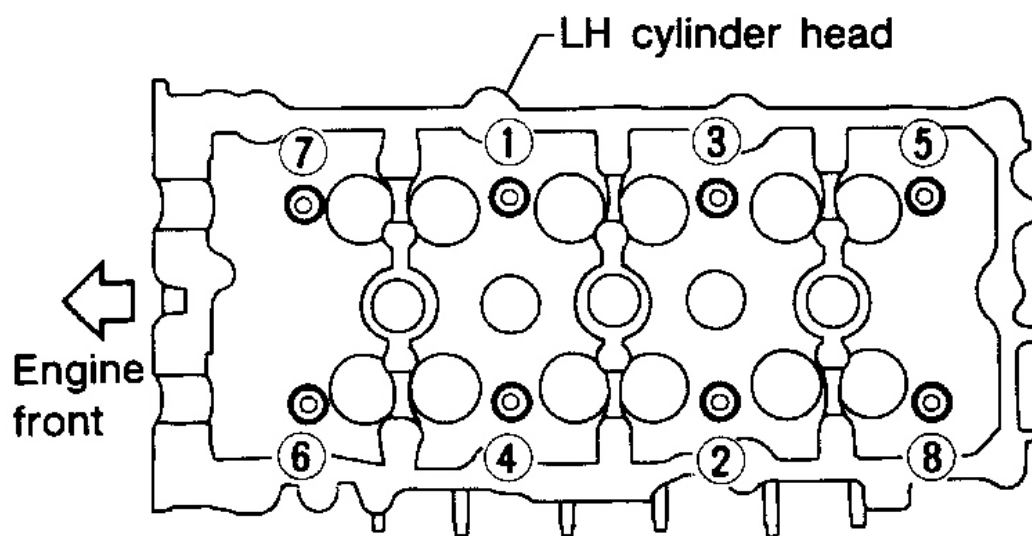
5. Tighten cylinder head outside bolts.
 - **Tightening procedure:**
 - a. Tighten all bolts to 98 N.m (10 kg-m, 72 ft-lb).
 - b. Completely loosen all bolts.
 - c. Tighten all bolts to 34.3 to 44.1 N.m (3.5 to 4.4 kg-m, 26 to 32 ft-lb).
 - d. Turn all bolts 90 to 95 degrees clockwise [target: 90 degrees (angle tightening)].
 - e. Turn all bolts 90 to 95 degrees clockwise again [target: 90 degrees (angle tightening)].
 - Tighten in numerical order shown in the figure.



G02090193

Fig. 189: Tightening Cylinder Head Outside Bolts (RH)

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



G02090194

Fig. 190: Tightening Cylinder Head Outside Bolts (LH)
Courtesy of NISSAN MOTOR CO., U.S.A.

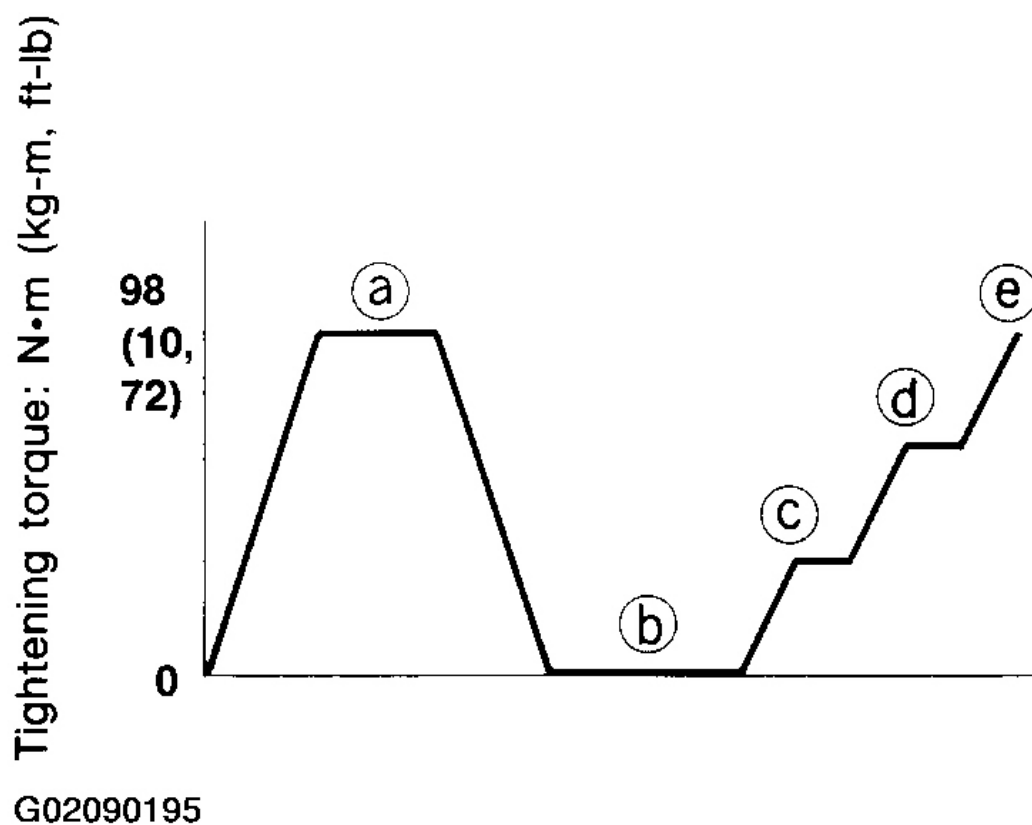
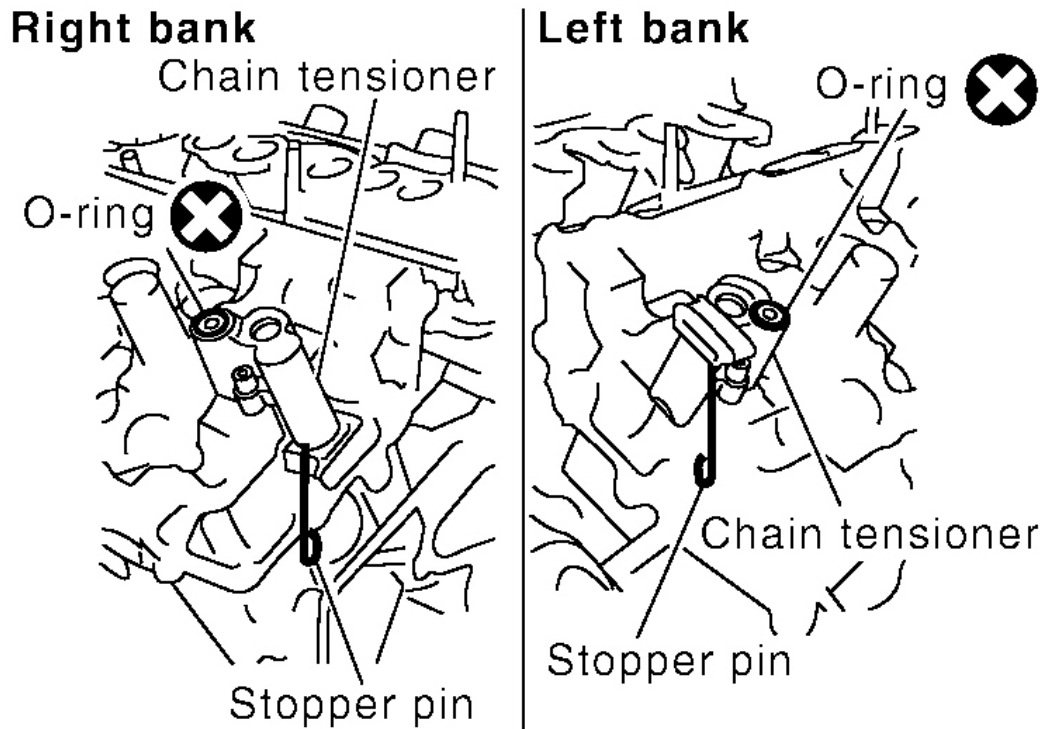


Fig. 191: Tightening Torque Graph
Courtesy of NISSAN MOTOR CO., U.S.A.

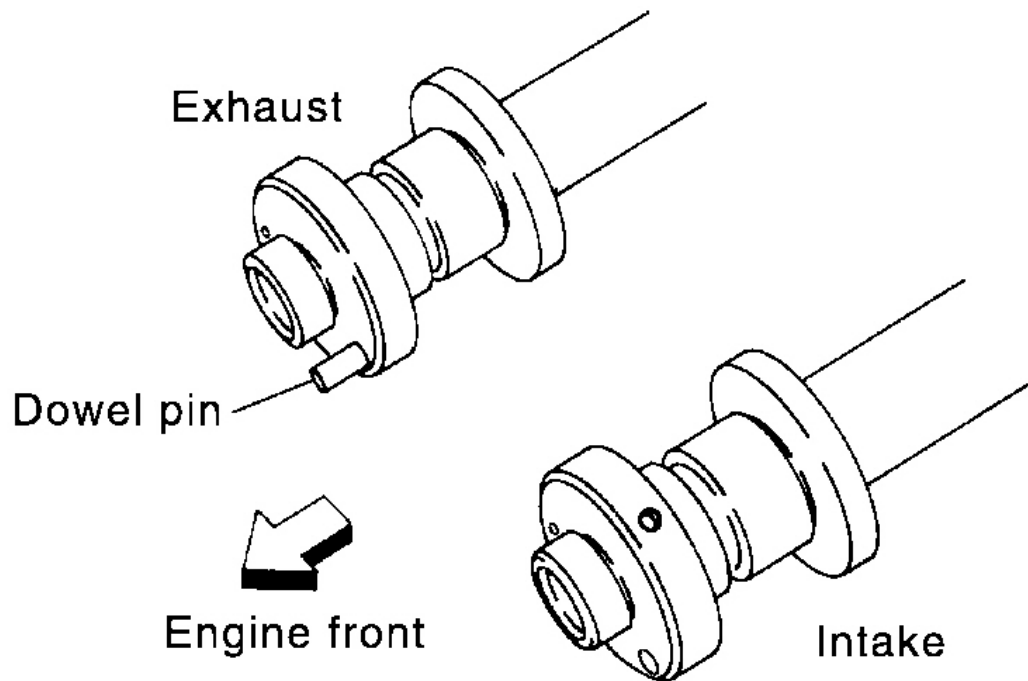
6. Install camshaft chain tensioners on both sides of cylinder head.



G02090196

Fig. 192: Installing Camshaft Chain Tensioners
Courtesy of NISSAN MOTOR CO., U.S.A.

7. Install exhaust and intake camshafts and camshaft brackets.
 - Exhaust camshaft has a dowel pin on camshaft sprocket mounting flange. Install it on the exhaust side.



G02090197

Fig. 193: Installing Exhaust And Intake Camshafts And Camshaft Brackets
 Courtesy of NISSAN MOTOR CO., U.S.A.

- Identification marks are present on camshafts.

Bank	INT/EXH	ID mark	Paint mark	
			M1	M2
RH	INT	RE	Yes	No
	EXH	RE	No	Yes
LH	INT	LH	Yes	No
	EXH	LH	No	Yes

G02090198

Fig. 194: Camshafts Paint Marks Specification

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

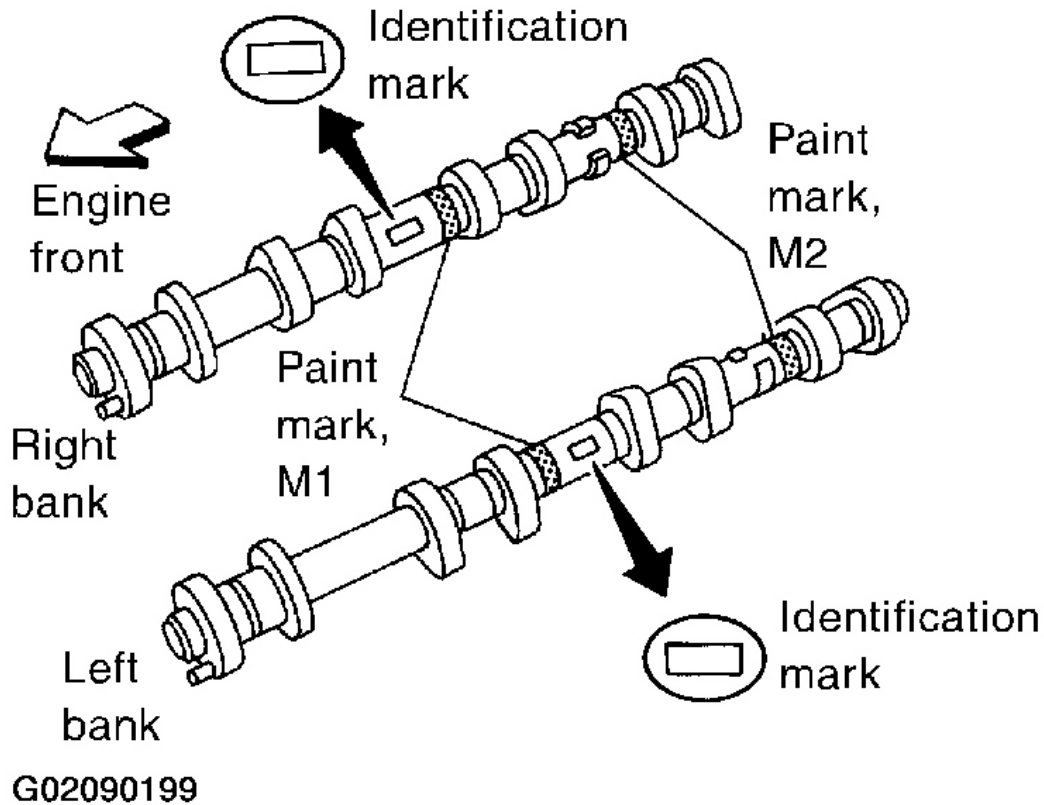
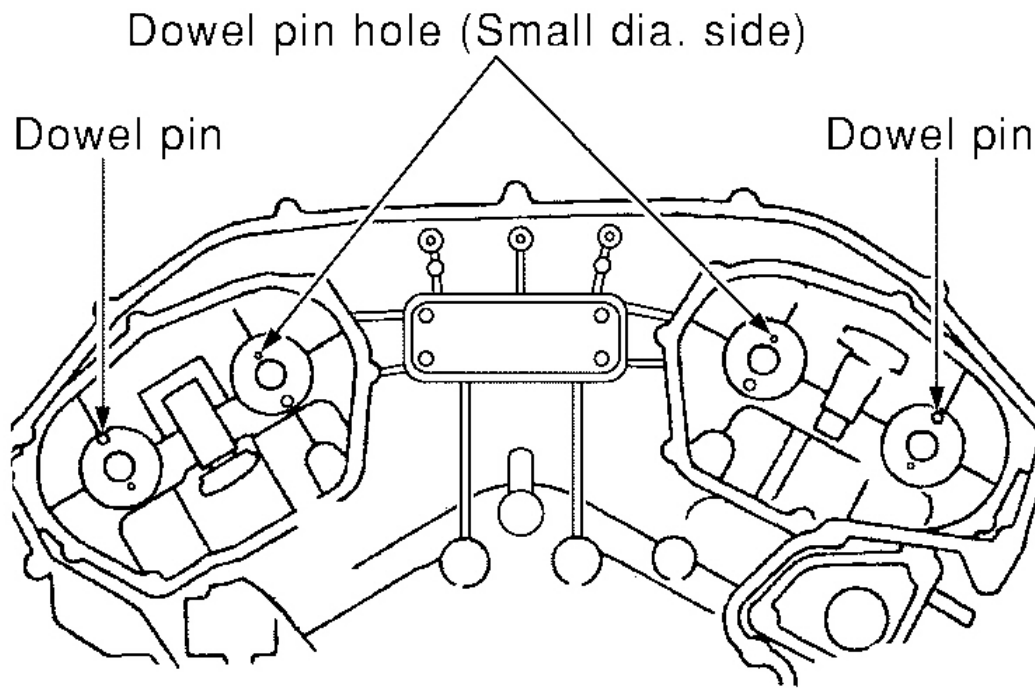


Fig. 195: Identifying Camshafts Marks
 Courtesy of NISSAN MOTOR CO., U.S.A.

- **Position camshaft**

RH exhaust camshaft dowel pin at about 10 o'clock

LH exhaust camshaft dowel pin at about 2 o'clock

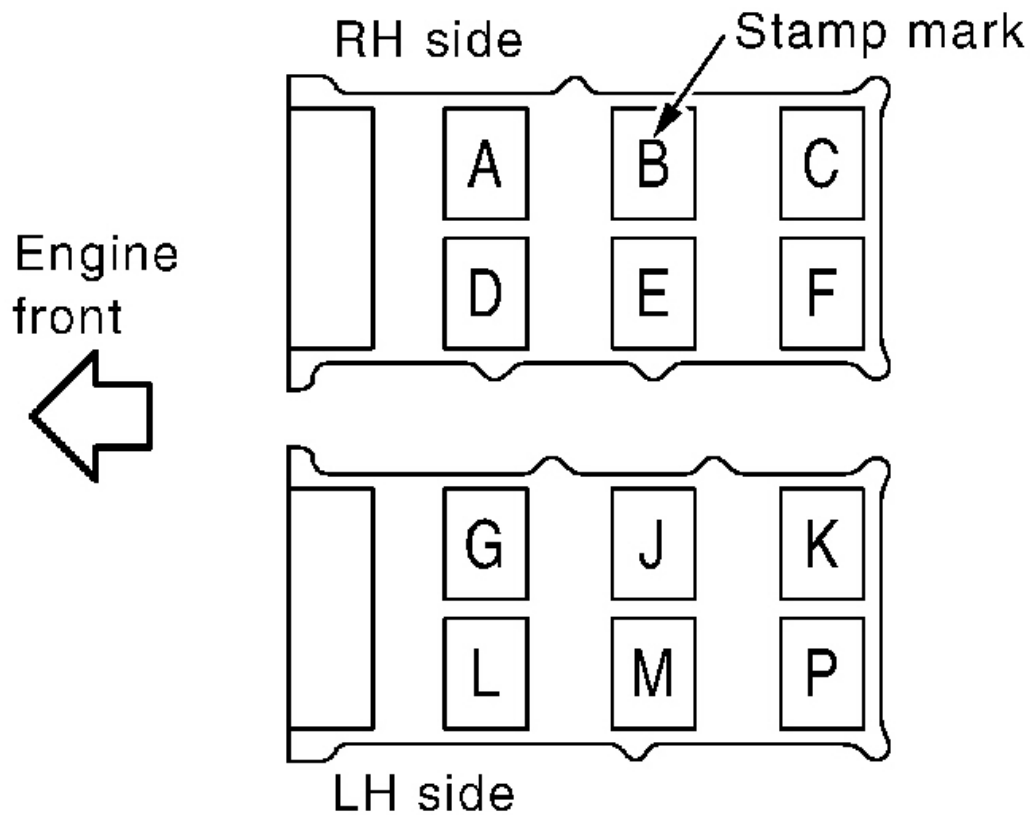


G02090200

Fig. 196: Positioning Camshaft Dowel Pin

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

8. Before installing camshaft brackets, apply sealant to mating surface of No. 1 camshaft bracket.
 - Refer to **POSITION FOR APPLYING LIQUID GASKET.**
 - Use Genuine RTV silicone sealant or equivalent.
 - Install camshaft brackets in their original positions. Align stamp mark as shown in the figure.



G02090201

Fig. 197: Identifying Camshaft Brackets
 Courtesy of NISSAN MOTOR CO., U.S.A.

- If any part of valve assembly or camshaft is replaced, check valve clearance according to reference data. After completing assembly check valve clearance. Refer to **CHECKING** and **ADJUSTING**.

Reference data valve clearance (Cold):

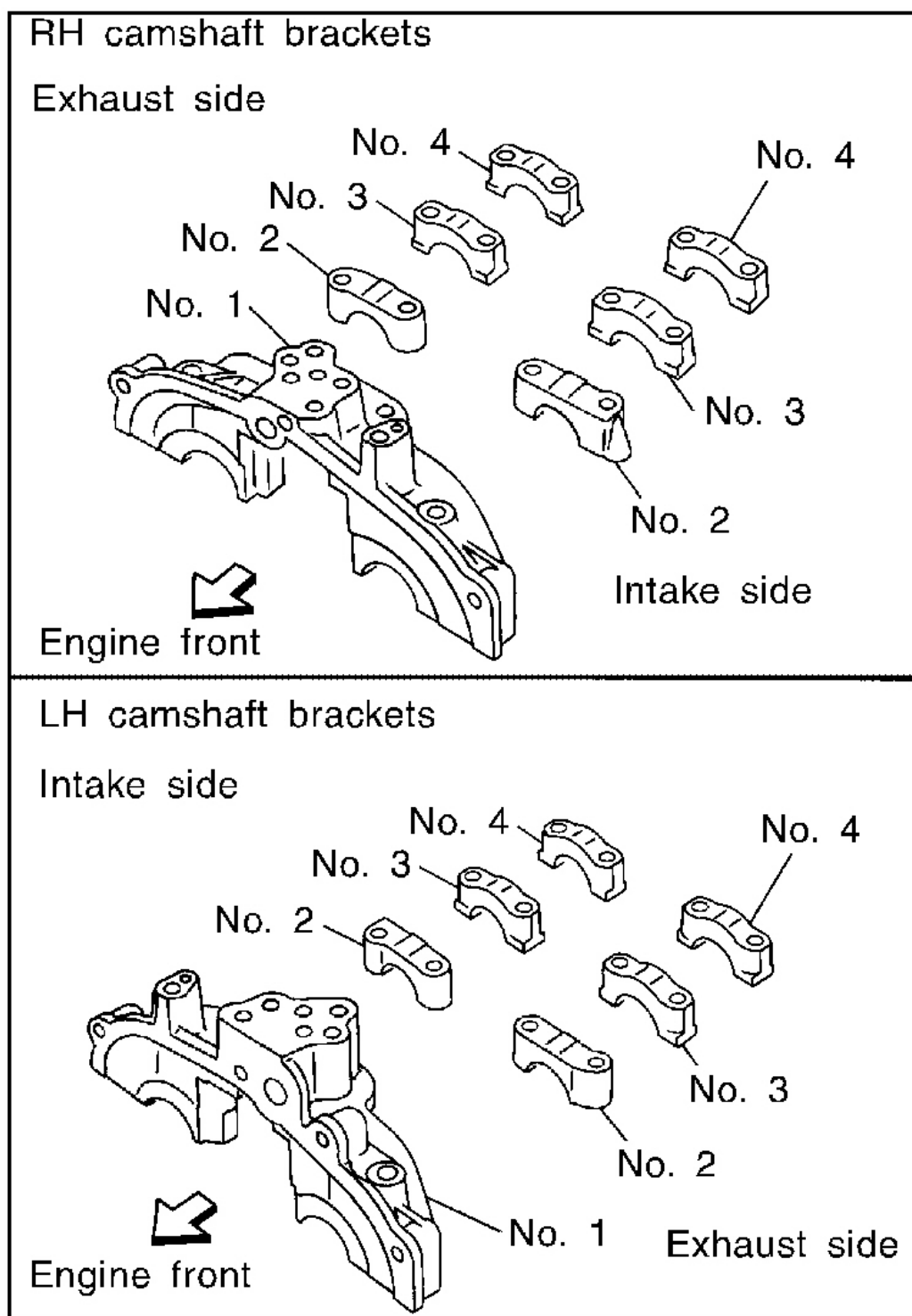
Intake

0.26 - 0.34 mm (0.010 - 0.013 in)

Exhaust

0.29 - 0.37 mm (0.011 - 0.015 in)

- Lubricate threads and seat surfaces of camshaft bracket bolts with new engine oil before installing them.



G02090202

Fig. 198: Identifying Camshaft Bracket (Exhaust Side)

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

- Tighten the camshaft brackets in the following steps.

Step	Tightening torque	Tightening order
1	1.96 N·m (0.2 kg-m, 17 in-lb)	Tighten in the order of 7 to 10, then tighten 1 to 6.
2	5.88 N·m (0.6 kg-m, 52 in-lb)	Tighten in the numerical order.
3	9.02 - 11.8 N·m (0.92 - 1.20 kg-m, 79.9 - 104.2 in-lb)	Tighten in the order of 1 to 6.
	8.3 - 10.3 N·m (0.9 - 1.0 kg-m, 74 - 91 in-lb)	Tighten in the order of 7 to 10.

G02090203

Fig. 199: Identifying Camshaft Bracket (Intake Side)

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

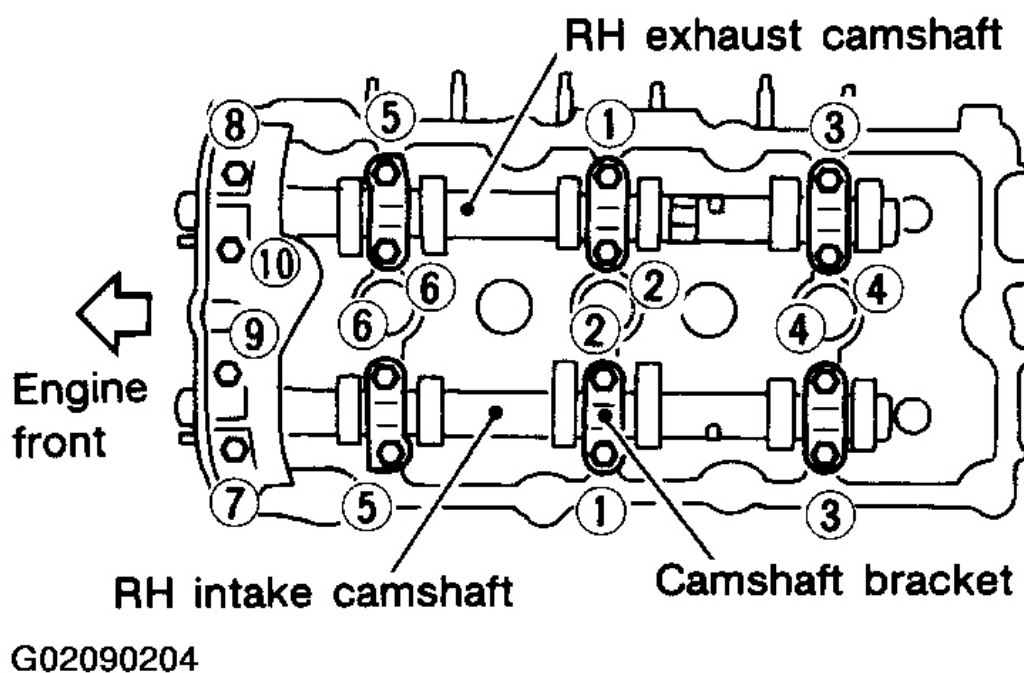
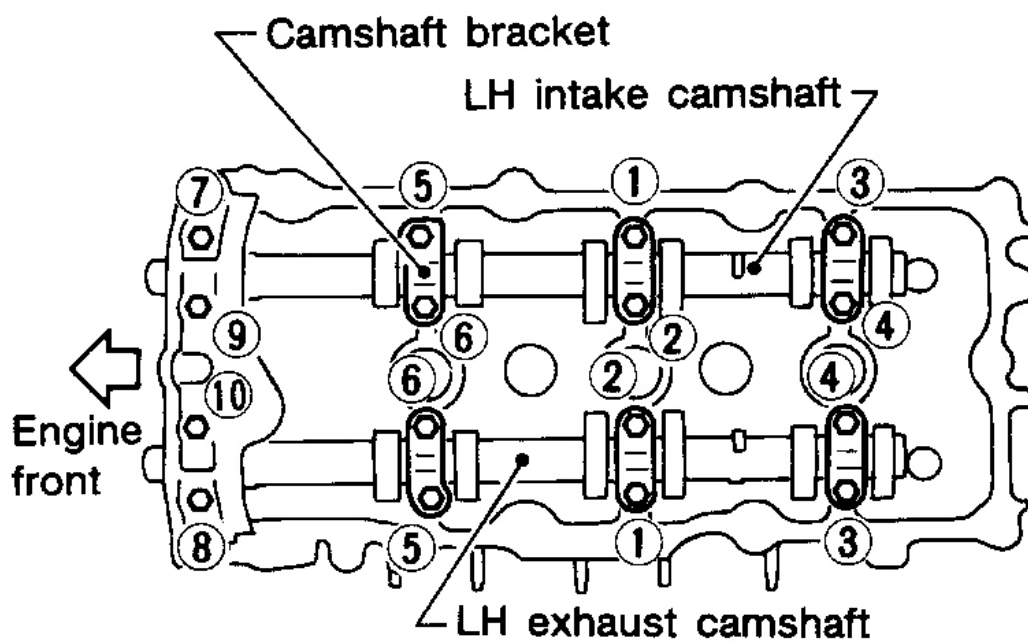


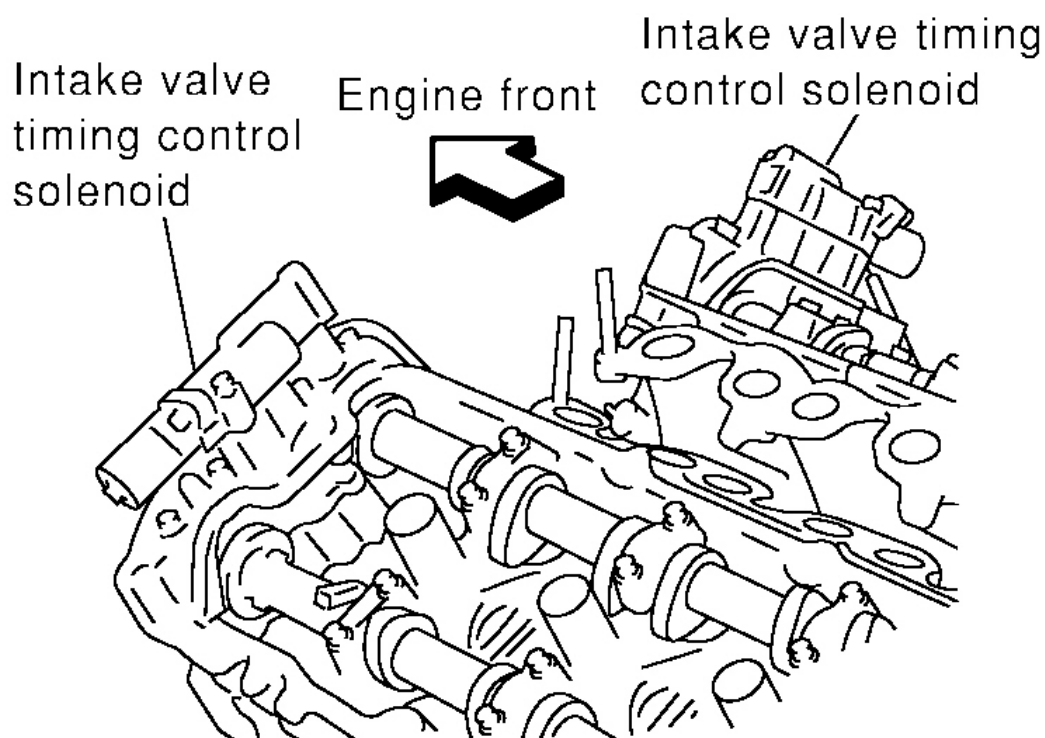
Fig. 200: Tightening Camshaft Bracket bolts (RH)
Courtesy of NISSAN MOTOR CO., U.S.A.



G02090205

Fig. 201: Tightening Camshaft Bracket bolts (LH)
Courtesy of NISSAN MOTOR CO., U.S.A.

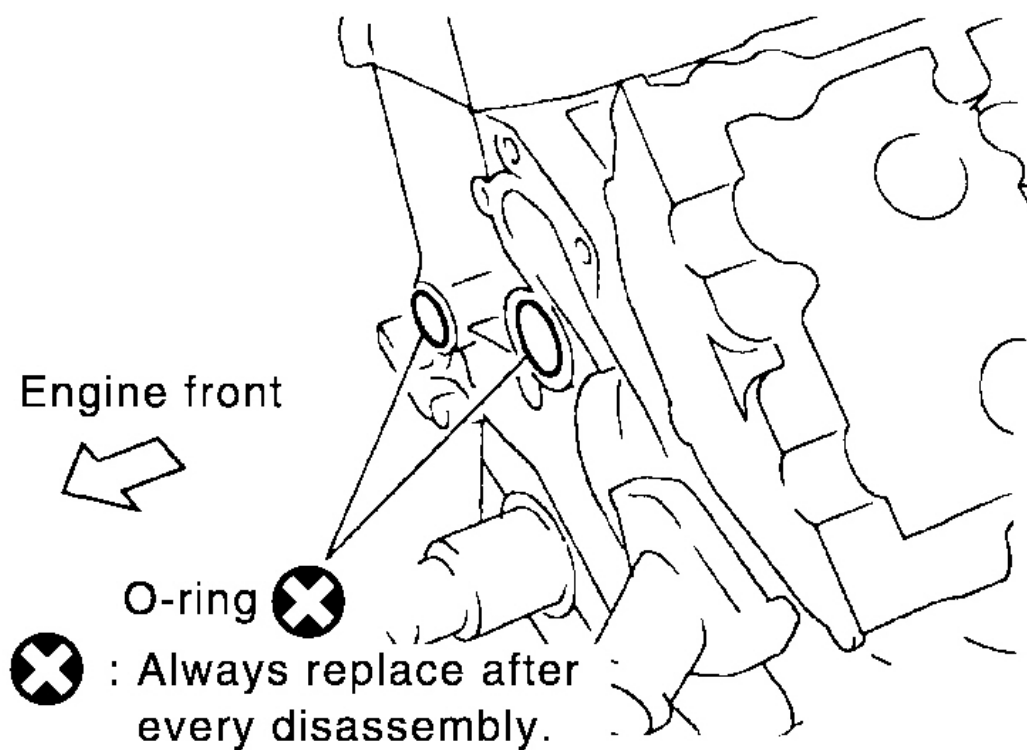
9. Install intake valve timing control solenoid valves.



G02090206

Fig. 202: Installing Intake Valve Timing Control Solenoid Valves
Courtesy of NISSAN MOTOR CO., U.S.A.

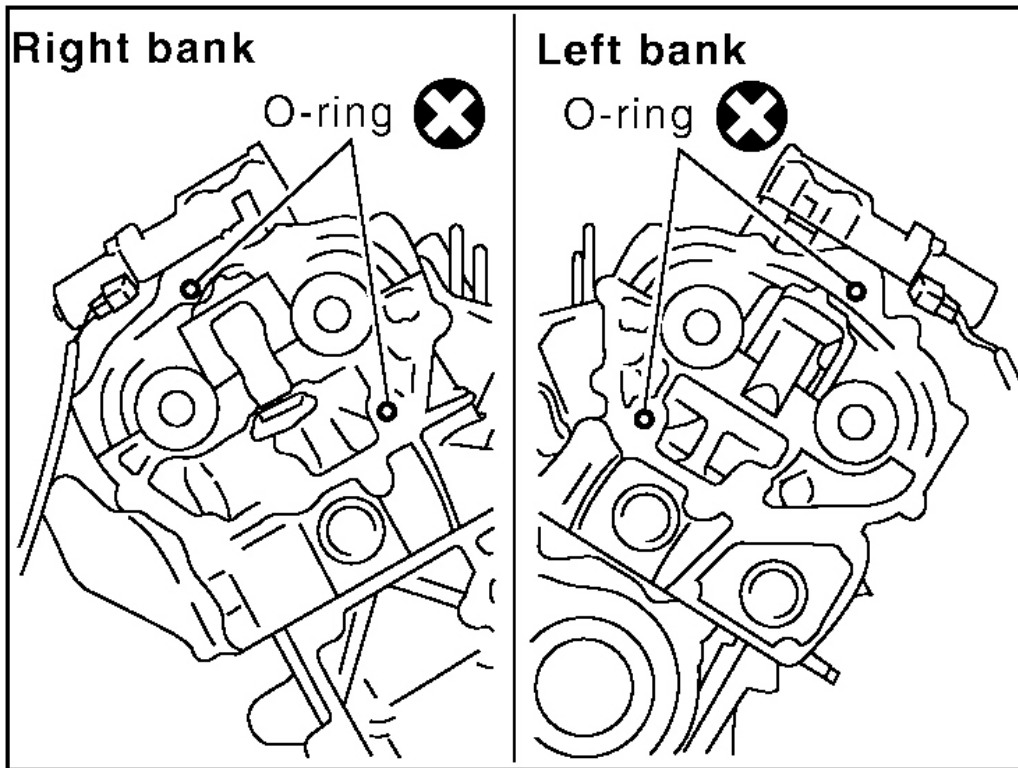
10. Install O-rings to cylinder block.



G02090207

Fig. 203: Installing O-Rings To Cylinder Block
Courtesy of NISSAN MOTOR CO., U.S.A.

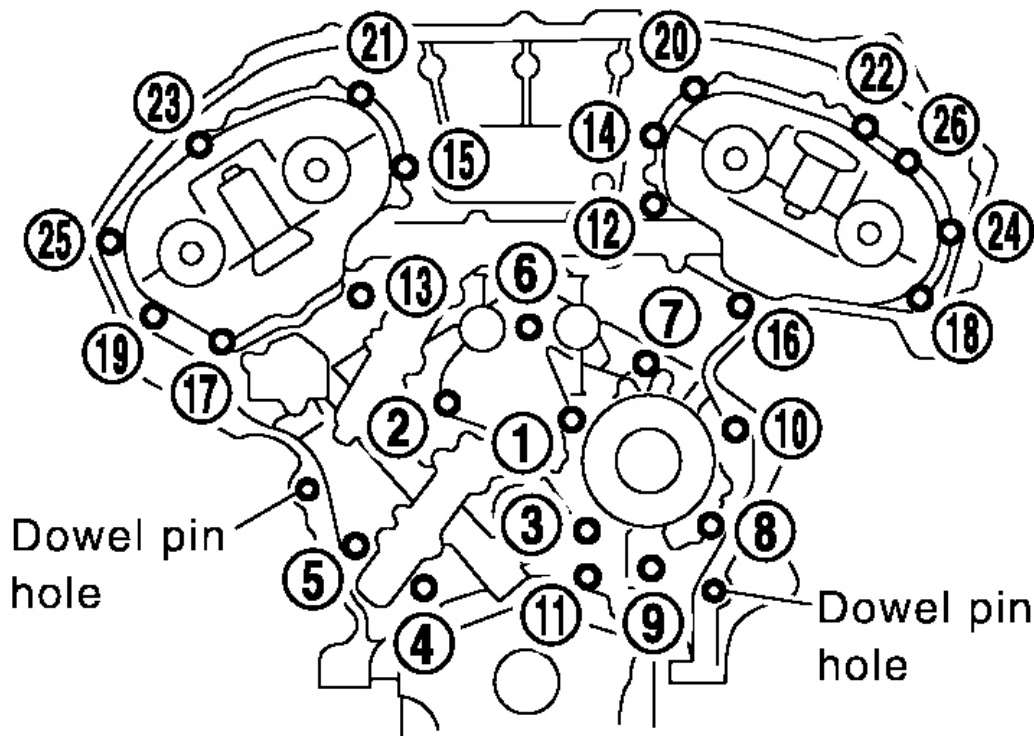
11. Install O-rings to cylinder head.



G02090208

Fig. 204: Installing O-Rings To Cylinder Head
Courtesy of NISSAN MOTOR CO., U.S.A.

12. Apply sealant to the hatched portion of rear timing chain case. Refer to **POSITION FOR APPLYING LIQUID GASKET**.
 - Apply continuous bead of liquid gasket to mating surface of rear timing chain case.
 - **Before installation, wipe off the protruding sealant.**



G02090209

Fig. 205: Identifying Dowel Pin Hole
 Courtesy of NISSAN MOTOR CO., U.S.A.

13. Align rear timing chain case with dowel pins, then install on cylinder head and block.
14. Tighten rear chain case bolts.
 - a. Tighten bolts in numerical order shown in the figure with smaller torque than specified.
 - b. Tighten bolts to the specified torque repeating above step a.
15. Reinstall all removed parts in reverse order of removal.

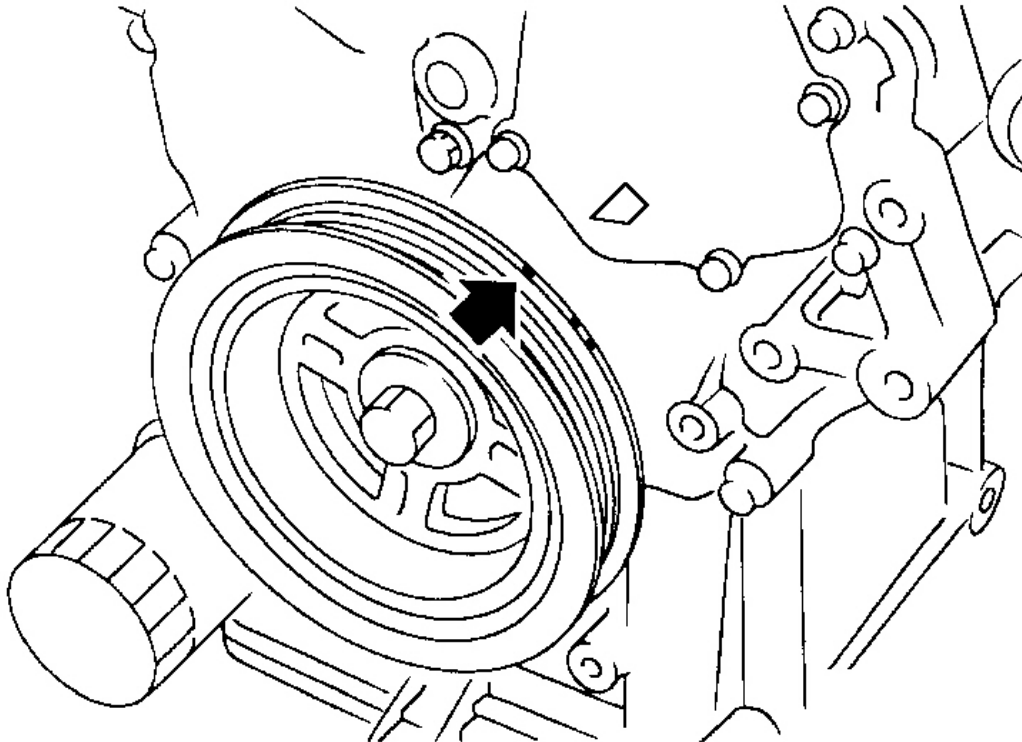
VALVE CLEARANCE

CHECKING

Check valve clearance while engine is cold and not running.

1. Remove ornament cover.
2. Remove air duct with air cleaner case, collectors, hoses, wires, harnesses, connectors and so on.
3. Remove intake manifold collectors. Refer to **TIGHTENING PROCEDURES**.

4. Remove ignition coils and spark plugs.
5. Remove RH and LH rocker covers. Refer to **REMOVAL**.
6. Set No. 1 cylinder at TDC on its compression stroke.
 - Align pointer with TDC mark on crankshaft pulley.



G02090210

Fig. 206: Aligning Crankshaft Pulley
Courtesy of NISSAN MOTOR CO., U.S.A.

- Check that valve lifters on No. 1 cylinder are loose and valve lifters on No. 4 are tight.

If not, turn crankshaft one revolution (360°) and align as shown.

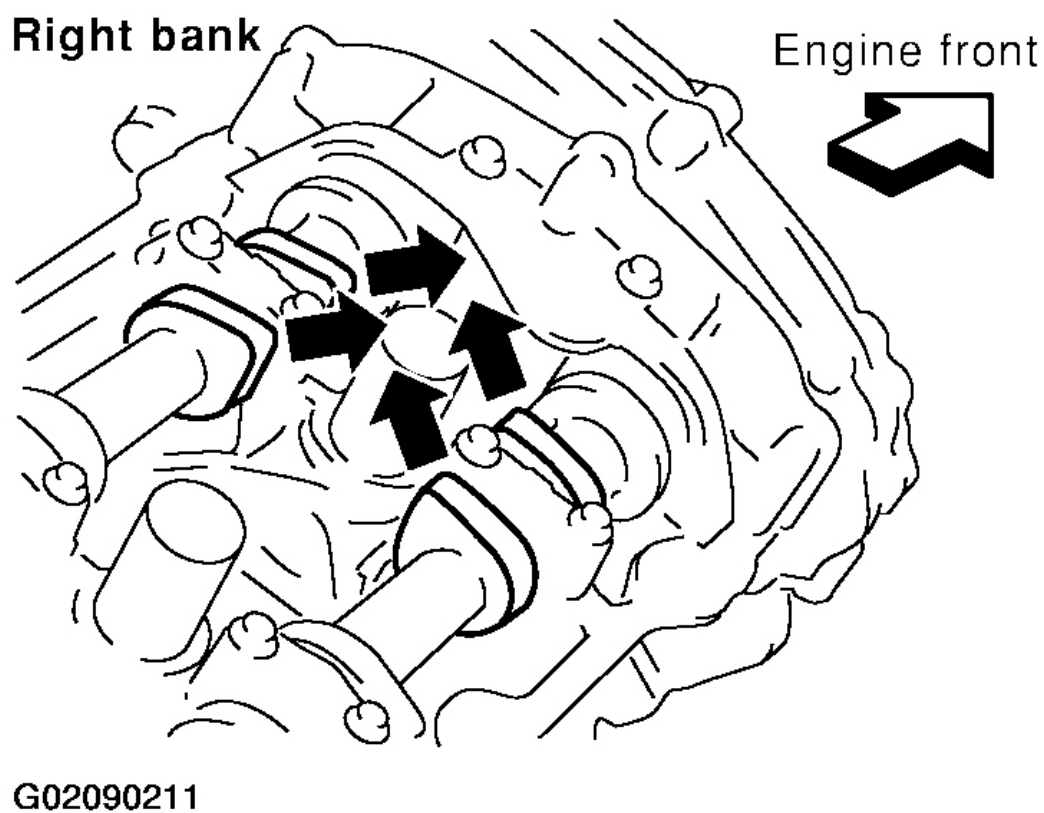


Fig. 207: Locating Valve Lifters
Courtesy of NISSAN MOTOR CO., U.S.A.

7. Check only those valves shown in the figure.

2003 Infiniti I35

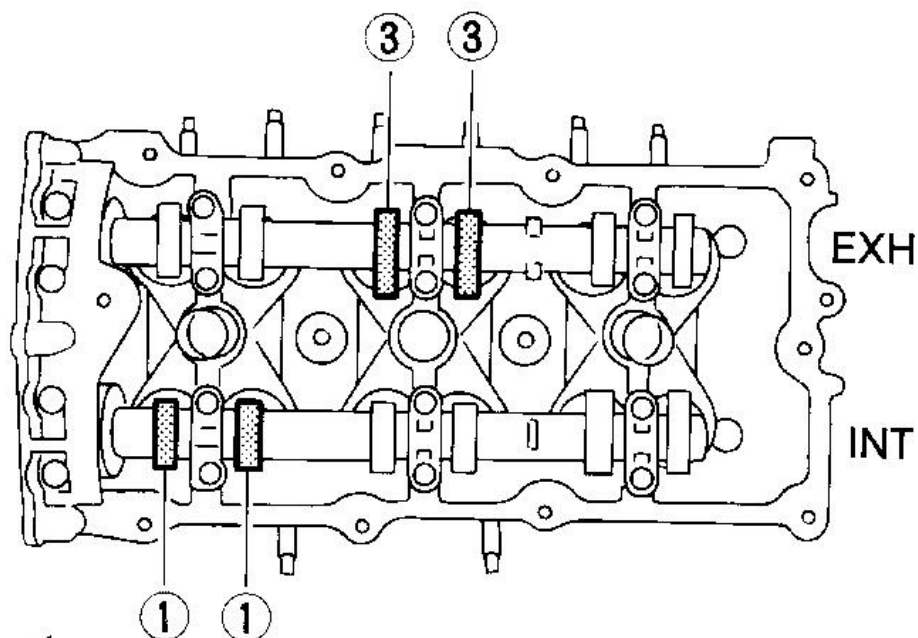
2003 ENGINE Engine Mechanical - I35

Measuring position (RH bank)		No. 1 CYL	No. 3 CYL	No. 5 CYL
No. 1 cylinder at TDC	EXH		X	
	INT	X		
Measuring position (LH bank)		No. 2 CYL	No. 4 CYL	No. 6 CYL
No. 1 cylinder at TDC	INT			X
	EXH	X		

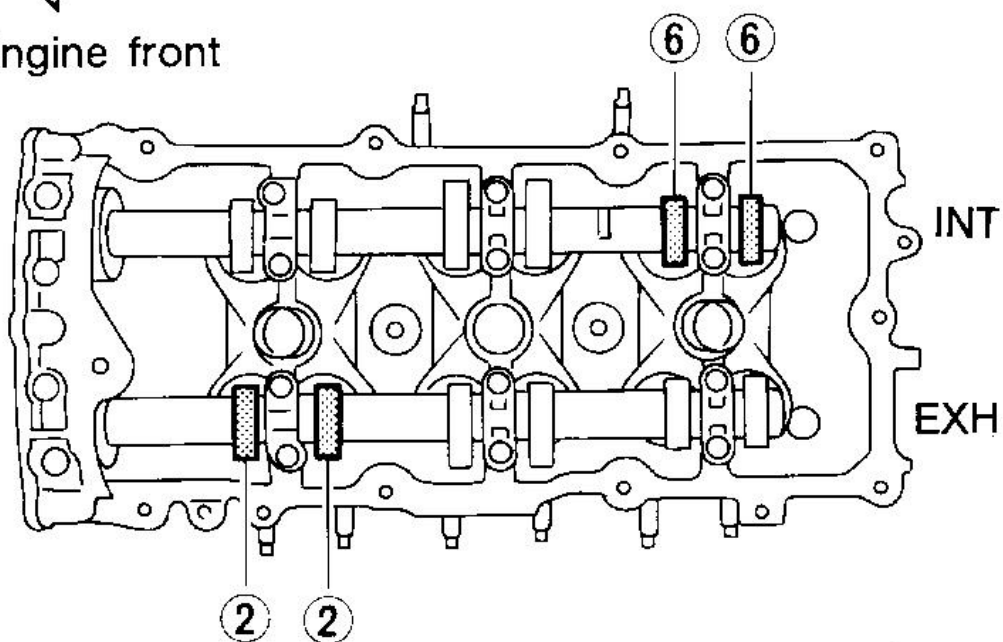
G02090212

Fig. 208: Measuring Camshaft Bracket bolts (RH)
Courtesy of NISSAN MOTOR CO., U.S.A.

RH cylinder head



Engine front



LH cylinder head

G02090213

Fig. 209: Camshaft Valve Reference

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

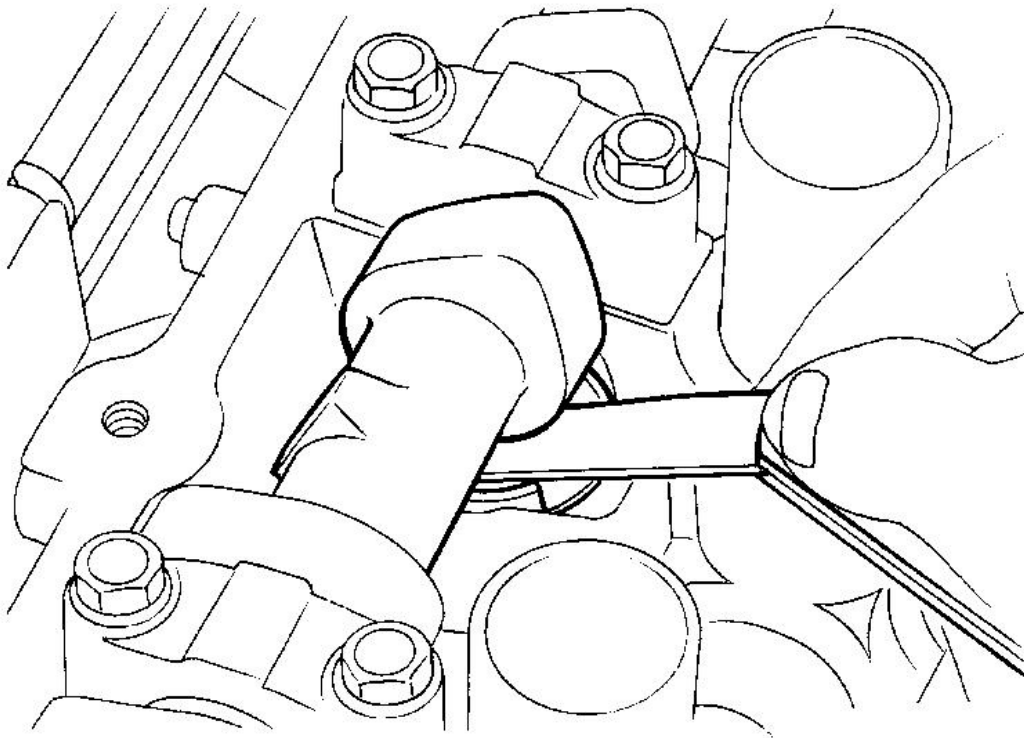
- Using a feeler gauge, measure clearance between valve lifter and camshaft.
- Record any valve clearance measurements which are out of specification. They will be used later to determine the required replacement valve lifter.

Valve clearance for checking (Cold):**Intake**

0.26 - 0.34 mm (0.010 - 0.013 in)

Exhaust

0.29 - 0.37 mm (0.011 - 0.015 in)



G02090214

Fig. 210: Measuring Clearance Between Valve Lifter And Camshaft

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

8. Turn crankshaft 240° and align as above.
9. Set No. 3 cylinder at TDC on its compression stroke.

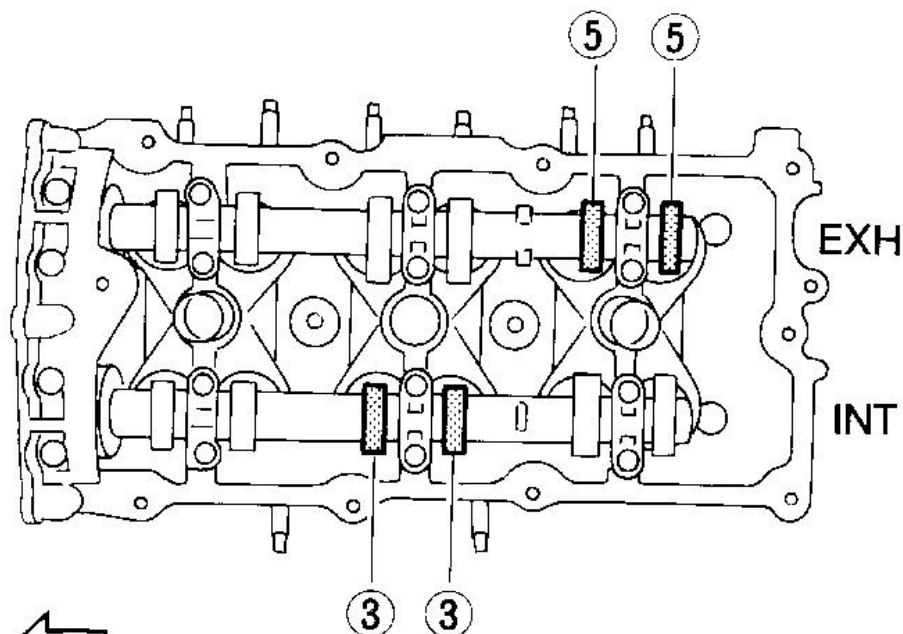
10. Check only those valves shown in the figure.

Measuring position (RH bank)		No. 1 CYL	No. 3 CYL	No. 5 CYL
No. 3 cylinder at TDC	EXH			X
	INT		X	
Measuring position (LH bank)		No. 2 CYL	No. 4 CYL	No. 6 CYL
No. 3 cylinder at TDC	INT	X		
	EXH		X	

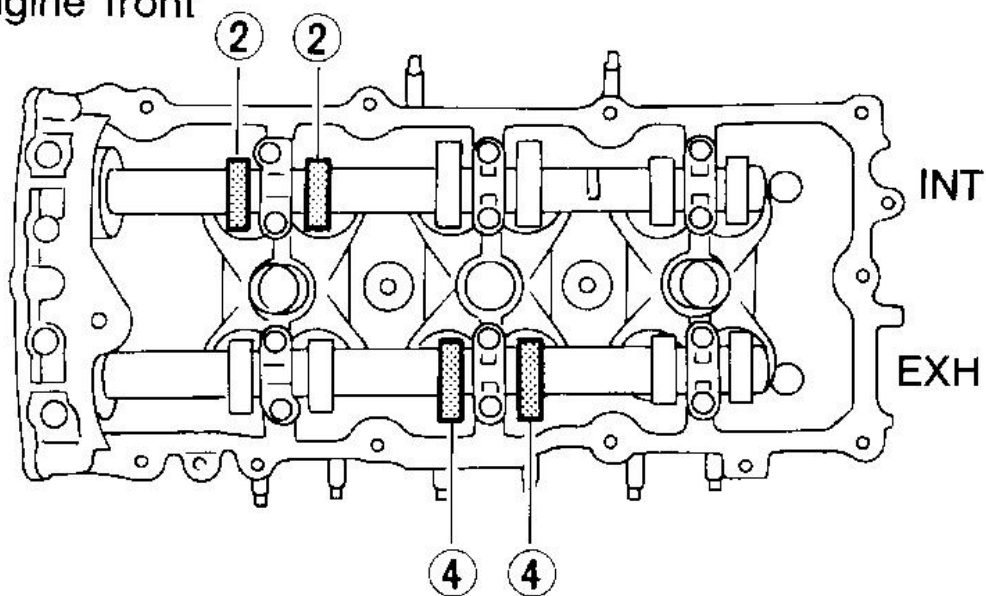
G02090215

Fig. 211: Setting No. 3 Cylinder TDC Compression Stroke
Courtesy of NISSAN MOTOR CO., U.S.A.

RH cylinder head



Engine front



LH cylinder head

G02090216

Fig. 212: Cylinder TDC Compression Stroke Reference
 Courtesy of NISSAN MOTOR CO., U.S.A.

11. Turn crankshaft 240° and align as above.
12. Set No. 5 cylinder at TDC on its compression stroke.
13. Check only those valves shown in the figure.

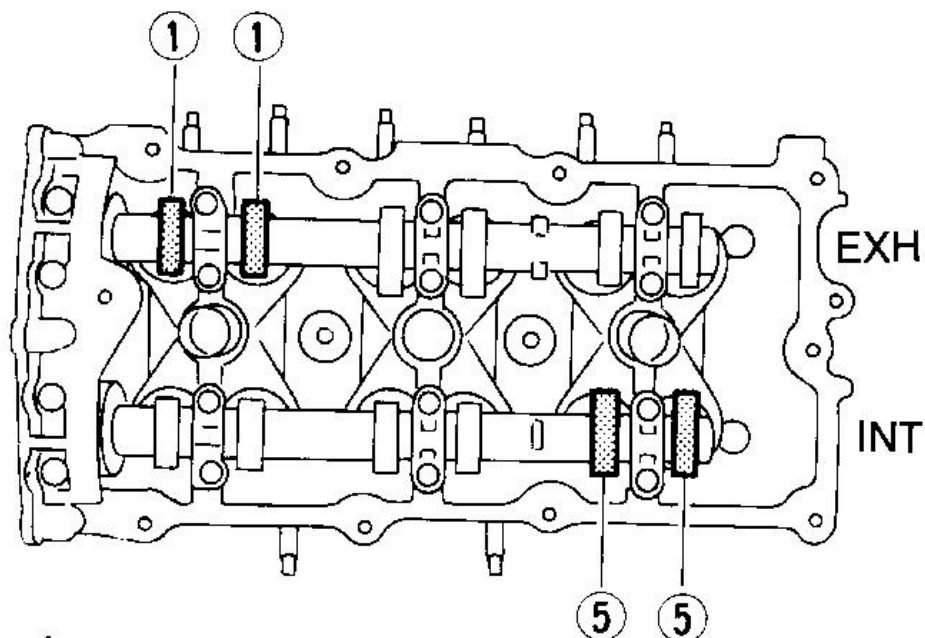
Measuring position (RH bank)		No. 1 CYL	No. 3 CYL	No. 5 CYL
No. 5 cylinder at TDC	EXH	X		
	INT			X
Measuring position (LH bank)		No. 2 CYL	No. 4 CYL	No. 6 CYL
No. 5 cylinder at TDC	INT		X	
	EXH			X

G02090217

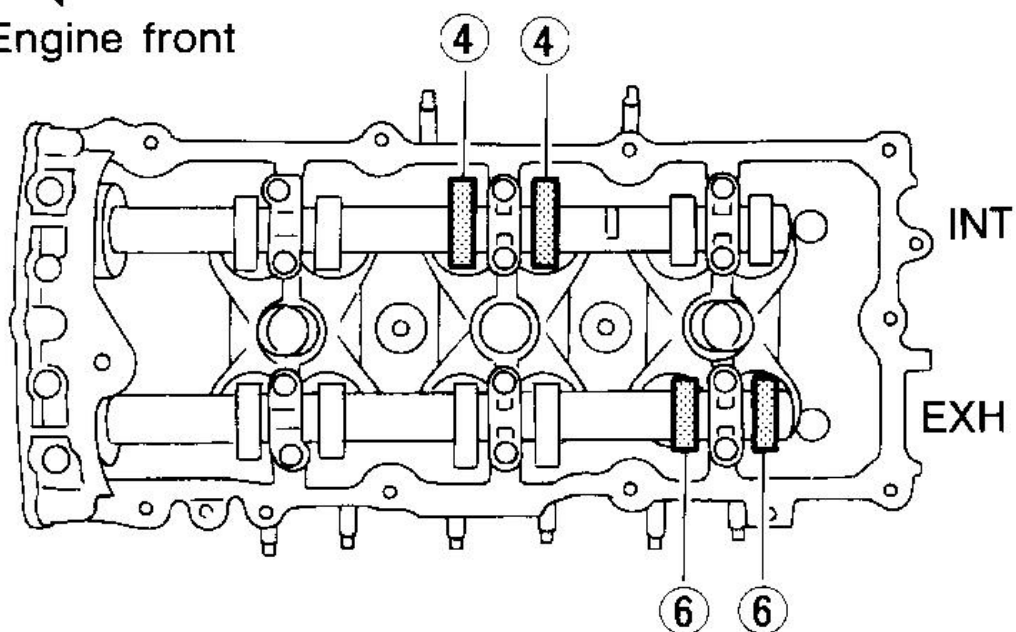
Fig. 213: Setting No. 5 Cylinder TDC Compression
 Courtesy of NISSAN MOTOR CO., U.S.A.

14. If all valve clearances are within specification, install the following parts. If they are out of specification, adjust the valve clearances.
 - Intake manifold collectors
 - RH and LH rocker covers
 - All spark plugs
 - All ignition coils

RH cylinder head



Engine front



LH cylinder head

G02090218

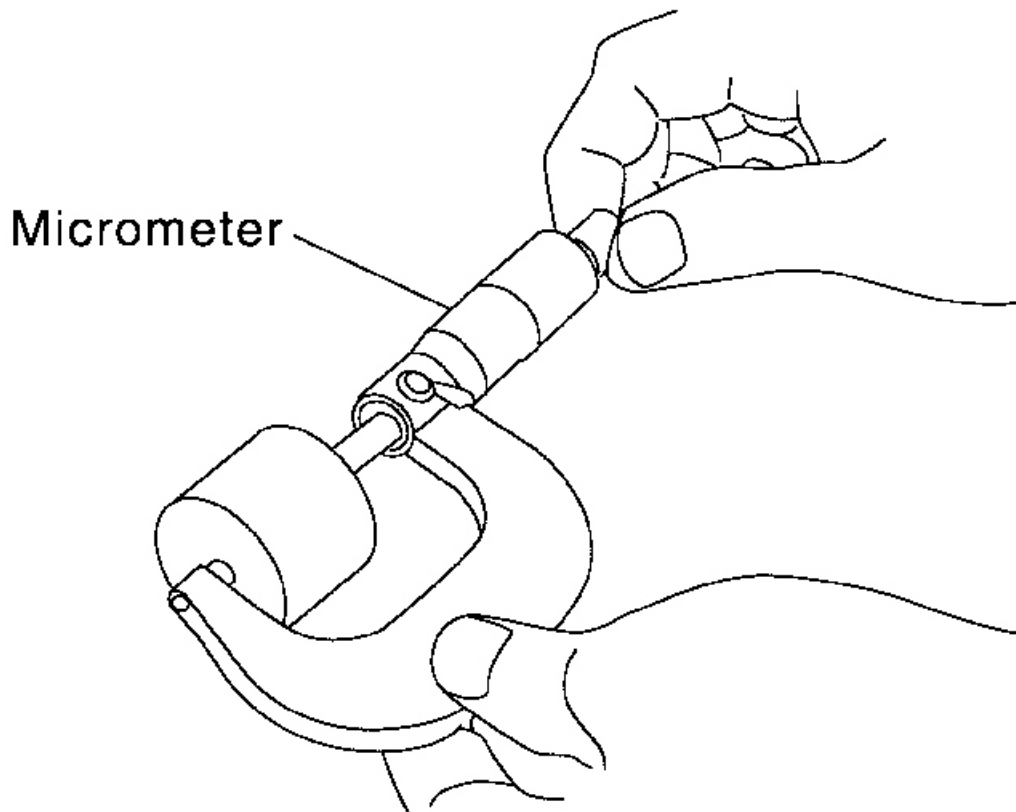
Fig. 214: Cylinder TDC Compression Stroke Reference
Courtesy of NISSAN MOTOR CO., U.S.A.

ADJUSTING

Adjust valve clearance while engine is cold.

Perform adjustment by selecting head thickness of valve lifter (Adjusting shims are not used).

1. Remove camshaft.
2. Remove valve lifter at location where measured value is outside standard.



G02090219

Fig. 215: Measuring Center Thickness
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Measure center thickness of removed valve lifter with micrometer.

4. Use equation below to calculate valve lifter thickness for replacement.

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

t = Thickness of replacement valve lifter

t1 = Thickness of removed valve lifter

C1 = Measured valve clearance

C2 = Standard valve clearance:

Intake: 0.30 mm (0.012 in)

Exhaust: 0.33 mm (0.013 in)

- Thickness of new valve lifter can be identified by stamp mark on reverse side (inside cylinder).

Unit: mm (in)

Stamp mark	Thickness of valve lifter
Starting: 788U or 788R	7.88 (0.3102)
Ending: 840U or 840R	8.40 (0.3307)

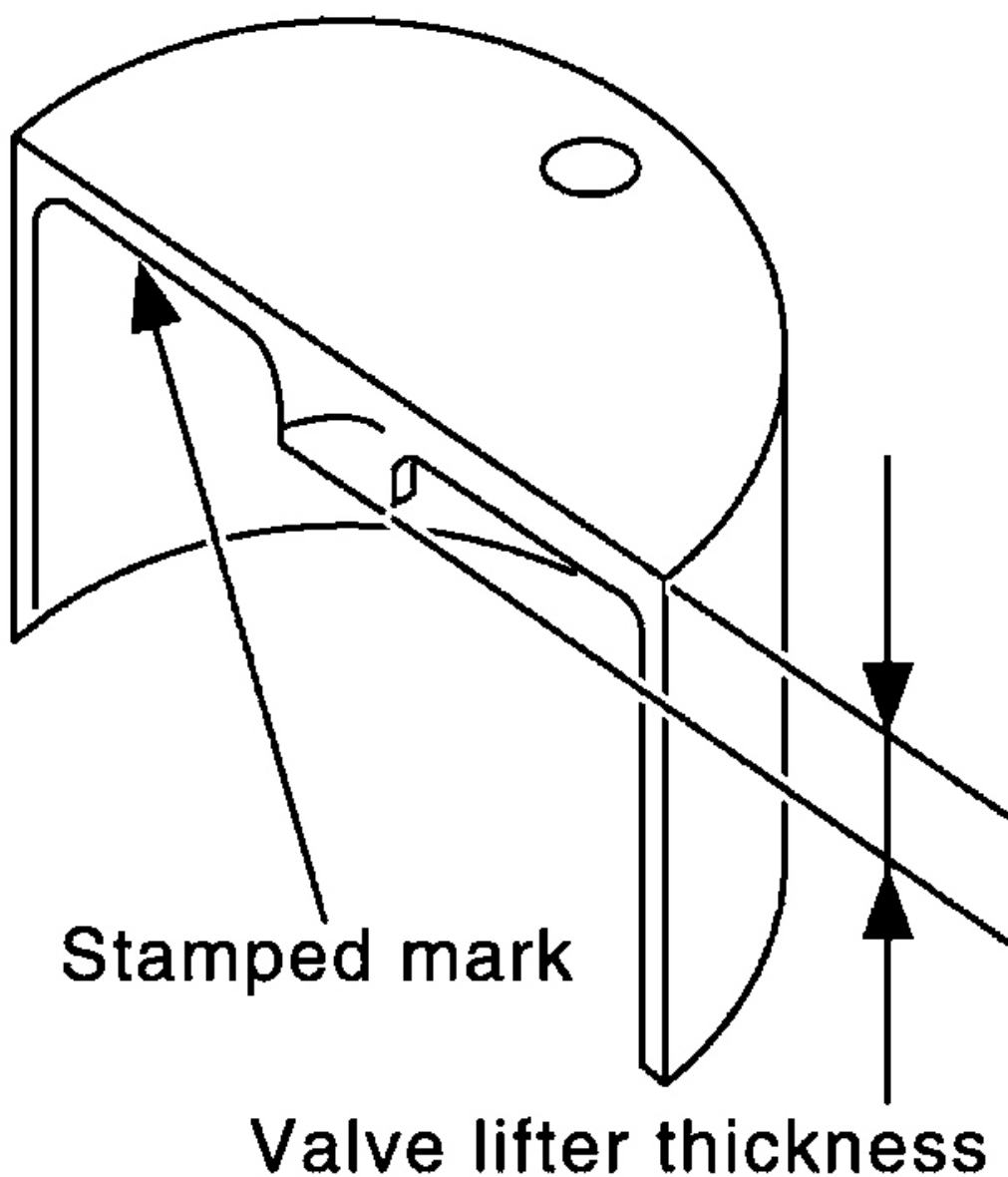
G02090220

Fig. 216: Measuring Valve Clearance

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

- Available thickness of valve lifter (Factory setting): 7.88 - 8.40 mm (0.3102 - 0.3307 in) [in 0.02 mm (0.0008 in) step] in 27 sizes (Intake/Exhaust)

5. Install selected valve lifter.



G02090221

Fig. 217: Checking Valve Thickness

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

6. Install camshaft.
7. Rotate crankshaft a few turns by hand.
8. Confirm that valve clearance is within standard.

9. After repair, confirm that valve clearance is within standard with engine warmed-up.

Unit: mm (in)

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

*: Approximately 80°C (176°F)

G02090222

Fig. 218: Valve Clearance Reference
 Courtesy of NISSAN MOTOR CO., U.S.A.

ENGINE ASSEMBLY

REMOVAL AND INSTALLATION

SEC. 112

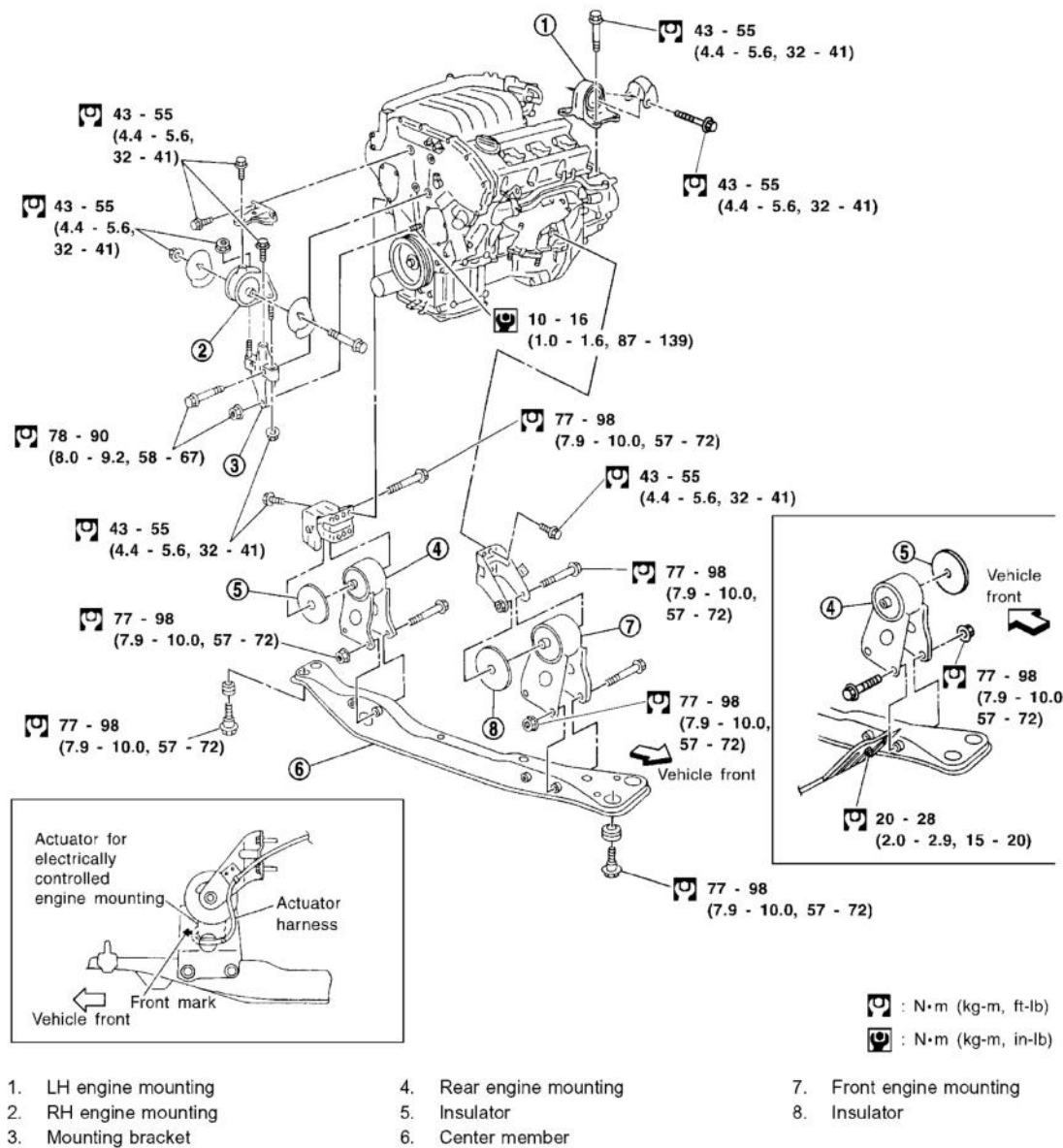


Fig. 219: Removing Engine Assembly
 Courtesy of NISSAN MOTOR CO., U.S.A.

WARNING:

- Situate vehicle on a flat and solid surface.
- Place chocks at front and back of rear wheels.
- Do not remove engine until exhaust system has completely cooled off. Otherwise, you may burn yourself and/or fire may break out in fuel line.
- For safety during subsequent steps, the tension of wires should be

slackened against the engine.

- Before disconnecting fuel hose, release fuel pressure from fuel line.

Refer to **FUEL PRESSURE RELEASE** .

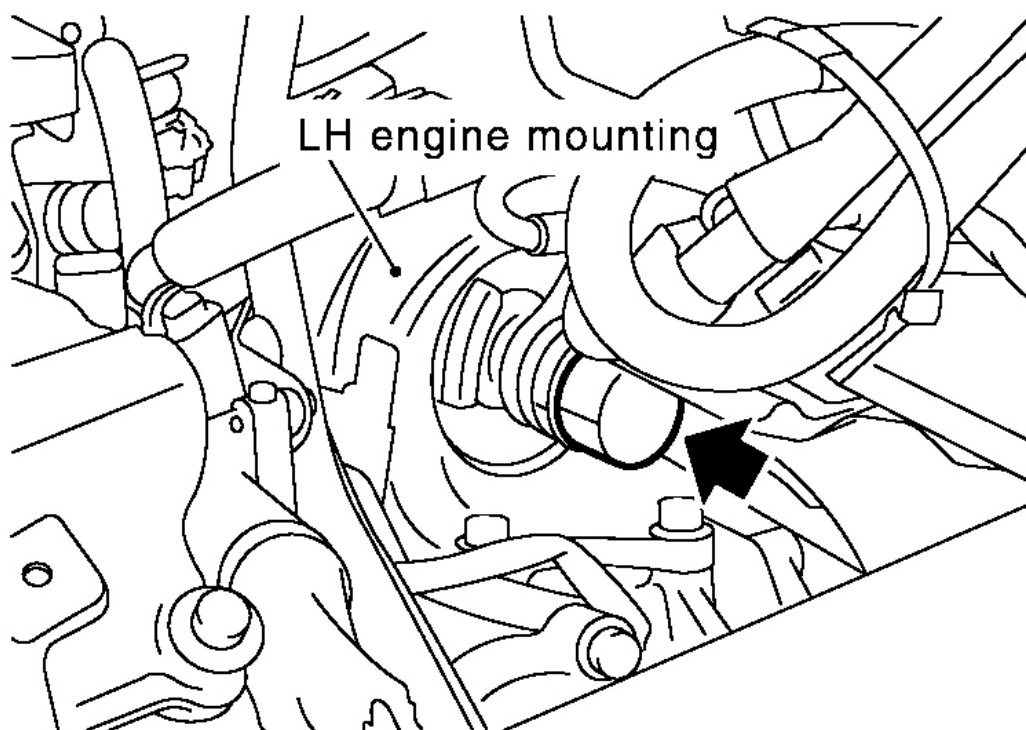
- Before removing front axle from transaxle, place safety stands under designated front supporting points.
- Be sure to hoist engine and transaxle in a safe manner.
- For engines not equipped with engine slingers, attach proper slingers and bolts described in PARTS CATALOG.

CAUTION:

- When lifting engine, be careful not to strike adjacent parts, especially the following: Accelerator wire casing, brake lines, and brake master cylinder.
- In hoisting the engine, always use engine slingers in a safe manner.
- In removing drive shaft, be careful not to damage grease seal of transaxle.
- Before separating engine and transaxle, remove the crankshaft position sensor (POS) from the assembly.
- Always pay extra attention not to damage edge of crankshaft position sensor (POS) or ring gear teeth.

REMOVAL

1. Remove engine undercover and hood.
2. Drain coolant from both cylinder block and radiator. .
3. Remove vacuum hoses, fuel hoses, wires, harnesses, connectors and so on.
4. Remove front exhaust tubes, ball joints and drive shafts.
5. Remove radiator and fans.
6. Remove drive belts.
7. Remove alternator, compressor and power steering oil pump from engine.



G02090224

Fig. 220: Identifying engine mounting (LH)

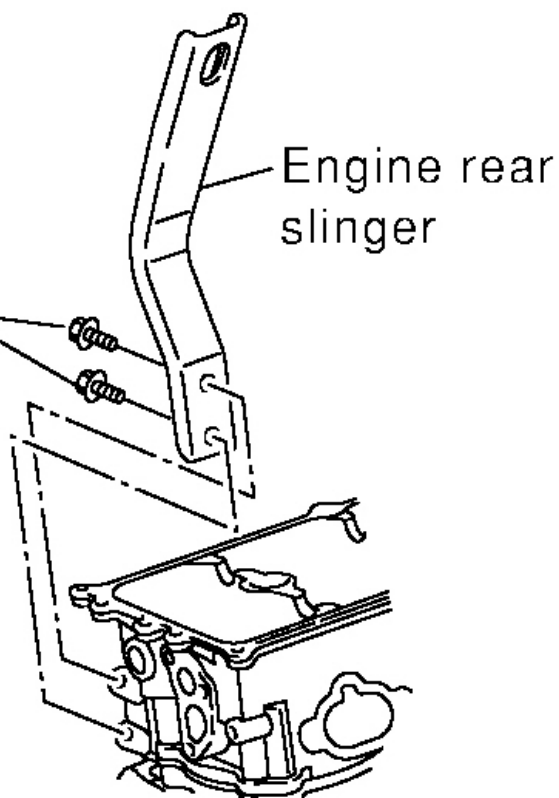
Courtesy of NISSAN MOTOR CO., U.S.A.

8. Set a suitable transmission jack under transaxle. Hoist engine with engine slinger.
9. Remove LH engine mounting.

Vehicle front

**24.5 - 31.4 N•m
(2.5 - 3.2 kg-m,
18 - 23 ft-lb)**


Engine front

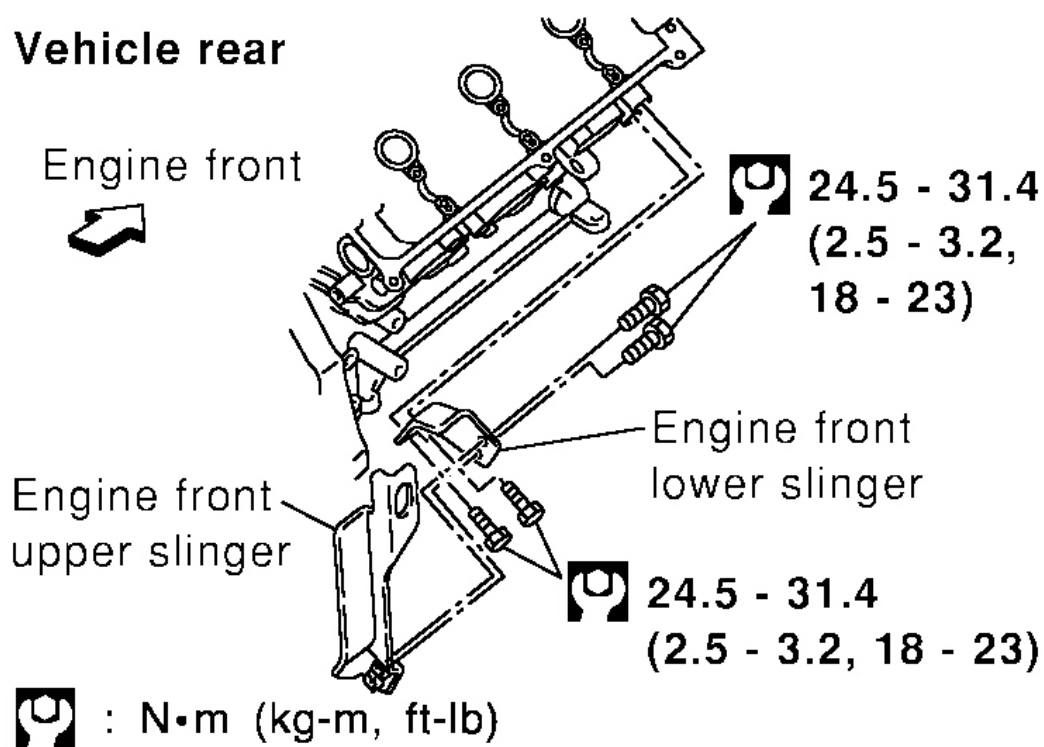


G02090225

Fig. 221: Identifying Engine Rear Slinger
Courtesy of NISSAN MOTOR CO., U.S.A.

Vehicle rear

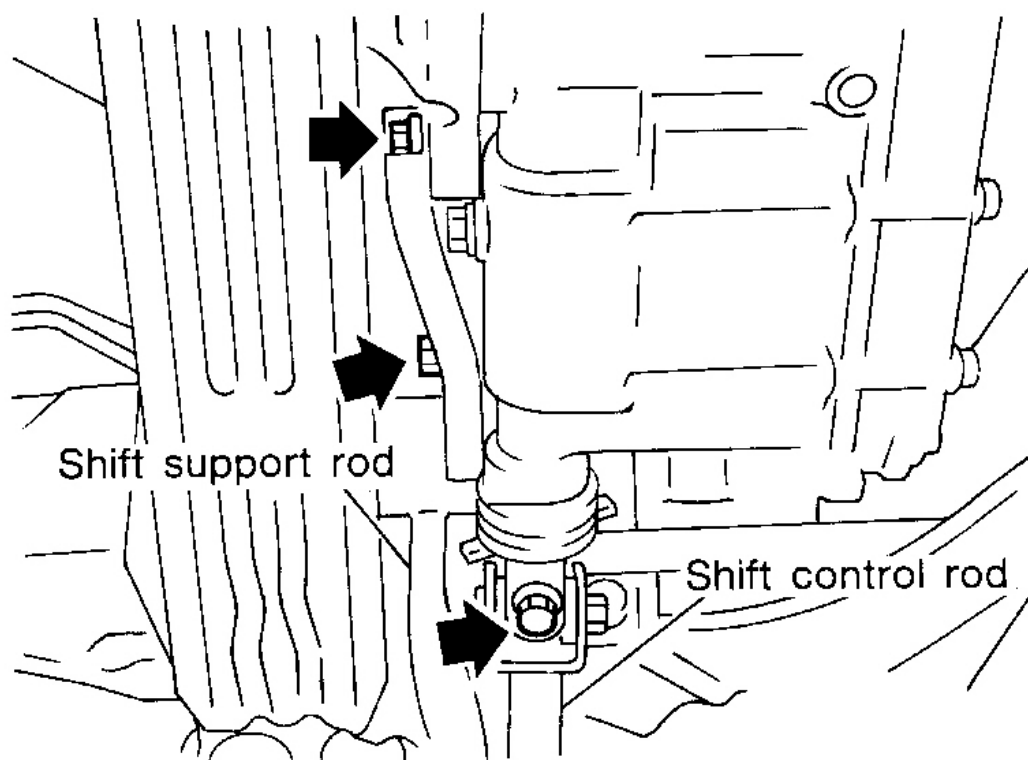
Engine front



G02090226

Fig. 222: Identifying Engine Front Lower Slinger
Courtesy of NISSAN MOTOR CO., U.S.A.

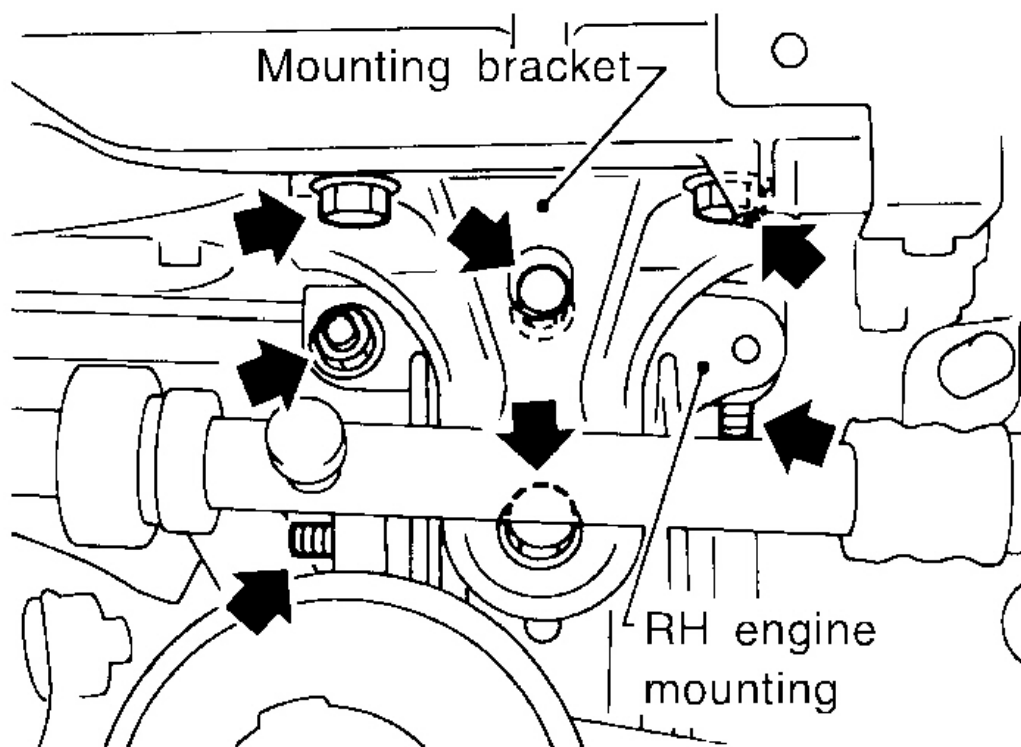
10. Disconnect control cable from transaxle.



G02090227

Fig. 223: Disconnecting Control Cable From Transaxle
Courtesy of NISSAN MOTOR CO., U.S.A.

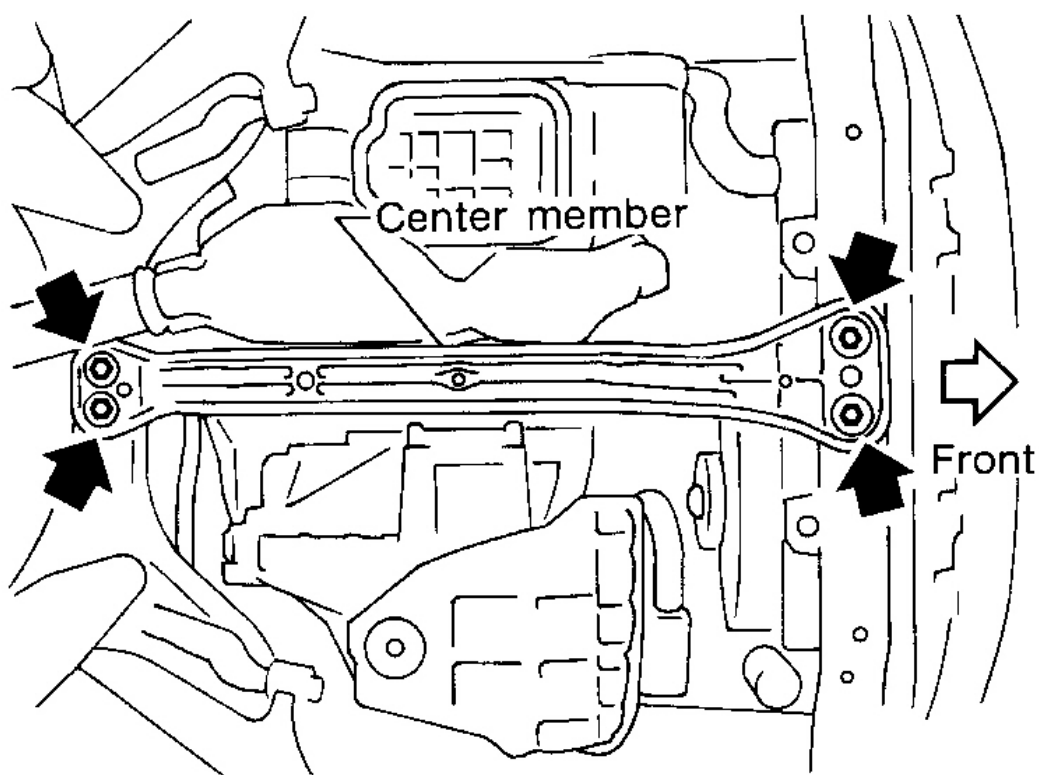
11. Remove RH engine mounting.



G02090228

Fig. 224: Removing engine mounting (RH)
Courtesy of NISSAN MOTOR CO., U.S.A.

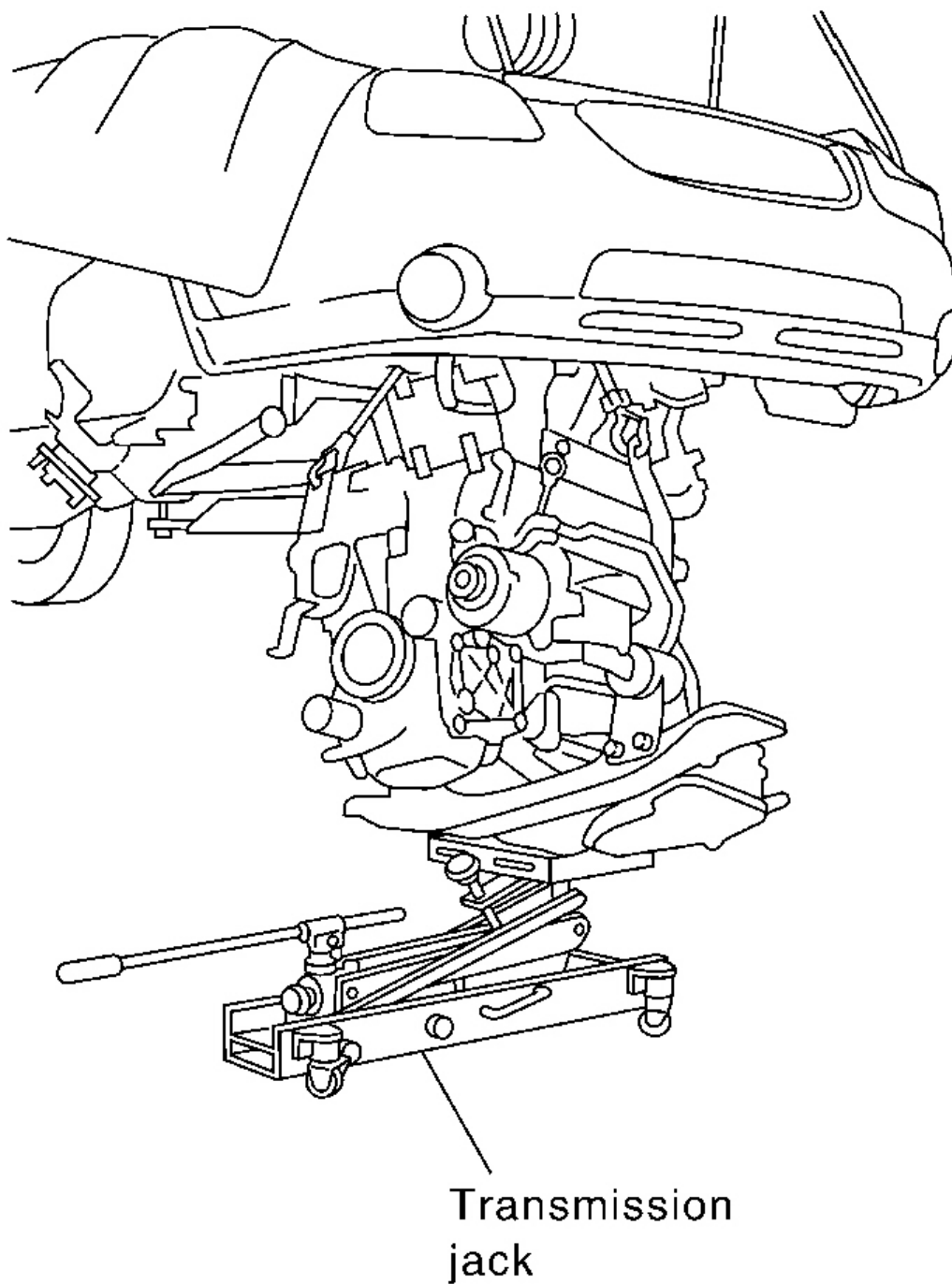
12. Remove center member and then slowly lower transmission jack.



G02090229

Fig. 225: Removing Center Member
Courtesy of NISSAN MOTOR CO., U.S.A.

13. Remove engine with transaxle as shown.



G02090230

Fig. 226: Removing Engine With Transaxle

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

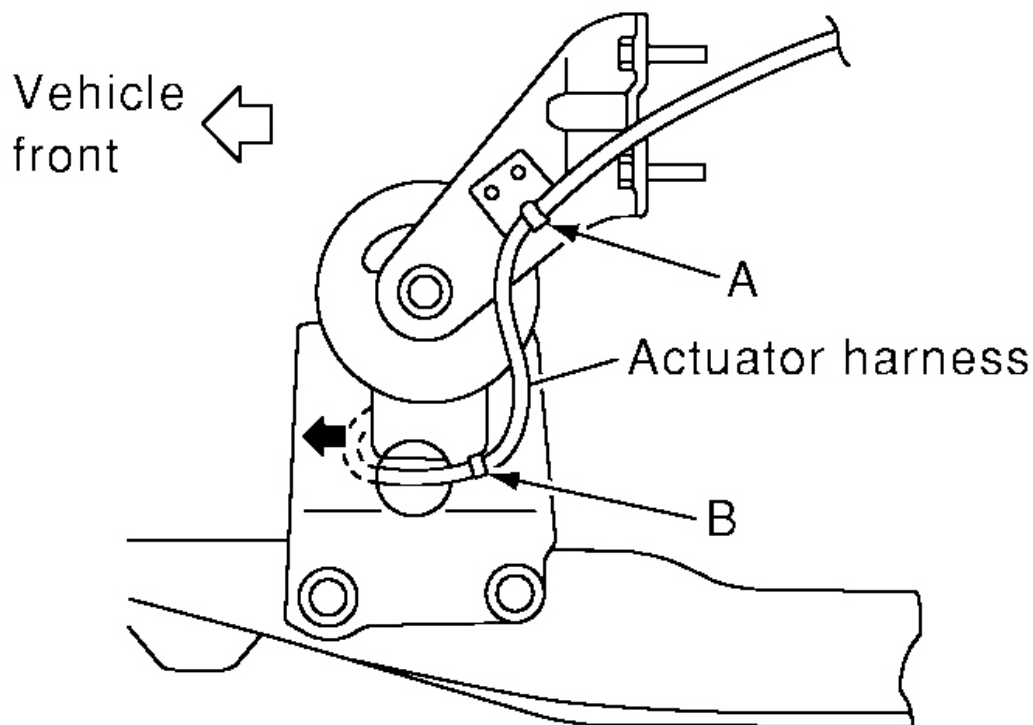
INSTALLATION

Installation is in the reverse order of removal.

Install the electronically-controlled engine mount harness to match the following values.

Length between A and B:

170 mm (6.69 in)



G02090231

Fig. 227: Identifying Actuator Harness

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

CYLINDER BLOCK

COMPONENTS

[illegible]

- G02090232

REMOVAL AND INSTALLATION

CAUTION:

- When installing bearings, pistons, or other sliding parts, lubricate contacting surfaces with new engine oil.
- Place removed parts such as bearings and bearing caps in their proper order and direction.
- When installing connecting rod nuts, and main bearing cap bolts, apply new engine oil to threads and seating surfaces.
- Do not allow any magnetic materials to contact the signal plate teeth of flywheel or drive plate.

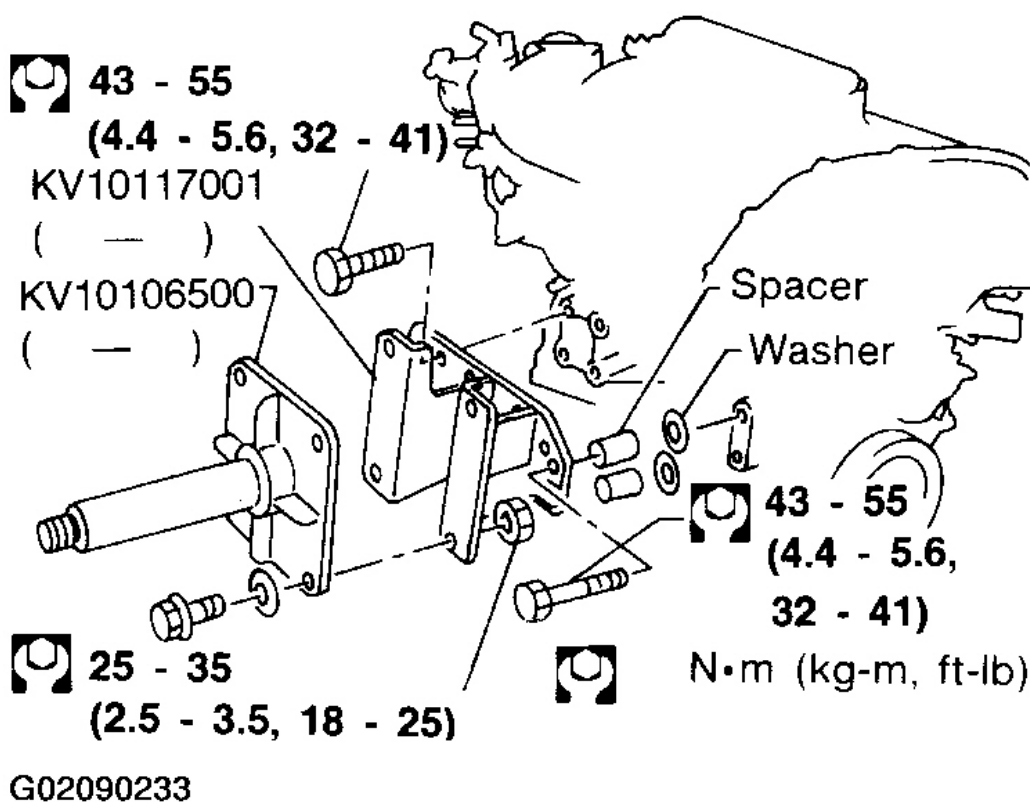
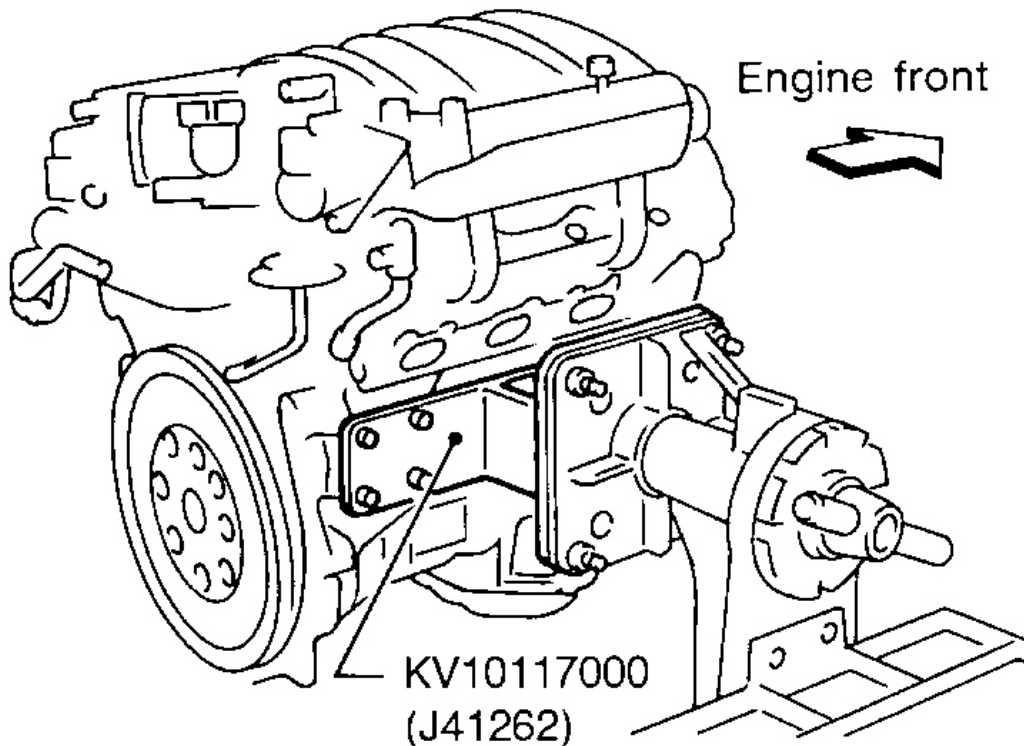


Fig. 229: Installing Engine Mounting Fixture
Courtesy of NISSAN MOTOR CO., U.S.A.

DISASSEMBLY**PISTON, CRANKSHAFT AND OIL JET**

1. Remove engine. Refer to **REMOVAL AND INSTALLATION**.
2. Place engine on a work stand.

3. Drain coolant and oil.
4. Remove oil pan. Refer to **REMOVAL**.
5. Remove timing chain. Refer to **REMOVAL**.
6. Remove cylinder head. Refer to **REMOVAL**.



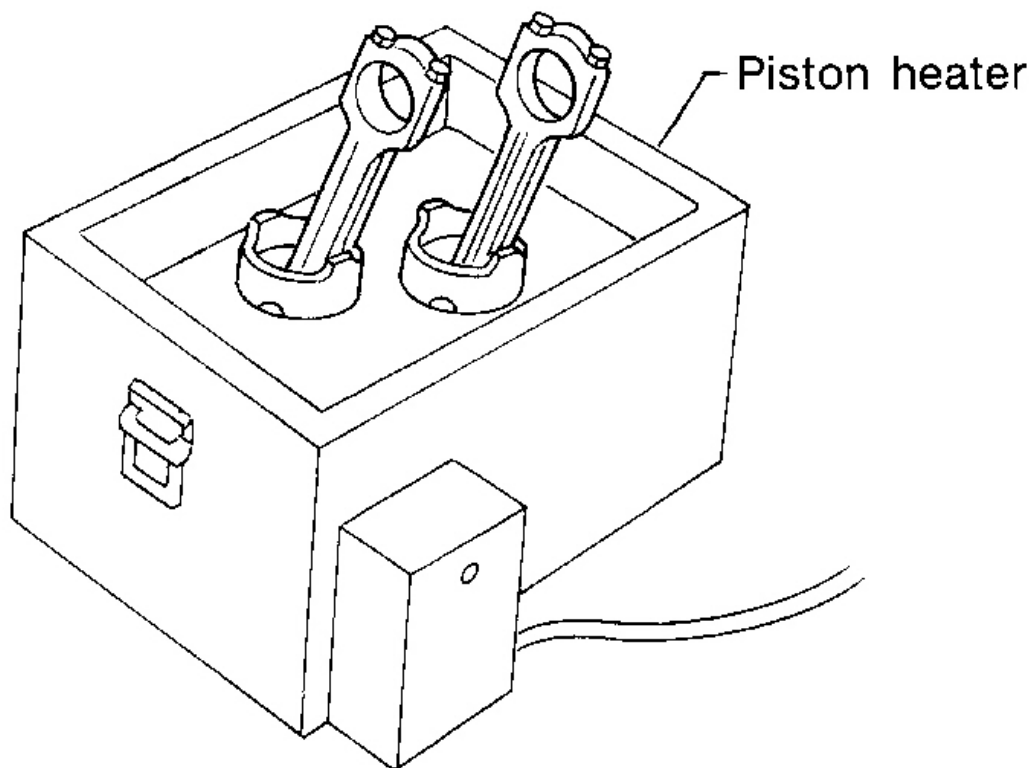
G02090234

Fig. 230: Engine Mounting Fixture
Courtesy of NISSAN MOTOR CO., U.S.A.

7. Remove pistons with connecting rods.
 - When disassembling piston and connecting rod, remove snap ring first, then heat piston to 60 to 70° C (140 to 158°F).
8. Remove rear oil seal retainer.

CAUTION:

- When piston rings are not replaced, make sure that piston rings are mounted in their original positions.
- When replacing piston rings, if there is no punchmark, install with either side up.



G02090235

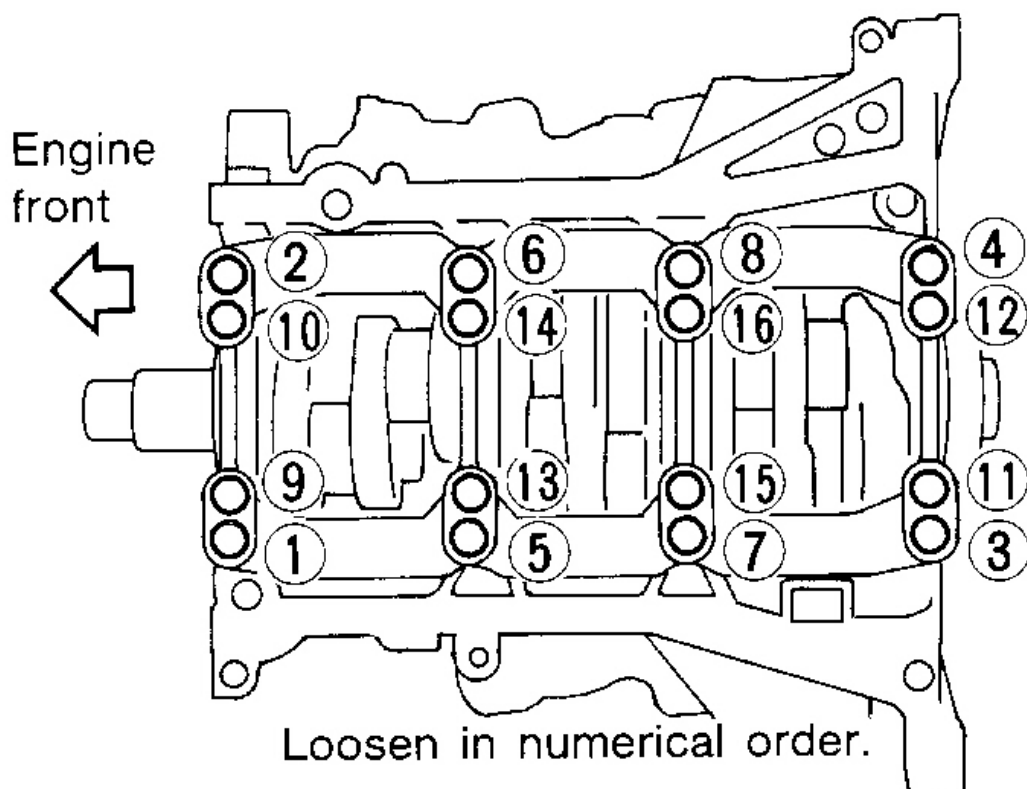
Fig. 231: Identifying Piston Heater

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

9. Loosen bolts in numerical order as shown and remove main bearing beam, bearing cap and crankshaft.
 - **Before removing bearing beam and bearing cap, measure crankshaft end play. Refer to CRANKSHAFT.**
 - **Bolts should be loosened in two or three steps.**
10. Remove knock sensor.

CAUTION:

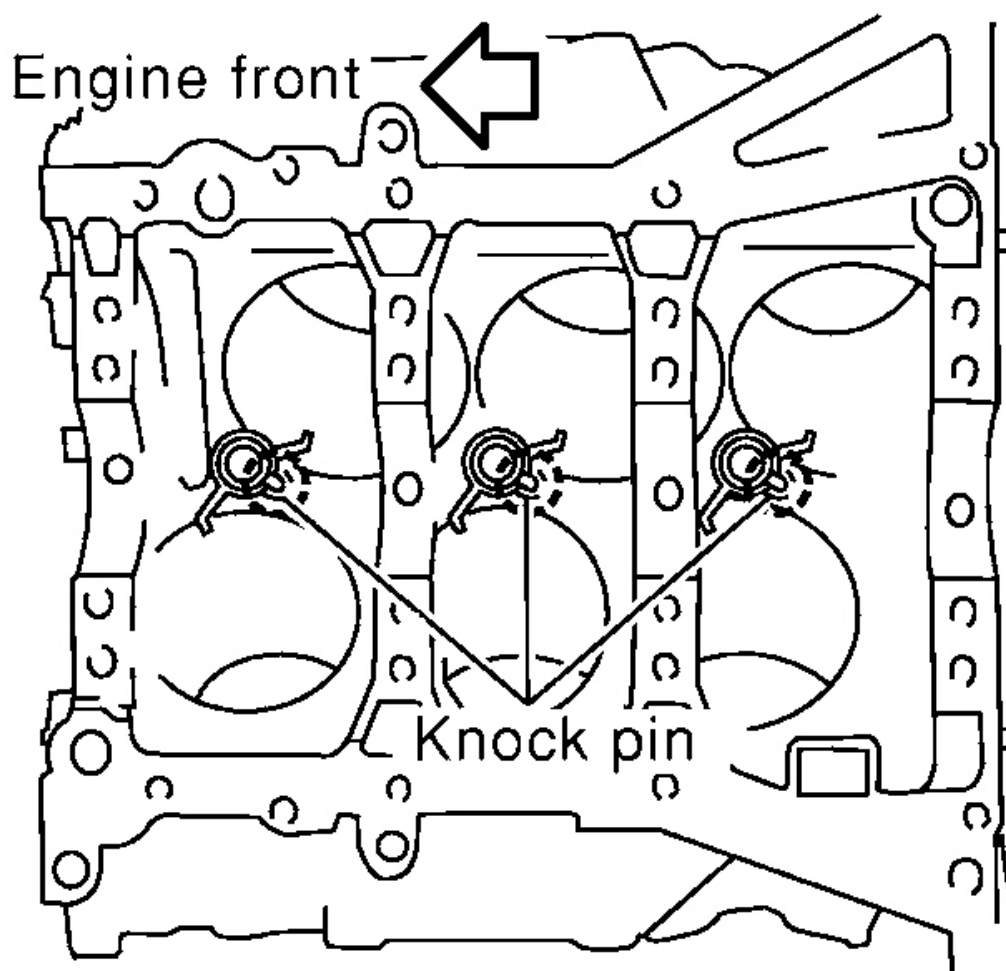
- **Carefully handle the sensor and avoid impacts.**



G02090236

Fig. 232: Identifying Bearing Cap
Courtesy of NISSAN MOTOR CO., U.S.A.

11. Remove oil jets.



G02090237

Fig. 233: Identifying Oil Jets

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

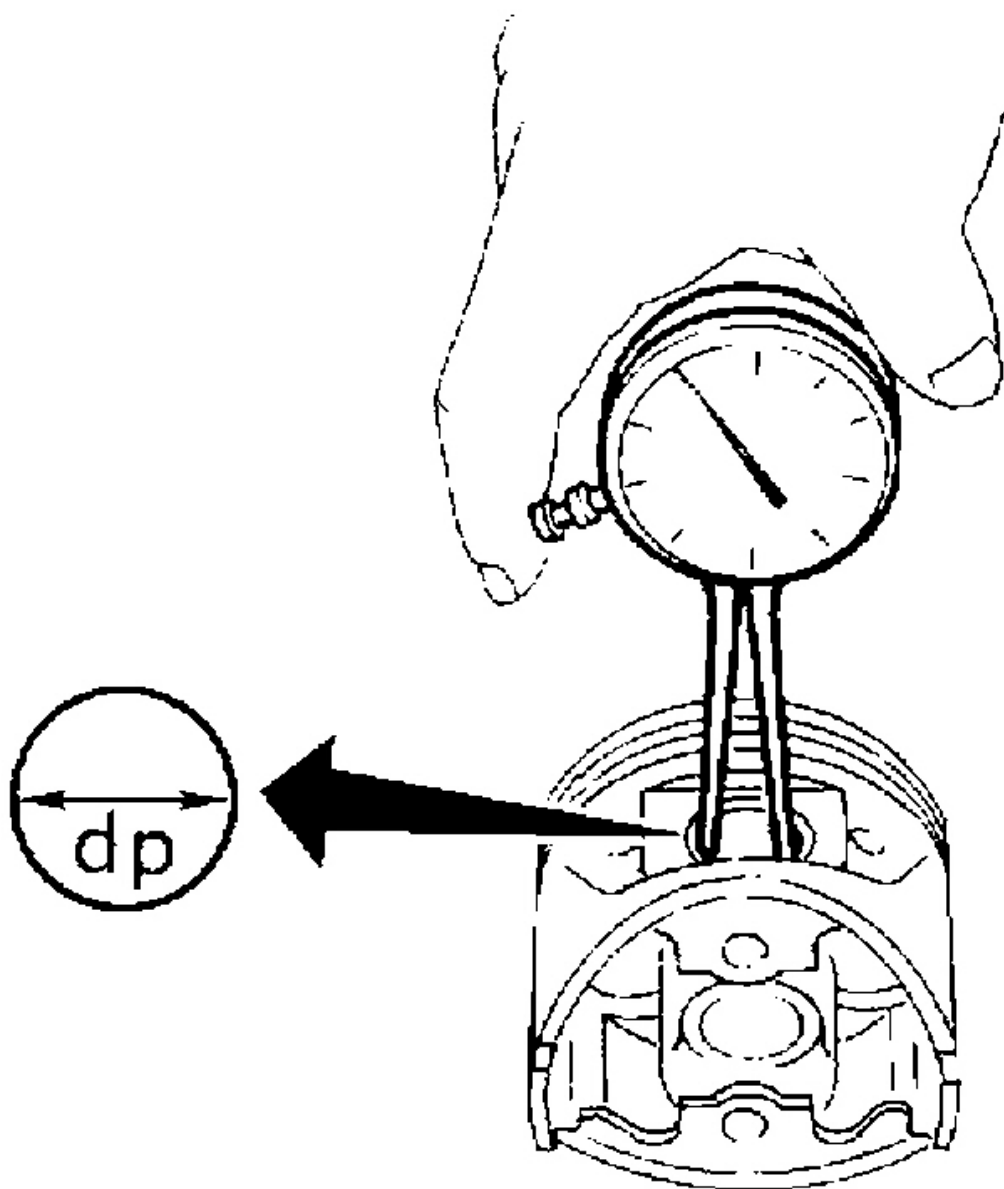
INSPECTION**PISTON AND PISTON PIN CLEARANCE**

1. Measure inner diameter of piston pin hole "dp".

Standard diameter "dp":**Grade No. 0****21.993 - 21.999 mm (0.8659 - 0.8661 in)**

Grade No. 1

21.999 - 22.005 mm (0.8661 - 0.8663 in)



G02090238

Fig. 234: Measuring Inner Diameter Of Piston Pin Hole (DP)
Courtesy of NISSAN MOTOR CO., U.S.A.

2. Measure outer diameter of piston pin "Dp".

Standard diameter "Dp":

Grade No. 0

21.989 - 21.995 mm (0.8657 - 0.8659 in)

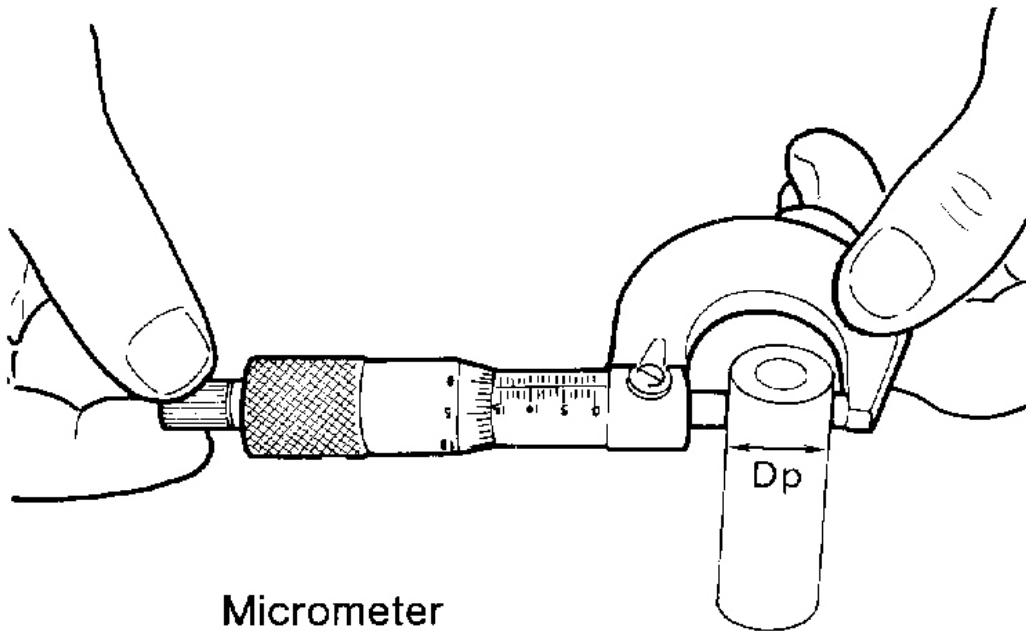
Grade No. 1

21.995 - 22.001 mm (0.8659 - 0.8662 in)

3. Calculate interference fit of piston pin to piston.

Dp - dp = 0.002 - 0.006 mm (0.0001 - 0.0002 in)

If it exceeds the above value, replace piston assembly with pin.



Micrometer

G02090239

Fig. 235: Measuring Outer Diameter Of Piston Pin (DP)

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

PISTON RING SIDE CLEARANCE

Side clearance:

Top ring

0.045 - 0.080 mm (0.0018 - 0.0031 in)

2nd ring

0.030 - 0.070 mm (0.0012 - 0.0028 in)

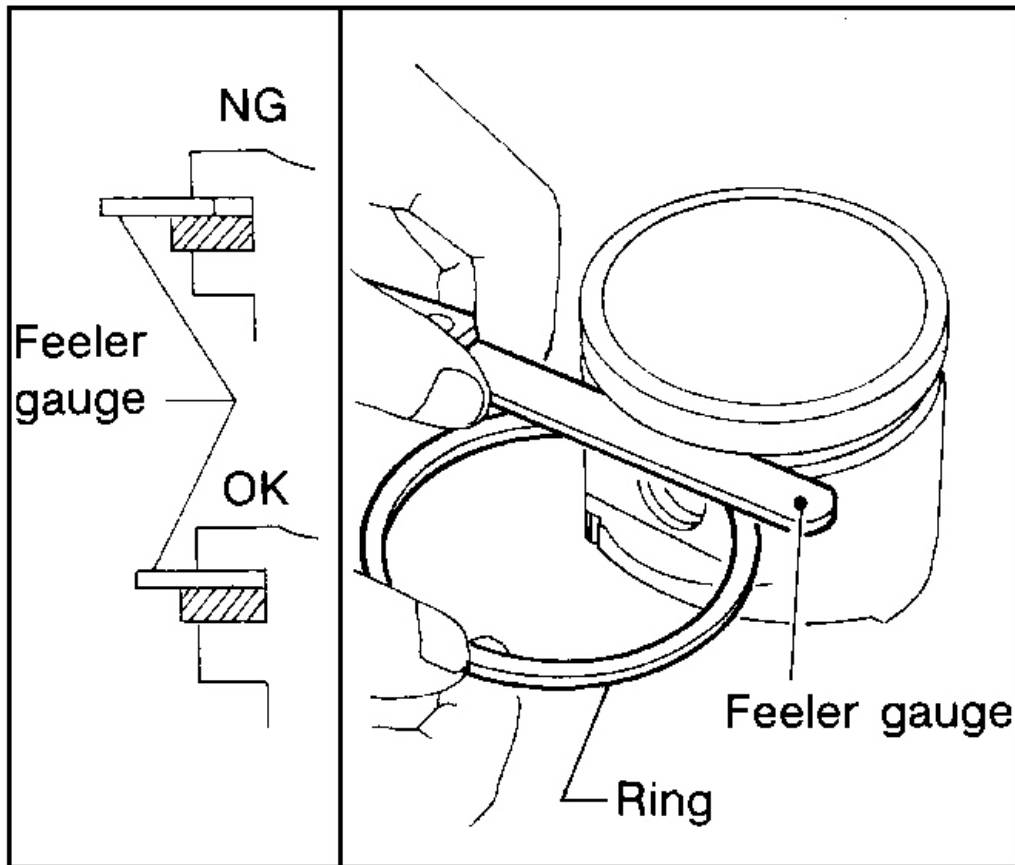
Oil ring

0.065 - 0.135 mm (0.0026 - 0.0053 in)

Max. limit of side clearance:

Top ring 0.11 mm (0.0043 in)

2nd ring 0.1 mm (0.004 in)



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Fig. 236: Measuring Piston Ring Side Clearance
Courtesy of NISSAN MOTOR CO., U.S.A.

If out of specification, replace piston ring. If clearance exceeds maximum limit with new ring, replace piston.

PISTON RING END GAP

End gap:

Top ring 0.23 - 0.33 mm (0.0091 - 0.0130 in)

2nd ring 0.33 - 0.48 mm (0.0130 - 0.0189 in)

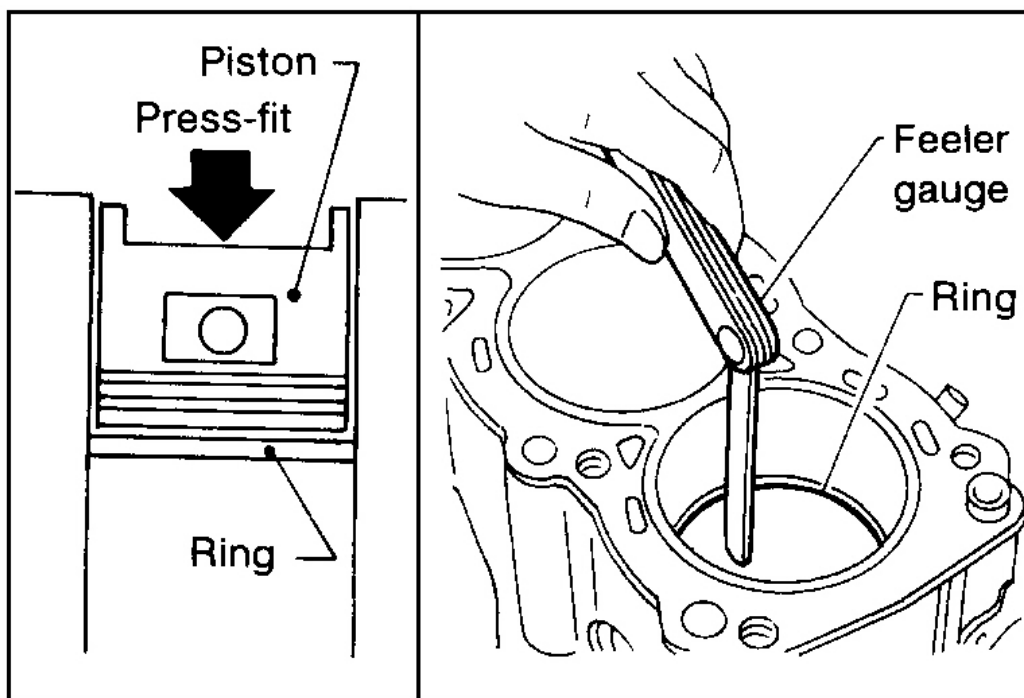
Oil ring 0.20 - 0.60 mm (0.0079 - 0.0236 in)

Max. limit of ring gap:

Top ring 0.54 mm (0.0213 in)

2nd ring 0.80 mm (0.0315 in)

Oil ring 0.95 mm (0.0374 in)



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Fig. 237: Measuring Piston Ring End Gap

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

If out of specification, replace piston ring. If gap still exceeds the limit even with a new ring, do the following. Rebore cylinder and use oversized piston and piston rings.

- When replacing the piston, check the cylinder block surface for scratches or seizure. If scratches or seizure is found, hone or replace the cylinder block.

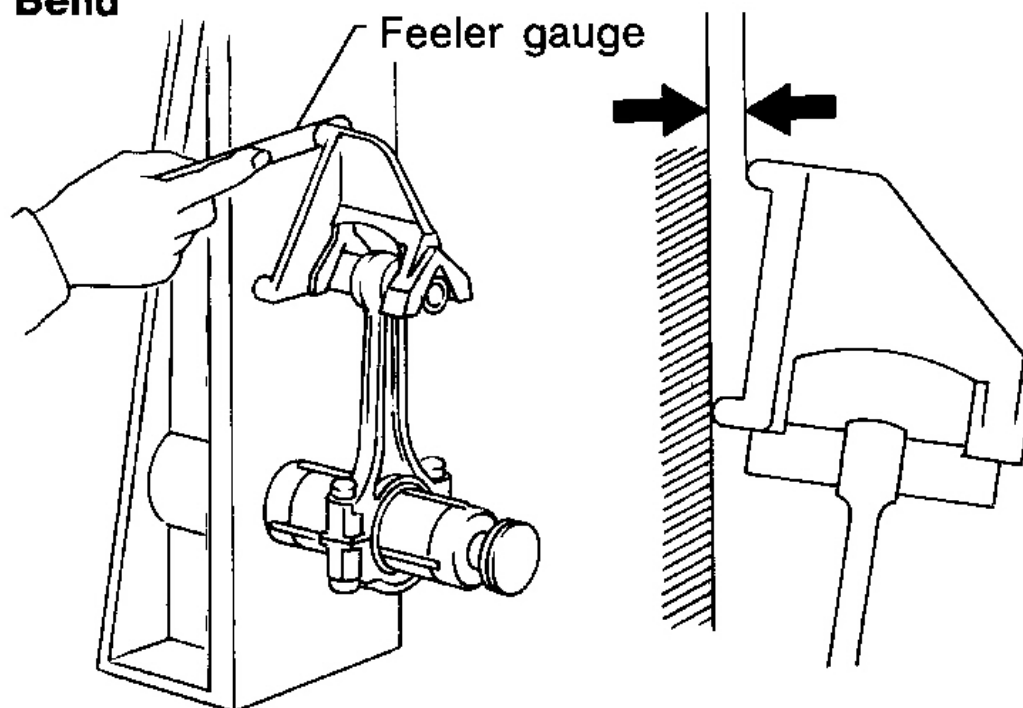
CONNECTING ROD BEND AND TORSION**Bend:**

Limit 0.15 mm (0.0059 in)
per 100 mm (3.94 in) length

Torsion:

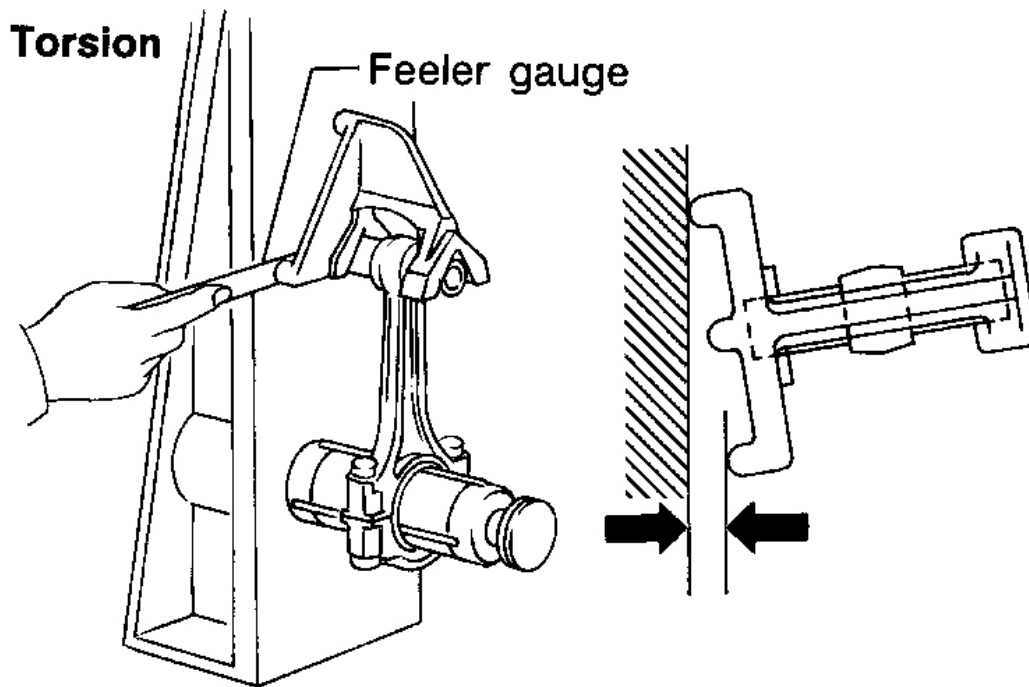
Limit 0.30 mm (0.0118 in)
per 100 mm (3.94 in) length
Distortion limit: 0.10 mm (0.0039 in)

If it exceeds the limit, replace connecting rod assembly.

Bend

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Fig. 238: Checking Connecting Rod Bend And Torsion
Courtesy of NISSAN MOTOR CO., U.S.A.



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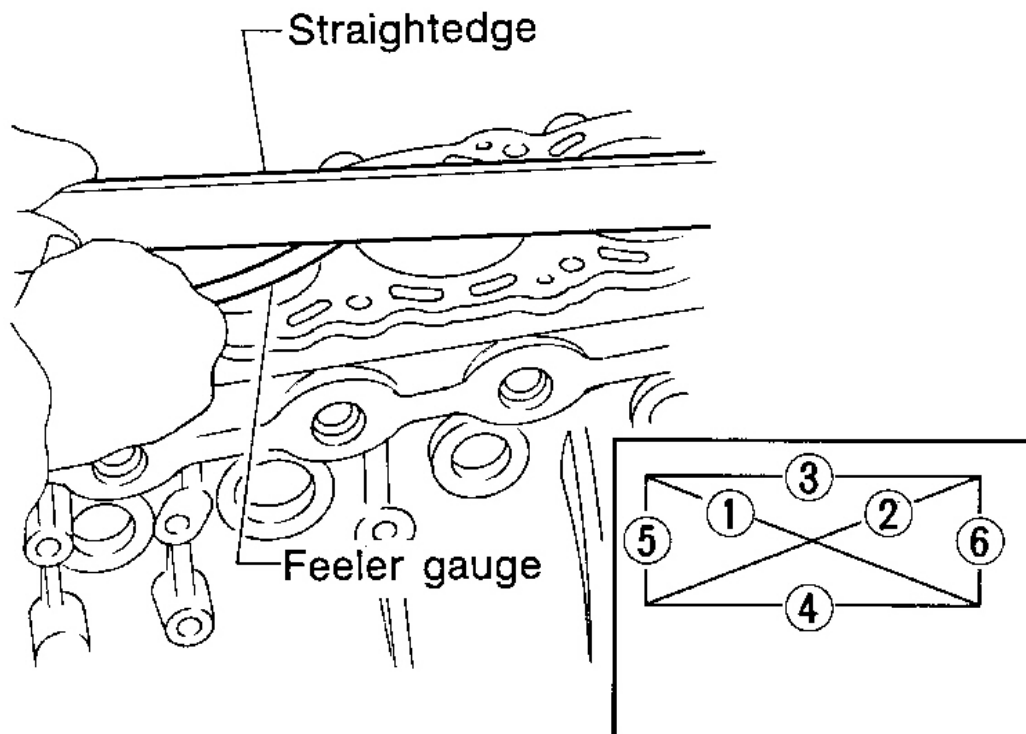
Fig. 239: Checking Connecting Rod Bend And Torsion
Courtesy of NISSAN MOTOR CO., U.S.A.

CYLINDER BLOCK DISTORTION AND WEAR

- Clean upper surface of cylinder block.

Use a reliable straightedge and feeler gauge to check the flatness of cylinder block surface.

Check along six positions shown in the figure.



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Fig. 240: Checking Cylinder Block Distortion And Wear
 Courtesy of NISSAN MOTOR CO., U.S.A.

Distortion limit: 0.10 mm (0.0039 in)

- If out of specification, resurface it. The limit for cylinder block resurfacing is determined by cylinder head resurfacing in engine.

Resurfacing limit:

Amount of cylinder head resurfacing is "A".

Amount of cylinder block resurfacing is "B".

The maximum limit is as follows:

$$A + B = 0.2 \text{ mm (0.008 in)}$$

Nominal cylinder block height from crankshaft center:

214.95 - 215.05 mm (8.4626 - 8.4665 in)

Refer to CYLINDER BLOCK.

- If necessary, replace cylinder block.

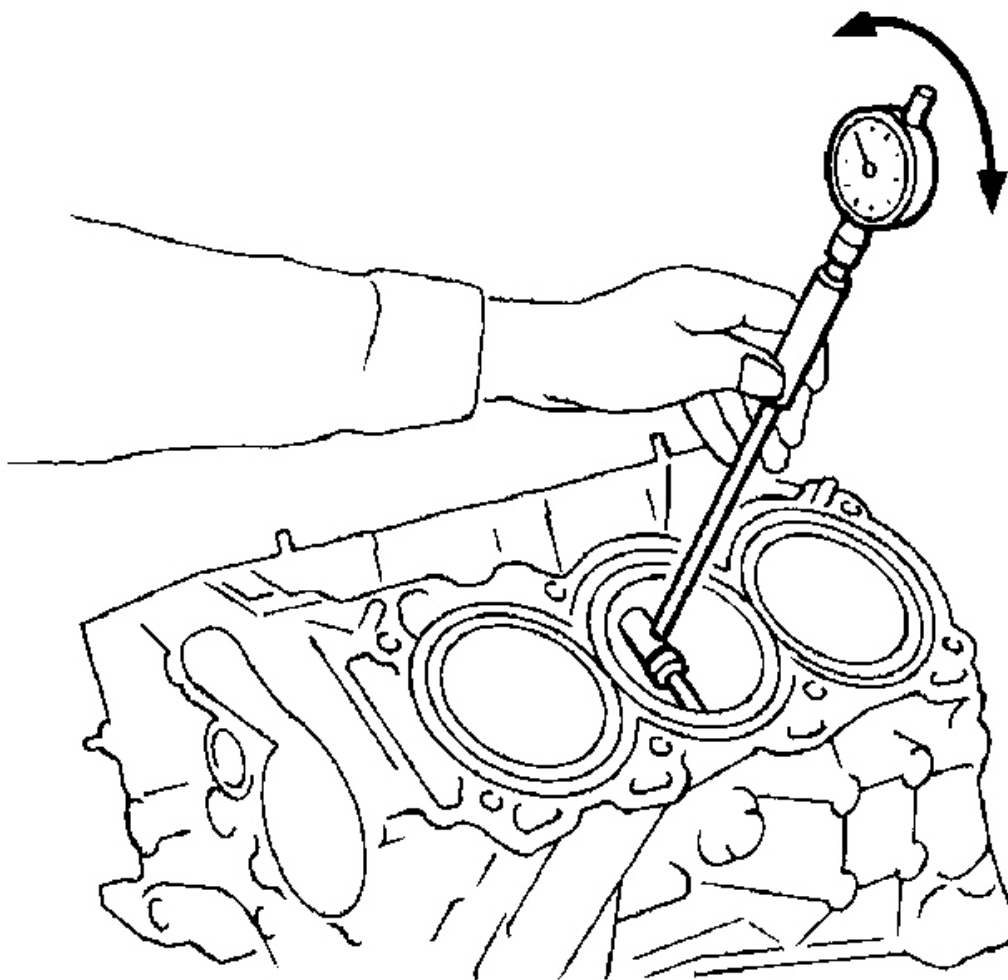
PISTON-TO-BORE CLEARANCE

1. Using a bore gauge, measure cylinder bore for wear, out-of-round and taper.

Grade No.	Standard inner diameter	Wear limit
No. 1	95.500 - 95.510 mm (3.7598 - 3.7602 in)	0.20 mm (0.0079 in)
No. 2	95.510 - 95.520 mm (3.7602 - 3.7606 in)	
No. 3	95.520 - 95.530 mm (3.7606 - 3.7610 in)	

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Fig. 241: Cylinder Bore Inner Diameter Specification
Courtesy of NISSAN MOTOR CO., U.S.A.



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Fig. 242: Measuring Cylinder Bore For Wear, Out-Of-Round And Taper
Courtesy of NISSAN MOTOR CO., U.S.A.

If it exceeds the limit, rebore all cylinders. Replace cylinder block if necessary.

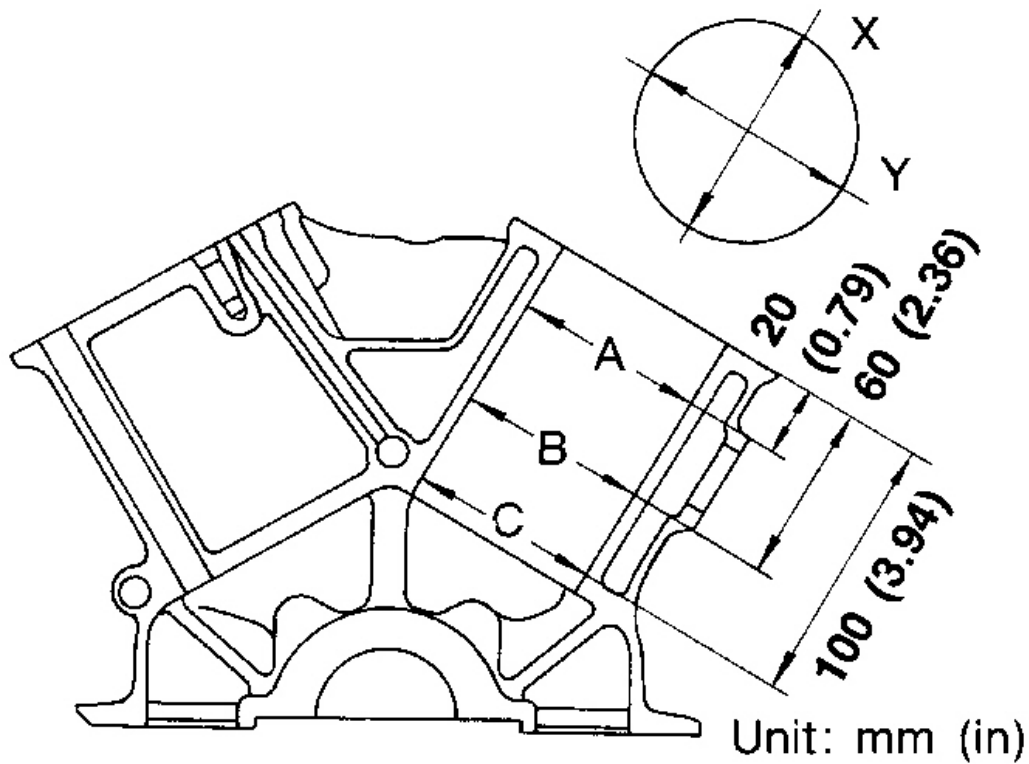
Out-of-round (Difference between X and Y):

Limit 0.015 mm (0.0006 in)

Taper (Difference between A and C):

Limit 0.015 mm (0.0006 in)

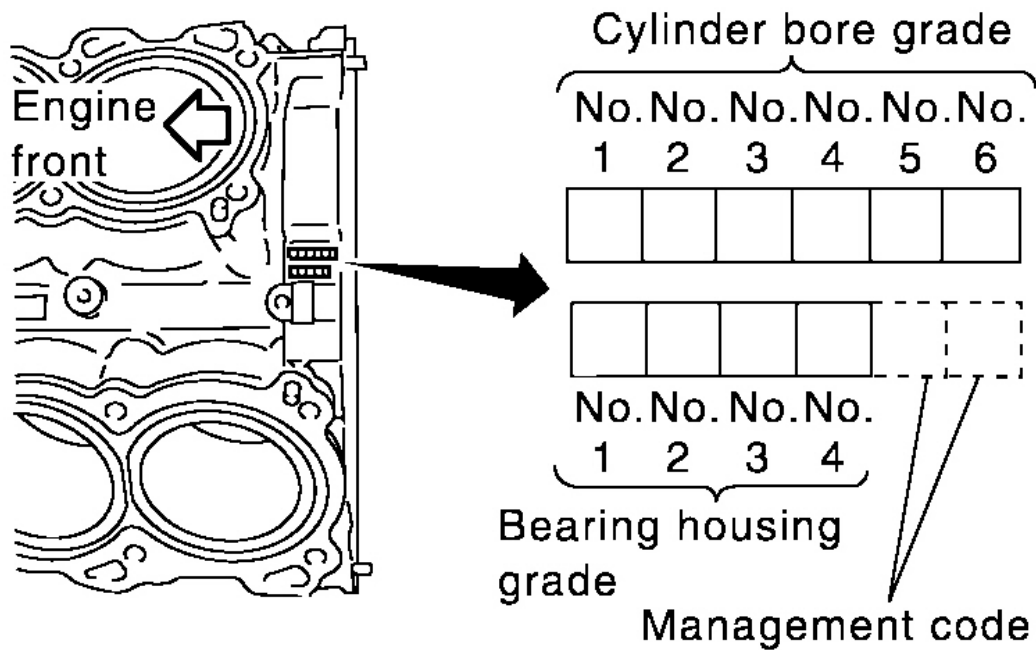
2. Check for scratches and seizure. If seizure is found, hone it.



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Fig. 243: Checking Cylinder Bore
Courtesy of NISSAN MOTOR CO., U.S.A.

- If both cylinder block and piston are replaced with new ones, select piston of the same grade number punched on cylinder block rear position. These numbers are punched in either Arabic or Roman numerals.



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Fig. 244: Identifying Cylinder Block Grade Number

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

3. Measure piston skirt diameter.

Piston diameter "A": Refer to PISTON, PISTON RING AND PISTON PIN.

Measuring point "a" (Distance from the top):

41.0 mm (1.61 in)

4. Check that piston-to-bore clearance is within specification.

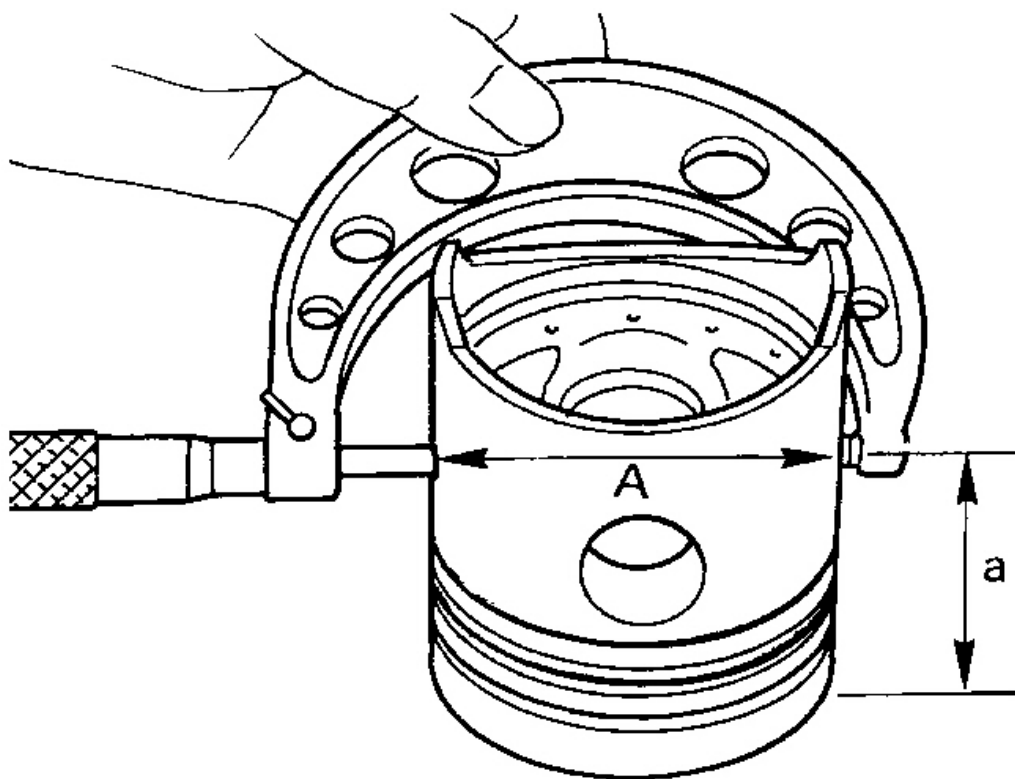
Piston-to-bore clearance "B":

0.010 - 0.030 mm (0.0004 - 0.0012 in)

5. Determine piston oversize according to amount of cylinder wear.

Oversize pistons are available for service.

Refer to PISTON, PISTON RING AND PISTON PIN.



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Fig. 245: Measuring Piston Skirt Diameter

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

- If oversize piston is used, use it for all cylinders with oversize piston rings.

6. 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

C: Honing allowance 0.02 mm (0.0008 in)

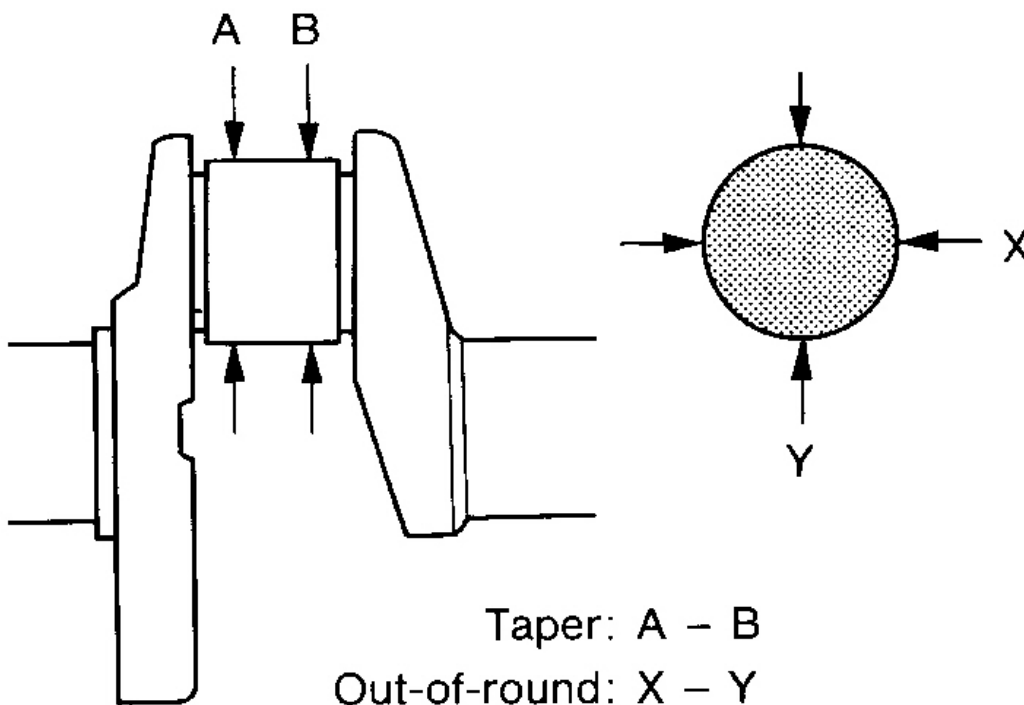
7. Install main bearing caps, and tighten to the specified torque. Otherwise, cylinder bores may be distorted in final assembly.
8. Cut cylinder bores.

- When any cylinder needs boring, all other cylinders must also be bored.

- **Do not cut too much out of cylinder bore at a time. Cut only 0.05 mm (0.0020 in) or so in diameter at a time.**
9. Hone cylinders to obtain specified piston-to-bore clearance.
 10. Measure finished cylinder bore for out-of-round and taper.
 - **Measurement should be done after cylinder bore cools down.**

CRANKSHAFT

1. Check crankshaft main and pin journals for score, wear or cracks.
2. With a micrometer, measure journals for taper and out-of-round.

Out-of-round (X - Y):**Standard****0.002 mm (0.0001 in)****Taper (A - B):****Standard****0.002 mm (0.0001 in)**

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Fig. 246: Measuring Journals For Taper And Out-Of-Round
Courtesy of NISSAN MOTOR CO., U.S.A.

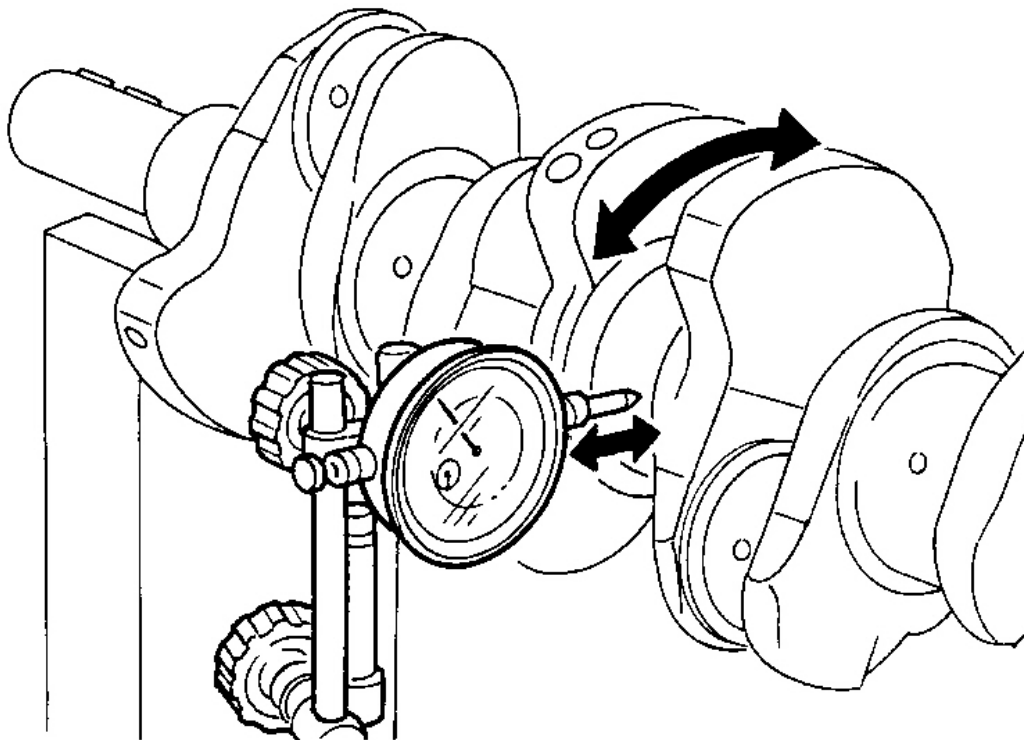
3. Measure crankshaft runout.

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

Runout (Total indicator reading):

Limit 0.10 mm (0.0039 in)

If it exceeds the limit, replace crankshaft.



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Fig. 247: Measuring Crankshaft Runout
Courtesy of NISSAN MOTOR CO., U.S.A.

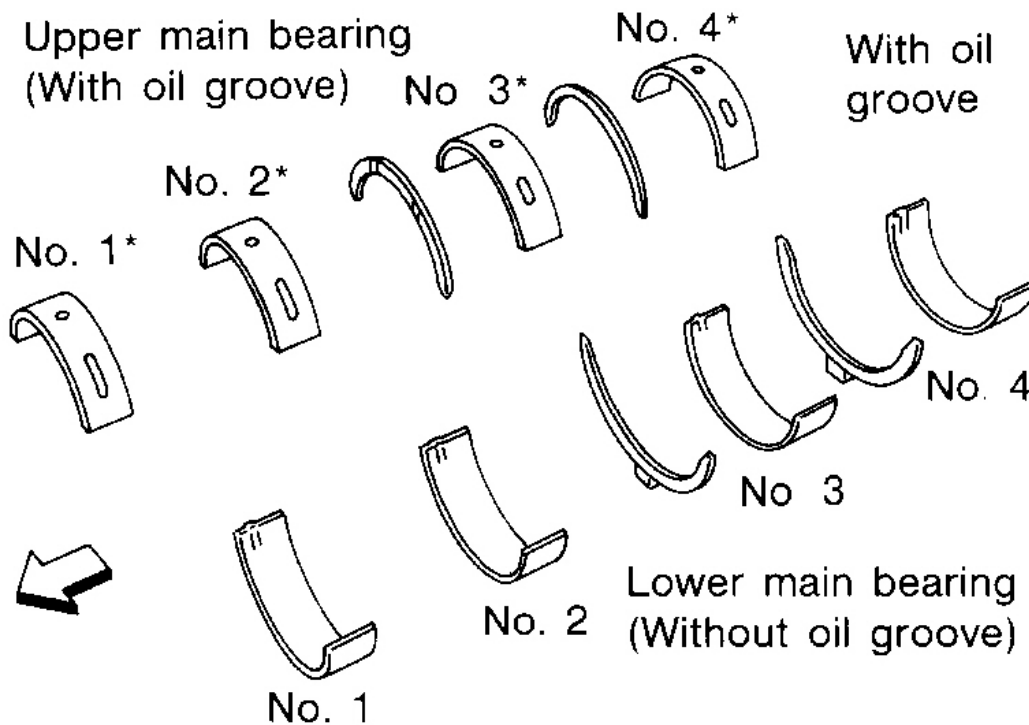
BEARING CLEARANCE

- Use either of the following two methods, however, method "A" gives more reliable results and is preferable.

Method A (Using bore gauge & micrometer)

Main bearing

1. Set main bearings in their proper positions on cylinder block and main bearing cap.



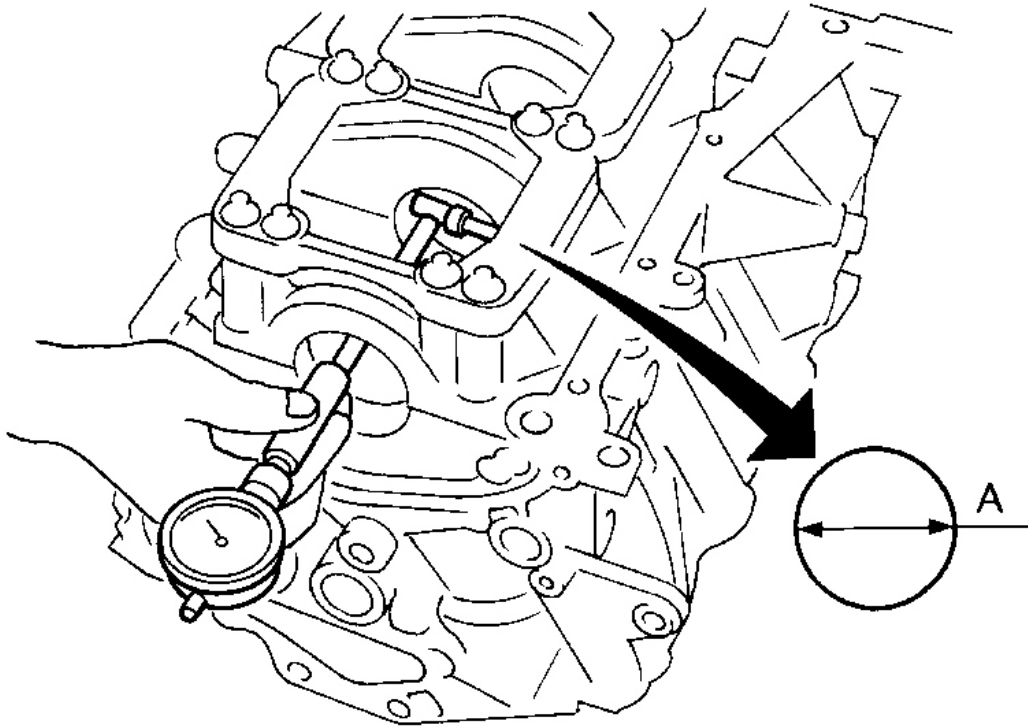
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Fig. 248: Identifying Cylinder Block And Main Bearing Cap
 Courtesy of NISSAN MOTOR CO., U.S.A.

2. Install main bearing cap and bearing beam to cylinder block.

Tighten all bolts in correct order.

3. Measure inner diameters "A" of each main bearing.



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Fig. 249: Measuring Inner Diameters (A) Of Each Main Bearing
Courtesy of NISSAN MOTOR CO., U.S.A.

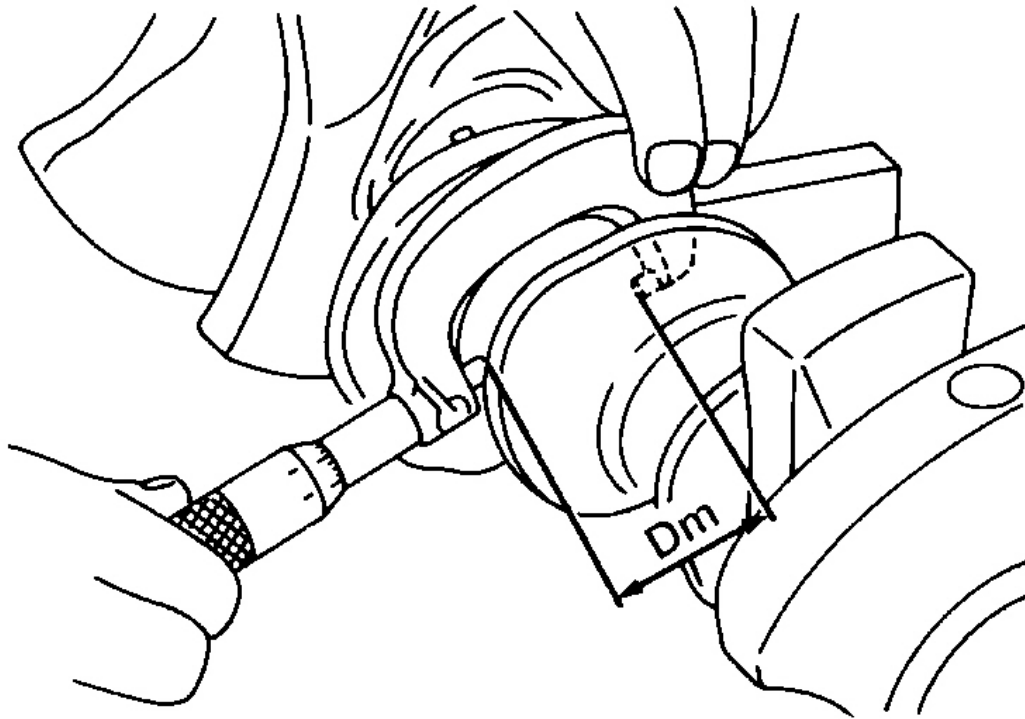
4. Measure outer diameters "Dm" of each crankshaft main journal.
5. Calculate main bearing clearance.

Main bearing clearance = A - Dm

Standard: 0.035 - 0.045 mm (0.0014 - 0.0018 in)

Limit: 0.065 mm (0.0026 in)

- If it exceeds the limit, replace bearing.
- If clearance cannot be adjusted using any standard bearing grade, grind crankshaft journal and use undersized bearing.



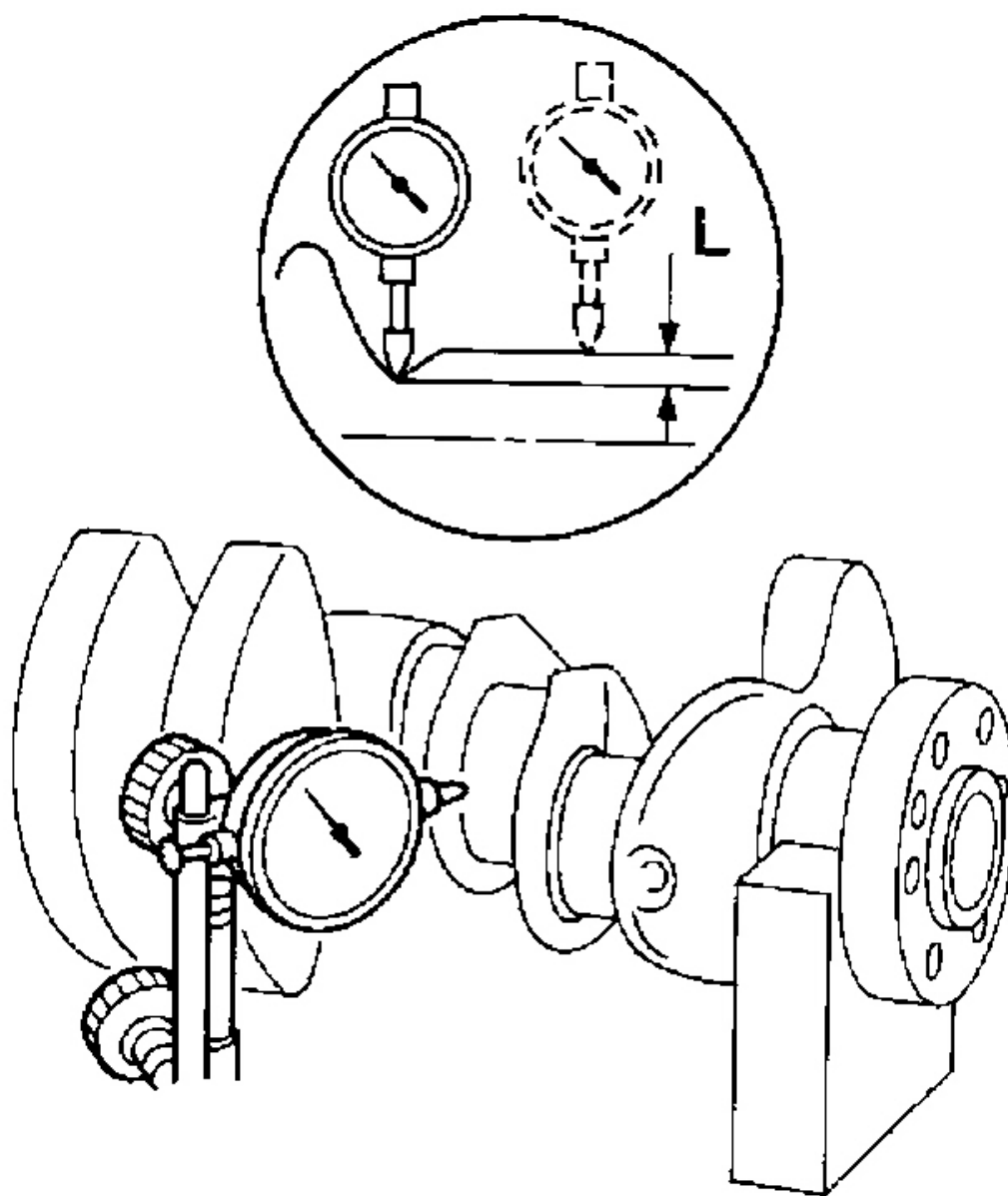
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Fig. 250: Measuring Outer Diameters (Dm) Of Each Crankshaft Main Journal
Courtesy of NISSAN MOTOR CO., U.S.A.

- a. When grinding crankshaft journal, confirm that "L" dimension in fillet roll is more than the specified limit.

"L": 0.1 mm (0.004 in)

- b. Refer to **SDS** for grinding crankshaft and available service parts.



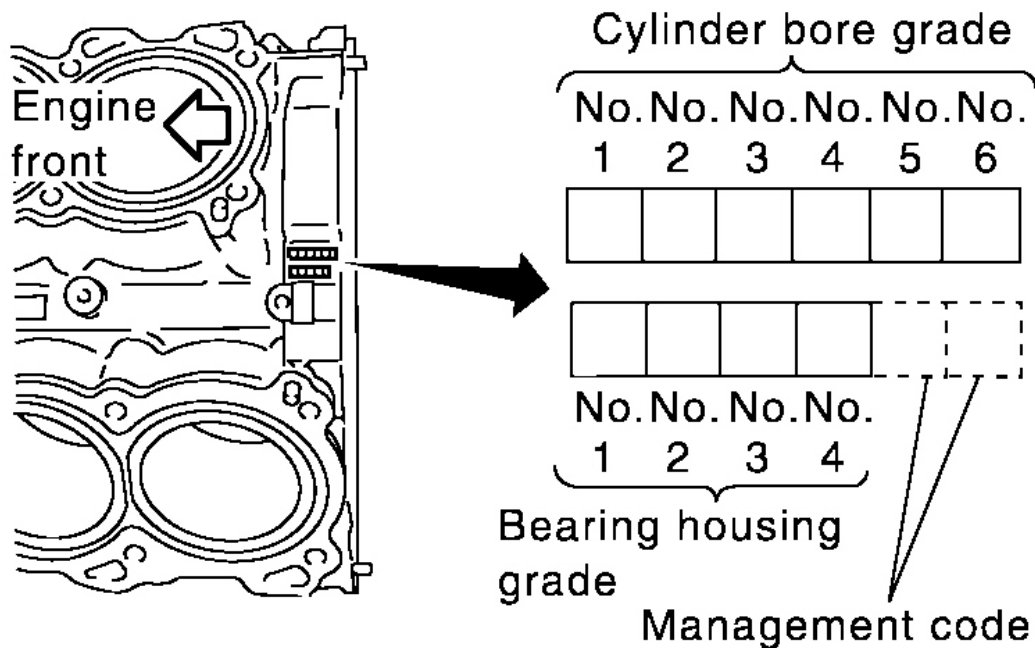
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Fig. 251: Measuring Crankshaft Main Journal Dimension
Courtesy of NISSAN MOTOR CO., U.S.A.

6. If crankshaft or cylinder block is replaced with a new one, select thickness of main bearings as follows:
 - a. Grade number of each cylinder block main journal is punched on the respective cylinder block.

These numbers are punched in either Arabic or Alphabet. Refer to **CYLINDER BLOCK**.

If measured diameter is out of grade punched, decide suitable grade using table in SDS.



G02090256

Fig. 252: Identifying Cylinder Bore Grade Number
Courtesy of NISSAN MOTOR CO., U.S.A.

- b. Grade number of each crankshaft main journal is punched on the respective crankshaft. These numbers are punched in either Arabic or Alphabet. Refer to **CRANKSHAFT**.

If measured diameter is out of grade punched, decide suitable grade using table in SDS.

- c. Select main bearing with suitable thickness according to the following table.

Refer to **AVAILABLE MAIN BEARING**, for available main bearings.

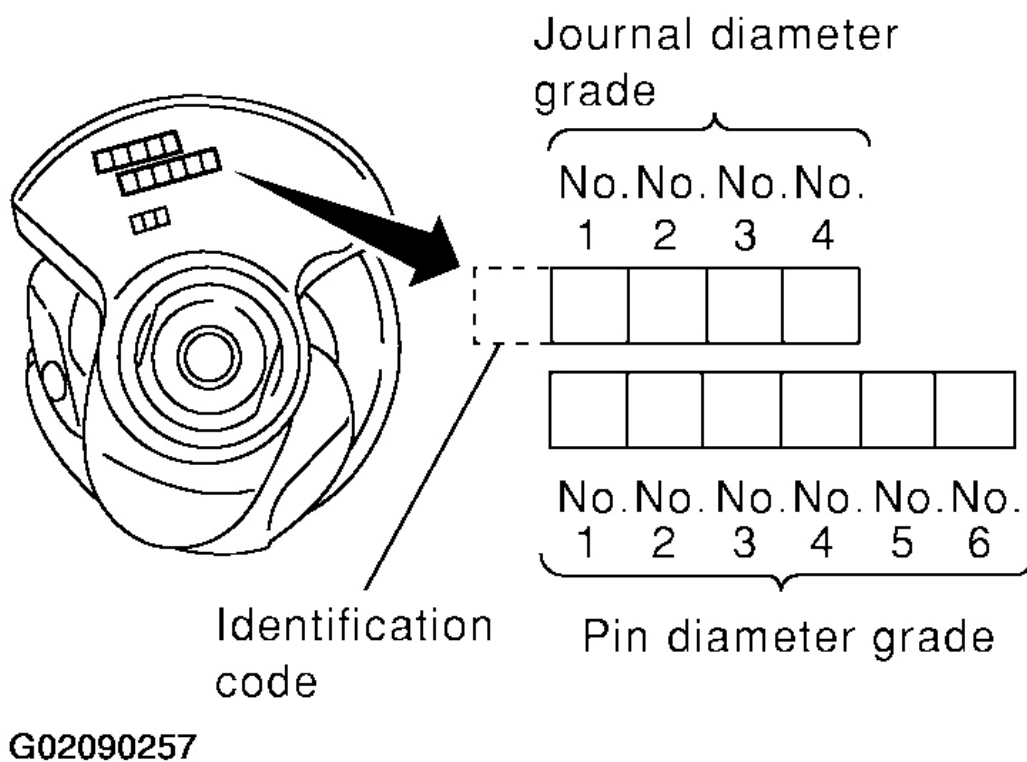


Fig. 253: Identifying Journal Diameter Grade Number
Courtesy of NISSAN MOTOR CO., U.S.A.

Cylinder block bearing housing inner diameter Unit: mm (in) Crankshaft main journal diameter Unit: mm (in)		Mark	Hole diameter																											
			A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V	W	X	Y	4	7				
			63.993 - 63.994 (2.5194 - 2.5194)	63.994 - 63.995 (2.5194 - 2.5195)	63.995 - 63.996 (2.5195 - 2.5195)	63.996 - 63.997 (2.5195 - 2.5196)	63.997 - 63.998 (2.5196 - 2.5196)	63.998 - 63.999 (2.5196 - 2.5196)	63.999 - 64.000 (2.5196 - 2.5197)	64.000 - 64.001 (2.5197 - 2.5197)	64.001 - 64.002 (2.5197 - 2.5198)	64.002 - 64.003 (2.5198 - 2.5198)	64.003 - 64.004 (2.5198 - 2.5198)	64.004 - 64.005 (2.5198 - 2.5199)	64.005 - 64.006 (2.5199 - 2.5199)	64.006 - 64.007 (2.5199 - 2.5200)	64.007 - 64.008 (2.5200 - 2.5200)	64.008 - 64.009 (2.5200 - 2.5200)	64.009 - 64.010 (2.5200 - 2.5201)	64.010 - 64.011 (2.5201 - 2.5201)	64.011 - 64.012 (2.5201 - 2.5202)	64.012 - 64.013 (2.5202 - 2.5202)	64.013 - 64.014 (2.5202 - 2.5202)	64.014 - 64.015 (2.5202 - 2.5203)	64.015 - 64.016 (2.5203 - 2.5203)	64.016 - 64.017 (2.5203 - 2.5203)				
Mark	Axle diameter																													
A	59.975 - 59.974 (2.3612 - 2.3612)	0	0	0	01	01	01	1	1	1	12	12	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4		
B	59.974 - 59.973 (2.3612 - 2.3611)	0	0	01	01	01	1	1	1	12	12	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4		
C	59.973 - 59.972 (2.3611 - 2.3611)	0	01	01	01	1	1	1	12	12	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4		
D	59.972 - 59.971 (2.3611 - 2.3611)	01	01	01	1	1	1	12	12	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	4		
E	59.971 - 59.970 (2.3611 - 2.3610)	01	01	1	1	1	12	12	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	4	45		
F	59.970 - 59.969 (2.3610 - 2.3610)	01	1	1	1	12	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	4	4	45	45		
G	59.969 - 59.968 (2.3610 - 2.3609)	1	1	1	12	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	4	45	45	45	45		
H	59.968 - 59.967 (2.3609 - 2.3609)	1	1	12	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	4	4	45	45	45	5		
J	59.967 - 59.966 (2.3609 - 2.3609)	1	12	12	12	2	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	4	4	45	45	45	5	5		
K	59.966 - 59.965 (2.3609 - 2.3608)	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	5	5	5		
L	59.965 - 59.964 (2.3608 - 2.3608)	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	5	5	5	56		
M	59.964 - 59.963 (2.3608 - 2.3607)	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	5	5	5	5	56		
N	59.963 - 59.962 (2.3607 - 2.3607)	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	5	5	5	5	5	56		
P	59.962 - 59.961 (2.3607 - 2.3607)	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	5	5	5	5	5	5	56		
R	59.961 - 59.960 (2.3607 - 2.3606)	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	5	5	5	5	5	5	5	56		
S	59.960 - 59.959 (2.3606 - 2.3606)	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	5	5	5	5	5	5	5	5	56		
T	59.959 - 59.958 (2.3606 - 2.3605)	23	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	5	5	5	5	5	5	5	5	5	56		
U	59.958 - 59.957 (2.3605 - 2.3605)	23	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	5	5	5	5	5	5	5	5	5	5	56		
V	59.957 - 59.956 (2.3605 - 2.3605)	3	3	3	34	34	34	4	4	4	45	45	45	5	5	5	5	5	5	5	5	5	5	5	5	5	5	56		
W	59.956 - 59.955 (2.3605 - 2.3604)	3	3	34	34	34	4	4	4	45	45	45	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	56		
X	59.955 - 59.954 (2.3604 - 2.3604)	3	34	34	34	4	4	4	45	45	45	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	56		
Y	59.954 - 59.953 (2.3604 - 2.3603)	34	34	34	4	4	4	45	45	45	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	56		
4	59.953 - 59.952 (2.3603 - 2.3603)	34	34	4	4	4	45	45	45	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	56		
7	59.952 - 59.951 (2.3603 - 2.3603)	34	4	4	4	45	45	45	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	56		

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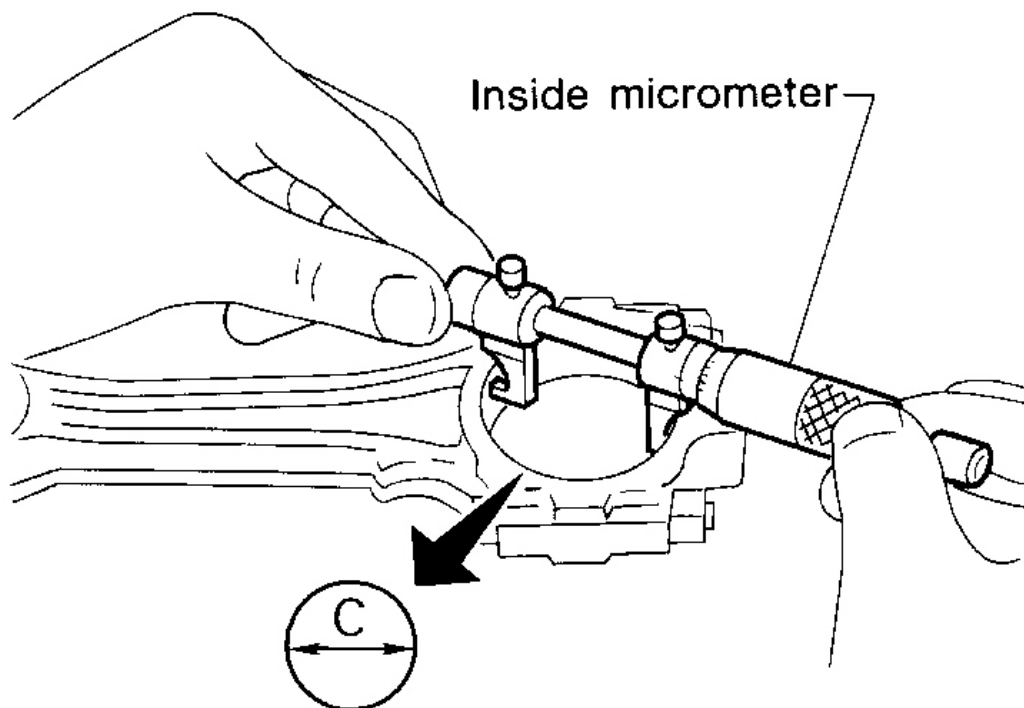
Fig. 254: Cylinder Block Bearing Specification
Courtesy of NISSAN MOTOR CO., U.S.A.

Connecting Rod Bearing (Big end)

1. Install connecting rod bearing to connecting rod and cap.
2. Install connecting rod cap to connecting rod.

Tighten bolts to the specified torque.

3. Measure inner diameter "C" of connecting rod.



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Fig. 255: Measuring Inner Diameter (C) Of Connecting Rod
Courtesy of NISSAN MOTOR CO., U.S.A.

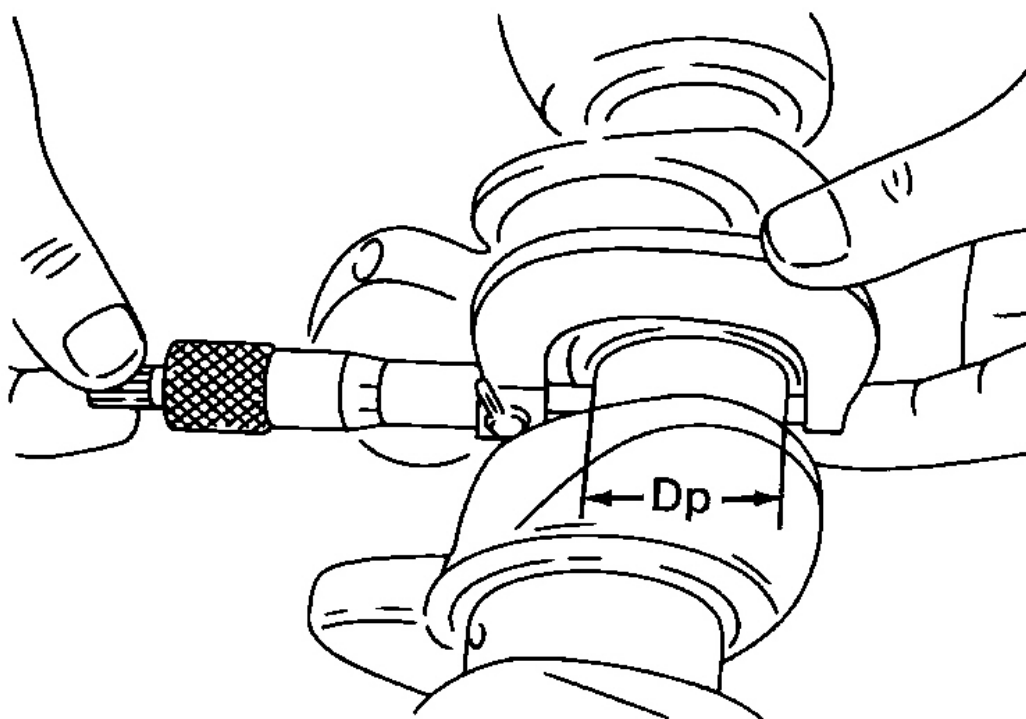
4. Measure outer diameter "Dp" of each crankshaft pin journal.
5. Calculate connecting rod bearing clearance.

Connecting rod bearing clearance = C - Dp

Standard: 0.034 - 0.059 mm (0.0013 - 0.0023 in)

Limit: 0.070 mm (0.0028 in)

6. If it exceeds the limit, replace bearing.
7. If clearance cannot be adjusted within the standard of any bearing, grind crankshaft journal and use undersized bearing. Refer to **BEARING CLEARANCE - MAIN BEARING**.



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Fig. 256: Measuring Outer Diameter (DP) Of Each Crankshaft Pin Journal
Courtesy of NISSAN MOTOR CO., U.S.A.

8. If crankshaft is replaced with a new one, select connecting rod bearing according to the following table.

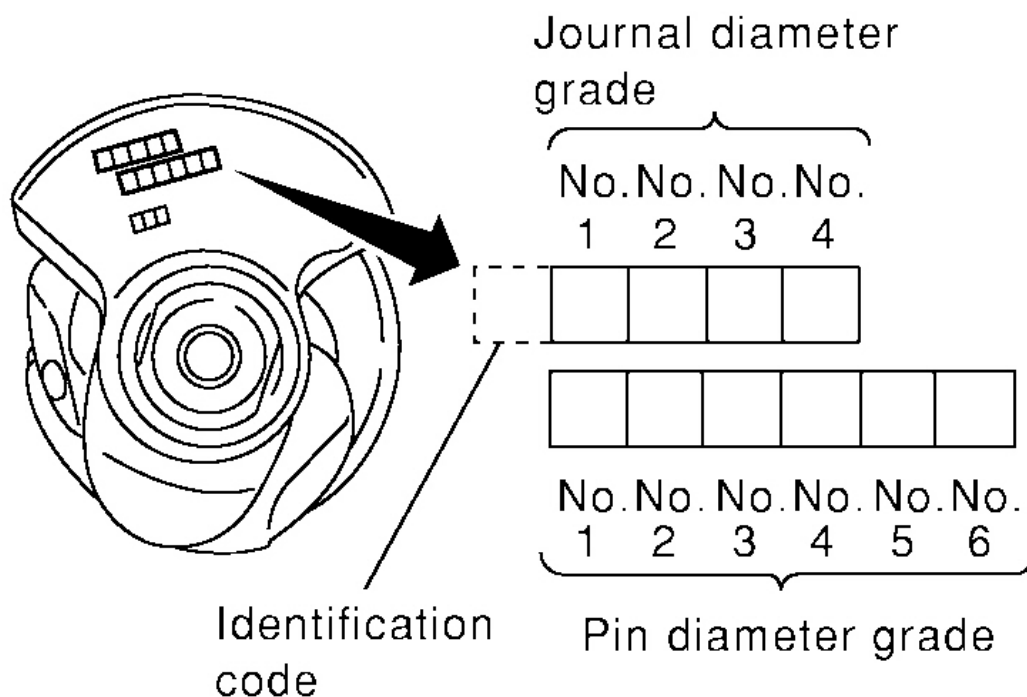
Connecting rod bearing grade number (Identification color):

These numbers are punched in either Arabic or Roman numerals.

Crankshaft pin journal grade number	Connecting rod bearing grade number
0	0 (Black)
1	1 (Brown)
2	2 (Green)

G02090261

Fig. 257: Identifying Journal Diameter Grade Number
 Courtesy of NISSAN MOTOR CO., U.S.A.



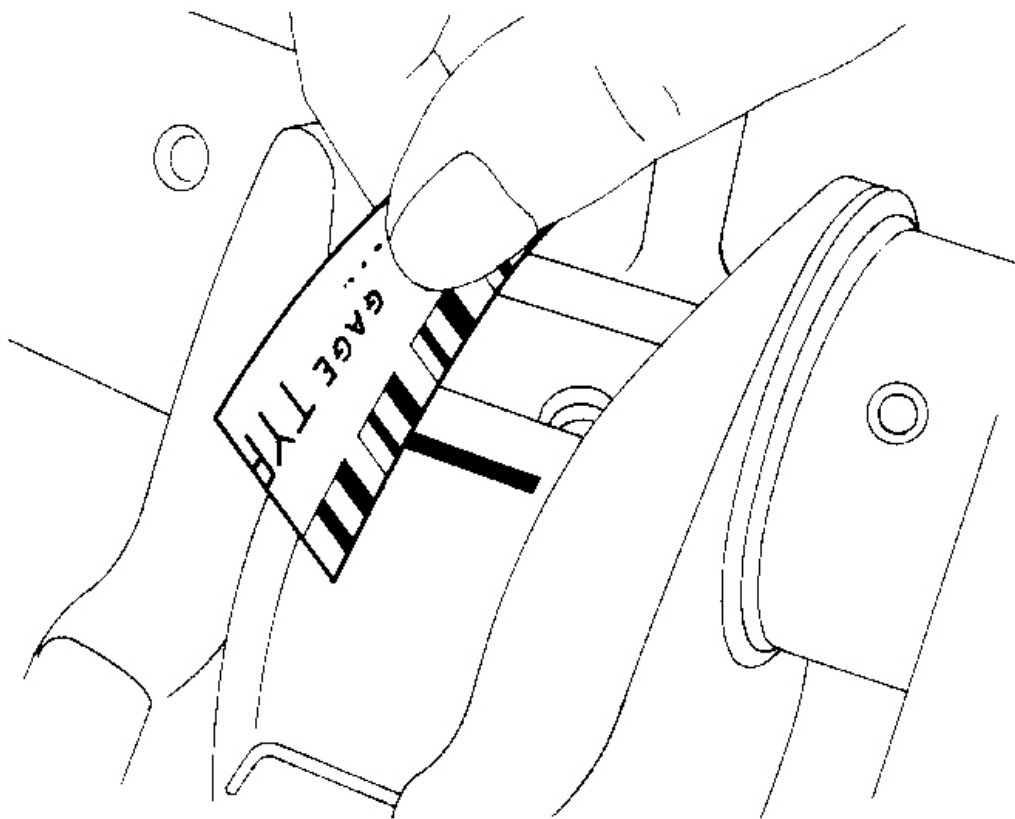
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Fig. 258: Connecting Rod Bearing Grade Number Chart
 Courtesy of NISSAN MOTOR CO., U.S.A.

Method B (Using plastigage)

CAUTION:

- Do not turn crankshaft or connecting rod while plastigage is being inserted.
- When bearing clearance exceeds the specified limit, ensure that the proper bearing has been installed. If incorrect bearing clearance exists, use a thicker or undersized main bearing to ensure specified clearance.

**G02090263****Fig. 259: Identifying Plastigage****Courtesy of NISSAN MOTOR CO., U.S.A.****CONNECTING ROD BUSHING CLEARANCE (SMALL END)**

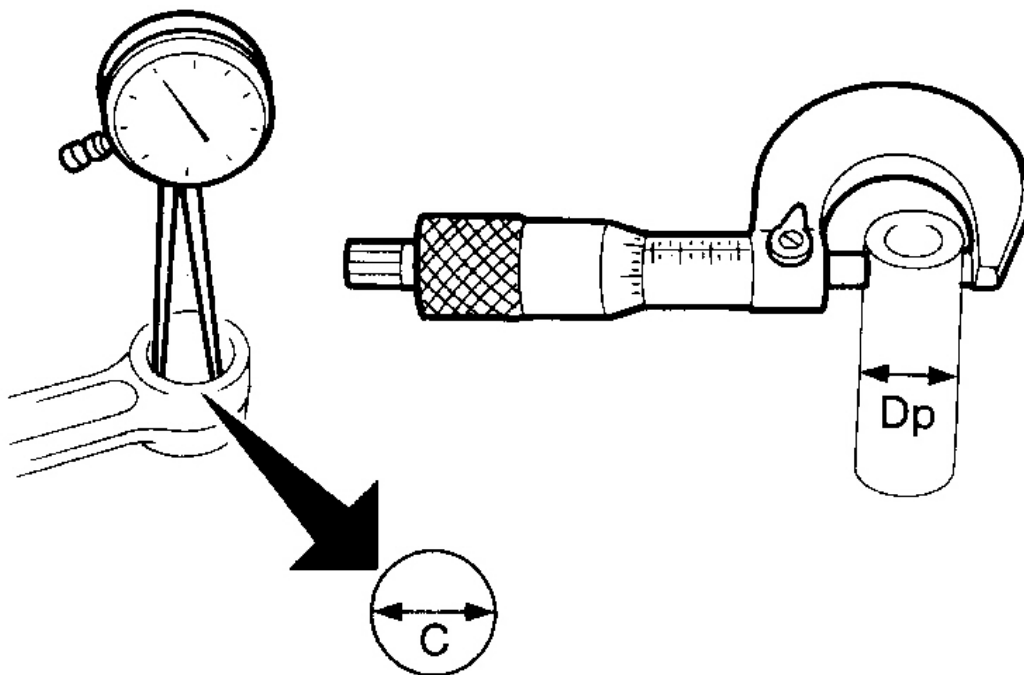
1. Measure inner diameter "C" of bushing.
2. Measure outer diameter "Dp" of piston pin.
3. Calculate connecting rod bushing clearance.

Connecting rod bushing clearance = $C - D_p$

Standard: 0.005 - 0.017 mm (0.0002 - 0.0007 in)

Limit: 0.030 mm (0.0012 in)

If it exceeds the limit, replace connecting rod assembly or connecting rod bushing and/or piston set with pin.



G02090264

Fig. 260: Measuring Inner Diameter (C) Of Bushing
Courtesy of NISSAN MOTOR CO., U.S.A.

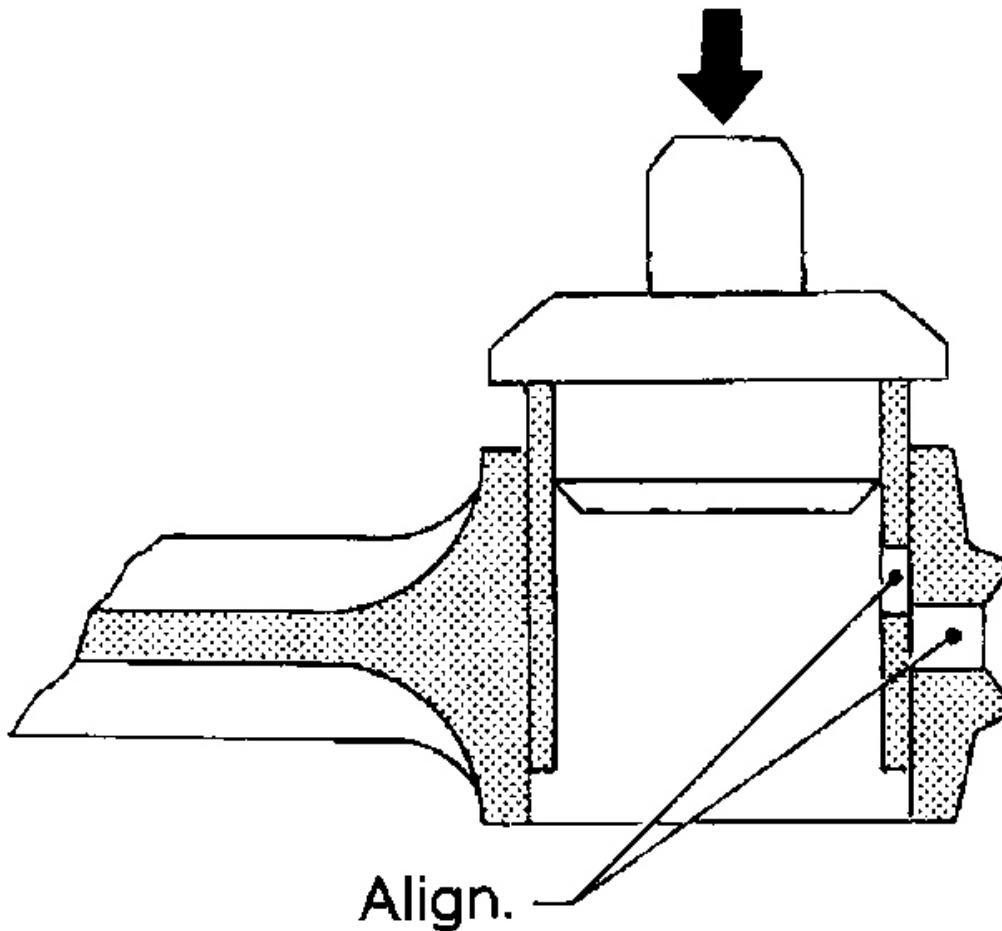
REPLACEMENT OF CONNECTING ROD BUSHING (SMALL END)

1. Drive in small end bushing until it is flush with end surface of rod.

Be sure to align the oil holes.

2. After driving in small end bushing, ream the bushing. This is to ensure the clearance between connecting rod bushing and piston pin is the specified value.

Clearance between connecting rod bushing and piston pin: 0.005 - 0.017 mm (0.0002 - 0.0007 in)



G02090265

Fig. 261: Installing Connecting Rod Bushing
Courtesy of NISSAN MOTOR CO., U.S.A.

DRIVE PLATE RUNOUT

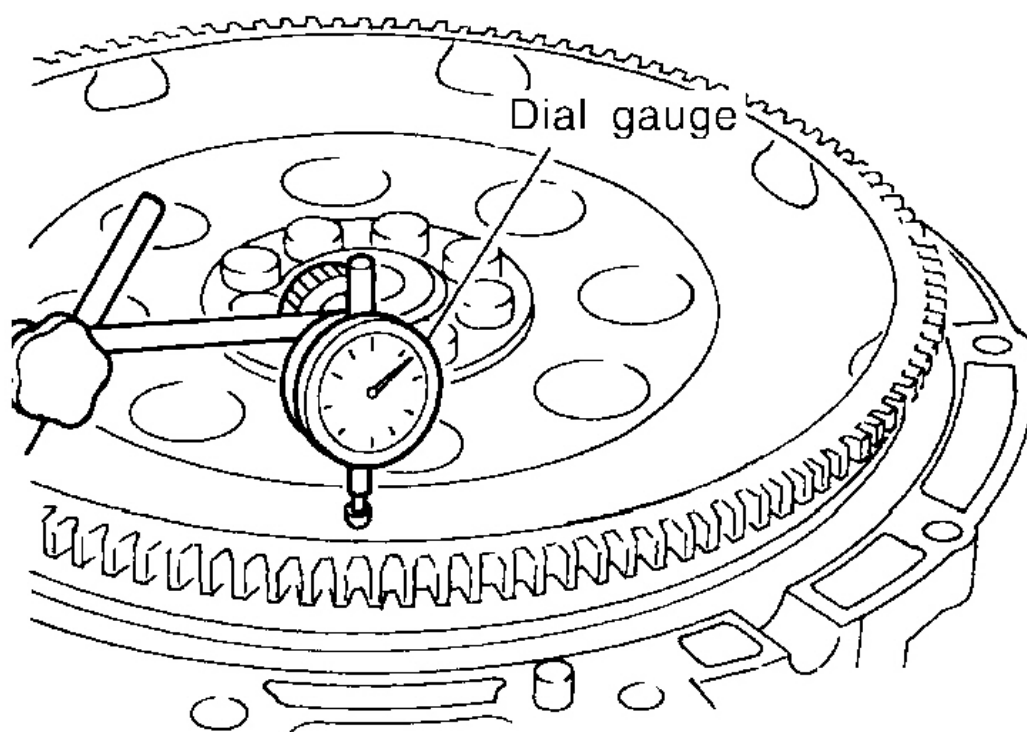
Runout (Total indicator reading):

Drive plate

Less than 0.15 mm (0.0059 in)

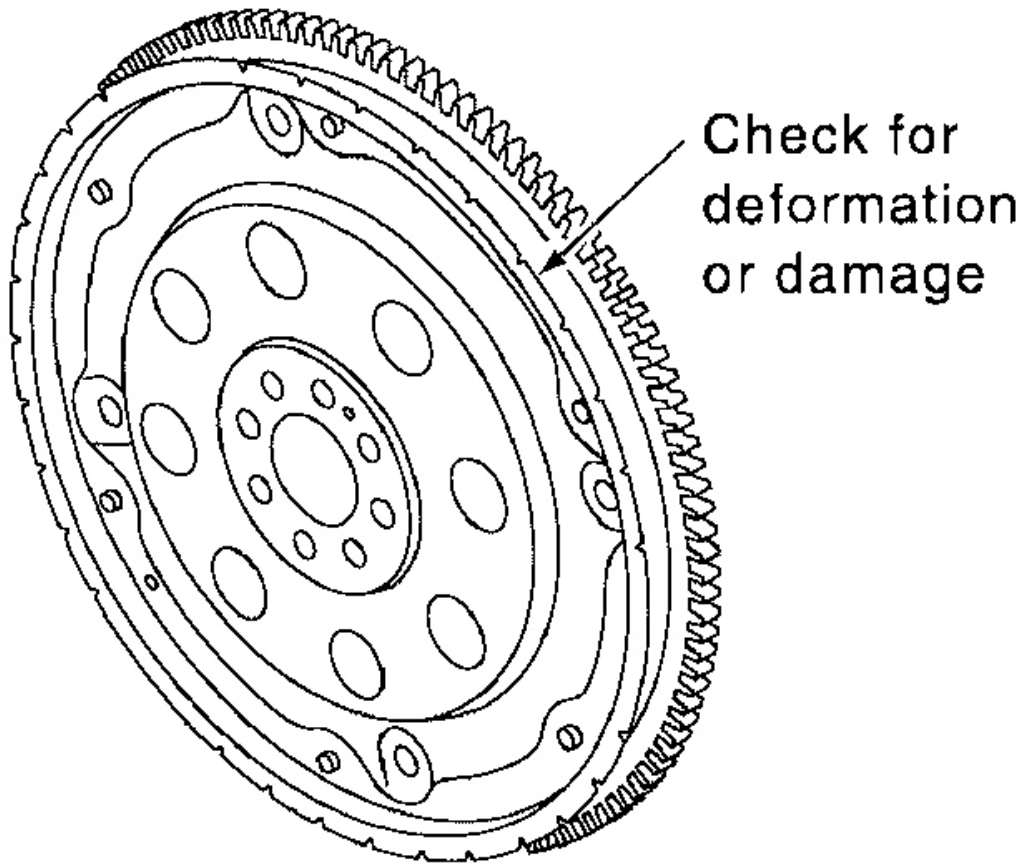
- CAUTION:**
- The signal plate is built into the drive plate assembly. Be careful not to damage the signal plate, especially the teeth.

- Check the drive plate and signal plate for deformation or cracks.
- Keep any magnetized objects away from the signal plate.
- Do not allow any magnetic materials to contact the signal plate teeth.



G02090266

Fig. 262: Measuring Drive Plate Runout
Courtesy of NISSAN MOTOR CO., U.S.A.



G02090267

Fig. 263: Identifying Drive Plate

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

ASSEMBLY

PISTON

1. Install new snap ring on one side of piston pin hole.
2. Heat piston to 60 to 70°C (140 to 158°F) and assemble piston, piston pin, connecting rod and new snap ring.
 - Align the direction of piston and connecting rod.
 - Numbers stamped on connecting rod and cap correspond to each cylinder.
 - After assembly, make sure connecting rod swings smoothly.

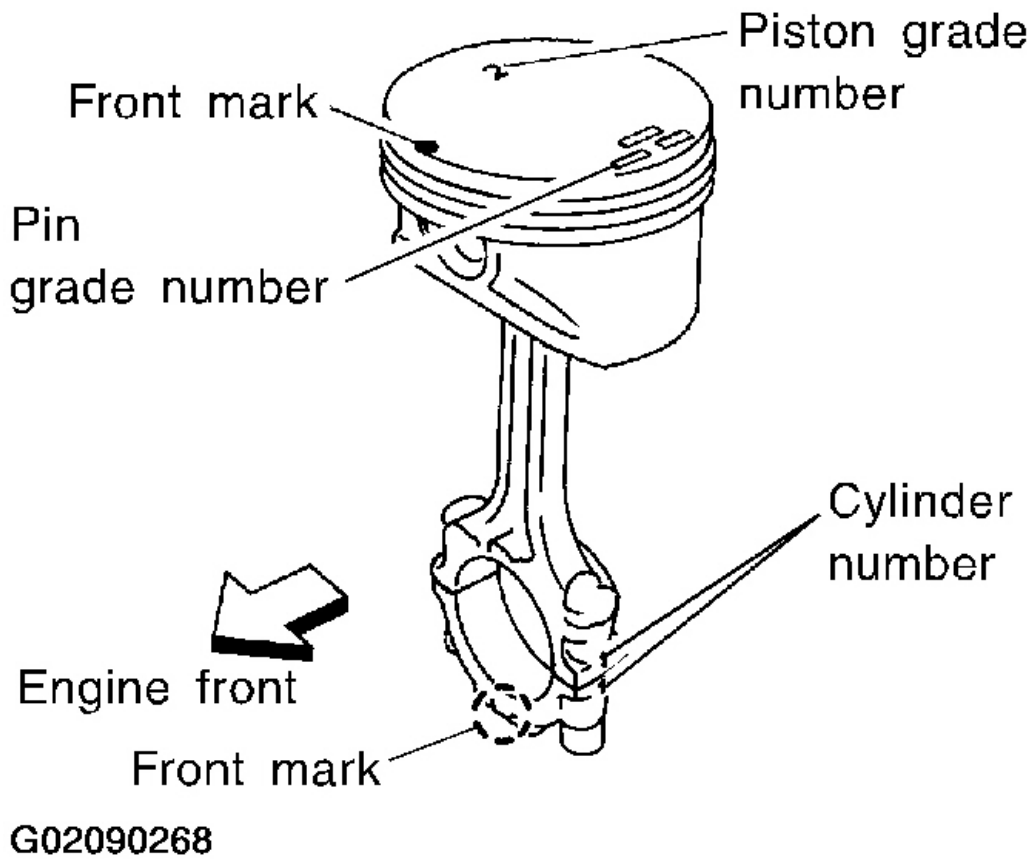


Fig. 264: Aligning Direction Of Piston And Connecting Rod
Courtesy of NISSAN MOTOR CO., U.S.A.

3. Set piston rings as shown.

CAUTION:

- When piston rings are not replaced, make sure that piston rings are mounted in their original positions.
- When replacing piston rings, those without punchmarks present can be mounted with either side up.

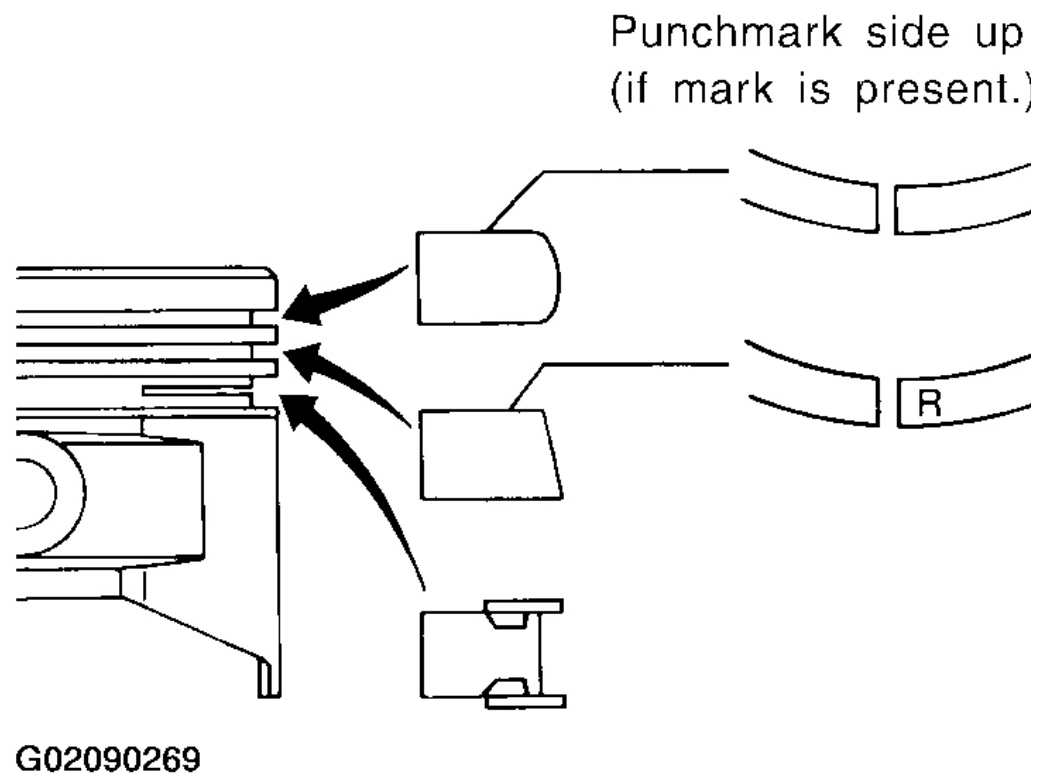


Fig. 265: Setting Piston Rings

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

- Align piston rings so that end gaps are positioned as shown in the fig

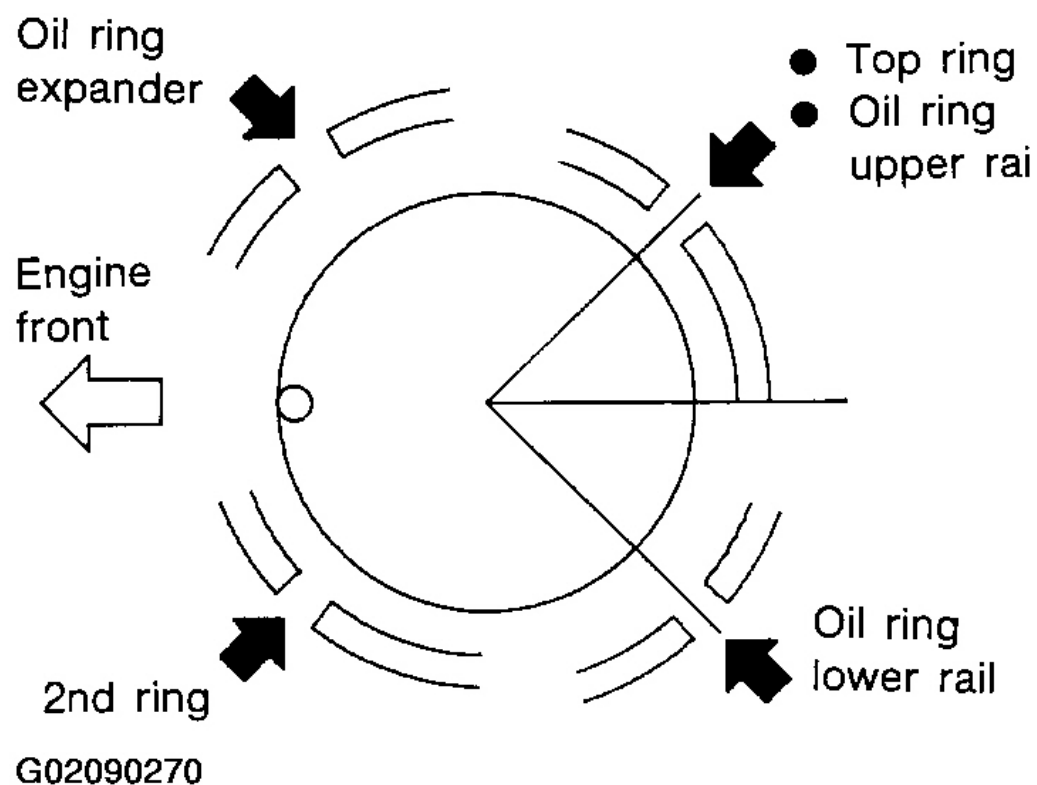
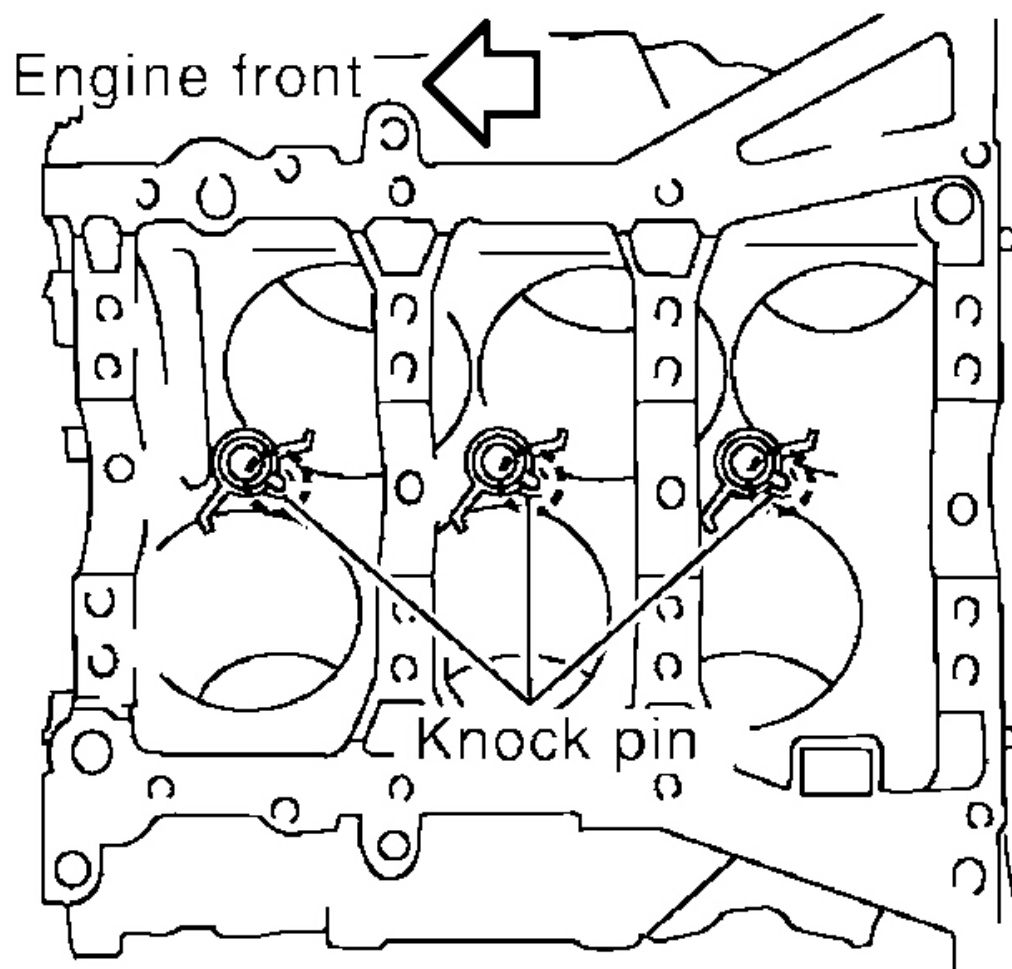


Fig. 266: Aligning Piston Rings
Courtesy of NISSAN MOTOR CO., U.S.A.

OIL JET

1. Install oil jets.
 - Insert oil jet knock pin into the cylinder block knock pin hole, and tighten the mounting bolts.



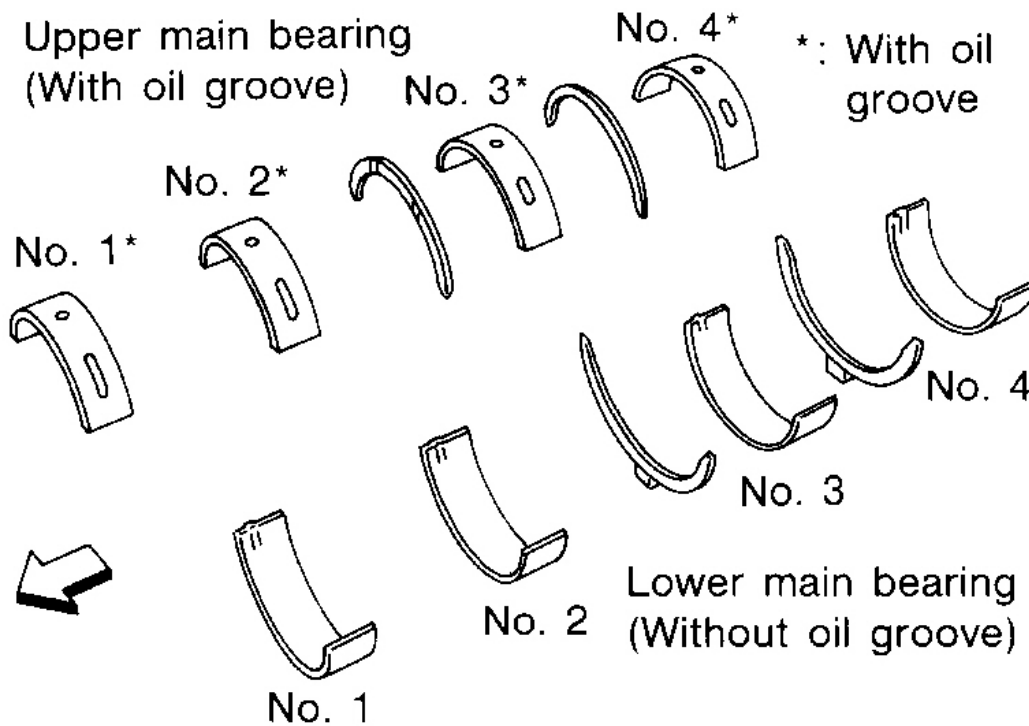
G02090271

Fig. 267: Identifying Knock Pin

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

CRANKSHAFT

1. Set main bearings in their proper positions on cylinder block and main bearing beam.
 - **Confirm that correct main bearings are used. Refer to INSPECTION.**



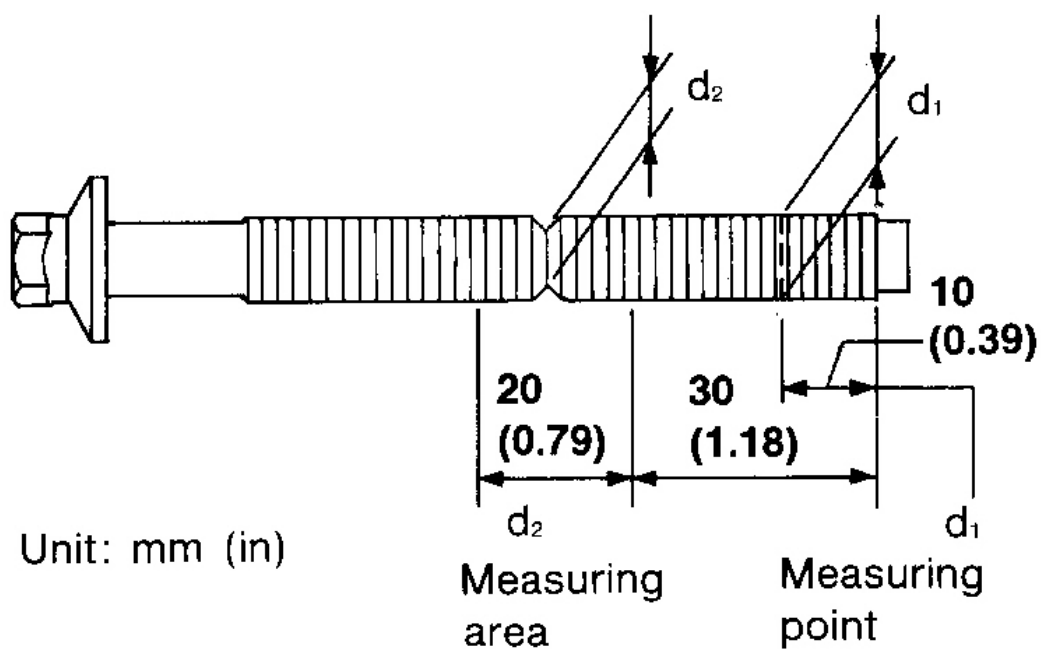
G02090272

Fig. 268: Identifying Crankshaft Bearing
 Courtesy of NISSAN MOTOR CO., U.S.A.

2. Instructions for re-use of main bearing cap bolts.
 - A plastic zone tightening method is used for tightening main bearing cap bolts. Measure d1 and d2 as shown in the figure.

d2: Select minimum diameter in the measuring area. If the difference between d1 and d2 exceeds the limit, replace the bolts with new ones.

Limit (d1 - d2): 0.11 mm (0.0043 in)



G02090273

Fig. 269: Measuring Bearing Cap Bolts
Courtesy of NISSAN MOTOR CO., U.S.A.

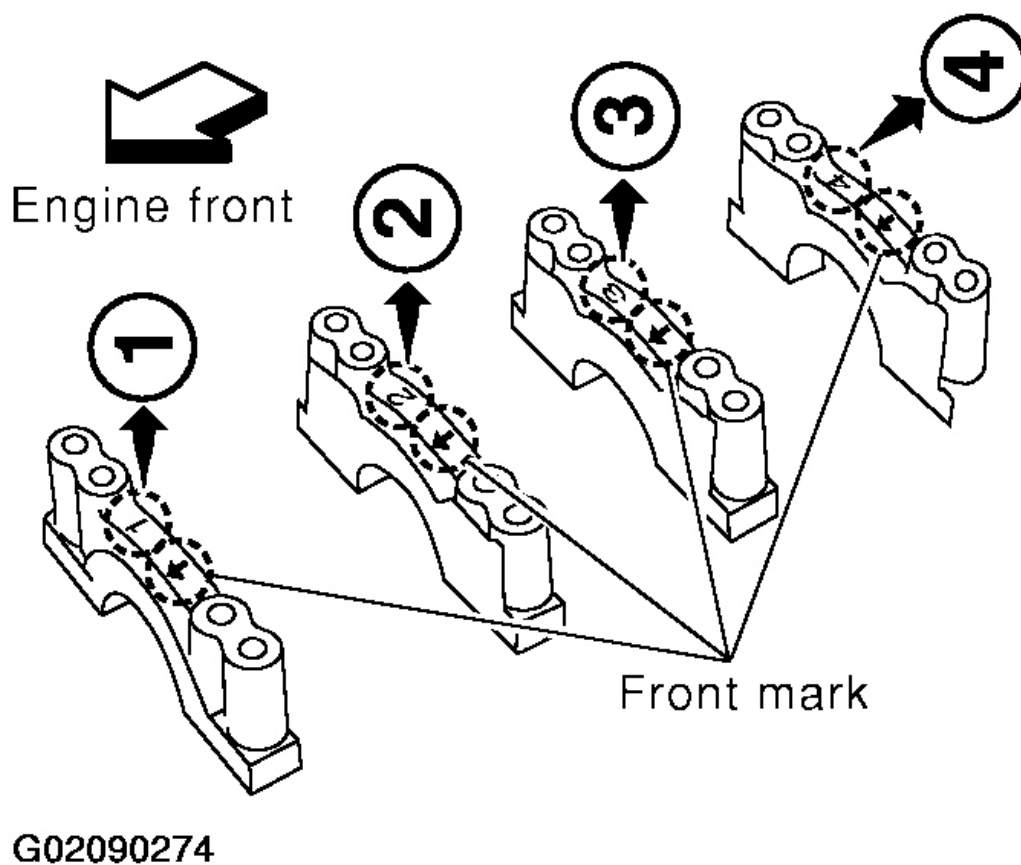
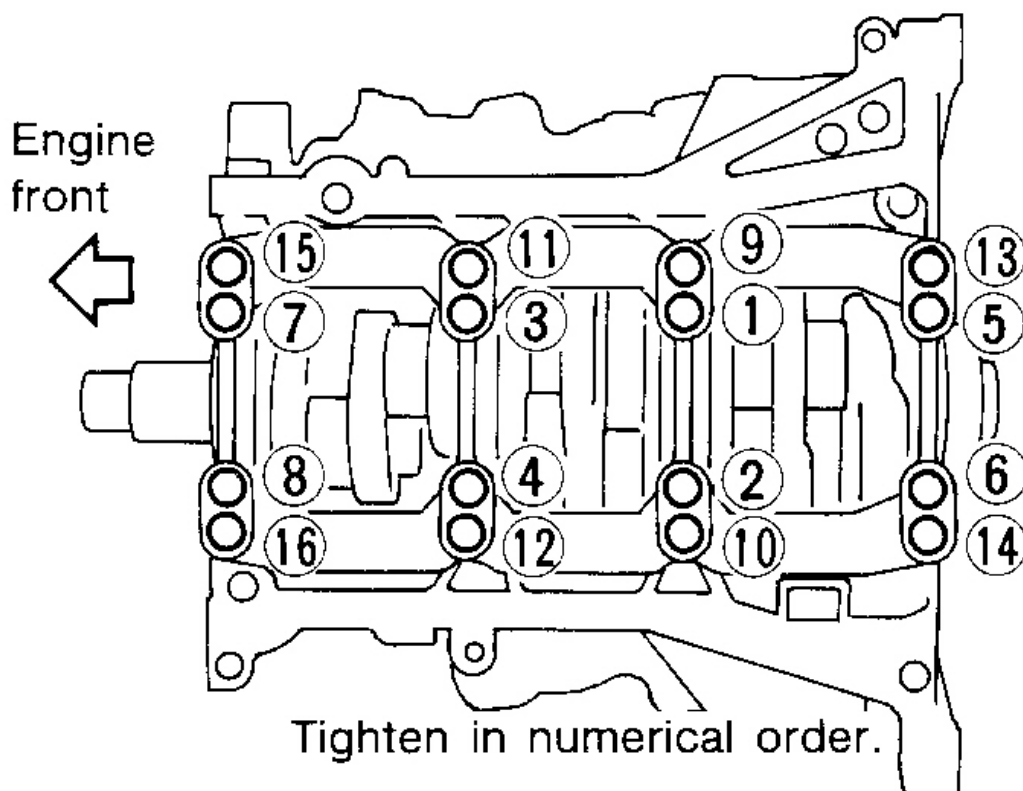


Fig. 270: Identifying Bearing Cap
Courtesy of NISSAN MOTOR CO., U.S.A.

3. After installing crankshaft, main bearing cap, main bearing beam and bearing cap bolts, tighten bearing cap bolts in numerical order as shown.



G02090275

Fig. 271: Tightening Bearing Cap Bolts

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

- Make sure that the front mark on the main bearing beam faces the front of the engine.
 - Tightening procedure
 - a. Tighten all bolts to 32 to 38 N.m (3.3 to 3.9 kg-m, 24 to 28 ft-lb) in several different steps.
 - b. Turn all bolts 90 to 95 degrees clockwise with angle wrench.
 - Prior to tightening bearing cap bolts, place bearing beam in its proper position by shifting crankshaft in the axial direction.
 - After securing bearing cap bolts, make sure crankshaft turns smoothly by hand.
 - Lubricate threads and seat surfaces of the bolts with new engine oil.
4. Measure crankshaft end play.
- Crankshaft end play:

Standard

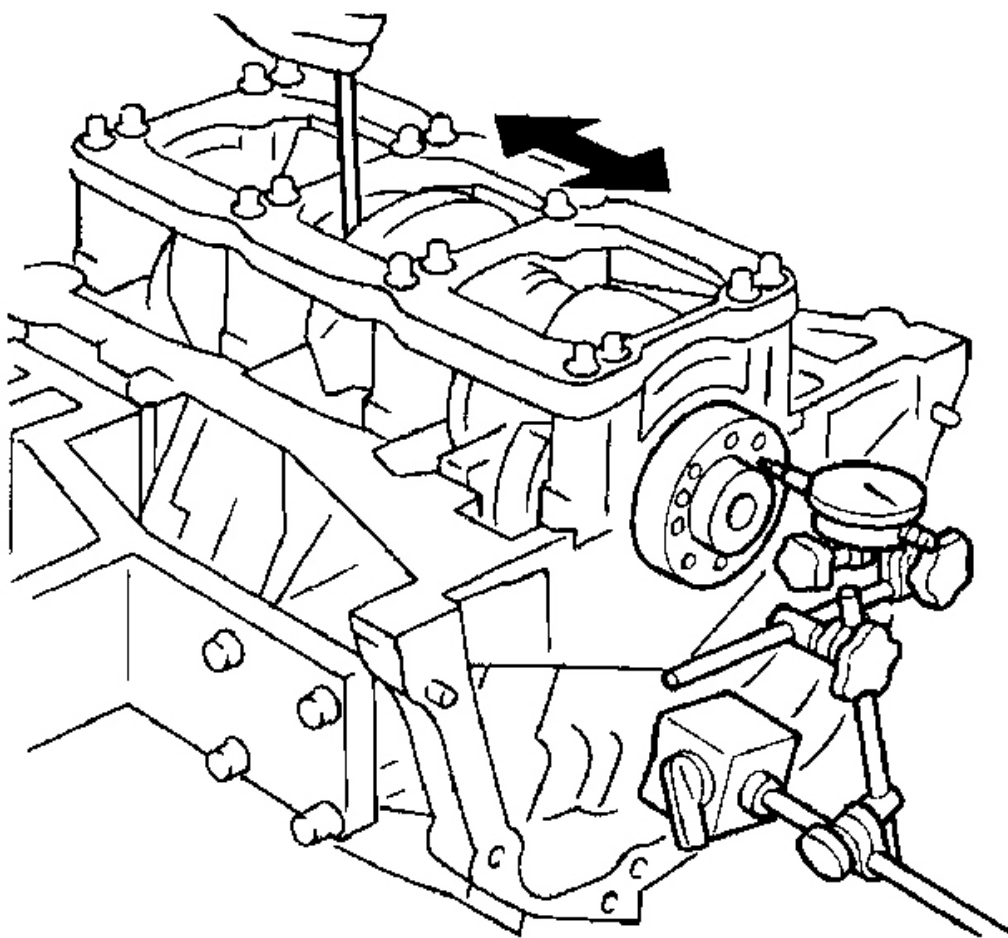
0.10 - 0.25 mm (0.0039 - 0.0098 in)

Limit

0.30 mm (0.0118 in)

If the measured value exceeds the limit, replace the thrust bearings and measure again.

If it still exceeds the limit, replace the crankshaft also.

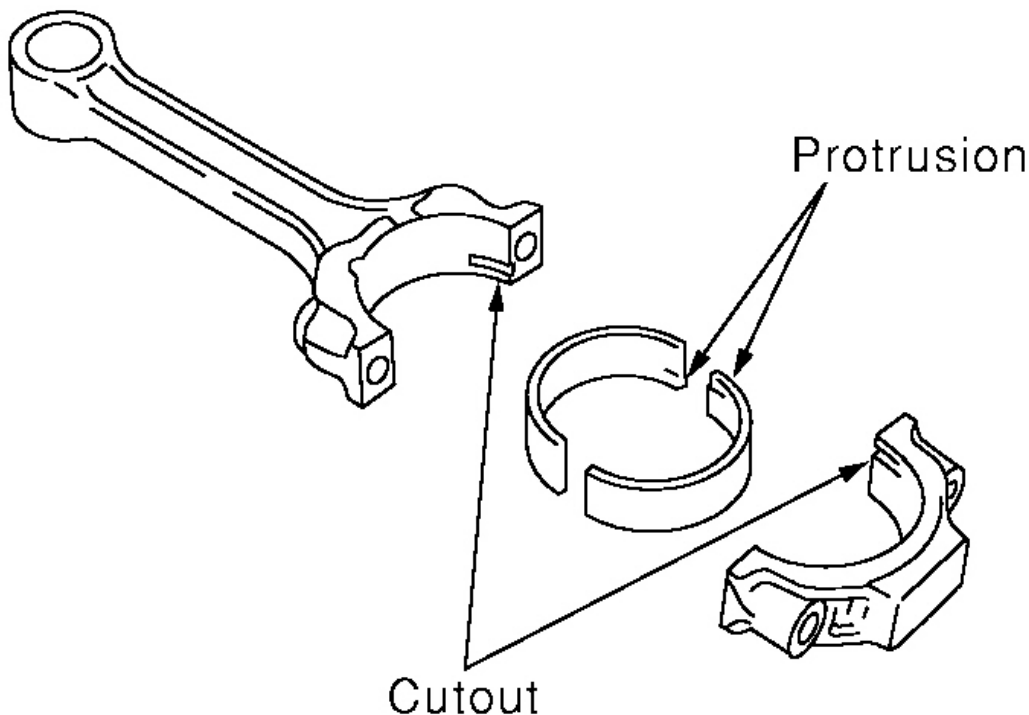


G02090276

Fig. 272: Measuring Crankshaft End Play
Courtesy of NISSAN MOTOR CO., U.S.A.

5. Install connecting rod bearings in connecting rods and connecting rod caps.

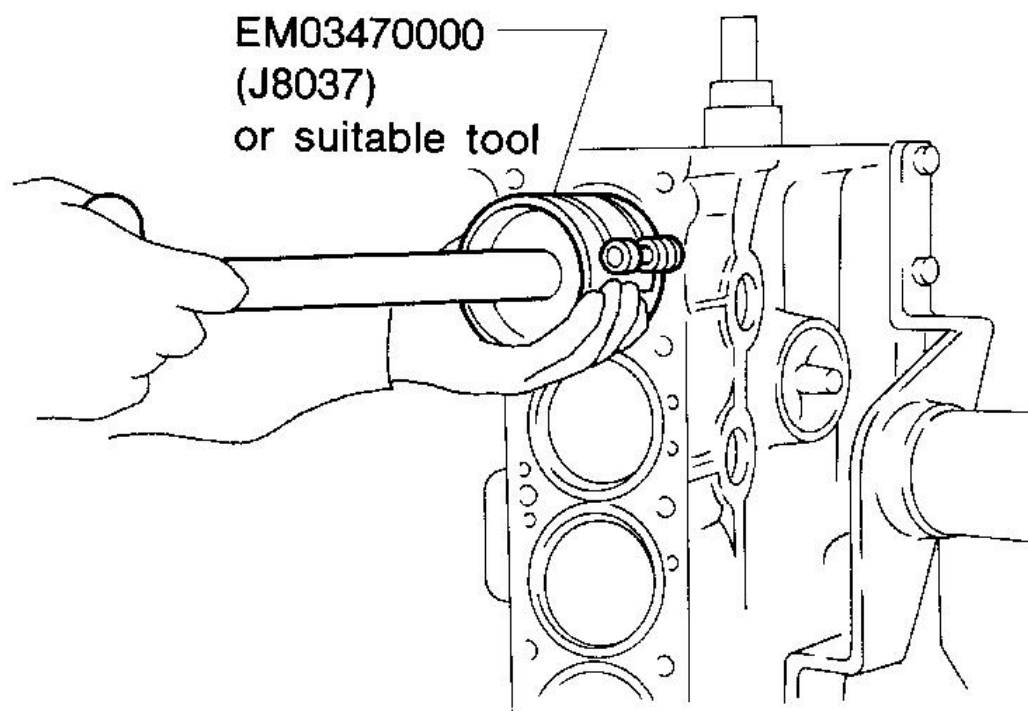
- **Confirm that correct bearings are used. Refer to CONNECTING ROD BEARING (BIG END).**
- a. When installing the connecting rod bearings, apply engine oil to the bearing surface (inside). Do not apply oil to the back surface, but thoroughly clean it.
- b. When installing, align the connecting rod bearing stopper protrusion with the cutout of the connecting rod to install.
- c. Check the oil hole on the connecting rod and that on the corresponding bearing are aligned.



G02090277

Fig. 273: Aligning Connecting Rod Bearing
Courtesy of NISSAN MOTOR CO., U.S.A.

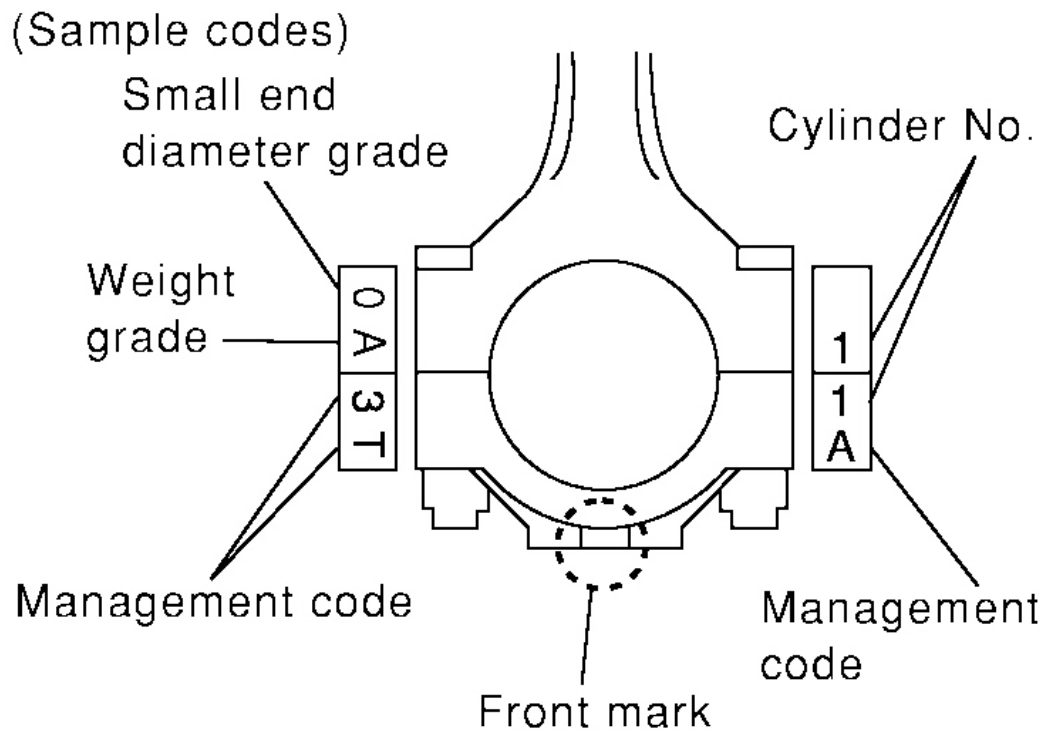
6. Install pistons with connecting rods.
 - a. Install them into corresponding cylinders with Tool.
 - **Be careful not to scratch cylinder wall with the connecting rod.**
 - **Arrange so that front mark on piston head faces toward engine front.**



G02090278

Fig. 274: Installing Pistons With Connecting Rods
Courtesy of NISSAN MOTOR CO., U.S.A.

- b. Install connecting rod caps.
- **Lubricate threads and seat surfaces with new engine oil.**
 - Install so that the cylinder number stamped on the connecting rod agrees with that stamped on cap side.
 - Make sure that front mark on the connecting rod cap faces the front of the engine.



G02090279

Fig. 275: Installing Connecting Rod Caps
 Courtesy of NISSAN MOTOR CO., U.S.A.

- c. Re-use connecting rod cap bolts as follows.
- Make sure that the bolts can be smoothly screwed-in to the end manually.
 - If not, measure the outer diameter "d" shown in the figure.

Outer diameter "d" of connecting rod cap bolt:

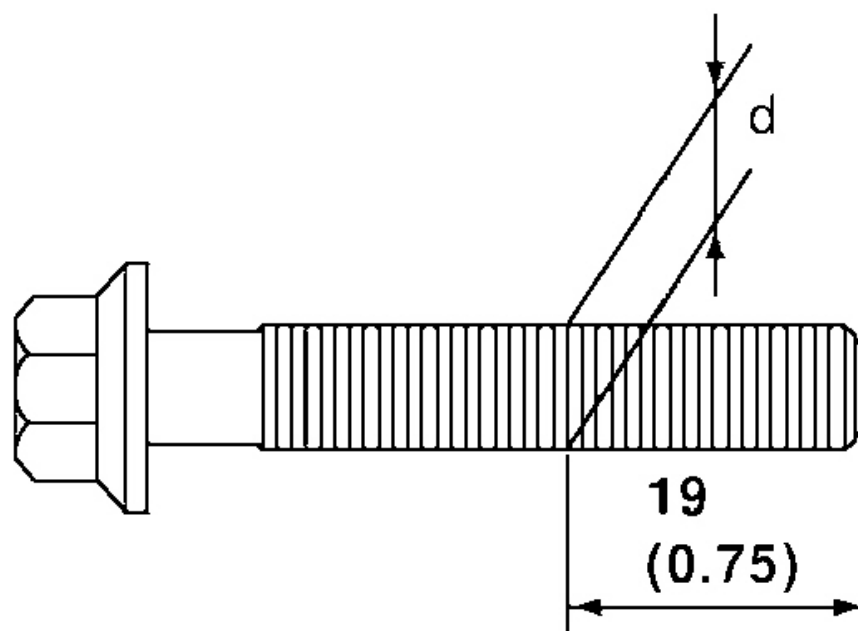
Standard

7.90 - 8.00 mm (0.3110 - 0.3150 in)

Limit

7.75 mm (0.3051 in)

- d. Tighten connecting rod cap bolts to the specified torque.



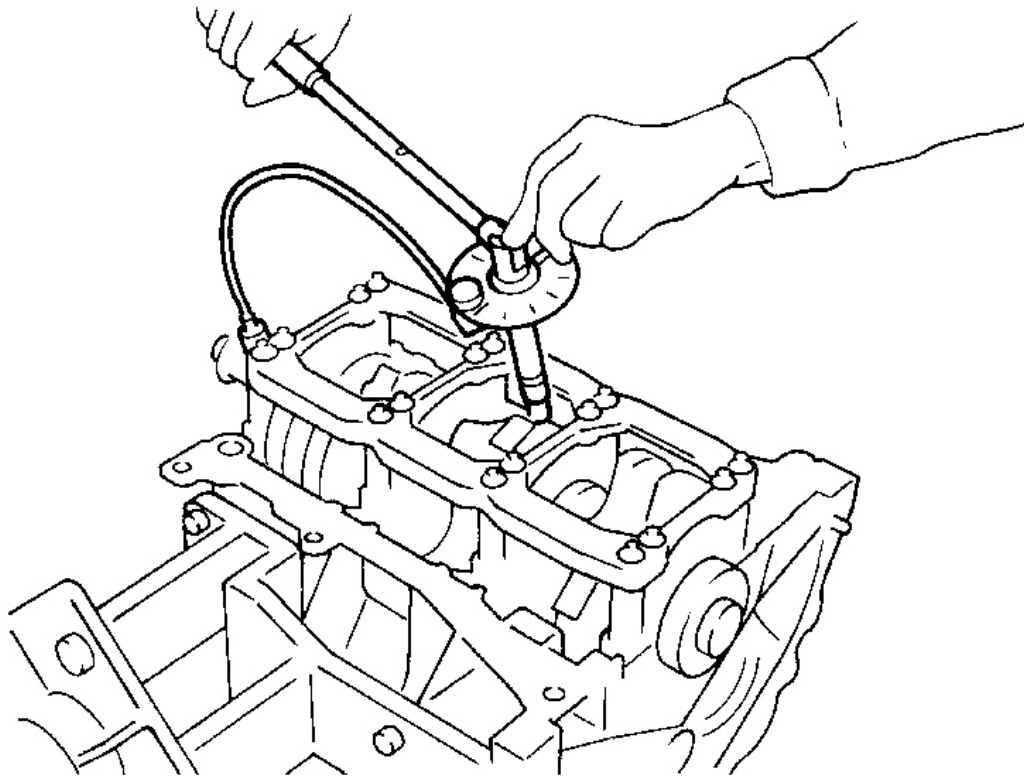
Unit: mm (in)

G02090280

Fig. 276: Measuring Outer Diameter (D)
Courtesy of NISSAN MOTOR CO., U.S.A.

Connecting rod cap bolt:

- Tighten nuts to 19 to 21 N.m (1.9 to 2.1 kg-m, 14 to 15 ft-lb).**
- Turn nuts 90 to 95 degrees clockwise with angle wrench.**



G02090281

Fig. 277: Tightening Connecting Rod Cap Bolt
Courtesy of NISSAN MOTOR CO., U.S.A.

7. Measure connecting rod side clearance.

Connecting rod side clearance:

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

8. Install rear oil seal retainer.

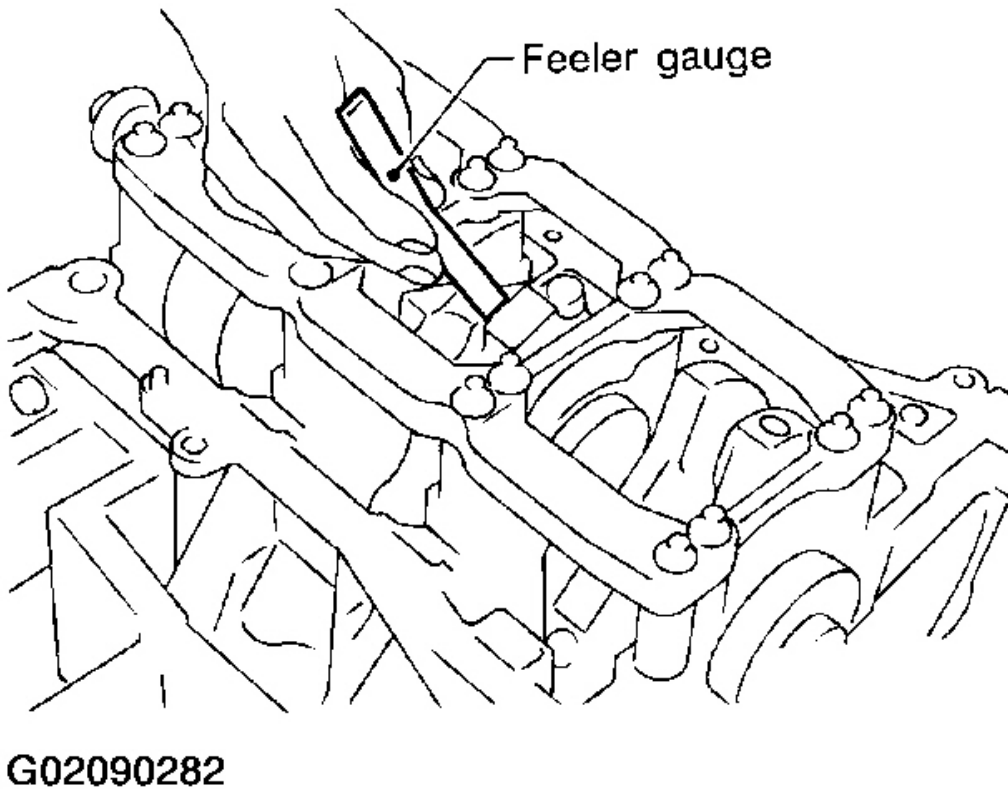


Fig. 278: Measuring Connecting Rod Side Clearance
Courtesy of NISSAN MOTOR CO., U.S.A.

KNOCK SENSOR

1. Install knock sensor.
 - Make sure that there is no foreign material on the cylinder block mating surface and the back surface of the knock sensor.
 - Install knock sensor so that connector faces rear of engine.
 - Do not tighten the mounting bolts while holding the connector.
 - Make sure that the knock sensor does not interfere with other parts.

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

- After installing knock sensor, connect sub-harness, and lay it out to rear of engine.

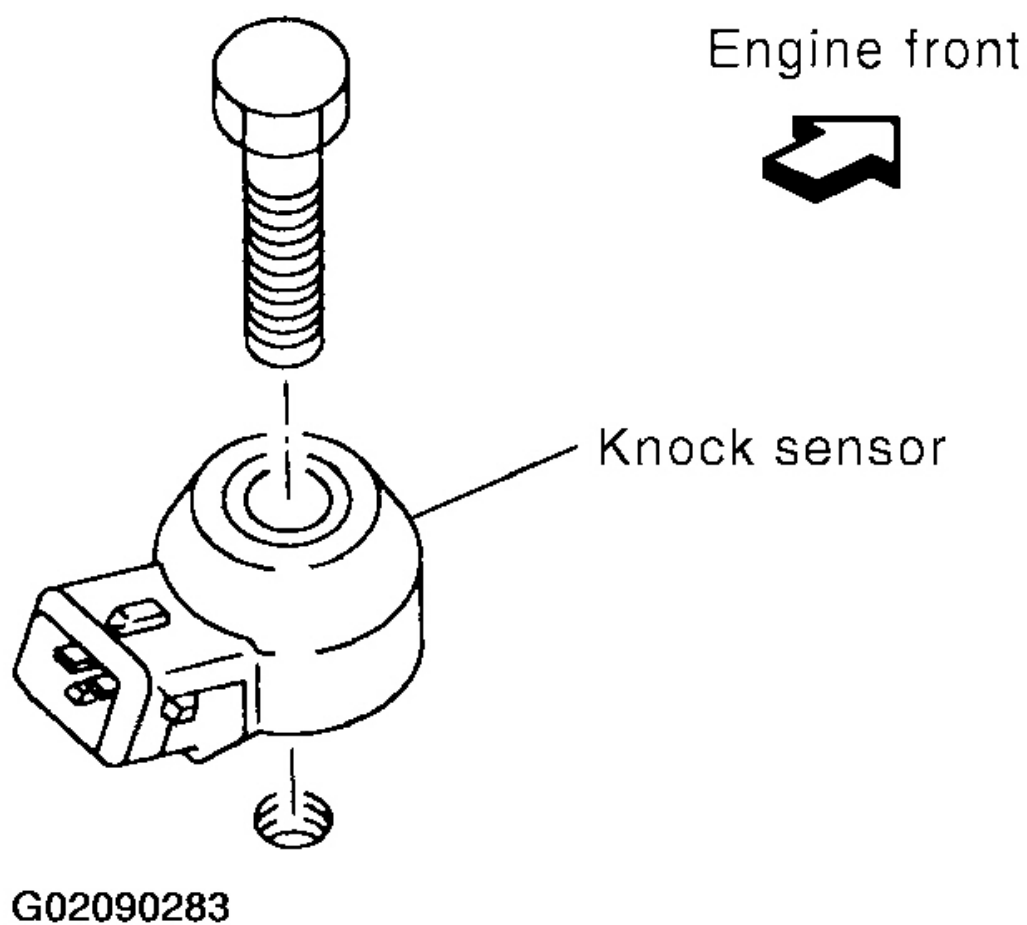


Fig. 279: Installing Knock Sensor
Courtesy of NISSAN MOTOR CO., U.S.A.

REPLACEMENT OF PILOT CONVERTER

1. Remove pilot converter using tool or suitable tool.

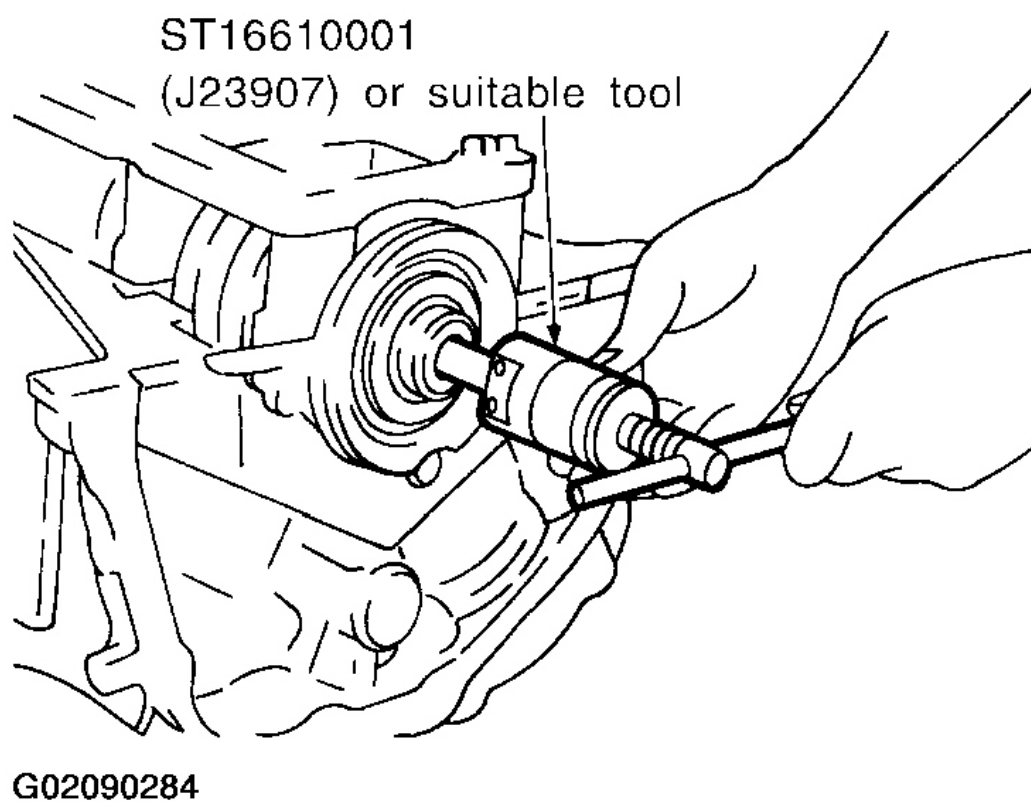
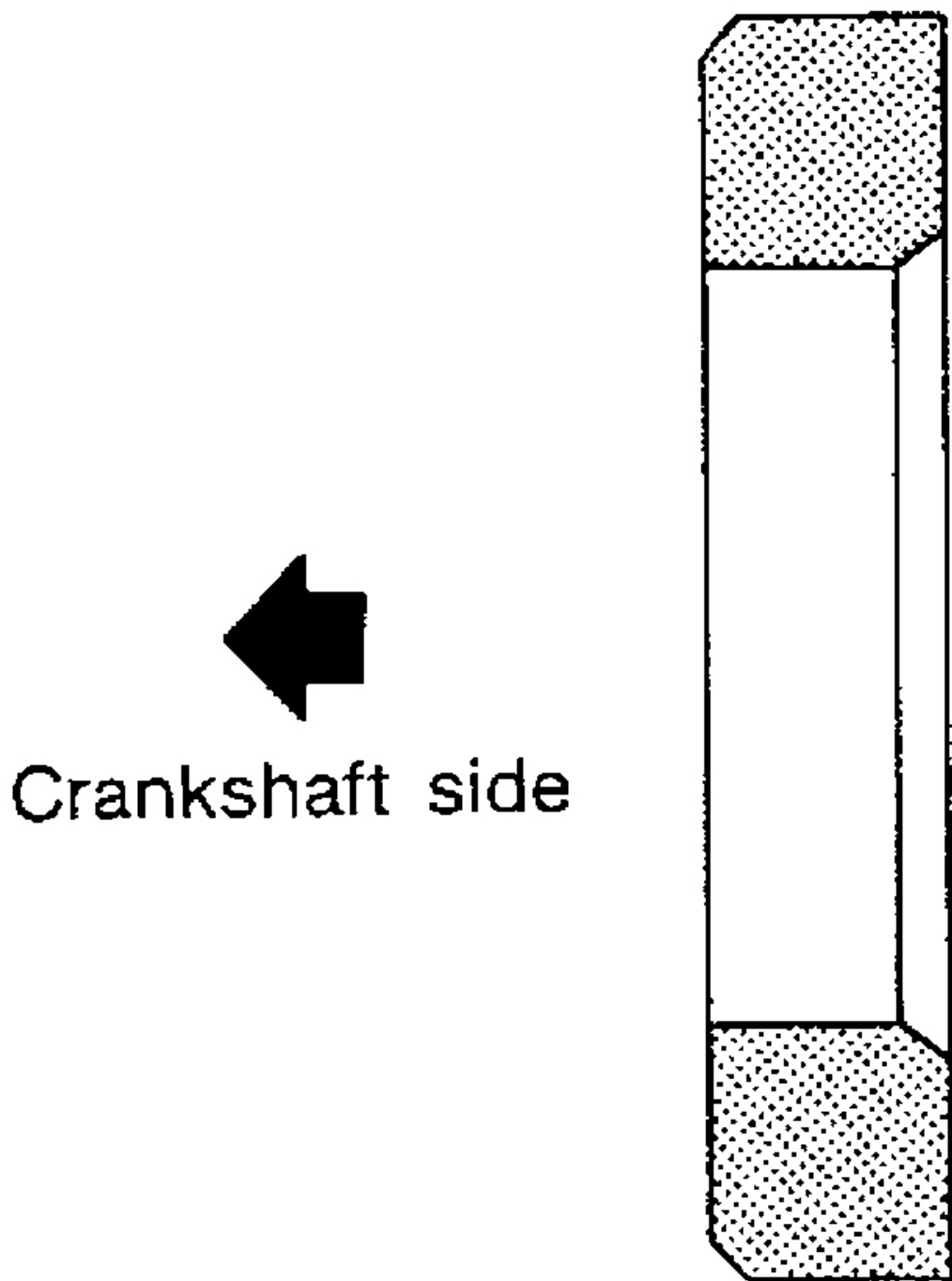


Fig. 280: Removing Pilot Converter Using Tool
Courtesy of NISSAN MOTOR CO., U.S.A.

2. Install pilot converter as shown.



G02090285

Fig. 281: Installing Pilot Converter

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

DRIVE PLATE

Install drive plate.

- Install the drive plate and reinforce plate in the direction shown in the figure.
- Align dowel pin of crankshaft rear end with pin holes of each parts.
- Secure the crankshaft using a ring gear stopper.
- Tighten the installation bolts crosswise over several times.

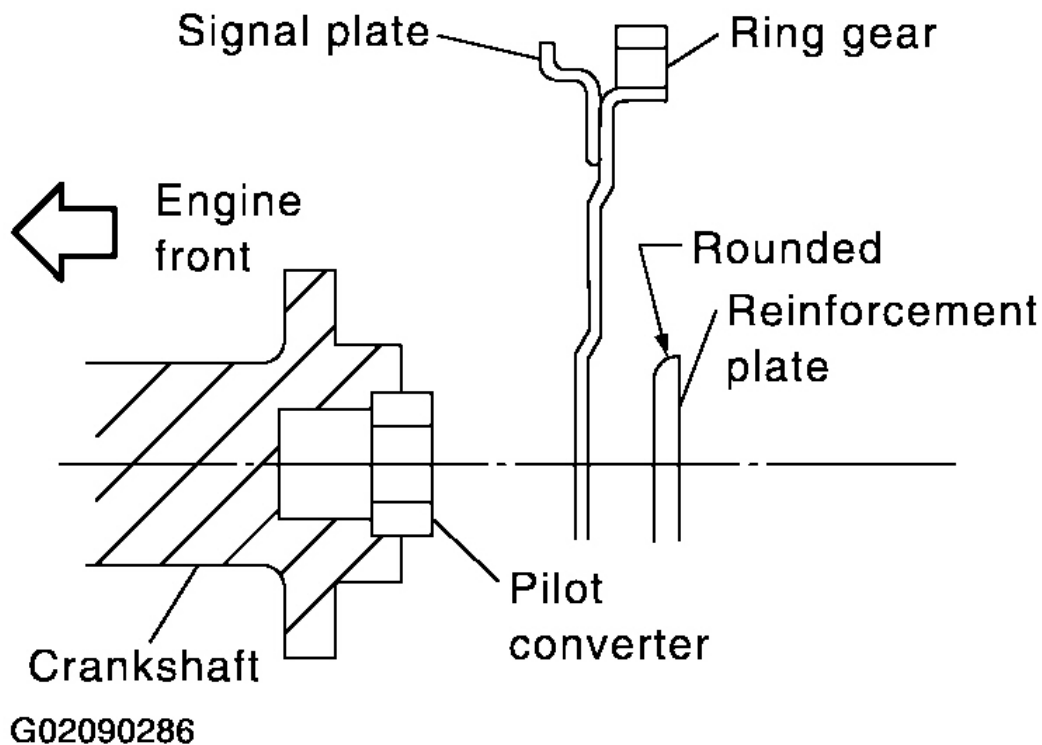


Fig. 282: Installing Drive Plate

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

SERVICE DATA AND SPECIFICATIONS (SDS)

GENERAL SPECIFICATIONS

General Specifications

Cylinder arrangement	V-6
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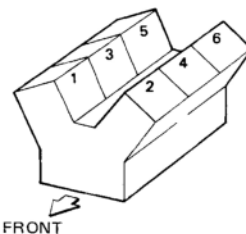
2003 Infiniti I35

2003 ENGINE Engine Mechanical - I35

Displacement cm ³ (cu in)		3,498 (213.45)
Bore and stroke mm (in)		95.5 x 81.4 (3.760 x 3.205)
Valve arrangement		DOHC
Firing order		1-2-3-4-5-6
Number of piston rings	Compression	2
	Oil	1
Number of main bearings		4
Compression ratio		10.3

COMPRESSION PRESSURE

Unit: kPa (kg/cm², psi)/300 rpm

Compression pressure	Standard	1,275 (13.0, 185)
	Minimum	981 (10.0, 142)
	Differential limit between cylinders	98 (1.0, 14)
Cylinder number	 FRONT	

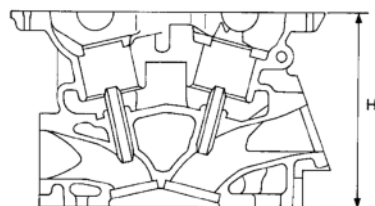
G02090288

Fig. 283: Identifying Cylinder Number
Courtesy of NISSAN MOTOR CO., U.S.A.

CYLINDER HEAD

Unit: mm (in)

	Standard	Limit
Head surface distortion	Less than 0.03 (0.0012)	0.1 (0.004)



Nominal cylinder head height:
H = 126.3 - 126.5 mm (4.972 - 4.980 in)

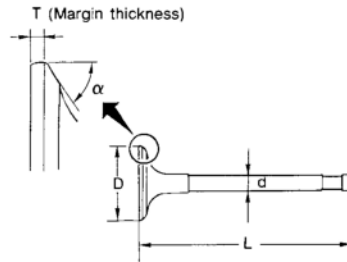
G02090289

Fig. 284: Measuring Cylinder Head Diameter

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

VALVE**VALVE**

Unit: mm (in)



Valve head diameter "D"	Intake	37.0 - 37.3 (1.4567 - 1.4685)
	Exhaust	31.2 - 31.5 (1.228 - 1.240)
Valve length "L"	Intake	96.12 - 96.62 (3.7842 - 3.8039)
	Exhaust	93.65 - 94.15 (3.6870 - 3.7067)
Valve stem diameter "d"	Intake	5.965 - 5.980 (0.2348 - 0.2354)
	Exhaust	5.955 - 5.970 (0.2344 - 0.2350)
Valve seat angle "α"	Intake	45°15' - 45°45'
	Exhaust	
Valve margin "T"	Intake	1.1 (0.043)
	Exhaust	1.3 (0.051)
Valve margin "T" limit		More than 0.5 (0.020)
Valve stem end surface grinding limit		Less than 0.2 (0.008)

G02090290

Fig. 285: Measuring Valve Head Diameter

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

VALVE CLEARANCE

Unit: mm (in)

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

*: Approximately 80°C (176°F)

G02090291

Fig. 286: Valve Clearances Specification

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

VALVE SPRING

2003 Infiniti I35

2003 ENGINE Engine Mechanical - I35

Free height	mm (in)	45.62 (1.7961)
Pressure	N (kg, lb) at height mm (in)	196 (20.0, 44.1) at 37.0 (1.457)
	Valve open	433 (44.2, 97.3) at 27.8 (1.094)
Out-of-square	mm (in)	Less than 2.0 (0.079)

G02090292

Fig. 287: Valve Specification

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

VALVE LIFTER

Unit: mm (in)

Valve lifter outer diameter	33.977 - 33.987 (1.3377 - 1.3381)
Lifter guide inner diameter	34.000 - 34.016 (1.3386 - 1.3392)
Clearance between lifter and lifter guide	0.013 - 0.039 (0.0005 - 0.0015)

G02090293

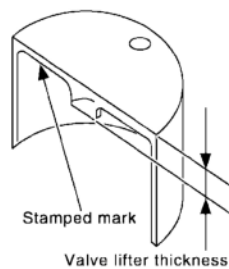
Fig. 288: Valve Lifter Specification

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

2003 Infiniti I35

2003 ENGINE Engine Mechanical - I35

Identification mark	Thickness mm (in)
788U or 788R	7.88 (0.3102)
790U or 790R	7.90 (0.3110)
792U or 792R	7.92 (0.3118)
794U or 794R	7.94 (0.3126)
796U or 796R	7.96 (0.3134)
798U or 798R	7.98 (0.3142)
800U or 800R	8.00 (0.3150)
802U or 802R	8.02 (0.3157)
804U or 804R	8.04 (0.3165)
806U or 806R	8.06 (0.3173)
808U or 808R	8.08 (0.3181)
810U or 810R	8.10 (0.3189)
812U or 812R	8.12 (0.3197)
814U or 814R	8.14 (0.3205)
816U or 816R	8.16 (0.3213)
818U or 818R	8.18 (0.3220)
820U or 820R	8.20 (0.3228)
822U or 822R	8.22 (0.3236)
824U or 824R	8.24 (0.3244)
826U or 826R	8.26 (0.3252)
828U or 828R	8.28 (0.3260)
830U or 830R	8.30 (0.3268)
832U or 832R	8.32 (0.3276)
834U or 834R	8.34 (0.3283)
836U or 836R	8.36 (0.3291)
838U or 838R	8.38 (0.3299)
840U or 840R	8.40 (0.3307)

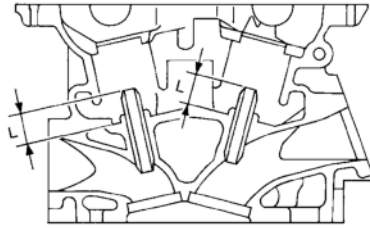


G02090294

Fig. 289: Measuring Valve Lifter Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

VALVE GUIDE

Unit: mm (in)



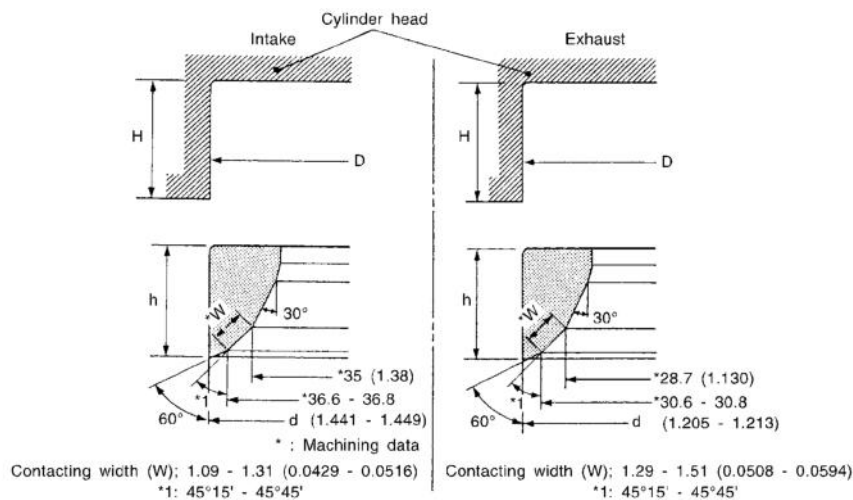
		Standard	Service
Valve guide	Outer diameter	10.023 - 10.034 (0.3946 - 0.3950)	10.223 - 10.234 (0.4025 - 0.4029)
Valve guide	Inner diameter (Finished size)	6.000 - 6.018 (0.2362 - 0.2369)	
Cylinder head valve guide hole diameter		9.975 - 9.996 (0.3927 - 0.3935)	10.175 - 10.196 (0.4006 - 0.4014)
Interference fit of valve guide		0.027 - 0.059 (0.0011 - 0.0023)	
		Standard	Max. tolerance
Stem to guide clearance	Intake	0.020 - 0.053 (0.0008 - 0.0021)	0.08 (0.0031)
	Exhaust	0.030 - 0.063 (0.0012 - 0.0025)	0.09 (0.0035)
Valve deflection limit	Intake	—	0.24 (0.0094)
	Exhaust	—	0.28 (0.0110)
Projection length "L"		12.6 - 12.8 (0.496 - 0.504)	

G02090295

Fig. 290: Measuring Valve Guide Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

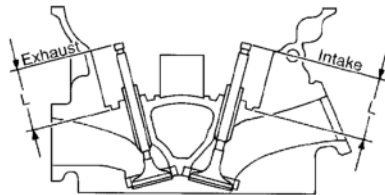
VALVE SEAT

Unit: mm (in)



G02090296

Fig. 291: Measuring Valve Seat Dimension (1 Of 2)
Courtesy of NISSAN MOTOR CO., U.S.A.



		Standard	Service
Cylinder head seat recess diameter (D)	Intake	38.000 - 38.016 (1.4961 - 1.4967)	38.500 - 38.516 (1.5157 - 1.5164)
	Exhaust	32.200 - 32.216 (1.2677 - 1.2683)	32.700 - 32.716 (1.2874 - 1.2880)
Valve seat interference fit	Intake	0.081 - 0.113 (0.0032 - 0.0044)	
	Exhaust	0.064 - 0.096 (0.0025 - 0.0038)	
Valve seat outer diameter (d)	Intake	38.097 - 38.113 (1.4999 - 1.5005)	38.597 - 38.613 (1.5196 - 1.5202)
	Exhaust	32.280 - 32.296 (1.2709 - 1.2715)	32.780 - 32.796 (1.2905 - 1.2912)
Height (h)	Intake	5.9 - 6.0 (0.232 - 0.236)	5.05 - 5.15 (0.1988 - 0.2028)
	Exhaust	5.9 - 6.0 (0.232 - 0.236)	4.95 - 5.05 (0.1949 - 0.1988)
Depth (H)		5.9 - 6.1 (0.232 - 0.240)	
Depth (L)	Intake	41.07 - 41.67 (1.6169 - 1.6405)	
	Exhaust	41.00 - 41.60 (1.6142 - 1.6378)	

G02090297

Fig. 292: Measuring Valve Seat Dimension (1 Of 2)
Courtesy of NISSAN MOTOR CO., U.S.A.

CAMSHAFT AND CAMSHAFT BEARING

Unit: mm (in)

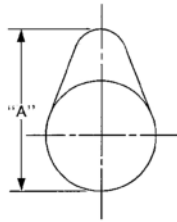
	Standard	Limit
Camshaft journal to bearing clearance	No. 1 0.045 - 0.086 (0.0018 - 0.0034)	0.15 (0.0059)
	No. 2, 3, 4 0.035 - 0.076 (0.0014 - 0.0030)	
Inner diameter of camshaft bearing	No. 1 26.000 - 26.021 (1.0236 - 1.0244)	—
	No. 2, 3, 4 23.500 - 23.521 (0.9252 - 0.9260)	
Outer diameter of camshaft journal	No. 1 25.935 - 25.955 (1.0211 - 1.0218)	—
	No. 2, 3, 4 23.445 - 23.465 (0.9230 - 0.9238)	
Camshaft runout [TIR*]	Less than 0.02 (0.0008)	0.05 (0.0020)
Camshaft sprocket runout [TIR*]	Less than 0.15 (0.0059)	—
Camshaft end play	0.115 - 0.188 (0.0045 - 0.0074)	0.24 (0.0094)

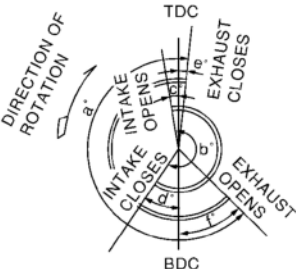
*: Total indicator reading

G02090298

Fig. 293: Camshaft And Camshaft Bearing Specification

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



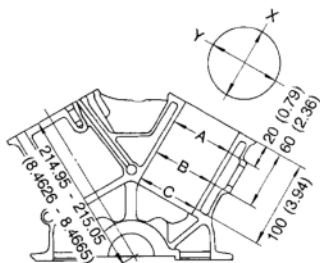
Cam height "A"	Intake and exhaust	44.865 - 45.055 (1.7663 - 1.7738)					
Wear limit of cam height		0.2 (0.008)					
Valve timing		 The diagram illustrates the valve timing on a camshaft. It shows two lobes: the intake lobe on the left and the exhaust lobe on the right. Key points are marked: 'a' for intake valve opening, 'a'' for intake valve closing, 'b' for exhaust valve opening, and 'b'' for exhaust valve closing. The top of the diagram is labeled 'TDC' (Top Dead Center) and the bottom is labeled 'BDC' (Bottom Dead Center). An arrow indicates the 'DIRECTION OF ROTATION' is clockwise. The text 'INTAKE OPENS', 'INTAKE CLOSES', 'EXHAUST OPENS', and 'EXHAUST CLOSES' are placed near their respective points on the lobes.					
Unit: degree							
		a	b	c	d	e	f
Intake valve timing control	OFF	240	238	-6	64	8	52

G02090299

Fig. 294: Camshaft And Camshaft Bearing Specification
 Courtesy of NISSAN MOTOR CO., U.S.A.

CYLINDER BLOCK

Unit: mm (in)



Surface flatness	Standard			Less than 0.03 (0.0012)
	Limit			0.10 (0.0039)
Cylinder bore	Inner diameter	Standard	Grade No. 1	95.500 - 95.510 (3.7598 - 3.7602)
			Grade No. 2	95.510 - 95.520 (3.7602 - 3.7606)
			Grade No. 3	95.520 - 95.530 (3.7606 - 3.7610)
		Wear limit		0.20 (0.0079)
Out-of-round (Difference between X and Y)				Less than 0.015 (0.0006)
Taper (Difference between A and C)				Less than 0.015 (0.0006)
Main journal inner diameter grade (Without bearing)	Grade No. A			63.993 - 63.994 (2.5194 - 2.5194)
	Grade No. B			63.994 - 63.995 (2.5194 - 2.5195)
	Grade No. C			63.995 - 63.996 (2.5195 - 2.5195)
	Grade No. D			63.996 - 63.997 (2.5195 - 2.5196)
	Grade No. E			63.997 - 63.998 (2.5196 - 2.5196)
	Grade No. F			63.998 - 63.999 (2.5196 - 2.5196)
	Grade No. G			63.999 - 64.000 (2.5196 - 2.5197)
	Grade No. H			64.000 - 64.001 (2.5197 - 2.5197)
	Grade No. J			64.001 - 64.002 (2.5197 - 2.5198)
	Grade No. K			64.002 - 64.003 (2.5198 - 2.5198)
	Grade No. L			64.003 - 64.004 (2.5198 - 2.5198)
	Grade No. M			64.004 - 64.005 (2.5198 - 2.5199)
	Grade No. N			64.005 - 64.006 (2.5199 - 2.5199)
	Grade No. P			64.006 - 64.007 (2.5199 - 2.5200)
	Grade No. R			64.007 - 64.008 (2.5200 - 2.5200)
	Grade No. S			64.008 - 64.009 (2.5200 - 2.5200)
	Grade No. T			64.009 - 64.010 (2.5200 - 2.5201)
	Grade No. U			64.010 - 64.011 (2.5201 - 2.5201)
	Grade No. V			64.011 - 64.012 (2.5201 - 2.5202)
	Grade No. W			64.012 - 64.013 (2.5202 - 2.5202)
	Grade No. X			64.013 - 64.014 (2.5202 - 2.5202)
	Grade No. Y			64.014 - 64.015 (2.5202 - 2.5203)
	Grade No. 4			64.015 - 64.016 (2.5203 - 2.5203)
	Grade No. 7			64.016 - 64.017 (2.5203 - 2.5203)
Difference in inner diameter between cylinders	Standard			Less than 0.03 (0.0012)

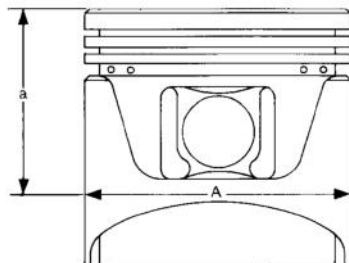
G02090300

Fig. 295: Measuring Cylinder Bore Inner Diameter
 Courtesy of NISSAN MOTOR CO., U.S.A.

PISTON, PISTON RING AND PISTON PIN

AVAILABLE PISTON

Unit: mm (in)



Piston skirt diameter "A"	Standard	Grade No. 1	95.480 - 95.490 (3.7590 - 3.7594)
		Grade No. 2	95.490 - 95.500 (3.7594 - 3.7598)
		Grade No. 3	95.500 - 95.510 (3.7598 - 3.7602)
		0.20 (0.0079) oversize (Service)	95.680 - 95.710 (3.7669 - 3.7681)
"a" dimension		41.0 (1.614)	
Piston pin hole diameter	Grade No. 0		21.993 - 21.999 (0.8659 - 0.8661)
	Grade No. 1		21.999 - 22.005 (0.8661 - 0.8663)
Piston clearance to cylinder block			0.010 - 0.030 (0.0004 - 0.0012)

G02090301

Fig. 296: Measuring Piston Skirt Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

PISTON RING

Unit: mm (in)

		Standard	Limit
Side clearance	Top	0.045 - 0.080 (0.0018 - 0.0031)	0.11 (0.0043)
	2nd	0.030 - 0.070 (0.0012 - 0.0028)	0.1 (0.004)
	Oil ring	0.065 - 0.135 (0.0026 - 0.0053)	—
End gap	Top	0.23 - 0.33 (0.0091 - 0.0130)	0.54 (0.0213)
	2nd	0.33 - 0.48 (0.0130 - 0.0189)	0.80 (0.0315)
	Oil (rail ring)	0.20 - 0.60 (0.0079 - 0.0236)	0.95 (0.0374)

G02090302

Fig. 297: Piston Ring Specification
Courtesy of NISSAN MOTOR CO., U.S.A.

PISTON PIN

2003 Infiniti I35

2003 ENGINE Engine Mechanical - I35

Unit: mm (in)

Piston pin outer diameter	Grade No. 0	21.989 - 21.995 (0.8657 - 0.8659)
	Grade No. 1	21.995 - 22.001 (0.8659 - 0.8662)
Interference fit of piston pin to piston		0.002 - 0.006 (0.0001 - 0.0002)
Piston pin to connecting rod bushing clearance	Standard	0.005 - 0.017 (0.0002 - 0.0007)
	Limit	0.030 (0.0012)

*: Values measured at ambient temperature of 20°C (68°F)

G02090303

Fig. 298: Piston Ring Specification

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

CONNECTING ROD

Unit: mm (in)

Center distance		144.15 - 144.25 (5.6752 - 5.6791)
Bend [per 100 (3.94)]	Limit	0.15 (0.0059)
Torsion [per 100 (3.94)]	Limit	0.30 (0.0118)
Connecting rod small end inner diameter		23.980 - 24.000 (0.9441 - 0.9449)
Piston pin bushing inner diameter*	Grade No. 0	22.000 - 22.006 (0.8661 - 0.8664)
	Grade No. 1	22.006 - 22.012 (0.8664 - 0.8666)
Connecting rod big end inner diameter		55.000 - 55.013 (2.1654 - 2.1659)
Side clearance	Standard	0.20 - 0.35 (0.0079 - 0.0138)
	Limit	0.40 (0.0157)

*: After installing in connecting rod

G02090304

Fig. 299: Connecting Rod Specification

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

CRANKSHAFT

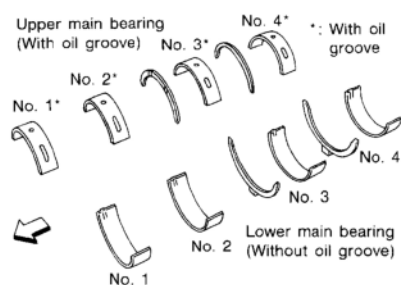
Unit: mm (in)

Main journal dia. "Dm" grade	Grade No. A	59.975 - 59.974 (2.3612 - 2.3612)
	Grade No. B	59.974 - 59.973 (2.3612 - 2.3611)
	Grade No. C	59.973 - 59.972 (2.3611 - 2.3611)
	Grade No. D	59.972 - 59.971 (2.3611 - 2.3611)
	Grade No. E	59.971 - 59.970 (2.3611 - 2.3610)
	Grade No. F	59.970 - 59.969 (2.3610 - 2.3610)
	Grade No. G	59.969 - 59.968 (2.3610 - 2.3609)
	Grade No. H	59.968 - 59.967 (2.3609 - 2.3609)
	Grade No. J	59.967 - 59.966 (2.3609 - 2.3609)
	Grade No. K	59.966 - 59.965 (2.3609 - 2.3608)
	Grade No. L	59.965 - 59.964 (2.3608 - 2.3608)
	Grade No. M	59.964 - 59.963 (2.3608 - 2.3607)
	Grade No. N	59.963 - 59.962 (2.3607 - 2.3607)
	Grade No. P	59.962 - 59.961 (2.3607 - 2.3607)
	Grade No. R	59.961 - 59.960 (2.3607 - 2.3606)
	Grade No. S	59.960 - 59.959 (2.3606 - 2.3606)
	Grade No. T	59.959 - 59.958 (2.3606 - 2.3605)
	Grade No. U	59.958 - 59.957 (2.3605 - 2.3605)
	Grade No. V	59.957 - 59.956 (2.3605 - 2.3605)
	Grade No. W	59.956 - 59.955 (2.3605 - 2.3604)
	Grade No. X	59.955 - 59.954 (2.3604 - 2.3604)
	Grade No. Y	59.954 - 59.953 (2.3604 - 2.3603)
	Grade No. 4	59.953 - 59.952 (2.3603 - 2.3603)
	Grade No. 7	59.952 - 59.951 (2.3603 - 2.3603)
Pin journal dia. "Dp"	Grade No. 0	51.968 - 51.974 (2.0460 - 2.0462)
	Grade No. 1	51.962 - 51.968 (2.0457 - 2.0460)
	Grade No. 2	51.956 - 51.962 (2.0445 - 2.0457)
Center distance "r"		40.36 - 40.44 (1.5890 - 1.5921)
Out-of-round (X - Y)	Standard	Less than 0.002 (0.0001)
Taper (A - B)	Standard	Less than 0.002 (0.0001)
Runout [TIR*]	Limit	Less than 0.10 (0.0039)
Free end play	Standard	0.10 - 0.25 (0.0039 - 0.0098)
	Limit	0.30 (0.0118)
		Out-of-round (X - Y) Taper (A - B)

*: Total indicator reading
G02090305

Fig. 300: Identifying Crankshaft Main Journal Diameter
Courtesy of NISSAN MOTOR CO., U.S.A.

AVAILABLE MAIN BEARING



Grade number		Thickness "T" mm (in)	Width "W" mm (in)	Identification color (UPR/LWR)	Remarks
0		2.000 - 2.003 (0.0787 - 0.0789)	19.9 - 20.1 (0.783 - 0.791)	Black	Grade is the same for upper and lower bearings.
1		2.003 - 2.006 (0.0789 - 0.0790)		Brown	
2		2.006 - 2.009 (0.0790 - 0.0791)		Green	
3		2.009 - 2.012 (0.0791 - 0.0792)		Yellow	
4		2.012 - 2.015 (0.0792 - 0.0793)		Blue	
5		2.015 - 2.018 (0.0793 - 0.0794)		Pink	
6		2.018 - 2.021 (0.0794 - 0.0796)		Purple	
7		2.021 - 2.024 (0.0796 - 0.0797)		White	
01	UPP	2.003 - 2.006 (0.0789 - 0.0790)		Brown/Black	Grade is different for upper and lower bearings.
	LWR	2.000 - 2.003 (0.0787 - 0.0789)			
12	UPR	2.006 - 2.009 (0.0790 - 0.0791)		Green/Brown	
	LWR	2.003 - 2.006 (0.0789 - 0.0790)			
23	UPR	2.009 - 2.012 (0.0791 - 0.0792)		Yellow/Green	
	LWR	2.006 - 2.009 (0.0790 - 0.0791)			
34	UPR	2.012 - 2.015 (0.0792 - 0.0793)		Blue/Yellow	
	LWR	2.009 - 2.012 (0.0791 - 0.0792)			
45	UPR	2.015 - 2.018 (0.0793 - 0.0794)		Pink/Blue	
	LWR	2.012 - 2.015 (0.0792 - 0.0793)			
56	UPR	2.018 - 2.021 (0.0794 - 0.0796)		Purple/Pink	
	LWR	2.015 - 2.018 (0.0793 - 0.0794)			
67	UPR	2.021 - 2.024 (0.0796 - 0.0797)		White/Purple	
	LWR	2.018 - 2.021 (0.0794 - 0.0796)			

G02090306

Fig. 301: Identifying Main Bearing
 Courtesy of NISSAN MOTOR CO., U.S.A.

UNDERSIZE

Unit: mm (in)

	Thickness	Main journal diameter "Dm"
0.25 (0.0098)	2.132 - 2.140 (0.0839 - 0.0843)	Grind so that bearing clearance is the specified value.

G02090307

Fig. 302: Undersize Thickness Specification

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

AVAILABLE CONNECTING ROD BEARING

CONNECTING ROD BEARING

Grade number	Thickness "T" mm (in)	Identification color (mark)
0	1.500 - 1.503 (0.0591 - 0.0592)	Black
1	1.503 - 1.506 (0.0592 - 0.0593)	Brown
2	1.506 - 1.509 (0.0593 - 0.0594)	Green

G02090308

Fig. 303: Connecting Rod Bearing Specification

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

UNDERSIZE

Unit: mm (in)

	Thickness	Crank pin journal diameter "Dp"
0.25 (0.0098)	1.626 - 1.634 (0.0640 - 0.0643)	Grind so that bearing clearance is the specified value.

G02090309

Fig. 304: Undersize Thickness Specification

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

MISCELLANEOUS COMPONENTS

Unit: mm (in)

Drive plate runout [TIR]*	Less than 0.15 (0.0059)
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*: Total indicator reading

G02090310

Fig. 305: Miscellaneous Components Specification

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

BEARING CLEARANCE

Unit: mm (in)

Main bearing clearance	Standard	0.035 - 0.045 (0.0014 - 0.0018)
	Limit	0.065 (0.0026)
Connecting rod bearing clearance	Standard	0.034 - 0.059 (0.0013 - 0.0023)
	Limit	0.070 (0.0028)

G02090311

Fig. 306: Bearing Clearance Specification
Courtesy of NISSAN MOTOR CO., U.S.A.