ENGINE MECHANICAL

SECTION EM

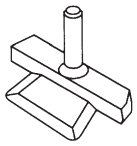
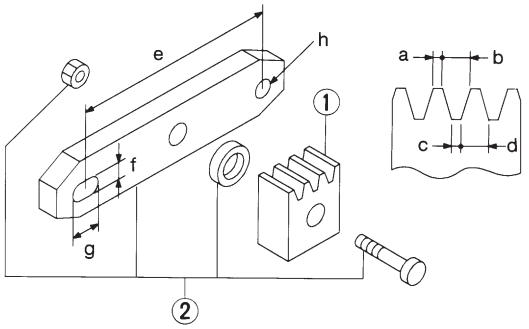
MODIFICATION NOTICE:

- Engine mounting parts have been modified.
- Models with three way catalyst have been introduced for the Middle East.
- TB48DE engine has been introduced for Europe.

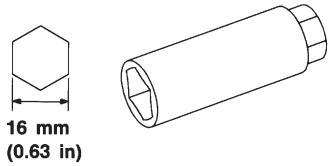
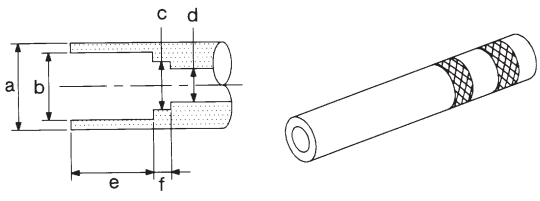
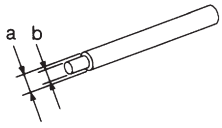
CONTENTS

TB48DE

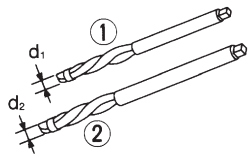
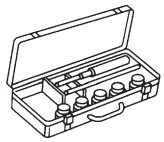
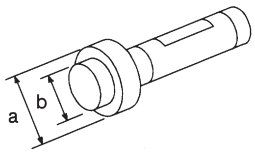
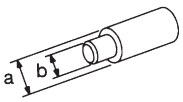
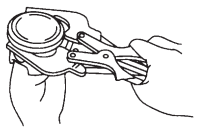
Special Service Tools

Tool number Tool name	Description	
KV10111100 Seal cutter	 NT046	Removing steel oil pan and timing chain case
KV101056S0 Ring gear stopper 1 KV10105630 Adapter 2 KV10105610 Plate	 NT617	Preventing crankshaft from rotating **a: 3 (0.12)** **b: 6.4 (0.252)** **c: 2.8 (0.110)** **d: 6.6 (0.260)** **e: 107 (4.21)** **f: 14 (0.55)** **g: 20 (0.79)** **h: 14 (0.55) dia.** Unit: mm (in)

Commercial Service Tools

Tool name	Description	
Spark plug wrench	 NT047	Removing and installing spark plug
Valve oil seal drift	 NT602	Installing valve oil seal **a: 25 (0.98) dia.** **b: 14.4 (0.567) dia.** **c: 11.8 (0.465) dia.** **d: 10 (0.39)** **e: 11 (0.43)** **f: 9 (0.35)** Unit: mm (in)
Valve guide drift	 NT015	Removing and installing valve guide **Intake & Exhaust** **a = 10 mm (0.39 in) dia.** **b = 6.5 mm (0.256 in) dia.**

Commercial Service Tools (Cont'd)

Tool name	Description	
Valve guide reamer	 NT016	Reaming valve guide ① or hole for oversize valve guide ② **Intake & Exhaust** **d_1 = 7.000 mm (0.2756 in) dia.** **d_2 = 11.19 mm (0.4406 in) dia.**
Valve seat cutter set	 NT048	Finishing valve seat dimensions
Front oil seal drift	 NT049	Installing front oil seal **a = 80 mm (3.15 in) dia.** **b = 58 mm (2.28 in) dia.**
Piston pin drift	 NT074	Removing and installing piston pin **a = 22.5 mm (0.886 in) dia.** **b = 12.5 mm (0.492 in) dia.**
Piston ring expander	 NT030	Removing and installing piston ring

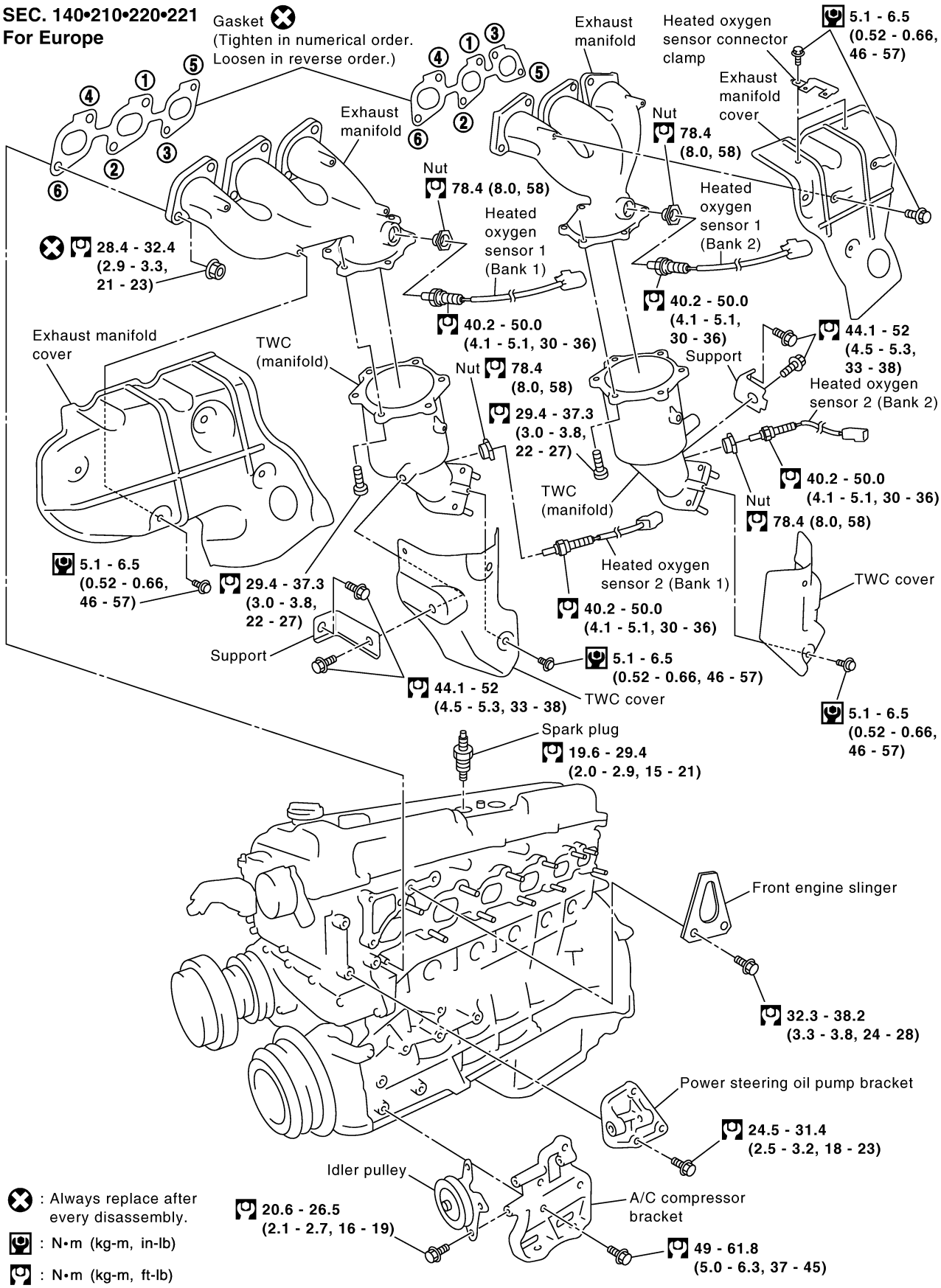
NVH Troubleshooting Chart — Engine Noise

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.

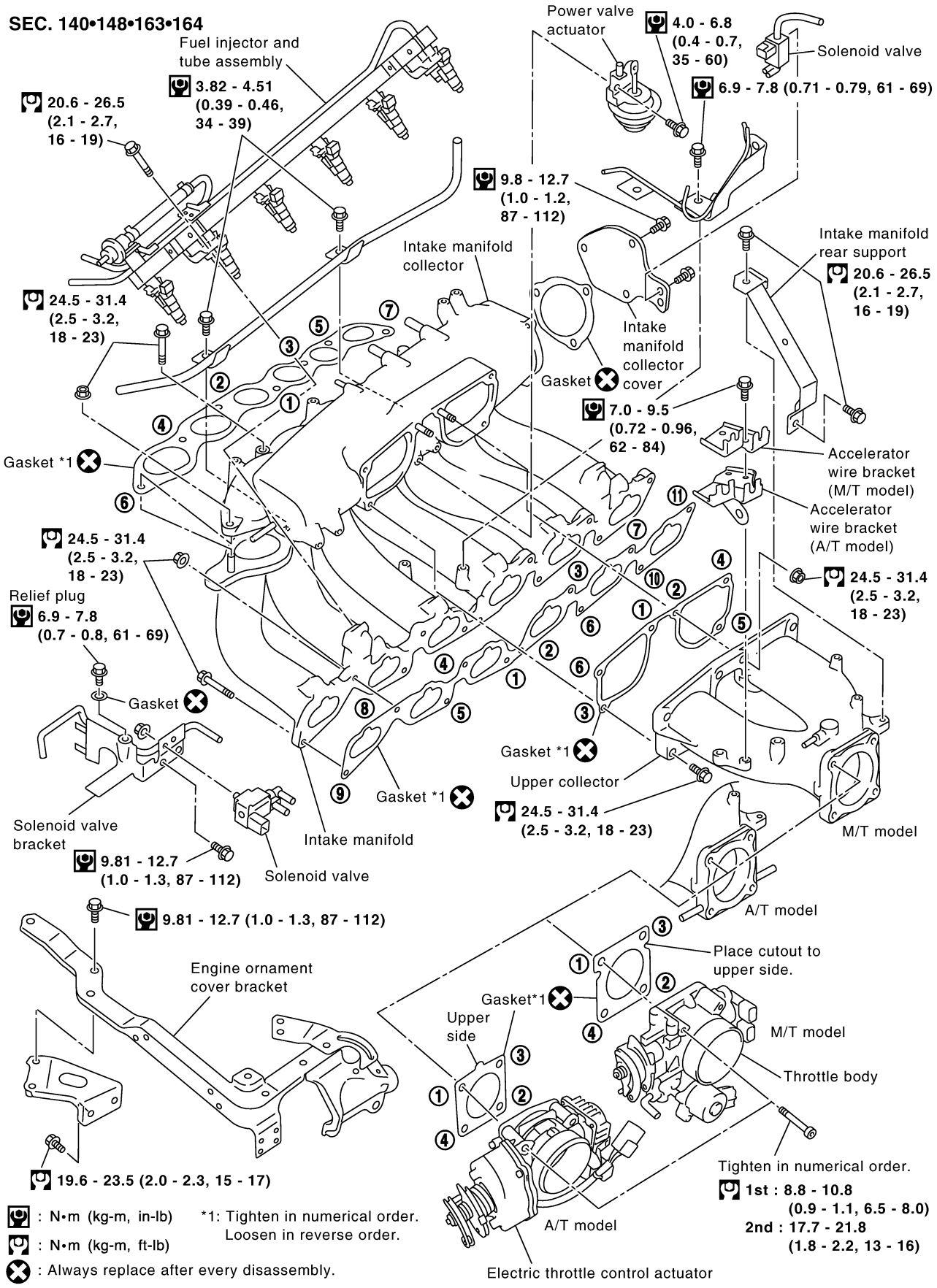
If necessary, repair or replace these parts.

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-35
	Rattle	C	A	—	A	B	C	Camshaft bearing noise	Camshaft journal clearance Camshaft runout	EM-30
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-46, 51
	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-46, 47
	Knock	A	B	C	B	B	B	Connecting rod bearing noise	Connecting rod bushing clearance (Small end) Connecting rod bearing clearance (Big end)	EM-50, 51
	Knock	A	B	—	A	B	C	Main bearing noise	Main bearing oil clearance Crankshaft runout	EM-49
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-15, 19
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


SEC. 140•210•220•221
For Europe
Gasket
(Tighten in numerical order.
Loosen in reverse order.)
Exhaust manifold
Heated oxygen sensor connector clamp
5.1 - 6.5 (0.52 - 0.66, 46 - 57)
Exhaust manifold cover
Nut
78.4 (8.0, 58)
Heated oxygen sensor 1 (Bank 2)
28.4 - 32.4 (2.9 - 3.3, 21 - 23)
Heated oxygen sensor 1 (Bank 1)
40.2 - 50.0 (4.1 - 5.1, 30 - 36)
44.1 - 52 (4.5 - 5.3, 33 - 38)
Support
Heated oxygen sensor 2 (Bank 2)
TWC (manifold)
29.4 - 37.3 (3.0 - 3.8, 22 - 27)
TWC cover
Heated oxygen sensor 2 (Bank 1)
Spark plug
19.6 - 29.4 (2.0 - 2.9, 15 - 21)
Front engine slinger
32.3 - 38.2 (3.3 - 3.8, 24 - 28)
Power steering oil pump bracket
24.5 - 31.4 (2.5 - 3.2, 18 - 23)
Idler pulley
A/C compressor bracket
20.6 - 26.5 (2.1 - 2.7, 16 - 19)
49 - 61.8 (5.0 - 6.3, 37 - 45)
: Always replace after every disassembly.
: N•m (kg-m, in-lb)
: N•m (kg-m, ft-lb)

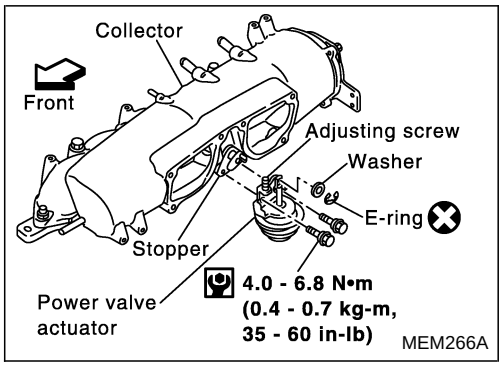
SEM018H


SEC. 140•148•163•164
Fuel injector and tube assembly
3.82 - 4.51 (0.39 - 0.46, 34 - 39)
20.6 - 26.5 (2.1 - 2.7, 16 - 19)
24.5 - 31.4 (2.5 - 3.2, 18 - 23)
Gasket *1
24.5 - 31.4 (2.5 - 3.2, 18 - 23)
Relief plug
6.9 - 7.8 (0.7 - 0.8, 61 - 69)
Gasket
Solenoid valve bracket
9.81 - 12.7 (1.0 - 1.3, 87 - 112)
Solenoid valve
Intake manifold
Gasket *1
Power valve actuator
4.0 - 6.8 (0.4 - 0.7, 35 - 60)
Solenoid valve
6.9 - 7.8 (0.71 - 0.79, 61 - 69)
9.8 - 12.7 (1.0 - 1.2, 87 - 112)
Intake manifold collector
Intake manifold rear support
20.6 - 26.5 (2.1 - 2.7, 16 - 19)
Gasket
Intake manifold collector cover
7.0 - 9.5 (0.72 - 0.96, 62 - 84)
Accelerator wire bracket (M/T model)
Accelerator wire bracket (A/T model)
24.5 - 31.4 (2.5 - 3.2, 18 - 23)
Gasket *1
Upper collector
24.5 - 31.4 (2.5 - 3.2, 18 - 23)
M/T model
A/T model
Place cutout to upper side.
Gasket*1
Upper side
M/T model
Throttle body
Tighten in numerical order.
1st : 8.8 - 10.8 (0.9 - 1.1, 6.5 - 8.0)
2nd : 17.7 - 21.8 (1.8 - 2.2, 13 - 16)
A/T model
Electric throttle control actuator
9.81 - 12.7 (1.0 - 1.3, 87 - 112)
Engine ornament cover bracket
19.6 - 23.5 (2.0 - 2.3, 15 - 17)
: N•m (kg-m, in-lb)
: N•m (kg-m, ft-lb)
: Always replace after every disassembly.
*1: Tighten in numerical order. Loosen in reverse order.

SEM044H

CAUTION:

- **Be careful not to damage heated oxygen sensor.**
- **Discard any heated oxygen sensor which has been dropped from a height of more than 0.5 m (19.7 in) onto a hard surface such as a concrete floor; use a new one.**
- **Perform procedures for "Throttle Valve Closed Position Learning" whenever harness connector of electric throttle control actuator is disconnected. Refer to BASIC SERVICE PROCEDURE in EC section.**
- **If electric throttle control actuator is replaced, perform procedures for "Idle Air Volume Learning" after finishing repairs. Refer to BASIC SERVICE PROCEDURE, in EC section.**



DISASSEMBLY

1. Remove washer and E-ring.
2. Remove actuator assembly.
3. Disconnect shaft lever from actuator rod.

ASSEMBLY

1. Connect shaft lever with actuator rod.
2. Install actuator assembly with stopper.
3. Install washer and E-ring.

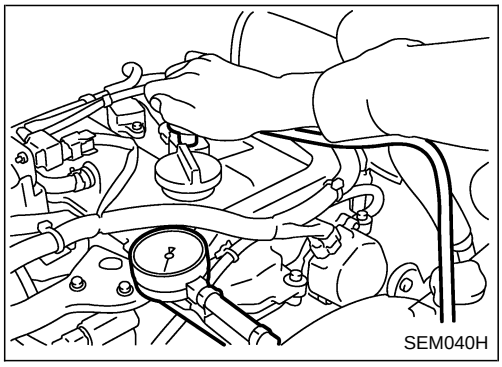
- **Use a new E-ring.**

ADJUSTMENT

1. Apply vacuum pressure of 33.3 to 40.0 kPa (333 to 400 mbar, 250 to 300 mmHg, 9.84 to 11.81 inHg) to the actuator.
2. Loosen adjusting screw until it is separated from the lever.
3. Screw in adjusting screw until it contacts the shaft lever, and then screw it in two turns ±45°.
4. Apply vacuum pressure of 40.0±13.3 kPa (400±133 mbar, 300±100 mmHg, 11.81±3.94 inHg) to the actuator. Switch on and off power valve to check more than three times if the valve operates smoothly with no play or looseness.

Measurement of Compression Pressure

1. Warm up engine.
2. Turn ignition switch OFF.
3. Release fuel pressure.
   Refer to “Releasing Fuel Pressure” in EC section.
4. Disconnect ignition coil harness connector.
5. Remove air intake duct, upper collector, throttle body (or electric throttle control actuator), ignition coil and all spark plugs.


SEM040H

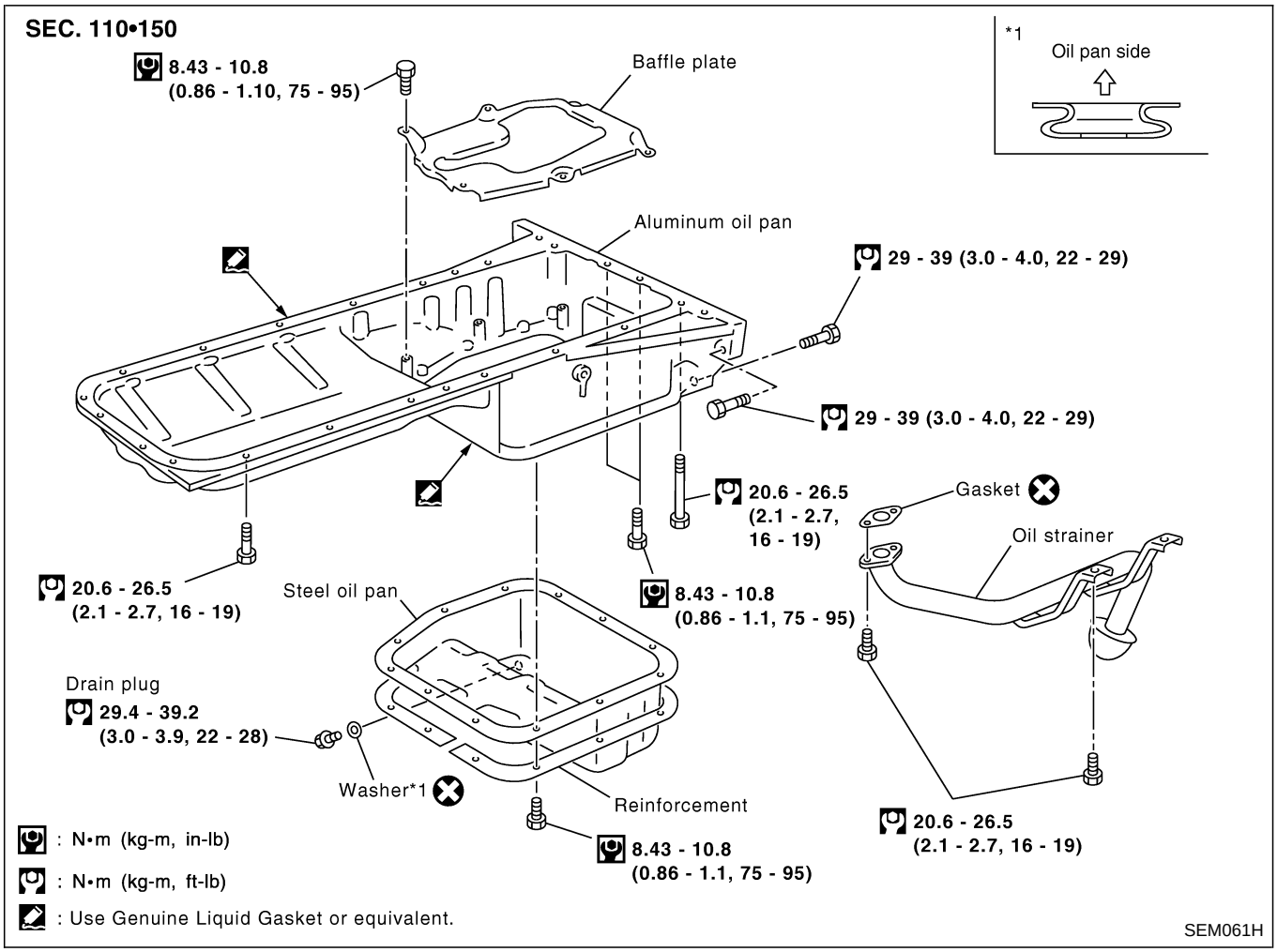
6. Attach a compression tester to No. 1 cylinder.
7. Crank the engine and record the highest gauge indication.
8. Repeat the measurement on each cylinder as shown below.

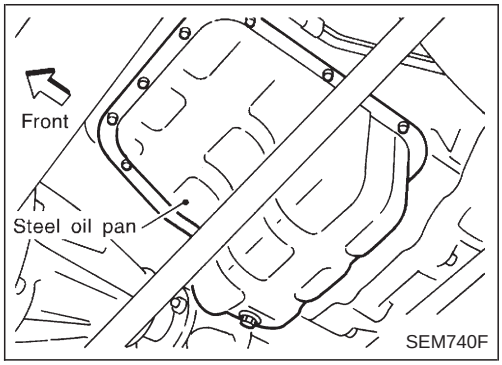
- **Always use a fully-charged battery to obtain specified engine revolution.**

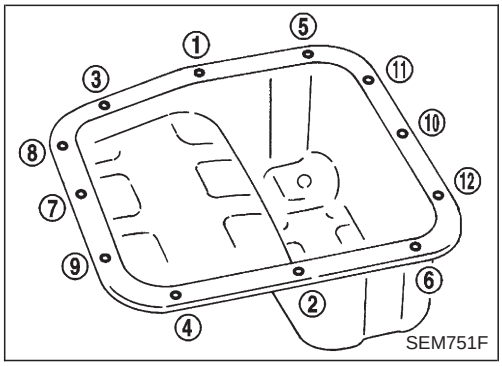
Compression pressure: kPa (bar, kg/cm^2, psi)/rpm
Standard
1,226 (12.26, 12.5, 178)/200
Minimum
1,030 (10.30, 10.5, 149)/200
Difference limit between cylinders:
98 (0.98, 1.0, 14)/200

9. If cylinder compression in one or more cylinders is low, pour a small amount of engine oil into cylinders through the spark plug holes and retest compression.

- **If adding oil helps the 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 SDS.) If valve or valve seat is damaged excessively, replace them.**
- **If compression in any two adjacent cylinders is low and if adding oil does not help the compression, there is leakage past the gasket surface. If so, replace cylinder head gasket.**



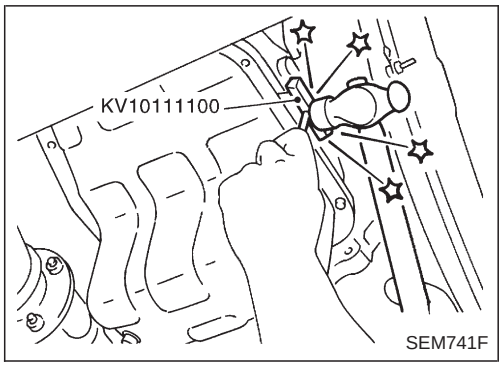




Removal

1. Remove engine undercover.
2. Drain engine oil.
3. Remove steel oil pan bolts.
- Loosen steel oil pan bolts in reverse order.

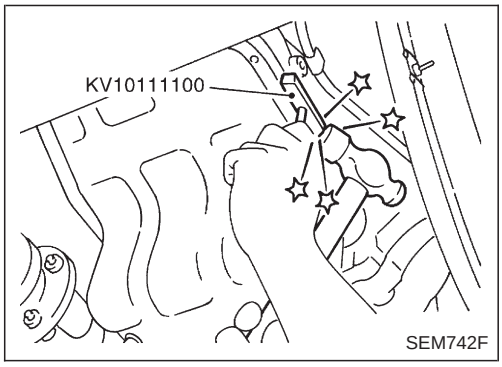
Removal (Cont'd)



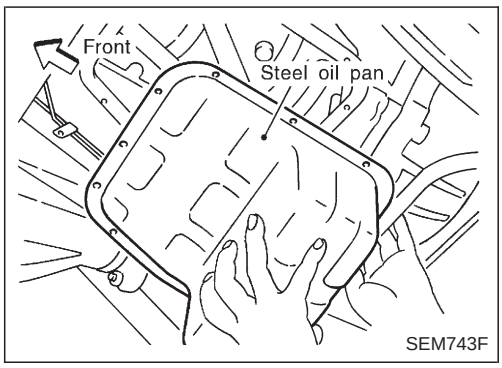
4. Remove steel oil pan.

a. Insert SST between aluminum oil pan and steel oil pan.

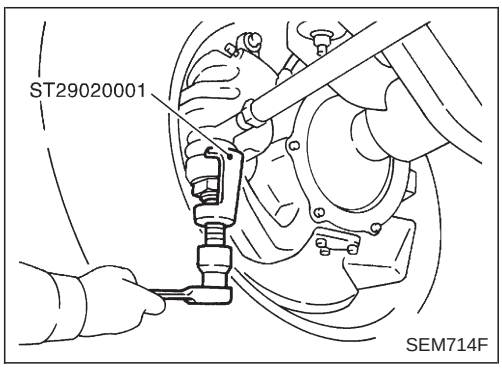
- **Be careful not to damage aluminum mating surface.**
- **Do not insert screwdriver, or oil pan flange will be deformed.**



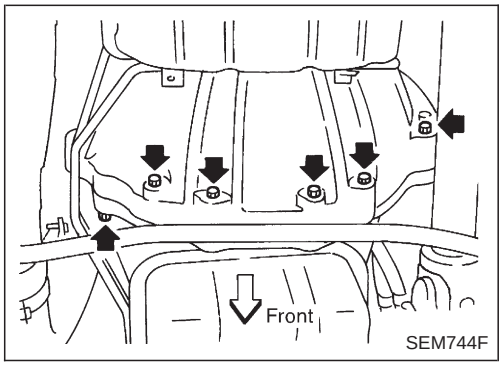
b. Slide SST by tapping on the side of the SST with a hammer.



5. Remove steel oil pan.

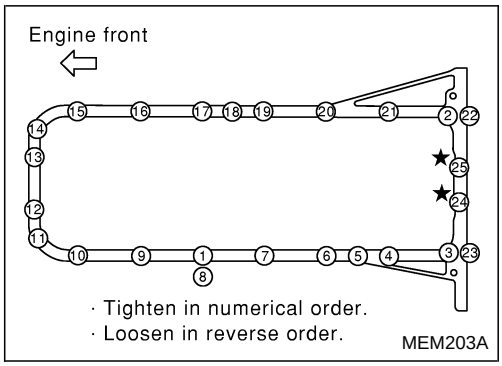


6. Disconnect left side of the tie rod end.
   Refer to "STEERING LINKAGE" in ST section.

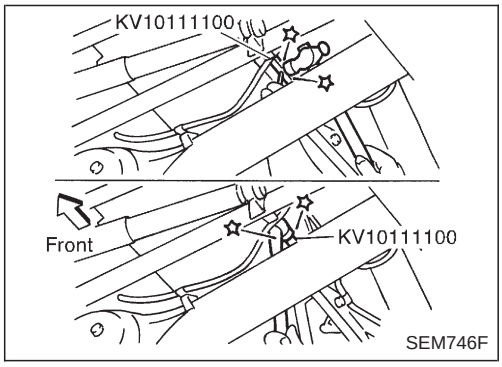


7. Remove transmission bolts.

Removal (Cont'd)



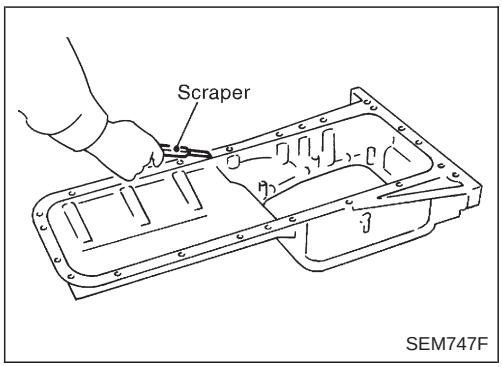
8. Remove aluminum oil pan bolts.
- Loosen aluminum oil pan bolts in reverse order.



9. Remove aluminum oil pan using SST.
- **Be careful not to damage aluminum mating surface.**
- **Do not insert screwdriver, or oil pan flange will be deformed.**

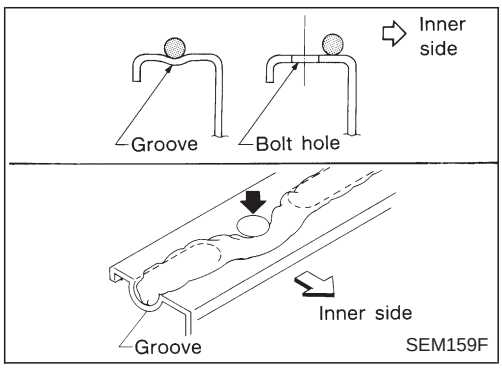
10. Remove oil strainer.

Installation

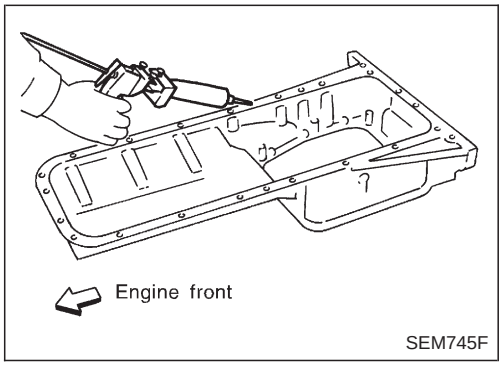


1. Install oil strainer.
2. Install aluminum oil pan.

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

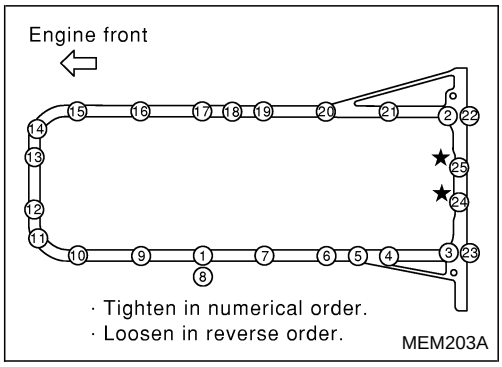


b. Apply a continuous bead of liquid gasket to mating surface of aluminum oil pan.
- **Use Genuine Liquid Gasket or equivalent.**



c. Apply liquid gasket to inner sealing surface as shown in figure.
- **Be sure liquid gasket is 3.5 to 4.5 mm (0.138 to 0.177 in) in diameter.**
- **Attaching should be done within 5 minutes after coating.**

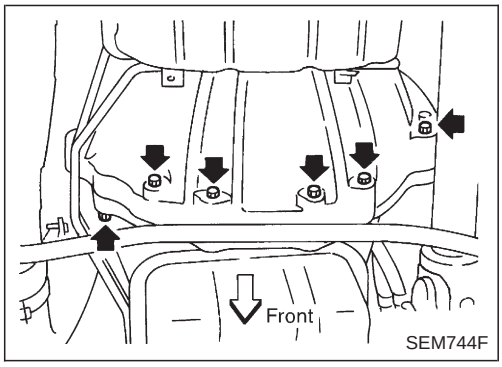
Installation (Cont'd)



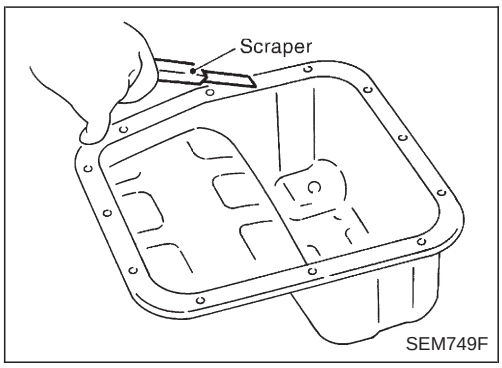
d. Install aluminum oil pan.
- Apply liquid gasket to the shank of the bolts marked with ★.
- Use Genuine Liquid Gasket or equivalent.
- Tightening should be done within 5 minutes after coating.
- Tighten bolts in numerical order.

Tightening torque:

★: 8.43 - 10.8 N·m (0.86 - 1.1 kg-m, 75 - 95 in-lb)
Others: 20.6 - 26.5 N·m (2.1 - 2.7 kg-m, 16 - 19 ft-lb)

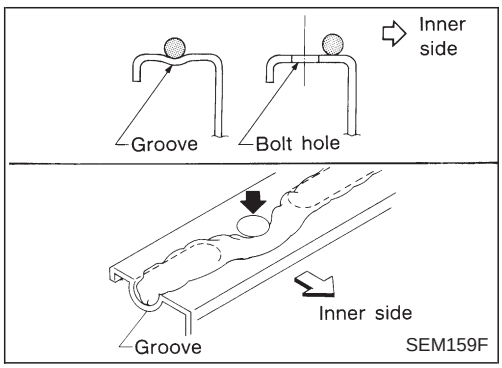


3. Install the transmission bolts. Refer to Service Manual NISSAN Y61 SUPPLEMENT-V 1st Revision (Publication No. SM1E-Y61EG1), AT-199.

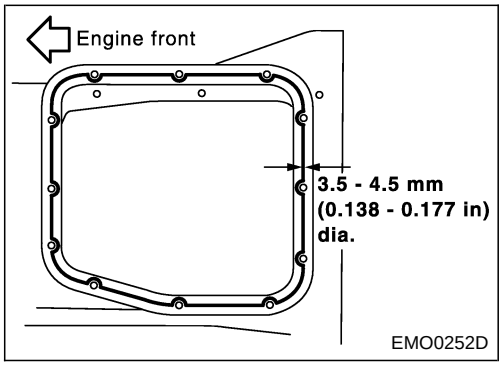


4. Install steel oil pan.

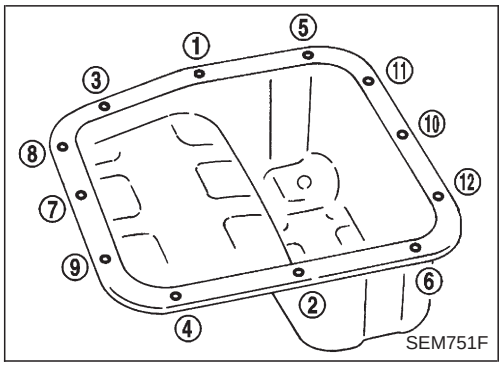
a. Use a scraper to remove all traces of liquid gasket from mating surfaces.
- Also remove traces of liquid gasket from mating surface of aluminum oil pan.



b. Apply a continuous bead of liquid gasket to mating surface of aluminum oil pan.
- **Use Genuine Liquid Gasket or equivalent.**
- **Be sure liquid gasket is 3.5 to 4.5 mm (0.138 to 0.177 in) in diameter.**
- **Attaching should be done within 5 minutes after coating.**



Installation (Cont'd)

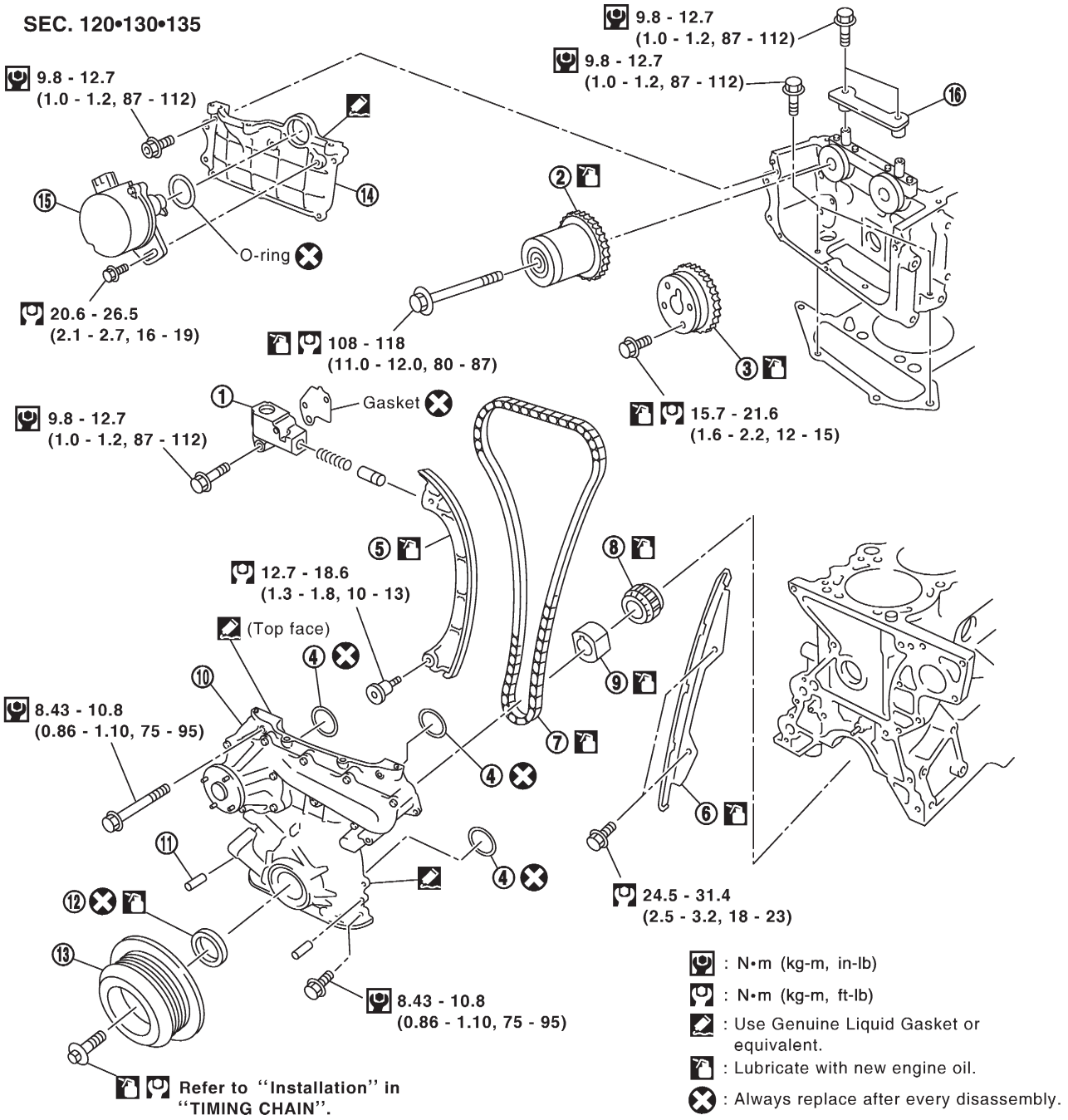


c. Install steel oil pan.
- **Tighten in numerical order as shown in the figure.**
- **Wait at least 30 minutes before refilling engine oil.**

4. Connect left side of the tie rod end.
   Refer to "STEERING LINKAGE" in ST section.
5. Install in reverse order of removal for remaining steps paying attention to the following.

- After refilling engine oil, check engine oil level.
- Start engine and check that there is no leakage of engine oil.

Components



SEM062H

1. Chain tensioner
2. Camshaft sprocket (Intake)
3. Camshaft sprocket (Exhaust)
4. O-ring
5. Timing chain slack guide
6. Timing chain tension guide
7. Timing chain
8. Crankshaft sprocket
9. Oil pump drive spacer
10. Front cover
11. Dowel pin
12. Front oil seal
13. Crankshaft pulley
14. Cylinder head front cover
15. Camshaft position sensor
16. Chain guide

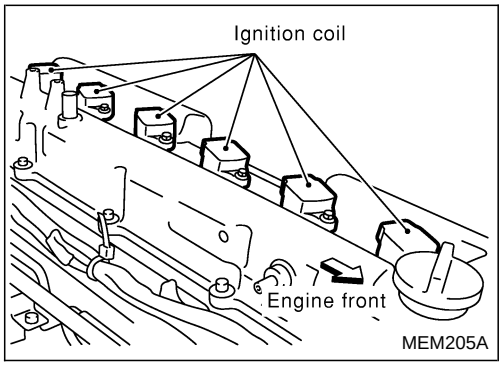
Components (Cont'd)

CAUTION

- **After removing timing chain, do not turn and camshaft separately, or valves will strike piston heads.**
- **When installing chain tensioner, oil seats, or other sliding parts, lubricate contacting surfaces with new engine oil.**
- **Apply new engine oil to bolt threads and seat surfaces when installing camshaft sprocket and crankshaft pulley.**
- **When removing oil pump assembly, remove camshaft position sensor (PHASE), then remove timing chain from engine.**
- **Be careful not to damage sensor edges.**

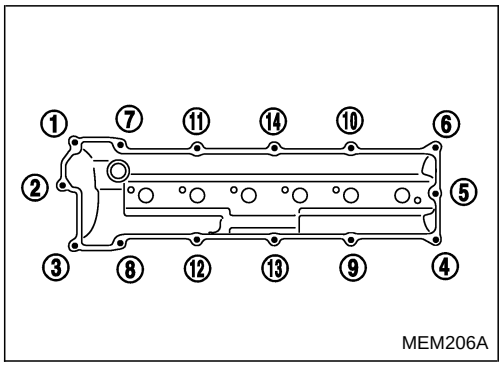
Removal

1. Remove engine undercover.
2. Drain engine oil.
3. Drain engine coolant from radiator.
   Be careful not to spill engine coolant on drive belts.
4. Remove radiator and radiator shroud.
   Refer to "Radiator" in LC section.
5. Release fuel pressure.
   Refer to "Fuel Pressure Release" in EC section.
6. Remove the following belts.
   - A/C compressor drive belt
   - Power steering oil pump drive belt
   - Alternator drive belt
7. Remove fan coupling with fan.
8. Remove power steering oil pump and power steering oil pump bracket.
9. Remove A/C compressor idler pulley.
10. Remove alternator and alternator bracket.
11. Remove oil pans. Refer to EM-13, "Removal" of OIL PAN. (Publication No. SM1E-Y61EG0)
12. Remove air duct from intake manifold collector.

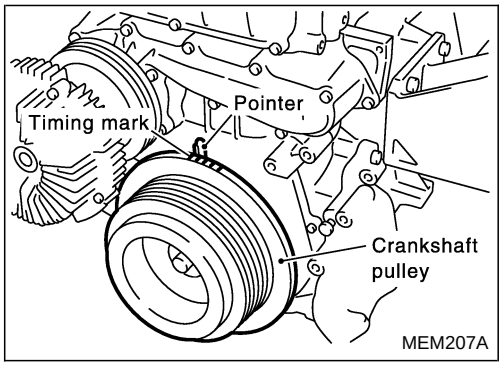


13. Remove vacuum hoses, fuel hoses, and so on.
14. Remove ignition coils.
15. Remove spark plugs.

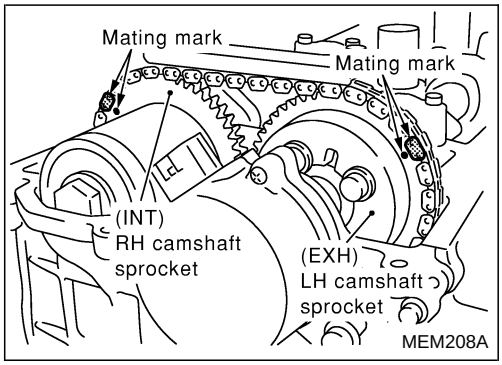
Removal (Cont'd)



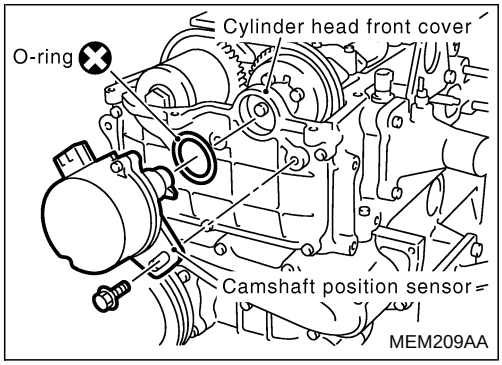
16. Remove rocker cover bolts in numerical order as shown in the figure.



17. Set No. 1 piston at TDC on its compression stroke.

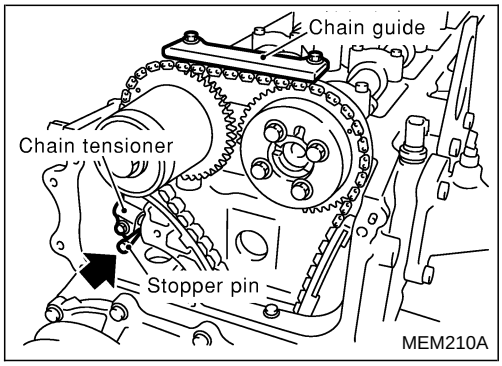


- **Rotate crankshaft until mating mark on camshaft sprocket is set at position indicated in figure.**



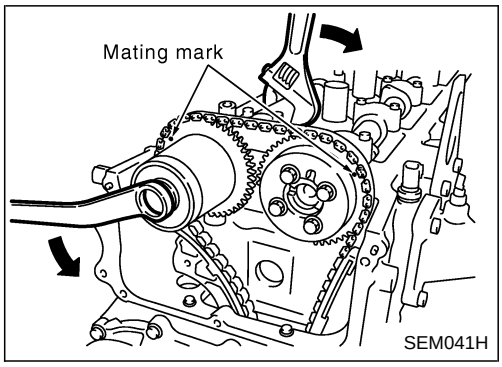
18. Remove camshaft position sensor.
- **Do not allow any magnetic materials to contact the camshaft position sensor.**
- **Be careful not to drop or damage sensor.**

19. Remove cylinder head front cover using Seal cutter [SST: KV10111100].



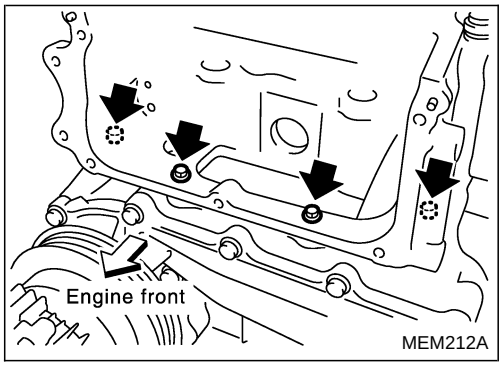
20. Remove timing chain guide from camshaft bracket.
21. Attach a suitable stopper pin to chain tensioner to hold plunger at its compressed position.
22. Remove chain tensioner.

Removal (Cont'd)

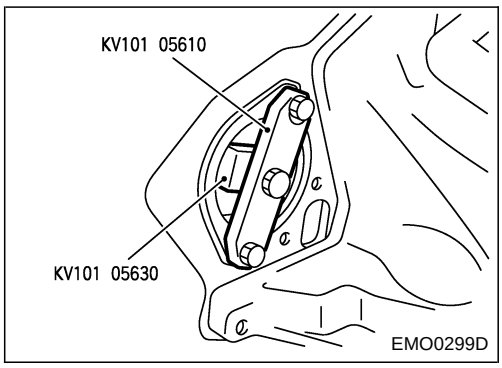


23. Loosen camshaft sprocket bolts holding camshaft at hexagonal area.
- **Apply paint to timing chain and cam sprockets for alignment during installation.**

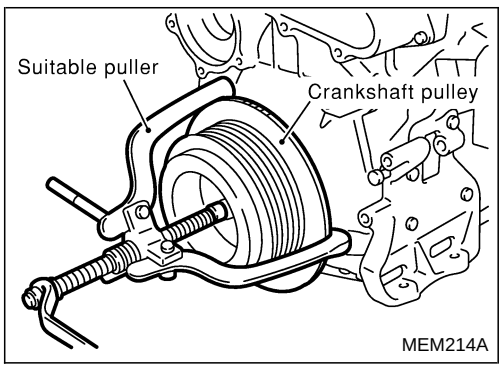
24. Remove camshaft sprockets.



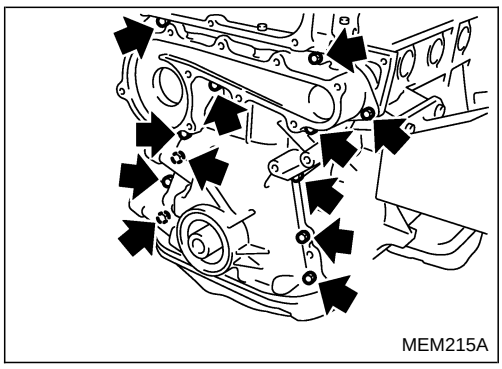
25. Remove front cover bolts at cylinder head front side.



26. Remove starter motor, and set ring gear stopper (SST) using mounting bolt holes of starter motor.

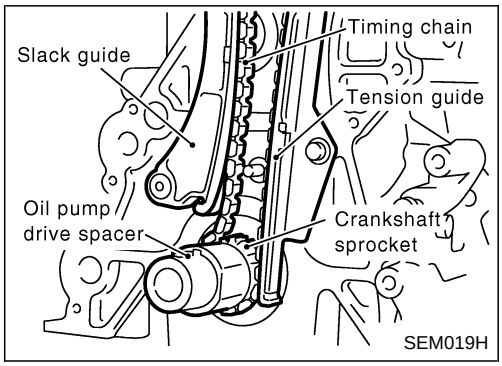


27. Loosen crankshaft pulley bolt.
28. Remove crankshaft pulley with a suitable puller.

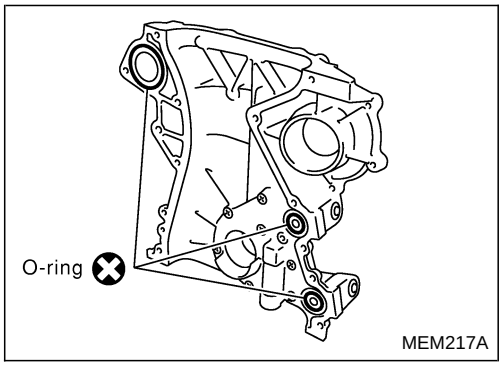


29. Remove water pump pulley and water pump. Refer to LC-13, "Water Pump" (Publication No. SM1E-Y61EG1).
30. Remove front cover bolts as shown.
31. Remove front cover carefully using Seal cutter [SST: KV10111100].
- **Be careful not to damage or bend front end of cylinder head gasket.**
- **If cylinder head gasket is damaged, replace it with a new one.**

Removal (Cont'd)



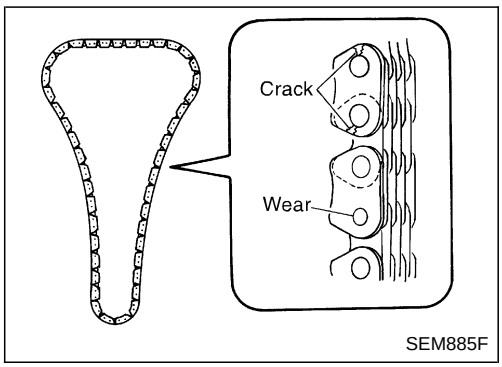
32. Remove timing chain.
33. Remove oil pump drive spacer.
34. Remove tension guide and slack guide.
35. Remove crankshaft sprocket.



36. Remove O-rings from front cover.

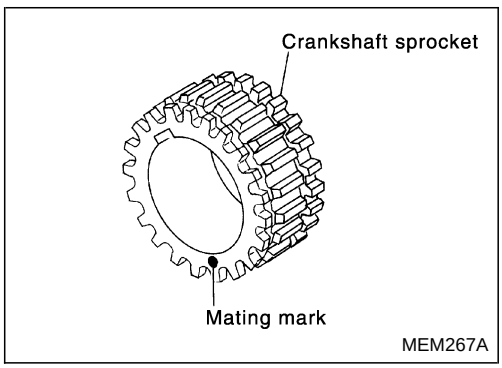
Inspection

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

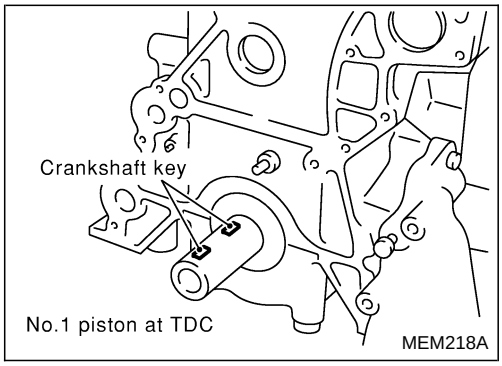


Installation

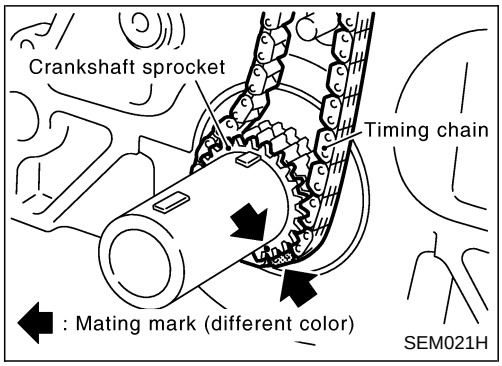
1. Install crankshaft sprocket on crankshaft.
- **There is no installation direction.**



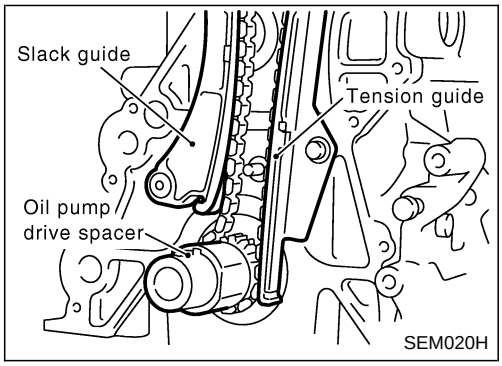
2. Position crankshaft so that No. 1 piston is at TDC and key way is at 12 o'clock.



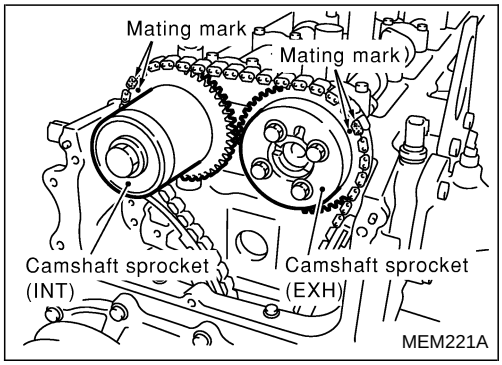
Installation (Cont'd)



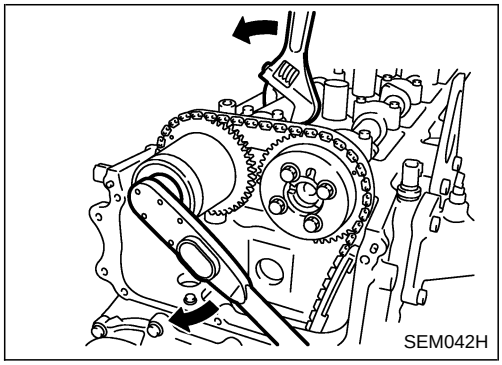
3. Install timing chain on crankshaft sprocket.
- **Support chain with a suitable tool to keep the mating mark aligned.**



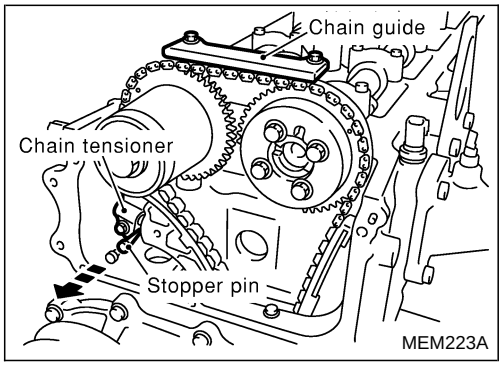
4. Install timing chain slack guide and timing chain tension guide.



5. Install camshaft sprocket.
- **Set timing chain by aligning mating marks with those of camshaft sprockets.**

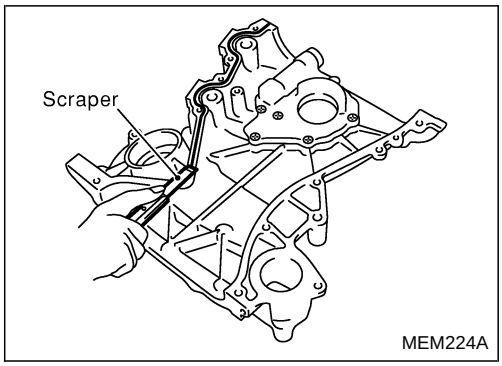


6. Install camshaft sprocket bolts and tighten them to specified torque holding camshaft at hexagonal area.
- **Apply new engine oil to bolt threads and seat surface.**

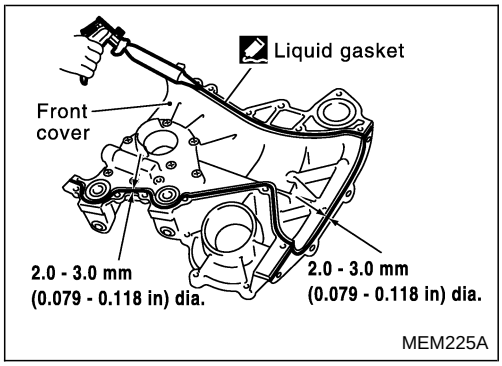


7. Install chain tensioner.
- **Before installing chain tensioner, insert a suitable pin into pin hole of chain tensioner to keep plunger compressed.**
- **After installing chain tensioner, remove the pin to release plunger.**
8. Install timing chain guide to camshaft bracket.

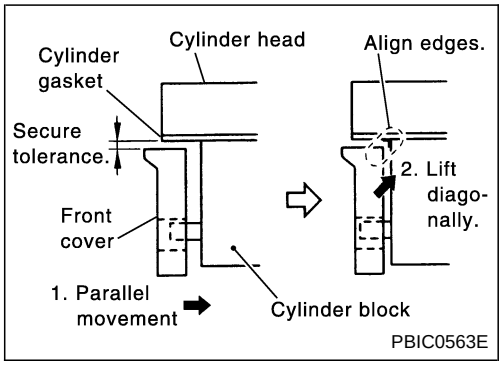
Installation (Cont'd)



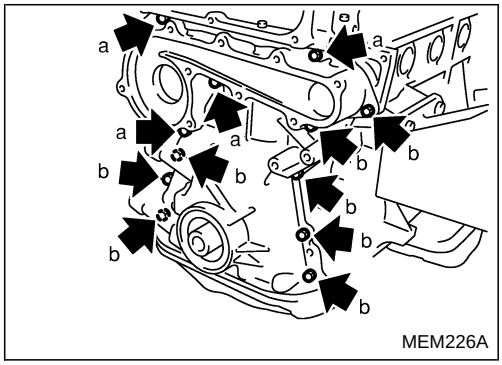
9. Replace front oil seal with new one, and remove all traces of liquid gasket from mating surface using a scraper.
- Also remove traces of liquid gasket from mating surface of cylinder block.
- For front oil seal replacement, refer to "FRONT OIL SEAL", EM-24.



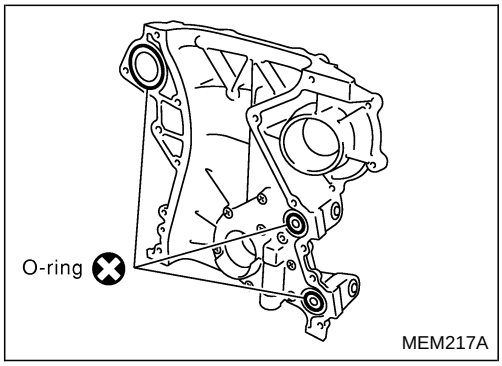
10. Apply a continuous bead of liquid gasket to mating surface of front cover.
- **Use Genuine Liquid Gasket or equivalent.**
- **Attaching should be done within 5 minutes after coating.**



11. Install front cover.
- **Lift front cover at an angle and install it to mounting position so that front cover will come in contact with both cylinder head gasket lower surface and cylinder block front surface at the same time.**
- **Be careful not to damage cylinder head gasket.**

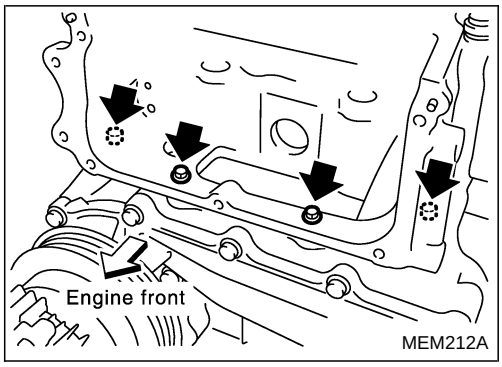


Bolt No.	Tightening torque N·m (kg-m, in-lb)	Bolt length mm (in)
a.	6.9 - 9.5 (0.70 - 0.97, 61 - 84)	45 (1.77)
b.		16 (0.63)

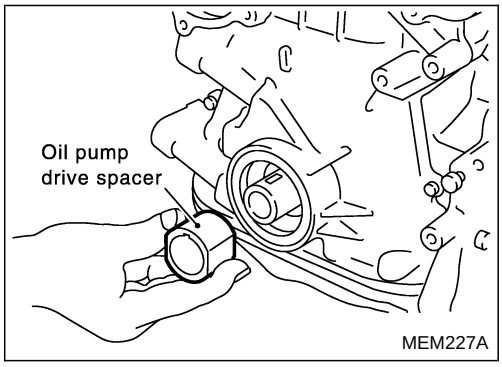


- **Make sure three O-rings are present and new ones.**
- **Be careful not to damage oil seal when installing front cover.**

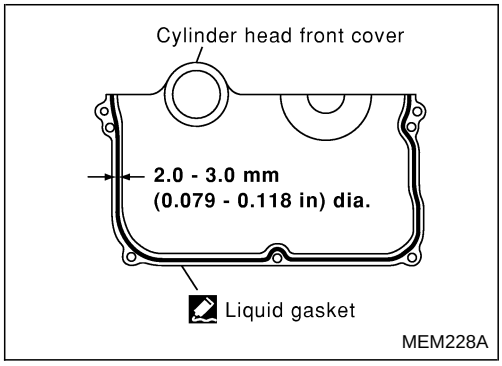
Installation (Cont'd)



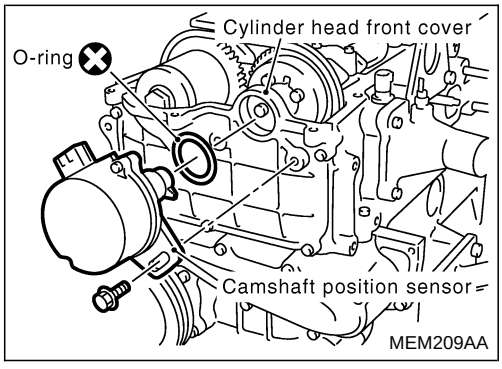
12. Install front cover bolts at cylinder head front side.



13. Install oil pump drive spacer.
14. Install water pump and water pump pulley.
    Refer to "Water Pump" in LC section.
15. Install idler pulley and bracket.
16. Install oil pan. Refer to EM-15, "Installation" (Publication No. SM1E-Y61EG0).
17. Install crankshaft pulley.
- **Tightening procedure**
  - **a. Tighten bolt to 54.0 to 63.8 N·m (5.5 to 6.5 kg-m, 39.8 to 47.0 ft-lb).**
  - **b. Turn bolt 120 to 125 degrees clockwise using marks provided on bolt flange.**
    Turning for one mark equals 120 degrees.
18. Remove ring gear stopper.
19. Install starter motor.

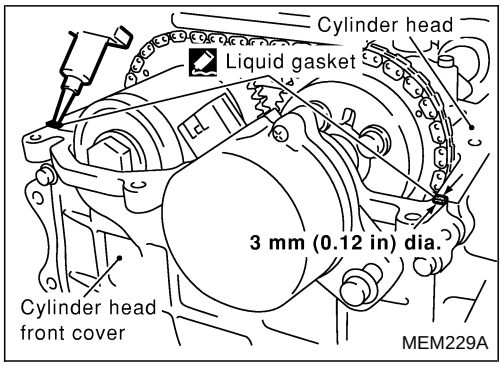


20. Install cylinder head front cover.
- **Apply liquid gasket to cylinder head front cover.**
- **Use Genuine Liquid Gasket or equivalent.**

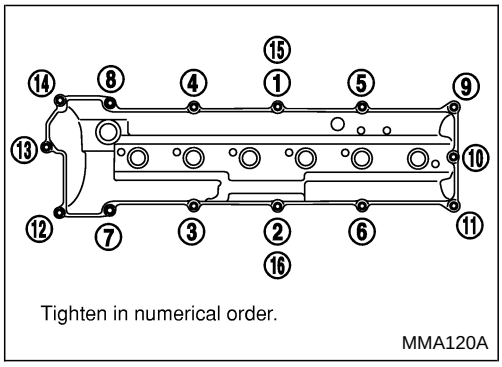


21. Install camshaft position sensor with new O-ring.

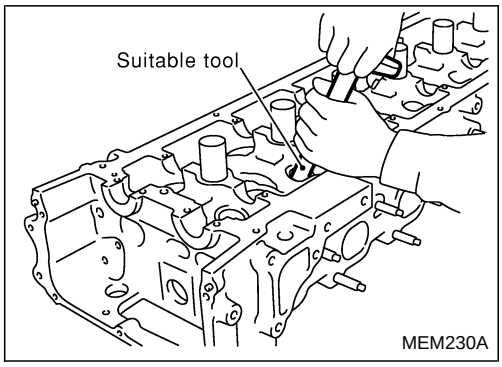
Installation (Cont'd)



22. Before installing rocker cover, apply a continuous bead of liquid gasket to mating surface of cylinder head.
- **Use Genuine Liquid Gasket or equivalent.**



23. Install rocker cover with new rocker cover gasket and tighten bolts in numerical order as shown in the figure.
24. Install spark plugs.
25. Install ignition coils.
26. Install alternator and alternator bracket.
27. Install power steering oil pump and power steering oil pump bracket.
28. Install fan coupling with fan.
29. Drive belts.
    For adjusting drive belt deflection, refer to "Checking Drive Belts" in MA section.
30. Reinstall parts in reverse order of removal.

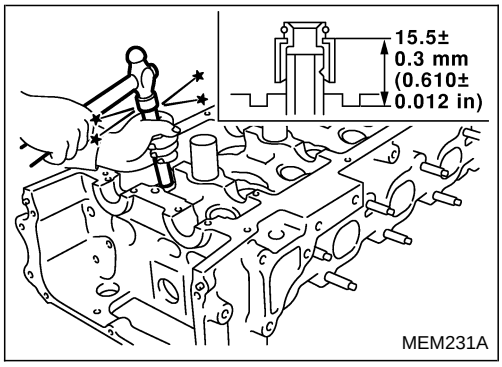


Replacement

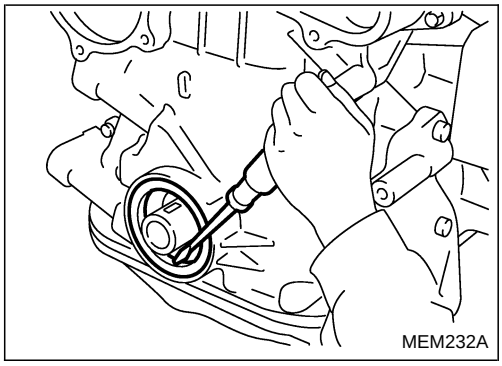
VALVE OIL SEAL

1. Remove rocker cover.
2. Remove camshaft.
3. Remove valve spring. Refer to “Removal”, EM-31 (Publication No. SM1E-Y61EG1).
4. Remove valve oil seal with suitable tool.

Piston concerned should be set at TDC to prevent valve from falling.



5. Apply new engine oil to new valve oil seal, and install it with [SST: KV10116300] to dimension as shown.



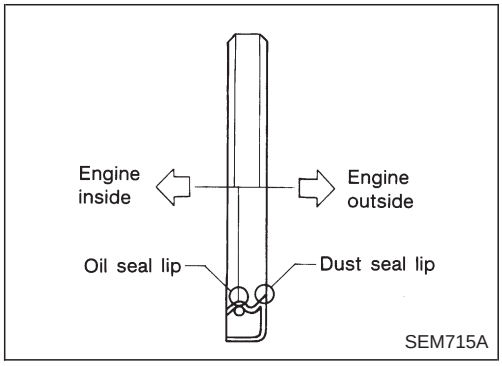
FRONT OIL SEAL

1. Remove the following parts:

- Engine under cover
- Radiator and radiator shroud: Refer to “Radiator” in LC section.
- Drive belts and cooling fan
- Crankshaft pulley and oil pump drive spacer: Refer to “TIMING CHAIN”, EM-15.

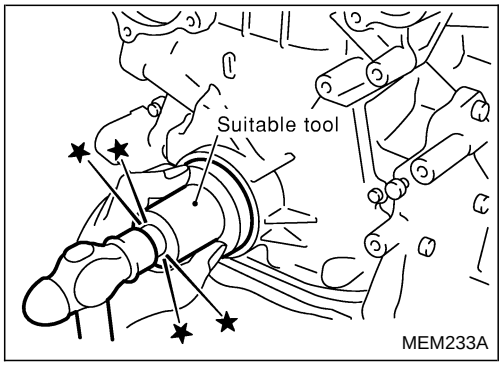
2. Remove front oil seal from front cover.

- **Be careful not to scratch front cover.**



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

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

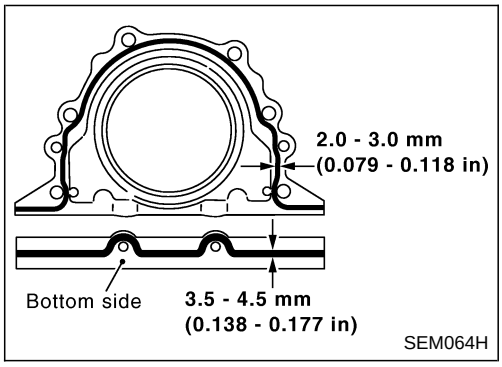


Replacement (Cont'd)

REAR OIL SEAL

1. Separate clutch assembly or automatic transmission. Refer to "REMOVAL AND INSTALLATION" in MT or AT section.
2. Remove flywheel or drive plate.
3. Remove bolts fixing from both rear and bottom sides.
4. Remove rear oil seal retainer assembly using Seal cutter [SST: KV10111100].
5. Remove traces of liquid gasket from mating surface of cylinder block and oil pan using scraper.

- **Replace oil seal and retainer assembly as a single unit.**



6. Apply a continuous bead of liquid gasket to mating surfaces of rear oil seal retainer (both for cylinder block and oil pan sides).

- **Use Genuine Liquid Gasket or equivalent.**

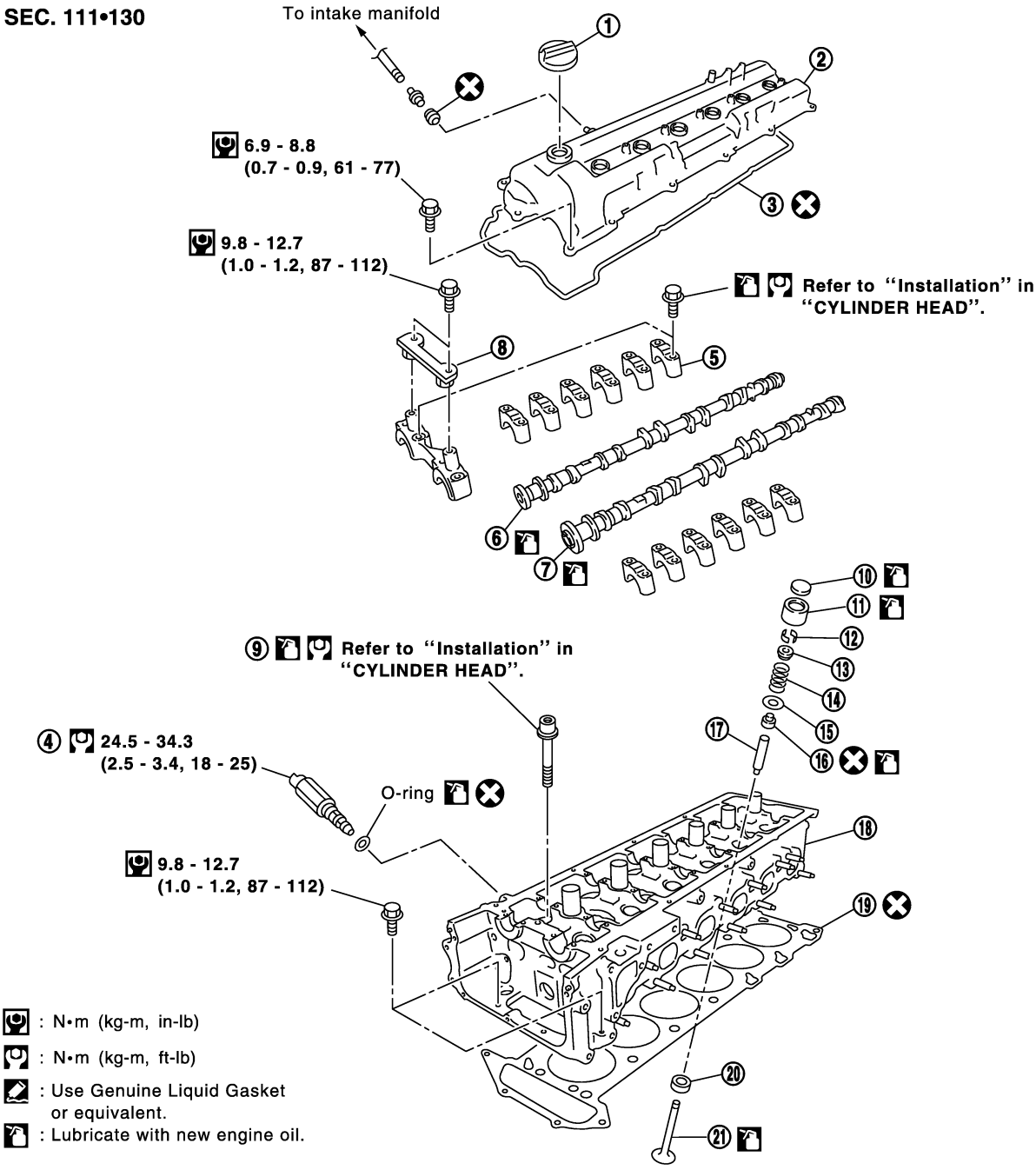
a. Coat of liquid gasket should be maintained within 2.0 to 3.0 mm (0.079 to 0.118 in) and 3.5 to 4.5 mm (0.138 - 0.177 in) dia. range.

b. Attach oil seal retainer to cylinder block within 5 minutes after coating.

c. Wait at least 30 minutes before refilling engine oil or starting engine.

Components

SEC. 111•130



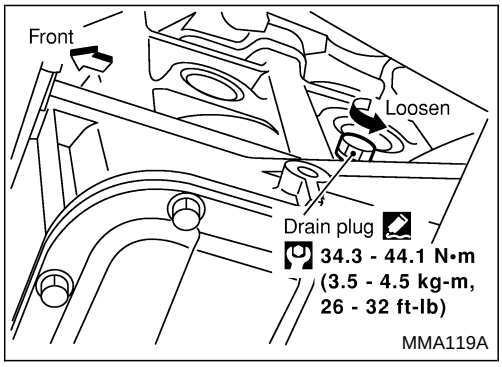
MEM234A

1. Oil filler cap
2. Rocker cover
3. Rocker cover gasket
4. Intake valve timing control solenoid valve (If so equipped)
5. Camshaft bracket
6. Intake camshaft
7. Exhaust camshaft
8. Timing chain guide
9. Cylinder head bolt
10. Shim
11. Valve lifter
12. Valve cotter
13. Valve spring retainer
14. Valve spring
15. Valve spring seat
16. Valve oil seal
17. Valve guide
18. Cylinder head
19. Cylinder head gasket
20. Valve seat
21. Valve

Components (Cont'd)

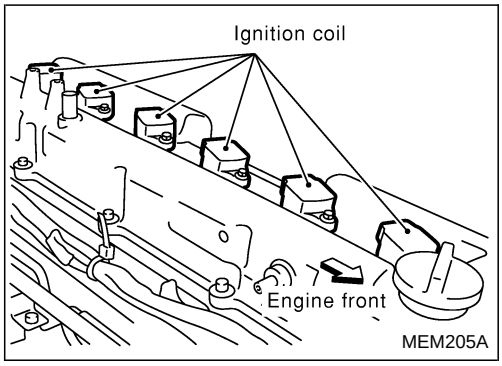
CAUTION

- **When installing camshaft, lubricate contacting surfaces with new engine oil.**
- **When tightening cylinder head bolts, camshaft sprocket bolts and camshaft bracket bolts, lubricate bolt threads and seat surfaces with new engine oil.**
- **Attach tags to valve lifters so as not to mix them up.**
- **Be careful not to damage heated oxygen sensor.**
- **Discard any heated oxygen sensor which has been dropped from a height of more than 0.5 m (19.7 in) onto a hard surface such as a concrete floor; use a new one.**

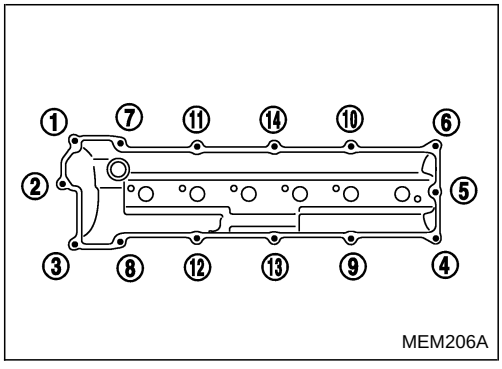


Removal

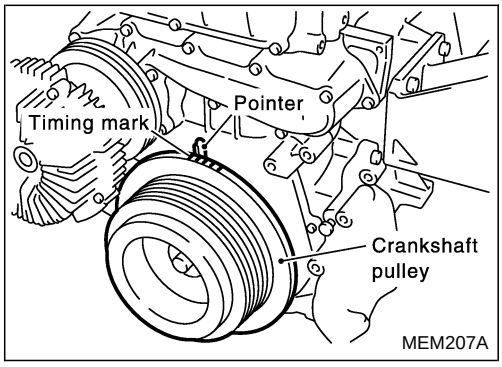
1. Remove engine undercovers.
2. Drain engine coolant from radiator and cylinder block.
   Be careful not to spill coolant on drive belts.
3. Release fuel pressure.
   Refer to "Fuel Pressure Release" in EC section.
4. Remove drive belts.
5. Remove air duct to intake manifold collector.
6. Remove front exhaust tube.



7. Disconnect vacuum hoses, fuel hoses, water hoses, wires, harness, connectors and so on.
8. Remove intake manifold.
9. Disconnect heated oxygen sensor connectors. (Except for the Middle East)
10. Remove exhaust manifold.
11. Remove ignition coils.
12. Remove spark plugs.

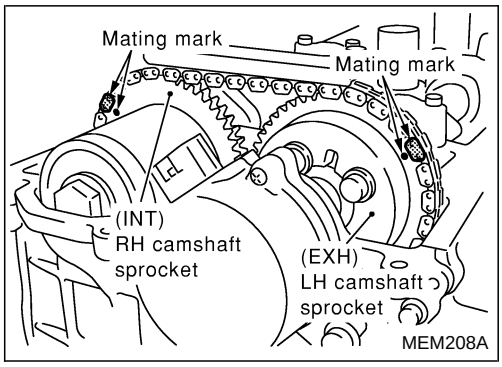


13. Remove rocker cover bolts in numerical order as shown in the figure.

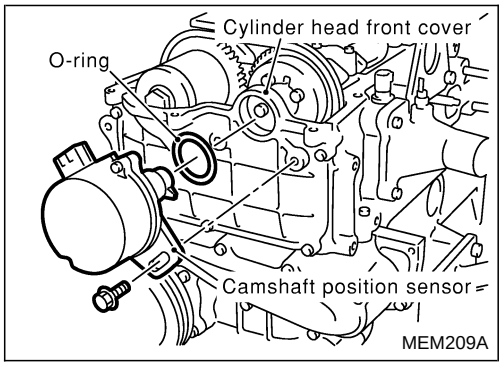


14. Set No. 1 piston at TDC on its compression stroke.

Removal (Cont'd)

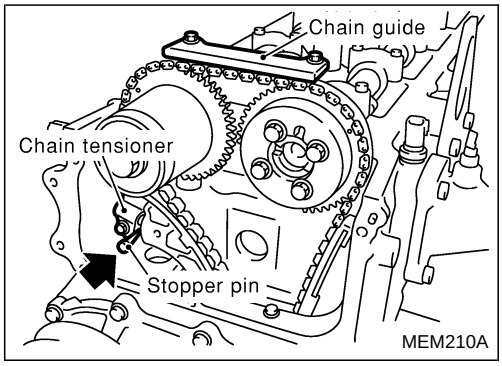


- **Rotate crankshaft until mating mark on camshaft sprocket is set at position indicated in figure at left.**

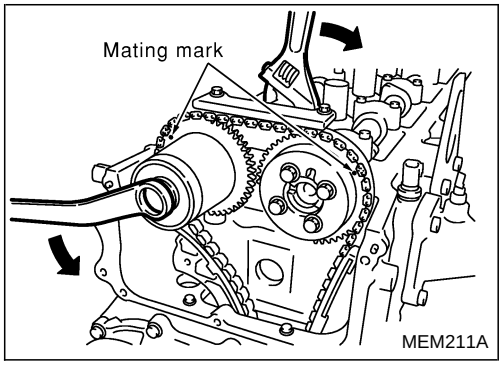


15. Remove camshaft position sensor.
- **Do not allow any magnetic materials to contact the camshaft position sensor.**
- **Be careful not to damage sensor.**

16. Remove cylinder head front cover using Tool (Seal cutter).

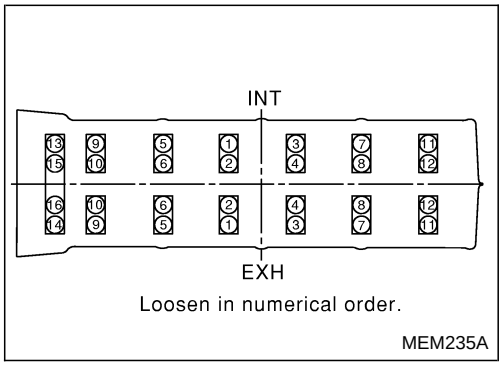


17. Remove timing chain guide from camshaft bracket.
18. Attach a suitable stopper pin to chain tensioner to hold plunger at its compressed position.
19. Remove chain tensioner.



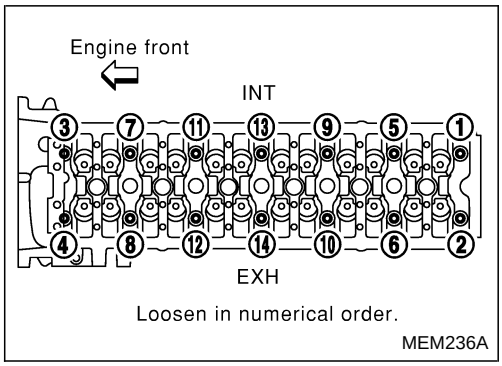
20. Loosen camshaft sprocket bolts holding camshaft at hexagonal area.
- **Apply paint to timing chain and cam sprockets for alignment during installation.**

21. Remove camshaft sprockets.



22. Remove camshaft brackets and camshafts.
- **Apply mating marks to brackets to ensure correct reassembly.**
- **Bolts should be loosened in two or three steps and in numerical order as shown.**

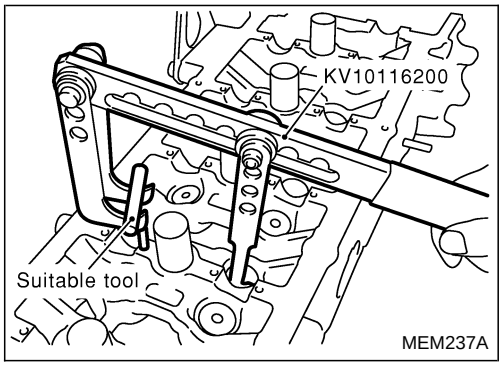
Removal (Cont'd)



23. Remove cylinder head bolts.
24. Remove cylinder head.

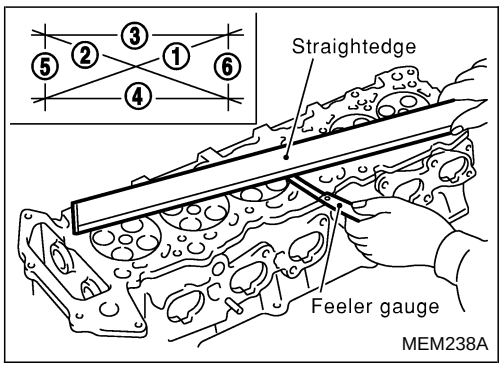
- **Head warpage or cracking could result from removing in incorrect order.**
- **Cylinder head bolts should be loosened in two or three steps and in numerical order as shown.**

Disassembly



1. Remove valve components with Tool.
2. Remove valve oil seal with a suitable tool.

Inspection



CYLINDER HEAD DISTORTION

- Clean surface of cylinder head.
- Use a reliable straightedge and feeler gauge to check the flatness of cylinder head mating surface.
- Check along six positions shown in figure.

Head surface flatness:

Standard: Less than 0.07 mm (0.0028 in)

Limit: 0.2 mm (0.008 in)

If beyond the specified limit, replace or resurface it.

Resurfacing limit:

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

Amount of cylinder head resurfacing is "A".

Amount of cylinder block resurfacing is "B".

The maximum limit is as follows:

A + B = 0.2 mm (0.008 in)

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

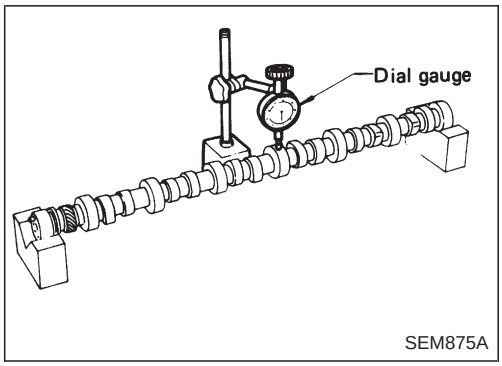
Nominal cylinder head height:

130.9 - 131.3 mm (5.15 - 5.17 in)

CAMSHAFT VISUAL CHECK

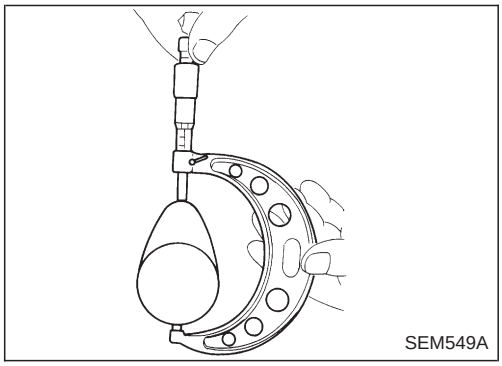
Check camshaft for scratches, seizure and wear.

Inspection (Cont'd)



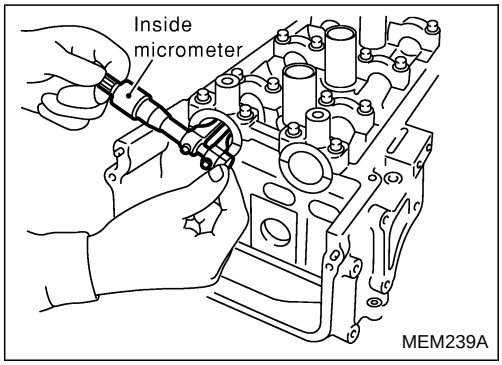
CAMSHAFT RUNOUT

1. Measure camshaft runout at the center journal.
   Runout (Total indicator reading):
   Standard
   Less than 0.02 mm (0.0008 in)
   Limit
   0.1 mm (0.004 in)
2. If it exceeds the limit, replace camshaft.



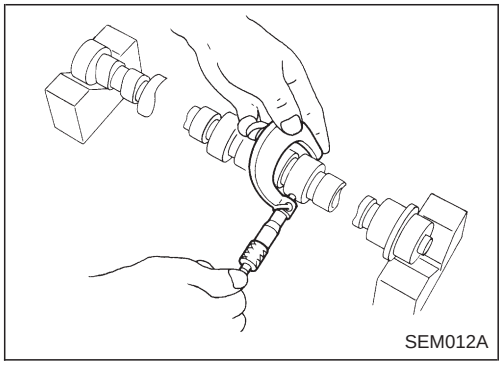
CAMSHAFT CAM HEIGHT

1. Measure camshaft cam height.
   Standard cam height:
   Intake
   43.465 - 43.655 mm (1.7112 - 1.7187 in)
   Exhaust
   43.065 - 43.255 mm (1.6955 - 1.7029 in)
   Cam wear limit:
   0.15 mm (0.0059 in)
2. If wear is beyond the limit, replace camshaft.

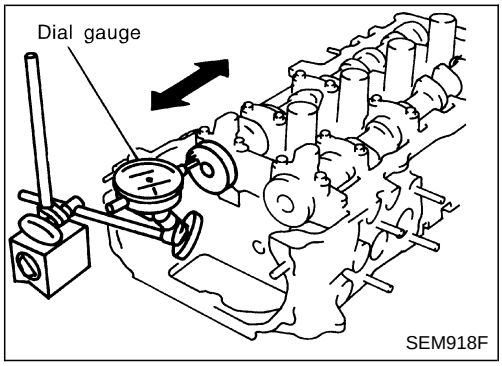


CAMSHAFT JOURNAL CLEARANCE

1. Install camshaft bracket and tighten bolts to the specified torque.
2. Measure inner diameter of camshaft bearing.
   Standard inner diameter:
   No. 1 to No. 7 bearing
   28.000 - 28.021 mm (1.1024 - 1.1032 in)



3. Measure outer diameter of camshaft journal.
   Standard outer diameter:
   No. 1 to No. 7 journal
   27.935 - 27.955 mm (1.0998 - 1.1006 in)
4. If clearance exceeds the limit, replace camshaft and/or cylinder head.
   Camshaft journal clearance:
   Standard
   0.045 - 0.086 mm (0.0018 - 0.0034 in)
   Limit
   0.15 mm (0.0059 in)

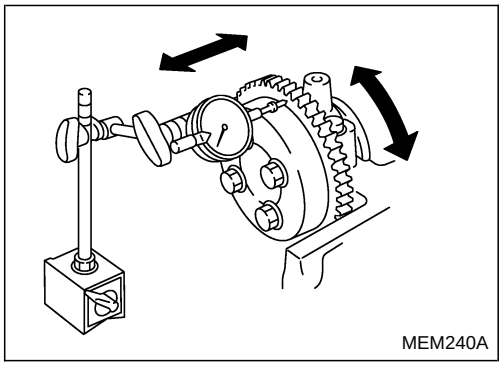


CAMSHAFT END PLAY

1. Install camshaft in cylinder head. Refer to EM-38.
2. Measure camshaft end play.
   Camshaft end play:
   Standard
   0.115 - 0.188 mm (0.0045 - 0.0074 in)
   Limit
   0.20 mm (0.0079 in)
3. If limit is exceeded, replace camshaft and remeasure end play.

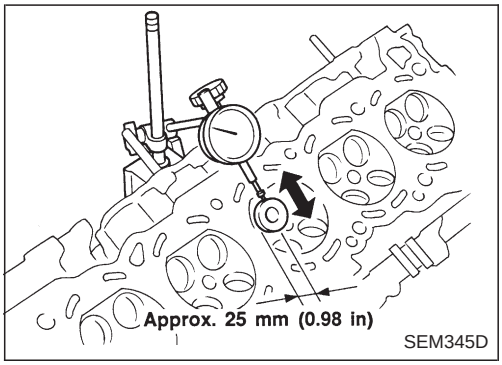
Inspection (Cont'd)

- **If limit is still exceeded after replacing camshaft, replace cylinder head.**


MEM240A

CAMSHAFT SPROCKET RUNOUT

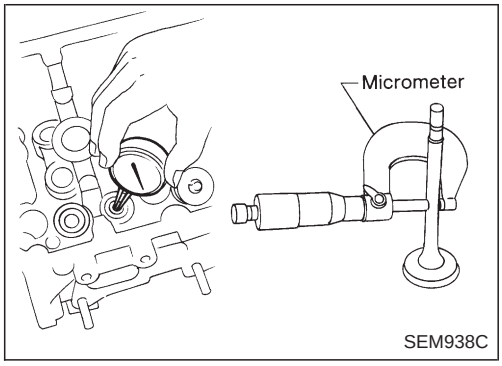
1. Install sprocket on camshaft.
2. Measure camshaft sprocket runout.
   Runout (Total indicator reading):
   Limit 0.15 mm (0.0059 in)
3. If it exceeds the limit, replace camshaft sprocket.



SEM345D

VALVE GUIDE CLEARANCE

1. Measure valve deflection as shown in figure. (Valve and valve guide wear the most in this direction.)
   Valve deflection limit (Dial gauge reading):
   Intake & Exhaust
   0.2 mm (0.008 in)



SEM938C

2. If it exceeds the limit, check valve to valve guide clearance.

a. Measure valve stem diameter and valve guide inner diameter.

b. Calculate valve to valve guide clearance.
   Valve to valve guide clearance = valve guide inner diameter − valve stem diameter.

c. Check that clearance is within specification.

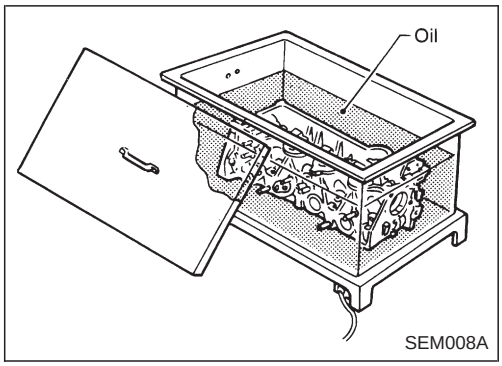
Unit: mm (in)

	Standard	Limit
Intake	0.020 - 0.053 (0.0008 - 0.0021)	0.1 (0.004)
Exhaust	0.040 - 0.073 (0.0016 - 0.0029)	0.1 (0.004)

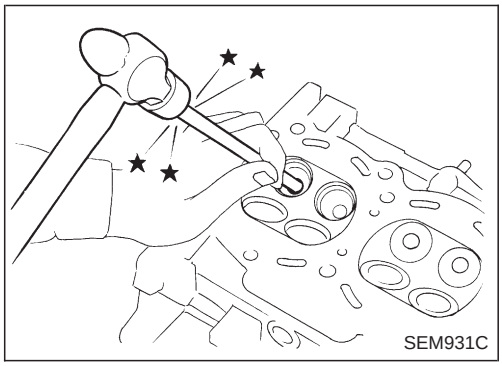
- If it exceeds the limit, replace valve and remeasure clearance.
- **If limit is still exceeded after replacing valve, replace valve guide.**

Inspection (Cont'd)

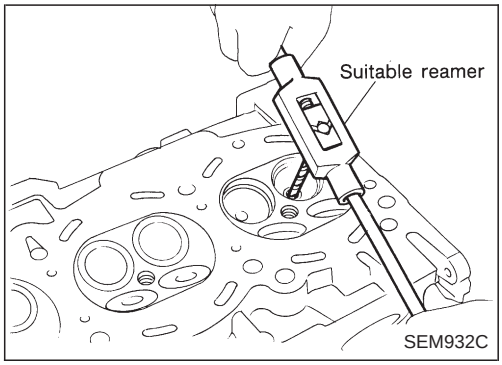
VALVE GUIDE REPLACEMENT



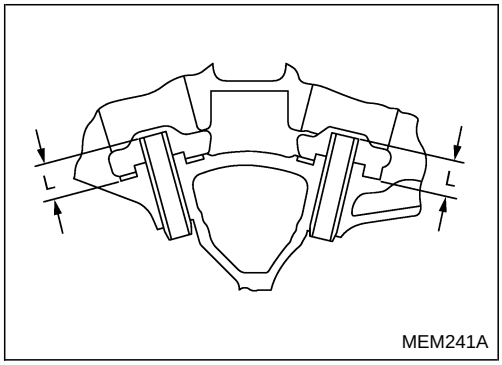
1. To remove valve guide, heat cylinder head to 110 to 130°C (230 to 266°F).



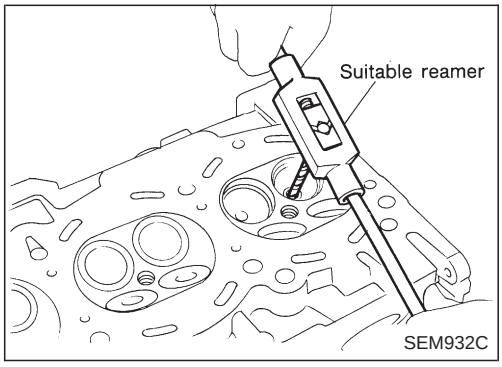
2. Drive out valve guide with a press [under a 20 kN (2 ton, 2.2 US ton, 2.0 Imp ton) pressure] or hammer and suitable tool.



3. Ream cylinder head valve guide hole.
   Valve guide hole diameter
   (for oversize service parts):
   Intake & Exhaust
   11.175 - 11.196 mm (0.4400 - 0.4408 in)



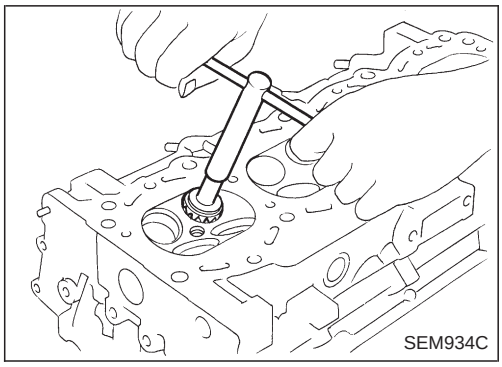
4. Heat cylinder head to 110 to 130°C (230 to 266°F) and press service valve guide into cylinder head.
   Projection "L":
   13.5 - 13.7 mm (0.531 - 0.539 in)



5. Ream valve guide.
   Finished size:
   Intake & Exhaust
   7.000 - 7.018 mm (0.2756 - 0.2763 in)

Inspection (Cont'd)

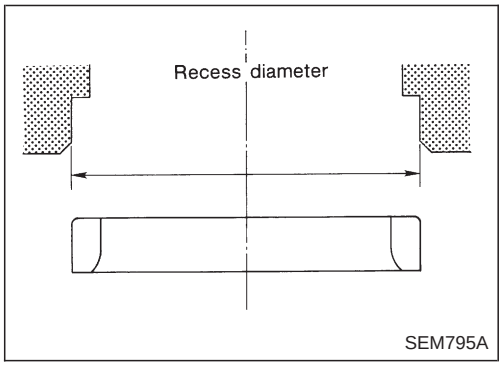
VALVE SEATS


SEM934C

Check valve seats for pitting at contact surface. Resurface or replace if excessively worn.

- **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.**

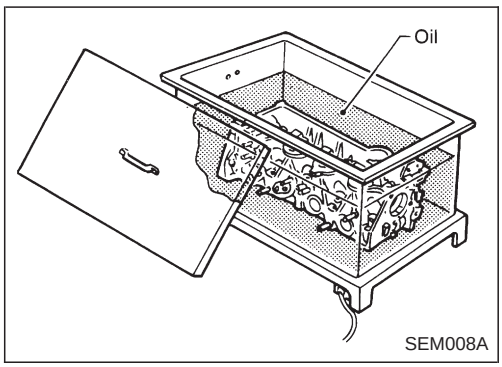
REPLACING VALVE SEAT FOR SERVICE PARTS



SEM795A

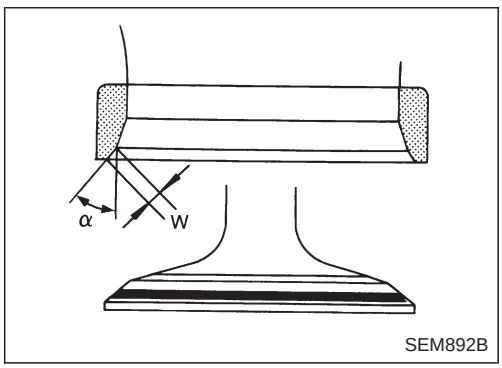
1. Bore out old seat until it collapses. Set machine depth stop so that boring cannot contact the bottom face of seat recess in cylinder head.
2. Ream cylinder head recess.
   Reaming bore for service valve seat
   Oversize [0.5 mm (0.020 in)]:
   Refer to SDS, EM-57.

Use the valve guide center for reaming to ensure valve seat will have the correct fit.



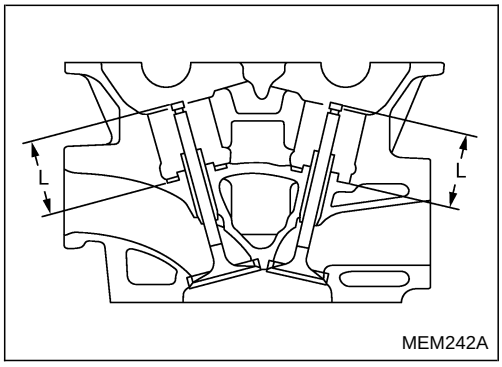
SEM008A

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



SEM892B

5. Cut or grind valve seat using suitable tool to the specified dimensions as shown in SDS, EM-57, 57.
6. After cutting, lap valve seat with abrasive compound.
7. Check valve seating condition.
   Seat face angle "α":
   44°45′
   Contacting width "W":
   Intake
   1.05 - 1.35 mm (0.0413 - 0.0531 in)
   Exhaust
   1.25 - 1.55 mm (0.0492 - 0.0610 in)

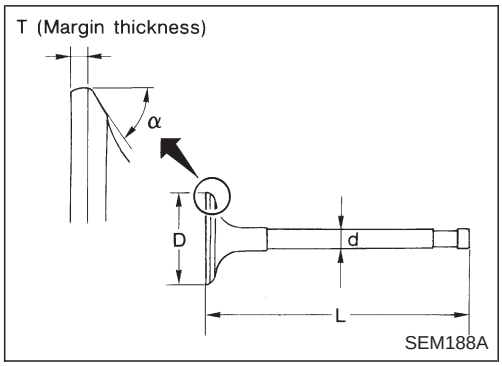


MEM242A

Valve stem projection (Standard):
Intake
41.46 mm (1.6323 in)
Exhaust
41.31 mm (1.6264 in)

Inspection (Cont'd)

VALVE DIMENSIONS

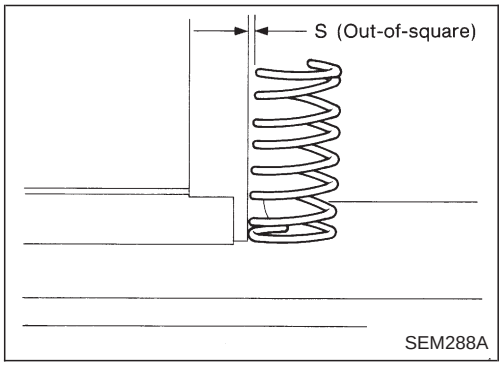


Check dimensions of each valve. Refer to SDS, EM-56 for dimensions.

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

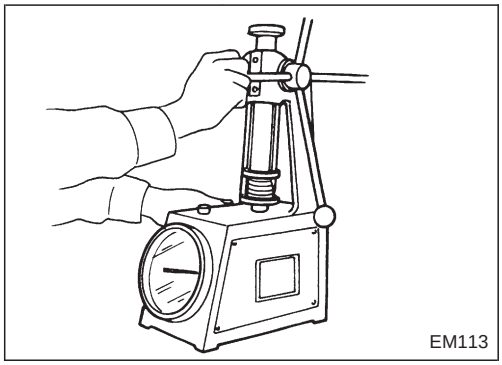
Grinding allowance for valve stem tip is 0.2 mm (0.008 in) or less.

VALVE SPRING



Squareness

1. Measure dimension "S".
   Out-of-square "S":
   Less than 2.2 mm (0.087 in)
2. If it exceeds the limit, replace spring.



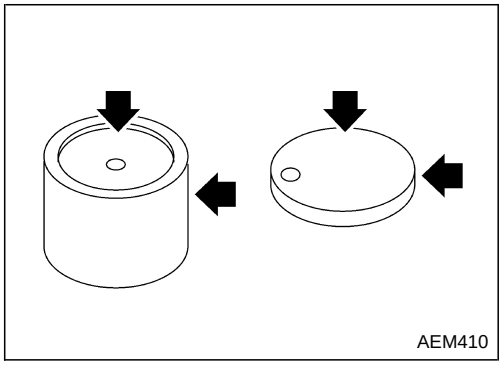
Pressure

Check valve spring pressure at specified spring height.

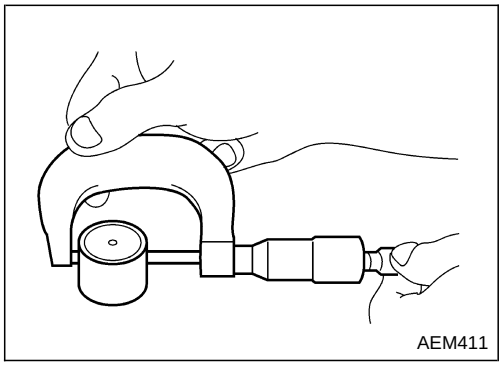
Pressure:
Standard
421 N (42.9 kg, 94.6 lb) at 27.4 mm (1.079 in)
Limit
More than 396 N (40.4 kg, 89.0 lb) at 27.4 mm (1.079 in)

If it exceeds the limit, replace spring.

VALVE LIFTER AND VALVE SHIM

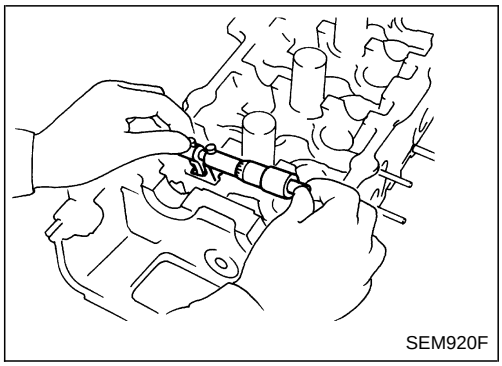


1. Check contact and sliding surfaces for wear or scratches.



2. Check diameter of valve lifter and valve lifter guide bore.
   Valve lifter outside diameter:
   33.960 - 33.975 mm (1.3370 - 1.3376 in)

Inspection (Cont'd)


SEM920F

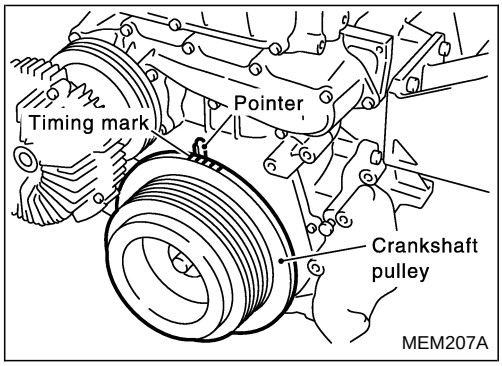
Lifter guide inside diameter:
34.000 - 34.021 mm (1.3386 - 1.3394 in)
Clearance between valve lifter and valve lifter guide:
Standard
0.025 - 0.061 mm (0.0010 - 0.0024 in)
Limit
0.1 mm (0.004 in)
If it exceeds the limit, replace valve lifter or cylinder head which exceeds the standard diameter tolerance.

Valve Clearance

CHECKING

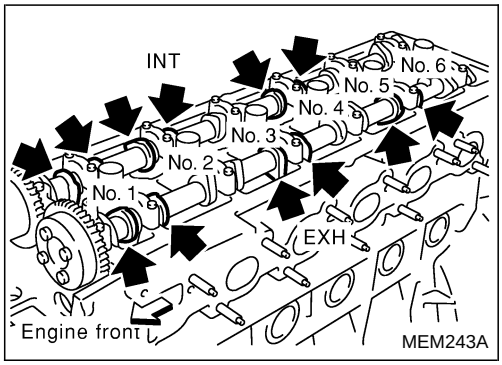
Check valve clearance while engine is cold and not running.

1. Remove engine ornament cover and rocker cover.
2. Remove all spark plugs.
3. Set No. 1 cylinder at TDC on its compression stroke.
- Align pointer with TDC mark on crankshaft pulley.
- Check that all valve lifters on No. 1 cylinder are loose.
- If not, turn crankshaft one revolution (360°) and align as described above.



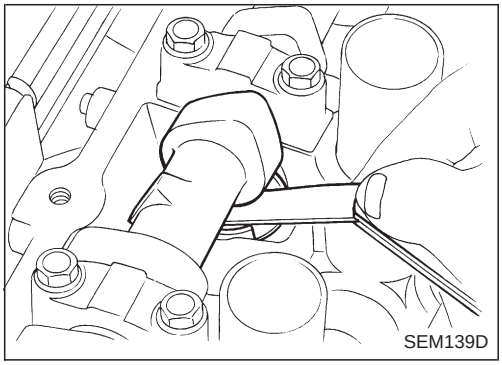
MEM207A

4. Check only those valves shown in the figure.



MEM243A

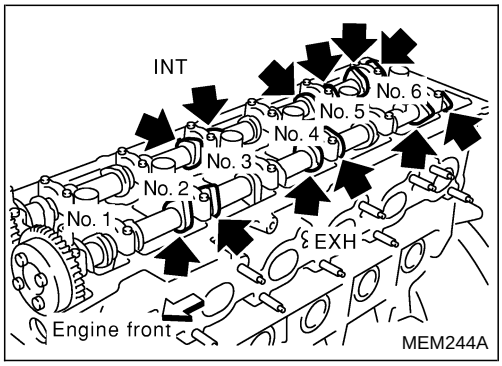
Crank-shaft posi-tion	Valve											
	No. 1		No. 2		No. 3		No. 4		No. 5		No. 6	
	INT	EXH	INT	EXH	INT	EXH	INT	EXH	INT	EXH	INT	EXH
No. 1 TDC	○	○	○			○	○			○		


SEM139D

- 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 adjusting shim.

Valve clearance for checking (Cold):
Intake
0.25 - 0.33 mm (0.010 - 0.013 in)
Exhaust
0.29 - 0.37 mm (0.011 - 0.015 in)

5. Turn crankshaft one revolution (360°) and align mark on crankshaft pulley with pointer.
6. Check only those valves shown in the figure.



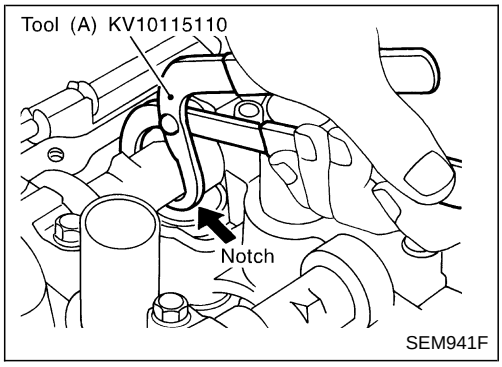
MEM244A

Crank-shaft posi-tion	Valve											
	No. 1		No. 2		No. 3		No. 4		No. 5		No. 6	
	INT	EXH	INT	EXH	INT	EXH	INT	EXH	INT	EXH	INT	EXH
No. 6 TDC				○	○			○	○		○	○

- Use the same procedure as mentioned in step 4.

Valve Clearance (Cont'd)

7. If all valve clearances are within specification, install the following parts:
- Rocker cover
- All spark plugs
- Engine ornament cover

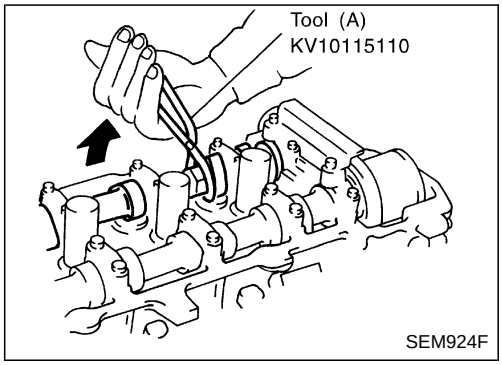


ADJUSTING

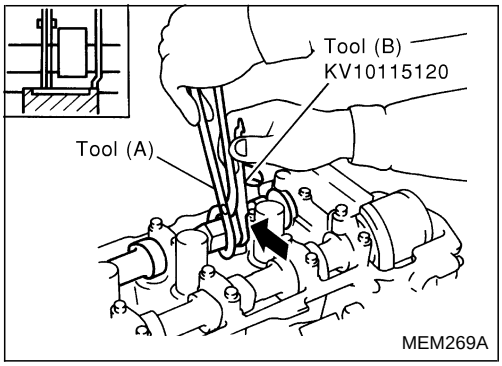
Adjust valve clearance while engine is cold.

1. Turn crankshaft. Position cam lobe upward on camshaft for valve that must be adjusted.
2. Place Tool (A) around camshaft as shown in figure.

CAUTION:
Be careful not to damage cam surface with Tool (A).



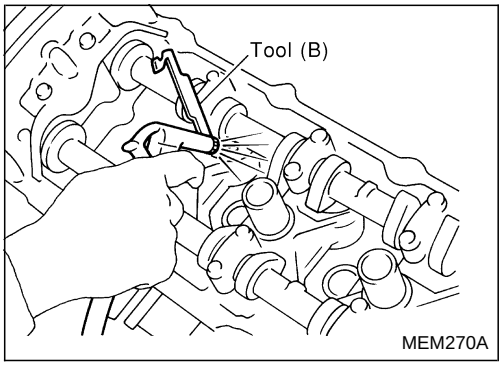
3. Rotate Tool (A) so that valve lifter is pushed down.



4. Place Tool (B) between camshaft and the edge of valve lifter to retain valve lifter.

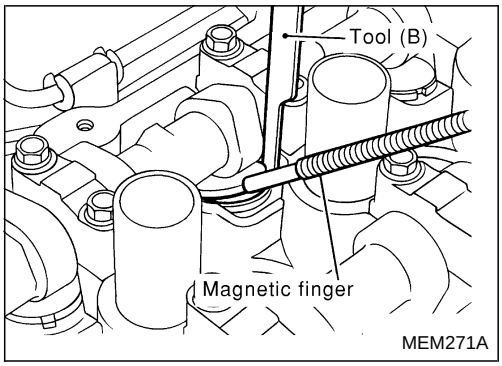
CAUTION:
- **Tool (B) must be placed as close to camshaft bracket as possible.**
- **Be careful not to damage cam surface with Tool (B).**

5. Remove Tool (A).



6. Blow air into the hole on adjusting shim to separate it from valve lifter.

Valve Clearance (Cont'd)



7. Remove adjusting shim using a small screwdriver and a magnetic finger.
8. Determine replacement adjusting shim size using the following formula.

- Use a micrometer to determine thickness of removed shim.
- Calculate thickness of new adjusting shim so valve clearance comes within specified values.

R = Thickness of removed shim
N = Thickness of new shim
M = Measured valve clearance

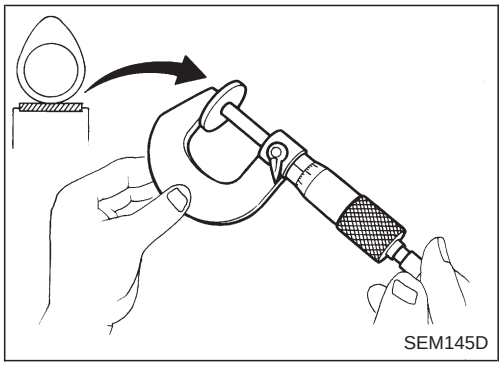
Intake:

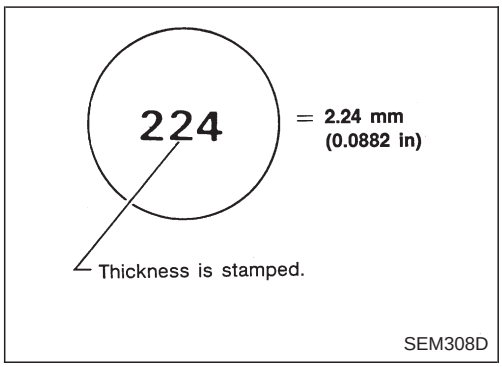
N = R + [M − 0.29 mm (0.011 in)]

Exhaust:

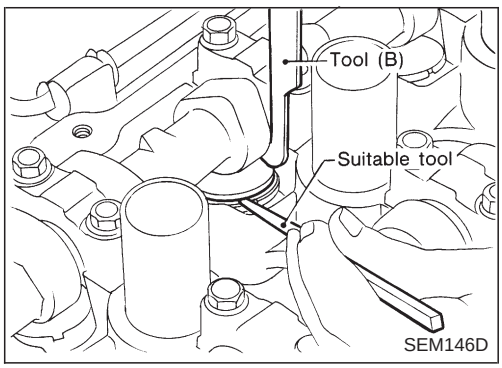
N = R + [M − 0.33 mm (0.013 in)]

Shims are available in 37 sizes from 1.96 mm (0.0772 in) to 2.68 mm (0.1055 in), in steps of 0.02 mm (0.0008 in).



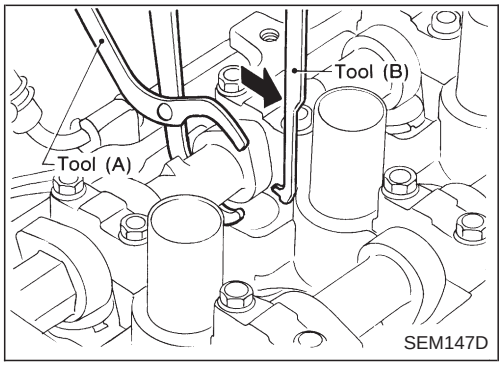


- Select the closest size shim to the calculated thickness. Refer to chart in SDS, EM-56.



9. Install new shim using a suitable tool.

- **Install with the surface on which the thickness is stamped facing down.**



10. Place Tool (A) as explained in steps 2 and 3.
11. Remove Tool (B).
12. Remove Tool (A).
13. Recheck valve clearance.

Valve clearance:

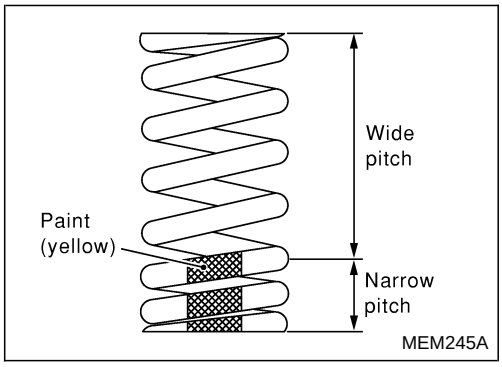
Unit: mm (in)

	Cold*	Hot (reference data)
Intake	0.25 - 0.33 (0.010 - 0.013)	0.32 - 0.40 (0.013 - 0.016)
Exhaust	0.29 - 0.37 (0.011 - 0.015)	0.33 - 0.41 (0.013 - 0.016)

Valve Clearance (Cont'd)

*: At a temperature of approximately 20°C (68°F)

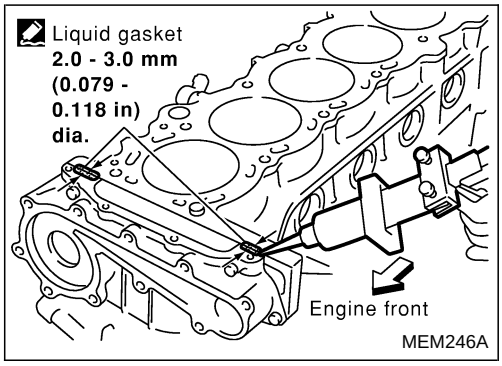
Whenever valve clearances are adjusted to cold specifications, check that the clearances satisfy hot specifications and adjust again if necessary.



Assembly

1. Install valve component parts.

- **Always use new valve oil seal. Refer to EM-24.**
- **Before installing valve oil seal, install valve spring seat.**
- **After installing valve components, tap valve stem tip with a plastic hammer to assure a proper fit.**
- **Install valve spring with paint mark (narrow pitch) end toward cylinder head.**



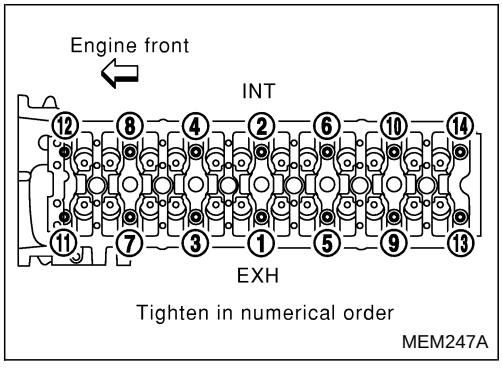
Installation

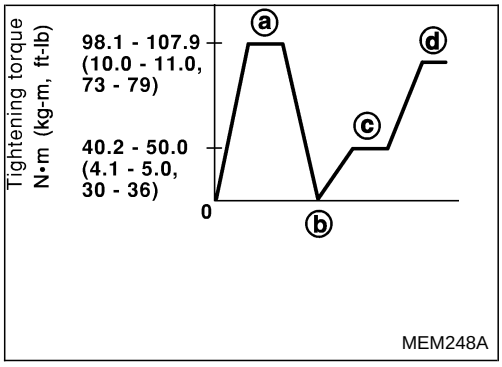
1. Before installing cylinder head gasket, apply a continuous bead of liquid gasket to mating surface of cylinder block.
2. Install cylinder head gasket.

- **When installing cylinder head, use new cylinder head gasket.**

3. Install cylinder head.

- **Do not rotate crankshaft and camshaft separately, or valves will strike piston heads.**
- **Apply new engine oil to cylinder head bolt threads and seat surfaces.**
- **Tightening procedure**
  - **a. Tighten bolts to 98.1 - 107.9 N·m (10 - 11 kg-m, 73 - 79 ft-lb).**
  - **b. Loosen bolts completely.**
  - **c. Tighten bolts to 40.2 - 50.0 N·m (4.1 - 5.0 kg-m, 30 - 36 ft-lb).**
  - **d. Turn bolts 90 to 95 degrees clockwise.**

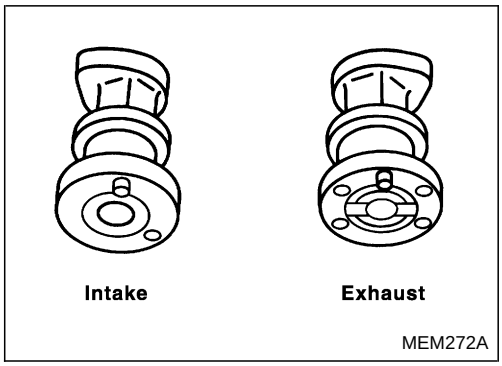


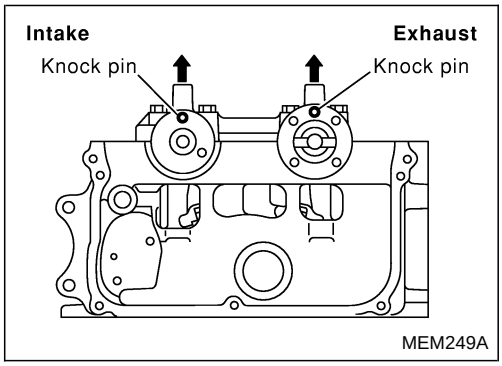


	Tightening torque N·m (kg-m, ft-lb)			
	a	**b**	**c**	**d**
Bolts (**1** - **14**)	98.1 - 107.9 (10.0 - 11.0, 73 - 79)	0 (0, 0)	40.2 - 50.0 (4.1 - 5.0, 30 - 36)	90 - 95 degrees

Installation (Cont'd)

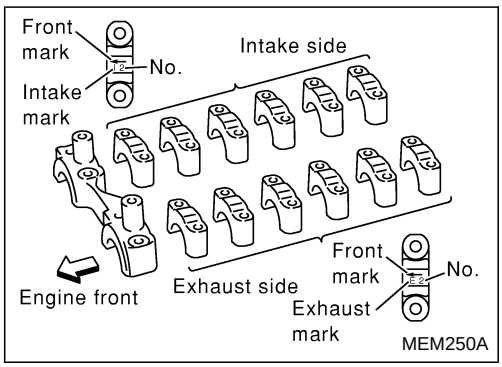
4. Install camshaft.

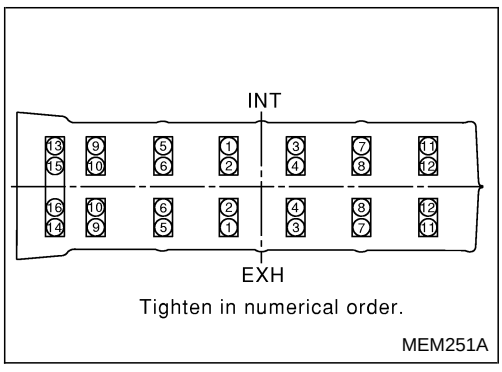




- **Make sure camshafts are aligned as shown in figure.**

5. Install camshaft brackets.
- **Make sure camshaft brackets are aligned as marked during disassembly.**





- **Apply new engine oil to bolt threads and seat surface.**
- **Tighten camshaft bracket bolts in the following steps.**
  a. Tighten bolts 13 - 16, then 1 - 12.
  : 1.96 N·m (0.2 kg-m, 17 in-lb)
  b. Tighten bolts 1 - 16.
  : 5.88 N·m (0.6 kg-m, 52 in-lb)
  c. Tighten bolts 1 - 16.
  : 9.02 - 11.8 N·m (0.92 - 1.20 kg-m, 80 - 104 in-lb)
- **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" in "VALVE CLEARANCE" (EM-35).**

  Reference data valve clearance (Cold):

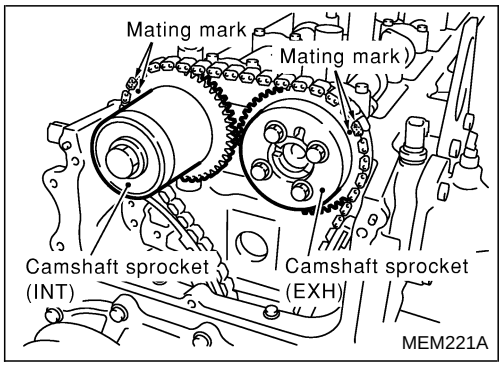
  Intake

  0.25 - 0.33 mm (0.010 - 0.013 in)

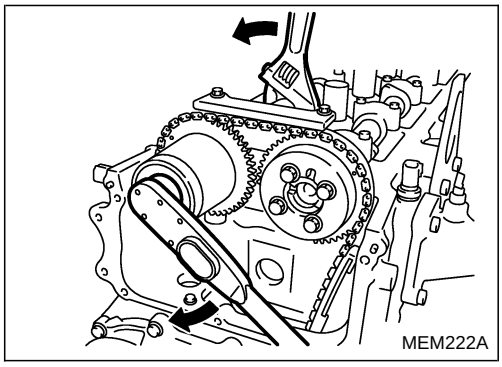
  Exhaust

  0.29 - 0.37 mm (0.011 - 0.015 in)

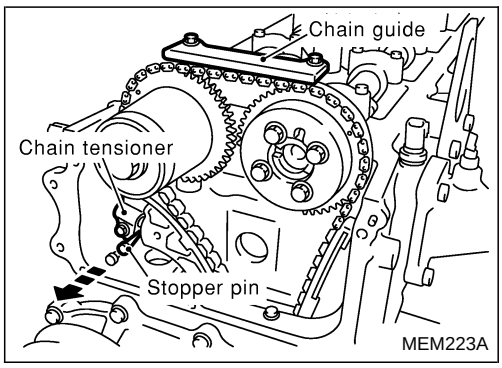
Installation (Cont'd)



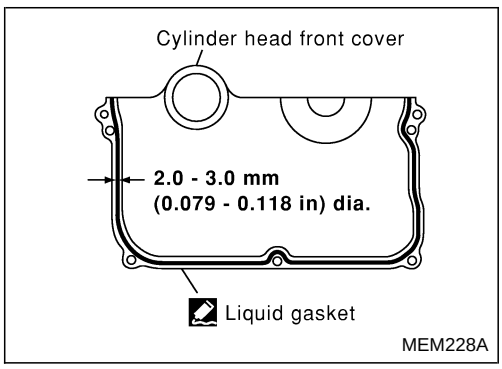
6. Install camshaft sprocket.
- **Set timing chain by aligning mating marks with those of camshaft sprockets.**



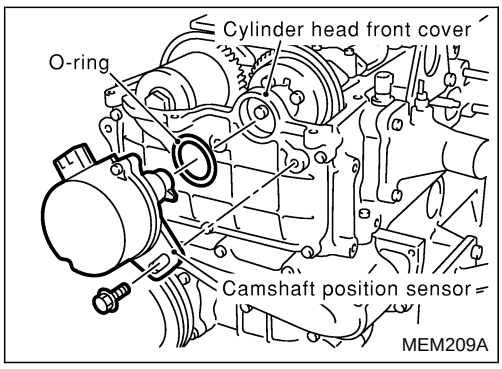
7. Install camshaft sprocket bolts to correct torque.
- **Apply new engine oil to bolt threads and seat surface.**



8. Install chain tensioner.
- **Before installing chain tensioner, insert a suitable pin into pin hole of chain tensioner.**
- **After installing chain tensioner, remove the pin.**
9. Install timing chain guide.

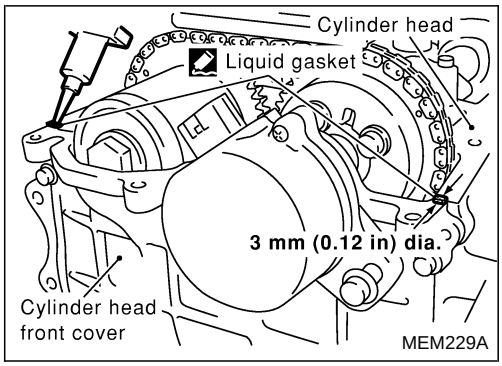


10. Install cylinder head front cover.
- Apply liquid gasket to cylinder head front cover.
- Use Genuine Liquid Gasket or equivalent.

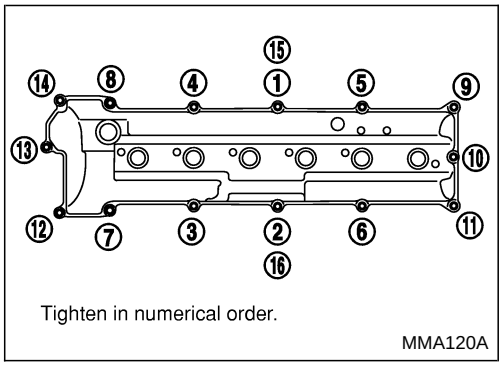


11. Install camshaft position sensor.

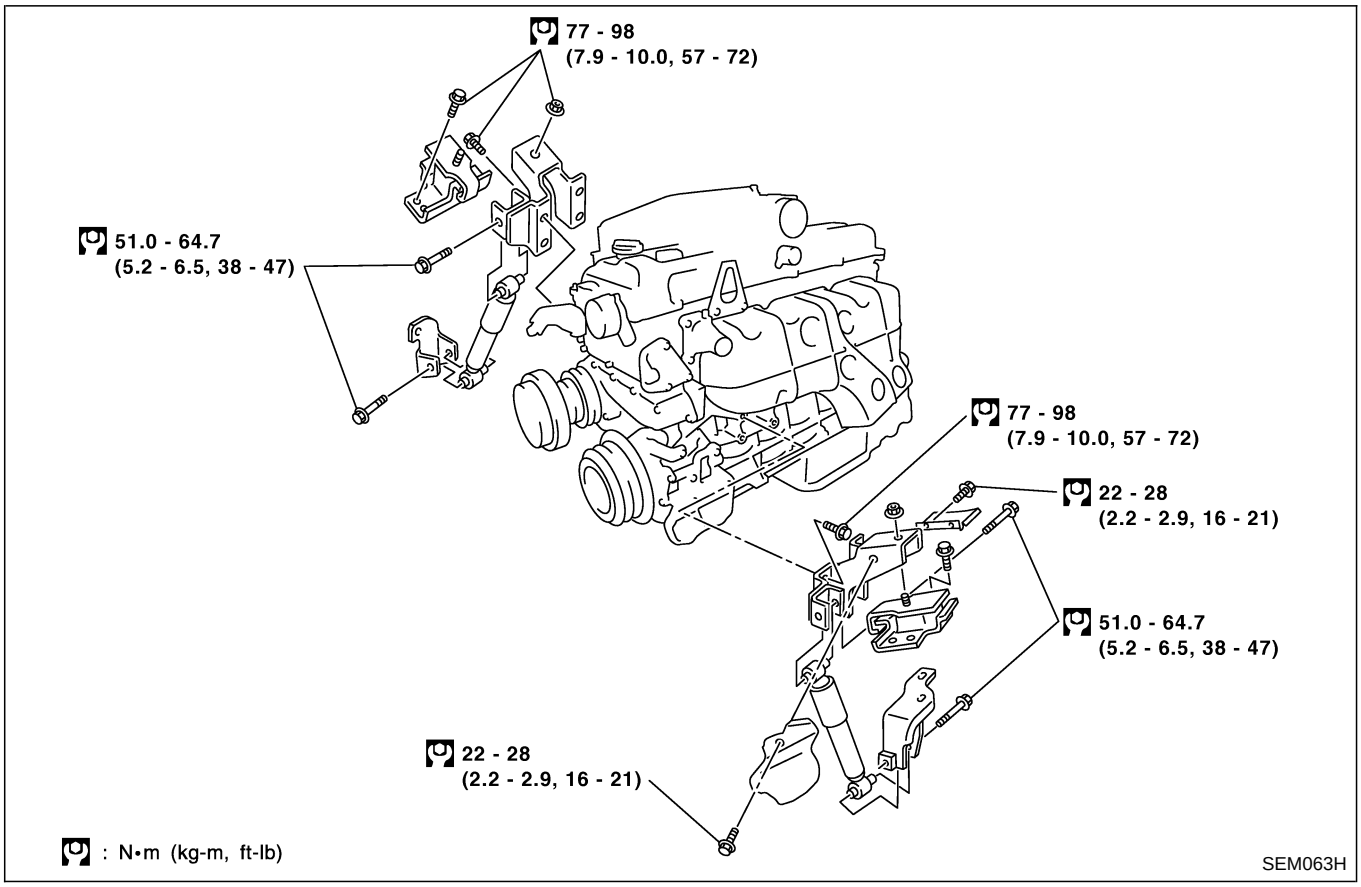
Installation (Cont'd)



12. Before installing rocker cover, apply a continuous bead of liquid gasket to mating surface of cylinder head.

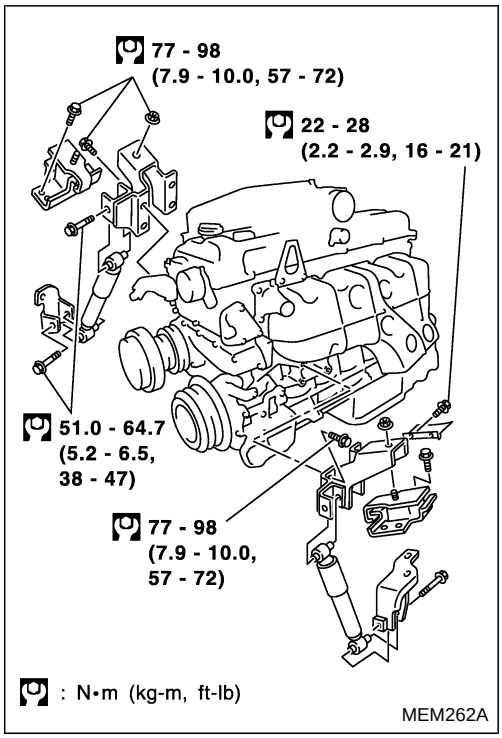


13. Install rocker cover with rocker cover gasket and tighten bolts in numerical order as shown in the figure.
14. Install spark plugs.
15. Install ignition coils.
16. Install exhaust manifold.
17. Install intake manifold.
18. Connect vacuum hoses, fuel hoses, water hose, wire, harness, connectors and so on.
19. Connect heated oxygen sensor. (Except for the Middle East models)
20. Install front exhaust tube.
21. Install engine undercovers.
22. Install air duct to intake manifold collector.
23. Drive belts.
    For adjusting drive belt deflection, refer to "Checking Drive Belts" in MA section.
24. Reinstall parts in reverse order of removal.



CAUTION:

- **Before removing engine assembly and transmission assembly, be sure to remove crankshaft position sensor on models for Europe.**
- **Be careful not to drop or damage crankshaft position sensor.**

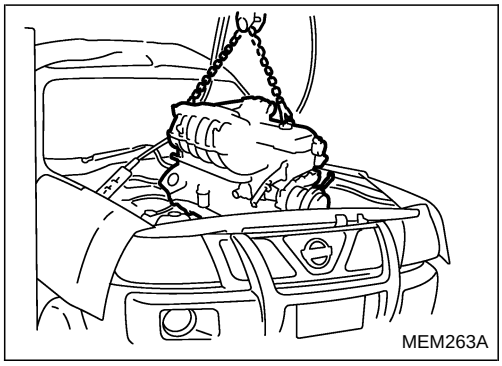


WARNING:

- **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 the 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 "Releasing Fuel Pressure" in EC section.
- **Be sure to hoist engine in a safe manner.**

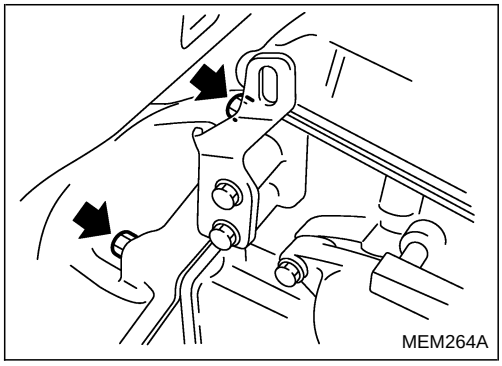
CAUTION:

- **When lifting engine, be careful not to strike adjacent parts, especially accelerator wire casing, brake lines, and brake master cylinder.**
- **In hoisting the engine, always use engine slingers in a safe manner.**
- **For engines not equipped with engine slingers, attach proper slingers and bolts described in the PARTS CATALOG.**

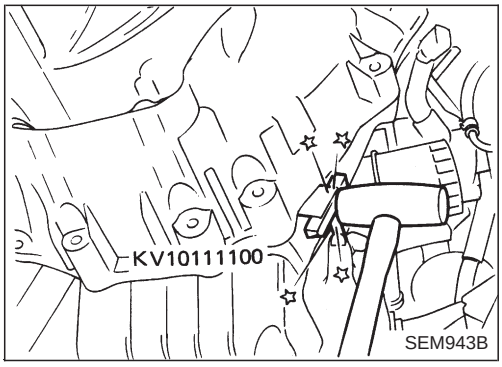


- Remove engine after removing transmission with transfer from vehicle paying attention to the following.

(1) Remove radiator. Refer to LC section.
(2) For transmission and transfer removal, refer to MT or AT section.



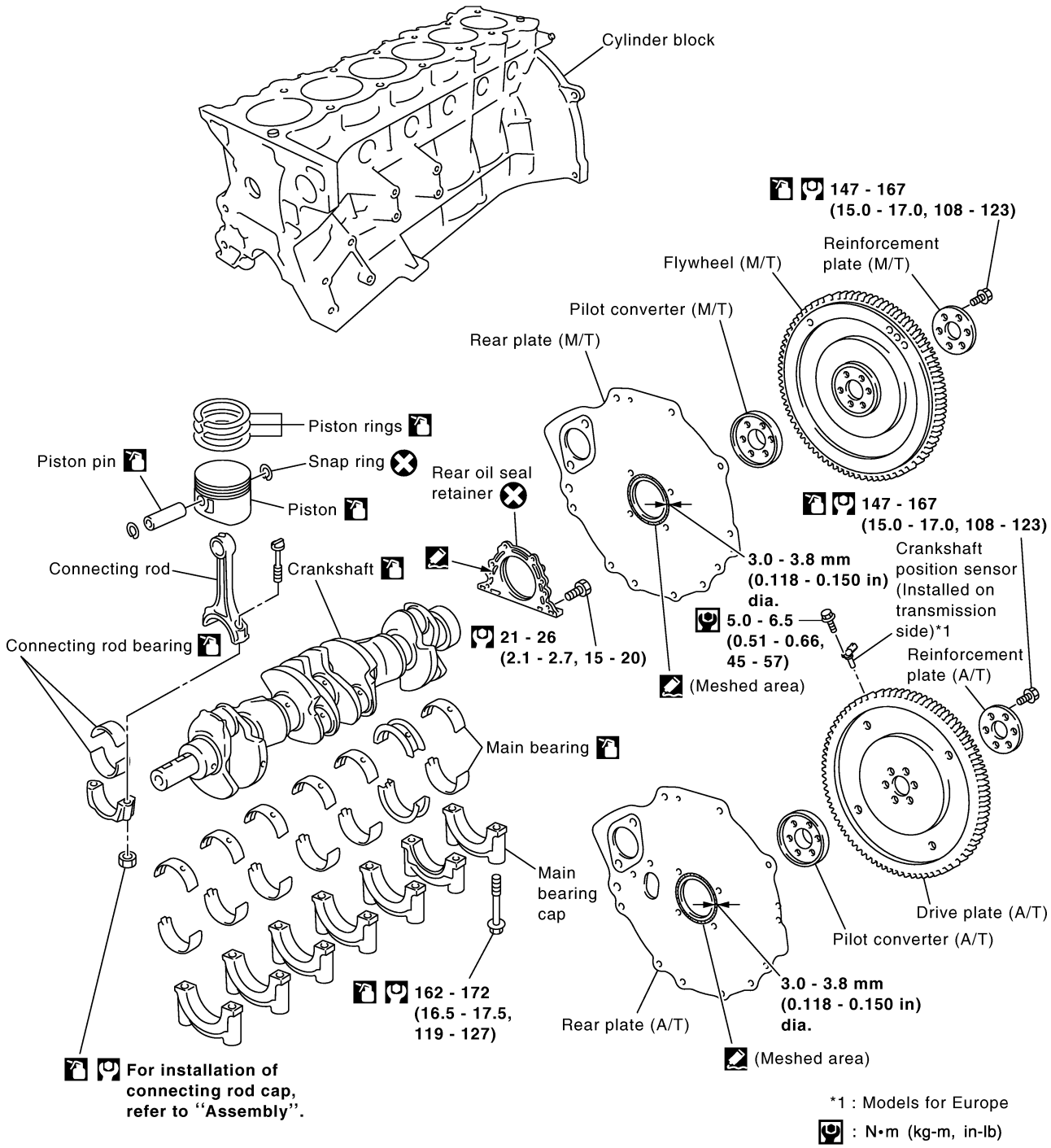
(3) When removing two mounting bolts from upper side of transmission, remove front engine mounts and lower engine to the minimum level of the front mount where the bolt removal is possible.



(4) When separating transmission and rear plate, remove transmission mounting bolts. Position Tool into mating surface of transmission and rear plate, and slide it along mating surface.

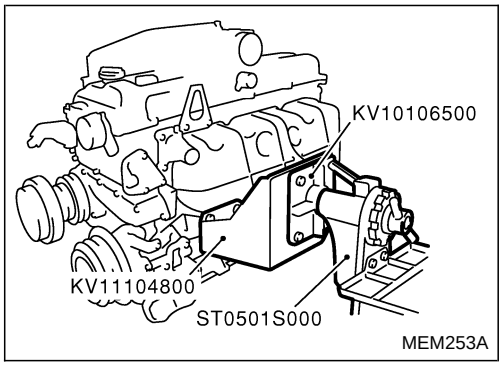
- **Be careful not to damage mating surfaces.**

SEC. 110•120•130



SEM043H

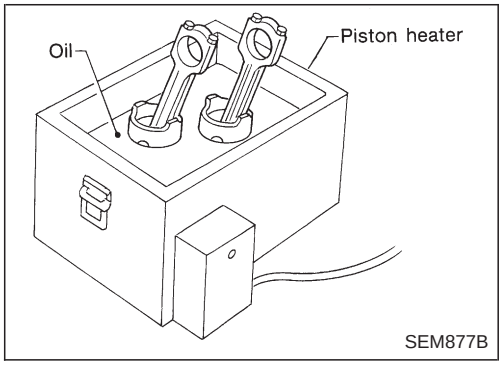
CAUTION:
- **When installing sliding parts such as bearings and pistons, be sure to apply engine oil on the sliding surfaces.**
- **Place the removed parts such as bearings and bearing caps in their proper order and direction.**
- **When tightening connecting rod nuts, main bearing cap bolts and flywheel bolts, apply engine oil to the thread portion and seating surface of them.**



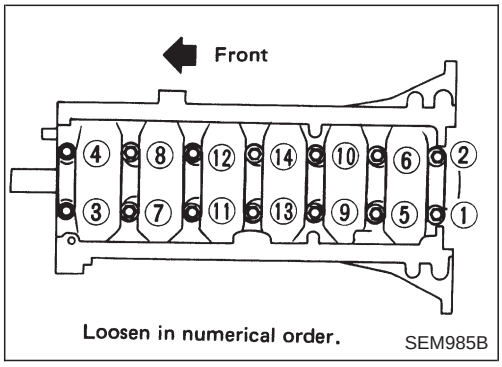
Disassembly

PISTON AND CRANKSHAFT

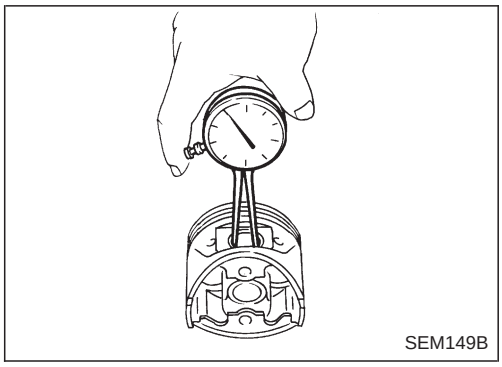
1. Place engine on work stand.
2. Drain coolant and remove water pump.
3. Drain oil.
4. Remove oil pan and oil strainer.
5. Remove rocker cover.
6. Remove cylinder head front cover.
7. Remove crankshaft pulley.
8. Remove front cover.
9. Remove timing chain.
10. Remove camshaft.
11. Remove cylinder head.
12. Remove flywheel or drive plate.



13. Remove pistons.
- When disassembling piston and connecting rod, remove snap rings first, then heat piston to 60 to 70°C (140 to 158°F) or use piston pin press stand at room temperature.



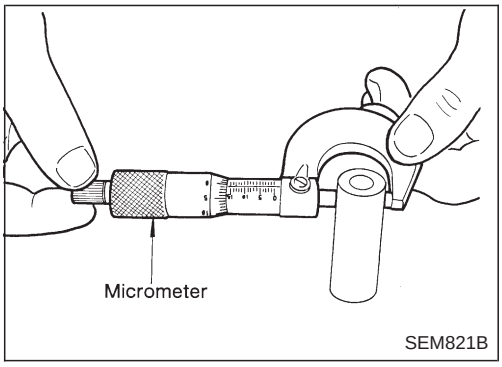
14. Remove bearing cap and crankshaft.
- **Before removing bearing cap, measure crankshaft end play.**


SEM149B

Inspection

PISTON AND PISTON PIN CLEARANCE

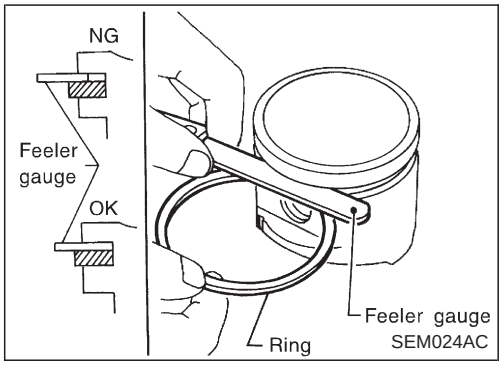
1. Measure inner diameter of piston pin hole “dp”.
   Standard diameter “dp”:
   22.993 - 23.005 mm (0.9052 - 0.9057 in)



SEM821B

2. Measure outer diameter of piston pin “Dp”.
   Standard diameter “Dp”:
   22.989 - 23.001 mm (0.9051 - 0.9055 in)
3. Calculate piston pin clearance.
   −0.002 to 0.010 mm (−0.0001 to 0.0004 in)

If it exceeds the limit, replace piston assembly with pin.

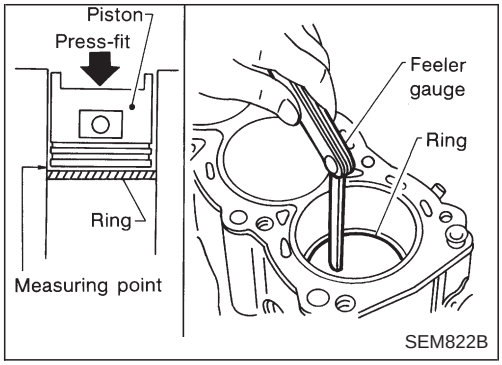


SEM024AC

PISTON RING SIDE CLEARANCE

Side clearance:
Top ring
0.040 - 0.080 mm (0.0016 - 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 and 2nd rings):
0.1 mm (0.004 in)

If out of specification, replace piston and piston pin assembly.



SEM822B

PISTON RING GAP

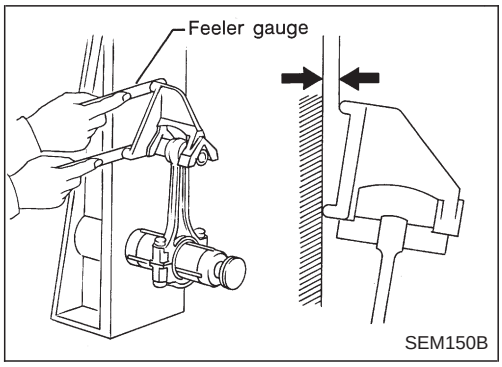
Standard ring gap:
Top ring
0.30 - 0.45 mm (0.0118 - 0.0177 in)
2nd ring
0.30 - 0.45 mm (0.0118 - 0.0177 in)
Oil ring
0.20 - 0.60 mm (0.0079 - 0.0236 in)
Max. limit of ring gap:
1.5 mm (0.059 in)

If out of specification, replace piston ring. If gap still exceeds the limit even with a new ring, rebore the cylinder and use oversized piston and piston ring assembly.

Refer to SDS, EM-59.

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

Inspection (Cont'd)

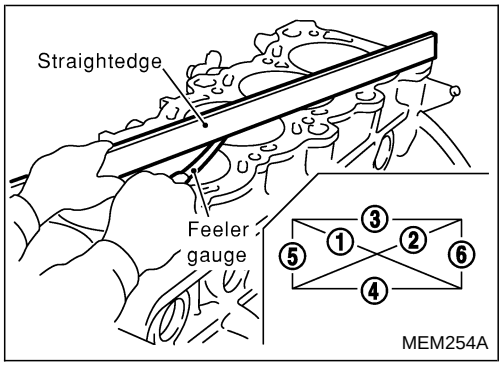


CONNECTING ROD BEND AND TORSION

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

Torsion:
Limit 0.3 mm (0.012 in)
per 100 mm (3.94 in) length

If it exceeds the limit, replace connecting rod assembly.



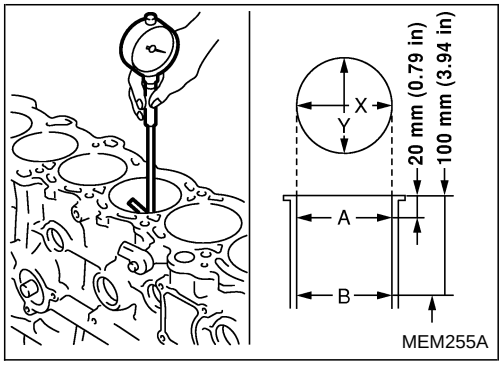
CYLINDER BLOCK DISTORTION AND WEAR

1. Clean upper face of cylinder block and measure the distortion.
   Limit: 0.10 mm (0.0039 in)
2. If out of specification, resurface it.
   The resurfacing limit is determined by the cylinder head resurfacing in engine.

Amount of cylinder head resurfacing is "A".
Amount of cylinder block resurfacing is "B".

The maximum limit is as follows:
A + B = 0.2 mm (0.008 in)
Nominal cylinder block height
from crankshaft center:
254.95 - 255.05 mm (10.0374 - 10.0413 in)

3. If necessary, replace cylinder block.



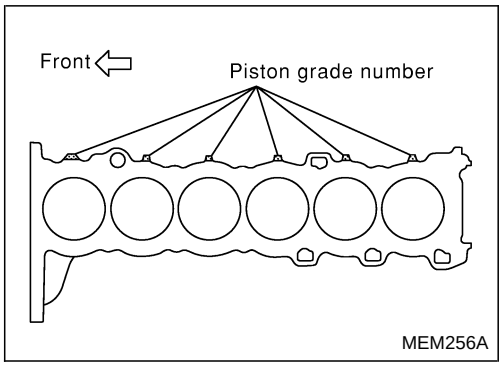
PISTON-TO-BORE CLEARANCE

Method A (Using bore gauge and micrometer)

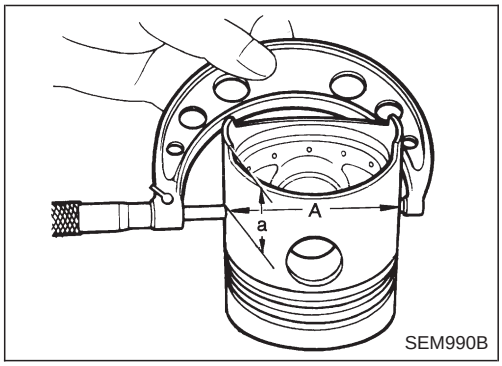
1. Using a bore gauge, measure cylinder bore for wear, out-of-round or taper.
   Standard inner diameter:
   99.500 - 99.550 mm (3.9173 - 3.9193 in)
   Wear limit:
   0.20 mm (0.0079 in)
   Out-of-round (X − Y) standard:
   0.025 mm (0.0010 in)
   Taper (A − B) standard:
   0.025 mm (0.0010 in)

   If it exceeds the limit, rebore all cylinders. Replace cylinder block if necessary.
2. Check for scratches or seizure. If seizure is found, hone it.

Inspection (Cont'd)



- **If cylinder block or piston is replaced with a new one, select piston of the same grade number punched on cylinder block upper surface.**



3. Measure piston skirt diameter.
   Piston diameter "A":
   Refer to SDS, EM-59.
   Measuring point "a" (Distance from the bottom):
   20 mm (0.79 in)
4. Check that piston-to-bore clearance is within the specification.
   Piston-to-bore clearance "B":
   0.030 - 0.050 mm (0.0012 - 0.0020 in)
5. Determine piston oversize according to amount of cylinder wear.

Oversize pistons are available for service. Refer to SDS.

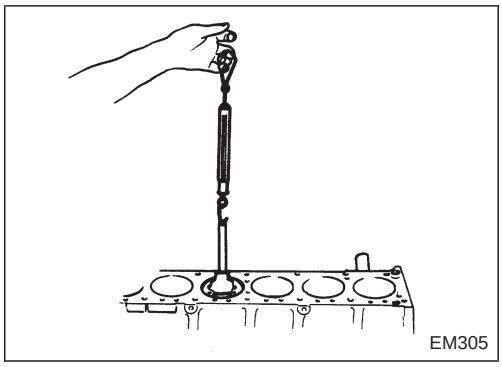
6. Cylinder size is determined by adding piston-to-bore clearance to piston diameter "A".
   Rebored size calculation:
   D = A + B − C
   where, D: Bored diameter
   A: Piston diameter as measured
   B: Piston-to-bore clearance
   C: Honing allowance 0.02 mm (0.0008 in)
7. Install main bearing caps, and tighten to the specified torque to prevent distortion of cylinder bores 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 the cylinder bore at a time. Cut only 0.05 mm (0.0020 in) or so in diameter at a time.**

9. Hone the cylinders to obtain specified piston-to-bore clearance.
10. Measure the finished cylinder bore for out-of-round and taper.

- **Measurement should be done after cylinder bore cools down.**

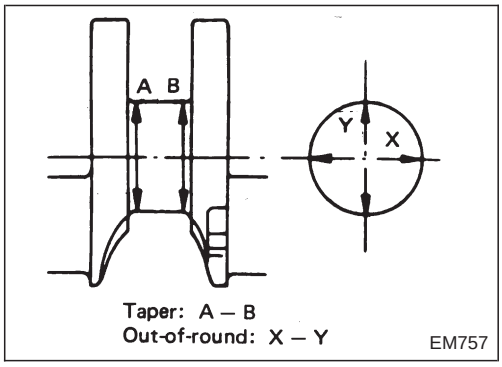
Inspection (Cont'd)


EM305

Method B (Using feeler gauge)

Measure the extracting force by pulling feeler gauge straight upward.

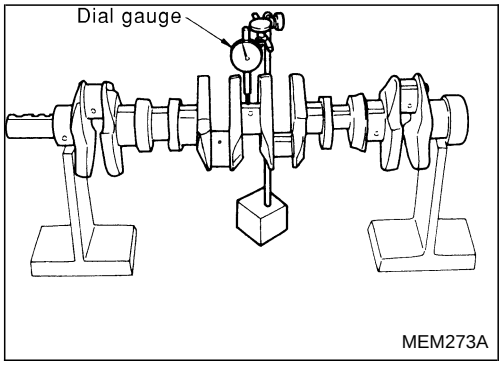
Feeler gauge thickness:
0.04 mm (0.0016 in)
Extracting force:
2.0 - 14.7 N (0.2 - 1.5 kg, 0.4 - 3.3 lb)



EM757

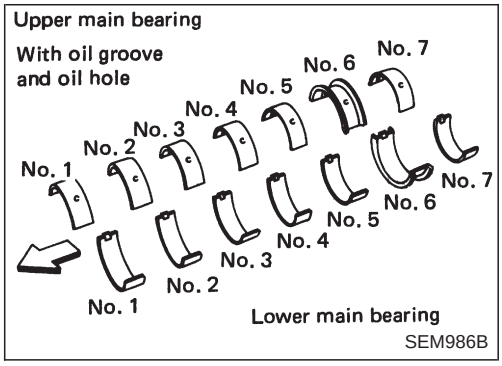
CRANKSHAFT

1. Check crankshaft main and pin journals for score, bias, wear or cracks.
2. With a micrometer, measure journals for taper and out-of-round.
   Out-of-round (X − Y):
   Less than 0.003 mm (0.0001 in)
   Taper (A − B):
   Less than 0.003 mm (0.0001 in)



MEM273A

3. Measure crankshaft runout.
   Runout (Total indicator reading):
   Less than 0.02 mm (0.0008 in)



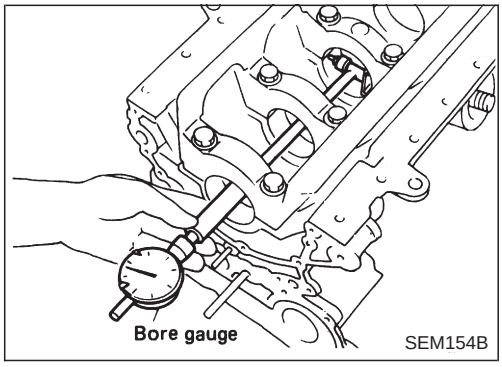
SEM986B

BEARING CLEARANCE

Method A (Using bore gauge and micrometer)

Main bearing clearance

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



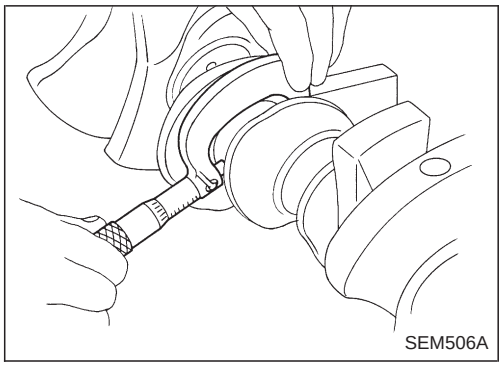
SEM154B

2. Install main bearing cap to cylinder block.

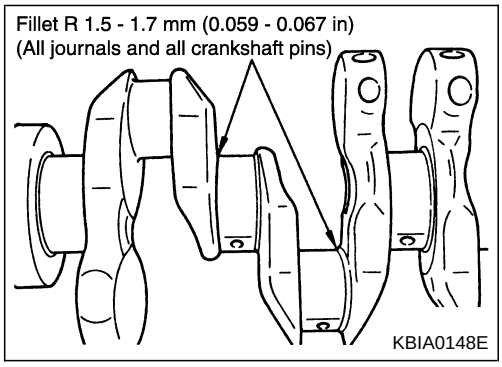
Tighten all bolts in correct order in two or three stages.

3. Measure inner diameter "A" of main bearing.

Inspection (Cont'd)


SEM506A

4. Measure outer diameter "Dm" of crankshaft main journal.
5. Calculate main bearing clearance.
   Main bearing clearance = A − Dm
   Standard: 0.030 - 0.087 mm (0.0012 - 0.0034 in)
   Limit: 0.09 mm (0.0035 in)
6. If it exceeds the limit, replace bearing.
7. If the clearance cannot be adjusted within the standard of any bearing, grind crankshaft journal and use undersized bearing.

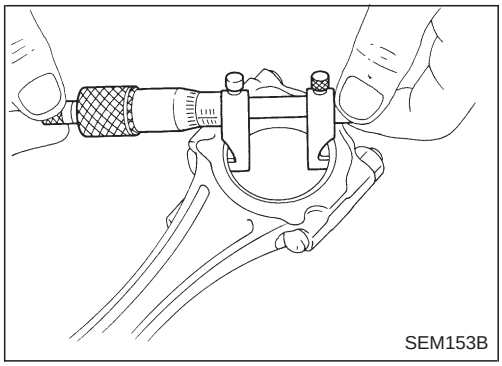


KBIA0148E

a. When grinding crank pin and crank journal, fillet R should be finished as shown in the figure.
   R: All journal
   1.5 - 1.7 mm (0.059 - 0.067 in)
   All pins
   1.5 - 1.7 mm (0.059 - 0.067 in)
b. Refer to SDS for grinding crankshaft and available service parts.

8. If crankshaft, cylinder block and main bearings are replaced with new ones, check that the clearance of main bearing is within specifications.

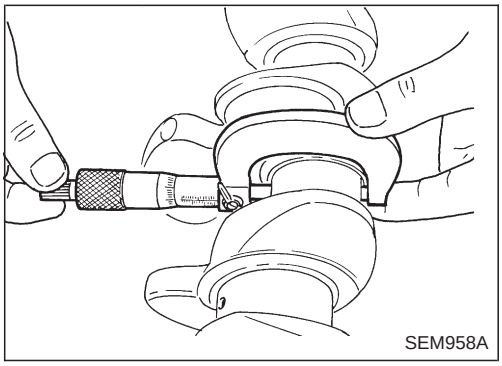
CONNECTING ROD BEARING CLEARANCE (Big end)


SEM153B

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

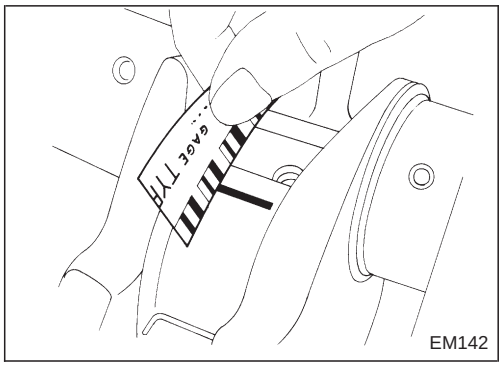
Tighten bolts to the specified torque.

3. Measure inner diameter "C" of bearing.


SEM958A

4. Measure outer diameter "Dp" of crankshaft pin journal.
5. Calculate connecting rod bearing clearance.
   Connecting rod bearing clearance = C − Dp
   Standard: 0.027 - 0.061 mm (0.0011 - 0.0024 in)
   Limit: 0.09 mm (0.0035 in)
6. If it exceeds the limit, replace bearing.
7. If the clearance cannot be adjusted within the standard of any bearing, grind crankshaft journal and use undersized bearing.
   Refer to step 7 of "MAIN BEARING CLEARANCE".

Inspection (Cont'd)



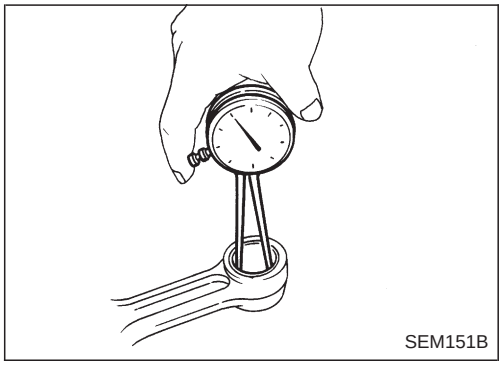
EM142

Method B (Using plastigage)

CAUTION:

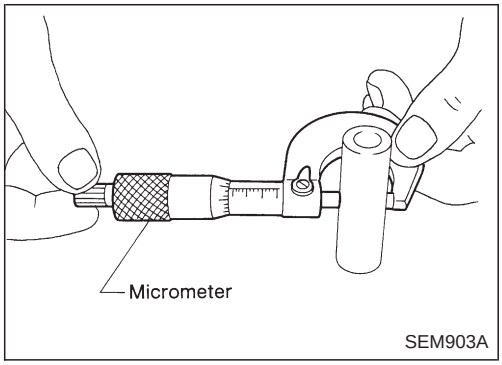
- **Do not turn crankshaft or connecting rod while the plastigage is being inserted.**
- **When bearing clearance exceeds the specified limit, ensure that the proper bearing has been installed. Then if excessive bearing clearance exists, use thicker main bearing or undersized bearing so that the specified bearing clearance is obtained.**

Main bearing clearance:
Standard
0.030 - 0.087 mm (0.0012 - 0.0034 in)
Limit
0.1 mm (0.004 in)
Connecting rod bearing clearance:
Standard
0.027 - 0.061 mm (0.0011 - 0.0024 in)
Limit
0.09 mm (0.0035 in)


SEM151B

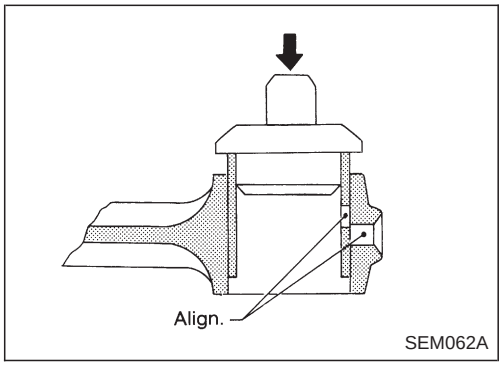
CONNECTING ROD BUSHING CLEARANCE (Small end)

1. Measure inner diameter "C" of bushing.



SEM903A

2. Measure outer diameter "Dp" of piston pin.
3. Calculate connecting rod bushing clearance.
   C − Dp = 0.005 - 0.017 mm (0.0002 - 0.0007 in)
   If it exceeds the limit, replace connecting rod bushing and/or piston set with pin.



SEM062A

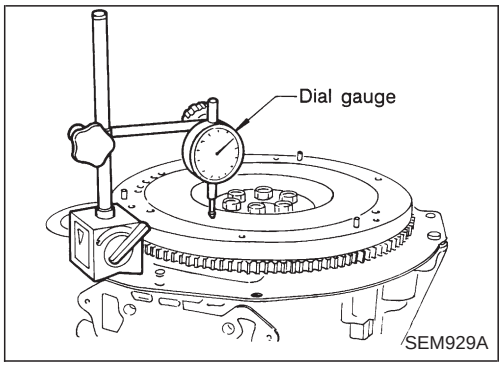
REPLACEMENT OF CONNECTING ROD SMALL END BUSHING

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

Be sure to align the oil holes.

2. After driving in the small end bushing, ream the bushing.
   Small end bushing inside diameter:
   Finished size
   23.000 - 23.012 mm (0.9055 - 0.9060 in)

Inspection (Cont'd)



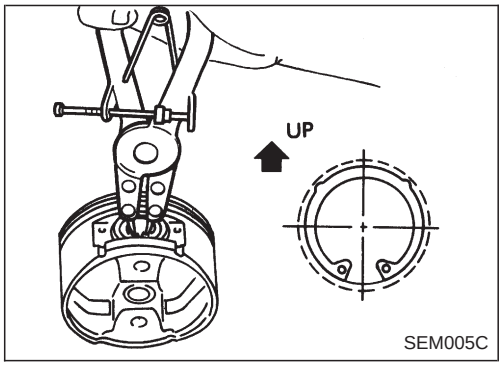
FLYWHEEL/DRIVE PLATE RUNOUT

Runout (Total indicator reading):
Flywheel (M/T model)
0.1 mm (0.004 in) or less
Drive plate (A/T model)
0.1 mm (0.004 in) or less

If runout exceeds the limit, replace flywheel.

CAUTION:
Do not disassemble flywheel assembly.

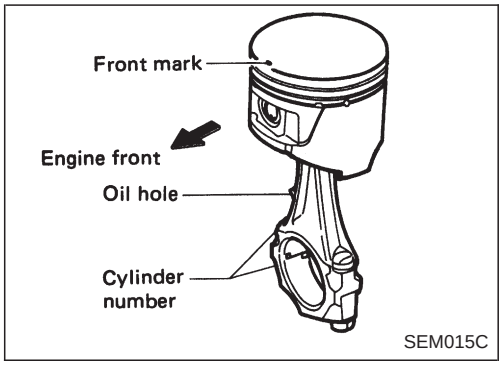
Assembly



PISTON

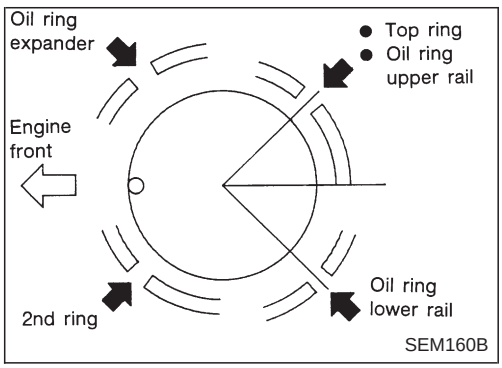
1. Install a new snap ring on one side of the piston pin hole.

Ensure that ends of snap ring face down and fit properly into groove.



2. Heat piston to 60 to 70°C (140 to 158°F) and assemble piston, piston pin, connecting rod and new snap ring.

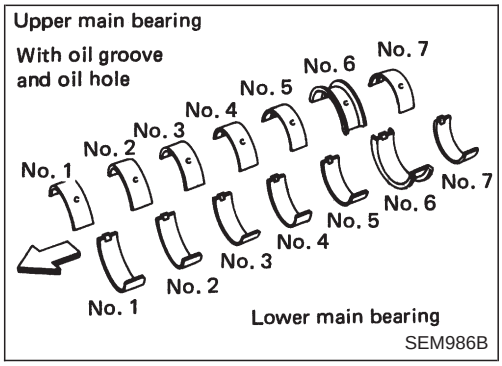
- **Align the direction of piston and connecting rod.**
- **Numbers stamped on connecting rod and cap correspond to each cylinder.**



- **After assembly, make sure piston swings smoothly.**

3. Set piston rings as shown.

Assembly

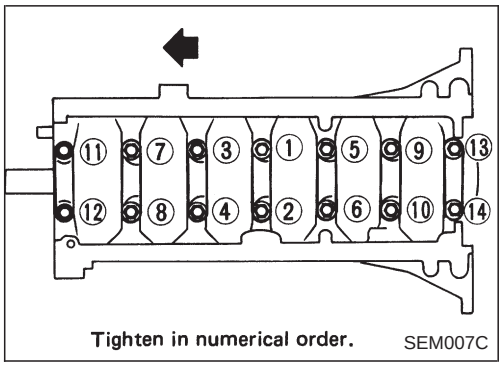


CRANKSHAFT

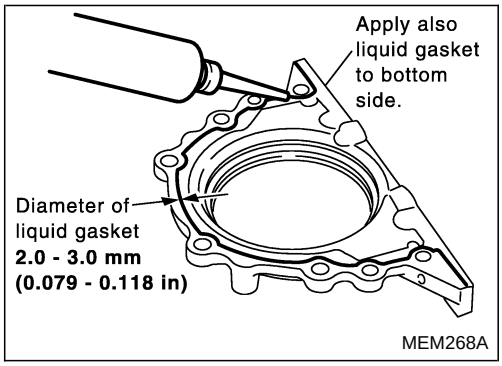
1. Set main bearings in their proper positions on cylinder block and main bearing cap.

- **Do not confuse upper and lower sides of main bearings.**

Assembly (Cont'd)

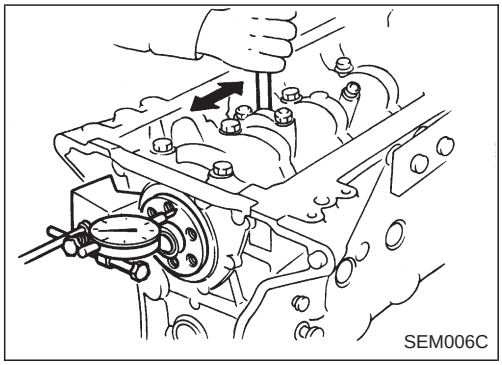


2. Install crankshaft and main bearing caps and tighten bolts to the specified torque.
- **Prior to tightening bearing cap bolts, place bearing cap in its proper position by shifting crankshaft in the axial direction.**
- **Tighten bearing cap bolts gradually in two or three stages starting with the center bearing and move outward sequentially.**
- **After securing bearing cap bolts, make sure crankshaft turns smoothly by hand.**



3. Apply a continuous bead of liquid gasket to mating surfaces of rear oil seal retainer (both for cylinder block and oil pan sides).
- **Use Genuine Liquid Gasket or equivalent.**

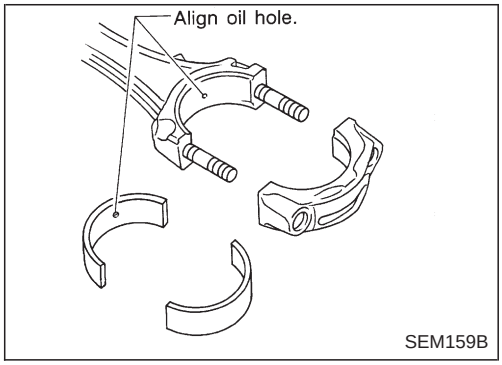
a. Coat of liquid gasket should be maintained within 2.0 to 3.0 mm (0.079 to 0.118 in) dia. range.
b. Attach oil seal retainer to cylinder block within 5 minutes after coating.
c. Wait at least 30 minutes before refilling engine oil or starting engine.



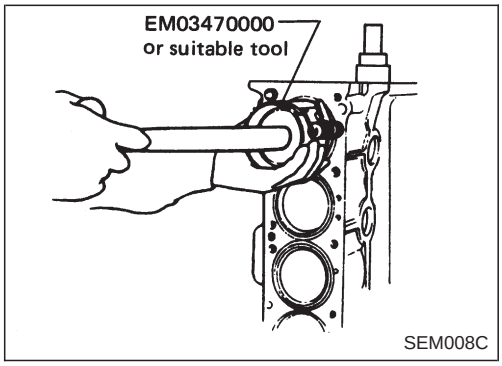
4. Measure crankshaft end play.

Crankshaft end play:
Standard
0.05 - 0.169 mm (0.0020 - 0.0067 in)
Limit
0.3 mm (0.012 in)

If end play exceeds the limit, replace No. 6 bearing and measure again.
If it still exceeds the limit, replace crankshaft also.

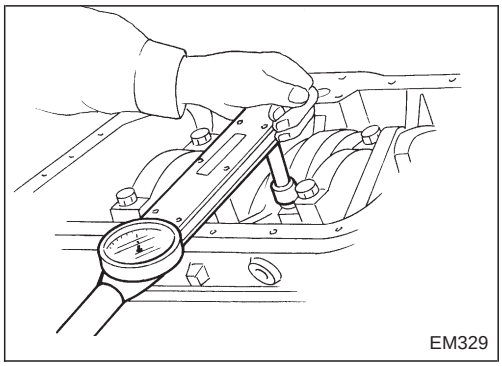


5. Install connecting rod bearings in connecting rods and connecting rod caps.
- Confirm that correct bearings are used. Refer to "Inspection", EM-47 (Publication No. SM1E-Y61EG1).
- Install bearings so that oil hole in connecting rod aligns with oil hole of bearing.



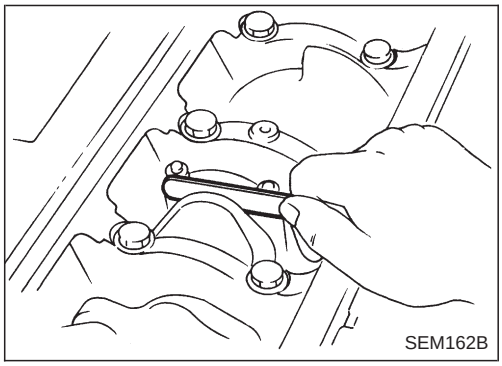
6. Install pistons with connecting rods.
(1) Install them into corresponding cylinders with SST.
- **Be careful not to scratch cylinder wall by connecting rod.**
- **Arrange so that front mark on piston head faces toward front of engine.**

Assembly (Cont'd)


EM329

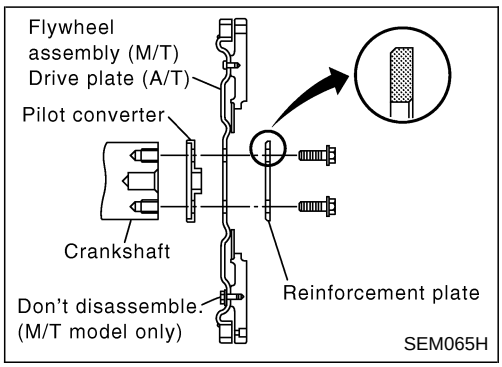
(2) Install connecting rod bearing caps.
Tighten connecting rod bearing cap nuts to the specified torque.

: Connecting rod bearing nut
(1) Tighten to 38 to 40 N·m
(3.9 to 4.1 kg-m, 28 to 30 ft-lb)
(2) Tighten to 67 to 71 N·m
(6.8 to 7.2 kg-m, 49 to 52 ft-lb)
or if you have an angle wrench, tighten bolts to 40 to 45 degrees clockwise.
Angle tightening is preferable.


SEM162B

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 clearance exceeds the limit, replace connecting rod and/or crankshaft.



8. Install flywheel (M/T) or drive plate (A/T) as shown in the figure.

General Specifications

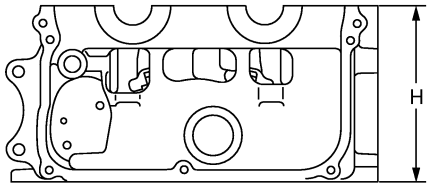
Cylinder arrangement	6, in-line
Displacement cm^3 (cu in)	4,759 (290.39)
Bore and stroke mm (in)	99.5 x 102.0 (3.917 x 4.016)
Valve arrangement	DOHC
Firing order	1-5-3-6-2-4
Number of piston rings	
Compression	2
Oil	1
Number of main bearings	7
Compression ratio	9.0

Unit: kPa (bar, kg/cm^2, psi)/rpm

Compression pressure	
Standard	1,226 (12.26, 12.5, 178)/200
Minimum	1,030 (10.30, 10.5, 149)/200
Differential limit between cylinders	98 (0.98, 1.0, 14)/200

Inspection and Adjustment

CYLINDER HEAD



MEM257A

Unit: mm (in)

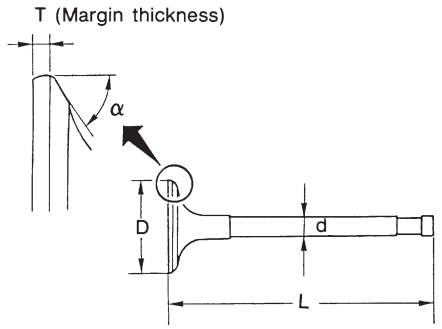
	Standard	Limit
Height (H)	130.9 - 131.3 (5.1535 - 5.1693)	0.2 (0.008)*
Surface distortion	Less than 0.07 (0.0028)	0.2 (0.008)

*: Total amount of cylinder head resurfacing and cylinder block resurfacing

Inspection and Adjustment (Cont'd)

VALVE

Unit: mm (in)



SEM188

Valve head diameter "D"	
Intake	38.35 - 38.65 (1.5098 - 1.5217)
Exhaust	33.15 - 33.45 (1.3051 - 1.3169)
Valve length "L"	
Intake	99.86 - 100.46 (3.9315 - 3.9551)
Exhaust	98.01 - 98.61 (3.8587 - 3.8823)
Valve stem diameter "d"	
Intake	6.965 - 6.980 (0.2742 - 0.2748)
Exhaust	6.945 - 6.960 (0.2734 - 0.2740)
Valve seat angle "α"	
Intake	45°15′ - 45°45′
Exhaust	
Valve margin "T"	
Intake	1.25 - 1.55 (0.0492 - 0.0610)
Exhaust	1.45 - 1.75 (0.0571 - 0.0689)
Valve margin "T" limit	More than 0.5 (0.020)
Valve stem end surface grinding limit	Less than 0.2 (0.008)

Valve clearance

Unit: mm (in)

	Cold*	Hot (reference data)
Intake	0.25 - 0.33 (0.010 - 0.013)	0.32 - 0.40 (0.013 - 0.016)
Exhaust	0.29 - 0.37 (0.011 - 0.015)	0.33 - 0.41 (0.013 - 0.016)

*: At temperature of approximately 20°C (68°F)

Whenever valve clearances are adjusted to cold specifications, check that the clearances satisfy hot specifications and adjust again if necessary.

Available shims

Thickness mm (in)	Identificaiton mark
1.96 (0.0772)	196
1.98 (0.0780)	198
2.00 (0.0787)	200
2.02 (0.0795)	202
2.04 (0.0803)	204
2.06 (0.0811)	206
2.08 (0.0819)	208
2.10 (0.0827)	210
2.12 (0.0835)	212
2.14 (0.0843)	214
2.16 (0.0850)	216
2.18 (0.0858)	218
2.20 (0.0866)	220
2.22 (0.0874)	222
2.24 (0.0882)	224
2.26 (0.0890)	226
2.28 (0.0898)	228
2.30 (0.0906)	230
2.32 (0.0913)	232
2.34 (0.0921)	234
2.36 (0.0929)	236
2.38 (0.0937)	238
2.40 (0.0945)	240
2.42 (0.0953)	242
2.44 (0.0961)	244
2.46 (0.0969)	246
2.48 (0.0976)	248
2.50 (0.0984)	250
2.52 (0.0992)	252
2.54 (0.1000)	254
2.56 (0.1008)	256
2.58 (0.1016)	258
2.60 (0.1024)	260
2.62 (0.1031)	262
2.64 (0.1039)	264
2.66 (0.1047)	266
2.68 (0.1055)	268

Valve spring

Free height	mm (in)	50.27 (1.9791)
Pressure height	mm/N (mm/kg, in/lb)	27.4/421 (27.4/42.8, 1.079/94.4)
Assembled height	mm/N (mm/kg, in/lb)	37/217 (37/22.1, 1.457/48.7)
Out-of-square	mm (in)	2.2 (0.087)

Valve lifter

Unit: mm (in)

	Standard	Limit
Valve lifter outer diameter	33.960 - 33.975 (1.3370 - 1.3376)	—
Cylinder block valve lifter hole diameter	34.000 - 34.021 (1.3386 - 1.3394)	—
Valve lifter to lifter hole clearance	0.025 - 0.061 (0.0010 - 0.0024)	0.1 (0.004)

*: Total indicator reading

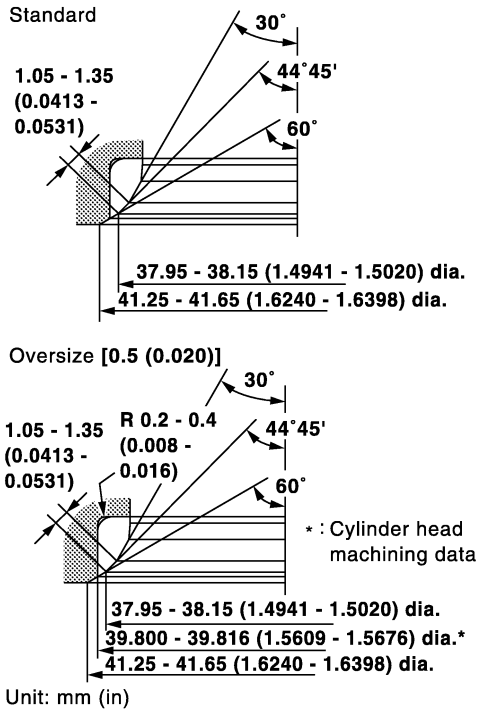
Valve guide

Unit: mm (in)

	Standard	Oversize
Valve guide		
Outer diameter		
Intake	11.023 - 11.034 (0.4340 -0.4344)	11.223 - 11.234 (0.4418 - 0.4423)
Exhaust		
Valve guide		
Inner diameter [Finished size]		
Intake	7.000 - 7.018 (0.2756 - 0.2763)	
Exhaust		
Cylinder head valve guide hole diameter		
Intake	10.975 - 10.996 (0.4321 - 0.4329)	11.175 - 11.196 (0.4400 - 0.4408)
Exhaust		
Interference fit of valve guide		
Intake	0.027 - 0.059 (0.0011 - 0.0023)	
Exhaust		

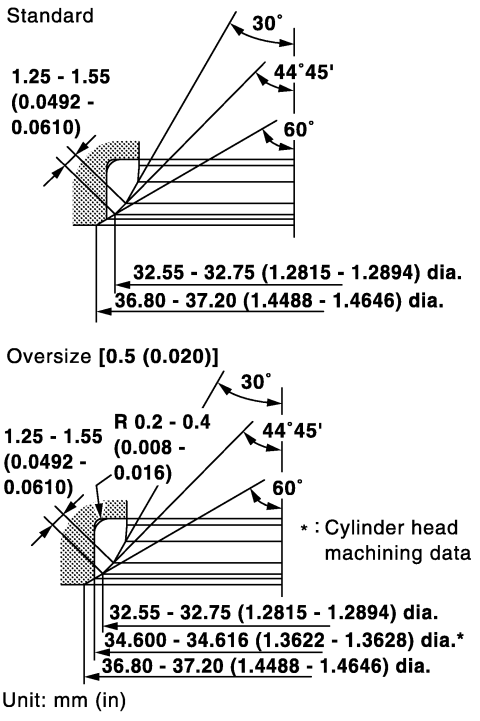
	Standard	Limit
Stem to guide clearance		
Intake	0.020 - 0.053 (0.0008 - 0.0021)	0.1 (0.004)
Exhaust	0.040 - 0.073 (0.0016 - 0.0029)	
Valve deflection limit	—	0.2 (0.008)

Intake valve seat



MEM258A

Exhaust valve seat

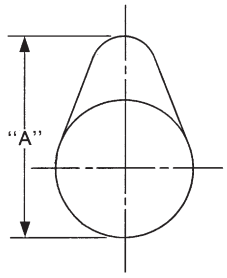


MEM259A

CAMSHAFT AND CAMSHAFT BUSHING

Unit: mm (in)

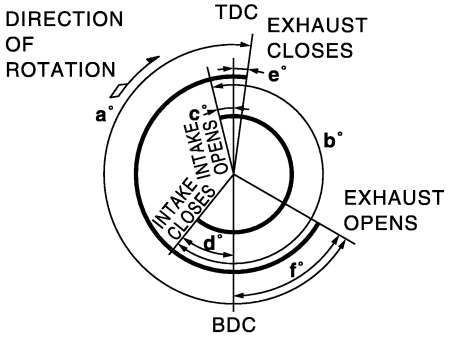
	Standard	Limit
Camshaft journal to bushing clearance [Oil clearance]	0.045 - 0.086 (0.0018 - 0.0034)	0.15 (0.0059)
Inner diameter of camshaft bearing		
1st-7th (Rear)	28.000 - 28.021 (1.1024 - 1.1032)	—
Outer diameter of camshaft journal		
1st-7th (Rear)	27.935 - 27.955 (0.9817 - 1.1006)	—
Camshaft runout (Total indicator reading)	Less than 0.02 (0.0008)	0.1 (0.004)
Camshaft end play	0.115 - 0.188 (0.0045 - 0.0074)	0.2 (0.0079)



EM671

Cam height "A"	
Intake	43.465 - 43.655 (1.7112 - 1.7187)
Exhaust	43.065 - 43.255 (1.6955 - 1.7029)
Wear limit of cam height	0.15 (0.0059)

Valve timing



MEM260A

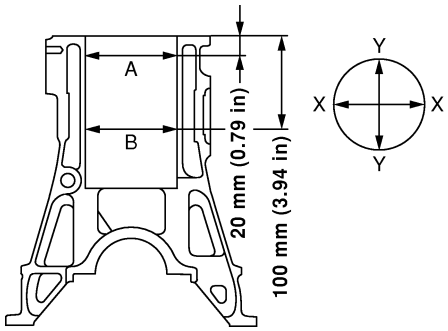
Unit: degree

		a	b	c	d	e	f
Intake valve timing control solenoid	ON	240	248	19	47	5	55
	OFF	240	248	−1	67	5	55

Inspection and Adjustment (Cont'd)

CYLINDER BLOCK

Unit: mm (in)



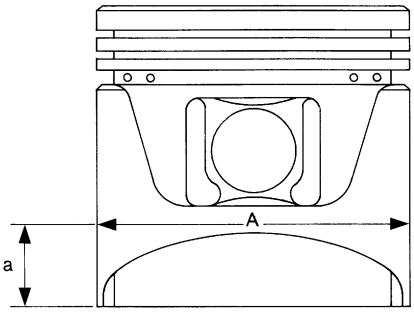
MEM261A

Surface flatness	
Standard	Less than 0.03 (0.0012)
Limit	0.10 (0.0039)
Cylinder bore	
Inner diameter	
Standard	
Grade No. 1	99.500 - 99.510 (3.9173 - 3.9177)
Grade No. 2	99.510 - 99.520 (3.9177 - 3.9181)
Grade No. 3	99.520 - 99.530 (3.9181 - 3.9185)
Grade No. 4	99.530 - 99.540 (3.9185 - 3.9189)
Grade No. 5	99.540 - 99.550 (3.9189 - 3.9193)
Wear limit	0.20 (0.0079)
Out-of-round (X − Y)	Less than 0.025 (0.0010)
Taper (A − B)	Less than 0.025 (0.0010)
Difference in inner diameter between cylinders	
Standard	Less than 0.05 (0.0020)
Wear limit	0.20 (0.0079)

PISTON, PISTON RING AND PISTON PIN

Available piston

Unit: mm (in)



SEM891B

Piston skirt diameter "A"	
Standard	
Grade No. 1	99.460 - 99.470 (3.9157 - 3.9161)
Grade No. 2	99.470 - 99.480 (3.9161 - 3.9165)
Grade No. 3	99.480 - 99.490 (3.9165 - 3.9169)
Grade No. 4	99.490 - 99.500 (3.9169 - 3.9173)
Grade No. 5	99.500 - 99.510 (3.9173 - 3.9177)
Oversize	
0.50 (0.0197) (mark: "50")	99.960 - 100.010 (3.9354 - 3.9374)
1.00 (0.0394) (mark: "100")	100.460 - 100.510 (3.9551 - 3.9571)
"a" dimension	20 (0.79)
Piston pin hole diameter	22.993 - 23.005 (0.9052 - 0.9057)
Piston clearance to cylinder block	0.030 - 0.050 (0.0012 - 0.0020)

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

Inspection and Adjustment (Cont'd)

Piston ring

Unit: mm (in)

	Standard	Limit
Side clearance		
Top	0.040 - 0.080 (0.0016 - 0.0031)	0.1 (0.004)
2nd	0.030 - 0.070 (0.030 - 0.070)	
Oil	0.065 - 0.135 (0.0026 - 0.0053)	
Ring gap [at master bore D = 99.500 (3.9173)] Top	0.30 - 0.45 (0.0118 - 0.0177)	1.5 (0.059)
2nd	0.30 - 0.45 (0.0118 - 0.0177)	
Oil	0.20 - 0.60 (0.0079 - 0.0236)	

Piston pin

Unit: mm (in)

Piston pin outer diameter	22.989 - 23.001 (0.9051 - 0.9055)
Interference fit of piston pin to piston	−0.002 to 0.010 (−0.0001 - 0.0004)
Piston pin to connecting rod bushing clearance	0.005 - 0.017 (0.0002 - 0.0007)

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

CONNECTING ROD

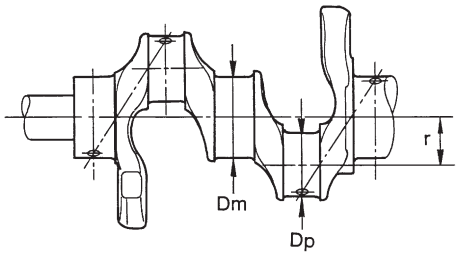
Unit: mm (in)

Center distance	163.45 - 163.55 (6.4350 - 6.4390)
Bend, torsion [per 100 (3.94)]	
Limit	Bend 0.15 (0.0059) Torsion 0.3 (0.012)
Piston pin bushing inner diameter	23.000 - 23.012 (0.9055 - 0.9060)
Connecting rod big end inner diameter	59.987 - 60.000 (2.3617 - 2.3622)
Side clearance	
Standard	0.20 - 0.35 (0.0079 - 0.0138)
Limit	0.40 (0.0157)

CRANKSHAFT

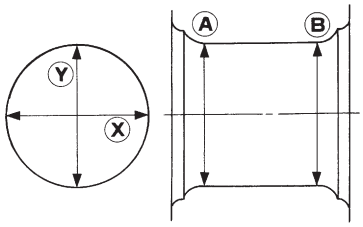
Unit: mm (in)

Main journal dia. "Dm"	70.897 - 70.921 (2.7912 - 2.7922)
Pin journal dia. "Dp"	56.913 - 56.926 (2.2407 - 2.2412)
Center distance "r"	50.95 - 51.05 (2.0059 - 2.0098)
Out-of-round (X − Y)	
Standard	Less than 0.003 (0.0001)
Taper (A − B)	
Standard	Less than 0.003 (0.0001)
Runout [TIR]*	
Standard	Less than 0.02 (0.0008)
Free end play	
Standard	0.05 - 0.169 (0.0020 - 0.0067)
Limit	0.30 (0.0118)



SEM645

Out-of-round (X) – (Y)
Taper (A) – (B)



EM715

*: Total indicator reading

Inspection and Adjustment (Cont'd)

AVAILABLE MAIN BEARING

Unit: mm (in)

	Thickness "T"	Main journal diameter "Dm"
Standard	2.008 - 2.012 (0.0791 - 0.0792)	—
Undersize		Grind so that bearing clearance is the specified value.
0.50 (0.0197)	2.258 - 2.262 (0.0889 - 0.0891)	
1.00 (0.0394)	2.508 - 2.512 (0.0987 - 0.0989)	

AVAILABLE CONNECTING ROD BEARING

Unit: mm (in)

	Thickness "T"	Crank pin journal diameter "Dp"
Standard	1.513 - 1.517 (0.0596 - 0.0597)	—
Undersize		Grind so that bearing clearance is the specified value.
0.25 (0.0098)	1.638 - 1.642 (0.0645 - 0.0646)	
0.50 (0.0197)	1.763 - 1.767 (0.0694 - 0.0696)	
0.75 (0.0295)	1.888 - 1.892 (0.0743 - 0.0745)	
1.00 (0.0394)	2.013 - 2.017 (0.0793 - 0.0794)	

MISCELLANEOUS COMPONENTS

Unit: mm (in)

Flywheel/Drive plate Runout [TIR]*	Less than 0.1 (0.004)

*: Total indicator reading

Bearing clearance

Unit: mm (in)

Main bearing clearance	
Standard	0.030 - 0.087 (0.0012 - 0.0034)
Limit	0.09 (0.0035)
Connecting rod bearing clearance	
Standard	0.027 - 0.061 (0.0011 - 0.0024)
Limit	0.09 (0.0035)