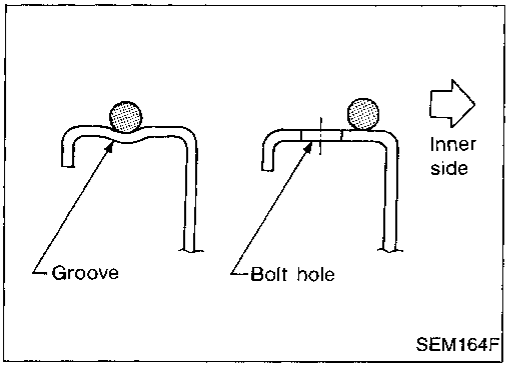
SECTION EM

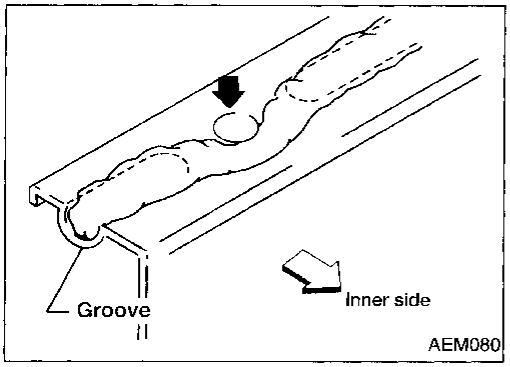
CONTENTS

PRECAUTIONS 2
Parts Requiring Angular Tightening 2
Liquid Gasket Application Procedure 2
PREPARATION 3
Special Service Tools 3
Commercial Service Tools 6
NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING 7
NVH Troubleshooting — Engine Noise 8
OUTER COMPONENT PARTS 9
COMPRESSION PRESSURE 12
OIL PAN 13
Removal 13
Installation 16
TIMING CHAIN 18
Removal 19
Inspection 23
Installation 23
OIL SEAL REPLACEMENT 33
Valve Oil Seal 33
Front Oil Seal 33
Rear Oil Seal 34
CYLINDER HEAD 35
Removal 36
Disassembly 36
Inspection 39
Cylinder Head Distortion 39
Camshaft Visual Check 39
Camshaft Runout 39
Camshaft Cam Height 39
Camshaft Journal Clearance 40
Camshaft End Play 40
Camshaft Sprocket Runout 41
Valve Guide Clearance 41
Valve Guide Replacement 41
Valve Seats 42
Replacing Valve Seat For Service Parts 43
Valve Dimensions 43
Valve Spring 44
Hydraulic Lash Adjuster 44
Rocker Arm, Shim And Rocker Arm Guide 45
Assembly 45
Installation 48
ENGINE REMOVAL 49
Removal 50
Installation 52
CYLINDER BLOCK 53
Disassembly 54
Inspection 54
Piston And Piston Pin Clearance 54
Piston Ring Side Clearance 55
Piston Ring End Gap 55
Connecting Rod Bend And Torsion 55
Cylinder Block Distortion And Wear 56
Piston-To-Bore Clearance 56
Crankshaft 57
Bearing Clearance 58
Connecting Rod Bushing Clearance (Small end) 60
Replacement of Connecting Rod Bushing (Small end) 61
Replacement of Pilot Bushing (M/T) Or Pilot Converter (A/T) 61
Flywheel/Drive Plate Runout 61
Assembly 62
SERVICE DATA AND SPECIFICATIONS (SDS) 65
General Specifications 65
Inspection and Adjustment 65

Parts Requiring Angular Tightening

- Use an angle wrench for the final tightening of the following engine parts:
  (1) Cylinder head bolts
  (2) Main bearing cap bolts (SR engine only)
  (3) Connecting rod cap nuts
- Do not use a torque value for final tightening.
- The torque value for these parts are for a preliminary step.
- Ensure thread and seat surfaces are clean and coated with engine oil.





Liquid Gasket Application Procedure

a. Use a scraper to remove old liquid gasket from mating surfaces and grooves. Also, completely clean any oil from these areas.

b. Apply a continuous bead of liquid gasket to mating surfaces. (Use Genuine RTV silicone sealant Part No. 999 MP-A7007, Three Bond TB1207D or equivalent.)
- **For oil pan, be sure liquid gasket diameter is 4.0 to 5.0 mm (0.157 to 0.197 in).**
- **For areas except oil pan, be sure liquid gasket diameter is 2.0 to 3.0 mm (0.079 to 0.118 in).**

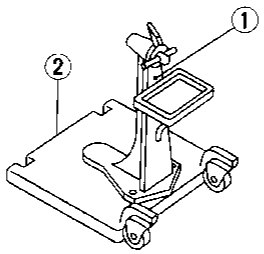
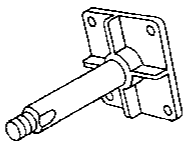
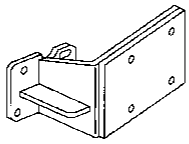
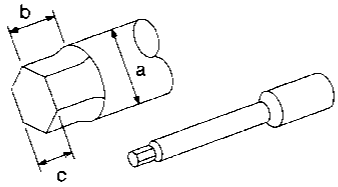
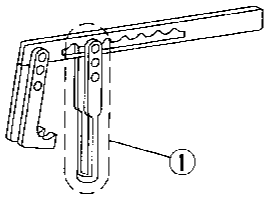
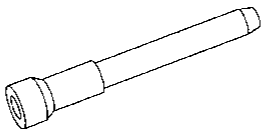
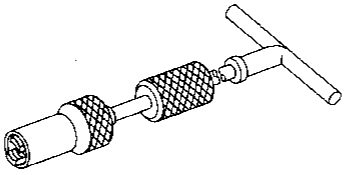
c. Apply liquid gasket around the inner side of bolt holes (unless otherwise specified).

d. Assembly should be done within 5 minutes after coating.

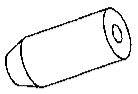
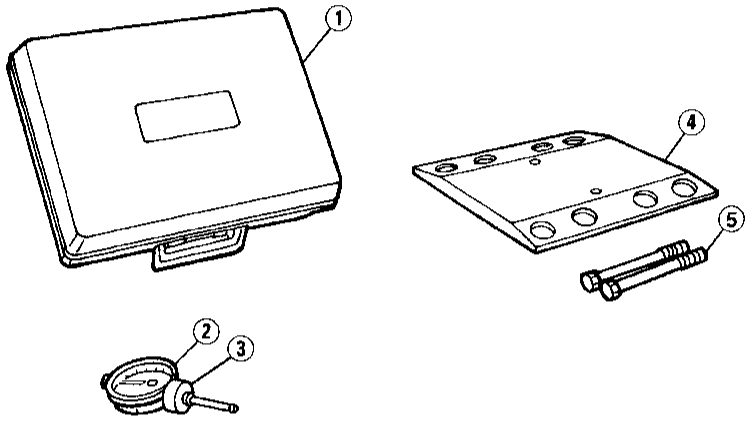
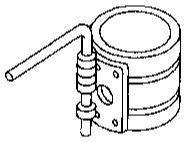
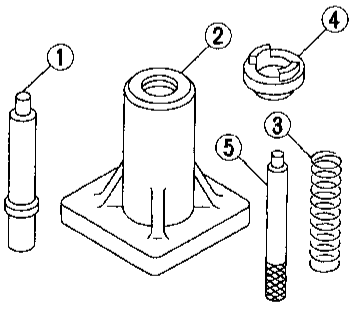
e. Wait at least 30 minutes before refilling engine oil and engine coolant.

Special Service Tools

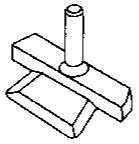
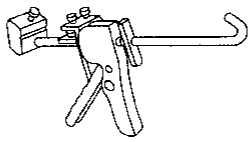
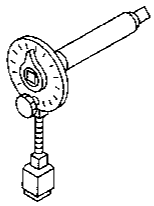
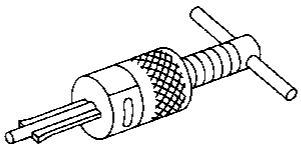
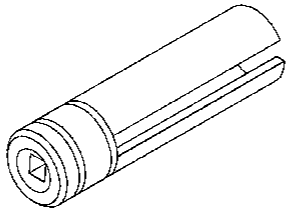
The actual shapes of Kent-Moore tools may differ from those of special service tools illustrated here.

Tool number (Kent-Moore No.) Tool name	Description	
ST0501S000 (—) Engine stand assembly ① ST05011000 (—) Engine stand ② ST05012000 (—) Base	 NT042	Disassembling and assembling
KV10106500 (—) Engine stand shaft	 NT028	
KV10115300 (—) Engine sub-attachment	 NT008	
ST10120000 (J24239-01) Cylinder head bolt wrench	 NT583	Loosening and tightening cylinder head bolt **a: 13 (0.51) dia.** **b: 12 (0.47)** **c: 10 (0.39)** Unit: mm (in)
KV10116200 (J26336-B) Valve spring compressor ① KV10115900 (J26336-20) Attachment	 NT022	Disassembling valve mechanism
KV10115600 (J38958) Valve oil seal drift	 NT024	Installing valve oil seal
KV10107902 (J38959) Valve oil seal puller	 NT011	Displacement valve lip seal

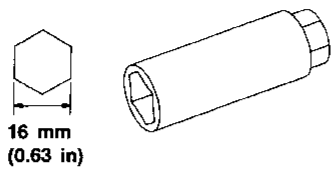
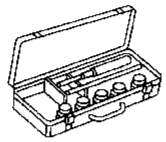
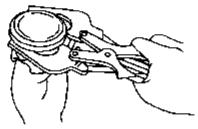
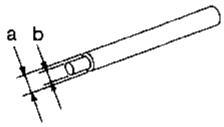
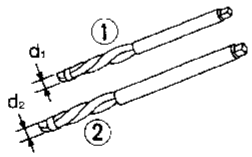
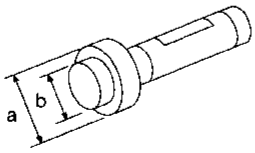
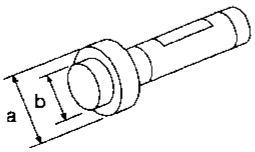
Special Service Tools (Cont'd)

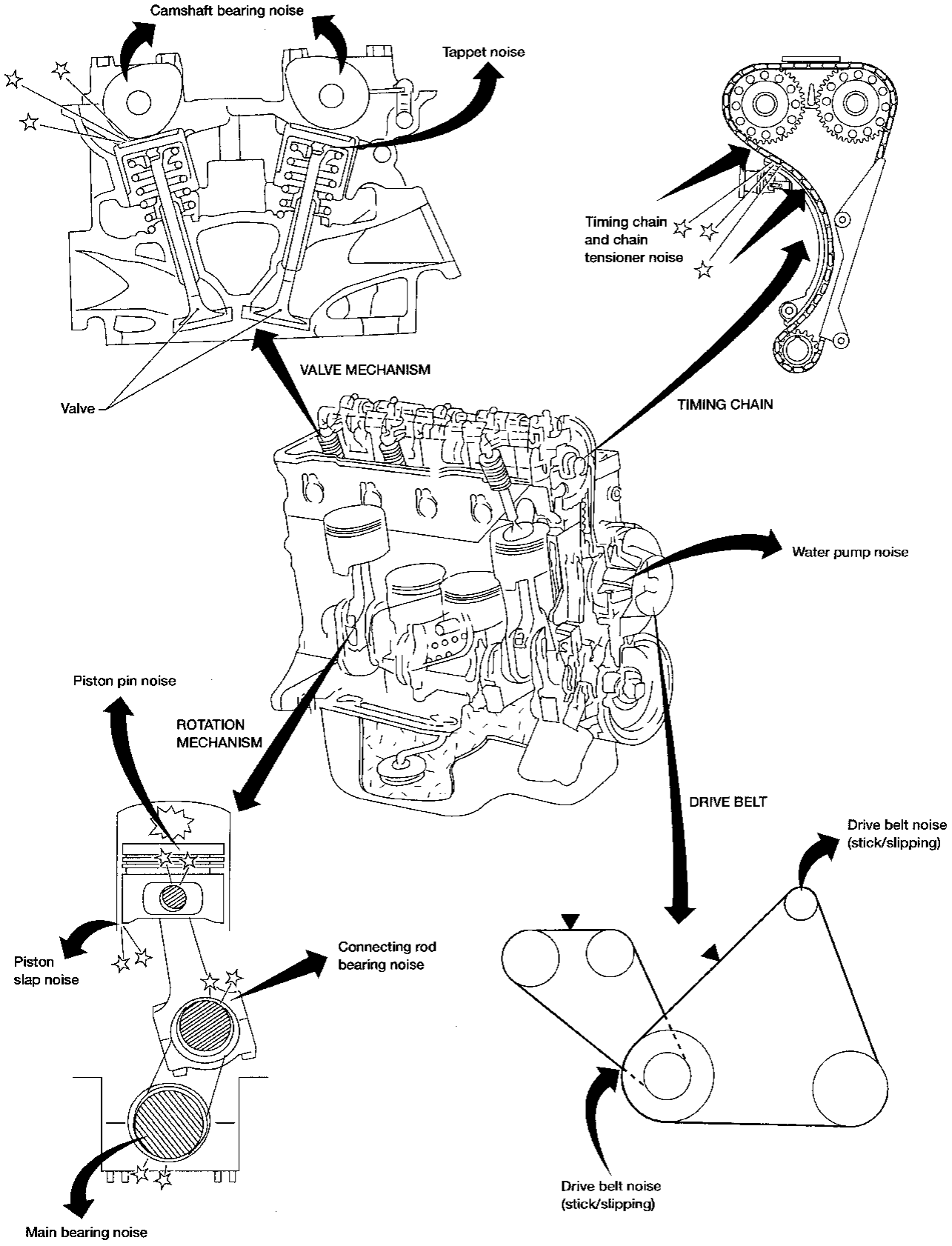
Tool number (Kent-Moore No.) Tool name	Description
KV10115700 (J38957) Dial gauge stand	Adjusting shims  NT012
(J38957-N) Valve shim gauge plate kit ① — (J35772) Plastic case ② — (J38957-8) Dial indicator ③ — (J38957-2) Collar ④ — (J38957-1) Plate ⑤ — (—) Hex bolts	Measuring valve shims  AEM274
EM03470000 (J8037) Piston ring compressor	Installing piston assembly into cylinder bore  NT044
KV10107400 (J26365-12, J26365) Piston pin press stand ① KV10107310 (—) Center shaft ② ST13040020 (—) Stand ③ ST13040030 (—) Spring ④ KV10107320 (—) Cap ⑤ ST13040050 (—) Drift	Disassembling and assembling piston pin  NT013

Special Service Tools (Cont'd)

Tool number (Kent-Moore No.) Tool name	Description	
KV10111100 (J37228) Seal cutter	 NT046	Removing oil pan
WS39930000 (—) Tube presser	 NT052	Pressing the tube of liquid gasket
KV10112100 (BT-8653-A) Angle wrench	 NT014	Tightening bolts for bearing cap, cylinder head, etc.
ST16610001 (J23907) Pilot bushing puller	 NT045	Removing pilot bushing
(J36471-A) Front (heated) oxygen sensor wrench	 NT379	Loosening or tightening front (heated) oxygen sensor

Commercial Service Tools

Tool name	Description	
Spark plug wrench	 NT047	Removing and installing spark plug
Valve seat cutter set	 NT048	Finishing valve seat dimensions
Piston ring expander	 NT030	Removing and installing piston ring
Valve guide drift	 NT015	Removing and installing valve guide **Intake & Exhaust** a: 9.5 mm (0.374 in) dia b: 5.0 mm (0.197 in) dia
Valve guide reamer	 NT016	Reaming valve guide ① or hole for oversize valve guide ② **Intake & Exhaust** d_1: 6.0 mm (0.236 in) dia d_2: 10.175 mm (0.4006 in) dia
Front oil seal drift	 NT049	Installing front oil seal **a: 75 mm (2.95 in) dia.** **b: 45 mm (1.77 in) dia.**
Rear oil seal drift	 NT049	Installing rear oil seal **a: 110 mm (4.33 in) dia.** **b: 80 mm (3.15 in) dia.**


Camshaft bearing noise
Tappet noise
Timing chain and chain tensioner noise
VALVE MECHANISM
Valve
TIMING CHAIN
Water pump noise
Piston pin noise
ROTATION MECHANISM
DRIVE BELT
Drive belt noise (stick/slipping)
Piston slap noise
Connecting rod bearing noise
Drive belt noise (stick/slipping)
Main bearing noise

AEM400

Use the table below to help you find the cause of the problem.
1. Locate the area where noise occurs.
2. Confirm the type of noise.
3. Specify the operating condition of the engine.
4. Check the specified noise source.

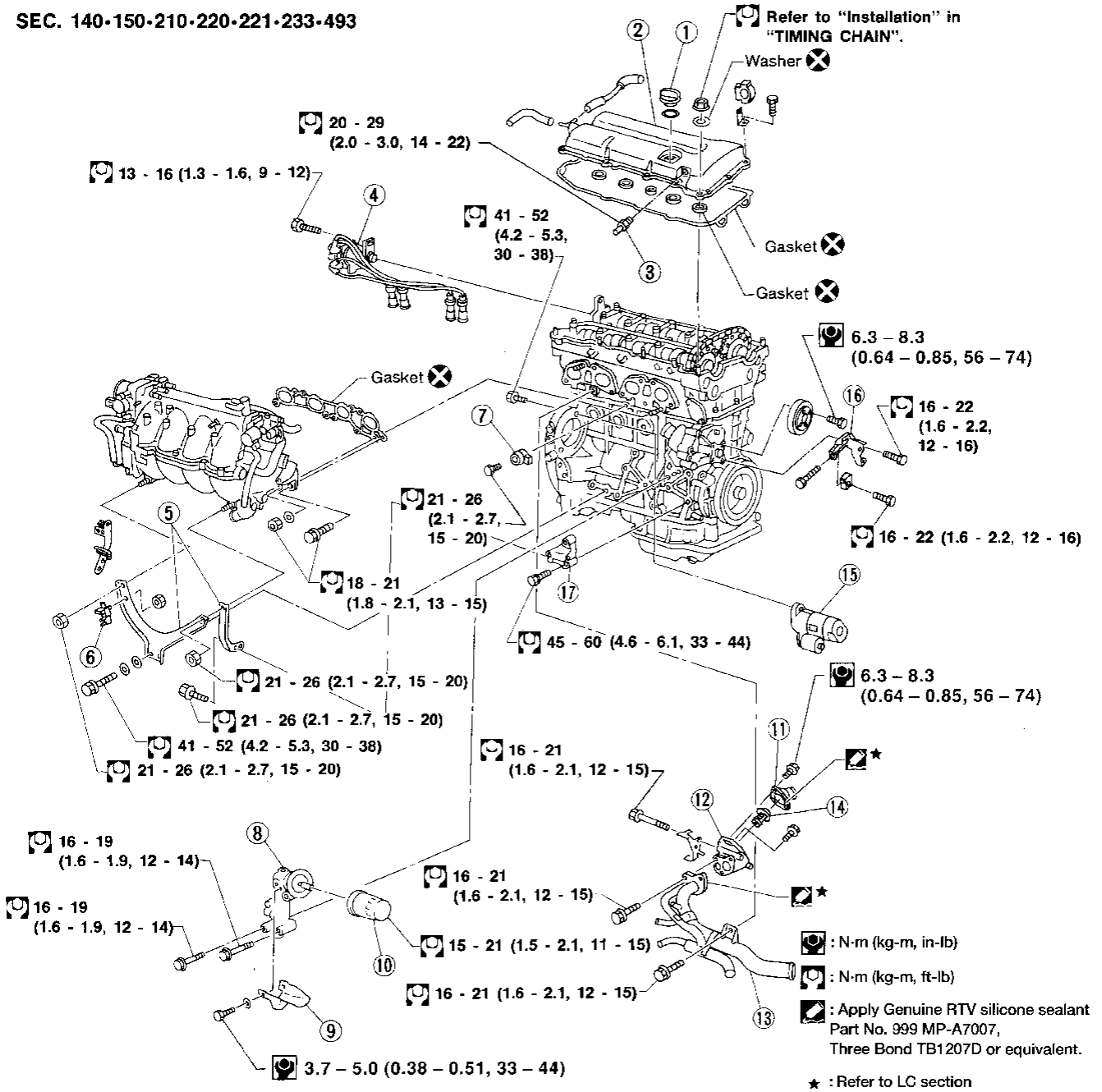
If necessary, repair or replace these parts.

NVH Troubleshooting — Engine Noise

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	Hydraulic lash adjuster	EM-46, 48
	Rattle	C	A	—	A	B	C	Camshaft bearing noise	Camshaft journal clearance Camshaft runout	EM-39, 40
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-54, 60
	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-55, 56
	Knock	A	B	C	B	B	B	Connecting rod-bearing noise	Connecting rod bushing clearance (Small end) Connecting rod bearing clearance (Big end)	EM-59, 60
	Knock	A	B	—	A	B	C	Main bearing noise	Main bearing oil clearance Crankshaft runout	EM-57, 58
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	EM-23
Front of engine	Squeaking or fizzing	A	B	—	B	—	C	Other drive belts (sticking or slipping)	Drive belt deflection	MA Section ("Checking Drive Belts", "ENGINE MAINTENANCE")
	Creaking	A	B	A	B	A	B	Other drive belts (slipping)	Idler pulley bearing operation	
	Squall or 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•150•210•220•221•233•493

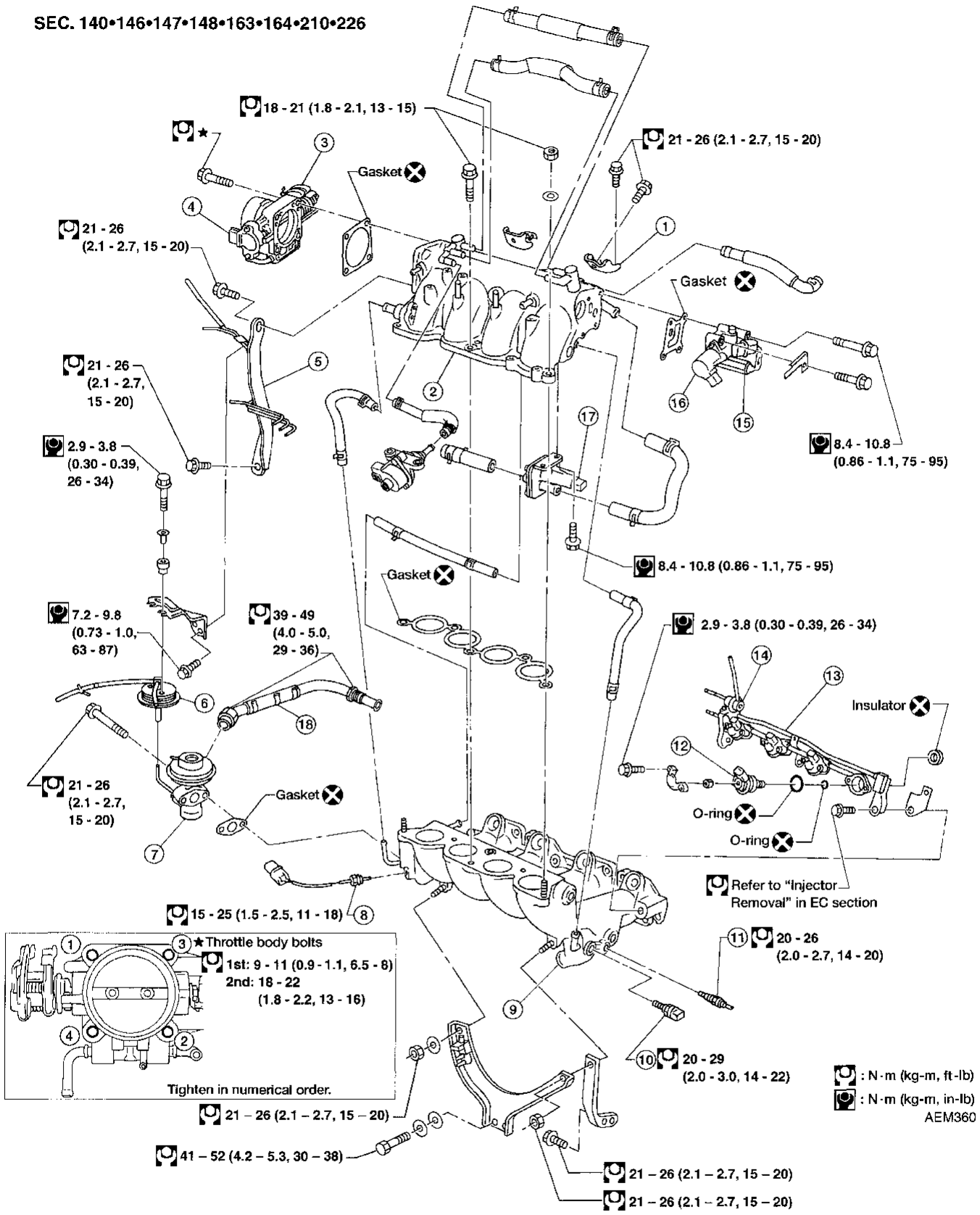


AEM359

① Oil filler cap
② Rocker cover
③ PCV valve
④ Distributor
⑤ Intake manifold supports
⑥ EGRC-solenoid valve
⑦ Knock sensor
⑧ Oil filter bracket
⑨ Oil catcher
⑩ Oil filter
⑪ Water inlet
⑫ Thermostat housing
⑬ Water pipe assembly
⑭ Thermostat
⑮ Starter motor
⑯ Power steering oil pump adjusting bar
⑰ Power steering oil pump bracket

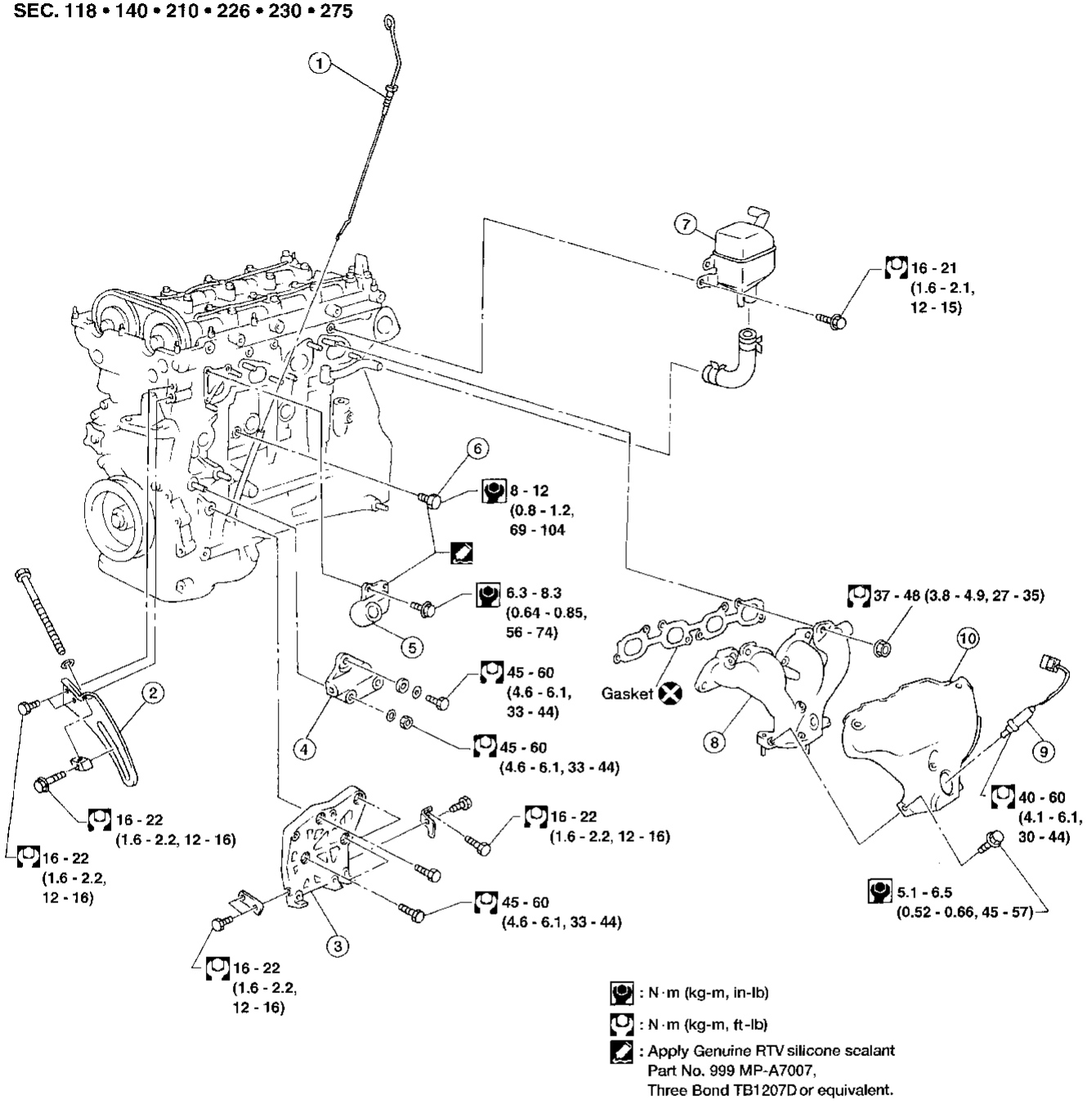
OUTER COMPONENT PARTS

SEC. 140•146•147•148•163•164•210•226



① Intake manifold collector support
② Intake manifold collector
③ Throttle body
④ Throttle position sensor
⑤ Intake manifold collector support
⑥ EGRC-BPT valve
⑦ EGR valve
⑧ EGR temperature sensor
⑨ Intake manifold
⑩ Engine coolant temperature sensor
⑪ Thermal transmitter
⑫ Injector
⑬ Fuel tube assembly
⑭ Pressure regulator
⑮ IACV-FICD solenoid valve
⑯ IACV-AAC valve
⑰ IACV-air regulator
⑱ EGR tube

SEC. 118 • 140 • 210 • 226 • 230 • 275

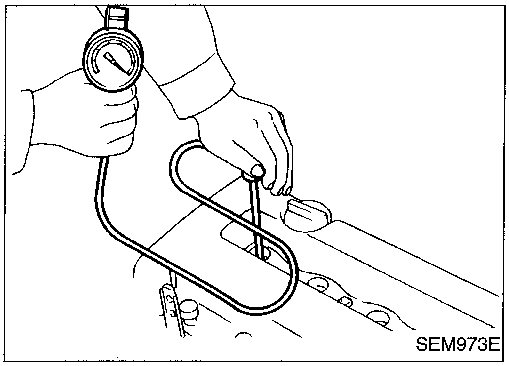


AEM346

① Oil level gauge
② Generator adjusting bar
③ A/C compressor bracket
④ Generator bracket
⑤ Water outlet
⑥ Cylinder block drain plug
⑦ Crankcase ventilation oil separator
⑧ Exhaust manifold
⑨ Front heated oxygen sensor
⑩ Exhaust manifold cover

Measurement of Compression Pressure

1. Warm up engine.
2. Turn ignition switch OFF.
3. Release fuel pressure.
   Refer to EC section ("Fuel Pressure Release", "BASIC SERVICE PROCEDURE").
4. Remove all spark plugs.
5. Disconnect distributor coil connector.


SEM973E

6. Attach a compression tester to No. 1 cylinder.
7. Depress accelerator pedal fully to keep throttle valve wide open.
8. Crank engine and record highest gauge indication.
9. Repeat the measurement on each cylinder.

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

Compression pressure: kPa (kg/cm^2, psi)/rpm

Standard

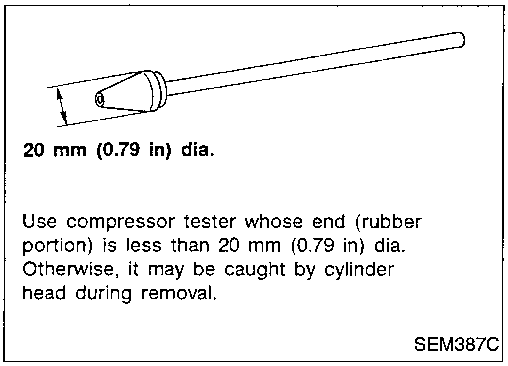
1,226 (12.5, 178)/300

Minimum

1,030 (10.5, 149)/300

Difference limit between cylinders

98 (1.0, 14)/300



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

SEM387C

10. If compression in one or more cylinders is low:

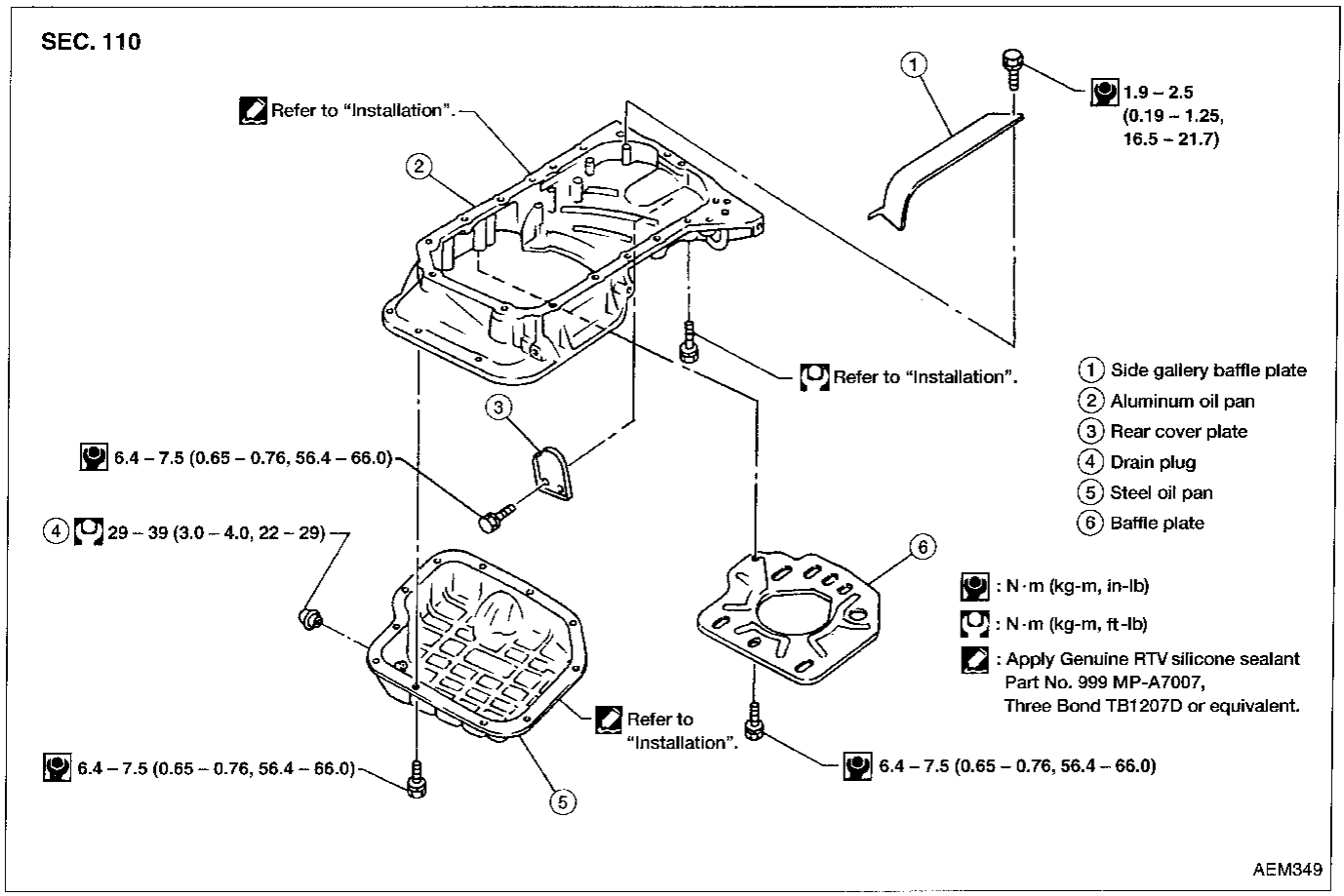
a. Pour a small amount of engine oil into cylinders through spark plug holes.

b. Retest compression.

- **If adding oil helps compression, piston rings may be worn or damaged. If so, replace piston rings after checking piston.**
- **If pressure stays low, a valve may be sticking or seating improperly. Inspect and repair valve and valve seat. Refer to SDS, EM-67. If valve or valve seat is damaged excessively, replace them.**
- **If compression stays low in two cylinders that are next to each other:**

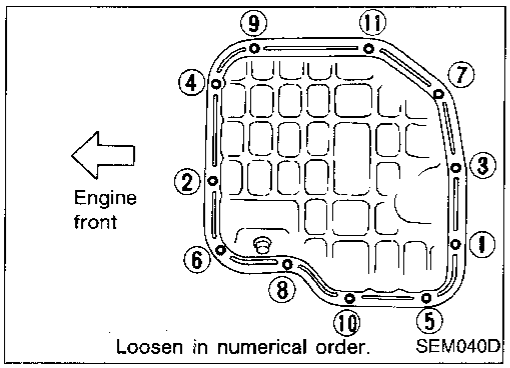
a. The cylinder head gasket may be leaking, or

b. Both cylinders may have valve component damage. Inspect and repair as necessary.

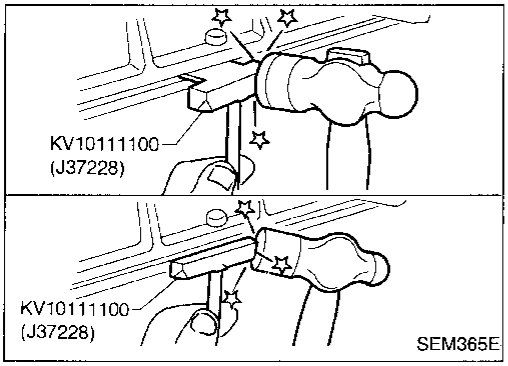


Removal

1. Remove engine side cover.
2. Drain engine oil.



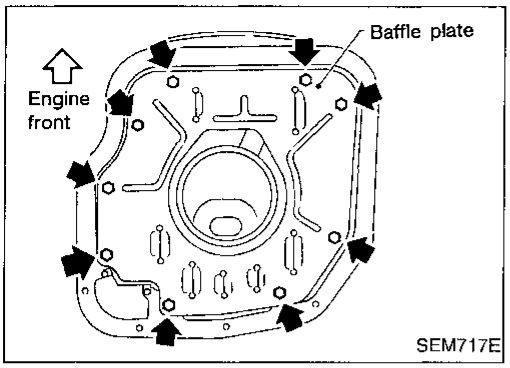
3. Remove steel oil pan bolts in numerical order.



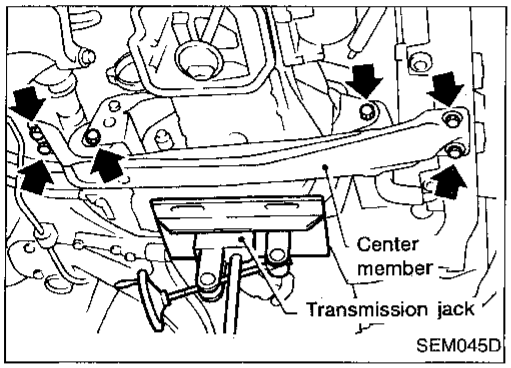
4. Remove steel oil pan.
a. Insert Tool between aluminum oil pan and steel oil pan.
- **Be careful not to damage aluminum mating surface.**
- **Do not insert screwdriver, or oil pan flange will be damaged.**

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

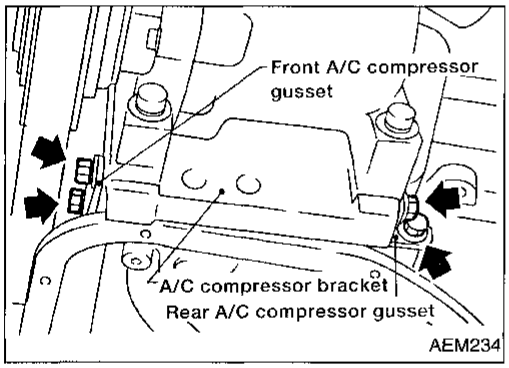
Removal (Cont'd)



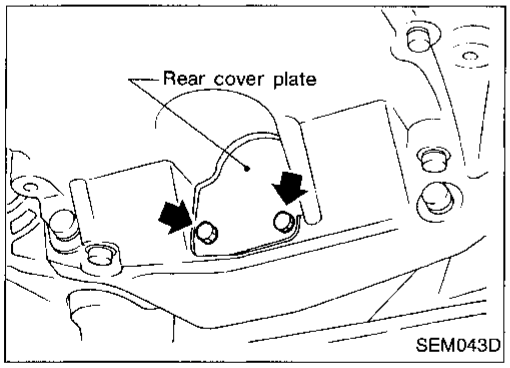
5. Remove baffle plate.



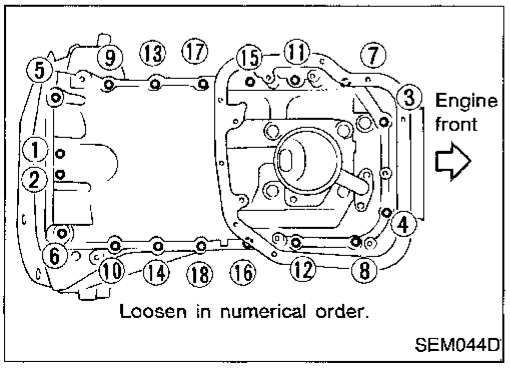
6. Remove front exhaust tube. Refer to FE section ("EXHAUST SYSTEM").
7. Set a suitable transmission jack under transaxle and lift engine with engine slinger.
8. Remove center member.
9. Remove A/T control cable.



10. Remove A/C compressor gussets.

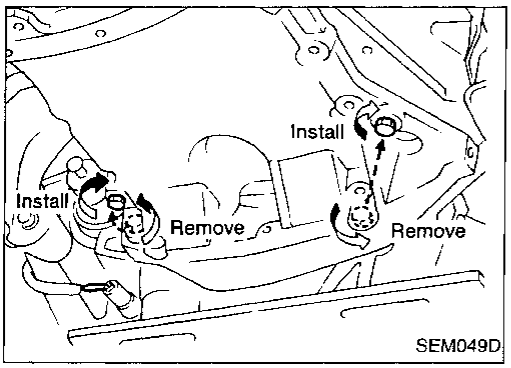


11. Remove rear cover plate.

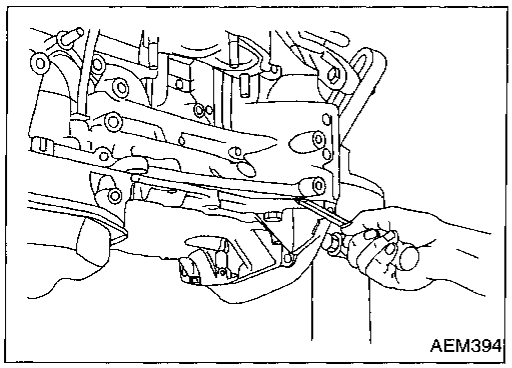


12. Remove aluminum oil pan bolts in numerical order.

Removal (Cont'd)

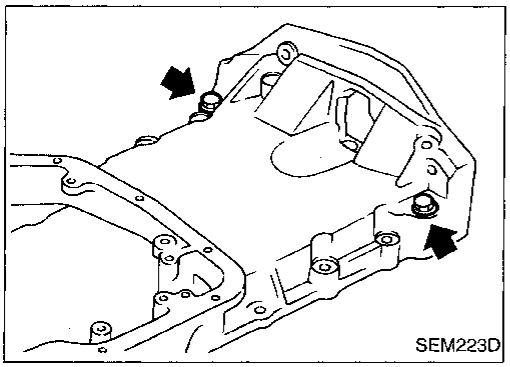


13. Remove two engine-to-transaxle bolts and install them into open bolt holes as shown. Tighten both bolts to separate aluminum oil pan from cylinder block.

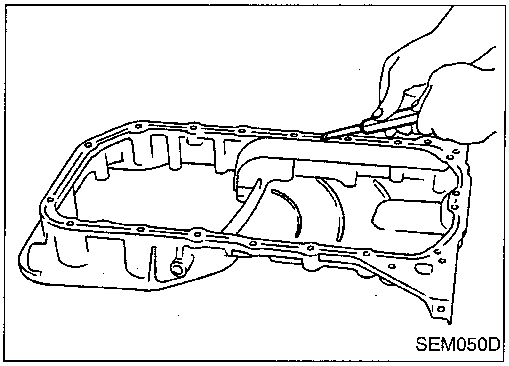


14. Remove aluminum oil pan.
a. Insert Tool between cylinder block and aluminum oil pan.
- **Be careful not to damage aluminum mating surface.**
- **Do not insert screwdriver, or oil pan flange will be damaged.**

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



15. Remove the two engine-to-transaxle bolts previously installed in aluminum oil pan.

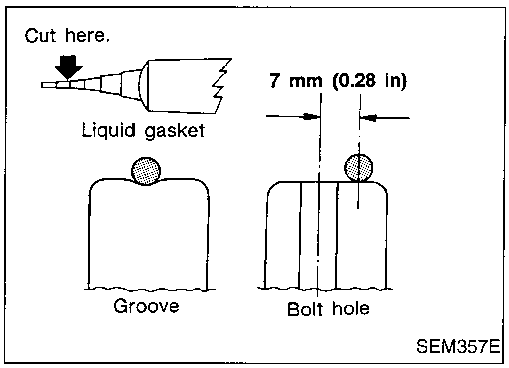

SEM050D

Installation

1. Install aluminum oil pan.

a. Use a scraper to remove old liquid gasket from mating surfaces.

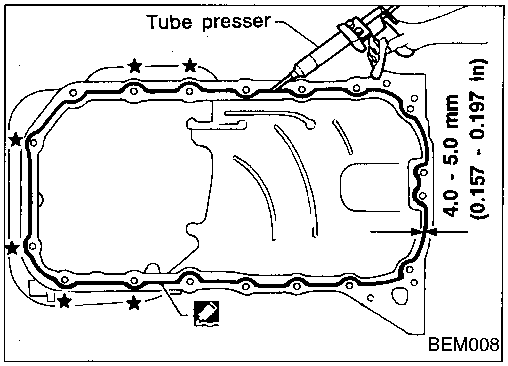
- **Also remove old liquid gasket from mating surfaces of cylinder block and front cover.**



SEM357E

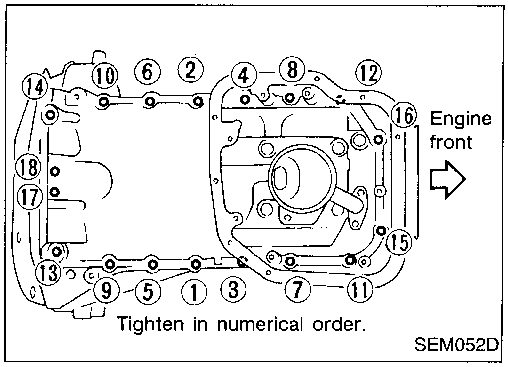
b. Apply a continuous bead of liquid gasket to mating surface of aluminum oil pan.

- **Use Genuine RTV silicone sealant Part No. 999 MP-A7007, Three Bond TB1207D or equivalent.**
- **Apply to groove on mating surface.**
- **Allow 7 mm (0.28 in) clearance around bolt holes.**



BEM008

- **For areas marked with "★", apply liquid gasket around the outer side of the bolt hole as shown.**
- **Be sure liquid gasket diameter is 4.0 to 5.0 mm (0.157 to 0.197 in).**
- **Attaching should be done within 5 minutes after coating.**



SEM052D

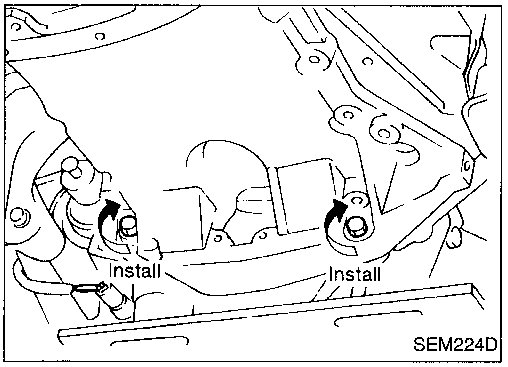
c. Tighten nuts and bolts in numerical order.

Bolts ① - ⑯ :

: 16 - 19 N·m (1.6 - 1.9 kg-m, 12 - 14 ft-lb)

Bolts ⑰ , ⑱ :

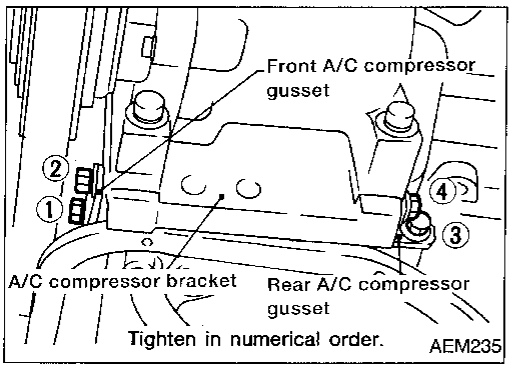
: 6.4 - 7.5 N·m (0.65 - 0.76 kg-m, 56.4 - 66.0 in-lb)



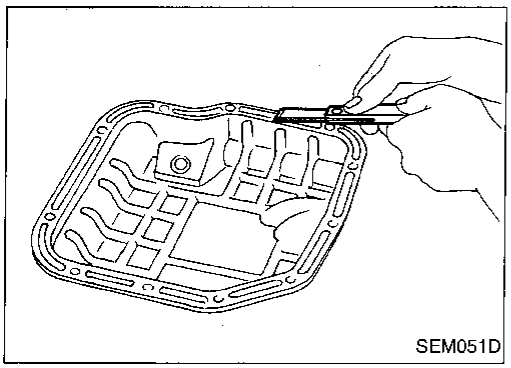
SEM224D

2. Install the two engine-to-transaxle bolts.
   For tightening torque, refer to MT or AT section ("REMOVAL AND INSTALLATION").
3. Install rear cover plate.

Installation (Cont'd)



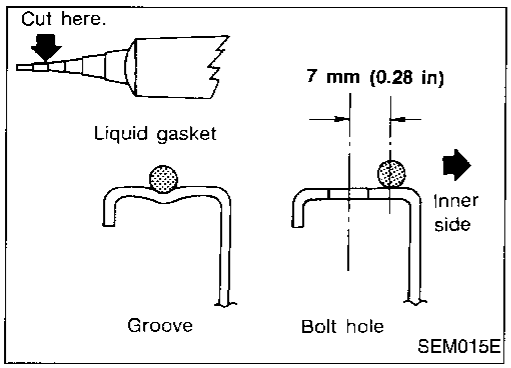
4. Install A/C compressor gussets.
5. Install A/T control cable.
6. Install center member.
7. Install front exhaust tube.
8. Install baffle plate.



9. Install steel oil pan.

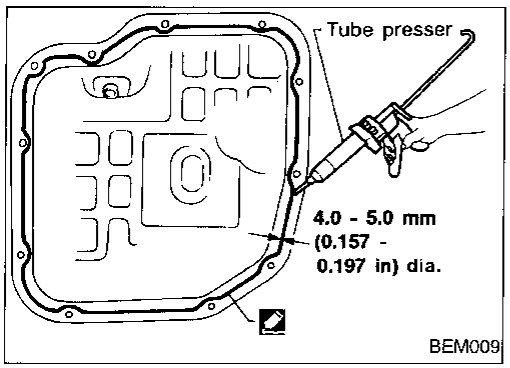
a. Use a scraper to remove old liquid gasket from mating surface of steel oil pan.

- **Also remove old liquid gasket from mating surface of aluminum oil pan.**

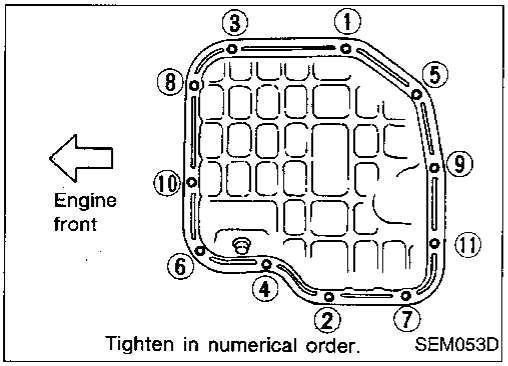


b. Apply a continuous bead of liquid gasket to mating surface of steel oil pan.

- **Use Genuine RTV silicone sealant Part No. 999 MP-A7007, Three Bond TB1207D or equivalent.**
- **Apply to groove on mating surface.**
- **Allow 7 mm (0.28 in) clearance around bolt hole.**



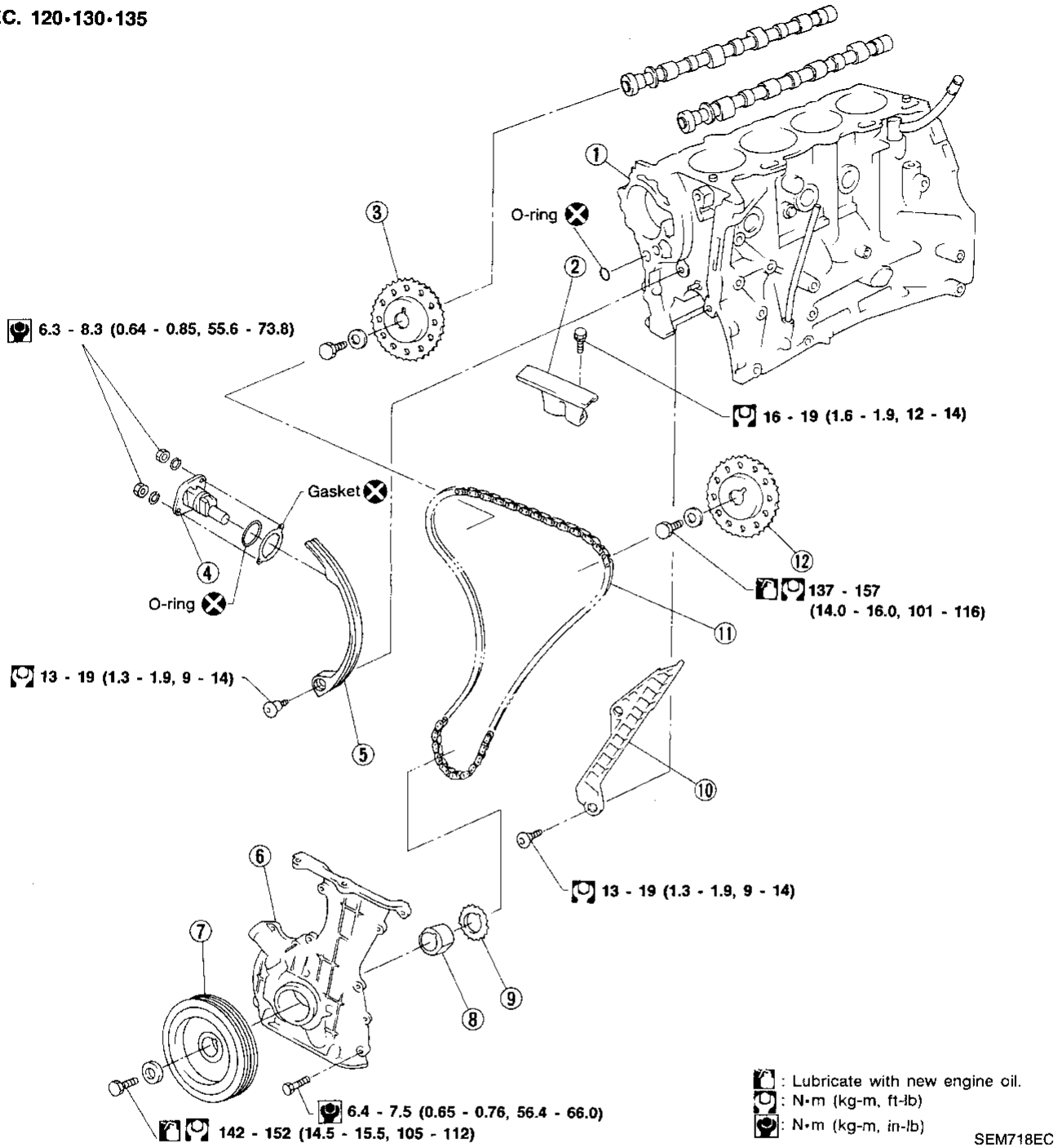
- **Be sure liquid gasket diameter is 4.0 to 5.0 mm (0.157 to 0.197 in).**
- **Attaching should be done within 5 minutes after coating.**



c. Tighten bolts in numerical order as shown.

- **Wait at least 30 minutes before refilling engine oil.**

SEC. 120•130•135



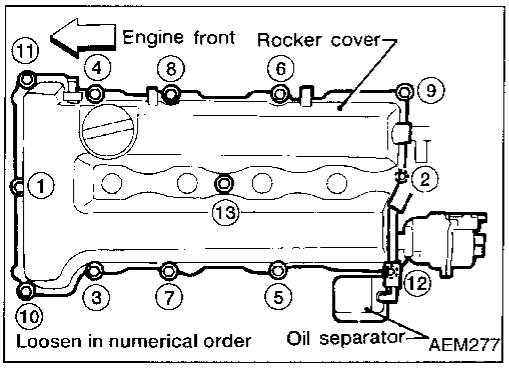
① Cylinder block
② Chain guide
③ RH camshaft sprocket
④ Chain tensioner
⑤ Chain guide
⑥ Front cover
⑦ Crankshaft pulley
⑧ Oil pump drive spacer
⑨ Crankshaft sprocket
⑩ Chain guide
⑪ Timing chain
⑫ LH camshaft sprocket

CAUTION:

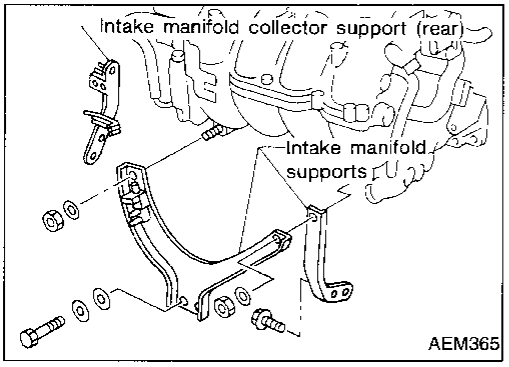
- **After removing timing chain, do not turn crankshaft and camshaft separately, or valves will strike piston heads.**
- **When installing rocker arms, camshafts, chain tensioner, oil seals, or other sliding parts, lubricate contacting surfaces with new engine oil.**
- **Apply new engine oil to bolt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

Removal

1. Release fuel pressure.
   Refer to EC section ("Fuel Pressure Release", "BASIC SERVICE PROCEDURE").
2. Remove engine under covers.
3. Remove front RH wheel and engine side cover.
4. Drain coolant by removing cylinder block drain plug and radiator drain cock. Refer to MA section ("Changing Engine Coolant", "ENGINE MAINTENANCE").
5. Remove radiator.
6. Remove air duct to intake manifold.
7. Remove drive belts and water pump pulley.
8. Remove generator and power steering pump.
9. Disconnect the following parts:
   - Vacuum hoses
   - Fuel hoses
   - Wires
   - Harness
   - Connectors
10. Remove all spark plugs.

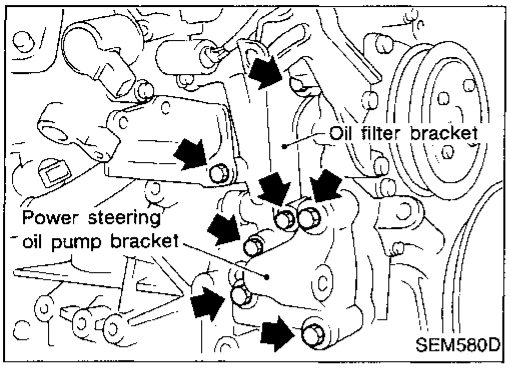


11. Remove rocker cover bolts in numerical order.
12. Remove rocker cover and oil separator.

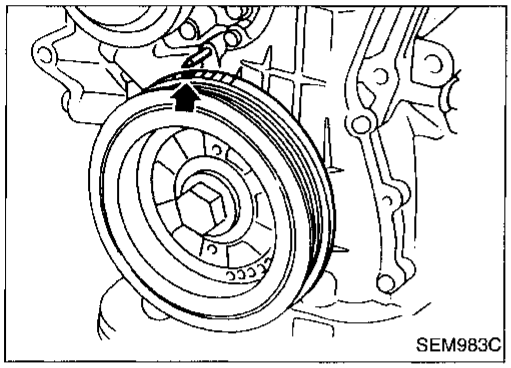


13. Remove intake manifold supports.

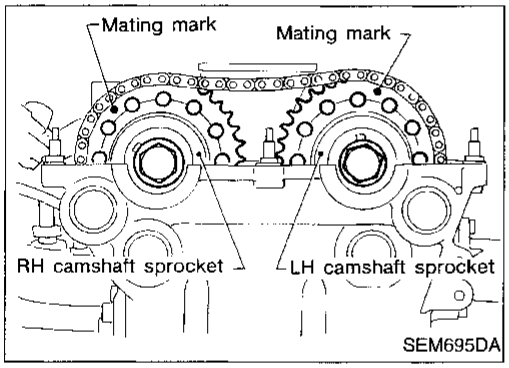
Removal (Cont'd)



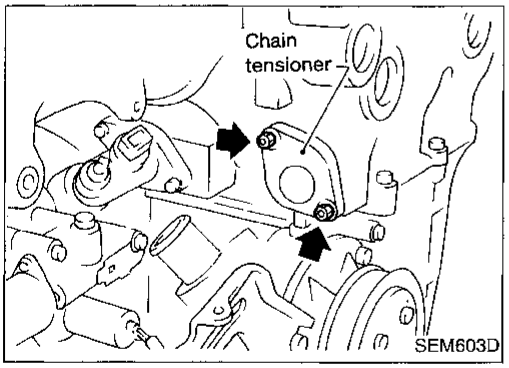
14. Remove oil filter bracket and power steering oil pump bracket.



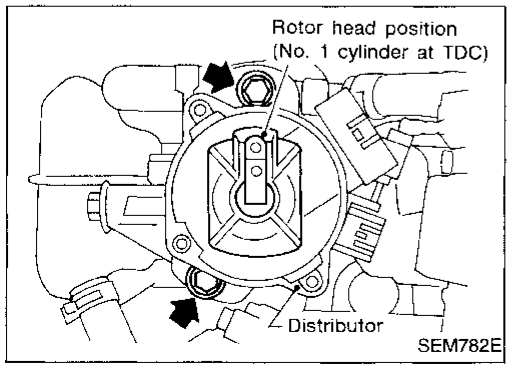
15. Set No. 1 piston at TDC of its compression stroke.



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



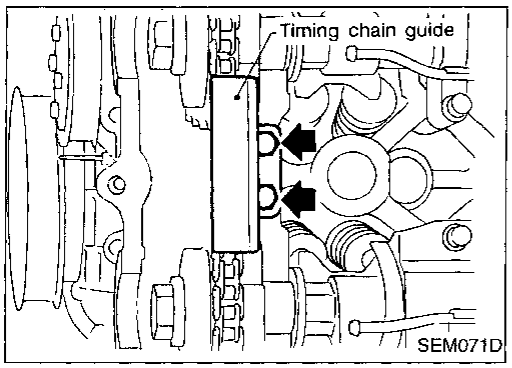
16. Remove chain tensioner.



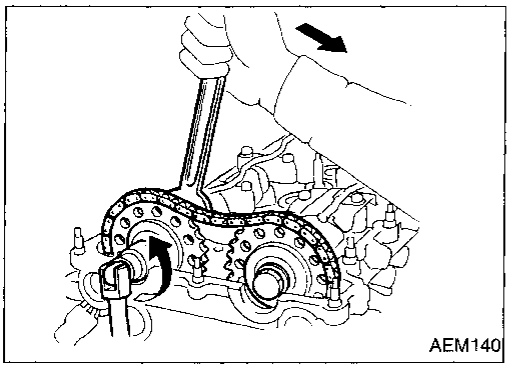
17. Remove distributor.

Do not turn rotor with distributor removed.

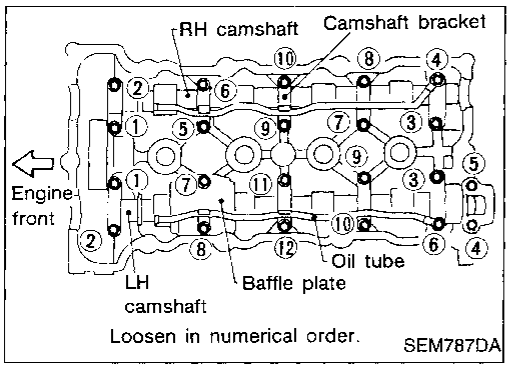
Removal (Cont'd)



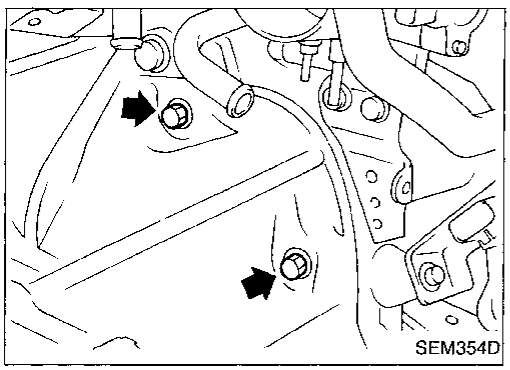
18. Remove timing chain guide.



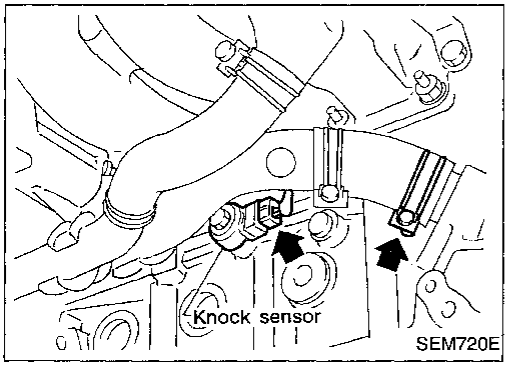
19. Remove camshaft sprockets.
- **For retiming in cylinder head removal, apply paint mark to timing chain matched with mating marks of camshaft sprockets.**



20. Remove oil tubes, baffle plate, camshaft brackets and camshafts.
- **Mark these parts' original positions for reassembly.**

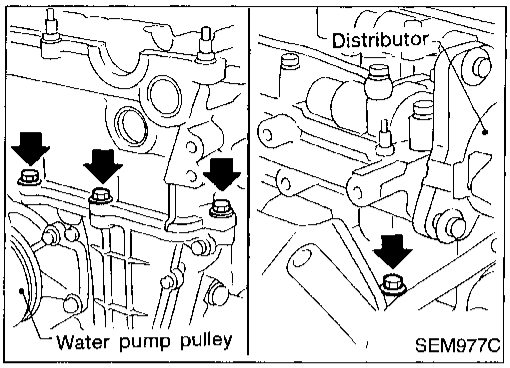


21. Remove starter motor.
22. Remove the following water hoses:
- Water hose for cylinder block.
- Water hoses for heater.

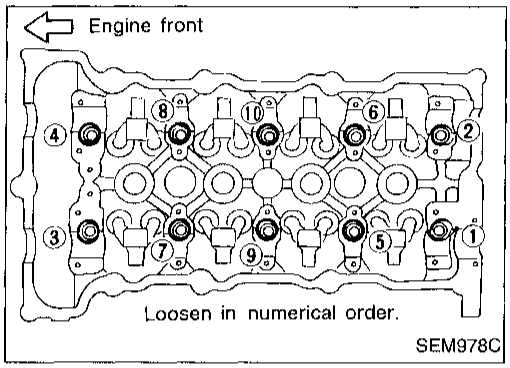


23. Remove knock sensor harness connector.
24. Remove EGR tube.

Removal (Cont'd)

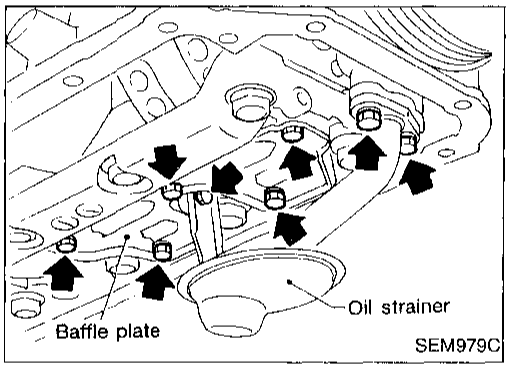


25. Remove cylinder head outside bolts.

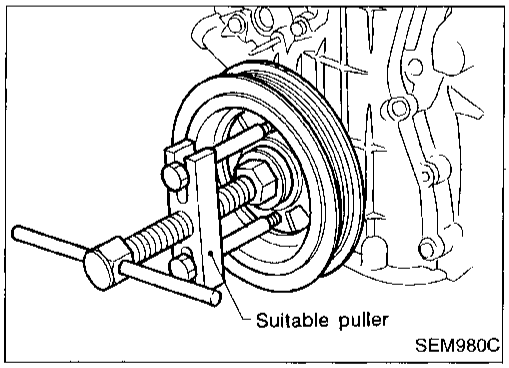


26. Remove cylinder head bolts in numerical order.
- **Removing bolts in incorrect order could result in a warped or cracked cylinder head.**
- **Loosen cylinder head bolts in two or three steps.**

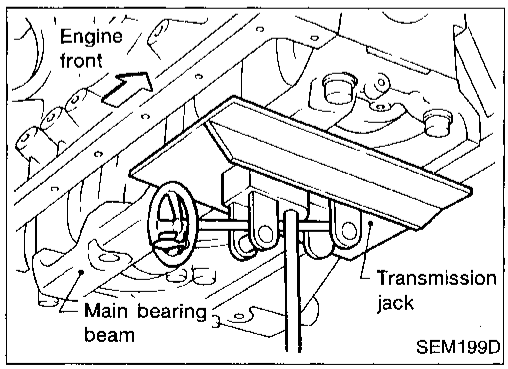
27. Remove cylinder head completely with intake and exhaust manifolds.
28. Remove oil pans.
    Refer to EM-13.



29. Remove oil strainer and baffle plate.

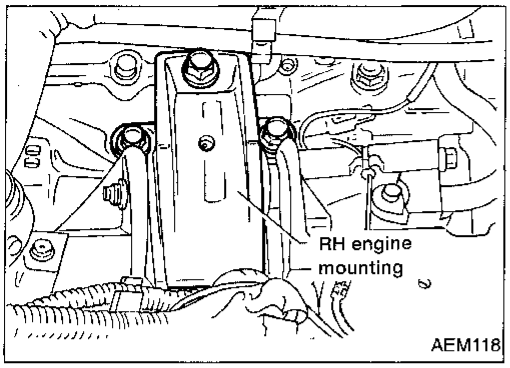


30. Remove crankshaft pulley.

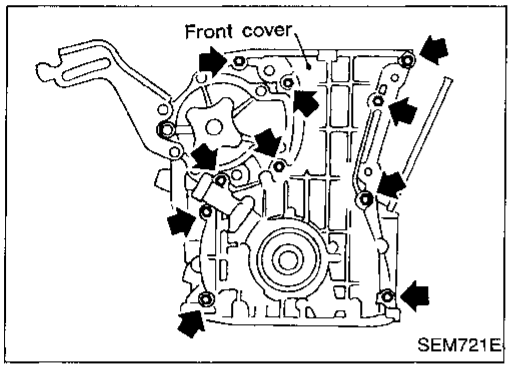


31. Set a suitable transmission jack under main bearing beam.

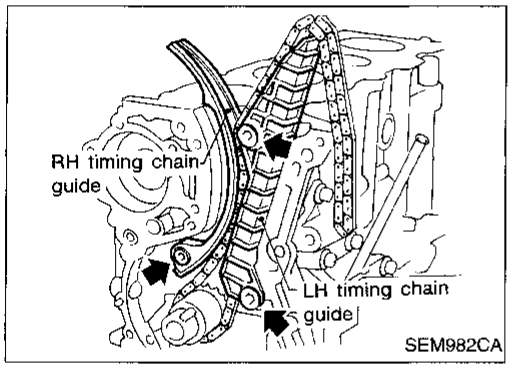
Removal (Cont'd)



32. Remove RH engine mounting.



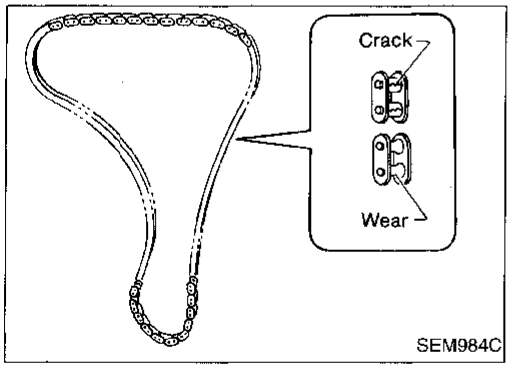
33. Remove front cover and oil pump drive spacer.
- **Inspect for oil leakage at front oil seal. Replace seal if oil leak is present.**



34. Remove timing chain guides and timing chain.

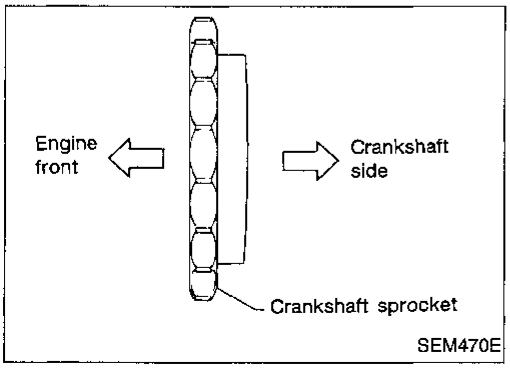
Inspection

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

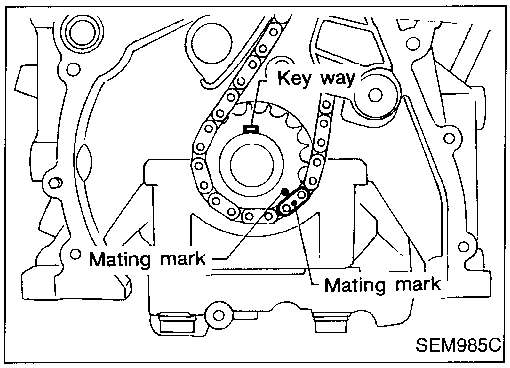


Installation

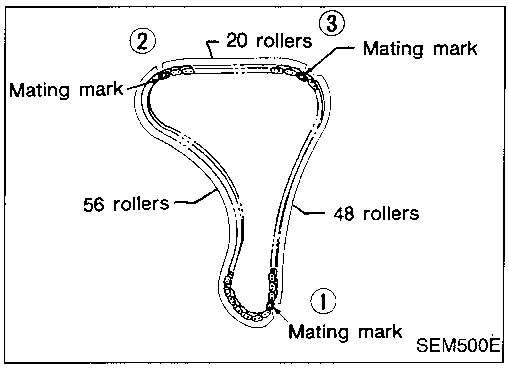
1. Install crankshaft sprocket on crankshaft.
- **Make sure that mating marks on crankshaft sprocket face front of engine.**



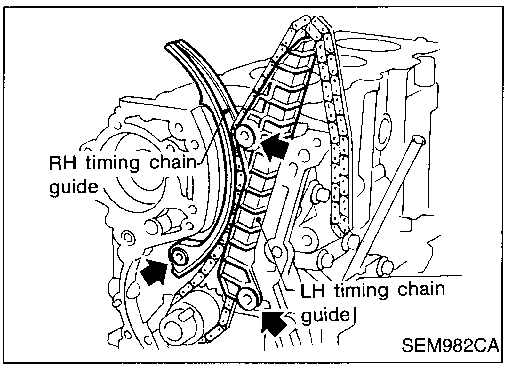
Installation (Cont'd)



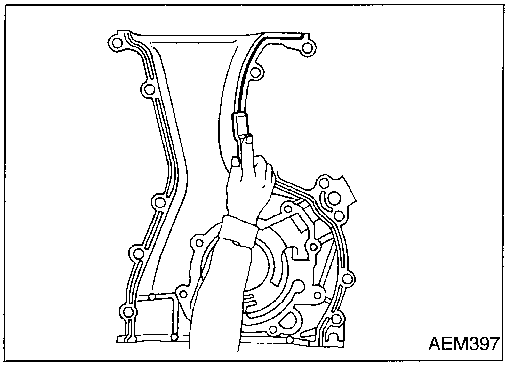
2. Position crankshaft so that No. 1 piston is set at TDC and key way is at 12 o'clock. Fit timing chain on crankshaft sprocket, aligning the mating marks.



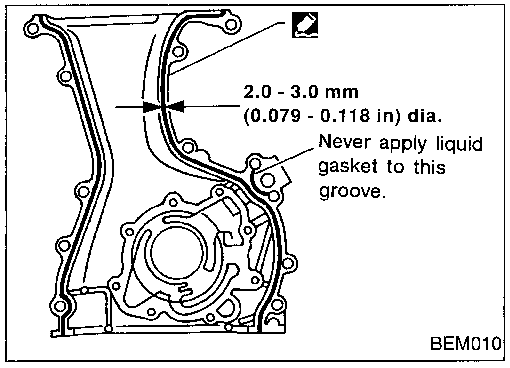
- Mating mark color on timing chain.
  ① : **Gold**
  ②, ③ : **Silver**



3. Install timing chain and timing chain guides.

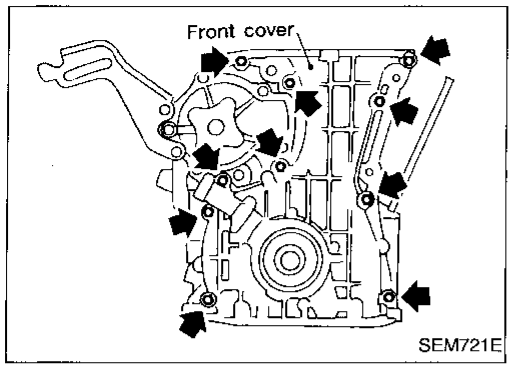


4. Use a scraper to remove old liquid gasket from mating surface of front cover.
- **Also remove old liquid gasket from mating surface of cylinder block.**

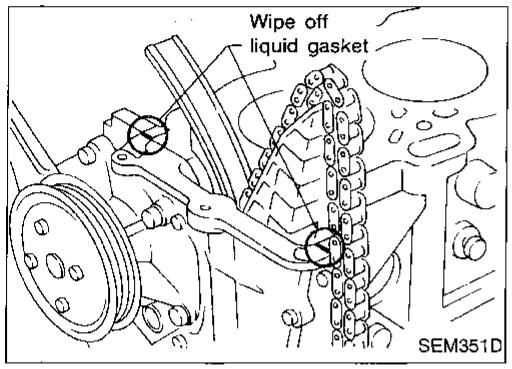


5. Apply a continuous bead of liquid gasket to front cover.
- **Use Genuine RTV silicone sealant Part No. 999 MP-A7007, Three Bond TB1207D or equivalent.**
- **Be sure to install new front oil seal in the right direction. Refer to EM-39.**

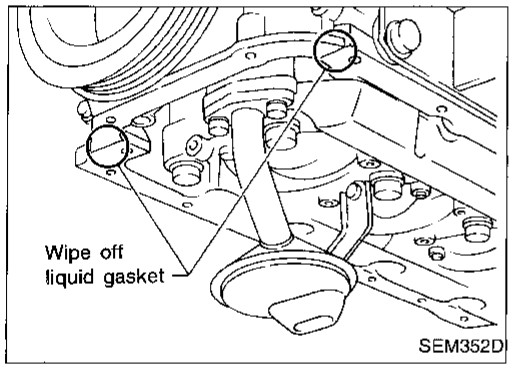
Installation (Cont'd)

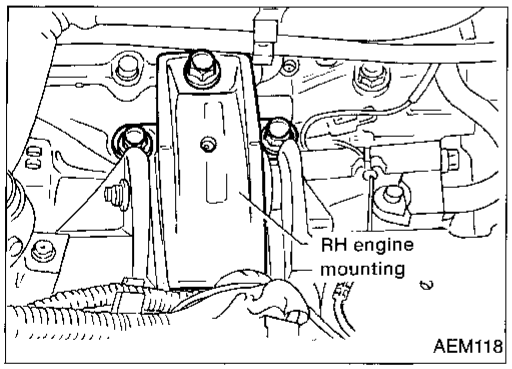


6. Install oil pump drive spacer and front cover.

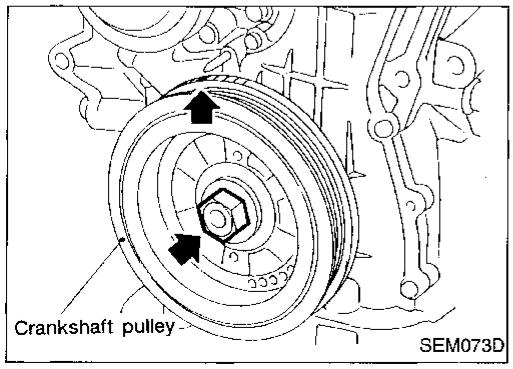


- Wipe off excessive liquid gasket.



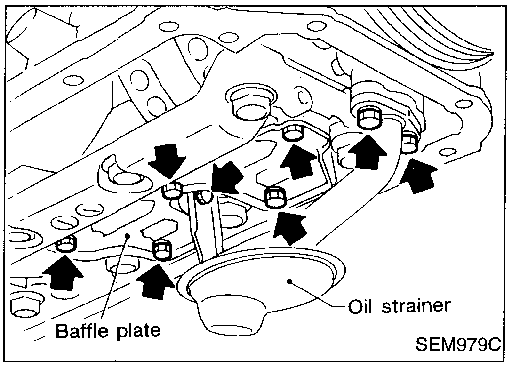


7. Install RH engine mounting.

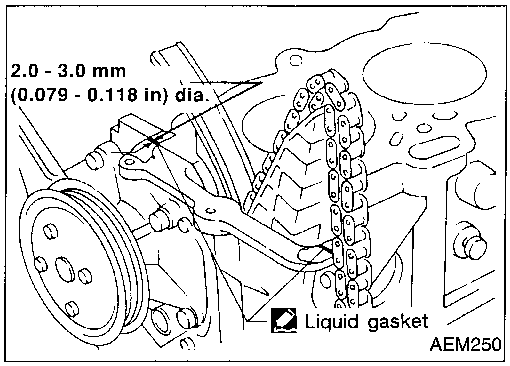


8. Install crankshaft pulley.
9. Set No. 1 piston at TDC of its compression stroke.

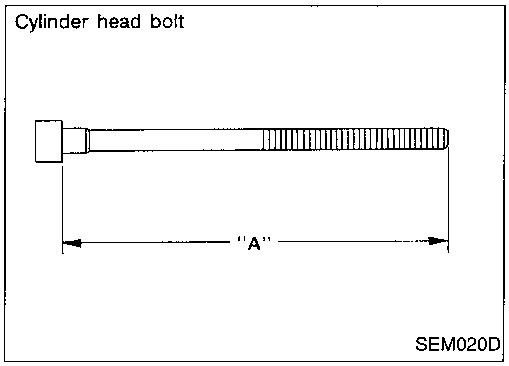
Installation (Cont'd)



10. Install oil strainer and baffle plate.
11. Install aluminum oil pan.
    Refer to EM-16.



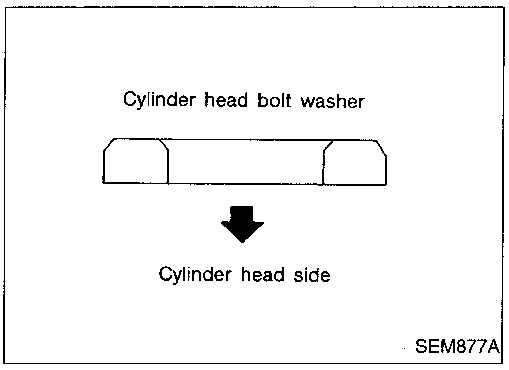
12. Before installing cylinder head gasket, apply liquid gasket as shown in the illustration.

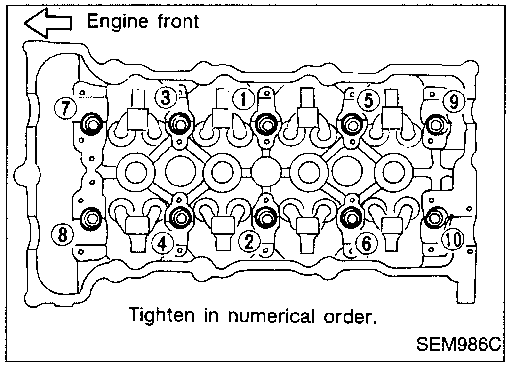


13. Install cylinder head completely with intake and exhaust manifolds.
- **Apply engine oil to threads and seating surfaces of cylinder head bolts before installing them.**
- **Be sure to install washers between bolts and cylinder head.**

CAUTION:
If cylinder head bolt exceeds limit of dimension "A", replace it.

Dimension "A":
158.2 mm (6.228 in)

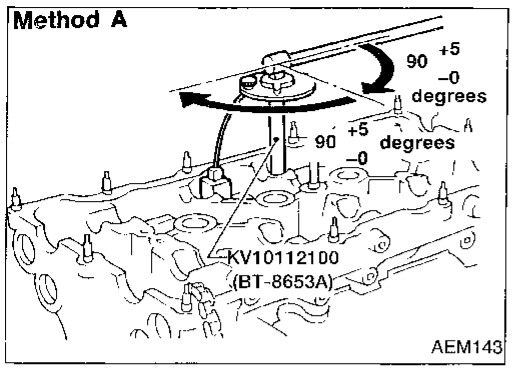




14. Tighten cylinder head bolts using the following procedure.

a. **Tighten all bolts to 39 N·m (4.0 kg-m, 29 ft-lb).**
b. **Tighten all bolts to 78 N·m (8.0 kg-m, 58 ft-lb).**
c. **Loosen all bolts completely.**
d. **Tighten all bolts to 34 to 44 N·m (3.5 to 4.5 kg-m, 25 to 33 ft-lb).**

Installation (Cont'd)



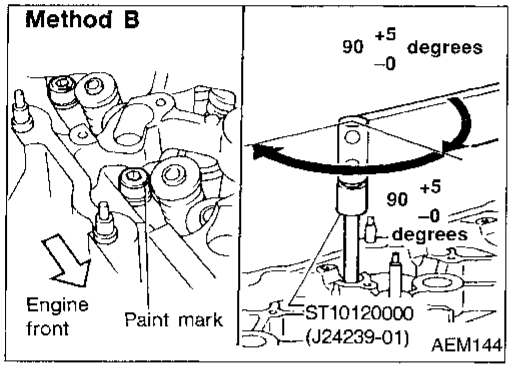
e. **Method A: Turn all bolts 90 to 95 degrees clockwise with Tool or suitable angle wrench.**

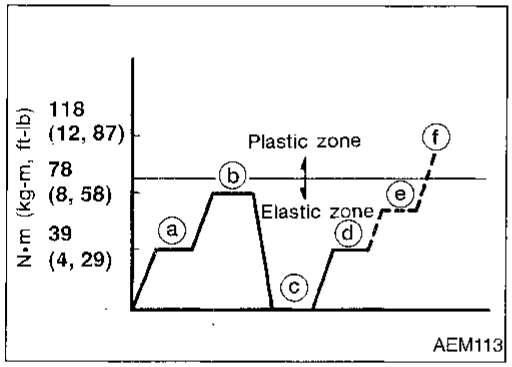
Method B: If an angle wrench is not available, mark all cylinder head bolts on the side facing engine front. Then, turn each cylinder head bolt 90 to 95 degrees clockwise.

f. **Turn all bolts another 90 to 95 degrees clockwise.**

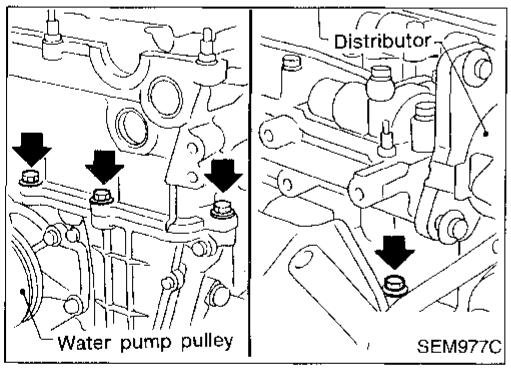
g. **Ensure that paint mark on each bolt faces the rear of the engine. (Method B only.)**

Do not turn any bolt 180 to 190 degrees clockwise all at once.

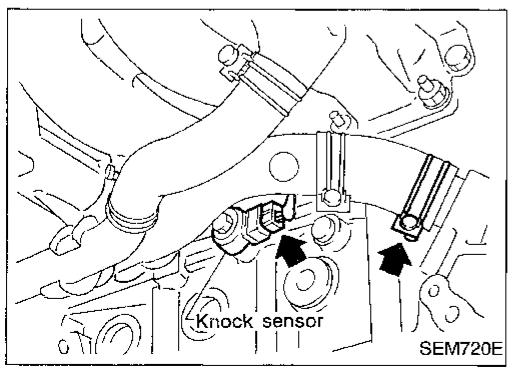




	Tightening torque N·m (kg-m, ft-lb)
a.	39 (4.0, 29)
b.	78 (8.0, 58)
c.	0 (0, 0)
d.	34 - 44 (3.5 - 4.5, 25 - 33)
e.	90 - 95 degrees (90 degrees preferred)
f.	90 - 95 degrees (90 degrees preferred)

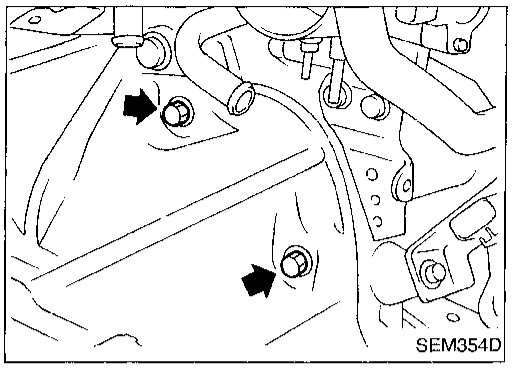


15. Install cylinder head outside bolts.
16. Install the following water hoses:
- Water hose for cylinder block.
- Water hoses for heater.

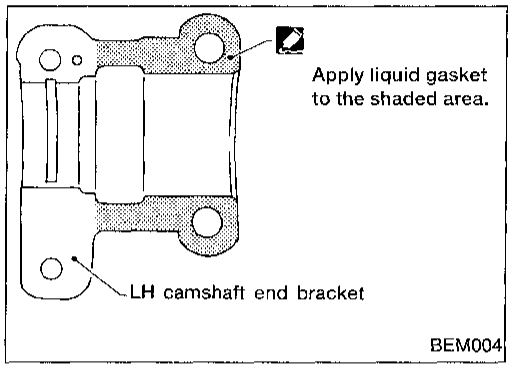


17. Install knock sensor harness connector.

Installation (Cont'd)

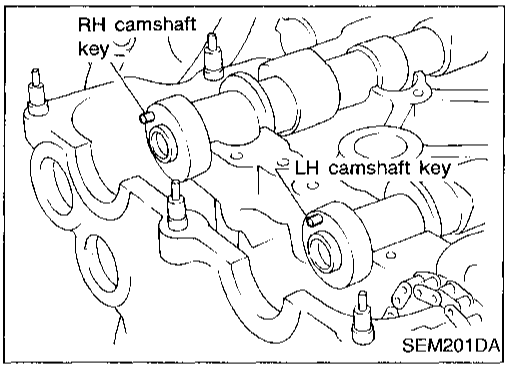


18. Install starter motor.



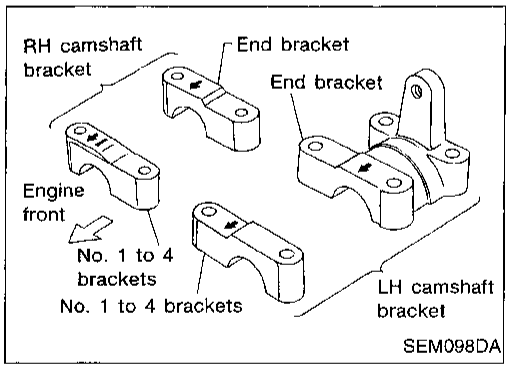
19. Remove old liquid gasket from mating surface of LH camshaft end bracket.
- **Also remove old liquid gasket from mating surface of cylinder head.**

20. Apply liquid gasket to mating surface of LH camshaft end bracket as shown in illustration.
- **Use Genuine RTV silicone sealant Part No. 999 MP-A7007, Three Bond TB1207D or equivalent.**



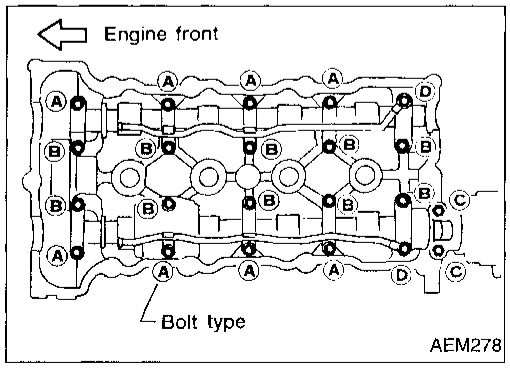
21. Install camshafts, camshaft brackets, oil tubes, and baffle plate.
- Position camshaft.
- LH camshaft key at about 12 o'clock.
- RH camshaft key at about 12 o'clock.

Apply new engine oil to bearing and cam surfaces of camshafts before installing them.



- Position camshaft brackets as shown in the illustration.

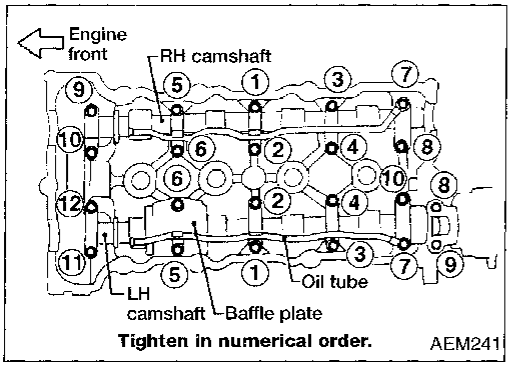
Apply new engine oil to threads and seating surfaces of camshaft bracket bolts before installing them.



- **Arrange bolts (Size and length).**

Ⓐ : M6 x 53.8mm (2.12 in.)
Ⓑ : M6 x 37 mm (1.46 in.)
Ⓒ : M8 x 35 mm (1.38 in.)
Ⓓ : M6 x 64 mm (2.52 in.)

Installation (Cont'd)



- **Tightening procedure**

STEP 1:

RH camshaft

Tighten bolts ⑨ - ⑩ in that order then tighten bolts ① - ⑧ in numerical order.

: 2 N·m (0.2 kg-m, 17 in-lb)

LH camshaft

Tighten bolts ⑪ - ⑫ in that order then tighten bolts ① - ⑩ in numerical order.

: 2 N·m (0.2 kg-m, 17 in-lb)

STEP 2:

Tighten bolts in numerical order.

: 6 N·m (0.6 kg-m, 52 in-lb)

STEP 3:

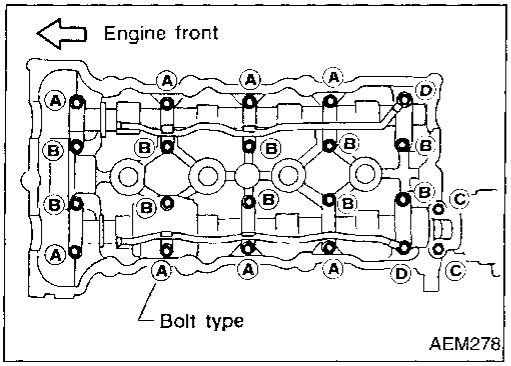
Tighten bolts in numerical order.

Bolt type Ⓐ Ⓑ Ⓓ

: 9.8 - 11.8 N·m (1.0 - 1.2 kg-m, 7.2 - 8.7 ft-lb)

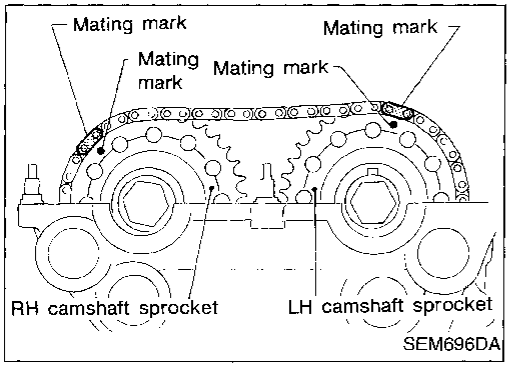
Bolt type Ⓒ

: 18 - 25 N·m (1.8 - 2.6 kg-m, 13 - 19 ft-lb)



22. Install camshaft sprockets.

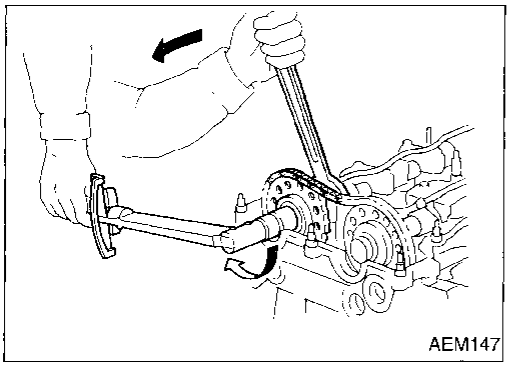
Line up mating marks on timing chain with mating marks on camshaft sprockets.



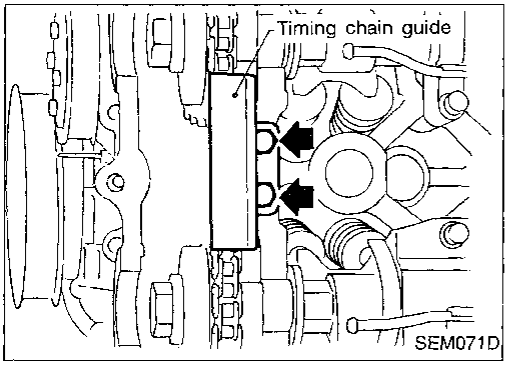
- Lock camshafts as shown in figure and tighten to specified torque.

: 137 - 157 N·m (14.0 - 16.0 kg-m, 101 - 116 ft-lb)

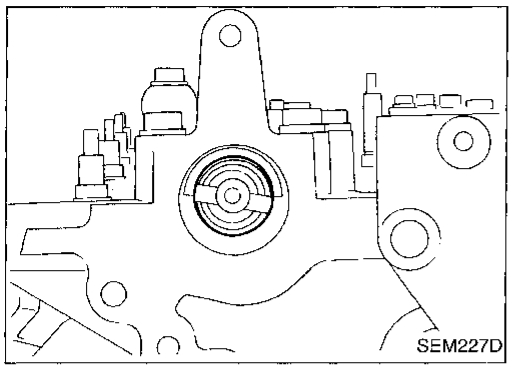
Apply new engine oil to threads and seating surfaces of camshaft sprocket bolts before installing them.



23. Install timing chain guide.

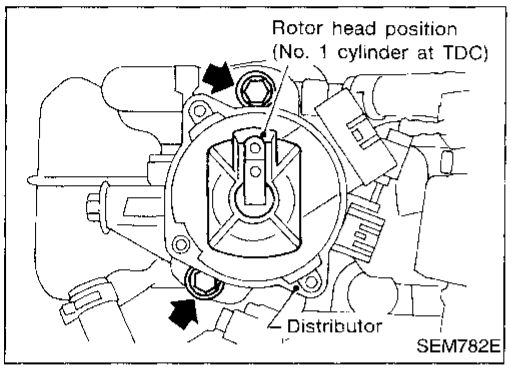


Installation (Cont'd)

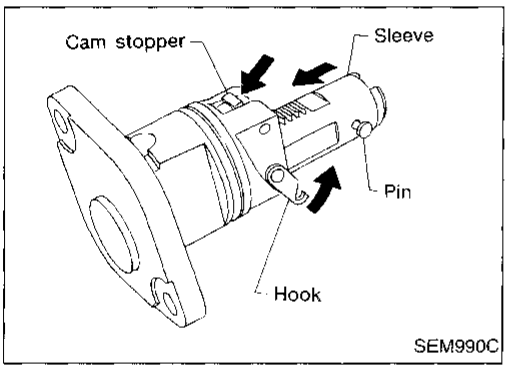


24. Install distributor.

- **Make sure that position of camshaft is as shown in figure.**



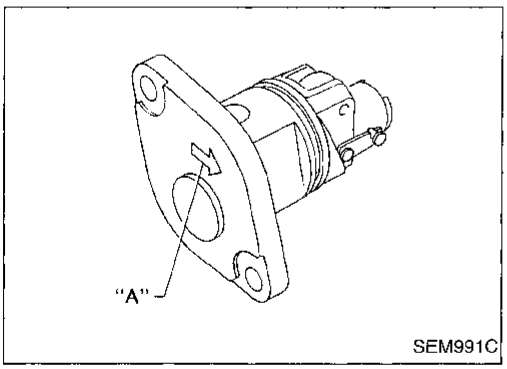
- **Make sure that No. 1 piston is set at TDC and that distributor rotor is set at No. 1 cylinder spark position.**

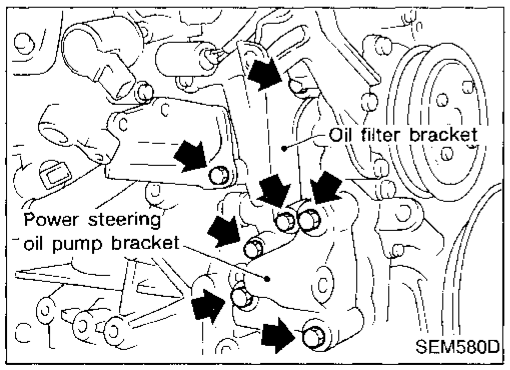


25. Install chain tensioner.

Make sure the camshaft sprockets are tightened completely.

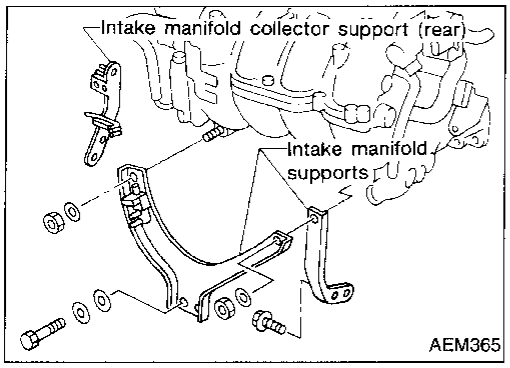
Press cam stopper down and "press-in" sleeve until hook can be engaged on pin. When tensioner is bolted in position the hook will release automatically. Make sure arrow "A" points toward engine front.



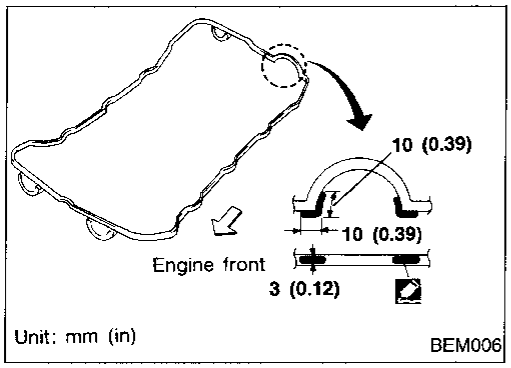


26. Install oil filter bracket and power steering oil pump bracket.

Installation (Cont'd)

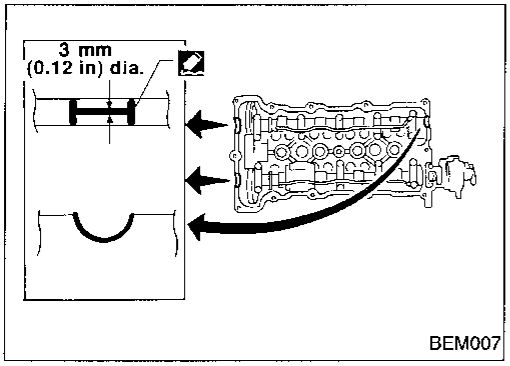


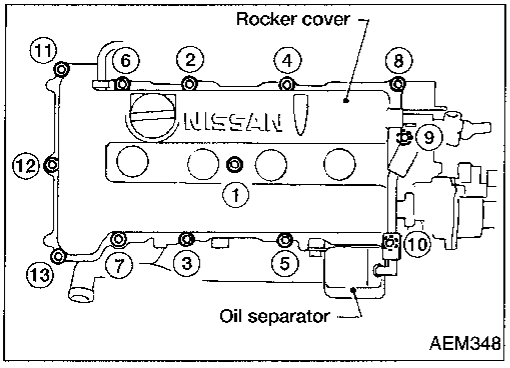
27. Install intake manifold supports.



28. Remove old liquid gasket from mating surfaces of rocker cover and cylinder head.
29. Apply a continuous bead of liquid gasket to rocker cover gasket and cylinder head as shown in the illustrations.

- **Use Genuine RTV silicone sealant Part No. 999 MP-A7007, Three Bond TB1207D or equivalent.**





30. Install rocker cover and oil separator.

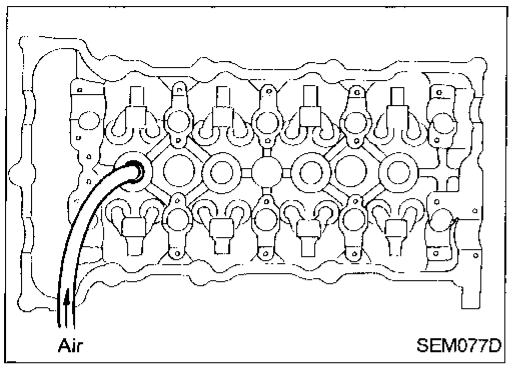
- **Be sure to install washers between bolts and rocker cover.**
- **Tightening procedure**
  STEP 1: Tighten bolts ① - ⑩ - ⑪ - ⑬ - ⑧
  STEP 2: Tighten bolts ① - ⑬
  : 8 - 10 N·m (0.8 - 1.0 kg-m, 69 - 87 in-lb)

31. Install the following parts:

- Spark plugs and leads
- Power steering pump
- Generator
- Water pump pulley and drive belts
  For adjusting drive belt deflection, refer to MA section ("Checking Drive Belts", "ENGINE MAINTENANCE").
- Radiator
  Refit hoses and refill with coolant.
  Refer to MA section ("Changing Engine Coolant", "ENGINE MAINTENANCE").
- Front RH wheel
- Engine under covers

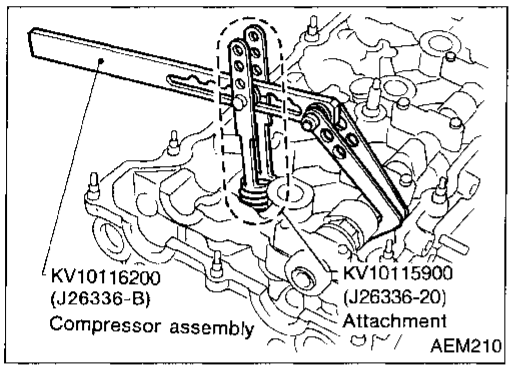
Installation (Cont'd)

32. Connect the following:
- Vacuum hoses
- Fuel hoses
- Wire harnesses and connectors
- Air duct to intake manifold



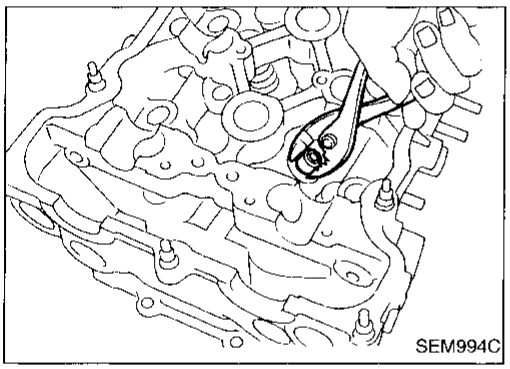
Valve Oil Seal

1. Remove accelerator wire.
2. Remove rocker cover and oil separator.
3. Remove camshafts and sprockets.
   Refer to EM-18.
4. Remove spark plugs.
5. Install air hose adapter into spark plug hole and apply air pressure to hold valves in place. Apply a pressure of 490 kPa (5 kg/cm^2, 71 psi).
6. Remove rocker arm, rocker arm guide and shim.

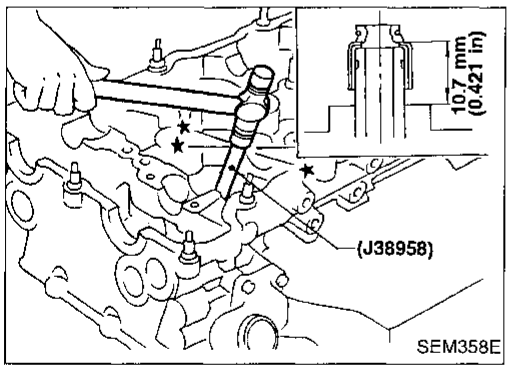


7. Remove valve spring with Tool. Temporarily install camshaft as shown.

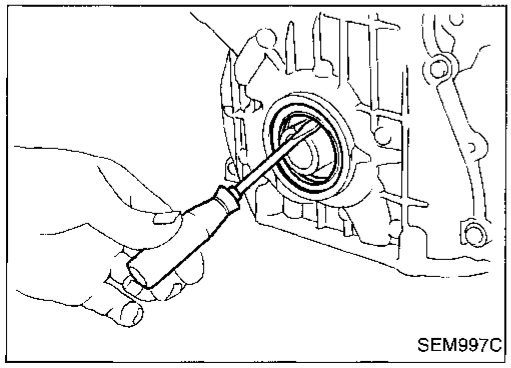
Piston concerned should be set at TDC to prevent valve from falling.



8. Remove valve oil seal with a suitable tool.



9. Apply new engine oil to new valve oil seal and install it with Tool.



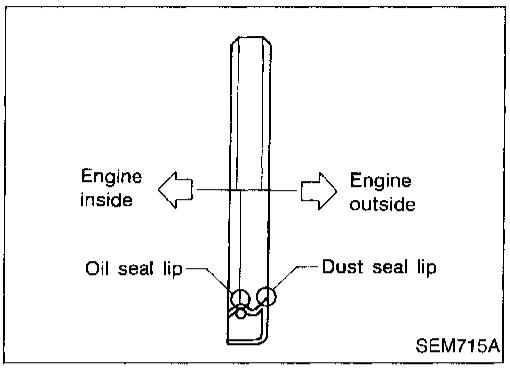
Front Oil Seal

1. Remove the following parts:
- Engine under cover
- Front RH wheel and engine side cover
- Drive belts
- Crankshaft pulley

2. Remove front oil seal.

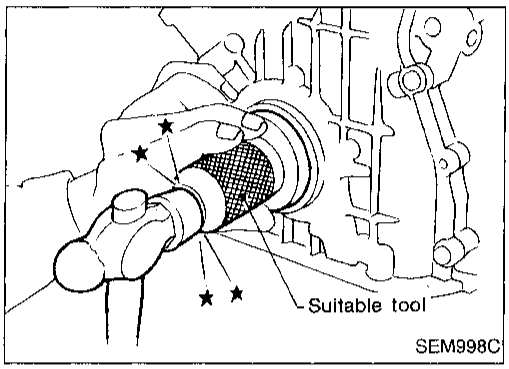
Be careful not to scratch front cover.

Front Oil Seal (Cont'd)



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

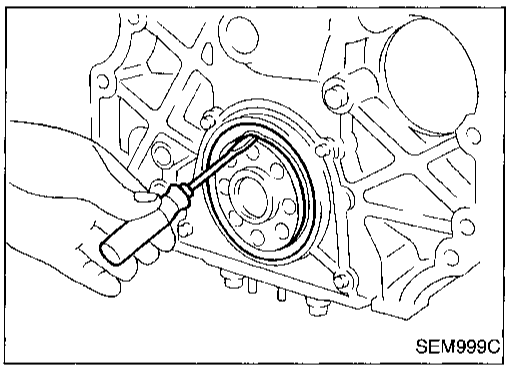
- **Install new oil seal in the direction shown.**

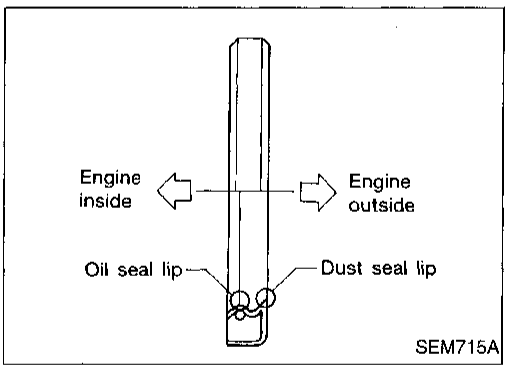


Rear Oil Seal

1. Remove transaxle. (Refer to MT or AT section.)
2. Remove flywheel or drive plate.
3. Remove rear oil seal.

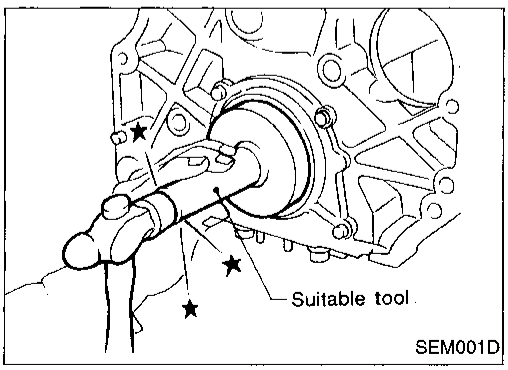
- **Be careful not to scratch rear oil seal retainer.**

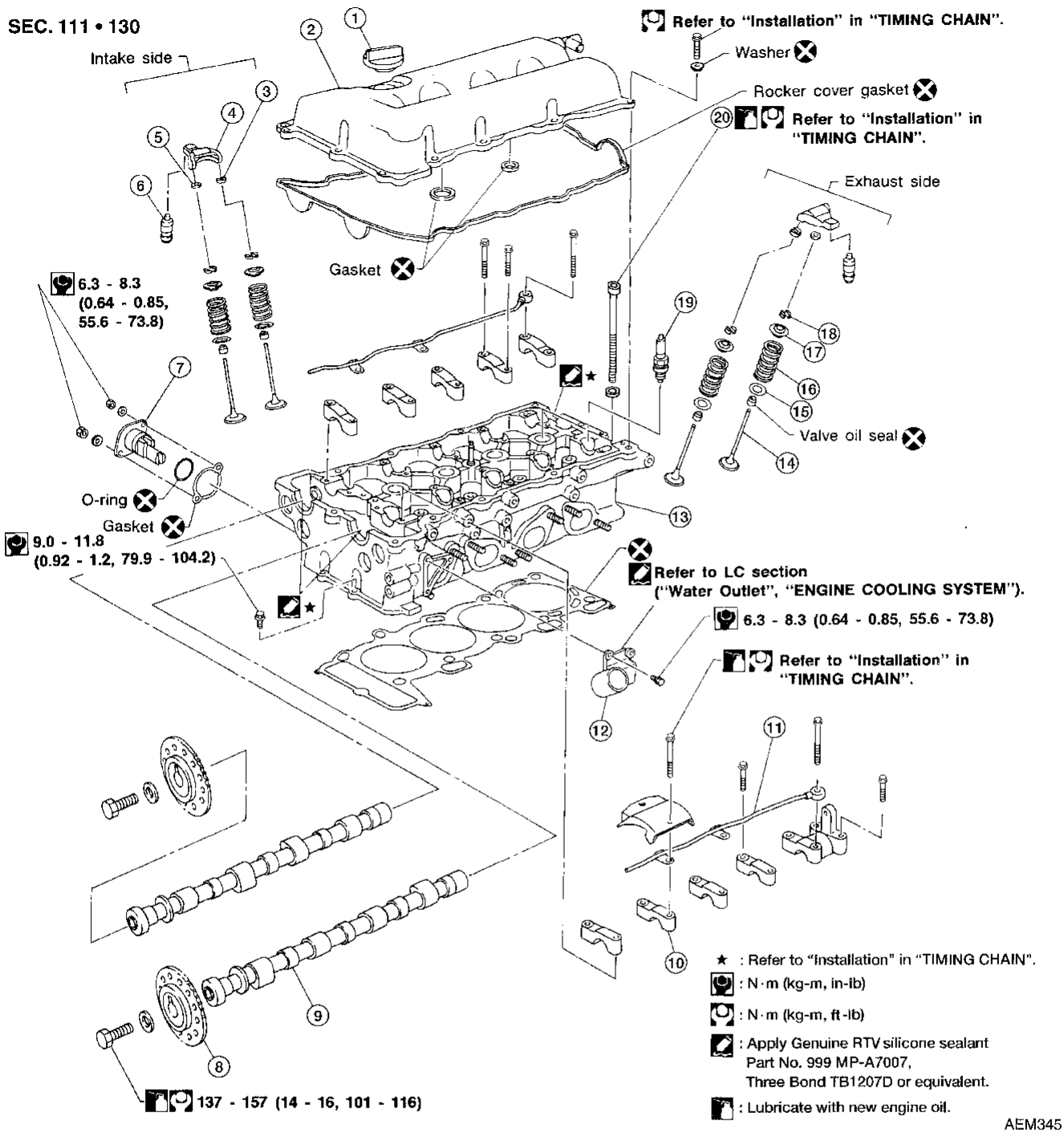




4. Apply new engine oil to new oil seal and install it using a suitable tool.

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

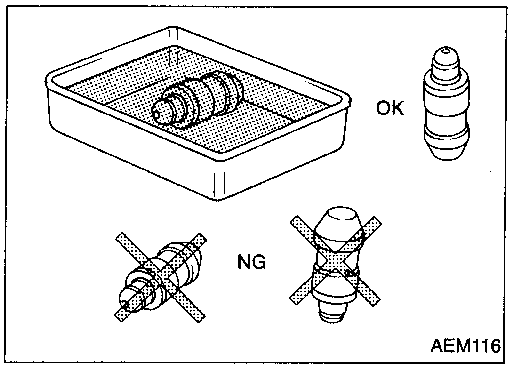




① Oil filler cap
② Rocker cover
③ Rocker arm guide
④ Rocker arm
⑤ Shim
⑥ Hydraulic lash adjuster
⑦ Chain tensioner
⑧ Camshaft sprocket
⑨ Camshaft
⑩ Camshaft bracket
⑪ Oil tube
⑫ Water outlet
⑬ Cylinder head
⑭ Valve
⑮ Valve spring seat
⑯ Valve spring
⑰ Valve spring retainer
⑱ Valve collet
⑲ Spark plug
⑳ Cylinder head bolt

CAUTION:

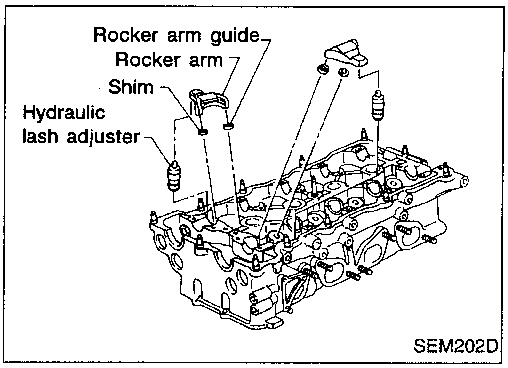
- **When installing rocker arms, camshaft and oil seal, lubricate contacting surfaces with new engine oil.**
- **When tightening cylinder head bolts, camshaft sprocket bolts and camshaft bracket bolts, lubricate bolt threads and seat surfaces with new engine oil.**



- **If a hydraulic lash adjuster is kept on its side, there is a risk of air entering it. When hydraulic lash adjusters are removed, stand them straight up or soak them in new engine oil.**
- **Do not disassemble hydraulic lash adjusters.**
- **Attach tags to lash adjusters so as not to mix them up.**

Removal

- The removal procedure is the same as for timing chain. Refer to EM-18.

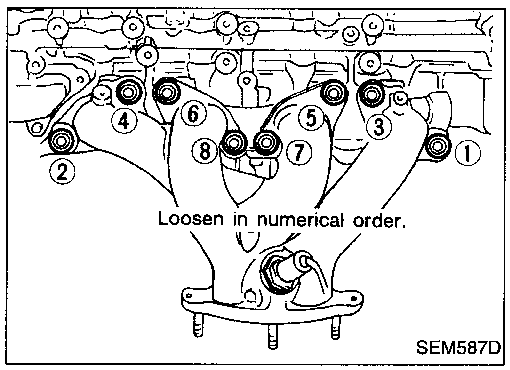


Disassembly

1. Remove rocker arms, shims, rocker arm guides and hydraulic lash adjusters from cylinder head.

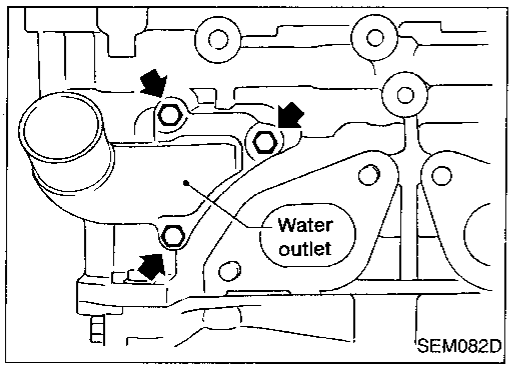
CAUTION:

Keep parts in order so they can be installed in their original positions during assembly.

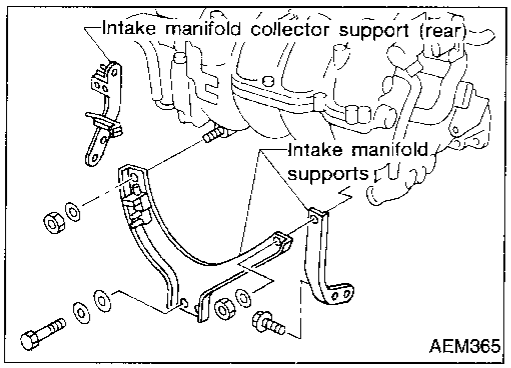


2. Remove exhaust manifold cover.
3. Remove exhaust manifold as shown.

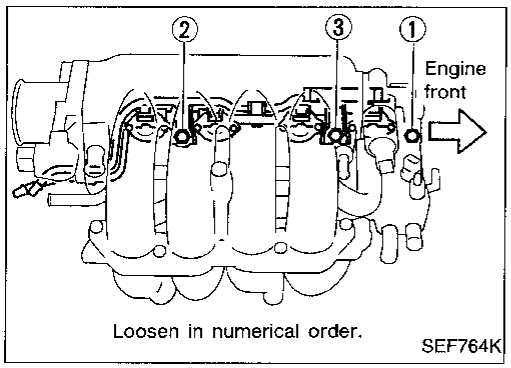
Disassembly (Cont'd)



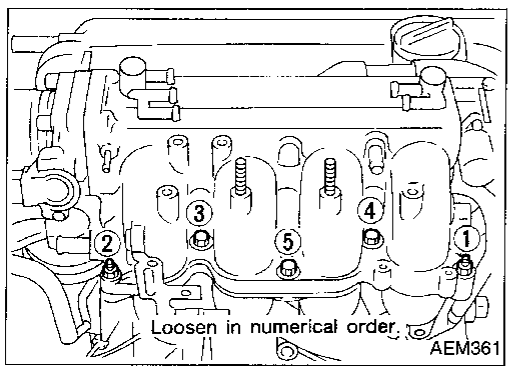
4. Remove water outlet.



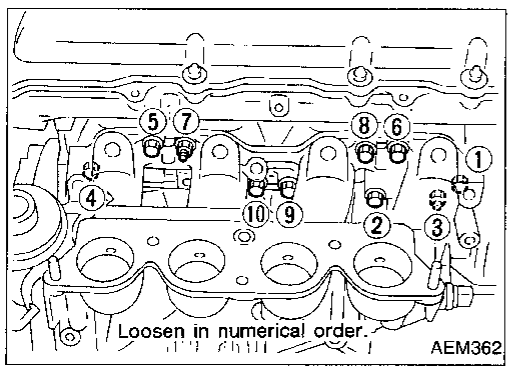
5. Remove intake manifold supports and intake manifold collector supports (both on rear and upper sides).



6. Remove fuel tube assembly. Refer to EC section ("Injector Removal and Installation", "BASIC SERVICE PROCEDURE").

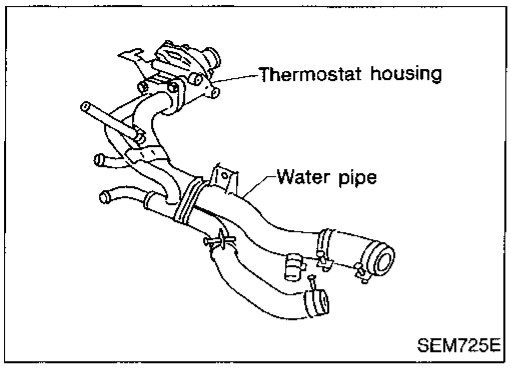


7. Remove intake manifold collector from intake manifold as shown.
8. Remove power steering oil pump bracket and oil filter bracket.

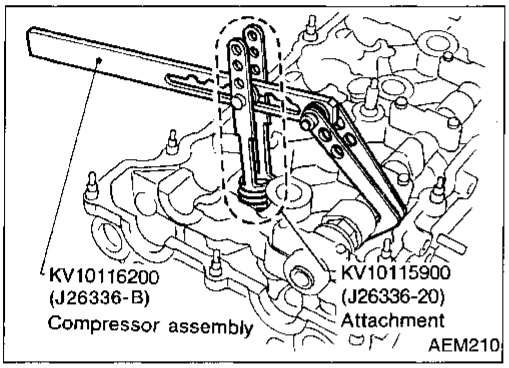


9. Remove intake manifold as shown.

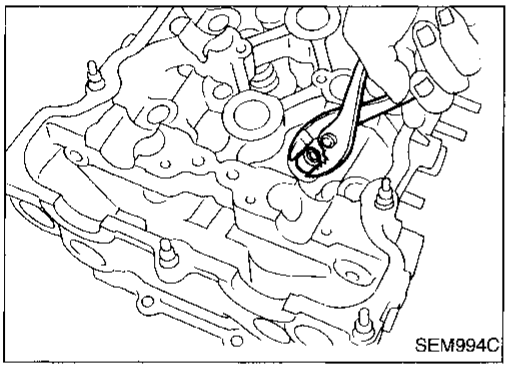
Disassembly (Cont'd)



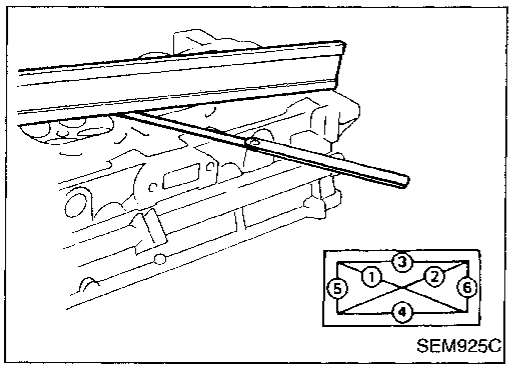
10. Remove thermostat housing with water pipe.



11. Remove valve components with Tool. Install camshaft temporarily.



12. Remove valve oil seal with a suitable tool.



Inspection

CYLINDER HEAD DISTORTION

- Clean mating 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.

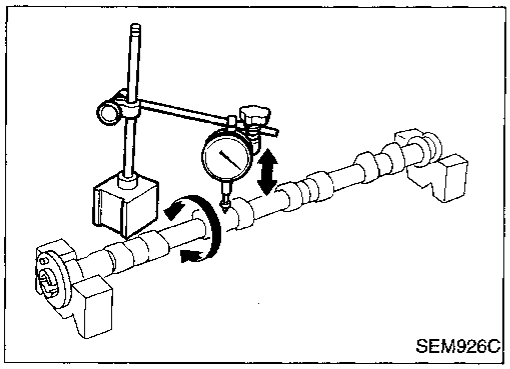
Head surface flatness:
Standard
Less than 0.03 mm (0.0012 in)
Limit
0.1 mm (0.004 in)

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, cylinder head must be replaced.

Nominal cylinder head height:
136.9 - 137.1 mm (5.390 - 5.398 in)

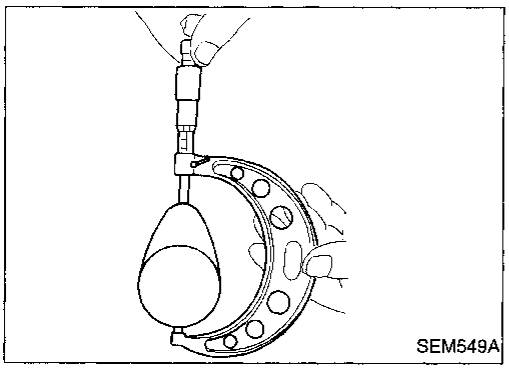


CAMSHAFT VISUAL CHECK

Check camshaft for scratches, seizure and wear.

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.

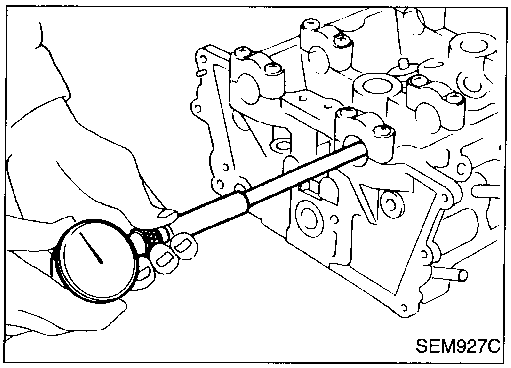


CAMSHAFT CAM HEIGHT

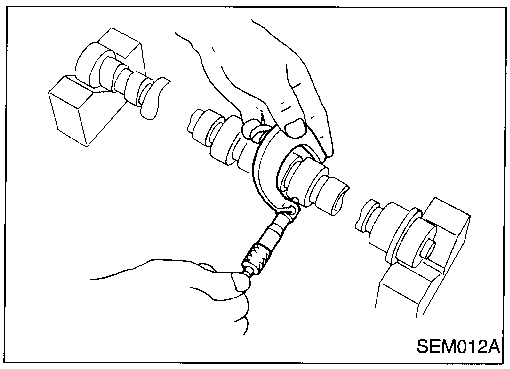
1. Measure camshaft cam height.
   Standard cam height:
   Intake
   37.550 - 37.740 mm (1.4783 - 1.4858 in)
   Exhaust
   37.920 - 38.110 mm (1.4929 - 1.5004 in)
   Cam height wear limit:
   Intake & Exhaust
   0.2 mm (0.008 in)
2. If wear is beyond the limit, replace camshaft.

Inspection (Cont'd)

CAMSHAFT JOURNAL CLEARANCE


SEM927C

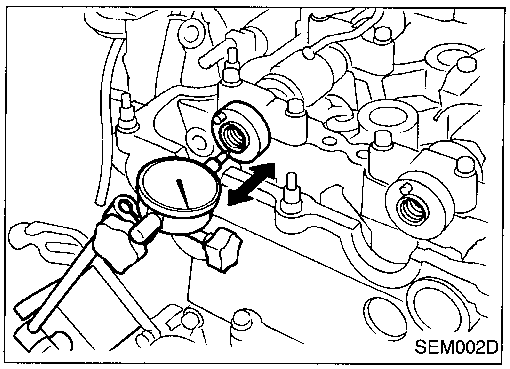
1. Install camshaft bracket and tighten bolts. Refer to EM-28.
2. Measure inner diameter of camshaft bearing.
   Standard inner diameter:
   28.000 - 28.021 mm (1.1024 - 1.1032 in)


SEM012A

3. Measure outer diameter of camshaft journal.
   Standard outer diameter:
   27.935 - 27.955 mm (1.0998 - 1.1006 in)
4. Calculate camshaft journal clearance.
   Camshaft journal clearance = standard inner diameter – standard outer diameter:
   Standard
   0.045 - 0.090 mm (0.0018 - 0.0035 in)
   Limit
   0.15 mm (0.0059 in)
5. If clearance exceeds the limit, replace camshaft and remeasure camshaft journal clearance.

- If clearance still exceeds the limit after replacing camshaft, replace cylinder head.

CAMSHAFT END PLAY

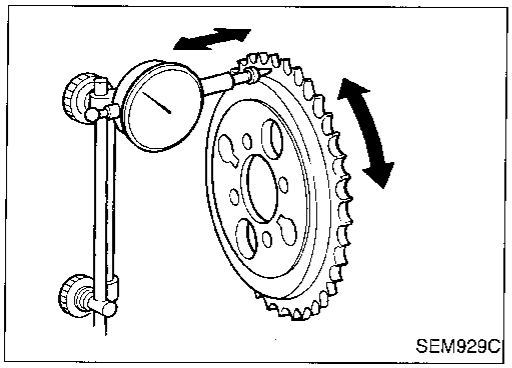

SEM002D

1. Install camshaft in cylinder head. Refer to EM-29.
2. Measure camshaft end play.
   Camshaft end play:
   Standard
   0.055 - 0.139 mm (0.0022 - 0.0055 in)
   Limit
   0.20 mm (0.0079 in)
3. If end play exceeds the limit, replace camshaft and remeasure camshaft end play.

- If end play still exceeds the limit after replacing camshaft, replace cylinder head.

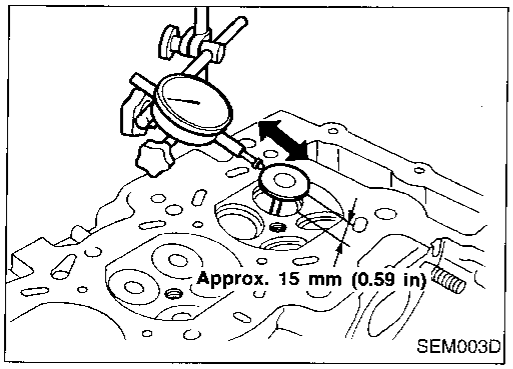
Inspection (Cont'd)

CAMSHAFT SPROCKET RUNOUT


SEM929C

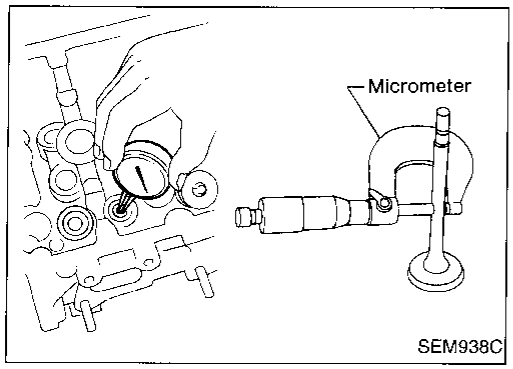
1. Install sprocket on camshaft.
2. Measure camshaft sprocket runout.
   Runout (Total indicator reading):
   Limit 0.25 mm (0.0098 in)
3. If it exceeds the limit, replace camshaft sprocket.

VALVE GUIDE CLEARANCE



SEM003D

1. Measure valve deflection as shown in illustration. (Valve and valve guide mostly wear 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.

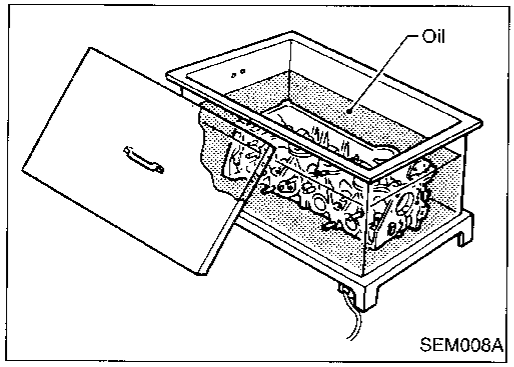
a. Measure valve stem diameter and valve guide inner diameter.

b. Calculate valve to valve guide clearance.
   Valve to valve guide clearance = valve guide inner diameter – valve stem diameter:
   Standard
   Intake 0.020 - 0.053 mm (0.0008 - 0.0021 in)
   Exhaust 0.040 - 0.073 mm (0.0016 - 0.0029 in)
   Limit
   Intake 0.08 mm (0.0031 in)
   Exhaust 0.1 mm (0.004 in)

c. If it exceeds the limit, replace valve and remeasure clearance.

- If clearance still exceeds the limit after replacing valve, replace valve guide.

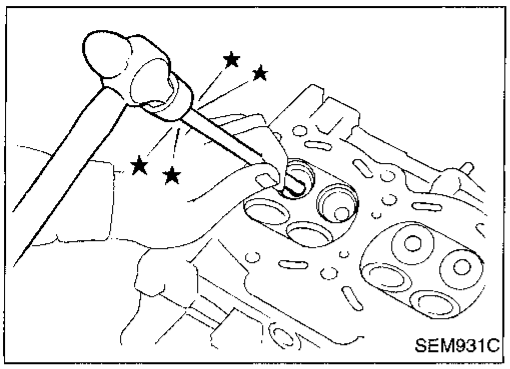
VALVE GUIDE REPLACEMENT



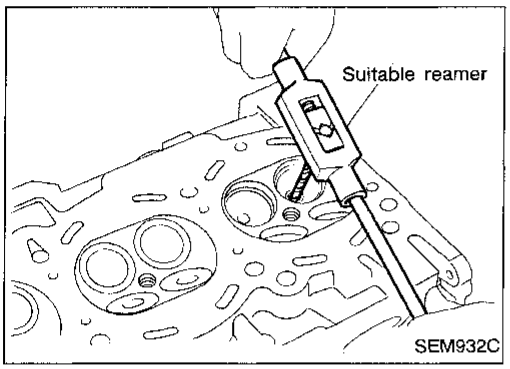
SEM008A

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

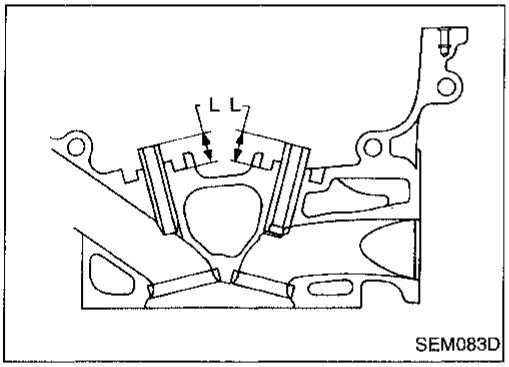
Inspection (Cont'd)



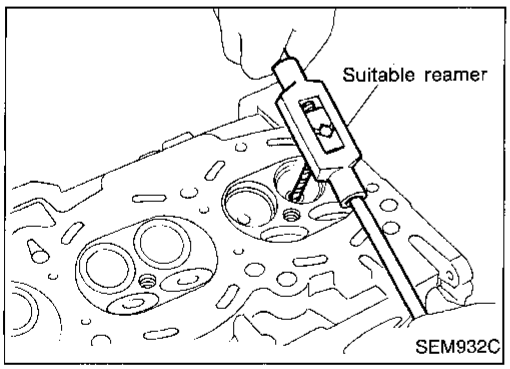
2. Drive out valve guide with a press (under a 20kN [2 ton, 2.2 US ton, 2.0 Imp ton] pressure) or hammer and suitable tool.



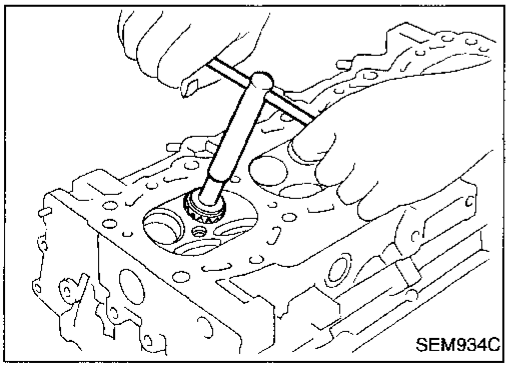
3. Ream cylinder head valve guide hole.
   Valve guide hole diameter
   (for service parts):
   Intake & Exhaust
   10.175 - 10.196 mm (0.4006 - 0.4014 in)



4. Heat cylinder head to 110 to 130°C (230 to 266°F) and press service valve guide into cylinder head.
   Projection "L":
   14.0 - 14.2 mm (0.551 - 0.559 in)



5. Ream valve guide.
   Finished size:
   Intake & Exhaust
   6.000 - 6.018 mm (0.2362 - 0.2369 in)



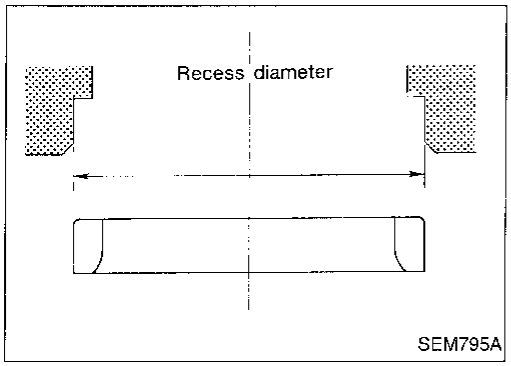
VALVE SEATS

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 are worn, replace them. Then correct valve seat.**
- **Use both hands to cut uniformly.**

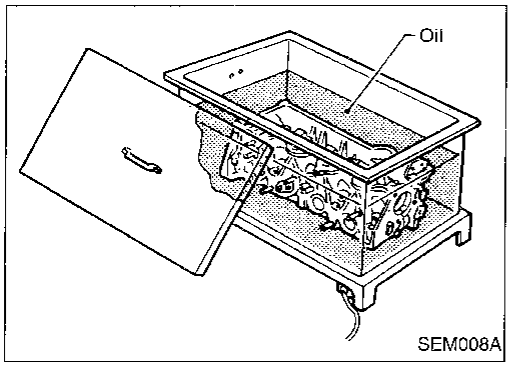
Inspection (Cont'd)

REPLACING VALVE SEAT FOR SERVICE PARTS

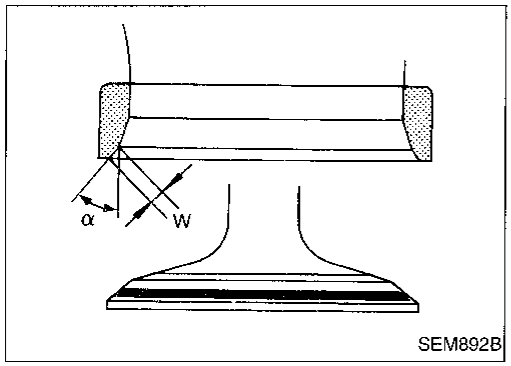


1. Bore out old seat until it collapses. Set machine depth stop so that boring cannot contact bottom face of seat recess in cylinder head.
2. Ream cylinder head recess.
   Reaming bore for service valve seat
   Oversize [0.5 mm (0.020 in)]:
   Intake 35.500 - 35.516 mm (1.3976 - 1.3983 in)
   Exhaust 31.500 - 31.516 mm (1.2402 - 1.2408 in)

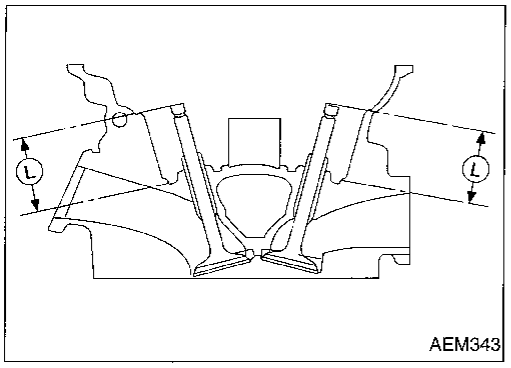
Use the valve guide center for reaming to ensure valve seat will have the correct fit.



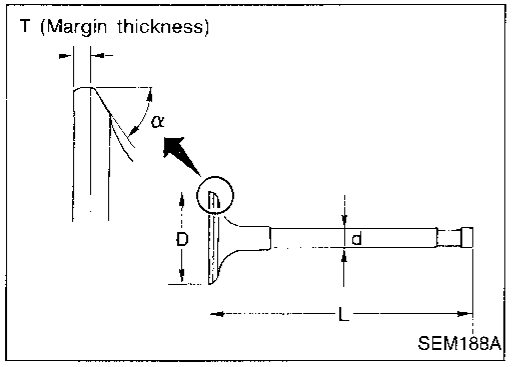
3. Heat cylinder head to 110 to 130°C (230 to 266°F).
4. Press fit valve seat until it seats on the bottom.



5. Cut or grind valve seat to the specified dimensions using a suitable tool. Refer to SDS, EM-67.
6. After cutting, lap valve seat with abrasive compound.
7. Check valve seating condition.
   Seat face angle "α":
   44°53′ - 45°07′
   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)



8. Use a depth gauge to measure the distance between the mounting surface of the cylinder head spring seat and the valve stem end.
   If the distance is shorter than specified, repeat step 5 above to adjust it.
   If it is longer, replace the valve seat with a new one.
   Valve seat resurface limit
   42.74 - 43.26 mm (1.6827 - 1.7031 in)

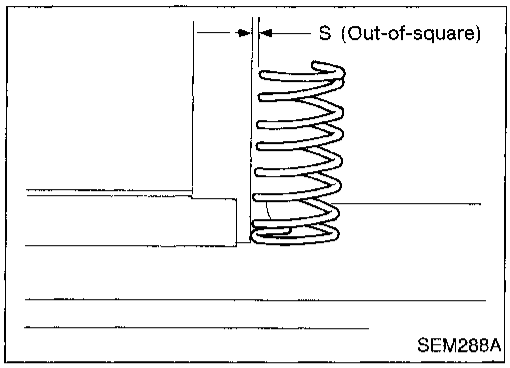


VALVE DIMENSIONS

Check dimensions of each valve. Refer to SDS, EM-66.
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.

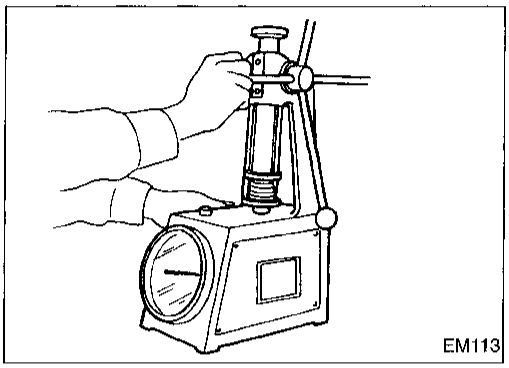
Inspection (Cont'd)



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.

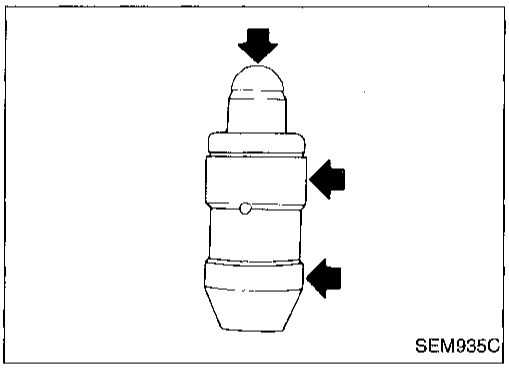


Pressure

Check valve spring pressure at specified spring height.

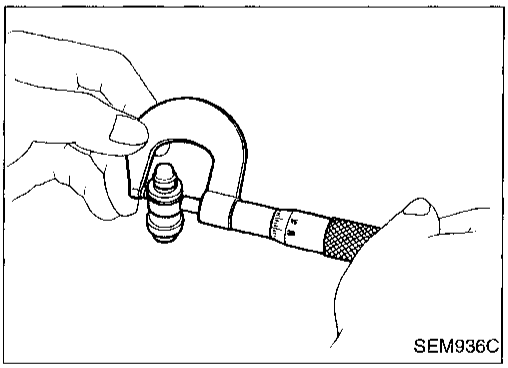
Pressure:
Standard
578.02 - 641.57 N (58.94 - 65.42 kg, 129.96 - 144.25 lb) at 30.0 mm (1.181 in)
Limit
More than 549.2 N (56.0 kg, 123.5 lb) at 30.0 mm (1.181 in)

If it exceeds the limit, replace spring.

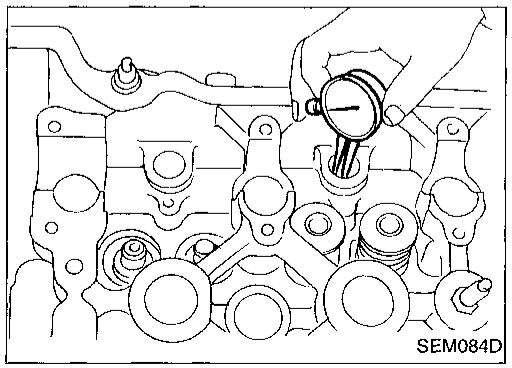


HYDRAULIC LASH ADJUSTER

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



2. Check diameter of lash adjuster.
   Outer diameter:
   16.980 - 16.993 mm (0.6685 - 0.6690 in)

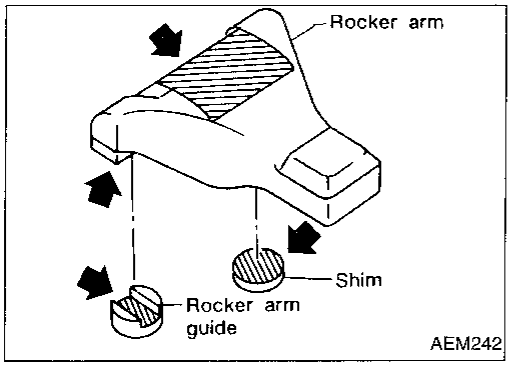


3. Check lash adjuster guide hole diameter.
   Inner diameter:
   17.000 - 17.020 mm (0.6693 - 0.6701 in)
   Standard clearance between lash adjuster and adjuster guide hole:
   0.007 - 0.040 mm (0.0003 - 0.0016 in)

Inspection (Cont'd)

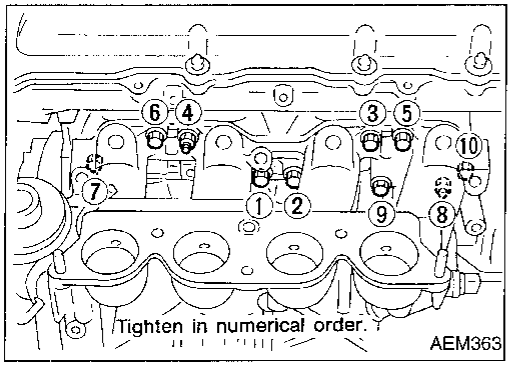
ROCKER ARM, SHIM AND ROCKER ARM GUIDE

Check contact and sliding surfaces of rocker arms, shims and rocker arm guides for wear or score.

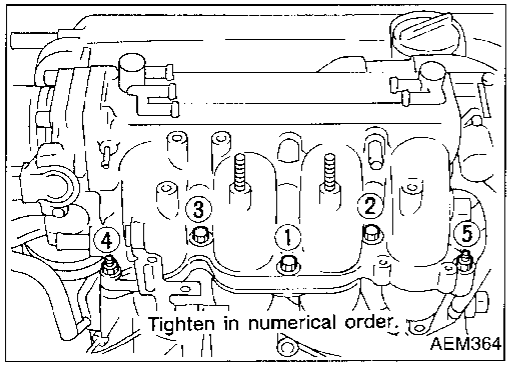


Assembly

1. Install intake manifold as shown.
2. Install fuel tube assembly.
   Refer to EC section ("Injector Removal and Installation", "BASIC SERVICE PROCEDURE").

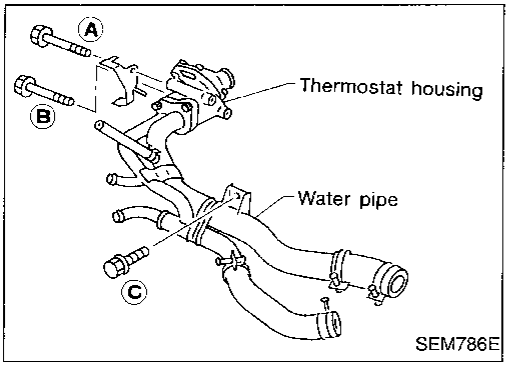


3. Install intake manifold collector to intake manifold as shown.
4. Install oil filter bracket and power steering oil pump bracket.

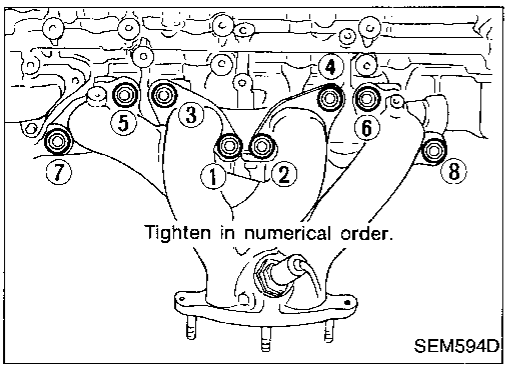


5. Install thermostat housing with water pipe using the following procedure.

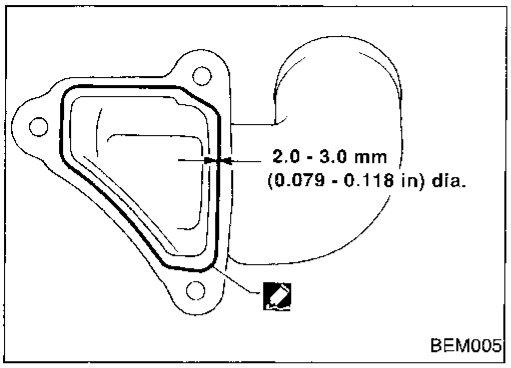
a. Tighten bolt Ⓐ.
   : 2 - 5 N·m (0.2 - 0.5 kg-m, 17 - 43 in-lb)
b. Tighten bolt Ⓒ.
   : 16 - 21 N·m (1.6 - 2.1 kg-m, 12 - 15 ft-lb)
c. Tighten bolt Ⓐ.
   : 16 - 21 N·m (1.6 - 2.1 kg-m, 12 - 15 ft-lb)
d. Tighten bolt Ⓑ.
   : 16 - 21 N·m (1.6 - 2.1 kg-m, 12 - 15 ft-lb)



6. Install exhaust manifold.
- Tighten exhaust manifold bolts in numerical order.
7. Install exhaust manifold cover.

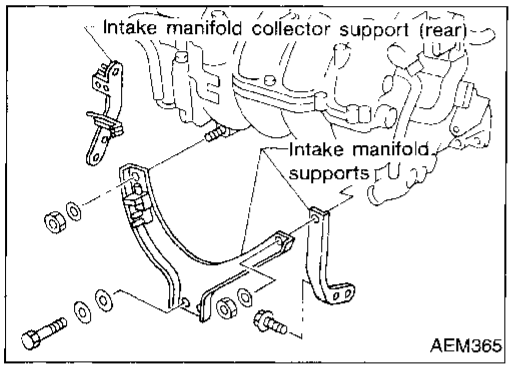


Assembly (Cont'd)

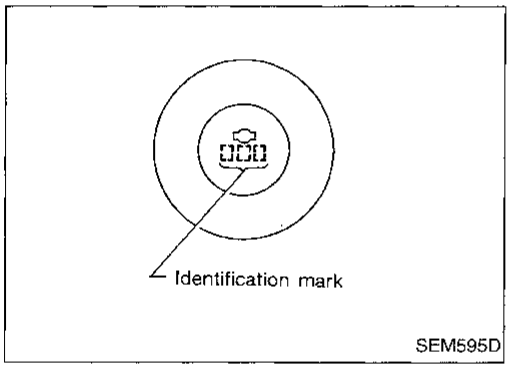


8. Install water outlet.
a. Remove old liquid gasket from mating surface of water outlet.
- **Also remove old liquid gasket from mating surface of cylinder head.**

b. Apply a continuous bead of liquid gasket to mating surface of water outlet.
- **Use Genuine RTV silicone sealant Part No. 999 MP-A7007, Three Bond TB1207D or equivalent.**

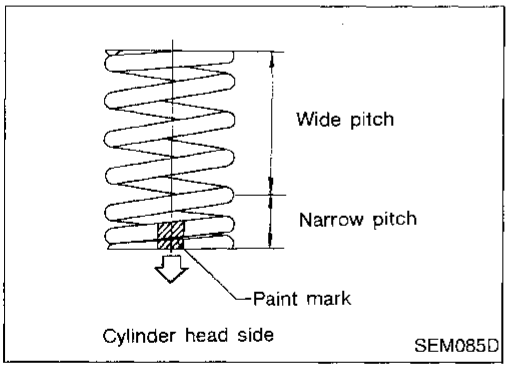


9. Install intake manifold supports and intake manifold collector supports.
10. Install EGR tube.
11. Install crankcase ventilation oil separator.

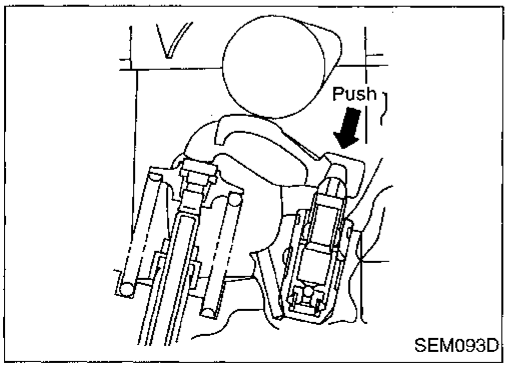


12. Install valve component parts.
- **Install valves, noting their identification marks as indicated in the table below.**

	Identification mark
Intake valve	E71
Exhaust valve	6Y2

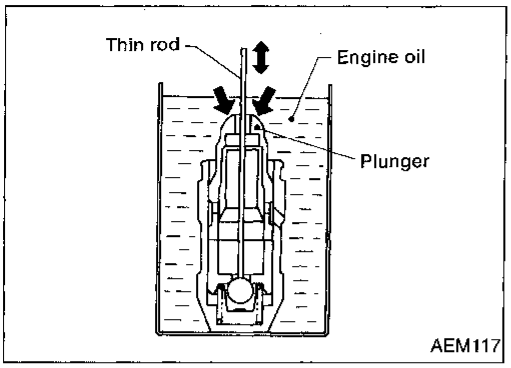


- **Always use new valve oil seal.**
  Refer to EM-33.
- **Before installing valve oil seal, install valve spring seat.**
- **Install valve spring (uneven pitch type) with its narrow pitched side (paint mark) toward cylinder head side.**
- **After installing valve components, use plastic hammer to lightly tap valve stem tip to assure a proper fit.**



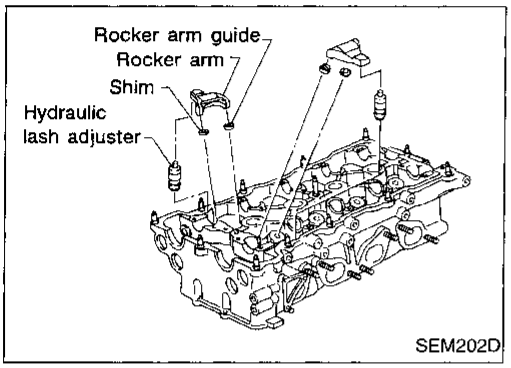
13. Check hydraulic lash adjusters.
a. Push on the rocker arm above the hydraulic lash adjuster. If it moves 1 mm (0.04 in) or more, there is air in the high pressure chamber of hydraulic lash adjuster.
Noise will be emitted from hydraulic lash adjuster if engine is started without bleeding air.

Assembly (Cont'd)

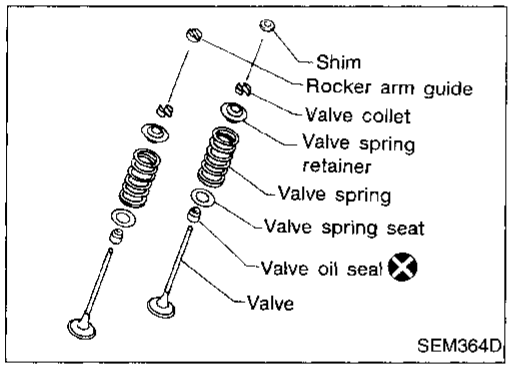


b. Remove hydraulic lash adjuster and dip in a container filled with new engine oil. While pushing plunger as shown in figure, lightly push check ball using a thin rod. Air is completely bled when plunger no longer moves.

Air cannot be bled from this type of lash adjuster by running engine.



14. Remove camshafts, rocker arms and shims. For future reference, identify each shim with the cylinder it was removed from. Since the shims are reusable, it may not be necessary to replace all of the existing shims.

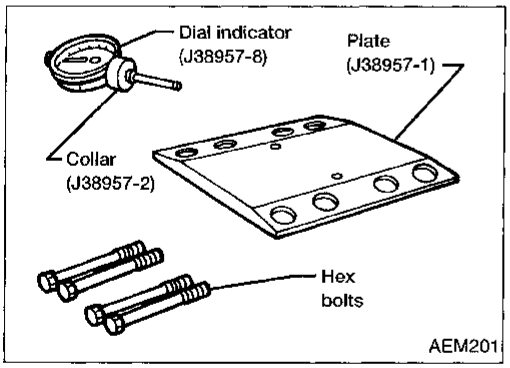


15. Before attempting any measurement, make sure the valve, valve spring, collet, retainer and rocker arm guide are properly installed in the head.

- **Always replace rocker arm guide with a new one.**

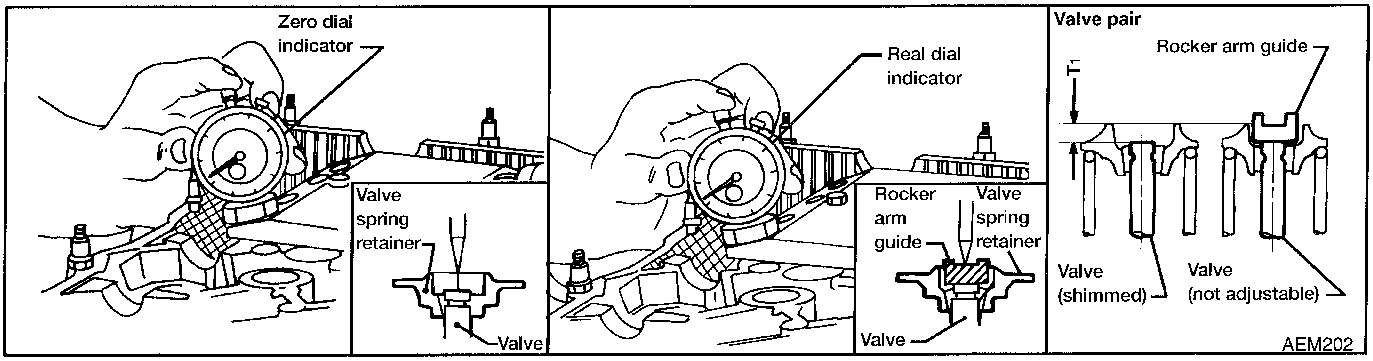
CAUTION:

Install parts in their original positions.

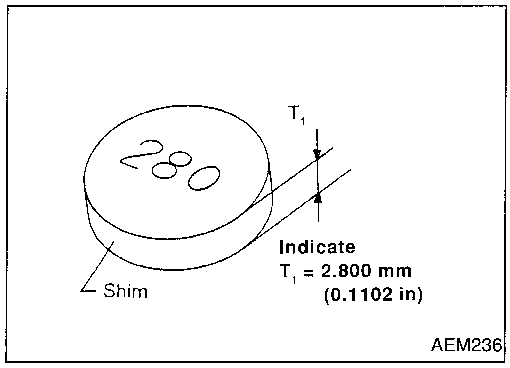


16. Install the J38957-1 gauge plate into the tapped holes at the cam journals and secure it to the head using two of the hex bolts supplied with the kit. (The two remaining bolts are spares.)

Assembly (Cont'd)

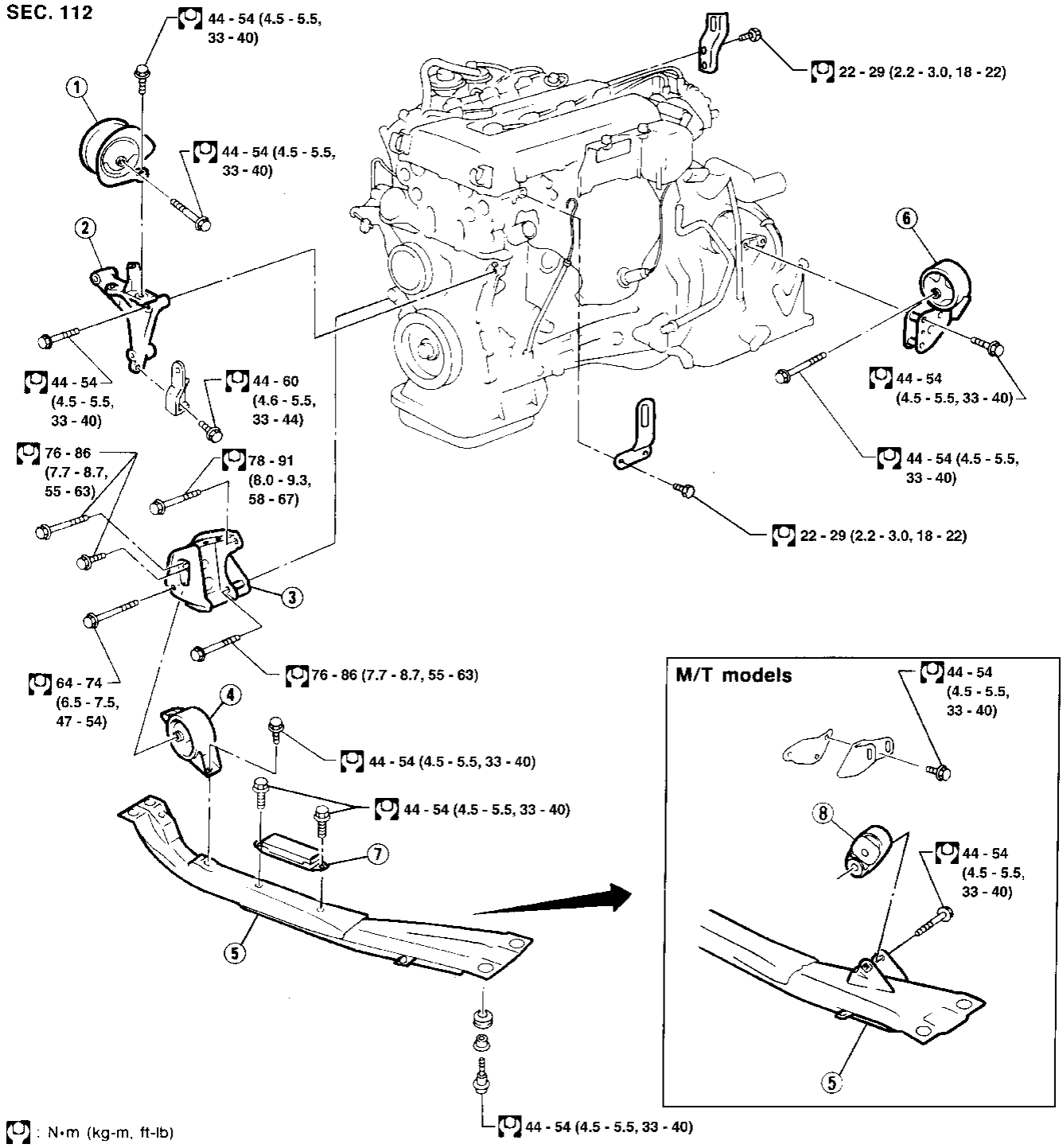


17. Place the J38957-2 collar on the J38957-8 dial indicator. Make sure the dished side of the collar is facing "up" (toward the dial indicator). Secure the collar to the dial indicator by tightening the set screw in the collar.
18. Place the indicator and collar over #1 cylinder intake valve shim side. Slide the tip of the dial indicator through the access hole and place it on the end of the valve stem. While resting the dial indicator collar on the gauge plate, "zero" the dial indicator.
19. Move the dial indicator and collar to the adjacent hole in the gauge plate and place the tip of the indicator in the center of the rocker arm guide. Write down the dial indicator reading. This measured distance between the valve stem end and the contact surface of the rocker arm guide is the "T_1" dimension.
20. Match the measured "T_1" dimension (in inches) to the available shim chart (in millimeters). Refer to SDS, EM-68. (The "T_1" dimension is equivalent to the thickness and size designation of the valve shim.) Select the closest size shim to the measured "T_1" dimension. For example, if the measured "T_1" dimension is 0.1154 in. use a 2.925 mm shim. Shims are available in 17 different thicknesses ranging from 2.800 mm (0.1102 in.) to 3.200 mm (0.1260 in.) and increase in increments of 0.025 mm (0.0010 in.).
21. Repeat this procedure on the remaining cylinders.



Installation

- The installation procedure is the same as for timing chain. Refer to EM-23.



AEM281

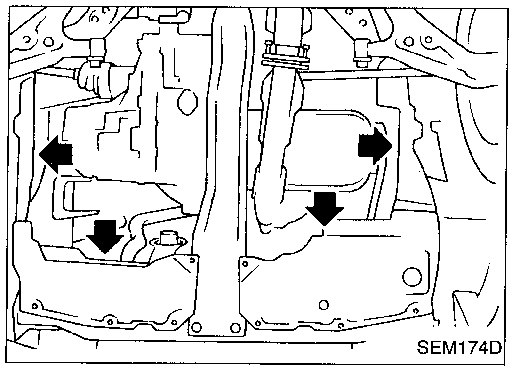
① Engine front mounting
② Mounting bracket
③ Rear engine mounting bracket
④ Rear insulator
⑤ Center member
⑥ LH engine mounting
⑦ Dynamic damper (A/T models)
⑧ Buffer

WARNING:

- **Position vehicle on a flat and solid surface.**
- **Place chocks at front and back of rear wheels.**
- **Do not remove engine until exhaust system has completely cooled off, otherwise you may burn yourself and/or fire may break out in fuel line.**
- **Before disconnecting fuel hose, release pressure. Refer to EC section ("Fuel Pressure Release", "BASIC SERVICE PROCEDURE").**
- **Before removing front axle from transaxle, place safety stands under designated front supporting points. Refer to GI section ("Garage Jack and Safety Stand", "LIFTING POINTS AND TOW TRUCK TOWING").**
- **Be sure to lift engine and transaxle in a safe manner.**
- **For engines not equipped with engine slingers, attach proper slingers and bolts described in PARTS CATALOG.**

CAUTION:

- **When lifting engine, be sure to clear surrounding parts. Use special care near accelerator wire casing, brake lines and brake master cylinder.**
- **In lifting the engine, always use engine slingers in a safe manner.**
- **In removing drive shaft, be careful not to damage grease seal of transaxle.**
- **Before separating engine and transaxle, remove the crankshaft position sensor (OBD) from the assembly.**
- **Always be extra careful not to damage edge of crankshaft position sensor (OBD) or ring gear teeth.**

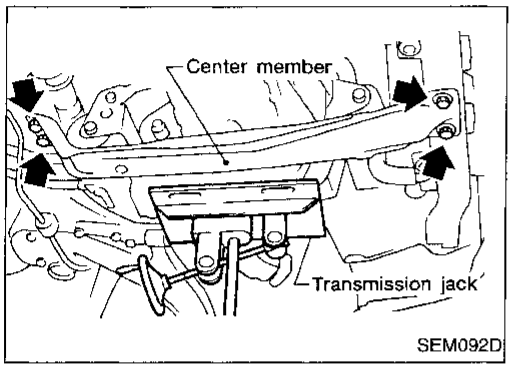

SEM174D

Removal

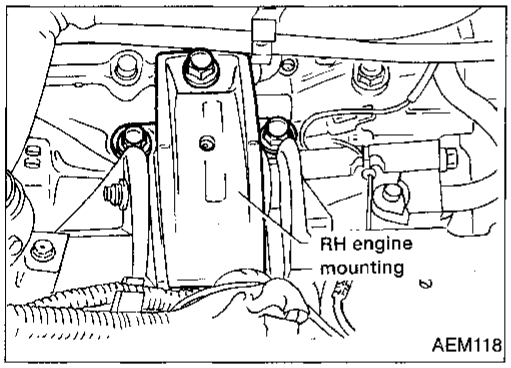
1. Remove engine under covers and engine side cover.
2. Drain coolant from both cylinder block and radiator. Refer to MA section ("Changing Engine Coolant", "ENGINE MAINTENANCE").
3. Drain engine oil.
4. Remove air cleaner assembly and duct.
5. Remove the battery and battery tray.
6. Disconnect the following:
   - Vacuum hoses
   - Heater hoses
   - A/T cooler hoses
   - Power steering hoses
   - Fuel lines
   - Wires
   - Harnesses and connectors
   - Throttle cable
   - ASCD cable
   - A/T control cable
7. Remove the cooling fans, radiator and recovery tank.
8. Remove front LH and RH wheels and drive shafts. Refer to FA section ("Drive Shaft", "FRONT AXLE").

Removal (Cont'd)

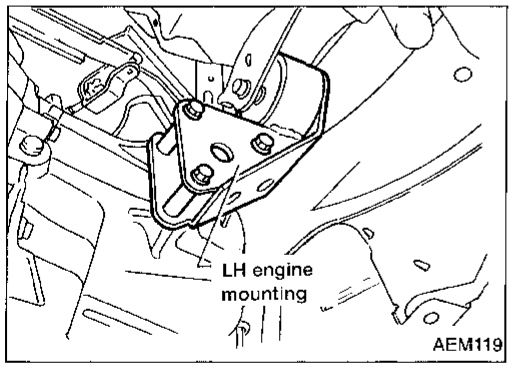
9. Remove front exhaust pipe.
10. Remove starter and intake manifold support.
11. Remove the drive belts.
12. Remove generator and adjusting bracket.
13. Remove power steering oil pump and A/C compressor.
14. Set a suitable transmission jack under transaxle. Lift engine with engine slinger.



15. Remove center member.

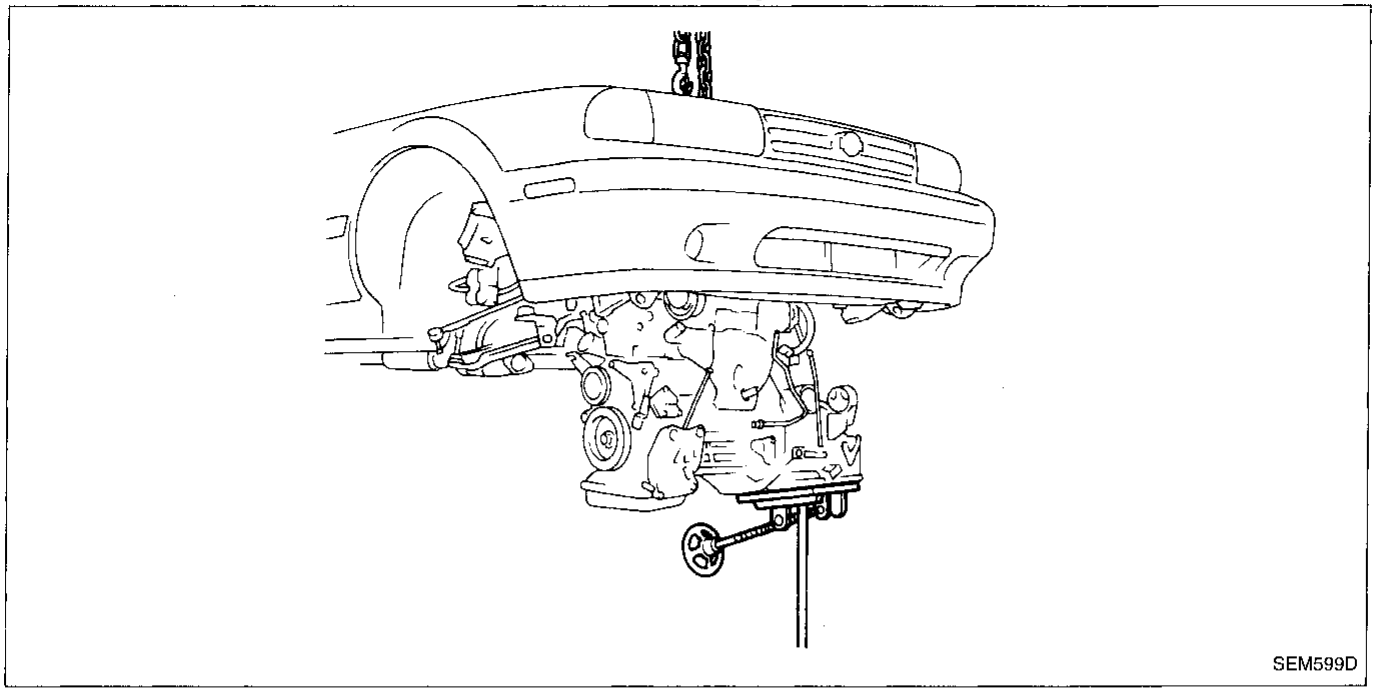


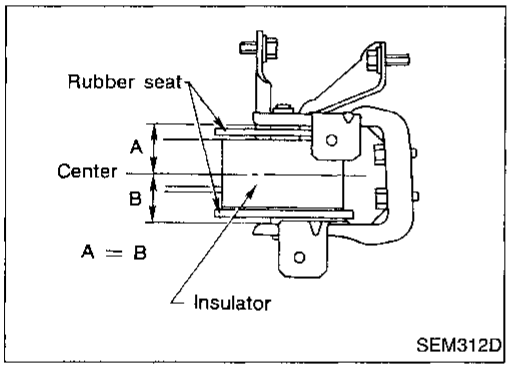
16. Remove engine mounting bolts from both sides, then slowly lower transmission jack.



Removal (Cont'd)

17. Remove engine with transaxle as shown.



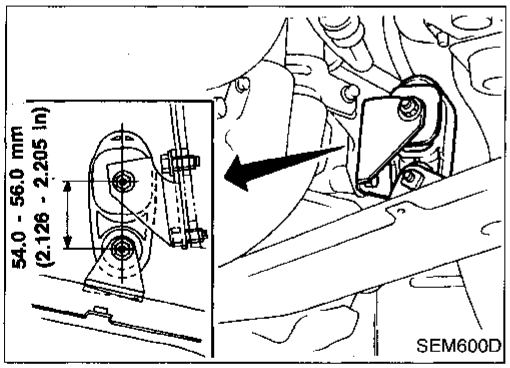


Installation

1. Install engine mounting bracket and fixing bolts.

Be sure that insulators are correctly positioned on the brackets.

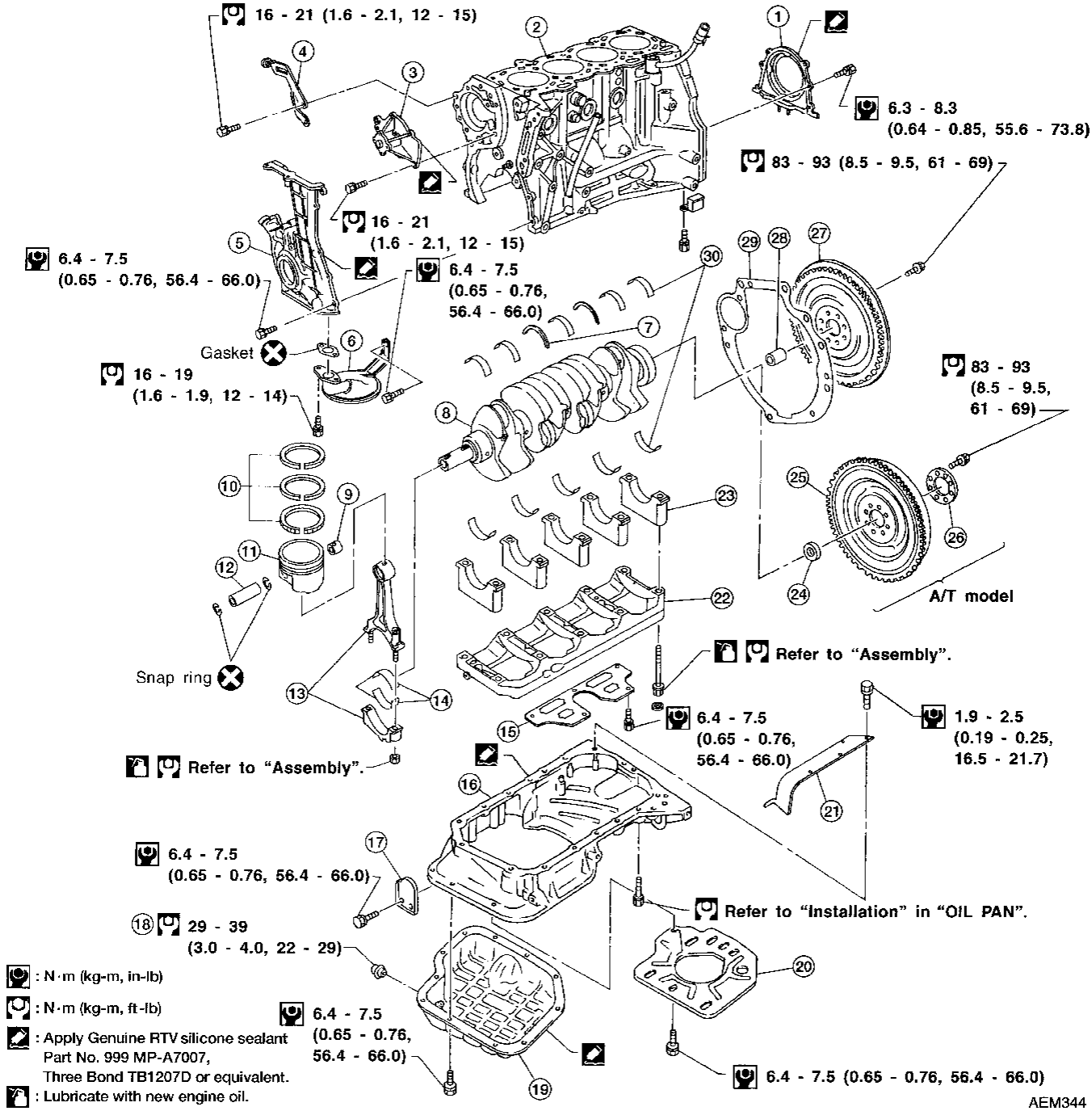
2. Carefully lower the engine onto engine mounting insulators.



When installing the engine, adjust the height of the engine mounting as shown. (For M/T models.)

3. Install in the reverse order of removal.

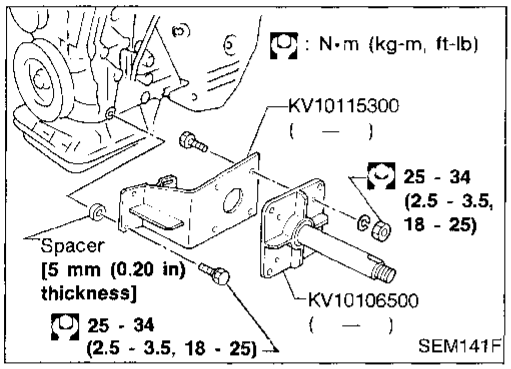
SEC. 110 • 120 • 150



① Rear oil seal retainer
② Cylinder block
③ Water pump
④ Power steering oil pump adjusting bar
⑤ Front cover with oil pump
⑥ Oil strainer
⑦ Thrust bearing
⑧ Crankshaft
⑨ Connecting rod bushing
⑩ Piston rings
⑪ Piston
⑫ Piston pin
⑬ Connecting rod
⑭ Connecting rod bearing
⑮ Baffle plate
⑯ Aluminum oil pan
⑰ Rear cover plate
⑱ Oil pan drain plug
⑲ Steel oil pan
⑳ Baffle plate
㉑ Side gallery baffle plate
㉒ Main bearing beam
㉓ Main bearing cap
㉔ Pilot converter
㉕ Drive plate
㉖ Reinforcement plate
㉗ Flywheel
㉘ Pilot bushing
㉙ Rear plate
㉚ Main bearing

CAUTION:

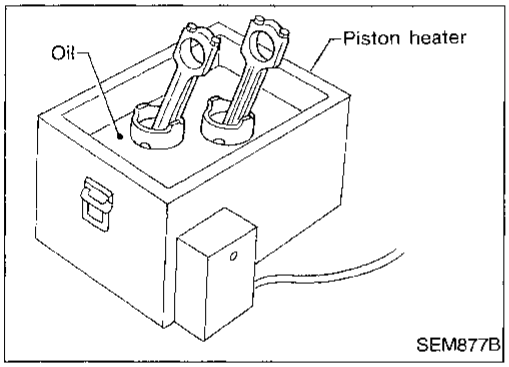
- **When installing sliding parts (bearings, pistons, etc.), lubricate contacting surfaces with new engine oil.**
- **Place removed parts such as bearings and bearing caps in their proper order and direction.**
- **When installing connecting rod nuts and main bearing cap bolts, apply new engine oil to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



Disassembly

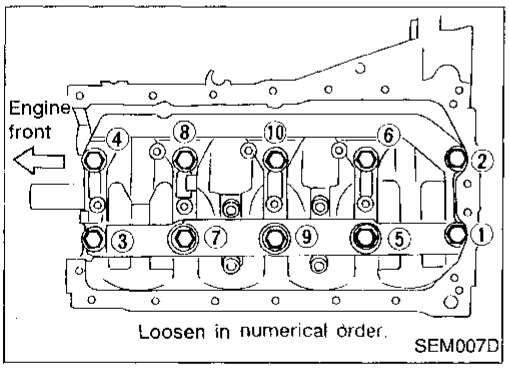
PISTON AND CRANKSHAFT

1. Place engine on engine stand (ST0501S000).
2. Remove cylinder head and timing chain.
   Refer to EM-18.
3. Remove oil pan.
   Refer to EM-13.

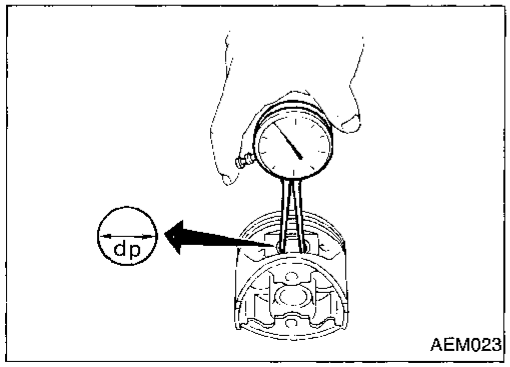


4. Remove pistons with connecting rods.
- To disassemble piston and connecting rod, first remove snap rings. Heat piston to 60 to 70°C (140 to 158°F) then use piston pin press to remove pin.
- **When piston rings are not replaced, make sure that piston rings are mounted in their original positions.**
- **When replacing piston rings, if there is no punchmark, install with either side up.**

5. Remove rear oil seal retainer.



6. Remove main bearing beam, bearing cap and crankshaft as shown.
- **Bolts should be loosened in two or three steps.**

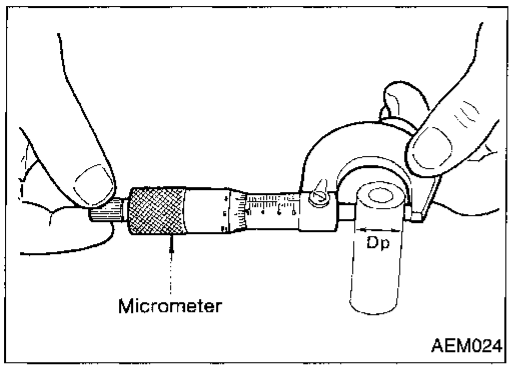


Inspection

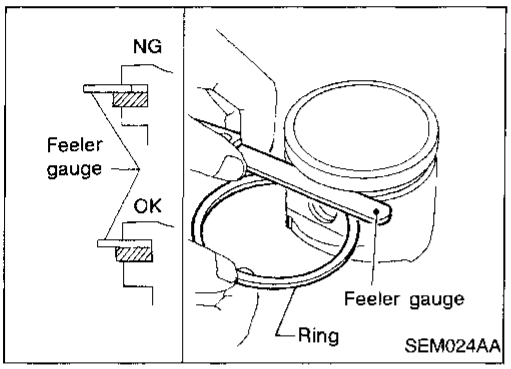
PISTON AND PISTON PIN CLEARANCE

1. Measure inner diameter of piston pin hole "dp".
   Standard diameter "dp":
   21.991 - 21.999 mm (0.8658 - 0.8661 in)

Inspection (Cont'd)



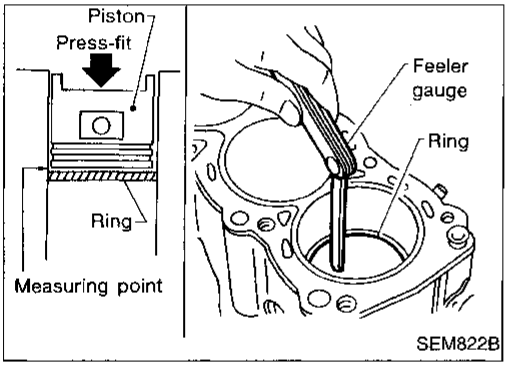
2. Measure outer diameter of piston pin "Dp".
   Standard diameter "Dp":
   21.991 - 21.999 mm (0.8658 - 0.8661 in)
3. Calculate interference fit of piston pin to piston.
   Dp – dp: 0 - 0.004 (0 - 0.0002 in)
   If it exceeds the above value, replace piston assembly with pin.



PISTON RING SIDE CLEARANCE

Side clearance:
Top ring
0.045 - 0.080 mm (0.0018 - 0.0031 in)
2nd ring
0.030 - 0.065 mm (0.0012 - 0.0026 in)
Max. limit of side clearance:
0.2 mm (0.008 in)

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

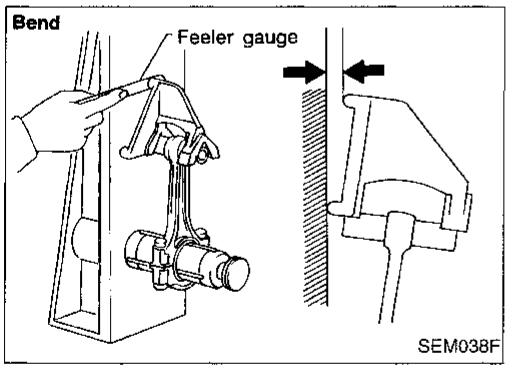


PISTON RING END GAP

End gap:
Top ring 0.20 - 0.30 mm (0.0079 - 0.0118 in)
2nd ring 0.35 - 0.50 mm (0.0138 - 0.0197 in)
Oil ring 0.20 - 0.60 mm (0.0079 - 0.0236 in)
Max. limit of ring gap:
1.0 mm (0.039 in)

If out of specification, replace piston ring. If gap exceeds maximum limit with a new ring, rebore cylinder and use oversized piston and piston rings. Refer to SDS, EM-70.

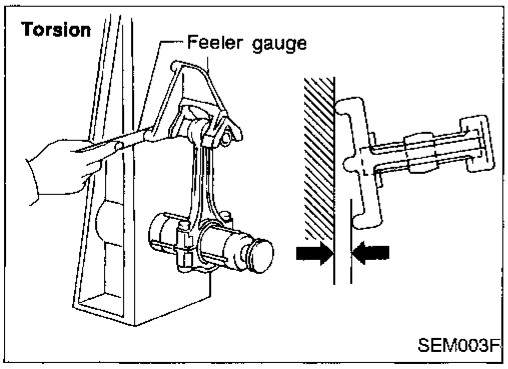
- When replacing the piston, check cylinder block surface for scratches or seizure. If scratches or seizure are found, hone or replace the cylinder block.



CONNECTING ROD BEND AND TORSION

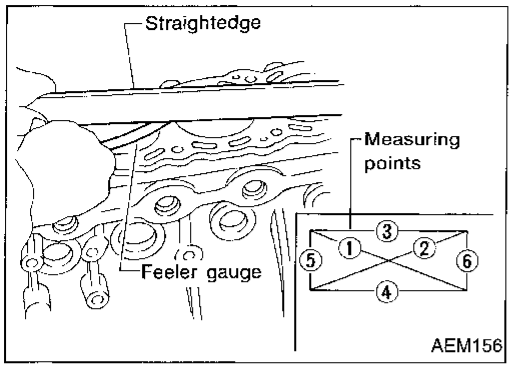
Bend:
Limit 0.15 mm (0.0059 in)
per 100 mm (3.94 in) length
Torsion:
Limit 0.30 mm (0.0118 in)
per 100 mm (3.94 in) length

If it exceeds the limit, replace connecting rod assembly.



Inspection (Cont'd)

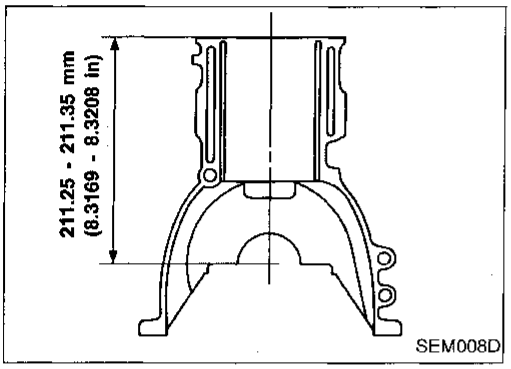
CYLINDER BLOCK DISTORTION AND WEAR



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

Block surface flatness:
Standard Less than 0.03 mm (0.0012 in)
Limit 0.10 mm (0.004 in)

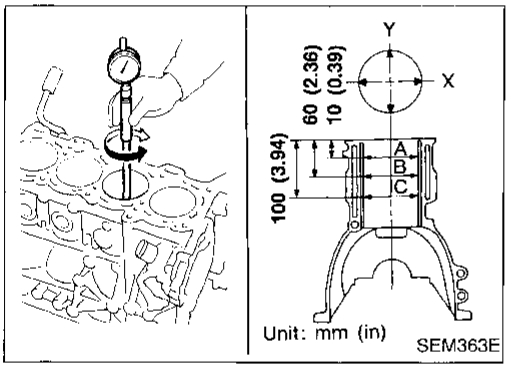
If out of specification, resurface it.
The limit for cylinder block resurfacing is determined by the amount of cylinder head resurfacing.



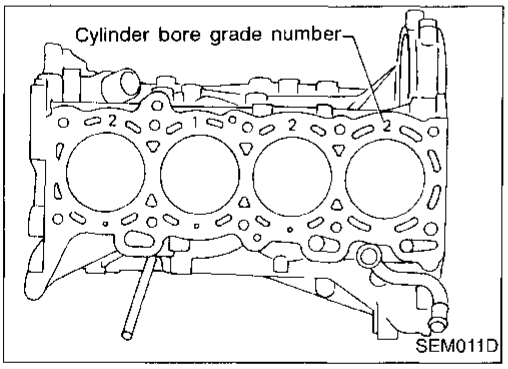
Amount of cylinder head resurfacing is "A".
Amount of cylinder block resurfacing is "B".
The maximum limit is as follows:
A + B = 0.2 mm (0.008 in)
Nominal cylinder block height from crankshaft center:
211.25 - 211.35 mm (8.3169 - 8.3208 in)

If necessary, replace cylinder block.

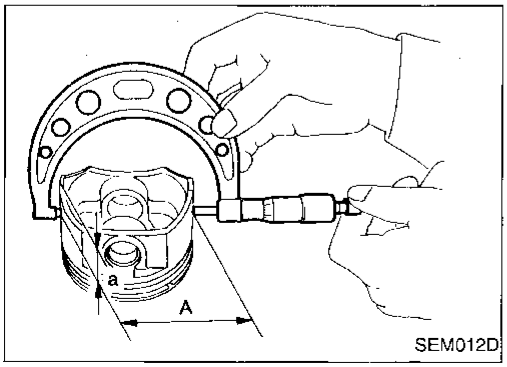
PISTON-TO-BORE CLEARANCE



1. Using a bore gauge, measure cylinder bore for wear, out-of-round and taper.
   Standard inner diameter:
   86.000 - 86.030 mm (3.3858 - 3.3870 in)
   Wear limit: 0.20 mm (0.0079 in)
   Out-of-round (X – Y) standard: 0.015 mm (0.0006 in)
   Taper (A – B and A – C) standard: 0.010 mm (0.0004 in)
   If it exceeds the limit, rebore all cylinders. Replace cylinder block if necessary.
2. Check for score and seizure. If seizure is found, hone it.



- **If cylinder block and piston are replaced, match piston grade with grade number on cylinder block upper surface.**



3. Measure piston skirt diameter.
   Piston diameter "A": Refer to SDS, EM-70.
   Measuring point "a" (Distance from the bottom):
   14.0 mm (0.551 in)
4. Check that piston-to-bore clearance is within specification.
   Piston-to-bore clearance = bore measurement "C" – Piston diameter "A":
   0.010 - 0.030 mm (0.0004 - 0.0012 in)
5. Determine piston oversize according to amount of cylinder wear.

Inspection (Cont'd)

Oversize pistons are available for service. Refer to SDS, EM-70.

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

   Rebored size calculation:

   D = A + B – C

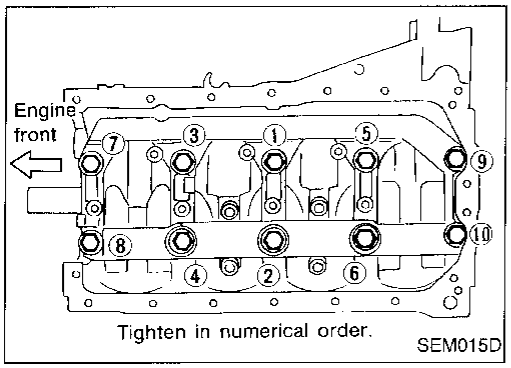
   where,

   D: Bored diameter

   A: Piston diameter as measured

   B: Piston-to-bore clearance

   C: Honing allowance 0.02 mm (0.0008 in)

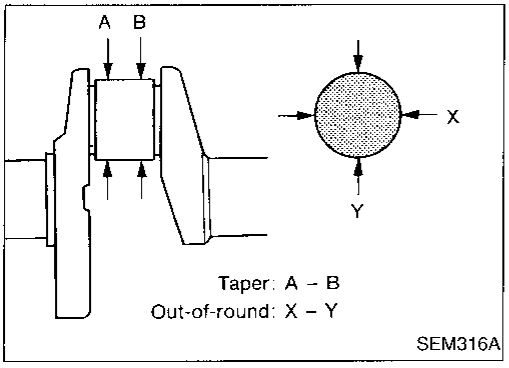


7. Install main bearing caps and tighten bolts to 26 to 32 N·m (2.7 to 3.3 kg-m, 20 to 24 ft-lb) as shown. This will prevent distortion of cylinder bores, otherwise cylinder bores may be distorted in final assembly.
8. Cut cylinder bores.

- **When any cylinder needs boring, all other cylinders must also be bored.**
- **Do not cut too much out of cylinder bore at a time. Cut only 0.05 mm (0.0020 in) or so at a time.**

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

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



CRANKSHAFT

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

   Out-of-round (X – Y):

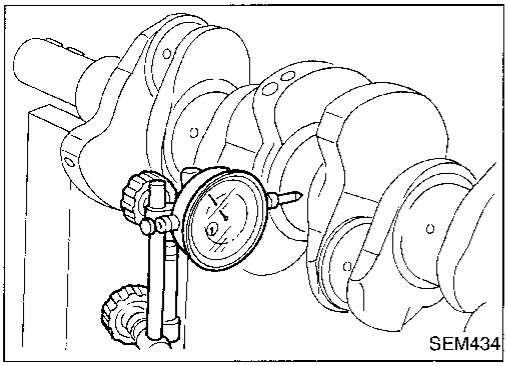
   Taper (A – B):

   Main journal

   Less than 0.005 mm (0.0002 in)

   Pin journal

   Less than 0.003 mm (0.0001 in)



3. Measure crankshaft runout.

   Runout (Total indicator reading):

   Less than 0.05 mm (0.0020 in)

Inspection (Cont'd)

BEARING CLEARANCE

- Use Method A or Method B. Method A is preferred because it is more accurate.

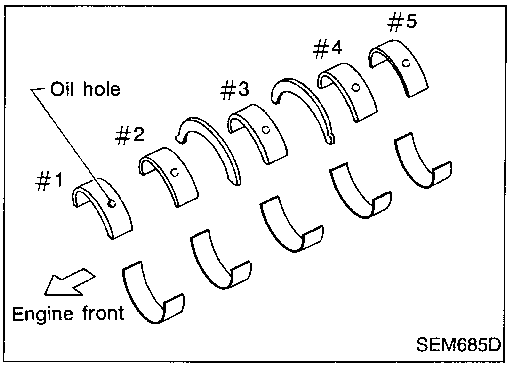
Method A (Using bore gauge and micrometer)

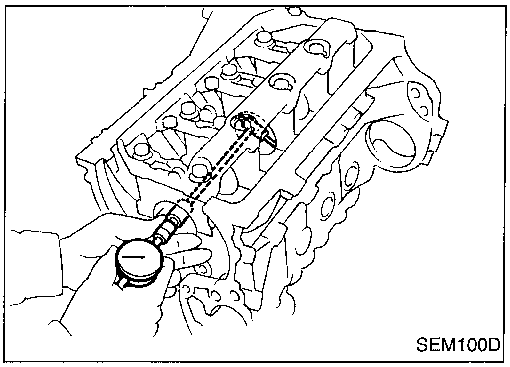
Main bearing

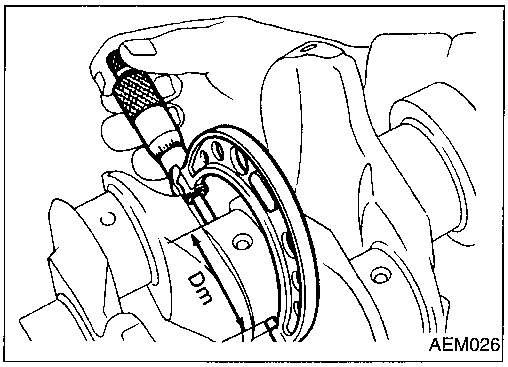
1. Set main bearings in their proper positions on cylinder block and main bearing cap.
2. Install main bearing cap and main bearing beam to cylinder block.

Tighten all bolts in correct order in two or three stages. Refer to EM-63.

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







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

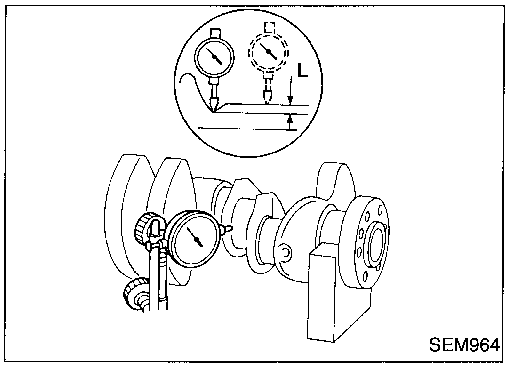
   Main bearing clearance = A – Dm

   Standard: 0.004 - 0.022 mm (0.0002 - 0.0009 in)

   Limit: 0.050 mm (0.0020 in)

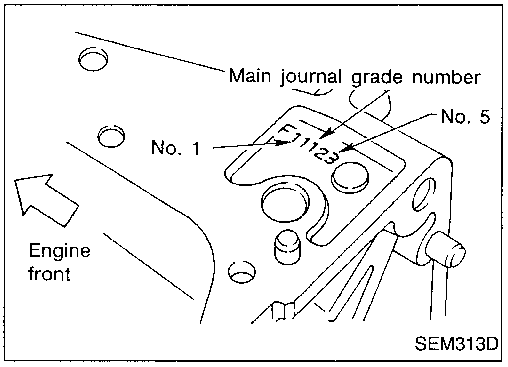
   If it exceeds the limit, replace bearing.

- If clearance cannot be adjusted within the standard of any bearing, grind crankshaft main journal and use undersized bearing.



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

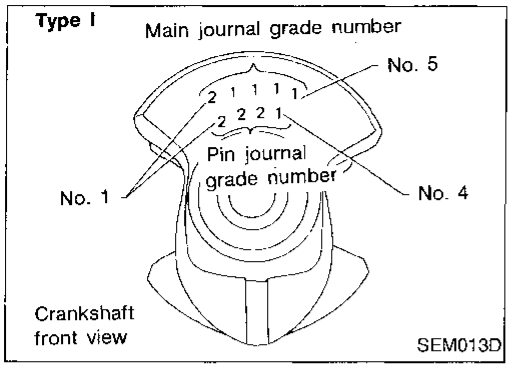
  "L": 0.1 mm (0.004 in)
- **Refer to SDS, EM-71 for grinding crankshaft and available service parts.**

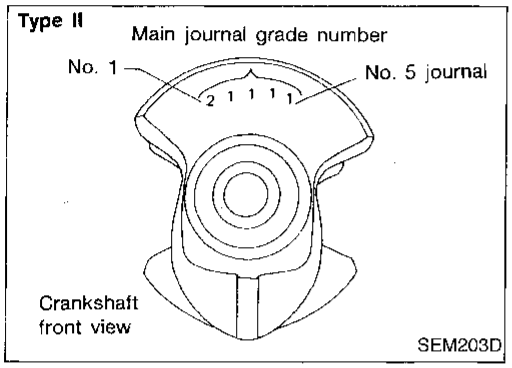


- If crankshaft is replaced, select thickness of main bearings as follows:

a. Grade number of each cylinder block main journal is punched on the respective cylinder block. These numbers are punched in either Arabic or Roman numerals.

Inspection (Cont'd)



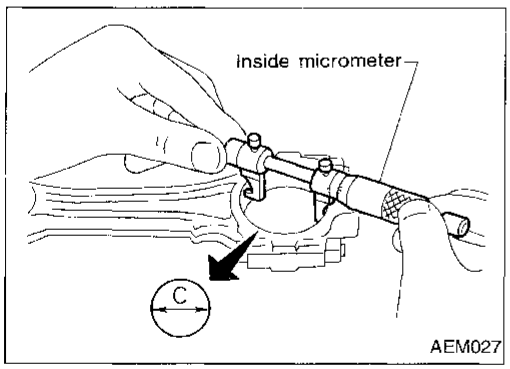


b. Grade number of each crankshaft main journal is punched on the respective crankshaft. These numbers are punched in either Arabic or Roman numerals.
c. Select main bearing with suitable thickness according to the following table.

How to select main bearings (Identification mark and color)

Crankshaft main journal grade number	Cylinder block main journal grade number			
	0	1	2	3
0	0 (A, Biack)	1 (B, Brown)	2 (C, Green)	3 (D, Yellow)
1	1 (B, Brown)	2 (C, Green)	3 (D, Yellow)	4 (E, Blue)
2	2 (C, Green)	3 (D, Yellow)	4 (E, Blue)	5 (F, Pink)
3	3 (D, Yellow)	4 (E, Blue)	5 (F, Pink)	6 (G, No color)

For example:
Cylinder block main journal grade number: 1
Crankshaft main journal grade number: 2
Main bearing grade number = 1 + 2
= 3 (D, Yellow)

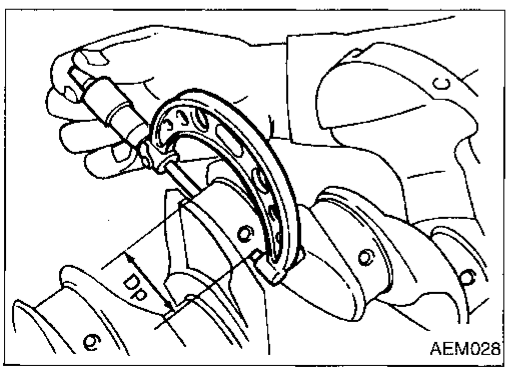


Connecting rod bearing (Big end)

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

Tighten bolts to the specified torque. Refer to EM-64.

3. Measure inner diameter "C" of each bearing.



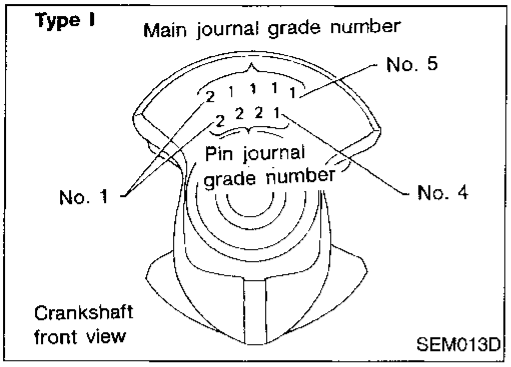
4. Measure outer diameter "Dp" of corresponding crankshaft pin journal.
5. Calculate connecting rod bearing clearance.

Connecting rod bearing clearance = C – Dp
Standard: 0.020 - 0.045 mm (0.0008 - 0.0018 in)
Limit: 0.065 mm (0.00256 in)

If it exceeds the limit, replace bearing.

- If clearance cannot be adjusted within the standard of any bearing, grind crankshaft journal and use undersized bearing. Refer to EM-58 for fillet roll remarks, grinding crankshaft and available service parts.

Inspection (Cont'd)

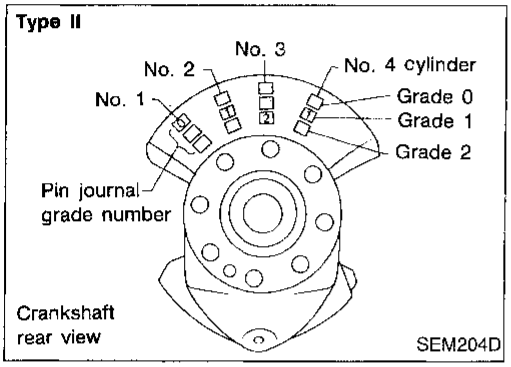


- If crankshaft is replaced with a new one, select connecting rod bearing according to the following table.

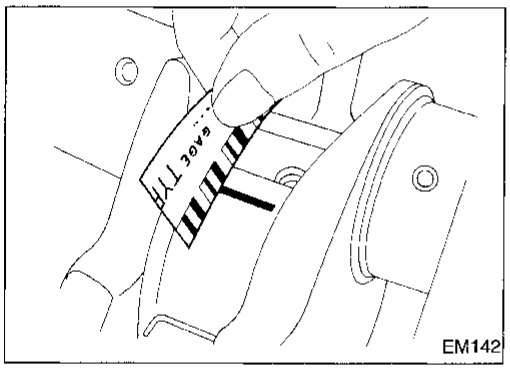
Connecting rod bearing grade number:

These numbers are punched in either Arabic or Roman numerals.

Crank pin grade number	Connecting rod bearing grade number
0	0
1	1
2	2



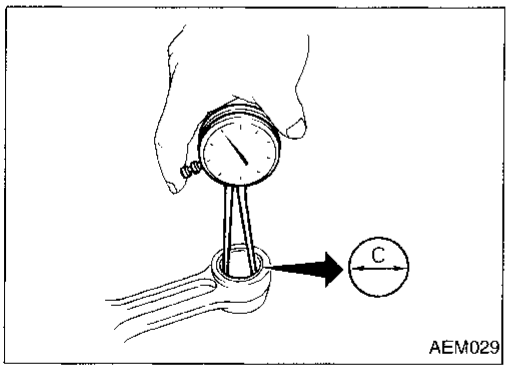
Identification color:
Grade 0; No color
Grade 1; Black
Grade 2; Brown



Method B (Using Plastigage)

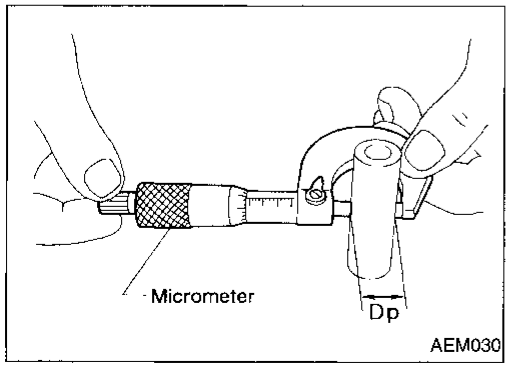
CAUTION:

- **Do not turn crankshaft or connecting rod while Plastigage is being inserted.**
- **If incorrect bearing clearance exists, use a thicker or undersized main bearing to ensure specified clearance.**



CONNECTING ROD BUSHING CLEARANCE (Small end)

1. Measure inner diameter "C" of bushing.



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

Connecting rod bushing clearance = C – Dp

Standard:

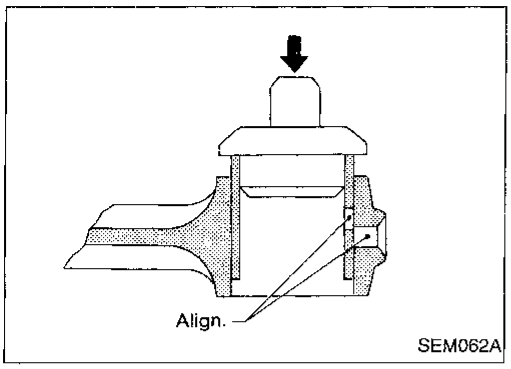
0.005 - 0.017 mm (0.0002 - 0.0007 in)

Limit:

0.023 mm (0.0009 in)

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

Inspection (Cont'd)



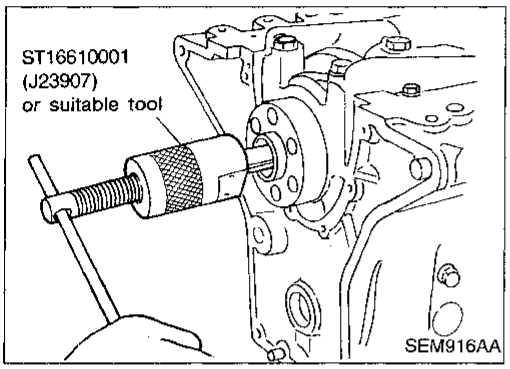
REPLACEMENT OF CONNECTING ROD BUSHING (Small end)

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

Be sure to align the oil holes.

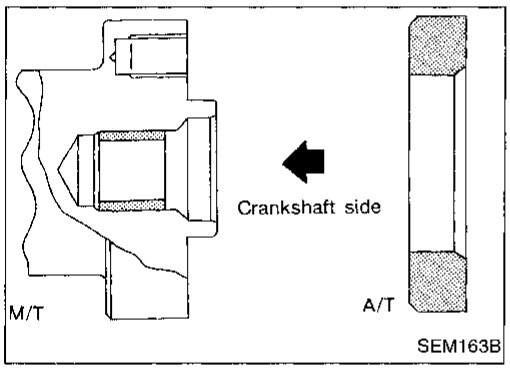
2. Ream the bushing so that clearance with piston pin is within specification.

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

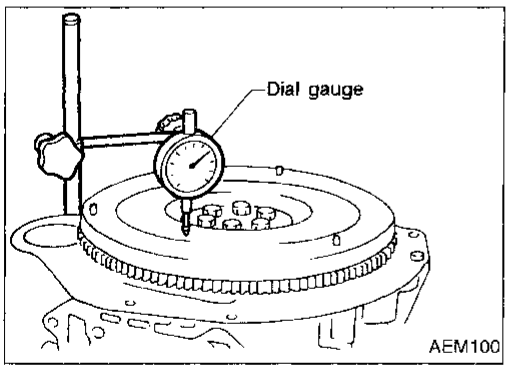


REPLACEMENT OF PILOT BUSHING (M/T) OR PILOT CONVERTER (A/T)

1. Remove pilot bushing or pilot converter using Tool or suitable tool.



2. Install pilot bushing or pilot converter as shown.

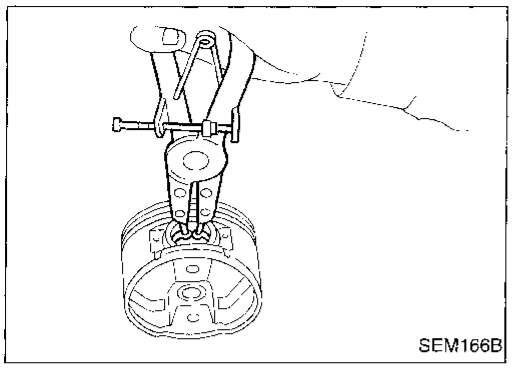


FLYWHEEL/DRIVE PLATE RUNOUT

Runout (Total indicator reading):
Flywheel (M/T model)
Less than 0.15 mm (0.0059 in)
Drive plate (A/T model)
Less than 0.20 mm (0.0079 in)

CAUTION:

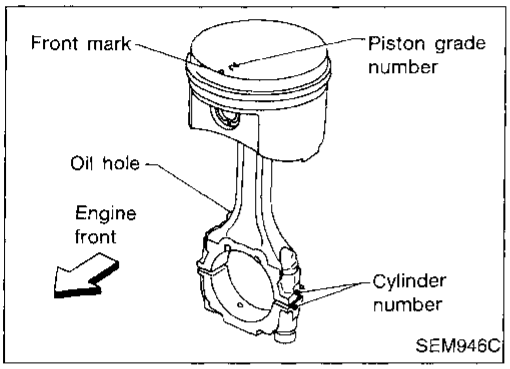
- **Be careful not to damage the ring gear teeth.**
- **Check the drive plate for deformation or cracks.**
- **Do not allow any magnetic materials to contact the ring gear teeth.**
- **Do not resurface flywheel. Replace as necessary.**


SEM166B

Assembly

PISTON

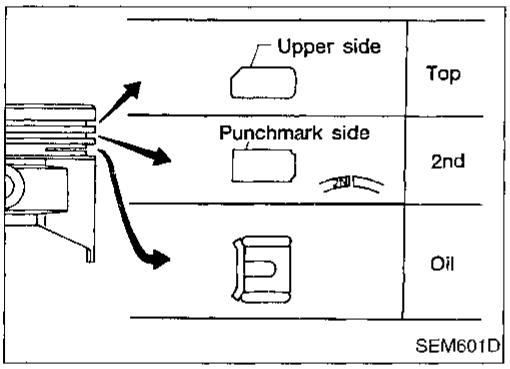
1. Install new snap ring on one side of piston pin hole.



SEM946C

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

- **Align the direction of piston and connecting rod.**
- **Numbers stamped on connecting rod and cap correspond to each cylinder.**
- **After assembly, make sure connecting rod swings smoothly.**

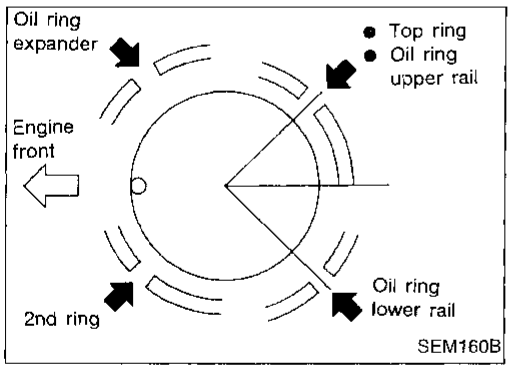


SEM601D

3. Set piston rings as shown.

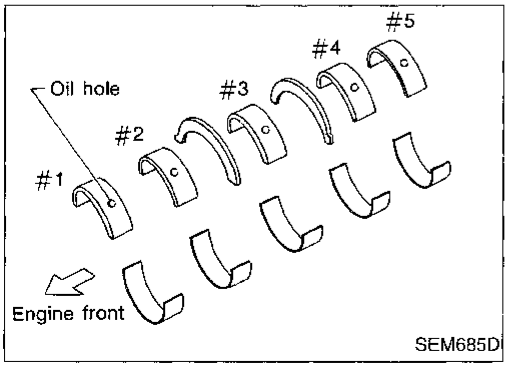
CAUTION:

- **When piston rings are not replaced, make sure that piston rings are mounted in their original positions.**
- **Install new piston rings either side up if there is no punch mark.**



SEM160B

- **Align piston rings so that end gaps are positioned as shown.**



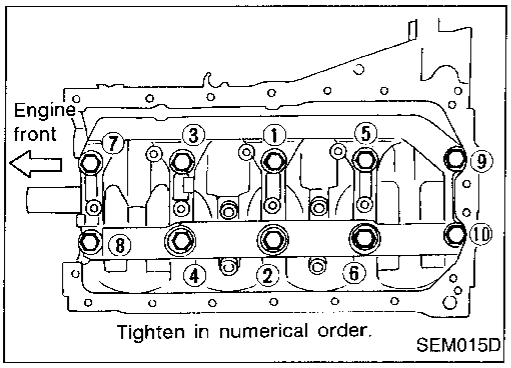
SEM685D

CRANKSHAFT

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

- **Confirm that correct main bearings are selected by using Method A or Method B. Refer to EM-58.**
- **Apply new engine oil to bearing surfaces.**

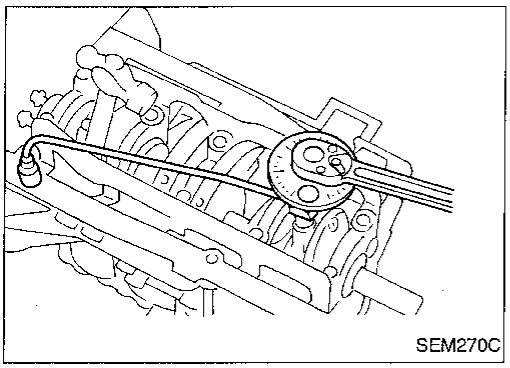
Assembly (Cont'd)



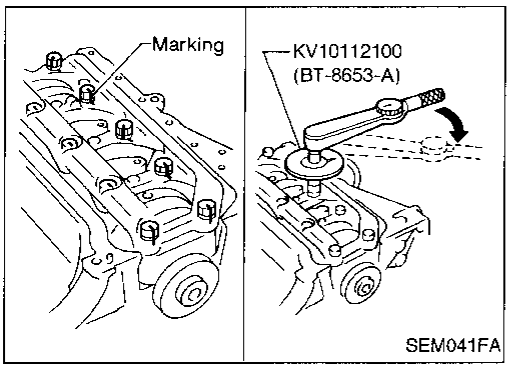
2. Install crankshaft, main bearing caps and beam, then tighten bolts to the specified torque.

- **Prior to tightening bearing cap bolts, shift crankshaft back and forth to properly seat the bearing cap.**
- **Apply new engine oil to threads and seating surfaces of bearing cap bolts before installing them.**
- **Tightening procedure:**

a. Tighten all bolts to 26 to 32 N·m (2.7 to 3.3 kg-m, 20 to 24 ft-lb).

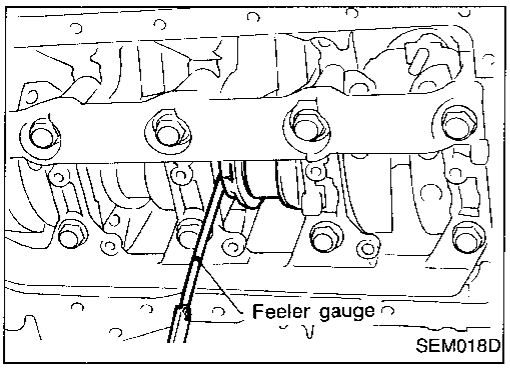


b. Turn all bolts 75 to 80 degrees clockwise with Tool or suitable angle wrench.
c. Loosen all bolts completely.
d. Tighten all bolts to 32 to 38 N·m (3.3 to 3.9 kg-m, 24 to 28 ft-lb).



e. Turn all bolts 45 to 50 degrees clockwise with Tool or suitable angle wrench.

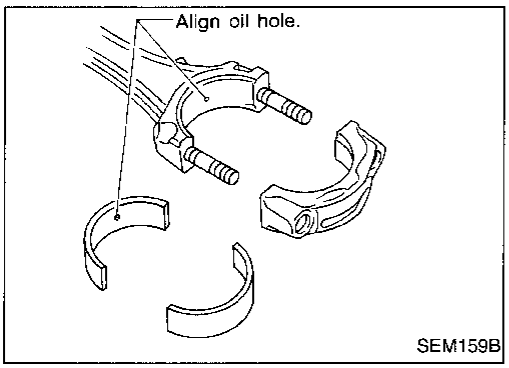
- **If an angle wrench is not available, mark all bearing cap bolts on the side facing engine rear. Then, turn each bolt specified degrees clockwise. Confirm angle of degrees with a graduator, not by eye measurement.**
- **After securing bearing cap bolts, make sure crankshaft turns smoothly by hand.**



3. Measure crankshaft end play.

Crankshaft end play:
Standard
0.10 - 0.26 mm (0.0039 - 0.0102 in)
Limit
0.30 mm (0.0118 in)

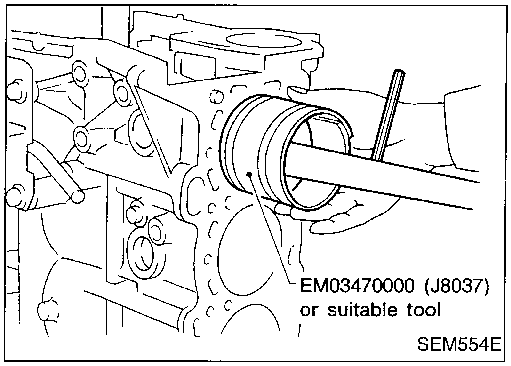
If beyond the limit, replace thrust bearing with new one.



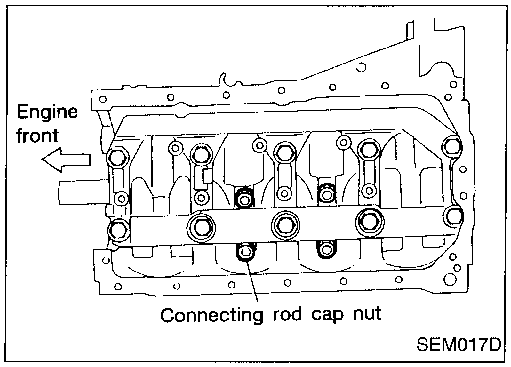
4. Install connecting rod bearings in connecting rods and connecting rod caps.

- **Confirm that correct bearings are used. Refer to EM-59.**
- **Install bearings so that oil hole in connecting rod aligns with oil hole of bearing.**
- **Apply new engine oil to bolt threads and bearing surfaces.**

Assembly (Cont'd)



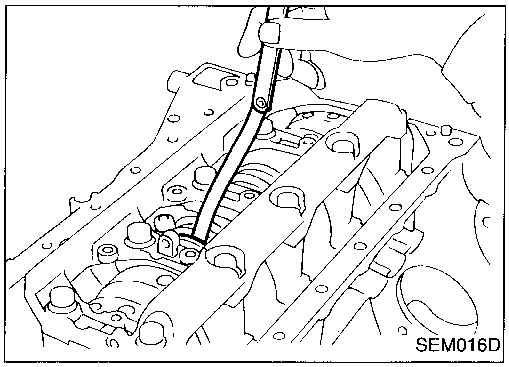
5. Install pistons with connecting rods.
a. Install them into corresponding cylinders with Tool.
- **Make sure connecting rod does not scratch cylinder wall.**
- **Make sure connecting rod bolts do scratch crankshaft pin journals.**
- **Arrange so that front mark on piston head faces engine front.**
- **Apply new engine oil to piston rings and sliding surface of piston.**



b. Install connecting rod caps.
- **Apply new engine oil to threads and seat surfaces.**

Tighten connecting rod cap nuts using the following procedure:

1) **Tighten nuts to 14 to 16 N·m (1.4 to 1.6 kg-m, 10 to 12 ft-lb).**
2) **Turn all nuts 60 to 65 degrees clockwise. If an angle wrench is not available, tighten nuts to 38 to 44 N·m (3.9 to 4.5 kg-m, 28 to 33 ft-lb).**



6. Measure connecting rod side clearance.

Connecting rod side clearance:

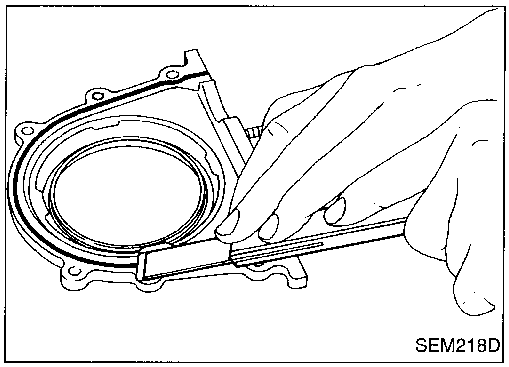
Standard

0.20 - 0.35 mm (0.0079 - 0.0138 in)

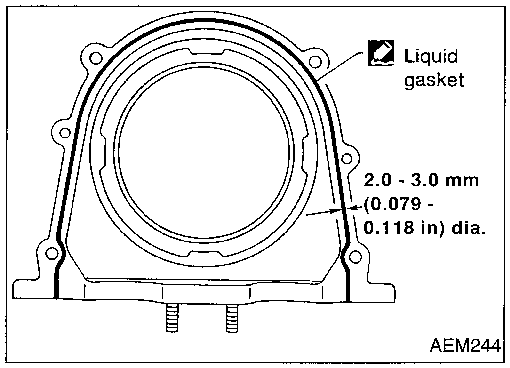
Limit

0.50 mm (0.0197 in)

If beyond the limit, replace connecting rod and/or crankshaft.



7. Install rear oil seal retainer.
a. Before installing rear oil seal retainer, remove old liquid gasket from mating surface.
- Also remove old liquid gasket from mating surface of cylinder block.

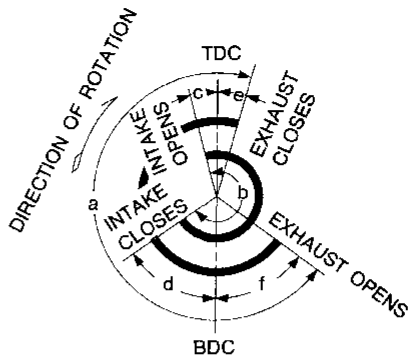


b. Apply a continuous bead of liquid gasket to mating surface of rear oil seal retainer.
- **Use Genuine RTV silicone sealant Part No. 999 MP-A7007, Three Bond TB1207D or equivalent.**
- **Apply around inner side of bolt holes.**

General Specifications

Cylinder arrangement		In-line 4
Displacement	cm^3 (cu in)	1,998 (121.92)
Bore and stroke	mm (in)	86 x 86 (3.39 x 3.39)
Valve arrangement		DOHC
Firing order		1-3-4-2
Number of piston rings		
Compression		2
Oil		1
Number of main bearings		5
Compression ratio		9.5

Valve timing



EM120

Unit: degree

a	b	c	d	e	f
240°	232°	5°	47°	3°	57°

Inspection and Adjustment

COMPRESSION PRESSURE

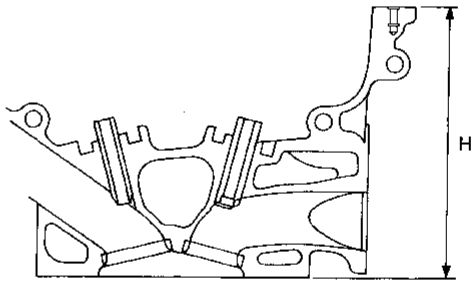
Unit: kPa (kg/cm^2, psi)/300 rpm

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

CYLINDER HEAD

Unit: mm (in)

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



SEM043F

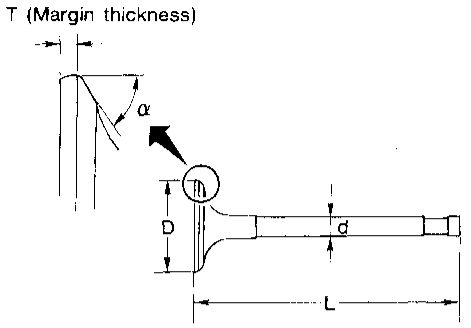
Nominal cylinder head height "H"	136.9 - 137.1 (5.390 - 5.398)
Resurfacing limit	0.2 (0.008)*

*Total amount of cylinder head resurfacing plus cylinder block resurfacing

Inspection and Adjustment (Cont'd)

VALVE

Unit: mm (in)



SEM188A

Valve head diameter "D"	
Intake	34.0 - 34.3 (1.339 - 1.350)
Exhaust	30.0 - 30.3 (1.181 - 1.193)
Valve length "L"	
Intake	101.19 - 101.61 (3.9839 - 4.0004)
Exhaust	102.11 - 102.53 (4.0201 - 4.0366)
Valve stem diameter "d"	
Intake	5.965 - 5.980 (0.2348 - 0.2354)
Exhaust	5.945 - 5.960 (0.2341 - 0.2346)
Valve seat angle "α"	
Intake	45°15′ - 45°45′
Exhaust	
Valve margin "T"	
Intake	1.1 (0.043)
Exhaust	1.3 (0.051)
Valve margin "T" limit	More than 0.5 (0.020)
Valve stem end surface grinding limit	Less than 0.2 (0.008)

Valve spring

Free height	mm (in)	49.36 (1.9433)
Pressure N (kg, lb) at height mm (in)		
Standard		578.02 - 641.57 (58.94 - 65.42, 129.96 - 144.25) at 30.0 (1.181)
Limit		549.2 (56.0, 123.5) at 30.0 (1.181)
Out-of-square	mm (in)	Less than 2.2 (0.087)

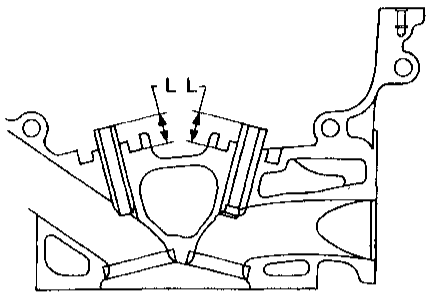
Hydraulic lash adjuster (HLA)

Unit: mm (in)

HLA outer diameter	16.980 - 16.993 (0.6685 - 0.6690)
HLA guide hole diameter	17.000 - 17.020 (0.6693 - 0.6701)
Clearance between HLA and HLA guide hole	0.007 - 0.040 (0.0003 - 0.0016)

Valve guide

Unit: mm (in)



SEM083D

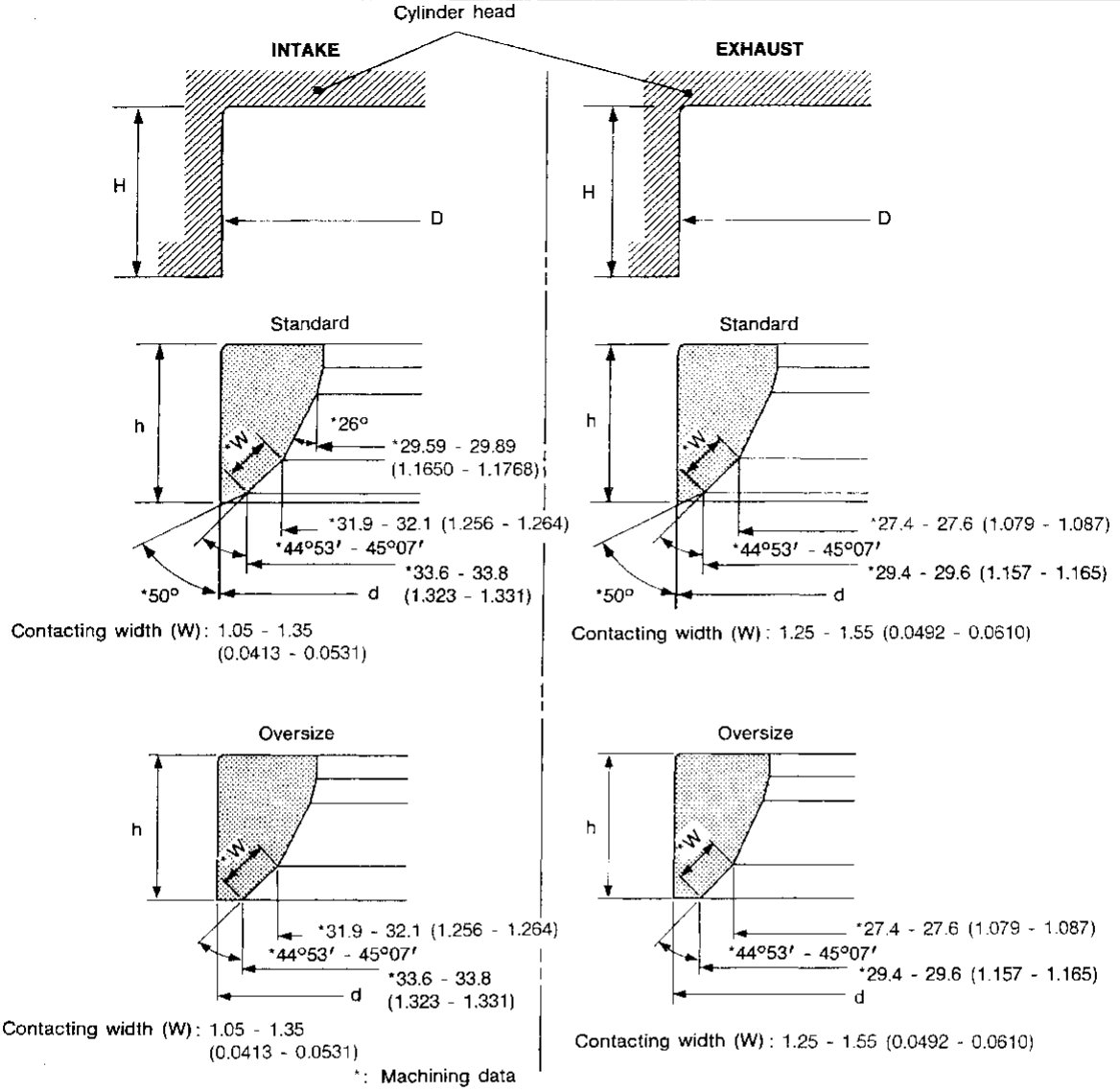
		Standard	Service
Valve guide Outer diameter	Intake	10.023 - 10.034 (0.3946 - 0.3950)	10.223 - 10.234 (0.4025 - 0.4029)
	Exhaust	10.023 - 10.034 (0.3946 - 0.3950)	10.223 - 10.234 (0.4025 - 0.4029)
Valve guide Inner diameter (Finished size)	Intake	6.000 - 6.018 (0.2362 - 0.2369)	
	Exhaust	6.000 - 6.018 (0.2362 - 0.2369)	
Cylinder head valve guide hole diameter	Intake	9.975 - 9.996 (0.3927 - 0.3935)	10.175 - 10.196 (0.4006 - 0.4014)
	Exhaust	9.975 - 9.996 (0.3927 - 0.3935)	10.175 - 10.196 (0.4006 - 0.4014)
Interference fit of valve guide		0.027 - 0.059 (0.0011 - 0.0023)	

		Standard	Limit
Stem to guide clearance	Intake	0.020 - 0.053 (0.0008 - 0.0021)	0.08 (0.0031)
	Exhaust	0.040 - 0.073 (0.0016 - 0.0029)	0.1 (0.004)
Valve deflection limit		0.2 (0.008)	
Projection length "L"		14.0 - 14.2 (0.551 - 0.559)	

Inspection and Adjustment (Cont'd)

Valve seat

Unit: mm (in)



SEM651DB

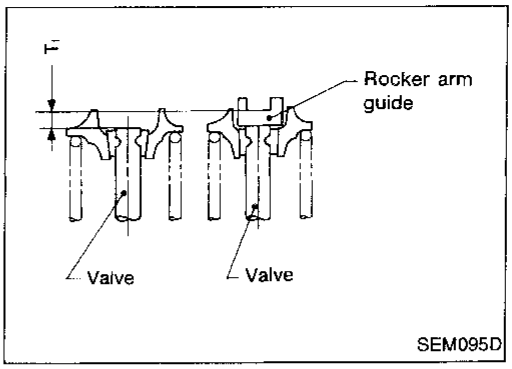
		Standard	Service
Cylinder head seat recess diameter (D)	In.	35.000 - 35.016 (1.3780 - 1.3786)	35.500 - 35.516 (1.3976 - 1.3983)
	Ex.	31.000 - 31.016 (1.2205 - 1.2211)	31.500 - 31.516 (1.2402 - 1.2408)
Valve seat interference fit	In.	0.064 - 0.096 (0.0025 - 0.0038)	
	Ex.	0.064 - 0.096 (0.0025 - 0.0038)	
Valve seat outer diameter (d)	In.	35.080 - 35.096 (1.3811 - 1.3817)	35.580 - 35.596 (1.4008 - 1.4014)
	Ex.	31.080 - 31.096 (1.2236 - 1.2242)	31.580 - 31.596 (1.2433 - 1.2439)
Depth (H)	In.	6.25 (0.2461)	
	Ex.	6.25 (0.2461)	
Height (h)		6.2 - 6.3 (0.244 - 0.248)	5.4 - 5.5 (0.213 - 0.217)

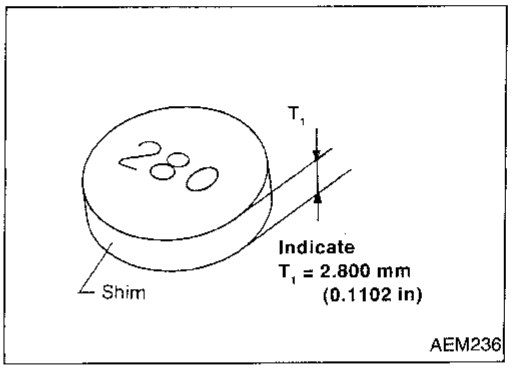
Inspection and Adjustment (Cont'd)

Valve shim clearance adjustment

Unit: mm (in)

Valve shim clearance (cold) Intake & Exhaust	Less than 0.025 (0.001)
Shim thickness "T_1"	T_1 ± 0.025 (0.001)





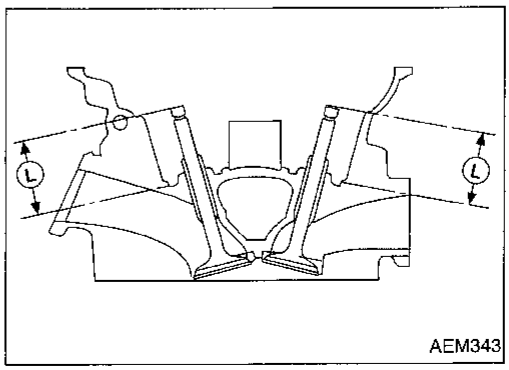
Available shim

Thickness mm (in)	Identification mark
2.800 (0.1102)	28 00
2.825 (0.1112)	28 25
2.850 (0.1122)	28 50
2.875 (0.1132)	28 75
2.900 (0.1142)	29 00
2.925 (0.1152)	29 25
2.950 (0.1161)	29 50
2.975 (0.1171)	29 75
3.000 (0.1181)	30 00
3.025 (0.1191)	30 25
3.050 (0.1201)	30 50
3.075 (0.1211)	30 75
3.100 (0.1220)	31 00
3.125 (0.1230)	31 25
3.150 (0.1240)	31 50
3.175 (0.1250)	31 75
3.200 (0.1260)	32 0

Valve seat resurface limit

Unit: mm (in)

Depth (L)	42.74 - 43.26 (1.6827 - 1.7031)

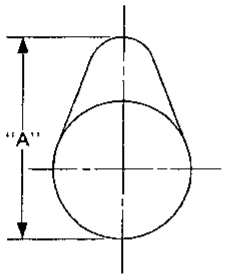


Inspection and Adjustment (Cont'd)

CAMSHAFT AND CAMSHAFT BEARING

Unit: mm (in)

	Standard	Limit
Camshaft journal to bearing clearance	0.045 - 0.086 (0.0018 - 0.0034)	0.15 (0.0059)
Inner diameter of camshaft bearing	28.000 - 28.021 (1.1024 - 1.1032)	—
Outer diameter of camshaft journal	27.935 - 27.955 (1.0998 - 1.1006)	—
Camshaft runout [TIR*]	Less than 0.02 (0.0008)	0.1 (0.004)
Camshaft sprocket runout [TIR*]	Less than 0.25 (0.0098)	—
Camshaft end play	0.055 - 0.139 (0.0022 - 0.0055)	0.20 (0.0079)



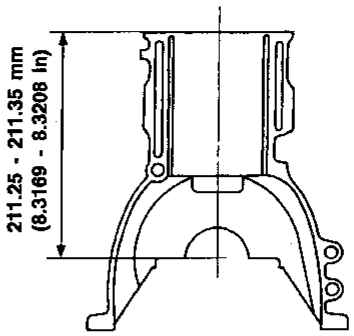
EM671

Cam height "A"	
Intake	37.550 - 37.740 (1.4783 - 1.4858)
Exhaust	37.920 - 38.110 (1.4929 - 1.5004)
Wear limit of cam height	0.2 (0.008)
Valve lift	
Intake	8.6 (0.339)
Exhaust	9.2 (0.362)

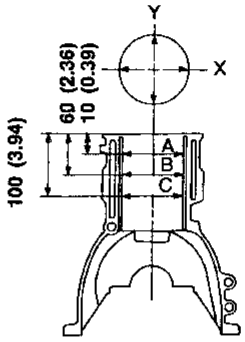
*Total indicator reading

CYLINDER BLOCK

Unit: mm (in)



SEM964E



SEM686D

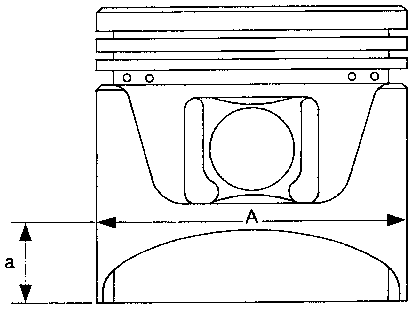
Surface flatness	
Standard	Less than 0.03 (0.0012)
Limit	0.1 (0.004)
Cylinder bore	
Inner diameter	
Standard	
Grade No. 1	86.000 - 86.010 (3.3858 - 3.3862)
Grade No. 2	86.010 - 86.020 (3.3862 - 3.3866)
Grade No. 3	86.020 - 86.030 (3.3866 - 3.3870)
Wear limit	0.20 (0.0079)
Out-of-round (X – Y)	Less than 0.015 (0.0006)
Taper (A – B and A – C)	Less than 0.010 (0.0004)
Difference in inner diameter between cylinders	
Limit	Less than 0.05 (0.0020)
Main journal inner diameter	
Grade No. 0	58.944 - 58.950 (2.3206 - 2.3209)
Grade No. 1	58.950 - 58.956 (2.3209 - 2.3211)
Grade No. 2	58.956 - 58.962 (2.3211 - 2.3213)
Grade No. 3	58.962 - 58.968 (2.3213 - 2.3216)

Inspection and Adjustment (Cont'd)

PISTON, PISTON RING, AND PISTON PIN

Piston

Unit: mm (in)



SEM750C

Piston skirt diameter "A"	
Standard	
Grade No. 1	85.980 - 85.990 (3.3850 - 3.3854)
Grade No. 2	85.990 - 86.000 (3.3854 - 3.3858)
Grade No. 3	86.000 - 86.010 (3.3858 - 3.3862)
0.20 (0.0079) over-size (Service)	86.180 - 86.210 (3.3929 - 3.3941)
"a" dimension	14.0 (0.551)
Piston clearance to cylinder block	0.010 - 0.030 (0.0004 - 0.0012)
Piston pin hole diameter	21.991 - 21.999 (0.8658 - 0.8661)

Piston ring

Unit: mm (in)

Side clearance	
Top	
Standard	0.045 - 0.080 (0.0018 - 0.0031)
Limit	0.2 (0.008)
2nd	
Standard	0.030 - 0.065 (0.0012 - 0.0026)
Limit	0.2 (0.008)
Ring gap	
Top	
Standard	0.20 - 0.30 (0.0079 - 0.0118)
Limit	1.0 (0.039)
2nd	
Standard	0.35 - 0.50 (0.0138 - 0.0197)
Limit	1.0 (0.039)
Oil	
Standard	0.20 - 0.60 (0.0079 - 0.0236)
Limit	1.0 (0.039)

Piston pin

Unit: mm (in)

Piston pin outer diameter	21.991 - 21.999 (0.8658 - 0.8661)
Interference fit of piston pin to piston	0 - 0.004 (0 - 0.0002)
Piston pin to connecting rod bushing clearance	
Standard	0.005 - 0.017 (0.0002 - 0.0007)
Limit	0.023 (0.0009)

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

Inspection and Adjustment (Cont'd)

CONNECTING ROD

Unit: mm (in)

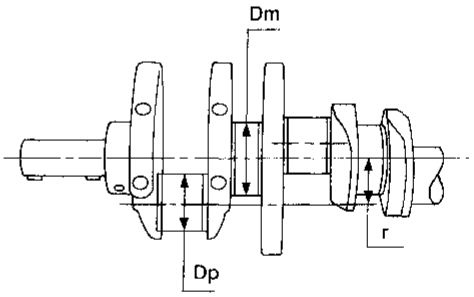
Center distance	136.25 - 136.35 (5.3642 - 5.3681)
Bend [per 100 (3.94)]	
Limit	0.15 (0.0059)
Torsion [per 100 (3.94)]	
Limit	0.30 (0.0118)
Connecting rod small end inner diameter	24.980 - 25.000 (0.9835 - 0.9843)
Piston pin bushing inner diameter*	22.000 - 22.012 (0.8661 - 0.8666)
Connecting rod big end inner diameter	51.000 - 51.013 (2.0079 - 2.0084)
Side clearance	
Standard	0.20 - 0.35 (0.0079 - 0.0138)
Limit	0.5 (0.020)

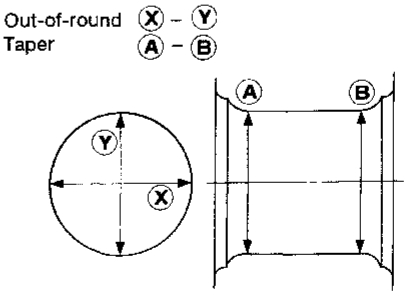
*After installing in connecting rod

CRANKSHAFT

Unit: mm (in)

Main journal dia. "Dm"		
Grade No. 0	54.974 - 54.980 (2.1643 - 2.1646)	
Grade No. 1	54.968 - 54.974 (2.1641 - 2.1643)	
Grade No. 2	54.962 - 54.968 (2.1639 - 2.1641)	
Grade No. 3	54.956 - 54.962 (2.1636 - 2.1639)	
Pin journal dia. "Dp"		
Grade No. 0	47.968 - 47.974 (1.8885 - 1.8887)	
Grade No. 1	47.962 - 47.968 (1.8883 - 1.8885)	
Grade No. 2	47.956 - 47.962 (1.8880 - 1.8883)	
Center distance "r"	42.96 - 43.04 (1.6913 - 1.6945)	
Out-of-round (X – Y)		
Standard	Main journal	Less than 0.005 (0.0002)
	Pin journal	Less than 0.003 (0.0001)
Taper (A – B)		
Standard	Main journal	Less than 0.005 (0.0002)
	Pin journal	Less than 0.0025 (0.0001)
Runout [TIR]		
Standard	Less than 0.025 (0.0010)	
Limit	Less than 0.05 (0.0020)	
Free end play		
Standard	0.10 - 0.26 (0.0039 - 0.0102)	
Limit	0.30 (0.0118)	

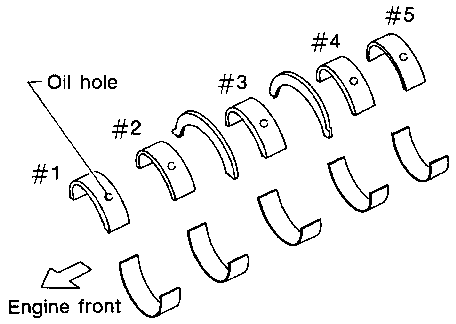




SEM954C

Inspection and Adjustment (Cont'd)

MAIN BEARING



SEM685D

Standard

Unit: mm (in)

Grade number	Thickness "T"	Width "W"	Identification color (mark)
0	1.977 - 1.980 (0.0778 - 0.0780)	18.9 - 19.1 (0.744 - 0.752)	Black (A)
1	1.980 - 1.983 (0.0780 - 0.0781)		Brown (B)
2	1.983 - 1.986 (0.0781 - 0.0782)		Green (C)
3	1.986 - 1.989 (0.0782 - 0.0783)		Yellow (D)
4	1.989 - 1.992 (0.0783 - 0.0784)		Blue (E)
5	1.992 - 1.995 (0.0784 - 0.0785)		Pink (F)
6	1.995 - 1.998 (0.0785 - 0.0787)		No color (G)

Undersize

Unit: mm (in)

Undersize	Thickness "T"	Main journal diameter "Dm"
0.25 (0.0098)	2.109 - 2.117 (0.0830 - 0.0833)	Grind so that bearing clearance is the specified value.

CONNECTING ROD BEARING

Standard size

Unit: mm (in)

Grade number	Thickness "T"	Width "W"	Identification color (mark)
0	1.500 - 1.503 (0.0591 - 0.0592)	16.9 - 17.1 (0.665 - 0.673)	No color (A)
1	1.503 - 1.506 (0.0592 - 0.0593)		Black (B)
2	1.506 - 1.509 (0.0593 - 0.0594)		Brown (C)

Undersize

Unit: mm (in)

Undersize	Thickness "T"	Crank pin journal diameter "Dp"
0.08 (0.0031)	1.541 - 1.549 (0.0607 - 0.0610)	Grind so that bearing clearance is the specified value.
0.12 (0.0047)	1.561 - 1.569 (0.0615 - 0.0618)	
0.25 (0.0098)	1.626 - 1.634 (0.0640 - 0.0643)	

BEARING CLEARANCE

Unit: mm (in)

Main bearing clearance	
Standard	0.004 - 0.022 (0.0002 - 0.0009)
Limit	0.05 (0.0020)
Connecting rod bearing clearance	
Standard	0.020 - 0.045 (0.0008 - 0.0018)
Limit	0.065 (0.00256)

MISCELLANEOUS COMPONENTS

Unit: mm (in)

Camshaft sprocket runout limit [TIR]	0.25 (0.0098)
Flywheel runout limit [TIR]	0.15 (0.0059)
Drive plate runout limit [TIR]	0.2 (0.008)