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				MT
				AT
				AX
				SU
				BR
				ST
				RS
				BT
				HA
				SC
				EL
				IDX

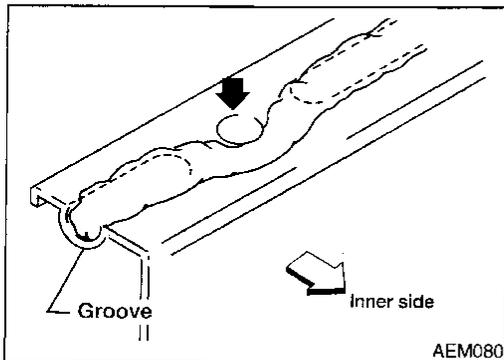
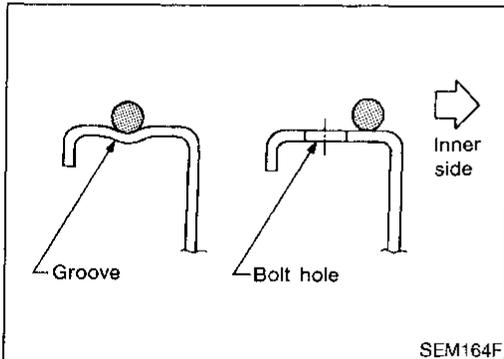
PRECAUTIONS

Parts Requiring Angular Tightening

Parts Requiring Angular Tightening

NCEM0001

- Use an angle wrench for the final tightening of the following engine parts:
 - a) Cylinder head bolts
 - b) Main bearing cap bolts
 - c) Connecting rod cap nuts
- 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

NCEM0002

1. Use a scraper to remove old liquid gasket from mating surfaces and grooves. Also, completely clean any oil from these areas.
2. Apply a continuous bead of liquid gasket to mating surfaces. (Use Genuine RTV silicone sealant part No. 999MP-A7007 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).
3. Apply liquid gasket around the inner side of bolt holes (unless otherwise specified).
4. Assembly should be done within 5 minutes after coating.
5. Wait at least 30 minutes before refilling engine oil and engine coolant.

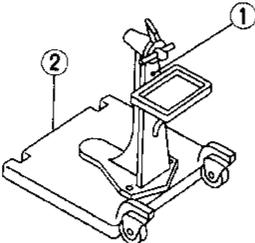
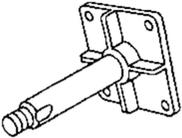
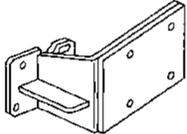
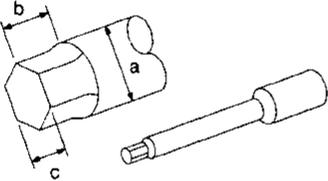
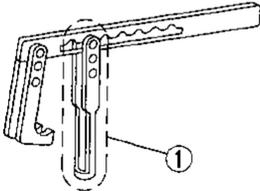
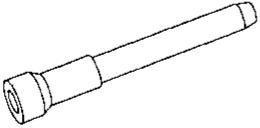
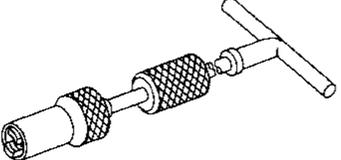
PREPARATION

Special Service Tools

Special Service Tools

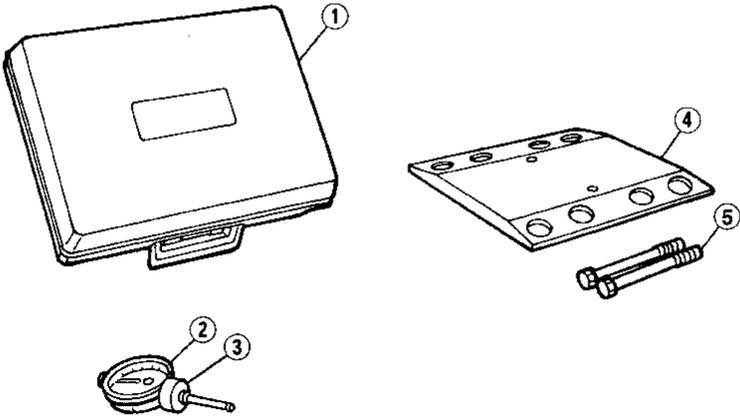
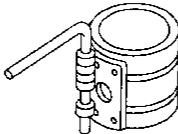
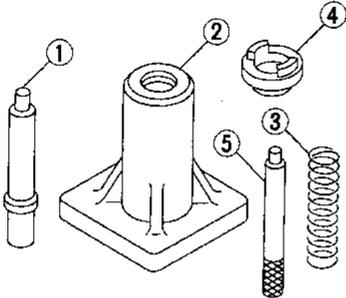
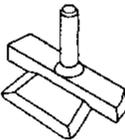
NCEM0003

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		GI MA
ST0501S000 (—) Engine stand assembly 1 ST05011000 (—) Engine stand 2 ST05012000 (—) Base	 <p>NT042</p>	Disassembling and assembling	EM LC EC
KV10106500 (—) Engine stand shaft	 <p>NT028</p>		FE CL
KV10115300 (—) Engine sub-attachment	 <p>NT008</p>		MT AT AX
ST10120000 (J24239-01) Cylinder head bolt wrench	 <p>NT583</p>	Loosening and tightening cylinder head bolt a: 13 (0.51) dia. b: 12 (0.47) c: 10 (0.39) Unit: mm (in)	SU BR
KV10116200 (J26336-B) Valve spring compres- sor 1 KV10115900 (J26336-20) Attachment	 <p>NT022</p>	Disassembling valve mechanism	ST RS BT
KV10115600 (J38958) Valve oil seal drift	 <p>NT024</p>	Installing valve oil seal	HA SC
KV10107902 (J38959) Valve oil seal puller	 <p>NT011</p>	Displacement valve lip seal	EL IDX

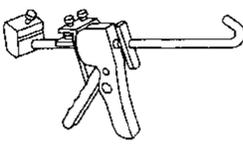
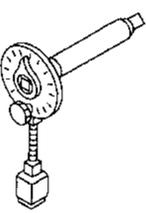
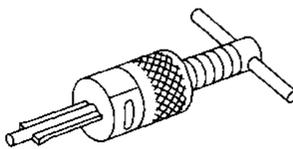
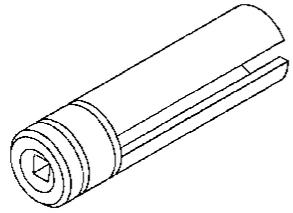
PREPARATION

Special Service Tools (Cont'd)

Tool number (Kent-Moore No.) Tool name	Description
KV10115700 (J38957) Dial gauge stand	<div style="text-align: center;">  </div> <p style="text-align: center;">Adjusting shims</p> <p style="text-align: center;">NT012</p>
(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	<div style="text-align: center;">  </div> <p style="text-align: center;">Measuring valve shims</p> <p style="text-align: center;">AEM274</p>
EM03470000 (J8037) Piston ring compressor	<div style="text-align: center;">  </div> <p style="text-align: center;">Installing piston assembly into cylinder bore</p> <p style="text-align: center;">NT044</p>
KV10107400 (J26365-12, J26365) Piston pin press stand 1 KV10107310 (—) Center shaft 2 ST13040020 (—) Stand 3 ST13040030 (—) Spring 4 KV10107320 (—) Cap 5 ST13040050 (—) Drift	<div style="text-align: center;">  </div> <p style="text-align: center;">Disassembling and assembling piston pin</p> <p style="text-align: center;">NT013</p>
KV10111100 (J37228) Seal cutter	<div style="text-align: center;">  </div> <p style="text-align: center;">Removing oil pan</p> <p style="text-align: center;">NT046</p>

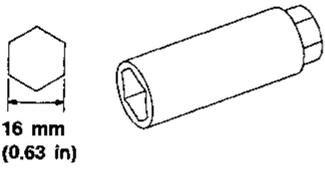
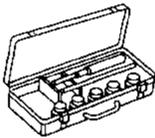
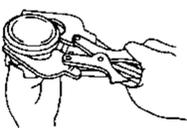
PREPARATION

Special Service Tools (Cont'd)

Tool number (Kent-Moore No.) Tool name	Description	
WS39930000 (—) Tube presser	 NT052	Pressing the tube of liquid gasket GI MA EM
KV10112100 (BT-8653-A) Angle wrench	 NT014	Tightening bolts for bearing cap, cylinder head, etc. LC EC FE
ST16610001 (J23907) Pilot bushing puller	 NT045	Removing pilot bushing CL MT
(J36471-A) Front (heated) oxygen sensor wrench	 NT379	Loosening or tightening front (heated) oxygen sensor AT AX SU

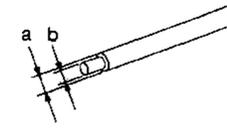
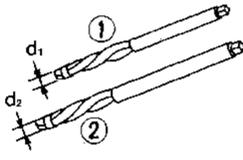
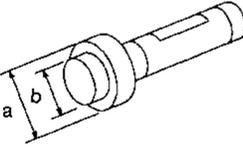
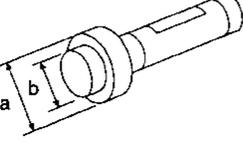
Commercial Service Tools

NCEM0004

Tool name	Description	
Spark plug wrench	 NT047	Removing and installing spark plug ST RS BT
Valve seat cutter set	 NT048	Finishing valve seat dimensions HA SC
Piston ring expander	 NT030	Removing and installing piston ring EL IDX

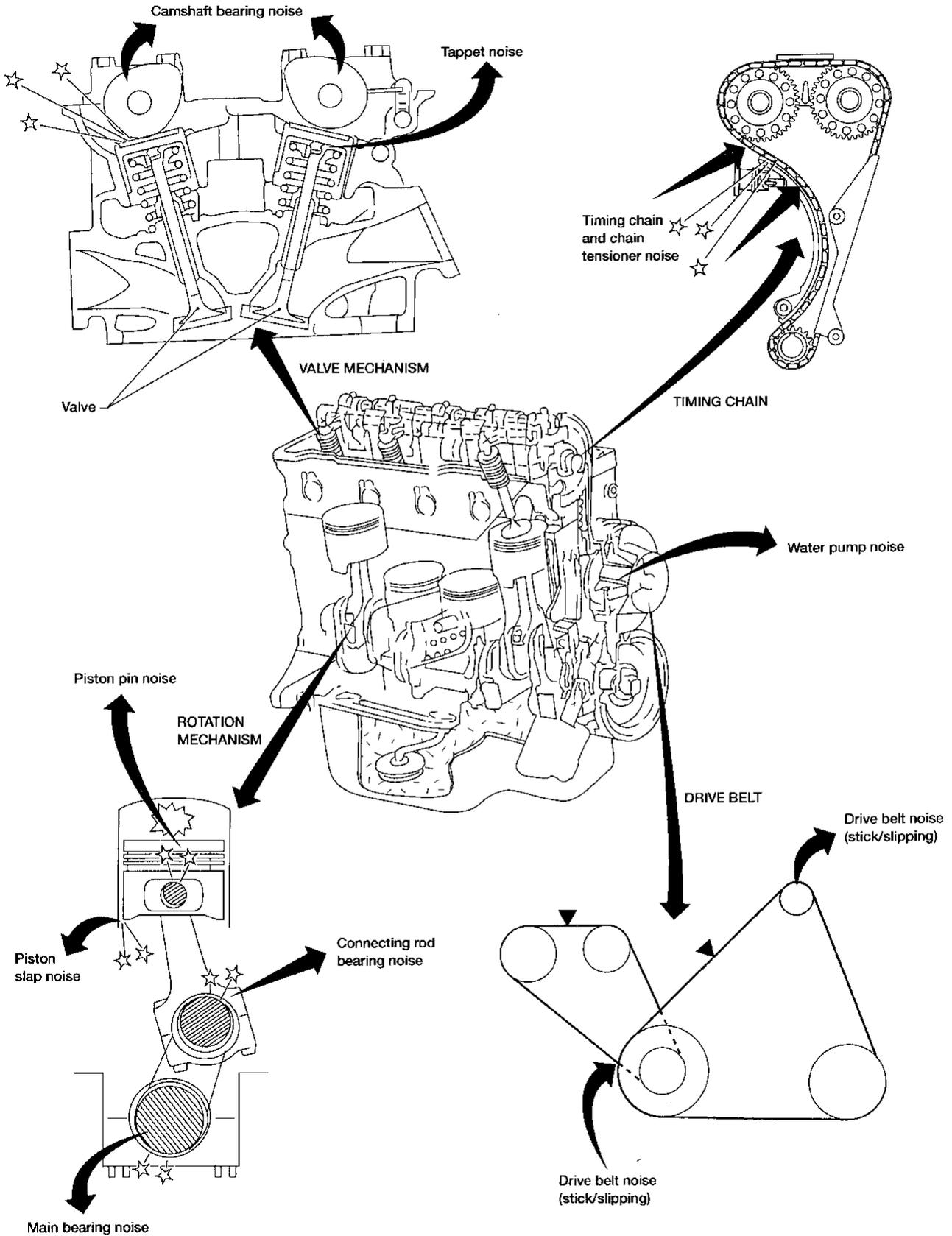
PREPARATION

Commercial Service Tools (Cont'd)

Tool name	Description
Valve guide drift	<div style="display: flex; align-items: center;">  <div style="margin-left: 20px;"> <p>Removing and installing valve guide</p> <p>Intake & Exhaust:</p> <p>a: 9.5 mm (0.374 in) dia.</p> <p>b: 5.0 mm (0.197 in) dia.</p> </div> </div> <p style="margin-top: 10px;">NT015</p>
Valve guide reamer	<div style="display: flex; align-items: center;">  <div style="margin-left: 20px;"> <p>Reaming valve guide 1 or hole for oversize valve guide 2</p> <p>Intake & Exhaust:</p> <p>d₁: 6.0 mm (0.236 in) dia.</p> <p>d₂: 10.175 mm (0.4006 in) dia.</p> </div> </div> <p style="margin-top: 10px;">NT016</p>
Front oil seal drift	<div style="display: flex; align-items: center;">  <div style="margin-left: 20px;"> <p>Installing front oil seal</p> <p>a: 75 mm (2.95 in) dia.</p> <p>b: 45 mm (1.77 in) dia.</p> </div> </div> <p style="margin-top: 10px;">NT049</p>
Rear oil seal drift	<div style="display: flex; align-items: center;">  <div style="margin-left: 20px;"> <p>Installing rear oil seal</p> <p>a: 110 mm (4.33 in) dia.</p> <p>b: 80 mm (3.15 in) dia.</p> </div> </div> <p style="margin-top: 10px;">NT049</p>

NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING

GI
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AT
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SU
BR
ST
RS
BT
HA
SC
EL
IDX



AEM400

NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING

Use the table below to help you find the cause of the symptom.

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

If necessary, repair or replace these parts.

NVH Troubleshooting — Engine Noise

NCEM0005S01

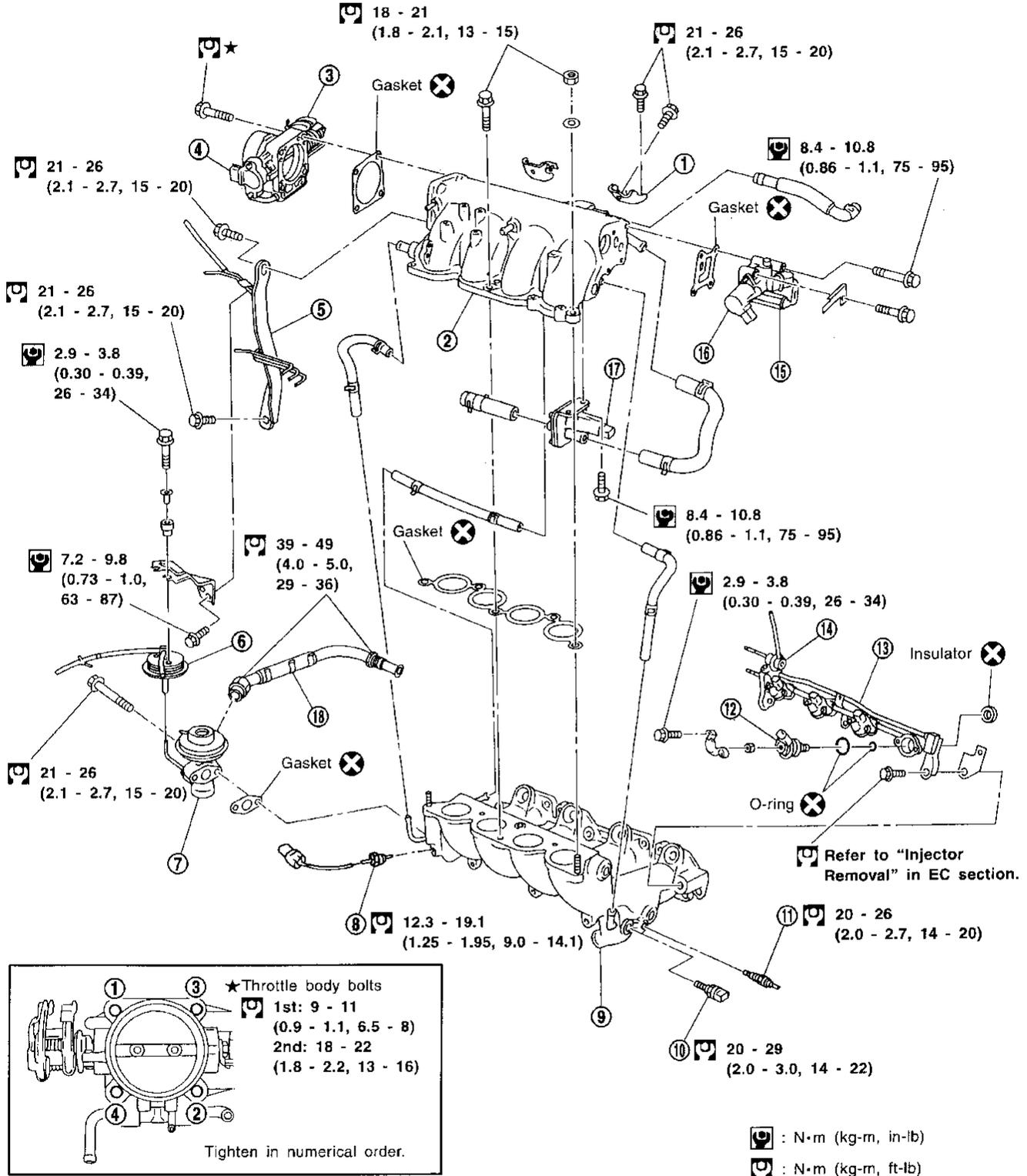
Location of noise	Type of noise	Operating condition of engine						Source of noise	Check item	Reference page
		Before warm-up	After warm-up	When starting	When idling	When racing	While driving			
Top of engine Rocker cover Cylinder head	Ticking or clicking	C	A	—	A	B	—	Tappet noise	Hydraulic lash adjuster	EM-44
	Rattle	C	A	—	A	B	C	Camshaft bearing noise	Camshaft journal clearance Camshaft runout	EM-39, 39
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-56, 55
	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 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

OUTER COMPONENT PARTS

Removal and Installation (Cont'd)

SEC. 140•146•147•148•163•164•210•226



SEM840F

- 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

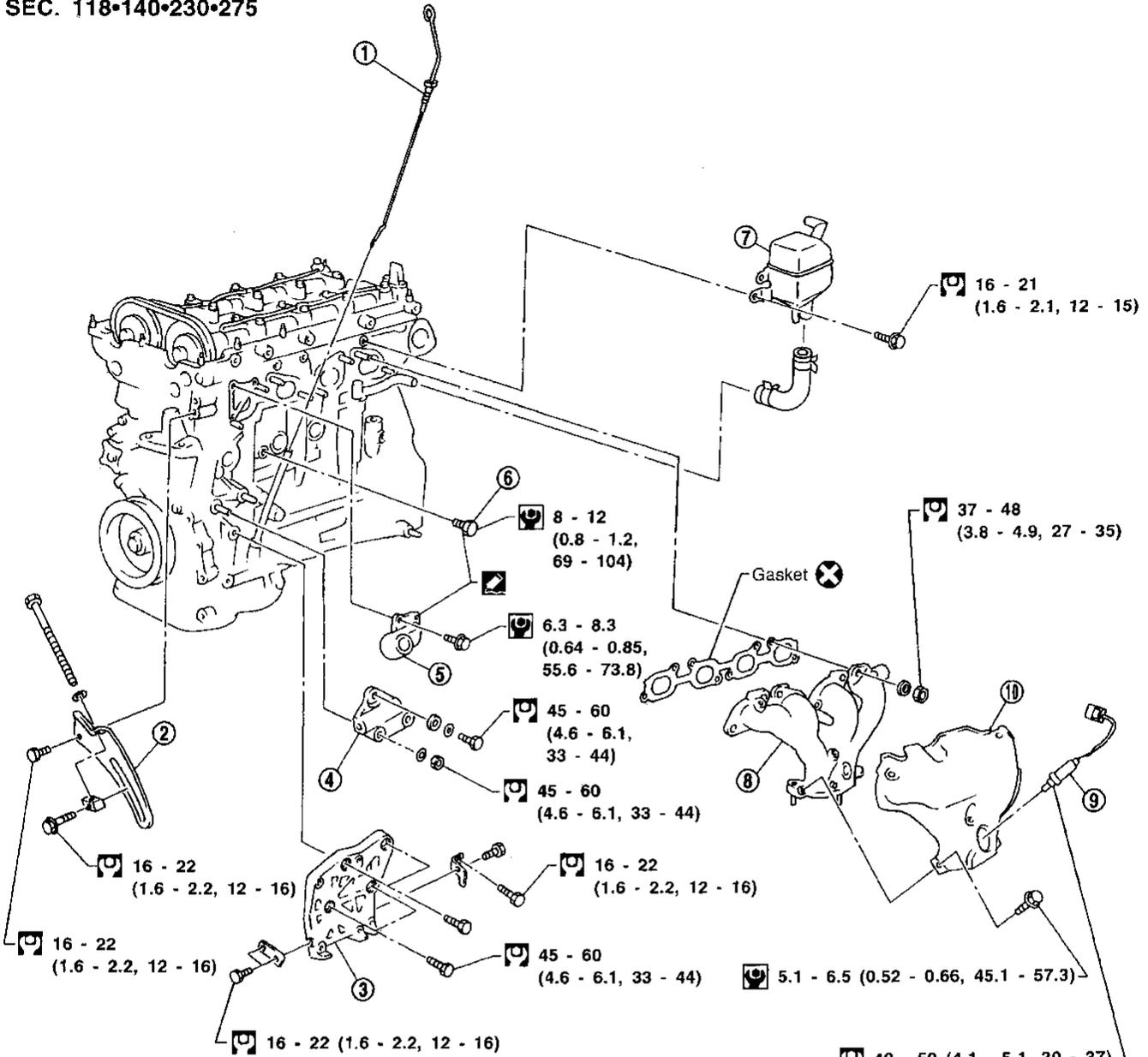
- 8. EGR temperature sensor
- 9. Intake manifold
- 10. Engine coolant temperature sensor
- 11. Thermal transmitter
- 12. Injector
- 13. Fuel tube assembly

- 14. Pressure regulator
- 15. IACV-FICD solenoid valve
- 16. IACV-AAC valve
- 17. IACV-air regulator
- 18. EGR tube

OUTER COMPONENT PARTS

Removal and Installation (Cont'd)

SEC. 118-140-230-275



- : N·m (kg-m, in-lb)
- : N·m (kg-m, ft-lb)
- : Apply liquid gasket.

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

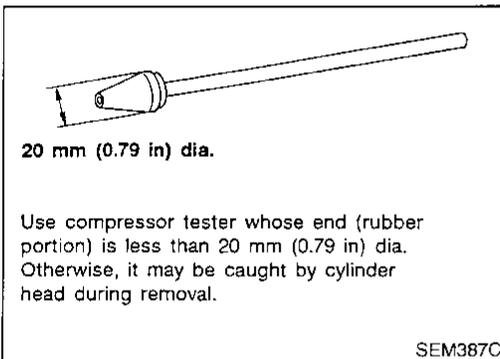
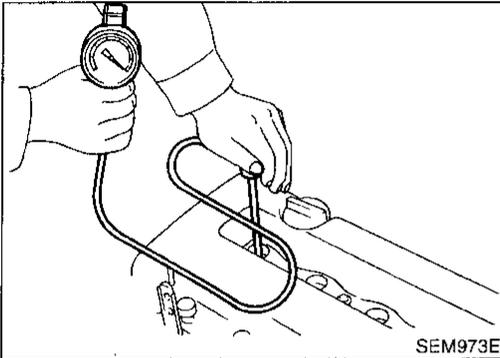
SEM233F

GI
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BR
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RS
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HA
SC
EL

IDX

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.



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/cm², psi)/rpm

Standard

1,226 (12.5, 178)/300

Minimum

1,030 (10.5, 149)/300

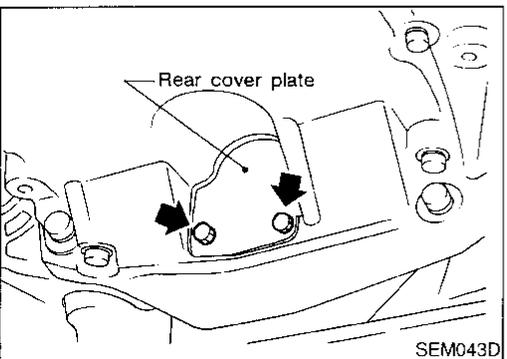
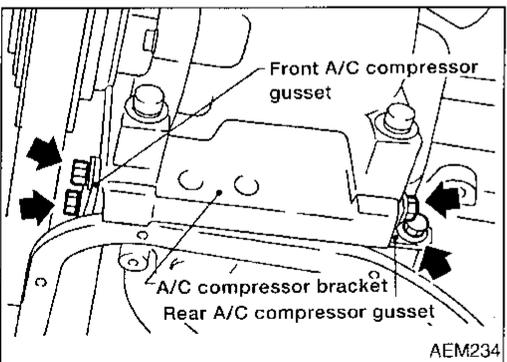
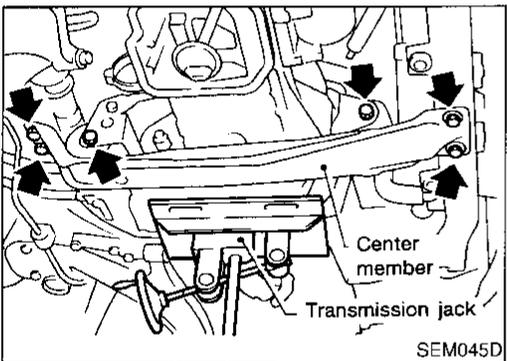
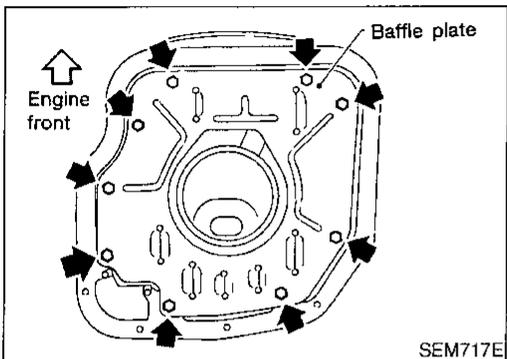
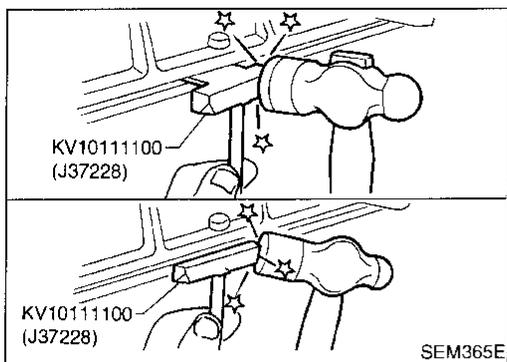
Difference limit between cylinders

98 (1.0, 14)/300

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-70. 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.**

OIL PAN

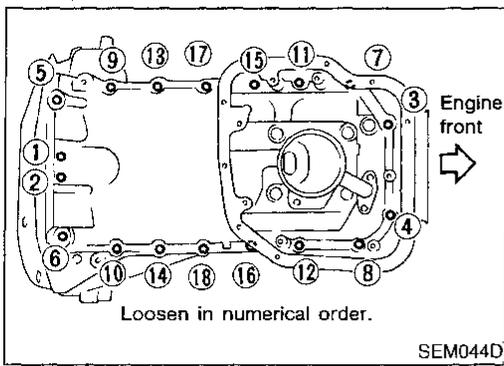
Removal (Cont'd)



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.
 - c. Remove steel oil pan.
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. (A/T only)
10. Remove A/C compressor gussets.
11. Remove rear cover plate.

OIL PAN

Removal (Cont'd)



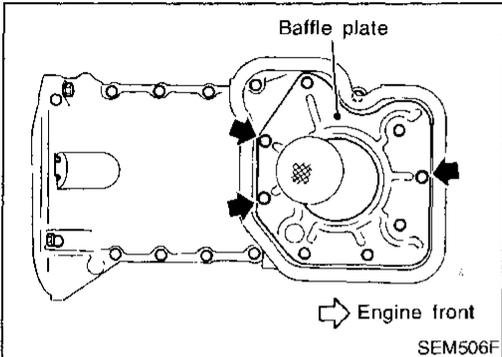
12. Remove aluminum oil pan bolts in numerical order.

GI

MA

EM

LC



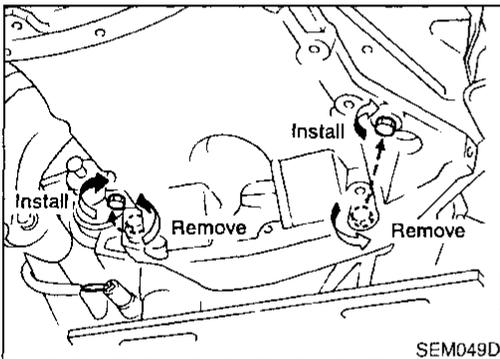
13. Remove baffle plate.

EC

FE

CL

MT



14. 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.

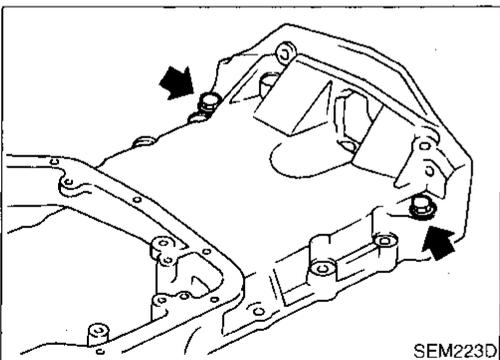
AT

15. Remove aluminum oil pan.

AX

SU

BR



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

ST

RS

BT

HA

SC

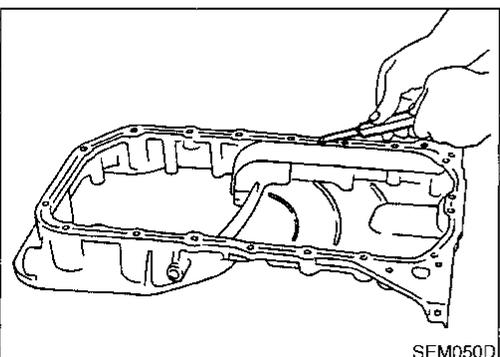
NCEM0010

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.

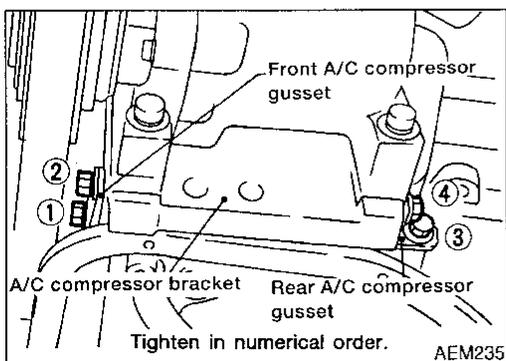
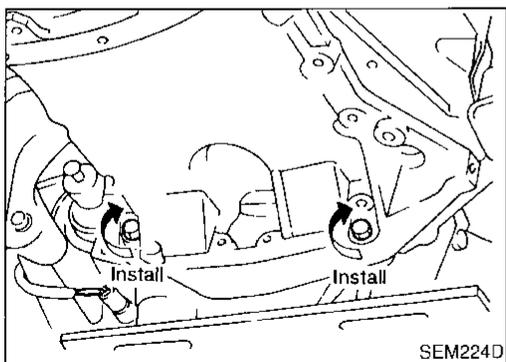
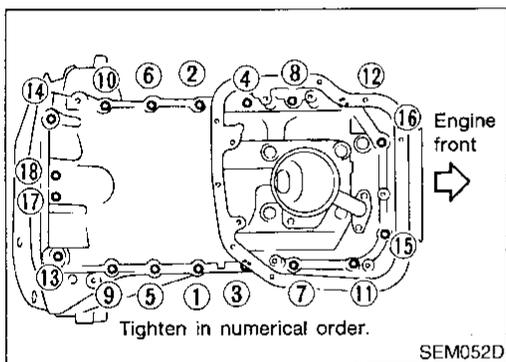
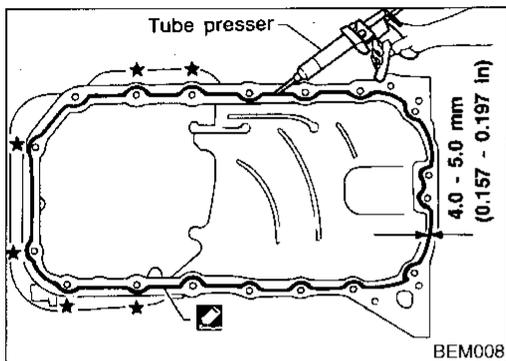
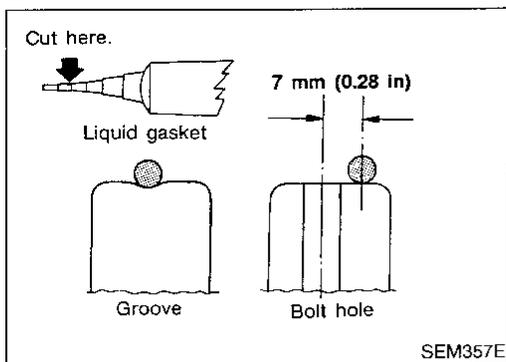
EL

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OIL PAN

Installation (Cont'd)



- b. Apply a continuous bead of liquid gasket to mating surface of aluminum oil pan.
 - Use Genuine RTV silicone sealant part No. 999MP-A7007 or equivalent.
 - Apply to groove on mating surface.
 - Allow 7 mm (0.28 in) clearance around bolt holes.

- 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.

- 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:

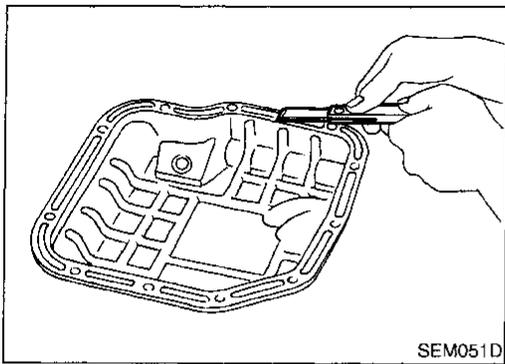
: 6.4 - 7.5 N·m (0.65 - 0.76 kg-m, 56.4 - 66.0 in-lb)

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.

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

OIL PAN

Installation (Cont'd)



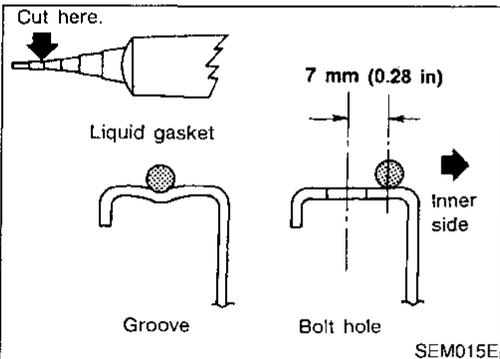
9. Install steel oil pan.
 - a. Use a scraper to remove old liquid gasket from mating surface of steel oil pan.
 - **Also remove old liquid gasket from mating surface of aluminum oil pan.**

GI

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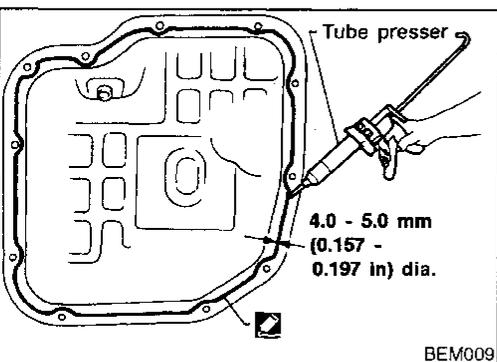
- b. Apply a continuous bead of liquid gasket to mating surface of steel oil pan.
 - **Use Genuine RTV silicone sealant part No. 999MP-A7007 or equivalent.**
 - **Apply to groove on mating surface.**
 - **Allow 7 mm (0.28 in) clearance around bolt hole.**

EC

FE

CL

MT



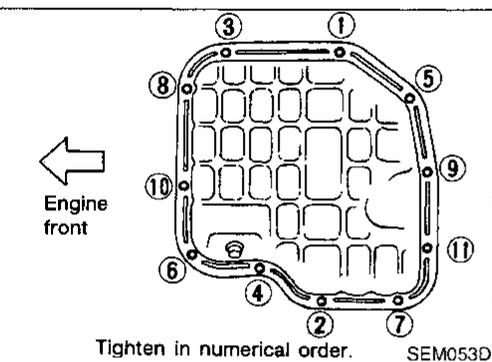
- **Be sure liquid gasket diameter is 4.0 to 5.0 mm (0.157 to 0.197 in).**
- **Attaching should be done within 5 minutes after coating.**

AT

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- c. Tighten bolts in numerical order as shown.
 - **Wait at least 30 minutes before refilling engine oil.**

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TIMING CHAIN

Components

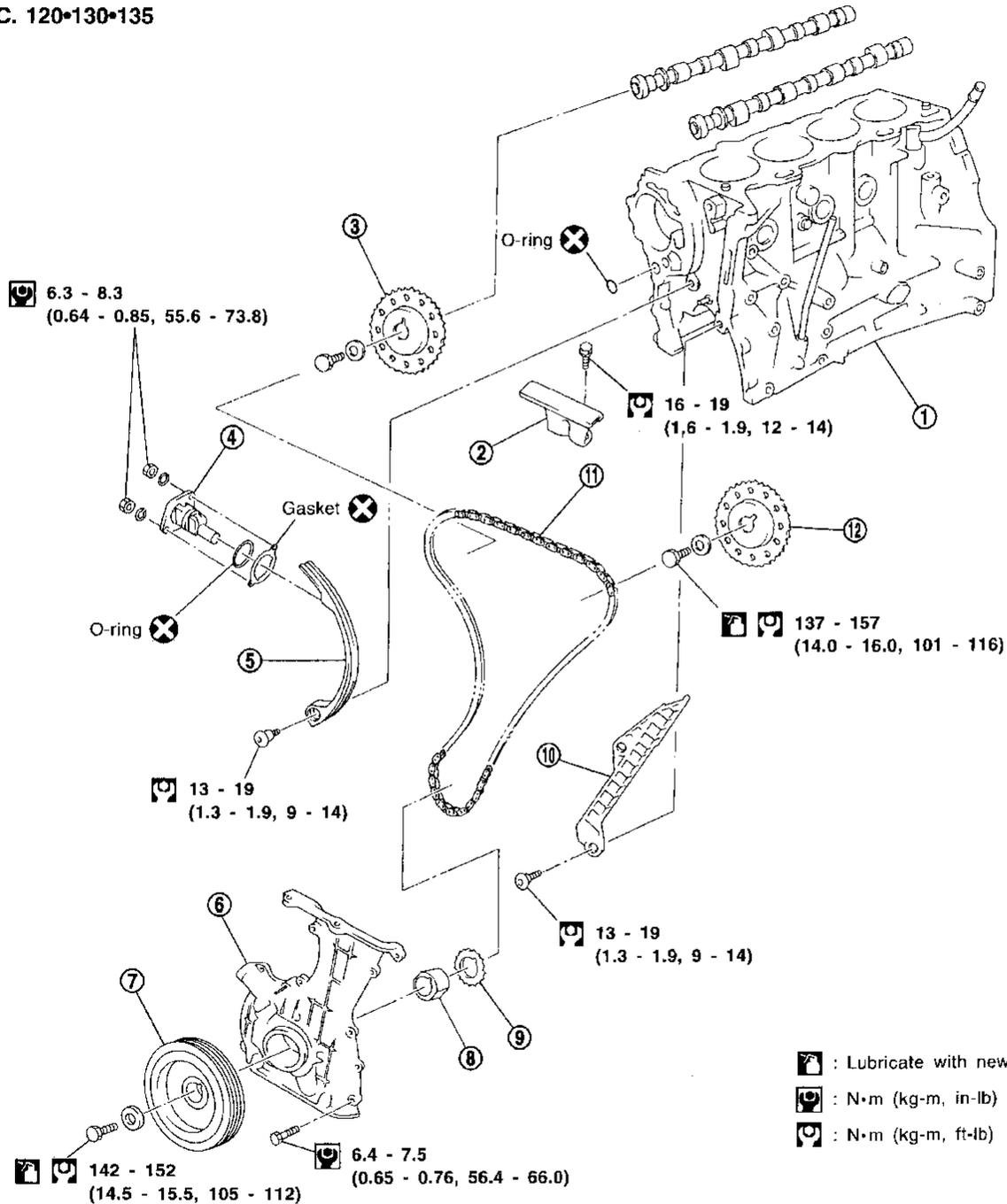
Components

NCEM0011

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.

SEC. 120•130•135



SEM718EC

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

TIMING CHAIN

Removal

Removal

NCEM0012

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.

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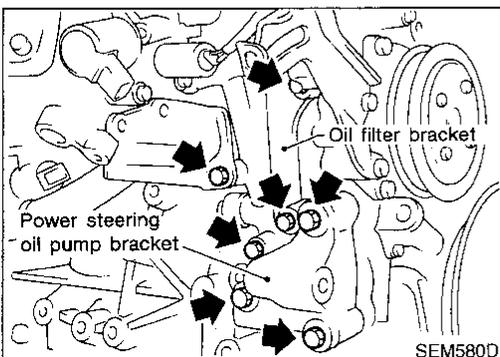
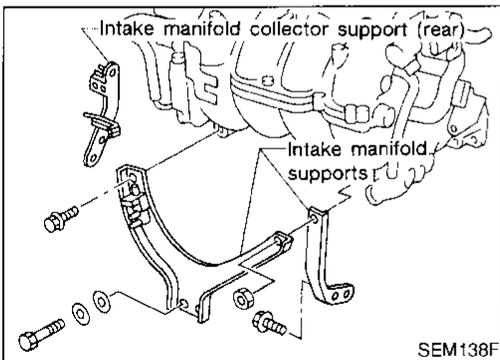
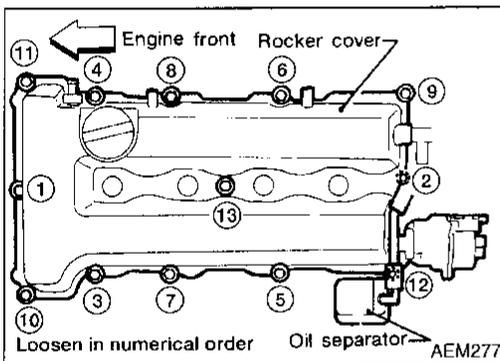
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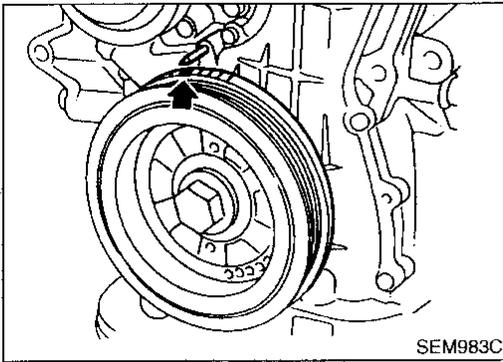
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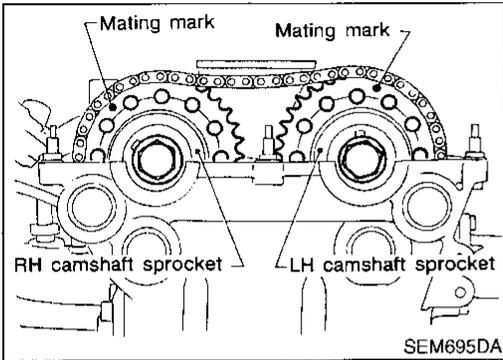
13. Remove intake manifold supports.
14. Remove oil filter bracket and power steering oil pump bracket.

TIMING CHAIN

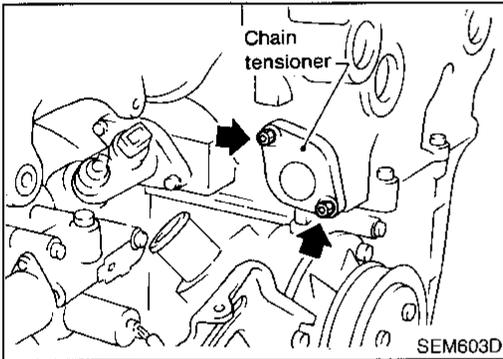
Removal (Cont'd)



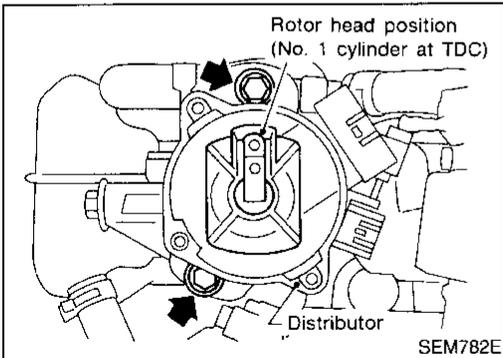
15. Set No. 1 piston at TDC of its compression stroke.



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

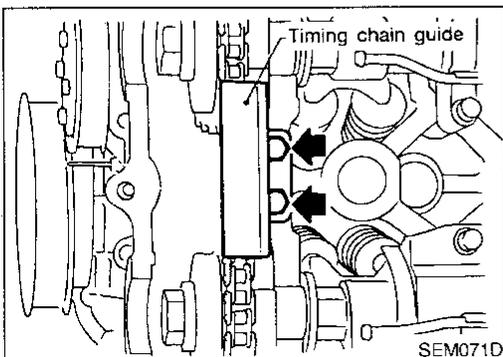


16. Remove chain tensioner.



17. Remove distributor.

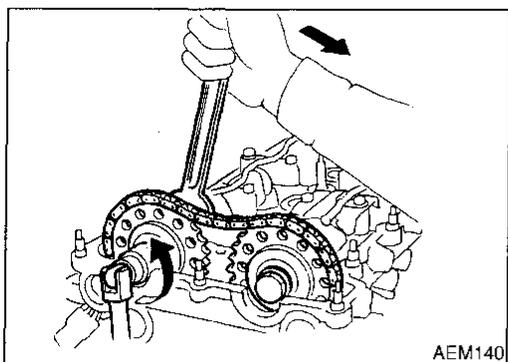
Do not turn rotor with distributor removed.



18. Remove timing chain guide.

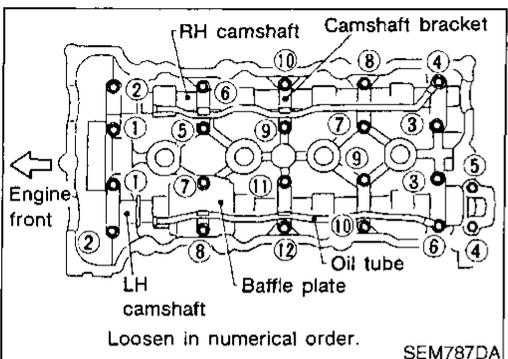
TIMING CHAIN

Removal (Cont'd)



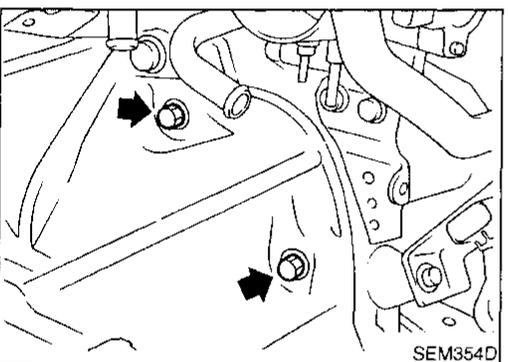
19. Remove camshaft sprockets.

- 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.

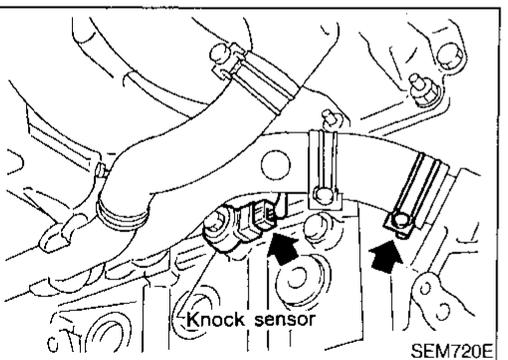
- Mark these parts' original positions for reassembly.



21. Remove starter motor.

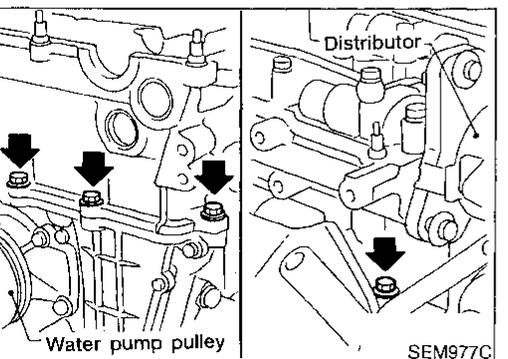
22. Remove the following water hoses:

- Water hose for cylinder block.
- Water hoses for heater.



23. Remove knock sensor harness connector.

24. Remove EGR tube.



25. Remove cylinder head outside bolts.

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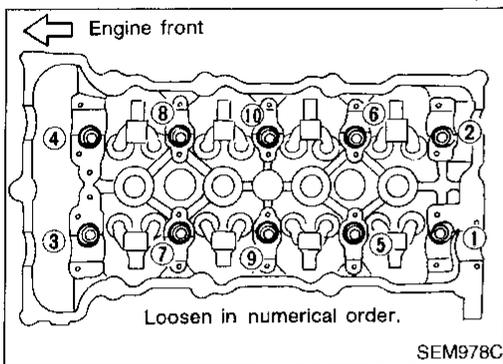
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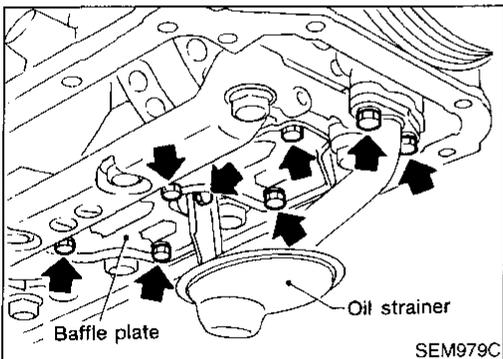
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TIMING CHAIN

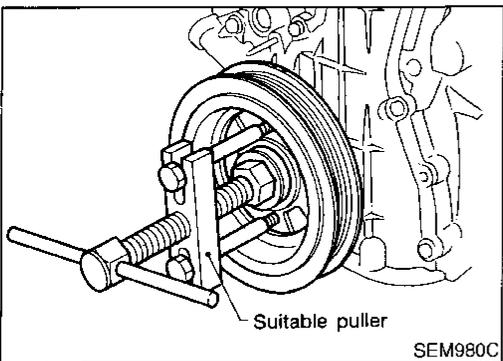
Removal (Cont'd)



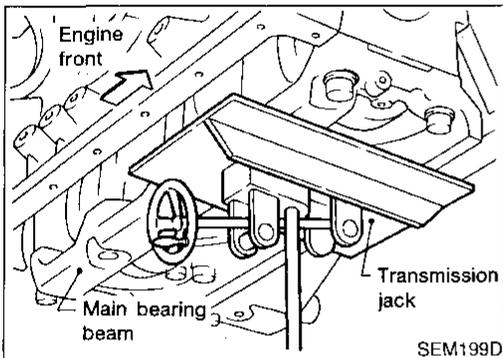
26. Remove cylinder head bolts in numerical order.
 - Removing bolts in incorrect order could result in a warped or cracked cylinder head.
 - Loosen cylinder head bolts in two or three steps.
27. Remove cylinder head completely with intake and exhaust manifolds.
28. Remove oil pans.
Refer to EM-13.



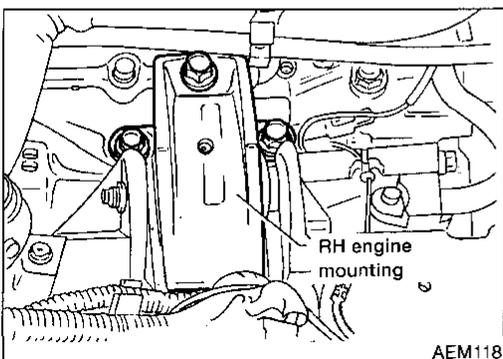
29. Remove oil strainer and baffle plate.



30. Remove crankshaft pulley.



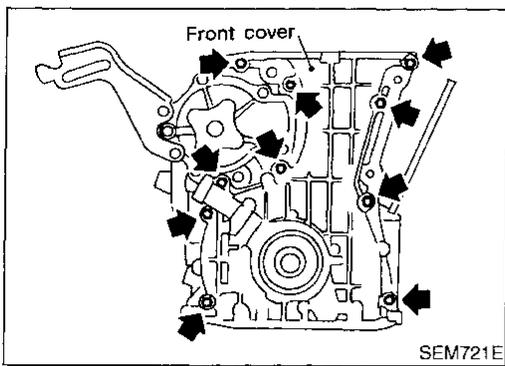
31. Set a suitable transmission jack under main bearing beam.



32. Remove RH engine mounting.

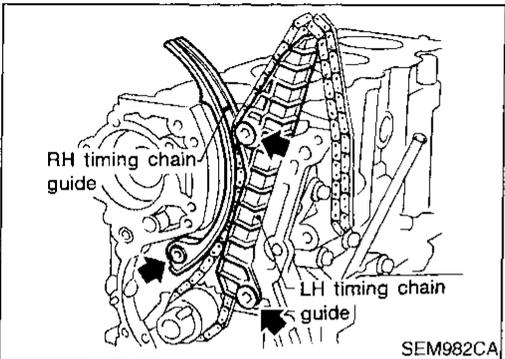
TIMING CHAIN

Removal (Cont'd)

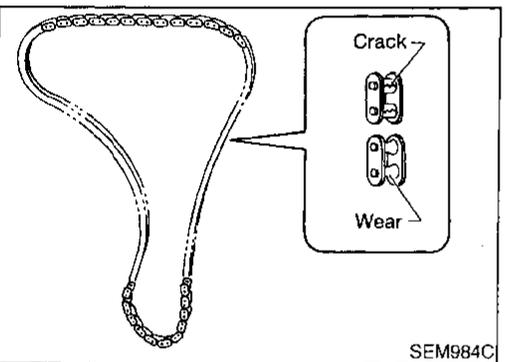


33. Remove front cover and oil pump drive spacer.

- **Inspect for oil leakage at front oil seal. Replace seal if oil leak is present.**



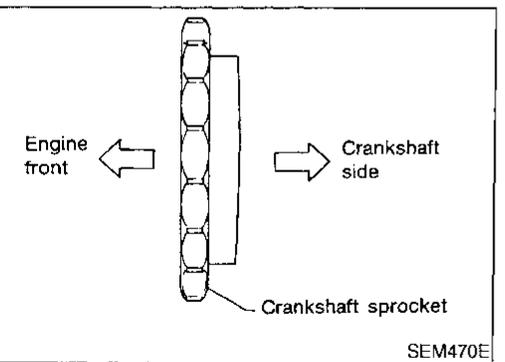
34. Remove timing chain guides and timing chain.



Inspection

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

NCEM0013

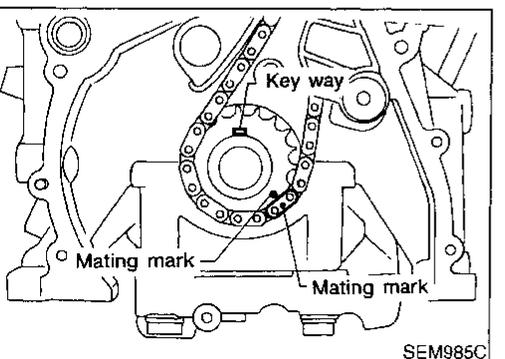


Installation

1. Install crankshaft sprocket on crankshaft.

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

NCEM0014



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.

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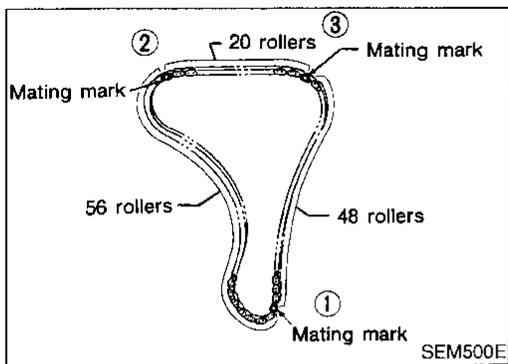
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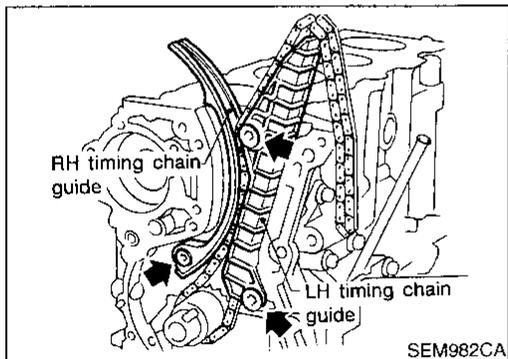
TIMING CHAIN

Installation (Cont'd)

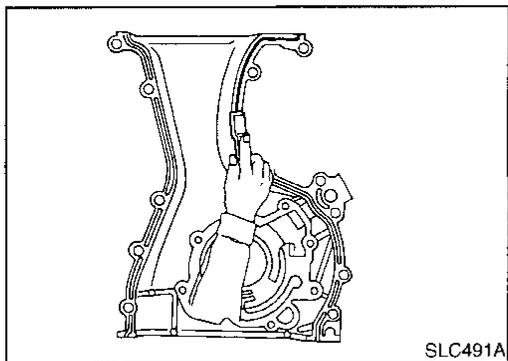


- Mating mark color on timing chain.

1: Gold
2, 3: Silver

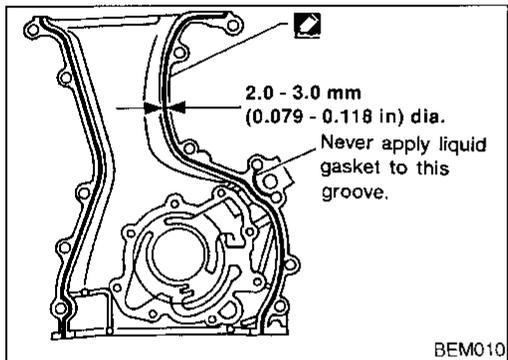


3. Install timing chain and timing chain guides.



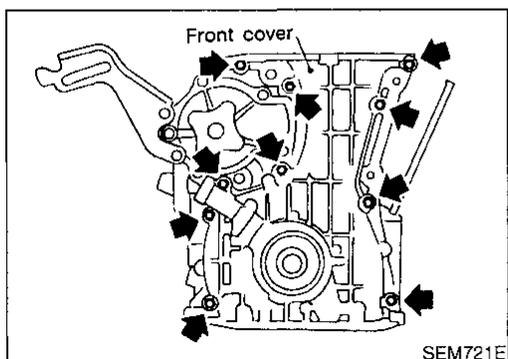
4. Use a scraper to remove old liquid gasket from mating surface of front cover.

- **Also remove old liquid gasket from mating surface of cylinder block.**



5. Apply a continuous bead of liquid gasket to front cover.

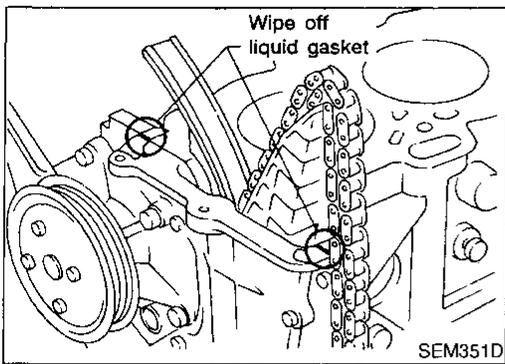
- **Use Genuine RTV silicone sealant part No. 999MP-A7007 or equivalent. Be sure to install new front oil seal in the right direction. Refer to EM-33.**



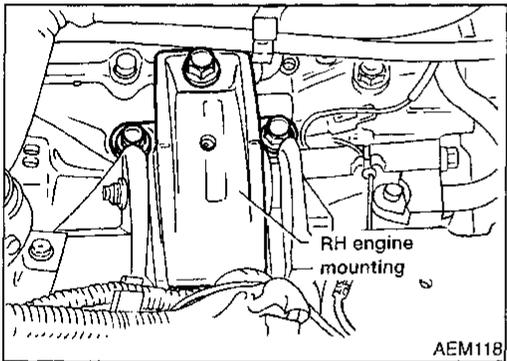
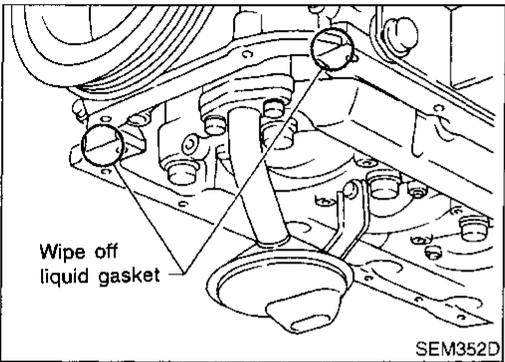
6. Install oil pump drive spacer and front cover.

TIMING CHAIN

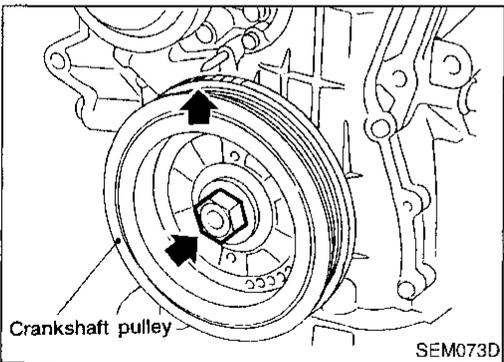
Installation (Cont'd)



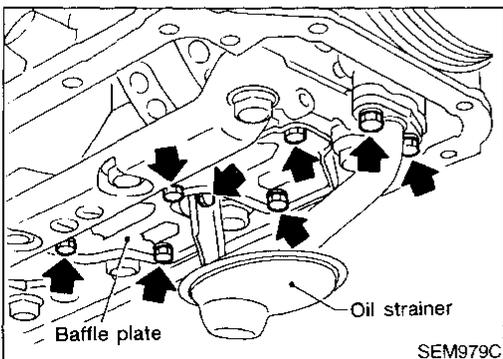
- Wipe off excessive liquid gasket.



7. Install RH engine mounting.



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



10. Install oil strainer and baffle plate.
11. Install aluminum oil pan.
Refer to EM-15.

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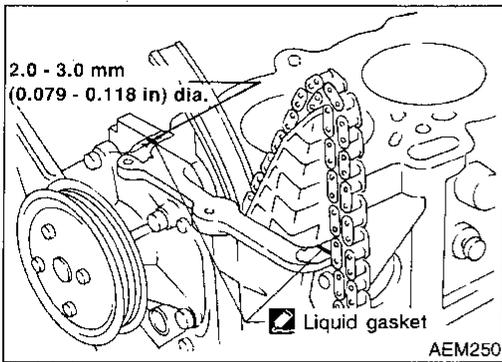
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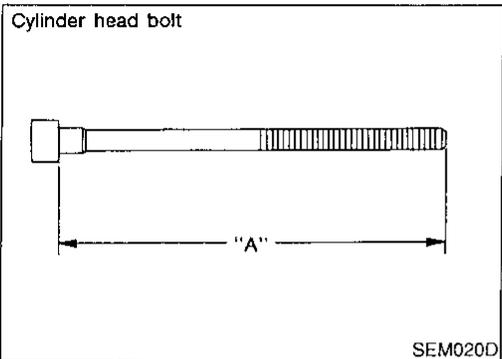
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TIMING CHAIN

Installation (Cont'd)



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

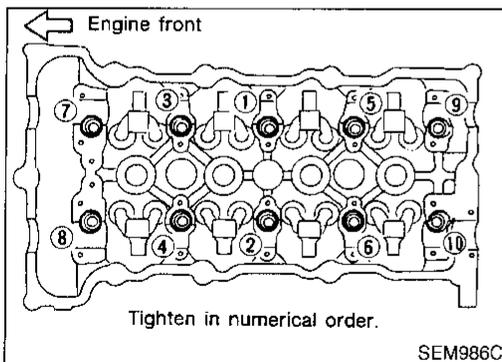
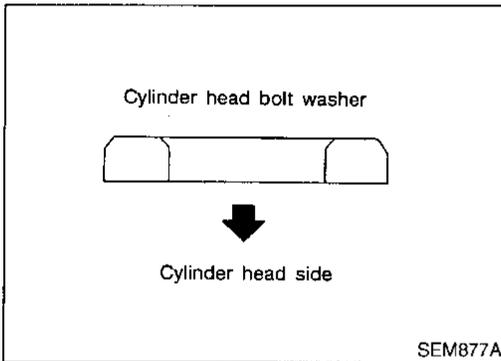


13. Install cylinder head completely with intake and exhaust manifolds.

- 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.

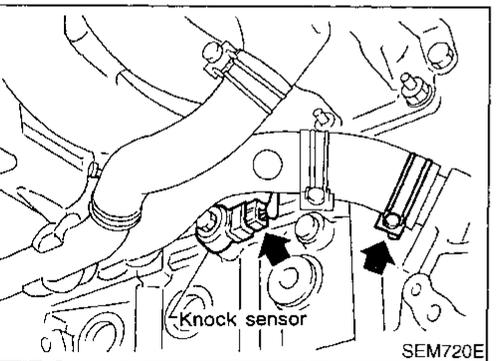
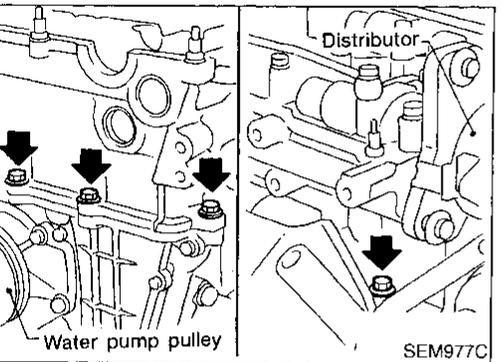
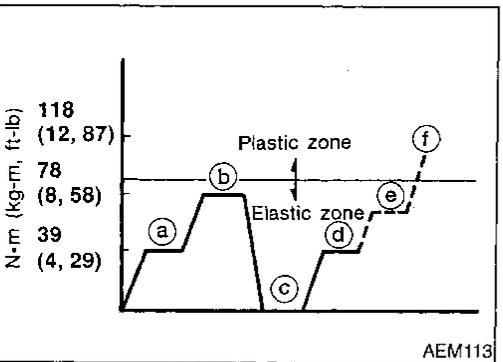
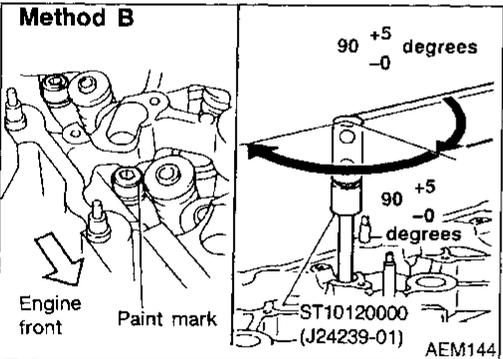
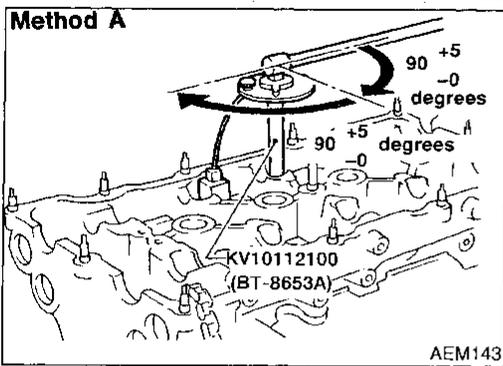
Dimension "A":
158.2 mm (6.228 in)



14. Tighten cylinder head bolts using the following procedure.
- Tighten all bolts to 39 N·m (4.0 kg-m, 29 ft-lb).
 - Tighten all bolts to 78 N·m (8.0 kg-m, 58 ft-lb).
 - Loosen all bolts completely.
 - Tighten all bolts to 34 to 44 N·m (3.5 to 4.5 kg-m, 25 to 33 ft-lb).

TIMING CHAIN

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.

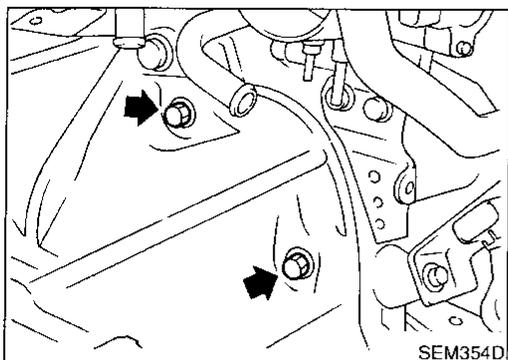
16. Install the following water hoses:

- Water hose for cylinder block.
- Water hoses for heater.

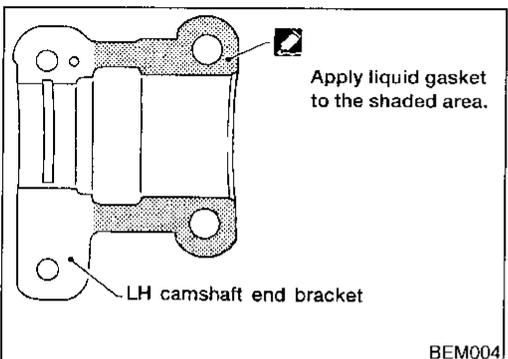
17. Install knock sensor harness connector.

TIMING CHAIN

Installation (Cont'd)



18. Install starter motor.

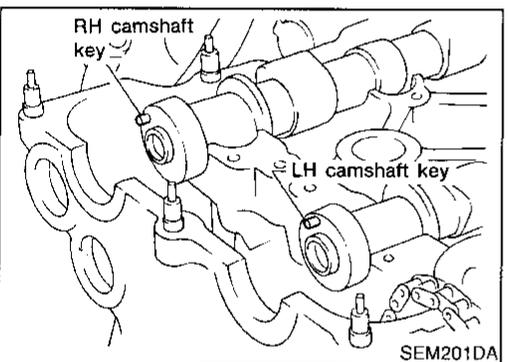


19. Remove old liquid gasket from mating surface of LH camshaft end bracket.

- **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. 999MP-A7007 or equivalent.**



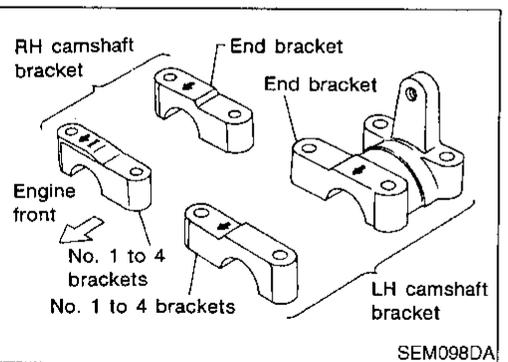
21. Install camshafts, camshaft brackets, oil tubes and baffle plate.

- Position camshaft.

- LH camshaft key at about 12 o'clock.

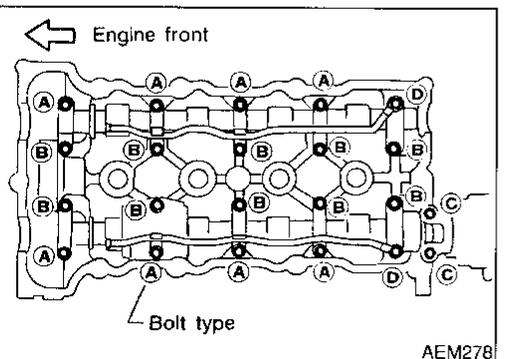
- RH camshaft key at about 12 o'clock.

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).**

A: M6 x 53.8 mm (2.12 in.)

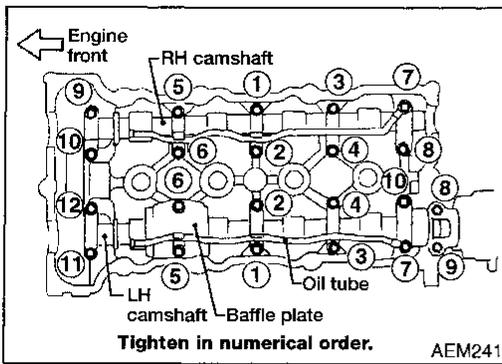
B: M6 x 37 mm (1.46 in.)

C: M8 x 35 mm (1.38 in.)

D: M6 x 64 mm (2.52 in.)

TIMING CHAIN

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:

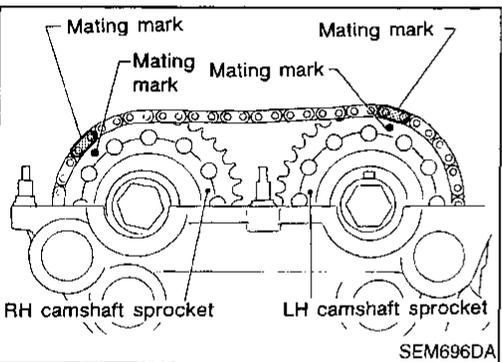
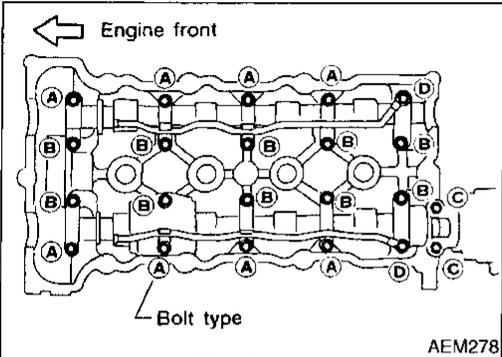
Tighten bolts in numerical order.

Bolt type A B D

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

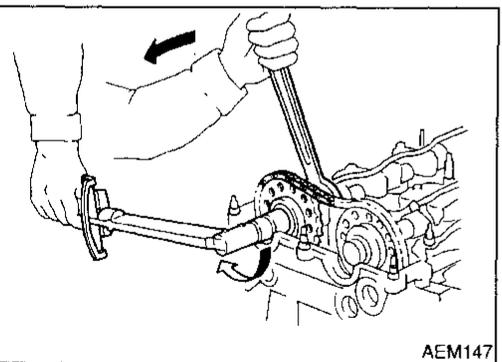
Bolt type C

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



22. Install camshaft sprockets.

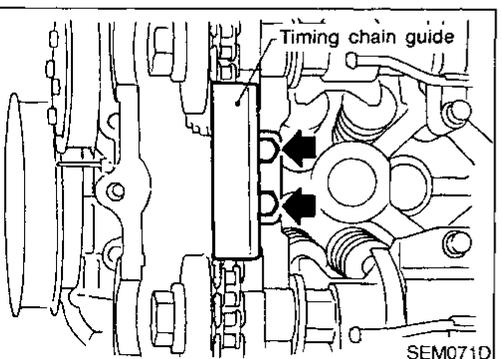
Line up mating marks on timing chain with mating marks on camshaft sprockets.



● 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)

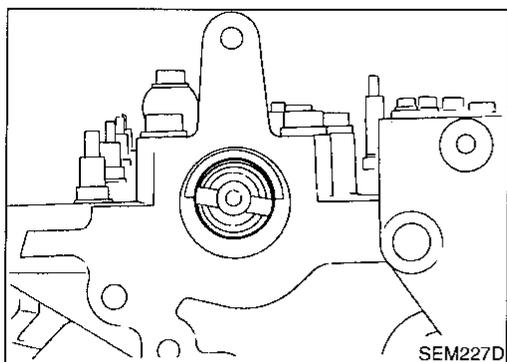
Apply new engine oil to threads and seating surfaces of camshaft sprocket bolts before installing them.



23. Install timing chain guide.

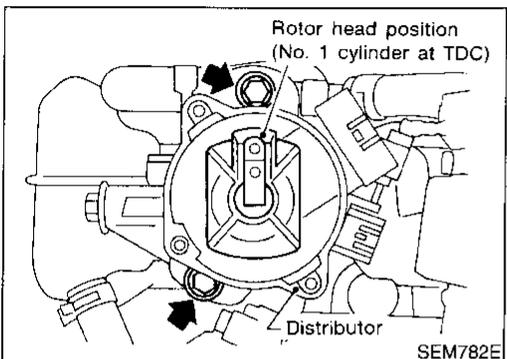
TIMING CHAIN

Installation (Cont'd)

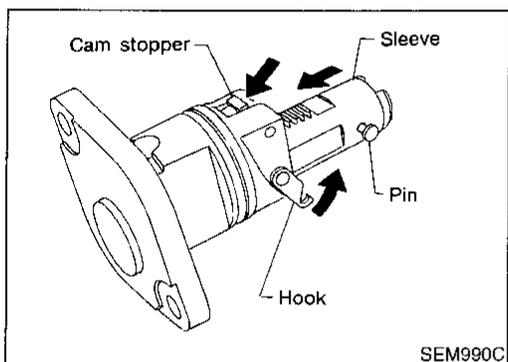


24. Install distributor.

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

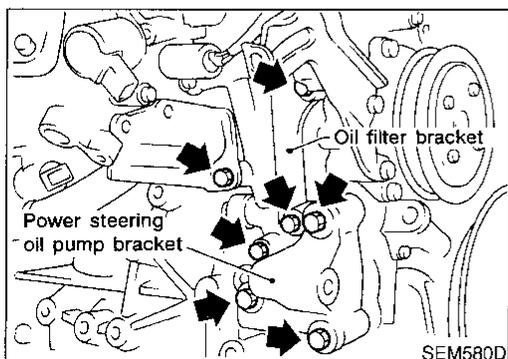
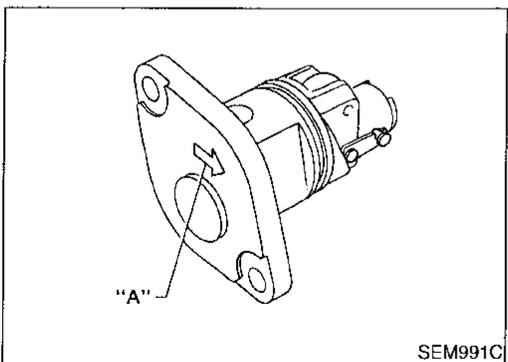


- Make sure that No. 1 piston is set at TDC and that distributor rotor is set at No. 1 cylinder spark position.

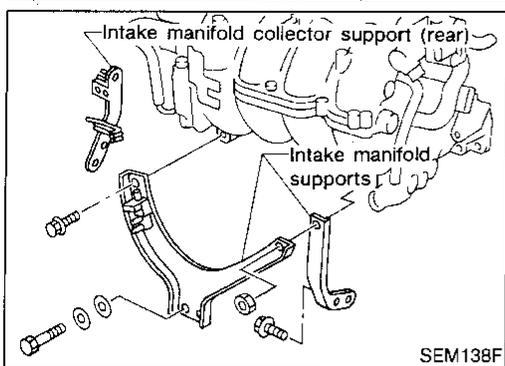


25. Install chain tensioner.

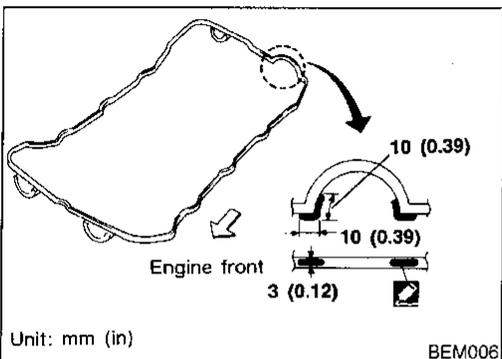
Make sure the camshaft sprockets are tightened completely. Press cam stopper down and "press-in" sleeve until hook can be engaged on pin. When tensioner is bolted in position the hook will release automatically. Make sure arrow "A" points toward engine front.



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



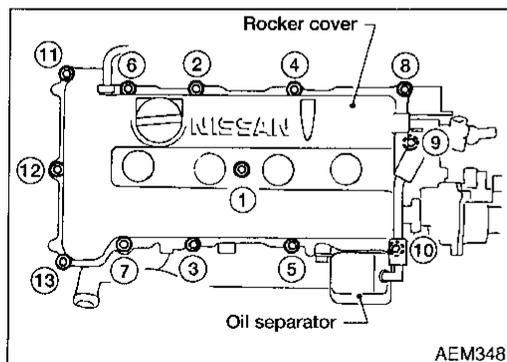
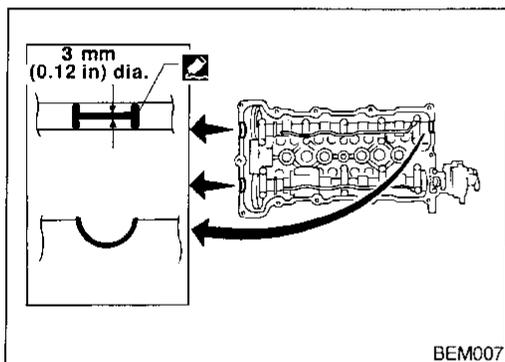
27. Install intake manifold supports.



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. 999MP-A7007 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 in that order.

STEP 2: Tighten bolts 1 - 13 in that order.

⊛ : 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
32. Connect the following:

- Vacuum hoses

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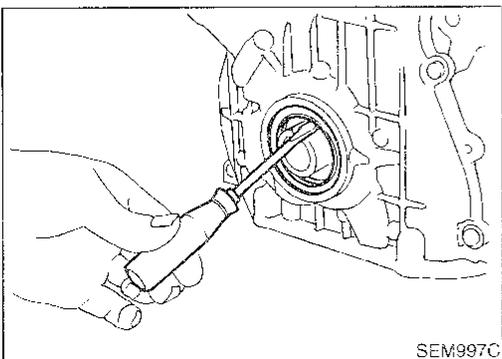
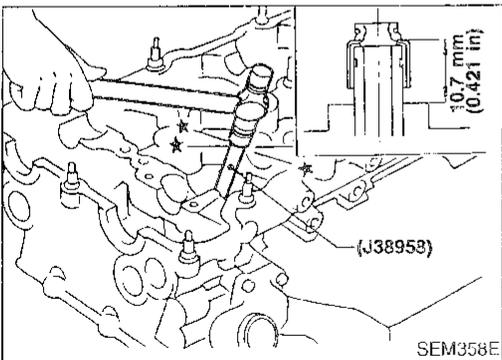
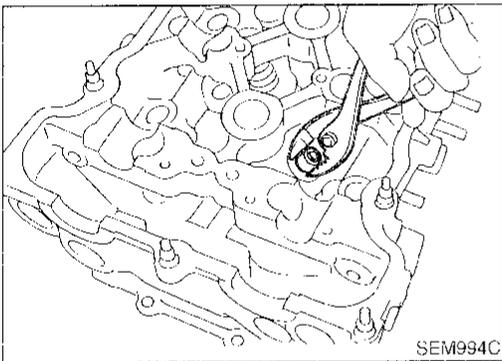
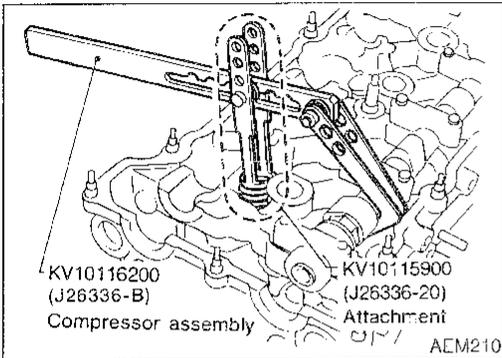
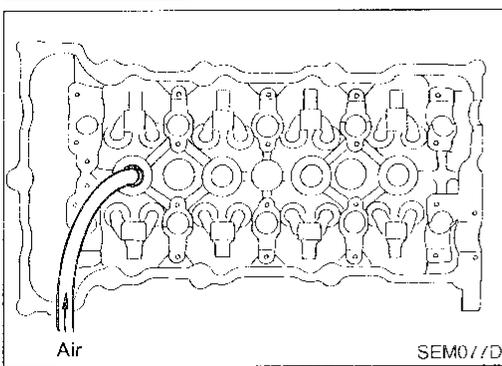
EL

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TIMING CHAIN

Installation (Cont'd)

- Fuel hoses
- Wire harnesses and connectors
- Air duct to intake manifold



Replacement VALVE OIL SEAL

NCEM0015

NCFM0015S01

1. Remove accelerator wire.
2. Remove rocker cover and oil separator.
3. Remove camshafts and sprockets. Refer to EM-19.
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/cm², 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

NCEM0015S02

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.

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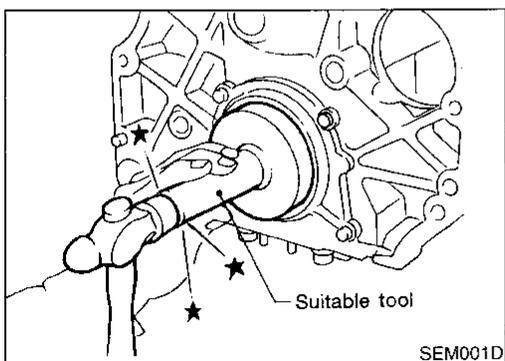
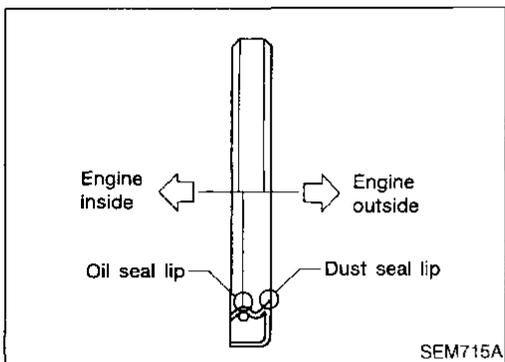
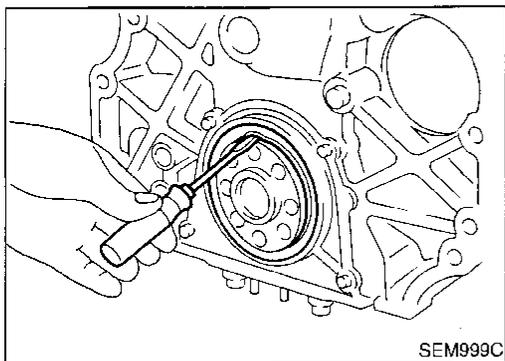
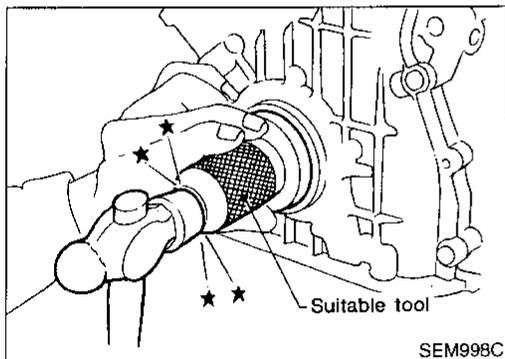
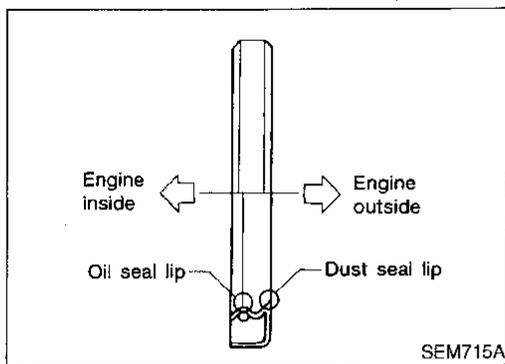
SC

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OIL SEAL

Replacement (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

NCEM0015S03

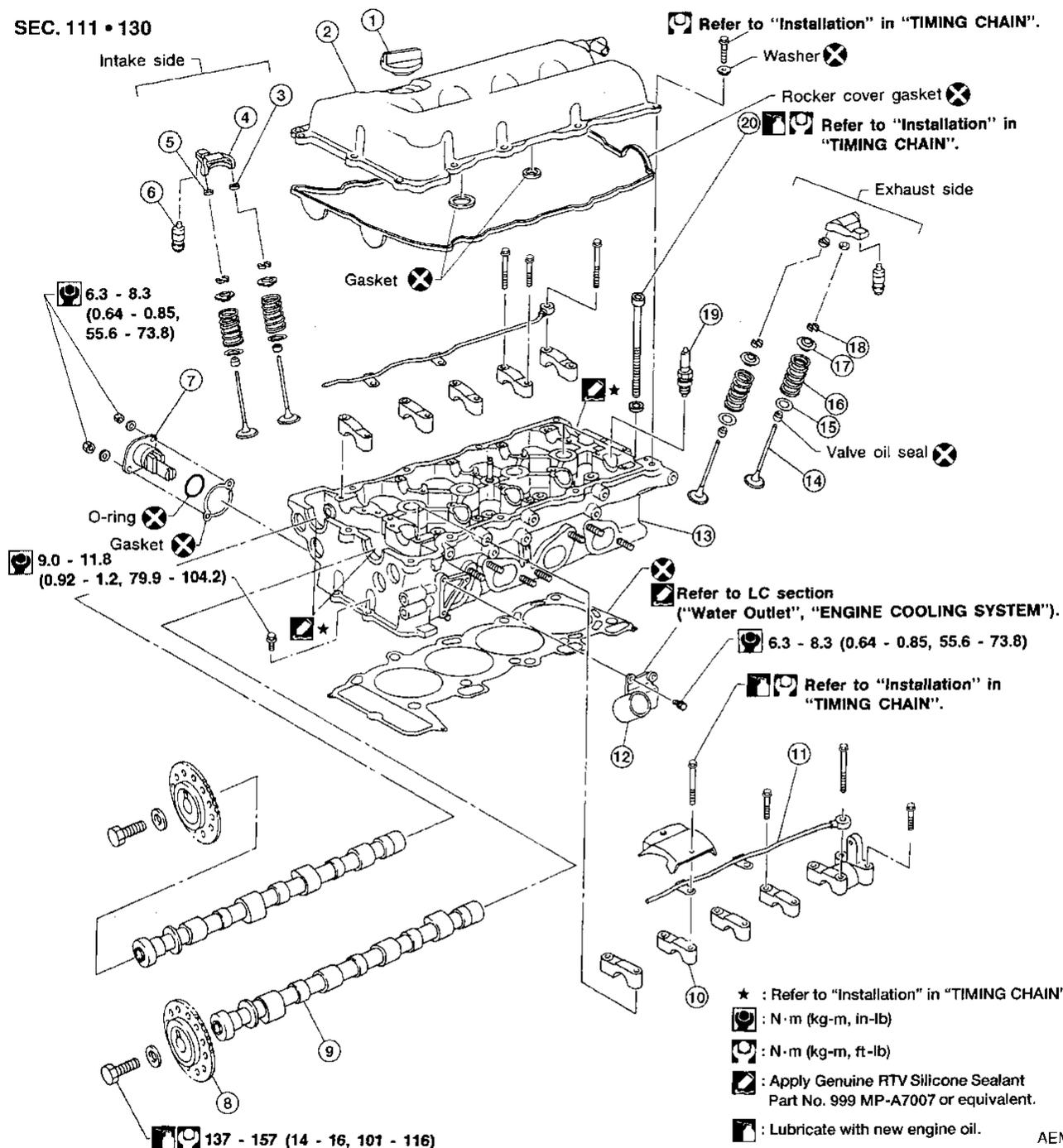
1. Remove transaxle. (Refer to MT or AT section.)
 2. Remove flywheel or drive plate.
 3. Remove rear oil seal.
- Be careful not to scratch rear oil seal retainer.

4. Apply new engine oil to new oil seal and install it using a suitable tool.
- Install new oil seal in the direction shown.

NCEM0016

Components

SEC. 111 • 130



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

GI

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CYLINDER HEAD

Removal

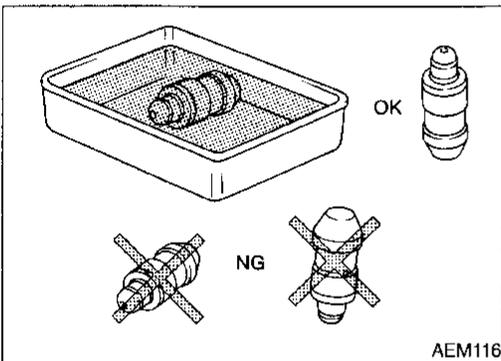
Removal

- The removal procedure is the same as for timing chain. Refer to EM-19. NCEM0017

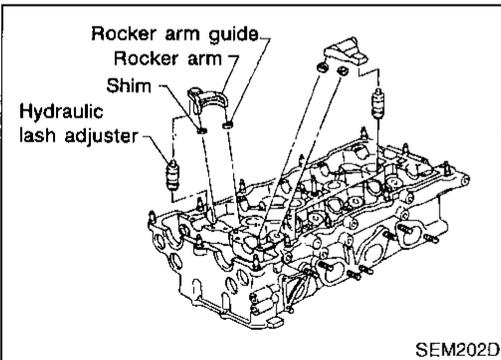
Disassembly

CAUTION:

- When installing rocker arms, camshaft and oil seal, lubricate contacting surfaces with new engine oil. NCEM0018
- When tightening cylinder head bolts, camshaft sprocket bolts and camshaft bracket bolts, lubricate bolt threads and seat surfaces with new engine oil.



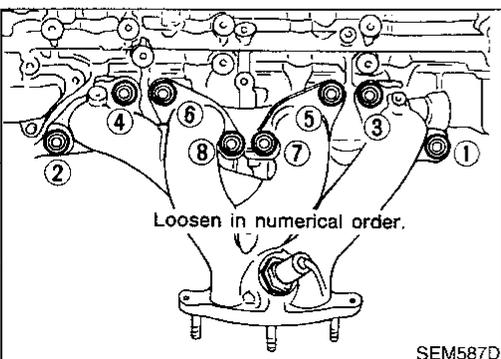
- If a hydraulic lash adjuster is kept on its side, there is a risk of air entering it. When hydraulic lash adjusters are removed, stand them straight up or soak them in new engine oil.
- Do not disassemble hydraulic lash adjusters.
- Attach tags to lash adjusters so as not to mix them up.



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

CAUTION:

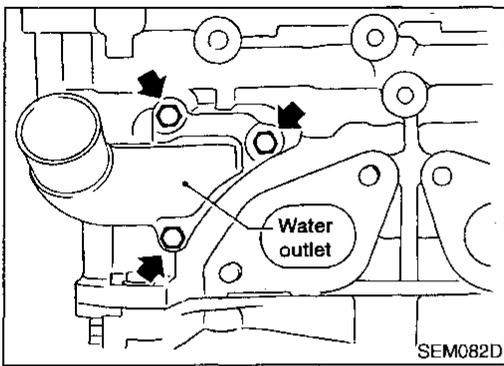
Keep parts in order so they can be installed in their original positions during assembly.



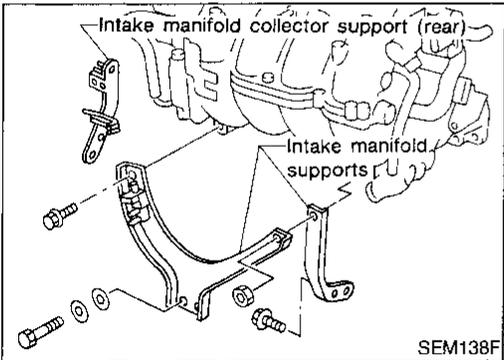
2. Remove exhaust manifold cover.
3. Remove exhaust manifold as shown.

CYLINDER HEAD

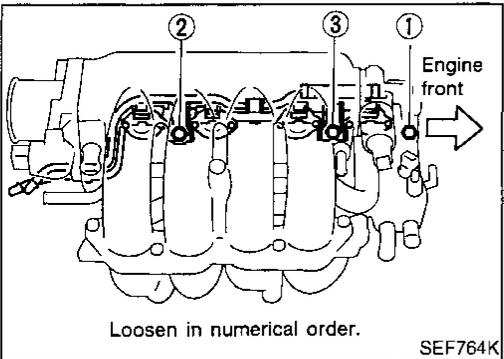
Disassembly (Cont'd)



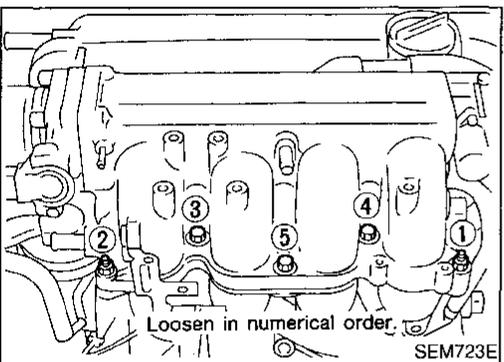
4. Remove water outlet.



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

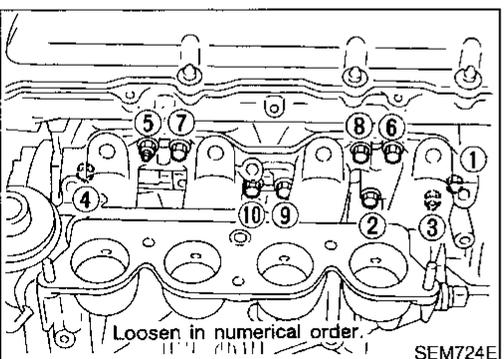


6. Remove fuel tube assembly. Refer to EC section ("Injector Removal and Installation", "BASIC SERVICE PROCEDURE").



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.

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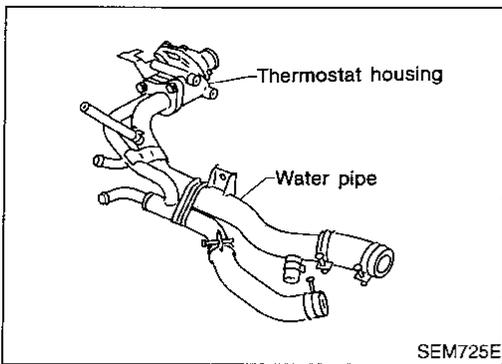
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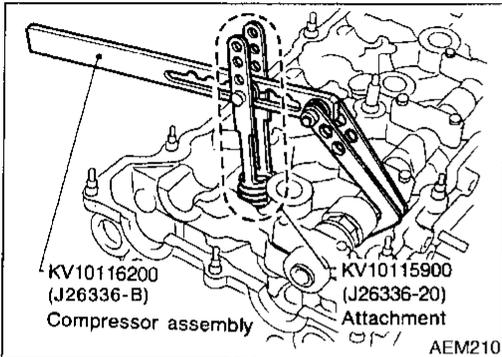
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CYLINDER HEAD

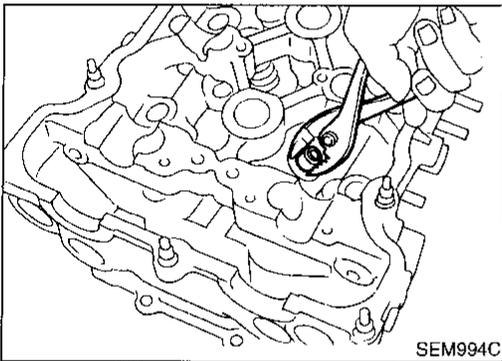
Disassembly (Cont'd)



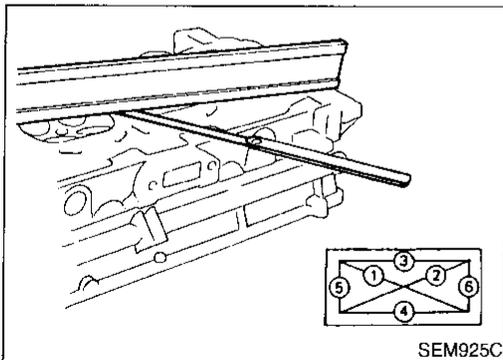
10. Remove thermostat housing with water pipe.



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



12. Remove valve oil seal with a suitable tool.



Inspection

CYLINDER HEAD DISTORTION

NCEM0019

NCEM0019S01

- 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:

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

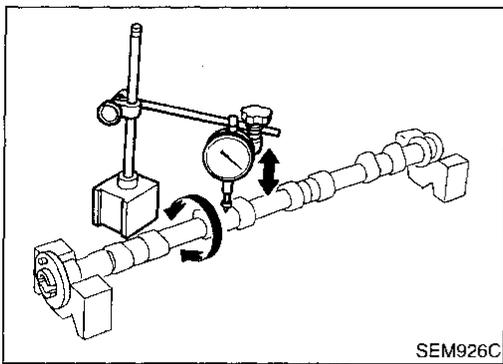
After resurfacing cylinder head, check that camshaft rotates freely by hand. If resistance is felt, cylinder head must be replaced.

Nominal cylinder head height:

136.9 - 137.1 mm (5.390 - 5.398 in)

CYLINDER HEAD

Inspection (Cont'd)



CAMSHAFT VISUAL CHECK

Check camshaft for scratches, seizure and wear.

NCEM0019S02

CAMSHAFT RUNOUT

1. Measure camshaft runout at the center journal.

NCEM0019S03

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

NCEM0019S04

1. Measure camshaft cam height.

Standard cam height:

Intake

37.550 - 37.740 mm (1.4783 - 1.4858 in)

Exhaust

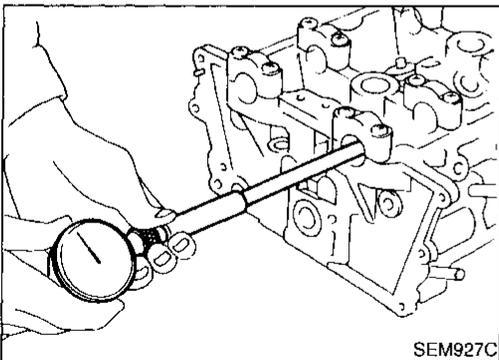
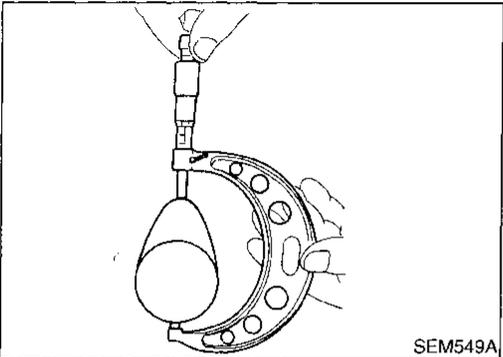
37.920 - 38.110 mm (1.4929 - 1.5004 in)

Cam height wear limit:

Intake & Exhaust

0.2 mm (0.008 in)

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



CAMSHAFT JOURNAL CLEARANCE

1. Install camshaft bracket and tighten bolts. Refer to EM-23.
2. Measure inner diameter of camshaft bearing.

NCEM0019S05

Standard inner diameter:

28.000 - 28.021 mm (1.1024 - 1.1032 in)

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.

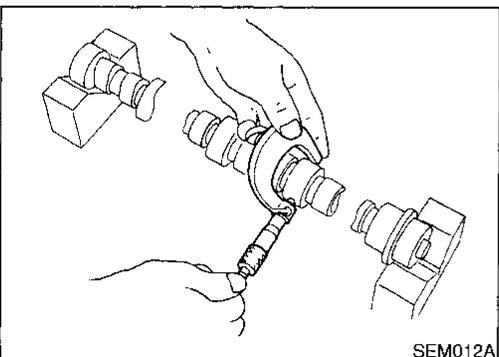
Camshaft journal clearance = standard inner diameter - standard outer diameter:

Standard

0.045 - 0.090 mm (0.0018 - 0.0035 in)

Limit

0.15 mm (0.0059 in)



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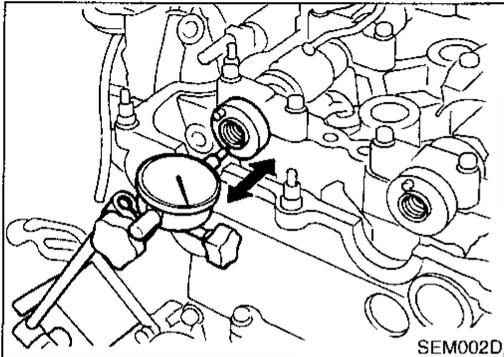
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CYLINDER HEAD

Inspection (Cont'd)

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

NCEM0019S06

1. Install camshaft in cylinder head. Refer to EM-23.
2. Measure camshaft end play.

Camshaft end play:

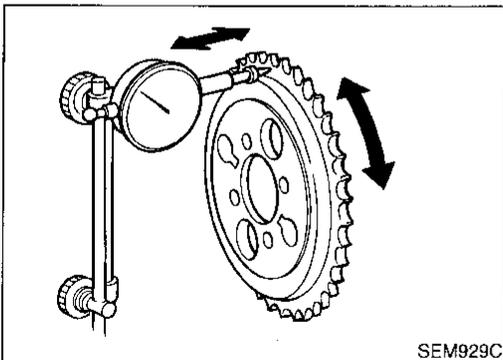
Standard

0.055 - 0.139 mm (0.0022 - 0.0055 in)

Limit

0.20 mm (0.0079 in)

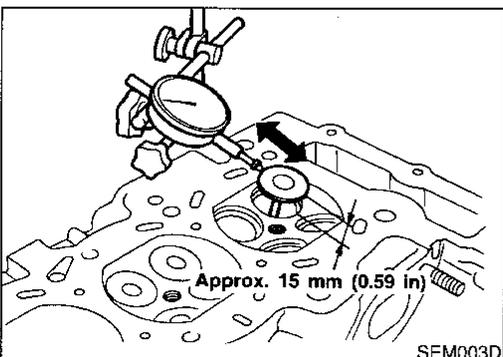
3. If end play exceeds the limit, replace camshaft and remeasure camshaft end play.
- If end play still exceeds the limit after replacing camshaft, replace cylinder head.



CAMSHAFT SPROCKET RUNOUT

NCEM0019S07

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.



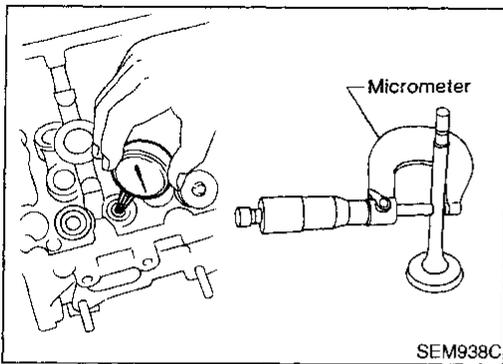
VALVE GUIDE CLEARANCE

NCEM0019S08

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)

CYLINDER HEAD

Inspection (Cont'd)



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.

GI

MA

EM

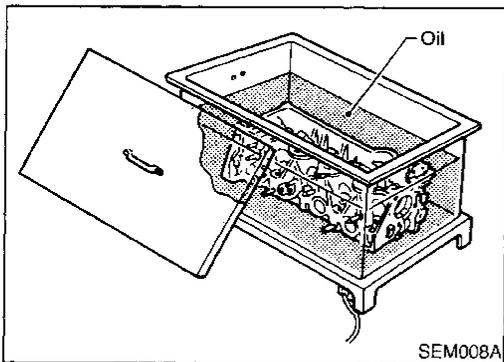
LC

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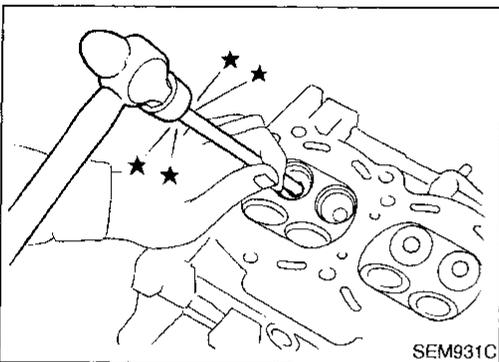
MT



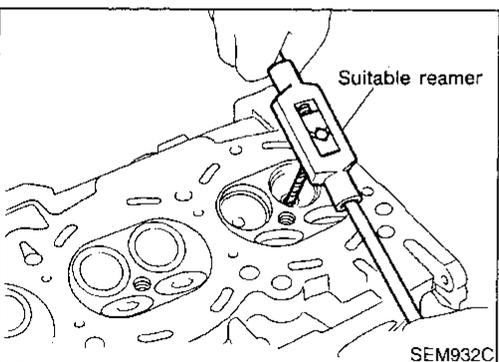
VALVE GUIDE REPLACEMENT

NCEM0019S09

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



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



3. Ream cylinder head valve guide hole.

Valve guide hole diameter

(for service parts):

Intake & Exhaust

10.175 - 10.196 mm (0.4006 - 0.4014 in)

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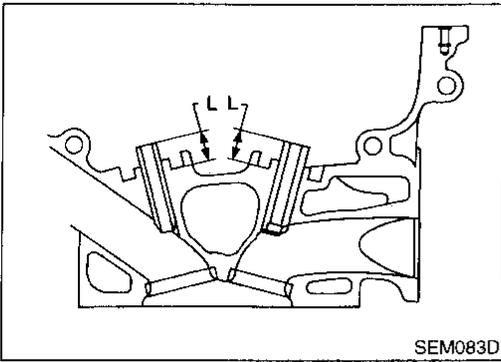
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CYLINDER HEAD

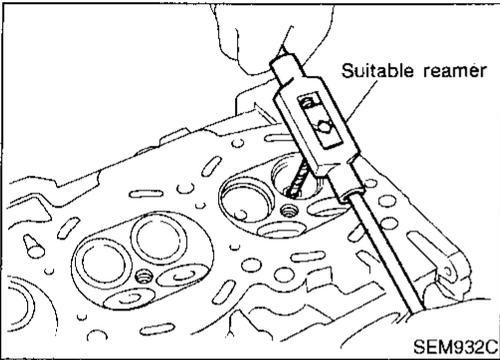
Inspection (Cont'd)



- 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)

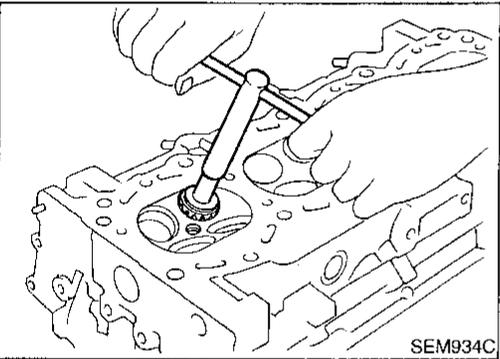


- Ream valve guide.

Finished size:

Intake & Exhaust

6.000 - 6.018 mm (0.2362 - 0.2369 in)

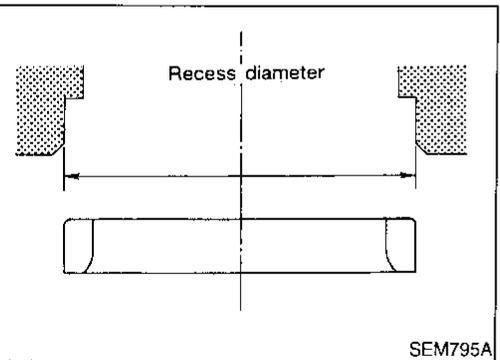


VALVE SEATS

NCEM0019S10

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.



REPLACING VALVE SEAT FOR SERVICE PARTS

NCEM0019S11

- Bore out old seat until it collapses. Set machine depth stop so that boring cannot contact bottom face of seat recess in cylinder head.
- Ream cylinder head recess.

Reaming bore for service valve seat

Oversize [0.5 mm (0.020 in)]:

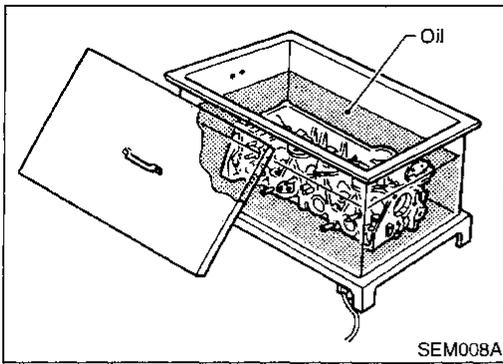
Intake 35.500 - 35.516 mm (1.3976 - 1.3983 in)

Exhaust 31.500 - 31.516 mm (1.2402 - 1.2408 in)

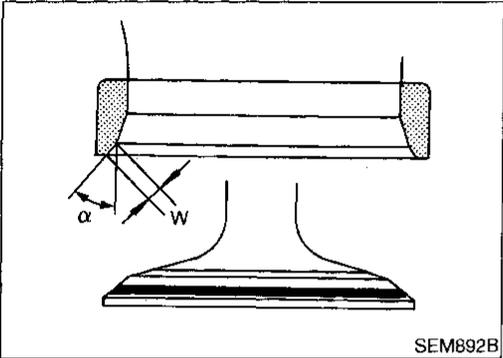
Use the valve guide center for reaming to ensure valve seat will have the correct fit.

CYLINDER HEAD

Inspection (Cont'd)



SEM008A



SEM892B

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-70.
6. After cutting, lap valve seat with abrasive compound.
7. Check valve seating condition.

Seat face angle "α":

44°53' - 45°07'

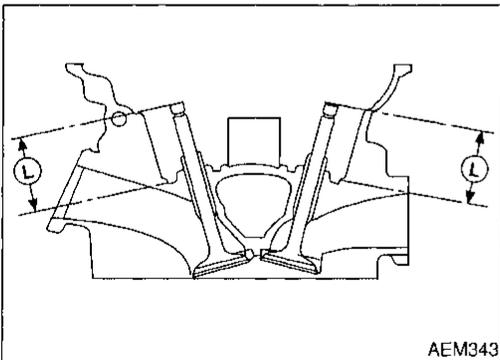
Contacting width "W":

Intake

1.05 - 1.35 mm (0.0413 - 0.0531 in)

Exhaust

1.25 - 1.55 mm (0.0492 - 0.0610 in)



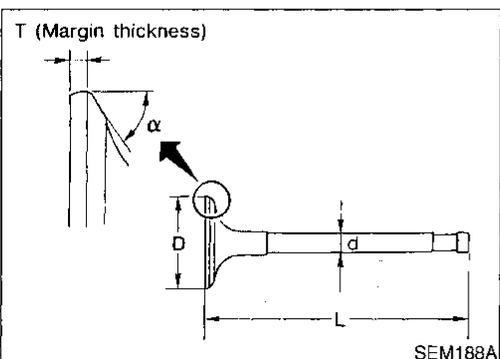
AEM343

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 the specified valve, 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)



SEM188A

VALVE DIMENSIONS

Check dimensions of each valve. Refer to SDS, EM-67.

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.

NCEM0019S12

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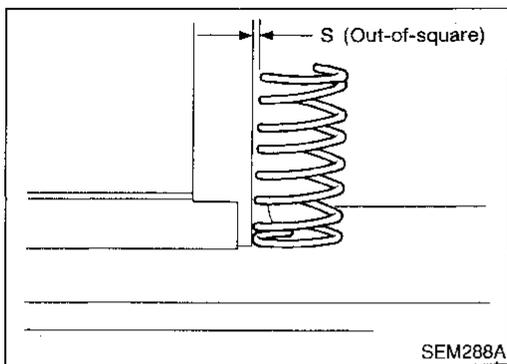
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CYLINDER HEAD

Inspection (Cont'd)



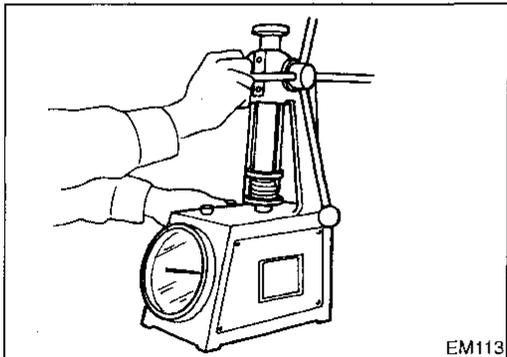
VALVE SPRING

NCEM0019S13

Squareness

NCEM0019S1301

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

NCEM0019S1302

Check valve spring pressure at specified spring height.

Pressure:

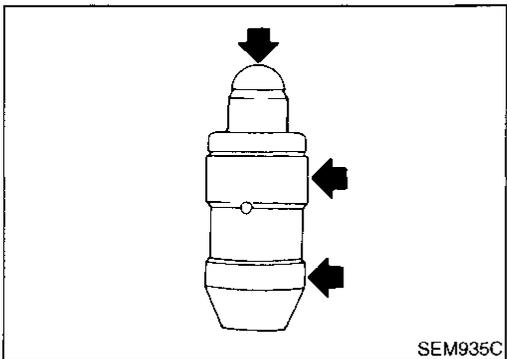
Standard

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)

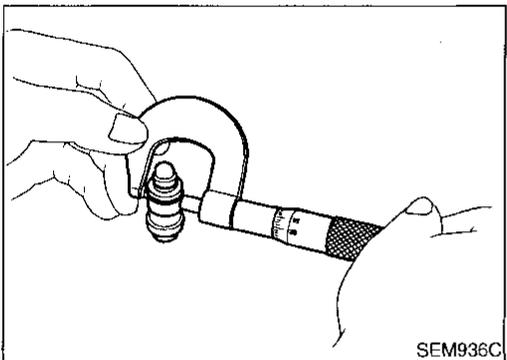
If it exceeds the limit, replace spring.



HYDRAULIC LASH ADJUSTER

NCEM0019S14

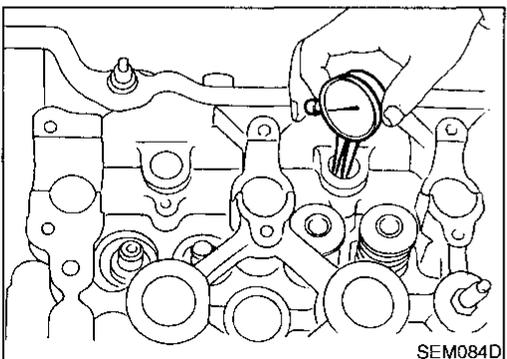
1. Check contact and sliding surfaces for wear or score.



2. Check diameter of lash adjuster.

Outer diameter:

16.980 - 16.993 mm (0.6685 - 0.6690 in)



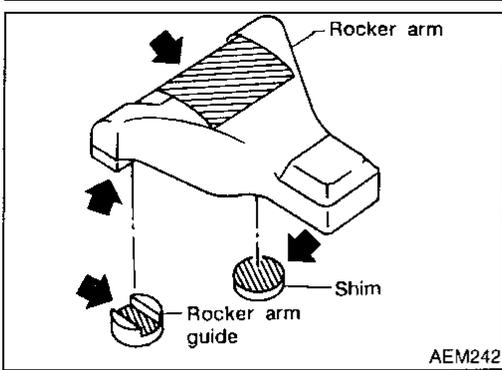
3. Check lash adjuster guide hole diameter.

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)



ROCKER ARM, SHIM AND ROCKER ARM GUIDE

NCEM0019S15

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

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Assembly

NCEM0020

CAUTION:

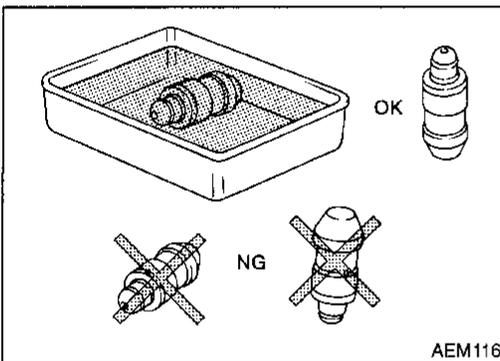
- When installing rocker arms, camshaft and oil seal, lubricate contacting surfaces with new engine oil.
- When tightening cylinder head bolts, camshaft sprocket bolts and camshaft bracket bolts, lubricate bolt threads and seat surfaces with new engine oil.

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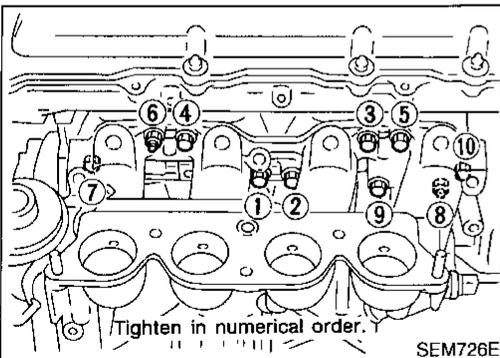
- If a hydraulic lash adjuster is kept on its side, there is a risk of air entering it. When hydraulic lash adjusters are removed, stand them straight up or soak them in new engine oil.
- Do not disassemble hydraulic lash adjusters.
- Attach tags to lash adjusters so as not to mix them up.

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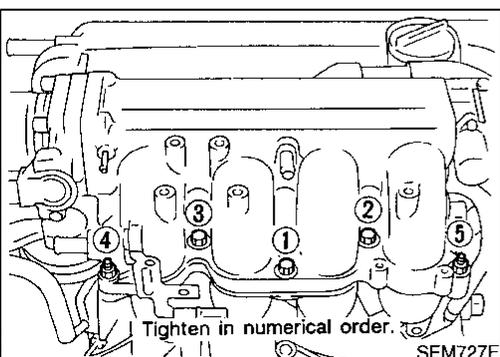
1. Install intake manifold as shown.
2. Install fuel tube assembly. Refer to EC section ("Injector Removal and Installation", "BASIC SERVICE PROCEDURE").

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

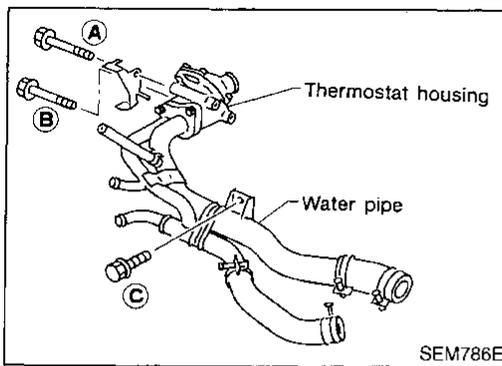
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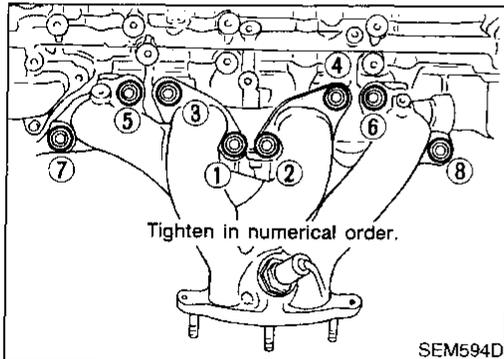
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CYLINDER HEAD

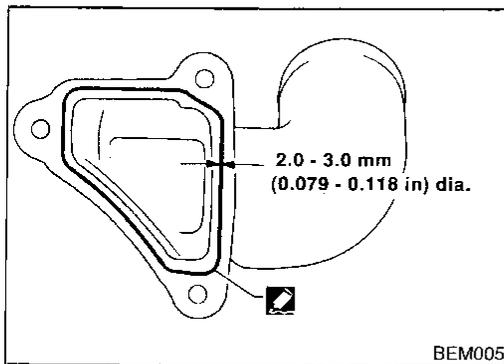
Assembly (Cont'd)



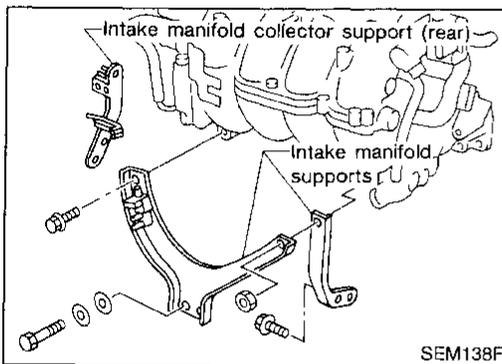
5. Install thermostat housing with water pipe using the following procedure.
 - a. Tighten bolt A.
 - ☞ : 2 - 5 N·m (0.2 - 0.5 kg-m, 17 - 43 in-lb)
 - b. Tighten bolt C.
 - ☞ : 16 - 21 N·m (1.6 - 2.1 kg-m, 12 - 15 ft-lb)
 - c. Tighten bolt A.
 - ☞ : 16 - 21 N·m (1.6 - 2.1 kg-m, 12 - 15 ft-lb)
 - d. Tighten bolt B.
 - ☞ : 16 - 21 N·m (1.6 - 2.1 kg-m, 12 - 15 ft-lb)



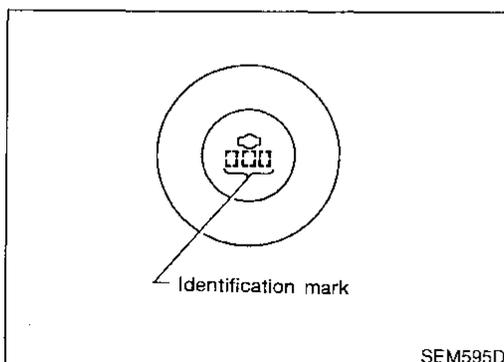
6. Install exhaust manifold.
 - Tighten exhaust manifold bolts in numerical order.
7. Install exhaust manifold cover.



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. 999MP-A7007 or equivalent.**



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

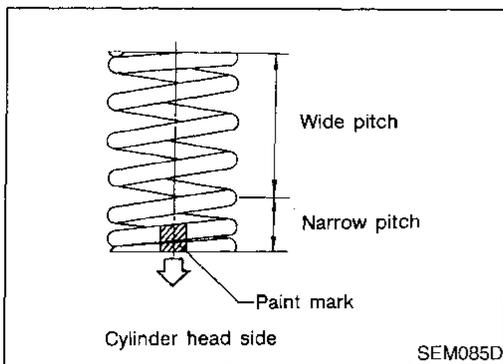


12. Install valve component parts.
 - **Install valves, noting their identification marks as indicated in the table below.**

	Identification mark
Intake valve	E71
Exhaust valve	6Y2

CYLINDER HEAD

Assembly (Cont'd)



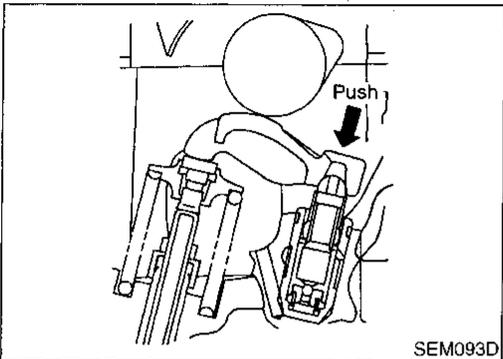
- Always use new valve oil seal. Refer to EM-33.
- Before installing valve oil seal, install valve spring seat.
- Install valve spring (uneven pitch type) with its narrow pitched side (paint mark) toward cylinder head side.
- After installing valve components, use plastic hammer to lightly tap valve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

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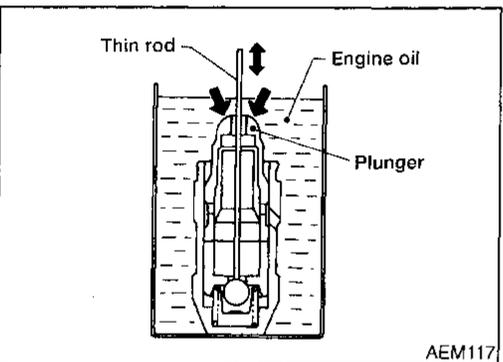
13. Check hydraulic lash adjusters.
 - a. Push on the rocker arm above the hydraulic lash adjuster. If it moves 1 mm (0.04 in) or more, there is air in the high pressure chamber of hydraulic lash adjuster. Noise will be emitted from hydraulic lash adjuster if engine is started without bleeding air.

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- 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.

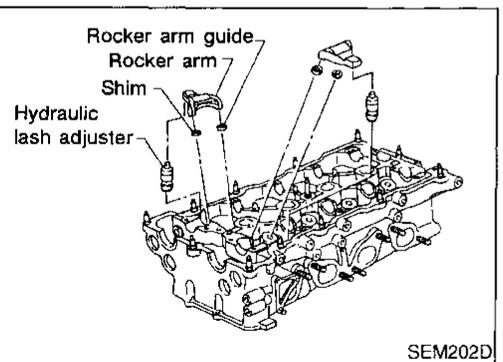
AT

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

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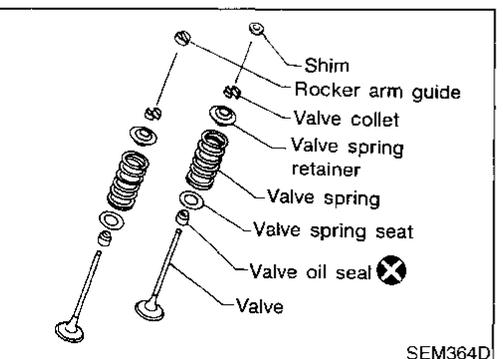
14. Remove camshafts, rocker arms and shims. For future reference, identify each shim with the cylinder it was removed from. Since the shims are reusable, it may not be necessary to replace all of the existing shims.

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

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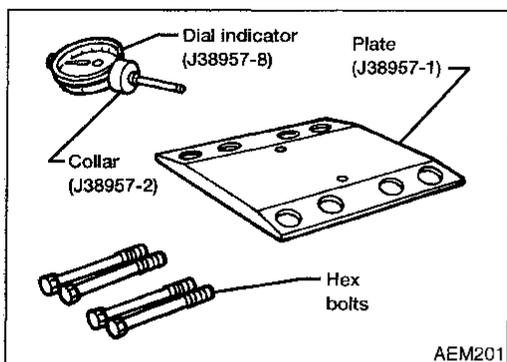
- Always replace rocker arm guide with a new one.

CAUTION:
Install parts in their original positions.

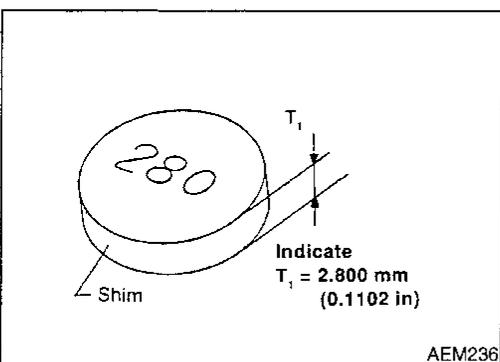
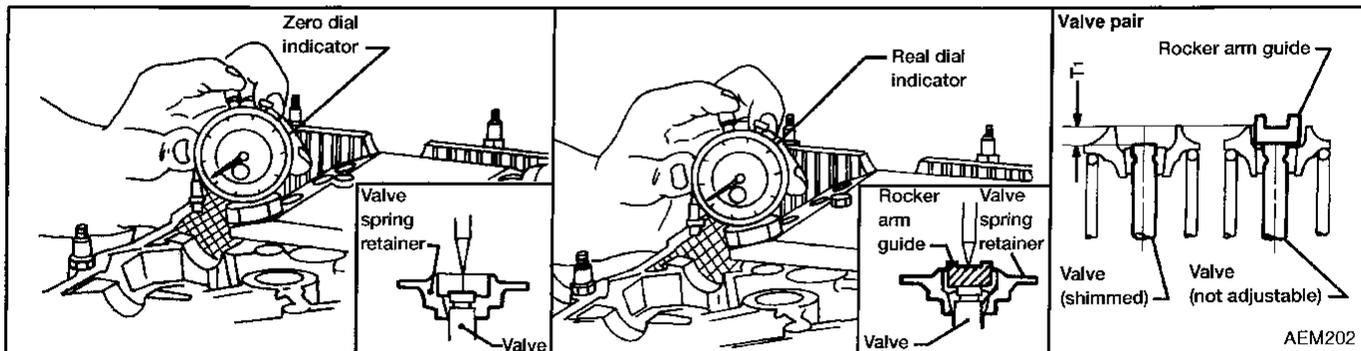
IDX

CYLINDER HEAD

Assembly (Cont'd)



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.)



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-69. (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 0.1152 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.

CYLINDER HEAD

Installation

Installation

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

NCEM0021

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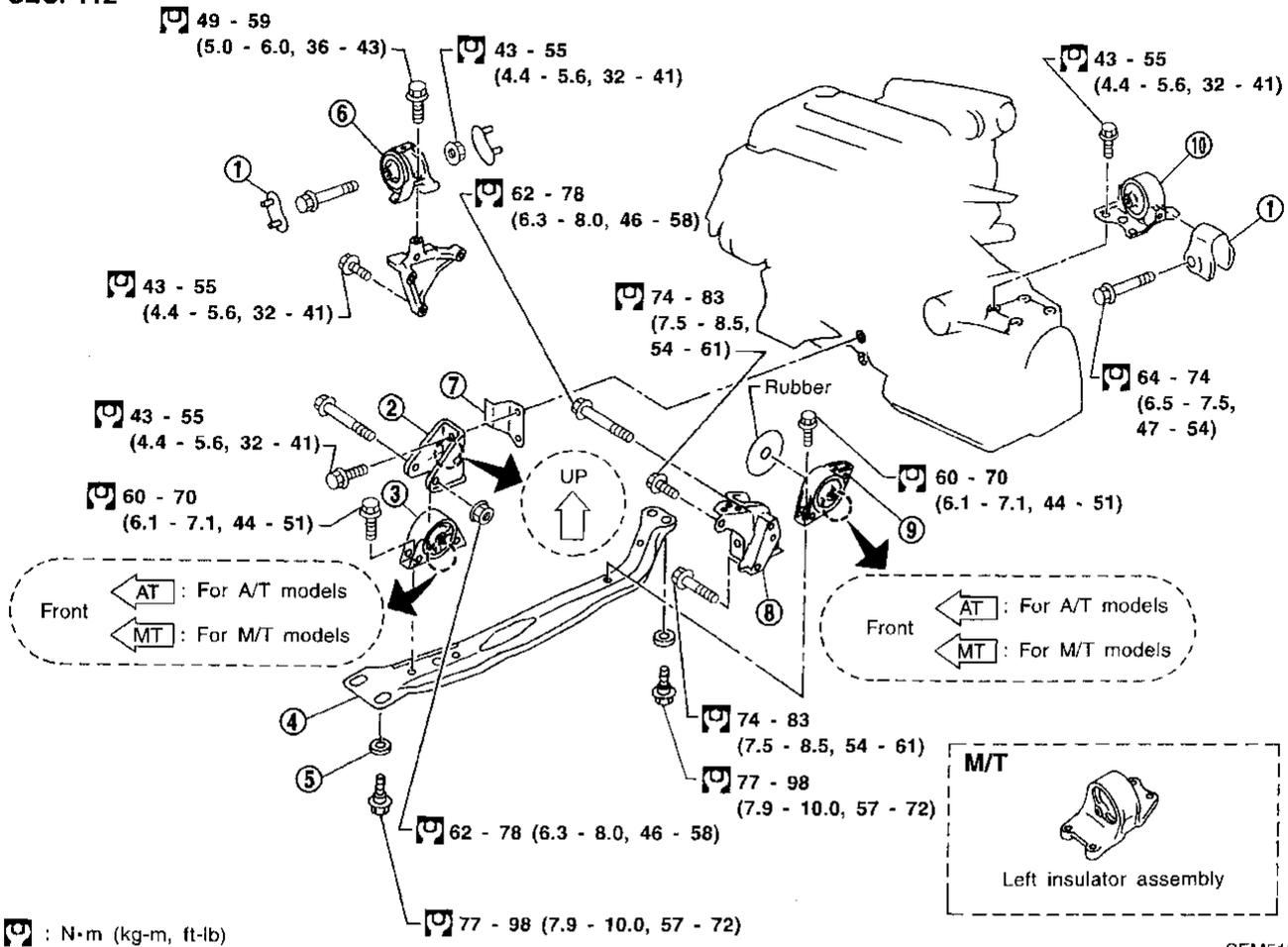
ENGINE ASSEMBLY

Removal and Installation

Removal and Installation

NCEM0022

SEC. 112



SEM518F

1. Stopper
2. Bracket
3. Front insulator assembly
4. Center member

5. Pad
6. Right insulator assembly
7. Exhaust bracket

8. Bracket
9. Rear insulator assembly
10. Left insulator assembly (A/T)

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.

ENGINE ASSEMBLY

Removal and Installation (Cont'd)

Use special care near accelerator wire casing, brake lines and brake master cylinder.

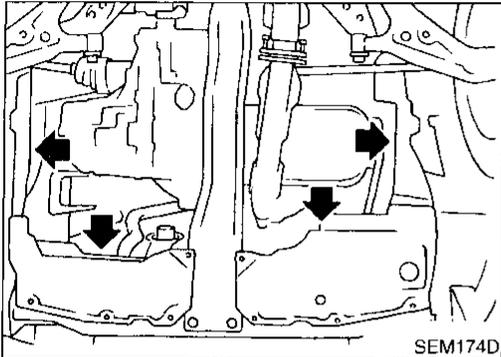
- In lifting the engine, always use engine slingers in a safe manner.
- In removing drive shaft, be careful not to damage grease seal of transaxle.
- Before separating engine and transaxle, remove the crankshaft position sensor (OBD) from the assembly.
- Always be extra careful not to damage edge of crankshaft position sensor (OBD) or ring gear teeth.

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REMOVAL

NCEM0022901

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 AX section ("Drive Shaft", "FRONT AXLE").
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.

EC

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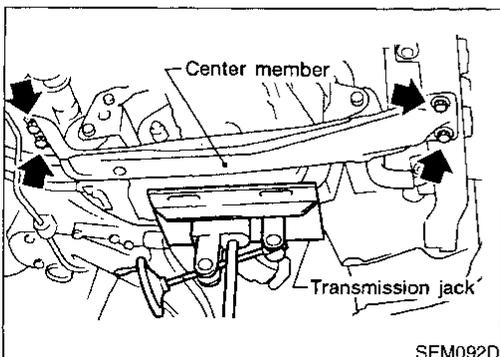
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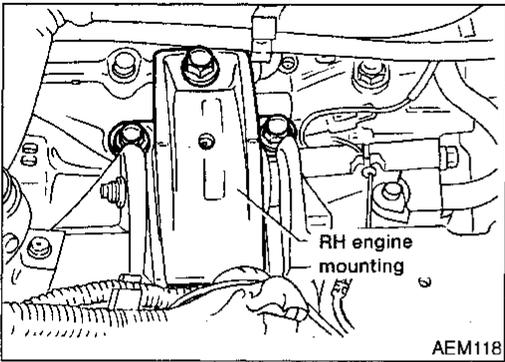
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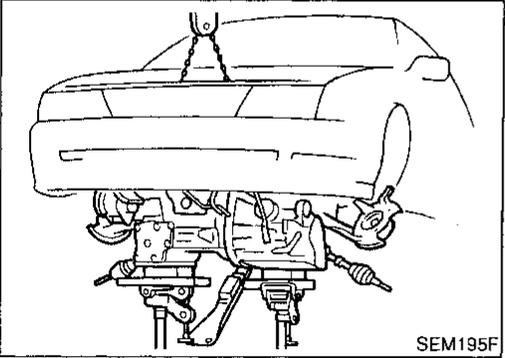
15. Remove center member.

ENGINE ASSEMBLY

Removal and Installation (Cont'd)



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



17. Remove engine with transaxle as shown.

INSTALLATION

1. Install in the reverse order of removal.

NCEM0022S02

CYLINDER BLOCK

Removal and Installation

Removal and Installation

NCEM0024

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.

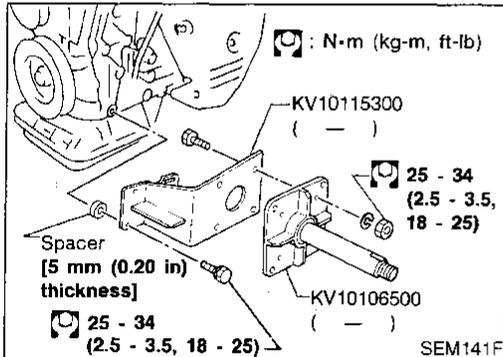
Disassembly

NCEM0025

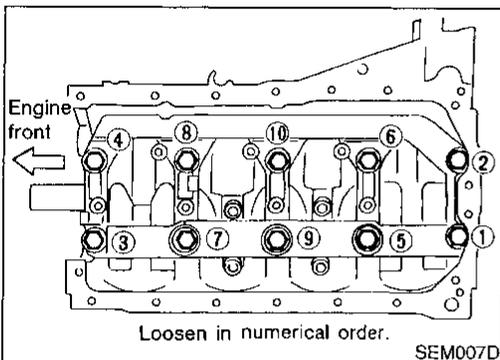
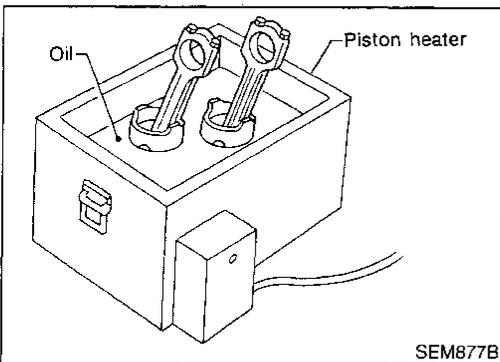
PISTON AND CRANKSHAFT

NCEM0025S01

1. Place engine on engine stand (ST0501S000).
2. Remove cylinder head and timing chain. Refer to EM-19.
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.



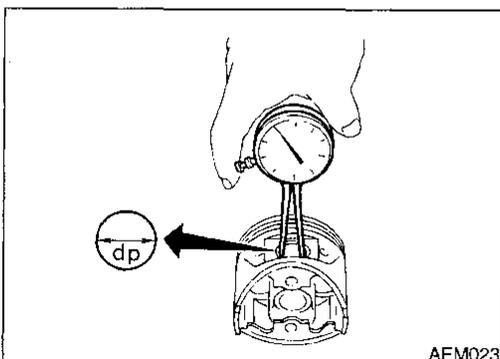
Inspection

NCEM0026

PISTON AND PISTON PIN CLEARANCE

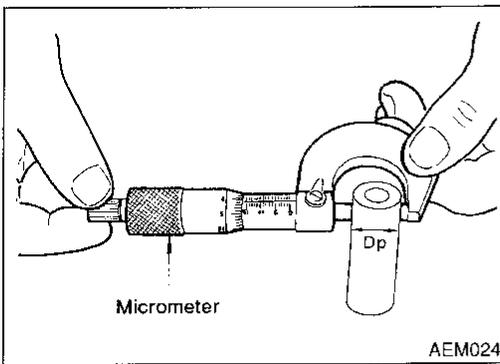
NCEM0026S01

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



CYLINDER BLOCK

Inspection (Cont'd)



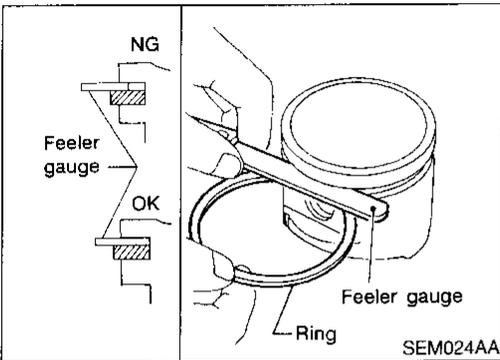
2. Measure outer diameter of piston pin "Dp".
Standard diameter "Dp":
21.991 - 21.999 mm (0.8658 - 0.8661 in)
3. Calculate interference fit of piston pin to piston.
Dp - dp: 0 - 0.004 (0 - 0.0002 in)
 If it exceeds the above value, replace piston assembly with pin.

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PISTON RING SIDE CLEARANCE

NCEM0026S02

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)

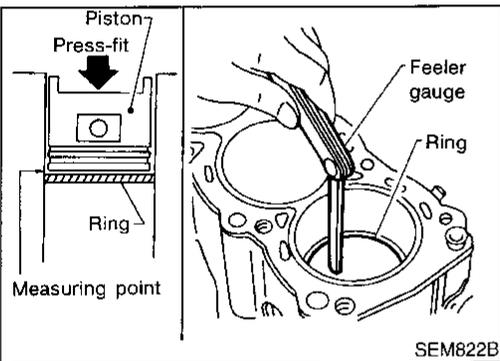
If out of specification, replace piston ring. If clearance exceeds maximum limit with new ring, replace piston.

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PISTON RING END GAP

NCEM0026S03

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)

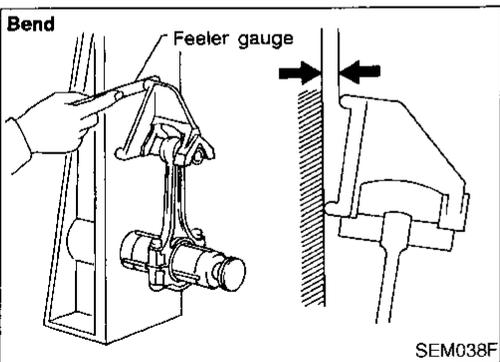
If out of specification, replace piston ring. If gap exceeds maximum limit with a new ring, rebore cylinder and use oversized piston and piston rings. Refer to SDS, EM-73.

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- 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

NCEM0026S04

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.

ST

RS

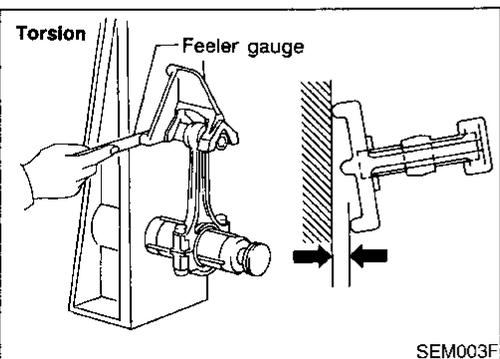
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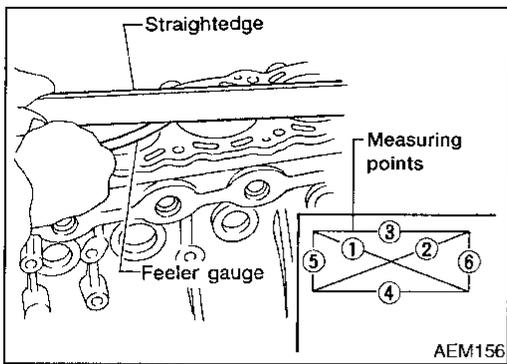
EL

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CYLINDER BLOCK

Inspection (Cont'd)



CYLINDER BLOCK DISTORTION AND WEAR

NCEM0026S05

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 (0.0039 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:

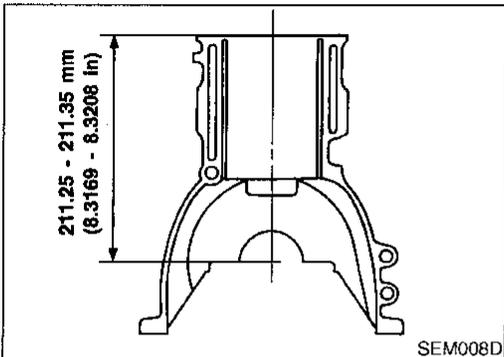
A + B = 0.2 mm (0.008 in)

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

NCEM0026S06

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)

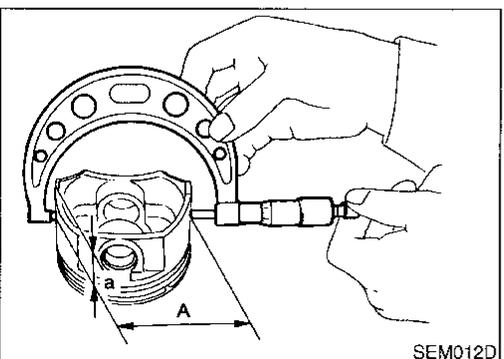
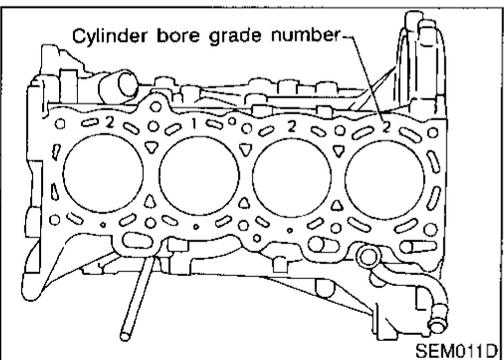
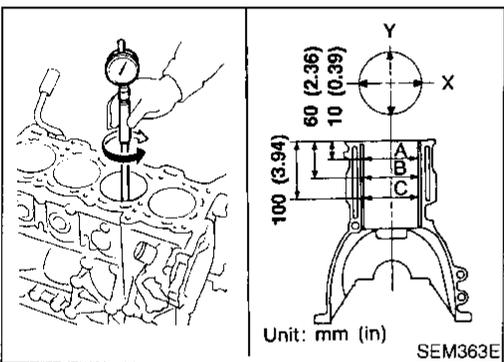
Taper (A - B and A - C) standard:

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-73.

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.

CYLINDER BLOCK

Inspection (Cont'd)

Oversize pistons are available for service. Refer to SDS, EM-73.

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

Rebored size calculation:

$$D = A + B - C$$

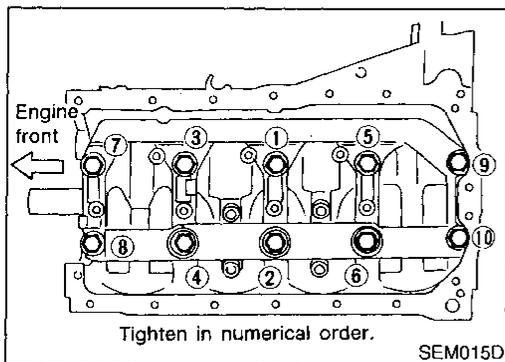
where,

D: Bored diameter

A: Piston diameter as measured

B: Piston-to-bore clearance

C: Honing allowance 0.02 mm (0.0008 in)



7. Install main bearing caps and tighten to the specified torque. This will prevent distortion of cylinder bores, otherwise cylinder bores may be distorted in final assembly.

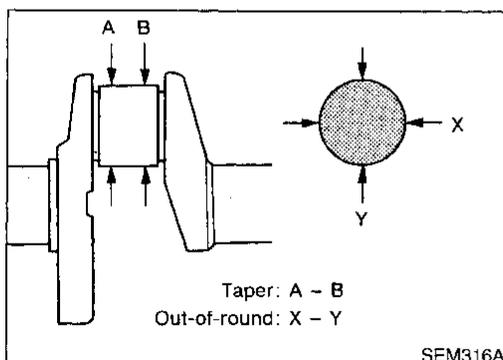
8. Cut cylinder bores.

- 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

NCEM0026S07

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):

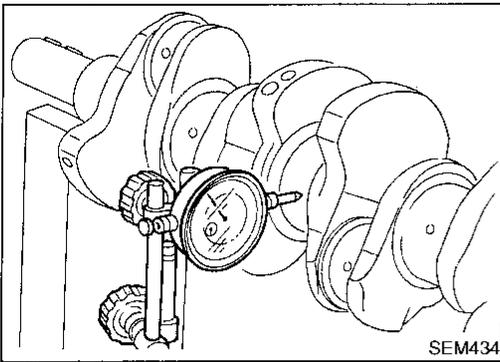
Taper (A - B):

Main journal: Less than 0.005 mm (0.0002 in)

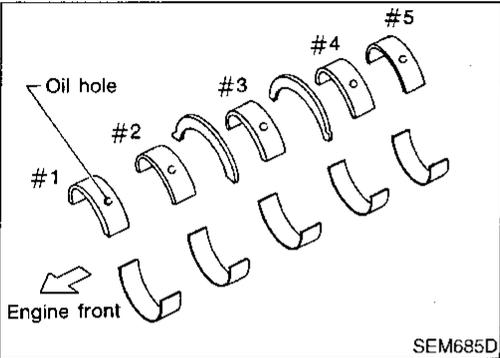
Pin journal: Less than 0.003 mm (0.0001 in)

CYLINDER BLOCK

Inspection (Cont'd)



3. Measure crankshaft runout.
Runout (Total indicator reading):
Less than 0.05 mm (0.0020 in)



BEARING CLEARANCE

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

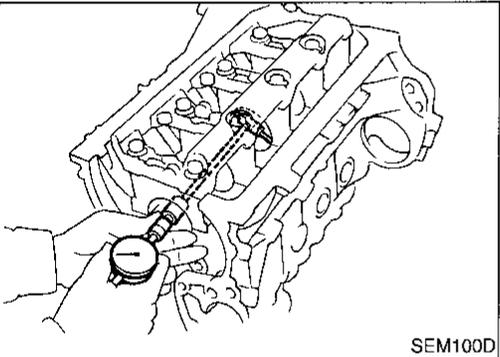
Method A (Using bore gauge and micrometer)

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.

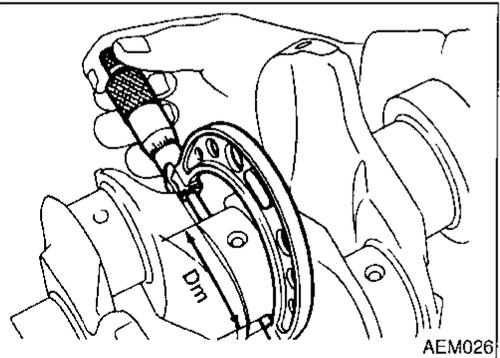
$$\text{Main bearing clearance} = A - D_m$$

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.

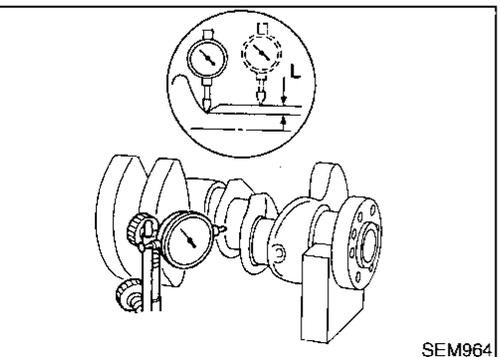
- If clearance cannot be adjusted within the standard of any bearing, grind crankshaft main journal and use undersized bearing.



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

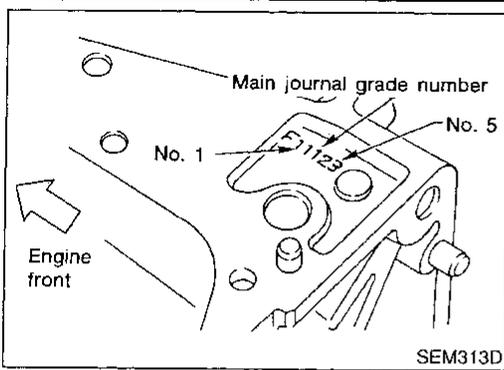
"L": 0.1 mm (0.004 in)

- Refer to SDS, EM-75 for grinding crankshaft and available service parts.

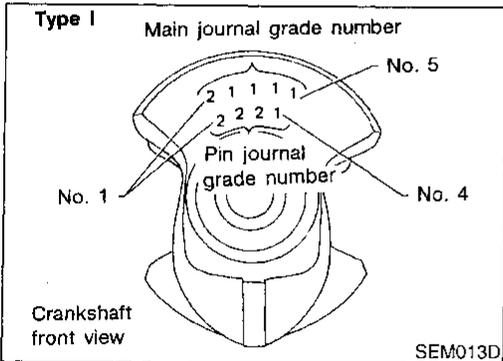


CYLINDER BLOCK

Inspection (Cont'd)



- 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.



- 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.

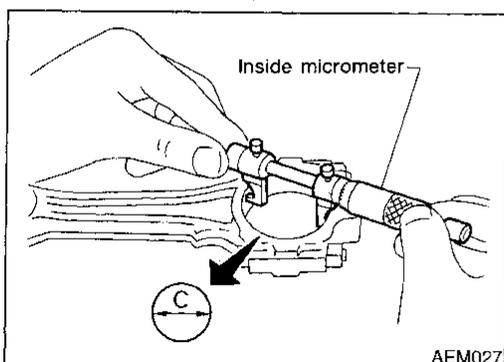
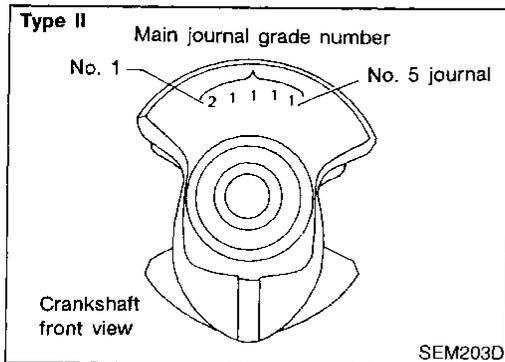
How to Select Main Bearings (Identification mark and color)

NCEM0026S0803

Crankshaft main journal grade number	Cylinder block main journal grade number			
	0	1	2	3
0	0 (A, Black)	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)



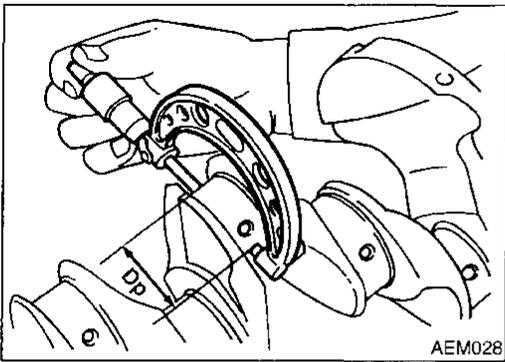
Connecting Rod Bearing (Big end)

NCEM0026S0802

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-63.**
3. Measure inner diameter "C" of each bearing.

CYLINDER BLOCK

Inspection (Cont'd)



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

$$\text{Connecting rod bearing clearance} = C - Dp$$

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

Limit: 0.065 mm (0.0026 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.
- 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.

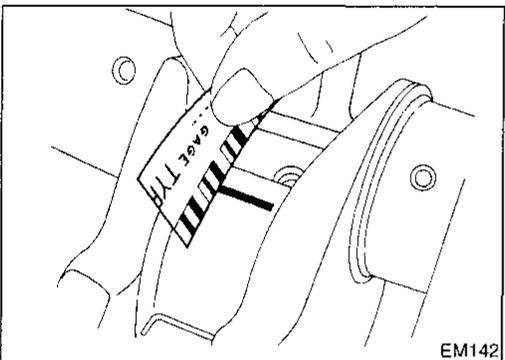
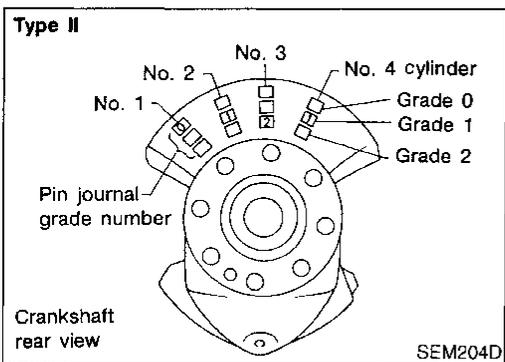
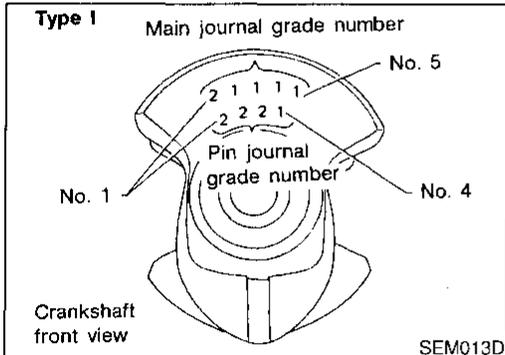
Crank pin grade number	Connecting rod bearing grade number
0	0
1	1
2	2

Identification color:

Grade 0; No color

Grade 1; Black

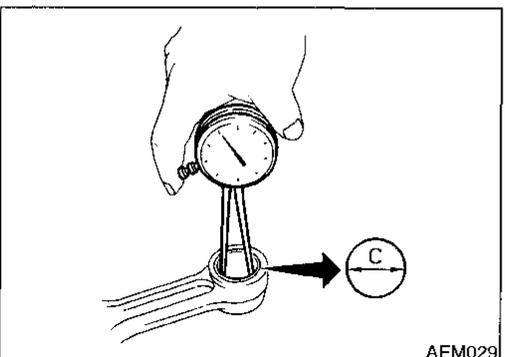
Grade 2; Brown



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.



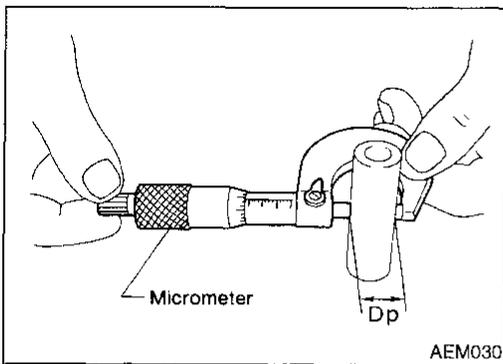
CONNECTING ROD BUSHING CLEARANCE (SMALL END)

NCEM0026S09

1. Measure inner diameter "C" of bushing.

CYLINDER BLOCK

Inspection (Cont'd)



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.

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REPLACEMENT OF CONNECTING ROD BUSHING (SMALL END)

NCEM0026S10

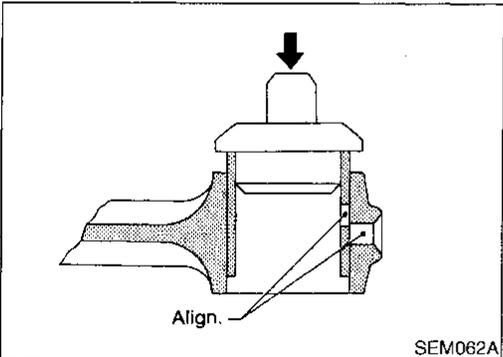
1. Drive in small end bushing until it is flush with end surface of rod.

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)



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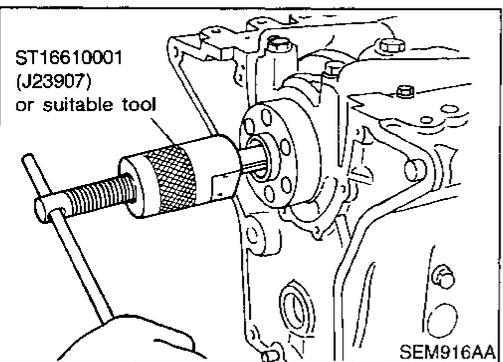
CL

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

NCEM0026S11

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



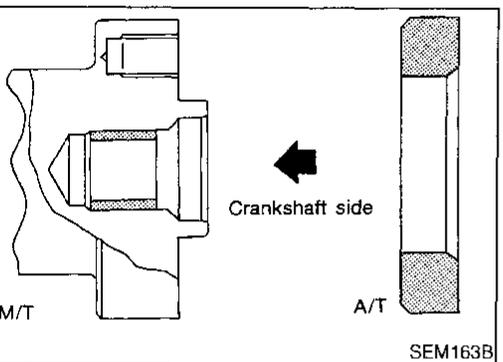
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2. Install pilot bushing or pilot converter as shown.



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FLYWHEEL/DRIVE PLATE RUNOUT

NCEM0026S12

Runout (Total indicator reading):

Flywheel (M/T model)

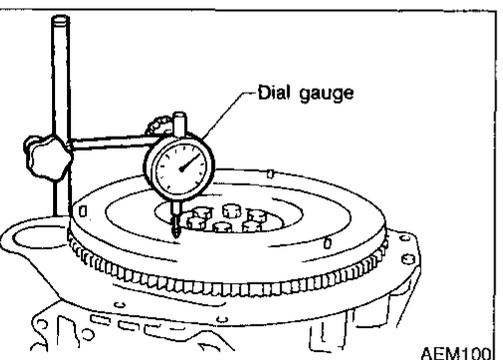
Less than 0.15 mm (0.0059 in)

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.



SC

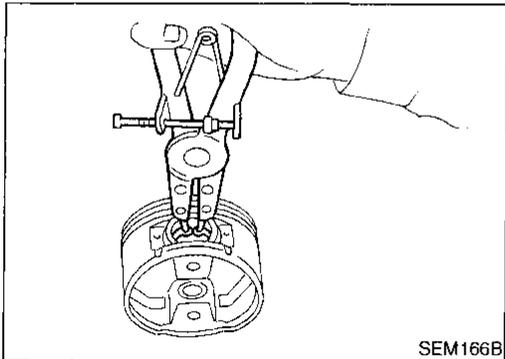
EL

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CYLINDER BLOCK

Inspection (Cont'd)

- Do not allow any magnetic materials to contact the ring gear teeth.
- Do not resurface flywheel. Replace as necessary.



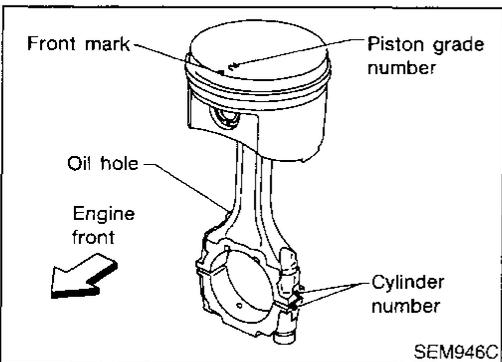
SEM166B

Assembly PISTON

NCEM0027

NCEM0027S01

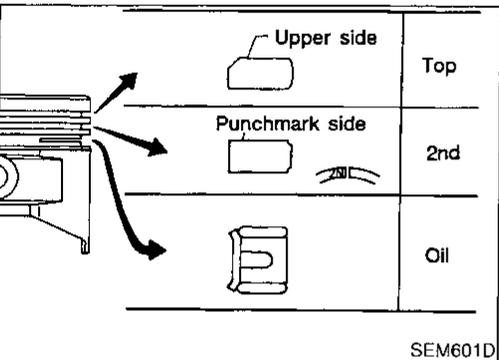
1. Install new snap ring on one side of piston pin hole.



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.

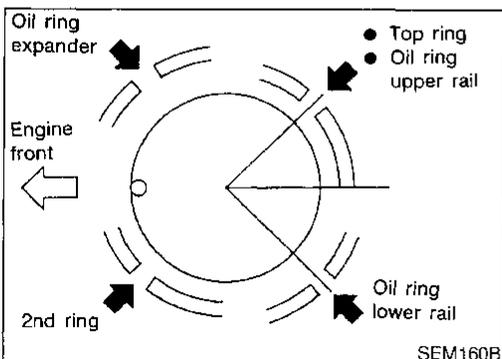


SEM601D

3. Set piston rings as shown.

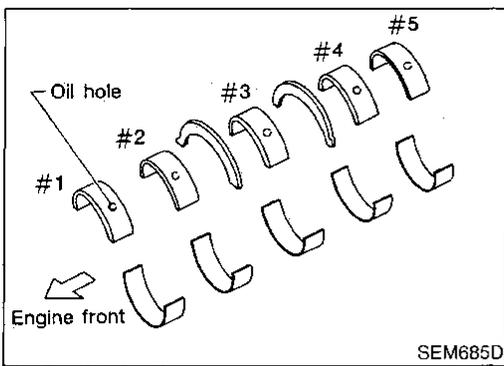
CAUTION:

- 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.

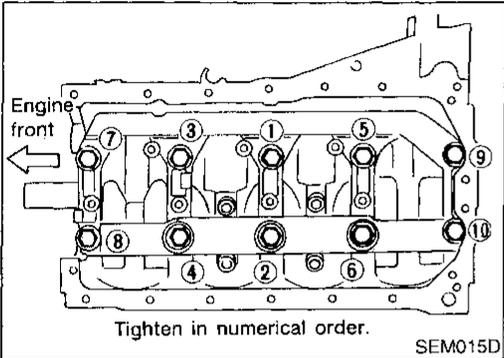


SEM160B

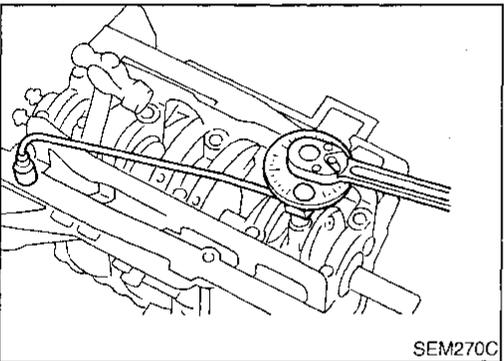
- Align piston rings so that end gaps are positioned as shown.



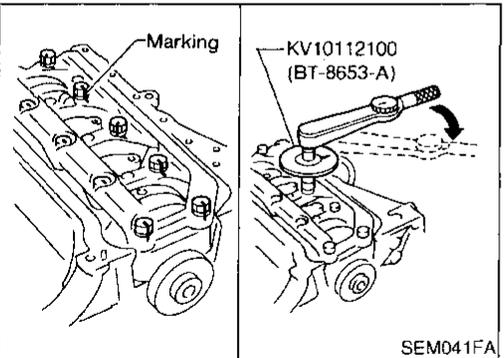
SEM685D



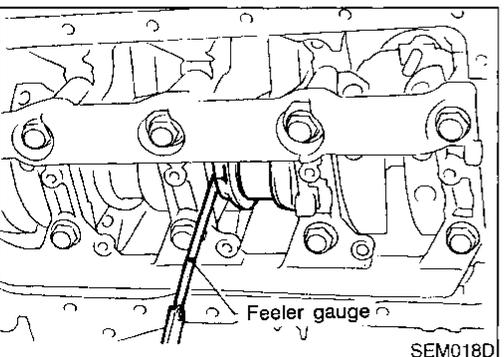
SEM015D



SEM270C



SEM041FA



SEM018D

CRANKSHAFT

NCEM0027S02

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.

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

EC

- 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:

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- a. Tighten all bolts to 32 to 38 N·m (3.3 to 3.9 kg·m, 24 to 28 ft·lb).

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

ST

- 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.

RS

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3. Measure crankshaft end play.

SC

Crankshaft end play:

Standard

0.10 - 0.26 mm (0.0039 - 0.0102 in)

Limit

0.30 mm (0.0118 in)

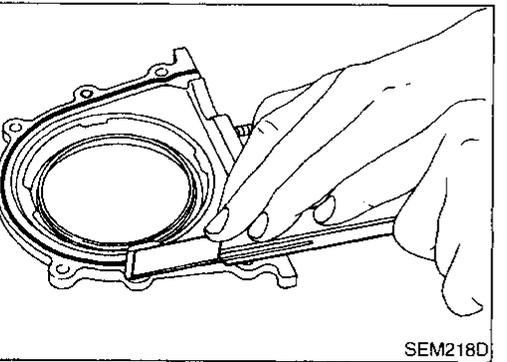
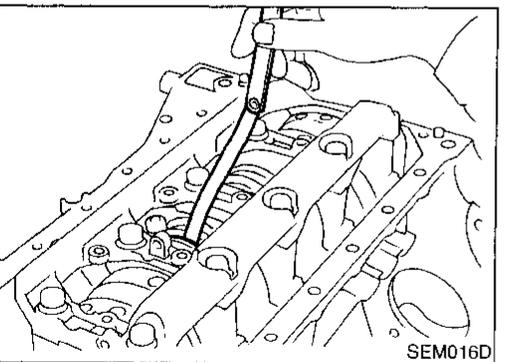
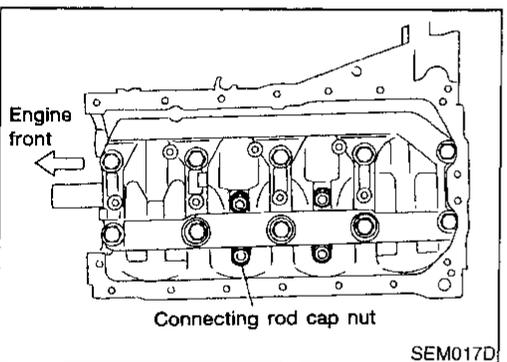
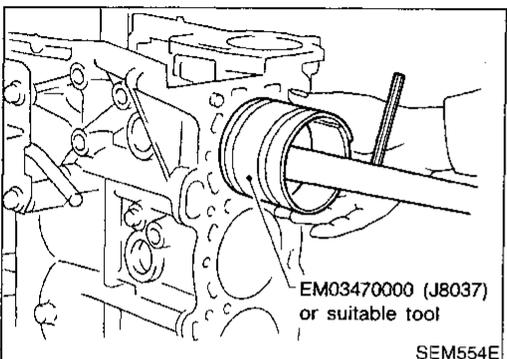
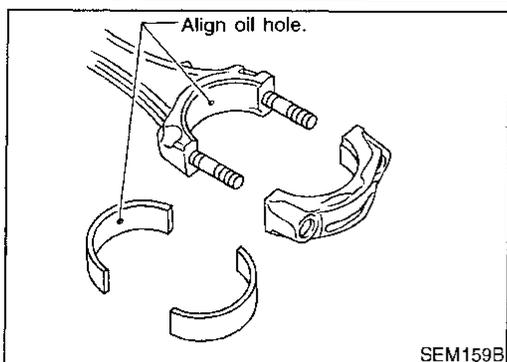
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If beyond the limit, replace thrust bearing with new one.

CYLINDER BLOCK

Assembly (Cont'd)



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.

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 not 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:
 - a) Tighten nuts to 14 to 16 N·m (1.4 to 1.6 kg·m, 10 to 12 ft·lb).
 - b) 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

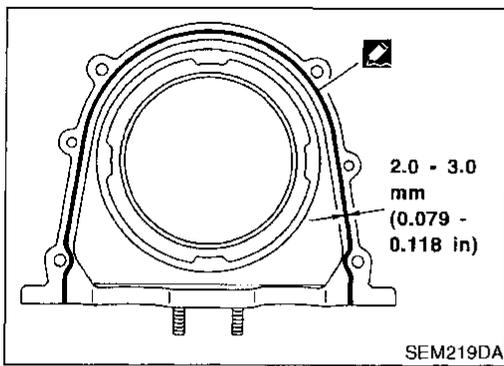
0.50 mm (0.0197 in)

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.

CYLINDER BLOCK

Assembly (Cont'd)



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

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SERVICE DATA AND SPECIFICATIONS (SDS)

Valve

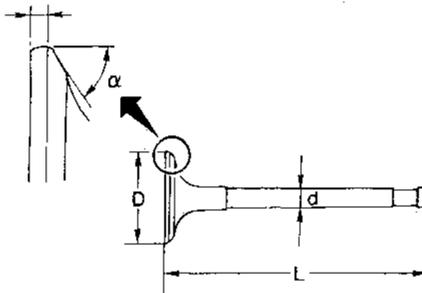
VALVE

Valve

NCEM0031

NCEM0031S01
Unit: mm (in)

T (Margin thickness)



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

NCEM0031S02

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)

NCEM0031S03
Unit: mm (in)

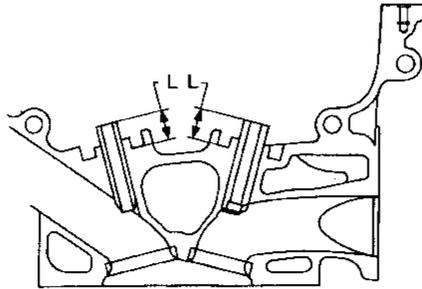
HLA outer diameter	16.980 - 16.993 (0.6685 - 0.6690)
HLA guide hole diameter	17.000 - 17.020 (0.6693 - 0.6701)
Clearance between HLA and HLA guide hole	0.007 - 0.040 (0.0003 - 0.0016)

SERVICE DATA AND SPECIFICATIONS (SDS)

Valve (Cont'd)

VALVE GUIDE

NCEM0031S04
Unit: mm (in)

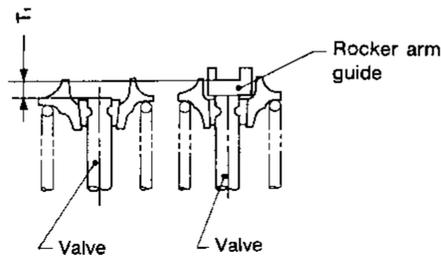


SEM083D

		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)	

VALVE SHIM CLEARANCE ADJUSTMENT

NCEM0031S06
Unit: mm (in)



SEM095D

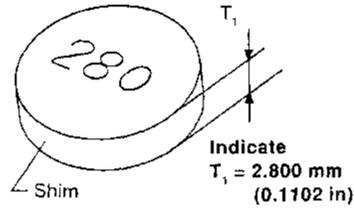
Valve shim clearance (cold) Intake & Exhaust	Less than 0.025 (0.001)
Shim thickness "T ₁ "	T ₁ ± 0.025 (0.001)

SERVICE DATA AND SPECIFICATIONS (SDS)

Valve (Cont'd)

AVAILABLE SHIM

NCEM0031S07



AEM236

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 00

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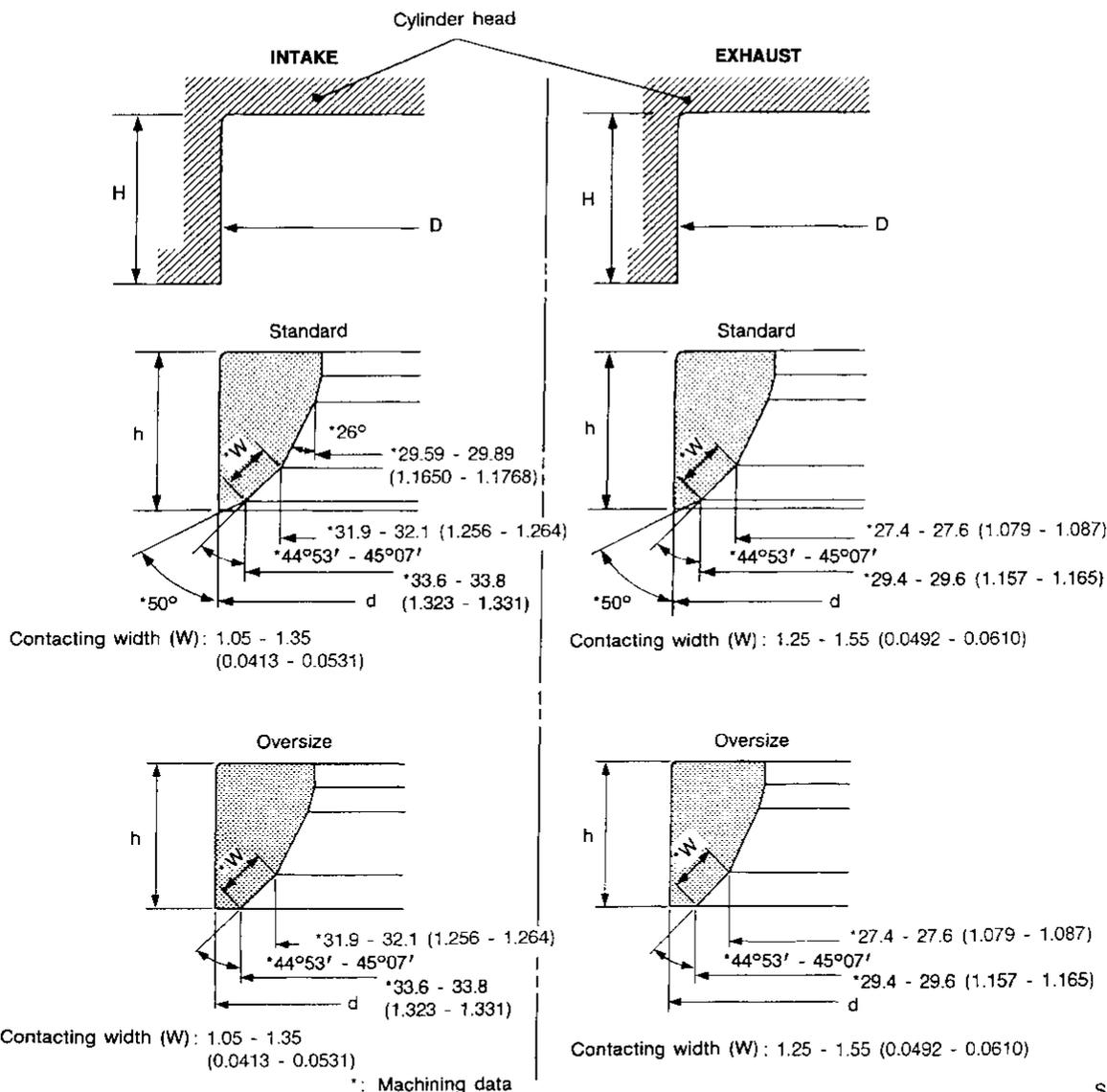
IDX

SERVICE DATA AND SPECIFICATIONS (SDS)

Valve (Cont'd)

VALVE SEAT

NCEM0031505
Unit: mm (in)



SEM651DB

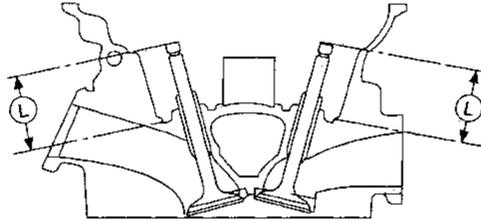
		Standard	Service
Cylinder head seat recess diameter (D)	In.	35.000 - 35.016 (1.3780 - 1.3786)	35.500 - 35.516 (1.3976 - 1.3983)
	Ex.	31.000 - 31.016 (1.2205 - 1.2211)	31.500 - 31.516 (1.2402 - 1.2408)
Valve seat interference fit	In.	0.064 - 0.096 (0.0025 - 0.0038)	
	Ex.	0.064 - 0.096 (0.0025 - 0.0038)	
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)

SERVICE DATA AND SPECIFICATIONS (SDS)

Valve (Cont'd)

VALVE SEAT RESURFACE LIMIT

NCEM0031S08
Unit: mm (in)



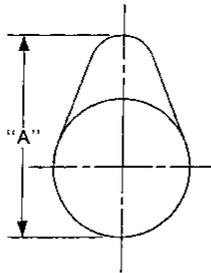
AEM343

Depth (L)	42.74 - 43.26 (1.6827 - 1.7031)
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Camshaft and Camshaft Bearing

NCEM0032
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)

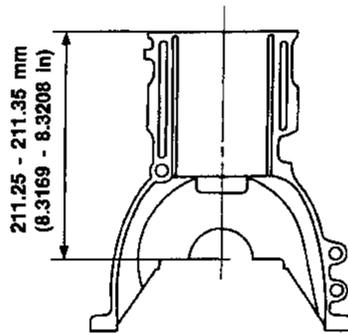
*Total indicator reading

SERVICE DATA AND SPECIFICATIONS (SDS)

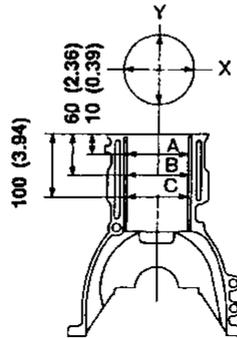
Cylinder Block

Cylinder Block

NCEM0033
Unit: mm (in)



SEM008D



SEM686D

Surface flatness	Standard	Less than 0.03 (0.0012)	
	Limit	0.10 (0.0039)	
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)	

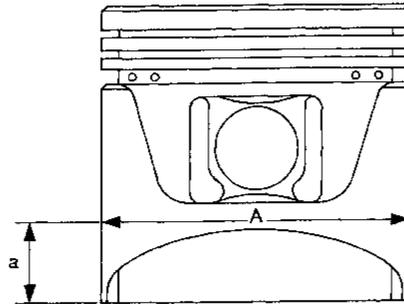
SERVICE DATA AND SPECIFICATIONS (SDS)

Piston, Piston Ring and Piston pin

PISTON

NCEM0034

NCEM0034S01
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) oversize (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

NCEM0034S02
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

NCEM0034S03
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)

SERVICE DATA AND SPECIFICATIONS (SDS)

Connecting Rod

Connecting Rod

NCEM0035
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

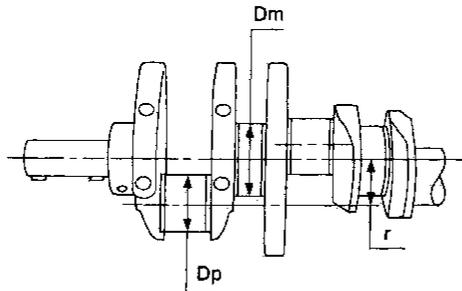
SERVICE DATA AND SPECIFICATIONS (SDS)

Crankshaft

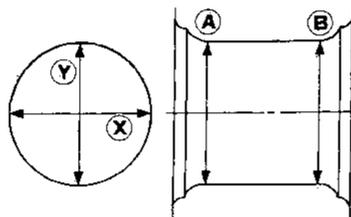
Crankshaft

NCEM0036
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)



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



SEM954C

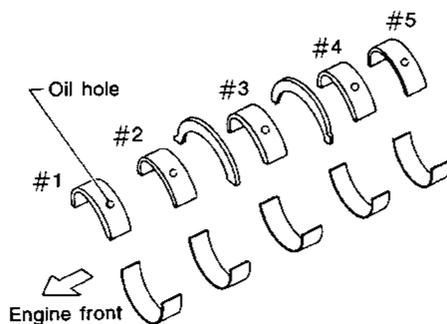
EM715

SERVICE DATA AND SPECIFICATIONS (SDS)

Main Bearing

Main Bearing

NCEM0037



SEM685D

STANDARD

NCEM0037S01
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

NCEM0037S02
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

NCEM0038

STANDARD SIZE

NCEM0038S01
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

NCEM0038S02
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)	

SERVICE DATA AND SPECIFICATIONS (SDS)

Bearing Clearance

Bearing Clearance

^{NCEM0039}
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 (0.0026)

GI

MA

EM

Miscellaneous Components

^{NCEM0040}
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)

LC

EC

FE

CL

MT

AT

AX

SU

BR

ST

RS

BT

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EL

IDX