

SECTION **EM**

GI

MA

EM

LC

EC

FE

CL

MT

AT

FA

RA

BR

ST

RS

BT

HA

EL

IDX

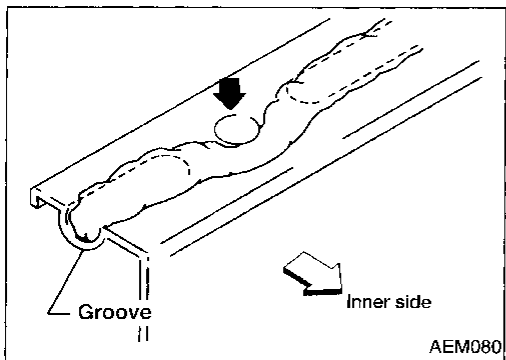
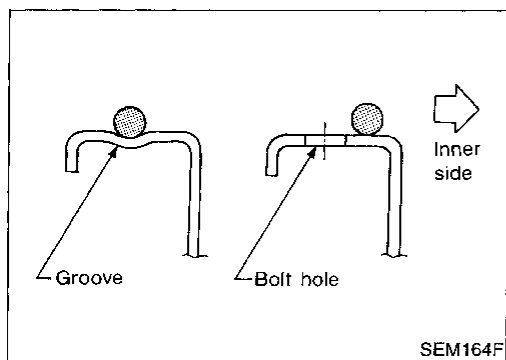
CONTENTS

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

PRECAUTIONS

Parts Requiring Angular Tightening

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



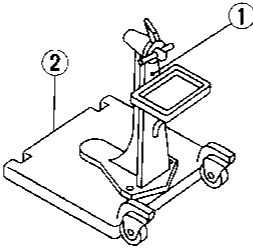
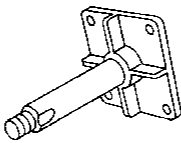
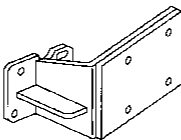
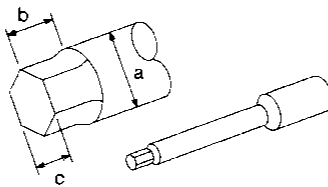
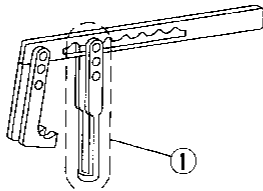
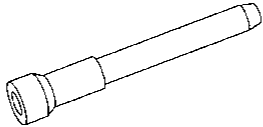
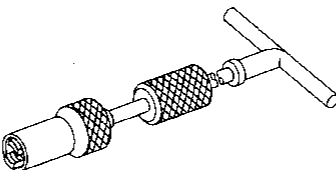
Liquid Gasket Application Procedure

- a. Use a scraper to remove old liquid gasket from mating surfaces and grooves. Also, completely clean any oil from these areas.
- b. Apply a continuous bead of liquid gasket to mating surfaces. (Use Genuine RTV silicone sealant Part No. 999 MP-A7007, Three Bond TB1207D or equivalent.)
 - For oil pan, be sure liquid gasket diameter is 4.0 to 5.0 mm (0.157 to 0.197 in).
 - For areas except oil pan, be sure liquid gasket diameter is 2.0 to 3.0 mm (0.079 to 0.118 in).
- c. Apply liquid gasket around the inner side of bolt holes (unless otherwise specified).
- d. Assembly should be done within 5 minutes after coating.
- e. Wait at least 30 minutes before refilling engine oil and engine coolant.

PREPARATION

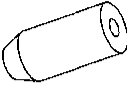
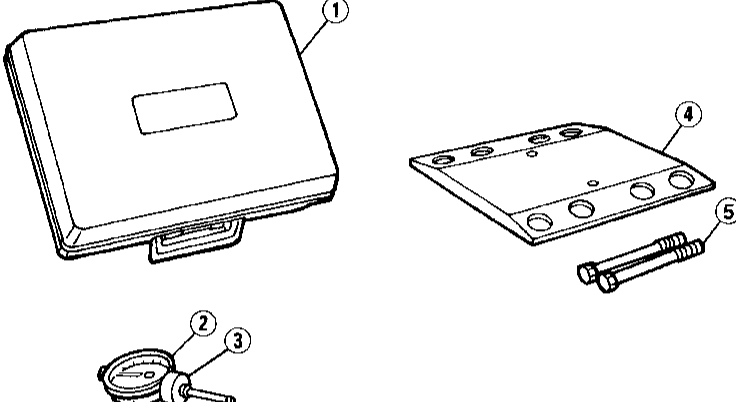
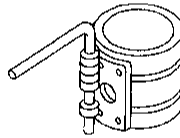
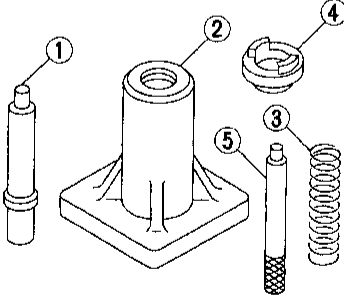
Special Service Tools

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

| Tool number (Kent-Moore No.) Tool name | Description | |
|--|--|--|
| ST0501S000 (—) Engine stand assembly ① ST05011000 (—) Engine stand ② ST05012000 (—) Base |  NT042 | Disassembling and assembling EM LC EC |
| KV10106500 (—) Engine stand shaft |  NT028 | FE CL |
| KV10115300 (—) Engine sub-attachment |  NT008 | MT AT |
| ST10120000 (J24239-01) Cylinder head bolt wrench |  NT583 | Loosening and tightening cylinder head bolt FA RA BR |
| KV10116200 (J26336-B) Valve spring compressor ① KV10115900 (J26336-20) Attachment |  NT022 | Disassembling valve mechanism ST RS BT |
| KV10115600 (J38958) Valve oil seal drift |  NT024 | Installing valve oil seal HA EL |
| KV10107902 (J38959) Valve oil seal puller |  NT011 | Displacement valve lip seal IDX |

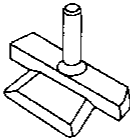
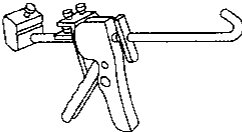
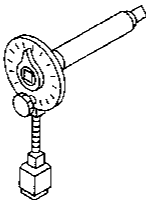
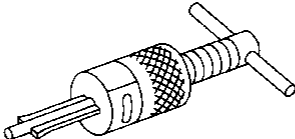
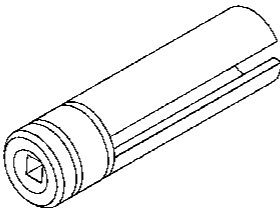
PREPARATION

Special Service Tools (Cont'd)

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

PREPARATION

Special Service Tools (Cont'd)

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

RS

BT

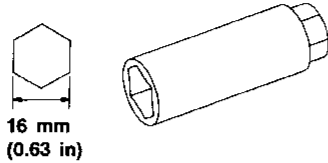
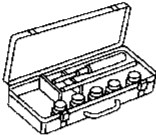
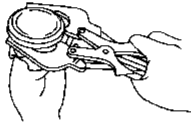
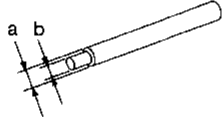
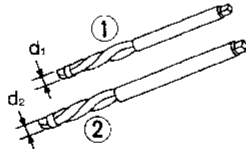
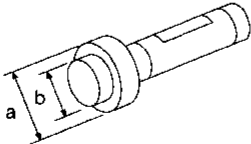
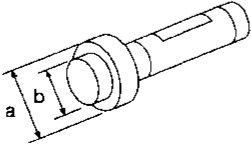
HA

EL

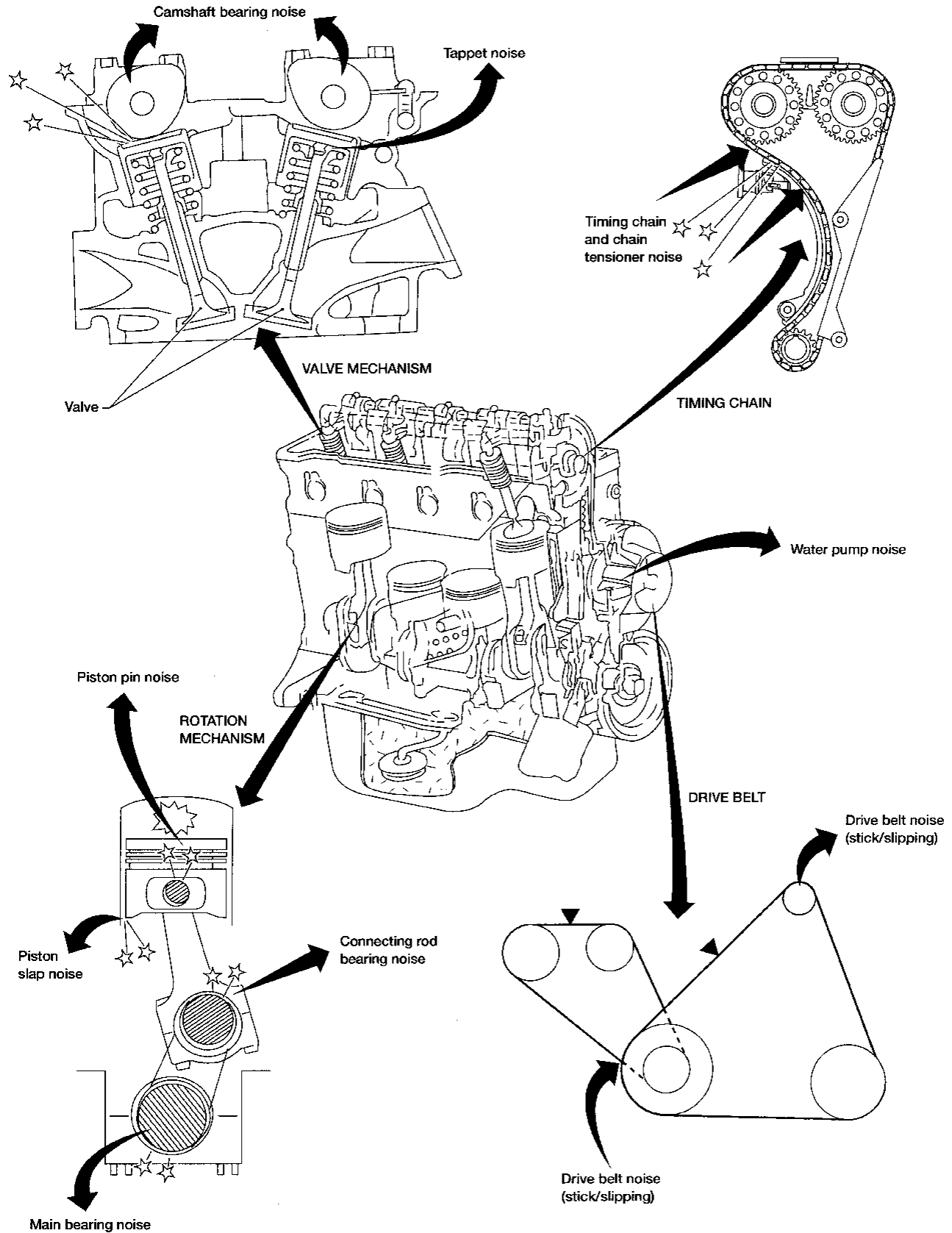
IDX

PREPARATION

Commercial Service Tools

| Tool name | Description | | | | | | |
|-----------------------|--|------------------|--|----------------|-----------------------|----------------|---------------------------|
| Spark plug wrench |  <p>16 mm (0.63 in)</p> <p>NT047</p> <p>Removing and installing spark plug</p> | | | | | | |
| Valve seat cutter set |  <p>NT048</p> <p>Finishing valve seat dimensions</p> | | | | | | |
| Piston ring expander |  <p>NT030</p> <p>Removing and installing piston ring</p> | | | | | | |
| Valve guide drift |  <p>NT015</p> <table border="1"> <thead> <tr> <th colspan="2">Intake & Exhaust</th></tr> </thead> <tbody> <tr> <td>a</td><td>9.5 mm (0.374 in) dia</td></tr> <tr> <td>b</td><td>5.0 mm (0.197 in) dia</td></tr> </tbody> </table> <p>Removing and installing valve guide</p> | Intake & Exhaust | | a | 9.5 mm (0.374 in) dia | b | 5.0 mm (0.197 in) dia |
| Intake & Exhaust | | | | | | | |
| a | 9.5 mm (0.374 in) dia | | | | | | |
| b | 5.0 mm (0.197 in) dia | | | | | | |
| Valve guide reamer |  <p>NT016</p> <table border="1"> <thead> <tr> <th colspan="2">Intake & Exhaust</th></tr> </thead> <tbody> <tr> <td>d₁</td><td>6.0 mm (0.236 in) dia</td></tr> <tr> <td>d₂</td><td>10.175 mm (0.4006 in) dia</td></tr> </tbody> </table> <p>Reaming valve guide ① or hole for oversize valve guide ②</p> | Intake & Exhaust | | d ₁ | 6.0 mm (0.236 in) dia | d ₂ | 10.175 mm (0.4006 in) dia |
| Intake & Exhaust | | | | | | | |
| d ₁ | 6.0 mm (0.236 in) dia | | | | | | |
| d ₂ | 10.175 mm (0.4006 in) dia | | | | | | |
| Front oil seal drift |  <p>NT049</p> <p>a: 75 mm (2.95 in) dia. b: 45 mm (1.77 in) dia.</p> <p>Installing front oil seal</p> | | | | | | |
| Rear oil seal drift |  <p>NT049</p> <p>a: 110 mm (4.33 in) dia. b: 80 mm (3.15 in) dia.</p> <p>Installing rear oil seal</p> | | | | | | |

NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING



GI

MA

EM

LC

EC

FE

CL

MT

AT

FA

RA

BR

ST

RS

BT

HA

EL

IDX

NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING

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

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

If necessary, repair or replace these parts.

NVH Troubleshooting — Engine Noise

| Location of noise | Type of noise | Operating condition of engine. | | | | | | Source of noise | Check item | Reference page |
|---|----------------------|--------------------------------|---------------|---------------|-------------|-------------|---------------|--|--|---|
| | | Before warm-up | After warm-up | When starting | When idling | When racing | While driving | | | |
| Top of Engine rocker cover Cylinder head | Ticking or clicking | C | A | — | A | B | — | Tappet noise | Hydraulic lash adjuster | EM-46, 48 |
| | Rattle | C | A | — | A | B | C | Camshaft bearing noise | Camshaft journal clearance Camshaft runout | EM-39, 40 |
| Crankshaft Pulley Cylinder block (Side of engine) Oil pan | Slap or knock | — | A | — | B | B | — | Piston pin noise | Piston and piston pin clearance Connecting rod bushing clearance | EM-54, 60 |
| | Slap or rap | A | — | — | B | B | A | Piston slap noise | Piston-to-bore clearance Piston ring side clearance Piston ring end gap Connecting rod bend and torsion | EM-55, 56 |
| | Knock | A | B | C | B | B | B | Connecting rod-bearing noise | Connecting rod bushing clearance (Small end) Connecting rod bearing clearance (Big end) | EM-59, 60 |
| | Knock | A | B | — | A | B | C | Main bearing noise | Main bearing oil clearance Crankshaft runout | EM-57, 58 |
| Front of engine Timing chain cover | Tapping or ticking | A | A | — | B | B | B | Timing chain and chain tensioner noise | Timing chain cracks and wear | EM-23 |
| Front of engine | Squeaking or fizzing | A | B | — | B | — | C | Other drive belts (sticking or slipping) | Drive belt deflection | MA Section ("Checking Drive Belts", "ENGINE MAINTENANCE") |
| | Creaking | A | B | A | B | A | B | Other drive belts (slipping) | Idler pulley bearing operation | |
| | Squall or creak | A | B | — | B | A | B | Water pump noise | Water pump operation | LC Section ("Water Pump Inspection", "ENGINE COOLING SYSTEM") |

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

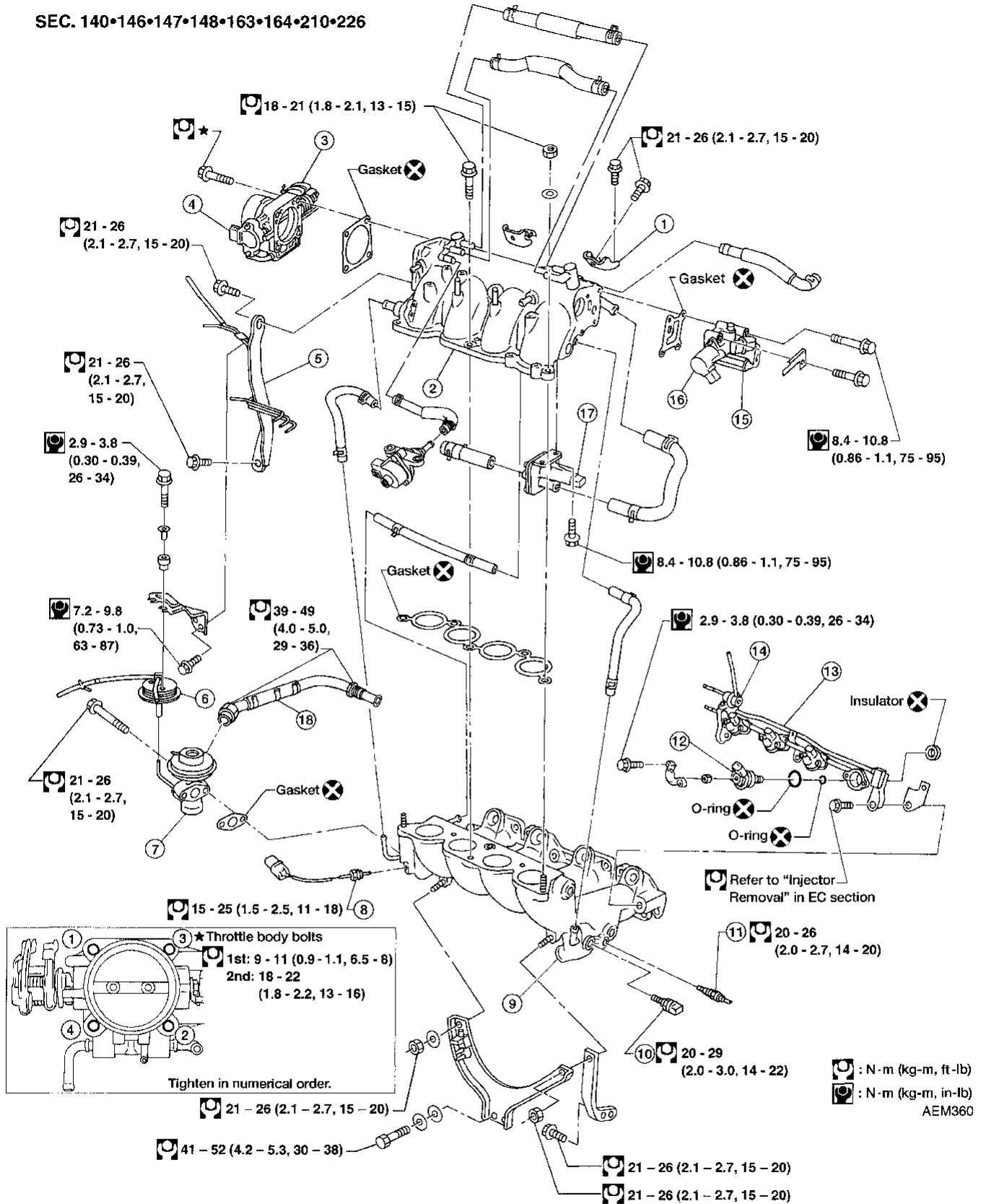
GI
MA
EM
LC
EC
FE
CL
MT
AT
FA
RA
BR
ST
RS
BT
HA
EL
IDX

EM



OUTER COMPONENT PARTS

SEC. 140•146•147•148•163•164•210•226



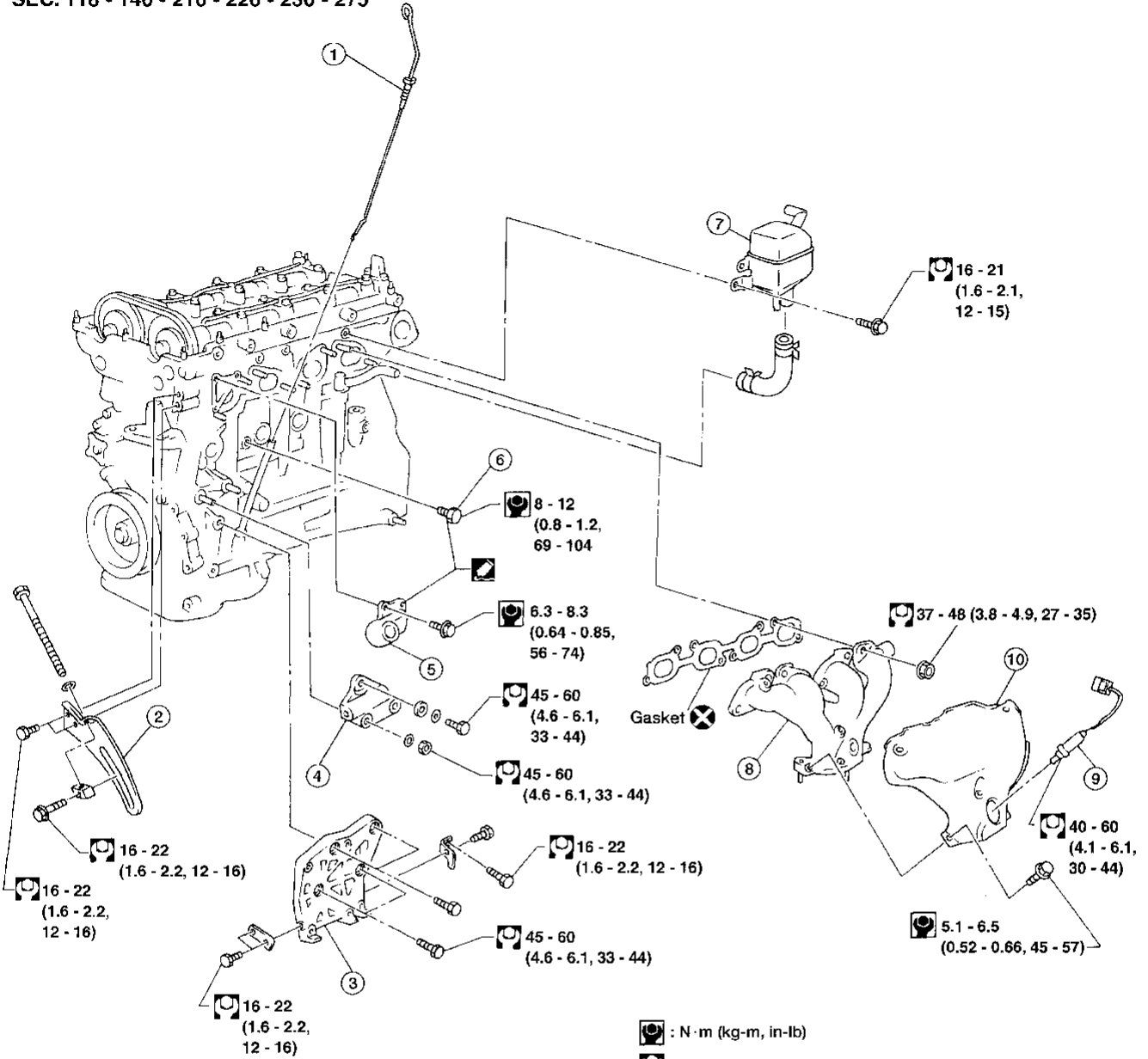
- ① Intake manifold collector support
- ② Intake manifold collector
- ③ Throttle body
- ④ Throttle position sensor
- ⑤ Intake manifold collector support
- ⑥ EGRC-BPT valve

- ⑦ EGR valve
- ⑧ EGR temperature sensor
- ⑨ Intake manifold
- ⑩ Engine coolant temperature sensor
- ⑪ Thermal transmitter
- ⑫ Injector

- ⑬ Fuel tube assembly
- ⑭ Pressure regulator
- ⑮ IACV-FICD solenoid valve
- ⑯ IACV-AAC valve
- ⑰ IACV-air regulator
- ⑱ EGR tube

OUTER COMPONENT PARTS

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



GI

MA

EM

LC

EC

FE

CL

MT

AT

FA

RA

BR

ST

RS

BT

HA

EL

IDX

AEM346

- ① Oil level gauge
- ② Generator adjusting bar
- ③ A/C compressor bracket
- ④ Generator bracket

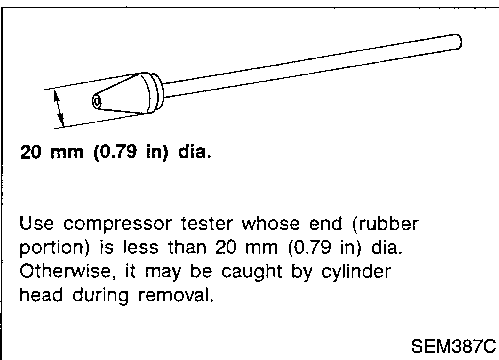
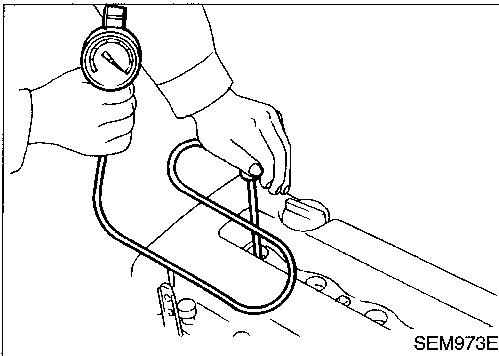
- ⑤ Water outlet
- ⑥ Cylinder block drain plug
- ⑦ Crankcase ventilation oil separator

- ⑧ Exhaust manifold
- ⑨ Front heated oxygen sensor
- ⑩ Exhaust manifold cover

COMPRESSION PRESSURE

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-67. If valve or valve seat is damaged excessively, replace them.**
 - **If compression stays low in two cylinders that are next to each other:**
 - a. **The cylinder head gasket may be leaking, or**
 - b. **Both cylinders may have valve component damage. Inspect and repair as necessary.**

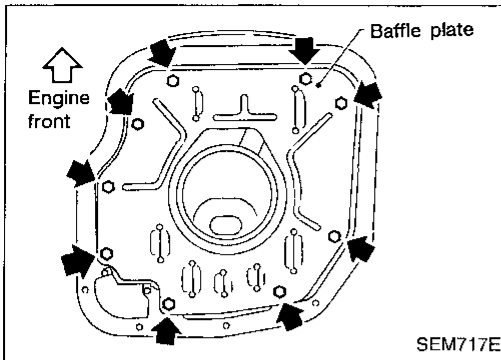
OX



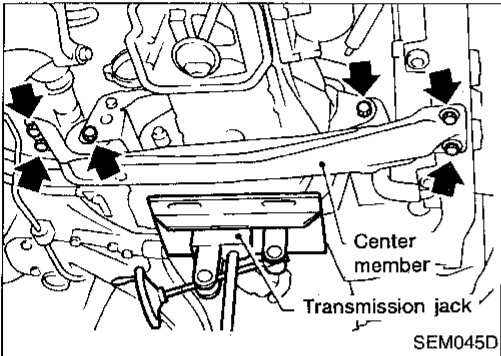
OIL PAN

Removal (Cont'd)

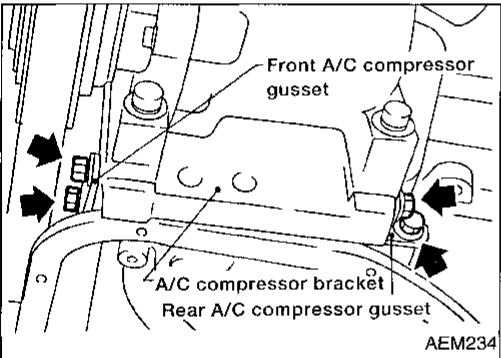
5. Remove baffle plate.



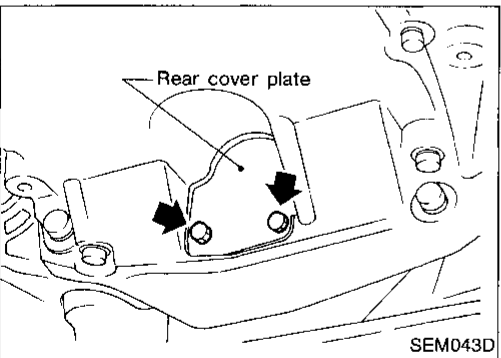
6. Remove front exhaust tube. Refer to FE section ("EXHAUST SYSTEM").
7. Set a suitable transmission jack under transaxle and lift engine with engine slinger.
8. Remove center member.
9. Remove A/T control cable.



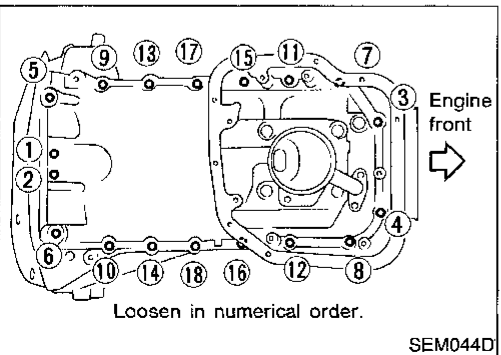
10. Remove A/C compressor gussets.



11. Remove rear cover plate.

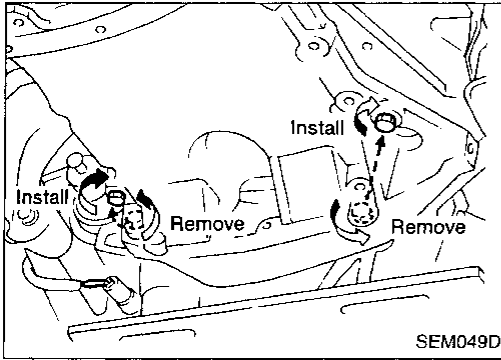


12. Remove aluminum oil pan bolts in numerical order.



OIL PAN

Removal (Cont'd)

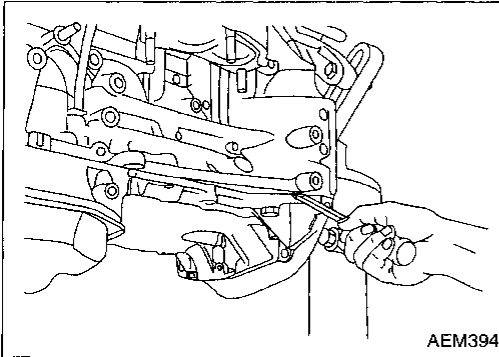


13. Remove two engine-to-transaxle bolts and install them into open bolt holes as shown. Tighten both bolts to separate aluminum oil pan from cylinder block.

GI

MA

EM

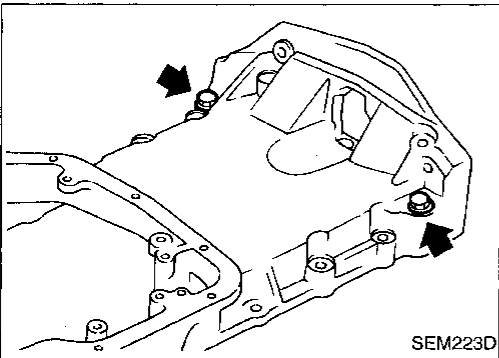


14. Remove aluminum oil pan.
- Insert Tool between cylinder block and aluminum oil pan.
 - Be careful not to damage aluminum mating surface.
 - Do not insert screwdriver, or oil pan flange will be damaged.
 - Slide Tool by tapping on the side of the Tool with a hammer.

LC

EC

FE



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

CL

MT

AT

FA

RA

BR

ST

RS

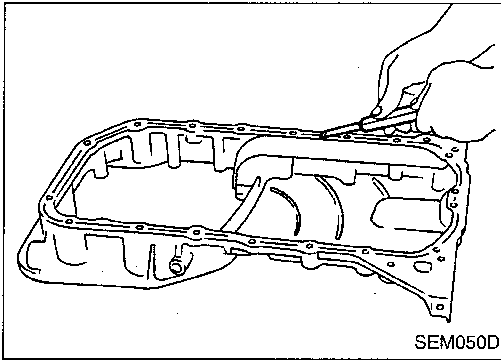
BT

HA

EL

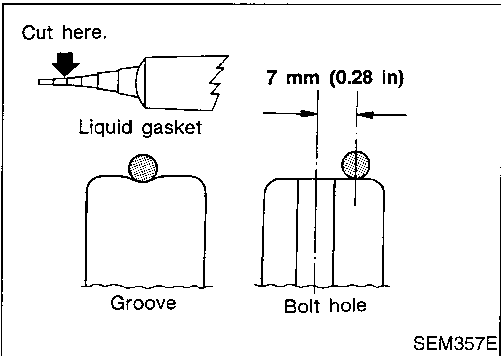
IDX

OIL PAN

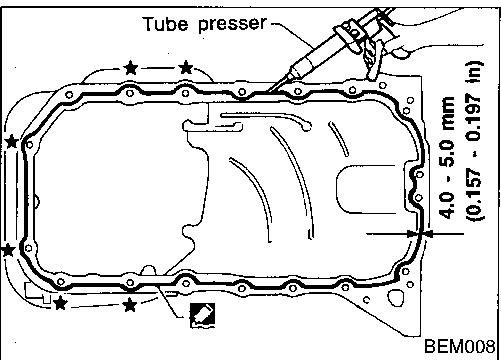


Installation

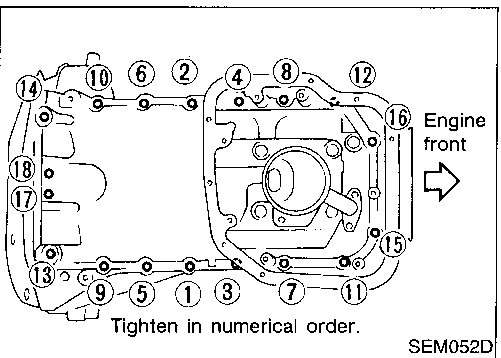
1. Install aluminum oil pan.
 - a. Use a scraper to remove old liquid gasket from mating surfaces.
 - Also remove old liquid gasket from mating surfaces of cylinder block and front cover.



- b. Apply a continuous bead of liquid gasket to mating surface of aluminum oil pan.
 - Use Genuine RTV silicone sealant Part No. 999 MP-A7007, Three Bond TB1207D or equivalent.
 - Apply to groove on mating surface.
 - Allow 7 mm (0.28 in) clearance around bolt holes.



- 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.



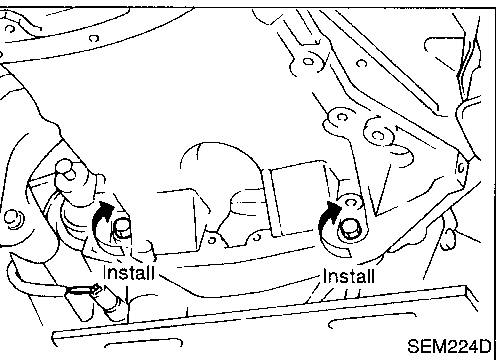
- c. Tighten nuts and bolts in numerical order.

Bolts ① - ⑩ :

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

Bolts ⑪ , ⑫ :

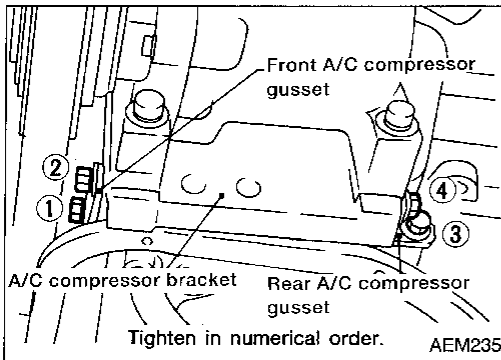
Ⓑ: 6.4 - 7.5 N·m (0.65 - 0.76 kg-m, 56.4 - 66.0 in-lb)



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.

OIL PAN

Installation (Cont'd)



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

GI

MA

EM

LC

EC

FE

CL

MT

AT

FA

RA

BR

ST

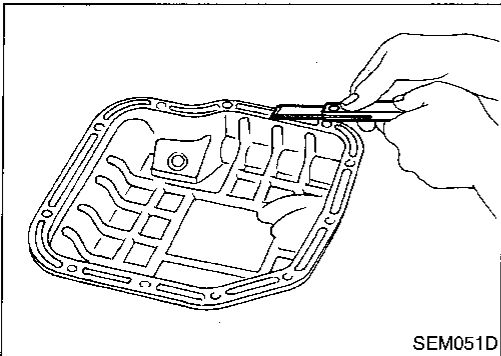
RS

BT

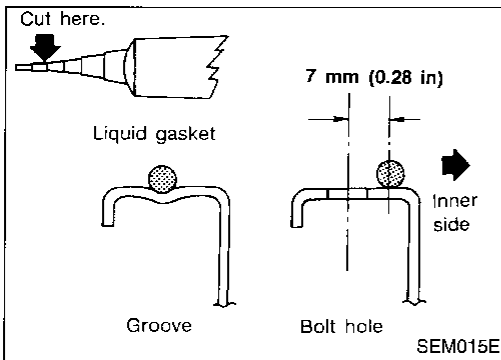
HA

EL

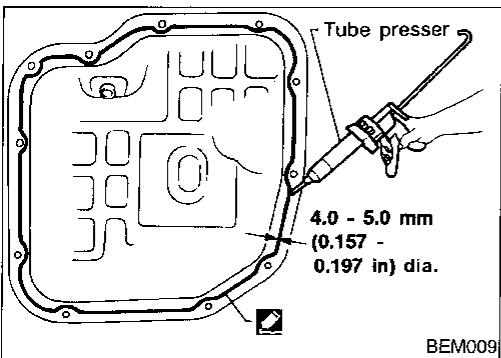
IDX



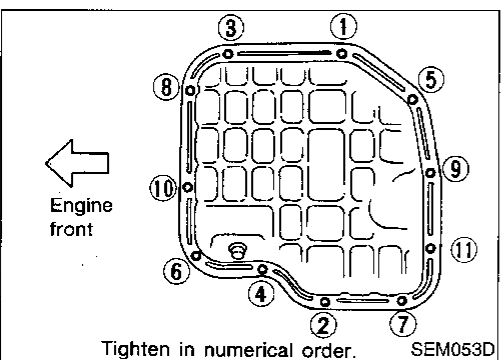
9. Install steel oil pan.
 - a. Use a scraper to remove old liquid gasket from mating surface of steel oil pan.
- Also remove old liquid gasket from mating surface of aluminum oil pan.



- b. Apply a continuous bead of liquid gasket to mating surface of steel oil pan.
 - Use **Genuine RTV silicone sealant Part No. 999 MP-A7007, Three Bond TB1207D or equivalent.**
 - Apply to groove on mating surface.
 - Allow 7 mm (0.28 in) clearance around bolt hole.



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



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

TIMING CHAIN

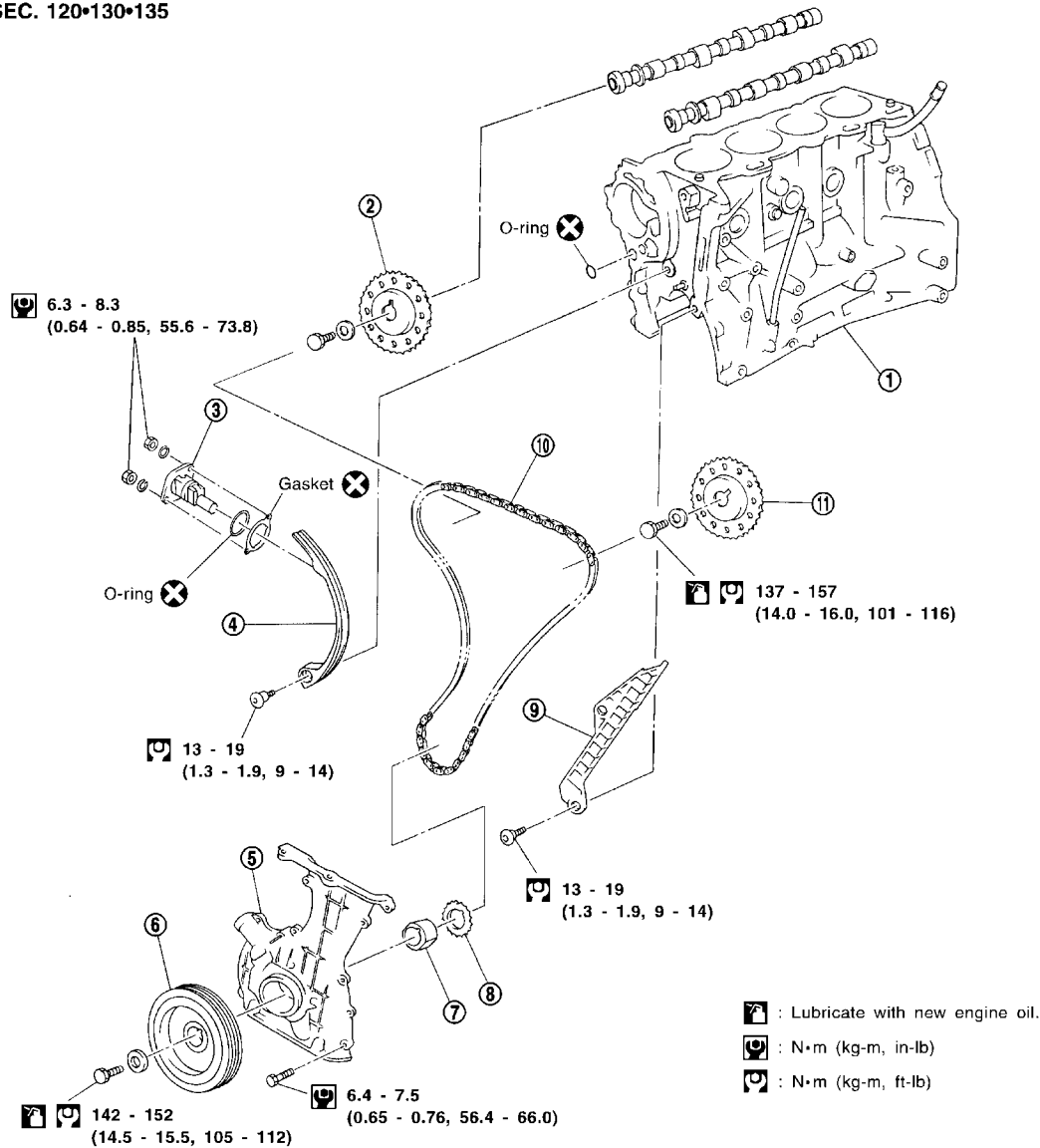
Components

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, camshaft sprockets, crankshaft pulley, and camshaft brackets.

SEC. 120•130•135



SEM081G

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

SMA99-029 This amendment replaces the existing service manual procedure for timing chain replacement on all 1991-99 models equipped with the SR20DE engine.

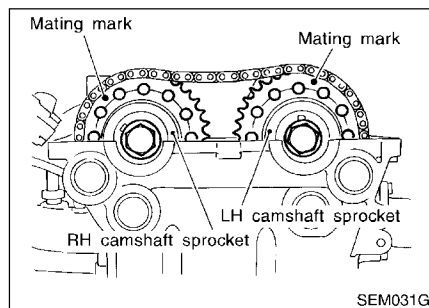
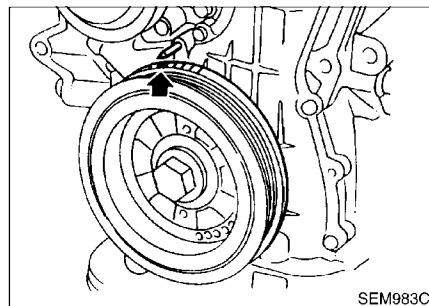
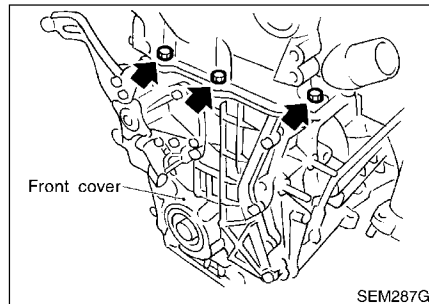
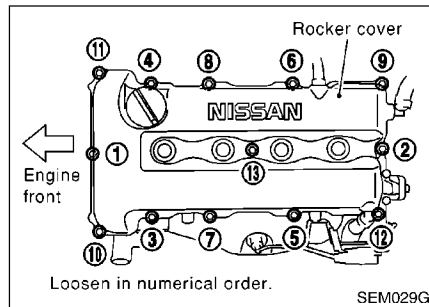
TP990742

TIMING CHAIN

Removal

NCEM0012

1. Remove engine under cover.
2. Remove front RH wheel and engine side cover.
3. Remove drive belts and water pump pulley.
4. Disconnect the following parts:
 - Vacuum hoses
 - Wires
 - Harness
 - Connectors
5. Remove rocker cover bolts in numerical order.
6. Remove rocker cover.



7. Remove cylinder head outside bolts.

8. 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.

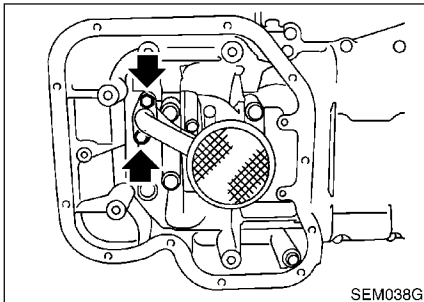
SMA99-029 This amendment replaces the existing service manual procedure for timing chain replacement on all 1991-99 models equipped with the SR20DE engine.

TP990743

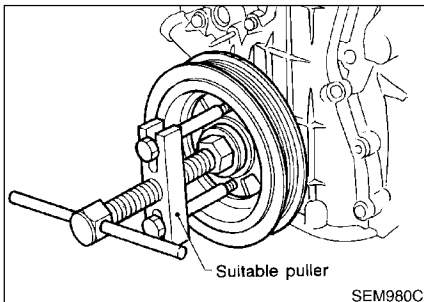
TIMING CHAIN

Removal (Cont'd)

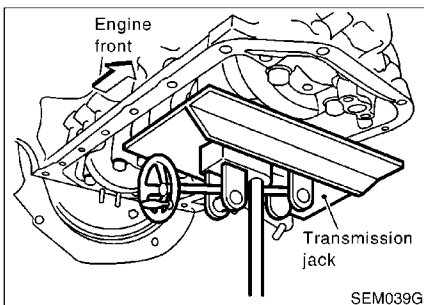
9. Remove oil pans.
Refer to original Service Manual.



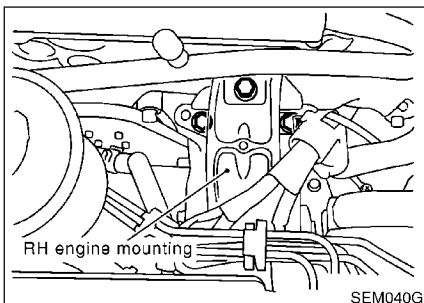
10. Remove oil strainer.
11. Temporarily install center member to support engine.



12. Remove crankshaft pulley.
13. Remove generator.
14. Remove A/C compressor and position it to the side.
15. Remove A/C bracket.
16. Remove generator bracket.



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

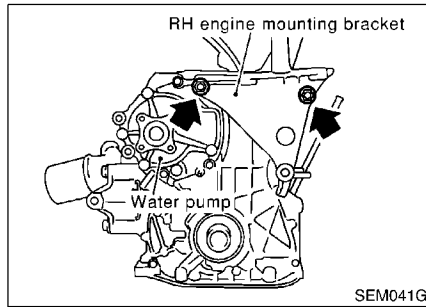


18. Remove RH engine mounting.

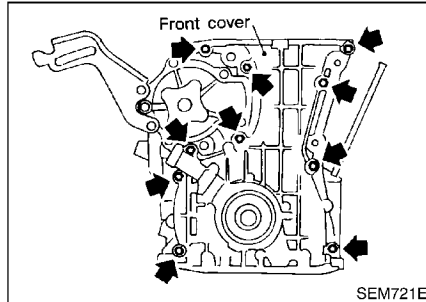
SMA99-029 This amendment replaces the existing service manual procedure for timing chain replacement on all 1991-99 models equipped with the SR20DE engine.

TP990744

TIMING CHAIN



19. Remove RH engine mounting bracket.



20. Remove oil pump drive spacer.

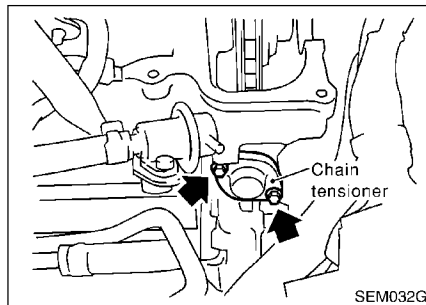
CAUTION:

Becareful not to damage oil pump drive spacer and front oil seal.

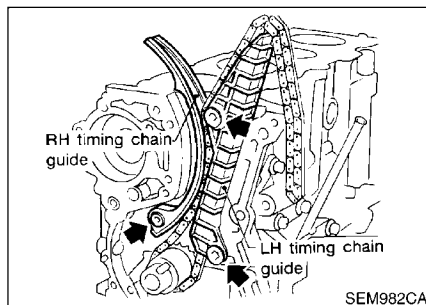
21. Remove front cover.

CAUTION:

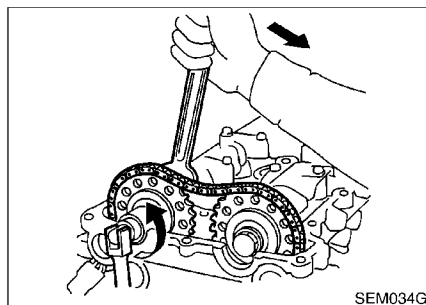
- **Becareful not to tear or damage the cylinder gasket.**
- **Inspect for oil leakage at front oil seal. Replace seal if oil leak is present.**



22. Remove chain tensioner.



23. Remove timing chain guides.



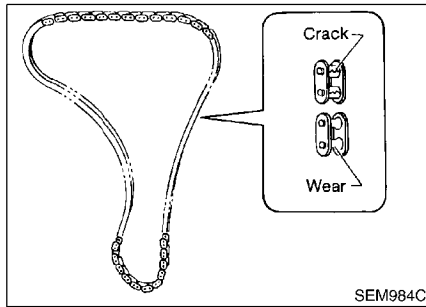
24. Remove camshaft sprockets.

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

25. Remove timing chain and crankshaft sprocket.

TIMING CHAIN

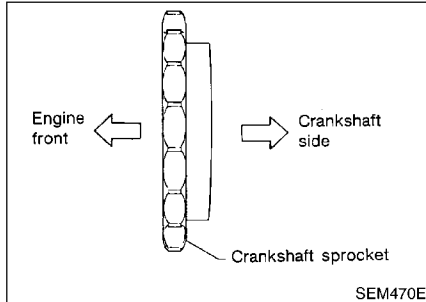
Inspection



Inspection

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

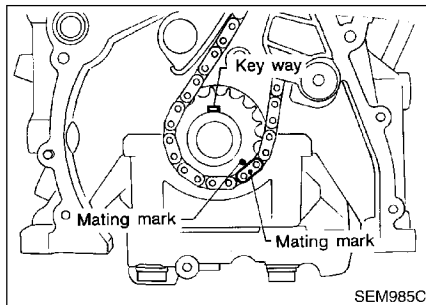
NCM0013



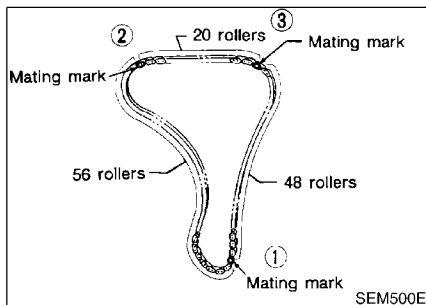
Installation

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

NCM0014



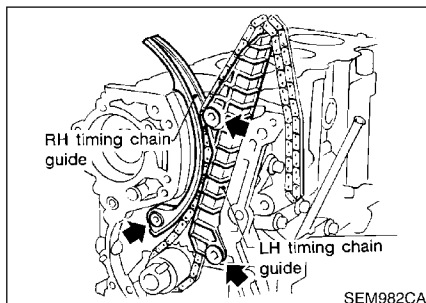
2. Position crankshaft so that No. 1 piston is set at TDC and key way is at 12 o'clock. Fit timing chain on crankshaft sprocket, aligning the mating marks.



- Mating mark color on timing chain.

1: Yellow

2, 3: Blue

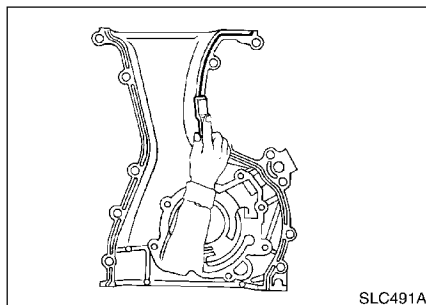
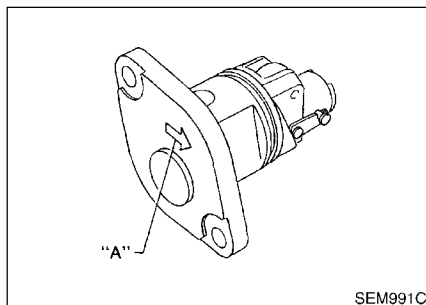
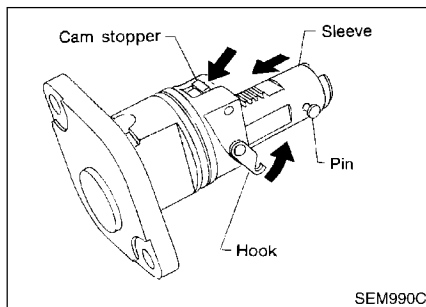
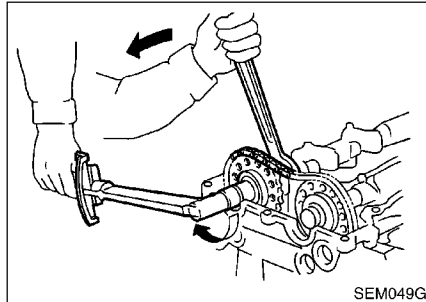
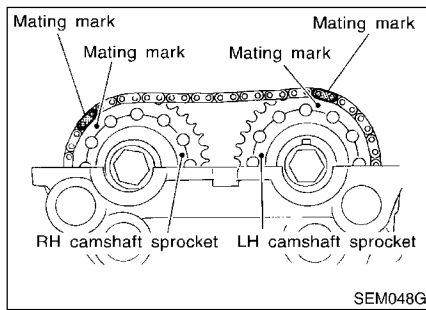


3. Install timing chain and timing chain guides.

SMA99-029 This amendment replaces the existing service manual procedure for timing chain replacement on all 1991-99 models equipped with the SR20DE engine.

TP990746

TIMING CHAIN



4. Install camshaft sprockets and timing chain on them.
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.

5. 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.

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

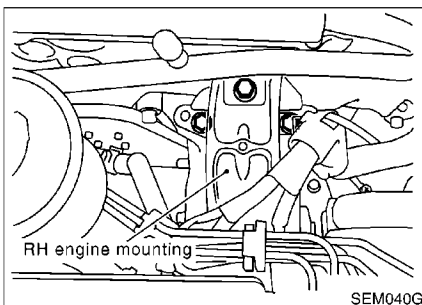
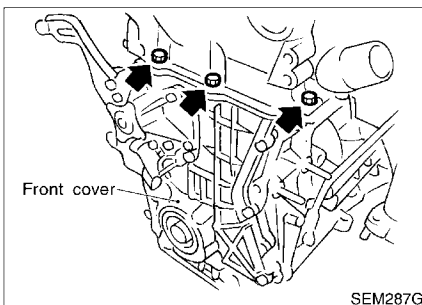
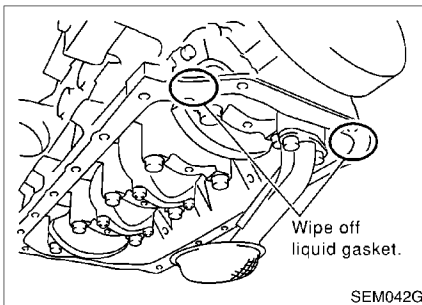
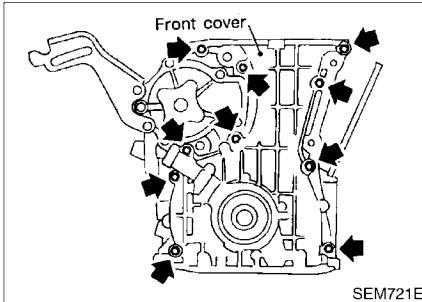
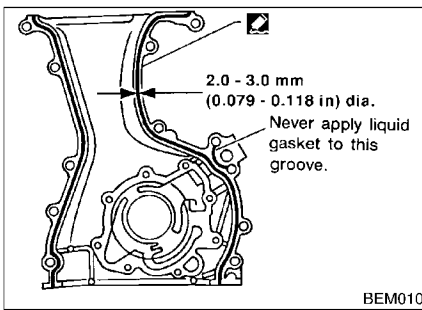
- **Also remove old liquid gasket from mating surface of cylinder block.**

SMA99-029 This amendment replaces the existing service manual procedure for timing chain replacement on all 1991-99 models equipped with the SR20DE engine.

TP990747

TIMING CHAIN

Installation (Cont'd)



7. Apply a continuous bead of liquid gasket to front cover.
Also apply liquid gasket to matching surface to cylinder head gasket.

- 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 "OIL SEAL" in original Service Manual.

8. Install oil pump drive spacer.
9. Install front cover.

- Wipe off excessive liquid gasket.

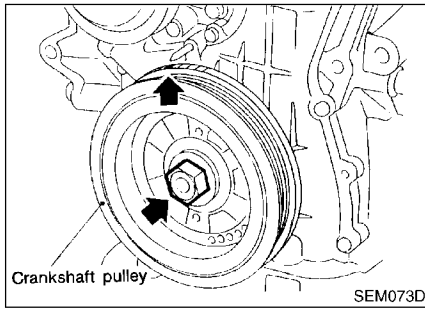
10. Install cylinder head outside bolts.

11. Install RH engine mounting and bracket.
12. Install generator bracket and generator.
13. Install A/C compressor bracket and compressor.

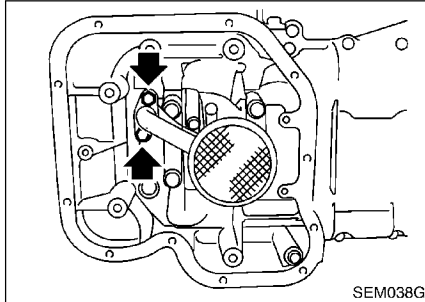
SMA99-029 This amendment replaces the existing service manual procedure for timing chain replacement on all 1991-99 models equipped with the SR20DE engine.

TP990748

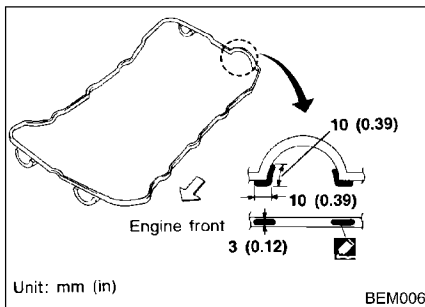
TIMING CHAIN



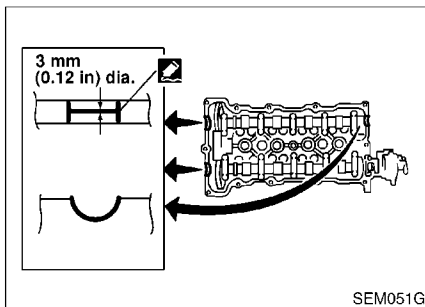
14. Install crankshaft pulley.
15. Set No. 1 piston at TDC of its compression stroke.



16. Install oil strainer.
17. Install oil pans.
Refer to original Service Manual.

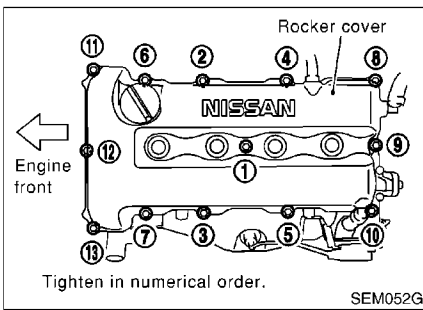


18. Remove old liquid gasket from mating surfaces of rocker cover and cylinder head.
19. Apply a continuous bead of liquid gasket to rocker cover gasket and cylinder head as shown in the illustrations.
 - Use Genuine RTV silicone sealant Part No. 999MP-A7007 or equivalent.



TIMING CHAIN

Installation (Cont'd)



20. 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)

21. Install the following parts:

- Spark plugs and leads
- Water pump pulley and drive belts.
For adjusting drive belt deflection, refer to MA section in original Service Manual, "Checking Drive Belts".
- Front RH wheel
- Engine under cover

22. Connect the following:

- Vacuum hoses
- Wire harnesses and connectors

**This page is intentionally blank due to a
revised procedure.
Continue to Page EM-33**

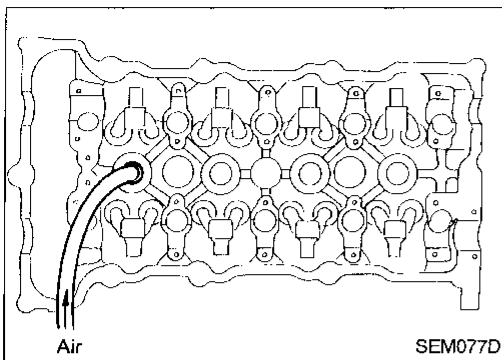
**This page is intentionally blank due to a
revised procedure.
Continue to Page EM-33**

**This page is intentionally blank due to a
revised procedure.
Continue to Page EM-33**

**This page is intentionally blank due to a
revised procedure.
Continue to Page EM-33**

**This page is intentionally blank due to a
revised procedure.
Continue to Page EM-33**

**This page is intentionally blank due to a
revised procedure.
Continue to Page EM-33**



Valve Oil Seal

1. Remove accelerator wire.
2. Remove rocker cover and oil separator.
3. Remove camshafts and sprockets. Refer to EM-18.
4. Remove spark plugs.
5. Install air hose adapter into spark plug hole and apply air pressure to hold valves in place. Apply a pressure of 490 kPa (5 kg/cm², 71 psi).
6. Remove rocker arm, rocker arm guide and shim.

GI

MA

EM

LC

EC

FE

CL

MT

AT

FA

RA

BR

ST

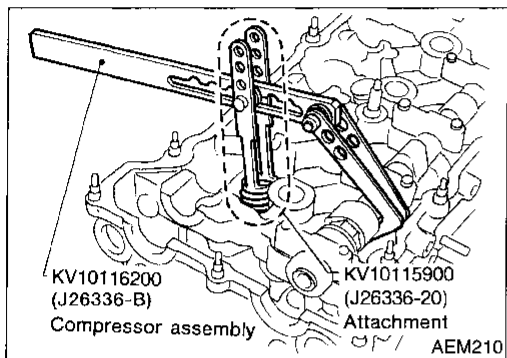
RS

BT

HA

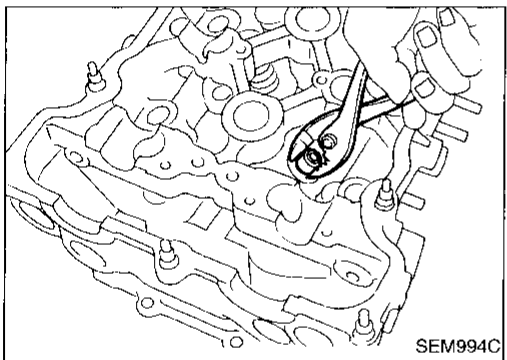
EL

IDX

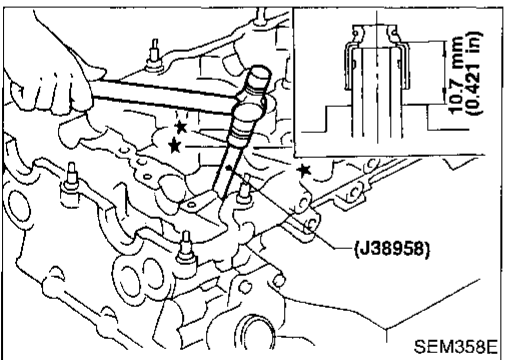


7. Remove valve spring with Tool. Temporarily install camshaft as shown.

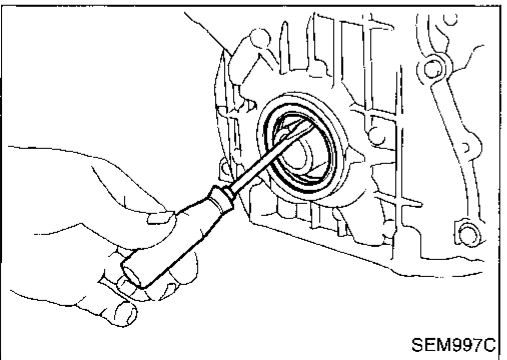
Piston concerned should be set at TDC to prevent valve from falling.



8. Remove valve oil seal with a suitable tool.



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



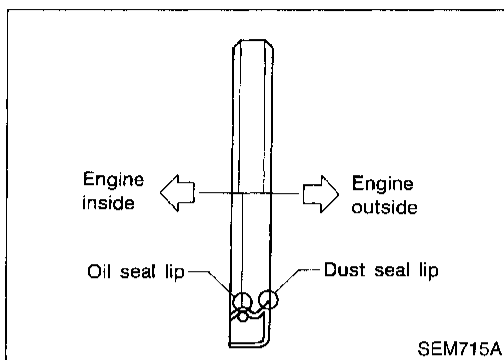
Front Oil Seal

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

Be careful not to scratch front cover.

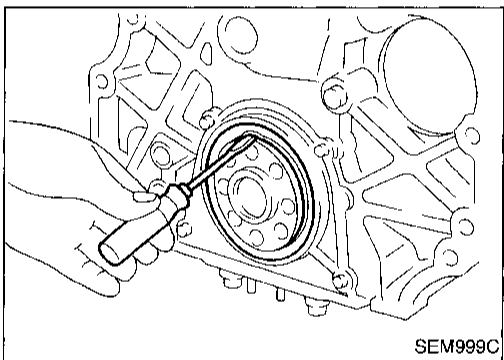
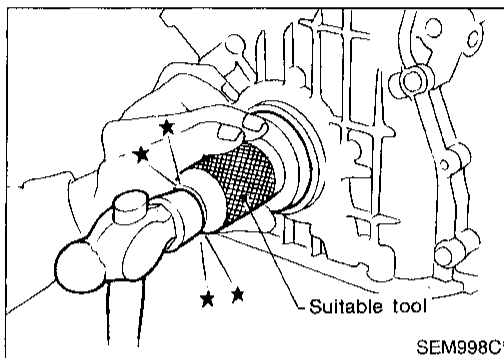
OIL SEAL REPLACEMENT

Front Oil Seal (Cont'd)



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

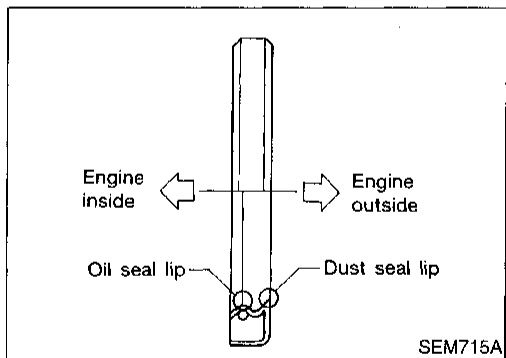
- **Install new oil seal in the direction shown.**



Rear Oil Seal

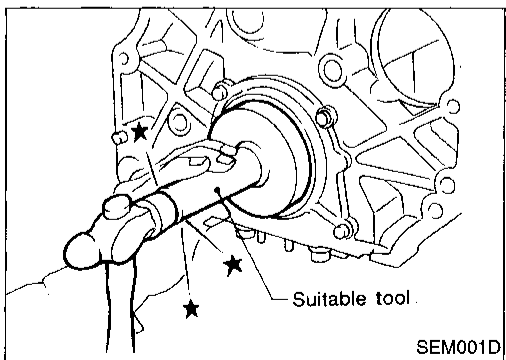
1. Remove transaxle. (Refer to MT or AT section.)
2. Remove flywheel or drive plate.
3. Remove rear oil seal.

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



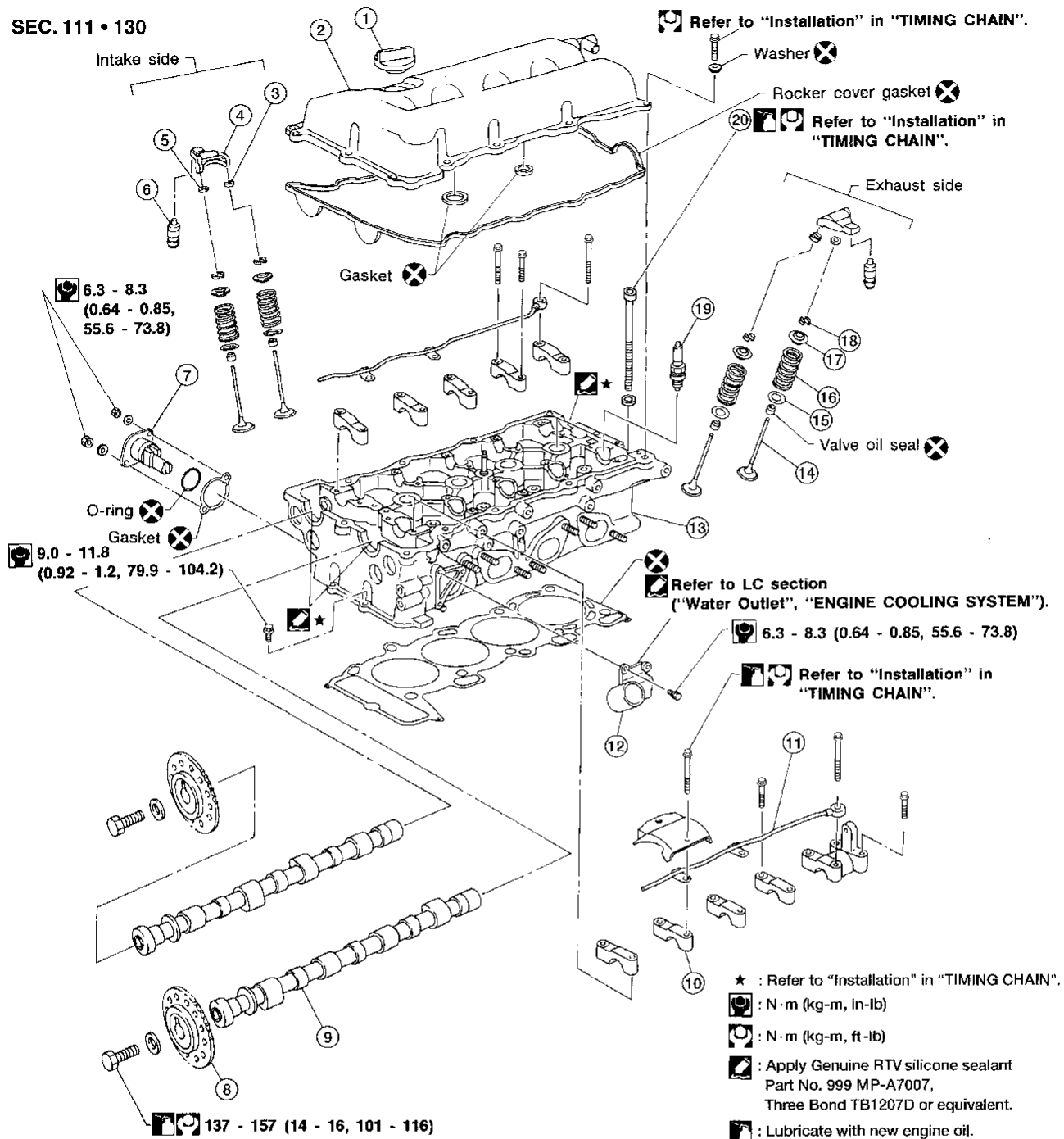
4. Apply new engine oil to new oil seal and install it using a suitable tool.

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



CYLINDER HEAD

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

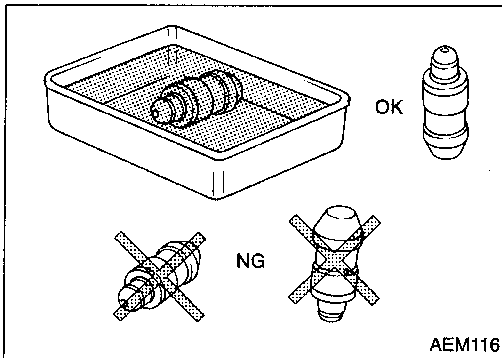
- ⑧ Camshaft sprocket
- ⑨ Camshaft
- ⑩ Camshaft bracket
- ⑪ Oil tube
- ⑫ Water outlet
- ⑬ Cylinder head
- ⑭ Valve

- ⑮ Valve spring seat
- ⑯ Valve spring
- ⑰ Valve spring retainer
- ⑱ Valve collet
- ⑲ Spark plug
- ⑳ Cylinder head bolt

CYLINDER HEAD

CAUTION:

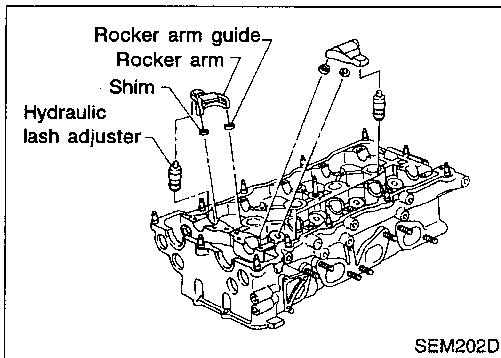
- When installing rocker arms, camshaft and oil seal, lubricate contacting surfaces with new engine oil.
- When tightening cylinder head bolts, camshaft sprocket bolts and camshaft bracket bolts, lubricate bolt threads and seat surfaces with new engine oil.



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

Removal

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

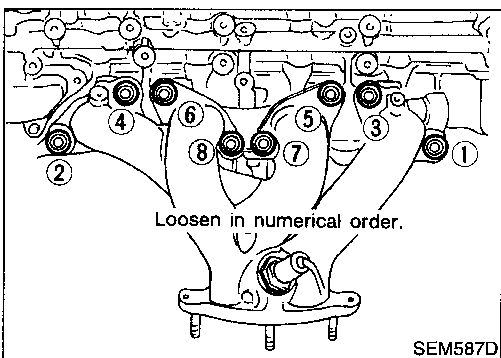


Disassembly

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

CAUTION:

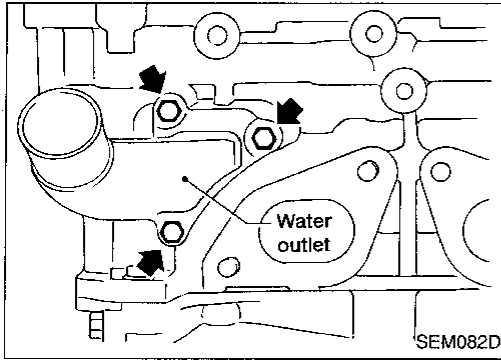
Keep parts in order so they can be installed in their original positions during assembly.



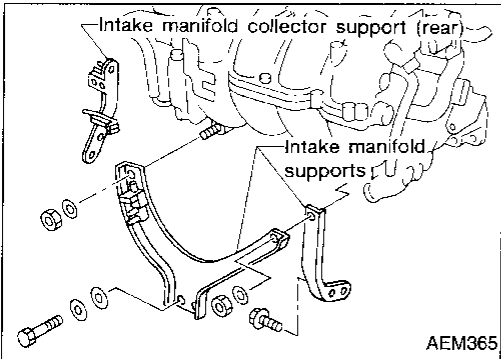
2. Remove exhaust manifold cover.
3. Remove exhaust manifold as shown.

CYLINDER HEAD

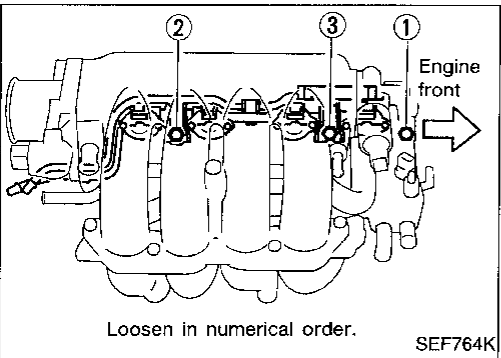
Disassembly (Cont'd)



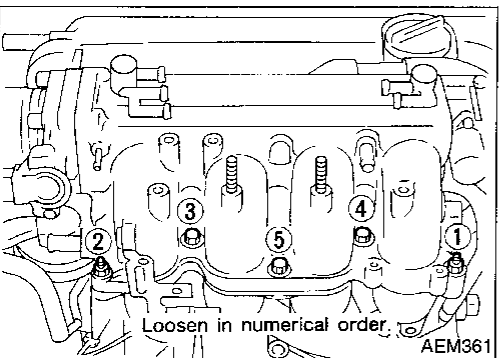
4. Remove water outlet.



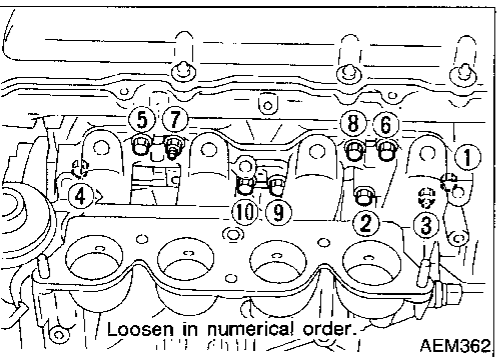
5. Remove intake manifold supports and intake manifold collector supports (both on rear and upper sides).



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.

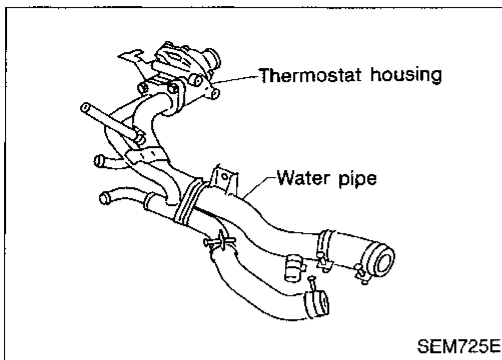


9. Remove intake manifold as shown.

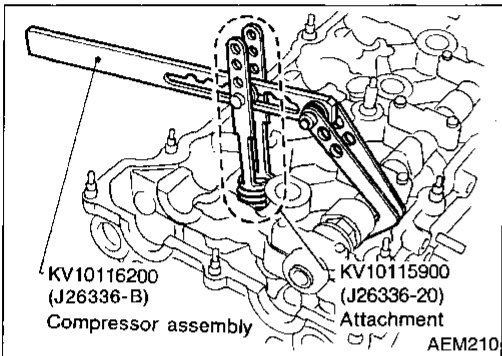
CYLINDER HEAD

Disassembly (Cont'd)

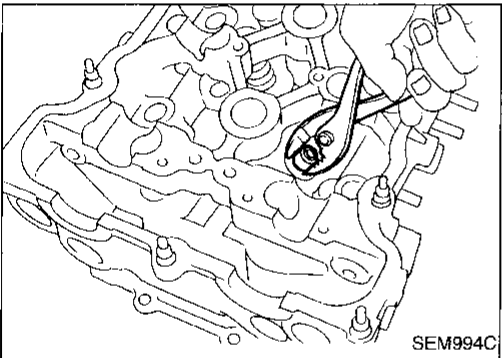
10. Remove thermostat housing with water pipe.



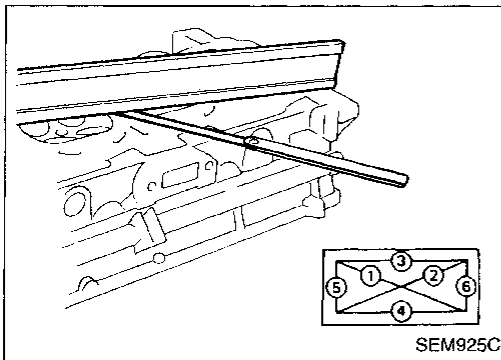
11. Remove valve components with Tool. Install camshaft temporarily.



12. Remove valve oil seal with a suitable tool.



CYLINDER HEAD



Inspection

CYLINDER HEAD DISTORTION

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

Head surface flatness:

Standard

Less than 0.03 mm (0.0012 in)

Limit

0.1 mm (0.004 in)

If beyond the specified limit, replace or resurface it.

Resurfacing limit:

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

Amount of cylinder head resurfacing is "A".

Amount of cylinder block resurfacing is "B".

The maximum limit is as follows:

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

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)

GI

MA

EM

LC

EC

FE

CL

MT

AT

FA

RA

BR

ST

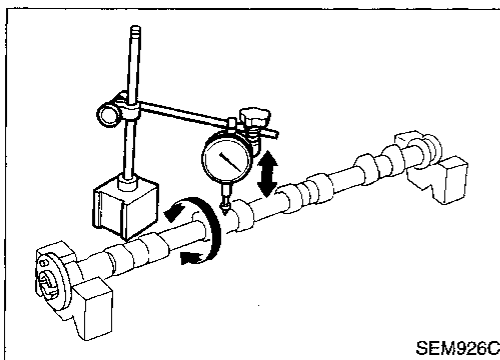
RS

BT

HA

EL

IDX



CAMSHAFT VISUAL CHECK

Check camshaft for scratches, seizure and wear.

CAMSHAFT RUNOUT

1. Measure camshaft runout at the center journal.

Runout (Total indicator reading):

Standard

Less than 0.02 mm (0.0008 in)

Limit

0.1 mm (0.004 in)

2. If it exceeds the limit, replace camshaft.

CAMSHAFT CAM HEIGHT

1. Measure camshaft cam height.

Standard cam height:

Intake

37.550 - 37.740 mm (1.4783 - 1.4858 in)

Exhaust

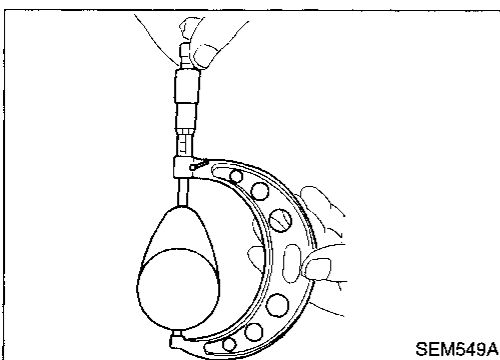
37.920 - 38.110 mm (1.4929 - 1.5004 in)

Cam height wear limit:

Intake & Exhaust

0.2 mm (0.008 in)

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



CYLINDER HEAD

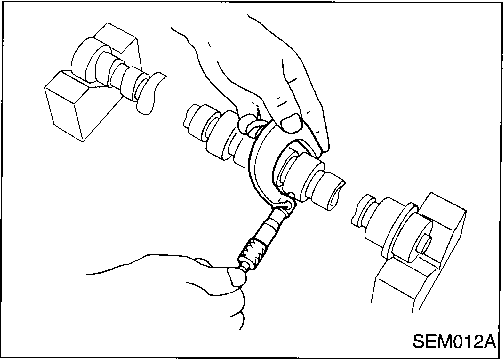
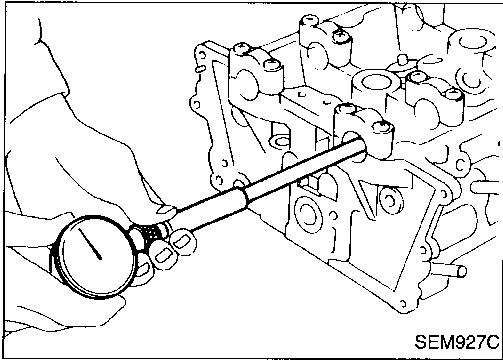
Inspection (Cont'd)

CAMSHAFT JOURNAL CLEARANCE

1. Install camshaft bracket and tighten bolts. Refer to EM-28.
2. Measure inner diameter of camshaft bearing.

Standard inner diameter:

28.000 - 28.021 mm (1.1024 - 1.1032 in)



3. Measure outer diameter of camshaft journal.

Standard outer diameter:

27.935 - 27.955 mm (1.0998 - 1.1006 in)

4. Calculate camshaft journal clearance.

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

Standard

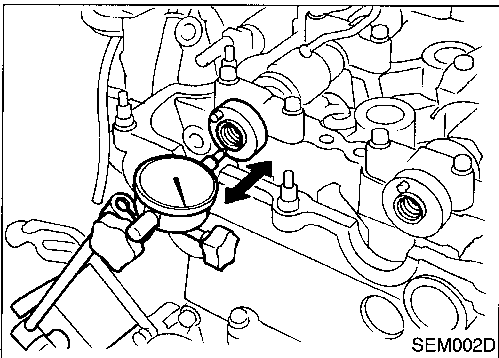
0.045 - 0.090 mm (0.0018 - 0.0035 in)

Limit

0.15 mm (0.0059 in)

5. If clearance exceeds the limit, replace camshaft and remeasure camshaft journal clearance.

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



CAMSHAFT END PLAY

1. Install camshaft in cylinder head. Refer to EM-29.
2. Measure camshaft end play.

Camshaft end play:

Standard

0.055 - 0.139 mm (0.0022 - 0.0055 in)

Limit

0.20 mm (0.0079 in)

3. If end play exceeds the limit, replace camshaft and remeasure camshaft end play.

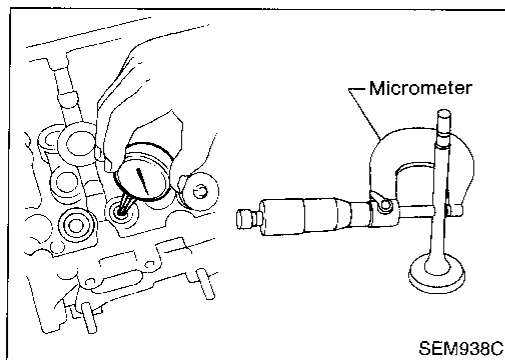
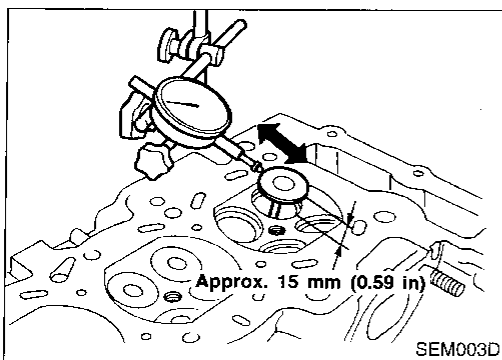
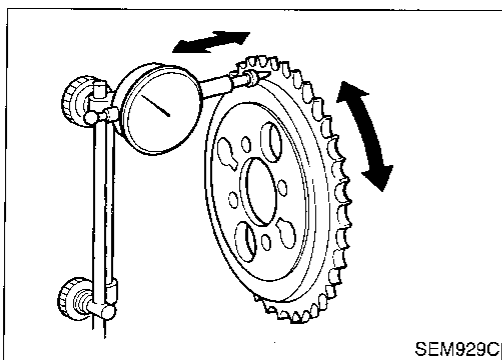
- If end play still exceeds the limit after replacing camshaft, replace cylinder head.

CYLINDER HEAD

Inspection (Cont'd)

CAMSHAFT SPROCKET RUNOUT

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

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)

2. If it exceeds the limit, check valve to valve guide clearance.
 - a. Measure valve stem diameter and valve guide inner diameter.
 - b. Calculate valve to valve guide clearance.

Valve to valve guide clearance = valve guide inner diameter – valve stem diameter:

Standard

Intake 0.020 - 0.053 mm (0.0008 - 0.0021 in)

Exhaust 0.040 - 0.073 mm (0.0016 - 0.0029 in)

Limit

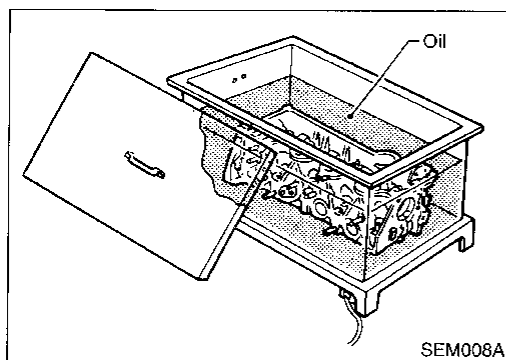
Intake 0.08 mm (0.0031 in)

Exhaust 0.1 mm (0.004 in)

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

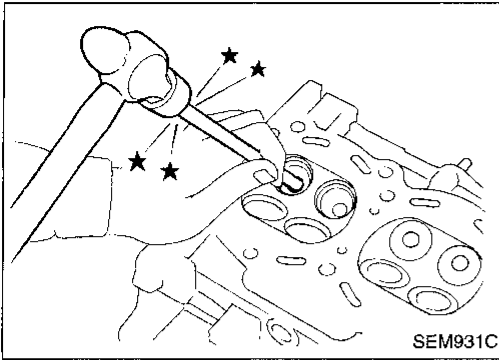
VALVE GUIDE REPLACEMENT

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

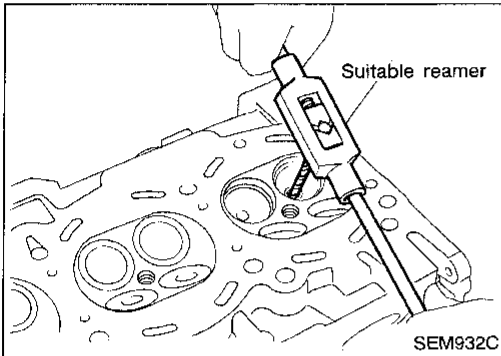


CYLINDER HEAD

Inspection (Cont'd)



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

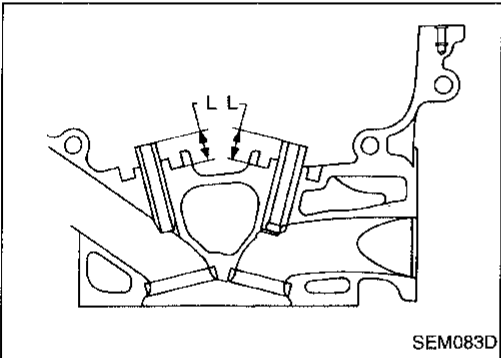


3. Ream cylinder head valve guide hole.

**Valve guide hole diameter
(for service parts):**

Intake & Exhaust

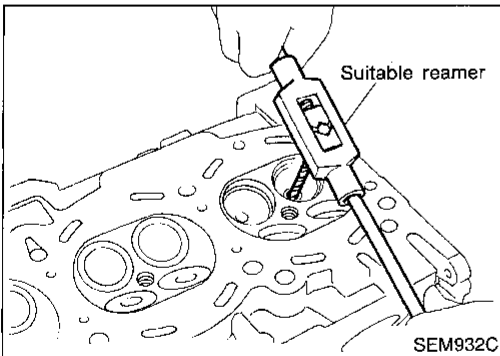
10.175 - 10.196 mm (0.4006 - 0.4014 in)



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

Projection "L":

14.0 - 14.2 mm (0.551 - 0.559 in)

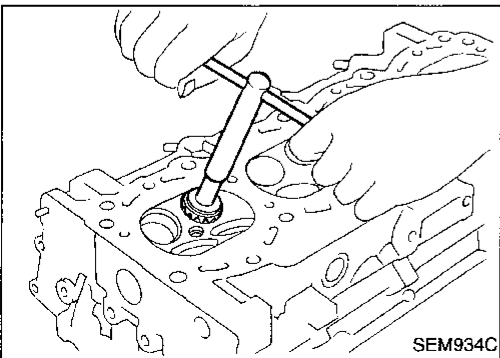


5. Ream valve guide.

Finished size:

Intake & Exhaust

6.000 - 6.018 mm (0.2362 - 0.2369 in)



VALVE SEATS

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

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

CYLINDER HEAD

Inspection (Cont'd)

REPLACING VALVE SEAT FOR SERVICE PARTS

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

2. Ream cylinder head recess.

Reaming bore for service valve seat

Oversize [0.5 mm (0.020 in)]:

Intake 35.500 - 35.516 mm (1.3976 - 1.3983 in)

Exhaust 31.500 - 31.516 mm (1.2402 - 1.2408 in)

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

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

5. Cut or grind valve seat to the specified dimensions using a suitable tool. Refer to SDS, EM-67.
6. After cutting, lap valve seat with abrasive compound.
7. Check valve seating condition.

Seat face angle "α":

44°53' - 45°07'

Contacting width "W":

Intake

1.05 - 1.35 mm (0.0413 - 0.0531 in)

Exhaust

1.25 - 1.55 mm (0.0492 - 0.0610 in)

8. Use a depth gauge to measure the distance between the mounting surface of the cylinder head spring seat and the valve stem end.

If the distance is shorter than specified, repeat step 5 above to adjust it.

If it is longer, replace the valve seat with a new one.

Valve seat resurface limit

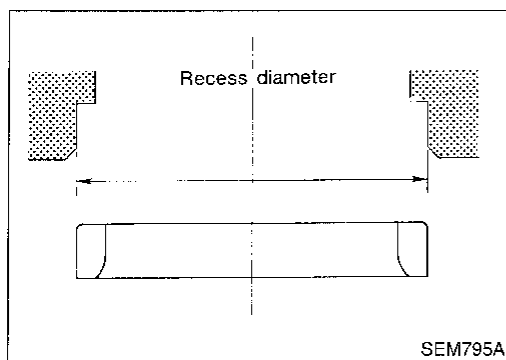
42.74 - 43.26 mm (1.6827 - 1.7031 in)

VALVE DIMENSIONS

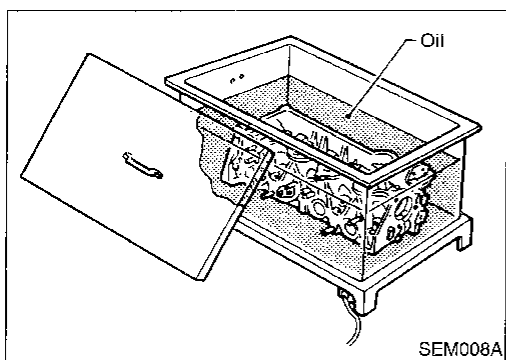
Check dimensions of each valve. Refer to SDS, EM-66.

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

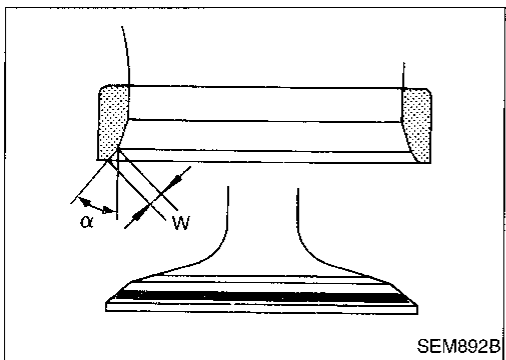
Grinding allowance for valve stem tip is 0.2 mm (0.008 in) or less.



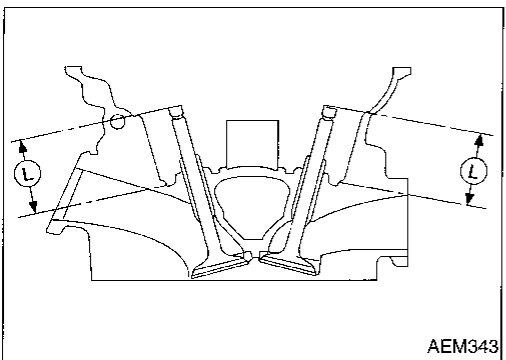
SEM795A



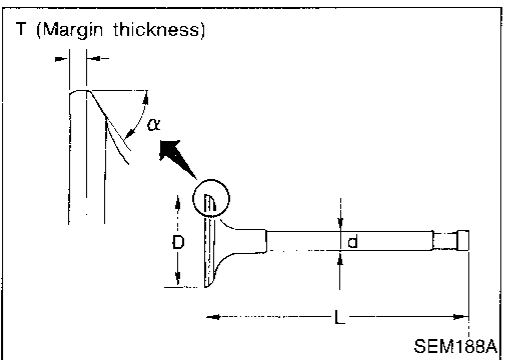
SEM008A



SEM892B



AEM343



SEM188A

CYLINDER HEAD

Inspection (Cont'd)

VALVE SPRING

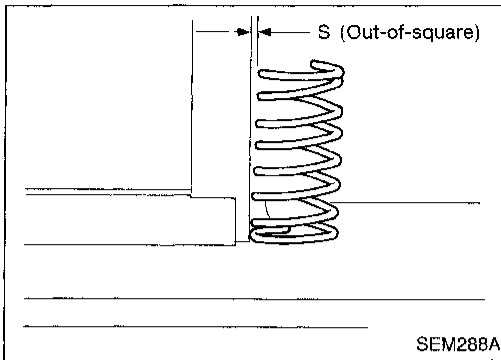
Squareness

1. Measure dimension "S".

Out-of-square "S":

Less than 2.2 mm (0.087 in)

2. If it exceeds the limit, replace spring.



Pressure

Check valve spring pressure at specified spring height.

Pressure:

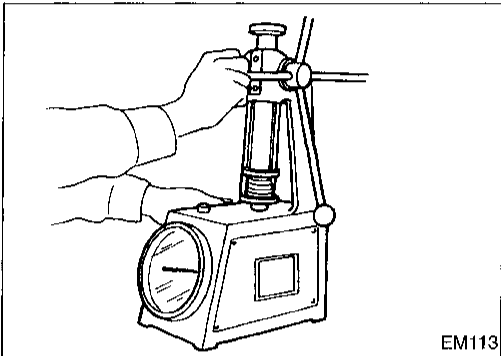
Standard

**578.02 - 641.57 N (58.94 - 65.42 kg,
129.96 - 144.25 lb) at 30.0 mm (1.181 in)**

Limit

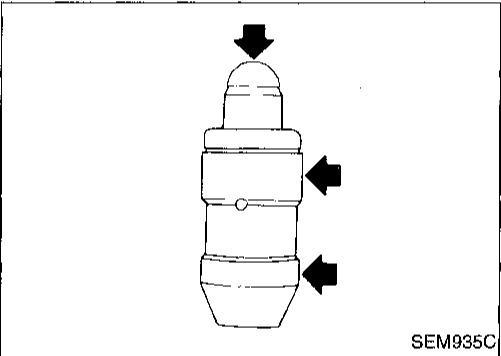
**More than 549.2 N (56.0 kg, 123.5 lb) at 30.0
mm (1.181 in)**

If it exceeds the limit, replace spring.



HYDRAULIC LASH ADJUSTER

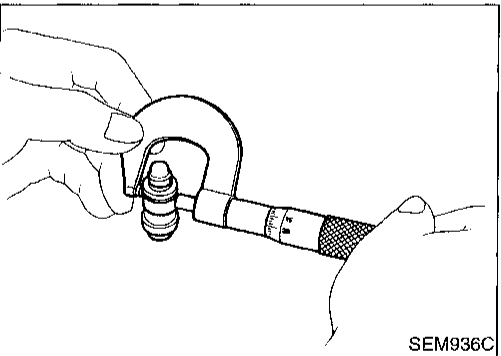
1. Check contact and sliding surfaces for wear or score.



2. Check diameter of lash adjuster.

Outer diameter:

16.980 - 16.993 mm (0.6685 - 0.6690 in)



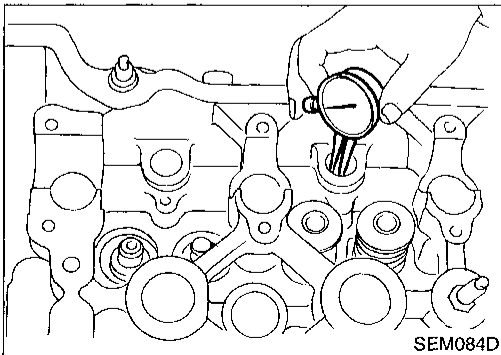
3. Check lash adjuster guide hole diameter.

Inner diameter:

17.000 - 17.020 mm (0.6693 - 0.6701 in)

**Standard clearance between lash adjuster and
adjuster guide hole:**

0.007 - 0.040 mm (0.0003 - 0.0016 in)



CYLINDER HEAD

Inspection (Cont'd)

ROCKER ARM, SHIM AND ROCKER ARM GUIDE

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

GI

MA

EM

LC

EC

FE

CL

MT

AT

FA

RA

BR

ST

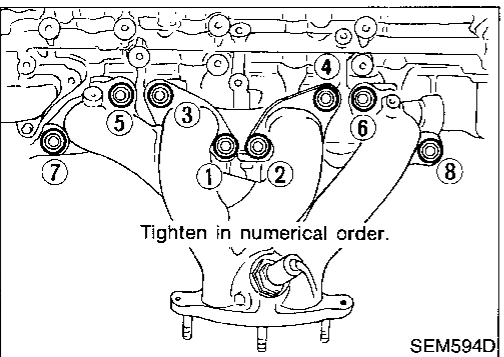
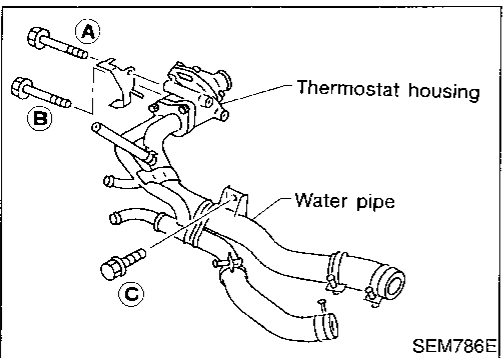
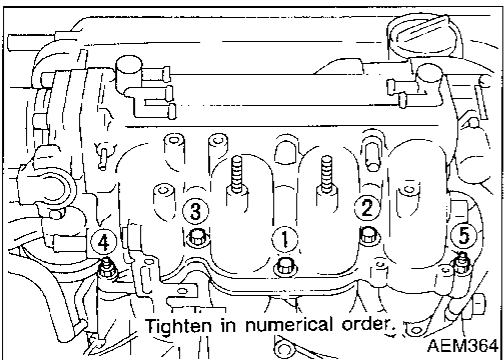
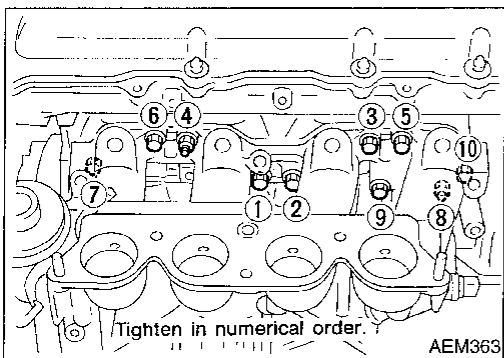
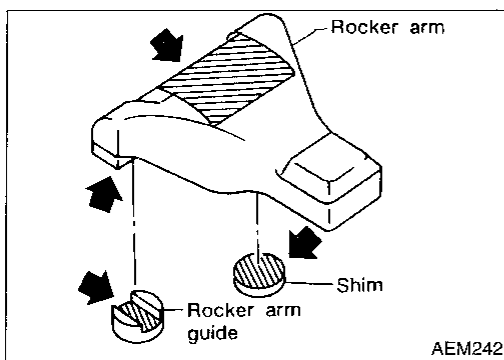
RS

BT

HA

EL

IDX



Assembly

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

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

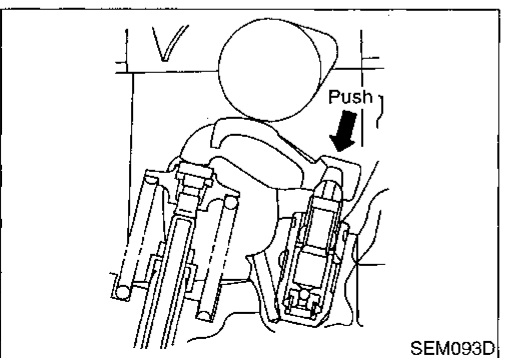
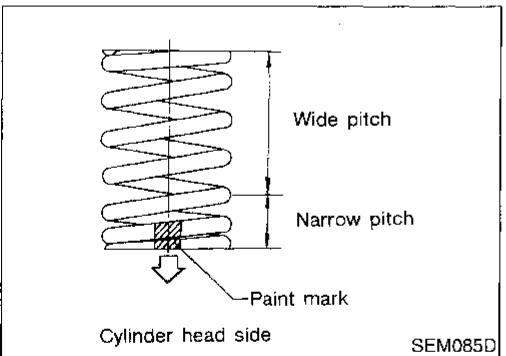
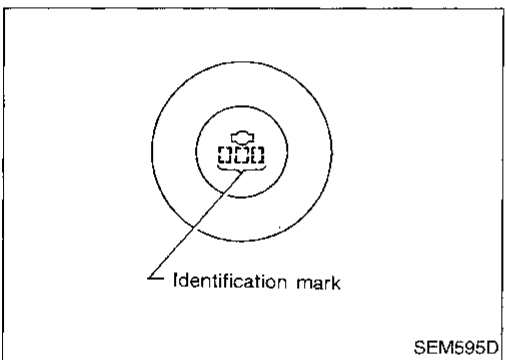
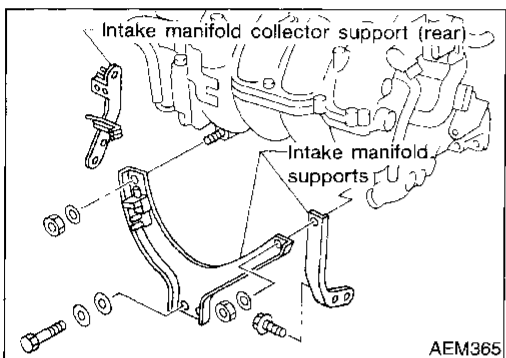
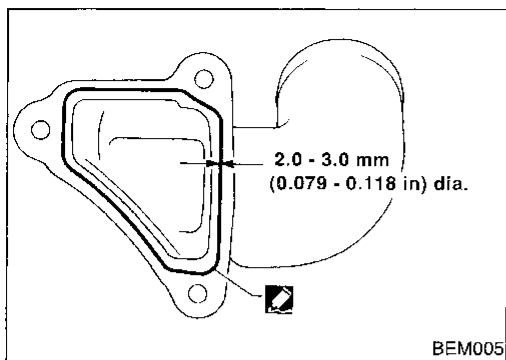
5. Install thermostat housing with water pipe using the following procedure.

- a. Tighten bolt (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.

CYLINDER HEAD

Assembly (Cont'd)



8. Install water outlet.
 - a. Remove old liquid gasket from mating surface of water outlet.
 - **Also remove old liquid gasket from mating surface of cylinder head.**
 - b. Apply a continuous bead of liquid gasket to mating surface of water outlet.
 - **Use Genuine RTV silicone sealant Part No. 999 MP-A7007, Three Bond TB1207D or equivalent.**
9. Install intake manifold supports and intake manifold collector supports.
10. Install EGR tube.
11. Install crankcase ventilation oil separator.

12. Install valve component parts.

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

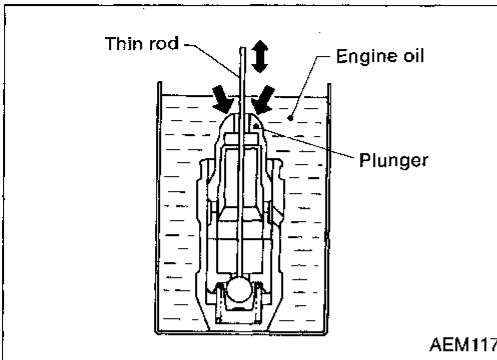
| | Identification mark |
|---------------|---------------------|
| Intake valve | E71 |
| Exhaust valve | 6Y2 |

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

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

CYLINDER HEAD

Assembly (Cont'd)



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

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

GI

MA

EM

LC

EC

FE

CL

MT

AT

FA

RA

BR

ST

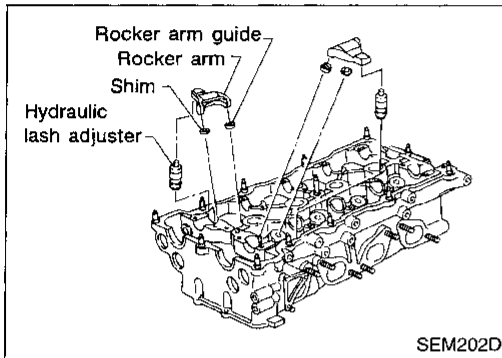
RS

BT

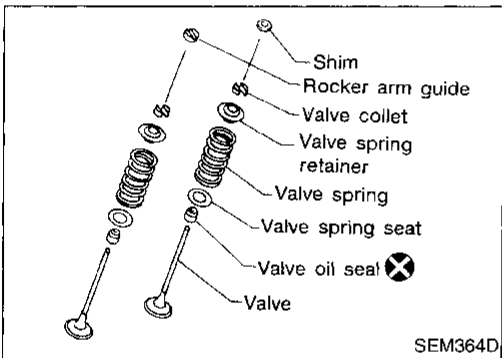
HA

EL

IDX



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

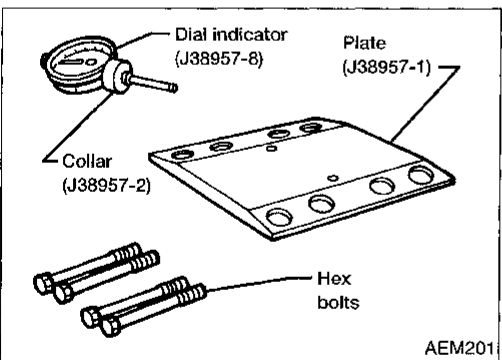


15. Before attempting any measurement, make sure the valve, valve spring, collet, retainer and rocker arm guide are properly installed in the head.

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

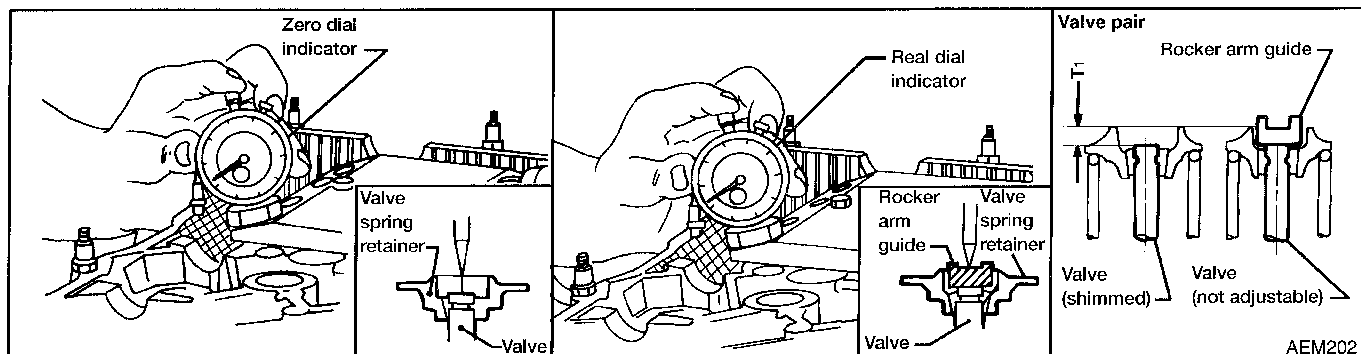
CAUTION:

Install parts in their original positions.

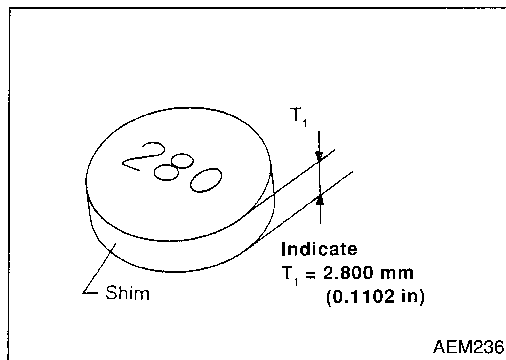


16. Install the J38957-1 gauge plate into the tapped holes at the cam journals and secure it to the head using two of the hex bolts supplied with the kit. (The two remaining bolts are spares.)

CYLINDER HEAD Assembly (Cont'd)



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



Installation

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

GI
MA
EM
LC
EC
FE
CL
MT
AT
FA
RA
BR
ST
RS
BT
HA
EL
DX

[illegible]

44 - 54 (4.5 - 5.5, 33 - 40)

- AEM281

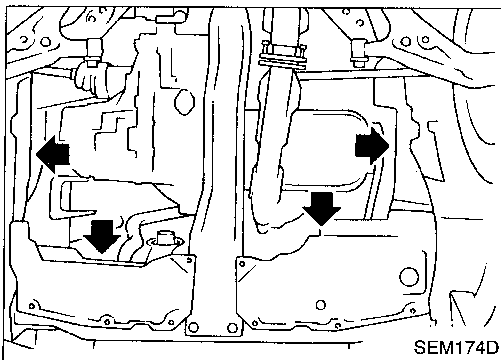
ENGINE REMOVAL

WARNING:

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

CAUTION:

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



Removal

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

ENGINE REMOVAL

Removal (Cont'd)

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

GI

MA

EM

LC

EC

FE

CL

MT

AT

FA

RA

BR

ST

RS

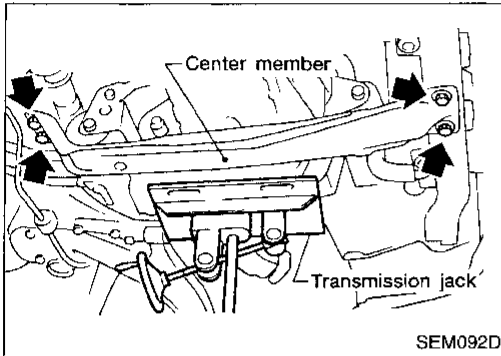
BT

HA

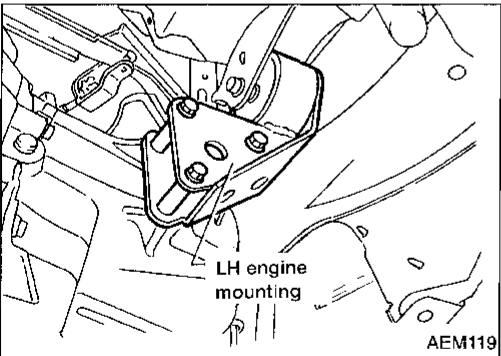
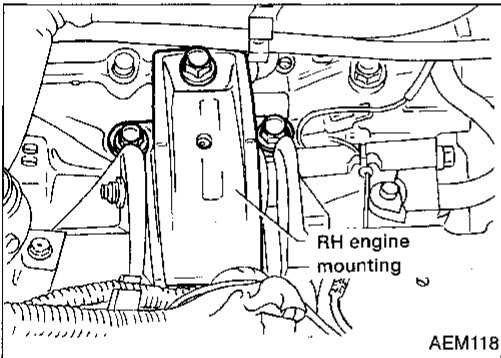
EL

IDX

15. Remove center member.



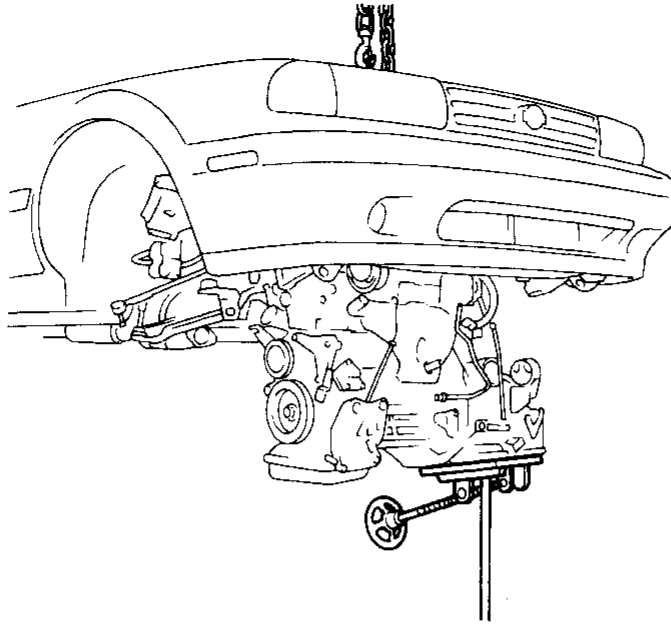
16. Remove engine mounting bolts from both sides, then slowly lower transmission jack.



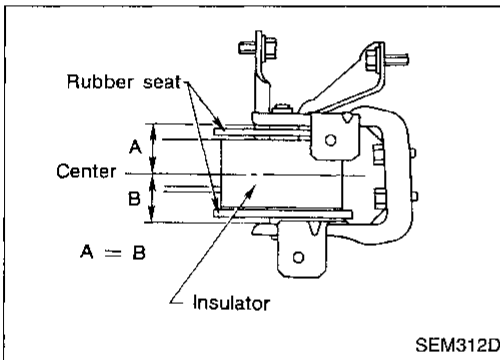
ENGINE REMOVAL

Removal (Cont'd)

17. Remove engine with transaxle as shown.



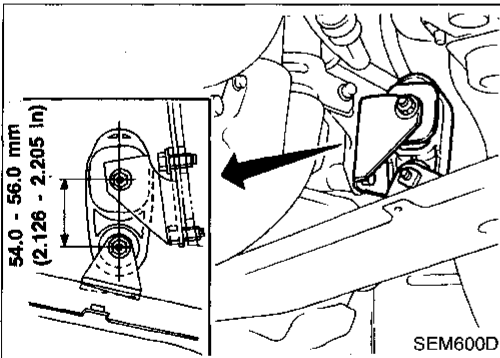
SEM599D



SEM312D

Installation

1. Install engine mounting bracket and fixing bolts.
Be sure that insulators are correctly positioned on the brackets.
2. Carefully lower the engine onto engine mounting insulators.



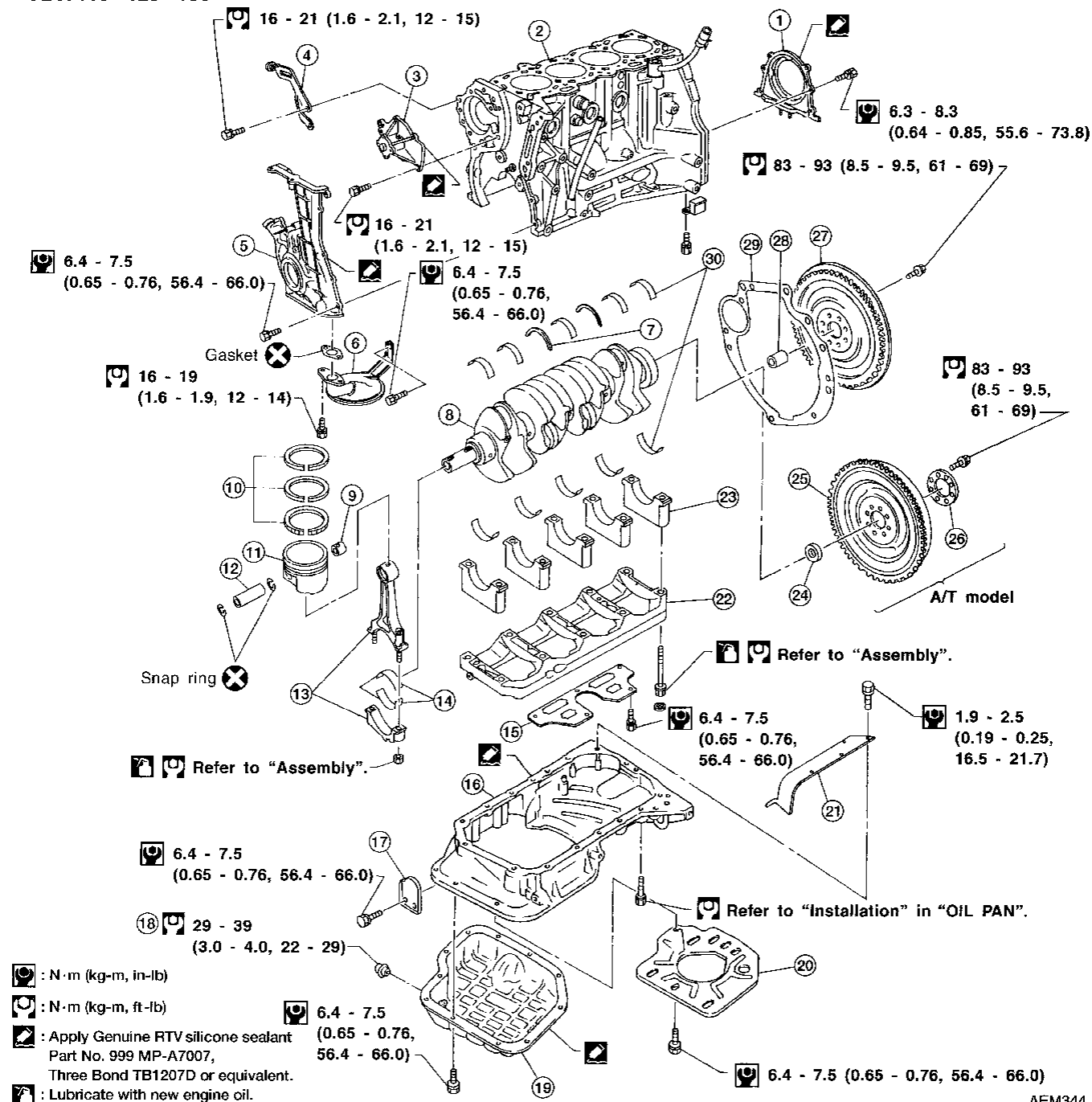
SEM600D

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

3. Install in the reverse order of removal.

CYLINDER BLOCK

SEC. 110 • 120 • 150



AEM344

- ① Rear oil seal retainer
- ② Cylinder block
- ③ Water pump
- ④ Power steering oil pump adjusting bar
- ⑤ Front cover with oil pump
- ⑥ Oil strainer
- ⑦ Thrust bearing
- ⑧ Crankshaft
- ⑨ Connecting rod bushing
- ⑩ Piston rings

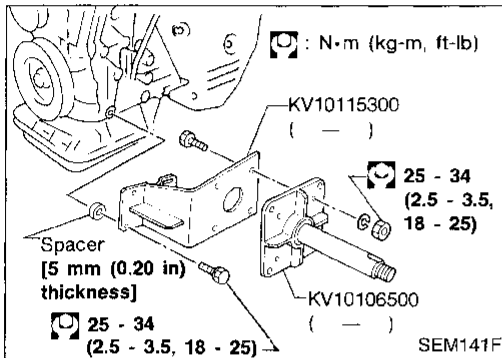
- ⑪ Piston
- ⑫ Piston pin
- ⑬ Connecting rod
- ⑭ Connecting rod bearing
- ⑮ Baffle plate
- ⑯ Aluminum oil pan
- ⑰ Rear cover plate
- ⑱ Oil pan drain plug
- ⑲ Steel oil pan
- ⑳ Baffle plate

- ㉑ Side gallery baffle plate
- ㉒ Main bearing beam
- ㉓ Main bearing cap
- ㉔ Pilot converter
- ㉕ Drive plate
- ㉖ Reinforcement plate
- ㉗ Flywheel
- ㉘ Pilot bushing
- ㉙ Rear plate
- ㉚ Main bearing

CYLINDER BLOCK

CAUTION:

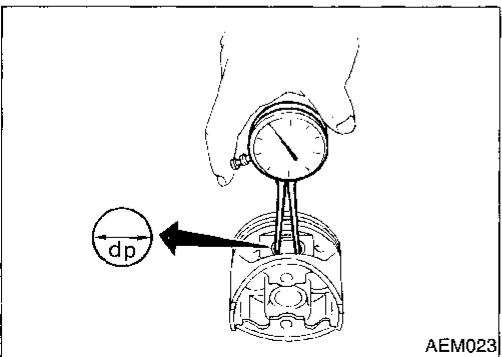
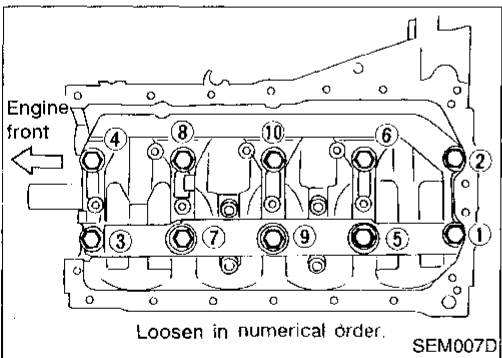
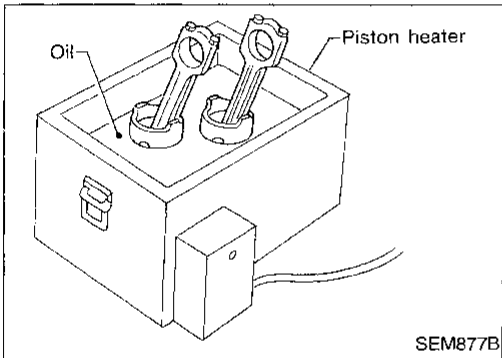
- When installing sliding parts (bearings, pistons, etc.), lubricate contacting surfaces with new engine oil.
- Place removed parts such as bearings and bearing caps in their proper order and direction.
- When installing connecting rod nuts and main bearing cap bolts, apply new engine oil to threads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



Disassembly

PISTON AND CRANKSHAFT

1. Place engine on engine stand (ST0501S000).
2. Remove cylinder head and timing chain. Refer to EM-18.
3. Remove oil pan. Refer to EM-13.
4. Remove pistons with connecting rods.
 - To disassemble piston and connecting rod, first remove snap rings. Heat piston to 60 to 70°C (140 to 158°F) then use piston pin press to remove pin.
 - When piston rings are not replaced, make sure that piston rings are mounted in their original positions.
 - When replacing piston rings, if there is no punchmark, install with either side up.
5. Remove rear oil seal retainer.
6. Remove main bearing beam, bearing cap and crankshaft as shown.
 - Bolts should be loosened in two or three steps.



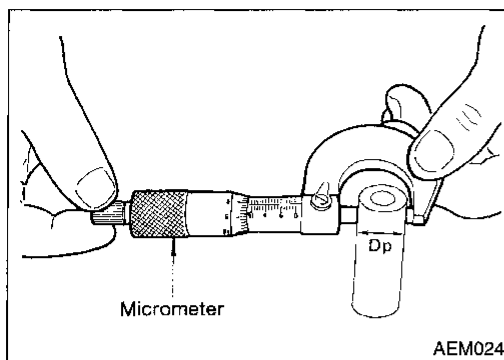
Inspection

PISTON AND PISTON PIN CLEARANCE

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

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.

GI

MA

EM

LC

EC

FE

CL

MT

AT

FA

RA

BR

ST

RS

BT

HA

EL

IDX

PISTON RING SIDE CLEARANCE

Side clearance:

Top ring

0.045 - 0.080 mm (0.0018 - 0.0031 in)

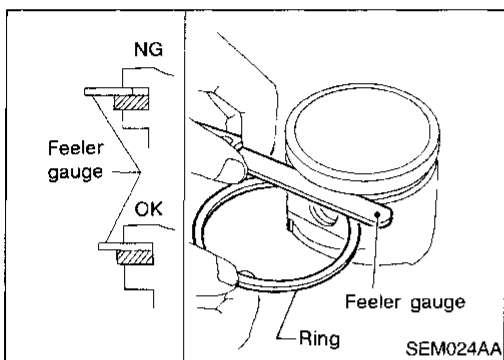
2nd ring

0.030 - 0.065 mm (0.0012 - 0.0026 in)

Max. limit of side clearance:

0.2 mm (0.008 in)

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



PISTON RING END GAP

End gap:

Top ring 0.20 - 0.30 mm (0.0079 - 0.0118 in)

2nd ring 0.35 - 0.50 mm (0.0138 - 0.0197 in)

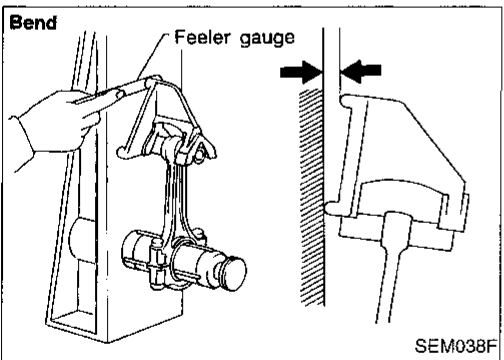
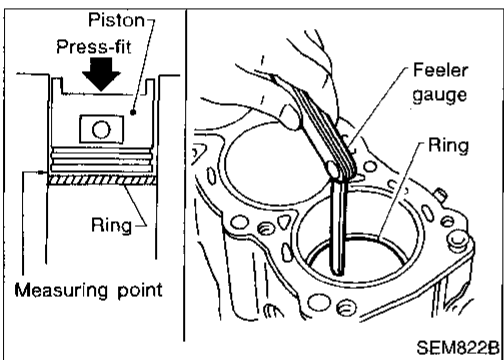
Oil ring 0.20 - 0.60 mm (0.0079 - 0.0236 in)

Max. limit of ring gap:

1.0 mm (0.039 in)

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

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



CONNECTING ROD BEND AND TORSION

Bend:

Limit 0.15 mm (0.0059 in)

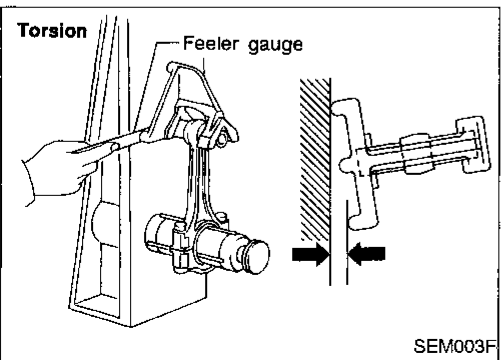
per 100 mm (3.94 in) length

Torsion:

Limit 0.30 mm (0.0118 in)

per 100 mm (3.94 in) length

If it exceeds the limit, replace connecting rod assembly.



CYLINDER BLOCK

Inspection (Cont'd)

CYLINDER BLOCK DISTORTION AND WEAR

Clean upper surface of cylinder block.

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

Block surface flatness:

Standard Less than 0.03 mm (0.0012 in)

Limit 0.10 mm (0.004 in)

If out of specification, resurface it.

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

Amount of cylinder head resurfacing is "A".

Amount of cylinder block resurfacing is "B".

The maximum limit is as follows:

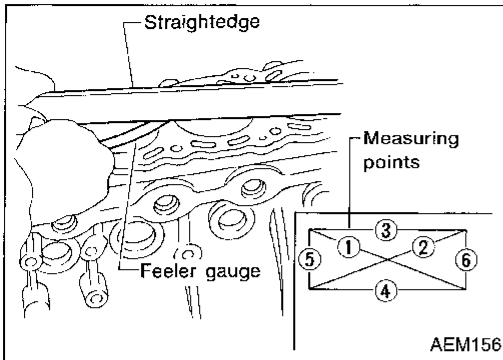
A + B = 0.2 mm (0.008 in)

Nominal cylinder block height

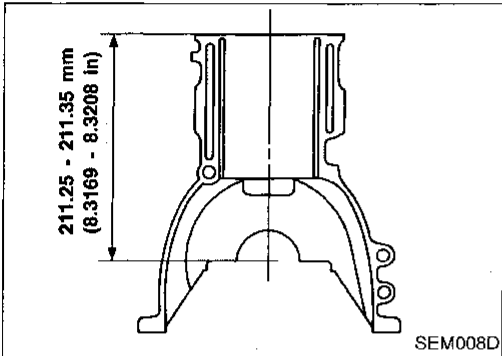
from crankshaft center:

211.25 - 211.35 mm (8.3169 - 8.3208 in)

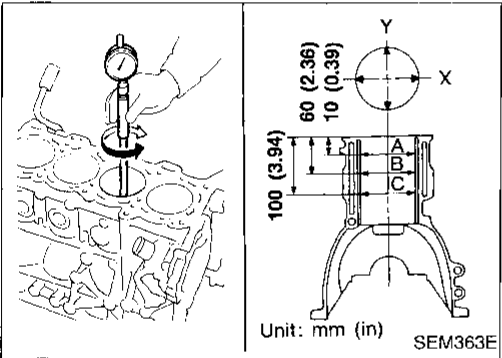
If necessary, replace cylinder block.



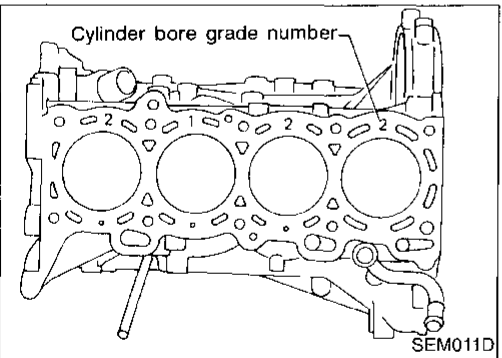
AEM156



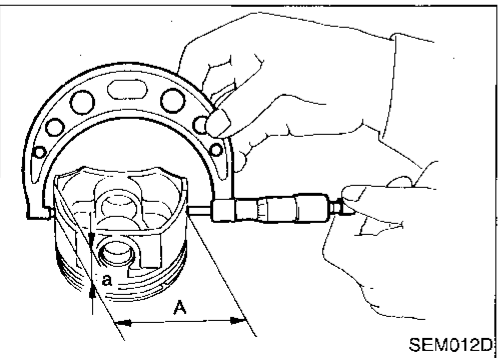
SEM008D



SEM363E



SEM011D



SEM012D

PISTON-TO-BORE CLEARANCE

- 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.

- 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.

- Measure piston skirt diameter.

Piston diameter "A": Refer to SDS, EM-70.

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

14.0 mm (0.551 in)

- 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)

- Determine piston oversize according to amount of cylinder wear.

CYLINDER BLOCK

Inspection (Cont'd)

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

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

Rebored size calculation:

$$D = A + B - C$$

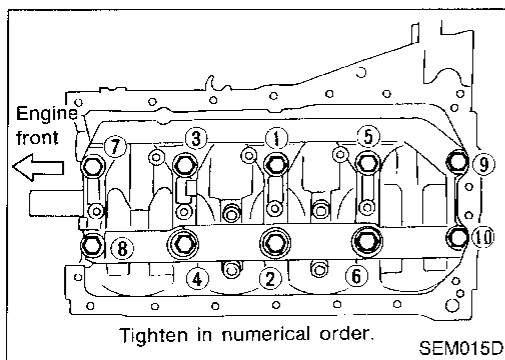
where,

D: Bored diameter

A: Piston diameter as measured

B: Piston-to-bore clearance

C: Honing allowance 0.02 mm (0.0008 in)



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

8. Cut cylinder bores.

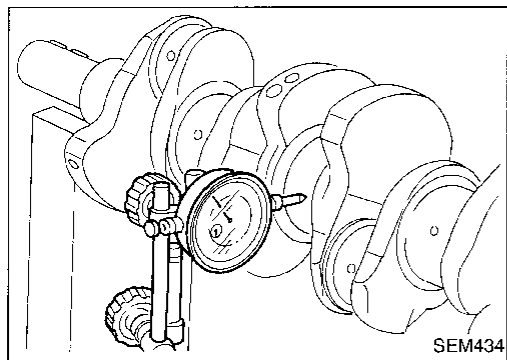
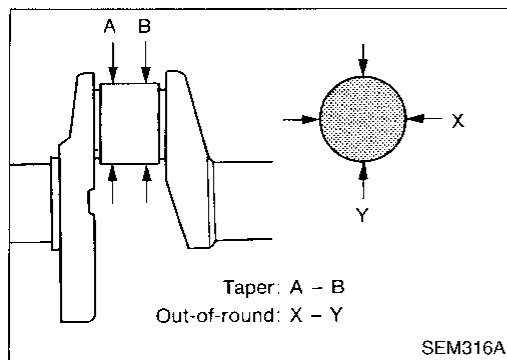
- **When any cylinder needs boring, all other cylinders must also be bored.**

- **Do not cut too much out of cylinder bore at a time. Cut only 0.05 mm (0.0020 in) or so at a time.**

9. Hone cylinders to obtain specified piston-to-bore clearance.

10. Measure finished cylinder bore for out-of-round and taper.

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



CRANKSHAFT

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

Out-of-round (X - Y):

Taper (A - B):

Main journal

Less than 0.005 mm (0.0002 in)

Pin journal

Less than 0.003 mm (0.0001 in)

3. Measure crankshaft runout.

Runout (Total indicator reading):

Less than 0.05 mm (0.0020 in)

CYLINDER BLOCK

Inspection (Cont'd)

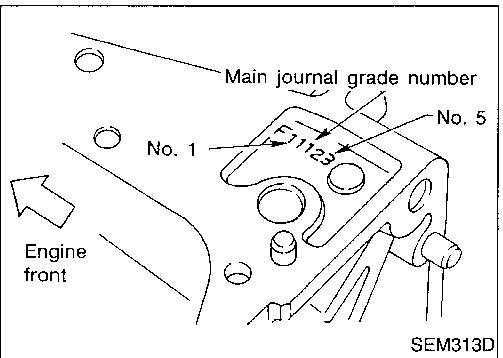
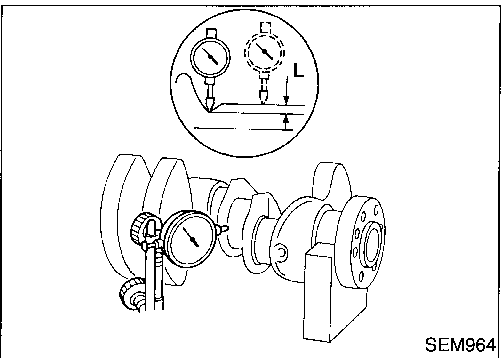
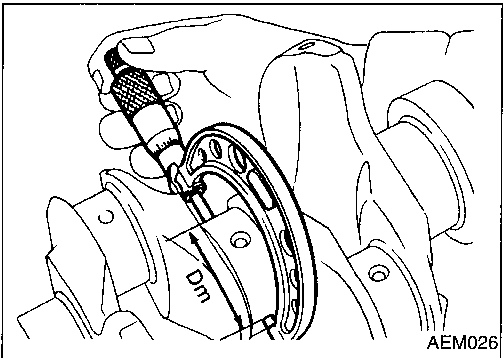
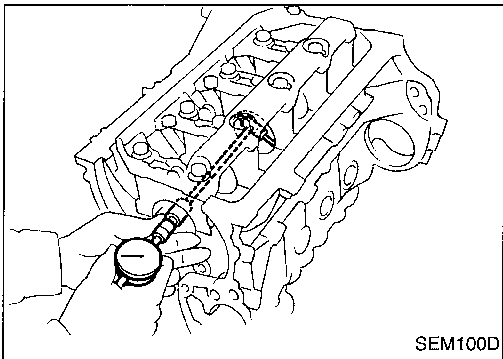
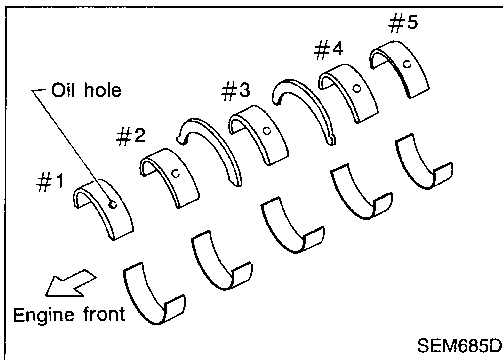
BEARING CLEARANCE

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

Method A (Using bore gauge and micrometer)

Main bearing

1. Set main bearings in their proper positions on cylinder block and main bearing cap.
 2. Install main bearing cap and main bearing beam to cylinder block.
- Tighten all bolts in correct order in two or three stages. Refer to EM-63.**
3. Measure inner diameter "A" of each main bearing.



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

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

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

Limit: 0.050 mm (0.0020 in)

If it exceeds the limit, replace bearing.

- If clearance cannot be adjusted within the standard of any bearing, grind crankshaft main journal and use undersized bearing.
- **When grinding crankshaft journal, confirm that "L" dimension in fillet roll is more than the specified limit.**
"L": 0.1 mm (0.004 in)
- **Refer to SDS, EM-71 for grinding crankshaft and available service parts.**

- If crankshaft is replaced, select thickness of main bearings as follows:
 - a. Grade number of each cylinder block main journal is punched on the respective cylinder block. These numbers are punched in either Arabic or Roman numerals.

CYLINDER BLOCK

Inspection (Cont'd)

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

How to select main bearings (Identification mark and color)

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

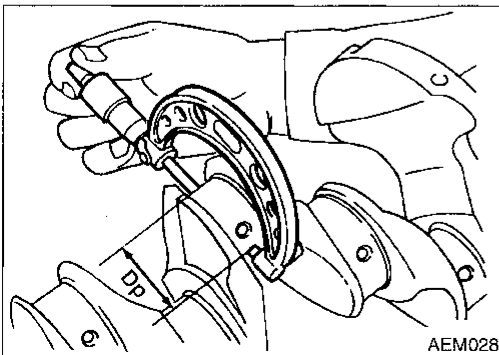
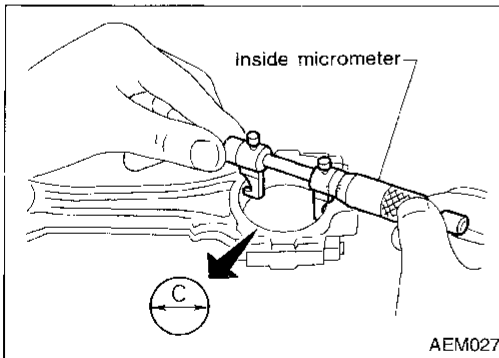
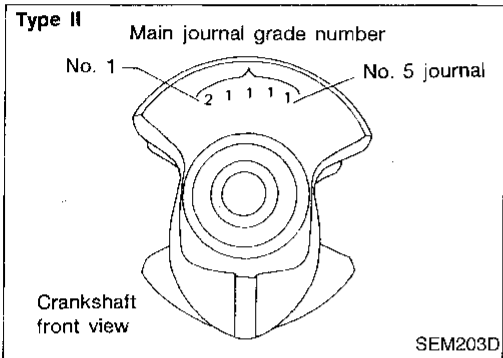
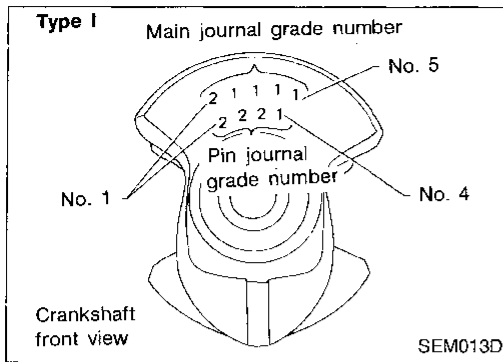
For example:

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)

- Install connecting rod bearing to connecting rod and cap.
- Install connecting rod cap to connecting rod.

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

- Measure inner diameter "C" of each bearing.

- Measure outer diameter "Dp" of corresponding crankshaft pin journal.

- Calculate connecting rod bearing clearance.

Connecting rod bearing clearance = C - Dp

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

Limit: 0.065 mm (0.00256 in)

If it exceeds the limit, replace bearing.

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

CYLINDER BLOCK

Inspection (Cont'd)

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

Connecting rod bearing grade number:

These numbers are punched in either Arabic or Roman numerals.

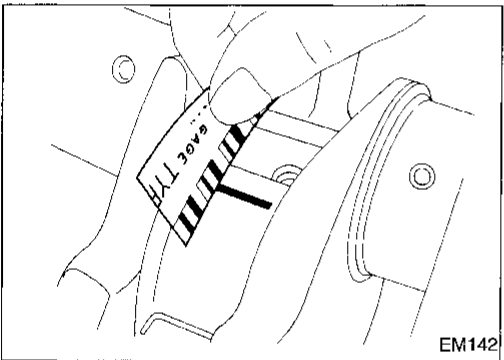
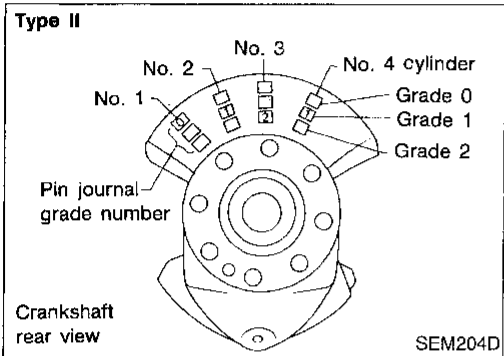
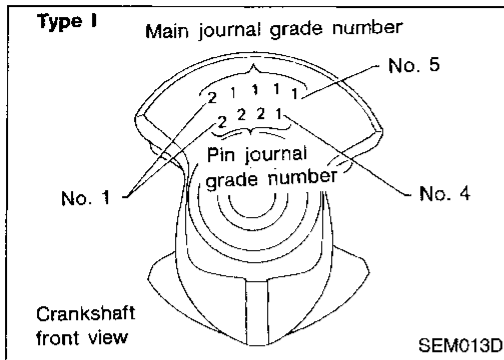
| Crank pin grade number | Connecting rod bearing grade number |
|------------------------|-------------------------------------|
| 0 | 0 |
| 1 | 1 |
| 2 | 2 |

Identification color:

Grade 0; No color

Grade 1; Black

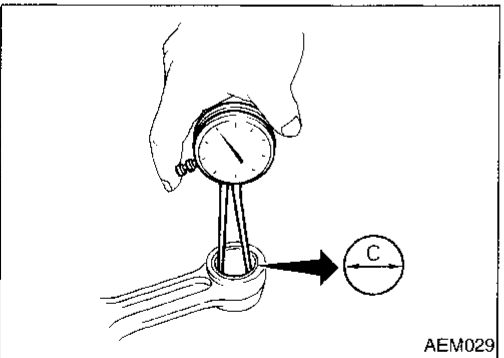
Grade 2; Brown



Method B (Using Plastigage)

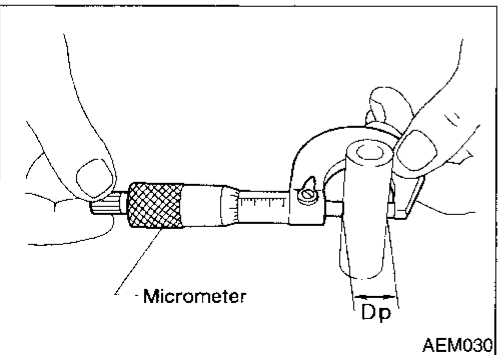
CAUTION:

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



CONNECTING ROD BUSHING CLEARANCE (Small end)

- Measure inner diameter "C" of bushing.



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

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

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.

CYLINDER BLOCK

Inspection (Cont'd)

REPLACEMENT OF CONNECTING ROD BUSHING (Small end)

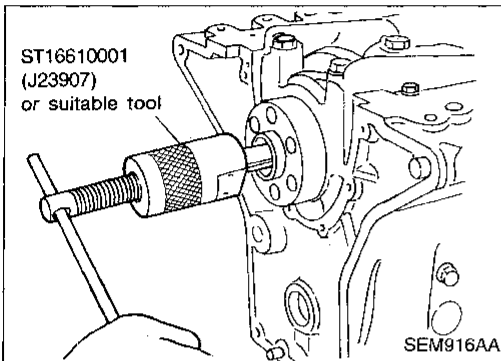
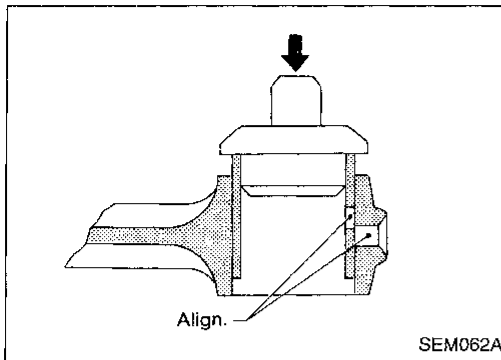
1. Drive in small end bushing until it is flush with end surface of rod.

Be sure to align the oil holes.

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

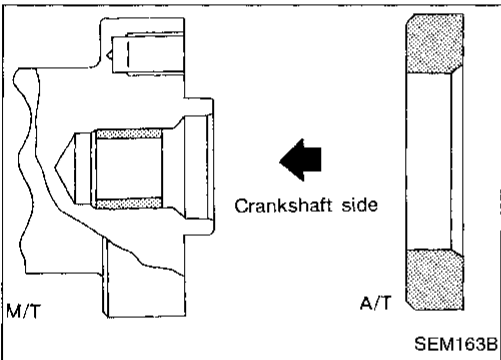
Clearance between connecting rod bushing and piston pin:

0.005 - 0.017 mm (0.0002 - 0.0007 in)

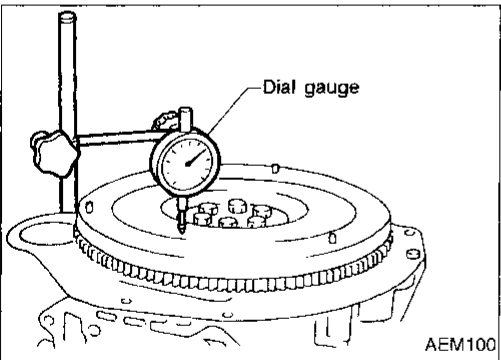


REPLACEMENT OF PILOT BUSHING (M/T) OR PILOT CONVERTER (A/T)

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



2. Install pilot bushing or pilot converter as shown.



FLYWHEEL/DRIVE PLATE RUNOUT

Runout (Total indicator reading):

Flywheel (M/T model)

Less than 0.15 mm (0.0059 in)

Drive plate (A/T model)

Less than 0.20 mm (0.0079 in)

CAUTION:

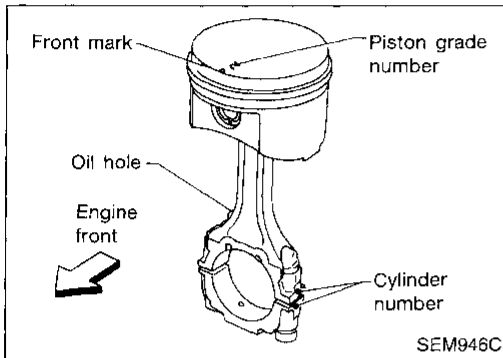
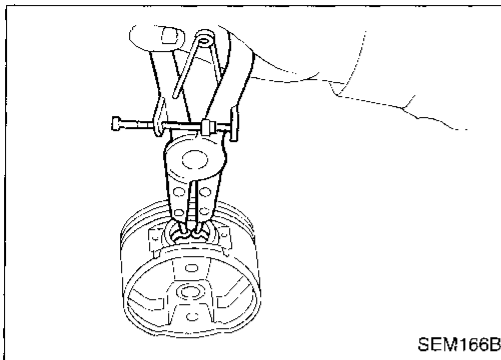
- Be careful not to damage the ring gear teeth.
- Check the drive plate for deformation or cracks.
- Do not allow any magnetic materials to contact the ring gear teeth.
- Do not resurface flywheel. Replace as necessary.

CYLINDER BLOCK

Assembly

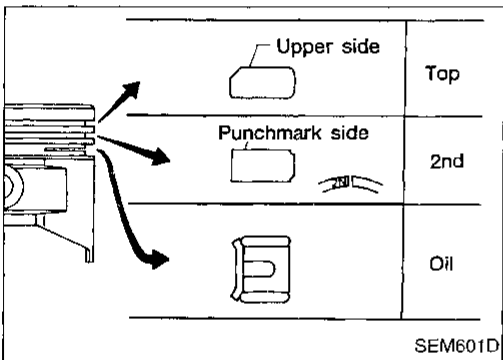
PISTON

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



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

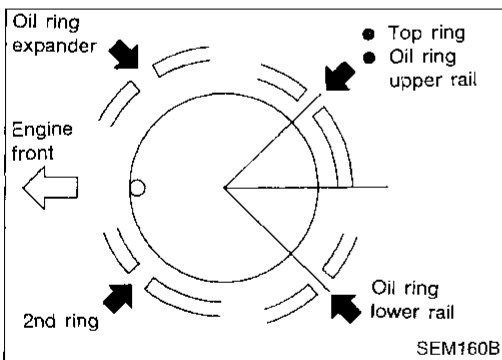
- Align the direction of piston and connecting rod.
- Numbers stamped on connecting rod and cap correspond to each cylinder.
- After assembly, make sure connecting rod swings smoothly.



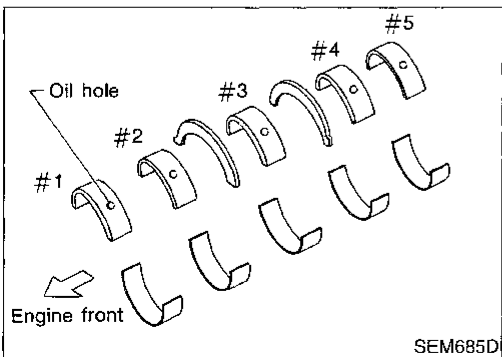
3. Set piston rings as shown.

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.



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

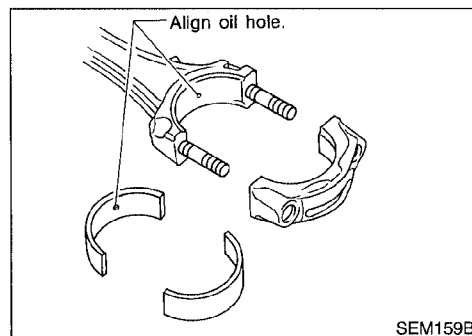
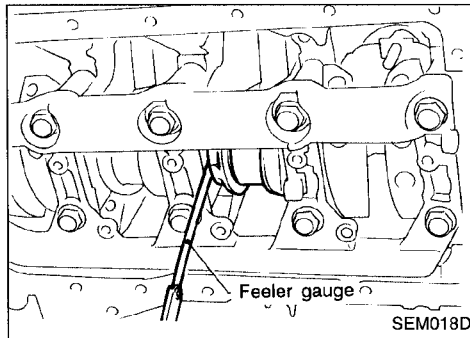
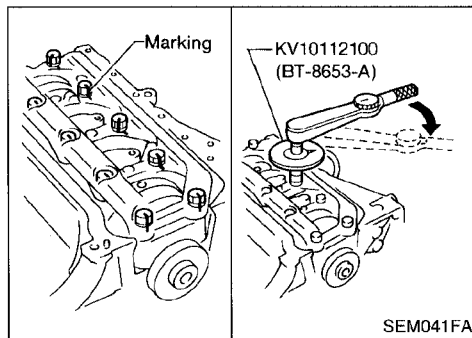
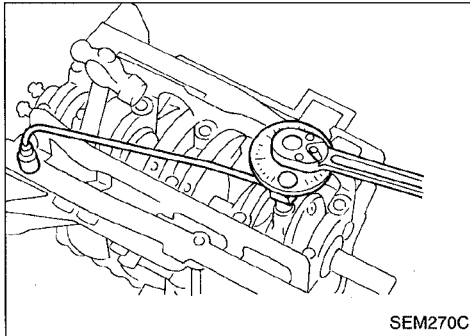
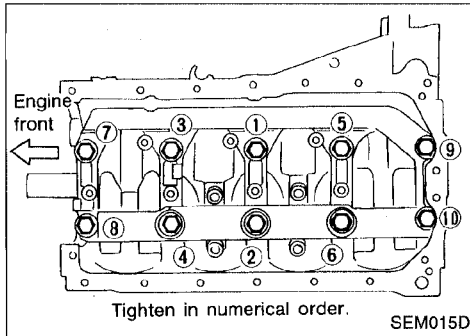


CRANKSHAFT

1. Set main bearings in their proper positions on cylinder block and main bearing cap.
- Confirm that correct main bearings are selected by using Method A or Method B. Refer to EM-58.
 - Apply new engine oil to bearing surfaces.

CYLINDER BLOCK

Assembly (Cont'd)



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

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

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

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

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



3. Measure crankshaft end play.

Crankshaft end play:

Standard

0.10 - 0.26 mm (0.0039 - 0.0102 in)

Limit

0.30 mm (0.0118 in)

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

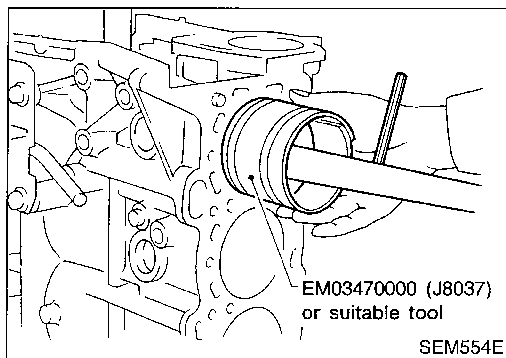
4. Install connecting rod bearings in connecting rods and connecting rod caps.

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

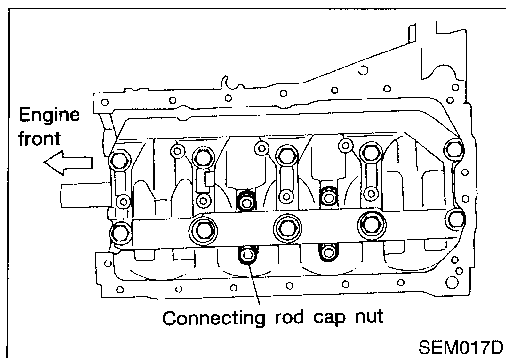
| | | | |
|-------------------------------------|------------------|------------------|-------------|
| SMA98-026 | '98 SENTRA/200SX | OCTOBER 1997(06) | SM8E-OB14UI |
| ARROW INDICATES AMENDED INFORMATION | | | |

CYLINDER BLOCK

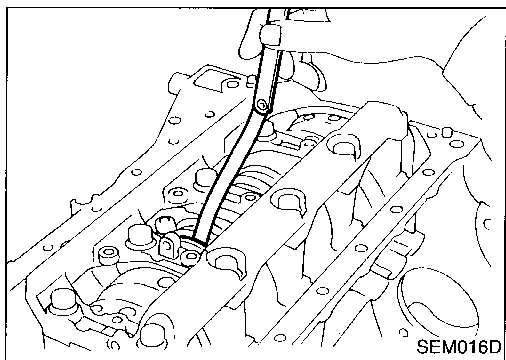
Assembly (Cont'd)



5. Install pistons with connecting rods.
 - a. Install them into corresponding cylinders with Tool.
 - **Make sure connecting rod does not scratch cylinder wall.**
 - **Make sure connecting rod bolts do 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:
- 1) Tighten nuts to 14 to 16 N-m (1.4 to 1.6 kg-m, 10 to 12 ft-lb).
 - 2) Turn all nuts 60 to 65 degrees clockwise. If an angle wrench is not available, tighten nuts to 38 to 44 N-m (3.9 to 4.5 kg-m, 28 to 33 ft-lb).



6. Measure connecting rod side clearance.

Connecting rod side clearance:

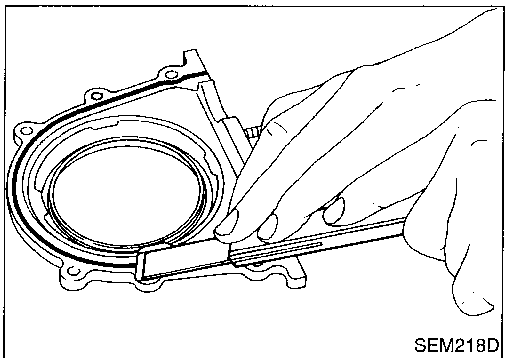
Standard

0.20 - 0.35 mm (0.0079 - 0.0138 in)

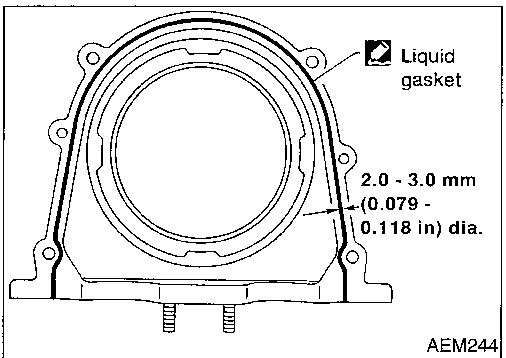
Limit

0.50 mm (0.0197 in)

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



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



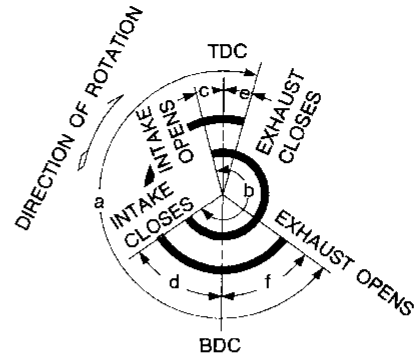
- b. Apply a continuous bead of liquid gasket to mating surface of rear oil seal retainer.
 - **Use Genuine RTV silicone sealant Part No. 999 MP-A7007, Three Bond TB1207D or equivalent.**
 - **Apply around inner side of bolt holes.**

SERVICE DATA AND SPECIFICATIONS (SDS)

General Specifications

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

Valve timing



EM120
Unit: degree

| a | b | c | d | e | f |
|------|------|----|-----|----|-----|
| 240° | 232° | 5° | 47° | 3° | 57° |

Inspection and Adjustment

COMPRESSION PRESSURE

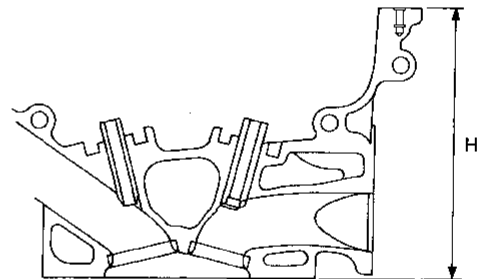
Unit: kPa (kg/cm², psi)/300 rpm

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

CYLINDER HEAD

Unit: mm (in)

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



SEM043F

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

*Total amount of cylinder head resurfacing plus cylinder block resurfacing

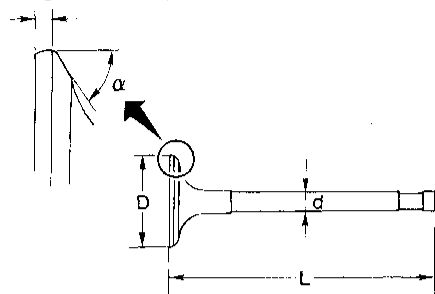
SERVICE DATA AND SPECIFICATIONS (SDS)

Inspection and Adjustment (Cont'd)

VALVE

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

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

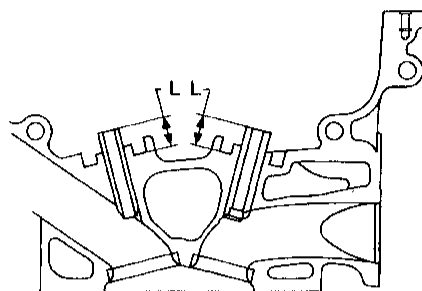
Hydraulic lash adjuster (HLA)

Unit: mm (in)

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

Valve guide

Unit: mm (in)



SEM083D

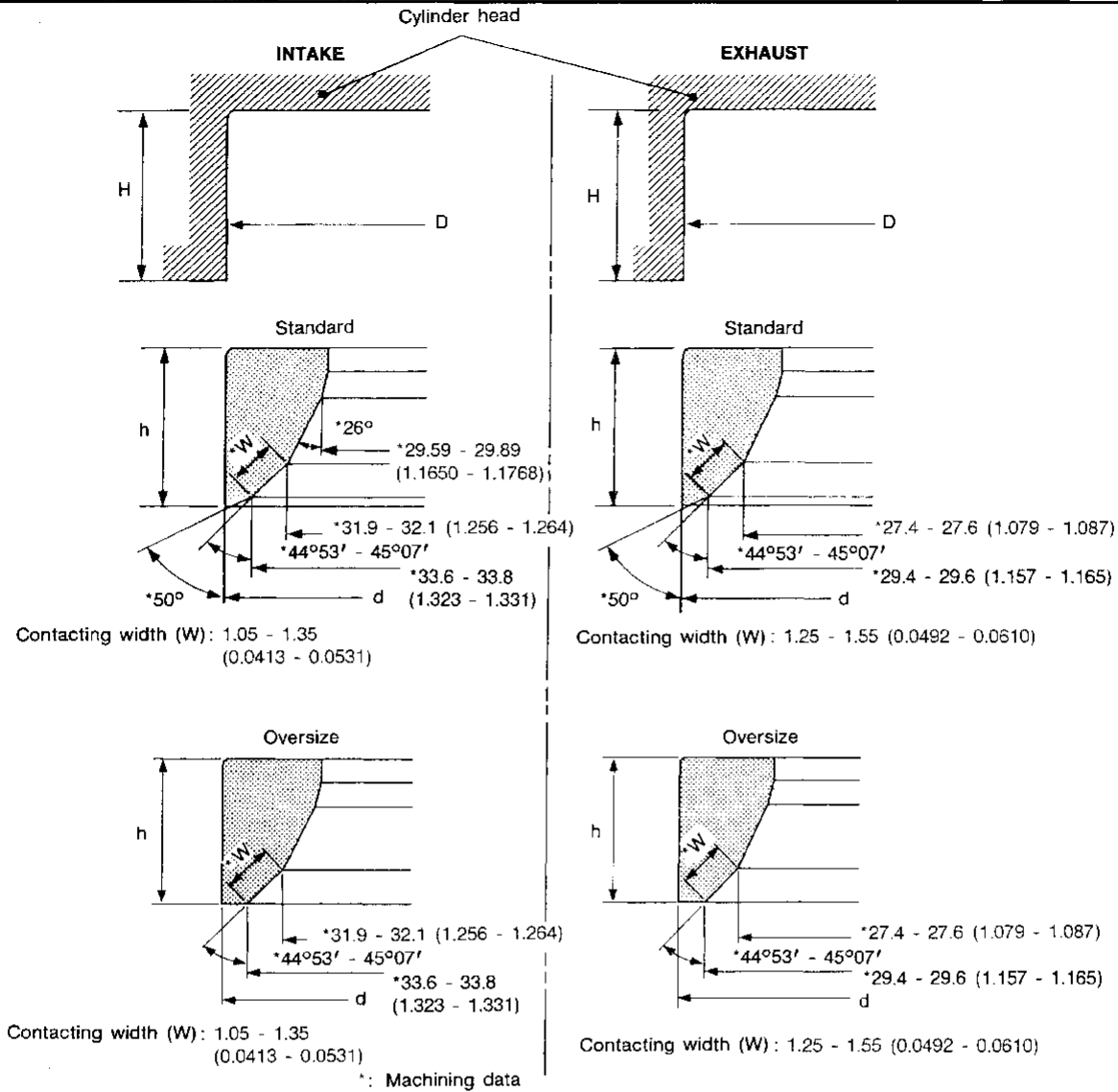
| | | Standard | Service |
|---|---------|--------------------------------------|--------------------------------------|
| Valve guide | | | |
| Outer diameter | Intake | 10.023 - 10.034 (0.3946 - 0.3950) | 10.223 - 10.234 (0.4025 - 0.4029) |
| | Exhaust | 10.023 - 10.034 (0.3946 - 0.3950) | 10.223 - 10.234 (0.4025 - 0.4029) |
| Valve guide | | | |
| Inner diameter (Finished size) | Intake | 6.000 - 6.018 (0.2362 - 0.2369) | |
| | Exhaust | 6.000 - 6.018 (0.2362 - 0.2369) | |
| Cylinder head valve guide hole diameter | Intake | 9.975 - 9.996 (0.3927 - 0.3935) | 10.175 - 10.196 (0.4006 - 0.4014) |
| | Exhaust | 9.975 - 9.996 (0.3927 - 0.3935) | 10.175 - 10.196 (0.4006 - 0.4014) |
| Interference fit of valve guide | | 0.027 - 0.059 (0.0011 - 0.0023) | |
| | | Standard | Limit |
| Stem to guide clearance | Intake | 0.020 - 0.053 (0.0008 - 0.0021) | 0.08 (0.0031) |
| | Exhaust | 0.040 - 0.073 (0.0016 - 0.0029) | 0.1 (0.004) |
| Valve deflection limit | | 0.2 (0.008) | |
| Projection length "L" | | 14.0 - 14.2 (0.551 - 0.559) | |

SERVICE DATA AND SPECIFICATIONS (SDS)

Inspection and Adjustment (Cont'd)

Valve seat

Unit: mm (in)



SEM651DB

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

SERVICE DATA AND SPECIFICATIONS (SDS)

Inspection and Adjustment (Cont'd)

Valve shim clearance adjustment Unit: mm (in)

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

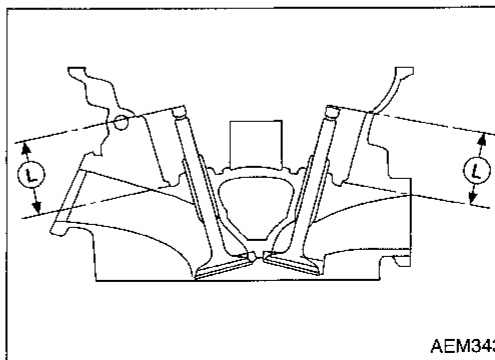
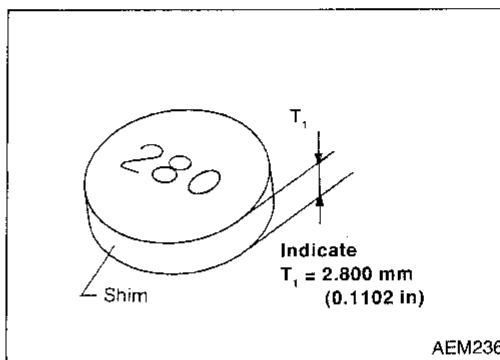
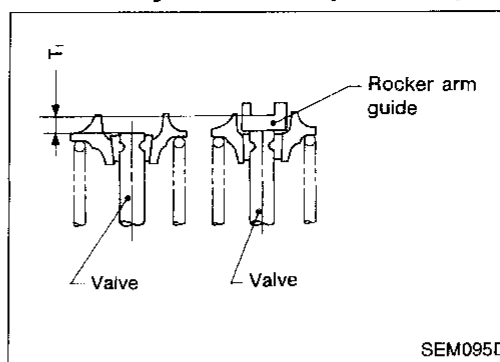
Available shim

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

Valve seat resurface limit

Unit: mm (in)

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



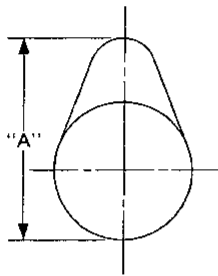
SERVICE DATA AND SPECIFICATIONS (SDS)

Inspection and Adjustment (Cont'd)

CAMSHAFT AND CAMSHAFT BEARING

Unit: mm (in)

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



EM671

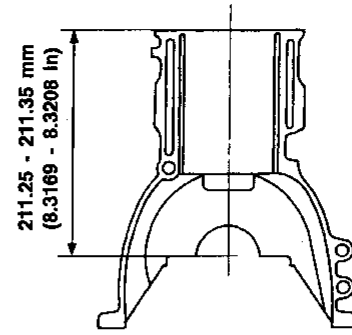
Cam height "A"

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

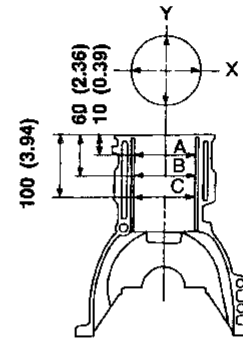
*Total indicator reading

CYLINDER BLOCK

Unit: mm (in)



SEM964E



SEM686D

Surface flatness

| | |
|----------|-------------------------|
| Standard | Less than 0.03 (0.0012) |
| Limit | 0.1 (0.004) |

Cylinder bore

Inner diameter

Standard

| | |
|-------------|-----------------------------------|
| Grade No. 1 | 86.000 - 86.010 (3.3858 - 3.3862) |
| Grade No. 2 | 86.010 - 86.020 (3.3862 - 3.3866) |
| Grade No. 3 | 86.020 - 86.030 (3.3866 - 3.3870) |

Wear limit 0.20 (0.0079)

Out-of-round (X - Y) Less than 0.015 (0.0006)

Taper (A - B and A - C) Less than 0.010 (0.0004)

Difference in inner diameter between cylinders

Limit Less than 0.05 (0.0020)

Main journal inner diameter

| | |
|-------------|-----------------------------------|
| Grade No. 0 | 58.944 - 58.950 (2.3206 - 2.3209) |
| Grade No. 1 | 58.950 - 58.956 (2.3209 - 2.3211) |
| Grade No. 2 | 58.956 - 58.962 (2.3211 - 2.3213) |
| Grade No. 3 | 58.962 - 58.968 (2.3213 - 2.3216) |

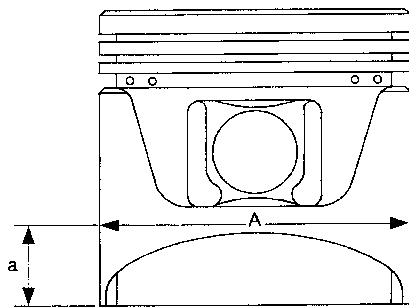
SERVICE DATA AND SPECIFICATIONS (SDS)

Inspection and Adjustment (Cont'd)

PISTON, PISTON RING, AND PISTON PIN

Piston

Unit: mm (in)



SEM750C

Piston skirt diameter "A"

Standard

| | |
|-----------------------------------|-----------------------------------|
| Grade No. 1 | 85.980 - 85.990 (3.3850 - 3.3854) |
| Grade No. 2 | 85.990 - 86.000 (3.3854 - 3.3858) |
| Grade No. 3 | 86.000 - 86.010 (3.3858 - 3.3862) |
| 0.20 (0.0079) over-size (Service) | 86.180 - 86.210 (3.3929 - 3.3941) |

"a" dimension 14.0 (0.551)

Piston clearance to cylinder block 0.010 - 0.030 (0.0004 - 0.0012)

Piston pin hole diameter 21.991 - 21.999 (0.8658 - 0.8661)

Piston ring

Unit: mm (in)

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

Piston pin

Unit: mm (in)

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

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

SERVICE DATA AND SPECIFICATIONS (SDS)

Inspection and Adjustment (Cont'd)

CONNECTING ROD

Unit: mm (in)

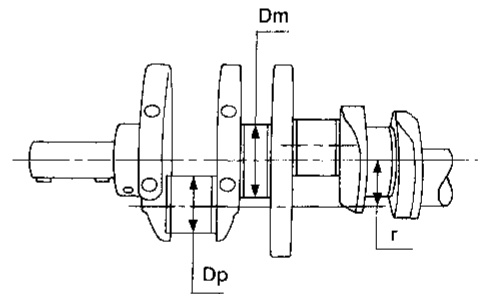
| | |
|---|-----------------------------------|
| Center distance | 136.25 - 136.35 (5.3642 - 5.3681) |
| Bend [per 100 (3.94)] | |
| Limit | 0.15 (0.0059) |
| Torsion [per 100 (3.94)] | |
| Limit | 0.30 (0.0118) |
| Connecting rod small end inner diameter | 24.980 - 25.000 (0.9835 - 0.9843) |
| Piston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

*After installing in connecting rod

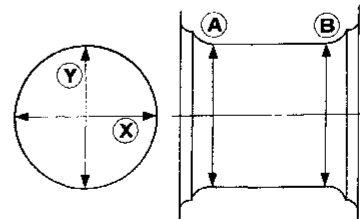
CRANKSHAFT

Unit: mm (in)

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



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



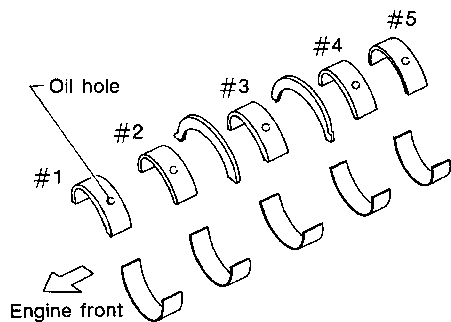
SEM954C

IDX

SERVICE DATA AND SPECIFICATIONS (SDS)

Inspection and Adjustment (Cont'd)

MAIN BEARING



SEM685D

Standard

Unit: mm (in)

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

Undersize

Unit: mm (in)

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

CONNECTING ROD BEARING

Standard size

Unit: mm (in)

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

Undersize

Unit: mm (in)

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

BEARING CLEARANCE

Unit: mm (in)

Main bearing clearance

| | |
|----------|---------------------------------|
| Standard | 0.004 - 0.022 (0.0002 - 0.0009) |
| Limit | 0.05 (0.0020) |

Connecting rod bearing clearance

| | |
|----------|---------------------------------|
| Standard | 0.020 - 0.045 (0.0008 - 0.0018) |
| Limit | 0.065 (0.00256) |

MISCELLANEOUS COMPONENTS

Unit: mm (in)

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