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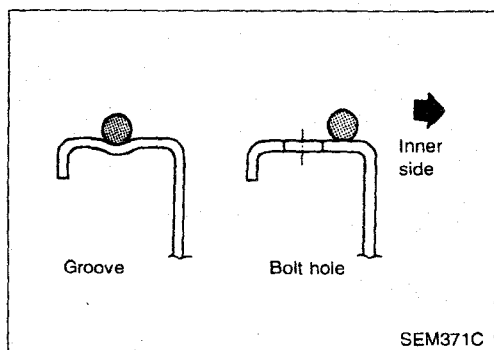
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PRECAUTIONS

Parts Requiring Angular Tightening

- Some important engine parts are tightened using an angular-tightening method rather than a torque setting method.
- If these parts are tightened using a torque setting method, dispersal of the tightening force (axial bolt force) will be two or three times that of the dispersal produced by using the correct angular-tightening method.
- Although the torque setting values (described in this manual) are equivalent to those used when bolts and nuts are tightened with an angular-tightening method, they should be used for reference only.
- To assure the satisfactory maintenance of the engine, bolts and nuts must be tightened using an angular-tightening method.
- Before tightening the bolts and nuts, ensure that the thread and seating surfaces are clean and then coated with engine oil.
- The bolts and nuts which require the angular-tightening method are as follows:
 - (1) Cylinder head bolts
 - (2) Connecting rod cap nuts



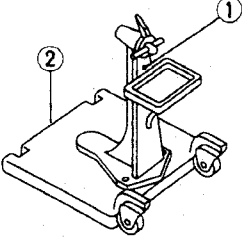
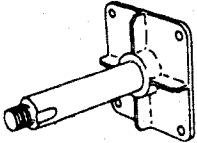
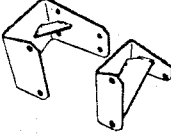

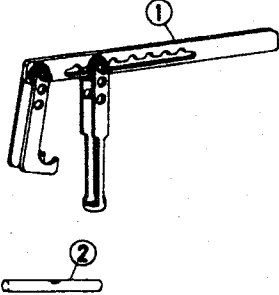
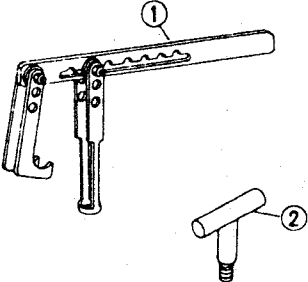

Liquid Gasket Application Procedure

- a. Before applying liquid gasket, use a scraper to remove all traces of old liquid gasket from mating surface and grooves, and then completely clean any oil stains from these portions.
- b. Apply a continuous bead of liquid gasket to mating surfaces. (Use Genuine Liquid Gasket or equivalent.)
 - Be sure liquid gasket is 3.5 to 4.5 mm (0.138 to 0.177 in) wide (oil pan).
 - Be sure liquid gasket is 2.0 to 3.0 mm (0.079 to 0.118 in) wide (in areas except oil pan).
- c. Apply liquid gasket to inner surface around hole perimeter. (Assembly should be done within 5 minutes after coating.)
- d. Wait at least 30 minutes before refilling engine oil and engine coolant.

PREPARATION

SPECIAL SERVICE TOOLS

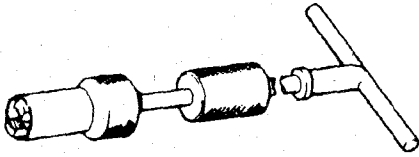
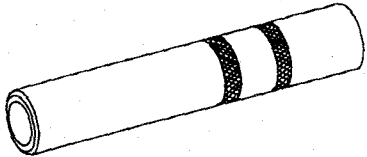
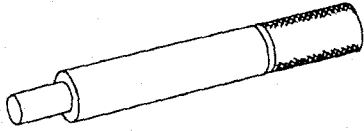
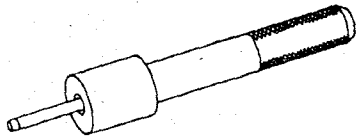
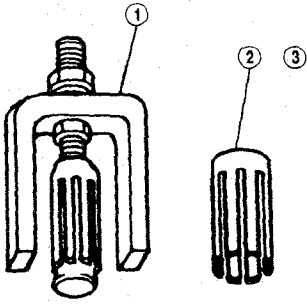
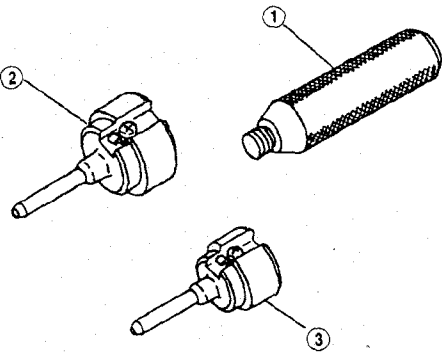
*: Special tool or commercial equivalent

Tool number Tool name	Description	Engine application		
		KA24E	TD27T	
ST0501S000* Engine stand assembly ① ST05011000 Engine stand ② ST05012000 Base		Disassembling and assembling	X	X
KV10106500* Engine attachment			—	X
KV11103200* Engine sub-attachment			—	X
KV10105001 Engine attachment			X	—
KV101092S0 Valve spring compressor ① KV10109210 Compressor ② KV10109220 Adapter		Disassembling and assembling valve components	X	—
① KV10109210* Valve spring compressor ② KV10111200* Adapter		Disassembling and assembling valve components	—	X
KV109B0010 Valve oil seal drift		Installing valve oil seal	X	—

PREPARATION

SPECIAL SERVICE TOOLS

*: Special tool or commercial equivalent

Tool number Tool name	Description	Engine application	
		KA24E	TD27T
KV10107900* Valve oil seal puller	 Disassembling valve oil seal	—	X
KV11103400 Valve oil seal drift	 Installing valve oil seal	—	X
ST11033000* Valve guide drift	 Removing valve guide	—	X
KV11103900* Valve guide drift	 Installing valve guide	—	X
① KV11101110 Valve seat remover ② KV11103610 Adapter (Intake) ③ KV11103620 Adapter (Exhaust)	 Removing valve seat	—	X
① ST15243000 Valve seat drift ② KV11103810 Adapter (Intake) ③ KV11103820 Adapter (Exhaust)	 Installing valve seat	—	X

PREPARATION

SPECIAL SERVICE TOOLS

*: Special tool or commercial equivalent

Tool number Tool name	Description	Engine application		
		KA24E	TD27T	
KV10110300 Piston pin press stand assembly ① KV10110310 Cap ② KV10110330 Spacer ③ ST13030020 Press stand ④ ST13030030 Spring ⑤ KV10110340 Drift ⑥ KV10110320 Center shaft		Disassembling and assembling piston with connecting rod	X	—
① KV11104010 Cylinder liner tool ② KV11104110 Adapter for removing ③ KV11104030 Adapter for installing		Removing and installing cylinder liner	—	X
EM03470000* Piston ring compressor		Installing piston into cylinder	X	X
KV111033S0 Engine stopper ① KV11103310 Stopper plate ② KV10105630 Stopper gear		Preventing crankshaft from rotating	—	X
ST16610001* Pilot bushing puller		Removing pilot bushing	X	X

PREPARATION

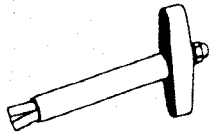
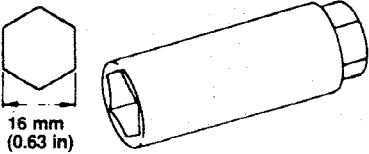


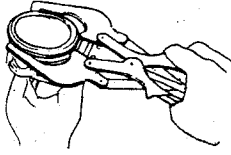
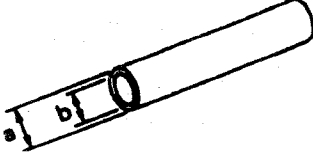
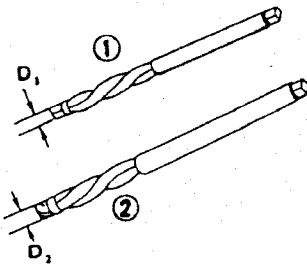
SPECIAL SERVICE TOOLS

*: Special tool or commercial equivalent

Tool number Tool name	Description	Engine application		
		KA24E	TD27T	
KV111045SO Cam bushing replacer set ① KV11104510 Replacer bar ② KV11104520 Guide plate ③ KV11104530 Adapter (1st bushing) ④ ST15243000 Drift		Removing cam bushing or installing cam bushing	—	X
KV10109300* Injection pump drive gear holder		Preventing drive gear from rotating	—	X
KV11103000* Injection pump drive gear puller		Removing drive gear	—	X
① ED19601000 Compression gauge ② ED19600600 Compression gauge adapter (for glow plug hole) ③ ED19600700 Compression gauge adapter (for injector hole)		Checking compression pressure	—	X
KV10111100 Seal cutter		Removing oil pan	X	—
WS39930000* Tube presser		Pressing the tube of liquid gasket	X	X

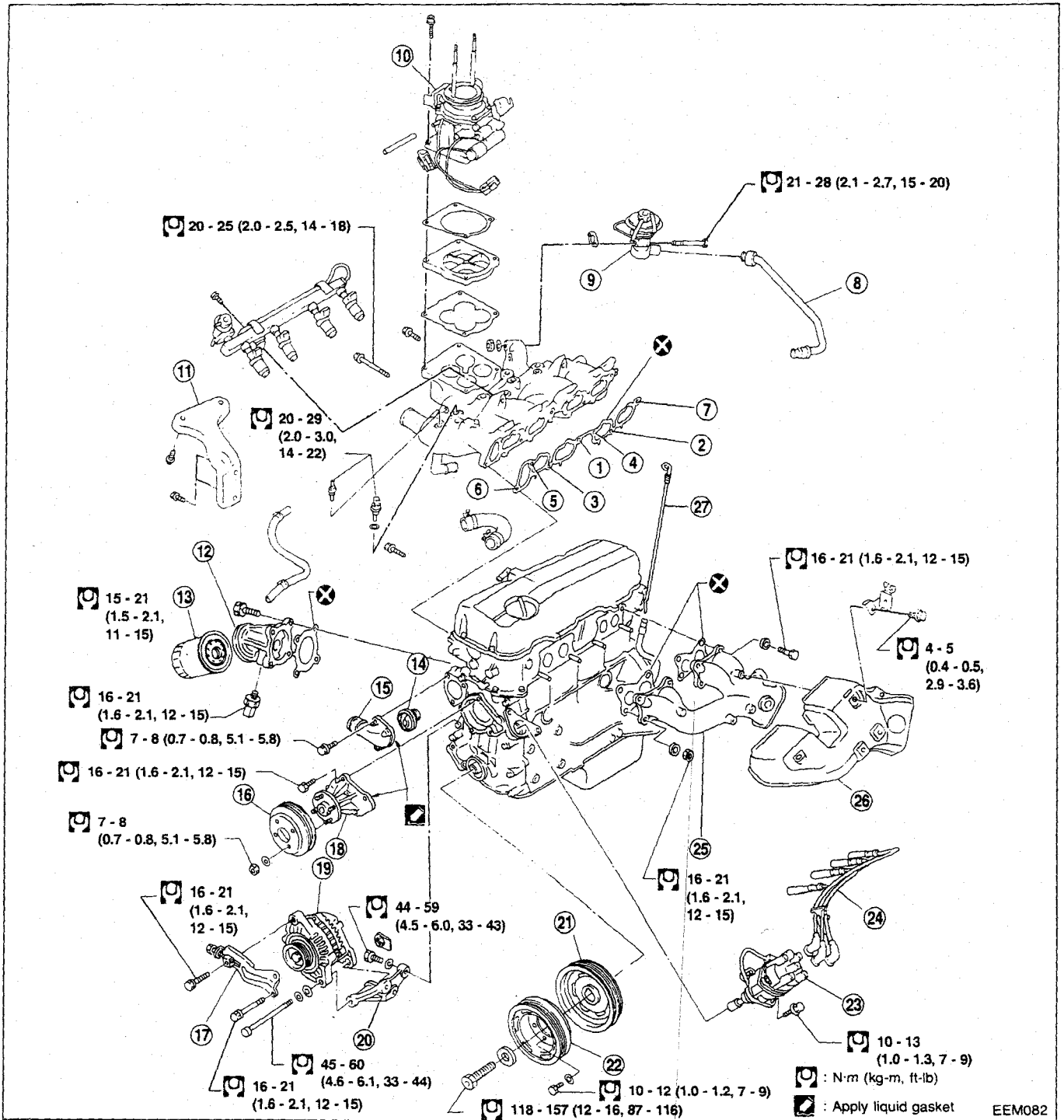
PREPARATION

COMMERCIAL SERVICE TOOLS

Tool name	Description	Engine application												
		KA24E	TD27T											
Valve oil seal remover	Removing valve oil seal 	X	—											
Spark plug wrench	Removing and installing spark plug 	X	—											
Pulley holder	Holding camshaft pulley while tightening or loosening camshaft bolt 	X	—											
Valve seat cutter set	Finishing valve seat dimensions 	X	—											
Piston ring expander	Removing and installing piston ring 	X	X											
Valve guide drift	Removing and installing valve guide Diameter: mm (in) <table border="1" style="margin-left: 20px; border-collapse: collapse;"> <thead> <tr> <th colspan="2"></th> <th style="text-align: center;">Intake</th> <th style="text-align: center;">Exhaust</th> </tr> </thead> <tbody> <tr> <td rowspan="2" style="text-align: center;">KA24E</td> <td style="text-align: center;">A</td> <td style="text-align: center;">10.5 (0.413)</td> <td style="text-align: center;">11.5 (0.453)</td> </tr> <tr> <td style="text-align: center;">B</td> <td style="text-align: center;">6.6 (0.260)</td> <td style="text-align: center;">7.6 (0.299)</td> </tr> </tbody> </table> 			Intake	Exhaust	KA24E	A	10.5 (0.413)	11.5 (0.453)	B	6.6 (0.260)	7.6 (0.299)	X	—
		Intake	Exhaust											
KA24E	A	10.5 (0.413)	11.5 (0.453)											
	B	6.6 (0.260)	7.6 (0.299)											
Valve guide reamer	Reaming valve guide ① or hole for oversize valve guide ② Intake: $D_1 = 7.0 \text{ mm (0.276 in) dia.}$ $D_2 = 11.2 \text{ mm (0.441 in) dia.}$ Exhaust: $D_1 = 8.0 \text{ mm (0.315 in) dia.}$ $D_2 = 12.2 \text{ mm (0.480 in) dia.}$ 	X	—											

OUTER COMPONENT PARTS

KA24E



EEM082

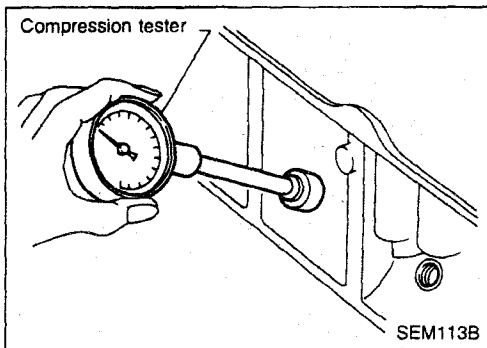
- ① - ⑦ Intake manifold installation
- ⑧ E.G.R. tube
- ⑨ E.G.R. valve
- ⑩ Throttle chamber
- ⑪ Manifold stay
- ⑫ Oil filter bracket
- ⑬ Oil filter

- ⑭ Thermostat
- ⑮ Water inlet
- ⑯ Water pump pulley
- ⑰ Adjusting bar
- ⑱ Water pump
- ⑲ Alternator
- ⑳ Alternator bracket

- ㉑ Crank pulley
- ㉒ Crank pulley damper
- ㉓ Distributor
- ㉔ High-tension cable
- ㉕ Exhaust manifold
- ㉖ Cover
- ㉗ Oil level gauge

Measurement of Compression Pressure

1. Warm up engine.
2. Turn ignition switch off.
3. Release fuel pressure. Refer to "Releasing Fuel Pressure" in "EF & EC" section.
4. Remove all spark plugs.
5. Disconnect distributor center cable.



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 as shown above.

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

Compression pressure: kPa (bar, kg/cm², psi)/rpm
Standard

1,324 (13.24, 13.5, 192)/300

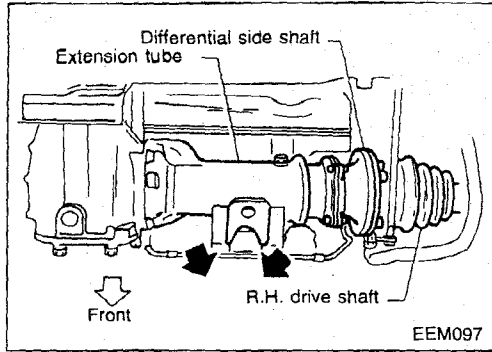
Minimum

981 (9.8, 10, 142)/300

Difference limit between cylinders

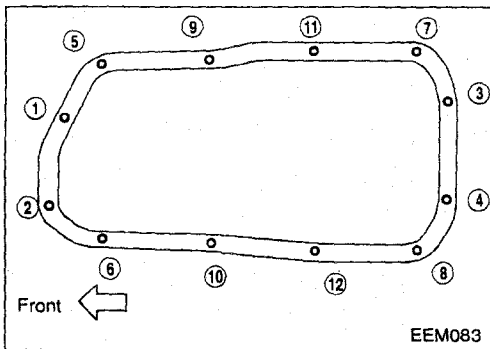
98 (0.98, 1.0, 14)/300

10. If cylinder compression in one or more cylinders is low, pour a small amount of engine oil into cylinders through spark plug holes and 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 S.D.S.) If valve or valve seat is damaged excessively, replace it.**
 - **If compression in any two adjacent cylinders is low and if adding oil does not help compression, there is leakage past the gasket surface. If so, replace cylinder head gasket.**

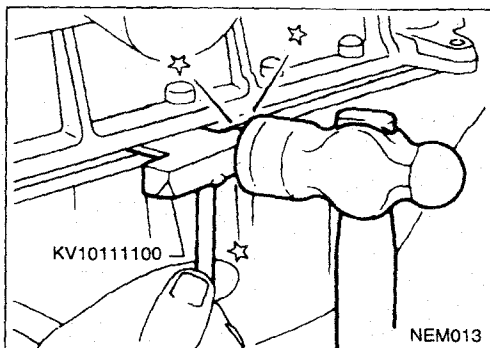


Removal

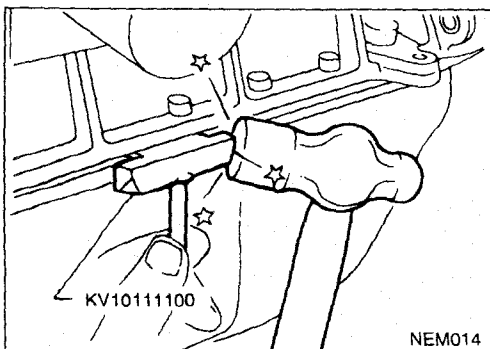
1. Raise vehicle and support it with safety stands.
2. Remove protecting covers.
3. Drain engine oil.
4. Remove R.H. lower shock absorber mounting bolt and move shock absorber up.
5. Disconnect R.H. drive shaft from axle by removing the six bolts. Then move the drive shaft toward the rear of the vehicle.
6. Disconnect differential side shaft from extension tube by removing bolts and pull out differential side shaft partly.
7. Disconnect extension tube from front differential by removing mounting bolts. Then remove extension tube with differential side shaft.



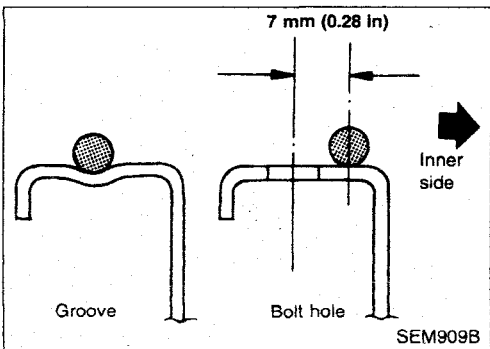
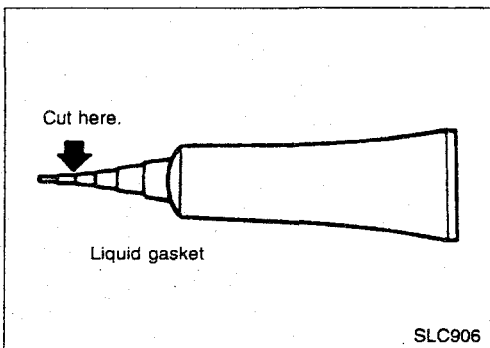
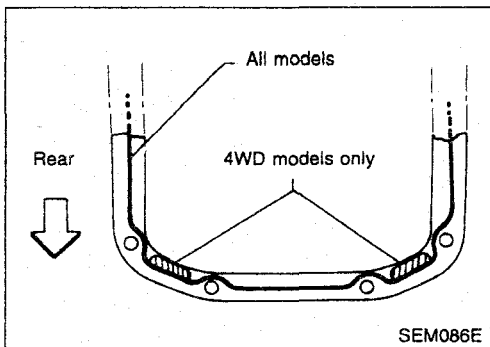
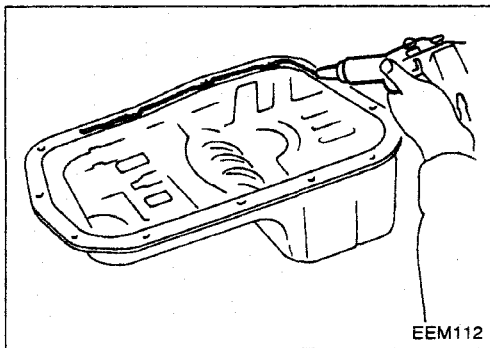
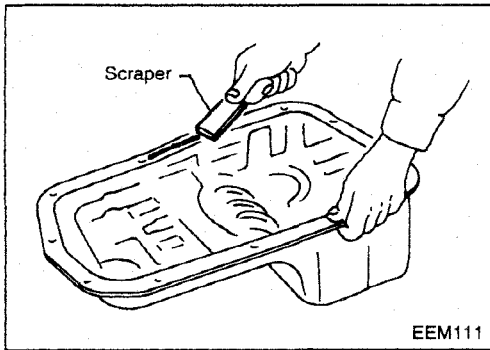
8. Remove oil pan bolts as shown at left.



9. Remove oil pan.
 - (1) Insert Tool between cylinder block and oil pan.
 - Do not drive seal cutter into oil pump or rear oil seal retainer portion, as aluminum mating face will be damaged.
 - Do not insert screwdriver, as oil pan flange will be deformed.



- (2) Slide Tool by tapping its side with a hammer, and remove oil pan.



Installation

1. Before installing oil pan, remove all traces of liquid gasket from mating surface using a scraper.
 - Also remove traces of liquid gasket from mating surface of cylinder block.

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

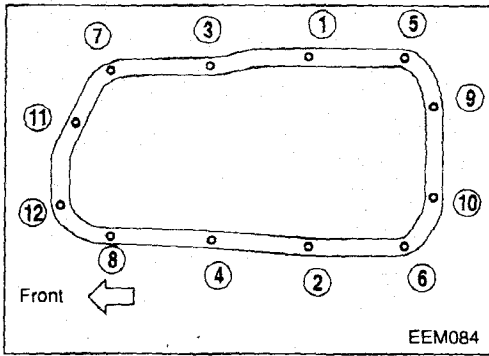
- Be sure liquid gasket is 3.5 to 4.5 mm (0.138 to 0.177 in) wide.

3. Apply liquid gasket to inner sealing surface as shown in figure.

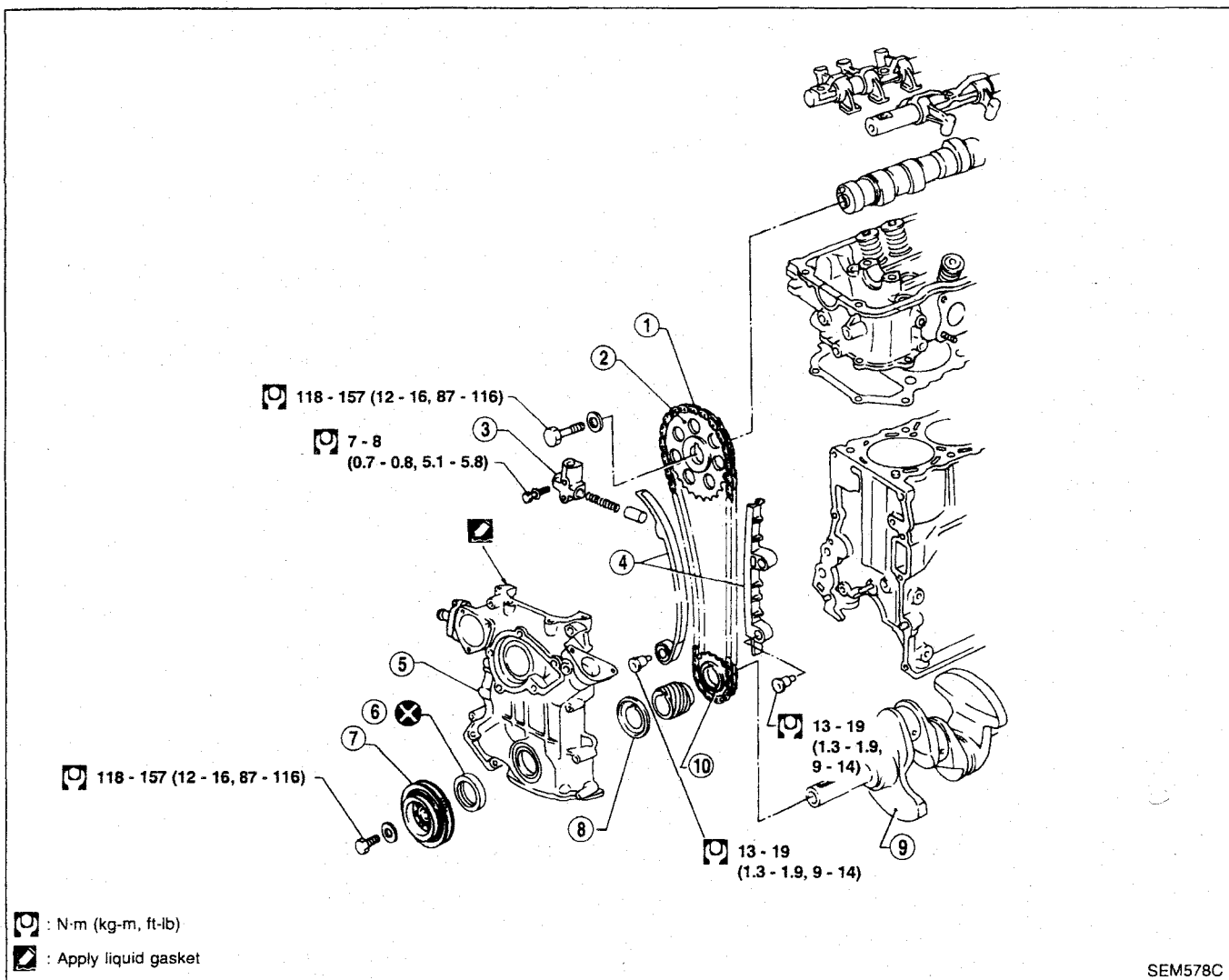
- Attaching should be done within 5 minutes after coating.

4. Install oil pan.

- Wait at least 30 minutes before refilling engine oil.

OIL PAN**Installation (Cont'd)**

5. Tighten oil pan bolts as shown at left.
6. Install all removed parts in reverse order of removal.



SEM578C

- ① Timing chain
- ② Camshaft sprocket
- ③ Chain tensioner
- ④ Chain guide

- ⑤ Front cover
- ⑥ Front oil seal
- ⑦ Crank pulley

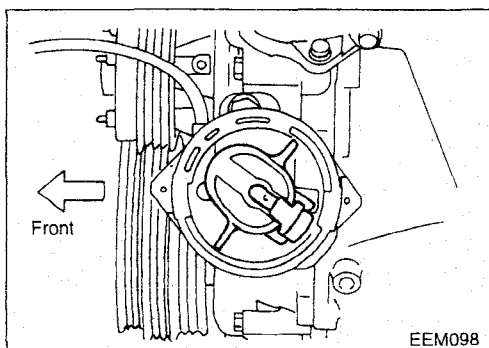
- ⑧ Oil thrower
- ⑨ Crankshaft
- ⑩ Crankshaft sprocket

CAUTION:

After removing timing chain, do not turn crankshaft and camshaft separately, or valves will strike piston heads.

Removal

1. Disconnect-battery terminal.
2. Drain coolant from radiator.
3. Remove radiator shroud and cooling fan.
4. Remove the following belts.
 - Power steering drive belt
 - Compressor drive belt
 - Alternator drive belt
5. Remove all spark plugs.
6. Set No. 1 piston at T.D.C. on its compression stroke.



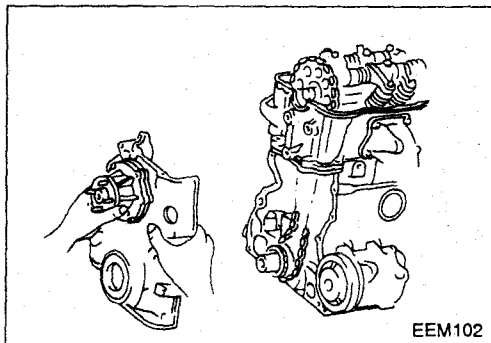
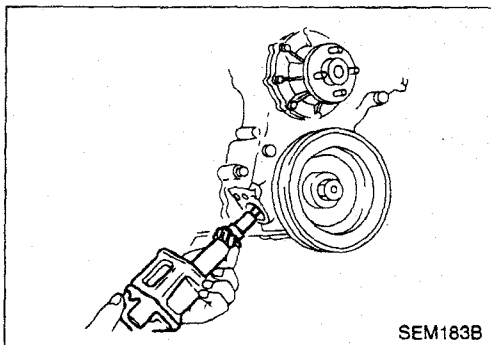
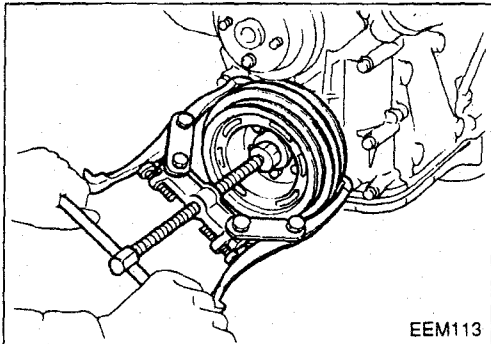
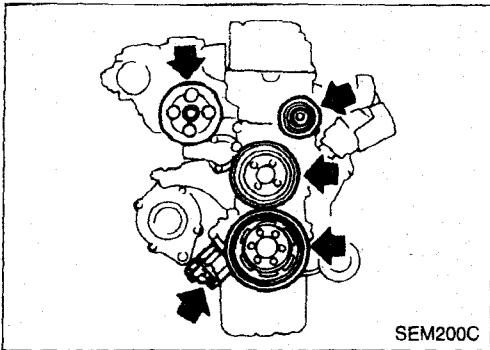
TIMING CHAIN

KA24E

Removal (Cont'd)

7. Remove the following parts.

- Power steering pump, idler pulley and power steering pump brackets
- Compressor idler pulley
- Crankshaft pulley
- Oil pump with pump drive spindle
- Distributor
- Rocker cover



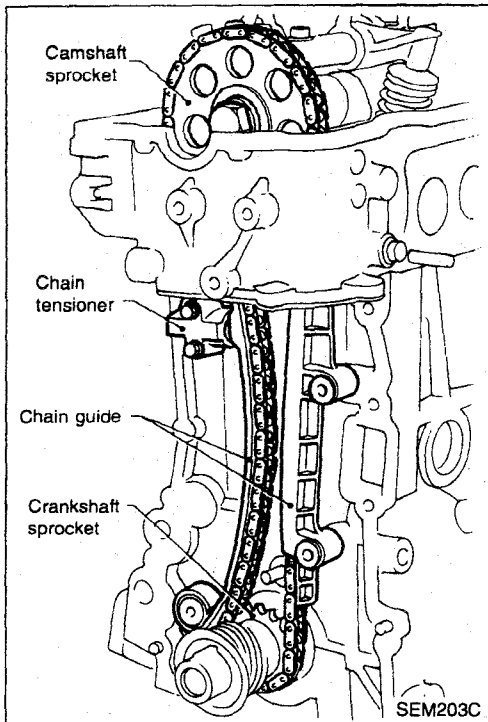
8. Remove oil pan. (Refer to "OIL PAN".)

9. Remove front cover.

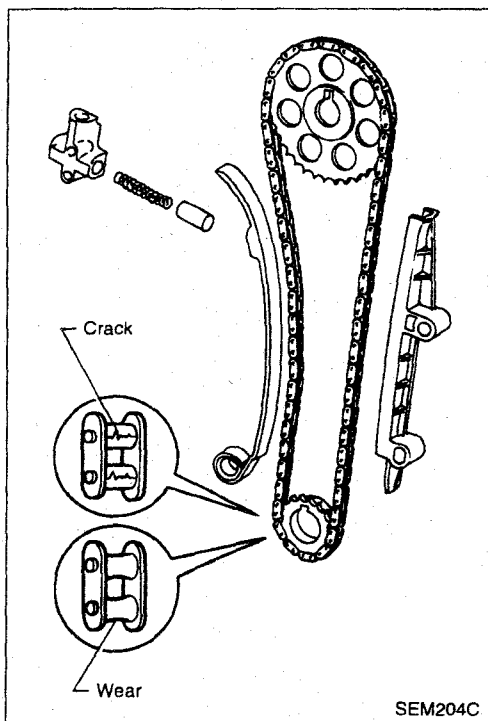
TIMING CHAIN**Removal (Cont'd)**

10. Remove the following parts.

- Chain tensioner
- Chain guides
- Timing chain and sprocket
- Oil thrower, oil pump drive gear and crankshaft sprocket

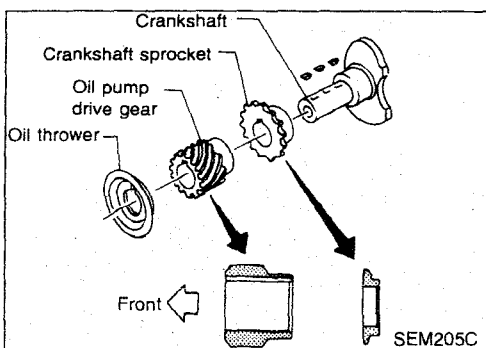
**Inspection**

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

**Installation**

1. Install crankshaft sprocket, oil pump drive gear and oil thrower.

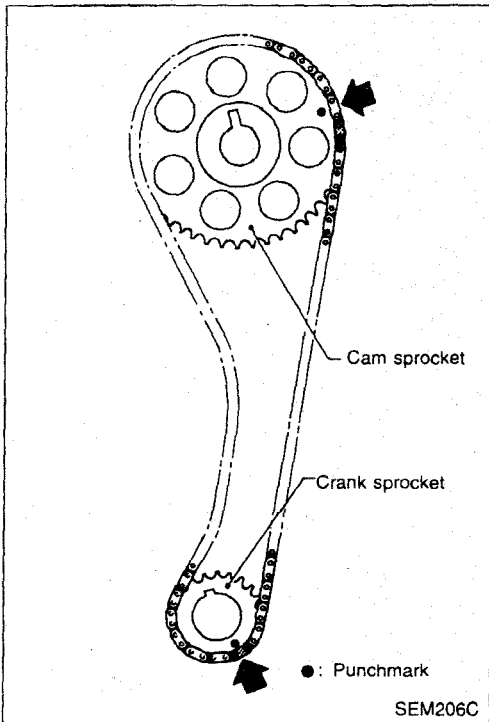
- **Make sure that mating marks of crankshaft sprocket face engine front.**



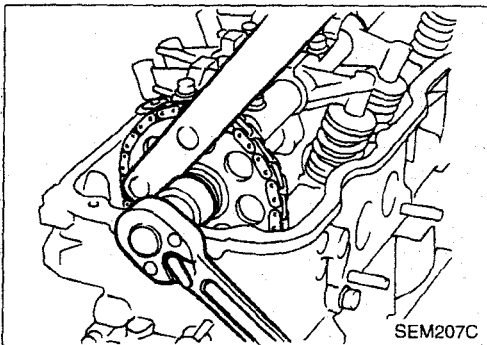
TIMING CHAIN

KA24E

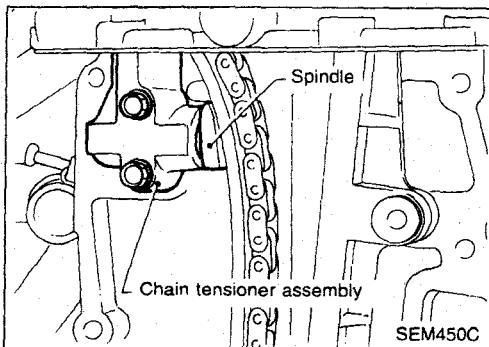
Installation (Cont'd)



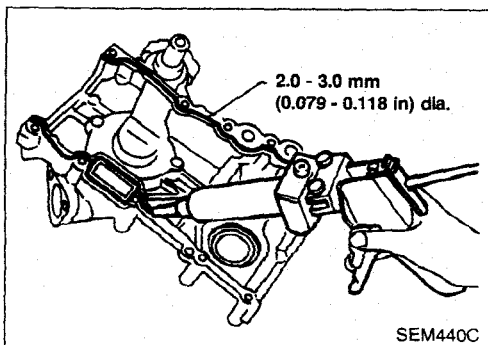
2. Install camshaft sprocket.
3. Confirm that No. 1 piston is set at T.D.C. on its compression stroke.
4. Install timing chain.
- **Set timing by aligning its mating marks with those of crankshaft sprocket and camshaft sprocket.**



5. Tighten camshaft sprocket bolt.

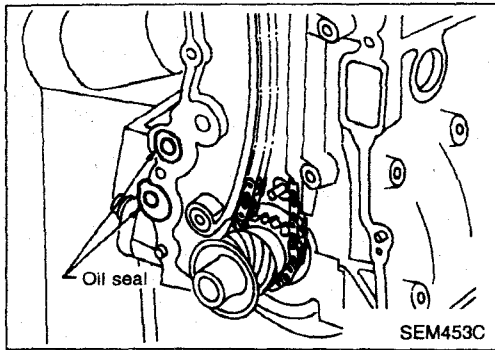


6. Install chain guides and chain tensioner.



7. Apply liquid gasket to front cover.
8. Apply lithium grease to sealing lip of crankshaft oil seal.

Installation (Cont'd)



9. Install front cover.

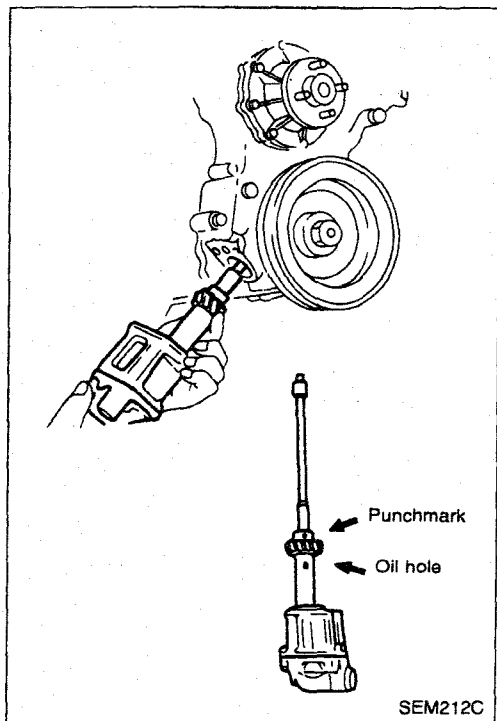
- **Be careful not to damage cylinder head gasket.**
- **Do not forget oil seals.**

10. Install rubber plug. (Refer to "Installation" in "CYLINDER HEAD").

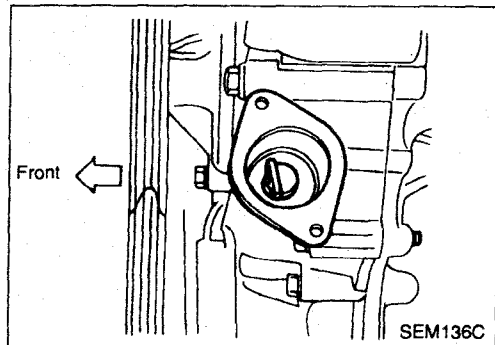
11. Install oil pan. (Refer to "OIL PAN".)

12. Install oil pump and distributor driving spindle with new gasket in front cover.

- (1) Assemble oil pump and driving spindle, aligning punchmark on driving spindle with oil hole.

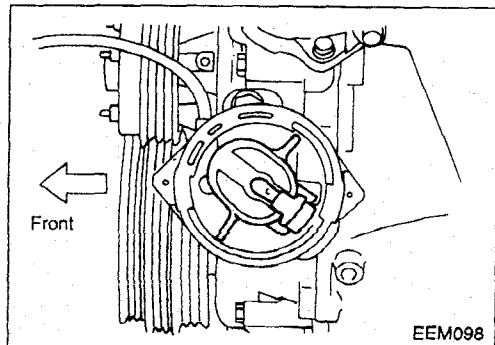


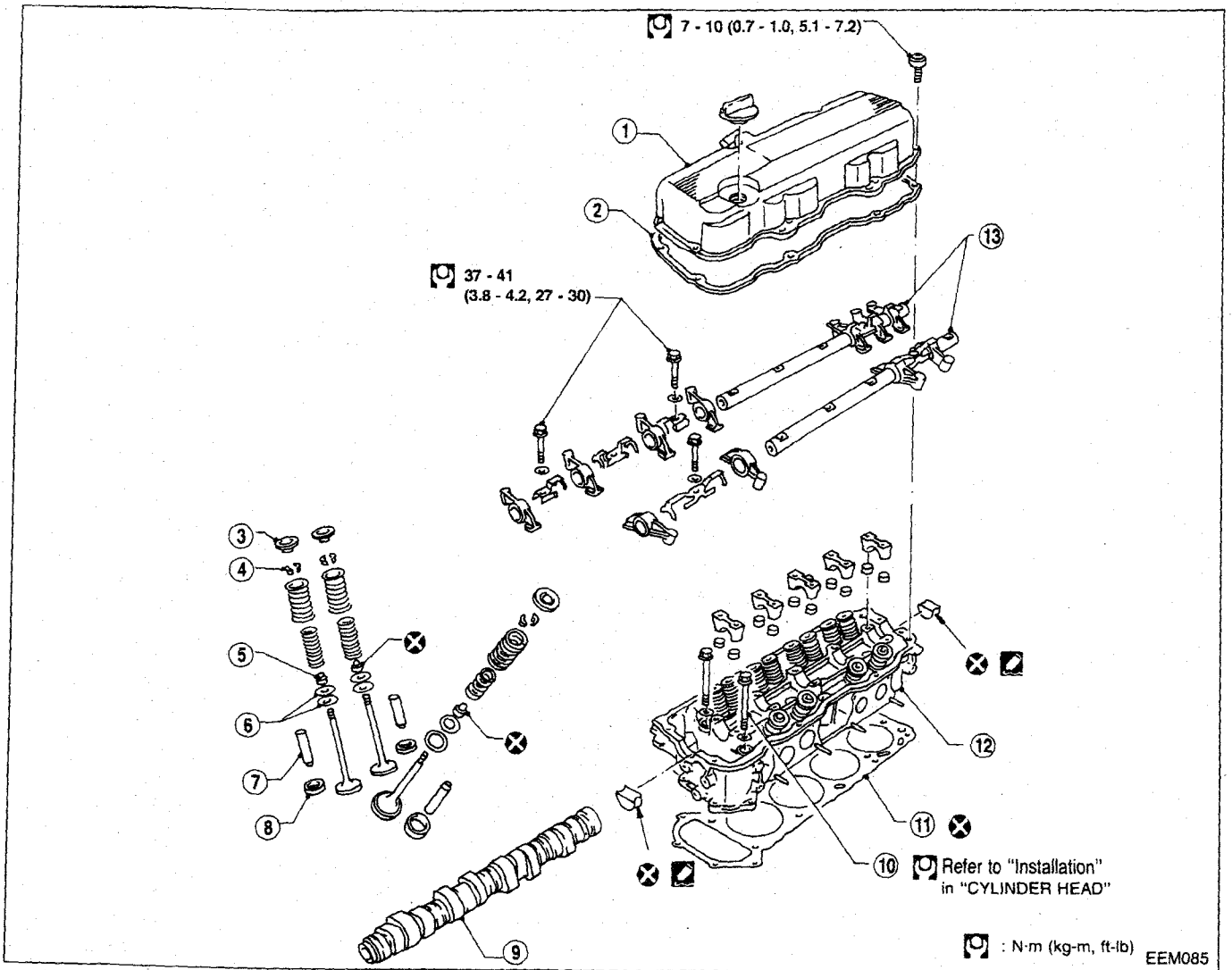
- (2) Make sure that driving spindle is set as shown in figure.



13. Install distributor.

14. Make sure that No. 1 piston is set at T.D.C. and that distributor rotor is set at No. 1 cylinder spark position.

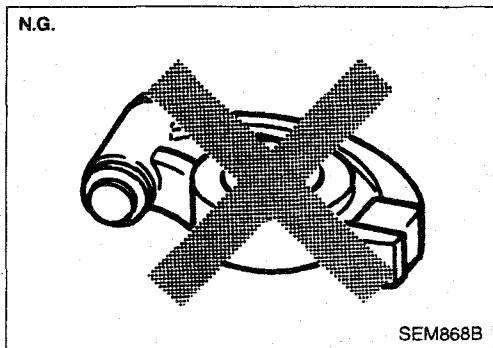
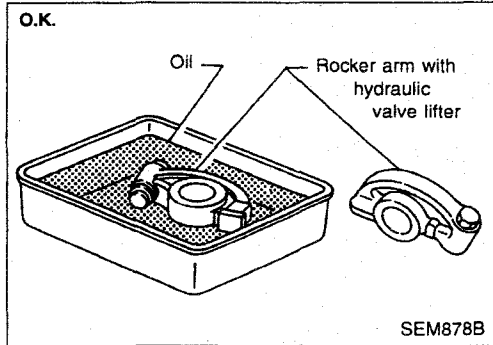
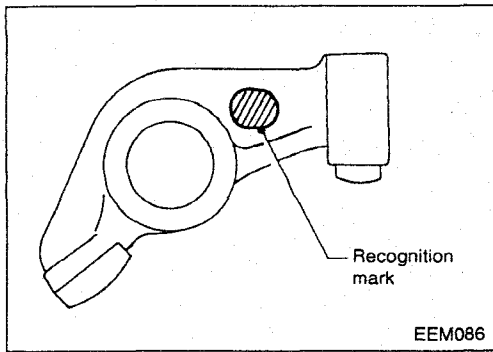




- ① Valve rocker cover
- ② Rocker cover gasket
- ③ Spring retainer
- ④ Valve cotter
- ⑤ Oil seal

- ⑥ Spring seat
- ⑦ Valve guide
- ⑧ Valve seat
- ⑨ Camshaft

- ⑩ Head bolt
- ⑪ Cylinder head gasket
- ⑫ Cylinder head
- ⑬ Valve rocker and shaft assembly

**CAUTION:**

- When installing sliding parts such as rocker arms, camshaft and oil seal, be sure to apply new engine oil on their sliding surfaces.
- When tightening cylinder head bolts and rocker shaft bolts, apply new engine oil to thread portions and seat surfaces of bolts.
- Make use of the recognition mark to distinguish the 4 different rocker arms.

- Hydraulic valve lifters are installed in each rocker arm. If a hydraulic valve lifter is kept on its side, even when installed in rocker arm, there is a possibility of air entering it. After removal, always set rocker arm straight up, or when laying it on its side, let it soak in new engine oil.

- Do not disassemble hydraulic valve lifter.
- Attach tags to valve lifters so as not to mix them up.

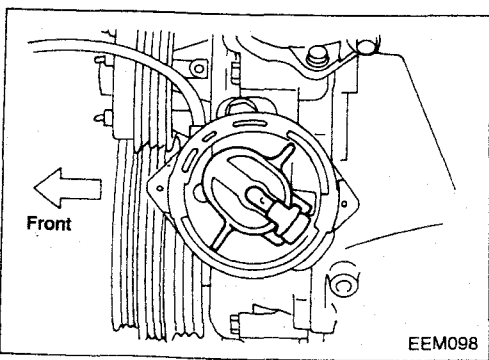
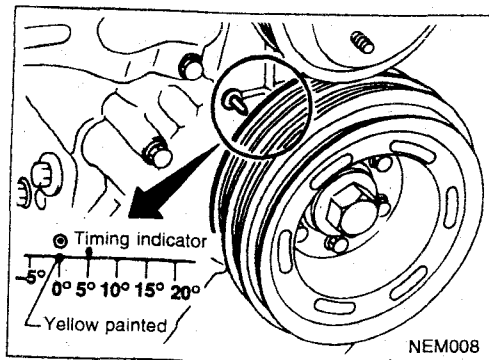
Removal

1. Drain coolant from radiator and drain plug of block.
2. Remove the following parts.
 - Power steering drive belt
 - Power steering pump, idler pulley and power steering brackets
 - Vacuum hoses of S.C.V. and of pressure control solenoid valve
 - Accelerator wire bracket
3. Disconnect E.G.R. tube from exhaust manifold.
4. Remove bolts which hold intake manifold collector to intake manifold.
5. Remove bolts which hold intake manifold to cylinder head while raising collector upwards.
6. Remove rocker cover.

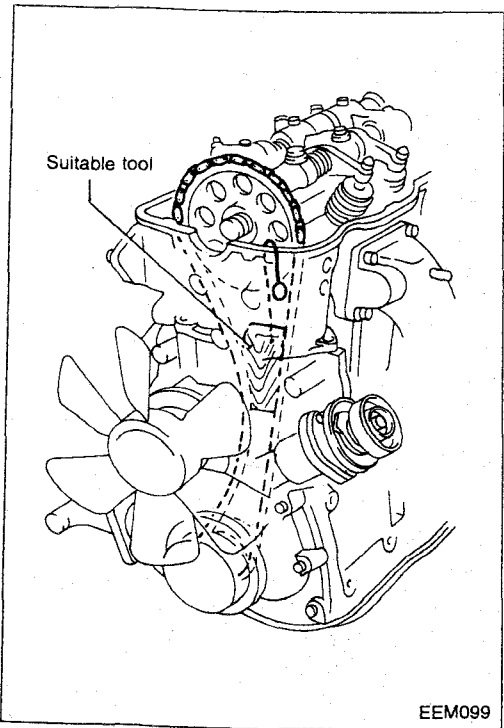
When removing rocker cover, do not hit rocker cover against rocker arms.

CYLINDER HEAD Removal (Cont'd)

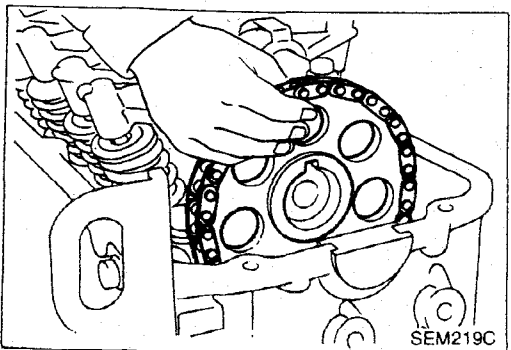
7. Set No. 1 piston at T.D.C. on its compression stroke.



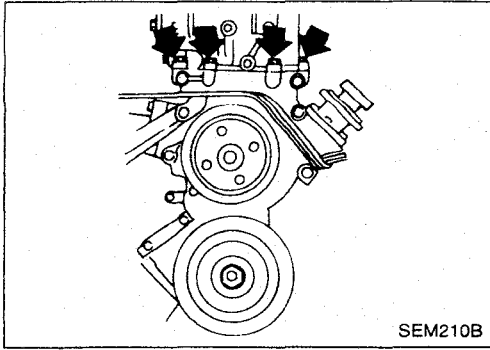
8. Loosen camshaft sprocket bolt.
- Support timing chain by using Tool as shown in figure.
 - If mating marks on timing chain and camshaft sprocket are not aligned, make marks yourself in order to be able to install camshaft sprocket in the right position.



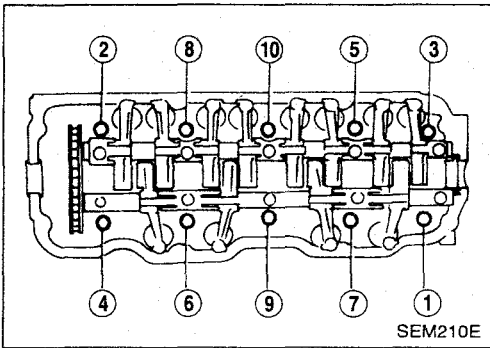
9. Remove camshaft sprocket.



Removal (Cont'd)

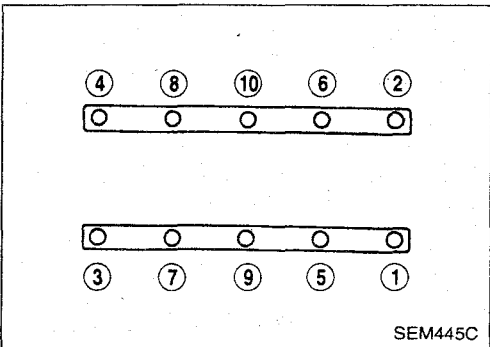


10. Remove front cover tightening bolts to cylinder head.



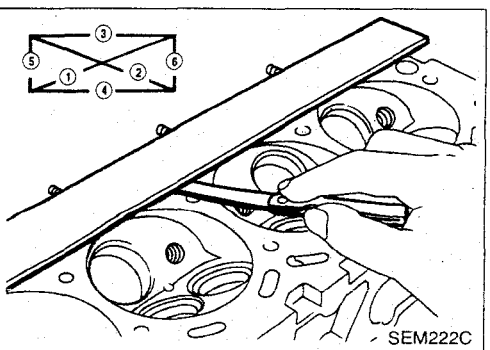
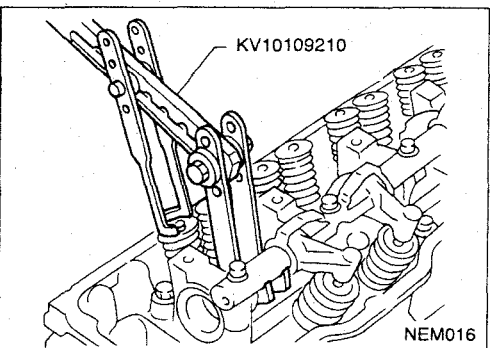
11. Remove cylinder head.

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



Disassembly

1. Remove rocker shaft assembly.
 - a. When loosening bolts, evenly loosen from outside in sequence.
 - b. Bolts should be loosened in two or three steps.
2. Remove camshaft.
 - Before removing camshaft, measure camshaft end play. (Refer to "Inspection".)
3. Remove valve components with Tool.
4. Remove valve oil seals. (Refer to "OIL SEAL REPLACEMENT").



Inspection

CYLINDER HEAD DISTORTION

Head surface distortion:

Less than 0.1 mm (0.004 in)

If beyond the specified limit, replace it or resurface it.

Resurfacing limit:

The resurfacing limit of cylinder head is determined by the cylinder block resurfacing in an engine.

Amount of cylinder head resurfacing is "A".

Amount of cylinder block resurfacing is "B".

Inspection (Cont'd)

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:

$$98.8 - 99.0 \text{ mm (3.890 - 3.898 in)}$$

CAMSHAFT VISUAL CHECK

Check camshaft for scratches, seizure and wear.

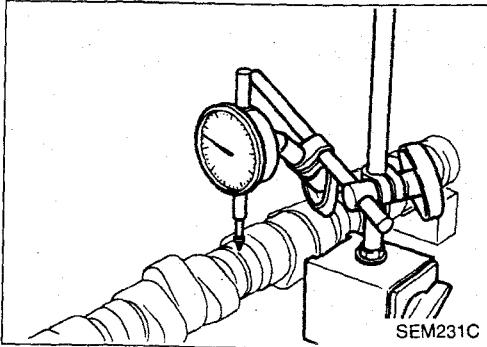
CAMSHAFT RUNOUT

1. Measure camshaft runout at the center journal.

Runout (Total indicator reading):

$$0 - 0.02 \text{ mm (0 - 0.0008 in)}$$

2. If it exceeds the limit, replace camshaft.



CAMSHAFT CAM HEIGHT

1. Measure camshaft cam height.

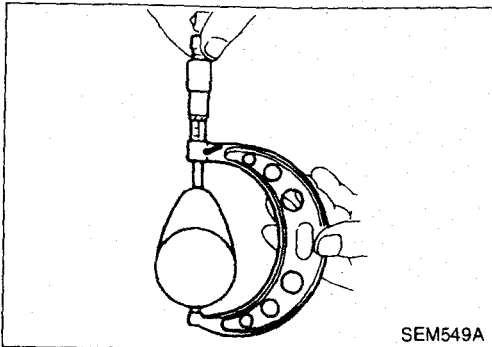
Standard cam height:

$$44.839 - 45.029 \text{ mm (1.7653 - 1.7728 in)}$$

Cam wear limit:

$$0.2 \text{ mm (0.008 in)}$$

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

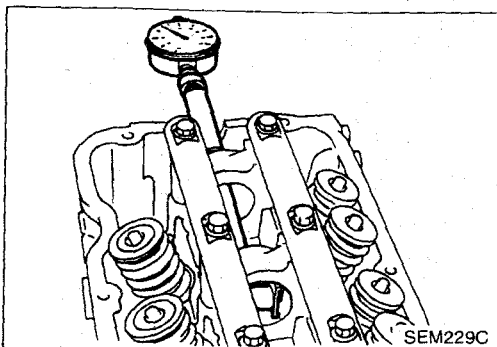


CAMSHAFT JOURNAL CLEARANCE

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

Standard inner diameter:

$$33.000 - 33.025 \text{ mm (1.2992 - 1.3002 in)}$$



3. Measure outer diameter of camshaft journal.

Standard outer diameter:

$$32.935 - 32.955 \text{ mm (1.2967 - 1.2974 in)}$$

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

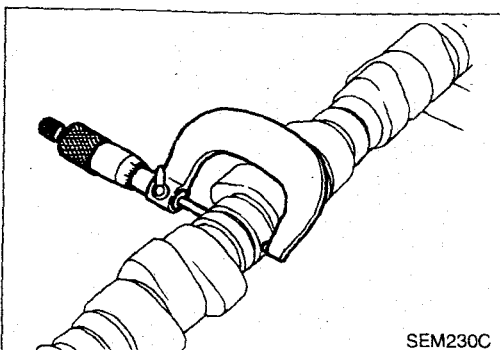
Camshaft journal clearance:

Standard

$$0.045 - 0.090 \text{ mm (0.0018 - 0.0035 in)}$$

Limit

$$0.12 \text{ mm (0.0047 in)}$$



Inspection (Cont'd)

CAMSHAFT END PLAY

1. Install camshaft in cylinder head.
2. Measure camshaft end play.

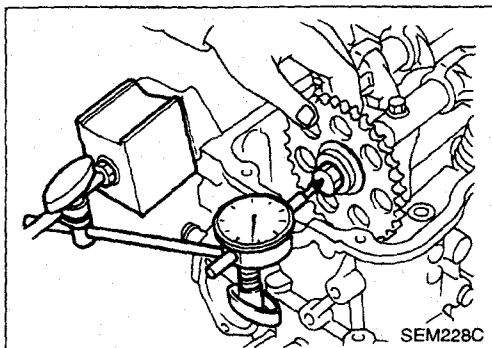
Camshaft end play:

Standard

0.07 - 0.15 mm (0.0028 - 0.0059 in)

Limit

0.2 mm (0.008 in)



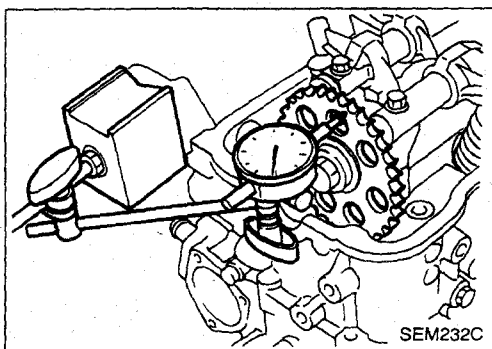
CAMSHAFT SPROCKET RUNOUT

1. Install sprocket on camshaft.
2. Measure camshaft sprocket runout.

Runout (Total indicator reading):

Limit 0.12 mm (0.0047 in)

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

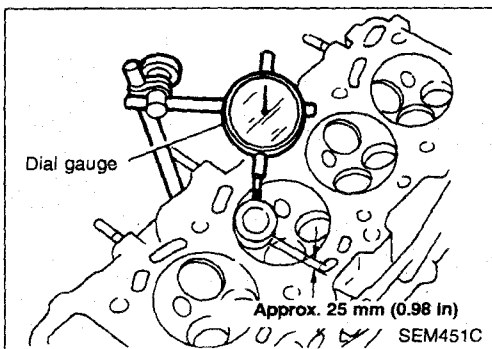


VALVE GUIDE CLEARANCE

1. Measure valve deflection in a right-angled direction with camshaft. (Valve and valve guide mostly wear in this direction.)

Valve deflection limit (Dial gauge reading):

0.15 mm (0.0059 in).



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

Valve to valve guide clearance:

Standard 0.020 - 0.053 mm

(0.0008 - 0.0021 in) (Intake)

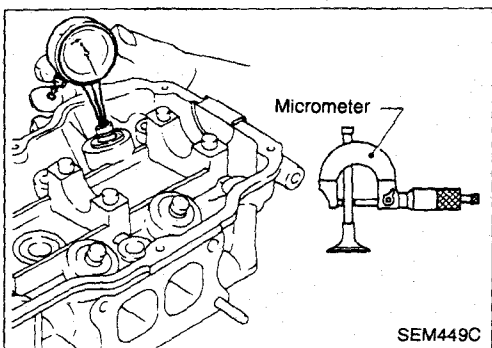
0.040 - 0.070 mm

(0.0016 - 0.0028 in) (Exhaust)

Limit

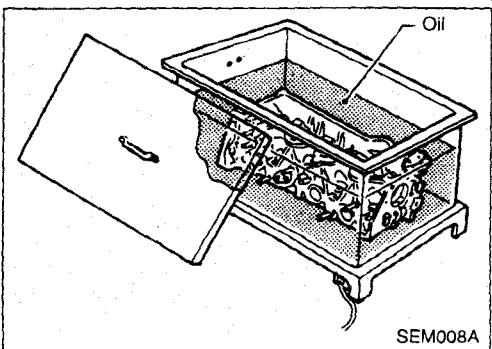
0.1 mm (0.004 in)

3. If it exceeds the limit, replace valve or valve guide.

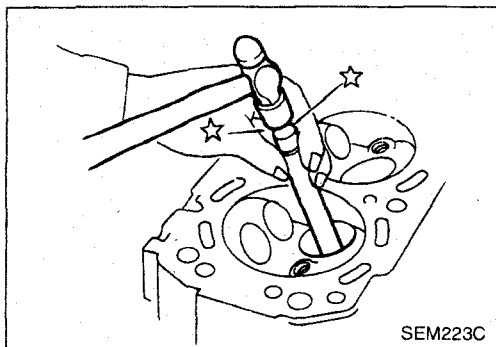


VALVE GUIDE REPLACEMENT

1. To remove valve guide, heat cylinder head to between 150 and 160°C (302 to 320°F).

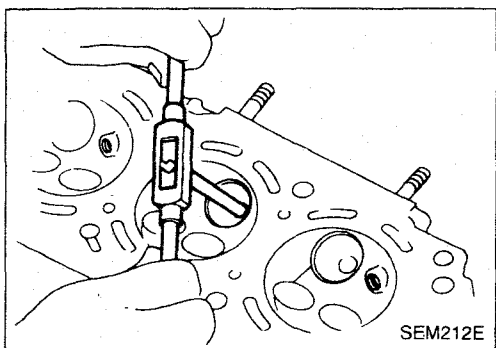


Inspection (Cont'd)



SEM223C

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



SEM212E

3. Ream cylinder head valve guide hole.

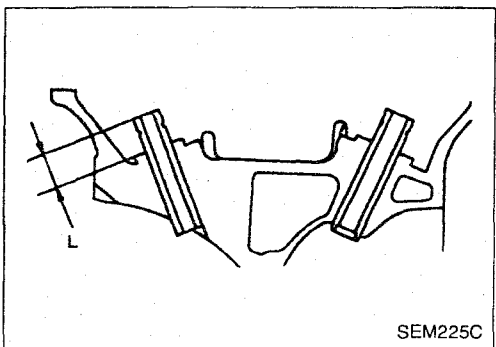
**Valve guide hole diameter
(for service parts):**

Intake

11.175 - 11.196 mm (0.4400 - 0.4408 in)

Exhaust

12.175 - 12.196 mm (0.4793 - 0.4802 in)

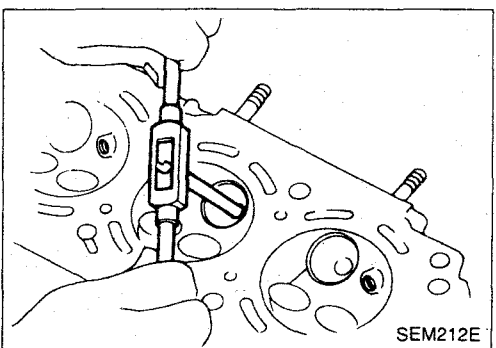


SEM225C

4. Heat cylinder head to between 150 and 160°C (302 to 320°F) and press service valve guide into cylinder head.

Projection "L":

14.9 - 15.1 mm (0.587 - 0.594 in)



SEM212E

5. Ream valve guide.

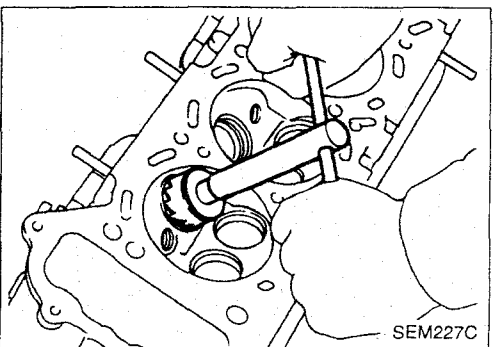
Finished size:

Intake

7.000 - 7.018 mm (0.2756 - 0.2763 in)

Exhaust

8.000 - 8.018 mm (0.3150 - 0.3157 in)



SEM227C

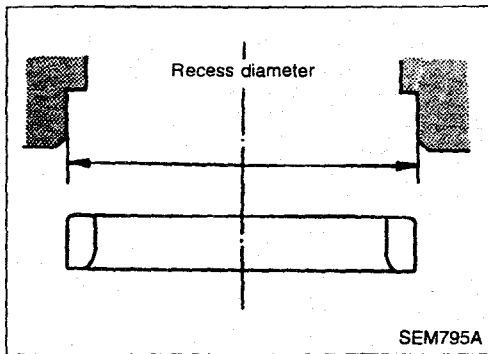
VALVE SEATS

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

- Before repairing valve seats, check valve and valve guide for wear. If they have worn, replace them. Then correct valve seat.
- Cut with both hands to uniform the cutting surface.

Inspection (Cont'd)

REPLACING VALVE SEAT FOR SERVICE PARTS


SEM795A

1. Bore out old seat until it collapses. The machine depth stop should be set so that boring cannot continue beyond the bottom face of the seat recess in cylinder head.
2. Ream cylinder head recess.

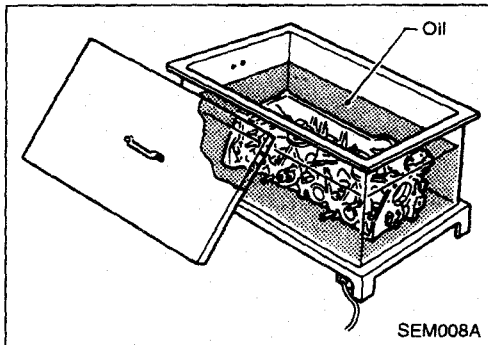
Reaming bore for service valve seat

Oversize [0.5 mm (0.020 in)]:

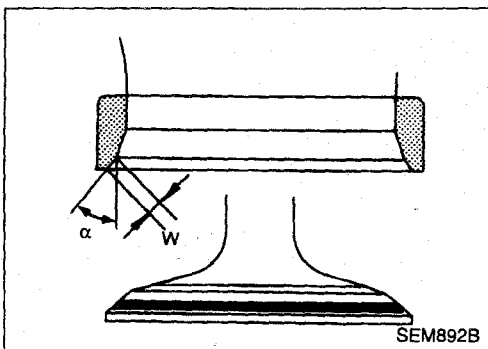
Intake 36.500 - 36.516 mm (1.4370 - 1.4376 in)

Exhaust 42.500 - 42.516 mm (1.6732 - 1.6739 in)

Reaming should be done to the concentric circles to valve guide center so that valve seat will have the correct fit.


SEM008A

3. Heat cylinder head to between 150 and 160°C (302 to 320°F).
4. Install new valve seat.


SEM892B

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

Seat face angle " α ":

45 deg.

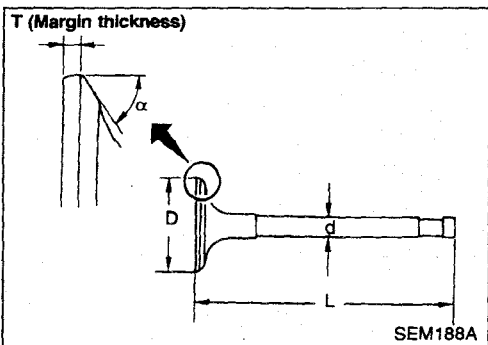
Contacting width " W ":

Intake

1.6 - 1.7 mm (0.063 - 0.067 in)

Exhaust

1.7 - 2.1 mm (0.067 - 0.083 in)


SEM188A

VALVE DIMENSIONS

Check dimensions in each valve. For dimensions, refer to S.D.S. When valve head has been worn down to 0.5 mm (0.020 in) in margin thickness, replace valve.

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

VALVE SPRING

Squareness

1. Measure " S " dimension.

Out-of-square:

Outer

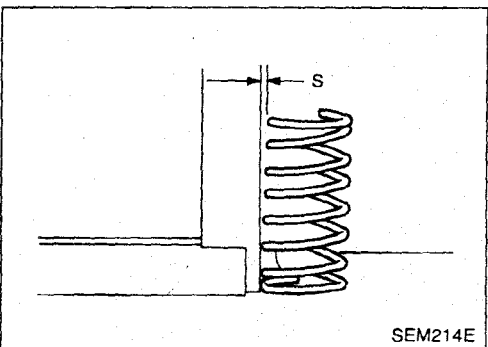
Intake: Less than 2.5 mm (0.098 in)

Exhaust: Less than 2.3 mm (0.091 in)

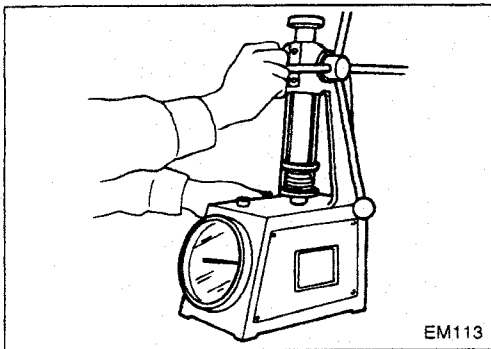
Inner

Intake: Less than 2.3 mm (0.091 in)

Exhaust: Less than 2.1 mm (0.083 in)


SEM214E

Inspection (Cont'd)



EM113

2. If it exceeds the limit, replace spring.

Pressure

Check valve spring pressure.

Pressure: N (kg, lb) at height mm (in)

Standard

Outer

Intake 604.1 (61.6, 135.8) at 37.6 (1.480)

Exhaust 640.4 (65.3, 144.0) at 34.1 (1.343)

Inner

Intake 284.4 (29.0, 63.9) at 32.6 (1.283)

Exhaust 328.5 (33.5, 73.9) at 29.1 (1.146)

Limit

Outer

Intake 567.8 (57.9, 127.7) at 37.6 (1.480)

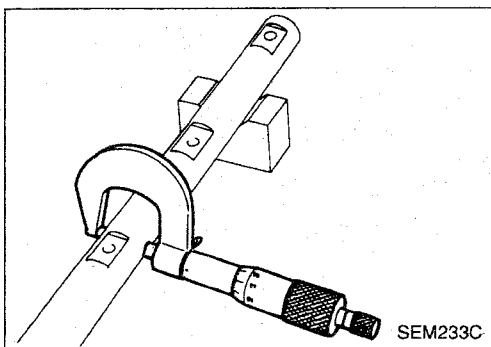
Exhaust 620.8 (63.3, 139.6) at 34.1 (1.343)

Inner

Intake 266.8 (27.2, 60.0) at 32.6 (1.283)

Exhaust 318.7 (32.5, 71.7) at 29.1 (1.146)

If it exceeds the limit, replace spring.



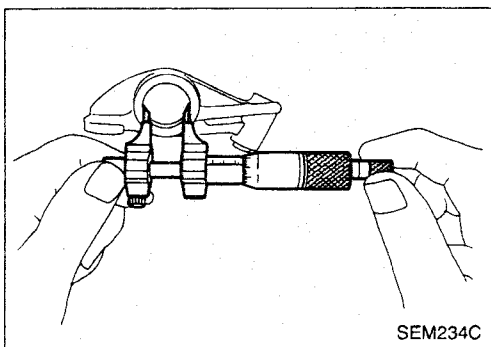
SEM233C

ROCKER SHAFT AND ROCKER ARM

1. Check rocker shafts for scratches, seizure and wear.
2. Check outer diameter of rocker shaft.

Diameter:

21.979 - 22.000 mm (0.8653 - 0.8661 in)



SEM234C

3. Check inner diameter of rocker arm.

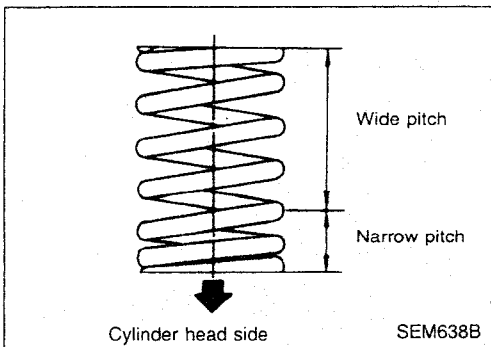
Diameter:

22.012 - 22.029 mm (0.8666 - 0.8673 in)

Rocker arm to shaft clearance:

0.012 - 0.050 mm (0.0005 - 0.0020 in)

- Keep rocker arm with hydraulic valve lifter standing to prevent air from entering hydraulic valve lifter when checking.



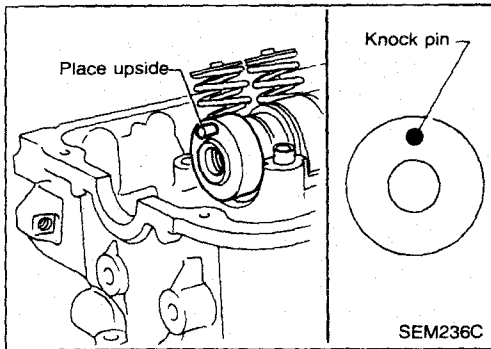
SEM638B

Assembly

1. Install valve component parts.
 - Always use new valve oil seal. Refer to "OIL SEAL REPLACEMENT".
 - Before installing valve oil seal, install inner valve spring seat.
 - Install valve springs (uneven pitch type) with their narrow pitch facing downwards toward cylinder head.
 - After installing valve component parts, use plastic hammer to lightly tap valve stem tip to assure a proper fit.

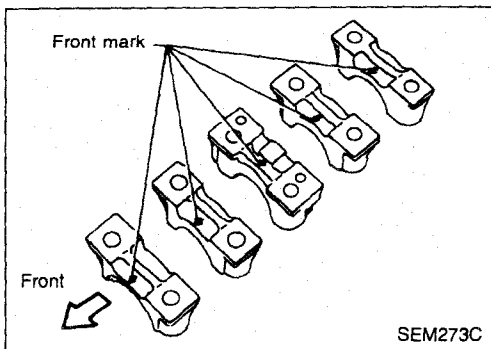
Assembly (Cont'd)

- Exhaust valve springs are marked with a color point in order to distinguish them from intake valve springs.



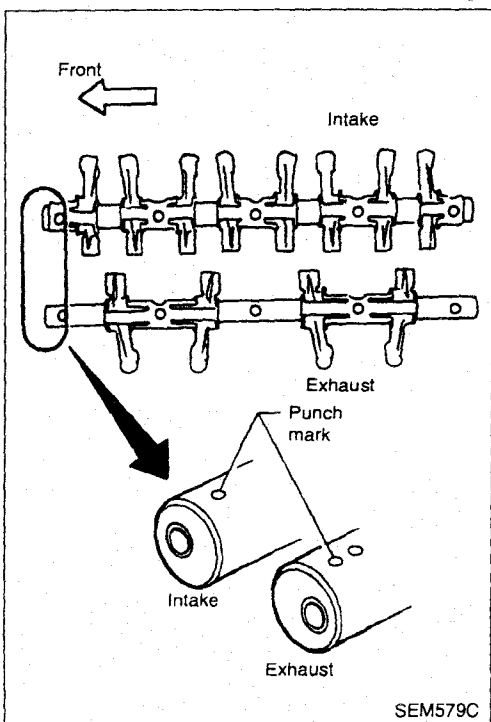
- Mount camshaft onto cylinder head, placing knock pin at front end to top position.

Apply engine oil to camshaft when mounting onto cylinder head.



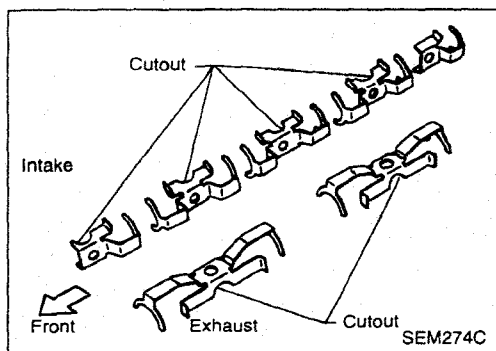
- Install camshaft brackets.

Front mark is punched on the camshaft bracket.

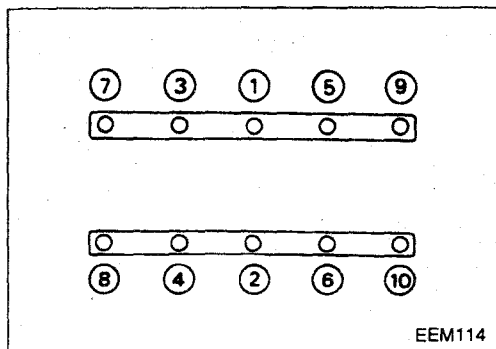


- Install rocker shafts with rocker arms.

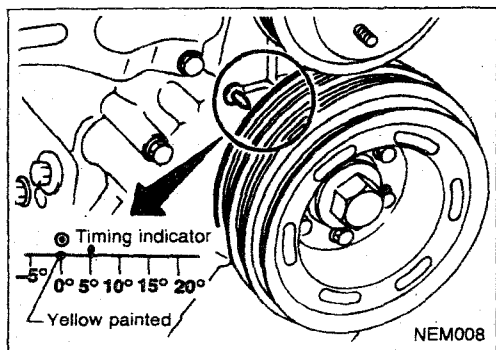
Assembly (Cont'd)



- Install retainer with cutout facing direction shown in figure at left.

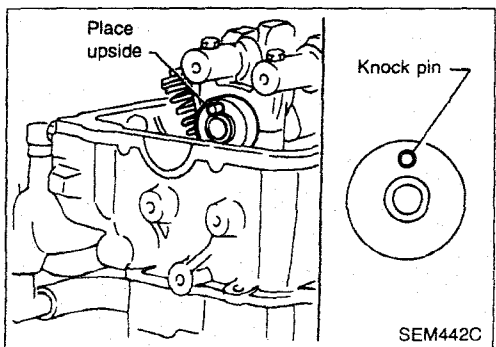
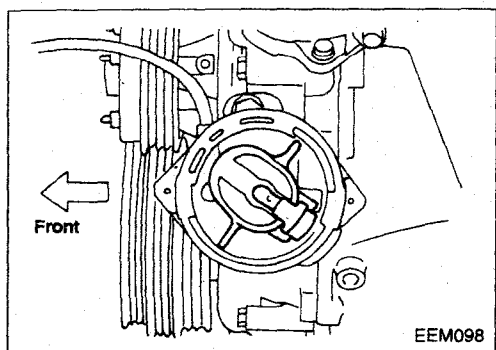


5. Tighten bolts as shown in figure at left.



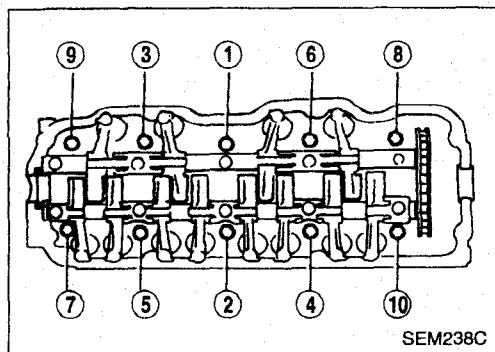
Installation

1. Confirm that No.1 piston is set at T.D.C. on its compression stroke.

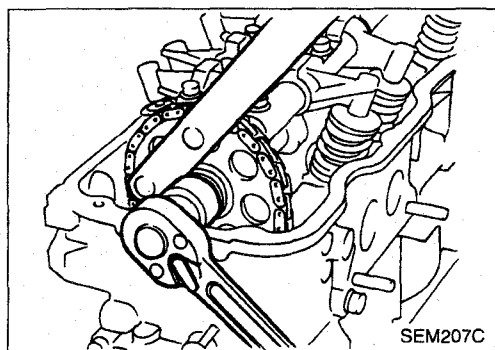


2. Confirm that knock pin on camshaft is set at the top.

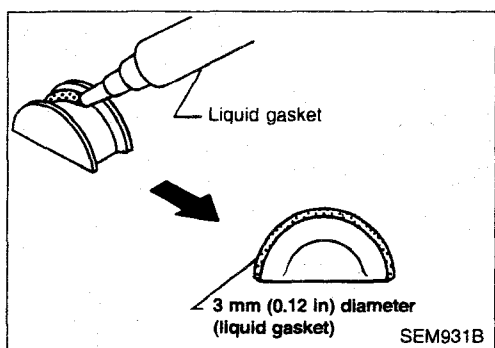
Installation (Cont'd)



3. Install cylinder head with new gasket and tighten cylinder head bolts in numerical order.
 - Do not rotate crankshaft and camshaft separately, or valves will hit piston heads.
 - Tightening procedure
 - (1) Tighten all bolts to 29 N·m (3.0 kg-m, 22 ft-lb).
 - (2) Tighten all bolts to 78 N·m (8.0 kg-m, 58 ft-lb).
 - (3) Loosen all bolts completely.
 - (4) Tighten all bolts to 29 N·m (3.0 kg-m, 22 ft-lb).
 - (5) Turn all bolts 80 to 85 degrees clockwise with an angle wrench, or if an angle wrench is not available, tighten all bolts to between 74 and 83 N·m (7.5 to 8.5 kg-m, 54 to 61 ft-lb).
4. Install front cover tightening bolts to cylinder head.
5. Set chain on camshaft sprocket by aligning each mating mark. Then install camshaft sprocket to camshaft.
6. Remove wooden tool, used to avoid timing chain from falling down.



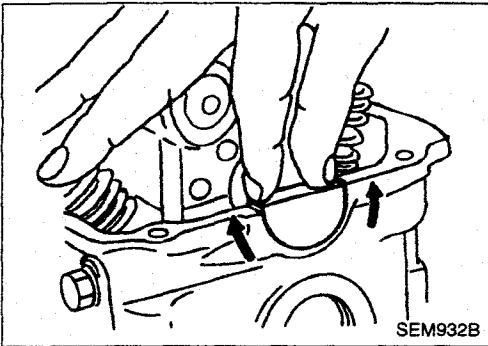
7. Tighten camshaft sprocket bolt.



8. Install rubber plugs as follows:
 - (1) Apply liquid gasket to rubber plugs.
 - Rubber plugs should be replaced by new ones.
 - Rubber plugs should be installed within 5 minutes of applying liquid gasket.

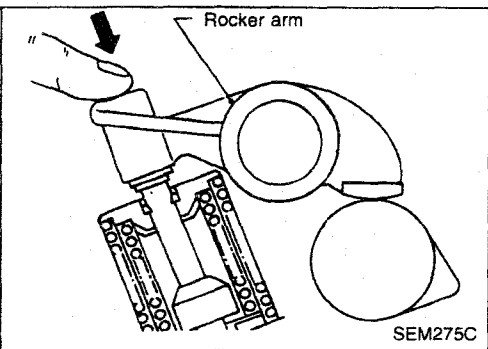
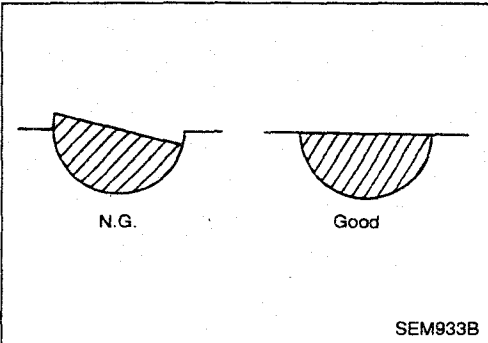
CYLINDER HEAD

Installation (Cont'd)



(2) Install rubber plugs, then move them with your fingers to uniformly spread the gasket on cylinder head surface.

- Rubber plugs should be installed flush with the surface.
- Do not start the engine for 30 minutes after installing rocker cover.
- Remove excessive liquid gasket from cylinder head top surface.



9. Check hydraulic valve lifter.

(1) Push hydraulic valve lifter forcefully with your finger.

- Be sure to check it with rocker arm in its free position.

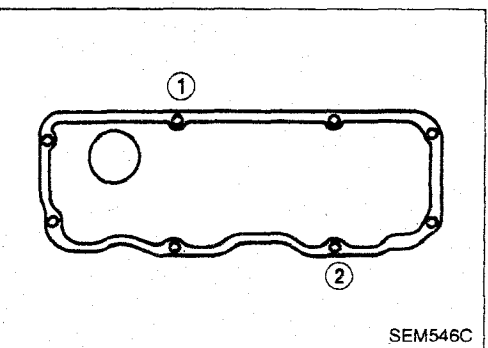
(2) If valve lifter moves more than 1 mm (0.04 in), air may be inside of it.

(3) Bleed air off by running engine at 1,000 rpm under no-load for about 20 minutes.

(4) If hydraulic valve lifters are still noisy, replace them and bleed air off again in the same manner as in step (3).

10. Install rocker cover.

- Be sure to avoid interference between rocker cover and rocker arms.

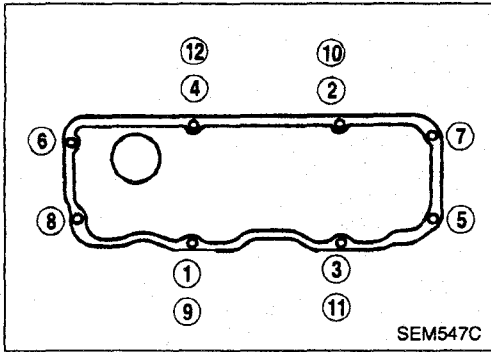


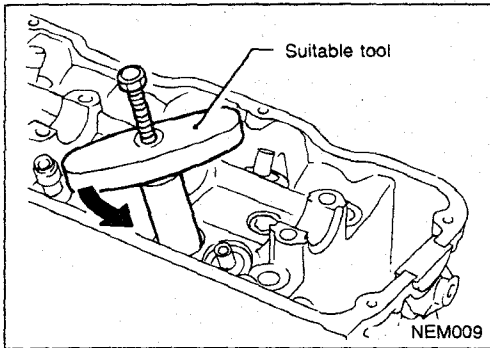
11. Tighten bolts as follows:

(1) Tighten 2 bolts to 3 N·m (0.3 kg-m, 2.2 ft-lb) temporarily in order shown in figure.

Installation (Cont'd)

(2) Then tighten all bolts to between 7 and 10 N·m (0.7 to 1.0 kg-m, 5.1 to 7.2 ft-lb) in order shown in figure.
12. Install any remaining parts.



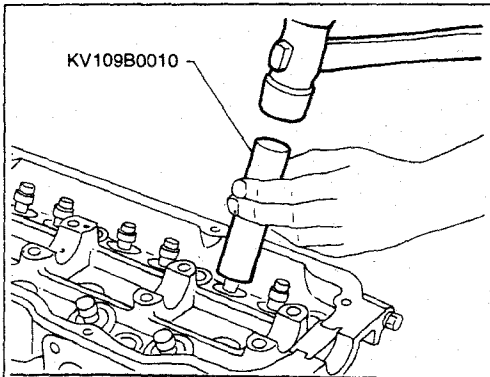


VALVE OIL SEAL

1. Remove rocker cover.
2. Remove rocker shaft assembly (Refer to "Disassembly" in "CYLINDER HEAD")
3. Remove valve springs and valve oil seal with suitable tool.

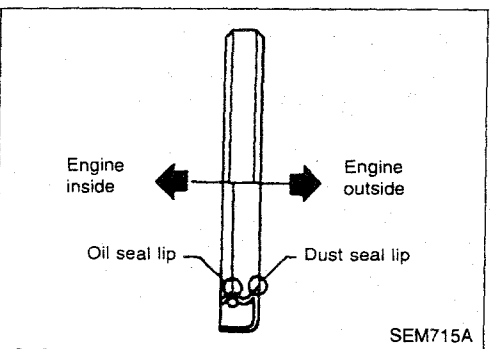
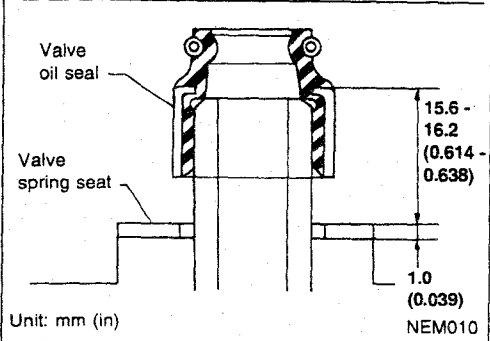
Piston concerned should be set at T.D.C. to prevent valve from falling.

NOTE: Install air hose adapter into spark plug hole and apply air pressure to hold valves in place. Apply a pressure of 490 kPa (4.9 bar, 5 kg/cm², 71 psi).



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

Before installing valve oil seal, install valve spring seat.



OIL SEAL INSTALLING DIRECTION

FRONT OIL SEAL

1. Remove protecting cover.
2. Remove radiator shroud and crankshaft pulley.
3. Remove front oil seal.

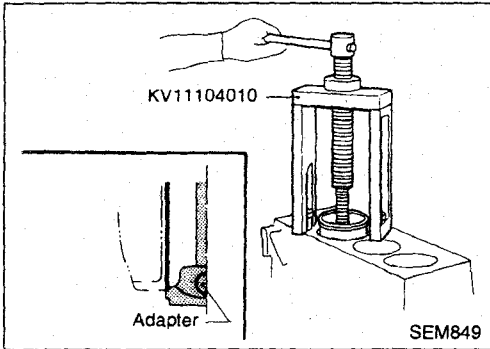
Be careful not to damage crankshaft.

Inspection (Cont'd)

CYLINDER LINER

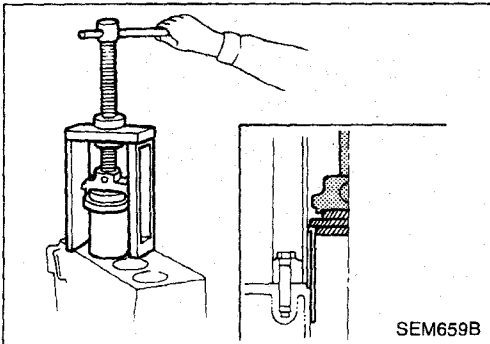
Replacement

1. Remove cylinder with Tool.



2. Install cylinder liner with Tool.

3. Check amount of projection of cylinder liner.



PISTON TO CYLINDER WALL CLEARANCE

1. Measure-piston and cylinder bore diameter.

Piston diameter "A":

Refer to S.D.S.

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

45.2 mm (1.78 in)

2. Check that piston clearance is within specification.

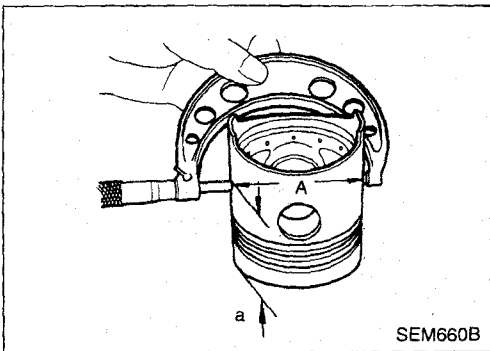
Piston to cylinder liner clearance:

0.043 - 0.077 mm

(0.0017 - 0.0030 in)

Measuring point "a" (distance from upper part):

69.2 mm (2.72 in)



PISTON AND PISTON PIN CLEARANCE

Check clearance between pistons and piston pins.

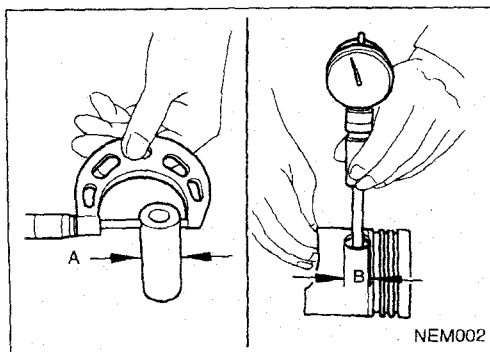
Clearance (A - B):

Standard

- 0.008 to 0.007 mm (- 0.0003 to 0.0003 in)

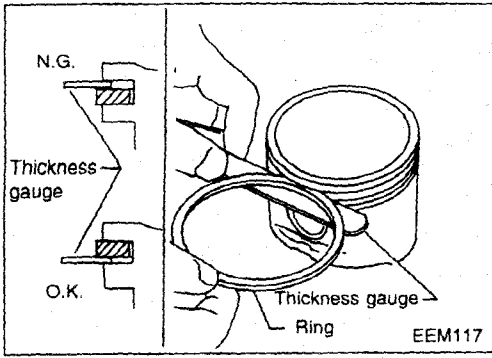
Limit

Less than 0.1 mm (0.004 in)



Inspection (Cont'd)

PISTON RING SIDE CLEARANCE



Side clearance:

Top ring

0.00 - 0.05 mm (0.0 - 0.0019 in)

2nd ring

0.04 - 0.072 mm (0.0016 - 0.0028 in)

Oil ring

0.035 - 0.040 mm (0.0014 - 0.0016 in)

Max. limit of side clearance:

Top ring

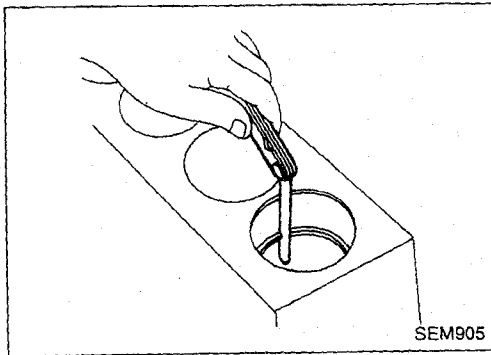
0.5 mm (0.020 in)

2nd ring

0.3 mm (0.012 in)

Oil ring

0.15 mm (0.0059 in)



PISTON RING END GAP

Standard ring gap:

Top ring

0.25 - 0.35 mm (0.0098 - 0.0138 in)

2nd ring

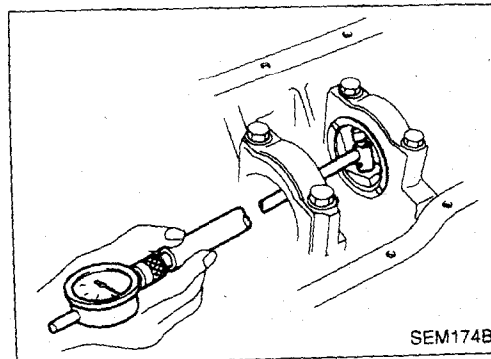
0.50 - 0.75 mm (0.0197 - 0.0295 in)

Oil ring

0.25 - 0.55 mm (0.0098 - 0.0217 in)

Max. limit of ring gap:

1.5 mm (0.059 in)



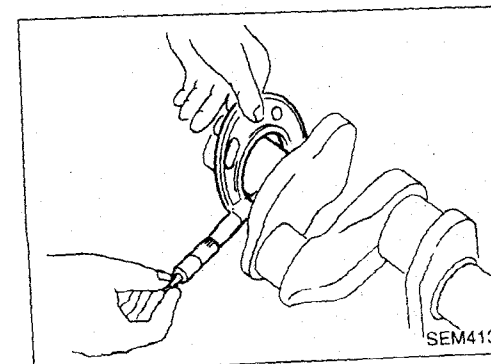
BEARING CLEARANCE

Main bearing

1. Install main bearings to cylinder block and main bearing cap.
2. Install main bearing cap to cylinder block.

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

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



4. Measure outside diameter "Dm" of main journal in crankshaft.

Inspection (Cont'd)

- Calculate main bearing clearance.

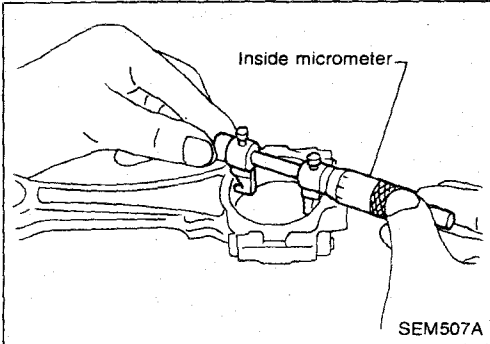
$$\text{Main bearing clearance} = A - Dm$$

Standard

0.035 - 0.087 mm (0.0014 - 0.0034 in)

Limit

Less than 0.15 mm (0.0059 in)



CONNECTING ROD BEARING (Big end)

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

Apply oil to the thread portion of bolts and seating surface of nuts.

- Measure inside diameter "A" of bearing.
- Measure outside diameter "Dp" of pin journal in crankshaft.
- Calculate connecting rod bearing clearance.

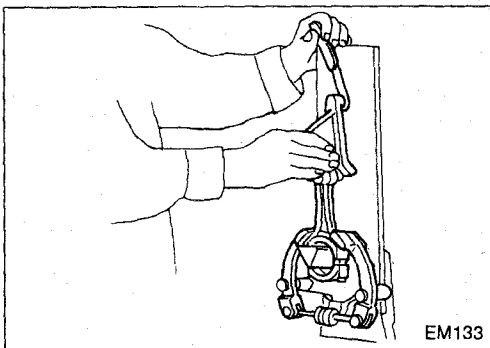
$$\text{Connecting rod bearing clearance} = A - Dp$$

Standard

0.035 - 0.081 mm
(0.0014 - 0.0032 in)

Limit

Less than 0.15 mm (0.0059 in)

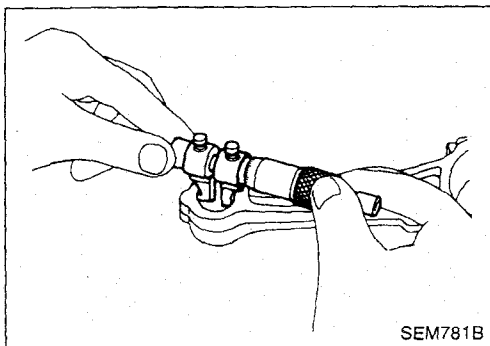


CONNECTING ROD BEND AND TORSION

Bend and torsion:

Limit

0,15 mm (0.0059 in)
per 200 mm (7.87 in) length



CONNECTING ROD BUSHING CLEARANCE (Small end)

- Measure inside diameter "A" of connecting rod small end bushings.

Inspection (Cont'd)

2. Measure outside diameter "D" of piston pin.
3. Calculate connecting rod small end bushing clearance.

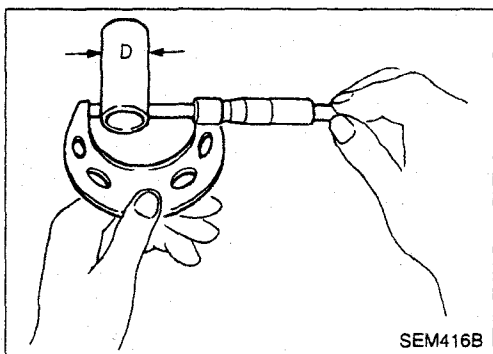
Connecting rod small end bushing clearance = A - D

Standard

0.025 - 0.045 mm (0.0010 - 0.0018 in)

Limit

0.15 mm (0.0059 in)



REPLACEMENT OF CONNECTING ROD BUSHING (Small end)

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

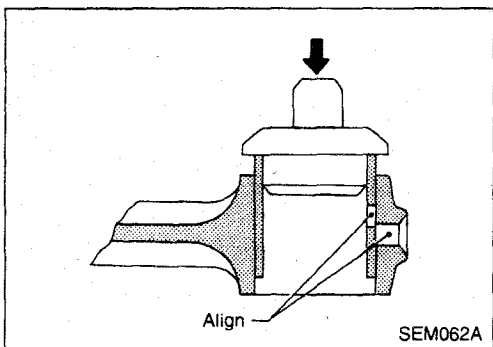
Be sure to align the oil holes.

2. After driving in the small end bushing, ream the bushing.

Small end bushing inside diameter:

Finished size

30.025 - 30.038 mm (1.1821 - 1.1826 in)



CRANKSHAFT

1. Check crankshaft journals and pins for score, bias, wear or cracks. If faults are minor, correct with fine crocus cloth.
2. Check journals and pins with a micrometer for taper and out-of-round.

Out-of-round (X - Y):

Standard

Less than 0.01 mm (0.0004 in)

Limit

0.02 mm (0.0008 in)

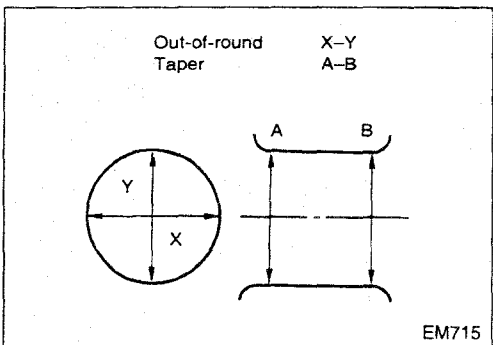
Taper (A - B):

Standard

Less than 0.01 mm (0.0004 in)

Limit

0.02 mm (0.0008 in)



3. Check crankshaft runout.

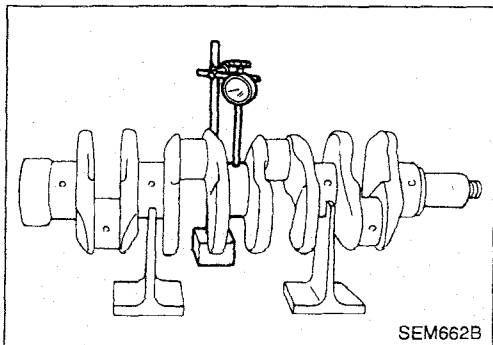
Runout (Total Indicator Reading)

Standard

0 - 0.03 mm (0 - 0.0012 in)

Limit

0.10 mm (0.0039 in)



Inspection (Cont'd)

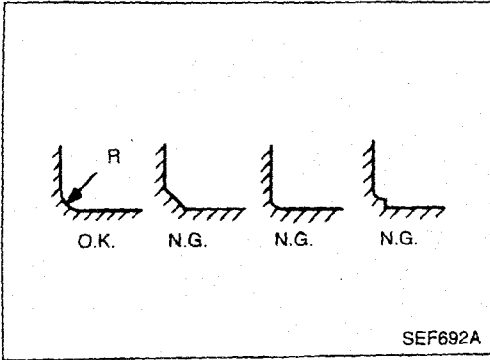
RESURFACING OF CRANKSHAFT JOURNAL AND CRANK PIN

When using undersize main bearings and connecting rod bearings, the crankshaft journals or crank pins must be finished to match the bearings.

R: Crank journal 3.0 mm (0.118 in)
Crank pin 3.5 mm (0.138 in)

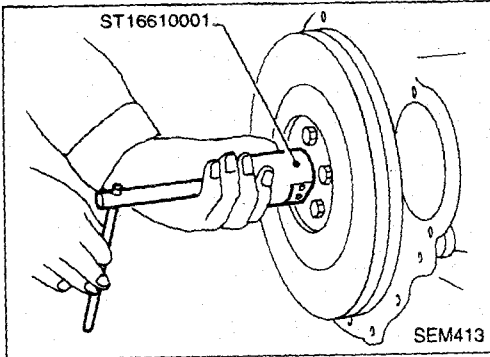
CAUTION:

- At the same time make sure that the surface width does not increase.
- Do not attempt to cut counterweight of crankshaft.



PILOT BUSHING REPLACEMENT

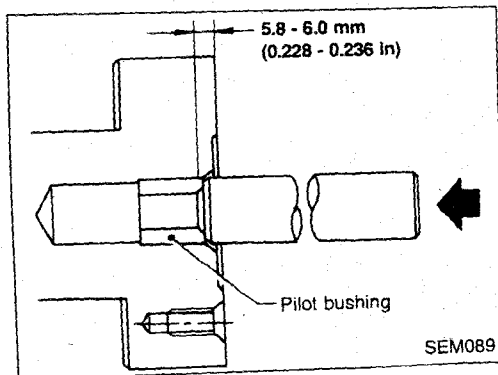
1. Pull out bushing with Tool.



2. Insert pilot bushing until distance between flange end and bushing is specified value.

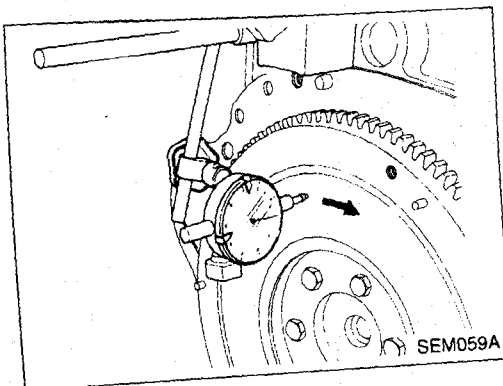
Distance:

Approx. 5.8 - 6.0 mm (0.228 - 0.236 in)



FLYWHEEL RUNOUT

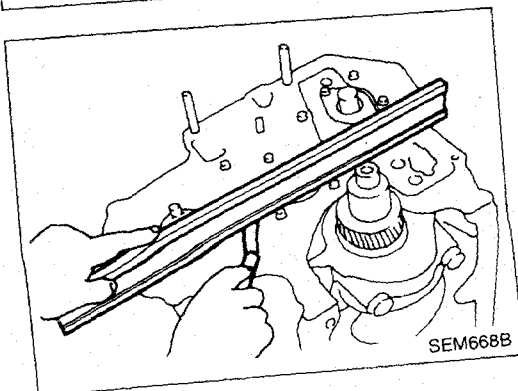
Runout (Total Indicator Reading):
Less than 0.15 mm (0.0059 in)



FRONT PLATE

Check front plate for warpage. If not within the limit, make flat or replace front plate.

Warpage limit:
0.2 mm (0.008 in)



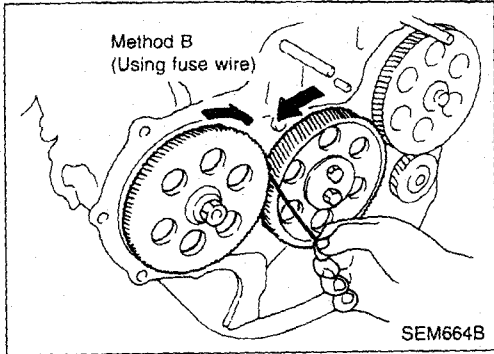
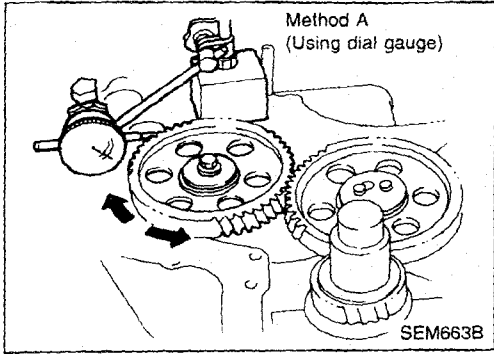
Inspection (Cont'd)

GEAR TRAIN

Camshaft drive gear, injection pump drive gear, oil pump gear, idler gear and crankshaft gear

1. If gear tooth and key have scratches or are excessively worn, replace gear and key.
2. Check gear train backlash before disassembling and after assembling.

Method A (Using dial gauge)
Method B (Using fuse wire)



If beyond the limit, replace gear.

Backlash:

Standard

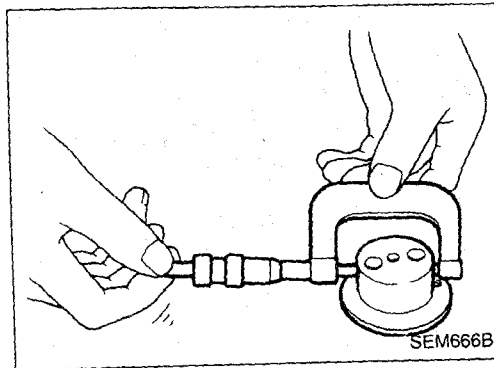
0.07 - 0.11 mm (0.0028 - 0.0043 in)

Limit

0.20 mm (0.0079 in)

IDLER GEAR BUSHING CLEARANCE

1. Measure idler gear shaft outer diameter.



2. Measure idler gear bushing inner diameter.
3. Calculate idler gear bushing clearance.

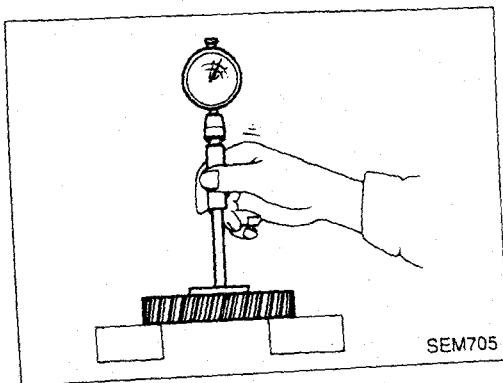
Bushing oil clearance:

Standard

0.025 - 0.061 mm (0.0010 - 0.0024 in)

Limit

0.20 mm (0.0079 in)



IDLER GEAR END PLAY

Measure idler gear end play between gear plate and gear.

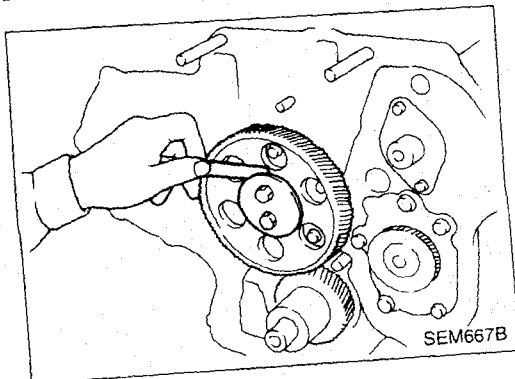
Idler gear end play:

Standard

0.03 - 0.14 mm (0.0012 - 0.0055 in)

Limit

Less than 0.3 mm (0.012 in)

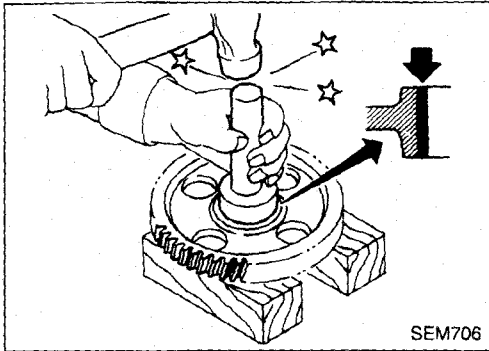


Inspection (Cont'd)

REPLACEMENT OF IDLER GEAR BUSHING

1. Use a suitable tool to replace bushing.
2. Ream idler gear bushing.

Finished size:
42.00 - 42.02 mm (1.6535 - 1.6543 in)



Idler gear shaft

Install idler gear shaft so that oil hole of shaft faces upward.

CAMSHAFT AND CAMSHAFT BUSHING

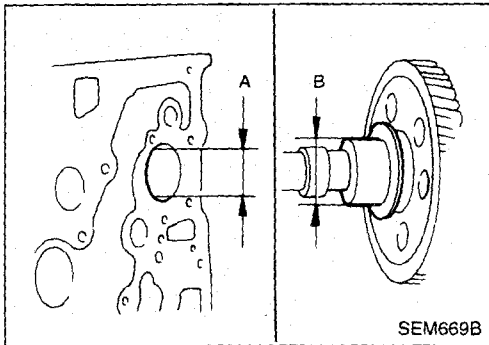
Camshaft bushing clearance

Measure inside diameter of camshaft bushing (A) and outside diameter of camshaft journal (B) with a suitable gauge.

Clearance between camshaft and bushing (A - B):

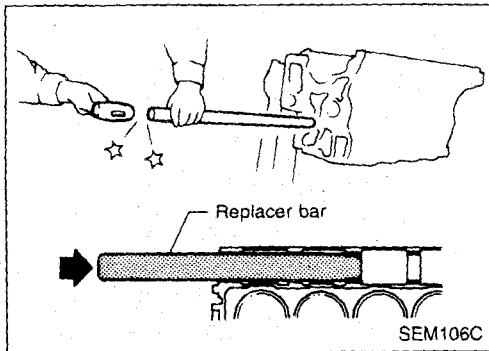
Standard
0.020 - 0.109 mm
(0.0008 - 0.0043 in)

Limit
Less than 0.15 mm (0.0059 in)

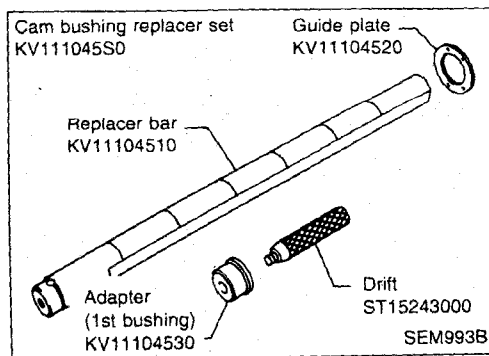


REPLACING CAMSHAFT BUSHING

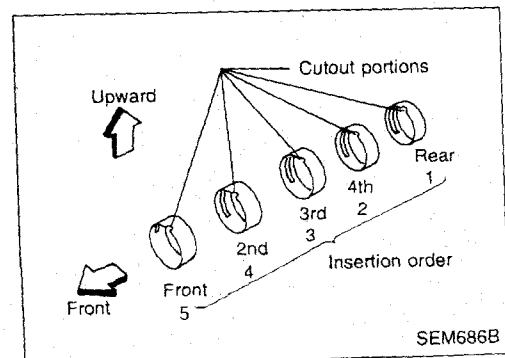
1. Remove welch plug.
Using Tool, remove camshaft bushings from the cylinder block. Some bushings must be broken in order to remove.



2. Using Tool, install camshaft bushings as follows:

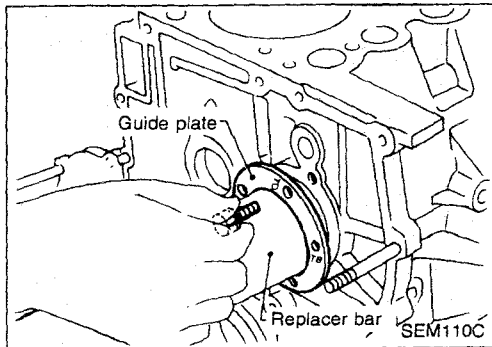
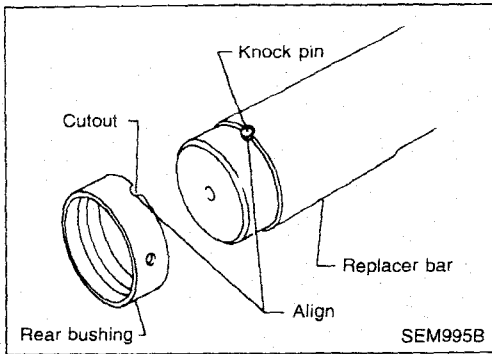


- (1) Install camshaft bushings in the order of "rear", "4th", "3rd", "2nd" and "front". All bushings must be installed from the front.
- (2) Face the cutout upward and toward the front of the engine during installation.



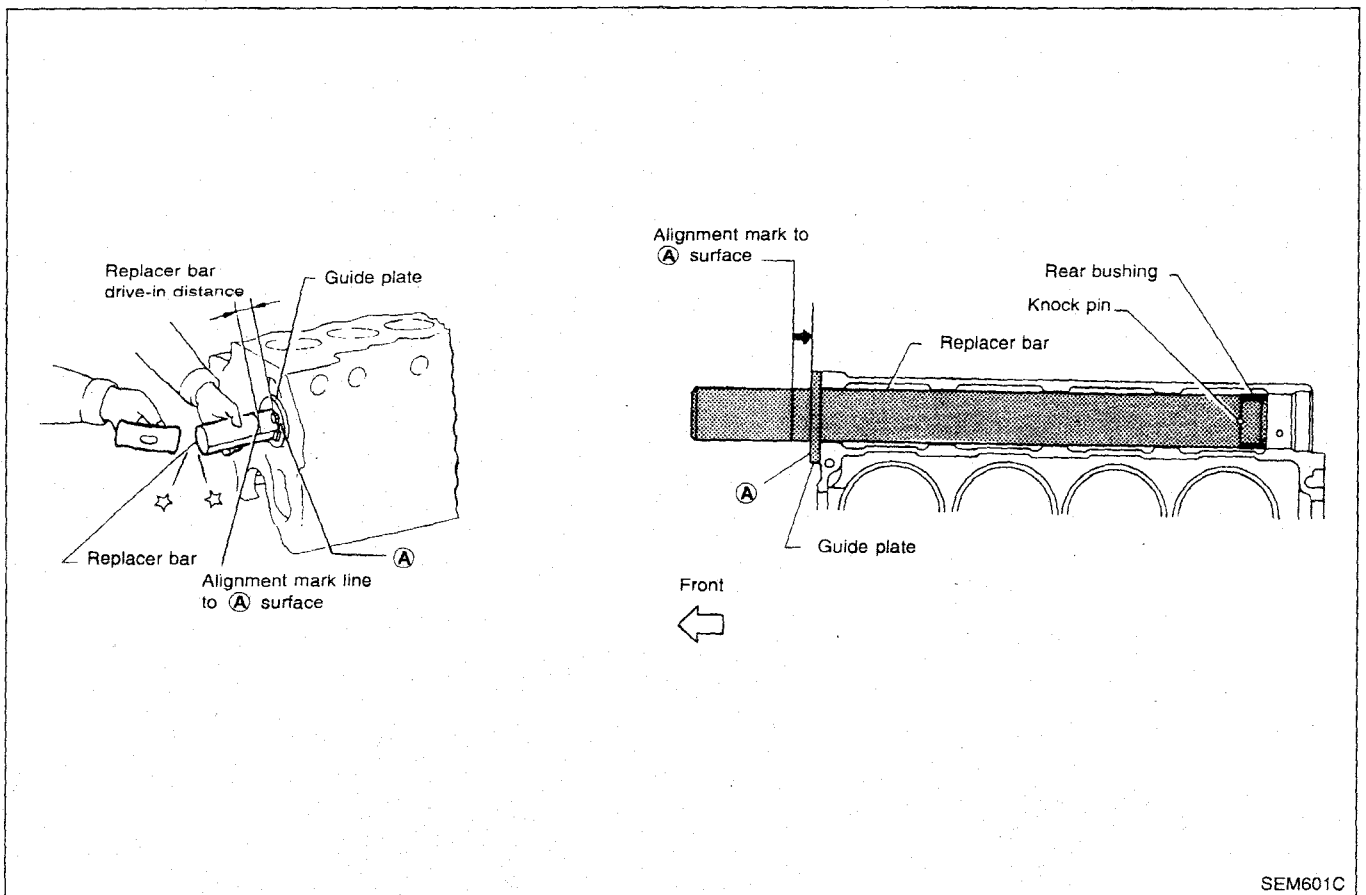
Inspection (Cont'd)

- (3) Rear camshaft bushing
Align the cutout of rear bushing with knock pin of replacer bar before installation



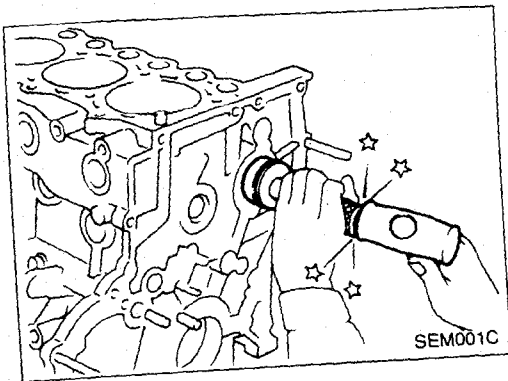
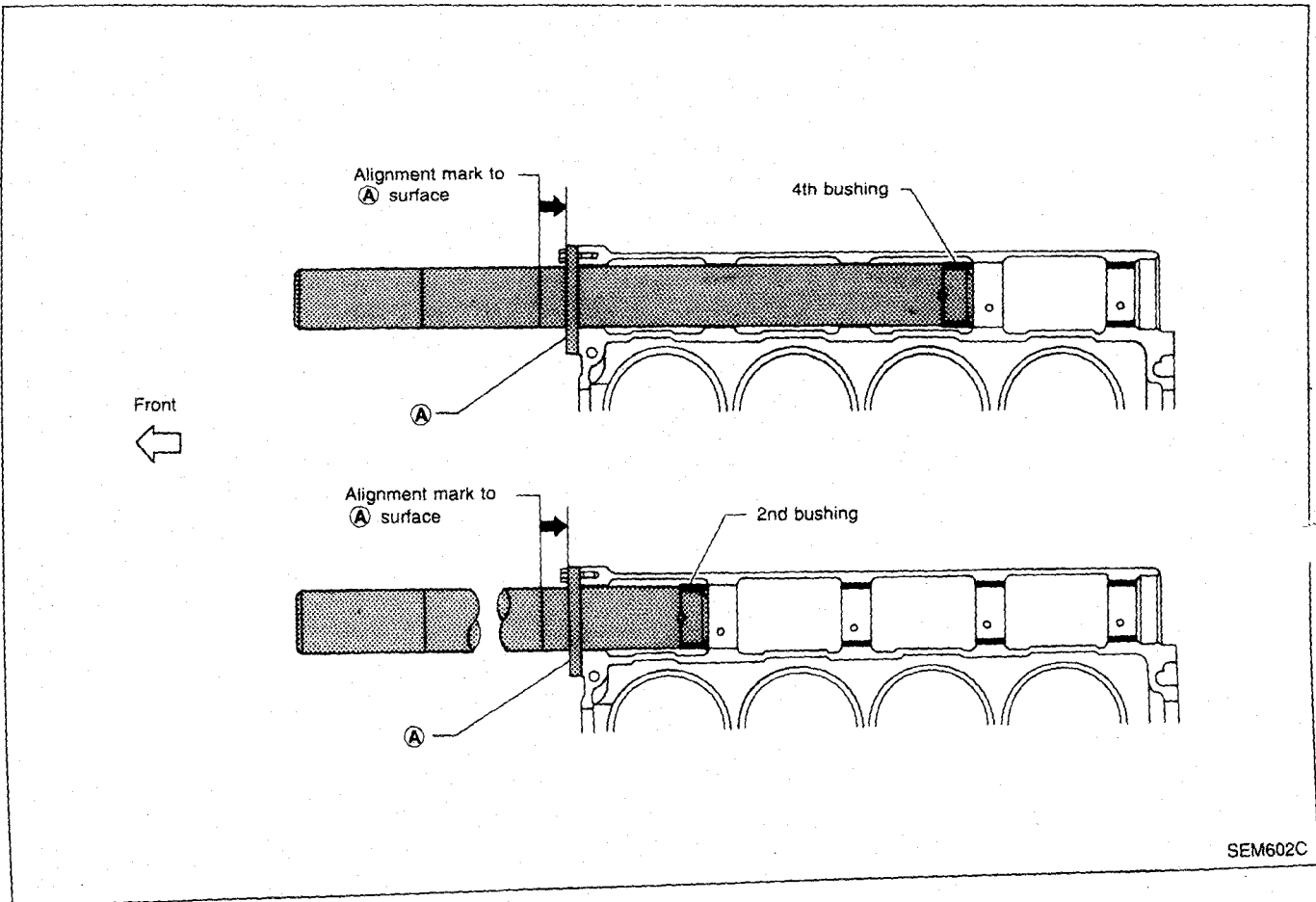
Insert rear bushing with replacer bar into the cylinder block. Install guide plate with bolt holes (on the "TD" mark side) facing upper side of cylinder block. Tighten bolts.

Drive replacer bar until the alignment mark on replacer bar is aligned with the end of replacer guide.
Remove replacer set.
After installation, check that oil hole in camshaft bushing are aligned with oil hole in cylinder block.

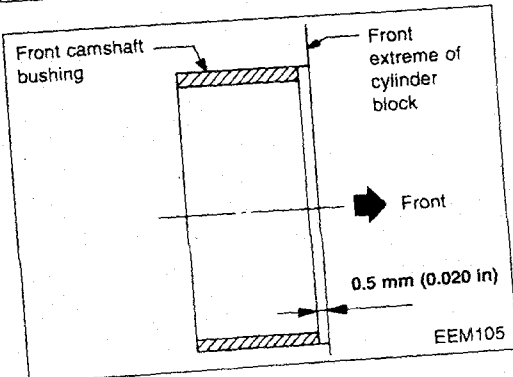


Inspection (Cont'd)

- (4) 4th, 3rd and 2nd camshaft bushings
Install in the same manner as rear camshaft bushing.



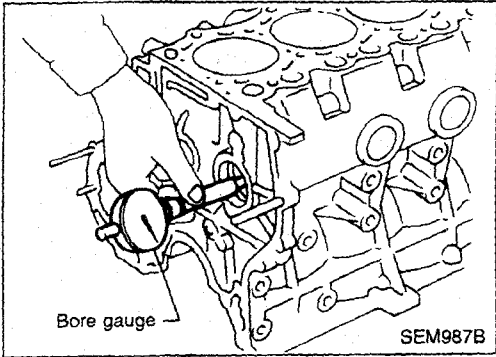
- (5) Front camshaft bushing
Using 1st bushing adapter, position front camshaft bushing so that oil hole in cylinder block is aligned with oil hole in bushing.



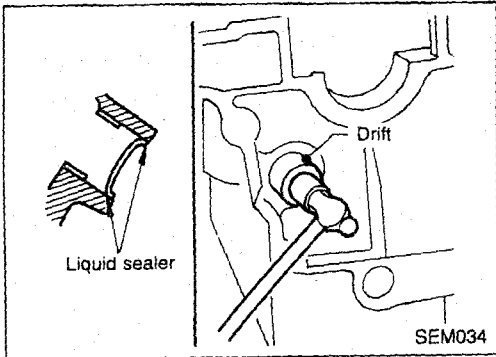
The camshaft bushing of the front side must be inserted at 0.5 mm (0.020 in) from the front extreme of cylinder block.

Inspection (Cont'd)

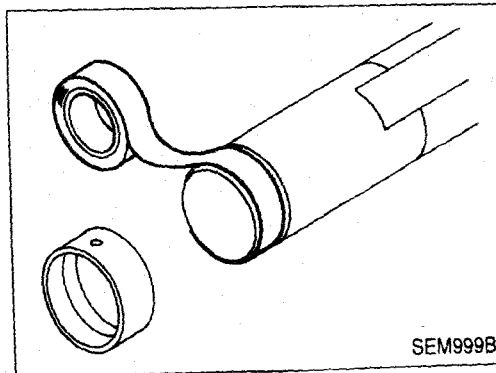
3. Check camshaft bushing clearance.



4. Install new welch plug with a drift.
Apply liquid sealer.



When setting 4th through 2nd bushings on replacer bar, tape the bar to prevent movement.



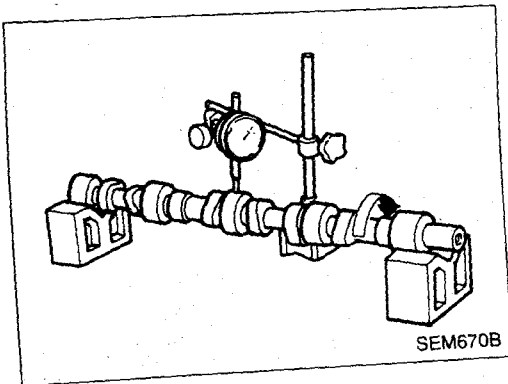
CAMSHAFT ALIGNMENT

1. Check camshaft journal and cam surface for cracks, wear of damage.
If fault is beyond limit, replace.
2. Check camshaft runout at center journal.
If runout is greater than specified limit, repair or replace camshaft.

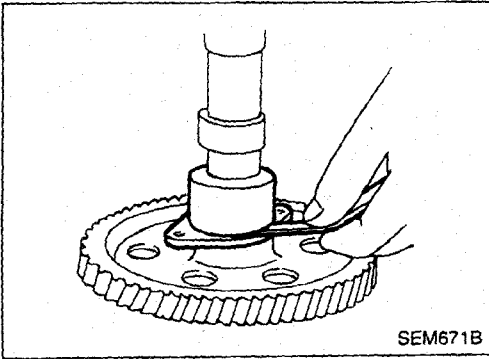
**Camshaft runout
(Total indicator reading):**

Standard
Less than 0.02 mm (0.0008 in)

Limit
Less than 0.06 mm (0.0024 in)



Inspection (Cont'd)



3. Measure camshaft end play between locating plate and gear. If beyond the specified limit, replace camshaft locating plate.

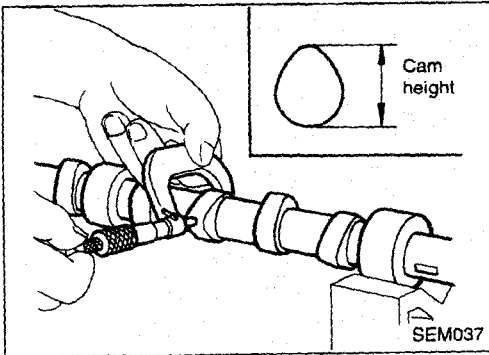
Camshaft end play:

Standard

0.08 - 0.28 mm (0.0031 - 0.0110 in)

Limit

Less than 0.5 mm (0.020 in)



4. Measure camshaft cam height. If beyond the specified limit, replace camshaft.

Cam height:

Standard

Intake

41.900 mm (1.6496 in)

Exhaust

41.900 mm (1.6496 in)

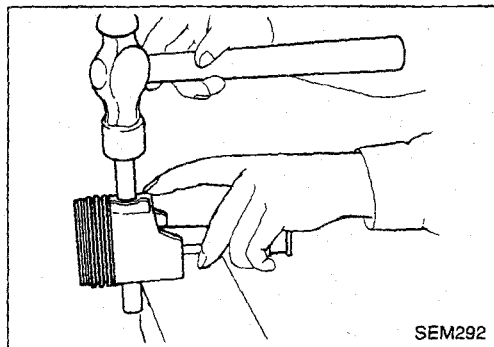
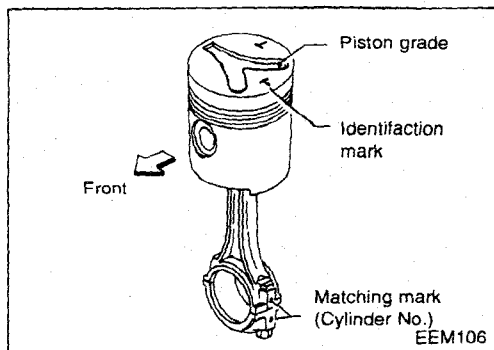
Limit

Intake

Less than 41.20 mm (1.6220 in)

Exhaust

Less than 41.40 mm (1.6299 in)



Assembly

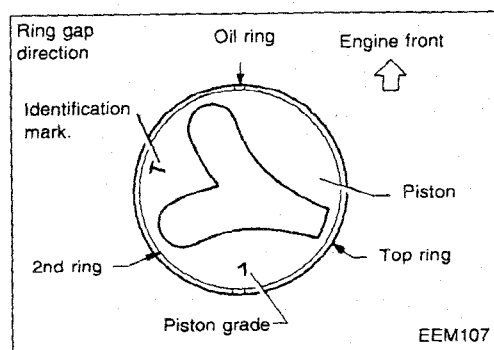
PISTON

1. Assemble pistons, piston pins, snap rings and connecting rods.
 - a. Numbers are stamped on the connecting rod and cap corresponding to each cylinder. Care should be taken to avoid a wrong combination including bearing.
 - b. When inserting piston pin in connecting rod, heat piston with a heater or hot water [approximately 60 to 70°C (140 to 158°F)] and apply engine oil to pin and small end of connecting rod.
 - c. After assembling, ascertain that piston swings smoothly.

2. Install piston assembly.

CAUTION:

- a. Stretch the piston rings only enough to fit them in the piston grooves.
- b. Be sure the manufacturer's mark faces upward.

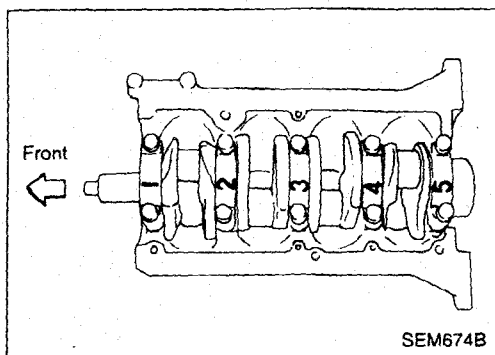


- c. Install No. 1 piston ring (oil ring) in such a way that its gap faces the direction of engine front, as shown in illustration at left; and then install 2nd and top rings so that their gap is positioned at 120° one to another.

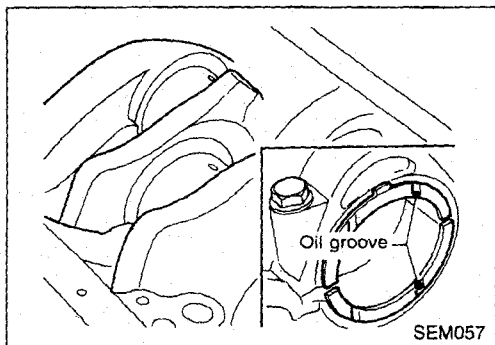
CRANKSHAFT

1. Install crankshaft.
 - (1) Set main bearings in the proper position on cylinder block.
 - a. If either crankshaft, cylinder block or main bearing is re-used again, it is necessary to measure main bearing clearance.
 - b. Upper bearings have oil hole and oil groove, however lower bearings do not.

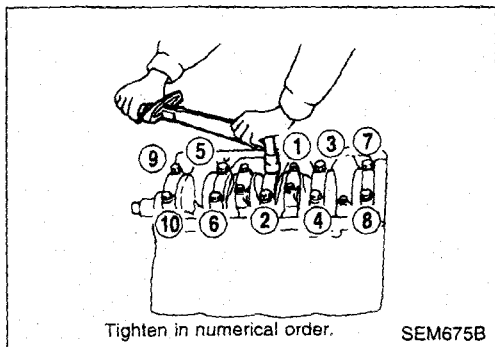
Assembly (Cont'd)



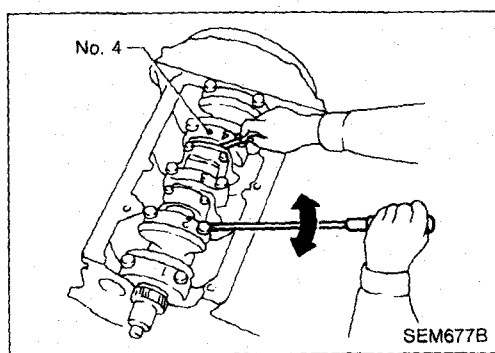
- (2) Apply engine oil to crankshaft journal and pin and install crankshaft.
- (3) Install main bearings caps.
 - a) Install main bearing cap with the lowest number facing the front of vehicle.
 - b) Apply engine oil to main bearing cap and cylinder block contact surfaces.
 - c) Install rear oil seal assembly. Apply engine oil to contact surface of rear end oil seal and crankshaft.



- (4) Install crankshaft thrust washer at the 4th journal from front. Install thrust washer so that oil groove can face crankshaft.



- (5) Tighten bearing cap bolts gradually in stages, starting from two to three separate stages, from center bearing and moving outward in sequence.



- (6) Measure crankshaft free end play at No. 4 bearing.

Crankshaft free end play:

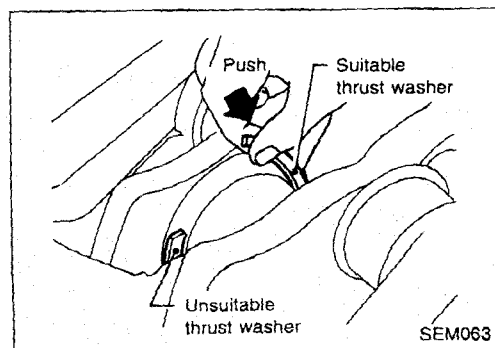
Standard

0.060 - 0.25 mm (0.002 - 0.01 in)

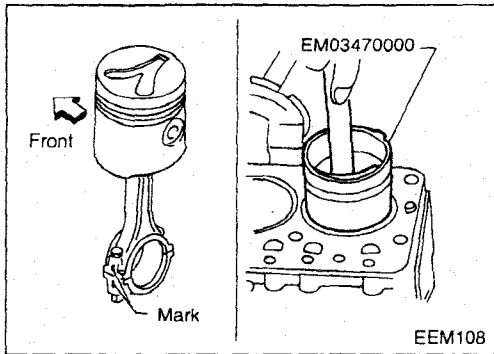
Limit

0.4 mm (0.016 in)

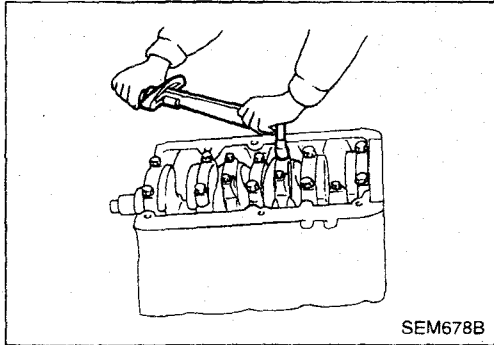
If beyond the limit, replace No. 4 main bearing thrust washer. Refer to S.D.S.



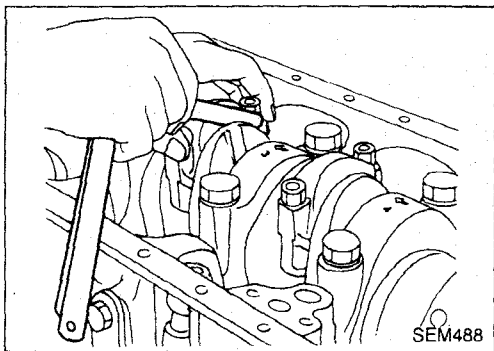
Assembly (Cont'd)



2. Install pistons with connecting rods.
 - (1) Install them into corresponding cylinder using Tool.
 - Be careful not to scratch cylinder wall with connecting rod.
 - Apply engine oil to cylinder wall, piston and bearing.
 - The leaf type combustion chamber on piston head must be facing toward the fuel pump side.



- (2) Install connecting rod bearing caps.



3. Measure connecting rod side clearance.

Connecting rod side clearance:

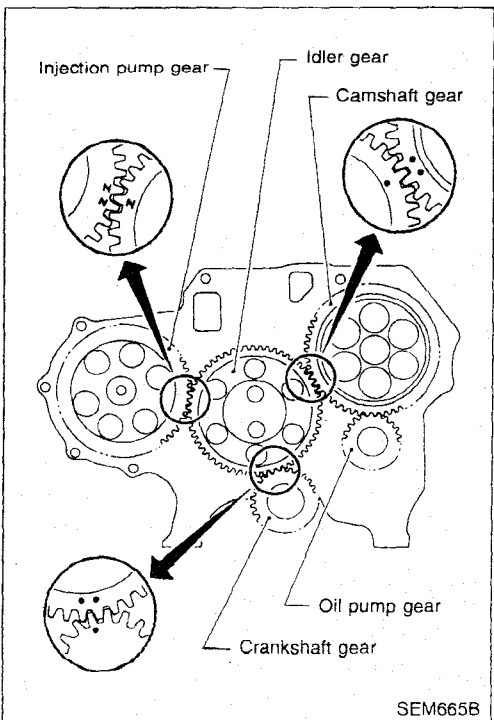
Standard
0.10 - 0.22 mm (0.0039 - 0.0087 in)

Limit
0.22 mm (0.0087 in)

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

4. Install oil strainer and oil pan.
5. Install all removed parts.

GEAR TRAIN

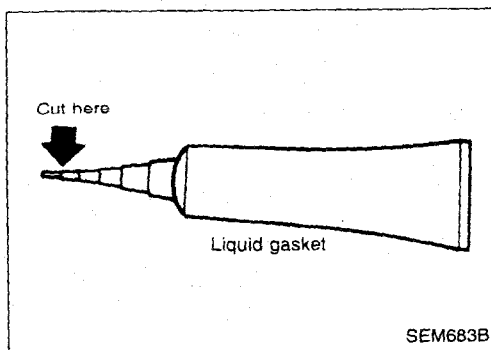
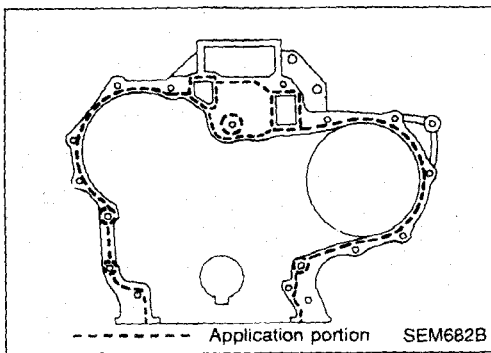
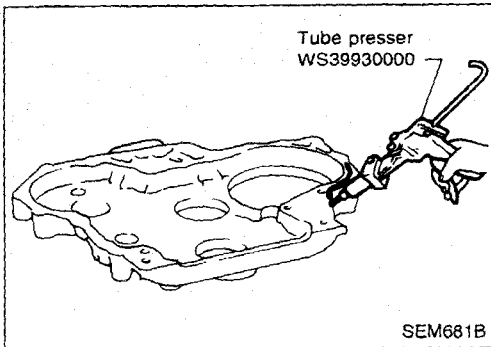
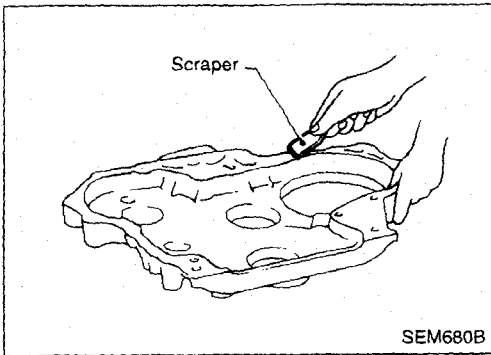


1. Set No. 1 piston at its Top Dead Center.
2. Align each gear mark and install gears.

Assembly (Cont'd)

TIMING GEAR CASE

Installation



1. Before installing timing gear case, remove all traces of liquid gasket from mating surface using a scraper. Also remove traces of liquid gasket from mating surface of front plate.

2. Apply a continuous bead of liquid gasket to mating surface of timing gear case.

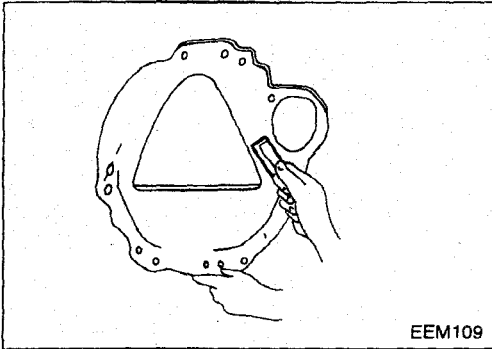
- Be sure liquid gasket is 2.5 to 3.5 mm (0.098 to 0.138 in) wide.
- Attach timing gear case to front plate within 20 minutes after coating.
- Wait at least 30 minutes before refilling engine coolant or starting engine.
- Use Genuine Liquid Gasket or equivalent.

Assembly (Cont'd)

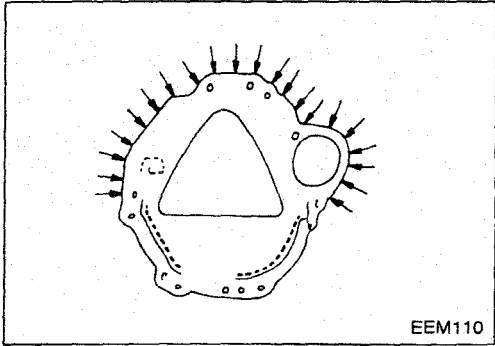
REAR PLATE

Installation

1. Before installing rear plate, remove all traces of liquid gasket from mating surface using a scraper. Also remove traces of liquid gasket from mating surface of cylinder block.



EEM109



EEM110

2. Apply a continuous bead of liquid gasket to mating surface of cylinder block.
3. Fit the rear plate into the cylinder block and apply liquid gasket in the area indicated by discontinuous line.
4. After the transmission is installed, apply liquid gasket in the area indicated by arrows.
5. Install all removed parts.

General Specifications

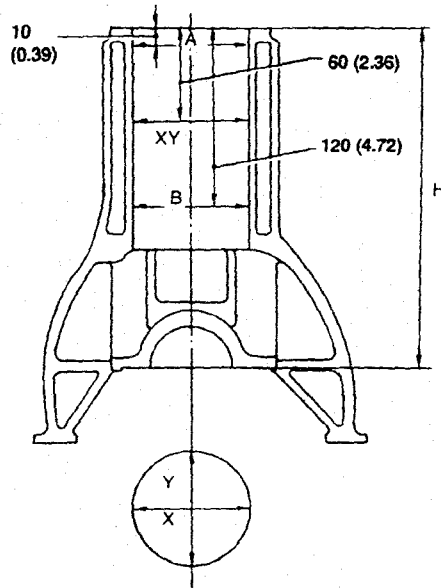
Engine model	KA24E	
Cylinder arrangement	4 in-line	
Displacement	cm ³ (cu in)	2,389 (145.78)
Bore x stroke	mm (in)	89 x 96 (3.50 x 3.78)
Valve arrangement	O.H.C.	
Firing order	1-3-4-2	
Number of piston rings		
Compression	2	
Oil	1	
Number of main bearings	5	
Compression ratio	8.6	

Unit: kPa (bar, kg/cm², psi)/rpm

Compression pressure		
Standard	1,324 (13.24, 13.5, 192)/300	
Minimum	981 (9.8, 10, 142)/300	
Differential limit between cylinders	98 (0.98, 1.0, 14)/300	

Inspection and Adjustment

CYLINDER BLOCK



SEM447C

Unit: mm (in)

		Standard	Limit
Distortion		—	0.1 (0.004)
Cylinder bore	Inner diameter	Grade 1	89.000 - 89.010 (3.5039 - 3.5043)
		Grade 2	89.010 - 89.020 (3.5043 - 3.5047)
		Grade 3	89.020 - 89.030 (3.5047 - 3.5051)
	Out-of-round (X-Y)		Less than 0.015 (0.0006)
Taper (A-B)		Less than 0.015 (0.0006)	—
Difference in inner diameter between cylinders		Less than 0.05 (0.0020)	0.2 (0.008)
Piston-to-cylinder clearance		0.020 - 0.040 (0.0008 - 0.0016)	—
Nominal height of cylinder block (From crankshaft center)		246.95 - 247.05 (9.7224 - 9.7264)	0.2 (0.008)**

* Wear limit

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

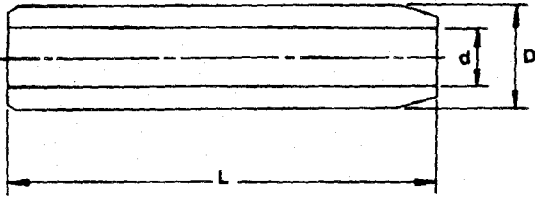
CYLINDER HEAD

Unit: mm (in)

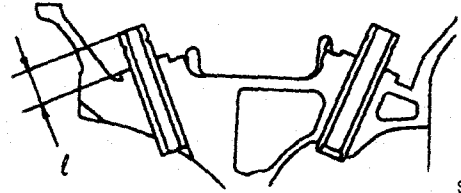
	Standard	Limit
Height (H)	98.8 - 99.0 (3.890 - 3.898)	0.2 (0.008)*
Surface distortion	0.03 (0.0012)	0.1 (0.004)

* Total amount of cylinder head surfacing and cylinder block resurfacing

VALVE GUIDE



SEM571B



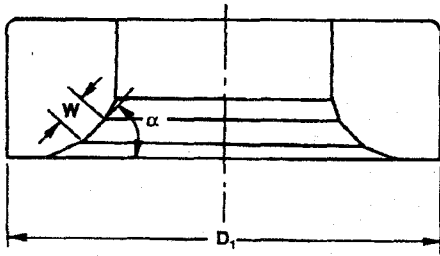
SEM225C

Unit: mm (in)

	Standard		Service		Limit
	Intake	Exhaust	Intake	Exhaust	
Length (L)	52.6 (2.071)	56.0 (2.205)	52.6 (2.071)	56.0 (2.205)	—
Outer diameter (D)	11.023 - 11.034 (0.4340 - 0.4344)	12.023 - 12.034 (0.4733 - 0.4738)	11.223 - 11.234 (0.4418 - 0.4423)	12.223 - 12.234 (0.4812 - 0.4817)	—
Inner diameter (d) (Finished size)	7.000 - 7.018 (0.2756 - 0.2763)	8.000 - 8.018 (0.3150 - 0.3157)	7.000 - 7.018 (0.2756 - 0.2763)	8.000 - 8.018 (0.3150 - 0.3157)	—
Cylinder head hole diameter	10.975 - 10.996 (0.4321 - 0.4329)	11.975 - 11.996 (0.4715 - 0.4723)	11.175 - 11.196 (0.4400 - 0.4408)	12.175 - 12.196 (0.4793 - 0.4802)	—
Interference fit	0.027 - 0.059 (0.0011 - 0.0023)				—
Stem to guide clearance	0.020 - 0.053 (0.0008 - 0.0021)	0.040 - 0.070 (0.0016 - 0.0028)	0.020 - 0.053 (0.0008 - 0.0021)	0.040 - 0.070 (0.0016 - 0.0028)	0.1 (0.004)
Tapping length (ℓ)	14.9 - 15.1 (0.587 - 0.594)				—

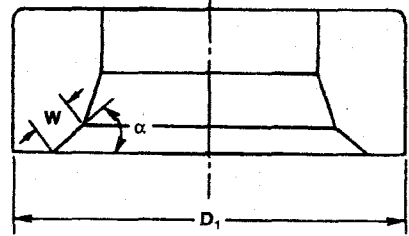
VALVE SEATS

Standard



SEM177

Service



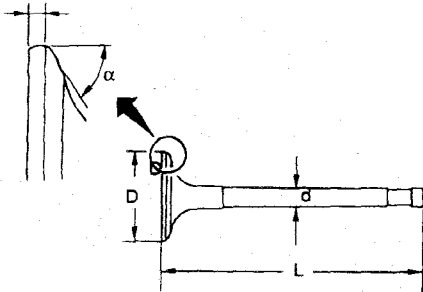
SEM178

Unit: mm (in)

	Standard		Service	
	Intake	Exhaust	Intake	Exhaust
Cylinder head seat recess diameter	36.000 - 36.016 (1.4173 - 1.4179)	42.000 - 42.016 (1.6535 - 1.6542)	36.500 - 36.516 (1.4370 - 1.4376)	42.500 - 42.516 (1.6732 - 1.6739)
Valve seat outer diameter (D ₁)	36.080 - 36.096 (1.4205 - 1.4211)	42.080 - 42.096 (1.6567 - 1.6573)	36.580 - 36.596 (1.4402 - 1.4408)	42.580 - 42.596 (1.6764 - 1.6770)
Face angle (α)	45°	45°	45°	45°
Contacting width (W)	1.6 - 1.7 (0.063 - 0.067)	1.7 - 2.1 (0.067 - 0.083)	1.6 - 1.7 (0.063 - 0.067)	1.7 - 2.1 (0.067 - 0.083)

VALVE

T (Margin thickness)



SEM188A

Unit: mm (in)

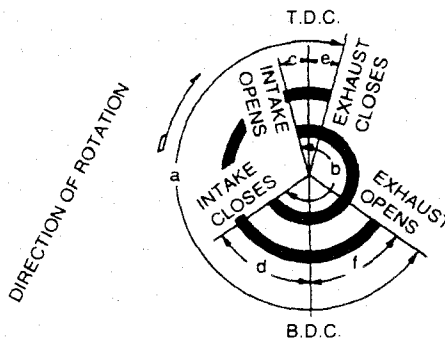
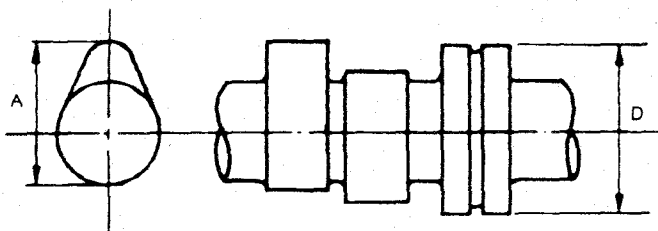
		Standard	Limit
Valve head diameter (D)	In.	34.0 - 34.2 (1.339 - 1.346)	—
	Ex.	40.0 - 40.2 (1.575 - 1.583)	—
Valve length (L)	In.	119.9 - 120.2 (4.720 - 4.732)	—
	Ex.	120.67 - 120.97 (4.7508 - 4.7626)	—
Valve stem diameter (d)	In.	6.965 - 6.980 (0.2742 - 0.2748)	—
	Ex.	7.948 - 7.960 (0.3129 - 0.3134)	—
Valve seat angle (α)	In.	45°30'	—
	Ex.	45°30'	—
Valve seat margin (T)	In.	1.15 - 1.45 (0.0453 - 0.0571)	0.5 (0.020)
	Ex.	1.35 - 1.65 (0.0531 - 0.0650)	
Valve clearance		0 (0)	

VALVE SPRING

Unit: mm (in)

		Standard		Limit	
		Intake	Exhaust	Intake	Exhaust
Free height	Outer	57.44 (2.2614)	53.21 (2.0949)	—	—
	Inner	53.34 (2.1000)	47.95 (1.8878)	—	—
Pressure N (kg, lb) at height	Outer	604.1 (61.6, 135.8) at 37.6 (1.480)	640.4 (65.3, 144.0) at 34.1 (1.343)	567.8 (57.9, 127.7) at 37.6 (1.480)	620.8 (63.3, 139.6) at 34.1 (1.343)
	Inner	284.4 (29.0, 63.9) at 32.6 (1.283)	328.5 (33.5, 73.9) at 29.1 (1.146)	266.8 (27.2, 60.0) at 32.6 (1.283)	318.7 (32.5, 71.7) at 29.1 (1.146)
Out-of-square	Outer	—	—	Less than 2.5 (0.098)	Less than 2.3 (0.091)
	Inner	—	—	Less than 2.3 (0.091)	Less than 2.1 (0.083)

CAMSHAFT AND CAMSHAFT BEARING



SEM568A

EM120

Unit: mm (in)

	Standard	Limit
Cam height (A)	44.839 - 45.029 (1.7653 - 1.7728)	—
Valve lift (h)	9.86 (0.3882)	—
Wear limit of cam height	—	0.2 (0.008)
Camshaft journal to bearing clearance	0.045 - 0.090 (0.0018 - 0.0035)	0.12 (0.0047)
Inner diameter of camshaft bearing	33.000 - 33.025 (1.2992 - 1.3002)	—
Outer diameter of camshaft journal (D)	32.935 - 32.955 (1.2967 - 1.2974)	—
Camshaft runout	0 - 0.02 (0 - 0.0008)	—
Camshaft end play	0.07 - 0.15 (0.0028 - 0.0059)	0.2 (0.008)
Valve timing (Degree on crankshaft)	a	248
	b	240
	c	3
	d	57
	e	12
	f	56

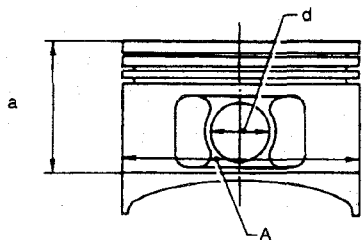
ROCKER ARM AND ROCKER SHAFT

Unit: mm (in)

Rocker arm to shaft clearance	0.012 - 0.050 (0.0005 - 0.0020)
Rocker shaft diameter	21.979 - 22.000 (0.8653 - 0.8661)
Rocker arm rocker shaft hole diameter	22.012 - 22.029 (0.8666 - 0.8673)

PISTONS, PISTON RING AND PISTON PIN

Piston



SEM444C

Unit: mm (in)

Piston skirt diameter (A)	Standard	Grade No. 1	88.970 - 88.980 (3.5027 - 3.5031)
		Grade No. 2	88.980 - 88.990 (3.5031 - 3.5035)
		Grade No. 3	88.990 - 89.000 (3.5035 - 3.5039)
	Service (Oversize)	0.5 (0.020)	89.470 - 89.500 (3.5224 - 3.5236)
		1.0 (0.039)	89.970 - 90.000 (3.5421 - 3.5433)
Dimension (a)	Approximately 52 (2.05)		
Piston pin hole diameter (d)	21.002 - 21.008 (0.8268 - 0.8271)		
Piston-to-cylinder bore clearance	0.020 - 0.040 (0.0008 - 0.0016)		

Piston pin

Unit: mm (in)

	Standard
Piston pin outer diameter	20.994 - 20.996 (0.8265 - 0.8266)
Pin to piston pin hole clearance	0.008 - 0.012 (0.0003 - 0.0005)
Piston pin to connecting rod clearance	-0.015 to -0.033 (-0.0006 to -0.0013)

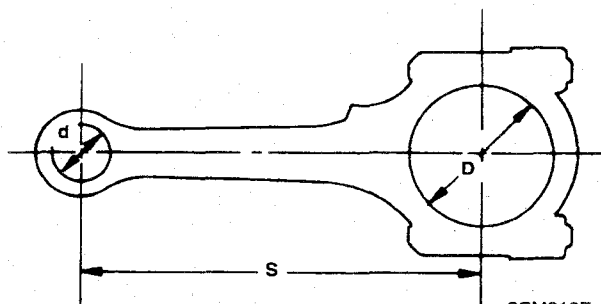
Piston ring

Unit: mm (in)

		Standard	Limit
Side clearance	Top	0.040 - 0.080 (0.0016 - 0.0031)	0.1 (0.004)
	2nd	0.030 - 0.070 (0.0012 - 0.0028)	0.1 (0.004)
	Oil	0.065 - 0.135 (0.0026 - 0.0053)*	0.1 (0.004)
Ring gap	Top	0.28 - 0.52 (0.0110 - 0.0205)	0.5 (0.020)
	2nd	0.45 - 0.69 (0.0177 - 0.0272)	0.5 (0.020)
	Oil (rail ring)	0.20 - 0.69 (0.0079 - 0.0272)	0.5 (0.020)

*: Riken-make

CONNECTING RODS

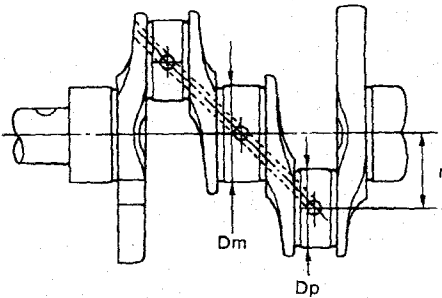


SEM216E

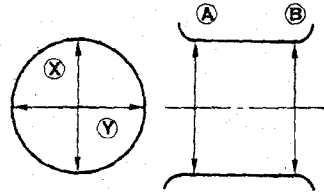
Unit: mm (in)

	Standard	Limit
Center distance (S)	164.95 - 165.05 (6.4941 - 6.4980)	—
Bend [per 100 mm (3.94 in)]	—	0.15 (0.0059)
Torsion [per 100 mm (3.94 in)]	—	0.3 (0.012)
Small end inner diameter (d)	20.948 - 20.978 (0.8247 - 0.8259)	—
Connecting rod big end inner diameter (D)	53.000 - 53.013 (2.0866 - 2.0871)	—
Side clearance	0.2 - 0.4 (0.008 - 0.016)	0.6 (0.024)

CRANKSHAFT



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



SEM394

EM715

Unit: mm (in)

Main journal diameter (Dm)	Grade	No. 0	63.645 - 63.652 (2.5057 - 2.5060)	
		No. 1	63.652 - 63.663 (2.5060 - 2.5064)	
		No. 2	63.663 - 63.672 (2.5064 - 2.5068)	
Pin journal diameter (Dp)		59.951 - 59.975 (2.3603 - 2.3612)		
Center distance (r)		47.97 - 48.03 (1.8886 - 1.8909)		
		Standard		Limit
Taper of journal and pin [(A) - (B)]	Journal	—		less than 0.01 (0.0004)
	Pin	—		less than 0.005 (0.0002)
Out-of-round of journal and pin [(X) - (Y)]	Journal	—		less than 0.01 (0.0004)
	Pin	—		less than 0.005 (0.0002)
Runout [T.I.R.]*		—		less than 0.10 (0.0039)
Free end play		0.05 - 0.18 (0.0020 - 0.0071)		0.3 (0.012)
Fillet roll		More than 0.1 (0.004)		

* Total indicator reading

BEARING CLEARANCE

Unit: mm (in)

	Standard	Limit
Main bearing clearance	0.020 - 0.047 (0.0008 - 0.0019)	0.1 (0.004)
Connecting rod bearing clearance	0.010 - 0.035 (0.0004 - 0.0014)	0.09 (0.0035)

AVAILABLE MAIN BEARING

Standard

Grade number	Thickness mm (in)	Identification color
0	1.821 - 1.825 (0.0717 - 0.0719)	Black
1	1.825 - 1.829 (0.0719 - 0.0720)	Brown
2	1.829 - 1.833 (0.0720 - 0.0722)	Green
3	1.833 - 1.837 (0.0722 - 0.0723)	Yellow
4	1.837 - 1.841 (0.0723 - 0.0725)	Blue

Undersize (service)

Unit: mm (in)

	Thickness	Main journal diameter "Dm"
0.25 (0.0098)	1.952 - 1.960 (0.0769 - 0.0772)	Grind so that bearing clearance is the specified value.

AVAILABLE CONNECTING ROD BEARING

Standard

Grade number	Thickness mm (in)	Identification color
0	1.505 - 1.508 (0.0593 - 0.0594)	—
1	1.508 - 1.511 (0.0594 - 0.0595)	Brown
2	1.511 - 1.514 (0.0595 - 0.0596)	Green

Undersize (service)

Unit: mm (in)

	Thickness	Crank pin journal diameter "Dp"
0.08 (0.0031)	1.540 - 1.548 (0.060 - 0.0609)	Grind so that bearing clearance is the specified value.
0.12 (0.0047)	1.560 - 1.568 (0.0614 - 0.0617)	
0.25 (0.0098)	1.625 - 1.633 (0.0640 - 0.0643)	

MISCELLANEOUS COMPONENTS

Unit: mm (in)

Camshaft sprocket runout [T.I.R.]*	Less than 0.12 (0.0047)
Flywheel runout [T.I.R.]*	Less than 0.1 (0.004)

* Total indicator reading

General Specifications

Engine model	TD27T
Cylinder arrangement	4, in-line
Displacement	cm ³ (cu in) 2,663 (162.5)
Bore x stroke	mm (in) 96 x 92 (3.8 x 3.6)
Valve arrangement	O.H.V.
Firing order	1-3-4-2
Number of piston rings	
Compression	2
Oil	1
Number of main bearings	5
Compression ratio	21.9 ± 0.2

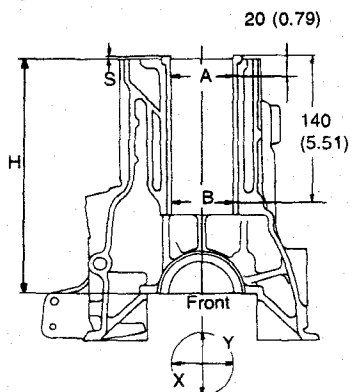
Unit: kPa (bar, kg/cm², psi)/rpm

Compression pressure	
Standard	2,942 (29.4, 30, 427)/200
Minimum	2,452 (24.5, 25, 356)/200
Differential limit between cylinders	294 (2.9, 3, 43)/200

Inspection and Adjustment

CYLINDER BLOCK AND CYLINDER LINER

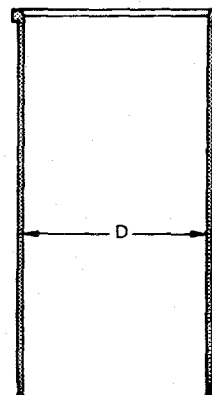
Unit: mm (in)



SEM950C

Nominal cylinder block height (H) (From crankshaft center)	54.95 - 55.05 (2.1634 - 2.1673)
Surface flatness (Without cylinder liner)	
Standard	Less than 0.05 (0.0020)
Limit	0.2 (0.008)
Cylinder bore	
Inner diameter	
Standard	99.000 - 99.020 (3.8976 - 3.8984)
Cylinder liner bore	
Inner diameter	
Standard	
Grade No. 1	96.000 - 96.010 (3.7795 - 3.7799)
Grade No. 2	96.010 - 96.020 (3.7799 - 3.7803)
Grade No. 3	96.020 - 96.030 (3.7803 - 3.7807)
Wear limit	0.20 (0.0079)
Out-of-round (X-Y)	Less than 0.020 (0.0008)
Taper (A-B)	Less than 0.20 (0.0079)
Projection "S"	0.02 - 0.09 (0.0008 - 0.0035)
Division of each cylinder	Less than 0.05 (0.0020)
Interference fit cylinder liner to block	-0.01 to 0.03 (-0.00044 to 0.0012)

Unit: mm (in)



SEM427

Cylinder liner diameter "D" (service)*	96.050 - 96.070 (3.7815 - 3.7823)
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* Before installing in cylinder block

SERVICE DATA AND SPECIFICATIONS (S.D.S.)

TD27T

Inspection and Adjustment (Cont'd)

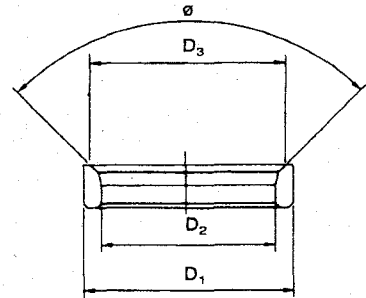
VALVE GUIDE

Unit: mm (in)

	Standard	Service
Valve guide outside diameter	12.033 - 12.044 (0.4737 - 0.4742)	—
Valve guide inner diameter (Finished size)	8.00 - 8.015 (0.3150 - 0.3156)	
Cylinder head valve guide hole diameter	12.00 - 12.011 (0.4724 - 0.4729)	—
Interference fit of valve guide	0.022 - 0.044 (0.0009 - 0.0017)	
	Standard	Limit
Valve to guide clearance		
Intake	0.020 - 0.050 (0.0008 - 0.0020)	0.15 (0.0059)
Exhaust	0.04 - 0.07 (0.0016 - 0.0028)	0.20 (0.0079)
Valve deflection limit		
Intake	0.30 (0.0118)	
Exhaust	0.40 (0.0157)	

VALVE SEAT

Unit: mm (in)



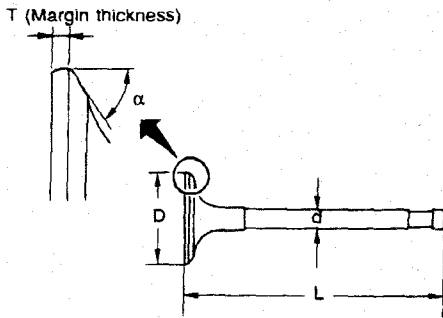
SEM953C

Intake	
Outer diameter "D ₁ "	44.535 - 44.545 (1.7533 - 1.7537)
Inner diameter "D ₂ "	38 ± 0.1 (1.50 ± 0.0039)
Diameter of seat "D ₃ "	42.4 - 42.6 (1.669 - 1.677)
Cylinder head valve seat diameter	44.500 - 44.515 (1.7520 - 1.7526)
Valve seat face angle "ø"	89° - 91°
Exhaust	
Outer diameter "D ₁ "	
Standard	39.535 - 39.545 (1.5565 - 1.5569)
0.2 (0.008) Oversize (Service)	39.735 - 39.745 (1.5644 - 1.5648)
0.4 (0.016) Oversize (Service)	39.935 - 39.945 (1.5722 - 1.5726)
Inner diameter "D ₂ "	32.9 - 33.1 (1.295 - 1.303)
Diameter of seat "D ₃ "	37.8 ± 0.1 (1.488 ± 0.0039)
Cylinder head valve seat diameter	
Standard	39.495 - 39.510 (1.5549 - 1.555)
0.2 (0.008) Oversize	39.695 - 39.710 (1.5628 - 1.5634)
0.4 (0.016) Oversize	39.895 - 39.910 (1.5707 - 1.5713)
Valve seat face angle "ø"	89° - 90°

Inspection and Adjustment (Cont'd)

VALVE

Unit: mm (in)



SEM188

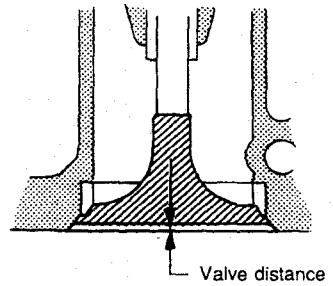
Valve head diameter "D"	
Intake	43.4 - 43.6 (1.709 - 1.717)
Exhaust	37.9 - 38.1 (1.492 - 1.500)
Valve length "L"	
Intake	117 (4.61)
Exhaust	
Valve stem diameter "d"	
Intake	7.965 - 7.980 (0.3136 - 0.3142)
Exhaust	7.945 - 7.960 (0.3128 - 0.3134)
Valve seat angle "α"	
Intake	45° - 45°30'
Exhaust	
Valve margin "T" limit	1.5 (0.059)
Valve stem end surface grinding limit	0.2 (0.008)
Valve clearance (Hot)	
Intake	0.25 (0.01)
Exhaust	

VALVE SPRING

Free length	mm (in)	
Painted red		53.80 (2.118)
Pressure height	mm/N (mm/kg, in/lb)	
Painted red		31.8/713.5 - 788.5 (31.8/72.7 - 80.4, 1.252/160.3 - 177.3)
Assembled height	mm/N (mm/kg, in/lb)	
Standard		42.3/314.5 - 361.5 (42.3/32.1 - 36.9, 1.665/70.8 - 81.4)
Limit		42.3/296.7 (42.3/30.2, 1.665/66.6)
Out of square	mm (in)	2.0 (0.079)

CYLINDER HEAD TO VALVE DISTANCE

Unit: mm (in)



SEM724C

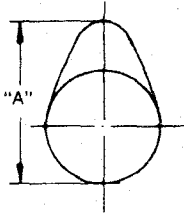
	Standard	Limit
Intake	0.79 - 1.19 (0.0311 - 0.0469)	Less than 1.75 (0.0689)
Exhaust	0.80 - 1.20 (0.0315 - 0.0472)	Less than 1.75 (0.0689)

Inspection and Adjustment (Cont'd)

CAMSHAFT AND CAMSHAFT BEARING

Unit: mm (in)

	Standard	Limit
Camshaft journal to bushing clearance	0.020 - 0.109 (0.0008 - 0.0043)	Less than 0.15 (0.0059)
Camshaft journal diameter		
Front	50.721 - 50.740 (1.9969 - 1.9976)	—
2nd	50.521 - 50.540 (1.9890 - 1.9898)	—
3rd	50.321 - 50.340 (1.9811 - 1.9819)	—
4th	50.121 - 50.140 (1.9733 - 1.9740)	—
Rear	49.921 - 49.940 (1.9654 - 1.9661)	—
Camshaft bend (Total indicator reading)	Less than 0.02 (0.0008)	Less than 0.06 (0.0024)
Camshaft end play	0.08 - 0.28 (0.0031 - 0.0110)	Less than 0.50 (0.0197)



EM671

	Standard	Limit
Cam height "A"		
Intake	41.900 (1.6220)	Less than 41.20 (1.6220)
Exhaust	41.900 (1.6496)	Less than 41.40 (1.6299)

VALVE LIFTER AND PUSH ROD

Unit: mm (in)

	Standard	Limit
Valve lifter outer diameter	24.960 - 24.970 (0.9827 - 0.9831)	—
Cylinder block valve lifter hole diameter	25.000 - 25.033 (0.9843 - 0.9855)	—
Valve lifter to lifter hole clearance	0.030 - 0.073 (0.0012 - 0.0029)	Less than 0.20 (0.0079)
Push rod bend (T.I.R.)*	Less than 0.3 (0.012)	Less than 0.5 (0.020)

*: Total indicator reading

ROCKER SHAFT AND ROCKER ARM

Unit: mm (in)

	Standard	Limit
Rocker shaft		
Outer diameter	19.979 - 20.00 (0.7866 - 0.7874)	—
Rocker shaft bend (T.I.R.)*	0 - 0.10 (0 - 0.0039)	Less than 0.30 (0.0188)
Rocker arm		
Inner diameter	20.014 - 20.035 (0.7880 - 0.7888)	—
Clearance between rocker arm and rocker shaft	0.014 - 0.056 (0.0006 - 0.0022)	Less than 0.15 (0.0059)

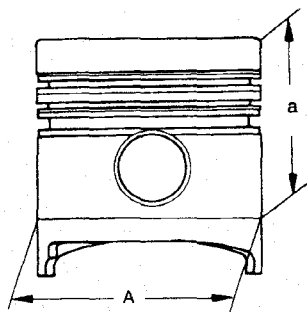
*: Total indicator reading

Inspection and Adjustment (Cont'd)

PISTON, PISTON RING AND PISTON PIN

Available piston

Unit: mm (in)



SEM778A

Piston skirt diameter "A"	
Standard	
Grade No. 1	95.890 - 95.900 (3.7752 - 3.7756)
Grade No. 2	95.900 - 95.910 (3.7756 - 3.7760)
Grade No. 3*	95.910 - 95.920 (3.7760 - 3.7764)
"a" dimension	45.2 (1.780)
Piston pin hole diameter	29.992 - 30.000 (1.1808 - 1.1811)
Piston to cylinder liner clearance	0.043 - 0.077 (0.0017 - 0.0030)
"a" dimension	69.2

* Grade No. 3 piston is not provided as a service part.

Piston pin

Unit: mm (in)

Piston pin outer diameter	29.993 - 30.000 (1.1808 - 1.1811)
Piston pin to piston clearance	-0.008 to 0.007 (-0.0003 to 0.0003)
Piston pin to connecting rod clearance	
Standard	0.025 - 0.045 (0.0010 - 0.0018)
Limit	0.15 (0.0059)

Piston ring

Unit: mm (in)

	Standard	Limit
Side clearance		
Top	0.00 - 0.05 (0.0 - 0.0019)	0.50 (0.0197)
2nd	0.04 - 0.072 (0.0016 - 0.0028)	0.30 (0.0118)
Oil	0.035 - 0.040 (0.0014 - 0.0016)	0.15 (0.0059)
Ring gap		
Top	0.25 - 0.35 (0.0098 - 0.0014)	1.5 (0.059)
2nd	0.50 - 0.75 (0.0197 - 0.0295)	
Oil (rail ring)	0.25 - 0.55 (0.0098 - 0.0217)	

CONNECTING ROD

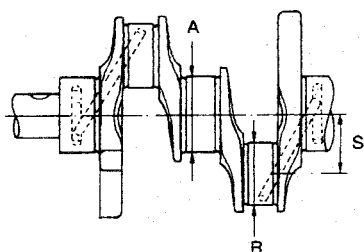
Unit: mm (in)

Center distance	156.975 - 157.025 (6.1801 - 6.1821)
Bend, torsion [per 200 (3.94)]	
Limit	0.15 (0.0059)
Piston pin bore dia.	30.025 - 30.038 (1.1821 - 1.1826)
Side clearance	
Standard	0.10 - 0.22 (0.0039 - 0.0087)
Limit	0.22 (0.0087)

Inspection and Adjustment (Cont'd)

CRANKSHAFT

Unit: mm (in)

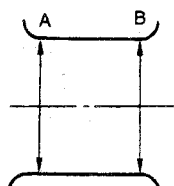
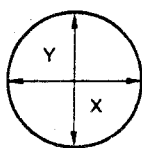


SEM100A

Journal diameter "A"	70.907 - 70.920 (2.7916 - 2.7921)
Pin diameter "B"	56.913 - 56.926 (2.2407 - 2.2411)
Center distance "S"	46.00 (1.8110)

Out-of-round
Taper

X-Y
A-B



EM715

Taper of journal and pin "A-B"	Standard	Less than 0.01 (0.0004)
	Limit	0.02 (0.0008)
Out-of-round of journal and pin "X-Y"	Standard	Less than 0.01 (0.0004)
	Limit	0.02 (0.0008)
Crankshaft bend	Standard	0 - 0.03 (0 - 0.0012)
	Limit	0.10 (0.0039)
Crankshaft end play	Standard	0.060 - 0.25 (0.0024 - 0.0098)
	Limit	0.40 (0.0157)

AVAILABLE MAIN BEARING

Bearing clearance

Unit: mm (in)

Main bearing clearance	
Standard	0.035 - 0.087 (0.0014 - 0.0034)
Limit	Less than 0.15 (0.0059)
Connecting rod bearing clearance	
Standard	0.035 - 0.081 (0.0014 - 0.0032)
Limit	Less than 0.15 (0.0059)

Main bearing undersize

Unit: mm (in)

	Crank journal diameter	
Standard	70.907 - 70.920 (2.7916 - 2.7921)	
Undersize	0.25 (0.0098)	70.657 - 70.670 (2.7818 - 2.7823)
	0.50 (0.0197)	70.407 - 70.420 (2.7719 - 2.7724)
	0.75 (0.0295)	70.157 - 70.170 (2.7621 - 2.7626)
	1.00 (0.0394)	69.907 - 69.920 (2.7522 - 2.7528)

AVAILABLE CONNECTING ROD BEARING

Connecting rod bearing undersize

Unit: mm (in)

	Crank pin journal diameter	
Standard	56.913 - 56.926 (2.2407 - 2.2412)	
Undersize	0.25 (0.0098)	56.663 - 56.676 (2.2308 - 2.2313)
	0.50 (0.0197)	56.413 - 56.676 (2.2210 - 2.2313)
	0.75 (0.0295)	56.163 - 56.176 (2.2111 - 2.2116)
	1.00 (0.0394)	55.913 - 55.926 (2.2013 - 2.2018)

Inspection and Adjustment (Cont'd)

AVAILABLE THRUST WASHER

Thrust washer undersize

Unit: mm (in)

	Thrust washer thickness
Standard	2.275 - 2.325 (0.0896 - 0.0915)
Oversize	
0.20 (0.0079)	2.475 - 2.525 (0.0974 - 0.0994)
0.40 (0.0157)	2.675 - 2.725 (0.1053 - 0.1073)

MISCELLANEOUS COMPONENTS

Unit: mm (in)

Gear train	
Backlash of each gear	
Standard	0.07 - 0.11 (0.0028 - 0.0043)
Limit	0.20 (0.0079)
Flywheel	
Runout (Total indicator reading)	Less than 0.15 (0.0059)
Front plate	
Warpage limit	0.2 (0.008)
Cylinder head	
Head surface distorsion	
Standard	Less than 0.07 (0.0028)
Limit	0.2 (0.008)
Minimum height	89.7 (3.532)