

ENGINE MECHANICAL

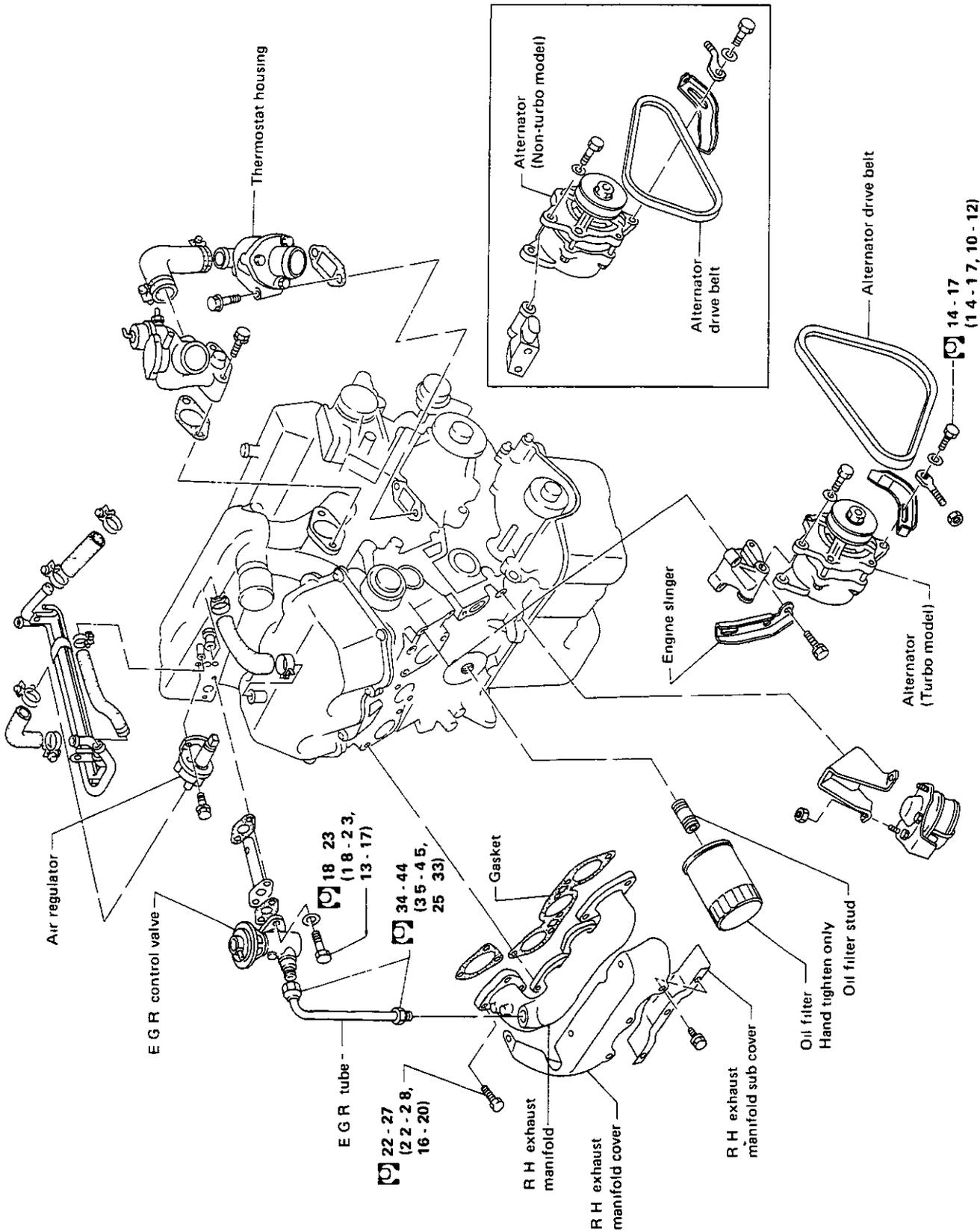
SECTION **EM**



CONTENTS

ENGINE COMPONENTS –Outer Parts–	EM- 2
COMPRESSION PRESSURE	EM- 4
TIMING BELT	EM- 5
CYLINDER HEAD	EM-11
OIL PAN	EM-23
OIL SEAL REPLACEMENT	EM-24
ENGINE REMOVAL	EM-25
ENGINE OVERHAUL	EM-26
SERVICE DATA AND SPECIFICATIONS (S D S)	EM-35
SPECIAL SERVICE TOOLS	EM-43

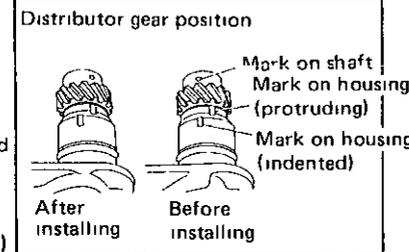
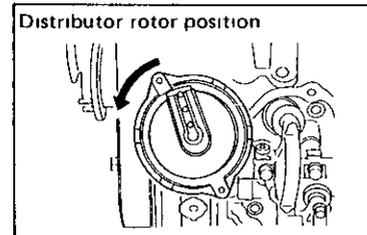
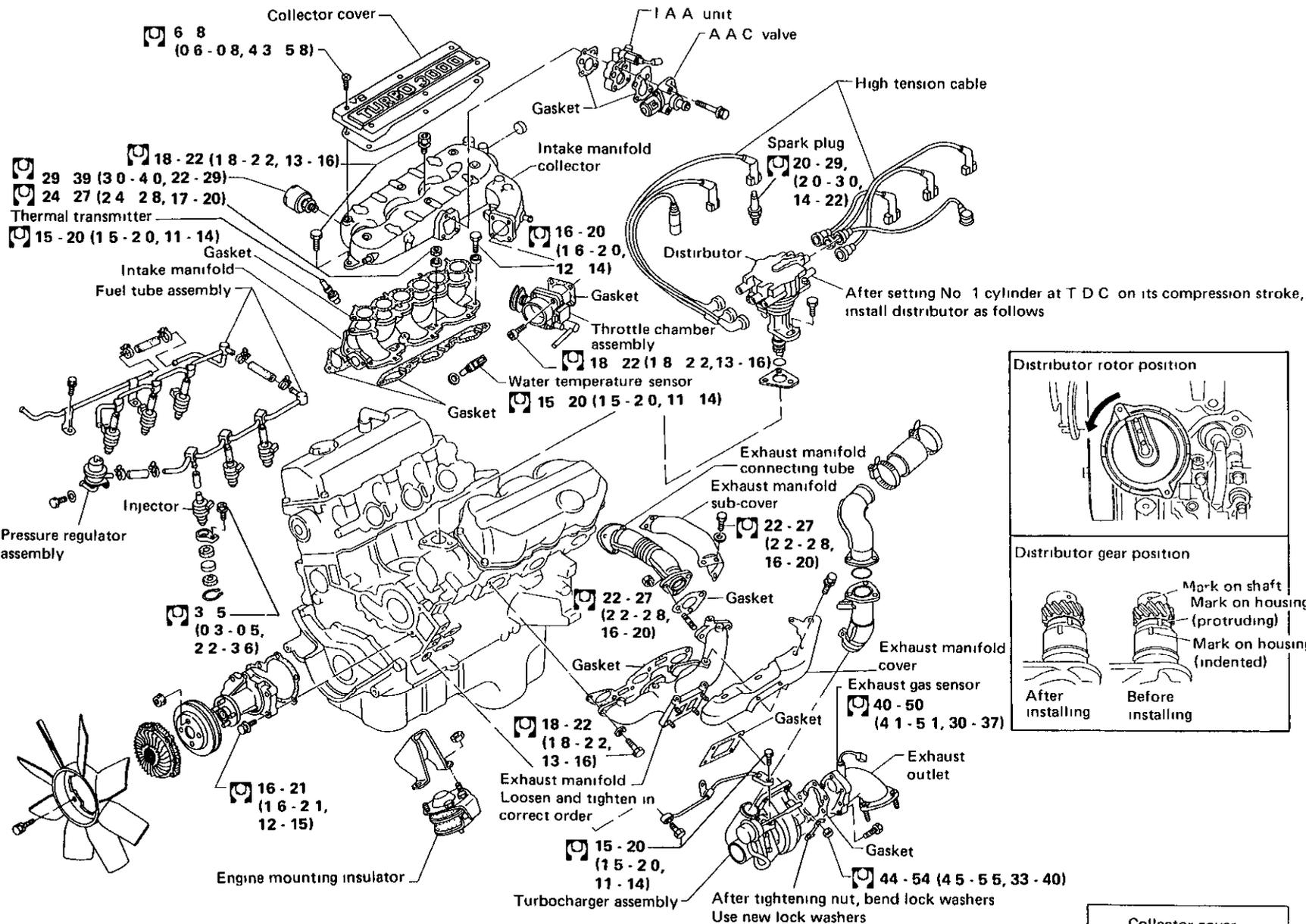
ENGINE COMPONENTS —Outer Parts—



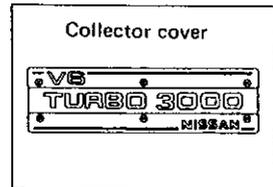
N m (kg-m, ft-lb)

14-17
(14-17, 10-12)

SEM234A



- Use new gaskets, O-rings and bronze washers
- Tighten collector and collector cover as shown to the right
Loosen them in reverse order of removal As for tightening order of exhaust manifolds and collector, refer to Cylinder Head



SEM235A

N m (kg m, ft-lb)

COMPRESSION PRESSURE

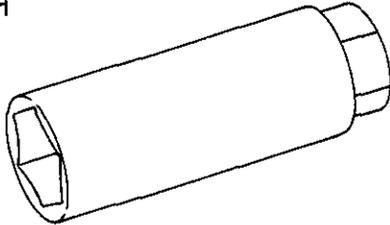
Measurement of Compression Pressure

- 1 Warm up engine
- 2 Remove all spark plugs

Use a suitable plug wrench shown below.

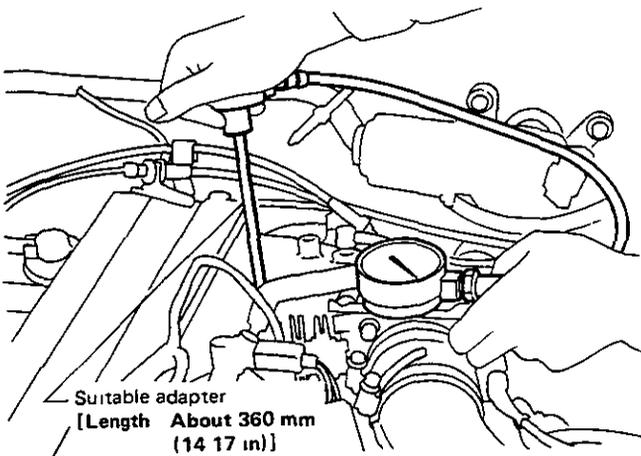


Wrench with a magnet
to hold spark plug



SEM294A

- 3 Attach a compression tester



SEM237A

- 4 Depress accelerator pedal to fully open throttle.
- 5 Crank engine and read gauge indication

Compression pressure:

kPa (kg/cm², psi) at rpm

Standard

Non-turbo 1,196 (12.2, 173)/300

Turbo 1,138 (11.6, 165)/300

Minimum

Non-turbo 883 (9.0, 128)/300

Turbo 834 (8.5, 121)/300

Differential limit between cylinders:

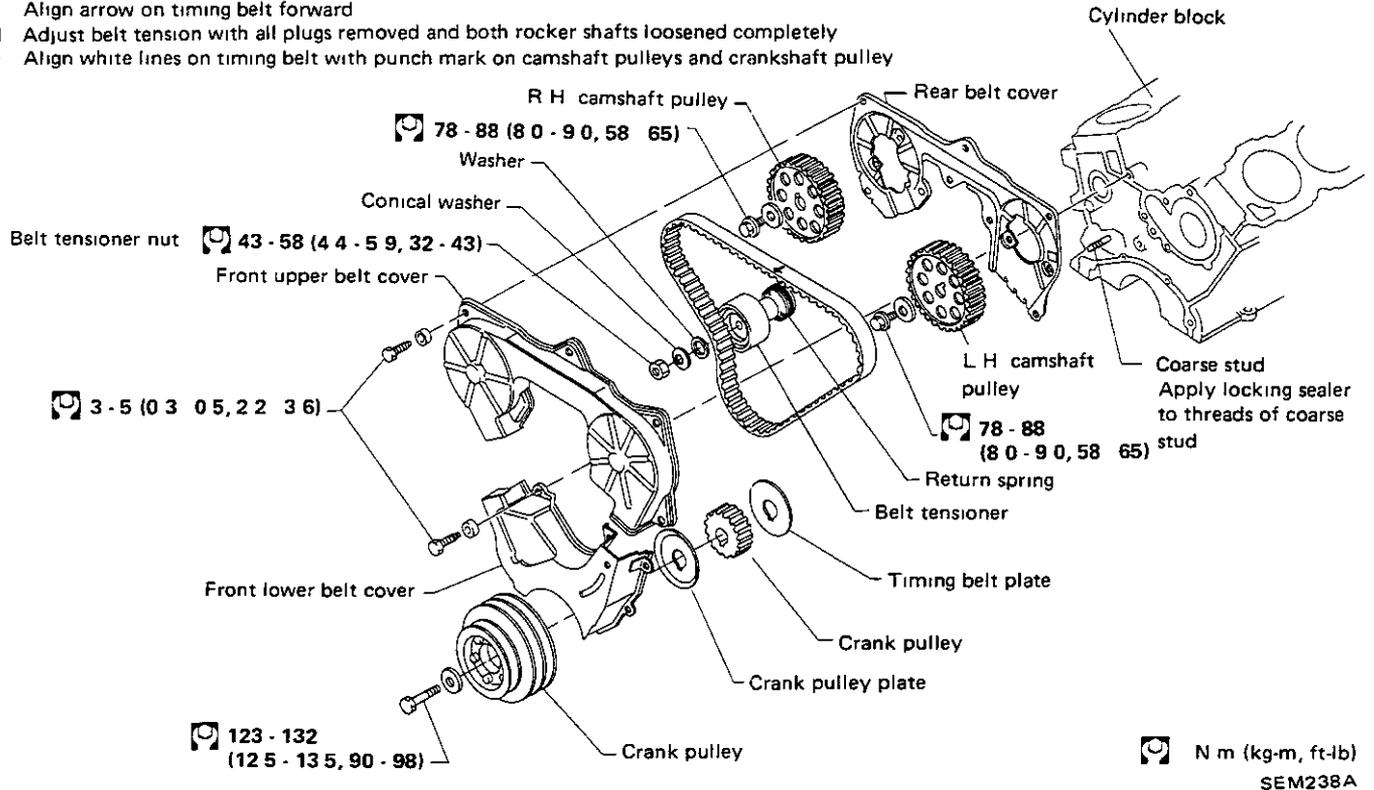
98 (1.0, 14)/300

- 6 If cylinder compression in one or more cylinders is low, pour a small amount of engine oil into cylinders through the spark plug holes and retest compression
- If adding oil helps the compression pressure, chances are that piston rings are worn or damaged.
 - If pressure stays low, valve may be sticking or seating improperly
 - If cylinder compression in any two adjacent cylinders is low, and if adding oil does not help the compression, there is leakage past the gasketed surface

TIMING BELT

Timing belt

- Ensure timing belt is clean and free from oil or water
- Before installing timing belt, confirm that No 1 cylinder is set at T D C on compression stroke
- Align arrow on timing belt forward
- Adjust belt tension with all plugs removed and both rocker shafts loosened completely
- Align white lines on timing belt with punch mark on camshaft pulleys and crankshaft pulley



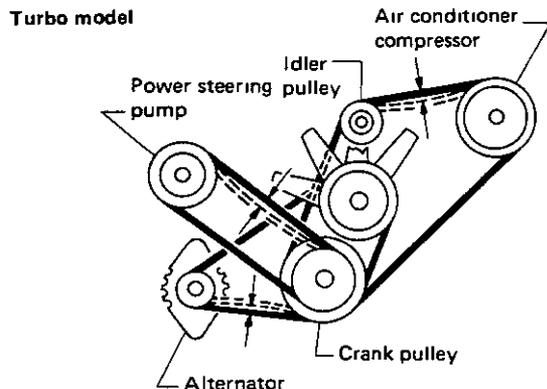
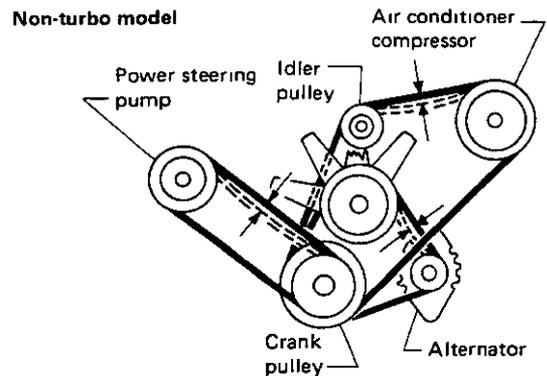
Removal

After removing cylinder head, do not rotate crankshaft and camshaft separately, because valves will hit piston heads

- Remove radiator shroud, fan and pulleys
Refer to Cooling System-Radiator (Section LC).
- Drain coolant from radiator and remove water pump hose

Be careful not to attach coolant to drive belts

- Remove the following belts
 - Power steering drive belt
 - Compressor drive belt
 - Alternator drive belt

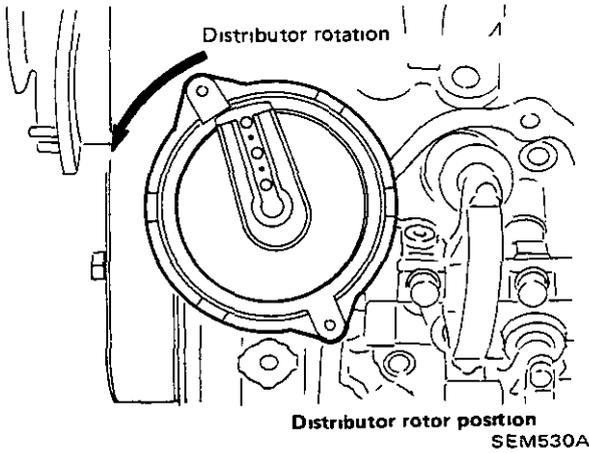
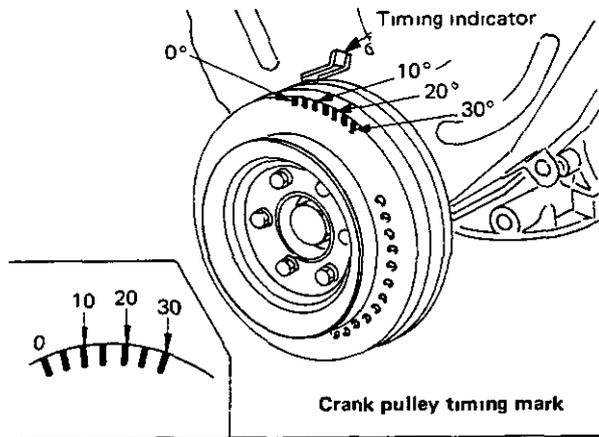


SEM239A

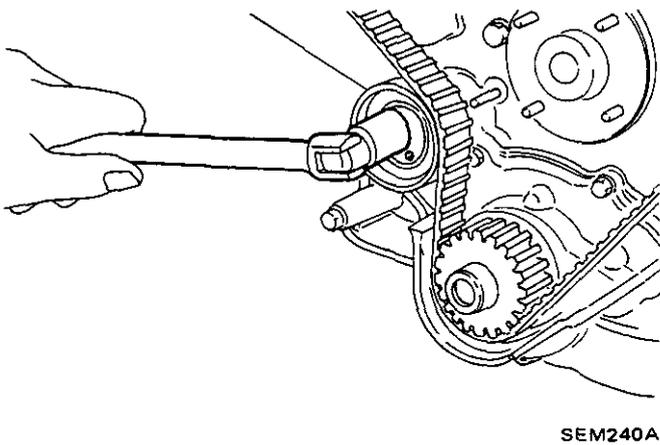
TIMING BELT

Removal (Cont'd)

- 4 Set No 1 cylinder at T.D C on its compression stroke



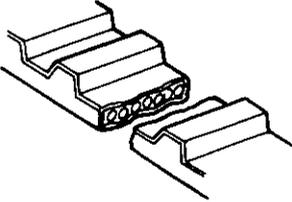
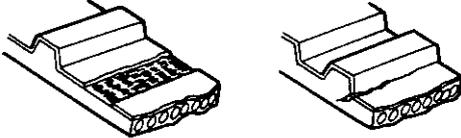
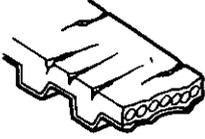
- 5 Remove front upper and lower belt covers.
6. Loosen timing belt tensioner and return spring then remove timing belt



TIMING BELT

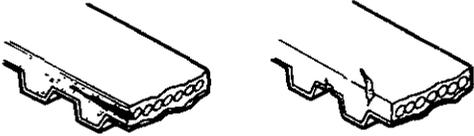
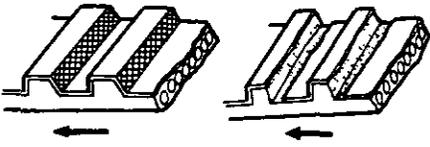
Inspection

Visually check the condition of the timing belt
 Replace if any abnormality is found

Item to check	Problem	Cause
Belt is broken	 <p>SEM393A</p>	<ul style="list-style-type: none"> ● Improper handling ● Poor belt cover sealing ● Coolant leakage at water pump
Tooth is broken/ tooth root is cracked	 <p>SEM394A</p>	<ul style="list-style-type: none"> ● Camshaft jamming ● Distributor jamming ● Damaged camshaft/crankshaft oil seal
Back surface is cracked/worn	 <p>SEM395A</p>	<ul style="list-style-type: none"> ● Tensioner jamming ● Overheated engine ● Interference with belt cover

TIMING BELT

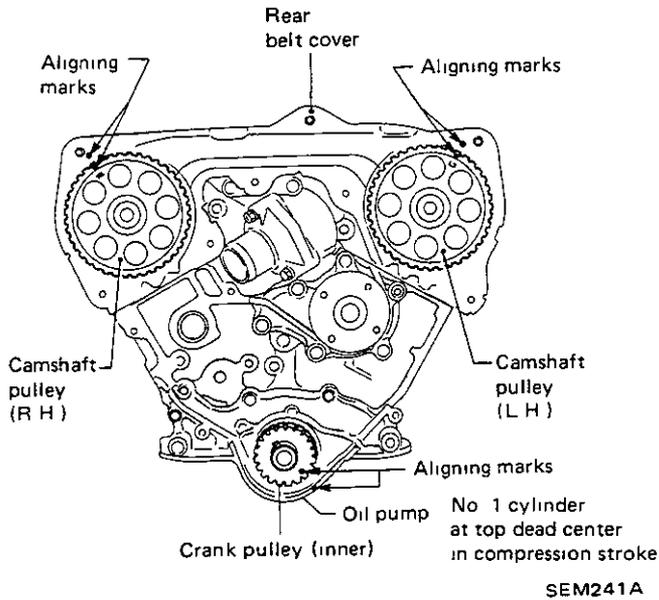
Inspection (Cont'd)

Item to check	Problem	Cause
Side surface is worn	 <ul style="list-style-type: none"> ● Side surface of belt is worn to such an extent that there is no trace of cutoff performed during manufacturing process ● Belt corners are worn and round ● Wicks are frayed and coming out <p style="text-align: right;">SEM396A</p>	<ul style="list-style-type: none"> ● Improper installation of belt ● Malfunctioning crank pulley plate/timing belt plate
Teeth are worn	 <ul style="list-style-type: none"> ● Canvas on tooth face is worn down ● Canvas on tooth is fluffy, rubber layer is worn down and faded white, or weft is worn down and invisible <p style="text-align: right;">SEM397A</p>	<ul style="list-style-type: none"> ● Poor belt cover sealing ● Coolant leakage at water pump ● Camshaft not functioning properly ● Distributor not functioning properly ● Excessive belt tension
Oil/Coolant or water is stuck to belt		<ul style="list-style-type: none"> ● Poor oil sealing of each oil seal ● Coolant leakage at water pump ● Poor belt cover sealing

TIMING BELT

Installation

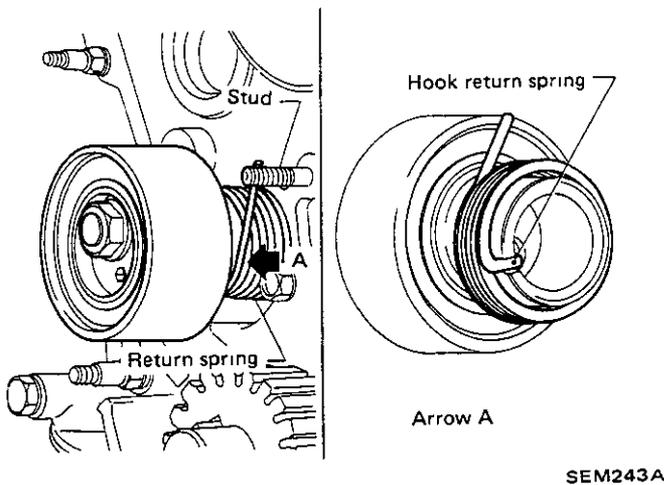
- 1 Confirm that No. 1 cylinder is set at T D C on its compression stroke.



- 2 Remove both rocker covers and loosen all rocker shaft securing bolts

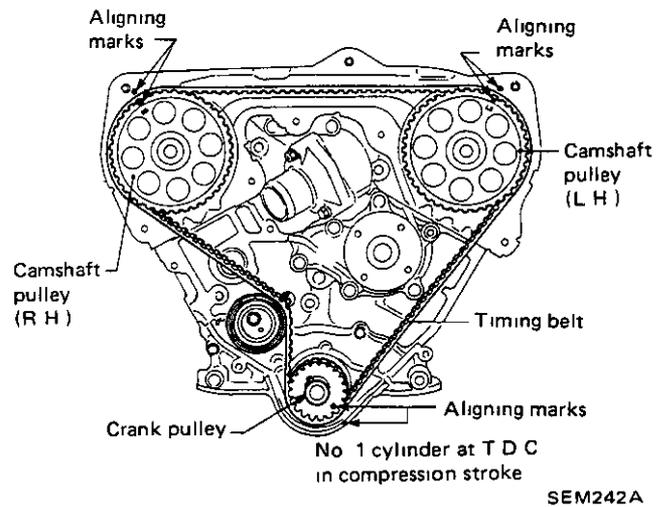
Loosen all rocker shaft securing bolts thoroughly so that timing belt tension can be adjusted correctly.

- 3 Install tensioner and return spring

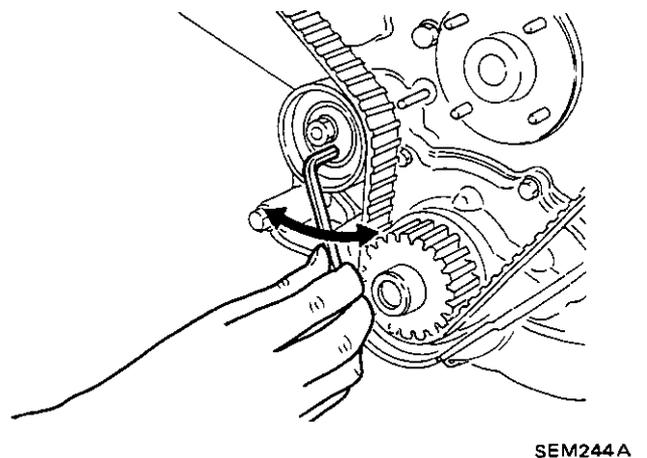


If coarse stud is once removed, apply locking sealer to threads of stud before installing

- 4 Set timing belt
 - a. Ensure timing belt is clean and free from oil or water Do not bend it
 - b. Align white lines on timing belt with punch mark on camshaft pulleys and crankshaft pulley.
 - c. Have arrow on timing belt pointing toward front belt covers



- 5 Slowly turn tensioner with hexagon wrench clockwise and counterclockwise two or three times



- 6 Tighten tensioner lock nut

 43 - 58 N·m
(44 - 5.9 kg-m, 32 - 43 ft-lb)

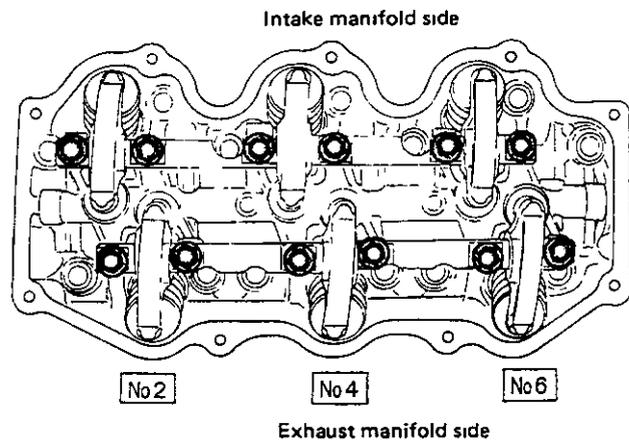
TIMING BELT

Installation (Cont'd)

7 Tighten rocker shaft securing bolts in two or three stages.

 18 - 22 N·m
(1.8 - 2.2 kg-m, 13 - 16 ft-lb)

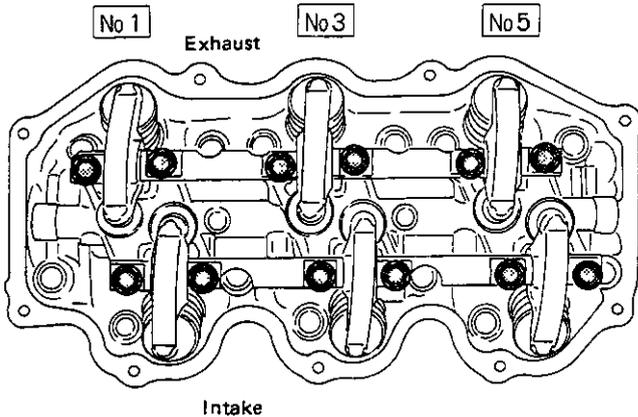
L H rocker shafts



SEM245A

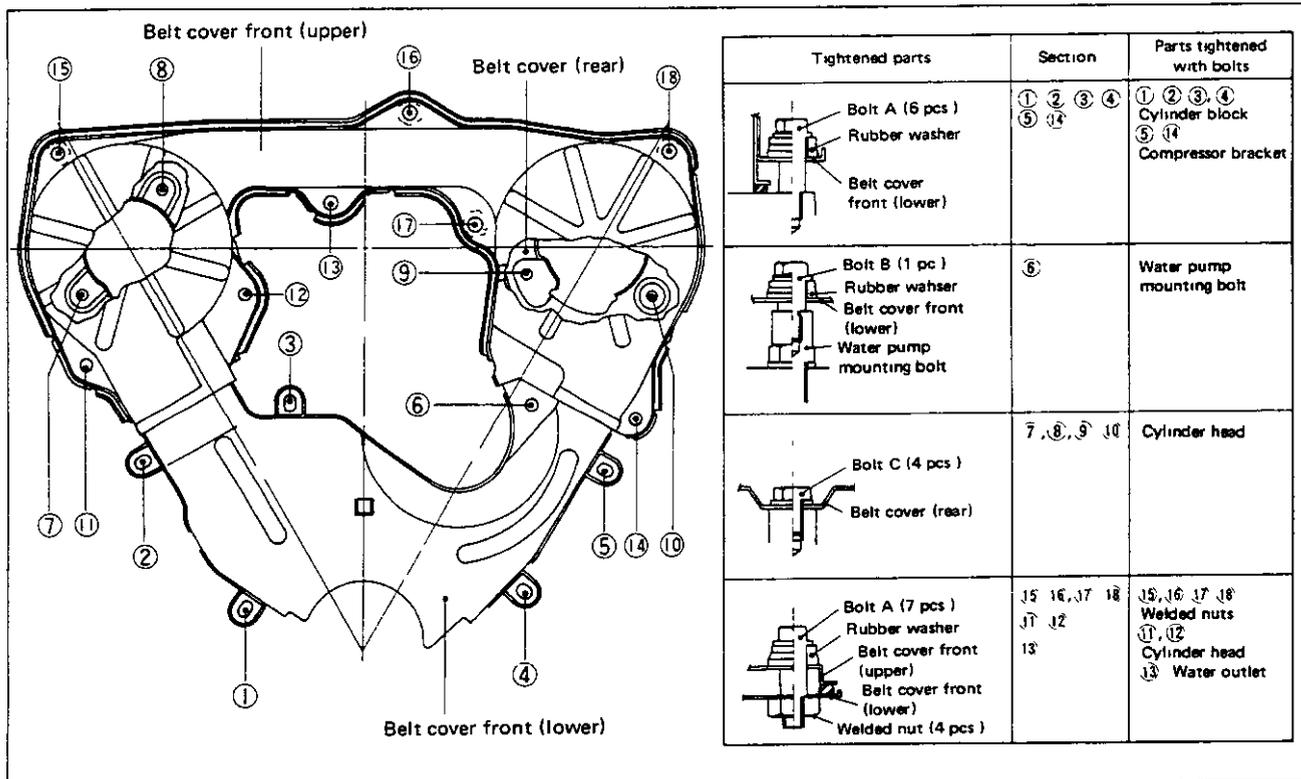
Before tightening, be sure to set camshaft lobe at the position where lobe is not lifted.

R H. rocker shafts



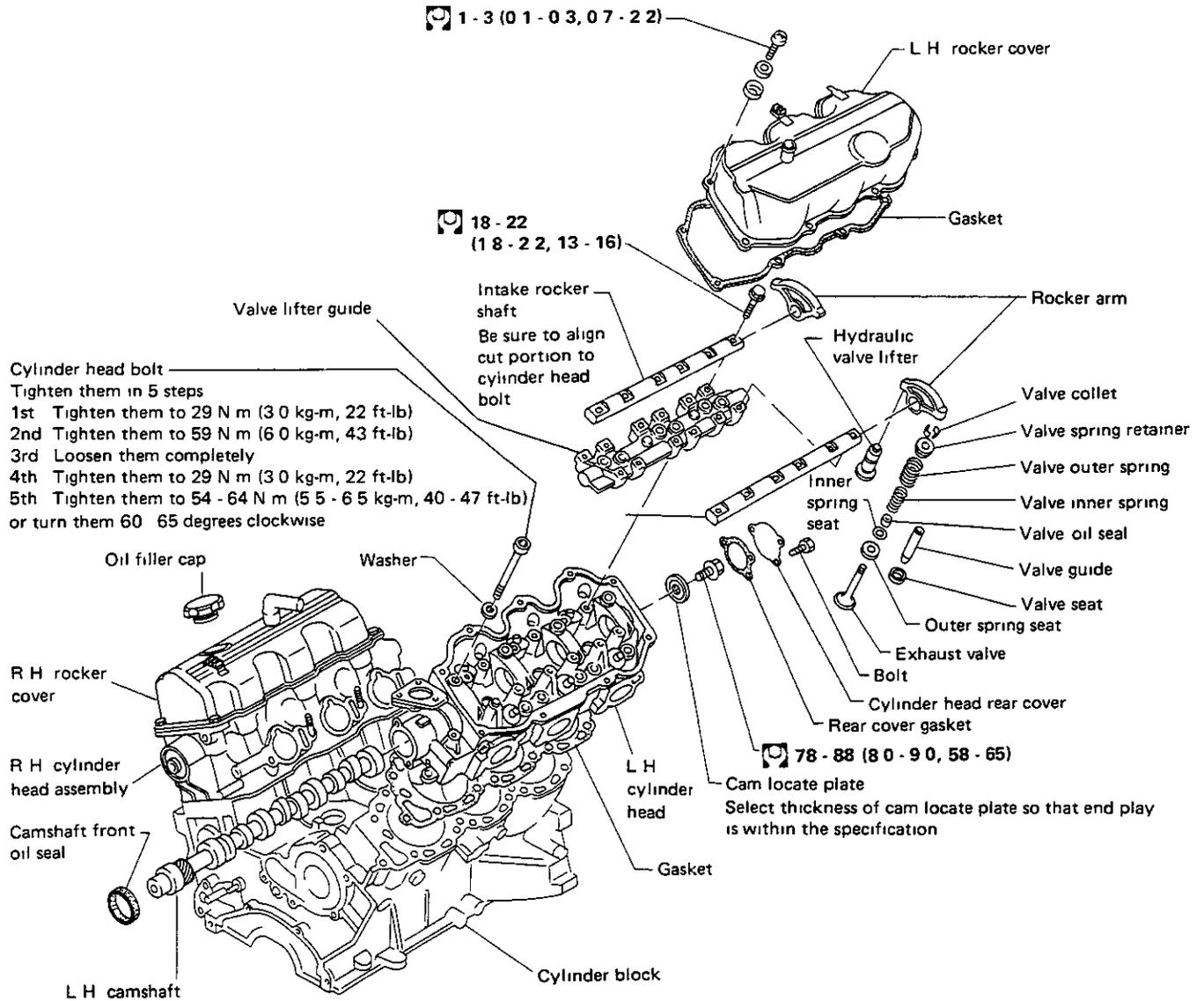
Intake

8 Install lower and upper belt covers



SEM248A

CYLINDER HEAD



- When installing sliding parts such as bearings, be sure to apply engine oil on the sliding surfaces
- Use new gaskets and oil seals

 N m (kg-m, ft-lb)

CYLINDER HEAD

Removal

To facilitate removal of both cylinder heads, it is advisable to dismount the engine as a unit in advance.

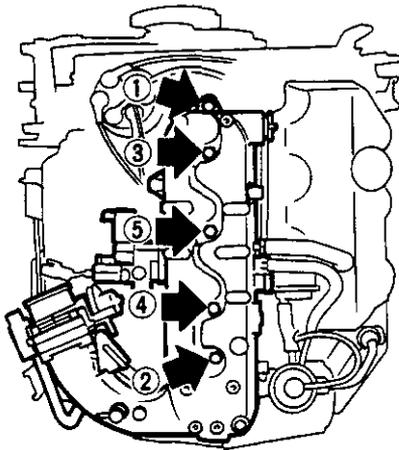
- 1 Remove timing belt.

Set No 1 cylinder at T D C on its compression stroke

After removing cylinder head, do not rotate crankshaft and camshaft separately, because valves will hit piston heads.

- 2 Remove collector cover and collector

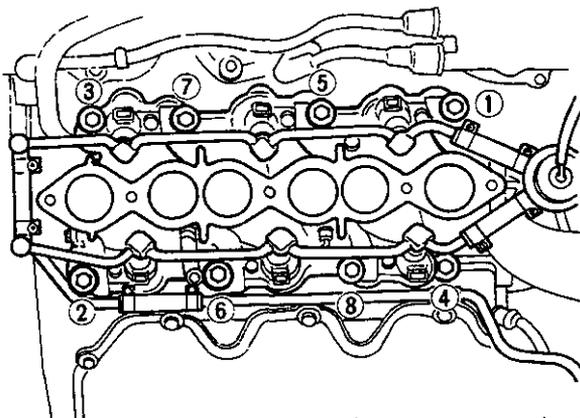
Before removing collector, be sure to drain coolant removing drain cocks in cylinder block



Loosen in numerical order and tighten in reverse order of removal

SEM251A

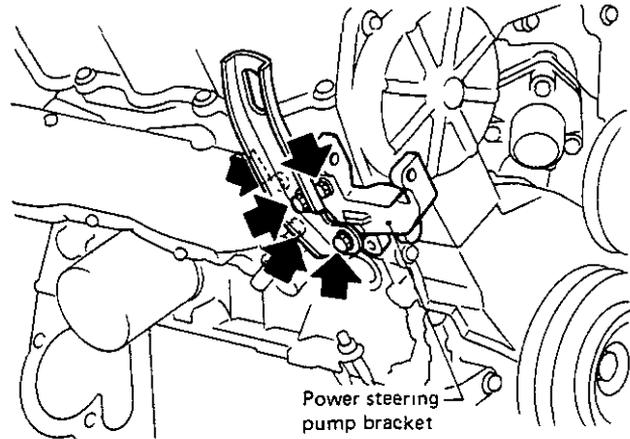
- 3 Remove intake manifold with fuel tube assembly.



Loosen in numerical order

SEM252A

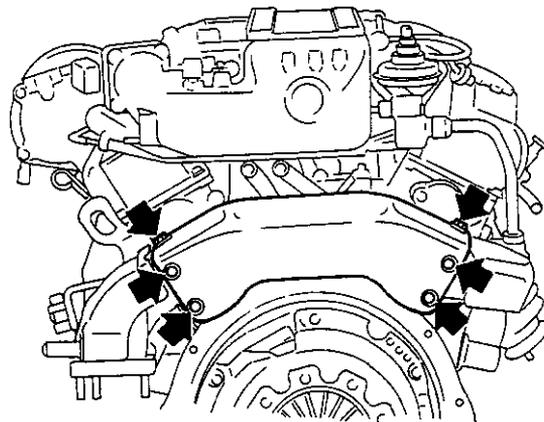
- 4 Remove power steering pump bracket



Power steering pump bracket

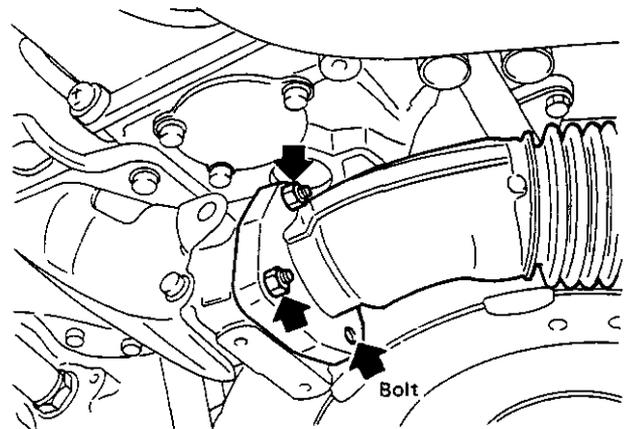
SEM253A

- 5 Remove exhaust manifold covers



SEM297A

- 6 Disconnect exhaust manifold connecting tube



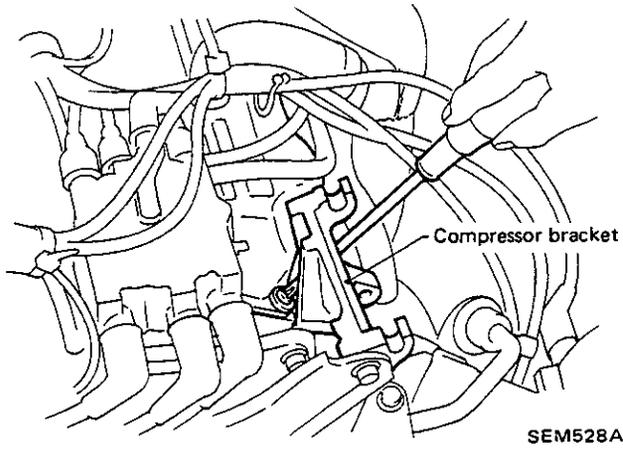
Bolt

SEM298A

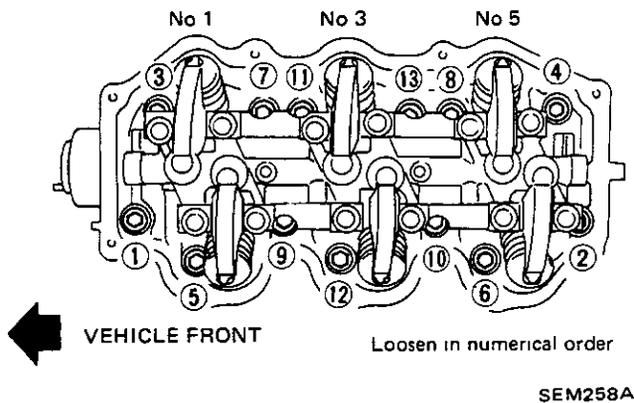
CYLINDER HEAD

Removal (Cont'd)

7. Remove camshaft pulleys and rear timing cover securing bolts.
8. Remove compressor and rocker covers



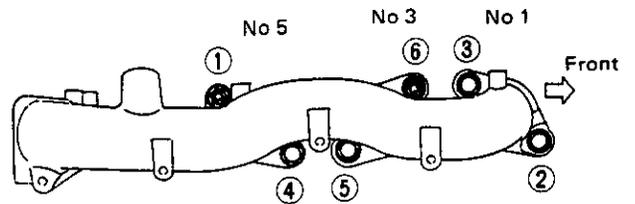
9. Remove cylinder head with exhaust manifold



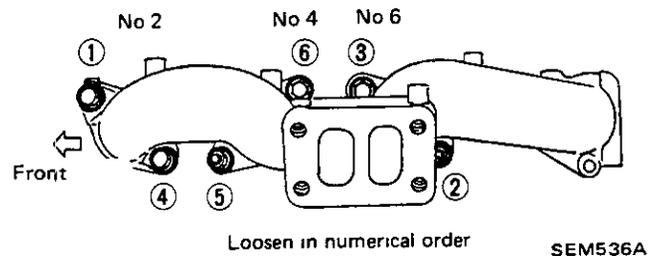
Disassembly

1. Remove exhaust manifold.

R.H exhaust manifold



L.H exhaust manifold



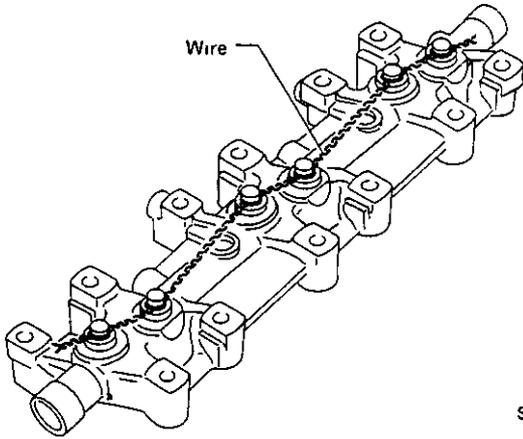
2. Remove rocker shafts with rocker arms.

The bolts should be loosened in two or three stages.

CYLINDER HEAD

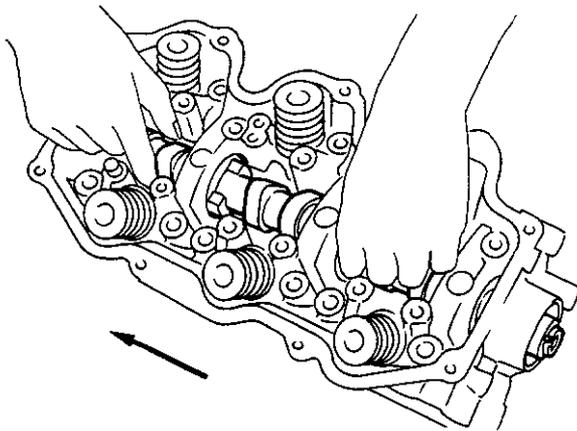
Disassembly (Cont'd)

- 3 Remove hydraulic valve lifters and lifter guide
 - a. Hold hydraulic valve lifters with wire so that they will not drop from lifter guide.



SEM304A

- b. Do not put hydraulic valve lifters upside down, otherwise air will enter valve lifter, causing it to make a noise.
 - c. Do not disassemble hydraulic valve lifter.
 - d. Put identification mark on valve lifters not to avoid mixing them up.
4. Remove camshaft



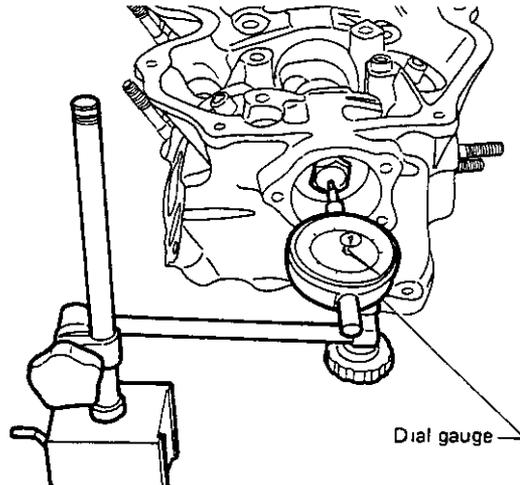
SEM259A

Inspection

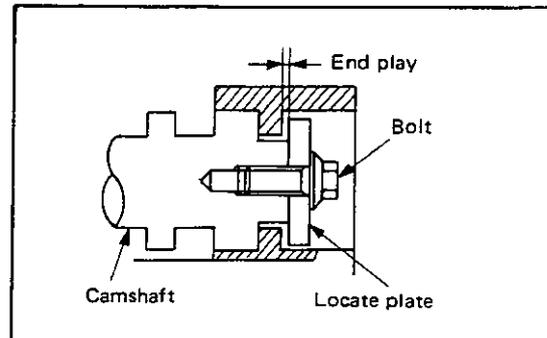
CAMSHAFT END PLAY

Camshaft end play

0.03 - 0.06 mm (0.0012 - 0.0024 in)

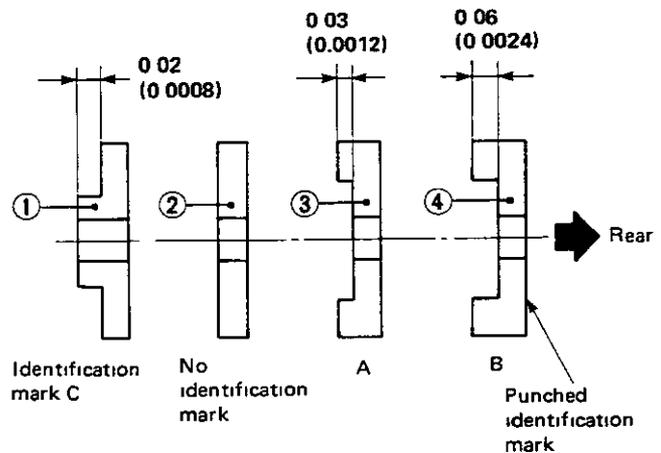


Dial gauge



SEM260A

- If camshaft end play exceeds the specified limit, select thickness of cam locate plate so that end play is within the specification.



SEM261A

CYLINDER HEAD

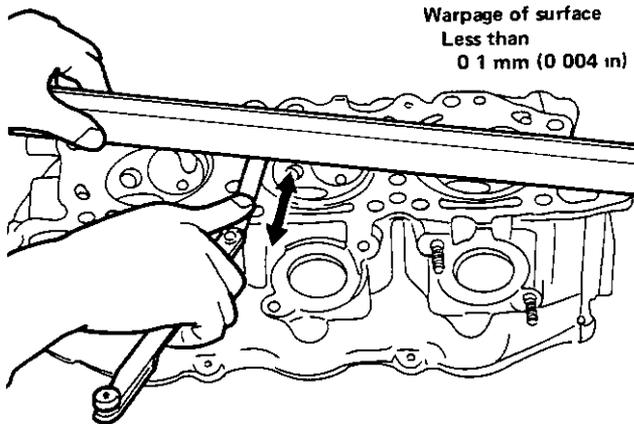
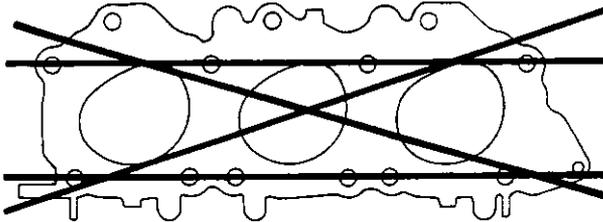
Inspection (Cont'd)

Example

When camshaft end play is 0.08 mm (0.0031 in) with shim ② used, change shim ② to shim ③ so that camshaft end play is 0.05 mm (0.0020 in)

CYLINDER HEAD DISTORTION

Measuring points



Warpage of surface
Less than
0.1 mm (0.004 in)

SEM262A

If beyond the specified limit, 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"

The maximum limit is as follows:

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

VALVE GUIDE CLEARANCE

- Valve guide clearance should be measured parallel with rocker arm (Generally, a large amount of wear occurs in this direction.)

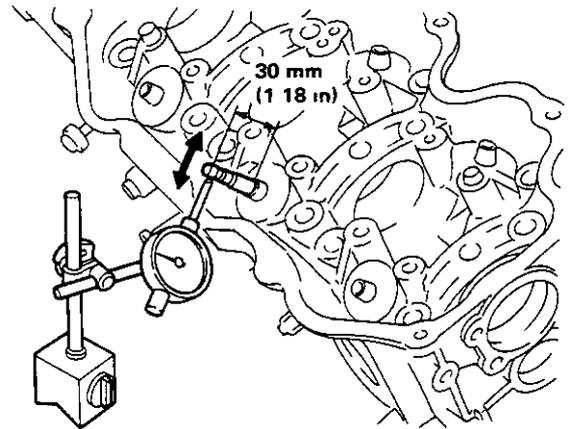
Stem to guide clearance:

Maximum limit

0.10 mm (0.0039 in)

Maximum allowable deflection
(Dial indicator reading)

0.2 mm (0.008 in)

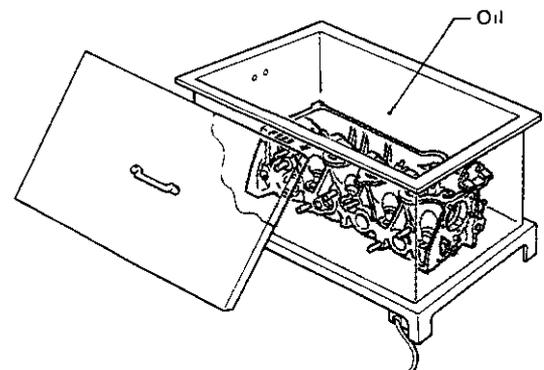


SEM263A

Replacement

Replace valve and/or valve guide

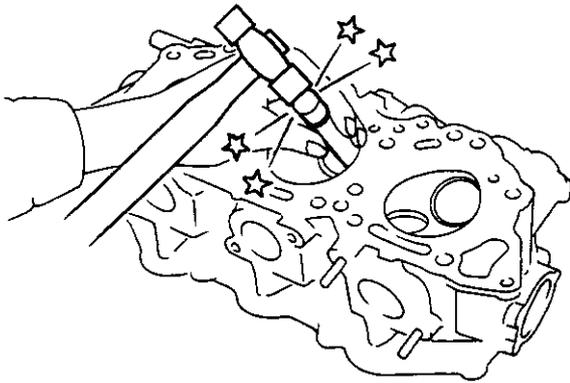
- 1 To remove valve guide heat cylinder head to 150 to 160°C (302 to 320°F) and drive out valve guide with a press [under a 20 kN (2t, 2.2 US ton, 2.0 Imp ton) pressure] or hammer, and suitable tool



SEM008A

CYLINDER HEAD

Inspection (Cont'd)

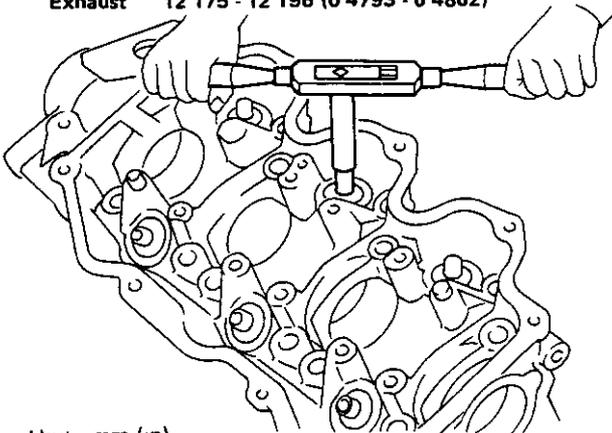


SEM264A

2 Rear cylinder head valve guide hole

Valve guide hole inside diameter

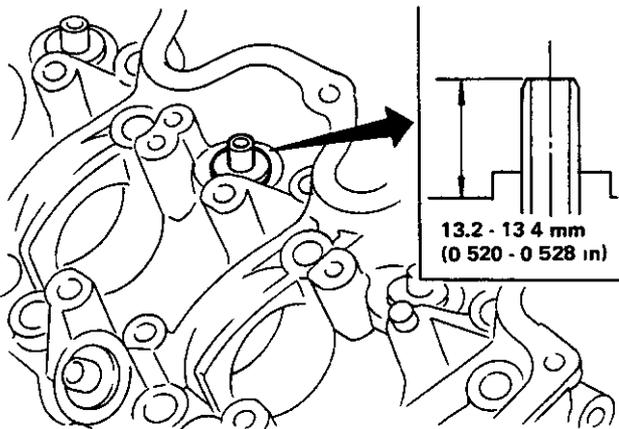
Intake	11 175 - 11 196 (0 4400 - 0 4408)
Exhaust	12 175 - 12 196 (0 4793 - 0 4802)



Unit mm (in)

SEM270A

3. Heat cylinder head to 150 to 160°C (302 to 320°F) and press service valve guide onto cylinder head



SEM271A

4 Rear valve guide

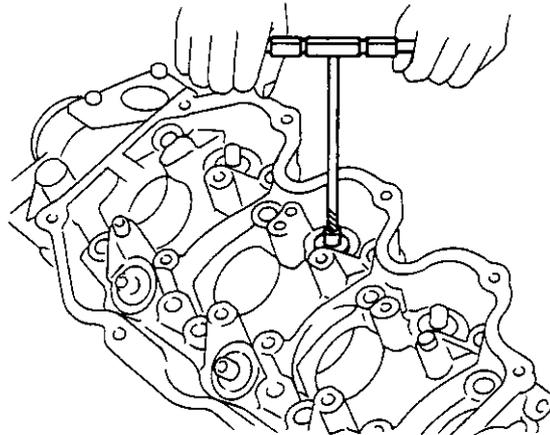
Finished size:

Intake

7 000 - 7 018 mm (0.2756 - 0.2763 in)

Exhaust

8.000 - 8.018 mm (0.3150 - 0.3157 in)



SEM272A

VALVE INSERTS

Check valve inserts for any evidence of pitting at valve contact surface, and reseat or replace if worn out excessively

- When repairing valve inserts, check valve and valve guide for wear beforehand. If worn, replace them. Then correct valve seat.
- The cutting should be done with both hands for uniform cutting.

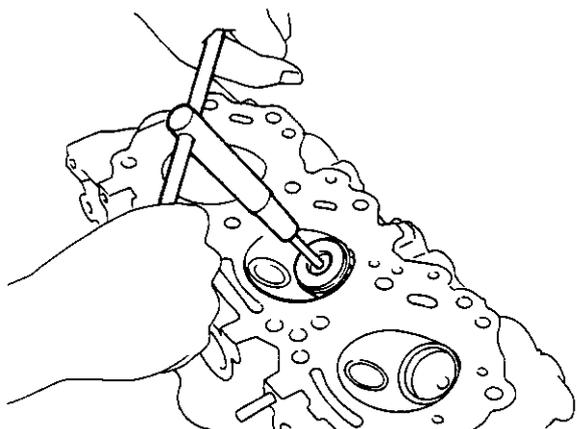
Replacement

If necessary, replace valve inserts as follows:

- 1 After removing valve insert, ream the cylinder head recess
2. Heat cylinder head to a temperature of 150 to 160°C (302 to 320°F)
- 3 Press fit insert until it seats on the bottom, and caulk more than 4 points
4. Cut or grind valve inserts using suitable tool at the specified dimensions as shown in S.D.S

CYLINDER HEAD

Inspection (Cont'd)



SEM265A

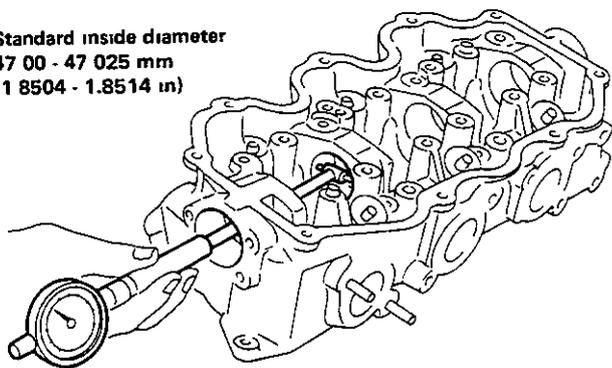
- 5 After cutting, lap valve inserts with a lapping compound
- 6 Check contact condition of valve inserts

CAMSHAFT JOURNAL CLEARANCE

Wear limit

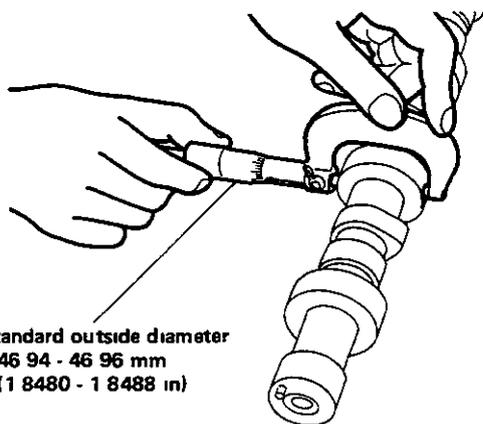
0.15 mm (0.0059 in)

Standard inside diameter
47.00 - 47.025 mm
(1.8504 - 1.8514 in)



SEM266A

Standard outside diameter
46.94 - 46.96 mm
(1.8480 - 1.8488 in)



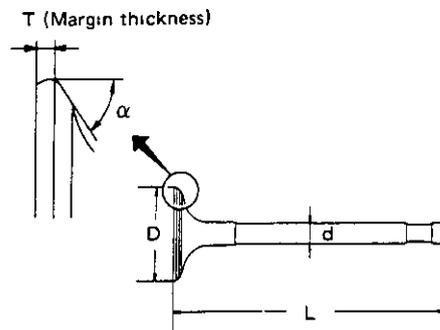
SEM267A

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 the valve.

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



SEM188A

VALVE SPRING SQUARENESS

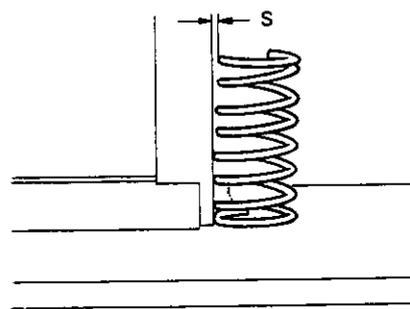
Out of square

Outer

Less than 2.2 mm (0.087 in)

Inner

Less than 1.9 mm (0.075 in)



SEM288A

VALVE SPRING PRESSURE LOAD

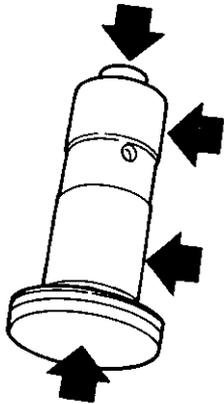
Refer to S.D S

CYLINDER HEAD

Inspection (Cont'd)

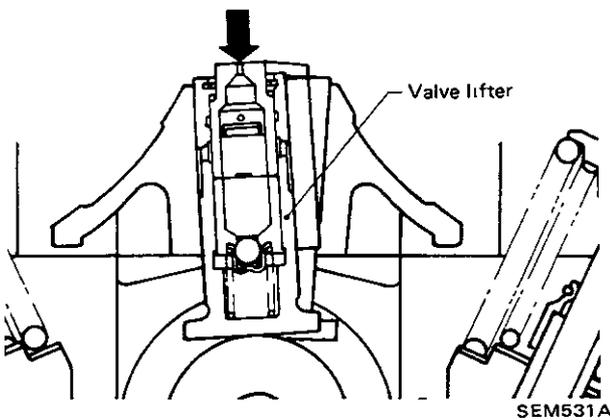
HYDRAULIC VALVE LIFTER

Check contact and sliding surfaces for wear or scratches.



SEM269A

If valve lifters are noisy, check valve lifter
(1) Depress plunger forcibly with your finger



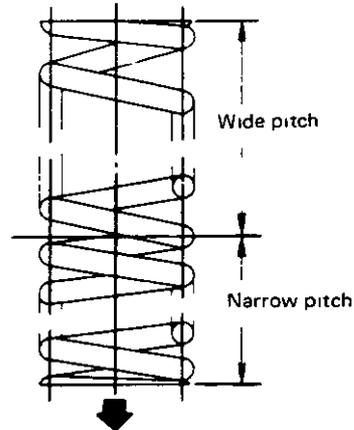
If it moves about 1 mm (0.04 in), it indicates air is inside valve lifter

- (2) Re-install rocker arm and rocker cover.
- (3) Bleed air by running engine at 1,000 rpm under no-load for about 10 minutes.
- (4) Next, remove rocker cover and rocker arm and check to ensure all air is bled. (Refer to step (1) above)
- (5) If there is still air, replace valve lifter.

Assembly

- 1 Install valve component parts.

Install outer valve spring (uneven pitch type) with its narrow pitch side toward cylinder head side



SEM052

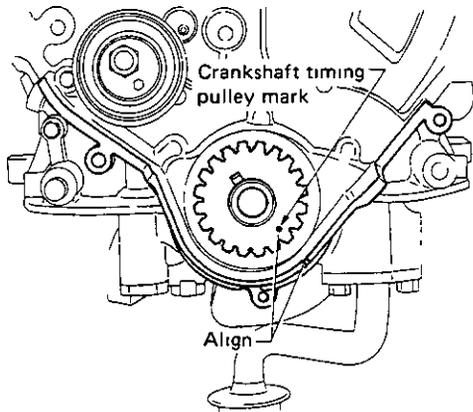
- 2 Install camshaft
- 3 Apply engine oil to camshaft oil seal and install it in place
- 4 Adjust camshaft end play with locate plate installed

CYLINDER HEAD

Installation

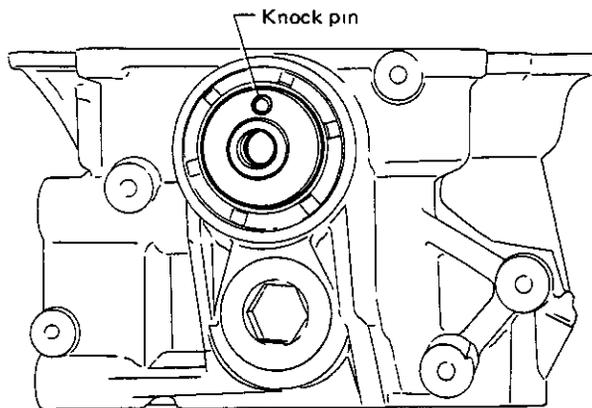
1 Before installing cylinder head, make sure that No 1 cylinder is set at T D C on its compression stroke as follows

(1) Crankshaft timing pulley mark should be aligned with mark on oil pump housing



SEM278A

(2) Have knock pin in front end of camshaft facing upward



SEM279A

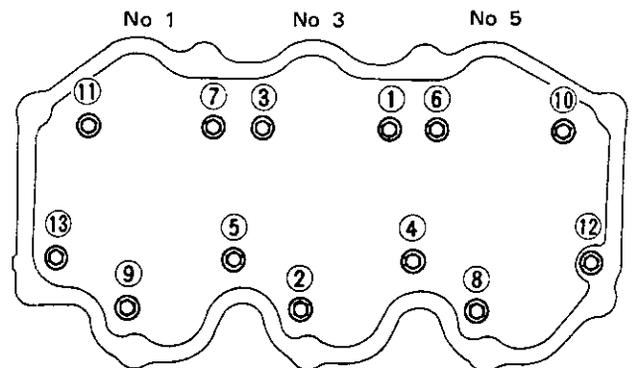
Do not rotate crankshaft and camshaft separately, because valves will hit piston heads.

2 Install cylinder head with new gasket

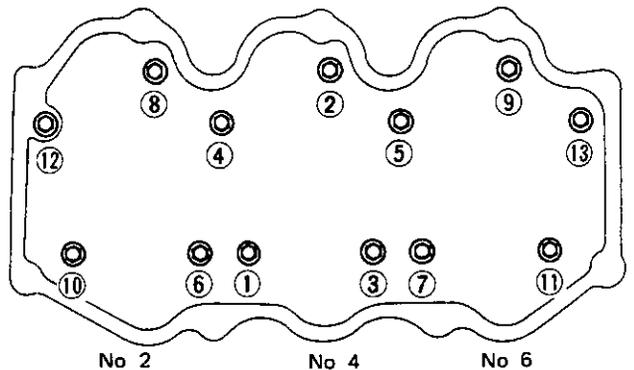
3. Tighten cylinder head bolts with washers using ST10120000.

• Tightening order

R H side



L.H side



SEM558A

• Tightening procedures

1st Tighten all bolts to 29 N·m
(3 0 kg·m, 22 ft·lb)

2nd Tighten all bolts to 59 N·m
(6 0 kg·m, 43 ft·lb)

3rd Loosen all bolts completely.

4th Tighten all bolts to 29 N·m
(3.0 kg·m, 22 ft·lb)

5th Tighten all bolts to 54 to 64 N·m
(5.5 to 6.5 kg·m, 40 to 47 ft·lb)

or if you have an angle wrench, turn all bolts 60 - 65 degrees clockwise

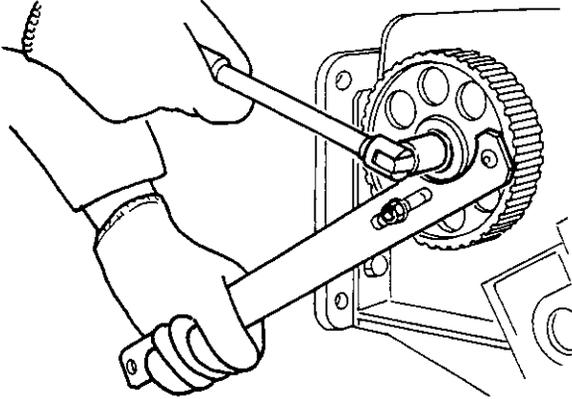
After engine has been operated for several minutes, retighten if necessary.

CYLINDER HEAD

Installation (Cont'd)

- 4 Tighten rear timing cover.
- 5 Install camshaft pulleys

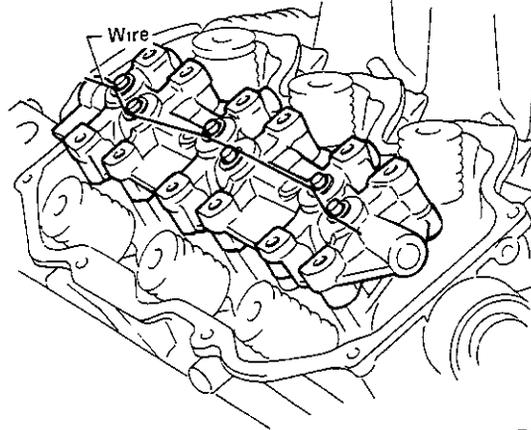
-  **Camshaft pulley**
 78 - 88 N·m
 (8.0 - 9.0 kg-m, 58 - 65 ft-lb)



SEM305A

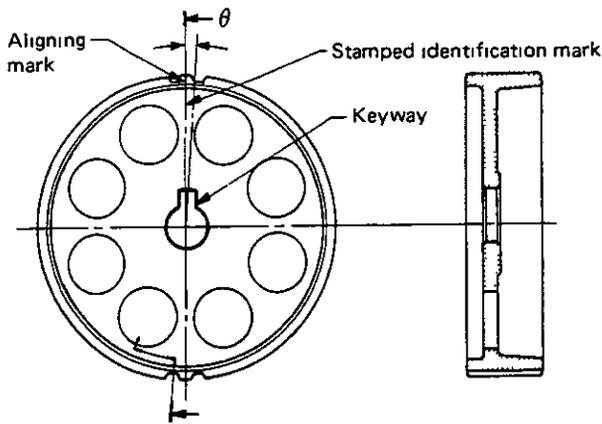
- 6 Install timing belt and adjust belt tension
- 7 Install front upper and lower belt covers
- 8 Install valve lifters and lifter guide

Assemble valve lifters to their original position and hold all valve lifters with wire



SEM280A

R H. camshaft pulley and L.H. camshaft pulley are different parts. Be sure to install them in the right positions.



SEM303A

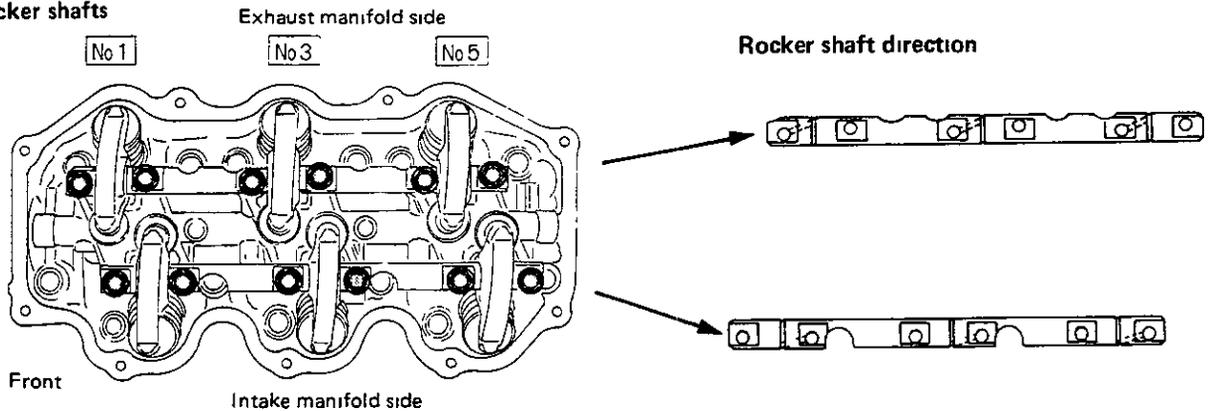
	Identification mark	θ
R H camshaft pulley	R3	$0^{\circ}53'$
L H camshaft pulley	L3	$-3^{\circ}27'$

CYLINDER HEAD

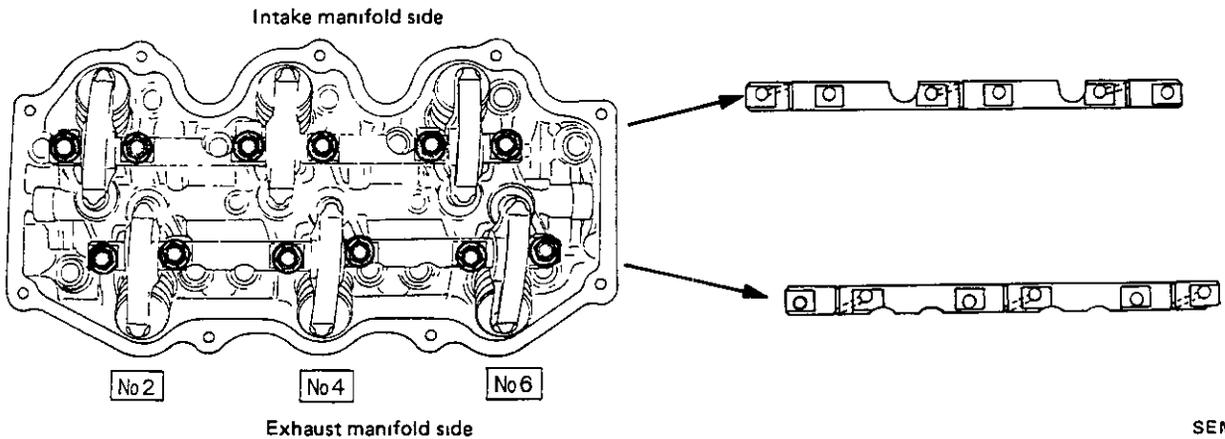
Installation (Cont'd)

9 Install rocker shafts with rocker arms and tighten rocker shaft securing bolts in two or three stages

R H rocker shafts



L H rocker shafts



SEM281A

10 Install rocker cover

Confirm rocker cover bolts, washers and trays are free from oil.

11 Install intake manifold and fuel tube

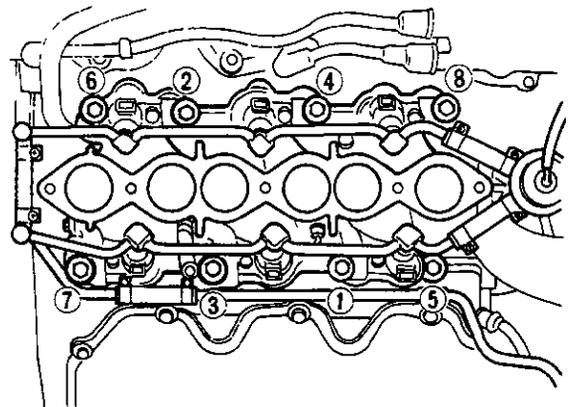
Tighten in two or three stages.

 Nut

- 1st 3 - 5 N·m
(0.3 - 0.5 kg-m, 2.2 - 3.6 ft-lb)
- 2nd 24 - 27 N·m
(2.4 - 2.8 kg-m, 17 - 20 ft-lb)

Bolt

- 1st 3 - 5 N·m
(0.3 - 0.5 kg-m, 2.2 - 3.6 ft-lb)
- 2nd 24 - 27 N·m
(2.4 - 2.8 kg-m, 17 - 20 ft-lb)



Tighten in numerical order

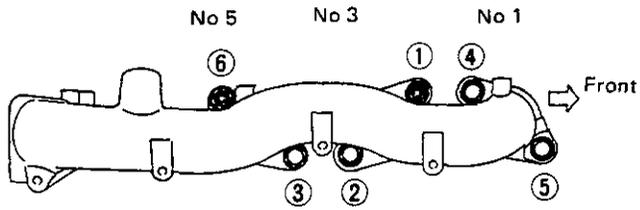
SEM529A

CYLINDER HEAD

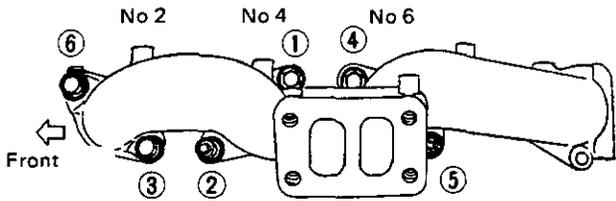
Installation (Cont'd)

12 Install exhaust manifolds and connecting tube

R H exhaust manifold



L H exhaust manifold



Tighten in numerical order

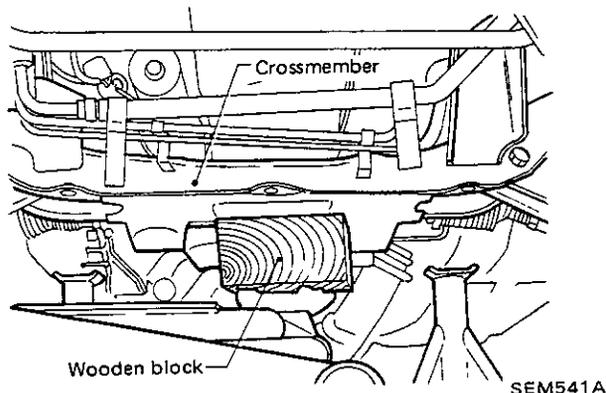
SEM535A

13 After assembling all disassembled parts, fill radiator with coolant up to the specified level
Refer to Changing Engine Coolant (Sections MA and LC)

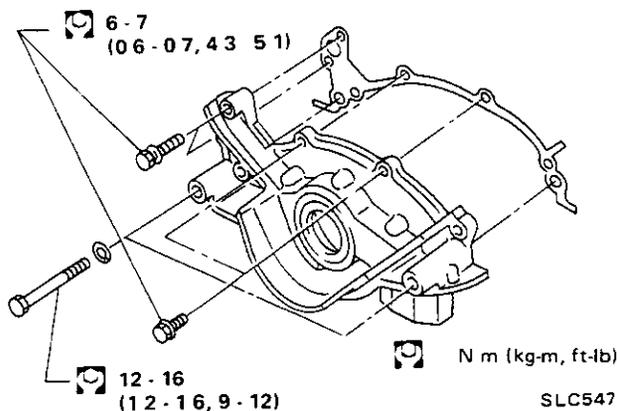
OIL PAN

Removal

- 1 Drain engine oil
- 2 Raise vehicle and support it with safety stands

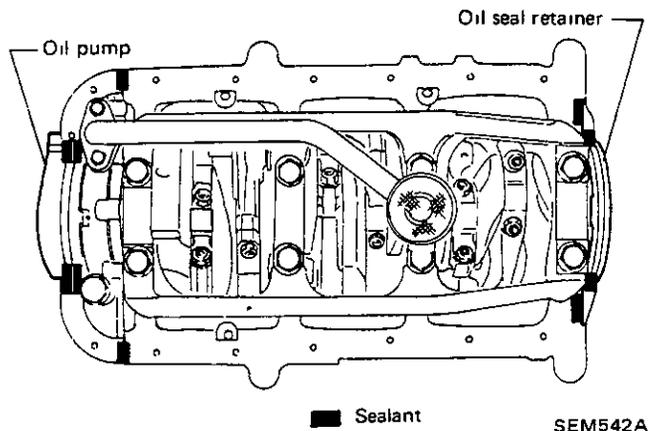


- 3 Remove front stabilizer bar securing bolts and nuts from suspension crossmember
- 4 Remove steering column shaft from gear housing
- 5 Remove tension rod securing nuts from transverse link
- 6 Lift engine
- 7 Remove rear plate cover from transmission case
- 8 Remove oil pan securing bolts
- 9 Remove suspension crossmember securing bolts
- 10 Remove strut mounting insulator securing nuts
- 11 Remove screws securing refrigerant lines and power steering tubes to suspension crossmember
- 12 Lower suspension crossmember
- 13 Remove oil pan from rear side
- 14 Remove oil strainer from oil pump assembly and cylinder block.
- 15 Remove oil pump assembly



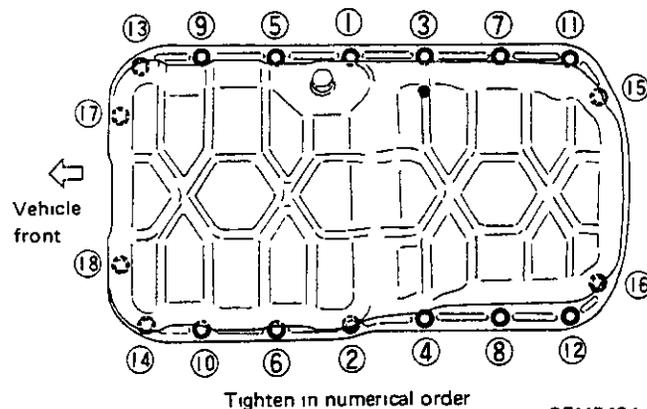
INSTALLATION

- 1 Apply sealant



- 2 Install oil pan

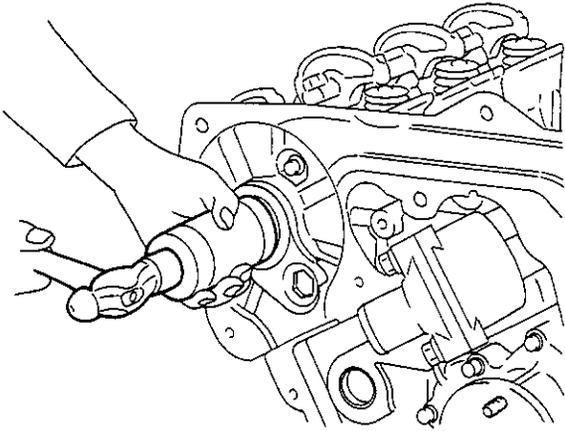
 **5 - 7 N m**
(0.5 - 0.7 kg-m, 3.6 - 5.1 ft-lb)



OIL SEAL REPLACEMENT

— Replacement of Camshaft Oil Seal —

- 1 Remove timing belt
- 2 Remove camshaft pulleys
- 3 Remove camshaft oil seal
- 4 Apply engine oil to camshaft oil seal and install it in place

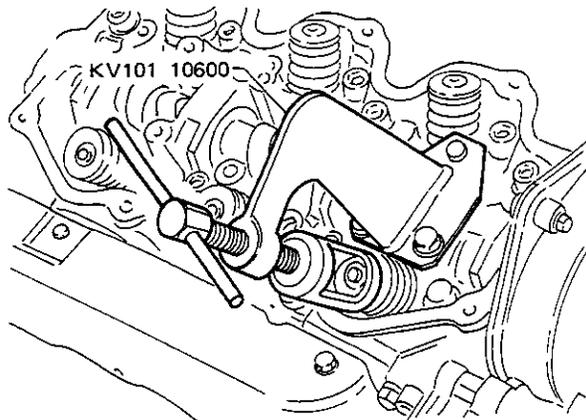


SEM284A

- 5 Install timing belt

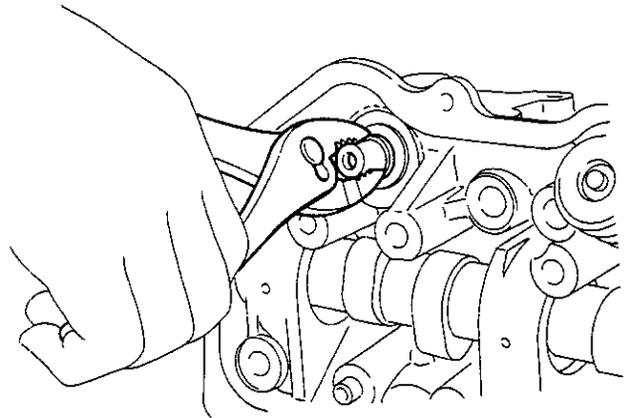
— Replacement of Valve Oil Seal —

- 1 Remove collector and rocker cover (L H only)
- 2 Remove rocker shaft assembly and valve lifters with valve guide
- 3 Remove valve springs, retainer and collets



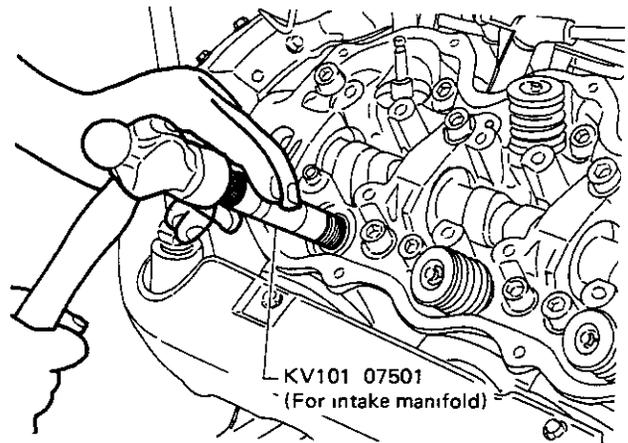
SEM257A

- 4 Remove valve oil seals



SEM285A

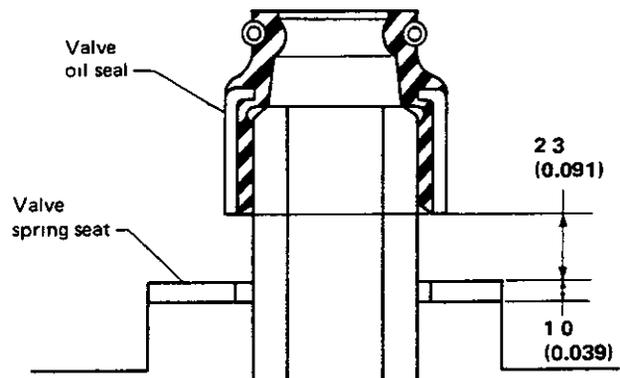
- 5 Apply engine oil to valve oil seal and install it in place.



KV101 07501
(For intake manifold)

SEM286A

When installing valve oil seal in exhaust manifold side, tool is not necessary.



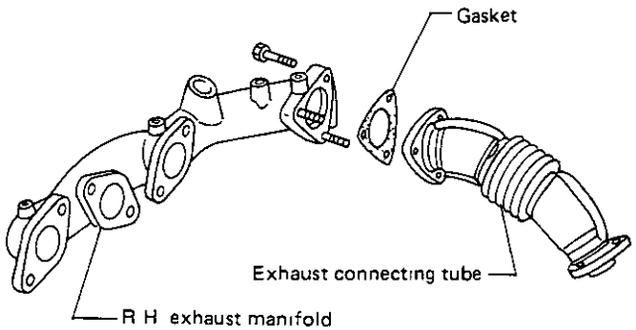
Unit mm (in)

SEM287A

ENGINE REMOVAL

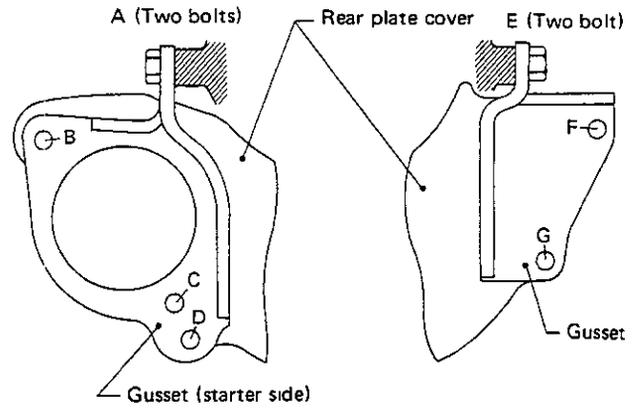
CAUTION.

- a. Before disconnecting fuel hose, release fuel pressure from fuel line. Refer to the "Releasing Fuel Pressure" in section MA
 - b. After separating engine and transmission, remove engine from the vehicle. At this time use a suitable safety stand such as hydraulic hoist to support transmission
- Remove R H exhaust manifold and exhaust connecting tube, then separate engine and transmission



SEM526A

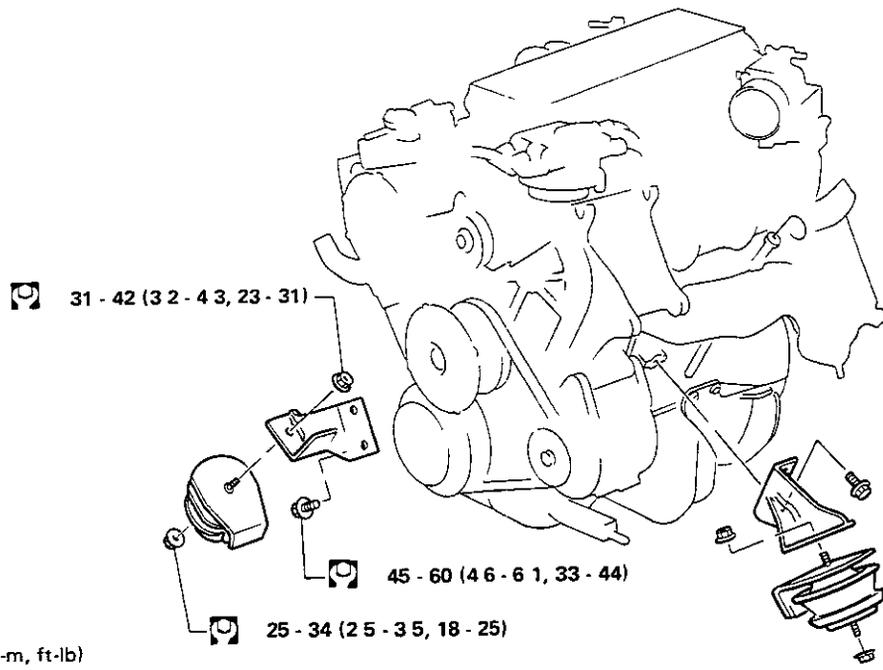
- When installing engine gussets, tighten bolts in 6 stages as shown below



Tightening order

SEM540A					
1st	2nd	3rd	4th	5th	6th
A*1	D*2	A*2	F*2 and G*2	E*2	B*2 and C*2

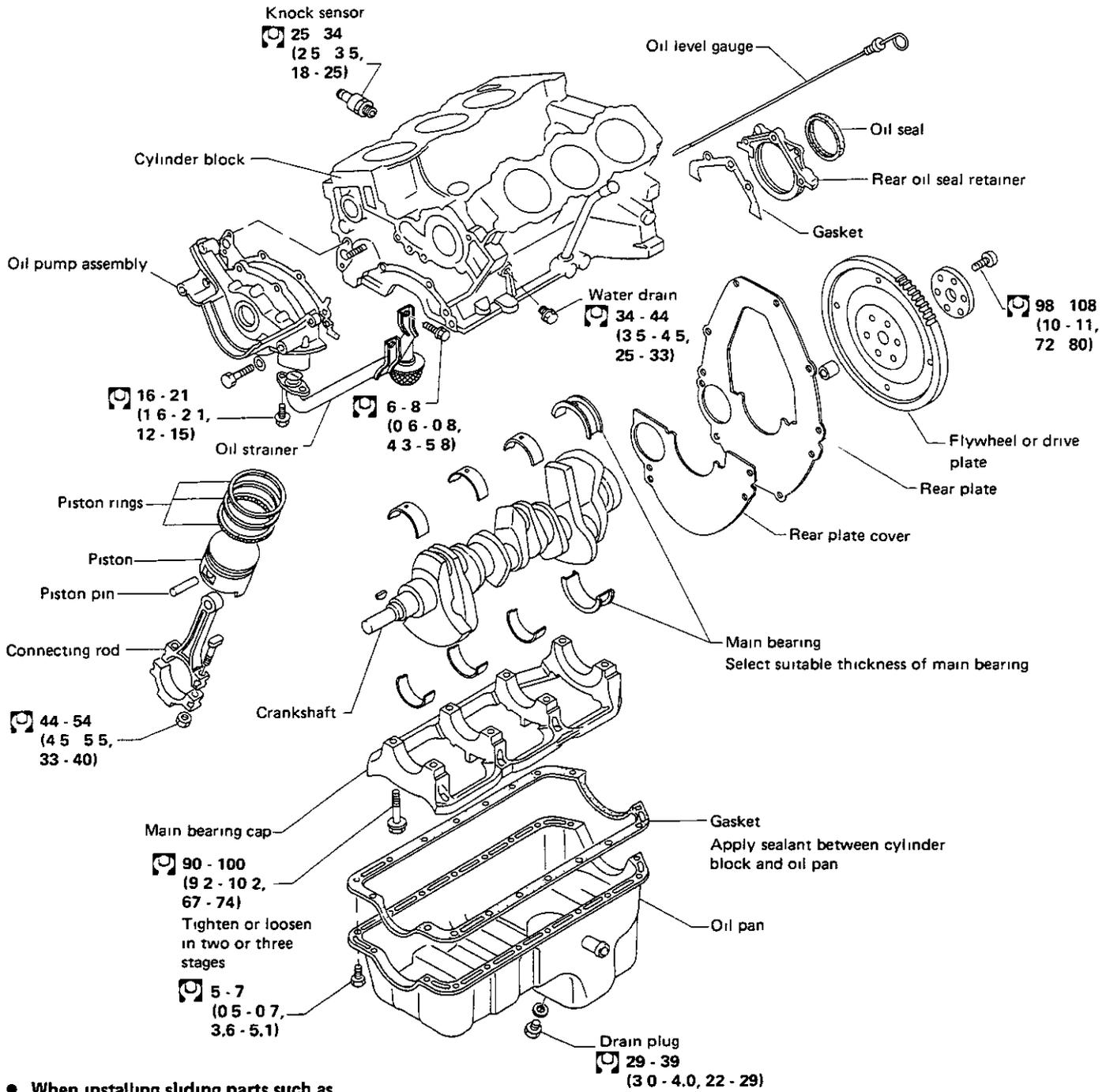
- *1 Tighten temporarily
- *2 Tighten completely



SEM307A

ENGINE OVERHAUL

Cylinder Block, Crankshaft and Piston



- When installing sliding parts such as bearings, be sure to apply engine oil on the sliding surfaces.
- Use new gaskets, oil seals and brazen washer

N m (kg-m, ft-lb)

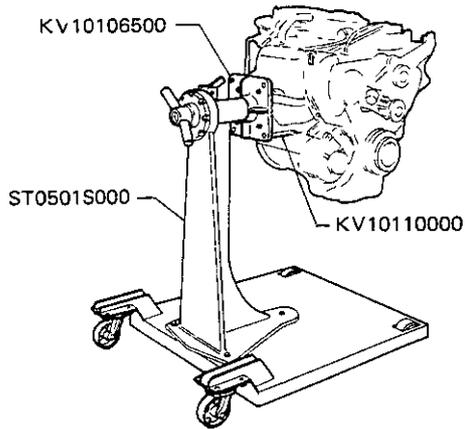
SEM504A

ENGINE OVERHAUL

Disassembly

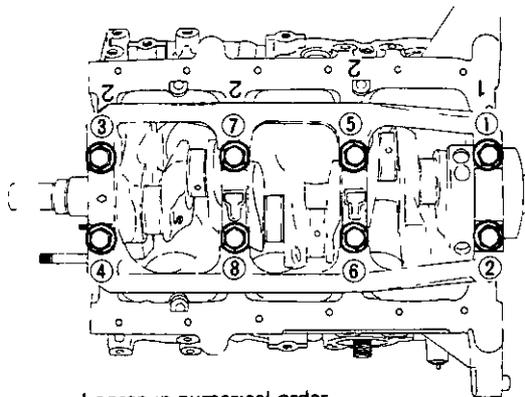
PISTON AND CRANKSHAFT

- 1 Place engine on work stand



SEM308A

- 2 Remove timing belt
- 3 Drain coolant and remove water pump
- 4 Drain oil
5. Remove oil pan and oil pump
- 6 Remove cylinder heads
- 7 Remove pistons
- 8 Remove bearing cap and crankshaft



SEM311A

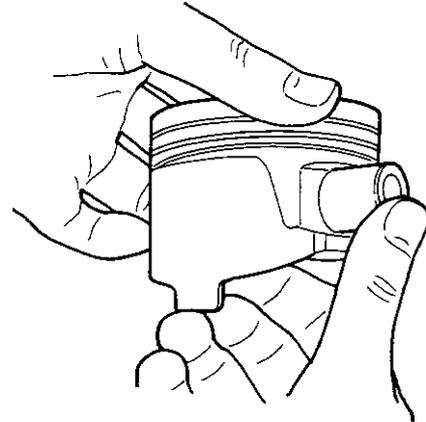
Inspection

PISTON AND PISTON PIN CLEARANCE

- Confirm the fitting of piston pin into piston pin hole to such an extent that it can be pressed smoothly by finger at room temperature

Piston pin to piston clearance:

0.008 - 0.012 mm (0.0003 - 0.0005 in)



PISTON RING SIDE CLEARANCE

Side clearance:

Top ring

0.040 - 0.073 mm (0.0016 - 0.0029 in)

2nd ring

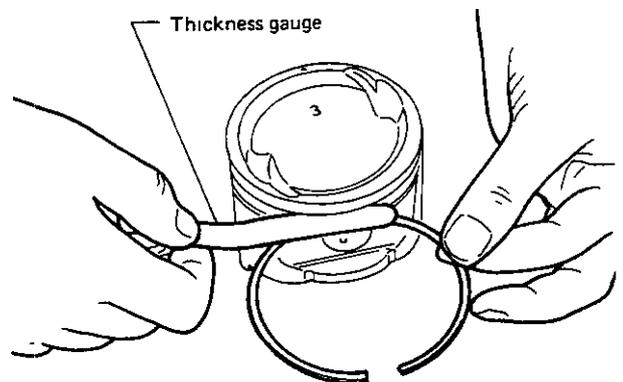
0.030 - 0.063 mm (0.0012 - 0.0025 in)

Oil ring

0.015 - 0.190 mm (0.0006 - 0.0075 in)

Max. limit of side clearance (Top and 2nd rings)

0.1 mm (0.004 in)



ENGINE OVERHAUL

Inspection (Cont'd)

PISTON RING GAP

Ring gap:

Top ring

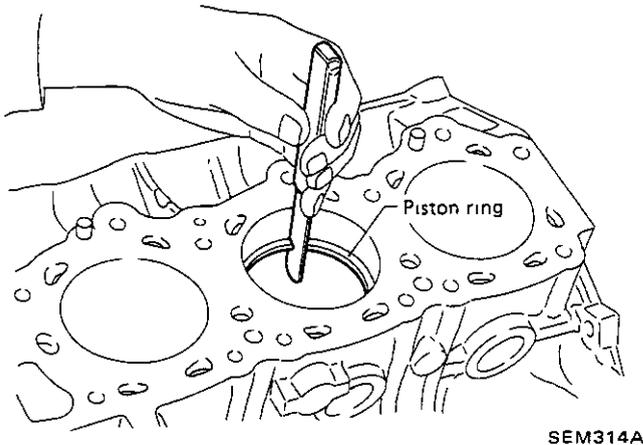
0.21 - 0.44 mm (0.0083 - 0.0173 in)

2nd ring

0.18 - 0.44 mm (0.0071 - 0.0173 in)

Oil ring

0.20 - 0.76 mm (0.0079 - 0.0299 in)



BEARING CLEARANCE

Bearing clearance:

Main bearing

0.028 - 0.055 mm (0.0011 - 0.0022 in)

Limit 0.090 mm (0.0035 in)

Connecting rod bearing

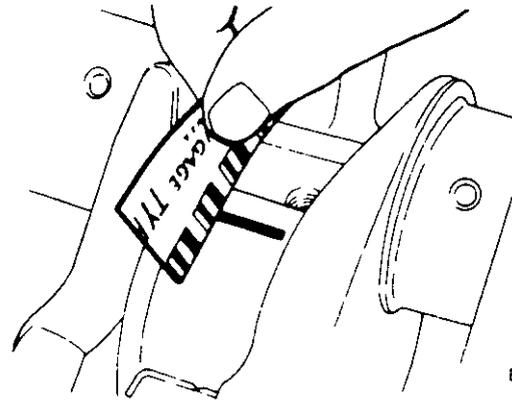
0.010 - 0.052 mm (0.0004 - 0.0020 in)

Limit 0.090 mm (0.0035 in)

Method A

CAUTION:

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



Method B

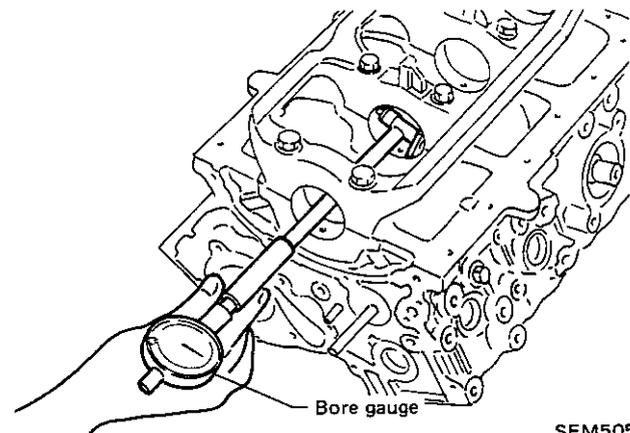
Main bearing

- 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

 : 90 - 100 N m
(9.2 - 10.2 kg-m, 67 - 74 ft-lb)

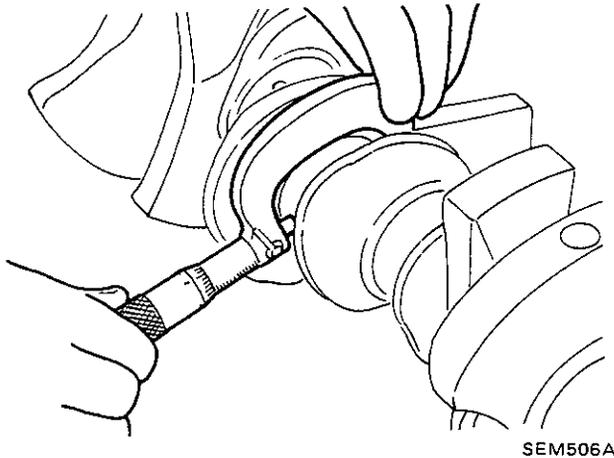
- 3 Measure inside diameter "A" of main journal



ENGINE OVERHAUL

Inspection (Cont'd)

- 4 Measure outside diameter "B" of main journal in crankshaft

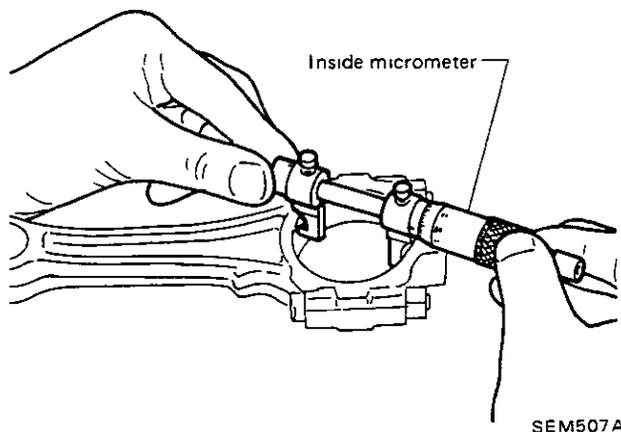


- 5 Calculate main bearing clearance
Main bearing clearance
= A - B

Connecting rod bearing

- 1 Install connecting rod bearing to connecting rod and cap
 - 2 Install connecting rod cap to connecting rod
-  **44 - 54 N·m**
(4.5 - 5.5 kg-m, 33 - 40 ft-lb)

- 3 Measure inside diameter "C" of bearing



- 4 Measure outside diameter "D" of connecting rod bearing in crankshaft.
- 5 Calculate connecting rod bearing clearance
Connecting rod bearing clearance
= C - D

CRANKSHAFT INSPECTION

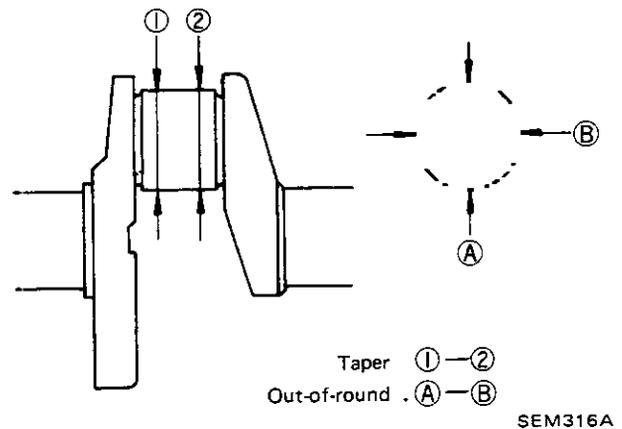
- 1 Check crankshaft journals for score, bias, wear or cracks. If faults are minor, correct with fine crocus cloth
- 2 Check journals with a micrometer for taper and out-of-round.

Out-of-round (X-Y):

0.006 mm (0.0002 in)

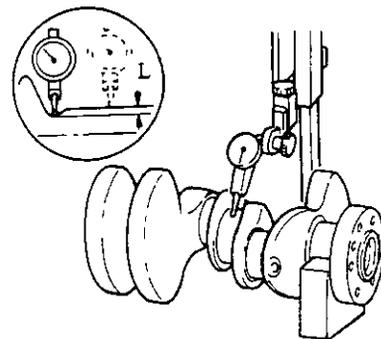
Taper (A-B):

Less than 0.006 mm (0.0002 in)



- a When regrinding crank pin and crank journal, measure "L" dimension in fillet roll. Make sure the measurements exceed the specified limit. If the measurements are within the specified limit, do not regrind

L. More than 0.13 mm (0.0051 in)



- b. Do not grind off fillet roll.
- c. Refer to S.D.S for regrinding crankshaft and available service parts

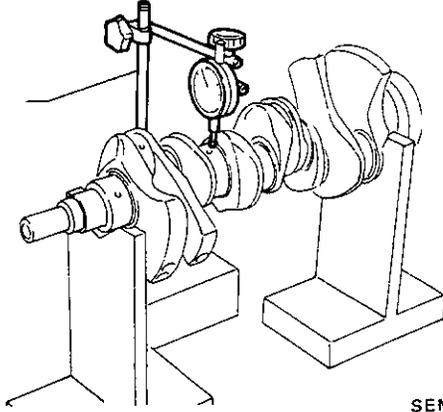
ENGINE OVERHAUL

Inspection (Cont'd)

CRANKSHAFT RUNOUT

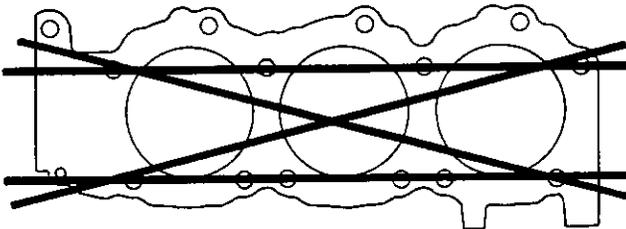
Check crankshaft runout

Runout [TIR (Total Indicator Reading)]
Less than 0.10 mm (0.0039 in)

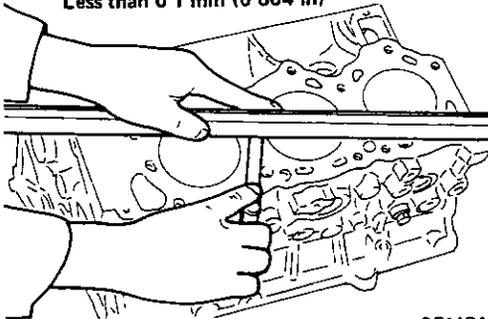


CYLINDER BLOCK DISTORTION AND WEAR

Measuring points



Warpage of surface
Less than 0.1 mm (0.004 in)



If beyond the specified limit, resurface it.

Resurfacing limit.

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

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

The maximum limit is as follows:

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

Using a bore gauge, measure cylinder bore for wear, out-of-round or taper

Standard inside diameter:

87.00 - 87.05 mm

(3.4252 - 3.4272 in)

Wear limit:

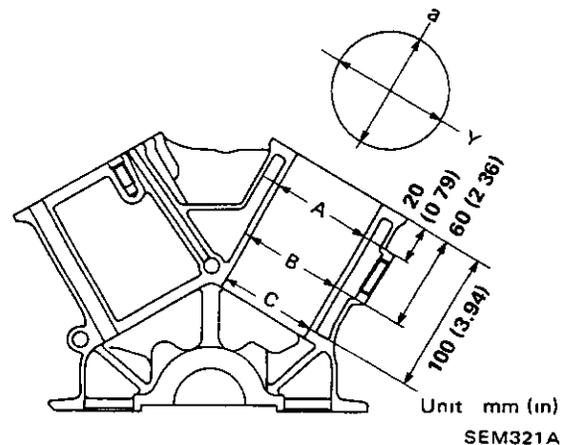
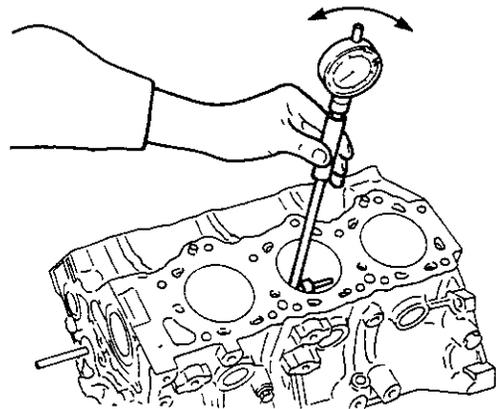
0.20 mm (0.0079 in)

Out-of-round (X-Y) limit:

0.015 mm (0.0006 in)

Taper (A-B) limit:

0.015 mm (0.0006 in)



Check for scratches or seizure. If seizure is found, hone it.

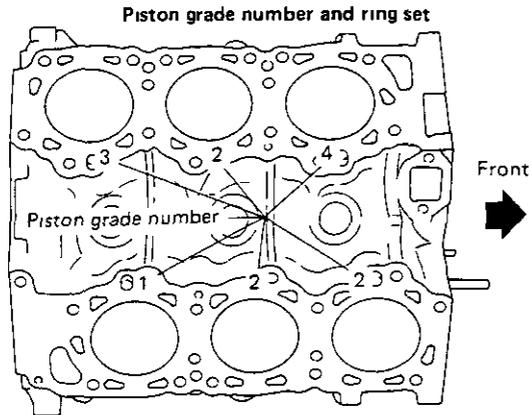
Never bore it.

If wear exceeds the specified limit, replace cylinder block.

ENGINE OVERHAUL

Inspection (Cont'd)

- If either cylinder block or piston is replaced with new one, select the same piston as piston grade number punched on cylinder block upper surfaces.



SEM557A

PISTON TO CYLINDER WALL CLEARANCE

- 1 Measure piston diameter
- 2 Check that piston clearance is within the specification

Piston clearance

0.025 - 0.045 mm (0.0010 - 0.0018 in)

ENGINE OVERHAUL

Inspection (Cont'd)

PISTON-TO-CYLINDER CLEARANCE

(Using feeler gauge)

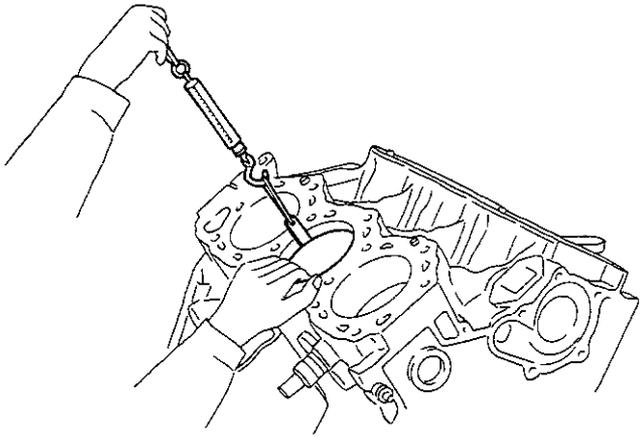
When pulling feeler gauge straight upward, measure the extracting force. It is recommended that piston and cylinder be heated to 20°C (68°F)

Feeler gauge thickness:

0.04 mm (0.0016 in)

Extracting force:

2.0 - 14.7 N (0.2 - 1.5 kg, 0.4 - 3.3 lb)

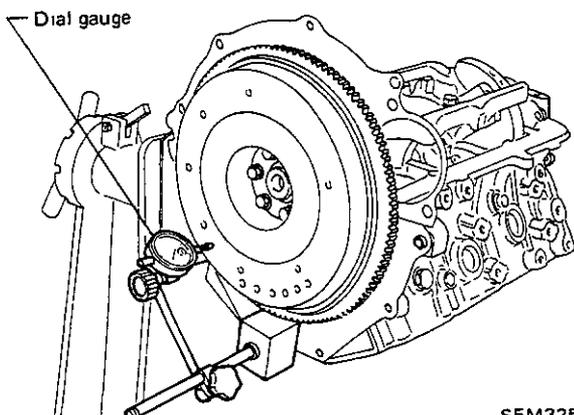


SEM324A

FLYWHEEL RUNOUT

Runout (Total indicator reading).

Less than 0.15 mm (0.0059 in)



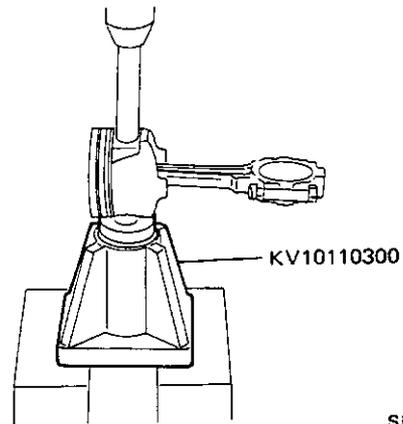
SEM325A

Install ring on flywheel, heating ring gear to about 180 to 220°C (356 to 428°F)

Assembly

PISTON

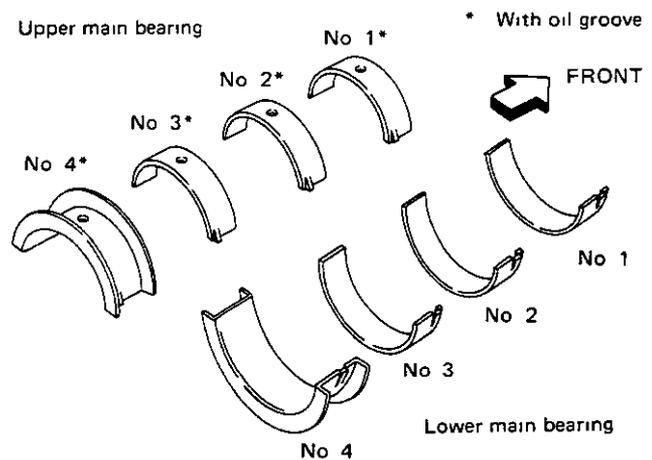
- Numbers are stamped on the connecting rod and cap corresponding to each cylinder. Care should be taken to avoid a wrong combination including bearing.
- When pressing piston pin in connecting rod, apply engine oil to pin and small end of connecting rod.



SEM326A

CRANKSHAFT

- Set main bearings in the proper position on cylinder block



SEM327A

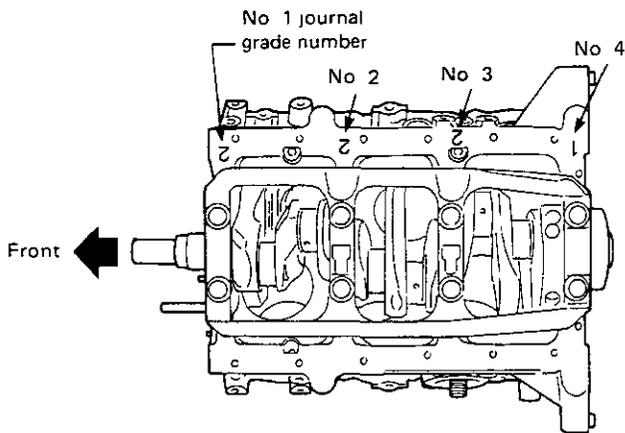
ENGINE OVERHAUL

Assembly (Cont'd)

2 If either crankshaft, cylinder block or main bearing is reused again, it is necessary to measure main bearing clearance.

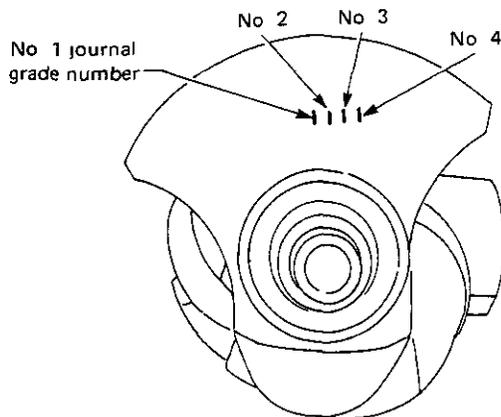
If all of crankshaft, cylinder block and main bearing are replaced with new ones, it is necessary to select thickness of main bearings as follows

a Grade number of each cylinder block main journal is punched on the respective cylinder block



SEM508A

b Grade number of each crankshaft main journal is punched on the respective crankshaft



SEM509A

c Select suitable thickness of main bearing according to the following table

		Main journal grade number		
		0	1	2
		Main bearing grade number		
		0	1	2
Crankshaft journal grade number	0	0	1	2
	1	1	2	3
	2	2	3	4

For example

Main journal grade number 1

Crankshaft journal grade number 2

Main bearing grade number = 1 + 2
= 3

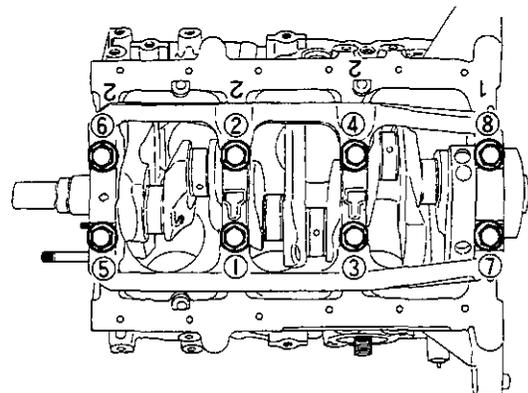
Main bearing:

Refer to S.D.S.

3 Install main bearing cap and tighten bolts to the specified torque

 • 90 - 100 N·m
(9.2 - 10.2 kg-m, 67 - 74 ft-lb)

• Tighten in two or three stages



SEM510A

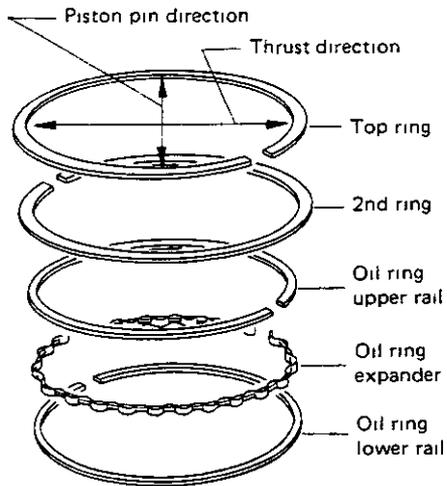
• After securing bearing cap bolts, ascertain that crankshaft turns smoothly by hand.

ENGINE OVERHAUL

Assembly (Cont'd)

4 Install piston assembly

Set piston rings as shown below.



Mark should be facing upward

SEM180A

5. Measure crankshaft free end play at No 4 bearing

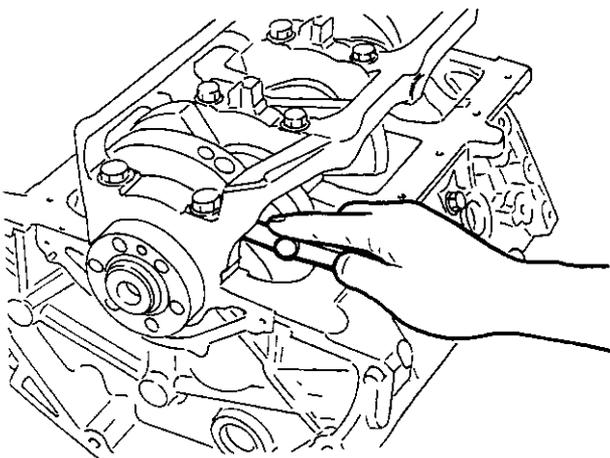
Crankshaft free end play:

Standard

0.05 - 0.17 mm (0.0020 - 0.0067 in)

Limit

0.30 mm (0.0118 in)



SEM511A

6 Measure connecting rod clearance

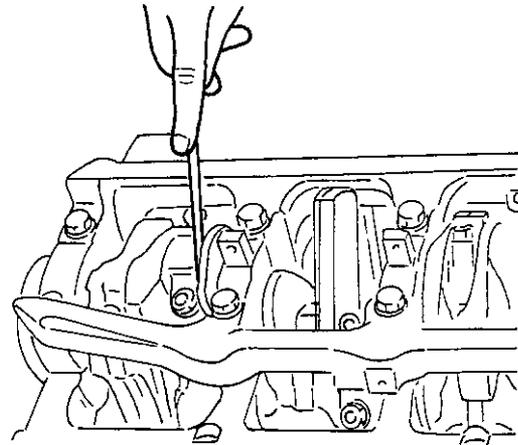
Connecting rod clearance:

Standard

0.20 - 0.35 mm (0.0079 - 0.0138 in)

Limit

0.40 mm (0.0157 in)



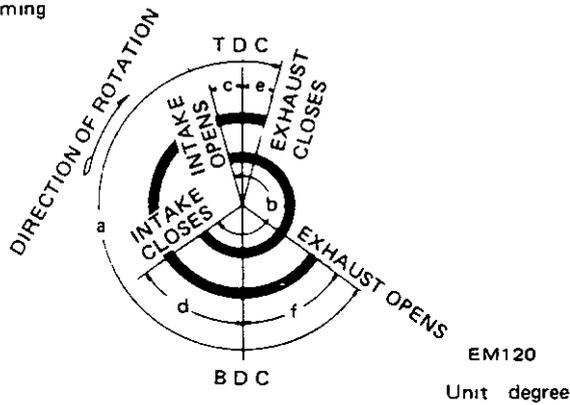
SEM512A

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

General Specifications

Engine		VG30E
Item		
Cylinder arrangement		V-6
Displacement	cm ³ (cu in)	2,960 (180 62)
Bore and Stroke	mm (in)	87 x 83 (3 43 x 3 27)
Valve arrangement		O H C
Firing order		1-2-3-4-5-6
Number of piston rings		
Compression		2
Oil		1
Number of main bearings		4
Compression ratio		
Non-turbo		9 0
Turbo		7 8

Valve timing



	a	b	c	d	e	f
	252°	252°	20°	52°	16°	62°

Unit kPa (kg/cm², psi)/rpm

	Non-turbo	Turbo
Compression pressure		
Standard	1,196 (12 2, 173) /300	1,138 (11 6, 165) /300
Minimum	883 (9 0, 128) /300	834 (8 5, 121) /300
Differential limit between cylinders	98 (1 0, 14) /300	98 (1 0, 14) /300

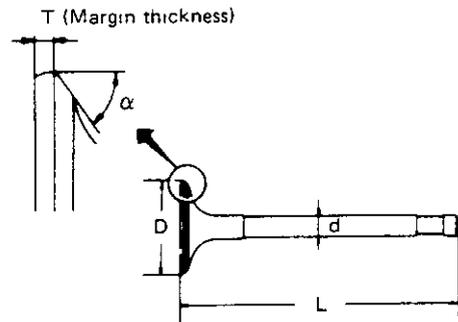
Inspection and Adjustment

CYLINDER HEAD

	Standard	Limit
Head surface flatness	Less than 0 05 (0 0020)	0 1 (0 004)

VALVE

	Unit	mm (in)
--	------	---------



SEM188

Engine		VG30E
Item		
Valve head diameter "D"		
Intake		42 0 - 42 2 (1 654 - 1 661)
Exhaust		35 0 - 35 2 (1 378 - 1 386)
Valve length "L"		
Intake		125 3 - 125 9 (4 93 - 4 96)
Exhaust		124 2 - 124 8 (4 89 - 4 91)
Valve stem diameter "d"		
Intake		6 965 - 6 980 (0 2742 - 0 2748)
Exhaust		7 945 - 7 960 (0 3128 - 0 3134)
Valve seat angle "alpha"		
Intake		45° 15' - 45° 45'
Exhaust		
Valve margin "T"		
Intake		1 3 (0 051)
Exhaust		1 5 (0 059)
Valve margin "T" limit		0 5 (0 020)
Valve stem end surface grinding limit		0 2 (0 008)
Valve clearance		
Intake		0 (0)
Exhaust		0 (0)

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

Inspection and Adjustment (Cont'd)

Valve spring

Free height	mm (in)	Outer	51.2 (2.016)
		Inner	44.9 (1.768)
Pressure height	mm/N (mm/kg, in/lb)	Outer	30.0/523.7 (30.0/53.4, 1.181/117.7)
		Inner	24.5/250.1 (24.5/25.5, 0.965/56.2)
Assembled height	mm/N (mm/kg, in/lb)	Outer	40.0/250.1 (40.0/25.5, 1.575/56.2)
		Inner	35.0/120.6 (35.0/12.3, 1.378/27.1)
Out of square	mm (in)	Outer	2.2 (0.087)
		Inner	1.9 (0.075)

Hydraulic valve lifter

	Unit	mm (in)
Lifter outside diameter		15.947 - 15.957 (0.6278 - 0.6282)
Lifter guide inside diameter		16.000 - 16.013 (0.6299 - 0.6304)
Clearance between lifter and lifter guide		0.043 - 0.066 (0.0017 - 0.0026)

Valve guide

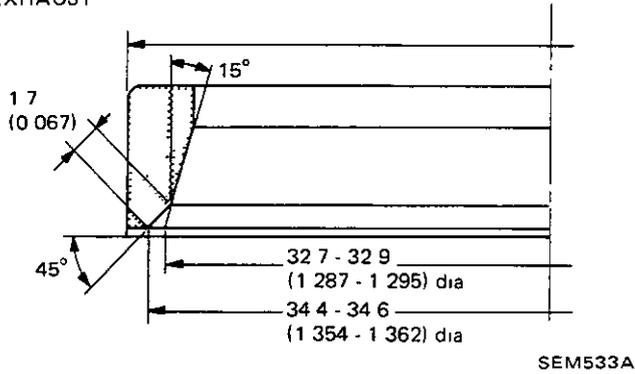
		Unit		mm (in)	
		Standard		Service	
Valve guide					
Outer diameter	Intake	11.023 - 11.034 (0.4340 - 0.4344)	11.223	11.234	(0.4418 - 0.4423)
	Exhaust	12.023 - 12.034 (0.4733 - 0.4738)	12.223	12.234	(0.4812 - 0.4817)
Valve guide					
Inner diameter [Finished size]	Intake	7.000 - 7.018 (0.2756 - 0.2763)			
	Exhaust	8.000 - 8.018 (0.3150 - 0.3157)			
Cylinder head valve guide hole diameter	Intake	10.975 - 10.996 (0.4321 - 0.4329)	11.175	11.196	(0.4400 - 0.4408)
	Exhaust	11.975 - 11.996 (0.4715 - 0.4723)	12.175	12.196	(0.4793 - 0.4802)
Interference fit of valve guide	Intake	0.027 - 0.059 (0.0011 - 0.0023)			
	Exhaust	0.027 - 0.059 (0.0011 - 0.0023)			
		Standard		Max tolerance	
Stem to guide clearance	Intake	0.020 - 0.053 (0.0008 - 0.0021)		0.1 (0.004)	
	Exhaust	0.040 - 0.073 (0.0016 - 0.0029)			
Valve deflection limit		-		0.2 (0.008)	

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

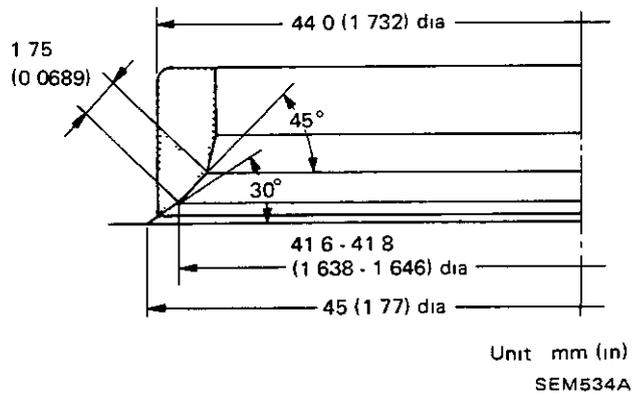
Inspection and Adjustment (Cont'd)

Valve seat

EXHAUST



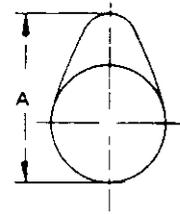
INTAKE



Unit mm (in)
SEM534A

CAMSHAFT AND CAMSHAFT BEARING

	Unit mm (in)	
	Standard	Max tolerance
Camshaft journal to bearing clearance	0.045 - 0.090 (0.0018 - 0.0035)	0.15 (0.0059)
Inner diameter of camshaft bearing	47.00 - 47.025 (1.8504 - 1.8514)	—
Outer diameter of camshaft journal	46.935 - 46.955 (1.8478 - 1.8486)	—
Camshaft runout [TIR*]	Less than 0.02 (0.0008)	0.1 (0.004)
Camshaft	0.03 - 0.06 (0.0012 - 0.0024)	—



EM671

Cam height "A"

Intake	39.607 - 39.657 (1.5593 - 1.5613)
Exhaust	

Wear limit of cam height 0.15 (0.0059)

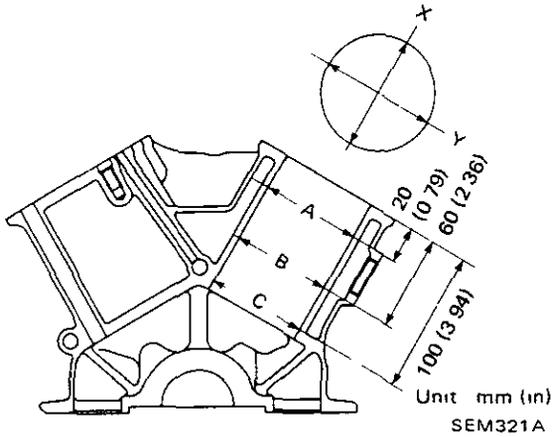
*Total indicator reading

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

Inspection and Adjustment (Cont'd)

CYLINDER BLOCK

Unit mm (in)



Surface flatness

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

Cylinder bore

Inner diameter	
Standard	
Grade No 1	87 000 - 87 010 (3 4252 - 3 4256)
Grade No 2	87 010 - 87 020 (3 4256 - 3 4260)
Grade No 3	87 020 - 87 030 (3 4260 - 3 4264)
Grade No 4	87 030 - 87 040 (3 4264 - 3 4268)
Grade No 5	87 040 - 87 050 (3 4268 - 3 4272)
0.02 (0.0008) oversize (Service)	
Grade No 3	87 020 - 87 030 (3 4260 - 3 4264)
Grade No 4	87 030 - 87 040 (3 4264 - 3 4268)
Grade No 5	87 040 - 87 050 (3 4268 - 3 4272)
Grade No 6	87 050 - 87 060 (3 4272 - 3 4276)
Grade No 7	87 060 - 87 070 (3 4276 - 3 4279)
Wear limit	0.20 (0.0079)

Out-of-round (X-Y)

Less than 0.015 (0.0006)

Taper (A-B-C)

Less than 0.015 (0.0006)

Main journal inner diameter

Grade No 0	66 645 - 66 654 (2 6238 - 2 6242)
Grade No 1	66 654 - 66 663 (2 6242 - 2 6245)
Grade No 2	66 663 - 66 672 (2 6245 - 2 6249)

Difference in inner

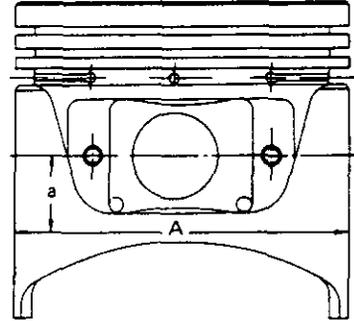
diameter between cylinders

Standard	Less than 0.05 (0.0020)
Wear limit	0.20 (0.0079)

PISTON, PISTON RING AND PISTON PIN

Available piston

Unit mm (in)



EM714

Model	Non-turbo	Turbo
Standard		
Piston skirt	Grade No 1	86 965 - 86 975 (3 4238 - 3 4242)
	Grade No 2	86 975 - 86 985 (3 4242 - 3 4246)
	Grade No 3	86 985 - 86 995 (3 4246 - 3 4250)
	Grade No 4	86 995 - 87 005 (3 4250 - 3 4254)
	Grade No 5	87 005 - 87 015 (3 4254 - 3 4258)
diameter	0.02 (0.0008)	
oversize (Service)	"A"	
	Grade No 3	86 985 - 86 995 (3 4246 - 3 4250)
	Grade No 4	86 995 - 87 005 (3 4250 - 3 4254)
	Grade No 5	87 005 - 87 015 (3 4254 - 3 4258)
	Grade No 6	87 015 - 87 025 (3 4258 - 3 4262)
	Grade No 7	87 025 - 87 035 (3 4262 - 3 4266)
"a" dimension	20.0 (0.787)	21.5 (0.846)
Piston pin hole diameter	21.001 - 21.008 (0.8268 - 0.8271)	
Piston clearance to cylinder block	0.025 - 0.045 (0.0010 - 0.0018)	

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

Inspection and Adjustment (Cont'd)

Piston ring

	Standard	Limit	Unit mm (in)
Side clearance			
Top	0 040 - 0 073 (0 0016 - 0 0029)	0 1 (0 004)	
2nd	0 030 - 0 063 (0 0012 - 0 0025)		
Oil	0 015 - 0 190 (0 0006 - 0 0075)	—	
Ring gap			
Top	0 21 - 0 44 (0 0083 - 0 0173)	1 0 (0 04)	
2nd	0 18 - 0 44 (0 0071 - 0 0173)		
Oil (rail ring)	0 20 - 0 76 (0 0079 - 0 0299)		

Piston pin

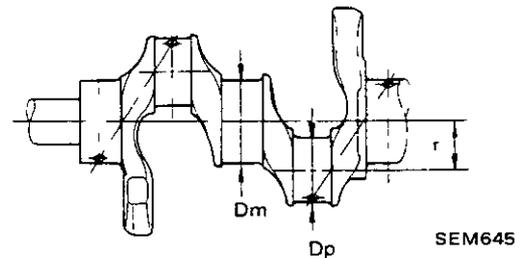
	Standard	Limit	Unit mm (in)
Piston pin outer diameter	20 993 - 20 998 (0 8265 - 0 8267)		
Piston pin to piston clearance	0 008 - 0 012 (0 0003 - 0 0005)		
Interference fit of piston pin to connecting rod	0 022 - 0 040 (0 009 - 0 0016)		

CONNECTING ROD

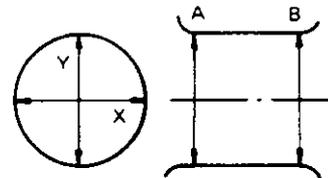
	Standard	Limit	Unit mm (in)
Center distance	154 10 - 154 20 (6 0669 - 6 0709)		
Bend, torsion [per 100 (3 94)]			
Limit	0 10 (0 0039)		
Piston pin bore dia	20 958 - 20 971 (0 8251 - 0 8256)		
Big end play			
Standard	0 20 - 0 35 (0 0079 - 0 0138)		
Limit	0 6 (0 024)		

CRANKSHAFT

	Standard	Limit	Unit mm (in)
Main journal dia "Dm"			
Grade No 0	62 967 - 62 975 (2 4790 - 2 4793)		
Grade No 1	62 959 - 62 967 (2 4787 - 2 4790)		
Grade No 2	62 951 - 62 959 (2 4784 - 2 4787)		
Pin journal dia "Dp"	49 961 - 49 974 (1 9670 - 1 9675)		
Center distance "r"	38 0 (1 496)		
Out of round (X-Y)			
Standard	Less than 0 006 (0 0002)		
Taper (A-B)			
Standard	0 006 (0 0002)		
Runout [T I R]			
Standard	Less than 0 10 (0 0039)		
Free end play			
Standard	0 05 - 0 17 (0 0020 - 0 0067)		
Limit	0 30 (0 0118)		



Out-of-round X Y
Taper A-B

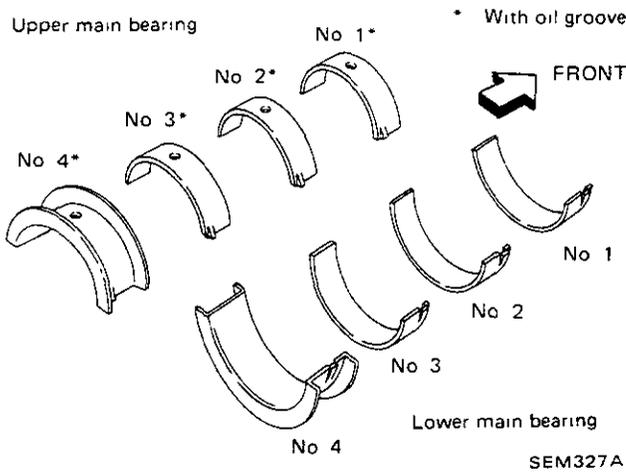


SEM645
EM715

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

Inspection and Adjustment (Cont'd)

AVAILABLE MAIN BEARING



No. 2 and 3 main bearing (With oil groove)

Grade number	Thickness "T" mm (in)	Width "W" mm (in)	Part number	Identification color
0	1 817 - 1 821 (0 0715 - 0 0717)		12231 02P00	White
1	1 821 - 1 825 (0 0717 - 0 0719)		12231 02P01	Brown
2	1 825 - 1 829 (0 0719 - 0 0720)	19 0 (0 748)	12231 02P02	Green
3	1 829 - 1 833 (0 0720 - 0 0722)		12231 02P03	Yellow
4	1 833 - 1 837 (0 0722 - 0 0723)		12231-02P04	Blue

No. 2 and 3 main bearing (Without oil groove)

Grade number	Thickness "T" mm (in)	Width "W" mm (in)	Part number	Identification color
0	1 817 - 1 821 (0 0715 - 0 0717)		12239-02P00	White
1	1 821 - 1 825 (0 0717 - 0 0719)		12239 02P01	Brown
2	1 825 - 1 829 (0 0719 - 0 0720)	19 0 (0 748)	12239-02P02	Green
3	1 829 - 1 833 (0 0720 - 0 0722)		12239 02P03	Yellow
4	1 833 - 1 837 (0 0722 - 0 0723)		12239-02P04	Blue

No. 1 main bearing (With oil groove)

Grade number	Thickness "T" mm (in)	Width "W" mm (in)	Part number	Identification color
0	1 817 - 1 821 (0 0715 - 0 0717)		12215-02P00	White
1	1 821 - 1 825 (0 0717 - 0 0719)		12215-02P01	Brown
2	1 825 - 1 829 (0 0719 - 0 0720)	22 5 (0 886)	12215-02P02	Green
3	1 829 - 1 833 (0 0720 - 0 0722)		12215-02P03	Yellow
4	1 833 - 1 837 (0 0722 - 0 0723)		12215-02P04	Blue

No. 1 main bearing (Without oil groove)

Grade number	Thickness "T" mm (in)	Width "W" mm (in)	Part number	Identification color
0	1 817 - 1 821 (0 0715 - 0 0717)		12223-02P00	White
1	1 821 - 1 825 (0 0717 - 0 0719)		12223-02P01	Brown
2	1 825 - 1 829 (0 0719 - 0 0720)	22 5 (0 886)	12223-02P02	Green
3	1 829 - 1 833 (0 0720 - 0 0722)		12223-02P03	Yellow
4	1 833 - 1 837 (0 0722 - 0 0723)		12223-02P04	Blue

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

Inspection and Adjustment (Cont'd)

No. 4 main bearing (With oil groove)

Grade number	Thickness "T" mm (in)	Part number	Identification color
0	1 817 1 821 (0 0715 0 0717)	12247 02P00	White
1	1 821 1 825 (0 0717 0 0719)	12247-02P01	Brown
2	1 825 - 1 829 (0 0719 - 0 0720)	12247-02P02	Green
3	1 829 1 833 (0 0720 0 0722)	12247-02P03	Yellow
4	1 833 - 1 837 (0 0722 0 0723)	12247-02P04	Blue

No. 4 main bearing (Without oil groove)

Grade number	Thickness "T" mm (in)	Part number	Identification color
0	1 817 1 821 (0 0715 0 0717)	12255 02P00	White
1	1 821 - 1 825 (0 0717 - 0 0719)	12255 02P01	Brown
2	1 825 1 829 (0 0719 - 0 0720)	12255-02P02	Green
3	1 829 - 1 833 (0 0720 - 0 0722)	12255-02P03	Yellow
4	1 833 - 1 837 (0 0722 - 0 0723)	12255-02P04	Blue

AVAILABLE CONNECTING ROD BEARING

Connecting rod bearing undersize

		Unit	mm (in)
		Crank pin journal diameter "Dp"	
Standard	49 961 - 49 974	(1 9670 - 1 9675)	
Under size			
0 08 (0 0031)	49 881	49 894	(1 9638 - 1 9643)
0 12 (0 0047)	49 841	49 854	(1 9622 - 1 9628)
0 25 (0 0098)	49 711	49 724	(1 9571 - 1 9576)

MISCELLANEOUS COMPONENTS

		Unit	mm (in)
Flywheel			
Runout [T I R]	Less than 0 15	(0 0059)	

Bearing clearance

		Unit	mm (in)
Main bearing clearance			
Standard	0 025 - 0 055	(0 0010 - 0 0022)	
Limit	0 090	(0 0035)	
Connecting rod bearing clearance			
Standard	0 010 - 0 052	(0 0004 0 0020)	
Limit	0 090	(0 0035)	

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

Tightening Torque

TIGHTENING TORQUE

Engine outer parts

	N m	kg-m	ft-lb
Collector cover	6 - 8	0.6 - 0.8	4.3 - 5.8
Collector	18 - 22	1.8 - 2.2	13 - 16
Throttle chamber	18 - 22	1.8 - 2.2	13 - 16
E G R control valve	18 - 22	1.8 - 2.2	13 - 16
Intake relief valve	29 - 39	3.0 - 4.0	22 - 29
Intake manifold bolt	16 - 20	1.6 - 2.0	12 - 14
Intake manifold nut	24 - 27	2.4 - 2.8	17 - 20
Injector holder	3 - 5	0.3 - 0.5	2.2 - 3.6
Water temperature sensor	15 - 20	1.5 - 2.0	11 - 14
Thermal transmitter	15 - 20	1.5 - 2.0	11 - 14
Exhaust manifold	18 - 22	1.8 - 2.2	13 - 16
Exhaust manifold stay	22 - 27	2.2 - 2.8	16 - 20
Exhaust outlet	25 - 29	2.5 - 3.0	18 - 22
E G R tube	34 - 44	3.5 - 4.5	25 - 33
Exhaust connecting tube	22 - 27	2.2 - 2.8	16 - 20
Exhaust gas sensor	40 - 50	4.1 - 5.1	30 - 37
Crank pulley	123 - 132	12.5 - 13.5	90 - 98
Water inlet	16 - 21	1.6 - 2.1	12 - 15
Detonation sensor	25 - 34	2.5 - 3.5	18 - 25
P C V valve	29 - 39	3.0 - 4.0	22 - 29
Distributor bolt	5 - 6	0.5 - 0.6	3.6 - 4.3
Alternator adjusting bar bolt	14 - 17	1.4 - 1.7	10 - 12
Air regulator	5 - 6	0.5 - 0.6	3.6 - 4.3

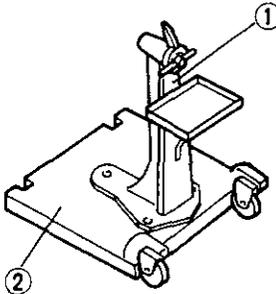
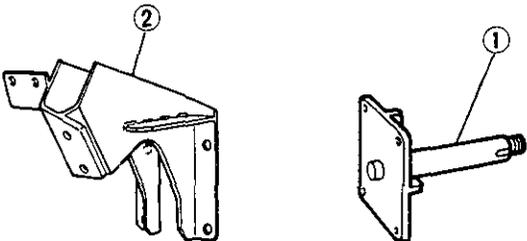
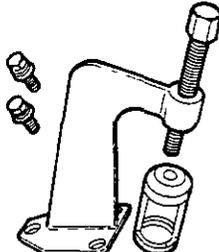
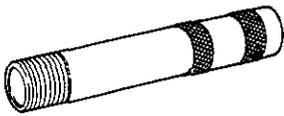
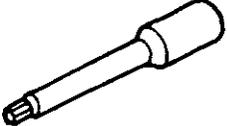
Engine internal parts

	N m	kg-m	ft-lb
Rocker cover	1 - 3	0.1 - 0.3	0.7 - 2.2
Tensioner nut	43 - 58	4.4 - 5.9	32 - 43
Belt cover	3 - 5	0.3 - 0.5	2.2 - 3.6
Rocker shaft	18 - 22	1.8 - 2.2	13 - 16
Camshaft pulley	78 - 88	8.0 - 9.0	58 - 65
Cylinder head	54 - 64	5.5 - 6.5	40 - 47
Camshaft locate plate	78 - 88	8.0 - 9.0	58 - 65
Water pump	16 - 21	1.6 - 2.1	12 - 15
Drain plug	29 - 39	3.0 - 4.0	22 - 29
Oil pan	5 - 7	0.5 - 0.7	3.6 - 5.1
Oil strainer regulator valve plug	29 - 39	3.0 - 4.0	22 - 29
Oil strainer bracket	16 - 21	1.6 - 2.1	12 - 15
Flywheel	98 - 108	10 - 11	72 - 80
Rear oil seal retainer	6	0.6	4.3
Connecting rod	44 - 54	4.5 - 5.5	33 - 40
Main bearing cap	90 - 100	9.2 - 10.2	67 - 74
Water drain plug	34 - 44	3.5 - 4.5	25 - 33
Spark plug	20 - 29	2.0 - 3.0	14 - 22

Turbocharger related parts

	N m	kg-m	ft-lb
Oil feed tube	15 - 20	1.5 - 2.0	11 - 14
Oil return tube	10 - 12	1.0 - 1.2	7 - 9
Turbocharger unit	44 - 54	4.5 - 5.5	33 - 40

SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No)	Tool name
ST0501S000 ① ST05011000 (-) ② ST05012000 (-)	Engine stand assembly Engine stand Base 
① KV10106500 (-) ② KV10110000 (-)	Engine attachment Sub attachment 
KV10110600 (-)	Valve spring compressor 
KV10107501 (-)	Valve oil seal drift 
ST10120000 (J25613)	Cylinder head bolt wrench 

SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No)	Tool name
KV10110300 (-) ① KV10110310 (-) ② KV10110330 (-) ③ ST13030020 (-) ④ ST13030030 (-) ⑤ KV10110340 (-) ⑥ KV10110320 (-)	Piston pin press stand assembly Cap Spacer Press stand Spring Drift Center shaft <div style="text-align: center; margin-top: 20px;"> </div>