

ENGINE MECHANICAL

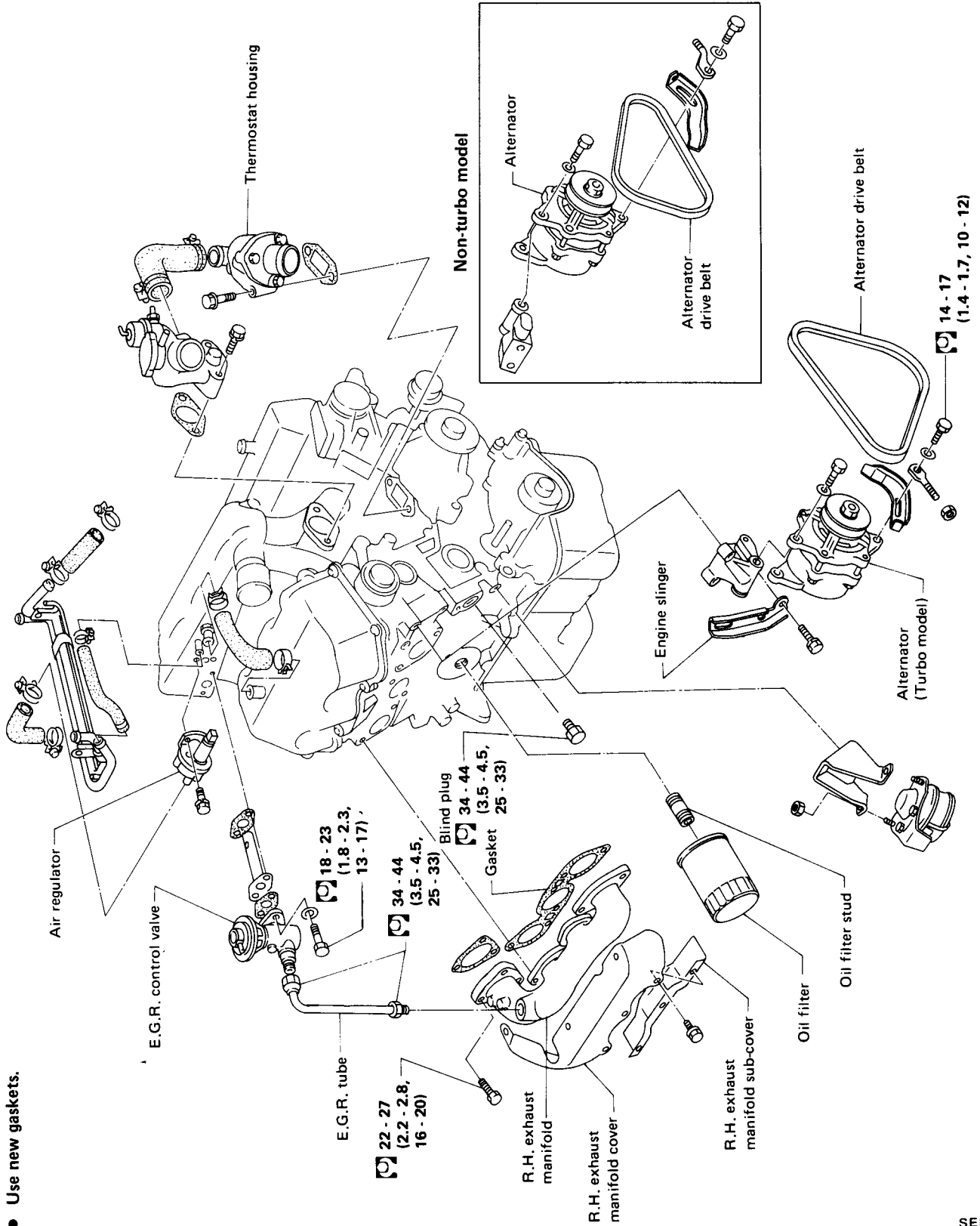
SECTION **EM**

EM

CONTENTS

ENGINE COMPONENTS —Outer Parts—	EM- 2
COMPRESSION PRESSURE	EM- 4
TIMING BELT	EM- 5
CYLINDER HEAD	EM-13
OIL PAN	EM-26
OIL SEAL REPLACEMENT	EM-27
ENGINE REMOVAL	EM-28
ENGINE OVERHAUL	EM-29
SERVICE DATA AND SPECIFICATIONS (S.D.S.)	EM-38
SPECIAL SERVICE TOOLS	EM-46

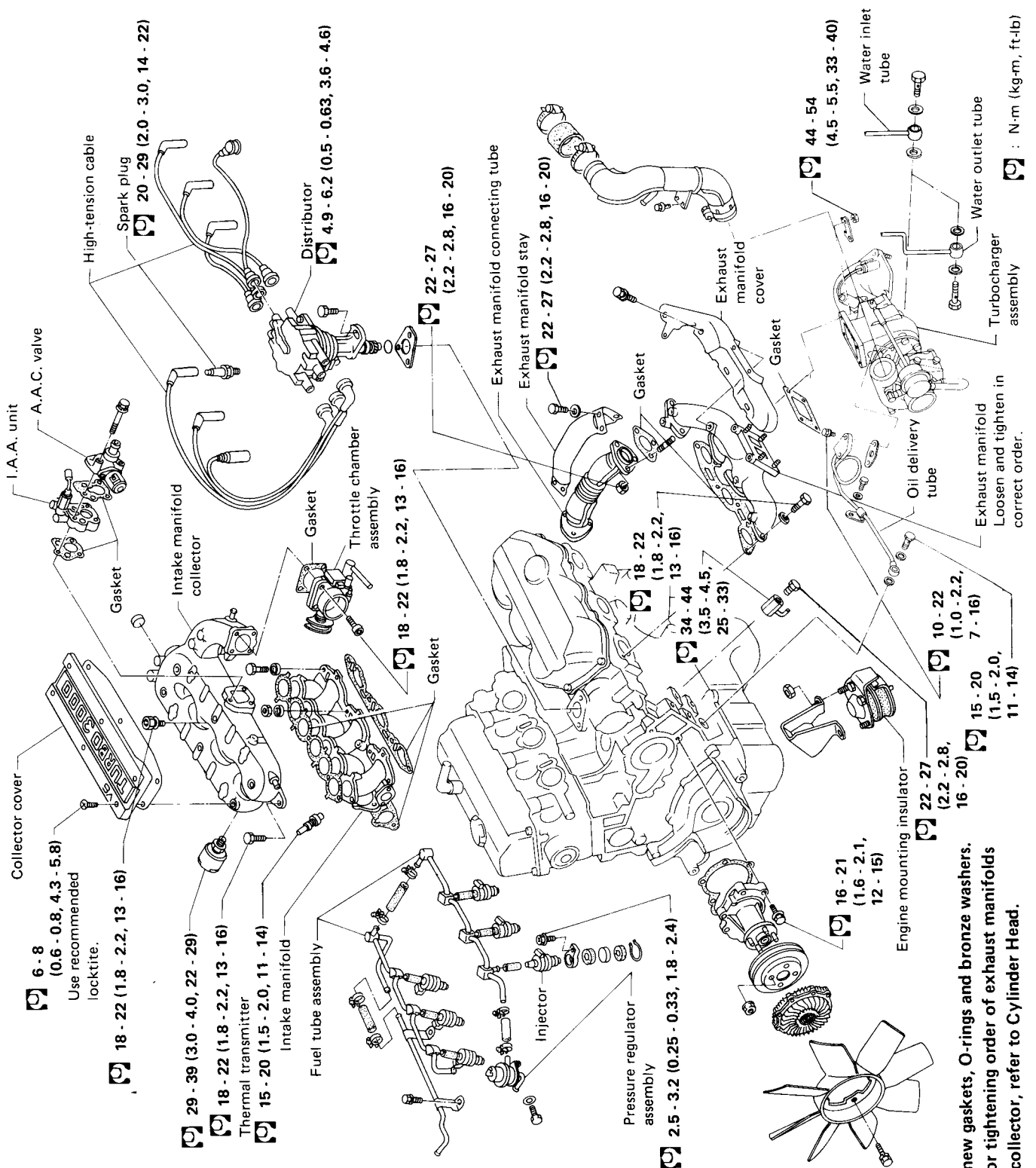
ENGINE COMPONENTS —Outer Parts—



□ : N·m (kg-m, ft-lb)

SEM010B

ENGINE COMPONENTS —Outer Parts—



- Use new gaskets, O-rings and bronze washers.
- As for tightening order of exhaust manifolds and collector, refer to Cylinder Head.

SEM011B

COMPRESSION PRESSURE

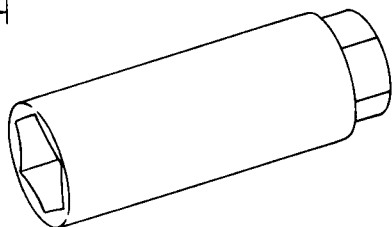
Measurement of Compression Pressure

1. Warm up engine.
2. Remove all spark plugs.

Use a suitable plug wrench shown below.

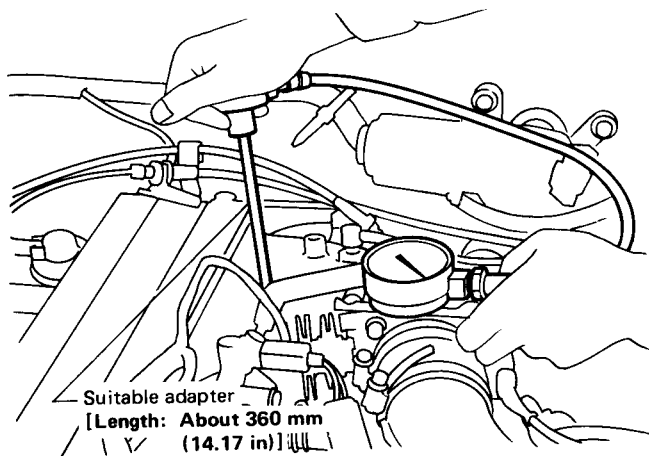


Wrench with a magnet to hold spark plug



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:

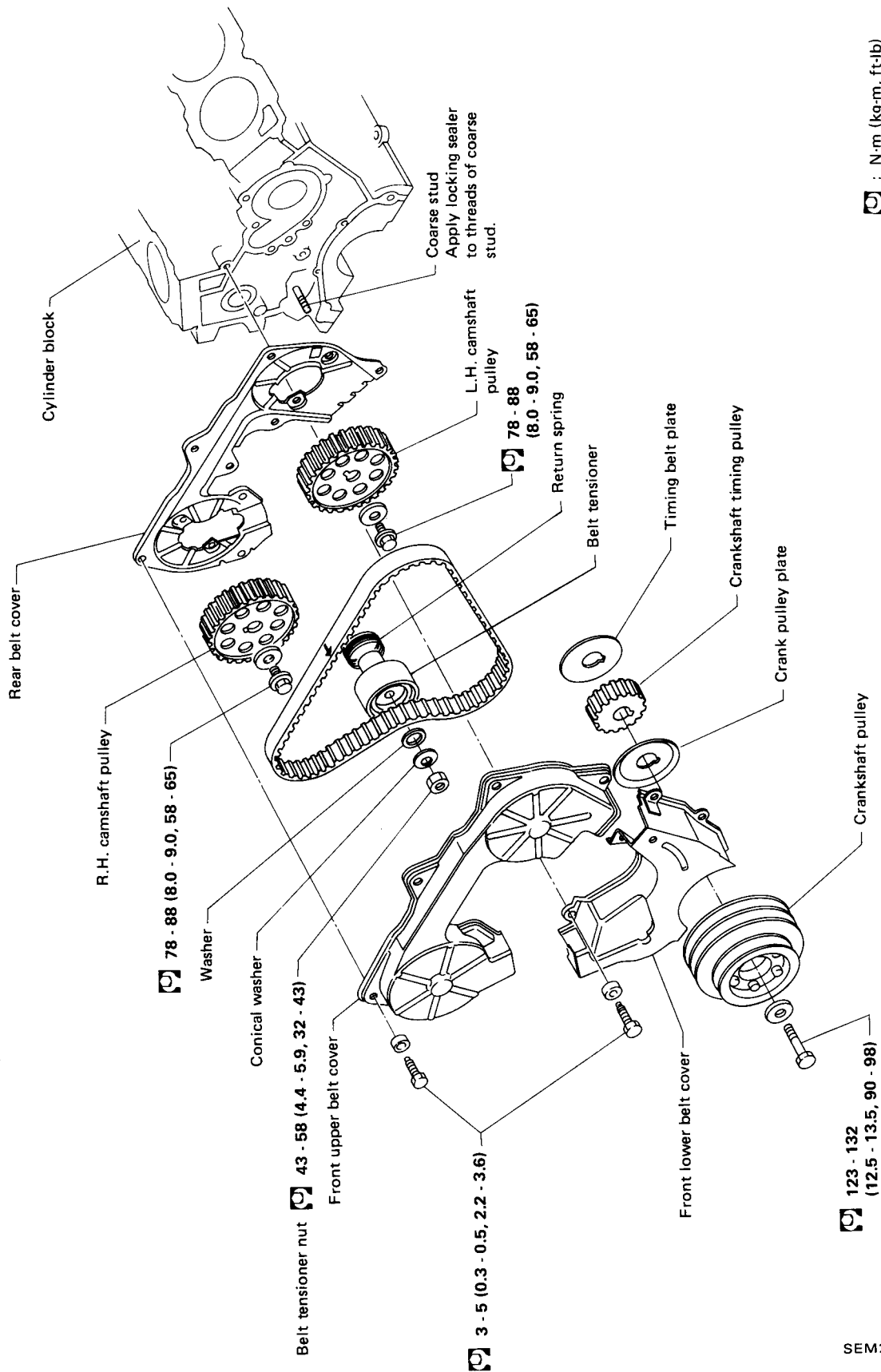
98 (1.0, 14)/300

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 camshaft pulleys, crankshaft timing pulley and belt tensioner are 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 spark plugs removed and both rocker shafts loosened completely.
- Align white lines on timing belt with punch mark on camshaft pulleys and crankshaft pulley.



: N·m (kg·m, ft·lb)

SEM238A

TIMING BELT

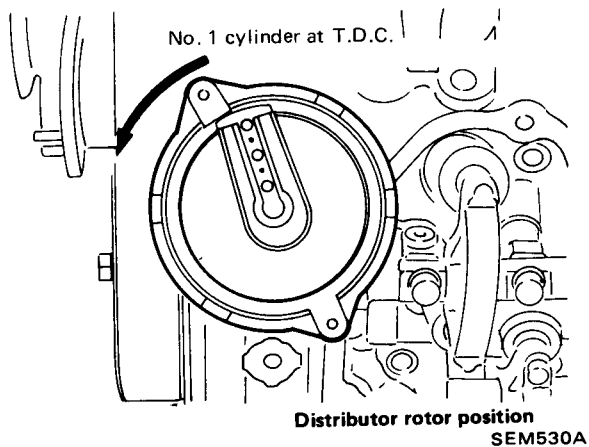
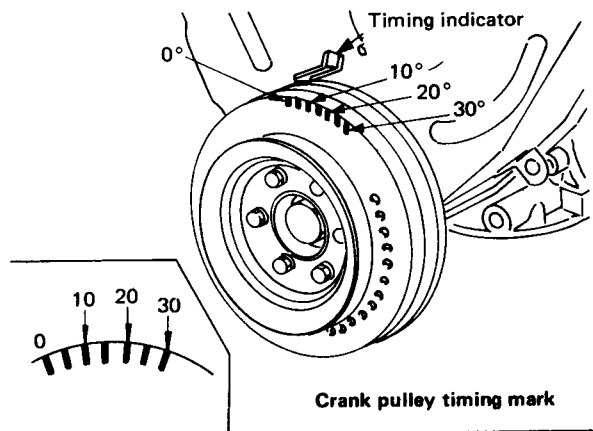
Removal

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

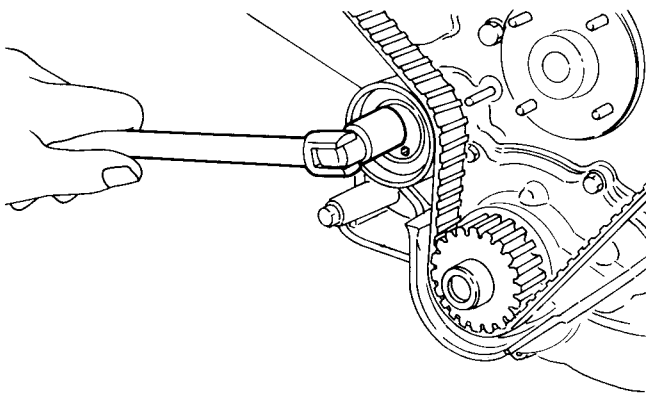
1. Remove engine undercover and drain engine coolant from radiator.

Be careful not to allow coolant to contact drive belts.

2. Remove radiator shroud and fan.
3. Remove the following belts.
 - Power steering drive belt
 - Compressor drive belt
 - Alternator drive belt
4. Remove upper and lower radiator hoses.
5. Set No. 1 cylinder at T.D.C. on its compression stroke.



6. Remove idler bracket of the compressor drive belt and crankshaft pulley.
7. Remove front upper and lower belt covers.
8. Replace timing belt by loosening timing belt tensioner and return spring.

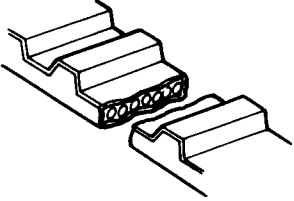
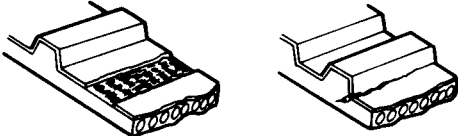
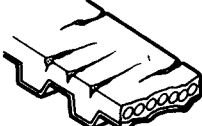


SEM240A

TIMING BELT

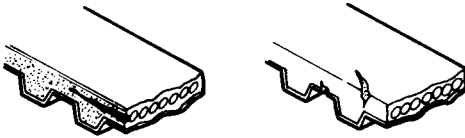
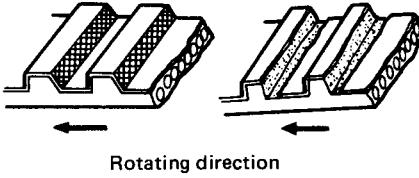
Inspection

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

Item to check	Problem	Cause
Belt is broken.	 SEM393A	• Improper handling • Poor belt cover sealing • Coolant leakage at water pump
Tooth is broken/ tooth root is cracked.	 SEM394A	• Camshaft jamming • Distributor jamming • Damaged camshaft/crankshaft oil seal
Back surface is cracked/worn.	 SEM395A	• Tensioner jamming • Overheated engine • Interference with belt cover

TIMING BELT

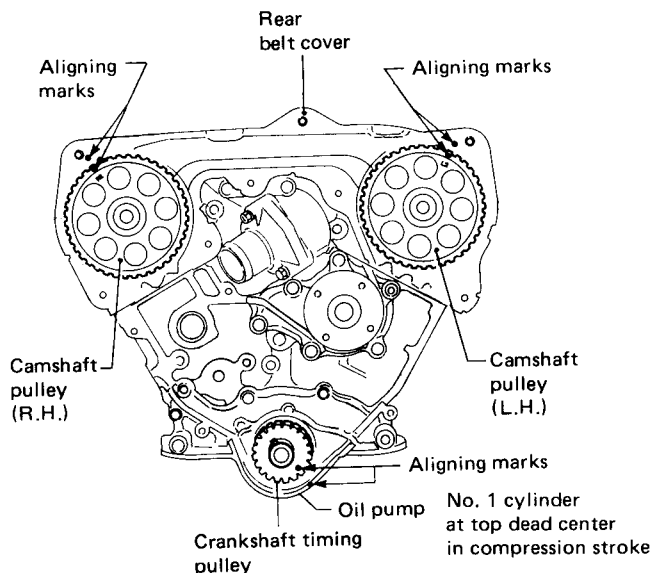
Inspection (Cont'd)

Item to check	Problem	Cause
Side surface is worn.	 • 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. SEM396A	• Improper installation of belt • Malfunctioning crank pulley plate/timing belt plate
Teeth are worn.	 • Canvas on tooth face is worn down. • Canvas on tooth is fluffy, rubber layer is worn down and faded white, or fiber is worn down and invisible. SEM397A	• 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.		• 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.



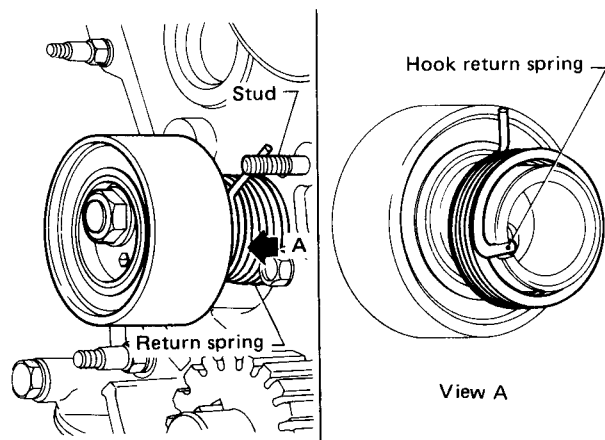
2. Disconnect all hoses, connectors and wires attached to intake collector and rocker covers.
3. Remove compressor from compressor bracket and secure with a suitable wire or rag to the body.
4. Remove collector cover and intake collector.
5. Remove both rocker covers and loosen all rocker shaft securing bolts.

Loosen all rocker shaft securing bolts thoroughly so that timing belt tension can be adjusted correctly. Otherwise, proper belt tension cannot be obtained.

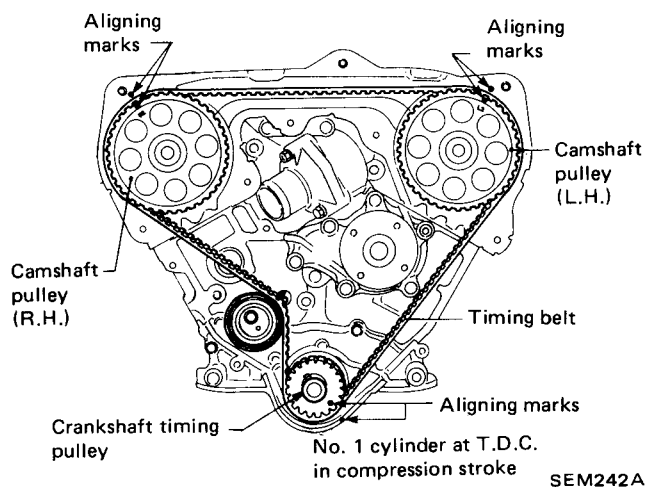
6. Install tensioner and return spring.

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

7. Turn tensioner clockwise with hexagon wrench and temporarily tighten tension lock nut.



8. 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.

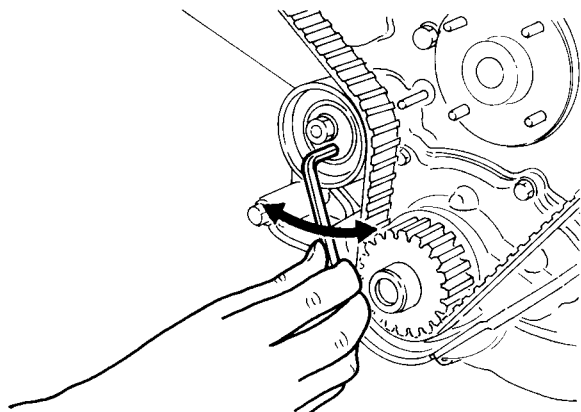


9. Loosen tensioner lock nut.

TIMING BELT

Installation (Cont'd)

10. Slowly turn tensioner with hexagon wrench clockwise and counterclockwise two or three times.



SEM244A

11. Tighten tensioner lock nut.

 : 43 - 58 N·m
(4.4 - 5.9 kg-m, 32 - 43 ft-lb)

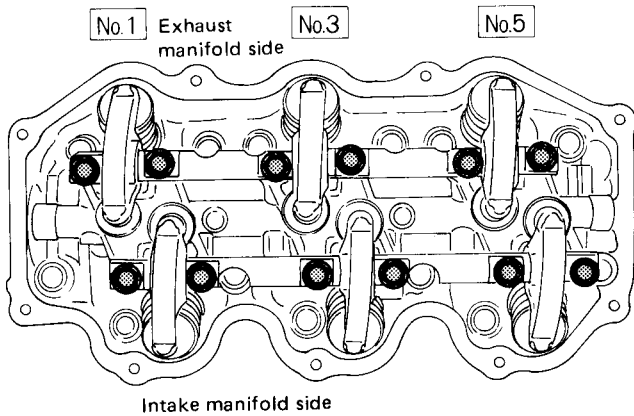
TIMING BELT

Installation (Cont'd)

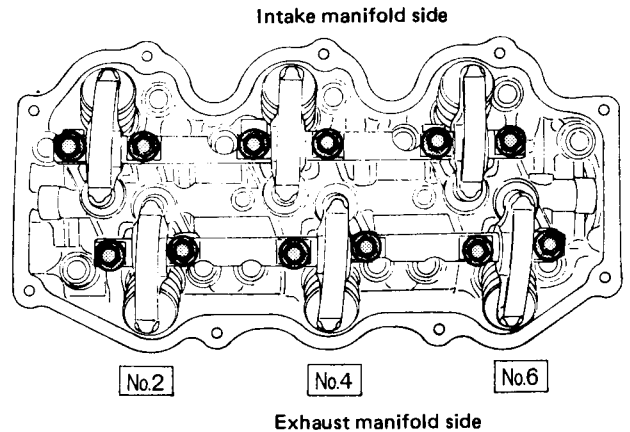
12. Tighten rocker shaft securing bolts in two or three stages.

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

R.H. rocker shafts



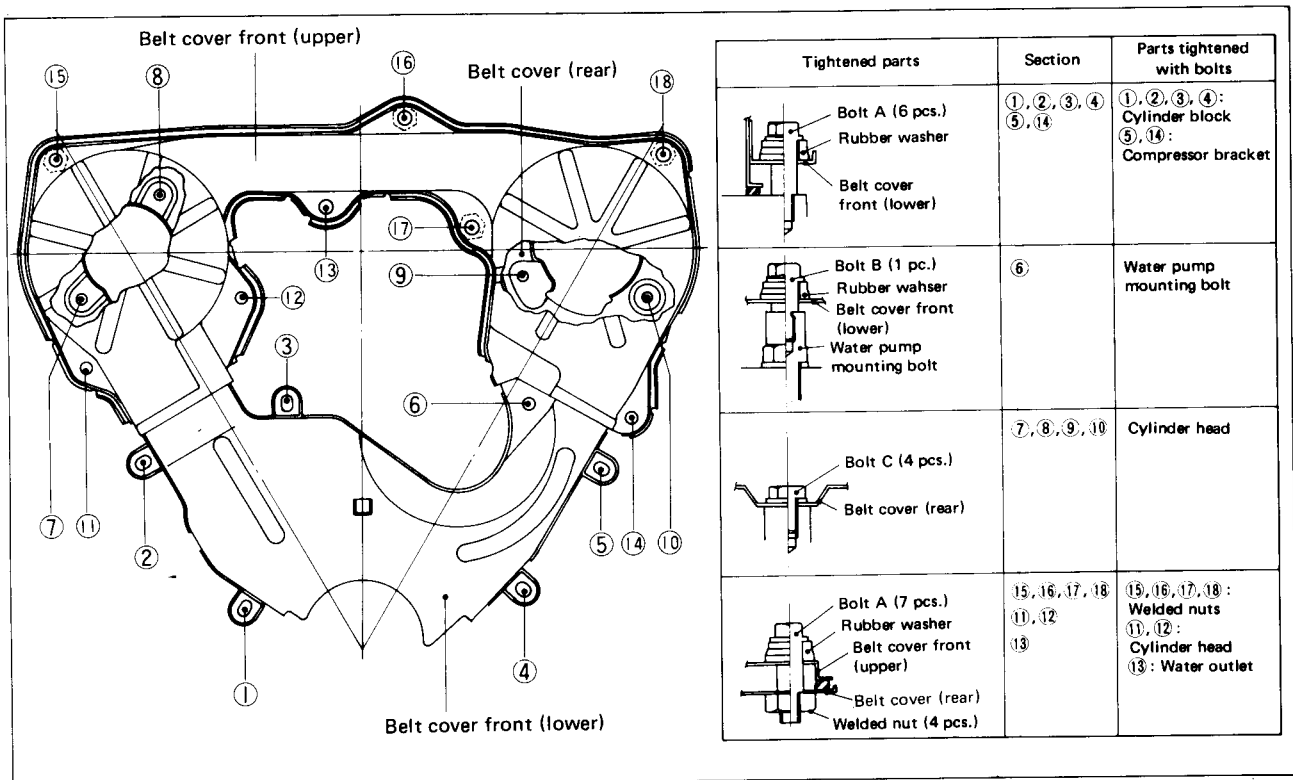
L.H. rocker shafts



SEM245A

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

13. Install lower and upper belt covers.



SEM248A

TIMING BELT

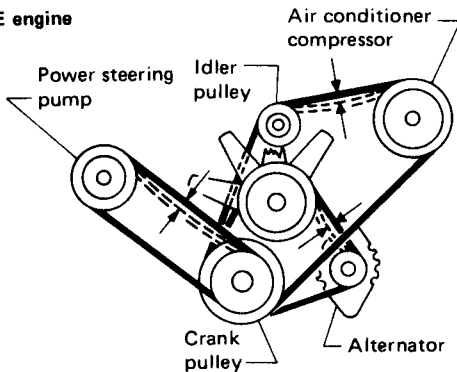
Installation (Cont'd)

14. Install rocker covers, intake collector and intake manifold.
15. Connect hoses, connectors and wires.
16. Install compressor to the engine.
17. Install crankshaft pulley and idler bracket of the compressor drive belt.

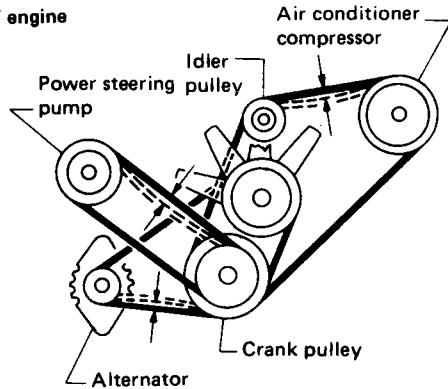
 : Crankshaft pulley bolt
123 - 132 N·m
(12.5 - 13.5 kg·m, 90 - 98 ft-lb)

18. Install lower and upper radiator hoses.
19. Install the drive belts.

VG30E engine



VG30ET engine



SEM239A

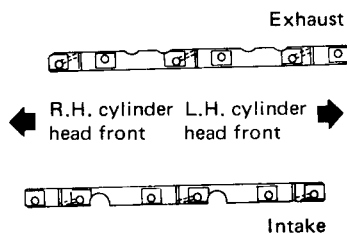
Unit: mm (in)

	Adjusted deflection of used belt	Set deflection of new belt
Alternator VG30E	6 - 8 (0.24 - 0.31)	5 - 7 (0.20 - 0.28)
VG30ET	6 - 9 (0.24 - 0.35)	5 - 8 (0.20 - 0.31)
Air conditioner compressor	9 - 11 (0.35 - 0.43)	7 - 9 (0.28 - 0.35)
Power steering oil pump	13 - 16 (0.51 - 0.63)	10 - 13 (0.39 - 0.51)
Applied pushing force	98 N (10 kg, 22 lb)	

20. Install fan and radiator shroud.
21. Fill radiator with engine coolant up to filler opening.
- Slowly pour coolant through coolant filler neck to allow air in system to escape.
22. Fill reservoir tank up to "MAX" level. Then close radiator cap.
23. Run the engine at approximately 2,000 rpm until it warms up.
24. Check area around radiator drain plug and radiator hoses for any sign of water leakage.
25. Stop the engine and after it cools down, refill the radiator and engine with coolant up to the filler opening. Fill the reservoir tank with coolant up to "MAX" level.

CYLINDER HEAD

Refer to page EM-24.



1 - 3 (0.1 - 0.3, 0.7 - 2.2)

18 - 22
(1.8 - 2.2, 13 - 16)

Intake rocker shaft
Be sure to align cut portion to cylinder head bolt.

L.H. rocker cover

Gasket

Rocker arm

Hydraulic valve lifter

Valve collet

Valve spring retainer

Valve outer spring

Valve inner spring

Valve oil seal

Valve guide

Valve seat

Outer spring seat

Exhaust valve

Bolt

Cylinder head rear cover

Rear cover gasket

78 - 88 (8.0 - 9.0, 58 - 65)

Camshaft locate plate

Select thickness of cam locate plate so that end play is within the specification.

Cylinder head bolt

Tighten them in 5 steps.

1st Tighten them to 29 N·m (3.0 kg-m, 22 ft-lb)

2nd Tighten them to 59 N·m (6.0 kg-m, 43 ft-lb)

3rd Loosen them completely.

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

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

or turn them 60 - 65 degrees clockwise.

Bolt M6 with washer

Washer

Oil filler cap

R.H. rocker cover

R.H. cylinder head assembly

Camshaft front oil seal.

L.H. camshaft

L.H. cylinder head

Gasket

Cylinder block

- 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)

SEM250A

CYLINDER HEAD

Removal

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

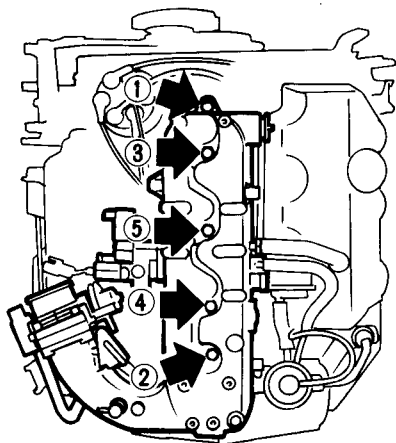
1. Remove timing belt.

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

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

2. Remove collector cover and collector.

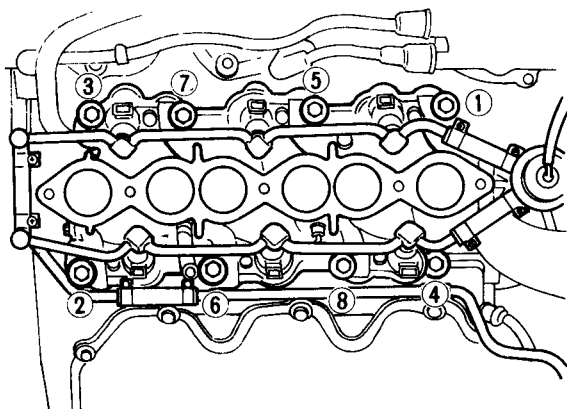
Before removing collector, be sure to drain coolant removing drain cocks in cylinder block.



Loosen in numerical order and tighten in reverse order of removal.

SEM251A

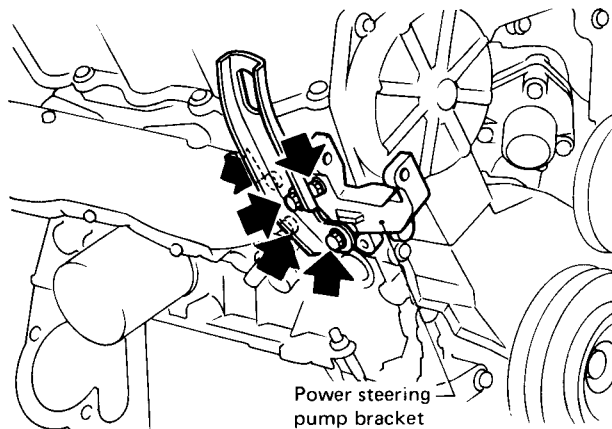
3. Remove intake manifold with fuel tube assembly.



Loosen in numerical order.

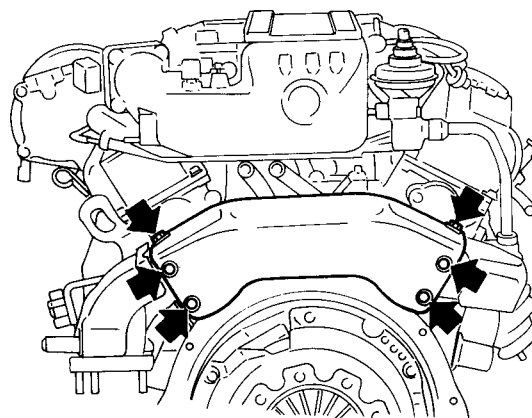
SEM252A

4. Remove power steering pump bracket.



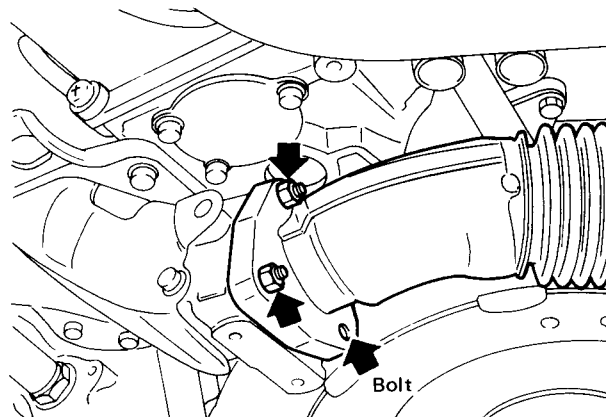
SEM253A

5. Remove exhaust manifold stay.



SEM297A

6. Disconnect exhaust manifold connecting tube.

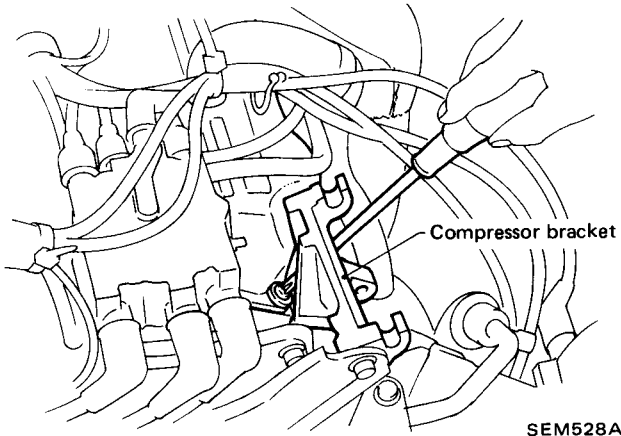


SEM298A

CYLINDER HEAD

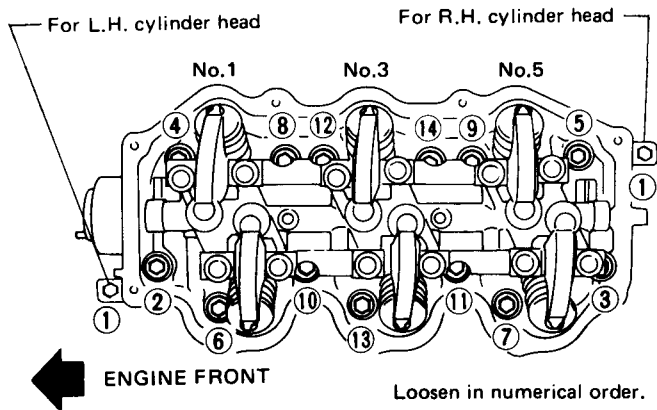
Removal (Cont'd)

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



SEM528A

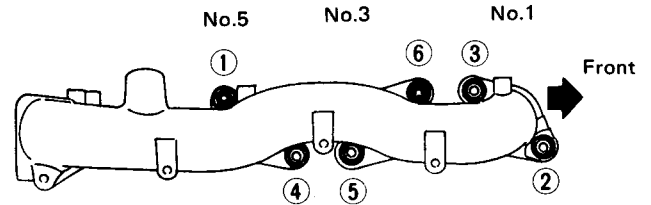
9. Remove cylinder head with exhaust manifold.



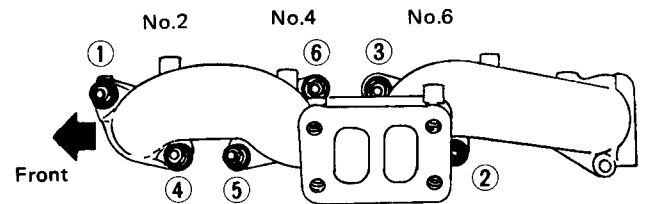
Disassembly

1. Remove exhaust manifold.

R.H. exhaust manifold



L.H. exhaust manifold



Loosen in numerical order.

SEM535A

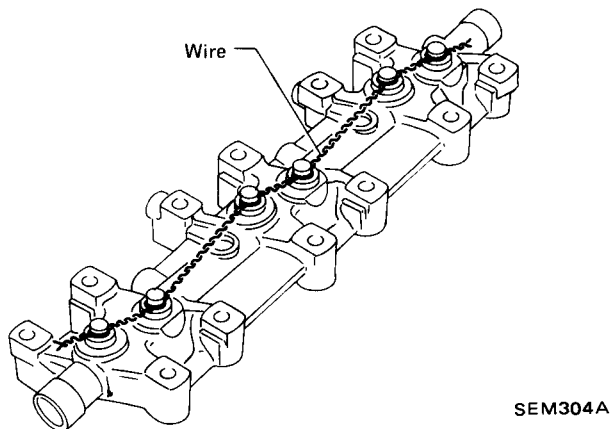
2. Remove rocker shafts with rocker arms.

The bolts should be loosened in two or three stages.

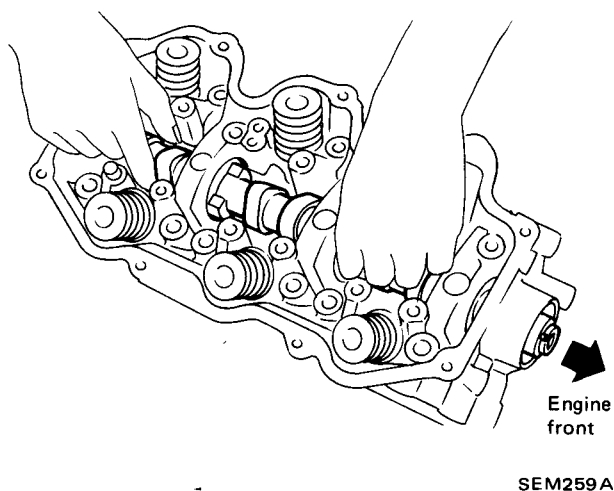
CYLINDER HEAD

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.



- 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. Attach tags to valve lifters so as not to mix them up.
4. Remove camshaft from front side.



SEM259A

Inspection

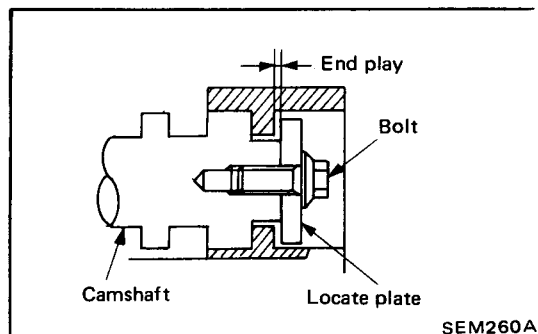
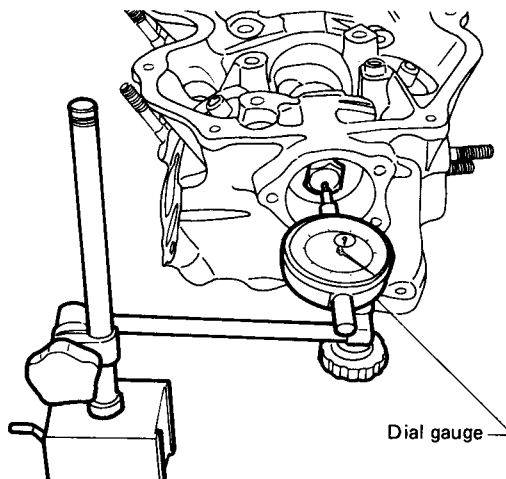
CAMSHAFT VISUAL CHECK

Check camshaft for scratches, seizure and wear.

CAMSHAFT END PLAY

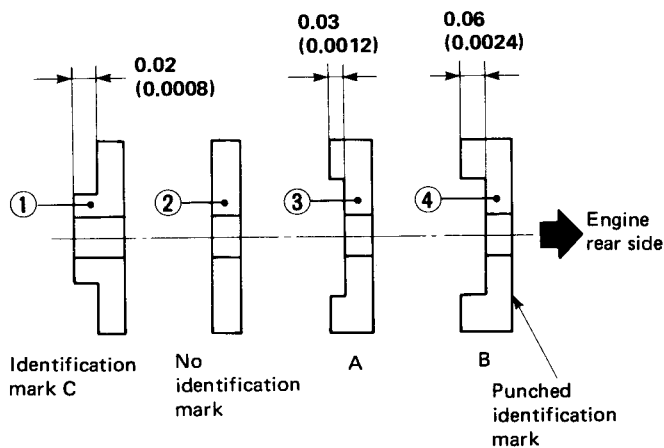
Camshaft end play:

0.03 - 0.06 mm (0.0012 - 0.0024 in)



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

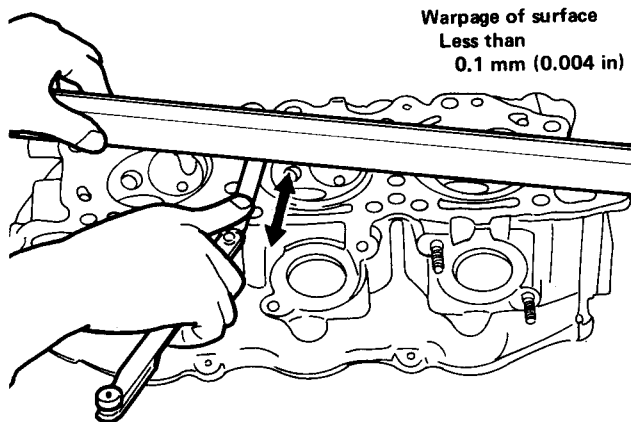
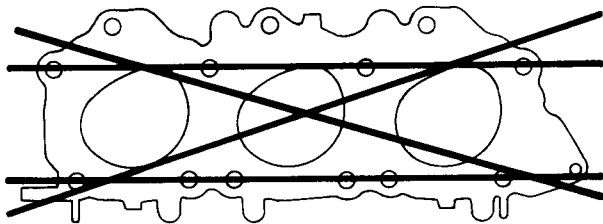
Inspection (Cont'd)

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, 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"

The maximum limit is as follows:

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

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

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:

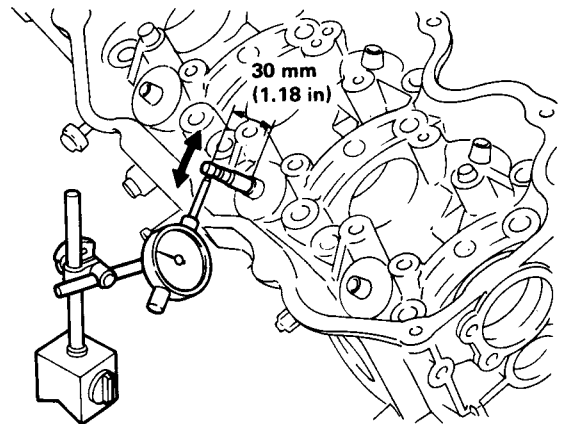
Maximum limit

0.10 mm (0.0039 in)

Maximum allowable deflection

(Dial indicator reading)

0.2 mm (0.008 in)

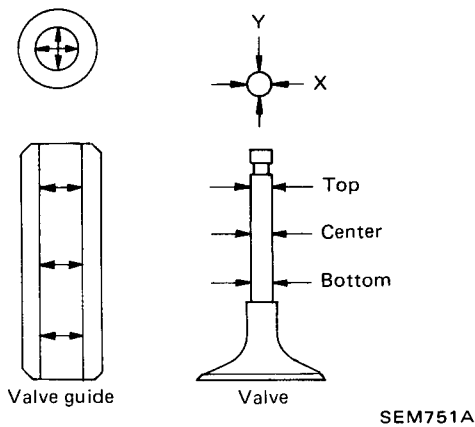
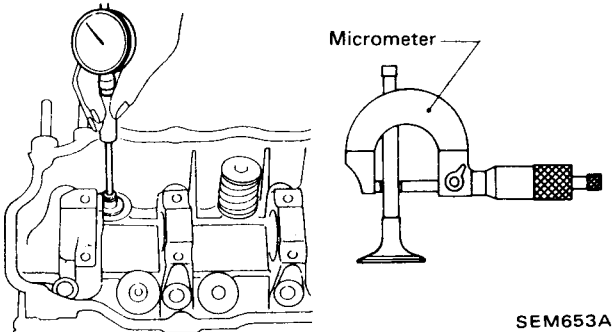


SEM263A

CYLINDER HEAD

Inspection (Cont'd)

- To determine the correct replacement part, measure valve stem diameter and valve guide bore.

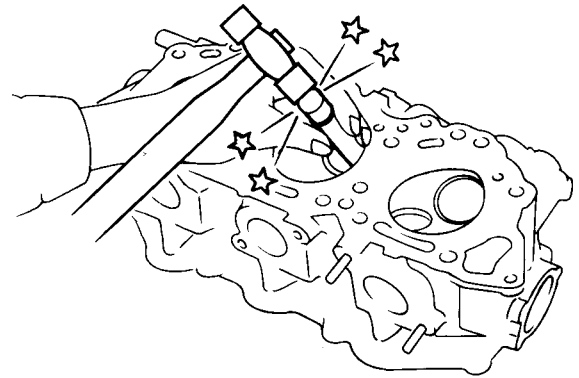
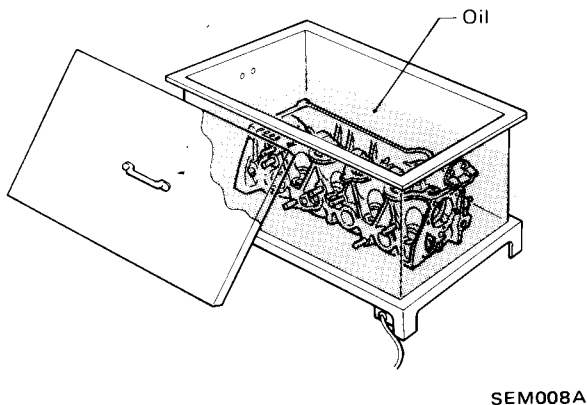


For dimensions, refer to S.D.S.

Replacement

Replace valve and/or valve guide.

- 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.

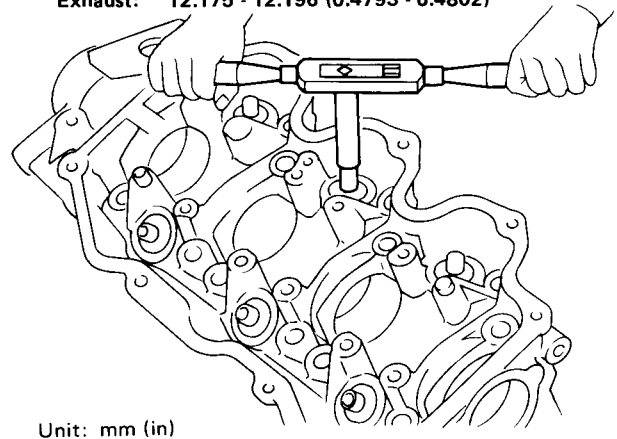


- Ream cylinder head valve guide hole.

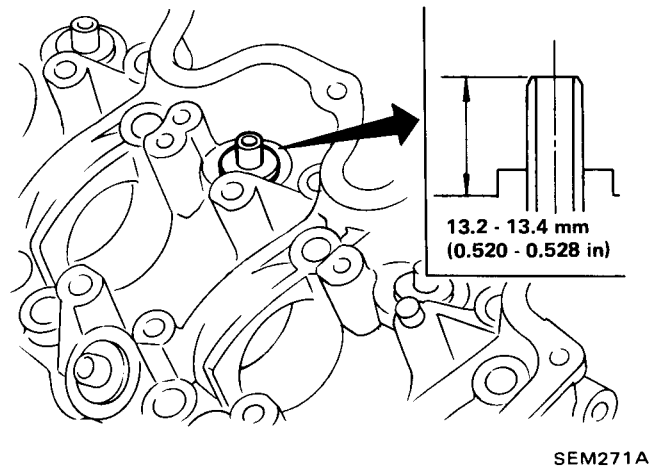
Valve guide hole inside diameter (For service parts)

Intake: 11.175 - 11.196 (0.4400 - 0.4408)

Exhaust: 12.175 - 12.196 (0.4793 - 0.4802)



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



CYLINDER HEAD

Inspection (Cont'd)

4. Ream valve guide.

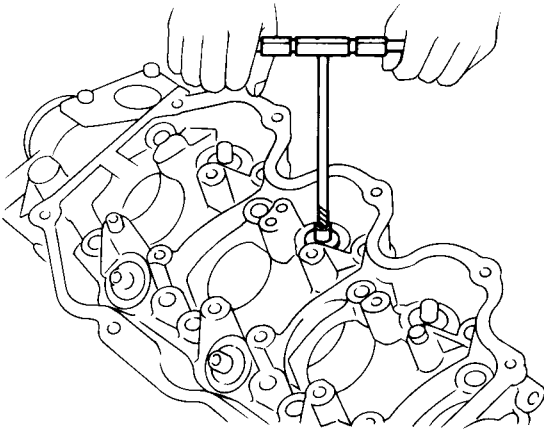
Finished size:

Intake

7.000 - 7.018 mm (0.2756 - 0.2763 in)

Exhaust

8.000 - 8.011 mm (0.3150 - 0.3154 in)



SEM272A

VALVE INSERTS

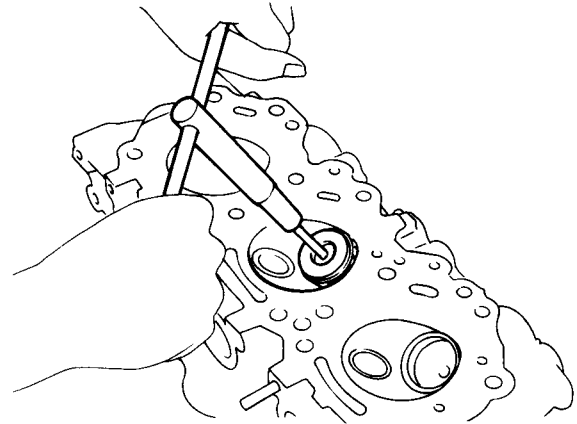
Check valve inserts for any evidence of pitting at valve contact surface, and reseal or replace if worn out excessively.

- 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. (For dimensions, refer to S.D.S.)
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.



SEM265A

5. After cutting, lap valve inserts with a lapping compound.

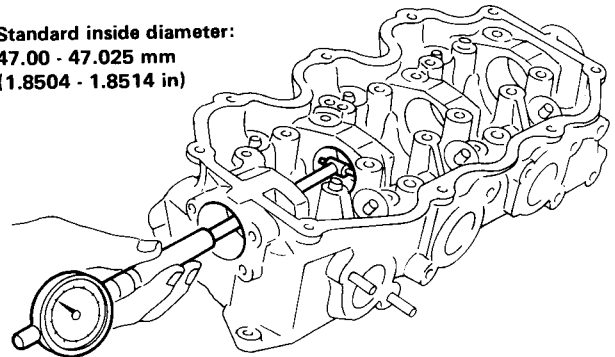
6. Check contact condition of valve inserts.

CAMSHAFT JOURNAL CLEARANCE

Wear limit

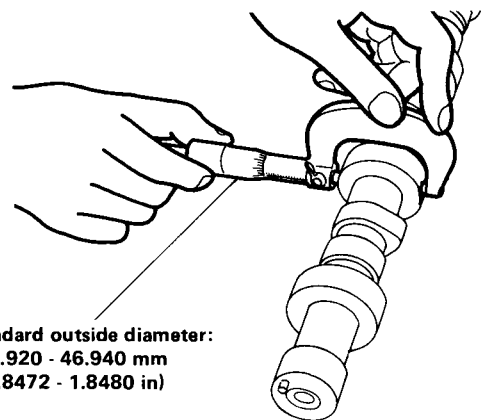
0.15 mm (0.0059 in)

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



SEM266A

Standard outside diameter:
46.920 - 46.940 mm
(1.8472 - 1.8480 in)



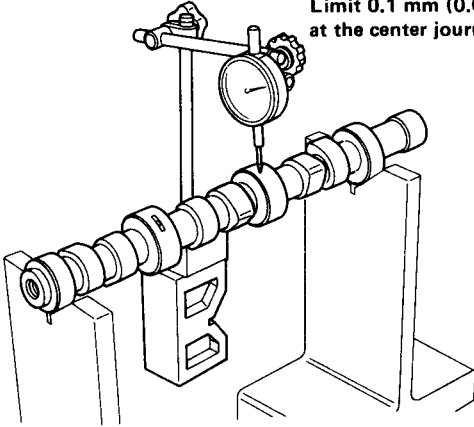
SEM267A

CYLINDER HEAD

Inspection (Cont'd)

CAMSHAFT RUNOUT

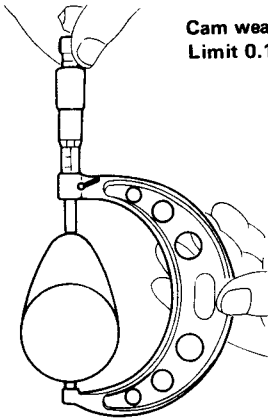
Runout [T.I.R.
(Total Indicator Reading)]
Limit 0.1 mm (0.004 in)
at the center journal.



SEM758A

CAMSHAFT CAM HEIGHT

Cam wear:
Limit 0.15 mm (0.0059 in)

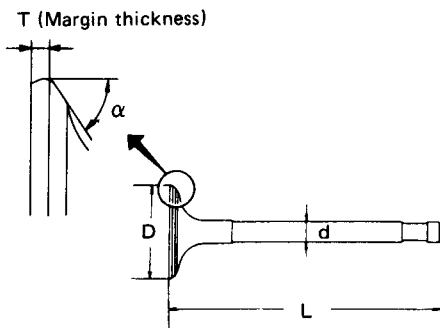


SEM549A

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

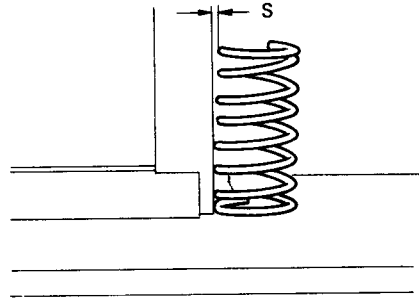
Out of square:

Outer

Less than 2.2 mm (0.087 in)

Inner

Less than 1.9 mm (0.075 in)



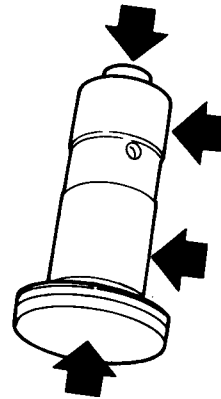
SEM288A

VALVE SPRING PRESSURE LOAD

Refer to S.D.S.

HYDRAULIC VALVE LIFTER

Check contact and sliding surfaces for wear or scratches.



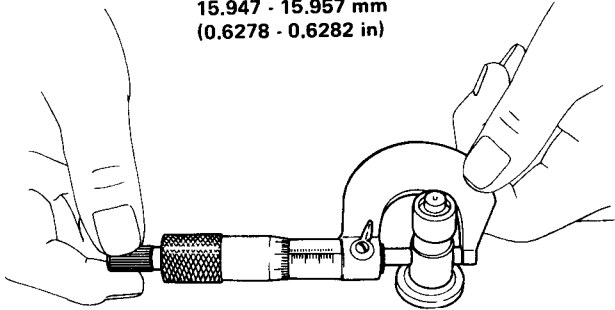
SEM269A

CYLINDER HEAD

Inspection (Cont'd)

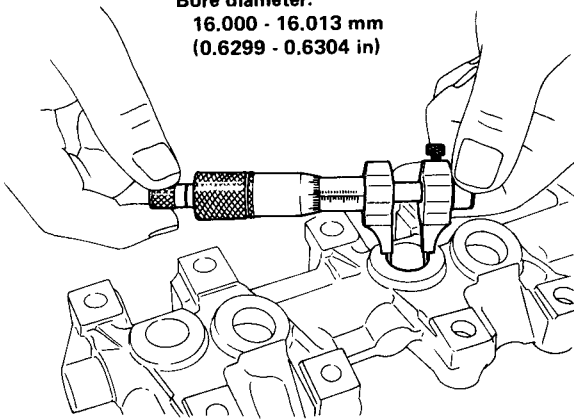
Check diameter of a valve lifter and a valve lifter guide bore.

Outside diameter:
15.947 - 15.957 mm
(0.6278 - 0.6282 in)



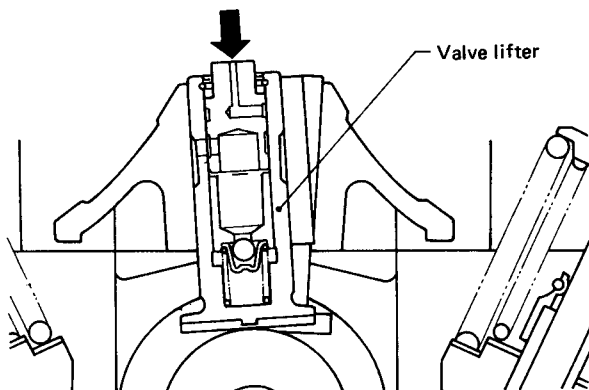
SEM759A

Bore diameter:
16.000 - 16.013 mm
(0.6299 - 0.6304 in)



SEM760A

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



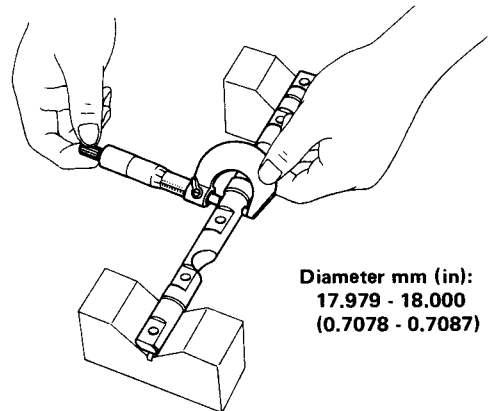
SEM531A

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.

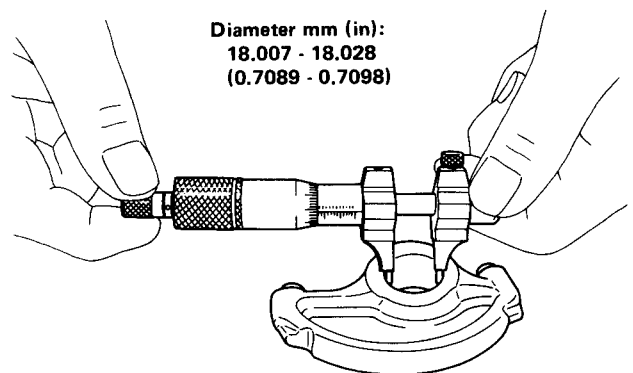
VALVE ROCKER AND ROCKER SHAFT

Check valve rockers and rocker shafts for wear and scratches. Check outside diameter of rocker shaft and inside diameter of rocker arm.



Diameter mm (in):
17.979 - 18.000
(0.7078 - 0.7087)

SEM761A



Diameter mm (in):
18.007 - 18.028
(0.7089 - 0.7098)

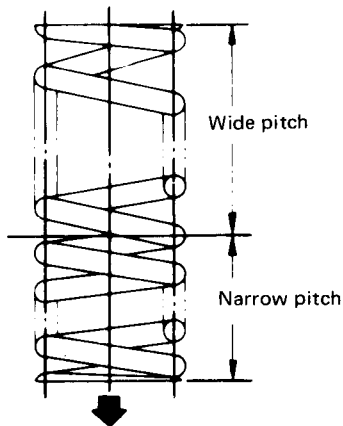
SEM762A

CYLINDER HEAD

Assembly

1. Install valve component parts.

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



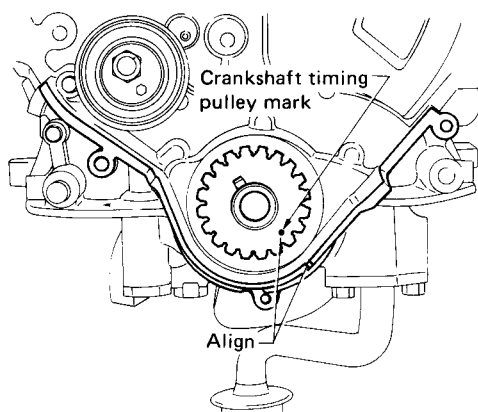
SEM052

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.

Installation

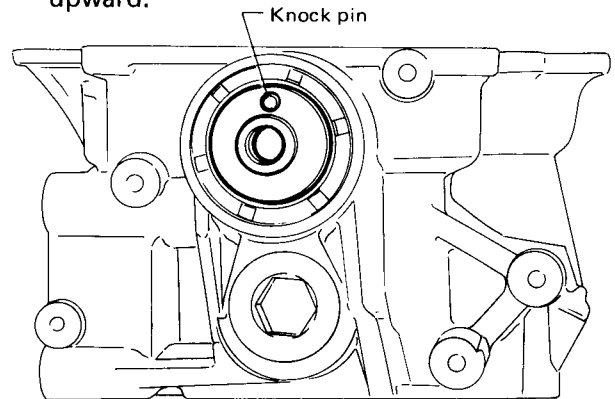
1. Before installing cylinder head, make sure that No. 1 cylinder is set at T.D.C. on its compression stroke as follows:

- (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.



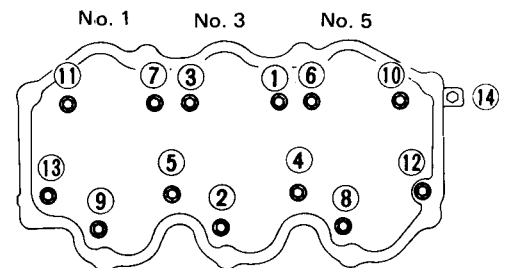
SEM279A

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

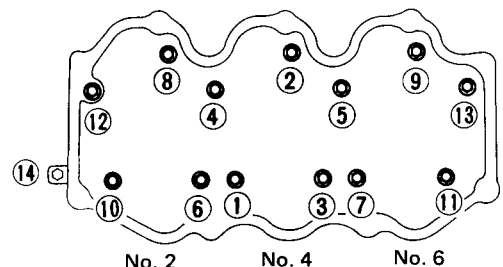
2. Install cylinder head with new gasket.
3. Apply oil to the thread portion and seat surface of bolts and tighten cylinder head bolts with washers using ST10120000 (J24239-01).

Tightening order

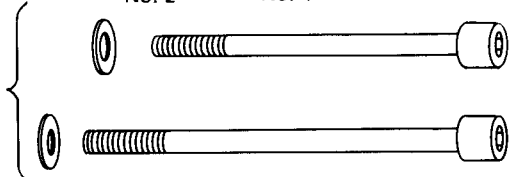
R.H. side



L.H. side



Cylinder head bolt



SEM928A

CYLINDER HEAD

Installation (Cont'd)

CAUTION:

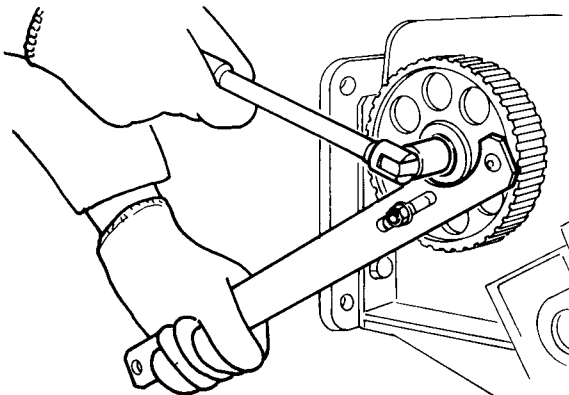
- ④ , ⑤ , ⑫ and ⑬ are the longer bolts.
 L = 127 mm (5.00 in) ④ , ⑤ , ⑫ , ⑬
 L = 106 mm (4.17 in) Except above

• 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.

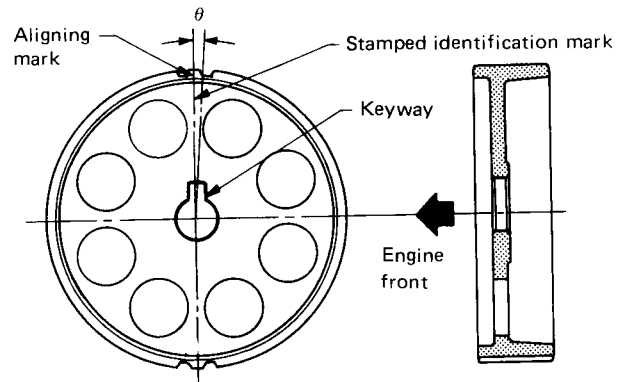
4. Install and tighten rear timing belt cover.
5. Install camshaft pulleys.

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



SEM305A

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

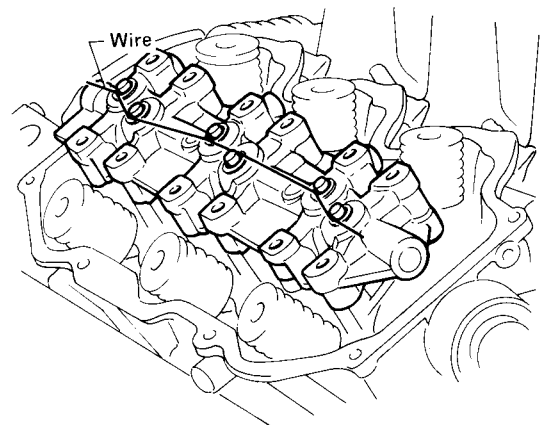


SEM303A

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

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.



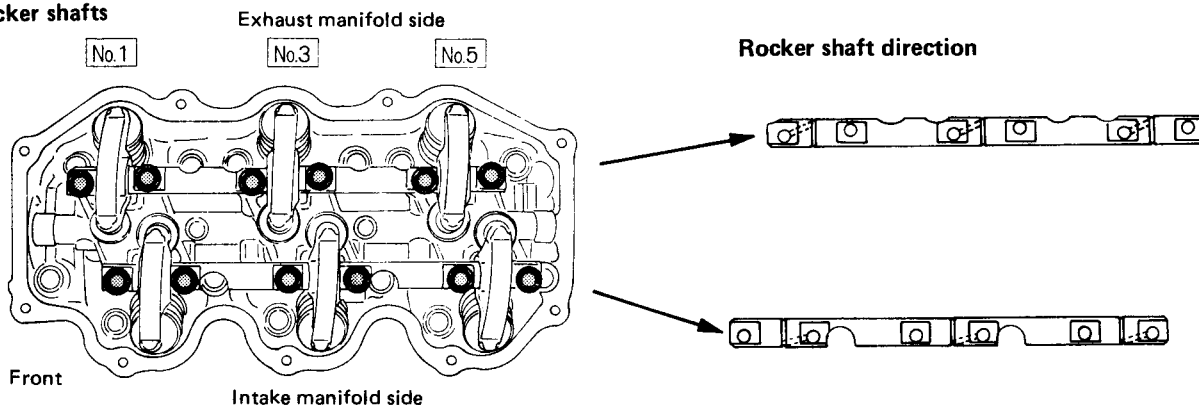
SEM280A

CYLINDER HEAD

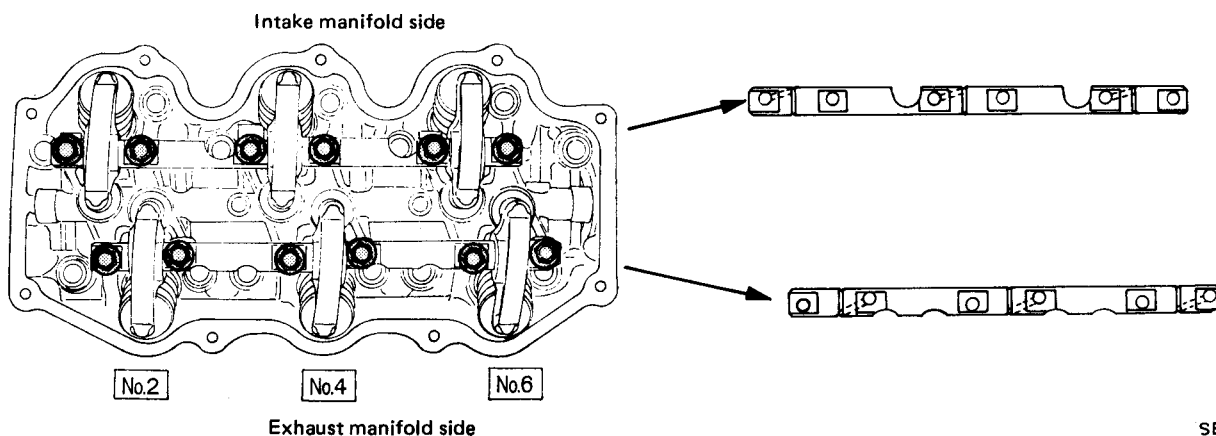
Installation (Cont'd)

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.

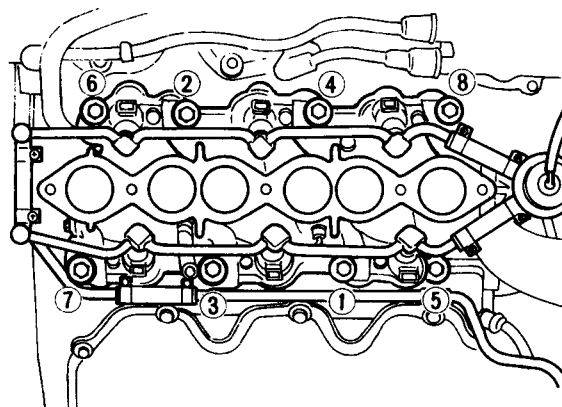
Tighten in two or three stages.

 : 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 16 - 20 N·m
(1.6 - 2.0 kg-m, 12 - 14 ft-lb)



Tighten in numerical order.

SEM529A

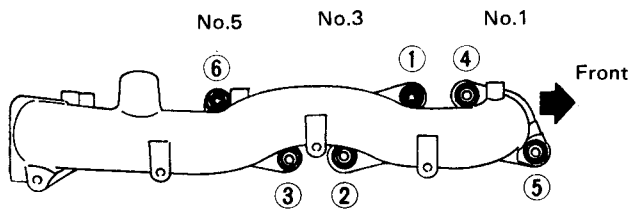
CYLINDER HEAD

Installation (Cont'd)

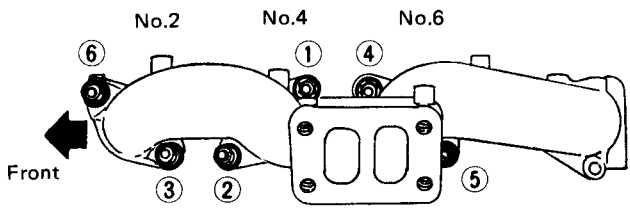
Distributor Installation

12. Install exhaust manifolds and connecting tube.

R.H. exhaust manifold



L.H. exhaust manifold



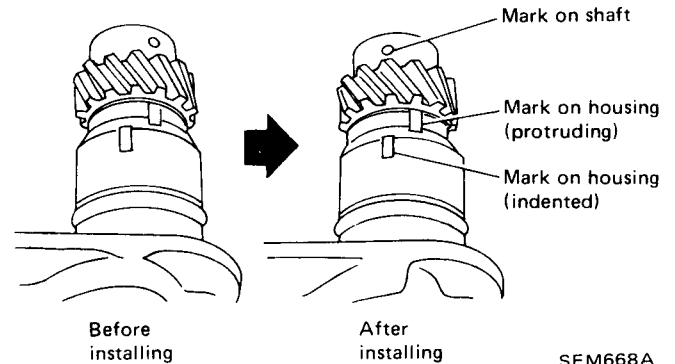
Tighten in numerical order.

SEM535A

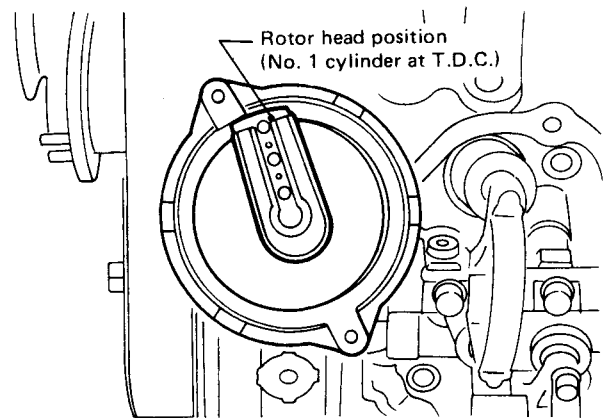
13. After assembling all disassembled parts, fill radiator with coolant up to the specified level. Refer to Changing Engine Coolant (Sections MA and LC).

1. Set the distributor gear position.

Distributor gear position



2. Install the distributor to the cylinder head.

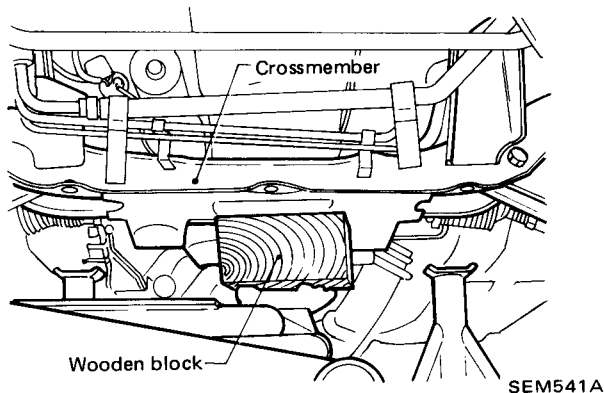


SEM669A

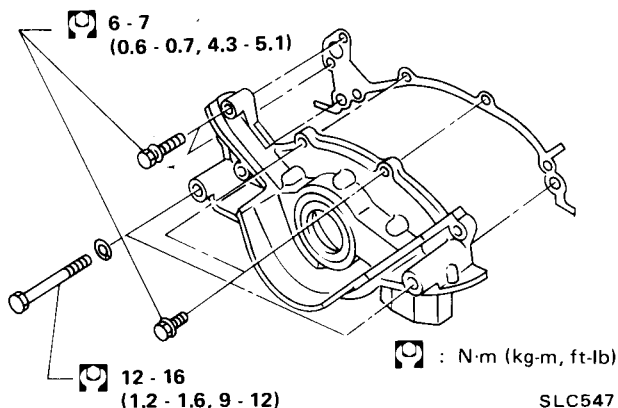
OIL PAN

Removal

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

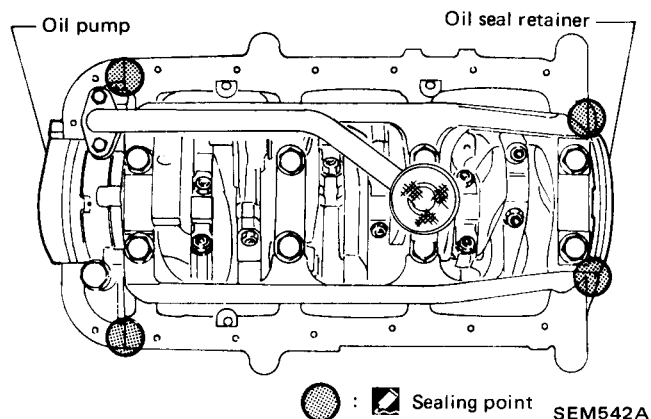


3. Remove front stabilizer bar securing bolts and nuts from suspension crossmember.
4. Remove steering column shaft from gear housing.
5. Remove tension rod securing nuts from transverse link.
6. Lift engine.
7. Remove rear plate cover from transmission case.
8. Remove oil pan securing bolts.
9. Remove 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. Pull oil pan out from rear side.
14. Remove oil strainer from oil pump assembly.
15. Remove oil pump assembly.

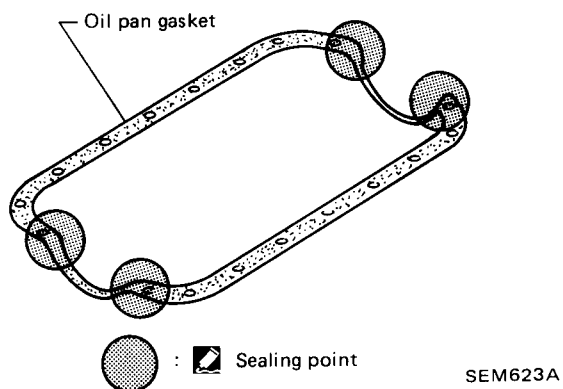


INSTALLATION

1. Wipe off oil and dust from sealing surfaces.
2. Apply sealant to cylinder block lower surface.



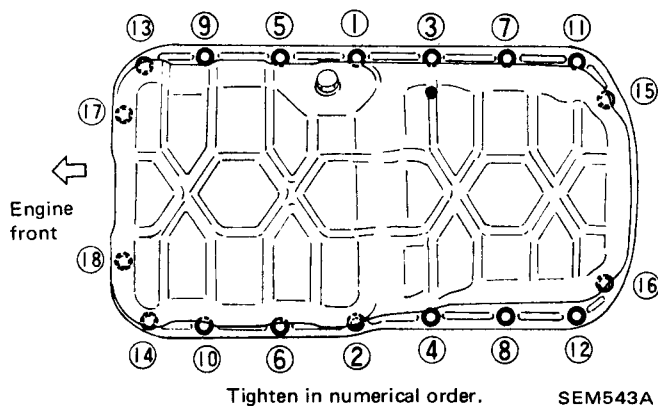
3. Apply sealant to oil pan gasket.



Apply sealant to upper and lower surfaces of oil pan gasket.

4. Install oil pan.

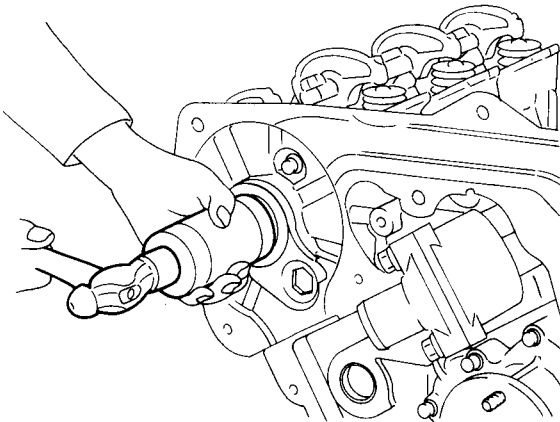
: 5 - 7 N·m
(0.5 - 0.7 kg·m, 3.6 - 5.1 ft·lb)



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.

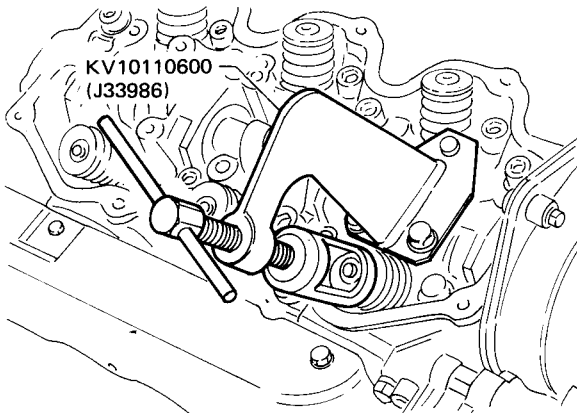


SEM284A

5. Install camshaft pulleys.
6. Install timing belt.

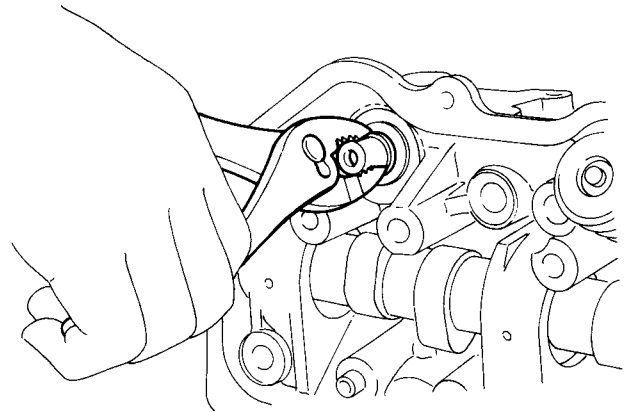
— Replacement of Valve Oil Seal —

1. Remove collector and rocker cover.
2. Remove rocker shaft assembly and valve lifters with valve guide.
3. Remove valve springs, retainer and collets.



SEM257A

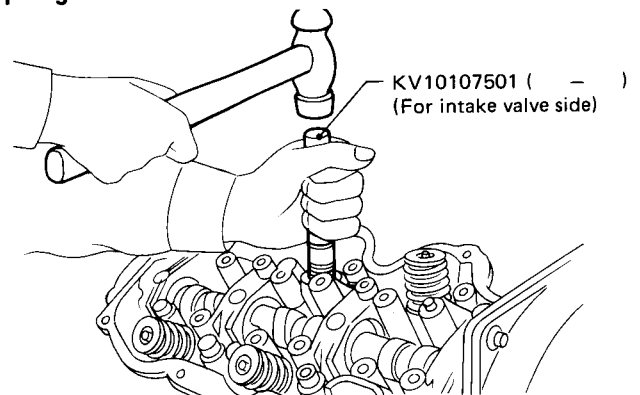
4. Remove valve oil seals.



SEM285A

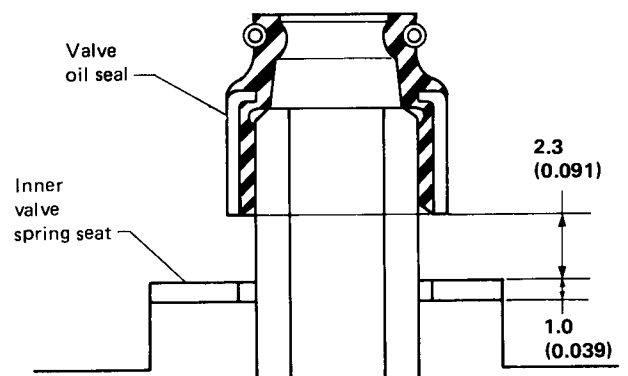
5. Apply engine oil to valve oil seal and install it in place.

Before installing valve oil seal, install inner valve spring seat.



SEM666A

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



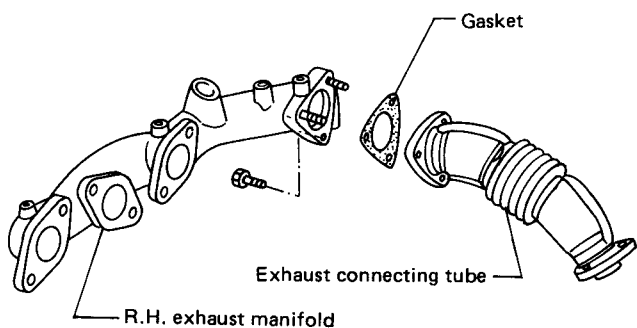
Unit: mm (in)

SEM287A

ENGINE REMOVAL

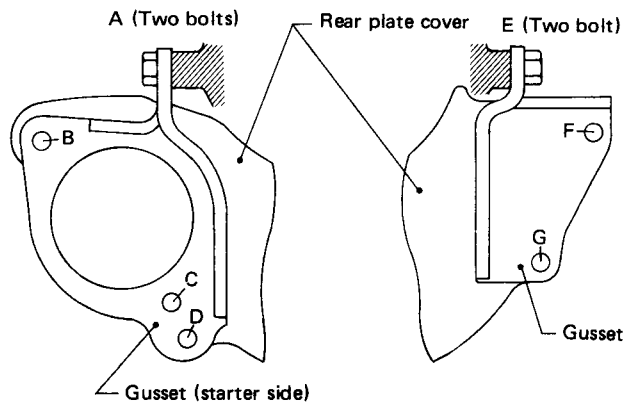
CAUTION:

- Before disconnecting fuel hose, release fuel pressure from fuel line. Refer to the "Releasing Fuel Pressure" in section MA.
 - 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.



SEM540A

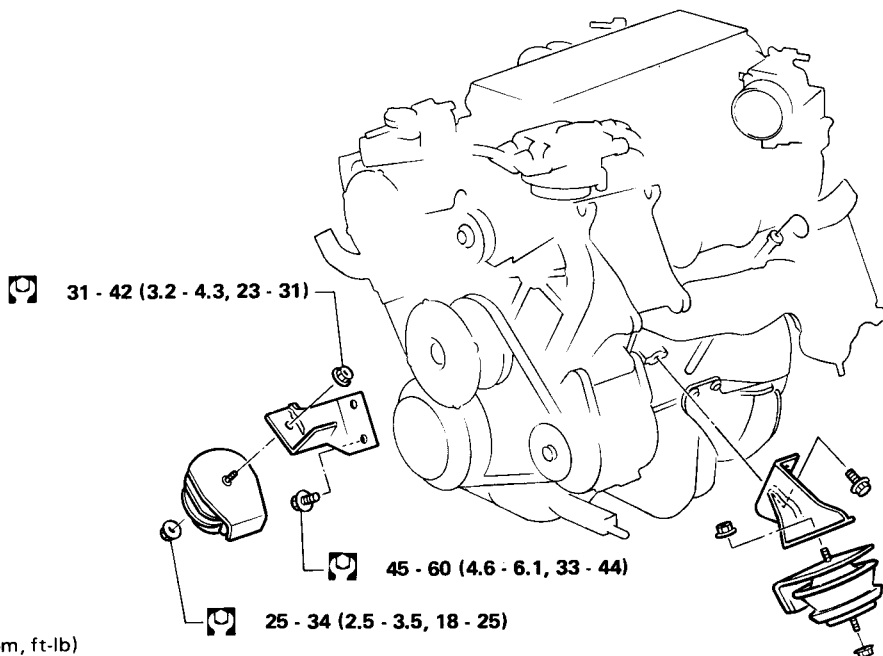
Tightening order

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

*1: Tighten temporarily.

*2: Tighten completely.

: 29 - 39 N·m
(3.0 - 4.0 kg-m, 22 - 29 ft-lb)

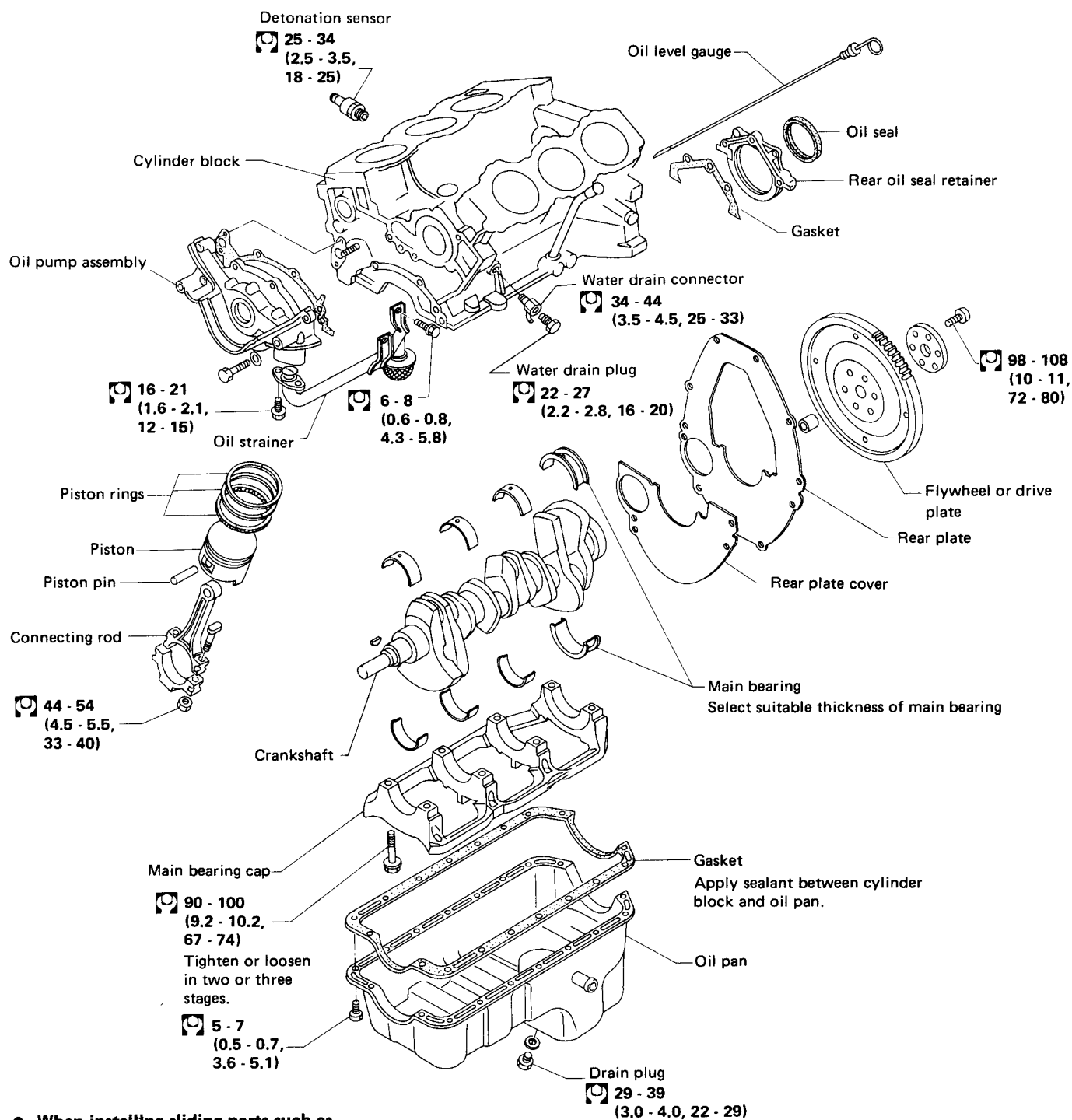


: N·m (kg-m, ft-lb)

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)

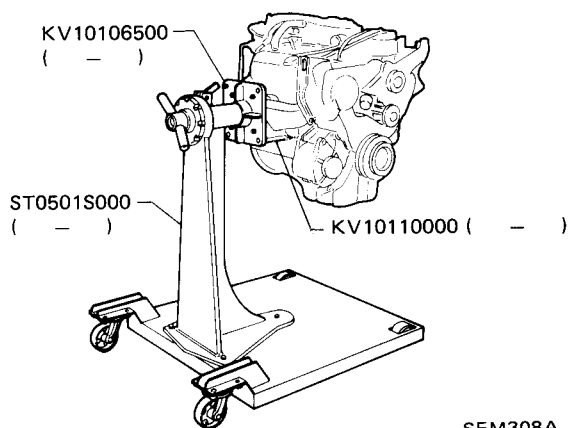
SEM504A

ENGINE OVERHAUL

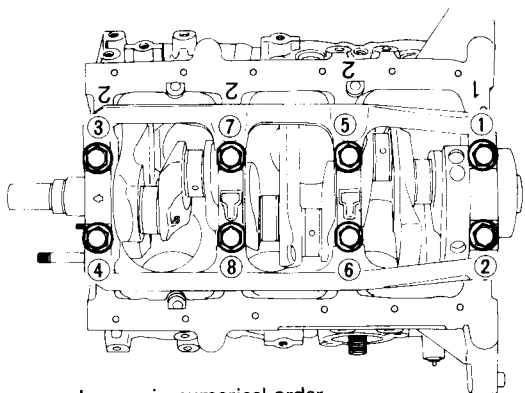
Disassembly

PISTON AND CRANKSHAFT

1. Place engine on work stand.



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



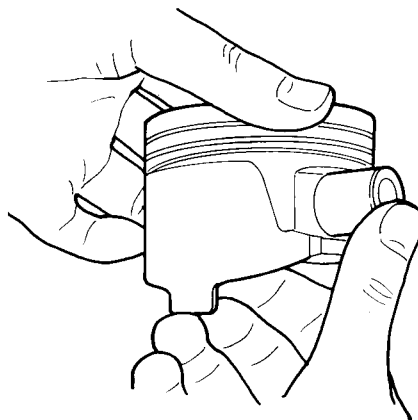
Inspection

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 - 0.010 mm (0.0003 - 0.0004 in)



PISTON RING SIDE CLEARANCE

Side clearance:

Top ring

0.040 - 0.073 mm (0.0016 - 0.0029 in)

2nd ring

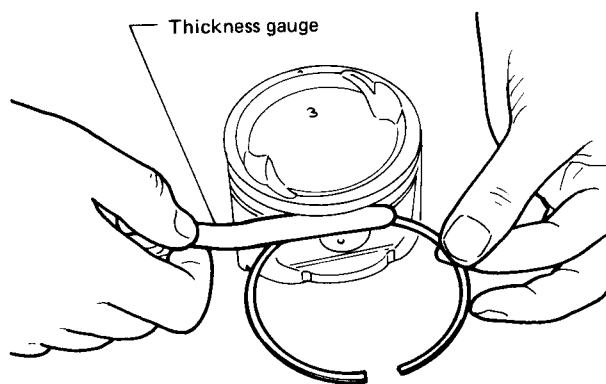
0.030 - 0.063 mm (0.0012 - 0.0025 in)

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

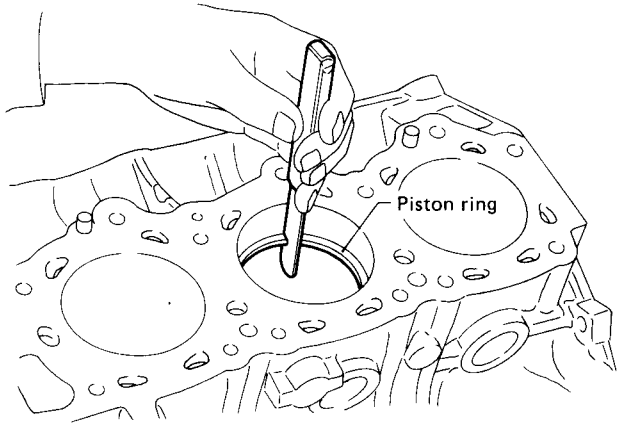
0.18 - 0.44 mm (0.0071 - 0.0173 in)

Oil ring

0.20 - 0.76 mm (0.0079 - 0.0299 in)

Max. limit of ring gap.

1.0 mm (0.039 in)



SEM314A

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

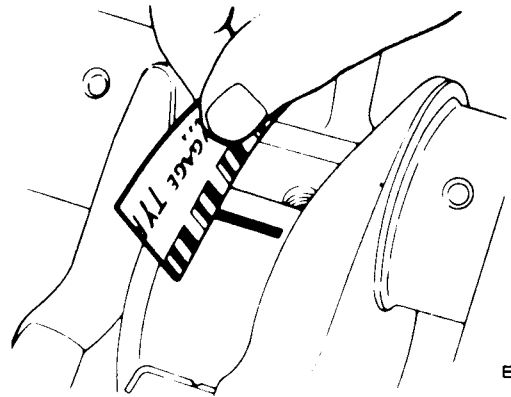
0.010 - 0.052 mm (0.0004 - 0.0020 in)

Limit 0.090 mm (0.0035 in)

Method A (Using plastigage)

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.



EM142

Method B (Using micrometer)

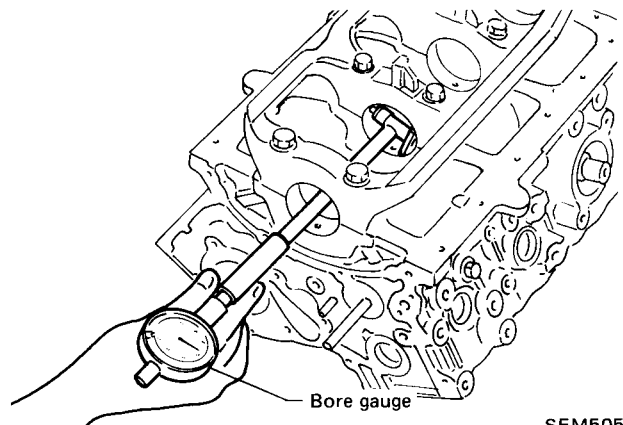
Main bearing

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.

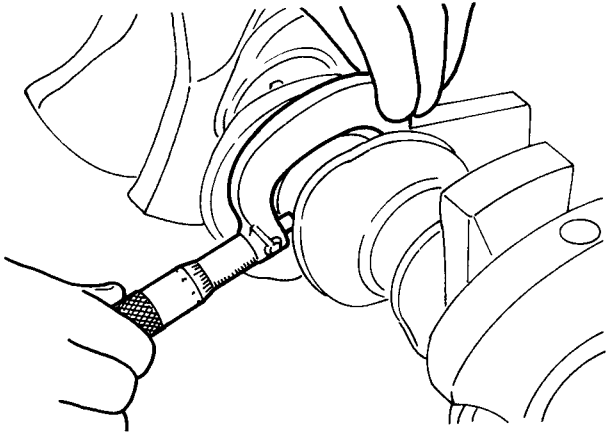


SEM505A

ENGINE OVERHAUL

Inspection (Cont'd)

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



SEM506A

5. Calculate main bearing clearance.

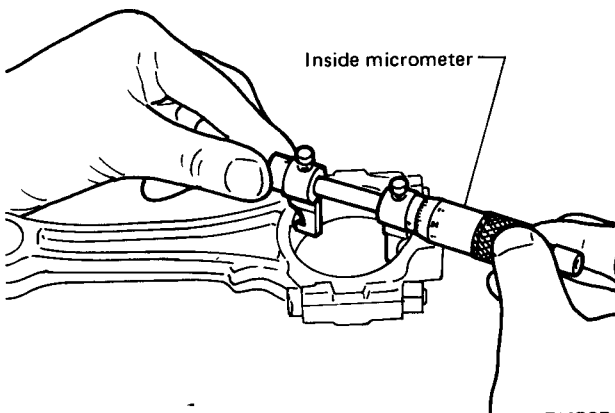
$$\begin{aligned} \text{Main bearing clearance} \\ = A - B \end{aligned}$$

Connecting rod bearing

1. Install connecting rod bearing to connecting rod and cap.
 2. Install connecting rod cap to connecting rod.
- Apply oil to the thread portion of bolts and seating surface of nuts.

 : 44 - 54 N·m
(4.5 - 5.5 kg-m, 33 - 40 ft-lb)

3. Measure inside diameter "C" of bearing.



SEM507A

4. Measure outside diameter "D" of pin journal in crankshaft.

5. Calculate connecting rod bearing clearance.

$$\begin{aligned} \text{Connecting rod bearing clearance} \\ = C - D \end{aligned}$$

CRANKSHAFT INSPECTION

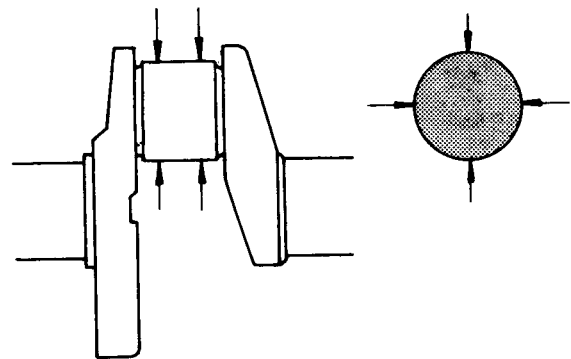
1. Check crankshaft journals for score, bias, wear or cracks. If faults are minor, correct with fine crocus cloth.
2. Check journals with a micrometer for taper and out-of-round.

Out-of-round:

Less than 0.005 mm (0.0002 in)

Taper:

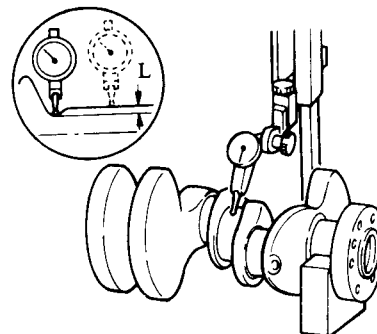
Less than 0.005 mm (0.0002 in)



SEM316A

- a. When regrounding 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)



SEM184A

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

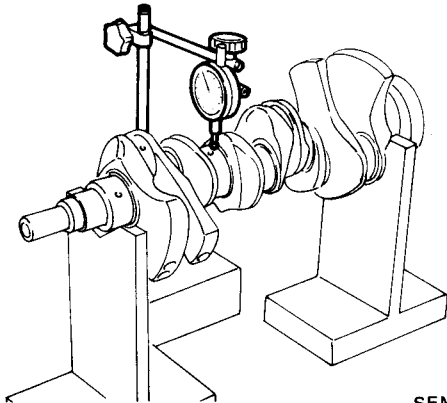
ENGINE OVERHAUL

Inspection (Cont'd)

CRANKSHAFT RUNOUT

Check crankshaft runout.

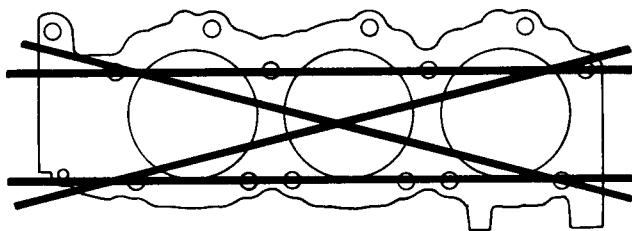
Runout [T.I.R. (Total Indicator Reading)]
Less than 0.10 mm (0.0039 in)



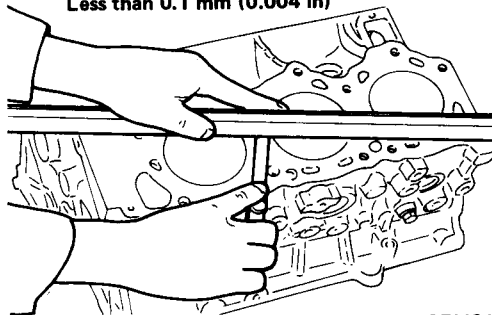
SEM318A

CYLINDER BLOCK DISTORTION AND WEAR

Measuring points



Warpage of surface:
Less than 0.1 mm (0.004 in)



SEM319A

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)

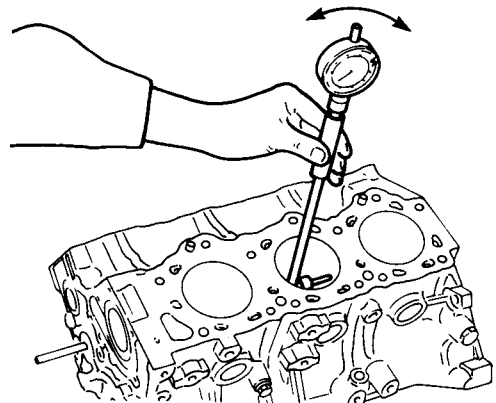
Refer to S.D.S.

Out-of-round limit:

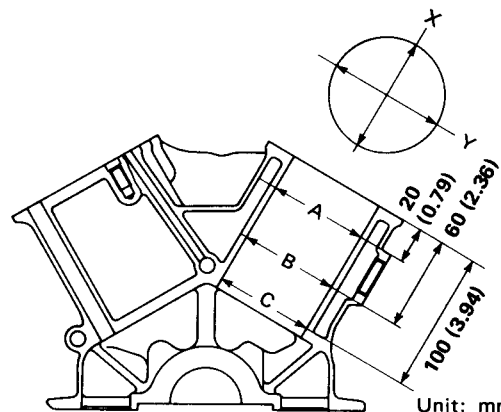
0.015 mm (0.0006 in)

Taper limit:

0.015 mm (0.0006 in)



SEM320A



Unit: mm (in)

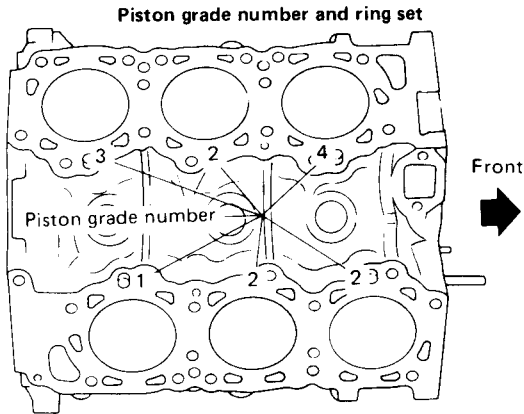
SEM321A

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

ENGINE OVERHAUL

Inspection (Cont'd)

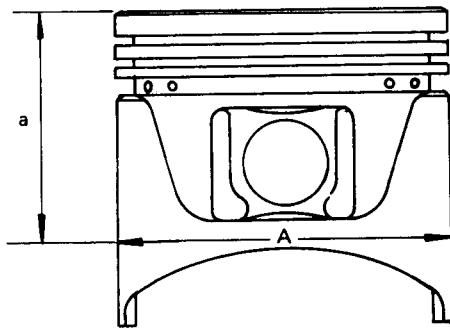
- If either cylinder block or piston is replaced with new one, select the same piston as piston grade number punched on cylinder block upper surfaces.



SEM557A

PISTON TO CYLINDER WALL CLEARANCE

1. Measure piston diameter.



a: 47 mm (1.85 in)

SEM765A

2. Check that piston clearance is within the specification.

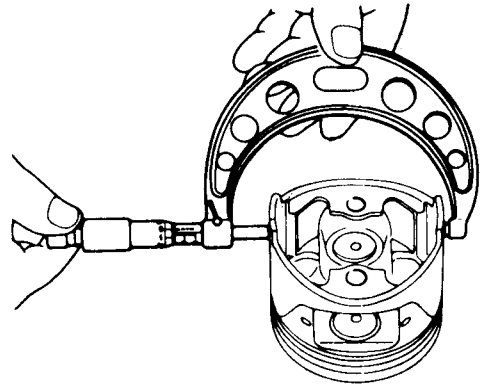
Piston clearance:

0.025 - 0.045 mm (0.0010 - 0.0018 in)

CYLINDER BORING

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

1. Determine piston oversize according to amount of cylinder wear.
Refer to S.D.S.
2. The size to which cylinders must be honed is determined by adding piston-to-cylinder clearance to the piston skirt diameter.



EM126

Rebored size calculation

$$D = A + B - C = A + [0.005 \text{ to } 0.025 \text{ mm} \\ (0.0002 \text{ to } 0.0010 \text{ in})]$$

where,

- D : Bored diameter
- A : Skirt diameter as measured
- B : Piston-to-wall clearance
- C : Honing allowance
0.02 mm (0.0008 in)

3. Install main bearing caps in place, and tighten to the specified torque to prevent distortion of the cylinder bores in final assembly.
4. Cut cylinder bores.
 - Do not cut too much out of the cylinder bore at a time. Cut only 0.05 mm (0.0020 in) or so in diameter at a time.
- 5.hone the cylinders to the required size referring to S.D.S.
6. Measure the finished cylinder bore for out-of-round and taper.

ENGINE OVERHAUL

Inspection (Cont'd)

PISTON-TO-CYLINDER CLEARANCE

(Using feeler gauge)

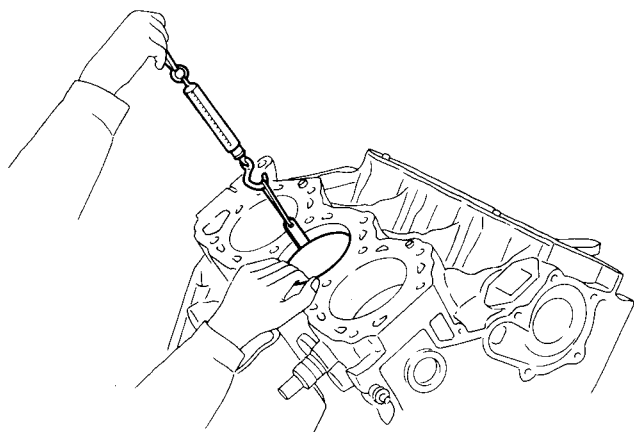
When pulling feeler gauge straight upward, measure the extracting force. It is recommended that piston and cylinder be heated to 20°C (68°F).

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)

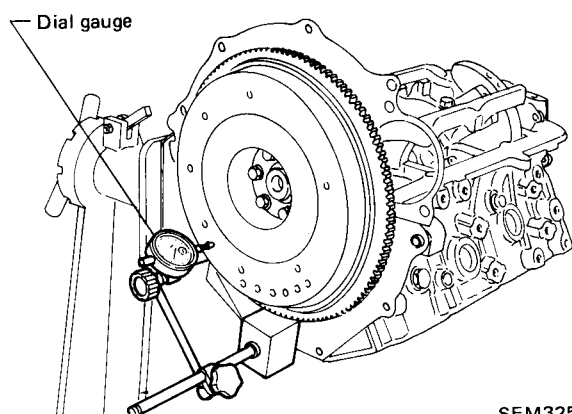


SEM324A

FLYWHEEL RUNOUT

Runout (Total indicator reading):

Less than 0.15 mm (0.0059 in)



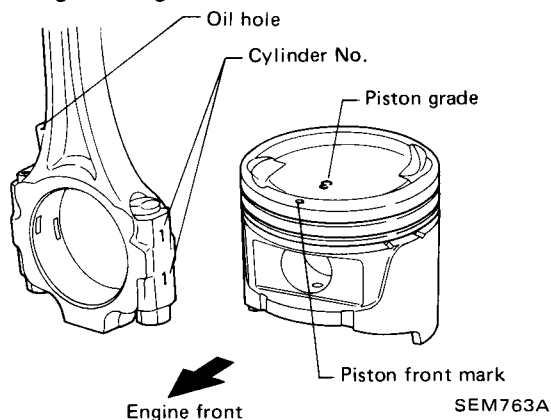
SEM325A

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

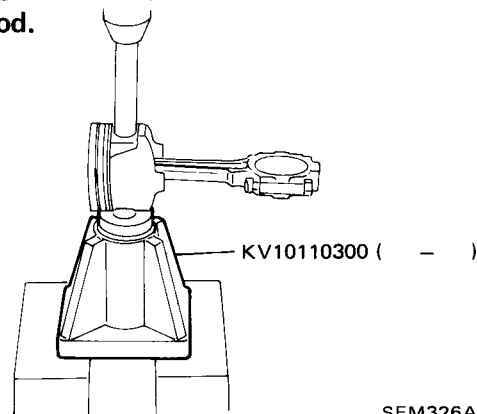
Assembly

PISTON

- 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.

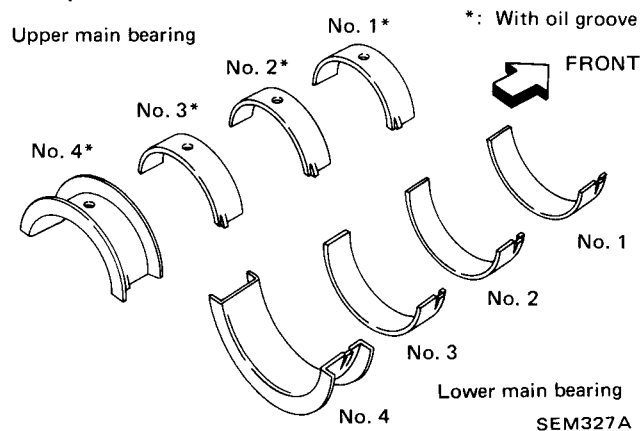


- b. When pressing piston pin in connecting rod, apply engine oil to pin and small end of connecting rod.



CRANKSHAFT

1. Set main bearings in the proper position on cylinder block.



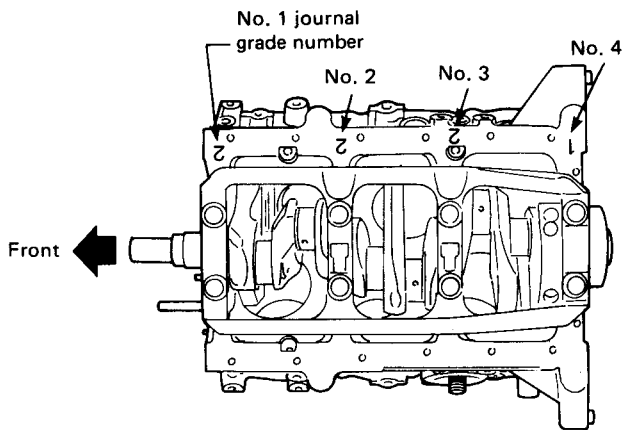
ENGINE OVERHAUL

Assembly (Cont'd)

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

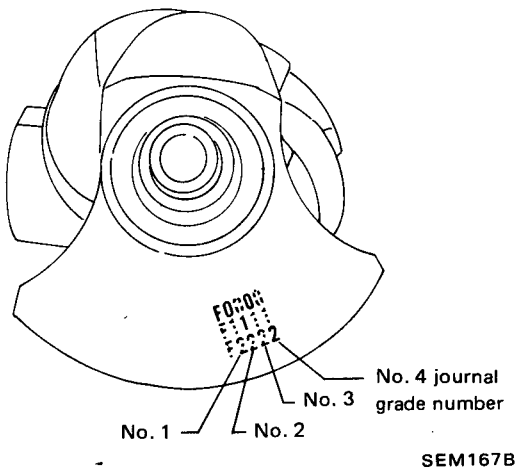
If all of crankshaft, cylinder block and main bearing are replaced with new ones, it is necessary to select thickness of main bearings as follows:

- 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.



SEM167B

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

	Main journal grade number			
	0	1	2	
	Main bearing grade number			
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

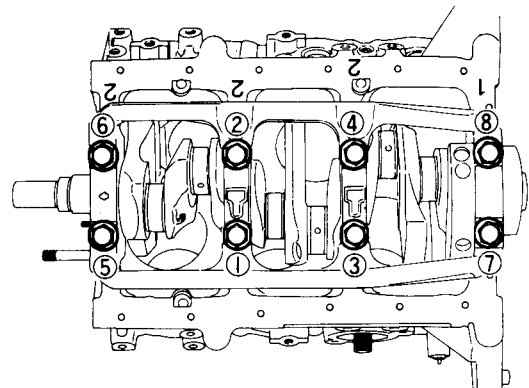
Main bearing:

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

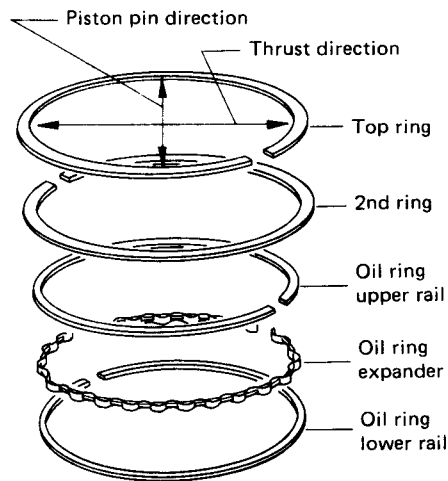
- After securing bearing cap bolts, ascertain that crankshaft turns smoothly by hand.

ENGINE OVERHAUL

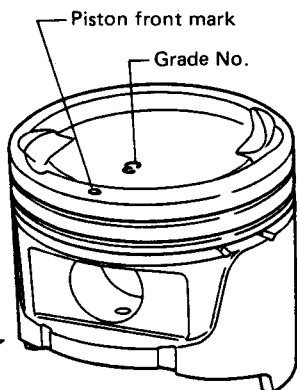
Assembly (Cont'd)

4. Install piston assembly.

Set piston rings as shown below.



SEM180A



Install towards engine front.

SEM764A

5. Measure crankshaft free end play at No. 4 bearing.

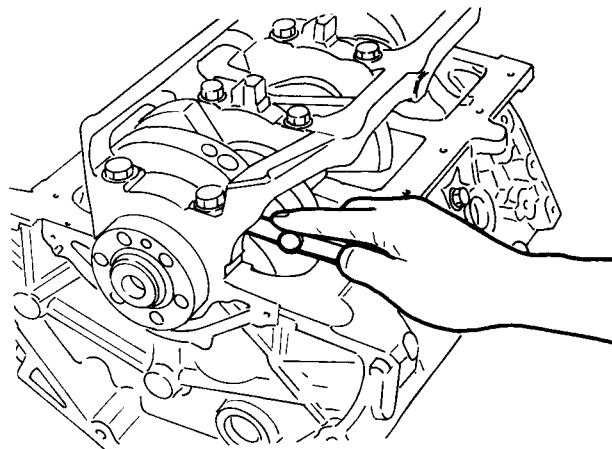
Crankshaft free end play :

Standard

0.05 - 0.17 mm (0.0020 - 0.0067 in)

Limit

0.30 mm (0.0118 in)



SEM511A

6. Measure connecting rod side clearance.

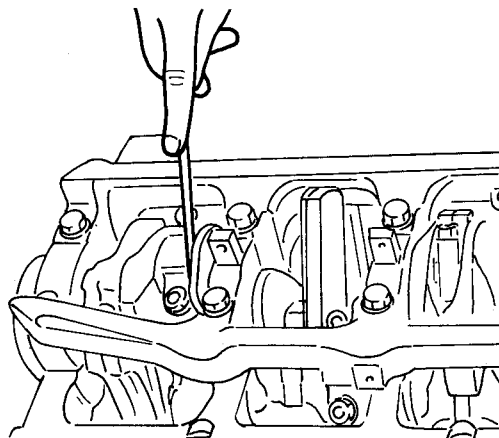
Connecting rod side clearance:

Standard

0.20 - 0.35 mm (0.0079 - 0.0138 in)

Limit

0.40 mm (0.0157 in)



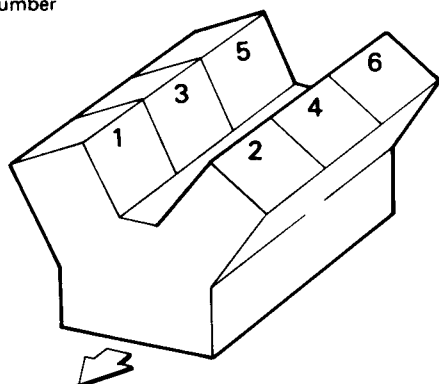
SEM512A

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

General Specifications

Engine		VG30
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

Cylinder number



FRONT

SEM713A

Unit: kPa (kg/cm², psi)/rpm

	Non-turbo	Turbo
Compression pressure		
	Standard	1,196 (12.2, 173) /300
	Minimum	883 (9.0, 128) /300
Differential limit between cylinders	98 (1.0, 14) /300	98 (1.0, 14) /300

Inspection and Adjustment

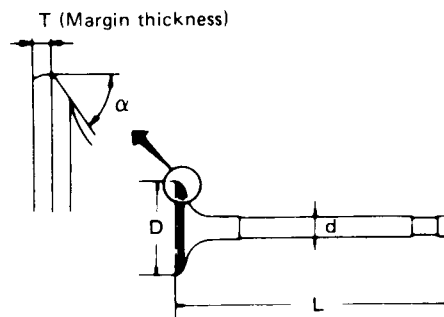
CYLINDER HEAD

Unit: mm (in)

	Standard	Limit
Head surface flatness	Less than 0.05 (0.0020)	0.1 (0.004)

VALVE

Unit: mm (in)



SEM188

Engine		VG30
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 (4.933 - 4.957)
Exhaust		124.2 - 124.8 (4.890 - 4.913)
Valve stem diameter "d"		
Intake		6.965 - 6.980 (0.2742 - 0.2748)
Exhaust		7.965 - 7.970 (0.3136 - 0.3138)
Valve seat angle "α"		
Intake		45° 15' - 45° 45'
Exhaust		
Valve margin "T"		
Intake		1.3 (0.051)
Exhaust		1.5 (0.059)
Valve margin "T" limit		More than 0.5 (0.020)
Valve stem end surface grinding limit		Less than 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	44.1 (1.736)
Pressure height mm/N (mm/kg, in/lb)		Outer	30.0/523.7 (30.0/53.4, 1.181/117.7)
		Inner	25.0/255.0 (25.0/26.0, 0.984/57.3)
Assembled height mm/N (mm/kg, in/lb)		Outer	40.0/250.1 (40.0/25.5, 1.575/56.2)
		Inner	35.0/107.9 (35.0/11.0, 1.378/24.3)
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	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	Intake	7.000 - 7.018 (0.2756 - 0.2763)	
	Exhaust	8.000 - 8.011 (0.3150 - 0.3154)	
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)

Rocker shaft and rocker arm

	Unit: mm (in)
Rocker shaft	
Outer diameter	17.979 - 18.000 (0.7078 - 0.7087)
Rocker arm	
Inner diameter	18.007 - 18.028 (0.7089 - 0.7098)
Clearance between rocker arm and rocker shaft	0.007 - 0.049 (0.0003 - 0.0019)

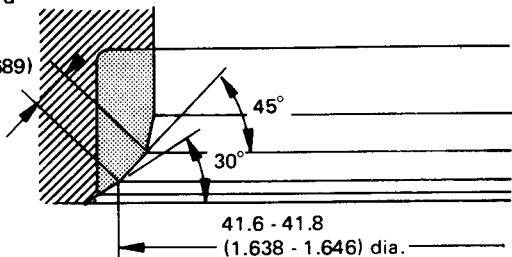
SERVICE DATA AND SPECIFICATIONS (S.D.S.)

Inspection and Adjustment (Cont'd)

Intake valve seat

Standard

1.75
(0.0689)



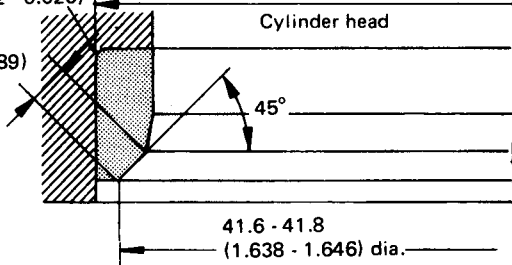
Oversize [0.5 (0.020)]

R0.3 - 0.5
(0.012 - 0.020)

44.500 - 44.516 (1.7520 - 1.7526) dia.

Cylinder head

1.75
(0.0689)



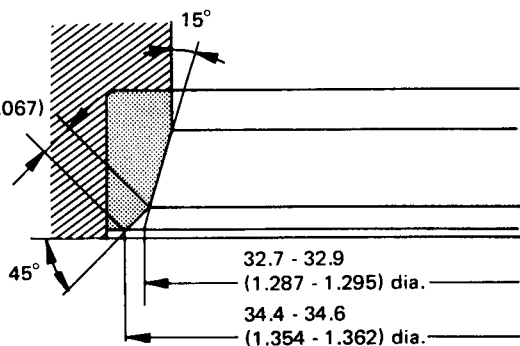
Unit: mm (in)

SEM755A

Exhaust valve seat

Standard

1.7 (0.067)



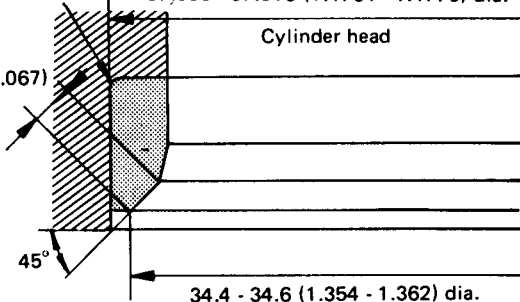
Oversize [0.5 (0.020)]

R0.3 - 0.5
(0.012 - 0.020)

37.500 - 37.516 (1.4764 - 1.4770) dia.

Cylinder head

1.7 (0.067)



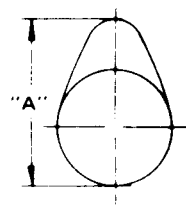
Unit: mm (in)

SEM756A

CAMSHAFT AND CAMSHAFT BEARING

Unit: mm (in)

	Standard	Max. tolerance
Camshaft journal to bearing clearance	0.060 - 0.105 (0.0024 - 0.0041)	0.15 (0.0059)
Inner diameter of camshaft bearing	47.00 - 47.025 (1.8504 - 1.8514)	—
Outer diameter of camshaft journal	46.920 - 46.940 (1.8472 - 1.8480)	—
Camshaft runout [T.I.R*]	Less than 0.04 (0.0016)	0.1 (0.004)
Camshaft end play	0.03 - 0.06 (0.0012 - 0.0024)	—



EM671

Cam height "A"

Intake
Exhaust

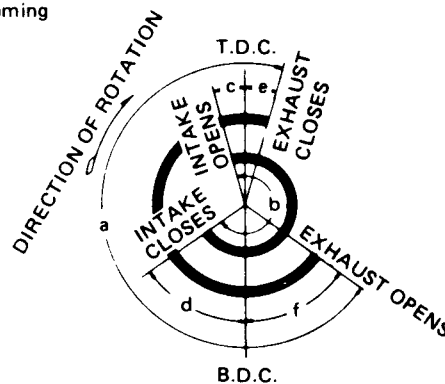
39.537 - 39.725 (1.5566 - 1.5640)

Wear limit of cam height

0.15 (0.0059)

*Total indicator reading

Valve timing



EM120

Unit: degree

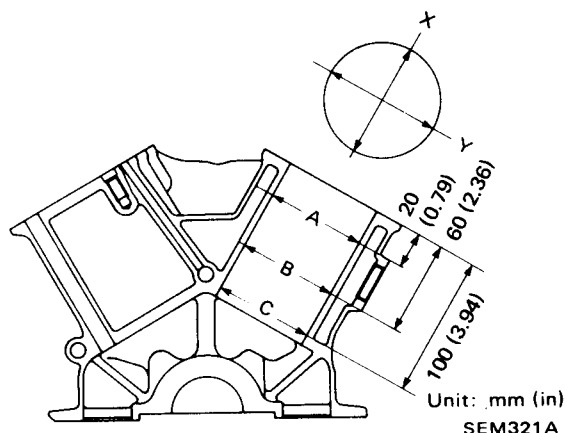
a	b	c	d	e	f
252°	252°	20°	52°	10°	62°

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

Inspection and Adjustment (Cont'd)

CYLINDER BLOCK

Unit: mm (in)

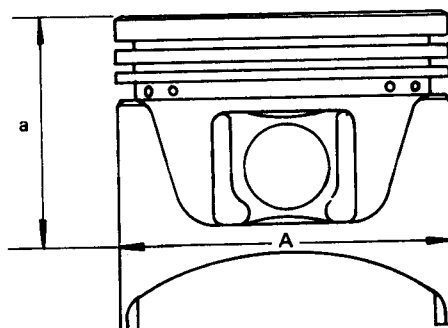


Surface flatness	
Standard	Less than 0.03 (0.0012)
Limit	0.10 (0.0039)
Cylinder bore	
Inner diameter	
Standard	
Grade No. 1	87.000 - 87.010 (3.4252 - 3.4256)
Grade No. 2	87.010 - 87.020 (3.4256 - 3.4260)
Grade No. 3	87.020 - 87.030 (3.4260 - 3.4264)
Grade No. 4	87.030 - 87.040 (3.4264 - 3.4268)
Grade No. 5	87.040 - 87.050 (3.4268 - 3.4272)
0.02 (0.0008)	
oversize (Service)	87.020 - 87.070 (3.4260 - 3.4279)
0.25 (0.0098)	
oversize (Service)	87.250 - 87.300 (3.4350 - 3.4370)
0.50 (0.0197)	
oversize (Service)	87.500 - 87.550 (3.4449 - 3.4468)
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)



SEM765A

Model	Non-turbo	Turbo
Standard		
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)	
Piston skirt diameter "A"		
0.02 (0.0008)		
oversize (Service)	86.985 - 87.035 (3.4246 - 3.4266)	
0.25 (0.0098)		
oversize (Service)	87.215 - 87.265 (3.4337 - 3.4356)	
0.50 (0.0197)		
oversize (Service)	87.465 - 87.515 (3.4435 - 3.4455)	
"a" dimension	47 (1.85)	
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

Unit: mm (in)

	Standard	Limit
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

Unit: mm (in)

Piston pin outer diameter	20.993 - 20.998 (0.8265 - 0.8267)
Piston pin to piston clearance	0.008 - 0.010 (0.0003 - 0.0004)
Interference fit of piston pin to connecting rod	0.022 - 0.040 (0.009 - 0.0016)

CONNECTING ROD

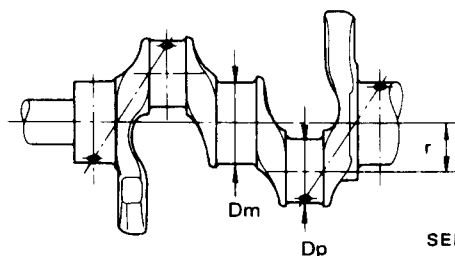
Unit: mm (in)

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	0.40 (0.0157)

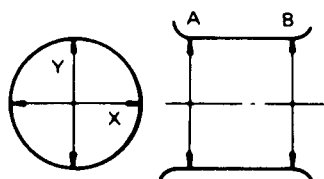
CRANKSHAFT

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"	41.5 (1.634)
Out-of-round (X-Y)	
Standard	Less than 0.005 (0.0002)
Taper (A-B)	
Standard	Less than 0.005 (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)



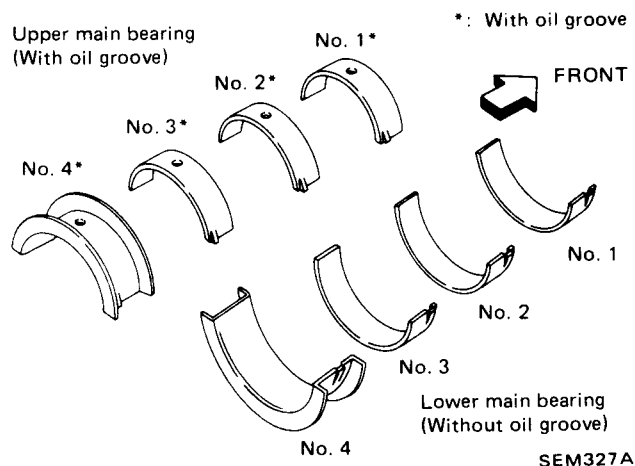
Out-of-round X-Y
Taper A-B



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

Inspection and Adjustment (Cont'd)

AVAILABLE MAIN BEARING



No. 1 main bearing

Grade number	Thickness "T" mm (in)	Width "W" mm (in)	Identification color
0	1.817 - 1.821 (0.0715 - 0.0717)		Black
1	1.821 - 1.825 (0.0717 - 0.0719)		Brown
2	1.825 - 1.829 (0.0719 - 0.0720)	22.5 (0.886)	Green
3	1.829 - 1.833 (0.0720 - 0.0722)		Yellow
4	1.833 - 1.837 (0.0722 - 0.0723)		Blue

No. 2 and 3 main bearing

Grade number	Thickness "T" mm (in)	Width "W" mm (in)	Identification color
0	1.817 - 1.821 (0.0715 - 0.717)		Black
1	1.821 - 1.825 (0.0717 - 0.0719)		Brown
2	1.825 - 1.829 (0.0719 - 0.0720)	19.0 (0.748)	Green
3	1.829 - 1.833 (0.0720 - 0.0722)		Yellow
4	1.833 - 1.837 (0.0722 - 0.723)		Blue

No. 4 main bearing

Grade number	Thickness "T" mm (in)	Identification color
0	1.817 - 1.821 (0.0715 - 0.0717)	Black
1	1.821 - 1.825 (0.0717 - 0.0719)	Brown
2	1.825 - 1.829 (0.0719 - 0.0720)	Green
3	1.829 - 1.833 (0.0720 - 0.0722)	Yellow
4	1.833 - 1.837 (0.0722 - 0.0723)	Blue

Main bearing 0.25 mm (0.0098 in) undersize

Unit: mm (in)

Thickness "T"	1.943 - 1.956 (0.0765 - 0.0770)
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SERVICE DATA AND SPECIFICATIONS (S.D.S.)

Inspection and Adjustment (Cont'd)

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 0.028 - 0.055 (0.0011 - 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 - 23	1.8 - 2.3	13 - 17
Intake relief valve	29 - 39	3.0 - 4.0	22 - 29
Intake manifold bolt	Refer to page EM-22.		
Intake manifold nut			
Injector holder	2.5 - 3.2	0.25 - 0.33	1.8 - 2.4
Cylinder head temperature sensor	12 - 16	1.2 - 1.6	9 - 12
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
Crankshaft 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	4.9 - 6.2	0.5 - 0.63	3.6 - 4.6
Alternator adjusting bar bolt	14 - 17	1.4 - 1.7	10 - 12
Air regulator	4.9 - 6.2	0.5 - 0.63	3.6 - 4.6

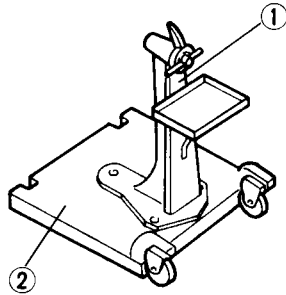
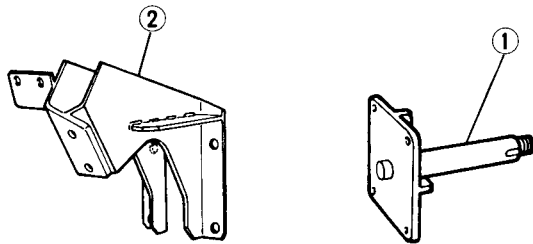
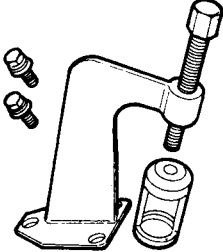
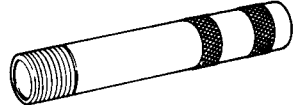
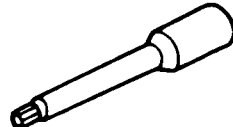
Engine parts

	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	Refer to pages EM-20 and 21.		
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 pump regulator valve	39 - 49	4.0 - 5.0	29 - 36
Oil pump securing bolts	6 - 7	0.6 - 0.7	4.3 - 5.1
	12 - 16	1.2 - 1.6	9 - 12
Oil strainer	16 - 21	1.6 - 2.1	12 - 15
Oil strainer bracket	6 - 8	0.6 - 0.8	4.3 - 5.8
Flywheel	98 - 108	10 - 11	72 - 80
Rear oil seal retainer	6 - 7	0.6 - 0.7	4.3 - 5.1
Connecting rod	44 - 54	4.5 - 5.5	33 - 40
Main bearing cap	90 - 100	9.2 - 10.2	67 - 74
Water drain connector	34 - 44	3.5 - 4.5	25 - 33
Water drain plug	22 - 27	2.2 - 2.8	16 - 20
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
Water inlet tube	31 - 41		
Water outlet tube			
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 (J33986)	Valve spring compressor 
KV10107501 (-)	Valve oil seal drift 
ST10120000 (J24239-01)	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 The diagram illustrates the components of the Piston pin press stand assembly. It includes a central press stand (3) with a threaded top. A cap (1) is shown with a spring (4) inside it. A spacer (2) is a small ring. A drift (5) is a long, thin rod. A center shaft (6) is a longer rod with a flange at one end. The components are numbered 1 through 6, corresponding to the list on the left.