

**DATSUN 200SX
MODEL S10 SERIES**

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THANKS MKLOTZ70**



**NISSAN MOTOR CO., LTD.
TOKYO, JAPAN**

SECTION EM

EM

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GENERAL DESCRIPTION

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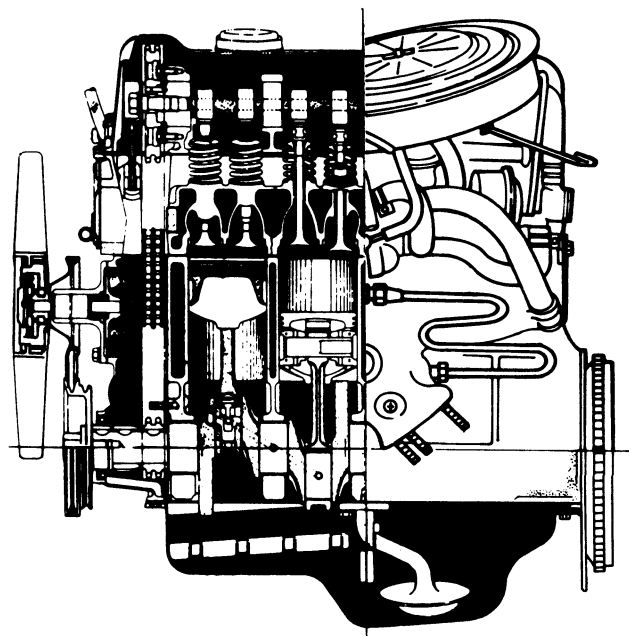
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MODEL L20B ENGINE

The L20B engine features O.H.C. valves, wedge-shaped combustion chamber, aluminum head and a fully balanced 5-bearing crankshaft to turn

out smooth, dependable power.

The cylinder block is cast as a single unit, and features deep skirting. This engine is equipped with a single, 2-barrel downdraft carburetor that incorporates a special device to control emissions. See Fig. EM-1.



EM664

Fig. EM-1 Cross Sectional View

Main specifications

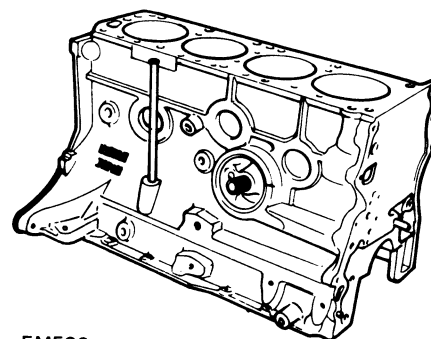
		L20B
Displacement	cc (cu in)	1,952 (119.1)
Bore x stroke	mm (in)	85 x 86 (3.35 x 3.39)
Compression ratio		8.5
Ignition timing Degree B.T.D.C./rpm	M/T	12/600 in "Neutral" position
	A/T	12/600 in "D" position

M/T: Manual Transmission A/T: Automatic Transmission

CYLINDER BLOCK

The cylinder block, a monoblock special casting structure, employs a five-bearing-support system for quietness and higher durability.

The cylinder bores are surrounded by cooling jackets and machined directly in the block. The oil ways in the block are arranged so that the full-flow oil filter is directly attached to the right hand side of the block.



EM536

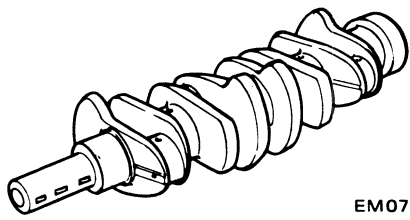
Fig. EM-2 Cylinder Block

CRANKSHAFT

The crankshaft is a special steel forging. Fully balanced, it turns out smooth, dependable power at high speed.

The L20B engine uses eight balance weights.

Main bearings are lubricated by oil pumped through the main oil gallery and the oil holes which run in parallel with cylinder bores. There are oilways drilled in the crankshaft for the lubricating oil. The center main bearing is equipped with thrust washers to take up end thrust of the crankshaft.



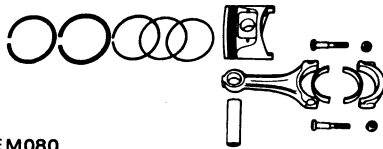
EM079

Fig. EM-3 Crankshaft

PISTON AND CONNECTING ROD

The pistons are of a special aluminum casting and have struts to control thermal expansion, two compression rings and one combined oil ring. The piston heads are slightly dished. The piston pins are a special hollow steel shaft. They are full-floating fit to the piston and press fit to the connecting rods.

The connecting rods are of a special forged steel. Oil is sprayed to the connecting rod small ends through drilled passages in the large ends of rod. Oil holes in the connecting rods are located so as to insure optimum lubrication under heavy load.

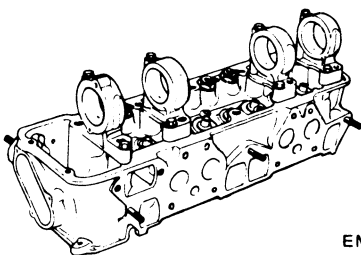


EM080

Fig. EM-4 Piston and Connecting Rod

CYLINDER HEAD

The cylinder head is made of a light, strong aluminum alloy with good cooling efficiency; it contains wedge type combustion chambers. A special aluminum bronze valve seat is used on the intake valve, while a heat resistant steel valve seat is installed on the exhaust valve. These parts are all hot press-fitted.



EM407

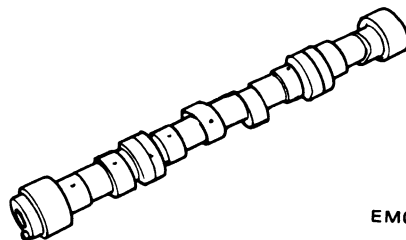
Fig. EM-5 Cylinder Head

CAMSHAFT

The camshaft is made of a special cast iron and is located inside the rocker cover. Four aluminum alloy brackets support it. Camshaft bearings are lubricated from oil holes which lead to the main oil gallery of the cylinder head.

Concentric passages are drilled in the front and rear parts of the camshaft.

Oil to each cam lobe is supplied through an oil hole drilled in the base circle of each lobe. Lubricant is supplied to the front oil gallery from the 2nd camshaft bearing and to the rear oil gallery from the 3rd camshaft bearing. These holes on the base circle of the lobe supply lubricant to the cam pad surface of the rocker arm and to the valve tip end. The cams feature a long-overlap profile to reduce NOx emission.



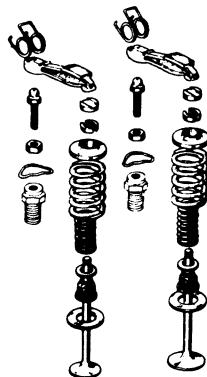
EM082

Fig. EM-6 Camshaft

VALVE MECHANISM

The valve system has the pivot type rocker arms that are activated directly by the cam mechanism; this has made its moving parts considerably lighter and provides ideal high speed performance.

Dual type valve springs are installed.

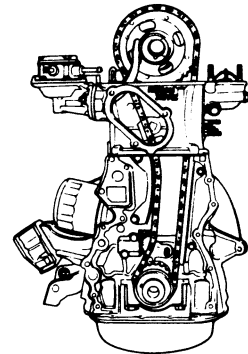


Exhaust Intake EM084

Fig. EM-7 Valve Mechanism

CAMSHAFT DRIVE

The camshaft is driven by a double row roller chain driven by the crankshaft. The tension of the chain is controlled by a chain tensioner which is operated by spring and oil pressure. The rubber shoe type tensioner damps vibration of the chain and controls its tension.



EM537

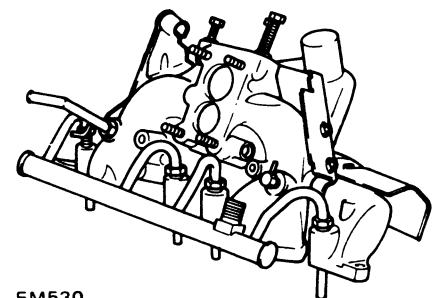
Fig. EM-8 Chain Driving System

MANIFOLDS

The intake manifold is made of cast aluminum alloy. Coolant from the cylinder head passes through the riser portion of the intake manifold, heating this portion and returns to the water pump.

The exhaust manifold is made of cast iron. No. 1/No. 4 and No. 2/No. 3 cylinders are grouped together.

The semi-dual system which combines exhaust gas flow at the point of exhaust pipe connection produces good exhausting efficiency.



EM530

Fig. EM-9 Intake and Exhaust Manifolds

ENGINE DISASSEMBLY

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PRELIMINARY CLEANING AND INSPECTION

Before disassembling engine, note the following:

1. Fuel, oil or water may leak past cylinder head and block. Prior to disassembling, check cylinder head, front chain cover, oil pan and oil filter gaskets and crankshaft and water pump seals for signs of leakage past their gasketed surfaces.
2. Check carburetor and fuel pump for condition; fuel hoses for deterioration, cracks or leakage of fuel past their jointed or connected surfaces.
3. Remove carburetor air cleaner.
 - (1) Disconnect hot air duct from air cleaner.
 - (2) Disconnect air cleaner-to-air pump hose at air cleaner.
 - (3) Disconnect air cleaner-to-rocker cover hose at rocker cover.
 - (4) Disconnect air cleaner-to-C.A.C. valve hose at air cleaner (for California).
 - (5) Disconnect air cleaner-to-A.B. valve hose at air cleaner.
 - (6) Disconnect air cleaner-to-related part vacuum hoses at air cleaner.
 - (7) Loosen air cleaner band bolt and remove carburetor air cleaner assembly from carburetor.
4. Plug up carburetor air-horn to prevent entry of foreign matter.
5. Remove alternator drive belt, alternator and alternator bracket.
6. Remove air pump drive belt, cooler compressor and idler pulley (if so equipped).
7. Remove starter motor from transmission.
8. Visually inspect cylinder head, cylinder block, rocker cover, front chain cover, oil pan and all other outer parts for oil, water and fuel leaks,

breakage or missing parts such as bolts and nuts.

9. Check piping and electrical circuits for deterioration, breakage, fittings, discontinuity or insulation.

DISASSEMBLY

To remove engine from car, refer to the instructions under the "Engine Removal and Installation" (ER) section.

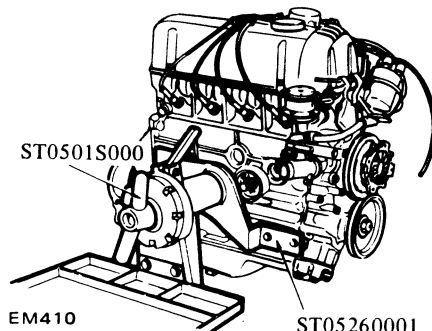
1. Remove transmission from engine.
2. Remove clutch assembly from flywheel.
3. Thoroughly drain engine oil and coolant by removing drain plugs.

Store engine oil and coolant, if they are to be used again.

4. Place engine assembly on engine stand.
 - (1) Remove cooling fan.
 - (2) Remove right engine mounting bracket.
 - (3) Remove oil filter with Oil Filter Wrench ST19320000.
 - (4) Remove oil pressure switch.
 - (5) Install engine attachment to cylinder block utilizing bolt holes in alternator bracket and water drain hole.
 - (6) Set engine on stand.

"Engine Attachment
ST05260001"

"Engine Stand
ST0501S000"

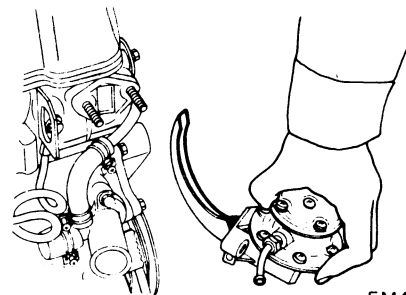


EM410

ST05260001

Fig. EM-10 Engine on Engine Stand

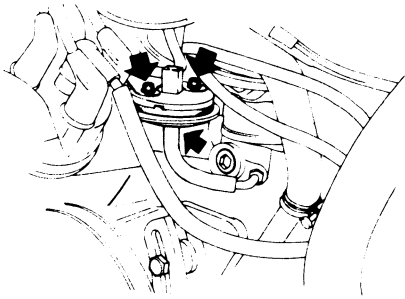
5. Remove oil level gauge.
6. Remove carburetor from intake manifold.
 - (1) Disconnect cylinder block-to-P.C.V. valve hose at P.C.V. valve.
 - (2) Disconnect A.B. valve-to-E.G.R. passage hose at E.G.R. passage.
 - (3) Disconnect vacuum tube-to-carburetor hoses at vacuum tube.
 - (4) Disconnect fuel hose from carburetor.
 - (5) Remove dash pot bracket from intake manifold (if so equipped).
 - (6) Remove carburetor attaching nuts and remove carburetor assembly and gasket.
7. Disconnect distributor high tension cables from spark plugs.
8. Disconnect vacuum hose from distributor and remove distributor assembly.
9. Disconnect fuel hose from fuel pump and remove fuel and vacuum hoses (combined) from cylinder head.
10. Remove fuel pump assembly from cylinder head.



EM412

Fig. EM-11 Removing Fuel Pump

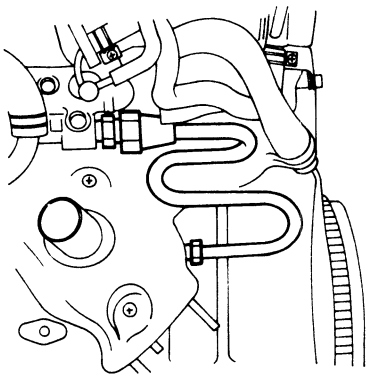
11. Remove intake and exhaust manifolds from cylinder head.
 - (1) Disconnect vacuum hose from B.P.T. valve and remove B.P.T. valve from air cleaner bracket.



EC082A

Fig. EM-12 Removing B.P.T. Valve

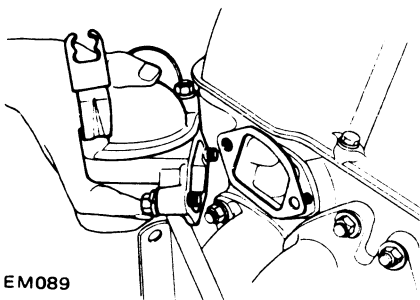
- (2) Remove carburetor air cleaner bracket.
- (3) Disconnect vacuum hose from E.G.R. valve.
- (4) Remove check valve from air gallery pipe.
- (5) Disconnect E.G.R. tube from E.G.R. passage and exhaust manifold.
- (6) Remove E.G.R. passage and E.G.R. valve from intake manifold.



EM661

Fig. EM-13 Removing E.G.R. Tube and Passage

- (7) Disconnect vacuum hoses from thermal vacuum valve and remove thermostat housing and gasket from cylinder head.

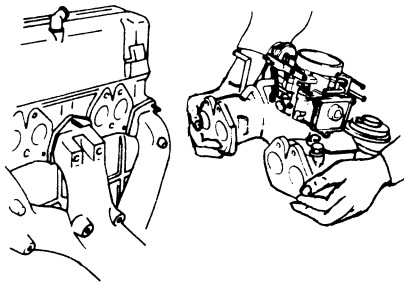


EM089

Fig. EM-14 Removing Thermostat Housing

- (8) Remove cylinder block-to-P.C.V. valve hose (blow-by gas hose) from cylinder block.

- (9) Remove manifold attaching bolts and remove intake manifold and gasket from cylinder head.



EM662

Fig. EM-15 Removing Intake Manifold

- (10) Remove air gallery pipes from exhaust manifold.

- (11) Remove exhaust manifold attaching nuts and remove exhaust manifold.

12. Remove left engine mounting bracket from cylinder block.

13. Remove air pump and cooler compressor bracket.

14. Remove crankshaft pulley locking bolt and washer and then remove pulley with a two-jaw puller.

15. Remove water pump assembly.

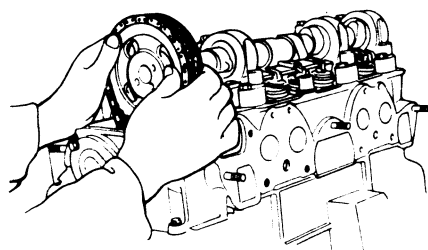
16. Remove rocker cover.

17. Remove spark plugs.

18. Remove fuel pump drive cam.

19. Remove camshaft sprocket.

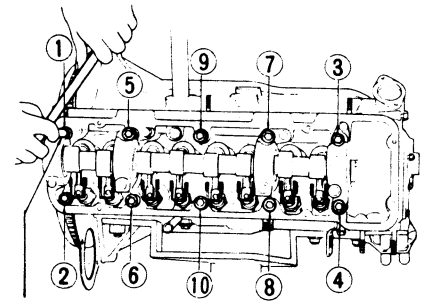
Refer to the following note during operation when removing camshaft sprocket from engine installed on car.



EM091

Fig. EM-16 Removing Camshaft Sprocket

20. Remove cylinder head assembly. Use Cylinder Head Bolt Wrench ST10120000 to remove cylinder head bolts. Loosen bolts from ① to ⑩ as shown in Fig. EM-17.



ST10120000

EM092

Fig. EM-17 Cylinder Head Bolt Loosening Sequence

Note: When removing cylinder head from engine installed on car, follow the instructions below.

- a. Turn crankshaft until No. 1 piston is at T.D.C. on its compression stroke.

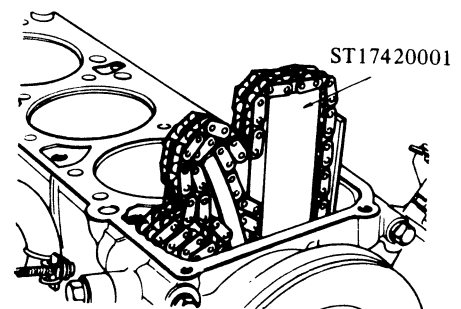
- b. Remove rocker cover and fuel pump.

- c. To facilitate assembling operation, scribe a mark on timing chain and camshaft sprocket with paint before removal.

- d. Loosen camshaft bolt and remove fuel pump drive cam.

- e. Support timing chain by utilizing Chain Stopper ST17420001 between timing chains as shown in Fig. EM-18.

This operation eliminates the problem of realigning timing marks on timing chain and crankshaft sprocket.



ST17420001

EM538

Fig. EM-18 Supporting Timing Chain

- f. Remove camshaft sprocket.

- g. Loosen cylinder head bolts and remove cylinder head.

Engine Mechanical

21. Invert engine.
22. Remove oil pan and oil strainer.
23. Remove oil pump and its drive spindle.

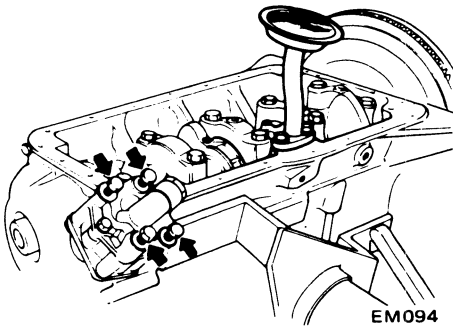


Fig. EM-19 Removing Oil Strainer and Oil Pump

28. Remove piston and connecting rod assembly. Extract connecting rod bearings, keeping them in order.

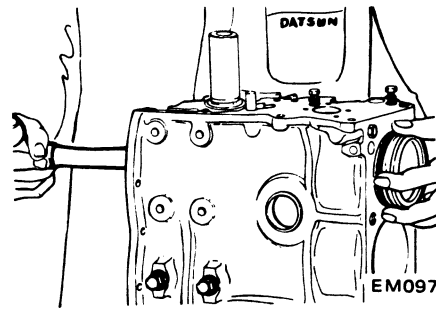


Fig. EM-22 Removing Piston and Connecting Rod Assembly

29. Remove flywheel and rear plate. Be careful not to drop them.

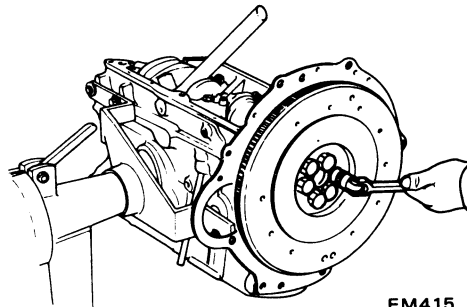


Fig. EM-23 Removing Flywheel

30. Remove main bearing caps.
Use Crankshaft Main Bearing Cap Puller KV101041S0 to remove center and rear main bearing caps. Keep them in order.

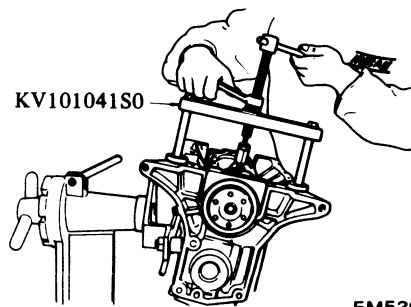


Fig. EM-24 Removing Rear Main Bearing Cap

31. Remove two side seals from rear main bearing cap.
32. Remove rear oil seal.

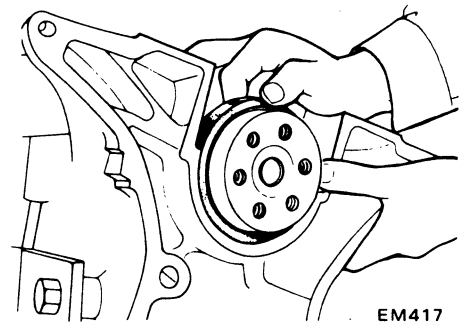


Fig. EM-25 Removing Rear Oil Seal

33. Remove crankshaft.
34. Remove baffle plate and cylinder block net.

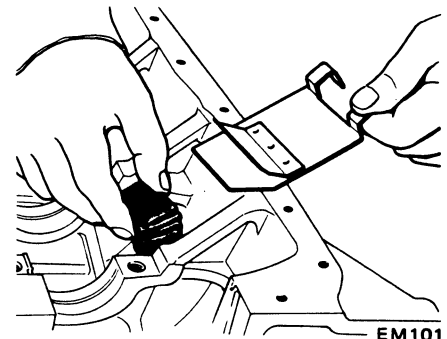


Fig. EM-26 Removing Baffle Plate and Net

24. Remove front cover.
25. Remove chain tensioner and chain slack side guide.
26. Remove timing chain.

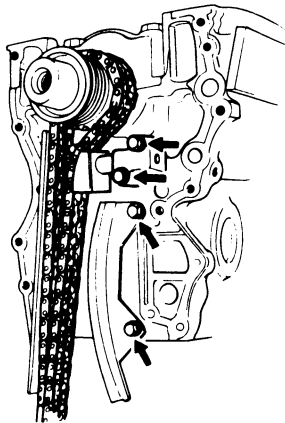


Fig. EM-20 Removing Chain Tensioner and Timing Chain

27. Remove oil thrower, crankshaft worm gear and chain drive sprocket.

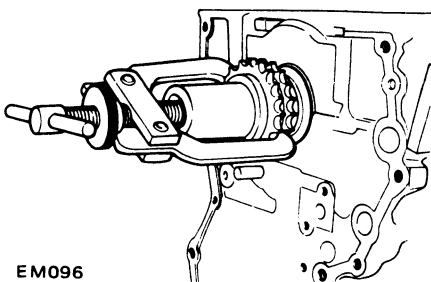


Fig. EM-21 Removing Chain Drive Sprocket

PISTONS AND CONNECTING RODS

1. Remove piston rings with a ring remover.

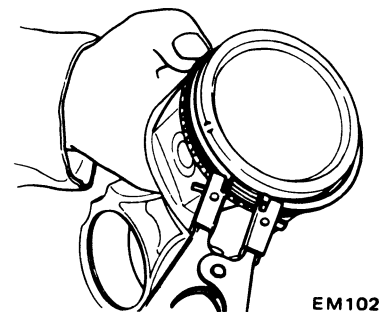
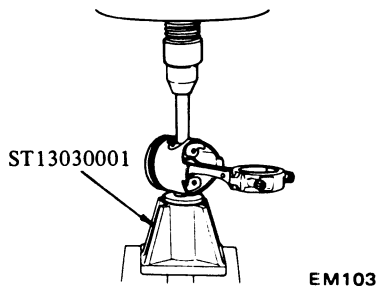


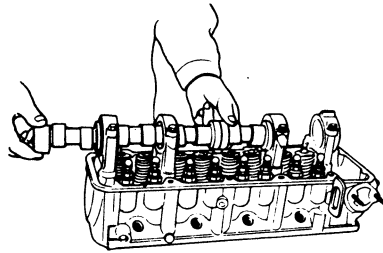
Fig. EM-27 Removing Piston Rings

2. Press piston pin out with Piston Pin Press Stand ST13030001.

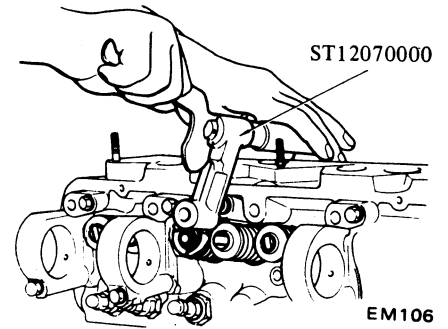


EM103
Fig. EM-28 Removing Piston Pin

- Remove locate plate, and remove camshaft.



EM105
Fig. EM-30 Removing Camshaft

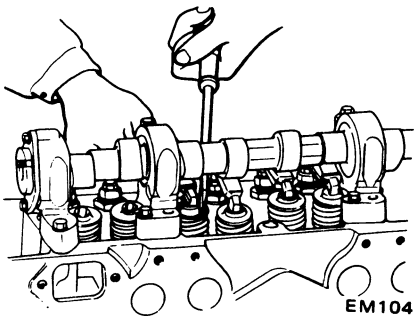


EM106
Fig. EM-31 Removing Valves

- Keep disassembled parts in order.

CYLINDER HEAD

- Remove valve rocker springs. Loosen valve rocker pivot lock nut and remove rocker arm by pressing valve spring down.



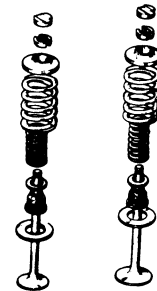
EM104
Fig. EM-29 Removing Rocker Arms

CAUTION:
Be careful not to damage camshaft bearings and cam lobes.

- Remove valves using Valve Lifter ST12070000.

Note:

- Take care not to lose valve spring seat, oil seal, valve collet, and valve rocker guide.
- Be sure to keep camshaft bearings intact, or the bearing center is liable to come out of alignment.



Exhaust Intake EM107
Fig. EM-32 Valve Components

INSPECTION AND REPAIR

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PREPARATION FOR INSPECTION

1. Before cleaning, check for signs of water and oil leaks in cylinder block and head.
2. Clean oil, carbon deposits and sealant from all parts. Remove gasket.
3. Clean all oil holes with solvent and dry with compressed air. Make sure that they are not restricted.

CAUTION:

Never remove camshaft bearings unless you have a suitable machine for boring camshaft bearing in line. If you once remove camshaft bearings, bearing centers will come out of alignment; re-conditioning is very difficult without center borings.

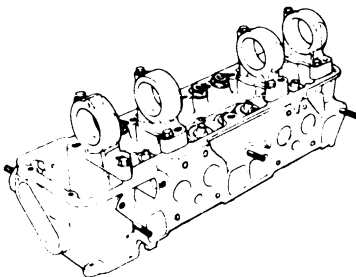
1. Make a visual check for cracks and flaws.
2. Measure the surface of cylinder head (on cylinder block side) for warpage. If it is found to be beyond the limit designated below, regrind the affected surface with a surface grinder.

Head surface flatness

Standard	Maximum
less than 0.05 mm (0.0020 in)	0.1 mm (0.004 in)

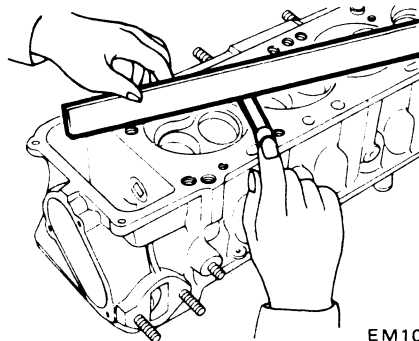
CYLINDER HEAD AND VALVE

CHECKING CYLINDER HEAD MATING FACE



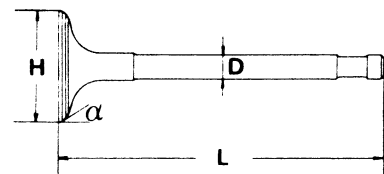
EM407

Fig. EM-33 Cylinder Head



EM108

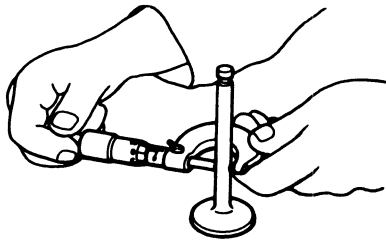
Fig. EM-34 Checking Cylinder Head Surface



EM109

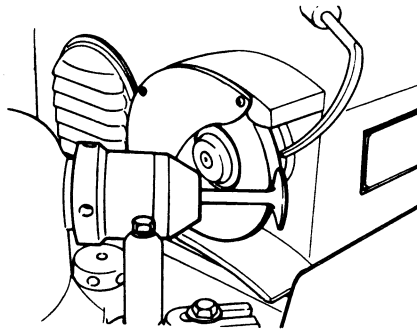
Fig. EM-35 Intake and Exhaust Valve Dimensions

H	Valve head diameter mm (in)	In.	42.0 to 42.2 (1.654 to 1.661)
		Ex.	35.0 to 35.2 (1.378 to 1.386)
L	Valve length mm (in)	In.	114.9 to 115.2 (4.52 to 4.54)
		Ex.	115.7 to 116.0 (4.56 to 4.57)
D	Valve stem diameter mm (in)	In.	7.965 to 7.980 (0.3136 to 0.3142)
		Ex.	7.945 to 7.960 (0.3128 to 0.3134)
α	Valve face angle Intake and Exhaust	In.	45°30'
		Ex.	45°30'



EM110

Fig. EM-36 Checking Valve Stem Diameter



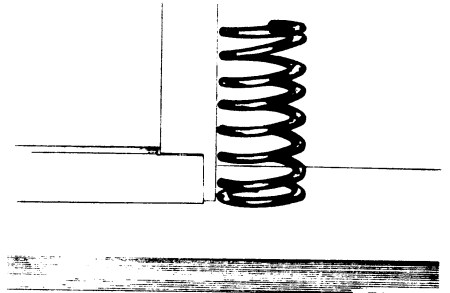
EM111

Fig. EM-37 Regrinding Valve Face

Note: When valve head has been worn down to 0.5 mm (0.020 in) in thickness, replace the valve.
Grinding allowance for valve stem end surface is 0.5 mm (0.020 in) or less.

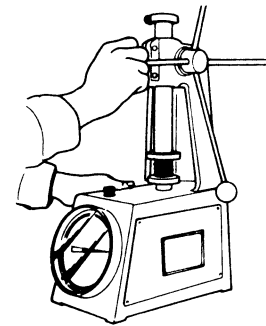
VALVE SPRING

1. Check valve spring for squareness using a steel square and surface plate. If spring is out of square more than 1.6 mm (0.063 in), replace.
2. Measure the free length and tension of each spring. If the measured value exceeds specified limit, replace spring.



EM112

Fig. EM-38 Measuring Spring Squareness



EM113

Fig. EM-39 Measuring Spring Tension

Spring specifications

Valve spring free length	mm (in)	
Intake and exhaust		
Outer		49.98 (1.9677)
Inner		44.85 (1.7657)
Valve spring pressured length (valve open)	mm/kg (in/lb)	
Intake and exhaust		
Outer		29.5/49.0 (1.161/108.0)
Inner		24.5/25.5 (0.965/56.2)
Valve spring assembled height (valve close)	mm/kg (in/lb)	
Intake and exhaust		
Outer		40.0/21.3 (1.575/47.0)
Inner		35.0/12.3 (1.378/27.1)

ROCKER ARM AND VALVE ROCKER PIVOT

Check pivot head and cam contact and pivot contact surfaces of rocker arm for damage or wear. If damage is found, replace them. A faulty pivot must be replaced together with its corresponding rocker arm.

VALVE GUIDE

Measure clearance between valve guide and valve stem. If clearance exceeds designated limit, replace worn parts or both valve and valve guide. In this case, it is essential to determine if such a clearance has been caused by a worn or bent valve stem or by a worn valve guide.

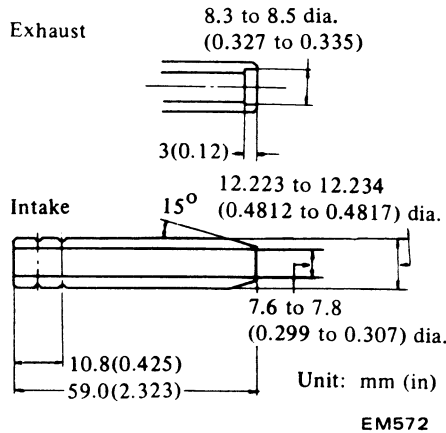


Fig. EM-40 Service Valve Guide

	Intake valve	Exhaust valve
Stem to guide clearance mm (in)	0.020 to 0.053 (0.0008 to 0.0021)	0.040 to 0.073 (0.0016 to 0.0029)
Maximum limit of above clearance mm (in)	0.10 (0.0039)	

As an emergency expedient, a valve can be pushed into valve guide and moved to the right and left. If its tip deflects about 0.2 mm (0.008 in) or more, it indicates that the clearance between stem and guide exceeds the maximum limit of 0.10 mm (0.0039 in).

Note: Valve should be moved in parallel with rocker arm. (Generally, a large amount of wear occurs in this direction.)

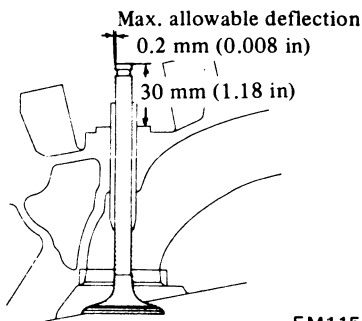


Fig. EM-41 Measuring Clearance between Valve Stem and Valve Guide

Replacement of valve guide

1. To remove old guides, use a drift and a press (under a 2-ton pressure) or a hammer.

Drive them out from combustion chamber side toward rocker cover. Heated cylinder head will facilitate the operation.

2. Ream cylinder head side guide hole at room temperature.

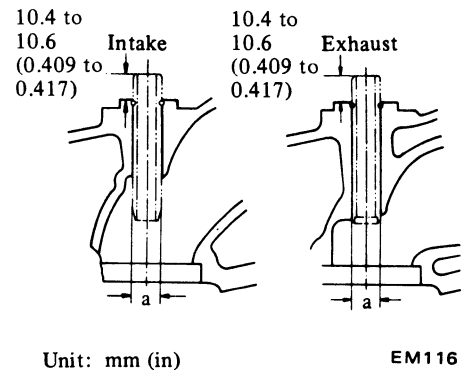


Fig. EM-42 Valve Guide Hole

Guide hole inner diameter "a" mm (in)	For factory standard valve guide	11.985 to 11.996 (0.4718 to 0.4723)
	For service valve guide	12.185 to 12.196 (0.4797 to 0.4802)

3. Carefully press new valve guide into valve so that it will fit smoothly after heating cylinder head to 150 to 200°C (302 to 392°F).

Valve guide of 0.2 mm (0.008 in) oversize diameter is available for service as indicated above.

Interference fit of valve guide to guide hole:

0.027 to 0.049 mm
(0.0011 to 0.0019 in)

Reaming bore:

8.000 to 8.018 mm
(0.3150 to 0.3157 in)

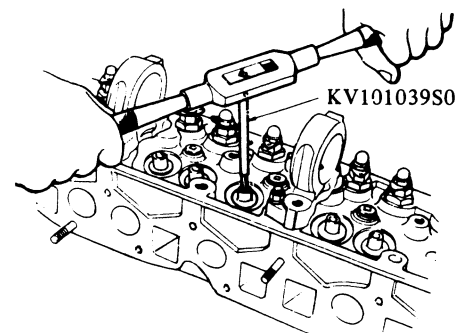


Fig. EM-43 Removing Valve Guide

4. Ream bore with valve guide pressed in, using Valve Guide Reamer Set KV101039S0.

5. Correct valve seat surface with new valve guide as the axis.

VALVE SEAT INSERTS

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

Valve seat insert of 0.5 mm (0.020 in) oversize is available for service as shown below.

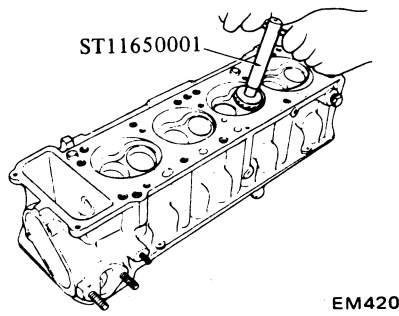


Fig. EM-44 Correcting Valve Seat

Replacing valve seat insert

1. Old insert can be removed by boring it out until it collapses. The machine depth stop should be set so that boring cannot continue beyond the bottom face of the insert recess in cylinder head.
2. Select a suitable valve seat insert and check its outside diameter.
3. Machine cylinder head recess to the concentric circles in valve guide center so that insert will have the correct fit.
4. Heat cylinder head to a temperature of 150 to 200°C (302 to 392°F).
5. Fit insert ensuring that it beds on the bottom face of its recess, and caulk more than 4 points.
6. Newly fitted valve seats should be cut or ground at the specified dimensions as shown in Fig. EM-46.
7. Apply small amount of fine grinding compound to valve contacting face and put valve into guide. Lap valve against its seat until proper valve seating is obtained. Remove valve and then clean valve and valve seat.

Intake	
Unit: mm (in)	EM573
Exhaust	
Unit: mm (in)	

Fig. EM-45 Service Valve Seat Dimensions

Cylinder head recess diameter

Unit: mm (in)

Intake	For factory standard insert	45.000 to 45.016 (1.7717 to 1.7723)
	For service insert	45.500 to 45.516 (1.7913 to 1.7920)
Exhaust	For factory standard insert	37.000 to 37.016 (1.4567 to 1.4573)
	For service insert	37.500 to 37.516 (1.4764 to 1.4770)

Interference fit mm (in)	Intake	0.081 to 0.113 (0.0032 to 0.0044)
	Exhaust	0.064 to 0.096 (0.0025 to 0.0038)

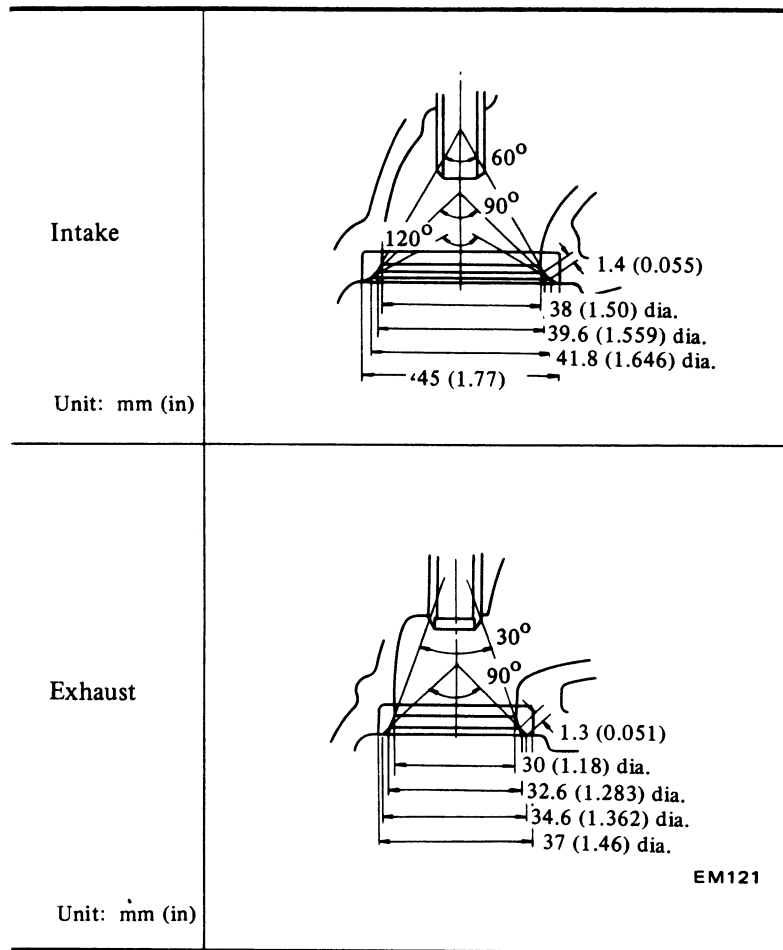
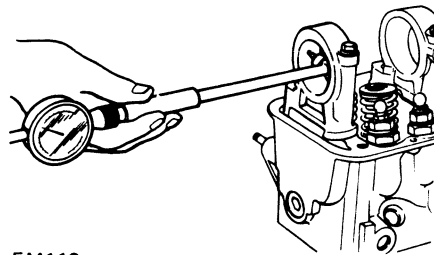


Fig. EM-46 Standard Valve Seat Dimensions

CAMSHAFT AND CAMSHAFT BEARING

CAMSHAFT BEARING CLEARANCE

Measure inside diameter of camshaft bearing with an inside dial gauge and outside diameter of camshaft journal with a micrometer. If wear is found inside of bracket, replace cylinder head assembly.



EM119

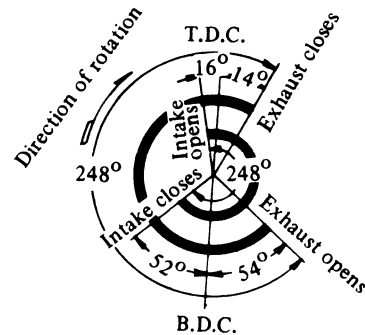
Fig. EM-47 Checking Camshaft Bearing

Camshaft journal to bearing clearance

	Standard	Wear limit
Oil clearance mm (in)	0.038 to 0.067 (0.0015 to 0.0026)	0.10 (0.0039)
Inner diameter of camshaft bearing mm (in)	48.000 to 48.016 (1.8898 to 1.8904)	—

VALVE TIMING

This diagram applies to all cylinders. If any valve is found out of specifications, one possibility is that cam lobe is worn or damaged. This calls for replacement of camshaft.



EM421

Fig. EM-48 Valve Timing Diagram

	Standard	Bend limit
Camshaft bend mm (in)	0.02 (0.0008)	0.05 (0.0020)

CAMSHAFT ALIGNMENT

1. Check camshaft, camshaft journal and cam surface for bend, wear or damage. If damage is beyond limits, replace affected parts.
2. A bend value is one-half of the reading obtained when camshaft is turned one full revolution with a dial gauge applied to 2nd and 3rd journals.

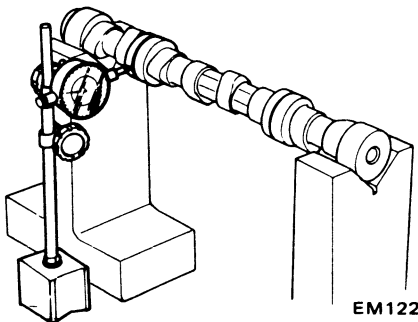


Fig. EM-49 Checking Camshaft Bend

Standard height of cam mm (in)	Intake	40.30 to 40.35 (1.5866 to 1.5886)
	Exhaust	
Wear limit of cam height	mm (in)	0.25 (0.0098)
Allowable difference in diameter between max. worn and min. worn parts of camshaft journal	mm (in)	0.05 (0.0020)
Maximum tolerance in journal diameter	mm (in)	0.10 (0.0039)
Camshaft end play	mm (in)	0.08 to 0.38 (0.0031 to 0.0150)

CYLINDER BLOCK

1. Visually check cylinder block for cracks or flaws.
2. Measure top of cylinder block (cylinder head mating face) for warpage. If warpage exceeds limits, correct it.

Note: Surface grinding limit:

Grinding limit of cylinder block can be determined by cylinder head grinding in an engine.

Depth of cylinder head grinding is "Hh".

Depth of cylinder block grinding is "Hb".

The limit is as follows:

$$Hh + Hb = 0.20 \text{ mm (0.0079 in)}$$

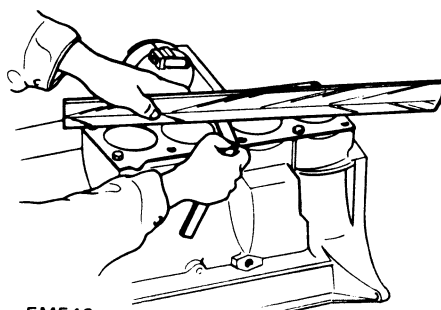


Fig. EM-50 Checking Cylinder Block Surface

	Standard	Maximum tolerance
Surface flatness mm (in)	less than 0.05 (0.0020)	0.10 (0.0039)

3. Using a bore gauge, measure cylinder bore for out-of-round or taper. If out-of-round or taper is excessive, re-bore cylinder walls with a boring machine. Measurement should be taken along bores for taper and around bores for out-of-round.

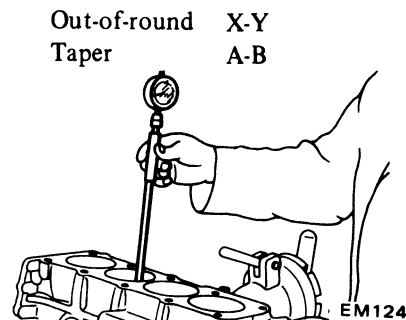


Fig. EM-51 Measuring Cylinder Bore Diameter

4. When wear, taper or out-of-round is minor and within limits, remove step at topmost portion of cylinder using a ridge reamer or other similar tool.

HOW TO MEASURE CYLINDER BORE

A bore gauge is used. Measure cylinder bore at top, middle and bottom positions toward A and B directions as shown in Fig. EM-52 and record the measured values.

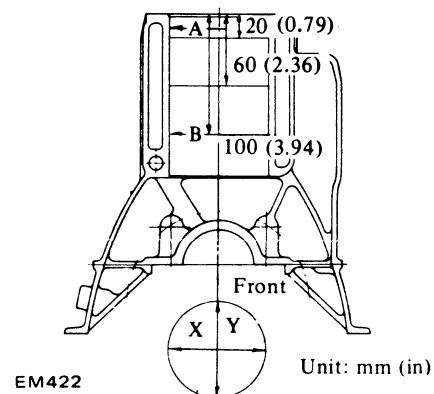


Fig. EM-52 Cylinder Bore Measuring Positions

		Standard	Wear limit
Cylinder bore mm (in)	Inner diameter	85.000 to 85.050 (3.3465 to 3.3484)	0.20 (0.0079)
	Out-of-round	0.015 (0.0006)	/
	Taper	0.015 (0.0006)	
Difference in cylinder bore mm (in)		0.05 (0.0020)	0.20 (0.0079)

CYLINDER BORING

1. When any cylinder needs boring, all other cylinders must also be bored at the same time.
2. Determine piston oversize according to amount of wear of cylinder.

Oversize pistons specifications

Piston diameter mm (in)	
Service standard	84.985 to 85.035 (3.3459 to 3.3478)
0.50 (0.0197) Oversize	85.465 to 85.515 (3.3648 to 3.3667)
1.00 (0.0394) oversize	85.965 to 86.015 (3.3844 to 3.3864)

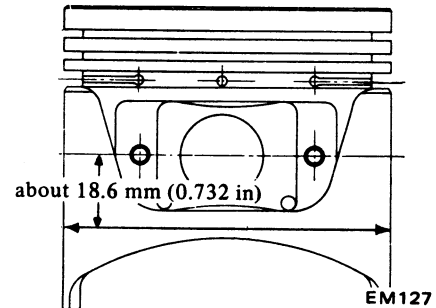


Fig. EM-54 Measuring Piston Skirt Diameter

Rebored size calculation

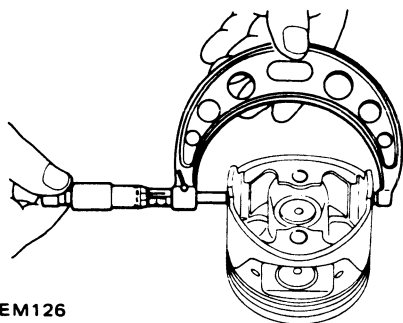
$$D = A + B - C = A + [0.005 \text{ to } 0.025 \text{ mm (0.0002 to 0.0010 in)}]$$

where,

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

3. The size to which cylinders must be honed is determined by adding piston-to-cylinder clearance to the largest piston diameter (at piston skirt in thrust direction).

Standard clearance	mm (in)	0.025 to 0.045 (0.0010 to 0.0018)
Feeler gauge	mm (in)	0.04 (0.0016)
Extracting force	kg (lb)	0.2 to 1.5 (0.44 to 3.31)



EM126

Fig. EM-53 Measuring Piston Diameter

CAUTION:

- a. To prevent strain due to cutting heat, bore the cylinders in the order of 2-4-1-3.
- b. Before boring any cylinder, install main bearing caps in place and tighten to the specification so that the crankshaft bearing bores will not become distorted from the boring operation.

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

5. Measurement of a just machined cylinder bore requires utmost care since it is expanded by cutting heat.
6. As a final step, cylinders should be honed to size.
7. Measure the finished cylinder bore for out-of-round or tapered part.
8. Measure piston-to-cylinder clearance.

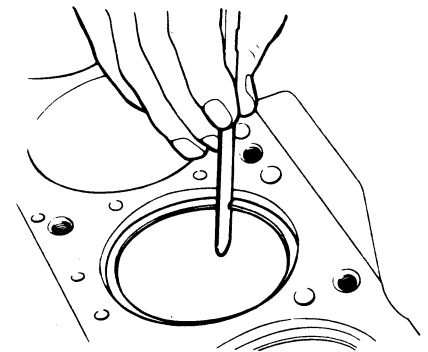
This clearance can be checked easily by using a feeler gauge and a spring balance hooked on feeler gauge, measuring the amount of force required to pull gauge out from between piston and cylinder.

Note:

- a. When measuring clearance, slowly pull feeler gauge straight upward.
- b. It is recommended that piston and cylinder be heated to 20°C (68°F).

**PISTONS,
PISTON PINS AND
PISTON RINGS**

1. Remove carbon from piston and ring grooves with a carbon scraper and a curved steel wire. Clean out oil slots in bottom land of oil ring groove.
2. Check for damage, scratches and wear. Replace if necessary.
3. Measure side clearance of rings in ring grooves as each ring is installed. Side clearance should be as follows.



EM542

Fig. EM-57 Measuring Ring Gap

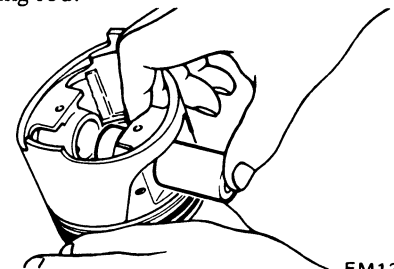
Note:

- a. When piston ring only is to be replaced, without cylinder bore being corrected, measure gap at bottom of cylinder where wear is minor.
- b. Oversize piston rings are available for service.

Oversize:

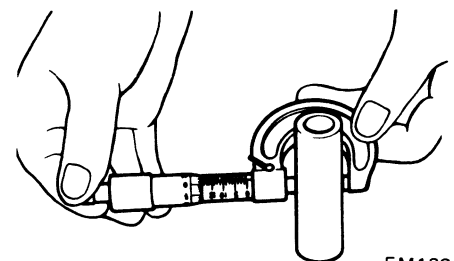
- 0.5 mm (0.020 in) and
- 1.0 mm (0.039 in)

5. Measure piston pin hole in relation to outer diameter of pin. If wear exceeds limit, replace each piston pin together with the piston on which it is installed.
6. Determine the fitting of piston pin into piston pin hole to such an extent that it can be finger pressed at room temperature. This piston pin must be a tight press fit into connecting rod.



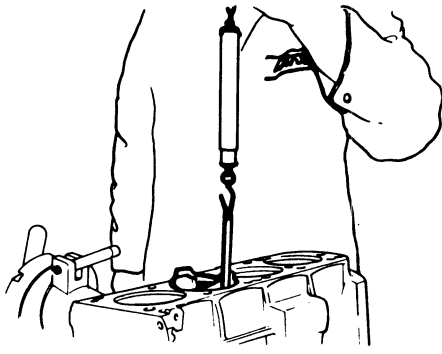
EM131

Fig. EM-58 Piston Pin Fitting



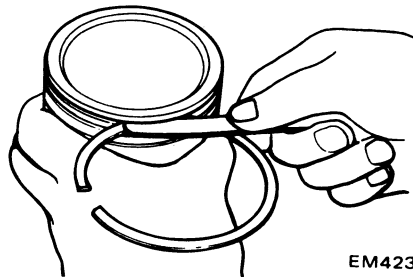
EM132

Fig. EM-59 Measuring Piston Pin Diameter



EM541

Fig. EM-55 Measuring Piston Fit in Cylinder



EM423

Fig. EM-56 Measuring Piston Ring Side Clearance

Side clearance

Unit: mm (in)

	Standard	Wear limit
Top ring	0.040 to 0.073 (0.0016 to 0.0029)	0.10 (0.0039)
Second ring	0.030 to 0.070 (0.0012 to 0.0028)	
Oil ring	—	—

4. Push ring into cylinder with piston so as to place it squarely in cylinder; measure ring gap with a

feeler gauge.

Ring should be placed to diameter at upper or lower limit of ring travel.

Ring gap

Unit: mm (in)

	Standard	Wear limit
Top ring	0.25 to 0.40 (0.0098 to 0.0157)	1.00 (0.0394)
Second ring	0.30 to 0.50 (0.0118 to 0.0197)	
Oil ring	0.30 to 0.90 (0.0118 to 0.0354)	

Unit: mm (in)

Piston pin outside diameter	20.993 to 20.998 (0.8265 to 0.8267)
Piston pin hole diameter	21.001 to 21.008 (0.8268 to 0.8271)
Piston pin to piston clearance	0.003 to 0.015 (0.0001 to 0.0006)
Interference fit of piston pin to connecting rod	0.015 to 0.035 (0.0006 to 0.0014)

CRANKSHAFT

1. Whenever crankshaft is removed from engine, it should be cleaned thoroughly in a suitable solvent. After cleaning, check crankshaft journal and crank pin for score, bias wear or cracks. Repair or replace as required. If damage is minor, dress with fine crocus cloth.

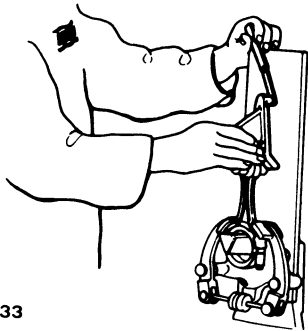
2. Check journals and crank pins for taper and out-of-round with a micrometer. Measurement should be taken along journals for taper and around journals for out-of-round. See Figure EM-62 for detailed information.

If journals or crank pins are tapered or out-of-round beyond limits, replace with a new shaft.

CONNECTING ROD

1. If a connecting rod has any flaw on either side of the thrust face or the large end, correct or replace it.

2. Check connecting rod for bend or torsion using a connecting rod aligner. If bend or torsion exceeds the limit, correct or replace.



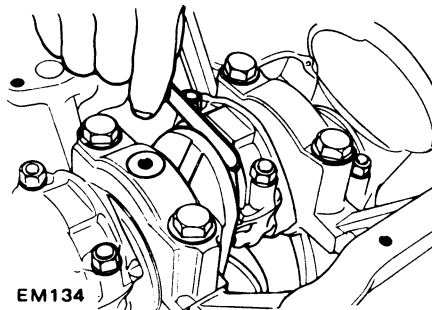
EM133

Fig. EM-60 Checking Rod Alignment

	Standard	Maximum
Connecting rod bend or torsion (per 100 mm or 3.94 in length) mm (in)	0.03 (0.0012)	0.05 (0.0020)

3. When replacing connecting rod, select rod so that weight difference between new and old ones is within 7 gr (0.25 oz).

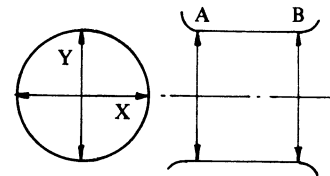
4. Install connecting rods with bearings on to corresponding crank pins and measure thrust clearance. If measured value exceeds limit, replace.



EM134

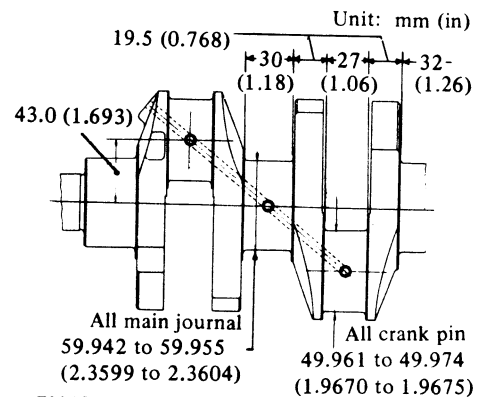
Fig. EM-61 Checking Big End Play

	Standard	Maximum
Big end play mm (in)	0.2 to 0.3 (0.008 to 0.012)	0.6 (0.024)



Out-of-round
Taper

X-Y
A-B



EM424

Fig. EM-62 Crankshaft and Journal Dimensions

	Standard	Maximum
Taper and out-of-round of journal and crank pin mm (in)	less than 0.01 (0.0004)	0.025 (0.0010)

3. Crankshaft bend can be checked by placing it on V-blocks and using a dial gauge with its indicating finger resting on center journal.

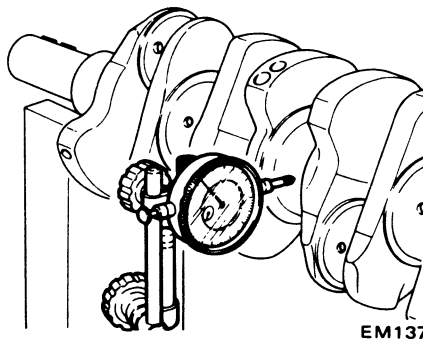


Fig. EM-63 Checking Crankshaft Bend

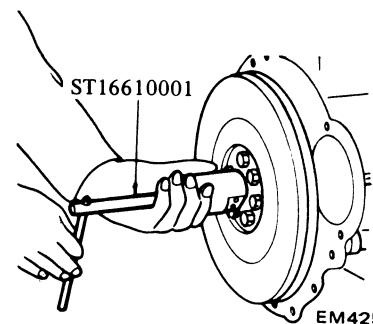


Fig. EM-65 Pulling Out Pilot Bushing

(2) Before installing a new bushing, thoroughly clean bushing hole. Press fit bushing so that its height above flange end is 4.5 to 5.0 mm (0.177 to 0.197 in). Do not oil bushing.

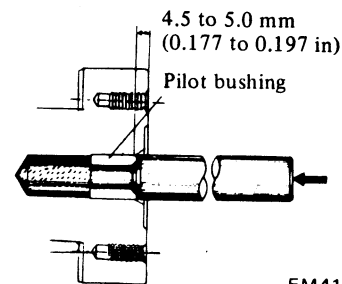


Fig. EM-66 Press-Fitting New Pilot Bushing

	Standard	Maximum
Crankshaft bend mm (in)	less than 0.05 (0.0020)	0.10 (0.0039)

Note: When measuring bend, use a dial gauge. Bend value is half of the reading obtained when crankshaft is turned one full revolution with a dial gauge attached to its center journal.

4. After regrinding crankshaft, finish it to the necessary size indicated on page EM-18 by using an adequate undersize bearing according to the extent of required repair.

5. Install crankshaft in cylinder block and measure crankshaft free end play.

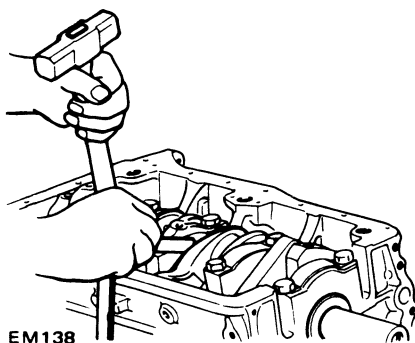


Fig. EM-64 Checking Crankshaft End Play

BUSHING AND BEARING

MEASUREMENT OF MAIN BEARING CLEARANCE

1. Thoroughly clean all bearings and check for scratches, melting score or wear.

Replace bearings if any fault is detected.

2. Crankshaft journals and bearings should be clean and free from dust and dirt before oil clearance is measured.

3. Set main bearing on cap block.

4. Cut a plastigage to width of bearing and place it in parallel with crank pin, getting clear of the oil hole. Install cap on the assembly and tighten them together to the specified torque.

Ⓣ **Tightening torque:**

Main bearing cap

4.5 to 5.5 kg-m

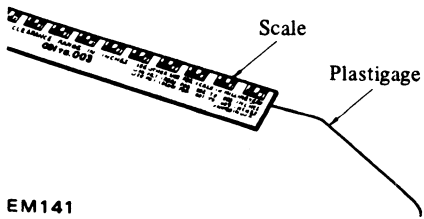
(33 to 40 ft-lb)

	Standard	Wear limit
Crankshaft free end play mm (in)	0.05 to 0.18 (0.0020 to 0.0071)	0.30 (0.0118)

6. At the rear end of crankshaft, check crankshaft pilot bushing for wear or damage. Replace it if any fault is detected.

To replace crankshaft rear pilot bushing, proceed as follows:

(1) Pull out bushing using Pilot Bushing Puller ST16610001.



EM141

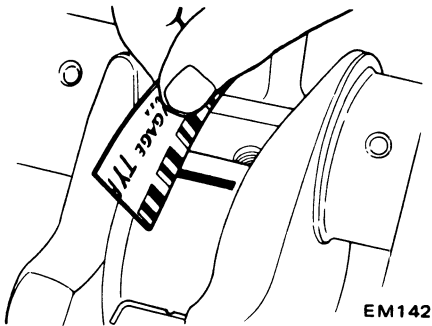
Fig. EM-67 Plastigage

Bearing oil clearance

	Standard	Wear limit
Main bearing clearance mm (in)	0.020 to 0.062 (0.0008 to 0.0024)	0.12 (0.0047)
Connecting rod bearing clearance mm (in)	0.025 to 0.055 (0.0010 to 0.0022)	0.12 (0.0047)

Note: Do not turn crankshaft while plastigage is being inserted.

5. Remove cap, and compare width of the plastigage at its widest part with the scale printed in plastigage envelope.



EM142

Fig. EM-68 Measuring Bearing Clearance

MEASUREMENT OF CONNECTING ROD BEARING CLEARANCE

1. Measure connecting rod bearing clearance in the same manner as above.

Ⓣ Tightening torque:

Main bearing cap

4.5 to 5.5 kg-m
(33 to 40 ft-lb)

2. If clearance exceeds specified value, replace bearing with an undersize bearing and grind crankshaft journal adequately.

Main bearing undersize

Unit: mm (in)

	Bearing top thickness	Crank journal diameter
STD	1.827 to 1.835 (0.0719 to 0.0722)	59.942 to 59.955 (2.3599 to 2.3604)
0.25 (0.0098) Undersize	1.952 to 1.960 (0.0769 to 0.0772)	59.692 to 59.705 (2.3501 to 2.3506)
0.50 (0.0197) Undersize	2.077 to 2.085 (0.0818 to 0.0821)	59.442 to 59.455 (2.3402 to 2.3407)
0.75 (0.0295) Undersize	2.202 to 2.210 (0.0867 to 0.0870)	59.192 to 59.205 (2.3304 to 2.3309)

Connecting rod bearing undersize

Unit: mm (in)

	Bearing top thickness	Crank pin diameter
STD	1.493 to 1.506 (0.0588 to 0.0593)	49.961 to 49.974 (1.9670 to 1.9675)
0.25 (0.0098) Undersize	1.618 to 1.631 (0.0637 to 0.0642)	49.711 to 49.724 (1.9571 to 1.9576)
0.50 (0.0197) Undersize	1.743 to 1.756 (0.0686 to 0.0691)	49.461 to 49.474 (1.9473 to 1.9478)
0.75 (0.0295) Undersize	1.868 to 1.881 (0.0735 to 0.0741)	49.211 to 49.224 (1.9374 to 1.9379)

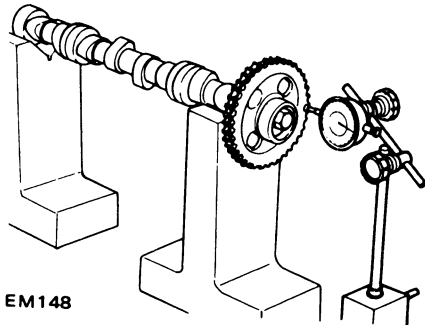
MISCELLANEOUS COMPONENTS

CRANKSHAFT AND CAMSHAFT SPROCKETS

1. Check tooth surface for flaws or wear. Replace sprocket if fault is found.
2. Install camshaft sprocket in position and check for runout. If it exceeds 0.10 mm (0.0039 in) total indicator reading, replace camshaft sprocket. Also check for end play.

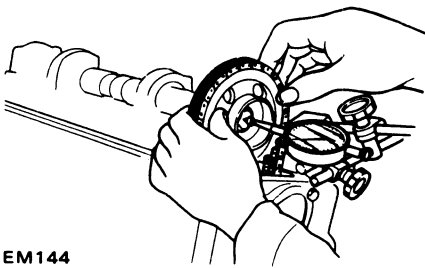
Camshaft end play:

**0.08 to 0.38 mm
(0.0032 to 0.0150 in)**



EM148

Fig. EM-69 Checking Camshaft Sprocket Runout



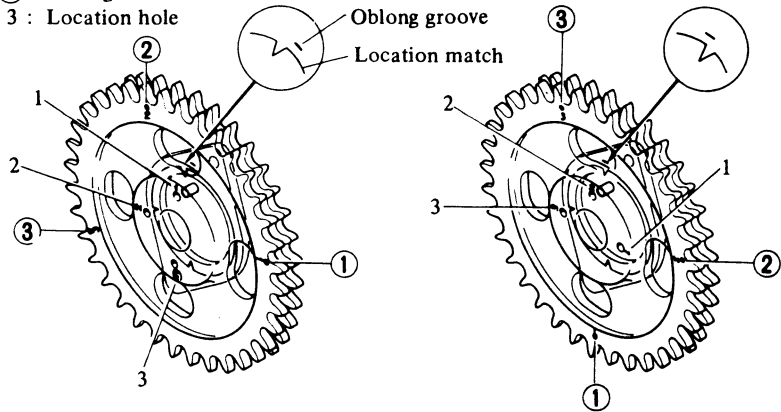
EM144

Fig. EM-70 Checking Camshaft End Play

3. Check chain for damage, excessive wear or stretch at roller links. Replace if faulty.
4. To properly adjust chain tension (or valve timing), camshaft sprocket has a cam locating plate and three location holes (Nos. 1, 2 and 3).

Camshaft sprocket is preset at No. 2 hole at the factory. If chain becomes loose, adjust it by setting camshaft sprocket at No. 3 hole.

- ① to ③: Timing mark
1 to 3: Location hole



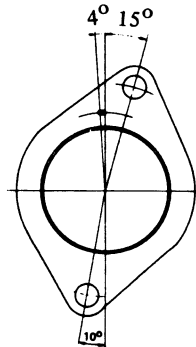
Before adjustment

After adjustment

EM311

Fig. EM-71 Adjusting Camshaft Sprocket Location

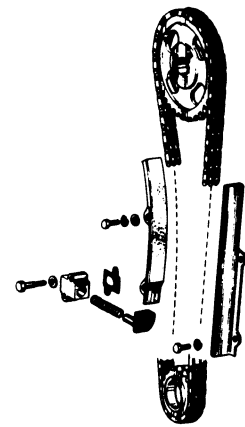
- (1) Turn engine until No. 1 piston is at T.D.C. on its compression stroke. Determine whether camshaft sprocket location notch comes off the left end of the oblong groove on camshaft locating plate. (If the location notch is off the left end of the oblong groove, chain stretch is beyond limits.)



EM146

Fig. EM-72 Camshaft Locating Plate

- (2) Turn engine until No. 1 piston is at T.D.C. on its compression stroke, setting camshaft on No. 2 location hole in camshaft sprocket. This No. 2 notch should then be on the right end of the oblong groove. When No. 2 hole is used, No. 2 timing mark must also be used. The amount of the modification is a 4° rotation of crankshaft.
- (3) When modification becomes impossible even by transferring camshaft location hole, replace chain assembly.

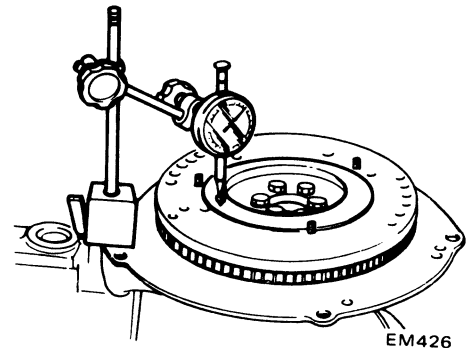


EM147

Fig. EM-73 Camshaft Drive Mechanism

FLYWHEEL

1. Check clutch disc contact surface with flywheel for damage or wear. Repair or replace if necessary.
2. Measure runout of clutch disc contact surface with a dial gauge. If it exceeds 0.15 mm (0.0059 in) total indicator reading, replace it.



EM426

Fig. EM-74 Checking Flywheel Deviation

CHAIN TENSIONER AND CHAIN GUIDE

Check for wear and breakage. Replace if necessary.

3. Check tooth surfaces of ring gear for flaws or wear. Replace if necessary.

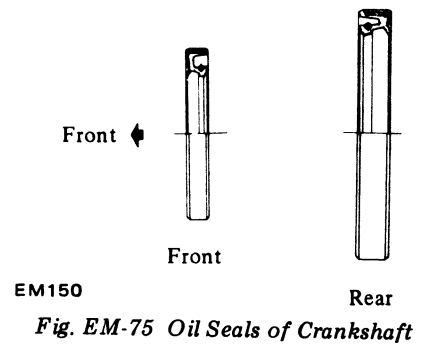
Note:

Replace ring gear at about 180 to 220°C (356 to 428°F).

FRONT COVER AND REAR OIL SEAL

First check front cover and rear oil seal for worn or folded over sealing lip or oil leakage. If necessary, install a new seal. When installing a new seal, pay attention to mounting direction.

Note: It is good practice to replace oil seal whenever engine is overhauled.



ENGINE ASSEMBLY

CONTENTS

PRECAUTIONS	EM-20	PISTON AND CONNECTING ROD	EM-21
CYLINDER HEAD	EM-20	ENGINE ASSEMBLY	EM-21

PRECAUTIONS

1. Use thoroughly cleaned parts. Especially, make sure that oil holes are clear of foreign matter.
2. When installing sliding parts such as bearings, be sure to apply engine oil to them.
3. Use new packings and oil seals.
4. Do not reuse lock washers.
5. Keep tools and work benches clean.
6. Keep necessary parts and tools near at hand.
7. Be sure to follow specified tightening torque and order.
8. Applying sealant

Use sealant to eliminate water and oil leaks. Parts requiring sealant are:

- (1) Front cover and corners of cylinder block:

Apply sealant at these points.

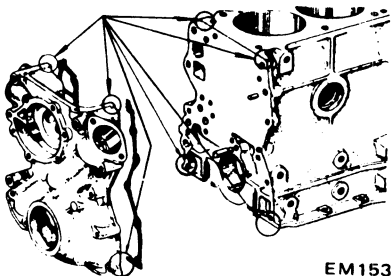


Fig. EM-76 Applying Sealant (Front cover and cylinder block)

- (2) Main bearing cap and cylinder block: Each side of rear main bearing cap and each corner of cylinder block.

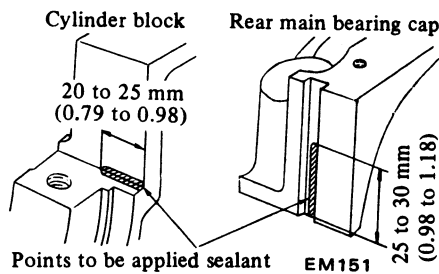


Fig. EM-77 Applying Sealant (Main bearing cap and cylinder block)

- (3) Cylinder block: Step portions at four mating surfaces (cylinder block to front chain cover and cylinder block to rear main bearing cap).

Note: Do not apply too much sealant.

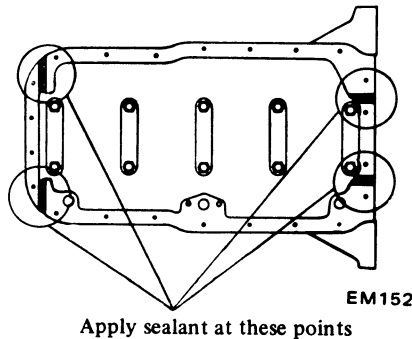


Fig. EM-78 Applying Sealant (Cylinder block)

CYLINDER HEAD

1. Valve assembly and valve spring
Using Valve Lifter ST12070000, set

EM-20

valve spring seat in position, and fit valve guide with oil seal.

Assemble valve in the order shown below: valve, inner and outer valve springs, spring retainer, valve collet and valve rocker guide.

Tightening torque:
Camshaft bracket
1.8 to 2.0 kg-m
(13 to 14 ft-lb)

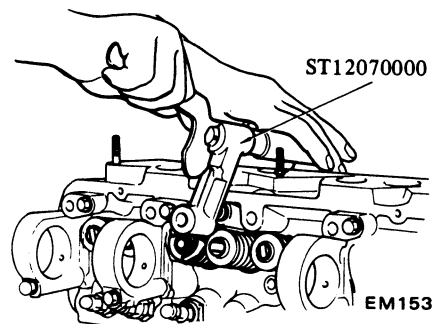


Fig. EM-79 Installing Valves

Note:

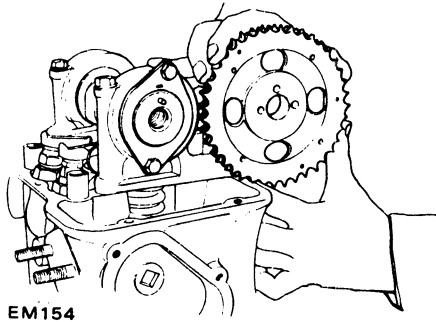
- a. Ensure that valve face is free from foreign matter.
- b. Outer valve spring is of an uneven pitch type.
Install spring facing painted side to cylinder head surface.

2. Valve rocker pivot assembly
Screw valve rocker pivots joined with lock nuts into pivot bushing.

3. Camshaft assembly

Set locating plate and carefully install camshaft in cylinder head. Do not damage the bearing inside. Oblong groove of locating plate must be directed toward front side of engine.

4. Install camshaft sprocket on camshaft and tighten it together with fuel pump drive cam to specified torque.



EM154

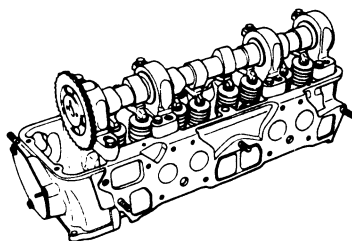
Fig. EM-80 Installing Camshaft Sprocket

Ⓣ Tightening torque:

Camshaft bracket
1.8 to 2.0 kg-m
(13 to 14 ft-lb)

At this time, check camshaft end play.

5. Install rocker arms by pressing valve springs down with a screwdriver.
6. Install valve rocker springs.
7. After assembling cylinder head, turn camshaft until No. 1 piston is at T.D.C. on its compression stroke.

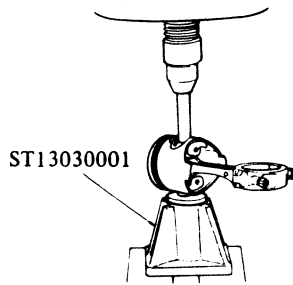


EM155

Fig. EM-81 Assembling Cylinder Head

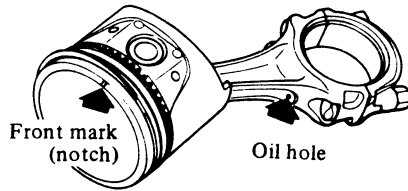
PISTON AND CONNECTING ROD

1. Assemble pistons, piston pins and connecting rods on the designated cylinder.



EM156

Fig. EM-82 Installing Piston Pin



EM157

Fig. EM-83 Assembling Piston and Connecting Rod

Note:

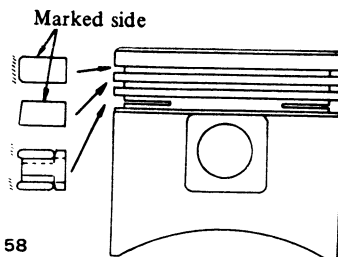
- a. Piston is pressed into connecting rod, with fitting force of 0.5 to 1.5 tons; aid of Piston Pin Press Stand ST13030001 is necessary. When pressing piston pin into connecting rod, apply engine oil to pin and small end of connecting rod.
- b. Arrange so that oil jet of connecting rod big end is directed toward right side of cylinder block.
- c. Be sure to install piston in cylinders with notch mark of piston head toward front of engine.

2. Install piston rings

Install top and second rings in right position, with marked side up.

Note:

- a. Top ring is chromium-plated on liner contacting face.
- b. Second ring has larger taper surface than top ring.
- c. In the combined oil ring, upper rail is the same as lower one.



EM158

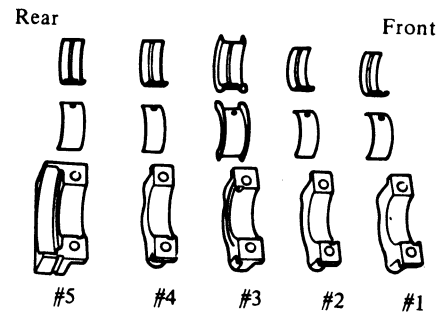
Fig. EM-84 Installing Piston Rings

3. Fix bearings on connecting rod and connecting rod cap.

Note: Clean back side of bearing carefully.

ENGINE ASSEMBLY

1. The first step in engine assembly is to bolt Engine Attachment ST05260001 to right hand side of cylinder block. Next, install block on another Engine Stand ST0501S000 with engine bottom up.
2. Set main bearings at the proper portion of cylinder block.



EM159

Fig. EM-85 Main Bearings

3. Install baffle plate including cylinder block net.

Note:

- a. Only center bearing (No. 3) is a flanged type.
- b. All inter-bearings (No. 2 and No. 4) are the same type.
- c. Front bearing (No. 1) is also the same type as rear bearing (No. 5). The difference is that an oil hole is provided in the front bearing.
- d. All upper and lower bearings are interchangeable.

4. Apply engine oil to main bearing surfaces on both sides of cylinder block and cap and then install crankshaft.

5. Install main bearing cap and tighten bolts to specified torque.

Ⓣ Tightening torque:

Main bearing cap
4.5 to 5.5 kg-m
(33 to 40 ft-lb)

Note:

- a. Apply sealant to each side of rear main bearing cap and each corner

of cylinder block as shown in Fig. EM-73.

- b. Arrange parts so arrow mark on bearing cap faces toward front of engine.
- c. Prior to tightening bearing cap bolts, place bearing cap in proper position by shifting crankshaft in the axial direction.
- d. Tighten bearing cap bolts gradually, in two to three stages outwardly from center bearing in the sequence as shown in Fig. EM-84.
- e. After securing bearing cap bolts, ascertain that crankshaft turns smoothly.

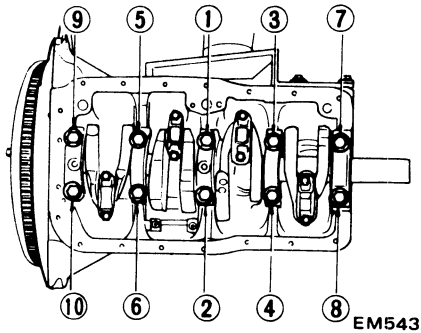


Fig. EM-86 Torque Sequence of Cap Bolts

6. Make sure that crankshaft has proper end play.

Crankshaft end play:
0.05 to 0.18 mm
(0.0020 to 0.0071 in)

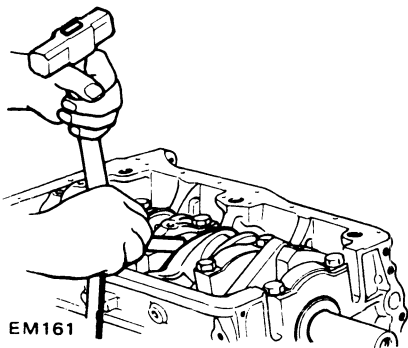


Fig. EM-87 Checking Crankshaft End Play

7. Install side oil seals into rear main bearing cap. Prior to installing, apply sealant to seals.

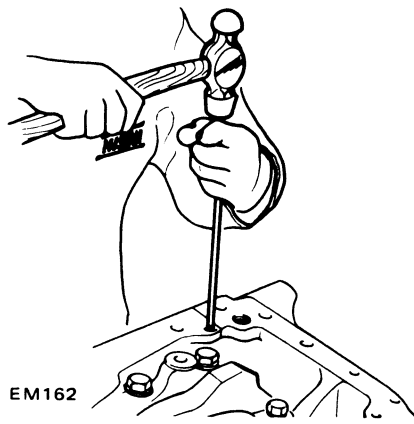


Fig. EM-88 Driving Side Oil Seal

8. Install rear oil seal using Crankshaft Rear Oil Seal Drift ST15310000.

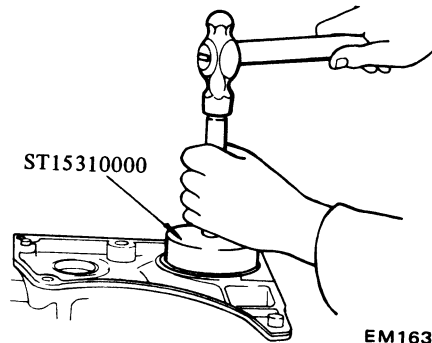


Fig. EM-89 Installing Rear Oil Seal

Note: When installing oil seal, give coating of engine oil to mating shaft to prevent scratches and folded lip. Also give coating of oil to periphery of oil seal.

9. Install rear end plate.
10. Install flywheel securely, and tighten bolts to specified torque.

Tightening torque:
Flywheel fixing bolts
14 to 16 kg-m
(101 to 116 ft-lb)

11. Insert pistons in corresponding cylinder using Piston Ring Compressor EM03470000.

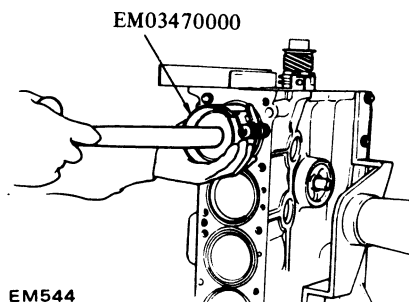


Fig. EM-90 Installing Piston Rod Assembly

Note:

- a. Apply engine oil to sliding parts.
- b. Arrange so that notch mark on piston head faces to front of engine.
- c. Install piston rings at 180° to each other, avoiding their fit in the thrust and piston pin directions.

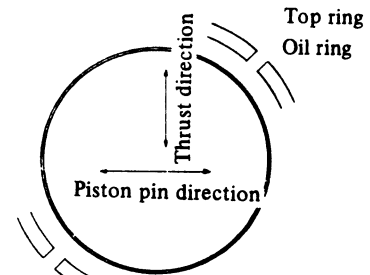


Fig. EM-91 Piston Ring Direction

12. Install connecting rod caps.

Tightening torque:
Connecting rod end nuts
4.5 to 5.5 kg-m
(33 to 40 ft-lb)

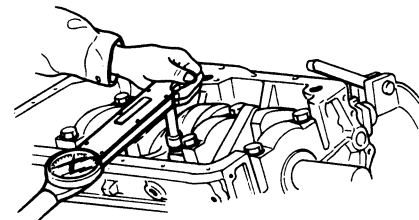


Fig. EM-92 Installing Connecting Rod Cap

Note: Arrange connecting rods and connecting rod caps so that the cylinder numbers face in the same direction.

13. Make sure that connecting rod big end has proper end play.

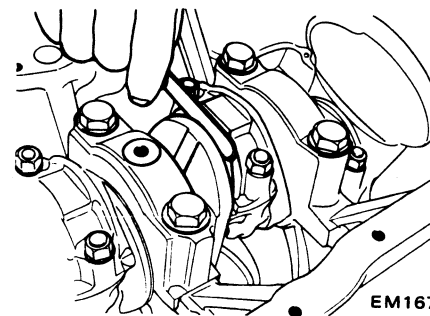


Fig. EM-93 Checking Big End Play

Big end play:
0.2 to 0.3 mm
(0.008 to 0.012 in)

14. Install cylinder head assembly.

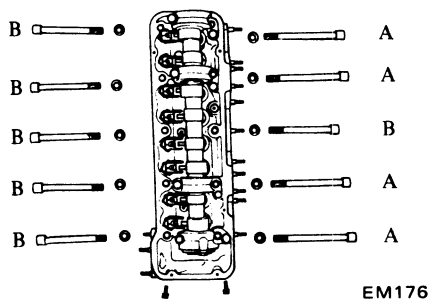


Fig. EM-94 Cylinder Head Bolts

(1) Thoroughly clean cylinder block and head surface.

Do not apply sealant to any other part of cylinder block and head surface.

(2) Turn crankshaft until No. 1 piston is at T.D.C. on its compression stroke.

(3) Make sure that camshaft sprocket location notch and plate oblong groove are aligned at their correct positions.

(4) When installing cylinder head, make sure that all valves are apart from heads of pistons.

(5) Do not rotate crankshaft and camshaft separately, or valves will hit heads of pistons.

(6) Temporarily tighten two bolts ①, ② shown in Fig. EM-100.

Tightening torque:
Cylinder head bolts
2 kg-m (14 ft-lb)

15. Install crankshaft sprocket and oil pump drive gear, and fit oil thrower.

Note: Make sure that mating marks of crankshaft sprocket face to front.

16. Install timing chain.

Note:

a. Make sure that crankshaft and camshaft keys point upwards.

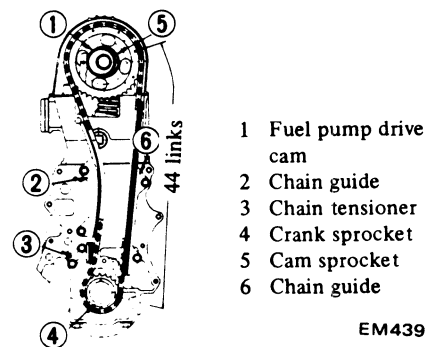


Fig. EM-95 Installing Timing Chain

b. Set timing chain by aligning its mating marks with those of crankshaft sprocket and camshaft sprocket at the right hand side. There are forty-four chain links between two mating marks of timing chain.

c. No. 2 hole is factory adjusted. When chain stretches excessively, adjust camshaft sprocket at No. 3 hole.

d. Use a set of timing marks and location hole numbers.

17. Install chain slack side guide to cylinder block.

18. Install chain tensioner.

Note: Adjust protrusion of chain tensioner spindle to 0 mm (0 in).

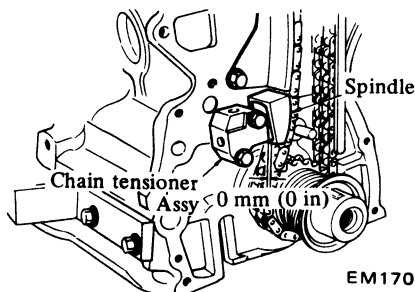


Fig. EM-96 Installing Chain Tensioner

19. Press new oil seal in front cover.

Note:

a. Front cover oil seal should be replaced when front cover is disassembled.

b. Before pressing oil seal into front cover, give coating of engine oil to periphery of oil seal.

c. This oil seal is a threaded seal type which has improved sealing characteristics. Do not apply grease to sealing lip.

20. Install front cover with gasket in place.

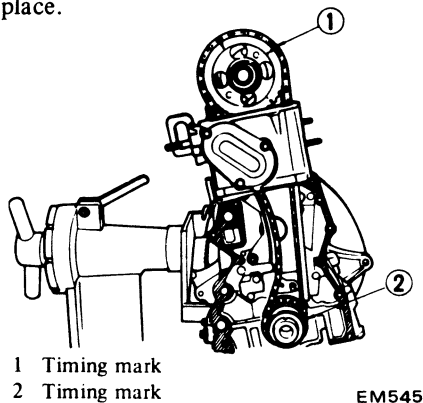


Fig. EM-97 Installing Front Cover

Note:

a. Apply sealant to front cover and corners of upper section of cylinder block as shown in Fig. EM-76.

b. Install front cover with head gasket in place.

c. Check height difference between cylinder block upper face and front cover upper face. Difference must be less than 0.15 mm (0.0059 in).

d. Note that different types of bolts are used.

e. Before installing front cover on cylinder block, apply coating of engine oil to sealing lip of oil seal.

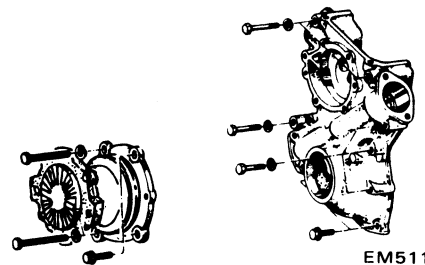


Fig. EM-98 Front Cover Bolts

Tightening torque:
Front cover bolts
Size M8
1.0 to 1.3 kg-m
(7 to 9 ft-lb)
Size M6
0.4 to 0.6 kg-m
(2.9 to 4.3 ft-lb)

21. Install crankshaft pulley and water pump assembly, then set No. 1 piston at T.D.C. on its compression stroke.

Tighten torque:
Crankshaft pulley locking bolt
12 to 16 kg-m
(87 to 116 ft-lb)

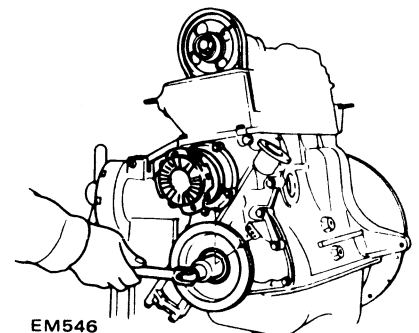


Fig. EM-99 Installing Crankshaft Pulley and Water Pump

22. Finally, tighten head bolts to the specified torque in several steps according to the tightening sequence

shown in Fig. EM-100.

Note that two types of bolts are used.

Special tool Cylinder Head Bolt Wrench ST10120000

- ⊕ **Tightening torque:**
Cylinder head bolts
 6.5 to 8.5 kg-m
 (47 to 61 ft-lb)

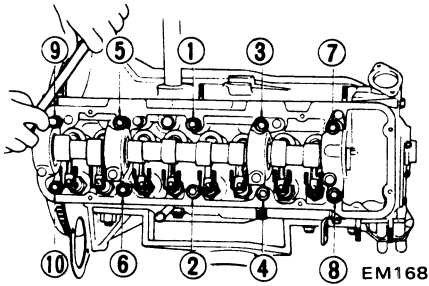


Fig. EM-100 Tightening Sequence of Cylinder Head Bolts

Note:

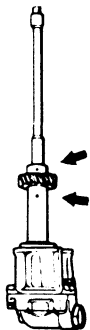
- a. Be sure to tighten two small bolts.
- b. After engine has been operated for several minutes retighten if necessary.

23. Install oil pump and distributor driving spindle in front cover.

- ⊕ **Tightening torque:**
Oil pump bolts
 1.1 to 1.5 kg-m
 (8 to 11 ft-lb)

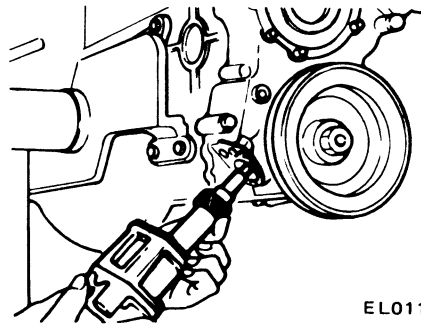
Note:

- a. Assemble oil pump and drive spindle, aligning driving spindle face with oil pump hole.
- b. Install oil pump together with drive spindle so that the projection on its top is located at the 11:25 a.m. position. At this point, the smaller bow-shape will be facing toward the front.
- c. Do not forget to install gasket.



EL009

Fig. EM-101 Setting Distributor Driving Spindle



EL011

Fig. EM-102 Installing Oil Pump

24. Install fuel pump, water inlet elbow and front engine slinger in their positions.

- ⊕ **Tightening torque:**
Fuel pump nuts
 1.2 to 1.8 kg-m
 (9 to 13 ft-lb)

Note: Do not forget to install fuel pump spacer and packing between spacer and block, spacer and fuel pump.

25. Install oil strainer, oil pan gasket and oil pan.

- ⊕ **Tightening torque:**
Oil strainer bolts
 0.8 to 1.1 kg-m
 (5.8 to 8.0 ft-lb)
Oil pan bolts
 0.6 to 0.9 kg-m
 (4.3 to 6.5 ft-lb)

Note:

- a. Apply sealant to the step portions at four mating surfaces as shown in Fig. EM-78.
- b. Oil pan should be tightened in criss-cross pattern to a final torque of 0.6 to 0.9 kg-m (4.3 to 6.5 ft-lb).

26. Adjust valve clearance to the specified dimensions.

Special tool
 Pivot Adjuster ST10640001

- ⊕ **Tightening torque:**
Pivot adjuster locking nut
 5.0 to 6.0 kg-m
 (36 to 43 ft-lb)

Note:

- a. First set clearance to the cold specifications.

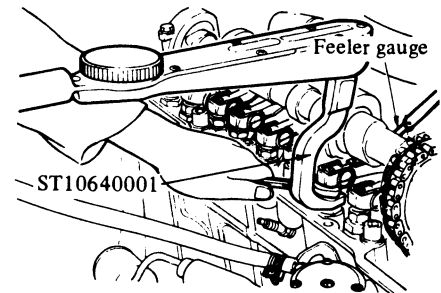


Fig. EM-103 Adjusting Valve Clearance

- b. After engine has been assembled, warm up engine until water temperature indicator points to middle of gauge and finally adjust clearance to hot specifications.

Valve clearance mm (in)	Cold	Intake	0.20 (0.008)
		Exhaust	0.25 (0.010)
	Hot	Intake	0.25 (0.010)
		Exhaust	0.30 (0.012)

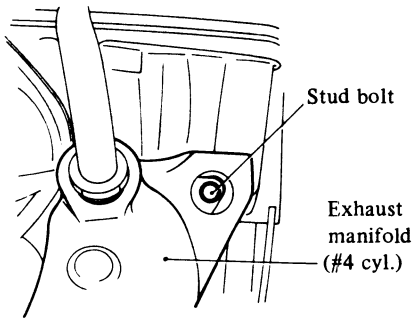
27. Install rocker cover to cylinder head.
28. Install air pump bracket and cooler compressor to cylinder block.
29. Install manifold gasket and exhaust manifold and intake manifold to cylinder head.

- ⊕ **Tightening torque:**
Intake and exhaust manifold securing bolts or nuts
 1.2 to 1.6 kg-m
 (9 to 12 ft-lb)

CAUTION:

When installing exhaust manifold, be careful that stud bolt is inserted into

center of outermost guide hole in manifold.



EM663
Fig. EM-104 Installing Exhaust Manifold

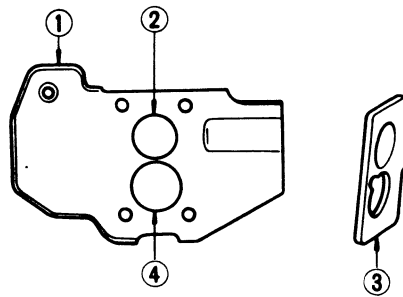
30. Install coolant hose from intake manifold to water pump.
31. Install air gallery pipe on exhaust manifold.
32. Install heatshield plate on exhaust manifold.
33. Install blow-by gas pipe on cylinder block and tighten with rear engine slinger.
34. Install thermostat housing gasket, thermostat housing and thermostat.
35. Install thermal vacuum valve on thermostat housing. Before installing, apply a liquid packing slightly to the threads.
36. Install E.G.R. passage and E.G.R. valve on intake manifold.
37. Connect E.G.R. tube to E.G.R. tube and exhaust manifold.
38. Install check valve on air gallery pipe.
39. Install air cleaner bracket on intake manifold.
40. Install air control valve on air cleaner bracket (if so equipped).
41. Install vacuum and fuel tubes (combined) on cylinder head.
42. Install distributor assembly.
43. Install heatshield plate, joint seat and carburetor.

Ⓣ **Tightening torque:**

Carburetor nuts

0.5 to 1.0 kg-m
(3.6 to 7.2 ft-lb)

Note: When installing joint seat, be sure to put the duct into primary hole in intake manifold. (Canada models)



- 1 Heatshield plate
- 2 Primary hole
- 3 Joint seat
- 4 Secondary hole

EM534

Fig. EM-105 Installing Carburetor Joint Seat

44. Install dash pot bracket and dash pot to intake manifold.

45. Connect all air, vacuum and fuel hoses and then secure with clamps.

Non-California models except Canada.

- (1) Cylinder block-to-P.C.V. valve hose
- (2) A.B. valve-to-E.G.R. passage vacuum hose
- (3) A.B. valve to E.G.R. passage air hose
- (4) Vacuum tube to carburetor vacuum hoses
- (5) Fuel tube to carburetor fuel hose
- (6) Fuel tube to fuel pump fuel hose
- (7) Distributor to vacuum switching valve vacuum hose
- (8) Air control valve vacuum hose
- (9) Thermal vacuum valve-E.G.R. to vacuum hose
- (10) Carbon canister vacuum hose
- (11) Air pump to check valve air hose
- (12) Air pump to air pump air cleaner air hose
- (13) F.I.C.D. vacuum hose (If so equipped)

California models

- (1) Cylinder block to P.C.V. valve hose
- (2) A.B. valve to E.G.R. passage vacuum hose
- (3) A.B. valve to E.G.R. passage air hose
- (4) Vacuum tube to carburetor vacuum hoses
- (5) Fuel tube to carburetor fuel hose
- (6) Fuel tube to fuel pump fuel hose
- (7) Distributor to vacuum switching valve vacuum hose

- (8) C.A.C. valve vacuum hose
- (9) Thermal vacuum valve-E.G.R. to vacuum delay valve vacuum hose
- (10) B.C.D.D. control valve to B.C.D.D. body hose
- (11) B.C.D.D. control valve vacuum hose
- (12) Carbon canister vacuum hose
- (13) Air pump to air check valve air hose
- (14) Air pump to air pump air cleaner air hose
- (15) C.A.C. valve to 3-way connector air hose
- (16) F.I.C.D. vacuum hose (If so equipped)

Canada models

- (1) Cylinder block to P.C.V. valve hose
- (2) A.B. valve to E.G.R. passage vacuum hose
- (3) A.B. valve to E.G.R. passage air hose
- (4) Vacuum tube to carburetor vacuum hose
- (5) Fuel tube to carburetor fuel hose
- (6) Fuel tube to fuel pump fuel hose
- (7) Distributor vacuum hose (M/T model only)
- (8) Distributor to vacuum delay valve vacuum hose (A/T model only)
- (9) Thermal vacuum valve-E.G.R. to vacuum hose
- (10) Thermal vacuum valve-E.G.R. to E.G.R. control valve vacuum hose
- (11) Carbon canister vacuum hose
- (12) Air pump to check valve air hose
- (13) Air pump to air pump air cleaner air hose
- (14) F.I.C.D. vacuum hose (If so equipped)

46. Install carburetor air cleaner on carburetor and then connect air and vacuum hoses as follows:

Non-California models except Canada

- (1) Air cleaner to exhaust manifold air duct
- (2) Air cleaner to rocker cover hose
- (3) Air cleaner to air control valve hose
- (4) Air cleaner to A.B. valve hose
- (5) Air cleaner to air pump air hose
- (6) Thermal vacuum valve-E.G.R. to B.P.T. valve vacuum hose
- (7) B.P.T. valve to E.G.R. control valve vacuum hose

(8) Other vacuum hoses

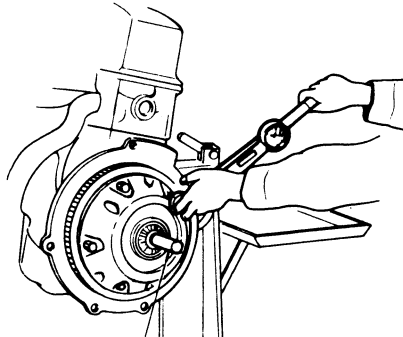
California models

- (1) Air cleaner to exhaust manifold air duct
- (2) Air cleaner to rocker cover hose
- (3) Air cleaner to C.A.C. valve air hose
- (4) Air cleaner to A.B. valve air hose
- (5) Thermal vacuum valve-E.G.R. to B.P.T. valve
- (6) B.P.T. valve to E.G.R. control valve vacuum hose
- (7) Altitude compensator to carburetor air hose
- (8) Other vacuum hose

Canada models

- (1) Air cleaner to exhaust manifold air duct
 - (2) Air cleaner to rocker cover hose
 - (3) Air cleaner to A.B. valve hose
 - (4) Air cleaner to air pump air hose
 - (5) Other vacuum hoses
47. Install spark plugs in place.
48. Connect all distributor high tension cables to spark plugs.
49. Install air pump, drive belt, cooler compressor and idler pulley.
50. Install left engine mounting bracket.
51. Install clutch assembly on flywheel with Clutch Aligning Bar KV30100100.

Tightening torque:
Clutch cover securing bolts
1.6 to 2.1 kg-m
(12 to 15 ft-lb)



KV30100100 EM440

Fig. EM-106 Installing Clutch Assembly

52. Using an overhead hoist and lifting cable, hoist engine away from engine stand and then down onto engine carrier.

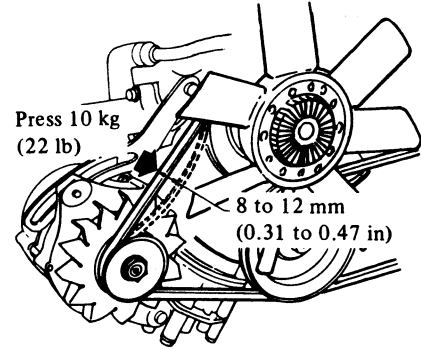
53. Install right engine mounting bracket, oil filter, oil pressure switch, oil level gauge and water drain plug. When installing oil filter, fasten it to cylinder block by hand.

Note: Do not overtighten filter, or oil leakage may occur.

54. Install alternator bracket adjusting bar, alternator, cooling fan and belt.

55. Adjust the deflection of drive belts when thumb pressure is applied midway between pulleys [A pressed force is above 10 kg (22.0 lb).]

Deflection of drive belts:
8 to 12 mm
(0.31 to 0.47 in)



EM157

Fig. EM-107 Fan Belt Tension

56. Fill engine oil up to specified level.

SERVICE DATA AND SPECIFICATIONS

GENERAL SPECIFICATIONS

Engine model	L20B
Cylinder arrangement	4, in-line
Displacement cc (cu in)	1,952 (119.1)
Bore and stroke mm (in)	85.0 × 86.0 (3.35 × 3.39)
Valve arrangement	O.H.C.
Firing order	1-3-4-2
Number of piston rings	
Compression	2
Oil	1
Number of main bearing	5
Compression ratio	8.5
Oil pressure (Warm at 2,000 rpm) kg/cm ² (psi)	3.5 to 4.0 (50 to 57)
Fan belt size mm (in)	11.2 × 900 (0.441 × 35.43)
Engine idle rpm	
U.S.A. models	
Manual transmission	600
Automatic transmission (in "D" position)	600
Canada models	
Manual transmission	600
Automatic transmission (in "D" position)	600

INSPECTION AND ADJUSTMENT

VALVE MECHANISM

Valve clearance (Hot)	mm (in)	
Intake		0.25 (0.010)
Exhaust		0.30 (0.012)
Valve clearance (Cold)	mm (in)	
Intake		0.20 (0.008)
Exhaust		0.25 (0.010)
Valve head diameter	mm (in)	
Intake		42.0 to 42.2 (1.654 to 1.661)
Exhaust		35.0 to 35.2 (1.378 to 1.386)
Valve length	mm (in)	
Intake		114.9 to 115.2 (4.52 to 4.54)
Exhaust		115.7 to 116.0 (4.56 to 4.57)

Engine Mechanical

Valve lift	mm (in)	
Intake and exhaust		10.5 (0.413)
Valve stem diameter	mm (in)	
Intake		7.965 to 7.980 (0.3136 to 0.3142)
Exhaust		7.945 to 7.960 (0.3128 to 0.3134)
Valve spring free length	mm (in)	
Intake and exhaust		
Outer		49.98 (1.9677)
Inner		44.85 (1.7657)
Valve spring pressured length (valve open)	mm/kg (in/lb)	
Intake and exhaust		
Outer		29.5/49.0 (1.161/108.0)
Inner		24.5/25.5 (0.965/56.2)
Valve spring assembled height (valve close)	mm/kg (in/lb)	
Intake and exhaust		
Outer		40.0/21.3 (1.575/47.0)
Inner		35.0/12.3 (1.378/27.1)
Valve spring out-of-square	mm (in)	
Outer		2.2 (0.087)
Inner		1.2 (0.047)
Valve guide length	mm (in)	
Intake and exhaust		59.0 (2.323)
Valve guide height from head surface	mm (in)	10.6 (0.417)
Valve guide inner diameter (Standard)	mm (in)	
Intake and exhaust		8.000 to 8.018 (0.3150 to 0.3157)
Valve guide outer diameter (service parts)	mm (in)	
Intake and exhaust		12.223 to 12.234 (0.4812 to 0.4817)
Valve guide (Oversize)		
Intake		12.223 to 12.234 (0.4812 to 0.4817)
Exhaust		12.223 to 12.234 (0.4812 to 0.4817)
Valve guide interference fit	mm (in)	0.027 to 0.049 (0.0011 to 0.0019)
Valve guide to stem clearance	mm (in)	
Intake		0.020 to 0.053 (0.0008 to 0.0021)
Exhaust		0.040 to 0.073 (0.0016 to 0.0029)
Valve seat width	mm (in)	
Intake		1.4 to 1.6 (0.055 to 0.063)
Exhaust		1.8 to 2.2 (0.071 to 0.087)

Engine Mechanical

Valve seat angle	degree	
Intake and exhaust		45°
Valve face angle	degree	
Intake		45° 30'
Exhaust		45° 30'
Valve seat interference fit	mm (in)	
Intake		0.081 to 0.113 (0.0032 to 0.0044)
Exhaust		0.064 to 0.096 (0.0025 to 0.0038)

CAMSHAFT AND TIMING CHAIN

Camshaft bend	mm (in)	0.02 (0.0008)
Camshaft bearing inner diameter	mm (in)	
1st, 2nd, 3rd and 4th		48.000 to 48.016 (1.8898 to 1.8904)
Camshaft journal to bearing clearance	mm (in)	0.038 to 0.067 (0.0015 to 0.0026)
Camshaft end play	mm (in)	0.08 to 0.38 (0.0032 to 0.0150)
Camshaft lobe lift	mm (in)	
Intake and exhaust		7.0 (0.276)
Camshaft journal diameter	mm (in)	
1st, 2nd, 3rd and 4th		47.949 to 47.962 (1.8877 to 1.8883)

CRANKSHAFT AND MAIN BEARING

Journal diameter	mm (in)	59.942 to 59.955 (2.3599 to 2.3604)
Journal taper & out-of-round	mm (in)	less than 0.01 (0.0004)
Maximum limit of dittoed clearance	mm (in)	0.12 (0.0047)
Crankshaft free end play	mm (in)	0.05 to 0.18 (0.0020 to 0.0071)
Wear limit of dittoed play	mm (in)	0.30 (0.0118)
Crank pin diameter	mm (in)	49.961 to 49.974 (1.9670 to 1.9675)
Crank pin out-of-round	mm (in)	less than 0.01 (0.0004)
Main bearing clearance	mm (in)	0.020 to 0.062 (0.0008 to 0.0024)
Wear limit of dittoed clearance	mm (in)	0.12 (0.0047)
Crankshaft bend	mm (in)	0.05 (0.0020)
Flywheel runout at clutch disc contact face	mm (in)	less than 0.15 (0.0059)

CONNECTING ROD

Center distance	mm (in)	.....	146 (5.75)
Big end play	mm (in)	.....	0.2 to 0.3 (0.008 to 0.012)
Connecting rod bearing clearance	mm (in)	.....	0.025 to 0.055 (0.0010 to 0.0022)
Connecting rod bend (per 100 mm or 2.937 in)	mm (in)	.....	less than 0.03 (0.0012)

PISTON

Piston diameter (Service standard)	mm (in)	.....	84.985 to 85.035 (3.3459 to 3.3478)
(Service parts)			
0.50 (0.0197) Oversize	mm (in)	.....	85.465 to 85.515 (3.3648 to 3.3667)
1.00 (0.0394) Oversize	mm (in)	.....	85.965 to 86.015 (3.3844 to 3.3864)
Ellipse difference	mm (in)	.....	0.32 to 0.35 (0.0126 to 0.0138)
Ring groove width	mm (in)		
Top		.....	2.030 to 2.050 (0.0799 to 0.0807)
Second		.....	2.020 to 2.040 (0.0795 to 0.0803)
Oil		.....	4.015 to 4.040 (0.1581 to 0.1591)
Piston to bore clearance	mm (in)	.....	0.025 to 0.045 (0.0010 to 0.0018)
Pin diameter	mm (in)	.....	20.993 to 20.998 (0.8265 to 0.8267)
Side clearance	mm (in)		
Top ring		.....	0.040 to 0.073 (0.0016 to 0.0029)
Second ring		.....	0.030 to 0.070 (0.0012 to 0.0028)
Ring gap width			
Top ring		.....	0.25 to 0.40 (0.0098 to 0.0157)
Second ring		.....	0.30 to 0.50 (0.0118 to 0.0197)
Oil ring		.....	0.30 to 0.90 (0.0118 to 0.0354)

CYLINDER BLOCK

Cylinder bore inner diameter	mm (in)	.....	85.000 to 85.050 (3.3465 to 3.3484)
Wear limit of dittoed inner diameter	mm (in)	.....	0.20 (0.0079)
Cylinder bore taper and out-of-round	mm (in)	.....	0.015 (0.0006)
Surface flatness	mm (in)	less than 0.05 (0.0020)

CYLINDER HEAD

Surfaces flatness	mm (in)	less than 0.05 (0.0020)
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TIGHTENING TORQUE

Cylinder head bolts	kg-m (ft-lb)	6.5 to 8.5 (47 to 61)
Connecting rod big end nuts	kg-m (ft-lb)	4.5 to 5.5 (33 to 40)
Flywheel fixing bolts	kg-m (ft-lb)	14 to 16 (101 to 116)
Main bearing cap bolts	kg-m (ft-lb)	4.5 to 5.5 (33 to 40)
Camshaft bracket bolts	kg-m (ft-lb)	1.8 to 2.0 (13 to 15)
Camshaft sprocket bolt	kg-m (ft-lb)	12 to 16 (87 to 116)
Rocker pivot lock nuts	kg-m (ft-lb)	5.0 to 6.0 (36 to 43)
Camshaft locating plate bolts	kg-m (ft-lb)	0.6 to 0.9 (4.3 to 6.5)
Oil pump bolts	kg-m (ft-lb)	1.1 to 1.5 (8 to 11)
Oil strainer bolts	kg-m (ft-lb)	0.8 to 1.1 (5.8 to 8.0)
Oil pan bolts	kg-m (ft-lb)	0.6 to 0.9 (4.3 to 6.5)
Oil pan drain plug	kg-m (ft-lb)	2.0 to 3.0 (14 to 22)
Front cover bolts	kg-m (ft-lb)	
8 mm dia.		1.0 to 1.3 (7 to 9)
6 mm dia.		0.4 to 0.6 (2.9 to 4.3)
Intake and exhaust manifold securing bolts or nuts	kg-m (ft-lb)	1.2 to 1.6 (9 to 12)
Carburetor nuts	kg-m (ft-lb)	0.5 to 1.0 (3.6 to 7.2)
Crankshaft pulley locking bolt	kg-m (ft-lb)	12 to 16 (87 to 116)
Fuel pump nuts	kg-m (ft-lb)	1.2 to 1.8 (9 to 13)
Water pump bolts	kg-m (ft-lb)	0.4 to 0.5 (2.9 to 3.6)
Alternator securing bolts	kg-m (ft-lb)	
Adjusting bar		1.0 to 1.6 (7 to 12)
Mounting bracket		2.0 to 3.0 (14 to 22)
Air pump securing bolts	kg-m (ft-lb)	
Adjusting bar		1.8 to 2.4 (13 to 17)
Mounting bracket		4.5 to 5.5 (33 to 40)

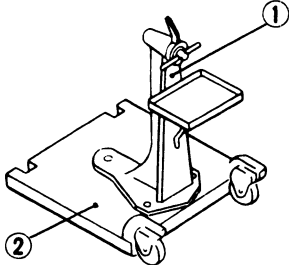
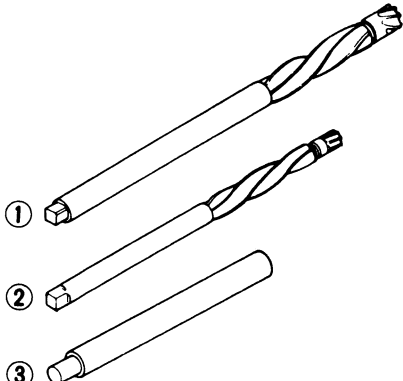
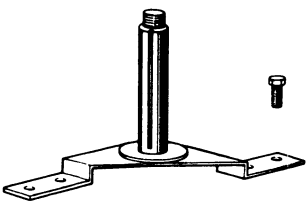
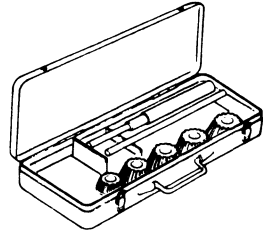
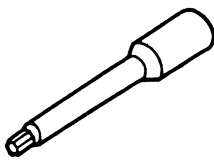
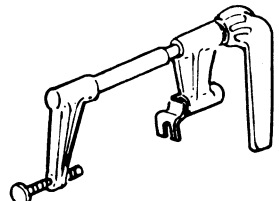
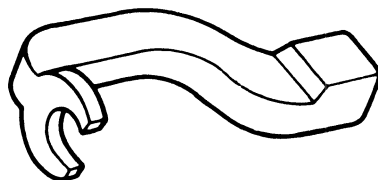
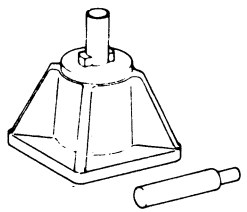
TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
I. Noisy engine Knocking of crankshaft and bearing	Loose main bearing. Seized bearing. Bent crankshaft. Uneven wear of journal. Excessive crankshaft end play.	Replace. Replace. Repair or replace. Correct. Replace center bearing.
Knocking of piston and connecting rod	Loose bearing. Seized bearing. Loose piston pin. Loose piston in cylinder. Broken piston ring. Improper connecting rod alignment.	Replace. Replace. Replace pin or bushing. Recondition cylinder. Replace. Realign.
Camshaft knocking	Loose bearing. Excessive axial play. Rough gear teeth. Broken cam gear.	Replace. Replace bearing thrust plate. Repair. Replace.
Timing chain noise	Improper chain tension. Worn and/or damaged chain. Worn sprocket. Worn and/or broken tension adjusting mechanism. Excessive camshaft and bearing clearance.	Adjust. Replace. Replace. Replace. Replace.
Camshaft and valve mechanism knocking	Improper valve clearance. Worn adjusting screw. Worn rocker face. Loose valve stem in guide. Weakened valve spring. Seized valve.	Adjust. Replace. Replace. Replace guide. Replace. Repair or replace.
Water pump knocking	Improper shaft end play. Broken impeller.	Replace. Replace.
II. Other mechanical troubles Stuck valve	Improper valve clearance. Insufficient clearance between valve stem and guide. Weakened or broken valve spring. Biting or damage of valve stem. Poor quality of fuel.	Adjust. Clean stem or ream guide. Replace. Replace or clean. Use good fuel.

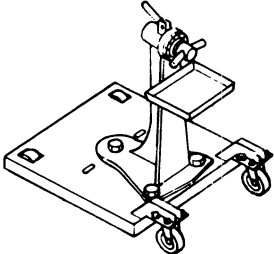

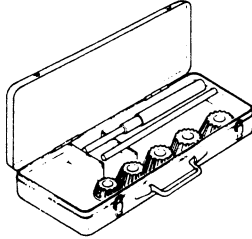
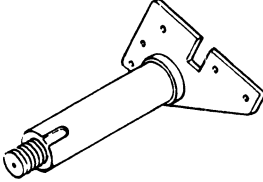
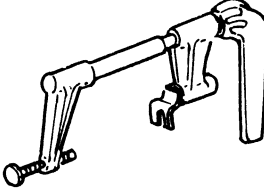
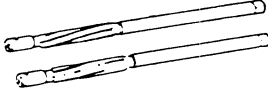

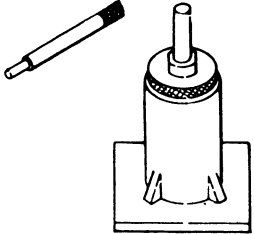
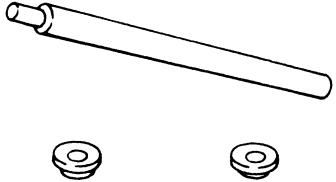
Engine Mechanical

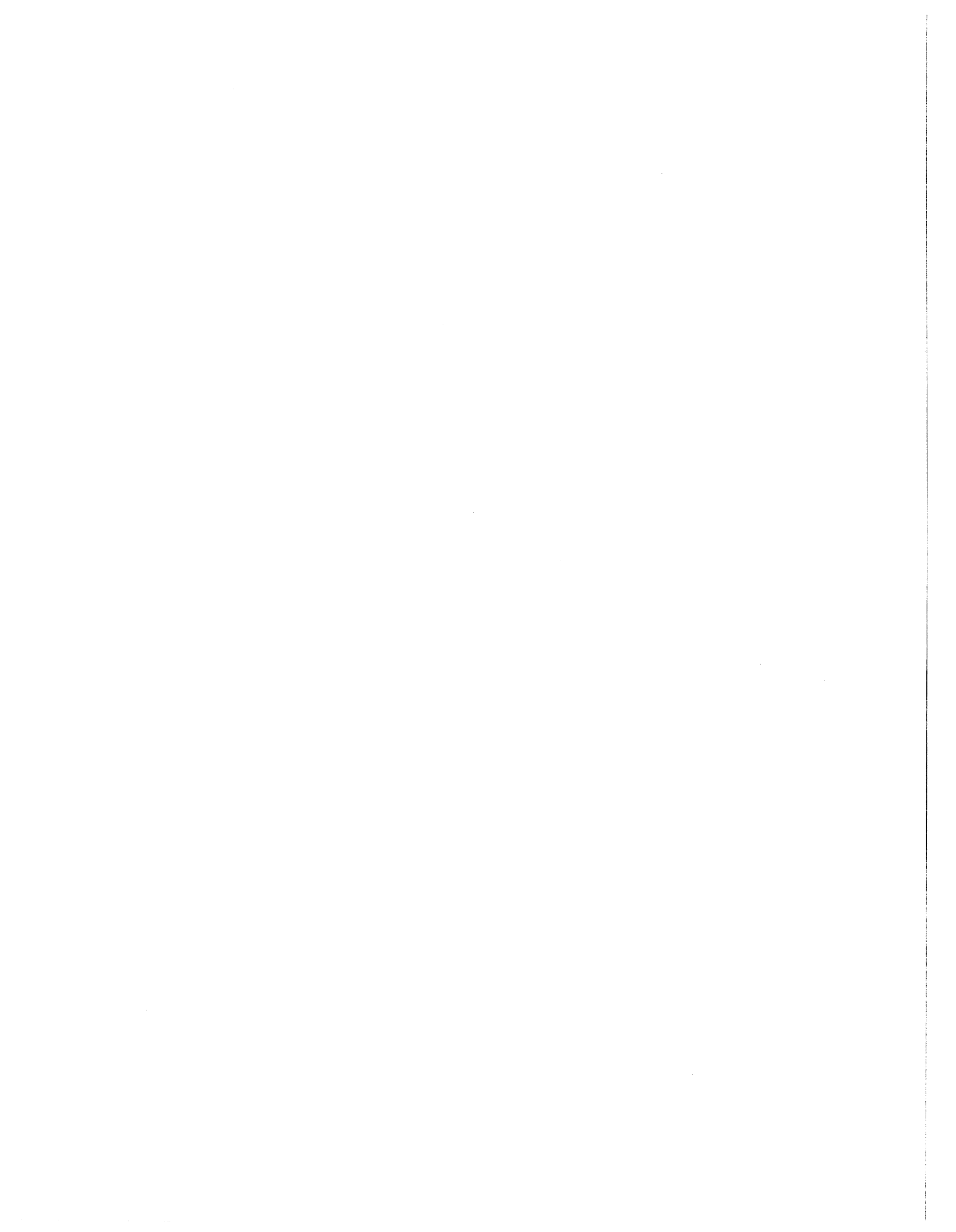
Condition	Probable cause	Corrective action
Seized valve seat	Improper valve clearance. Weakened valve spring. Thin valve head edge. Narrow valve seat. Overheating. Over speeding. Stuck valve guide.	Adjust. Replace. Replace valve. Reface. Repair or replace. Drive at proper speeds. Repair.
Excessively worn cylinder and piston	Shortage of engine oil. Dirty engine oil. Poor quality of oil. Overheating. Wrong assembly of piston with connecting rod. Improper piston ring clearance. Broken piston ring. Dirty air cleaner. Mixture too rich. Engine over run. Stuck choke valve. Overchoking.	Add or replace oil. Clean crankcase, replace oil and oil filter element. Use right oil. Repair or replace. Repair or replace. Adjust. Replace. Clean. Adjust. Drive at proper speeds. Clean and adjust. Start correct way.
Faulty connecting rod	Shortage of engine oil. Low oil pressure. Poor quality of engine oil. Rough surface of crankshaft. Clogged oil passage. Bearing worn or eccentric. Bearing improperly assembled. Loose bearing. Connecting rod alignment incorrect.	Add oil. Correct. Use proper oil. Grind and replace bearing. Clean. Replace. Correct. Replace. Repair or replace.
Faulty crankshaft bearing	Shortage of engine oil. Low oil pressure. Poor quality of engine oil. Crankshaft journal worn or out-of-round. Clogged oil passage in crankshaft. Bearing worn or eccentric. Bearing improperly assembled. Eccentric crankshaft or bearing.	Add or replace. Correct. Use proper oil. Repair. Clean. Replace. Correct. Replace.

SPECIAL SERVICE TOOLS

Tool number & tool name	Kent-Moore No.	Tool number & tool name	Kent-Moore No.
	Reference page or Fig. No.		Reference page or Fig. No.
ST0501S000 Engine stand assembly ① ST05011000 Engine stand ② ST05012000 Base	J 26023 ① J 26023-2 ② J 26023-1 Fig. EM-10	KV101039S0 Valve guide reamer set ① ST11081000 Reamer [12.2 mm (0.480 in)] dia. ② ST11032000 Reamer [8.0 mm (0.315 in)] dia. ③ ST11320000 Drift	J 25618 ① J 25618-3 ② J 25618-2 ③ J 25618-1 Fig. EM-43
			
ST05260001 Engine attachment	J 26029 Fig. EM-10	ST11650001 Valve seat cutter set	Fig. EM-44
			
ST10120000 Cylinder head bolt wrench	J 25613 Fig. EM-17 Fig. EM-100	ST12070000 Valve lifter set	J 25631 Fig. EM-31 Fig. EM-79
			
ST10640001 Pivot adjuster	J 25615-01 Fig. EM-103	ST13030001 Piston pin press stand	J 25634 Fig. EM-28 Fig. EM-82
			

ENGINE MECHANICAL SPECIAL SERVICE TOOLS

Tool number & tool name	Kent-Moore No.	Tool number & tool name	Kent-Moore No.
	Reference page or Fig. No.		Reference page or Fig. No.
ST0501S000 Engine stand assembly ① ST05011000 Engine stand ② ST05012000 Base 	J26023 ① J26023-2 ② J26023-1 Fig. EM-11 Page EM-22 Page EM-25	KV10104800 Valve lip seal drift 	— Fig. EM-67
	ST11670000 Valve seat cutter set 	— Fig. EM-37 Page EM-10	
ST05200000 Engine attachment 	J26097 Page EM-22 Page EM-25	ST12070000 Valve lifter 	J25631 Fig. EM-24 Fig. EM-68
KV101039S0 Valve guide reamer set ① KV11081000 [12.2 mm (0.480 in) dia.] ② KV11032000 [8 mm (0.31 in) dia.] ③ KV11320000 (drift)  	J25618 ① J00000-0 ② J00000-0 ③ J00000-0 Fig. EM-34 Fig. EM-36 Page EM-9	ST13040000 Piston pin press stand 	J25635 Fig. EM-23 Fig. EM-70
	ST16110000 Camshaft bearing drift 	J25644 Fig. EM-41	



SECTION EL

ENGINE LUBRICATION SYSTEM

EL

DATSUN 200SX
MODEL S10 SERIES

ENGINE LUBRICATION SYSTEM	EL- 2
SERVICE DATA AND SPECIFICATIONS	EL- 5
TROUBLE DIAGNOSES AND CORRECTIONS	EL- 5
SPECIAL SERVICE TOOL	EL- 6

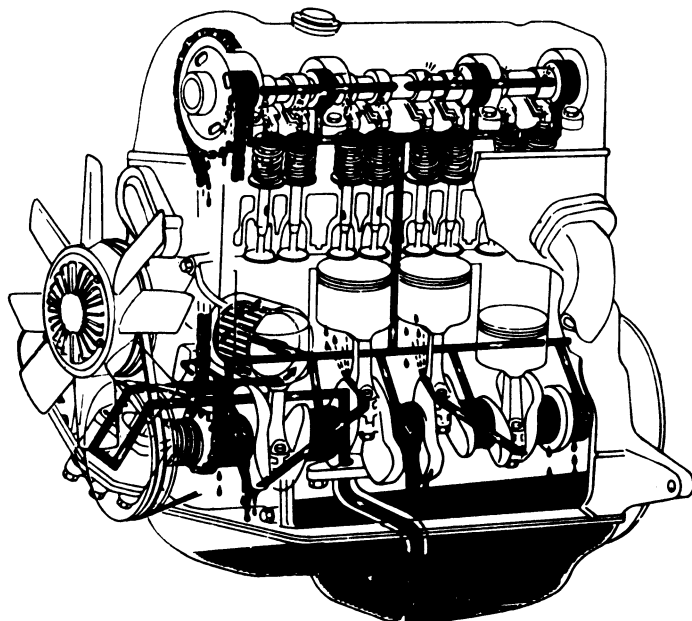


NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

ENGINE LUBRICATION SYSTEM

CONTENTS

LUBRICATION CIRCUIT	EL-2	INSPECTION	EL-3
OIL PUMP	EL-2	OIL PRESSURE REGULATOR VALVE	EL-4
REMOVAL	EL-2	OIL FILTER	EL-4
INSTALLATION	EL-2	RELIEF VALVE	EL-4
DISASSEMBLY AND ASSEMBLY	EL-3		



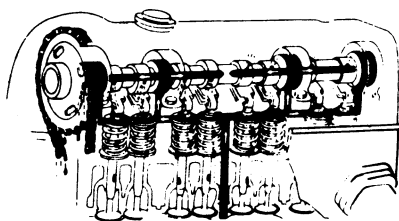
EL079

Fig. EL-1 Lubricating Circuit

LUBRICATION CIRCUIT

The pressure lubrication of the engine is accomplished by a trochoid-type oil pump. This pump draws the oil through the oil strainer into pump housing and then forces it through the full flow type oil filter into the main oil gallery. Part of the oil is supplied to all crankshaft bearings, chain tensioner and timing chain. Oil supplied to crankshaft bearings is fed to connecting rod bearings through the drilled passages in the crankshaft. Oil injected from jet holes on connecting rods lubricates the cylinder walls and piston pins. The other part of the oil is brought to the oil gallery in the

cylinder head to provide lubrication of the valve mechanism and timing chain as shown in Figs. EL-1 and EL-2.



EL050

Fig. EL-2 Lubricating Valve Mechanism

From this gallery, oil holes go directly to all camshaft bearings through cam brackets.

Oil supplied through the No. 2 and No. 3 camshaft bearings is then fed to the rocker arm, valve and cam lobe through the oil gallery in the camshaft and the small channel at the base circle portion of each cam.

OIL PUMP

The oil pump is secured on the bottom of the front cover with four bolts and driven by the oil pump drive spindle assembly which is driven by the helical gear on the crankshaft.

The oil pump assembly consists of an oil pressure regulator valve and outer and inner rotors.

The spring-loaded oil pressure regulator valve limits the oil pressure to a maximum of 5.6 kg/cm² (80 psi).

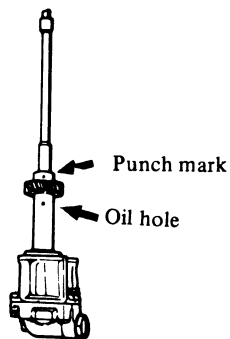
REMOVAL

1. Remove distributor.
2. Remove splash shield board.
3. Remove oil pump body with drive spindle assembly.

INSTALLATION

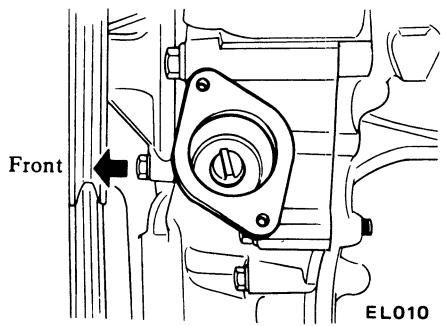
1. Before installing oil pump on engine, turn crankshaft so that No. 1 piston is at T.D.C.

2. Fill pump housing with engine oil, then align punch mark of spindle with hole in oil pump as shown in Fig. EL-3.

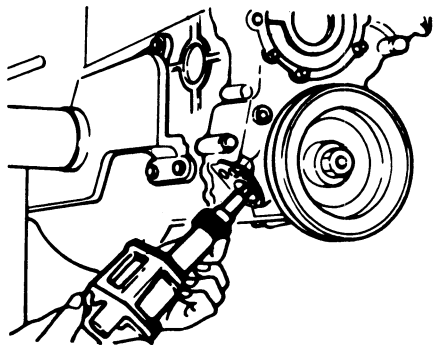


EL009
Fig. EL-3 Aligning Punch Mark and Oil Hole

3. Using a new gasket, install oil pump and drive spindle assembly so that the projection on its top is located in 11:25 a.m. position, at this time, the smaller bow-shape will be placed toward the front as shown in Fig. EL-4.



EL010
Fig. EL-4 Setting Drive Spindle



EL011
Fig. EL-5 Installing Oil Pump

Ascertain whether or not the engagement is in order by checking the top of spindle through distributor fitting hole.

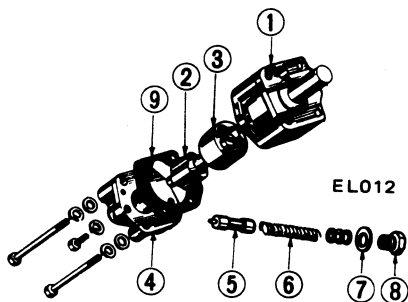
4. Tighten bolts securing oil pump to front cover.

DISASSEMBLY AND ASSEMBLY

1. Remove pump cover attaching bolts, pump cover and cover gasket, and slide out pump rotors.
2. Remove regulator cap, regulator valve and spring.
3. Install pressure regulator valve and related parts.
4. Install outer rotor, inner rotor and shaft in pump body and do not turn cover gasket up.

Note:

The marks dotted on outer and inner rotors should face to oil pump body.



- EL012
- | | |
|-------------------------|--------------------|
| 1 Oil pump body | 6 Regulator spring |
| 2 Inner rotor and shaft | 7 Washer |
| 3 Outer rotor | 8 Regulator cap |
| 4 Oil pump cover | 9 Cover gasket |
| 5 Regulator valve | |

Fig. EL-6 Oil Pump

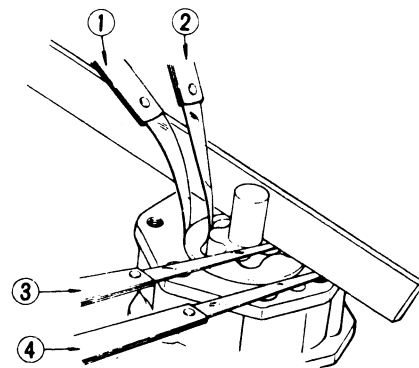
INSPECTION

Wash all parts in cleaning solvent and dry with compressed air.

1. Inspect pump body and cover for cracks or excessive wear.
2. Inspect pump rotors for excessive

wear.

3. Check inner rotor shaft for looseness in pump body.
4. Inspect regulator valve for wear or scoring.
5. Check regulator spring to see that it is not worn on its side or collapsed.
6. Using a feeler gauge, check tip clearance (2) and outer rotor-to-body clearance (1) shown in Fig. EL-7.



- EL059
- 1 Outer rotor to body clearance
 - 2 Tip clearance
 - 3 Gap between rotor and straight edge
 - 4 Gap between body and straight edge

Fig. EL-7 Checking Rotor Clearances

7. Place a straight edge across the face of pump and depress it slightly as shown in Fig. EL-7. Check gap (4) between body and straight edge or gap (3) between rotor and straight edge.

Gap:

−0.03 to 0.06 mm
(−0.0012 to 0.0024 in)

Rotor side clearance (rotor to bottom cover clearance) with gasket should satisfy the specifications.

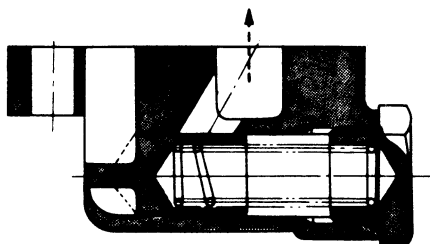
	Standard	Wear limit
Rotor side clearance (rotor to bottom cover) mm (in)	0.04 to 0.08 (0.0016 to 0.0031)	0.20 (0.0079)
Rotor tip clearance ② mm (in)	Less than 0.12 (0.0047)	0.20 (0.0079)
Outer rotor to body clearance ① mm (in)	0.15 to 0.21 (0.0059 to 0.0083)	0.50 (0.0197)

Note:

Pump rotors and body are not serviced separately. If pump rotors or body are damaged or worn, replacement of the entire oil pump assembly is necessary.

OIL PRESSURE REGULATOR VALVE

The oil pressure regulator valve is not adjustable. At the released position, the valve permits the oil to by-pass through the passage in the pump cover to the inlet side of the pump. Check regulator valve spring to ensure that spring tension is correct.



EL014

Fig. EL-8 Regulator Valve

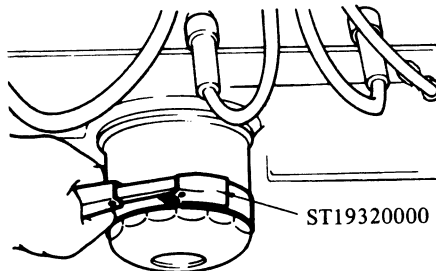
OIL FILTER

The oil filter is a cartridge type. The oil filter element should be replaced periodically, with the use of Oil Filter Wrench ST19320000.

When installing an oil filter, fasten it to cylinder block by hand.

Note:

Do not overtighten filter, or oil leakage may occur.



EL015

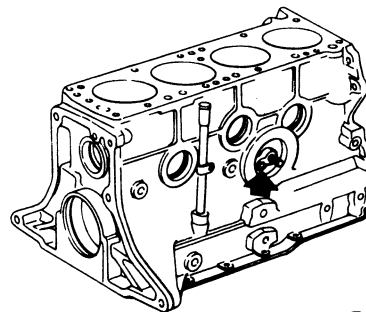
Fig. EL-9 Removing Oil Filter

RELIEF VALVE

The relief valve located at the center portion securing oil filter to the cylinder block by-passes the oil

into the main gallery when the oil filter element is excessively clogged.

With oil filter removed, check valve unit for operation. Inspect for a cracked or broken valve. If replacement is necessary, remove valve by prying it out with a screwdriver. Install a new valve in place by tapping it.



EL016

Fig. EL-10 Relief Valve

SERVICE DATA AND SPECIFICATIONS

Oil pump

		Standard	Wear limit
Rotor side clearance (rotor to bottom cover)	mm (in)	0.04 to 0.08 (0.0016 to 0.0031)	0.20 (0.0079)
Rotor tip clearance	mm (in)	less than 0.12 (0.0047)	0.20 (0.0079)
Outer rotor to body clearance	mm (in)	0.15 to 0.21 (0.0059 to 0.0083)	0.50 (0.0197)

Oil pressure regulator valve

Oil pressure at idling	kg/cm ² (psi)	0.8 to 2.8 (11 to 40)
Regulator valve spring:		
Free length	mm (in)	52.5 (2.067)
Pressured length	mm (in)	34.8 (1.370)
Regulator valve opening pressure	kg/cm ² (psi)	3.5 to 5.0 (50 to 71)

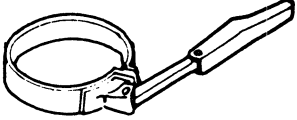
Tightening torque

Oil pump bolt	kg-m (ft-lb)	1.1 to 1.5 (8 to 11)
Oil pump cover bolt	kg-m (ft-lb)	0.7 to 1.0 (5.1 to 7.2)
Regulator valve cap nut	kg-m (ft-lb)	4 to 5 (29 to 36)

TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable causes	Corrective actions
Oil leakage	Damaged or cracked body cover. Oil leakage from gasket. Oil leakage from regulator valve. Oil leakage from blind plug.	Replace. Replace. Tighten or replace. Replace.
Decreased oil pressure	Leak of oil in engine oil pan. Dirty oil strainer. Damaged or worn pump rotors. Faulty regulator. Use of poor quality engine oil.	Correct. Clean or replace. Replace. Replace. Replace.
Warning light remains "on"-engine running	Decreased oil pressure. Oil pressure switch unserviceable. Electrical fault.	Previously mentioned. Replace. Check circuit.
Noise	Excessive backlash in pump rotors.	Replace.

SPECIAL SERVICE TOOL

Tool number & tool name	Kent-Moore No.	Tool number & tool name	Kent-Moore No.
	Reference page or Fig. No.		Reference page or Fig. No.
ST19320000 Oil filter wrench	J 25664		
	Fig. EL-9		