SERVICE MANUAL

MODEL

L20A, L24 & L26 SERIES

ENGINES

NISSAN

NISSAN MOTOR CO., LTD.

TOKYO, JAPAN

SECTION EM

ENGINE MECHANICAL

EM

GENERAL DESCRIPTION

CONTENTS

L20A, L24 AND L26 ENGINES

The 230 series models are powered either by the L20A or L26 engines. The L24 engine with a single carburetor is used on the HGC110 series models and the twin carburetor of L26(T) engine is on the S30 series models.

These engines feature O.H.C. valves, wedge-shaped combustion chamber, aluminum heads and fully balanced 7-bearing crankshaft to turn out smooth, dependable power. The cylinder block is cast in a single unit, featuring deep skirting.

The twin carburetor provides proper air-fuel mixture for L26(T) engine. This is also equipped with a single, 2-barrel, downdraft carburetor.

The L20A and L24 engines use only the same single, 2-barrel carburetor that is used on the L26 engine.

Main specifications

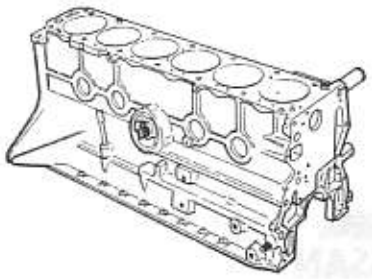
	L20A	L24	L26	
	Single carb.	Single carb.	Single carb.	Twin carb.
Displacement cc (cu in)	1,998 (121.9)	2,393 (146.0)	2,565 (156.5)	2,565 (156.5)
Bore x stroke mm (in)	78 x 69.7 (3.071 x 2.749)	83 x 73.7 (3.071 x 2.902)	83 x 79 (3.271 x 3.110)	83 x 79 (3.271 x 3.110)
Compression ratio	8.6	8.5	8.6	8.3
Ignition timing for M/T B.T.D.C. (for A/T)	10°/550 (650)	17°/550 (650)	10°/550 (650)	10°/650 (700)

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

Note: On vehicles equipped with an air conditioner, increase engine speed by 150 rpm higher than that indicated above while F.I.C.D. is in operation.

CYLINDER BLOCK

The cylinder block, which is of a monoblock special casting structure, adopts the seven bearing-support system, for quietness and higher durability. Of a highly rigid deep-skirt design, it requires no complicated tappet chamber because of the OHC engine system and thus is light-weight.

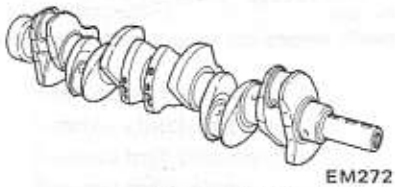


EM271

Fig. EM-1 Cylinder block

CRANKSHAFT

The crankshaft is fabricated of special forged steel. Provided with a high capacity balance weight, it shows quietness and high durability at high speed operation. Main bearings are lubricated from oil holes which intersect the main oil gallery which runs parallel to the cylinder bores.



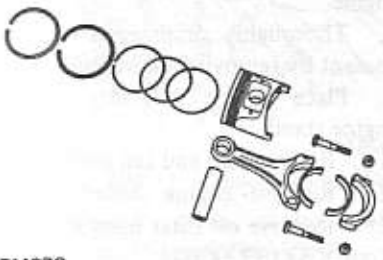
EM272

Fig. EM-2 Crankshaft

PISTONS AND CONNECTING RODS

New-design light-weight pistons are of cast aluminum slipper-skirt type with invar-strut. The piston pin is of a special steel hollow type and is connected to the piston in a full floating fit, and is press-fitted onto the connecting rod.

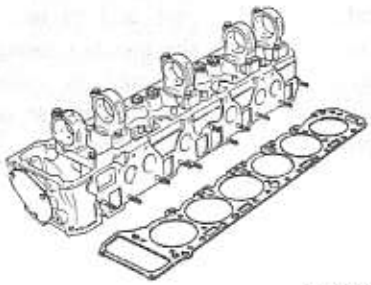
Connecting rods are made of forged steel. Full pressure lubrication is directed to the connecting rods by drilled oil passages from the adjacent main bearing journal. Oil holes at the connecting rod journals are located so that oil is supplied to give maximum lubrication just proper to full bearing load.



EM273

Fig. EM-3 Piston and connecting rod

CYLINDER HEAD



EM274

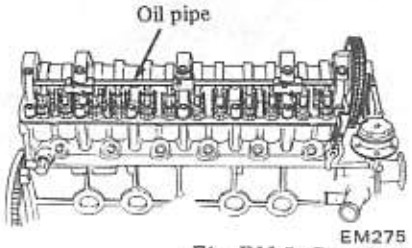
Fig. EM-4 Cylinder head

The cylinder head is made of light and strong aluminum alloy with good cooling efficiency. A brass cast 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.

CAMSHAFT

Camshaft is made of special cast iron and located inside the rocker cover. In this engine five aluminum alloy brackets support the camshaft.



EM275

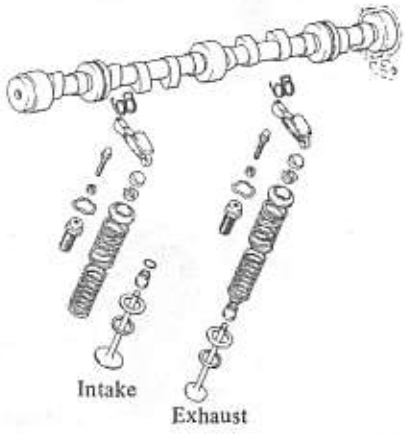
Fig. EM-5 Camshaft

Camshaft bearings are lubricated from oil holes which intersect the main oil gallery of the cylinder head.

There is no oil gallery in the camshaft and to lubricate the cam pad surface of the rocker arm an oil pipe with many oil holes is provided along the camshaft. This oil pipe provided is supported by No. 1, 3 and 5 camshaft brackets and from No. 3 brackets lubrication is supplied to this oil pipe.

VALVE MECHANISM

The valve system has a pivot type rocker arm that is activated directly by the cam mechanism, and this has made its moving parts considerably lighter and provides an ideal high-speed performance.

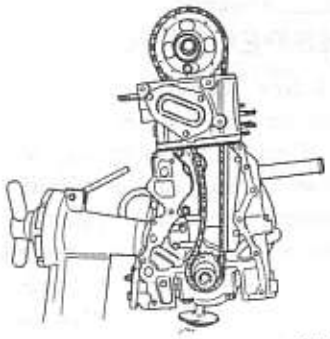


EM276

Fig. EM-6 Valve mechanism

CAMSHAFT DRIVE

Camshaft is driven by a double row roller chains driven by crankshaft. The tension of the chain is controlled by a chain tensioner which is operated by spring and oil pressure.



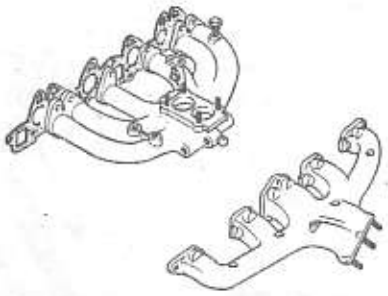
EM277

Fig. EM-7 Camshaft driving chain

MANIFOLDS

The intake manifold is aluminum cast.

The exhaust manifold types, is a dual exhaust system intended to prevent decline in output due to exhaust interference and to increase output through the inertia scavenging action. It is connected to exhaust pipes by flanges, which insure complete absence of exhaust leaks.



L20A, L24 & L26 (Single carb.)

Fig. EM-8 Exhaust and intake manifolds

ENGINE DISASSEMBLY

CONTENTS

PRELIMINARY CLEANING AND INSPECTING

Before disassembling engine, observe the following items:

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 sign of leak past their gasketed surfaces.
2. Check carburetor and fuel pump for condition; fuel hoses for deterioration, cracks or otherwise leakage of fuel past their jointed or connected surfaces.
3. Remove air cleaner, alternator, distributor and starter, and plug up carburetor air-horn and distributor hole to prevent entry of foreign matter.
4. Wipe dust and mud off engine.
5. Inspect block, rocker cover, front chain cover, oil pan and all other outer parts for visual defects and broken or missing parts such as bolts and nuts.
6. Test all pipings and electrical circuits for discontinuity or broken or damaged insulation.

DISASSEMBLY

To remove engine from vehicle, refer to relative topic under "Engine Removal and Installation" in Chassis and Body Service Manual, Section ER.

1. Remove transmission from engine.
2. Thoroughly drain engine oil and coolant by removing drain plugs.
3. Place engine assembly on the engine stand.
   (1) Remove fan and fan pulley.
   (2) Remove engine mounting R.H.
   (3) Remove oil filter using Oil Filter Wrench ST19320000.
   (4) Remove oil pressure switch.
   (5) Install engine attachment to cylinder block using bolt holes securing alternator bracket and engine mounting.
   (6) Set engine on the stand.

Engine Attachment ST05340000
Engine Stand ST0501S000

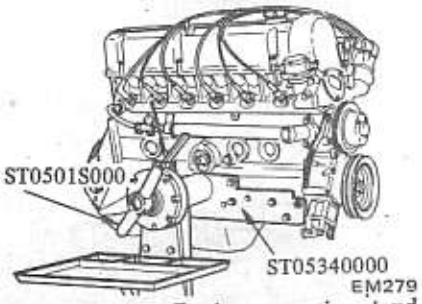


Fig. EM-9 Engine on engine stand

4. Remove oil level gauge.
5. Remove clutch assembly.
6. Remove high tension cable.
7. Remove spark plugs.
8. Remove fuel lines and heater hoses.
9. Remove fuel pump.

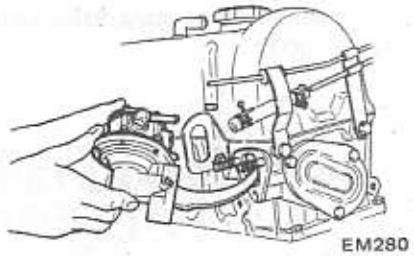


Fig. EM-10 Removing fuel pump

10. Remove thermostat housing.
11. Remove engine mounting L.H.
12. Remove intake manifolds with carburetor.
13. Remove exhaust manifold.

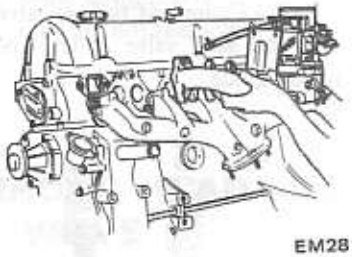


Fig. EM-11 Removing manifolds

14. Remove crank pulley using Puller Crank Pulley ST16540000.

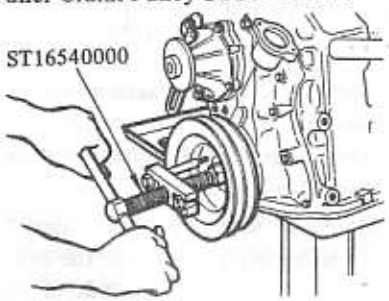


Fig. EM-12 Removing crank pulley

15. Remove water pump.
16. Remove rocker cover.
17. Remove fuel pump.
18. Remove fuel pump drive cam.
19. Remove camshaft sprocket using Chain Stopper ST17420001.

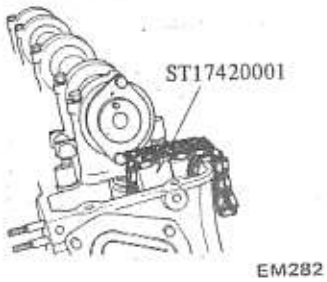


Fig. EM-13 Removing camshaft sprocket

20. Remove oil pipe.
21. Remove cylinder head assembly. Use Cylinder Head Bolt Wrench ST10120000 to remove cylinder head bolts. Loosen bolts from ① to ⑭ as shown in Figure EM-14.

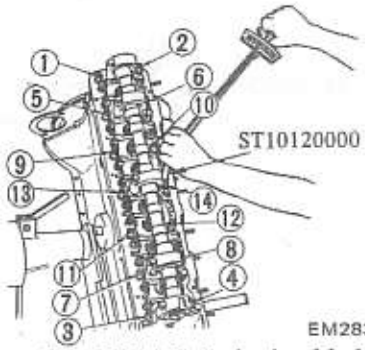


Fig. EM-14 Cylinder head bolt loosening sequence

Note: For the convenience of cylinder head replacement, Chain Stopper ST17420001 is prepared to support timing chain during the service operation. By using this tool, timing marks on crankshaft sprocket and timing chain will be unchanged. So the work for aligning timing marks will be saved so much.

22. Invert engine.
23. Remove oil pan and oil strainer.
24. Remove oil pump and its drive spindle.
25. Remove front cover.

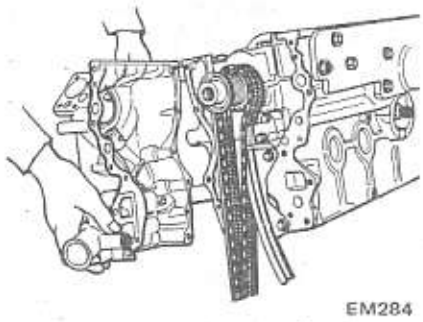


Fig. EM-15 Removing front cover

26. Remove chain tensioner and chain guides.

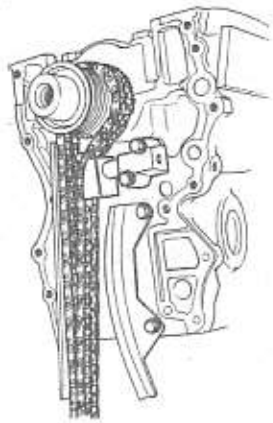


Fig. EM-16 Removing chain tensioner and timing chain

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

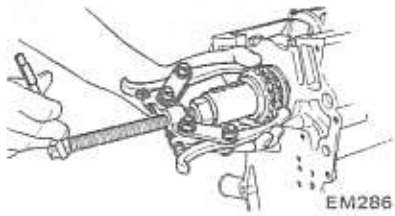


Fig. EM-17 Removing chain drive sprocket

29. Remove piston and connecting rod assembly. Take off connecting rod bearings and keep them in order.

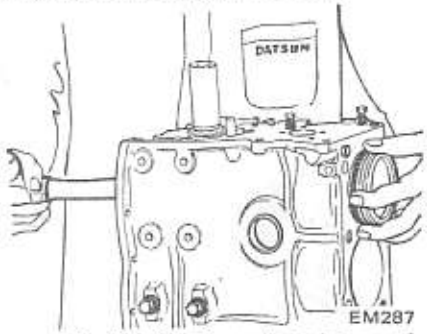


Fig. EM-18 Removing piston and connecting rod assembly

30. Remove flywheel and end plate. Be careful not to drop it.

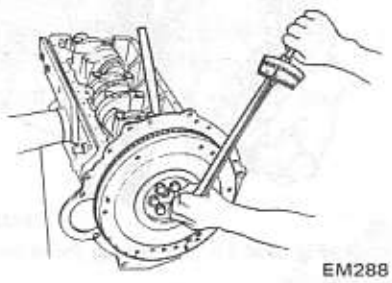


Fig. EM-19 Removing flywheel

31. Remove main bearing caps.

Use Crankshaft Main Bearing Cap Puller ST1651S000 to remove center and rear main bearing caps. Keep them in order.

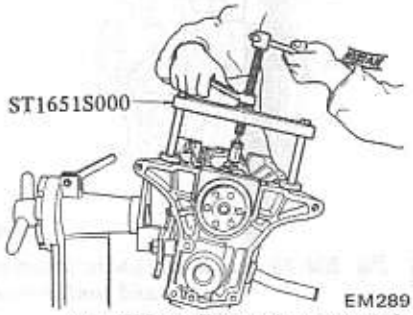


Fig. EM-20 Removing rear main bearing cap

32. Remove rear oil seal.

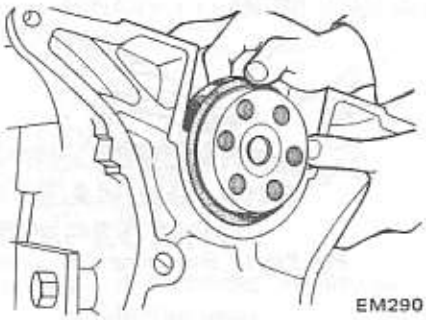


Fig. EM-21 Removing rear oil seal

33. Remove crankshaft.

34. Remove buffle plate and cylinder block net.

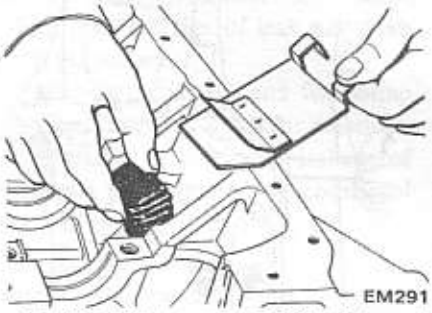


Fig. EM-22 Removing buffle plate and net

PISTON AND CONNECTING ROD

1. Remove piston rings with a ring remover.

Note: Avoid damaging piston rings by spreading excessively, which otherwise would make them unfit for further service due to breakage or weakened tension.

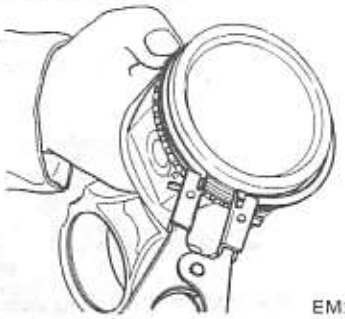


Fig. EM-23 Removing piston ring

2. Press out piston pin with Piston Pin Press Stand ST13060001.

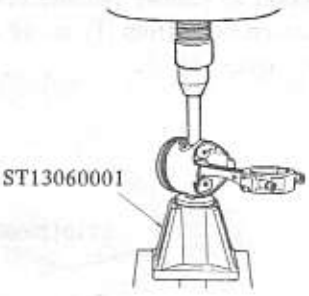


Fig. EM-24 Remvoing piston pin

3. Keep the disassembled parts in order.

CYLINDER HEAD

1. Loosen valve rocker pivot lock nut and remove rocker arm by pressing down valve spring.

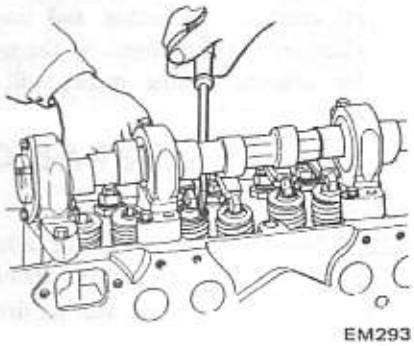


Fig. EM-25 Removing rocker arm

Note: Take care not to lose valve rocker guide.

2. Remove camshaft.

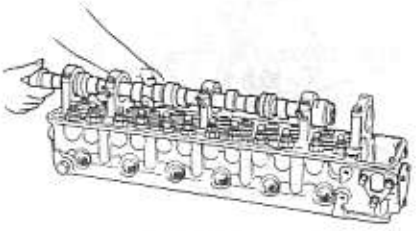


Fig. EM-26 Removing camshaft

Note: At this time, take care not to damage camshaft bearings and cam lobes.

3. Remove valves using Valve Lifter ST12070000.

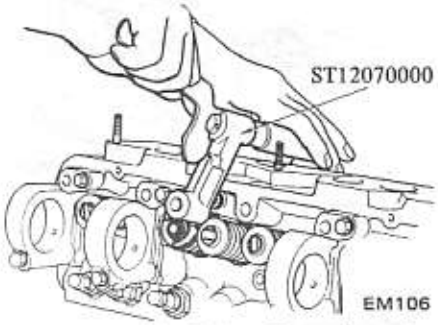


Fig. EM-27 Removing valve

4. Take care not to lose valve spring seat, oil seal, valve collet, and valve rocker guide.

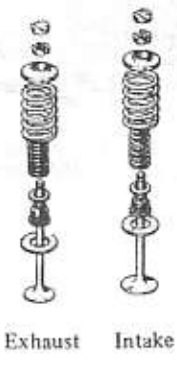


Fig. EM-28 Valve components

Note: Be sure to leave camshaft bearing intact. Because the bearing center is liable to be out of alignment.

INSPECTION AND REPAIR

CONTENTS

PREPARATION FOR INSPECTION

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

CYLINDER HEAD AND VALVE

CHECKING CYLINDER HEAD MATING FACE

Note: 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 be out of alignment and reconditioning 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.

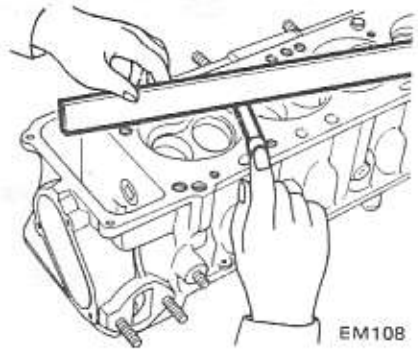


Fig. EM-29 Checking cylinder head surface

Head surface flatness

Standard	Maximum
less than 0.05 mm (0.0020 in)	0.1 mm (0.0039 in)

Surface grinding limit

The grinding limit of cylinder head is available by the cylinder block grinding in an engine.

Depth of cylinder head grinding is "A"

Depth of cylinder block grinding is "B"

The limit is following;

A + B = 0.2 mm (0.0079 in)

VALVE ASSEMBLY

1. Check each of the intake and exhaust valve for worn, damaged or deformed valve caps or stems. Correct or replace the valve that is faulty.
2. Valve face or valve stem end surface should be refaced by using a valve grinder.

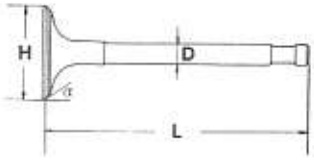


Fig. EM-30 Intake and exhaust valve dimensions

H	Valve head diameter mm (in)	L20A L24	In.	38.0 to 38.2 (1.496 to 1.504)
			Ex.	33.0 to 33.2 (1.299 to 1.307)
		L26 L26 (Twin carb.)	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)	L20A L24	In.	115.6 to 115.9 (4.551 to 4.563)
			Ex.	115.7 to 116.0 (4.555 to 4.567)
		L26 L26 (Twin carb.)	In.	114.9 to 115.2 (4.524 to 4.535)
			Ex.	115.7 to 116.0 (4.555 to 4.567)
D	Valve stem diameter mm (in)	L20A L24 L26 L26 (Twin carb.)	In.	7.965 to 7.980 (0.3136 to 0.3142)
			Ex.	7.945 to 7.960 (0.3128 to 0.3134)
α	Valve seat angle In. & Ex.			45°30'

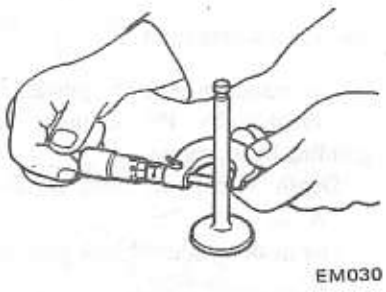


Fig. EM-31 Checking valve stem diameter

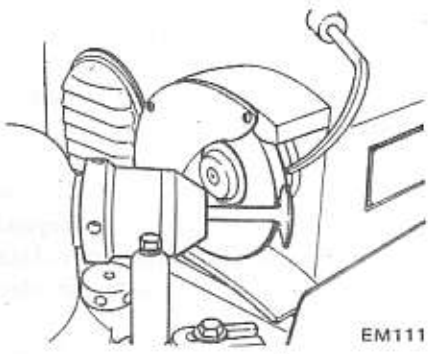


Fig. EM-32 Regrinding valve face

Note: When valve head has been worn down to 0.5 mm (0.0197 in) in thickness, replace the valve.
Grinding allowance for the valve stem end surface is 0.5 mm (0.0197 in) or less.

VALVE SPRING

1. Check valve spring for squareness using a steel square and surface plate. If spring is out of square "S" in Figure EM-33. more than specified limit, replace with new ones.
2. Measure the free length and the tension of each spring. If the measured value exceeds the specified limit, replace spring.

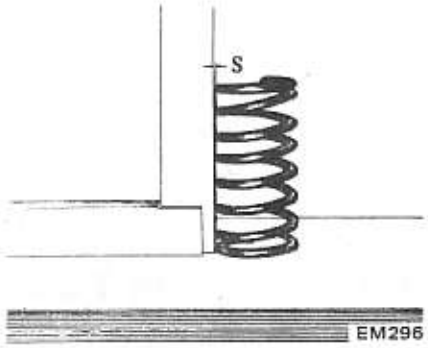


Fig. EM-33 Measuring spring squareness

Fig. EM-34 Measuring spring tension

Valve spring specifications

		L20A and L24 (Single carb.)	L26	L26 (Twin carb.)
Valve spring free length mm (in)				
	Outer	47.75 (1.88)	49.98 (1.968)	
	Inner	44.68 (1.76)	44.85 (1.766)	
Valve spring pressured length (valve open) mm/kg (in/lb)				
Intake	Outer	30.0/43.0 (1.181/94.8)	30.0/47.7 (1.181/105.2)	
	Inner	25.0/19.6 (0.984/43.2)	25.0/24.9 (0.984/54.9)	
Exhaust	Outer	30.0/43.0 (1.181/94.8)	29.5/49.0 (1.161/108)	
	Inner	25.0/19.6 (0.984/43.2)	24.5/25.5 (0.965/56.2)	
Valve spring assembled height (valve close) mm/kg (in/lb)				
	Outer	40.0/16.6 (1.575/36.6)	40.0/21.3 (1.575/47.0)	
	Inner	35.0/9.6 (1.378/21.2)	35.0/12.3 (1.378/27.1)	
Out of square ("S") mm (in)				
	Outer		2.2 (0.866)	
	Inner		1.2 (0.047)	

ROCKER ARM AND VALVE ROCKER PIVOT

Check pivot head and cam contact and pivot contact surfaces of rocker arm for damage or wear. If necessary, replace parts. A faulty pivot necessitates its replacement together with the corresponding rocker arm.

VALVE GUIDE

Measure the clearance between valve guide and valve stem. If the clearance exceeds the designated limit, replace the 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.

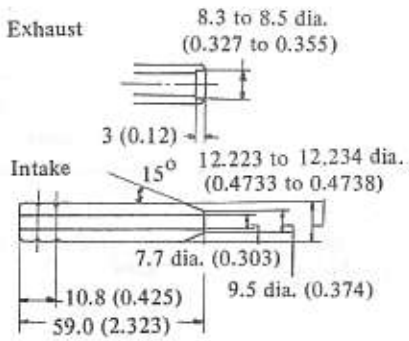


Fig. EM-35 Service valve guide

Determining clearance

Precise measurement of clearance between valve stem and valve guide needs the aid of a micrometer and a telescope hole gauge. By using these gauges, check the diameter of valve stem in three places; top, center and bottom. Insert telescope hole gauge in valve guide bore, measuring at center. Subtract the highest reading of valve stem diameter from valve guide bore to obtain the stem to guide clearance.

	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)
Max. tolerance of above clearance mm (in)	0.1 (0.0039)	

As an emergency expedient, a valve is pushed in valve guide and moved to the left and the right and which point if its tip deflects about 0.2 mm (0.0079 in) or more, it will be known that the clearance between stem and guide exceeds the maximum limit of 0.1 mm (0.0039 in).

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

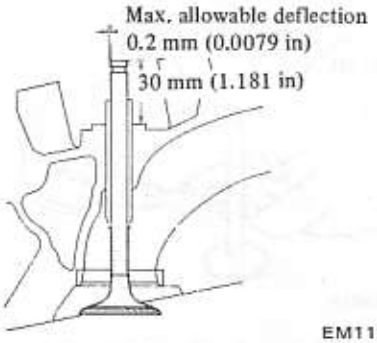


Fig. EM-36 Measuring clearance between valve stem and valve guide

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.

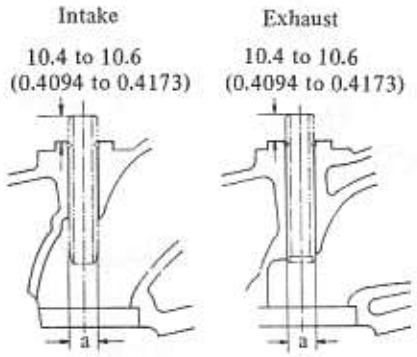


Fig. EM-37 Valve guide hole for service

		L20A, L24, L26, L26 (Twin carb.)
Guide hole inner diameter "a" mm (in)	For 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. Press new valve guide into head carefully 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 (0.0079 in) oversize diameter is available for service. See Figure EM-35.

	L20A, L24, L26, L26 (Twin carb.)
Interference fit of valve guide to guide hole mm (in)	0.027 to 0.049 (0.0011 to 0.0019)

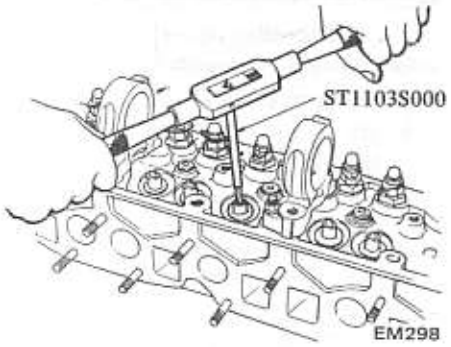


Fig. EM-38 Reaming valve guide

4. Ream the bore with valve guide pressed in, using Valve Guide Reamer Set ST1103S000.

Reaming bore:
8.000 to 8.018 mm
(0.3150 to 0.3157 in)

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 reseat or replace if worn out excessively.

Valve seat insert of 0.5 mm (0.0197 in) oversize is available for service in this L series engine.

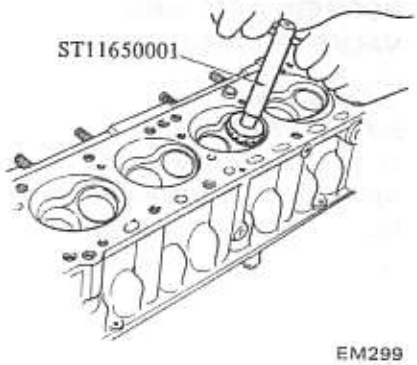
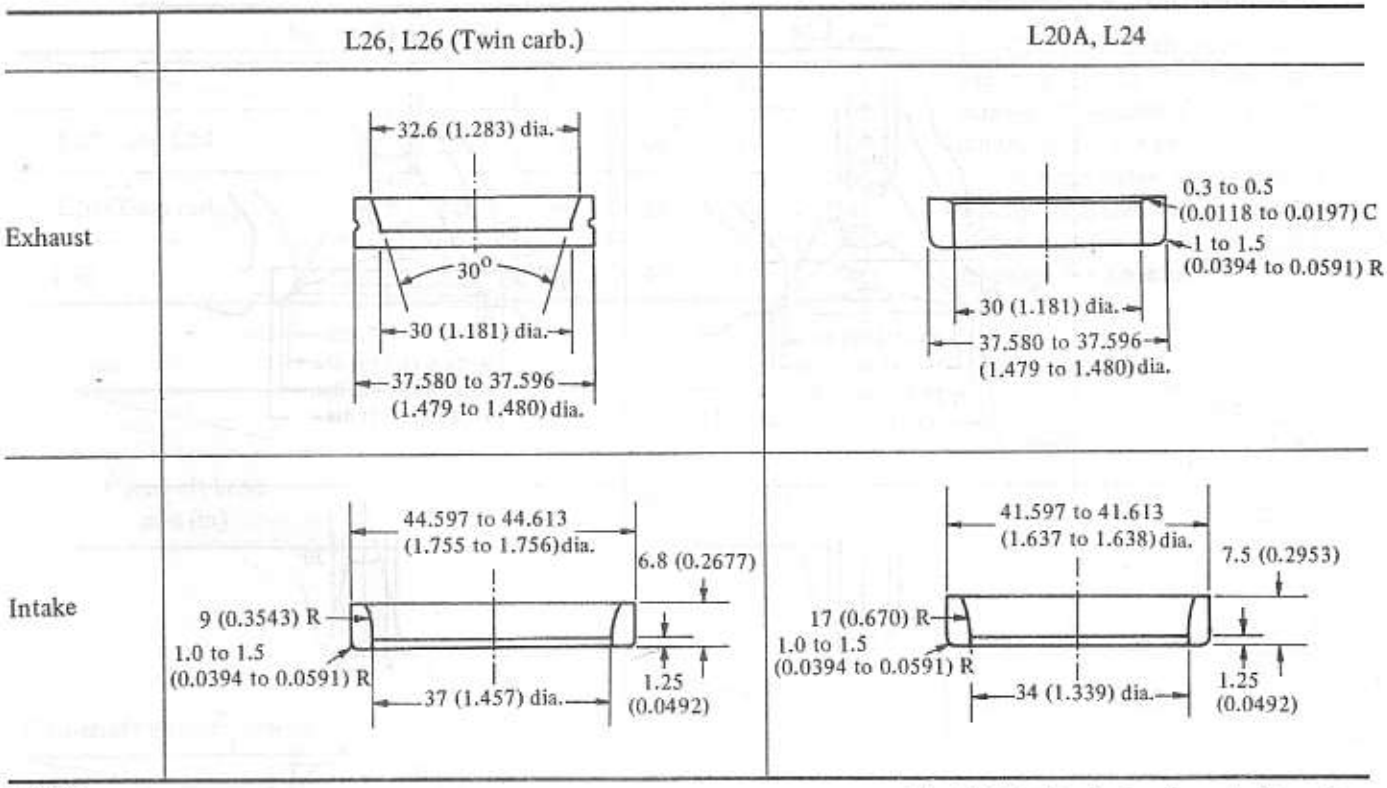


Fig. EM-39 Correcting valve seat



EM300

Fig. EM-40 Standard valve seat dimensions

Cylinder head recess diameter

Unit: mm (in)

		L20A, L24	L26, L26 (Twin carb.)
Intake	For standard insert	41.000 to 41.016 (1.6142 to 1.6148)	44.000 to 44.016 (1.7323 to 1.7329)
	For service insert	41.500 to 41.516 (1.6339 to 1.6345)	44.500 to 44.516 (1.7520 to 1.7526)
Exhaust		L20A, L24, L26, L26 (Twin carb.)	
	For 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)

Replacing valve seat insert

1. Old insert can be removed by boring 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 to valve guide center so that insert will have the correct fit.
4. Ream the cylinder head recess at room temperature.
5. Heat cylinder head to a temperature of 150° to 200°C (302° to 392°F).
6. Fit insert ensuring that it beds on the bottom face of its recess, and caulk more than 4 points.
7. Valve seats newly fitted should be cut or ground using Cutter Set Valve Seat ST11650001 at the specified dimensions as shown in Figure EM-41.
8. Apply small amount of fine griding 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.

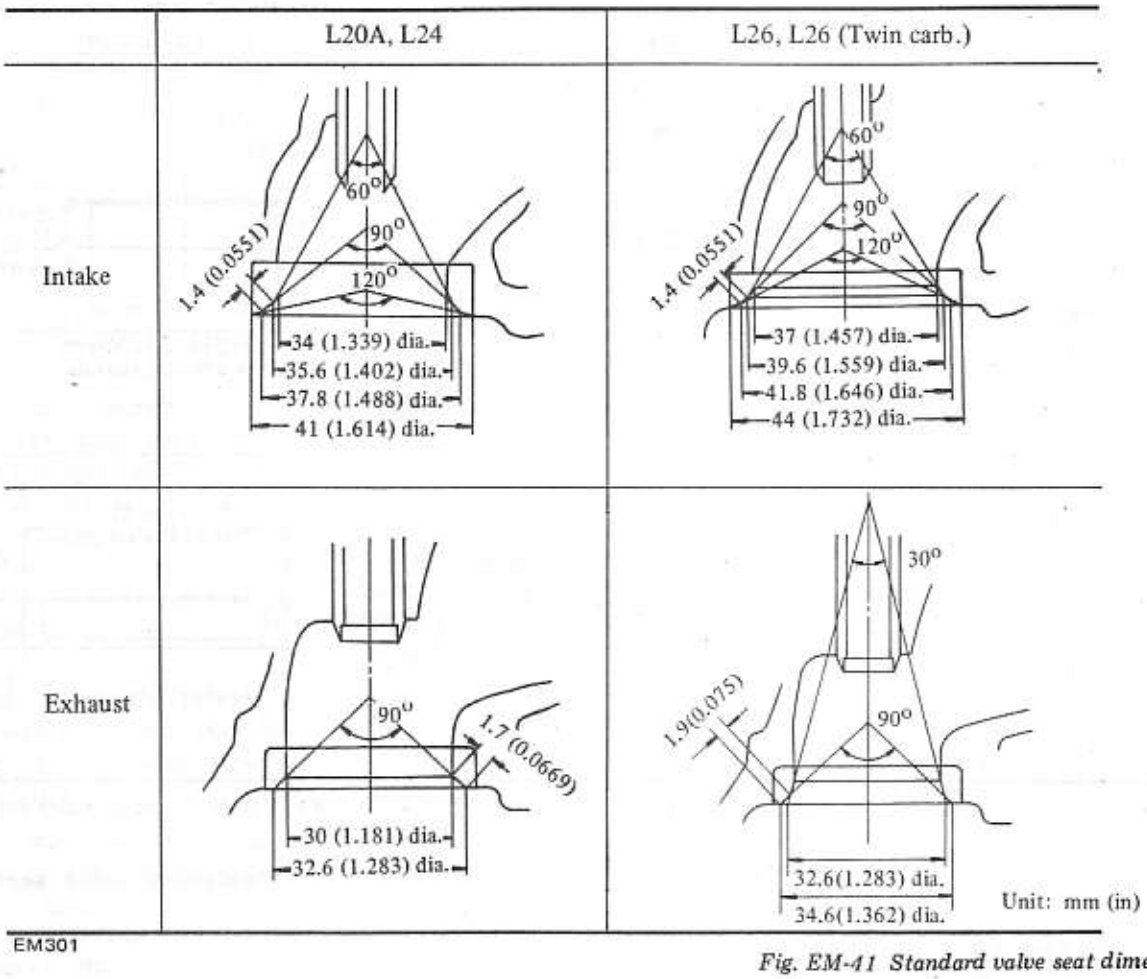


Fig. EM-41 Standard valve seat dimensions

CAMSHAFT AND CAMSHAFT BEARING

CAMSHAFT BEARING CLEARANCE

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

Camshaft journal to bearing clearance

	Standard	Wear limit
Oil clearance mm (in)	0.038 to 0.067 (0.0015 to 0.0026)	0.1 (0.0039)
Inner diameter of cam shaft bearing mm (in)	48.000 to 48.016 (1.8898 to 1.8904)	———

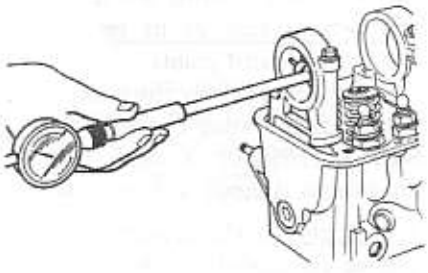


Fig. EM-42 Checking camshaft bearing

VALVE TIMING

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

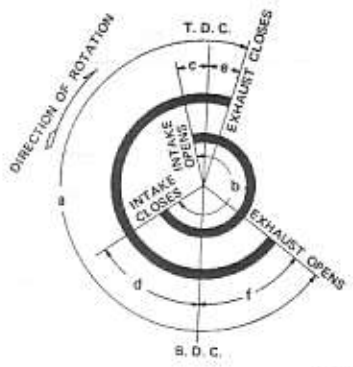


Fig. EM-43 Valve timing diagram

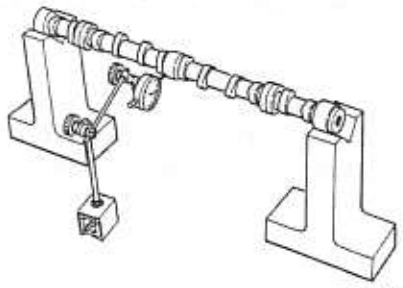
Unit: degree

	a	b	c	d	e	f
L20A and L24	240	232	8	44	10	50
L26 (Twin carb.)	248	248	16	52	14	54
L26	248	240	12	48	14	54

	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 problems are beyond the limits, replace the parts.
2. A bend valve is one-half of the reading obtained when camshaft is turned one full revolution with a dial gauge applied to the center journal.



EM302

Fig. EM-44 Checking camshaft bend

Camshaft specifications

		L20A, L24	L26, L26 (Twin carb.)
Standard height of cam mm (in)	Intake	39.95 to 40.00 (1.5728 to 1.3748)	39.95 to 40.00 (1.5728 to 1.5748)
	Exhaust		40.30 to 40.35 (1.5866 to 1.5886)
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)		0.1 (0.0039)	
Camshaft end play mm (in)		0.08 to 0.38 (0.0031 to 0.0150)	

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

CYLINDER BLOCK

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

Surface grinding limit;

The grinding limit of cylinder block is available by the cylinder head grinding in an engine.

Detpth of cylinder head grinding is "A"

Depth of cylinder block grinding is "B"

The limit is following:

A + B = 0.2 mm (0.0079 in)

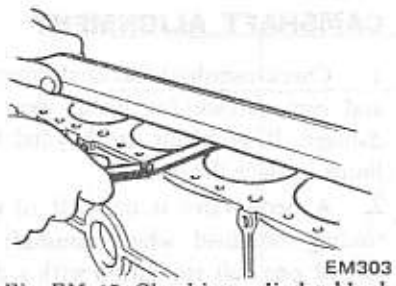


Fig. EM-45 Checking cylinder block surface

3. Using a bore gauge, measure cylinder bore for out-of-round or taper. If, out-of-round or taper is excessive, rebore the cylinder walls by means of a boring machine. Measurement should be taken along bores for taper and around bores for out-of-round. See Figure EM-47.

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

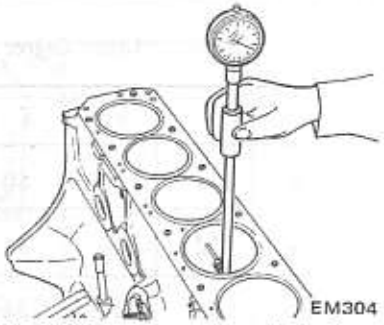


Fig. EM-46 Measuring cylinder bore diameter

4. When wear, taper or out-of-round is minor and within the limit, remove the step at the 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 Figure EM-47 and record the measured values.

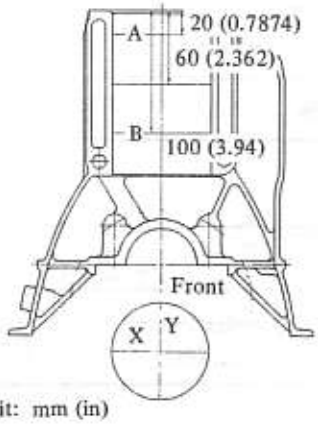


Fig. EM-47 Cylinder bore measuring positions

		Standard		Wear limit
		L20A	L24, L26 L26 (Twin carb.)	
Cylinder bore mm (in)	Inner diameter	78.000 to 78.050 (3.0709 to 3.0728)	83.000 to 83.050 (3.2677 to 3.2697)	0.2 (0.0079)
	Out-of-round	0.020 (0.0008)	0.015 (0.0006)	
	Taper	0.015 (0.0006)		
Difference cylinder bore mm (in)		0.05 (0.0020)		0.2 (0.0079)

Oversize pistons (with pin) specifications

	L20A	L24, L26, L26 (Twin carb.)
Piston diameter mm (in)		
Standard	77.935 to 77.985 (3.0683 to 3.0703)	82.985 to 83.035 (3.2671 to 3.2691)
0.25 (0.0098) Oversize	78.165 to 78.215 (3.0774 to 3.0793)	
0.50 (0.0197) Oversize	78.415 to 78.465 (3.0872 to 3.0892)	83.465 to 83.515 (3.2860 to 3.2880)
0.75 (0.0295) Oversize	78.665 to 78.715 (3.0970 to 3.0990)	
1.00 (0.0394) Oversize	78.915 to 78.965 (3.1069 to 3.1089)	83.965 to 84.015 (3.3057 to 3.3077)
1.50 (0.0591) Oversize	79.415 to 79.465 (3.1266 to 3.1285)	

CYLINDER BORING

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

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

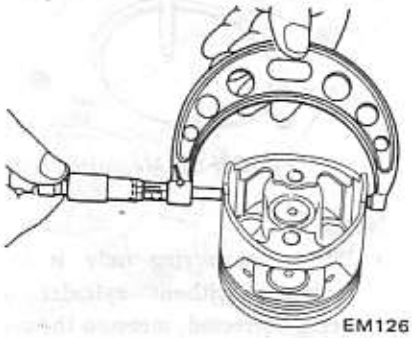


Fig. EM-48 Measuring piston diameter

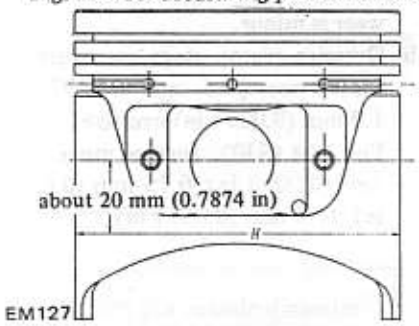


Fig. EM-49 Measuring piston skirt diameter

Rebored size calculation

D = A + B − C = A + [0.005 to 0.025 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)]

Note: To prevent strain due to cutting heat, bore the cylinders in the order of 1-5-3-6-2-4.

4. Do not cut too much out of cylinder bore at a time, but cut 0.05 mm (0.0020 in) or so at a time.
5. Measurement of cylinder bore just machined requires the 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 out gauge from between piston and cylinder.

Notes:

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

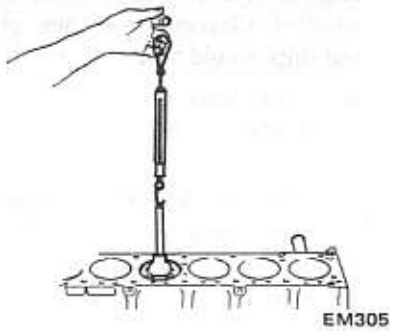


Fig. EM-50 Measuring piston fit in cylinder

		L20A, L24, L26, L26 (Twin carb.)
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)

Note: If cylinder bore has worn beyond the wear limit, use-cylinder liner.
Undersize cylinder liners are available for service.
Interference fit of cylinder liner in cylinder block should be 0.08 to 0.09 mm (0.0031 to 0.0035 in).

Cylinder liner for service

Unit: mm (in)

	L20A		L24, L26, L26 (Twin carb.)	
	Outside diameter	Inner diameter	Outside diameter	Inner diameter
4.0 (0.1575) Undersize	81.95 to 82.00 (3.2264 to 3.2283)	77.45 to 77.55 (3.0492 to 3.0531)	87.00 to 87.05 (3.4252 to 3.4272)	82.50 to 82.60 (3.2480 to 3.2520)
4.5 (0.1772) Undersize	82.45 to 82.50 (3.2461 to 3.2480)		87.50 to 87.55 (3.4449 to 3.4468)	
5.0 (0.1969) Undersize	82.95 to 83.00 (3.2657 to 3.2677)		88.00 to 88.05 (3.4646 to 3.4665)	

PISTONS, PISTON PINS AND PISTON RINGS

1. Remove carbon from piston and ring grooves with a carbon scraper and a curved steel wire. The wire will be useful in cleaning bottom land of ring groove. Clean out oil slots in bottom land of oil ring groove.
2. Check for damage, scratches and wear. Replace if such a defect is detected.
3. Measure the side clearance of rings in ring grooves as each ring is installed. Clearance with new pistons and rings should be as follows.

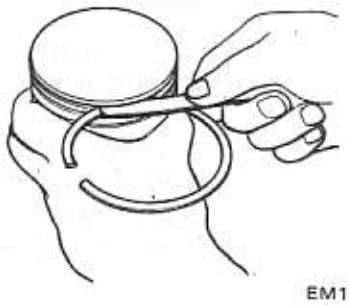


Fig. EM-51 Measuring piston ring side clearance

4. Push ring into cylinder with a 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.

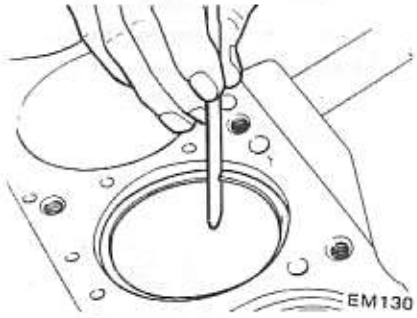


Fig. EM-52 Measuring ring gap

Notes:

a. **When piston ring only is to be replaced, without cylinder bore being corrected, measure the gap at the bottom of cylinder where the wear is minor.**

b. **Oversize piston rings are available for service. [0.5 mm (0.0197 in), 1.0 mm (0.0394 in) oversize].**
For L24 (S30): further move 0.25 mm (0.0098 in), 0.75 mm (0.0295 in), 1.50 mm (0.0591 in).

Side clearance Unit: mm (in)

	Standard		Wear limit
	L20A	L24, L26, L26 (Twin carb.)	
Top ring	0.040 to 0.080 (0.0016 to 0.0031)	0.045 to 0.08 (0.0018 to 0.0031)	0.1 (0.0039)
Second ring	0.030 to 0.070 (0.0012 to 0.0028)	0.030 to 0.070 (0.0012 to 0.0028)	

Ring gap Unit: mm (in)

	Standard		Wear limit
	L20A	L24, L26, L26 (Twin carb.)	
Top ring	0.20 to 0.35 (0.0079 to 0.0138)	0.23 to 0.38 (0.0091 to 0.0150)	1.0 (0.0394)
Second ring	0.14 to 0.29 (0.0055 to 0.0114)	0.15 to 0.30 (0.0059 to 0.0118)	
Oil ring	0.30 to 0.90 (0.0118 to 0.0354)	0.3 to 0.9 (0.0118 to 0.0354)	

5. Measure piston pin hole in relation to the outer diameter of pin. If wear exceeds the limit, replace such piston pin together with 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.

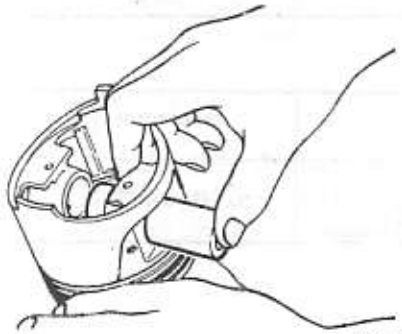

EM131

Fig. EM-53 Piston pin fitting

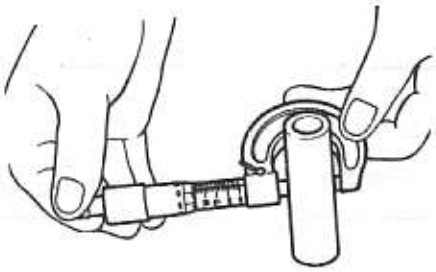

EM132

Fig. EM-54 Measuring piston pin diameter

Unit: mm (in)

	L20A, L24, L26, L26 (Twin carb.)
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	0.006 to 0.013 (0.00024 to 0.0005)
Interference fit of piston pin to connecting rod	0.015 to 0.033 (0.00059 to 0.00130)

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

L20A, L24, L26, L26 (Twin carb.)	Standard	Maximum
Big end play mm (in)	0.2 to 0.3 (0.0079 to 0.0118)	0.6 (0.0240)

CONNECTING ROD

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

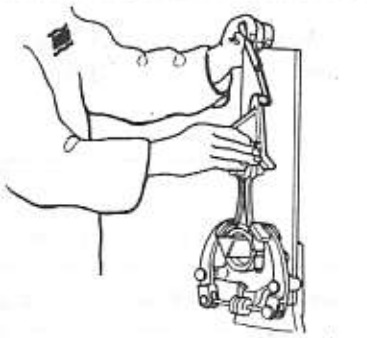

EM133

Fig. EM-55 Checking rod alignment

2. Check connecting rod for bend or torsion using a connnecting rod aligner. If bend or torsion exceeds the limit, correct or replace.
3. When replacing connecting rod, select rod so that weight difference between new and old ones is with in 7 gr (0.247 oz).
4. Install connecting rods with bearings on to corresponding crank pins and measure the thrust clearance. If the measured value exceeds the limit, replace such connecting rod.

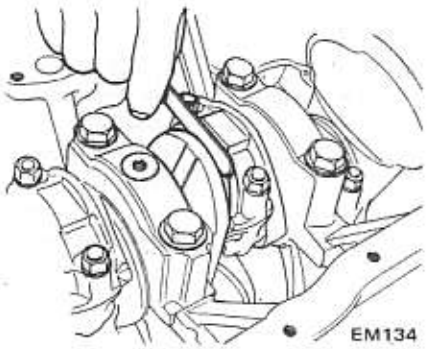

EM134

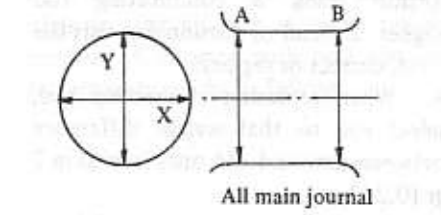
Fig. EM-56 Checking big end play

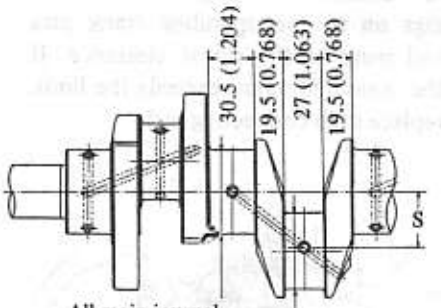
CRANKSHAFT

1. Whenever crankshaft is removed from engine, it should be cleaned toroughly in a suitable solvent. After cleaning check crankshaft journal and crank pin for score, bias wear or cracks. Repair or replace as required. If defects are minor, dress with fine crocus cloth.
2. Check with a micrometer journals and crank pins for taper and out-of-round. Measurement should be taken along journals for taper and around journals for out-of-round. See Figure EM-57 for detail information.

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

	S
L20A	34.85 mm (1.372 in)
L24	36.85 mm (1.451 in)
L26	39.50 mm (1.555 in)





Unit: mm (in) EM306

Fig. EM-57 Crankshaft and journal dimensions

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

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

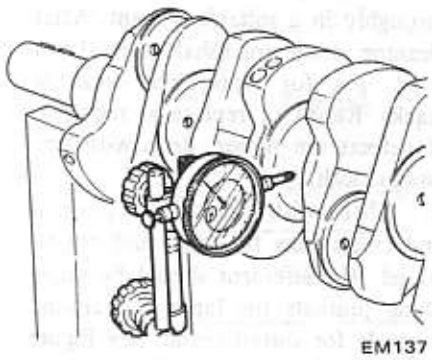


Fig. EM-58 Checking crankshaft bend

L20A, L24, L26, L26 (Twin carb.)	Standard	Maximum
Taper and out-of-round of journal and crank pin mm (in)	less than 0.01 (0.0004)	0.03 (0.0012)

L20A, L24, L26, L26 (Twin carb.)	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 a 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 in the list on page EM-20 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.

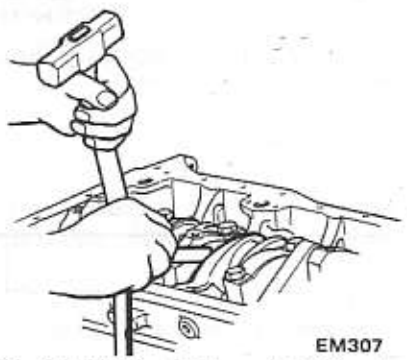


Fig. EM-59 Checking crankshaft end play

	Standard	Wear limit
Crankshaft free end play mm (in)	0.05 to 0.18 (0.0020 to 0.0071)	0.3 (0.0118)

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

To replace crankshaft rear pilot bushing proceed as follows:

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

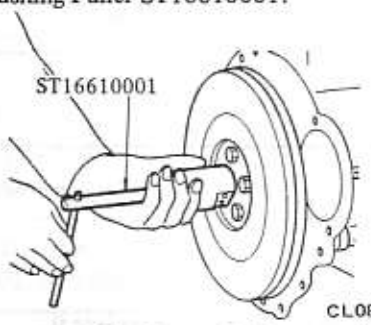


Fig. EM-60 Pulling out pilot bushing

(2) Before installing a new bushing, thoroughly clean bushing hole. Press fit bushing so that its height above flange end is 6.5 to 7.0 mm (0.26 to 0.28 in). Do not oil bushing.

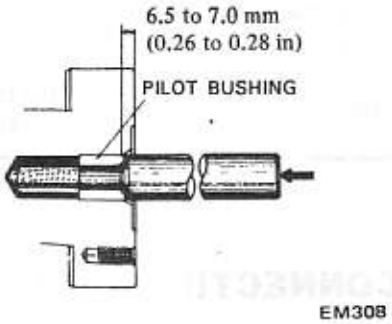


Fig. EM-61 Press-fitting new pilot bushing

BUSHING AND BEARING

MEASUREMENT OF MAIN BEARING CLEARANCE

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

Replace bearings, if any defect is detected.

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

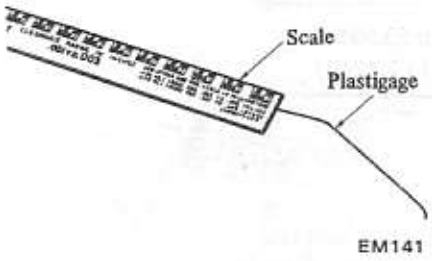


Fig. EM-62 Plastigage

3. Set main bearing on cap block.
4. Cut a plastigage to the 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:
4.5 to 5.5 kg-m
(33 to 40 ft-lb)

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

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

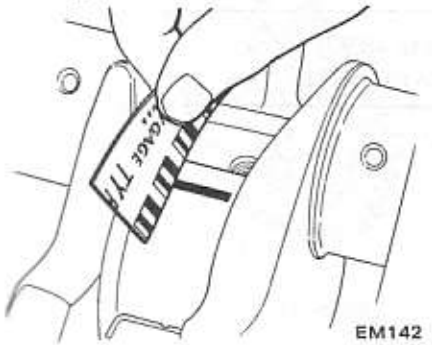


Fig. EM-63 Measuring bearing clearance

MEASUREMENT OF CONNECTING ROD BEARING

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

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

Bearing oil clearance

L20A, L24, L26, L26 (Twin carb.)	Standard	Wear limit
Main bearing clearance mm (in)	0.020 to 0.072 (0.0008 to 0.0028)	0.12 (0.0047)
Connecting rod bearing clearance mm (in)	0.025 to 0.055 (0.0010 to 0.0022)	0.12 (0.0047)

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

FITTING BEARINGS

Bearings are manufactured with crush to make bearings snug down into its bore. To measure this, proceed as follows:

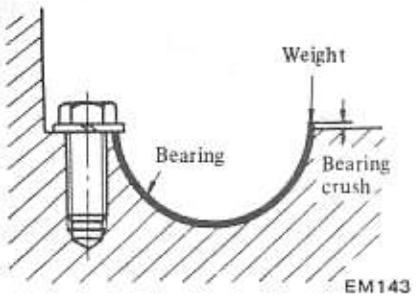


Fig. EM-64 Checking bearing crush

1. Set main bearing in main bearing cap recess or cylinder block bearing recess correctly.
2. Lock the one side end of bearing and press the other side until the bearing back surface touches the recess.
3. Then, measure bearing crush "H" with a feeler gauge. See Figure EM-64. The standard bearing crush value is listed below.
4. Handle connecting rod bearing in the same manner as above.

Bearing crush

	L20A, L24, L26, L26 (Twin carb.)
All main bearing mm (in)	0 to 0.03 (0 to 0.0012)
All connecting rod bearing mm (in)	0.015 to 0.045 (0.0006 to 0.0018)

Main bearing undersize

Unit: mm (in)

L20A, L24, L26, L26 (Twin carb.)	Bearing top thickness	Crank journal diameter
STD	1.822 to 1.835 (0.0717 to 0.0722)	54.942 to 54.955 (2.1631 to 2.1636)
0.25 (0.0098) Undersize	1.947 to 1.960 (0.0767 to 0.0772)	54.692 to 54.705 (2.1532 to 2.1537)
0.50 (0.0197) Undersize	2.072 to 2.085 (0.0816 to 0.0821)	54.442 to 54.455 (2.1434 to 2.1439)
0.75 (0.0295) Undersize	2.197 to 2.210 (0.0865 to 0.0870)	54.192 to 54.205 (2.1335 to 2.1341)
1.00 (0.0394) Undersize	2.322 to 2.335 (0.0914 to 0.0919)	53.942 to 53.955 (2.1237 to 2.1242)

Connecting rod bearing undersize

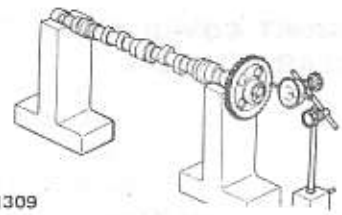
Unit: mm (in)

	Bearing top thickness	Crank pin diameter
	L20A, L24, L26, L26 (Twin carb.)	L20A, L24, L26, L26 (Twin carb.)
STD	1.493 to 1.506 (0.0588 to 0.0593)	49.961 to 49.974 (1.9670 to 1.9675)
0.6 (0.0236) Undersize	1.523 to 1.536 (0.0600 to 0.0605)	49.901 to 49.914 (1.9646 to 1.9651)
0.12 (0.0047) Undersize	1.553 to 1.566 (0.0611 to 0.0617)	49.841 to 49.854 (1.9622 to 1.9628)
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) Unsersize	1.868 to 1.881 (0.00735 to 0.0741)	49.211 to 49.224 (1.9374 to 1.9379)
1.00 (0.0394) Undersize	1.993 to 2.006 (0.0785 to 0.0790)	48.961 to 48.974 (1.9276 to 1.9281)

MISCELLANEOUS COMPONENTS

CRANKSHAFT SPROCKET, CAMSHAFT SPROCKET

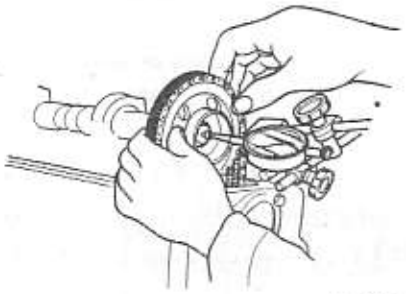
1. Check tooth surface for flaws or wear. Replace sprocket if any fault is found.
2. Install camshaft sprocket in position and check for runout. If it exceeds 0.1 mm (0.00393 in) total indicator reading, replace camshaft sprocket. Also check for end play.



EM309

Fig. EM-65 Checking camshaft sprocket runout

	L20A, L24, L26, L26 (Twin carb.)
Camshaft end play mm (in)	0.08 to 0.38 (0.0031 to 0.0150)



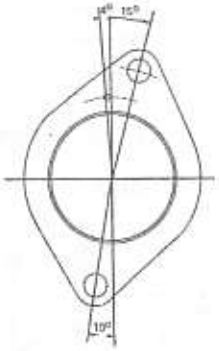
EM310

Fig. EM-66 Checking camshaft end play

3. Check chain for damage, excessive wear or stretch at its roller links. Replace a faulty chain.
4. When chain stretches excessively, the valve timing goes out of order. Two location (camshaft set) holes are provided in camshaft sprocket to correct the valve timing.

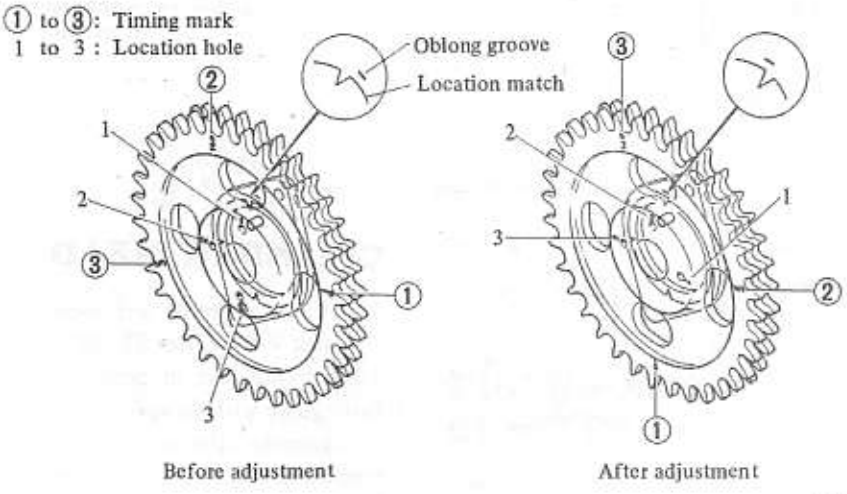
Adjust camshaft sprocket location. If the stretch of chain roller links is excessive, adjust the camshaft sprocket location by transferring the camshaft set position of camshaft sprocket to No. 2 or No. 3 holes.

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



EM146

Fig. EM-67 Camshaft locate plate



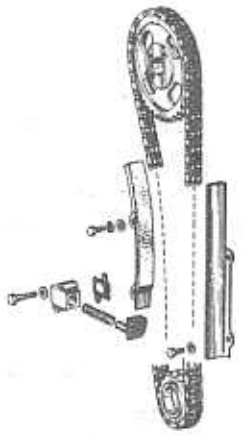
EM311

Fig. EM-68 Adjusting camshaft sprocket location

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. Then this No. 2 notch should be on the right end of the oblong groove. When No. 2 hole is used, also No. 2 timing mark have to be used. The amount of the modification is 4° by the rotation of crankshaft.
3. If the valve timing cannot be corrected by using No. 2 hole, use No. 3 hole in the same procedure as mentioned above. The amount of the modification by using No. 3 hole is 8° by the rotation of crankshaft.
4. When the modification becomes impossible even by transferring the camshaft location hole, replace chain assembly.

CHAIN TENSIONER AND CHAIN GUIDE

Check for wear and breakage. Replace if necessary.



EM147

Fig. EM-69 Comshaft drive mechanism

FLYWHEEL

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

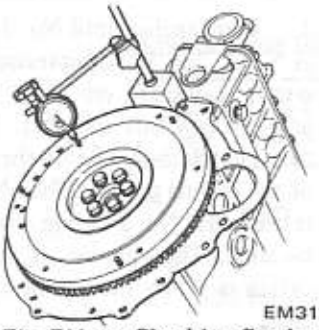

EM312

Fig. EM-70 Checking flywheel deviation

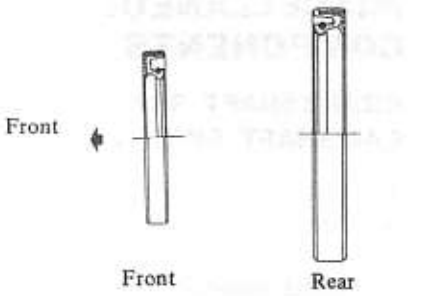
3. Check tooth surfaces of ring gear for flaws or wear.
   Replace if necessary.

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, replace with a new seal. When installing a new seal, pay attention to its mounting direction.

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



EM150

Fig. EM-71 Oil seal of crankshaft

ENGINE ASSEMBLY

CONTENTS

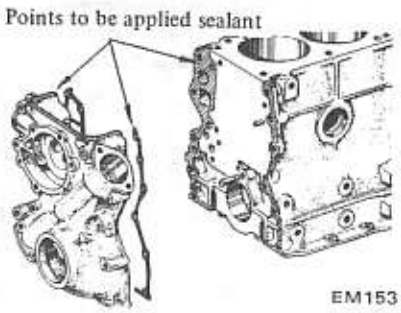
PRECAUTIONS

1. Use thoroughly cleaned parts. Particularly, 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 that have been removed.
5. Keep tools and work benches clean.
6. Keep the necessary parts and tools ready 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:

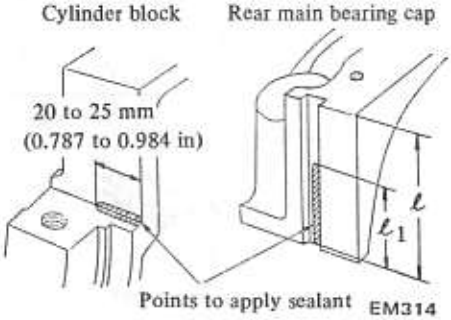
(1) Front cover gasket: Front side of cylinder block and cover gasket. See Figure EM-72.
(2) Front cover: Top of front cover, see Figure EM-72.
(3) Main bearing cap and cylinder block: Each side of rear main bearing cap and each corner of cylinder block. See Figure EM-73.
(4) Cylinder block: Step portions at four mating surfaces (cylinder block to front chain cover and cylinder block to rear main bearing cap). See Figure EM-74.

Note: Do not apply sealant too much.



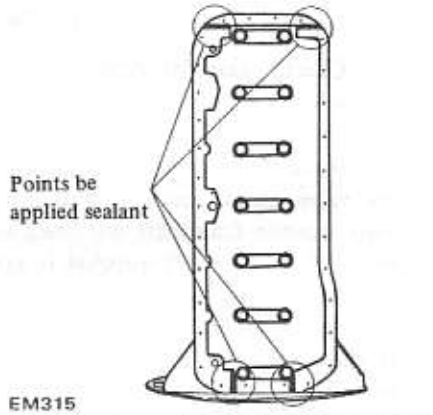
EM153

Fig. EM-72 Applying sealant (Front over and gasket)



EM314

Fig. EM-73 Applying sealant (Main bearing cap and cylinder block)



EM315

Fig. EM-74 Applying sealant (Cylinder block)

CYLINDER HEAD

1. Valve assembly and valve spring.
   Using Valve Lifter ST12070000, set valve spring seat in position, and fit valve guide with oil seal.

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

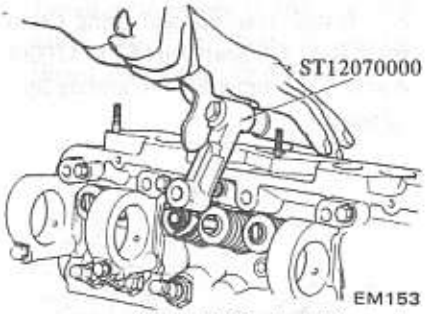


Fig. EM-75 Installing valve

Notes:

a. **Check whether the valve face is free from foreign matters.**
b. **Outer valve spring is of an uneven pitch type. Install spring facing painted side to cylinder head surface.**

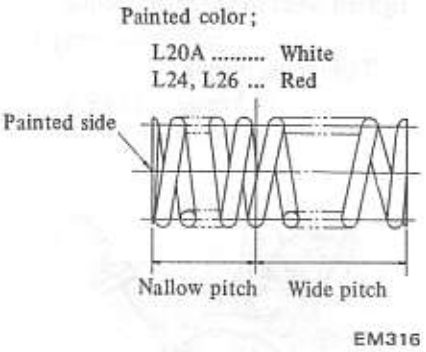


Fig. EM-76 Installing valve spring

2. Valve rocker pivot assembly

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

3. Camshaft assembly

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

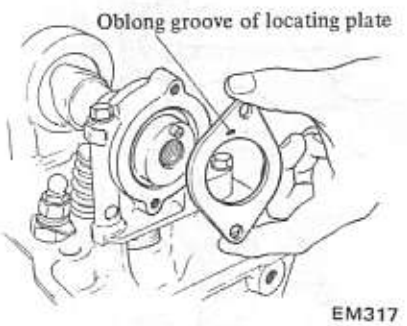


Fig. EM-77 Installing camshaft locating plate

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

Tightening torque:
13 to 15 kg-m
(94 to 108 ft-lb)

At this time, check camshaft end play.

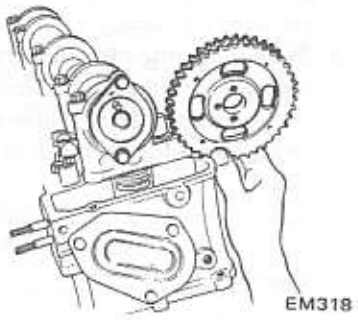


Fig. EM-78 Installing camshaft sprocket

5. Install rocker arms by pressing down valve springs with a screwdriver.

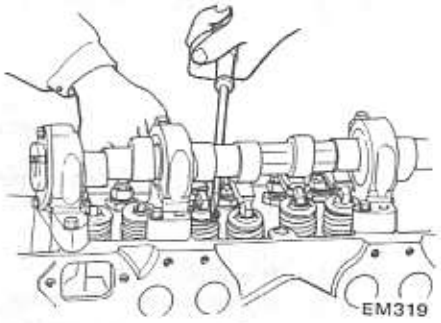


Fig. EM-79 Installing rocker arm

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.

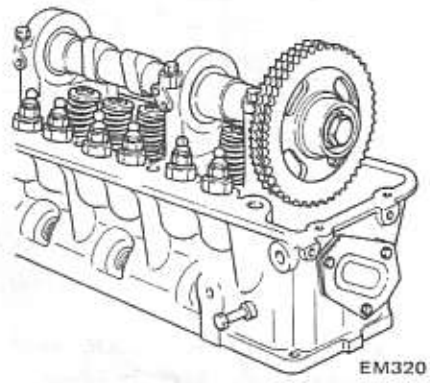


Fig. EM-80 Assembling cylinder head

PISTON AND CONNECTING ROD

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

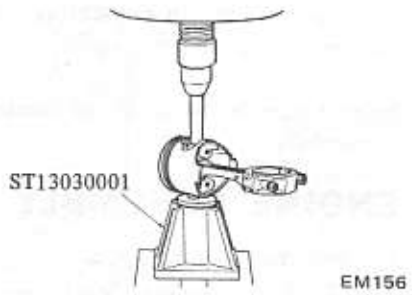


Fig. EM-81 Installing piston pin

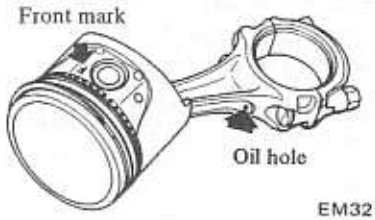


Fig. EM-82 Assembling piston and connecting rod

Notes:

a. **Piston is pressed into connecting rod, and fitting force is from 0.5 to 1.5 tons and the aid of Piston Pin Press Stand ST13030001 is necessary.**
When pressing piston pin in 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 the right side of cylinder block.**
c. **Be sure to install piston in cylinders with notch mark of piston head toward the front of engine.**

2. Install piston rings

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

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.**

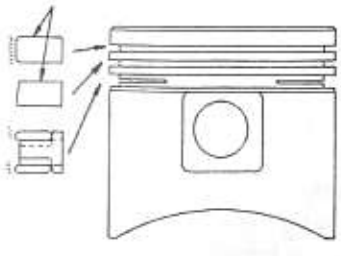


Fig. EM-83 Installing piston ring

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

Note: Clean the back side of bearing carefully.

ENGINE ASSEMBLY

1. The first step in engine assembly is to bolt Engine Attachment ST05340000 to right hand side of cylinder block. In succession, install block in Engine Stand ST0501S000 with engine bottom up.

2. Set main bearings at the proper portion of cylinder block.

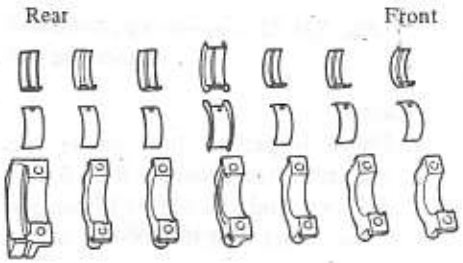


Fig. EM-84 Main bearings

3. Install baffle plate including cylinder block net.

Notes:

a. Only center bearing (No. 4) is a flanged type.
b. All inter-bearings are the same type.
c. Front bearing (No. 1) is also the same type as rear bearing (No. 7).
d. All bearings have an interchangeability between upper and lower bearings.

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

Install crankshaft.

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

Tightening torque:
4.5 to 5.5 kg-m
(32.5 to 39.8 ft-lb)

Notes:

a. Apply sealant to each side of rear main bearing cap and each corner of cylinder block as shown in Figure EM-73.
b. Arrange the parts so that the arrow mark on bearing cap faces toward the 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 separating two to three stages and outwardly from center bearing in the sequence as shown in Figure EM-85.
e. After securing bearing cap bolts, ascertain that crankshaft turn smoothly.

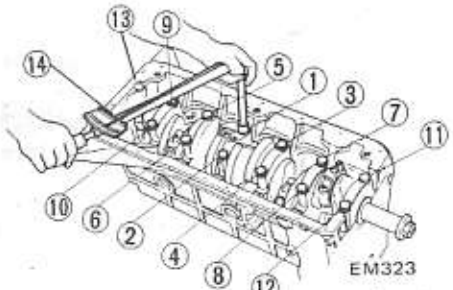


Fig. EM-85 Torque sequence of cap bolts

6. Make sure that there exists proper end play at crankshaft.

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

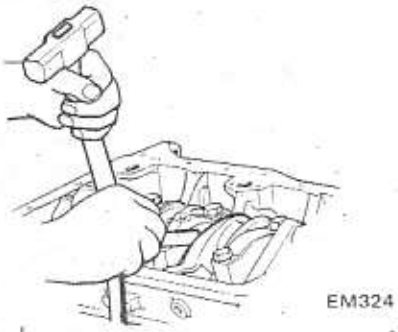


Fig. EM-86 Checking crankshaft end play

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

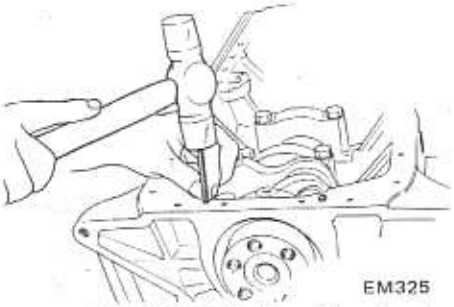


Fig. EM-87 Driving side oil seal

8. Install rear oil seal using Crankshaft Rear Oil Seal Drift ST15310000. Apply a lithium grease to sealing lip of oil seal.

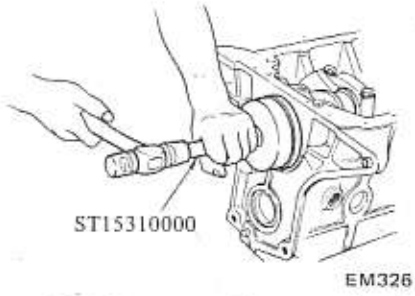


Fig. EM-88 Installing rear oil seal

9. Install rear end plate.

10. Install flywheel securely, and tighten bolts to specified torque.

Tightening torque:
13 to 15 kg-m
(94 to 108 ft-lb)

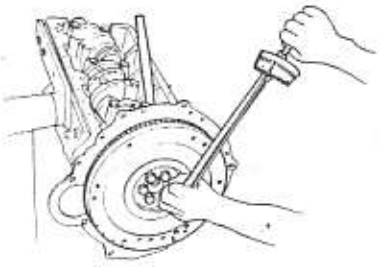


Fig. EM-89 Installing flywheel

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

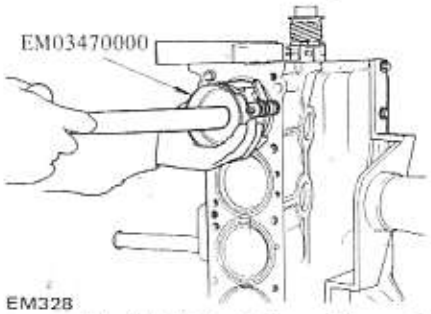


Fig. EM-90 Installing piston-rod assembly

Notes:

a. Apply engine oil to sliding parts.
b. Arrange so that the notch mark on piston head faces to the front of engine.

c. **Install piston rings at 180° to each other, avoiding their fit in the thrust and piston pin directions.**

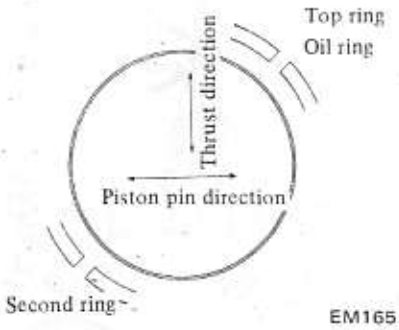


Fig. EM-91 Piston ring direction

12. Install connecting rod caps.

Tightening torque:

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

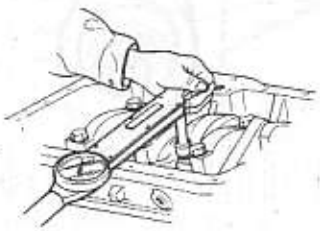


Fig. EM-92 Installing connecting rod cap

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

13. Make sure that there exists proper end play at connecting rod big end.

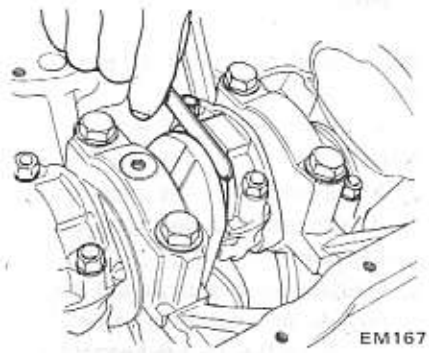


Fig. EM-93 Checking big end play

Big end play:
0.2 to 0.3 mm
(0.0079 to 0.0118 in)

14. Install cylinder head assembly.

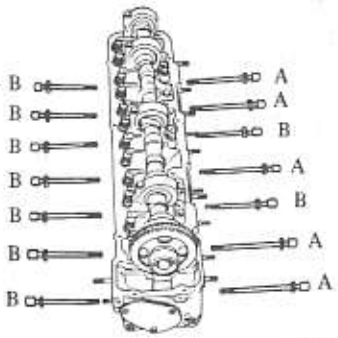


Fig. EM-94 Cylinder head bolts

(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 head of pistons.

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

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

Tightening torque:
2 kg-m (14.5 ft-lb)

15. Install crankshaft sprocket and distributor drive gear and fit oil thrower.

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

16. Install timing chain.

Notes:

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

1 Fuel pump drive cam
2 Chain gauide
3 Chain tensioner
4 Crank sprocket
5 Cam sprocket
6 Chain guide

Fig. EM-95 Installing timing chain

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

c. **No. 1 hole is factory adjusted. When chain stretches excessively, adjust camshaft sprocket at No. 2 or No. 3 hole.**

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

17. Install chain guide to cylinder block.

18. Install chain tensioner.

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

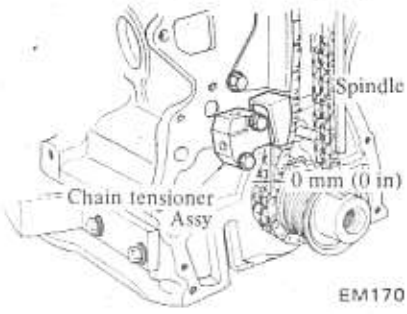


Fig. EM-96 Installing chain tensioner

19. Press new oil seal in front cover. (front cover oil seal should be replaced when front cover is disassembled.)

20. Install front cover with gasket in place.

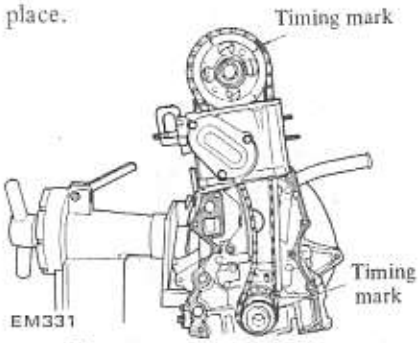
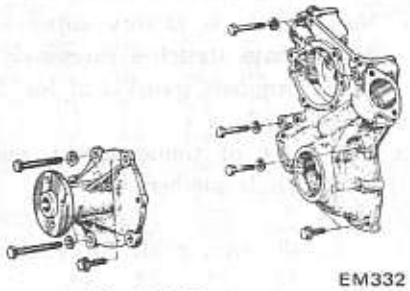


Fig. EM-97 Installing front cover

Notes:

a. Apply sealant to front side of cylinder block and front cover gasket as shown in Figure EM-72.
b. Apply sealant only to the top of front cover as shown in Figure EM-72.
c. Install front cover with head gasket in place.
d. Check the height difference between cylinder block upper face and front cover upper face. Its difference must be less than 0.15 mm (0.0059 in).
e. Note that different types of bolts are used.
f. Apply a lithium grease to sealing lip of oil seal.



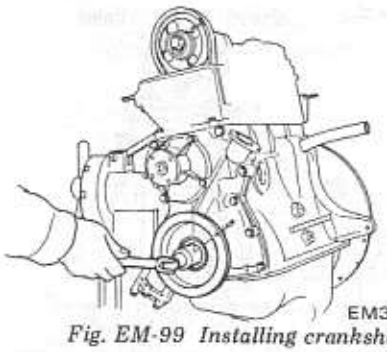
EM332

Fig. EM-98 Front cover bolts

Tightening torque:
Size M8
(0.315 in)
1.0 to 1.6 kg-m
(7.2 to 11.6 ft-lb)
Size M6
(0.236 in)
0.4 to 0.8 kg-m
(2.9 to 5.8 ft-lb)

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

Crankshaft pulley nut tightening torque:
12 to 16 kg-m
(86.8 to 115.7 ft-lb)



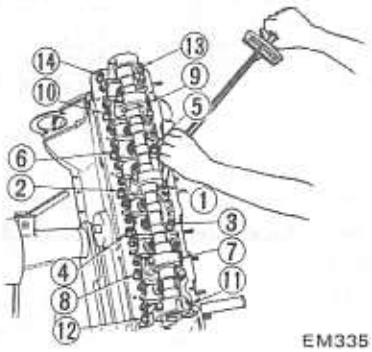
EM334

Fig. EM-99 Installing crankshaft pulley

22. Finally tighten head bolts to the specified torque in three steps according to the tightening sequence as shown in Figure EM-100.

Note that two types of bolts are used.

Special tool Cylinder Head Bolt Wrench ST1012000.
Tightening torque:
1st turn
4.0 kg-m (28.9 ft-lb)
2nd turn
6.0 kg-m (43.4 ft-lb)
3rd turn
6.5 to 8.5 kg-m
(47.0 to 61.5 ft-lb)



EM335

Fig. EM-100 Tightening sequence

Notes:

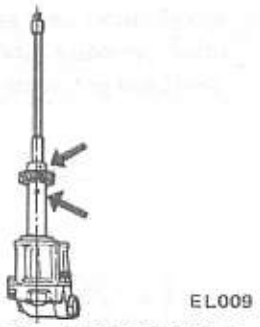
a. Be sure to tighten two small bolts.
b. After engine has been operated for several minutes; if necessary, retighten.

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

Tightening torque:
1.1 to 1.5 kg-m
(8.0 to 10.8 ft-lb)

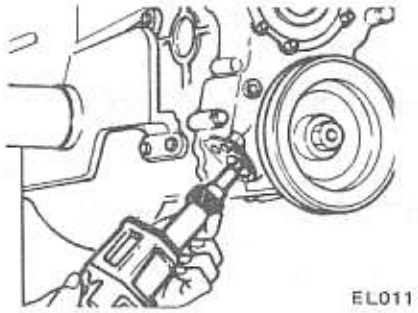
Notes:

a. Assemble oil pump and drive spindle, making driving spindle mark face to oil pump hole, and then move by one notch as shown in Figure EM-101.
b. Install oil pump together with drive spindle 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.
c. Do not forget to install gasket.



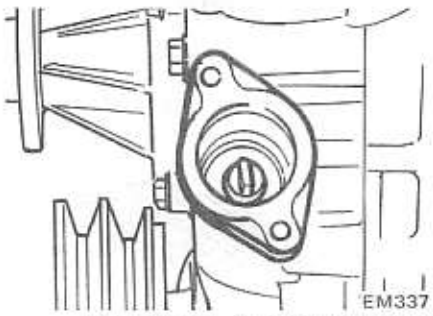
EL009

Fig. EM-101 Setting distributor driving spindle



EL011

Fig. EM-102 Installing oil pump



EM337

Fig. EM-103 Setting distributor drive spindle

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

Fuel pump tightening torque:
1.2 to 1.8 kg-m
(8.7 to 13.0 ft-lb)

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

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

Notes:

a. Apply sealant to the step portions at four mating surfaces as shown in Figure EM-74.
b. Tightening oil pan should be performed in criss-cross pattern and finally to 0.6 to 1.0 kg-m (4.3 to 7.2 ft-lb) torque.

26. Adjust valve clearance to the specified dimensions.

Special tool Pivot Adjuster
ST10640001.
Tightening torque:
5.0 to 6.0 kg-m
(36.2 to 43.4 ft-lb)

Notes:

a. **First set clearance to the cold specifications.**

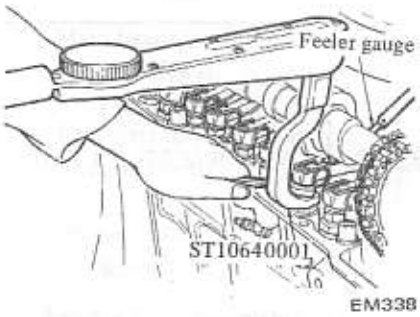


Fig. EM-104 Adjusting valve clearance

			L20A, L24, L26, L26 (Twin carb.)
Valve clearance mm (in)	Cold	Intake	0.2 (0.0079)
		Exhaust	0.25 (0.0098)
	Hot	Intake	0.25 (0.0098)
		Exhaust	0.30 (0.0118)

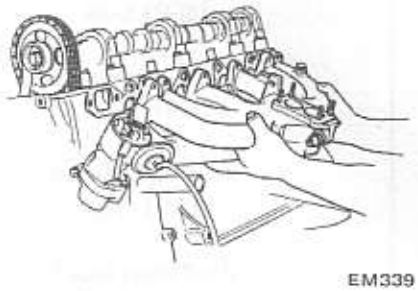


Fig. EM-105 Installing manifolds

28. Install distributor assembly.
29. Install carburetor assembly and carburetor insulator with stamp facing upward. Tightening torque 0.8 to 1.2 kg-m (5.8 to 8.7 ft-lb).

For L24 (Twin carb.) Install heat shield plate at the same time.

b. **After engine has been assembled, run it for at least several minutes, finally adjust the clearance to the warm specifications.**
For details, refer to "Adjusting intake and exhaust valve clearance" in ET section.

27. Install rear engine slinger, exhaust manifold and intake manifold.

Tightening torque:
1.2 to 1.6 kg-m
(8.7 to 11.6)

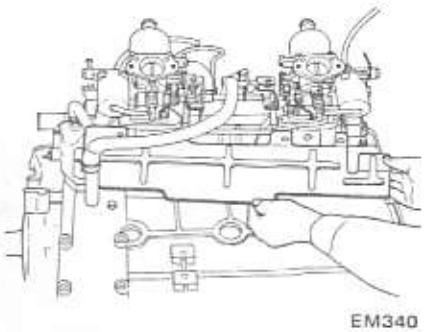


Fig. EM-106 Installing heat shield plate

30. Install fuel pipes and vacuum hose.

All pipes and hoses should be clamped securely, being careful not to allow them to interfere with adjacent or surrounding parts.

31. Install thermostat housing, thermostat and water outlet in their positions. Do not forget to install gasket.
32. Install rocker cover.

Note: Bond gasket to rocker cover using sealant. Then, install rocker cover to cylinder head.

33. Install spark plugs.
34. Connect distributor to plug high tension lead wire.
35. Install engine mount bracket on left hand side.
36. Install clutch assembly.

Special tool Clutch Aligning Bar
ST20630000.
Tightening torque:
1.2 to 2.2 kg-m
(8.7 to 16.0 ft-lb)

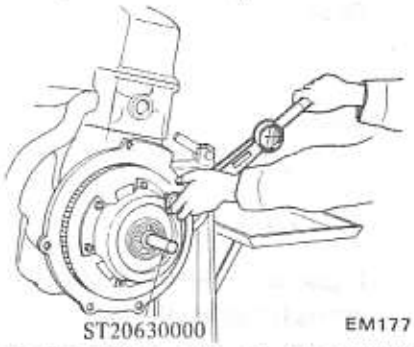


Fig. EM-107 Installing clutch assembly

37. Using an overhead hoist and lifting cable, hoist engine up a way from engine stand and then down onto engine carrier. Install alternator bracket, adjusting bar, alternator, fan pulley, fan and fan belt in this order. Then, check to be sure that deflection of fan belt is held within 8 to 12 mm (0.315 to 0.472 in) when thumb pressure is applied midway between pulleys [A pressed force is about 10 kg (22.0 lb)].

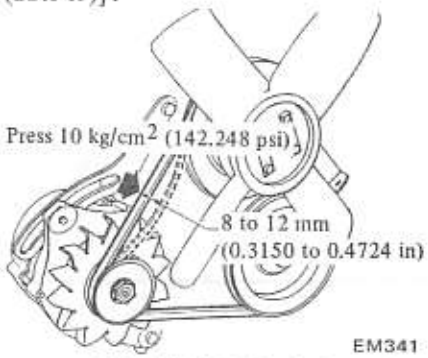


Fig. EM-108 Fan belt tension

38. Install engine mount bracket (right hand), oil filter, oil pressure switch, oil level gauge and water drain plug. When installing an oil filter, fasten it on cylinder block by hand.

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

39. Power engine oil up to specified level.

SERVICE DATA AND SPECIFICATIONS

GENERAL SPECIFICATION

Model	L20A	L24	L26	
Cylinder arrangement	6, in line			
Displacement cc (cu in)	1,998 (121.92)	2,393 (146.02)	2,565 (156.52)	
Bore and stroke mm (in)	78 x 69.7 (3.071 x 2.749)	83 x 73.7 (3.271 x 2.902)	83 x 79 (3.271 x 3.110)	
Valve arrangement	O.H.C.			
Firing order	1-5-3-6-2-4			
	Single carb.	Single carb.	Single carb.	Twin carb.
Engine idle rpm				
M/T	550	550	550	650
A/T	650	650	650	700
Engine idle manifold mmHg (inHg) at idle rpm	450 (17.7)	450 (17.7)	450 (17.7)	430 (16.9)
Oil pressure (Warm at 2,000 rpm) kg/cm^2 (psi)	3.5 to 4.0 (49.8 to 56.9)			

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

TIGHTENING TORQUE

Model	L20A	L24	L26	
			Single carb.	Twin carb.
Cylinder head bolts kg-m (ft-lb)	1st Turn 4.0 (28.9)	2nd Turn 6.0 (43.4)	3rd Turn 7.5 to 8.5 (54.2 to 61.5)	
Connecting rod big end nuts kg-m (ft-lb)		3.7 to 4.3 (26.8 to 31.1)		
Flywheel fixing bolts kg-m (ft-lb)		13 to 15 (94 to 108)		
Main bearing cap bolts kg-m (ft-lb)		4.5 to 5.5 (33 to 40)		
Camshaft sprocket bolt kg-m (ft-lb)		13 to 15 (94 to 108)		
Oil pan bolts kg-m (ft-lb)		0.6 to 1.0 (4.3 to 7.2)		
Oil pump bolts kg-m (ft-lb)		1.1 to 1.5 (8.0 to 10.8)		
Oil pan drain plug kg-m (ft-lb)		2.0 to 3.0 (145. to 21.7)		
Rocker pivot lock nuts kg-m (ft-lb)		5.0 to 6.0 (36.2 to 43.4)		
Camshaft locating plate bolts kg-m (ft-lb)		0.5 to 0.8 (3.6 to 5.8)		
Carburetor nuts kg-m (ft-lb)		3.6 to 7.2 (26 to 52)		
Manifold nuts kg-m (ft-lb)		0.8 to 1.2 (5.8 to 8.7)		
Fuel pump nuts kg-m (ft-lb)		1.2 to 1.8 (8.7 to 13.0)		
Crank pulley bolt kg-m (ft-lb)		13.0 to 15.0 (94 to 108)		
Front cover bolts kg-m (ft-lb)				
6M		0.4 to 0.8 (2.9 to 5.8)		
8M		1.0 to 1.6 (7.2 to 11.6)		
Oil strainer kg-m (ft-lb)		0.4 to 0.6 (2.9 to 4.3)		

SPECIFICATIONS

Model		L20A	L24	L26	
				Single carb.	Twin carb.
a) Valve mechanism					
Valve clearance (Hot) mm (in)		In. 0.25 (0.0098)		Ex. 0.30 (0.0118)	
Valve clearance (Cold) mm (in)		In. 0.20 (0.0079)		Ex. 0.25 (0.0098)	
Valve head dia. mm (in)					
	–Intake	38 (1.5000)		42 (1.6535)	
	–Exhaust	33 (1.3102)		35 (1.3779)	
Valve stem dia. 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 length mm (in)					
	–Intake	115.6 to 115.9 (4.551 to 4.562)		114.9 to 115.2 (4.524 to 4.535)	
	–Exhaust	115.7 to 116.0 (4.555 to 4.567)		115.7 to 116.0 (4.555 to 4.567)	
Vlave lift mm (in)					
	–Intake	10.0 (0.394)		11 (0.433)	
	–Exhaust	10.0 (0.394)		11 (0.433)	
Valve spring free length mm (in)					
	–Outer	47.75 (1.88)		49.98 (1.968)	
	–Inner	44.68 (1.76)		44.85 (1.766)	
Valve spring pressured length (valve open) mm (in)/kg (lb)					
Intake	–Outer	30.0/43.0 (1.181/94.8)		30.0/47.7 (1.181/105.2)	
	–Inner	25.0/19.6 (0.984/43.2)		25.0/24.7 (0.984/54.5)	
Exhaust	–Outer	30.0/43.0 (1.181/94.8)		29.5/49.0 (1.161/108.0)	
	–Inner	25.0/19.6 (0.984/43.2)		24.5/25.5 (0.965/56.2)	

Model		L20A	L24	L26	
				Single carb.	Twin carb.
Valve spring assembled height (valve close) mm/kg (in/lb)					
	–Outer	40.0/16.6 (1.575/36.6)		40.0/21.3 (1.575/47.0)	
	–Inner	35.0/9.6 (1.378/21.2)		35/12.3 (1.378/27.1)	
Valve spring effective turns					
Intake	–Outer		5.0		
	–Inner		5.5		
Exhaust	–Outer		5.0		
	–Inner		5.5		
Valve spring wire dia. mm (in)					
Intake	–Outer	4.0 (0.1575)		4.0 (0.1575)	
	–Inner	2.7 (0.106)		2.9 (0.1142)	
Exhaust	–Outer		4.0 (0.1575)		
	–Inner		2.9 (0.1142)		
Valve spring coil dia. mm (in)					
	–Outer	33.2 (1.307)		33.2 (1.307)	
	–Inner	24.2 (0.953)		24.9 (0.980)	
Valve guide length mm (in)					
	–Intake		59.0 (2.323)		
	–Exhaust		59.0 (2.323)		
Valve guide height from head surface mm (in)			10.4 to 10.6 (0.410 to 0.417)		
Valve guide inner dia. mm (in)					
	–Intake		8.000 to 8.018 (0.3150 to 0.3157)		
	–Exhaust		8.000 to 8.018 (0.3150 to 0.3157)		

Model	L20A	L24	L26	
			Single carb.	Twin carb.
Valve guide outer dia. (standard) mm (in)				
–Intake	12.023 to 12.034 (0.4733 to 0.4738)			
–Exhaust	12.023 to 12.034 (0.4733 to 0.4738)			
Valve guide to stem clearnace 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)			
Valve seat angle				
–Intake	45°			
–Exhaust	45°			
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)			
Valve guide interference fit mm (in)	0.027 to 0.049 (0.011 to 0.0019)			
b) Camshaft and timing chain				
Camshaft end play mm (in)	0.08 to 0.38 (0.0031 to 0.0150)			
Camshaft robe lift mm (in)				
–Intake	6.65 (0.2618)		7.00 (0.2756)	
–Exhaust			7.00 (0.2756)	

Model	L20A	L24	L26	
			Single carb.	Twin carb.
Camshaft journal dia. mm (in)				
—1st		47.949 to 47.962 (1.8877 to 1.8883)		
—2nd		47.949 to 47.962 (1.8877 to 1.8883)		
—3rd		47.949 to 47.962 (1.8877 to 1.8883)		
—4th		47.949 to 47.962 (1.8877 to 1.8883)		
—5th		47.949 to 47.962 (1.8877 to 1.8883)		
Camshaft bend mm (in)		0.02 (0.0007)		
Camshaft journal to bearing clearance mm (in)		0.038 to 0.067 (0.0015 to 0.0026)		
Camshaft bearing inner dia. mm (in)				
—1st		48.000 to 48.016 (1.8898 to 1.8904)		
—2nd		48.000 to 48.016 (1.8898 to 1.8904)		
—3rd		48.000 to 48.016 (1.8898 to 1.8904)		
—4th		48.000 to 48.016 (1.8898 to 1.8904)		
c) **Rocker arm lever ratio**		1.5		
d) **Connecting rod**				
Center distance mm (in)	133.0 (5.24)	133.0 (5.24)	130.35 (5.132)	
Bearing material		F770		
Bearing thickness (S.T.D.) mm (in)		1.493 to 1.506 (0.0588 to 0.0593)		
Big end play mm (in)		0.20 to 0.30 (0.0079 to 0.0118)		
Connecting rod bearing clearance mm (in)		0.025 to 0.055 (0.0010 to 0.0022)		
Connecting rod bend or torsion (per 100 mm or 2.937 in) mm (in)		less than 0.03 (0.0012)		

Model	L20A	L24	L26	
			Single carb.	Twin carb.
e) Crankshaft and main bearing				
Journal dia. mm (in)	54.942 to 54.955 (2.1631 to 2.1636)			
Journal taper & out-of-round mm (in)	less than 0.01 (0.0004)			
Crankshaft free end play mm (in)	0.05 to 0.18 (0.0020 to 0.0071)			
Wear limit of dittoed play mm (in)	0.3 (0.0118)			
Crank pin dia. mm (in)	49.961 to 49.974 (1.9670 to 1.9675)			
Crank pin taper & out-of-round mm (in)	less than 0.01 (0.0004)			
Main bearing material	F770			
Main bearing thickness (S.T.D.)	1.822 to 1.835 (0.0717 to 0.0722)			
Main bearing clearance mm (in)	0.020 to 0.072 (0.0008 to 0.0028)			
Wear limit of dittoted clearance mm (in)	0.12 (0.0047)			
Crankshaft bend mm (in)	0.05 (0.0019)			
f) Piston				
Piston dia. –S.T.D. mm (in)	77.915 to 77.965 (3.0675 to 3.0695)	82.985 to 83.035 (3.2671 to 3.2691)	82.985 to 83.035 (3.2671 to 3.2691)	
0.25 (0.0098) Oversize	77.935 to 77.985 (3.0683 to 3.0703)	83.215 to 83.265 (3.2762 to 3.2781)	83.215 to 83.265 (3.2762 to 3.2781)	
0.50 (0.0197) Oversize	78.165 to 78.215 (3.0774 to 3.0793)	83.465 to 83.515 (3.2860 to 3.2880)	83.465 to 83.515 (3.2860 to 3.2880)	
0.75 (0.0295) Oversize	78.415 to 78.465 (3.0872 to 3.0892)	83.715 to 83.765 (3.2959 to 3.2978)	83.715 to 83.765 (3.2959 to 3.2978)	
1.00 (0.0394) Oversize	78.665 to 78.715 (3.0970 to 3.0990)	83.965 to 84.015 (3.3057 to 3.3077)	83.965 to 84.015 (3.3057 to 3.3077)	
1.50 (0.0590) Oversize	78.915 to 78.965 (3.1069 to 3.1089)	84.465 to 84.515 (3.3254 to 3.3274)	84.465 to 84.515 (3.3254 to 3.3274)	

Model	L20A	L24	L26	
			Single carb.	Twin carb.
Ellipse difference mm (in)	0.29 to 0.33 (0.0114 to 0.0130)	0.32 to 0.35 (0.0126 to 0.0138)		
Ring groove width				
—Top		2.0 (0.0787)		
—Second		2.0 (0.0787)		
—Oil		4.0 (0.1575)		
Piston to bore clearance mm (in)		0.025 to 0.045 (0.0010 to 0.0018)		
Piston pin hole off-set mm (in)		0.95 to 1.05 (0.0374 to 0.0413)		
Piston pin hole diameter mm (in)		21.001 to 21.008 (0.8268 to 0.8271)		
g) Piston pin				
Pin dia. mm (in)		20.993 to 20.998 (0.8265 to 0.8267)		
Pin length mm (in)	66.40 to 66.65 (2.6142 to 2.6240)	72.00 to 72.25 (2.8346 to 2.8445)		
Piston pin to piston clearance mm (in)		0.006 to 0.013 (0.00623 to 0.00051)		
Interference fit of piston pin to connecting rod bushing mm (in)		0.015 to 0.033 (0.0006 to 0.0013)		
h) Piston ring				
Ring height mm (in)				
—Top		1.977 (0.0778)		
—Second		1.977 (0.0778)		
Side clearance mm (in)				
—Top	0.040 to 0.080 (0.0016 to 0.0031)	0.045 to 0.080 (0.0018 to 0.0031)		
—Second		0.030 to 0.070 (0.0012 to 0.0028)		

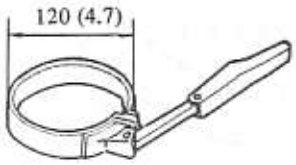
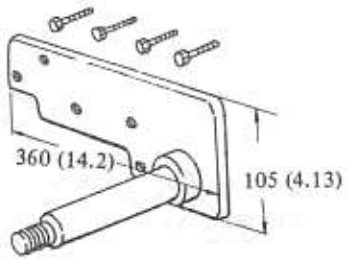
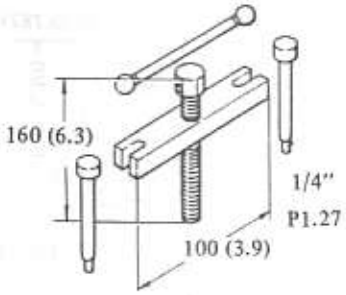
Model		L20A	L24	L26	
				Single carb.	Twin carb.
Ring gap mm (in)					
	–Top	0.20 to 0.35 (0.0079 to 0.0138)	0.23 to 0.38 (0.0091 to 0.0150)		
	–Second	0.14 to 0.29 (0.0055 to 0.0114)	0.15 to 0.30 (0.0059 to 0.0118)		
	–Oil	0.30 to 0.90 (0.0118 to 0.0354)	0.15 to 0.30 (0.0059 to 0.0118)		

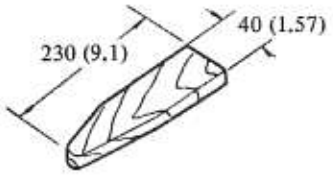
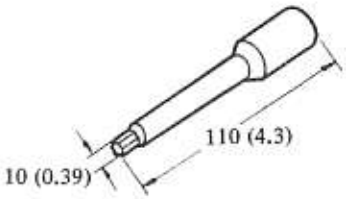
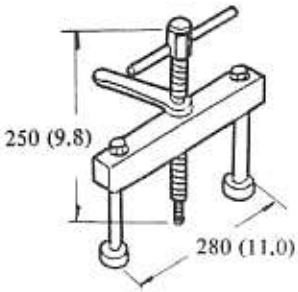
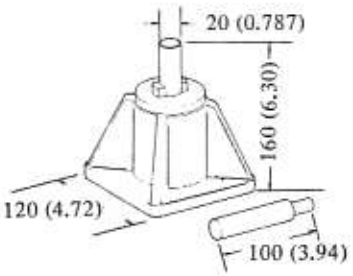
TROUBLE DIAGNOSES AND CORRECTIONS

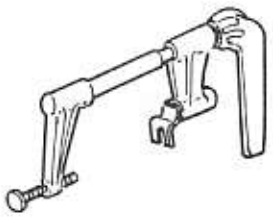
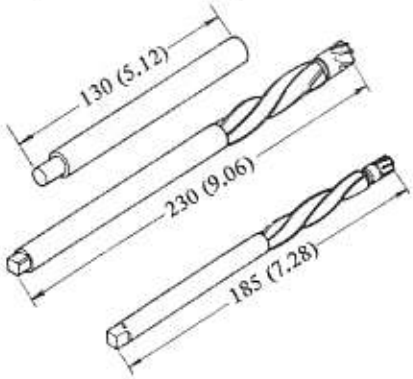
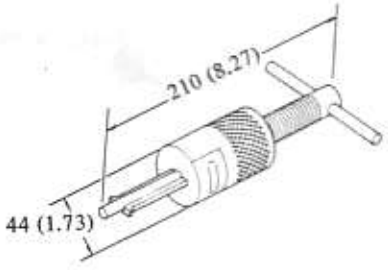
Condition	Probable cause	Corrective action
I. Noisy engine		
Knocking of crankshaft and bearing.	Loose main bearing.	Replace.
	Seized bearing.	Replace.
	Bent crankshaft.	Repair or replace.
	Uneven wear of journal.	Correct.
	Excessive crankshaft end play.	Replace center bearing.
Piston and connecting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

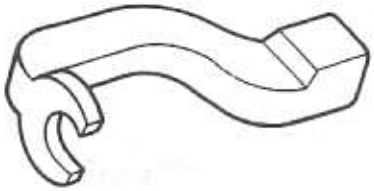
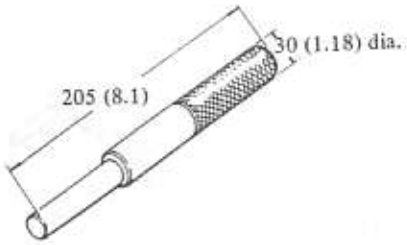
Condition	Probable cause	Corrective action
Seized valve seat.	Improper valve clearnce.	Adjust.
	Weakned valve spring.	Replace.
	Thin valve head edge.	Replace valve.
	Narrow valve seat.	Reface.
	Overheat.	Repair or replace.
	Over speeding.	Drive under proper speed.
	Sticked valve guide.	Repair.
Excessively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

SPECIAL SERVICE TOOLS

No.	Tool number & tool name	Description Unit: mm (in)	For use on	Reference page or figure No.
1.	ST19320000 Oil filter wrench	This tool is used to take oil filter out of place. In tightening the filter, do not use this tool, to prevent excess tightening.  SE197	All models	Page EM-4
2.	ST05340000 Engine attachment	Attachment for setting the engine on the engine stand.  SE292	L20A L24 L26	Fig. EM-9 Page EM-24
3.	ST0501S000 Engine stand assembly ST05011000 Engine stand ST05012000 Base	This engine stand assembly is used for disassembling or assembling engine block or differential carrier throughout 360° in all directions.  SE184	All models	Fig. EM-9 Page EM-24
4.	ST16540000 Puller crank pulley	For removing the crank pulley with damper.  SE293	L20A L24 L26	Fig. EM-12

No.	Tool number & tool name	Description Unit: mm (in)	For use on	Reference page or figure No.
5.	ST17420001 Chain stopper	This tool is used to prevent chains from falling out of place in removing cylinder heads or cam gears and shafts.  SE195	All L-series	Fig. EM-13 Page EM-5
6.	ST10120000 Cylinder head bolt wrench	Special hollow set bolts are used in tightening cylinder heads in L-series engines. This wrench is used to torque cylinder head bolts and its head can be inserted into the torque wrench.  SE186	All L-series	Fig. EM-14 Page EM-26
7.	ST1651S000 Crankshaft main bearing cap puller ST16511000 Body ST16512001 Adapter	This tool is used to remove the cap from main bearing. When using this tool, turn its adapter into the threaded hole in main bearing cap.  SE190	All L-series	Fig. EM-20
8.	ST13030001 Piston pin press stand	This tool is used with a press to drive pin into, or out of, connecting rod.  SE188	All L-series	Fig. EM-81

No.	Tool number & tool name	Description Unit: mm (in)	For use on	Reference page or figure No.
9.	ST12070000 Valve lifter	This tool is used to compress valve spring by the combined action of its cam and lever, thereby facilitating the removal or installation of collect (for general use.)  SE194	All models	Page EM-22 Fig. EM-75 Fig. EM-27
10.	ST1103S000 Valve guide reamer set –ST11031000 Reamer (12.2 mm dia.) –ST11032000 Reamer (8.0 mm dia.) –ST11033000 Drift	This guide is used for: o Pressing used guide out of place. o Driving a new guide into place. o Finishing the bore of new guide.  SE192	All L-series	Fig. EM-38
11.	ST11650001 Cutter set valve seat	For correcting the valve seat insert.  SE295	L24 L20A L16 L13	Fig. EM-39 Page EM-11
12.	ST16610001 Pilot bush puller	This tool is used to push pilot bush out of place.  SE191	All L-Series	Fig. EM-60

No.	Tool number & tool name	Description Unit: mm (in)	For use on	Reference page or figure No.
13.	ST15310000 Crankshaft rear oil seal drift	This tool is used to push a lip type rear oil seal for L-series engine into place by giving hammer blows.  SE189	All L-series	Fig. EM-88
14.	EM03470000 Piston ring compressor	This tool is used to compress piston rings while piston is being inserted into cylinder.  SE199	All models	Fig. EM-90
15.	ST10640001 Pivot adjuster	This tool is used together with a torque wrench in tightening pivot lock nut for valve clearance adjustment.  SE187	All L-series	Fig. EM-104
16.	ST20630000 Clatch aligning	For centering the clutch disc.  SE294	130 230 S30 HGC110 A30	Fig. EM-107