SERVICE MANUAL

MODEL
L14, L16 & L18 SERIES
ENGINES

NISSAN

NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

SECTION EM

ENGINE MECHANICAL

EM

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GENERAL DESCRIPTION

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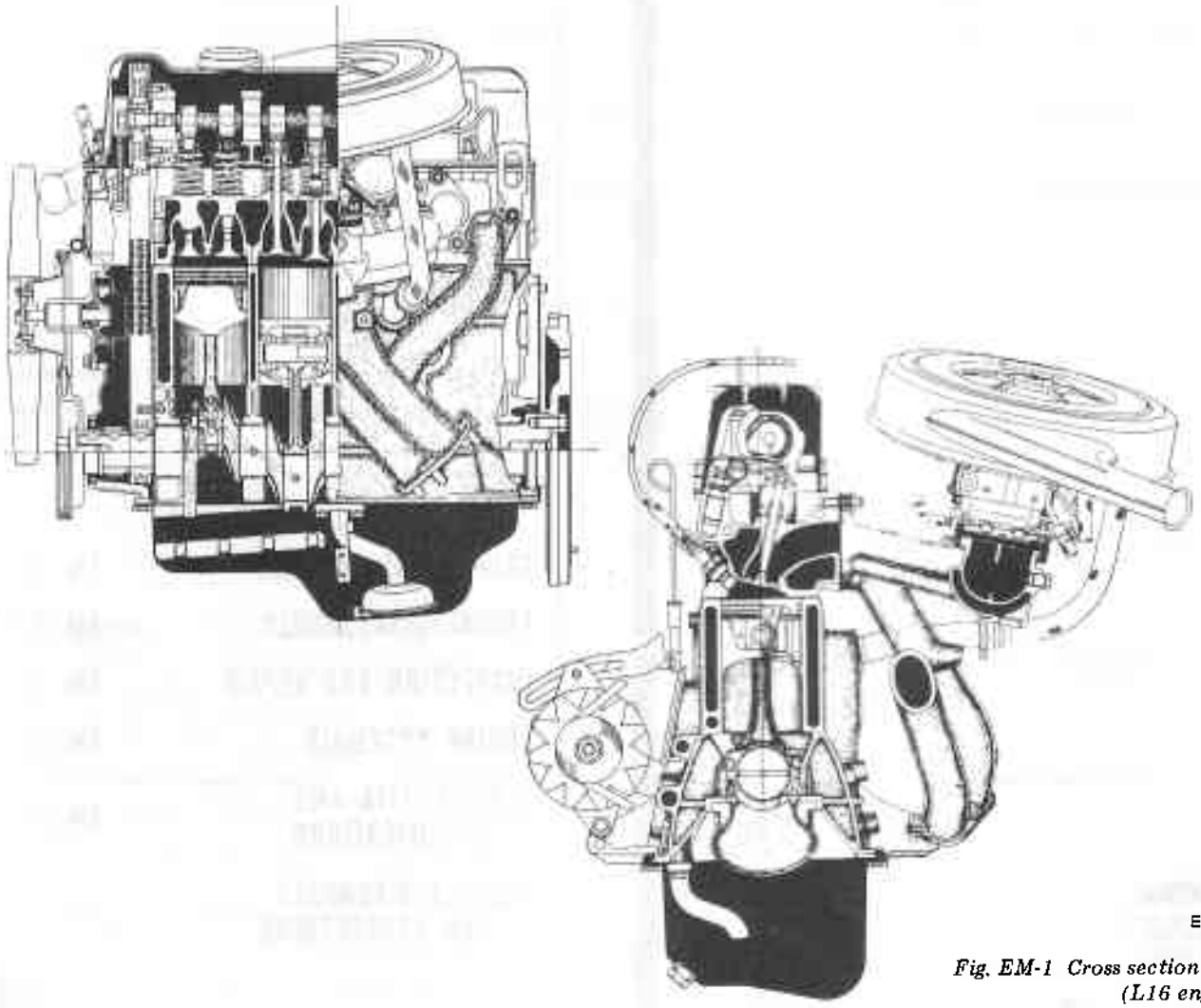
L14, L16 AND L18 ENGINE

The 510 series models are powered by the L14 and L16 engines. The L16 engine is also utilized to power the 610. For the 610, the L18 engine is also available for faster, harder use on highways and streets. The engines feature O.H.C. valves, wedge-shaped combustion chamber, alminum heads and fully balanced 5-bearing crankshaft to turn out smooth, dependable power. The cylinder block is cast in a single unit, featuring deep skirting.

SU type carburetor is used to provide proper air-fuel mixing for the L16 and L18 engines. These engines are also equipped with single, 2-barrel, downdraft carburetor. The L14 engine uses only the same single, 2-barrel carburetor that is used on the L16 and L18 engine.



EM076

Fig. EM-1 Cross section view (L16 engine)

Main specifications

	L14	L16		L18	
	Single carb.	Single carb.	Twin carb.	Single carb.	Twin carb.
Displacement cc (cu in)	1,428 (87.14)	1,595 (97.33)	←	1,770 (108.01)	←
Bore x stroke mm (in)	83 x 66 (3.268 x 2.598)	83 x 73.7 (3.268 x 2.902)	←	85 x 78 (3.346 x 3.071)	←
Compression ratio	9.0	8.5	9.5	8.5	9.5
Ignition timing for M/T B.T.D.C. (for A/T)	8°/600 rpm	10°/600 rpm (650)	14°/650 rpm (700)	10°/600 rpm (650)	14°/650 rpm (700)

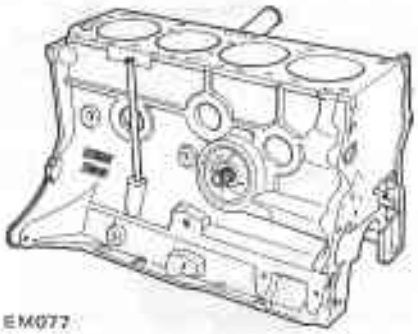
M/T: Manual Transmission A/T: Automatic Transmission

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

CYLINDER BLOCK

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

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



EM077

Fig. EM-2 Cylinder block

CRANKSHAFT

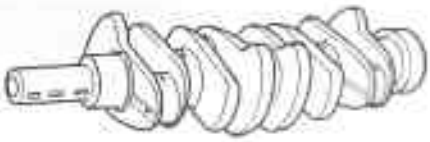
The crankshaft is a special steel forging. Fully balanced, it turns out smooth, dependable power at high speed.

The L18 engine uses eight balance weights, while the others use four.

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

EM078

Fig. EM-3 Crankshaft (L14 and L16)



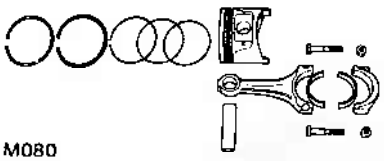
EM079

Fig. EM-4 Crankshaft (L18)

PISTON AND CONNECTING ROD

The pistons are special alminum casting with struts to control thermal expansion and have two compression rings and one combined oil ring. The L16 engine equipped with twin carburetors, and the L14 engine equipped with single carburetor use the flat head pistons and others use slightly dished pistons. The piston pin is a special hollow steel shaft. It is full-floating fit to the piston and press fit to the connecting rods.

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



EM080

Fig. EM-5 Piston and connecting rod

CYLINDER HEAD

The cylinder head is made of light and strong aluminum alloy with good cooling efficiency; it contains wedge type combustion chambers. A special aluminum bronze valve seat is used on the intake valve, while a heat resistant

steel valve seat is installed on the exhaust valve. These parts are all hot press-fitted.

EM081

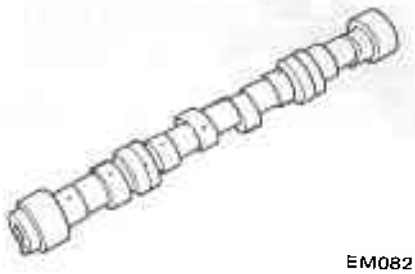
Fig. EM-6 Cylinder head

CAMSHAFT

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

The concentric passages are drilled in the front and rear part of the camshaft.

The oil to each cam lobe is supplied through an oil hole drilled in the base circle of each lobe. Lubricant is supplied to the front oil gallery from 2nd camshaft bearing and to the rear oil gallery from 3rd camshaft bearing. These holes on the base circle of lobe supply lubricant to the cam pad surface of the rocker arm and to the valve tip end.



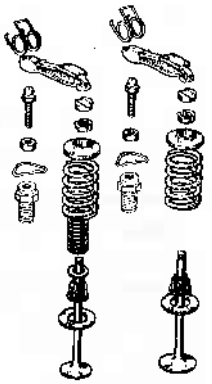
EM082

Fig. EM-7 Camshaft

VALVE MECHANISM

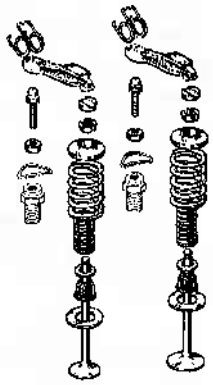
The valve system has a pivot type rocker arm that is activated directly by the cam mechanism, and this has made its moving parts considerably lighter and provides an ideal highspeed performance.

Only the L14 engine uses the single type valve springs intake valve only and all other engines use the dual type valve springs.



EM083

Fig. EM-8 Valve mechanism (L14)



EM084

Fig. EM-9 Valve mechanism (L16 and L18)

CAMSHAFT DRIVE

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

EM085

Fig. EM-10 Chain driving system

MANIFOLDS

The intake manifold is made of casted aluminum alloy. The twin-carburetor type engines use the one with an independent design for each carburetor, while the single carburetor type engines use a monoblock manifold.

The exhaust manifold, identical in design on both engine types is a dual exhaust system intended to prevent decrease 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.

EM086

Fig. EM-11 Manifolds for single carburetor

EM087

Fig. EM-12 Manifolds for twin carburetor

ENGINE DISASSEMBLY

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PRELIMINARY CLEANING AND INSPECTION

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 special tool "Oil Filter Wrench ST19320000."
   (4) Remove oil pressure switch.
   (5) Install engine attachment to cylinder block using bolt holes securing alternator bracket and water drain plug.
   (6) Set engine on the stand.

   "Engine Attachment ST05260001"
   "Engine Stand ST0501S000"

Fig. EM-13 Engine on engine stand

4. Remove oil level gauge.
5. Remove clutch assembly.
6. Remove high tension cable.
7. Remove spark plugs.
8. Remove thermostat housing.

Fig. EM-14 Removing thermostat housing

9. Remove rocker cover.
10. Remove carburetor.
11. Remove intake and exhaust manifolds.

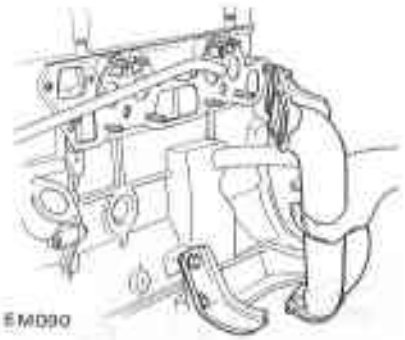

Fig. EM-15 Removing manifolds

12. Remove engine mounting L.H.
13. Remove crank pulley.
14. Remove water pump.
15. Remove fuel pump.
16. Remove fuel pump drive cam.
17. Remove camshaft sprocket.

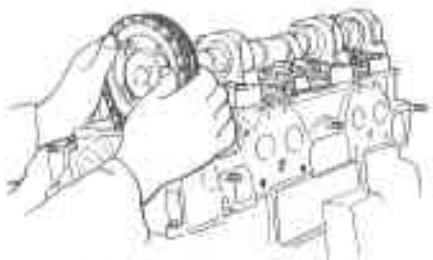

Fig. EM-16 Removing camshaft sprocket

18. Remove cylinder head assembly. Use special tool "Cylinder Head Bolt Wrench ST10120000" to remove cylinder head bolts. Loosen bolts from ① to ⑩ as shown in Figure EM-17.

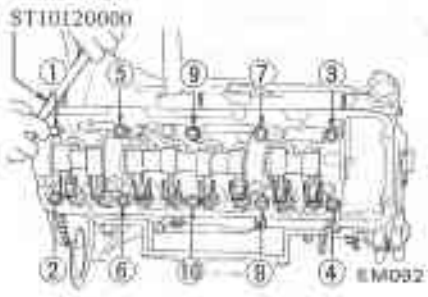

Fig. EM-17 Cylinder head bolt loosening sequence

Note: **For the convenience of cylinder head replacement, special tool "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.**

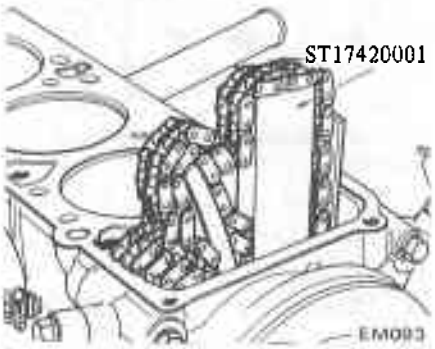

Fig. EM-18 Supporting timing chain

19. Invert engine.
20. Remove oil pan and oil strainer.

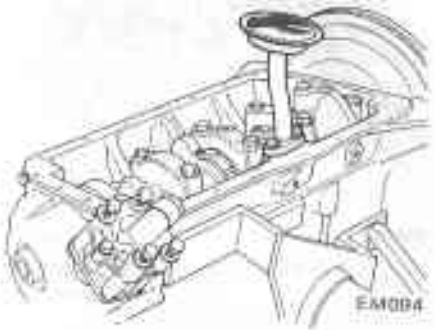

Fig. EM-19 Removing oil strainer and oil pump

21. Remove oil pump and its drive spindle.
22. Remove front cover.
23. Remove chain tensioner.

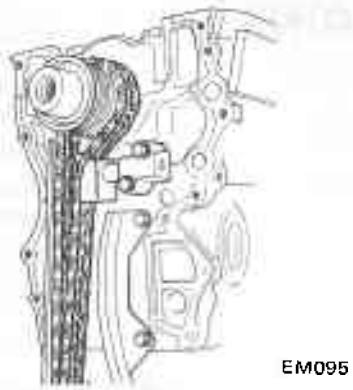

Fig. EM-20 Removing chain tensioner and timing chain

24. Remove timing chain.
25. Remove oil thrower, crankshaft worm gear and chain drive sprocket.

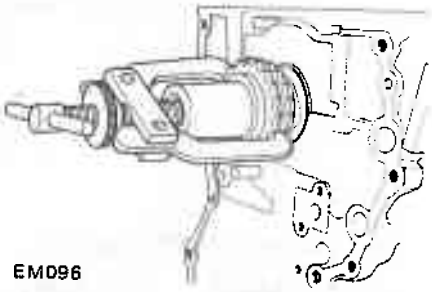

Fig. EM-21 Removing chain drive sprocket

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

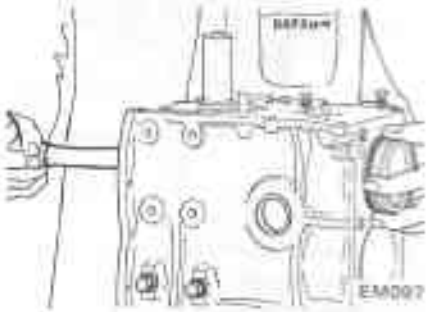

Fig. EM-22 Removing piston and connecting rod assembly

27. Remove flywheel. Be careful not to drop it.

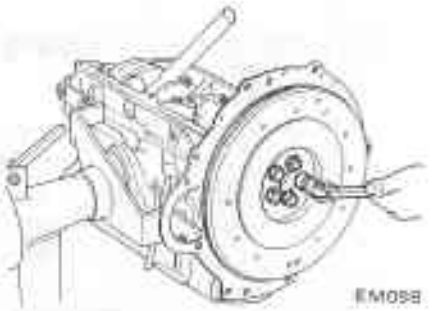

Fig. EM-23 Removing flywheel

28. Remove main bearing caps.

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

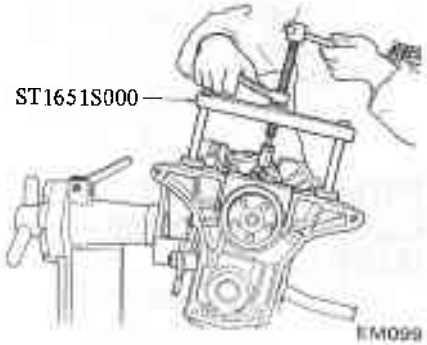

Fig. EM-24 Removing rear main bearing cap

29. Remove rear oil seal.

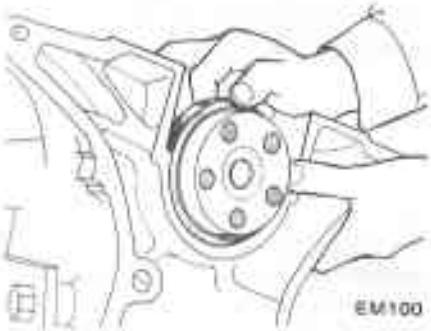

Fig. EM-25 Removing rear oil seal

30. Remove crankshaft.
31. Remove buffle plate and cylinder block net.

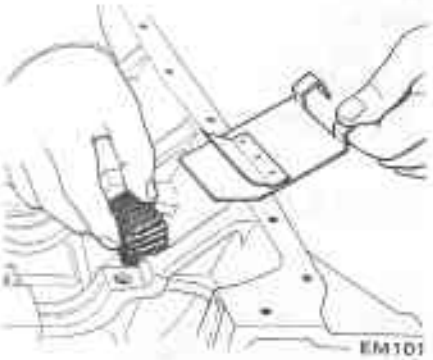

Fig. EM-26 Removing buffle plate and net

PISTONS AND CONNECTING RODS

1. Remove piston rings with a ring remover.

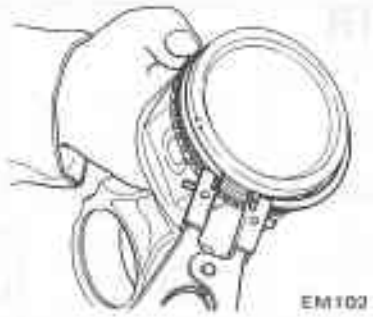

Fig. EM-27 Removing piston ring

2. Press out piston pin with special tool "Piston Pin Press Stand ST13030001."

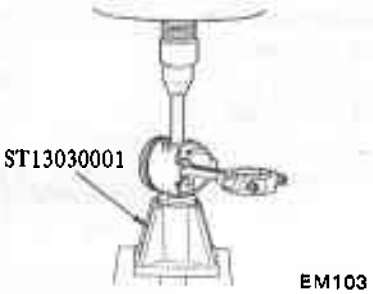

Fig. EM-28 Removing piston pin

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.

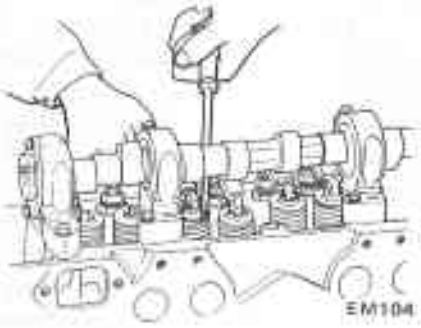

Fig. EM-29 Removing rocker arm

Note: Take care not to lose valve rocker guide.

2. Remove camshaft.

Fig. EM-30 Removing camshaft

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

3. Remove valves using special tool "Valve Lifter ST12070000."

Fig. EM-31 Removing valve

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

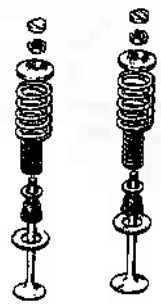

Fig. EM-32 Valve components

Notes:

a. **Be sure to leave camshaft bearing intact. Because the bearing center is liable to be out of alignment.**
b. **Only the L14 engine uses the single type spring for intake valve.**

INSPECTION AND REPAIR

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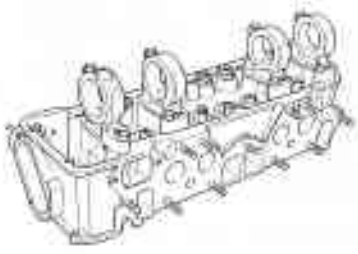
PREPARATION FOR INSPECTION

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

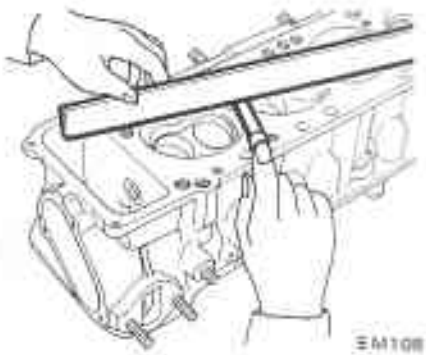


EM081

Fig. EM-33 Cylinder head

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.



EM108

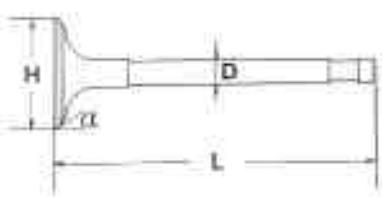
Fig. EM-34 Checking cylinder head surface

Head surface flatness

Standard	Maximum
less than 0.05 mm (0.0020 in)	0.1 mm (0.0039 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 defective.
2. Valve face or valve stem end surface should be refaced by using a valve grinder.



EM109

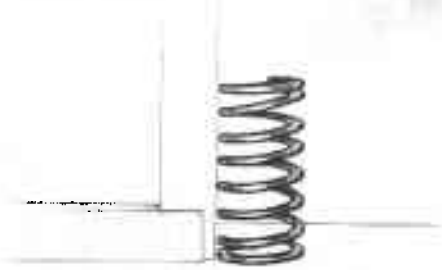
Fig. EM-35 Intake and exhaust valve dimensions

H	Valve head diameter mm (in)	L14	In.	38.0 to 38.2 (1.496 to 1.504)
			Ex.	33.0 to 33.2 (1.299 to 1.307)
		L16	In.	42.0 to 42.2 (1.654 to 1.661)
			Ex.	33.0 to 33.2 (1.299 to 1.307)
		L18	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)	L14	In.	115.6 to 115.9 (4.551 to 4.562)
			Ex.	115.7 to 116.0 (4.555 to 4.567)
		L16 L18	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)	L14 L16 L18	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'

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 more than 1.6 mm (0.063 in), 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.

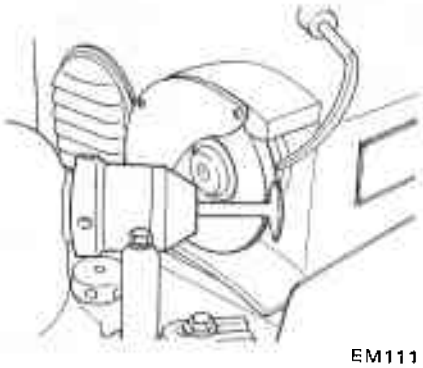


EM112

Fig. EM-38 Measuring spring squareness

EM110

Fig. EM-36 Checking valve stem diameter



EM111

Fig. EM-37 Regrinding valve face

EM113

Fig. EM-39 Measuring spring tension

Spring specifications

	L14	L16 and L18	
		Single carb.	Twin carb.
Valve spring free length mm (in)			
Intake Outer	49.0 (1.929)	49.98 (1.968)	
Intake Inner		44.85 (1.766)	
Exhaust Outer	49.98 (1.968)	49.98 (1.968)	
Exhaust Inner	44.85 (1.766)	44.85 (1.766)	
Valve spring pressured length (valve open) mm/kg (in/lb)			
Intake Outer	30.0/60.0 (1.181/132.3)	30.0/47.7 (1.181/105.2)	29.5/49.0 (1.161/108)
Intake Inner		25.0/24.9 (0.984/54.9)	24.5/25.5 (0.965/56.2)
Exhaust Outer	30.0/47.7 (1.181/105.2)	29.5/49.0 (1.161/108)	29.5/49.0 (1.161/108)
Exhaust Inner	25.0/24.9 (0.984/54.9)	24.5/25.5 (0.965/56.2)	24.5/25.5 (0.965/56.2)
Valve spring assembled height (vale close) mm/kg (in/lb)			
Intake Outer	40.0/28.4 (1.575/62.6)	40.0/21.3 (1.575/47.0)	
Intake Inner		35.0/12.3 (1.378/27.1)	
Exhaust Outer		40.0/21.3 (1.575/0.839)	
Exhaust Inner		35.0/12.3 (1,378/0.484)	

Rocker arm and valve rocker pivot

Check pivot head and cam contact and pivot contact surfaces of rocker arm for damage or wear. If defects are found, replace them. A defective 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.

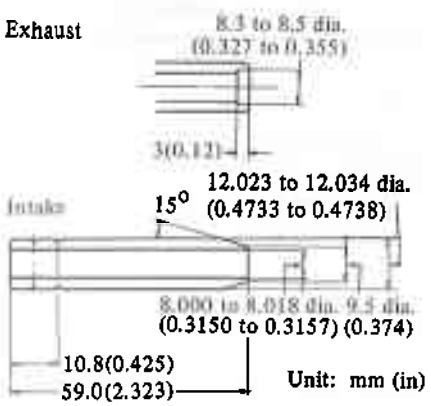


Fig. EM-40 Standard valve guide

		Intake valve	Exhaust valve
Stem to guide clearance mm (in)	L14 L16, L18	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)	All	0.1 (0.0039)	

As an emergency expedient, a valve is pushed in valve guide and moved to the left and the right at 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.)

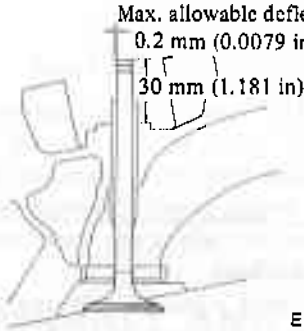


Fig. EM-41 Measuring clearance between valve stem and valve guide

Replacement of valve guide

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

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

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

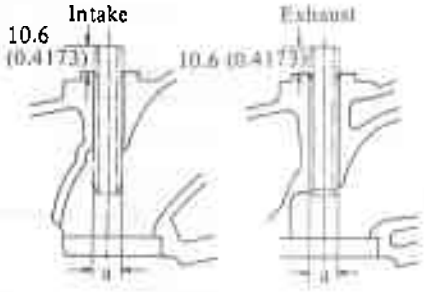


Fig. EM-42 Valve guide hole

		L14, L16 and L18
Guide hole inner diameter "a" mm (in)	For standard valve guide	11.985 to 11.996 (0.4719 to 0.4723)
	For service valve guide	12.185 to 12.196 (0.4797 to 0.4802)

3. Press new valve guide into valve 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.

	L14, L16 and L18
Interference fit of valve guide to guide hole mm (in)	0.027 to 0.049 (0.0011 to 0.0019)

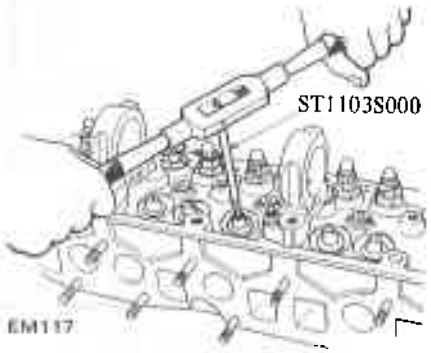


Fig. EM-43 Reaming valve guide

4. Ream the bore with valve guide pressed in, using special tool "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.

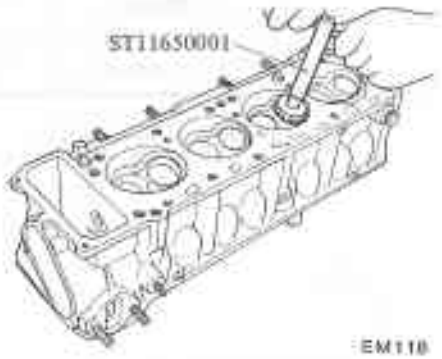


Fig. EM-44 Correcting valve seat

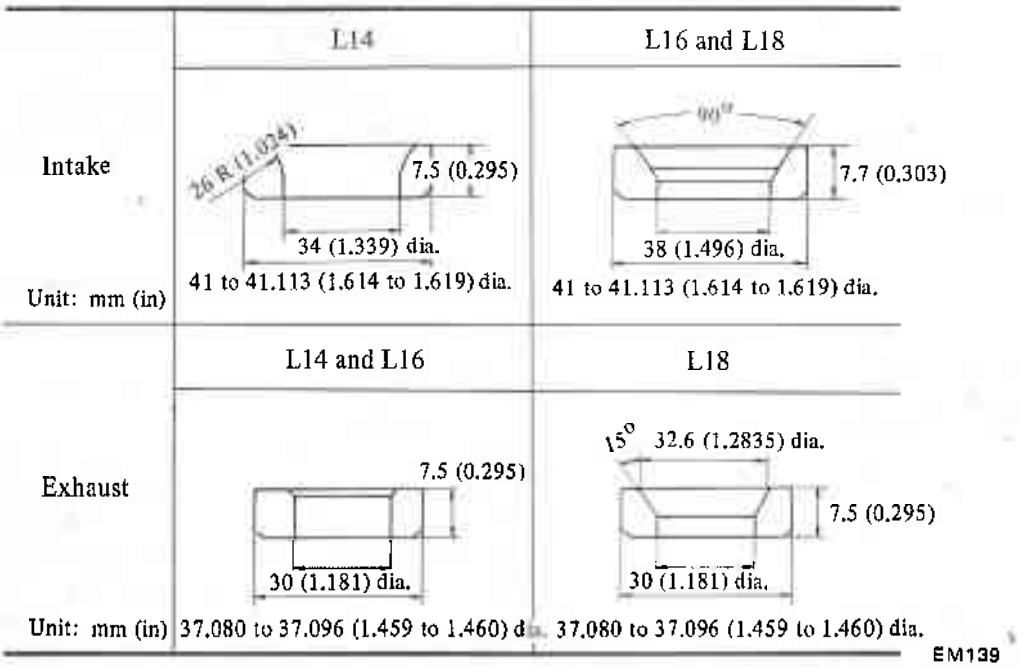


Fig. EM-45 Standard valve seat dimensions

Cylinder head recess diameter

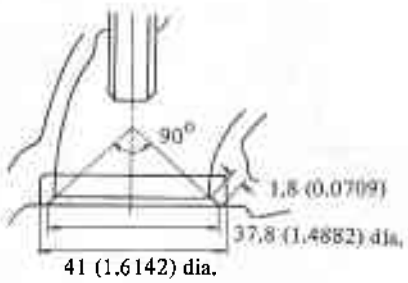
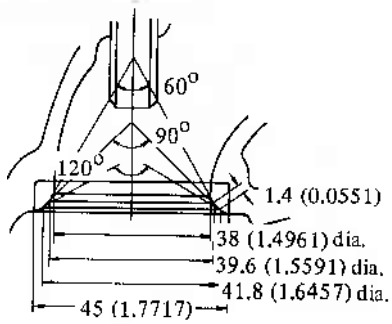
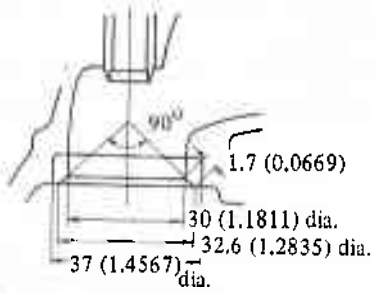
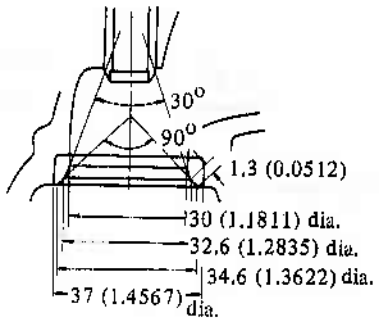
Unit: mm (in)

		L14	L16 and L18
Intake	For standard insert	41.000 to 41.016 (1.6142 to 1.6148)	45.000 to 45.016 (1.7717 to 1.7723)
	For service insert	41.500 to 41.516 (1.6339 to 1.6345)	45.500 to 45.516 (1.7913 to 1.7920)
		L14, L16 and L18	
Exhaust	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 at the specified dimensions as shown in Figure EM-46.
8. Apply small amount of fine grinding compound to valve contacting face and put valve into guide. Lap valve against its seat until proper valve seating is obtained. Remove valve and then clean valve and valve seat.

	L14	L16 and L18
Intake Unit: mm (in)		
	L14 and L16	**L18**
Exhaust Unit: mm (in)		

EM121

Fig. EM-46 Valve seat dimensions

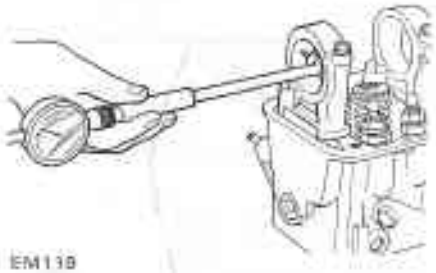
CAMSHAFT AND CAMSHAFT BEARING

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)	—

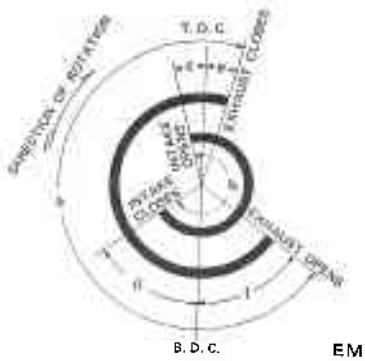


EM119

Fig. EM-47 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.



EM120

Fig. EM-48 Valve timing diagram

Unit: degree

		a	b	c	d	e	f
L14		240	232	8	44	18	50
L16	Single	248	240	12	48	18	54
	Twin	248	248	16	52	18	54
L18	Single	248	240	12	48	18	54
	Twin	248	248	16	52	18	54

Camshaft alignment

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

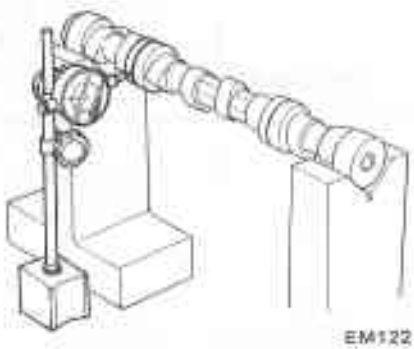


Fig. EM-49 Checking camshaft bend

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

		Single carb.		Twin carb.
		L14	L16 and L18	L16 and L18
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)	40.30 to 40.35 (1.5866 to 1.5886)
	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)		

CYLINDER BLOCK

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

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.

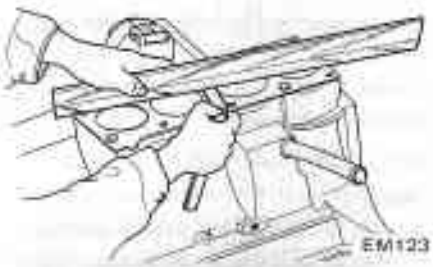


Fig. EM-50 Checking cylinder block surface

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-52.

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

Fig. EM-51 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-52 and record the measured values.

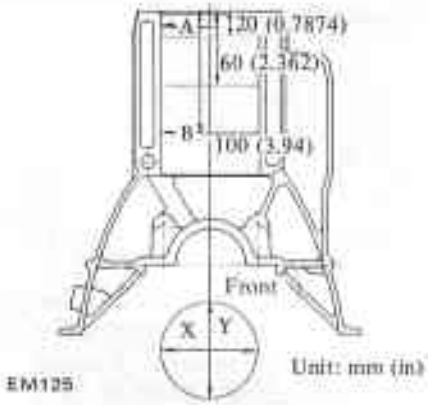


Fig. EM-52 Cylinder bore measuring positions

		Standard		Wear limit
		L14, L16	L18	
Cylinder bore mm (in)	Inner diameter	83.000 to 83.050 (3.2677 to 3.2697)	85.000 to 85.050 (3.3465 to 3.3484)	0.2 (0.0079)
	Out-of-round	0.015 (0.0006)		
	Taper	0.015 (0.0006)		
Difference cylinder bore mm (in)		0.05 (0.0020)		0.2 (0.0079)

Oversize pistons specifications

	L14 and L16	L18
Piston diameter mm (in)		
Standard	82.985 to 83.035 (3.2671 to 3.2691)	84.985 to 85.035 (3.3459 to 3.3478)
0.25 (0.0098) Oversize	83.215 to 83.265 (3.2762 to 3.2781)	
0.50 (0.0197) Oversize	83.465 to 83.515 (3.2860 to 3.2880)	85.465 to 85.515 (3.3648 to 3.3667)
0.75 (0.0295) Oversise	83.715 to 83.765 (3.2959 to 3.2978)	
1.00 (0.0394) over size	83.965 to 84.015 (3.3057 to 3.3077)	86.965 to 86.015 (3.4238 to 3.3864)
1.25 (0.0492) over size	84.465 to 84.515 (3.3254 to 3.3274)	

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.

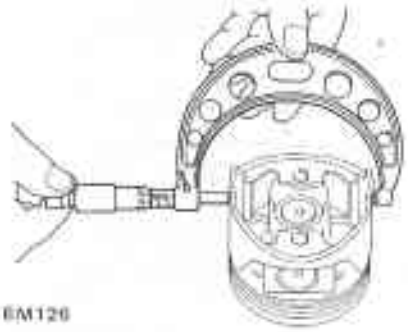


Fig. EM-53 Measuring piston diameter

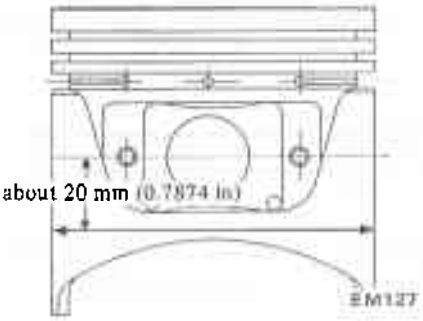


Fig. EM-54 Measuring piston skirt diameter

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 2-4-1-3.

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).

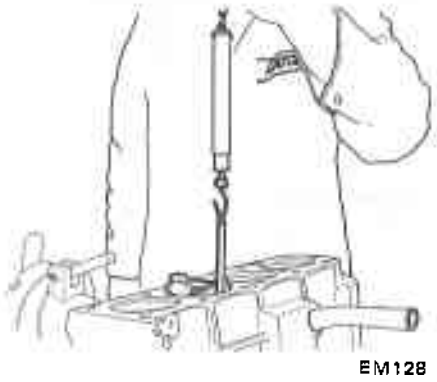


Fig. EM-55 Measuring piston fit in cylinder

		L14, L16 and L18
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)

	L14, L16 and L18	
	Outside diameter	Inner diameter
4.0 (0.1575) Undersize	87.00 to 87.05 (3.4252 to 3.4272)	82.45 to 82.60 (3.2461 to 3.2520)
4.5 (0.1772) Undersize	87.500 to 87.55 (3.4449 to 3.4468)	
5.0 (0.1969) Undersize	88.00 to 88.05 (3.4646 to 3.4665)	