1971-72 LAND ROVER 2.25 LITER 4 CYLINDER

GENERAL SPECIFICATIONS										
Year	Displ.		Carburetor	HP at RPM	Torque (Ft. Lbs. at RPM)	Compr. Ratio	Bore		Stroke	
	cu. ins.	cc					in.	mm	in.	mm
1971-72	139.5	2286	1-Bbl.	81@4250	127@2500	8.0-1	3.562	90.47	3.5	88.9

ENGINE IDENTIFICATION

Engine serial number is stamped on left front of engine.

ENGINE REMOVAL

1) Remove hood, air cleaner, radiator and front floor.
2) Disconnect exhaust pipe at manifold.
3) Disconnect heater hoses, if fitted.
4) Disconnect carburetor linkage at ball joint and choke cable at carburetor.
5) Remove distributor leads from coil and engine ground cable.
6) Disconnect fuel inlet pipe at fuel pump.
7) Remove clutch hydraulic line from retaining clips at rear of engine.
8) Disconnect the following electrical leads:

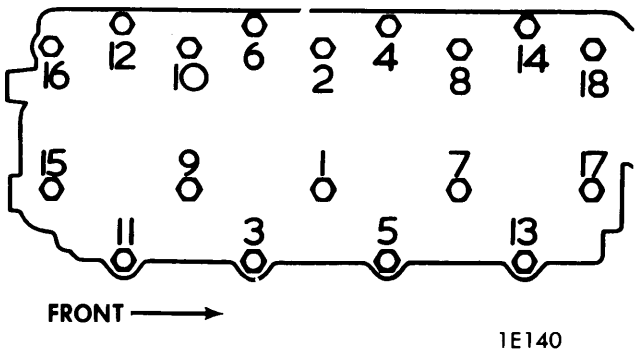
   Starter at solenoid.
   Alternator.
   Snap connectors next to firewall and retaining clips.

9) Remove speedometer from retaining clip on engine.
10) Disconnect vacuum line at distributor.
11) Remove upper nuts from rubber engine mounts.
12) Attach lifting sling to engine lifting hooks.
13) Remove lower nut from left-hand rubber engine mount.
14) Remove support bracket bolts from right-hand rubber engine mount.
15) Tension hoist sufficient to withdraw rubber engine mounts, then lower engine to its original position.
16) Remove bolts attaching bell housing to flywheel housing.
17) Move clutch slave cylinder aside without disconnecting hydraulic line.
18) Support transmission with a suitable jack or stand.
19) Pull engine forward enough to clear bell housing and clutch pinion.
20) Lift engine clear of body.

CYLINDER HEAD REMOVAL

1) Remove hood, air cleaner, and battery ground cable.
2) Drain cooling system.
3) Disconnect vacuum line at distributor.
4) Disconnect distributor leads at coil and high tension leads at spark plugs.
5) Remove spark plugs.
6) Remove fan shroud.
7) Disconnect oil gallery pipe.
8) Disconnect by-pass hose and hose from thermostat housing.
9) Disconnect carburetor linkage at ball joint and choke cable at carburetor.
10) Disconnect fuel line at carburetor and release line from clip on head.
11) Remove heat shield and disconnect exhaust pipe from manifold.
12) Remove rocker arm cover.
13) Loosen tappet adjusting screws to remove load on rocker arms.
14) Remove rocker arm support bolts. Do not remove rocker arm assembly at this point.
15) Invert rocker cover and slide over studs. Secure rocker arm assembly to cover. Lift off rocker arm assembly and cover as a unit.
16) Remove push rods and retain them in order for reassembly.
17) Remove remaining head bolts and lift off head.

NOTE – When reinstalling cylinder head, coat both sides of head gasket with oil. Position head gasket with lettering "PETROL" upward.



CYLINDER HEAD TIGHTENING SEQUENCE

1971-72 LAND ROVER 2.25 LITER 4 CYLINDER (Cont.)

VALVES							
Engine & Valve	Head Diam.	Face Angle	Seat Angle	Seat Width	Stem Diameter	Stem Clearance	Valve Lift
2.25 Liter							
Int.	1.750-1.755"	30°	30°	.....	.3107-.3112"	.0013-.0019"	.374"
Exh.	1.375-1.380"	45°	45°	.....	.3410-.3145"	.0023-.0029"	.388"

VALVE ARRANGEMENT

E-I-I-E-E-I-I-E (front to rear).

VALVE GUIDES

If guides are worn, drive out of cylinder head. Lubricate new guide and drive into head using a suitable drift.

VALVE STEM OIL SEALS

Fit valve stem seals to valve guide with large diameter toward valve guide. Stem seal with external projections is fitted to exhaust valve guide. Seal with spring is for intake valve guide.

VALVE SPRINGS			
Engine	Free Length	PRESSURE (LBS.)	
		Valve Closed	Valve Open
2.25 Liter			
Inner	1.680"	17.7@1.462"	.....
Outer	1.822"	46@1.587"	.....

ROCKER ARM ASSEMBLY OVERHAUL

Disassembly – 1) With rocker arm cover removed, loosen tappet adjusting screws to remove load on rocker shaft.

2) Remove rocker shaft support bolts and lift off rocker arm assembly.

3) Remove locating screw and washer from intermediate rocker bracket. Withdraw all components from rocker shaft.

4) Inspect all components for wear. New bushings may be installed in rocker arms. Press out old bushing and press in new bushings making sure oil holes are properly aligned. Ream bushings to .530-.531". Shaft-to-rocker arm clearance is .0005-.0015".

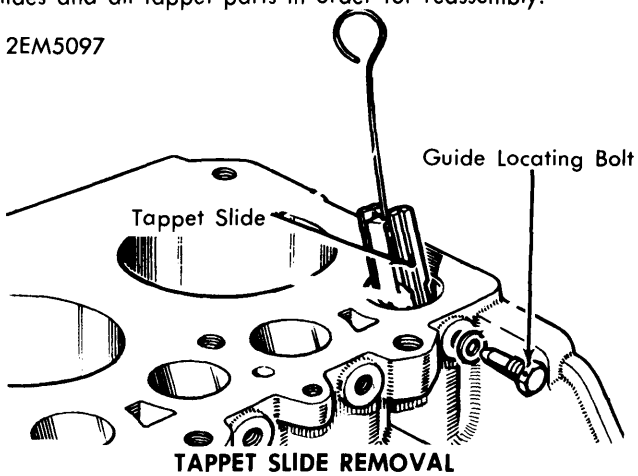
Reassembly – 1) Install an intermediate rocker bracket with locating screw through larger hole in shaft. Place remaining components on shaft (see illustration).

2) Replace rocker arm assembly on cylinder head. Torque bolts to specifications.

VALVE LIFTER SERVICE

Removal – 1) With cylinder head removed, remove tappet guide locating bolts from right side of cylinder block. *CAUTION – Do not remove tappet guides before rollers are withdrawn or rollers will fall into crankcase.*

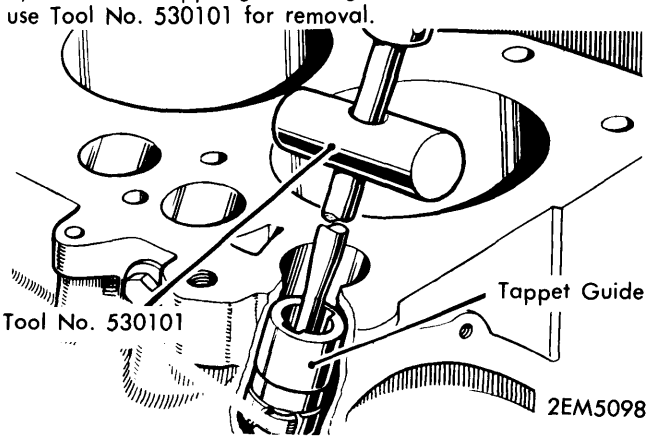
2) Using long nose pliers or wire, remove tappet slides. Keep slides and all tappet parts in order for reassembly.



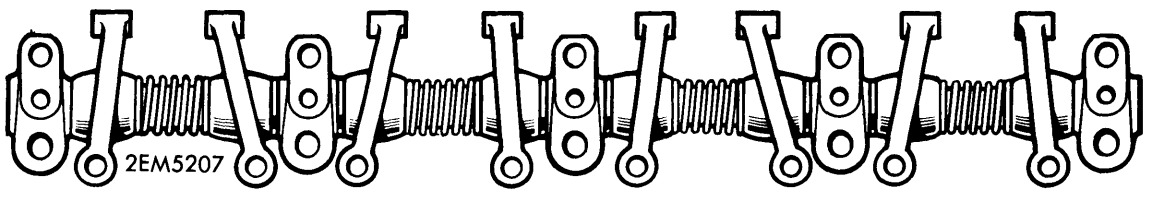
TAPPET SLIDE REMOVAL

3) Remove rollers.

4) Withdraw tappet guides. If guides are difficult to remove use Tool No. 530101 for removal.



TAPPET GUIDE REMOVAL



ROCKER ARM ASSEMBLY

1971-72 LAND ROVER 2.25 LITER 4 CYLINDER (Cont.)

Installation – 1) Fit tappet guides in block in proper order, aligning locating holes. Screw in locating bolts enough to hold guides in position.

2) Insert rollers with large chamfer facing forward.

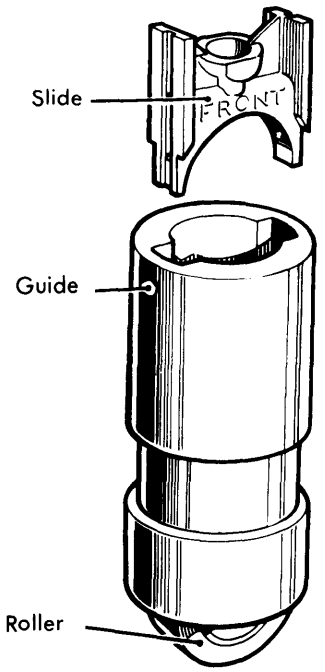
3) Insert tappet slides with marking "FRONT" toward front of engine.

4) Tighten tappet guide locating bolts and lockwire bolts in pairs.

VALVE CLEARANCE ADJUSTMENT

Valve clearance is .010" intake and exhaust. To check clearances, turn crankshaft until valves in first column are fully open, then valves in second column may be checked and adjusted.

Valves Open	Valves to Adjust
1	8
3	6
5	4
2	7
8	1
6	3
4	5
7	2



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ROLLER TAPPET ASSEMBLY

PISTONS, PINS, RINGS						
	PISTONS	PINS		RINGS		
Engine	Clearance	Piston Fit	Rod Fit	Rings	End Gap	Side Clearance
2.25 Liter	.0044-.0053"	Push Fit By Hand	.0001-.0008"	Comp.	.010-.015"	.0025-.0045"
				Oil	.015-.045"	.0015-.0025"

OIL PAN REMOVAL

Drain oil, remove oil pan bolts and oil pan. Upon reinstallation use new gasket, position oil pan and reinstall bolts.

PISTON & ROD INSTALLATION

Fit piston to connecting rod using new circlips. Fit rod to crankshaft with rod number matching correct rod journal. Torque rod caps to specifications and check end-play.

PISTON PIN REPLACEMENT

Remove piston circlips, push out piston pin. If rod small end bushing is worn, replace. Press in new bushing and ream to size, making sure oil holes are properly aligned. Pin must not fall through piston, it is a push fit by hand. To check clearances (see specifications).

FITTING PISTONS

Measure pistons at bottom of skirt at 90° to piston pin bore approximately half way down. If a new standard size piston is fitted, make sure grade letters on block and piston are the same. Grade letters are; "Z" is nominal to plus .0002", "A" is plus .0002-.0004", "B" is plus .0004-.0006", "C" is plus .0006-.0008" and "D" is plus .0008-.001". If cylinder wear or taper exceeds specifications, fit over size pistons. Oversize pistons are not graded and come in .010", .020", .030" and .040" oversizes.

Place rings in cylinder bore and check end gaps. Fit the expander for the oil ring with ends over piston pin, with the side rails one inch away. Fit compression rings in grooves with markings "T" or TOP facing upward.

1971-72 LAND ROVER 2.25 LITER 4 CYLINDER (Cont.)

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS							
	MAIN BEARINGS				CONNECTING ROD BEARINGS		
Engine	Journal Diam.	Clearance	Thrust Bearing	Crankshaft Endplay	Journal Diam.	Clearance	Sideplay
2.25 Liter	2.4995-2.500"	.0008-.0022"	Center	.002-.006"	2.312-2.31275"	.0007-.0025"	.007-.012"

REPLACEMENT BEARINGS

Bearings for both crankshaft and connecting rods are available in the following undersizes, .010", .020", .030" and .040".

CONNECTING RODS

1) Check connecting rod alignment. Assemble cap to rod leaving out bearings halves. Torque rod nuts to 25 ft. lbs. Loosen one nut and check joint to see that there is no clearance between joint faces. If clearance exists, rod must be replaced.

2) Remove rod cap and place new bearings in rod. Fit cap and torque rod nuts to 25 ft. lbs. Loosen one nut, using a .004-.008" feeler gauge, insert between rod and cap. The bearing crush may be adjusted by using slightly varying thickness of bearing inserts to achieve proper gap.

3) Make a final check to prove bearing clearance, using a .0025" shim paper. With shim paper inserted between rod half and journal, rod should resist rotation and turn freely when shim paper is removed.

4) Rods may also be checked using the Plastigage method to determine clearance.

MAIN BEARINGS

1) Fit main bearing caps, less bearing halves. Torque bolts to 85 ft. lbs. Loosen one bolt and check gap between cap and block. If any gap is present cylinder block must be replaced.

2) Remove main bearing caps, place inserts in block and caps. Torque cap bolts to 85 ft. lbs. Loosen one bolt and check gap between block and cap. It should be .004-.006". Gap may be adjusted by using slightly varying thickness bearing inserts.

3) Make final check of main bearing clearance by inserting a .0025" shim paper between one half of bearing and crankshaft. Torque cap bolts to specifications. Crankshaft should resist rotation and with shim paper removed should be free to turn. This procedure is done one bearing at a time.

4) Main bearings may also be checked using the Plastigage method to determine clearance.

THRUST BEARING ALIGNMENT

1) Place crankshaft in position in crankcase. Mount a dial indicator to read off end of crankshaft.

2) Check crankshaft end-play. If end-play is not to specifications select thrust washers of proper thickness.

3) Place thrust washers with plated side toward crankshaft. Right and left thrust washers must be within .003" of the same thickness to maintain crankshaft centering in block. Thrust washers are available in .0025", .005", .0075" and .010" oversizes.

REAR MAIN BEARING OIL SEAL

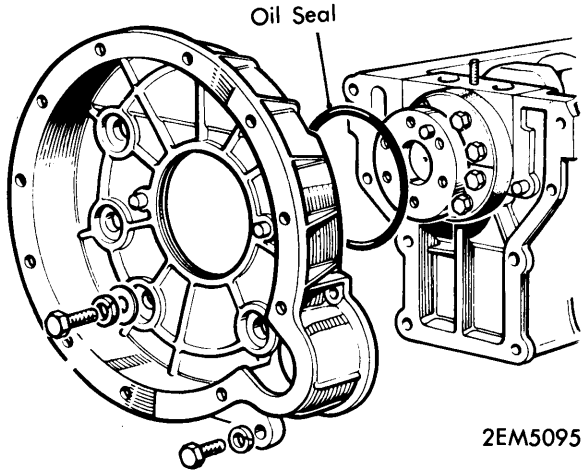
Removal – 1) Remove hood, front floor seat base and transmission. Place a block between flywheel housing and chassis crossmember.

2) Remove starter, oil pan, clutch assembly and flywheel.

3) Attach a lifting sling to engine, apply sufficient tension to support weight of engine.

4) Remove block placed between flywheel housing and crossmember during transmission removal.

5) Remove flywheel housing and oil seal.



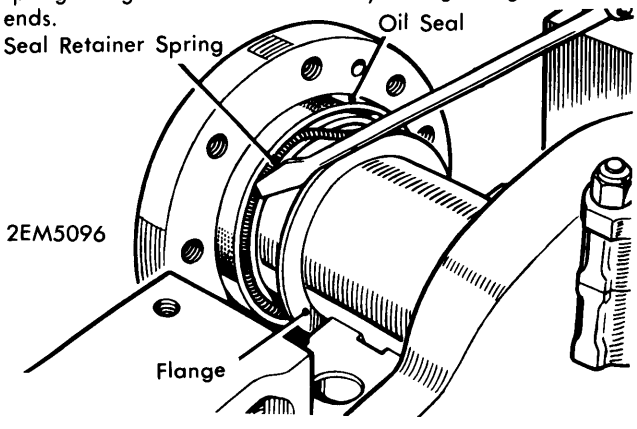
FLYWHEEL HOUSING SEAL

6) Remove rear main bearing cap, upper and lower oil seal retainers and rear main bearing oil seal.

Installation – 1) Assemble seal retainer spring on crankshaft by engaging hook and eye. *CAUTION – Do not stretch spring.*

2) Apply silicone grease to oil seal journal and ends of oil seal.

3) Open seal ends just enough to slide over crankshaft. Install seal with spring groove towards flange (see illustration). Work spring into groove with hook and eye at right angles to oil seal ends.



REAR MAIN BEARING OIL SEAL

1971-72 LAND ROVER 2.25 LITER 4 CYLINDER (Cont.)

4) Rotate seal until seal ends are facing toward cylinder head.

5) Apply suitable sealer to seal retainer halves.

6) Attach upper seal retainer half, leaving the two end bolts finger tight.

7) Attach lower seal retainer half to main bearing cap in the same manner as upper half.

8) Using silicone grease, fit "T" seals to main bearing cap. Trim top edges of "T" seals to prevent them from fouling block when being fitted.

9) Fit seal guides to crankcase. Install main bearing cap and "T" seal to crankcase. Leaving .030" clearance between cap and crankcase, check to see that all seals are properly positioned.

10) Torque main bearing cap to 85 ft. lbs. Fully tighten all bolts of seal retainers. *NOTE — Turn bolt heads so they will clear flywheel housing seal.*

11) Trim ends of "T" seals to leave .030" protruding from bearing cap.

ENGINE FRONT COVER

Removal — 1) Remove hood, radiator, fan belt, starter dog and crankshaft pulley.

2) Disconnect by-pass hose from thermostat housing.

3) Remove front cover nuts and bolts and remove cover.

4) Drive oil seal from front cover.

Installation — 1) Coat outside diameter of oil seal with suitable sealing compound and press into front cover.

2) Smear grease on both sides of cover gasket and reinstall front cover.

CAMSHAFT			
Engine	Journal Diam.	Clearance ①	Lobe Lift
2.25 Liter	.....	.....	.....

① — End-Play .0025-.0055"

CAMSHAFT SPROCKET REPLACEMENT

1) With front cover removed, remove chain tensioner and timing chain.

2) Remove camshaft bolt, lock and washer.

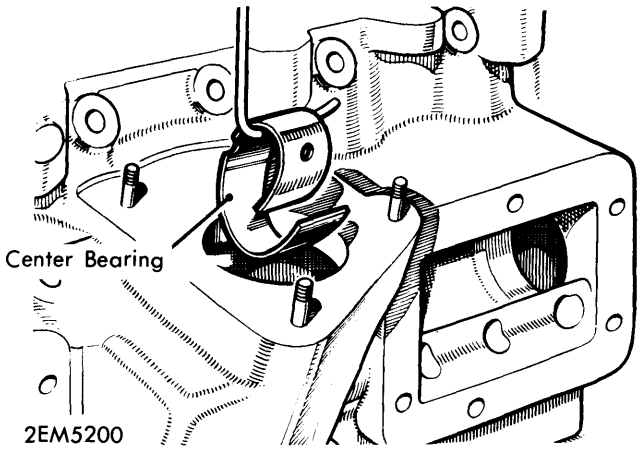
3) To reinstall camshaft sprocket. **See Valve Timing.** After sprocket is correctly on camshaft, replace washer, lock and bolt.

CAMSHAFT & BEARING REPLACEMENT

Removal — 1) With camshaft sprocket removed, remove thrust plate from camshaft. Extract camshaft using Tool No. 530101. *NOTE — Before camshaft bearings may be removed, engine must be removed and completely disassembled.*

2) Drift out front and rear bearings and remove through side cover openings.

3) Drift out two center bearings into distributor drive chamber. Collapse bearings and remove from block, (see illustration).



CAMSHAFT BEARING REMOVAL

Installation — 1) Position cylinder block vertical with rear face down. Place one bearing, with single oil hole, over number two bearing bore. Using suitable tools, press bearing into block. Make sure oil holes are properly aligned.

2) Install front bearing, which has two oil holes. The small oil hole aligns with vertical hole in block. Press bearing into block until bearing is just below front face of cylinder block. *NOTE — Make sure bearing is pressed in far enough so that it will not interfere with thrust plate.*

3) Turn block over and install two rear bearings in the same manner.

4) Place Guide Plug No. 274394 in front camshaft bearing. Use two thrust plate retaining screws to secure plug.

5) Insert Reamer No. 274389 from rear of block into guide plug in front bearing.

6) Locate guide collar, immediately in front of reamer cutter, into rear most bearing, tighten screws retaining guide plug.

7) Ream two center and rear bearings. Remove guide plug and ream front bearing. *NOTE — No lubricant is used during reaming, best results are achieved when bearings are cut dry. Use compressed air to blow chips out of way while reaming.*

8) Remove reamer handle and bolt. Remove reamer by turning in cutting direction.

9) Remove plugs from ends of oil gallery passages. Using compressed air blow all chips out of oil passages and reinsert plugs.

10) Screw plugs into rear of block, using new washers and sealing compound.

11) Reinstall camshaft and thrust plate. Place camshaft sprocket on shaft without using lock. Attach a dial indicator to cylinder block so endplay of camshaft may be checked (see specifications). If endplay is excessive replace thrust plate.

12) Reset valve timing and reassemble engine.

1971-72 LAND ROVER 2.25 LITER 4 CYLINDER (Cont.)

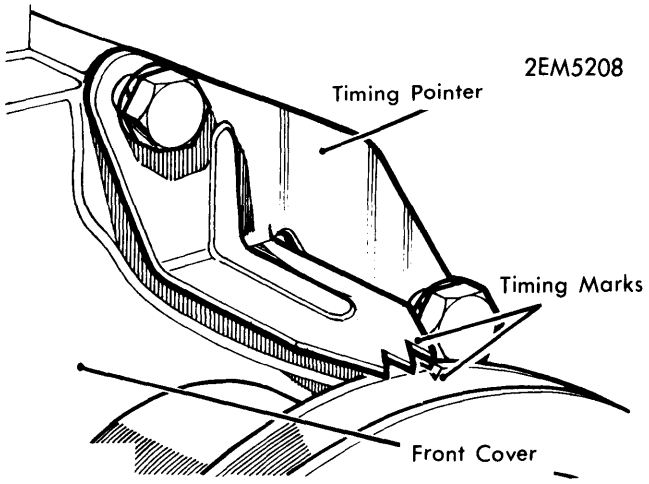
VALVE TIMING				
	INTAKE		EXHAUST	
Engine	Open (BTDC)	Close (ABDC)	Open (BBDC)	Close (ATDC)
2.25 liter	6°	52°	34°	24°

TIMING CHAIN REPLACEMENT

Remove chain tensioner and lift off chain. Fit new chain and see that there is no slack on drive side of chain, See **Valve Timing** for adjustment procedure. Reinstall tensioner.

VALVE TIMING

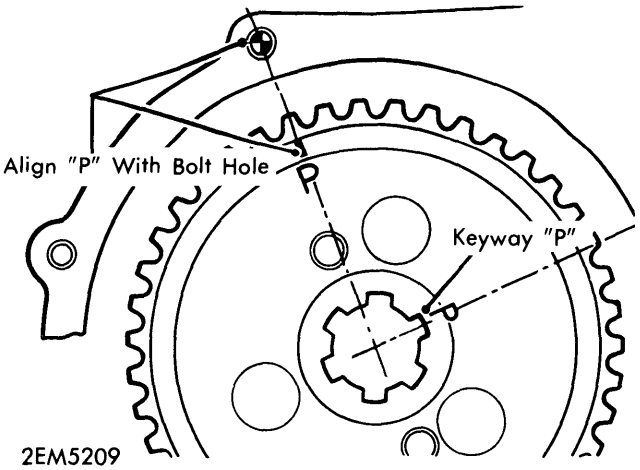
1) Rotate crankshaft until timing mark in crankshaft pulley is aligned with longest tongue on timing pointer (see illustration). This is No. 1 piston at TDC.



TIMING MARKS

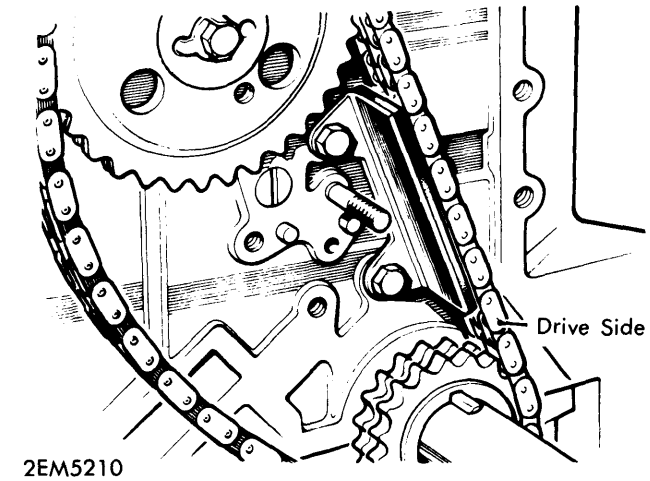
2) Without moving crankshaft, remove pulley, timing pointer and gear cover.

3) Fit camshaft sprocket, using keyway marked "P". Rotate camshaft until "P" mark is aligned with center of bolt hole (see illustration).



VALVE TIMING MARK

4) Fit timing chain with no slack on drive side (see illustration). If slack is present, slide camshaft sprocket off camshaft, without moving shaft. Try alternate keyways until one with no slack is found.



TIMING CHAIN POSITION

5) Install chain tensioner and tighten camshaft sprocket bolt to specifications.

CAUTION — When rotating crankshaft without timing chain installed, camshaft may have to be rotated to prevent pistons from interfering with valves.

ENGINE OILING

ENGINE OILING SYSTEM

Engine lubrication is by a gear type pump. Pump feeds oil to an oil gallery from which oil feeds crankshaft main bearings. Oil from main bearings goes through passages in crankshaft to lubricate connecting rod journals. Oil passages from oil gallery goes to rocker arm shaft, where rocker arms and valve stems are oiled.

Crankcase Capacity — 7-4 qts. (with filter).

Oil Fitler Type & Replacement — Paper, Replace every 6,000 miles.

Normal Oil Pressure — 45-65 psi.

Pressure Regulator Valve — Non-adjustable.

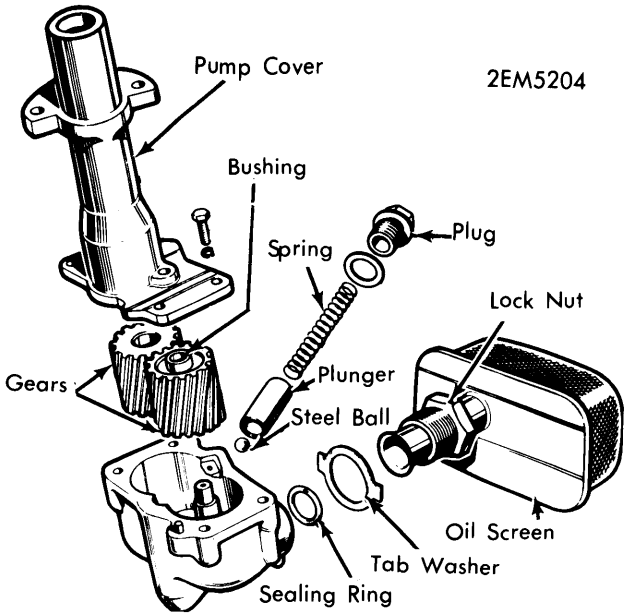
1971-72 LAND ROVER 2.25 LITER 4 CYLINDER (Cont.)

ENGINE OILING (Cont.)

OIL PUMP

Removal – 1) Remove oil pan and two bolts and tab washers securing oil pump. Withdraw oil pump and oil pump drive shaft.

2) Loosen oil screen lock-nut. Remove oil screen and sealing ring.

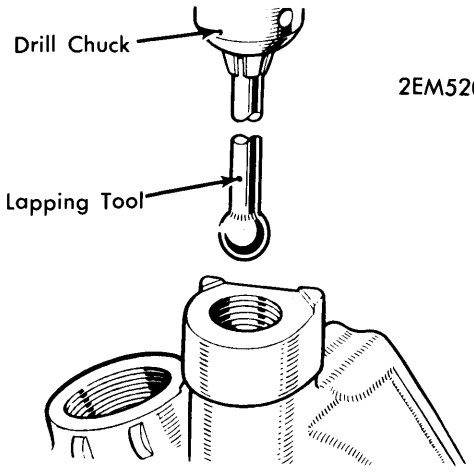


OIL PUMP

3) Remove oil pump cover and pump gears.

4) Remove plug for oil pressure relief valve. Remove spring, plunger and ball.

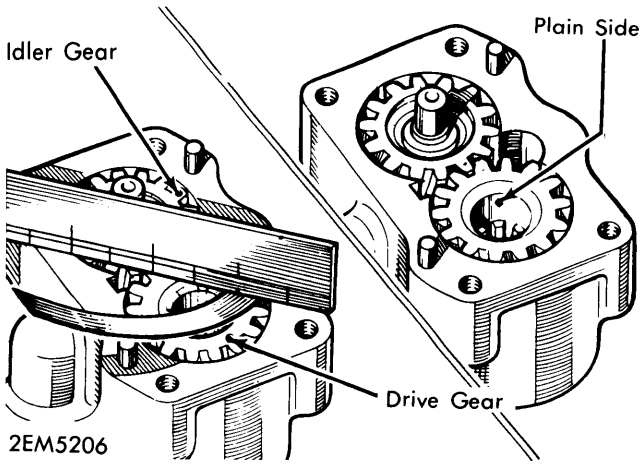
5) Replace idler gear bushing if worn. Press in new bushing and drill .125" diameter lubrication hole. Ream bushing to .500".



PRESSURE RELIEF VALVE LAPPING

6) Inspect pressure relief valve seat. If necessary, lap seat with a steel ball (Rover Part No. 3748) soldered to a piece of tubing. Chuck tool in drill press and lap with a coarse compound. Finish by hand lapping with a fine compound. Thoroughly clean after lapping.

7) Check end-play of oil pump gears (see specifications). Install drive gear with plain side of gear bore facing up (see illustration).



OIL PUMP GEARS

8) Coat faces of pump body and cover with sealing compound. Replace cover and screws.

9) Install pressure relief valve assembly. Concave end of plunger must face toward steel ball.

10) Replace oil screen. Position oil screen so it will be square with pan baffle plate.

11) Insert longer splined end of pump drive shaft into pump.

12) Insert pump and drive shaft into engine block, engaging drive shaft splines.

13) Reinstall two pump bolts and tab washers. Refit oil pan.

Oil Pump Specifications

Pump Gear Endplay	
Steel Gear	.002-.005"
Aluminium Gear	.003-.006"
Radical Clearance of Gears	.001-.004"
Backlash of Gears	.006-.012"
Relief Valve Spring	
Free Length	2.670"
Compressed Length	2.450"

1971-72 LAND ROVER 2.25 LITER 4 CYLINDER (Cont.)

ENGINE-COOLING

Cooling System Specifications

Radiator Capacity – 8.5 qts.

Radiator Cap – 9 psi.

TIGHTENING SPECIFICATIONS

Application	Torque (Ft. Lbs.)
Rod Cap	25
Main Bearing Cap	85
Cylinder Head (5/16")	18
(1/2")	65
Rocker Shaft (5/16")	18
(1/2")	65
Starter Dog	150
Flywheel	60-65
Clutch Cover	22-25