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**NOTE:** To improve engine accessibility it is advantageous to place both front wheels on blocks of wood and disconnect bonnet stay; this allows bonnet to hinge further forward. The blocks should be approximately 30.5 cm (12 in) long, 25.4 cm (10 in) wide and 15 cm (6 in) high. Ensure bonnet is adequately supported after disconnecting stay.

## CAMSHAFT

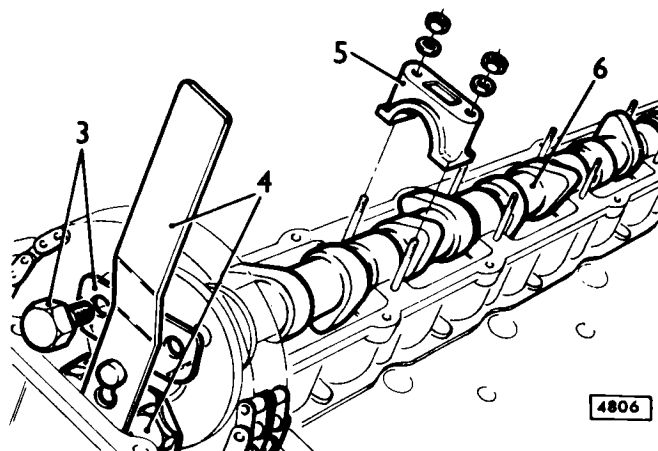
### Remove and Refit

12.13.01

Service tools: Sprocket retaining tool JD.40. Valve timing gauge C.3993.

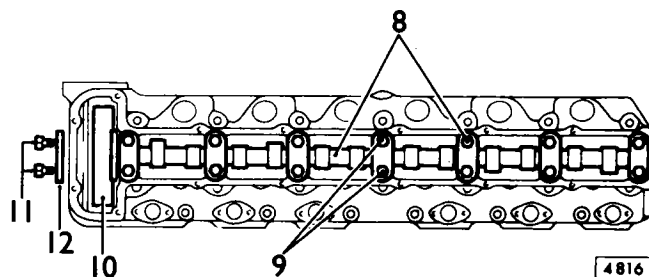
#### Removing

1. Disconnect carburettor linkage.
2. Remove camshaft cover — 12.29.42.
3. Bend back locking tabs and remove two camshaft sprocket retaining bolts.
4. Rotate engine until valve timing gauge can be fitted to slot in camshaft; bend back locking tabs, mark relative position of camshaft to sprocket, remove bolts. Fit sprocket retaining tool JD.40. DO NOT rotate engine with camshaft disconnected.
5. Progressively slacken camshaft bearing cap nuts starting with centre cap and working outwards; lift off bearing caps.
6. Lift camshaft out of tappet block.



#### Refitting

7. Smear camshaft journals and tappets with clean engine oil.
8. Position camshaft in tappet block, refit bearing caps, washers and nuts.
9. Progressively tighten bearing cap nuts working from the centre outwards to a torque of 1.2 kg.m (9.0 lb.ft)
10. Engage camshaft sprocket with carrier and fit two retaining bolts.
11. Rotate engine, fit remaining bolts.
12. Secure bolts with tabwashers.
13. Refit camshaft cover 12.29.42.



## CAMSHAFT

### Overhaul

12.13.26

1. Check that journal diameters are within limits — See Engine data 05.
2. Ensure all oil passages are unobstructed, blow through with dry, clean compressed air.

## TAPPET BLOCK – Left Hand

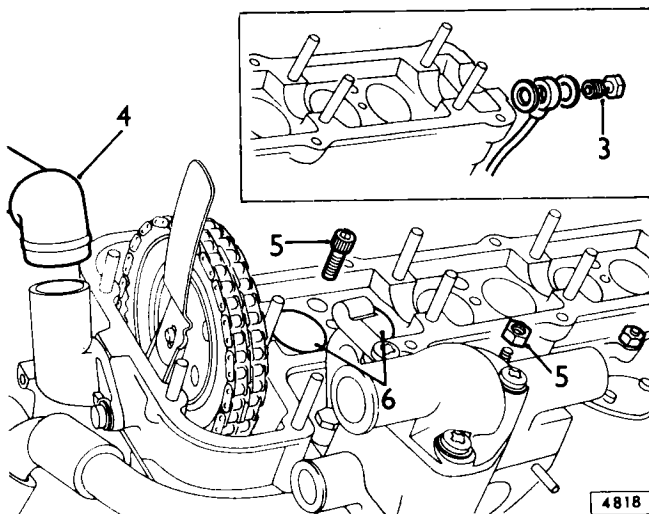
## Remove and refit

12.13.29

## Removing

1. Disconnect carburettor linkage.
2. Remove camshaft – 12.13.01.
3. Remove banjo bolt securing oil feed pipe to tappet block.
4. Disconnect breather pipe.
5. Progressively slacken retaining nuts and capscrews, working from centre outwards.
6. Lift off tappet block carefully, retrieve tappets and valve adjusting pads.

**NOTE:**— Record which valve each tappet and pads are removed from. Failure to do this will result in incorrect valve adjustment upon reassembly.

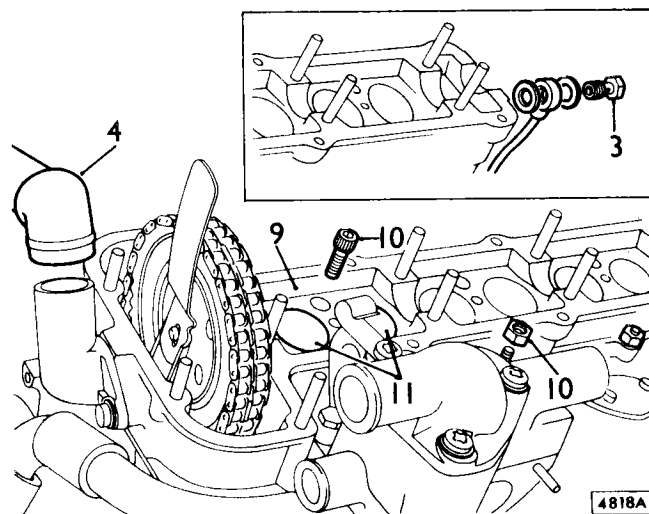


4818

## Refitting

7. Ensure that mating surfaces of tappet block and cylinder head are clean.
8. Smear mating surfaces of tappet block and cylinder head with Hylomar.
9. Fit tappet block ensuring that dowels are correctly located.
10. Tighten retaining nuts and capscrews by diagonal selection working from centre outwards.
11. Lubricate tappets and adjusting pads with clean engine oil, fit to their respective valves.
12. Reverse operations 1 to 4 inclusive.

**NOTE:** If tappet block has been renewed, it will be necessary to check valve clearances; see operation 12.29.48.



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## TAPPET BLOCK – Right Hand

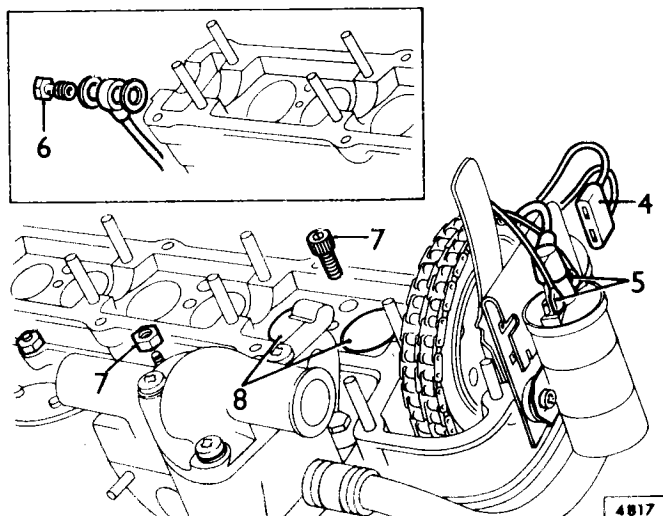
## Remove and refit

12.13.30

## Removing

1. Disconnect battery – 86.15.19 (Negative lead only).
2. Disconnect carburettor linkage.
3. Remove camshaft – 12.13.01.
4. Disconnect wires from ballast resistor unit.
5. Disconnect wires and H.T. Lead from coil.
6. Remove banjo bolt securing oil feed pipe to tappet block.
7. Progressively slacken retaining nuts and capscrews, working from centre outwards.
8. Lift off tappet block carefully, retrieve tappets and valve adjusting pads.

**NOTE:**— Record which valve each tappet and pads are removed from. Failure to do so will result in incorrect valve adjustment upon reassembly.

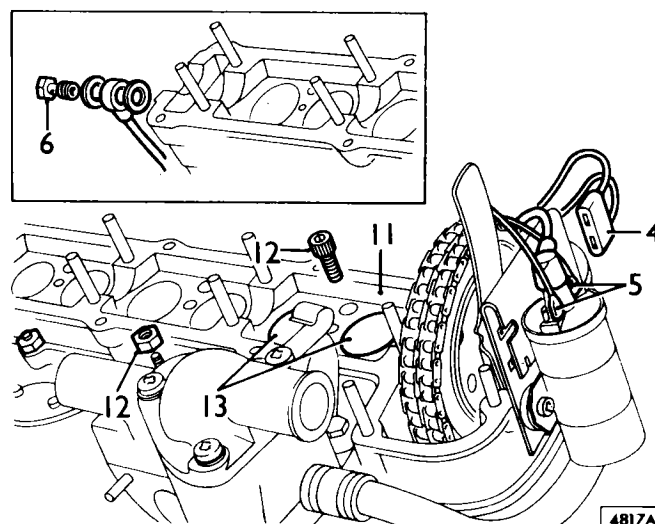


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**Refitting**

9. Ensure that mating surfaces of tappet block and cylinder head are clean.
10. Smear mating surfaces of tappet block and cylinder head with Hylomar.
11. Fit tappet block ensuring that dowels are correctly located.
12. Tighten retaining nuts and capscrews by diagonal selection working from centre outwards.
13. Lubricate tappets and adjusting pads with clean engine oil, fit to their respective valves.
14. Reverse operations 1 to 6 inclusive.

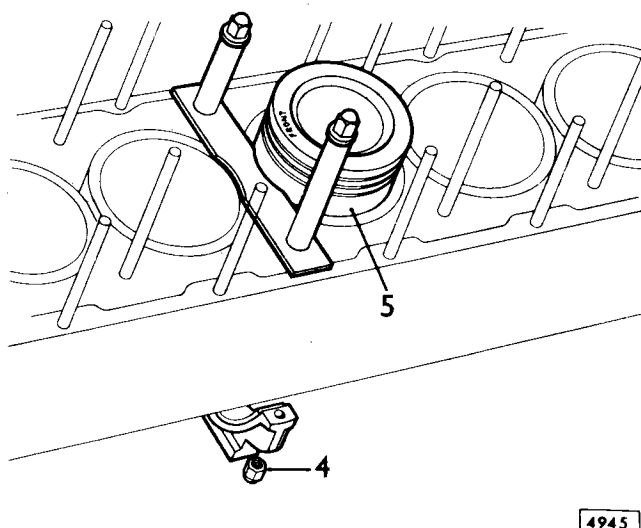
**NOTE:**— If tappet block has been renewed, it will be necessary to check valve clearances, see operation 12.29.48.

**PISTON AND CONNECTING ROD****Remove and refit (Engine in situ)****12.17.01**

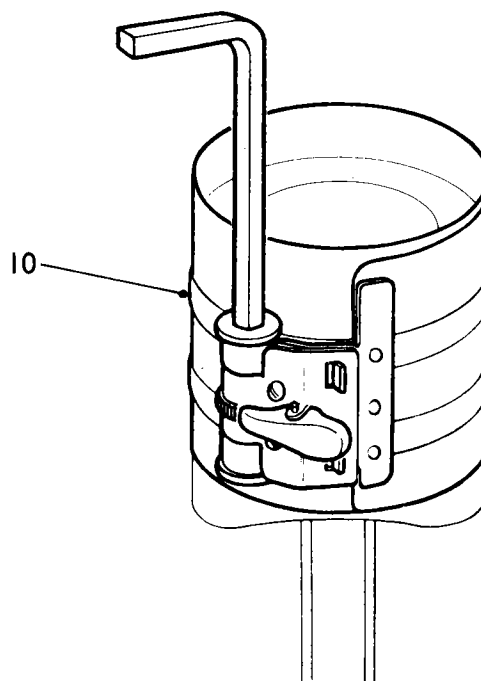
Service tool: Piston ring clamp 38U.3.

**Removing**

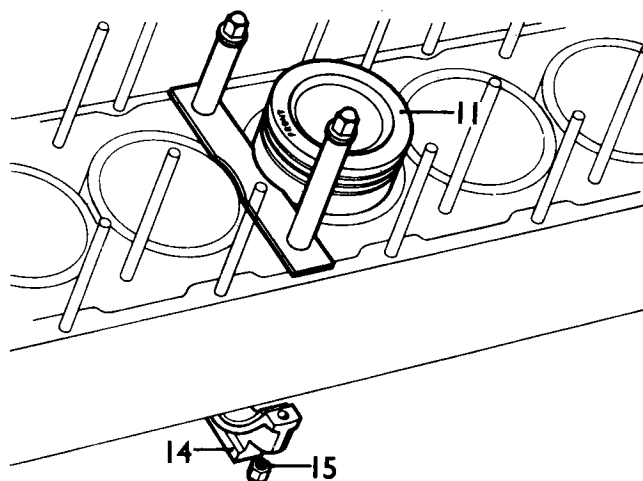
1. Remove cylinder head — 'A' right hand — 12.29.12  
'B' left hand — 12.29.11
2. Remove engine sump — 12.60.44
3. Rotate crankshaft until bearing cap to be removed is accessible.
4. Remove nuts, bearing cap and shell.
5. Remove any carbon deposit from top of cylinder bore. Push connecting rod up cylinder bore, withdraw piston together with connecting rod.
6. Retrieve remaining bearing shell.

**Refitting**

7. Ensure that cylinder bore, piston and all bearing surfaces are scrupulously clean.
8. Coat piston rings, gudgeon pin, big end bearing shell and cylinder bore liberally with clean engine oil.
9. Ensure that piston ring gaps are spaced evenly around circumference of piston.
10. Compress piston rings with Service Tool 38U.3



11. Enter piston and connecting rod into bore ensuring that word stamped 'FRONT' on piston faces front of engine.
12. Push piston and connecting rod down bore, do not use undue force.
13. Check that big end shell bearing tab is correctly located in connecting rod.
14. Fit other half of big end bearing shell to cap; oil shell and crankshaft journal.
15. Refit bearing cap and nuts; tighten nuts to torque of 5.1 kg.m. (37.5 lb.ft.).
16. Refit engine sump – 12.60.44.
17. Refit cylinder head – 'A' right hand – 12.29.12 'B' left hand – 12.29.11.



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## PISTON AND CONNECTING ROD

### Overhaul

12.17.10

**NOTE:** Pistons are supplied complete with gudgeon pin. As pins and pistons are matched assemblies, it is not permissible to interchange component parts.

1. Remove circlips.
2. Push gudgeon pin out of piston.
3. Withdraw connecting rod.

### Refitting

4. Fit gudgeon pin in piston.

**CAUTION:** Connecting rods must be refitted to pistons in such a way that when installed in engine, word 'FRONT' on piston crown faces front of engine and chamfer on big end eye faces crank pin radius.

5. Align small end with end of gudgeon pin and push pin home.
6. Use new circlips to retain gudgeon pin.

**NOTE:** Gudgeon pin is a push fit in piston at 20 deg. C (60 deg. F)

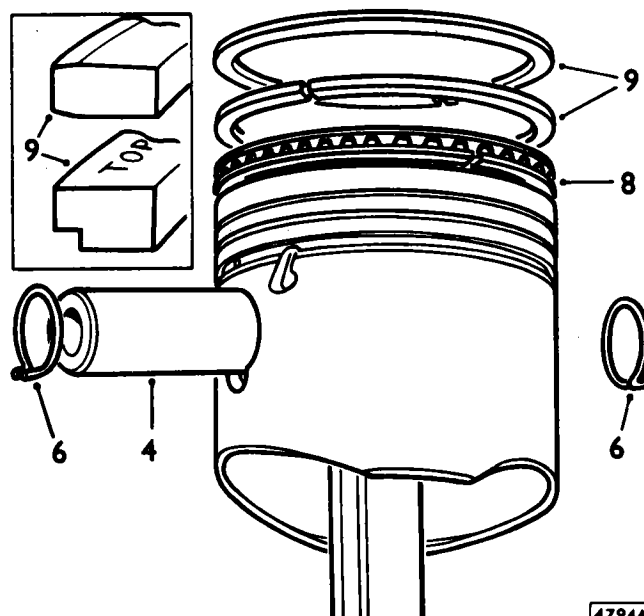
Three piston rings are fitted, they are as follows:—

- a. Top ring – Compression.
- b. Second ring – Compression.
- c. Bottom ring – Oil control

Both top and second rings have tapered peripheries and second rings are marked 'TOP' to ensure correct fitting. In addition, the top ring has a chrome plated periphery and is also cargraph coated. This coating is coloured RED and must not be removed.

The bottom ring consists of an expander sandwiched between two rails, the assembly being held together by an adhesive.

7. Check piston ring gap in bore. Push ring to a point midway down bore, check that ring is square and measure gap – See Engine data 05.
8. Fit bottom ring ensuring that expander ends are not overlapping.
9. Fit second and top rings ensuring that they are fitted the correct way up.

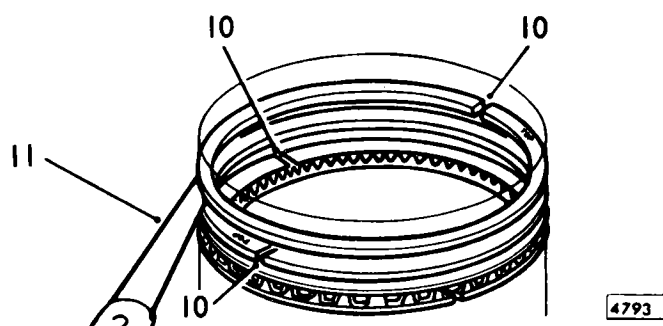


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10. Position rings so that gaps are in positions shown.
11. Check side clearance of rings in piston groove. See Engine data 05.
12. Check connecting rods for alignment on a suitable jig.
13. Check bore of small end bush – See Engine data 05.

**CAUTION:** If small end bush is worn beyond acceptable limits; a service exchange connecting rod must be fitted. It is NOT possible to renew bushes as specialised equipment is needed to hone bushes to finished size.



## CRANKSHAFT DAMPER AND PULLEY

### Remove and refit (Engine in situ)

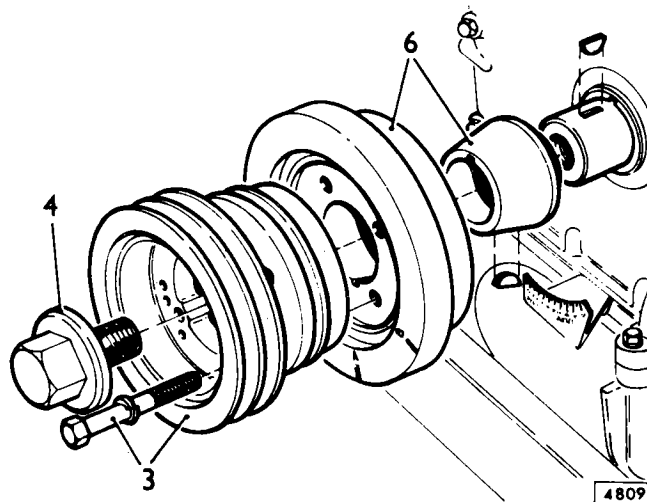
12.21.01

#### Removing

1. Remove alternator drive belt – 86.10.03.
- \*\*2. Remove air pump and steering pump drive belts see operations 17.25.15 and 57.20.02.\*\*
3. Remove bolts securing pulley to damper, withdraw pulley.
4. Remove crankshaft damper bolt.
5. Strike damper sharply with hide mallet to loosen.
6. Withdraw damper and cone.

#### Refitting

Reverse operations 1 to 6; tighten damper bolt to 17.3 kg.m to 20.7 kg.m (125 lb.ft to 150 lb.ft)



## CRANKSHAFT FRONT OIL SEAL

### Remove and refit

12.21.14

#### Removing

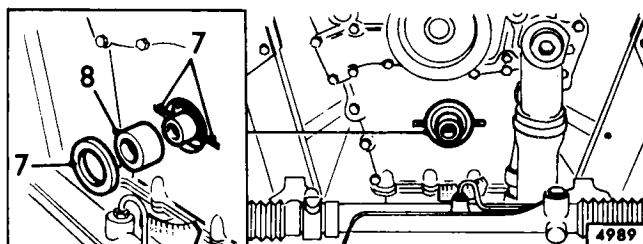
1. Remove radiator – 26.40.01.
2. Remove alternator drive belts – 86.10.03.

**WARNING: ON NO ACCOUNT MUST ANY PORTION OF THE AIR CONDITIONING SYSTEM BE DISCONNECTED BY ANYONE OTHER THAN A QUALIFIED REFRIGERATION ENGINEER. BLINDNESS CAN RESULT IF THE GAS CONTAINED WITHIN THE SYSTEM COMES INTO CONTACT WITH THE EYES.**

3. Remove compressor drive belt – 82.10.02  
Cars fitted with air conditioning only.
4. Remove air pump drive belt – 17.25.15. – Cars fitted with exhaust emission control only.
5. Remove power assisted steering pump drive belt – 57.20.02.
6. Remove crankshaft damper and pulley – 12.21.01.
7. Prise seal out of timing cover and discard.
8. Withdraw spacer.

#### Refitting

9. Ensure that seal recess in timing cover is thoroughly clean.
10. Smear new oil seal with clean engine oil.
11. Position oil seal squarely in recess and tap gently home using a hide mallet.
12. Refit spacer.
13. Reverse operations 1 to 6.



## CYLINDER LINERS

### Checking

12.25.25

1. Check bore of liner and compare dimension obtained with dimensions quoted in Engine data 05.
2. Bore grade of liner e.g. 'A' or 'B' is stamped on top of liner. When liners are to be renewed; the new liner must be of the same grade as the old one.

### Cylinder Block – General

1. Following engine dismantling or honing operations crankcase must be thoroughly cleaned.
2. Check all Welch washers and renew any showing signs of corrosion.
3. Ensure that all galleries are unobstructed. Blow through with dry, clean compressed air.
4. Check condition of studs, renew any showing signs of corrosion.

## CYLINDER HEAD

### Remove and refit

Right hand 'A' Bank  
Left hand 'B' Bank

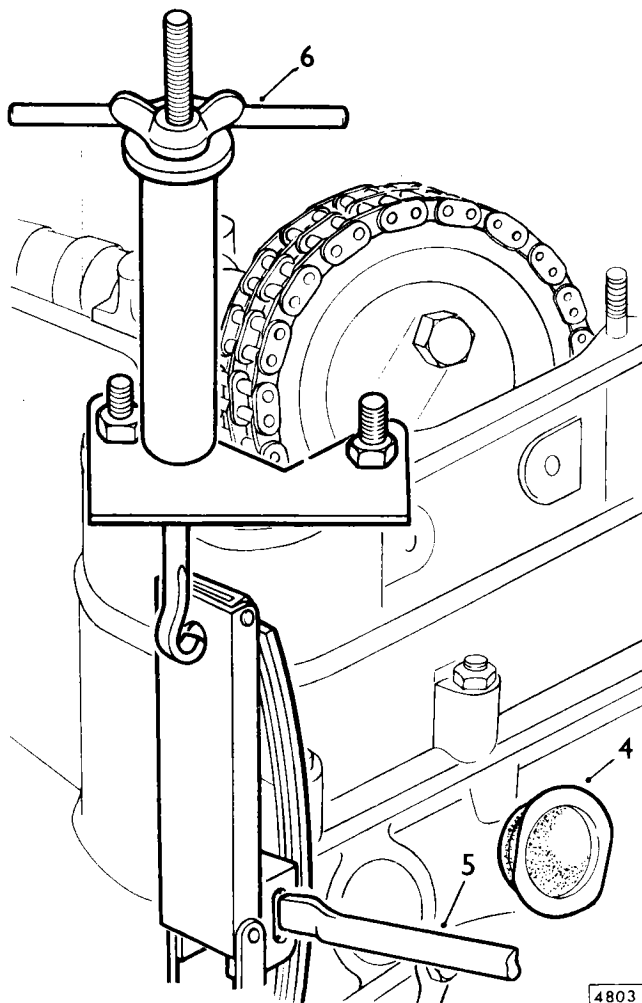
12.29.12  
12.29.11

Service tools: Timing chain tensioner retractor tool JD.42; Support plate JD.42-1; Special screwdriver JD.42-2; Camshaft sprocket retaining tool JD.40; Cylinder liner retaining tool JD.41; Valve timing gauge C.3993

### Removing

1. Disconnect battery – 86.15.01
2. Drain cooling system – 26.10.01.
3. Remove right hand camshaft cover – 12.29.42.
4. Remove rubber grommet from timing cover.
5. Insert blade of screwdriver JD.42-2 through hole and release locking catch on timing chain tensioner.
6. Using Special tool JD.42 and support plate JD.42-1, retract timing chain tensioner.
7. Remove left hand camshaft cover – left hand cylinder head only – 12.29.42.
8. Disconnect camshaft sprocket from camshaft, fit sprocket retaining tool JD.40.
9. Disconnect exhaust down pipe(s) from exhaust manifolds – 30.10.05.
10. Remove three nuts securing front of cylinder head to timing cover.
11. Progressively slacken cylinder head nuts working from centre outwards.
12. Lift off cylinder head and place on blocks of wood to prevent damage to valves which, when open, protrude below cylinder head face. Remove and discard old gasket.

**CAUTION:** Do not rotate engine until cylinder liner retaining tools JD.41 have been fitted to cylinder head studs.



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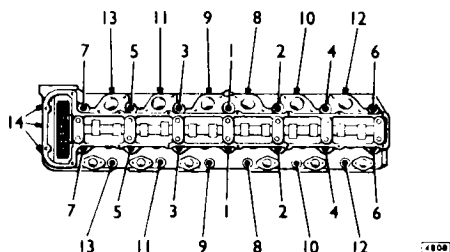
### Refitting Right hand 'A' Bank or both Banks.

13. Ensure mating surfaces of cylinder head and block are clean.
14. Attach a suitable clock gauge to a cylinder head stud.
15. Rotate engine and by means of clock gauge, set number one piston 'A' Bank at T.D.C.
16. Turn camshaft until valve timing gauge C.3993 can be fitted to slot in camshaft front flange.
17. Repeat operation 16 on left hand cylinder head.
18. Remove cylinder liner retaining tools JD.41.

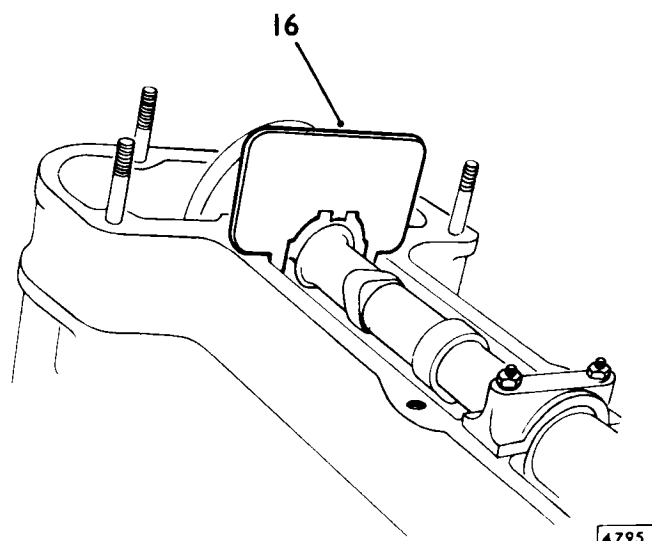
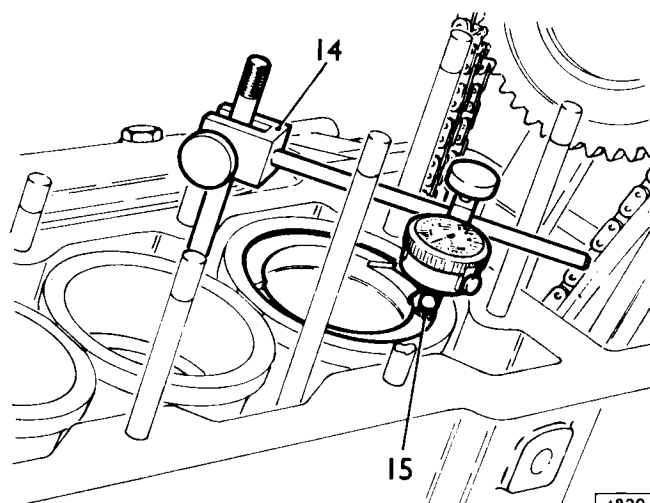
**CAUTION:** Do not rotate engine until cylinder head(s) are fitted.

19. Ensure mating surfaces of cylinder block and head are clean.
20. Fit gasket ensuring side marked "TOP" is uppermost. Do not use jointing compound or grease.
21. Fit right hand cylinder head and retaining nuts.
22. Tighten retaining nuts in order shown to a torque of:-

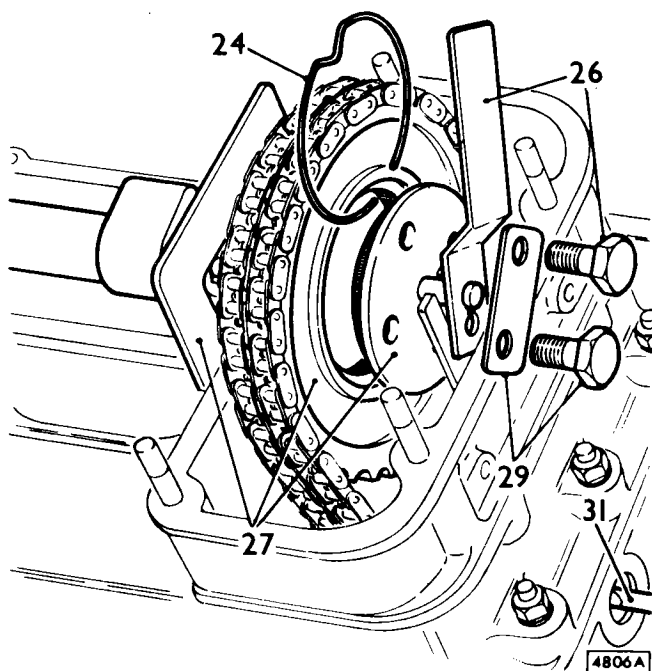
7.2 kg.m (52 lb.ft) for  $\frac{1}{4}$  in nuts.  
3.7 kg.m (27.5 lb.ft) for  $\frac{3}{8}$  in nuts.



Cylinder head tightening sequence



23. Tighten cylinder head to timing cover nuts to a torque of 1.2 kg.m (9 lb.ft)
24. If camshaft and sprocket holes are not in alignment, remove circlip retaining camshaft coupling to sprocket and disengage coupling from splines.
25. Rotate coupling until access to retaining bolt holes is obtained.
26. Remove sprocket retaining tool JD.40, bolt coupling to camshaft.
27. Engage sprocket with coupling, refit circlip and remove gauge C.3993.
28. If left hand 'B' bank cylinder head has been removed, repeat operations 18 to 27 on this head
29. Rotate engine until remaining camshaft sprocket retaining bolts can be fitted; secure bolts with tab washers.
30. Remove timing chain tensioner retracting tool JD.42 and support plate JD.42-1.
31. Insert screwdriver JD.42-2 through hole in timing cover and trip locking catch, refit rubber grommet.
32. Refit exhaust down pipes - 30.10.05
33. Refit camshaft cover(s) - 12.29.42
34. Refill cooling system - 26.10.01
35. Reconnect battery - 86.15.01





## ENGINE

15. Heat cylinder head for half an hour from cold at a temperature of 150 deg. C (300 deg. F).
16. Fit insert ensuring that it beds evenly in the recess.
17. Renew or reface valves as necessary.  
Correct valve seat angles are  
Inlet      Exhaust  
44½ deg. 44½ deg.
18. Check valve stems for distortion or wear, renew valves with stems worn in excess of .08 mm (.003 in) see section 05.
19. Using a suitable suction tool, grind the valves into their respective seats.
20. If new valve inserts have been fitted, the clearance between valve stem and cam must be checked; this should be 8.13 mm (.320 in) plus the valve clearance. The dimension must be taken between valve stem and back of cam. Should this dimension not be obtained, metal must be ground from valve seat of insert.

**NOTE:** Only suitable grinding equipment should be used.

21. Fit valves and place cylinder head on wooden blocks.
22. Fit valve spring seats, inlet valve guide oil seals, springs and collars.
23. Compress springs using Service Tool No. J.6118B and adaptor J.6118C-2, insert split cotters.

## CAMSHAFT COVER

### Remove and refit

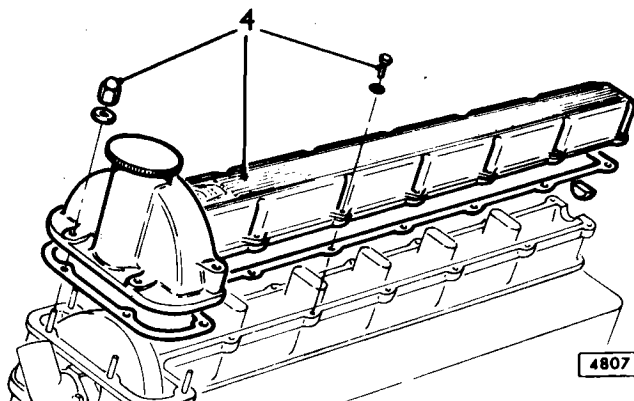
12.29.42

#### Removing

1. Disconnect carburettor linkage.
2. Remove front inlet manifold – 30.15.02.
3. Remove rear inlet manifold – 30.15.03.
4. Remove setscrews, domed head nuts and washers securing camshaft cover to tappet block, lift off cover.

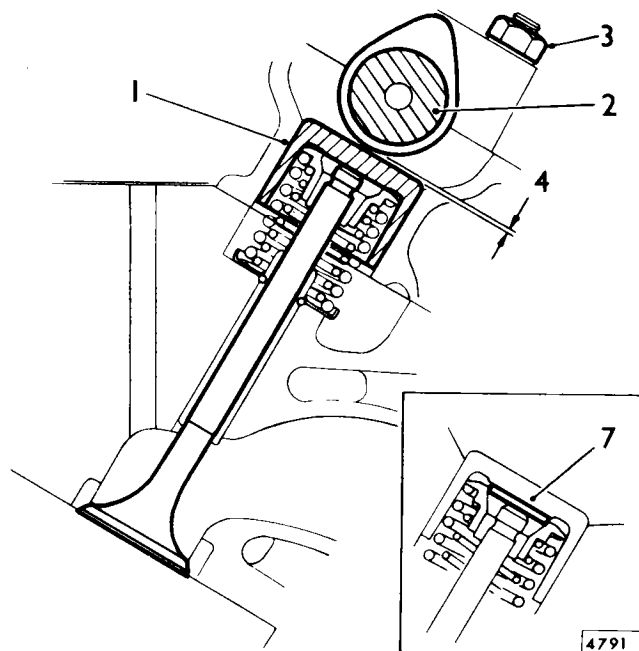
#### Refitting

Reverse operations 1 to 4, use a new gasket and neoprene sealing plug. Tighten nuts and bolts by diagonal selection to a torque of 1.1 kg.m (8.0 lb.ft)



**TAPPETS****Adjust****12.29.48**

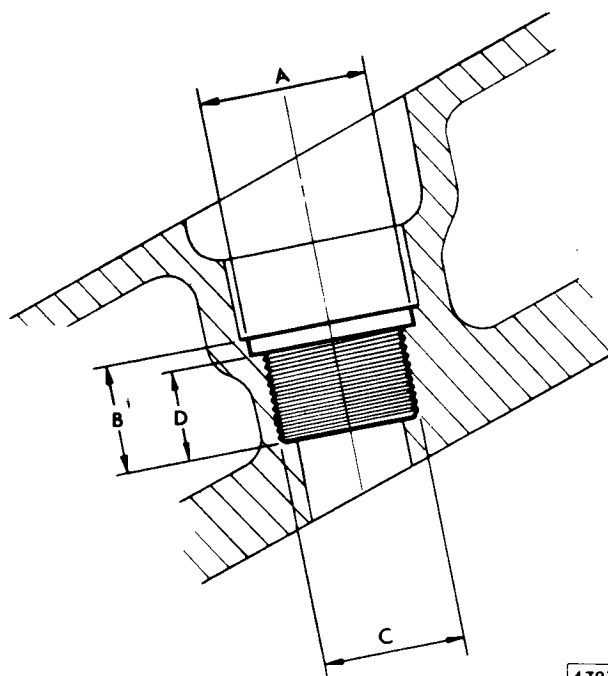
1. Ensure valve adjusting pad is fitted; fit tappets to their respective valves.
2. Fit camshaft, bearing caps, washers and nuts.
3. Tighten bearing cap nuts evenly to a torque of 1.2 kg.m (9 lb.ft)
4. Check and record clearance between each tappet and heel of each cam.  
Valve clearance .304 mm to .355 mm (.012 in to .014 in).
5. Subtract appropriate valve clearance from dimension obtained and select suitable adjusting pads which equal this new dimension. Adjusting pads are available rising in .03 mm (.001 in) sizes from 2.16 mm to 2.79 mm (.085 in to .110 in) and are etched on the surface with letter 'A' to 'Z' each letter indicating an increase in size of .03 mm (.001 in).
6. Remove camshaft and tappets.
7. Fit adjusting pads.
- \*\*8. Repeat operations 1 to 3.\*\*



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**SPARKING PLUG INSERTS****Fitting****12.29.78**

1. Remove cylinder head – 12.29.10.
2. Remove inlet and exhaust valves – 12.29.62.
3. Bore out stripped thread to 19.05 mm (.750 in) diameter and tap out to .5 in B.S.P.
4. Counterbore to 22.62 mm (.890 in).  
Dimension 'A' = 22.62 mm (.890 in).  
Dimension 'B' = 14.28 mm (.562 in).  
Dimension 'C' = 12.7 mm (.50 in) B.S.P.  
Dimension 'D' = 11.1 mm – .13 mm – .15 mm  
(.437 in – .005 in – .010 in).
5. Fit screwed insert ensuring that it sits firmly at bottom of thread.
6. Drill and ream a 3.17 mm (.125 in) diameter hole between side of insert and head.
7. Drive in locking pin and secure by peening edge of insert and locking pin.  
Dimension 'A' = 11.1 mm (.437 in).



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## ENGINE AND GEARBOX ASSEMBLY

### Remove and refit

12.37.01

#### Removing

1. Remove bonnet – 76.16.01
2. Remove battery – 86.15.01
3. Drain cooling system – 26.10.01
4. Remove air cleaners – 19.10.01
5. Remove bolt and washer securing earth lead to bell housing.
6. Disconnect wires from oil pressure sender unit.
7. Disconnect radiator harness at snap and lucar connectors.
8. Remove radiator securing nuts.
9. Disconnect oil cooler hoses from radiator – Cars fitted with Automatic Transmission only.
10. Disconnect top water pipes from hoses (Engine end and Radiator end).
11. Disconnect hose from underside of header tank.
12. Disconnect header tank hose from radiator.
13. Disconnect bottom hose.

Operations 14, 15, and 16 are only applicable to cars fitted with air conditioning.

**WARNING:** No attempt should be made to disconnect any portion of the air conditioning system. Blindness can result if the gas contained within the system comes into contact with the eyes.

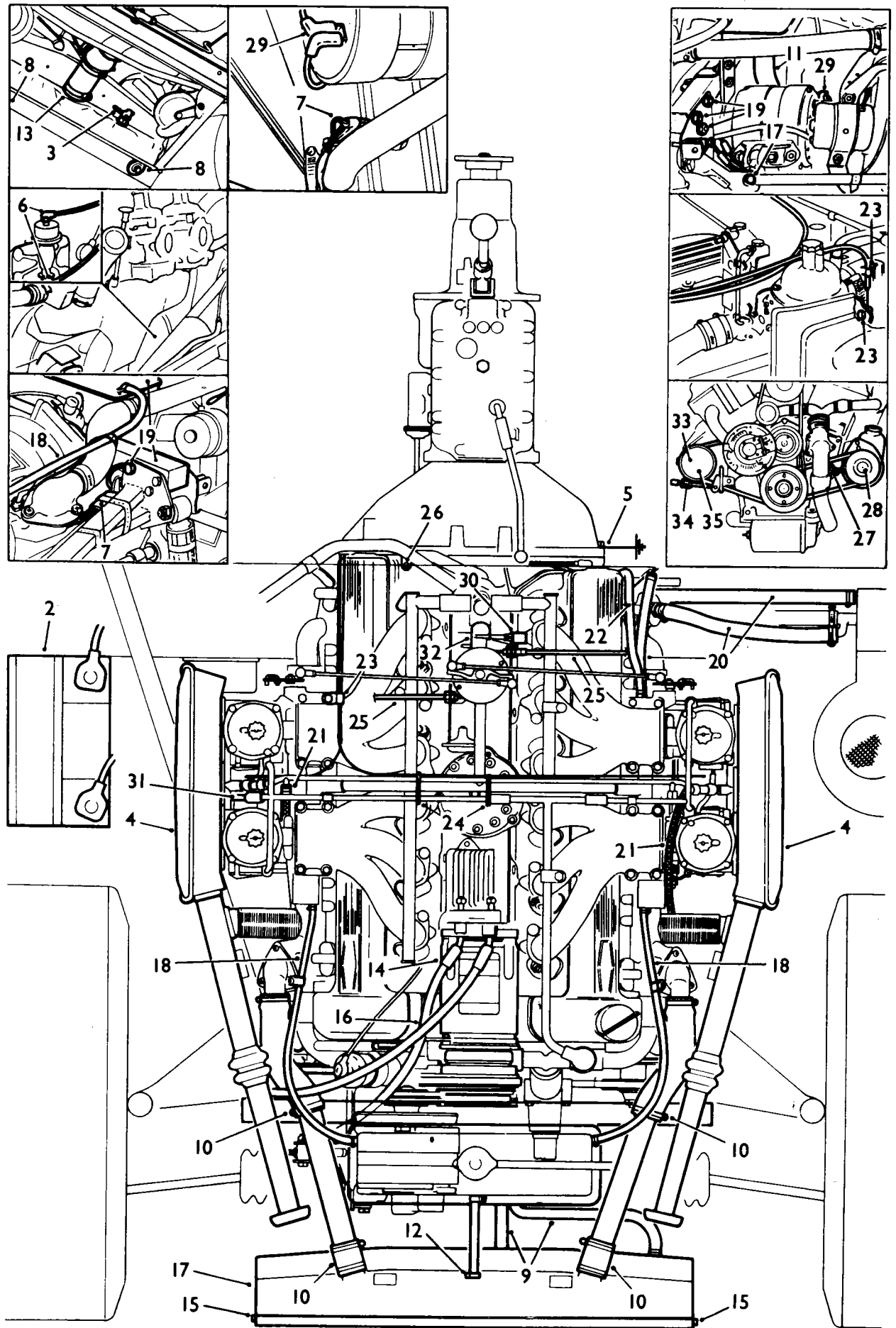
14. Remove nuts and bolts securing compressor to mounting bracket.
15. Remove bolts securing condenser to radiator assembly.
16. Place compressor and condenser on the floor to the right-hand side of sub-frame, ensuring that hoses are not damaged by excessive twisting.
17. Remove nuts and bolts securing radiator stays to sub-frame. Lift out radiator complete with fans and cowls.
18. Disconnect hoses from left and right-hand induction housings.
19. Remove six nuts and bolts, securing front cross member to sub-frame, detach earth lead and lift off cross member complete with header tank.
20. Disconnect hoses from heater.
21. Disconnect inlet and left and right hand petrol pipes from cross over pipe.
22. Disconnect breather pipe from rear left hand inlet manifold.
23. Slacken pinch bolts and release clips securing choke cables to left and right hand carburetters.
24. Release clips securing choke cables to cross over pipe.
25. Disconnect throttle cable from pedestal.
26. Disconnect clutch pipe at bulkhead union bracket; plug or tape all broken connections to prevent ingress of dirt.

27. Remove power assisted steering pump trunnion securing bolt.
28. Remove power assisted steering pump mounting bolts, swing pump clear of engine.
29. Disconnect wires from alternator paying particular attention regarding relationship of wires to terminals.
30. Disconnect wires from kickdown switch – Cars fitted with automatic transmission only.

The following operations are only applicable to cars fitted with exhaust emission control.

31. Disconnect carbon canister pipe from balance pipe.
32. Disconnect balance pipe from hose.
33. Disconnect flexible and rubber pipes from rear of air pump.
34. Remove air pump trunnion securing bolt.
35. Remove air pump securing bolts, lift air pump off mounting bracket.





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36. Remove oddments tray and gearbox console – 76.25.01.
37. Fold carpet away from lower edge of gearbox cover.
38. Remove two bolts, one on either side of gearbox cover, securing rear cross member; retrieve cross member from under car.
39. Remove exhaust system – 30.10.01.
40. Disconnect speedometer cable from gearbox.
41. Disconnect reverse light at snap connectors.
42. Remove two bolts securing front lower cross member, disengage cross member from mounting brackets.
43. Remove six screws securing rear heat shield to floor pan, remove heat shield.
44. Remove three screws from each front heat shield, remove shields.
45. Disconnect starter motor and solenoid leads.
46. Position a trolley jack under gearbox tail shaft housing.
47. Attach chains to engine lifting eyes.

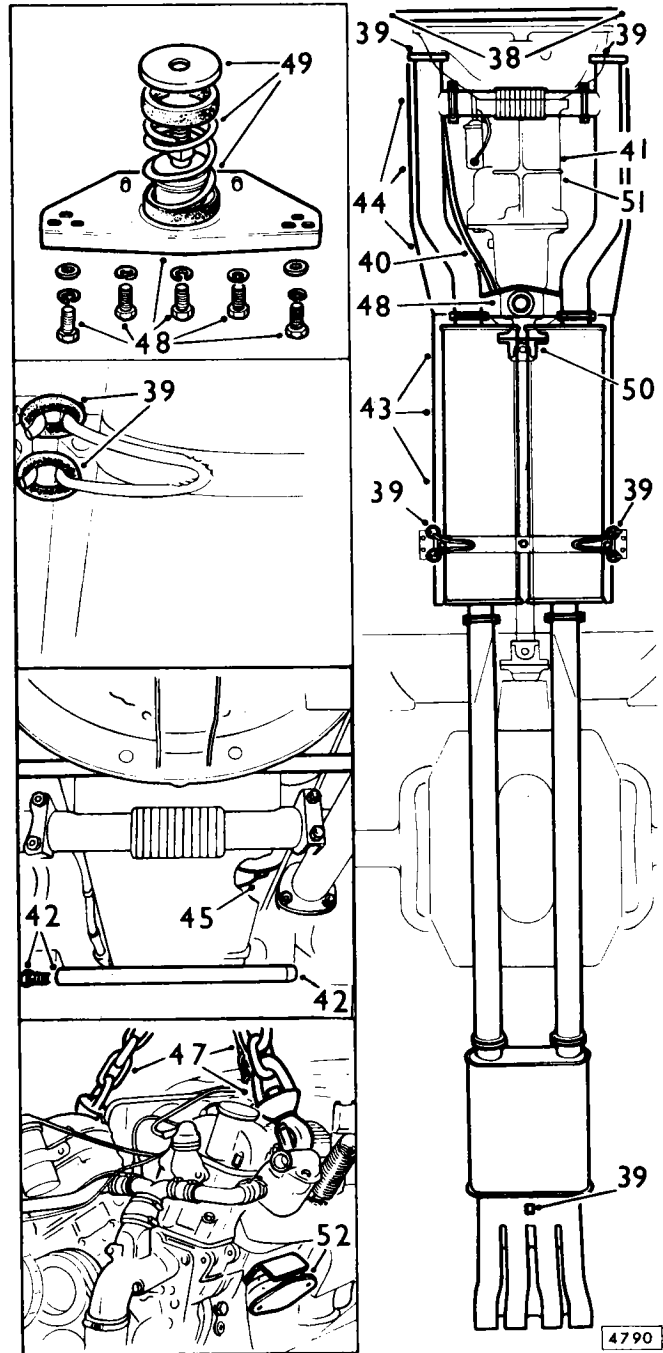
**WARNING:** Chains must be of sufficient length to ensure that the distance between lifting eyes and hook of hoist is as follows:—

Front lifting eyes to hook 876 mm (34.5 in)

Rear lifting eyes to hook 1041 mm (41 in)

48. Remove five bolts, washers and spacers securing rear engine mounting bracket support plate to floor pan.
49. Remove centre nut from rear engine mounting followed by washer, support plate, spring, spring seat, spacers and washers.
50. Lower rear of engine slightly, remove nuts and bolts securing propeller shaft to gearbox output flange.
51. Disconnect gear change linkage – Automatic transmission cars only.
52. Remove nuts and bolts securing engine mounting feet to bearers.
53. Lift engine slightly and withdraw through front of sub-frame.

**WARNING:** Care should be taken at all times to ensure that engine or gearbox does not foul anything, particular attention being paid to the gear-lever and pipe connections on power assisted steering rack.



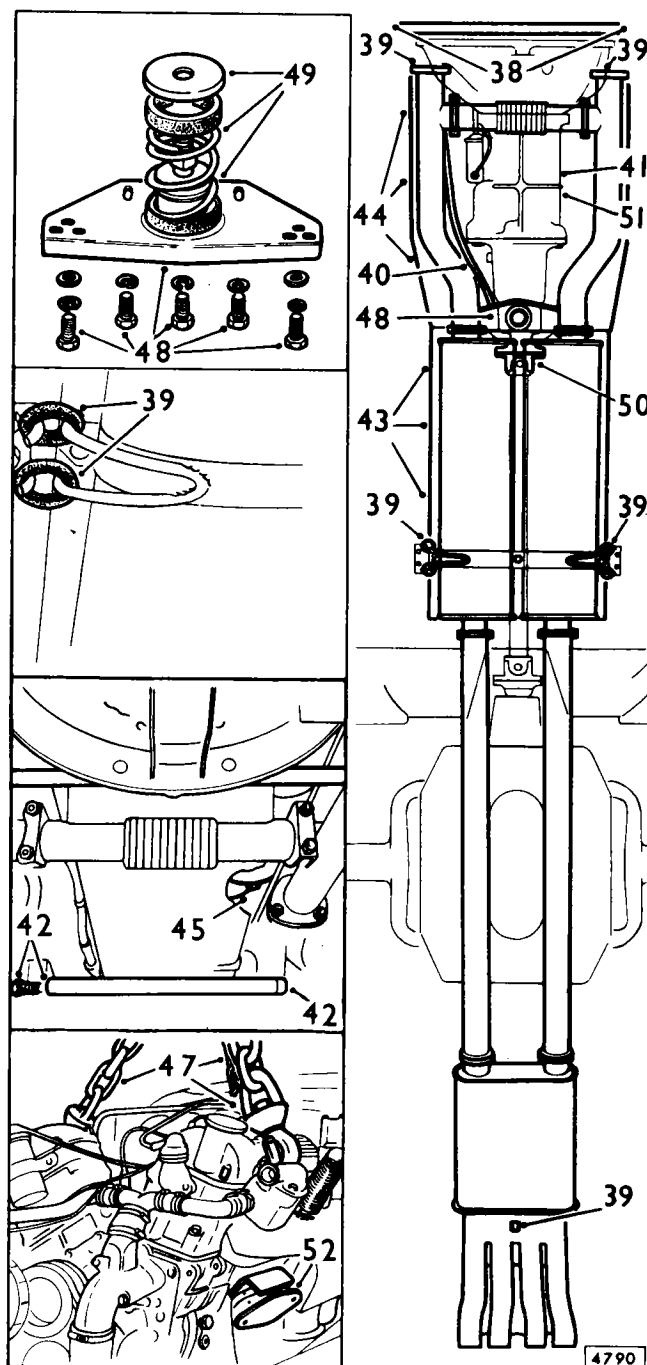
4790

**Refitting**

54. Lower engine and gearbox into sub-frame, position trolley jack under tail shaft housing and continue lowering engine until engine mounting feet rest on engine bearers.
55. Raise trolley jack until engine mounting bolts and nuts can be fitted; do not tighten at this stage.
56. Connect propeller shaft to output flange, use new self-locking nuts.
57. Reconnect gear change linkage — Automatic transmission cars only.
58. Fit plain washer, shaped washer, spacers, spring, spring seat and support plate to rear engine mounting stud; ensure that spring seats properly.

**NOTE:** Two plain washers are used on cars fitted with automatic transmission.

59. Push support plate upwards to compress spring, fit plain washer and self-locking nut; do not tighten nut at this stage.
60. Fit five bolts, plain washers and spacers to secure support plate to floor pan, tighten bolts progressively, tighten self locking nut.
61. Tighten engine mounting nuts.
62. Reverse operations 1 to 47.
63. Bleed clutch — Cars fitted with manual transmission only — 33.15.01.
64. Adjust air pump drive belt — Cars fitted with exhaust emission control only — 17.25.13.
65. Adjust compressor drive belt — Cars fitted with air conditioning only — 82.10.01.



## ENGINE

### Dismantle and reassemble

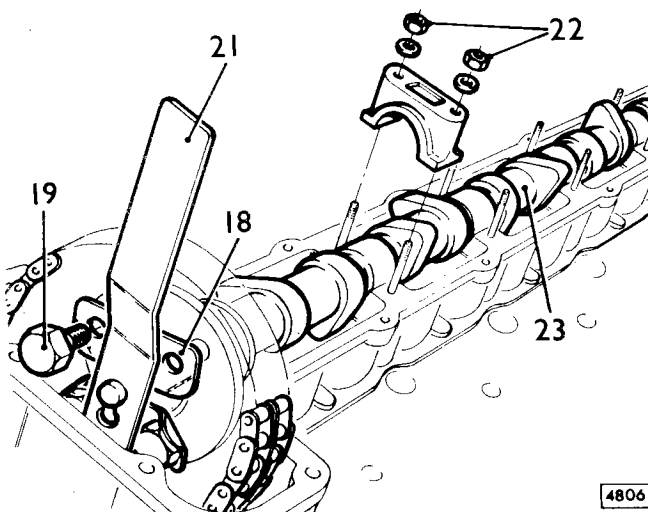
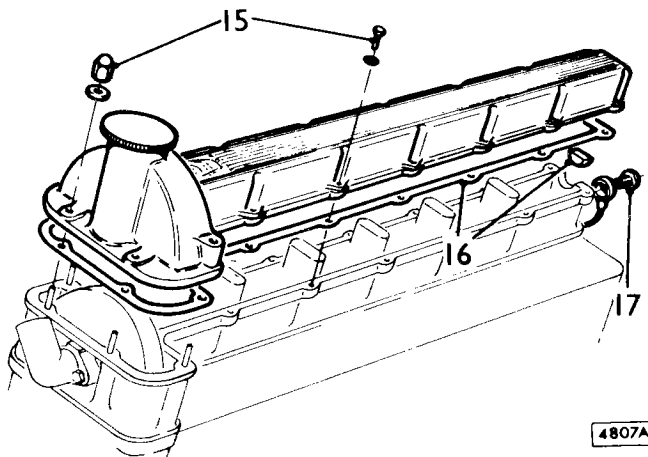
12.41.05

**NOTE:** All instructions unless otherwise stated, apply to both 'A' bank right hand and 'B' bank left hand cylinder head assemblies.

Service tools: Camshaft sprocket retaining tools JD.40; Cylinder liner retaining tools JD.41; Jackshaft retaining tool JD.39; Oil seal pre-sizing tool JD.17B and adaptor JD.17B-1; Piston ring clamp 38U.3; Valve timing gauge C.3993; Special screwdriver JD.42-2.

#### Dismantle

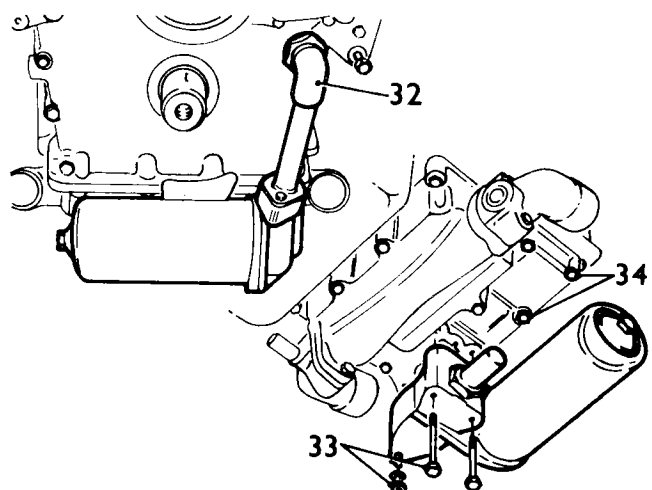
1. Remove engine and gearbox — 12.37.01
2. Remove inlet manifolds — front 30.15.02  
— rear 30.15.03
3. Remove exhaust manifolds — front 30.15.10  
— rear 30.15.11
4. Remove gearbox — 37.20.01 — Manual transmission cars only.
5. Remove clutch — 33.10.01 — Manual transmission cars only.
6. Remove gearbox — 44.20.01 — Automatic transmission cars only.
7. Remove torque converter — 44.17.07 — Automatic transmission cars only.
8. Remove alternator — 86.10.02.
9. Remove air pump — 17.25.07 — Cars fitted with exhaust emission control only.
10. Remove water pump — 26.50.01.
11. Remove bolts, washers and spacers securing alternator and air pump mounting bracket.
12. Remove starter motor — 86.60.01.
13. Remove distributor — 86.35.20.
14. Remove amplifier unit — \*\*86.35.30.\*\*
15. Remove domed head nuts, copper washers and setscrews securing camshaft covers to cylinder head; lift off covers.
16. Remove and discard gaskets and neoprene plugs.
17. Remove banjo bolts securing camshaft oil feed pipes to rear of tappet blocks.
18. Bend back locking tabs securing camshaft sprocket retaining bolts.
19. Remove two bolts from each sprocket.
20. Rotate engine until remaining bolts are accessible and remove.
21. Fit retaining tool JD.40 to each sprocket.
22. Slacken off camshaft bearing cap nuts working from centre outwards.
23. Remove camshafts.
24. Remove nuts and capscrews securing tappet block to cylinder head; remove tappet block together with tappets.
25. Retrieve valve adjusting pads.
26. Progressively slacken cylinder head nuts, working from centre outwards.
27. Lift off cylinder head and place on blocks of wood to prevent damaging valves which when open, protrude below cylinder head face.
28. Fit cylinder liner retainers JD.41.
29. Remove four bolts securing crankshaft pulley to damper, withdraw pulley.
30. Remove damper bolt, strike damper sharply with hide mallet, withdraw damper.
31. Remove damper cone and Woodruff key.



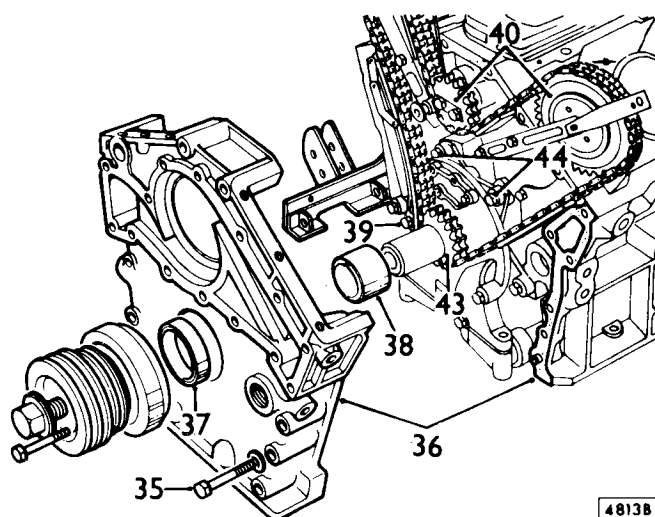
32. Unscrew oil pipe union nut from timing cover.
33. Remove bolts and nut securing oil filter head to oil cooler; remove filter bowl and head.
34. Remove bolts securing timing cover to oil sump.
35. Remove bolts securing timing cover to cylinder block noting relative positions of long, short and dowelled bolts.
36. Remove timing cover, lift off gaskets and discard.
37. Remove oil seal from cover and discard.
38. Withdraw spacer and Woodruff key from crankshaft.
39. Move chain tensioner clear of locating bracket and slide off dowel pin.
40. Disengage timing chain from sprockets and remove.
41. Remove bolts securing oil cooler to engine sump.
42. Remove oil cooler, retrieve and discard 'O' rings from suction and delivery pipes.
43. Withdraw crankshaft sprocket and Woodruff key.
44. Remove bolts securing oil pump to cylinder block, withdraw pump, drive gear and Woodruff key.
45. Remove bolts securing jackshaft cover to cylinder block, lift off cover.
46. Remove setscrews and tabwasher securing sprocket to jackshaft; withdraw sprocket, discard tabwasher.
47. Remove bolts securing jackshaft locking plate to cylinder block; lift plate out of groove in jackshaft flange.
48. Withdraw jackshaft.
49. Remove bolts securing sump to cylinder block, lift off sump; remove and discard gasket.
50. Remove and discard gasket.

**NOTE:** Care must be taken to identify pistons with their respective bores, big end caps should be fitted to connecting rods immediately after removal.

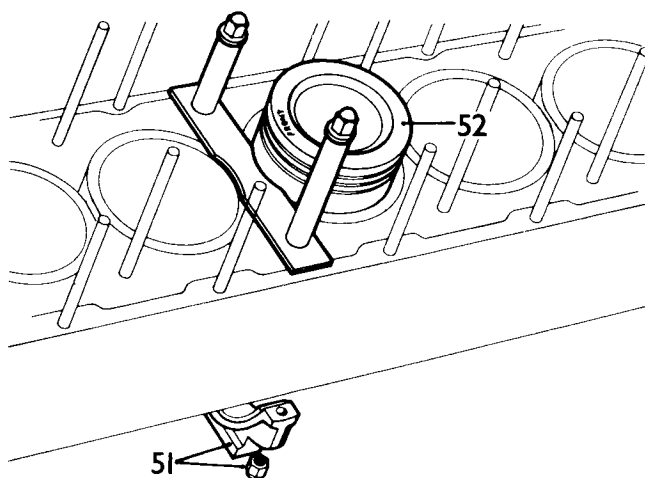
51. Remove nuts securing connecting rod bearing cap; lift off cap together with shell bearing.
52. Remove carbon deposit from top of bore; push connecting rod and piston up cylinder bore and withdraw.



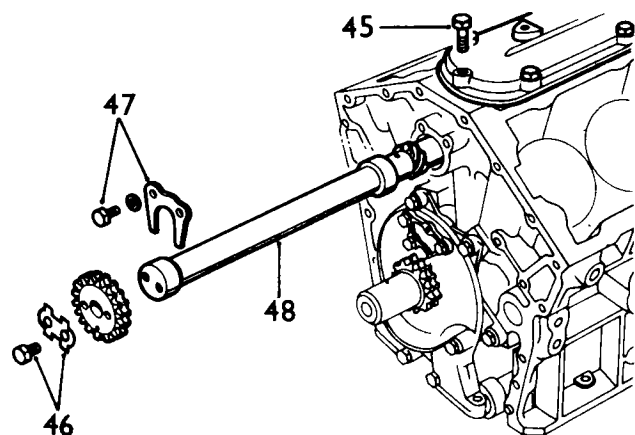
4822



4813B



4945B



4823





53. Repeat operations 51 and 52 on remaining pistons.

**NOTE:** Care must be taken to identify pistons with their respective bores, big end caps should be refitted to connecting rods immediately after removal.

54. Remove bolts and locking plate securing flywheel (manual transmission cars) or drive plate (automatic transmission cars) to crankshaft.  
 55. Lift off flywheel or drive plate.  
 56. Remove nut and bolt securing oil suction pipe clamp to bracket; remove suction pipe.  
 57. Remove small nuts securing main bearing caps, starting from centre bearing.  
 58. Remove pillar nuts and large nuts securing main bearing caps starting from centre bearing.  
 59. Lift off bearing caps and shell, slide rear main bearing casting out of cylinder block, remove and discard seals.  
 60. Lift crankshaft out of cylinder block, retrieve upper half of main bearing shells.

**NOTE:** If for any reason cylinder liners are to be removed and re-used, they should be marked 'front' and refitted in their original bore.

61. Remove cylinder liner retaining tools JD.41.  
 62. Position a suitable mandrel between cylinder liner and press arbor.  
 63. Press out cylinder liners from below.

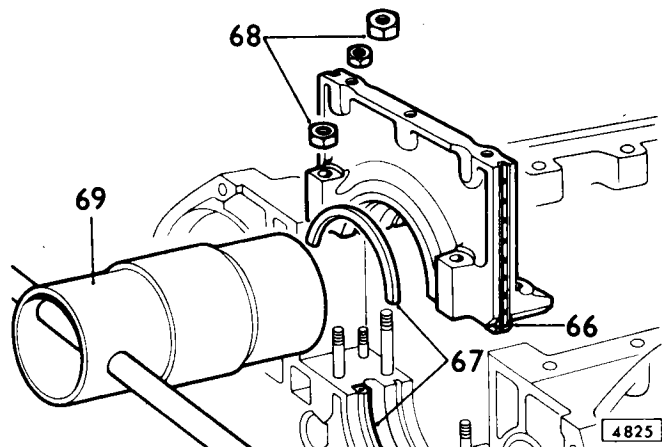
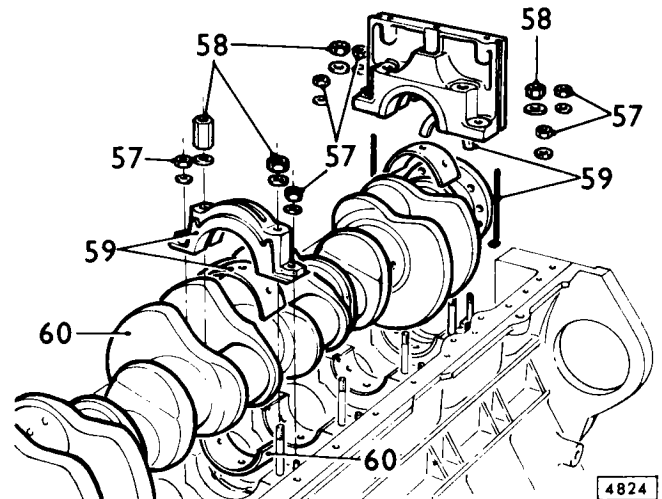
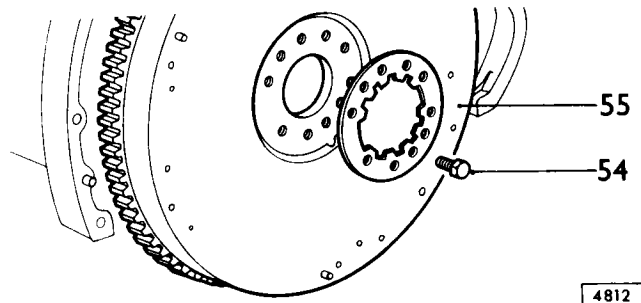
## Reassembling

**CAUTION:** Ensure that all components are scrupulously clean, blow out all oil galleries in crankshaft, camshafts etc., with dry clean compressed air.

64. Smear shoulders of cylinder liners with Hylomar and slip them into cylinder block. Remove excess sealant.

**NOTE:** Cylinder liners must be fitted dry.

65. Ensure liners are correctly seated and fit retaining tools JD.41.  
 66. Fit new sealing strips to grooves of rear main bearing casting.  
 67. Fit new crankshaft rear oil seal.  
 68. Fit main bearing casting to cylinder block and tighten retaining nuts.  
 69. Pre-size rear oil seal using Service Tool JD.17B, together with adaptor JD.17B-1.  
 70. Remove rear main bearing casting.



71. Liberally oil upper main bearing shells and fit in cylinder block. Smear rear oil seal with Dag Colloidal Graphite.

**CAUTION:** Centre and main bearing shells must not be confused with each other; rear main bearing shell has an oil groove whilst centre main bearing shell is plain.

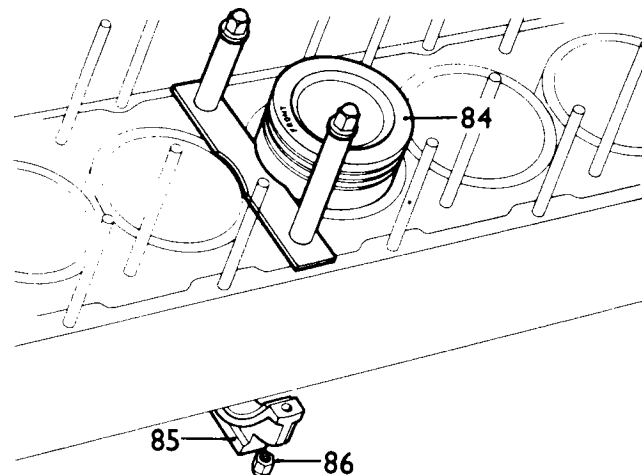
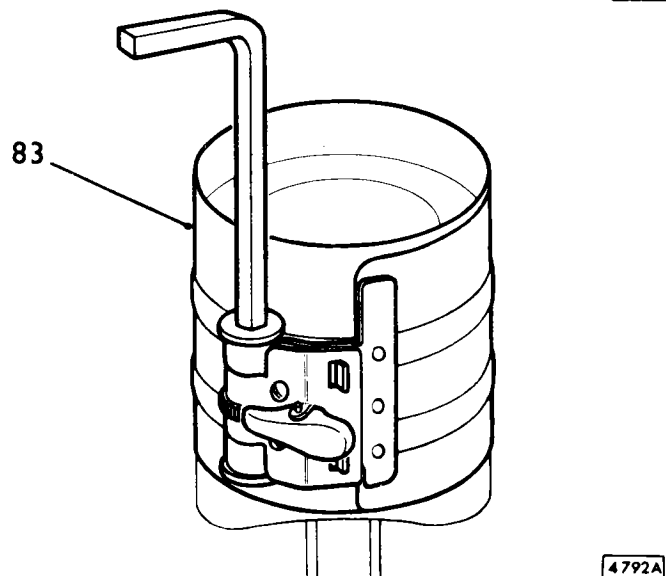
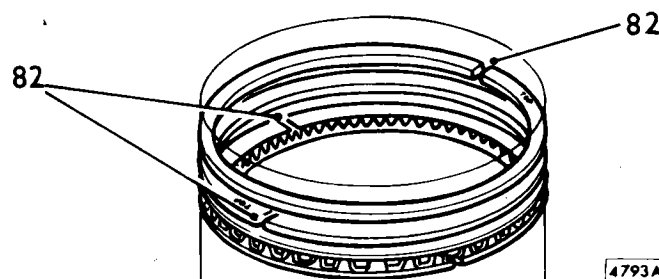
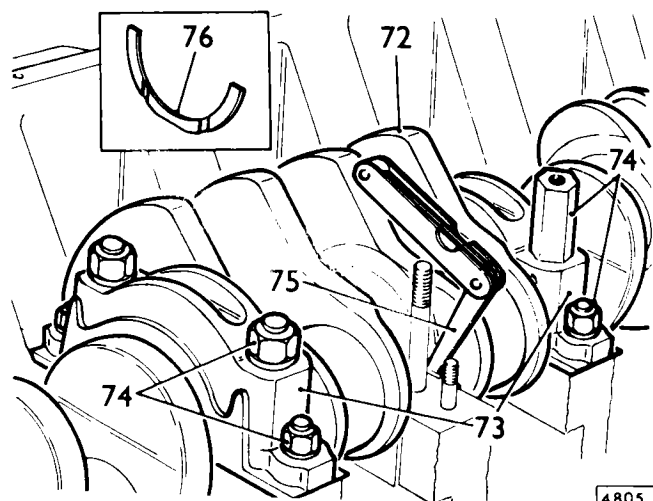
71. Liberally oil upper main bearing shells and fit in cylinder block.  
 72. Position crankshaft in cylinder block.  
 73. Fit bearing shells to caps; fit caps.  
 74. Tighten securing nuts to a torque of:—  
 3.7 kg.m (27.5 lb.ft) for: 9.5 mm ( $\frac{3}{8}$ in) studs  
 8.6 kg.m (62.5 lb.ft) for: 12.7 mm ( $\frac{1}{2}$ in) studs  
 75. Check crankshaft end float.  
 76. Select thrust washers which will reduce end float to .10 to .15 mm (.004 in to .006 in). For sizes of thrust washers available see Engine data 05.  
 77. Remove bearing caps and fit thrust washers selected to groove in block.

**NOTE:** Grooved side of washers must face outwards.

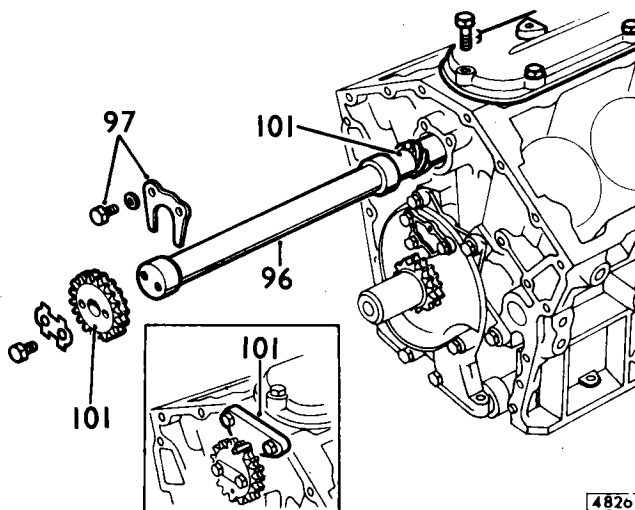
78. Fit bearing shells to caps, oil shells and crankshaft journals.  
 79. Fit main bearing caps and nuts; smear oil seals in rear main bearing casting with oil before assembly.

**NOTE:** Ensure that reference marks on bearing caps face marks on cylinder block.

80. Tighten bearing caps one at a time working from centre outwards to a torque of:—  
 3.7 kg.m (27.5 lb.ft) for: 9.5 mm ( $\frac{3}{8}$ in) studs.  
 8.6 kg.m (62.5 lb.ft) for: 12.7 mm ( $\frac{1}{2}$ in) studs.  
 81. Liberally smear bore of number one cylinder with clean engine oil.  
 82. Ensure that piston ring gaps of number one piston are evenly spaced around circumference of piston.  
 83. Smear piston rings with oil and compress using Service Tool 38U.3.  
 84. Enter piston and connecting rod into top of bore ensuring that 'FRONT' stamped on piston faces forward. DO NOT use undue force when fitting piston.  
 85. Fit big end bearing shell to connecting rod and bearing cap; ensure that locking tabs on shells are correctly located.  
 86. Oil shells and crankshaft journal, fit bearing cap ensuring that it is correct way round. Tighten connecting rod nuts to 5.1 kg.m (37.5 lb.ft).  
 87. Repeat operations 81 to 86 on remaining pistons.  
 88. Check that engine rotates freely.  
 89. Refit oil suction pipe.



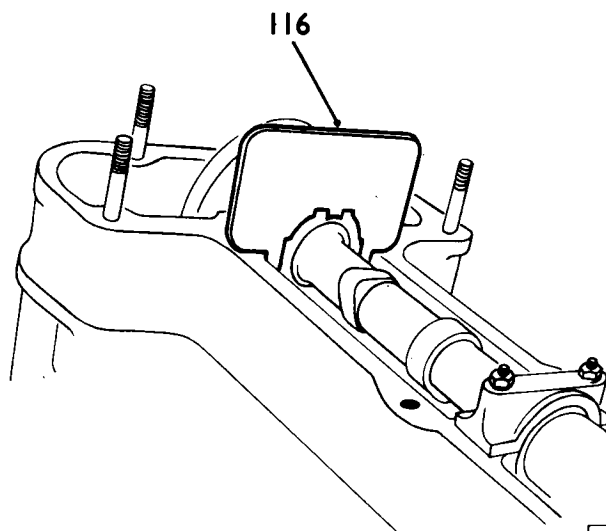
90. Refit flywheel or drive plate; use new locking plate; tighten bolts to 9.1 kg.m (66.5 lb.ft)
91. Refit oil pump to drive gear.
92. Refit oil pump, use new 'O' ring on suction pipe.
93. Refit crankshaft sprocket.
94. Refit timing chain guides – 12.65.50.
95. Refit timing chain tensioner ensuring that it is fully retracted.
96. Smear journals of jackshaft with clean engine oil and fit jackshaft.
97. Refit jackshaft locking plate.
98. Refit camshaft sprockets, use retaining tools JD.40.
99. Attach clock gauge to number one 'A' bank cylinder head stud.
100. Turn engine over and by means of clock gauge set number one 'A' bank piston at T.D.C.
101. Refit jackshaft sprocket ensuring that centre punch marks on sprocket and jackshaft are at 180° and that mark on jackshaft is at top. Fit jackshaft retaining tool JD.39.
102. Refit timing chain. Remove jackshaft retaining tool JD.39.



4826

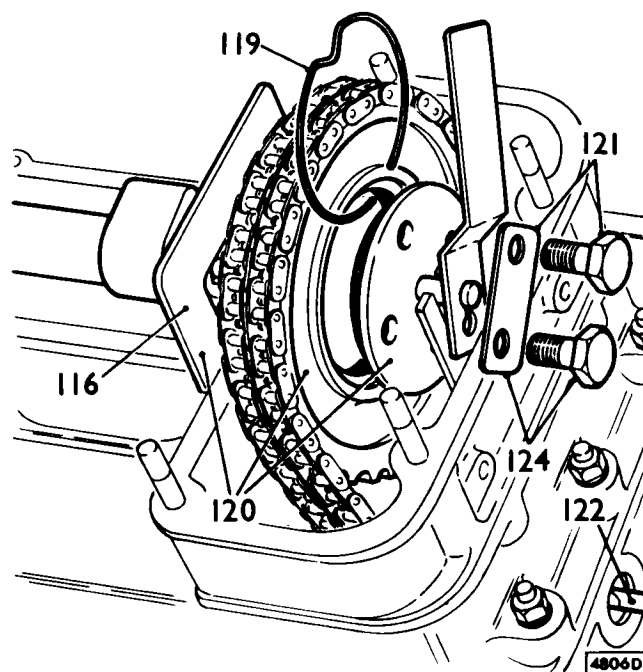
**CAUTION:** Engine must on no account be rotated until camshaft sprockets are coupled to camshafts.

103. Refit timing cover, use new crankshaft oil seal and gaskets, tighten bolts by diagonal selection.
104. Refit crankshaft distance piece.
105. Refit sump, use new gaskets, tighten bolts by diagonal selection.
106. Refit oil cooler, use new gaskets and 'O' rings.
107. Refit oil filter, do not overtighten union nut.
108. Refit crankshaft damper cone and damper; tighten bolt to 17.3 kg.m to 20.7 kg.m (125 lb.ft to 150 lb.ft).
109. Remove cylinder liner retaining tools JD.41.
110. Smear mating faces of tappet block and cylinder head with Hylomar.
111. Refit tappet block, tighten nuts and capscrews by diagonal selection working from centre outwards.
112. Refit camshaft.
113. Refit bearing caps ensuring that reference marks correspond, tighten nuts by diagonal selection working from centre outwards to a torque of 1.2 kg.m (9.0 lb.ft).
114. Adjust tappets 12.29.48.
115. Fit cylinder head gasket with 'TOP' uppermost. Do not use jointing compound or grease.
116. Turn each camshaft until valve timing gauge C.3993 can be fitted to slot in front flange.
117. Reconnect camshaft oil feed pipe.



47958

118. Refit cylinder head, tighten nuts in order shown to a torque of:—  
3.7 kg.m (27.5 lb.ft) for  $\frac{1}{2}$  in nuts.  
7.2 kg.m (52 lb.ft) for  $\frac{3}{4}$  in nuts.
119. Remove circlip retaining camshaft sprocket coupling, rotate coupling until two bolt holes align with holes in camshaft.
120. Refit coupling to camshaft sprocket, refit circlip, remove gauge C.3993.
121. Remove retaining tool JD.40, bolt coupling to camshaft.
122. Insert screwdriver JD.42-2 through hole in timing cover and release chain tensioner locking catch; refit rubber grommet.
123. Rotate engine until remaining bolt holes in coupling are visible.
124. Fit remaining bolts, secure all bolts with tabwashers.
125. Use new camshaft cover gaskets and neoprene sealing plugs.
126. Refit camshaft cover, tighten bolts to a torque of 1.1 kg.m (8.0 lb.ft).
127. Refit jackshaft cover.
128. Reverse operations 1 to 14.
129. Check engine timing by means of a stroboscope.



## CRANKSHAFT – GENERAL

Following crankshaft removal, journals should be checked in accordance with dimensions given in group 05.

**NOTE:** Due to the extremely hard surface of crankshaft journals, it is not possible to grind crankshafts satisfactorily. Crankshafts are available on an exchange basis and are supplied complete with matching bearing shells.

## OIL PUMP

### Remove and refit

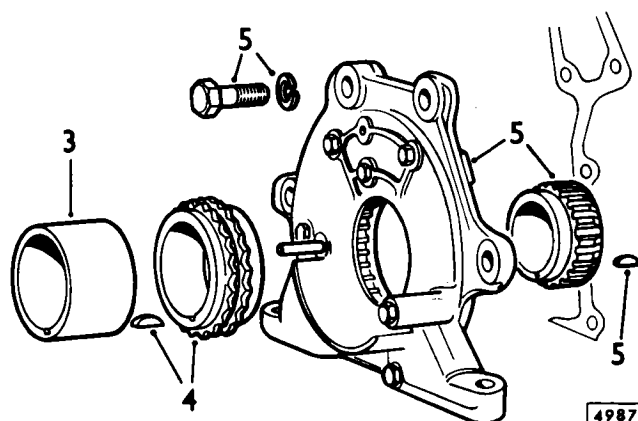
12.60.26

#### Removing

1. Remove timing cover – 12.65.01.
2. Remove the timing chain tensioner – 12.65.28.
3. Remove spacer from crankshaft.
4. Withdraw timing chain and sprocket from crankshaft; collect Woodruff key.
- DO NOT ROTATE ENGINE.**
5. Remove four bolts and lockwashers and withdraw oil pump and gear; collect Woodruff key.

#### Refitting

Reverse operations 1 to 5.

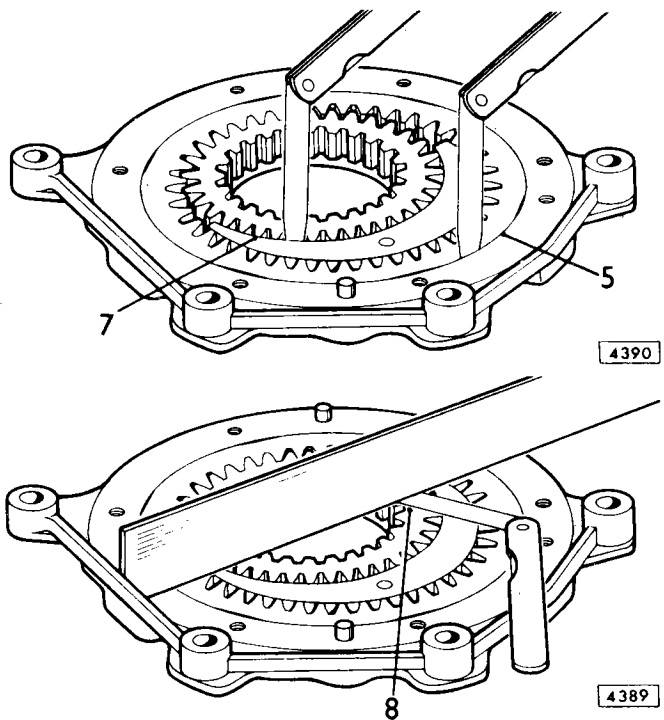


## OIL PUMP

### Overhaul

12.60.32

1. Remove eight bolts and lockwashers and detach pump cover from gear housing.
2. Mark drive and driven gear faces to ensure that when reassembled the gears are replaced in the same position as prior to removal.
3. Remove both gears, wash all parts in clean petrol and dry with compressed air.
4. Check the condition of all gear teeth and remove any burrs with a fine file.
5. Refit driven gear and check radial clearance between gear and housing. Checks should not be taken at the six radial flats on the gear.
6. Clearance should not exceed .127 mm (0.005 in).
7. Refit drive gear and check radial clearance between gear and crescent. Clearance should not exceed .152 mm (0.006 in).
8. Check gear end float by placing a straight edge across joint face of housing and measuring clearance between straight edge and gears.
9. Figure obtained should not exceed .127 mm (0.005 in).
10. Reassembly is the reverse of items 1 to 3.
11. Lubricate gears with clean engine oil before refitting pump assembly and check that all surfaces are clean.



## ENGINE SUMP

### Remove and refit (Engine in situ)

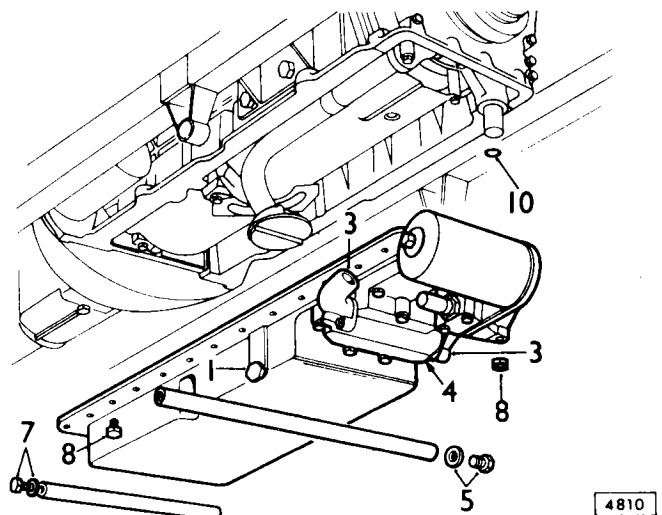
12.60.44

#### Removing

1. Remove sump plug and drain oil into a suitable container.
2. Drain cooling system – 26.10.01
3. Disconnect water hoses.
4. Disconnect heater pipe hose.
5. Remove bolts securing front cross member to mounting brackets, remove cross member.
6. Fold carpet away from both sides of gearbox cover.
7. Remove rear cross member securing bolts; one from each side of gearbox cover; remove rear cross member.
8. Remove sump securing bolts and serrated washers.
9. Lower sump.
10. Remove and discard 'O' ring from oil delivery elbow.

#### Refitting

Reverse operations 1 to 10; fit new 'O' ring in oil delivery elbow, use new sump gasket.



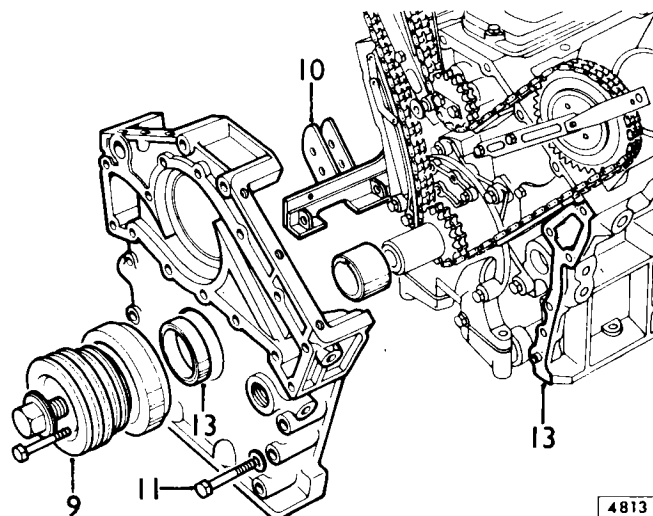
## TIMING COVER

## Remove and refit (Engine in situ)

12.65.01

## Removing

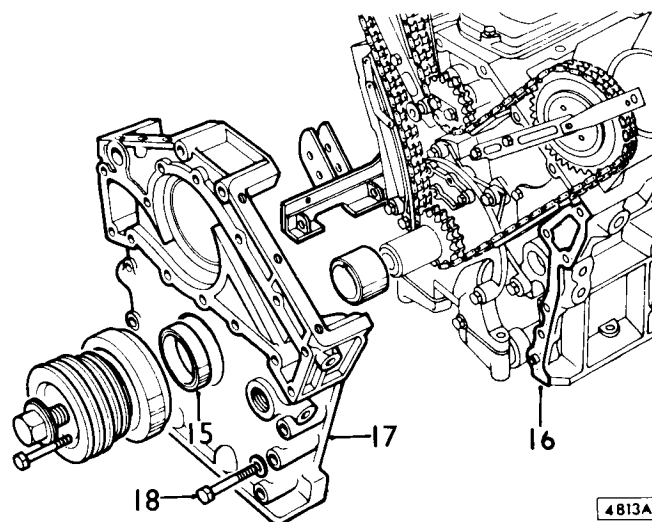
1. Drain cooling system – 26.10.01.
2. Remove front sub-frame cross member complete with header tank – 12.45.05.
3. Remove cylinder heads – 'A' right hand – 12.29.12 'B' left hand – 12.29.11.
4. Remove engine sump – 12.60.44.
5. Remove alternator – 86.10.02.
6. Remove power assisted steering pump – 57.20.14.
7. Remove emission control air pump – Cars fitted with exhaust emission control only – 17.25.07.
8. Remove water pump – 26.50.01.
9. Remove crankshaft pulley and damper – 12.21.01
10. Remove bolts, washers and spacers securing alternator and air pump mounting bracket.
11. Remove bolts and serrated washers securing timing cover to cylinder block noting relative positions of different length bolts also dowel bolts.
12. Remove timing cover together with oil seal.
13. Remove gaskets and oil seal and discard.



4813

## Refitting

14. Ensure mating surfaces of timing cover and cylinder block are scrupulously clean.
15. Immerse new oil seal in clean engine oil and press into timing cover.
16. Smear both sides of each new gasket with suitable jointing compound and position on timing cover.
17. Fit timing cover ensuring that lip on oil seal is not distorted or damaged.
18. Fit bolts and serrated washers, tighten bolts by diagonal selection.
19. Reverse operations 1 to 10.



4813A

## TIMING CHAIN

## Remove and refit (Engine in situ)

12.65.12

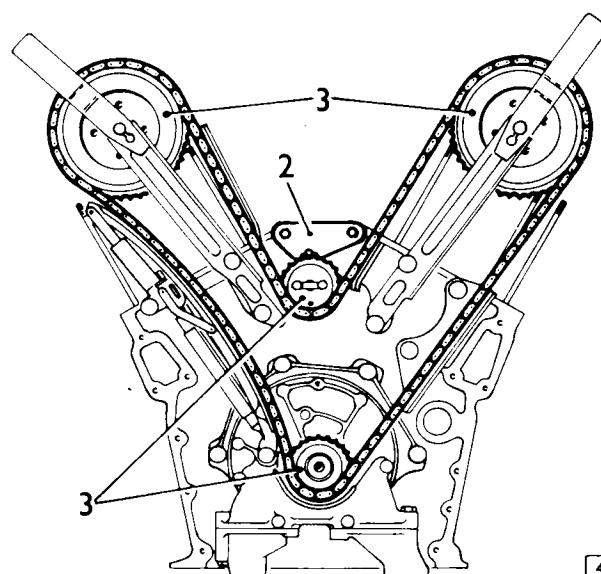
Service tool: Jackshaft retaining tool JD.39.

## Removing

1. Remove timing cover – 12.65.01.
2. Fit jackshaft retaining tool JD.39.
3. Disconnect timing chain from camshaft and jackshaft sprockets; withdraw crankshaft sprocket and chain. DO NOT ROTATE ENGINE.

## Refitting

Reverse operations 1 to 3; check engine timing by means of a stroboscope.



4815

## TIMING CHAIN TENSIONER

### Remove and refit (Engine in situ)

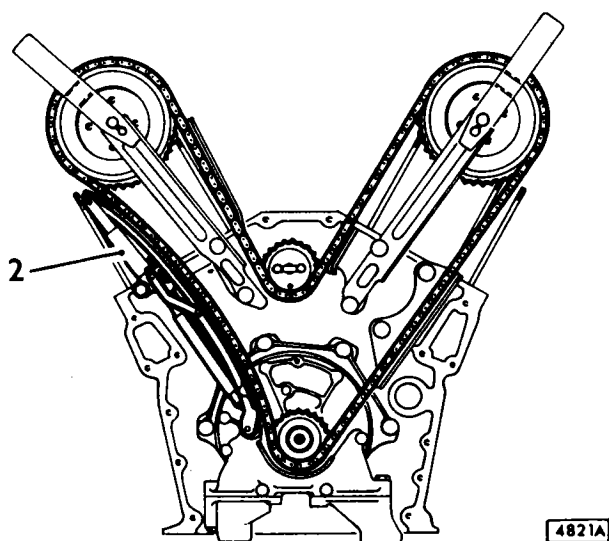
12.65.28

#### Removing

1. Remove timing cover – 12.65.01.
2. Move chain tensioner clear of locating bracket and slide off dowel pin.

#### Refitting

Reverse operations 1 and 2.



## TIMING CHAIN DAMPERS

### Remove and refit

12.65.50

Service tool: Timing chain damper setting jig JD.38.

#### Removing

1. Remove engine and gearbox assembly – 12.37.01
2. Remove timing chain – 12.65.14.
3. Remove oil pump – 12.60.26.
4. Remove bolts securing camshaft sprocket hangers and timing chain dampers to cylinder block.

#### Refitting

5. Fit camshaft sprocket hangers and timing chain dampers to cylinder block; do not fully tighten bolts at this stage.
6. Note relative position of jackshaft sprocket to jackshaft sprocket retaining tool (fitted to engine under operation 12.65.14).
7. Remove jackshaft sprocket retaining tool JD.39.
8. Position damper setting jig JD.38 (shown in skeleton form opposite) on front of cylinder block; do not overtighten retaining bolts.
9. Position camshaft sprocket hangers and timing chain dampers so that they are in even contact with locating dowels; tighten securing bolts.
10. Remove damper setting jig JD.38.
11. Refit jackshaft sprocket retaining tool JD.39.
12. Reverse operations 1 to 3.

