workshop manual for the G4.203 gasoline engine

Perkins Engines Limited
Peterborough England

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FOREWORD

This workshop manual has been compiled for use in conjunction with normal workshop practice. Mention of certain workshop practices, therefore, has been purposely omitted in order to avoid repetition.

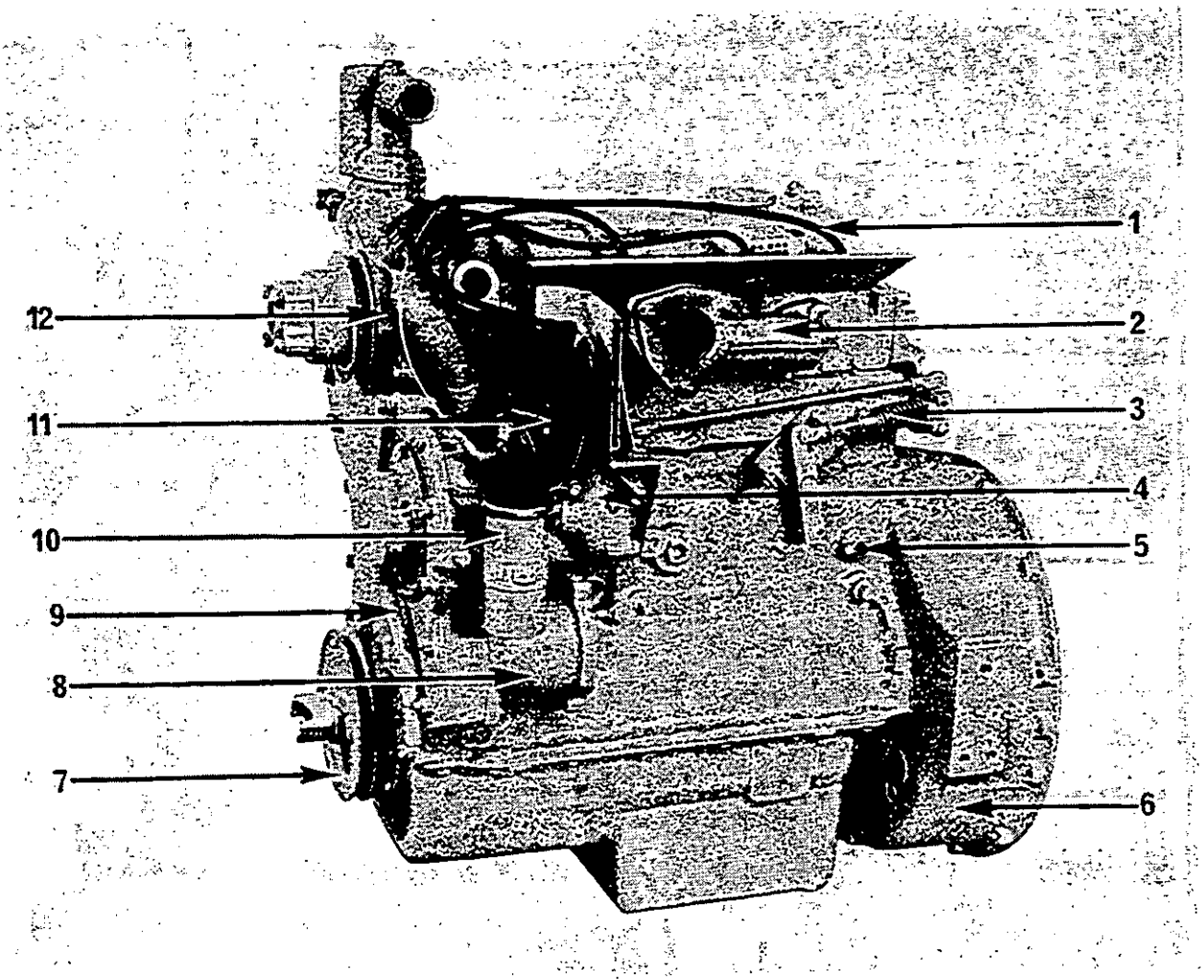
Where the removal, dismantling, assembly or refitting of a part is straightforward, it is omitted from the text. Similarly, references to renewing joints, cleaning joint faces, cleaning before inspection and reassembly and removal of burrs and scale have largely been omitted, it being understood that these procedures will be carried out where applicable.

It follows that any open ports of precision components e.g., carburettor, exposed by dismantling, will be blanked off until reassembled, to prevent the ingress of foreign matter.

This publication is produced by the Service Publications Department of Perkins Engines Limited and every endeavour is made to ensure that the information contained in this manual is correct at the date of publication but due to continuous developments, the manufacturers reserve the right to alter this specification without notice.

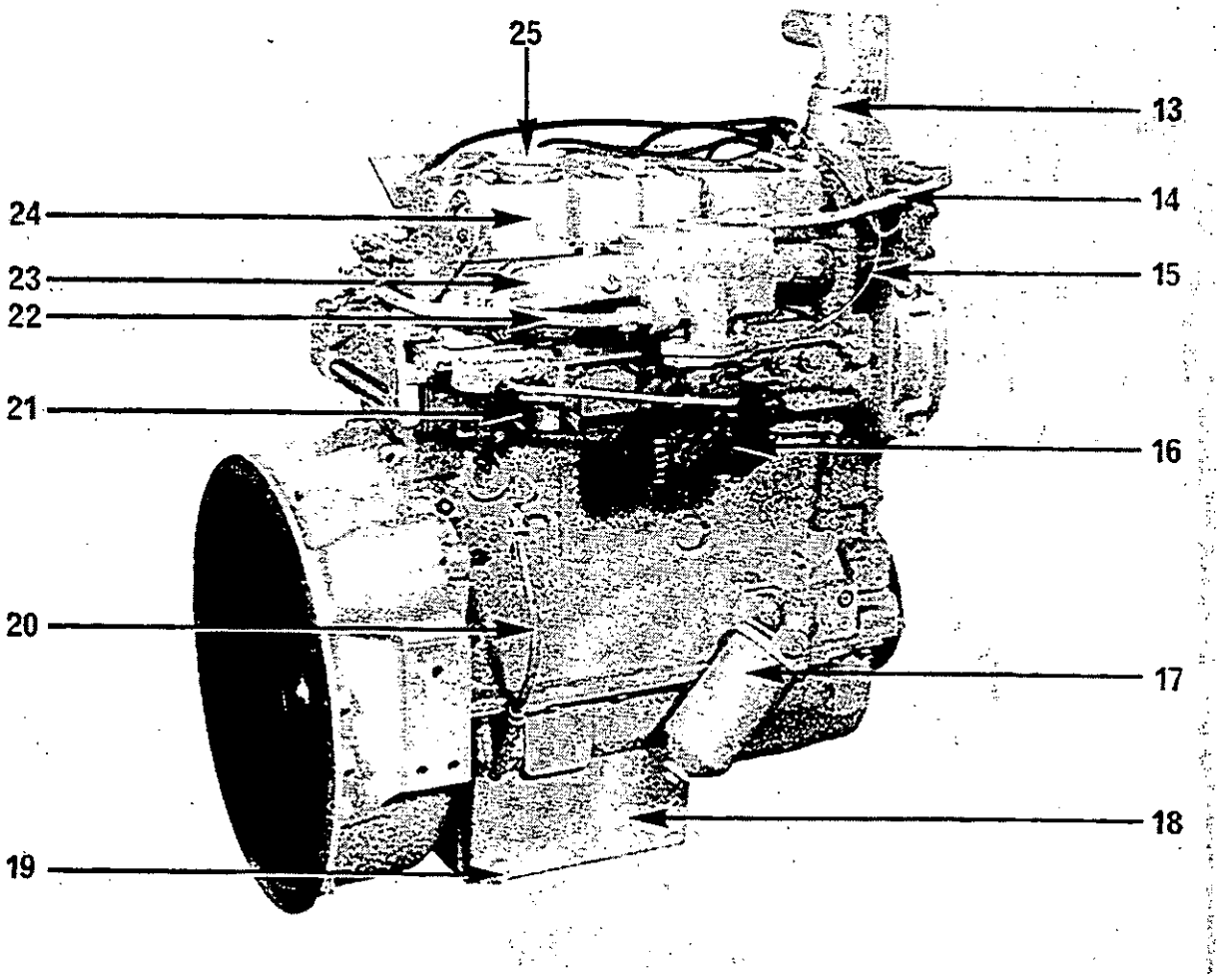
This publication has been written for gasoline (petrol) engines only and any information required on L.P.G. (liquid petroleum gas) engines which is not to be found in this publication, such as starting procedure, gas pressure reducing equipment, pre-heating and carburation, should be obtained from the manufacturer of the machine or his supplier.

Perkins Engines Limited is not responsible for any damage caused to this engine or its component parts by fitting of any L.P.G. conversion equipment not approved by the Company or which is incorrectly fitted or adjusted.



VIEW OF LEFT HAND SIDE OF ENGINE

1 Sparking Plug Lead
2 Exhaust Manifold
3 Throttle Linkage
4 Governor
5 Cylinder Block Water Drain Tap
6 Flywheel Housing
7 Crankshaft Pulley
8 Hydraulic Pump Drive
9 Breather Pipe
10 Ignition Coil
11 Distributor
12 Water Pump



VIEW OF RIGHT HAND SIDE OF ENGINE

13 Thermostat Housing
14 Pipe from Water Pump to Heated Inlet Manifold
15 Vacuum Pipe from Carburettor to Distributor
16 Carburetter
17 Lubricating Oil Filter
18 Sump
19 Sump Drain Plug
20 Dipstick
21 Fuel Lift Pump
22 Water Pipe from Inlet Manifold to Cylinder Head
23 Inlet Manifold
24 Rocker Cover
25 Lubricating Oil Filler

General Information (B)

DATA

Type	Four cylinder, four stroke
Bore	3.6 in (91,44 mm)—nominal
Stroke	5 in (127 mm)
Compression Ratio	7.0 : 1
Cubic Capacity	203 in³ (3,33 litre)
Firing Order	1,3,4,2.
Tappet Clearance	Inlet (cold) — 0.012 in (0,30 mm) Exhaust (cold) — 0.015 in (0,38 mm)
Oil Pressure	30/60 lbf/in² (2,1/4,2 kgf/cm²) at maximum engine speed and normal operating temperature.
Ignition Timing	10° B.T.D.C. (Static) 17½° B.T.D.C. @ 1,400 rev/min (Dynamic) 24° B.T.D.C. @ 2,000 rev/min (Dynamic)
Lubricating Oil Sump Capacity	13 U.K. pints — 15,6 U.S. pints 7,38 litre
Sparking Plug	Champion N88 14 mm
Sparking Plug Gap	0.025 in (0,64 mm)
Contact Breaker Points Gap	0.019/0.021 in (0,48/0.53 mm)
Fuel Specification	91 octane

Rating Details

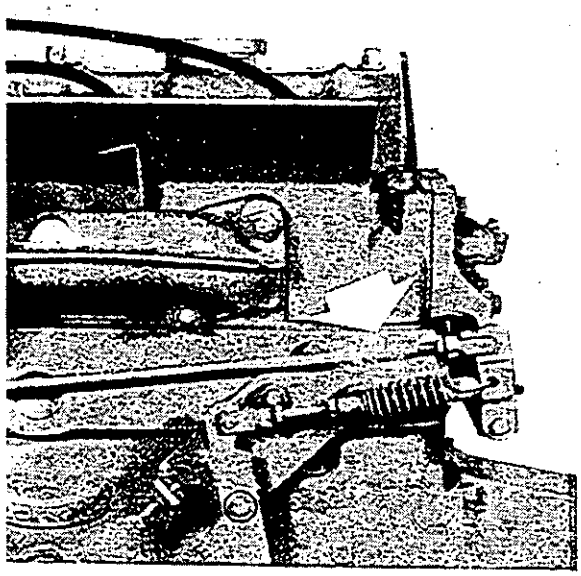
Rated Output (Gross)	64 bhp @ 2,500 rev/min
Maximum Torque	174 lbf ft @ 1,200 rev/min

Recommended Torque Tensions

Component	Screw Size U.N.F.	lbf ft	kgf m
Cylinder head nuts	⅞	60	81,3
Big end nuts (PHOSPHATED)	⅞	45 60	61 81
Main bearing setscrews	⅞	115	156
Camshaft gear retaining setscrew	⅝	21	28,5
Idler gear retaining nuts	⅜	21	28,5
Crankshaft Pulley setscrew	⅞	110	149
Flywheel setscrews	½	80	108.4
Distributor drive thrust plate retaining setscrew	¼	7	9,5
Sparking plug	14 mm	30	40,6

Engine Number

The engine number is located on a facing high at the rear of the distributor side of the cylinder block (see Fig. B.1). It consists of figures and letters e.g., 203U250A. The first three figures indicate the engine capacity, the letter U that it was built in the United Kingdom, the next group of figures, the engine serial number and finally the letter A signifying a gasoline engine.



B1

Preventive Maintenance (C)

Periodical Attentions

Daily

Check oil pressure.
Check fuel level.
Check water in radiator.
Check oil level in sump (make sure machine is standing level).
Under adverse conditions, service air cleaner (see air cleaner manufacturers recommendations).

Every 200 hours or 4 months

(whichever occurs first)
Clean air cleaner element (dry paper type).
Check fan belt adjustment.
Drain oil from sump and renew.
Lubricate distributor cam.

Every 400 hours or 12 months

(whichever occurs first)
Renew element in lubricating oil filter.
Clean fuel water trap and pre-filters (where fitted).
Check tappet clearances.
Clean and service sparking plugs.
Re-face and set contact breaker points.

Every 800 hours

Renew sparking plugs
Renew and set contact breaker points.
Strip and clean carburetter. Do not use wire brushes.
Re-check dynamic ignition timing to confirm effective operation of the automatic advance mechanism.
Note: If equipment for the above operation is not available, check static ignition timing.
Renew air cleaner element (or once a year, whichever occurs first).

Every 2,400 hours

Arrange for examination and service of proprietary equipment, i.e., compressor, starter motor, alternator etc.

POST DELIVERY CHECKOVER

After a customer has taken delivery of his engine, a general checkover must be carried out after the first 25/50 hours in service and comprises the following :—

1. Drain the lubricating oil sump and refill to the correct level with clean new oil (do not overfill). Renew lubricating oil filter element.
2. Check fan belt tension.
3. Check tightness of all external nuts, setscrews, hose-clips, mountings, etc.
4. Start engine and check for fuel, coolant or lubricating oil leaks.
5. Check ignition timing (engine running).

PRESERVATION OF LAID UP ENGINES

Where an engine is to be laid up for several months, it must be protected as follows :—

1. Clean all external parts.
2. Run engine until warm. Stop engine and drain lubricating oil sump.
3. Throw away paper element in lubricating oil filter, clean bowl and fit new element. Part fill bowl with new oil of an approved grade, a list of which appears in the appendix.
4. Clean out breather pipe.
5. Fill lubricating oil sump to correct level with new oil of an approved grade.
6. Drain fuel system.
7. Seal air vent in tank or filler cap with waterproof adhesive tape.
8. Drain the cooling system. To ensure complete draining, remove drain taps and check holes are not blocked by scale.
9. Remove sparking plugs and spray into cylinder bores ¼ pint (0,15 litre) of lubricating oil divided between the cylinders. Rotate the crankshaft one complete revolution and replace the sparking plugs.
10. Remove air filter and any piping. Seal air intake with waterproof adhesive tape.
11. Remove exhaust pipe and seal manifold port.
12. Remove fan belt.

Batteries

13. Remove batteries and top up cells with distilled water. Clean terminals and lightly smear with petroleum jelly. Recharge and store in a cool dry, dust-free place. Avoid freezing. Recharge once a month.

Starter, Dynamo or Alternator

14. Clean terminals and lightly smear with petroleum jelly. If the machine is to stand in the open, the alternator or dynamo, starter motor and control board must be protected against inclement weather.

PREPARING ENGINE FOR RETURN TO SERVICE

When the engine is to be returned to service, the following procedure must be observed :

1. Thoroughly clean all external parts.
2. Close the cylinder block and radiator drain taps and fill system with clean coolant. Check for leaks.
3. Rotate fan by hand to ensure freedom of water pump seals.
4. Refit fan belt.
5. Remove rocker cover, lubricate rocker assembly with engine oil and replace cover.
6. Remove adhesive tape from air intake. Clean and refit air filter and any intake pipes.
7. Remove adhesive tape from exhaust manifold port and refit exhaust pipe.
8. Connect batteries.

9. Wipe grease from starter, dynamo or alternator terminals and check all connections are sound.
10. Check the level and condition of the sump oil. Change the oil if necessary.
11. Remove adhesive tape from fuel tank vent or filler cap.
12. Fill fuel tank.
13. Start engine and check for oil pressure and generator charge. Whilst the engine is reaching normal working temperature, check for oil, water or fuel leaks.

Fault Finding (D)

Fault Finding Chart.

Fault	Possible Cause
Low cranking speed	22, 31, 35, 38.
Will not start	1, 5, 30, 31, 32, 35, 38, 39, 40, 41, 42, 43, 54, 55.
Stalls	1, 5, 28, 29, 37, 40, 41, 42, 44, 47, 48, 51, 52.
Misfiring at idling speed	1, 5, 28, 29, 34, 35, 36,. 37, 39, 40, 41, 42, 43, 48, 52.
Misfiring at high speed	1, 27, 28, 32, 34, 36, 37, 40, 41, 42, 46, 47, 50.
Misfiring on acceleration	1, 29, 32, 40, 42, 46, 50.
Loss of power	1, 5, 6, 9, 10, 24, 28, 29, 30, 32, 33, 36, 37, 40, 41, 42, 46, 47, 50, 52, 54.
Overheating	9, 11, 12, 13, 14, 22, 30, 32, 46, 47, 49.
Low oil pressure	15, 16, 17, 19, 20, 21, 22, 23, 25.
High oil pressure	18, 21, 22.
Excessive crankcase pressure	7, 8, 9, 24.
Starts but stops	45, 53.
Races on no load condition	10.
Erratic performance	36.,
Noisy	2, 25, 28.
High oil consumption	3, 4, 7, 15, 18, 22, 24.
Knocking	25, 26, 27, 46.

Key to Fault Finding Chart

1. Dirty or incorrectly gapped sparking plugs.
2. Piston slap.
3. Worn valve guides.
4. Sump overfilled.
5. Carburetter float setting incorrect.
6. Exhaust system restricted.
7. Partially choked breather pipe.
8. Worn or sticking piston rings.
9. Cylinder head gasket blown.
10. Governor faulty or set wrongly.
11. Thermostat stuck.
12. Fan belt slipping.
13. Radiator or system partially blocked.
14. Coolant level in system too low.
15. External oil leak.
16. Loose or restricted lubricating oil pipes.
17. Pressure relief valve sticking open.
18. Pressure relief valve sticking closed.
19. Oil pump suction pipe faulty.
20. Oil pump worn.
21. Pressure gauge incorrect.
22. Incorrect grade of lubricating oil.
23. Insufficient oil in sump.
24. Worn bores.
25. Worn or damaged bearings.
26. Piston striking a valve.
27. Broken valve spring.
28. Valve clearances incorrect.
29. Worn, burned or pitted valves.
30. Incorrect valve timing.
31. Starter motor unserviceable.
32. Incorrect ignition timing.
33. Incorrect automatic advance.
34. Unserviceable rotor arm.
35. Battery not fully charged.
36. Distributor drive shaft worn.
37. Distributor cam worn.
38. Poor electrical connections.
39. Cracked distributor head.
40. Unservcieable H.T. coil or condenser.
41. Unserviceable H.T. heads.
42. C.B. points dirty, pitted or incorrectly gapped.
43. Damp H.T. leads.
44. Air leak in induction manifold.
45. Fuel tank vent blocked.
46. Incorrect grade fuel.
47. Dirt or water in carburetter.
48. Idling speed incorrect.
49. Weak carburetter mixture.
50. Carburetter jets dirty or partially blocked.
51. Choke adjustment incorrect.
52. Idling mixture incorrect.
53. Vapour lock.
54. Dirty or blocked fuel feed pipe.
55. Carburetter flooded.

Cylinder Head (E)

To Remove Head

Drain water from radiator and cylinder block.
Detach hose connections to water pump/thermostat housing.
Remove water pipes to and from induction manifold.
Remove carburetter, vacuum advance pipe, throttle linkage, fuel pipes, rear end plate assembly, alternator adjusting link, induction and exhaust manifolds.
Remove H.T. leads, sparking plugs and breather pipe.
Remove cylinder head cover and remove rocker shaft assembly.
Remove lubricating oil feed pipe between camshaft chamber and cylinder head.
Remove heat shield.
Remove cylinder head nuts and remove head.

To Remove Valves

An exploded view of the valve assembly is shown in Fig. E.1.
Depress the spring cap and springs using a valve spring compressor and remove the two half conical collets.
Remove the spring caps and rotators (on exhaust valves only).
Remove inner and outer valve springs and inlet valve seals. Remove valves.
Valve faces and seats can be reconditioned in the orthodox manner using grinding compound. The valve face and seat angle is 44°. Do not unnecessarily grind valve seats.
The inlet valve seat has a 55° flare machined between the seat and the cylinder head.
All valves are numbered to their respective cylinders.

Rocker Levers

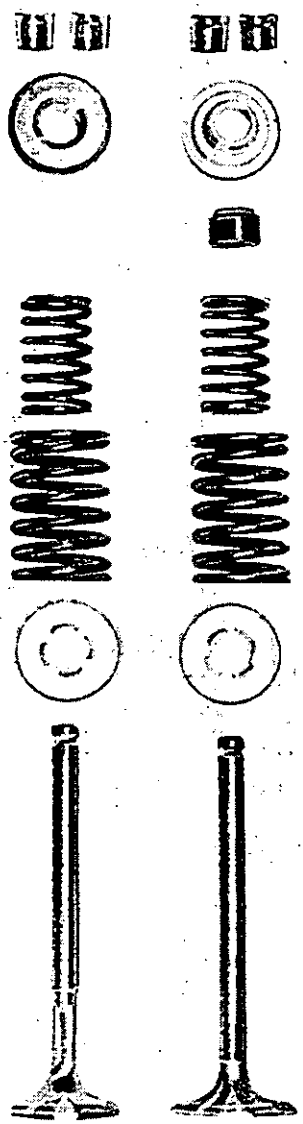
Examine the rocker lever bores for wear. They should be an easy fit on the shaft without excessive sideplay. If the rocker bores are worn, then new rocker levers must be fitted.
When dismantling rocker shaft assemblies, note the order of assembly to facilitate re-build in the correct component order (See Fig. E.2).

Valve Bores

Where valve guide bores are unduly worn, the valve guides should be replaced.
Removal and replacement is effected by means of a special tool. When fitting a guide, ensure that it protrudes 0.370/0.380 in (9,40/9,65 mm) above the top face of the cylinder block.
N.B. Where a new valve guide is fitted, it is essential that the valve seating in the cylinder head be recut to ensure concentricity of the seat with the guide.

Tappets

The running clearance between the tappet and rocker lever should be 0.012 in (0,30 mm) for the inlet valve and 0.015 in (0,38 mm) for the exhaust valve with the engine cold (see fig. E.3).



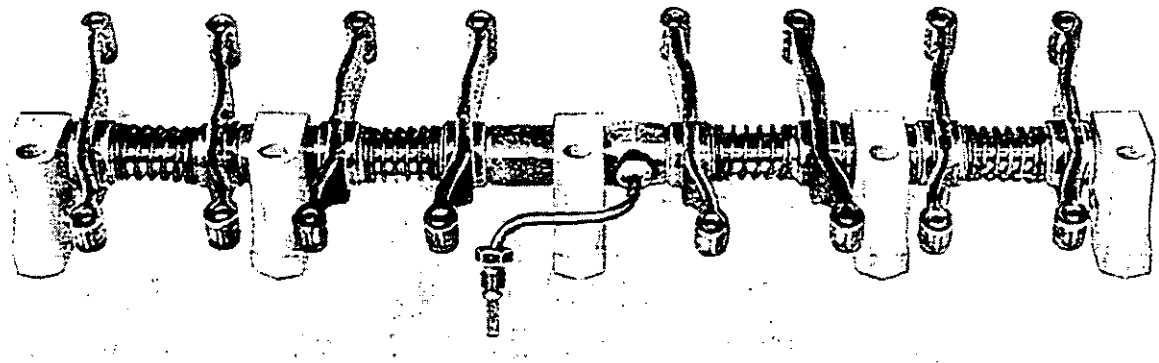
E1

General

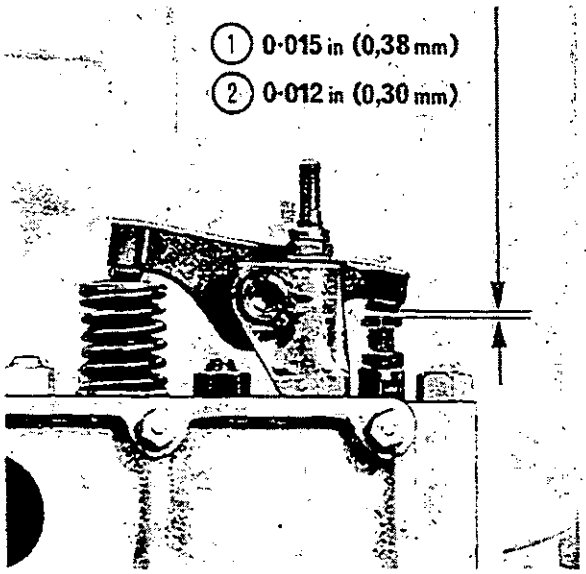
All studs on the cylinder head and top face of the cylinder block should be examined for looseness or damage. The cylinder head nuts should also be checked for thread damage.

Re-assembly

Replace the valves, washers, rotators, seals, collars, springs and collets, taking care that the numbers stamped adjacent to the valve seats correspond to the numbers stamped on the valves.
Fit a new cylinder head gasket. A coating of jointing compound should be applied to both sides of the gasket before fitting.



E2



E3

Lower head into position on its studs and torque nuts to the correct value and in the right sequence (See Fig. E.4).

Refit lubricating oil feed pipe between camshaft chamber and cylinder head.

Replace rocker assembly, tighten down evenly and re-connect lubricating oil feed pipe.

Adjust tappet clearance as follows :

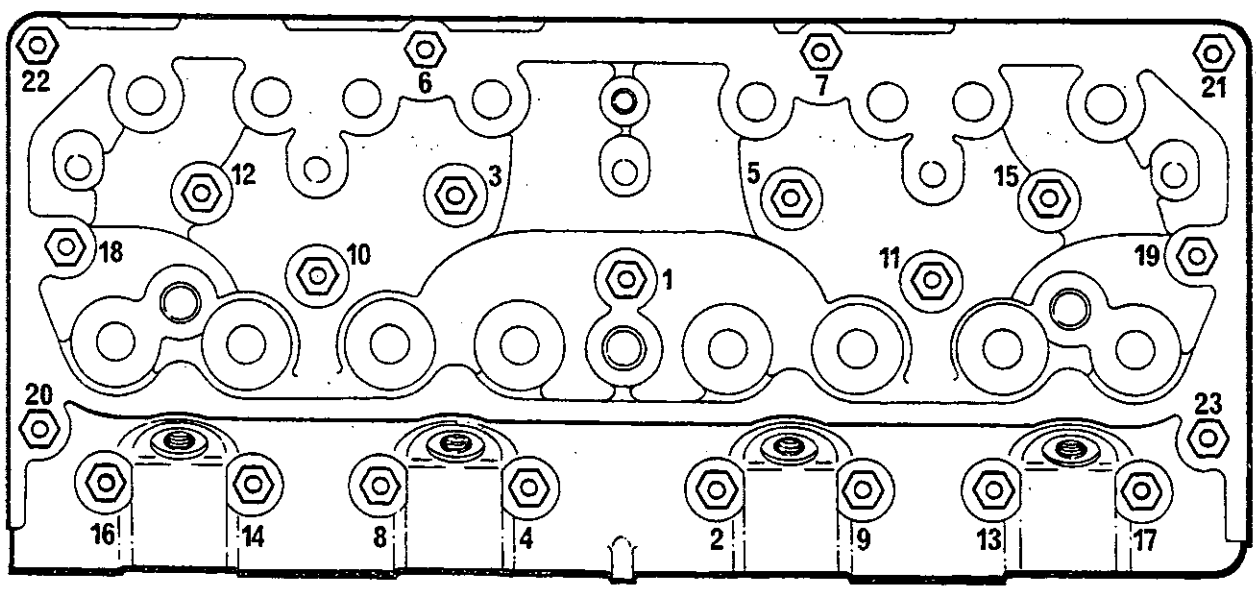
With valves rocking on No. 4 cylinder (i.e. the period between the opening of the inlet valve and the closing of the exhaust valve), set the tappet clearances on No. 1 cylinder.

With valves rocking on No.2 cylinder, set the tappet clearances on No. 3 cylinder.

With valves rocking on No. 1 cylinder, set the tappet clearances on No. 4 cylinder.

With valves rocking on No. 3 cylinder, set the tappet clearances on No. 2 cylinder.

Tappet clearances are (cold) 0.012 in (0,30 mm) inlet and 0.015 in (0,38 mm) exhaust.



E4

Data and Dimensions for Cylinder Head Assembly

Cylinder Head

Cylinder Head Depth	2.985/3.015 in (75,82/76,58 mm)
Leak Test Pressure	30 lbf/in² (2,11 kgf/cm²3
Valve Seat Angle	44°
Bore in Head for Valve Guides	0.4955/0.5005 in (12,69/12,71 mm)

Valve Guides

Outer Diameter	0.50125/0.50175 in (12,73/12,74 mm)
Inner Bore Diameter	0.3145/0.3155 in (7,99/8,01 mm)
Protrusion above top face of cylinder block	0.370/0.380 in (9,40/9,65 mm)

Exhaust Valve

Valve Stem Diameter	0.3110/0.31175 in (7,90/7,92 mm)
Clearance of Valve in Guide	0.00275/0.0045 in (0,06/0,11 mm)
Valve Head Diameter	1.310/1.320 in (33,27/33,52 mm)
Valve Face Angle	44°
Valve Head Protrusion above cylinder head face	0.069/0.082 in (1,75/2,08 mm)
Overall Length	4.518/4.528 in (118,21/118,61 mm)

Inlet Valve

Valve Stem Diameter	0.311/0.312 in (7,90/7,92 mm)
Clearance of Valve in Guide	0.0025/0.0045 in (0,06/0,11 mm)
Valve Head Diameter	1.530/1.540 in (38,86/39,12 mm)
Valve Face Angle	44°
Valve Head Depth below cylinder head face	0.062/0.075 in (1,57/1,91 mm)
Overall Length	4.489/4.511 in (114,02/114,58 mm)

Inner Valve Springs

Fitted Length	1.1875 in (30,16 mm)
Load at Fitted Length	8.0 lb ± 1 lb (3,63 kg ± 0,45 kg)

Outer Valve Springs

Fitted Length	1.500 in (38,10 mm)
Load at fitted Length	22.75 lb ± 2 lb (10,34 kg ± 0,91 kg)

Tappets

Bore in Cylinder Head for Tappet	0.6245/0.62575 in (15,86/15,89 mm)
Tappet Shank Diameter	0.62225/0.62375 in (15,81/15,84 mm)
Clearance of Tappet in Bore	0.00075/0.0035 in (0,019/0,189 mm)

Rocker Shaft

Diameter	0.62225/0.62375 in (15,81/15,84 mm)

Rocker Lever

Bore Diameter	0.625/0.628 in (15,88/15,95 mm)
Lever Clearance on Rocker Shaft	0.00125/0.00575 in (0,03/0,15 mm)

Tappet Clearances (Cold)

Inlet	0.012 in (0,30 mm)
Exhaust	0.015 in (0,38 mm)