

SECTION B

Technical Data

Engine Data

					4.108 and 4.107	4.99
Bore (nominal — See Page B.3) ...	...	...	...	...	3.125 in (79,37 mm)	3.00 in (76,2 mm)
Stroke ...	...	...	...	...	3.5 in (88,9 mm)	3.5 in (88,9 mm)
No. of Cylinders ...	...	...	...	...	Four	Four
Cubic Capacity ...	...	...	...	...	107.4 in ³ (1,760 litre)	99 in ³ (1,621 litre)
Compression Ratio ...	...	...	...	...	22:1	20:1
Firing Order ...	...	...	...	...	1, 3, 4, 2.	1, 3, 4, 2.
Cycle ...	...	...	...	...	Four-Stroke	Four-Stroke
Combustion System ...	...	...	...	...	Indirect Injection	Indirect Injection
Engine Rotation ...	...	...	...	...	Clockwise viewed from front	Clockwise viewed from front

Rating Details

	4.99	4.107	4.108
Maximum Gross Rated Output	48 bhp (37 kW) at 4000 rev/min	41 bhp (30,6 kW) at 3000 rev/min	55 bhp (41 kW) at 4000 rev/min
Maximum Gross Torque Output	73 lbf ft (10,1 kgf m) at 2250 rev/min	79 lbf ft (10,9 kgf m) at 1900 rev/min	83 lbf ft (11,5 kgf m) at 2200 rev/min

Engine Weights, Dry

Approx. dry weight, bare engine, i.e. complete with fuel injection equipment, pressed steel oil sump, dynamo, water pump, but not including starter motor, air cleaner, fan, flywheel or flywheel housing: 330 lb (150 kg).

Typical dry weight, engine with all accessories: 450 lb (204 kg).

De-rating for Altitude

Where engines are called upon to operate in rarefied atmospheres occasioned by altitude, such engines should be de-rated.

The following table is given as a general guide, which may be applied on a percentage basis, where specific figures for a particular engine rating are not available.

Altitude	Maximum fuel delivery de-rating*
0— 2,000 feet (600 metre)	No change
2,000— 4,000 feet (1,200 metre)	6%
4,000— 6,000 feet (1,800 metre)	12%
6,000— 8,000 feet (2,400 metre)	18%
8,000—10,000 feet (3,000 metre)	24%
10,000—12,000 feet (3,600 metre)	30%

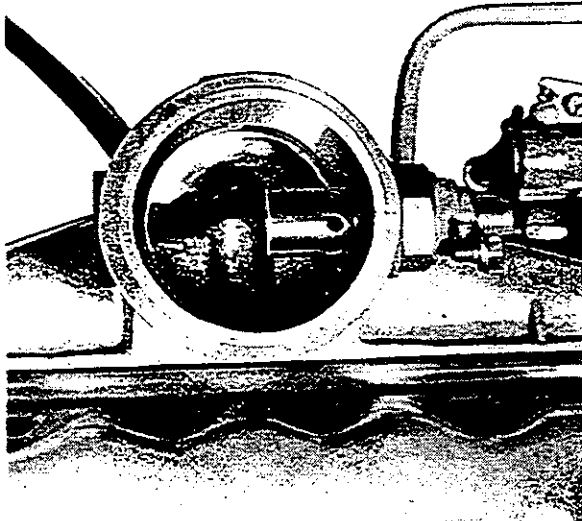
*Measured at setting speed given in pump setting code.

Any necessary adjustments in this respect to the fuel pump should be carried out by the C.A.V. dealer or Perkins Distributor for the territory concerned.

For any further information apply to Technical Services Department, Perkins Engines Limited, Peterborough or to one of the Perkins Companies listed on Page 2.

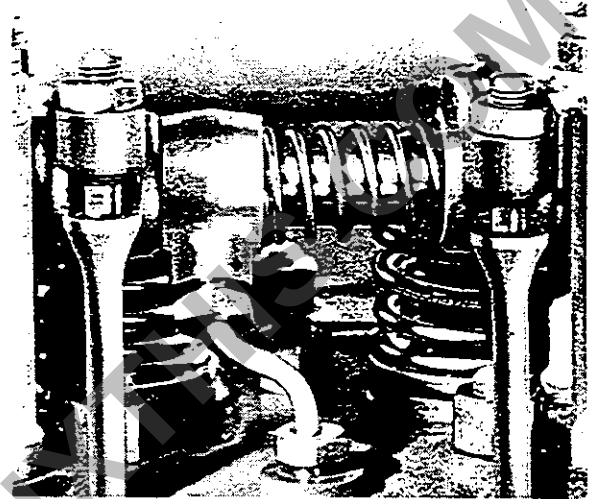
SECTION E

Cylinder Head



E1

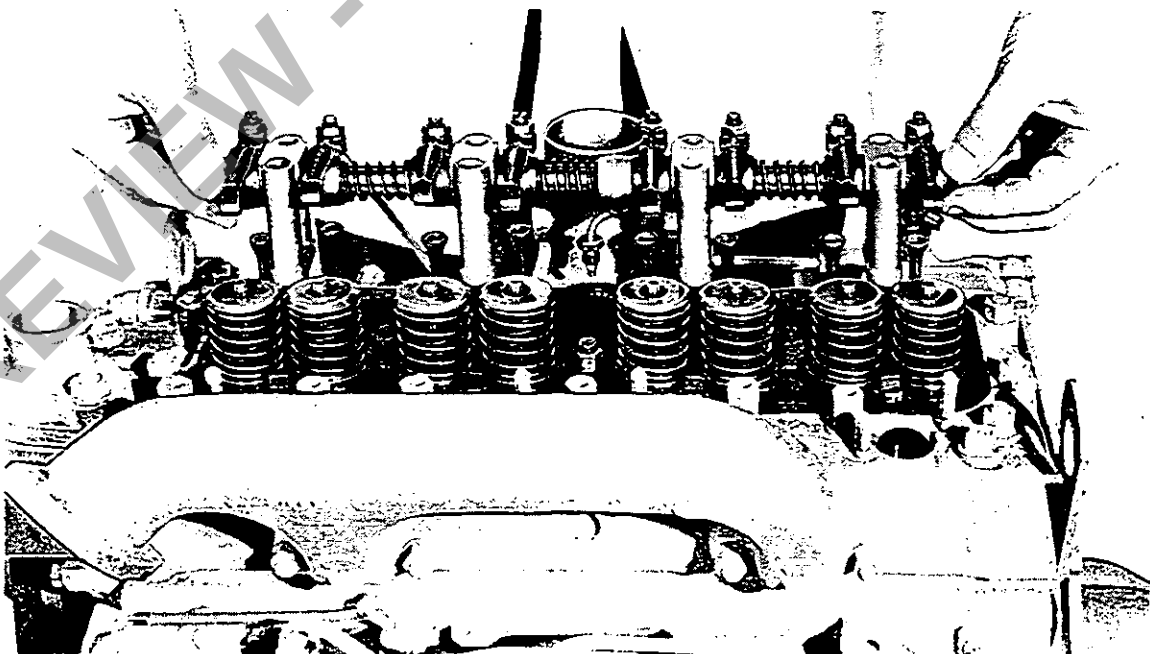
Before commencing to overhaul the cylinder head ensure that all joints, gaskets and any other parts expected to be required are available. Remove any external components from the vicinity of the cylinder head cover, atomisers and fuel pump.



E2

To Remove the Cylinder Head

1. Completely drain the cooling system.
2. Disconnect the battery terminals.
3. Remove the securing nuts and detach the exhaust pipe from the exhaust manifold. Blank off the end of the exhaust pipe to prevent entry of any foreign matter.



E3

SECTION D

Fault Diagnosis

Fault	Possible Cause
Low cranking speed	1, 2, 3, 4.
Will not start	5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22, 31, 32, 33.
Difficult starting	5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 22, 24, 29, 31, 32, 33.
Lack of power	8, 9, 10, 11, 12, 13, 14, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 31, 32, 33.
Misfiring	8, 9, 10, 12, 13, 14, 16, 13, 19, 20, 25, 26, 28, 29, 30, 32.
Excessive fuel consumption	11, 13, 14, 16, 18, 19, 20, 22, 23, 24, 25, 27, 28, 29, 31, 32, 33.
Black exhaust	11, 13, 14, 16, 18, 19, 20, 22, 24, 25, 27, 28, 29, 31, 32, 33.
Blue/white exhaust	4, 16, 18, 19, 20, 25, 27, 31, 33, 34, 35, 45, 56.
Low oil pressure	4, 36, 37, 38, 39, 40, 42, 43, 44, 58.
Knocking	9, 14, 16, 18, 19, 22, 26, 28, 29, 31, 33, 35, 36, 45, 46, 59.
Erratic running	7, 8, 9, 10, 11, 12, 13, 14, 16, 20, 21, 23, 26, 28, 29, 30, 33, 35, 45, 59.
Vibration	13, 14, 20, 23, 25, 26, 29, 30, 33, 45, 47, 48, 49.
High oil pressure	4, 38, 41.
Overheating	11, 13, 14, 16, 18, 19, 24, 25, 45, 50, 51, 52, 53, 54, 57.
Excessive crankcase pressure	25, 31, 33, 34, 45, 55, 60.
Poor compression	11, 19, 25, 28, 29, 31, 32, 33, 34, 46, 59.
Starts and stops	10, 11, 12.

Key to Fault Finding Chart

- | | |
|---|--|
| 1. Battery capacity low. | 31. Worn cylinder bores. |
| 2. Bad electrical connections. | 32. Pined valves and seats. |
| 3. Faulty starter motor. | 33. Broken, worn or sticking piston ring/s. |
| 4. Incorrect grade of lubricating oil. | 34. Worn valve stems and guides. |
| 5. Low cranking speed. | 35. Overfull air cleaner or use of incorrect grade of oil. |
| 6. Fuel tank empty. | 36. Worn or damaged bearings. |
| 7. Faulty stop control operation. | 37. Insufficient oil in sump. |
| 8. Blocked fuel feed pipe. | 38. Inaccurate gauge. |
| 9. Faulty fuel lift pump. | 39. Oil pump worn. |
| 10. Choked fuel filter. | 40. Pressure relief valve sticking open. |
| 11. Restriction in air cleaner or induction system. | 41. Pressure relief valve sticking closed. |
| 12. Air in fuel system. | 42. Broken relief valve spring. |
| 13. Faulty fuel injection pump. | 43. Faulty suction pipe. |
| 14. Faulty atomisers or incorrect type. | 44. Choked oil filter. |
| 15. Incorrect use of cold start equipment. | 45. Piston seizure/pick up. |
| 16. Faulty cold starting equipment. | 46. Incorrect piston height. |
| 17. Broken fuel injection pump drive. | 47. Damaged fan. |
| 18. Incorrect fuel pump timing. | 48. Faulty engine mounting (Housing). |
| 19. Incorrect valve timing. | 49. Incorrectly aligned flywheel housing, or flywheel. |
| 20. Poor compression. | 50. Faulty thermostat. |
| 21. Blocked fuel tank vent. | 51. Restriction in water jacket. |
| 22. Incorrect type or grade of fuel. | 52. Loose fan belt. |
| 23. Sticking throttle or restricted movement. | 53. Choked radiator. |
| 24. Exhaust pipe restriction. | 54. Faulty water pump. |
| 25. Cylinder head gasket leaking. | 55. Choked breather pipe. |
| 26. Overheating. | 56. Damaged valve stem oil seals (if fitted) |
| 27. Cold running. | 57. Coolant level too low. |
| 28. Incorrect tappet adjustment. | 58. Blocked sump strainer. |
| 29. Sticking valves. | 59. Broken valve spring. |
| 30. Incorrect high pressure pipes. | 60. Defective exhaust/leaking vacuum pipe. |

OPERATING AND MAINTENANCE—C.3

- † On stop start low mileage work, the hours run are more applicable than the mileage covered.

Daily or every 8 hours

Check coolant level.
Check sump oil level.
Check oil pressure (where gauge is fitted).
In extreme dust conditions, clean oil bath air cleaner and empty dust bowl on dry type air cleaner.

Every 4,000 miles (6,000 km), 150 hours or 3 months

- † Drain and renew lubricating oil (see list of approved lubricating oils Appendix).
- † Renew lubricating oil filter element or canister.
Clean oil bath air cleaner.
Empty dust bowl on dry type air cleaner.
*Check drive belt tension.
Clean water trap.
Lubricate dynamo rear bush (where applicable).

Every 12,000 miles (18,000 km) 450 hours or 12 months

- † Renew final fuel filter element — agricultural and industrial applications.
Clean element of dry type air cleaner or renew (if not indicated earlier).

Every 24,000 miles (36,000 km) or 900 hours

Renew final fuel filter element — vehicle applications.

Every 72,000 miles (108,000 km) or 2,700 hours

Arrange for examination and service of proprietary equipment, i.e., compressor, exhauster, starter, dynamo etc.
Service atomisers.
Check and adjust valve clearance.

- † Refrigeration unit engines have a larger capacity sump and larger lubricating oil filter canister, therefore the lubricating oil and filter change can be extended to 1000 hours. Also with a primary fuel oil filter fitted, the main fuel filter element change period can be extended to 1000 hours.

*The drive belt tension should be checked monthly on engines rated above 3,000 rev/min.

POST DELIVERY CHECKOVER

After a customer has taken delivery of his Perkins Diesel engine, it is advisable, in his own interest, that a general checkover of the engine be carried out after

the first 500/1000 miles (800/1600 km) or 25/50 hours in service.

It is also recommended that the following procedure be adopted where an engine has been laid up for a considerable period before it is again put into service. With the engine thoroughly warmed through, this checkover should comprise the following points.

1. Drain lubricating oil sump. Renew lubricating oil filter element or canister. (Refer to Page L.5 or L.6).
2. Remove the rocker assembly, check that the cylinder head nuts are to the correct torque. (Refer to Page B.2).
3. Refit rocker assembly and set valve clearances. (Refer to Page B.8).
4. Refill lubricating oil sump with clean new oil to the correct level. (Do not overfill).
5. Check fan belt tension. (Refer to Page M.1).
6. Check coolant level in radiator, inspect for any coolant leaks.
7. Check security of all external nuts, setscrews, hose clips, mountings, etc.
8. Start engine and check for any fuel or lubricating oil leaks.
9. Carry out test to check general performance of engine.

Thereafter routine maintenance should be in accordance with Periodical Attentions which are given on previous Page.

NOTE: If the cylinder head is removed for any reason e.g. top overhaul, then it is recommended that the cylinder head nuts are retorqued as shown in Fig. E.23 after 500/1000 miles (800/1600 km) or 25/50 hours with the engine hot, to the setting given on Page B.2. It is assumed that electrical equipment will have already been checked for such points as dynamo rate of charge, effectiveness of connections and circuits, etc.

Protection of an engine not in service

The recommendations given below are to ensure that damage is prevented when an engine is removed from service for an extended period. Use these procedures immediately the engine is removed from service. The instructions for the use of POWERPART products are given on the outside of each container.

1. Thoroughly clean the outside of the engine.
2. Where a preservative fuel is to be used, drain the fuel system and fill with the preservative fuel. POWERPART Lay-Up 1 can be added to the normal fuel to change it to a preservative fuel. If preservative fuel is not used, the system can be kept charged with normal fuel but this will have to be drained and discharged at the end of the period together with the fuel filter.
3. Run the engine until it is warm. Correct any fuel, lubricating oil or air leakage. Stop the engine and drain the lubricating oil sump.
4. Renew the lubricating oil filter canister.
5. Fill the sump to the full mark on the dipstick with clean new lubricating oil or with a correct preservative fluid. POWERPART Lay-Up 2 can be added to the lubricating oil to give protection against corrosion during the period in storage. If a preservative fluid is used, this must be drained and normal lubricating oil used when the engine is returned to service.

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SAFETY PRECAUTIONS



THESE SAFETY PRECAUTIONS ARE IMPORTANT. You must refer also to the local regulations in the country of use. Some items only apply to specific applications.

- Only use these engines in the type of application for which they have been designed.
- Do not change the specification of the engine.
- Do not smoke when you put fuel in the tank.
- Clean away fuel which has been spilt. Material which has been contaminated by fuel must be moved to a safe place.
- Do not put fuel in the tank while the engine runs (unless it is absolutely necessary).
- Do not clean, add lubricating oil, or adjust the engine while it runs (unless you have had the correct training; even then extreme caution must be used to prevent injury).
- Do not make adjustments that you do not understand.
- Ensure that the engine does not run in a location where it can cause a concentration of toxic emissions.
- Other persons must be kept at a safe distance while the engine, or equipment, is in operation.
- Do not permit loose clothing or long hair near moving parts.
- Keep away from moving parts during engine operation. Attention: Some moving parts cannot be seen clearly while the engine runs.
- Do not operate the engine if a safety guard has been removed.
- Do not remove the filler cap of the cooling system while the engine is hot and while the coolant is under pressure, because dangerous hot coolant can be discharged.
- Do not use salt water or any other coolant which can cause corrosion in the closed coolant circuit.

- Do not allow sparks or fire near the batteries (especially when the batteries are on charge) because the gases from the electrolyte are highly flammable. The battery fluid is dangerous to the skin and especially to the eyes.
- Disconnect the battery terminals before a repair is made to the electrical system.
- Only one person must control the engine.
- Ensure that the engine is operation only from the control panel or from the operator's position.
- If your skin comes into contact with high-pressure fuel, obtain medical assistance immediately.
- Diesel fuel and lubricating oil (especially used lubricating oil) can damage the skin of certain persons. Protect your hands with gloves or a special solution to protect the skin.
- Do not wear clothing which is contaminated by lubricating oil. Do not put material which is contaminated with oil into the pockets.
- Discard used lubricating oil in a safe place to prevent contamination.
- Do not move mobile equipment if the brakes are not in good condition.
- Ensure that the control level of the transmission drive is in the "out-of-drive" position before the engine is started.
- Use extreme care if emergency repairs must be made at sea or in adverse conditions.
- The combustible material of some components of the engine (for example certain seals) can become extremely dangerous if it is burned. Never allow this burnt material to come into contact with the skin or with the eyes.
- Fit only genuine Perkins parts.

ASBESTOS JOINTS



Some joints and gaskets contain compressed asbestos fibres in a rubber compound or in a metal outer cover. The "white" asbestos (Chrysotile) which is used is a safer type of asbestos and the risk of damage to health is extremely small.

The risk of asbestos from joints occurs at their edges or if a joint is damaged when a component is removed or if a joint is removed by abrasion.

To ensure that the risk is kept to a minimum, the procedures given below must be applied when an engine which has asbestos joints is dismantled or assembled.

- Work in an area with good ventilation.
- Do not smoke.
- Use a hand scraper to remove the joints — do not use a rotary wire brush.
- Ensure that the joint to be removed is wet with oil or water to contain loose particles.
- Spray all loose asbestos debris with water and put it in a closed container which can be sealed for safe disposal.

Connecting Rod Bearings 4.108, 4.107, 4.99

Type ...	Pre-finished. Steel Backed, Aluminium Tin Lined
Shell Width ...	0.870/0.880 in (22,098/22,325 mm)
Outside Dia. of Con. Rod Bearing ...	2.1465 in (54,521 mm)
Inside Dia. of Con. Rod Bearing ...	2.0015/2.0025 in (50,838/50,863 mm)
Running Clearance ...	0.0014/0.0032 in (0,036/0,081 mm)
Steel Thickness ...	0.060 in (1,524 mm) Max.
Aluminium Thickness ...	0.012/0.01225 in (0,305/0,311 mm)

Camshaft 4.108, 4.107, 4.99

No. 1 Journal Length ...	1.347/1.351 in (34,214/34,315 mm)
No. 1 Journal Dia. ...	1.791/1.792 in (45,491/45,517 mm)
No. 1 Cylinder Block Camshaft Bore Dia. ...	1.794/1.7955 in (45,568/45,606 mm)
No. 1 Journal Running Clearance ...	0.002/0.0045 in (0,051/0,114 mm)
No. 2 Journal Length ...	1,250 in (31,750 mm)
No. 2 Journal Dia. ...	1.781/1.782 in (45,237/45,263 mm)
No. 2 Cylinder Block Camshaft Bore Dia. ...	1,784/1,787 in (45,314/45,390 mm)
No. 2 Journal Running Clearance ...	0.002/0.006 in (0,051/0,152 mm)
No. 3 Journal Length ...	1.000 in (25,400 mm)
No. 3 Journal Dia. ...	1.773/1.774 in (45,034/45,060 mm)
No. 3 Cylinder Block Camshaft Bore Dia. ...	1.776/1.778 in (45,110/45,161 mm)
No. 3 Journal Running Clearance ...	0.002/0.005 in (0,051/0,127 mm)
Cam Lift ...	0.2592/0.2622 in (6,58/6,66 mm)
Oilways for Rocker Shaft Lubrication ...	No. 2 Journal

Camshaft Thrust Plates 4.108, 4.107, 4.99

Type ...	180° Oil Impregnated Sintered Iron
Thrust Plate Outside Dia. ...	2.555/2.557 in (64,897/64,948 mm)
Cylinder Block Recess Dia. for Thrust Plate ...	2.5585/2.5685 in (64,986/65,240 mm)
Clearance Fit of Thrust Plate in Recess ...	0.0015/0.013 in (0,038/0,330 mm)
Thrust Plate Inside Dia. ...	1.500 in (38,100 mm)
Thrust Plate Thickness ...	0.158/0.162 in (4,013/4,115 mm)
Cylinder Block Recess Depth for Thrust Plate ...	0.158/0.164 in (4,009/4,166 mm)
Thrust Plate Height in relation to Cylinder Block Face ...	-0.006/+0.004 in (-0,152/+0,102 mm)
Camshaft End Float ...	0.003/0.009 in (0,076/0,228 mm)

Valve and Fuel Pump Timing

Refer to later section on timing (page K.1).

CYLINDER HEAD 4.108, 4.107, 4.99

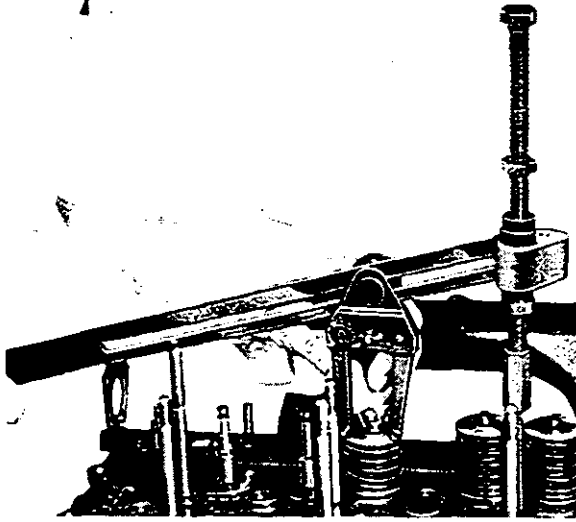
Overall Length of Cylinder Head ...	20.000 in (508,000 mm)
Overall Depth of Cylinder Head ...	2.617/2.633 in (66,472/66,878 mm)
Skimming Allowance on Cylinder Head Face ...	NIL—On no account can the cylinder head face be skimmed
Pressure for Water Leakage Test ...	20 lbf/in ² (1,4 kgf/cm ²) — 138 kN/m ²
Valve Seat Angle ...	45°
Bore in Cylinder Head for Guide ...	0.4995/0.5005 in (12,687/12,713 mm)
Bore in Cylinder Head for Combustion Chamber Inserts ...	1.250/1.252 in (31,750/31,801 mm)
Depth of Bore in Cylinder Head for Combustion Chamber Inserts ...	0.373/0.376 in (9,474/9,550 mm)

Combustion Chamber Inserts 4.108, 4.107, 4.99

Outside Dia. of Insert ...	1.248/1.249 in (31,699/31,724 mm)
Depth of Insert ...	0.374/0.375 in (9,499/9,525 mm)
Height of Insert in relation to Cylinder Head Face ...	0.002 in (0,051 mm) above or below
Clearance Fit of Insert in Cylinder Head Bore ...	0.001/0.004 in (0,025/0,102 mm)
Method of Location in Cylinder Head ...	By Cylinder Block Face and Expansion Washer

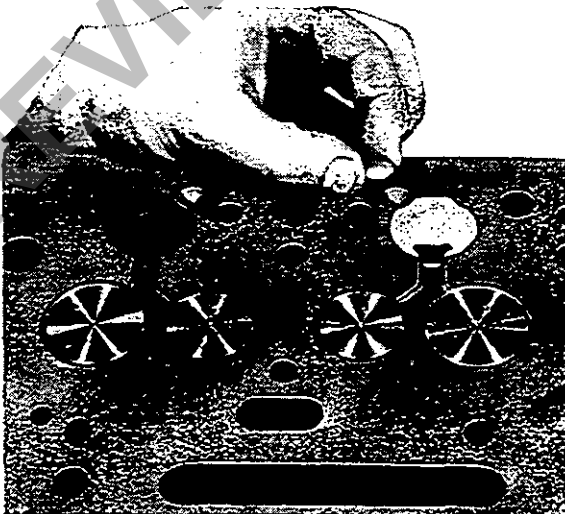
Valve Guides (Inlet) 4.108, 4.107, 4.99

Inside Dia. ...	0.3141/0.3155 in (7,978/8,014 mm)
Outside Dia. ...	0.5013/0.5018 in (12,733/12,746 mm)
Interference fit of Guide in Cylinder Head Bore ...	0.0008/0.0023 in (0,020/0,058 mm)
Overall length of Guide ...	2.130 in (54,102 mm)
Guide Protrusion Above Top Face of Cylinder Head ...	0.800/0.815 in (20,320/20,701 mm)

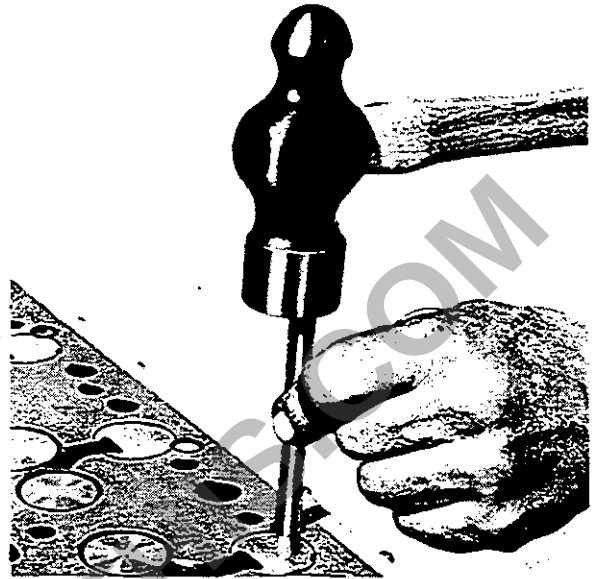


E7

10. Remove the eight push rods and place somewhere safe (possibly in the cylinder head cover) to avoid the possibility of any being accidentally bent.
11. Unscrew the small banjo bolts on the tops of the atomisers and remove the leak-off pipe by unscrewing the union on top of the fuel filter.
12. Remove the low pressure fuel pipes between the fuel filter and the fuel pump, remove the fuel filter after disconnecting the feed pipe from the lift pump, blank off all pipes and ports to prevent ingress of foreign particles.
13. Remove the four high pressure fuel pipes from the fuel pump to the atomisers. Blank off fuel pump outlet ports.
14. Remove the atomiser securing nuts and carefully remove the atomisers. (Refer to Fig. E.4). Blank off the exposed ports on the atomisers.
15. Uncouple the dynamo or alternator adjusting link.



E8



E9

16. Remove the cylinder head securing nuts and lift off the cylinder head complete with the inlet and exhaust manifolds. (Refer to Fig. E.5).

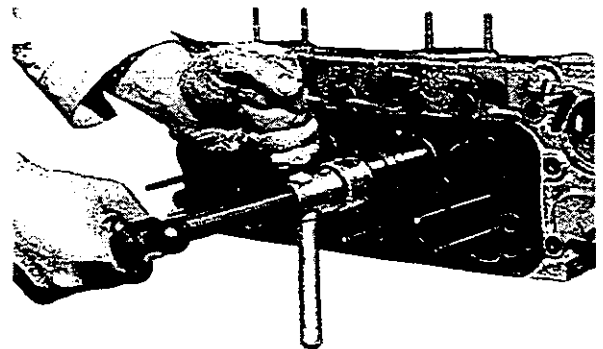
NOTE: On 4.99 and 4.107 engines, to prevent liner movement should the engine be turned with the cylinder head removed, it is suggested that the liners are held in position by suitable tubing placed over two of the cylinder head studs and locked with nuts and washers.

To Remove the Valves

With earlier engines, the valves were numbered and the cylinder head was marked with corresponding numbers (see fig. E.6).

With current engines, the valves and seats are not numbered and where a valve is to be used again, it should be suitably identified to ensure it is replaced in its original position.

1. Remove collets by compressing the valve springs as shown in Fig. E.7.
2. Remove the spring caps, springs, seals (where fitted) and spring seats. Remove valves.



E10

CYLINDER BLOCK AND LINERS—G.2



G3

suitably marked so that they may be refitted to their original parent bore and in the same position in that bore, that is, thrust side of the liner to the thrust side of the cylinder block.

To Renew Cylinder Liners (wet)

Remove all components from cylinder block.
Remove liners using a suitable liner removing tool (see Fig. G.4).

Once the liner has cleared the rubber sealing rings in the cylinder block, the liner can be removed by hand. Remove any corrosion and burrs which may be present at the inner ends of the landings.

Renew the rubber sealing rings in the grooves at the bottom lands.

To ease fitting of the liners when the rings have been placed in position, smear the liners with soft soap or soapy water.

Place liner in position and press home by hand, ensuring that the rubber sealing rings remain in their grooves (see Fig. G.5).

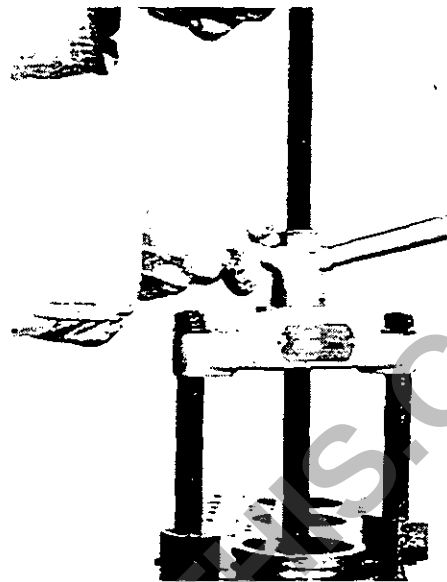
The liners are a push fit and no force is required.

After fitting the liners, the cylinder block should be water tested at a pressure of 20 lbf/in² (1.4 kgf/cm²). Re-assemble engine as required and to instructions given for the various components.

Note: If engine is overheated, it could have an adverse affect on the liner sealing rings.

All 4.107 and later 4.99 engines have four small holes drilled along the fuel pump side of the cylinder block, each one breaking through into the area between the two sealing rings at the bottom of each cylinder liner. These holes permit any coolant which may have leaked past the upper sealing ring to escape thus relieving the bottom sealing ring of any pressure above it and preventing coolant from entering the engine sump.

In the case of a new engine, or where cylinder liners and/or sealing rings have been fitted, it is possible that a slight leakage of coolant could occur from these holes. This should ease as the liners and sealing rings settle down after the initial period of running, but



G4

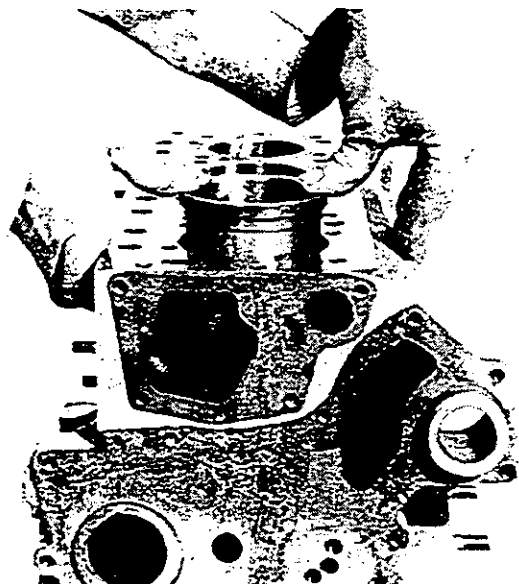
where difficulty is experienced, then the use of BARSEAL in the cooling system (in accordance with the manufacturers instructions) is approved.

Oversize Cylinder Liners

Oversize outside diameter cylinder liners are available for service use on 4.108 engines, if the standard parent bore has been made larger to remove damage.

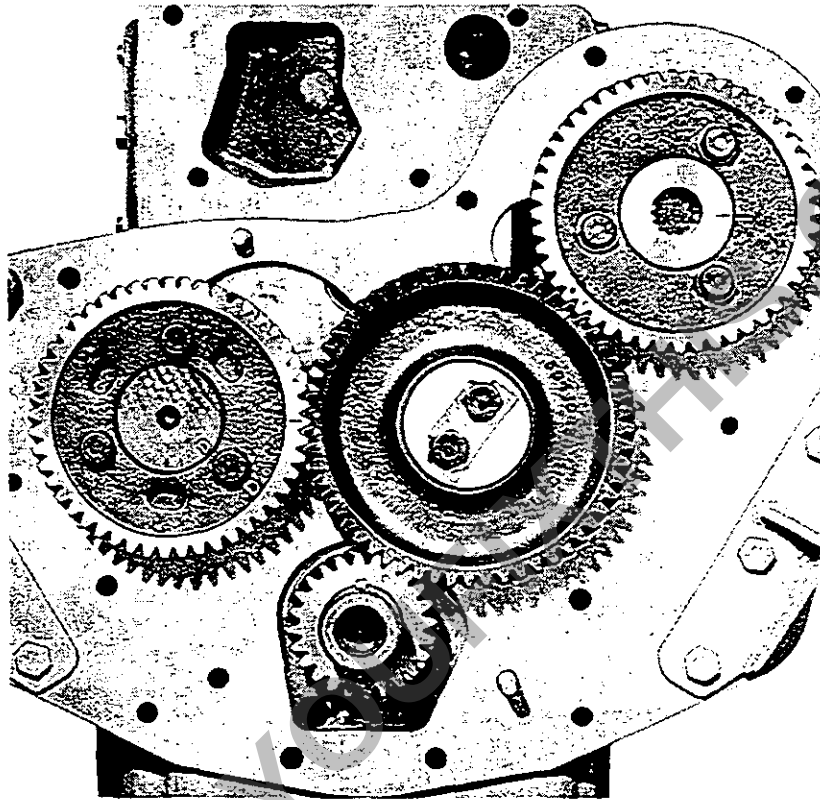
Oversize	Description
0.010 in (0,25 mm)	Cast Iron Flangeless—Bore & hone
Where a parent bore is made larger in service, it should be machined to the dimension by adding 0.010 in (0,25 mm) to the standard parent bore diameter given on Page B.3. A chamfer must be machined at the top of the new parent bore.	

When oversize liners are fitted at the factory, the liner oversize is stamped on the top face of the cylinder block between the liner and the edge of the cylinder block.



SECTION K

Timing



K1

General

As timing gears are employed, the factory setting remains constant. It is also worth remembering that the removal of the cylinder head in no way effects either the fuel pump or the valve timing.

TIMING MARKS

When the engine is originally timed at the factory, certain marks are stamped on the gears, so that if for any reason the engine timing has to be disturbed, then to reset to the original timing is quite straight forward.

To Reset the Engine to the Original Timing

Before commencing the retiming procedure it is assumed that (a) the camshaft, fuel pump and idler gears have all been removed, and (b) the camshaft is free to turn by hand. (If the cylinder head assembly is still in position, it is advisable to remove the atomisers and rocker shaft to facilitate the retiming operations).

1. Turn the engine until the keyway in the front of the

crankshaft is uppermost as shown in Fig. K.1. (This will bring Nos. 1 and 4 pistons to T.D.C.)

2. Fit the camshaft gear to its hub ensuring that the 'D' marks are correctly aligned. (Refer to Fig. J.5). Secure with the three setscrews.
3. Similarly, fit the fuel pump gear to the fuel pump drive hub ensuring that the stamped timing marks align as shown in Fig. J.6. Secure with the three setscrews.
4. Replace the idler gear so that the double dots on the idler gear are matched to the single dot on the crankshaft gear and single line (or dot) on the camshaft gear, whilst the single dot on the idler gear matches with the double dots on the fuel pump gear. These timing marks when correctly positioned will appear as shown in Fig. K.1.
5. Locate the idler gear with the hub and the two securing setscrews using a new tabwasher.
6. Backlash adjustment should be carried out as described under the heading 'To Refit the Idler Gear and Hub. (See Page J.1).

FUEL OIL FILTERS

The element in this filter is of the paper type and therefore no attempt should be made to clean it. Its life will be governed by the quality and condition of the fuel passing through it, but under average conditions the element should be renewed in accordance with the recommended Periodical Attentions given on Page C.2. This period would naturally be reduced if it was apparent from the condition of the element if removed and inspected, that conditions warranted it.

On early engines the filter element is contained inside a filter bowl, (Fig. N5). On later engines the filter element is situated between the filter head and the bottom cover, (Fig. N6).

To Renew the Filter Element

1. Clean the outside of the filter.
2. Release the setscrew in the centre of the filter head.
3. Lower the filter bowl, (Fig. N5) or the bottom cover, (Fig. N6) depending on which type of filter is used and discard any fuel together with the used filter element.
4. Clean the inside of the filter head and the inside of the filter bowl or bottom cover.
5. Inspect the seals and renew them if they are damaged.
6. Place the new filter element inside the bowl or put the bottom cover on the bottom of the new filter element. Offer up the filter bowl or element assembly to fit centrally on the seal in the filter head.
7. Hold in this position whilst the securing setscrew is located and tightened. Do not overtighten.
8. Prime the fuel system as detailed in page N.11.



N6

2. Rotate the engine and note if there is a well defined spurt of fuel from the outlet port once every two engine revolutions.

NOTE: As an alternative the pump may be operated by means of the hand primer as shown in Fig. N.7, which should give the same result every time the priming lever is operated. However should the engine happen to have stopped in such a position that the eccentric operating the lift pump is in the maximum lift position, then it will not be possible to operate the hand primer properly. If such a condition arises the remedy is to rotate the engine one complete revolution.

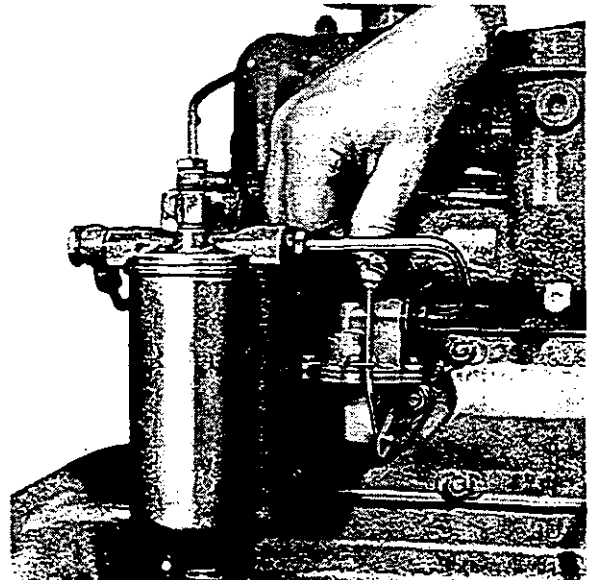
FUEL LIFT PUMP

Testing the Pump in Position

1. Disconnect the outlet pipe (lift pump to filter) leaving a free outlet from the pump.



N5



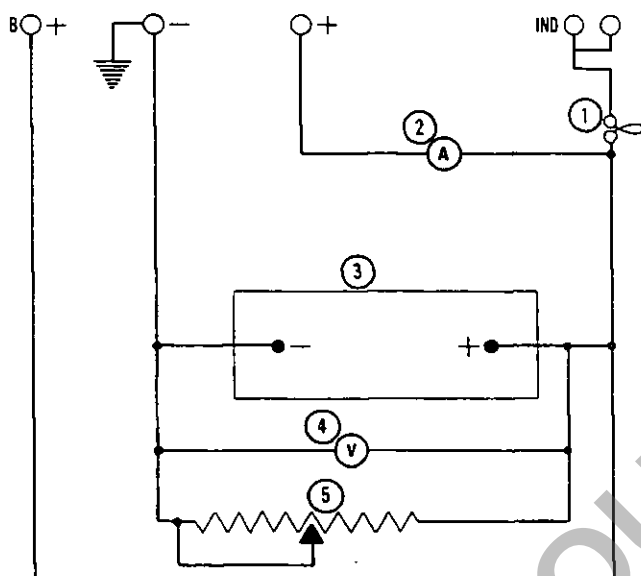
N7

ELECTRICAL EQUIPMENT—Q.4

Alternator Output Test with Regulator Inoperative

Withdraw the two-part connector from the alternator, remove the moulded cover (secured by two screws) and link together regulator terminals 'F' and '—'.

Connect an external test circuit to the alternator output terminals as shown in Fig. Q.1.



Q1

1. 12 volt 2.2 watt Bulb
2. 0-40 or 0-60 Ammeter
3. 12 volt Battery
4. 0-20 Voltmeter
5. 0-15 ohm 35 amp Variable Resistor

Observe carefully the polarity of battery and alternator terminals — reversed connections will damage the alternator diodes.

The variable resistor across the battery terminals must not be left connected for longer than is necessary to carry out the following test.

Start the engine. At 1,500 rev/min (alternator speed), the test circuit bulb should be extinguished. Increase engine speed until the alternator is running at 6,000 rev/min approximately, and adjust the variable resistance until the voltmeter reads 14.0 volts. The ammeter reading should then be approximately equal to the rated output (See previous paragraph). Any appreciable deviation from this figure will necessitate the alternator being removed from the engine for further examination.

Failure of one or more of the diodes will be indicated in the above test by effect on alternator output, and also in some instances by abnormally high alternator temperature and noise level.

Regulator Test

The following test assumes the alternator to have been tested and found satisfactory.

Disconnect the variable resistor and remove the link bridging regulator terminals 'F' and '—'.

With the remainder of the test circuit connected as for the alternator output test, start the engine and again run the alternator up to 6,000 rev/min until the ammeter shows an output current of less than 10 amperes. The voltmeter should then give a reading of 14.0 — 14.4 volts. Any appreciable deviation from this (regulating) voltage means that the regulator is not functioning properly and must be replaced.

If the foregoing tests show the alternator and regulator to be satisfactorily performing, disconnect the test circuit and reconnect the alternator terminal connector. Now connect a low-range voltmeter between the positive terminal of the alternator (the moulded terminal connector is open-ended to facilitate this) and the positive terminal of the battery. Switch on battery load (headlights etc.), start the engine and increase speed until the alternator runs at approximately 6,000 rev/min. Note the voltmeter reading.

Transfer the voltmeter connections to the negative terminals of alternator and battery and again note the meter reading.

If the reading exceeds 0.5 volt on the positive side or 0.25 volt on the negative side, there is a high resistance in the charging circuit which must be traced and remedied.

DYNAMO

The following information is concerned with the Lucas C40-1 model. Should information be required in connection with any other type of dynamo then the relevant manufacturer should be contacted.

The C40-1 is of extruded yoke construction and is a ventilated type. Holes in each end bracket allow a pulley mounted fan to draw cooling air through the dynamo.

Description

It is a shunt wound, two pole, two brush machine designed to work in conjunction with a compensated voltage control regulator unit. A ball bearing supports the armature at the driving end and a porous bronze bush at the rear supports the commutator end.

The output of the dynamo is controlled by the regulator unit and is dependent on the state of charge of the battery and the loading of the electrical equipment in use. When the battery is in a low state of charge, the dynamo gives a high output, whereas if the battery is fully charged, the dynamo gives only sufficient output to keep the battery in good condition without any possibility of overcharging. An increase in output is given to balance the current taken by lamps and other accessories when in use.

When fitting a new control box, it is important to use only an authorised replacement. An incorrect replacement can result in damage to the dynamo.

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