# workshop manual for 4.108 4.107 and 4.99 diesel engines



**Perkins Group Limited**

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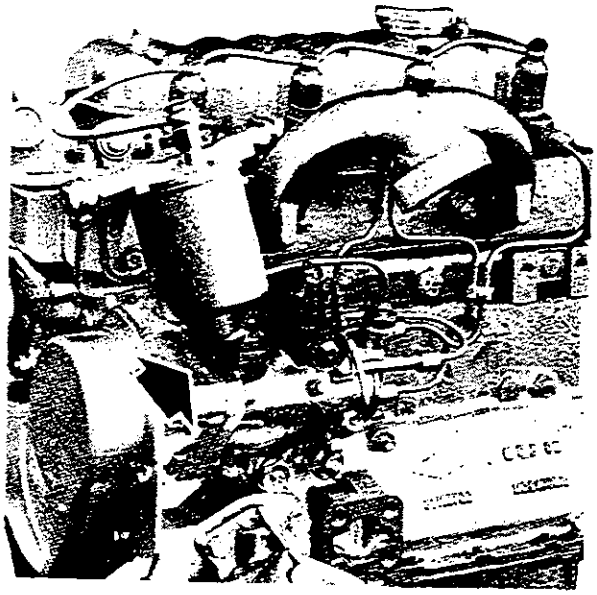
# FOREWORD

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

Reference to renewing joints and cleaning off joint faces has to a great extent been omitted from the text, it being understood that this will be carried out where applicable.
Similarly, it is understood that in reassembly and inspection, all parts are to be thoroughly cleaned and where present, burrs and scale are to be removed.
It follows that any open ports of high precision components, e.g., fuel injection equipment, exposed by dismantling, will be blanked off until reassembled, to prevent the ingress of foreign matter.

**When setscrews or studs are fitted into holes which are tapped through into the inside of the engine, a suitable sealant must be used on the threads.**

Throughout this manual, whenever the "left" or "right" hand side of the engine is referred to, it is that side of the engine as viewed from the flywheel end.



The engine number is stamped on the fuel pump mounting flange as shown in the above illustration.

Three systems of engine numbering have been used.
On very early engines the serial number consisted of seven digits as follows :—

| Engine Type | Typical Engine Number |
|---|---|
| 4.108 | 7300269 |
| 4.107 | 7100399 |
| 4.99 | 7000251 |

Identification on these engines can be identified by cbserving the first two figures of the engine number which remain constant depending on engine type.
With later engines, the number consisted of figures and letters :—

| Engine Type | Typical Engine Number |
|---|---|
| 4.108 | 108U251 |
| 4.107 | 107U251 |
| 4.99 | 99U251 |

The first figures represent the capacity of the engine in cubic inches, the letter "U" signifies that the engine was built in the United Kingdom and the last group of figures comprises the engine serial number.

On current engines, the number can consist of up to fifteen letters and figures, a typical number being ED21512U510256D

# 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.

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# EXAMPLES OF SERVICE FACILITIES

**Service**
If any problems occur with your engine or the components fitted to it, your Perkins distributor can make the necessary repairs and will ensure that only the correct parts are fitted and that the work is done correctly.
Certain components can be supplied by your Perkins distributor through the Perkins Power exchange system. These will enable you to reduce the cost of some repairs.

**Extended Warranty**
The engine warranty period can be extended to two years. For details, get in contact with your nearest Perkins distributor.

**Service Literature**
Users handbooks and other service publications are available from your Perkins distributor at a nominal cost.

**Training**
Local training on correct engine operation, overhaul and service is available at some Perkins distributors. If special training is needed, your Perkins distributor can give details on how to get this at the Product Education Department, Peterborough, or other main centres.

# SECTION A
# Engine Views

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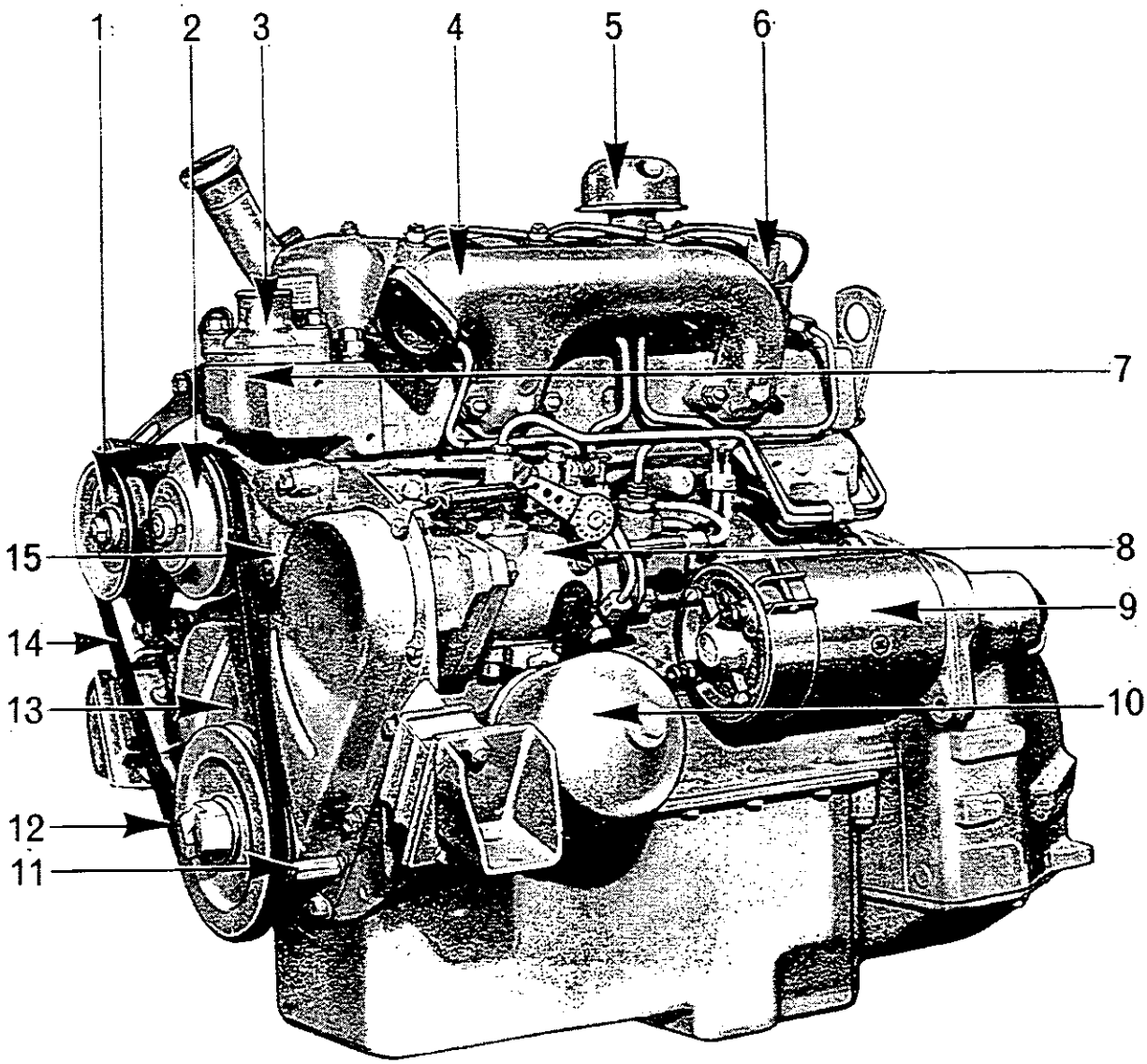
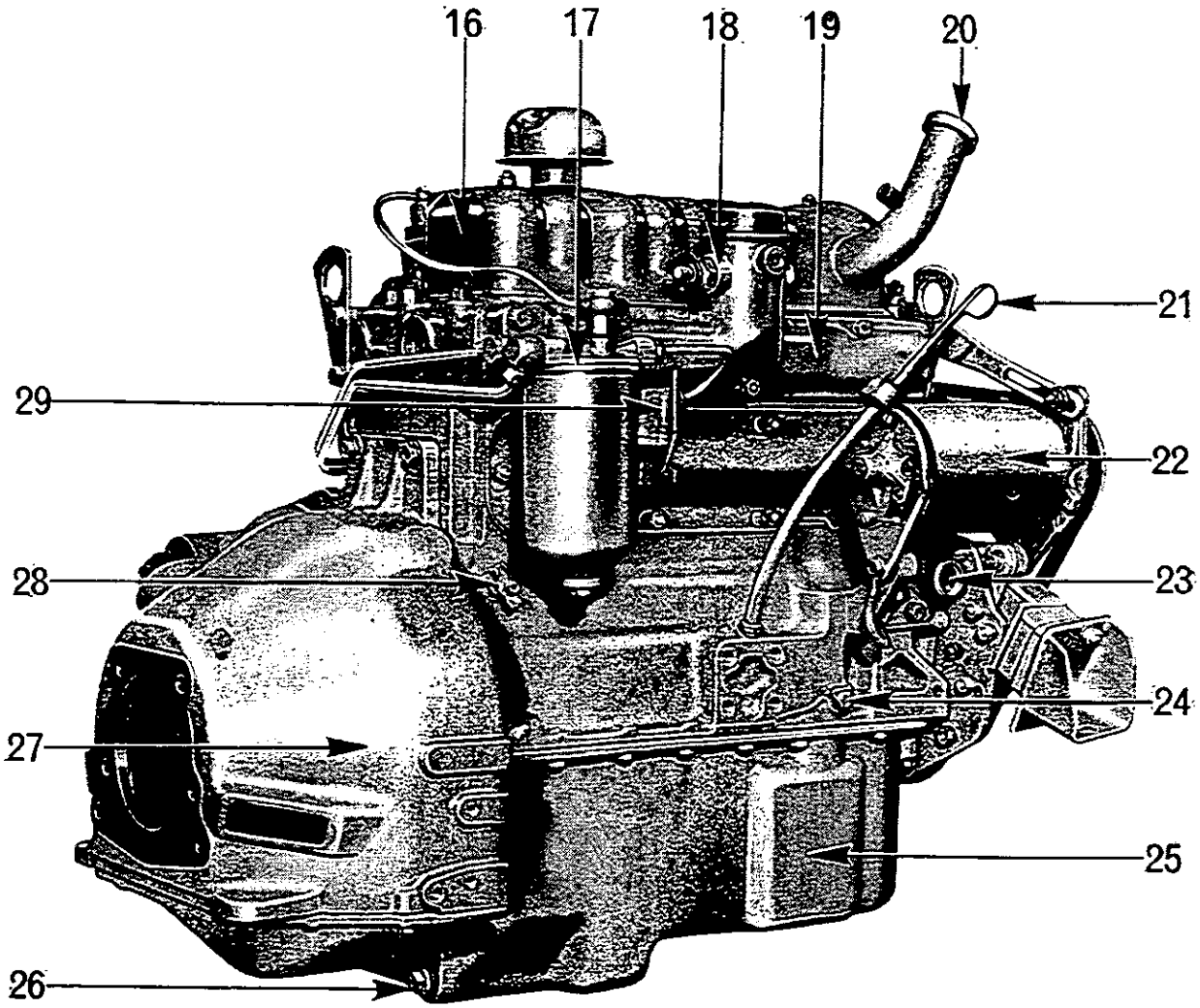



VIEW OF FUEL PUMP SIDE OF ENGINE




VIEW OF CAMSHAFT SIDE OF ENGINE

# 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.

## TECHNICAL DATA—B.2

### Recommended Torque Tensions

The following torque figures will apply with the components lightly oiled before assembly:—

| | 4.107 and 4.99 | | | 4.108 | | |
|---|---|---|---|---|---|---|
| | lbf ft | kgf m | Nm | lbf ft | kgf m | Nm |
| Cylinder Head Nuts ... ... ... ... | 42 | 5,81 | 57 | 60 | 8,3 | 81 |
| Connecting Rod Setscrews ... ... ... | 42 | 5,81 | 57 | 42 | 5,81 | 57 |
| *Main Bearing Setscrews ... ... ... | 85 | 11,5 | 115 | 85 | 11,5 | 115 |
| Flywheel Setscrews ... ... ... ... | 60 | 8.3 | 81 | 60 | 8,3 | 81 |
| Idler Gear Hub Setscrews ... ... ... | 36 | 4,98 | 49 | 36 | 4,98 | 49 |
| Crankshaft Pulley Setscrew — 1.56 in (39,6 mm) long with 1.875 in (47,6 mm) dia. washer ... ... | 150 | 20,7 | 203 | 150 | 20,7 | 203 |
| Crankshaft Pulley Setscrew — 1.68 in (42,7 mm) long with 1.75 in (44,6 mm) dia. washer (Cadmium Plated) | | | | 190 | 26,3 | 250 |
| Crankshaft Pulley Setscrew (Phosphated) ... ... | | | | 230 | 31,5 | 310 |
| Atomiser Securing Nuts or Setscrew ... ... ... | 12 | 1,7 | 16 | 12 | 1,7 | 16 |
| High Pressure Fuel Pipe Nuts ... ... ... | 15 | 2,1 | 20 | 15 | 2,1 | 20 |
| Dynamo Pulley Retaining Nut ... ... ... | 20 | 2,8 | 27 | 20 | 2,8 | 27 |
| Alternator Pulley Retaining Nut ... ... ... | 30 | 4,1 | 41 | 30 | 4,1 | 41 |
| Thermostart Unit ... ... ... ... | 10 | 1,38 | 13 | 10 | 1,38 | 13 |
| Thermostart Insulating Adaptor ... ... ... | 10 | 1,38 | 13 | 10 | 1,38 | 13 |

*The tab and shim washers may be discarded where used on earlier engines, but the setscrews must be tightened to the torque loading indicated.

### Service Wear Limits

The following "wear limits" indicate the condition when it is recommended that the respective items should be servicec or replaced.

| | | |
|---|---|---|
| Cylinder Head Bow ... ... | Longitudinal | 0.006 in (0,15 mm) |
| Cylinder Head Bow ... ... | Transverse | 0.003 in (0,08 mm) concave<br>0.005 in (0,13 mm) convex |
| Maximum Bore Wear (when new liners are necessary) | | 0.006 in (0,15 mm) |
| Crankshaft Main and Big End Journal | Wear | 0.001 in (0,03 mm) |
| Crankshaft Main and Big End Journal | Ovality | 0.0005 in (0,01 mm) |
| Maximum Crankshaft End Float ... ... | ... | 0.020 in (0,51 mm) |
| Valve Stem to Guide Clearance ... ... | inlet | 0.005 in (0,13 mm) |
| Valve Stem to Guide Clearance ... ... | exhaust | 0.006 in (0,15 mm) |
| Valve Head Thickness at outer edge ... | ... | 0.025 in (0,64 mm) |
| Rocker Clearance on Shaft ... ... | ... | 0.005 in (0,13 mm) |
| Camshaft Journals — Ovality and Wear ... | ... | 0.002 in (0,05 mm) |
| Camshaft End Float ... ... ... | ... | 0.020 in (0,51 mm) |
| Idler Gear End Float ... ... ... | ... | 0.010 in (0,25 mm) |
| *Valve Head Depth below Head Face—inlet and exhaust | | 0.048 in (1,22 mm) |

*Where vehicle engines have to conform with the smoke density regulation B.S.AU 141a: 1971, then the valve depths must not exceed production limits as given on page B.8.

### Manufacturing Data and Dimensions

The data regarding clearances and tolerances are given for personnel engaged upon major overhauls.
**Further information can be obtained on request from the Technical Services Department, Perkins Engines Ltd., Peterborough.**

### CYLINDER BLOCK

| | | |
|---|---|---|
| Total Height of Cylinder Block between Top & Bottom Faces | 4.108, 4.107, 4.99 | 9.936/9.939 in (252,374/252,451 mm) |
| Parent Bore Dia. for Cylinder Liner | 4.108 | 3.249/3.250 in (82.525/82,550 mm) |
| Parent Bore Dia. for Cylinder Liner | 4.107, 4.99 | Wet Liners |
| Main Bearing Parent Bore | 4.108, 4.107, 4.99 | 2.3950/2.3955 in (60.833/60.846 mm) |
| Camshaft Bore Dia. No. 1 | 4.108, 4.107, 4.99 | 1.794/1.7955 in (45.568/45.606 mm) |
| Camshaft Bore Dia. No. 2 | 4.108, 4.107, 4.99 | 1.784/1.787 in (45.314/45.390 mm) |
| Camshaft Bore Dia. No. 3 | 4.108, 4.107, 4.99 | 1.776/1.778 in (45,110/45,161 mm) |
| Tappet Bore Dia. | 4.108, 4.107, 4.99 | 0.562/0.56325 in (14.275/14,307 mm) |
| Fuel Pump Drive Hub Bearing Bore Dia. | 4.108, 4.107, 4.99 | 1.8125/1.8141 in (46,037/46,078 mm) |

## Cylinder Liner 4.108

| | |
|---|---|
| Type ... ... ... ... ... ... | Cast Iron — Dry — Interference Fit |
| Interference Fit of Liners ... ... ... | 0.003/0.005 in (0,076/0,127 mm) |
| Inside Dia. of Liner after Finish Boring and Honing ... | 3.125/3.126 in (79,375/79,40 mm) |
| Height of Liner in relation to Cylinder Block Top Face | 0.023/0.027 in (0,584/0,686 mm) above |
| Overall Length of Liner ... ... ... ... | 6.495/6.505 in (164,973/165,227 mm) |

## Cylinder Liner 4.107 and 4.99

| | | |
|---|---|---|
| Type ... ... ... ... ... ... | | Cast Iron — Wet — Push Fit |
| Inside Dia. of Liner Pre-Finished ... ... | 4.99 | 3.00/3.001 in (76,20/76,225 mm) |
| Inside Dia. of Liner Pre-Finished ... ... | 4.107 | 3.125/3.126 in (79,374/79,4 mm) |
| Thickness of Top Flange ... ... ... | 4.99 | 0.3125/0.3145 in (7,937/7,988 mm) |
| Depth of Recess in Block for Liner Flange ... | 4.99 | 0.3115/0.3135 in (7,912/7,963 mm) |
| Thickness of Top Flange ... ... ... | 4,107 | 0.250/0.252 in (6,35/6,4 mm) |
| Depth of Recess in Block for Liner Flange ... | 4.107 | 0.249/0.251 in (6,325/6,375 mm) |
| Height of Liner in relation to Cylinder Block Top Face ... | 4.107 and 4.99 | 0.003 in (0,076 mm) Above. 0.001 in (0,025 mm) Below |
| Liner Flange Outside Dia. ... ... | 4.99 | 3.618/3.621 in (91,898/91,973 mm) |
| Cylinder Block Top Bore for Liner Flange ... | 4.99 | 3.625/3.627 in (92,075/92,125 mm) |
| Clearance Fit of Liner Flange to Block Bore ... ... | 4.107 and 4.99 | 0.004/0.009 in (0,102/0,229 mm) |

## Pistons 4.108

| | |
|---|---|
| Type ... ... ... ... ... ... | Flat Topped |
| Piston Height in relation to Cylinder Block Top Face ... | 0.002/0.006 in (0,051/0,152 mm) Above |
| Bore Dia. for Gudgeon Pin ... ... ... | 1.0627/1.0629 in (26,993/26,998 mm) |
| Compression Ring Groove Width—Top ... ... | 0.0805/0.0815 in (2,045/2,070 mm) |
| Compression Ring Groove Width—2nd ... ... | 0.0645/0.0655 in (1,638/1,664 mm) |
| Compression Ring Groove Width—3rd ... ... | 0.0645/0.0655 in (1,638/1,664 mm) |
| Oil Control Ring Groove Width—4th ... ... | 0.126/0.127 in (3,200/3,225 mm) |
| Oil Control Ring Groove Width—5th ... ... | 0.190/0.191 in (4,826/4,851 mm) |

**With engines rated at 3.000 rev/min or below, the fourth ring groove is the same as the fifth ring groove.**

**Note:** There is a Steel Insert fitted above the Top Groove.

## Pistons 4.108 (Controlled Expansion)

| | |
|---|---|
| Type ... ... ... ... ... ... | Flat Topped — Four Ring |
| Piston Height above Top Face of Cylinder Block ... | 0.002/0.006 in (0,05/0,15 mm) |
| Bore Dia. for Gudgeon Pin ... ... ... | 1.0627/1.0629 in (26,992/26,999 mm) |
| Compression Ring Groove Width, Top ... ... | 0.0801/0.0821 in (2,035/2,086 mm) |
| Compression Ring Groove Width, Second and Third ... | 0.064/0.065 in (1,64/1,65 mm) |
| Oil Control Ring Groove Width ... ... ... | 0.1887/0.1895 in (4,79/4,81 mm) |

## Pistons 4.108 (Controlled Expansion)

| | |
|---|---|
| Type ... ... ... ... ... ... | Flat Topped — Three Ring |
| Piston Height above Top Face of Cylinder Block ... | 0.002/0.006 in (0,05/0,15 mm) |
| Bore Dia. for Gudgeon Pin ... ... ... | 1.0627/1.0629 in (26,992/26,999 mm) |
| Compression Ring Groove Width, Top ... ... | 0.080/0.082 in (2,035/2,086 mm) |
| Compression Ring Groove Width, Second ... ... | 0.099/0.1005 in (2,53/2,55 mm) |
| Oil Control Ring Groove Width ... ... ... | 0.1890/0.1900 in (4,80/4,826 mm) |

## Pistons 4.107 and 4.99

| | |
|---|---|
| Type ... ... ... ... ... ... | Flat Topped |
| Piston Height in relation to Cylinder Block Top Face ... | 0.0085/0.012 in (0,22/0,30 mm) Above |
| Bore Dia. for Gudgeon Pin later 4.99 and all 4.107 engines ... ... ... | 0.93755/0.93775 in (23,81/23,82 mm) |
| Early 4.99 engines ... ... ... ... | 0.87505/0.87525 in (22,22/22,23 mm) |
| Compression Ring Groove Width—Top ... ... | 0.0801/0.0811 in (2,034/2,06 mm) |
| Compression Ring Grooves Width 2nd and 3rd ... | 0.0645/0.0655 in (1,638/1,664 mm) |
| Oil Control Ring Grooves 4th and 5th ... ... | 0.190/0.191 in (4,826/4,851 mm) |

## Piston Rings 4.108

| | |
|---|---|
| Top—Compression | Parallel Faced |
| Second and Third Compression | Internally Stepped |
| Fourth—Oil Control | Laminated Segment * |
| Fifth—Oil Control | Slotted Scraper |
| Top Compression Ring Width | 0.0771/0.0781 in (1,958/1,984 mm) |
| Ring Clearance in Grove | 0.0024/0.0044 in (0,061/0,112 mm) |
| Second and Third Compression Ring Width | 0.0615/0.0625 in (1,562/1,587 mm) |
| Ring Clearance in Groove | 0.002/0.004 in (0,051/0,102 mm) |
| Fifth Scraper Ring Width | 0.1865/0.1875 in (4,737/4,762 mm) |
| Ring Clearance in Groove | 0.0025/0.0045 in (0,063/0,114 mm) |
| Ring Gap—Top Compression | 0.009/0.017 in (0,229/0,432 mm) |
| Ring Gap—Second and Third Compression | 0.009/0.017 in (0,229/0,432 mm) |
| Ring Gap—Fifth Scraper | 0.009/0.017 in (0,229/0,432 mm) |

* Engines rated at 3,000 rev/min and below have a slotted scraper fitted in the fourth groove which has the same width, clearance and gap as the fifth ring.

## Piston Rings 4.108(Controlled Expansion — Four Ring)

| | |
|---|---|
| Top Compression | Chrome Insert — Parallel Faced |
| Second and Third Compression | Internally Stepped |
| Fourth Oil Control | Spring Loaded Scraper |
| Top Compression Ring Width | 0.077/0.078 in (1,96/1,98 mm) |
| Ring Clearance in Groove | 0.002/0.005 in (0,05/0,13 mm) |
| Second and Third Compression Ring Width | 0.0615/0.0625 in (1,56/1,59 mm) |
| Ring Clearance in Groove | 0.0015/0.0035 in (0,04/0,09 mm) |
| Oil Control Ring Width | 0.186/0.1865 in (4,72/4,74 mm) |
| Ring Clearance in Groove | 0.0022/0.0035 in (0,05/0.09 mm) |
| Ring Gap, Top | 0.012/0.023 in (0,30/0,58 mm) |
| Ring Gap, Second and Third | 0.009/0.020 in (0,23/0,50 mm) |
| Ring Gap, Oil Control | 0.010/0.021 in (0,25/0,53 mm) |

## Piston Rings 4.108 (Controlled Expansion — Three Ring)

| | |
|---|---|
| Top Compression | Chrome, Taper Faced |
| Second Compression | Internally Stepped, Taper Faced |
| Third Oil Control | Spring Loaded Scraper |
| Top Compression Ring Width | 0.0765/0.0775 in (1,943/1,969 mm) |
| Clearance in Groove | 0.0025/0.0055 in (0,063/0,140 mm) |
| Second Compression Ring Width | 0.097/0.098 in (2,46/2,49 mm) |
| Clearance in Groove | 0.0015/0.0035 in (0,039/0,089 mm) |
| Oil Control Ring Width | 0.1865/0.1875 in (4,737/4,763 mm) |
| Clearance in Groove | 0.0015/0.0035 in (0,039/0,089 mm) |
| Ring Gap, Top | 0.012/0.023 in (0,31/0,59 mm) |
| Ring Gap, Second | 0.009/0.020 in (0,23/0,51 mm) |
| Ring Gap, Oil Control | 0.012/0.023 in (0,31/0,59 mm) |

## Piston Rings
## 4.99 Vehicle Engines

| | |
|---|---|
| Top Compression | Parallel Faced Chrome Plated |
| Second and Third Compression | Internally Stepped |
| Fourth and Fifth Oil Control | Slotted Scraper |

## Piston Rings 4.107 and 4.99
## Agricultural and Industrial Engines

| | |
|---|---|
| Top Compression | Parellel Cast Iron |
| *Second and Third Compression | Internally Stepped |
| Fourth—Oil Control | Chrome Plated Spring Loaded Scraper |
| Fifth—Oil Control | Slotted Scraper |

*4.99 Agricultural engines have taper faced cast iron compression rings fitted in the second and third ring grooves.

| | |
|---|---|
| Top Compression Ring Width | 0.0771/0.0781 in (1,96/1,984 mm) |
| Ring Clearance in Groove | 0.002/0.004 in (0,051/0,102 mm) |
| Second and Third Compression Ring Width | 0.0615/0.0625 in (1,562/1,587 mm) |
| Ring Clearance in Groove | 0.002/0.004 in (0,051/0,102 mm) |
| Fourth and Fifth Scraper Ring Width | 0.1865/0.1875 in (4,737/4,762 mm) |
| Ring Clearance in Groove | 0.0025/0.0045 in (0,064/0.114 mm) |
| Ring Gap—Compression Rings Chrome Vehicle | 0.012/0.020 in (0,30/0,50 mm) |
| Ring Gap—Oil Control Rings Cast Iron Vehicle | 0.009/0.017 in (0,30/0,432 mm) |
| Ring Gap—Compression Rings Cast Iron Agricultural and Industrial | 0.009/0.017 in (0,30/0,432 mm) |

## Gudgeon Pin 4.108

| | |
|---|---|
| Type | Fully Floating |
| Outside Dia. of Gudgeon Pin | 1.0624/1.0626 in (26,985/26,990 mm) |
| Length of Gudgeon Pin | 2,673/2,687 in (67,894/68,250 mm) |
| Fit in Piston Boss | Transition |

## Gudgeon Pin 4.107 and 4.99

| | |
|---|---|
| Type | Fully Floating |
| Outside Dia. of Gudgeon Pin (Later Engines) | 0.9375 in/0.9377 in (23,812/23,817 mm) |
| Outside Dia. of Gudgeon Pin (Earlier Engines) | 0.875/0.8752 in (22,225/22,23 mm) |
| Fit in Piston Boss | Transition |

## Small End Bush 4.108

| | |
|---|---|
| Type | Steel Backed, Lead Bronze Lined |
| Length of Small End Bush | 0.935/0.955 in (23,749/24,257 mm) |
| Outside Dia. of Small End Bush | 1.221/1.222 in (31,013/31,039 mm) |
| Inside Dia. before Reaming | 1.0495/1.0545 in (26,657/26,784 mm) |
| Inside Dia. after Reaming | 1.06315/1.0632 in (27,004/27,005 mm) |
| Clearance between Small End Bush and Gudgeon Pin | 0.0005/0.0008 in (0,0127/0,0203 mm) |

## Small End Bush 4.107 and 4.99

| | |
|---|---|
| Type | Steel Backed, Lead Bronze Lined |
| Length of Small End Bush | 0.865/0.885 in (22,00/22,48 mm) |
| Outside Dia. of Small End Bush on later 4.99 and all 4.107 engines | 1.065/1.066 in (27,05/27,08 mm) |
| Early 4.99 engines | 1.0025/1.0035 in (25,46/25,49 mm) |
| Inside Dia. after Reaming on later 4.99 and all 4.107 engines | 0.9382/0.93875 in (23,83/23,84 mm) |
| Early 4.99 engines | 0.8757/0.87625 in (22,24/22,26 mm) |
| Clearance between Small End Bush and Gudgeon Pin | 0.0005/0.00125 in (0,01/0,03 mm) |

**Note.** Bushes to be reamed to suit respective Gudgeon Pins, and are provided with a reaming allowance.

## Connecting Rod 4.108

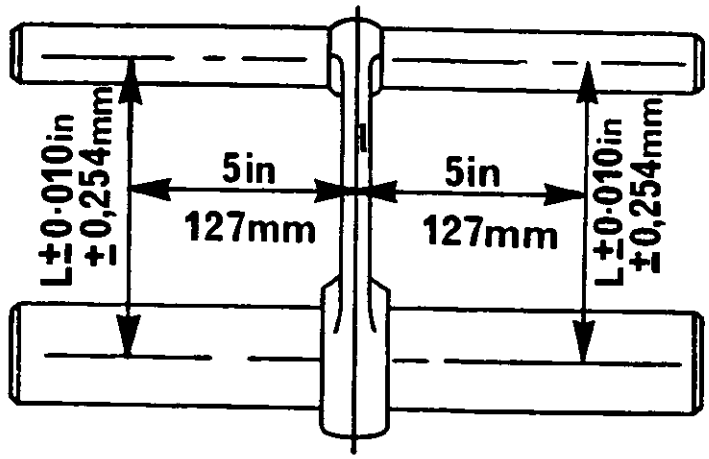
| | |
|---|---|
| Type | 'H' Section |
| Cap Location to Connecting Rod | Serrations, Offset 45° to the Horizontal |
| Big End Parent Bore Dia. | 2.146/2.1465 in (54,508/54,521 mm) |
| Small End Parent Bore Dia. | 1.21875/1.21975 in (30,956/30,981 mm) |
| Length from Centre Line of Big End to Centre Line of Small End | 6.217/6.219 in (157,912/157,963 mm) |
| Big End Setscrew | 0.375 in ($\frac{3}{8}$ in) U.N.F. |
| Connecting Rod End Float | 0.0065/0.0105 in (0,165/0,267 mm) |

## Connecting Rod 4.107 and 4.99

| | |
|---|---|
| Type | 'H' Section |
| Cap Location to Connecting Rod | Serrations, Offset 45° to the Horizontal |
| Big End Parent Bore Dia. | 2.146/2.1465 in (54,508/54,521 mm) |
| Small End Parent Bore Dia. on later 4.99 and all 4.107 engines | 1.0625/1.0635 in (26,99/27,01 mm) |
| Early 4.99 engines | 1.00/1.001 in (25,4/25,43 mm) |
| Length from Centre Line of Big End to Centre Line of Small End | 6.405/6.407 in (162,69/162,74 mm) |
| Big End Setscrew | 0.375 in ($\frac{3}{8}$ in) U.N.F. |
| Connecting Rod End Float on later 4.99 and all 4.107 engines | 0.0065/0.0105 in (0,16/0,27 mm) |
| Early 4.99 engines | 0.0075/0.0105 in (0,19/0,27 mm) |

## Connecting Road Alignment 4.108, 4.107, 4.99

Large and small end bores must be square and parallel with each other within the limits of ±0.010 in (0,25 mm) measured 5 in (127 mm) each side of the axis of the rod on test mandrel as shown in Fig. B.1. With the small end bush fitted, the limit of ±0.010 in (0,25 mm) is reduced to ±0.0025 in (0,60 mm).




B1

## Crankshaft 4.108, 4.107, 4.99

| | |
|---|---|
| Overall Length | 21.125 in (536,575 mm) |
| Main Journal Dia. Nos. 1 and 2 | 2.248/2.2485 in (57,099/57,112 mm) |
| Main Journal Dia. No. 3 | 2.2475/2.248 in (57,086/57,099 mm) |
| Main Journal Length No. 1 | 1.40625 in (35,719 mm) |
| Main Journal Length No. 2 | 1.496/1.504 in (37,998/38,202 mm) |
| Main Journal Length No. 3 | 1.499/1.502 in (38,075/38,151 mm) |
| Main Journal Fillet Radii | 0.125/0.141 in (3,175/3,581 mm) |
| Crankpin Dia. | 1.9993/2.0001 in (50,78/50,80 mm) |
| Crankpin Length | 1.1875/1.1895 in (30,162/30,213 mm) |
| Crankpin Fillet Radii | 0.15625/0.17187 in (5/32/11/64 in) (3,969/4,366 mm) |
| Surface Finish—All Journals | 8-16 micro-in (0,2 - 0,4 micron) |
| Main Journal and Crankpin Regrind Undersizes | 0.010, 0.020, 0.030 in (0,25, 0.51,0,76 mm) |
| Oil Seal Helix Dia. | 2.21075/2.21175 in (56,153/56,178 mm) |
| Oil Seal Helix Width | 0.050/0.080 in (1,270/2,032 mm) |
| Oil Seal Helix Depth | 0.004/0.008 in (0,102/0,203 mm) |
| Flange Dia. | 3.9985/3.9995 in (101,562/101,587 mm) |
| Flange Width | 0.500 in (12,700 mm) |
| Spigot Bearing Recess Depth | 0.875 in (22,225 mm) |
| Spigot Bearing Recess Bore | 1.250 in (31,750 mm) |
| Crankshaft End Float | 0.002/0.156 in (0,05/0,41 mm) |

## Crankshaft Thrust Washers 4.108, 4.107, 4.99

| | |
|---|---|
| Type | Steel Backed—Lead Bronze Faced |
| Position in Engine | Rear Main Bearing |
| Thrust Washer Thickness (STD) | 0.089/0.091 in (2,261/2,311 mm) |
| Thrust Washer Thickness (O/S) | 0.0965/0.1005 in (2.451/2,553 mm) |
| Thrust Washer Outside Dia. | 3.245/3.255 in (82,423/82,677 mm) |
| Thrust Washer Inside Dia. | 2.590/2.600 in (65,786/66,040 mm) |

## Main Bearings 4.108, 4.107, 4.99

| | |
|---|---|
| Type | Pre-finished, Steel Backed, Aluminium Tin Lined |
| Shell Width | 1.245/1.255 in (31,623/31,877 mm) |
| Outside Dia. of Main Bearing | 2.3955 in (60,846 mm) |
| Inside Dia. of Main Bearing | 2.2505/2.2515 in (57,163/57,188 mm) |
| Running Clearance—Nos. 1 and 2 | 0.002/0.0035 in (0,051/0,089 mm) |
| Running Clearance—No. 3 | 0.0025/0.004 in (0,063/0,102 mm) |
| Steel Thickness | 0.060 in (1,524 mm) Max. |
| Aluminium Thickness | 0.012/0.01225 in (0,305/0,311 mm) |

## 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/in² (1,4 kgf/cm²) — 138 kN/m² |
| 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) |

## Valve Guides (Exhaust) 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) |
| Depth of Counterbore | 0.380 in (9,650 mm) |
| Overall Length of Guide | 2.440 in (61,980 mm) |
| Guide Protrusion above Top Face of Cylinder Head | 0.800/0.815 in (20,320/20,701 mm) |

## Valves (Inlet) 4.108, 4,107, 4.99

| | |
|---|---|
| Valve Stem Dia. | 0.312/0.313 in (7,925/7,950 mm) |
| Clearance fit of Valve Stem in Guide | 0.0011/0.0035 in (0,028/0,089 mm) |
| Valve Head Dia. | 1.410/1.414 in (35,814/35,916 mm) |
| Valve Face Angle | 45° |
| Valve Head Depth Below Cylinder Head Face | 0.028/0.039 in (0,711/0,991 mm) |
| Overall Length of Valve | 4.592/4.608 in (116,637/117,043 mm) |
| Sealing Arrangement | Rubber Oil Seal |

## Valve (Exhaust) 4.108, 4.107, 4.99

| | |
|---|---|
| Valve Stem Dia. | 0.3115/0.3125 in (7,912/7,937 mm) |
| Clearance Fit of Valve Stem in Guide | 0.0016/0.004 in (0,041/0,102 mm) |
| Valve Head Dia. | 1.191/1.195 in (30,251/30,353 mm) |
| Valve Face Angle | 45° |
| Valve Head Depth Below Cylinder Head Face | 0.021/0.032 in (0,533/0,813 mm) |
| Overall Length of Valve | 4.600/4.616 in (116,840/117,246 mm) |
| Sealing Arrangement | No Seal fitted to Exhaust Valve |

## Inner Valve Springs (where fitted)

| | |
|---|---|
| Fitted Length | 1.530 in (38,862 mm) |
| Load at Fitted Length | 28.6 lbf ± 2 lbf (13,0 kgf ± 0,91 kgf) |
| Fitted Position | Damper Coil to Cylinder Head |

## Outer Valve Springs 4.108, 4.107, 4.99

| | |
|---|---|
| Fitted Length | 1.780 in (45,212 mm) |
| Load at Fitted Length | 56.0 lbf±2.8 lbf (25,4 kgf±1,27 kgf) |
| Fitted Position | Damper Coil to Cylinder Head |

## Rocker Levers 4.108, 4.107, 4.99

| | |
|---|---|
| Length between Centre Line of Adjusting Screw and Centre Line of Rocker Shaft | 1.042/1.058 in (26,467/26,873 mm) |
| Length between Centre Line of Rocker Lever Pad and Centre Line of Rocker Shaft | 1.567/1.583 in (39,802/40,208 mm) |
| Inside Dia. of Rocker Lever Bore | 0.71825/0.71950 in (18,243/18,275 mm) |
| Outside Dia. of Rocker Lever Bush | 0.7205/0.7215 in (18,301/18,326 mm) |
| Interference Fit of Bush in Rocker Lever | 0.001/0.00325 in (0,025/0,082 mm) |
| Finished Inside Dia. of Rocker Lever Bush | 0.6245/0.62575 in (15,862/15,894 mm) |
| Clearance of Rocker Lever Bush on Rocker Shaft | 0.00075/0.0035 in (0,019/0,089 mm) |

## Valve Clearances 4.108, 4.107, 4.99

| | |
|---|---|
| Clearance between Valve Stem Tip and Rocker Lever | 0.010 in (0,25 mm) Hot |

## Rocker Shaft 4.108, 4.107, 4.99

| | |
|---|---|
| Overall Length of Shaft | 14.5625 in (369,887 mm) |
| Outside Dia. of Shaft | 0.62225/0.62375 in (15,805/15,843 mm) |
| Lubrication | Oil Feed from Cylinder Head through Central Passage to Individual Rocker Levers |

## Push Rods 4.108, 4.107, 4.99

| | |
|---|---|
| Overall Length | 8.527/8.560 in (216,58/217,42 mm) |
| Outside Dia. | 0.250 in (6,350 mm) |

## Tappets 4.108, 4.107, 4.99

| | |
|---|---|
| Overall Length | 2.250 in (57,150 mm) |
| Outside Dia. of Tappet Shank | 0.560/0.561 in (14,224/14,249 mm) |
| Cylinder Block Tappet Bore Dia. | 0.562/0.56325 in (14,275/14,307 mm) |
| Tappet Running Clearance in Cylinder Block Bore | 0.001/0.00325 in (0,025/0,082 mm) |
| Outside Dia. of Tappet Foot | 1.245/1.255 in (31,623/31,877 mm) |

## TIMING GEARS 4.108, 4.107, 4.99

Note: Some engines are fitted with spur gears instead of helical gears, in which case the number of teeth on each gear are given in brackets.

### Camshaft Gear

| | |
|---|---|
| Number of Teeth | 48 (50) |
| Inside Dia. of Gear Boss | 1.750/1.7514 in (44,450/44,486 mm) |
| Outside Dia. of Camshaft Hub | 1.7496/1.7509 in (44,430/44,473 mm) |
| Transition Fit of Gear and Hub | 0.0009/0.0018 in (0,023/0,046 mm) |

### Fuel Pump Gear

| | |
|---|---|
| Number of Teeth | 48 (50) |
| Inside Dia. of Cylinder Block Bore for Fuel Pump Drive Hub Bearing | 1.8125/1.8141 in (46,037/46,078 mm) |
| Outside Dia. of Fuel Pump Drive Hub Bearing | 1.8145/1.8152 in (46,088/46,106 mm) |
| Interference Fit of Drive Hub Bearing in Cylinder Block Bore | 0.0004/0.0027 in (0,010/0,069 mm) |
| Inside Dia. of Fuel Pump Drive Hub Bearing | 1.3125/1.3135 in (33,34/33,78 mm) |
| Outside Dia. of Fuel Pump Gear Drive Hub | 1.3105/1.3115 in (33,287/33,312 mm) |
| Running Clearance of Drive Hub in Bearing | 0.0031/0.0051 in (0,079/0,129 mm) |
| Drive Hub End Float | 0.002/0.010 in (0,051/0,254 mm) |

### Idler Gear and Hub

| | |
|---|---|
| Number of Teeth | 57 (42) |
| Inside Dia. of Gear Boss | 1.7187/1.7197 in (43,655/43,680 mm) |
| Inside Dia. of Gear Boss with Bush Fitted | 1.5625/1.5641 in (39,687/39,728 mm) |
| Outside Dia. of Gear Hub | 1.5612/1.5619 in (39,654/39,668 mm) |
| Running Clearance of Gear on Hub | 0.0003/0.0016 in (0,008/0,041 mm) |
| Idler Gear Width | 1.3105/1.3135 in (33,287/33,363 mm) |
| Hub Width | 1.3165/1.3195 in (33,439/33,52 mm) |
| Idler Gear End Float | 0.003/0.008 in (0,076/0,208 mm) |

### Crankshaft Gear

| | |
|---|---|
| Number of Teeth | 24 (25) |
| Inside Dia. of Gear | 1.250/1.2512 in (31,750/31,780 mm) |
| Crankshaft Dia. for Gear | 1.250/1.2506 in (31,750/31,756 mm) |
| Transition Fit of Gear on Crankshaft | 0.0006/0.0012 in (0,015/0,030 mm) |

### Timing Gear Backlash

| | |
|---|---|
| Clearance between Crankshaft/Idler and Camshaft/Idler Gear | 0.0015/0.0025 in (0,038/0,064 mm) |

## LUBRICATING SYSTEM 4.108, 4.107, 4.99

| | |
|---|---|
| Lubricating Oil Pressure | 30/60 lbf/in² (2,1/4,2 kgf/cm²) — 207/414 kN/m² at maximum engine speed and normal working temperature. |

### Sump

| | |
|---|---|
| Dipstick Position | Camshaft side of engine opposite No. 2 cylinder |
| Strainer Location | End of suction pipe to lubricating oil pump. |

### Typical Sump Capacities

| Refill Capacities—Engine Level | Imp. pt | U.S. pt | Litre |
|---|---|---|---|
| Standard Sump | 7.0 | 8.4 | 4.0 |
| Vauxhall Motors | 9.0 | 10.8 | 5.1 |
| Chrysler Cars | 8.6 | 10.3 | 4.9 |
| Ford Motor Co. | 8.75 | 10.5 | 5.0 |

**Note:** The above sump capacities are intended to be used as a guide and actual capacities should be governed by the level indicated on the dipstick.

When refilling the engine after an overhaul has been carried out a further 2 imp. pints, 2½ U.S. pints or 1 litre approximately should be added to the capacities quoted, to allow for filling the pipes, oilways, filter assembly, etc.

## Lubricating Oil Pump

| | |
|---|---|
| Type | Rotor Type |
| Number of Lobes—Inner Rotor | Three or Four |
| Number of Lobes—Outer Rotor | Four or Five |
| Method of Drive | By Spiral Gears from the Camshaft |

## Pump Clearances

| | |
|---|---|
| Inner Rotor to Outer Rotor | 0.0015/0.003 in (0,038/0,076 mm) |
| Outer Rotor to Pump Body | 0.006/0.013 in (0,152/0,330 mm) |
| Inner Rotor End Clearance | 0.0015/0.0035 in (0,038/0,089 mm) |
| Outer Rotor End Clearance | 0.0005/0.003 in (0,013/0,076 mm) |
| Inside Dia. of Bore for Pump Shaft | 0.500/0.501 in (12,700/12,725 mm) |
| Outside Dia. of Pump Shaft | 0.4983/0.4986 in (12,655/12,664 mm) |
| Running Clearance, Shaft in Bore | 0.0014/0.0027 in (0,036/0,069 mm) |

## Lubricating Oil Pump Drive Gear

| | |
|---|---|
| Number of Teeth | 12 |
| Inside Dia. of Gear Bore | 0.4965/0.4970 in (12,611/12,624 mm) |
| Outside Dia. of Oil Pump Drive Shaft | 0.4983/0.4986 in (12,655/12,664 mm) |
| Interference Fit of Gear on Shaft | 0.0013/0.0021 in (0,033/0,053 mm) |
| Lubricating Oil Pump Drive Gear Backlash | 0.0155/0.019 in (0,394/0,483 mm) |

## Relief Valve

| | |
|---|---|
| Type | Spring Loaded Plunger |
| Pressure Setting | 50/65 lbf/in² (3,5/4,6 kgf/cm²) — 344/448 kN/m² |
| Length of Plunger | 0.9375 in (23,813 mm) |
| Outside Dia. of Plunger | 0.5585/0.5595 in (14,19/14,21 mm) |
| Inside Dia. of Valve Housing Bore | 0.5605/0.5625 in (14,24/14,29 mm) |
| Clearance of Plunger in Bore | 0.001/0.004 in (0,025/0,102 mm) |
| Outside Dia. of Spring | 0.368/0.377 in (9,347/9,576 mm) |
| Spring—Free Length | 1.5 in (38,10 mm) |

## Lubricating Oil Filter

| | |
|---|---|
| Type | Full Flow |
| Element Type | Paper or Canister |
| By-Pass Valve Setting | Open between 13-17 lbf/in² (0,91-1,2 kgf/cm²) — 90-117 kN/m² pressure differential |

## COOLING SYSTEM 4.108, 4.107, 4.99

| | |
|---|---|
| Type | Water Cooled |
| Cylinder Block and Head | Thermo-Syphon Impeller Assisted |
| Engine Water Capacity (Less Radiator) | 6 Imp. pt (7.2 U.S. pt or 3,4 Litre) |

## Thermostat

| | |
|---|---|
| Type | Wax Capsule |
| Opening Temperature | 152/167°F (67/75°C) or 170/185°F (77/85°C) |
| Fully open at | 185/190°F (85/88°C) or 197/208°F (92/98°C) |
| Minimum Travel at Fully Open Temp. | 0.358 in (9,1 mm) minimum |

## Water Pump

| | |
|---|---|
| Type | Centrifugal—Belt driven from Crankshaft |
| Outside Dia. of Shaft for Pulley (Separate Bearing Pump) | 0.5905/0.5908 in (14,999/15,006 mm) |
| Inside Dia. of Pulley Bore (Separate Bearing Pump) | 0.588/0.589 in (14,935/14,961 mm) |
| Outside Dia. of Shaft for Pulley (Combined Bearing and Shaft) | 0.6262/0.6267 in (15,808/15,920 mm) |
| Inside Dia. of Pulley Bore (Combined Bearing and Shaft Pump) | 0.6239/0.6247 in (15,849/15,869 mm) |
| Interference Fit of Pulley on Shaft | 0.0015/0.0028 in (0,038/0,071 mm) |
| Outside Dia. of Shaft for Impeller | 0.498/0.499 in (12,649/12,675 mm) |
| Inside Dia. of Impeller Bore | 0.497/0.4975 in (12,624/12,636 mm) |
| Interference Fit of Impeller on Shaft | 0.0005/0.002 in (0,013/0,051 mm) |

| | |
|---|---|
| Outside Dia. of Impeller | 3.094/3.125 in (78,588/79,375 mm) |
| Water Pump Seal Type | Synthetic Rubber—Carbon Faced |

## FUEL SYSTEM 4.108, 4.107, 4.99

### Fuel Lift Pump

| | |
|---|---|
| Type | AC Delco Diaphragm 'YJ' Series |
| Spring Colour Code | Green |
| Method of Drive | From Eccentric on Camshaft via Push rod |
| Total Stroke of Operating Lever | 0.192 in (4,877 mm) |
| Static Pressure—No Delivery | 4-7 lbf/in² (0,28-0,49 kgf/cm²) — 28-48 kN/m² |
| Pump to Distance Piece Gasket Thickness | 0.018/0.022 in (0,457/0,559 mm) |
| Distance Piece—Lift Pump to Tappet Inspection Cover | 0.256 in (6,502 mm) |

### Final Fuel Filter

| | |
|---|---|
| Element Type | Paper |
| Overflow Valve Type | Gravity Ball Check Valve |
| Valve in Fuel Pump Drain Connection | Spring Loaded Non-Return Valve set at 0.71-1.25 lbf/in² (0,0522-0,0875 kgf/cm²) — 5-9 kN/m² |

### Fuel Injection Pump

| | |
|---|---|
| Make | C.A.V. |
| Type | D.P.A. |
| Rotation | Clockwise (Viewed from Drive End) |
| Plunger Dia. | 6 mm |

### Hydraulically Governed

| | 4.108 | 4.107 | 4.99 |
|---|---|---|---|
| Timing Letter | A | | A |
| No. 1 Cylinder Outlet | W | | W |

### Mechanically Governed

| | 4.108 | 4.107 | 4.99 |
|---|---|---|---|
| Timing Letter | C | C | C |
| No. 1 Cylinder Outlet | W | W | W |

## Static Timing Position

The static timing position varies according to application, but can be obtained by referring to the first group of letters and digits of the fuel pump setting code (stamped on the fuel pump identification plate).
On the latest 4.108 engines the setting codes start with the fuel pump part number followed by the two code letters. Only the two code letters are used in the table for identification purposes.

| First Group of Fuel Pump Code | (USING TIMING TOOL MS67B) Engine Checking Angle (Degrees) | Fuel Pump Marking Angle (Degrees) | ALTERNATIVE DROP VALVE METHOD Static Timing (Degrees) BTDC | Piston Displacement in (mm) BTDC |
|---|---|---|---|---|
| **4.99** | | | | |
| AH28 | 282 | 295 | 26 | 0.226 (5,74) |
| BH26 | 287 | 300 | 26 | 0.226 (5,74) |
| CH35 | 280½ | 290 | 19 | 0.120 (3,05) |
| DH19 | 287 | 300 | 26 | 0.226 (5,74) |
| LH20, LH26 | 282 | 292 | 20 | 0.134 (3,40) |
| LH29 | 281 | 292 | 22 | 0.160 (4,06) |
| MH26 | 281 | 290 | 18 | 0.110 (2,79) |
| **4.107** | | | | |
| CH35 | 280½ | 290 | 19 | 0.120 (3,05) |
| LH23, LH28, LH29, LH31 (exceptions below) | 282 | 292 | 20 | 0.134 (3,40) |
| LH31/900/2/2770, LH31/900/2/3130, LH31/900/9/1880 | 281 | 292 | 22 | 0.160 (4,06) |
| MH27, PH28, PH30 | 281 | 290 | 18 | 0.110 (2,79) |
| PH34 | 280 | 290 | 20 | 0.134 (3,40) |
| **4.108** | | | | |
| EH, EH34E, EH39 | 281 | 290 | 18 | 0.110 (2,79) |
| LH30 | 281 | 292 | 22 | 0.160 (4,06) |
| PH | 281 | 290 | 18 | 0.110 (2,79) |
| PH23E, PH25E (exceptions below) | 281 | 290 | 18 | 0.110 (2,79) |
| PH25E500/5/2450, PH25E500/9/1990, PH25E500/9/2090 | 279½ | 290 | 21 | 0.150 (3,81) |
| PH27, PH28, PH30 (exceptions below) | 281 | 290 | 18 | 0.110 (2,79) |
| PH30/500/5/2450, PH30/500/6/1570, PH30/500/9/1990, PH30/500/9/2090 | 279½ | 290 | 21 | 0.150 (3,81) |
| RH, RH30E, SH33E | 279½ | 290 | 21 | 0.150 (3,81) |
| TH, TH23E | 281 | 291 | 20 | 0.134 (3,40) |

*Note: For 4.107 and 4.99 mechanically governed engines rated above 3,000 and 2,500 rev/min respectively, the static timing is altered to 22° B.T.C.D. - piston displacement 0.160 in (4,06 mm). For 4.108 engines prior to engine numbers 108U15973 and 108UD20214, the static timing was 19° B.T.D.C. - piston displacement 0.120 in (3,05 mm). When re-setting these pumps, it is advisable to set at the figures quoted in above table.*

*For 4.107 industrial engines having a fuel pump coding of PH30 and an idling speed of 1,000 rev/min, the static timing is 21° B.T.D.C. and a piston displacement of 0.147 in (3,73 mm).*

### Atomisers

### 4.108 Veh., M., Ind., Comb.
### 4.107 M., Ind., TA

| | |
|---|---|
| Make ... | C.A.V. |
| Holder Type ... | BKB40SD5224 |
| Nozzle Type ... | BDN12SD6236 |
| Code Letter ... | BG |
| Min. Working Pressure ... | 135 atm (2000 lbf/in² or 140 kgf/cm²) |
| Setting Pressure ... | 150 atm (2200 lbf/in² or 155 kgf/cm²) |

### 4.108M, Ind., Comb.

| | |
|---|---|
| Make ... | C.A.V. |
| Holder Type ... | BKB40SD5224 |
| Nozzle Type ... | BDN4SD6769 |
| Code Letter ... | GY |
| Min. Working Pressure ... | 135 atm (2000 lbf/in² or 140 kgf/cm²) |
| Setting Pressure ... | 150 atm (2200 lbf/in² or 155 kgf/cm²) |
| Make | OMAP |
| Holder type | 2646522 |
| Nozzle type | 2646724 |
| Min. working pressure | 145 atm (2130 lbf/in²) 150 kgf/cm² |
| Setting pressure | 155 atm (2280 lbf/in²) 160 kgf/cm² |

**Note:** Earlier atomisers bearing the identification code letter 'J' had a setting pressure of 140 atm. When servicing of these atomisers is carried out, they should be reset in accordance with the settings quoted above.

| | **4.99 Veh** | **4.99 Veh** | **4.99 Ind. & 4.107 Ind.** |
|---|---|---|---|
| Make ... | C.A.V. | C.A.V. | C.A.V. |
| Holder Type ... | BKB40S5223 | BKB40S5224 | BKB40S5224 |
| Nozzle Type ... | BDN12SD6236 | BDN12SD6236 | BDN4S6157 |
| Code Letter ... | BK | BL | BE |
| Min. Working Pressure ... | 120 | 125 | 130 |
| Setting Pressure ... | 130 | 130 | 135 |

### Starting Aid

| | |
|---|---|
| Make ... | C.A.V. |
| Type ... | Thermostart |
| Voltage ... | 12 Volt |
| Maximum Current Consumption ... | 12.9 Amperes at 11.5 Volts |
| Fuel Flow Rate through Unit ... | 4.3-4.9 cm³ min at 70°F (21°C) |
| Height of Reservoir (where fitted) above Centre of Thermostart ... | 4.5-10 in (11,4-25,4 cm) |

## Electrical System

### Dynamo

| | |
|---|---|
| Make ... | Lucas |
| Type ... | C40 |
| Max. Output ... | 11A |

### Alternator

| | |
|---|---|
| Make ... | Lucas or C.A.V. |
| Type ... | AC5 (12V or 24V), 11AC (12V or 24V), 15ACR (12V) and 17ACR (12V) |
| Max. Output (hot) | |
| AC5 (12V) ... | 53A |
| AC5 (24V) ... | 30A |
| 11AC (12V) ... | 43A |
| 11AC (24V) ... | 23A |
| 15ACR ... | 28A |
| 17ACR ... | 36A |

### Starter Motor

| | |
|---|---|
| Make ... | Lucas |
| Type ... | MG45 or 2M113 |
| Max. Current ... | 900A |
| Starter Cable Resistance ... | 0.0017 ohms (Max.) |
| No. of Teeth on Pinion ... | 10 |

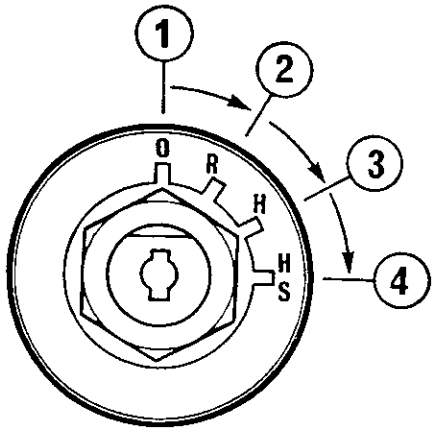
# SECTION C
# Operating and Maintenance

## Starting the Engine

If the weather is warm or the engine has only been stopped for a little while, place the accelerator in the fully open position and engage the starter motor by turning the starter switch in a clockwise direction to the "HS" position (See Fig. C.1).

If the battery is well up, enough to turn the starter motor quickly, the engine should start.

Always be sure that the starter pinion and flywheel have stopped revolving before re-engaging the starter, otherwise the ring or pinion may be damaged.




C1

1. Off Position
2. Run Position
3. Heat Position
4. Heat and Start Position

## To Operate the Starting Aid

In cold weather the procedure for the use of this equipment is as follows:—

Ensure that the engine stop control is in the "run" position.

Turn on the fuel supply tap of the starting aid reservoir, where fitted.

Turn start switch in direction to "H" position for fifteen to twenty seconds.

With accelerator in the fully open position, turn the switch a further clockwise movement to the "HS" position thereby engaging the starter motor.

If the engine does not start after fifteen seconds, return switch to "H" position for ten seconds and then re-engage the starter motor.

As soon as the engine starts, the switch should be returned to the "R" position, and the tap on the starting reservoir, when fitted, turned off.

NOTE: The above procedure is not necessary when the engine is hot. To re-start, turn the switch in a clockwise direction to the "HS" position which will engage the starter motor.

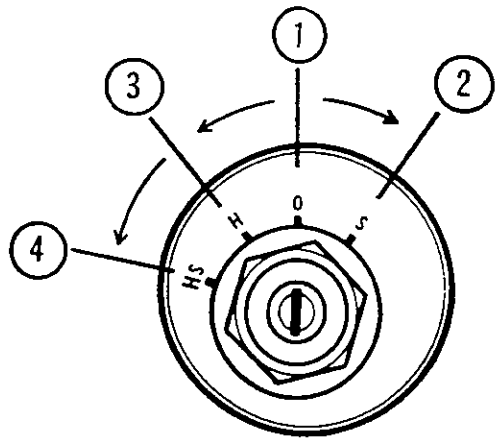
## Earlier Heat Start Switch

The cold start switch fitted to earlier engines is shown in Fig. C.2.

With this switch, starting a warm engine is effected by turning the switch in a clockwise direction to the "S" position.

In cold weather, the switch should be turned to the "H" position for fifteen to twenty seconds and then to the "HS" position in order to engage the starter motor. As soon as the engine starts, the switch should be returned to the "O" position.

Where this type of switch is used, it was customary to have a separate switch for the electrical circuits and this should be turned on before starting the engine and turned off after stopping the engine.




C2

1. Off Position
2. Start Position
3. Heat Position
4. Heat and Start Position

## Alternative Method

With some engines, a different starter switch is provided and the cold start aid is operated by means of a separate push button switch.

The cold starting procedure is the same i.e.
Switch on by turning the starter switch in a clockwise direction to the first position.

Press the heater button for fifteen to twenty seconds and then, with the heater button still pressed, turn the starter switch in a further clockwise direction to engage the starter motor. As soon as the engine starts, release switch and heater button.

## Glow Plugs

Glow plugs are sometimes fitted to engines in applications such as refrigeration units, fork lift trucks and other certain 4.108 mechanically governed engines rated at 3,000 rev/min and below. As the buss bar connecting these glow plugs may not be insulated, extreme care must be exercised to keep pipes, clips or other metal objects well clear as the consequences of a direct short of this buss bar to earth when energised are obvious.
It must be noted that in no circumstances should either or any other unauthorised starting aids be used at the same time as glow plugs.
To operate, use the following procedure :—
Before operating the starter motor, press the "Heat" button for 20 to 30 seconds.
With the "Heat" button still pressed, engage the starter motor until the engine starts.
Continue to press the "Heat" button for a few seconds after the engine has started until even running has been obtained.
If the engine does not start, disengage the starter motor, but keep the "Heat" button pressed for a further 10 to 15 seconds, when a further attempt should be made to start the engine, keeping the glow plugs energised whilst starting and for a few seconds after the engine has fired until even running is obtained.

## Points to Note

Ensure that the electrical connection to the starting aid is correctly made.

Always ensure that the reservoir feeding fuel to the starting aid is fully primed and is not leaking. With some later engines, this fuel reservoir has been deleted, the cold start aid being fed direct from the fuel filter through a non-return valve.

Extended use of the cold starting equipment above the time periods already stated should be avoided, otherwise the starting aid in the induction manifold may be damaged also continuous flaming will starve the engine of oxygen.

In the event of difficult starting, check that fuel is reaching the starting aid in the induction manifold by unscrewing the inlet fuel connection. If fuel is reaching it satisfactorily, then it may be that the starting aid itself is not working correctly. This can be checked by removing the air cleaner and watching the starting aid whilst the equipment is used. When the starting switch is turned to the "heat" position, the element should become red hot, and upon engagement of the starter motor ignition of the fuel should take place.

4.108, 4.107 and 4.99 engines are fitted with efficient starting equipment and no responsibility can be accepted for any damage caused by unauthorised starting aids.

To prevent thermostart damage, it is essential that the thermostart is not operated **DRY**. After any operation which allows fuel to drain from the the thermostart feed pipe, the pipe must be disconnected at the thermostart and all air bled from the pipe before the thermostart is operated.

Where a thermostart starting aid has to be replaced, care must be taken not to exceed the torque figure quoted on Page B.2. Excessive torque loading can crack the insulator adaptor causing an electrical short and hard starting characteristics.

## Stopping the Engine

A spring loaded stop control is located near the normal engine controls and functions by cutting off the fuel at the fuel injection pump.

To operate, pull the knob and hold in this position until the engine ceases to rotate. Ensure that the control returns to the "run" position, otherwise difficutly may be experienced in re-starting the engine.

Return latest cold start switch to the "O" position.

Some engines may have an electric solenoid stop control on the fuel injection pump operated by a switch on the control panel.

## Running In Procedure

It is not necessary to gradually run-in a new or factory rebuilt engine and any prolonged light load running during the early life of the engine can in fact prove harmful to the bedding in of piston rings and liners.

Full load can be applied on a new or factory rebuilt engine as soon as the engine is used, **provided that the engine is first allowed to reach a temperature of at least 140°F (60°C).**

## PREVENTIVE MAINTENANCE

These preventive maintenance periods are general in application. Check the periods given by the manufacturer of the equipment in which the engine is installed and, where necessary, use the shorter periods.
These periods and procedures must also be adapted to ensure correct operation for any local machine regulations.
It is good maintenance to check for leakage and loose fasteners at each service interval.
These maintenance periods are only for engines that are operated with fuel and lubricating oil to the specifications given in this manual.
The schedules which follow must be applied at the interval (miles, kilometres, hours or months) which occurs first.