Engine Data

Type	Four cylinder, four stroke, in-line.
Bore, nominal	92 mm
Stroke	101,6 mm
Capacity	2,710 litres
Compression ratio	21 : 1
Combustion system	Indirect injection, anti-chamber
Firing order	1 - 3 - 4 - 2
Minimum lubricating oil pressure	2,07 Bars (30 lbf/in²) at 80°C
Valve tip clearance — Inlet, cold	0,30 mm (0.012 in)
Valve tip clearance — Exhaust, cold	0,40 mm (0.016 in)
Lubricating oil sump capacity	Varies with application. Engine to be filled to dipstick maximum mark and topped up after running for five minutes.
Cooling water capacity, engine only	6,3 litres

Rating details

Rated output, Gross	70 bhp — 52,2 Kw at 3,600 rev/min
Nett to DIN 70020	48 Kw (65 PS)
Maximum torque, Gross	152 Nm at 2,050 rev/min
Nett	149 Nm
Engine weight, dry, approximately	201 Kg (441 lb)

Recommended Torque Tensions

The following figures will apply with the components lightly oiled before assembly.

Component	Screw Size	Nm	lbf ft	kgf m
Cylinder Head Securing Setscrews	M12 x 1,75	122	90	12,4
Main Bearing Cap Setscrews	M12 x 1,75	109	80	11,1
Connecting Rod Nuts	M12 x 1,75	102	75	10,4
Crankshaft Pulley Setscrew	M20 x 2,5	332	245	33,9
Flywheel Setscrews	M12 x 1,75	88	65	9,0
Camshaft Gear Setscrew	M12 x 1,75	70	52	7,2
Idler Gear Hub Nuts	M8 x 1,25	28	21	3,0
Atomiser Securing Nuts	M8 x 1,25	16	12	1,7
High Pressure Fuel Pipe Nuts	M12 x 1,5	20	15	2,1
Adaptor Plate (Housing) Setscrew	M10 x 1,5	32	24	3,6
Fuel Pump Drive Gear Setscrew	M8 x 1,25	20	15	2,1

De-Rating For Altitude

Where engines operate at high altitudes they should be de-rated.
The following tale is given as a general guide, to be applied on a percentage basis, where specific figures for a particular engine rating are not available.

De-Rating For Altitude

Where engines operate at high altitudes they should be de-rated.
The following table is given as a general guide, to be applied on a percentage basis, where specific figures for a particular engine rating are not available.

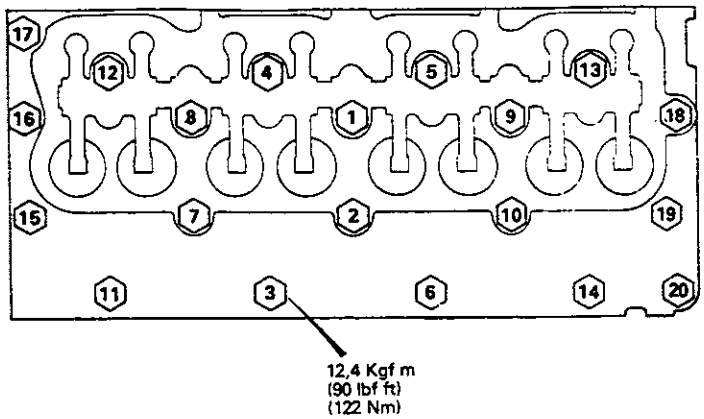
Altitide	Maximum fuel delivery de-rating*
0/ 2000 ft (600 metre)	No change
2000/ 4000 ft (1200 metre)	6%
4000/ 6000 ft (1800 metre)	12%
6000/ 8000 ft (2400 metre)	18%
8000/10000 ft (3000 metre)	24%
10000/12000 ft (3600 metre)	30%

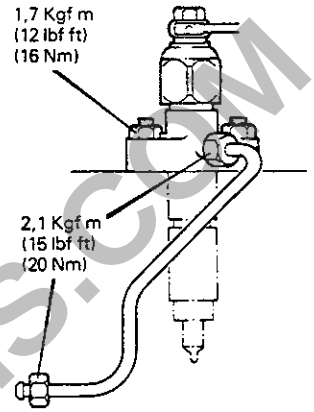
*Measured at setting speed given on pump setting code.

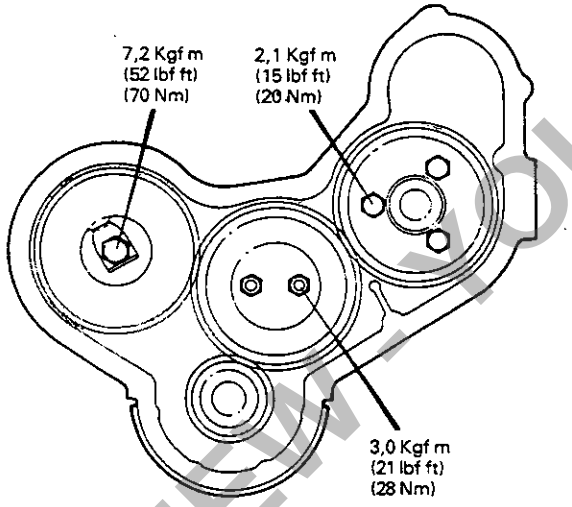
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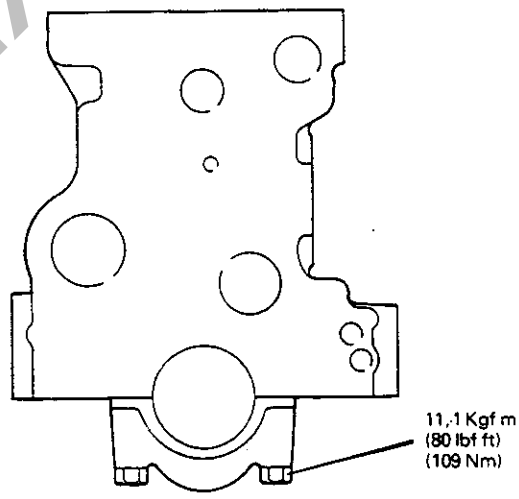
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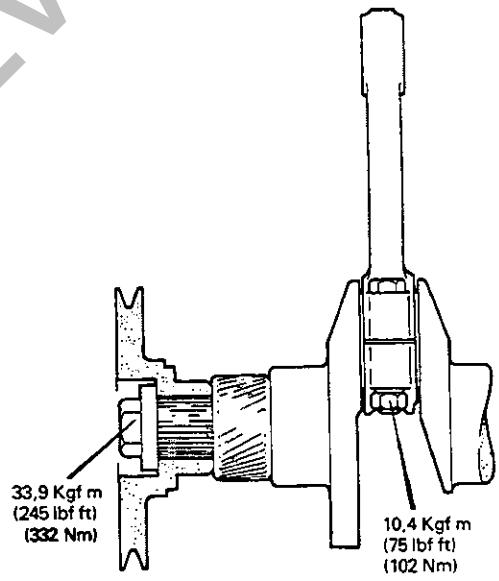
Torque Tensions

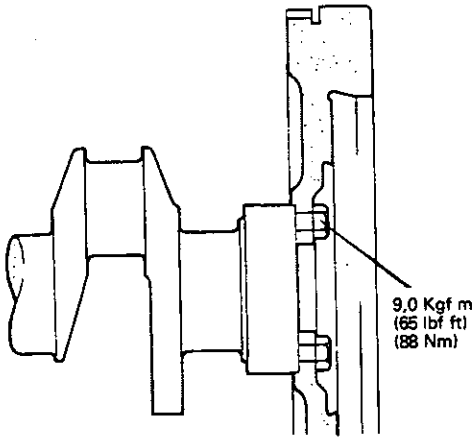






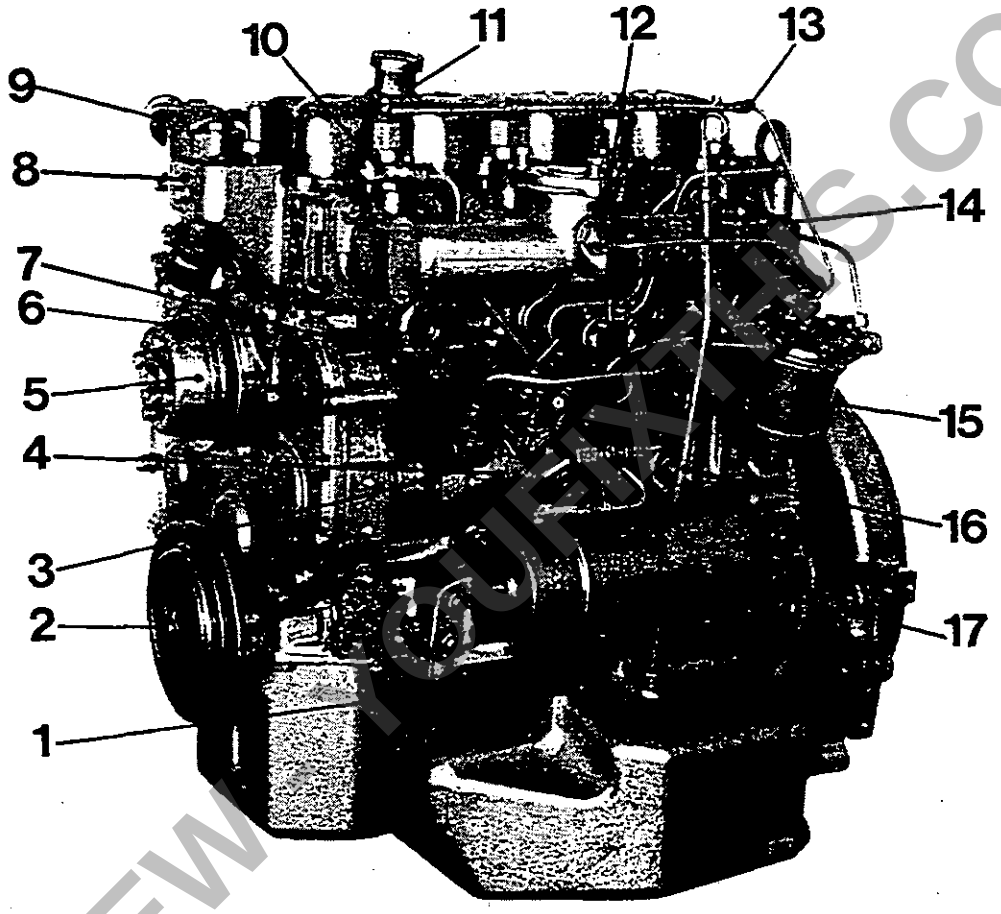






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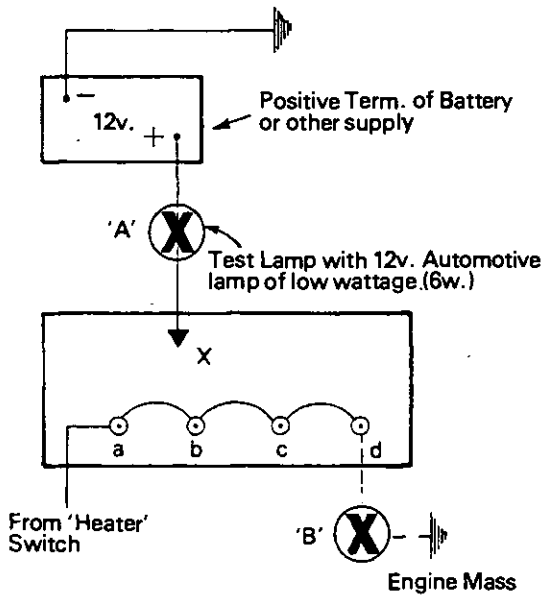
A1 View on fuel pump side of engine.

1 Engine Mounting Bracket.
2 Crankshaft Front Pulley.
3 Fuel Injection Pump Drive Adaptor.
4 Fuel Injection Pump.
5 Water Pump Drive Pulley.
6 Water Pump.
7 Engine Serial Number Location.
8 Thermostat Housing.
9 Water Outlet.
10 Atomiser.
11. Lubricating Oil Filler.
12 Thermostart.
13 Leak-off Pipe (Atomisers).
14. Induction Manifold.
15 Fuel Filter Canister.
16 Dipstick Tube.
17 Lubricating Oil Filter Canister.

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CHECKING GLOW PLUGS



Glow Plugs

Where glow plugs are used as a starting aid, the buss bar connecting the four plugs is electrically energised when the equipment is used.

As this buss bar is not insulated, extreme care must be exercised in as much as all pipes, clips or other metal objects must be kept well clear.

The consequences of a direct short of this buss bar to earth when energised are obvious.

To Check for Continuity of Glow Plugs

(a) Remove leads from Glow Plugs.

(b) Connect test lamp (A) as shown, between live (+VE) terminal and,

(c) Check operation of lamp by earthing end (X) to engine head.

(d) Connect test point "X" to each glow plug terminal in turn, lamp will light on 'good' glow plugs and will not light on open circuit (faulty) glow plugs.

To Check Supply to Glow Plugs

Connect test lamp (B) between point 'd' and earth (engine mass).

When heater switch is operated the lamp should light.

Checking Glow Plugs Using a Volt-Meter

1. Disconnect glow plug interconnecting links and main feed wire.
2. To check each glow plug individually connect a 50-0-50 ammeter in series with main feed cable and glow plug terminal.
3. Connect a 0-20 voltmeter from Glow Plug terminal to earth.
4. Press heater button — observe ammeter and voltmeter readings. An initial current surge of approximately 40 amps will be observed, but will drop to about 11 amps, after approx. 10 seconds. The voltmeter reading after this time should be in the region of 11-12 volts.
5. If the reading is low, or non existent, plug should be replaced.
6. If no volt-meter reading is observed, a defective feed cable or switch is the probable cause.

Operators note

Users of the 4.165 engine are reminded that the following Preventive Maintenance and Running-in Procedure schedule is general in application, therefore he should compare the routine maintenance for his engine with the requirements of his vehicle, bearing in mind that on stop-start work, the number of hours running time of the engine is more applicable than the mileage covered.

Preventive Maintenance

Daily or every 8 hours (whichever occurs first)

Check level of the coolant.

Check the level of the lubricating oil with the dipstick ensuring that the vehicle is standing level.

Check the lubricating oil pressure where a gauge is fitted.

When operating in dusty conditions, empty the dust bowl of the heavy duty air cleaner, or as frequently as necessary.

Every 7,500 km, 5,000 miles, 200 hours or 4 months (whichever occurs first)

Drain and renew the lubricating oil which should meet the approved specification of MIL-L-2104C or MIL-L-46152.

Renew the lubricating oil filter element. Page L8.

Empty the dust bowl of the heavy duty air cleaner.

Check the drive belt tension and adjust if necessary to 10 mm in the longest run.

Check for leaks of lubricating oil, fuel oil and water. Rectify where necessary.

Clean the fuel oil water trap.

Every 15,000 km, 10,000 miles, 400 hours or 12 months (whichever occurs first)

Check coolant hoses and clips.

Renew the air cleaner element (or clean the element where possible).

Clean the fuel lift pump gauze strainer.

Check and adjust the valve tip clearance to 0.012 in (0.30 mm) cold for the inlet valve and 0.016 in (0.40 mm) cold for the exhaust valve (see page E.6).

Renew final fuel filter element (Agricultural and Industrial).

Every 30,000 km, 20,000 miles, 800 hours.

Renew the final fuel filter element (Vehicle applications).

continued.....

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CYLINDER HEAD

To Remove the Cylinder Head

Drain the cooling system. Disconnect the battery and electrical connections.

Disconnect the water outlet, by-pass, cab heater and engine vent hoses from the cylinder head front cover.

Remove the high and low pressure fuel pipes. Remove the atomisers and washers, Fig. E.1. Atomiser heat shields are described later. The fuel filter complete with bracket. Disconnect breather pipe and dipstick.

Disconnect temperature sender.

Remove the glow plugs if fitted, to prevent damage to the terminals. See Fig. E.2.



E1



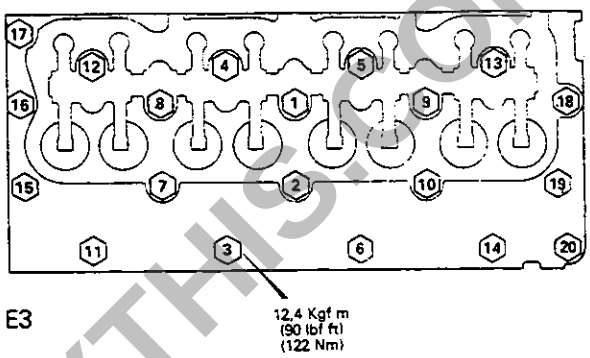
E2

Remove the air cleaner, exhaust pipe, induction and exhaust manifolds, and the rocker cover.

Blank off the fuel injection pump, fuel filter and atomiser to prevent the ingress of dirt.

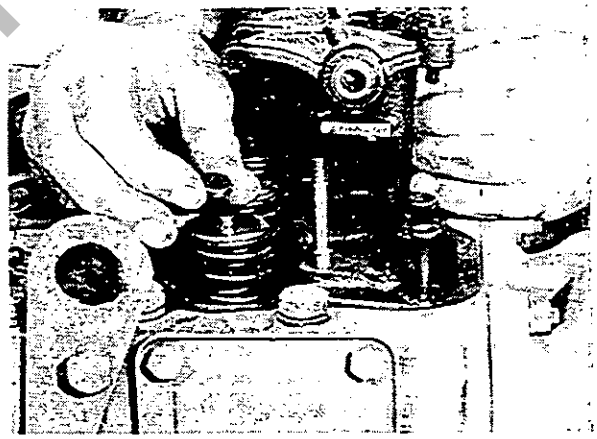
Remove the two nuts from the studs locating in Nos. 1 and 7 rocker shaft support bracket.

Remove the cylinder head setscrews in the reverse order to that shown in Fig. E.3, and remove the rocker assembly and push-rods.



E3

Remove the cylinder head, taking care that the caps on top of the valve stems (Fig. E.4) are not lost and place on a flat (wooden) surface. Remove the head gasket.

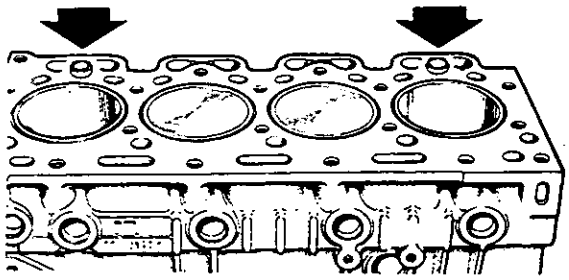


E4

To Fit the Cylinder Head

Fit a new cylinder head gasket, without jointing compound, locating it over the two dowels in the cylinder block, Fig. E.5.

Position the cylinder head on the gasket and locate the push rods.



E5

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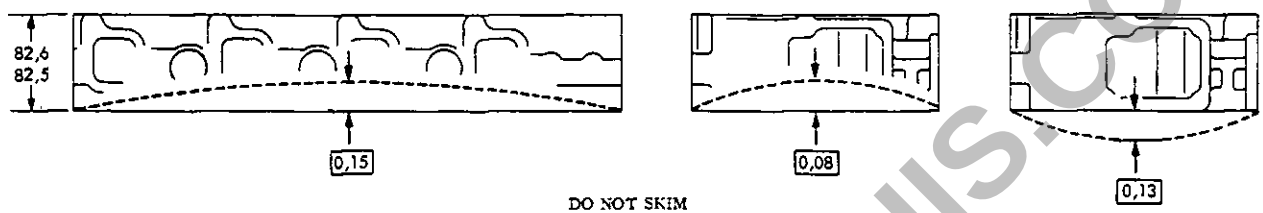
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Fits and Tolerances

Cylinder Head Dimensions

Millimetres

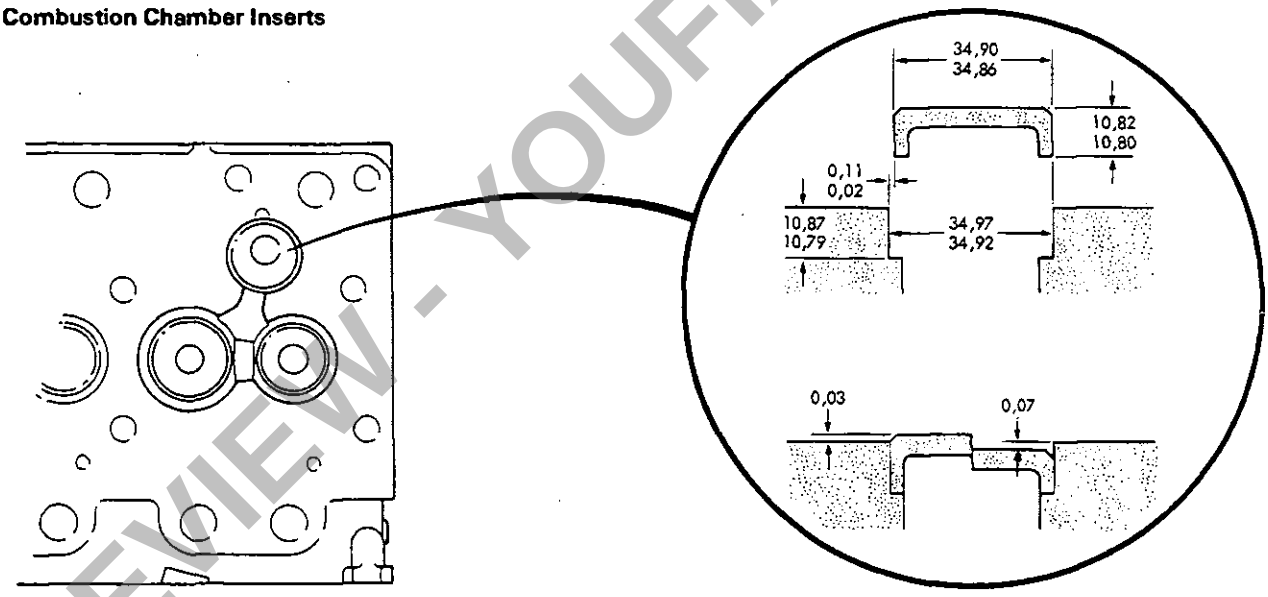
Service limits shown thus — ▭



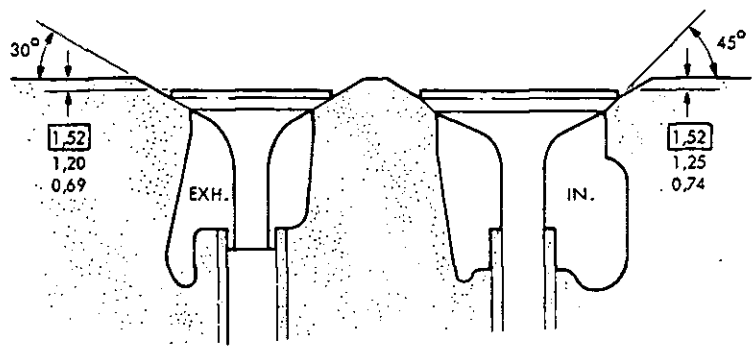
DO NOT SKIM

Pressure for Water Leak Test	...	...	...	2,07 Bars (30 lbf/in²)

Combustion Chamber Inserts



Valve Seat Angle and Depth



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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.

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

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.

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.

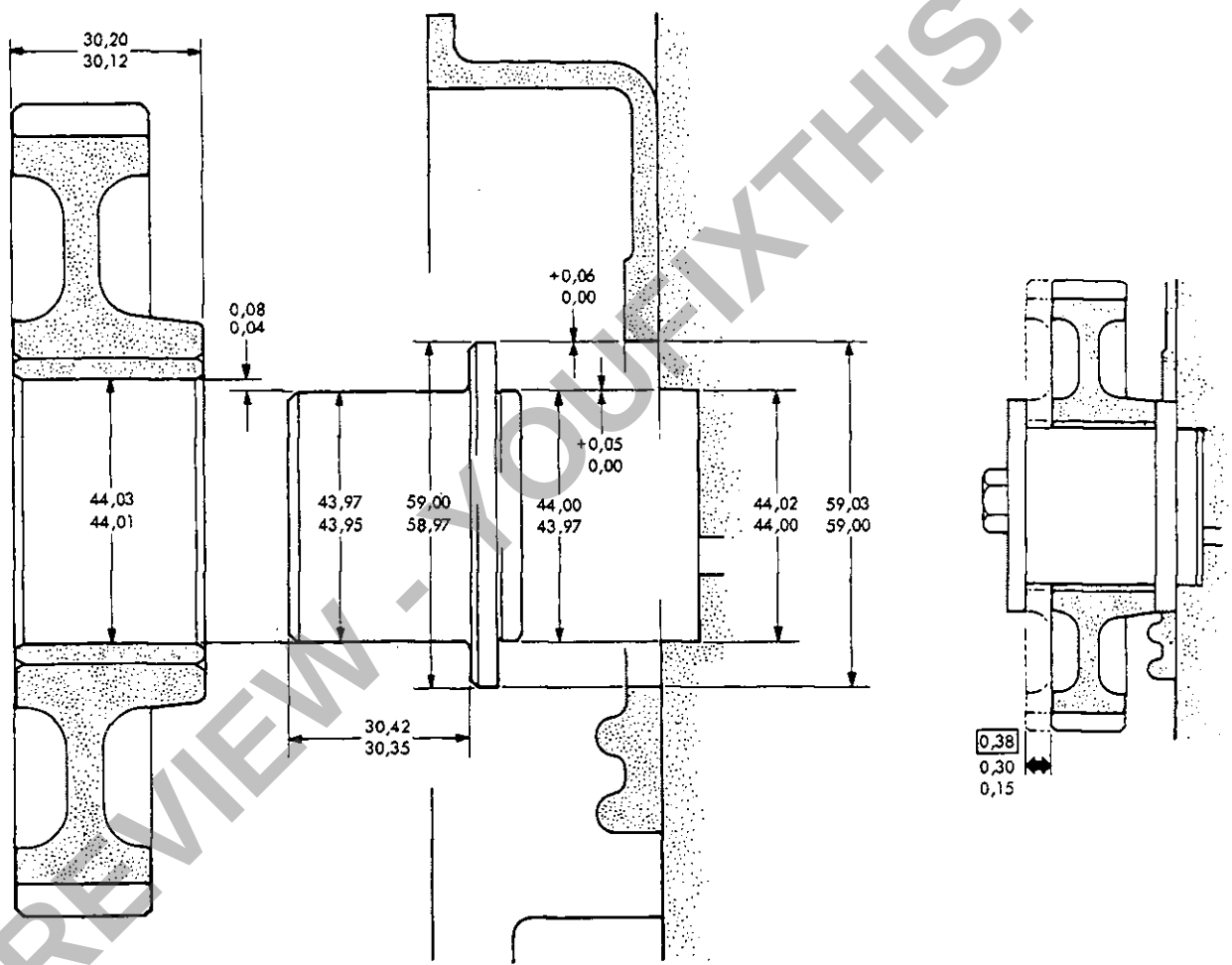
Full load can be applied to a new or factory rebuilt engine as soon as the engine is used, provided that the engine coolant is first allowed to reach a temperature of at least 140°F (60°C).

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Idler Gear and Hub

Millimetres

Service limits shown thus —▭



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SECTION F
Pistons and Connecting Rods

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SECTION K
Timing

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N5



N6

A spurt of fuel should emit from the outlet port every time the hand priming lever is depressed.

If the hand priming lever cannot be depressed, rotate the engine one complete revolution in order to turn the eccentric on the camshaft from its maximum lift position.

Pressure Checking of Fuel Lift Pump in Position

Fit a 1 bar pressure gauge to the outlet of the pump. Ensure there are no leaks at the connections between pump and gauge. Crank the engine for ten seconds and note the maximum pressure on the gauge. If the pressure recorded is less than 75% of the minimum production static pressure (0,28 bars), then rectify the pump. Also observe the rate at which the pressure drops to half the maximum figure obtained when cranking has ceased. If less than thirty seconds, rectify the pump.

To Remove the Lift Pump

Disconnect the fuel pipes from the inlet and outlet ports.

Remove the four nuts and two retaining plates which secure the pump to the cylinder block and withdraw the pump, Fig. N.5.

Fuel Lift Pump

Type ...	...	AC — Delco, Series X.D.
Method of Drive...	...	Eccentric on Camshaft
Spring colour code	...	Green
Static Pressure — (No delivery)		0,28/0,48 Bars

To Dismantle the Lift Pump

Before dismantling, make a file cut across the two flanges for re-location purposes. Remove the six cover screws and separate the two main parts. Turn the diaphragm assembly through 90° in either direction and lift out.

The valves are "staked in" and can be prised out. Clean the casting so that new valves can be correctly seated. Press the valves in using a suitable dolly. Stake the casting around the valves in six places.

The rocker arm pin can be removed by securing the rocker arm in a vice and tapping the face of the body with a soft mallet until the retainers are dislodged. The rocker, pin, lever and return spring can now be examined for wear.

To Re-assemble the Lift Pump

Fit the rocker arm assembly into the bottom half of the lift pump. Fit the rocker arm return spring ensuring it seats properly.

Tap new retainers into the grooves in the casting and stake over the open ends of the grooves.

Place the diaphragm assembly over the spring, with the pull-rod downwards, locating the top of the spring in the diaphragm protector washer. Position the rod so that the notched blade locates into the rocker arm. Press downwards on the diaphragm assembly so that the notches on the pull rod align with the rocker arm link and twist it through 90° in either direction, this action will engage and retain the pull rod in the fork of the link.

When re-assembling the two pump halves, push the rocker arm towards the pump until the diaphragm is level with the body flanges. The cover assembly can now be placed in position, with the file marks aligned. Maintaining the pressure on the rocker arm, fit the securing screws and washers and tighten evenly.

To Refit the Fuel Lift Pump

Ensure that the pump flange and cylinder block pump mounting face is clean and using a new joint, enter the pump operating lever into the aperture in the block. Fit the pump onto the mounting studs and secure with the nuts and retaining plates.

FUEL INJECTION PUMP

Unless proper test equipment and trained technicians are available, adjustment or maintenance of the fuel pump should not be attempted.

To Remove the Fuel Pump

Disconnect the stop and speed controls from the fuel pump and remove the return spring.

Remove the high and low pressure fuel pipes and blank off all the ports.

Remove the fuel pump flange securing nuts, plain and spring washers and withdraw the pump. See Fig. N.6.

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