Perkins 3.152 engine Sample File.

This single sample file contains samples for

Perkins condensed workshop manual - 100 pages
Perkins expanded workshop manual - 460 pages
Perkins Engine Fault Finding Guide - 24 pages
Perkins General Installation Manual - 200 pages

workshop manual for 3.152 series diesel engines 3.152 D3.152 3.1522 3.1524 T3.1524 and D3.152M, 3HD46 marine engines.

Publication No. TPD 1091 1208E

This publication supersedes the previous edition number 601 TPD 0786 1208.

This publication is written in Perkins Approved Clear English

PACE

This Publication is written for world wide use. In countries where legislation controls engine smoke emission, noise, safety factors, etc., then all instructions, data and dimensions given must be applied so that, after service (preventive maintenance) or repair, the engine operation is correct to the local regulations.

Contents

* Operating and maintenance information can be found in section 3 of the multi-lingual 3.152 Series Users handbook

Engine identification

The first two letters of the engine number give an indication of the engine type as shown below.

CD 3.152 engine
CE D3.152, D3.152(M) and 3HD46 engines
CJ 3.1522 engine
CM 3.1524 engine
CN T3.1524 engine

The engine number is stamped on a machined pad on the right side of the cylinder block forward of the fuel lift pump (see fig. A1). A typical engine number is CJ30060U510251F.

If you need any parts, service or information for your engine, you must give the complete engine number to your Perkins distributor.

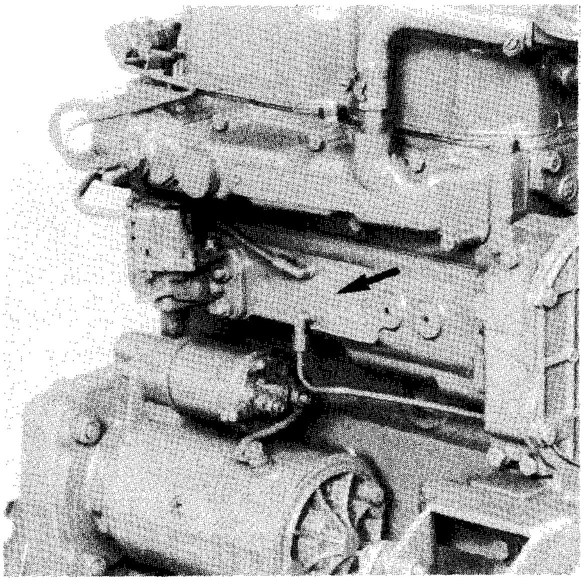


Fig. A1

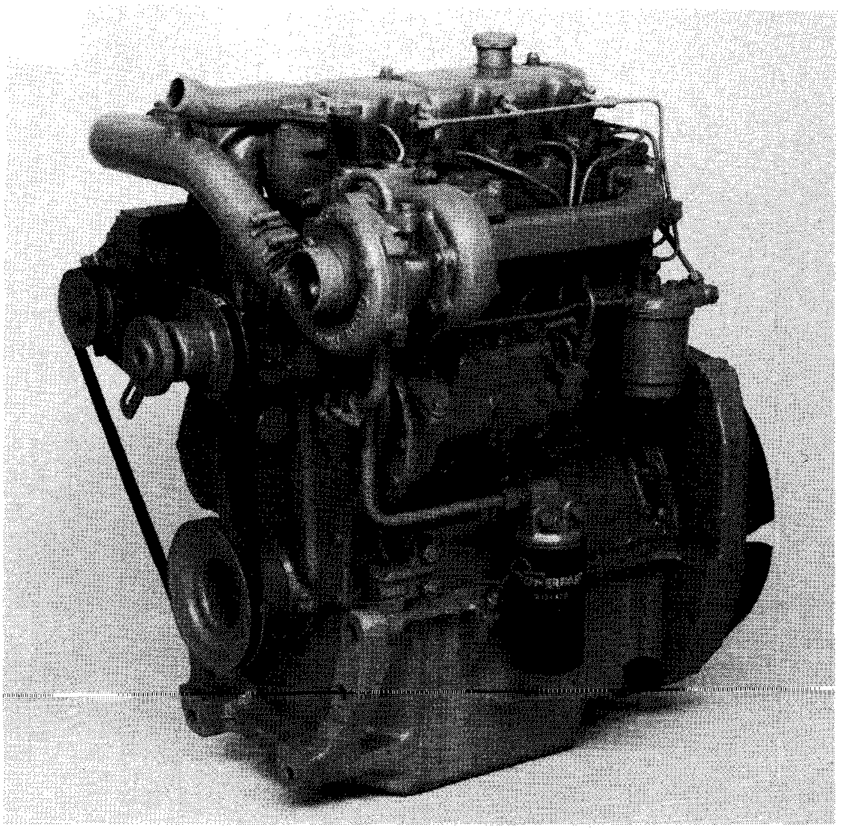


Fig. B7
Front/left side of T3.1524 engine

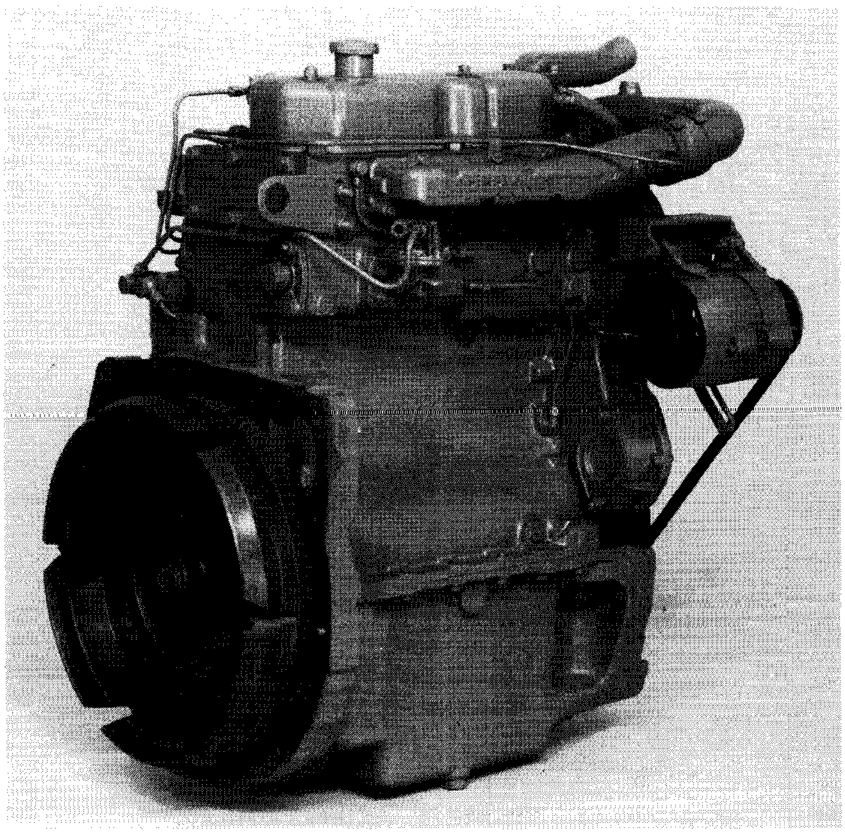


Fig. B8
Rear/right side of T3.1524 engine

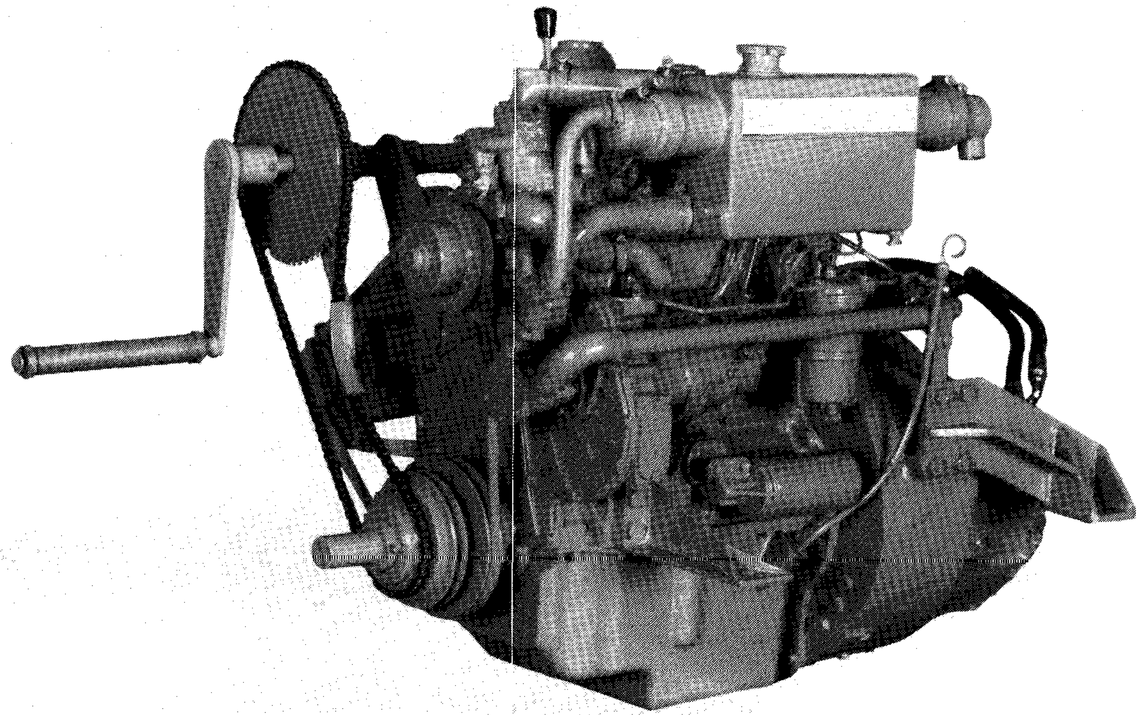


Fig. B9
Front left side of 3HD46 Mk2 engine

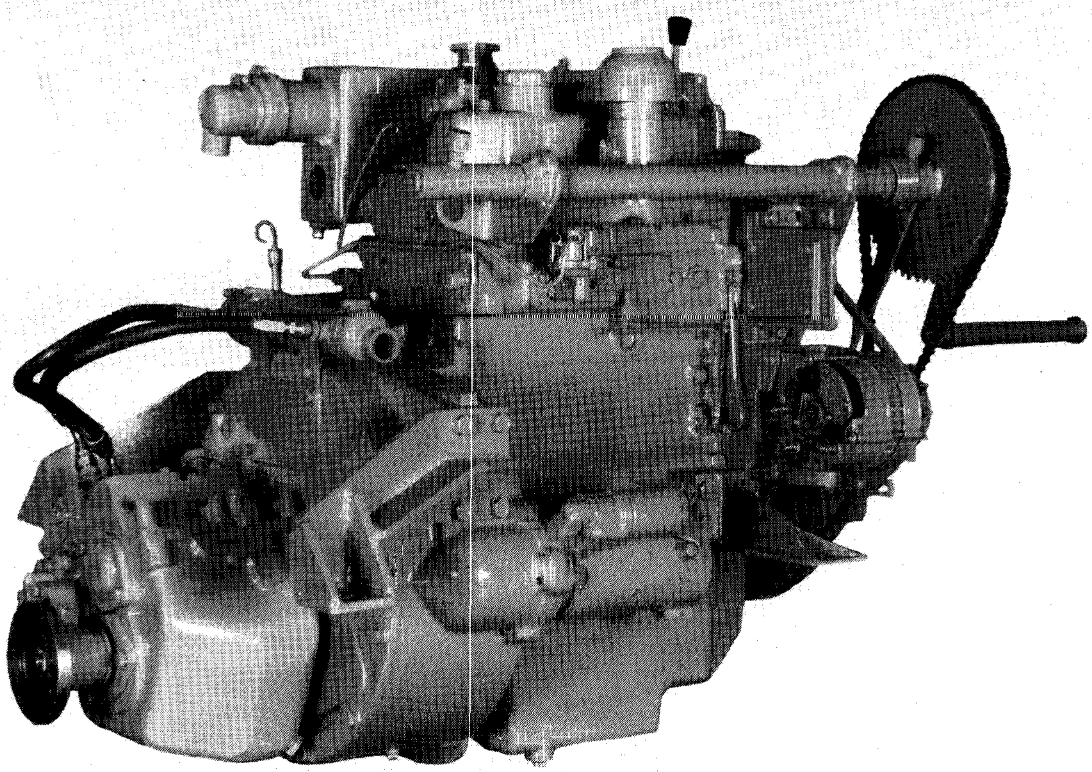
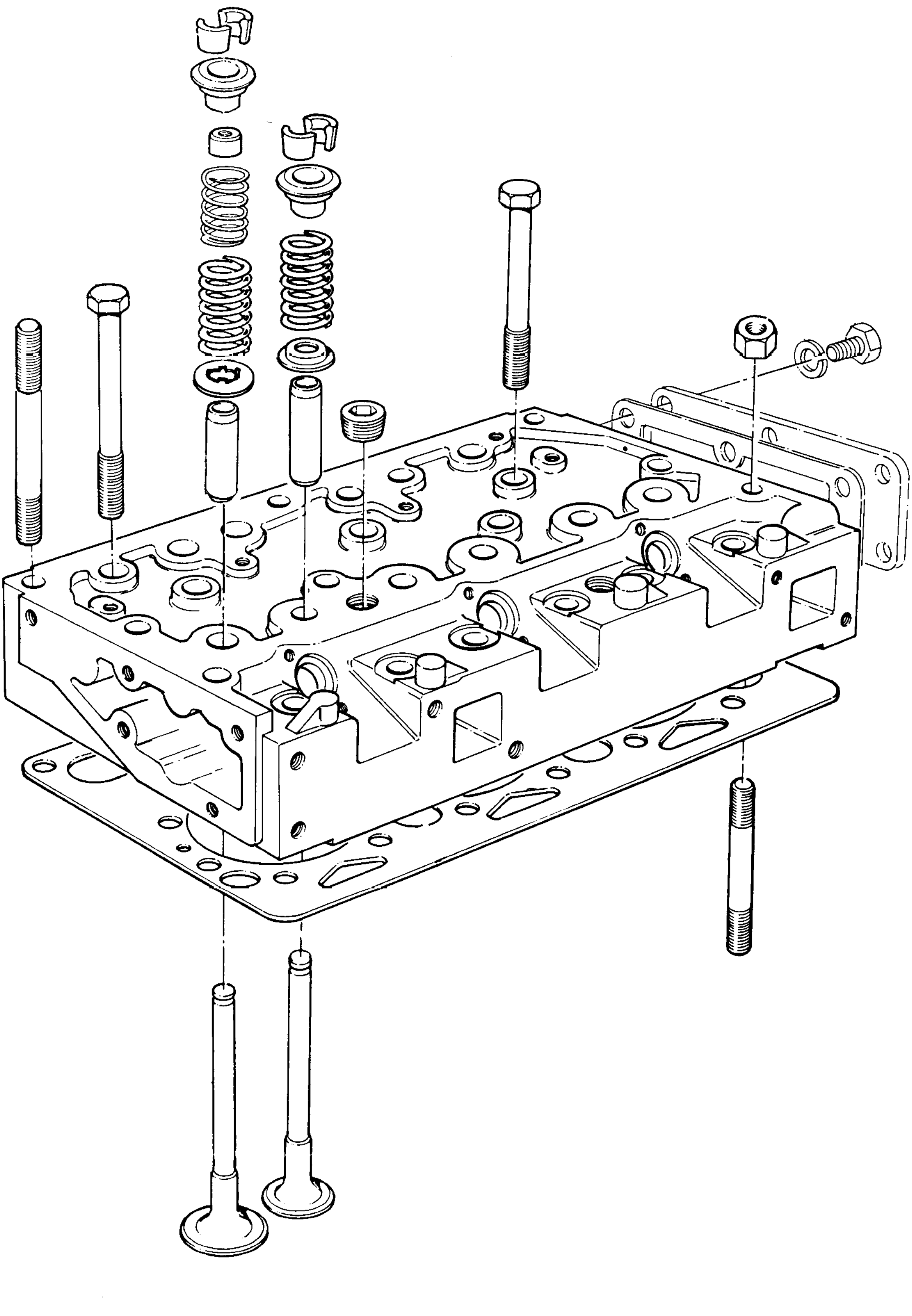


Fig. B10
Rear right side of 3HD46 Mk2 engine

SECTION C
Technical Data

SECTION F
Cylinder Head



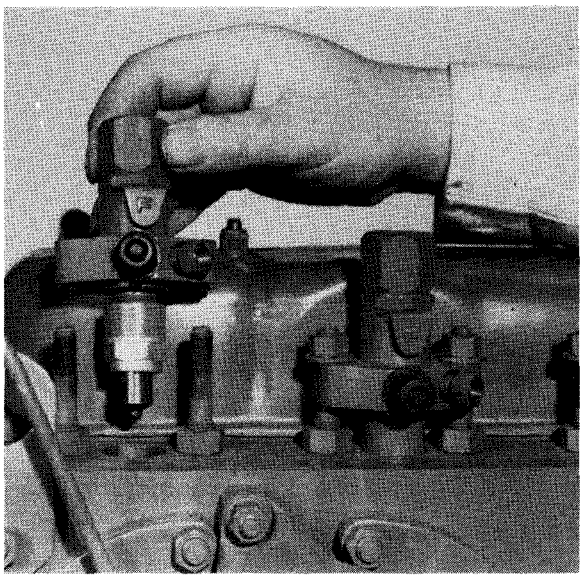


Fig. F1

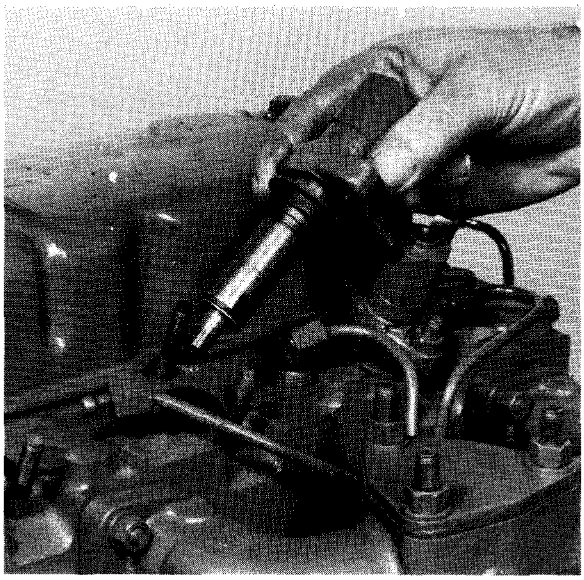


Fig. F2

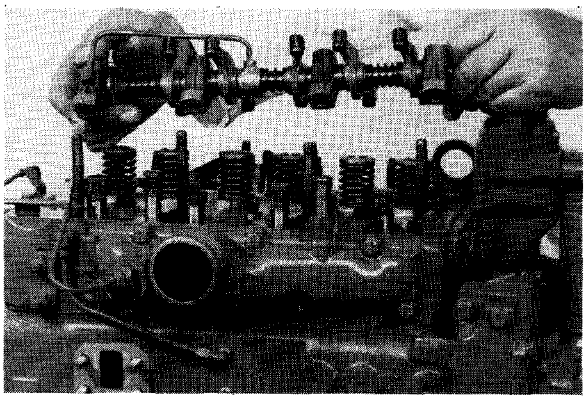


Fig. F3

To remove cylinder head

1. Drain the coolant from the radiator and cylinder block.
2. Disconnect the hose connection from the thermostat housing at the front of the cylinder head.
3. Remove crankcase vent valve and hose from cylinder head cover and induction manifold – 3.1522 engines only.
4. Remove coolant connections to and from exhaust manifold (flame-proof engines only).
5. Remove the air cleaner or filter, or disconnect the air inlet hose from the induction manifold.
6. Disconnect cold start equipment connections.
7. Remove the lubricating oil pipe from the camshaft housing to the cylinder head.
8. Disconnect the exhaust pipe from the exhaust manifold. Remove turbocharger (T3.1524 engines).
9. Disconnect and remove the high pressure fuel pipes from the fuel injection pump and atomisers. Fit suitable caps to the pump and atomiser connections.
10. Remove atomiser leak off pipes.
11. Remove atomisers (see figs. F1 or F2).
12. Where necessary, remove fuel filter and fuel pipe from filter to cold start aid. Remove clip which secures fuel pipe to rear of cylinder head.
13. Remove the cylinder head cover.
14. Disconnect lubricating oil pipe to rocker shaft and remove rocker shaft assembly with pipe (see fig. F3).
15. Remove the cylinder head nuts/setscrews in the reverse sequence to that given in figs. F15 or F16.
16. Remove the cylinder head (see fig. F4) and put it on a flat wood surface to prevent damage. Do not use a sharp tool between the cylinder head and the cylinder block.

To remove valves

Put a suitable mark on the face of each valve so that they can be fitted in their original positions if they are used again.

Compress the valve springs with a suitable valve spring compressor (see fig. F5) and remove the split collets. Tool 6118B with adaptor PD6118-3 can be used to compress the valve springs with the head on a flat surface.

Remove the spring caps, springs, seals and spring seats and the valves can be removed.

2. Remove the two bottom half thrust washers from the rear main bearing cap.
3. The two top half thrust washers can be removed by the use of a suitable piece of wood to push them out when the crankshaft is turned (see fig. J3).
4. To fit new thrust washers, lightly lubricate the two top halves with clean lubricating oil and push one into the recess on each side of the rear main bearing housing. The steel side of the thrust washers must be towards the bearing housing.
5. Renew the main bearing cap 'O' rings (lip seal crankshafts only). Lightly apply Perkins POWERPART Hylomar jointing compound to the rear main bearing cap mounting faces, outside the grooves machined in the faces (see fig. J7). The jointing compound must not go into the grooves.
6. Fit a bottom half thrust washer on each side of the rear main bearing cap and fit the cap.
7. Tighten the main bearing setscrews to the torque given on page C3. Check crankshaft end clearance (see fig. J4).
8. Fit rear oil seal housing, flywheel, sump and other components as given in this workshop manual.

To remove crankshaft

1. Remove sump and lubricating oil pump (see Section M).
2. Remove water pump (see Section N).
3. Remove crankshaft pulley.
4. Remove timing case front cover and remove idler gear.
5. Remove starter motor, flywheel and flywheel housing. Before the flywheel is removed, fit two guide studs in the crankshaft flange to give support when the flywheel is removed.
6. Remove connecting rod caps and big end bearings.
7. Remove the bolts which fasten the two halves of the rope seal housing or remove the lip seal housing.
8. Remove the main bearing setscrews and the main bearing caps and bottom half bearings. Keep the bearings and caps together.
9. Lift out the crankshaft (see fig. J5) and remove the top half main bearings. Make a mark on the bearings to ensure that they are fitted to their original positions.

If it is necessary to remove the crankshaft gear, ensure that the timing mark is to the front of the gear when it is fitted. The distance piece between the gear and crankshaft must be fitted with the chamfer to the inside.

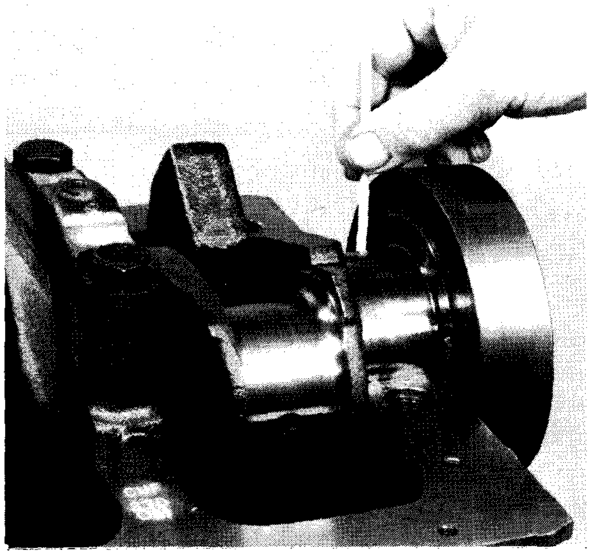


Fig. J3

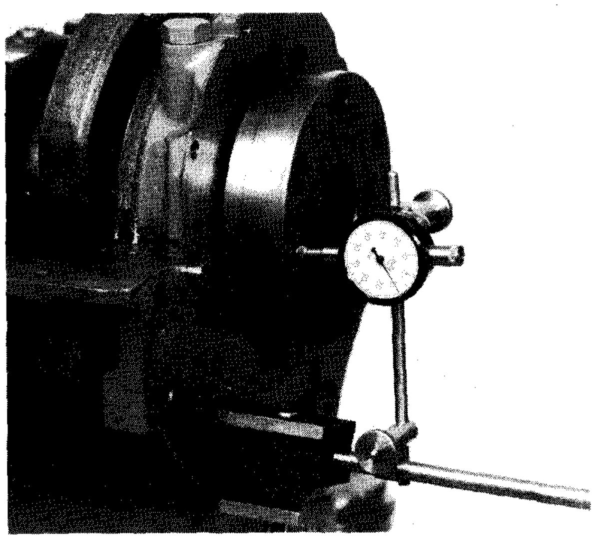


Fig. J4

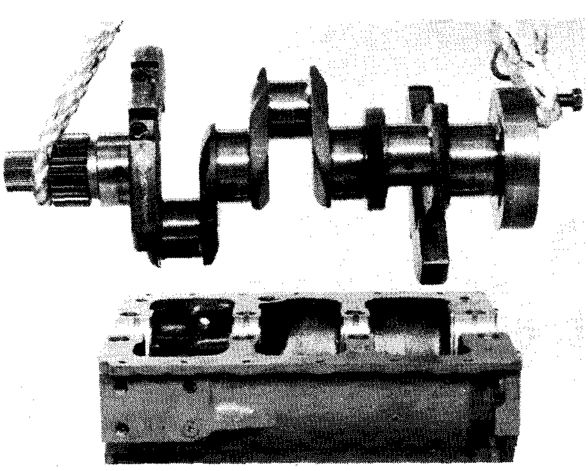


Fig. J5

If the main bearings are to be used again, they must be suitably marked to ensure they are fitted in that same positions from which they were removed.

Balance weights

If it is necessary to renew crankshaft balance weights. These are normally supplied in sets of two and must be fitted as a set. Where one weight is renewed, then the weight difference must not exceed 28.3 g (1 oz).

Crankshaft overhaul

The main journals and crankpins of a standard crankshaft can be machined 0,25 mm (0.010 in), 0,51 mm (0.020 in) or 0,76 mm (0.030 in) undersize on diameter. Special bearings are available for these undersize journals and pins.

Note: Crankshafts fitted to all 3.1522, 3.1524 and T3.1524 engines and crankshaft Part Nos. 31312718, 31312722 and 31313057 are Tufftrided and must be hardened by the Tufftrided process after they have been machined. If this is not possible, they can be nitrided for 20 hours, or if this is not possible, a new or Power Exchange crankshaft must be fitted.

Check the crankshaft for cracks before and after the crankshaft is machined.

Ensure that the fillet radii are machined correctly.

The finished sizes for corrected crankshafts are given below.

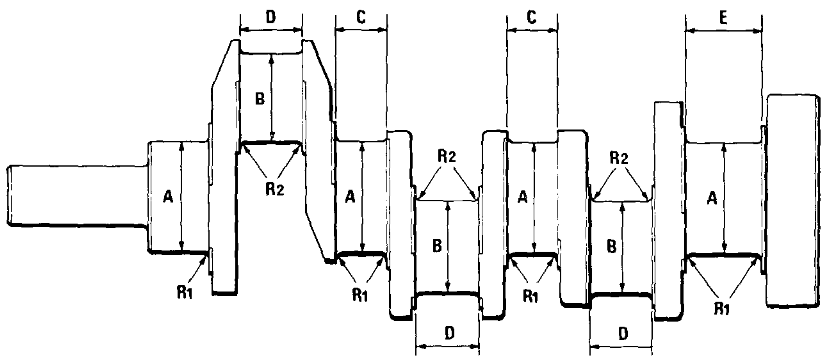


Fig. J6

	0,25 mm (0.010 in) Undersize	0,51 mm (0.020 in) Undersize	0,76 mm (0.030 in) Undersize
A	69,56/69,58 mm (2.7385/2.7393 in)	69,30/69,32 mm (2.7285/2.7293 in)	69,05/69,07 mm (2.7185/2.7193 in)
B	56,86/56,88 mm (2.2384/2.2392 in)	56,60/56,62 mm (2.2284/2.2292 in)	56,35/56,37 mm (2.2184/2.2912 in)
C	31,184 mm (1.22775 in) maximum		
D	40,00 mm (1.575 in) maximum		
E	Crankshafts with rope seal – 48,06 mm (1.892 in) maximum		
E	Crankshafts with lip seal – 47,27 mm (1.861 in) maximum		
R1	2,38/2,78 mm (0.0937/0.1093 in) all journals		
R2	3,97/4,36 mm (0.1562/0.1718 in) all crankpins		

Finished surface of journals and crankpins, 0,40 microns (16 micro inches). Fillet radii 1.3 microns (50 micro inches) centre line average maximum.

Magnetic crack check DC flow – 2 amps AC current – 1300 amps

Maximum taper and out of round for journals and crankpins —

Taper	0,009 mm (0.00035 in)	Out of round	0,010 mm (0.004 in)

Maximum run-out with crankshaft mounted on end journals —
Crankshaft pulley diameter (total indicator reading) 0,025 mm (0.001 in)
Rear oil seal diameter (total indicator reading) 0,025 mm (0.001 in)
Flywheel flange diameter (total indicator reading) 0,025 mm (0.001 in)

Journals (total indicator reading). Run-out must not be opposite.

Number 1	Number 2	Number 3	Number 4
Mounting	0,05 mm (0.002 in)	0,05 mm (0.002 in)	Mounting

After the crankshaft has been machined, removed any sharp corners from the lubricating oil holes.

To Remove and Fit Fuel Lift Pump, see Fig. N.8

Disconnect the inlet and outlet fuel pipes.

Remove the setscrews and retaining plates and remove the pump and joint.

If difficulty is encountered in removing the lift pump from the engine, turn the crankshaft to rotate the camshaft eccentric to a position which will enable the rocker arm to withdraw.

Fit pump using a new joint, ensuring that the mating faces are clean.

Damage can be caused to the pump operating lever if the pump is fitted to the engine with the pump driving eccentric on the camshaft in the maximum lift position. This problem is most likely if the four pump fasteners are not tightened evenly.

Therefore when the pump is fitted to an engine (especially a four bolt pump) ensure that the camshaft eccentric is on minimum lift, rotating the engine if necessary, and also that the pump fasteners are tightened evenly.

A loss of maximum engine power can occur if the lift pump is damaged during fitment.

The securing setscrews should be tightened to 20 lbf ft (2,8 kgf m) or 27 Nm and re-torqued when hot.

Re-connect pump inlet and outlet pipes.

Bleed the fuel system, Page N.7.

To Dismantle Fuel Lift Pump

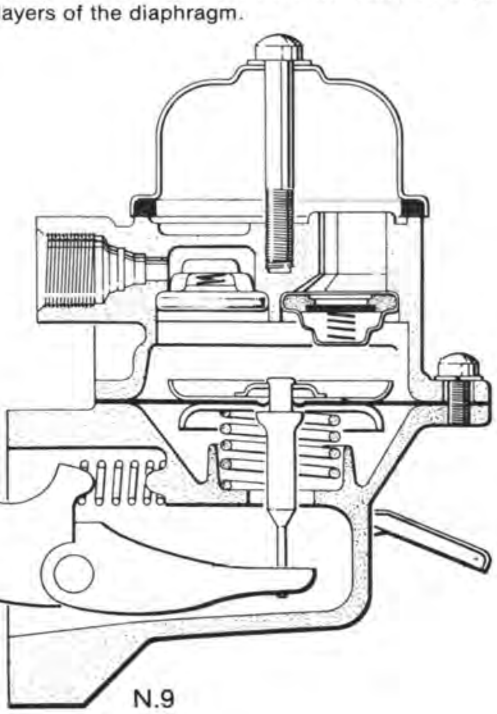
Clean exterior and file mark the flanges of top and bottom bodies for guidance in re-assembly. Remove the domed end cover and seal.

The gauze filter may now be lifted off.

Release the five setscrews securing the two halves of the pump and separate the two halves.

Turn the diaphragm assembly through 90° and lift the diaphragm and pull rod assembly from the body.

The diaphragm and pull rod assembly are serviced as an assembly and no attempt should be made to separate the layers of the diaphragm.



N.9

The valves are "staked in" and can be prised out using a screwdriver or other suitable tool. Clean the casting so that new valves can be correctly seated.

Press valves into position 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 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, see Fig. N.9

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

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

Fit the spring into its location and place the diaphragm and pull rod 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 link.

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 top half can now be placed in position with the file marks aligned.

N.10 **(C.A.V. Pump)**

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POWER
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All information in this guide is substantially correct at the time of printing but may be altered subsequently by the Company.

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Perkins
POWER SERVICE

Fault Finding Guide for Diesel Engines

Perkins
POWER

Fault Finding Guide for Diesel Engines

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Peterborough, England

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CONTENTS

INTRODUCTION

This Fault Finding Guide should assist in the identifying of the probable cause of the problems which can occur. Having identified the problem, a remedy can be applied.

The relevant Workshop Manual should be consulted for any required detail.

The fuel injection equipment fitted to diesel engines is manufactured to extremely tight tolerances and cannot tolerate the ingress of any dirt particles. Therefore, if the fuel injection equipment, such as the lift pump, the fuel injection pump or the atomisers are suspect, then the equipment should be removed from the engine to the specialised fuel injection equipment workshop for testing and repair, or new replacement components fitted.

WARNING

Removal of the seals, or the breaking of the seals, on fuel injection pumps, will render any warranty claim on an engine, null and void.

Before commencing any work on a Perkins engine, ensure that you understand what the complaint is. For example, if the user complains that the engine is knocking, can **you** hear the knock which is being complained about.

If it becomes necessary to use new parts, ensure that the parts you use are genuine Perkins Parts. Your authorised Perkins parts counter will supply the proper part against the Perkins engine serial number.

STARTING PROBLEMS

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LOW CRANKING SPEED

INCORRECT GRADE OF LUBRICATING OIL	Check with the user or his supplier that the oil brand and viscosity is in accordance with the approved list. See the relevant Service Literature.
BATTERY CAPACITY LOW (VOLTAGE)	Ensure that the battery is to the manufacturer's specification. Check the battery capacity and replace if necessary.
BAD ELECTRICAL CONNECTIONS BETWEEN BATTERY, STARTER MOTOR AND EARTH	Check for corroded or loose connections. Clean, tighten or remake connections as necessary using the correct cable specification.
FAULTY STARTER MOTOR	Check the voltage drop at the starter motor with the starter switched on. Check with the manufacturer's specification.

- Voltage drop normal → Replace or repair starter motor
- Voltage drop excessive → Have auto-electrician investigate further

Perkins
INSTALLATION MANUAL

This publication supersedes the second edition of the General Installation Manual, publication 801 SER 0280 1164.

Publication TPD 1536, Issue 1

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Perkins Engines Company Limited, Peterborough PE1 5NA

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1

Installation Considerations

Engine Selection

Available Engine Power

When matching engine to machine it is essential that the real available installed engine power is considered and not the gross mean power offered by Perkins. A number of factors must be considered in this respect. Both the required auxiliaries and operating conditions, well as engine power variation within the published to tolerance band. Typical considerations may include:

- Engine Power tolerance nominal ±5%.
- Cooling Air Fan.
- Air Conditioning Compressor.
- Power Steering Pump.
- Auxiliary Hydraulic Pump.
- Transmission Efficiency.
- In addition ambient conditions affect the gross power output.
- Temperature of Inlet Air.
- Ambient Air Pressure includes altitude effects.
- Fuel Temperature at Engine Inlet.
- Fuel viscosity and Density.

These last 2 points are frequently not considered, but their significance is high. Engine power is directly related to fuel density. Depending on the fuel injection equipment used the effect of fuel temperature is typically 2% per 10°C change. In certain applications this presents a particular problem due to fuel heating in the engine/ fuel system. Installation, and it may be necessary to install a fuel cooling radiator to maintain adequate power.

The importance of these considerations can be related to the type of machine in which the engine is installed. In many mobile machines failure to consider all the factors will probably result in claims of poor machine performance. In other types hard facts become available. Agricultural tractors with P.T.O. facilities are frequently power checked using dynamometers, equipment such as air compressors and water pumps require a minimum power to allow the machine to operate at its design speed.

In the following sections related to more detailed power matching, the power considered must include consideration of all the above if a satisfactory machine performance is to result.

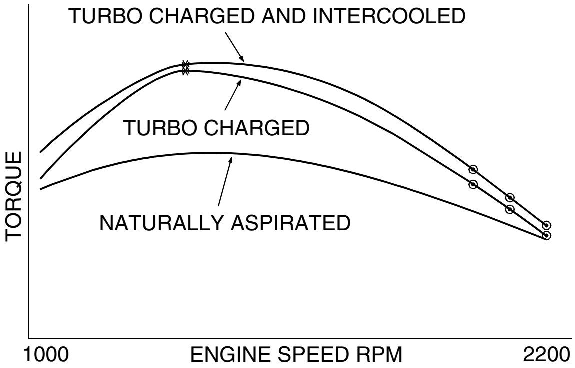
Power & Torque Matching

In order to give satisfactory performance the engine must be correctly matched to the power and torque requirements of the machine over its entire range of transient and steady state operation. The practice, still common, of selecting an engine purely on maximum power and torque is very rarely adequate, and is the prime source of customer 'Low Power', 'Poor Response' type of complaints.

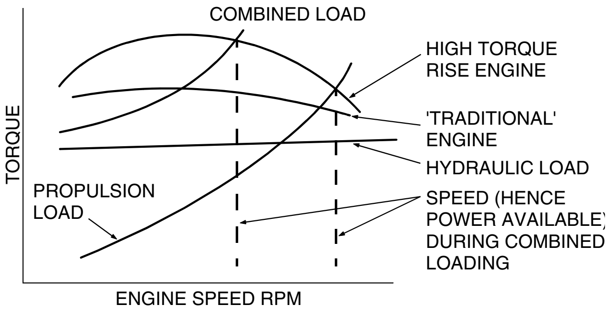
As engine specific outputs have increased both through improved combustion and breathing and especially by turbocharging plus aftercooling for the higher ratings, the available torque characteristics have been significantly modified.

The diagram below shows a comparison of typical curve shapes, for reference a typical curve of a traditional naturally aspirated engine also shown.

Typical 'Traditional' Naturally Aspirated Engine

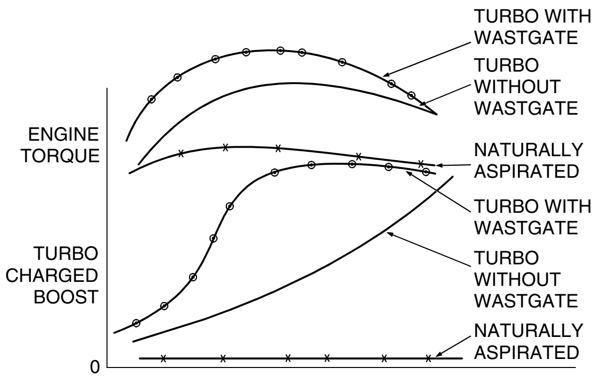


The increase in mid speed torque when related to maximum power has obvious advantages for machines such as agricultural tractors with mechanical transmissions. It also gives considerable benefit to machines using hydrodynamic (torque converter) and hydrostatic transmissions and which also have hydraulically operated equipment such as lifting forks and buckets etc. fitted. The diagram shows how under combined hydraulic load and propulsion load the performance is improved.



Low Speed Operation (Below 1000rpm)

In taking advantage of the improved torque characteristics available care must be taken to avoid problems if the engine is loaded at low rpm. Despite modern advantages in engine and turbocharger design, including the use of wastegates to improve the operating speed range of turbocharged engines it is inevitable that at very low speeds the boost level of a turbocharger is reduced and the fuel quantity which can be burned and corresponding engine torque approach the levels of a similar engine in naturally aspirated form.



As can be seen from the diagram the level of torque at very low speeds is much reduced in comparison with that available at high rpm. If the machine is expected to operate at very low speeds (below 1000 rpm) then the load which can be placed on the engine must consider this fact, and basing the load on the higher speed torque capability will lead to problems of stall out or at the very least a sluggish response.

Direction of Airflow

Cooling air flow may be in either direction through the radiator core, depending on the type of cooling fan used. It is important however that consideration should be given to the following factors when deciding on the most suitable flow direction for a particular installation:

- When possible, the direction of flow should be such that air temperature at entry to the radiator is as close as possible to ambient temperature. In general, this requirement will be met most satisfactorily by the use of a 'puller' i.e. suction type fan, since the case of a 'pusher' (pressure) type fan, pre-heating of the cooling air will take place due to passage over the engine surfaces.
- In mobile applications with significant forward velocity, the flow direction should be chosen to take advantage of the resulting 'ram' effect.
- Cooling fan efficiency and noise output is greatly affected by flow conditions at the fan inlet. In general, less obstructed flow conditions and improved inlet conditions will be achieved with a puller type fan, since this is not subjected to the obstruction imposed by the engine in the case of a pusher fan installation.
- Although the use of a puller (suction) fan will in general result in a more efficient cooling system, the following factors should be taken into account:

  In the case of enclosed installations, under bonnet/engine enclosure air temperature will be relatively high.

  For certain applications, e.g., earthmoving and construction machinery, operating in high sand/dust environments, the use of a 'puller' fan may be unsuitable, due to the likelihood of radiator plugging and sand blasting.

  In a number of applications a puller fan is not suitable, since due to the layout of the machine, the operator would be subjected to high temperatures due to the warm air leaving the radiator.

  In rear engined applications with significant forward speed, the 'ram' effect due to forward motion may oppose the flow of cooling air from a 'puller' fan (if the engine faces towards the rear), and careful ducting of the cooling air flow is necessary in order to prevent possible adverse effects.

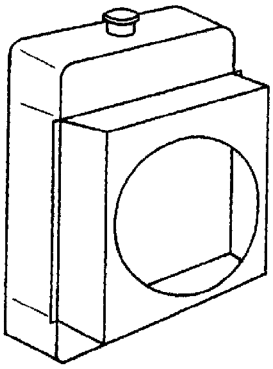
Fan Cowls

In all installations, the use of an efficient fan cowl is essential, since this will enable the most effective use to be made of the available core area, and will also assist in the prevention of recirculation of cooling air.

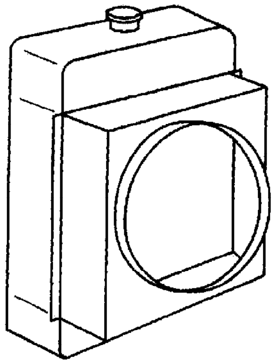
The use of an efficient cowl will, in many cases, make it possible to use a lower cooling air flow rate, while still achieving satisfactory cooling, and so reduce the cooling fan power requirement and noise emission.

The various types of fan cowl are illustrated.

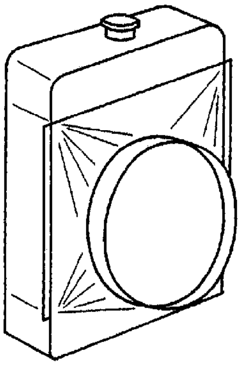
Typical Fan Cowl Types



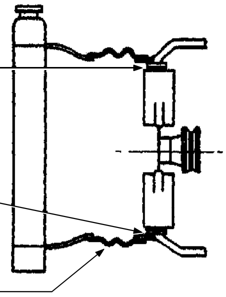
'BOX' COWL



'BOX' COWL WITH RING



'SHAPED' COWL



ENGINE-MOUNTED FAN RING WITH FLEXIBLE GAITER

Type 1

This is the simplest, and least expensive type of cowl, and is suitable for general use in installations where the system restriction (and hence fan working pressure) is relatively low.

Normally, this will apply to installations where radiator pressure drop is low, due to the use of a low number of tube rows, and moderate cooling air flow rate.

Type 2 and 3

In cases where the system pressure drop is higher, as in installations using radiator cores with a higher number of tube rows, and possibly also close fin spacing, greater efficiency will be achieved by the incorporation of a fan 'ring' on the cowl, as shown. This assists in the prevention of air 'leakage' at the fan tip, and allows the fan to build up the required working pressure. The width of the ring should be equal to approximately half the projected fan blade width.

In general, optimum results will be obtained with the 'shaped' cowl design (3) due to the improved flow distribution over the radiator core, but this type is more expensive to produce.

Type 4

In installations where there is considerable relative movement between the fan and radiator cowl, as in the case of some flexibly mounted engines, the arrangement shown may be used, in order that fan tip clearance may be kept to a minimum (see Cooling Fan Tip Clearance).

Fan/Cowl Relationship

The position of the cooling fan relative to the cowl has a considerable effect on efficiency. In many cases, the optimum position will be established by adjustment during cooling tests, but in general, the relationships shown in the diagrams below have been found to give satisfactory results.

In cases where the overall airflow restriction is high, such as when the radiator is in series with other coolers it may be found that the fan adopts a radial as well as an axial flow. In such cases it may be advantageous to modify the relationship to encourage this. The fan manufacturer's advice should be sought.