workshop manual for 4.154 diesel engines

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This publication is written for world-wide use. In territories where legal requirements govern smoke emission, noise, safety factors etc., then all instructions, data and dimensions given must be applied in such a way that, after servicing, (preventive maintenance) or repairing an engine, it does not contravene the local regulations when in use.

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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, have been omitted in order to avoid repetition. Where the removal, dismantling, assembly or refitting of a part is straightforward it is omitted from the text. Similarly, references to renewing joints, cleaning joint faces, cleaning before inspection and re-assembly and removal of burrs and scale have largely been omitted, it being understood that these procedures will be carried out where applicable. It follows that any open ports of high precision components, e.g. fuel injection equipment, exposed by dismantling, will be blanked off until re-assembled, to prevent the ingress of foreign matter. The difference between the minimum and maximum dimensions which are given in the Manufacturing Data and Dimensions for the relevant component parts quoted in each of the sections in this manual is known as "the manufacturing tolerance". This tolerance is necessary as an aid to manufacture and its numerical value is an expression of the accuracy of the desired quality of workmanship.

If when carrying out a major overhaul it is found that a bush and corresponding shaft have worn and that the majority of wear has taken place in the bush it may be necessary to renew the bush only; however, good workshop practice will ensure that consideration will be given as to the advisability of returning worn parts to service with an expectation of life that will involve labour costs at an early date.

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 as viewed from the rear or flywheel end of the engine.

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SAFETY PRECAUTIONS

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

- Only use these engines in the type of application for which they have been designed.
- Do not change the specification of the engine.
- Do not smoke when you put fuel in the tank.
- Clean away fuel which has been spilt. Material which has been contaminated by fuel must be moved to a safe place.
- Do not put fuel in the tank while the engine runs (unless it is absolutely necessary).
- Do not clean, add lubricating oil, or adjust the engine while it runs (unless you have had the correct training; even then extreme caution must be used to prevent injury),
- Do not make adjustments that you do not understand.
- Ensure that the engine does not run in a location where it can cause a concentration of toxic emissions.
- Other persons must be kept at a safe distance while the engine, or equipment, is in operation.
- Do not permit loose clothing or long hair near moving parts.
- Keep away from moving parts during engine operation. Attention: Some moving parts cannot be seen clearly while the engine runs.
- Do not operate the engine if a safety guard has been removed.
- Do not remove the filler cap of the cooling system while the engine is hot and while the coolant is under pressure, because dangerous hot coolant can be discharged.
- Do not use salt water or any other coolant which can cause corrosion in the closed coolant circuit.
- Do not allow sparks or fire near the batteries (especially when the batteries are on charge) because the gases from the electrolyte are highly flammable. The battery fluid is dangerous to the skin and especially to the eyes.
- Disconnect the battery terminals before a repair is made to the electrical system.
- Only one person must control the engine.
- Ensure that the engine is operated 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 remove mobile equipment if the brakes are not in good condition.
- Ensure that the control lever 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.
- Read and use the instructions relevant to asbestos joints.
- 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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Section 'A'
GENERAL INFORMATION

ENGINE DATA

Type	Four Cylinder, Four Stroke, In-Line
Bore (Nominal, see page D.1.)	3.5 in (88,9 mm)
Stroke	4.0 in (101,6 mm)
Capacity	153.9 in^3 (2,523 litres)
Compression Ratio	21.5:1
Combustion System	Indirect Injection, Ante-Chamber (Perkins "H" type)
Firing Order	1 – 3 – 4 – 2
Valve Tip Clearance	0.012 in (0,30 mm) Cold

RATING DETAILS

Automotive type Applications

Hydraulic Governor	70 bhp (52 kw) at 3,600 rev/min
Maximum Torque	113 lbf ft (15.6 kgf m) at 2,000 rev/min

Agricultural type Applications

Mechanical Governor	62 bhp (46 kw) at 3,000 rev/min
Maximum Torque	113 lbf ft (15,6 kgf m) at 2,000 rev/min

Intermittently Operated Industrial Applications

Mechanical Governor	62 bhp (46 kw) at 3,000 rev/min
Maximum Torque	113 lbf ft (15,6 kgf m) at 2,000 rev/min

Variable Speed Light Duty Industrial Applications

Hydraulic Governor	70 bhp (52 kw) at 3,600 rev/min
Maximum Torque	113 lbf ft (15,6 kgf m) at 2,000 rev/min

Continuously Operated Industrial Applications

Mechanical Governor	55 bhp (41 kw) at 3,000 rev/min
Minimum Governed Speed	1800 rev/min

Note: The above ratings can vary according to application. For details of individual ratings, apply to Technical Services Department, Perkins Engines Ltd., Peterborough.

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PREVENTIVE MAINTENANCE

Operators of 4.154 engines are reminded that the following Preventative Maintenance schedule is general in application, therefore he should compare the routine maintenance for his engine with the schedule specified by the manufacturer of the application to which the engine is fitted, and where necessary adapt the shorter periods also bearing in mind that on stop-start low mileage work, the hours run are more applicable than the mileage covered.

Whilst we have given specific periods for preventive maintenance, you should have due regard for the local regulations concerning your vehicle or machine and ensure that the engine is operating within those regulations.

It is good engineering practice to check for water, fuel and lubricating oil leaks and the tightness of nuts, set-screws and hose clips at each servicing period.

It should be noted that the maintenance periods given are on the assumption that the fuel and lubricating oils are to the specifications given in this workshop manual.

DAILY OR EVERY 8 HOURS whichever is soonest.

Check level of coolant.

Check level of lubricating oil in sump (make sure the vehicle or machine is standing level).

Check lubricating oil pressure (where gauge is fitted).

In extreme dust conditions, empty dust bowl on dry type air cleaner.

Under adverse agricultural conditions, clean chaff screens, radiators and centrifugal pre-filters.

4,000 MILES (6,000 km) 150 HOURS or 3 MONTHS, whichever is the soonest.

Drain and renew lubricating oil — Lubricating oil must meet the approved specification. See engine fluids page in the appendix.

Renew element in lubricating oil filter.

Empty dry air cleaner dust bowl.

Check fan belt tension – For engines rated at above 3,000 rev/min the fan belt tension should be checked monthly.

Clean water trap.

Where fitted, lubricate dynamo rear bush.

12,000 MILES (18,000 km) 450 HOURS or 12 MONTHS, whichever is the soonest.

Tractor and Industrial applications, renew the final fuel filter element.

Check and adjust valve tip clearance.

Clean element of dry type air cleaner, or renew, (if not indicated earlier)

24,000 MILES (36,000 km) 900 HOURS

Vehicle Applications, renew the final fuel filter element.

72,000 MILES (108,000 km) 2,700 HOURS

Arrange for examination and service of proprietary equipment, i.e. Compressor/Exhauster, Starter Motor, Dynamo etc.

Service atomisers.

The Kilometre conversions of miles are not accurate. They are periods in Kilometres which should be used in place of miles in relevant countries.

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 coolant temperature of at least 140°F (60°C).

POST DELIVERY CHECKOVER

After a customer has taken deliveryof his engine, a general checkover must be carried out after the first 500/1,000 miles (800/1,600 km) or 20/40 hours in service and must include the retightening of the cylinder head setscrews in the correct sequence. With the engine thoroughly warmed through, the check-over comprises the following:–

1. Drain the lubricating oil sump and refill to the correct level with clean new engine oil (Do not overfill).
2. Renew lubricating oil filter element (canister).
3. Tighten the cylinder head setscrews in the correct sequence (see fig. B.2) and to the correct torque of 85 lbf ft (115 Nm. 11,75 kgf m).
4. Reset the valve tip clearances to 0.012 in (0,30 mm) (see page B.5).
5. Check oil feed to rockers.
6. Check the tension of the fan belt (see page K.2.)
7. Check the tightness of all external nuts, set-screws, mountings, hose clips, etc.
8. Start the engine and check for any fuel, coolant or lubricating oil leaks.
9. Adjust idling speed if necessary.

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To Remove the Cylinder Head

The following parts are bracketed to the cylinder head which will have to be detached before the cylinder head can be removed.

Lubricating oil filler tube.

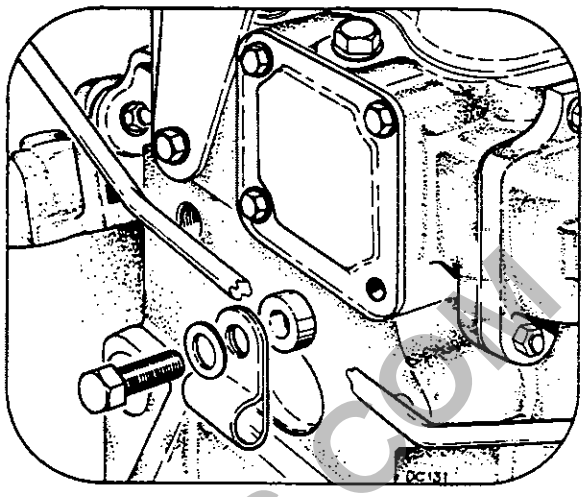
Engine breather pipe.

Fuel pipe from lift pump to fuel filter (bracketed to rear cover plate of cylinder head). See Fig. B.1.

Fuel filter.

Because the ROCKER ASSEMBLY is secured to the head by the cylinder head securing setscrews, it will be necessary to adopt the following procedure.

Remove the two self-locking nuts from studs locating in Nos. 1 and 7 rocker support brackets, counting from the front. Loosen all the cylinder head setscrews in the reverse order to that shown on Fig. B.2. Remove the seven setscrews securing the rocker assembly. The rocker assembly can now be removed.



B1

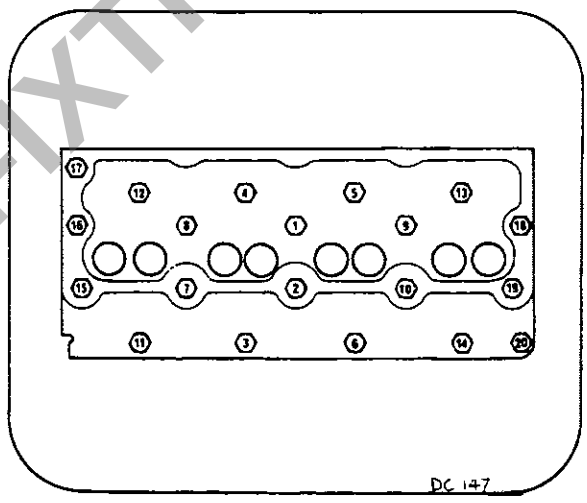
Valves

To remove the valve collets use a valve spring compressor and a suitable adaptor.

The valves are numbered to ensure refitment to their original positions. If servicing is necessary, check that the valve depths relative to the cylinder head face will be contained within the limits quoted on Page B.2. See Fig. B.3. Valve seat and valve angle is 45° for both inlet and exhaust valves. As narrow a seat as possible should be maintained.

When refitting the valve assembly into the cylinder head, take care that the rubber oil deflector on the inlet valve only is fitted onto the valve stem, open end facing downwards, under the valve spring cap, see Fig.B.3.

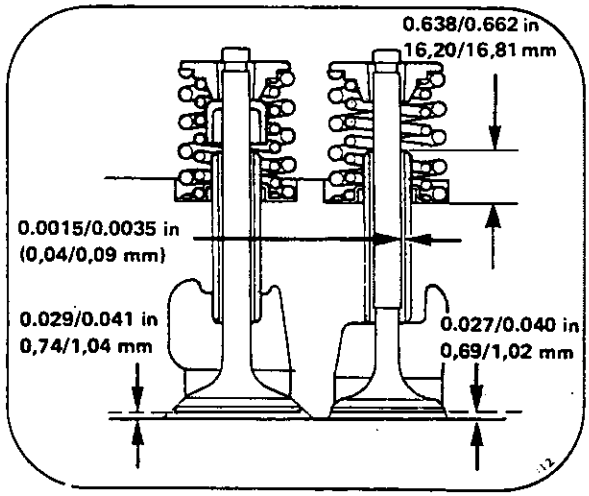
VALVE SEAT INSERTS cannot be fitted to the 4.154 engine.



B2

Valve Guides

When renewing valve guides, remove the worn guides by using a suitable dolly and press. For the replacement of new guides use a special tool with adaptor to pull in, but care must be taken that when the pulling in of the guide is commenced, the operation must be continued until the guide is fully home. If the pulling of the guide into its location is halted before the operation is completed, difficulty is likely to be experienced in restarting. Use of the special stop will ensure correct guide protrusion as quoted on Page B1, see Fig. B.3.



B3

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SERVICE WEAR LIMITS

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

Cylinder Head Bow	Transverse	0.003 in (0,08 mm) concave 0.005 in (0,13 mm) convex
	Longitudinal	0.006 in (0,15 mm)
Maximum Bore Wear (when reboring or new liners are necessary)		0.006 in (0,15 mm)
Crankshaft Main and Big End Journals	Ovality	0.0005 in (0,01 mm)
	Wear	0.001 in (0,03 mm)
Maximum Crankshaft End Float		0.020 in (0,51 mm)
Valve Stem to Guide Bore Diametrical Clearance	Inlet	0.005 in (0,13 mm)
	Exhaust	0.006 in (0,15 mm)
Valve Head Thickness at Outer Edge		0.045 in (1,14 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		0.015 in (0,38 mm)
Idler Gear End Float		0.015 in (0,38 mm)
Max. Top Piston Ring Lift		0.008 in (0,20 mm)

RECOMMENDED TORQUE TENSIONS

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

Component	Screw Size	lbf ft	kgf m	Nm
Cylinder Head Setscrews (also Secure Rocker Shaft bracket)	1/2 in	85	11,7	115
Main Bearing Setscrews	1/2 in	85	11,7	115
Connecting Rod Nuts (non phosphated)	7/16 in	45	6,2	61
Connecting Rod Nuts (phosphated)	7/16 in	60	8,3	82
Flywheel Setscrews	1/2 in	80	11,1	108
Crankshaft Pulley Retaining Setscrews	5/8 in	123	17,0	166
Power Take-off Pulley Setscrews	3/8 in	32	4,5	43
Camshaft Gear Setscrew	1/2 in	50	6,9	68
Idler Gear Hub to Cylinder Block Nuts	5/16 in	21	2,9	28*
Dynamo Pulley Nut	7/16 in	20	2,8	27
Alternator Pulley Nut	7/16 in	30	4,15	41
Atomiser Securing Nut	5/16 in	12	1,7	16
Lubricating Oil Filter Bowl Securing Setscrews	1/2 in	10	1,38	13
Fuel Pump Drive Gear Securing Setscrews	5/16 in	21	2,9	28
Atomiser Securing Nuts		12	1,7	16
High Pressure Fuel Pipe Nuts		15	2,1	20
Thermostart		10	1,4	13,6

If Connecting Rod Nuts are removed, they should be replaced by new ones.

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fault finding chart

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

KEY TO FAULT FINDING CHART

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

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