workshop manual for 4.192, 4.203 & D4.203 diesel engines

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Perkins Engines Limited
Peterborough England
1981

Publication no. 601SER06811010

This publication supersedes the previous edition numbered 601 SER03791010 and includes Amendment: Page Sets 1 and 2 issued in 1984 and 1989.

This publication is written for world wide use. In territories where legal requirements govern engine 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.

Published by Perkins Engines Limited
and Printed in England

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This Publication is produced by the Service Publications Department of Perkins Engines Ltd., and every endeavour is made to ensure that the information contained in this Manual is correct at the date of publication but due to continuous developments, the manufacturers reserve the right to make alterations without notice.

USE ONLY GENUINE PERKINS PARTS

TO ENSURE YOU OBTAIN THE BEST RESULTS FROM YOUR ENGINE AND TO SAFEGUARD YOUR OWN GUARANTEE, FIT ONLY GENUINE PERKINS PARTS. THESE ARE READILY OBTAINABLE THROUGHOUT THE WORLD.

SAFETY PRECAUTIONS

THESE SAFETY PRECAUTIONS ARE IMPORTANT. Refer also the the local and government regulations applicable in your jurisdiction.

Do not use these engines in marine applications.

Do not modify the engine.

Do not smoke when refuelling.

Always remove spilt fuel and soaked clothing to a safe place.

Do not refuel whilst the engine is running (unless absolutely necessary).

Never clean, lubricate or adjust the engine whilst it is running (unless qualified to do so, in which case, extreme care should be taken to avoid injury).

Do not attempt any adjustments you do not understand.

Ensure the engine is positioned so as to prevent a build-up of toxic emissions.

Warn persons in the area to keep well clear during engine and equipment or vehicle operation.

Do not wear loose clothing or allow long hair near moving machinery.

Keep well clear of rotating parts or machinery in operation. Note that fans are not clearly visible whilst the engine is running.

Do not run the engine with any safety guards removed.

Do not remove the radiator cap whilst the engine is hot and the coolant is under pressure as scalding can result.

On no account should sea water or any other electrolytic or corrosive medium be used in the cooling system.

Keep sparks or flames away from batteries as the gases from the electrolyte (especially whilst the battery is under charge) are highly inflammable. This acid is also dangerous to the skin and especially the eyes.

Always disconnect the battery terminals before repairing or interfering with the electrical system.

Only one person should be in control of the engine.

Always operate the engine from the control panel or operators seat.

If your skin comes into contact with high pressure fuel, seek medical attention immediately.

Diesel fuel can cause skin infection to some people. Use protective gloves or hand cream.

Do not move mobile equipment without first ensuring that the brakes are in good working order.

Ensure that the transmission drive control is in "Out of Drive" position before starting the engine.

Fit only genuine Perkins Parts.

SAFETY IS SENSE. USE IT.

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SECTION B
Technical Data

Type	Four Cylinder, Four Stroke
Combustion System 4.192/4.203	Indirect Injection
Combustion System D4.203	Direct Injection
Bore 4.203/D4.203	3.6 in (91,44 mm)*
Bore 4.192	3.5 in (88,9 mm)*
Stroke	5 in (127 mm)
Cubic Capacity 4.203/D4.203	203 in³ (3,33 Litres)
Cubic Capacity 4.192	192 in³ (3,14 Litres)
Compression Ratio 4.192	16.5 : 1
Compression Ratio 4.203	17.4 : 1
Compression Ratio D4.203	18.5 : 1
Firing Order	1, 3, 4, 2.
Tappet Clearances (4.192, 4.203 and D4.203 prior to Engine No. JE. . . U564083G)	
Inlet and Exhaust	0.012 in (0,30 mm) Cold
Tappet Clearances (D4.203 from Engine No. JE. . U564083G)	
Inlet	0.008 in (0,20 mm) Cold
Exhaust	0.012 in (0,30 mm) Cold

*Nominal—for actual bore size, refer to inside diameter of finished liner. Page B.3.

Engine Ratings

4.192

Vehicle Engine.....60 bhp (45 kW) at 2,600 rev/min
Maximum Torque .....143 lbf ft (19,7 kgf m)
Agricultural Engine.....54 bhp (40 kW) at 2,250 rev/min
Maximum Torque .....143 lbf ft (19,7 kgf m)
*Industrial Engine (Mech. Governor).....50 bhp (37 kW) at 2,000 rev/min
Maximum Torque .....143 lbf ft (19,7 kgf m)
*Industrial Engine (Hyd. Governor).....58 bhp (43 kW) at 2,400 rev/min
Maximum Torque .....143 lbf ft (19,7 kgf m)
*Maximum intermittent rating varies according to application.

4.203

Vehicle Engine.....63 bhp (47 kW) at 2,600 rev/min
Maximum Torque .....147 lbf ft (20,3 kgf m)
Agricultural Engine.....57 bhp (42 kW) at 2,250 rev/min
Maximum Torque .....151 lbf ft (20,9 kgf m)
*Industrial Engine (Hyd. Governor).....60 bhp (45 kW) at 2,400 rev/min
Maximum Torque .....141 lbf ft (19,5 kgf m)
*Industrial Engine (Mech. Governor).....53 bhp (39 kW) at 2,000 rev/min
Maximum Torque .....151 lbf ft (20,9 kgf m)
*Maximum intermittent rating varies according to application.

D4.203

Agricultural Engine.....56 bhp (41 kW) at 2,000 rev/min
Maximum Torque .....161 lbf ft (22,2 kgf m)

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Recommended Torque Tensions

	lb ft	kgf m	Nm
Cylinder Head utilising nuts only	60	8,3	81
Cylinder Head utilising nuts and setscrews	70	9,7	95
Cylinder Head utilising setscrews with integral head washer	80	11,1	108
Connecting Rod Nuts (Phosphated – dull black)	60	8,3	81
Connecting Rod Nuts (Cadmium Plated – silver)	45	6,2	61
Connecting Rod Nuts (non-plated self locking)	70	9,7	95
Main Bearing Setscrews	115	15,9	156
Camshaft Gear to Camshaft Setscrew	21	2,9	28
Idler Gear Hub Retaining Nuts	21	2,9	28
Flywheel Setscrews	80	11,1	108
Water Pump Pulley Retaining Nut	55	7,6	74
Crankshaft Pulley Retaining Setscrew, 4,8mm thick washer	110	15,2	149
Crankshaft Pulley Retaining Setscrew, 8,9mm thick washer	240	33,0	225
Atomiser Securing Nuts	12	1,6	16
High Pressure Fuel Pipe Nuts	15	2,1	20
Thermostat with Adaptor	10	1,4	13

Engine Weights, Dry

4.192, 4,203 and D4.203 engines with standard basic accessories, i.e. water pump, fuel pump and generator.

Approximate weights	4.192		4.203	
Vehicle (non exhauster) and Vehicle based	lb.	(kg)	lb.	(kg)
Industrial and Agricultural engines	477	216,5	477	216,5
Industrial engines with standard cast iron sump	520	236	520	236
Agricultural engines with standard cast iron sump	520	236	520	236

Typical weights, dry, of standard, basic engines plus flywheel, housing, starter motor, air cleaner, fan and filters.

	4.192		4.203		D4.203	
	lb.	(kg)	lb.	(kg)	lb.	(kg)
Vehicle engines	635	288	635	288		
Agricultural engines with cast iron sump	744	338	745	338,4	745	338,4
Industrial engines with cast iron sump	712	323	712	323		

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 ft (600 metre)	No change
2,000— 4,000 ft (1200 metre)	6%
4,000— 6,000 ft (1800 metre)	12%
6,000— 8,000 ft (2400 metre)	18%
8,000—10,000 ft (3,000 metre)	24%
10.000—12.000 ft (3600 metre)	30%

*Measured at the pump setting speed as given in the Fuel Pump Setting Code.

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

For any further information, apply to Service Department, Perkins Engines Ltd., Peterborough, or to those Overseas Companies listed on page 2.

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CYLINDER HEAD—E.2

The Diesel engine rarely requires the removal of the cylinder head since, unlike its petrol counterpart, carbon deposits beyond a superficial coating do not accumulate in the combustion chambers. After a period, depending on the conditions under which the engine is operated, the valves and valve seats may need attention, this being indicated by a loss of power. A top overhaul is then necessary.

To Remove the Cylinder Head from the Engine

Ensure that the cooling system is completely drained. Drain taps or plugs are provided, one on the left hand side of the cylinder block and one usually at the base of the radiator.

Disconnect the water outlet hose from the thermostat housing.

Disconnect the exhaust pipe flange from the exhaust manifold.

Remove the lub. oil pipe between the camshaft chamber and the cylinder head.

Remove the air cleaner connection from the air intake and disconnect the fuel oil supply pipe and the electrical connection from the cold starting aid.

Remove the fuel injection pipes taking care to cover the fuel injection pump outlets with suitable caps or clean non fluffy cloth.

Disconnect the atomiser leak-off pipes and remove the atomisers.

Disconnect fuel pipe support clip from rear of cylinder head (where fitted).

Remove the rocker cover and rocker assembly together with its lub. oil supply pipe.

Remove the cylinder head securing nuts and/or set-screws slackening off in the reverse order to that shown in Fig. E.13 or E.14.

When removing the cylinder head, it is advisable not to force steel wedges (i.e. screwdrivers etc.) between the cylinder head and the cylinder block, otherwise damage may be caused to the machined faces.

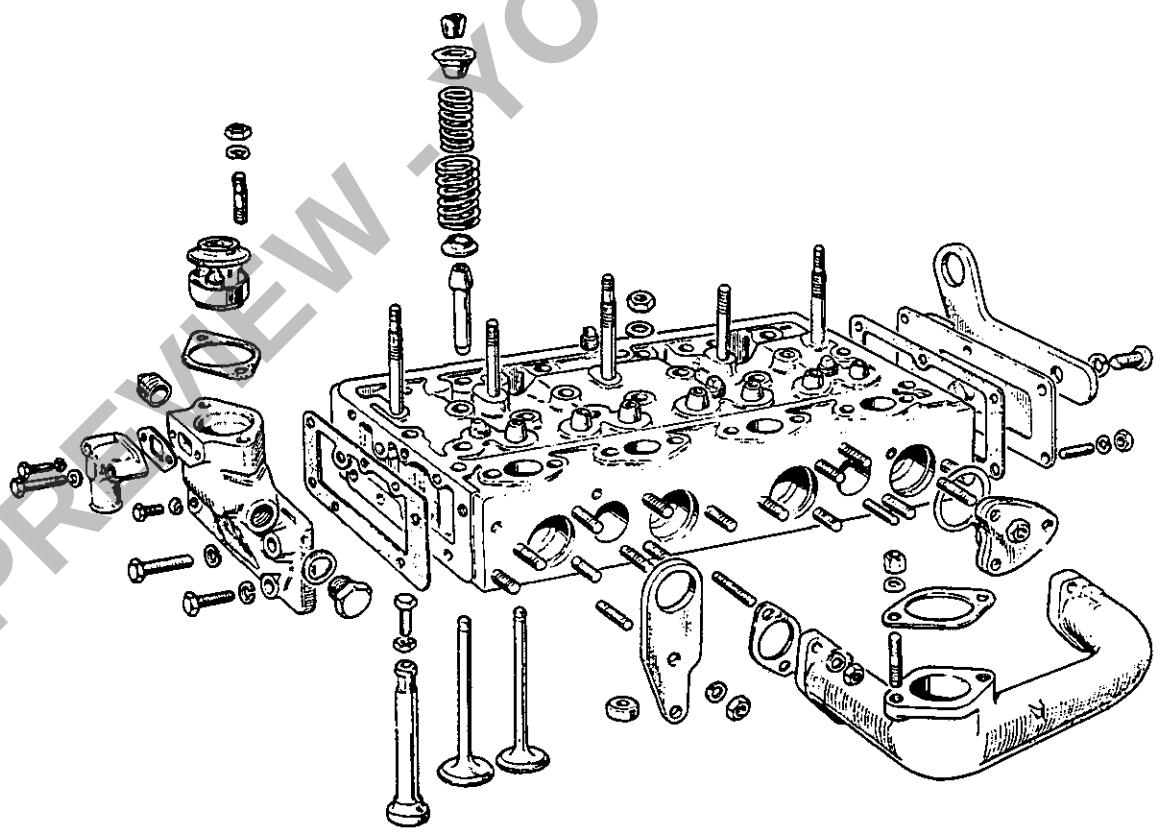


Fig. E.1.
Exploded view of Cylinder Head Assembly.

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FAULT FINDING—D.2

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, 39, 40, 42, 43, 44, 58.
Knocking	9, 14, 16, 18, 19, 22, 26, 28, 29, 31, 33, 35, 36, 45, 46, 59.
Erratic running	7, 8, 9, 10, 11, 12, 13, 14, 16, 20, 21, 23, 26, 28, 29, 30, 33, 35, 45, 59.
Vibration	13, 14, 20, 23, 25, 26, 29, 30, 33, 45, 47, 48, 49.
High oil pressure	4, 38, 41.
Overheating	11, 13, 14, 16, 18, 19, 24, 25, 45, 50, 51, 52, 53, 54, 57.
Excessive crankcase pressure	25, 31, 33, 34, 45, 55, 60.
Poor compression	11, 19, 25, 28, 29, 31, 32, 33, 34, 46, 59.
Starts and stops	10, 11, 12.

Key to Fault Finding Chart

1. Battery capacity low.
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. Incorrect 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 pipe.

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PREVENTIVE MAINTENANCE

Operators of engines are reminded that the following preventive maintenance periods are general in application. They should be compared with the schedules specified by the manufacturer of the application to which the engine is fitted and where necessary, the shorter periods should be adopted.

With vehicles operating on stop-start low mileage work, the hours worked are more important than the miles run.

It is good maintenance practice for the checking of coolant, oil or fuel leaks and the tightness of nuts, setscrews and hose clips at each servicing period.

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

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.

Daily or Every 8 hours (Whichever occurs first)

Check coolant level.

Check sump level.

Check oil pressures (where gauge fitted).

In extreme dust conditions, clean oil bath air cleaner or empty dust bowl on dry type air cleaner.

Every 250 hours, 5,000 Miles (7,500 km) or 4 months (Whichever occurs first)

Drain and renew engine lubricating oil. (See list of approved lubricating oils in appendix).

Renew lubricating oil filter element or canister.

Clean oil bath air cleaner or empty dust bowl on dry type air cleaner.

Check drive belt tension.

Check for oil, water or fuel leaks.

Lubricate dynamo rear bush (where fitted).

Clean lift pump pre-filter (where fitted).

Every 500 hours, 10,000 Miles (15,000 km) or 12 months — (Whichever occurs first)

Renew final fuel element.

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

Every 2,500 hours, 60,000 Miles (90,000 km) (Whichever occurs first)

Arrange for examination and service of proprietary equipment i.e. compressor/exhauster, starter motor, generator etc.

Service atomisers.

Check and adjust tappets.

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PISTONS AND CONNECTING RODS—F.2

The pistons are of high silicon aluminium and are not graded to bore size. They are not interchangeable between the 4.192 and the 4.203 engine due to difference in bore size. Grooves are provided to take three compression rings and one oil control ring above the gudgeon pin and one oil control ring below the gudgeon pin. (See Fig. F.1). Later D4.203 engines are fitted with four ring pistons which do not have the lower oil control ring below the gudgeon pin.

Pistons for early D4.203 engines have a toroidal cavity in the crown, later engines have a flat bottom cavity in the crown.

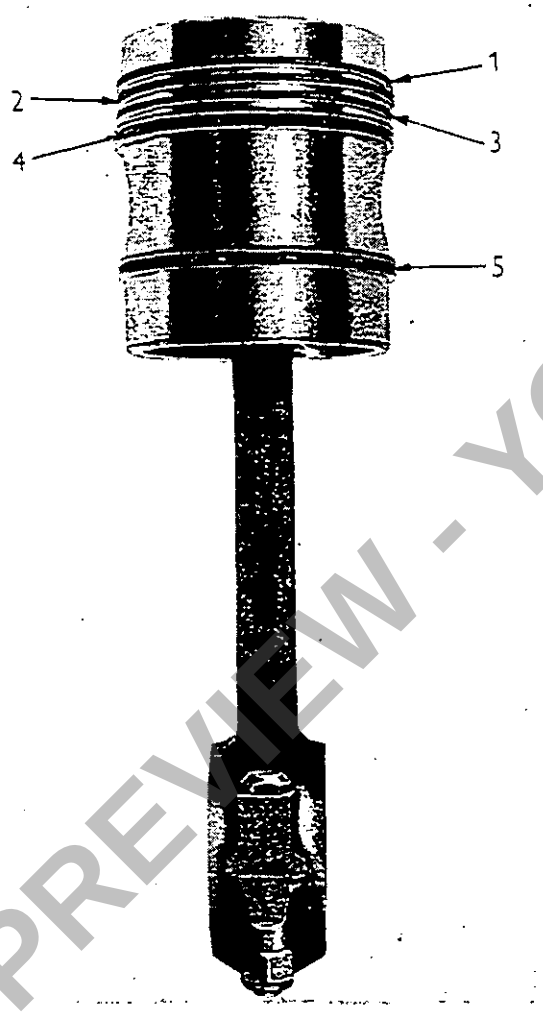


Fig. F.1.
Connecting Rod Assembly.

1. Top Compression Ring.
2. 2nd Compression Ring.
3. 3rd Compression Ring.
4. Upper Oil Control Ring.
5. Lower Oil Control Ring.

Pistons for the 4.192 engine can be obtained in two sizes, standard and plus 0.030 in (0,76 mm), it being possible to rebore the cast iron cylinder liners.

Pistons for the 4.203 and D4.203 can only be obtained in one size—standard—no reboring of the chrome or thin wall cast iron liners being possible.

The connecting rods are of high tensile steel 'H' section forgings. The big end is split at right angles to the axis of the rod, the cap being secured by two fitted bolts, secured by nuts. Thin wall pre-finished, steel backed plated, copper lead lined or aluminium tin lined big end bearings and lead bronze lined, steel backed wrapped small end bushes are fitted.

The connecting rods are numbered on cap and rod, (See Fig. F.1 and F.4) when fitted to the engine in production and the assembly is fitted to the crankshaft so that these numbers are on the fuel pump side of the engine. Always fit the cap to the connecting rod so that the numbers are both on the same side. Never reassemble the cap to the connecting rod incorrectly.

It is advisable when removing a piston assembly from the engine to check whether or not the connecting rod and cap has been suitably marked, as they may have been replaced at some time after the engine left the factory, in which case the numbering may not have been carried out. Such connecting rods and caps should be suitably marked.

To Remove a Connecting Rod and Piston Assembly

1. Remove the cylinder head assembly.
2. Remove the sump.
3. Turn the crankshaft until the piston to be removed is at the bottom of its stroke.
4. If necessary, remove the oil pump suction and delivery pipes.
5. Carefully remove any carbon that may have formed at the top of the cylinder bore.
6. Release and remove the nuts from the connecting rod bolts and remove the cap, bottom half of the big end bearings and the connecting rod bolts.
7. Turn the crankshaft until the piston is at the top of its stroke, push the piston and its connecting rod up the bore sufficiently to enable removal of the top half of the big end bearing. Continue to push the piston and connecting rod up and out of its bore. (See Fig. F.2).
8. Reassemble the bearings and cap to the connecting rod.

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Alternator

Models 15ACR, 18ACR, A115/45, A127 and LR Series

Precautions

The diodes in the alternator function as one-way valves and the transistors in the regulator/control box operate as fast switches. Both are accurate and sensitive.

They do not wear out and seldom require adjustment, because they are sensitive to voltage changes and high temperature, the precautions are vital to prevent them from being destroyed.

(a) DO NOT disconnect the battery whilst the engine is running. This will cause a voltage surge in the alternator charging system that will immediately ruin the diodes or transistors.

(b) DO NOT disconnect a lead without first stopping the engine and turning all electrical switches to the off position.

(c) DO NOT cause a short circuit by connecting leads to incorrect terminals. Always identify a lead to its correct terminal. A short circuit or wrong connection giving reverse polarity will immediately and permanently ruin transistors or diodes.

(d) DO NOT connect a battery into the system without checking for correct polarity and voltage.

(e) DO NOT "flash" connections to check for current flow. No matter how brief the contact the transistors may be ruined.

Maintenance

The alternator charging system will normally require very little attention, but it should be kept free from build-up of dirt, and a check made if it fails to keep the battery charged.

(a) Regularly inspect the driving belts for wear and correct tension. It is important to ensure that all belts on a multiple belt drive have equal tension and are each carrying their share of the load. Slack belts will wear rapidly and cause slip which will not drive the alternator at the required speed. Drive belts which are too tight impose severe side thrust on the alternator bearings and shorten their life. Periodically ensure that the alternator is correctly aligned to the drive.

(b) Do not replace faulty belts individually in a multi-belt system. A complete matched set of drive belts must always be used.

(c) Keep the alternator clean with a cloth moistened in kerosene or cleaning fluids. Ensure that ventilation slots and air spaces are clear and unobstructed.

(d) Remove any dirt accumulated on the regulator/control box housing, and ensure that cooling air can pass freely over the casing.

Testing the 15ACR and 17ACR in Position

First check the driving belt for condition and tension. The nominal hot outputs at 6,000 rev/min (alternator speed) are 28 amps and 36 amps for 15ACR and 17ACR respectively. These figures may be exceeded slightly when the alternator is running cold. To avoid misleading results, the following test procedure should therefore be caried out with the alternator running as near as possible to its normal operating temperature.

NOTE: De-rated 17ACR alternators, giving a hot output of 25 amps may be fitted to combine harvesters and similar applications where the engine is operating in dusty conditions.

Alternator Output Test with Regulator Inoperative

Withdraw the cable connector(s) from the alternator, remove the moulded cover (secured by two screws) and earth the regulator green lead or connector strip to frame.

Connect an external test circuit to the alternator output terminals as shown in Fig. Q.1, Q.2, or Q.3.

Value of components in Figs. Q.1, Q.2 and Q.3 are as follows:—

1. 12 volt 2.2 watt bulb.
2. 0—60 ammeter.
3. 12 volt battery.
4. 0—20 moving coil voltmeter.
5. 0—15 ohm 35 amp variable resistor.

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

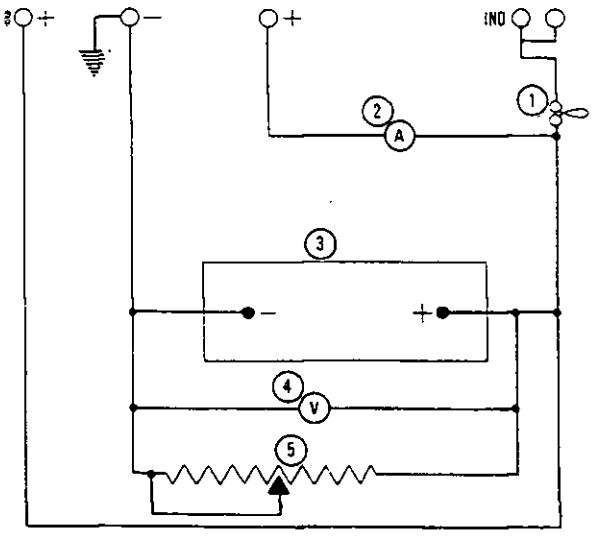


Fig. Q.1.
Test Circuit for 15ACR and 17 ACR Alternators.
Standard terminations, battery-sensed.

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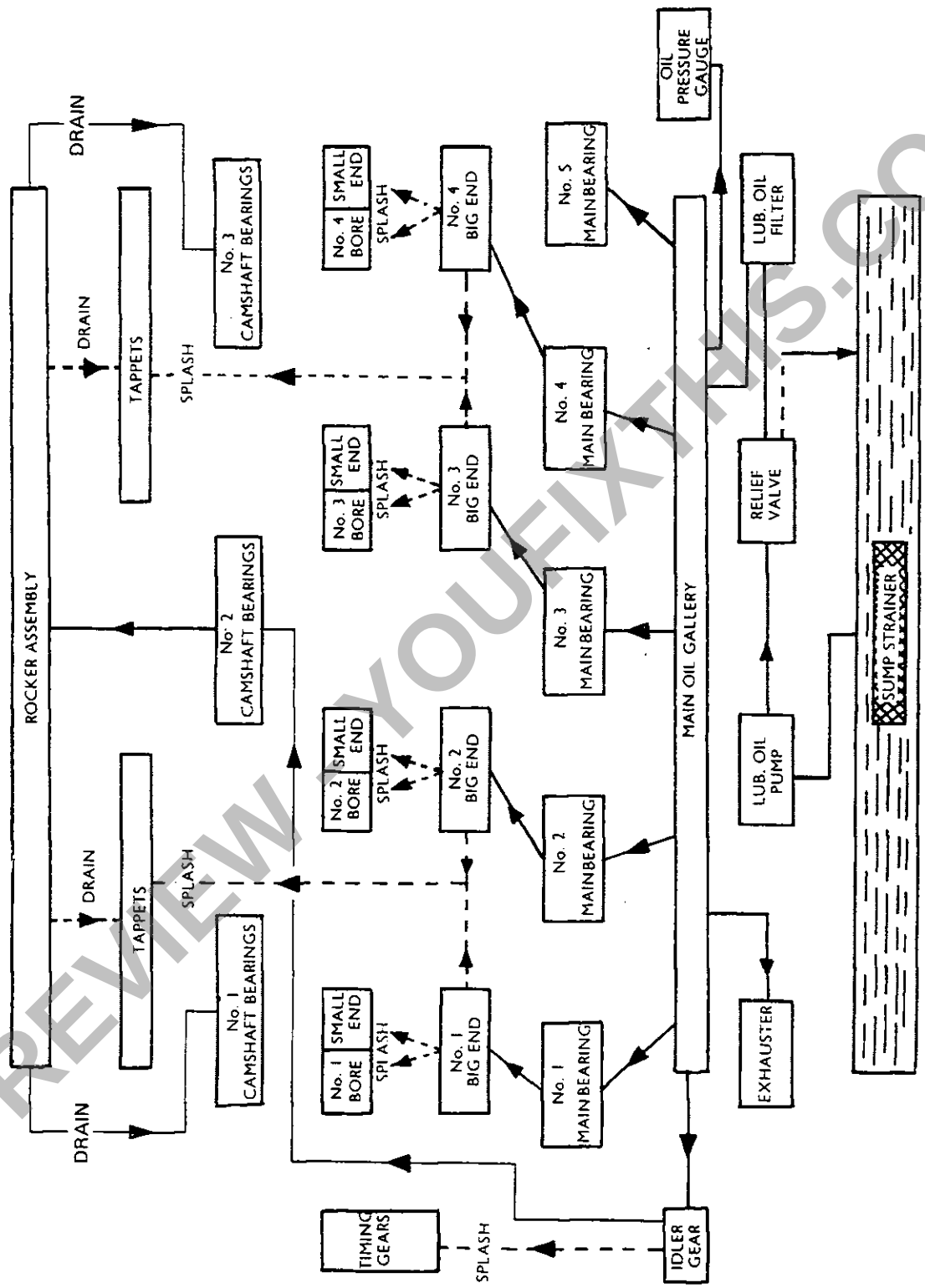


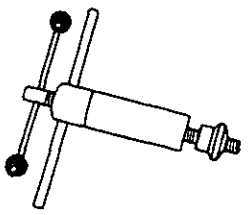
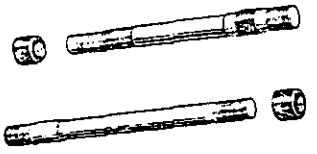
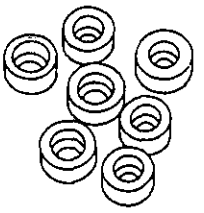
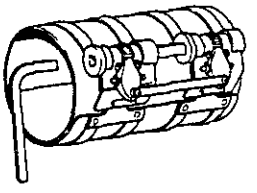
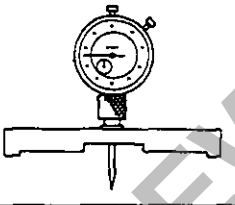
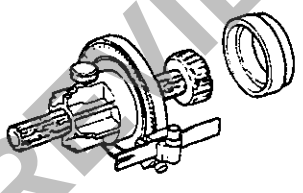
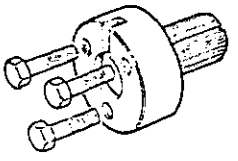
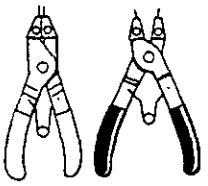
Fig. L.1. Lubricating Oil Diagram.

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APPROVED SERVICE TOOLS

The majority of these tools are available from your Perkins Distributor. Those marked with an asterisk are available from V. L. Churchill & Co. Ltd., Daventry, Northamptonshire, NN11 4NF, England.

	Tool No.	Description
	21825026	VALVE GUIDE REMOVER AND REPLACER (MAIN TOOL)– EARLY ENGINES ONLY
	21825027	ADAPTOR FOR 21825026 A pair of puller bars fitted with knurled nuts. Suitable for 5/16" and 3/8" guides.
	21825029	ADAPTOR FOR 21825026 A 15 mm (19/32 in) distance piece used to replace exhaust valve guides to a set height.
	21825033	ADAPTOR FOR 21825026 A 9,5 mm (3/8) distance piece used to replace inlet valve guides to a set height.
	21825018	PISTON RING SQUEEZER
	21825019	PISTON HEIGHT AND VALVE DEPTH GAUGE A simple method of quickly checking piston height.
	MS.67B*	UNIVERSAL TIMING GAUGE For checking fuel injection pump timing.
	PD.67B-1*	ADAPTOR FOR MS.67B For use with mechanically governed fuel injection pump.
	21825017	CIRCLIP PLIERS (internal and external)

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