



Perkins 1100 Series

Models RE, RF, RG, RH, RJ and RK

WORKSHOP MANUAL

4 cylinder diesel engines for industrial, agriculture and construction applications



TEREX AMERICAS

Perkins 1100 Series

Models RE, RF, RG, RH, RJ and RK

WORKSHOP MANUAL

4 cylinder diesel engines for industrial, agriculture and construction applications

Publication TPD 1487E, Issue 1.

© Proprietary information of Perkins Engines Company Limited, all rights reserved.

The information is correct at the time of print.

Published in October 2002 by Technical Publications.

Perkins Engines Company Limited, Peterborough PE1 5NA, England

This publication is written in
Perkins Approved Clear English

PACE

Chapters

- 1 General information**
- 2 Specifications**
- 3 Cylinder head assembly**
- 4 Piston and connecting rod assemblies**
- 5 Crankshaft assembly**
- 6 Timing case and drive assembly**
- 7 Cylinder block assembly**
- 8 Engine timing**
- 9 Aspiration system**
- 10 Lubrication system**
- 11 Fuel system**
- 12 Cooling system**
- 13 Flywheel and housing**
- 14 Electrical equipment**
- 15 Auxiliary equipment**
- 16 Special tools**

The following pages contain a detailed table of contents

Contents

1 General information

Introduction	1
Engine views	2
Engine identification	3
Safety precautions	5
Engine lift equipment	7
Viton seals	8
POWERPART recommended consumable products	9

2 Specifications

Basic engine data	11
Data and dimensions	12
Thread sealant	29
Standard torque values	30
Specific torque values	31
Compression test data	34

3 Cylinder head assembly

General description	35
Atomiser cover	
Operation 3-1 To remove and to fit	36
Rocker cover	
Operation 3-2 To remove	37
Operation 3-3 To fit	38
Rocker assembly	
Operation 3-4 To remove and to fit	39
Operation 3-5 To dismantle and to assemble	40
Operation 3-6 To inspect and to correct	40
Valve tip clearances	
Operation 3-7 To check and to adjust	41
Valve springs	
Operation 3-8 To change the valve springs (with cylinder head fitted)	42
Cylinder head assembly	
Operation 3-9 To remove	44
Operation 3-10 To fit	46
Valves and valve springs	
Operation 3-11 To remove	49
Operation 3-12 To fit	50
Operation 3-13 To inspect and to correct	51
Valve guides	
Operation 3-14 To inspect	52
Operation 3-15 To remove	53
Operation 3-16 To fit	54
Cylinder head	
Operation 3-17 To inspect and to correct	56
Operation 3-18 To correct a valve seat with a valve seat cutter	57
Operation 3-19 To fit valve seat inserts	59

4 Piston and connecting rod assemblies

General description 61

Big end bearing

Operation 4-1 To remove 63

Operation 4-2 To fit 64

Operation 4-3 To inspect 64

Piston and connecting rod

Operation 4-4 To remove 65

Operation 4-5 To fit 66

Operation 4-6 To check the piston height above the cylinder block 68

Piston rings

Operation 4-7 To remove 69

Operation 4-8 To fit 69

Piston and connecting rod assembly

Operation 4-9 To dismantle 70

Operation 4-10 To assemble 71

Operation 4-11 To check the length of a connecting rod 72

Piston and piston rings

Operation 4-12 To inspect 73

Connecting rod

Operation 4-13 To inspect 74

Partially finished small end bush

Operation 4-14 To remove and to fit 75

Piston cooling jets

Operation 4-15 To remove and to fit 76

Operation 4-16 To check the jet alignment 76

5 Crankshaft assembly

General description 77

Crankshaft pulley

Operation 5-1 To remove and to fit 78

Rear end oil seal assembly

Operation 5-2 To remove and to fit the rear end oil seal assembly	79
Operation 5-3 To remove and to fit a wear sleeve	83

Thrust washers

Operation 5-4 To check crankshaft end-float	84
Operation 5-5 To remove	85
Operation 5-6 To fit	86

Main bearings

Operation 5-7 To remove (with the crankshaft in position)	87
Operation 5-8 To fit (with the crankshaft in position)	88
Operation 5-9 To inspect	88

Crankshaft

Operation 5-10 To remove	89
Operation 5-11 To fit	90
Operation 5-12 To inspect	93
Operation 5-13 To remove	94
Operation 5-14 To fit	95

Balancer unit

Operation 5-15 To remove and to fit	96
Operation 5-16 To dismantle (oil pump)	98
Operation 5-17 To assemble (oil pump)	99
Operation 5-18 To inspect	100

6 Timing case and drive assembly

General description	101
----------------------------	-----

Timing case cover

Operation 6-1 To remove	102
Operation 6-2 To fit	103

Mechanical fuel pump gear

Operation 6-3 To remove	104
Operation 6-4 To fit	106

Electronic fuel pump gear

Operation 6-5 To remove	108
Operation 6-6 To fit	109

Idler gear and hub

Operation 6-7 To remove 110
Operation 6-8 To fit 111
Operation 6-9 To remove and fit idler gear bushes 113

Heavy duty idler gear assembly

Operation 6-10 To dismantle 114
Operation 6-11 To assemble 115

Camshaft gear

Operation 6-12 To remove and to fit 116

Front oil seal

Operation 6-13 To remove 117
Operation 6-14 To fit 118
Operation 6-15 To fit a wear sleeve 120

Timing case

Operation 6-16 To remove 121
Operation 6-17 To fit 122

Crankshaft gear

Operation 6-18 To remove and to fit 124

Camshaft and tappets

Operation 6-19 To remove 125
Operation 6-20 To fit 126

7 Cylinder block assembly

General description 129

Cylinder block

Operation 7-1 To dismantle 130
Operation 7-2 To assemble 131
Operation 7-3 To inspect 132

Cylinder bore

Operation 7-4 To inspect 133

8 Engine timing

General description 135

Engine timing

Operation 8-1 To set number 1 piston to TDC on the compression stroke	136
Operation 8-2 To check the timing of the Bosch VP30 fuel injection pump	137
Operation 8-3 To check the timing of the Bosch EPVE fuel injection pump	138
Operation 8-4 To adjust the timing of the Bosch EPVE fuel injection pump	139
Operation 8-5 To check the timing of the Delphi DP210 fuel injection pump	141
Operation 8-6 To check the valve timing	142

9 Aspiration system

General description	143
----------------------------	-----

Aspiration system

Operation 9-1 To remove and to fit an exhaust elbow	145
---	-----

Turbocharger side mounted

Operation 9-2 To remove	146
Operation 9-3 To fit	147
Operation 9-4 To check the operation of the waste-gate	149

Turbocharger faults	150
----------------------------	-----

Open engine breather

Operation 9-5 To remove and to fit the breather pipe	152
--	-----

Naturally aspirated engine breather

Operation 9-6 To remove and fit the breather pipe	154
---	-----

Closed engine breather

Operation 9-7 To clean and to renew	156
-------------------------------------	-----

10 Lubrication system

General description	157
----------------------------	-----

Lubrication system flow diagram	158
--	-----

Filter canister

Operation 10-1 To renew (canister type oil filter)	159
Operation 10-2 To renew (element type oil filter)	160

Filter head

Operation 10-3 To remove and to fit 161
 Operation 10-4 To remove 162
 Operation 10-5 To fit 163

Dipstick tube

Operation 10-6 To remove and to fit 166

Oil strainer and suction pipe

Operation 10-7 To remove and to fit 167
 Operation 10-8 To inspect and to correct 167

Lubricating oil pump assembly

Operation 10-9 To remove 168
 Operation 10-10 To fit 168
 Operation 10-11 To inspect 169

Relief valve

Operation 10-12 To remove and to fit the relief valve of the balancer 170
 Operation 10-13 To remove and to fit the relief valve of the lubricating oil pump 171
 Operation 10-14 To inspect the relief valve of the lubricating oil pump/balancer 171

11 Fuel system

General description 173

Cold start advance unit (KSB) 175

Typical fuel system 177

Fuel filter assembly

Operation 11-1 To renew 178

Atomisers

Operation 11-2 To identify a faulty atomiser 179
 Operation 11-3 To remove 180
 Operation 11-4 To fit 181

Fuel lift pump and filter assembly

Operation 11-5 To remove and to fit 182
 Operation 11-6 To test 183
 Operation 11-7 To test pressure regulator 183

Air in the fuel system

Operation 11-8 To eliminate air from the fuel system 184

Bosch VP30 fuel injection pump

Operation 11-9 To remove	186
Operation 11-10 To fit	188

Bosch EVPE fuel injection pump

Operation 11-11 To remove	192
Operation 11-12 To fit	194

Delphi DP210 fuel injection pump

Operation 11-13 To remove	197
Operation 11-14 To fit	199

12 Cooling system

General description	201
----------------------------------	-----

Coolant flow diagram	202
-----------------------------------	-----

Thermostat

Operation 12-1 To remove	203
Operation 12-2 To fit	204
Operation 12-3 To test	205

Coolant pump	206
---------------------------	-----

Operation 12-4 To remove	206
Operation 12-5 To fit	207
Operation 12-6 To dismantle	208
Operation 12-7 To assemble	210

Fan

Operation 12-8 To remove and to fit	212
---	-----

Fan drive

Operation 12-9 To remove and to fit	212
---	-----

Lubricating oil cooler

Operation 12-10 To remove	213
Operation 12-11 To fit	213
Operation 12-12 To dismantle and to assemble	214
Operation 12-13 To remove and to fit a coolant by-pass pipe	215

13 Flywheel and housing

General description	217
Flywheel	
Operation 13-1 To remove and to fit	217
Ring gear	
Operation 13-2 To remove and to fit	218
Flywheel housing	
Operation 13-3 To remove and to fit	219

14 Electrical equipment

Alternators

Operation 14-1 To check the drive belts	222
Operation 14-2 To adjust drive belt tension	223
Operation 14-3 To remove and to fit the drive belts	223
Operation 14-4 To remove and to fit the alternator	224
Operation 14-5 To maintain	224
Operation 14-6 Fault diagnosis for the alternator	225

Starter motors

Operation 14-7 To remove and to fit	228
Operation 14-8 To maintain the brush gear and the commutator	229
Operation 14-9 To test on the engine	229

Starting aid

Operation 14-10 To remove and to fit a glow plug	230
Operation 14-11 To check the glow plugs' power supply continuity	231
Operation 14-12 To check the operation of the glow plug	232

Electronic components

Operation 14-13 To remove and to fit the Engine Control Module (ECM)	235
Operation 14-14 To remove and to fit the Voltage Load Protection Module (VLPM)	237
Operation 14-15 To program a new ECM	238
Operation 14-16 To remove and to fit the speed and timing sensor	239
Operation 14-17 To remove and to fit a pressure sensor	240
Operation 14-18 To remove and to fit a temperature sensor	242

Wiring harness

Operation 14-19 To repair a sensor connector	246
Operation 14-20 To repair a Diagnostic, a ECM, or a MIC connector	248
Operation 14-21 To connect a new wire or connector to the wiring harness	250

15 Auxiliary equipment

Power steering pump

Operation 15-1 To remove and to fit 252

Adaptor for a hydraulic pump or a steering pump

Operation 15-2 To remove and to fit 253

Operation 15-3 To dismantle 254

Operation 15-4 To assemble 255

Exhauster

Operation 15-5 To remove and to fit 256

16 Special tools

List of special tools 258

1

General information

Introduction

This Workshop Manual has been written to provide assistance in the service and overhaul of Perkins 1100 Series 4 cylinder engines. It should be used in conjunction with normal workshop practise and information contained in current service bulletins. Mention of certain accepted practices therefore, has been purposely omitted in order to avoid repetition. For overhaul procedures the assumption is made that the engine is removed from the application.

The engine conforms with USA (EPA/CARB) stage 2 and EEC stage 2 emissions legislation for agriculture, construction and industrial applications.

Most of the general information which is included in the relevant User's Handbook has not been repeated in this workshop manual and the two publications should be used together.

Where the information applies only to certain engine types, this is indicated in the text.

The details of some operations will be different according to the type of fuel injection pump which is fitted. The specific pump type used can be found by reference to the manufacturer's identification plate on the pump body but, generally, the type of pump fitted is as shown below:

- Delphi - DP210 Series
- Bosch - VP 30
- Bosch - EPVE.

When reference is made to the "left" or "right" side of the engine, this is as seen from the flywheel end of the engine.

Special tools have been made available and a list of these is given in Chapter 16, Special tools. Reference to the relevant special tools is also made at the beginning of each operation.

POWERPART recommended consumable products are listed under "POWERPART recommended consumable products" on page 9. Reference to the relevant consumable products is also made at the beginning of each operation.

Data and dimensions are included in Chapter 2, Specifications.

Read and remember the "Safety precautions" on page 5. They are given for your protection and must be used at all times.

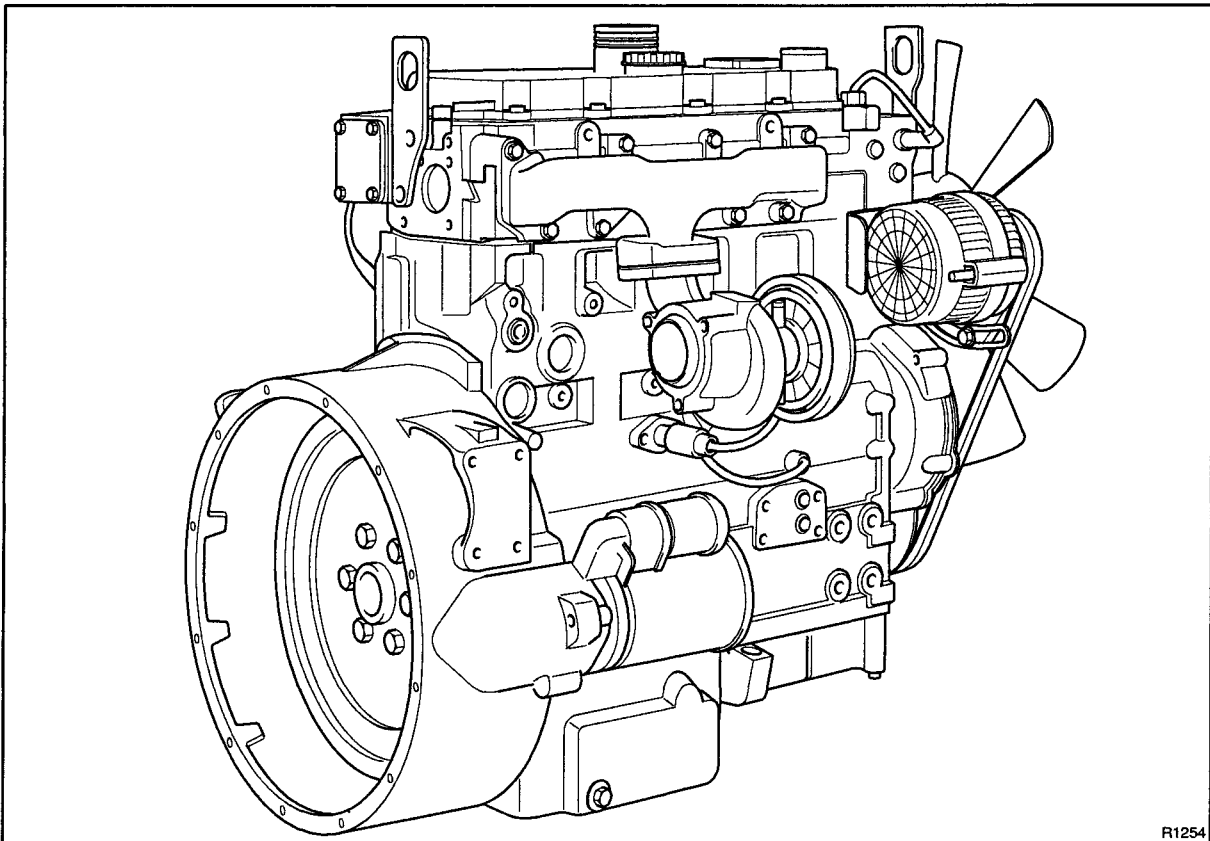
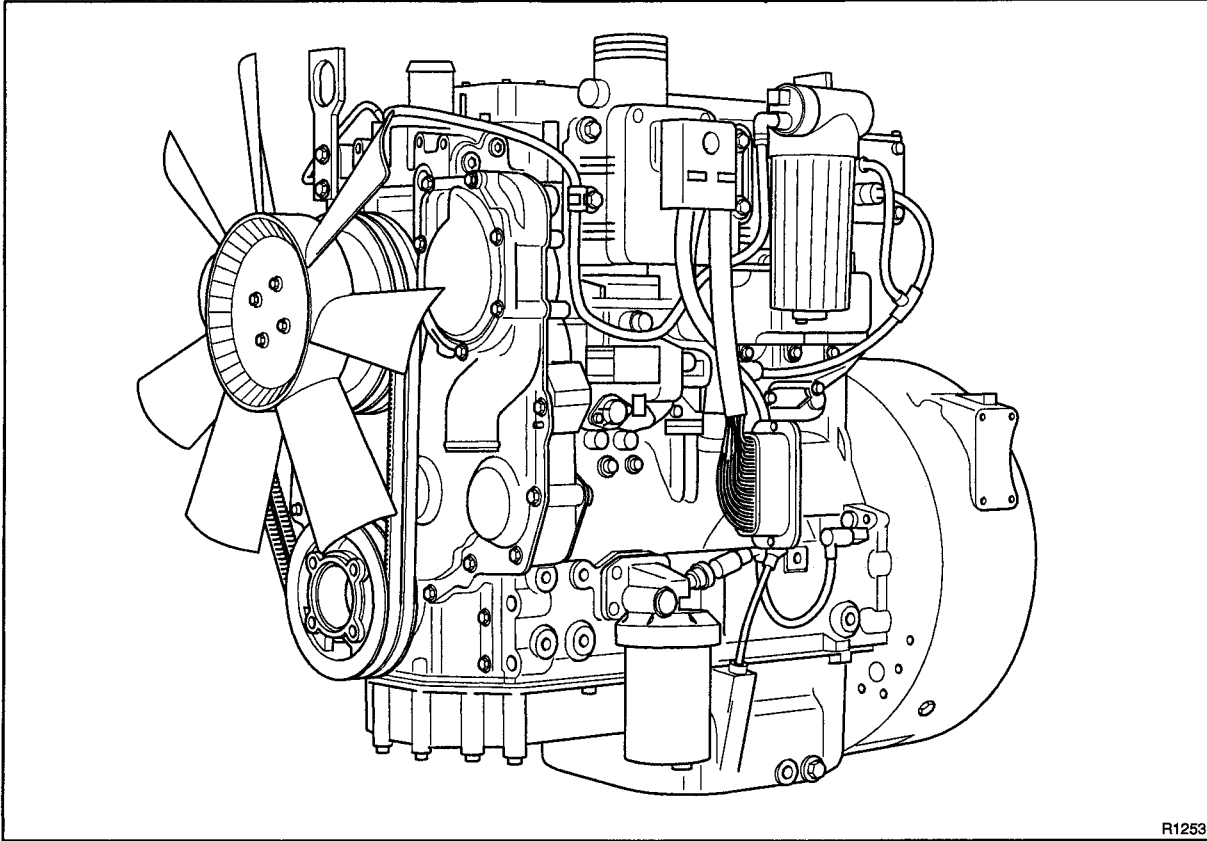
Danger is indicated in the text by two methods:

Warning! This indicates that there is a possible danger to the person.

Caution: This indicates that there is a possible danger to the engine.

Note: Is used where the information is important, but there is not a danger.

Engine views



Engine identification

The Perkins 1100 Series 4 cylinder engines have been designed for industrial, construction and agricultural applications. There are a range of four cylinder engines with or without electronics, available in naturally aspirated, turbocharged and air to air charge cooled models.

In this Workshop Manual, the different models are indicated by their code letters. The first two letters of the engine number are indicated below:

RE	Naturally aspirated
RF	Naturally aspirated, electronic
RG	Turbocharged
RH	Turbocharged, electronic
RJ	Turbocharged, charge cooled
RK	Turbocharged, charge cooled, electronic

Continued

The Perkins 1100 Series 4 cylinder engines have been designed for agricultural, industrial and construction applications.

The correct identification of the engine is by the full engine number.

The engine number is stamped on a label which is fastened to the left side (A2) of the cylinder block. An example of an engine number is:

RE.....*U.....*

If you need parts, service or information for your engine, you must give the complete engine number to your Perkins Dealer/Distributor. If there is a number in the area of the label marked TPL No, then this number must also be given to your Perkins Dealer/Distributor.

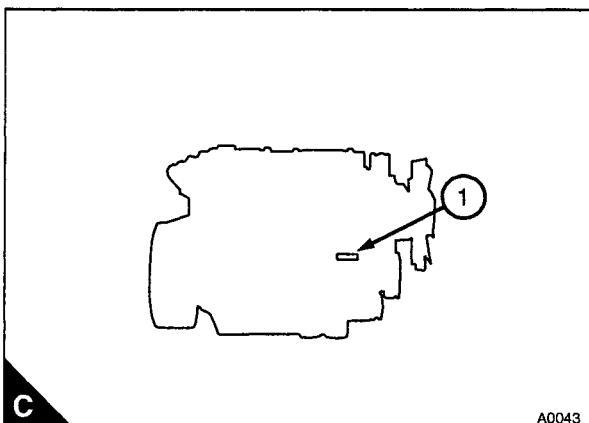
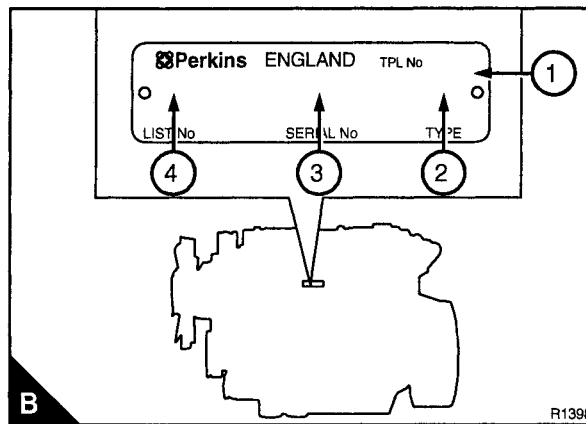
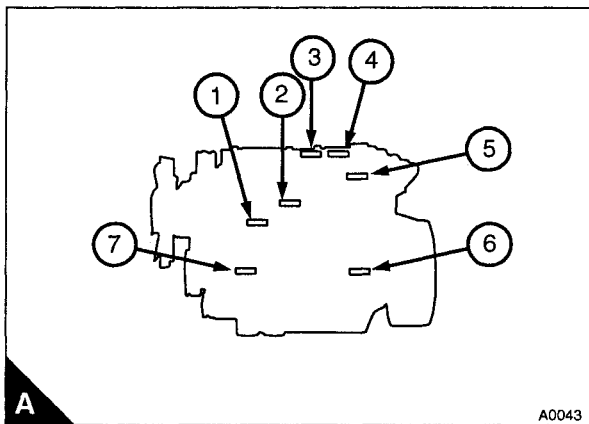
Other identification labels fitted to the engine include:

- A label (A1) with the fuel injection pump part numbers.
- An emissions legislation label (A3), (A6), (A7) and (C1) can be fitted in four different positions on the engine.
- A "Ether" warning label (A5) is fitted on the intake manifold.
- A "caution please read User's Handbook label" (A4) is screen printed into the atomiser cover.

If a short engine has been fitted in service, two engine serial numbers and a TPL number are stamped on the engine serial number label (B3).

The engine serial number plate (B) contains the following information:

- TPL number (1).
- Type (2).
- Serial number (3).
- List number (4).



Safety precautions

These safety precautions are important. You must refer also to the local regulations in the country of use. Some items only refer 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 care 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 auxiliary equipment is in operation.
- Do not permit loose clothing or long hair near moving parts.
- Keep away from moving parts during engine operation.

Warning! *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, or any component 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 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.
- 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, see "Viton seals" on page 8 for safety precautions.
- Do not wear clothing which is contaminated by lubricating oil. Do not put material which is contaminated with oil into the pockets of clothing.
- Discard used lubricating oil in a safe place to prevent contamination.
- 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 in adverse conditions.
- Read and use the instructions relevant to "Engine lift equipment" on page 7.

Continued

- Always use a safety cage to protect the operator when a component is to be pressure tested in a container of water. Fit safety wires to secure the plugs which seal the hose connections of a component which is to be pressure tested.
- Do not allow compressed air to contact your skin. If compressed air enters your skin, obtain medical help immediately.
- Turbochargers operate at high speed and at high temperatures. Keep fingers, tools and items away from the inlet and outlet ports of the turbocharger and prevent contact with hot surfaces.
- Do not clean an engine while it runs. If cold cleaning fluids are applied to a hot engine, certain components on the engine may be damaged.
- Fit only genuine Perkins parts.

Engine lift equipment

The maximum weight of the engine without coolant, lubricant, or a gearbox fitted will vary for different applications. It is recommended that lift equipment of the minimum capacity listed below is used:

Four cylinder engines	600 kg (1320 lbs)
-----------------------	-------------------

Note: Use lift equipment or obtain assistance to lift heavy engine components such as the cylinder block, cylinder head, balancer unit, flywheel housing, crankshaft and flywheel.

Before the engine is lifted:

- Always use lift equipment of the approved type and of the correct capacity to lift the engine. It is recommended that lift equipment of the type shown in (A) is used, to provide a vertical lift directly above the engine lift brackets (A1). Never use a single lift bracket to raise an engine.
- Check the engine lift brackets for damage and that they are secure before the engine is lifted. The torque for the setscrews for the engine lift brackets is 44 Nm (33 lbf ft) 4,5 kgf m.
- To prevent damage to the rocker cover, ensure that there is clearance between the hooks and the rocker cover.

