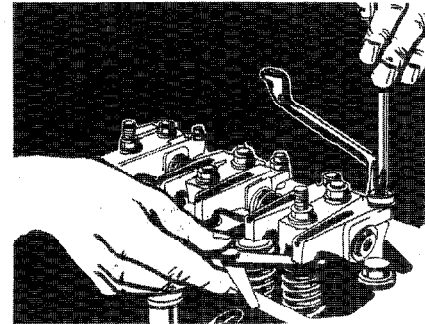


## Service Data



**Part 2: Current Products  
up to 8,70 litres (530 cu in)**

**VARITYPerkins**

**Perkins Group of Companies**

Peterborough PE1 5NA England

**VARITYPerkins**

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# Perkins Service Data Booklet

Part 2: Current products up to 8,7 litres (530 cu in)

**100 Series**

**4.41**

**Prima/500 Series**

**700 Series**

**900 Series**

**Phaser/1000 Series**

**Peregrine/1300 Series**



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## Foreword

The Perkins Service Data Booklet contains the data which is most commonly used by experienced mechanics and technicians.

The booklet contains information for Perkins Peterborough engines and is available in two parts:

### Part 1: Mature products up to 8,85 litres (540 cu in)

4.108

3.152 Series

4.203 Series

4.236 Series

6.3544 Series

V8.540 Series

### Part 2: Current products up to 8,7 litres (530 cu in)

100 Series

4.41

Prima/500 Series

700 Series

900 Series

Phaser/1000 Series

Peregrine/1300 Series

The booklet should be used together with the relevant User's Handbook, Workshop Manual and Service Bulletins.

Any recommendations for future issues of the booklet should be sent to Technical Publications Department.

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**Perkins companies****Australia**

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Moteurs Perkins S.A.,  
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Fax: 0081 (0) 3 582 1596

**United Kingdom**

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Eastfield, Peterborough PE1 5NA,  
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**United States of America**

Perkins International - North America  
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Suite 620,  
999, Ponce de Leon Boulevard,  
Coral Gables,  
Florida 33134, U.S.A.  
Telephone: 001 305 442 7413  
Telex: 32501 Perken G  
Fax: 001 305 442 7419

**In addition to the above companies, there are  
Perkins distributors in most countries. Perkins  
International Ltd, Peterborough or one of the  
above companies can provide details.**

**List of Perkins service publications**

Engine type	User's Handbook	Workshop Manual
4.41	TPD 1319E (1)	TPD 1322E (1)
100 Series	100816243-0695 (1)	1339/2/92E (1) 513/9/95 (1)
Prima/500 Series	TPD 0295 1260EFG (6) TPD 0295 1260EIS (7) TPD 0895 1313E (1)	TPD 0192 1273 (1)
700 Series	TPD 1336E (1) TPD 1336S (5)	TPD 1359E (1)
900 Series	TPD 1325E (1) TPD 1325F (2) TPD 1325G (3) TPD 1325I (4) TPD 1325S (5)	TPD 1345E (1)
Phaser/1000 Series	TPD 1328E (1) TPD 0696 1261EFG (6)	TPD 1312E (1)
Peregrine/1300 Series	TPD 1315E (1) TPD 1315F (2) TPD 1315G (3) TPD 1315I (4) TPD 1314E (1)	TPD 1347E(1)

- (1) Printed in English  
(2) Printed in French  
(3) Printed in German.  
(4) Printed in Italian.  
(5) Printed in Spanish.  
(6) Printed in English, French and German.  
(7) Printed in English, Italian and Spanish.

## POWERPART recommended consumable products

Perkins have made available the products recommended below in order to assist in the correct operation, service and maintenance of your engine and your machine. The instructions for the use of each product are given on the outside of each container. These products are available from your Perkins distributor.

### POWERPART Antifreeze

Protects the cooling system against frost and corrosion. Part number 1 litre 21825166 or 5 litres 21825167.

### POWERPART Atomiser thread sealant

To seal the threads of the atomiser into the cylinder head. Currently Hylomar Advance Formulation.

### POWERPART Chisel

Allows easy removal of old gaskets and joints. Currently Loctite chisel. Part number 21825163.

### POWERPART Compound

To seal the outer diameter of seals. Currently Loctite Forma Gasket No 2. Part number 1861147.

### POWERPART Easy Flush

Cleans the cooling system. Part number 2182501.

### POWERPART Gasket eliminator

Improves flange sealing when a gasket is not used. It provides a seal with temperature resistance that is flexible in positions where vibration and pressure occur. Currently Loctite 515. Part number 21826040.

### POWERPART Jointing compound

Universal jointing compound which seals joints. Currently Hylomar. Part number 1861155 or 1861117.

### POWERPART Lay-Up 1

A diesel fuel additive for protection against corrosion. Part number 1772204.

### POWERPART Lay-Up 2

Protects the inside of the engine and of other closed systems. Part number 1762811.

### POWERPART Lay-Up 3

Protects outside metal parts. Part number 1734115.

### POWERPART Liquid gasket

To seal flat faces of components where no joint is used. Especially suitable for aluminium components. Currently Loctite 518. Part number 21820518.

### POWERPART Nutlock

To retain and seal threaded fasteners and cup plugs where easy removal is necessary. Currently Loctite 242e. Part number 21820242.

### POWERPART Platelock

Medium strength anaerobic threadlock for tight fitted metal surfaces. Suitable for metal plated surfaces and stainless steel. Currently Loctite 243. Part number 21826039.

### POWERPART Repel

Dries damp equipment and gives protection against corrosion. Passes through dirt and corrosion to lubricate and to assist removal of components. Currently Loctite repel. Part number 21825164.

### POWERPART Retainer (high strength)

To retain components which have an interference fit. Currently Loctite 638. Part number 21820638.

### POWERPART Retainer (oil tolerant)

To retain components which have a transition fit. Currently Loctite 603. Part number 21820603.

### POWERPART Silicone adhesive

An RTV silicone adhesive for application where low pressure tests occur before the adhesive sets. Used for sealing flange where oil resistance is needed and movement of the joint occurs. Currently Loctite 5900. Part number 21826038.

### POWERPART Silicone rubber sealant

Silicone rubber sealant which prevents leakage through gaps. Currently Hylasil. Part number 1861108.

### POWERPART Studlock

To permanently retain large fasteners and studs. Currently Loctite 270. Part number 21820270.

*Continued*

## POWERPART recommended consumable products *Continued*

### POWERPART Threadlock

To retain small fasteners where easy removal is necessary. Currently Loctite 222e. Part number 21820222.

### POWERPART Threadlock (heavy duty)

To provide a heavy duty seal to components that have a light interference fit. Currently Loctite 262. Part number 21820262.

## Engine number location guide

Engine type	Position
100 Series	B3
4.41	A3
Prima/500 Series	A2
700 Series	B2
900 Series	A1
Phaser/1000 Series	A3 or B1
Peregrine/1300 Series	A4

### Notes:

Illustration A shows the left side when looked at from the flywheel end of the engine.

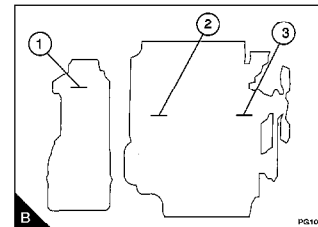
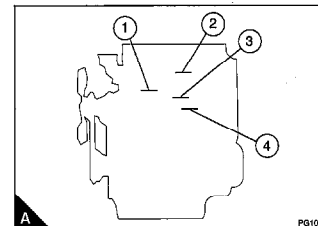
Illustration B shows the right side when looked at from the flywheel end of the engine, and the rear view of the engine.

## POWERPART Threadlock (hydraulic/pneumatic)

To retain and seal pipe connections with fine threads. Especially suitable for hydraulic and pneumatic systems. Currently Loctite 542. Part number 21820542.

## POWERPART Threadlock (pipe)

To retain and seal pipe connections with coarse threads. Pressure systems can be used immediately. Currently Loctite 575. Part number 21820575.



**Engine number guide** For engines made after 1974

Example of an engine number is TU20300U510256F

TU ..... Engine Family and type code, see Table 1  
 20300 ..... Parts list number or SOS order reference number  
 U ..... Country of manufacture code, see Table 2  
 510256 ..... Engine serial number  
 F ..... Year of manufacture code, see Table 3

**Table 1 - Engine Family and Type Code**

<b>A Phaser/1004</b>	<b>E 4.108</b>	LE	G4.236	TW	6.3544
AA Naturally aspirated	EA 4.99	LF	4.248	TX	C6.3544
AB Turbocharged	EB 4.107	LG	4.2482	TY	H6.3544
AC Compensated	EC T4.107	LH	C4.236	TZ	HT6.3544
AD Charge cooled	ED 4.108	LJ	T4.236	<b>U 700 Series</b>	
AE Fed. Charge cooled	EE T4.108	LK	D4.236	UA	704-26
AG Narrow front end naturally aspirated	<b>G 4.154/200</b>	LL	4.38	UB	704-30
AH Narrow front end turbocharged	GA 4.154	LM	4.41	W	<b>Peregrine/1300</b>
<b>New Phaser/1004</b>	<b>H 4.165</b>	GB 4.135	<b>N 4.318</b>	WA	6.466
AJ Naturally aspirated	HA 4.165	GC 4.182	NA 4.270	WB	T6.466
AK Turbocharged	<b>J 4.203</b>	GD 4.25	NB 4.300	WC	CC6.466
AM Turbocharged intercooled	JA P4	GE 4.30	NC 4.318	WD	T6.67
AP Naturally aspirated	JB 4.192	ND 4.3182	NE 4.3182	WE	CC6.67
AQ Turbocharged	JC P4.192	PA P6	PF 6.305	WF	T6.76
<b>B Prima/500</b>	<b>K Perama/100</b>	PD PF6.305	<b>R 6.247</b>	WG	CC6.76
BA Naturally aspirated	KA 2 cyl. 0,4 litres	PE 6.288	RA 6.247	WH	T6.87
BB Turbocharged	KB 3 cyl. 0,6 litres	PC 6.305	RB 6.247	WJ	CC6.87
BC Gasolene	KC 3 cyl. 0,9 litres	PD PF6.305	<b>X V8.540</b>	<b>X V8.540</b>	
<b>C 3.152</b>	KD 3 cyl. 1,0 litres	TA 6.306	XC	XD	V8.510
CA P3	KE 3 cyl. 1,5 litres	TB 6.335	XE	XE	V8.510
CB 3.144	KF 4 cyl. 1,9 litres	TC 6.354	<b>Y Phaser/1006</b>	YA	Naturally aspirated
CC P3.144	KG 3 cyl. 1,2 litres	TD H6.354	YB Turbocharged	YB	Turbocharged
CD 3.152	KH 3 cyl. 1,3 litres	TE T6.354	YC Compensated	YC	Compensated
CE D3.152	KJ 3 cyl. 1,5 litres D	TF H6.354	YD Charge cooled	YD	Charge cooled
CF G3.152	KK 4 cyl. 1,9 litres D	TH T6.3541	YE Fed. Charge cooled	YE	Fed. Charge cooled
CG P3.152	KL 3 cyl. 0,7 litres	TJ 6.3542	<b>New Phaser/1006</b>		
CJ 3.1622	KN 2 cyl. 0,5 litres	TK C6.3542	YG Naturally aspirated	YG	Naturally aspirated
CM 3.1624	KR 4 cyl. 2,2 litres	TL 6.3543	YH Turbocharged	YH	Turbocharged
CN T3.1624	<b>L 4.236</b>	TM C6.3543	YK Turbocharged intercooled	YK	Turbocharged intercooled
<b>C 900 Series</b>	LA 4.212	TN H6.3543	<b>Z V8.640</b>	ZA	V8.640
CP 3.27	LB G4.212	TP T6.3543	ZB	ZB	TV8.640
CR T3.27	LC 4.224	TQ HT6.3543			
CS 3.25	LD 4.236	TR 6.372			
		TS 6.3723			
		TT TC6.3541			
		TU T6.3544			
		TV 6.3724			

C	Compensated Charge cooled	F	Made in France Fed. Federal	H	Horizontal Narrow front end (Belt driven water pump)	P	Timing chain Turbocharged
D	Direct injection	G	Gasolene or gas	N		V	Vee form

**Table 2 - Country of manufacture code**

This code indicates the country of manufacture of the basic engine.

A	Argentina	H	Group	M	Mexico	U	United Kingdom
B	Brazil	HM	Indonesia	MX	Mexico	V	Pakistan
C	Australia	HK	Iraq	N	USA	W	Iran
D	Germany	HU	Hungary	P	Poland	X	Peru
E	Spain	J	Japan	S	India	Y	Yugoslavia
F	France	K	Korea	SA	South Africa		
G	Greece	L	Italy	T	Turkey		

**Table 3 - Year of manufacture code**

This code indicates the year of manufacture. The letters I, O, Q, R and Z will not be used.

A	1974	H	1981	S	1988	A	1995
B	1975	J	1982	T	1989	B	1996
C	1976	K	1983	U	1990	C	1997
D	1977	L	1984	V	1991	D	1998
E	1978	M	1985	W	1992	E	1999
F	1979	N	1986	X	1993	F	2000
G	1980	P	1987	Y	1994	G	2001

## Basic fault-finding guide

The chart below is given to assist in the correct diagnosis of basic engine faults.

### Problems and possible causes

Problem	Possible causes
The starter motor turns the engine too slowly	1, 2, 3, 4
The engine does not start	5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 17, 34, 35, 36, 37, 38, 40, 42, 43, 44
The engine is difficult to start	5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 19, 34, 36, 37, 38, 40, 42, 43, 44
Not enough power	8, 9, 10, 11, 12, 13, 16, 17, 18, 19, 20, 21, 34, 36, 37, 38, 39, 42, 43, 44, 61, 63, 64
Misfire	8, 9, 10, 12, 13, 15, 20, 22, 34, 36, 37, 38, 39, 40, 41, 43
High fuel consumption	11, 13, 15, 17, 18, 19, 21, 22, 34, 36, 37, 38, 39, 40, 42, 43, 44, 63
Black exhaust smoke	11, 13, 15, 17, 19, 21, 22, 34, 36, 37, 38, 39, 40, 42, 43, 44, 61, 63
Blue or white exhaust smoke	4, 15, 21, 23, 36, 37, 38, 39, 42, 44, 45, 52, 58, 62
The pressure of the lubricating oil is too low	4, 24, 25, 26, 46, 47, 48, 50, 51, 59
The engine knocks	9, 13, 15, 17, 20, 22, 23, 36, 37, 40, 42, 44, 46, 52, 53, 60
The engine runs erratically	7, 8, 9, 10, 11, 12, 13, 15, 16, 18, 20, 22, 23, 34, 38, 40, 41, 44, 52, 60
Vibration	13, 18, 20, 27, 28, 34, 38, 39, 40, 41, 44, 52, 54
The pressure of the lubricating oil is too high	4, 25, 49
The engine temperature is too high	11, 13, 15, 19, 27, 29, 30, 32, 34, 36, 37, 39, 52, 55, 56, 57, 64
Crankcase pressure	31, 33, 39, 42, 44, 45, 52
Bad compression	11, 22, 37, 39, 40, 42, 43, 44, 45, 53, 60
The engine starts and stops	10, 11, 12

### List of possible causes

- Battery capacity low.
- Bad electrical connections.
- Fault in starter motor.
- Wrong grade of lubricating oil.
- Starter motor turns engine too slowly.
- Fuel tank empty.
- Fault in stop control.
- Restriction in a fuel pipe.
- Fault in fuel lift pump.
- Dirty fuel filter element.
- Restriction in filter/cleaner or air induction system.
- Air in fuel system.
- Fault in atomisers or atomisers of an incorrect type.
- Cold start system used incorrectly.
- Fault in cold start system.
- Restriction in fuel tank vent.
- Wrong type or grade of fuel used.
- Restricted movement of engine speed control.
- Restriction in exhaust pipe.
- Engine temperature is too high.
- Engine temperature is too low.
- Valve tip clearances are incorrect.
- Too much oil or oil of wrong specification used in wet type oil cleaner.
- Not enough lubricating oil in sump.
- Defective gauge.
- Dirty lubricating oil filter element.
- Fan damaged.
- Fault in engine mounting or flywheel housing.
- Too much lubricating oil in sump.
- Restriction in air or water passages of radiator.
- Restriction in breather pipe.
- Insufficient coolant in system.
- Vacuum pipe leaks or fault in exhaustor.
- Fault in fuel injection pump.
- Broken drive on fuel injection pump.
- Timing of fuel injection pump is incorrect.
- Valve timing is incorrect.
- Bad compression.
- Cylinder head gasket leaks.
- Valves are not free.
- Wrong high-pressure pipes.
- Worn cylinder bores.
- Leakage between valves and seats.
- Piston rings are not free or they are worn or broken.
- Valve stems and/or guides are worn.
- Crankshaft bearings are worn or damaged.
- Lubricating oil pump is worn.
- Relief valve does not close.
- Relief valve does not open.
- Relief valve spring is broken.
- Fault in suction pipe of lubricating oil pump.
- Piston is damaged.
- Piston height is incorrect.
- Flywheel housing or flywheel is not aligned correctly.
- Fault in thermostat or thermostat is of an incorrect type.
- Restriction in coolant passages.
- Fault in water pump.
- Valve stem seal is damaged (if there is one fitted).
- Restriction in sump strainer.
- Valve spring is broken.
- Turbocharger impeller is damaged or dirty.
- Lubricating oil seal of turbocharger leaks.
- Induction system leaks (turbocharged engines).
- Turbocharger waste-gate does not work correctly (if there is one fitted).



## Turbocharger fault guide

The chart below is given to assist in the correct diagnosis of turbocharger faults.

If the inside of the induction manifold is wet, check that there is not a fuel leak from the fuelled starting aid, if there is one fitted.

### Problems and possible causes

Problem	Possible causes
Not enough power	1, 4, 5, 6, 7, 8, 9, 10, 11, 18, 20, 21, 22, 25, 26, 27, 28, 34, 35, 36
Black smoke	1, 4, 5, 6, 7, 8, 9, 10, 11, 18, 20, 21, 22, 25, 26, 27, 28, 34, 35, 36
Blue smoke	1, 2, 4, 6, 8, 9, 17, 19, 20, 21, 22, 30, 31, 32, 34
High lubricating oil consumption	2, 8, 15, 17, 19, 20, 28, 29, 31, 32, 34
Too much lubricating oil at turbine end	2, 7, 8, 17, 19, 20, 22, 28, 30, 31, 32
Too much lubricating oil at compressor end	1, 2, 4, 5, 6, 8, 19, 20, 21, 28, 31, 32
Not enough lubrication	8, 12, 14, 15, 16, 23, 24, 29, 32, 33, 37, 38
Lubricating oil in the exhaust manifold	2, 7, 17, 18, 19, 20, 22, 28, 31, 32
Inside of the induction manifold wet	1, 2, 3, 4, 5, 6, 8, 10, 11, 17, 18, 19, 20, 21, 28, 32, 34, 39, 40
Damaged compressor impeller	3, 4, 6, 8, 12, 15, 16, 20, 21, 23, 24, 29, 32, 33, 37, 38
Damaged turbine rotor	7, 8, 12, 13, 14, 15, 16, 18, 20, 22, 23, 24, 25, 27, 29, 32, 33, 37, 38
Rotating assembly does not turn freely	3, 6, 7, 8, 12, 13, 14, 15, 16, 18, 20, 21, 22, 23, 24, 29, 32, 33, 37, 38
Worn bearings, bearing bores, journals	6, 7, 8, 12, 13, 14, 15, 16, 23, 24, 29, 33, 37, 38
Noise from turbocharger	1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 20, 21, 22, 23, 24, 29, 32, 33, 34, 37, 38
Sludge or carbon deposit in bearing housing	2, 11, 13, 14, 15, 17, 18, 24, 29, 33, 37, 38

### List of possible causes

40 Crack in backplate of compressor.

- 1 Element of the air filter dirty
- 2 Restricted crankcase breather
- 3 Element of the air filter not fitted, or not sealing correctly. Loose connection to turbocharger.
- 4 Internal distortion or restriction in pipe from air filter to turbocharger.
- 5 Damaged/restricted crossover pipe, turbocharger to induction manifold.
- 6 Restriction between air filter and turbocharger.
- 7 Restriction in exhaust system.
- 8 Turbocharger loose or clamps/setscrews loose.
- 9 Induction manifold has cracks, is loose, or has flange distortion.
- 10 Exhaust manifold has cracks, is loose, or has flange distortion.
- 11 Restricted exhaust system.
- 12 Delay of lubricating oil to turbocharger at engine start.
- 13 Insufficient lubrication.
- 14 Dirty lubricating oil.
- 15 Incorrect lubricating oil.
- 16 Restricted lubricating oil supply pipe.
- 17 Restricted lubricating oil drain pipe.
- 18 Turbine housing damaged or restricted.
- 19 Leakage from turbocharger seals.
- 20 Worn turbocharger bearings.
- 21 Excessive dirt in compressor housing.
- 22 Excessive carbon behind turbine rotor.
- 23 Engine speed raised too rapidly at initial start.
- 24 Insufficient engine idle period.
- 25 Faulty fuel injection pump.
- 26 Worn or damaged atomisers.
- 27 Valves burned.
- 28 Worn piston rings.
- 29 Lubricating oil leakage from supply pipe.
- 30 Excessive preservation fluid (on initial engine start).
- 31 Excessive engine idle period.
- 32 Restriction in turbocharger bearing housing.
- 33 Restriction in lubricating oil filter.
- 34 Wet type air cleaner: Restricted, dirty element, viscosity of oil to low/high.
- 35 Waste-gate actuator faulty or damaged.
- 36 Waste-gate valve not free.
- 37 Engine stopped too soon from high load.
- 38 Insufficient lubricating oil.
- 39 Fuel leakage from fuelled starting aid.

## General 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 spilled. 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 use salt water or any other coolant which can cause corrosion in the closed circuit of the cooling system.
- 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 operators 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 of clothing.
- Discard used lubricating oil in accordance with local regulations to prevent contamination.
- Ensure that the control lever of the transmission drive is in the "out-of-drive" position before the engine is started.
- 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 lift equipment.
- Wear a face mask if the glass fibre cover of the turbocharger is to be removed or fitted.
- 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 debris away from the inlet and outlet ports of the turbocharger and prevent contact with hot surfaces.
- Fit only genuine Perkins parts.

## Engine data

100 Series .....	2.02
4.41 .....	2.08
Prima/500 Series .....	2.13
700 Series .....	2.17
900 Series .....	2.21
Phaser/1000 Series .....	2.25
Peregrine/1300 Series .....	2.33

## Basic technical data

Horse power	
- 102.04, 102.05 .....	8,2 kW (11.0 bhp)
- 103.06, 103.07 .....	12,3 kW (16.5 bhp)
- 103.09 .....	16,5 kW (21.5 bhp)
- 103.10 .....	17,5 kW (23.5 bhp)
- 103.12 .....	19,8 kW (26.5 bhp)
- 103.13 .....	20,9 kW (28.0 bhp)
- 103.15 (KE) .....	23,5 kW (31.5 bhp)
- 103.15 (KJ) .....	24,6 kW (33.0 bhp)
- 104.19 (KK) .....	32,8 kW (44.0 bhp)
- 104.19 (KF) .....	31,3 kW (42.0 bhp)
- 104.22 .....	37,3 kW (50.0 bhp)
Number of cylinders	
- 102.04, 102.05 .....	2
- 103.06, 103.07, 103.09, 103.10, 103.12, 103.13, 103.15 .....	3
- 104.19, 104.22 .....	4
Cycle .....	4 stroke
Induction system .....	Naturally aspirated
Combustion system	
- 103.15 (KJ), 104.19 (KK) .....	Direct injection
- remainder .....	Indirect injection
Nominal bore	
- 102.04, 103.06 .....	64 mm (2.5 in)
- 102.05, 103.07 .....	67 mm (2.6 in)
- 103.09 .....	72 mm (2.8 in)
- 103.10 .....	75 mm (3.0 in)
- 103.12 .....	82 mm (3.2 in)
- 103.13, 103.15 (KE), 103.15 (KJ), 104.19 (KK), 104.19 (KF), 104.22 .....	84 mm (3.3 in)
Stroke	
- 102.04, 102.05, 103.06, 103.07 .....	64 mm (2.5 in)
- 103.09, 103.10 .....	72 mm (2.8 in)
- 103.12, 103.13 .....	80 mm (3.2 in)
- 103.15, 104.19 .....	90 mm (3.5 in)
- 104.22 .....	100 mm (3.9 in)

*Continued*Basic technical data *continued*

Compression ratio	
- 102.04, 103.10, 103.13 .....	23:1
- 102.05, 103.07, 103.09 .....	24:1
- 103.06 .....	23.5:1
- 103.12, 103.15 (KE), 104.19 (KK) .....	22.5:1
- 103.15 (KJ), 104.22 .....	19:1
- 104.19 (KF) .....	22:1
Cubic capacity	
- 102.04 .....	0,4 litres (24.4 in <sup>3</sup> )
- 102.05 .....	0,5 litres (30.5 in <sup>3</sup> )
- 103.06 .....	0,6 litres (36.6 in <sup>3</sup> )
- 103.07 .....	0,7 litres (42.7 in <sup>3</sup> )
- 103.09 .....	0,9 litres (54.9 in <sup>3</sup> )
- 103.10 .....	1,0 litres (61.0 in <sup>3</sup> )
- 103.12 .....	1,2 litres (73.3 in <sup>3</sup> )
- 103.13 .....	1,3 litres (79.3 in <sup>3</sup> )
- 103.15 (KE), 103.15 (KJ) .....	1,5 litres (91.5 in <sup>3</sup> )
- 104.19 (KK), 104.19 (KF) .....	1,9 litres (116.0 in <sup>3</sup> )
- 104.22 (KF) .....	2,2 litres (134.3 in <sup>3</sup> )
Firing order	
- 102.04, 102.05 .....	1-2
- 103.06, 103.07, 103.09, 103.10, 103.12, 103.13, 103.15 .....	1-2-3
- 104.19, 104.22 .....	1-3-4-2
Valve tip clearances	
- Inlet (hot or cold) .....	0,22 mm (0.008 in)
- Exhaust (hot or cold) .....	0,22 mm (0.008 in)
Lubricating oil pressure at maximum engine speed and normal engine temperature	
- 102.04, 02.05, 103.06, 103.07, 103.09, 103.10 .....	290/490 kPa (42/71 lbf/in <sup>2</sup> ) 3,0/5,0 kgf/cm <sup>2</sup>
- 103.12, 103.13, 103.15, 104.19, 104.22 .....	241/359 kPa (35/52 lbf/in <sup>2</sup> ) 2,5/3,7 kgf/cm <sup>2</sup>
Coolant temperature	
- 102.04, 02.05, 103.06, 103.07 .....	87 °C (189 °F)
- 103.09, 103.10 .....	95 °C (203 °F)
- 103.12, 103.13, 103.15, 104.19, 104.22 .....	93 °C (199 °F)

*Continued*

**Basic technical data** *continued*

Thermostat starts to open

- horizontal type ..... 69/73 °C (156/163 °F)

- vertical type ..... 80/84 °C (176/183 °F)

Thermostat fully open

- horizontal type ..... 82 °C (180 °F)

- vertical type ..... 95 °C (203 °F)

Direction of rotation ..... Clockwise from front

Idling speed ..... 800 to 1200 according to the application

Location of maximum no-load speed ..... None

Location of number 1 cylinder ..... Crankshaft pulley end

Location of engine timing marks ..... Crankshaft, camshaft gear and idler gears

Atomiser codes ..... Part numbers only

- 102.04, 102.05, 103.06, 103.07 ..... 131406340

- 103.09, 103.10 ..... 131406330

- 103.12, 103.13, 103.15 (KE), 04.19 (KF), 104.22 ..... 131406360

- 103.15 (KJ), 104.19 (KK) ..... 131406370

Fuel pump codes ..... None, one pump supplied which is adjusted by shims

Location of fuel pump code ..... None

Location of fuel pump timing marks ..... Front crankshaft pulley and timing case

Belt tension ..... 5 kgf ( 1bf)

Belt deflection at longest free length ..... 5 mm (0.2 in)

**Preventive maintenance periods**

These preventive maintenance periods apply to average conditions of operation. Check the periods given by the manufacturer of the equipment in which the engine is installed. Use the periods which are shortest. When the operation of the engine must conform to the local regulations these periods and procedures may need to be adapted to ensure correct operation of the engine.

It is good preventive maintenance to check for leakage and loose fasteners at each service.

**Maintenance schedules****A** Every day or every 8 hours**B** First service 20/50 hours**C** Every 100 hours or 3 months**D** Every 200 hours or 6 months**E** Every 400 hours or 12 months**F** Every 600 hours or 18 months

The schedules which follow must be applied at the interval (hours or months) which occur first.

A	B	C	D	E	F	Operation
•				•		Check the level of coolant (top up with coolant only)
						Check concentration of coolant
				•		• Renew coolant ( <i>fill slowly, ensure correct quantity is used</i> )
•				•		Check engine lubricating oil level
				•		• Renew engine lubricating oil ( <i>fill slowly, ensure correct quantity is used</i> )
				•		Renew engine oil filter
				•		Drain water from fuel filter and pre-filter
				•		Renew fuel filter canister (N.B. air vent screws on filter and fuel pump)
•	•	•				Check tension of alternator drive belt
						Check alternator drive belt for wear
				•		• Renew alternator drive belt
				•		• Check and adjust idle speed (1)
				•		• Tighten cylinder head (1)
				•		• Check and adjust valve clearances (1)
				•		• Check electrical systems (1)
				•		• Check all nuts and bolts for tightness
				•		• Check injectors for performance (1)
	•	•				Clean air filter (earlier check may be necessary)
				•		Renew air filter element
•	•	•				Check and correct any leaks or engine damage

(1) By a person who has had the correct training.

The operations above are to be carried out by trained personnel with reference to the Workshop Manual where necessary. These preventive maintenance periods apply to average conditions of operation. Check the periods given by the manufacturer of the equipment in which the engine is installed. If necessary, use the shorter periods.

The oil change interval will change with the amount of sulphur in the fuel (see the table on page 3.03 and the fuel specification). The interval to change the canister of the lubricating oil filter is not affected.

**Recommended torque tensions**

The torque tensions below apply to components lubricated lightly with clean engine oil before they are fitted.

Description	Thread size	Torque		
		Nm	lbf ft	kgf m
Setscrews, cylinder head, refer to head tightening sequence		-	-	-
Plug, lubricating oil sump		34	25	3,5
<b>Atomiser</b>				
- 102.04, 102.05, 103.06, 103.07, 103.09, 103.10		81	60	8,3
- 103.12, 103.13, 103.15 (KE), 104.19 (KF), 104.22		65	47	6,5
Setscrew, atomiser clamp				
- 103.15 (KJ), 104.19 (KK)		23	17	2,3
<b>Nuts, high-pressure fuel pipes</b>				
- 102.04, 102.05, 103.06, 103.07, 103.09, 103.10		23	17	2,3
- 103.12, 103.13, 103.15, 104.19, 104.22		19	14	2,0
<b>Setscrews, main bearing</b>				
- holder, upper and lower 102.04, 102.05, 103.06, 103.07, 103.09, 103.10		21	16	2,1
- holder, to cylinder block 102.04, 102.05, 103.06, 103.07, 103.09, 103.10		28	20	2,8
- holder, hexagonal hole type 103.12, 103.13, 103.15, 104.19, 104.22		26	20	2,8
- holder, hexagonal bolt type 103.12, 103.13, 103.15, 104.19, 104.22		51	38	5,2
<b>Nuts, connecting rods</b>				
- 102.04, 102.05, 103.06, 103.07		23	17	2,3
- 103.09, 103.10		32	23	3,2
- 103.12, 103.13, 103.15, 104.19, 104.22		51	38	5,2
<b>Nut, crankshaft pulley</b>				
- 102.04, 102.05, 103.06, 103.07, 103.09, 103.10		122	90	12
- 103.12, 103.13, 103.15, 104.19, 104.22		305	224	31
<b>Setscrews, flywheel to crankshaft</b>				
- 102.04, 102.05, 103.06, 103.07		75	54	7,5
- 103.09, 103.10, 103.12, 103.13, 103.15, 104.19, 104.22		65	47	6,5

**Cylinder head torque sequence**

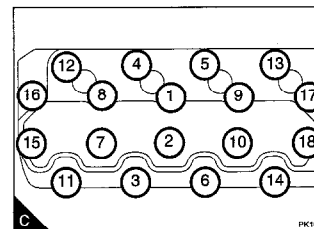
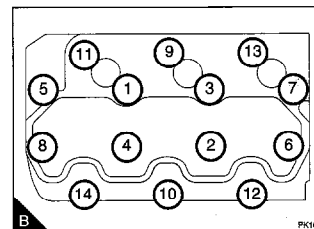
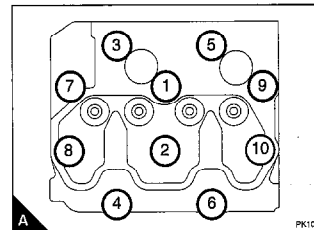
**Caution:** This operation must be done by a person with the correct training. If in doubt, refer to the workshop manual.

- 1 Lightly lubricate the threads and the thrust faces of the setscrews.
- 2 Gradually and evenly tighten the setscrews to the correct torque in the correct sequence shown in the tables below.

Engine type	Torque		
	Nm	lbf ft	kgf m
102-4, 102-4, 103-6, 103-7	37	27	3,7
103-9, 103-10	51	37	5,2
103-12, 103-13, 103-15, 104-19, 104-22	92	67	9,2

Engine type	Sequence
2 cylinder	Illustration A
3 cylinder	Illustration B
4 cylinder	Illustration C

**Note:** Release the cylinder head setscrews evenly and gradually in the reverse sequence to that shown in (A).



**Basic technical data**

Horse power .....	60 kW (81 bhp)
Number of cylinders .....	4
Cycle .....	Four stroke
Induction system .....	Naturally aspirated
Combustion system .....	Direct injection
Nominal bore .....	101 mm (3.98 in)
Stroke .....	127 mm (5.00 in)
Compression ratio .....	15.3:1
Cubic capacity .....	407 litres (248 in <sup>3</sup> )
Firing order .....	1-3-4-2
Valve tip clearances	
- Inlet (cold) .....	0,20 mm (0.008 in)
- Exhaust (cold) .....	0,45 mm (0.018 in)
Lubricating oil pressure	
- maximum engine speed and normal engine temperature .....	207/414 kPa (30/60 lbf/in <sup>2</sup> ) 2,1/4,2 kgf/cm <sup>2</sup>
Coolant temperature .....	60 °C (140 °F)
Thermostat starts to open .....	77/85 °C (170/185 °F)
Thermostat fully open .....	92/98 °C (197/208 °F)
Direction of rotation .....	Clockwise from front
Idling speed .....	See application manual
Location of maximum no-load speed .....	Fuel injection pump data plate
Location of number 1 cylinder .....	Crankshaft pulley end
Location of engine timing marks .....	Marks on the pulley/damper or crankshaft, camshaft gear, fuel pump gear and idler gears
Atomiser codes .....	HD, HL, HU, HZ, NP
Fuel pump codes .....	AD, BD, CD, DD, FD
Location of fuel pump code .....	Fuel injection pump data plate
Location of fuel pump timing marks .....	Fuel pump flange and timing case
Belt tension .....	45 N (10 lbf) 4,5 kgf
Belt deflection at longest free length .....	10 mm (3/8 in)

**Preventive maintenance periods**

These preventive maintenance periods apply to average conditions of operation. Check the periods given by the manufacturer of the equipment in which the engine is installed. Use the periods which are shortest. When the operation of the engine must conform to the local regulations these periods and procedures may need to be adapted to ensure correct operation of the engine.

It is good preventive maintenance to check for leakage and loose fasteners at each service.

**Maintenance schedules**

<b>A</b> First service at 20/40 hours	<b>D</b> Every 400 hours or 12 months
<b>B</b> Every day or every 8 hours	<b>E</b> Every 2000 hours
<b>C</b> Every 200 hours or 6 months	

The schedules which follow must be applied at the interval (hours or months) which occur first.

A	B	C	D	E	Operation
•	•				Check the amount of coolant
			•		Check the concentration of the coolant (2)
•	•				Check the drive belt of the alternator
			•		Clean the sediment chamber and the strainer of the fuel lift pump
•	•				Check for water in the pre-filter (1)
			•		Renew the elements of the fuel filter
•			•		Ensure that the atomisers are checked (3)
			•		Ensure that the idle speed is checked and adjusted, if it is necessary (8)
			•		Check the amount of lubricating oil in the sump
•			•		Check the lubricating oil pressure at the gauge (1)
			•		Renew the engine lubricating oil (4) (5)
•			•		Renew the canister of the lubricating oil filter (4)
			•		Clean the engine breather system
•	•				Clean the air cleaner or empty the dust bowl of the air filter
			•		- extremely dusty conditions
			•		- normal conditions
			•		Clean or renew the air filter element, if it has not been indicated earlier
			•		Check the engine mounts
			•		Check all hoses and connections
•			•		Ensure that the valve tip clearances of the engine are checked and, if necessary, adjusted (3)
			•		Ensure that the alternator, the starter motor are checked (3)

- (1) If one is fitted.
- (2) Renew the antifreeze every 2 years. If a coolant inhibitor is used instead of antifreeze, it should be renewed every 6 months.
- (3) By a person who has had the correct training.
- (4) The lubricating oil and the filter canister must be renewed every 250 hours or 12 months for applications where the engine normally runs at full load for periods of more than 20 minutes, for example: generating sets or water pumps.
- (5) The oil change interval will change with the amount of sulphur in the fuel (see the table on page 3.03 and the fuel specification). The interval to change the canister of the lubricating oil filter is not affected.

## Fuel pump codes and timing

### CAV fuel injection pump

Type .....	DPA
Direction of rotation from drive end .....	Clockwise
Outlet for number 1 cylinder .....	Letter "W"

### Static timing

The engine check angle must be used with special tool MS.67B and with the engine set with number 1 piston at top dead centre (TDC) on the compression stroke. The pump is checked with the pump set at the start of injection for number 1 cylinder.

The code letters are included in the setting code stamped on the data plate of the fuel injection pump. Some fuel pumps may have the setting code stamped on a modification plate which is fastened to the flange of the pump. If a modification plate is fitted, use the code letters stamped on this plate. A typical setting code is 2643D000AD/2/2420; in this example the code letters are "AD".

Fuel pump code letters	Engine check angle (degrees)	Pump mark angle (degrees)
AD	280.5	291
BD	280.5	293
CD	280.5	287
FD	286	296

### Stanadyne fuel injection pump

Type .....	Stanadyne DB2
Outlet for number 1 cylinder .....	8 o'clock position as seen from the rear of the pump
Direction of rotation from drive end .....	Clockwise
Fuel system .....	Self-vent

### Static timing

The engine check angle must be used with special tool MS.67B and with the engine set with the piston of the number 1 cylinder at top dead centre (TDC) on the compression stroke. The pump is checked with the pump set at the start of injection for the number one cylinder.

Fuel pump code letters	Engine check angle (degrees)	Pump mark angle (degrees)
DD	286	297

## Recommended torque tensions

The torque tensions below apply to components lubricated lightly with clean engine oil before they are fitted.

Description	Thread size	Torque		
		Nm	lbf ft	kgf m
Setscrews, cylinder head, refer to head tightening sequence	1/2 UNF	110	80	11,1
Plug, lubricating oil sump	3/4 UNF	34	25	3,5
Setscrews, atomiser clamp	M8	12	9	1,2
Union nuts, high-pressure fuel pipes	M12	22	16	2,2
Setscrews, main bearings	5/8 UNF	250	185	26,0
Nuts, connecting rods	1/2 UNF	125	92	12,7
Setscrews, crankshaft pulley	7/16 UNF	115	85	11,8
Setscrews, flywheel to crankshaft	1/2 UNF	105	77	10,7

## Cylinder head torque sequence

**Caution:** This operation must be done by a person with the correct training. If in doubt, refer to the workshop manual.

It is important that the studs and the three different lengths of setscrews are fitted in their correct positions.

Fastener type	Fastener length mm (in)	Illustration and position
Setscrew	Short	A 5, 6, 11, 12, 16, 17, 21, 22
Setscrew	Medium	A 1, 2, 3, 4, 7, 8, 9, 10, 13, 15, 18, 20
Setscrew	Long	A 14, 19

1 Lightly lubricate the threads and the thrust faces of the setscrews.

2 Gradually and evenly tighten the setscrews to 110 Nm (80 lbf ft) 11,1 kgf m in the sequence shown in (A). Repeat to ensure that all the setscrews are tightened to the correct torque.

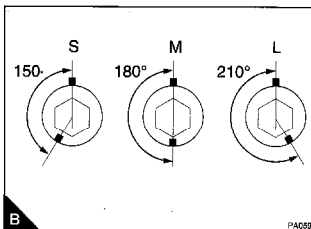
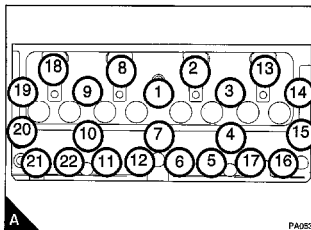
3 Use the special angle gauge MS.1531 to tighten the setscrews, in the correct sequence (A), a further part of a turn according to the length of the setscrews, see the table below.

Fastener	Further part of a turn
A 5, 6, 11, 12, 16, 17, 21, 22	150° or 2 1/2 flats
A 1, 2, 3, 4, 7, 8, 9, 10, 13, 15, 18, 20	180° or 3 flats
A 14, 19	210° or 3 1/2 flats

4 If the special angle gauge MS.1531 is not available, make a suitable mark on the cylinder head in line with a corner of each setscrew (B). Make another mark, at the correct angle (counter-clockwise), on the edge of the flange of each fastener according to the length of the setscrew.

Tighten each setscrew in the correct sequence until the marks on the flange are next to, and in line with, the marks on the cylinder head.

**Note:** Release the cylinder head setscrews evenly and gradually in the reverse sequence to that shown in (A).



## Basic technical data

Horse power	36,5 to 59,7 kW (49 to 80 bhp)
Number of cylinders	4
Cycle	Four stroke
Induction system	Naturally aspirated or turbocharged
Combustion system	Direct injection
Nominal bore	84,5 mm (3.33 in)
Stroke	88,9 mm (3.50 in)
Compression ratio	
- Prima naturally aspirated	18.1:1
- Prima turbocharged	17.2:1
- 500 Series	17.1:1
Cubic capacity	1,994 litres (172 in <sup>3</sup> )
Firing order	1-3-4-2
Valve tip clearances	Refer to the workshop manual
Lubricating oil pressure	
- maximum engine speed and normal engine temperature	250 kPa (36 lbf/in <sup>2</sup> ) 2,5 kgf/cm <sup>2</sup>
Coolant temperature	60 °C (140 °F)
Thermostat starts to open	
- Prima	85/89 °C (185/192 °F)
- 500 Series	77/85 °C (170/185 °F)
Thermostat fully open	
- Prima	99/102 °C (210/215 °F)
- 500 Series	92/98 °C (197/208 °F)
Direction of rotation	Clockwise from front
Idling speed	820 to 1050 rev/min
Location of maximum no-load speed	None
Location of number 1 cylinder	Crankshaft pulley end
Location of engine timing marks	Timing pin method
Atomiser codes	JC, JD, RG, JP, RL
Fuel pump codes	None
Location of fuel pump code	None
Location of fuel pump timing marks	Timing pin method, camshaft and flywheel
Belt tension	
- new belt	440 N (100 lbf) 45,0 kgf
- after 20 hours service	355 N (80 lbf) 3,6 kgf
Belt deflection at longest free length	9,5 mm (0,375 in)



### Preventive maintenance periods

These preventive maintenance periods apply to average conditions of operation. Check the periods given by the manufacturer of the equipment in which the engine is installed. Use the periods which are shortest. When the operation of the engine must conform to the local regulations these periods and procedures may need to be adapted to ensure correct operation of the engine.

It is good preventive maintenance to check for leakage and loose fasteners at each service.

### Maintenance schedules

- |                                       |  |
|---------------------------------------|--|
| <b>A</b> First service at 25/50 hours | <b>E</b> Every 400 hours or 6 months   |
| <b>B</b> Every day or every 8 hours   | <b>F</b> Every 800 hours or 12 months  |
| <b>C</b> Every week                   | <b>G</b> Every 1600 hours or 24 months |
| <b>D</b> Every month                  | <b>H</b> Every 2000 hours or 30 months |

The schedules which follow must be applied at the interval (hours or months) which occur first.

A	B	C	D	E	F	G	H	Operation
•	•				•			Check the amount of coolant Check the concentration of the coolant Renew the coolant
•				•			•	Check the drive belt of the alternator Renew the drive belt of the alternator
		•			•			Drain water from the fuel pre-filter Renew the canister of the fuel filter Clean the sediment chamber of the fuel lift pump
•	•							Check the amount of lubricating oil in the sump Check the lubricating oil pressure at the gauge (1) Renew the engine lubricating oil (3) Renew the canister of the lubricating oil filter
•	•				•			Clean the air cleaner or empty the dust bowl of the air filter - extremely dusty conditions - normal conditions Clean or renew the air filter element, if it has not been indicated earlier
•			•				•	Clean the engine breather Check the performance of the glow plugs
•				•				Ensure idle speed is checked and adjusted, if necessary (2) Ensure that the valve tip clearances of the engine are checked and, if necessary, adjusted (2) Ensure that the timing belt is checked for wear, damage and the correct tension (2) Ensure that the timing belt is renewed (2) Ensure that the alternator and the starter motor are checked (2)

(1) If there is one fitted.

(2) By a person who has had the correct training.

(3) The oil change interval will change with the amount of sulphur in the fuel (see the table on page 3.03 and the fuel specification). The interval to change the canister of the lubricating oil filter is not affected.

### Recommended torque tensions

The torque tensions below apply to components lubricated lightly with clean engine oil before they are fitted.

Description	Thread size	Torque		
		Nm	lbf ft	kgf m
Setscrews, cylinder head, see cylinder head torque sequence	M12	-	-	-
Sump plug	1/4 BSP	43	32	4,4
Setscrew, atomiser clamp	M10	43	32	4,4
Union nut, high pressure fuel pipes	M12	22	16	2,2
Setscrews, main bearing	M12	112	83	11,4
Nuts, big end bearing	11/32 UNF	47	35	4,8
Front pulley, refer to the workshop manual	-	-	-	-
Setscrews, flywheel	7/16 UNF	65	48	6,6

### Cylinder head torque sequence

**Caution:** Refer to Section 12 of the workshop manual before following these instructions. There is a special timing pin fitted to the engine that must be fitted in the correct position. If it is not, the engine will be damaged.

- 1 Lightly lubricate the threads and the thrust faces of the cylinder head setscrews.
- 2 Fit the setscrews in their correct positions and tighten them finger tight.

Setscrew type	Illustration and position
Short	A 1 to 6
Long	A 7 to 10

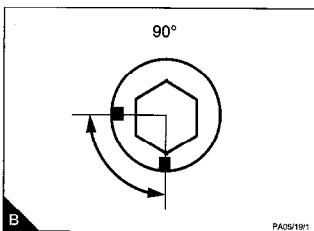
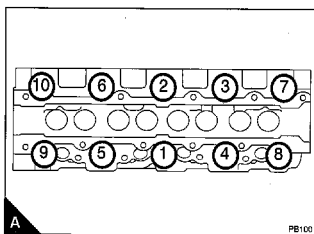
3 Gradually and evenly tighten the setscrews to 50 Nm (37 lbf ft) 5,1 kgf m, in the correct sequence (A).

4 Tighten the setscrews to 100 Nm (74 lbf ft) 10,2 kgf m, in the correct sequence (A).

5 Use the special angle gauge MS.1531 to tighten the setscrews, in the correct sequence, a further quarter of a turn (90°).

If the special angle gauge MS 1531 is not available, make a suitable mark on the cylinder head in line with a corner of each setscrew (B). Make another mark, at 90° (counter-clockwise), on the edge of the flange of each setscrew. Tighten each setscrew in the correct sequence until the marks on the flange are next to, and in line with, the marks on the cylinder head.

**Caution:** If the original setscrews have been fitted again, mark the top of each setscrew with a centre punch to indicate it has been tightened in service. A maximum of four centre punch marks is permitted.



**Note:** Release the cylinder head setscrews evenly and gradually in the reverse sequence to that shown in (A).

### Basic technical data

Horse power	
- 704-26	43 to 47 kW (57.7 to 63.0 bhp)
- 704-30	43 kW (57.7 bhp)
Number of cylinders	4
Cycle	Four stroke
Induction system	Naturally aspirated
Combustion system	
- 704-26	Indirect injection
- 704-30	Direct injection
Nominal bore	
- 704-26	91.0 mm (3.58 in)
- 704-30	97.0 mm (3.82 in)
Stroke	100 mm (3.90 in)
Compression ratio	
- 704-26	22:1
- 704-30	17.5:1
Cubic capacity	
- 704-26	2,6 litres (159 in <sup>3</sup> )
- 704-30	3,0 litres (183 in <sup>3</sup> )
Firing order	1-3-4-2
Valve tip clearances	
- Inlet (cold)	0,35 mm (0.014 in)
- Exhaust (cold)	0,35 mm (0.014 in)
Lubricating oil pressure	
- maximum engine speed and normal engine temperature	420 kPa (61 lbf/in <sup>2</sup> ) 4,3 kgf/cm <sup>2</sup>
Coolant temperature	60 °C (140 °F)
Thermostat starts to open	82 °C (179 °F)
Thermostat fully open	95 °C (203 °F)
Direction of rotation	Clockwise from front
Idling speed	Refer to the User's Handbook of the application
Location of maximum no-load speed	Fuel pump data plate
Location of number 1 cylinder	Crankshaft pulley end
Location of engine timing marks	Crankshaft pulley

*Continued*

**Basic technical data** *Continued*

Atomiser codes .....	UA, UB
Fuel pump codes .....	AJ, BJ
Location of fuel pump code .....	Fuel pump data plate
Location of fuel pump timing marks .....	None
Belt tension .....	45 N (10 lbf) 4,5 kgf
Belt deflection at longest run .....	10 mm (3/8 in)

**Preventive maintenance periods**

These preventive maintenance periods apply to average conditions of operation. Check the periods given by the manufacturer of the equipment in which the engine is installed. Use the periods which are shortest. When the operation of the engine must conform to the local regulations these periods and procedures may need to be adapted to ensure correct operation of the engine. It is good preventive maintenance to check for leakage and loose fasteners at each service.

**Maintenance schedule**

The schedules which follow must be applied at the interval (hours or months) which occur first.

<b>A</b> First service at 25/50 hours	<b>F</b> Every 500 hours or 12 months (704-26)
<b>B</b> Every day or every 8 hours	<b>G</b> Every 1000 hours
<b>C</b> Every 250 hours or 6 months (704-30)	<b>H</b> Every 2000 hours
<b>D</b> Every 250 hours or 6 months (704-26)	<b>J</b> Every 3000 hours
<b>E</b> Every 500 hours or 12 months (704-30)	

A	B	C	D	E	F	G	H	J	Operation
•	•	•	•						Check the amount of coolant Check the concentration of the coolant (3) Check the condition of the drive belt
•	•			•	•				Drain water from the fuel pre-filter (1) Renew the canister of the fuel filter and renew the fuel strainer Ensure that the atomisers are checked (2) <i>always use new clamps on 704-30</i> Ensure that the idle speed is checked and adjusted, if it is necessary (2)
•	•								Check the amount of lubricating oil in the sump Check the lubricating oil pressure at the gauge (1) Renew the engine lubricating oil (5) (4) Renew the canister of the lubricating oil filter
•	•								Clean the air cleaner or empty the dust bowl of the air filter -extremely dusty conditions -normal conditions Clean or renew the air filter element, if this has not been indicated earlier
•								•	Ensure that the valve tip clearances of the engine are checked and, if necessary, adjusted (2) Check all hoses and connections Remove and clean the engine breather pipe) Renew the engine breather (2)
								•	Ensure that the alternator, the starter motor, etc. are checked (2) Ensure that the glow plugs are checked (2)
								•	inspect the electrical system (2)

(1) If one is fitted.

(2) By a person who has had the correct training.

(3) Renew the antifreeze every 2 years.

(4) The oil change interval will change if a lubricating oil sump with a capacity of less than 8 litres is used. If there is doubt, contact Technical Services, Perkins International Limited, Peterborough.

(5) The oil change interval will change with the sulphur content of the fuel (see the table on page 3.03 and the Fuel Specification in section 5). The interval to change the canister of the lubricating oil filter is not affected.

**Recommended torque tensions**

The torque tensions below apply to components lubricated lightly with clean engine oil before they are fitted.

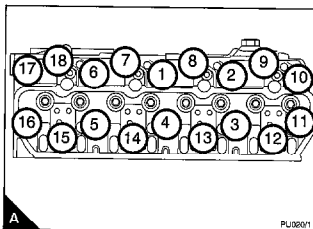
Description	Thread size	Torque		
		Nm	lbf ft	kgf m
Setscrews, cylinder head, refer to head tightening sequence	M11	-	-	-
Plug, lubricating oil sump	3/4 UNF	34	25	3,5
Setscrews, atomiser clamp	M8	12	9	1,2
Union nuts, high-pressure fuel pipes	M12	22	16	2,2
Setscrews, main bearings	M14	147	108	15,0
Nuts, connecting rods	M9	54	40	5,5
Setscrews, crankshaft pulley	M16	185	136	19,0
Setscrews, flywheel to crankshaft	M12	100	77	10,7

**Cylinder head torque sequence**

**Caution:** This operation must be done by a person with the correct training. If in doubt, refer to the workshop manual.

- 1 Lightly lubricate the threads and the thrust faces of the setscrews.
- 2 Gradually and evenly tighten the setscrews to 70 Nm (52 lbf ft) 7,1 kgf m in the correct sequence, shown in (A).
- 3 Tighten the setscrews to 100 Nm (74 lbf ft) 10,2 kgf m in the correct sequence, shown in (A).
- 4 Repeat stage 3.

**Note:** Release the cylinder head setscrews evenly and gradually in the reverse sequence to that shown in (A).

**Basic technical data**

Horse power	39,5 kW (53 bhp)
Number of cylinders	3
Cycle	Four stroke
Induction system	Naturally aspirated
Combustion system	Direct injection
Nominal bore	95 mm (3.74 in)
Stroke	127 mm (5.00 in)
Compression ratio	17.5:1
Cubic capacity	2,7 litres (164.76 in <sup>3</sup> )
Firing order	1-2-3
Valve tip clearances	
- Inlet (cold)	0.20 mm (0.008 in)
Exhaust	0.45 mm (0.018 in)
Lubricating oil pressure	
- maximum engine speed and normal engine temperature	207/414 kPa (30/60 lbf/in <sup>2</sup> ) 2,1/4,2 kgf/cm <sup>2</sup>
Coolant temperature	60 °C (140 °F)
Thermostat starts to open	80/84 °C (176/183 °F)
Thermostat fully open	96 °C (205 °F)
Direction of rotation	Clockwise from front
Idling speed	750 rev/min
Location of maximum no-load speed	Fuel pump data plate
Location of number 1 cylinder	Crankshaft pulley end
Location of engine timing marks	Crankshaft, fuel pump gear, camshaft gear, idler gears, and alignment of holes in the flywheel backplate
Atomiser codes	KB
Fuel pump codes	AN - BN
Location of fuel pump code	Left side of pump from rear of engine
Location of fuel pump timing marks	Fuel pump flange
Belt tension	45 N (10 lbf) 4,5 kgf
Belt deflection at longest run	10 mm (3/8 in)

## Preventive maintenance periods

These preventive maintenance periods apply to average conditions of operation. Check the periods given by the manufacturer of the equipment in which the engine is installed. Use the periods which are shortest. When the operation of the engine must conform to the local regulations these periods and procedures may need to be adapted to ensure correct operation of the engine.

It is good preventive maintenance to check for leakage and loose fasteners at each service.

## Maintenance schedules

A First service at 25/50 hours	E Every 1000 hours
B Every day or every 8 hours	F Every 2000 hours
C Every 200 hours or 4 months	G Every 4000 hours
D Every 500 hours or 12 months	

The schedules which follow must be applied at the interval (hours or months) which occur first.

A	B	C	D	E	F	G	Operation
•	•						Check the amount of coolant Check the concentration of the coolant (1) Check the drive belt of the alternator
•	•						Drain water from the fuel pre-filter Renew the elements of the fuel filter Ensure that the atomisers are checked (3) Ensure idle speed is checked and adjusted, if necessary (3)
•	•						Check the amount of lubricating oil in the sump Check the lubricating oil pressure at the gauge (2) Renew the engine lubricating oil (4) Renew the canister of the lubricating oil filter Clean external vent holes on breather valve Renew the engine breather valve
•	•						Clean the air cleaner or empty the dust bowl of the air filter - extremely dusty conditions - normal conditions Clean or renew the air filter element, if it has not been indicated earlier
•	•						Check the engine mounts Check all hoses and connections (also includes breather pipe)
•	•						Ensure that the valve tip clearances of the engine are checked and, if necessary, adjusted (3) Check all electrical cables and connections (5) Ensure that the alternator and the starter motor are checked (3)

- Renew the antifreeze every 2 years. If a coolant inhibitor is used instead of antifreeze, it should be renewed every 6 months.
- If there is one fitted
- By a person who has had the correct training.
- The oil change interval will change with the amount of sulphur in the fuel (see the table on page 3.03 and the fuel specification). The interval to change the canister of the lubricating oil filter is not affected.
- Caution:** If there is a failure in the electrical circuit for the cold start advance, the engine will run continuously with the timing in the fully advanced position and damage the engine.

## Fuel pump codes

### Lucas fuel injection pump

Type .....	Lucas DP 200
Direction of rotation from drive end .....	Clockwise
Outlet for number 1 cylinder .....	Letter "U"

### Static timing

An example of the pump code is 2644A000AN/2/2270. The fuel pump code begins with the pump part number, followed by two letters, then a number for the governor spring position and lastly the maximum no-load speed. For identification purposes, only the two code letters are used. This information can be found on the data plate of the fuel pump. The mark on the flange of the pump can be checked with timing tool MS.67B. The lock angle is set with timing tool MS.67B.

The fuel injection pump is timed to the engine with the engine set at TDC No.1 cylinder on the compression stroke.

Fuel pump code letters	Pump mark angle (degrees)
AN	88
BN	88

## Recommended torque tensions

The torque tensions below apply to components lubricated lightly with clean engine oil before they are fitted.

Description	Thread size	Torque		
		Nm	lbf ft	kgf m
Setscrews, cylinder head	M12/M14	-	-	-
Sump plug	3/4 UNF	34	25	3,5
Atomiser clamp	M8	22	16	2,2
Union nuts, high-pressure fuel pipes	M12	22	16	2,2
Main bearing	9/16 UNF	152	112	15,5
Big end bearing	7/16 UNF	77	57	7,9
Crankshaft pulley	7/8 UNF	325	240	33,2
Flywheel	1/2 UNF	105	77	10,7

**Caution:** This operation must be done by a person with the correct training. If in doubt, refer to the workshop manual.

There are two types of cylinder head gasket in use:

- Part number 3681E026, a brown 'soft' gasket with beads of red sealant.
- Part number 3681E028, a black laminated steel gasket.

In service, engines fitted with gasket, part number 3681E026, can also use gasket, part number 3681E028. Engines fitted with gasket, part number 3681E028, must use only this gasket.

Tighten the studs into the cylinder block to 25 Nm (18 lbf ft) 2,5 kgf m.

1 Lightly lubricate the threads and the thrust faces of the fasteners.

2 Fit the fasteners in their correct positions and tighten them finger tight.

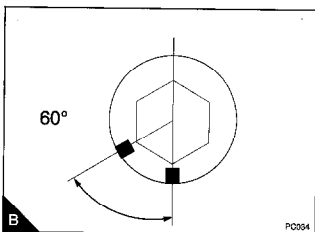
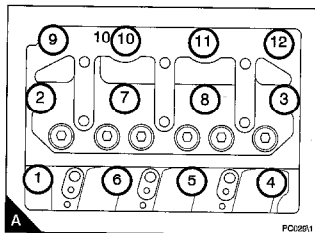
**Note:** From engine number 308450B, two studs and nuts (A10 and A11) were replaced by setscrews.

Gasket type and fastener type	illustration and position
3681E026 and 3681E028 up to 308449B setscrew nut	A 1 to 8 A 9 to 12
3681E028 from 308450B setscrew nut	A 1 to 8, 10, 11 A 9, 12

3 Gradually and evenly tighten the setscrews in positions A1 to A8 *only* in the sequence shown in (A) to the values shown the table below.

Gasket type and fastener position	Torque		
	Nm	lbf ft	kgf m
3681E026			
A 1 to 8	90	66	9,2
A 9 to 12	60	44	6,1
3681E028			
A 1 to 8	70	52	7,1
A 9 to 12	50	37	5,1

4 Repeat stage 3.



5 Use the special angle gauge MS.1531 to tighten setscrews A1 to A6, in the correct sequence a further one flat (60°).

6 Repeat stage 5.

7 Gradually and evenly tighten the setscrews in positions A9 to A12 *only* in the sequence shown in (A) to the values shown the table opposite.

8 Repeat stage 7.

9 Use the special angle gauge MS.1531 to tighten the setscrews A9 to A12 in the correct sequence, a further one flat (60°).

If the special angle gauge MS.1531 is not available for stages 5, 6 and 9, make a suitable mark on the cylinder head in line with a corner of each fastener (B). Make another mark, at 60° (counter-clockwise), on the edge of the flange of each fastener. Tighten each fastener in the correct sequence until the marks on the flange are next to, and in line with, the marks on the cylinder head.

**Note:** Release the cylinder head fasteners evenly and gradually in the reverse sequence to that shown in (A).

## Basic technical data

Horse power	50,7 kW (68/210 bhp)
Number of cylinders	
- AA, AB, AC, AD, AG, AH, AE	4
- YA, YB, YC, YD, YE	6
Cycle	Four stroke
Induction system	
- AA, AG, YA	Naturally aspirated
- AB, AH, YB	Turbocharged
- AC, YC	Compensated
- AD, YD, AE, YE	Turbocharged/intercooled
Combustion system	Direct injection
Nominal bore	100 mm (3.937 in)
Stroke	127 mm (5,000 in)
Compression ratio	
- AA, AG, YA (some YA engines are 17.5:1)	16.5:1
- AB, AC, AD, AH, YB, YD, YC (some YD engines are 17.5:1 or 17.25:1)	16:1
- AE, YE	17.5:1
Cubic capacity	
- AA, AB, AC, AD, AG, AH, AE	4 litres (243 in <sup>3</sup> )
- YA, YB, YC, YD, YE	6 litres (365 in <sup>3</sup> )
Firing order	
- AA, AB, AC, AD, AG, AH, AE	1-3-4-2
- YA, YB, YC, YD, YE	1-5-3-6-2-4
Valve tip clearances	
- Inlet (cold)	0,20 mm (0,008 in)
- Exhaust (cold)	0,45 mm (0,018 in)
Lubricating oil pressure max engine speed and normal engine temperature	
- with cooling jets	280 kPa (40 lbf/in <sup>2</sup> ) 2,8 kgf/cm <sup>2</sup>
- without cooling jets	207 kPa (30 lbf/in <sup>2</sup> ) 2,1 kgf/cm <sup>2</sup>
Coolant temperature	60 °C (140 °F)
Thermostat starts to open	
- single wax type (6 cylinder engines)	67/75 °C (152/167 °F)
- twin wax type (4 cylinder engines)	77/85 °C (170/185 °F)

*Continued*



## Maintenance schedule - Phaser

- A First service at 1000/2000km (600/1200 miles) or 20/40 hours  
 B Every day or every 8 hours  
 C Every 10000 km (6,250 miles) 200 hours or 6 months  
 D Every 20000 km (12,500 miles) 400 hours or 12 months  
 E Every 100000 km (62,500 miles) or 2000 hours

The schedules which follow must be applied at the interval (kilometres, miles, hours or months) which occur first.

A	B	C	D	E	Operation
•	•	•			Check the amount of coolant
•	•	•			Check the concentration of the coolant (2)
•	•	•			Check the drive belt(s)
			•		Clean the sediment chamber and the strainer of the fuel lift pump
			•		Check for water in the pre-filter (1)
			•		Renew the elements of the fuel filter(s)
			•		Ensure that the atomisers are checked (3)
			•		Ensure that the idle speed is checked and adjusted, if it is necessary (3)
				•	Check the amount of lubricating oil in the sump
				•	Check the lubricating oil pressure at the gauge (1)
				•	Renew the engine lubricating oil (4) (5)
				•	Renew the canister(s) of the lubricating oil filter (4)
				•	Renew the gauze element of the engine breather system
				•	Clean the air cleaner or empty the dust bowl of the air filter
				•	- extremely dusty conditions
				•	- normal conditions
				•	Clean or renew the air filter element, if it has not been indicated earlier
				•	Ensure that the turbocharger impeller and turbocharger compressor casing are cleaned (3)
				•	Clean the compressor air filter (1)
				•	Ensure that the exhaustor or compressor (1) is checked (3)
				•	Ensure that the valve tip clearances of the engine are checked and, if necessary, adjusted (3)
				•	Ensure that the alternator, the starter motor are checked (3)

(1) If one is fitted.

(2) Renew the antifreeze every 2 years. If a coolant inhibitor is used instead of antifreeze, it should be renewed every 6 months.

(3) By a person who has had the correct training.

(4) The lubricating oil and the filter canister(s) must be renewed every 250 hours or 12 months for applications where the engine normally runs at full load for periods of more than 20 minutes.

(5) The oil change interval will change with the amount of sulphur in the fuel (see the table on page 3.03 and the fuel specification in section 5). The interval to change the canister of the lubricating oil filter is not affected.

## Fuel pump codes

## Lucas fuel injection pump

Type ..... DPA or DPS  
 Direction of rotation from drive end ..... Clockwise  
 Outlet for number 1 cylinder  
 AA, AB, AC, AD ..... Letter "W"  
 YA, YB, YC, YD ..... Letter "Y"

The engine check angle must be used with special tool MS.67B and with the engine set with number 1 piston at top dead centre (TDC) on the compression stroke. The pump is checked with the pump set at the start of injection for number 1 cylinder.

The code letters are included in the setting code stamped on the data plate of the fuel injection pump. Some fuel pumps may have the setting code stamped on a modification plate which is fastened to the flange of the pump. If a modification plate is fitted, use the code letters stamped on this plate. A typical setting code is 2643C601BM/4/2860; in this example the code letters are "BM".

Fuel pump code letters	Engine check angle (degrees)	Pump mark angle (degrees)
AK	325.5	336
AM	282.25	292
BM	282.25	290.5
CM	280.5	291.5
DM	282.25	290.5
FK	325.5	336
GK	324	336
GM	282.25	292
HK	327	336
HM	282.25	291
JK	325.5	334
KK	325	334
LK	326.5	337.5
MK	325	336
PK	326	334
RK	327.5	336
UK	332	343



**Bosch fuel injection pump**

Type .....	EPVE
Outlet for number 1 cylinder .....	"C"
Direction of rotation from drive end .....	Clockwise
Fuel system .....	Self-vent

**Static timing**

The engine check angle must be used with special tool MS.67B and with the engine set with number 1 piston at top dead centre (TDC) on compression stroke. The pump mark angle and the piston displacement are checked with the pump plunger set at 1,00 mm (0.039 in) plunger lift.

**Note:** If there are no marks on the pump flange or on the timing case, refer to the workshop manual.

The code letters are included in the setting code stamped on the side of the fuel injection pump. Some fuel pumps may have the setting code stamped on a modification plate which is fastened to the flange of the pump. If a modification plate is fitted, use the code letters stamped on this plate. A typical setting code is 2643J603DK1/3020; in this example the code letters are "DK".

Fuel pump code letters	Engine check angle (degrees)	Pump mark angle (degrees)
BK	308	314
CK	308	314
DK	307	313
EK	308.5	315.5
EK (1)	308.5	315.5
EM	288.5	295.5
FM	288.75	295
JM (3)	-	-
JM (2) (3)	-	-
SK (3)	-	-

(1) Engines to build lists YA80433 and YA50360 with the modification plate stamped J609.

(2) Engines to build lists AD70229 and AD70230.

(3) For an engine which does not have pump timing marks which have been put on in the factory.

**Recommended torque tensions**

The torque tensions below apply to components lubricated lightly with clean engine oil before they are fitted.

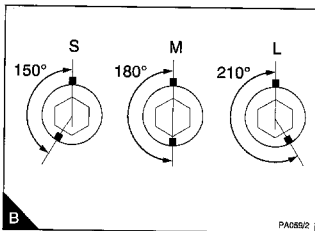
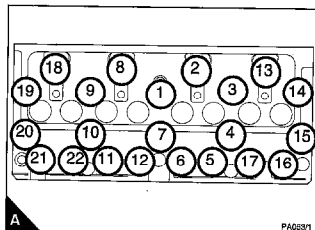
Description	Thread size	Torque		
		Nm	lbf ft	kgf m
Setscrews, cylinder head, refer to head tightening sequence	1/2 UNF	-	-	-
Sump plug	3/4 UNF	34	25	3,5
Setscrew, atomiser clamp	M8	16	9	1,2
Union nut, injector pipe	M12	20	14	1,9
Setscrews, main bearing, 4 cylinder	5/8 UNF	250	185	26,0
Setscrews, main bearing, 6 cylinder		265	196	27,0
Nuts, big end bearing	1/2 UNF	125	92	12,7
Setscrews, big end bearing		155	114	15,8
Front pulley	7/16 UNF	407	85	11,8
Setscrews, flywheel	1/2 UNF	108	77	10,7

**Cylinder head torque sequence  
4 cylinder engines**

**Caution:** This operation must be done by a person with the correct training. If in doubt, refer to the workshop manual.

It is important that the studs and the three different lengths of setscrews are fitted in their correct positions.

Fastener type	Fastener length mm (in)	Illustration and position
Setscrew	Short	A 5, 6, 11, 12, 16, 17, 21, 22
Setscrew	Medium	A 1, 2, 3, 4, 7, 8, 9, 10, 13, 15, 18, 20
Setscrew	Long	A 14, 19,



- 1 Lightly lubricate the threads of the cylinder head setscrews and the thrust faces of the setscrew.
- 2 Gradually and evenly tighten the setscrews to 110 Nm (80 lbf ft) 11,1 kgf m in the sequence shown in (A). Repeat to ensure that all the setscrews are tightened to the correct torque.
- 3 Use the special angle gauge MS.1531 to tighten the setscrews, in the correct sequence (A), a further part of a turn according to the length of the setscrews, see the table below.

Fastener	Further part of a turn
A 5, 6, 11, 12, 16, 17, 21, 22	150° or 2 1/2 flats
A 1, 2, 3, 4, 7, 8, 9, 10, 13, 15, 18, 20	180° or 3 flats
A 14, 19,	210° or 3 1/2 flats

4. If the special angle gauge MS.1531 is not available, make a suitable mark on the cylinder head in line with a corner of each setscrew (B). Make another mark, at the correct angle (counter-clockwise), on the edge of the flange of each fastener according to the length of the setscrew. Tighten each setscrew in the correct sequence until the marks on the flange are next to, and in line with, the marks on the cylinder head.

**Note:** Release the cylinder head setscrews evenly and gradually in the reverse sequence to that shown in (A).

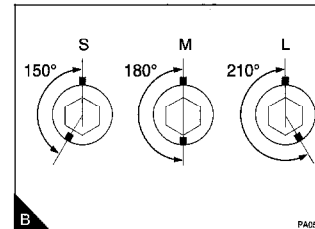
**Cylinder head torque sequence  
6 cylinder engines**

**Caution:** This operation must be done by a person with the correct training. If in doubt, refer to the workshop manual.

It is important that the studs and the three different lengths of setscrews are fitted in their correct positions.

Fastener type	Fastener length mm (in)	Illustration and position
Setscrew	Short	A 5, 6, 11, 12, 16, 17, 21, 22, 26, 27, 31, 32
Setscrew	Medium	A 1, 2, 3, 4, 7, 8, 9, 10, 13, 14, 15, 18, 19, 20, 23, 25, 28, 30
Setscrew	Long	A 24, 29

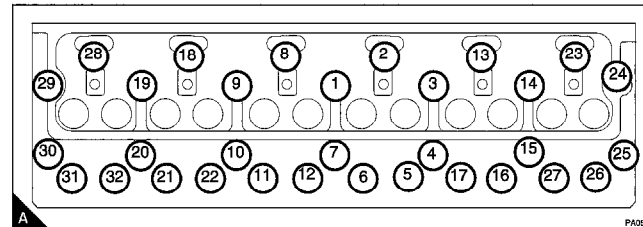
- 1 Lightly lubricate the threads of the cylinder head setscrews and the thrust faces of the setscrew.
- 2 Gradually and evenly tighten the setscrews to 110 Nm (80 lbf ft) 11,1 kgf m in the sequence shown in (A). Repeat to ensure that all the setscrews are tightened to the correct torque.
- 3 Use the special angle gauge MS 1531 to tighten the setscrews, in the correct sequence (A), a further part of a turn according to the length of the setscrews, see the table opposite.



Fastener	Further part of a turn
A 5, 6, 11, 12, 16, 17, 21, 22, 26, 27, 31, 32	150° or 2 1/2 flats
A 1, 2, 3, 4, 7, 8, 9, 10, 13, 14, 15, 18, 19, 20, 23, 25, 28, 30	180° or 3 flats
A 24, 29	210° or 3 1/2 flats

- 4 If the special angle gauge MS 1531 is not available, make a suitable mark on the cylinder head in line with a corner of each setscrew (B). Make another mark, at the correct angle (counter-clockwise), on the edge of the flange of each fastener according to the length of the setscrew. Tighten each setscrew in the correct sequence until the marks on the flange are next to, and in line with, the marks on the cylinder head.

**Note:** Release the cylinder head setscrew evenly and gradually in the reverse sequence to that shown in (A).



**Basic technical data**

Horse power .....	119/224 kW (160/300 bhp)
Number of cylinders .....	6
Cycle .....	Four stroke
Induction system .....	Turbocharged or Turbocharged/charge cooled
Combustion system .....	Direct injection
<b>Nominal bore</b>	
- WB, WC, WF, WG .....	109,2 mm (4.301 in)
- WD, WE .....	114,3 mm (4.500 in)
- WH, WJ .....	116,5 mm (4.590 in)
<b>Stroke</b>	
- WB, WC, WF, WG, WH, WJ .....	135,9 mm (5.350 in)
- WD, WE .....	118,9 mm (4.680 in)
<b>Compression ratio</b>	
- WB, WC .....	16.5:1
- WD, WE, WF, WG, WH, WJ .....	15.8:1
<b>Cubic capacity</b>	
- WB, WC, WF, WG .....	7,6 litres (466 in <sup>3</sup> )
- WD, WE .....	6,7 litres (408 in <sup>3</sup> )
- WH, WJ .....	8,7 litres (530 in <sup>3</sup> )
Firing order .....	1-5-3-6-2-4
<b>Valve tip clearances</b>	
- Inlet (cold) .....	0,64 mm (0.25 in)
- Exhaust (cold) .....	0,64 mm (0.25 in)
<b>Lubricating oil pressure</b>	
- maximum engine speed and normal engine temperature .....	345/497 kPa (50/72 lbf/in <sup>2</sup> ) 3,5/5,1 kgf/cm <sup>2</sup>
Coolant temperature .....	98,8 °C (210 °F)
Thermostat starts to open .....	82 °C (180 °F)
Thermostat fully open .....	94 °C (202 °F)
Direction of rotation .....	Clockwise from front
Idling speed .....	700 rev/min
Location of maximum no-load speed .....	Emissions label, if one is fitted
Location of number 1 cylinder .....	Crankshaft pulley end
Location of engine timing marks .....	Emissions label, if one is fitted. If not see the workshop manual
Atomiser codes .....	B, C, D, F, G, H, J, K, L, M, N, P, R, S, T, U, W, AB, AD, AE, AF
Fuel pump codes .....	Identified by part number
Fuel pump codes .....	Fuel pump governor data plate
Location of fuel pump timing marks .....	Timing pin method
Belt tension .....	Automatic tensioner

**Preventive maintenance periods**

**Caution:** On short distance operation with frequent starts and stops the hours of operation are more important than the distance.

These preventive maintenance periods apply to average conditions of operation. Check the periods given by the manufacturer of the equipment in which the engine is installed. Use the periods which are shortest. When the operation of the engine must conform to the local regulations these periods and procedures may need to be adapted to ensure correct operation of the engine.

It is good preventive maintenance to check for leakage and loose fasteners at each service.

**Maintenance schedules**

- A** Every day or every 8 hours
- B** Every 450 hours or 6 months or 19 300 km (12 000 miles)
- C** Every 900 hours or 12 months or 38 800 km (24 000 miles)
- D** Every 3600 hours or 24 months or 154 400 km (96 000 miles)
- E** Every 4950 hours or 193 100 km (120 000 miles)
- F** Every 6750 to 7500 hours or 290 000/322 000 km (180 000/200 000 miles)
- G** Annually

The schedules which follow must be applied at the interval (hours or months) which occur first.

A	B	C	D	E	F	G	Operation
•							Check the amount of coolant Check the intercooler and the coolant radiator for debris Renew the canister of the coolant filter (3) Renew the coolant (4) Check the condition of the drive belt
•		•					Drain water from the fuel pre-filter (1) Renew the canister of the fuel filter and renew the fuel strainer Ensure that the atomisers are checked (2) Ensure that the idle speed is checked and adjusted, if it is necessary (2)
•					•		Check the amount of lubricating oil in the sump Check the lubricating oil pressure at the gauge (1) Renew the engine lubricating oil (5) Renew the canister of the lubricating oil filter
•						•	Clean or renew the air filter element (or earlier if in extremely dusty conditions)
						•	Ensure that the valve tip clearances of the engine are checked and, if necessary, adjusted (2)
						•	Ensure that the turbocharger impeller and the turbocharger compressor casing are cleaned (2)
						•	Ensure that the alternator, the starter motor, and the turbocharger, etc. are checked (2)
						•	Inspect the thermostat (2)
						•	Inspect the electrical system (2)

- (1) If there is one fitted.
- (2) By a person who has had the correct training.
- (3) Also if the coolant system has been drained.
- (4) The system should be flushed and a new filter canister fitted
- (5) The oil change interval will change with the sulphur content of the fuel (see the table on page 3.03 and fuel specification). The interval to change the canister of the lubricating oil filter is not affected

**Fuel pump codes****Fuel injection pump**

Type ..... P3000 or P7100 in line  
 Outlet for number 1 cylinder ..... The outlet nearest to the front of the engine  
 Direction of rotation from drive end ..... Clockwise  
 Fuel system ..... Self-vent

**Static timing chart**

Pump part number	Static timing BTDC	Pump part number	Static timing BTDC	Pump part number	Static timing BTDC
1817 593 C91	17°	1820 271 C91 C	15°	1823 109 C91	13°
1818 694 C91	15°	1820 271 C91 D	17°	1823 109 C91 A	13°
1818 694 C91 A	15°	1820 271 C91 E	17°	1823 135 C91	13°
1819 913 C91	15°	1820 271 C91 F	17°	1823 135 C91 A	13°
1819 914 C91	15°	1820 271 C91 G	17°	1823 136 C91	13°
1819 915 C91	10°	1820 271 C91 H	17°	1823 136 C91 A	13°
1819 916 C91	11°	1820 271 C91 J	17°	1823 137 C91	13°
1819 917 C91	13°	1820 271 C91 K	17°	1823 137 C91 A	13°
1819 918 C91	13°	1820 271 C91 L	17°	1823 138 C91 A	13°
1819 919 C91	13°	1820 271 C91 M	17°	1823 309 C91	20°
1819 920 C91	13°	1820 271 C91 N	17°	1823 309 C91 A	20°
1819 921 C91	12°	1820 271 C91 P	17°	1823 369 C91	24°
1819 922 C91	12°	1820 271 C91 Q	17°	1823 369 C91 A	24°
1819 923 C91	12°	1820 888 C91	15°	1823 388 C91	14°
1819 924 C91	15°	1820 904 C91	12°	1823 837 C91	14°
1820 268 C91	12°	1821 048 C91	15°	1823 837 C91 A	14°
1820 267 C91	12°	1821 048 C91 A	15°	1823 837 C91 B	14°
1820 268 C91	20°	1821 048 C91 B	15°	1823 837 C91 C	14°
1820 268 C91 A	20°	1821 048 C91 C	12°	1823 837 C91 D	14°
1820 269 C91	17°	1821 958 C91	12°	1823 837 C91 E	14°
1820 269 C91 A	17°	1822 011 C91	17°	1823 837 C91 F	14°
1820 269 C91 B	17°	1822 012 C91	17°	1823 837 C91 G	14°
1820 269 C91 C	20°	1822 012 C91 A	17°	1823 837 C91 H	14°
1820 269 C91 D	20°	1822 140 C91	17°	1823 837 C91 J	14°
1820 269 C91 E	17°	1822 169 C91	15°	1823 837 C92 D	14°
1820 271 C91	16°	1822 370 C91	20°	1823 959 C91	12°
1820 271 C91 A	15°	1823 105 C91	12°		
1820 271 C91 B	15°	1823 105 C91 A	12°		

**Recommended torque tensions**

The torque tensions below apply to components lubricated lightly with clean engine oil before they are fitted.

Description	Thread size	Torque		
		Nm	lbf ft	kgf m
Setscrews, cylinder head, see torque sequence		-	-	-
Sump plug		68	50	6,9
Setscrew, atomiser clamp		26	19	2,6
Union nut, high-pressure fuel pipes		40	30	4,2
Setscrews, main bearing		156	115	15,9
Setscrews, big end bearing		156	115	15,9
Setscrews, crankshaft pulley/damper assembly		136	100	13,8
Setscrews, flywheel		136	100	13,8

**Cylinder head torque sequence**

1 Lightly lubricate the threads and the thrust faces of the cylinder head setscrews with clean engine lubrication oil.

2 Engage all the setscrews in their correct positions, except the end setscrews (A20 and A21), tighten the setscrews finger tight.

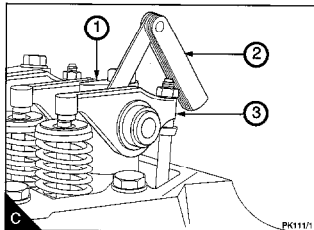
3 Put a 0,13 mm (0.005 in) feeler gauge (C2) between the rocker lever (C3) for the inlet valve of number one cylinder and the first mounting bracket (C1) of the rocker shaft.

4 Put another 0,13 mm (0.005 in) feeler gauge between the rocker lever for the exhaust valve of number six cylinder and the last bracket of the rocker shaft.

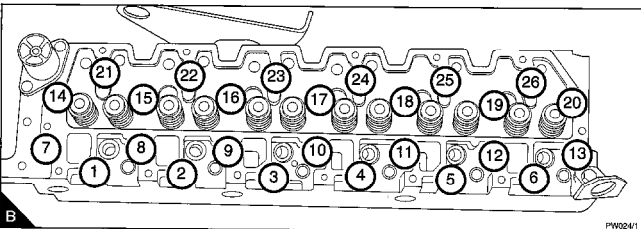
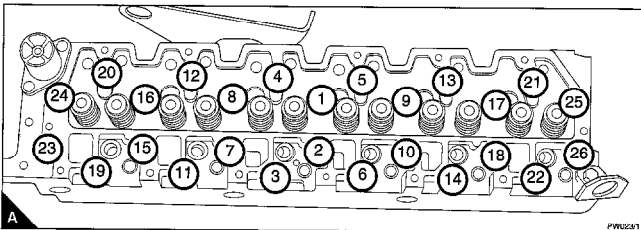
5 Fit and tighten the end setscrews (A20) and (A21) of the rocker shaft assembly. Tighten the setscrews finger-tight.

6 Evenly and gradually tighten all the cylinder head setscrews as follows:

- 150 Nm (110 lbf ft) 15 kgf m in the sequence shown in (A).
- 210 Nm (155 lbf ft) 21,5 kgf m in the sequence shown in (A).
- 225 Nm (165 lbf ft) 23 kgf m in the sequence shown in (B).



- 7 Remove both of the feeler gauges.
- 8 Check the rocker shaft for free movement.



**General data**

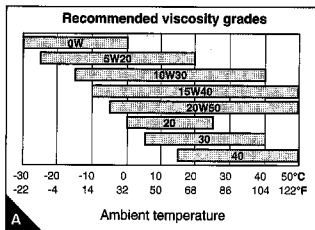
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## Specification of engine fluids

### Minimum lubricating oil specification

100 Series	
- Naturally aspirated	API CC/SE or CCMC D1 or MIL L 46152
- Naturally aspirated, heavy duty	API CD/SE or CCMC D2 or MIL L 2104C (1)
4.41	
- Naturally aspirated	API CC/SE
- Naturally aspirated, heavy duty	API CD/SE (1)
Prima/500 Series	
- Naturally aspirated	API CC/SE
- Naturally aspirated, heavy duty	API CD/SE or CCMC PD2 (1)
- Turbocharged	API CD/SE or CCMC PD2
700 Series	
- Naturally aspirated	API CC/SE
- Naturally aspirated, heavy duty	API CD/SE or CCMC D4 (1)
900 Series	
- Naturally aspirated	API CC/SE
- Naturally aspirated, heavy duty	API CD/SE or CCMC D4 (1)
Phaser/1000 Series	
- Naturally aspirated	API CC/SE
- Naturally aspirated, heavy duty	API CD/SE or CCMC D4 (1)
- Turbocharged, 4 cylinder	API CD/SE or CCMC D4
- Turbocharged, 6 cylinder	CCMC D5
Peregrine/1300 Series	
- All	API CD/SE or CCMC D5

(1) Not recommended during the first 20 to 50 hours or for light load applications.



### Fuel specification

Viscosity	
- 100 Series, 500 Series, 700 Series	2.5/4.5 centistokes at 40 °C
- 4.41, 900 Series, Phaser/1000 Series, Peregrine/1300 Series	2.0/4.5 centistokes at 40 °C
Density	0,835/0,855 kg/litre
Distillation	85% at 350 °C
Aviation kerosene fuels	JP5 and JP8 only, refer to user's handbook
Cetane number	
- 4.41, Phaser/1000 Series, Peregrine/1300 Series	50 minimum
- 100 Series, 500 Series, 700 Series, 900 Series	45 minimum
Sulphur (1)	
- 100 Series	0.5% of mass, maximum
- 4.41, 500 Series, 700 Series, 900 Series, Phaser/1000 Series, Peregrine/1300 Series	0.2% of mass, maximum

(1) The oil change interval will change with the amount of sulphur in the fuel (see the table below and the fuel specification)

Amount of sulphur in the fuel %	Oil change interval
<0,5	Normal
0,5 - 1,0	3/4 of normal
>1,0	1/2 of normal

### Coolant specification

Recommended coolant	POWERPART antifreeze
Concentration of antifreeze	
- 100 Series	-12 °C (10 °F) 25%, -18 °C (0 °F) 33%
	-25 °C (-13 °F) 40%, -37 °C (-34 °F) 50%
- 4.41, 500 Series, 700 Series, 900 Series, Phaser/1000 Series, Peregrine/1300 Series	50%
Corrosion inhibitor mixture	Refer to user's handbook
Part numbers for the inhibitor are shown in the table below:	

Quantity litres	Part number
0,6	1 815 586 C1
1,0	1 815 587 C1
208,0	1 815 583 C1

Coolant capacity ..... See application user's handbook

### Standard torque settings - except Peregrine/1300 Series

#### General notes

- For 'service', use the nominal torque value. Tolerances to be within  $\pm 25\%$  of nominal.
- If there are changes to phosphated surfaces or to thread tolerances, the torque values must change.
- Torque values in these tables are for 'dry threads'.
- These values are not suitable for Merwin C3 type fasteners.

#### Studs

Thread size	Nominal torque		
	Nm	lbf ft	kgf m
M6 x 1,00	5	3.7	0,51
M8 x 1,25	11	8.1	1,12
M10 x 1,50	18	13.3	1,84
M12 x 1,75	25	18.4	2,55

#### Setscrews and nuts

Thread size	Nominal torque		
	Nm	lbf ft	kgf m
M6 x 1,00	9	6.6	0,92
M8 x 1,25	22	16.2	2,24
M10 x 1,50	44	32.5	4,49
M12 x 1,75	78	57.5	7,95
M14 x 2,00	124	91.5	12,64
M16 x 2,00	190	140.0	19,37

#### Pipe threaded fasteners

Thread size	Nominal torque		
	Nm	lbf ft	kgf m
1/8" PTF	9,5	7.0	0,97
1/4" PTF	17,0	12.5	1,73
3/8" PTF	30,0	22.1	3,06
3/4" PTF	45,0	33.2	4,59

### Standard torque settings - Peregrine/1300 Series

#### General note

Torque values below apply to components lubricated with clean engine oil before they are fitted.

#### Flanged head fasteners

Thread size	Nominal torque		
	Nm	lbf ft	kgf m
M6 x 1,00	11	8.0	1,1
M8 x 1,25	24	18.0	2,5
M10 x 1,50	49	36.0	5,0
M12 x 1,75	83	61.0	8,4
M16 x 2,00	209	154.0	21,3

#### Non-flanged head fasteners

Thread size	Nominal torque		
	Nm	lbf ft	kgf m
M6 x 1,00	8	6.0	0,8
M8 x 1,25	20	15.0	2,1
M10 x 1,50	41	30.0	4,1
M12 x 1,75	69	51.0	7,1
M16 x 2,00	174	128.0	17,7

### How to check the specific gravity of the coolant

For mixtures which contain inhibited ethylene glycol:

- Ensure that the machine is on level ground.
- Operate the engine until it is warm enough to open the thermostat. Continue to run the engine until the coolant has circulated the cooling system.
- Stop the engine.
- Allow the engine to cool until the temperature of the coolant is below 140 °F (60 °C).

**Warning!** Do not drain the coolant while the engine is still hot and the system is under pressure because dangerous hot coolant can be discharged.

- Remove the filler cap of the cooling system.
- Drain some coolant from the cooling system into a suitable container.

7 Use a special coolant hydrometer that will check the temperature and the specific gravity of the coolant, follow the manufacturer's instructions.

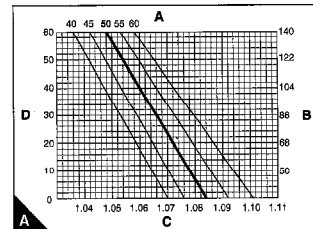
**Note:** If a special coolant hydrometer is not available, put a hydrometer and a separate thermometer into the antifreeze mixture and check the readings on both instruments. Compare the readings with the chart (A).

- Adjust the strength of the mixture as necessary.

**Note:** If it is necessary to fill or replenish the coolant system in service, mix the coolant to the correct strength before it is added to the coolant system.

Protection against frost is as follows:

Antifreeze/water (% by volume)	Protection down to (°C)
50/50	-35
60/40	-40



#### Specific gravity chart

- A = Percentage antifreeze by volume  
 B = Mixture temperature in Fahrenheit  
 C = Specific gravity  
 D = Mixture temperature in Celsius

## Conversion tables

Inch Fraction	Inch	mm	mm	inch
1/4	0.25	6.4	1	0.04
1/2	0.5	12.7	2	0.08
3/4	0.75	19.1	3	0.12
1	1	25.4	4	0.16
2	2	50.8	5	0.20
3	3	76.2	6	0.24
4	4	101.6	7	0.28
5	5	127.0	8	0.31
6	6	152.4	9	0.35
7	7	177.8	10	0.39
8	8	203.2	20	0.79
9	9	228.6	30	1.19
10	10	254.0	40	1.57
20	20	508.0	50	1.97
30	30	762.0	100	3.94
40	40	1016.0	1000	39.37

Feet	Metres	Metres	Feet
1	0.31	1	3.28
2	0.61	2	6.56
3	0.91	3	9.84
4	1.22	4	13.12
5	1.25	5	16.4
6	1.83	6	19.69
7	2.13	7	22.97
8	2.44	8	26.25
9	2.74	9	29.53
10	3.05	10	32.81
20	6.1	20	65.62
30	9.15	30	98.43
40	12.19	40	92.19
50	15.24	50	164.04

Miles	Kilometres	Kilometres	Miles
1	1.61	1	0.62
2	3.22	2	1.24
3	4.83	3	1.86
4	6.44	4	2.49
5	8.05	5	3.10
6	9.66	6	3.73
7	11.27	7	4.35
8	12.87	8	4.97
9	14.48	9	5.59
10	16.09	10	6.21
20	32.19	20	12.43
30	48.28	30	18.64
40	64.37	40	24.85
50	80.47	50	31.07
100	160.93	100	62.14

Conversion tables *continued*

Pounds	Kilograms	Kilograms	Pounds
0.1	0.05	0.1	0.22
0.2	0.09	0.2	0.44
0.3	0.14	0.3	0.66
0.4	0.18	0.4	0.88
0.5	0.23	0.5	1.1
0.6	0.27	0.6	1.32
0.7	0.32	0.7	1.54
0.8	0.36	0.8	1.76
0.9	0.41	0.9	1.98
1	0.45	1	2.2
2	0.91	2	4.41
3	1.36	3	6.61
4	1.81	4	8.82
5	2.27	5	11.02
6	2.72	6	13.23
7	3.18	7	15.43
8	3.63	8	17.64
9	4.08	9	19.84
10	4.54	10	22.05
20	9.07	20	44.09
30	13.61	30	66.14
40	18.14	40	88.18
50	22.68	50	110.23

Gallons	Litres	Litres	Gallons
1	4.55	1	0.22
2	9.09	2	0.44
3	13.64	3	0.66
4	18.18	4	0.88
5	22.73	5	1.1
6	27.28	6	1.32
7	31.82	7	1.54
8	36.37	8	1.76
9	40.92	9	1.98
10	45.46	10	2.2

Pints	Litres
0.5	0.27
1	0.55
2	1.1
3	1.65
4	2.2
5	2.75



## Atomiser Information - except Peregrine/1300 Series

Code	Holder	Nozzle	Set and reset pressure		
			atm	(lbf/in <sup>2</sup> )	MPa
AB	BKBL67S5151/ OKLL6752930	BDLL150S6435/ OLL150S6705	175	2573	17,7
AC	2646460	2646677	175	2573	17,7
BG	BKB40SD5224	BDN12SD6236	135	1985	13,7
BU	BKBL67S5151	BDLL150S6435	175	2573	17,7
BV	BKBL67S5151	BDLL150S6513	170	2499	17,2
CR	BKBL67S5151	BDLL150S6513	170	2499	17,2
CF	BKBL67S8299	BDLL150S6507	185	2720	18,7
CS	BKBL67S5151	BDLL150S6554	170	2499	17,2
CU	BKBL67S5151/ OKLL6752930	BDLL150S6556/ OLL150S6556	175	2573	17,7
DD	BKB35S5258	BDL110S6133	120	1764	12,2
DE	BKB35S5258	BDL110S6267	120	1764	12,2
DF	BKBL67S5151	BDLL150S6558	170	2499	17,2
DL	BKBL67S5299	BDLL150SY6545	210	3087	21,3
DM	BKBL67S5151	BDLL150S6561	175	2573	17,7
DN	BKBL67S5299	BDLL150S6564	170	2499	17,2
EA	BKBL67S5299/ OKLL6752930	BDLL150S6591/ OLL150S6649	215	3161	21,8
EE	2646466	2646825	190	2739	19,3
EG	2646466	2646826	210	3087	21,3
FC	2646466	2646831	210	3087	21,3
FL	BKBL67S5299	BDLL150S6673	200	2940	20,3
FN	BKBL67S5299	BDLL150S6639	195	2867	19,8
FS	BKBL67S5299	BDLL150S6674	170	2499	17,2
FW	2646466	2646826	185	2720	18,7
FY	2646460	2646842	175	2573	17,7
GC	BKB35SD5259	BDL110S6709	170	2499	17,2
GD	BKBL67S5299	BDLL150S6730	200	2940	20,3
GG	2646466	2646845	210	3087	21,3
GH	BKBL67S5299	BDLL150S6738	210	3087	21,3
GK	2646572	2646782	275	4043	27,9
GL	2646460	2646844	175	2573	17,7
GM	2646466	2646848	185	2720	18,7
GS	2646475	2646850	252	3704	25,5
GW	BKB35SD5258	BDLL150S6709	170	2499	17,2
GX	2645F301	2645F601	250	3675	25,3
GY	2646522	2646724	150	2205	15,2
HA	2646466	2646854	215	3161	21,8

Continued

Atomiser information - except Peregrine/1300 Series *continued*

Code	Holder	Nozzle	Set and reset pressure		
			atm	(lbf/in <sup>2</sup> )	MPa
HA	2646466	2646854	215	3161	21,8
HB	2646466	2646855	215	3161	21,8
HC	2645A302	2645A602	245	3602	24,8
HD	2645A301	2645A601	260	3822	26,4
HE	2645A302	2645A603	230	3381	23,3
HH	2645A302	2645K603	250	3675	25,3
HK	26456466	2645A605	215	3161	21,8
HL	2645A302	2645K602	230	3381	23,3
HM	2645A301	2645K603	250	3675	25,3
HN	2646467	2646850	240	3528	24,3
HP	2645A302	2645A602	225	3308	22,8
HR	2645A302	2645A605	270	3989	27,4
HS	2646466	26466844	200	2940	20,3
HT	LRB67014	JB6801019	200	2940	20,3
HU	2645A302	2645K604	220	3234	22,3
HX	2645A301	2645K603	210	3087	21,3
HY	2646466	2646845	175	2573	17,7
HZ	2645A302	2645K603	230	3381	23,3
JA	LRB67014	JB6801057	220	3234	22,3
JB	2645A302	2645A608	250	3675	25,3
JC	LRB67030	JB6801062	225	3308	22,8
JD	LRB67030	JB6801062	225	3308	22,8
JE	2645A302	2645A608	220	3234	22,3
JF	2645A304	2645A606	250	3675	25,3
JG	2645A304	2645A607	230	3381	23,3
JH	LRB67014	JB6801064	250	3675	25,3
JJ	2645A302	2645A611	250	3675	25,3
JK	2645A302	2645A613	220	3234	22,3
JL	2645A304	2645A614	250	3675	25,3
JP	2645P301	2645P601	360	5292	36,5
JR	2645A304	2645A615	250	3675	25,3
JS	2645A304	2645A612	250	3675	25,3
JT	2645A304	2645A616	250	3675	25,3
JU	2645A302	2645A617	220	3234	22,3
JV	2645A302	2645A618	250	3675	25,3
JY	2645A302	2645A621	250	3675	25,3
JZ	2645A301	2645A622	230	3381	23,3
KB	2645A308	2645A624	300	4410	30,4
KE	2645A311	2645A627	290	4236	29,4

Continued

Atomiser Information - except Peregrine/1300 Series *continued*

Code	Holder	Nozzle	Set and reset pressure		
			atm	(lbf/in <sup>2</sup> )	MPa
KF	2645A311	2645A628	295	4337	29,9
KG	2645A314	2645A629	300	4410	30,4
KH	2645A314	2645A630	290	4263	29,4
KJ	2645A315	2645A631	250	3675	25,3
KK	2645A312	2645A632	300	4410	30,4
KL	2645A312	2645A633	300	4410	30,4
KN	2645A315	2645A635	290	4263	29,4
KP	2645A311	2645A636	290	4263	29,4
LM	2645A313	2645A634	290	4263	29,4
NB	2645L301	2645L602	195	2867	20,3
NC	2645L302	2645L603	170	2499	17,2
ND	2645L301	2645L604	175	2573	17,7
NH	2645L304	2645L606	230	3381	23,3
NJ	2645L304	2645L607	220	3234	22,3
NK	2645L305	2645L609	225	3308	22,8
NL	2645L305	2645L608	225	3308	22,8
NM	2645L304	2645L611	230	3381	23,3
NN	2645L303	2645L612	230	3381	23,3
NP	2645L304	2645L613	230	3381	23,3
NR	2645L303	2645L614	230	3381	23,3
NS	2645L303	2645L612	250	3675	25,3
NT	2645L304	2645L615	230	3381	23,3
NU	2645L303	2645L605	220	3234	22,3
NV	2645L304	2645L616	220	3234	22,3
NW	2645L303	2645L613	290	4263	29,4
NX	2645L306	2645L617	290	4263	29,4
NY	2645L306	2645L618	290	4263	29,4
RB	2645F304	2645F606	250	3675	25,3
RD	2645F303	2645F603	250	3675	25,3
RE	2645F304	2645F604	250	3675	25,3
RF	2645F304	2645F605	250	3675	25,3
RG	2645F305	2645F607	225	3308	22,8
RH	2645F304	2645F608	250	3675	25,3
RK	2645F304	2645F610	270	3969	27,4
RM	2645F306	2645F611	250	3675	25,3
RM	2645F306	2645F611	250	3675	25,3
RP	2645F309	2645F611	250	3675	25,3
RR	2645F307	2645F614	250	3675	25,3
RS	2645F307	2645F615	250	3675	25,3

*Continued*Atomiser information - except Peregrine/1300 Series *continued*

Code	Holder	Nozzle	Set and reset pressure		
			atm	(lbf/in <sup>2</sup> )	MPa
RT	2645F308	2645F616	250	3675	25,3
RU	2645F310	2645F617	250	3675	25,3
RV	2645F311	2645F610	250	3675	25,3
RW	2645F312	2645F614	250	3675	25,3
RX	2645F313	2645F617	250	3675	25,3
RZ		2645F619	250	3675	25,3
UB	2646522	2646724	150	2205	15,2
VA	2645M301	2645M601	185	2720	18,7
VB	HB54S893	NL550	170	2499	17,2
VJ	BKBL54S5312	BDLL150S6573	170	2499	17,2
VN	2646562	2646862	200	2940	20,3
VU	2645C564	2646866	225	3308	22,8
VW	2646562	2646869	210	3087	21,3
WW	2645C302	2645C602	240	3528	24,3
WY	2645C303	2645C805	235	3455	23,8
WZ	2646568	2646869	210	3087	21,3
XA	2645C303	2645K601	230	3381	23,3
XB	2645C303	2645K604	235	2455	23,8
XC	2645C305	2645C608	175	2573	17,7
XD	2645C306	2645C609	170	2499	17,2
XG	2645C305	2645C615	210	3087	21,3
XX	2645C307	2645C613	245	3602	24,8
XY	2646568	2646864	210	3087	21,3
XZ	2645C308	2645C614	220	3234	22,3
Y	2646460	2646872	175	2573	17,7
YA	2645C308	2645C618	240	3528	24,3
YB	2645C304	2645C616	155	2279	15,7
YD	2645C310	2645C618	240	3528	24,3

**Atomiser information - Peregrine and 1300 Series**

Atomiser pressures for engine models WD, WE, WF, WG, WH, WJ

- set and reset .....	245/255 atm (3600/3750 lbf/in <sup>2</sup> ) 25/26 Mpa
- service limit .....	197 atm (2900 lbf/in <sup>2</sup> ) 20 Mpa

Code	Holder	Nozzle
B	1820834C91	1820835C1
C	1820836C92	1820837C1
D	1820838C91	1820839C1
F	1820842C91	1820843C1
G	1820844C91	1820845C1
H	1820846C91	1820847C1
J	1820848C91	1820849C1
K	1820890C91	1820891C1
L	1820892C91	1820893C1
M	1820894C91	1820895C1
N	1822141C91	1822142C1
P	1822143C92	1822144C1
R	1822349C91	1820835C1
S	1822351C91	1820839C1
T	1822352C91	1820843C1
U	1822527C91	1822528C1
V	1823282C91	1820837C1
W	1823148C91	1822144C1
AB	1823757C91	1820835C1
AD	1823761C91	1820837C1
AE	1823783C91	1820841C1
AF	1823765C91	1820845C1

**Turbocharger waste-gate settings****Waste-gate test pressure for rod movement of 1,00 mm (0,039 in)**

The turbocharger part number is on the turbocharger identification plate, which is fitted to the body of the turbocharger.

Turbocharger part number	Waste-gate pressure			Turbocharger part number	Waste-gate pressure		
	kPa	lbf/in <sup>2</sup>	kgf/cm <sup>2</sup>		kPa	lbf/in <sup>2</sup>	kgf/cm <sup>2</sup>
2674A053	113/120	16.4/17.4	1,15/1,22	2674A098	96	13.9	0,98
2674A054	110/120	16.0/17.4	1,12/1,22	2674A104	99/106	14.3/15.4	0,99/1,07
2674A055	120/130	17.4/18.9	1,22/1,32	2674A105	99/106	14.3/15.4	0,99/1,07
2674A056	120/130	17.4/18.9	1,22/1,32	2674A106	99/106	14.3/15.4	0,99/1,07
2674A057	118/126	17.1/18.3	1,20/1,28	2674A108	99/106	14.3/15.4	0,99/1,07
2674A058	118/126	17.1/18.3	1,20/1,28	2674A122	99/106	14.3/15.4	0,99/1,07
2674A059	118/126	17.1/18.3	1,20/1,28	2674A128	101/109	14.6/15.8	1,02/1,11
2674A062	113/120	16.4/17.4	1,15/1,22	2674A129	101/109	14.6/15.8	1,02/1,11
2674A063	92/98	13.3/14.2	0,93/0,99	2674A130	113/120	16.4/17.4	1,15/1,22
2674A064	110/103	15.9/14.9	1,11/1,04	2674A131	101/109	14.6/15.8	1,02/1,11
2674A067	120/130	17.4/18.9	1,22/1,32	2674A138	113/120	16.4/17.4	1,15/1,22
2674A068	110/103	15.9/14.9	1,11/1,04	2674A139	120/130	17.4/18.9	1,22/1,32
2674A072	120/130	17.4/18.9	1,22/1,32	2674A143	99/106	14.3/15.4	0,99/1,07
2674A075	118/126	17.1/18.3	1,20/1,28	2674A144	113/120	16.4/17.4	1,15/1,22
2674A077	113/120	16.4/17.4	1,15/1,22	2674A146	113/120	16.4/17.4	1,15/1,22
2674A079	120/130	17.4/18.9	1,22/1,32	2674A149	133/143	19.3/20.7	1,35/1,45
2674A081	88/98	12.8/14.2	0,90/1,00	2674A150	145/155	21,0/22.5	1,47/1,58
2674A082	88/92	12.8/13.5	0,90/0,93	2674A304	105	15.2	1,04
2674A084	118/128	17.1/18.6	1,20/1,30	2674A305	105	15.2	1,04
2674A085	88/98	12.8/14.2	0,90/1,00	2674A308	96	13.9	0,98
2674A086	118/126	17.1/18.3	1,20/1,28	2674A311	145	21.0	1,47
2674A087	101/109	14.7/15.8	1,03/1,09	2674A313	96	13.9	0,98
2674A089	150	21.8	1,52	2674A314	145	21.0	1,47
2674A093	110	15.9	1,11	2674A315	150	21.8	1,52
2674A094	105	12.5	1,04	2674A316	96	13.9	0,98
2674A095	145	21.0	1,47	2674A701	155	22.5	1,58
2674A096	150	21.8	1,52				

**Thermostat ratings**

Nominal temperature stamped on thermostat by-pass valve	"Start to open" temperature	"Fully open" temperature	Minimum valve lift, fully open
82 °C (180 °F)	77/85 °C (170/185 °F)	92/98 °C (198/208 °F)	9 mm (0.35 in)
71 °C (160 °F)	67/75 °C (153/167 °F)	85/88 °C (185/190 °F)	9 mm (0.35 in)