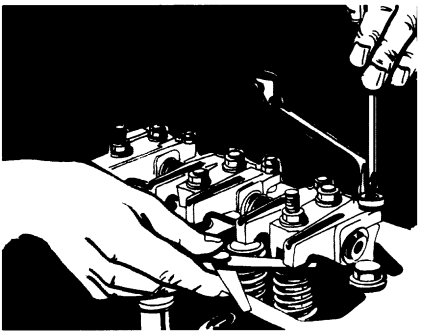
Perkins

Service Data



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

VARITY Perkins

Perkins Service Data Booklet

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

Publication TPD 1357E, Issue 1.

Published in January 1997 by Technical Publications,
Perkins International Limited, Peterborough PE1 5NA, England

Foreword

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

The booklet contains information for all 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)

4.41
100 Series
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.

Contents

General information

Perkins companies

Australia

Perkins Engines Australia Pty. Ltd,
Suite 2, 364 Main Street,
Mornington 3931, Victoria, Australia.
Telephone: 597 51877
Telex: Perkoil AA30816
Fax: 0597 1305

France

Moteurs Perkins S.A.,
9-11 Avenue Michelet,
93583 Saint Ouen, Cedex, France.
Telephone: (1) 40 10 42 70
Telex: 642924F
Fax: (1) 40-10-42-45

Germany

Perkins Motoren GmbH,
Saalaeckerstrasse 4,
63801 Kleinostheim,
Germany.
Telephone: 6027 5010
Fax: 6027 501124

Hong Kong

Perkins International Ltd,
Varity Asia/Pacific,
Suite 3301
Convention Plaza,
1 Harbour road,
Wanchai
Hong Kong.
Telephone: 852 2588 1883
Fax: 852 2827 2311

Italy

Motori Perkins S.p.A.,
Via Socrate 8,
22070 Casnate con Bernate (Como), Italy.
Telephone: 031 564633 or 564625
Telex: 380658 Perkit I
Fax: 031 249092 or 564145

Japan

Varity (Japan) K.K.,
Reinanzaka Building, 5th Floor,
14-2 Akasaka, 1-chome, Minato-ku,
Tokyo 107, Japan.
Telephone: 03 586 7377
Telex: Perkoil J2424823
Fax: 03 582 1596

United Kingdom

Perkins International Ltd,
Eastfield, Peterborough PE1 5NA,
England.
Telephone: 01733 67474
Telex: 32501 Perken G
Fax: 01733 582240

United States of America

Perkins International - North America
12025 Tech Center Drive
Livonia
Michigan 48150
USA
Telephone: 313 266 5427
Fax: 313 266 2700

Perkins Engines Latin America Inc,
Suite 620,
999, Ponce de Leon Boulevard,
Coral Gables,
Florida 33134, U.S.A.
Telephone: 305 442 7413
Telex: 32501 Perken G
Fax: 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
4.108	201 TPD 1090 1218	601 SER 0692 1088
3.152 Series	TPD 0596 1285 EFG **(1)** TPD 0696 1285 EIS **(2)**	TPD 1091 1208
4.203, D4.203	201 TPD 1090 1216	601 SER 0681 1010
4.2032	201 TPD 1090 1216	601 TPD 0580 1158
4.236, 4.248	TPD 1095 1291 EFG TPD 0596 1291 EIS	601 TPD 0393 1229
6.3544 Series	TPD 0594 1289 EFG TPD 0590 1289 EIS	TPD 1089 1146
V8.540 Series	201 TPD 1090 1207	601 TPD 0690 1215

(1) Printed in English, French and German.
(2) Printed in English, Italian and Spanish.

ÞWERPART recommended nsumable products

rkins have made available the products ommended below in order to assist in the rect operation, service and maintenance of your gine and your machine. The instructions for the of each product are given on the outside of h container. These products are available from r Perkins distributor.

WERPART Antifreeze

tects the cooling system against frost and rosion. Part number 1 litre 21825166 or 5 litres 25167.

WERPART Easy Flush

ans the cooling system. Part number 2182501

WERPART Jointing compound

versal jointing compound which seals joints. rently Hylomar. Part number 1861155 or 1117.

WERPART Silicone rubber sealant

cone rubber sealant which prevents leakage ugh gaps.Currently Hylosil Part number 1108.

WERPART Lay-Up 1

iesel fuel additive for protection against rosion. Part number 1772204.

WERPART Lay-Up 2

tects the inside of the engine and of other ed systems. Part number 1762811.

WERPART Lay-Up 3

tects outside metal parts. Part number 1734115.

WERPART Chisel

ws easy removal of old gaskets and joints. rently Loctite chisel. Part number 21825163.

WERPART Repel

s damp equipment and gives protection against rosion. Passes through dirt and corrosion to icate and to assist removal of components. rently Loctite repel. Part number 21825164.

WERPART Threadlock

retain small fasteners where easy removal is essary. Currently Loctite 222e. Part number 20222.

WERPART Studlock

permanently retain large fasteners and studs. rently Loctite 270. Part number 20270.1820222.

POWERPART Nutlock

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

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 Threadlock (hydraulic/pnuematic)

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.

POWERPART Retainer (oil tolerant)

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

POWERPART Retainer (high strength)

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

POWERPART Atomiser thread sealant

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

POWERPART Compound

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

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 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 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.

Engine number location guide

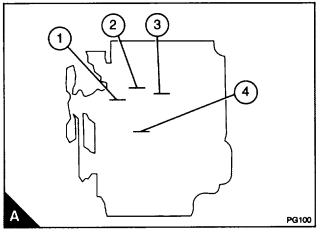
Engine type	Position
4.108	A1
3.152 Series - up to engine CE31244U906114W - from engine CE31244U906114W	B3 A4
4.203 Series	B1 or B4
4.236	A2 or B2
4.248	A2
6.3544 Series	A3
V8.540 Series	C1

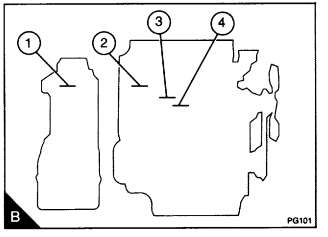
Notes:

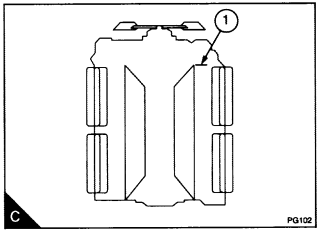
Illustration A shows the left side when looked at from the flywheel end of the engine.

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

Illustration C shows the top of the engine.







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

A	**Phaser/1004**	**E**	**4.108**	LE	G4.236	TV	6.3724
AA	Naturally aspirated	EA	4.99	LF	4.248	TW	6.3544
AB	Turbocharged	EB	4.107	LG	4.2482	TX	C6.3544
AC	Compensated	EC	T4.107	LH	C4.236	TY	H6.3544
AD	Charge cooled	ED	4.108	LJ	T4.236	TZ	HT6.3544
AE	Fed. Charge cooled	EE	T4.108	LK	D4.236	**U**	**700 Series**
AG	Narrow front end naturally aspirated	**G**	**4.154/200**	LL	4.38	UA	704-26
AH	Narrow front end turbocharged	GA	4.154	LM	4.41	UB	704-30
	New Phaser/1004	GB	4.135	**N**	**4.318**	**W**	**Peregrine/1300**
AJ	Naturally aspirated	GC	4.182	NA	4.270	WA	6.466
AK	Turbocharged	GD	4.25	NB	4.300	WB	T6.466
AM	turbocharged intercooled	GE	4.30	NC	4.318	WC	CC6.466
AP	Naturally aspirated	**H**	**4.165**	ND	4.3182	WD	T6.67
AQ	Turbocharged	HA	4.165	**P**	**6.305**	WE	CC6.67
B	**Prima/500**	**J**	**4.203**	PA	P6	WF	T6.76
BA	Naturally aspirated	JA	P4	PB	6.288	WG	CC6.76
BB	Turbocharged	JB	4.192	PC	6.305	WH	T6.87
BC	Gasolene	JC	P4.192	PD	PF6.305	WJ	CC6.87
C	**3.152**	JD	4.203	**R**	**6.247**	**X**	**V8.540**
CA	P3	JE	D4.203	RA	6.247	XA	V8.510
CB	3.144	JF	G4.203	**SD**	**Sabre CC6.68**	XB	TV8.510
CC	P3.144	JG	4.2032	**T**	**6.354**	XC	V8.540
CD	3.152	**K**	**Perama/100**	TA	6.306	XD	V8.605
CE	D3.152	KA	2 cyl. 0,4 litres	TB	6.335	XE	TV8.540
CF	G3.152	KB	3 cyl. 0,6 litres	TC	6.354	**Y**	**Phaser/1006**
CG	P3.152	KC	3 cyl. 0,9 litres	TD	H6.354	YA	Naturally aspirated
CJ	3.1522	KD	3 cyl. 1,0 litres	TE	T6.354	YB	Turbocharged
CM	3.1524	KE	3 cyl. 1,5 litres	TF	H6.354	YC	Compensated
CN	T3.1524	KF	4 cyl. 1,9 litres	TG	6.3541	YD	Charge cooled
C	**900 Series**	KG	3 cyl. 1,2 litres	TH	T6.3541	YE	Fed. Charge cooled
CP	3.27	KH	3 cyl. 1,3 litres	TJ	6.3542		**New Phaser/1006**
CR	T3.27	KJ	3 cyl. 1,5 litres D	TK	C6.3542	YG	Naturally aspirated
CS	3.25	KK	4 cyl. 1,9 litres D	TL	6.3543	YH	Turbocharged
		KL	3 cyl. 0,7 litres	TM	C6.3543	YK	Turbocharged intercooled
		KN	2 cyl. 0,5 litres	TN	H6.3543		
		KR	4 cyl. 2,2 litres	TP	T6.3543	**Z**	**V8.640**
		L	**4.236**	TQ	HT6.3543	ZA	V8.640
		LA	4.212	TR	6.372	ZB	TV8.640
		LB	G4.212	TS	6.3723		
		LC	4.224	TT	TC6.3541		
		LD	4.236	TU	T6.3544		

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

1 Battery capacity low.
2 Bad electrical connections.
3 Fault in starter motor.
4 Wrong grade of lubricating oil.
5 Starter motor turns engine too slowly.
6 Fuel tank empty.
7 Fault in stop control.
8 Restriction in a fuel pipe.
9 Fault in fuel lift pump.
10 Dirty fuel filter element.
11 Restriction in filter/cleaner or air induction system.
12 Air in fuel system.
13 Fault in atomisers or atomisers of an incorrect type.
14 Cold start system used incorrectly.
15 Fault in cold start system.
16 Restriction in fuel tank vent.
17 Wrong type or grade of fuel used.
18 Restricted movement of engine speed control.
19 Restriction in exhaust pipe.
20 Engine temperature is too high.
21 Engine temperature is too low.
22 Valve tip clearances are incorrect.
23 To much oil or oil of wrong specification used in wet type oil cleaner.
24 Not enough lubricating oil in sump.
25 Defective gauge.
26 Dirty lubricating oil filter element.
27 Fan damaged.
28 Fault in engine mounting or flywheel housing.
29 Too much lubricating oil in sump.
30 Restriction in air or water passages of radiator.
31 Restriction in breather pipe.
32 Insufficient coolant in system.
33 Vacuum pipe leaks or fault in exhauster.
34 Fault in fuel injection pump.
35 Broken drive on fuel injection pump.
36 Timing of fuel injection pump is incorrect.
37 Valve timing is incorrect.
38 Bad compression.
39 Cylinder head gasket leaks.
40 Valves are not free.
41 Wrong high-pressure pipes.
42 Worn cylinder bores.
43 Leakage between valves and seats.
44 Piston rings are not free or they are worn or broken.
45 Valve stems and/or guides are worn.
46 Crankshaft bearings are worn or damaged.
47 Lubricating oil pump is worn.
48 Relief valve does not close.
49 Relief valve does not open.
50 Relief valve spring is broken.
51 Fault in suction pipe of lubricating oil pump.
52 Piston is damaged.
53 Piston height is incorrect.
54 Flywheel housing or flywheel is not aligned correctly.
55 Fault in thermostat or thermostat is of an incorrect type.
56 Restriction in coolant passages.
57 Fault in water pump.
58 Valve stem seal is damaged (if there is one fitted).
59 Restriction in sump strainer.
60 Valve spring is broken.
61 Turbocharger impeller is damaged or dirty.
62 Lubricating oil seal of turbocharger leaks.
63 Induction system leaks (turbocharged engines).
64 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

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.
40 Crack in backplate of compressor.

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 spilt. Material which has been contaminated by fuel must be moved to a safe place.
- Do not put fuel in the tank while the engine runs (unless it is absolutely necessary).
- Do not clean, add lubricating oil, or adjust the engine while it runs (unless you have had the correct training; even then extreme care must be used to prevent injury).
- Do not make adjustments that you do not understand.
- Ensure that the engine does not run in a location where it can cause a concentration of toxic emissions.
- Other persons must be kept at a safe distance while the engine or auxiliary equipment is in operation.
- Do not permit loose clothing or long hair near moving parts.
- Keep away from moving parts during engine operation. ***Warning!*** *Some moving parts cannot be seen clearly while the engine runs.*
- Do not operate the engine if a safety guard has been removed.
- Do not remove the filler cap or any component of the cooling system while the engine is hot and while the coolant is under pressure, because dangerous hot coolant can be discharged.
- Do not 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

Basic technical data

Horse power	35,0 kW (47 bhp)
Number of cylinders	4
Cycle	Four stroke
Induction system	Naturally aspirated
Combustion system	Indirect injection
Nominal bore	79,37 mm (3.125 in)
Stroke	88,90 mm (3.500 in)
Compression ratio	22:1
Cubic capacity	1,760 litres (107.4 in^3)
Firing order	1-3-4-2
Valve tip clearances	
- Inlet (cold)	0,30 mm (0.012 in)
- Exhaust (cold)	0,30 mm (0.012 in)
Lubricating oil pressure	
- at maximum engine speed and normal engine temperature	207/414 kN/m^2 (30/60 lbf/in^2) 2,1/4,2 kgf/cm^2
Coolant temperature	60°C (140°F)
Thermostat starts to open	
- bellows type	67/75°C (152/167°F)
- wax type	77/85°C (170/185°F)
Thermostat fully open	
- bellows type	85/88°C (185/190°F)
- wax type	92/98°C (197/208°F)
Direction of rotation	Clockwise from front
Idling speed	550 rev/min
Location of maximum no-load speed	Fuel injection pump data plate
Location of number 1 cylinder	Crankshaft pulley end
Location of engine timing marks	Scribe lines on fuel injection pump and pump flange
Atomiser codes	CAV = BG, GY, OMAP = YB
Fuel pump codes	EH34E, EH39, PH30
Location of fuel pump code	Data plate on fuel pump
Location of fuel pump timing marks	Fuel pump mounting flange
Belt tension	45 N (10 lbf) 4,5 kgf
Belt deflection at longest run	10 mm (3/8 in)

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 150 hours or 3 months or 6000 km (4000 miles)
C Every 450 hours or 12 months or 18000 km (12000 miles)
D Every 900 hours or 36000 km (24000 miles)
E Every 2700 hours or 108000 km (72000 miles)

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 **(2)**
	•				Check the drive belt of the alternator
					Lubricate dynamo rear bush (where fitted)
	•				Check for water in the fuel pre-filter and drain as necessary
		•	•		Renew the elements of the fuel-filter
•					Check the amount of lubricating oil in the sump
•					Check the lubricating oil pressure at the gauge **(1)**
	•				Renew the engine lubricating oil **(4)**
	•				Renew the canister of the lubricating oil filter **(4)**
	•				Clean air compressor filter, if fitted
					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 valve tip clearances of the engine are checked and, if necessary, adjusted **(3)**
				•	Ensure that the alternator, starter motor etc. are checked **(3)**

(1) If there is one 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 oil change interval will change with the sulphur content of the fuel (see the table on page 3.02 and fuel specification). The interval to change the canister of the lubricating oil filter is not affected.

Fuel pump codes

CAV fuel injection pump

Type ..... Lucas DPA

Direction of rotation ..... Clockwise from drive end

Outlet for number 1 cylinder ..... Letter "W"

Fuel injection pump 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.

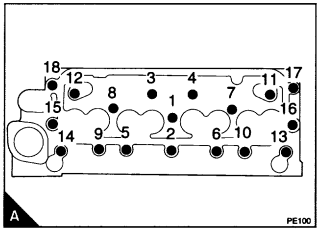
Fuel pump code letters	Engine check angle (degrees)	Pump mark angle (degrees)
EH, EH34E, EH39	281	290
LH30	281	292
PH, PH23E, PH27, PH28, PH30	281	290
PH25E500/5/2450 PH25E500/9/1990 PH25E500/9/2090 PH30/500/5/2450 PH30/500/6/1570 PH30/500/9/1990 PH30/500/9/2090	279.5	290
RH, RH30E	279.5	290
SH33E	279.5	290
TH, TH23E	281	291

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
Nuts, cylinder head	1/2	81	60	8,3
Sump plug	3/4	50	37	5,1
Atomiser clamp	5/16	16	12	1,7
Injector pipe union nut	M12 x 1.5	20	15	2,1
Main bearing	1/2	115	85	11,8
Big end bearing	3/8	57	42	5,8
Front pulley	5/8	203	150	20,7
Flywheel	7/16	81	60	8,3

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 of the cylinder head studs and nuts.

2 Gradually and evenly tighten the nuts in three stages. Tighten the nuts in the final stage to 81 Nm (60 lbf ft) 8,3 kgf m.

3 Start the engine and run it until the coolant temperature is 170°F (77°C). Switch the engine off.

4 Check the tightness of the nuts in the correct sequence.

- If a nut moves when checked, tighten it to the correct torque.
- If a nut does not move before the correct torque is reached, loosen the nut 1/12 to 1/6 (30° to 60°) of a turn and then tighten it to the correct torque.

Caution: *It is important that the cylinder head nuts are tightened again to the correct torque, in the correct sequence, after 800/ 1600 km (500/1000 miles) 25/50 hours.*

Basic technical data

Horse power

- 3.152 ..... 33,6 kW (45 bhp)
- D3.152 ..... 36,5 kW (49 bhp)
- 3.1522 ..... 33,2 kW (44.5 bhp)
- 3.1524 ..... 38,8 kW (52 bhp)
- T3.1524 ..... 44,7 kW (60 bhp)

Number of cylinders 3

Cycle ..... Four stroke

Induction system

- 3.152, D3.152, 3.1522, 3.1524 ..... Naturally aspirated
- T3.1524 ..... Turbocharged

Combustion system

- 3.152 ..... Indirect injection
- D3.152, 3.1522, 3.1524, T3.1524 ..... Direct injection

Nominal bore ..... 91,44 mm (3.60 in)

Stroke ..... 127 mm (5 in)

Compression ratio

- 3.152 ..... 17.4:1
- D3.152 ..... 18.5:1
- 3.1522 ..... 19.0:1
- 3.1524 ..... 16.5:1
- T3.1524 ..... 15.5:1

Cubic capacity ..... 2.5 litres (152.7 in^3)

Firing order 1-2-3

Valve tip clearances

Inlet (cold)
3.152, D3.152 ..... 0,30 mm (0.012 in)
3.1522, 3.1524, T3.1524 ..... 0,20 mm (0,008 in)

- Exhaust (cold)

3.152, D3.152 ..... 0,30 mm (0.012 in)
3.1522, 3.1524, T3.1524 ..... 0,32 mm (0,0125 in)

Lubricating oil pressure

- at maximum engine speed and normal engine temperature ..... 207/414 kN/m^2 (30/60 lbf/in^2) 2,1/4,2 kgf/cm^2

Coolant temperature ..... 60°C (140°F)

Thermostat starts to open

- bellows type ..... 72/82°C (170/179°F)
- wax type ..... 81/84°C (177/183°F)

Thermostat fully open

- bellows type ..... 93°C (199°F)
- wax type ..... 98°C (208°F)

Continued

Basic technical data, *Continued*

Direction of rotation ..... Clockwise from front

Idling speed ..... 750 rev/min

Location of maximum no-load speed ..... Fuel injection pump data plate

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

Location of engine timing marks ..... Fuel injection pump flange, rear face of timing case

Atomiser codes

- 3.152 ..... DD, DE, GC, GW
- D3.152 ..... BV, CR, CS, DF, DN, EE, FS, GM, ND, UB, XC, XG
- 3.1522 ..... GS
- 3.1524 ..... EE, HN, ND, XG
- T3.1524 ..... HM, HN, HX

Fuel pump codes

- 3.152 ..... LW, PW
- D3.152 ..... AW, EW, CW, MW, RW, SW, TW, WW
- 3.1522 ..... XW
- 3.1524 ..... EW, WW, ZW
- T3.1524 ..... BW, YW, DW

Location of fuel pump code ..... Left hand side of FIP

Location of fuel pump timing marks ..... Fuel pump mounting flange

Belt tension ..... 45 N (10 lbf) 4,5 kgf

Belt deflection at longest run ..... 10 mm (3/8 in)

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 First service at 25/50 hours (all engines)
B Every day or every 8 hours (all engines)
C Every 200 hours or 4 months (3.1524, T3.1524)
D Every 250 hours or 4 months (D3.152)
E Every 400 hours or 12 months (3.1524, T3.1524)
F Every 500 hours or 12 months (D3.152)
G Every 800 hours or 12 months (3.1524, T3.1524)
H Every 2400 hours (3.1524, T3.1524)
I Every 2500 hours (D3.152)

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

A	B	C	D	E	F	G	H	I	Operation
•	•								Check the amount of coolant
•		•							Check the drive belt(s)
•		•	•						Check for water in the fuel pre-filter **(1)**
				•	•				Renew the fuel-filter element(s)
						•		•	Ensure that the atomisers are checked **(2)**
•									Ensure idle speed is checked and adjusted, if necessary **(2)**
	•								Check the amount of lubricating oil in the sump
•	•								Check the lubricating oil pressure at the gauge **(1)**
•				•	•				Renew the lubricating oil **(3)**
•				•	•				Renew the canister(s) 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
							•	•	Ensure that the turbocharger impeller and turbocharger compressor casing are cleaned
		•	•						Clean the compressor air filter **(1)**
							•	•	Ensure that the exhauster or compressor **(1)** is checked **(2)**
•					•		•	•	Ensure that the tappet clearances are checked and adjusted, if necessary **(2)**
							•	•	Ensure that the alternator, starter motor etc. 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 3.02 and the fuel specification). The interval to change the canister of the lubricating oil filter is not affected.

Fuel pump codes

Lucas fuel injection pump

Type ..... DPA or DP 200
Direction of rotation from drive end ..... Clockwise
Outlet for number 1 cylinder ..... Letter "W" or "Z"

Fuel injection pump 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.

Fuel pump code letters	Engine check angle (degrees)	Pump mark angle (degrees)	Fuel pump code letters	Engine check angle (degrees)	Pump mark angle (degrees)
AW	27	41	PW50	29	38
BW, YW	27	35	RW50, RW52, RW54	25	37
CW	27	35	SW except below	25	37
			SW/8/1800, SW/8/1890	22.25	37
			SW48	24	37
			SW52, SW57, SW58	25	37
DW	26.5	35	TW48E	27	37
LW45, LW49	32	40	TW50	26	37
LW51, LW52	29	38	WW except below	25	35
			WW/3/2470, WW/6/2200, WW/6/2470, WW47E, WW48	27	35
LW58, LW59	29	40	XW50E	29	36
MW47E, MW49, MW53E, MW57	25	37	ZW	25	37
PW43, PW44	30	38			

Stanadyne fuel injection pump

Type ..... Stanadyne
Outlet for number 1 cylinder ..... 11 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. To set the pump mark angle, see workshop manual, publication number TPD 1091 1208E.

Fuel pump code letters	Engine check angle (degrees)	Pump mark angle (degrees)
EW	26	322

Basic technical data

Horse power

- 4.203
  vehicle ..... 47,0 kW (63 bhp)
  agriculture ..... 42,5 kW (57 bhp)
- 4.2032 ..... 44,7 kW (60 bhp)

Number of cylinders 4

Cycle ..... Four stroke

Induction system ..... Naturally aspirated

Combustion system

- 4.203 ..... Indirect injection
- 4.2032, D4.203 ..... Direct injection

Nominal bore ..... 91,44 mm (3.6 in)

Stroke ..... 127 mm (5 in)

Compression ratio

- 4.203 ..... 17.4:1
- 4.2032 ..... 19:1

Cubic capacity ..... 3,33 litres (203 in^3)

Firing order 1-3-4-2

Valve tip clearances

All 4.192 and 4.203
and D4.203 up to engine number JE....U564083G

- Inlet (cold) ..... 0,30 mm (0.012 in)
- Exhaust (cold) ..... 0,30 mm (0.012 in)

D4.203 from engine number JE....U564083G

- Inlet (cold) ..... 0,20 mm (0.008 in)
- Exhaust (cold) ..... 0,30 mm (0.012 in)

Lubricating oil pressure

- at maximum engine speed and
  normal engine temperature ..... 207/414 kN/m^2 (30/60 lbf/in^2) 2,1/4,2 kgf/cm^2

Coolant temperature ..... 60°C (140°F)

Thermostat starts to open ..... 82°C (179°F)

Thermostat fully open

- bellows type ..... 95°C (203°F)
- wax type ..... 98°C (208°F)

Direction of rotation ..... Clockwise from front

Idling speed ..... 550 - 750 depending on application

Location of maximum no-load speed ..... Fuel injection pump data plate

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

Location of engine timing marks ..... Timing pin on timing case and crankshaft pulley

Continued

Basic technical data, *Continued*

Atomiser codes ..... AV, BM, DN, EC, EG, EV, FJ, FM, FR, FS, GB, GC, GM, GR, GS, GW, H, HM, HW, HX, J, TC, YA, Z, UA, VA

Fuel pump codes ..... AF, BF, LF, MP, PP, RP, SP, TP,

Location of fuel pump code

- 4.203 ..... Fuel pump mounting flange and fuel pump carrier plate
- 4.2032 ..... Fuel pump mounting flange and timing case

Location of fuel pump timing marks ..... Fuel pump mounting flange

Belt tension ..... 45 N (10 lbf) 4,5 kgf

Belt deflection at longest run ..... 10 mm (3/8 in)

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 schedule 4.203

A Every day or every 8 hours
B Every 250 hours or 4 months
C Every 500 hours or 12 months
D Every 2500 hours

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

A	B	C	D	Operation
•				Check the amount of coolant
				Check the concentration of the coolant **(2)**
	•			Check the drive belt
			•	Lubricate dynamo rear bush (where fitted)
		•		Clean the sediment chamber and the strainer of the fuel lift pump
	•			Check for water in the pre-filter **(1)**
		•	•	Renew the element of the fuel-filter
				Ensure that the atomisers are checked **(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)**
	•			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
			•	Ensure that the valve tip clearances of the engine are checked and, if necessary, adjusted **(3)**
			•	Ensure that the alternator, starter motor etc. are checked **(3)**

(1) If there is one 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 oil change interval will change with the sulphur content of the fuel (see the table on page 3.02 and fuel specification). The interval to change the canister of the lubricating oil filter is not affected.

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 schedule 4.2032

A Every day or every 8 hours
B Every 200 hours or 4 months
C Every 400 hours or 12 months
D Every 800 hours
E Every 2400 hours

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
		•			Clean the sediment chamber and the strainer of the fuel lift pump
	•				Check for water in the pre-filter **(1)**
		•			Renew the element 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 **(1)**
		•			Renew the engine lubricating oil **(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 it has not been indicated earlier
		•			Ensure that the valve tip clearances of the engine are checked and, if necessary, adjusted **(3)**
				•	Ensure that the alternator, starter motor etc. are checked **(3)**

(1) If there is one 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 oil change interval will change with the sulphur content of the fuel (see the table on page 3.02 and fuel specification). The interval to change the canister of the lubricating oil filter is not affected.

Fuel pump codes 4.203 and 4.2032

CAV fuel injection pump

Type ..... DPA

Direction of rotation from drive end ..... Counter-clockwise

Outlet for number 1 cylinder ..... Letter "W"

Fuel injection pump 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.

4.203 Series			4.203 Series		
Fuel pump code letters	Engine check angle (degrees)	Pump mark angle (degrees)	Fuel pump code letters	Engine check angle (degrees)	Pump mark angle (degrees)
AF37	287	277	LF59	289	279
AF44E	287	277	LP55	287	275
AF46/600/0/280	285	277	MP50	290	277
AF46/600/0/292	286	277	MP54	293	280
AF49E	287	277	MP55	293	280
AF50	287	277	MP57	293	280
AF53	287	277	PP48E	289.5	281
AF56	289	279	PP53E	289.5	281
BF41E	290	281	PP46E	289.5	281
BF51	290	281	PP50E	289.5	281
LF48	289	279	RP50E	290.0	281
LF51	289	279	SP	289.5	281
LF56	289	279	TP	290.0	281

Recommended torque tensions

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

4.203

Description	Thread size	Torque		
		Nm	lbf ft	kgf m
Fasteners, cylinder head				
- nuts only	7/16	81	60	8,3
- nuts and setscrews		95	70	9,7
- engine numbers JG..U609019S to JG..U609185S		95	70	9,7
Sump plug	3/4	50	37	5,1
- with 'washer'		34	25	3,5
- with 'O' ring		34	25	3,5
Atomiser clamp	3/8	16	12	1,6
Injector pipe union nut	M12 x 1.5	20	15	2,1
Main bearing	9/16	156	115	15,9
Big end bearing				
- phosphate	7/16	81	60	8,3
- cadmium		61	45	6,2
Front pulley	7/8	149	110	15,2
Flywheel	1/2	108	80	11,1

4.2032

Description	Thread size	Torque		
		Nm	lbf ft	kgf m
Fasteners, cylinder head	7/16	95	70	9,7
Sump plug	3/4	50	37	5,1
- with 'washer'	3/4	34	25	3,5
- with 'O' ring	3/4	34	25	3,5
Atomiser clamp	5/16	15	12	1,6
Injector pipe union nut	M12 x 1.5	20	15	2,1
Main bearing	9/16	156	115	15,9
Big end bearing	7/16	60	45	6,2
Front pulley	7/8	149	110	15,2
Flywheel	1/2	110	80	11,1

Cylinder head torque sequence 4.203 and 4.2032

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

Flame protected engines still have all nuts. All other engine were changed to nuts and setscrews, from the engine numbers below.

203U93838CL
203U6963DL
203UA130434DL

On 4.203 engines, all but two of the studs were changed to setscrews as well as the eight special studs which also retain the atomisers.

Fastener type	Illustration and position
Stud	**A** 10, 11
Setscrew	**A** 1 to 9 and 12 to 19

On D4.203 and 4.2032 engines, all but two of the studs were changed to setscrews.

Fastener type	Illustration and position
Stud	**B** 16, 17
Setscrew	**B** 1 to 15 and 18 to 23

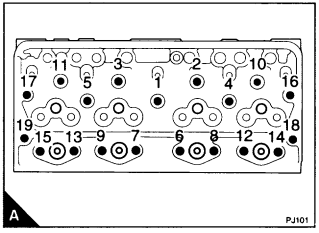
If these two studs are removed they must be put back in their correct positions, because they guide the cylinder head gasket into position.

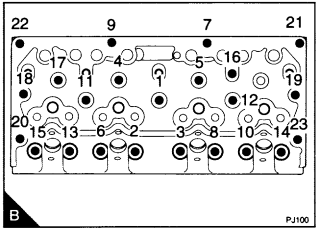
1 Lightly lubricate the threads of the fasteners.

2 Gradually and evenly tighten the fasteners to the correct torque in the sequence shown in (A or B). Repeat to ensure that all the fasteners are tightened to the correct torque shown in the table below.

Fastener type	Torque
Nuts only fitted	81 Nm (60 lbf ft) 8,3 kgf m
Nuts and setscrews	95 Nm (70 lbf ft) 9,7 kgf m

Caution: *Engines fitted with cylinder head gasket, part number 36812138, must have the fasteners for the cylinder head tightened again after the first 25/50 hour of use.*





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

Basic technical data

Horse power

- 4.236
  vehicle ..... 61,1 kW (82 bhp)
  industrial/agriculture ..... 60,0 kW (81 bhp)
- 4.248 ..... 62,6 kW (84 bhp)

Number of cylinders 4

Cycle ..... Four stroke

Induction system ..... Naturally aspirated

Combustion system ..... Direct injection

Nominal bore

- 4.236 ..... 98,43 mm (3.857 in)
- 4.248 ..... 100,96 mm (3.975 in)

Stroke ..... 127 mm (5 in)

Compression ratio 16:1

Cubic capacity ..... 3,86 litres (236 in^3)

Firing order 1-3-4-2

Valve tip clearances

- Inlet (cold) ..... 0,30 mm (0.012 in)
- Exhaust (cold) ..... 0,30 mm (0.012 in)

Lubricating oil pressure

- at maximum engine speed and normal engine temperature ..... 207/414 kN/m^2 (30/60 lbf/in^2) 2,1/4,2 kgf/cm^2

Coolant temperature ..... 60°C (140°F)

Thermostat starts to open ..... 77/83°C (170/180°F)

Thermostat fully open ..... 94°C (202°F)

Direction of rotation ..... Clockwise from front

Idling speed ..... 550 - 750 - 1000 rev/min

Location of maximum no-load speed ..... Fuel injection pump data plate

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

Location of engine timing marks ..... Scribe lines on fuel injection pump and pump flange

Atomiser codes

- 4.236 ..... CF, UA, AC, DM, CU, AB, EA, FY, XD, FC, FL, HY, NB, NC, ND, XE, YC
- 4.248 ..... DL, BU, CU, RG, FW

Fuel pump codes ..... AS, AT, BS, BT, DT, FT, GT, HT, JT, KT, LS, LT, MS, MT, PS, PT, RS, RT, SS, ST, TT, TS, VS, VT, WS, XS, XT, YT, ZS, ZT

Location of fuel pump code ..... Data plate on fuel pump

Location of fuel pump timing marks ..... Fuel pump mounting flange and timing case

Belt tension ..... 45 N (10 lbf) 4,5 kgf

Belt deflection at longest run ..... 10 mm (3/8 in)

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 First 25/50 hours
B Every 8 hours or every day
C Every 250 hours or 4 months
D Every 500 hours or 12 months
E Every 2500 hours

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 drive belt of the alternator
			•		Clean the sediment chamber and the strainer of the fuel lift pump
•		•			Check for water in the fuel pre-filter **(1)**
			•		Renew the elements of the fuel-filter
				•	Ensure that the atomisers are checked **(2)**
•					Ensure idle speed is checked and adjusted, if 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 **(3) (5)**
•		•			Renew the canister of the lubricating oil filter **(3)**
					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 **(4)**
				•	Clean the vent valve of the engine breather system **(1)**
				•	Ensure that the turbocharger impeller and turbocharger compressor casing are cleaned
		•			Clean the compressor air filter **(1)**
				•	Ensure that the exhauster or compressor **(1)** is checked **(2)**
•				•	Ensure that the valve tip clearances are checked and adjusted, if necessary **(2)**
				•	Ensure that the alternator, starter motor etc. are checked **(3)**

(1) If there is one fitted.
(2) By a person who has had the correct training.
(3) 4.2482 engines, every 500 hours or 12 months.
(4) 4.2482 engines, every 1000 hours.
(5) The oil change interval will change with the sulphur content of the fuel (see the table on page 3.02 and fuel specification). The interval to change the canister of the lubricating oil filter is not affected.

Fuel pump codes

CAV fuel injection pump

Type ..... DPA and DPS
Direction of rotation from drive end ..... Clockwise
Outlet for number 1 cylinder ..... DPA letter "W", DPS letter "X"

Fuel injection pump 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.

Fuel pump code letters	Engine check angle (degrees)	Pump mark angle (degrees)	Fuel pump code letters	Engine check angle (degrees)	Pump mark angle (degrees)
AS, AT60E, AT67E	279	292	PS...62, 66	281	292
BS44	281	296	PT (2643C210)	279.5	291
BS...49, 54, 62, 64	281	292	PT (2643C211)	280.5	291
BT73E	280.5	293	RS...45, 52, 56, 58	286	297
DT74E	280	289	RT	281	292
FT70E	280	290	SS...64, 66, 68	285	297
FT73E -before U940900L -from U940900L	 286 284	 293 293	ST	279.5	291
FT	284	293	TT (build list LJ50272)	280	288
GT78E	278.25	291	TS...59, 65	281	292
HT87E -before U028270M -from U028270M	 281 280	 293 293	TS67 except below	281	292
JT57E	279.5	291	TS67/850/2/2380 TS67/850/2/2480 TS67/850/6/2700	285	292
KT68L	284	292	VS51VS51	284	296
LS44	281	296	VT	280	293
LS...45, 49, 52, 55	284.5	296	WS62, 66	280	292
LS...57, 61, 63, 67	284.5	296	XS	280	293
LS62	283.5	296	XS55E, XS60E	281	293
LS66	281	292	XT	281	292
LT	9.25	17	YS68E	281	289
MS67	279	292	YT	280	291
MT80L	278	285	ZS51E	278.25	291
PS...45, 48, 51, 54, 55, 57	281	292			
PS61 excecpt below	281	292			
PS61/850/4/3120 PS61/850/7//3100 PS61/850/9/2400	280.5	292			

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.

4.236, 4.248 and 4.2482 engines

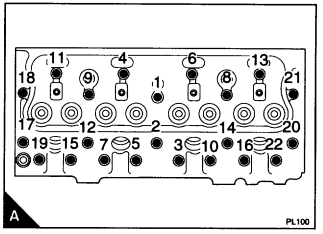
Fastener type	Fastener length mm (in)	Illustration and position
Stud	-	**A** 19, 22
Setscrew	Small	**A** 5, 6, 11, 12, 16, 17
Setscrew	Medium	**A** 1, 2, 3, 4, 7, 8, 9, 10, 13, 14, 15, 20
Setscrew	Large	**A** 18,21

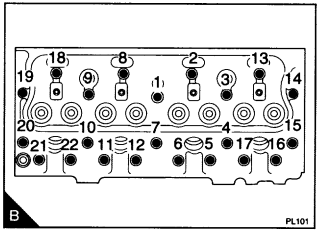
T4.236 engines

Fastener type	Fastener length mm (in)	Illustration and position
Stud	-	**B** 16, 21
Setscrew	Small	**B** 3, 5, 7, 10, 15, 19, 22
Setscrew	Medium	**B** 1, 2, 4, 6, 8, 9, 11, 12, 13, 14, 17, 20
Setscrew	Large	**B** 14, 19

Choose the correct methbd and torque from the table below.

Engine type	Torque method	Torque		
		Nm	lbf ft	kgf m
4.236				
engines with nuts only	1	81	60	8,3
up to U550185W	1	136	100	13,8
from U550185W	2	120	88	11,8
T.4236				
up to engine U027774M	1	136	100	13,8
from engine U027774M	2	120	88	11,8
4.248 and 4.2482				
up to engine U573000	1	136	100	13,8
from engine U573000	2	120	88	11,8





Method 1

1 Lightly lubricate the threads of the cylinder head fasteners.

2 Gradually and evenly tighten the fasteners to the correct torque and method shown in the table opposite. Tighten the fasteners in the correct sequence (A or B).

3 Start and run the engine until it reaches normal temperature of operation. Stop the engine.

4 Remove the rocker shaft and remove the atomisers, then tighten the fasteners again to the correct torque in the correct sequence.

If a fastener moves when checked, tighten it to the correct torque.

If a fastener does not move when checked, loosen it 1/12 to 1/6 (30° to 60°) of a turn then tighten it to the correct torque.

5 Check the first 10 positions again, during this check do not loosen the fasteners.

6 The fasteners of all engines except the 4.2482 must be tightened again after the first 25/50 hours use.

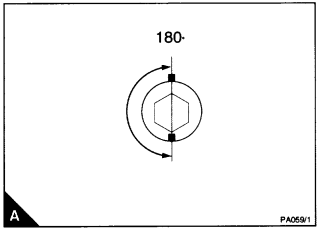
Method 2

Follow steps 1 and 2 in method 1, then:

Use the special angle gauge MS 1531 to tighten the setscrews, in the correct sequence, a further half of a turn (180°).

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 (A). Make another mark, at 180° (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.

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



Basic technical data

Horse power

6.3544 ..... 95.5 kW (128 bhp)
T6.3544 ..... 115 kW (155 bhp)

Number of cylinders 6

Cycle ..... Four stroke

Induction system

- 6.3544 ..... Naturally aspirated
- T6.3544 ..... Turbocharged

Combustion system ..... Direct injection

Nominal bore ..... 98,4 mm (3.875 in)

Stroke ..... 127 mm (5 in)

Compression ratio

- 6.3544 ..... 16:1
- T6.3544 ..... 15.5:1

Cubic capacity ..... 5.80 litres (354 in^3)

Firing order 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

- at max engine speed and normal engine temperature ..... 207/414 kN/m^2 (30/60 lbf/in^2) 2,1/4,2 kgf/cm^2

Coolant temperature ..... 60°C (140°F)

Thermostat starts to open

- bellows type ..... 67/75°C (152/167°F)
- wax type ..... 77/85°C (170/185°F)

Thermostat fully open

- bellows type ..... 85/88°C (185/190°F)
- wax type ..... 92/98°C (197/208°F)

Direction of rotation ..... Clockwise from front

Idling speed ..... Fuel injection pump data plate

Location of maximum no-load speed ..... Fuel injection pump data plate

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

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

Atomiser codes ... FL, FN, GD, GG, GH, GK, GL, GX, HC, HE, HK, HP, HS, HT, HU, RA, RB, VU, XX, Y

Fuel pump codes ..... AY, BY, CY, DY, EX, EY, FX, FY, GY, HY, JY, KY, LX, LY, MR, MX, MY, PX, PY, SX, TX, TY, VR, VX, WR, WX, XX, ZX

Location of fuel pump code ..... Fuel injection pump data plate

Location of fuel pump timing marks ..... Fuel pump mounting flange and adaptor plate

Belt tension ..... 45 N (10 lbf) 4,5 kgf

Belt deflection at longest run ..... 10 mm (3/8 in)

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 6.3544 and T6.3544

A First service at 25/50 hours
B Every day or every 8 hours
C Every 250 hours or 4 months
D Every 500 hours or 12 months
E Every 1000 hours
F Every 2500 hours

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 amount of coolant
•		•				Check the drive belt(s)
			•			Clean the sediment chamber and the strainer of the fuel lift pump
•	•					Check for water in the fuel pre-filter **(1)**
			•			Renew the fuel filter element (fuel filter with single element)
				•		Renew the fuel filter element (fuel filter with twin element)
					•	Ensure that the atomisers are checked **(2)**
•						Ensure that the idler speed is checked and adjusted if necessary **(2)**
	•					Check the amount of lubricating oil in the sump
•	•					Check the lubricating oil pressure at the gauge **(1)**
•		•				Renew the lubricating oil **(3)**
•		•				Renew the canister of the lubricating oil filter
					•	Clean the vent valve of the engine breather system **(1)**
						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, turbocharger compressor casing and turbocharger drain pipe for the lubricating oil are cleaned **(2)**
		•				Clean the compressor air filter **(1)**
					•	Ensure that the exhauster or compressor **(1)** is checked **(2)**
•					•	Ensure that the valve tip clearances are checked and adjusted, if necessary **(2)**
					•	Ensure that the alternator, starter motor etc. are checked **(3)**

(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 3.02 and fuel specification). The interval to change the canister of the lubricating oil filter is not affected.

Fuel pump codes 6.3544

CAV fuel injection pump

Type ..... DPA
Direction of rotation from drive end ..... Counter-clockwise
Outlet for number 1 cylinder X

Fuel injection pump 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.

Fuel pump code letters	Engine check angle (degrees)	Pump mark angle (degrees)	Fuel pump code letters	Engine check angle (degrees)	Pump mark angle (degrees)
AY	160	146	MX/4/2640	161	146
BY	160	146	MX/5/2420 from engine no. 728207L	159	146
EX	160	146	MX/5/2530	161	146
FX	160	146	PX (except below)	159	146
GY	162	154	PX list TW31012 only	160	146
HY	162	154	SX (6.3724)	159	146
MR (except below)	158	144	TY	153	141.5
MR from engine no. U780699P	158	147	WR	160	146
MX (except below)	160	146	WX	157	144

Fuel pump codes T6.3544

CAV fuel injection pump

Type ..... DPA
Direction of rotation from drive end ..... Counter-clockwise
Outlet for number 1 cylinder ..... Letter "X"

Fuel injection pump 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.

Fuel pump code letters	Engine check angle (degrees)	Pump mark angle (degrees)	Fuel pump code letters	Engine check angle (degrees)	Pump mark angle (degrees)
CY	153	145	PY	160	144
DY	160	144	TX	159	144
JY	159	144	VR	159	144
LX	159	144	XX	159	144
LY	153	145	YX	160	144
MY	159	144	ZX	159	144

Bosch fuel injection pump

Type ..... Rotary
Direction of rotation from drive end ..... Counter-clockwise
Outlet for number 1 cylinder ..... D

Fuel injection pumptiming

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)
EY (L21-2)	135	125.5
FY (L21-3)	135	127.5
KY (L107)	123	118
VX (L21 or L73)	135	127

The settings given for Bosch fuel pumps are with the pump set at 1 mm plunger lift. It is important that these pumps are not fitted at the static timing positions for the CAV pumps. The code given is stamped on the side of the pump.

Recommended torque tensions

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

6.3544 and T6.3544

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
Atomiser clamp	5/16	12	9	1,2
Injector pipe union nut	M12	20	15	2,1
Main bearing - cadmium - phosphated	5/8 UNF	270 102	200 75	27,7 10,4
Big end bearing - cadmium - phosphated	1/2 UNF	129 88	95 65	13,1 9,0
Front pulley	7/16 UNF	125	92	12,7
Flywheel	1/2 UNF	108	80	11,1

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.*

Any cylinder head studs removed from the cylinder block should be fitted with "Loctite".

The cylinder head gasket fitted to the T6.3544 and 6.3544 engine is not interchangeable with other 6.354 Series engines. It is marked "TOP FRONT". A different cylinder head gasket is used on 6.3724 engines because of the larger bore size.

The cylinder head gasket must be fitted dry.

There are two methods to tighten the cylinder head fasteners for service, methods 1 and 2 shown below. Currently, the factory uses method 2.

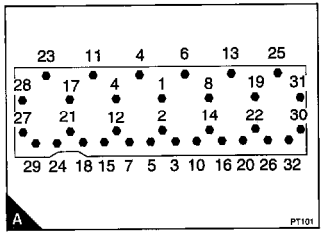
Method 1 - hot torque

1 Lightly oil threads of cylinder head studs and setscrews. See the table below.

2 Gradually and evenly tighten the fasteners to the correct torque shown in the table below, in the sequence shown in (A).

3 Start and run the engine until it reaches normal temperature of operation. Stop the engine. Tighten the fasteners again to the correct torque in the correct sequence.

Fastener type	Position	Torque		
		Nm	lbf ft	kgfm
Plain fasteners which are fitted with separate washers	A 1 to 32	130	95	13,1
Flanged fasteners fitted with head gasket, part number 36812611	A 1 to 32	156	115	15,9
Small setscrews	A 33 to 38	38	28	3,9



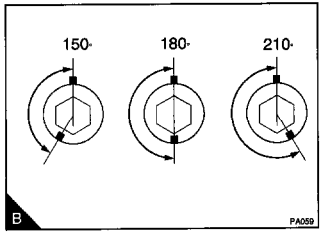
Method 2 - torque and angle

Follow steps 1 and 2 in method 1, then:

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, 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, 24	180° or 3 flats
A 24, 25, 29, 30	210° or 3 1/2 flats
A 33 to 38	None, check torque

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. 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.



Basic technical data

Horse power	
- V8.540	134 kW (180 bhp)
- TV8.540	175 kW (235 bhp)
Number of cylinders	8
Cycle	Four stroke
Induction system	
V8.540	Naturally aspirated
TV8.540	Turbocharged
Combustion system	Direct injection
Nominal bore	108,0 mm (4.25 in)
Stroke	120,7 mm (4.75 in)
Compression ratio	
V8.540	16.5:1
TV8.540	15:1
Cubic capacity	8,85 litres
Firing order	1-8-7-5-4-3-6-2
Valve tip clearances	
- Inlet (cold)	
V8.540	0,25 mm (0.10 in)
TV8.540	0,25 mm (0.10 in)
- Exhaust (cold)	
V8.540	0,25 mm (0.10 in)
TV8.540	0,50 mm (0.20 in)
Lubricating oil pressure	
- at maximum engine speed and normal engine temperature	280 kN/m² (40 lbf/in²) 2,8 kgf/cm²
Coolant temperature	60°C (140°F)
Thermostat starts to open	67/75°C (152/167°F))
Thermostat fully open	85/88°C (185/190°F)
Direction of rotation	Clockwise from front
Idling speed	Fuel injection pump data plate
Location of maximum no-load speed	Fuel injection pump data plate
Location of number 1 cylinder	Front of left bank at crankshaft pulley end
Location of engine timing marks	Scribe lines on fuel injection pump and pump flange
Atomiser codes	VA, VB, VJ, VN, WC, FG, GU, VW, WW, WY, WZ, XA, XB, XY
Fuel pump codes	TBA
Location of fuel pump code	Fuel injection pump data plate
Location of fuel pump timing marks	Fuel pump mounting flange and pump adaptor plate
Belt tension	45 N (10 lbf) 4,5 kgf
Belt deflection at longest run	10 mm (3/8 in)

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 8 hours or every day
B Every 500 hours or 6 months
C Every 1000 hours
D Every 2000 hours
E Every 2500 hours
F Every 4000 hours

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 amount of coolant
	•					Check the drive belts of the alternator
	•					Check for water in the pre-filter **(1)**
		•				Renew the elements of the fuel-filter
			•			Ensure that the atomisers are checked **(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)**
	•					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
				•		Clean the turbocharger impeller and casing **(3)**
					•	Check the turbocharger **(3)**
	•					Ensure that the valve tip clearances are checked and adjusted, if necessary **(3)** - V8.540
		•				- TV8.540
				•		Ensure that the alternator, starter motor etc. are checked **(3)**

(1) If there is one 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 oil change interval will change with the sulphur content of the fuel (see the table on page 3.02 and fuel specification). The interval to change the canister of the lubricating oil filter is not affected.

Fuel pump codes

Fuel injection pump

Type ..... CAV Minimec, DP15 or Bosch MW

Direction of rotation from drive end ..... Clockwise

Spill timing of CAV Minimec or Bosch MW

Fuel pump code letters			Spill timing position BTDC (degrees)	Piston position BTDC mm (in)
MB71/800/A02/1800 MB71/800/A02/1880 MB71/800/C02/1560 MB71/800/C02/1575 RB69/800/41A/2350 RB69/800/41A/2530 RB69/800/44A/2830 RB71/800/41A/2330	RB71/800/41A/2350 RB71/800/41A/2390 RB71/800/41A/2480 RB71/800/41A/2500 RB71/800/41A/2530 RB71/800/41A/2560 RB72/800/41A/2380 RB72/800/41A/2530	2642A210MB/C02/1575 2642A211MB/A02/1890 2642A215RB/41A/2500 2642A215RB/41A/2530 2642A228RB/41A/2330	26	7,62 (0.300)
LB71/800/12/2500 LB71/800/22/2500 MB71/800/D01/2340 MB71/800/D01/2360 MB71/800/D01/2380 MB71/800/D01/2400 MB71/800/D01/2420 MB71/800/D01/2520 MB71/800/E01/2720	RB70/800/44A/2910 RB71/800/41A/2550 RB71/800/41A/2660 RB71/800/41A/2730 RB71/800/44A/2630 RB71/800/44A/2770 RB71/800/44A/2830 RB71/800/44A/2850*	2642A213MB/D01/2360 2642A213MB/D01/2420 2642A213MB/D01/2520 2642A214RB/44A/2770 2642A215RB/41A/2550 2642A215RB/41A/2660 2642A223RB/E01/2720	28	8,89 (0.350)
LG68E/800/44A/2960 RB71/800/44A/2850** RB71/800/44A/2910 RB71/800/44A/2960	YB68E/800/44A/2960	2642A209RB/44A/2960 2642A214RB/44A/2850 2642A230LG/44A/2960	29	9,53 (0.375)
PB73L/900/D01/2400 PB81E/1100/D01/2520 PB81E/1100/D01/2600	PB81E/1100/D01/2610 PB81E/1100/D01/2620 PB81E/1100/D01/2650	PB81E/1100/E01/2740 2642A243PB/D01/2600 2642A243PB/D01/2520	31	10,85 (0.427)

* Non-vehicle applications
** Vehicle applications

Static timing of CAV DP15

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.

Static timing position BTDC ..... 16°

Timing check angle ..... 312°

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	9/16 UNF	-	-	-
Sump plug	3/4 UNF	50	37	5,1
Atomiser clamp	5/16 UNF	16	12	1,7
Injector pipe union nut	M12 x 1.5	20	15	2,1
Main bearing	5/8 UNF	285	210	29
Big end bearing	9/16 UNF	142	105	14,5
Front pulley	7/8 UNF	407	300	41,5
Flywheel	1/2 UNF	108	80	11,1

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.

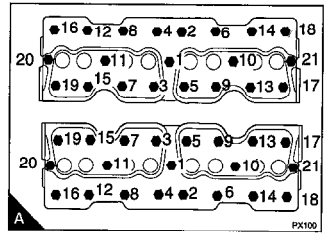
Fastener type	Fastener length mm (in)	Illustration and position
Stud	-	**A** 16, 18
Setscrew	Small	**A** 2, 4, 6, 8, 12,14,
Setscrew	Medium	**A** 3, 5, 7, 9, 13, 15, 17, 19
Setscrew	Large	**A** 1, 10, 11, 20, 21

1 Lightly lubricate the threads of the studs and the cylinder head setscrews and the thrust faces of the setscrew.

2 Gradually and evenly tighten the setscrews and nuts of each bank to the correct torque, in the sequence (A). Tighten again all the setscrews and nuts to the correct torque, in the sequence (A).

Engine and fastener type	Torque		
	Nm	lbf ft	kgf m
V8.540			
flanged fasteners	169	125	17,3
flanged fasteners, scant shank setscrews with gasket 3681H401	185	135	18,2
plain fasteners with separate washers with gasket 3681H401	210	155	1,47
TV8.540			
flanged fasteners	210	155	21,4

3 Run the engine until it reaches normal temperature of operation. Stop the engine. Tighten again all the setscrews and nuts of each bank to the correct torque, in the sequence (A).



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

General data

Specification of engine fluids

Lubricating oil specification	**4.108, 3.152, 4.203, 4.2032, 4.236, 4.248 6.3544, T6.3544, V8.540**
Minimum lubricating oil specification - naturally aspirated engines - turbocharged engines	API CC/SE API CD/SE or CCMC D4 (1)
Lubricating oil capacity	Dependent on sump fitted, see application user's handbook
Fuel specification	
Viscosity	4.236, 4.248, V8540 ..... 2.5/4.5 centistokes at 40°C 4.108, 3.152, 4.203, 4.2032, 6.3544, T6.3544 ..... 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	All 4.236, 4.248 Vehicle only 6.3544, T6.3544, V8.540 ..... 50 minimum industrial/ag 6.3544, T6.3544, V8.540 All 4.108, 3.152, 4.203, 4.2032 ..... 45 minimum
Sulphur (2)	4.108, 4.203, 4.2032, 6.3544 T6.3544, V8.540 ..... 0.5% of mass, maximum 3.152, 4.236, 4.248 ..... 0.2% of mass, maximum
Coolant specification	
Recommended coolant	POWERPART antifreeze
Concentration of antifreeze	50%
Corrosion inhibitor mixture. Must have a specification at least as good as BS6580 or MOD AL39	Refer to user's handbook
Coolant capacity	See application user's handbook

(1) Not recommended for naturally aspirated engines during the first 20 to 50 hours or for light load applications.
(2) 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

Standard torque settings

General notes

1 For 'service', use the nominal torque value. Tolerances to be within ±25% of nominal.

2 If there are changes to phosphated surfaces or to thread tolerances, the torque values must change.

3 Torque values in these tables are for 'dry threads'.

4 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

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	1.18
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

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

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

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

Code	Holder	Nozzle	Set and reset pressure		
			atm	(lbf/in²)	MPa
AB	BKBL67S5151/ OKLL6752930	BDLL150S6435/ OLL150S6705	175	2573	17,7
AC	2646460	2646677	175	2573	17,7
AV	BKBL67S5151	BDLL50S6372	170	2499	17,2
BC	BKB35SD5260	BDL110S6133	120	1764	12,2
BG	BKB40SD5224	BDN12SD6236	135	1985	13,7
BM	BKB35SD5260	BDL110S6267	120	1764	12,2
BT	BKBL67SD5151	BDLL150S6310	175	2573	17,7
BU	BKBL67S5151	BDLL150S6435	175	2573	17,7
BV	BKBL67S5151	BDLL150S6513	170	2499	17,2
CR	BKBL67S5151	BDLL150S6513	170	2499	17,2
CF	BKBL67S5299	BDLL150S6507	185	2720	18,7
CS	BKBL67S5151	BDLL150S6554	170	2499	17,2
CT	BKBL67SD5151	BDLL150S6555	175	2573	17,7
CU	BKBL67S5151/ OKLL6752930	BDLL150S6556/ OLL150S6556	175	2573	17,7
CY	OKLL66M11340	OLL150M9302	230	3381	23,3
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	BDLL150S6554	170	2499	17,2
EA	BKBL67S5299/ OKLL6752930	BDLL150S6591/ OLL150S6649	215	3161	21,8
EC	RKBL67S5268	RDLL150S6554	165	2426	16,7
EE	2646466	2646825	190	2793	19,3
EG	2646466	2646826	210	3087	21,3
EV	BKB35SD5260	BDL110S6267	180	2646	18,2
FC	2646466	2646831	210	3087	21,3
FJ	BKB35SD5259	BDL110S6267	170	2499	17,2
FL	BKBL67S5299	BDLL150S6673	200	2940	20,3
FM	BKB35SD5260	BDL110S6685	170	2499	17,2
FN	BKBL67S5299	BDLL150S6639	195	2867	19,8
FR	BKB35SD5260	BDL110S6267	170	2499	17,2
FS	BKBL67S5299	BDLL150S6674	170	2499	17,2
FW	2646466	2646826	185	2720	18,7
FY	2646460	2646842	175	2573	17,7
GB	BKB35SD5260	BDL110S6709	170	2499	17,2

Continued

Atomiser information *continued*

Code	Holder	Nozzle	Set and reset pressure		
			atm	(lbf/in²)	MPa
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	4042	18,7
GL	2646460	2646844	175	2573	17,7
GM	2646466	2646848	185	2720	18,7
GS	2646475	2646850	252	3704	17,1
GW	BKB35SD5258	BDLL150S6709	170	2499	17,2
GX	2645F301	2645F601	250	3675	25,3
GY	2646522	2646724	150	2205	15,2
H	BKB32S5141	BDL110S6267	120	1764	12,2
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
HF	LRB67014	JB6801022	210	3087	21,3
HG	LRB67014	JB6801022	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	3969	18,4
HS	2646466	26456844	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
J	BKB32SD5141	BDL110S6133	120	1764	12,2
JZ	2645A301	2645A622	230	3381	23,3
NB	2645L301	2645L602	195	2867	19,8
NC	2645L302	2645L603	170	2499	17,2
ND	2645L301	2645L604	175	2573	17,7
NH	2645L304	2645L606	230	3381	23,3
RA	2645F303	2645F602	247	3631	16,8
RB	2645C304	2645F606	250	3675	25,3

Continued

Atomiser information, *continued*

Code	Holder	Nozzle	Set and reset pressure		
			atm	(lbf/in²)	MPa
TC	BKB35SD5259	BDL110S6709	170	2499	17,2
UA	2645M301	2645M601	TBA	TBA	TBA
UB	2646522	2646724	150	2205	15,2
VA	2645M301	2645M601	TBA	TBA	TBA
VB	HB54S693	NL550	170	2499	17,2
VJ	BKBL54S5312	BDLL150S6573	170	2499	17,2
VN	2646562	2646862	200	2940	20,3
VR	OKLL54S2965	OLL150S3385	195	2867	19,8
VT	OKLL54S5312	OLL150S7777	195	2867	19,8
VU	2645C564	26466866	225	3308	22,8
VW	2646562	2646869	210	3087	21,3
VX	OKLL54S5312	OLL150S7777	195	2867	19,8
VY	OKLL54S2924	OLL150S7777	195	2867	19,8
VZ	OKLL54S2924	OLL150S7788	195	2867	19,8
WA	OKLL54S2924	OLL150S3385	195	2867	19,8
WC	2646568	2646871	195	2867	19,8
WD	OKLL54S2996	OLL150S7604	195	2867	19,8
WJ	OKLL54S3014	OLL150S7788	195	2867	19,8
WK	OKLL54S3014	OLL150S3385	195	2867	19,8
WL	OKLL54S3014	OLL150S7777	195	2867	19,8
WN	2646568	2646872	217	3190	21,9
WP	OKLL54S3052	OLL150S3385	210	3087	21,3
WU	OKLL54M3059	OLL150S8388	235	3455	23,8
WV	OKLL54M3052	OLL150S7788	195	2867	19,8
WW	2645C302	2645C602	240	3528	24,3
WX	2645C303	2645C804	201	2955	20,4
WY	2645C303	2645C605	235	3455	23,8
WZ	2646568	2646869	195	2867	19,8
XA	2645C303	2645K601	230	3381	23,3
XB	2645C303	2645K604	235	3455	23,8
XC	2645C305	2645C608	175	2573	17,7
XD	2645C306	2645C609	170	2499	17,2
XE	2645C305	2645C610	195	2867	19,8
XG	2645C305	2645C615	210	3087	21,3
XJ	2645C305	2645C621	170	2499	17,2
XL	2645C305	2645C619	170	2499	17,2
XX	2645C307	2645C613	245	3602	24,8
XY	2646568	2646864	210	3087	21,3
XZ	2645C308	2645C614	220	3234	22,3

Continued

Atomiser information, *continued*

Code	Holder	Nozzle	Set and reset pressure		
			atm	(lbf/in²)	MPa
Y	2646460	2646672	175	2573	17,7
YA	2645C308	2645C618	240	3528	24,3
YB	2645C304	2645C616	155	2279	15,7
YC	2645C307	2645C617	230	3381	23,3
YD	2645C310	2645C618	240	3528	24,3
Z	BKBL67SD5151	BDLL50S6355	170	2499	17,2

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/in²	kgf/cm²		kPa	lbf/in²	kgf/cm²
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)

Compression test data

Tests have shown that many factors affect compression pressures. Battery and starter motor condition, ambient conditions and the type of gauge used can give a wide variation of results for a given engine. It is not possible to give accurate data for compression pressure, but tests have shown that the results should be within 2000/3500 kPa (300/500 lbf/in²) 21,0/35,0 kgf/cm² for diesel engines.

Compression tests should only be used to compare between the cylinders of an engine. If one or more cylinders vary by more than 350 kPa (50 lbf/in²) 3,5 kgf/cm², then those cylinders may be faulty.

Compression tests should not be the only method used to show the condition of an engine, but they should be used together with other symptoms and tests.

How to do a compression test

Caution: *Before the compression test, ensure that the battery is in good condition and that it is fully charged. Also ensure that the starter motor is in good condition.*

1 Ensure that the valve tip clearances are set correctly.

2 Remove the atomisers.

3 Fit a suitable gauge into the atomiser hole of the cylinder to be tested.

4 Ensure that the engine cannot start:

Disconnect the stop solenoid or put the stop control in the no-fuel position.

Operate the starter motor and note the pressure indicated on the gauge.

5 Repeat for each cylinder.