Perkins

Operators Handbook

4000 Series

GB

4006/4008 In-Line Diesel

TSL4184

WARNING ⚠

READ AND UNDERSTAND ALL SAFETY PRECAUTIONS AND WARNINGS MENTIONED IN THIS MANUAL.
IMPROPER OPERATION OR MAINTENANCE PROCEDURES COULD RESULT IN A SERIOUS ACCIDENT OR DAMAGE TO THE EQUIPMENT CAUSING INJURY OR DEATH.
NON-COMPLIANCE WITH THESE INSTRUCTIONS AND THOSE INCLUDED IN THE INSTALLATION MANUAL TSL4068 MAY INVALIDATE THE WARRANTY OFFERED WITH THE ENGINE.
MAKE QUITE CERTAIN THAT THE ENGINE CANNOT BE STARTED IN ANY WAY BEFORE UNDERTAKING ANY MAINTENANCE, PARTICULARLY IN THE CASE OF AUTOMATICALLY STARTING GENERATING SETS.

The purpose of this Manual is to enable the operator to carry out routine servicing of the engine.
Before undertaking any work on the engine the appropriate section in the **Manual** should be read fully and completely understood prior to starting work.
The information contained within the manual is based on such information as was available at the time of going to print. In line with Perkins Engines (Stafford) Limited policy of continual development and improvement that information may change at any time without notice. The engine user should therefore ensure that he has the latest information before starting work.
The instructions contained in this Manual will, provided that they are correctly carried out, ensure the safe operation of the equipment.
Users are respectfully advised that it is their responsibility to employ competent persons to operate, maintain and service the equipment in the interest of safety.
Certain overhaul operations are impracticable without the use of special tools, and those operators who are not equipped to undertake major repairs are urged to consult their Perkins distributor.
When not working on the engine, ensure that all covers, blank flanges, doors, etc., are refitted to openings to prevent the ingress of dirt, etc.
Please quote the engine type and serial number with all your enquiries. This will help us to help you. The type and serial number are on a plate fitted to the crankcase.
If any doubt exists regarding the installation, use or application of the engine, the Installation Manual should be consulted for further advice contact Applications Department at Perkins Engines (Stafford) Ltd.
Oil change intervals may be changed according to operating experience by agreement with Perkins Engines (Stafford) Limited and subject to oil analysis being carried out at regular intervals.
Please note that this 4000 Series manual also covers SE engines dispatched from the factory from 1 March 1996.
A table of equivalent engine designations is given on **page 2**.

PERKINS COMPANIES

Perkins Group of Companies
Perkins Engines (Peterborough) Ltd.
Frank Perkins Way, Eastfield,
Peterborough, PE1 5NA, England.
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Telex: 32501 PERKEN G
Fax: (01733) 582240

Perkins Engines (Shrewsbury) Ltd.
Lancaster Road, Shrewsbury,
SY1 3NX, England.
Tel: (01743) 212000
Telex: 35171/2 PESL G
Fax: (01743) 212700

Perkins Engines (Stafford) Ltd.
Tixall Road, Stafford, ST16 3UB, England.
Tel: (01785) 223141
Telex: 36156 PERKEN G
Fax: (01785) 215110

Perkins Powerpart Distribution Centre
Frank Perkins Way,
Northbank Industrial Park, Irlam,
Manchester, M44 5PP, England.
Tel: (0161) 776 5000
Specifications Help Desk
Tel: (0161) 776 5151
Fax: (0161) 776 5200
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Tel: (0161) 776 5100
Telex: 32501 PERKEN G

Perkins International - North America
12025 Tech Center Drive,
Livonia, Michigan 48150,
U.S.A.
Tel: 313 266 5427
Fax: 313 266 2700

Perkins Engines Latin America Inc
999 Ponce de Leon Boulevard,
Suite 710, Coral Gables,
Florida 33134, U.S.A.
Tel: (305) 442 7413
Telex: 32501 PERKEN G
Fax: (305) 442 7419

Perkins Engines Australia Pty Ltd
Suite 2, 364 Main Street, Mornington
3931, Victoria, Australia.
Tel: (059) 75 1877
Telex: 30816
Fax: (059) 75 1305

Motori Perkins SpA
Via Socrate. 8,22070 Casnate
Con Bernate (Como), Italy.
Tel: 031 56 46 25 / 031 56 46 33
Telex: 380658 PERKIT I
Fax: 031 24 90 92 / 031 56 41 45

Perkins Motoren GmbH
D-63801 Kleinostheim,
Saalackerstrasse 4, Germany.
Tel: (49) (6027) 5010
Fax: (49) (6027) 501130

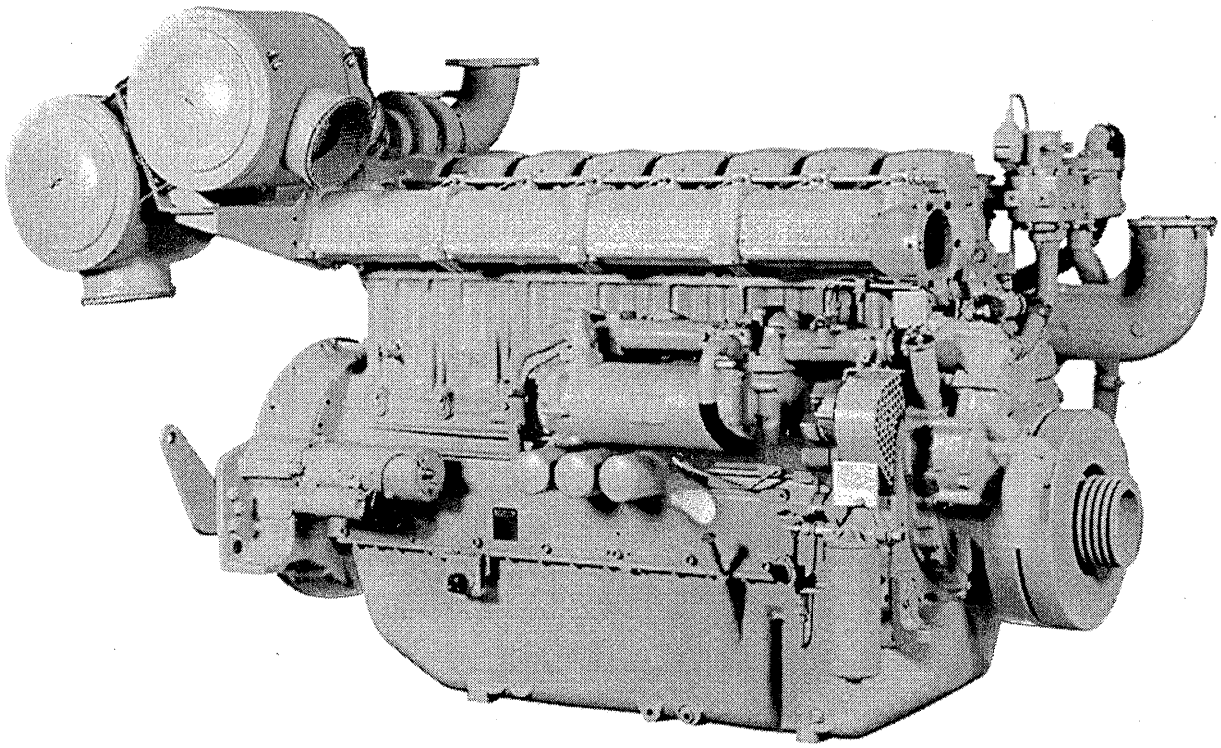
Moteurs Perkins SA
Parc de Reflets - Paris Nord II,
165 Avenue du Bois de la Pie, BP 40064,
95913 Roissy CDG Cedex, France
Tel: 00 33 149 90 71 72
Fax: 00 33 149 90 71 90

Perkins Engines (Far East) Pte Ltd.
39 Tuas Avenue 13,
Singapore 638999.
Tel: (65) 861 1318
Fax: (65) 861 6252

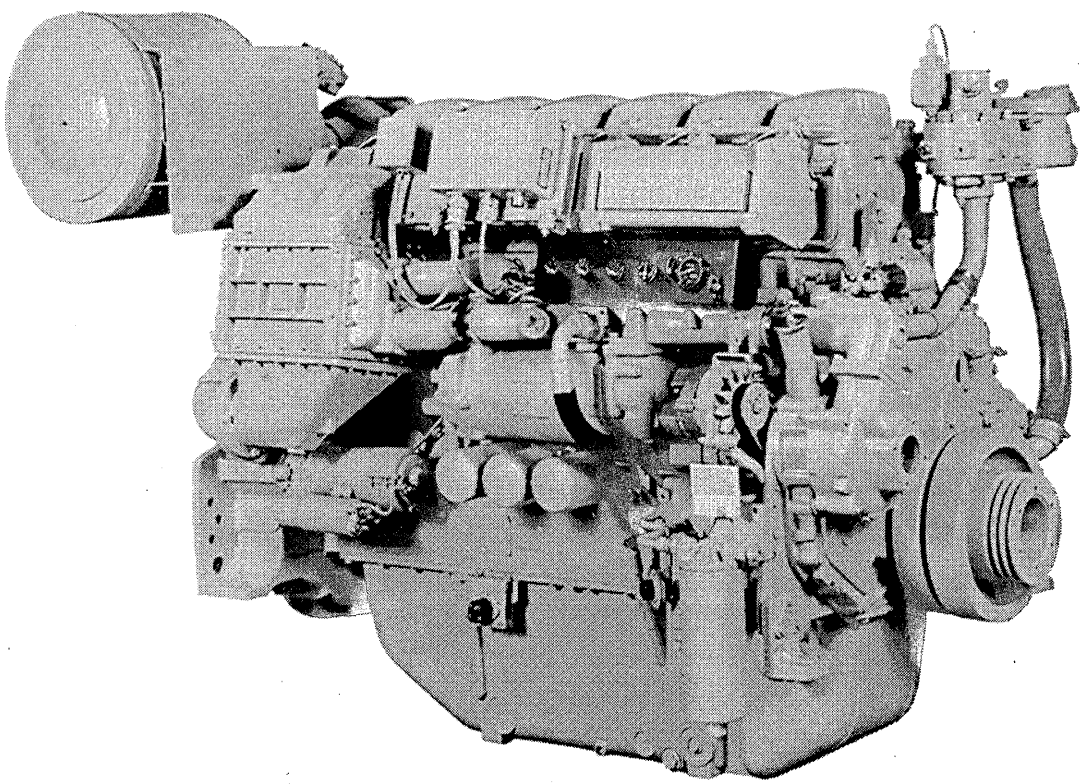
In addition to the above companies, there are Perkins distributors in most countries. Perkins Engines (Peterborough) Limited or one of the above companies can provide distributor handbooks Publication No. 1407/4/97

Publication TSL4184
Published by the Technical Publications Department, Stafford.

PERKINS ENGINES (STAFFORD) ENGINE DESIGNATIONS 4000 SERIES AND SE SERIES EQUIVALENT TERMS	
4000 SERIES	**SE SERIES**
4006TG	6SET
4006TWG	6SETCR
4006TWG3	6SETCR3
4006TAG1	6SETCA1
4006TAG2	6SETCA2
4006TAG3	6SETCA3
4006TEG	6SETCW
4008TWG2	8SETCR2
4008TAG	8SETCA
4008TAG1	8SETCA1
4008TAG2	8SETCA2



4008TAG1/2



4006TWG

⚠ SAFETY PRECAUTIONS

For safe and reliable operation of the engine it is essential that the recommended procedures as outlined in the manual are adhered to, and where necessary the special tools are used. Improper operation or maintenance procedures are dangerous and could result in injury or death.

The operator should check before operation that all the basic safety precautions have been carried out to avoid an accident occurring.

Read and understand all safety precautions and warnings before operating or servicing the engine.

The safety precautions that must be adhered to when operating the engine or carrying out service work are listed below under separate headings together with the relative symbols:

Ensure guards are fitted 	(a) over exposed rotating parts (b) over exposed hot surfaces (c) over exposed air intakes (d) over exposed belts (e) over live electrical terminals, high and low tension
Ensure protection equipment: for hands, ears, eyes, feet etc.  (1)  (2)  (3)  (5)  (4)	(a) (1) is worn when using inhibitors (b) (1) is worn when using anti-freeze (c) (1) is worn when taking pressure cap off radiator or heat exchanger filler (d) (5) is worn when working on or underneath engine (e) (3) is worn when using air pressure line (f) (1) is worn when changing lubricating oil/filter (g) (2) is worn when working in enclosed engine room (h) (1) is worn when changing electrolyte in battery (j) (4) is worn always when working on the engine
No smoking or naked flame 	(a) when checking battery electrolyte (b) when working in engine room (c) when operating or servicing engine
Fuel/oil pipes 	(a) check for leaks (b) check for spilt oil (clean up) (c) always use barrier cream on hands
Gas/air pipes 	(a) check for gas/air mixture leaks (b) never run gas engine with failed pressure disc (c) that gas line and valves meet local safety standards (d) that the gas line pressure is correct
Shutdown equipment 	(a) for stopping engine in case of over speed, high water temperature or low oil pressure should be provided (b) for heat sensors, methane and smoke detectors should be provided (if applicable) (c) test that protection system is working correctly (d) Always be in a position to stop engine (even remotely)
Start up 	(a) disconnect battery or any other means in case of accidental start up when working on engine (b) never start engine with governor linkage disconnected (c) do not hold stop lever in run position when starting engine (d) always hold stop lever in stop position when cranking only
Electrical equipment 	(a) check that electrics are earthed to local safety standards (b) disconnect electrical supply to water jacket heater (if fitted) before working on engine (c) take care against electric shocks (d) Never re-adjust settings of electronic equipment without reference to Operation Manual

Freezing or heating component 	(a) Always wear heat resistant gloves and use correct handling equipment
Exhaust system 	(a) check for leaks (b) check for correct ventilation of engine room (c) check that guards are fitted (d) check that diesel exhaust is clear (e) check that pipework allows gas to escape upwards (f) check that pipework is supported
Stop the engine 	(a) before changing lubricating oil (b) before filling radiator or topping up with anti-freeze (c) before repairing engine (d) before adjusting belts (e) before adjusting tappets (f) before changing spark plugs/injectors (g) before changing air/oil/fuel filters (non change-over) (h) before tightening fixing bolts etc
Flammable fluids 	(a) never store near engine (b) never use near naked light
Clothing 	(a) do not wear loose clothing, ties, jewellery etc. (b) always wear steel toe cap shoes (c) always wear head, eye and ear protection (d) always wear overalls (e) always replace spillage contaminated overall immediately
Lifting heavy components 	(a) use correct lifting equipment (b) do not work alone (c) always wear helmet
Viton 'O' rings 	(a) always wear both hand and eye protection when handling 'O' rings which have been exposed to very high temperatures (eg a fire)
De-scaling solution 	(a) always wear both hand and eye protection whilst handling (b) always wear overalls and proper footwear
Handling/cutting gaskets and joints containing asbestos 	(a) always wear respiratory protection (b) always provide dust extract system (c) always dispose of waste in accordance with local/legislative requirement
Waste disposal 	(a) do not leave oily rags on or near the engine (b) do not leave loose items on or near the engine (c) provide fireproof container for oily rags

Most accidents are caused by failure to observe basic precautions, and can be avoided by recognising potentially dangerous situations before an accident occurs.

Stop and isolate the engine, and ensure it cannot be restarted whilst servicing the engine.

Improper operation of the engine is dangerous and could result in injury or death.

Warnings are outlined in the operation manual and on the engine and are identified by the following symbol.

WARNING △— USE APPROPRIATE SYMBOL

There are many potential hazards that can occur during operation of the engine which cannot always be anticipated. Therefore a warning cannot be included in the manual for every possible circumstance that might involve a potential hazard.

Should a procedure be used not specially recommended then you must satisfy yourself that it is safe and will not damage the engine.

KEY TO SYMBOLS THAT MAY BE FOUND IN THE MANUAL					
	WARNING		NO SMOKING		WEAR EYE PROTECTION
	HIGHLY FLAMMABLE		NO NAKED LIGHT		USE EAR PROTECTORS
	DANGER LIVE WIRES		EMERGENCY STOP		PROTECTIVE FOOTWEAR MUST BE BE WORN
	DANGER HOT SURFACE		GUARDS MUST BE FITTED BEFORE STARTING		WEAR HELMET
	STAND CLEAR SUSPENDED LOADS		DANGER BATTERY ACID		HAND PROTECTION MUST BE WORN

4006TG	6 cylinder, inline, water cooled, 4 stroke, turbocharged diesel engine, with jacket water cooled oil cooler in engine cooling circuit.
4006TWG	6 cylinder, inline, water cooled, 4 stroke, turbocharged diesel engine, with jacket water cooled oil cooler and charge air cooler in engine cooling circuit.
4006TWG3	Up-rated version of the 4006TWG. 6 cylinder, inline, water cooled, 4 stroke, turbocharged diesel engine, with jacket water cooled oil cooler and charge air cooler in engine cooling circuit.
4006TAG1	6 cylinder, inline, water cooled, 4 stroke, turbocharged diesel engine, with jacket water cooled oil cooler in engine cooling circuit and air cooled charge air cooler in radiator.
4006TAG2	Up-rated version of the 4006TAG1. 6 cylinder, inline, water cooled, 4 stroke, turbocharged diesel engine, with jacket water cooled oil cooler in engine cooling circuit and air cooled charge air cooler in radiator.
4006TAG3	Up-rated version of the 4006TAG2. 6 cylinder, inline, water cooled, 4 stroke, turbocharged diesel engine, with jacket water cooled oil cooler in engine cooling circuit, and air cooled charge air cooler in radiator.
4006TEG	6 cylinder, inline, water cooled, 4 stroke, turbocharged diesel engine, with jacket water cooled oil cooler in engine cooling circuit, and water cooled charge air cooler with raw water pump in separate cooling circuit.
4008TWG2	8 cylinder, inline, water cooled, 4 stroke, turbocharged diesel engine, with jacket water cooled oil cooler and charge air cooler in engine cooling circuit.
4008TAG	8 cylinder, inline, water cooled, 4 stroke, turbocharged diesel engine, with jacket water cooled oil cooler in engine cooling circuit and air cooled charge air cooler in radiator.
4008TAG1	Up-rated version of the 4008TAG. 8 cylinder, inline, water cooled, 4 stroke, turbocharged diesel engine, with jacket water cooled oil cooler in engine cooling circuit and air cooled charge air cooler in radiator.
4008TAG2	Up-rated version of the 4008TAG1. 8 cylinder, inline, water cooled, 4 stroke, turbocharged diesel engine, with jacket water cooled oil cooler in engine cooling circuit and air cooled charge air cooler in radiator.

SAFETY

Engine lift equipment

Use only the lift equipment which is designed for the engine.

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

Check the engine lift brackets for security before the engine is lifted.

Asbestos joints

Some joints and gaskets contain compressed asbestos fibres see **Warning label Fig. 1** in a rubber compound or in a metal outer cover. The 'white' asbestos (Chrysotile) which is used is a safer type of asbestos and the danger of damage to health is extremely small.

Contact with asbestos particles normally occurs at joint edges or where a joint is damaged during removal, or where a joint is removed by an abrasive method.

To ensure that the risk is kept to a minimum, the procedures given below must be followed when an engine which has asbestos joints is dismantled or assembled.

- Work in an area with good ventilation.
- Do NOT smoke.
- Use a hand scraper to remove the joints - do NOT use a rotary wire brush.
- Ensure that the joint to be removed is wet with oil or water to contain any loose particles.
- Spray all asbestos debris with water and place it in a closed container which can be sealed for safe disposal.

Dangers from used engine oils

Prolonged and repeated contact with mineral oil will result in the removal of natural oils from the skin, leading to dryness, irritation and dermatitis. The oil also contains potentially harmful contaminants which may result in skin cancer.

Adequate means of skin protection and washing facilities should be readily available.

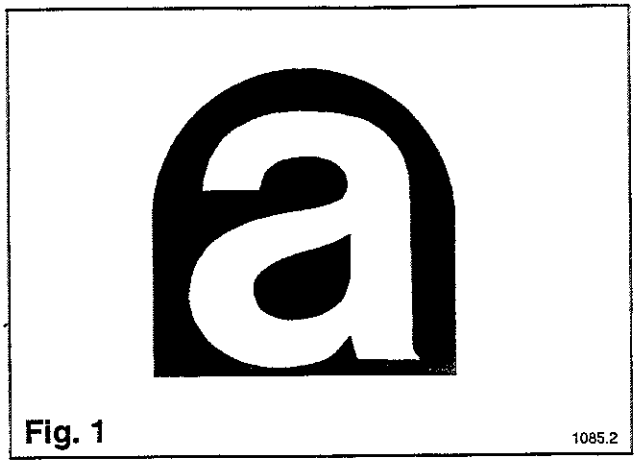


Fig. 1 1085.2

The following is a list of 'Health Protection Precautions', suggested to minimise the risk of contamination.

1. Avoid prolonged and repeated contact with used engine oils.
2. Wear protective clothing, including impervious gloves where applicable.
3. Do not put oily rags into pockets.
4. Avoid contaminating clothes, particularly underwear, with oil.
5. Overalls must be cleaned regularly. Discard unwashable clothing and oil impregnated footwear.
6. First aid treatment should be obtained immediately for open cuts and wounds.
7. Apply barrier creams before each period of work to aid the removal of mineral oil from the skin.
8. Wash with soap and hot water, or alternatively use a skin cleanser and a nail brush, to ensure that all oil is removed from the skin. Preparations containing lanolin will help replace the natural skin oils which have been removed.
9. Do NOT use petrol, kerosene, diesel fuel, gas oil, thinners or solvents for washing the skin.
10. If skin disorder appears, medical advice must be taken.
11. Degrease components before handling if practicable.
12. Where there is the possibility of a risk to the eyes, goggles or a face shield should be worn. An eye wash facility should be readily available.

Environmental protection

There is legislation to protect the environment from the incorrect disposal of used lubricating oil. To ensure that the environment is protected, consult your Local Authority who can give advice.

Viton seals

Some seals used in engines and in components fitted to engines are made from Viton.

Viton is used by many manufacturers and is a safe material under normal conditions of operation.

If Viton is burned, a product of this burnt material is an acid which is extremely dangerous. Never allow this burnt material to come into contact with the skin or with the eyes.

If it is necessary to come into contact with components which have been burnt, ensure that the precautions which follow are used:

- Ensure that the components have cooled.
- Use Neoprene gloves and discard the gloves safely after use.
- Wash the area with a calcium hydroxide solution and then with clean water.
- Disposal of gloves and components which are contaminated, must be in accordance with local regulations.

If there is contamination of the skin or eyes, wash the affected area with a continuous supply of clean water or with a calcium hydroxide solution for 15-60 minutes. Obtain immediate medical attention.

Practical Information

To clean components

It is important that the work area is kept clean and that the components are protected from dirt and other debris. Ensure that dirt does not contaminate the fuel system.

Before a component is removed from the engine, clean around the component and ensure that all openings, disconnected hoses and pipes are sealed.

Remove, clean and inspect each component carefully. If it is usable, put it in a clean dry place until needed. Ball and roller bearings must be cleaned thoroughly and inspected. If the bearings are usable, they must be flushed in low viscosity oil and protected with clean paper until needed.

Before the components are assembled, ensure that the area is free from dust and dirt as possible. Inspect each component immediately before it is fitted, wash all pipes and ports and pass dry compressed air through them before connections are made.

Use suitable gloves for protection when components are degreased or cleaned with trichloroethylene, white spirit, etc. Degreasing solutions which are basically trichloroethane are not recommended.

For full technical data please refer to the **Product Information Manual.**
Type: Water-cooled, turbocharged, charge cooled, industrial diesel engine.

RANGE	**4006**	**4008**
Cycle	4 Stroke	
No. of cylinders	6	8
Configuration	Inline	
Bore	160 mm	
Stroke	190 mm	
Total swept volume	22.92 litres	30.561 litres
Compression ratio	13.6:1	
Rotation	Anti-clockwise looking on flywheel end	
Firing order	1-5-3-6-2-4	1-4-7-6-8-5-2-3
Cylinder numbering	Cylinder 1 furthest from flywheel	
Valve Clearance		
Inlet and exhaust (cold)	0.40 mm (0.016")	
Valve dia. (mm)	48 (early engines)	
Inlet and exhaust	52 (later and uprate engines)	
Valve setting	See **Page 51**	
Valve timing	See Workshop Manual **Section U**	
Injection timing	See Engine Number plate	
Piston speeds	Engine r/min.	m/s (ft/min.)
	1000	6.33 (1247)
	1200	7.60 (1496)
	1500	9.50 (1870)
	1800	11.40 (2244)

TYPICAL COOLING SYSTEM

Approved coolants — See **Page 17**

Water capacity (block only) — 36 litres (8 gal) — 48 litres (10.5 gal)

Total water capacity
Engine with tropical radiator

Ltrs	Gals	Spec
106	23.3	TG
110	24.2	TAG1
110	24.2	TAG2
125	27.5	TAG3
106	23.3	TWG
130	28.6	TWG3
46	10.1	TEG**

Ltrs	Gals	Spec
135	29.7	TAG
145	31.9	TAG1
145	31.9	TAG2
48	10.6	TWG2*

* Engine only
** Engine with heat exchanger

Engine shut down temperature	96°C
Max water temperature into engine	To be determined from heat dissipated & water flow through each particular engine model
Thermostat opening temperature	71°C
System pressure	0.5 to 0.7 bar

FUEL SYSTEM

	4006	4008
Approved fuels	See **page 18**	
Relief valve setting	276 kPa (40 lb/in^2)	
Injector nozzle pressure	225-235 atm	
Injection equipment	Lucas-Bryce unit injector	
Filter/water separator	Spin-on expendable canister(s)	
Fuel lift pump	Maximum suction lift 2 metres	
Fuel flow	13.4 litres/min. (3 gpm) @ 1800 r/min.	

GOVERNORS

Type	Electronic	Electronic
Type	Hydraulic	Hydraulic

LUBRICATION SYSTEM

Recommended oil	See **page 15**	
Type of system	Wet sump, external engine mounted oil pump	
Total oil capacity (oil cooler and filter)	122.7 litre (27 gal)	165.6 litre (36.5 gal)
Sump capacity (dipstick) Min.	90.7 litre (20 gal)	127 litre (27.9 gal)
Sump capacity (dipstick) Max.	113.4 litre (25 gal)	154 litre (33.9 gal)
Min. oil pressure (rated speed) to bearings	200 kPa (28 lb/in^2)	
Crankcase pressure	25 mm water gauge	
Max. oil temperature to bearings	105°C	
Lubricating oil filter	disposable canister type	

INDUCTION SYSTEM

Air cleaner	Single air cleaner	Twin air cleaners
	Twin air cleaners (Uprate)	
Type (paper element)	S551A	
Max. Air intake Depression	381mm H_2O (28mm Hg)	
Air restriction Indicator setting	380mm H_2O	
Turbocharger	Garrett (x1)	(x2)
	(x2 uprate only)	

EXHAUST SYSTEM

	4006	4008
Manifold type	Dry	Dry
Exhaust outlet flange (non uprate)	Vertical (single)	Vertical (single) Option
(uprate)	Vertical (single) Option Vertical (twin)	Vertical (twin)
Mating flange (non uprate)	1 x 8" Table "D" BS4	1 X 10" Table "D"
(up rate)	1 X 10" Table "D" 2 X 6" Table "D" Option	2 X 6" Table "D"
Max. exhaust back pressure	See **Product Information Manual**	
Max. exhaust temperature	See **Product Information Manual**	

FLYWHEEL

SAE size	14"	18"

FLYWHEEL HOUSING

SAE size	0	0

CRANKSHAFT

Max. overhung weight on rear bearing	1000 kg	
Tuning plate	1 x 14.6"	-
T.V. damper (non uprate)	1 x 14"	2 x 20"
(uprate)	1 x 18"	

NOTE: Subject to a torsional vibration investigation different T.V. dampers may be fitted.

TYPICAL DRY WEIGHT

	4006	4008
Dry weight (engine)	2295 kg 4006TG 2320 kg 4006TAG1/2 2340 kg 4006TWG 2420 kg 4006TEG 2400 kg 4006TAG3 2340 kg 4006TWG3	3120 kg 4008TAG 3250 kg 4008TAG1/2 3325 kg 4008TWG2
Dry weight (engine and tropical radiator)	2636 kg 4006TG 2761 kg 4006TAG1/2 2477 kg 4006TWG1/2 3010 kg 4006TAG3 2790 kg 4006TWG3	3730 kg 4008TAG 4360 kg 4008TAG1/2
Dry weight (engine and heat exchanger)	2560 kg 4006TEG	3462 kg 4008TWG2

HOLDING DOWN BOLT HOLES

Bolt size (engine feet)	20 mm
No. off	6

ELECTRICAL SYSTEM

Voltage	24	
Alternator type	PRESTOLITE (BUTEC) A3024 with internal regulator	
Alternator output (amps)	30 at a stabilised output of 28 volts	
Starter motor type	PRESTOLITE/BUTEC MS1/105	MS7/3A
No. of teeth (gear ring)	190	
No. of teeth (starter motor)	12	
Battery capacity cold cranking amps to IEC Standard at 0°C (32°F)	540 (each battery)	600 (each battery)
Battery (lead acid) 24V	(2 x 12V) Total 143 Ah	(2 x 12V) Total 178 Ah

PROTECTION EQUIPMENT

Before resetting protection equipment, it must be established whether special settings (for that individual engine) have been specified in the engine sales contract. This is particularly important with ALL high water temperature settings.

Standard settings for protection equipment are as follows:-

	4006	4008
Shutdown switches	**Alarm**	**Shutdown**
High Oil temperature	105°C	110°C
Low oil pressure	2.06 bar (30 lb/in²)	1.93 bar (28 lb/in²)
High water temperature		
71°C Thermostat	91°C	96°C

Caution: The above standard settings do not supersede any settings specified in the engine sales contract.

Overspeed	15% (on 1500 rev/min)
	7% (on 1800 rev/min)

AIR STARTING

Air starter pressure	30 bar
Compressed air supply	17 bar
Type	Ingersoll-Rand Type SS350
Type	GALI A25

INSTRUMENT PANEL (ENGINE MOUNTED)

	Normal Operation
Oil pressure	Between 300-560 kPa (42.6-80 lb/in2)
Oil temperature	Between 80-90°C (176-194°F)
Water temperature	Between 65-85°C (149-185°F)
Exhaust temperature	See **Product Information Manual**
Boost pressure	See Test Certificate

COOLANT JACKET HEATING

Heater	1 x 2 kW	1 x 4 kW

WARNING ⚠ IT IS ESSENTIAL THAT THE CORRECT LENGTH OF SCREW OR BOLT IS USED. INSUFFICIENT THREAD MAY RESULT IN THE THREAD BEING STRIPPED. WHEREAS TOO LONG A THREAD MAY RESULT IN BOTTOMING IN A BLIND HOLE, OR CATCHING ON ADJACENT COMPONENTS.

NOTE: * Bolt and threads must be lubricated with clean engine oil.
** Cylinder head bolts to be lubricated under the heads, under the washers and on the threads with P.B.C. (Poly-Butyl-Cuprysil) grease. **Important:** See **Section R10 in the Operation Manual** before fitting. All other bolt threads only to be lubricated with clean engine oil. Care must be taken not to oil the heads and faces.

TORQUE SETTINGS

		lbf.ft	Nm
CYLINDER HEAD GROUP			
** Cylinder head bolt (early type)	M24	550	750
** Cylinder head bolt (later (waisted) type)	M24	530	723
Rocker shaft bolt/nut	M16	90	120
Rocker adjuster nut inlet/exhaust	M12	35	50
Rocker adjuster nut pump/injector	M14	50	70
Rocker box bolt	M10	35	50
Air manifold bolt	M10	35	50
Exhaust manifold bolt	M10	50	70
Turbocharger V-band clamp nuts	M8	8	11
CRANKCASE AND CRANKSHAFT GROUPS			
* Main bearing bolt	M24	580	783
Side bolts (main bearing caps)	M16	124	168
Bolts sump to crankcase	M10	40	57
* Connecting rod bolt	M16	210	285
Viscous damper bolts (4006/8 series)	M12	120	160
Flywheel bolt	M16	250	340
Front drive adaptor bolts	M16	250	340
Balance weight bolt	M16	250	340
Front crankshaft pulley bolt	M16	250	340
Piston cooling jet bolt	M10	7	10
Flywheel housing bolt	M10	35	50
Crankcase side bolts	M16	200	270
LUBRICATING OIL PUMP			
Bolts, pump housing to gearcase plate	M10	35	50
Thin nut gear to drive shaft	M24	175	237

		lbf ft	Nm
LUBRICATING OIL PUMP			
Bolts, pump housing to gearcase plate	M10	35	50
Thin nut, gear to drive shaft	M30	175	237
CAMSHAFT GROUP			
Camshaft gear bolt	M12	110	150
Camshaft thrust plate bolt	M10	35	50
Camshaft follower housing bolt	M10	35	50
Idler gear hub bolts	M10	35	50
WATER PUMP			
Water pump gear nut	M24	170	230
Water header to oil cooler bolts	M10	35	50
Water pump to gearcase bolts	M10	35	50
Raw water pump gear securing nut, **dry thread**	M35	180	244
ENGINE FEET			
Engine feet to base frame bolts	M20	350	475
Engine feet to cushion feet bolts	M16	160	215
Engine feet to gearcase and suspension plate bolt	M10	35	50
GOVERNOR			
Control shaft mounting plate bolt	M10	35	50
FAN			
Fan driven pulley taper lock bush screws	1/2" BSW	35	50
Fan driven pulley taper lock bush screws	5/8" BSW	65	90
ALTERNATOR			
Drive pulley taper lock bush screw	3/8" BSW	15	20
FUEL PUMP/INJECTORS			
Injector capscrew clamp to cylinder head, early engines	M10	50	70
Injector capscrew clamp to cylinder head, later engines	M12	70	95
Injector nozzle nut to holder	M27	150	203
Fuel pump control linkage screw	2BA	6	8
Unit injector control lever capscrews	M5	6	8
FLEXIBLE COUPLING (HOLSET)			
Flexible coupling cover screw	M12 or 1/2" UNC	90	129
Coupling driving flange screws (coupling size 2.15)	M12 or 1/2" UNC	90	129

GENERAL TORQUE LOADINGS

The following torque loadings are general for metric coarse threads for grade 8.8 steel and do not supersede the figures quoted above.

Thread Size (mm)	lbf.ft	Nm
8	18	25
10	35	50

General Note:

M10-12.9 steel	50	70

These are based to BS 3692.

QUANTITY OF OIL

Sump capacity dipstick	4006	4008
Minimum	90.7 litre (20 gal)	127.4 litre (28 gal)
Maximum	113.4 litre (25 gal)	154 litre (34 gal)

TYPE OF OIL

The industrial diesel engine should be lubricated with a good quality oil conforming to API CD or CCMC D4 specifications. All the major oil companies formulate oils to the above specifications.

VISCOSITY OF OIL

Use oil of:

SAE10W/30	in starting temperatures below -15°C (without sump heater)	
SAE15W/40	in starting temperatures from -15°C to 0°C	
SAE30	in starting temperatures from 0°C to 32°C	} or Mobil Delvac Super 1300 SAE 15W/40
SAE40	in starting temperatures above 32°C	

OIL CHANGE PERIODS

For normal operation of the engine the oil should be changed every 250 hours or annually whichever is the sooner.

Under certain circumstances where a centrifugal oil filter is fitted to the engine and an oil analysis programme has been carried out with the oil supplier over a period of 1000 hours of engine operation, it may be possible to extend the oil change period up to maximum of 350 hours.

To achieve this extended oil change period, a centrifugal oil filter must be fitted and cleaned every 250 hours between routine oil changes, and at every oil change point i.e. 350 hours maximum.

As the oil deteriorates it is essential that the following parameters must not be exceeded at the oil change point:

1. The viscosity of the oil must not increase by more than 10cSt at 100°C.
2. The total base number of the oil should not reduce to less than 50% of the value of new oil.
3. The flash point of the oil should exceed 180°C.
4. The water content of the oil must not exceed 1%.
5. The fuel content of the oil must not exceed 1%.
6. Oil samples should be taken from the mean sump oil level of the engine.