



MARINE ENGINES

 **Hawker Siddeley Marine**

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Hawker Siddeley Group supplies electrical and
mechanical equipment with world-wide sales and service

Operators Handbook

INTRODUCTION

The purpose of this handbook is to lay down operating guidelines to the engine user who should consult Hawker Siddeley Marine for further advice and technical assistance.

Illustrations identifying the engines are given at the beginning of each Section. For operators wishing to carry out their own service and maintenance, a fully illustrated Workshop Manual covering the complete servicing of this engine can be obtained from Hawker Siddeley Marine or the local Lister distributor.

Instructors and statements contained within this book are given with our best intentions and are correct at the time of going to press. They are subject at any time to alteration.

IMPORTANT

Please write your engine type and serial number in the space below and quote on all correspondence.

Engine Number:—

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Note: The engine type is suffixed with the letter M on all marine engines:

M	—	Marine Auxiliary
MG	—	Marine Propulsion
MP	—	Marine Propulsion without Gearbox
MGR	—	Marine Propulsion with Reduction Gear

IMPORTANT

When purchasing parts or giving instructions for repairs customers should in their own interests, always specify:

Genuine Lister Parts

Parts that have not been supplied by the Lister organisation cannot be relied upon for correct material, dimensions or finish.

R A LISTER & CO. LTD cannot therefore, be responsible for any damage arising from the use of such parts and the guarantee will be invalidated.

In your own interest, therefore, specify:

GENUINE LISTER PARTS

INSTALLATION INFORMATION

This installation information is intended as a general guide only. Hawker Siddeley Marine should be consulted for more comprehensive information.

COOLING—AIR COOLED ENGINES

LT, ST and HR2 & 3

A fan impeller is secured to the flywheel. Air is drawn into the impeller and discharged through trunking and shrouding to the fins of the cylinder and cylinder head.

HR4 & 6 and JA

A single stage axial flow fan, belt driven from the crankshaft, delivers air through ducting to the fins of the cylinders and cylinder heads.

COOLING AIR

The hot air outlet duct, also the inlet openings, are to be of the minimum sectional areas as follows.

For trunking up to 1.9 m. (6 ft.) in length:—

Engine	Outlet Duct cm ²	Outlet Duct in ²	Inlet Duct cm ²	Inlet Duct in ²
LT1	160	25	208	33
LT2	320	50	416	65
ST1	194	30	252	39
ST2	390	60	503	78
ST3	580	90	780	120
HR2	450	70	580	90
HR3	645	100	970	150
HR4	1032	160	1355	210
HR/S6	1613	250	2129	330
JAS	1871	290	2516	390

The trunking areas are net, exclusive of the obstructed area caused by slats or wire mesh protection over openings. Where trunking is over 1.97 m. (6 ft.) in length the areas are to be increased as follows:

For 1.97 m. (6 ft.)—3.28 m. (10 ft.) length multiply by 1.4

For 3.61 (11 ft.)—8.2 m. (25 ft.) length multiply by 2.25

For 8.20 m. (25 ft.)—16.4 m. (50 ft.) length multiply by 3.50.

Arrangements must be made to ensure that the cooling air is not recirculated or restricted.

COMBUSTION AIR REQUIREMENTS AT 1500 rev/min

Note. The pressure is directly proportional to the rev./min²

Engine	m ³ /min	(ft ³ /min)	Engine	m ³ /min	(ft ³ /min)
LT1	0.243	8.6	JA6	6.7	237
LT2	0.486	17.2	JAS6	9.2	325
ST1	0.41	14.4	HRW2	1.34	47.5
ST/W2	0.81	28.8	HRW3	2.0	71
ST/W3	1.22	43.1	HRW4	2.7	95
HR2	1.34	47.5	HRW6	4.0	142
HR3	2.0	71.0	HRWS6	6.5	230
HR4	2.7	95.0	JW6	6.7	237
HR6	4.0	142	JWS6	9.2	325
HR/S6	6.5	230	JWSC6	11.8	415

COOLING—WATER COOLED ENGINES

The cooling system is of the closed circuit fresh water type which consists of a combined heat exchanger and header tank mounted on the engine at the forward end. Sea water is circulated by means of a pump, which is direct driven from the engine gear train, whilst the fresh water is circulated by a centrifugal pump mounted at the forward end and driven by two V belts. Keel cooling can be used instead of heat exchanger cooling. (Refer to STW engines)

Depending on the ambient temperature and the load factor, the engine may be operated up to 95°C (203°F). Consult Hawker Siddeley Marine for further information.

The system is pressurised to 0.4 bar (6 lbf/in²) and care must be taken if the filler cap is removed when the engine is hot.

Exhaust Pipes

Pipes should slope gradually away from the engine down to the outlet or ship's side or transom and be kept as straight and short as possible, the minimum radius in any bend being not less than 4 times the pipe bore. Adjacent wood structure must be protected from exhaust heat by adequate clearance and lagging.

If it is found necessary to fit a swan neck in the exhaust pipe to prevent the ingress of water this should be made as near the pipe outlet as possible. A small hole at the top of the bend will break any possible vacuum.

Where a wet exhaust system is installed, care must be taken to ensure that water cannot run or drain back into the engine. The pipe and silencer should gradually fall away from the point of water injection, and the outlet should always be below this point.

Note: *LT Engines—The outlet of the silencer must face upwards or horizontal away from the engine unless it is connected to a tail pipe. It is important to ensure that exhaust gases are not sucked by the air cleaner or the cooling fan, otherwise premature choking will occur.*

Alignment

Accurate alignment is essential. The engine should be lined up to the shaft temporarily while boat is out of the water. Before launching, the coupling bolts should be let go and the engine re-aligned when the craft has taken her normal shape in the water.

Flexible couplings do not excuse bad alignment of the engine to the propeller shaft. A solid dummy bobbin should be used when aligning engine to shafting, and afterwards replaced by the flexible coupling.

Rotation: (looking on flywheel)

Clockwise: LT1, ST/W
 Anticlockwise: LT1B2, HR/W, J Range

Note: *The output shaft rotation will depend on the type of gearbox fitted and if a reduction gear is used.*

Sterngear

Packing glands should allow free rotation of the tailshaft. Stern tubes should be filled with grease before inserting shaft. It is essential during preliminary run to check that stern gland is not overheating. If necessary slacken back gland. Long lengths of unsupported shafting must be avoided by the use of plummer blocks.

If the stern tube inboard gland is more than 229 mm (9") from the flexible coupling, a bearing or plummer block must be fitted and positioned as near the coupling as practicable. If an intermediate shaft is installed, this bearing must be fitted close up to the coupling.

Important

The stern tube **MUST** be filled with a suitable grease, such as Vickers NEOX DT immediately after installation. To ensure complete filling of the tube it is imperative that a grease gun be used for the initial filling. For service use, regular attention to the grease cup provided should be sufficient to make up any loss incurred.

Since **NO PROVISION** is made in the engine design to take **END THRUST**, a thrust block must be provided for all propulsion installations.

LISTER reverse and reverse/reduction gears are provided with thrust bearings.

Ambient Temperatures and Engine Derating for High Ambient Temperatures

From the aspect of engine performance, the temperature of the air entering the engine is the only criterion of ambient temperature. The power developed by the engine depends on the temperature of the combustion air, measured at the air manifold inlet (or the air cleaner), and the temperature of the cooling air measured at the fan inlet. The higher of these two temperatures is taken as being the "Ambient Temperature" as far as engine ratings are concerned.

The engines are able to run satisfactorily at Ambient temperatures (as defined above) up to 29.4°C (84°F) without derating. Above this temperature the rated brake horsepower must be reduced by 1% for every 2.78°C (5°F). The maximum temperature is 52°C (125°F) and if it is desired to run at a higher temperature, Hawker Siddeley Marine must be consulted.

MAXIMUM CONDITIONS OF LIST AND TRIM

Engine	Trim	Permanent List	Roll
LT1	15° F/Wheel up or 10° F/Wheel down	10°	22½°
LT2	15° F/Wheel up or 10° F/Wheel down	10°	22½°
ST/M	10° F/Wheel up or down	15°	22½°
ST/W/2M	15° F/Wheel up or down	15°	22½°
ST/W/3M	10° F/Wheel up or 15° F/Wheel down	15°	22½°
HR/W/2M	15° F/Wheel up or down	15°	22½°
HR/W/3M	15° F/Wheel up or down	15°	22½°
HR/W/4M	15° F/Wheel up or down	15°	22½°
HR/W/6M	11½° F/Wheel up or 15° F/Wheel down	15°	22½°
HR/W/6M	11½° F/Wheel up or 15° F/Wheel down	15°	22½°
JA/W/6M	10° F/Wheel up or down	15°	22½°
JA/W/6M	10° F/Wheel up or down	15°	22½°
JWSC6M	10° F/Wheel up or down	15°	22½°

CARE OF YOUR NEW ENGINE

Before leaving the makers' works, each engine is carefully tested and inspected; this includes full load running, followed by detailed examination and tightening of all nuts and unions.

When the engine is put into service, further setting of some joints will occur and the valve gear beds down. For these reasons, if the best results are to be obtained from the engine, it is important that it should receive regular attention, particularly during the first 500 hours of its life. The same applies to an engine which has been completely overhauled.

Initial Attention

To ensure that the top cups of the push rods are full of oil and that the valve springs are lubricated, pour lubricating oil over the valve gear.

It is recommended that the following are attended to after the engine has run 25 hours and again after the engine has run 250 hours.

1. Adjust tappet clearance.
2. Check and tighten nuts, bolts and unions paying particular attention to the fuel system.
3. Check belt tension. It is particularly important that the tension be checked after overhaul or after new belts have been fitted. Do not over-tighten.
4. Change the lubricating oil for the first time after 100 hours; thereafter:— Engines running at or over 3000 rev/min—125 hours. All other engines—250 hours.
5. Clean the engine and keep it clean.
6. Observe the exhaust at the normal full load. The exhaust must be free from soot. A black exhaust means that the engine is overloaded or that the injection equipment is out of order. Do not allow the engine to run with a dirty exhaust without investigating the cause as this may result in an expensive breakdown.

Routine Maintenance

Following the initial attention, the normal routine maintenance must be carried out.

Lubricating Oil

Always use oils of the correct viscosity and type. This will ensure easy starting, lowest fuel consumption, minimum wear and longest periods between overhauls.

SAFETY PRECAUTIONS

GENERAL

Ensure engine is securely mounted where a generous supply of fresh air is assured.

On water cooled engines ensure the radiator/tank is full and no leaks are apparent.

Keep the engine clean.

On basic engines, starting shaft guards are available which in the opinion of Hawker Siddeley Marine comply with the requirements of the Health and Safety at Work Act 1974 (UK). Special accessories may require special guards which Hawker Siddeley Marine do not supply and must be fitted by the purchaser.

When testing fuel injection equipment, particularly injection nozzles, there is a danger of high pressure oil penetrating the skin — **ON NO ACCOUNT ALLOW ANY UNPROTECTED SKIN TO COME INTO CONTACT WITH THE SPRAY.**

STARTING

All Engines:—

Ensure engine is free to turn without obstruction. Check that the level of the fuel and lubrication oil is correct (also in gearboxes if fitted); check that the fuel and oil systems are correctly primed.

Hand Start Engines:—

Use the CORRECT Lister starting handle. Ensure there are no burrs on starting shaft and lightly oil before fitting handle. Do not attempt to start an engine if the starting handle is damaged and always check the arrow on the handle boss for direction of rotation.

On ST and HR/W engines, a clutch pin (pawl) on the starting handle engages with a keyway on the starting shaft. After fitting handle, turn in opposite direction to that required to start the engine in order to check that the clutch pin will disengage from keyway, and does not bind on the starting shaft, before attempting to start engine.

Hand starting any diesel engine can be dangerous in the hands of inexperienced people. Engine operators must be instructed in correct procedures before attempting to start the engine. If these conditions cannot be met electric starting should be used.

Note: *When engine is firing it is dangerous to allow the handle to rotate on the running shaft.*

SAFETY PRECAUTIONS

ALTERNATOR

The following points must be strictly observed when an alternator is fitted otherwise serious damage can be done.

Never disconnect the battery whilst the alternator is running.

Never disconnect a lead unless the alternator is stopped and all switches are in the OFF position.

Always ensure that leads are fitted to their correct terminals. A short circuit or reversal of polarity will ruin the diodes or transistors.

Never connect a battery into the system without checking that voltage and polarity are correct.

Never flash the connection to check the current flow.

Never experiment with adjustments or repairs to the system.

FUEL

Specification

Engines must be used only with fuel oils which conform to the British Standard Specification 2869: 1970 Class A1 or A2. They must be distillate, and not a residual oil or blend thereof. Vaporising oils are NOT suitable as fuels for these diesel engines.

The user is cautioned that although the engines may operate on fuels outside the above specification, such operation may well result in excessive wear and damage.

This Company can accept no responsibility for such wear or damage which has been caused by the use of unsuitable or dirty fuels.

The local supplier should be consulted if in doubt as to its suitability.

CLEAN FUEL—FREE FROM WATER—IS OF UTMOST IMPORTANCE

It is not recommended that engine is run until fuel is exhausted. If however this occurs, the fuel system will need bleeding, i.e., all air removed from the fuel system when tank is refilled. See Priming Fuel System in relevant engine section.

LUBRICATION

The temperatures mentioned in the table are the ambient temperatures at the time when the engine is started. However if the running ambient temperatures are much higher than the starting temperatures, a compromise must be struck and a high viscosity oil used, provided starting is satisfactory; multigrade oils overcome the problem, provided they have a suitable specification.

Naturally aspirated diesel engines must be run on H.D. Diesel lubricating oils to specifications equal to or better than DEF2101D or BS 1905 type B or MIL-L-46152 or AP1 CC. Straight mineral oils are not suitable, neither are oils of less detergency than specified.

MIL-L-2104B or MIL-L-2104C or AP1 CD oils are recommended for engines running at a high load factor, particularly in conjunction with high ambient temperatures. They must also be used if the sulphur content of the fuel exceeds 0.6%.

Series 3 or MIL-L-2104C or AP1 CD oils must be used in all turbocharged engines, and in other engines, when the oil changes are made at periods longer than specified.

Multigrade oils must meet the specifications MIL-L-2104B or MIL-L-2104C. For turbocharged engines the oil must meet MIL-L-2104C. The oils must not be used in very heavy duty applications except in LT engines.

The oil should be suitable for oil changes every 250 hours or 125 hours in engines running at 3000 rev/min and over without undue oxidation, with sump temperatures reaching 150°C in tropical climates under extremely severe applications, and 120°C under normal applications.

Viscosity

The viscosity of the lubricating oil must be as follows.

For starting temperatures:

below -15°C	SAE 5W
between -15°C and 4°C	SAE 10W
between 4°C and 30°C	SAE 20/20W
above 30°C	SAE 30

ROUTINE MAINTENANCE

Periodicity	Operation	HR HRW HR HRW									
		LT	ST	283	283	486	486	JA	JW	JWSC	JWSC
Daily	Check supply of fuel oil	•	•	•	•	•	•	•	•	•	•
	Check level and condition of lubricating oil (also in gearbox if fitted) with the engine stopped	•	•	•	•	•	•	•	•	•	•
	Clean air cleaner under very dusty conditions	•	•	•	•	•	•	•	•	•	•
Every 125 Hours	Check water level in radiator or cooling tanks	•	•	•	•	•	•	•	•	•	•
	Change element if necessary or clean air cleaner under moderately dusty conditions	•	•	•	•	•	•	•	•	•	•
	Check for fuel and lubricating oil leaks - tighten nuts and fittings as necessary	•	•	•	•	•	•	•	•	•	•
Every 125 Hours	Check level of electrolyte in battery if electric starting is used	•	•	•	•	•	•	•	•	•	•
	Change oil on engines running at 3000 rev/min and over	•	•	•	•	•	•	•	•	•	•

ROUTINE MAINTENANCE

Periodicity	Operation	HR HRW HR HRW									
		LT	ST	283	283	486	486	JA	JW	JWSC	JWSC
Every 250 Hours	Drain lubricating oil, flush out system, renew filter element and refill with correct grade and type oil. Change filter element in turbo-charged engines	•	•	•	•	•	•	•	•	•	•
	Clean the fuel injector nozzles if the exhaust is dirty	•	•	•	•	•	•	•	•	•	•
	Check belt tension (also after 25 hours when new belts are fitted). Do not reset unless belts are slack	•	•	•	•	•	•	•	•	•	•
Every 1000 Hours	Renew Fuel Filter element if fuel not perfectly clean	•	•	•	•	•	•	•	•	•	•
	Decarbonise if the engine shows loss of compression or blow-by past the piston Do not disturb otherwise	•	•	•	•	•	•	•	•	•	•
	Adjust valve clearances	•	•	•	•	•	•	•	•	•	•
	Clean the cylinder and cylinder head finning under dusty conditions if necessary	•	•	•	•	•	•	•	•	•	•
	Check the condition of all belts and pulleys; change as necessary	•	•	•	•	•	•	•	•	•	•
Every 1000 Hours	Clean the restrictor banjo union at the top end of the lubricating oil feed pipe in each cylinder head	•	•	•	•	•	•	•	•	•	•
	Renew Fuel Filter element	•	•	•	•	•	•	•	•	•	•

NOTE: Decarbonising the engine is usually carried out at 2000 hours. Comprehensive information on Routine Maintenance up to 6000 hours can be found in the relevant engine Workshop Manual (see page 17).

SPANNER TORQUES (Metric)

Thread Size	Torque		Engines	Location
	kgf.m.	lbf.ft.		
M3 x 0.5	0.07	0.5	LT	Fuel hose clips
M4 x 0.7	0.30	2.2	LT LT	Governor link adjusting nuts. Decompressor screw.
M6 x 1.0	0.90	6.5	LT LT LT LT	Fuel filter to tank cap screw. Valve/rocker adjusting screw/nuts. Manifold lower nuts. Fuel pump holding down bolts.
M8 x 1.0	2.15	15.5	LT LT	Connecting rod nuts. Injector clamp screw.
M8 x 1.25	2.15	15.5	LT LT LT	Manifold higher nuts. Main bearing housing screws. Sump retaining screws.
M8 x 1.25	0.8/1.5	5.8/10.6	LT	Oil starter adaptor taper thread.
M10 x 1.25	4.20	30	LT	Cylinder head nuts.
M10 x 1.5	3.50	25	J range	Valve rocker screw nuts.
M12 x 1.5	3	21	ALL	Fuel injection pipe nuts.
M12 x 1.75	8	58	J range	Shaft extension fan nuts.
M12 x 1.75	5.50	40	J range	Injector clamp nuts.
M12 x 1.75	3.50	25	J range	Fuel pump inlet union.
M16 x 2.0	20	145	J range	Connecting rod nuts.
M18 x 1.5	5.5	40	LT H range	Fuel pump delivery valve holder.
M18 x 1.5	20	145	LT	Flywheel retaining screw.
M18 x 1.5	19/21	140/150	JA	Cylinder head nuts.
M18 x 1.5	25	180	JW	Cylinder head nuts.
M20 x 1.25	2.8	20	LT	Injector top plug.
M20 x 1.5	6.20	45	J range	Fuel pump delivery valve holder.
M20 x 2.5	40	290	J range	Flywheel set screws.
M21 x 1.5	9	65	ST, H & J ranges	Injector top cap and locknut.
M24 x 3.0	44/47	320/340	J range	Main bearing cap nuts.

SPANNER TORQUES (Unified)

Thread Size	Torque		Engines	Location
	kgf.m.	lbf.ft.		
1/2" -24 UNS	1.40	10	J range	Fuel pump inlet union nut.
5/16" UNF	2.1	15	ST, H range	Injector clamp nuts.
3/8" UNF	4.4	32	ST ST	Balance weight setscrew. Connecting rod nuts.
7/16" UNF	6.9 6.9	50 50	ST H range	Cylinder head holding down nuts. Dynamo shaft nuts.
1/2" UNF	9.4	68	H range	Connecting rod nuts.
7/8" UNF	41.4	300	ST	Flywheel crankshaft setscrew.
9/16" UNF	11.0 13.8 13.8	80 100 100	HR HRW H range (4 & 6)	Cylinder head nuts. Cylinder head nuts. Flywheel setscrews.
3/4" UNF	27.6	200	H range	Main bearing cap nuts.
1" UNF	55.2	400	H range (2 & 3)	Flywheel crankshaft screw.

STARTING AND RUNNING FAULTS

Difficult Starting

- (1) Overload trip not lifted or excess fuel button not operated.
- (2) Unsuitable lubricating oil (too heavy).
- (3) Incorrect grade of fuel.
- (4) No fuel in tank.
- (5) Choked fuel filter.
- (6) Air lock in fuel system.
- (7) Injector nozzle valve stuck open.
- (8) Fuel pump delivery valve scored.
- (9) Injector loose on seat.
- (10) Leaking valves.
- (11) Sticking rings.
- (12) Exhaust valve sticking.
- (13) Worn cylinder.
- (14) Sticking fuel pump rack.

Knocking

- (1) Valve, probably exhaust, sticking in guide and touching piston.
- (2) Slack bearing.
- (3) Worn gudgeon pin or small end bearing.
- (4) Insufficient clearance between piston and cylinder head.
- (5) Injection too early.
- (6) Flywheel coupling or pulley loose.
- (7) Too much crankshaft end float.
- (8) Excessive carbon deposit on piston.
- (9) Excessive clearance between piston and cylinder.

Excessive Carbon Deposits

- (1) Choked air filter.
- (2) Choked exhaust system.
- (3) Unsuitable fuel oil.
- (4) Unsuitable lubricating oil.
- (5) Continuous idling.
- (6) Defective spraying.
- (7) Late injection of fuel.
- (8) Too much side play on valve rockers.

SECTION 1

Smoky Exhaust

Black smoke due to incomplete combustion of fuel can be caused by:

- (1) Overload.
- (2) Choked air filter.
- (3) Inlet air temperature too high.
- (4) Defective spraying.
- (5) Unsuitable fuel oil or water in fuel.

Note: *Faint blue smoke is generally the result of light load. Heavy blue smoke is due to lubricating oil passing the piston rings and is attributable to stuck, worn or broken piston rings, or to worn cylinder barrel.*

Engine Stops

- (1) Lack of fuel.
- (2) Air or water in fuel system.
- (3) Choked fuel filter or blocked nozzle.
- (4) Overload.
- (5) Overheating.
- (6) Loss of compression.

Loss of Power

- (1) Loss of compression.
- (2) Incorrect tappet clearance.
- (3) Choked air filter.
- (4) Choked exhaust system
- (5) Fuel injector or pump out of order.
- (6) Choked fuel filter.

Failure to attain normal speed

- (1) Engine started on overload.
- (2) Fuel system not properly primed.
- (3) Insufficient fuel.
- (4) Injection retarded.

SECTION 1

Loss of Oil Pressure

- (1) Low oil level.
- (2) Strainer choked.
- (3) Fractured pipe or leaking joint.
- (4) Badly worn bearings.
- (5) Relief valve not seating.
- (6) Oil pump worn or drive failed.
- (7) Oil cooler choked.

Overheating - Air Cooled

- (1) Cooling air being re-circulated.
- (2) Fins of cylinder head or cylinder blocked with dirt.
- (3) Cooling air inlet obstructed.
- (4) Cooling air outlet obstructed.
- (5) Engine cooling air used also to cool driven unit.

Overheating - Water Cooled

- (1) Thermostat faulty.
- (2) Injection timing faulty.
- (3) Overload.
- (4) Lubricating oil or cooling water, level too low.
- (5) Water pump belt slipping.
- (6) Blockage in water cooling system.

Note: *This section is intended as a guide only. Any rectification of faults should be in accordance with the Engine Workshop Manual. When in doubt consult Hawker Sidddeley Marine.*



ASSOCIATED PUBLICATIONS

WORKSHOP MANUALS

Engine	Book No.
LT	2000
ST/W	2001
HR/W2 G 3	2003
HR/W4, 6 G S6	2004
J Range	2005

Note: *All these books are available in Spanish, and with the exception of Book 2005 are also available in French.*

PARTS LISTS

Engine	Book No.
LT	1819PL
ST	1704PL(ST)
STW	1704PL(STW)
HR2 G 3	1444PL(HR)
HR4, 6 G S6	1442PL(HR)
HRW2 G 3	1444PL(HRW)
HRW4, 6 G S6	1442PL(HRW)
J A/S	1586PL(JA)
J W/S	1586PL(JW)
JWSC	1586PL(JWSC)

When ordering replacement parts, always quote the **Engine No., Part No. and Description of Part.**



SECTION TWO

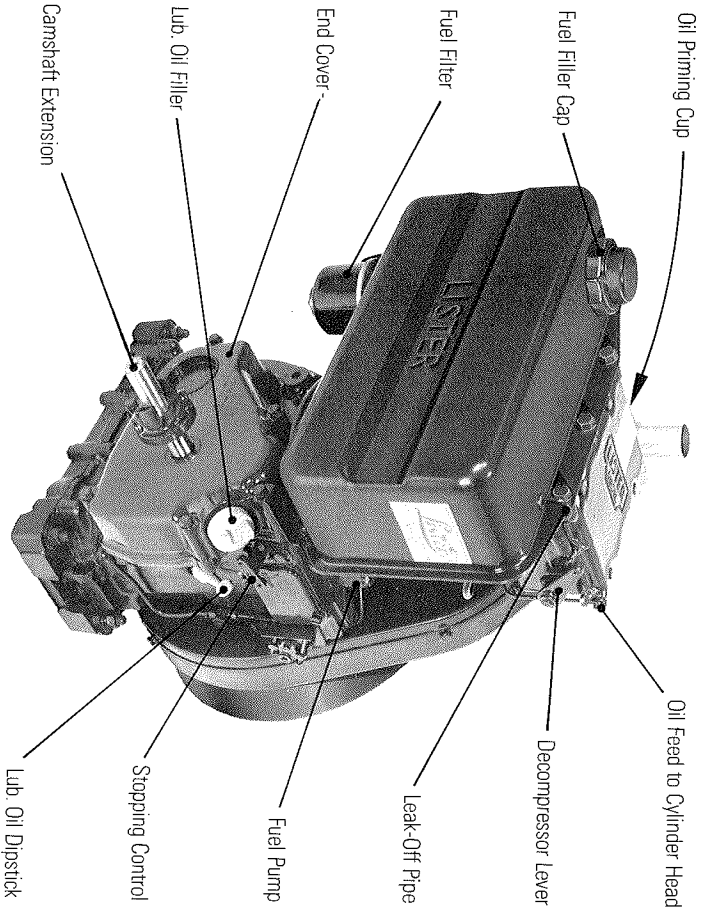


Fig. 1. LT1 Air Cooled Auxiliary Engine

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Note: The engine number plate is fitted to the air shield or the fan shroud.

SECTION 2

LUBRICATING OIL PRESSURE:

1.03 bar (15 lbf/in²).

CAPACITY:

LT1 — 1.5 litres; Brit. 2.64 pints; U.S. 0.4 gal.

LT2 — 3.58 litres; Brit. 6.30 pints; U.S. 0.95 gal.

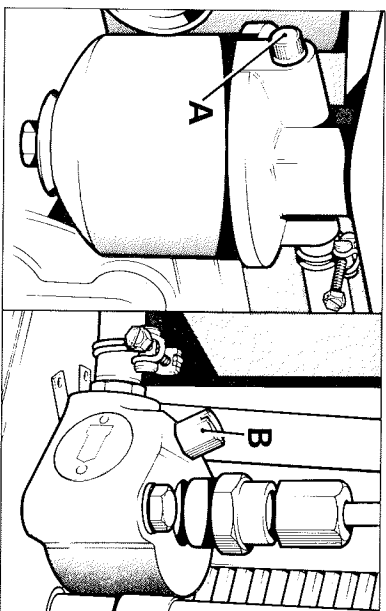


Fig. 2. Priming Fuel System

PRIMING THE FUEL SYSTEM (Fig. 2).

- (a) Fill fuel tank.
- *(b) Vent fuel filter through bleed screw A until a full air free flow of fuel is obtained.
- (c) Vent fuel at pump through bleed screw B.

*When remote mounted fuel supply is used, the bleed screw is located on the top of the fuel filter nearest the fuel inlet.

SECTION 2

DECOMPRESSOR ADJUSTMENT

Remove cylinder head cover.

Turn the engine until the piston is on T.D.C. firing stroke (both valves closed).
Turn the decompressor screw down until the valve rocker just begins to depress the valve.

Turn the screw one turn clockwise (so that it travels towards the rocker).

INJECTOR PRESSURE

The injector is set on a rig to 200 atmospheres and will settle to 190 atmospheres when working in the engine.

VALVE CLEARANCE

The valve clearance for both inlet and exhaust, set with the engine cold is: —
Up to and including 3000 rev/min

0.13 mm (0.005") GO
0.18 mm (0.007") NOT GO

Inlet valve 3600 rev/min **0.05 mm (0.002") GO**
(Exhaust valve as slower speeds) **0.10 mm (0.004") NOT GO**

To Adjust

- Remove the cylinder head cover and turn the engine until the piston is on T.D.C. position on the firing stroke (both valves closed).
- Slacken the locknut on the adjusting screw and turn the screw until the correct clearance has been obtained.
- Tighten the locknut whilst restraining the adjusting screw and re-check to ensure that clearance is correct.

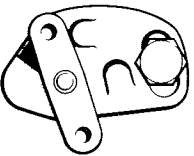
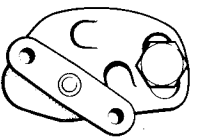
**START****RUN****STOP**

Fig. 3. Engine Control (LT)

STARTING AND STOPPING**Before Starting**

- Read Safety Precautions on page 7.
- Fill the engine — and gearboxes etc. if fitted — with the right grade of lubricating oil to the correct level.
- Ensure there is an adequate supply of fuel and fuel system is primed.
- Ensure air cleaner is firmly attached and air joints are properly sealed.
- On electric start engines, ensure batteries are filled to correct level, charged and connected

To Start Engine (Hand Starting) (Fig. 3)

- Check the engine is free to turn without obstruction.
- Pull the Control Lever outward over the middle catch and turn it clockwise to an almost vertical position; this allows extra fuel for starting. If a variable speed control lever is fitted, move towards FAST.
- Move Decompressor Lever(s) towards the flywheel; lightly oil end of starting shaft and fit correct and fully serviceable starting handle.
- Turn the engine slowly from 3 to 20 turns according to the temperature and period of standing unused in order to prime combustion chamber and lubricating oil system.
- Crank the engine really fast and when sufficient speed is obtained, move Decompressor Lever(s) towards fuel tank (or gear end); continue to crank until engine fires. Retain grip on starting handle and remove from shaft.
- Turn control lever to RUN position abutting against the middle catch. When speed control is fitted, reduce speed as required.

To Start Engine (Electric Starting)

- Carry out items (a) and (b) as hand starting: —
- Press starter button and release immediately the engine fires. Do not motor the engine continuously for more than 10 secs.
 - Turn control lever to RUN position abutting against the middle catch. When speed control is fitted, reduce speed as required.

Cold Starting Below — 10°C (14°F)

A cup and plunger is fitted on each combustion air intake port. To operate, withdraw the plunger and fill one third of the cup with the same type of lubricating oil as used in the engine. Replace the plunger and inject the oil just before starting. The device must not be used more than three times in succession. The engine should be turned 20 revolutions with the fuel on after injecting the oil before attempting to start.

To Stop Engine

Turn the Control Lever anti-clockwise and position over the lower catch until engine stops — or, if fitted, pull the Remote Stopping Control.

**NEVER STOP THE ENGINE BY OPERATING THE
DECOMPRESSOR LEVER**

SECTION THREE

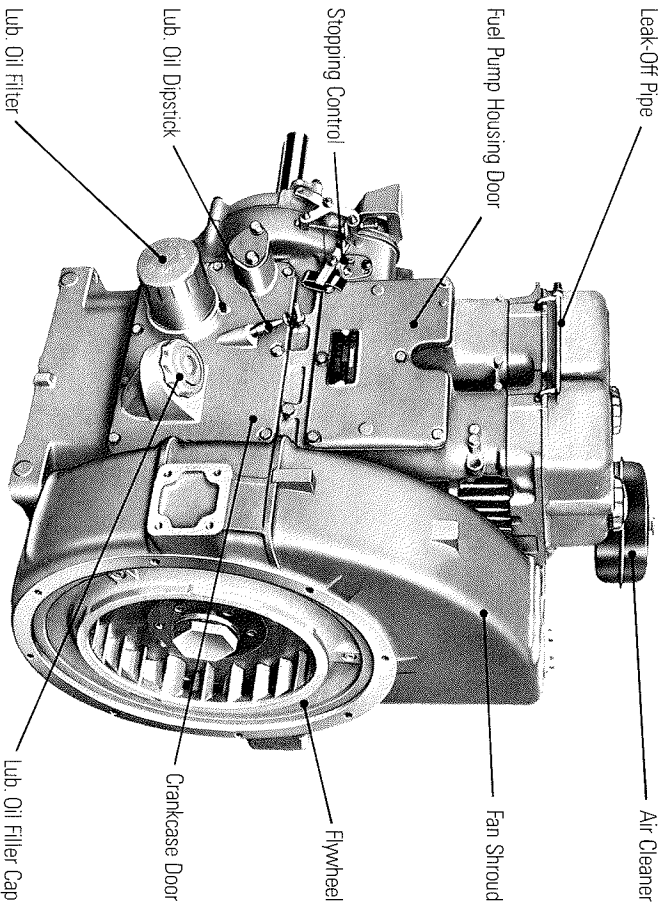


Fig. 4. ST2 Air Cooled Auxiliary Engine

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Lubricating Oil Pressure and Capacities	24
Servicing Foam Element Air Cleaner	25
Priming the Fuel System	25
Decompressor Adjustment... ..	28
Injector Pressure	28
Valve Clearance	28
Starting and Stopping	26

Note: The engine number plate is fitted to the fuel pump housing door or the air outlet duct.

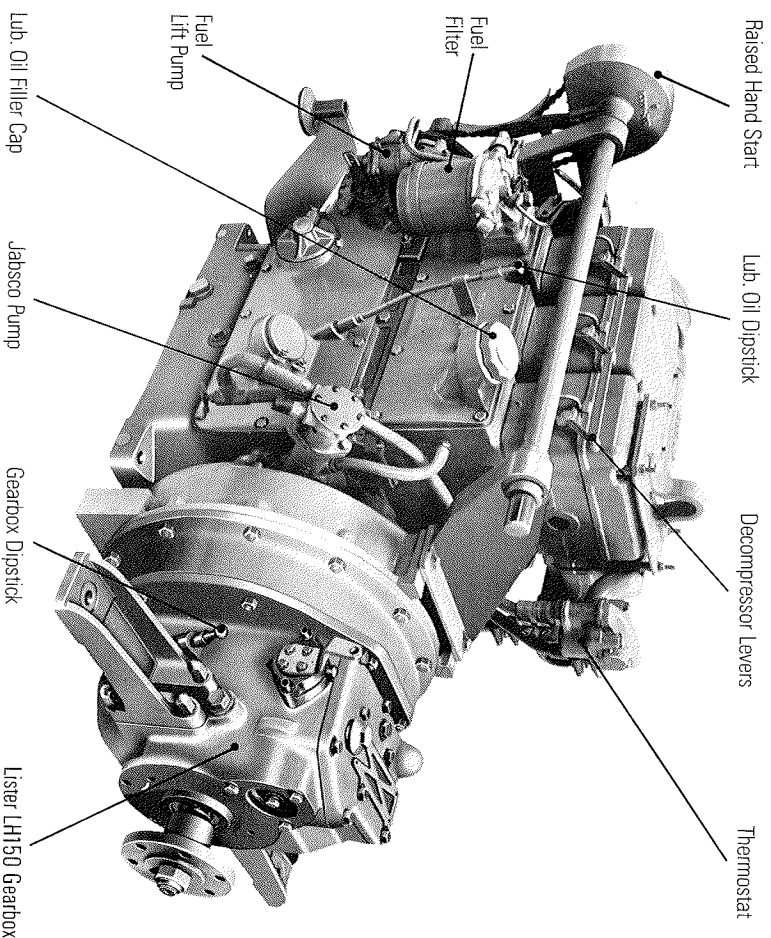


Fig. 5. STW3 Water Cooled Propulsion Engine

NOTE: STW engines are normally direct raw water cooled but keel cooling is available. Heat exchanger cooling is not available.

LUBRICATING OIL PRESSURE:

1.05/1.4 bar (15–20 lbf/in²) at 1500 rev. min.
0.35 bar (5 lbf/in²) at 750 rev. min.

CAPACITIES:

ST1 — 2 litres; Brit. 3.5 pints; U.S. 0.53 gal.
ST/W2 — 5.4 litres; Brit. 9.5 pints; U.S. 1.43 gal.
ST3 — 7.2 litres; Brit. 11.5 pints; U.S. 1.73 gal.
STW3 — 7.7 litres; Brit. 13.5 pints; U.S. 2.03 gal.

GEARBOX AND REDUCTION GEAR

Fill the reverse gear and reduction gear (if fitted) to the marks on the respective dipsticks. Do not overfill.

CAPACITIES:

Lister Reverse Gear — Manually Operated 0.85 litre; Brit. 1½ pints; U.S. 0.225 gal.
Hydraulic Operated 1.2 litre; Brit. 2 pints; U.S. 0.3 gal.
Lister Reduction Gear 0.3 litre; Brit. ½ pint; U.S. 0.075 gal.

Change the oil every 1000 hours and clean magnetic drain plug.

The external ends of the reverse gear operating shaft must be oiled frequently to prevent rust formation which may stiffen the shaft. To lubricate the port side of the shaft, the locating screw should be removed and a few drops of oil poured down the hole.

NOTE: Consult the manufacturer's instructions when engines are fitted with other gearboxes.

PRIMING THE FUEL SYSTEM (Fig. 6)

- Fill fuel tank or connect fuel supply.
- Slacken each bleed screw A on top of the filter body and in the outlet banjo union. Tighten each bleed screw when a full air-free flow of fuel is obtained working from the fuel tank.
- Slacken bleed screw B on fuel pump(s) nearest the tank first; tighten when all air has been displaced from fuel at each pump.

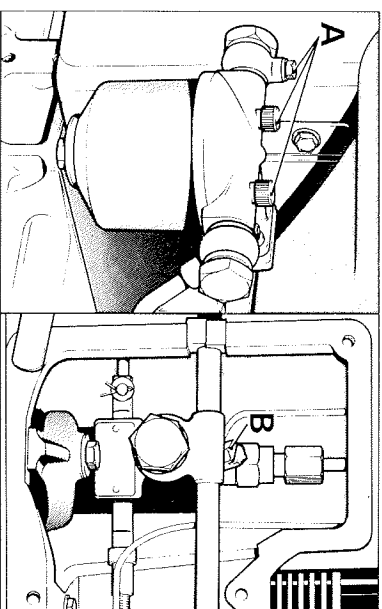


Fig. 6. Priming Fuel System

SERVICING OF FOAM ELEMENT AIR CLEANER (ST1)

The foam element should be treated before initial fitting and subsequently cleaned as follows:

- Remove the inner and outer perforated reinforcements.
- Wash the element in a mixture of fuel oil and 5% lubricating oil, and wring dry.
- Refit the reinforcements ensuring that approximately 6mm (¼") of foam element protrudes from the reinforcements at both ends for sealing purposes.

Note: See page 10 for 'Routine Maintenance' of dry air filters.

STARTING AND STOPPING

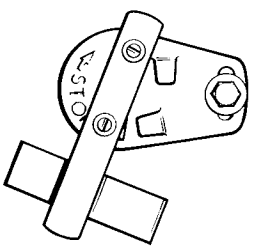
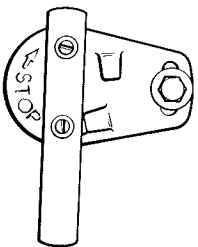
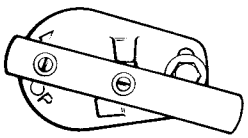


Fig. 7. Engine Control

Before Starting

1. Read Safety Precautions on page 7.
2. Fill the engine and gearboxes etc., if fitted — with the right grade of lubricating oil to the correct level.
3. Ensure there is an adequate supply of fuel and fuel system is primed. If the engine is fitted with a fuel lift pump, prime the fuel filter by using the priming lever on the lift pump.
4. Ensure air cleaner is firmly attached and air joints are properly sealed.
5. On electric start engines, ensure batteries are filled to correct level, charged and connected

To Start Engine (Hand Starting)

- (a) Check the engine is free to turn without obstruction.
- (b) Pull the control lever outwards and turn it anti-clockwise to an almost vertical position, this allows extra fuel for starting.
If a variable speed control is fitted, move towards FULL:
- (c) Move Decompressor Lever(s) towards the flywheel; lightly oil end of starting shaft and fit correct handle.
- (d) Turn the engine slowly from 3 to 20 turns according to the temperature and period of standing unused in order to prime the combustion chamber(s) and lubricating oil system.
- (e) Crank the engine and when sufficient speed is obtained, move Decompressor Lever(s) towards fuel tank (or gear end), continue to crank until engine fires. Retain grip on handle and remove from shaft.
- (f) Turn Control Lever to RUN position abutting against the middle catch. When speed control is fitted, reduce speed as required.

SECTION 3

To Start Engine (Electric Starting)

- Carry out items (a) and (b) as Hand Starting.
- (c) Press starter button and release immediately the engine fires. Do not motor the engine continuously for more than 10 seconds.
 - (d) Turn Control Lever to RUN position.
When speed control is fitted, reduce speed as required.

Cold Starting Below — 10°C (14°F)

A cup and plunger is fitted on the combustion air intake port(s). To operate, withdraw the plunger and fill one third of the cup with the same type of lubricating oil as used in the engine. Replace the plunger and inject the oil just before starting. The device must not be used more than three times in succession. The engine should be turned 20 revolutions with the fuel on after injecting the oil before attempting to start.

To Stop Engine

Turn the Control Lever clockwise and fix it in the clip. When remote control is fitted move lever to STOP.

NEVER STOP THE ENGINE BY OPERATING THE DECOMPRESSOR LEVER

SECTION 3

DECOMPRESSOR ADJUSTMENT

For engines provided with an oil filler hole in each cylinder head cover, access to the decompressors is through these holes.

Turn the engine until the piston is on T. D. C. firing stroke. (Both valves closed).

Move the decompressor lever over towards the flywheel

Slacken the locknut and turn the decompressor screw down until the exhaust valve touches the piston.

Turn the screw back ½ turn and tighten the locknut.

When no filler is provided in the cylinder head cover, the decompressor should be adjusted so that when the cover is tightened down in position, the adjusting screw just touches the valve rocker when operated. The adjusting screw should then be screwed down ¾ turn and locked in position.

Repeat the procedure for all cylinders.

INJECTOR PRESSURE

The injector(s) is set on a rig to 200 atmospheres and will settle to 190 atmospheres when working in the engine.

VALVE CLEARANCE

The valve clearance for both inlet and exhaust, set with the engine cold, is:

ST Engines **0.15 mm (0.006") GO**

0.20 mm (0.008") NOT GO

STW Engines **0.56 mm (0.022") GO**

0.61 mm (0.024") NOT GO

To Adjust

- (a) Remove the cylinder head cover and turn the engine until the piston is on T. D. C. position firing stroke (both valves closed).
- (b) Slacken the locknut on the adjusting screw and turn the screw until the correct clearance has been obtained.
- (c) Tighten the locknut whilst restraining the adjusting screw, and re-check to ensure that the clearance is correct.

Repeat the procedure for all valves.

SECTION 3

SECTION FOUR

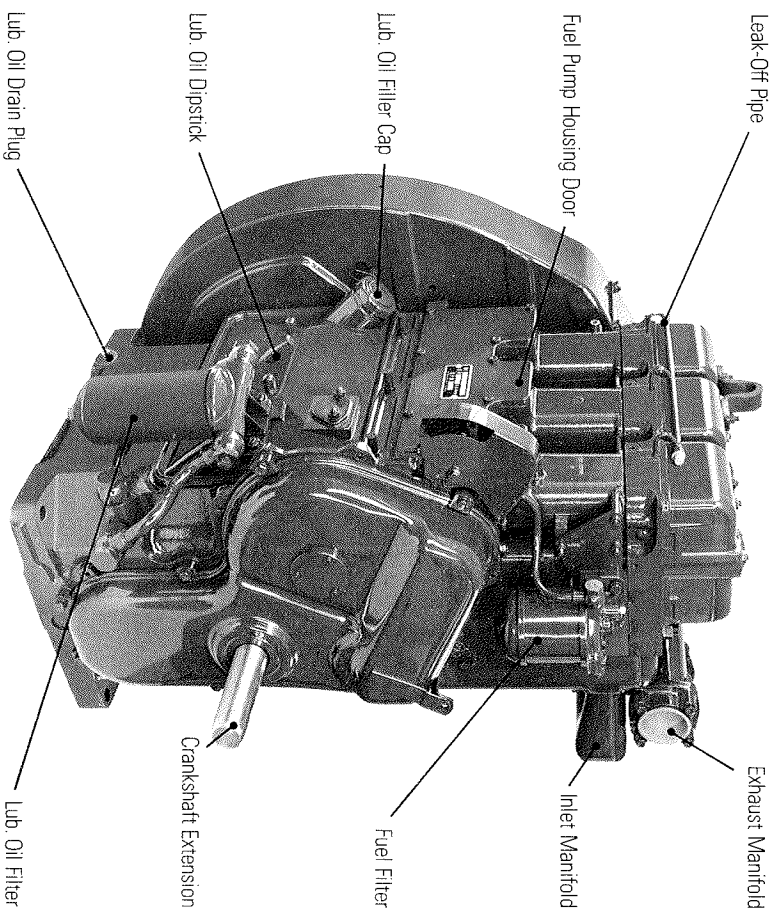


Fig. 8. HR3 Air Cooled Auxiliary Engine

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Note: The engine number plate is fitted to the fuel pump housing door.

SECTION 4

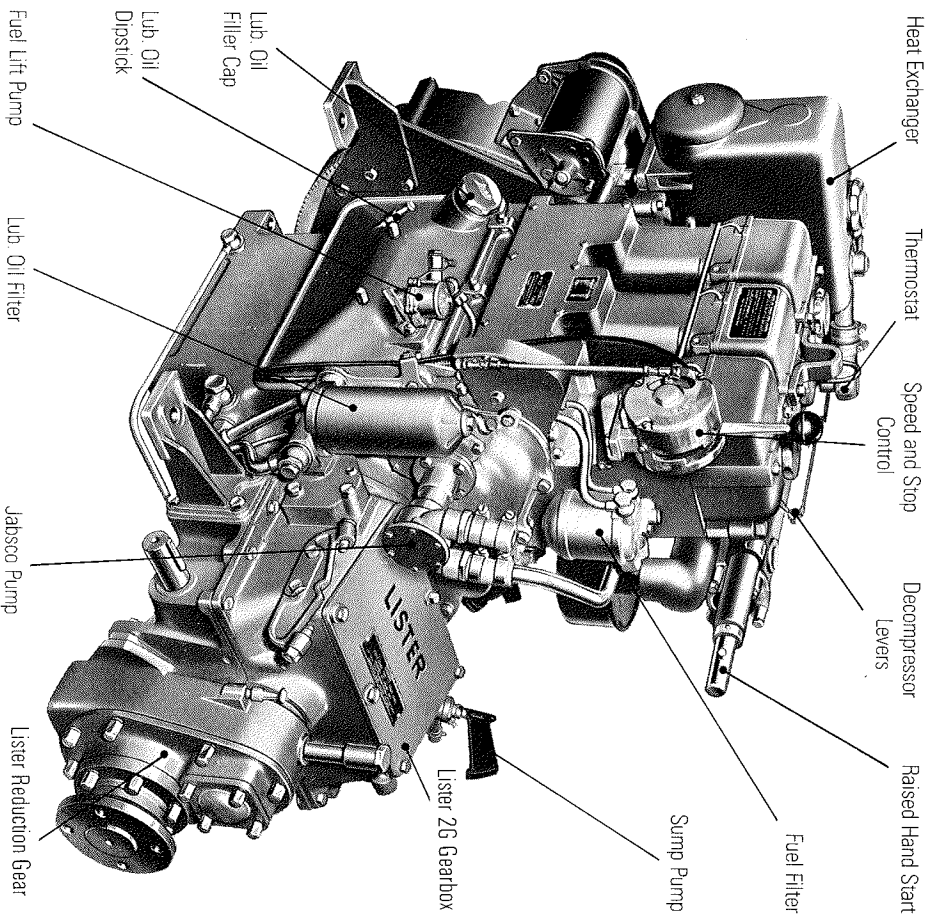


Fig. 9. HRW3 Water Cooled Propulsion Engine

LUBRICATING OIL PRESSURE:

2.1-3.1 bar. (30-45 lbf/in²).

CAPACITIES:

HR/W2 10.2 litres; Brit. 18 pints; U. S. 2.7 gal.

HR/W3 14.2 litres; Brit. 25 pints; U. S. 3.75 gal.

GEARBOX AND REDUCTION GEAR

The Lister 2G mechanical reverse gearbox is lubricated from the engine system; the reduction gear uses a mild type EP gear lubricant: SAE 80 below 5°C. SAE 90 above 5°C. Detailed information on servicing the gearboxes can be found in the engine Workshop Manual (Book 2003).

NOTE:

Consult the manufacturer's instructions when engines are fitted with other gearboxes.

PRIMING THE FUEL SYSTEM (Fig. 10)

Note: When carrying out this operation, care should be taken to prevent a large over-flow of fuel into the crankcase. On completion, ensure all joints are serviceable or renewed and all bleed screws and connections are tightened firmly.

- Fill fuel tank or connect fuel supply; remove fuel pump housing door.
- Slacken bleed screw A on top of the fuel filter body; tighten when an air free flow of fuel is obtained.
- Slacken in turn, each bleed screw on the fuel pumps B starting from the pump nearest the filter. Tighten when all air has been displaced from the fuel at each pump.

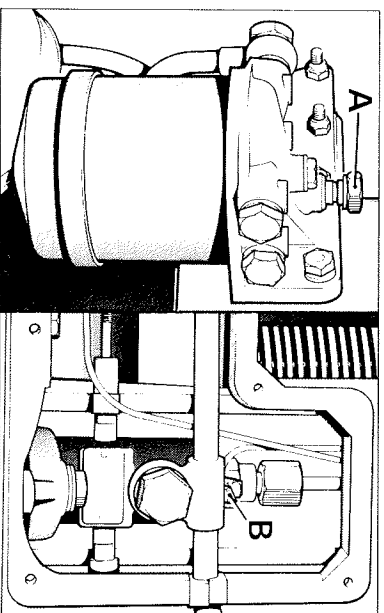


Fig. 10. Priming Fuel System

DECOMPRESSOR ADJUSTMENT

For engines provided with an oil filler hole in each cylinder head cover, access to the decompressors is through these holes.

Turn the engine until the piston is on T. D. C. firing stroke (both valves closed). Move the decompressor lever over towards the flywheel.

Slacken the locknut and turn the decompressor screw down until it touches the rocker pad.

Turn the screw $\frac{3}{4}$ turn clockwise and tighten the locknut.

When no filler is provided in the cylinder head cover, the decompressor should be adjusted so that when the cover is tightened down in position, the adjusting screw just touches the valve rocker when operated. The adjusting screw should then be screwed down $\frac{3}{4}$ turn (clockwise) and locked in position.

INJECTOR PRESSURE

The injectors are set on a rig to 180 atmospheres and will settle to 170 atmospheres when working in the engine.

VALVE CLEARANCE

The valve clearance for both inlet and exhaust, set with the engine cold is:

Air Cooled Engines (HR)

0.05 mm (0.002") GO
0.10 mm (0.004") NOT GO

Water Cooled Engines (HRW)

0.38 mm (0.015") GO
0.43 mm (0.017") NOT GO

To Adjust

- Turn the engine until the piston is on T. D. C. position of the firing stroke (both valves closed).
 - Slacken the locknut on the adjusting screw and turn the screw until the correct clearance has been obtained.
 - Tighten the locknut whilst restraining the adjusting screw and re-check to ensure that clearance is correct.
- Repeat the procedure for all valves.

STARTING AND STOPPING

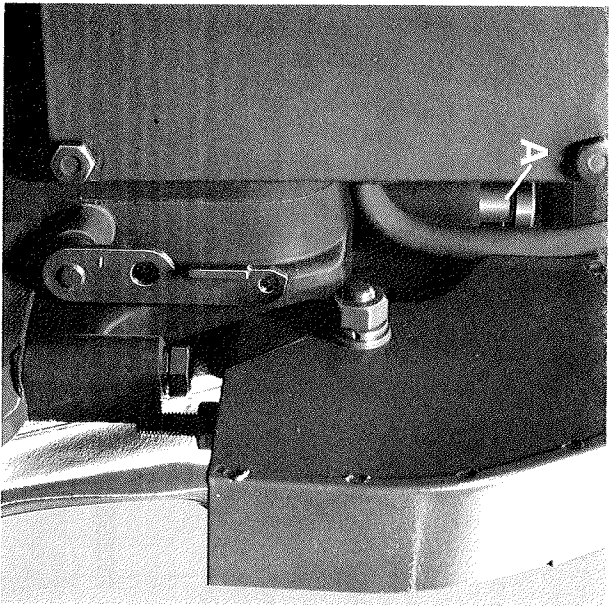


Fig. 11. Engine Controls

- Before Starting**
1. Read Safety Precautions on page 7.

2. Fill the engine — and gearboxes etc., if fitted — with the right grade of oil to the correct level.
3. Ensure there is an adequate supply of fuel and fuel system is primed. If the engine is fitted with a fuel lift pump, prime the fuel filter by using the priming lever on lift pump.
4. Ensure air cleaner is firmly attached and air joints are properly sealed.
5. On electric start engines, ensure batteries are filled to correct level, charged and connected
6. On water cooled engines, fill heat exchanger tank.

SECTION 4

To Start Engine (Hand Starting)

- (a) Check the engine is free to turn without obstruction.
- (b) In cold weather only, lift Overload Stop A to allow the pumps to deliver excess fuel.
If a variable speed control is fitted, move to FULL.
- (c) Move Decompressor Levers away from the flywheel; lightly oil end of starting shaft and fit correct starting handle.
- (d) Turn the engine slowly from 3 to 10 turns according to the temperature and period of standing unused in order to prime the combustion chambers and lubricating oil system.
- (e) Crank the engine and when sufficient speed is obtained, move Decompressor Levers towards the flywheel; continue to crank until engine fires. Retain grip on handle and remove from shaft.
- (f) When speed control is fitted, reduce speed as required.

To Start Engines (Electric Starting)

Carry out items (a) and (b) as Hand Starting.

- (c) Press start button and release immediately the engine fires. Do not motor the engine continuously for more than 10 seconds.
- (d) When speed control is fitted, reduce speed as required.

To Stop the Engine

Move the control lever towards the flywheel and hold in this position until the engine stops.

**NEVER STOP THE ENGINE BY OPERATING THE
DECOMPRESSOR LEVERS**

SECTION FIVE

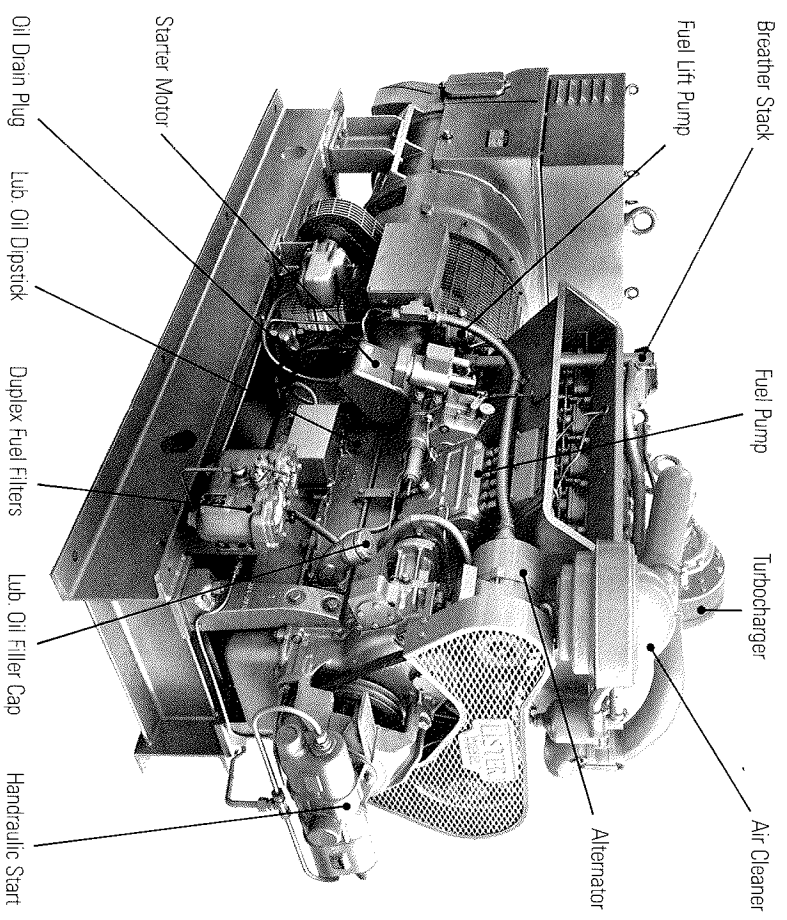


Fig. 12. HRS6 Air Cooled Engine
(Fitted to Marine Auxiliary Generating Set)

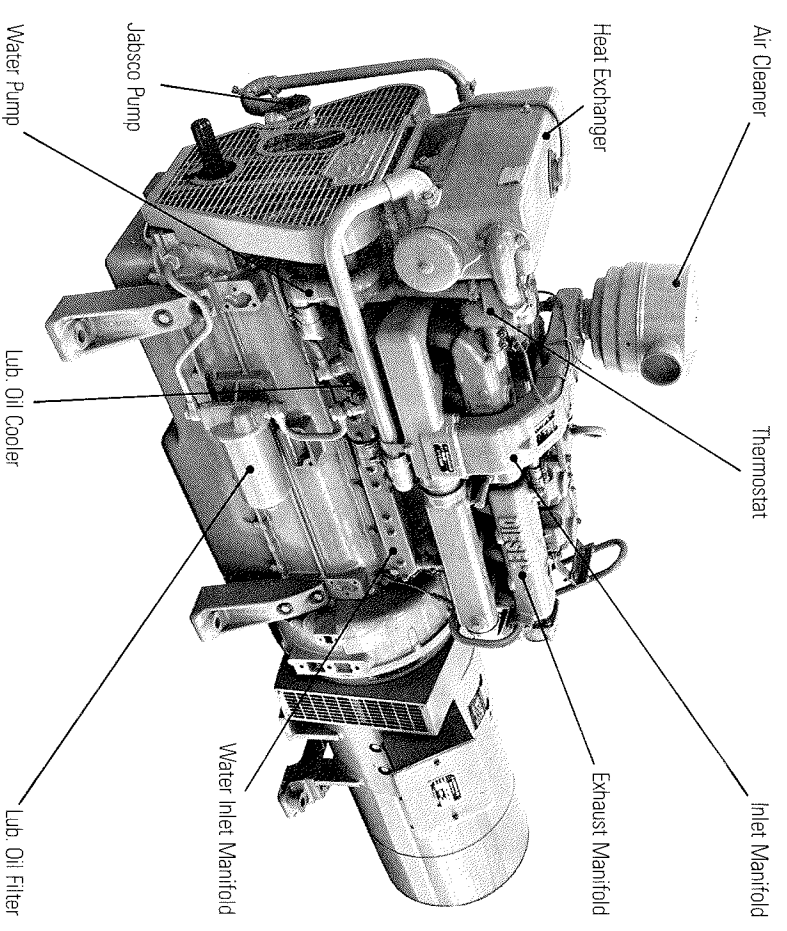


Fig. 13. HRW6 Water Cooled Engine
(Fitted to Marine Auxiliary Generating Set)

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Note: The engine number plate is fitted to the oil cooler cover HR and the air intake manifold HRW.

LUBRICATING OIL PRESSURE:

2.1-3.1 bar (30-45 lbf/in²).

CAPACITIES:

Four Cylinder Engines — 18.2 litres; Brit. 32 pints; U.S. 4.8 gal.

Six Cylinder Engines — 23.9 litres; Brit. 42 pints; U.S. 6.3 gal.

GEARBOXES AND REDUCTION GEAR

The Lister 3G mechanical reverse gearbox is lubricated from the engine lubricating system. The reduction gear uses EP gear lubricant.

Detailed information on servicing and adjusting the gearboxes can be found in the engine Workshop Manual (Book 2004).

NOTE: *Consult the manufacturer's instructions when engines are fitted with other gearboxes.*

PRIMING THE FUEL SYSTEM

Connect fuel supply and manually operate lift pump during the following operations:—

DPA Fuel Pump (Fig. 14)

- (a) Release vent screw on top of fuel filter and tighten when an air free flow of fuel is obtained.
- (b) Release vent screws A, B and C in that order and tighten when an air free flow of fuel is obtained.
- (c) Slacken any two injector pipe unions at the fuel pump end. Set stop control 1 to RUN; on variable speed engines set speed control to FULL. Turn engine until an air free flow of fuel is obtained. Tighten injector unions.

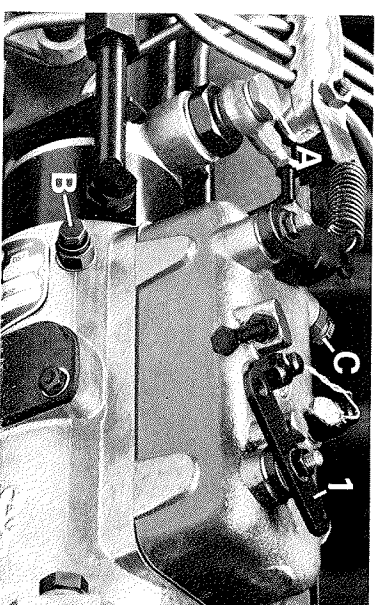
SECTION 5

Fig. 14. DPA Fuel Pump

MINIMEC Fuel Pump (Fig. 15)

- (a) Release vent screw on top of fuel filter and tighten when an air free flow of fuel is obtained.
- (b) Release screw A on the side of the pump. Tighten when an air free flow of fuel is obtained.

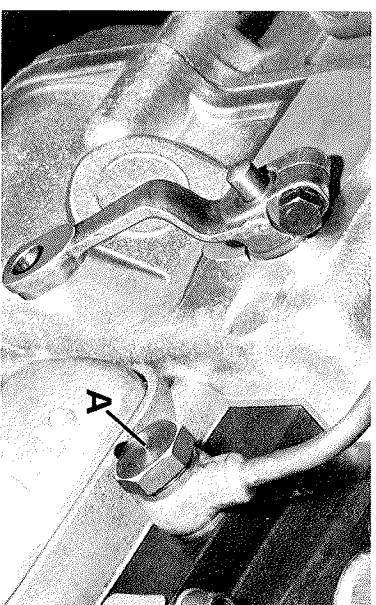


Fig. 15. Minimec Fuel Pump

SECTION 5

STARTING AND STOPPING

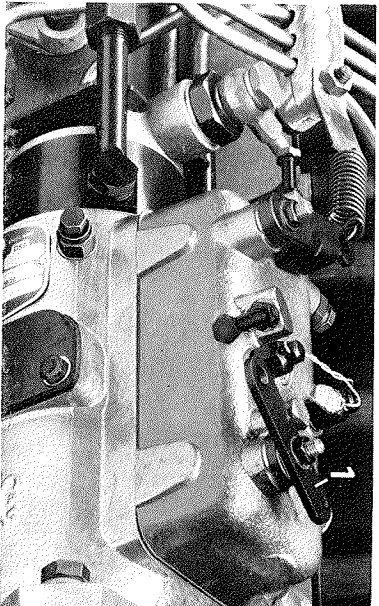


Fig. 16. Engine Controls—DPA Fuel Pump.

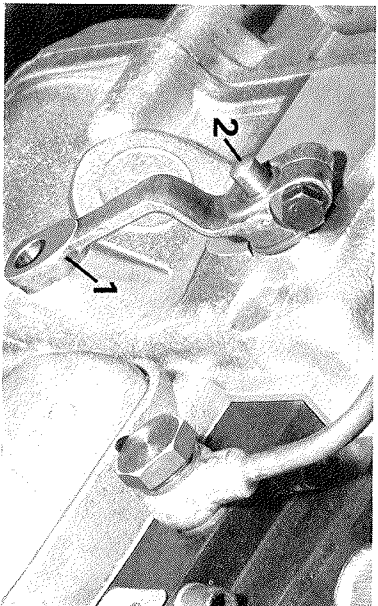


Fig. 17. Engine Controls—Minimec Fuel Pump.

Before Starting:

1. Read Safety precautions on page 7.
2. Fill the engine—and gearboxes etc. if fitted—with the right grade of oil to the correct level.
3. Ensure there is an adequate supply of fuel and fuel system is primed.
4. Ensure air cleaner is firmly attached and air joints are properly sealed.
5. On electric start engines, ensure batteries are filled to correct level, charged and connected
6. On water cooled engines, fill heat exchanger tank.

SECTION 5

To Start Engine:

- (a) Check the engine is free to turn without obstruction.
- (b) Move Stopping Lever 1 to RUN position.
If a variable speed control is fitted move to FULL.
- (c) Engines with a MINIMEC fuel pump:
Press button 2 in the centre of stopping lever (Fig. 17), to obtain excess fuel for starting.
- (d) Press starter button and release immediately the engine fires. Do not motor the engine continuously for more than 10 seconds.
- (e) When speed control is fitted, reduce speed as required.

THERMOSTART (Cold Starting Aid)

To Start the Engine (Push Button)

Press the Starting Aid push button and hold for 15 to 20 seconds then press electric start push button.
Immediately engine starts release both buttons.

To Start the Engine (Key Switch)

Turn key anti-clockwise and hold for 15 to 20 seconds then turn the key clockwise to start the engine.
Immediately engine fires release switch.

Note: *When the engine is hot, turn key clockwise only.*

To Start Engine—Emergency Hand Start

- Carry out items (a) to (c) as electric starting.
- (d) Move Decompressor Levers away from the flywheel; lightly oil end of starting shaft and fit correct starting handle.
 - (e) Crank the engine and when sufficient speed is obtained, move Decompressor Levers towards the flywheel; continue to crank until engine fires. Retain grip on handle and remove from shaft.
 - (f) When speed control is fitted, reduce speed as required.

To Stop Engine

Move Stopping Lever to the left and hold in position until the engine stops.

Turbocharged Engines (HR/WS6)

If possible, turbocharged engines should be run for about one minute on no load after starting and before stopping to ensure satisfactory turbocharger lubrication at the start and general heat dissipation before stopping.

DECOMPRESSOR ADJUSTMENT

Access to the decompressor adjuster is gained by removing the cylinder head cover.

Turn the engine until the piston is on the T.D.C. position of the firing stroke (both valves closed).

Set the adjustment screw so that when the cover is refitted, the screw will just touch the exhaust valve rocker lever.

Turn the adjustment screw down a further 3/4 turn and lock in position.

Repeat the procedure for all cylinders.

INJECTOR PRESSURE

The injectors are set on a rig to 180 atmospheres and will settle to 170 atmospheres when working in the engine.

VALVE CLEARANCE

The valve clearance for both inlet and exhaust, set with the engine cold is:

All Air Cooled Engines (HR) with steel push rods:

0.05 mm (0.002") GO

0.10 mm (0.004") NOT GO

All Water Cooled Engines (HRW) and air cooled engines with alloy push rods (hand start):

0.38 mm (0.015") GO

0.43 mm (0.017") NOT GO

To Adjust

- (a) Turn the engine until the piston is on the T.D.C. position of the firing stroke (both valves closed).
- (b) Slacken the locknut on the adjusting screw and turn the screw until the correct clearance has been obtained.
- (c) Tighten the locknut whilst restraining the adjusting screw and re-check to ensure that clearance is correct.

Repeat the procedure for all valves.

SECTION 5

SECTION SIX

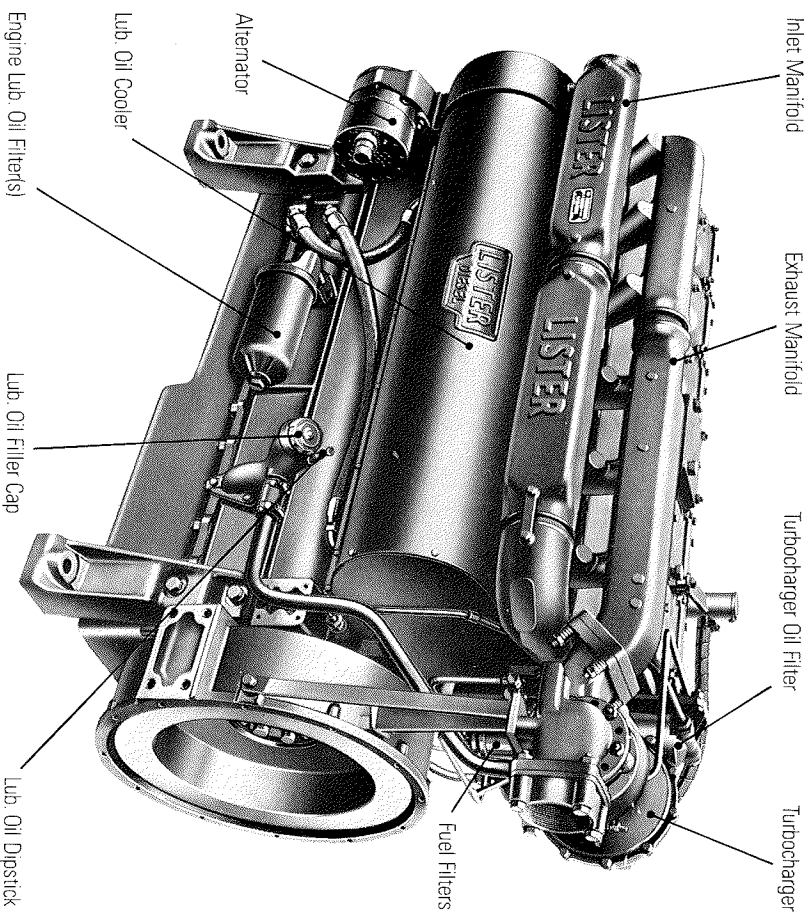


Fig. 18. JAS Air Cooled Auxiliary Engine

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Note: The engine number plate is fitted to the air intake manifold.

SECTION 6

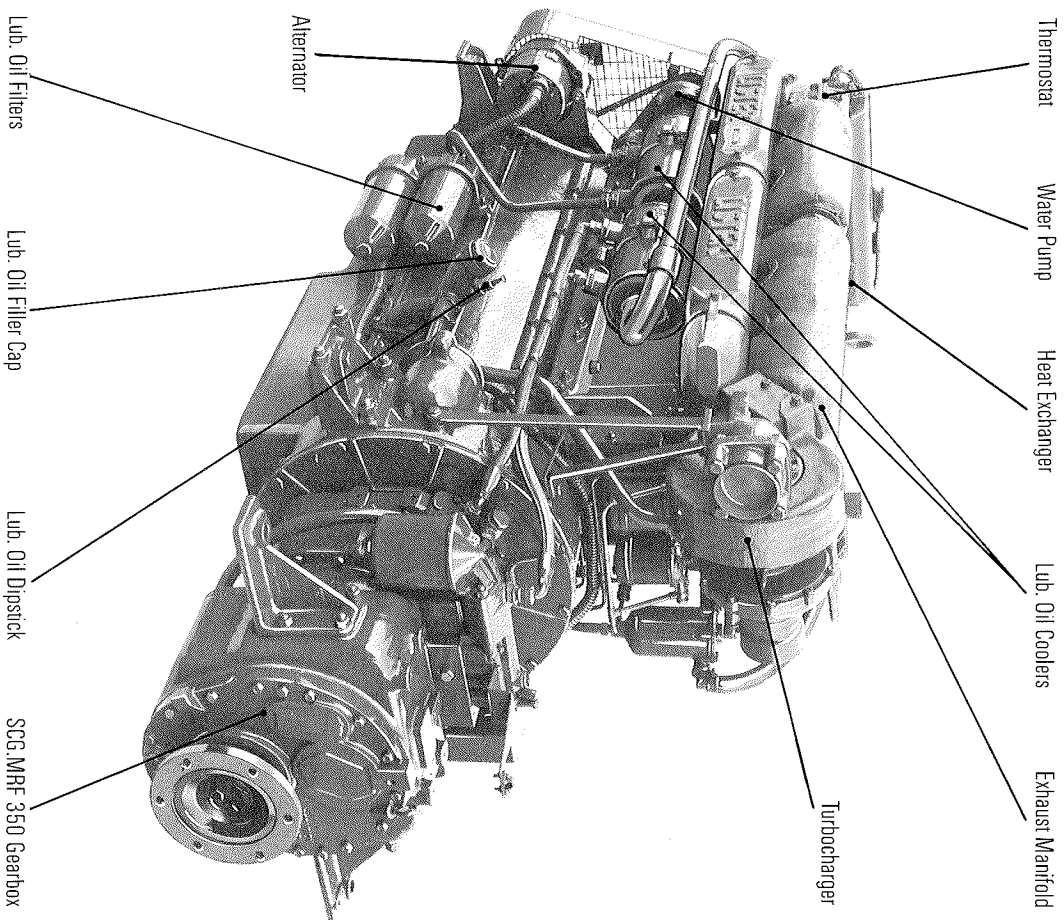


Fig. 19. JWS Water Cooled Propulsion Engine

LUBRICATING OIL PRESSURE:

2.8-3.8 bar (40-55 lbf./in²).

CAPACITY (All J Engines):

44.4 litres; Brit. 78 pints; U.S. 11.7 gal.

GEARBOXES AND REDUCTION GEAR

Consult Manufacturer's Instructions

PRIMING THE FUEL SYSTEM (Fig. 20)

- (a) Connect fuel supply.
- (b) Slacken each non-return valve on top of fuel filters A and operate lever on lift pump. Tighten NRVs when an air free flow of fuel is obtained.
- (c) Release vent screw B at the gearcase end of the fuel delivery pipe to the fuel pumps. Tighten when an air free flow of fuel is observed.

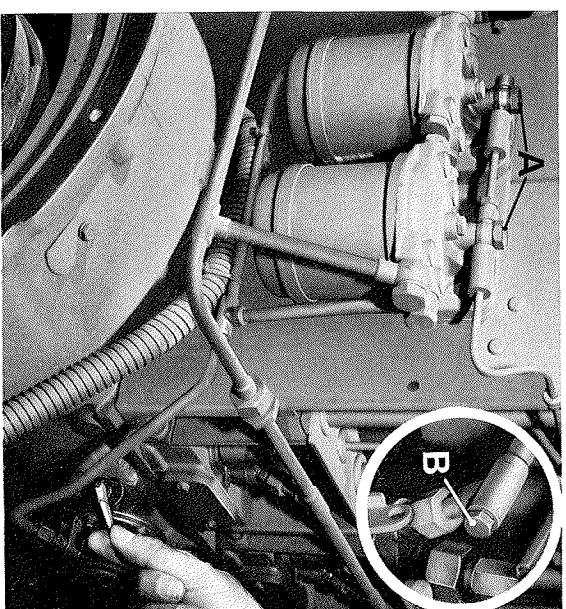


Fig. 20. Priming Fuel System

STARTING AND STOPPING

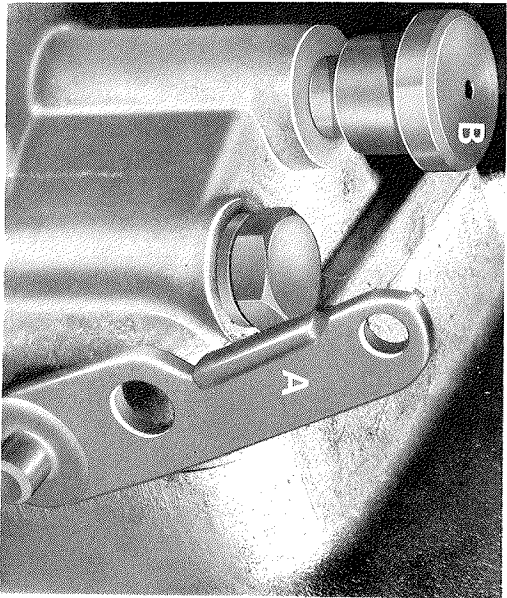


Fig. 21. Engine Controls

Before Starting:

1. Read Safety Precautions on page 7.
2. Fill the engine—and gearboxes etc., if fitted—with the right grade of oil to the correct level.
3. Ensure there is an adequate supply of fuel and fuel system is primed.
4. Ensure air cleaner(s) is firmly attached and air joints are properly sealed.
5. Check that batteries are filled to correct level, charged and connected.
6. On water cooled engines, fill heat exchanger tank.

To Start Engine

- (a) Check the engine is free to turn without obstruction.
- (b) Move Stopping Lever A to RUN position; if necessary lift overload stop plunger B.
On variable speed engines set speed control to FULL.
- (c) Press starter button and release immediately the engine fires. Do not motor the engine continuously for more than 10 seconds.
- (d) When speed control is fitted, reduce speed as required.

SECTION 6

THERMOSTART (Cold Starting Aid)

Ensure thermostart tank is full. Carry out items (a) and (b) in previous paragraph. Operate the starting aid for 15 to 20 seconds then start engine. On engines with push button start, press button; on engines fitted with a key switch, turn key from HEAT to START.

To Stop Engine

Move the stopping lever A towards the end cover and hold in this position until the engine comes to rest. Never shut off the fuel supply to stop the engine.

Turbocharged Engines

If possible, turbocharged engines should be run for about one minute on no load after starting and before stopping to ensure satisfactory turbocharger lubrication at the start and general heat dissipation before stopping.



INJECTOR PRESSURE

The injectors are set on a rig to 180 atmospheres and will settle to 170 atmospheres when working in the engine.

VALVE CLEARANCE

The valve clearance for both inlet and exhaust, set with the engine cold is:—

Air Cooled Engines (JA)	0.05 mm (0.002") GO
	0.10 mm (0.004") NOT GO
Water Cooled Engines (JW)	0.10 mm (0.004") GO
	0.15 mm (0.006") NOT GO

To Adjust

Note: A barring hub may be fitted to the crankshaft extension to enable engine to be turned by hand; it is recommended that the injectors are removed to decompress the engine. The firing order is 1–5–3–6–2–4.

- (a) Turn the engine until the piston is on the T. D. C. position of the firing stroke (both valves closed).
 - (b) Slacken the locknut on the adjusting screw and turn the screw until the correct clearance has been obtained.
 - (c) Tighten the locknut whilst restraining the adjusting screw and re-check to ensure that clearance is correct.
- Repeat the procedure for all valves.