

FORM. : 977.371
REVISED:
JANUARY.2004

SABB L DIESEL

OPERATORS HANDBOOK

FOR

L2093LB/L3.139LB/L4.186LB/L4T.186LB

LIFEBOAT ENGINE

SABB MOTOR A.S

P.O.Box 7170 - 5020 BERGEN - NORWAY

Telefon +47 55348800 Telefax +47 55348801 e-mail firmapost@sabb.no

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GENERAL PRECAUTIONS

- Ensure that the engine is securely mounted.
- Ensure that the ventilation and combustion air ducts are not obstructed.
- Keep the engine and surrounding areas clean.
- Never allow any part of the body to come into contact with high pressure fuel oil when testing injection equipment.
- Avoid contact with exhaust pipe when the engine is, or has recently been running. These parts can be very hot and can cause severe burns.
- Rectify all fuel, water and oil leaks as soon as possible.
- Isolate the battery when working on the engine.
- All drive belts must receive regular attention.
- Keep electrical contacts free from corrosion etc by smearing them with petroleum jelly.
- Batteries under charge release explosive gases, therefore the battery compartment must be well ventilated at all times. Never allow any smoking, sparks or flames near the batteries.
- Wear protective goggles when handling liquids which are harmful to the eyes, for ex. battery acid. If any of these substances are splashed in the eyes, wash out thoroughly with clean water.
- Many liquids used in engines are harmful if taken internally.
In the event of accidentally swallowing oil, fuel, anti-freeze or battery acid obtain medical assistance immediately.

CAUTION!

NEVER OPERATE GLOW PLUG WHEN USING ETHER PUMP

INTRODUCTION

The SABB-L-DIESEL, types L2.093LB, L3.139LB, L4.186LB is based upon the LISTER PETTER engine types LPW2, LPW3 AND LPW4 and adapted for life boat propulsion conforming to the latest requirements incl. SOLAS 1998, Chapter III, and LSA of 1998.

It is essential that the operators read carefully the main points in this manual before the engine is put into service. Reference is made to:

"CHECKS BEFORE STARTING", "STARTING", "OPERATION" and "STOP".

The engine must be able to start and operate under the most severe conditions. Therefore the engine must be carefully maintained in accordance with this manual. The engine should be started and tested at regular intervals according to the rules for lifeboat engines.

The information, specifications, illustrations, instructions and statements contained within this publication are given with our best intentions and are believed to be correct at the time going to press. Our policy is one of continued development and we reserve the right to amend any technical information with or without prior notice.

Whilst every effort is made to ensure the accuracy of the particulars contained within this publication neither the Manufacturer, Distributor or Dealer shall in any circumstances be held liable for any inaccuracy or the consequences thereof.

Users of this book are advised that the specification details apply to a range of engines and not to any one particular engine. In cases of difficulty consult SABB MOTOR A.S, BERGEN, NORWAY or a local SABB MOTOR or Lister-Petter Distributor for further advice and technical assistance.

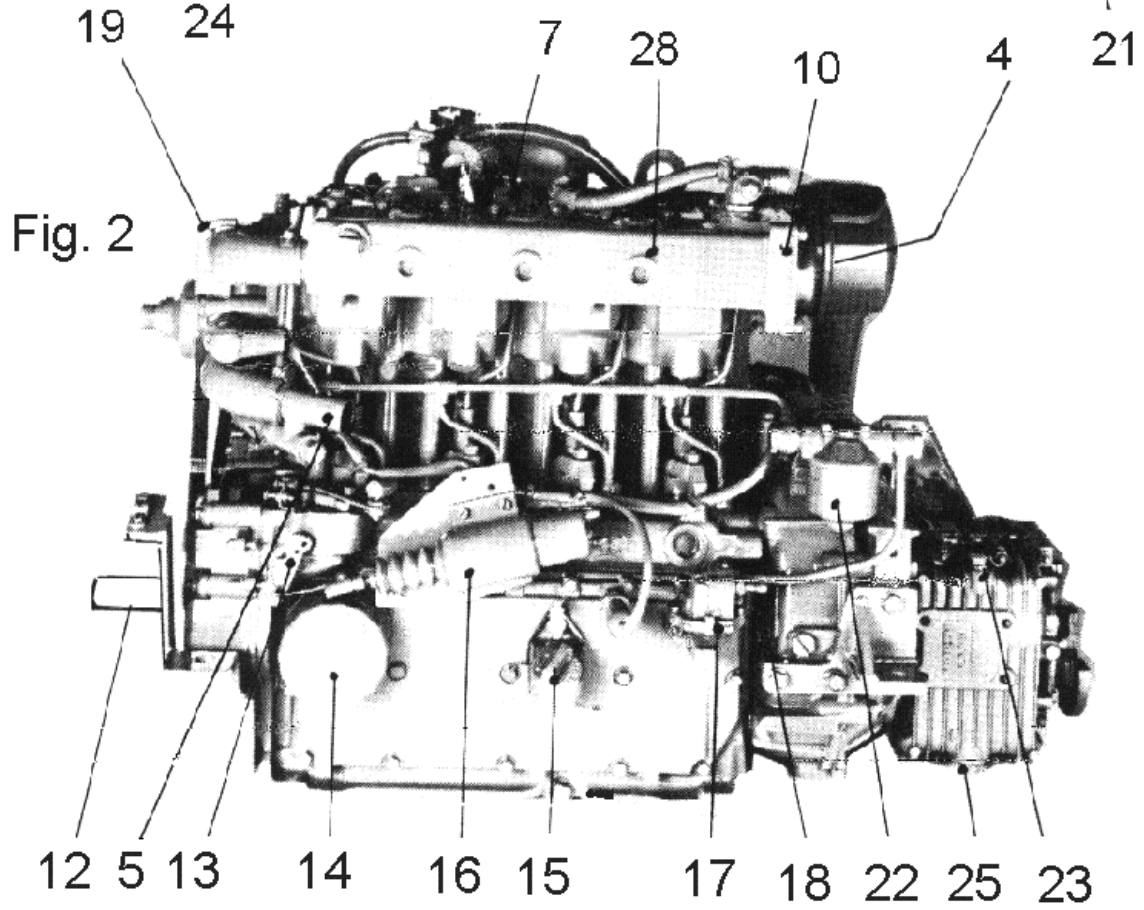
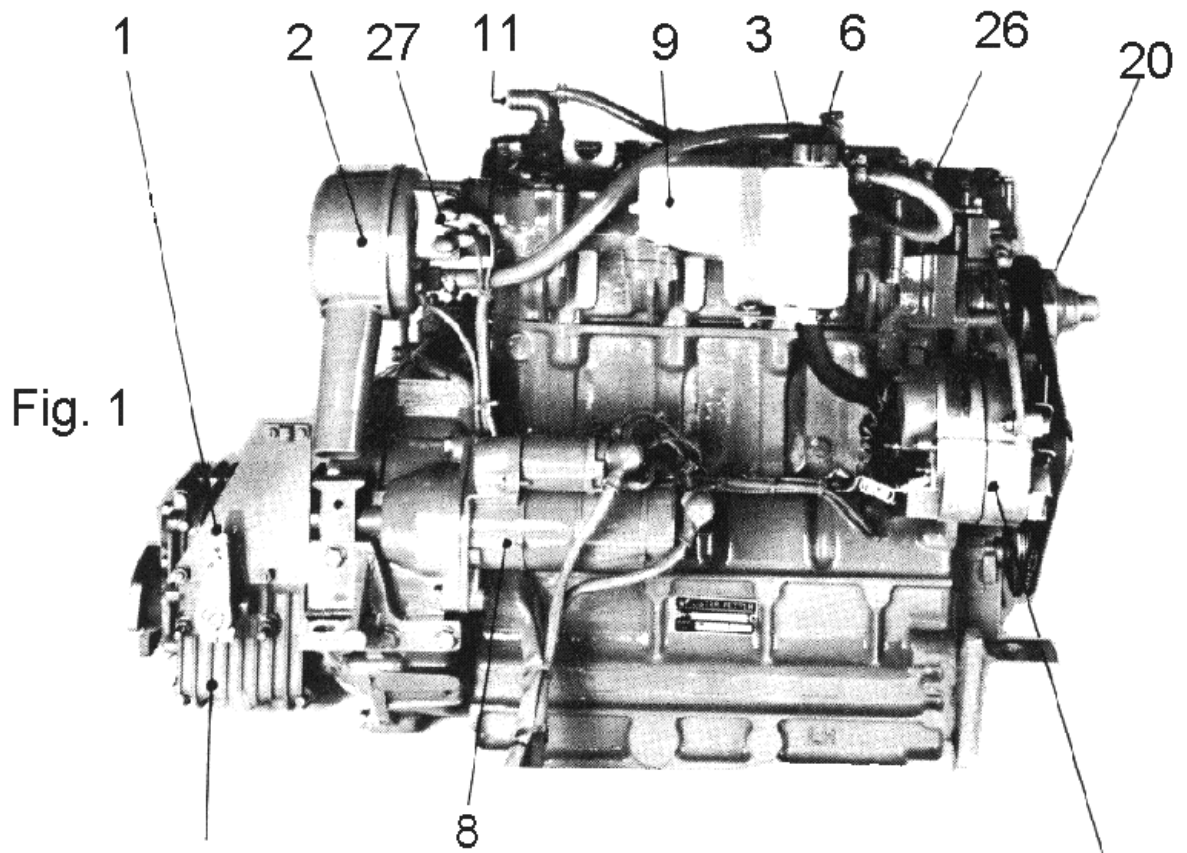
The information given is subject to the Company's current Conditions of Tender and Sale, and is for the assistance of users and is based upon results obtained from tests carried out at the place of manufacture. This company does not guarantee that the same results will be obtained elsewhere under different conditions.

When purchasing parts or giving instructions for repairs customers should, in their own interests, always specify **GENUINE SABB MOTOR A.S PARTS.**

Parts that have not been supplied by the SABB MOTOR A.S cannot be relied upon for correct material, dimensions or finish.

This Company cannot therefore be responsible for any damage arising from the use of such parts and the guarantee will be invalidated.

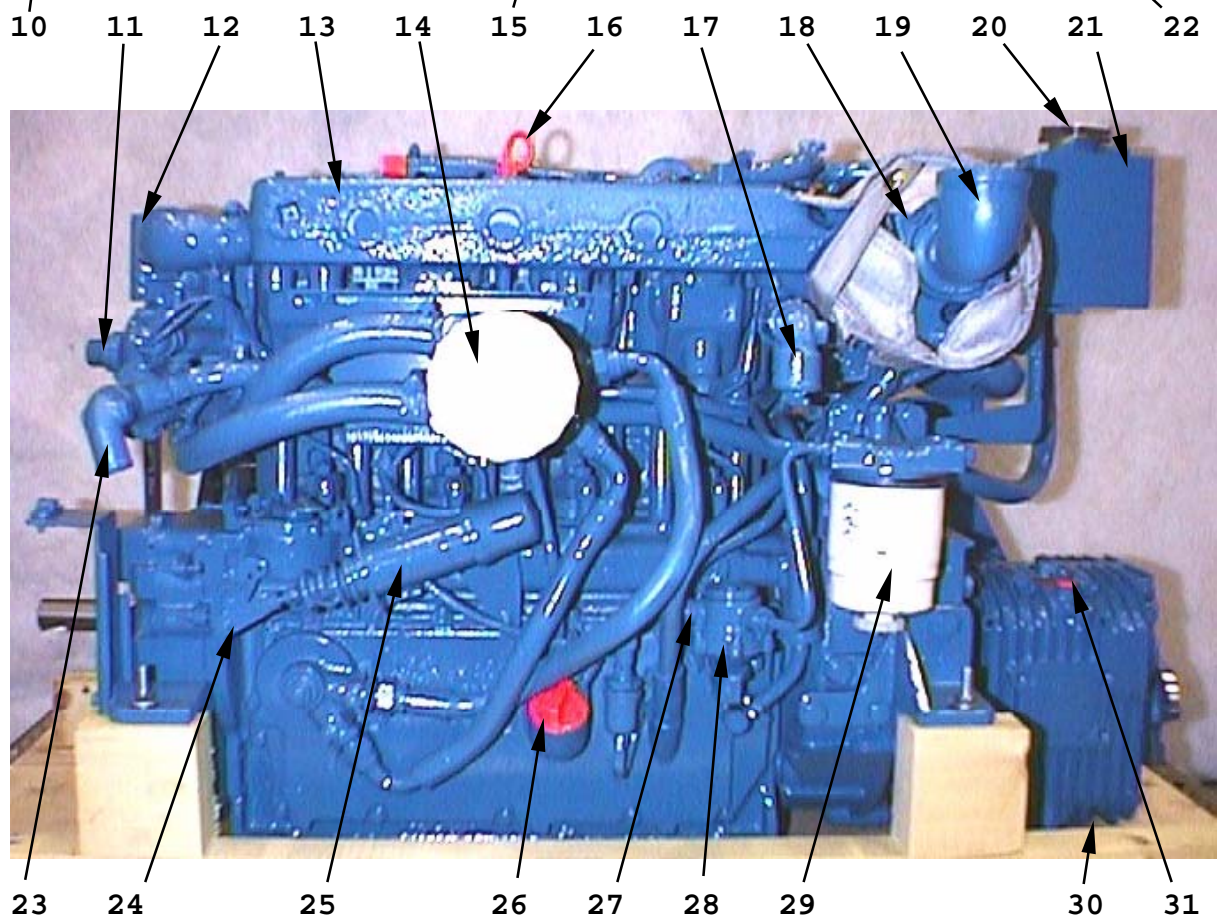
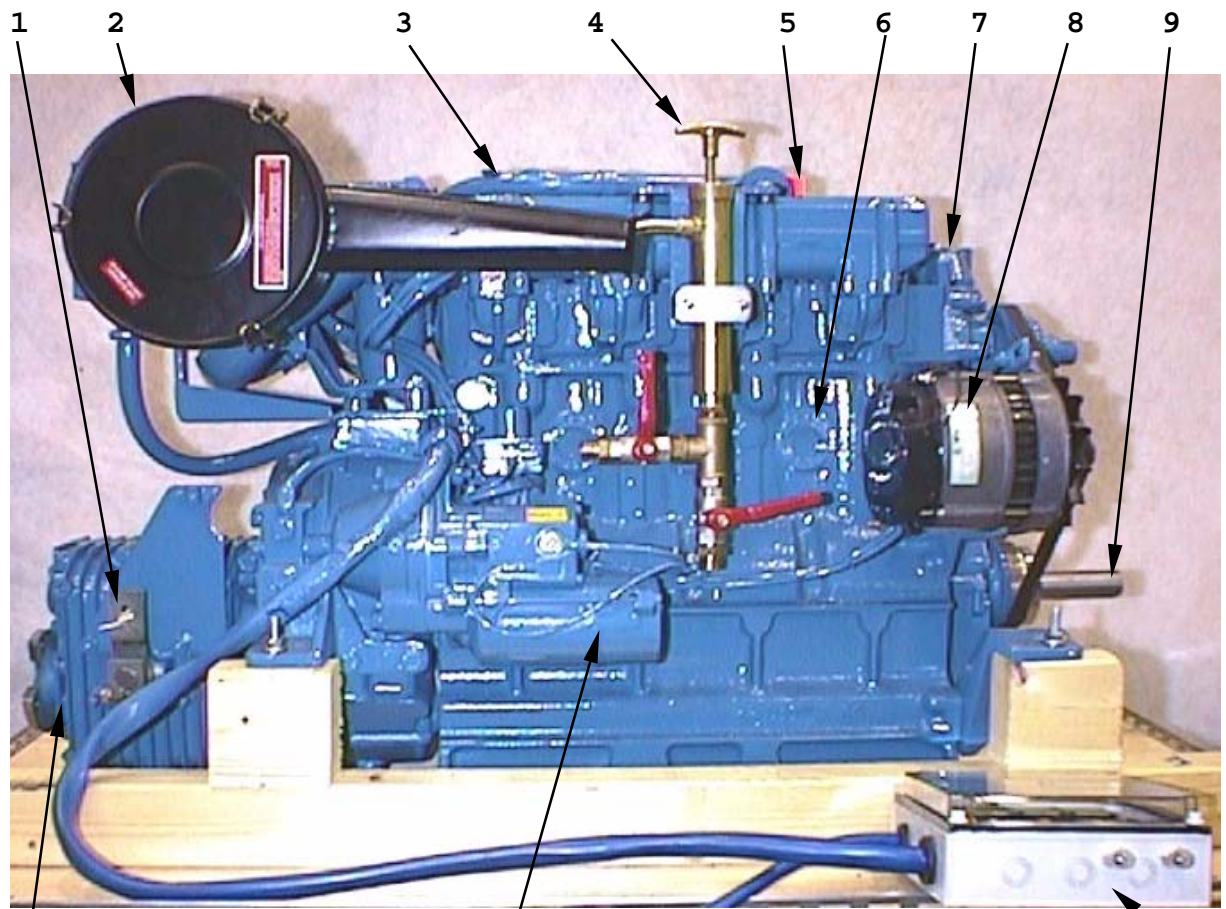
STARBOARD / PORTSIDE VIEW – ENGINE L2 – L3 – L4



DESCRIPTION OF ENGINE VIEWS – ENGINE L2 – L3 – L4

1. Gearbox Lever
2. Air Inlet Damper
3. Oil Filler Cap, Valve Cover
4. Engine Heater
5. Coolant Inlet
6. Coolant Filler Cap
7. Dipstick
8. Starter Motor
9. Header Tank
10. Exhaust Flange
11. Coolant Outlet
12. Shaft Extension
13. Stop Lever
14. Lubricating Oil Filter
15. Oil Filler Cap, Crankcase Door
16. Stop Solenoid
17. Fuel Lift Pump
18. Fuel supply
19. Thermostat housing
20. Fresh Water Pump
21. Alternator
22. Fuel Filter
23. Gearbox Dipstick
24. Gearbox
25. Gearbox Oil Drain Plug
26. Fuel Return to Tank
27. Heater plug
28. Exhaust manifold

STARBOARD / PORTSIDE VIEW – ENGINE L4T



DESCRIPTION OF ENGINE VIEWS – ENGINE L4T

1. Gearbox Lever
2. Air Inlet Damper
3. Heater plug
4. Sump Oil Drain Pump
5. Oil Filler Cap, Valve Cover
6. Jacket Heater Mounting
7. Fuel Return to Tank
8. Alternator
9. Shaft Extension
10. Gearbox
11. Fresh Water Pump
12. Thermostat housing
13. Exhaust manifold
14. Lubricating Oil Filter
15. Starter Motor
16. Dipstick
17. Coolant Outlet
18. Exhaust Outlet
19. Turbocharger
20. Coolant Filler Cap
21. Header Tank
22. Relaybox Compl.
23. Coolant Inlet
24. Stop Lever
25. Stop Solenoid
26. Oil Filler Cap, Crankcase Door
27. Fuel supply
28. Fuel Lift Pump
29. Fuel Filter
30. Gearbox Oil Drain Plug
31. Gearbox Dipstick

GENERAL ENGINE DATA - L2 – L3 – L4

Model	<u>L2.093LB</u>	<u>L3.139LB</u>	<u>L4.186LB</u>
Basic Engine Make	Lister Petter Ltd		
Rotation	<u>Clockw., looking on Gearbox End</u>		
Injection	<u>Direct</u>		
No. of Cyl.	2	3	4
Bore, mm	86	86	86
Stroke, mm	80	80	80
Cyl. Capacity litres	0,930	1.395	1,860
Firing Order	1-2	1-2-3	1-3-4-2
Compression Ratio	18,5 : 1		
Output at 3000 RPM, kW/bhp	19 / 14,2	21,6 / 29	29 / 39
Output Reference	Continuous		
Fuel Oil Consumption, l/h	3,9	5,9	7,8
Lub. Oil Consumption, l/24h	0,70	1,06	1,41
Air Consumption, l/sec	19,74	29,60	39,47
Max Exhaust Temp. °C	560	560	560
Engine Total Length, mm	697	809	909
Width, mm	495	495	495
Height, mm	570	570	570
Weight kg		190	200
Max. Inclination	20°Astern/Ahead/LateralRunning		

GENERAL ENGINE DATA - L4T

Model-----	L4.186GR-LB.T
Basic Engine Make-----	Lister Petter Ltd
Rotation-----	Anticlockw.looking on Flywheel
Injection-----	Direct
Aspiration-----	Turbocharged with Wastegate
No. of Cyl.-----	4
Bore, mm -----	86
Stroke, mm -----	80
Cyl. Capacity litres----	1,860
Firing Order-----	1-3-4-2
Compression Ratio-----	16,2 : 1
Output at 3000 RPM, kW/bhp-----	40,2/54,7 Intermittent rating at flywheel
Output Reference-----	ISO 3046
Fuel Oil Consumption, l/h-----	11,45
Max.lub. Oil Consumption,l/24h--	2.06
Air Consumption, l/sec-----	57
Idling Speed-----	900 r/min
Minimum full load Speed-----	1500 r/min
Fuel Pump maximum Lift-----	3.05 m
Fuel Pump maximum Head-----	0.6 m
Max. Exhaust Temp. EC-----	-480°C after Turbocharger
" " " EC-----	-580°C before Turbocharger
Boost Pressure-----	0.8 bar (max)
Max. Intake Restriction-----	254 mm H ₂ O
Max. Exhaust Backpressure-----	510 mm H ₂ O
Engine Total Length, mm-----	950
Width, mm-----	565
Height, mm-----	605
Weight kg-----	230
Max. Inclination-----	20° Astern/Ahead/Lateral Running

FUEL SYSTEM

Fuel Pump Timing.....18E BTDC
 Injector Settings.....New:/Used 240 bars
 Fuel Specification.....Gas oil conforming BS2869:1970
 Class A1 or A2 or to USA Specification
 ASTM D-975-77 Grades No. 1-D and 2-D

If the engine has to work in areas with extremely low ambient temperatures, use fuel with good clog characteristic. Clog point (CFPP) -25E C

EXCESS FUEL DEVICE.

This device is fitted as standard, being automatically selected when the engine is intentionally stopped. Should the engine run out of fuel and stop, the device will not select excess fuel until the engine mounted stop lever is moved to the stop position by pressing the stop button and releasing it.

The engine will automatically disengage the excess fuel position when the engine runs up to speed.

LUBRICATION SYSTEM

Lub. Oil Pressure.....Min. 1.0 bar at idle. Min. 2,5 bar at
 3000 rpm (Turbo idle min. = 0,7 bar)
 Oil Sump Capacity.....L2.093: 3,2 litres
 L3.139: 3,8 "
 L4.186: 6,0 "
 L4T.186:6,5 "

Gearbox Sump Capacity....Hurth HBW100: 0,36 litres,
 Hurth HBW125: 0,56 "
 Hurth HBW250: 0,75 "

The oil level marks on the dipstick are correct only for engines in horizontal position. Check the oil level after installation and readjust the marks if necessary.

COOLING SYSTEM

Cooling System Capacity (With Keel Cooler)
 L2.093LB:.....
 L3.139LB:.....4,6 litres
 L4.186LB(L4T.186LB):.....8,0 litres

Water Temperature.....75-80E C.

An anti-freeze concentration of 40 % should be used as an all year round coolant. This concentration will give low temperature protection down to -25°C.

Additionally, a 40% concentration will protect the cooling system from corrosion.

WARNING: Anti-freeze contains Monoethylene Glycol and other constituents which are toxic if taken internally, and can be absorbed in toxic amounts under prolonged skin contact. If clothing is splashed with anti-freeze, it should be washed before being worn again. If anti-freeze is swallowed accidentally, medical advice should be sought immediately.

ELECTRIC SYSTEM

Voltage.....12 V insulated return
 Starter Motor.....1,7 kW
 Alternator Variant 1.....55 A, Lucas, Radio Suppressed
 Engine Block Heater.....42 V, 300 W, if fitted
 Inlet Manifold Heater Plug....345 W. (L4 & L4T = x2)

ENGINE BLOCK HEATER

The engine shall start easily at -25°C , and an engine block heater is part of the equipment. The engine heater should always be energised in environments where the temperature is -15°C or lower.

The engine heater is 300 W and the voltage is 42 V.

An externally mounted thermostat controls the heater element and is preset to open the electric circuit below 0°C and close above $+13^{\circ}\text{C}$ ambient temperature.

If the engine is built in compliance with SOLAS 1998 Chapter III Regulations, the minimum cold start requirement is -15°C . For those engines, engine block heater does not belong to standard equipment, but may be fitted.

GEARBOX

Engine model	L2/L3-LB	L3.139LB	L4.186LB	L4T.186LB
Hurth Gearbox type	ZF10	ZF12M	ZF25M	ZF25M
Gearbox Ratio forward/reverse	2,72/1,86 1,79/1,86	2,63/1,95 2,14/1,95	2,63/1,95 2,63/1,95	1,88/2,10 2,74/2,72

Gearbox Ratio forward/reverse for Hurth HBW 250-3: 2,74/2,72
 Gearbox Ratio forward/reverse for Hurth HBW 250-2: 1,88/2,10

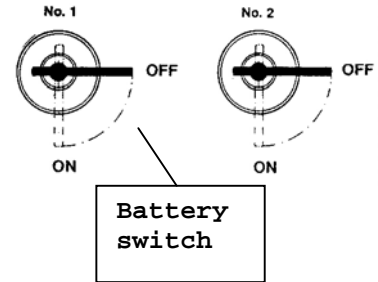
Rotation of Propeller....Right (RH)

OPERATION INSTRUCTIONS

(This is an example on a std operational instruction.)

BEFORE STARTING:

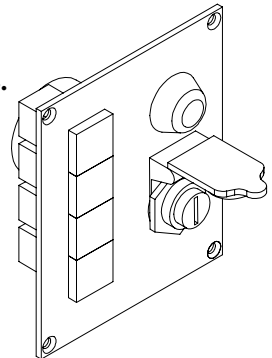
1. TURN BATTERY SWITCH NO. 1 TO POSITION "ON".
2. MOVE THE SPEED CONTROL LEVER TO MAX.SPEED POSITION WITH GEARBOX DISENGAGED.



STARTING:

1. TURN STARTER SWITCH TO "IGNITION" POSITION.
2. CONTINUE TO "HEATING" POSITION. KEEP SWITCH IN "HEATING" POSITION FOR 10-20 SECONDS, DEPENDING ON AMBIENT TEMPERATURE.
3. PRESS INN THE KEY AND TURN THE SWITCH TO "START" POSITION. WHEN ENGINE HAS STARTED, MOVE THE SWITCH BACK TO "IGNITION" POSITION. WARNING LAMPS SHOULD NOW BE OFF.

IF THE BATTERY IS IN POOR CONDITION, TURN THE BATTERY SWITCH FROM BATTERY NO 1 TO BATTERY NO 2 AND REPEAT THE STARTING PROCEDURE.

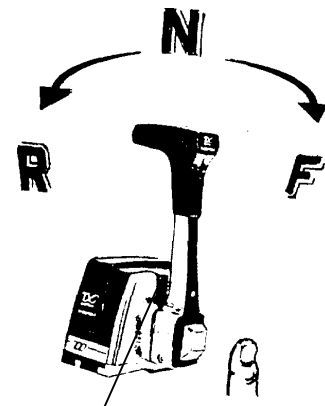


OPERATION:

ENGAGE THE GEARBOX BY PUSHING THE SPEED CONTROL LEVER TO FORWARD OR BACKWARD POSITION. FULL ENGINE SPEED IS 3000 RPM .

STOP:

1. MOVE THE CONTROL LEVER TO NEUTRAL POSITION.
2. STOP THE ENGINE BY TURNING THE STARTER SWITCH TO "STOP" POSITION. THEN MOVE THE SWITCH TO "0" POSITION.
3. TURN THE BATTERY SWITCH TO "OFF" POSITION.



FUSES

STOP CONTROL AND INSTRUMENT PANEL ARE PROTECTED BY AUTOMATIC FUSES. IF THE ENGINE FAILS TO BE STOPPED OR THE CHARGE LIGHT DOES NOT LIGHT WHEN THE BATTERY SWITCH IS "ON", OPEN THE ENGINE ROOM COVER AND READ THE INSTRUCTION ON THE RELAY BOX.

NOTE. WHEN THE BOAT IS BEING TOWED, THE GEARBOX SHOULD BE DISENGAGED

STARTING PRECAUTIONS

Starting any engine can be dangerous in the hands of inexperienced people. Before attempting to start any engine, the operator should be fully conversant with starting procedure and controls.

- Ensure that the batteries are in serviceable condition and correctly connected.
- Check that the oil levels in the engine and the gearbox are correct.
- Check that the fuel tank is full and that the system is primed.
- Check that all water drain plugs and cocks are closed. Check that water inlet valves, if fitted, are opened.
- Check that the water level in the header tank is filled up with mixture of water/anti-freeze (40%).
Under no circumstances must the engine be started without liquid in the cooling system.
- Ensure that the gearbox is in neutral.

CHECKS BEFORE STARTING

- Oil level in engine and gearbox.
- Coolant level in header tank.
- Battery main switch is ON. The charge control and oil pressure lights will now be on and the buzzer will sound.

STARTING

1. Before attempting to start the engine, the operator should be familiar with the safety precautions as described earlier.
2. Move the speed/gearbox lever into max.speed position by means of the control lever, with gearbox disengaged.
3. Dependent on temperature, turn the starter switch into the preheat position (position 1) and hold it for 10-20 seconds. Then turn the switch further into position 2 to energise the starter. Release immediately the engine starts, and it will return to position 0. The alarm light as well as the charging light should now be off.
4. If the engine should fail to start, due to poor battery condition, turn the battery switch to the second start battery and repeat the starting procedure.
If the engine fails to start within 15 seconds, despite good battery condition, release the switch and investigate the cause (see **FAULT FINDING**). The starter motor should be allowed to cool for at least 15 seconds before attempting to restart.
5. In very cold weather (below appr. - 10°C), it could be necessary to increase the glowing time to appr. 30 seconds and run the starter motor for up to 1 minute.

STARTING WITH EMERGENCY EL-STARTER

(If fitted)

Engine with twin electric starting system.

Some users require twin electric starting system.

The second starting system, with its own battery, is totally separated from the main starting system.

The second starter is located in the rear end of the flywheel housing.

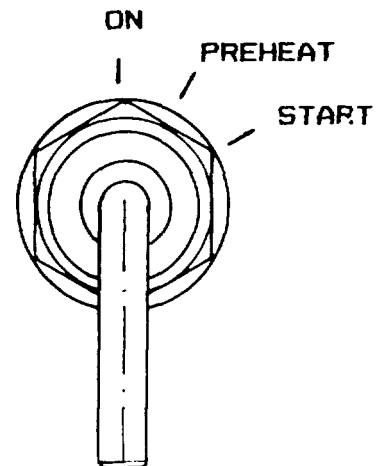
The starter panel is mounted in front and on port side of the engine.

EMERGENCY STARTING.

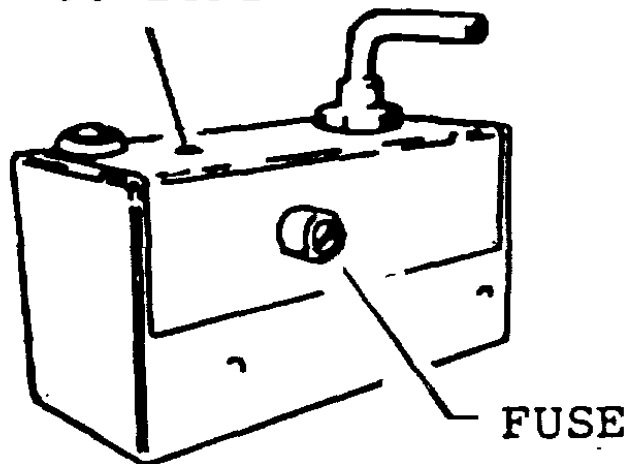
If the main starting system fails to work, open the engine room cover and read the starting instruction on the engine mounted emergency starter switch panel.

EMERGENCY STARTING INSTRUCTIONS.

1. PUT EMERGENCY BATTERY SWITCH ON.
(LOCATED ON BATTERY SWITCHBOARD)
2. MOVE STARTER SWITCH TO PREHEAT POSITION AND HOLD IT THERE FOR 10-20 SECONDS.
3. MOVE THE SWITCH TO START POSITION AND RELEASE WHEN ENGINE STARTS.



INSTRUCTIONS



STARTING WITH SPRING STARTER

(If fitted)

The spring loading is fully energised by twelve revolutions of the winding handle. When restarting a hot engine, the starter need only be partly energised.

When required, the starter can be unwound without discharging the stored-up energy into the engine flywheel.

SEQUENCE OF OPERATIONS TO START ENGINE WITH SPRING STARTER:

1. Press reset button.
2. Fit winding handle, turn about twelve revolutions, when fully energised a red indication appears in the inspection window. Remove winding handle.
3. Ensure that the stop control lever has been moved fully clockwise until it is against the stop screw which also is the start position.
3. Operate the trip lever.

At low temperature it may be necessary to ease the starting by means of Start Gas (Ether).

Pump 2-3 shots Start Gas before operating the trip lever. At very low temperature it may be necessary to give some extra shots even after ignition to boost the process.

CAUTION!**NEVER OPERATE GLOW PLUG WHEN USING ETHER PUMP*****OPERATION***

If one or more alarm lamps do not go out, or lights up when the engine runs, the engine should be stopped at once to trace the reason.

When all functions are normal, engage the gearbox by pushing the control lever forward or backward.

Increase the speed gradually if possible, allowing the engine to warm up, before going full speed.

In case of emergency, the lever can be moved into full speed position immediately.

STOP

Move control lever into neutral position.

Allow the engine to idle for apprx. 2 minutes to cool.

Stop the engine by pressing the stop button.

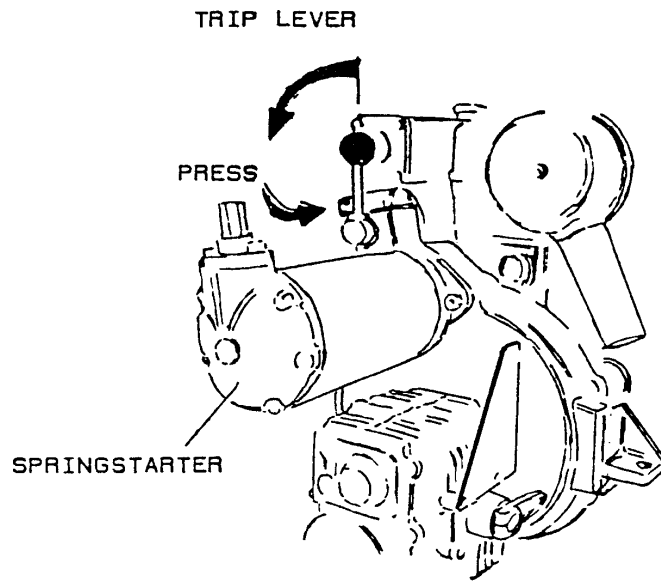
Switch off the battery main switch.

If the engine should fail to stop when pressing the stop button, the reason may be that the electric circuit has been overloaded and the automatic fuse has blown.

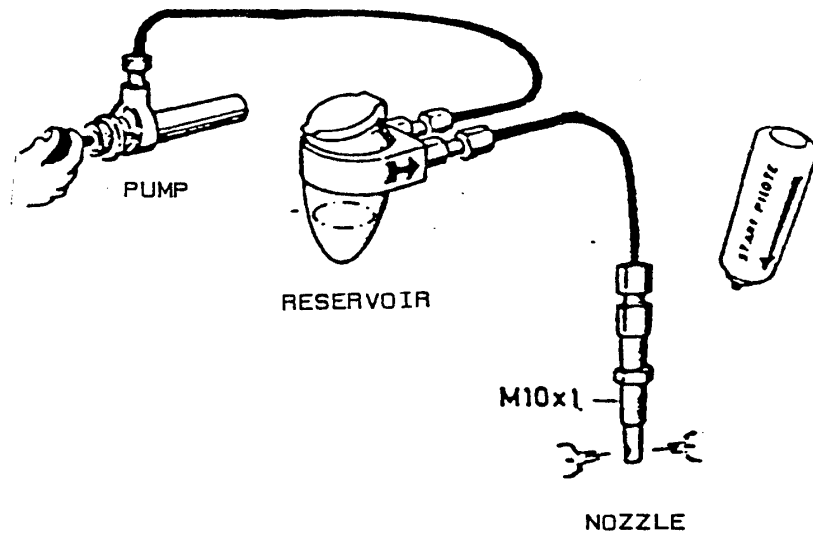
Restore the circuit by pressing the fuse button.

The fuse is shown as item no. 64 on the wiring diagram and is located in the separate relay box.

SPRING STARTER



CAUTION ! NEVER OPERATE GLOW PLUG WHEN USING ETHER PUMP



ROUTINE MAINTENANCE

The engine has passed the Life Boat Engine Test Programme before delivery. Still however the engine is not completely run in. It is recommended to operate the engine moderately during the first hours after it has been put into service. Full speed only for short periods during the first 15-20 hours.

INITIAL ATTENTION.

(AFTER THE FIRST 15 HOURS OF OPERATION)

- Check and tighten all hose clamps and unions, paying particular attention to the fuel system.
- Check and tighten all external nuts and bolts, particularly mounting bolts, shaft coupling bolts and exhaust manifold bolts and nuts.
- Check belt tension, see **ALTERNATOR BELT TENSION.**
- Check lubrication oil and coolant level

ROUTINE MAINTENANCE PERIODS

PERIOD	ATTENTION
After the First 15 Hours or after the First 3 Months	See INITIAL ATTENTION
Before Start or Weekly	Check engine oil level. Check coolant level. Check fuel level in tank. Drain water and contaminants from water separator. Grease stern gland.
Every 3 months or 25 hours	Check gearbox oil level. Check battery condition.
Every year or 200 hours	Change engine oil and filter element. Change gearbox oil. Grease remote control parts. Change fuel oil filter. Check belt tension. Check block heater and manifold heater plug. Check electrical connections for tightness and corrosion. Tighten nuts, bolts unions and hose clamps.

LUBRICATION OIL SPECIFICATION

Temp. on Starting	°C	°F	Monograde	Multigrade
Below	-15	5	5W	5W/20W
Between and	-15 4	5 39	10W	10W/20W
Between and	4 30	39 86	20/20W 10W/30W	15W/40W
Above	30	86	30W	15W/40W 20W/40W

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

The engines must be run on heavy duty lubricating oils, meeting the requirements of API CC, DEF2101D, MIL-L-2104B or MIL-L-46152A/B. Straight mineral oils are not suitable, neither are oils of less detergency than specified.

API CD, Series 3, or MIL-L-2104C/D oils can inhibit the running-in process in new or reconditioned engine is recommended for engines running at high load factor, such as the L4T, particularly in conjunction with high ambient temperatures.

GEARBOX OIL SPECIFICATION

Automatic Transmission Fluid ATF: Must be used, see the operators manuals for the recommended types

STERNLAND AND REMOTE CONTROL GREASE

Following types of universal grease may be used:

BP Energrease LS-EP
 Norol Universalfett EP2
 Castrol Spheerol AP2
 Chevron Dura-Lith Grease No. 2
 Esso MP Grease Beacon EP2

Fina Marson EPL
 Gulfpride SF
 Mobilux 2 or Mobilplex 47
 Shell Alvania Grease EP2
 Texaco Multifak EP2

REPLACING AN INJECTOR

1. Pull off the injector leak-off pipe from the injector body stub pipe.
2. Remove the cylinder head cover nut retaining the fuel pump to injector pipe clip and release the clip.
3. Hold the fuel pump delivery valve holder (B) with a spanner and slacken the pump to injector pipe nuts.
4. Slacken the injector clamp bolt.
5. Remove the pump to injector pipe.
6. Remove the injector clamp and lift out the injector.
7. Remove the injector sealing washer from the cylinder head taking care not to damage the seating area.
8. Ensure the seating in the cylinder head is clean and smooth.
9. Lightly smear a very small amount of high melting point grease to one side of a new injector sealing washer and place it over the injector nozzle, greased side first.
10. Replace the injector and clamp. Hand tighten the clamp bolt.
11. Replace the pump to injector pipe hand tightening the nuts.
12. Fit new rubber 'O'rings into the recesses on the cylinder head cover.
13. Replace the pipe clip and torque the nut to 9,0 Nm (6,5 lbf ft).
14. Torque the injector clamp bolt to 21,0 Nm (15,5 lbf ft).
15. Hold the fuel pump delivery valve holder with a spanner and torque the fuel pipe nuts to 29,0 Nm (21,0 lbf ft).
16. Replace the injector leak-off pipe.
17. Fuel injector setting: 240 bar.

SPANNER TORQUE SETTINGS

DESCRIPTION	Nm	lbf ft
Crankcase Door Bolt (see D in Fig.7) End Cover Nut (see E in Fig. 8) Fuel Filter Bracket Screw Manifold Bolts Rocker Cover Nut	8,8	6,5
Fuel lift pump Injector Clamp Nut Alternator Bolt Water Pump Bolt	21,0	15,5
Injector Pipe Nuts	28,5	21,0
Fuel Pump Clamp	33,9	25,0
Starter Motor Screw	40,7	30,0
Fuel Pump Delivery Valve Holder	47,5	35,0
Flywheel Bolt	67,8	50,0
Flywheel Housing Screw	78,6	58,0
Injector Nozzle Nut	81,3	60,0
Cylinder Head Nut (see C Fig.6)	88,1	65,0
Crankshaft Pulley (left hand thread)	300,0	221,0
Prop.Shaft Coupling Bolts (acid proof)	86,3	63,0
Crankshaft Main Bearing	21,0	15,5
Conn. Rod Big End Bearing	24,5	18,1

TIGHTENING SEQUENCES FOR CYLINDER HEAD BOLTS, CRANKCASE DOOR BOLTS AND END COVER NUTS.

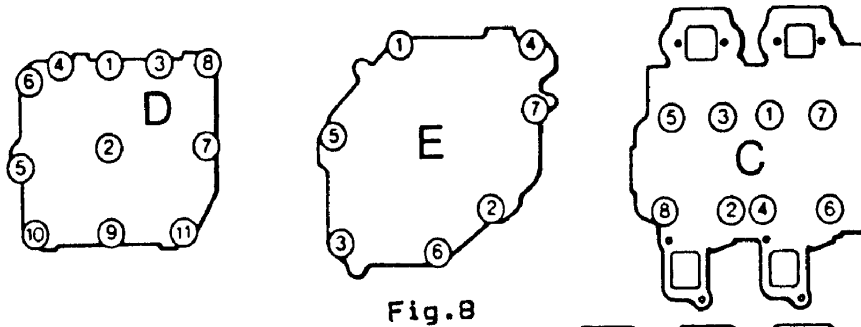


Fig. 8

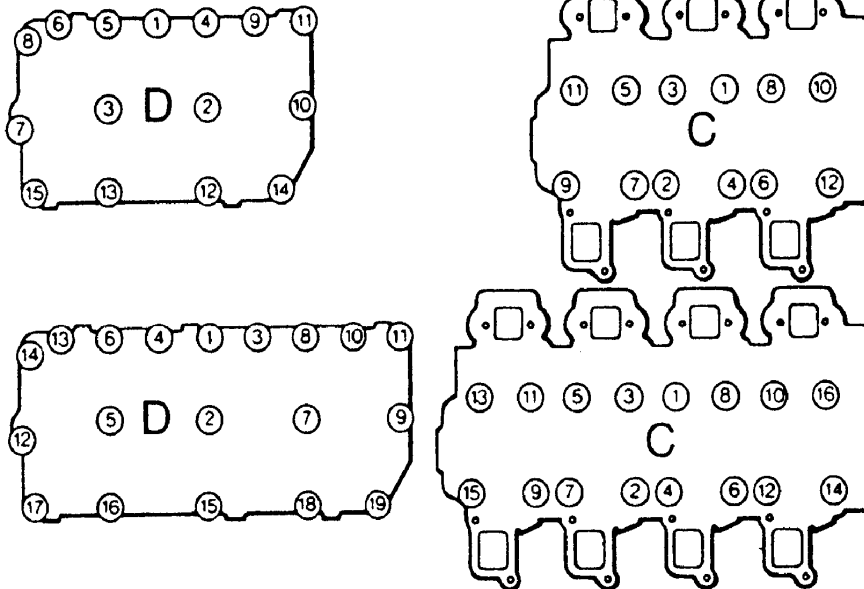


Fig. 7

Fig. 6

CHECK OF LUBRICATION OIL LEVEL

The lubrication oil level should always be checked before starting.

The level should never be allowed to fall below lower mark. Note that the marks indicate correct level when the engine has appr. horizontal position. The marks should be corrected according to installation angle.

Regarding "Free Fall Lifeboats, see separate poster on free fall lifeboats.

LUBRICATION OIL CHANGE

The oil change should be done when the engine is warm. Remove the oil filler cap, see Fig. 1, position 15, and pump up the oil by means of the sump oil drain pump. Remove the crankcase ventilation hose and undo the filler plug (which also contains the capsized valve) on the top of the valve cover. Use a spanner on the square headed valve nipple. See Fig. 2, position 15. Fill up new oil through oil filler cap in valve cover. If the filler hole, position 15, is accessible, the filling may be done there. Run the engine after oil and filter change and check for any leaks from oil filter. Stop the engine, allow the oil to settle and top up if necessary.

CHANGE OF OIL FILTER ELEMENT

Use a suitable strap wrench, unscrew and remove filter canister. Thoroughly clean the crankcase oil filter housing face. Apply a thin film of clean oil to the oil filter sealing gasket. Screw on the new oil filter canister until the sealing gasket abuts the filter head and tighten a further half turn.

GEARBOX OIL CHECK AND CHANGE.

Unscrew the dipstick 23, see Fig.2, from the gearbox. Check the oil level by reinserting through hole. Fill up if the oil level is below the mark. Drain the oil through bottom drain plug or through the dipstick hole with a drain pump. Refill new ATF oil to correct level.

CHANGING FUEL OIL FILTER

If the fuel oil tank is installed at a level above the engine, the cock must be closed before fuel filter change. The filter is shown on Fig. 2, position 22. Unscrew the filter container and discard the filter element. Ensure that the rubber gaskets and the spring are correctly fitted before the filter container is reinstalled after filter change.

Prime the fuel system after filter change, see following chapter.

WATER SEPARATOR

A water separator/fuel filter is mounted between the fuel lift pump and the engine.

Drain the separator by loosening the bottom tap.

PRIMING THE FUEL SYSTEM

The fuel system has to be primed before initial starting, after fuel filter change, if the fuel system has been disconnected, or if the engine has run out of fuel and stops.

Start the priming at the water separator.

1. Loosen the vent plug on top of the separator and let the fuel flow until no air is left.
Re-tighten the vent plug.
2. Release the bleed screws at the fuel oil filter. Start at the inlet side and proceed at the outlet side.
Pump with the fuel lift pump lever until no further air bubbles are left in the fuel oil. Tighten priming screws.
3. The fuel return line from the fuel oil filter is connected to the nozzle leak off lines and is led back to the fuel tank.
Continue pumping for 5-6 strokes to prime the fuel injection pump supply.

NOTE. It is of the greatest importance for trouble-free performance that no air has access to the fuel system. Make therefore sure that all connections, particularly on the suction side, are properly tightened.

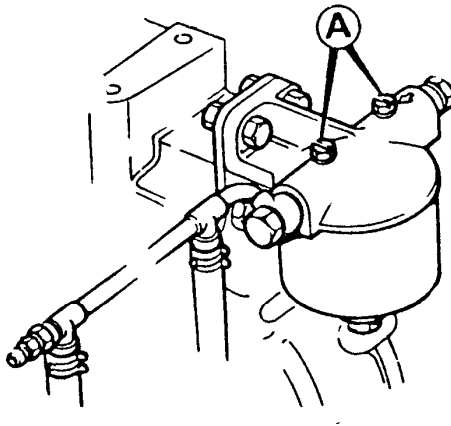


Fig.9

COOLANT LEVEL CHECK

The engine should be allowed to cool down for some time before coolant level check.

Be careful when removing the coolant filler cap when the engine is warm.

Use a rag to protect against scalding.

If necessary, fill up with clean fresh water/anti freeze mixture. If the engine has extra header tank, the coolant level is always checked in the upper tank.

TO DRAIN THE COOLANT.

Remove the filler cap on header tank.

Drain the coolant through tap or plug hole in front of the crankcase, see Fig.10.

Close the tap securely after draining.

Refill the system with correct water/anti freeze mixture.

Let the engine idle for 20-30 minutes with the filler cap off and top up.

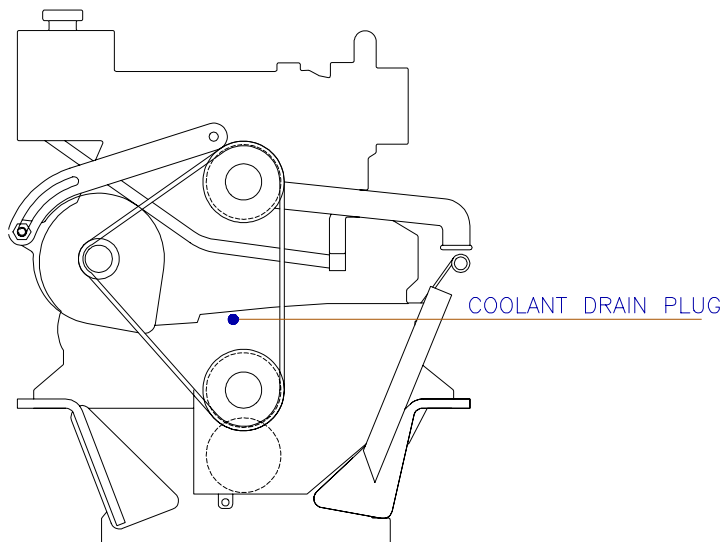


FIG.10

CHECK OR REPLACE THERMOSTAT

The Thermostat Housing is shown on Fig. 1, position 19.

Loosen the rubber bend between the thermostat housing and the water cooled exhaust manifold (or header tank on L4.139 LB) Unscrew the thermostat housing bolts and remove the housing with thermostat.

To check the thermostat function, put it into hot water. The thermostat is set to open at 74EC. It should close again when put into cold water.

If the thermostat is defect, it must be replaced.

The gasket should also be replaced before assembling the thermostat housing.

Ensure that all hose clamps are properly fixed and drain tap closed, before refilling with water/anti-freeze mixture.

IDLING SPEED ADJUSTMENT

Start the engine and run until normal operating temperature is reached.

Correct idling speed is 950-1000 RPM and is factory set before despatch. Adjustment should only be carried out after consulting SABB MOTOR A.S

The idling speed is adjusted with the adjusting screw "A". see Fig. 11.

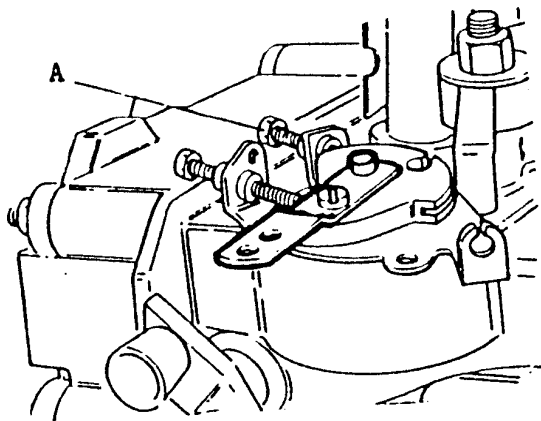


Fig 11

Fig.11

VALVE CLEARANCE ADJUSTMENT

The engine is fitted with hydraulic tappets and therefore no adjustment is necessary or possible.

NOTE.

If the cylinder head and the valve gear for any reason have been removed, the assembling sequence must be according to the Service Manual which may be obtained from the factory.

ALTERNATOR BELT TENSION.

It is important that the belt tension is checked after an overhaul or when new belt is fitted.

New belt tension:

A force of 3-3,5 kg to deflect belt 3,5 mm

Checking and adjustment at service intervals:

A force of 2,2-2,4 kg to deflect belt 3,5 mm

CHECK AND CHANGE OF ENGINE HEATER

The engine heater is shown on Fig.1, position 4. (3-cyl. engine).

If the heater is being continuously used, the heater element is subject to burning and should be checked yearly or if the heating does not work.

- Drain the coolant through the drain plug.
- Disconnect the leads and unscrew the heater, using a 26 mm wrench.
- If the inner reducer should loosen, reglue with epoxy glue or Loctite.
- If the element is badly burnt or corroded, replace it by a new one.
- If the new heater element does not work, check the thermostat and replace if defective. See wiring diagram inside the thermostat box, Fig. 12.

Note: The engine heater should not be tested in open air as it will be overheated and damaged.

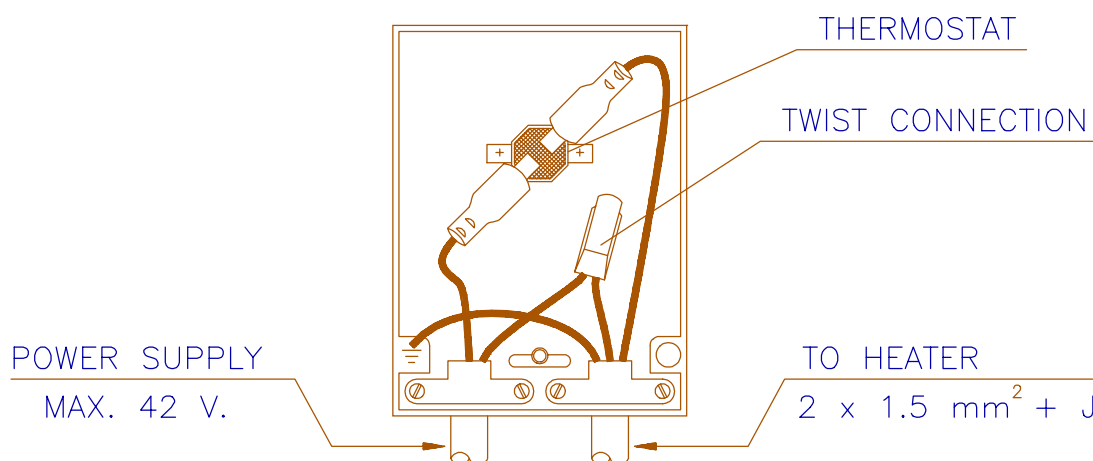


FIG. 12

CHECK OF BATTERY

The condition of the battery should be checked every third month. The specific gravity of a fully charged battery depends on the ambient temperature.

The table below indicates the relationship between the specific gravity and the temperature.

Temperature	Spec.Gravity	Temperature	Spec. Gravity
0° C	1,287	-10° C	1,259
10° "	1,280	-20° "	1,248
20° "	1,273	-30° "	1,241
25° "	1,270		
30° "	1,267		
35° "	1,263		

The specific gravity of the electrolyte increases/decreases by 0,0007 every 1 degree above/below 25°C.

The electrolyte level should be 6-9 mm above the separators. Top up with distilled water if necessary.

NOTE: In cold weather distilled water should be added only before charging the battery. Keep the battery terminals clean and coat with petroleum jelly.

If the battery is of the maintenance free type without filler plugs, the condition may be checked by means of an accurate digital voltmeter.

The battery should be allowed to stabilise for 6-8 hours with the leads disconnected before measuring the voltage.

The average specific gravity can be calculated according to following formula:

$$\text{SPECIFIC GRAVITY} = \frac{\text{MEASURED VOLTAGE}}{\text{NUMBER OF CELLS}} - 0,84$$

Example:

Measured voltage: 12.65 V

Number of cells : 6

$$\text{Specific gravity} = \frac{12,65}{6} - 0,84 = 1,27$$

CAUTION

The electrolyte is sulphuric acid and should be handled with great care. Always wear goggles when servicing the battery. If battery acid accidentally is splashed in the eyes, wash with clean water and obtain qualified medical assistance immediately.

STARTING AND RUNNING THE ENGINE WHILE THE LIFEBOAT IS HOOKED IN DAVIS OR IN FREE FALL RIG.

The engine should be started and run once a week and after any kind of maintenance work.

The running should be limited to 5 minutes at idle speed. The water temperature alarm should be watched.

GENERAL PRECAUTIONS REGARDING ELECTRIC SYSTEM

The following points must be strictly observed when working on the electric system, otherwise serious damage can occur.

- Never remove any electrical cable without first disconnecting the batteries.
- Never disconnect the alternator cables while the engine is running.
- Only disconnect the batteries with engine stopped and all switches in the OFF position.
- Always check that cables are connected to their correct terminals before reconnecting the batteries. A reversal of polarity or short circuit will destroy diodes and transistors in the alternator and regulator.
- Never flash any connections to check the current flow.
- Always keep the electrical connections properly tightened.

FAULT FINDING SCHEME

This section is intended as a guide only. If in difficulty consult Lister-Petter Marine or any local Lister-Petter Marine Distributor.

DIFFICULT STARTING

- a. Stop lever not in start position
- b. Unsuitable lubrication oil
- c. Incorrect fuel
- d. No fuel in tank
- e. Choked fuel filter
- f. Air lock in fuel system
- g. Discharged battery
- h. Poor battery connections
- i. Defect heater plug or engine heater (In cold weather)

EXCESSIVE CARBON DEPOSITS

- a. Choked exhaust system
- b. Unsuitable fuel oil
- c. Unsuitable lubricating oil
- d. Continuous idling

ENGINE STOPS

- a. Lack of fuel
- b. Air or water in fuel system
- c. Choked fuel filter
- d. Overload
- e. Overheating
- f. Loss of compression
- g. Lack of lubricating oil

LOSS OF POWER

- a. Loss of compression
- b. Chocked exhaust system
- c. Fuel injector dirty
- d. Choked fuel filter
- e. Worn engine

OVERHEATING

- a. Thermostat faulty
- b. Low coolant level
- c. Water pump belt too slack
- d. Overload
- e. Lubricating oil level too low
- f. Obstructed cooling water system

ENGINE FAILS TO BE STOPPED

- a. Automatic fuse is out. Press the fuse button.
- b. Stop solenoid linkage is loose.
- c. Defect stop solenoid.

DESCRIPTION OF THE ELECTRICAL OPERATED STOP/START SYSTEM.

The lever "A" has two functions:

1. To stop the engine. The engine is stopped when the lever "A" is moved fully anticlockwise until it is against the stop screw "C".
2. The lever is reset to start position (excess fuel) when it is moved fully clockwise until it is against the screw "B".

The electrical stop solenoid takes care of those two functions. When pressing the stop button on the instrument table, the stop solenoid is energised, and the lever "A" is pulled to its stop position.

As soon as the stop button is released, the return spring inside the rubber boot moves the lever back to its start position.

STOP SOLENOID DESCRIPTION.

The stop solenoid has two coils, one for pull and one for hold. When the stop button is pressed, both the pull and hold coil are energised and the plunger retracts. As soon as it "BOTTOMS", the internal switch disconnects the high current winding, and the plunger is kept retracted by the hold coil.

The stop solenoid is secured by an automatic fuse (circuit breaker), located in the relay box. If the stop function fails, the reason is likely a blown fuse. It should be reset by pressing the upper fuse button.

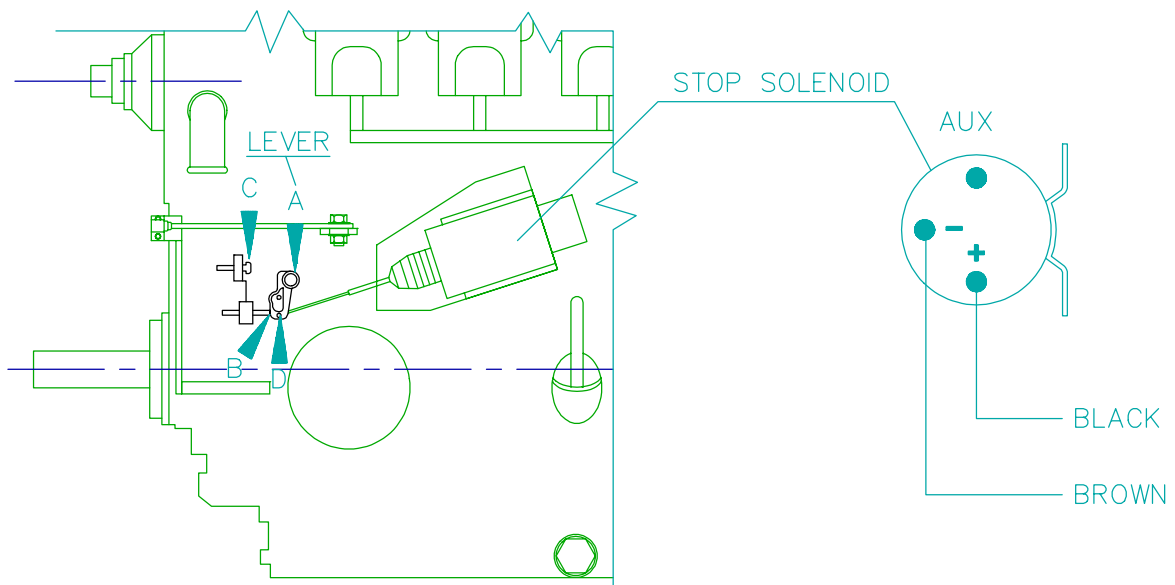


FIG. 13

FIG. 14

IMPORTANT!

If the stop solenoid for any reason has been dismantled, it should be refitted in following way:

Move the lever "A" by hand until it rests against the screw "C". Press the stop solenoid plunger fully until it "BOTTOMS". Secure the screw "D" in this position.

Check the function by pressing the stop button. It is very important that the stop solenoid plunger is completely home, otherwise the pull coil fails to be unswitched, and the fuse may blow.

If the stop solenoid fails to work, although the fuse is reset, the reason may be loose or defect wire connections or a faulty internal switch in stop solenoid.

Check the connections. If the connections are in good order, the internal switch may be sticking or corroded.

It may be a good remedy to remove the stop solenoid plunger and spray some contact cleaner (f.inst. crc 2-26) against the bottom. The nylon switch pin should be loose in its bore.

If the stop solenoid still does not work, try to interconnect the + terminal and the aux. terminal by means of a piece of wire. See fig. 14. When doing so, the pull coil is always energised as long as the stop button is pressed. If the stop button is pressed for more than 4 seconds, the fuse may blow, but usually 4 seconds should be adequate to stop the engine.

If the fuse should blow , the stop solenoid should be allowed to cool down for some time before resetting the fuse.

If everything fails, the engine is stopped manually by moving the lever "A" fully anticlockwise until the engine stops, and so fully clockwise again to reset in start position.

A new stop solenoid should be ordered for replacement.

ORDERING SPARE PARTS

For ordering spare parts, see the separate SPARE PARTS CATALOGUE for correct part name and part number.

When ordering, always state full details:

1. Engine type and Serial no. (Identification plate, Fig. 15)
2. Part name and part No. (See page No. 5 and 6)
3. Quantity
4. Full address, name of ship, port of call, marking and forwarding instructions (air freight, air mail, by ship, by mail).

SABB MOTOR A.S BERGEN NORWAY		
TYPE	SERIE NR.	HK/TURT.
L3.139LB	6 NO	29/3000
TYPE	SERIAL NO.	HP/RPM

FIG. 15