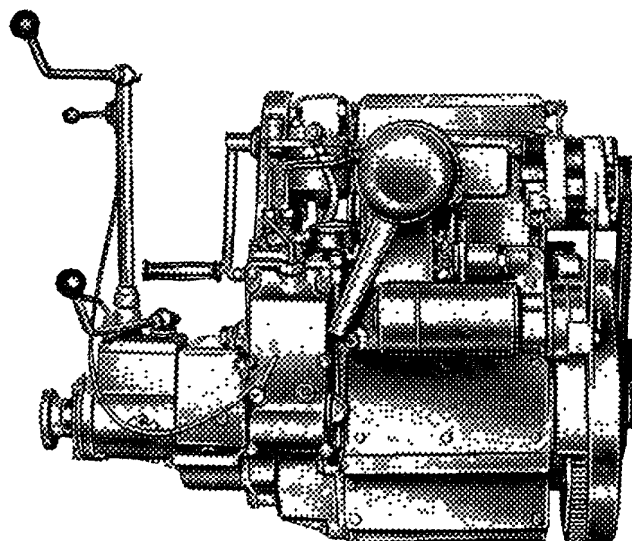


SABB DIESEL

Type 2H

Instruction Book



SABB MOTOR A.S

Telephone: (05) *26 05 04 — Telegram: "Sabbmotor" — Telex: 42559 Sabb n

BOX 2728 — 5010 BERGEN — NORWAY

INTRODUCTION

Before taking into service your new **SABB DIESEL**, we advise you to read through the main points in this manual. Most important are:

BEFORE STARTING — STARTING — RUNNING-IN

The manufacturer's engine guarantee is effective on the condition that the engine has been correctly installed and is operated and serviced according to the directions in this manual.

We constantly strive to improve and enlarge our service department which is at our customer's disposition. For any queries, need of service or spare parts contact your nearest **SABB DIESEL** representative or the factory in Bergen.

With all correspondence quote the type of engine and the serial number.

August 1977

SABB MOTOR A·S

ENGINE SERIAL NO.

Dimensions and specifications subject to alteration without notice.

INSTRUCTION BOOK

FOR SABB MARINE DIESEL ENGINE

MODEL 2H:

Engine with controllable pitch propeller

MODEL 2HG:

Engine with reverse gear and solid propeller

MODEL 2HSP

Engine with fully feathering propeller

SABB MOTOR A·S

BOX 2728 — 5010 BERGEN — NORWAY

Telegram: Sabbmotor — Telephone: (05) 26 05 04 — Telex: 42559 sabb n

CONTENTS

	Page
Engine Specification	3
Rules for Starting	6
Operation	8
Running-in a new Engine	10
Electrical Equipment	11
Instrument Connections	13
MAINTENANCE SCHEDULE	14
Lubricating Oil System, Checking Oil	15
Changing Lub. Oil, Engine, Gearbox	17
Changing Oil Filter	19
Greasing	19
Fuel Oil. Changing Fuel Oil Filter	24
Bleeding Fuel System	25
Cleaning Injector Nozzles	26
Cooling Water. Draining	28
Fresh Water Cooling	29
Adjustments (see Maintenance Schedule)	37
Engine Checks (see Maintenance Schedule)	41
Winter Laying Up	48
Checking the Alignment	49
Irregular Engine Operation. Faults Location Chart	50
SABB SERVICE	
Main SABB Importers and Service Stations	53

**SPECIFICATION:
2-cyl., water cooled, 4-stroke diesel engine.**

Cyl.bore/stroke	90 x 90 mm	3.54 x 3.54 in.
Cubic capacity	1140 cm ³	69.6 cu.in.
Compression ratio	22:1	
Compression pressure	30 kp/cm ²	426,7 p.s.i.
Continuous rating at 2000rpm	16 HP (DIN B)	(11,7 kW/33 r/s)
Continuous rating at 2250 rpm	18 HP (DIN B)	(13,2 kW/37 r/s)
Brake mean effective pressure	6.3 kp/cm ²	89,6 p.s.i.
Fuel consumption 210 g/hph (18 HP)	4.7 liters/h	
Lub.oil. consumption 1.5—2 g/hph (18 HP)	0.035—0.045 l/h	
Lub.oil pressure	1.5—2.5 kp/cm ²	
Reduction ratio	2:1	
Propeller torque	11.5 kpm	83 ft.lb.
Rotation	Left	
Propeller dia x pitch (2 HG)	16'' x 14''	
Weight of engine, less stern gear	190 kg	419 lbs.
Max. installation angle, under power	15 degrees	
Valve stem clearance, ex and air (cold)	0.3 mm	.012 in.
Piston top clearance, incl. gasket	1.0-1.25 mm	
Injection pressure (opening press.)	100 kp/cm ²	
Injection commences (against atm. press.)	15 degrees BTDC	
Inj.pump element, dia.....	6.5 mm	
Exh. valve opens, before B.D.C.	50 degrees	
Exh. valve closes, after T.D.C.	15 degrees	
Inl. valve opens, before T.D.C.	15 degrees	
Inl. valve closes after B.D.C.	50 degrees	

Lubricating oil capacities:

Crankcase sump (incl. 0.5 l in filter)	4.5 liters
Clutch housing, 2H—2HSP	0.5 liters
Reverse gearbox, 2HG	0.5 liters

Lubricating oil grade (single grade):

Winter	SAE 10
Summer	SAE 20
Reverse gearbox or clutch housing	SAE 20

Capacity of cooling water:

Fresh water (closed) cooling system with keel cooler	5 liters	8.8 pints
---	----------	-----------

Bolts and nuts torques:

Cylinder head nuts	11 kpm	79 ft.lbs
Crankcase-cyl.block studs (fit in crankcase)	12 kpm	87 ft.lbs
Rocker arm bolts	8 kpm	58 ft.lbs
Big end bearing. Tensilock M12	12 kpm	87 ft.lbs
Big end bearing. Tensilock M14 (before 1972)...	17 kpm	123 ft.lbs
Flywheel bolts. Tensilock M14	17 kpm	123 ft.lbs
Found.iron bolts (fit in crankcase)		
Tensilock M12	12 kpm	87 ft.lbs
Propeller boss bolts. M10 hex.socket	5—5.5 kpm	38 ft.lbs
Propeller boss bolts. ½”W. bronze	2—3 kpm	16 ft.lbs
Fresh water tank nuts	4,5 kpm	32 ft.lbs

Remaining bolts and nuts:

M8 (5/16 UNC)	2—2.4 kpm	14—17 ft.lbs
M10 (3/8 UNC)	4—4.2 kpm	29—30 ft.lbs

SABB DIESEL MODEL 2 H

1. Clutch lever
2. Pitch control lever
3. Governor (speed) control lever
4. Dipstick
5. Lub.oil pressure gauge (connection)
6. Fuel filter
7. Inlet muffler
8. Rocker cover
9. Injection pipe (fore)
10. Alternator
11. V-belt, alternator
12. Clutch housing cover
13. Adj. screw max. propeller pitch
14. Injection pump
15. Governor cover
16. Crankcase cover
17. Selfstarter
18. Foundation iron
19. Starting cigarette socket
20. Decompressor
21. Exhaust silencer
22. Exhaust flange, 1½" B.S.P.
23. Wet exhaust pipe
24. Fuel leak-off pipe
25. Starting bracket
26. Starting handle
27. Prop.pitch hand screw
28. V-belt, bilge pump
29. Bilge pump
30. Drain cock, bilge pump
31. Lub.oil filter
32. Fuel lift pump
33. Water valve housing
34. Drain cocks, engine & water pump
35. Clutch housing
36. Grease nipples

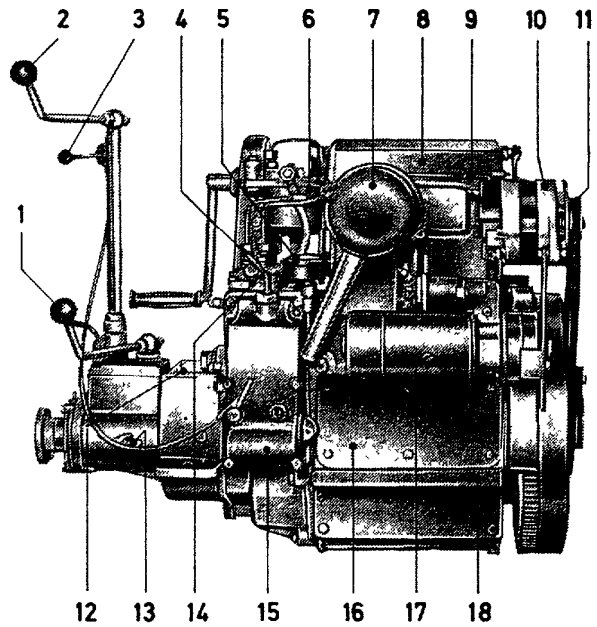


Fig. 1

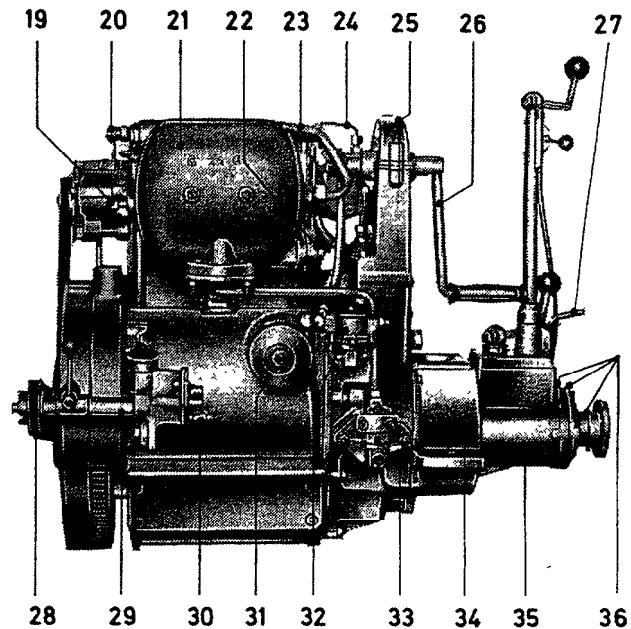


Fig. 2

RULES FOR STARTING

Before starting first time:

1. Fuel tank filled up, fuel tank cock open. See page 24
2. Fuel system bled, all connections tight, see bleeding page 25
3. Lubricating oil in engine and clutch or reverse gearbox. Page 17—18
4. Sea cock open, pump drain cocks (2 in No) closed.
Impeller pump cover tight (if fitted, page 35)..... 28
5. Fresh water cooled engines:
System filled with fresh water or water/antifreeze mixture. See page 29
6. Electrical equipment:
Correctly connected.
Exercise particular care with alternating current installations. See page 11

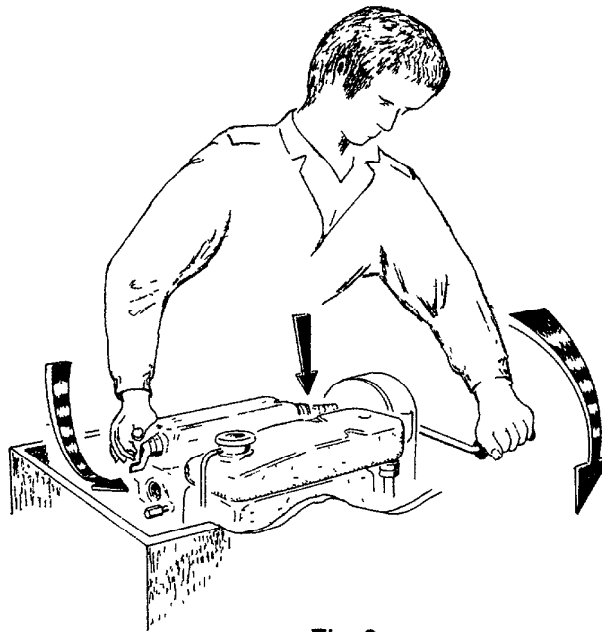


Fig. 3

STARTING:

Hand Starting:

1. Ensure that alternator and regulator are connected to the battery.
2. Propeller disengaged (gearbox or clutch in neutral).
3. Set governor control handle (2) to full speed position (down). Turn decompressor lever (3) downwards and set decompressor arm (4) so that it engages with the threads on the starting spindle.
4. For cold weather starting. See cigarette starting, page . . .
5. Stand to starboard of the engine, not behind it. (fig. 3.) The starting handle (5) is operated using the left hand, (except where there is a front starting handle). Turn the engine over rapidly until the decompressor closes and the engine starts. Remove starting handle.
6. When the engine has started and is running evenly, return the governor control handle to a position giving a suitable engine speed.
7. Check oil pressure (6) and cooling water temperature.

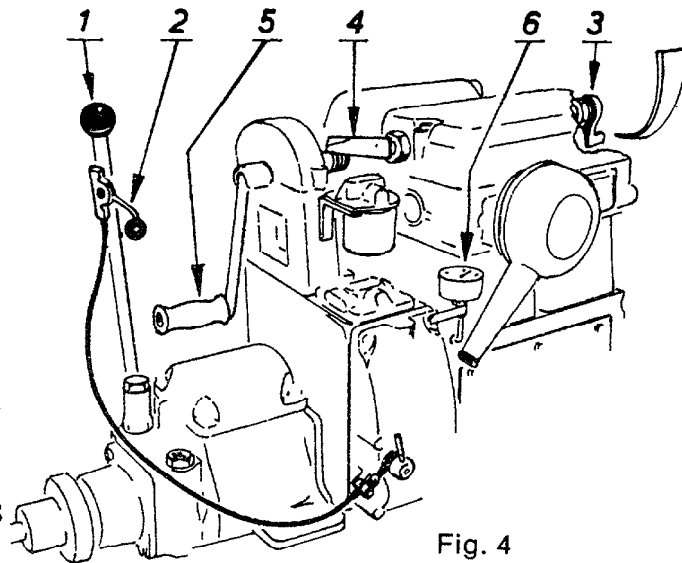


Fig. 4

Electrical starting:

If the battery is well charged, decompression is not necessary.

In cold weather, or if the battery charge is low, the starter load can be reduced by using the decompressor valve.

1. Propeller disengaged (gearbox or clutch in neutral).
2. Set governor control handle to full speed position. Handle (2) pointing downwards.

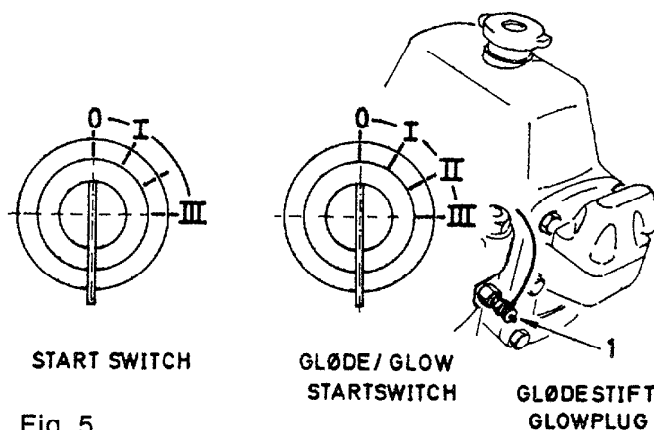


Fig. 5

Electrical Starting (Continued from page 7)

3. 0 KEY: Insert (or remove) (fig. 5.)
I ON: Normal operating position.
II HEATING: Keep in position for heating of plugs (1) for 20—40 seconds.
4. III START: Push key in and turn clockwise. When engine starts, release key which returns to position I.
5. Set engine speed by returning governor control handle to suitable position.
6. Check oil pressure, cooling water circulation and battery charging.

Starting using Cartridges (starting cigarettes)

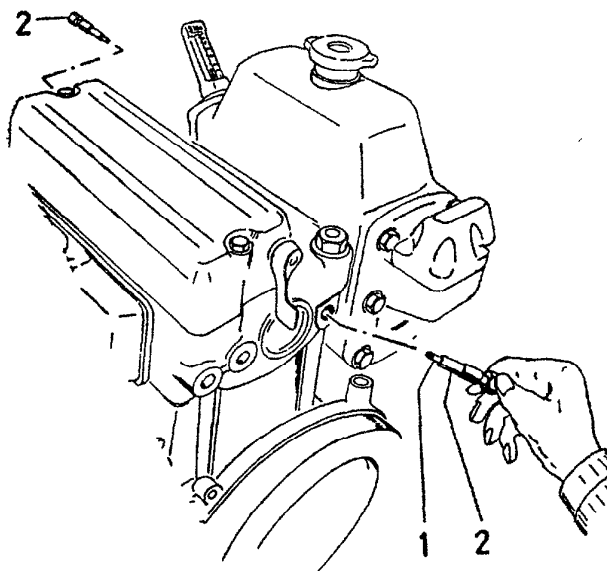


Fig. 6

In cold weather, or if the engine has not been used for some time, use starting cartridges. (cigarettes.)

1. Unscrew both cigarette holders (2).
2. Insert cigarettes (1) into holders (2), white end first. Replace holders and screw firmly home. The cigarettes (7 mm) are self-igniting provided that they are dry.
3. As an alternative to, or in addition to, starting cigarettes, a recommended procedure is to spray 6 full shots of LUBRICATING OIL into the cylinders to facilitate starting, using squirt can supplied in tool box.

OPERATION

1. Let the engine idle at 400—600 rpm.
2. ENGAGING CLUTCH:
Type 2HG: Engage gear lever using light pressure.
Type 2H: Press clutch lever forward to full extent of its travel. It moves over an indent to hold it in the engaged position.
Ensure that gear lever or clutch lever does not foul on the engine casing or other obstruction.

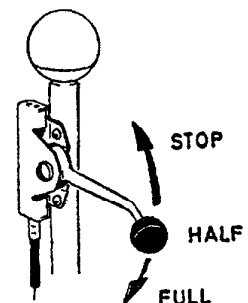


Fig. 7

3. Use pitch control lever to select desired propeller pitch (2H).

NOTE:

The fully feathering (sailing) propeller for model 2HSP is feathering in rearmost position of pitch control lever. It is recommended to stop engine or disengage clutch before the blades are set into feathering position.

4. Select desired engine speed using governor control lever. Do not use full power until the engine has started to warm up. The fuel supply should be gradually increased up to maximum.

5. Check instruments:

Cooling water temperature:

Fresh water cooling: 55—75° C

Sea water cooling: 40—60° C

Oil pressure: 1.5—2.5 kg/cm²

Charging indicator lamp: Should be off.

Engine speed. See page 10.

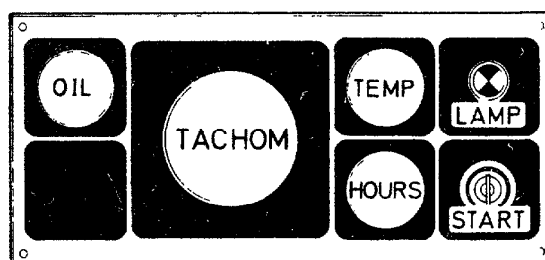


Fig. 8

IMPORTANT:

For controllable pitch and fully feathering propellers the clutch must always be fully engaged when manoeuvring. All manoeuvring should be done using the propeller pitch control and not with the clutch.

For both controllable pitch and fixed propellers, use reduced engine speed when manoeuvring. Never approach a jetty at full speed but slow down in good time.

STOPPING

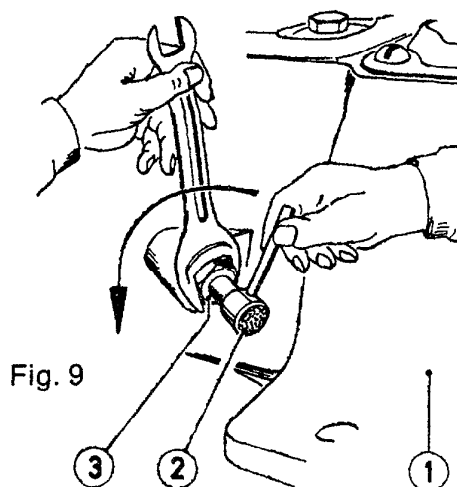
1. Reduce engine speed.
2. Gearbox or clutch in neutral.
3. Allow engine to idle for a few minutes to dissipate heat.
4. Stop engine. Governor control lever up.
5. Turn switch key to position "O". Remove key. Replace protective cover.

SETTING ADJUSTING SCREW FOR MAXIMUM PITCH

(Not applicable to Type 2HSP with fully feathering propeller.)

A pitch control adjusting screw (2) is situated on the starboard side of the clutch housing (1). This screw facilitates the setting of propeller pitch for full speed. (Normal position.)

1. Unscrew nut (3) one turn.
2. Insert pin in head of adjusting screw and adjust position of screw, in or out, when engine is running at maximum speed.
3. Set position of adjusting screw so that maximum propeller pitch corresponds to the optimum value of full speed rpm from the point of view of vibration and boat speed. This engine speed will depend on the boat's size and hull form. It will normally be in the region of 2000 rpm and must not exceed 2250.



Note that the propulsive power of the engine (propeller torque) is nearly constant for engine speeds in the range 1800—2000 rpm but falls at higher engine speeds. This means that, with a controllable pitch propeller, maximum propulsive power will be obtained in this engine speed range. There is therefore little point, in the case of most boats, of running the engine at the maximum of 2250 rpm. Only if the boat is particularly easy to propel will the use of maximum rpm result in higher boat speed.

If the boat is used for fishing, it is generally preferable to use maximum pitch when towing lines and a slightly reduced pitch for full speed.

RUNNING-IN A NEW ENGINE

A new engine should not be subjected to any unnecessary stress or loading. Run the engine carefully to begin with using full speed only for short periods. Increase the engine loading gradually during the initial 25 hours running.

Remember that treating the engine sensibly during the running-in period will lengthen the life of the engine appreciably.

After the first 25 hours running:

1. Change engine sump oil	Page	17
2. Type 2HG: Change reverse gearbox oil	Page	18
3. Type 2H: Check clutch	Page	39
4. Check engine alignment	Page	49
5. Check all pipe connections		
6. Check V-belt tightness	Pages	37—38

After the first 50-100 hours running:

1. Adjust valve clearances	Page	40
2. For subsequent routine maintenance, follow chart "CARE AND MAINTENANCE"	Page	14

ELECTRICAL EQUIPMENT

Alternator 12V 35A (500W) S.E.V.

The alternator produces 3-phase alternating current. The alternating outputs of each phase are rectified by means of 6 silicon diodes (3 positive and 3 negative diodes). During starting, the field current is fed to the rotor from the battery via the regulator.

The alternator must therefore only be run if the battery is connected. If a battery isolating switch is fitted the engine must not be started until battery has been switched on.

Use of an alternator ensures continuous charging of the battery even if the engine is idling for long periods.

The SEV alternator has an integral electronic regulator.

Follow the connection diagram precisely. Incorrect connection will probably damage alternator or voltage regulator and repair will be expensive.

In addition to the above:

1. Check carefully that all connections are made as shown in diagram.
2. The alternator must never be run unless both battery terminals and the regulator are connected. Remove the alternator drive belt before disconnecting the battery.
3. If the battery is to be charged from an external source, first disconnect both battery terminals.
4. When welding on board (steel hulls), disconnect the battery negative terminal beforehand.

Starter, BOSCH

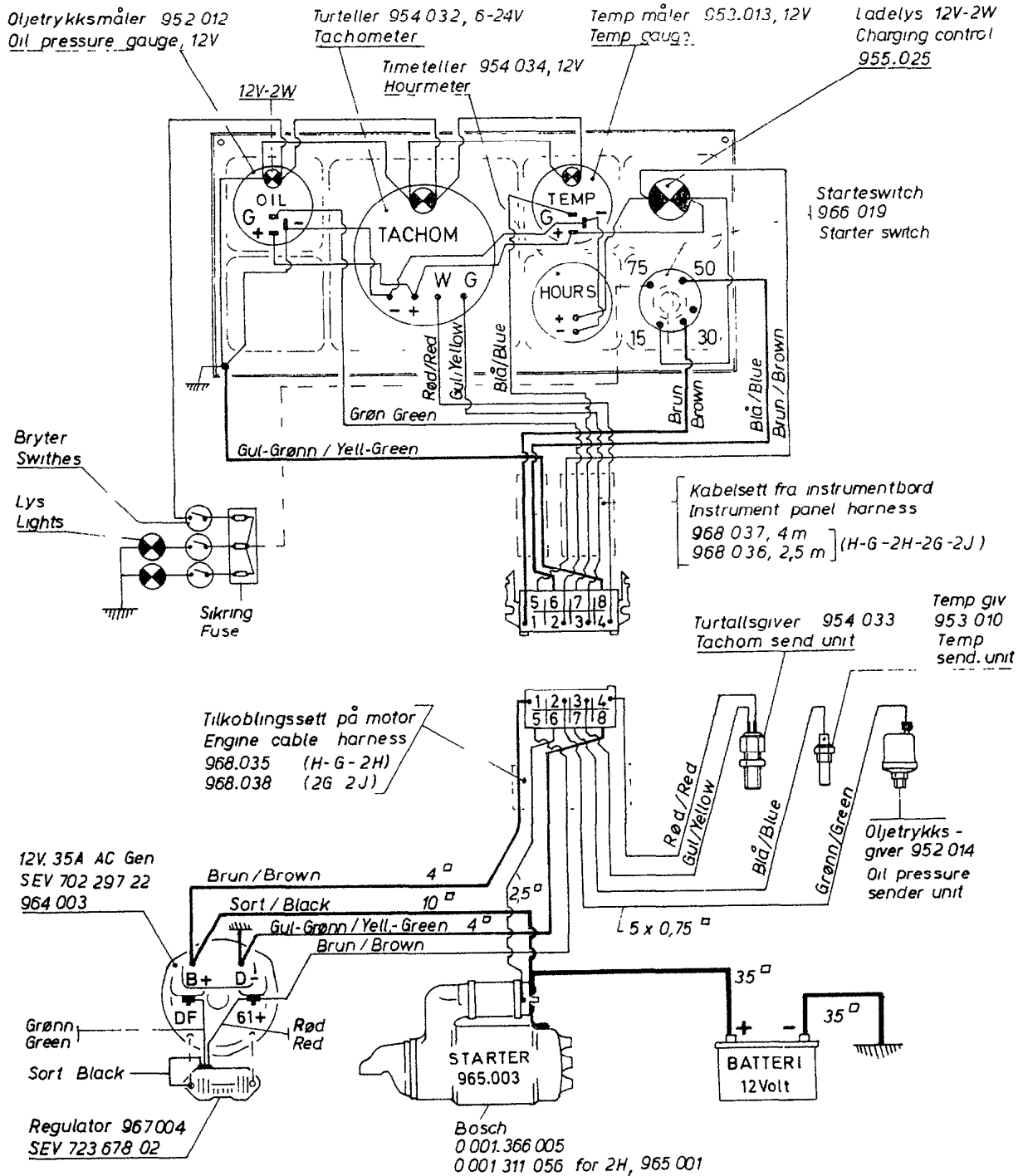
It is very important that the starter should not be exposed to sea water. The engine must not be started if the level of water in the bilge reaches to the flywheel. Pump out sufficiently to avoid splashing the starter.

Battery

The battery should be contained in its own box made of wood or special plastic and it should be positioned as near to the engine as possible. The battery box should be well ventilated and the battery firmly secured.

Check the battery regularly. Top up with distilled water to keep the electrolyte level $\frac{1}{2}$ cm-1 cm above the plates. After topping up in cold weather, run the engine for a while to ensure circulation of the electrolyte. Keep the battery terminals and cable clamps clean. Remove any oxidation and coat lightly with vaseline. Make sure the cables are tightly clamped onto the terminals.

The electrical equipment is not covered by the engine guarantee.



KJØR IKKE VEKSELSTRØMSDYNAMO MED FRAKOPLET BATTERI ELLER REGULATOR
DO NOT RUN ALTERNATOR IF THE BATTERY OR REGULATOR ARE DISCONNECTET

H-G-2H-2G-2J
No 68-30/772c

Wiring diagram for starter, alternator 12V-35A. Charge control, VDO electrical instruments.

INSTRUMENT CONNECTIONS

Tachometer (Mechanical Drive Type).

1. Unscrew tachometer drive end nut (1).
2. Insert hexagonal part of tachometer drive screw (2) through centre of axial bearing housing to engage with hexagonal socket (3).
3. Couple up the tachometer drive cable and tighten the cable nut (4).

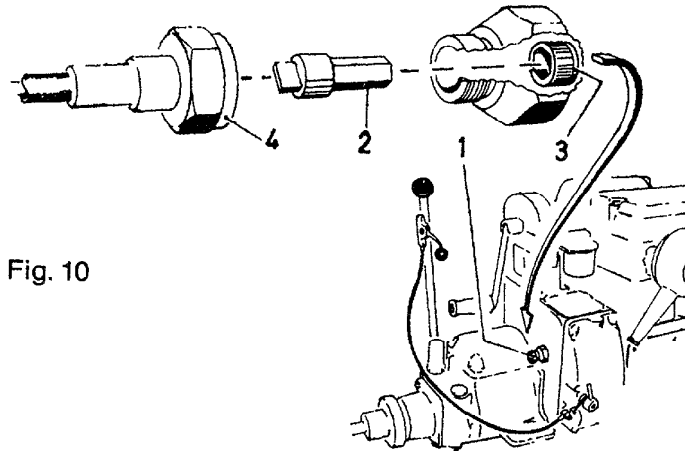


Fig. 10

Avoid sharp bends in the drive cable. Minimum radius: 50 cm (20 in.)
Drive cables longer than 1.5 m (5 ft.) should be secured with clips.

The water temperature gauge is connected to the temperature sensor fitted in the port after wall of the cylinder head.

The oil pressure gauge pipe is connected to the nipple on the starboard side forward of the governor cover.

Tachometer (Electrical Impulse Type — after August 1977.)

1. Fit impulse sender unit (A)
Fig. 11, in flywheel shield of main bearing housing. Adjust distance between sender point and starter ring 1.5 mm (1/16")
 2. Connect wires to tachometer.
See wiring diagram page 12.
- Water Temperature Gauge (Electrical)
Temperature sender unit (B) is fitted into cylinder head.

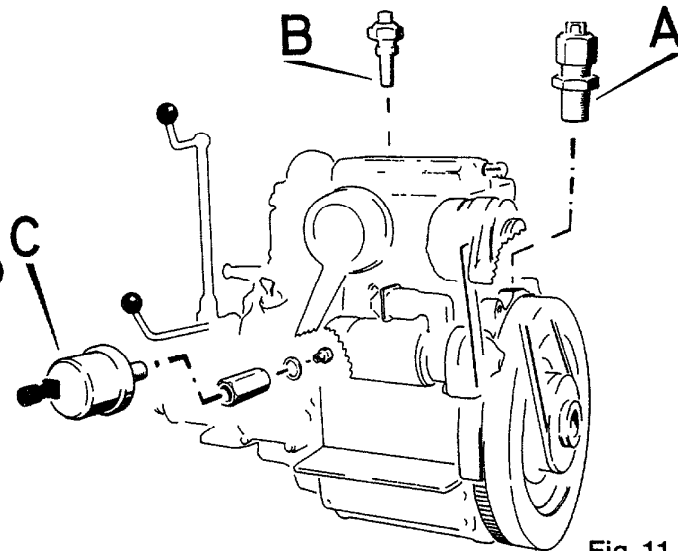


Fig. 11

Oil Pressure Gauge (Electrical or Mechanical).
Sender unit (C) or gauge pipe is connected to the nipple on starboard side of crankcase.

CARE AND MAINTENANCE

To achieve good results in operation, it is important to give the engine the attention recommended. The following section includes general guidance, descriptive notes and sketches to assist in routine maintenance.

If the specified maintenance is carried out correctly and at the recommended intervals, engine deterioration will be minimised and optimum performance will be ensured.

MATERIALS

A. LUBRICATING OIL SYSTEM

The lubricating oil system is pressurised, the oil being pumped from the sump oil filter (1) via the oil pump (2) (gear pump fitted inside pump housing) and, under pressure, to the full flow filter (3). Oil channels in the crankcase/main bearing housing provide lubrication for crankshaft main bearings and connecting rod bearings. A pulsed oil flow is also fed via the camshaft (5) and the pipe (6) to the rocker arm bearings before being returned to the sump.

The oil pressure is limited by the oil pressure relief valve (4) fitted behind the oil filter (see Figs 12 and 18). The oil pressure is indicated on the pressure gauge (7).

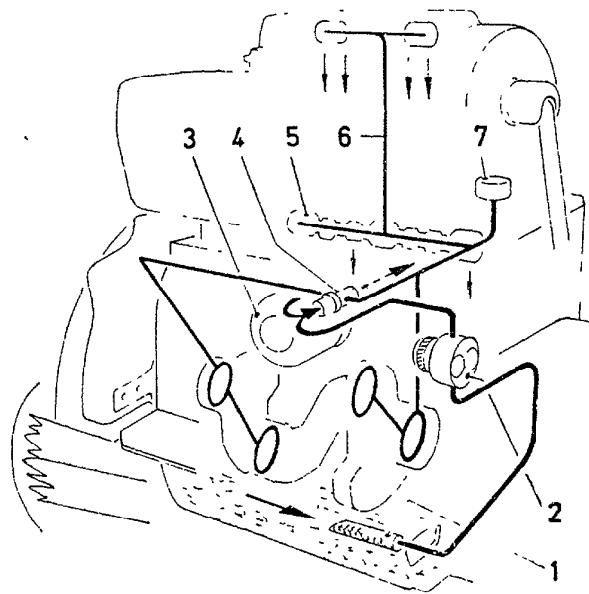


Fig. 12

LUBRICATING OIL

The engine oil should be checked daily before starting. The dipstick is located in the governor cover and has two level marks. The upper mark indicates the oil level when the sump is full (4 litres). The level should never be allowed to fall below the lower mark.

To ensure effective lubrication and long lasting engine cleanliness, it is important to use an approved oil to the correct specification.

API-SERVICE CD (Previous nomenclature: Service DS-Series III):

The manufacturer recommends the use of mono-grade oil (SAE 10, SAE 20 or SAE 30.) Multi-grade oil (SAE 10/30) should not be used.

LUB. OIL QUALITY	VISCOSITY AT AMBIENT TEMPERATURES			SUMP CAPACITY	
	Below +10° C (50° F)	+10 to +30° C (50-86° F)	Above +30° C (86° F)	Oil Change	Incl. Oil Filter
Service CD	SAE 10	SAE 20	SAE 30	4 litres (7 pints)	4.5 litres (8 pints)

The following makes and grades may be used (as may other makes of corresponding quality):

BP Energol DS3
Chevron Delo 300 Motor Oil
Castrol Devsol RX Super
Essolube XD-3
Fina Solna S3
Gulfpride Series 3

Mobil Delvac 1300
Ocean Diesoline 3
Reginol CD-SD
Shell Super Marine Oil
Texaco Ursa S3

Use the same oil for clutch/gearbox.

IMPORTANT:

If the engine has been wholly or partly immersed in water, all oil in the crankcase and clutch housing (or gearbox) must be changed immediately.

1). DIPPING ENGINE OIL (Daily):

1. Withdraw dipstick (1) and wipe clean.
2. Insert dipstick fully and withdraw to read oil level. Repeat if necessary.
3. The oil level must never be allowed to fall below the lower mark on the dipstick. If necessary, top up so that level is at upper mark.
4. Replace dipstick and screw home.
If the engine is mounted at an angle exceeding 8 degrees the oil level when the sump is full (4 litres) will lie above the upper mark on the dipstick. The oil level should normally lie between the two marks.

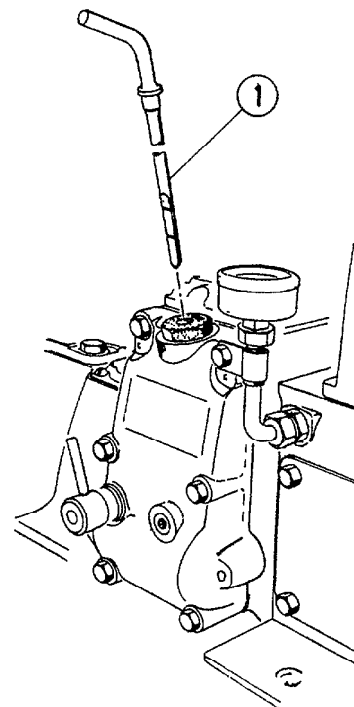


Fig. 13

2. DIPPING GEARBOX OIL (Weekly):

1. Unscrew dipstick ("OIL" cap) (1) and wipe clean.
 2. Insert dipstick fully (to first thread) and withdraw to read oil level.
 3. Top up if necessary and replace "OIL" cap and screw home.
- Note that dipstick reading is dependent on engine mounting angle.

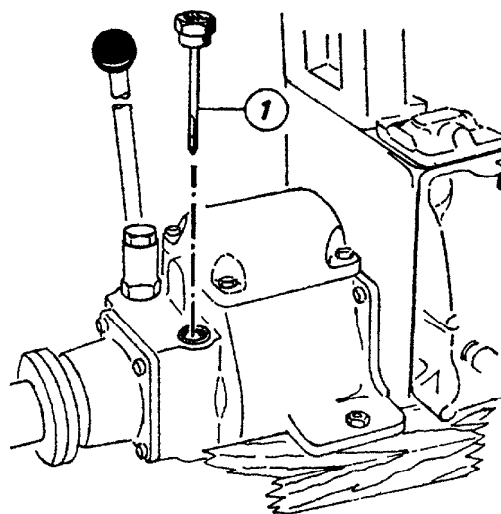


Fig. 14

3. ENGINE OIL CHANGE (at least annually):

The crankcase sump holds 4 litres of oil and this should be changed while it is still warm.

1. Clean round "OIL" cap (1) and unscrew cap.
2. Hold oil removal syringe (2) with its flexible tube down in the sump. Pump oil out and into an empty can.
3. Place a funnel in the filler opening and fill with 4 litres of oil of the correct grade. (See page 16.)
4. Screw back the "OIL" cap and replace the dipstick.
5. Start engine and check oil pressure.

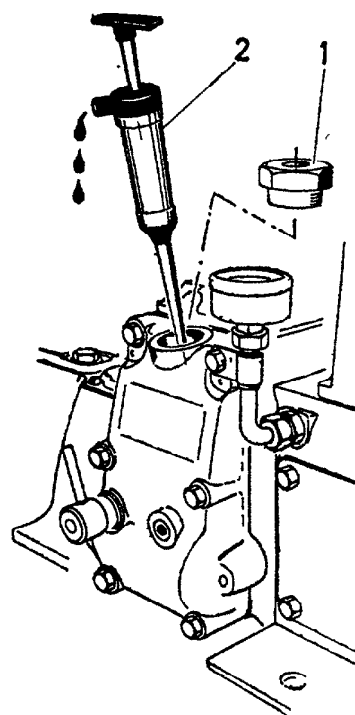


Fig. 15

4. CHECKING OIL IN CLUTCH (at least annually)

The clutch housing holds 0.5 litres of lubricating oil.

1. Unscrew clutch housing cover (Fig 16 Item 1) and check oil level in the clutch. Turn the engine over and check that the clutch reaches into the oil. Top up if necessary.
2. Check condition of cover gasket and replace cover.

5. CHANGING CLUTCH HOUSING OIL (at least annually):

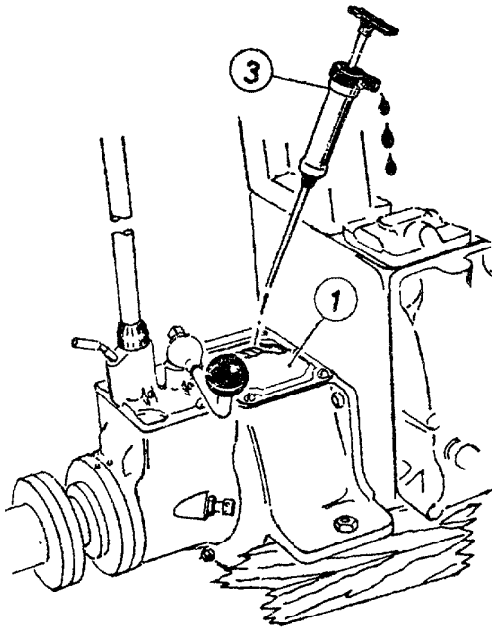


Fig. 16

1. Unscrew clutch housing cover (1). Hold oil removal syringe (3) with its flexible tube down in the clutch sump. Pump the oil out and into an empty can.
2. If the oil is thick or dirty, wash out the clutch housing with fuel oil and carefully wipe dry before refilling with new oil.
3. Fill with 0.5 litre clean lubricating oil through cover opening. Do not add extra oil. If the clutch slips, see Item 36 for clutch tension adjustment.

6. CHANGING REVERSE GEARBOX OIL (at least annually):

The reverse gearbox holds 0.5 litres of lubricating oil.

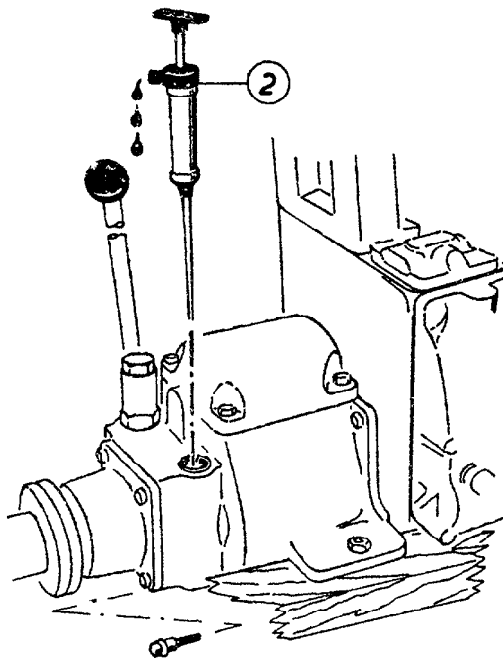


Fig. 17

1. Unscrew dipstick. Hold oil removal syringe (2) with its flexible tube passing through the dipstick opening and down into the reverse gearbox sump. Pump the oil out and into an empty can.
2. The oil can also be drained by unscrewing the magnetic plug in the after end of the reverse gearbox. Always remove the magnetic plug and clean before replacing.
3. If the oil is thick or dirty, remove the gearbox housing cover and wash out the gearbox with fuel oil and carefully wipe dry before filling with 0.5 litres of clean lubricating oil by way of either gearbox housing cover opening or dipstick opening.
4. Replace dipstick.

7. CHANGING ENGINE OIL FILTER (at least annually):

The oil filter is located on the outside of the crankcase on the left hand side. It should be changed in conjunction with changing the engine oil.

1. Loosen the oil filter (1) with a spanner or hammer a screw driver through the filter to facilitate loosening. Unscrew and dispose of both filter and rubber gasket.

2. Before fitting a new filter — (FRAM PH9A or MANN W9.20/7), dry the sealing face of the filter holder using a clean rag.

3. The new filter gasket (2) is lightly coated with oil and fitted into the filter seating. Screw on the filter by hand until the gasket is touching the sealing face. Tighten by hand one further *half turn*. Do not tighten using tools. (Item (3) is the oil pressure relief valve.)

4. After filling with oil (4.5 litres including filter), start the engine and check that there is no leakage at the filter seal.

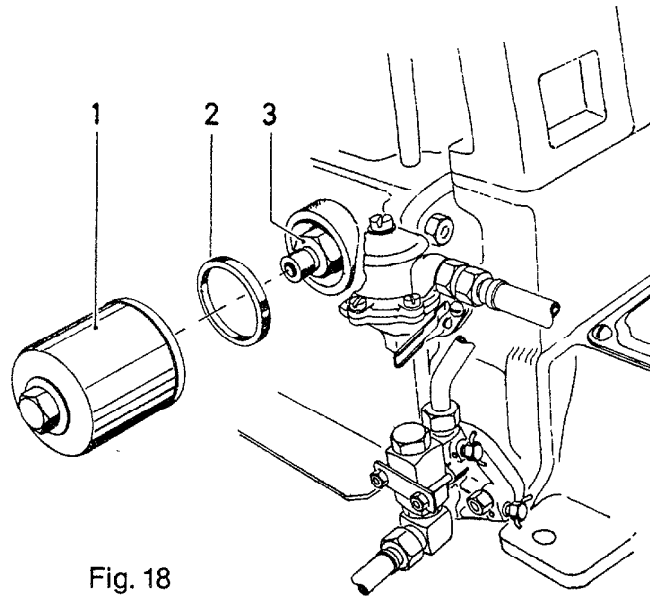


Fig. 18

B. GREASE

The engine, and remote control equipment if fitted, have greasing points that require regular attention.

The following types of universal grease can be used for all greasing points (engine propeller):

BP Energrease LS-EP

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

8. GREASING OF PROPELLER (Daily):

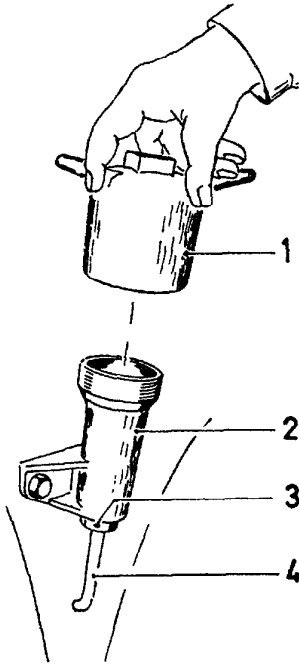


Fig. 19

Propeller and stern bearings are lubricated by screwing up one turn on the grease cup (1) after every 5 hours running or daily.

Note:

When operating in sandy waters it is important that the controllable pitch propeller should be greased regularly and liberally.

IMPORTANT:

If the controllable pitch propeller controls are noticeably heavier when the boat has been out of use for some time, the reason may be that the propeller grease has been washed out by contaminated sea water or strong current etc. In such cases the propeller should be greased with special stern grease.

There are many good quality stern greases but they should only be used for propellers and stern bearings.

9. GREASING OF INBOARD STUFFING BOX (Daily).

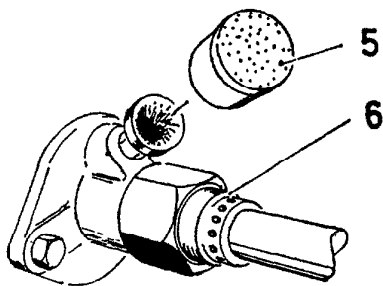


Fig. 20

One turn of the grease cup (5) after every 5 hours running or daily.

The stuffing box has a gland (6) packed with tallow. The gland should only be tightened just sufficiently to prevent leakage. Excessive tightening causes overheating and wear on the shaft.

The tallow packing should be changed when the gland movement is fully taken up or if the gland does not seal properly.

10. GREASING OF PROPELLER CONTROL (Weekly):

The engine, including clutch/propeller control, has 5 nipples for grease gun lubrication (see fig) 2H-2HSP.

1. Sliding bolts:
2 shots with grease gun.
2. Oil Seals:
2 shots with grease gun.
3. Propeller control bearing:
2 shots with grease gun.
4. Propeller control lever:
2 shots every 50-100 hours running.
5. Clutch lever:
2 shots every 50-100 hours running.

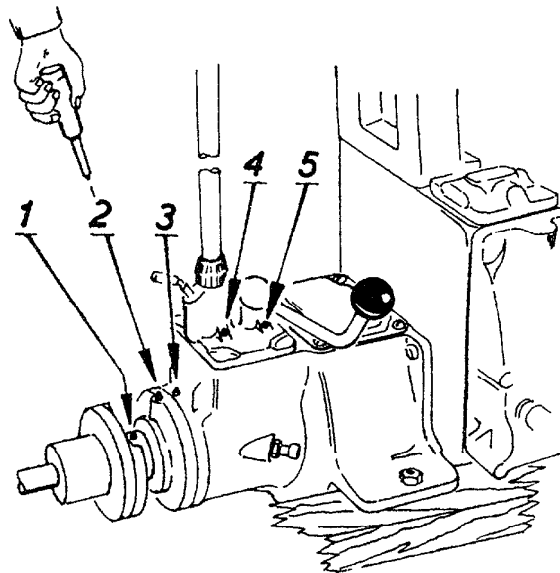


Fig. 21

11. GREASING OF GEARBOX SEALS (Weekly):

The rear sealing rings (6) should be lubricated weekly, 2 shots with a grease gun or until grease emerges round the wear ring.

IMPORTANT:

If there is so much water in the boat that it covers the sealing rings, the boat should be pumped out before operating the gearbox.

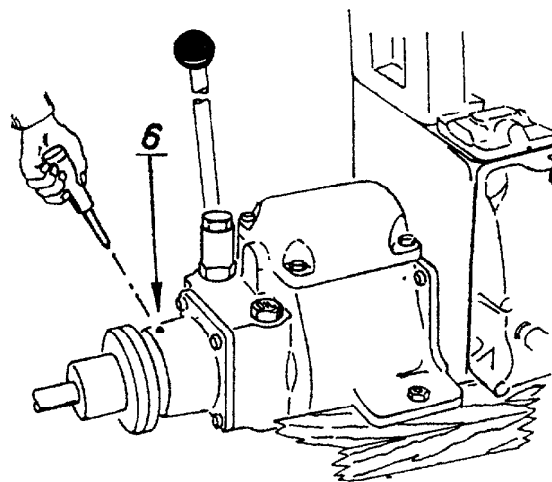


Fig. 22

GREASING OF AUXILIARY EQUIPMENT

12. Greasing of Starter Pinion (as required):

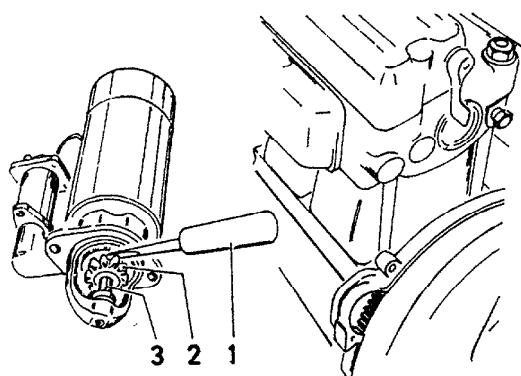


Fig. 23

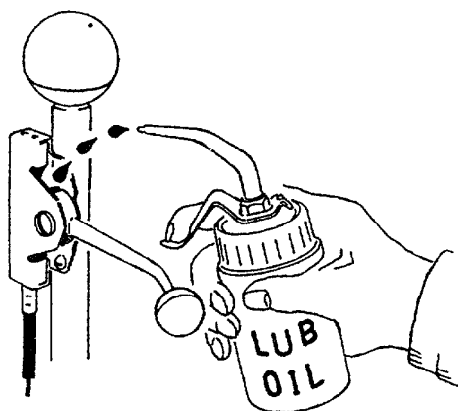


Fig. 24

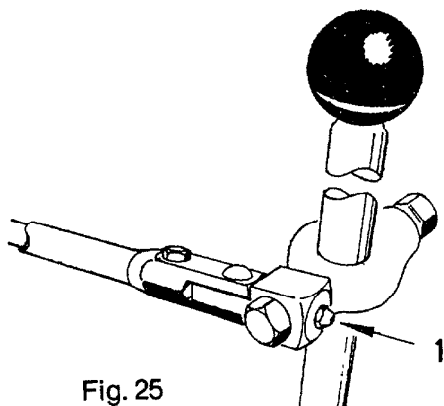


Fig. 25

The starter must not be subjected to water spray off the starter ring.
(See page 11.)

If the bendix pinion becomes rusted, the starter should be removed (or sprayed with oil) and the starter pinion greased.

1. Disconnect the electrical leads and unscrew the starter from the engine.
2. Insert a screwdriver (1) behind the pinion (2). Lever the starter pinion out while turning it clockwise.
3. Apply grease (or lubricating oil) to the shaft (3) and the starter pinion. Turn the pinion to and from until it moves freely in its track.
4. Assemble and fit the starter. Reconnect electrical leads and battery.

13. Lubrication of Remote Control Lever (as required):

Apply oil or grease regularly to the rack drive as shown in the figure.

14. Greasing of Remote Control (as required):

The drive block on the end of the telescope tube is free to move on its securing bolt and this nipple (1) should be greased regularly to ensure the easiest possible manoeuvring.

Cables for propeller pitch, clutch or reverse gearbox control, rudder control cables and cable guides should be coated with grease during installation.

Suitable grease: *Esso Beacon 300 EP*.

15. Greasing of Rudder Controls (as required):

SABB rudder controls incorporate 2 grease nipples. One is on the underside of the Operating Unit and one (2) is on the universal joint. Both points should be greased regularly.

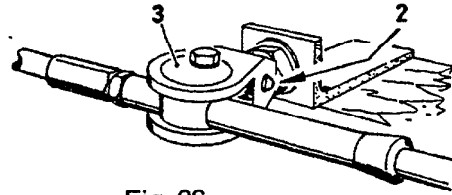


Fig. 26

Gearwheel Bilge Pump

The pump is driven by a V-belt (LT 28) on the outermost track of the flywheel drive pulley. The V-belt is tightened by slackening screw (1) and turning the whole pump. Re-tighten the screw securely.

Engaging and disengaging (handle 5) must only be performed at low engine speeds to avoid wear on the driving pulley or damage to the drive key. Ensure that the pump is engaged or disengaged fully.

The drive key (2) can be replaced by unscrewing the set screw (3) with a 3/8" socket spanner. A new drive key can be made from 1/4" x 1/4" x 34 mm mild steel.

If the pump is not working properly or if it needs excessive priming, this may be an indication of internal wear causing leakage between suction and pressure sides of the pump. In this case the end clearances of the gearwheels must be reduced by filing the pump housing flange until flush with the gearwheels.

Use a thin gasket (0.15-0.20 mm)

16. Greasing (as required):

Remember to lubricate regularly using the grease cup (6). The coupling sleeve and coupling bolt also need greasing occasionally.

The bearings are sealed and do not require greasing.

Use the drain cock (4) to drain off the water in cold weather.

Keep the strainer clean.

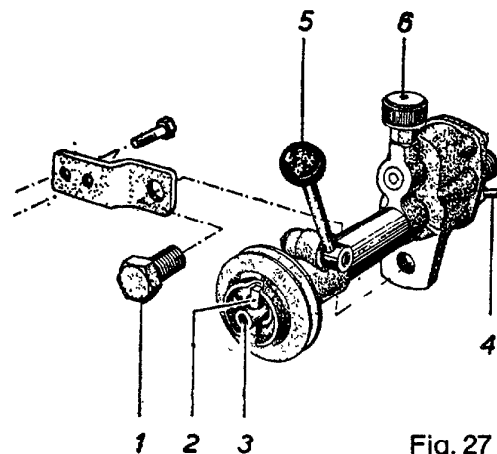


Fig. 27

C. FUEL OIL

Use only *gas oil* (auto diesel).

The oil must be absolutely clean and should contain as little water as possible. This is a good insurance against fuel pump or injector nozzle problems.

Drain off water and sediment from the fuel tank regularly, at least once for each time the tank is filled. Use a straining cloth, cotton cloth or nylon stocking over the funnel when filling.

Make sure that the tank is never run dry. If this does happen, the fuel system must be bled. It is not necessary to close the fuel tank cock because leakage is not possible provided that the fuel pipes are intact.

If the engine is started with the cock closed it will stop after a few minutes and bleeding will be necessary.

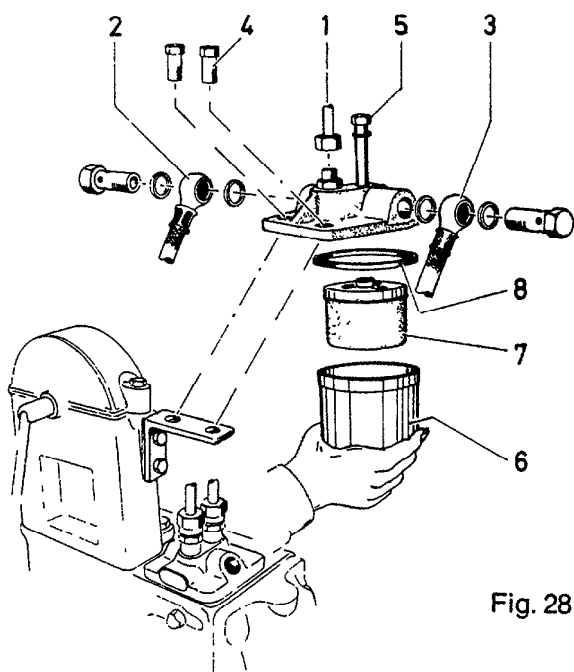


Fig. 28

17. CHANGING FUEL OIL FILTER (At least annually):

1. Close the fuel tank cock.
2. Unscrew the fuel leak-off pipe (1), fuel hoses (2 and 3) from the filter cover. Loosen screws (4) and lift off the filter.
3. Unscrew the central bolt (5) and lower filter bowl (6) and element (7).
Remove and dispose of used element (7). Clean filter bowl and insert new element.
(BOSCH FJ/SJ 2751 — 1 457 431 324)
4. Ensure that the rubber gasket (8) is correctly located in the filter bowl seating and tighten the central bolt (5). Fit the filter to its bracket and secure the fuel hoses and fuel leak-off pipe.
5. Open the fuel tank cock and bleed the fuel system. See Bleeding page 25. — Tighten central bolt.

18. BLEEDING THE FUEL SYSTEM (as required).

1. Check level of fuel in tank and see that fuel tank cock is open.
2. Bleed filter by loosening nut on fuel leak-off pipe (1) three turns.
Operate hand pumping lever (Fig 32, item 6) on fuel lift pump until oil escaping from filter is free of bubbles.
3. Bleed fuel hose (2) to injection pump by slackening banjo nipple plug (4) three turns and operating hand pumping lever until the escaping oil is free of bubbles.

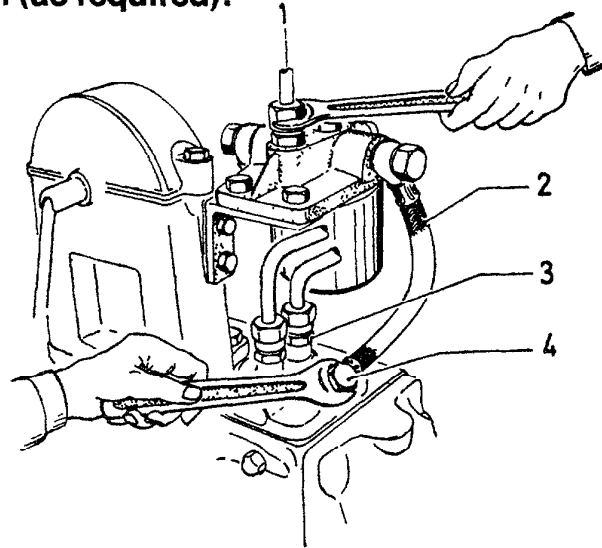


Fig. 29

4. Retighten banjo nipple plug securely, making sure that the hose is not kinked during tightening.

NOTE: Never unscrew the injection pump delivery valves (3).

5. Open decompressor valve and set governor control lever to full speed position. Turn the engine over (either by hand or using the starter) until noticeable "knocking" can be felt in the injector pipes coincident with each injection.

The knocking indicates that the system is free of air and that the nozzles are working.

19. CLEANING THE INJECTOR NOZZLES (As required):

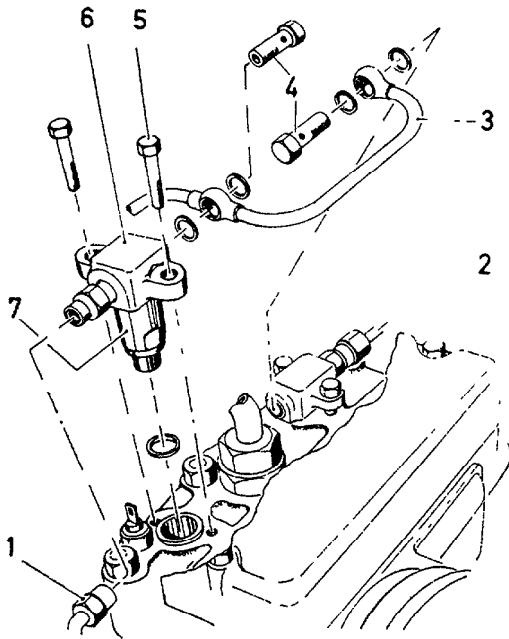


Fig. 30

Impurities in the fuel, or fuel containing water, can lead to poor atomisation in the nozzles, spray distortion or post-injection leakage. The engine may knock, make black smoke in the exhaust and be difficult to start.

If this is the case, the nozzle must be cleaned or renewed.

1. Unscrew injector pipes (1 and 2) from injector bodies (6). Unscrew banjo nipple plugs (4) and remove fuel leak-off pipe (3).
2. Remove injector body bolts and withdraw injector bodies for further dismantling.

The injector body is best held upside down in a vice but it may also be placed upside down on the cylinder head and secured by means of its bolts (5).

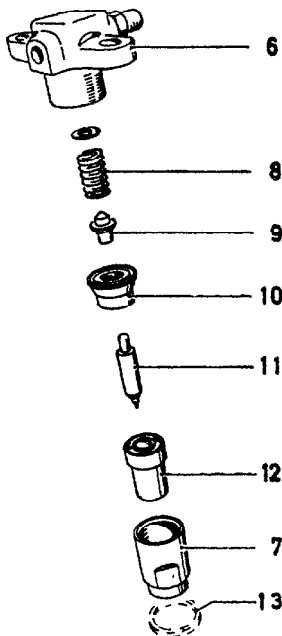


Fig. 31

3. The nozzle sleeve (7) is unscrewed and the nozzle removed. The needle (11) should move freely in the nozzle. Never touch the needle itself but hold it by the cylindrical spigot. Wash all components in clean fuel oil. Any particles adhering to the nozzle end or to the needle should be removed using a small piece of wood or matchstick.

4. Re-assemble the injector body exactly as shown in Fig 31, ensuring that item 9 is fitted with its shorter spigot towards the spring.

Remember to insert the nozzle joint washer (13) before positioning and securing the injector body.

5. Fit the fuel leak-off pipe. The injection pipe nuts should be screwed up lightly. Turn the engine over with governor control lever set to full speed (decompressor lever open) until oil sprays out. Tighten nuts securely.

20. CLEANING OF LIFT PUMP STRAINER (When renewing fuel oil filter element):

The lift pump is positioned on the left hand side of the crankcase and supplies fuel to the filter.

1. Close fuel tank cock.
2. Unscrew central bolt (1). Remove cover. Remove and wash out the strainer (2).
3. Replace strainer and fit cover, ensuring that the gasket is properly in position. Tighten central bolt securely.
4. Open fuel tank cock and bleed the system.

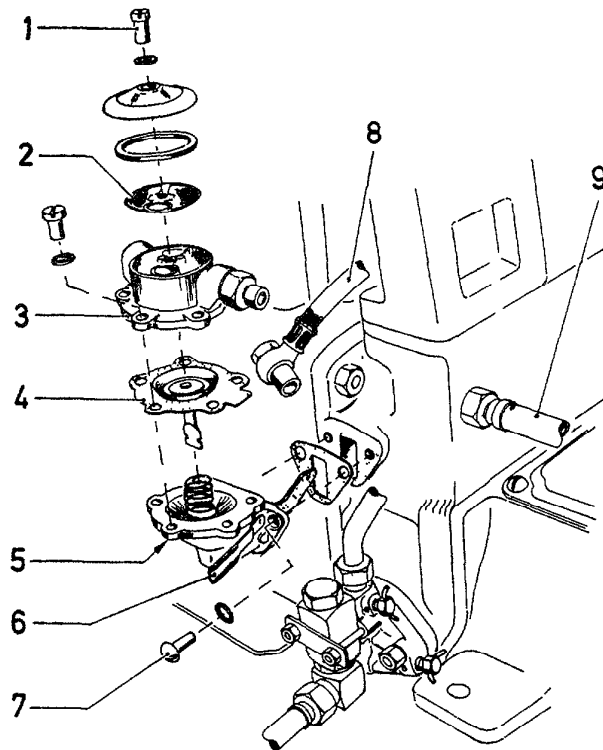


Fig. 32

21. CHECKING OR RENEWING LIFT PUMP DIAPHRAGM (as required:)

1. Close fuel tank cock.
2. Unscrew fuel pipe (9) and fuel hose (8) from lift pump. Remove securing screws (7) and withdraw lift pump from engine. Clean strainer as in item 2 above.
3. Loosen and remove upper body (3) or lift pump. Check that the two valves and the diaphragm are in good order. If the diaphragm needs renewing, hold the lift pump arm and press down on the diaphragm while at the same time turning it a quarter of a turn to free it for removal.

Ensure that the spring underneath the diaphragm is properly in place before fitting a new diaphragm.

4. Check that the air vent (5) on the underside of the lift pump body is open. (Prevents fuel being pumped into the engine if the diaphragm is damaged.)
5. Re-assemble lift pump, fit to engine (check that gasket is in good condition) and secure.

Refit fuel hose and pipe and bleed the system.

D. COOLING WATER

The cooling water pump is a diaphragm pump consisting of a rubber diaphragm sandwiched between the pump housing and the flange beneath.

The rate of flow of cooling water can be regulated by means of the gate valve to give a suitable cooling water temperature with the engine fully loaded. This temperature should be between 40° and 60° C.

At reduced speed this temperature will fall somewhat. This will not damage the engine and there is no need to adjust the gate valve as engine loading varies.

To protect the cooling water channels and piping against electrolytic corrosion, a zinc anode (plug) is fitted to the forward end of the silencer. Page 35.

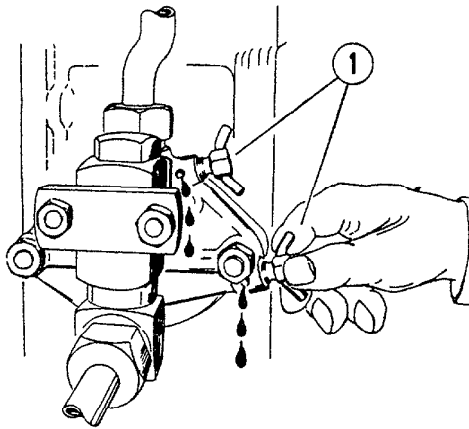


Fig. 33

NOTE: In particularly sandy waters, the diaphragm pump can be replaced by an impeller pump.

22. DRAINING OFF THE COOLING WATER

Important – in case of frost.

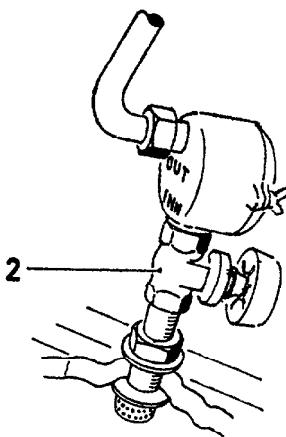


Fig. 34

1. In cold weather — or when there is a risk of frost — the water must be drained off using the two drain cocks (1) on the water pump (fig. 33).
2. The silencer can be drained by unscrewing the zinc plug on the forward end (see page 35).
3. Remember that the gate valve (2) must always be closed before the drain cocks are opened or the impeller pump body cover is loosened.
4. Open bilge pump drain cock.

For draining of impeller pump, see page 35.

FRESH WATER COOLING (Closed System)

The fresh water tank (2) (1974 model) is separate from the silencer and is mounted on top of it.

The thermostat (3) is located in the silencer where it adjoins the fresh water tank.

The keel cooler (4) is mounted on the underside of the hull.

If preferred, it is possible to fit an internal heat exchanger in place of an external cooler. This requires a separate pump. See page 30.

When first starting, fill the tank with clean fresh water, or a water/antifreeze mixture, via the filler with pressure cap (1).

Top up as the water disperses through the system until the tank is full. Check that there are no leaks in the system.

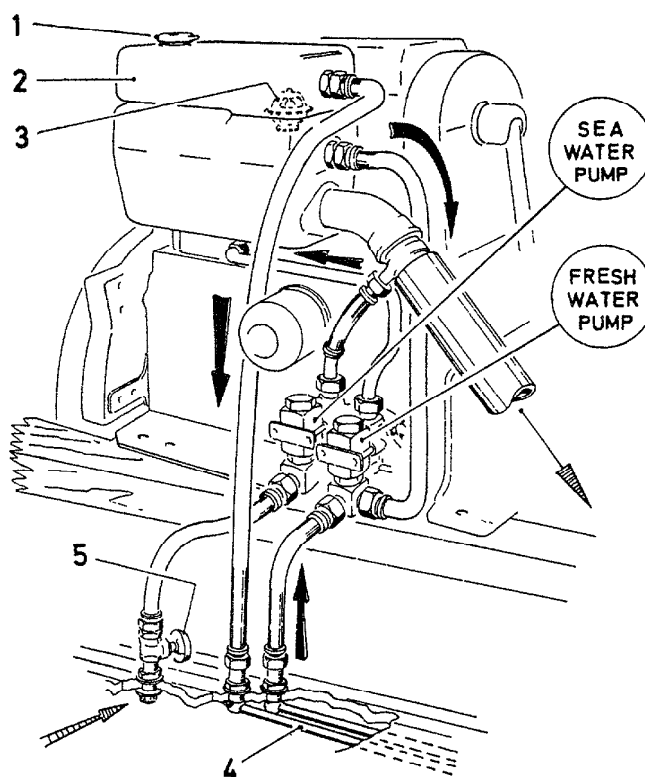


Fig. 35

Operation

Until the cooling water has warmed up the water flow is through the silencer cooling jacket channels, out of the rear of the silencer and via the by-pass pipe back to the water pump.

When the engine has warmed the cooling water up to 55 °C, the thermostat begins to open and divert part of the water via the fresh water tank to the external cooler (or internal heat exchanger where it is cooled before once more entering the water pump).

When in operation, the thermostat will automatically distribute the cooling water between external cooler and by-pass pipe, thus maintaining the cooling water temperature between 55° and 75° C. (130-170° F.)

In case of incorrect operation (water temperature too high or too low) check:

- | | |
|---------------------------------------|---------|
| 1. Water pump diaphragm | Page 32 |
| 2. Water valves | Page 31 |
| 3. Thermostat | Page 34 |
| 4. Too little water in the tank | Page 31 |

- 5. Keel cooler defective or painted Page 29
- 6. Heat exchanger Page 36
- 7. Cracked cylinder head causing compression leak into cooling jacket. Symptom will be heavy bubbling in water tank. Most easily confirmed by letting the motor cool and then letting it idle.

Winter Use

For use in winter the system should be filled with an approved make of glycol anti-freeze. With standard piping the system holds approximately 5 litres. The addition of 1 litre antifreeze (4 litres water) affords protection down to -8°C while 1.5 litres of antifreeze will protect down to -15°C . Flush the whole system with water before filling with antifreeze solution. After filling, run the engine for 3 minutes to ensure thorough mixing. When using glycol antifreeze it is not necessary to drain the system before or after winter use (or laying up) provided that the coolant remains clean and free of rust flakes. If this is not the case the system must be flushed through.

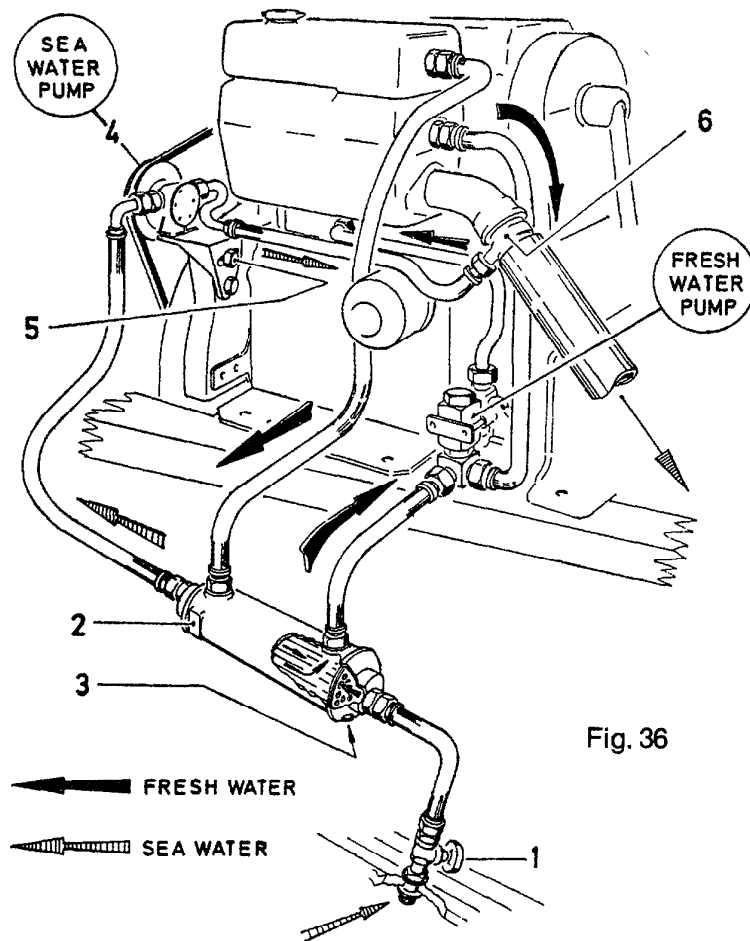


Fig. 36

Fresh Water Cooling with Heat Exchanger

The impeller pump (4) pumps sea water through the heat exchanger (2) where the engine fresh water is cooled. The sea water may be discharged overboard via the exhaust hose (wet exhaust).

NOTE:

When there is a risk of frost the sea water must be drained from heat exchanger and impeller pump. The pump may be drained by slacking off the pump housing cover slightly. The heat exchanger may be drained by slacking off the drain plug (3). Close the gate valve (1).

23. CHECKING COOLING WATER LEVEL (Weekly):

A weekly check is generally adequate but if the engine is being run continuously in warm weather, a daily check may be necessary.

1. The engine cooling water must have cooled down sufficiently for the fresh water tank to be touched without discomfort.
2. Open the pressure cap carefully. Beware of any water spraying out since this can scald.
3. Check the level and top up if necessary to bring the water level up to the lower edge of the filler neck.

If the system contains anti-freeze, it should be topped either with a solution of the same strength or with neat anti-freeze. (See page 30.)

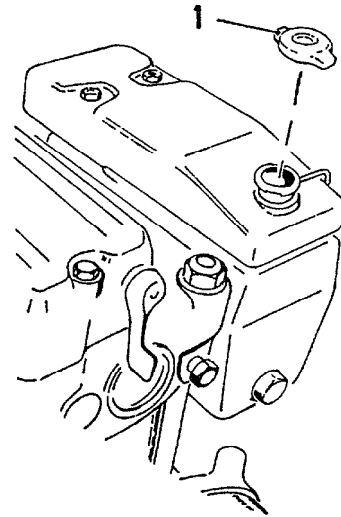


Fig. 37

24. CHECKING THE WATER VALVE (as required):

The water valve housing (4) is mounted on the cooling water pump on the left of the engine. If pump effectiveness is reduced, the cause may be dirt under the valves (3).

1. Close the gate valve.
Open the drain cocks (9).
2. Undo the suction pipe connection to valve seat (5) and unscrew the valve housing (4).
3. Holding the valve housing in a vice, unscrew the plug (1) and the valve seat (5). Check for any dirt under the valves. Renew valves and springs if necessary.

The housing may alternatively be secured to the water pump for removal of plug and valve seat.

If the valve seat is scored it can be rubbed carefully over a fine file, rotating the seat while doing so.

4. Before securing the valve housing in position between clamp (7) and water pump housing, check that the gasket (8) is in good condition.
5. Fit the suction pipe. Close drain cocks and open gate valve.

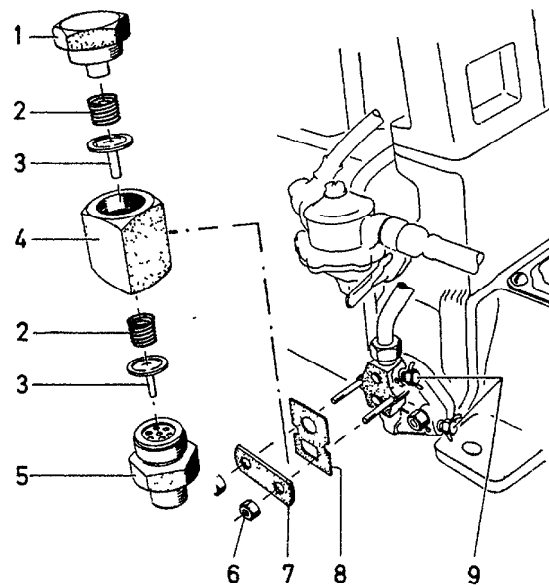


Fig. 38

25. CHECKING WATER PUMP DIAPHRAGM

(At least once annually):

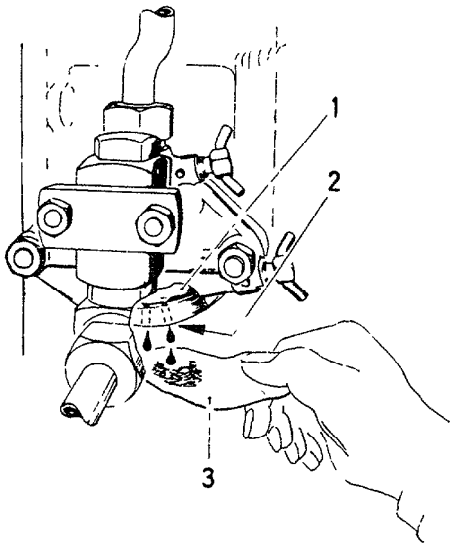


Fig. 39

1. If the cooling water level (fresh water cooled engines) falls abnormally, or if the pump circulation is irregular (sea water cooled engines), the cause may be a defective diaphragm.
2. In the case of both sea water cooled and fresh water cooled engines, this may easily be checked by slipping a piece of paper (3) underneath the pump housing and flange while the engine is running.
3. The pump flange (1) has drain holes (2) underneath and, if diaphragm is defective, water will drain out and wet the paper.

26. RENEWING WATER DIAPHRAGM

(as required).

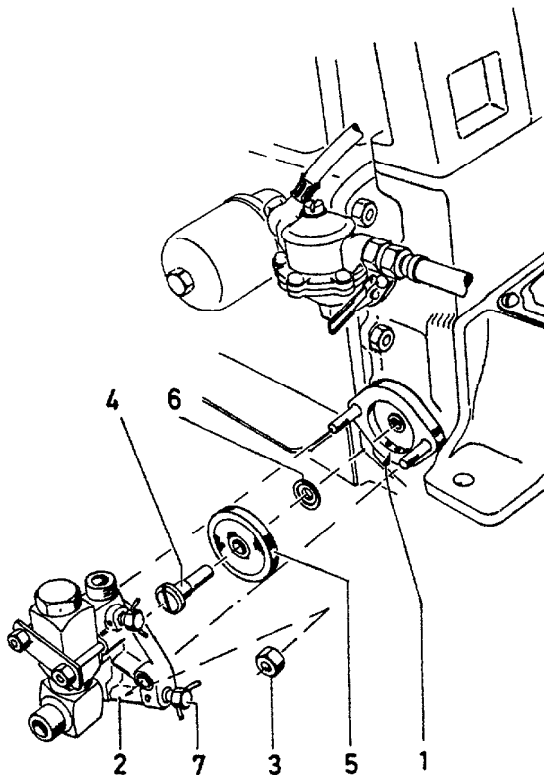


Fig. 40

1. Close gate valve. Open drain cocks (7) and undo the pipe connections. In the case of fresh water cooled engines, drain off the anti-freeze into an empty can.
2. Unscrew the nuts (3) and withdraw pump housing (2) and valve housing together.
3. Undo the diaphragm screw (4) using a good screwdriver, remove diaphragm washer (6), and replace defective diaphragm (5) with a new one.
4. The new diaphragm is fitted with its marked side facing inwards. The diaphragm washer is fitted on the inner side of the diaphragm with its convex side against the diaphragm. Screw firmly home.
5. Fit the pump housing and close the drain cocks. Fit the pipe connections and open the gate valve. In the case of fresh water cooled engines, fill cooling system adding anti-freeze as required.

27. CHECKING DIAPHRAGMS IN DOUBLE WATER PUMP

(At least once annually):

Fresh water cooled engines are usually fitted with a double water pump (wet exhaust). The standard pump (outermost) circulates the fresh water and the extra pump (nearest engine) cools the rubber exhaust hose.

1. Remove pressure cap, open drain cocks (6) off anti-freeze into an empty can.

2. Close gate valve for extra pump (4) and undo all pipe connections to both pumps.

3. Undo securing bolts (7) and withdraw pump housing (8).

4. Unscrew the diaphragm screw (9) using a good screwdriver, remove the diaphragm (10) and diaphragm washer (11). Undo the securing bolts (5) and withdraw pump housing (4). Remove large diaphragm (3) and inner washer (2).

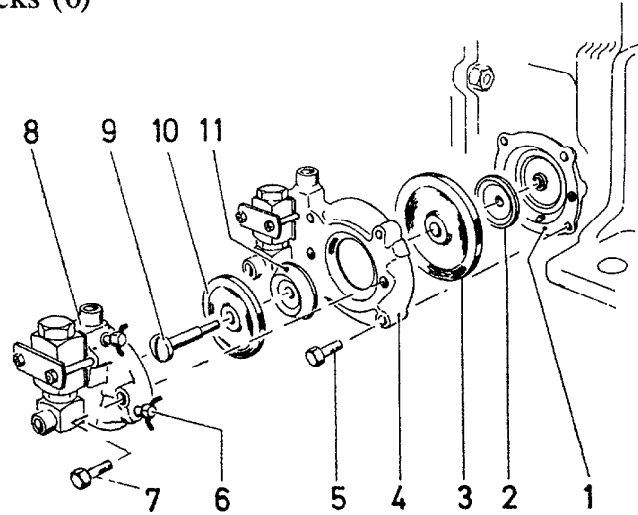


Fig. 41

5. Check both diaphragms and renew if necessary.

Assembly:

6. Diaphragm (10), with its marked side facing inwards, is fitted onto the diaphragm screw (9). Then fit the diaphragm washer (11) with its convex side against the diaphragm.

7. The large diaphragm (3) is positioned in the pump housing seating and the diaphragm screw, with diaphragm and washer, is inserted from the outside. The diaphragm washer (2) is fitted onto the end of the screw (9) and the whole assembly is positioned against the pump flange (1), centred and secured using the fixing bolts (5).

8. Tighten the diaphragm screw (9) securely, fit the water pump and re-make all pipe connections. Close the drain cocks and open the gate valve on the extra pump. Top up the fresh water system.

**28. CHECKING THERMOSTAT,
CLEANING THERMOSTAT
STRAINER**
(At least once annually):

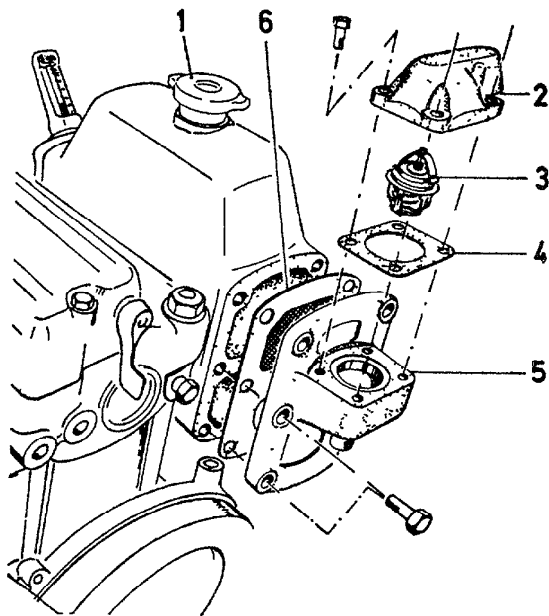


Fig. 42

1. Remove pressure cap (1) and open drain cocks on water pump.
2. Drain off anti-freeze into an empty can.
3. Remove thermostat housing (2) and withdraw thermostat (3). Place it in hot water at a temperature above 60° C. The thermostat should now open and close again when placed in cold water.
4. Remove thermostat cover (5) and wash out strainer in gasket (6). Thermostat and strainer can be washed in white spirit if necessary. If the thermostat does not function, the installation can be run without a thermostat provided the by-pass pipe is blanked off.
5. Re-assemble. Ensure that the correct amount of anti-freeze is added during topping up. Close the drain cocks.

**29. CHECKING THERMOSTAT
(1974 Model):**

1. Disconnect the return hose (11) from the after end of the fresh water header tank.
2. Remove pressure cap (7) to allow air into the tank and drain off the anti-freeze into an empty can via the nipple at the after end of the tank.

Undo the nuts (9), lift off the fresh water tank (10) and remove the thermostat (8). Place it in hot water at a temperature above 60° C. It should now open, then close again when placed in cold water. If necessary, wash the thermostat in white spirit.

If the thermostat does not function, the installation can be run without a thermostat provided that the by-pass pipe is blanked off.

4. Re-assemble. See item 5 above.

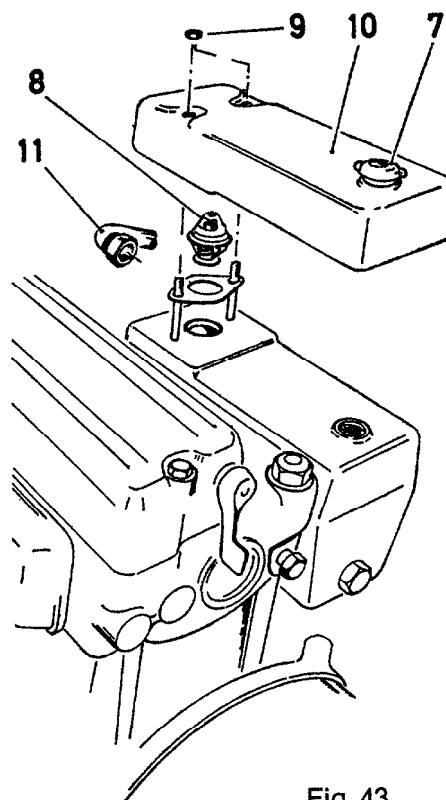


Fig. 43

30. CHECKING ZINC ANODE (At least once annually):

1. Close gate valve and open water pump drain cocks. Loosen cover plate (3), allowing air into container to assist draining.
2. Unscrew zinc anode (1) from forward end of silencer (2).
3. If a deposit has formed on the anode, this should be scraped off.
If more than half the anode has been corroded away, it should be renewed.
Spare Part No 516.006.
4. Ensure that there is good contact between zinc anode and silencer body.
5. Close drain cocks. Tighten down silencer cover plate. Open gate valve.
In the case of fresh water cooled engines, top up with anti-freeze.

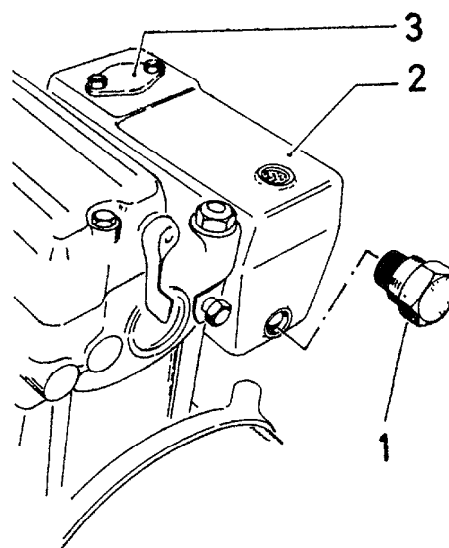


Fig. 44

31. REPLACEMENT OF IMPELLER (as required):

The pump is self-priming and self-lubricating and it requires no maintenance apart from replacement of impeller.

The impeller (4) is made of neoprene rubber and it will be damaged if run dry as a result of a cooling water blockage.

1. Close gate valve. Undo screws (1) and remove coverplate (2) and gasket (3).
2. Insert a screwdriver (6) from one side, levering against the pump housing (5) to ease off the impeller.
3. Fit new impeller, (Part No 947.010), replace pump coverplate and tighten screws evenly. Open gate valve.

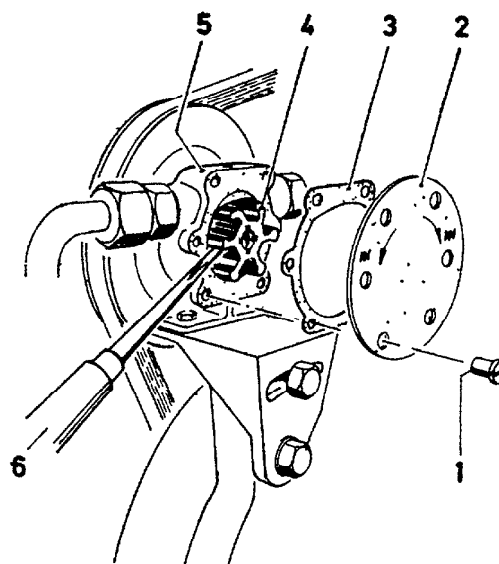


Fig. 45

If there is a risk of frost:

Close gate valve and slacken off pump coverplate (2).

32. CHECKING HEAT EXCHANGER

An apparent failure in the cooling water supply (rising engine temperature) that can not be attributed either to a faulty impeller or to air in the pump or associated piping, may be due to an end aperture blockage in the tube cooler.

Checking:

1. Close the gate valve. Open drain cock (1) to drain sea water from the tube cooler.
2. Remove suction hose and end cover (3). Remove any waste material (grass etc) that may be blocking the cooler end apertures and preventing effective flow through the cooler.
3. Re-assemble in reverse order.

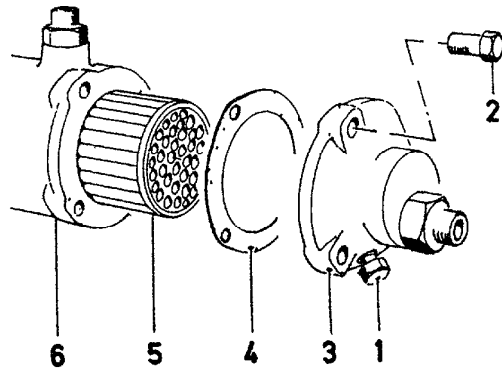


Fig. 46

Checking tube cooler:

If the level falls abnormally, the tube cooler should be checked. Remove the entire heat exchanger.

4. Remove the covers (3) and gaskets (4) from both ends of the heat exchanger.
5. Place a piece of wood over one end of the tube cooler (5) and tap carefully to remove cooler from its housing (6).
6. Insert replacement cooler, fit end covers and re-connect hoses. Top up engine fresh water cooling system.

E. ADJUSTMENTS

33. ADJUSTMENT OF V-BELTS (Alternator)

Every 100 running hours:

The important function of the V-belt is to drive the alternator and maintain the battery charge.

Therefore check the V-belt tension regularly (initially after 25 running hours), and particularly if charging is not satisfactory.

1. Slightly loosen the securing bolts (2 and 3) and slacken off the tensioning bolt (5).
2. Tension the belt (6) by moving the alternator (1) upwards. Tighten the tensioning bolt (5).
3. Check the tension. When the tension is correct, it should be possible to deflect the belt about 3 mm using thumb pressure at a point midway between flywheel and drive pulley.
4. Tighten bolts 2 and 3, check that tensioning bolt (5) is tight. (V-belt: Rofan 3915.)

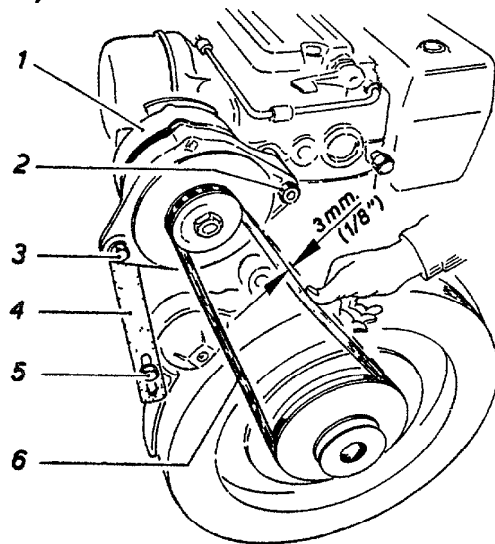


Fig. 47

Direct Current Generator

1. Slightly loosen securing nut (1).
 2. Tension the belt (3) by turning the hand-wheel (2) clockwise until the desired tension is achieved (see item 3 above).
 3. Re-tighten securing nut.
- (V-belt: Rofan 3915.)

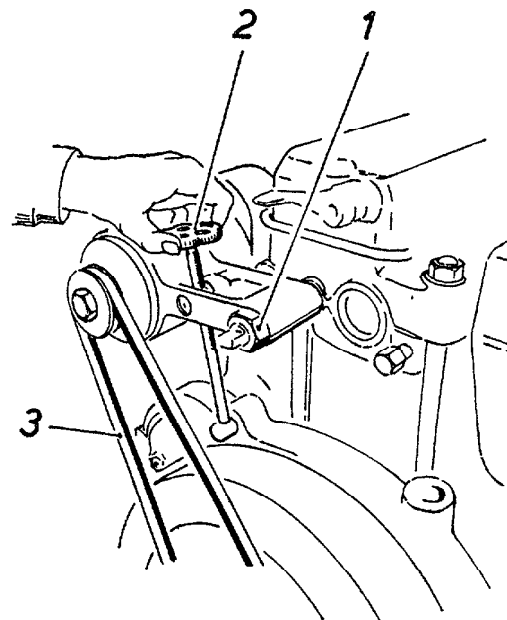


Fig. 48

34. ADJUSTMENT OF V-BELT

(Impeller pump):

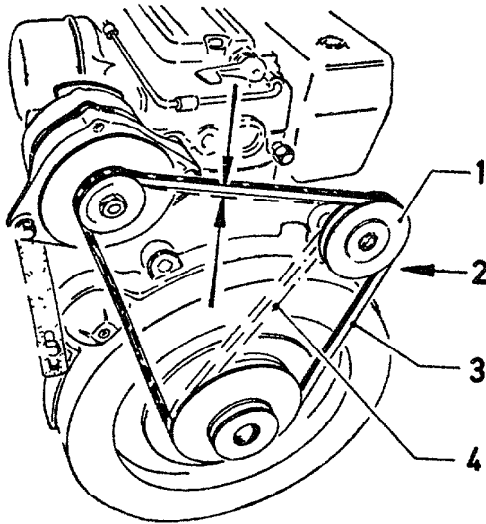


Fig. 49

In the case of engines fitted with impeller pump and alternator, V-belt (3) tensioning is carried out as described for engines with alternators (see Fig 47), but with the tension tested midway between pump and alternator.

For engines fitted only with an impeller pump, the V-belt (4) is tensioning by slacking off the securing and tensioning bolts (2) and moving the pump outwards. The tensioning screw is shown as item 5 in Fig 36.

Re-tighten bolts securely.

35. ADJUSTMENT OF ENGINE IDLING

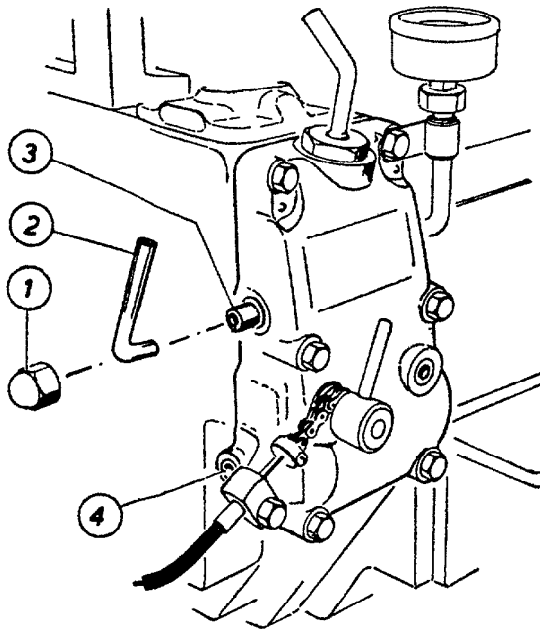


Fig. 50

Idling speed may be adjusted externally by means of the set screw on the rear of the governor cover.

1. Remove the dome nut (1).
2. Insert key (2) into hexagonal socket of idle set screw (3).
3. Adjust idling speed by turning set screw. Screwing set screw (3) out will tighten spring and increase engine idling speed.

Minimum idling speed should be set at about 350—400 rpm and it should remain constant for 10°—15° movement of the governor control lever.

4. Setting "extent" of idling range (not usually necessary to adjust).

Unscrew plug (4) using 5/16 Allen key. Insert screwdriver in opening and engage with governor arm adjusting screw. Screwing in the adjusting screw will increase the idling range given by the governor but it will at the same time reduce the maximum engine speed available.

36. ADJUSTING OF CLUTCH (as required):

The clutch may be adjusted when necessary (e.g. if slipping occurs), preferably in conjunction with a clutch oil change.

1. Remove clutch housing cover.

2. First check that the clutch lever (1) is pushed right forward. The clutch arms (2) must pass the indent if the clutch is to remain in position.

3. The engagement pressure can be regulated by means of the nuts (3) on the two clutch clamps (4).

After tightening all these nuts by $1/6$ turn, check engagement pressure by operating clutch lever. If the clutch is then too tight it may be sufficient to slack back $1/6$ turn on one nut on each clamp, ie two nuts are diametrically opposed to one another.

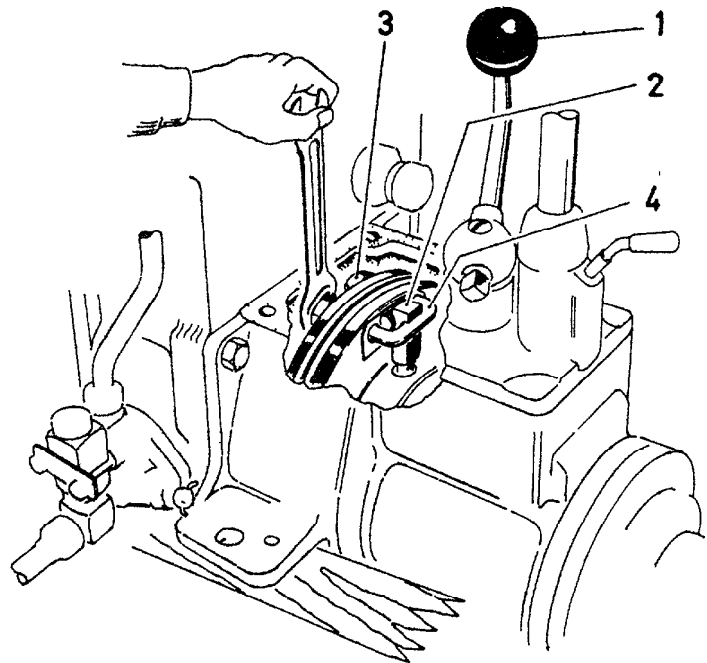


Fig. 51

On the next occasion of clutch adjustment, tighten up correspondingly on the other two nuts. In this way an even adjustment is assured. The nuts are locked by means of the springs positioned against the flats.

37. ADJUSTMENT OF INLET AND EXHAUST VALVE CLEARANCES (0.3 mm with engine cold):

Adjust initially after 50-100 running hours and subsequently after every 600 running hours or if starting difficulties are experienced.

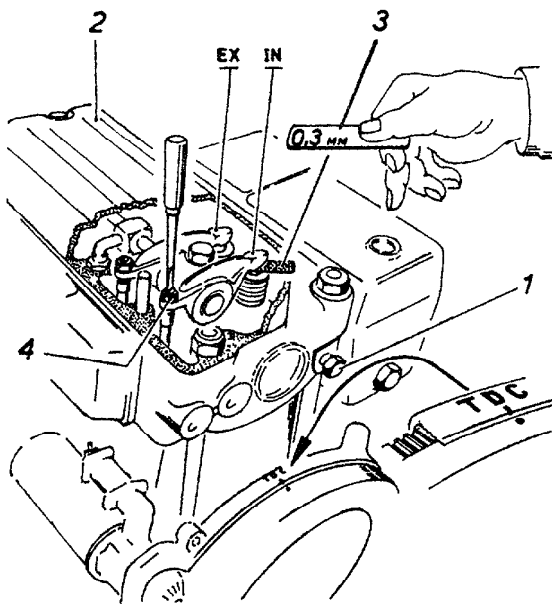


Fig. 52

1. Unscrew both starting cigarette plugs (1). Free the spring at the rear end of the cylinder head, unscrew the rocker cover bolts and lift the cover (2) off.
2. Turn the flywheel until the piston in cylinder No 1 (nearest flywheel) is at the top of its travel and both valves for cylinder No 1 are closed. (Push rods free to move.
See top dead centre mark (TDC) on the flywheel guard and on the flywheel (single mark).
3. Insert valve clearance feeler gauge (3) —(0.3 mm) between rocker arm and valve stem. Slacken off nut (4). Using a screwdriver, set the adjusting screw so that the feeler can be moved with only slight resistance.

Re-tighten nut (4) and check clearance again. Transfer feeler gauge to exhaust valve (EX) and set the same clearance as for the inlet valve.

4. Similarly for cylinder No. 2: Turn the flywheel until the piston in cylinder No 2 is at the top of its travel and both valves are closed. (Both push rods free to move.) See TDC mark on the flywheel guard and twin marks on flywheel. Continue as in item 3 above.

38. ADJUSTING DECOMRESSOR VALVE

With decompressor handle (C) in lower (open) position the engine should be easy to

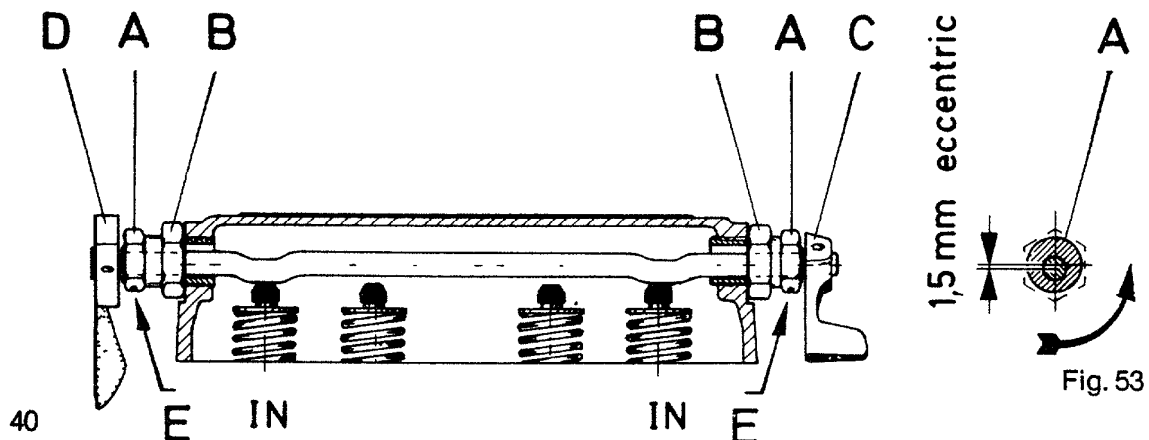


Fig. 53

crank by hand. The decompressor shaft acts on both inlet valves and keep them in open position. If not, the decompressor is adjusted by means of the eccentric bearing (A) both ends of rocker cover. Pointmark (E) on bearing shows position of eccentric. With point down the decompressor has max. opening.

F. CHECKS

39. CHECK OR RENEWAL OF GOVERNOR SPRINGS (as required).

In the case of any apparent irregularity in governor control, the governor components should be checked to see that they move freely and without fouling. Governor control irregularities may also be due to stretch in the governor springs, in which case these should be renewed.

1. Remove dipstick and detach governor cover (4).
2. Check that the governor components can be moved freely. If necessary, wash them in fuel oil.

If it is necessary to renew the governor springs, this can now be done without removing the governor itself.

3. Assemble governor cover. Check measure 21 mm of arm position. The arm can be slightly bent to get correct measure. Ensure that the fuel pump spigot (6) engages in the slot in the governor arm (5). This can be felt as a slight "click" or dead movement when the governor control lever (8) is turned in the "stop" position.
4. If the governor has to be removed, unscrew the set screw (7). Then release the cap nut in the after end of the governor cover and the idling adjusting screw can be screwed in through the hole (without dismantling the spring) in the cover and the whole arm can then be removed. The centrifugal governor (9) can be detached using a 22mm spanner.

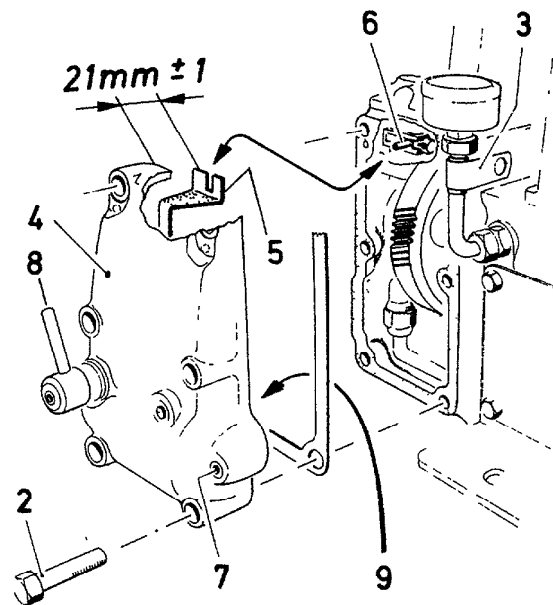


Fig. 54

NOTE: Right hand thread.

40. TIGHTENING CYLINDER HEAD BOLTS

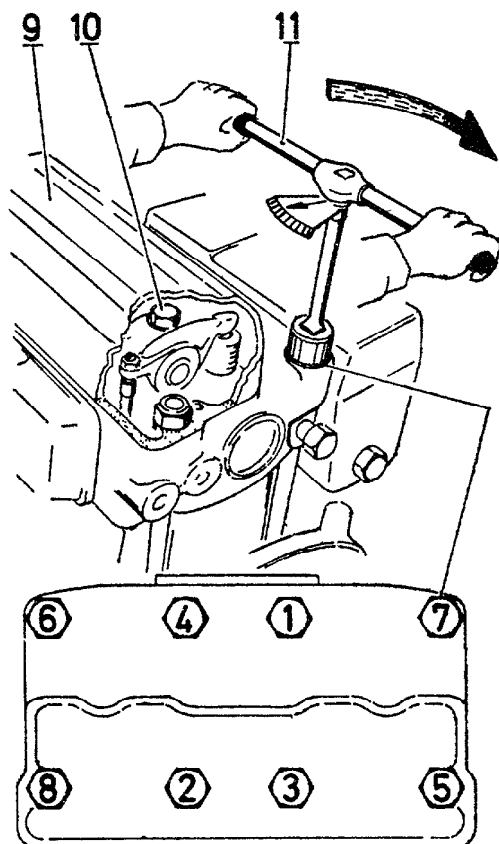


Fig. 75

If the cylinder head has been removed, the cylinder head bolts should be tightened after about 10 hours further running.

1. Run engine until it reaches normal working temperature then stop.
2. Unfasten the decompressor spring at the rear end of the cylinder head.
Remove rocker cover (9).
3. Slacken both bolts (10). Carefully lift off the rocker arm brackets and branch pipes without further dismantling.
4. Tighten the cylinder head bolts in the correct sequence. Use a torque wrench (11). Start with bolt No 1 on the port (silencer) side and then tighten No 2 and No 3 on the starboard side etc.
(Torque setting 11 kgm, 79 ft.lbs.)
5. Fit rocker arm brackets (torque setting 8 kgm, 58 ft.lbs.), adjust valve clearances and fit rocker cover.

41. CLEANING CRANKCASE SUMP AND OIL STRAINER

(Once every 2 or 3 years)

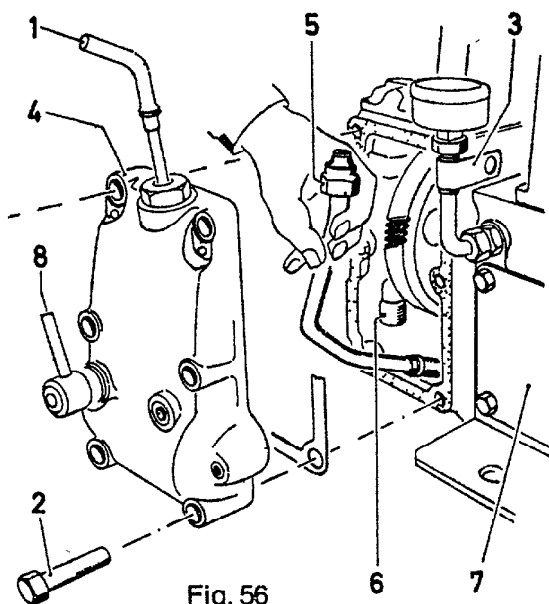


Fig. 56

The strainer only needs to be removed for cleaning if the oil pressure is low on starting (when the oil is thickest) when the oil level is normal. Otherwise it is sufficient to wash out only the crankcase sump itself (see item 3 on the next page).

1. Withdraw dipstick (1). Undo the securing screws (2), bend the fixing clip (3) to one side and remove the governor cover (4).
2. The strainer pipe (5) is visible through the opening in the gear housing. Undo nut on L-piece (6) and carefully ease the pipe out.

Wash out the pipe (strainer) in fuel oil and wipe or blow dry.

3. Remove crankcase cover (7) and wash out crankcase internally using fuel oil. Remove oil with oil syringe inserted through the cover opening. Dry thoroughly with paper wipes or lint-free rag.

Assembly:

4. Insert strainer pipe through cover opening, down towards the forward corner of the gear housing and with the strainer in the crankcase. Ease the pipe carefully into position and secure firmly.

IMPORTANT:

Ensure that the pump spigot (see Fig 54, item 6) engages with the slot in the governor arm (Fig 54 item 5). This can be felt as a slight "click" or dead movement when the governor control lever (8) is turned in the "stop" position.

42. CONTROLLABLE PITCH PROPELLER

The propeller blade pitch is altered by means of the drive block (4), the whole shaft being moved in and out. The drive block thus both transmits the engine power and controls the pitch of the propeller blades.

The thrust bearing is located in the forward end of the propeller boss and consists of three nylon rings, two (2 and 3) to take the ahead thrust and one (the centre one, not shown) to take the astern thrust.

Pitch Control Stiff:

- A. If the pitch control is stiff to operate, it may be due to lack of grease in the propeller boss, poor alignment between engine and propeller shaft, or to stiffness of the drive block within the propeller boss.
- B. Check shaft alignment by inserting a feeler gauge between the coupling flange and the engine drive flange, and then try with the two flanges disconnected.
If pitch control then works freely and the shaft alignment is correct, the boat must be slipped for examination of the propeller.
- C. In the case of new engines, stiffness in propeller control may be due to incorrect assembly of the propeller components. Therefore check that the marks on the drive block, the propeller boss and one blade all point the same way.
- D. If the stiffness continues after a period of use, it may be due to the propeller having struck some obstruction or having become fouled by rope etc.

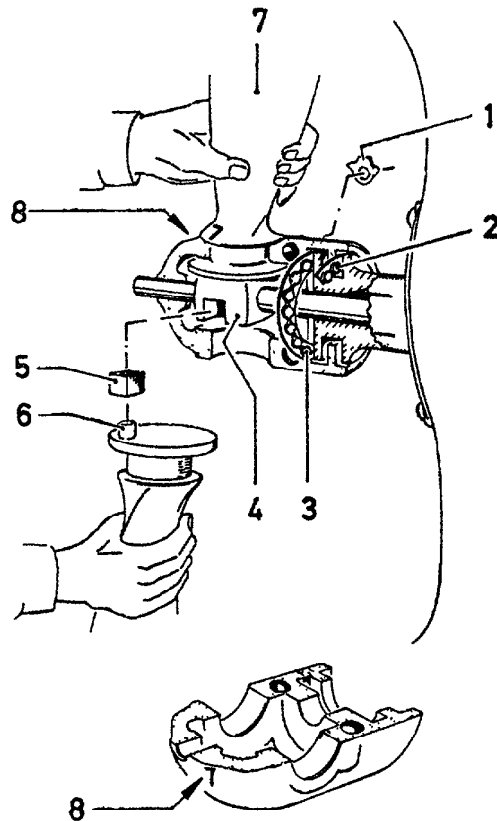


Fig. 57

Dismantling Propeller .

1. Clutch in neutral.
2. Undo boss screws using 8 mm (5/16") Allen key.
3. Remove the boss and propeller blades. Check whether the drive block (4) is cracked. If not, the stiffness can possibly be cured by careful filing of the drive block faces.
If the drive block is cracked or loose on its threads, it must be replaced.
4. If the propeller blades are damaged, they must be repaired so that they are again identical. Any blade differences will cause vibration leading quickly to wear on the shaft.

Assembly.

1. Fit the blade tap blocks (5) to the blade taps (6).
2. The marked blade (7) is positioned with its tap block (5) engaged in the recess on the marked side of the drive block. One half of the propeller boss (8) is then fitted in position from the port side in such a way that all the marks point in the same direction.
3. The other blade is then fitted with its tap block (5) engaged in the remaining recess in the drive block.
4. Fit the thrust rings, ensuring that the raised beaded side of each rings runs in contact with the corresponding stern bearing surfaces. Fill stern propeller boss with grease.
5. Fit the remaining half of the propeller boss and screw home the boss screws which are locked with lock washers (1).
Torque setting, stainless steel bolts M10 5-5.5 kgm (38 ft.lbs.)
Torque setting, brass bolts (old type) 1/2"W 2-3 kgm (16ft.lbs.)

Replacement of Shaft Drive Block

The propeller shaft is manufactured from stainless steel and has parallel threads. Ensure therefore that the replacement drive block is fitted the correct way round (see Fig 58). A replacement block can be tinned and sweated in position but the use of Loctite is preferred.

1. Clean shaft threads thoroughly to remove all grease. Use Loctite Activator T or trichloroethylene. The residue of any previous Loctite is most easily removed by heating the threaded length carefully using a gas flame. Clean out threads with a wire brush. Remove any loose material.

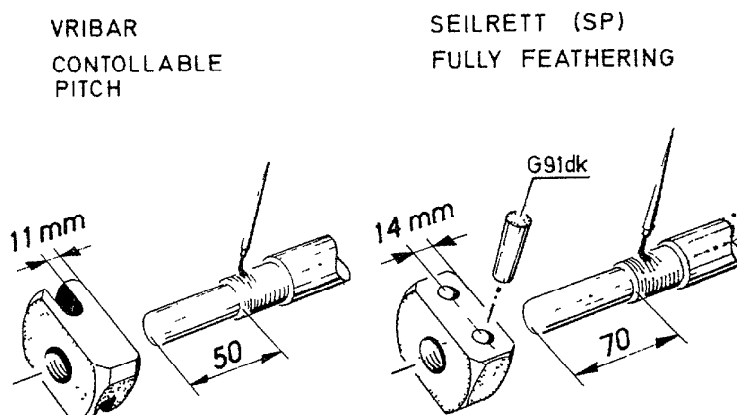


Fig. 58

2. Use LOCTITE 307 as locking compound and LOCQUIC ACTIVATOR T as activator. Apply ACTIVATOR T to the threads of both drive block and propeller shaft. Wait for the volatile component to evaporate and then apply LOCTITE 307 thinly and evenly to both threaded surfaces. This is most easily done using a small clean paint brush.

Screw the block into position immediately. (NOTE: The right way round, see Fig 58.) Tighten securely using, for example, a large spanner.

The driving block for fully feathering propeller is fitted without its two taps G91dk. When the block has been fitted, broach through holes ($3/8'' = 9,5 \text{ mm}$) and insert the taps.

The setting time varies from 1 to 4 hours according to temperature. Setting can be accelerated by warming the ready assembled parts to a temperature of 100°C for 10 minutes.

If the propeller shaft is to be fitted immediately and the boat refloated, it is best to wait at least 4 hours to ensure satisfactory setting before using the engine.

3. The drive block must be fitted to the propeller boss and blades by careful filing of the drive block surfaces, and one block face should be marked to ensure that it is fitted the right way round.

43. REVERSE GEARBOX

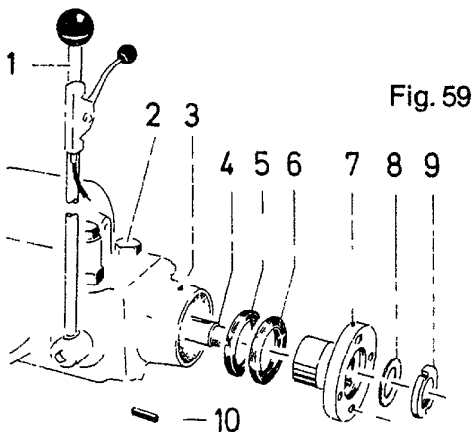
The reverse gearbox works on the principle of self-adjusting cone clutches for ahead and astern drive. When the gear lever is moved, the gear shaft (4), together with flange coupling (7) and propeller shaft, is moved forward for ahead drive and backward for reverse.

The clutch is held engaged by the propeller thrust. To avoid a degree of clutch slip during engagement, the clutch lever should be engaged with a light pressure. As soon as the propeller has begun to generate thrust, the clutch will hold in. The lever must not touch engine casing etc.

The nature of this method of clutch operation makes it important that exact alignment between engine and propeller shaft is maintained. Any misalignment could give rise to clutch slip.

If the water level in the boat is such that water may reach the oil seals in the rear face of the gearbox, operation of the gearbox should be avoided until the boat has been pumped out. This will prevent damage to the ball race on the far side of the seals.

Replacement of Oil Seals (Gearbox Engines) (as required):



1. Remove dipstick (2) and pump out the lubricating oil.

2. Remove the flange coupling bolts and ease the propeller shaft and after coupling flange approx 9 cm to the rear.

It usually pays to undo the engine mounting bolts so that it can be tilted forward.

3. Straighten the locking tabs and knock the ring nut (9) loose. Remove lock washer (8).

4. Set gear lever in the fully back position. Position two wooden blocks, about 1" thick, between coupling flange (7) and gearbox flange (3). Press the coupling flange off by pushing the gear lever carefully forward. If this is not effective, an extractor must be used. Take care of the key (10).

5. Tip the oil seals (5 and 6) out of the gearbox flange (3) and clean the sealing face.

6. Insert new oil seals, both with their open ends inwards. The outer seal has the dust lip turned outwards. Place a flat piece of wood over the oil seals and knock them in, one at a time. Apply a little grease. See that the grease nipple hole is open into the space between the oil seals.

7. Position the key and ease the coupling flange (7) carefully onto the gear shaft (4). Fit the lock washer, knock the nut tight and lock with locking tabs. Fill with fresh oil. Fit propeller shaft.

Gear Lever Movement

If the ahead clutch cone lining becomes worn after a long time in use, the lever must be pushed further forward to engage the clutch. This can be adjusted using shims between the clutch cone forward face and the ballrace on the shaft spigot in the gear housing (2).

Similarly, if the astern clutch cone line becomes worn, the clutch lever backward movement can be reduced by removing the shims from the forward end of the ballrace in the operating sleeve (3). This is a major repair and should be carried out by a SABB Workshop or other approved agency. Detailed instructions will be supplied on request.

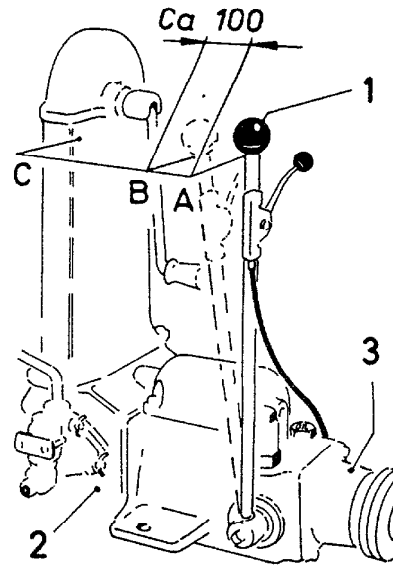


Fig. 60

Check:

1. The correct gear lever travel from neutral (A) to ahead (B) or astern is approx 100 mm.

44. CHECKING INJECTION PUMP (as required)

The injection pump is rugged and reliable provided that the fuel oil is clean and free of water, but it is a precision product and will not stand improper use.

The pump can be removed for checking but removal of the delivery valves (2) should only be carried out by qualified service representatives, as should any repairs to the pump.

The pump can be taken out without removing the governor cover.

1. Governor control lever (Fig 4, item 2) set to "stop" (upwards).
2. Disconnect oil hose (3) and fuel pipes and bend to one side.
3. Remove securing nuts (4), using tubular or other suitable spanner, and lift out pump halfway. Turn pump anti-clockwise (forwards) through 90° and withdraw for inspection.

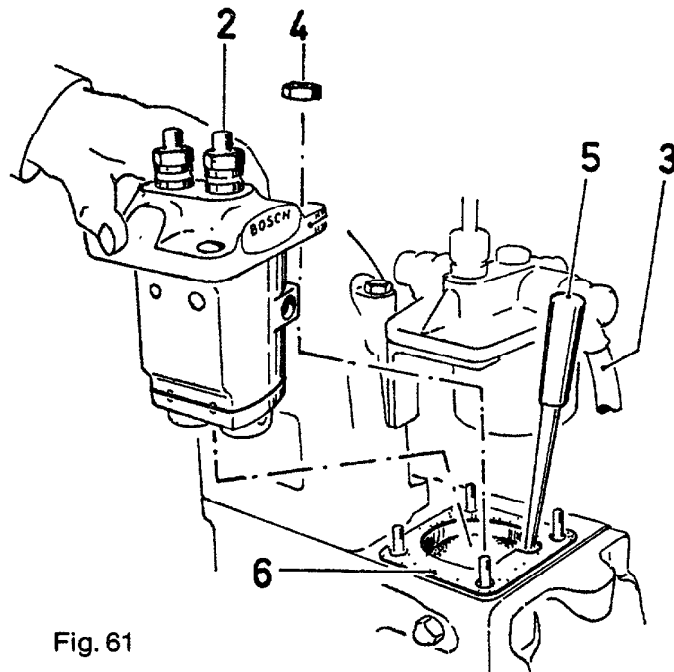


Fig. 61

Assembly:

4. Insert screwdriver (5) in the gap in the pump shim (6) and pump housing so that the governor arm (Fig 54 item 5) can be carefully levered out and held in that position.
5. Hold the pump as shown. Ease it downwards into the opening until the lowest part of the pump has passed the governor arm and hold in that position. Withdraw the screwdriver, turn the pump clockwise through 90° and press it down into position.
6. Ensure that the fuel pump spigot engages with the slot in the governor arm. This can be felt as a slight "click" or dead movement when the governor control lever is moved in the "stop" position.

G. WINTER LAYING UP

Before laying the boat up for the winter, protect the engine as follows:

Change the oil in crankcase and clutch or reverse gearbox.

Grease all nipples.

Close gate valve and allow engine to idle for half a minute to expel any water from the exhaust hose.

Drain the water from engine, silencer, water pump and piping.

For sea water cooled engines, flush cooling system through with fresh water.

For fresh water cooled engines with closed cooling system, there is no need to drain provided that anti-freeze has been added. See "Fresh Water Cooling". If the system is drained, any external cooler must be blown dry.

If a heat exchanger is fitted, the gate valve must be closed and sea water drained from the heat exchanger. Open impeller pump cover, extract impeller and replace cover.

Unscrew start cigarette plugs and spray 10 shots (about 10 cc) of lubricating oil into each cylinder. Turn the engine over a few times. Repeat once or twice during the course of the winter.

Clean engine externally and touch up with engine paint.

Keep engine covered.

Drain off any condensed water in the fuel tank and top up with fuel.

Remove battery from boat, charge and store in a dry frost-free place. The battery should be recharged at intervals two or three times during the winter.

Disconnect the flange coupling and separate slightly. This ensures that the shaft will not be damaged if the hull should distort during the lay-up.

PREPARATION AFTER WINTER LAY-UP:

When preparing the engine following winter lay-up, it pays to spend as much time on the work as necessary.

When the boat has been re-floated, the engine alignment should be checked.

If the engine is supported in rubber mounts, the adjusting nuts (D) above and below the support frames should be checked. Also check the bolts (E).

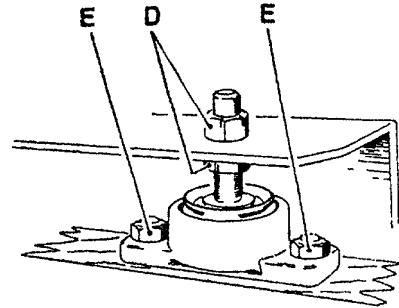


Fig. 62

Sea Water Cooled Engines:

Inspect the zinc anode plug (also for fresh water cooled engines) at the forward end of the silencer. Renew if necessary.

Close drain cocks. Make sure that the gate valve is open and that the exhaust hose is connected to the silencer.

Fit a fully charged battery and connect it as shown in the wiring diagram.

NOTE: Never start the engine before the alternator and regulator have been connected to the battery. Adjust V-belt tension.

Check that there is fuel in the tank. Drain off sediment.

Check that there is oil in engine and clutch or gearbox. Grease all nipples and propeller boss.

Fresh Water Cooled Engines (without anti-freeze):

Inspect zinc anode plug at the forward end of the silencer. Suction and return hoses must be connected to the engine and to the external cooler. Fill system with clean fresh water.

CHECKING THE ALIGNMENT

The alignment of engine and propeller shaft should be checked after the boat has been in the water a sufficient length of time to permit the hull to set. The alignment is controlled with a feeler gauge between the coupling flanges (see fig 63), in 4 positions up, down and laterally.

If required loosen engine fixing bolts and fit shims under frames until flanges are exactly parallel. Check again after engine is fixed.

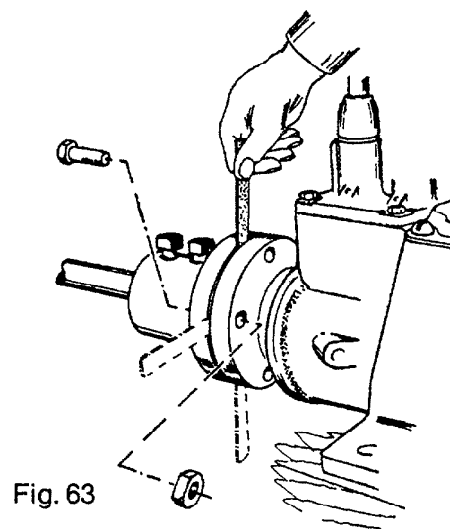


Fig. 63

IRREGULAR ENGINE OPERATION

Fault Location

1. ENGINE FAILS TO START

- a. Governor control not full open.
- b. Crankcing speed too low.
- c. Dry cylinder walls. Lubricate with 4-5 shots of lubricating oil into each cylinder using squirter can through plug holes.
- d. Water in fuel.
- e. Fault injection. Check nozzles.

2. LACK OF COMPRESSION

- a. Check correct valve clearances (0.3 mm, page 40).
- b. Valve sticking. Check valve movement by hand. If necessary squirt fuel oil through springs to lubricate valve stems while pressing down by hand.
- c. Start cartridge residue on valve seating. Listen for leakage while turning engine over by hand.

3. ENGINE HARD TO CRANK

- a. Lubricating oil too thick.
- b. Bent propeller shaft. Check alignment at flange coupling (page 49).

4. LACK OF POWER

- a. Blocked fuel filter. Renew filter element (page 24).
- b. Air in fuel system.
- c. Dirt in injector nozzles (page 26).
- d. Blocked air filter.
- e. Clutch slipping (page 39).
- f. Incorrect valve clearances (page 40).
- g. Blocked exhaust pipe. Collapsed rubber exhaust hose (kinking or over-heating).

5. ENGINE STOPS

- a. Fuel starvation. Fuel cock closed.
- b. Air or water in fuel system.
- c. Injector pipe leak.
- d. Too little lubricating oil. Top up. Check compression after allowing to cool until easy to turn over. Re-start and increase load slowly.

6. SMOKY EXHAUST

- a. Blocked nozzles (page 26).
- b. Worn piston rings and poor compression.
- c. Valve leakage. Clean and re-grind.
- d. Air intake blocked.

7. UNEVEN RUNNING, HUNTING

- a. Governor parts sticking due to thick, dirty oil. Remove governor cover and wash out with fuel oil (page 41).
Change lubricating oil (page 17).

8. ENGINE WILL NOT IDLE

- a. Valve leakage
- b. Nozzle blocked (page 26).
- c. Incorrect relative setting of governor control lever and remote control lever.
- d. Governor idling spring too slack (page 38).
- e. Blocked filter element in fuel filter (page 25).

9. EXCESSIVE LUBRICATING OIL CONSUMPTION

- a. Oil leakage past defective seals.
- b. Cylinder liners and piston rings worn. Check wear and change rings if necessary.

10. LOW OIL PRESSURE

- a. Lubricating oil too thin.
- b. Too little oil. Pump sucking air.
- c. Defective oil pressure gauge.
- e. Dirt in oil pressure relief valve (pages 15 and 19).
- f. Lubricating oil pipe leakage.
- g. Engine room too hot, inadequate ventilation.

11. ENGINE KNOCKING

- a. Blocked nozzles. Leak-off pipe blocked.
- b. Mechanical failure. Check valves, big-end bearings and gudgeon pins.

12. ENGINE OVER-HEATING OR WATER PUMP NOT FUNCTIONING

- a. Water inlet or water valves blocked.
- b. Defective water pump diaphragm. Leakage from drain holes in pump flange.
- c. Engine room too hot, inadequate ventilation.

13. KNOCKING SOUND FROM CLUTCH OR PROPELLER

- a. Lack of grease in propeller boss.
- b. If sternpost is too thick, this can give rise to knocking at the clutch when at full power. Fair off sternpost to give smooth water flow to propeller.
- c. Shaft coupling loose.

14. PITCH CONTROL HARD TO OPERATE

- a. Inadequate greasing of propeller or incorrect grease.
Grease propeller and sliding bolts (pages 20 and 21).
- b. Bent propeller shaft. Check alignment (page 49).
- c. Damaged propeller.
- d. Propeller shaft worn in stuffing box.
- e. Worn thrust rings in propeller boss. Renew rings or add shims (page 43).

15. CLUTCH SLIPPING

- a. Clutch not properly engaged. Press lever right forward and check that it does not foul engine casing etc.
- b. Incorrect clutch tension (page 39).

16. REVERSE GEARBOX SLIPPING

- a. Gear lever movement obstructed.
- b. Bent propeller shaft. Check alignment (page 49).
- c. Too much oil in reverse gearbox.
- d. Shaft coupling loose. Check set screws.
- e. Stern bearing gland loose.
- f. Excessive lever movement due to defective bearings in operating sleeve.
- g. Excessive lever movement due to cone lining wear.
Adjust with shims on clutch cone forward face (page 47).

17. ENGINE NOT RUNNING EVENLY ON BOTH CYLINDERS

- a. Faulty nozzle. Change over or replace (page 26).
- b. Valve leakage on one cylinder (page 40).

RECOMMENDED ON BOARD SPARES

For long journeys or holidays, we recommend that a standard maintenance spare parts kit should be held on board.

These kits contain a selection of those gaskets, pipes and spare parts that experience has shown to be most useful.

For type 2H : Maintenance Spare Parts Kit V-12.

For type 2HG: Maintenance Spare Parts Kit V-12A.

also available:

Maintenance Set of Gaskets P-10A (included in V-12).

Repair Set of Gaskets P-11A.

O-Rings and Oil Seals O-12.