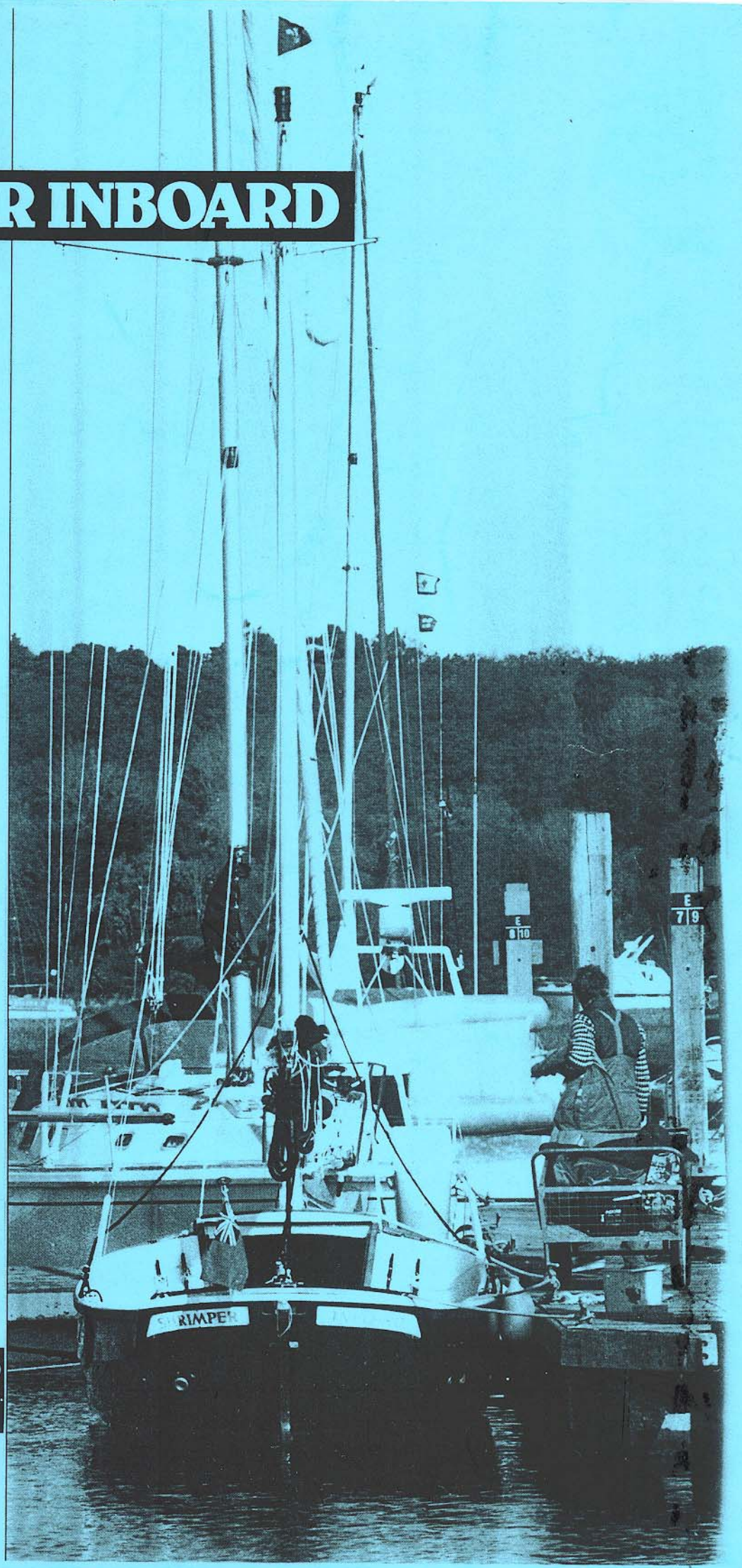
SHRIMPER INBOARD

Designed by Roger Dongray

ENGINE NOTES



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SHRIMPER INBOARD

NOTES ON THE ENGINE INSTALLATION AND ITS MAINTENANCE

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N.B.(1) These notes should be read in conjunction with the Operation Manual for the Yanmar 1GM10 and other manufacturers notes such as those supplied with the CAV fuel filter.

N.B.(2) If you have an engine problem which you cannot solve with the aid of these notes or the Yanmar Operation Manual, do not hesitate to contact us as a first step before calling in a marine engineer - we will do our best to help.

April 1989

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NOTES ON THE ENGINE INSTALLATION AND ITS MAINTENANCE

A. Basic Data of Standard Installation

Engine Type	Yanmar 1GM10 single cylinder marine diesel 1 Hr rating output: 9.0 HP @ 3600 RPM
Dry Weight	76 KG
Reduction Gear	Ahead 2.60:1 Astern 3.06:1
Lube Oil Capacity	Crank Case: 1.30 Litres Gearbox : 0.25 Litres
Lube Oil Type	Duckhams Hypergrade (see page 37 of engine manual for alternatives)
Alternator	HITACHI 12 volt 35 amp output
Battery	LUCAS 12 volt 70 amp/hour capacity
Prop. Shaft	Stainless 1" diameter 50" overall length with 1 in 12 taper over $2\frac{1}{8}$" with $\frac{1}{4}$" keyway for prop
Propeller	2 bladed "Swedish type" Diam: 12" Pitch: 12"
Inboard Bearing	Flexibly mounted bronze bearing with fibrous gland packing compressed by a castellated nut and requiring regular greasing via remote greasing system provided.
Grease type	Golden Film (Morris's of Shrewsbury). or other proprietary stern tube grease
Outboard Bearing	Cutlass type - water lubricated butyl rubber Castellated bearing in bronze shell partly recessed within the hull
Fuel Tank	Nominal 4 gallon capacity mild steel with bottom outlet via fuel tap incorporating gause initial filter, adjacent drain plug for flushing, fuel return inlet and central filler cap with air vent
Fuel Type	"Light Diesel Oil" for marine use, available from marinas fuelling pontoons, boatyards and marine bunkering facilities etc.
Fuel Filter	C.A.V Filtrap 100- water trap type with glass sediment/separation bowl and filter element.
Wasting Anode	Single pole type M.G.Duff. earthed to engine

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B. General Description of the Installation.

To accommodate an inboard engine, the cockpit area of the Shrimper has to be modified along with the moulded keel adjacent to the rudder.

The base of the cockpit well is cut away and the sides are instead bonded to the inside of the hull which permits the glassing in of engine bearers at lowest level. The Yanmar engine is flexibly mounted to these bearers so that it is aligned and is rigidly coupled to the stainless steel prop shaft. the shaft passes through the flexible inboard bearing and glass fibre stern tube which is bonded firmly into the aft keel area and out of the hull through a water lubricated outboard bearing after which the shaft is tapered and keyed to accept the rigid two blade propeller.

The after part of the fixed keel is moulded differently to form a streamlined aperture within which the propeller rotates thus there is no change in rudder shape and the prop can if required be stopped in a dead vertical position to minimise drag when sailing. The lower rudder pintle is however re-sited above the aperture to be clear of the prop. This general arrangement is shown in fig.1.

A new cockpit sole moulding is mechanically fixed to timber bearers and existing flanges close above the installed engine and sterngear and the joint is also packed with silicone sealant so that it is watertight. this moulding, shown in fig.2, is raised and developed forward to form the engine box whilst it is recessed aft to form a shallow sump from which surface water can be pumped. This sump is also fitted with a small inspection hatch which provides access to the inboard bearing for adjustment of the gland packing. The threads of the inspection hatch lid should be kept greased to ensure that it remains watertight.

The slightly angled top of the engine box is fitted with a wide moulded lid which provides major access to the engine. however a bayonet type inspection hatch is fitted within this lid which gives sufficient access to the compartment to enable the opening of the cooling water inlet and electric starting of the engine - a great advantage with a crowded cockpit or in adverse weather.

The centreplate winch rope is routed through a sheave so that it emerges under the bridge deck clear ahead of the engine compartment where jamming and horncleats are provided for belaying.

Thus for operation of the engine, sufficient access is gained via the inspection hatch whilst wider access for routine maintenance such as oil level checks or bleeding the fuel

system is available through the engine box lid. Removal of the engine or access to the shaft coupling will necessitate removal of the cockpit sole and engine box moulding by removing the fixing screws around the edges and breaking the silicone sealant joint when the whole moulding can be eased out. On refitting the sole the joint should be re-sealed.

Cedar floorboards span the cockpit sole to form a non-slip working surface. At the aft end of the cockpit well,two bilge pumps are sited. The port hand unit draws from the cockpit sump whilst the starboard deals with the engine bilge from its deepest point below the prop shaft.

On the port side of the cockpit well the single lever "morse type" throttle and gear control is sited together with the stop control.

Under the bridge deck is a stainless steel mushroom vent which is unscrewed to open. this vent provides air to the engine compartment and should be open under all normal circumstances. However it could be closed in very heavy weather conditions to ensure the engine keeps dry.

No aperture is cut through the base of the outboard motor well as this area is utilised to house the diesel fuel tank as shown in fig.3. Indeed by fitting tank bearers, cutting out the forward corner of the well moulding and mechanically fastening a new moulded lid , the fuel tank is nicely contained with access to the fuel tap and line via the adjacent port hand locker, access for filling via an inspection hatch in the moulded well lid and access if necessary to the whole tank by removing this lid.

The port hand locker also houses the remote grease cup for the inboard bearing and provides access to the backside of the single lever control unit (having removed some rigid foam bouyancy which is retained by a removable bulkhead.)

The lids to the cockpit lockers and the engine box are hinged, gasketted, equipped with screw down fasteners and hasps for padlocks to provide integrity and security.

The Yanmar 1GM10 engine is flexibly mounted on to timber bearers to provide the lowest possible engine height. The coupling ex the gearbox to the prop shaft is rigid but the inboard bearing is flexible to absorb shaft movement emanating from the engine. The short stern tube is firmly bonded into the after keel area and encloses the cutlass type outboard bearing which is water lubricated. The starter motor and alternator are linked to the heavy duty battery sited in the cabin via high tension leads which pass through the main bulkhead. There is no hand start facility due to the presence of the centreplate and its case immediately ahead of the engine.

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C. Starting, Running and Stopping Procedure

Starting from cold.

1. Check there is fuel in the tank and that outlet tap is turned on (hexagon side pushed in).

2. Turn down cap of remote greaser one turn.

3. Turn isolation switch on battery to "on" and open cowl vent under bridge deck (air inlet to engine compartment).
4. Open gate valve of cooling water inlet through hull fully.

5. Ensure decompressor lever above engine cylinder is closed i.e. facing forward, thus ensuring full compression.

6. Make sure there are no trailing warps etc. near prop eg that the dinghy painter is shortened up.

7. Check gear shift is in neutral (single lever vertical) then increase throttle setting by pressing in the red button whilst moving the single lever forward to (say) "2 o'clock". The red button should stay in until the lever is later moved back to vertical (neutral) to enable forward or reverse gear to be selected.

8. Insert engine key in panel and turn to "on" when oil and charge lights will show and buzzer will sound.

9. Press and hold down Starter button (adjacent to key) until engine fires but if engine has not fired after 10 - 15 revolutions, release starter button, give battery a minute to recover, increase throttle setting slightly and press starter button again.

   If after three or four attempts the engine does not start please see 1-3 in section D: Troubleshooting below.

10. When engine fires, oil and charging lights should go out and buzzer should cease. Engine revs can now be adjusted to a comfortable level above tick-over to enable warm up for a couple of minutes before moving off or just to charge the battery.

    N.B. For the first time of running with a new engine it will be beneficial to run it in neutral at a little more than tick-over (800 revs) for 15 - 20 minutes before putting under load

    If oil or charge lights remain on (denoted by buzzer) many seconds after engine starts, stop engine by returning single lever to vertical (neutral) and pulling out the adjacent

stop button, subsequently turning key to "off". Then consult note 4-5 in section D Troubleshooting below.

11. Soon after engine fires, check that cooling water is circulating by watching the exhaust outlet in the transom. A small amount of water should be expelled intermittently although it is possible that this water may take more than a minute to appear if the cooling system was dry hitherto. A second check is to watch for the illumination of the water warning light on the panel (denoted by the buzzer).

    The commencement of this warning indicates insufficient water flow for adequate cooling. Stop engine and consult note 6 in section D Troubleshooting below.

Stopping the Engine 1 (ready for re-use).

12. As mentioned in 10 above, stop engine by returning single lever to vertical (neutral, tick-over), allowing to idle for a few minutes pulling out the adjacent stop button and subsequently turning key to "off".
    Water, battery and fuel can be left turned on ready for re-starting in which case re-start procedure will commence at 6. above.

Stopping the Engine 2 (Finished with Engines!)

13. Stop engine as described above then close gate valve on water inlet and turn off battery isolation switch. Occasionally spray over the engine with WD40 or similar remove engine key and lock engine box lid. We suggest that the fuel tap should always be left on to avoid risk of air lock if and when engine was re-started without re-opening the tap.

    If the boat is to be left for any length of time it will be advisable to fit the cockpit cover to avoid rain flooding the cockpit.

Running the Engine Under Load.

14. Assuming that the engine is running smoothly and with no warnings operating, forward or reverse gear can be engaged. This is achieved by returning the single lever to vertical (neutral tickover) when the red button should extend. When the single lever is moved forward again it will travel until approximately "1 o'clock" engaging forward gear but with revs remaining at tick-over. This condition is ideal for gentle manoeuvring but by moving the lever further forward increasing revs will be achieved to give increasing boat speed. Exactly the same occurs in reverse when the lever is moved aft of vertical.

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On no account move the lever rapidly from high revs forward to reverse without allowing the revs to drop in neutral and for the prop shaft to become stationary.

15. **RUNNING IN.**- During the first five hours of operation do not run the engine hard ie. at peak revs. Keep to around half throttle whilst moving parts bed in. In addition ensure a plentiful supply of grease to the inboard bearing by turning down the cap of the remote greasing unit one turn each hour of operation - refilling the grease cup as necessary.

16. **AFTER RUNNING IN.** engine revs can be chosen at will after a few minutes warm up but there is little point in running at full throttle other than in an emergency. Little increase in boat speed will be achieved over three quarter throttle whilst there will be an inevitable increase in engine noise and vibration.

    With practice, ideal cruising revs will be found where the boat is close to displacement speed and feels comfortable with the minimum of noise and vibration. Even after running in, half a turn on the grease cap every two or three hours of operation will ensure the inboard bearing remains well lubricated. Over lubrication will cause no harm - merely a scattering of grease on the hull interior close to the bearing which can be wiped off occasionally via the inspection hatch.

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D. Troubleshooting.

1. **Engine does not turn over when starter button is pressed.**

   Check battery isolation switch is "on".
   Check in line fuse in loom near to alternator (spare fuse in cartridge).
   Check battery terminal connections.
   Check state of battery - If necessary re-charge.

2. **Engine turns over only slowly when starter button is pressed**

   Weak Battery - Try activating decompression lever on top of engine by facing lever aft, reducing compression and thus resistance for starter motor. Re-compress if engine turns over and with luck the engine will fire. Once started the battery will be rapidly charged by the alternator.
   If engine will not start, re-charge battery ashore.

3. **Engine turns over well but will not fire.**
   or
   Engine will not continue to run.

   Try various throttle settings.
   Check that stop button is pressed fully in.
   If engine still won't start, the failure is almost certainly due to absence of fuel to injector caused by airlock in fuel supply - follow procedure for bleeding the fuel system. Otherwise the cause could be the presence of water in the fuel or indeed a faulty injector (see below).

BLEEDING THE FUEL SYSTEM

General.

Small marine diesels are extremely reliable and providing there is enough power in the battery to turn the engine over properly and diesel fuel is present, the engine should start. However, it is possible for fuel "starvation" to occur either because the fuel tank is empty, a fuel tap has been left inadvertently closed or some temporary blockage has occurred in the fuel line. Any of which could cause the presence of air in the fuel system. If sufficient air is drawn in, a classic airlock will occur and insufficient fuel will be available to and through the fuel pump to feed the diesel injector which must spray a fine vapour of fuel at high pressure into the cylinder prior to each detonation. The Yanmar is provided with facility to manually expel air from the system so that neat fuel can again be available to the injector.

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The necessary procedure for bleeding the system to remove the airlock is now described and whilst reading this it will be useful to refer to the sketch in fig 4.

First check the fuel tank to make sure that fuel is present. A nearly empty tank is suspect particularly if the engine has been used with the boat heeling. Replenish the fuel tank if necessary to a sensible level ie not less than one third full.

Check that the fuel tap below the the tank is open so that fuel can flow.

Next open the bleed nut on top of the CAV fuel filter (the outboard highest nut - see fig 4) until fuel spills out without bubbles then close the nut tight again. This will ensure that the fuel line to the filter and the unit itself is free of air.

A short transparent fuel line leads from the filter to the low pressure pump (marked "A" in fig 4) and this pump has a manual plunger which can be moved up and down by hand. The lever emerges to starboard of the pump cylinder. From this pump a flexible but opaque fuel line feeds a second fuel filter (marked "B" on fig 4) which has arrows on top of the filter casting to show "fuel in" and "fuel out". In the centre of the top of the filter is a large Phillips screw. The screw should be loosened 2/3 turns with a Phillips screwdriver (From the tool kit). Next, surround the top of the filter with some scrap cloth or paper tissue to absorb fuel leakage. Then with the screwdriver poised to close and re-tighten the screw, work the plunger on the low pressure pump up and down, drawing fuel into the filter to be expelled around the screw. As soon as continued movements seem to pump through fuel which is free of bubbles, close off the screw with the screwdriver whilst continuing to move the pump lever slowly. This will prevent any drawback of air into the filter as the screw is closed home.

Air has now been cleared between the tank and as far as the filter outlet and the next point for bleeding is the entrance to the high pressure pump which is ahead of the manifold (marked "C" in fig 4). This pump can be identified by following the solid metal fuel line from the filter. The line will end up at the pump by way of a "banjo" fitting in the centre of which is another large Phillips screw. This screw faces forward and may be difficult to engage with a screwdriver. fortunately the sides of the screw are hexagon and so a small spanner from the tool kit can be used instead. Loosen the screw 2/3 turns, surround it with absorbent material and work the low pressure pump lever up and down again until fuel comes through bubble free. Once again, close off the screw whilst continuing to pump slowly.

Having bled through to the high pressure pump the engine will usually start although it may take more than 20 revolutions of the engine by the starter motor before the engine fires.

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If after two attempts at starting the engine has not fired, it will be necessary to check for air in the final section of the fuel line - between the high pressure pump and the injector (which is marked "D" in fig 4). Loosen the union which locks the rigid fuel pipe into the injector, surround with absorbent material and then turn the engine over by the starter motor with the engine decompressed (by turning the lever marked "E" in fig 4 aft instead of the normal forward position).

As soon as bubble free fuel exudes from around the union nut. close it home with a spanner from the kit and re-compress the engine by returning lever "E" forward.

The engine should now start but if difficulty is still experienced, repeat the bleeding procedure. If the engine still will not start the cause may be either a blocked injector, requiring the services of a marine engineer ashore, or the presence of water in the fuel system: see below.

REMOVING WATER FROM THE FUEL SYSTEM.

The presence of water in the fuel system could be due to condensation within the fuel tank or faulty fuel etc. The CAV water trap filter, type: Filtrap 100 allows separation of water into the bottom half of the unit which comprises a glass bowl. Any build-up of water can be seen in the bowl and can be vented from the system via the plastic drain plug in the base unit.

If a build-up of water goes unnoticed it is clearly possible for the level to rise in the filter until it passes through the fuel pipe into the low pressure pump and onwards. When water gets to the injector the engine will obviously fail to fire.

In this situation, having vented the CAV filter it will be necessary to "purge" the remaining fuel system in the engine by following the same procedure as for bleeding described above to achieve pure water free fuel at all stages including at the injector.

A FAULTY INJECTOR.

The injector must deliver a measured amount of diesel fuel under very high pressure as a fine spray before each detonation. It is thus a piece of precision equipment which would not operate if it became partially or wholly blocked by a piece of grit or other foreign body in the fuel. With two filters in the system, the risk of blockage is very small, nevertheless it is possible. In the event of a suspected blockage it is necessary to consult a qualified marine engineer. If he agrees the diagnosis he will need to remove the injector for cleaning under high pressure and re-setting ashore.

4. **Oil warning light stays on after starting.**

The oil light should go out after five seconds of running. If not, check engine oil level at dipstick and top up as necessary.

5. **Charging light stays on after starting.**

The charging light should go out after approximately ten seconds of running. If not, try increasing engine revs slightly via the single lever control. If the light then goes out, it is likely that the idling speed needs increasing as described in the Operation Manual.

Another possible cause is slippage of the drive belt to the Alternator. The procedure for tensioning the belt is described in the Operation Manual.

Other causes include faulty relay switch, faulty Alternator or damaged/faulty wiring. Consult us or a marine engineer for advice.

6. **Water warning light comes on after starting.**

The illumination of this light on the panel, accompanied by the buzzer sounding, indicates that insufficient cooling water is circulating. Providing the engine is switched off promptly following the warning, no damage should be sustained by overheating.

Check first that the cooling water inlet gate valve is fully open. If not, open it fully and restart engine. Cooling water light and buzzer should go off after about 30 seconds and water should be intermittently discharged from the exhaust.

If gate valve was open, next check the strainer above the gate valve for weed as follows. First close gate valve again then loosen the two brass butterfly nuts on top of the strainer body when the "lid" can be swung back to reveal a white gause filter. Lift the filter out and rinse off any weed or other debris. Before returning the gause, open the gate valve slightly to prove that water flows freely. If not it is likely that weed or perhaps a plastic bag has blocked the inlet outside the hull. This may necessitate a paddle or even a swim if you have no long handled deck scrubber handy!

Having thus cleared any blockage associated with the inlet, re-assemble the strainer, open the gate valve and restart engine as above

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If cooling water will still not flow, it must be assumed that the water pump impeller is faulty or that V drive belt to the pump is too slack. Replace and/or adjust as described in the Yanmar operation manual or consult a marine engineer.

E. Routine Maintenance.

General.

Routine and annual maintenance of the engine unit is well covered in the operation manual, particularly in section 9, where the types and periodicity of maintenance are listed.

Many owners will request a marine engineer with a knowledge of Yanmar engines to undertake winter service whilst others will wish to service the unit themselves with the help of the manual.

However, there are several checks which should be made regularly during the season including the following:-

During the season.

1. Check crankcase and gearbox oil levels regularly via the dipsticks provided but do not overfill.

2. Remember to grease the inboard bearing frequently during use as described in section C above.

3. Pump out the engine and cockpit bilges after every trip and the cockpit bilge whilst under way in wet weather. Introduce some detergent to the engine bilge occasionally to remove any oil or grease.

4. Inspect the inboard bearing via the inspection hatch for leaks (say) once per month or if there is a build-up of water in the engine bilge. The arrangement of the inboard bearing is shown in fig 5.

A very occasional water drip (every two minutes or more) is acceptable but more frequent leakage needs attention. Ahead of the metal bearing at the inboard end of the stern tube is a quantity of "stuffing" which looks like greased string and which encircles the prop shaft. This is held into the stern tube and against the bearing to form a "gland" by a castellated nut. This gland and the adjacent bearing are lubricated by grease from the remote grease point (hence the need for regular greasing) but if the stuffing is not sufficiently compressed by the castellated gland nut,water leakage will occur. Over compression of the stuffing will on the other hand make the prop shaft very stiff to turn, putting an unnecessary load on the engine. It is thus necessary by adjustment of the gland nut to find point between these two extremes where the shaft can be turned by hand with the engine in neutral whilst there is no water leakage.

Aft of the gland nut is a second locking nut which will need to be eased before the gland nut can be turned (see fig 5). Move

the lock nut back down the threaded stern tube by tapping it clockwise (looking aft) with the aid of a drift and a light hammer. Then to increase compression on the stuffing and thus to reduce leakage, tap the gland nut also clockwise ¼ turn at a time as necessary but ensuring that the shaft will still turn by hand.

When the ideal point is reached, spin back the locking nut against the gland nut and tighten it firmly with the drift and hammer. Finally apply a little more sterntube grease via the remote greaser.

5. Check the liquid level in the starter battery once per month. Top up if necessary with distilled water.

6.Check fuel level in the tank regularly. Fuel usage is incredibly small on the Yanmar 1GM10, thus its quite easy to get caught out by forgetting to check at all. It is best to keep the tank not less than one third full during the season.

At the end of the season.

Again, consult the operation manual but in addition:-

7. Clean/replace fuel and oil filters (see operation manual)

8. Change crankcase lubricating oil with a proprietary evacuation pump. This is best undertaken immediately after the engine has been run up to operating temperature.

9. Clean engine bilge, inhibit exterior with WD40 or similar and either fill fuel tank to the brim or empty it completely. Condensation is likely to occur in a part full tank. Also check CAV filter for presence of water and purge if necessary.

10.Externally whilst boat is dried out, check propeller for damage. Also check the Zinc Wasting Anode which is mounted on the hull under the port aft stowage locker. This anode protects the adjacent stern gear (prop and shaft etc) from galvanic corrosion. The Zinc gradually wastes away rather than the stern gear being attacked. At the end of the first season any soft coating should be chipped off to expose an anode of reduced size but after the second season it may well be necessary to replace the remaining Zinc block. Single pole anodes by M.G.Duff Should be readily available but in case of difficulty please contact Cornish Crabbers.

Finally check that the grill over the water inlet is free from obstruction.

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F. Winterising Procedure.

The operation manual gives the procedure for winterising including draining the cooling water system which must involve dismantling the water pump. The following alternative method is suggested by E.P. Barrus Ltd, the concessionaires:-

Assuming the boat is removed from the water, carry out the following:

1. Disconnect the cooling water supply pipe from the water inlet seacock.

2. Arrange for a fresh water supply from a 2-3 gallon bucket (preferably topped up from a mains supply).

3. Run engine for 10-15 minutes until operating temperature is reached and thermostat is permitting full circulation around the block.

4. Stop engine momentarily and recharge bucket with 2 gallons of antifreeze solution. Then run engine again until bucket is empty when all fresh water in the cooling system should have been replaced by antifreeze mix.

5. The block can then be drained via the drain tap if preferred (see operation manual) or the antifreeze left throughout the waterways of the cooling system for the winter.

Peter Keeling
Managing Director, Cornish Crabbers Ltd. April 1989.

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Fig 1

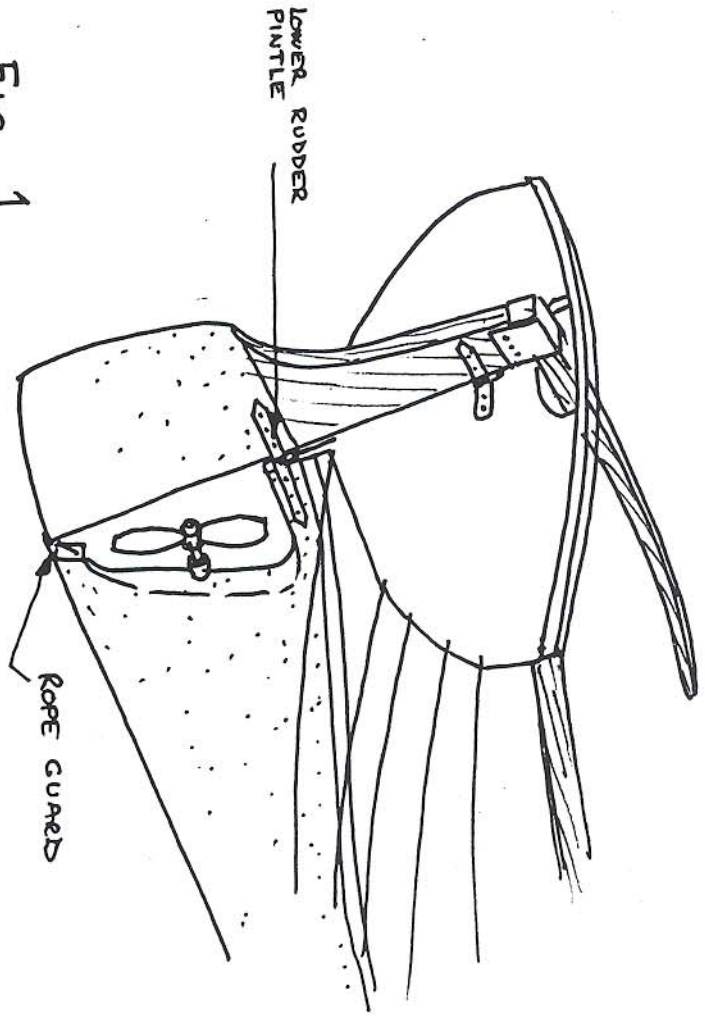

FIG 1.

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fig 2

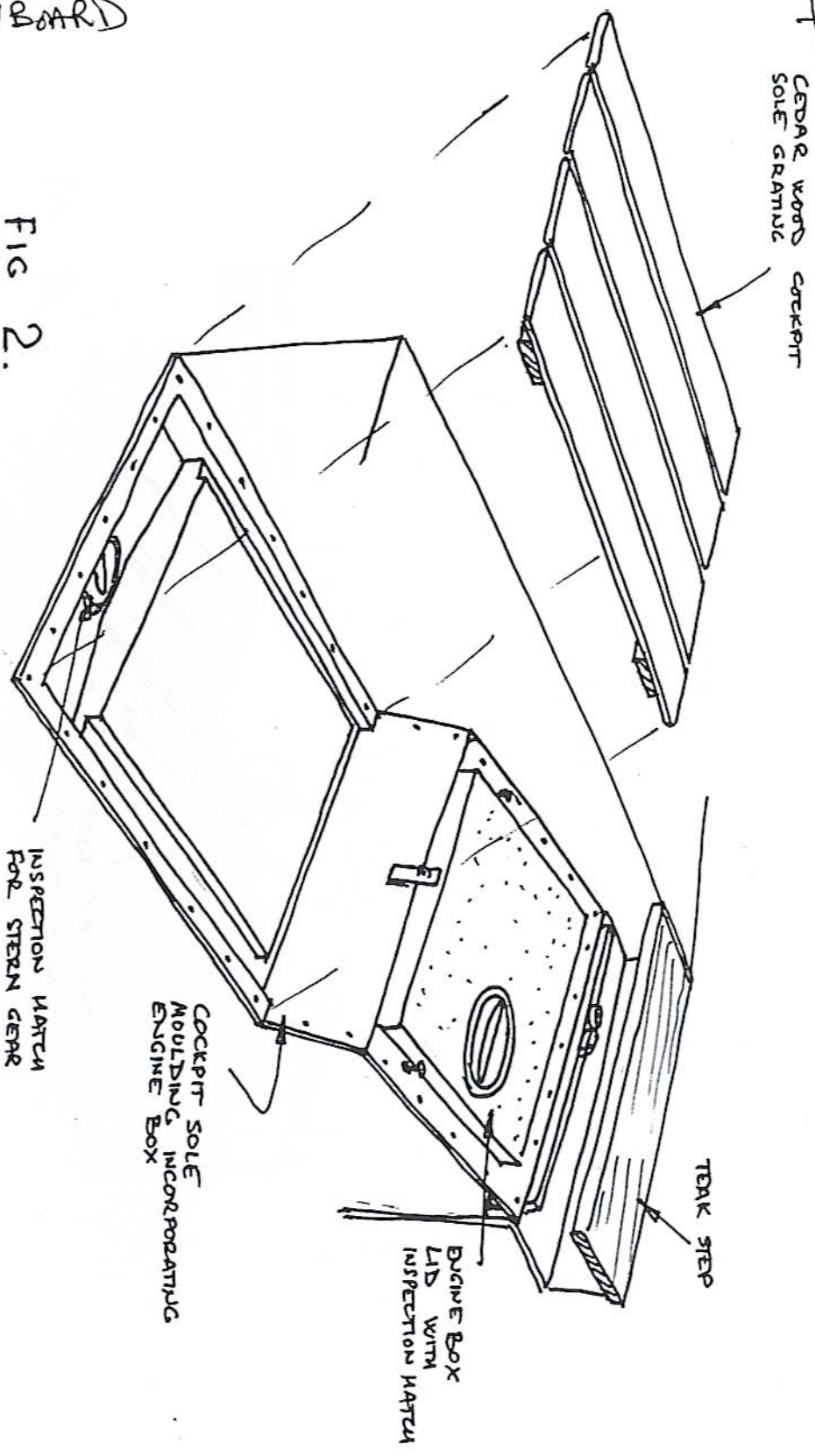

FIG 2.

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FIG 3.

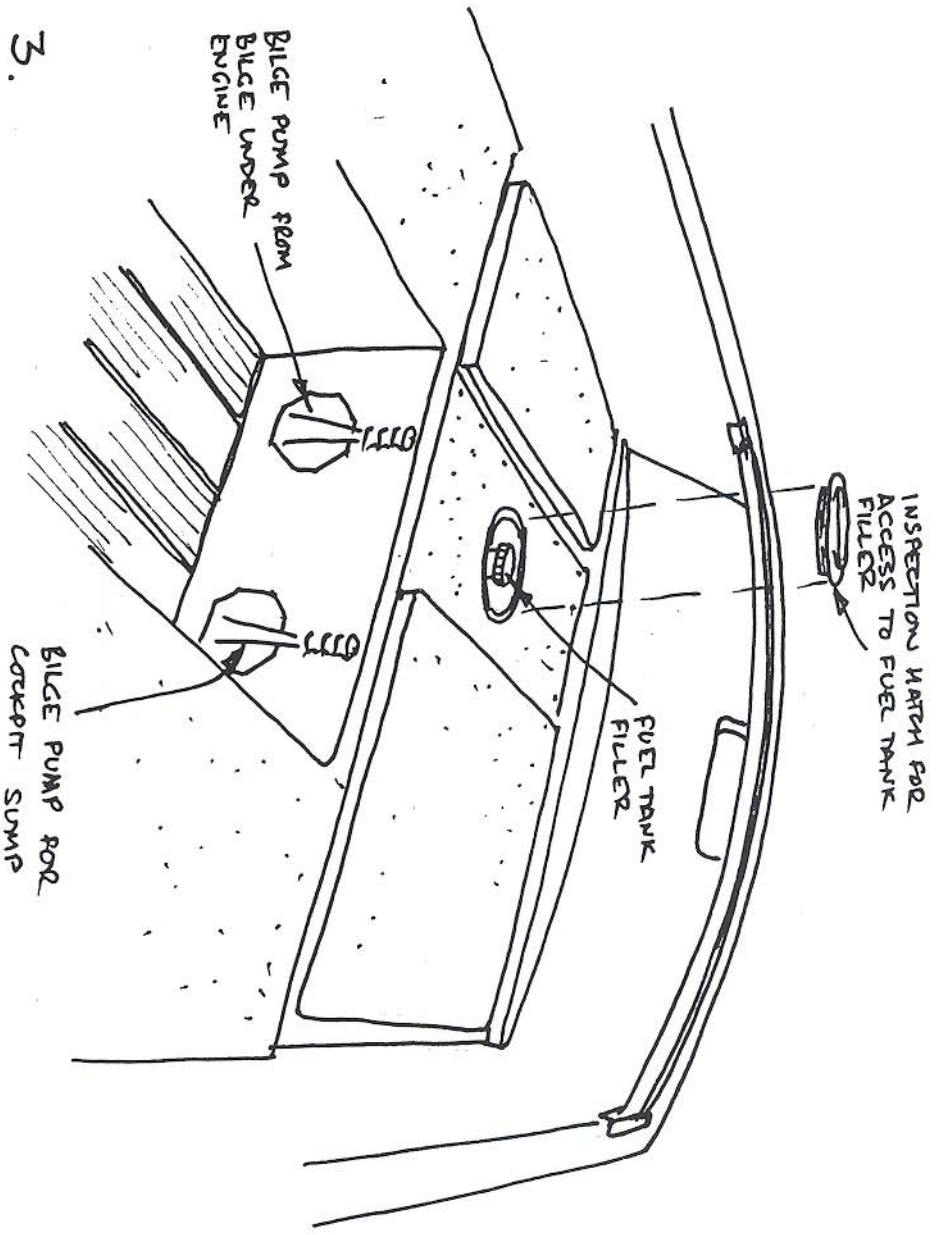

fig 4.

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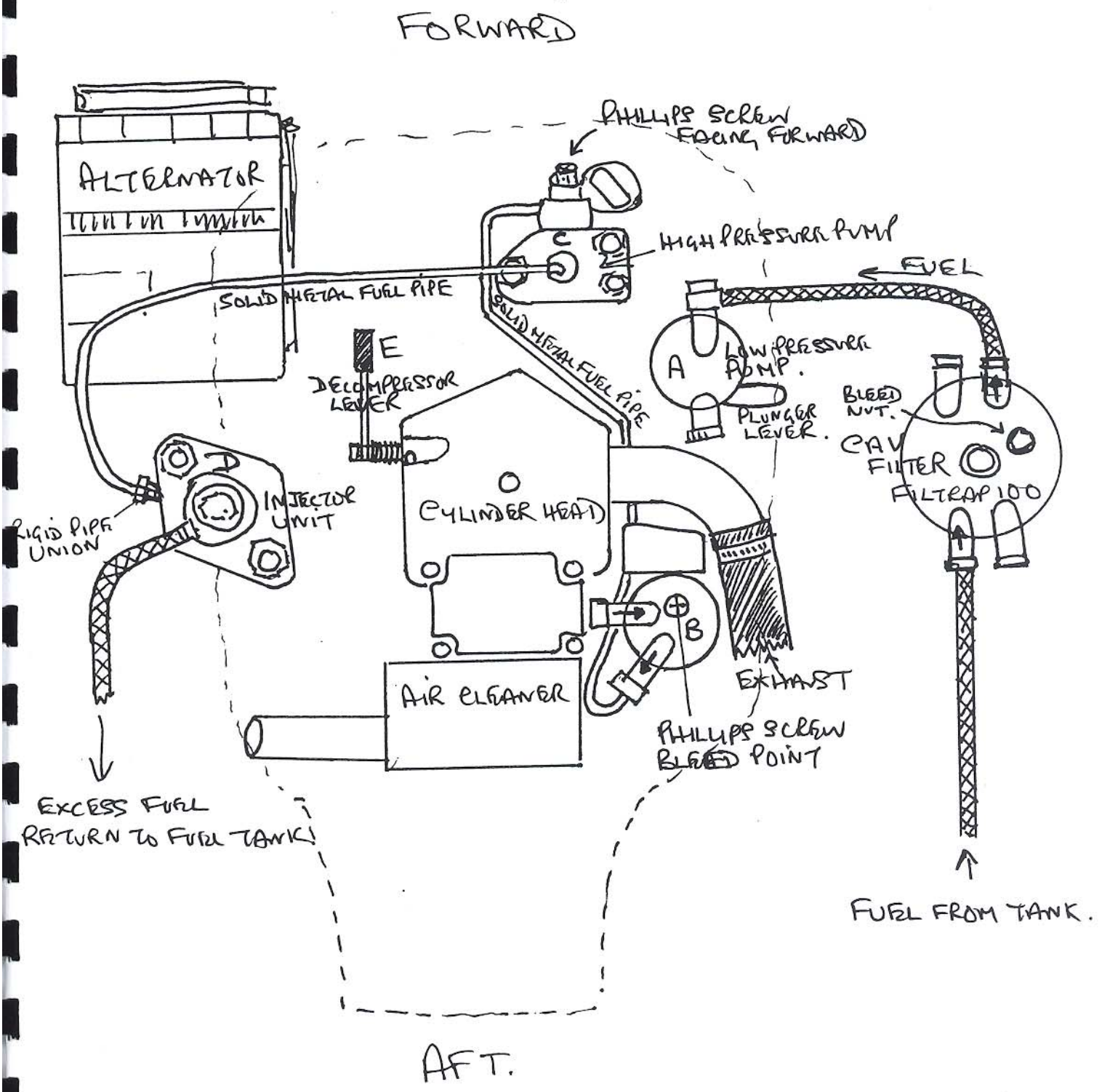
BLEEDING THE FUEL SYSTEM

SKETCH DIAGRAM OF BLEED POINTS ON YANMAR 1GM10
(NOT TO SCALE)



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ARRANGEMENT OF STERN GLAND AND INBOARD BEARING

Fig 5.

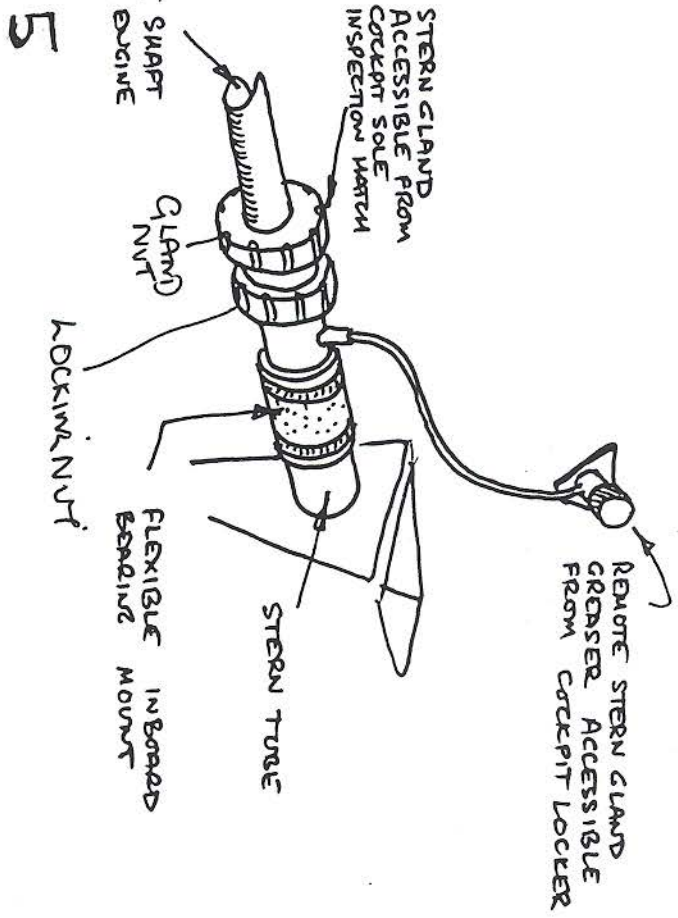

FIG 5