About turn!

To go astern you had to stop it and start it again. But the latest Dolphin is more sophisticated, says Pat Manley

THE ORIGINAL engine, designed in 1958, was air-cooled and used in a motor-cycle and the Berkley motor car. Designer Peter Hogan, produced the first marinised version as a unit for racing hydroplanes. This 350cc engine was water-cooled and drove the prop through a 90° 2:1 gearbox, rather like a modern saildrive. Delivering 45bhp at 9500rpm, this engine won the British 500cc class hydroplane championship in both 1960 and 1961. Approximately 50 of them were built in a de-rated form and mainly used on the Thames in the early '60s.

Production of the water-cooled Dolphin 12 marine engine was taken on by Richard Cristoforidies' company, R.C.A. Ltd, starting in 1962. Richard was succeeded by his son Benjamin in 1966, who moved the company to a factory at Bodmin in 1971. Peak production reached 350 units a year, but the arrival of the Japanese lightweight diesels unfortunately pushed RCA into bankruptcy in 1978.

Dolphin engines were distinctive in having direct drive with no reverse gear. Going astern was achieved by stopping the engine and restarting it running backwards by means of a separate set of contact breaker points. Around 2000 of these engines were made.

Peter Hogan and David Chapman then bought out the remnants of the company, intending to make 10-12 engines a month with just two staff. David, who had worked for RCA during its heyday, now runs Dolphin Engines as a one-man company, selling spares and repairing and reconditioning all Dolphin engines. He also produces the new Dolphin Series II engines at the rate of around 15 - 20 a year. These series II engines use a conventional ahead/neutral/astern gearbox and are available to order only. Since 1986, 250 series II engines have been built.

When I visited David, he seemed to spend quite a lot of time answering 'phone queries from owners. His patience and probing questions provided an insight to his deep interest in his Dolphins.

ENGINE STARTING

Start the engine in the usual way and check that the cooling water is flowing. If the cooling system is working correctly it should always be possible to place your hand on the cylinder block – although the cylinder head will be too hot to allow this. The crank-case gets very hot, and on a long run will reach 80°C. If a water injection exhaust is fitted, excessive noise will indicate a lack of water flow.

If the engine is very cold a little throttle may be needed for start-

DOLPHIN 12

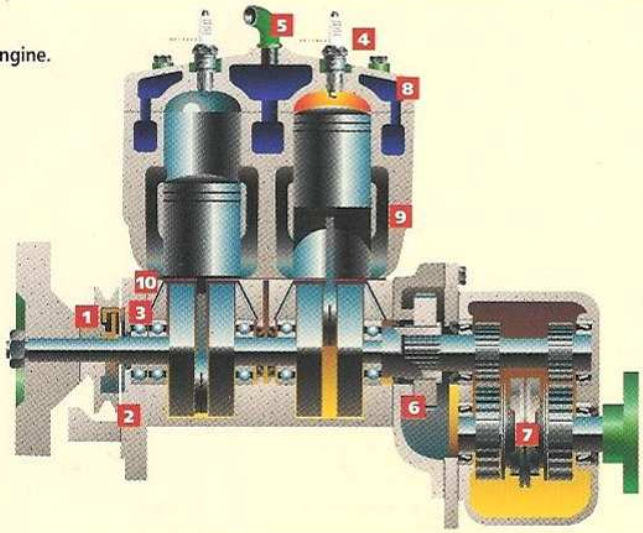
Two cylinder, water cooled, two-stroke, petrol engine.

Bore:	63mm
Stroke:	56mm
Capacity:	349cc
BHP:	12 at 3200 rpm
Compression ratio:	8.0:1
Weight:	52kg
Engine lubrication:	2-stroke oil suitable for water-cooled engine 32:1 (running in 24:1)
Spark plugs:	AC 46XL, 46XLS or equivalent, gap 0.030in

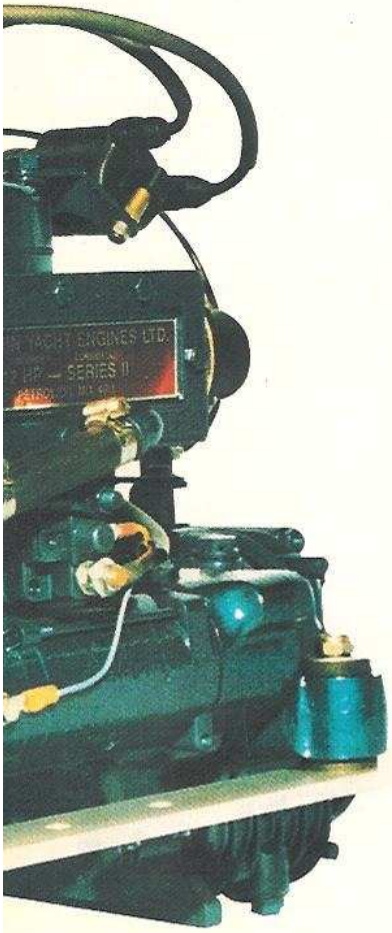
Torque wrench settings

Exhaust manifold bolts:	7 ft lb 0.97 Kg.m
Cylinder head bolts:	35 ft lb 4.84 Kg.m
Flywheel nut:	55 ft lb 7.60 Kg.m

A 16 HP Series II engine is available with a capacity of 440cc. (68 x 60mm bore & stroke)



1. Electronic ignition timing disc
2. Alternator pulley
3. Electronic ignition sender unit
4. Spark plug
5. Water outlet
6. Starter roller clutch and gear
7. Servo clutch
8. Cooling water chambers
9. Scavenge air transfer ducts
10. Oil feeds



ing. A warm engine needs no choke. Don't bother with warming up. Start the engine as soon as possible. Two-stroke engines prefer it this way.

The ignition warning light should extinguish when the engine speed rises above 1500rpm. Once charging, the light will stay off at lower speeds.

EMERGENCY HAND STARTING

All Dolphin engines can be hand started as long as there's sufficient battery power to produce a spark. This is achieved by wrapping a belt either around the freewheel clutch on a direct drive engine or around the flywheel on a Series II engine, in a clockwise direction when seen from the front.

Ensure the ignition is 'OFF'. Wrap the strap a couple of times around the clutch/flywheel. Turn on the ignition and apply a firm, steady pull to the belt. (Be sure the gearbox is in neutral.)

STOPPING THE ENGINE

If the engine is to be run again soon, stop the engine in the normal way by switching off

DIRECT DRIVE ENGINES

On the direct drive engine, the electrical system is probably the most important group of components. Not only are they responsible for the ignition and electrical generation, but they also provide that vital reverse drive.

Mounted on the forward end of the crankshaft is a starter/generator and two sets of contact breaker points. Each set of points is in circuit with its own coil and powers the sparking plug of one cylinder. This obviates the need for a distributor.

For reliable starting, the starter motor runs on 24 volts, although the generator and the normal electrical system are only 12 volts. Two 12 volt batteries run in series to produce 24 volts for starting but otherwise run in parallel for the 12 volt system.

All change-over functions are handled by a pair of hefty relays and a multi-position ignition switch. Originally the relays were made 'in-house' but, since 1995, proprietory parts have been used. However, the two are interchangeable.

Starting current is 50amps at 24 volts. The ignition key start position energises a relay which connects the batteries in series and operates the 24 volt starter motor.

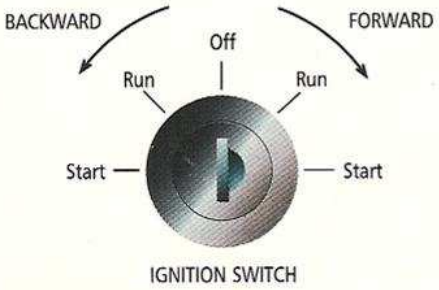
There are two start positions for the key – forward and astern. A relay in the astern position reverses the polarity of the starter motor coils and swaps the contact breakers so that number one spark plug is fired by number two breaker and vice versa. This enables the engine to start and run backwards, to provide astern thrust (see diagram).

To achieve this rather complex electrical system all the components except the starter, generator and points are mounted on a separate electrical panel, which should ideally be mounted away from the engine compartment and protected from the elements. It's been found preferable to use a 24 volt ignition warning light bulb rather than the more usual 12 volt type.

The electrical control panel of the Dolphin Direct Drive engine (above) and a cut-away showing the ignition system in place (right)

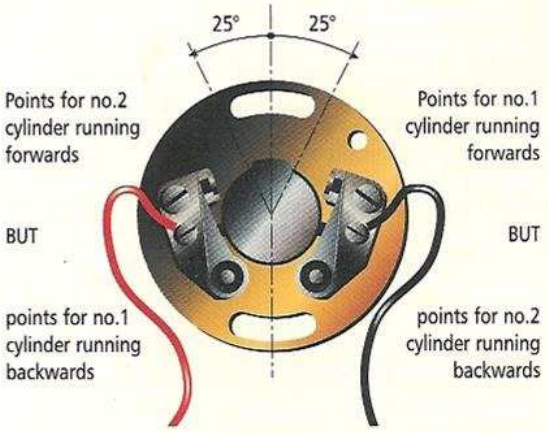
The generator output on these engines is low at only 8 - 10 amps maximum. Because of the higher than normal electrical consumption for starting, running and astern, the battery can run down even if there's no domestic demand. An additional source or charging – wind generator, solar panel – can be helpful.

Ignition timing can be set by loosening the clamp screws on the contact breaker mounting plate and rotating the adjustment cam screws. The points should start to open at 25° before TDC.



IGNITION SWITCH

Instead of using a gearbox to provide astern thrust, the Series I engines are restarted to rotate in reverse, thus the two-way ignition switch, relays swap the coils and the contact breaker points trigger the opposite cylinder's sparking plug.



SERIES II ENGINES

An orthodox 12 volt system is employed with separate starter motor and Lucas 17ACR 500 watt alternator, which should supply adequate charging. Because a normal gearbox is used, the reversing circuits with all their relays obviously aren't required.

The ignition unit is a high energy discharge system triggered by optical pulses rather than contact breaker points. The optical device uses a small beam of light which is interrupted by a disk having two slots. Twice a revolution the light pulse shines through the slot, triggering sparks at both plugs simultaneously, one of which is redundant. This redundant spark, occurring at bottom dead centre, has no effect on the running of the engine. Ignition timing on the Series II engine is set at the factory and cannot be adjusted.

Failure of the light transmitter or receiver would cause the ignition system to fail. Since replacement requires the removal of the flywheel, etc., a second optical unit is fitted 180° from the first and the wires terminated in a plug on engines from number 8097 onwards. The systems can be swapped over should the need arise and, thanks to the redundant spark. method of operation, the engine will run normally.

ROUTINE MAINTENANCE

There will be variations according to each type of engine and its accessories but the 'in season' maintenance is never very much.

- Keep pump and alternator belt adjusted.
- Keep battery topped up and charged.
- Check gearbox oil from time to time.
- Check all electrical connections at about mid-season.
- Check water pump filter.
- Tighten water pump greaser every 1-2 hours running.

At the end of season:

- Flush the cooling system.
- At the end of the final engine run, prior to shutting down, remove the air cleaner and squirt oil into the carburettor air intake. Blip the throttle during this operation. About 4 to 6 squirts should do nicely.
- Renew the air filter element with the hole facing the carburettor.
- Renew the fuel filter.
- Renew spark plugs.
- Check ignition timing.
- Clean the fuel pump filter.
- Check gearbox oil level.
- Check all electrical and mechanical connections.
- Check exhaust pipe from engine to waterlock/silencer for a build-up of carbon.

SPARES

Virtually all spares are available from Dolphin Engines regardless of the age of the unit, but have your engine number to hand when making an order. The only exception is the Zenith carburettor, but this can be replaced with an Amal. The old starter/generator can be rebuilt. It's not possible to replace it with a separate starter motor and alternator.

A cylinder block will cost about £300 and a head £110. An exhaust manifold or an exhaust bend will set you back about £60. All castings are available new.

A total rebuild by Dolphin Engines costs around £800 plus VAT, depending on the state of the original castings. If you wish to exchange a direct drive Dolphin for a Series II you could expect an allowance of £2-300 including your old panel.

David Chapman runs Dolphin Engines and can be found at: 7 Paardeberg Road, Walker Lines Industrial Estate, Bodmin, Cornwall, PL31 1EY. Tel: (01208) 73501. Fax: (01208) 73502.

the ignition and then closing the fuel cock.

If the engine is to be left longer than, say, two weeks, partially empty the carburettor by turning the fuel off about half a minute or so before turning off the ignition. Although some of the petrol will evaporate away, leaving a heavily oil-based mixture in the carburettor ready to lubricate the cylinders, and with enough fuel pouring into the carburettor the Dolphin should start without any fuss.

When the engine is in regular use then it's not advisable to drain the Series II's carburettor since excessive cranking may then be needed to pump fuel up to the carburettor.

CONSTRUCTION

Dolphins use a cast iron cylinder block mated to an aluminium alloy cylinder head and crankcase. Crankcase volume is very small, which reduces the chances of sparking plug oiling at low revs. No crankcase drain plugs are provided.

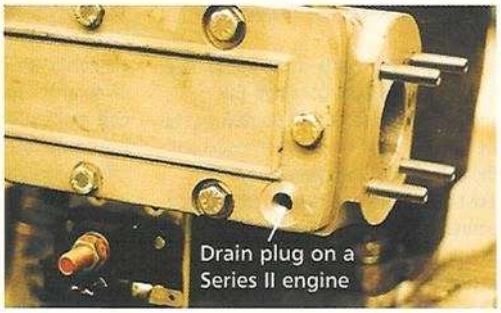
TRANSMISSION

Direct drive engines have a centrifugal clutch, which allows the engine to idle without the propeller turning. As the throttle is opened, and the engine turns faster, the clutch engages and drives the propeller shaft. Should the clutch fail to take up the drive, a pin can be inserted in the clutch plate to lock the drive. The engine is then started 'in gear'.

Direct drive engines have a lubricated rear bearing which needs half a dozen pumps from a grease gun at the end of the season. The two types of engine differ at the rear of the crankcase as the Series II mates up with the gearbox.

Series II engines were originally fitted with ZF gearboxes but, later, Hurth boxes became standard. Due to the reverse rotation of the propellor shaft with a gearbox, replacement of a direct drive engine by a Series II requires an opposite-hand prop but the new engine will fit the old beds.

COOLING SYSTEM


Drain plug on a Series II engine


Drain plug on a direct drive engine

In the raw water cooling system, water is circulated by a belt driven pump, having a rubber impeller. It's not practical to dismantle the pump assembly in-situ because of its position. To renew or inspect the impeller, remove the pump from its mounting. Wear or distortion of the end cover plate will reduce the efficiency of the pump and, if badly worn, can prevent the pump working at all. Flatten the end cover with emery paper or replace with a new one.

The Jabsco pump used on engines numbered from 8080 to 9610 has an adjustable spindle gland, which should be checked when the pump is removed for servicing. This gland is behind the pulley and adjustment requires the lock-nut to be slackened and the gland-nut tightened half to one turn until resistance is felt. Don't over-tighten the lock-nut after adjustment. The pulley should rotate quite easily with a steady resistance. A further half turn may be necessary if water leaks with the engine running. And this Jabsco pump has a greaser which should be tightened every 1 to 2 hours of running time.

There isn't a thermostat in the cooling system, but the water is pumped to the exhaust manifold before it reaches the cylinders to reduce the warm-up time. Water flows from the manifold to the cylinder block via a passageway sealed by an 'O' ring and leaves the engine from the top of the cylinder head. Series II engines have a temperature sensor on the top of the cylinder head. If the overheat alarm operates, check the temperature of the cylinder block by hand. If it's possible to place your hand on the block it's probably a fault in the sender unit. The engine can run for a surprisingly long time with no coolant – but this should be done only in emergency as severe damage can result.

A sacrificial zinc anode is fitted just above the inlet manifold and should be checked annually – more often if corrosion is found to be severe. The anode should be replaced when half worn.

The cooling waterways in the block and head are generous and, provided the system is flushed out at the end of the season, overheating caused by blockage shouldn't be a problem. Direct drive engines have a cylinder block drain under the aft exhaust port, whereas Series II engines have a drain plug in the manifold itself. This won't fully drain the cylinder block and, to do this, the lower right hand manifold stud should be removed. The threads on the stud should be greased on reassembly. Engines fitted with the Jabsco pump (engine numbers 8080 to 9610) had a brass drain plug in the pipe carrying water to the manifold which is used to drain the block.

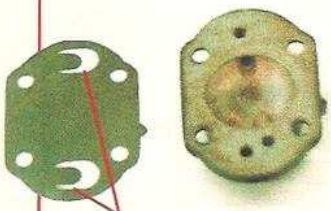
Direct drive engines have a crankcase cooler at the rear of the engine. Any cooling system blockage is likely to be found here and, if suspected, the end plugs can be removed and the passage cleared. Series II engines don't have this cooler.

A fresh water cooling kit is available for £400 to £500.

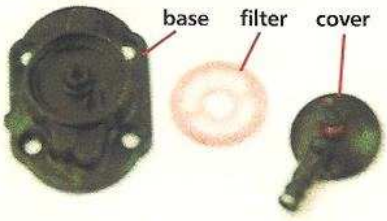

This is what happens to your cylinder head if you don't check and change your sacrificial anode at regular intervals.

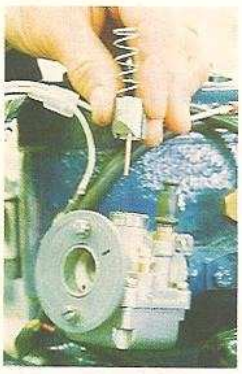
The majority of direct drive Dolphins have gravity fed fuel systems, which if installed properly give no problems. However, poor installation can lead to fuel starvation. Typical symptoms are that after running for a while the engine stops, but after bleeding the fuel system, the engine re-starts. This is caused by a fuel vapour build up just below the tank, especially in hot weather. The cure is to have a fuel pipe of at least 6mm, ideally 8mm, to allow the vapour to rise into the tank. For the same reason the pipe should run downhill to the engine, with no upward loops.

Series II engines have an Amal diaphragm fuel pump, operated by the varying crankcase pressure. The diaphragm should be renewed every two years and, on re-assembly, make sure that the locating 'bump' on the diaphragm lines up with a similar shaped bump on the casing. Clean the filter annually. Fuel starvation may occur if the fuel pipe from the tank is too small. A fuel filter between the tank and engine should be fitted as a matter of course.



AMAL LIFT PUMP PARTS
assemble bump to bump





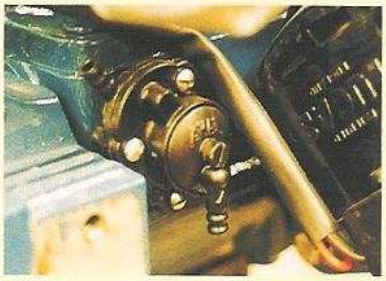
The Amal carburettor is fitted to later engines. Note throttle needle and slide (above left).

Carburettors

Early engines used Zenith carburettors, but spares are becoming difficult to obtain. They can be exchanged for the current Amal carburettor and, if you're having problems, this may well be the best course of action.

Zenith Carburettors have a 'tickler' which should be held down for a couple of seconds to allow the gravity fed fuel to fill the float chamber. Don't overdo this or fuel may spill out causing a fire hazard. The 'choke' knob is pushed in for starting and is automatically returned to 'normal' when the throttle is opened.

There's no tickler on the Amal carburettor. Here the choke is lifted for starting and must be manually re-set when the engine warms up.



The Amal fuel pump

The Amal fuel pump has no non-return valve so when the tank's fuel level is below the pump, fuel may drain back to the tank when the engine stops. If left standing, the engine will have to be turned over for a while before fuel arrives at the carb. If this is a bother, the sort of priming bulb used on outboard engine fuel tanks can be incorporated in the fuel line.

TO SET AND ADJUST THE AMAL CARBURETTOR.

1 Run engine for 2-3 minutes until it's warm

2 Slacken off the throttle cable to carburettor top cap. You should be able to lift cable on top of carb by at least 2mm without affecting the tick-over speed.

3 Allow the engine to idle and adjust the throttle stop screw until safe tick-over is obtained.

4 Adjust in an anti-clockwise direction (weaken) the mixture control screw until the tick-over starts to slow and then screw in ¼ to ½ a turn.

5 Try to reduce tick-over speed and then repeat step 4.

6 You may need to repeat steps 4 & 5 several times to obtain the best setting for all temperatures. A two-stroke engine is best adjusted when it has run for 4 or 5 minutes – not when very hot after a long run.

7 Run engine at half throttle and listen for any misfiring. (a) If misfire is reduced by operating the choke the engine is too lean. (b) Conversely, if the misfire is increased (four-stroking) when you use the choke the mixture is too rich. In the event of (a) lift slide needle and (b) drop needle by one notch. Repeat 3 - 6. [To access slide needle, unscrew top cap of carburettor and withdraw entire needle assembly. Remove cable by depressing spring and carefully lift out needle. Move circlip nearer to middle of needle for (a) and nearer to end for (b).]

8 Series II engines have a single lever control

9 Remove slack from the Bowden cable running from the carb to the throttle reduction arm and adjust the length of the single lever control (SLC) cable to allow the engine speed to increase to the point which best suits your usual running speed. Ideally, the throttle should just open as the gearbox engages. However, this means that the engine is running at a fast cruising speed once the first detent in the SLC is reached. This is a matter of choice but you may wish to increase the slack in either the Bowden or SLC cable to allow more control over the engine speed at the lower throttle openings.

EXHAUST SYSTEM

Dolphin engines may have either a dry or wet exhaust system. Wet systems should be provided with a water lock. An anti-syphon device is required if the water injection point is less than 150mm (6in) above the waterline and it should be fitted a minimum of 300mm (12in) above the waterline. Although not critical, the water lock should be fitted between 450 and 800mm (18 - 30in) behind the water injection bend, as it acts as an expansion chamber.

Dolphin's own water-lock consists of two end plates with a 150mm (6in) length of 150mm diameter rubber exhaust hose clamped with jubilee clips. This can be taken apart for occasional cleaning or replacement of the hose. On reassembly make sure the unit is the correct way round