

Maintaining Johnson/Evinrude 9.9 & 15 hp outboards 1974 – 1992



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Maintaining Johnson/ Evinrude 9.9 & 15 hp outboards

1974 – 1992

(Engine Troubleshooting)



I am sure that sometime you may acquire a motor, or be asked to help with one that has sat for some time & or possibly will not start. This section will deal basically with getting a motor running, & not fine tuning it, as that is covered on the "Normal Repairs" article. Here will be my suggestions as to where to look & in the order generally accepted.. You are going to have to have at least the 3 main things functioning for you, & they are all about equal in requirements. It is assumed on the first part of this section that the motor will pull over with the recoil starter, but will not start.

Has someone else tried to repair it & what did they do? If they did not know what they were doing, are the wires going to the right places? Are the ground wires making good connections? Is the motor just in need of TLC because of negligence on the previous owners lack of outboard motor maintenance knowledge?

Don't totally believe what the previous owner told you about the history of the motor. I purchased one motor that was supposed to have just quit. Usually this would mean that the problem would be spark related. When I got into it, there was dry, redish brown rust on the outsides of both coils, indicating that the motor had laid on it's side in rusty water. Compression was 62# & 105#. With the head off, it was evident that this motor had been immersed in water in some way. Maybe not dunked in the lake, but my guess in the bilge of a boat or laid somewhere that rain water accumulated. Both cylinders were hosts to LOTS of rusty & carbony oil. This excessive amount of oil could not have gotten there from inside the motor, it had to be squirted into the spark plug holes. There was also evidence of use of lots of starting fluid around the carburetor in apparent failed attempts to start it. The thermostat was missing also, & why is any ones guess. The picture of this block with the head off is shown below. He had told an untruth in order to hopefully gain a little more in dollars in a transaction.

These are all clues that you will have to consider in being a outboard motor detective. Sometimes the word "Detective" & "Mechanic" are closely related in cases like this.

For problems other than just getting it started, then read farther down in this section.

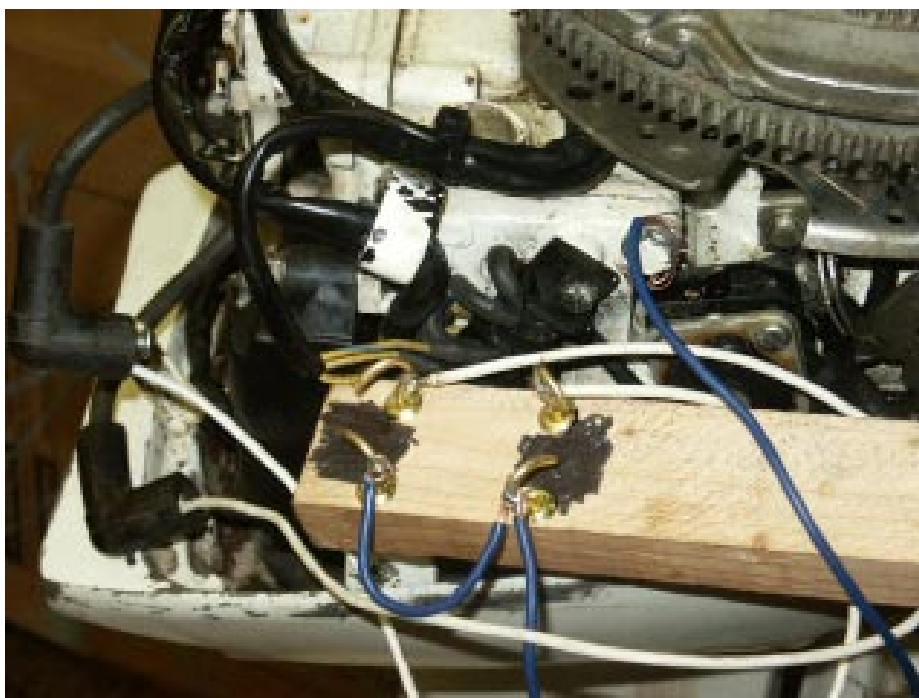
(1) Spark: Pull the plugs & look at them. Are they black & oily or just a gray color? They will usually be oily & possibly fouled since this motor uses an oil mix in the gasoline. You can clean them, & the best is with a sandblaster. Plugs are reasonably priced & it may be beneficial to purchase a couple of sets. Then you can have a new set, & clean the others for spares. You might consider vacuum packing them. This will assure you that they are clean & dry when you need to use them, especially if you are near saltwater. These motors seem to run best on Champion L77JC4's, than any other brand. Gap settings are .030.

You may be able to check for spark, by pulling the plug from the head, & reinserting it in the plug boot & then ground it, (holding the metal body against some metal part of the motor), while pulling the starter rope. If you have made a good connection to the motor, (somewhere where the paint is not insulating your connection., you should be able to see a blue spark jump from the center electrode to the overarm on the plug's metal threaded area. It will not shock you, unless you happen to touch the exact area of the spark jumping. This may be hard to see if you are alone & have to pull the rope AND look for the spark while the motor happens to be moving slightly. Here is where you may need the help of the wife or a fishing buddy.

If this is hard to see, you can make a simple spark jump tester out of a piece of 1" X 4" X 6" wood, & screw 2 sets of opposing brass cup holder hooks into the wood. Screw them so that the ends of the hooks

are pointing at each other & that the gap is about 3/8". The actual gap should be 7/16" to 1/2", but you can twist these hooks away from each other to what ever gap you want. Now you can solder a 12" automotive #14 primary wire onto each of the "incoming" hooks. Then solder another wire to the "outgoing", or ground side. This you want to solder one hook to the other with a small loop between, & have a tail of the wire another 12" or so long. The loop needs to be there so you can rotate the hook for your desired distance. Skin back the insulation off the ends of all 3 wires. Now take both plugs out, With your single ground wire, loosen a bolt on the water cover sideplate & place a flat washer under the bolt head & wrap this ground wire around the bolt, tighten it against the motor. Then take each of the other 2 wires & push them into the spark plug boot. You might wrap the skinned wire around a small 10-24 bolt an inch or so long & then with it & the wrapped wire to be tight enough as to make good contact with the wire inside the boot. You may want to use a black marking pen to darken the wood under the intended arc point so you can see the arc jump better.

Improvised spark tester



Pull the starter rope as if you were trying to start the motor. You should see the spark jump between BOTH hooks for each cylinder. If it only jumps on one then you have a coil bad or possibly a bad ground connection at the coil, or even inside one of the rubber connectors.

Another thing to look at after you get it to run but has no power, is it running on both cylinders? You would be amazed at how good it may seem to run by just using muffs & not in a tank or under power, on just one cylinder. The method of checking this is while it is running at a low or medium speed, pull one spark plug wire off, replace it & then pull the other. If it is running on just one cylinder it will die when you pull the wire that is firing.

(2) Fuel: First would be to check the vent on your fuel tank's cap. If you are using the old metal OMC tank, the cap is vented by the center screw head having slots cut under the head. This will automatically vent the tank unless these small square notches get plugged. If you are using any of the newer or aftermarket plastic tanks, they all require you to unscrew the vent screw slightly. This need not be backed out to the point it may fall off, but just a turn or so. If you do not vent the tank, the fuel pump will suck a vacuum & no more & no more fuel can be pulled into the carburetor.

Check the fuel connectors to both the motor & the fuel tank. Sometimes they may pop off just enough to disconnect themselves but still be on the guide pin. Make sure you have the fuel line on correctly, as it can

be attached either way, but the check valves in the primer bulb will only work one way. On the bulb itself is an ARROW, indicating which way the fuel needs to flow from the tank to the motor. You will need to prime the motor, or pump gas from the tank into the carburetor. Squeeze the pump bulb, does it pump fuel into the carburetor? It should pump up until it gets hard after about 8 to 10 squeezes. After the motor is running, this bulb will become somewhat less firm than it was initially when you primed the motor.

If fuel starts running out of the carburetor when you pump the bulb, then you possibly have the carburetor float stuck or the needle valve may have dirt under it & not be shutting off. Also check for any possible fuel leakage at any of the fuel line fittings or at the fuel pump cover. On the older motors up until about 1990 or so that used the small fuel pump mounted on the RH side of the powerhead, there will be a large headed metal screw with a coin slot in it on the outside of the fuel pump. This can be loosened & the cover removed, revealing a stainless steel screen. Make sure this screen is not clogged, & that the neoprene gasket is intact & sealing properly.

If the fuel pump is bad, you can keep the motor running by squeezing the primer bulb in the fuel line. This would be an indication that the fuel pump would be bad, if you can pump the bulb when the motor hesitates, & it will resume running until the carburetor goes dry again. These older small fuel pumps are rather cantankerous to work on & make them function. You may notice that the early ones do not show a repair kit for them. The later kits will fit, it is just that the early bodies do not have index tabs on them, so you need to be sure that the diaphragms go back the same as the originals were.

Also you may want to double check the fuel pump cover, as it being plastic, can become cracked & allow a gas leakage out, when you pump the bulb & air leakage in when the motor is running. Both the above are detrimental to the engine performance/running.

(3) Compression: Pull both spark plugs & check the compression. Use a good screw in type tester. You may encounter slightly different readings even when using 2 different testers, even if they are the same make & model. Twist the throttle handle to wide open to open the throttle plate to give it as much a chance to breathe as possible. Ground out both the plugs so as to not damage the electronics, or leave your spark tester hooked up. Pull it over as if you were trying to start it. You may get a difference of opinion here, but 3 pulls seems to be the norm. Do both with equalness in effort as to speed of your pulling & the length of the pull to assure that you are getting genuine readings. I like to pull it just far enough that I can feel the starter rope bottom out at the end of the stroke.

You will not find a recommended compression data from OMC, but they will say it needs to be about equal between the 2 cylinders, this being within 5# of each other. I have seen used motors seemingly run quite well at 75# & others that were a new rebuild at 120#. I would not like to see anything under the 75# however, especially if one was at 50# & the other cylinder was at 80# or 90#. This out of balance one would be a candidate for a re-ring job, as it would possibly be hard to start, & one plug would more than likely foul out often. The consensus from many boat mechanics is that if you have compression of 100# or more on this series of motors, that you have an exceptional motor.

If your testing shows low, then I would do 2 things, before I would get really dejected. First I would pull the head & look for evidence of carbon on the top of the piston. If carbon is there, then you may also have it in the rings also. This could seize the ring to the piston & cause it to not seal in the bore effectively, which can contribute to low compression. While it is down, rotate the flywheel & look at the cylinder walls, are they scored or evidence of rust pitting? One thing to do when taking the head off, would be to mark which coil is the top one (this will be an invaluable help later.). Another thing to remember is that when you took the head off the 2 bottom bolts could not be taken out of the head while it was still in place because they hit the lower cowling. This means when you reinstall the head IF the powerhead is still on the motor, that you will have to insert these 2 bolts in their respective head holes BEFORE you slide it in place.

Look at the head gasket. Is there any sign of a non sealing surface between the head & the block. The head may be warped & need to be resurfaced.

The next step would be to remove the bypass cover on the LH side of the motor. With this cover off, you can see into the side of the powerhead & see the sides of parts of the piston & the rings, which will give you

another clue as to what may be wrong. Are the rings stuck in the ring grooves, or is the piston grooves worn enough so that the rings wobble in the groove?

Rusty/Carboned cylinders, 62# & 105# compression
The white color in the water jacket around the cylinders, top & bottom is salt.



Bypass cover removed showing pistons & rings thru holes, note top piston is pulled back to show rings
Note brownish rusty oil for top cylinder.



Since these motors are 2 cycle, & fire on the rise of the piston each time, it is crucial that the motor has GOOD compression on each stroke. You might therefore compare the compression on the first stroke & then against cranking it over another 3 or 4 times. By the nature of most compression testers, they allow a compounded poundage if cranked repeatedly. Just because you can come up with a higher compression by cranking it over more times, does not give you a true idea of the 2 stroke motor's capabilities & needs.

(4) Timing: This may not be as critical as the others, but the twist grip does have a position marked as "START". This is a position where the timing plate's cam positions the carburetor arm to where the ideal setting is for starting. This cam plate setting should not have to be reset unless someone has tinkered with the motor, & they unknowingly may have changed this setting.

The throttle cam plate that rotates under the flywheel when you twist the twist grip has an arrow type mark on the front of it. This mark needs to be timed so that when you advance the throttle twist grip, that

the carburetor roller is at this mark when the carburetor throttle shaft just starts to turn open. To adjust this, you loosen the 2 bolts on the RH side of the plate & adjust the cam plate to where it just aligns with the roller. To tell exactly when the shaft STARTS to move, take a small alligator clamp & attach a 2" wire to it. Clamp the clamp onto the carburetor throttle shaft's Starboard side with the wire pointing UP. Twist the throttle until you see this wire pointer move. The cam plate arrow should be lined up. If not, loosen the 2 screws on the side & rotate the plate until it is aligned & retighten the screws.

Neutral Safety: These motors are designed so that you can not start (by pulling the starter rope or engage the electric starter) the motor if the shift lever is in gear & the throttle is advanced beyond the start position. For the manual starter version, the starter spool interlock ratchet teeth has a dog lever on the top, or the side (depending on the year) of the manual starter spool that drops down & engages a ratchet that prevents the starter rope from being pulled if it is in gear. You can pull the starter rope handle right off the end or break the rope, if you jerk the rope hard enough & are not suspecting that the thing is locked in the safety position.

On this 1987, manual start motor, note the shift lever in neutral & the black plastic Neutral Safety lever stopping the movement of the plated metal timing plate arm at the center of the picture just below the center of the flywheel.



On this 1983, with the shift lever in forward, the metal Neutral Safety lever is dropped down, allowing the timing plate to just over-ride the stop & give full throttle movement. This timing plate is rotated by linkage to the twist grip throttle handle.



If You Have Checked Everything & It Still Does Not Run : Another check would be the flywheel key. If for some reason, the flywheel nut was not totally tight, and/or the motor backfired, the flywheel key could have gotten partly sheared off. If this happens, the flywheel can get slid enough to throw the timing off enough to not allow it to start.

Engine Has Sat For a While : If the engine hasn't been used in quite awhile, very possibly with gas sitting in the carburetor, it may possibly require cleaning, which seems to be the standard recommendation for motors in this situation. However, it may be worthwhile to try to run it at least once before jumping into a carburetor repair. I have found that sometimes the gasket between the main carburetor body & the bottom fuel bowl can deteriorate. When this happens, for what ever reason, chunks of the neoprene gasket get into the fuel bowl & can partially plug the high speed jet, cause erratic engine performance. It has also been found that the newer non-leaded gasoline is less likely to cause internal gumming problems in the carburetor if allowed to set for extended periods of time.

The only way to fix a clogged/fouled carburetor is to remove, dismantle, clean, and rebuild it. Do not try to spray a carburetor cleaner in the breather or run it thru the fuel & expect it to do a cleaning job. If you try this while the engine is running it very well could ruin the engine, as there would be little lubricant inside the engine for the bearings. If you take the carburetor apart, make notes and drawings as to what goes where, or use a digital camera. Regardless of how simple it seems, you will find something where you can't remember how it should be when it comes time to put the parts back together.

Engine is Seized & You Have no idea Why: Here you will have to do some detective work. Look over the outside of the block to ascertain if there is a broken connecting rod that may be protruding out a hole in the block. Put it in neutral & see if it still will not pull over. Try to rotate the prop, what you are trying to determine is that the problem is either in the powerhead or the gearcase. Can you rotate the flywheel any amount? There will be some slack in the bearings & connecting rods, but if it the pistons are froze up, it will not rotate more than a slight amount. if you get the flywheel to rotate a quarter turn or so, then it could be a broken rod.

It could be that the gearcase is seized up. This could be due to lack of gear oil, but usually it would be because a seal was leaking & water leaked in, creating rust. If this motor was used in salt water, then usually the price of the bearings, & gears make the repair not worthwhile. You might be able to pick up a complete gearcase unit on eBay from a blown powerhead motor for less than 1/2 the price of repair parts.

Engine Has Been Hot & Seized : This will more than likely be caused by a non-functioning water pump, or something wrong with the cooling system. In this situation, the pistons more than likely have expanded due to excess heat & since the aluminum pistons expand more than the steel cylinders, the pistons can get seized in the cylinder bores. If the motor was running fast when this happened, the flywheel will be still rotating & will put a lot of torque on the rods & will usually break or badly bend a rod also.

Engine Has Been Dunked: Obviously this situation will need IMMEDIATE ATTENTION. You will have to pull the spark plugs immediately after recovery, pull the starter rope over enough blow any water that is inside the motor out. Spray WD-40 in the plug holes, crank it over numerous times & spray more oil in. If it is fresh water, you will be able to clean the motor & salvage it. I would first pull the carburetor & clean all the water out of it. I would also recommend that you immerse it in denatured alcohol. This is so that the alcohol will absorb any water that you can not blow out with an air hose. The alcohol will then evaporate, taking the water with it. Without doing this you may have to run it for MANY hours at a not to successful situation trying to get the water out.

You will also have to look at the electrical system. There are rubber connectors on the wiring that should be disconnected & cleaned any water out of the connector holes. If it is a motor prior to 1977, you had probably pull the flywheel & clean the points.

I would then place it in a large 55 gallon tank, as compared to muffs, as you will need to run it for many hours to dry thing out.. Then you can try to restart it. A few squirts of starting fluid into the air breather tube may make it jump into life. Mix a fuel oil mixture twice the normal ratio, like 25-1 as you need to lubricate the internal parts of this motor & that is the way a 2 stoke engine is lubricated on the pistons & internal bearings, is with the oil mixture with the gas. Once you get it running try to keep it running at a

speed above idle, because need to dry out the water & lubricate the internals. this is also a good time to after a few hours of running to adjust the carburetor for an idle.

I recovered one motor that had been dunked for 2 weeks & it is now running fine.

Engine Has Been Dunked in Saltwater: In a situation like this you will need to totally disassemble the motor & clean all the salt off SOON. And I mean TOTALLY disassemble it as if you were rebuilding it & do it ASAP. The lower unit should have survived since it is sealed to keep the gear oil in.

Engine Was Running When it Was Dunked: This will be a totally different situation, in that the motor will have sucked water into the carburetor, which will have built a something solid (water) inside the crankcase when the piston comes back on the fired stroke. Usually something will break inside the motor.

What To Do if the Lower Unit is Dry of Oil: This can be a scary situation, especially if you just purchased the motor used from a neighbor. Is it just out of oil, or is there any evidence of water in the gearcase? If it is just dry because of a leak? But usually if oil leaks out, then water can leak in. And if the motor was used in salt water, then the bearings could be damaged. Is the lower drain plug loose, or even VERY TIGHT? If it is tight, then possibly the previous owner knew there was a leak, & he was trying to plug it by TIGHTENING this plug.

I would refill the gearcase with Kerosene, & crank the motor over in both forward & reverse gear if you can. Let it set for a few days & then crank it over again, then drain it out, catching the oil in a margarine tub. Let the Kerosene set for a day & then carefully pour it off, leaving whatever residue in the bottom. This residue will give you clues as to the internal condition of the gearcase. If it is just black sediment, you might be OK, but if it has metal filings or gritty gunk that is attracted to a magnet, then possibly the bearings are worn.

This test will determine your next course of action as to whether you simply refill it with gear oil, replace the plug & filler screw plastic seal/washers & hope for the best, or you tear it apart & actually see what is wrong.

Pressure Test the Gearcase: Drain the unit, install either the drain/fill or the oil level screw, then apply 7 to 12# of air pressure to the other remaining open oil screw hole. That should allow you to find the actual source of the leakage either by sight, sound, or both if using soapy water so you can see the air bubbles if it is leaking. There are 3 seals & you can not see 2 unless you pull the lower unit off the exhaust housing. There is one O-Ring around the shift rod, a seal under the water pump on the driveshaft & a double, back-to back seal on the prop shaft.

Note that applying the steady air pressure can be easily obtained by using a very short piece of rubber hose between the air nozzle and the unit.

At that point, it simply a matter of replacing that seal, and whatever might be related to it if that related item should also be faulty.



Maintaining Johnson/Evinrude 9.9 & 15 hp outboards 1974 – 1992

(Part 1, normal repair)



These outboards, like any that get used & or abused may need to be torn apart & repaired over time. As they get older, the depreciated value of a somewhat neglected/abused motor is such that with a motor in the 25 year old range, it could be questionable as to whether taking it to an outboard mechanic is worthwhile for other than electrical trouble shooting type of repairs. Some shops even refuse to work on anything over 20 years old. I have seen abused motors that I would not pay \$50 for, & then again the next one that has been used but maintained, may be worth from \$500 to \$1000, depending on the compression, the year & whether it is electric start & a longshaft or not. It is my observation that most outboard motor problems are not that the motor is worn out, but it is the NEGLECT / ABUSE & lack of care it received over it's lifetime. An older well cared for motor, is worth way more than a newer neglected / damaged motor.

This article is not meant to take the place of a service manual. It however has some tips from my personal experiences & other information that has been gleaned from many sources over the years that may make owning and /or repairing your motor a little easier to understand. Most commercial outboard mechanics have to work on many different makes & sizes of motors in order to make a living, therefore it is unreasonable to expect them to remember the whole history & the little extra things to look for when repairing one particular make & model. Hopefully this article will help those of you who do decide to "DO IT YOURSELF".

If there is any chance that you do decide to work on it yourself, it is recommended that you purchase one of the excellent illustrated service manuals that covers your motor before you venture too far into trying to repair something you may not be that familiar with. It is also recommended that you get a factory parts catalog for the motor in question. This way you can see the exploded view of the parts & can order by part number. The part numbers may have been superceded, but the shop you go to when ordering parts, can cross-reference to the new number. This parts manual also helps you positively identify the part you need, as compared to ordering something by the wrong name & getting the wrong part. Remember, most of mechanics/counterpersons flunked mind-reading school. These parts manuals will provide a picture placement of the related parts.

One source of original manuals would be to go to <http://www.e-bay.com/> & then type in outboard motor or 9.9 johnson as a search. You need original, or copies of Service Manuals for the year you are working on. There may be some latitude as for years if it is close to what yours, with the exception of the 74-76, being on their own. Used original OMC parts manuals for these motors usually go for from between \$5 to \$20. The service manuals are very helpful & explain in detail just how to repair the motor. You really need both the service manual & the parts manual. Owners manuals do not really help you when doing repairs.

Also be aware that when you go to the dealer to order parts, that many times some of the larger dealers would rather you brought your motor in to them to work on. Therefore they possibly may not place your parts order at the top of the "To Order" list, since you are planning on doing the repairs yourself. If you go to them with part numbers they may be more obliging to place an order, since the monkey is on your back for providing the right or wrong part numbers, & you are then obliged to pay for them even if some wrong parts show up. However, if you do come up with your own numbers, also have the description, so they have some idea of what it is. It would also be best to indicate which year of parts list you used, as many of these older parts numbers have been superceded by newer numbers.

Another thing to consider is that most times the manufacturer or distributor like to have an order from the dealer in minimum quantity or dollar value to cut down on excess shipping. There is the possibility that the dealer may have just placed an order & will not place another until they get enough accumulated to qualify for another order. Also when the order comes in, even though you requested them to call you, with possibly more than one person in the shop, that information may have gotten misplaced.

If you are like me, & do not have anywhere near a photographic memory, by the time you tear it apart, get the parts ordered & then try to reassemble it weeks later, you can not really remember the exact sequence or placement of some critical parts. Also someone else could have worked on it in the past & the part may not be where it actually belongs. Most times you can figure it out by trial & error, but proper placement of others that may be somewhat internal, where if you guess wrong, may require the whole engine or lower unit to be disassembled again just to reposition or add one forgotten part, which can be frustrating. This miss-placement of a part will usually come to you some time later, & usually in the middle of the night. With the digital cameras commonly in use now, this may be a good way to record what things should look like before or while you take it apart.

This is Not a Trouble-Shooting Article : You will find the troubleshooting article by itself. In this article, it is assumed that the motor is in a good enough condition to run. If you have bad spark plugs, rings, carburetor being fouled, or anything that may contribute to the engine not running then you will need to address that situation, especially as a pre-requisite to doing anything else. Any work needed should also be done in addition to what is covered here. AND we are assuming that you have the motor mounted on the transom properly with the cavitation plate even with the hull's bottom & the motor tilted at an angle that lets the cavitation plate be straight with the bottom.

Free Advice : You may find persons who offer free advice on about any subject, outboard motors are no different, but I have found that MOST of these Good Samaritans may not be as good as they think they are. If you happen to frequent some of the fishing, boat or motor message boards, you will soon see a response to the question of a motor not running exactly right. A very common response is to rebuild the carburetor. OK, this may be part of the problem, but it is not the cure-all, as your problem could also be ignition or compression related. Another response often seen is that you should replace the water pump impeller every 2 to 3 years, just a precautionary measure. This might be so, if you are operating in VERY MUDDY, SANDY or debris infected water, or using it as in a main motor that is used many miles offshore. The current new impellers should last for MANY years if the motor is treated right. I replaced mine after 20 years, it was still intact & functioning as far as I could tell. It however was not as pliable as the newer one I replaced it with. The reason I replaced it is that I was adding a long shaft unit & decided while I had the lower unit off, that I has just as well replace the water pump impeller at that time also. However any impeller could be ruined after only a few seconds of running without water.

A few years ago, I purchased a 70 hp Johnson from a private individual, when I was looking at it & I asked if it ran, reached over, twisted the ignition key & started it, (it was still on his boat). THE MOTOR WAS NOT HOOKED UP TO WATER MUFFS. I quickly told him to shut it off, his reply was, that's OK, I ran it like this yesterday. I immediately deducted \$100 off my offer. And YES the impeller was totally demolished.

Proper Repairs ?? : There are at least 2 ways to repair anything, with outboard motors not excluded. You can skimp by & just repair or replace what is needed to keep it running. Or you can go one step farther & clean up plugged water passages, or replace any other parts you find that are not really up to par. This extra could be a frayed starter rope, a hardened fuel line primer pump, twist grip throttle gears that jump out of mesh, or a leaking gearcase drain plug seal. I for one do not like the idea of fighting my motors just to get me to, or more importantly, getting me back from the fishing area. This can also cut deeply into your limited fishing time. And paddling against the tide or wind is not a very rewarding situation, it may however become exciting.

Most parts for these motors are still available from different sources, either new or used, however price may be prohibitive on some cases. With this in mind you may consider making or repairing your own, or purchasing replacement bolts from the hardware store. Now I am not saying to tie the broken twist grip handle on with bailing twine, but I am sure human ingenuity can prevail if the need arises.

Spare Parts Availability : Most marine repair shops even though they may not be a OMC dealer, can get parts if they want to. Also, you can go to any CarQuest automotive store & request a "Sierra" marine parts catalog. NAPA also has a "Marine Catalog", which by the way, uses the same parts numbers as the Sierra catalog. These catalogs will not have all the specialized individual parts like motor mounts or decals, but they do list pistons, rings, bearings, gaskets, seals, water pumps, fuel pumps, impellers, & many ignition parts. The one thing about it however, you may need the manufacturers parts manual to give you some of the original part numbers, to properly identify the needed part. Here again the need for a manufacturers parts manual. But also bear in mind that even OMC changes /updates part numbers. This means that the number you get out of a 1983 OMC parts book, if it is still available, may be changed to a totally different number. So the dealer can not just order the numbers you give them, they have to look it up & if applicable, go to the cross-referenced update list to get current part numbers.

Some Shops Refuse to Work on Old Motors : There may come the time when you do need to take it to a marine mechanic, because you simply do not have enough spare parts to exchange in testing, or the needed electronic test equipment to diagnose a ignition/electrical failure. However I recently ran into a independent marine dealer who has decided they will not work on any motor over 20 years old, this 9.9 OMC included. Their explanation was that parts for many of these older motors are not obtainable. I had what I thought was an electronic problem & in the year 2002, I took my motor in & presented this dealer a complete list that contained the motor year, model, serial number & of all the previous repairs & the things that I had done to the motor, like compression test, spark jump test, how it was acting etc. Now, their refusal may be understandable in one sense, but for this series motor that has not really changed that much during a time span of 18 years, with the last of this series being made in 1992, it seems like they are not really interested in service. And I for one will seriously consider whether I need to patronize them again, unless it is an emergency on my part.

Story #1 -- I had acquired a used 1974 "rebuilt" powerhead off eBay that was supposed to have run hot after a recent rebuild. The owner got exasperated, stripped it down & sold the individual parts.

Since it was just a powerhead & readily accessible when I got it, I wanted to find out any potential problems before I put it on an ailing motor that I had acquired earlier. Upon disassembly, I discovered that YES, it had seen a wrench before. Namely a different (red) gasket sealer material under the head gasket, powerhead to upper housing unit & also under the water jacket, indicating that someone had at least had it somewhat apart & looked at it in the not to distant past. I did also find evidence of the same gasket sealer in between the front & rear sections of the block, so at least the block had been apart & possibly there were new rings put in. OH yes, and it had a recent paint job.

The head & headgasket came off the block OK, but the headgasket was still stuck to the head. They had not removed the gasket off the head in an apparent attempt to do a cheap overhaul using the old gaskets. The suspicion on my part was that this was probably because they were afraid if they tried to take it off the

head, that they would ruin it & could not use it over again. There was however new sealer material between the gasket & the block.

What I did find, was that the motor apparently had been in salt water numerous times & had not been flushed well. When I took the gasket off the head, there were salt crystals/aluminum corrosion pretty well blocking the lower cylinder's water jacket passage in the head. This model has the thermostat at this lower location. The water passages were blocked solidly enough that I doubt that very little water could have even passed on into the plugged thermostat, much less on thru the rest of the engine & on out. Pictures are shown below in "The Possible Water Circulation Problems" section.

Story #2 -- Another situation presented itself that bothers me relates to dealer ethics. I again purchased off eBay a 1987 15hp Johnson motor for \$76 that was sold as "needing repair/for parts". It was close enough (200 miles) that I drove & personally picked it up from the young man. He advertised it as needing rings & that he had the marine shop's estimates. He is a young Coast Guardsman & had gotten the motor from his father 2 years before. On his first attempt ever to start it this spring, it would not start, so he took it to a marine repair shop in a decent sized town located on salt water with lots of boat traffic, which should have had enough exposure to be pretty well acquainted with outboard motor problems, plus they did all the Coast Guard's repair work. He had also broken the starter rope in his efforts, since he was not aware that the motor needed to be in neutral when trying to start it. The work order he gave me from the dealer says "low compression - pull head & diagnose, & call with estimate. recoil repair".

The diagnosis reads "Bad Rings - new power head, not cost effective to repair unit". They had taken the head off, inspected the piston & rings, re-bolted the head back on lightly & without the gasket (apparently so no one could start it). The headgasket, broken recoil starter rope & handle were stuffed under the motor's cowling. The estimate of needed parts included carburetor kit, fuel kit, water pump kit, rings, rod bearings, wrist pin & bearings, main bearings & seals, oversize pistons & rebore to match pistons & a thermostat for a total parts estimate of \$294. This mind you did not include the labor.

OK, on the surface this looks like it could be appropriate. But after I got it home, I noticed on the top of the flywheel was written in felt pen, "Comp 1 - 100#, 2 - 105#, & spark OK". I took the head back off & the pistons were clean, with no carbon, there was wear of about .004 in the cylinder walls & another approx. .010" piston wear for a total of about .028" + - SLOP between the pistons & cylinder walls. Yes, it was WORN. But my thoughts were if compression was at the 100# mark why did they even take the head off? I just reassembled it using the original head gasket with some gasket sealant. I had a used starter rope that I installed. BUT -- the one thing I did install that was missing, was the "C" shaped horse-shoe clip in the kill button on the end of the twist grip.

I had the motor running within 3 min. My question is, how did they check the spark without using their own clip on the kill button? It would appear that they never told him about the kill switch being OFF. OK, maybe this now running motor is not 100% factory new, but I will bet that it will run for quite some time as a fishing motor.

My guess is that this young man did not know anything about the "Man Overboard Kill Switch lanyard" that was missing. With this gone, it was essentially like turning off the key. They could have replaced the starter rope, changed plugs, adjusted the carburetor idle & charged him \$70-\$90, he would have been happy & they made a enough to cover the diagnosis & the actual repair to have made a profit. I will bet they even tried to sell him a newer motor & or offered him a minimal trade in.

Story #3 -- I happened to be talking to my neighbor & spied an older 10hp QD Johnson, I asked how it was running. His response was, well it had belonged to his Dad many years before & had been setting for some time, when his sons decided to use it, sad to say the water pump did not function. They took it to an independent mechanic (well known to the locals as being a scalper), who replaced the water pump for a mere \$200. They thought they got a good deal, as he told them that a new motor of that size would have

cost them over \$2000. This may not have been a proper comparison, but in any event the repair was still about 1/2 of the price of a used motor of the same year. This mechanic probably had an hours labor & possibly \$20 worth of parts in this repair. From the experiences I have had with this mechanic, he looks at how you dress, the vehicle you drive, what knowledge you appear to have as for outboard motors & adjusts the price accordingly.

Just one more of the reasons why I am writing this article.

History : The earlier 10 hp QD series motors were made from 1949 thru 1963. If you need year of a manufacture for these motors, or any before OMC went to the year code, as described below, go to <http://www.marineengine.com/manuals/johnson/>.

10hp QD 21 series



9.5 hp Johnson



The 9.5 hp, was built from 1964 to 1973, which was the first of the low profile motor series, and is not a sleek looking motor in my opinion, with a squatty oversized motor cover & upper housing sitting on a standard lower unit. The lower unit was not unitized like the later 9.9's, in that the bottom half of the 9.5's at the output shaft was split allowing easier access to the shaft & gears. It was also basically a souped up 7.5 hp motor. Some experienced mechanics say the crankshaft does not stand up under heavy usage of the 9.5. It was not designed for remote controls, however I have seen one that was set up for them, but I am not sure whether it was a factory or aftermarket kit.

The 9.9 hp motors covered in this article, came out in 1974. They were the second series of motors in this size range which were made with the compact lowered powerhead & more easily fished over the top of & set the trend for other manufacturers. The outward appearance of this motor, other than paint & decals, remained virtually unchanged for 18 years, & even today (2004), it evolved into the backbone for the current 2 stroke model. Both the current 2 stroke & 4 stroke use the same water pump as the 1974 version. The 9.9 was basically a detuned 15 hp, initially using only a different carburetor & decals. This series of motors appears to have been among the first of the thru the prop exhaust motors.

1974 Shortshaft (earliest of this series)



1992 Longshaft (last of this series)



Year of Manufacture : This is important in any repair, for obvious reasons. Prior to 1979, Johnson used the last 2 digits of the year in the model number. As a model 10R78M, would indicate a 10 hp, Rope starter, 1978 year of manufacture & M model revision. Since this does not have in the code L between the hp designation & the year, it is a short shaft version. Evinrude in those years used a different 5 digit model code, as 10424. The numbers you are looking for will be the first 3 numbers which equates to the hp & then the middle to the year, as 10 hp, the (4) equates to 1974. Here is a [LINK](#) to help you determine yours.

After 1979, OMC's manufacturing year code, which included Evinrude, is the word "INTRODUCES", with each letter equating to a number ie: I=1, N=2, T=3, R=4, etc. as illustrated below. As before, the last 3 letters are what you are looking for. Then in this case, disregard the last one, as it pertains only to a model revision that only on specific cases may be revelent.. A code of J10ELENA would equate to Johnson, 10hp, Electric start, Long 20" shaft, 1992, & the A could be a model revision, so this motor would probably be made in the very first part of the year. You may encounter a code of something similar to J10SELCTC. This would have been Johnson, 10hp, SailMaster, Electric start, Extra Long shaft, 1983, & the C could be a model revision. In this case with the SE in the model number, indicating a SailMaster, all the SailMasters would have all had the extra long 25" shaft.

I N T R O D U C E S
1 2 3 4 5 6 7 8 9 0

Using this code system, if the motor was sold as an Evinrude, then the first letter would have been an E instead of the J. Then you can encounter motors made in or for other countries, which will have some added letters as previously mentioned.

Sometimes the nameplate found on the LH side of the upper steering/clamping bracket can get removed. If this happens, you can still usually tell which motor it is by looking at the 25 cent size soft plug in the upper rear RH side of the block. The model & year are stamped in this soft plug also. It is interesting to also note that the 15 hp uses the same block as the 9.9, so you could see a 15 hp with the same 10R78M numbers here as the 9.9 has. However I have heard from one person that his plug had numbers that do not match any of the codes, so possibly this had a replacement powerhead..

In 1981 the marine industry went from powerhead rating to a prop rating. The word was that the Japanese engines of the same rating were outperforming the US engines, as they were rated differently. To get the equivalent prop HP on a US motor prior to 1981, take the HP rating & subtract about 10%, this will get you close to the newer rating.

Non North American made Motors : European Johnson/Evinrude motors did not follow the year-on-year model changes as their American counterparts. So, if you are working on one of these, & have a Clymer or Seloc manual, read it with caution, & be prepared if a few things might be different. Australian motors also can be included in this group. Also there are usually additional letters in the model plate ID. If it was a Canadian motor, there would have been a prefix letter "C" on the model number as in, CJ10RCDB. You may even find some motors designed to run on Kerosene. Apparently they were designed to be sold in underdeveloped countries where gasoline was hard to obtain, but where Kerosene was used for heating oil. They usually have 2 headgaskets to lower the compression, used hotter spark plugs & possibly a small gas tank for starting, & then switch over to kerosene after it is running. These motors if shipped from the factories as a Kerosene motor would have had a "K" as a prefix to the model number. An interesting thing here is that Kerosene has a LONG shelf life & is less of a fire hazard, so it is well accepted as propellant for sail boats that are at sea for extended periods of time.

AC Output : Some of these later motors (approximately 80-92?) could have been fitted with different stator assembly under the flywheel that gave a AC output voltage. I as of yet have not been able to find out exactly how much voltage. The manuals say the regular output to the power pack is 300 volts AC, so

it could be possible to change this output to a usable voltage. The parts manual indicates that these stators were for motors with serial number prefixes of A, B, C, or E if used on an electric start model, while the prefix would have been H if on a rope starter version. This manual says "Serial Number prefix" however it would seem more in line with how things were done IF it was a prefix to the model number. There was a plug in outlet on the LH rear side of the upper lower cowling that had a rubber plug cap the covered the outlet. I however, have never seen one of these versions yet.

One Australian motor, model AE15BAESR was referenced in an e-mail inquiry from Australia that had 3 wires coming out the side, we decided that it must have been the AC output. His conclusion is as follows: A = Australia E = Evinrude 15 = HP BA = AC Lighting, Rope Start ES = 1990 R = Model revision. This is a little different than what I come up with as far as the starter type, but it is an example of the model number.

Commercial Motors : There is mention in the manuals of "Commercial" 10 hp motors. It appears these are cheaper units, made from 1988 to 1991. They essentially are the same motor as the 9.9, but have only a rope starter with a tiller throttle handle system.. They used the older CD II ignition system instead of the UFI as used on the regular motors at that same time. There is no provision for electric start or a charging system.

Controls : This series of motors have all the same basic controls. That is on the front panel, the choke pull knob is on the left side looking back to the motor. To the immediate right is a large (approx 1" dia) knob that rotates, but will only go about 1 turn. This is the carburetor idle adjustment knob. In the center is the manual starter pull handle. On the far right will be the kill button. If it is electric start, on the left side, hidden in the mounting base is the start button.

On the right side again looking back, is another large black knob located immediately behind the fuel line connector. It is the idle speed control screw. In effect this is basically for setting a trolling speed, where you want to return to after making a run. In setting this one, you may have to adjust it & the carburetor idle knob simultaneously to fine tune each.

On the left side again looking back is the shift lever. On the left side again just above the mounting brackets is a lever that moves forward & back. It locks the motor down so that if you put it in reverse & try to attain a high speed, that the lower unit will not jump up & out of the water. This lever, when moved forward, allows you to raise the motor & lock it in the up/out of the water position. The upper cowling lever is located at the rear & under the edge of the cowling, rotating it down allows you to remove the upper cowling to access the engine compartment.

Remote Controls : These motors were designed to be also used with remote controls, of which OMC sold as "Remote Control Adapter Kit # 398032. This kit was only the adapters to the motor & did not include the cables or control lever box. The throttle cable is ran thru the hole that normally is occupied by the kill button. The kill button is moved over into the position under the RH front lower upper cowling where the starter button would have been. The starter button is not be used in this case as if it was electric start, the starter switch would have been on the shift/throttle control box.

The throttle cable was ran under the manual starter spool & attached to the peg on the vertical control shaft to the timing plate. The twist grip handle was designed to be lifted into the up position, which disengaged the cog teeth of the drive gears, allowing the cable to function without removing the twist grip unit. This however creates problems when the motor is not operated with cables if the operator is unaware of the situation, as described later in this article. The angle that the tiller handle is mounted on the upper housing allows the handle to tip out & away from the motor for clearance. If you snap the rubber cover off, & raise the handle, you can see that the higher the handle is raised the farther disengaged the gears become as the throttle handle's twist shaft is not on the same plane as the intermediate shaft that the mating gear is on.

The shifting cable was attached to the 2 plugged holes on the RH front side of the lower motor cowling. And the cable end was attached to the upper hole in the shifter handle by a spring loaded twist pin. Factory outfitted remote motors could have had a electric choke solenoid if they were in the mid 1980's.

The One Weak Thing on This Motor : The first series up to about 1985 uses twist grip gear teeth to activate the throttle on this series. These gear teeth mesh on both the twist shaft & the mating linkage shaft gear function so that the handle can be raised & lowered & yet be twisted. BUT this feature was not really intended to be used this way as mentioned earlier under "Remote Controls". DO NOT RAISE the handle very high & twist the throttle unless you are prepared to disengage the gears, & change the twist grip timing relationship. This is explained in a subsequent section. Later, in about 1986 a throttle cable push/pull system was used to eliminate this problem.

If it Does Not Run : OK, I LIED, THIS MAY HAVE SOME SLIGHT TROUBLE SHOOTING SECTIONS MIXED IN. One thing to check would be the flywheel key. If for some reason, the flywheel nut was not totally tight, or the motor backfired, the flywheel key could have gotten partly sheared off. If this happens, the flywheel can get slid enough to throw the timing off enough to not allow it to start.

Another thing to look at if it runs but has no power, is it running on both cylinders? You would be amazed at how good it may seem to run by just using muffs & not in a tank or under power, on just one cylinder. The method of checking this is while it is running at a low or medium speed, pull one spark plug wire off, replace it & then pull the other. If it is running on just one cylinder it will die when you pull the wire that is firing.

Engine Has Sat For a While : If the engine hasn't been used in quite awhile, very possibly with gas sitting in the carburetor, it may possibly require cleaning, which seems to be the standard recommendation for motors in this situation. However, it may be worthwhile to try to run it at least once before jumping into a carburetor repair. I have found that sometimes the gasket between the main carburetor body & the bottom fuel bowl can deteriorate. When this happens, for what ever reason, chunks of the neoprene gasket get into the fuel bowl & can partially plug the high speed jet, cause erratic engine performance. It has also been found that the newer non-leaded gasoline is less likely to cause internal gumming problems in the carburetor if allowed to set for extended periods of time.

The only way to fix a clogged/fouled carburetor is to remove, dismantle, clean, and rebuild it. Do not try to spray a carburetor cleaner in the breather or run it thru the fuel & expect it to do a cleaning job. If you try this while the engine is running it very well could ruin the engine, as there would be little lubricant inside the engine for the bearings. If you take the carburetor apart, make notes and drawings as to what goes where, or use a digital camera. Regardless of how simple it seems, you will find something where you can't remember how it should be when it comes time to put the parts back together.

Carburetor, early : When they designed this series of motors, they designed it as a 15 hp & then detuned it with a different carburetor for the 9.9. When the 9.9hp and 15hp came into being in 1974 and up thru 1980, the only real difference between the two motors was the carburetor. This increased the RPM about 1000 RPM. In 1981 there was a change made in the inner exhaust housing for the 15 hp OMCs only. Also at this time, a sort of tuned exhaust was added, allowing the engine to breathe better, which in addition to the different carburetor, gained about another 10% in overall HP. The 9.9 inner exhaust housing stayed the same as it was. The big difference in the performance between the 9.9 & 15hp will be in the last 1/3 of the throttle range where the increased fuel/air flow of the carburetor will be readily apparent with the increase in RPM.

The 15 hp carburetor is different in that the inside diameter of the throat is larger than on the 9.9 hp. This larger throat allows more air to enter the engine. The main jet is also larger allowing more fuel to be sucked in. The combination of these 2 factors allow the motor to gain up to another 1000 RPM, increasing the horse power. Do not think that you can up the horsepower by simply modifying a existing 9.9

carburetor by replacing the main jet with a 15hp main jet. All you accomplish is that the engine is being fed too much fuel & not enough air to properly mix with it & the engine will then blubber (floods out) at the top end. It can run OK on the lower end & idle OK because it is using the idle jet then, but it will have less top end power than with the original 9.9 main-jet. Believe me, as I have been there/done that. Matter of fact that is what got me into writing this article, as I could not readily find any factual information on the subject.

Factory specification rating for RPM of the 9.9hp is at 5000 & the 15hp at 5500. With operating range for the 9.9hp at 4500 to 5500 RPM, & the 15hp at 5500 to 6500 RPM.

The outside visual dimensions of both carburetors appear the same, unless you look inside the throat. The 9.9hp carburetor's internal throat is .625 dia., 15hp internal throat is .875 dia. The outlet throat dia. is the same on both & match the manifold port dia. The idle jet venturi system is also slightly different between the two. The part number for the 9.9 hp Carburetor Assembly is #388936, while the 15 hp Carburetor Assembly is #338273 up to about mid 1987. A problem in buying a used carburetor is that the part number may be hard to read as it is only stenciled on. And many people do not see enough of these to be really sure which is which. The reason for this is that when these motors were sold, say in 1978 the 9.9 went for \$595, while the 15 was another \$150. Needless to say way more 9.9's were sold than the 15's by possibly 80%.

If the float bowl gasket on the carburetor is black, it is the older cork material used for bowl gaskets, then you are probably way overdue for a overhaul. There could be pieces of this gasket floating around inside the bowl, occasionally plugging the main jet.

Early production motors had all metal carburetors. Then from about 1980 to late 1987 the same basic carburetor as previously was used, but had a black plastic bottom fuel bowl. This seemed to be an improvement if water had entered in the system & got in the bowl, then sat for a while creating RUST inside the carb.

Carburetor, 1974 to 1979



Carburetor, 1980 to early 1987



Carburetor, late : Late 1987 & newer production carburetors up thru 1996 were completely different & had the bottom fuel bowl & top made of heavy black plastic. They were apparently designed for easier manufacture as the plastic top has the idle jet in it & the juncture between this top & the main body serves as a passage (depending on the the gasket) for the fuel from one chamber to the other. There is a white nylon collection box that is sandwiched & gasketed between the main body & the bottom fuel bowl that has a removable mainjet on one side. These carburetors appear the same for the 9.9 & the 15 hp with the exception of the mainjet AND the throat dia. in the main body. In the parts list, the mainjet for the 9.9 is spec'ed out at a hole #34 (.055dia), while the 15 is #54 (.110 dia.). The idle jet suction tube comes off this collection box & goes up into the plastic top for suction to the idle jet itself. This arrangement appears to help keep debris out of the jets.

The choke butterfly is the same as the previous models, but the throttle plate is smaller. The internal throat of the 9.9 is about .500 dia. while the outlet hole into the manifold is .750 dia. This is quite a bit smaller than the earlier versions, & the guess is that this newer carburetor is probably more efficient. It appears to have all the screw holes & outboard fittings in the same locations, but whether it would interchange with the earlier versions & function reliably is a question. Probably not in that the the internal castings of the intake manifold appears different also. OMC repair kit #439073, or NAPA /SIERRA part# 18-7219.

If it is more efficient, then the motor will possibly idle better & have less of a black oily residue ooze out of the lower part of the exhaust housing for weeks after it is put into storage. One other observation while the carburetor is off, you will notice the intake manifold has a slight vertical separator on the bottom section up about 3/16". The supposition is that this may help fuel flow to the individual cylinders better. These later carburetors also had an adjustment screw for the cam follower.

Both these older & newer style carburetors use the same air box or silencer, but to most of us it is known as the air breather.

Removal of the Carburetor : You need to remove the plastic carburetor intake cover (OMC calls it a silencer). However the early ones I have seen are white instead of the common black color that is on the later versions. It just could have been that some motors that had white ones that were made of a material that did not survive vibrations as I have seen may missing. Remove the choke lever & the idle knob. When removing the idle knob, make note as to the location where the indicator tit is pointing, as you should replace it in the same location when reassembling.

You also need to remove the recoil starter unit. The manual starter unit can be unbolted with the one 9/16" headed bolt head in the center of the recoil unit. Be very careful as that spring is dangerous! Pull the rope out a few feet and tie a slip knot in it so that it can't rewind back. Carefully remove the starter handle, then grab the rope inside at the starter pulley, then let the rope withdraw somewhat but not completely (leave a foot or so to work with). Now, secure the rope inside at the starter pulley to the upright pulley gear guide in a manner that will prevent the spring from rewinding the cord etc. Hold the manual starter assembly together when loosening the top large retaining bolt (do not remove that bolt completely from the starter housing assembly). Carefully remove the starter assembly while holding it together. Screw a 3/8" nut on the bottom of that large retaining bolt to hold the starter together while you're working on other components.

There is a small coil spring from the carburetor to the ratchet of the starter up to about 1979 that needs to be unhooked.

Now you can get to the RH (looking forward) carburetor nut more easily. The LH nut is harder to get to & you may only get the nut to move one flat at a time with the wrench. You may also decide that by removing the flywheel it is easier to get to this LH nut.

Remove the fuel line.

Clean & Rebuild the Carburetor : Disassemble the unit. Once the carburetor is off, unscrew the bottom screws that hold the sheet-metal bottom pan on. When removing this pan, be careful & try to save the gasket if you are not going to get a repair kit. Remove the cross pin that holds the float, remove the float & the needle valve. You will need to also remove the idle shaft screw, count the revolutions it takes before it comes out. In this way you can replace it with the same number of revolutions when you reassemble it. If the insides are dirty, you can get a can of carburetor cleaner & spray on or soak until things soften up. Usually you can use an air hose to blow thru the passages & be sure they are clear.

You can possibly get by without a repair kit or gaskets if you are careful in your disassembly & use a gasoline proof gasket sealer when you reassemble it. If it just had debris & water in the bottom, you can get by without one. But if it is gummed up with varnish you will need to go farther. For the price of a \$12.75 repair kit for the early versions, while about \$21.75 for the later style. You get all new gaskets, needle valve, main jet & new metal plugs that are needed to replace the old ones if you have to get all the channels cleaned out, and float adjustment instructions.

When reassembling, place the float back in position & replace the cross pin. Tip the unit upside down & check the float height. The now upside down unit should have the top of the float parallel with the now top of the housing. If not, you can adjust it by bending the metal tab that acts as a stop for the float. Be sure that the float can move up & down freely, otherwise if it binds, the motor may run at different speeds depending on how much your boat is tipped to one side or the other.

Screw the bottom pan back together & reinstall the carburetor onto the motor's intake manifold. Remember to reattach the small spring on the starter ratchet if it was made prior to about 1982.

When reassembling the idle jet screw, & you forgot how many turns it was set at, a good starting spot would be to screw it in until it lightly bottoms out, then back it out one & a half turns.

Removal of intake manifold : If for some reason you have to remove the manifold to replace the leaf valves, now would be the time to do it, other than when you do a complete engine overhaul. The bottom 1/4" bolts are a tight location to access. While the carburetor is off, you will need a 1/4" drive speed handle & preferably a 7/16" wobbly socket, (one that is a combo universal joint & socket combined). You may be able to squeak by with a universal & a thin socket after taking out the front motor mount screw, which will allow you to gain a slight amount of room. The hard ones are the RH & LH bottom, as the RH bolt is tucked under the support bracket. The LH one you will have to remove the bolts from the shifter shaft & slide it to the left enough to get the socket on the bolt head. On motors made in the first 2-3 years of this model, I have found that these bolts are indeed a 1/4" coarse thread, but using a head size of 3/8" You may be able to twist the manifold enough to get it up & out from under the throttle cam plate. But in reassembling when you have the gasket in place, it may well be best to remove the stator & timing plate. In doing this you now can position the manifold & gasket in the proper place without disturbing the gaskets location. Otherwise you may be taking it off again, as there is a fuel drain hole in the bottom of the manifold that allows excess fuel to drain back into the crankcase, that if not sealed good with the gasket, will allow gasoline to dribble out & down along side the block & upper housing.

Check the leaf valves, (commonly called reed valves) or replace them. Clean the old gasket & use a good gasoline resistant sealant on the new gaskets & reassemble in reverse order.

Reinstall & Adjust the Carburetor : After reinstalling the carburetor to the intake housing & you need to reinstalled the choke knob. The choke knob shaft has a slot in the middle that the carburetor's choke lever goes into. This shaft needs to be installed with the longest length of the slot upwards, otherwise the choke lever does not have enough room to function. Now you need to re-install the plastic carburetor intake cover. The idle knob is next. Even after you replace in the same location as it was before tearing it down, & you get it running again, you may need to fine-tune adjust this idle knob for trolling. There is also a large knob on the left hand side of the lower cowling on all but the very early years motors. This large knob activates an internal threaded rod that acts as a stop for the throttle plate linkage.

After the motor has been run enough to have it warmed up, try to let it idle. If it runs too fast or slow you can adjust the large knob stop screw on the motor's left hand side. It may be best to initially do this with the motor cover off, so that you get an idea of which way to turn this screw. Turning this knob counter-clockwise pulls the threaded rod out & makes the motor run slower.

When you get the motor running at your trolling speed, then turn the carburetor idle screw knob (lean/rich) clockwise a slight amount, let the motor run for a few minutes, & rotate it slightly more in the same direction again. Doing this you are making the motor run leaner. Eventually you'll hit the point where the engine wants to die out or it will spit back (sounds like a mild backfire). At that point, back out the valve 1/4 turn. Within that 1/4 turn, you'll find the smoothest slow speed setting & the smoothest the motor will run at slow speed.

When you have finished the above adjustment, pull the knob off & reinstall it so the pointer is in the "DOWN" position. You will now have a "GO TO" position if need be, which will be discussed later.

From the start in 1974 it seems that the Evinrudes utilized a slow speed adjustment on the middle LH side of the lower cowling, & it also appears that from about mid 1975 on, for the Johnsons. This is simply a large external plastic knob attached to a LH threaded stop screw that limits the travel of the throttle's twist linkage. Turning this knob counter-clockwise decreases the low speed. You may have to also re-adjust this screw to obtain the proper slow speed in conjunction with the carburetor idle jet adjustment. Later in about 1986 when the cable throttle unit was introduced, this side knob was replaced by a knob on the end of the twist throttle handle.

It makes a lot of sense when shutting down the motor for what may well be an extended period of time, to disconnect the fuel line & run the motor unit it dies, using up all the fuel in the carburetor.

Hard Starting When Cold : The one most common problem with hard cold starting, can probably be contributed to someone who uses the motor strictly for lake trolling & is prone to adjust the idle jet lower than it is actually designed for. When you are adjusting this timing & idle jet for trolling, you will be doing so while the motor is warm & running. Then when the motor cools down, things are going to be slightly different. What happens then is that in the cold starting mode, the motor does not get enough fuel, & you have to choke it & pull more times on the starter rope to get enough fuel into the cylinders for it to fire. One thing you may do in this case is to after you have adjusted it for your trolling speed is to then pull the knob straight forward & off the carburetor idle shaft, reposition the idle knob to position the pointer down & push it back on. Then when you go to start it, you twist this knob counterclockwise all the way up (about 90 degrees) till it bumps. This should give you more fuel to start, & then you can reset it to your known trolling position later.

Motor Not Revving Up Like it Used To : If all other normal things have been checked out & the motor will not run at the faster speed, sometimes if it has sat for some time with the fuel not run out of the carburetor when it was put away, the main jet can get partially plugged. The bowl of the carburetor can also accumulate some debris. If this happens, the motor may start & run at a medium speed, but is not getting enough fuel to allow it to run at a faster speed.

The other thing is as mentioned before that the twist throttle gears may be out of mesh.

Also if the timing plate linkage may have become disconnected from the upper throttle linkage peg, the motor will not run right. This peg has a plastic bushing & wavy washer with a small cotter pin holding it all together.

Timing : The throttle cam plate that rotates under the flywheel when you twist the twist grip has an arrow type mark on the front of it. This mark needs to be timed so that when you advance the throttle twist grip, that the carburetor roller is at this mark when the carburetor throttle shaft just starts to turn open. To adjust this, you loosen the 2 bolts on the RH side of the plate & adjust the cam plate to where it just aligns with the roller at the same exact time that the throttle plate begins to rotate.

Manual Starter Anchor Bolt Threads Becoming Stripped : If this happens the threads in the aluminum base plate are what is stripped. The manual starter will become floppy & may have problems engaging the flywheel ring gear. The only practical way to cure this other than replace the manifold, is to drill out the base hole & tap it to install a Heli-Coil insert thread back to the 3/8" NC thread.

Reinstalling the Manual Starter Spool : New rope is 5/32" dia & 72" long. The spool has to be replaced in the proper location. The underside of this spool housing has a 90 degree metal lug protrusion that hangs down & goes into a round hole in the base that the unit bolts onto. It is hard to see where this protrusion goes unless you place a felt pencil mark on the housing in line with this metal protrusion. There is a flat washer between the mounting housing & the starter spool & under the recoil spring. Be sure this washer is in this position, if you put it below the housing & above the bracket, the housing will compress the unit to the point it will bind & the spool will not rewind properly.

The manual starter spool was changed after 1978. The neutral safety interlock system & ratchet teeth were moved from the top to the side of the spool. Also the recoil spring was changed at this same time. You need to have the anchor bolt backed almost all the way out of the housing (but not all the way, otherwise the coiled spring may pop out of its housing) when you place the unit in position. If when you get the spool unit in place & the metal protrusion in the hole, but have problems aligning the bolt into the hole, hold the unit together as best you can & you can remove the bolt. Now you can look down thru the bolt hole & align the hole in the housing to the threaded hole in the base. The flat washer needs to be installed

under the anchor bolt's head, otherwise the starter gear will not stop on it's upward motion & bind in the flywheel gear teeth.

You will find it harder to get the manual starter out & back into position if you are working on an electric start version, as this ring gear makes for a closer fit.

LH side of a 1976 Evinrude showing the manual starter.
Notice the starter spool interlock ratchet teeth laying flat.



LH side of a 1982 Evinrude showing the manual starter.
Now notice the different starter spool interlock ratchet teeth & red dog.



Removing the Flywheel : If you have to remove the flywheel, you will first loosen the nut on top with a 7/8" socket wrench. There are 3 holes around the center of the flywheel that are designed to use a 3 armed puller. However if it is not stuck excessively tight, you may be able to remove it by the alternate method. Unscrew this nut 3 or 4 turns. Holding up on the flywheel, & with a plastic or lead mallet, tap this nut with a sharp rap or two. This should loosen & pop the flywheel off the tapered crankshaft. Don't hit the shaft threads, but only the backed out nut. If it is TIGHT, you may strip the nut's threads, so be prepared to purchase a new nut for \$3.03, if you try it this way. If this doesn't loosen it, then you will have to use the 3 armed gear puller & the 3 holes in the top of the flywheel like it was designed to do. tighten the center bolt against the end of the crankshaft until it will go no farther, then hit the head of the puller bolt with a 1# hammer using a sharp rap. If it does not pop off, tighten the bolt again & hit it again. Once the flywheel is off, inspect the flywheel key for sloppiness or evidence that it does not fit snugly, as this can allow the flywheel to move slightly & change the ignition timing. Note, there is no lock washer under the nut here.

Flywheel puller in position



Ignition : These motors have transitioned thru 4 electronic ignition systems. The first 3 years from 1974 thru 1976 has a straight magneto setup with points and condensers, but does have external coils, which are energized by what's called a "Driver Coil" located under the flywheel. All OMC models that utilize points, will have them set at .020. This point setting is usually stamped on the armature plate under the flywheel, & on the inside of the flywheel, so if you remove the flywheel you can see this setting. If you encounter hard starting on this series of motors, you could try opening up the points a bit. Some "Old Timer Mechanics" word is that to make those ignitions work a little better, they mechanics would open up the points to where it ran better, even about .060". This older ignition using condensers, if they start to break down, can start & run for a while, but when things warm up, the condensers & coils can begin to short out & the motor may die. You can crank until you are blue in the face but it refuses to start. Let it set for an hour & it may start. Time to change condensers.

If that driver coil starts to fail, is cracked, or starting to melt down, or whatever, there is a possibility that it would operate when cold, but fail by shorting out when heated up by the running of the motor. However do not just replace them because they are oozing black tar like goo. They may still run for some time. There is an aftermarket conversion kit that converts these early points & condenser type to electronic ignition. From the experience of a marine dealer that says it does not work well if it is being used for trolling, as it appears the RPM is so low that it does not give adequate ignition. Then from 1977 thru 1984 they have electronic capacitor discharge ignition, sometimes called a CD ignition, or as OMC calls it, Mag Flash ignition. This has a charge coil under the flywheel that sends a small voltage to the power pack, which ups the voltage to 300 volts & is then sent to individual coils & on to the spark plugs. From 1985 thru 1988 a slightly improved version of the system was used that was called CDII. Then from 1989 thru 1993 another system called the UFI (Under the Flywheel Ignition) was used.

This repainted 1974 was a electric start motor that had the starter, rectifier, the Neutral Safety lever & dog removed at some time, but still has the charging coils & terminal block in place. No powerpack was used on these early magneto ignition motors. If it was a rope start, then the 2 rear coils would be missing.



This 1977 is a CD electric start version, notice the starter shaft at the top of the photo.
Also notice the black powerpack on the starboard rear.
The silencer was removed for photography purposes.



This 1987 is a CD rope start model. Again the powerpack. Also the shift handle is black plastic.



1992 electric start with UFI ignition, notice no powerpack on the block & a hose coming from the suction side of the block (near the pink wire) to the fuel pump on the Port side.



Electric Start & Charging Systems : There are at least a couple different charging systems for the later engines. With the later electric start there was also a different stator plate, which included an alternator & a charging system. You can convert a manual start to the electric start if you get all the components, which would include a starter, by-pass cover, (the starter mounting bracket), flywheel, charge plate & rectifier. Sometimes a person wants the motor to charge a auxiliary battery without the use of a electric starter. Add on charge units (no starter) are listed for the 1977 thru 1982 list for \$182.00. The motors OMC part #174037 is designed to fit from 1983 to 1988, & lists for approx \$68.00 . However, the 1989 through 1992 engines require OMC part # 175251 which lists for approx \$62.00 . The main benefit to this is that the alternator will keep the battery charged if you use it for a lot of trolling & are using a depth-finder, radio, & or electric downriggers

The start button is tucked away on the right hand side of the front handle plate of the motor. The electric starter mounts on the left side of the power head behind the center of the flywheel.

Power Pack : The usual problem if the motor dies & refuses to start with no spark, may be traced to a bad power pack. And this power pack can fail with no forewarning. OMC revised number is #582452 & cost of a new one is \$72.08. Aftermarket rebuilt ones may go for about half that. This power pack fits most all the 2 cylinder OMC motors of the same time period up to 50 hp. They can have a RPM limiter built in. This is not needed for these 9.9 size of motors, but are more important on the larger HP units that are used as a speed boat. This power pack is a black plastic unit about 2" wide by 6" long & a little over 1" thick that is bolted vertically on the RH rear of the block. The rear part is made on a taper, that coincides with the angle of the spark plugs, to allow for spark plug wrench clearance.

Coils : The coils on these models are bolted on the LH rear side of the motor block. As you may suspect the top coil is for the top cylinder. These coils have a orange & a black wire coming from them along with the spark plug wire. The black wire is the ground. The orange wire is the high tension wire. These wires go into a black rubber coupler that has 3 prongs in it. The prong placement is identified by "A", "B" & "C". The orange coil wires need to be in their respective locations in this coupler or the timing will be off. The top coil wire needs to be in "B" socket & mates to the orange /blue stripped wire in the other half of this coupler. The black wire "A" socket in this coupler is for the kill switch. To remove both the coil assemblies on the early motors, you may need to cut this black wire, (depending on the year) & then crimp on a "bullet type coupler" on each end for later continuity on reassembly.

The coils for the early point type ignition motors 1974 to 1976 are different than the later Capacitor Discharge systems. All the early original coils that I have seen are a light greenish color, while the later CD coils are black.

To do a spark test, remove the plugs with a 13/16" wrench and see if you can get the spark to jump from the ignition wire to a source of ground across a gap of at least 1/2 of an inch. When you are doing this, either leave the other wire on the spark plug or be sure to ground the ignition wires that you are not testing so that there is no damage to the CD modules. It is even better if you can rig it so that you test both ignition wires at the same time. Using this method, it is easier to notice if there is some erratic pattern to the spark.

Spark plugs : Spark plugs are made in what is called a "heat range". This means you can purchase plugs that are designed to run COLD in a motor that is run FAST & over a long period of time, in a heated up motor where the colder plug is needed to keep the piston cooler to keep it from burning a hole in the top. In reverse of that, if you only run the motor at trolling speeds, then you need a HOTTER plug to allow it to burn the oil mixture in the gas well enough to keep the plug from fouling. The outboard motor manufacturers seem to recommend colder plugs as a general all around plug, as this is their way of making "One Size Fits All", so the colder plug keeps them out of trouble, but if you are getting fouling over extended periods of time when trolling their recommended plug is going to be to cold & wrong for you. The problem comes in for you to try to find a dealer that can identify what you need & then carries it in inventory. Don't expect to find any help on Champion's website either.

One of the motor's spark plug wires usually will have an original plastic tape on it with the recommended spark plug number. Depending on the year, this tape may recommend different plug numbers. If the recommended number is Champion L78V. This is the non-electrode "air gap" or "surface gap" plug that fires in 360 degrees to the sides of the plug. This plug is COLDER in comparison to the others & is on the low end of the heat range. These stock plugs have an air gap in the insulator that is suppose to increase spark, but as the ignition system gets older & somewhat weaker, the system just can't put out the voltage needed to effectively fire this type of plug. If you go out and run Wide Open Throttle all day, and just slow down when its required by law or you come in to the dock, then you should use these air gap type plugs. They have no idle bar, & if you run slow using them, they will foul easily.

Then other model motors, in the mid 1980's, will have the tape on the plug wire recommending Champion L77J4 plug which is not currently available & has been replaced by the L77JC4, which has a copper design for better performance. The QL77JC4 would be the newer replacement in a resistor type plug. If you needed a hotter plug in this series, then the next one up the ladder would be QL78C, (don't confuse this with the L78V above), & the next one up from there would be QL82C, with the hottest in the range being QL86C. I would recommend that you go up in heat range one step at a time however.

If I an confusing you old geezers out there when life was simple back when, Champion has changed their plug codes & now the last numbers DO NOT represent the heat range as it did years ago. The last number now represents the gap with "4" equaling .030.

The spark plug gap for the OMC 9.9 /15 is the same on all 74 thru 2000 recommended being set at .030. But depending on what book you look at, the recommended plugs & gap settings may vary. An old trick to increase the heat range was to open the gap a bit (to .035" or .040") & some of the old timers say it may improve your idle if you do a lot of trolling with your motor.

The other OMC recommended plug is from AC, with a number of M40FFX. The NGK brand also makes good spark plugs, #B7S (or BR7S resistor) would be about equal to the L77JC4, but gapped at .035. will also work, however the consensus from many users is that the Champions seem to work better on these OMC motors.

FYI, American plugs such as Champion, Autolite, have a colder heat as spark plug part number decreases, as in the OLD code a J4 is colder than J8. Japanese plugs are opposite, B8S is colder than B7S. The middle ground appears to be about "6", so a Champion "77" would be about equal to a NGK "6" in heat the range, however there is some overlap & sometimes there is no exact equal. The most important things are plug reach & heat range. Reach too long will hit piston and wreck engine, too short won't ignite fuel properly. heat range too hot will melt plug, cause pre-ignition & engine damage. Too cold will cause plug fouling, poor fuel economy and loss of power. The trick is to find a heat range where plugs burn hot enough to stay clean but not too hot to cause pre-ignition or spark plug damage. Most marine engine/ outboards spec a colder spark plug because the engine is loaded more and there's more combustion chamber heat. Bosch, Autolite, Denso & NGK, are all in the cross reference matrix.

Neutral Safety Position : These motors are designed so that you can not start (by pulling the starter rope or engage the electric starter) the motor if the shift lever is in gear & the throttle is advanced beyond the start position. For the manual starter version, the starter spool interlock ratchet teeth has a dog lever on the top, or the side (depending on the year) of the manual starter spool that drops down & engages a ratchet that prevents the starter rope from being pulled if it is in gear. Therefore it is wise to, each time you are going to start these motors to twist the throttle to the slow side & then bring it back to the start position. The reason for this is that since there is some slack in the throttle pivot gears. Many times, just bringing the throttle twist grip back from the fast position to the start position, the linkage has not reset it to the neutral safety position. You can pull the starter rope handle right off the end or break the rope, if you jerk the rope hard enough & are not suspecting that the thing is locked in the safety position.

On this 1987, manual start motor, note the shift lever in neutral & the black plastic Neutral Safety lever stopping the movement of the plated metal timing plate arm at the center of the picture just below the center of the flywheel. Here you can also see the new type thermostat housing on the top of the head.



On this 1983, with the shift lever in forward, the metal Neutral Safety lever is dropped down, allowing the timing plate to over-ride the stop & give full throttle movement. This timing plate is rotated by linkage to the twist grip throttle handle. Also note the powerpack positioned in front of the spark plugs with the writing on it.



Initially some motors that I saw that did not have the above pictured interlock, I thought previous owners had removed parts of this system, but it appears some of the electric start versions did not have this, but retained the starter dog system. The motor will still function with these safety features removed. It is possible to remove the starter spool dog system, & I suspect the motors that may be used mostly for trolling may be prime candidates in this instance, where the owner may not have wanted to take the time & hassle to change the throttle setting to shift then to neutral, restart, shift & reposition the twist grip back to the same exact idle position.

The early ratchet notches for this neutral safety dog are on the top of the starter spool, in 1979 they were moved to the outside of the spool & the dog activator was moved from the throttle linkage to the timing plate. On this later unit the dog spring's outer tail needs to lay over (behind) the upright steel guide post on the rear edge of the starter housing.

The electric start versions also have an electronic neutral safety switch, which is an inline switch between the actual starter button & the starter itself. It is activated by the bottom of the spring detent plate that holds the shift lever in or out of gear. Occasionally if the motor will not start with the shift lever in neutral, check this switch. The mounting bracket for this switch bolts to the side of the block below the fuel pump of the pre- 88 motors. Loosen the bracket & the bolt holes are sloppy enough that you can usually get the switch button aligned so the bottom protrusion of the cam plate will push the button down when the shift lever is in neutral.

Another thing to be aware of on these motors, is that the clutch dogs in the gearcase's transmission are rather large in relationship to some other models. This is good in that you most likely will not experience the motor jumping out of gear because of worn clutch dogs if the linkage adjustment is not properly set. But also at the same time, it means that you should NOT try to FORCE the shift lever into a gear while the motor is NOT RUNNING. You could very well break the shift lever, especially the newer plastic levers, or bend some of the linkage. If you HAVE to place the transmission in gear with the motor not running & the shift lever does not want to engage, try slowly pulling on the starter rope just enough to allow the clutch dogs to mesh in the gears.

Motor Makes More Noise Than Normal : The 1st, & many times not as obvious, would be to be sure the insulation is still inside the motor hood cowling. After that then look at the following things. (2) Has someone has repaired the lower unit, like replacing the water pump, they may have left out the exhaust baffle. This is discussed in a later section. (3) Also it could be that the upper motor mount seal/grommet is deteriorated enough that it may be letting noise, (& oily residue) leak out. This is a rubber seal that is located between the upper rear of the pivot shaft housing & the upper exhaust housing. At this location on the exhaust housing on each side you will see a 1/4" Phillips head screw on each side. These screws go into the upper rubber motor mount that is located inside the housing. The grommet is the seal between the pivot shaft & the housing. The above 2 conditions will have more of an exhaust type sound.

If you have a tinny type noise or rattle, then it could be (4) The pistons may be worn & could have lots of slop in the cylinders. This will usually quiet down as the RPM is increased however. (5) The flywheel could be loose, but this will be more of a rattle.

Water Pump Impeller Replacement : The one thing that will be the most likely need to replace is the water pump impeller. If you get no water spraying out the overboard water indicator hole, get a small single strand wire & poke it in from the outside of this hole while the motor is running. There may just be slight salt water crystals, or if it has set for a while, maybe a bug crawled up there. If your engine overheats & this overboard water indicator is not spraying, shut it off & look for debris plugging the intake screens on the sides of the lower unit. Start it up again & again look for water spraying out. If you can NOT get water coming out this hole, then SHUT IT DOWN QUICKLY. If you get steam coming out this hole, you DO NOT have water being pumped. Do not let it run to where the engine block is so hot you can not place your hand on the top of the block without getting burned or the paint starts to scorch., as you WILL run the rings..

If there appears to be nothing plugging these holes on the lower unit & you have cleaned the hole and there still is not water showing, then in all probability the impeller is aged, worn or damaged. One thing that will wear it more than anything else is to start & run the motor without any water going thru the pump for even a few seconds. It needs the water flowing thru it to lubricate the impeller. If run dry, the ends of the impeller can get worn/melted off, & or the nylon impeller housing can get melted & between the impeller rubber & melted nylon, plug the water pump outlet. This chewed up rubber can then get forced up into the water jackets of the motor, making a blockage that is hard to remove without about a total teardown.

If the pump housing is the older pot metal as used on the very early motors, replace the whole pump unit with the newer nylon housing kit which has a stainless steel liner that fits inside the housing. There is also a stainless bottom plate. The impeller fits in this stainless cup liner which gives a very long lasting situation.

Things to look for after the water pump is removed are, the impeller can take on a curl rather than have the blades snap straight outwards when removed from the housing. It may have also picked up some sand or some other type abrasive material which has created a scoring in the lower impeller plate and/or upper housing. That scoring alone would have a tendency to create a air pocket creating inefficiency in the pump.



On the left, OMC water pump kit complete #394711. Fits all Johnson and Evinrude 9.9 and 15hp 2 stroke motors from 1974 thru 2004 and 4 stroke 8, 9.9 and 15hp motors from 1995 thru 2001.

This complete kit, with all needed parts to completely replace the water pump and instructions. It sells for about \$40 at most dealers.

On right is just the impeller.

On these motors, the water goes to the outer water jacket first, the overboard water indicator line comes off the lower jacket (closest to the pump location). This overboard water indicator will have water first, before going into the rest of the motor. Therefore if you do not have water coming out of this indicator hole, & you are sure that everything is clear, your water pump IS NOT WORKING.

Actual Removal of Gearcase to Access the Water Pump : Have the motor mounted either on the transom of the boat, or on a motor stand or saw horses. It also will make a slight difference in the procedure whether the motor is a long shaft or not. There are 6 stainless, 5/16" bolts with 3/8" heads that come in from the bottom & are bolted up into the exhaust housing assembly. If it is a short shaft, they are the only ones there. If however it happens to be a longshaft, there is a 5" extension, or if a Sailmaster a 10" extension between the lower unit & this housing. If so, then remove the upper 6 bolts. The lower 6 bolts attach this extension to the lower unit. When you get these 6 bolts removed, the gear case unit should drop down about 1/2". If it does not, you may have to tap it with a plastic mallet. Shift the gearshift into forward. When the lower unit does slide down, there will be, inside the housing in the front right hand side, a connector that is a strap with 2, 1/4" holes top & bottom & 2 bolts that are screwed in from opposite sides. These bolts go in a circular groove of the shifting rod, & hold it in place. Remove only the top screw with a 7/16" socket.. It has a hex head & also a screwdriver slot. Once this screw is removed the gear case unit & drive shaft can be moved downward & off.



There is a stainless steel exhaust baffle screen that is slid into the rear partitions lower exhaust housing at the juncture where the gear case unit fits together on all motors except the first year or two. This baffle has many small holes in it & apparently helps reduce some of the exhaust noise.

The driveshaft may have a O-Ring around it on the splines that engage the motor crankshaft. The earlier motors had a groove around the shaft for this O-Ring, while the newer ones had the O-Ring in a internal groove in the lower end of the driveshaft. If it on the shaft, remove it until you are ready to re-install the parts.

Now on the gear case unit, you will find 4 bolts holding the water pump with the driveshaft going thru this pump housing. The housing can be of pot metal or plastic, depending on the vintage. The plastic/nylon type is the newer style. If it is the pot metal type & has been using saltwater, you may consider replacing the whole pump with the plastic style instead of just the impeller, as the internal portion where the impeller rubs will be corroded & will soon chew up a new impeller .

Unscrew these 4 bolts & slide the water pump housing up & off the driveshaft. The front 2 screws are longer than the rear ones. Keep this in mind when you reassemble the unit. Make note of which direction the impeller vanes are facing, as you need to install the new impeller the same way, otherwise it will not pump right. Now also there will be a key that holds the impeller to the shaft. Save this also for reassembly.

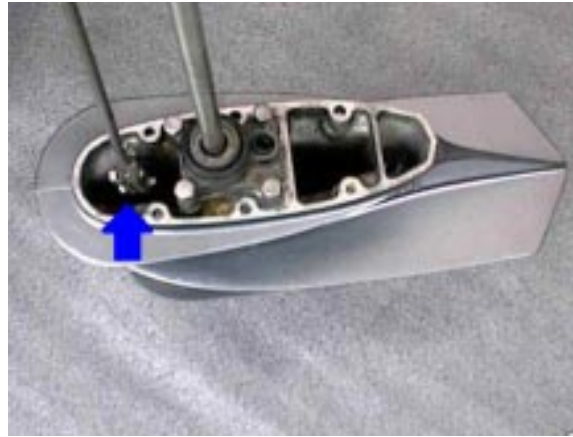
If you take it apart & the impeller appears still intact, you should consider inspecting it further, as it is not uncommon for the inner hub to become unbonded from the rubber impeller, allowing the hub to spin inside the impeller rubber. Also some aftermarket impellers can be thinner than the originals, not sealing on the sides, sucking air & creating erratic pumping.

If you have been having water problems, you may consider at this time, fabricating a garden hose to the copper water supply tubing from the water pump to the powerhead. You can hose clamp the garden hose onto this tube. Without the motor running, turn on the garden hose water supply, starting slowly until you see what is happening. If nothing, or very little water exits the overboard tell tale hole, poke the small wire up there to clean it out again. On the early 1974 to 1976 motors that did not have a overboard tell tale hole, this method will not work. Turn the water on full force & see if you can force debris, salt or sand out using this method. If there is considerable debris, you may have to constantly poke the wire in to clear the exit hole. If this does not do it & it is apparent that there may be considerable debris inside, then you should probably remove the thermostat cover & see if the water exits out the back of the head. The good thing about using this method is that you can tell if it is the water pump, or a blockage inside the powerhead or water jacket passages.

On the early motors up to about 1986 when they moved the thermostat to the top rear of the head, you will have to remove the rear motor cover latch handle from the lower cowling if you need to get the rear water jacket & or thermostat out, as there is not enough room for a wrench with the latch in place. This is not an easy chore to hold everything in place & install the 1/4" bolt from the inside with the water jacket very close.

Clean the Front Cavity & Drain : While you have it apart this far, you should consider looking at the large forward cavity in the gear case unit. This cavity is only accessible from the top when the gear case is removed. This cavity has a drain hole coming out just above & on the left hand side of the rounded gearcase boss. If the motor has been used near saltwater, this whole inner cavity can become plugged with salt residue. The shifting rod runs down into the gear case in the middle of this cavity. Do not remove this shifting rod at this time, as it has a rubber O-Ring seal around the lower end to keep the water out. If you unscrew this shaft & take it out before you clean this cavity, salt & debris will fall inside the gearbox. And you might have problems getting the threaded end of the shaft aligned back so that it will start into the threads of the shifting yoke inside the lower unit.

This is what it should look like. The water pump housing is what you see attached by the 4 bolts.



Salt corrosion & what it CAN look like. I have seen worse Shifting rod coupler visible on the small shaft.



You may have to use a long screwdriver or something similar to dig out much of this debris. This salt/aluminum debris can be packed in very hard. Wash it out & keep digging, as there is quite a large cavity here. The internal drain hole to the outside drain hole is in the very forward part of this triangle cavity. You will also need to weld a 1/4" extension on a standard 3/16" drill bit that will be about 9" overall. Use it on a drill motor to drill out this crap, especially down to the drain hole. You will then need an 1/8" drill to clean out from the outside hole to where both holes meet. (On the later motors of late 1980's this hole was increased to 1/4"). When you get this cavity clean, wash it out with water, & observe whether the water runs out the outer drain hole.

You may think that since you flush your motor that with muffs each time, that this cleans this inside cavity as well. Not for this cavity. If the cavity & corresponding drain hole is clear, when you remove the motor from the water, about 1/2 a cup of water should run out this outer drain hole. When removal from the water, this can drain water out for a couple of minutes. It is recommended that you find a small nozzle & back-flush water into the outer drain hole each time you flush the motor. The later models increased hole size would be recommended at this time, in that the factory must have decided the smaller hole may have been detrimental.

Unburned gas/oil from excess idling during trolling may drain out this hole also.

Now that you have cleaned the gear case unit & the area around the water pump housing, you are ready to reassemble things.

Reassembly of Water Pump : Place the new impeller in the water pump housing with the vanes ALL pointing in the same direction as when you took the old one out. If you forgot, remember that the motor

rotates in a clockwise direction, therefore the vanes need to be pointing in the opposite direction as the motor is rotating as the rotating shaft will force the vanes back. Also take into consideration that you maybe assembling this unit upside down before you slide it onto the driveshaft. If you get them in wrong, it probably will not hurt, as when the motor is started, the centrifugal force of the rotation more than likely establish them in the right relationship anyway.

It is a good idea to put a slight amount of oil on the impeller vanes at this time also. The new plastic housing pumps have a stainless steel inset that the impeller rotates inside of. This insert has to also be aligned & in the right place when assembling the upper housing. You will have to slightly force the impeller to one side as the housing is not centered but is eccentric with the shaft to make the impeller pump water. With the impeller in the stainless cage, slide the pump housing & impeller unit onto the shaft, Again be SURE that ALL the vanes are pointing in the same direction. Remember the rotation of the engine is ClockWise. Clean the driveshaft to remove any debris or rust.

I have found it best to install the upper pump housing on the shaft with the shaft while NOT in the lower unit. The shaft simply slides into the splines in the lower gear. The shaft can be put back in more easily after the impeller & upper housing are installed, than trying to fight the impeller & key position with no room to work against the lower impeller housing.

Slide the water pump unit with impeller installed, down to near the flat on the shaft for the key, then place the key in the shaft's flat, (chassis grease may help hold it). The driveshaft has a flat in this location, but the key may be just a round pin. Now move the pump housing down & rotate it to a location that the notch in the impeller & the flat on the driveshaft make it easy to install the key. If you insist on a better key, a Mercury impeller key can be shortened to fit. The Mercury keys are made in the form of a brimmed hat of extruded stainless. They fit the flat better & have the rounded key made as an integral part. These Mercury keys are usually are too long & need to be shortened slightly.

Align the drive shaft so the key is even with the bottom of the impeller. Now you can slide the shaft & upper housing/impeller down into the lower unit, engage the splines in the gear & install the four bolts on the top of the housing. Once the pump housing is down & in place you can now replace the 4 bolts holding the housing to the lower unit. Remember the pump housings require 2 longer bolts in the forward part as compared to the shorter 2 rear bolts.

Be sure that the rubber grommet on the rear of the pump housing is in place with the 2 rubber ears in the corresponding side holes of the housing. These ears hold the grommet in place when you slide the copper tube into the grommet on final assembly.

You might consider placing a smear of chassis grease on the lower end (where it mates into the grommet of the pump housing) of the copper tubing water tube leading up into the exhaust housing. This grease helps insure this grommet does not get pushed out of position.

There is a large rubber O-Ring about 1 1/2" in diameter that sits on top of the water pump & between the exhaust housing, this ring more than likely will stay in the housing., however it may come off & be still on the upper pump housing. It is essentially a seal & alignment between the water pump & the exhaust housing. Check to see that it is still in place. You might want to clean it up & apply a light coat of grease on it to ensure that it also aligns readily.

Replace the rubber O-Ring on the driveshaft, & grease the splines with a marine wheel bearing grease. If you forget to grease these splines, the next person to tear this motor apart 10 years from now may have trouble getting the shaft to separate from the motor.

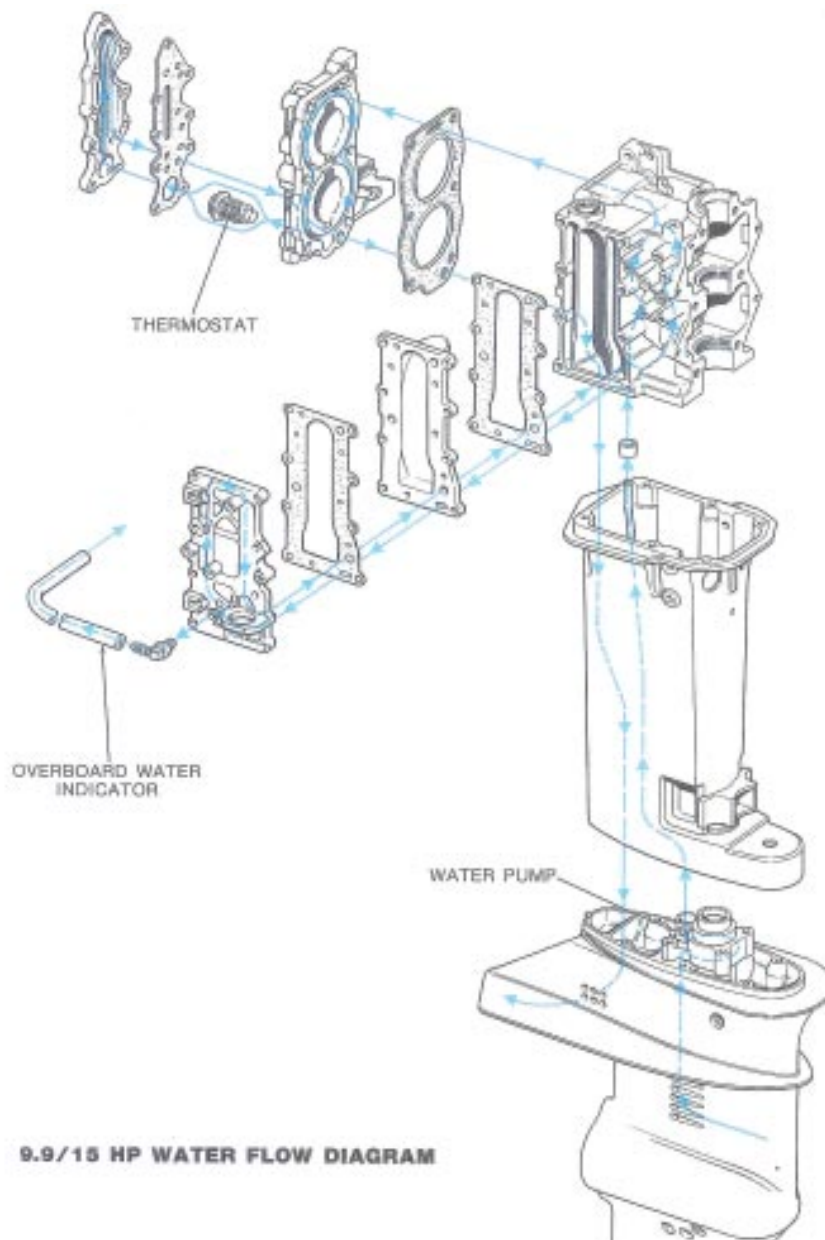
If your motor is from about 1976 on, be sure to then replace the stainless steel baffle screen that is slid into the rear divided section of the exhaust housing at the juncture where the gear case fits together. It simply slides in a slot & is held in place when the exhaust housing & gear case unit are assembled. If this is left out it may increase the noise level to some degree.

Now you have to align the copper tube, the driveshaft splines with the crankshaft & the shift linkage rod at about the same time. Slide the complete gear case up to where the linkage rod is in the clamp. You can look in & see if the shaft groove is in the proper location. If the shift rod is not down far enough, shift the shifting lever into forward, this will force the linkage down slightly. Place the upper clamp bolt in (it may help to use a spring fingered type pickup tool) & tighten the screw. With everything now in place on the

exhaust housing, push it up, being sure the copper tube is still aligned & in the rubber grommet of the pump housing. At this same time you need to have the driveshaft splines engage the motor's crankshaft splines. If it does not go readily, you may have to either rotate the flywheel or the prop, or both. Once everything slides together, you can replace the 6 bolts holding the lower unit to the exhaust housing. I have replaced the impeller on these units & had it back together in 30 min, but I have also done it a few times before.

If you get it all back together & running, but you still get no water spraying out the overboard water indicator hole, quickly get your small wire & again poke it into the hole to try to break up any debris that may be lodged in the hole.

Water Passage Route in the Motor : As shown in this 1978 repair manual page, the water is sucked into the lower unit thru the screened holes in both sides of the gear case unit. It goes up & into the water pump. From there it is pumped up the supply tube to a block that is bolted to the underside of the power head. From here it is directed into the bottom of the water jacket on the right hand side of the power head. Some of the water can go out the overboard water indicator tube, but the majority goes up in this water jacket & then back down & into the block. Here it circulates around the sides of the cylinders, up & into the top of the head & thru both sides of the head & into the thermostat. Then out the thermostat, up thru the water cover plate on the rear of the head & back out thru a passage in the head & out into the exhaust housing to be either sucked out thru the prop hub or thru the holes in the sides of the lower unit if the boat is not moving.



The 5 water inlet holes with slight grooves ahead of them are shown here about centered in the housing in front of the prop, on this longshaft unit. There are 6 round holes above the cavitation plate, but only 4 of them go all the way thru into the inner chamber & are for relieving backpressure, if the motor is boat is not moving.



This powerhead shows where the Overboard Water Indicator elbow is attached to the water jacket. This particular motor was off a 1974. Since this motor originally had no indicator, the jacket was Heliarc welded here to match the later motors & tapped for a 1/8" pipe tap, then a plastic tube out the back



No Overboard Water Indicator for the First 2 to 3 Years : The water simply went thru the motor, then was exhausted out the bottom of the powerhead into a split section in the exhaust housing, there is a baffle that is only open on the bottom, slightly below the one 3/8" hole on the outer rear of the housing.

Backpressure from the exhaust inside the total housing forces some of the outlet water up & it pushes a combination of exhaust gasses & a watery mix out this indicator hole. This system was common to all the earlier OMC engines prior to these years. With this older system it was hard to tell whether your water pump was working or not.

From looking at parts & service manuals for 1975 & from correspondence of owners of 1976 motors & looking at the parts manuals, it is my observation that the "New Overboard Water Indicator" was not introduced in this series until possibly late 1976 or early 1977. I have one 74 powerhead that has no provision for any overboard water indicator of any kind, but I have another with a model number suffix of G, it has a modified water jacket that has an 1/8" pipe fitting tapped into the upper section, It also has some sort of a formed plastic spacer that goes over this section & the tapped Ell pipe fitting going thru both. This main water jacket area is thin & possibly the plastic was designed to help eliminate leakage. This threaded hole is located in the upper mid part of the water jacket. This location could only have been used for a manual start motor as it would have been in the way of the wire connection terminal block of an electric start version. My assumption is that this is was not a factory modification but an aftermarket or dealer modification. Then I have another same year motor with a prefix S, that has a raised threaded boss like the later versions on the lower section of the water jacket. The simple method of converting would be

to replace the outer water jacket with a newer one with the pipe thread outlet & drill a 1/2" hole in the rear of the lower cowling with a rubber tube connecting them. The picture above shows the normal outlet position of this modified jacket.

The above 1974 "S" motor has in the lower rear of the RH water jacket the 1/8" plastic pipe Ell fitting that had a short 1/4" OD rubber tube extend out a hole in the right rear of the lower motor cowling. After seeing numerous motors, I think it may have been an aftermarket conversion. My 1975 Johnson parts manual does not show this water outlet tube. The 1977 motors do have this Overboard Water Indicator.

I would recommend anyone having one of these older motors without the "Pee Hole" to convert it to the newer style, as there is no doubt if the water pump is then working or not.

This hole in the 1977 & later plastic overboard water indicator is small enough (.085 dia.) which is about the size of a wooden matchstick, small enough as to not draw off a high volume of water. From there, the water is routed up the rear of this jacket, over the top, down & into the block. The flow then splits & goes on each side of the cylinders & out the top into the water jacket of the head. The flow splits again & circulates around the inside of the head's water jacket & out the bottom to the thermostat. It then goes out the thermostat, when the proper temperature is reached, up to the top & then back down the thermostat water jacket, into the lower head & then into the lower block & out thru the exhaust housing's divided section, out the baffle & then out thru the 4 holes on each rear side of the gear case above the cavitation plate. These holes are there so that when the motor is being run in the water without being in gear, the backpressure is vented out thru these holes. When the motor is in gear, the prop is turning & the boat is moving forward, this backpressure is sucked out thru the center of the prop.

The protruding black rubber tube on the RH lower part of the cowling is possibly a overboard water indicator outlet conversion. The other hole in the rear of the housing on this rebuilt & repainted 1974, is the original water/exhaust hole that does not indicate a lot as to whether the motor is working right.



This 1983 motor is typical of the type of plastic overboard water indicator outlets you will encounter in about 1977. It has a small nipple in the center with a small hole (.085 dia.) in the center for the actual outlet. Also note the smaller water/exhaust hole in the housing.



Water exiting from this indicator should be not that much warmer than the water the boat is setting in, as it is just an indicator that the water pump is functioning & water is exhausted from the engine before it has a chance to really warm up. If you DO NOT see any water coming from this overboard water indicator hole, AND you are sure the hole is NOT PLUGGED, then you most likely do not have any water circulating in the motor. With the motor running for a period of time enough to warm it up & the engine is too hot to hold your hand on for any time on the block's top, there is NO WATER going thru the motor. If not, or a minimal amount of water is being pumped, you may see steam coming out the overboard water indicator hole. AGAIN, NOT A GOOD THING. The engine should be warm enough that you can place your hand on the main block for a period of time without being unbearably hot. If it is so hot that you can not touch it without getting burned, or the paint starts to burn, it is too hot, SHUT IT DOWN immediately & hope you have not ruined the rings or scored the pistons/cylinder walls.

It has been observed that before the motor gets warm & the thermostat opens, the overboard water indicator hole spews more of a volume of water than after the thermostat opens. Since the thermostat is near the last spot in the water cooling system, when the thermostat opens allowing a flow of the water to pass out of the motor. This then lowers the pressure slightly at the overboard water indicator hole.

Replacing the Thermostat : It is advisable if you are having water pumping problems to also take a look at the thermostat, since if the water pump impeller had gotten any of the vanes worn off, this is a location that this chewed up vane rubber material can collect & plug things up. If your motor is older, you may consider replacing the thermostat anyway. The reason is that the impellers are constructed of a better material & operate better than many of the older ones. On the motors before 1986 this thermostat is located in the lower portion of the outside water cover, which is bolted onto the rear of the head. The thermostat is in the very bottom of this cover. The cover can be removed from the motor without removal of the power head. BUT you will have to remove the rear cover latch to allow enough room to access the cover bolts to remove the cover. There was also a change in the head & this cover to allow better access to both spark plugs in 1977, with the gasket also being changed at this time.

The later motors, from 1987 on, have a different head. The water jacket that the thermostat is housed in, was changed to place the thermostat on the upper rear, making it a lot easier to access the thermostat. This thermostat is all together different, in that it is encapsulated inside a plastic unit. And the thermostat plate gasket is simply a neoprene O-Ring.

1974, NOT showing the thermostat, because it is buried in the bottom of the cover plate between the cover latch & the bottom of the head



1987, showing the newer rounded cover thermostat housing, retained by 3 bolts on top of the head



Possible Water Circulation Problems : One cause could possibly be is that if the motor has been run in very muddy or debris filled water, & that some of the internal water passages could be plugged. If this is the case, the restriction or blockage will usually be in the RH water jacket sideplate, (the first water jacket the water is pumped thru). However you can not take this plate off to check & clean the passages unless you remove the powerhead because the motor mount is in the way of ONE bolt underneath it. The other area of restriction could be in the head at the thermostat.

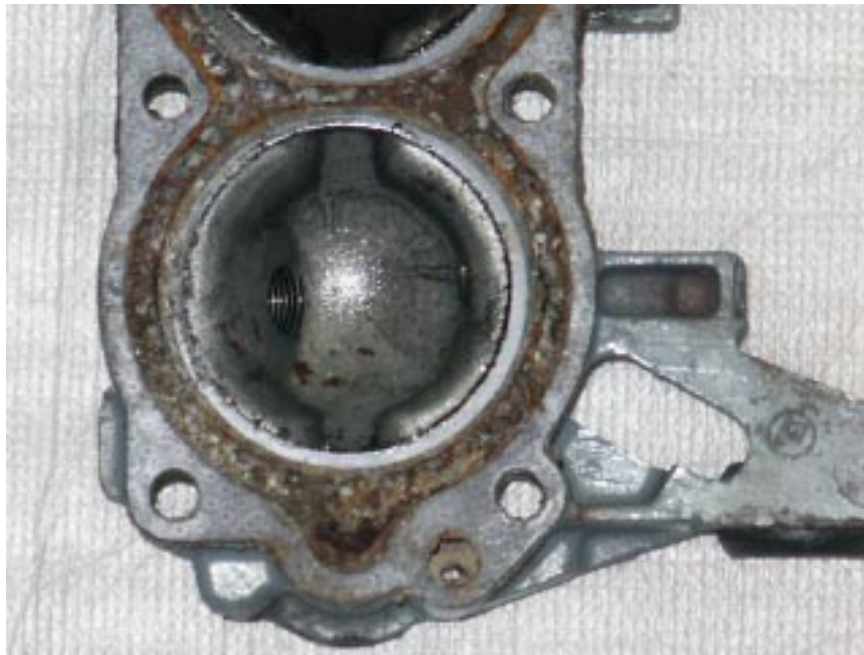
If you are absolutely sure that the water pump is good, and the passages are clear, and you are also as sure that what you are seeing is exhaust exiting from the thermostat area, the following could be the cause.

One thing you should do if no water is coming out, is to poke a wire up in the overboard indicator to dislodge any debris there. I have seen small bugs build nests in there. If this does not do it, then possibly there is a blockage at the plastic elbow on the other end of the tube that goes into the water jacket on the motor. The way things are put together, you can not get to the lower front bolt to remove this cover plate without complete powerhead removal. I have eye-balled the location of this elbow & marked on the outside of the lower motor cowling, then drilled a 3/16" hole thru this cowling. Then if needed to enlarge it use a Dremel tool & a 1/8" burr to enlarge it in line with the elbow center. Now drill out the center of the elbow with a #29 drill & tap it to 10-32 threads. You can now use this hole to poke a wire directly into the water jacket on the motor & possibly clean out other debris. Then get a 10-32 round head brass machine screw, cut the threads to about 3/16" long & use it to plug the elbow. You have a small access 5/16" or so hole in the lower cowling, but that is a lot better than the hassle of removing the lower unit & then the power head just to get the one bottom bolt of the side cover off.

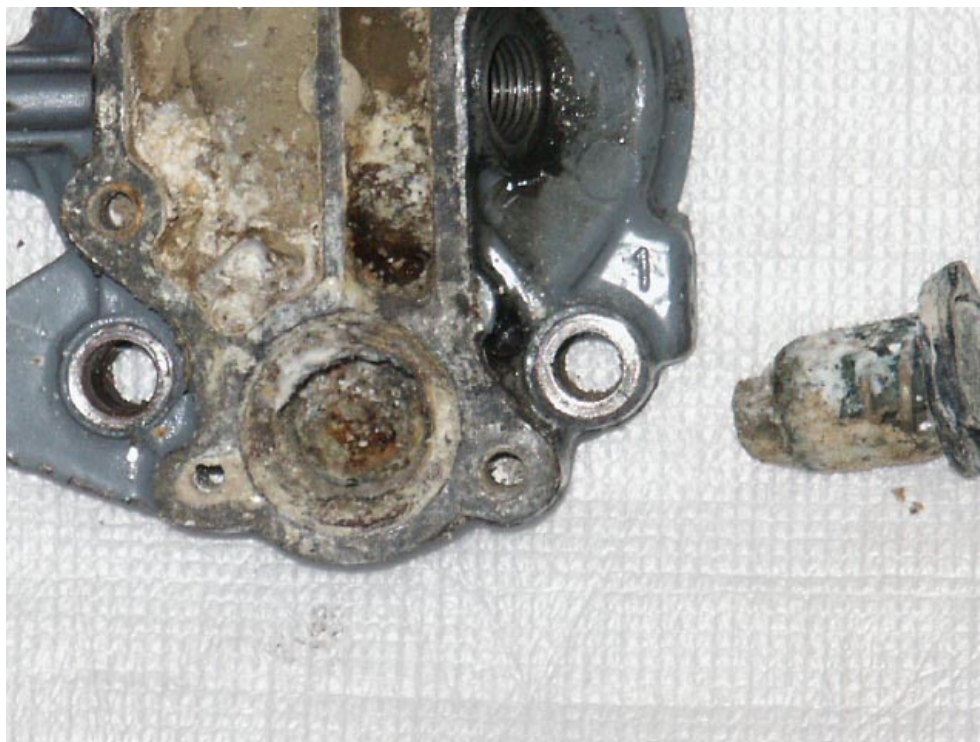
Another thing to look at is either the head gasket or the sealing area surfaces between the cylinder head and the block have become faulty. This would allow the combustion, the power from the explosion in a cylinder to escape across to the water jacket area, forcing its way down against the water pressure that's attempting to travel upwards. This results in a stalemate obviously and the engine overheats. I'd suggest that you remove the cylinder head and inspect that area.

The pictures below are from the motor described in Story #1. Note -- in the left picture you can not see clear thru the area on the bottom, & into the thermostat location. The picture on the right is the other side of the same head, with the water/thermostat cover is removed. The thermostat came from the large round cruddy area on the bottom.

1974 head viewed from the front, showing blocked water passage, behind the headgasket



Same head as on the left, but from the rear, showing debris under the water/thermostat cover & the totally plugged thermostat. Note on this 1974 head, the straight vertical part where the cover is near the spark plug hole, on the later heads this cover is radiused slightly inward here to give better clearance for the spark plugs



You may have some other problems other than the obvious of a bad water pump impeller, but the above listings are the most common.

Fuel Pump Repair/Replace : Typically this size of fuel pumps were used on about all the 2 cylinder engines in the same year range, from the 2.5hp up to the 55hp models. The fuel pump is normally pretty trouble free device. These pumps are activated by vacuum created below the pistons of the motor thru a hole into the inside the motor's side plate that leads into the crankcase. If a problem occurs, check the 2 hold down machine screws & the neoprene gasket under the fuel pump. There is also a filter screen on the outside of the fuel pump.

The older pumps are basically the same as the new ones with the exception that the new bodies have 2 external tabs, that align with the diaphragm tabs & other gaskets to help make it easier to assemble the parts wrong. The repair kits do not even list a kit before 1982. You however can use the new kits in the older pumps if you are careful & replace the new parts just as the older parts came out. Price on a rebuild kit is about \$12.00. There are 2 spring activated check valves, one on the suction & the other on the outlet. There is also a small spring & plunger inside all this, making it slightly hard to keep everything in the proper locations while making the final assembly. It is suggested that you use the 2 longer attaching screws as guides in from the back side to align things before the final assembly. Do not be surprised that you may have to do back & reassemble it a time or two before you get it right. One word of caution, do your repairs on a clean LARGE uncluttered table as the parts are small & may tend to crawl off & hide. Also read & understand the instructions that come with the kit.

The new fuel pumps are different, from about mid1987 on, but the old type was still used for the rope starter versions while the new type was used on the electric starter models. The new type was moved to the LH side of the power head. A 5/16" NF threaded hole was tapped into the original fuel pump vacuum location with a hose fitting allowing the hose to be rerouted behind the head to where the new pump is located just in front of the electric starter. This new fuel pump was not designed specifically for this motor, as it was also being used on almost all of the larger motors of this date.

1987, with the old style fuel pump on the right side, & new style thermostat housing.
Black plastic shift lever. Manual starter flywheel.



1992, notice the new style fuel pump on left side, in front of the electric starter. Note the additional upper flywheel gear for the electric starter.



Fuel Tank Problems : These engines use a single line fuel tank hose & a fuel pump that is a suction type, which has been used on OMC since 1959, therefore the vent on the top of the tank HAS to be cracked open. The hose couplings are the same on the tank as on the motor, so be sure you attach the hose properly, allowing the fuel to flow toward the motor. The primer bulb has 2 check valve balls inside of it making the gas flow only one direction & there are usually arrows on the bulb indicating the direction of flow. The arrow needs to point toward the motor. If you find where the primer bulb will not pump up & stay hard prior to starting, there is probably a air leak in the fuel line or fittings on the tank. Also, if at times and the requirement will be to pump the bulb occasionally to keep the motor running, this is usually an indication of a fuel line leak, as it is sucking air somewhere. It can even be a split suction line inside the tank. Assuming that there's no air leaks or restrictions between the primer bulb and the fuel supply, then the problem could be caused by faulty valves in the primer bulb. To check this out, with the engine running, hold the bulb in a vertical position, with the upper hose being the one that leads to the engine. This vertical position is best in order to have the internal valves work properly. If that doesn't bring an improvement, it is strongly suggested purchasing a new primer bulb assy.

Another situation is when the boat & motor is setting for a while, & if you leave your fuel line attached to both the motor & the portable tanks full, WITH THE TANK VENT CLOSED, that when the weather gets warm, the pressure inside the tank will force gas up into & past the carburetor float & in to the engine. This excess gas will then leak out & down the exhaust housing, mixing with carbon inside this housing & cause a black oily residue to ooze out of the motor.

There can at times be other problems related to heat & gas vaporizing in warm weather. There is the possibility it could actually pop the internal ball valves out of one end or the other of the fuel connectors, plus possible internal damage to the fuel line bulb. Some boaters when leaving the motor set for a while, will push the ball in with a pencil to relieve the internal pressure on the fuel line. It is best to get into the habit of unplugging the fuel lines from both the tank & the motor when not being used.

When the engine is running, the fuel primer bulb should NOT be firm, as when you primed it. When the engine is running, the bulb is usually laying in somewhat of a horizontal position & the fuel simply flows through it (more or less about half full). If you find that the bulb is hard, the fuel valve inside the bulb probably has come apart & the inner portion fallen out, turned itself around, & or then pulled back inside the valve housing. In effect this is shutting off the fuel supply. Also many times the primer bulb can, over time, get hard enough that it is hard to prime the engine. If this is so, it is probably about time to replace

the whole fuel line assembly as the lines usually then also be getting hard.

Some of the older Tempo plastic gas tanks with unitized fuel gage and fuel pickup with the rectangular clear plastic viewing dome, may WARP after a period of time and the neoprene gasket underneath does not seal anymore. If the tank is exposed to the elements, when it rains, the water runs in on the top of the tank around this seal where it collects. This can be checked by simply tipping a full tank & if gasoline leaks out around the gauge/outlet, water can surely leak in. As a temporary fix, you can usually remove the O-ring & use silicone sealer between the tank & this bolt on flange.

In many metropolitan areas, disposal of contaminated gasoline cost upwards to \$3.50 a gallon. I think I could figure out a method of filtering, or straining it & reusing it in a lawnmower or something.

If the gas tank has been setting for some time with fuel in it & the fuel has somewhat evaporated or turned to a brown jellied mass, one method I have used to clean the internal parts of the tank, is to put some paint stripper along with some pea gravel or small rocks inside the tank. Let it set for a day or two, then shake, twist & turn the tank repeatedly. The rocks will help break things loose & the paint thinner helps loosen the old gas. You might have to do this numerous times changing the paint stripper, depending on the severity of the contamination. When it is fairly clean, dump the contents & replace the paint stripper with rubbing alcohol. Repeat until the tank is clean. The rubbing alcohol is cheap and will also mix with any water that may have remained in the tank, so the water is removed at the same time. The alcohol also evaporates, so you do not have a disposal problem, which you would if you used gas to clean the tank.

Fuel to Oil Mix Ratio : The fuel/oil mix should be 50:1. This means 50 parts of unleaded 87 octane gas to 1 part of TWC-2 or TWC-3 outboard motor oil. You probably will not see much of the older TWC-2 oil out there anymore. You can spend your money & purchase OMC oil for about \$6.50 a quart, or buy a name brand quart for \$2.79. Sure the manufacturers want you to buy their oil, & for a new motor under warranty, it may be best to do so. But the consensus from many experienced boaters is to use any good brand of oil, as long as it has the TWC-3 rating, it meets or exceeds the manufacturers specifications. The TWC-3 represents, Two cycle, Water Cooled, type 3 formula. The formula 3 has decarbonizing additives designed to be more compatible with the newer non-leaded fuel.

From 1985 to 1989, OMC recommended a 100 to 1 mix, this was written on a decal placed on motors of these years. The actual change back to the 50 to 1 mixture was made sometime in 1989. There was a Technical Bulletin #2162 dated March 1986, for the mechanics to remove the decal, replace it with a 50/1 new decal & inform the owner, when the motor was serviced in an OMC repair shop. This was recommended for rental, commercial & heavy duty service engines. The suspicion apparently was that some motors, under the right conditions, if ran at a high RPM or under a load for extended periods of time, may seize due to lack of adequate internal lubrication.

The gas should be non-leaded, 87 octane rating and probably NOT ARCO brand, which has gasohol in it. This alcohol additive may soften your fuel lines, fuel pump diaphragm, carburetor gaskets & not be compatible with some current outboard motor needs.

The reason for mixing oil into the gasoline is that since these engines are 2 cycle, (sometimes called 2 stroke) there needs to be oil mixed into the gas to lubricate the internal parts (piston, crankshaft & bearings) of the engine, as there is no crankcase oil reservoir or oil pump as in the 4 stroke engines.

Less oil than recommended in the fuel makes the engine run leaner and warmer (less power, causes detonation, & overheating), more oil makes the engine run rich and fowls plugs (less power too), forms carbon deposits & friction can increase as the carbon builds up, so more heat is also made. Therefore a happy medium needs to be achieved.

If you try to lessen the oil ratio, and yet run it at higher speeds, you then will possibly run into other major internal problems. This may not only be for proper crankshaft / rod bearing / piston wall oiling, because 2 strokes burn hot when run lean & you can likely get a partially melted piston top in the lower cylinder. To avoid this possible damage, and a melt-through of the complete piston top, you need to be aware that this can happen on a lean condition. The solution is to run the correct fuel to oil mixture ratio of 50-1.

Checking & or Changing Lower Unit Oil : Here are two flat headed stainless plug screws, one in the front bottom of the right hand side of the lower unit (gear case) & the other above it by 6 to 7". There is an-

other round headed #2 Phillips headed screw below the lowest flat headed one, near the other lower drain plug screw, **DO NOT TAKE THIS ONE OUT.** This round headed screw is the pivot pin for the shifting mechanism in the lower unit. If you take it out, then the whole lower unit may have to be disassembled to locate & reassemble the parts using a special tool, unless you are **VERY LUCKY** with an ice pick & a steady handed friend slowly moving the shifter lever to realign it so you can put the screw back in place with the inner end going into the shift pivot hole.

The simplest way to add or change this oil is to purchase from an OMC / Bomardier dealer, a quart of gear oil in a plastic pump bottle. The pump spout has a clear plastic tube with a threaded end, that screws into the hole that you will remove the lower screw from.

Remove this lower screw & check the color of the oil that comes out. If the oil is, a golden brown it usually is OK, if it is blackish then it is probably OK, but really needs to be changed. If it shows no water contamination, then quickly screw the pump tube into the same hole. You will not be able to stop some oil from draining out while doing this, but if you act quickly, you will not loose a lot. Then remove the top screw. Now pump oil in the bottom hole until the oil runs out the top hole. Replace the upper screw first, this will act as a vacuum & not allow much oil to drain out as fast. Remove the fill tube & **QUICKLY** replace the bottom screw. While you have the screws out you should inspect the nylon seals, as **IF** they do not make a secure seal, water can get into the gear case here also & the price for these seals are about \$.50.

If it is a creamy to light chocolate color that means there is water in the lower unit's gear case. If this is the situation, then allow all of the oil to drain out. Flush it out with Mineral Spirits. It is suggested that you simply change oil & run it, but check it every so often to see how bad the leak is. If it slight & you are not using it in saltwater, you can get by for some time or until the next winter (slow season) by just removing the lower plug screw, allowing any water that may have collected in the section to drain out & then adding new oil.

If it continues to leak, be prepared to at least replace the prop shaft seals & the drive shaft seals under the water pump. There is also a O-Ring seal around the shifting lever rod into the gear case itself. You should catch the drained oil & inspect it to see if there are any metal filings of any kind in it, which could mean damaged gears or bearings. These seals are a double, back to back seals & you can not replace the outer ones only, since removal requires a internal type slide hammer which will ruin the inner seal. Therefore to replace the seals, the whole gearcase will need to be removed & disassembled.

There is an option when replacing this gear oil. You can replace the oil with regular gear oil, called Hi Vis by OMC, or now you can get synthetic gear oil. The synthetic oil does provide a slipperier, more efficient oil that allows the gear case to run at a lower temperature. This is usually not a big issue with these motors, as they are usually being only used as trolling motors & or as an emergency "get home motor". The word is do not mix regular gear oil with the synthetic oil. If you intend to use synthetic oil, drain the gear case & refill it with the new oil. Then make a note somewhere that you have installed synthetic oil in the gear case.

The Prop : OMC factory props are 3 blades & available in different dia. & pitches, with the most often seen being a 9 1/2" X 10" for both the 9.9 & the 15 hp. A 9 1/4" X 8" is shown for the Sailmaster & a power prop is listed at a 10" X 5". However aftermarket prop companies such as Michigan Propeller make other sizes also. This lower unit can handle a prop up to 10" dia. A 10" X 7" (or thereabouts) seems to be a good compromise for a heavier boat, or if the motor is used mainly for trolling as it will not lug the motor down as much.

Removing the Prop : The prop shaft splines should be greased with marine wheel bearing grease when reinstalling the prop, to ensure that the prop can be easily removed next time. These props have a rubber mounted hub, so if the splines are seized tightly enough, when removing a prop, the hub can be pulled off or pulled partly off leaving the prop blades misaligned & out of balance. The nut, a 13/16" (same size wrench as the spark plugs) needs to be snugged down so that one of the slots align with the cotter pin hole in the shaft, but not so tight that it has to have an impact wrench to remove it next time. However a air

impact wrench may be the only way to remove a stuck prop since it has a rubber mounted hub & any other method may ruin the rubber. Be sure that you replace the cotter pin when you replace the prop. The factory recommendation is to not reuse the old cotter pin, since it could be cracked & if reused may break & come off possibly allowing the nut to work loose & thereby loosening the prop.

Converging Ring on Prop : On the rear outer of the prop's exhaust hub is a plastic ring with a scooped portion pointing forward. This serves a couple of purposes. One is that since this motor uses an exhaust thru the prop, it then uses this ring as a scoop to force water into this center exhaust hole, forcing the exhaust away & not allowing it to build up a backpressure in the motor at a lower speed. The other thing it does is that when the motor is in reverse, it again helps relieve the possible exhaust pressure.

Over time, these plastic rings can get brittle & break off. New ones are not expensive, \$5 to \$7, & are replaced by simply laying the prop on a floor or workbench & with a short section of 2x4, & a large hammer pound the ring onto the rear of the prop hub. The prop has a slight groove that the ring snaps into to hold it in place. You might consider doing this in a warm room so the ring has warmed up enough to not break it during your installation process.

If the aluminum prop blades get dinged by hitting underwater objects, & they are not damaged too bad, you try to remove the dents out by laying the blade against some heavy metal object & hammering the bends out. Then you should file the blades edges down enough to remove any roughness or deep gouges. The standard prop is a 9 1/2" x 10" for both motors. This means it is 9 1/2" in diameter & rotates one revolution in 10". New replacement props run about \$50 each.

Black Oil Coming Out of Upper Exhaust Vent &/or Lower Unit Holes : Many of these motors are basically used as a secondary motor, & usually then as a trolling motor, and are ran for considerable length of time at a lower RPM. The fuel oil mixture ratio of 50-1 is probably too rich by some. The black oil that seeps out of the motor is just unburned oil from the gas mixture. The black color is coming from the carbon created during the pistons firing situation & is accumulated unburned inside the exhaust housing. You can reduce the amount somewhat by properly adjusting the carburetor idle jet to its leanest position & where the motor runs best at an idle.

Or it could be a 6 gallon tank that the fuel line is still attached to the motor & the outside temperature is high enough to expand the fuel inside the tank to where the gas is forced into the carburetor & IF the needle valve is leaking, it will force fuel into the engine & out the exhaust & mix with the exhaust carbon & leach out as BLACK oil out the prop's exhaust.

This oil seepage may not be evident until a day or so after usage, & then will seep out up to a couple of weeks later. It seems best for most boaters to then simply live with the idea that you may have to wipe it down after each usage.

It is observed that if these motors are used on a smaller boat as the only propulsion, and act as a "get there" motor & also as a trolling motor, this black residue is considerably less to almost non-existent.

I have been experimenting with using 2 gas tanks for the last couple of years. One, a 3 gal., mixed at 100-1 & it is used ONLY FOR TROLLING, the other is the 6 gal. main 50-1 tank also used for my 70hp outboard jet on the same boat. Again, I am using the 100-1 only for trolling with the 9.9. If & when I need to run with this 9.9 motor faster, even if it is trolling against the current where the RPM has to be increased to maintain desired speed, I simply switch to the 6 gallon tank.

I got the above idea from the newer VRO oil injection motors. This VRO abbreviation stands for Variable Ratio Oil Injection, & the larger motors using it (not the 9.9 or 15hp however) electronically sense the different RPMs & automatically adjust the oil injected ratio. They put out a 50-1 ratio at high speed & a 100-1 at slow speeds. Recently the motor manufacturers have gotten away from this VRO system & went to a direct constant ratio pump. This is because if you are idling, or trolling at the lower ratio fuel mix & you decide to pick up & run, the carburetor still has the bowl full of that low ratio mix & the engine will then be under lubricated until the fresh fuel is drawn into the carburetor.

Since I many times use the boat in bays which are somewhat salt water, I will switch tanks to the 50-1, when I use the muffs to flush out the motor at the end of the day. The thought here is to use the richer gas to leave a better oily film inside the motor when it is stored until next time. I also, at this point when flushing, do NOT KILL the motor with the kill button, but choke it to kill it. This will tend to also in-

crease the fuel/oil inside the motor if I let it set for a while.

Adjusting the Motor Pivot Tension : If the motor does not stay where it is put when trolling, but vibrates & keeps moving from one side or the other, you may need to adjust the pivot shaft screw. This is a screw that is mounted on the left hand side of the exhaust housing. This screw has a coil spring under it's head that you can not see. By screwing this screw in, it tightens the tension on the motors pivot shaft.

Motor Mounting Clampscrew : The 2 clampscrews that hold the motor to the transom may need service occasionally. The pivoting handles of these screws should have oil placed on the pivot pins from time to time to keep them from seizing up & then breaking off. To service these screws, it is best to

remove them from the bracket. There is a smaller screw that comes in from the rear & is screwed into the rear of the main clampscrew, holding on the large cupped washer. Use a 7/16" socket wrench to remove this smaller screw & then you can unscrew the clampscrew & totally remove it from the bracket, clean & replace.

Somewhere in production before 1983 the clampscrew handles were changed from aluminum to nylon. You may want to keep these screws well oiled as replacement screw assemblies cost \$31.84 each. In this area also later, about 1990 there were zerck grease fittings installed in the front of the tilt hinge shaft boss.

Not Enough Tension on Tiller Handle : For the early motors up to about 1986, if the tiller handle will not stay where you put it, you will need to tighten it. However this is not done as you would at first suspect. The 3/8" nut showing at the hinge, when the handle is raised, is only a lock nut. It has to be loosened, & the bolt's head end, that it is accessible from under the steering bracket needs to be tightened, then this visible lock nut retightened. It is however recommended that you remove the bolt, clean the nylon bushing & apply a slight amount of grease before you reassemble it. If you do take this bolt out, be careful that you re-engage the throttle shaft dog teeth properly when you reinstall it.

Throttle Twist Grip Functioning : Again for the early motors if the twist grip throttle handle (steering grip assembly) has developed enough slack that it is hard to find your position except if you move it from one way all the time. Or the engagement gears on the twist grip shaft & the intermediate shaft allow the gear teeth to jump out of mesh to where you may not be able to rotate the twist grip, you may need to make some shim spacers. These can be made from the plastic of the sides of milk jugs or other plastic bottles. There is one screw on the underside of the twist handle that allows you to take the handle off. Be careful when reassembling the handle as there is a internal thrust spacer between the spring & the handle that has 2 protruding lugs that have to align with notches on the main arm. If you try to reassemble the twist handle & these mating thrust spacer notches are not aligned, you can not get the handle on far enough to get the screw in. You may need to twist things until the lugs engage, & then after they are, you may again need to twist the handle so that the screw in the shaft align with the hole in the handle. this screw. Be very careful that everything is square & properly positioned when you try to start the screw, as the shaft is aluminum & the screw is stainless. If it starts & goes in cross-threaded, it will just get tighter & to the point that it will not go all the way in. This can be a problem later, as the screw may not be able to be removed without breaking the plastic handle. If it does cross-thread, it may be wise to get a 12-28 tap & clean up the threads in the shaft.

If the throttle twist gears disengage, you may be able to place a spacer on the twist grip shaft between the end gear & the housing, pushing the shaft rearward. This can be performed without tearing any major parts of the motor apart. If this does not help & the gears still jump the teeth & get out of time, then it is time for a new shaft with the new gears, price of \$46.70 for both it & the matching nylon bushing. You can weld new teeth back in or add bronze or silver solder to the tips to give more positive engagement. The newer parts have both bronze teeth as compared to sintered steel, nylon or aluminum for the older units. However, there seems to be one MAJOR problem with these models, and that is that the twist grip is not really designed to be operated in any other position than up to a 45 degree angle. If you tip it up farther & twist the throttle, you can experience these teeth to jump out of mesh 1 or 2 gear teeth without knowing what you just did. When in this condition, it will usually run, but at about only up to 1/2 throttle. It will

not rev up to maximum speed as this flat will not allow complete shaft throttle movement.

When this happens, you may luck out by again raising the handle all the way up & twisting the handle back to SLOW, then moving the handle down & hopefully re-engage the teeth. There is a rubber cover on the top that does not allow you to see what has just happened. These gears at the handle pivot have one large flat on each, about the spacing of 2 gear teeth which have to mate, acting as a timing situation & main thrust function. When timed right these 2 wide gears should mate together in a position mostly in the upper position.

Farther inside is a vertical bevel gear that sits in the lower cowling is held in position by a separate plastic shaft. To get to this you will need to unbolt the vertical control linkage shaft that goes into this lower gear & attaches on it's upper peg to the timing plate arm.

This gear shaft has a hollow center in it & can be removed by simply forcing a medium sized screwdriver or 1/4" lag bolt into this hole, & then by twisting at the same time you raise the lag bolt, you can pull the shaft up & out of the lower gear. Mating into it on the front is a horizontal gear that is held in place by a snap ring. These 2 bevel gears have a dot on one & a groove on the other which need to be aligned. In reassembling the intermediate shaft, to the gears, there are timing marks on all mating parts. The shaft has square ends, with one end having 2 small raised lumps, the other end has 3 small raised lumps. These lumps mate into matching small notches in the square holes in the gears.

If you get things out of time here, the mark on the twist handle will not align with the corresponding "SLOW", "SHIFT", "START", or "FAST" or positions.

If you have slack between the handle itself & the linkage for the throttle plate, then you will have to probably shim the bevel gears on the end of the intermediate shaft & the housing, pushing the one gear rearward into a better mesh with the other bevel gear. You may also have to shim under the other bevel gear (raising it) that is pivoted into the lower cowling. These last two jobs will have to be performed after the manual starter, vertical control shaft & vertical control shaft gear are removed.

Cable Type Throttle Linkage : Motors after about 1986 eliminated the above problem by doing to a cable throttle linkage system instead. One thing you may look for in the cable system, is that on the end of the cable where the nylon socket is that attaches to the ball, is this cable end seems to rotate slightly depending on the position of the handle's height. The nylon socket is threaded onto the end of the cable's shaft. You may have to thread it on farther or less to position it so the socket is about level with the handle elevated slightly, otherwise if it twists far enough it may pop off the ball.

Occasionally you may encounter one of these cable systems that the twist grip will not stay where you put it. The motor will usually slowly slow the speed down by itself if you let go of the twist grip throttle. A solution for this was passed on by a retired marine mechanic. His solution was to take a electricians #6 copper grounding split bolt clamp & simply clamp it around the throttle cable in an out of the way place. There is enough room on the underside the the tiller handle. Tighten the nut enough to just squeeze the cable inside the plastic sheath. Works like a charm.

Zinc Anodes : On motors from about 1983 on you may see (2) 1/4" holes drilled on one side of the cavitation plate. These are for attachment of a zinc anode. These anodes are threaded & bolts come up from the bottom with the anode on top of the cavitation plate. These holes are evident in the picture below of the prop shaft being removed..

Converting a 9.9 to 15 HP : This question seems to pop up quite frequently & can get controversial. As you can see from information in this article, it is possible. New carburetors are expensive, (over \$200), but used ones go for half that, then you can probably expect to rebuild it. Some will tell you that you need different reed valves & reed valve stops. I bought a 9.9 new in 1978 & still use it. It is the basis initially for writing this article, & as I was trying to convert to 15 hp & there was no information available. I also bought the repair & parts manuals at the same time. From this parts manual I can assure you that the reed valves for either engine are the same for that year. I have also owned & rebuilt a 1974 15 hp, a 1977 15 hp, a 1983 9.9 Sailmaster, a 1987 15 hp & a 1992 9.9. The information I use here for the models in between these, comes from a friend who owns a marine outboard repair shop & who has graciously allowed me to go thru some of his parts manuals that I don't have & I have obtained some of his expertise over time.

Props are the same for both the 9.9 & 15 hp motors.

Also, as mentioned, the inner exhaust housing was changed after about 1981 for the 15 hp. This exhaust tube on the 15hp has a circular cross-section and gets wider at the bottom, as opposed to the narrow, rectangular shape on the 9.9.

I will speculate myself & use hearsay on that it is probably not worth the price or effort to change this housing when upgrading on the older motors, if trying to up the hp to the full blown 15. Remember that the older (pre 1981s) motors still used the same 9.9 exhaust housing on both motors. Do not think that by just by changing the housing that you do not need to also change the carburetor. Tuned exhausts are well known in racing two stroke motorcycles & are very effective at specific RPMs. The larger carburetor will gain the most in increased RPM, (about 1000 RPM more, according to OMC) which in this case also relates to more horsepower. If you insist on squeezing that last ounce of energy, then maybe the aftermarket reed valves, polishing & deburring the intake manifold & replacing the exhaust housing will be of some benefit. But, if you are trying to push it this far, at wide open throttle for an extended period of time, my thoughts are that then the rest of the engine may not stand up for long, so go to a larger motor. On the later motors from late 1987 on thru the 1992 versions, when they changed carburetors, the inner exhaust tube is quite a bit shorter than the early ones & this same part is identical for both the 9.9 & the 15 hp versions. Why, I am not sure at this point in time.

Converting over to a full electric start/charge system : This can be done, but may not be cost effective if you price new parts depending on the year of your motor. The simplest would be to buy a complete used set of parts. Many times this can not be done, or you can not find the used parts off the same family of years in relationship to the ignition systems. As you can see from the preceding info that the ignition & therefore also the charge units are vastly different. Starters & the by-pass cover are the same up to 1992. However when it comes to flywheels, new ones are expensive & trying to find the right used one may take some time. There are 2 main differences in the electric start flywheel. The manual start version has only the larger cast in aluminum toothed lower gear, while the electric start in addition to the manual start cast in gear, has a steel ring gear for the electric starter to engage into.

One thing to be aware of if you tend to buy used parts off eBay or elsewhere, is that if you are trying to upgrade your motor to a electric start / charge system, the flywheel needs to be compatible with the timing plate / driver coils. You need to get all the parts needed, as flywheel, timing plate assy, starter, starter bypass cover bracket, start button, neutral safety switch, junction block, & rectifier. You could put the complete "KIT" from any year motor onto any other motor within the 18 year series, no matter whether it originally was the earlier 74-76 points ignition or not.

If you do find the right charging system, you will also need to be sure to get & install a rectifier in the charging system.

You could make it just a electric starter style without the charge capability, but you would need the right flywheel (with starter ring gear) to match your ignition system. It just will not recharge the battery. The actual flywheel is also slightly smaller by about 1/4" overall diameter. This smaller size is to allow clearance for the starter shaft nut. You can lathe turn the outside diameter of a manual starter flywheel & re-cut the emergency starter rope groove. The original electric start flywheel is made differently & uses the starter ring gear as the lower edge of the emergency rope groove.

OMC does not sell just the ring gear as a separate item. I suspect it is not made by OMC but another supplier, since there are numbers & a trademark stamped on the underside of this gear. The numbers appear to be, j E:T.N 4 511208 (M). The M is inside a parallelogram. The inside diameter of this gear is 7.0". Also the pre-1977 flywheels have a smaller inside stator diameter.

One thing you can do, is that you will have your old flywheel but you can only find a different ignition version than is needed, is to take it anyway, remove the ring gear. Have a machine shop, or if you posses a metal lathe, make a tapered shaft to fit the flywheel, or use an crankshaft & mount your old flywheel on it, then turn your flywheel down to the EXACT size of the one that had the gear on it. Heat the gear with a propane torch. This will expand it just enough (just hot enough that you need a rag to hold onto it), Install it quickly by dropping the heated gear over the flywheel's newly machined surface. You might have

to tap it into place before the heat transfers to the aluminum flywheel & locks it there. This is called shrinking the gear in place, as the gear expands slightly when heated.

The internal diameter of the flywheels are different on many of the style ignition. The 1974-1976 is 4 1/2". The later ones are larger.

Shaft Length Differences : The standard motor comes to mount on a regular boat's 15" transom. This is designed so that the bottom of the boat is even with the cavitation plate of the motor. The cavitation plate is the flat fin in the lower unit housing above the prop. The difference in the longshaft unit is that it has a 5" aluminum extension the same physical size as the exhaust housing, to fit a 20" transom. This unit is supplied as a kit, comprising the extension, a new 5" longer driveshaft, a 5" longer shifting linkage rod, a copper water tube long enough to couple between the water pump & the old tube from the power head & 6 more bolts to assemble it to the gear case.

When replacing the water pump impeller if your motor has the longshaft, you first remove the upper bolts attaching the spacer from the exhaust housing. Once you have the gear case unit & the spacer off the exhaust housing, then you will have to remove the extension unit to get to the water pump that is still in it's original location on the top of the lower gear case unit.

1986 Regular shaft



1988 Long shaft



1990 Sailmaster, Extra Long shaft



The SailMaster is basically the same 9.9 motor with electric start & a 10" shaft extension for use on sailboats. My 1981 sales literature says the SailMaster has a heavy duty reverse gears with a higher reverse thrust. The parts list does not substantiate this however. The Yachtwin, was Evinrude's version of the Johnson Sailmaster

Short Shaft converted to Long Shaft : Motors can be converted from short to long, or long back to short with the proper parts. When converting a short shaft to a long shaft, you will have to purchase a conversion kit, which includes a 5" housing spacer with the 6 bolts, a new 5" longer driveshaft, longer shifting rod, & a water pump tube extension. These unit, or parts of them can be found used on e-Bay at times.

Long Shaft converted to Short Shaft : I have shortened long driveshafts & welded them back together. Short shaft overall length is 22 3/8". If in doing this you would finally have to be sure that it is straightened so there would be no wobble. Again if doing this, go to a welding shop that can weld stainless with a wire feed welder (more penetration), grind the mating ends to a cone type taper with the center about 3/16" dia left. Place them in an angle iron that is mounted in a vise so it forms a Vee to hold it in line for the initial weld. Once welded & initially straightened, the weld can be rough turned down to slightly oversize to the outside dia. & at this time while in the lathe, ran, straightened & ran again until it is close with the least amount of wobble.

Or another method would be to make a sleeve, 2 to 3" long that can be slid over the shaft & have it welded to the shaft on each end of this sleeve. This would change your installation procedure slightly as the water pump unit then would have to be slid onto the shaft from below before you installed it into the lower unit. The splice would need to be maybe mid point between the water pump & the upper end, or at least enough above the water pump so the pump body could be installed above it's final location & then slid down to

mount up.

The shifter rod can just be cut off. You will not have to re-groove it like the original, as you just need to grind a notch in the location that the bolt goes thru that attaches to the upper rod. Be sure however that the notch is in the exact same relationship from the top, but the 5" lower, as this times the shifting. You can adjust this slightly by how many threads you screw it into the lower unit shift linkage.

In converting a factory long shaft to a short shaft, you can simply cut off the 1/2" copper water tube. Cut off 5", or so that the tube protrudes 1" below the exhaust housing. The best way to do this would be to mark it & use a Dremel Tool with a part off stone. Be sure to remove any rough edges, as this has to fit into the rubber grommet in the top of the water pump housing, & you can't really see if it is going or not, as it is mostly out of sight at the time.

One of you internet readers on the east coast inquired about doing this above conversion. I suggested he contact a marine repair shop & see if they had a used driveshaft instead of cutting & welding his. The mechanic said it was impossible to do this conversion. I wonder if he was drinking more than just water?

Repaint : You can purchase OMC original white paint #771226 specified for 1981-1990 at about \$7.95 a can. Tempo #0204601, (Johnson White 1981 to Present) which is an aftermarket marine paint for about \$1.00 less, or Krylon brand which is available in about any hardware or automotive store, in about any color you want, it may not match exactly the original color however, but it is less than 1/2 the price. I am torn between the Krylon brand & the original, as I like the idea of being able to touch up paint scratches if the need arises. Krylon's Ivory Gloss #1504, is very close to the standard white that most of many of these later motors were painted with. I have found with the OMC paint, do not try to do thick coverage or it MAY wrinkle. Do many thin coats. The only drawback using a non-original paint is that it may not be as resistant to gasoline & gooey black oil as the factory or replacement types.

The Johnson color was changed from the OD green for 1974 to white in 1976.

If you decide to repaint the cowling & the rubber motor seal is OK, you can pry it away from the fiberglass or plastic depending on the year, placing matchsticks between the rubber & the fiberglass to allow for a better paint job to go under the seal. This original rubber seal is stapled onto the fiberglass. If you need to replace the seal (about \$40.00) after repainting, to reinstall it instead of trying to staple it, just use a latex adhesive & many old wooden spring type clothes pins until the adhesive dries.

If you plan on replacing the decals, you will probably not be able to find any factory available earlier than about 1993 or 1994. Price is about \$40 for these original replacements. If you purchase these later model decals, you will have to cut them to fit, as the newer side decals sets lower than you might think. This is because the motors have a upper cowling that the seam is more horizontal instead of at an angle on the pre 93's. This changes the position of the decals if used on an older cowling. You will have to trim some off the front bottom at an angle of these side decals to get the lettering horizontally positioned. And you will also have to trim the bottom rear decal to be somewhat close to a decent position. Lay them out & tape them on the cowling before you install them. You will not get a decal for the front where the control knobs are on these newer decals as there are none used on these later models.

There has recently become available on e-Bay, aftermarket vinyl decals that are generic for this series of motors at a price of about \$14.00 + \$3.85 shipping a set. These generic ones are quite good, a close coloration to the later originals, but do not match any specific year. They have the "Sea Horse" & appear to be die or laser cut. They are made for both the Johnson & Evinrude 9.9 & the 15 hp. The picture below appears to be on a repainted 1987 or newer motor.



Aftermarket Decals

When installing any of these, it is best to lightly pencil mark the cowling with the top & front locations of the edges of the decal. These will be VERY sticky, so BE SURE where you want it to do. When you peel off the backing, start on one corner, but just let it lightly stick, if it appears correct, allow it to lay in a rolling motion, by peeling more of the backing off. You will be trying to get the top parallel to the top edge of the cowling, with the rest laying down while NOT allowing any air bubbles to get under it. IF you are lucky you MAY be able to let one end lightly lay in position, then if the rest appears to lay OK, roll it with your hand working out any air bubbles & pull the first up, re-setting it & rolling it back forward again without any bubbles. If you do get a few bubbles under the decal, take a needle & prick the decal, then work the air out the pricked hole.

The later motors as shown in above pictures, had the power head, flywheel & prop painted black.

Gasoline shelf life : According to Chevron.... "Gasoline stored in a tightly closed container in a cool place will stay good for at least a year. It is better if the container or gas tank is almost (95%) full. If the container or gas tank will be in the direct sun or will be heated above 80 degrees F. much of the time, add an aftermarket fuel stabilizer to the gas when you first buy it. Gasoline-oil blends for two-stroke cycle engines stored under the proper conditions will keep as well as gasoline itself."

The oil additive therefore does not make any difference in storage life.

And this from Shell.... "All gasoline has finite storage life. If storing gasoline longer than 6 months, you may want to use a supplement fuel preservative additive.

If aged long enough, gasoline can form gum & varnish that can cause engine operating problems, & sometimes to the engine & fuel tank. All Shell gasoline - conventional & reformulated - meet ASTM requirements for stability (a measure of protection against oxidation that can degrade gasoline properties). How long gasoline can be stored, depends mostly on storage conditions. Increased temperature, exposure to air and contaminants, and the material the storage container is made of can shorten storage life. Generally, gasoline stored for longer than 6 months will likely benefit from adding a supplemental stabilizing additive. Usually available at your Shell service station. Stored gasoline only in an approved container, well away from sources of ignition."

For tanks that are mostly full & going to be left for a considerable length of time, add a fuel stabilizer.

Premix a couple of gallons of gas with enough stabilizer for the total amount in the tank, then add this mixture into the tank. Different stabilizers give different "life" times, so therefore some brands of stabilizers "do" more.

Now for my opinion on this, BS. The above oil companies are just like politicians, they say a lot but, are only trying to cover their behinds. From my observations, I think that the newer non-leaded fuels produced by modern technology aren't anywhere near prone to "varnish" as the older leaded gasoline was. My thought is that it would take serious neglect and long, long periods of storage to form "varnish" in a fuel system with current fuel.

How many of you just park your lawn mower after the mowing season, & it will start the next year with only a few pulls of the rope.

Ongoing Improvements : Other than the before mentioned changes, there have been ongoing improvements in this model since it's inception. The throttle cable twist grip system changed in about 1986, ini-

tially still used the original kill button. In 1987 the kill button was moved to the end of the twist grip control. There is a problem with this type, if some makes of extended tiller handles are used that the owner then can not reach the kill button when these handles are installed. In 1991 the kill button was moved again to the middle of the steering arm near the rear of the twist grip, it utilizes the safety lanyard disconnect "Man Over Board" kill switch. If this safety lanyard/clip is missing, or pulled out, the motor will not start. If you are using the motor for a auxiliary motor, the safety type unit may just get in the way, so you can then purchase a override, which is a small red plastic horseshoe clip called "clip-restart" #431808 for about \$3.60 which makes a neat configuration & allows the motor to run, while still allowing the kill button to be activated.

The SailMaster motors used a metal 3/16" rod that came out of the front cowling above the rope starter handle, went across & back in on the other side of the handle. It was slightly arched upward in the middle. Apparently this was to prevent the starter rope from becoming readily frayed if the motor was over the stern & lower on the transom than on regular boats.

Each year had a different decal, so if you have a good memory, you could identify each year this way. The earlier Evinrude's had a different motor cowling, in that it was slightly radiused on the front & back & had a slight hump in the middle. The top cowling appears to be change slightly in about 1987, in that the upper corners have a bevel of a little over an inch all the way around the top, & they got away from the squarish shape of before.

1975 Evinrude



1989 Johnson



The 1991 & 92 still had the hole where the old kill button was located. It was plugged with a plastic plug, so that if control cables were desired, the throttle cable again went thru this hole as before.

1993 & Newer Motors : Then in 1993, the motor was basically a complete makeover other than possibly the bare power head, eliminating problem areas & improving the design. From then on, the motor underwent a new design change & a new look as far as the motor cowling & many bolt on units to the block. The cowling now separates on basically a horizontal line as compared to the older angled to the rear line. The lower motor cowling is made in 2 pieces that allow you to get to the sides of the motor's block more easily. The head is arranged so that the spark plugs are on the Left Hand side of the block. The manual starter has been redesigned, moved & now is somewhat supported by an over arm above the flywheel. The manual starter engagement dogs are on the inside of a ring in the flywheel. The electric start motor mounting bolts come in from the outside instead of the top. The shift lever is now in the front of the motor above the mounting clamp screws.

1993, notice the different cowling cover shape's more straight line & the lower cowling extends lower



The clamping bracket is now made so that a push/pull steering cable goes thru the hole in the tilt pivot shaft like the later larger motors that are set up for remote steering. And the carrying handle has been changed to go crosswise of the motor & is attached to the main motor tilt shaft & when not in use lays back out of the way. The steering handle is moved more to the center of the motor instead of off to the LH side.

There is a flushing plug on the top RH side of the power head's water jacket sideplate.

The lower unit has changed slightly with removable water intake screens & a place for zinc anodes on the sides for both the 2 stroke & the 4 stroke motors. The gears, shaft & seals appear the same as the earlier versions.

This series too, will be undergoing more improvements of it's own.

Recommended Spare Parts : If I was in a location where spare parts may be harder to come by when needed, I would consider stocking the following spare parts & in the following order. Spare spark plugs would always be a requirement. (1) fuel pump filter cap & gasket (2) starter rope (3) flywheel key (4) small fuel hose clamps (5) lower unit drain plug seals (6) spare prop, splined thrust washer, shaft nut & cotter pin (7) water pump impeller (8) fuel line primer bulb. If for the older 1974 to 1976, then I would add points & condensers. As an extra precaution, then maybe a carburetor kit. One thought here is to take your spare parts & vacuum pack them. This will keep them from collecting moisture & rusting before you need them. Plus it also puts them in one bag so they don't get scattered around & lost.

Replacement Parts from Bombardier : OMC sold out to the Canadian company Bombardier a few years ago. Replacement parts for some of the older motors has dried up somewhat as the new owners may not be as committed to supplying older parts as under the previous OMC ownership. Now when ordering replacement parts, the dealer will see a new listing in place of the older N L A . This new listing is Vintage, which actually means the same as the previous No Longer Available. Bombardier also changed the discount structure for many parts. The retail prices are still listed, but the dealers get less of a discount.

Replacement Parts thru Sierra or NAPA : The Sierra catalog is available from Car Quest stores & NAPA the catalog is available from them of course. Many times you can get a part a lot faster by going thru these automotive stores, in that they are probably moving a lot more parts than a marine mechanic & your order can get called in almost daily. But be advised that they will have to add on shipping, & normally do UPS or FEDX air to keep their mechanics happy. So, unless you specify that you do not need it ASAP, your shipping will be more expensive.

One thing I have also found, is that these automotive parts dealers are just that, & they usually are not knowledgeable at all in the outboard applications that you may require. If you ordered off their catalog & ordered wrong, it is your responsibility to pay for it even if it is the wrong item. I ordered a thermostat kit #18-3674, thinking that I also needed other parts than just the thermostat that I might not have been aware of. The thermostat itself was #18-3672. What I got was the thermostat & every gasket, spring, seal etc. that would allow me to fit it to MANY different models, for a price of \$25.26. I found out later that the thermostat alone (all that I really needed) would have been \$11.86.

Also some of the gasket sets are not complete or they are misleading as to years covered. They list the gasket set as fitting 1974-1992, WRONG. For motors prior to 1977 if you order a gasket set, the water cover gasket, (the one the thermostat is under) gasket, is not supplied if you order the set, as there are 2 different water cover gaskets as described previously. The older one from 1974 to about 1977, OMC #318917, is (NAPA #18-0397). The later one from 1978 up to 1986, OMC #321387 which is they show as #18-2905, & which they call "water cover gasket" is the one that comes in the overhaul gasket set, not both as you would think if there was an overlap.

In reality I have found #18-0397 that they call "thermostat gasket" is the proper one, which OMC calls "water cover gasket". Also If you order #18-0112 that they call the "powerhead mounting gasket", I have not been able to find where it goes on this motor, but in reality I really wanted #18-2907 that they call an "adapter housing gasket" that OMC calls "powerhead to exhaust housing gasket". So buyer beware!!!

One comment here on the electronic conversion kit. I was at one time was quoted at about \$50 for this unit. Also from the experience of a marine dealer that says it does not work well if it is being used for trolling, as it appears the RPM is too low to give adequate ignition.

Also be prepared to pay the shipping & handling costs, with an average about \$6.00 for a \$23.42 gasket set. Where if you ordered it from a marine dealer & it was shipped with his other parts orders, he may well equal out the shipping costs.

Listed below are some of the normally used parts found in the respective Marine Catalogs. It is found that they both use the same part numbers. The bold numbers are current prices.

Electronic conversion kit 1974-1976

#18-1501

\$60.00

Head gasket 1974-1992

#18-2963

\$ 7.80

Power pack 1977-1984

#18-5758

\$72.08

Gasket set 1974-1992 **

#18-4306

\$23.42

Coil 1974-1976

#18-5196

\$33.86

Rewind spring 1974-1978

#18-6503

\$28.46

Coil 1977-1984

#18-5176

\$25.48

Rewind spring 1980-1992

#18-6522

\$24.35

Coil 1985-1992

#18-5179

\$22.67

Prop nut

#18-3706

\$ 2.57

Coil 1993 up

#18-5170

\$34.17

Cotter pin

#18-3740

\$.44

Condenser 1974-1976

#18-5205

\$ 3.29

Universal manual starter rope & handle

#18-4904

\$ 6.92

Tune Kit 1974-1976

#18-5003

\$29.25

Piston, Standard, 1981-1993, with rings, wrist
pins & circlips
#18-4106
\$68.81
Carburetor kit 1974-1987
#18-7223
\$12.75
Rings, Standard 2.188 dia. bore
#18-3931
.
Carburetor kit 1988-1996
#18-7219
\$21.86
Rod bearing cage with needles 74-83
#18-1359
\$25.96
Fuel pump kit 1982-1986
#18-7823
\$11.86
Center main bearing 1974-1983
#18-1359
\$25.96
Water pump impeller 1974 up
#18-3050
\$10.00
Electric starter 1974-1992
#18-5617
\$225.26
Thermostat 1974-1986
#18-3553
\$11.86
Crankshaft seal kit
#18-4332
\$17.06
Water cover gasket 74-76
#18-0397
\$ 1.99
Lower Unit drain/fill plug screw
#18-2387
\$3 .16
Water cover gasket 78-85
#18-2905
\$ 1.00
Lower unit plug seal (washer)
\$.50
Bypass cover gasket- all
#18-0967
\$ 2.37
** wrong, - should be only from 78-92, as it does not have right water cover gasket #18-0397
.
.

The Internet & E-Bay can also be a source of new & used parts. However, if you are on e-Bay, then you had better be darned sure that you are bidding on the right part, as many of these sellers do not know what they really have & they must think that most everything interchanges. As you have more than likely concluded after reading this article that it is NOT ONE SIZE FITS ALL, especially in the electronics.

Stolen Motors : Sad to say, many fishermen find that "kicker" motors of this size are a prime target for thieves these days. I begin to wonder after looking on e-Bay as to why many of these motors are broken down & sold as parts. I can see it if the power head was blown, or a lower unit seized up, but occasionally about all of the parts are being sold at the same time & the person selling them appears to no real idea what he has. That is until you realize that you do not see many of the mounting/clamping brackets that have the Serial Numbers on them put up for sale. Kind of makes one begin to wonder???

Suggested guidelines if your motor is stolen. The thieves are going to likely dispose it it SOON, so act quickly.

(1) File a police report & provide them with make , model, & serial number. If you do not have the model & serial number GET IT NOW.

Give a picture, if you have one, if not, GET IT NOW Think about any markings, dings, etc. that could help identify it.

(2) Call your insurance agent.

(3) Run an add in the paper wanting to buy a motor of your loss, & see who calls

(4) Check local pawn shops

(5) Keep an eye on e-Bay

(6) Do a periodic on-line search for an engine of your make, year, & model. But don't bother to use the serial

number as it will likely have been removed anyway..

(7) Don't hold your breath waiting for it to be returned, but miracles do happen.

(8) Take a trip one day to your local boat launch facility, kick back & just watch, you never know what may

turn up & it can be entertaining seeing all the misadventures.

(9) Don't buy any motor that has the serial number altered, unless you can positively identify it as yours.



Maintaining Johnson/Evinrude 9.9 & 15 hp outboards 1974 – 1992 (Part 2, Powerhead & Gearcase Rebuild)

Does it really Need to be Rebuilt?: What is wrong? If there appears a problem, this problem should be diagnosed before jumping into a rebuild. Why does it not start/run? What is the compression? Is there any spark? What about the fuel system? Does it rattle (piston wear) when running slow? All these need to be checked out & sometimes just the little things are the culprit. If the spark plugs are fouling a lot, are they the right ones, & is the fuel mixture right, what about the carburetor adjustments, are they right? If any of the above can not be remedied, then a rebuild may be considered. Of course if there happens to be a blown piston, then you have no choice than to rebuild, other than scrap the motor. But will it be cost effective, even if you do the repairs yourself?

Removal of the Powerhead: If it comes time that you need to get into the powerhead, you should probably strip all the bolt on parts off before you unbolt the powerhead from the exhaust housing. Here is where you need the illustrated manual or a darned good memory as to where things came from. If any of the bolts appear frozen, you might try to tap the bolt head with a hammer, this sometimes slightly breaks a bond between the bolt & the plate it holds.

It is best if you have used butter buckets or similar plastic dishes to put the screws, bolts or pins & washers into. If you have 3 or 4 of these, you can then place the parts into different ones pertaining to the different parts of the motor. Then remove the shift lever cotter pin & cross pin, allowing the clevis to be disconnected from the shift lever. Next, take the fuel line loose from the fuel pump.

Another thing you need to do is to cut the kill switch wire that goes into the rubber coupler. Later units have a bullet type quick connector. The kill switch ground wire can be unbolted from the powerhead. You can either take the powerhead off first or remove the lower unit first. The lower unit will have to be removed anyway as it is a whole lot easier to line the driveshaft splines up into the crankshaft if the powerhead is bolted on first in reassembly. I like to take the lower unit off first.

Remove the cotter pin holding the shift lever yoke to the motor. Also remove the overboard water indicator hose.

You will need to do the same basic removal of the exhaust housing from the gear case as required to replace the water pump impeller. Once the gear case unit is off, then you will need to remove the 6 bolts that hold the powerhead to the exhaust housing. Next is removing the 3 motor mount bolts. One is under the manual starter unit, with the other 2 in the rear, both right & left sides

After removing these bolts, the powerhead should be free. It may not seem like that since it is probably stuck to the gaskets with gasket sealer. You may have to rap the powerhead sideways hard, or use a large screwdriver to break it free.

If Powerhead Won't come off: If the powerhead does rotate slightly, then IF it was repaired before, someone did not grease the driveshaft splines where they enter the lower end of the crankshaft & the driveshaft

is stuck into the crankshaft. I guess that I would try to get 2 or 3 LARGE screwdrivers in between the powerhead & the exhaust housing & try to pry the 2 apart for starters. You can not rotate it sideways very far, as there is the inner exhaust tube & the water pump outlet pipe both attached into the bottom of the powerhead.

If that fails, then I would take the lower unit (Gearcase) loose (if not already done) as if I was going to change the water pump. This will allow the lower unit to drop down about 1/2" till it is stopped by the shifting rod. If it does not drop this amount, move the shifting lever, & if still no movement, you can pretty well be assured that the driveshaft is frozen into the crankshaft. But, with this lower unit loose, you may then be able to take a large rubber mallet or block of wood & try to pound on the stiffener angled brace on the rear that goes to the cavitation plate, maybe even the propshaft gear housing, (or anyplace that you will not break).

If that fails on 1st attempt, rebolt the powerhead bolts & tip the motor upside down, & get a Plews squirt oil can, filled with penetrating oil & get LOTS in around the waterpump, allowing it to run down with the motor upside down. With enough penetrating oil in there, (2" at least inside the housing) let it set for a week upside down, then tip it back up, (all the oil will run out & be a mess) but it may just have gotten some in to help loosen the stuck shafts. Take out the powerhead bolts, and try again.

If this does not do it, pound hard enough or pry on the lower unit (evenly) to break the top of the water pump (all that holds the driveshaft in other than the splines when totally assembled is the impeller key). Try to move the whole lower down, allowing the driveshaft to be pulled out of the impeller & thru the top of the now broken upper water pump housing. The driveshaft floats on splines on both ends, one in the crankshaft & the other in the pinion gear in the gearcase.

If this works, now the driveshaft can then be pulled up & out with the powerhead so you can at least get to the splines & free the shaft. The older water pump is just pot metal on the early motors or plastic if the motor is a later version.

Once the powerhead is loose & all the parts are off, pull it up & off. There will be an squareish exhaust tube about 1 1/2" across & a 1/2" copper water supply tube bolted onto the bottom part of the powerhead. Unbolt this block & remove the attached parts.

9.9 Powerhead with exhaust tube & water supply tube, note the squareness of the exhaust tube



A Powerhead disassembled



Disassemble the Powerhead: First you will have to remove the 4 outer screw that hold the armature plate with the charge coil & timing sensor coil. Next remove the 4 screws that hold the retainer plate. Now you can remove the crankcase head, which is a aluminum plate with a circular tapered tube that us held on by 3 bolts to the underside of the powerhead & which the driveshaft does up into connecting it to the powerhead. Remove the head. Next remove the intake manifold, the reed valve plate and the bolts under it for the front half of the powerhead.

Now the powerhead should come apart at the center or crankshaft area. It will have an alignment dowel on one side, which may have to be tapped out. If the two halves do not want to come apart, readily, then with a plastic mallet, tap the crankshaft forward or rearward.

Once you have it apart, you now can get to the connecting rod bearing caps. Loosen the Allen head cap bolts & take the caps off. There is a mark on these so that they have to go back the same way they came off. However it is best to file 1 mark on one side of the top rod, either right or left on both the cap & the rod so you know where it goes back. Do the same only file 2 marks on the bottom cap & rod. When you take the roller bearings & cages out, place them, or mark them so they will go back on the same rod they came off of.

On this motor the rod bearings are also the same as the center main bearing. The bottom main bearings are regular ball bearing type bearing & is pressed onto the crankshaft. The rod & center main bearings were changed in 1984. The top main bearing is a caged roller unit. Regular seals are used top & bottom.

The rings used are 2 per piston, with the top one tapered from the outside upward & inward. If you are going to re-ring it, you need to hone the cylinder walls enough to score them, helping the new rings to seat properly. If you do not have a hone, then it is suggested that you use emery cloth of about 80 grit & sand the cylinders in a circular motion to break the glaze & give the new rings something to help seat them in.

Remove all the old gaskets & clean the areas where the gaskets were. Check for carbon buildup & remove it. Clean the piston tops & the head.

Reassemble the Powerhead: Check the new rings into the respective cylinders to ensure that there is sufficient end gap so that when they get hot when the motor is running that they do not expand to there they brake or score the cylinder walls. If they fit the specs, then install them on the pistons. Lightly oil the pistons & insert them from the rear of the block using a ring compressor.

Install the crankshaft bearings, place the crankshaft in place on the block, & assemble the rod bearings,

making note of the previous alignment markings. You may find that an extra roller bearing will be included than actually needed. I was sure I placed all of them in one rod, but when I found an extra the next day, I tore the whole thing apart again just to be sure. Torque the rod bolts down to specs. Place the aluminum mating gasket cement on the two halves & assemble them. replace all the bolts holding the two halves together, being sure to remember the one under the intake manifold.

Install the seals & the crankcase head. Check out the reed valve unit, & be sure that these valves are not rusty or bent & lay flat against the plate. Replace this unit & the other covers etc. using the regular gasket sealer.

Parts & Gaskets Most Likely Needed: If the motor is in need of repair, the most common problem will probably be the rings need replacing. The rod & main bearings are usually good. Seals should however be replaced whenever the unit is torn apart. And a new gasket set is probably in order. If you order a gasket set, check for the components, as if it is an OMC set, usually the bottom crankshaft seal comes with the set. If it is an aftermarket set the seal does not come with the set. A gasket set will also include, carburetor to manifold gasket, fuel pump base plate gasket & fuel filter gasket among others. You will also need some gasket sealer & a sealer designed to seal the two halves of the block together that does not utilize a gasket, but only the two mating aluminum parts. It is however best to wait until you have it all disassembled before you order what you think you may need.

Repaint Before Final Reassembly: You can purchase OMC original paint at about \$8 a can, or Krylon brand which is available in about any hardware or automotive store, in about any color you want, it may not match exactly the original color however, but it is less than 1/2 the price. You may be able to get by with one can if you do not use a lot of it on the inside cowling or on the powerhead. I am torn between the Krylon brand & the original, as I like the idea of being able to touch up paint scratches if the need arises. Krylon's Ivory Gloss #1504, is very close to the standard white that most of many of these later motors were painted with. I have found with the OMC paint, do not try to do thick coverage or it MAY wrinkle. Do many thin coats. The only drawback using a non-original paint is that it may not be as resistant to gasoline as the factory type. Krylon makes a Crystal Clear Gloss #1301 spray paint that would be good for a top coat. Then you will want to wax the paint-job to help preserve it & keep any oily residue from the exhaust to stain it. This wax however makes later repainting somewhat of a hassle.

The Johnson color was changed from the OD green in 1974 to white in 1976.

If you plan on replacing the decals, you will probably not be able to find anything available earlier than about 1993 or 1994. Price is about \$40 for these original replacements. If you purchase these newer decals, you will have to cut them to fit, as the newer side decals sets lower than you might think. This is because the motors have a upper cowling that the seam is more horizontal instead of at an angle on the pre 93's. This changes the position of the decals if used on an older cowling. You will have to trim some off the front bottom at an angle of these side decals to get the lettering horizontally positioned. And you will also have to trim the bottom rear decal to be somewhat close to a decent position. Lay them out & tape them on the cowling before you install them. You will not get a decal for the front where the control knobs are on these newer decals as there are none used on these later models.

There has recently become available on e-Bay aftermarket vinyl decals that are generic for this series of motors at a price of about \$13.00 + a set. These generic ones are quite good, a close coloration to the originals, but do not match any specific year, have the "Sea Horse" & appear to be die or laser cut. They appear to be only made for the 9.9 hp Johnson & Evinrude however & not the 15 hp. See picture on the Part 1 article.

When installing any of these, it is best to lightly pencil mark the cowling with the top & front locations of the edges of the decal. These will be VERY sticky, so BE SURE where you want it to do. When you peel off the backing, start on one corner, but just let it lightly stick, if it appears correct, allow it to lay in a rolling motion, by peeling more of the backing off. You will be trying to get the top parallel to the top edge of the cowling, with the rest laying down while NOT allowing any air bubbles to get under it. IF you are lucky you MAY be able to let one end lightly lay in position, then if the rest appears to lay OK, roll it with your hand working out any air bubbles & pull the first up, re-setting it & rolling it back forward again

without any bubbles. If you do get a few bubbles under the decal, take a needle & prick the decal, then work the air out the pricked hole.

If you decide to repaint the cowling & the rubber motor seal is OK, you can pry it away from the fiberglass or plastic depending on the year, placing matchsticks between the rubber & the fiberglass to allow for a better paint job to go under the seal. This original rubber seal is stapled onto the fiberglass. If you need to replace the seal (about \$40.00) after repainting, to reinstall it instead of trying to staple it, just use a latex adhesive & many old spring type clothes pins until the adhesive dries.

The later motors had the power head, flywheel & prop painted black.

Reinstall the Powerhead: Basically reverse order in your re-assembly. Install all the bolt on parts except the manual recoil starter, before you try to assemble the power head unit to the lower cowling & exhaust housing. Be sure that the lower crankshaft seal is in place & the exhaust housing is bolted in place to the bottom of the powerhead. Next, you should be sure the large rubber grommet that acts as a seal between the lower cowling & the exhaust housing is in its proper place on the exhaust housing.

Run a new 1/4" neoprene fuel line from the coupler on the LH side, down inside the LH motor mount, around behind & on the right side near where it will go forward & connect to the fuel pump. This fuel line HAS TO GO outside the RH rear motor mount to give clearance to bolt these motor mounts down. If the motor is a manual start, the fuel line will attach to the rotatable fuel filter cover with the hose fitting pointing rearward. If it is a electric start model the filter cover will need to be pointing forward & down & the fuel line needs to be longer to accommodate this move. The reason is the electric start rectifier sits in the location where it interferes with the fuel line. Bolt the 3 motor mount bolts in with the washers both above & below the rubber bushings.

The best way I have found to install the shift linkage rod is to assemble it to the shift lever linkage & install the cotter pin in the pivot pin, then as you slide things together with the rod down in the housing, you can see this rod hitting the grommet near the bottom. There is enough room here to use a screwdriver to reach in & position it so it will go down into the grommet & farther down. You may however have fun aligning the water pump tube so that it goes into its allocated hole.

It is easier at this point to also be sure that the twist grip mid section throttle gears are aligned & the shaft is in its proper relationship with the mating holes as indicated by the grooves & mating bumps for their respective locations.

Start the 6 bolts that hold the powerhead to the exhaust housing, once they are started & everything looks like it is OK the snug them tight. Reassemble all the external parts. Replace the lower unit (gear case) as when you would have replaced the water pump impeller.

Removal & Replacement of the Upper Motor Mount: The upper motor mount usually does not require any attention. However while the motor is this far torn down it may be best to at least check this rubber mount. I have two motors that I purchased used, that had been used with a clamp around the housing that was used for a trolling tie bar to an I/O unit. The problem was that whoever attached it to the motor put the clamp around the lower housing AND the driveshaft housing. This put so much pressure on the rubber mount that over time it disintegrated & left a lot of wobble forward & back. Repair required the complete power head be removed to get to this upper mount.

There is also a rubber seal or grommet that usually needs to be replaced at the same time as the upper mount. This grommet acts as a seal for some exhaust noise & oily residue from the inner exhaust system. There may be some confusion here as in the picture below, it shows the 2 mount locations where the mount assemblies are & a thrust mount in the middle. These mounts are essentially an aluminum block that is secured into the sides of the housing by (2) 1/4" screws for each that come in from the outside. Bonded into these blocks are rubber bushings that have a steel sleeve also bonded to the hole thru the rubber. Here you may be able to improvise by taking a thick rubber & freezing it, drilling a hole for the bushing, then turning the outside down & then super-glueing the rubber to the sleeve. The reason for freezing the rubber is so that you can machine it.

The upper thrust mount for motors is a rectangular piece of hard rubber is 1/2" X 21/32" X 1 3/16" in size & is clamped between a bar inside the exhaust upper housing & two fingers that protrude rearward thru a set of rubber grommets that seal & slightly support things. There are four 1/4" Philips headed screws

protruding on each side of the outer upper exhaust housing, (the upper ones are tucked up under the lower powerhead cowling), that hold the internal brackets that this mount assembly is attached to. These screws may be frozen into the internal bracket & may have to be broken loose by the aid of an impact driver set. If you strip the Phillips heads, you may have to set it up in a sturdy drill press or milling machine & drill the screw head off. All you need is to get thru the head, as the threads are usually loose in the inner bracket, but the screw is corroded in the exhaust housing. Then you may be able to drive it in to take it apart & then twist out the remaining screw threads.

View of upper exhaust housing from top, note upper rubber motor mounts top & bottom with the thrust mount in the middle. The grommets are the circular black in front of the motor mounts



There are also three lower rubber mounts that complete the mounting unit. These normally do not require any replacement.

Break in the Rebuilt Motor: Once started, it might be wise to increase the oil to gas ratio by about double for the first 3-4 hours of run time. The reason for this is that there may be more friction due to tighter bearings & piston rings, which create heat. The extra oil will help keep it from seizing up. Bolt the motor onto the in side of a 55 gallon barrel with water filled high enough to cover the cavitation plate, & run it. Do not just run it at an idle, but speed it up to a fast RPM occasionally. This is also a good time to get the carburetor set for it's proper setting at an idle, as you want the motor running at it's best before you get on the water.

To make one of these run barrels, use a 55 gallon steel fuel/oil barrel, cut part of the top out, but leave about 1/3 still attached. Cut back about 5" along the sides of this remaining top. Now bend this 5" section down into the barrel to form a downward lip. This will allow you to rev up the engine for short periods of time while in gear without blowing the water up & out of the barrel, as this baffle diverts the prop water back down into the barrel.

One thing to check, is that if you leave the barrel set outside from year to year with water in it, you should dump it out occasionally, as any debris in the water can plug up the water intake screens & make you think the water pump is bad when you later run a motor.

Disassemble or Rebuild the Gearcase: The lower unit, or gearcase needs to be taken off as if you were replacing the water pump impeller.

Remove the (2), 1/4" screws that come in from the rear above & below the propshaft exhaust opening. You may luck out & be able to rotate the bearing housing & pull it rearward & then tap or pry it

back. However be careful not to break anything, so look at the next paragraph.

OMC makes a gearcase bearing housing puller #386631. The puller pictured below is a actual copy that I made of the original OMC puller. You can make your own simpler puller by using (2), 5" pieces of 1/4" X 20 TPI, or course all-thread, (6) 1/4" nuts & (2) flat washers for the stand offs. The puller cross bar needs to be 1/2" x 1 1/2" flat bar 5" long. In this cross bar drill (1) 1/2" hole in the center. Then on each side of the 1/2" hole drill (1) 1/4" hole 1 5/8", so that these 1/4" holes are 3 1/4" apart with the 1/2" in the center of them. Now screw (2) nuts onto the rod & at about the middle & lock them down, one against the other. These double nuts now give you something to use to screw the rods into the gearcase with. Screw the other nuts, (1) on each rod in from the outermost end in about 1", and slide the flat washer on outside of the nut as added support when you assemble everything & start your pulling.



In use, these rods are threaded into the existing 2 holes which the bearing housing is retained to the gearcase with, & act as a guide & stand-off when pulling. Thread these rods into the existing holes so & adjust the 2 end nuts are about equal distance to accommodate any length needed to set the crossbar in the appropriate position.. The crossbar slides over the rods on the outer ends of the rods. The propshaft goes thru the crossbar's center 1/2" hole. The prop nut is now reinstalled onto the shaft outside of the crossbar & it is used in conjunction with the other puller rods to pull the shaft, which in turn pulls the bearing housing out of the gearcase. You may have to hold the propshaft with pliers to keep it from turning, being careful to not mar the splines when you tighten the prop nut to pull this unit.

The bearing housing only has to move about 3/8" to come free. It comes hard enough that you WILL PROBABLY need this puller to do the job. It will usually come hard for the first 1/8" or so, as there will usually be some debris around the inside of the housing around the large internal O-Ring that acts as a sealer between the bearing housing & the gearcase.

Unscrew the shift rod that is protruding upward in the front section of this unit. It will unscrew about 3/8" & then can be pulled upward & separated from the unit. You now have to remove the #2 Philips headed

screw from the RH outside of the lower case. This is the pivot point for the internal shift linkage.

Disassemble & Inspect the Internal Gearcase Parts: Now you can disassemble all the internal parts, clean & wash them off in solvent & inspect for any damage. There are (2), 7/32" steel balls with a spring between them that go thru the propshaft that keeps the shifter (clutch dog) in place. One thing to observe when taking the parts out is the condition of the old gear oil. Check to see if it has any filings or metal flakes, gear teeth, which would be indicative of bad bearings or gear parts. Lay the parts out in a sequence that you took them apart. Your service or parts manual becomes invaluable here. You may even want to use a digital camera to record where things came from.

If there has been a water leakage into the gearcase & or it has sat unattended over a winter season or more, the bearings could be rusted & need replacing. There are (3) needle bearings, (1) small thrust ball bearing & (1) Timken tapered bearing in this unit. There are also (1), O-Ring seal around the shifting linkage, & (2) sets of double seals placed back to back on the driveshaft & also (2) on the propshaft. These seals are priced at about \$10.50 each & the O-ring at \$1.00. It may be advisable to replace them while you have the unit apart if there is any doubt of leakage, either in or out.

Removal & Replacement of the Shaft Seals: To remove the shaft seals, you can make a puller by using a 5/16" or 3/8" rod about 15" long. Make a sharp bend on one end, that protrudes out about 3/8". Grind both top & bottom of this protrusion so that there is a flat on the bottom & no radius on the inside. Thread the other end long enough to accept a couple of nuts. To remove the propshaft seals, screw a couple of nuts on the end, jam them tight so that no part of the threaded rod protrudes. Lay the bearing (propshaft) housing on a flat surface with the rear surface down. Insert your removal rod down inside the bearings & against the rear seals. Pound down on the nuts with a hammer, removing the seals from this housing. You will notice that 2 these seals are installed back to back, this is a dual purpose, one is to seal the oil from escaping from the inside & the other is to seal the water out. Replace them the same way they came off. You will need some sort of a solid round object to drive the seals back in with. Sometimes you can find a 1/2" drive socket that may be of the appropriate size.

For the driveshaft seals, you can use the same removal rod as above, but inserting it from the top & hooking the protrusion under the seals. Install the slide hammer & again the nuts on the end. With the slide hammer, pull these seals from the upper gearcase unit. These might well be in rather solid, & you may have to resort to a Dremel tool & a cutter to remove some metal from the seals to relieve tension. DO NOT cut so deep that you nick the gearcase, as this would allow water/oil leakage. It seems to work best to tip the gearcase upside down in this instance while you are pounding downward. Once they are out & things are cleaned up, replace the seals the same back to back installation as described above. It should be noted that care needs to be taken to keep any residue out of the bearings. This can be done to some extent by tamping a section of paper towel into the bearings, and removing it just prior to reassembly.

If you need to replace the needle bearings in either of the above units, do so before you replace the seals. You will need a puller about the same as the one mentioned above to pull the bearings. And properly sized bearing cup bushings are needed to drive the bearings back into the housings

The lower shifting rod can become pitted at the O-Ring seal area. If this is the case, either replace it, or since it is stainless steel, you can silver solder up the pitting & then lathe turn or bandsand & back down to close to the original size & polish it. It does no good to rebuild this unit & then allow a minor spot to be a leakage point. To replace the O-Ring seal for this rod, you will need a slide hammer type puller. Take a 1/4" All-Thread about 20" long, slightly taper one end, & grind off the corners of a 1/4" nut so that it will just go inside the hole in the lower unit that this shifting rod goes into. Push the pointed end of All-Thread down thru the shifting rod hole in the gearcase housing. Using a flexible spring loaded pick-up tool, position the ground off nut inside the gearcase housing & thread the All-Thread into this nut. Slide the slide hammer handle onto the All-Thread, & screw another nut onto the upper end for the slide hammer to hit against. Now it works best to tip the unit upside down, & using the slide hammer, pull the washer, O-Ring & brass bushing from the gearcase. Clean them up, & in all probability the lower washer may get deformed in this pulling operation. Hammer it flat again. Remove the old O-Ring from inside the brass guide, install the new one & place these parts back in place. Use a 1/2" rod to drive all these parts back down into the gearcase housing.

Another important thing to inspect is the water intake screen that is in this unit. If the screens have been

damaged, which can be observed from the outside, it should also be replaced, as if large intake holes are there, then debris can get sucked into the water pump & farther up into & possibly plug the internal water passages. This is simply a small plastic basket that is tapered on 4 sides & has perforation holes on 2 sides which acts as a filter for larger debris. The screen is inserted into a blind hole of the intake cavity. The old screen is removed by simply using a long screwdriver to break it apart enough to remove the pieces. The new one is inserted by making a wooden insertion tool the shape of the internal part of it & tapping it down into place.

Reassemble the Internal Gearcase Parts: Once everything is ready, now you can start reassembling. Put the Timken tapered bearing in it's race in the front of the housing first. The manual calls for the use of a shifter yoke locator tool. This is nothing more than a speedometer type cable or soft wire about 20" long, with a short 10-24 size screw (same size threads as the shifter rod) silver soldered to one end. Some mechanics say you can get by without it, but experience indicates it's usage far outweighs the problems encountered without it. In use the cable is fed down thru the shifter rod bushing & O-Ring unit, out the bottom & rear of the gearcase enough to allow it to be screwed into the shifter yoke maybe 2 threads or so. The forward bevel gear is positioned in place on the shifter yoke. The clutch dog cradle should be snapped into place on the yoke arms & then these parts guided in this unit in from the rear & being guided by pulling on the cable, you can guide it into place. This is a tight fit to get things down low enough, yet keep the lower shifter yoke aligned to go into the lower slot & at the same time pull the front end with the locator tool.

Now you can install the pinion gear. But to get in in place you need to slightly tip the forward gear down in front to allow enough clearance to get the pinion gear to be installed. The upper thrust washer, thrust bearing (not a real bearing, but a hardened washer like bearing), & lower thrust washer. These 2 thrust washers are a different thickness. Place the thinner on onto the pinion gear first with the outer chamfer down, then the bearing & lastly the upper, thicker washer goes on it with the chamfer edge up. You now need a approximate 5/16" dia. rod with a 1 1/2" 90 degree bend on one end, forming an Ell. A 5/16 long shank Allen wrench will work. On this assembly rod tool, you stack the pinion gear, bearing & washer unit, which you can now guide into the gearcase housing & up into the lower driveshaft bearing.

Once everything is in place, you can now look thru the pivot hole in the outer RH side of the housing, by pulling the locator tool & using a long screwdriver, jockey the gear/yoke until the yoke hole aligns with the housing hole. You might have to use a long pointed ice pick type tool to really align it once you get it close. Then install the Philips headed pivot screw into the gearcase & into the pivot hole of the yoke. Next you will have to reinstall the lower shifter rod down thru the O-Ring seal & align it with the threaded end of the shifter yoke. You might need the use of a flashlight & slightly moving the yoke internally to get the yoke's threaded end to be in line to allow the shifter rod to be threaded into it. Screw it in until it stops, & if the bend is not facing forward, back it up to where the bend does face forward.

Now, with the use of a spring fingered type mechanics pickup tool, you can position the clutch dog (which as a groove on each dog that goes forward) on the cradle & push it down, then rotate in into place with these 2 grooves pointing forward.

Take the prop shaft, install the detent spring & apply some trailer wheel bearing grease on the outer ends of the spring & at the holes in the shaft. Position the 2 ball detent ball bearings in this grease to hold them in place temporarily. Slide the propshaft down into the gearcase taking care to align the ball bearings with the ears of the clutch dog, which has a slight taper at this location to allow the springs to be compressed & slide inside the dog. Push the prop shaft in thru the forward gear & into the front bearing.

Now the reverse gear can be slid onto the propshaft. Be sure the rear bearing housing has been cleaned on the forward end & a new O-Ring installed. Lightly oil the O-Ring & the propshaft. This rear housing can now be slid on the propshaft & aligned with the 2 rear holes & tightened up. It may be advisable to place some anti-seize on the threads before reinstalling them.

The driveshaft & water pump can now be installed on the gearcase housing & the whole unit then reinstalled on the motor's exhaust housing as described before in the water pump replacement section.