POA Webfiles, Section 3.1

Yamaha 9.9HP Engines

The PDQ 34/36 was originally designed as a fast light boat and the Yamaha T9.9EHU was selected as auxiliary. The reasons (quoting Charles Kanter from the following article) "..it has powerful gearing and a huge prop to deliver as much torque at sailboat speeds as a 25HP two-stroke. Its light weight, reasonable cost, quiet operation, low maintenance, good dealer support and fuel efficiency are the building blocks of its popularity".

We have about 1200 hrs on each of the engines on Cadenza over three six-month cruising seasons. During this time problems have been few but do point to particular areas of maintenance requiring some attention. After about six hundred hours the high tension (ignition) coils on one stator burned out requiring a new stator. The cause appeared at the next routine maintenance check - the thermostat was jammed in the closed position and the engine had been running too hot. The same check on the other engine showed the thermostat jammed in the open position. As pointed out by Charles Kanter in the following article, annual brief flushing of the engine with vinegar (I had my mechanic use oxalic acid solution) followed by extended flushing with fresh water (get all the acid out as quickly as possible) is recommended to keep the inside of the engine clean. Carry at least one spare thermostat (plus gasket) and have them checked at annual maintenance time.

Note that Len Scharf (*Anagyri*) reports a clogged thermostat due to salt build up on one engine but not the other. Mike Houghton (ex-*Trinket*) reports serious corrosion. Charles Kanter recommends checking the grounding wires carefully - ours at water level get battered by flotsam.

The factory installed fuel filters worked fine until we picked up about a gallon of water on one of our fuel fills in South Carolina. We installed Racor filters on both engines which have a drain tap allowing us to check for water and drain if necessary.

We don't seem to use the engines very much anymore, sailing or motor-sailing where possible, but our first season we went everywhere with both engines running at full throttle. This caused vibration, which in turn caused two problems. The first was that the water line to the sink in the head vibrated off and all the water in the tank was pumped into the bilge. The second was much more serious. The vibration wore through the wires exiting the engine, shorted onto the carrying handle, and set on fire. We were able to put the fire out with a fire extinguisher and were lucky enough to be only five miles from Wrightsville Beach where Atlantic Marine air-freighted in a new wiring harness and we were on our way again in forty eight hours. We slit some heavy tubing and taped it round the carrying handles to prevent a recurrence.

Oil changing is a snap. The engine is tilted up about 30 degrees and the oil pumped out by inserting the tube from Jabsco Model 33799-0000 (Boat/U.S. Item # 162003) brass hand pump down the oil dipstick tube. It takes only 8 - 9 strokes to get all the oil out. If you really want the last traces you can remove the oil drain plug and catch it with a small plastic bag taped to the back of the engine, but its really not worth the effort.

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Yamaha 9.9 Four-stroke

A User/Surveyor Perspective

By Charles E. Kanter www.sailcopress.com
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The advantages of the engine go back all the way to the beginning when they advertised it as "Jack of One Trade". Here was an engine specifically designed to be an auxiliary. It is not a worked over skiff engine. It has powerful gearing and a huge prop to deliver as much torque at sailboat speeds as a 25 h.p. two-stroke. Its lightweight, reasonable cost, quiet operation, low maintenance and good dealer support and fuel efficiency are the building blocks of its popularity.

The major problem with using a more powerful two-stroke as a sailboat auxiliary is that the shaft length and gearing are designed for lightweight, high-speed craft. The Yamaha 9.9 has a high, 3:1 reduction gear and a huge 11 3/4 x 9 1/4 standard prop, and an extra-long 25-inch shaft. It actually produces more torque and greater thrust at low speed, in reverse, and in maneuvering situations than most 25 h.p. two-cycle engines. Its dual-thrust prop is designed to keep the exhaust gases away from the bite of the prop in reverse, the bane of so many outboards used as auxiliary engines.

Many people are now using the Yamaha 9.9 four-stroke extra-long-shaft engine as an auxiliary. For those who are intrigued by its advantages, let me give you an insider's view of the engines based on having personally owned and used four and surveyed dozens more. I have made numerous trips of well over 1000 miles on the Intracoastal Waterway. Trips during which, day after day, the engine would run continuously at three-quarter throttle with occasional bursts of full-throttle to catch a drawbridge opening or buck a current, from an hour before dawn until dark. In all the years and miles I have averaged fuel consumption of .6 gallons per hour.

I purchased my first of four Yamaha 9.9 four-stroke in 1985 to replace the Honda which had given me so much trouble (see *Multihulls,* May/June 1986). The Yamaha gave me yeoman service for about 700 hours then began to have oil pressure problems. The automatic oil pressure shutdown system would come on at the oddest times. When this happened, the engine would only idle. Shutting sown the engine for a few minutes would allow full throttle again. From 1985 through 1987, not one service person in any of the dealerships that I tried - and not even the factory reps- were able to help. Nevertheless, the engine was so much more satisfactory that any I had previously owned that in 1988 I just traded the engine in on a new one.

My second engine lasted 1400 hours. I did have problems with plugging the cooling passages with both salt deposits and aluminum oxide. In retrospect, it is possible that the cooling system was the cause of my first engine's problem. Finally, when I notices chips of aluminum oxide spitting out in the by-pass stream, I decided to trade up again.

My third engine lasted 1000 hours of tough use. I also had to replace a lower unit because galvanic corrosion had welded it into a solid mass. It, too, had cooling system problems: but by this time I was expert enough to consider them routine and I had developed a maintenance regimen that precluded most of my problems. It's a fairly simple regimen:

1) 100 hours, change oil and clean oil filter. Change the filter every other oil change. Check ground wire and engine zincs.
2) Six months, remove thermostat flush with distilled vinegar.
3) Yearly, remove the lower unit, check rotor, clean inside, re-install bolts using anti-seize.

Having discovered idiosyncrasies of the Yamaha 9.9 four-stroke, I have broken them down:

1) Electric Output - The engines are very sensitive to ground. If the grounds are not perfect, the rectifier will not charge. Check out the grounding yourself with a VOM. You should have continuity every place. Especially check the wire that connects the upper unit to the lower unit and the grounds in the motor casing.
The ignition system is AC with a rectifier not an alternator. There is no regulator. The rectifier will put out as much as 13 amps at 13.5 volts. You can tell if the rectifier is working by measuring the voltage at the cables. Make sure all other charge sources are shut. It should read 13.5 volts with the engine running above quarter throttle.

2) Galvanic corrosion - Keep your zinc anodes fresh. Replace very often. (Zincs are cheap and a few dollars well spent on zincs will save you big dollars later on.) Disassemble the lower unit at least once a year and put anti-seize on the bolts (if you don't and you wait until you have a rotor failure, you may find that galvanic corrosion has turned your lower unit into a solid chunk as I did on engine number 3). Bubbling in the paint is the first clue of galvanic corrosion. Some boats are affected worse than others, depending upon the boat's electrical system. It may be necessary to add a second zinc anode on top of the cavitation plate.

3) Changing oil - So far I have not figured out a foolproof way of changing the oil without making a mess. One user is pumping the oil out through the filler cap with a small hand pump. I will try that next. On my second engine, I constructed a drain made from a plug into which I drilled and tapped an auto radiator drain. From the drain spigot, I attached a piece of tubing that I led into an empty plastic contained. This worked well until the corrosion problems from dissimilar metals caused me to remove it. I could not find a plastic plug of the proper size or I would have used one.
Oil filters on older models are integral with the drain plug. Newer models have them on the starboard side and they can be replaced without removing the drain plug. Those with older models are consigned to forever creating a mess when you pull the plug. One user has his engine installed in such a way that he can tip it far enough forward so that the crankcase oil is away from the drain plug and substitutes a pipe nipple with a piece of tubing on the end, tips the engine back down allowing the oil to drain out through the tube into a receptacle.

4) Overheating - Plugging the water passages is an insidious problem because it may not be an obvious problem. The bypass stream looks good, water is exiting at a powerful stream and things look normal, but they may not be. I even had one dealer's mechanic tell me: "I wish my engine had a stream like that". Actually, the stream was so strong because the engine water passages were partially plugged and all the pressure was going to the bypass outlet.
Most important: Keep a good watch on the cooling system. It has a habit of getting plugged with salt and aluminum oxide (white rust) from the engine block and occasionally seaweed. The bypass stream is not a good indication of cooling problems. This bypass essential function is to alert you that the water pump is pumping (one dealer wishes they would do away with it because it misleads so many customers).
If the stream falters or stops, first place to check (after looking for trash covering the water inlet) is the exit hole at the base of the case where the pipe connects to the exit fitting. Poke up in there with a piece of wire. If that is not where the problem is, take off the engine cover and pull off the rubber hose connecting the two cylinders (port side of engine). If no water is coming out do them, you most likely have a stoppage or a defective rotor. Take off the lower unit and repair.
However, if you do have water pressure from the pump but water is either not flowing from the pipes or only coming from one of the pipes, blow into the pipes with either a water hose or air hose. (I use a bicycle pump with a tapered fitting used for filling toys.) Sometimes you will need the pressure of a garden hose. Jury-rig some type of reducing fitting. I have a two-foot piece of tubing that I slip over the end of the outlet pipe and jam the other end into the hose nozzle. It's a wet process, but it works.
Plugging at the thermostat is common. In this case, the bypass stream is extra strong and you fool yourself into thinking that the cooling system is okay. Put your hand on

the outside of the case and the lower leg. If they are too hot to touch, the engine is overheating. The circulation system is supposed to cool the leg with the return flow. Often, a clue to overheating is blue smoke. What actually happens is the block expands beyond its designed limit and the piston rings cannot wipe back all the oil so you have the symptoms of a worn engine, poor compression and oil burning.

For routine flushing use the special fitting that screws into the leg, or 'ear muffs' or you can raise the engine, slip a plastic garbage bag ove4r the leg, lower it back into the water then fill the plastic bag with fresh water. For extensive flushing, remove the bypass pipe from the exit fitting and either plug the end with an appropriate item of lift the end of the pipe higher than the thermostat housing. Remove the thermostat and pour vinegar into the water-jackets through the thermostat opening until the block is full, and let it soak. Reassemble and flush with fresh water.

A priority overheating check procedure:

a) Check engine coolant bypass. After warm-up, water temperature from bypass should be warm, but not hot. The stream should be strong, but not excessively powerful.

b) Put your hand on the case, the leg and the cover. These areas should not be hot (this is especially important in installations where the bypass pipe has been modified because of the engine being installed in a compartment.

c) When you shut down the engine, the bypass stream should continue for a few seconds and no steam should come out.

d) With the engine running, pull off the lower portion of the connector tube. Water should gush from both pipes. It should be hot, but not so hot you can't keep your hand in it. This tube is located on the port side of the engine just behind the spark plugs.

Note: The older models do not have this connector tube. The connector is internal and part of the valve cover. While this system is more difficult to diagnose, it is easier to clear a blockage. Four bolts hold the cover in place. The fuel pump is mounted on the cover. It is not necessary to remove the pump to remove the cove, just slip off the hoses. With the cover removed, you have access to the cylinder head water jacket. It can be cleaned with a round nylon or bristle brush and flushed with a garden hose.

5) Shift and throttle cables - If you are not using the factory-supplied cables this will not apply. Some engineering anomaly allowed the user of a ferrous metal cable housing with a stainless control wire and plastic end stops. What happens is the cable housings rust, expand, and break the plastic end stops. If the shift cable breaks first, there is an auxiliary shift mechanism on the right side of the engine you can operate with a wrench (the side with the handle). If the throttle cable breaks first, you have a bigger problem. My experience is that these cables last about one year. I filed several reports to the factory about this problem and hopefully it will be corrected. If you have one of the older model engines and are not using remote controls or no -factory cables, keep a pair of cables in your spares it.

Other comparative data:

A recap of the costs involved is very interesting. If I would have purchased an equivalent diesel with a sonic drive, it would have cost about $10,000.00, not including rebuilding the transom to accept it. The total weight would be about 220 lbs. It I would have purchased a Yanmar 27 h.p. diesel outboard, it would weigh about 200 lbs and cost $8000, not including modifying the bracket for the extra weight.

The Yamaha four-stroke, long-shaft electric start model weighs in at 99 lbs and cost $2500 at that time. Figuring trade-ins, my actual cash layout for all four engines is about $5000, including the box full of spares I still own. Figuring a difference in fuel prices and consumption, I burned about 600 gallons of gasoline in 3000 hours at $1.50 per gallon, which equals $900. Had it been a diesel burning only 300 gallons at $1.25 per gallon, fuel cost would have been $375. Therefore, a cost differential of $525. Adding that to my actual cash outlay equals $5525 compared to a minimum diesel cost of $8000 you can see that financially I am far ahead of the game. This is especially dramatic when you consider I have a brand-new engine which includes all the parts such as the drive train and prop. If I had a diesel, I would be dealing with a 12-year-old system (this does not take into account the vast difference in noise level).