



## **MOST REQUESTED ARTICLE**

(FROM: Ask the Surveyor, March 1999)

### **Checking the Basics of the Atomic 4 Engine**

by Tom Aversa

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From what I know about Atomic 4's (A-4) is that if you have the basics, good spark (ignition), good compression and good clean fuel the engine should run. These three factors, along with proper maintenance, will keep the Atomic 4 going as it has for over thirty years.

The Atomic 4, (also known as the Atomic Bomb or Anemic 4) is a very reliable engine. There were over 40,000 engines built with approximately half still out there running today! They are very simple, grass roots, low tech engines that (like every other engine) require routine maintenance such as frequent oil changes, tune ups, clean fuel, visual inspections, and proper cooling systems.

There are problems associated with Atomic 4's that can lead to its eventual failure. The biggest cause of engine failure is without a doubt overheating. If you are looking at a boat with an A-4, chances are it is raw water cooled, meaning the engine is cooled to proper operating temperature by the use of sea water flowing through the cooling passages in the engine. This is also known as an open cooling system. Some A-4's were delivered with fresh water cooling (closed system). Fresh water cooling is simply the use of a heat exchanger where coolant, such a mixture of anti freeze and fresh water, flows through the engine's cooling passages being cooled as the water passes through the heat exchanger which in turn has sea water flowing though it as well. The sea water and fresh water do not mix, they are separated by a series of inner tubes in the heat exchanger. As sea water passes into the heat exchanger from outside the hull through a sea water pump, it cools the circulating fresh water. The cooled fresh water returns to the engine cooling passages and the cycle begins again. The sea water, (also known as raw water), flows out of the heat exchanger and back overboard through the exhaust, cooling the exhaust gases exiting the engine.

With a closed fresh water system the engine's coolant passages remain virtually corrosion free. There is not much opportunity for corrosion in the form of rust or sludge to buildup unless the cooling system is not maintained. The heat exchanger on a fresh water cooled engine should periodically be inspected for a corrosion buildup in the sea water side of the cooling tubes.

A sea water cooled engine can have not only a build-up of corrosion because of the caustic corrosive effects of sea water, it can have a buildup of tiny organisms that were sucked in the engine sea water pump, got lodged in the heat exchanger or passed through the exchanger and got trapped in the coolant passages within the engine. This effect over time will not give the sea water cooled engine the longevity of the fresh water cooled engine.

Normally a sea water cooled A-4 should run between 140° and 160°, depending on the thermostat installed. This is another potential problem the A-4 could face. Running at 140° or 150° will create a buildup of carbon on the valves, because an engine that runs too cool creates condensation, which in turn causes the combustion chambers to not burn fuel efficiently. A buildup of carbon will in turn cause sticky valves which reduce compression. A fresh water cooled A-4 runs at 180 to 190 degrees. This is the desired operating temperature for these engines. Some A-4 owners have removed the thermostat in their sea water cooled engines and installed water bypass valves so they can regulate the flow of cooling water, either increasing or reducing the operating temperature as desired. Some mechanics don't like this setup, but to the engine owner, as long as it works, they're happy.

Things to look for when surveying the cooling system of these engines: inspect (while the engine is running) the raw water exhaust outlet at the transom. Make sure you are getting a proper flow. Check temperature gauges for operating temperature. Run the engine under a load at varied RPM's. Make sure the water flow and temperature gauge remains fairly constant. Remember, the single biggest problem with A-4's is overheating. If the engine was built with fresh water cooling it will more than likely be in better condition as far as the cooling system is concerned. With the resurgence in popularity in Atomic 4's, there are companies who have designed after market kits such as fresh water cooling kits that can be installed to a sea water cooled engine. I recommend these kits for increased reliability and extended service life of these engines. They are easily installed and affordable.

The Westerbeke engine company sells Atomic 4 parts, including fresh water cooling kits. Another company is Don Moyer at Moyer Marine. Their telephone number is 717-564-5748. This company does repairs, supplies just about any part, and puts out a neat newsletter on the Atomic 4. They are the Atomic 4 gurus without a doubt. A company in Virginia, Indigo Electronics also makes a fresh water cooling kit.

An option to installing a thermostat is a thermostic control valve. It's a nifty device that regulates engine temperature. So you can run all day at 180°, but when you are ready to shut down you can lower the operating temperature and slowly cool down the engine without shutting down. Their telephone number is 1-800-544-5758. Next month I will get into other systems on these often misunderstood engines, such as the proper compression, oil pressure proper size prop and other strange but true facts.. I hope to dispel some of the myths regarding the Atomic 4 and give facts needed for you to make an informative decision.

FROM APRIL ISSUE, 1999

This month we continue discussing the Atomic 4. I must say, I have never had such a positive response to any other column in the eleven years that I have been writing.

One reader called to remind me that with a raw water cooled Atomic 4, running it at above 135 degrees will cause the promotion of salt crystals to build up in the engine cooling passages. This in turn will cause a blockage of coolant flow, which promotes overheating. He recommends filling the block with white vinegar and leaving it there for 24 hours. This will break down any salt crystals in the block. If you are running your A-4 at a low operating temperature, he also suggests putting a pint of Marvel Mystery oil in the crankcase every oil change. This will help keep the rings and valves from gumming up. Marvel Mystery oil is a very helpful tool when maintaining A-4's. It will definitely help keep the engine running clean.

Another common problem with Atomic 4's is that most of them tend to have to turn the wrong size propeller, which causes lugging or over reeving of the engine. Depending on the keel configuration most A-4 equipped boats are comfortable with a prop of about 12x7 for a full keel sailboat (12 inch diameter and 7 degrees pitch). Fin keel lightweight boats might be more comfortable with a smaller pitched prop. Some of you might remember the column I wrote last year regarding my purchase of a Pearson Vanguard in Florida. The engine, which was an A-4, had me going crazy until I realized the big culprit was a propeller that was too large. The engine would not turn over 1200 RPM's. Atomic 4's are rated at 30 HP at 3000 RPM's. That meant I was only getting about 6 - 9 hp and lugging down the engine at that. Most A-4's, even properly wheeled, will turn top end at about 1800 to 2000 rpm's, delivering about 15 - 18 hp.

Because of the number of A-4's still in operation and the resurgence of this engine, there is a company called Cruising Designs (CDI) who build a propeller specifically for the Atomic 4. It is a 12x7 two blade made of a polymer. They boast that with this prop you will get 20% more thrust in forward and 80% in reverse! The shape of the prop is almost half moon shape. It's very lightweight and from reports I've gotten very durable. Cruising designs can be reached at

978-922-2322. You can also order a CDI prop through Moyer marine at 717-432-0601.

The exhaust system is a component that has caused A-4 owner's a lot of grief. If it is not designed properly the exhaust system can spell death to your engine. On older sailboats the exhaust system consisted of a solid double walled copper tubing coming from the exhaust manifold. The outer wall of the tubing contained the water injection from the engine exhaust sea water. The inner wall contained the exhaust gases which were cooled by the sea water flowing through the outer wall. This was a very simple exhaust system that had some drawbacks. Over time the system can develop pitting corrosion, permitting the sea water to enter the inner tubing and then flow back into the exhaust manifold. Ouch!! Water backing up into the engine will cause all sorts of problems. It's also heavy. The weight of an all copper exhaust system is something to consider. The waterlift/muffler type wet exhaust system will alleviate the threat of water backing up into the engine if installed properly. Before attempting this installation I suggest consulting with a marine mechanic or with your boatyard.

The fuel system on the A-4 was delivered with a mechanical fuel pump. I've heard from other A-4 owners that these pumps could be trouble. They had the potential for leaking fuel which is a very dangerous situation with a gasoline engine. There are electrical fuel pump substitutes now which are safer. There was also the potential for fuel to pass through the diaphragm in the mechanical pump and enter into the crankcase, diluting the lube oil. Again, a very dangerous situation.

The carburetor is very functional and simple. However, any dirt accumulation can clog the main jet preventing proper fuel supply. Dirt in the fuel problems will lead back to the fuel tank. On older boats this could be a problem. Over the years gasoline becomes stale and forms a varnish like substance along the inner walls of the fuel tank. This stuff can flake off and cause blockage and clogging in the carb. Also, check the fuel tank vent components. If the vent becomes clogged it sets up a vacuum restricting fuel supply. I would recommend a large Racor type fuel filter in line if there isn't one now. The fuel filter would capture any particulates coming from the fuel tank.

Troubleshooting an A-4 problem takes a logical approach. Remember the engine needs three things to keep it running, i.e.: fuel, ignition and good compression. If the engine lacks the proper compression chances are you'll have to look into major work such as rings or valves. All of these items are simple, preventable problems that, with proper care and maintenance, can all be something that happens to the other guy.

The ignition system is an annoying source of endless frustration. The system gets wet or worn, making the engine hard to start or even keep running. There are alternatives and upgrades. Indigo Electronics developed an electronic ignition after market kit that will improve the ignition system dramatically. Some mechanics tell me that using a hotter spark plug than the one recommended in the A-4 operation manual helps these engines run better as well. Indigo can be reached at 1-800-428-8569.

Keep the oil changed, maintain the fuel system, install fresh water cooling, and maintain the ignition system and the Atomic 4 will keep on running. There are drawbacks to this engine however. It is an old engine, it needs to be tinkered with often, the range under power is not like a diesel. These engines burn approximately one gallon per hour. That is approximate, of course, depending on the prop size, the rpm's, boat bottom condition, etc. A like-size diesel will burn half that approximately.

If I was planning a long cruise in out of the way places I would probably want a diesel. However, for most of us that sail around our home port on day sails, and do a few week long cruises, the purchase of a diesel repower over the Atomic 4 is overkill, providing the A-4 is running well and stays well maintained.

One fact that I heard a few weeks ago is there has never been a gas explosion for an Atomic 4. Keep it safe, use the 12 volt blower before starting, make sure there are not any fuel leaks into the bilge and use common sense. Don't be the first. That formula will give you many hours of

enjoyment for this simple, low-tech reliable engine.

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