Propeller Installation Hints

The enclosed propeller has been designed for optimum performance on sailboats with direct drive Atomic 4 engines. It is precision cast, machined and balanced to insure proper performance. However, other parts of your propulsion system have a direct impact on the performance of the system, especially with regard to noise and vibration. Your engine and shafting system will now be operating at higher RPM than before and the following areas should at least be checked to insure satisfactory operation:

1. The existing propeller can be readily removed with a "Two Jaw Gear Puller". Remove the cotter pin in the end of the shaft and the first nut (there should be two nuts). Back off the second nut about 1/8". Install the Two Jaw Gear Puller and tighten the drive bolt to hold the puller in place. Continue to tighten the drive bolt and the prop should jump free of the shaft and be caught by the nut. If it does not, obtain a propane torch ("Bernzomatic" or similar) and aggressively apply heat to the hub of the propeller. The hub will expand more quickly that the shaft and the prop will break free very suddenly. Make sure the last nut is not fully removed as you want to contain the propeller when it breaks free.
2. Check to insure that the propeller shaft is not bent. 15 minutes with a dial indicator while the shaft is still installed can save a lot of agony later. Although seemingly crude, a simple check is to rest a pointed stick on the rudder aligning the pointed end with the machined center of the shaft and then rotating the shaft. The machined center should not "runout" relative to the stick as the shaft is turned.
3. Make sure the cutlass bearing is tight. If there is any more than just a little play (.008"), the bearing should be replaced.
4. Check that the key fits the keyways (both shaft and propeller). The key should slide easily through the keyways with no appreciable slop. It may be helpful to note the direction of the key in the keyways. When installing the propeller, **be particularly careful that the propeller does not bind on the key or that the key does not ride up the forward end of the shaft keyway, preventing the propeller from seating properly on the tapered portion of the shaft**.
5. "Dry fit" the propeller to the shaft. Check that the propeller does not rock on the taper.
6. Install the propeller with key. Some people prefer some lubricant on the shaft, dry is OK. If you prefer a lubricant, select something that is very light bodied, like WD40. The nuts can go on either way. I prefer to draw the propeller up with the small nut (here is where lubricant on the shaft threads, nut threads and the face of the nut against the propeller is a very good idea) and then "jam" it with the large nut. Torque the large nut to about 100 ft lbs. (Everything you can get on a 12" combination wrench or adjustable wrench) Do not forget a new cotter pin.
7. After the boat is in the water for 24 hours, engine to shaft alignment at the coupling should be checked and the engine realigned if necessary. As a rule of thumb, with the coupling bolts loose, the gap between the coupling halves should reject a .004" feeler all around.
8. ***Optional Protection from Marine Growth***: The propeller is made of a proprietary alloy. Normal installation calls for a shaft zinc around the stainless shaft. If so desired, this propeller can be installed on a stainless steel shaft without a zinc and it will remain barnacle free in salt water. (If you have a bronze shaft, you will have to install a zinc) This lack of marine growth occurs because there will be galvanic activity between the propeller and the shaft such that barnacles will not like the slight electrical discharge on the surfaces of the propeller. There will be some very controlled sacrificing of the propeller and propeller life will be reduced. **Any installation without a shaft zinc will be strictly at your own risk as there are too many variables which affect the rate of Galvanic Activity.** If you choose to eliminate the zinc on the shaft, you must install **stainless steel nuts** and you need to give some attention to the galvanic protection which the shaft zinc was previously providing to your other brass/bronze fittings under seawater. There are two possible arrangements you should consider:
    1. There is **no** bonding conductor (wire) running between the engine and all of your thru hull fittings. In this case, the only zinc necessary would be one to protect the brass/bronze fittings on the engine itself. This can be accomplished by install a ½" brass/bronze tee fitting in either the sea water suction to the pump or the seawater discharge from the manifold. In the side leg of the tee, install a short nipple (about 2 ½") and a 1/2" x 3/8" reducing coupling. Then install a "pencil zinc" on a 3/8" pipe plug in the reducing coupling. The side leg of the tee should point down at at least a 45° angle to prevent debris from the zinc going downstream and causing problems.
    2. There is a bonding conductor (wire) You will need to make provisions for a zinc on the seawater side of the hull. This zinc must be attached to one of the brass/bronze fittings in the bonded circuit.

ABOUT YOUR NEW PROPELLER

Surface Finish – The propeller is investment cast and then hand finished. Following the machining operation to establish the tapered bore, the keyway is broached and the propeller is statically balanced. Balance is accomplished by removing metal by sanding the suction faces of the blades. Both the suction and pressure faces are then touched up with a small surface finishing disc to remove any small blemishes. "Parting lines" from the wax mold on the hub and other small blemishes are touched up as well but no effort is made to polish the hub as no work is accomplished there.

RPM – You should be able to attain about 2400 RPM at wide open throttle underway in the ahead direction with a clean prop, clean hull, and an Atomic 4 in reasonable condition. Quite often we get comments back about not being able to attain anywhere near that RPM (maybe 1800) yet the boat is moving very well and everything sounds like it should. The most likely culprit in these cases is the tachometer. To aid in your understanding of the props performance, there are listed below two data points which were obtained with a calibrated optical tachometer, a clean propeller, a PSS shaft seal system, and an Atomic 4 in very good condition (24 years old with no overhaul that I know of). The boat was secured in its slip for this "dock trial" thus the RPM attained are lower that the boat under way. However, the RPM will be the same for any size or shape boat (provided there is reasonable water flow into and away from the prop) as the boat was not moving.

AHEAD at Wide Open Throttle	**1975 RPM**
ASTERN at Wide Open Throttle	**2700 RPM**

If you run your engine under these same conditions and do not get these RPM, your tachometer is most likely out of calibration or not properly scaled. Other causes could be one or more cylinders not firing, timing off, or a tired engine.

Operation – If you had a 2 blade propeller before, you should experience significantly less vibration with your new propeller. It is not uncommon for a "chirping" noise to be heard coming from the propeller when accelerating the propeller and thus the boat. This noise is caused by hydraulic "slippage" of the propeller during periods of acceleration. You may also experience this when running the engine in forward when tied in your slip. The noise should diminish or go away altogether once the boat is moving at a constant speed.

INSTALLATION OF PROPELLER WITHOUT A ZINC

If you choose to install your new propeller without a zinc to achieve the elimination of marine growth on the propeller, you must consider two very important issues:

1. If your shaft and propeller are supported by a strut such that there is more than 4 inches of exposed shafting, **all but two inches of the shaft must be painted** with anti-fouling paint to limit the surface area of exposed stainless steel shaft. This limits the amount of galvanic activity.

2. It is absolutely critical that your AC Shore Power installation is designed to eliminate stray electrical currents from circulating between your boat and others in your marina. If not so protected, your propeller can be severely damaged within just one season through this excessive galvanic activity. Even if you install a zinc, it is still a good idea to have such protection as a zinc can quickly be consumed leaving your prop in danger. This protection from circulating current is best provided by what is known as a **Galvanic Isolator**. Galvanic isolators connect to the green wire on the AC system on the boat, close to the shore-power inlet to the boat. Simply put, isolators block the circuit of galvanic current flow between neighboring boats. Isolators contain diodes, which are like valves whose inherent resistance blocks low DC voltage generated by galvanic activity (up to 1.0 volt), but which conduct higher voltages exceeding the initial resistance. The idea is that you boat becomes isolated from passing or receiving low-voltage galvanic current between neighboring boats while still being able to pass dangerous higher AC voltages through the green wire to the shore ground. The most efficient isolators have a capacitor, which allow low levels of only AC current to immediately bypass the diodes to the shore ground ... an important feature, since stray AC current is more common than not. Considering that marina wiring is often less than ideal, and that as little as 5 milli-amps of stray AC current can imperil a swimmer, it makes sense to immediately pass as much stray AC current through the isolator to shore ground as possible before stray current seeks an alternative parallel path to ground. In addition, without a capacitor to immediately bleed-off low levels of stray AC current, stray AC voltage and galvanic DC voltage can together add up to a sufficiently high voltage to cause the diodes in the isolator to conduct, thus leaving the boat unprotected without the owner knowing it.

Good Galvanic Isolators with capacitors and status indicators can be found at places like WestMarine.com or Defender.com

Indigo Electronics shall accept no responsibility for any damage resulting from installation of this propeller without a zinc if a Galvanic Isolator is not installed.

The diagram below shows a typical AC shore-power installation with a Galvanic Isolator.