

Integrated Pest Management

Cornell Cooperative Extension
Suffolk County

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Anti-fouling Paints and Boat Bottom Maintenance

2.5 Best Management Practices for Zinc Anodes

Two different metals that are physically and electrically connected in seawater are essentially a battery.

- Galvanic Corrosion:
 - Current flows between two metals
 - Electrons that make up current are supplied by one of the metals, so it essentially is sacrificing bits of itself to the seawater in the form of ions therefore destroying the underwater metal that is giving up bits of itself.
 - The most common cause of Galvanic corrosion is a bronze or aluminum propeller on a stainless-steel shaft, but the following also at risk:
 - metal struts
 - rudders
 - rudder fittings
 - outboards
 - stern drives

How is Galvanic Corrosion Counteracted?

- Add a third metal into the circuit.
- Make sure that this third metal is quicker than the other two to give up its electrons.
- This is called a SACRIFICIAL ANODE.
 - Usually, zinc.

Note: NEVER PAINT SACRIFICIAL ANODES: THIS DESTROYS THEIR ABILITY TO ACT AS THE THIRD METAL IN THE CIRCUIT AND THUS ITS SACRIFICIAL ABILITY.

Sacrificial anodes must be maintained:

- If the anode is missing or almost gone, then other metals begin to dissolve because no more protection from the sacrificial anode.
- The amount of protection a zinc anode gives, depends on:
 - SURFACE AREA of metal being protected.
 - The kind of metal being protected.
 - The chemical makeup of water the boat is exposed to.

Rule of thumb number ONE: use 1% of surface area of metal being protected for size of anode (as a starter).

- Check protected metal frequently and if there is corrosion despite the zinc anode, then you will

need more zinc surface area and thus more zinc anodes.

Rule of thumb number TWO: Replace sacrificial zinc anodes when 50% of the anode is lost to corrosion.

- Other Considerations for Zinc Anodes:
 - You will want your anodes to last at least one year prior to replacement.
 - The longevity of a zinc anode is a function of its weight.
 - If it lasts less than a year, it needs MORE WEIGHT.

Rule of thumb number three: You cannot put zinc anodes just anywhere!

- Must be in electrical contact with metal being protected.
- Mount zinc directly to metal being protected.
- Or connect zinc to the metal being protected with a wire.

NOTE: A hanging anode can provide protection if it is connected by a wire to the metal being protected.

Where zinc is directly mounted to the metal, it is supposed to protect other metals.

- For example: bolted to the side of a metal rudder.
- Must make sure surface UNDER zinc anode is bare and bright before installing zinc anode to ensure good electrical contact.

Propellers and Rudders

- Propellers are normally protected by a zinc collar in two pieces that are bolted together around the shaft, forward of the propeller.
- Make sure the shaft of the propeller is clean and bright before clamping the zinc collar to it!
- Corrosion protection for outboard and outdrive propellers is typically providing a:
 - bolt-in-place zinc ring
 - zinc prop nut
- Metal rudders and struts are most easily protected with zinc discs bolted directly to the metal.
 - Rudder zinc anodes may have a shallow dome shape to streamline them and minimize drag and turbulence.

Hull Plates

- Boats with all underwater fittings bonded together electrically are usually fitted with one or more zinc plates bolted to the hull.

- Mounting bolts for these zinc plate anodes are connected by heavy gauge electrical cable to the bonding circuit.
 - If these zinc plate anodes are allowed to deplete, or if the electrical connection deteriorates, other underwater metal (for example, bronze through hull fittings) will begin to corrode.
- Zinc anode plates are also fitted to metal boats to protect the hull: MONITOR to make sure that they are not depleted beyond 50%.
 - IF YOU SWITCH. YOU MUST SWITCH TO ALL NODES MADE OF ALUMINUM! NO MIXING!
 - Effective, even for protecting other aluminum components.
 - However, aluminum is more expensive than zinc and harder to find.
 - Aluminum lasts longer than zinc.
 - Aluminum works better than zinc in BRACKISH water.

Environmental concerns about zinc.

- Zinc is a heavy metal.
- Zinc anodes should always be recycled. Check to see who will take zinc to recycle locally.
- Cadmium, another heavy metal, in zinc products is a concern that has led to a call for aluminum anodes.

Protecting Outdrives from Corrosion with Zinc Anodes

- Outdrives include sterndrives and outboards. These are particularly prone to galvanic corrosion because of the mix of metals.
 - May need multiple anodes.
 - Must know where every anode is located.
 - Renew any anode that is 50% depleted.
- Anode tips and locations:
 - Sacrificial Trim Tab has an early warning of depletion by a change in the steering.
 - There may be 1-2 zinc plates attached to the gear case or anti-ventilation plate.
 - There may be zinc anodes in the exhaust cavity.
 - There may be anodes in the cooling water jacket.

What about ALUMINUM?

- Aluminum is an even better anode than zinc and lasts 50% longer.
- Not all aluminum anodes are alike with the best quality anodes composed of brand new, never used aluminum or repurposed aluminum alloys from equipment or power lines.
- Do not purchase “new” aluminum anodes made with recycled old aluminum anodes.
- Look for third party certification to ensure best quality aluminum in the product.

Zinc pencils

- Copper heat exchangers are at risk for galvanic corrosion and are therefore fitted with a “zinc pencil anode”.
 - May be located under the brass plug in the exchanger.
- You just must unscrew the zinc anode pencil from the plug for replacement.
- May also have a zinc pencil anode in the cooling water jacket to protect engine metals.

What about FRESH WATER?

- Magnesium anodes protect underwater metals better in fresh water.
- Do NOT use magnesium anodes in salt water or brackish water.
 - If you switch your boat between salt or brackish water and fresh water, DO NOT USE MAGNESIUM anodes.

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