

MINI ANTI-INCRUSTATION AND ANTI-CORROSION SYSTEM FOR PIPES AND SEA WATER INTAKES

OBJECTIVES:

The first objective is to kill the marine organisms that obstruct water intakes provoking failures in refrigeration. The second objective is to form a fine layer of isolation in the walls of the pipes to minimize the corrosion in said pipes. This insulating layer is made of Aluminum Hydroxide.

COMPONENTS:

The first objective is achieved through use of a copper anode and its corresponding regulator. The intensity of the current is based on the amount water flow.

The second objective is achieved with an Aluminum anode and regulator which also depend on the amount of water flow. At each sea water intake point the following should be installed:

- 1 Aluminum Anode
- 1 Copper Anode
- 2 Regulators, one for each anode

Anodes: The table displays all of the dimensions of the components. These figures are based on the maximum flow/sea water intake.

Equipment	Diameter (Ø) Copper and Aluminum	Length Copper	Length Aluminum	Support Thread size
20 m3/hour	22mm	200mm	300mm	³∕₄" gas
40 m3/hour	30mm	200mm	300mm	1" gas
80 m3/hour	38mm	200mm	300mm	1 ¼" gas

If a situation arises where the anode is excessive and doesn't fit, it's possible to cut down the edges. In that case, the useful life of the anode would be reduced in the same proportion as the amount removed.



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FLOWS AND MAXIMUM PERFORMANCE:

The maximum flows for our mini-systems are 20, 40 and 80 m3/hour per Sea Water intake. The power supply for the regulator can be either 12 or 24 volts DC. 12 volts will perform better for flows in the ranges of 20 and 40 m3/hour

For flows of over 80m3/hour power supply is not relevant.

Important: The relay installed inside of the 20 and 40 m3/hr systems can only be powered by 24 Volts. The 80 m3/hr models can be powered by either 12 volts or 24 volts.

DURATION:

The life of the anodes depends primarily on the time they have been functioning with maximum flow. Once the anodes are worn out they can be replaced with new or repaired anodes in order to save on costs. Replacements can only be done in the factory if the bases are in good condition.

For better safety, the anodes are threaded on a titanium shaft which helps avoid the destruction of the stainless steel base should the anode wear out before it can be replaced.

INSTALLATION:

ANODES:

Anodes should be installed in the Sea Water intake box or as close as possible such as in the sea weed/debris filters in order for the generated copper ions to reach the debris filter bars. This is where the highest risk for incrustation build-up can occur.

Two stainless steel hoses should be soldered (one per anode) with corresponding interior threads¹. The length of the threads should be between 25-30mm. To ensure the installation is waterproof, use Teflon tape.

REGULATORS:

Power cables come through the left wire conduit (through wire fitting) of the regulator identified by the word BAT. The red wire should be connected to the positive terminal of the battery with a 1 Amp fuse in between. The black wire should be connected to the grounding plate for the tubes, which should also be connected to the negative terminal of the battery.

¹ See components table on page 1

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The red wire from the right side conduit (through wire fitting) should be connected to the anode and the black wire should be connected to the tubes/pipes grounding plate. It is advisable to use parallel red and black cables that are at least 1 - 2mm thick. Although this wire diameter may seem small, it's more than sufficient due to the low intensity of current travelling through the wires.

It is advisable to install micro-switches at the current entry point of the regulator. The microswitch allows for the deactivation of the corresponding regulator when the anode is worn out and the activation when it is replaced. It should be determined whether there is electrical continuity between the stainless steel (INOX) thread support and the hose where it is threaded to ensure it is protected cathodically as well.

ADJUSTMENT:

The regulator has two positions (2), one for maximum flow and one for when the water is still. This changes from one state to the other with a relay installed in each regulator. The Relay is powered by current from the motor or the water pump if it's electric.

The relay cable is identified in the regulator by yellow tape with the words RELE.

The regulation of maximum flow will be based on 1.6 - 1.7 mA. of power per cubic meter/hr of flow (3m/hr). With a flow of 45 m3/hr the system would need an adjustment of approximately 72 mA. This value should be the same for the Aluminum (Aluminum) anode as for the copper anode.

The adjustment for the system at rest is calculated dividing the previous value by 6. In the previous example, the resting state value would be 12 mA.

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Figure 1: Aluminum Anode and Regulator



Figure 2: Copper Anode and Regulator



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CONTROL OF POTENTIALS FOR SEA WATER INTAKES IN ALUMINUM BOXES

If the anti-incrustation anodes are placed in a box with aluminum walls, a measurer of potentials with an electrode needs to be placed inside the box. This will avoid overprotection of the aluminum metal of the box and it being henceforth damaged . The following page shows a diagram with the electric connections of the equipment used along with the anti-incrustation system.

