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EMCS
INDUSTRIES LTD.

MARELCO™

MARELCO USER MANUAL

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EXPERIENCE THE FREEDOM OF NO FOULING

Anti-fouling System Installation & Operational Manual

Vessel Name/ Company	
EMCS INDURUSTRIES LTD. Reference Number	
Vessel Superintendent/ Project Manager	

Revision	Date	Description	Signature
1		MARELCO ANODES & CONTROL PANEL	

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GENERAL DESCRIPTION

(1) INTRODUCTION

Marine growth fouling of sea water cooling systems has posed a problem to ship owners, offshore operators, and industry for many years. Tremendous costs are incurred due to partially blocked cooling systems; equipment damage caused by system failures; increased demand on equipment, and higher fuel consumption due to reduced cooling water reaching condensers. **MARELCO™** aids in reducing these costs and problems.

Since its first installation, **MARELCO™** has proven that shore based industry, and ships of all types, will reap immediate and lasting benefits.

For owners, a substantial reduction in operating, maintenance, and replacement costs will be realized with **MARELCO™** protection. Cost savings and benefits include:

- (a) reduced fuel consumption;
- (b) increased plant and equipment efficiency;
- (c) reduced costs for cleaning sea chests, gratings, heat exchangers, condensers, pipes, valves, etc.
- (d) increased life span of piping;
- (e) less back up of equipment inventory;
- (f) abolition of chemical costs, and;
- (g) increased sea time - routine dry dockings only.

(2) GENERAL DESCRIPTION

MARELCO™ is a patented impressed current system employing specially alloyed anodes. **MARELCO™** eliminates marine growth infestation and reduces corrosion in saltwater cooling systems. **MARELCO™** provides continuous protection, demands negligible maintenance, and is easily applied to new or existing installations.

(i) Marine Growth Protection

Marine growth fouling occurs where sedentary organisms ranging from fungi and bacteria to simple plants and animals settle on surfaces immersed in sea water, thus affecting the operation and maintenance of equipment. These organisms can greatly alter corrosion process and plug condensers, piping, and valves. Fouling causes important increases in frictional resistance, fuel consumption, loss of production and increased cleaning costs.

Many methods have been tried, but always with associated problems. Historically, chlorination has been used as the major chemical control of bio-fouling. Government regulations have placed increasingly severe limitations on chlorine concentrations and duration, to the extent that intermittent chlorination at the dosages permitted is not always an effective deterrent to the settlement and growth of marine organisms. Chemical methods produce severe corrosion problems and can cost more to operate. Methods must be capable of controlling primary fouling organisms, have low solubility, reduce pitting, be compatible with existing equipment, and present no environmental hazards.

MARELCO™ meets these requirements by slowly dissolving special alloyed anodes into electrolytic products (less than 10 mg/litre) which creates an environment hostile to primary forms of marine fouling while at the same time reducing corrosion.

Impressed direct constant current is applied to the anodes, generating aluminum hydroxide from the trap corrosion anode and copper ions into solution from the marine growth anode. Aluminum hydroxide suspends the released copper, and being highly gelatinous spreads out into the slower moving areas of the sea chests, where marine growth larvae are most likely to settle. Treatment is concentrated at the inlet areas before water enters the various services. Sea water moving past the anodes acts as the mixing agent, and the motive force to carry the suspension throughout the system.

Not only does the trap corrosion anode produce the colloidal suspension, it also actuates a corrosion cell that protects the cathode from adverse reaction to copper. This dual system guarantees the elimination of marine growth, reduction of corrosion, elimination of pitting, and is environmentally safe.

(ii) Corrosion Protection

Total corrosion prevention is rarely achieved, although it can be in specific instances. The concept of corrosion control includes a broad spectrum of techniques ranging from acceptance of a finite life to some quantitative diminution of the rate of attack, for example, in inhibited cooling water systems.

MARELCO™ inhibits corrosion in water cooling systems by an electrochemical and barrier film technique. The system produces a tiny, corrosion resistant and sacrificial film between the metal and its environment. The trap corrosion anode creates ionic products which form a gelatinous alkaline coating on the pipe surface or structure (the cathode) inhibiting corrosion up to 85% in a complete corrosion protection system with the installation of treatment tanks. In practice, the pipe looks as if its internal surface is coated.

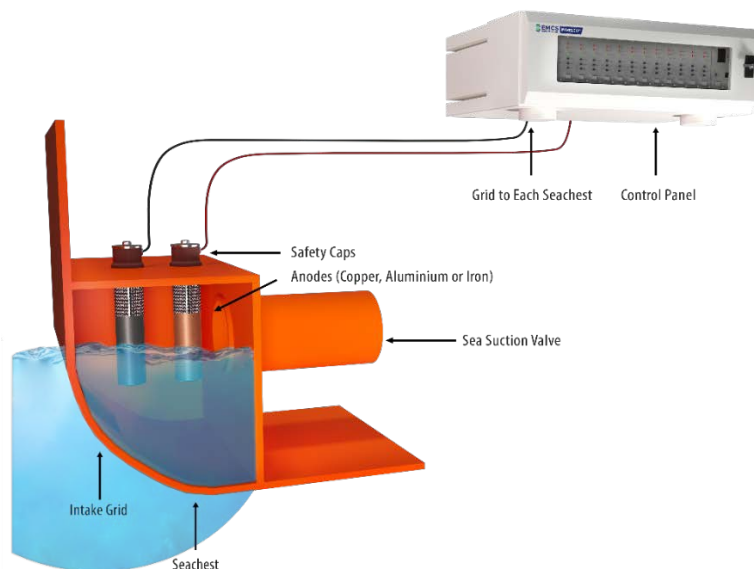
(3) MARINE INSTALLATIONS

Ships of all types and offshore rigs will benefit with **MARELCO™** protection. Marine growth fouling can be eliminated and corrosion inhibited in all sea water circulating systems.

The anodes located in sea chests, suction inlets, and sea bays, treat raw sea water before it enters the various services. Additional anodes may be located within the services being protected. Components that may receive protection include gratings, sea chests, sea wells, holding tanks, thrusters, piping, scoops, condensers/heat exchangers, valves, fire pumps, sanitary systems, etc. Every installation is specifically designed to meet the parameters of the system, and services it is to protect.

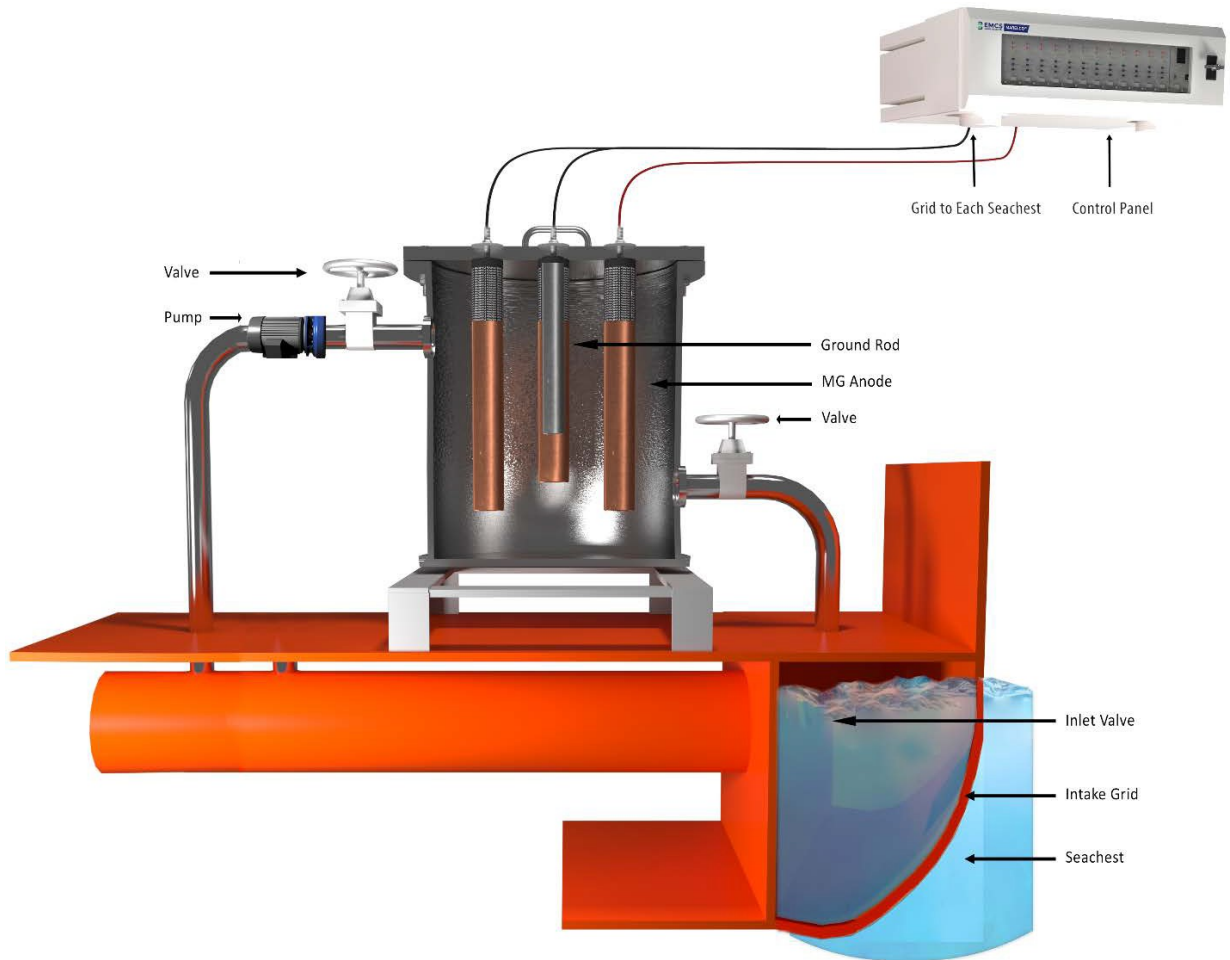
By eliminating bio-fouling and corrosion scale **MARELCO™** ensures free circulation of water, resulting in optimum plant performance. Dry docking and maintenance routines can be expanded. Down time due to overheating will be reduced and sea time increased.

BASIC SYSTEM LAYOUT - SEA CHEST DIAGRAM

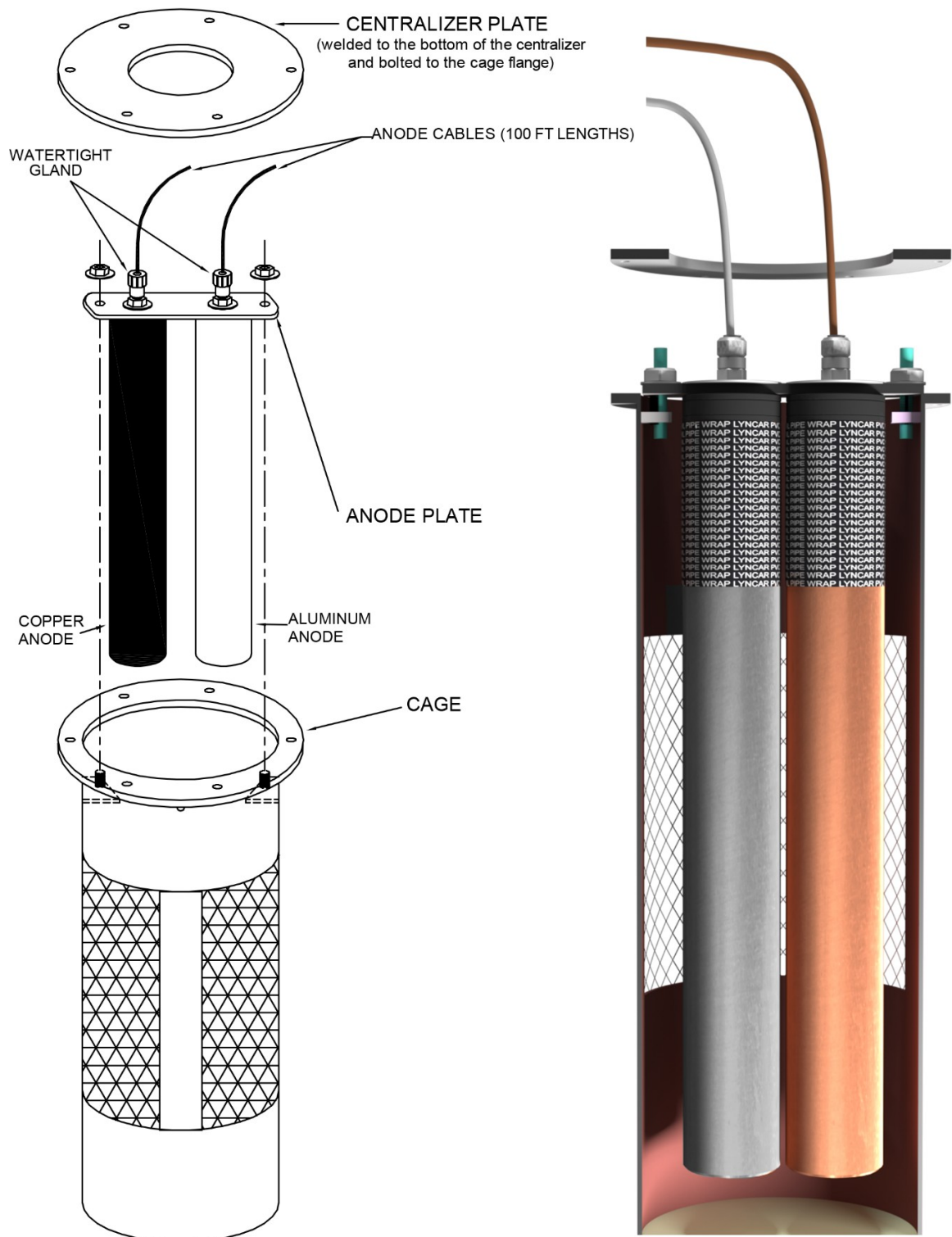


MARELCO™ TREATMENT TANKS

Wiring for anodes to Control Panels is identical to the wiring of all other Anode products



MARELCO™ ANODE CAGE



SECTION B.

SYSTEM DESCRIPTION

This is an automatic electrolytic process for the prevention of marine growth fouling by algae, mussels, barnacles, hydroid, etc., and other fouling organisms higher than single cell organisms.

Fouling prevention is ensured by the controlled dissolution of copper in water intakes. A complete system comprises of an electronic control/monitoring panel, safety caps, anodes, cable and power.

(1) CONTROL PANEL

The MARELCO™ constant current control unit is a high quality steel dust/splash proof cabinet which incorporates all solid state circuitry and heavy duty components produced to meet any specification (explosion proof and complete watertight is optional). The cabinet exterior is corrosion and oil stain resistant, coated with baked marine enamel. Power consumption is less than 0.5 kW.

Panel Dimensions

See drawings marked - Control Panel - Dimensions

(i) Panel Exterior Construction

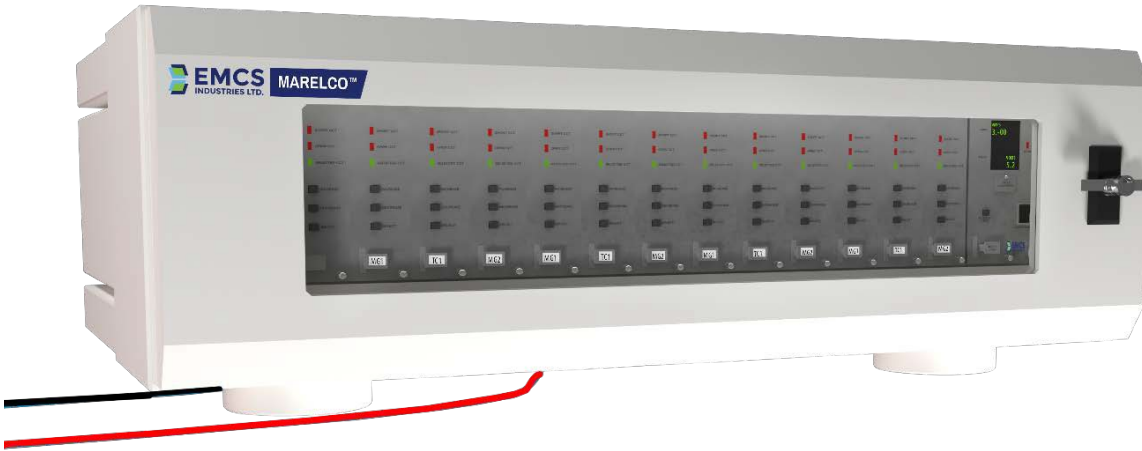
- 16 guage construction
- Seams continuously welded and ground smooth
- Doors are removable and interchangeable
- Nearly flush oil-tight latches hold door and body halves securely closed
- Latches are opened and closed with a security key (key included)
- Full-tinted acrylic window door
- Thru-hole rack angles welded in front
- Mounting holes on back of enclosure
- Oil-resistant gasket and adhesive

READINGS SHEET | VESSEL: _____

Anode Ref	Type	Location	Amps	Volts

Date: _____ SIGNED: _____

(ii) Panel Interior



The fully automatic control unit utilizes power from the ship's on board services supply. The transformer/rectifier converts the AC supply to low DC voltage.

The green light indicates "ON" when the unit is energized. The green light will run continuously indicating that everything is functioning properly with the power supply.

The red-light indicator should be "OFF" at all times. When the red light is "ON" an anode card inside the panel will register an "OPEN" or "SHORT" which causes the red indicator to illuminate.

Amperage remains constant to the calibrated settings. All internal electronic, monitoring, and control components are mounted in sub-racks. The rack system is totally constructed of corrosion resistant materials.

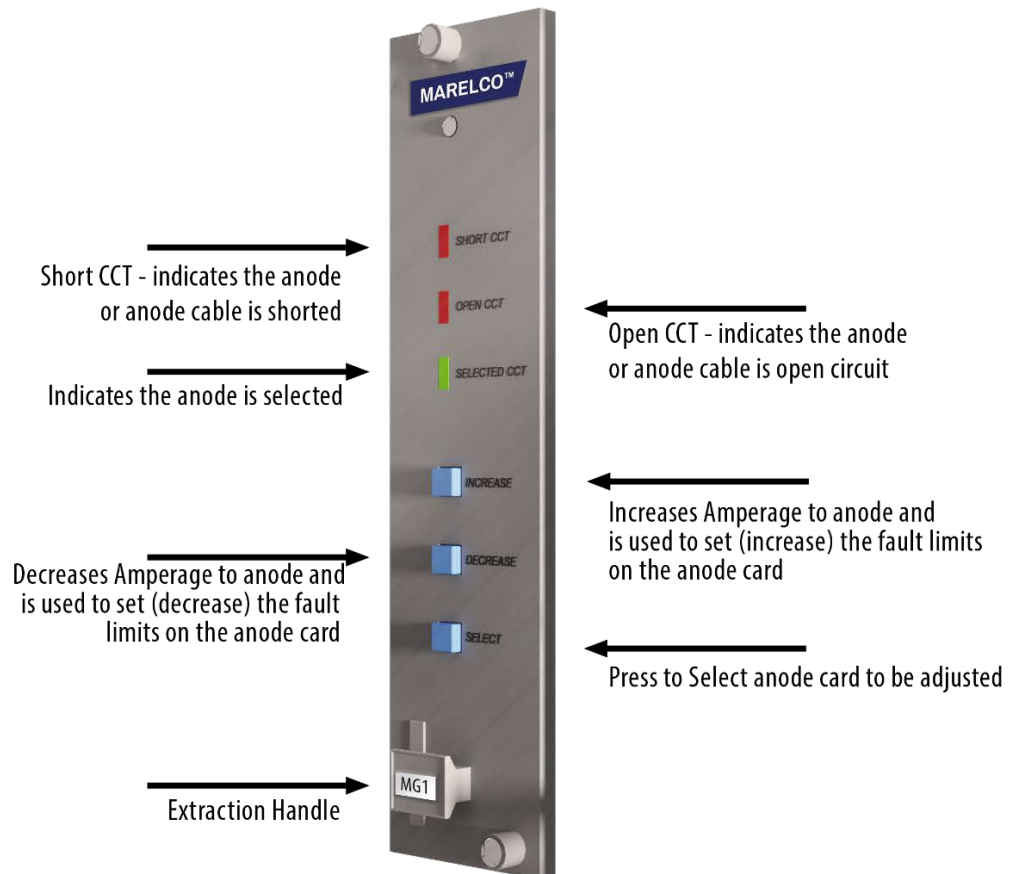
METER CARD

Each control panel contains a meter card that indicates voltage and amperage to each anode. The meter card incorporates the following features mounted on the face plate:



ANODE CARDS

Identical anode cards incorporate the following features mounted on face plate:



METER CARD - OPEN CIRCUIT FAULT LEVEL MODE

Warning: These settings are factory set and should not be adjusted unless you have specific instructions from the manufacturer.

This mode is used to adjust the open circuit alarm level. The open circuit alarm will be activated when the selected card's output voltage is higher than normal. This could be caused by:

- broken anode wire
- expired anode
- disconnected anode
- blown fuse on this anode card
- fresh water or no water in anode locations

TO ADJUST THE OPEN CIRCUIT FAULT LEVEL

- Select the anode card to be adjusted by pressing the "SELECT" button on the faceplate of the anode card.
- The green "SELECTED" LED will be illuminated.
- Select the Open CCT fault level mode by pressing the "FAULT LEVEL (OPEN CCT)" button.
- The word "Hf" will appear on the first line of the LED readout.
- Set the required voltage by pressing the "INCREASE" or "DECREASE" buttons on the - anode card.
- To De-select the card press the "DESELECT CARDS" button Refer to Figure #3 on the next page.



METER CARD - SHORT CIRCUIT FAULT LEVEL MODE

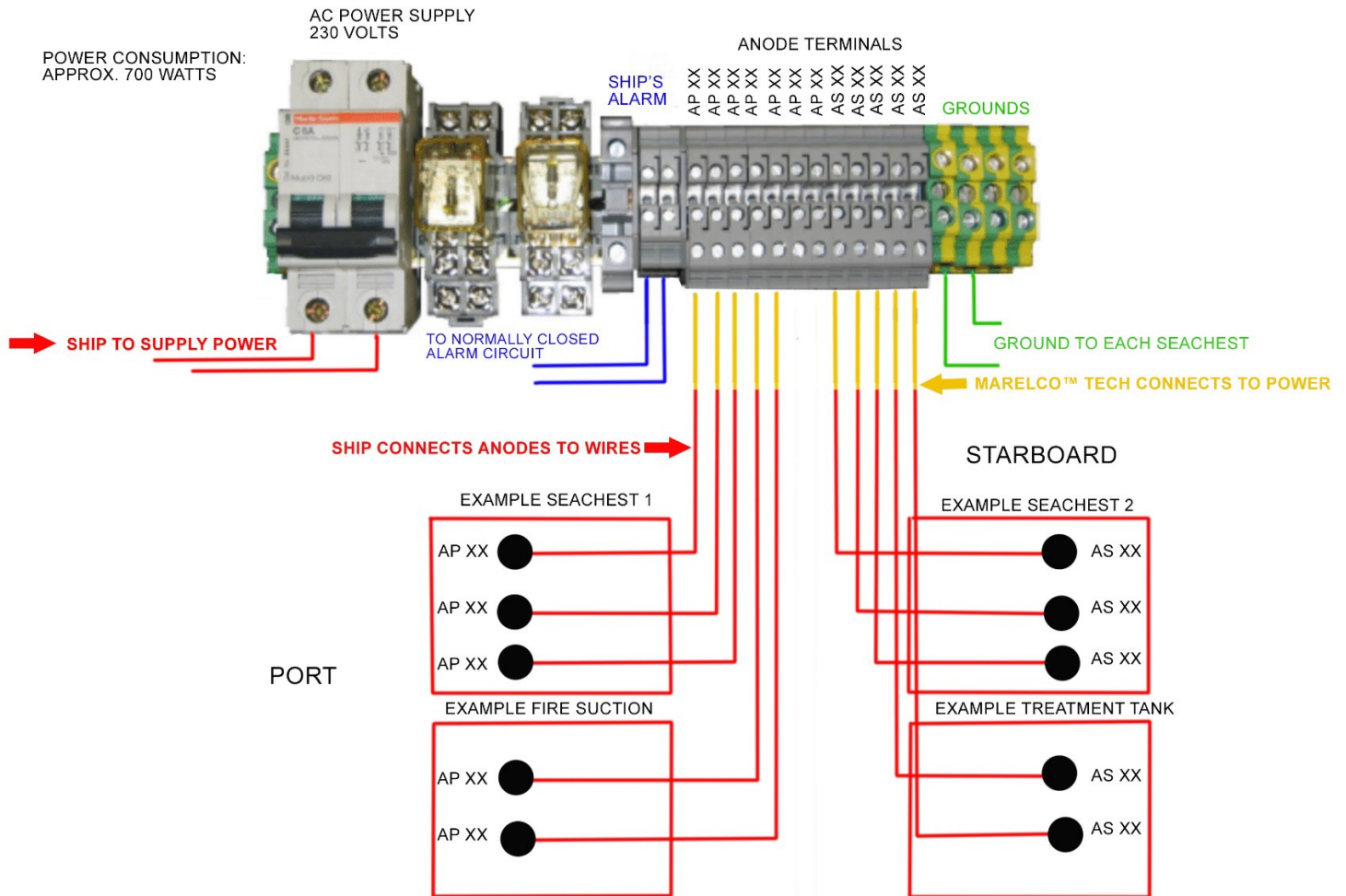
Warning: These settings are factory set and should not be adjusted unless you have specific instructions from the manufacturer.

This mode is used to adjust the short circuit alarm level. The alarm will be activated when the following occurs

- broken or damaged wire shorting to the cathode (steel)
- anode not properly insulated from the cathode (steel) TO ADJUST THE SHORT CIRCUIT FAULT LEVEL
- Select the anode card to be adjusted by pressing the "SELECT" button on the face plate of the anode card.
- The green "SELECTED" LED will be illuminated.
- Select the Short CCT fault level mode by pressing the "FAULT LEVEL (SHORT CCT)" button.
- The word "LO" will appear on the first line of the LED readout.
- Set the required voltage by pressing the "INCREASE" or "DECREASE" buttons on the anode card.
- To De-select the card press the "DESELECT CARDS" button.



CONTROL PANEL TERMINAL CONNECTIONS



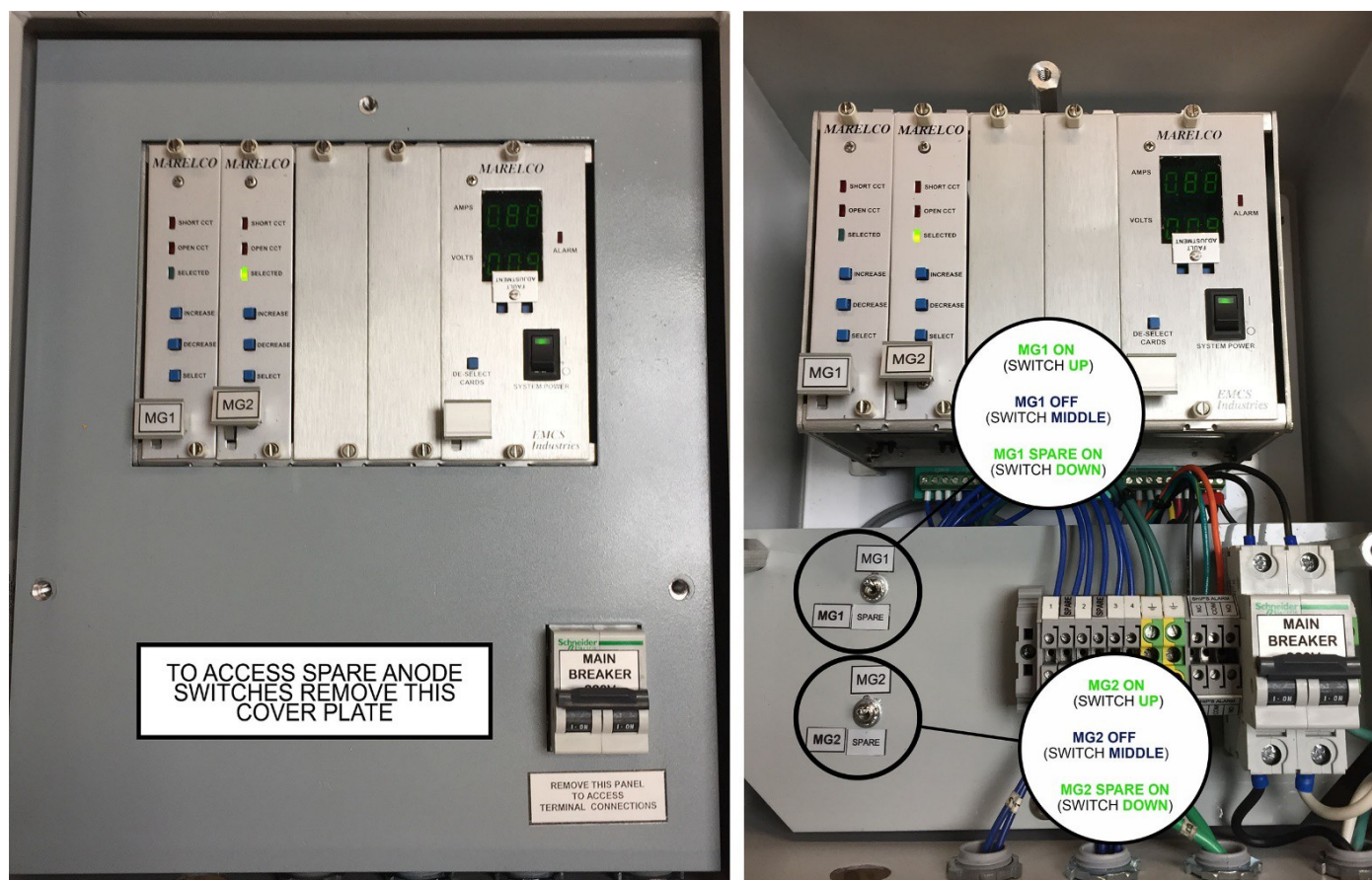
RED INDICATES CUSTOMER RESPONSIBILITY

YELLOW INDICATES EMCS TECHNICIAN COMMISSIONING RESPONSIBILITY

NOTE: ALL INSTALLS SHOULD BE SUPERVISED BY AN AUTHORISED MARELCO TECHNICIAN

CUSTOM CONTROL PANELS

Custom Control Panels specially made for your vessel system are made available according to the application. The below is an example of a Control Panel designed to avoid the use of Spare Anodes being used before it necessary.



SEE FIG 4A ABOVE: IN THE EVENT A SPARE IS REQUIRED TO BE TURNED ON, THIS WILL AUTOMATICALLY PREVENT THE USE OF THE MAIN MG ANODE. REMOVE COVER PLATE TO ACCESS THE SWITCHES AS SHOWN ABOVE

(2) SAFETY CAPS

MARELCO™ safety caps are hydraulically tested to 100 p.s.i., and approved by Lloyds, C.S.I., the American Bureau of Shipping and R.I.N.A.

EMCS Ltd. will supply the safety caps to be installed as per instructions in **Section C**.

(3) ANODES

Standard anodes are constructed of extruded materials. The highest grades of copper, aluminum, iron, and other metals are used. Anodes can be formed to any configuration allowing flexibility in positioning and arranging anode locations. Various anode stud diameters are used to meet military and ice breaking standards.



(i) MG Anodes

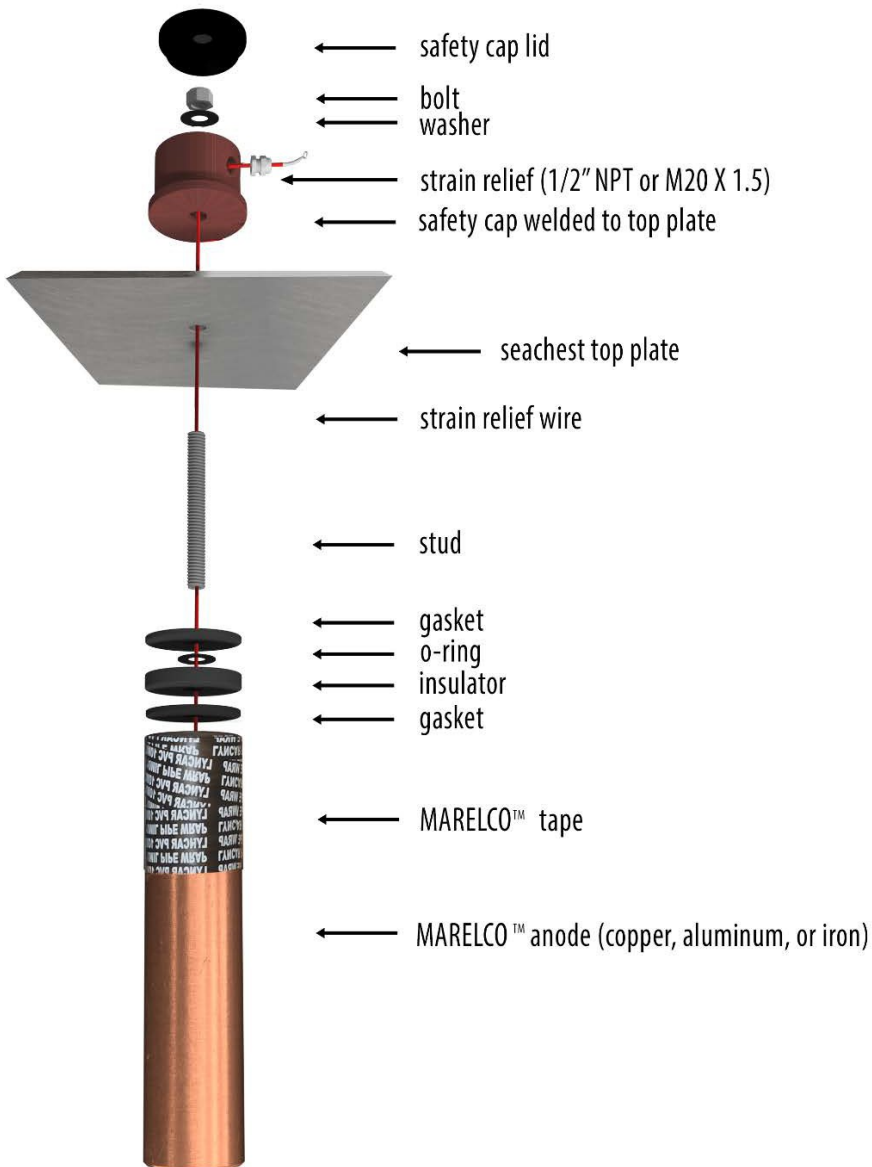
The MG anode is constructed of specially alloyed extruded material principally copper, plus various alloys. It is always employed in conjunction with the TRAP (fC) anode. It reacts with sea water to produce an environment that prevents biological fouling (I.E. shellfish, spat, spawn, etc.) from inhabiting.

(ii) Trap (TC) Anode

The Trap (TC) anode is constructed of specially alloyed extruded materials principally aluminum or iron, plus various other alloys. It produces a colloidal suspension to support the products of the MG anode.

The size and shape of anodes vary according to the dimensions of the sea chest, pipes, gratings, water conditions, flow rates and dry docking schedules.

Only in exceptional circumstances will the weight of anodes exceed man-handling proportions. Each anode is stamped with a number corresponding to its position on the drawing. The number will be found on the side of each anode, just below the tape.



(4) CABLE

Cable from the junction box to the safety cap shall be supplied by the owner or shipyard and shall be:

- #12 or 3.3. mm single conductor marine cable.
- or #14 or 2.0 mm double conductor marine cable.
- or local equivalent to conform to classification society requirements and accepted practice.

(5) POWER

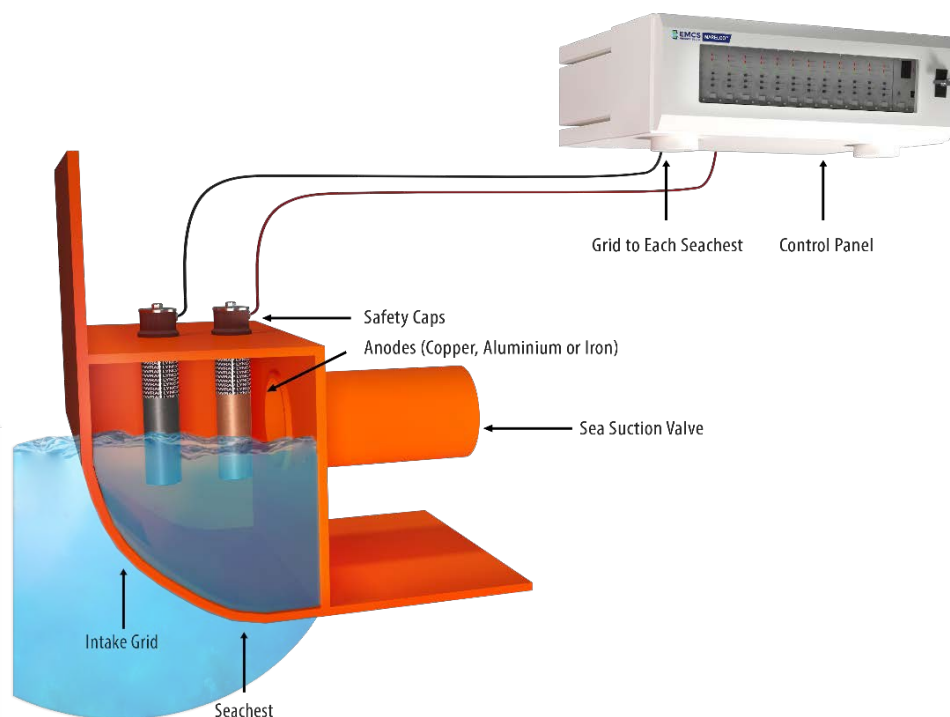
MARELCO™ is energized by power from the AC main supply, and is converted to DC Any voltage and frequency of the electrical system can be incorporated upon request.

METER SETTINGS	
Amperage:	MG Anodes - .20 amps. to 3 amps. TC Anodes - .20 amps. to 3 amps.

(6) MARINE INSTALLATION REQUIREMENTS

(i) Sea Chests

Anodes mounted in the sea chests treat raw sea water before it enters the services. The MG anodes are positioned as close to inlets as possible. The TC anodes are positioned in the line of flow of the water. A white calcareous protective coat will build on the sea chest walls.



TYPICAL SEACHEST INSTALLATION

WARNING

There must be proper circulation of water in the sea chest for the system to be effective. All sea chests must be adequately vented.

INSTALLATION

The MARELCO™ System supplied by EMCS Industries Ltd. will consist of the following parts:

1. Control Panel c/w Junction Box (if applicable)
2. Anodes
3. Safety Caps

The owner, general contractor or shipyard will be responsible for the supply of:

1. Cable
2. Cable Clamps
3. Cable Terminals
4. Terminal Nuts and Bolts
5. Panel Mounting Brackets and Bolts.

INSTALLATION METHOD

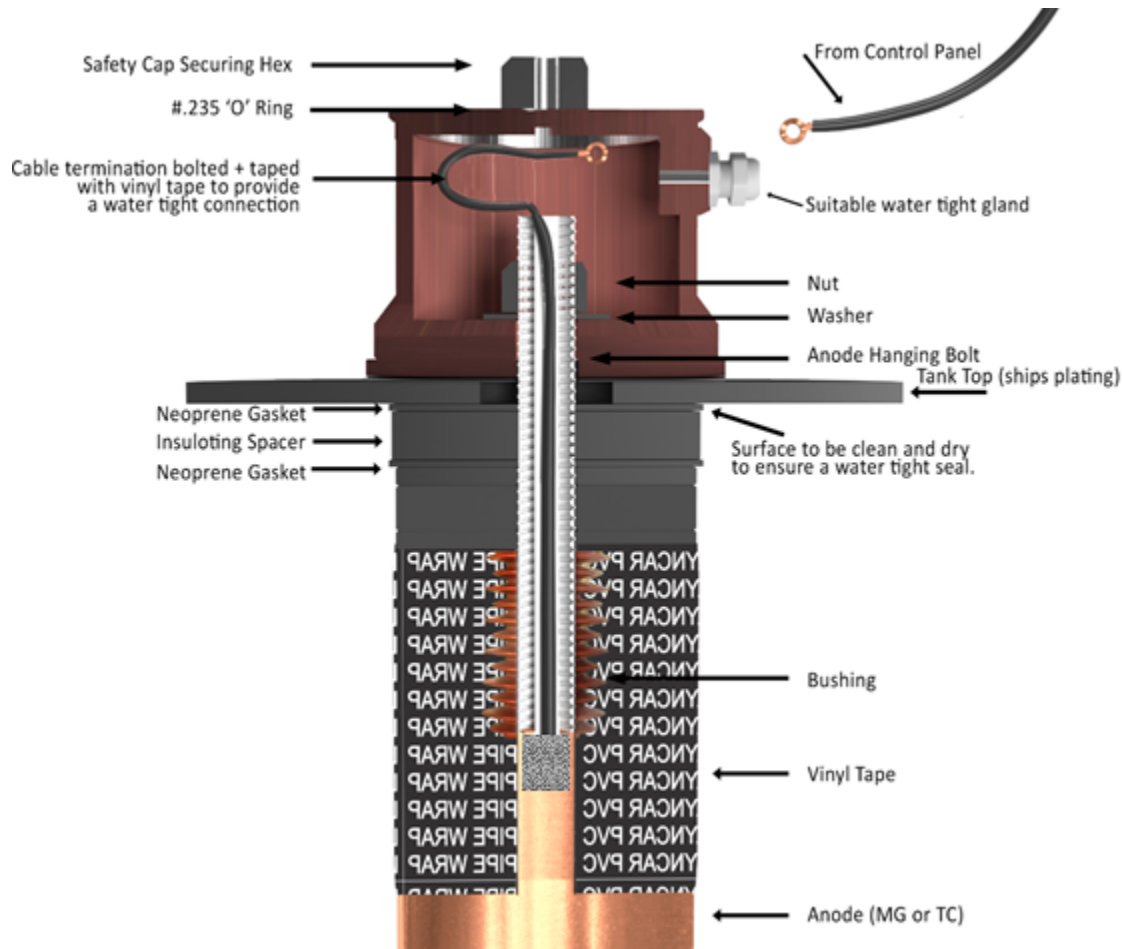
(1) CONTROL PANEL

- (a) Mount panel in the control room or on the bulkhead in the engine room.
- (b) Care must be taken to ensure that the ventilation slots in the back of the panel are not obstructed. The control panel should be opened so that the back section (Junction section) is exposed.

(2) CABLE

- (a) Run AC power from the main supply to the control panel terminals located on back panel of the controller. (Refer to drawings.)
- (b) Wire two conductor #14 AWG or 2.0 mm conductor from the seachests to the control panel grounds.
- (c) Run a cable from the control panel anode terminal blocks to each safety cap, taking care that the anode number matches the number on the terminal block.
- (d) Secure cables to the control panel bottom with a cable clamp.
- (e) Install cable from the control panel anode terminals into the side of the safety cap using a 13 mm brass watertight gland. At least 150 mm of cable must be left inside the safety cap. To the end of the cable fasten a terminal with a 5 mm hole.
- (f) Run ground cable from the control panel ground terminals to each group of anode locations. (Refer to drawings.)

3) SAFETY CAPS AND ANODES



If anode installation differs from above - see enclosed drawings .

- Locate the anode positions, as indicated on the drawings
- Locate appropriate numbered anodes as marked on each anode.
- Clean mounting ring and gasket.
- Place anode on mounting ring and gasket and secure accordingly. (Use a torque setting of 100 foot/pound).
- Secure anode cable in anode gland and connect the anode lead terminal to the junction box cable terminal with nut and bolt, making sure of a tight and clean electrical bond.
- Bind the connection with electrician's tape ensuring a water pproof connection.
- Place the "O" ring in the groove around the lip of the safety cap.
- Screw on safety cap cover and tighten until secure. Use anti-seize compound on safety cap cover.

When installing bent anodes or anodes exceeding 30 kg. use two nuts to secure anode hanging bolt.

(4) POWER

Connect panel to the main AC supply. The installation is now complete, and the system is ready for calibration (commissioning).

(5) SYSTEM CALIBRATION

All amperage settings will be supplied with the equipment (Refer to anode amperage settings).

METHOD

1. Ensure anodes are fully immersed in water prior to energizing equipment.
 2. Check panel for damage .
 3. Ensure that all anode circuit cards, the meter card, and fuses are secured in holders or racks.
 4. Switch on the primary power supply.
 5. Check that the green operational light is on.
 6. Check each anode to ensure that each anode card registers a current (amp) reading and a voltage (volts) If meter does not register on all circuits take the following steps:
 - (i) Check anode card fuses , meter card fuse/breaker, and AC supply fuse/breaker.
 - (ii) Check ground connections.
 - (iii) Check the vent lines to the tank tops, sea chests or sea bays to ensure that there is water in them.
 - (iv) Check anode lead connections in the control panel.
 7. Check that amperage settings are those supplied with the equipment. Record voltage for each anode.
 8. If the amperage settings are incorrect, adjust amperage on each anode circuit card. Record voltage for each anode.
-

Install new anode by reversing the above procedure. Check to see if anode is working before installing.

1. Connect anode cable to anode.
2. Turn on panel power. (Make sure anode is insulated from deck).
3. Take DC volt meter to anode location.
4. Turn meter on.
5. Put ground probe to ground (i.e. cathode). (NB: Make sure of proper contact, i.e. no paint or other material on the grounding area.)
6. Put other probe on anode material.
7. Check indicator on meter to see that circuit is complete.

NOTE

If anodes require supports refer to drawing marked
Anode Supports

Tools required to replace anodes:

1. Electrician's tape.
2. Screwdriver.
3. Pliers.
4. 1 - 1/8" box/open end spanner (28.6 mm).
5. 1 - 1/8" deep socket - 1/2" driver (28.6 mm).
6. 1/2" driver ratchet (13 mm).
7. 6" (152 mm), 12" (305 mm) extension, 1/2" (13 mm) drive.
8. Anti-seize compound.

OPERATING VARIABLE

(1) FRESH WATER

Upon entering fresh water, meter readings will become erratic (amperage will decrease and voltage will increase). This is due to the change in resistivity of the electrolyte (water). Although power is supplied to the panel, the anodes will not draw current unless the resistivity of the electrolyte is sufficient to activate the system (greater than 6 parts per thousand NaCl). In effect, the system automatically shuts down where water conditions do not require its use.

DO NOT TRY TO ADJUST THE SYSTEM

(2) ICE

To a lesser extent similar meter reading variations may be observed when operating to ice conditions. Sea water resistivity will vary according to the amount of fresh water present. MARELCO™ will monitor itself.

DO NOT TRY TO ADJUST THE SYSTEM

(3) IN PORT - SEAWATER

This section applies only to vessels with services designed with treatment tanks.

When in port for extended periods (over one week), power should be switched off to the treatment tank anodes. If the main sea water circulation is not in operation, water does not flow over the anodes in the treatment tanks. No treatment is affected, and anodes are needlessly dissipated.

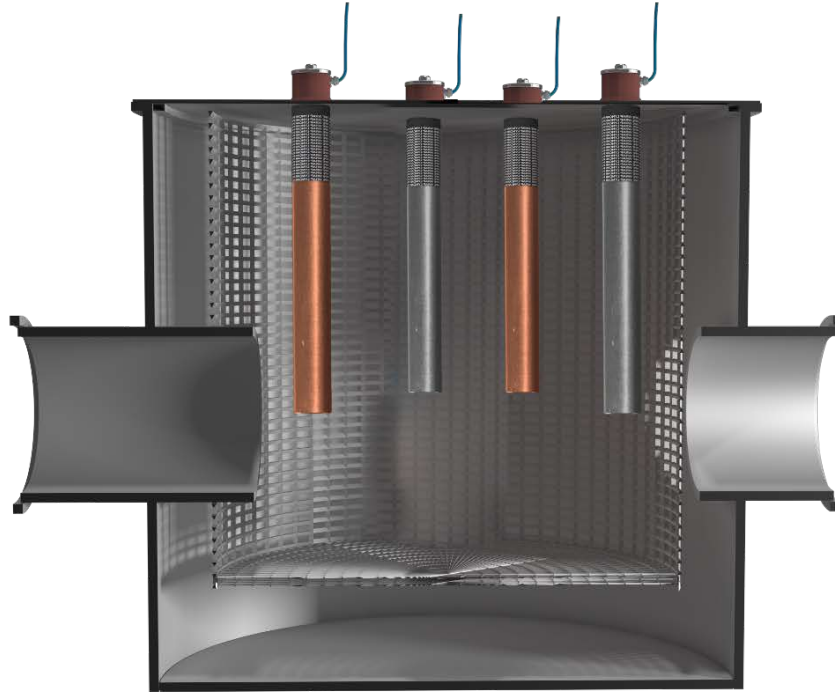
ALL OTHER SERVICES MUST REMAIN IN OPERATION. RE-ACTIVATE THE SYSTEM BEFORE LEAVING PORT.

(4) PARTIAL ANODE OPERATION

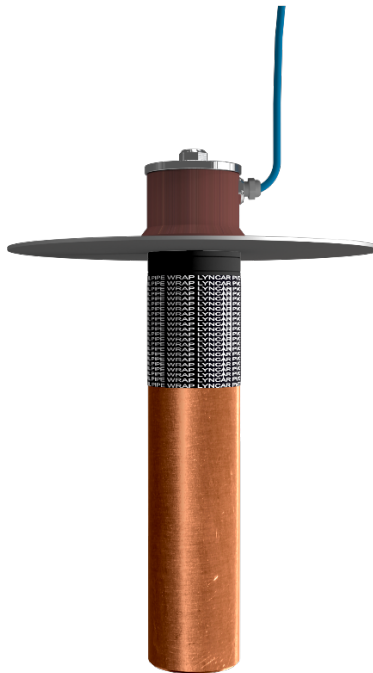
In a situation where an anode is out of commission due to a fault in the anode or a card, it is advisable to increase the amperage on the surrounding anodes to compensate protection until a replacement is installed.

VARIOUS ANODE INSTALLATION METHODS

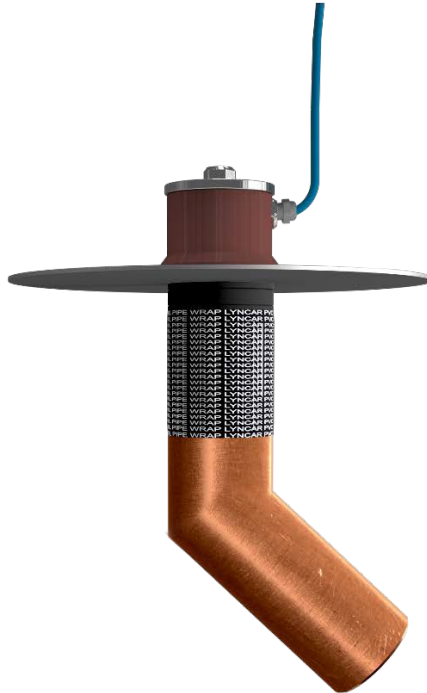
Strainers (various layouts, safety caps are welded to top of strainer)



Weld Safety Caps on Tank Tops

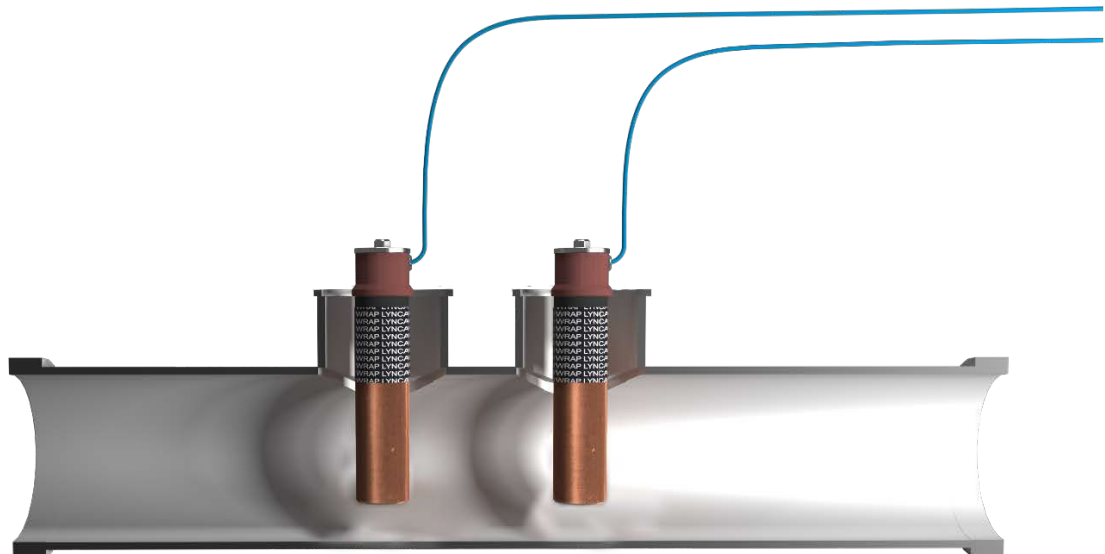


Bent anode (special request only)



Crossovers or Piping Systems

(various layouts, safety caps are welded to top of pipes, ground anodes needed in steel piping)



EMCS INDUSTRIES LTD IS THE INVENTOR OF THE MGPS ANODE SYSTEM, THE INVENTION WAS REGISTERED IN 1955. IT IS STRONGLY RECOMMENDED THAT FOR BEST PERFORMANCE ALL MARELCO™ ANODES ARE MANAGED AND RUN BY THE MARELCO™ LIBERATOR CONTROL PANEL.

ALL ANODE INSTALLATIONS MUST BE SUPERVISED BY EMCS INDUSTRIES CERTIFIED TECHNICIANS. EMCS WILL SUPPORT ALL PRODUCT SUPERVISED BY OUR TECHNICIANS. EMCS INDUSTRIES WILL NOT BE RESPONSIBLE FOR ANY FAILURE IF CERTIFIED TECHNICIANS WERE NOT PROVIDING OVERSIGHT.

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