



**CATHODIC MARINE
ENGINEERING**



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***CATHODIC PROTECTION SYSTEMS
MARINE GROWTH PREVENTION-ANTI FOULING SYSTEMS
BALLAST WATER TREATMENT SYSTEMS***

Sacrificial Anodes



Sacrificial anodes are used on pipelines, platforms, subsea structures; wind turbine foundations and monopiles, wave and tidal generators; quay and harbour walls, jetties & pontoons, dock gates; ships and boats hulls, ballast, grey and potable water tanks; power station intake screens and storage tanks. In short any where steel is immersed in water, anodes will be found.

Zinc Anodes are cast from a high purity zinc alloy to ensure an even corrosion pattern, reliable electrical efficiency and long working life. The zinc alloy is in accordance with the US MIL A-1800H specifications.

ZINC ANODES SPECIFICATIONS

Aluminium	: 0.10 - 0.50 %
Cadmium	: 0.025 - 0.15 %
Lead	: 0.006 % max
Iron	: 0.005 % max
Copper	: 0.005 % max
Silicon	: 0.125 % max
Zinc	: Remainder

PERFORMANCE STANDARDS :

Open Circuit Potential w.r.t. Ag/AgCl :
- 0.95V

Consumption Rate :
11.25 Kg /Amp.Yr

Anode Capacity :
780 Amp.Hr / kg



Aluminium Anodes are cast in alloys of aluminium & indium plus additions and have been developed specifically for use in seawater.

ALUMINIUM ANODES COMPOSITION

Zinc	: 2.0 – 5.0 %
Copper	: 0.05 % Max
Silicon	: 0.13 % max
Iron	: 0.13 % max
Indium	: 0.01 -0.05 %
Aluminium	: Remainder

PERFORMANCE STANDARDS :

Open Circuit Potential :
-1.07V (Ag/AgCl reference cell)

Consumption Rate :
3.4 Kg /Amp.Yr

Anode Capacity :
2500 Amp.Hr / kg



Plasma Ballast Water Treatment System

According to the result of IMO(International Maritime Organization), More than 3~5 billion tons of seawater and 7 thousands of aquatic species are carried in ship's ballast water each year. The introduction and spread of alien invasive species is a serious problem that has ecological, economic, health and environmental impacts, including loss of native biological diversity.

PLASMA BWTS was developed to prevent movement of marine life, it physically disinfect the marine life in ballast water through three steps, Filter, Plasma, UV module. PLASMA BWTS is composed of three parts, Auto filter, Plasma module and MPUV module sterilization system, they sterilize marine microbes and toxic substances which are prohibited from moving.

Model of PLASMA BWTS

FILTRATION MODULE

- Removes larger particles and organisms included in ballast water that are bigger than 35µm during injection of the ballast water.
- It is the double filtration which is highly accurate and reliable for filtering micro-organisms.
- Operates at only ballast mode.



LOW VOLTAGE PLASMA MODULE

- This unit can generate plasma underwater by using a low- voltage generator during its encounter with the ballast water in the vessel.
- Produces a pressure shockwave by a high- energy plasma arc.
- A shock wave destroys targeted micro-organisms such as zooplankton and phytoplankton by causing physical damage to their cell membranes underwater.



MPUV MODULE

- Accomplished uniform and efficient disinfection for bacteria and viruses.
- No need to add any chemical substances.
- No formation of residual toxics or harmful substances. Acts safely.
- Not only economical but also an eco-friendly system when compared to others.
- Use a wavelength of UV-C(200~280nm) to sterilize microorganisms.



Propeller Shaft Earthing System

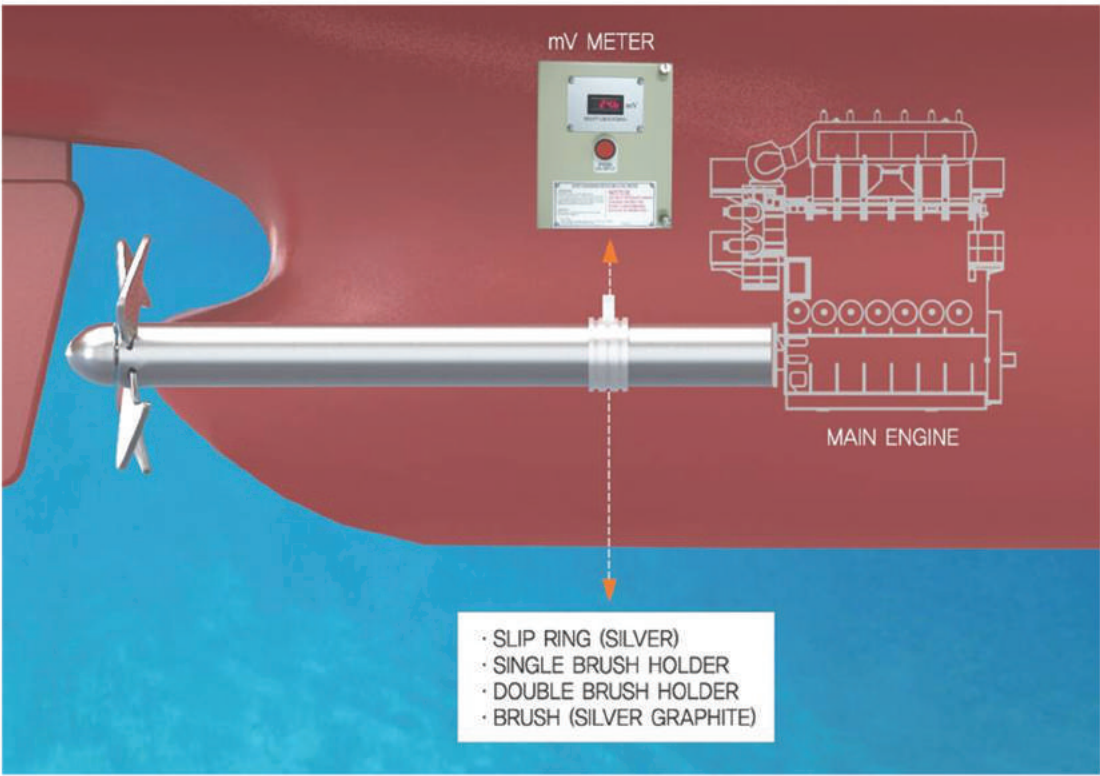
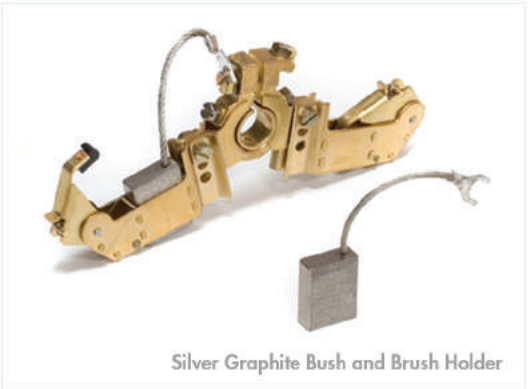
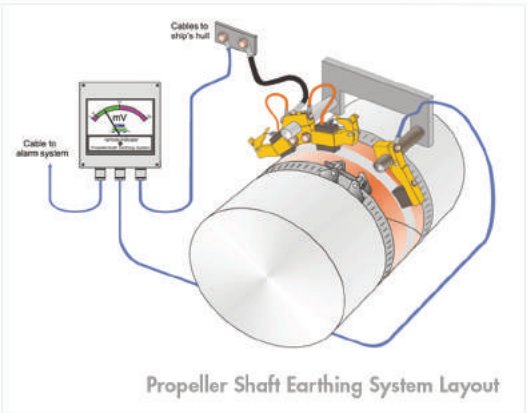
In conjunction with the ICCP system, the shaft insulation will prevent the propeller and the boss from receiving protection. Trouble can be avoided and cathodic protection extended to the propeller if the shaft is properly earthed with a shaft earthing system.

Advantages of a Propeller Shaft Earthing System

- Serves for a short circuit between the rotating propeller shaft and the ship's hull.
- Ensures an excellent potential decomposition and the contact brushes ensure lubrication and long life.
- A remote indicator system in order to achieve a continuous control the effectiveness of the whole system
- A continuous slip ring cleaning device to prevent an increase of the residual potential during operation

Propeller Shaft Earthing System consists of the following

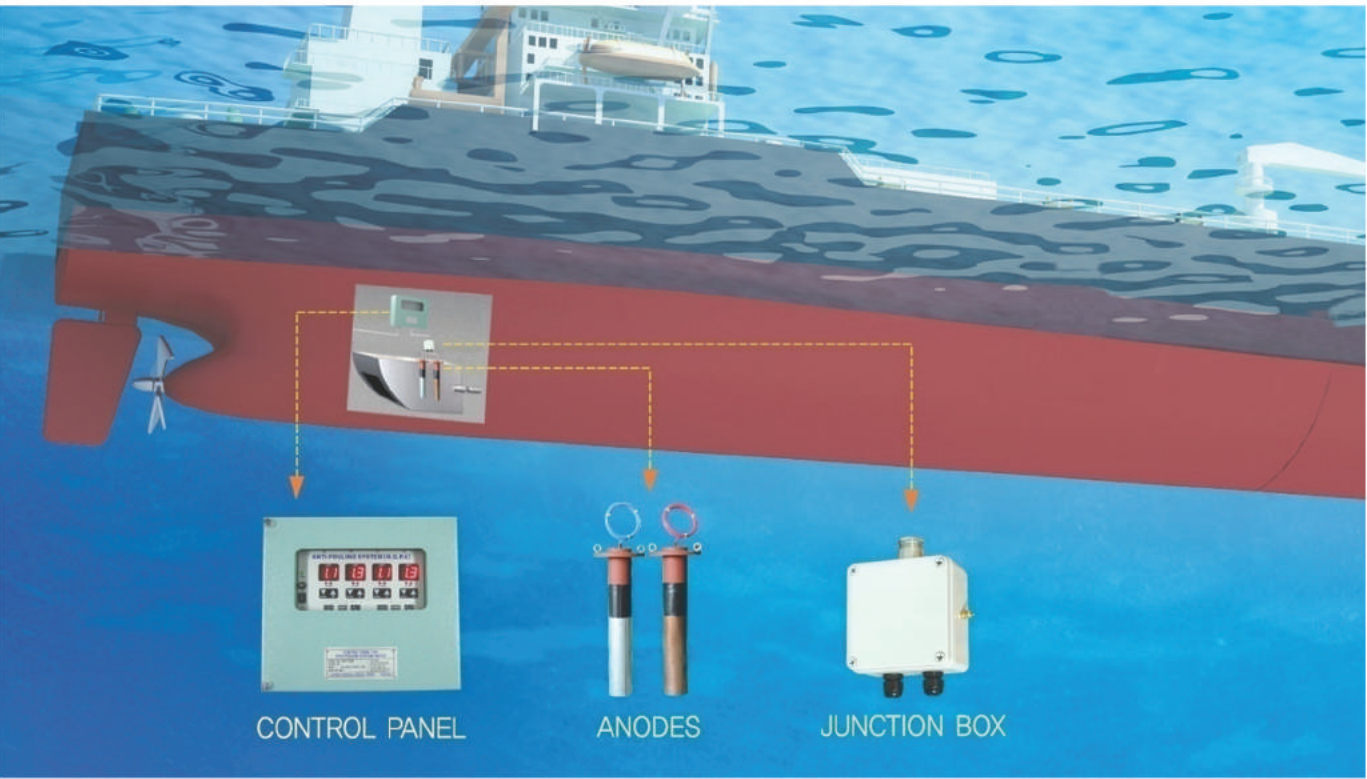
- Slip Ring - Elevated silver band reduce dirt for best possible contact.
- Brush Holders - Double and single brush holders for grounding and measurement. Strong springs for proper brush pressure.
- Silver slip band - Reliable contact. Easy installation
- Silver brushes - High purity silver brushes for proper shaft grounding.
- Monitoring Meter - Continuously monitoring the shaft potential. (Remote Indicator).



Marine Growth Prevention System / Antifouling System

What is Marine Growth?

Seawater contains several marine organisms which enter the ship along with the seawater and deposit and flourish on the parts of the ship's system. These macro and micro marine organisms such as sea worm, molluscs barnacles, algae, hard shells stick to the surface of the ship and flourish over there, resulting in marine growth.

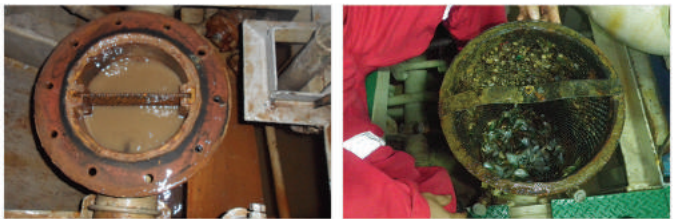


The ions, spread over the system and produce a anti fouling and anti corrosive film over the **Sea Water Pipelines , Intercoolers, Condensors , Heat Exchangers, Valves, Refrigeration Systems , Box Coolers and AC units** internally. Increasing seawater circulation.

Effects of Marine Growth

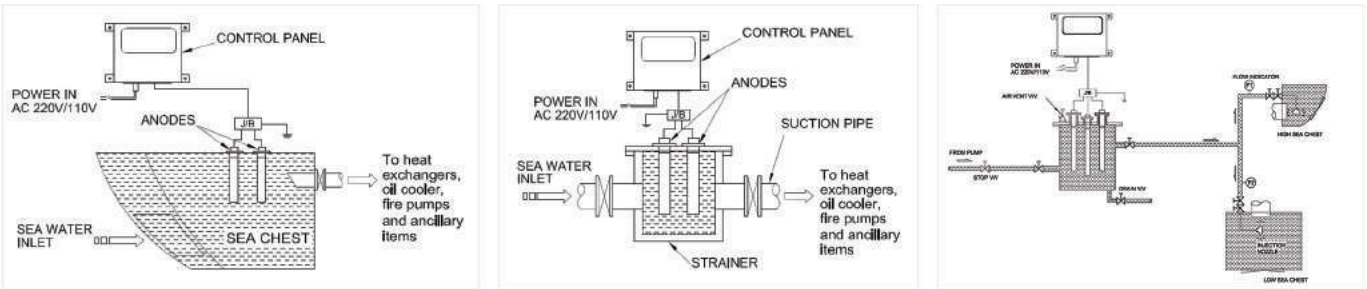
The marine organisms block and narrow the passage of cooling water, resulting in the following factors:

- Impairing the heat transfer system.
- Overheating of several water-cooled machineries.
- Increase in the rate of corrosion and thinning of pipes.



Fighting Marine Growth

The process involves usage of **Copper, Aluminum and Ferrous Anodes**.

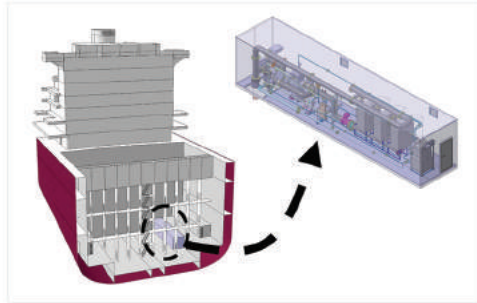


Electrochlorination / Hypochlorite Generation System

This system is designed to prevent the adhesion of marine growths to the internal pipe line of ships through the chemical reaction of chlorine compounds which are produced through the electrolyzation of sea water.

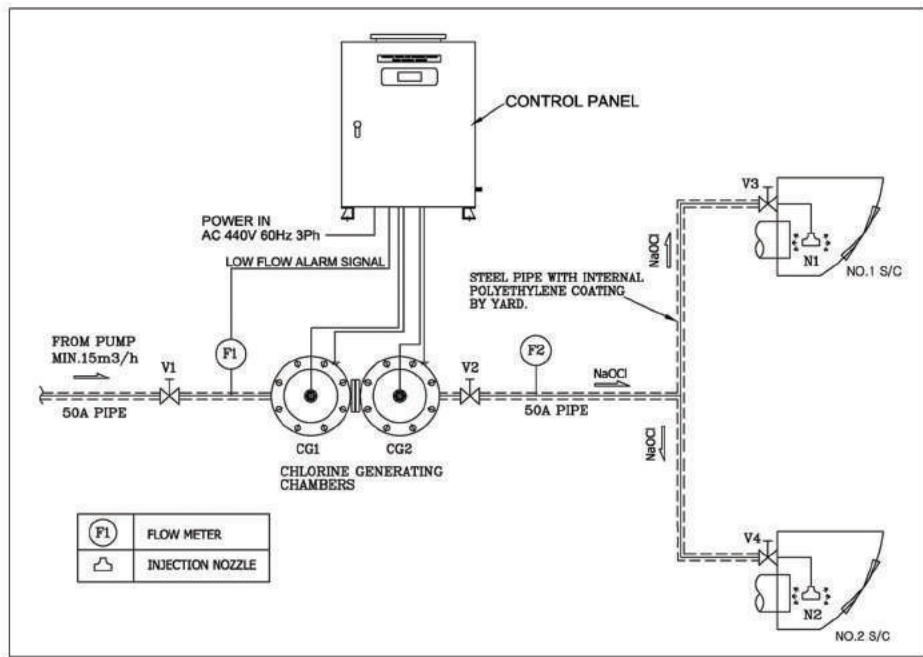
Effects of Chlorine

- Chlorine is a well known toxicant. It has been shown that 0.2 to 0.5 PPM of continuous chlorination will prevent all marine fouling in time.
- A trace residual discharge will insure the killing of all fouling organisms in a sea water system when constant chlorination is employed. It should be emphasized that constant chlorination is the best method for safe and efficient fouling and bacteria control.



System Componentes

- Power Supply** - This is a power converting device, transforming the Client supplied AC440 Volts, 60 Hz, Input power to a Low Voltage and High Current CONTROLLED DC Output power. This DC power is supplied to the Ti anodes, to produce the designed Sodium Hypochlorite Output.
- Generating Chamber** - Ti anodes arranged on the Chamber lid by flange mounting. So the entire seawater passes through Ti anodes.



Maintenance and Service

There are service and maintenance procedures presented in each of our Manuals. However, the equipment has no moving parts and should require for little or no maintenance. The renewal of Ti anodes will be required periodically and can be accomplished with a minimum of down time if the procedures in this manual are followed.

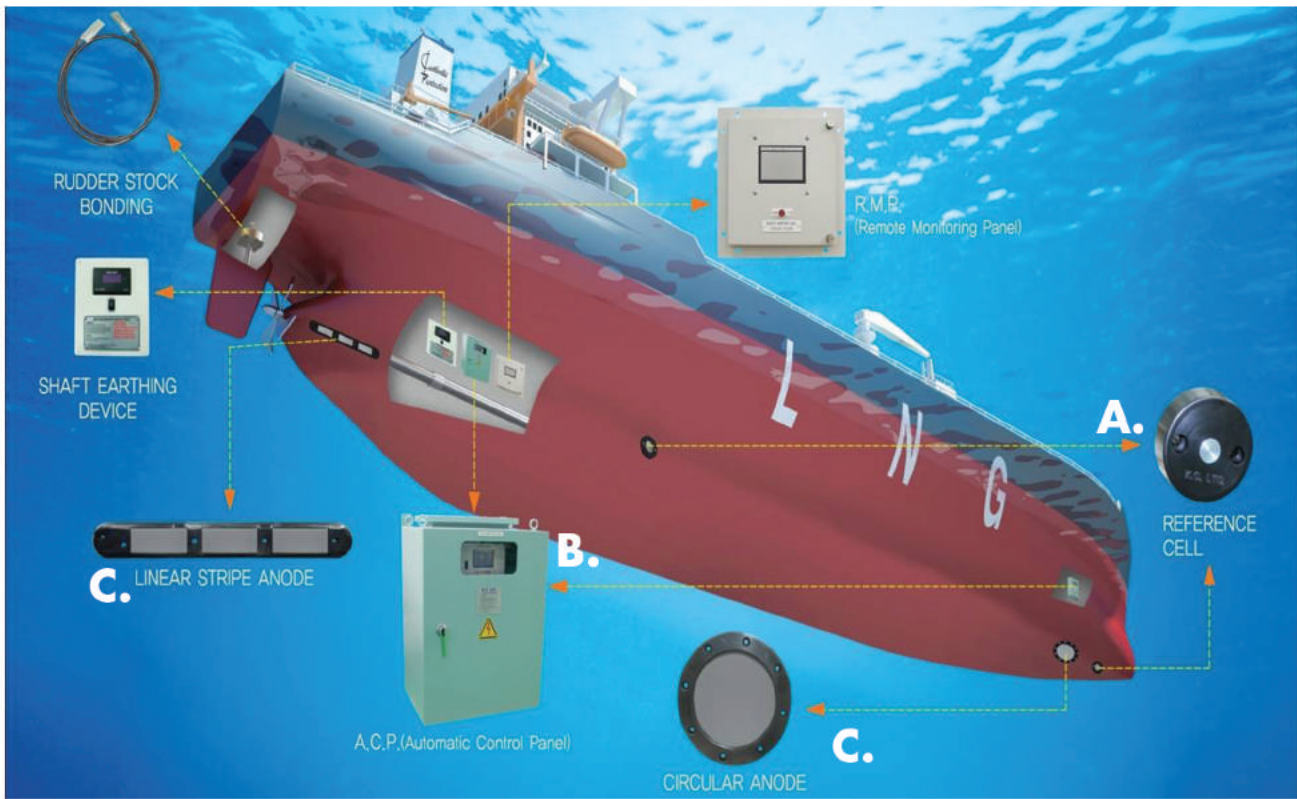
Ti-Pt Titanium Anode TD180P 360P 600P 800P 1200P 1600P 2400P series



Impressed Current Cathodic Protection (ICCP) System

Impressed current cathodic protection systems provide automatic, permanent protection that prevents electrolysis and galvanic corrosion from attacking the submerged surfaces of a broad range of sea-going vessels and fixed or mobile offshore structures.

ICCP Typical System Components



A. Computer Controllers

Each standard ICCP system utilizes a solid-state controller which monitors and controls the protection as measured by the Zinc Reference electrode.

B. Reference Electrodes

ICCP systems are controlled to assure optimum protection. This control is obtained by inserting a third electrode between the anode and the cathode. Electrodes constructed of Zinc are used exclusively with the ICCP system.

C. MMO-surfaced Anodes

MMO-surfaced anodes on Tantalum and Niobium and Titanium Substrates are used exclusively in the ICCP system. ICCP anodes are manufactured in Linear Loop, Elliptical anodes, and Circular shaped with insulating holders. They are available up to a capacity of 225 amperes.

Electrocatalytic Products



CAPAC Pt-Nb Anode



Ag/AgCl, Reference Electrode - Part No 32622