

Cathelco 

**ICCP Hull Corrosion
Protection Systems**

 **C-SHIELD**



The Problem of Corrosion

Corrosion takes many forms in the marine environment. It can be seen as pitting on hull plates; in the disintegration of weld seams; around bow thrusters and on the surfaces of rudders and other vital components.

A well designed ICCP system can eliminate these problems, safeguarding the structural integrity of the vessel and significantly reducing maintenance costs throughout its operational life.

By installing a Cathelco system you can have the advantage of world leading ICCP technology combined with the expertise which goes with wide understanding of corrosion problems and the most effective way of solving them.



Pitting corrosion around exhaust discharge.



General corrosion on hull plate.



Corrosion around bow thruster.



Corrosion 'blisters' on hull plate.

Cathelco ICCP systems for vessels of every type

Cathelco C-Shield impressed current cathodic protection (ICCP) systems have now been fitted to more than 10,000 vessels around the world, establishing a record of effective performance and reliability on ships of every type:-

- Cruise Ships
- Container Vessels
- VLCCs
- Ferries
- FPSOs
- Ice Class Vessels

The systems continue to advance through the introduction of a wider range of control panels. These take advantage of the latest advances in technology to provide systems which are not only effective, but economical to install.

Cathelco have also developed an unusually wide range of anodes covering elliptical, circular and linear loop designs to suit various hull profiles with the aim of simplifying installation time and reducing costs.

Other developments have included the introduction of ICCP systems which are specifically designed to protect bow and stern thruster tunnels. Alongside this has gone the design of more sophisticated shaft earthing systems and rudder bonding equipment to provide reliable protection for propulsion and steering systems on today's vessels.

In the case of smaller vessels, the Minitek and Alutek systems are compactly designed to protect steel and aluminium hulls, respectively.

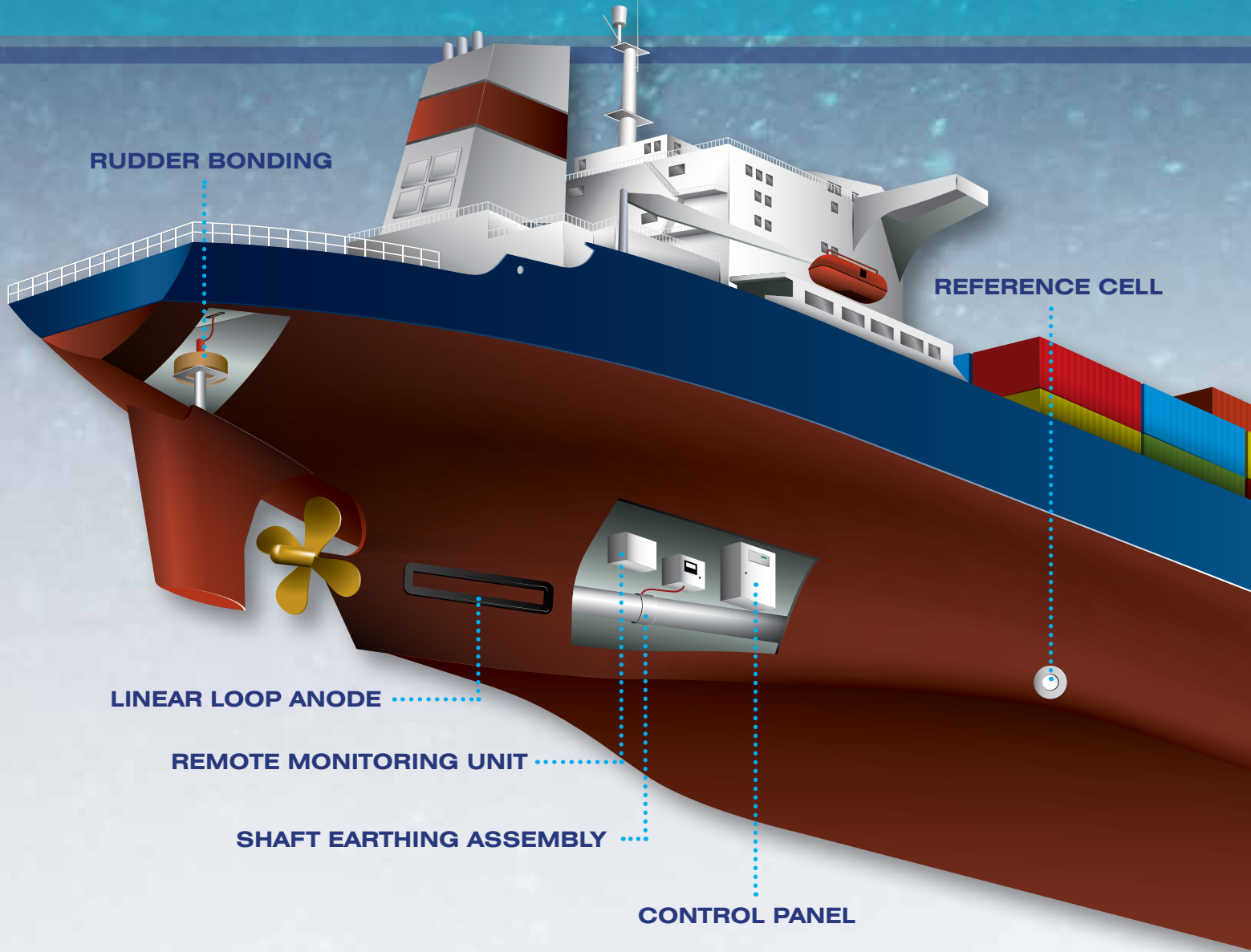
Cathelco serves customers globally through a well established network of over 40 agents who can provide on-the-spot access to technical advice and commercial support.

Following a series of takeovers, Cathelco incorporates the following product ranges:-

- Cathelco
- Corrintec
- Jotun
- Morgan Berkeley
- Wilson Taylor
- F.A.Hughes



Impressed Current Cathodic Protection Systems



Linear Loop Anodes

Produce a powerful output from a relatively small surface area. Lightweight and easy to install.



Circular Anodes

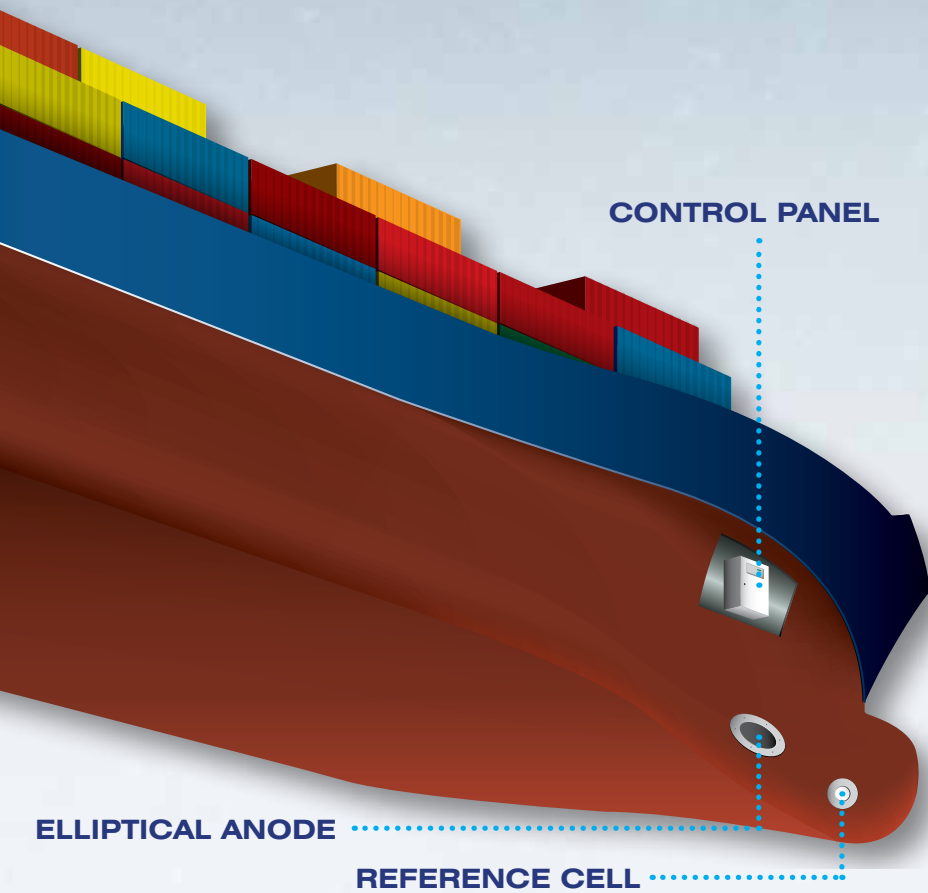
Ideally suited to vessels where a smooth hull profile is required. Can be flush mounted in areas where space is limited.



Elliptical Anodes

The elliptical shape enhances current distribution. Provides the flexibility to fit into complex hull profiles.

Most operators recognise the need to combine modern hull coatings with a purpose designed impressed current cathodic protection system. The C-Shield system suppresses corrosion on the wetted surface of the hull using an arrangement of hull mounted anodes and reference cells connected to a control panel. This neutralises 'corrosion cells' and eliminates problems that arise through dissimilar metals and the proximity of components such as propellers.



CONTROL PANEL

ELLIPTICAL ANODE

REFERENCE CELL



Diver Change Anodes

Can be changed from the outside of the hull by a diver. Ideal for FPSOs and vessels with long intervals between drydocking.



Reference Cell

Designed to measure the electrical 'potential' at the seawater/hull interface.

A choice of control panels

Thyristor Panels

C-Shield thyristor control panels combine cost effectiveness with rugged reliability that has been proved on vessels of all sizes worldwide.

They also incorporate the latest computerised information systems enabling the status of the ICCP system to be monitored by ships' computers.

Thyristor control panels can be used for systems of up to 1,000 amps with 8 anodes and 4 reference cells being controlled by an individual panel. They are ideal for the requirements of cruise ships, VLCCs and many types of container and cargo vessels.

The popularity of these panels means that they can generally be supplied within relatively short lead times.

- For ICCP systems of up to 1,000 amps.
- Reliable performance with minimum attention.
- Economical control for systems of all sizes.
- Combines computerised output displays, alarms and information systems.
- Up to 8 anodes and 4 reference cells per panel.
- Easily configured to clients' requirements.



Modular Panels

The C-Shield modular control panel, based on advanced computerised electronics, is designed for installations of up to 350 amps.

Extremely lightweight and compact in design, it can be easily installed in engine rooms and requires the minimum of attention from the crew.

One of the major advantages of the unit is that the modules are interchangeable and can be quickly removed and replaced if necessary, thereby offering greater reliability.

- For ICCP systems of up to 350 amps.
- Modular design for greater reliability and flexibility.
- Extremely lightweight and compact.
- Clear digital output displays.
- Incorporates 'under' and 'over' protection alarms
- Can be linked to bridge information systems

Minitek Panels

The Minitek system has been designed to protect smaller steel hulled vessels against corrosion. It has been widely installed on tugs, fishing vessels and workboats where engine room space is at a premium.

- Operates from 230V a.c. electrical supply.
- Control panel measures 600mm x 600mm x 210mm
- Far superior to sacrificial anode systems where output cannot be verified.



Alutek Panels

The Alutek system provides carefully controlled protection for aluminium hulls using an arrangement of flush mounted anodes, monitoring electrodes, controlling electrodes and di-electric shield sensors.

- Operates from 230V or 115V a.c. electrical supply.
- Control panel measures 400mm x 500mm x 210mm.
- Lower yard installation cost than recessed sacrificial anode systems

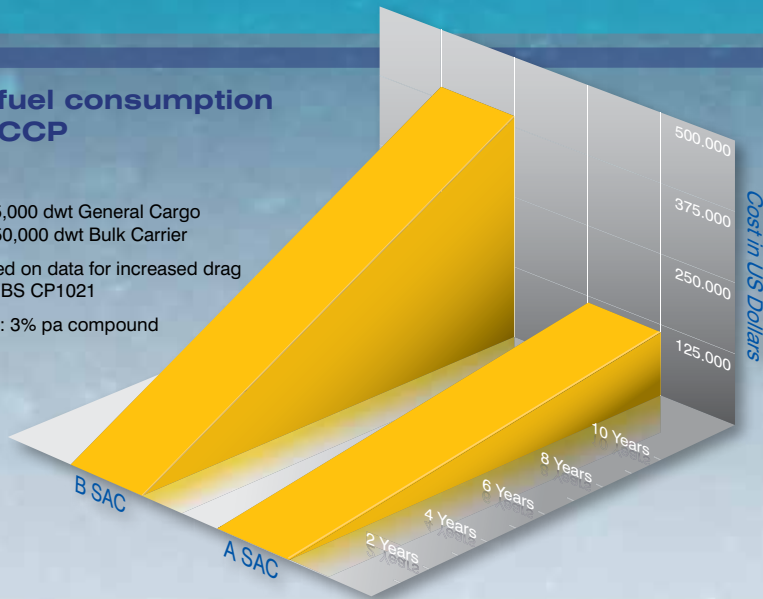


C-Shield - the savings

Additional fuel consumption - Sacs vs ICCP

Notes

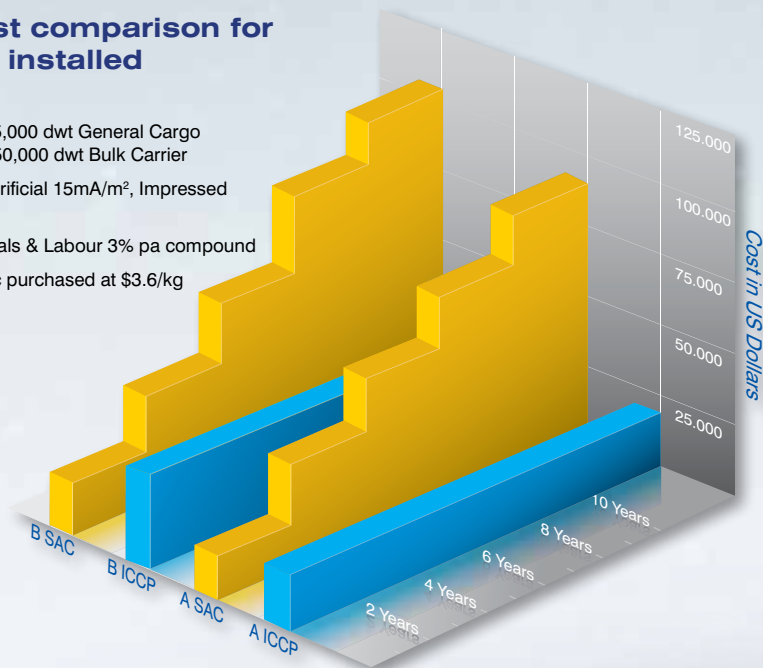
1. Ship Types: A - 25,000 dwt General Cargo
B - 150,000 dwt Bulk Carrier
2. Costings based on data for increased drag contained in BS CP1021
3. Escalation: 3% pa compound



Capital cost comparison for equipment installed

Notes

1. Ship Types: A - 25,000 dwt General Cargo
B - 150,000 dwt Bulk Carrier
2. Design Basis: Sacrificial 15mA/m², Impressed Current 30mA/m²
3. Escalation: Materials & Labour 3% pa compound
4. SAC Anodes: Zinc purchased at \$3.6/kg



Over a ten year period, significant savings result from the use of C-Shield impressed current cathodic protection.

It used to be the case that ICCP systems were more expensive to install than sacrificial anode systems, but the escalating price of zinc has reduced the cost differential making ICCP systems an even more attractive proposition.

One of the main disadvantages of sacrificial anodes is that they have to be renewed at periodic drydocking intervals as they become consumed, resulting in on-going replacement costs.

In contrast C-Shield anodes last for many years and achieve a more much reliable level of protection without the extra weight or drag which is inevitably associated with sacrificial methods.

In addition, major operational savings result from the use of C-Shield. A smooth hull, free from corrosion ensures the lowest fuel consumption for the vessel. Data has shown that unprotected vessels, after as little as 2.5 years, can require an additional 30% increase in shaft power to maintain service speed.

Throughout the design of the C-Shield system, every care has been taken to ensure the highest reliability commensurate with minimal installation time. The lowest cost system may leave the installer with the highest work load.



Shaft Earthing

Even on ships fitted with ICCP or sacrificial anode systems, propeller shaft bearings are vulnerable to corrosion.

This is because turning propeller shafts are electrically insulated from the hull by the lubricating oil film in the bearings and by the use of non-metallic bearing materials in the tail shaft.

The problem can be eliminated if the shaft is earthed to the hull using a propeller shaft slipring. Cathelco supply complete shaft earthing assemblies consisting of a pair of high silver content/graphite compound brushes mounted in a balanced brush holder, running on a copper slipring with a solid silver inlay track. This combination has been proved to give the optimum electrical continuity. The number of brushes depends on the size of the vessel. Smaller craft have a single brush holder.



Installation

The shaft slipring is supplied as two matched halves, complete with band and clamping arrangement and can be readily installed by competent engineering personnel.

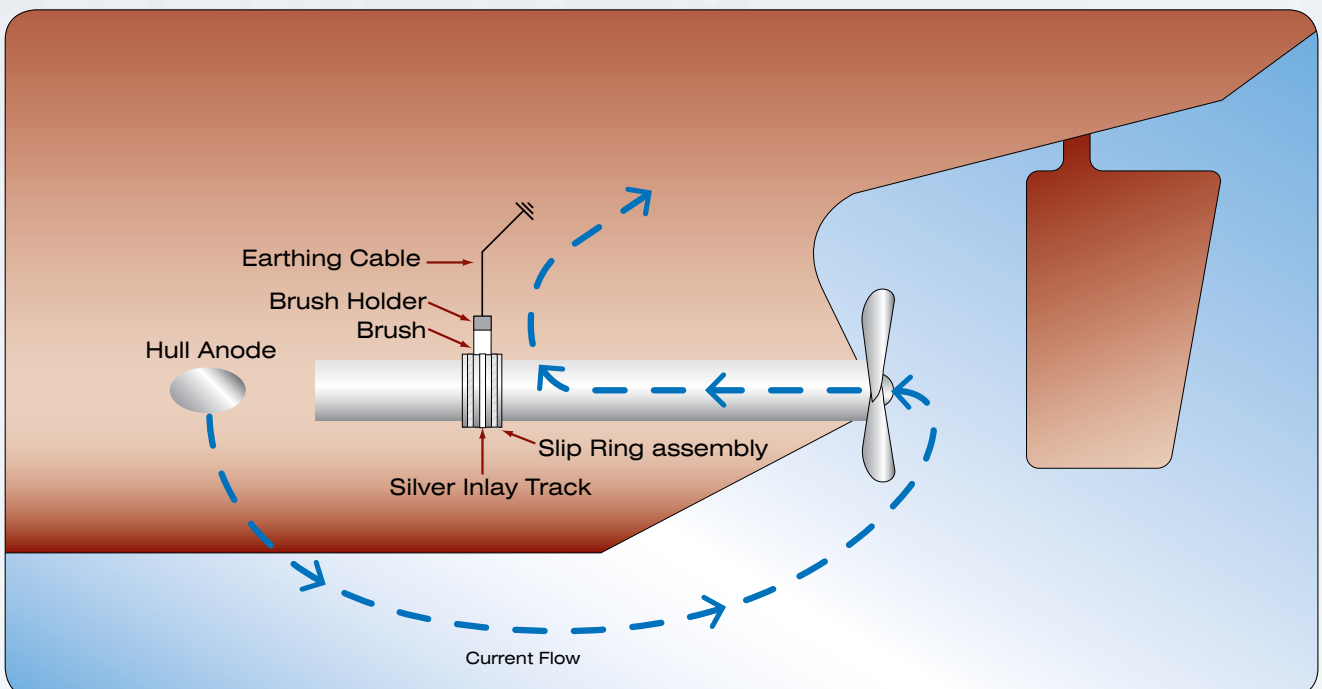
The balanced brush holder is supplied ready for fitting to a shipyard-supplied 20mm diameter rod and mounting bracket.

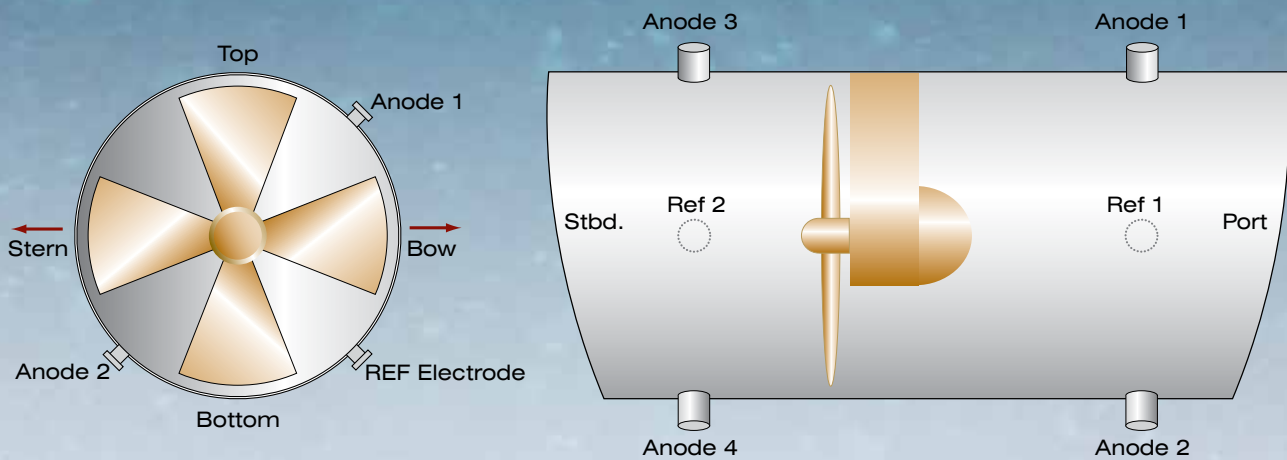
Each brush holder has an adjustable tensioner to ensure good electrical contact and maximum brush utilisation.



Propeller shaft potential monitoring

Cathelco supply compact millivolt meters to monitor the potential between the shaft and the hull and verify the effectiveness of the system. The meters can be located in a convenient position for monitoring by the crew.





Large Thruster Tunnel ICCP Systems

Bow and stern thruster protection is a specialised area where Cathelco have developed a system which is uniquely effective in providing corrosion protection.

Problems of corrosion arise because of the dissimilarity of the materials used in the hull and thruster tunnel construction and remain unchecked because they are outside the scope of conventional ICCP systems.

Cathelco's thruster tunnel systems are installed on ocean going vessels, harbour tugs and in offshore oil and gas applications.

The equipment consists of a power unit/controller and an arrangement of reference cells and anodes positioned on either side of the tunnel. The anodes and reference electrodes are flush mounted to maintain the optimum performance of the thrusters and reduce the effects of turbulence which can accelerate corrosion.



The Star Ismene is fitted with bow and stern thruster tunnel ICCP Systems



Example of corrosion in and around thruster tunnel.

This has a number of advantages in comparison with sacrificial anode systems where anodes are much heavier, have to be checked at regular intervals and replaced at each drydocking. In contrast, the Cathelco system provides carefully monitored, precisely delivered corrosion protection for a design life of up to 15 years.

The system operates continuously when the vessel is at sea, but when the impeller is activated during docking, the equipment is automatically shut down using a fail-safe switching system which is installed by the shipyard. This prevents any stray current damage occurring to the bearings and seals.

A system specifically designed to protect your ship against corrosion

System Design

C-Shield systems are specifically designed for the particular requirements of individual vessels and their operating conditions. They can be installed at newbuilding or retrofitted to existing tonnage during scheduled drydocking.

With comprehensive experience of ICCP system design and the factors which influence hull corrosion, Cathelco's engineers will formulate the most effective arrangement of hull anodes, reference cells and control panel(s). An important part of the service is the preparation of detailed installation drawings and instructions covering every aspect of the system.

All systems are provided with comprehensive manuals as part of the standard package. These include sections on theory, installation, operation, maintenance, fault finding, drawings and spare part listing.

Customer support

Cathelco engineers, based world-wide, provide on-going service support for customers including:-

- Commissioning systems.
- On-site instruction for operating staff.
- Attending service call outs and routine drydocking.

Log sheet analysis

Our service extends to a 'life-time' log sheet analysis service. Log sheets with daily readings completed by the ship's staff are returned to us by e-mail and analysed by our engineers. Reports with comments are then e-mailed back to the operator, ensuring that the system continues to operate effectively.

Quality Approvals

The manufacture of C-Shield systems conforms to the highest standards of quality.

Cathelco Ltd has been assessed by Lloyd's Register Quality Assurance and is registered under BS EN ISO 9001:2000

The C-Shield system fully complies with all British and International Standards.

In particular, BS7361: Part 1: 1991 Cathodic Protection, and is approved by all leading ship classification societies.



Replacement Anodes

C-Shield anodes can be used as direct replacements for any ICCP system currently used in the world. They are also designed to be totally compatible with the full range of manufacturers' control systems.

This enables operators to benefit from the latest developments in anode technology, whilst providing considerable cost savings in comparison with replacement using conventional designs from the original equipment manufacturer.



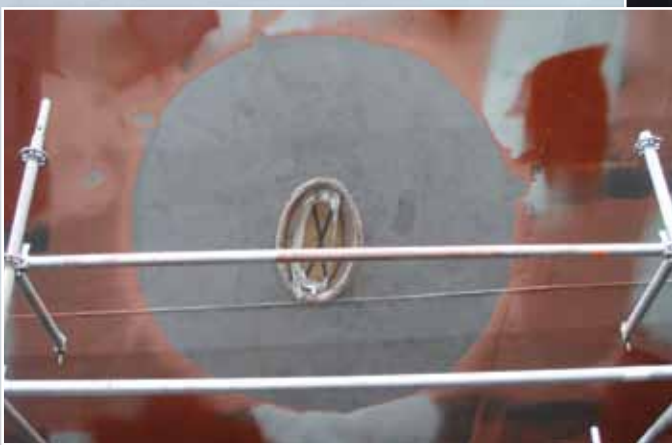
Easier installation

The installation of C-Shield systems follows well established principles which have been approved by all of the leading classification societies.

Depending on the type of anodes being fitted, work begins by cutting holes in the hull to accommodate bosses or doubler plates. These are welded in position ready to receive cofferdams, enabling watertight electrical connections to be made to the anode.



Elliptical anode being fitted



Di-electric shield surrounding elliptical anode

For surface mounted anodes, a mounting plate or mounting studs are welded to the exterior hull surface in preparation for fitting the anode. At this stage, the surrounding area is carefully grit blasted to a white metal finish. Next, a layer of mastic is applied to the anode mounting surface in order to create a watertight seal when the anode is fitted and the studs are tightened. Finally, mastic is applied to the area surrounding the anode to produce a di-electric shield which is essential to ensure the maximum spread of current over the hull surface.



Elliptical anode with di-electric shield



Linear loop anode with di-electric shield

Marine pipework anti-fouling systems

Cathelco is the world's largest manufacturer of seawater pipework anti-fouling systems.

The systems provide complete protection against blockages caused by barnacles and mussels which result in engines overheating, increased fuel usage and costly pipework cleaning and renewal work.

Based on the electrolytic principle, Cathelco systems are easy to install, automatic in operation and have a record of effectiveness on more than 20,000 vessels of every type.



Jotun Marine Coatings

In more than 50 countries Jotun Marine Coatings assists and advises customers on the most effective solutions to the prevention of corrosion and fouling.



Jotun is active in every aspect of coating technology. This expertise is built on investment, innovation and practical knowledge earned in the protection of more than 15,000 vessels throughout the world. Jotun is recognised as the leading supplier of high technology coatings and the most advanced TBT free antifoulings.

Jotun Marine Coatings and Cathelco can offer customers a complete package where the combination of both coatings and cathodic protection will give the most effective prevention against corrosion and fouling.



We recommend Jotun coatings

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Worldwide Service Network

Our worldwide network of sales and service centres can provide immediate advice and assistance on the complete range of Cathelco products. Agents' contacts details are available on our website: www.cathelco.com

Abu Dhabi	Israel
Algeria	Italy
Argentina	Japan
Australia	Korea (<i>Seoul & Pusan</i>)
Belgium	Malaysia
Brazil	Mexico
Bulgaria	New Zealand
Canada (<i>East & West Coast</i>)	Norway
Chile	Philippines
China (<i>Dalian, Guangzhou, Shanghai, Hong Kong</i>)	Poland (<i>Gdansk & Szczecin</i>)
Croatia	Portugal
Cyprus	Romania
Denmark	Russia
Egypt	Singapore
Finland	South Africa (<i>Durban & Cape Town</i>)
France (<i>Atlantic & Mediterranean Coasts</i>)	Spain
Germany	Sweden
Greece	Taiwan (<i>Kaohsiung & Taipei</i>)
Holland	Thailand
Iceland	Turkey
India	United Arab Emirates
Indonesia	USA (<i>East, West & Gulf Coasts</i>)
Iran	Vietnam
Ireland	Venezuela



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