



## M.C.S –For Marine Anti-corrosion & Anti-fouling

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Marine ICCP & MGPS System

*Marine Corrosion Service Limited*  
钦盾船舶工程(上海)有限公司



## Company Introduction:

Marine Corrosion Service (MCS) is a company providing Marine Cathodic Protection solutions and services in China, we have an expert engineering team, who is available for the marine ICCP anti-corrosion system & MGPS anti-fouling system.

We are also authorized service stations and spare distributors of the main makers in China.

Based upon our experienced engineers, with the best spare part solutions (We have sufficient inventory of the spares to be standby for the emergency needs), which enable us to carry out the complete engineering work on the systems with competitive cost.

The main global makers listed as below:

CATHELCO / KC / WILSON WALTON / ACG / CAPAC / JOTUN / WILSON TAYLOR / MORGAN / MME / NIPPON / C.W.C / CHUO-KOUSAN / TRATEC / SAACKE/DAST



Anode renewal



Ref. cell renewal

## Our specialties are:

### Technical service for ICCP & MGPS system

- Pre-docking inspections
- Inspection, repair and maintenance work while in dry-dock
- Spare part renewal & engineering work while in dry-dock

### Spare part and material supply for ICCP & MGPS system

- Spare anode/reference cell for ICCP system
- Spare anode/electrode for MGPS system (Cu/Al/Fe)
- Ag alloy brush/brush holder/slip ring/mV meter for shaft earthing/monitoring assembly
- Controller power unit for ICCP & MGPS system
- Epoxy filler for Di-electric shield

### Sacrificial Zinc/Al anode supply & service

To survey and assess the status on site to calculate and propose the proper anode distribution scheme for the Hull/Tank/Rudder/Propeller/Sea chest areas

Based upon the long term cooperation with the anode foundry in China, We can always be able to provide the most reliable quality products with competitive cost.



Circular Anode



Linear Anode



Elliptical Anode



ICCP system inspections in dry-dock



ICCP anode renewal work in Dry-dock



New MGPS electrode assembly



MGPS anode



ICCP system inspections on the control panel



Di-electric shield coated

## 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.

As 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 utilizing MCS service you can have the advantage of professional service engineers who goes with wide understanding of corrosion problems and the most effective way of solving them.



Hull conditions with defective ICCP system



Hull conditions with ICCP system working

## ICCP(Impressed Current Cathodic Protection)

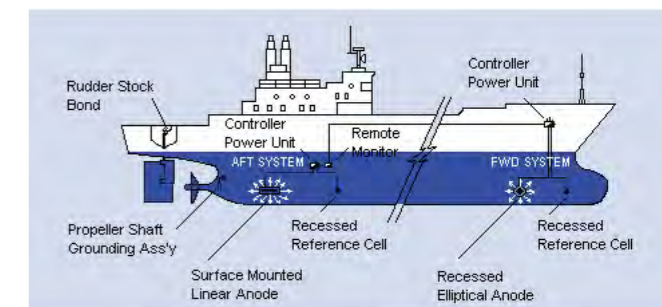
### HOW DOES AN ICCP SYSTEM WORK?

Although modern hull coatings provide some protection against corrosion they do not offer a complete solution. For this reason operators choose to protect their vessels with a purpose designed impressed current cathodic protection system.

Using an arrangement of hull mounted anodes and reference cells connected to a control panel(s), the system produces a more powerful external current to suppress the natural electro-chemical activity on the wetted surface of the hull.

This eliminates the formation of aggressive corrosion cells on the surface of plates and avoids the problems which can exist where dissimilar metals are introduced through welding or brought into proximity by other components such as propellers.

The systems are designed to automate the current output while the voltage output is varied. This allows the protection level to be maintained as the seawater resistivity alters. In a sacrificial anode system, increases in the seawater resistivity can cause a decrease in the anode output and a decrease in the amount of protection provided.



Typical Layout of Impressed Current Cathodic Protection System

With ICCP systems protection does not decrease in the range of standard seawater.

An essential feature of ICCP systems is that they constantly monitor the electrical potential at the seawater/hull interface and carefully adjust the output to the anodes in relation to this. Therefore, the system is much more effective and reliable than sacrificial anode systems where the level of protection is unknown and uncontrollable.

By installing a ICCP system, operators can make significant savings in hull maintenance costs as well as achieving reductions in fuel costs by having a smooth hull surface. Furthermore, the system will safeguard the owner's investment and ensure greater safety through stronger hull integrity.



ICCP anode renewal work



Inspection & repair on MGPS panel



MGPS anodes on strainer's lid



CAPAC Pt/Ti Anode



ICCP anode renewal work



Fault finding on the ICCP power unit

## Service scope:

- Technical service of all makers and models
- Full system testing and evaluation, both in-water and on dry-docking
- Hull component inspection and replacement
- New system installation/supervision
- Offshore health check surveys and Class inspections
- Offshore hull potential surveys

AT MCS, Our Service Team, known for their can-do attitude, years of experience and diagnostic expertise, is eager to provide support for your fleet and solutions to your problems. We offer efficient, reliable service on all ICCP & MGPS systems.



New set S.E.D. installed

## ICCP Logsheet Month

Month October  
Year 2011

Vessel Name Hull Number 307325 Next Dry Docking NA Vessel Type Tanker 30  
 Manufacturer Serial Number 15117/R Forward Set Point NA mV Aft Set Point NA mV  
 Aft System Capacity 400 Amp 24 Volts Forward System Capacity 100 Amp 24 Volts

Day	Area of Operation	Sea Temp/ C	Shaft Earthing Potential 0~250mv	Aft ICCP System						Forward ICCP System							
				Current /A	Voltage /V	Ref Cell S1/mV	Ref Cell S2/mV	Ref Cell S3/mV	Ref Cell S4/mV	Mode /Status	Current /A	Voltage /V	Ref Cell S1/mV	Ref Cell S2/mV	Ref Cell S3/mV	Ref Cell S4/mV	Mode /Status
1	AT SEA	27	50	0	1.4	210	215	NA	NA	A-0%	5	4.6	220	220	NA	NA	A-0%
2	Suez Canal - Transit	28	50	0	1.4	210	220	NA	NA	A-0%	5	4.4	220	225	NA	NA	A-0%
3	AT SEA	28	60	0	1.7	205	215	NA	NA	A-0%	8	5.7	220	220	NA	NA	A-0%
4	AT SEA	29	50	0	1.5	210	220	NA	NA	A-0%	8	5.7	220	220	NA	NA	A-0%
5	AT SEA	31	50	0	1.1	210	220	NA	NA	A-0%	8	5.7	220	220	NA	NA	A-0%
6	AT SEA	32	50	0	1.7	205	215	NA	NA	A-0%	7	5.5	220	215	NA	NA	A-0%



ICCP Linear anode renewal work



Relocate the MGPS anode from sea chest to strainer



MGPS anode with micro chip



Faulty Anode



New anode installed



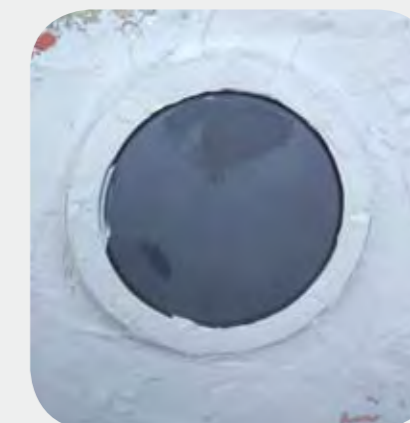
Ref. cell in poor condition



Ref. cell renewal



Di-electric shield applied



New anode installed



Anode leakage



Di-electric shield in poor conditions



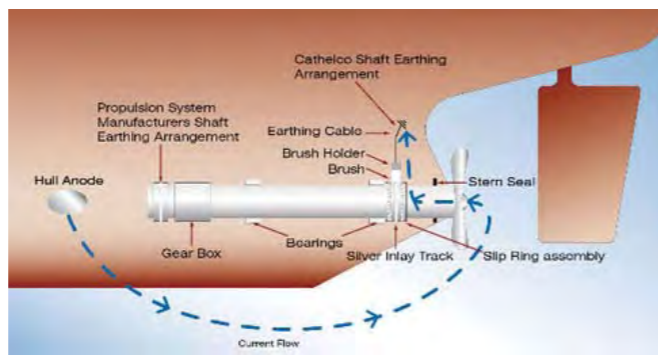
Ag/AgCl Ref. cell

## S.E.D. (Shaft Earthing Device)

Even on ships fitted with ICCP or sacrificial anode systems, propeller shaft bearings are vulnerable to corrosion. This is because turning shafts are electrically insulated from the hull by the lubricating oil film in the bearings and by the use of non-metallic bearings in the tail shaft. The problem can be eliminated if the shaft is earthed to the hull using a propeller shaft slip-ring. The complete shaft earthing assemblies consisting of a pair of high silver content/graphite brushes mounted in a balanced brush holder, running on a copper slip-ring with a solid silver inlay track. This combination has been proved to give the optimum electrical continuity.

The compact mV meter to monitor the potential between the shaft and the hull and verify the effectiveness of the system, If the assembly is not working properly:

- Spark erosion resulting in damage to the bearings.
- Cavitation damage to the tips of the propellers.
- Formation of deeper pits in propellers due to the corrosion/erosion cycle.



The layout of the shaft earthing & monitoring assembly



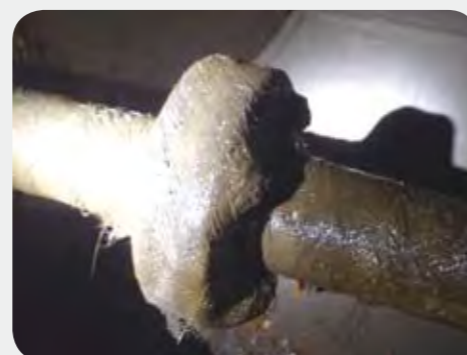
Slip ring in poor conditions



ICCP anode inspection



CAPAC Panel



Conduit pipe leakage repaired



Shaft polishing



Poor Slip ring



Poor shaft



Shaft polished



Poor brush holder



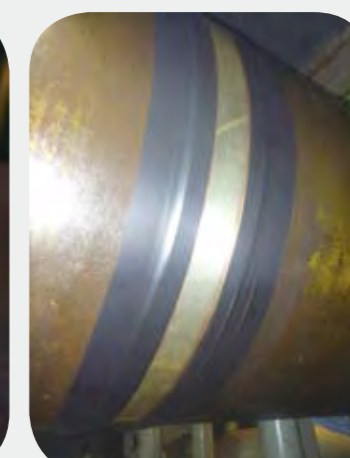
Slip ring installed



New S.E.D. installed



Faulty slip ring



New slip ring fixed

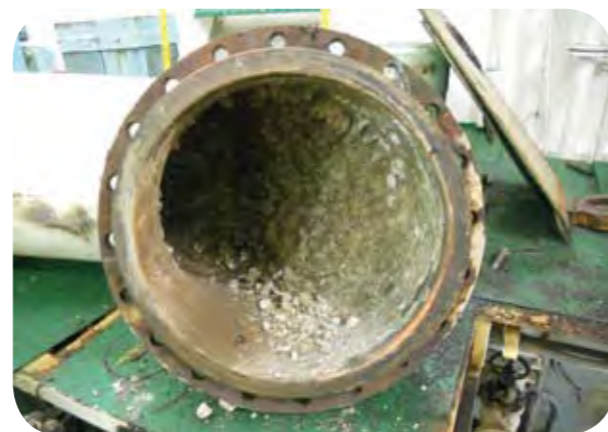
## The problem of bio-fouling in pipework

The purpose of the MGPS system is to prevent blockages in seawater cooling systems caused by various forms of marine growth.

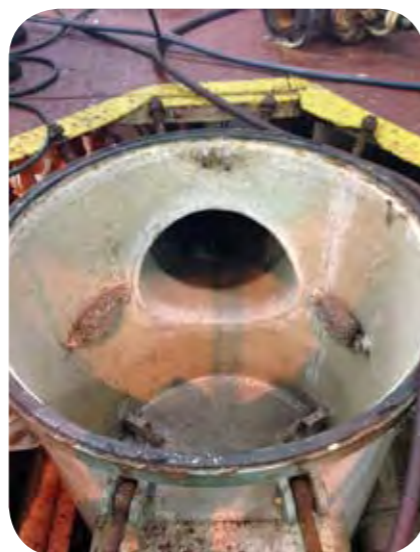
Blockages are expensive and time consuming to remove, particularly when whole sections of pipework need to be cleaned or replaced.

There is also the risk that seawater valves and other important items of equipment are affected jeopardizing the operational capability and safety of the vessel.

Even partial blockages can have serious consequences, making engines run at abnormally high temperatures and significantly increasing fuel usage. This has a direct bearing on the cost of vessel operation and profitability.



Pipework with defective MGPS system



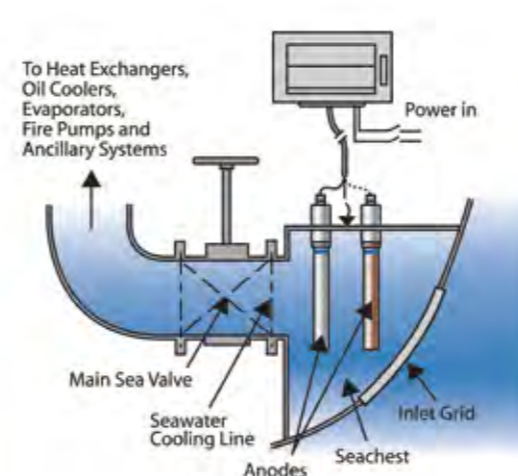
Pipework with MGPS system working

## MGPS(Marine Growth Prevention System)

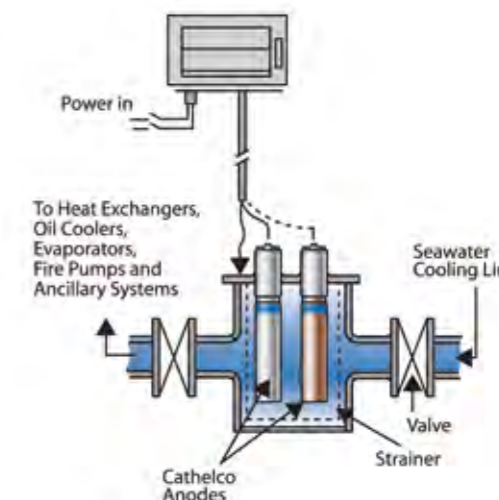
### HOW DOES A SEAWATER PIPEWORK ANTIFOULING (MGPS) SYSTEM WORK?

The anti-fouling system, also known as MGPS, has proved to be an effective and reliable method of eliminating blockages caused by bio-fouling.

The system usually consists of pairs of copper and aluminum anodes which are mounted in sea chest or strainers and wired to a control panel. In the case of cupro-nickel pipe work, a ferrous anode is used instead of the aluminum anode.



Anodes mounted in sea chest



Anodes mounted in strainer

Remark( Left ) : The anodes can be renewed/checked only while vessel is in dry dock in case anodes are installed in sea chest.

Remark ( Right ) : The anodes are free from any renewal/maintenance/inspection even while vessel is afloat in case anodes are installed in strainer.



K.C. Ref. cell



Cathelco ICCP anode 75 Amps



Sacrificial anode



Worn MGPS anode



New MGPS anode assembly



mV meter for S.E.D.

In operation, the copper anode produces ions which are carried by the flow of seawater, creating an environment in which barnacles and mussels will not settle or multiply.

By introducing copper ions in very small concentrations, around 2 parts per billion, the system interrupts the settlement sequence of mussel and barnacle larvae.

Instead of adhering to the surface of seachests, strainers and pipework, the larvae pass harmlessly through the cooling water system to the point of discharge.

Without anti-fouling protection, pipes become encrusted with organisms leading to partial or total blockages which reduce the efficiency of the seawater cooling system.

The action of the copper ions is assisted by aluminum hydroxide created by the aluminum anodes which flocculates the released copper from the copper anodes.

This highly gelatinous copper-aluminum hydroxide floc is carried throughout the system and tends to spread out into the slow moving areas closer to the pipe surfaces where marine larvae are most likely to settle.

As a result, marine growth larvae do not settle, instead passing direct to discharge. At the same time, aluminum film is built up on the internal surfaces of pipes to suppress corrosion. In this way, the system has a dual action protecting seawater pipework against bio-fouling and corrosion.



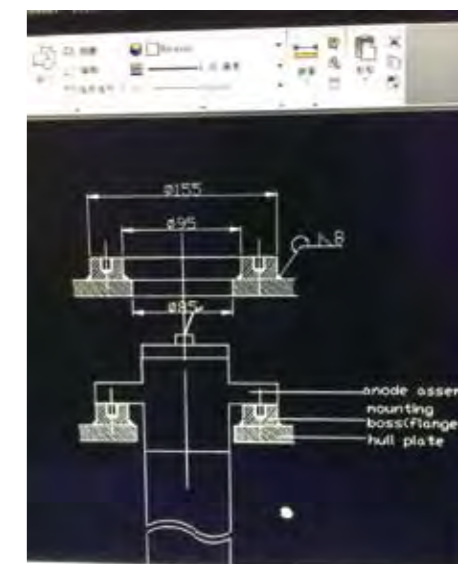
MGPS Anode Ass'y

## Service scope:

- Service of all makers and models
- Full system testing and evaluation, both in-water and on dry-docking
- Anode inspection and replacement
- System installation
- Offshore health check surveys and Class inspections

We also monitor system data, providing analysis, system status reports and recommended actions.

Ensuring that your ships and offshore drilling assets are protected from corrosion at all times is our top priority.



## MGPS SYSTEM DESIGN

DRY DOCKING INTERVAL	3.0
PIPEWORK MATERIAL	Ferrous
ON BOARD POWER	220VAC
UTILISATION	0.8
DOSING RATE (ppb)	2.0

SEACHEST		1	2	3	4	5
FLOWRATE (m3/Hour)		1110	1110			
COPPER	Weight (kg)	73.0	73.0	0.0	0.0	0.0
	Quantity	1.0	1.0	1.0	1.0	1.0
	Diameter (mm)	120.0	120.0	102.0	102.0	102.0
	Length (mm)	725.0	725.0	0.0	0.0	0.0
ALUMINUM	Weight (kg)	51.5	51.5	0.0	0.0	0.0
	Quantity	0.8	0.8	1.0	1.0	1.0
	Diameter (mm)	120.0	120.0	102.0	102.0	102.0
	Length (mm)	725.0	725.0	0.0	0.0	0.0
CURRENT (A)	Copper	1.85	1.85	0.00	0.00	0.00
	Aluminum	1.72	1.72	0.00	0.00	0.00



New MGPS anode assembly



MGPS anodes mounted on strainer's lid



New MGPS anode assembly



Anode renewal work in the tank



Maintenance and repair work on the Di-electric shield



Inspection on mV meter for shaft grounding assembly



Worn anode



Anode with micro chip



worn anode



New anode



MGPS Commissioning



New anode



Worn anode



MGPS system



Worn anode

## Spare parts & materials

We are the authorized spare distributor for the main global makers on ICCP and MGPS systems, we guarantee offering genuine spare parts with competitive prices, and the main global makers listed as below:

CATHELCO / KC / WILSON WALTON / ACG / CAPAC / JOTUN / WILSON TAYLOR / MORGAN /MME / NIPPON / C.W.C / CHUO-KOUSAN / TRATEC / SAACKE/DAST



MGPS anode & accessories



Spare MGPS anode



Wilson Walton Ref. cell



Epoxy filler for ICCP Di-electric shield





Slip ring in stock



Cathelco Ref. cell



Cathelco ICCP Anode



Capac Ref. cell



ACG Anode & Ref. cell



Silver alloy brush & holder

## Sacrificial zinc Anodes ( L.R. Certified )

### Characteristics

Zinc anodes are cast in Special High Grade high purity alloys, which are the ideal corrosion protection solution where the use of aluminum anodes is restricted, as in the upper areas of tanks

- Economical and Time-Tested, Zinc anodes set the standard for affordable corrosion protection.
- Optimal Composition, Quality & Fit is ensured with anodes designed and manufactured at MCS own foundry.
- Comprehensive Range of hull, tank, engine room, bracelet and other anodes is available to suit virtually every marine application.
- Pit-Guard Anodes stop corrosive pitting in cargo and ballast tanks simply and economically.
- Zinc Alloys include the latest Mil-Spec delivering trusted performance, as well as Special High Grade for reliable protection wherever Mil-Spec is not required.
- Immediate Delivery of large quantities of standard anodes is available from stock.
- Custom Zinc Anodes can be produced to satisfy unique specifications.

### Applications

- Ship hulls
- Ballast tanks
- Sea chests
- Rudders
- Propellers

### Installation & Operation

Zinc Anodes are normally clamped or welded into position from an integrated steel core. Zinc Anodes can be installed by shipboard maintenance personnel in accordance with MCS-supplied layout

drawings.

With proper installation, anodes will operate efficiently and economically without attention. They generate their own current and work silently and surely to control corrosion. Apart from routine inspection, no labor costs are involved after installation and no electrical supply is required.

### Zinc anodes are simple and economical

Designed specifically for reliable performance under a variety of environmental conditions, Zinc operates effectively at both low and high temperatures. MCS sacrificial anodes are performance-proven with years of research and commercial use.



Anode for hull & W.B.T.



Welding type anode

## Sacrificial aluminum Anodes ( L.R. Certified )

High Capacity Aluminum Sacrificial Anodes for Shipping & Offshore Industries

Aluminum anodes are cast in low-iron high efficiency aluminum alloys.

MCS anodes are characterized by lightweight and high amperage output.

### Features & Benefits

- Improved Corrosion Protection is provided by MCS higher driving potential compared to zinc or aluminum/mercury alloys.
- Lower Cost per System is achieved because MCS greater efficiency means fewer anodes are needed, saving on material and installation labor costs.
- Optimal Composition, Quality & Fit is ensured with anodes designed and manufactured at MCS own foundry.
- Bulk Melter enables the production of anodes in excess of 1,000lbs.
- Purity Matters. Contaminants like iron reduce anode life and effectiveness, are the purest available, offering exceptional corrosion protection:P0404 Alloy – the purest
- low-iron aluminum alloy for offshore structures and other applications demanding high performance and extended anode life. Contains MAX 0.04% silicon and 0.04% iron.P0506 & P0610 Alloys – low-iron aluminum alloys offering superior performance for most marine applications.
- P0506 contains MAX 0.05% silicon and 0.06% iron. P0610 contains MAX 0.06% silicon and 0.10% iron.

### Applications

- Ship hulls
- Ballast tanks
- Sea chests

- Rudders
- Propellers

### Installation & Operation of Aluminum Anodes

Aluminum anodes are normally clamped or welded into position from an integrated steel core. Aluminum Anodes can be installed by customer maintenance personnel in accordance with MCS supplied layout drawings.

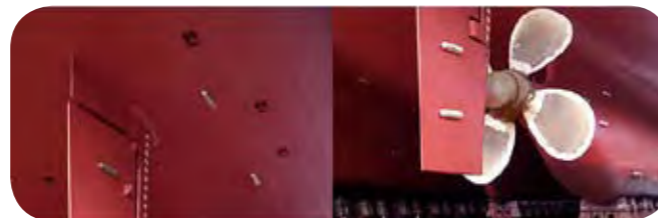
With proper installation, Al anodes will operate efficiently and economically without attention. They generate their own current and work silently and surely to control corrosion. Apart from routine inspection, no labor costs are involved after installation and no electrical supply is required.

### Aluminum Anodes are simple and economical

Designed specifically for reliable performance under a variety of environmental conditions, Aluminum anodes operates effectively at both low and high temperatures. MCS sacrificial aluminum anodes are performance-proven with years of research and commercial use.



Anode for bow thruster

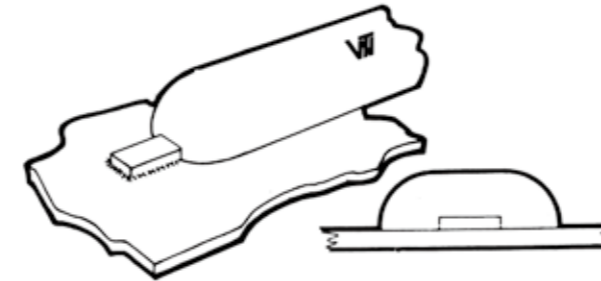


Anode for rudder & stern area

## Typical Methods of Attaching Anodes For Hull and Tank Applications

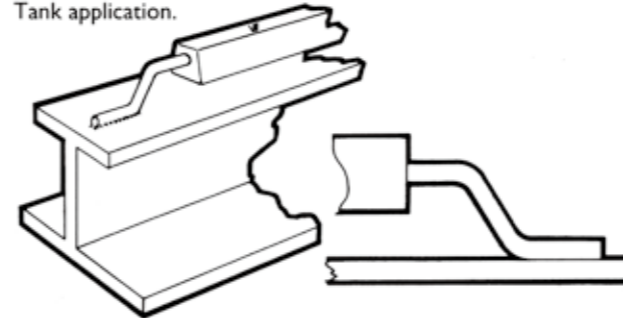
### EXTERNAL

External Hull applications.

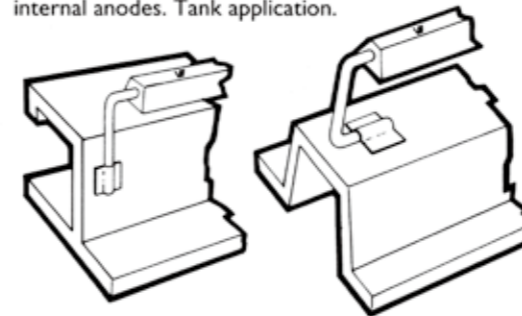


### INTERNAL

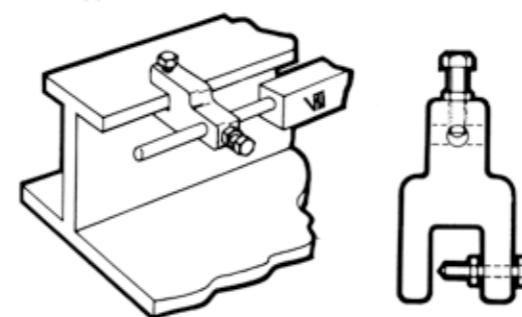
Z TYPE crank weld attachment for internal anodes. Tank application.



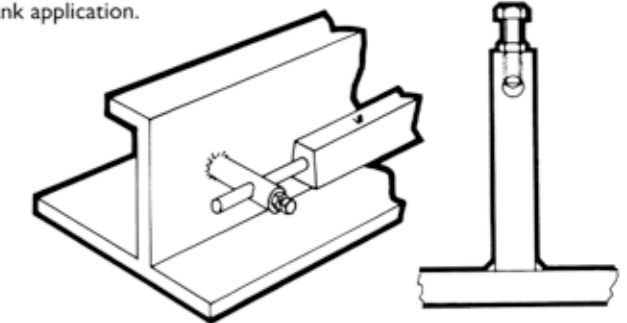
SINGLE & DOUBLE CRANKWELD attachments for internal anodes. Tank application.



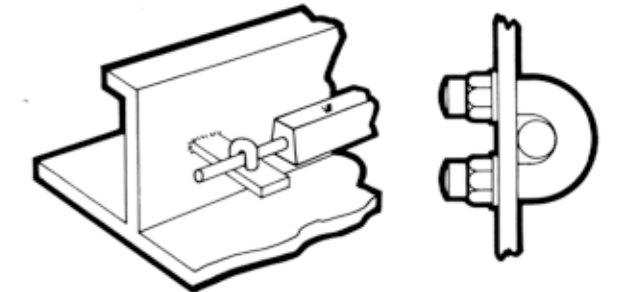
M TYPE clamp attachment for internal anodes. Tank Application.



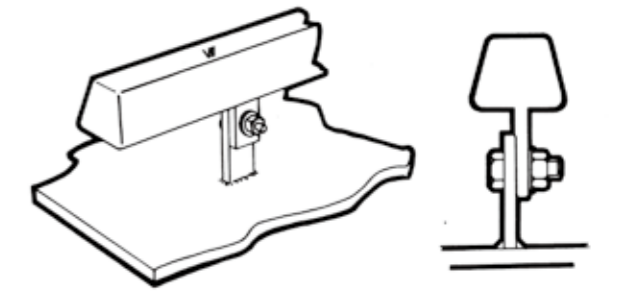
E TYPE stud attachment for internal anodes. Tank application.



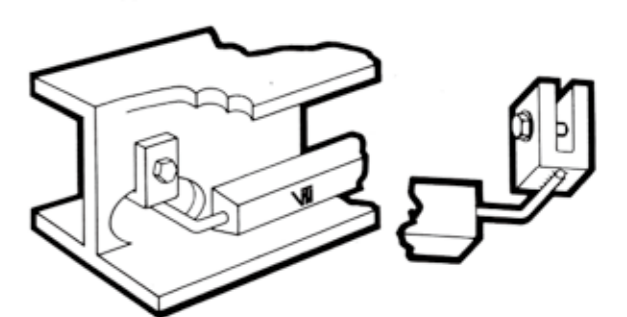
U BOLT attachment for internal anodes. Tank application.



STAND-OFF TYPE attachment for internal anodes. Tank application.



CLAMP TYPE for pitting prevention. Tank bottom application.





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