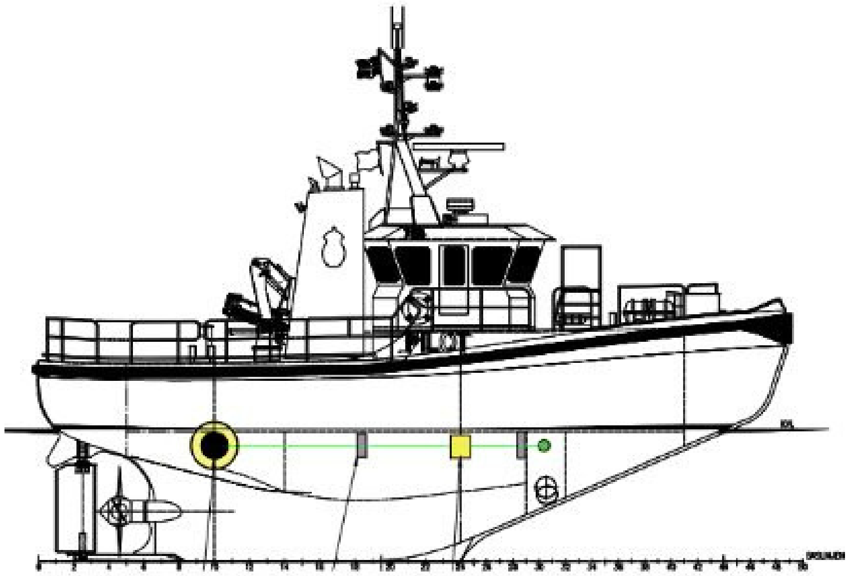
# Corrosion-Group

## Specialists in external corrosion protection since 1989

## Compendium of cathodic protection – ships



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CORROSION GROUP

# Cathodic protection with sacrificial anodes

## Cathodic protection with sacrificial anodes (galvanic protection)

Cathodic protection with sacrificial anodes is based on a spontaneous process in which a base metal (e.g. zinc or magnesium anodes) is sacrificed and slowly dissolves as it emits electrons (current) to the hull, which then becomes a cathode and is protected against corrosion. The sacrificial anodes are attached directly to the hull, the potential difference between the hull and the anode causes a current (electrons) to be emitted from the anode to the hull, which is thus protected.

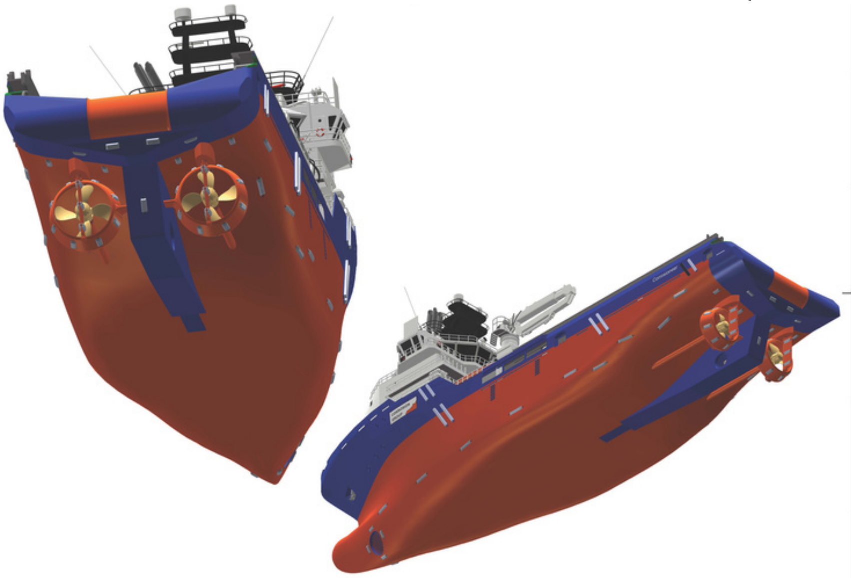

Fig. 5. cathodic protection with sacrificial anodes

## Types of sacrificial anodes

For cathodic protection with sacrificial anodes, zinc, aluminum or magnesium is used. The anodes are mounted with bolts or welding. See figure 6. The choice of material depends on the resistivity of the water, which is affected by the salinity of the water. In general, the following materials are chosen depending on the type of salinity:

-Zinc or aluminum anodes in seawater
-Zinc or magnesium anodes in brackish water
-Magnesium anodes in fresh water

Fig. 6. sacrificial anodes

# Cathodic protection with impressed current

## Impressed current cathodic protection (ICCP*)

This system uses a rectifier as a power source, inert MMO/titanium anodes and a reference
a reference electrode. See figures 7 and 8. The negative pole of the rectifier is connected to the protection object, e.g. a ship's hull, which then becomes the cathode. The potential of the protected object is lowered to a level where it cannot corrode. The positive pole of the rectifier is connected to the anodes, creating a potential difference between the anodes and the protected object. Sacrificial anodes have a consumption in the order of kg/Ampere x year, while inert anodes have a consumption in the order of grams/Ampere x year. Inert anodes consist for example of MMO and titanium. With ICCP, the current output is usually regulated by means of one or more reference electrodes,
which gives good control of the corrosion protection even when the ship is in waters with varying salinity.

*ICCP (Impressed Current Cathodic Protection)

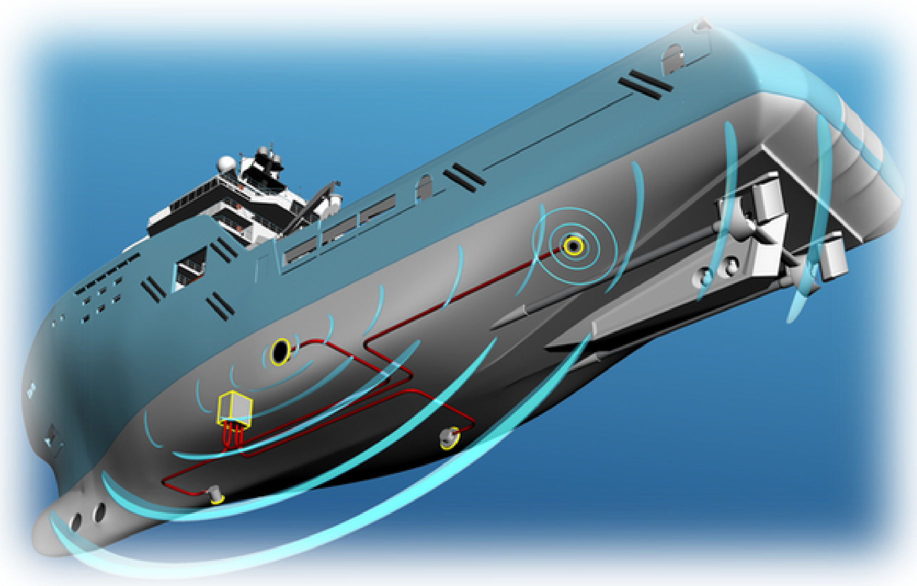

Fig. 7. Impressed current cathodic protection (ICCP)

Fig. 8. MMO/Ti anode and reference electrodes

# Shore current and corrosion

## Corrosion and shore current

There is an increased risk of corrosion when the ship is moored. Leakage currents from various sources cause corrosion that increases the rate of anode consumption or the rate of corrosion below the waterline. There is a risk of severe corrosion when a ship is electrically connected to shore, even if standards and regulations are followed. Corrosion occurs because the hull acts as an anode when the ship is connected to shore power and its protective earth conductor is made of e.g. copper (see Figure 9). The hull and the earth electrode thus form a galvanic steel-copper cell, and the flow of current between these two electrodes causes the hull to corrode, as steel is the less noble metal. To prevent corrosion problems, shore power should be connected through protective transformers. This means that the incoming earth does not make contact with any part of the ship, thus preventing corrosion.

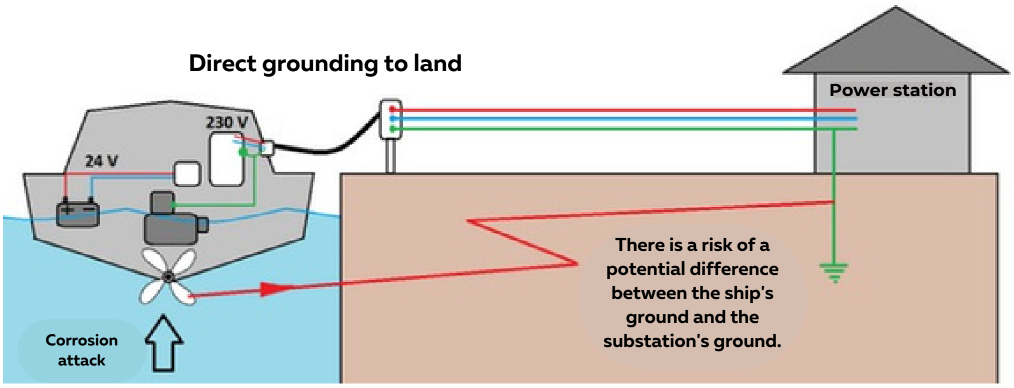


Fig. 9 Corrosion caused by shore power

# Design of cathodic protection

## Design of cathodic protection

For cathodic protection to work, the following criteria must be met:

There must be an electrical contact between the object of protection and the anode. The object of protection and the anode must be placed in the same electrolyte.
The electrolyte must have sufficiently low resistivity to conduct current.

# To be continued....

## Would you like to get hold of the whole compendium ?

Contact us today and we will send it to you.

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