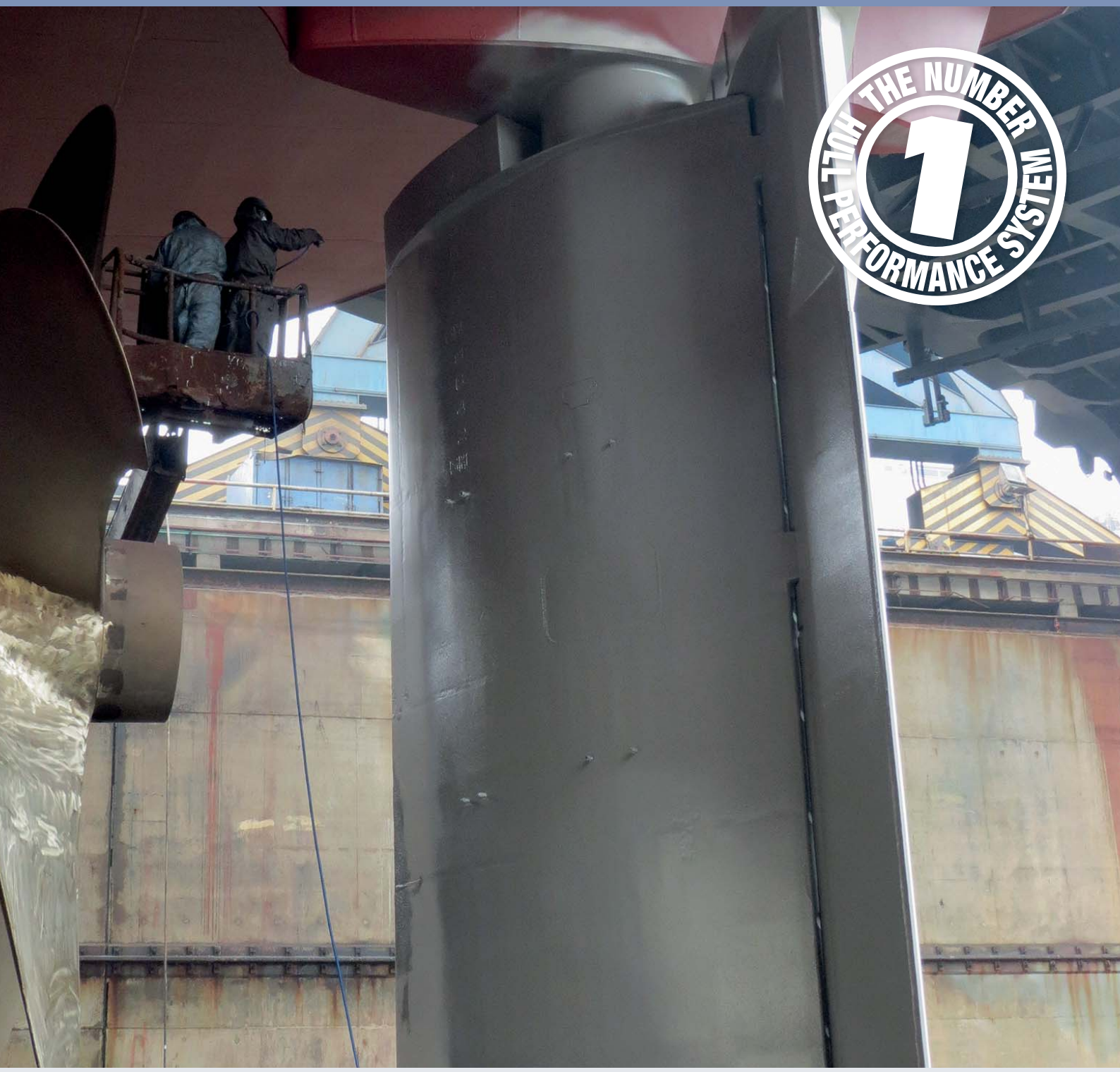
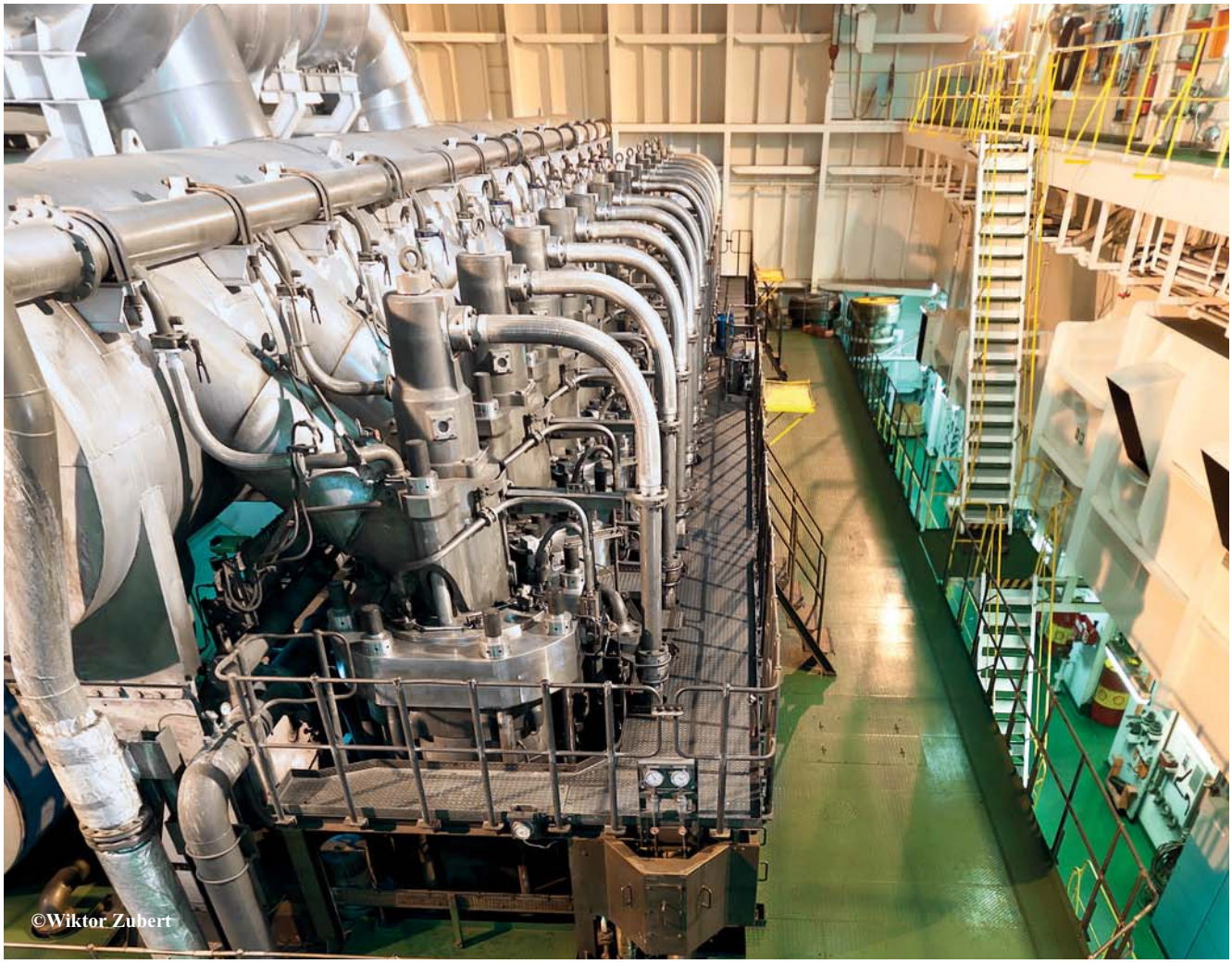
ECOSPEED®

SHIP HULL PERFORMANCE TECHNOLOGY

Magazine





The only hull performance system that gives your engine a break

Ecospeed provides your vessel with long-term protection and dramatically improves the ship's performance.

An impermeable and extremely tough coating is combined with an underwater cleaning system. This keeps the hull roughness at an optimum level and results in a major saving in fuel.

Ecospeed gives a very thorough and lasting defense against cavitation and corrosion damage for a ship hull's entire service life. The coating comes with a ten year guarantee. No repaint will be needed during future drydockings.

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Phone: +32 3 213 5318 info@ecospeed.be
Fax: +32 3 213 5321 **www.ecospeed.be**

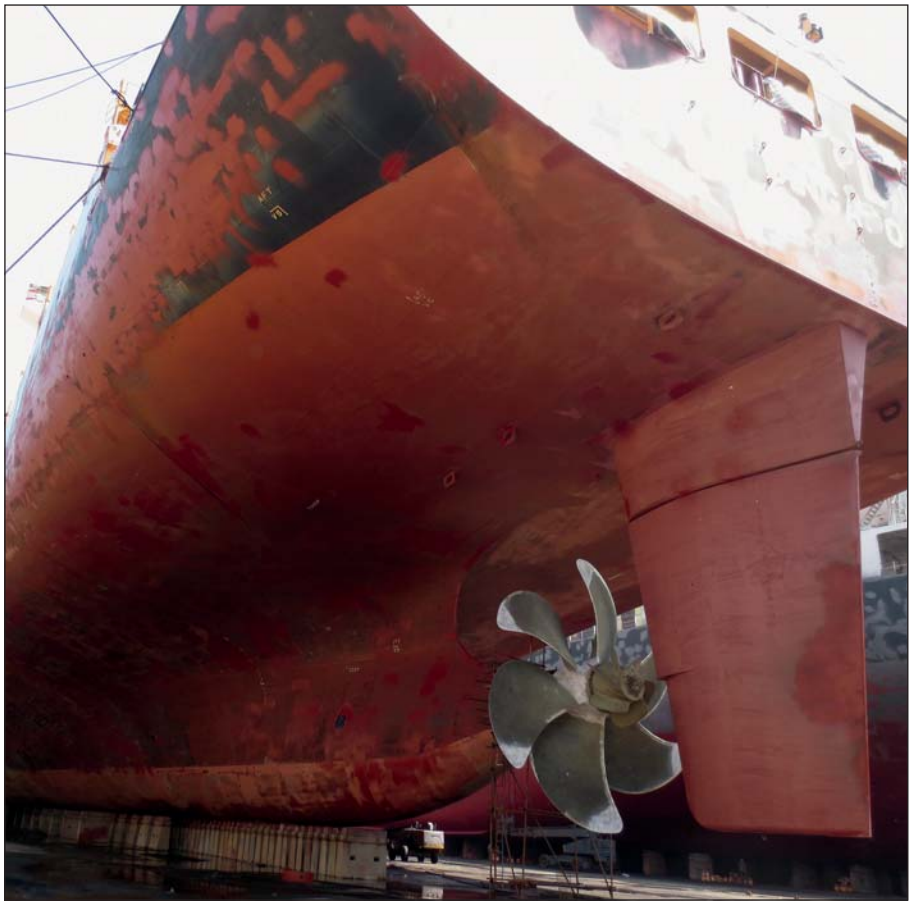
Ecoshield® rudder applications prevent cavitation erosion damage

Over the last couple of months a number of vessels have had their rudders coated with Ecoshield at shipyards in China. These include several container vessels and a car carrier. The applications will protect the rudders against cavitation and corrosion damage for the remainder of the vessels' service lives.

Proof of this has been given over the last couple of years by numerous case studies. Last month we wrote about m/v *Maersk Deva* which came into drydock five years after application without having to replace Ecoshield. More recently another container vessel drydocked in Shanghai. The vessel had been sailing with Ecoshield on its rudder for two years and the coating was still in excellent condition. No repaint or even touch-up was required.

Most of these ships belong to different owners, but they had all experienced firsthand the devastating effect of cavitation on rudders coated with a traditional coating system. For this reason they decided to use Ecoshield to ensure lasting

The devastating effect corrosion can have on a rudder if not protected properly.



Rudder of container vessel, two years after application. The rest of the hull was not coated with one of the Ecospeed products and needed to be repainted.

Seatrade AWARDS 2014

Winner of

Innovation in Ship Operations Award

Surface preparation prior to Ecoshield application.

Ecoshield is applied in only two, identical layers.

Application is very flexible and can easily be adapted to a yard's schedule.

No repaint will be needed during future drydockings.

Ecoshield provides lifelong protection against corrosion and cavitation damage.

protection against corrosion and erosion damage for the rudders of their vessels.

The coating provides the rudder with an impenetrable protective layer. At the same time its toughness and flexibility enables absorption of the forces that are produced by cavitation. This prevents the damage normally caused by this phenomenon.

Ecoshield's flexibility makes it easy to adapt the application to the rest of the activities scheduled at the shipyard or drydock so as not to interfere with these. Overcoating time can be as short as three hours, which means that for smaller surfaces such as rudders or bow thrusters the two coats required can usually be applied in one single day.

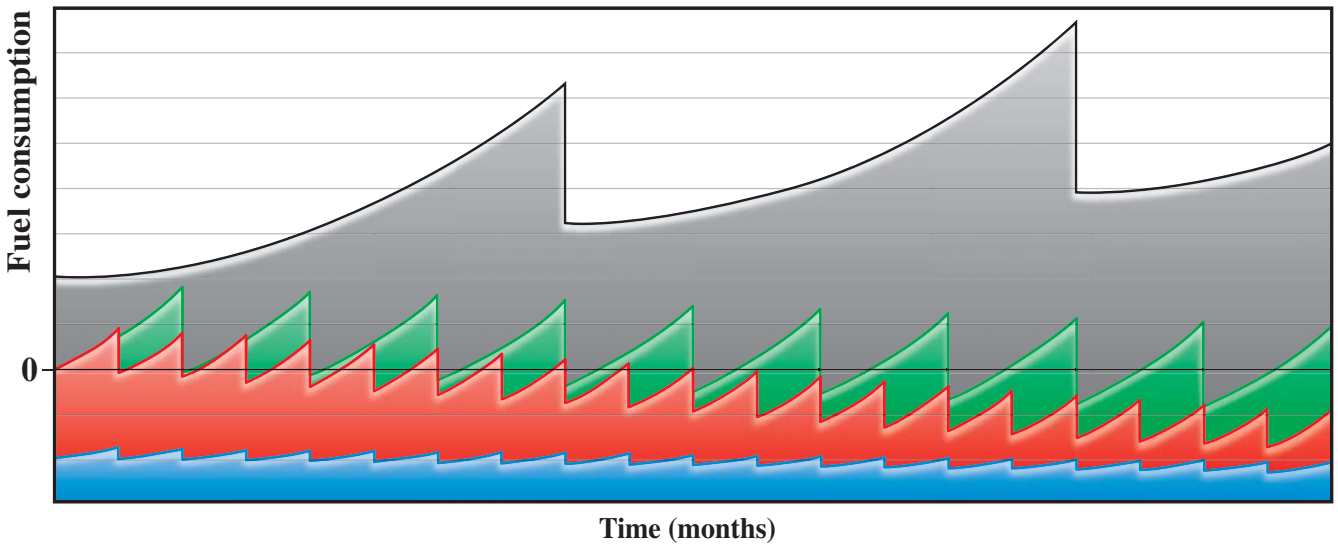
Ecoshield is also ideally suited for other areas prone to cavitation erosion or other damage, such as propeller nozzles, thruster tunnels, the bulbous bow or stabilizer fins. ■

ECOSHIELD®

THE DIAMOND STANDARD IN STEEL PROTECTION

Optimization of ship performance

Development of additional fuel consumption over time



Ecospeed with 2 cleanings per year
Ecospeed with 4 cleanings per year
Ecospeed with optimum cleaning intervals
Active antifouling paints

The expected development of added fuel consumption over time for a biocidal antifouling is compared with three treatment scenarios for Ecospeed for one particular trading area.

In the green scenario, Ecospeed includes an underwater treatment every 6 months. In the red scenario, the treatment interval is halved to three months; fouling will not occur as extensively and the associated added fuel consumption is limited. Both scenarios show that with each treatment, effective cleaning restores the added fuel consumption to the zero reference observed at sea trials. The unique conditioning aspect that is carried out simultaneously with each cleaning optimizes the surface gradually over time, producing fuel savings with each treatment. In a third scenario, extensive best possible conditioning is carried out immediately after curing. As a result the fuel consumption observed at the sea trials will be lower and better protection prevents that fouling will occur as rapidly. The total savings in fuel consumption over the life-time of a vessel is directly proportional to the area between the antifouling plot and the different Ecospeed scenarios.

Adjusting the frequency of underwater treatments allows an optimization of the vessel's service speed and minimization of its fuel consumption.

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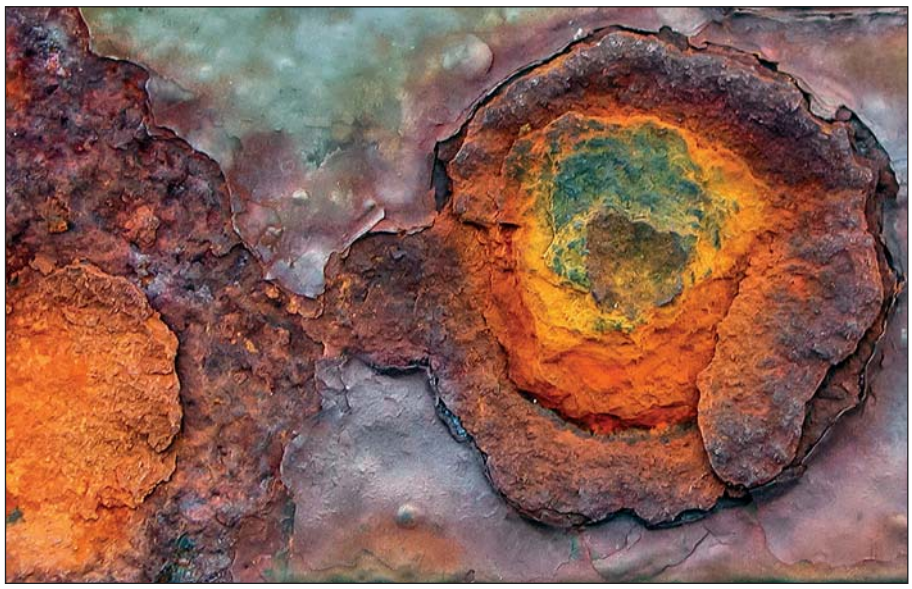
Preventing corrosion of ship hulls and running gear

Part I, The problem

Corrosion, what it is, what it costs, causes and effects

The steel in general use in ship hulls and running gear has a tendency to corrode rapidly in seawater. This is a major problem in shipbuilding and maintenance. It is far better and less expensive to take steps to protect the steel from corrosion than to replace the corroded steel.



Corroded steel on ship hull.

Corrosion protection is just as important inside the ship as on the outside hull, the splash zone (the area just above the water line where the highest corrosive forces are concentrated), and the superstructure of vessels and rigs subject to the onslaught of salt spray, condensation, extreme heat and other factors.

A corrosion-prone industry

The sea is one of the most corrosive environments on earth. The chemicals stored or transported in the tanks of ships vessels include some of the most corrosive of all. The combination means that the tanks and hulls of such vessels are subjected to highly corrosive elements, both inside and out.

The cost of corrosion

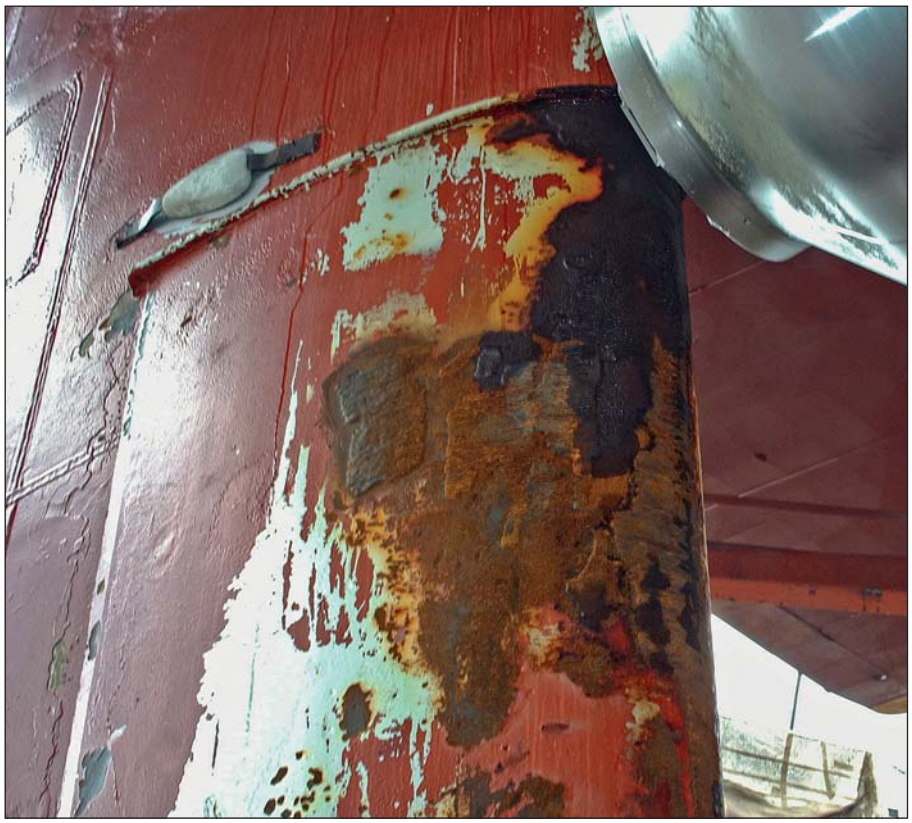
Around the beginning of this millennium the US government ordered a two-year study on the cost of corrosion in the United States by industry sector, and on measures which could be taken to reduce that cost. The total annual direct cost of corrosion to the US shipping industry was estimated at $2.2 billion. This broke down into the costs associated with new ship construction ($1.1 billion), maintenance and repairs ($0.8 billion) and corrosion-related downtime ($0.8 billion).

A NACE report of about the same time period calculated that the average cost of corrosion protection due to new ship construction is $7.5 billion per year. This equates to approximately seven to ten percent of the cost of the vessel, and with chemical tankers it goes as high as thirty percent. The annual cost for repair and maintenance due to corrosion was estimated at $5.4 billion with an additional $5.2 billion cost associated with downtime.

Accurate or rough, these figures make the point. Corrosion is very expensive!

What is corrosion?

When some metals are immersed in water they are subject to marine corrosion. This is caused by flows of electrical current from one part of the metal to another part of the same metal or to a different metal. The current flows from a negatively charged part of the surface of the metal, the anode, to a positively charged point of metal, the cathode, or between different metals. In the case of different metals, the baser or more active metal (in terms of energy and electrical flows) is the anode. The anode loses metal to the electrolyte (electrically conductive



Badly corroded rudder.

liquid) as electrons flow between anode and cathode. In other words, the metal corrodes at the anode. Seawater, because of its chloride content, is a particularly effective electrolyte.

Rain, condensation, various solutions can all be electrolytes and create a corrosive environment for metals.

The basic principle of corrosion is this electrochemical reaction.

The effects of corrosion

The result of corrosion of a ship's hull, frame, plates and tanks is loss of material and resulting structural weakness. Taken to extremes, corrosion can result in such a weakening of a ship's structure that the ship sinks. A corroded tank can become so flimsy that it no longer holds the liquid it is supposed to contain. A corroded hull can reach a point where it no longer keeps out seawater. A corroded rudder becomes less efficient and eventually, if not repaired or replaced, can simply fall off, rendering the vessel unsteerable and helpless.

Preventing corrosion

From the point of view of preventing corrosion, the most important factor in all of this is that in order for corrosion to occur, it must be possible for a current to flow, for positively charged particles to leave the anode and flow through an electrolyte to the cathode. If the steel, aluminum or other metal were completely insulated from the liquid it is immersed in, it will not corrode.

Any attempt to prevent corrosion must take this basic cause into consideration and, by whatever means, prevent this electrochemical reaction.

Protective coatings

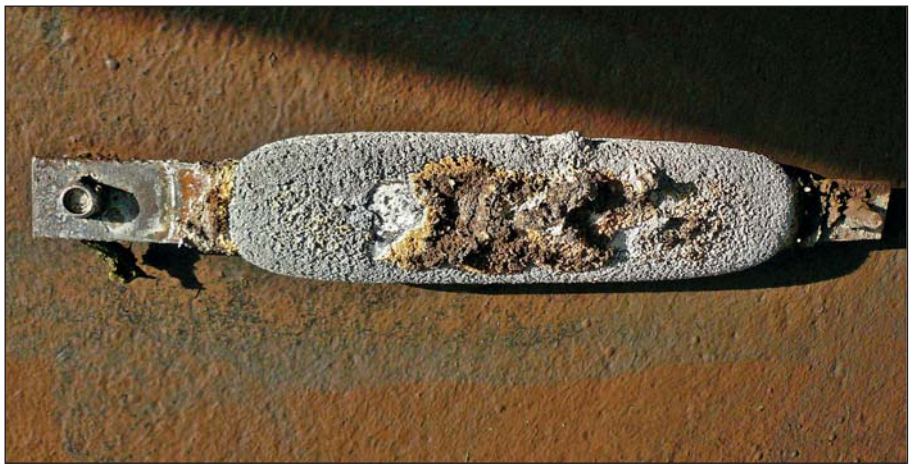
As has been stated, if complete protection and isolation of the steel of the hull and tanks from corrosive elements can be achieved and maintained, there will be no corrosion.

When it comes to coatings for protecting hulls and tanks, the choice can appear bewildering: different types of coatings and coating systems and different brands of each type, all claiming to be the best, can make the final choice difficult.

There have been three main approaches to coating steel in a saltwater environment, or three main coating types:

a. One approach is to create a barrier between steel and environment which is hard, im-

Corrosion of steel despite coating.



Small sacrificial anode on vessel hull.

penetrable and impermeable, preventing the passage of any moisture, current, ions, electrons (in other words complete electrical insulation), chemicals or vapor from the environment to the underlying steel. This approach also assumes complete adhesion with no corrosive agents entrapped underneath. It also assumes that the coating will be durable, tough and flexible enough to continue to protect the steel for a long time. It is of course a lot to ask for from a very thin layer of material which must perform all these functions perfectly and for many years without failure.

b. The other two approaches assume that (a) cannot be achieved or maintained and try to deal with this in one of two ways. One way is to inhibit the effects of the corrosive elements which do penetrate the coating by reacting with the corrosive environment to create a protective film or barrier on the surface of the steel which will then prevent or at least slow down further corrosion. This approach has been in use for a long time, originally using an oil-based primer heavily loaded with red lead.

c. The other type of corrosion inhibiting coating uses cathodically protective pigments in a base, usually in the form of additives in the primer. Particularly effective is an inorganic zinc-based primer such as a zinc-silicate, which is in very widespread use. These coatings work by shifting the potential of the corrosive elements which do penetrate the coating so that it is less cathodic and therefore less corrosive.

The problem is really that the coatings in general use with the methods of application which prevail simply do not perform the job they are supposed to. A compromise is then sought where the coating or the cathodic protection system attempts to mitigate the corrosive effects of the environment on the steel.

Faced with this admitted failure, observable in the real universe every day even when the results are not catastrophic, shipowners/operators of vessels have come to believe that the problem is not solvable.

Cathodic protection

Cathodic protection works by balancing up the potential difference between the anode and cathode so that the electrochemical reaction is eliminated or reduced.

There are two ways to do this. One is by impressed current, where an external source of DC current is used to nullify the corrosive current being generated between the cathodes and anodes. The other is the use of “sacrificial” anodes, usually zinc or aluminum, strategically placed on the hull or in the tanks which utilize the galvanic action of metals with different potentials so that they become the anodes in the system instead of the steel on the hull or in the tank and are sacrificed to prevent corrosion of the steel.

This is particularly useful where the coating has failed to some degree and is no longer providing the protection it is supposed to. The cathodic system is then used to minimize the corrosion in the steel at those points of coating failure or inadequacy, holidays, blisters, flaking paint and other damage.

The most prevalent methods in use to reduce corrosion of the steel of ships’ hulls and tanks are a combination of coating and cathodic system. These methods are based on an unspoken admission of failure on the part of coatings.

The breakdown

The most usual sequence of breakdown in corrosion protection with resulting serious loss of steel and structural fatigue and failure is

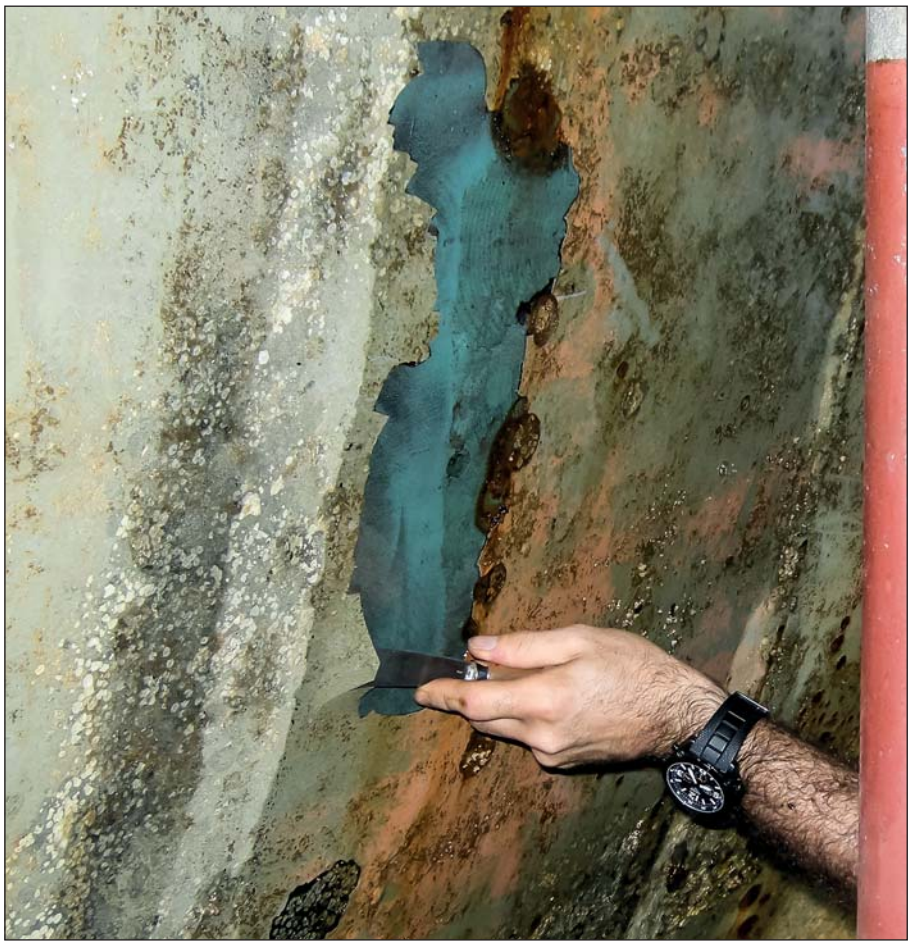
1. the coating starts to break down for one or more of a number of reasons
2. this then exposes the underlying steel to corrosion
3. the cathodic protection system is inadequate to prevent the

resulting corrosion

4. the corrosion sources combine and compound to accelerate the corrosion process so that in some cases the corrosion proceeds amazingly rapidly.
5. the outcome is a long, costly stay in drydock or expensive on-board or voyage repairs involving extensive steel replacement long before the hoped for service life of the vessel has been reached.

This expensive and sometimes fatal downward spiral begins with a failure of the protective coating. It is the weakest link.

Part II of this article will appear in the next edition of the ECOSPEED newsletter and will cover the solutions to the problems which have been discussed in Part I. ■



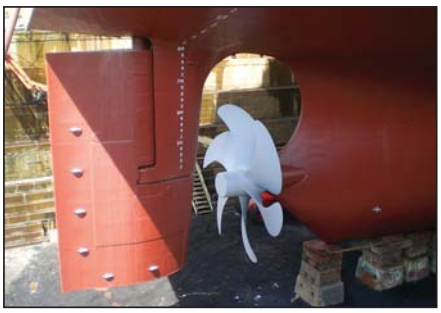
Coating failure on a hull using conventional antifouling paint.

Supreme Rudder Protection









Ecoshield gives a very thorough and lasting defense against cavitation and corrosion damage for a ship hull's entire service life.

The coating equally provides the rudder with an impenetrable protective layer while its flexibility enables absorption of the forces that are produced by cavitation. This prevents the damage normally caused by this phenomenon.

Without proper protection against cavitation and the resulting erosion and corrosion damage, the financial consequences can be severe.

By removing the existing paint layers and applying Ecoshield on the rudder we can break the never ending cycle of painting, suffering damage, having to perform extensive repairs in drydock followed by a full repainting, again and again.

With an Ecoshield application no full repaint will be needed during drydocking. Ecoshield is guaranteed for ten years. At the most, minor touch-ups will be required.

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Belgian headquarters
Phone: + 32 3 213 5318
Fax: + 32 3 213 5321
info@ecospeed.be

US Office
Phone: + 1 727 443 3900
Fax: + 1 727 443 3990
info@ecospeed.us

www.ecospeed.be

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EU Office
Phone: + 32 3 213 5318
Fax: + 32 3 213 5321
info@ecospeed.be

US Office
Phone: + 1 727 443 3900
Fax: + 1 727 443 3990
info@ecospeed.us

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