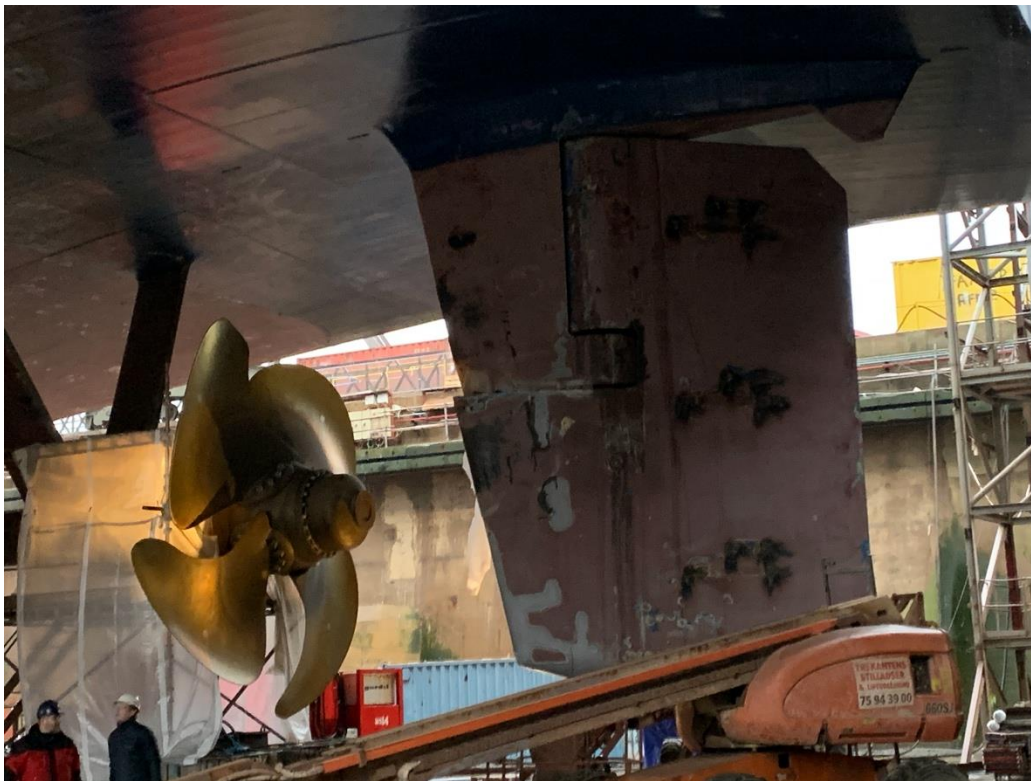


Rudder Refurbishment Protection

Application:	Reconstruction and subsequent protection of cavitation-damaged rudder edges
Place:	FA Yard
Date:	December 2019
Job and report done by:	Breki Ship Service ApS
Wencon products used:	Wencon UW Coating, Wencon Cream



Service description:

Semi-spade rudder with horn suffering from cavitation damages due to the environment at cruise speed.

Cavitation is one of the most severe and damaging phenomena metals can be exposed to. The impact effect can be compared to continuously shot blasting on the same spot day in and day out, neither steel nor coating will withstand such impacts.

Cavitation is the formation of steam cavity in a liquid - i.e. floating zones – which is a consequence of forces acting on the fluid. This usually happens when a liquid is subjected to rapid changes in pressure which causes the formation of voids where the pressure is relatively low. Upon exposure to higher pressure, the cavities implode which can generate an intense shock wave.

Non-inertial cavitation is the process in which a bubble in a liquid is forced to fluctuate in size or shape due to energy supply, such as an acoustic field. Such a cavitation is often observed in pumps, propeller & putter areas etc., common conditions in the rudder surroundings and the cavitation damages on the front of rudders are quite normal.

Under such conditions small vapor bubbles are created in the liquid, and within milliseconds after being created these bubbles implode against the substrate.

This causes damages to the metal, coatings etc.

Therefore, cavitation is extremely damaging to metals and to the products within Wencon's product line as well.

In terms of solving the cavitation problem we postpone the cavitation damages to the metal by applying protective coatings.

Basically, it prevents further damage to the metal, and the physical properties remain in the Rudder construction.

Due to above mentioned facts, it is uncertain how long a Wencon application will last.

A Wencon application will postpone the cavitation attack to the steel significantly and it is a natural part of the maintenance program.

1. Rudder blade top view

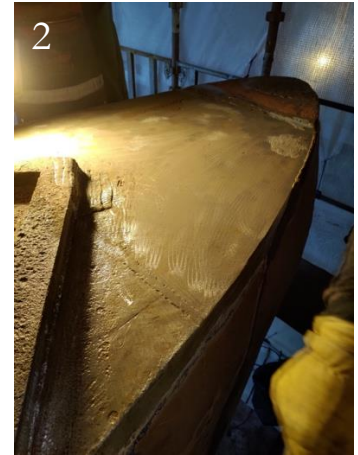
Deep damages that have impaired the physical properties have roughly been re-welded according to class requirements.

Hereafter, surface will be prepared by grit blasting prior application of Wencon products.



2. Rudder blade top view

Surface prepared and ready for applying Wencon products.



3. Front edge of the rudder

The image shows the coating from the last dry docking remains even after grit blasting.

Protection ability remains and should not be removed but remain as a protective layer.



4. Rudder front edge

Due to high humidity at the repair site, Wencon UW coating was used to ensure adhesion to moist surface.

Secondly the structure has been reconstructed using Wencon Cream



5. Rudder blade top view – below the horn.

Application of Wencon protective coatings in progress.

When protecting a surface from cavitation. As thick a layer of coating as possible should be applied, to postpone the attack of cavitation as long as possible.



6. Overview

Since cavitation commonly occurs locally, the application is also executed locally only.

The rudder is now protected in the best way possible, and ready for another 2 years in service, hopefully without suffering further damage to the metal and the physical properties will remain sufficient to achieve yet another class approval.

