



Declaration

Operation of the Hydrosmart aboard the
roro-vessels Norstream and Norsky



Written by:

Bart van Gils
Michiel Gronheid
Peter Verstraete

Maritiem Instituut “De Ruyter”
Flushing, The Netherlands



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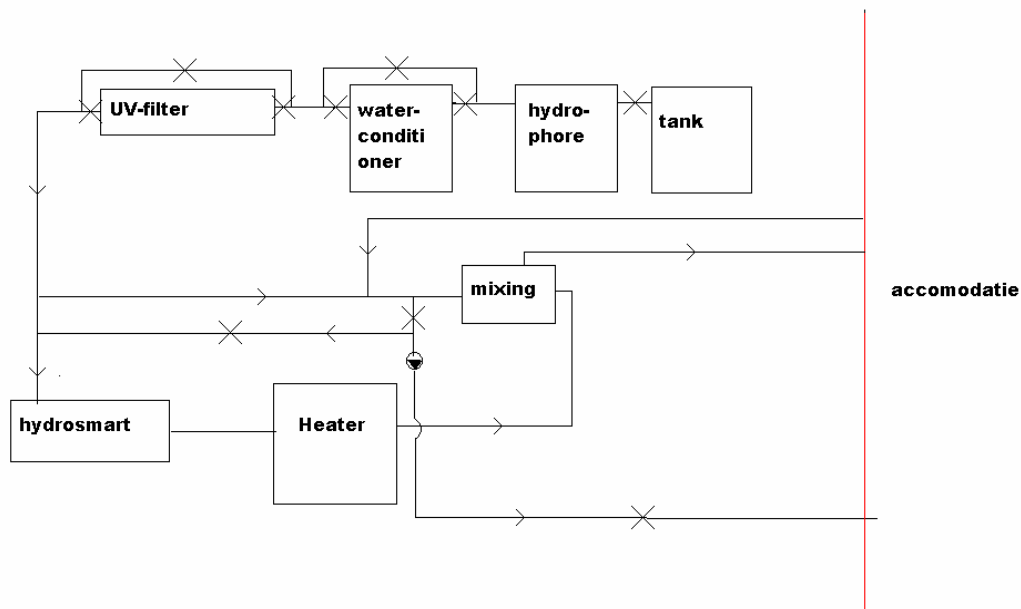
1. Introduction

The Norstream and the Norsky run a daily service between the United Kingdom and Zeebrugge (Belgium). Our contacts on these ships are the two Chief Engineers with whom we had good rapport.

1.1 General System

For the project it was necessary to collect general data of the hot water system design and flow path. In previous reports no general drawing of the equipment of the system has been provided. The Hydrosmart unit is externally wound around the water supply pipe, feeding the steam hot water heater aboard the Norstream.

A schematic of the system is as follows:



General view of the hot water system aboard the Norstream

The drinking water for consumption on the vessel is bunkered in the port of Zeebrugge or Hull. The water is local mains supply which is relatively hard water with many minerals and salts.

Because this water is hard it regularly causes scaling on the heating elements of the vessels water heater which is considered to be a problem. In the case of the trial vessel, the 'Norstream', water is treated by the Hydrosmart water conditioner prior to entering the water heater. This is to assess if it could make water softer and provide protection against scale formation.



1.2 Technical specifications of the heater

Technical specifications

Type	Tube Exchanger	
Serial no.	ABO 9801404	
Volume	0,4	m ³
Capacity	20	Kw
Max working pressure	7.0	Bar
Max temperature	100	°C
Min temperature	0	°C
Heating surface	0.5	m ²

The water is heated by steam, this steam condenses.

Behind the exchanger, on the steam side there is a floating steam trap (dynamic steam trap)

The hot water is kept at a temperature of 75°C.



Hydrosmart installed aboard the Norstream



2. Heat exchanger Norsky

The exchanger aboard the Norsky was cleaned on 27th of October 2005. Hereafter the system was again put back into usual operation. On the 12th of January 2006 an email was sent to both ships asking if there were any problems developing with the heater of the hot water system. The Norsky have then responded advising that the water remains at the correct temperature on high loads, and the heater has not been polluted with scale. The Norstream also reported that no problems had occurred.

After another month, around the 12th of February 2006, problems occurred with the heater aboard the Norsky. At high loads, the temperature of the hot water fell. The engineers suspected that there was a high build-up of scale on the tube stack. The heater was then opened up and photographs taken of the elements which had scaled up significantly. In the two pictures below you will see the diameter of the scale around the pipes was about 3 mm.



Heat Exchanger aboard the Norsky, 12th of February 2006



Heat exchanger aboard the Norsky, 12th of February 2006

After approximately 3.5 months (12 Feb 2006) the heater on the Norsky was polluted with a high scale build up. At this stage the condition of the Norstream was unknown as it had not yet been opened up for inspection.



3. Heat exchanger Norstream

The Norstream was visited in the port of Zeebrugge on Monday 22nd of May 2006. 7 months earlier the heating systems elements using Hydrosmart had been cleaned by the previous project group. With help of Chief Engineer the boiler was shut down, drained and opened up.

What was found was photographed at that time and the photographs are as below:



Opening of the Heat exchanger aboard the Norstream



Heat exchanger aboard the Norstream, 22nd of May 2006



Heat exchanger aboard the Norsky, 12 February 2006

It was observed that only on the side where the steam comes in there was some minor scale, the rest of the heat exchanger showed no build up on any of its surfaces.



4. Conclusion Bore vessels

The difference in scale on both exchangers is to be seen clearly on the photographs provided. The exchangers were both cleaned in the same week to commence this trial, providing identical situations at trials commencement. The bunkering with mains water at each port was not controllable, but it is assumed the water quality was of the same source of supply in both vessels at the time of bunkering. Considering the ships are of the same type and on the same shipping lane we assume this to be consistent to both vessels.

After 3.5 months the exchanger running without Hydrosmart treatment was polluted with significant scale build up. When the heat exchanger on the Norstream was opened after 7 months, hardly any visible scale could be seen.

We can therefore conclude that the Hydrosmart treatment extends the time between cleaning of heat exchangers on these vessels and lowers maintenance problems very certainly.

Filled in truthfully,

Bart van Gils

Michiel Gronheid

Peter Verstraete

Flushing, 14th of June 2006
The Netherlands