
Report of the Emulsion Experiment as Attachment of the Statement of Facts

Date: 2022-03-29

Ref. No.: A1187803

Reference: STI LILY FOWE Test

1. General

Above mentioned vessel was subject to a verification survey of the emulsion blender as well as to an Emission test for the Main Engine carried out from 27th March 2022 to 2022-03-29 at sea. The undersigned DNV Principal Surveyor Mr. Henning Lanz attends the ship in order to get a true and genuine impression of the function of the emulsion blending unit and the emission measurement.

The verification survey was agreed between the DNV Head Office in Spain and Scorpio Marine Management in Mumbai, enabling to verify the emulsion process and to carry out an emission measurement at sea. Details stated below and findings are based on the information's provided by the FOWE Engineer Mr. Franjo Kusec, the Pacific Green Engineer Mr. Kelvin Campbell, the WWTechnic Engineer Mr. Rafal Bendza (responsible for the engine parameter collection), the Scorpio Project Manager Mr. Karlo Jaksic and Mr. Henning Lanz (DNV Principal Surveyor). The verification survey was carried out at sea on Board of the fully laden MT STI LILY between Algeciras (Spain) and Shell Haven (Great Britain).

2. Objective of the test

The maker of the emulsion blending unit (in the following called FOWE Unit) and the ships manager want to verify that it is possible to create a stabile emulsion with 12% water content without adding chemicals only on a physical process. Further it shall be verified that it is possible to reduce the NOx emission and saving fuel.

3. Ships Particulars

IMO No.:	9838242
Ships Name:	STI LILY
Type:	Oil Tanker
Shipyard:	New Times Shipyard China
Flag:	Singapore
Port of Registry.:	Singapore
Length o.A	249.9m
Bredth.:	44.0m
Draft during Test:	13.9m
Class:	ABS

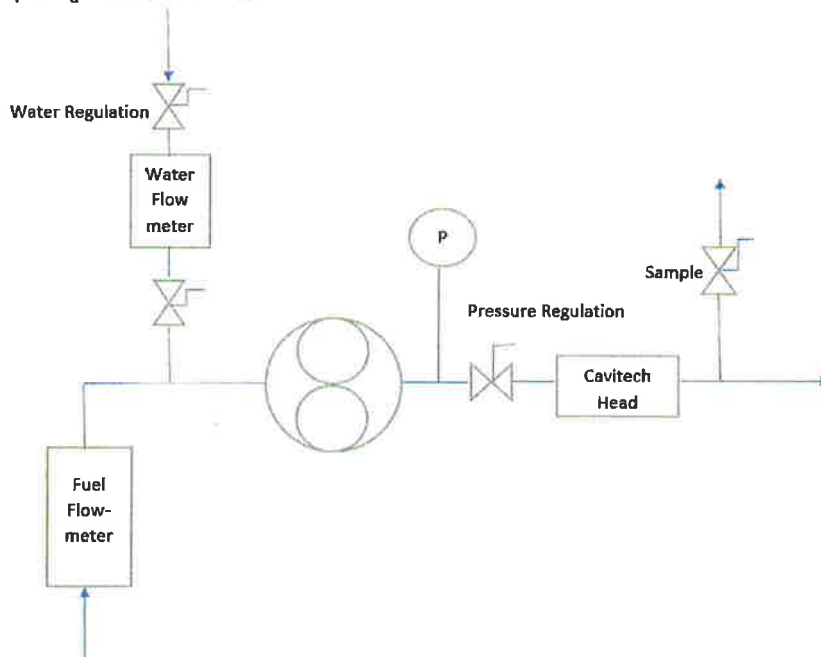
3.1 Engine Particulars

Maker:	CMD MAN B&W CSSC-MES Diesel Co. Ltd
Type:	6G 60-ME-C9 Tier III
Built:	08-2018
Engine No.:	CE0576A
Power:	11850kW @ 89rpm
Turbo Charger:	ABB A270L 18060rpm

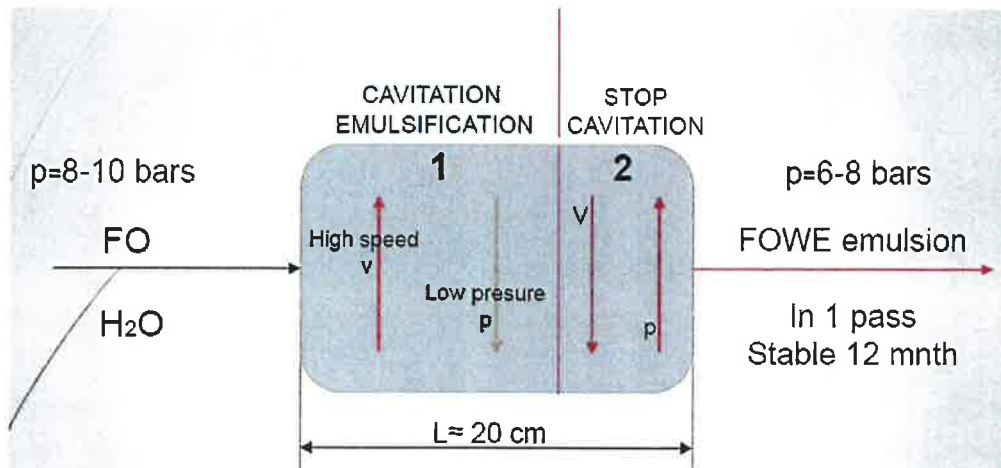
4. Description

The Manager of the ship MT STI LILY, Scorpio Marine Management Mumbai, decided to fit an emulsion plant (FOWE Unit) consisting of a fuel flowmeter, a water flowmeter, a booster pump, an adjusting valve and the emulsion cavitation head to the a.m. ship in order to produce stabile emulsion, this shall also lead to a reduction of the fuel consumption and consequently the greenhouse gas impact. The emulsion plant was temporarily connected to the fuel system with hoses and shall be able to create a stabile emulsion with heavy fuel oil and water, as well as with MGO and water. The aim was to create a stabile emulsion with 12% Water content. Therefore, a reference measurement on Main Engine was taken to compare later the behavior of the engine running on emulsion

|Principle Diagram of the FOWE Unit



Working Principle of the Cavitech Head (Graphic of Messrs. FOWE)



5. Verification Survey

5.1 Survey preparation

Before the actual test started the undersigned surveyor met the responsible persons from Scorpio Marine Management, the Maker FOWE, the WWTechnic Engineer, the Pacific Green Engineer and the Chief Engineer to discuss the test procedure. The discussion held in a very warm and constructive atmosphere was leading to the final decision how to carry out the test on board. Following was agreed:

- a) All equipment which is necessary for the measurement shall be on board
- b) The measurement instruments for the exhaust gas measurement shall be calibrated (Calibration certificates are attached hereto)
- c) Prior to the test with HFO an emulsion with MGO shall be created and the samples of water, fuel and emulsion shall be taken in presence of the undersigned surveyor. The samples will be analysed in an accredited laboratory
- d) A reference test (FOWE called baseline test) will be carried out for four hours without any emulsion but only with fuel. Engine Parameters will be taken by the WWTechnic Engineer, as representative of the engine maker CSSC, with all necessary parameters. Performance protocols are attached hereto. A sample from a drip sampler will be taken over the four hours run. Every 30 minutes an exhaust gas measurement will be done, in order to get a picture of the exhaust gas content. The Fuel Sample will be taken and sealed in presence of the undersigned surveyor. Engine performance data will be taken in presence of the undersigned surveyor.
- e) HFO Cavitation Sample: The LSFO Settling Tank will be filled to maximum level with HFO and will be purified in circle for at least 24 hrs. Fuel oil samples will be taken and sealed in presence of the undersigned surveyor. After that the Fuel will be processed through the FOWE Unit without adding water and discharged to the LSFO Settling Tank. Fuel oil samples will be taken in presence of the undersigned surveyor. (Fuel Diagram is attached hereto)

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This report was prepared without prejudice to the rights of the involved. It is based on information made available to the undersigned at the time of survey and on personal observations.

- f) HFO Emulsion Production: The LSFO Service Tank will be empty as possible. The FOWE Unit suction is connected to the LSFO Settling Tank and discharge to the LSFO Service Tank with adding approximately 12% Water. This Test shall verify the production of stabile emulsion of approximately 12%. Samples will be taken in presence of the undersigned surveyor and send to the laboratory for analysis.
- g) Aux. Engines and Main Engine performance test with FOWE Unit: Two of three Generator Diesel Engines are running with MGO. One engine is running with emulsion HFO from the FOWE Unit. After stable conditions the Generator Diesel Engine supplied with FOWE Unit HFO is going to run in parallel with one MGO supplied Generator Diesel Engine. If no irregularities are observed the fuel Unit of the Main Engine will be supplied by the FOWE Unit. The aim is to run the Engines with emulsion of 12% water content. During the Main Engine is running with FOWE Emulsion the engine performance will be checked and compared with the reference test. The Test shall run over a period of 12 hrs. During the test samples will be taken in presence of the undersigned surveyor.
- h) The sample collection and measurements will be done in presence of the undersigned surveyor. Performance protocols and lists of the samples are attached hereto.

After all equipment was dismantled, the temporarily installed connections to the fuel system were brought back to normal and from the class ABS approved installation.

7. Resume after Test at sea

The test was carried out as accurate as possible with means given on board. It can be already stated that a stabile emulsion with a water content above 12% can be produced by the FOWE Unit. As in item 6.2 mentioned. As the Auxiliary Engine Diesel Generator No. 1, as well as the Main Engine were running with Emulsion, neither irregularities nor abnormal pressures and temperatures were observed. The Exhaust Gas Measurements were showing slightly differences in NO_x- and CO-emissions, however these are uncorrected values, which have to be corrected after the fuel analysis from the laboratory has arrived. A resume about any changes of the real fuel consumption is only possible if the analysis from the laboratory has arrived. Tendencies regarding NO_x reduction or fuel saving without the analysis of the fuel samples are not confirmed yet and pending until the final fuel consumption is calculated.

8. Special Thanks

Special Tanks to the crew and the Master Mr. Ivica Baskovic, the Chief Engineer Mr. Samir Magdum, the Scorpio Project Manager Mr. Karlo Jaksic for the warm atmosphere and the hospitality on board of the good vessel MT STI LILY.

At sea 2022-03-29



Henning Lanz
Principal Surveyor to DNV

Attachments:

- FOWE test protocol
- FOWE test log prepared by Mr. Campbell
- Sample Quantities and Identification Log
- Chain of Custody Form
- Calibration Certificates Gas Analyzer Max Sievert A/S No. 115/2022 date: 2022-03-08
- Main Engine Performance Records CS&C Report
- Exhaust gas Sampling and Analysis Form
- Fuel Consumption and Power Readings
- Scrubber Gas Log EGCS
- Test Program Log
- Fuel Diagram
- Bunker Delivery Note

9. Photo Documentation

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