SERVICE REPORT

Heat Rate test

April 2013

Project 60095

Maersk Fluid Technology A/S

Index

1. Basic data

Plant:	Barbados Light and Power	
Customer:	Maersk Fluid Technology A/S	
Period:	7-15 April 2013	
Participants:	Maersk Fluid Technology A/S:	Henrik Bak Weimar
	BWSC A/S:	Carsten Otte
		Finn Hansson

Maersk Fluid Technology A/S
Technical & Operational Manager: Henrik B Weimar

BWSC A/S

Test Engineer:	Carsten Otte
Manager Field Service	Finn Hansson
Project Manager:	Jeanett Grandjean

2. Technical systems

Diesel engine

Maker:	MAN
Type:	9K80MC-S
Engine No.:	D14
Running hours:	59915

Other equipment
Power Meter:

Maker:	Zimmer Electronic System
Type:	LMG450

Flowmeter:

Maker:	KRAL
Type:	OMG

3. Scope of work

In connection with a SEA-Mate® Blending on Board, tests were performed to check for any differences in the mechanical properties/efficiency related to friction in the bearings when operating an engine on "used, but useable" lubricating oil, e.g. lube oil which has been in operation for a long time, only replenished due to leakage or sweetened, when the BN (Base Number) are found to high compared to fresh new oil.

4. Executive summary

This heat rate test was performed to evaluate the differences in SFOC (Specific Fuel Oil Consumption) when operating a diesel engine on used/useable lubricating oil compared to new/fresh lubricating oil.
A fuel saving of 0.86g/kWh or 0.44% was noted as well as a lube oil temperature reduction of 0.7°C in the temperature increase between inlet and outlet.

5. Work carried out

A heat rate test was performed to evaluate differences in SFOC (Specific Fuel Oil Consumption) when operating a two stroke diesel engine on used/useable compared to new/fresh lubricating oil.

The engine was tested immediately upon a major overhaul, completed running-in and adjustment.
The engine was tested, first on the existing "used" lube oil and subsequently after complete replacement of all the lube oil with fresh lube oil.
During the replacement of the lube oil, proper cleaning of the bottom tank was carried-out.
The test was made within a few days and with no adjustment done between the two tests.
The test was performed with the engine at 27MW load, which is the normal operation load at 90%, and any differences in site conditions having an impact on the SFOC such as fuel oil temperature, cooling water temperature, air inlet temperature, humidity and ambient pressure were compensated for.

Each test was performed over a period of approximately 1 hour.
An average of the results from the tests carried-out was used as final result.
Any test, during which a load change or unforeseen circumstances occurred, was not included in the result.

Calibrated and certified instruments were used for all measurements taken:

- Power meter (see attachment #1)
- Flow meter (see attachment # 2)
- Temperature sensors (see attachment # 3)
- Humidity sensors (see attachment # 3)
- Barometer (see attachment # 3)
- Stopwatches (see attachment # 3)

Power meter connected to the CT and VT (current- and voltage transformer) (see attachments # 4a, b, c).
Flow meter installed in the fuel supply line (see attachments # 5a, b, c).
Existing return flow meter checked with the KRAL test meter and found within tolerances.
Fuel oil temperatures were measured at the fuel meter location
Cooling water temperatures were measured at scavenging air coolers and calculated to an average.
Air temperatures were measured at the T/C inlets and calculated to an average.
Lubricating oil temperatures over the bearings were monitored and recorded (see attachment # 6).
Fuel oil samples were taken during the test and used for correction of SFOC (see attachments # 7 & 8, used and new oil respectively).
Lubrication oil samples were taken for used oil (see attachment # 9) and new oil (see attachment # 10).

6. Measurements and findings

First set of measurements with used/existing lube oil, were taken during April 10 2013 (see attachments 11a, b, c, d, e).
On April 11, 2013, the engine was stopped due to planned scavenging port inspection.

Next set of measurements with used/existing lube oil were taken during April 12, 2013 (see attachments 11f, g, h).

On April 13 and 14, the engine was stopped for lubricating oil change.

A set of measurements with new/fresh lube oil was taken during April 15, 2013 (see attachments 12a, b, c, d, e).

A summary of measurements before and after oil change is enclosed (see attachment # 13).

7. Conclusion

- It can be concluded that Specific Fuel Oil Consumption has decreased by 0.86g/kWh equivalent to 0.44% after the oil change.
- It can be concluded that the temperature raise over the bearings has decreased 0.7°C after the oil change.
- As the test has been performed on a stationary engine coupled directly to a generator, the output may be justified as exact.

With the three above statements in mind, it can be concluded that when operating with the SEA-Mate® Blending on Board system, the mechanical efficiency has increased due to reduced friction in the bearings as a consequence of operating the engine on fresh oil, compared to "used".
As mentioned above, the test was performed on a stationary two stroke engine that does not have a large thrust bearing compared to a marine application, which may have even higher increase in mechanical efficiency than the stationary application when operating on clean lubricating oil.

8. Enclosures

Attachment # 1:	Power meter specification
Attachment # 2:	Flow meter specification
Attachment # 3:	Instruments
Attachment # 4a, b, c:	Photos of power meter installation
Attachment # 5a, b, c:	Photos of fuel meter installation
Attachment # 6:	Lubrication oil temperature drop
Attachment # 7:	Fuel oil sample during "used" oil test
Attachment # 8:	Fuel oil sample during "new" oil test
Attachment # 9:	Lubricating oil sample "used" oil test
Attachment #10:	Lubricating oil sample "new" oil test
Attachment #11a, b, c, d, e, f, g, h:	Measuring sheet during "used" oil test
Attachment #12a, b, c, d, e:	Measuring sheet during "used" oil test
Attachment #13:	Summary of measurements