

SEA-Mate® Blending-on-Board

Fit-for-Purpose Lubrication

CASE STUDY: Grete Maersk

The SEA-Mate® Blending-on-Board (BOB) system was installed on Grete Maersk in March 2011 after 36,000 hours of vessel in service. From January 2010 to March 2011, Grete Maersk had an average cylinder oil feed rate of 1.46 g/kWh using a 70 BN cylinder oil. Despite the high feed rate, the engine cylinder condition was challenged and continuously deteriorating.

VESSEL DATA

Year of building:	2005
Vessel type:	Container Ship
Main engine:	12RT-Flex 96C-B
Main engine power:	68,658 kW
Cylinder lubrication system:	CLU3 Lubrication system
Cylinder lubrication feed-rate (2010):	1,46 g/kWh
Cylinder lubrication minimum feed-rate:	0,9 g/kWh

REDUCED LUBRICATION COST AND IMPROVED CONDITION

After the blender installation, Grete Maersk have managed to reduce the feed-rate from 1,46 g/kWh to 0,90 g/kWh, by blending up to 100 BN cylinder oil, instead of using standard commercial 70 BN. A total cylinder oil consumption reduction of 38 %.

CYLINDER LUBRICATION FEED-RATE REDUCTION

(Data from 2010-2012)

	Pre BOB (reference)	2012 Apr-jun
Feed-rate (g/kWh)	1,46	0,90
Total reduction (g/kWh)	0	0,56
Feed-rate reduction (%)	100%	-38%



Blender B3000

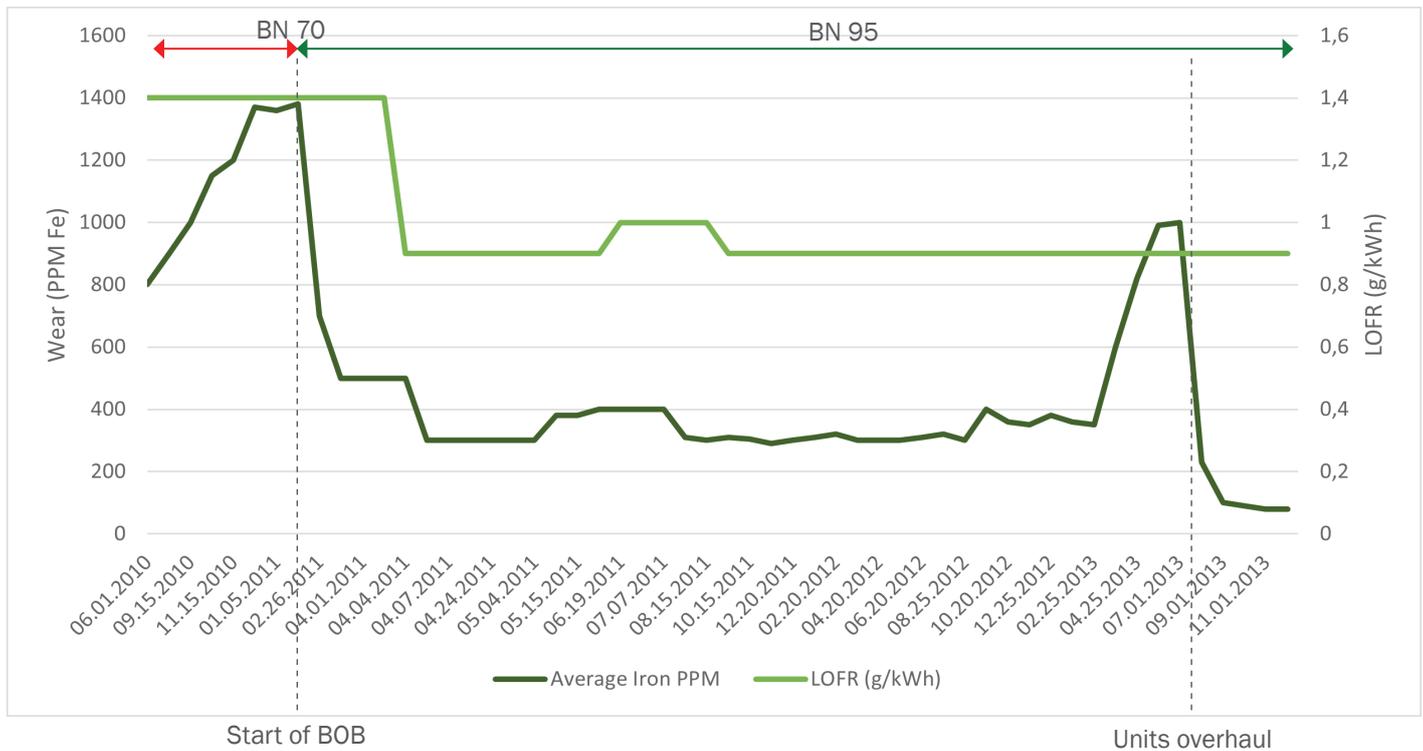


Grete Maersk

PISTON RUNNING AND CYLINDER LINER CONDITION

Before the SEA-Mate® BOB system was installed, the cylinder liners experienced severe corrosive wear, leading to excessive engine wear of 0.7 mm/1,000 running hours. Shortly after the BOB system was put into operation, the feed rate was reduced from an average of 1.46 g/kWh at 70BN cylinder oil, to 0.9 g/kWh and a variable BN operation ranging from 40 to 100 BN was applied. Immediately the cylinder conditions started to stabilize as the cylinder oil BN was continuously adjusted to meet the operation conditions and fuel sulfur used, the piston ring and cylinder liner wear rates were significantly reduced as per the graph, thus allowing an extension of the parts TBO (Time-between-Overhaul)

The graph illustrates that while the engine was operating with a high sulphur fuel (>3.4 S%), cold corrosion was taking place, inducing a high wear rate of the liners and piston rings. With BOB, an optimization of the cylinder lubrication feed rate was made possible by the adjustment of the BN from 70 to 100, performed in a safe way as the actual condition and wear behavior of the engine could be monitored with the SEA-Mate XRF Analyzer. During 2011, the cylinder units were in a recovery mode, and a careful monitoring of the cylinder condition with the SEA-Mate XRF Analyzer confirmed the stabilized wear situation, and the wear rate was further reduced by continuously adjusting the BN and the cylinder oil feed rate to the actual wear behaviour of the engine.



**“With Blending-on-Board installed on our Wartsila engines, we have managed to increase piston ring lifetimes to 32,000-36,000 hours”
- Ole Christensen, Senior Mechanical Engineer at Maersk Line.**

SYSTEM OIL CLEANLINESS

In March 2011 the crankcase condition were very dirty as seen on figure 1. After introducing the BOB unit to the vessel and six months of continuously refreshment of ME system oil was clear. The Engine crankcase was showing a significantly cleaner appearance as pr. figure 2. The advantages of having a clean crank case and cleaner, fresher system oil are numerous and not only

- System oil properties, like detergency, dispersancy and anti-oxidation (necessary for optimum engine performance), are restored.
- Critical components, such as bearings, fuel pumps, and the piston cooling system, will perform optimally.
- It improves viscosity control, reduces friction losses in the engine, and ultimately delivers a substantial fuel saving of up to 0.5%.



Figure 1 - Crank case before BOB operation

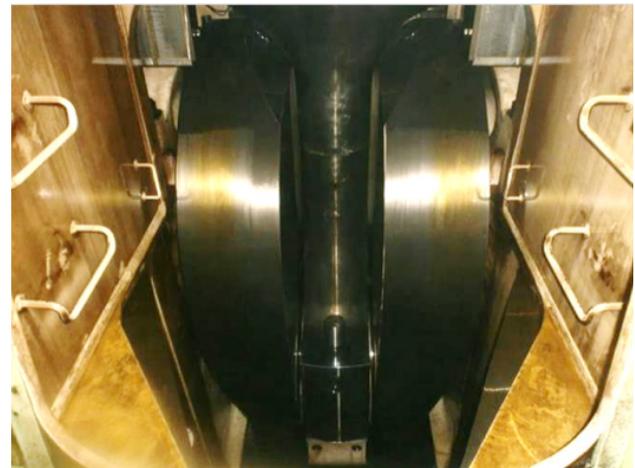


Figure 2 - Crank case after six months of BOB operation

CONCLUSION

The 12 RT-Flex 96 C-B engine had been exhibiting a continuously deteriorating piston running behavior. Most of the cylinder units were showing significant wear, mainly due to cold corrosion but also due to heavy abrasion and adhesive wear that was leading to local scuffing. As a consequence, the wear rate, was remaining very high and continuously increasing. The origin of those issues was on fuels with high sulphur content, combined with slow steaming.

The installation of a Blending-on-Board (BOB) lubrication system in March 2011 drastically changed the situation by decreasing the wear rates observed (see Graph). Likewise, the condition of the cylinder unit and its piston rings started to improve.

Since Maersk introduced the BOB onboard their RT-Flex 96 engines, the piston rings last between 32,000-36,000 running hours between replacement. From a state where the cylinder units were undergoing too much wear (cold corrosion, heavy abrasion, and adhesive wear), the use of BOB led to an improved state of controlled mild abrasion. This mild abrasion is, of course, normal and made it possible to achieve wear rate reductions of up to 70% while having an average reduction of cylinder oil feed rates of 38%.

Similar results have also been achieved on MAN B&W engines. Indeed, the working principle of 2-stroke engines is comparable and a transposition of this case can be made for Wärtsilä RTA's and RT Flex's or MAN MC's and ME's engines.

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