



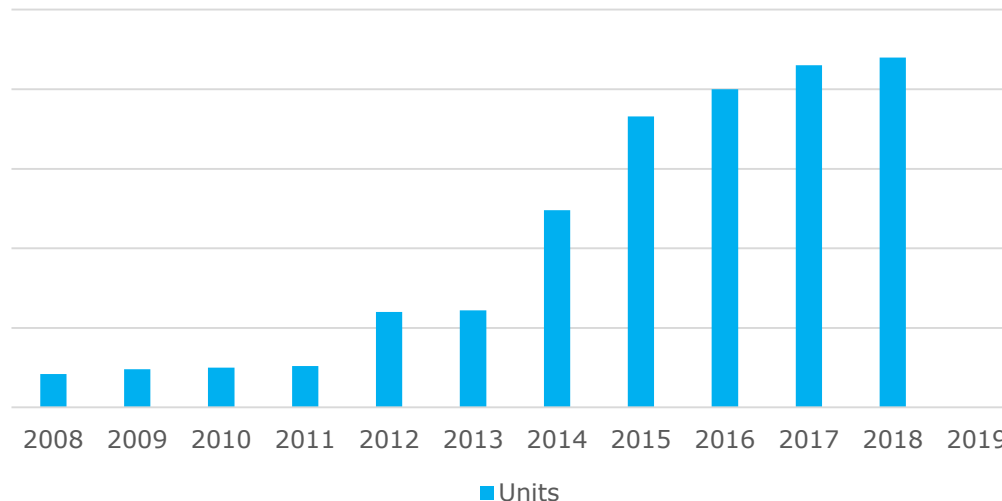
Blending-on-Board Lubrication Flexibility & Optimization

2019

Marine Fluid Technology A/S

- Operating with a licence from A.P. Møller-Mærsk
- Started by the management of Maersk Fluid Technology A/S
- Millions of cylinder operation hours logged

Units in operation (today +200 units)



WHAT IS BLENDING-ON- BOARD?

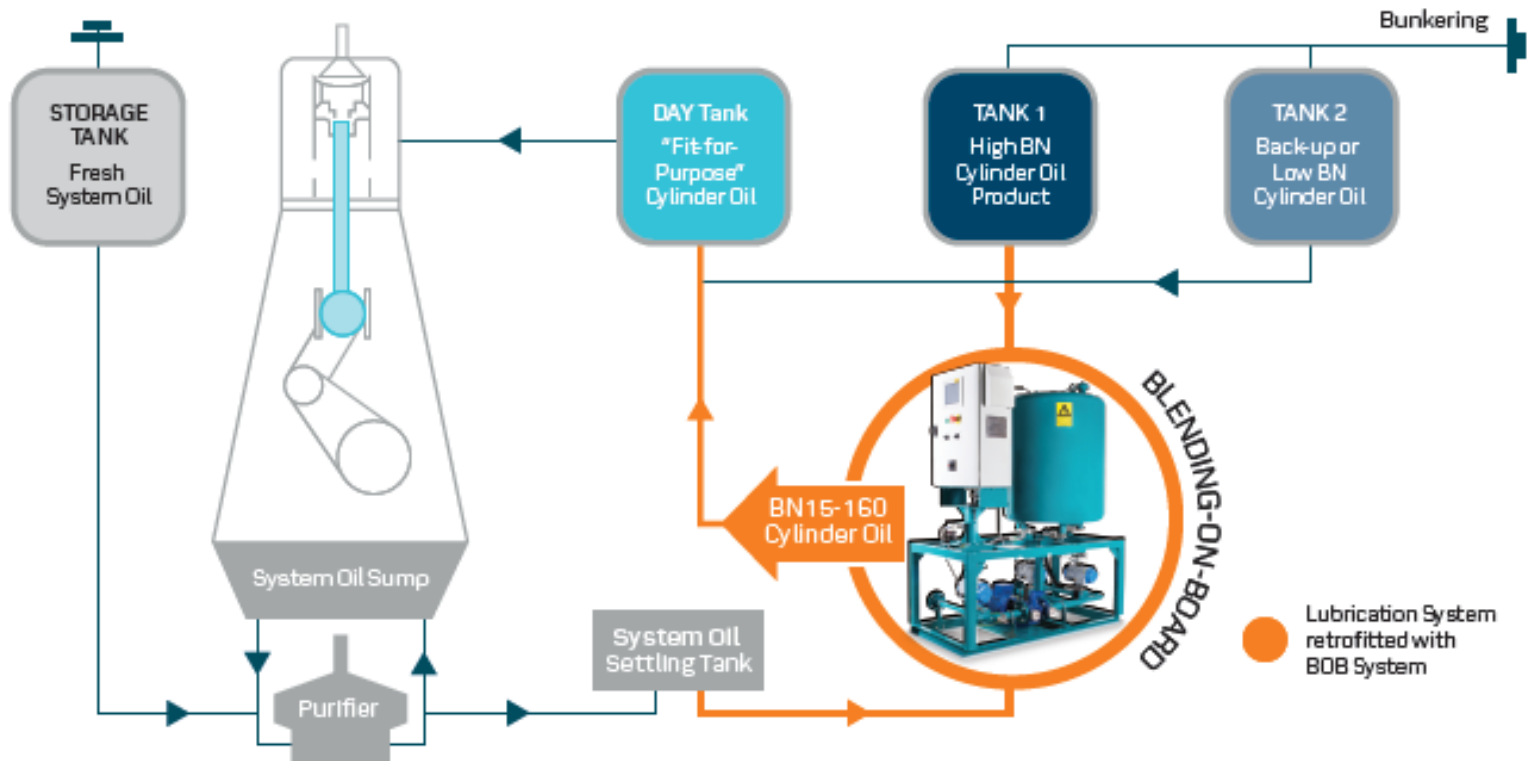
Principle of Blending-on-Board



**The BOB system is
Patented by Maersk and
has been approved by all
major Classification
societies and OEM's for
use with their engines.**

A flexible alternative to fixed composition cylinder lubricants for 2-stroke engines

Blending-on-Board set-up



No Objection Letters

MAN Diesel

MAN Diesel A/S • Denmark



Wärtsilä Switzerland Ltd

Att.: Mr Keith Saddler

Maersk Fluid Technology, Inc.
Attn.: Jens Byrgesen
Director, Global Sales and Marketing
One Commercial Place, 13th floor
Norfolk, Virginia 23510, - U.S.A.

Winterthur, 19.05.2011

LSP/KEA/TGL/43992

13 December 2007

No Objection Letter

**Subject: Letter of no objection for cylinder oil blended on board
with XOM additive RT2522-2. (BN 30 to BN120)**

To. Maersk Fluid Technology

Att. Keith Saddler

Letter of No Objection Letter for operating A.P.M blending on-board concept.

With reference to Letter of 20 November 2007 we can inform you as follows:

MAN Diesel has made the following test of A.P.M blending on board concept MFT-I where system lube oil is mixed with an additive tailor made to compensate for the lack of cylinder lube oil abilities and the Lube oil is hereafter used as cylinder lube oil.

This technique is new to the market and the reason for deviating from the traditional use of System and Cylinder oil is primarily to secure a continued exchange of lube oil and thereby keeping high quality, cleanliness and lubricity of the System oil.

Dear Sir,

Considering the information received from MFTI, the chemical and physical properties and the satisfactory laboratory bench tests results, we have no objection to the use of cylinder oil lubricant blended on board with 2-stroke crank case system oil, up to 15% v/v of 4 stroke lubricating oil for a field test in a suitable vessel.


The system oil used for blending as well as the blended cylinder oil must be analyzed and documented; the analysis must be made transparent for each running hour and for each batch blended.

Wärtsilä does not take any responsibility for the functionality of the blending on board equipment. Wärtsilä disclaims any responsibility for damage or losses in case the equipment was used during the engine warranty period.

The application must comply with Wärtsilä lubricating oil requirements and recommendations. Lubricants should be used as recommended in the Wärtsilä Service Bulletin RT-18.4 and manuals. The supplying Oil Company and MFTI are responsible for the performance of the oil in service, to the exclusion of any liability of Wärtsilä Switzerland Ltd.

Yours faithfully,
Wärtsilä Schweiz AG


M. Wengle
General Manager Technical Services 2-stroke


S. Juma
Tribology Expert

BLEND ON BOARD BENEFITS

TECHNICAL

- Flexibility, the BN can be adjusted onboard
- Lower feed rate, reduced deposits
- Continuously renewed system oil
- Corrosion can be reduced by higher BN

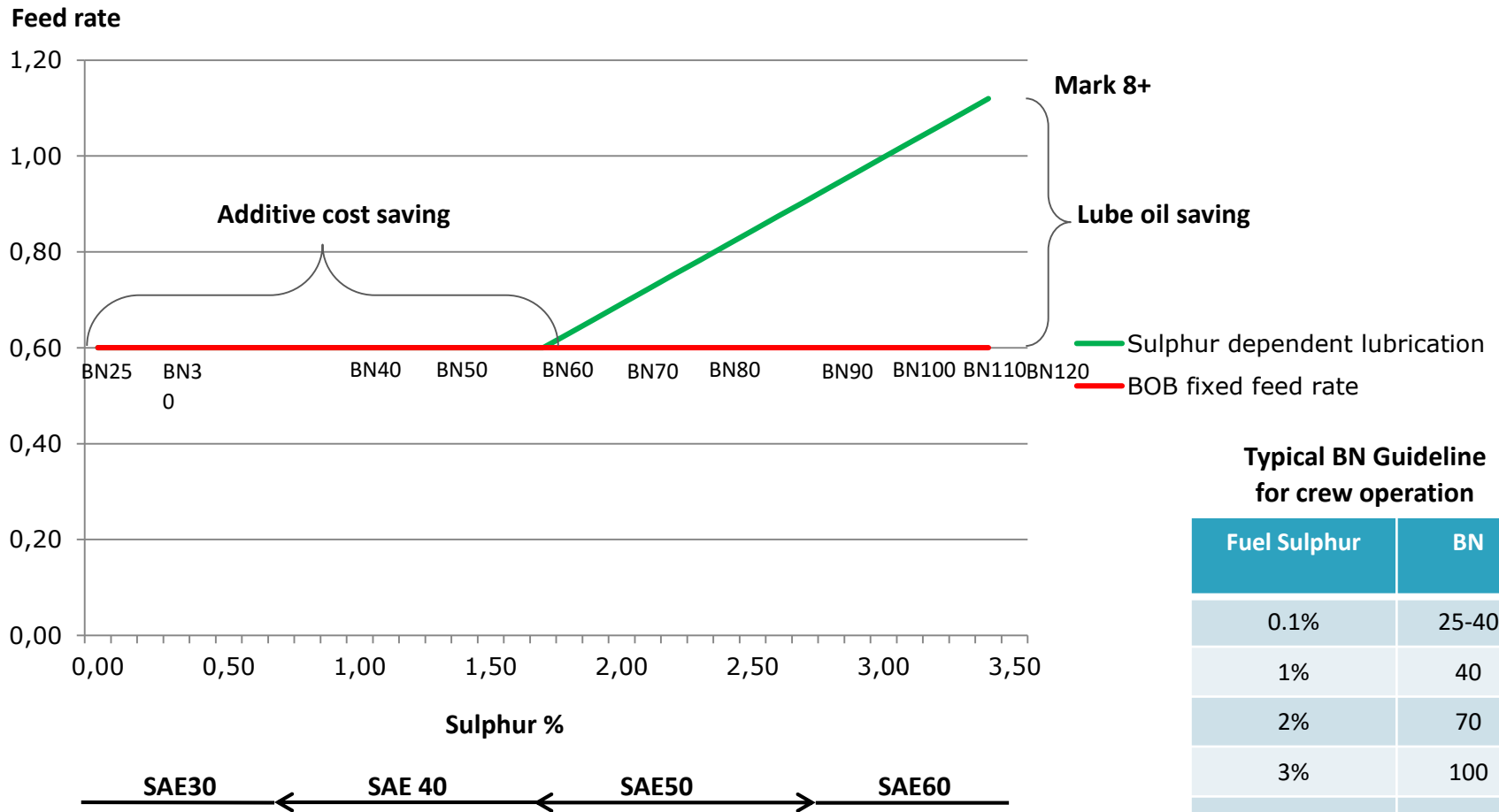
FINANCIAL

- Reduced system oil losses when the purifiers need to run fewer hours.
- Reduced cylinder oil consumption when adjusting BN and not feed rate
- Cleaner system oil->reduced wear on hydraulic components.
- Reduced energy consumption

After 2020 (low sulphur fuels)

- All the tried and tested benefits to the system oil.
- Increased flexibility to choose cylinder oils, with the blender the BN can be blended down to what is needed in the engine.

Cylinder oil feed rate and viscosity (BN100)



Cylinder Lubrication Guideline Example

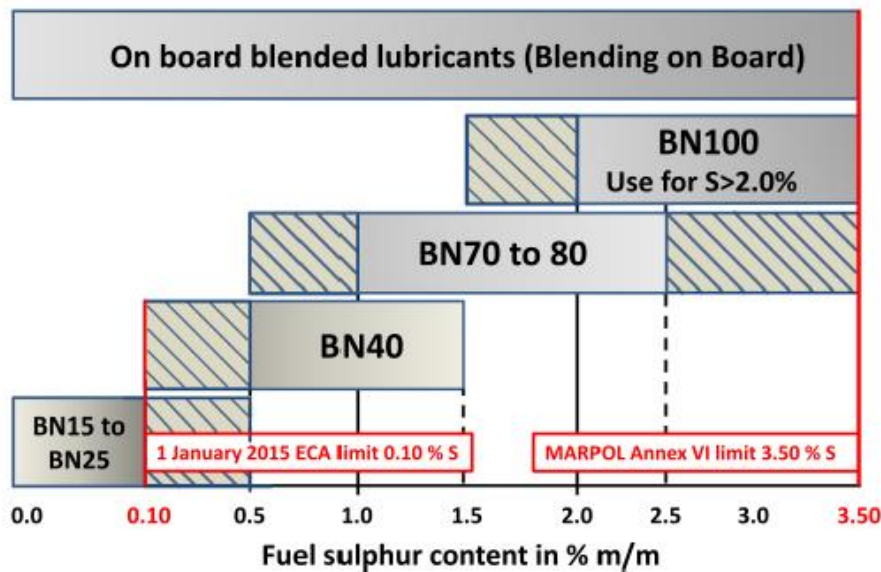


Figure 1 Relationship between fuel sulphur content and cylinder oil BN

*Conditions for validation of lubricating oils for 2-stroke diesel engines –
Cylinder oil & System oil, Revision 7- January 2016*

Example: Optimising for Sulphur neutralisation



CIMAC
CONGRESS

HELSINKI | JUNE 6–10, 2016


2016 | 153

Henrik Rolsted, MAN Diesel & Turbo

Athanasios Saloufas, Costamare

Dimitrios Tsalapatis, Costamare Shipping Company S.A. Athens Hellas

Jesper W. Fogh, MAN Diesel & Turbo

Increased BN	Dosage	Lubricating efficiency
	%	
Ref. BN70	100	Improved efficiency 
BN80	82	
BN85	80	
BN90	74	
BN100	54	

The aim with the blending is to have optimal BN in relation to the actual sulphur content in the fuel and always to have minimum oil dosages. Hereby, a considerable amount of cylinder oil can be saved and an optimal cylinder condition ensured at any time.

Figure 2: Cylinder oil reduction as function of increased BN.
Oil reduction significantly higher than the price increase

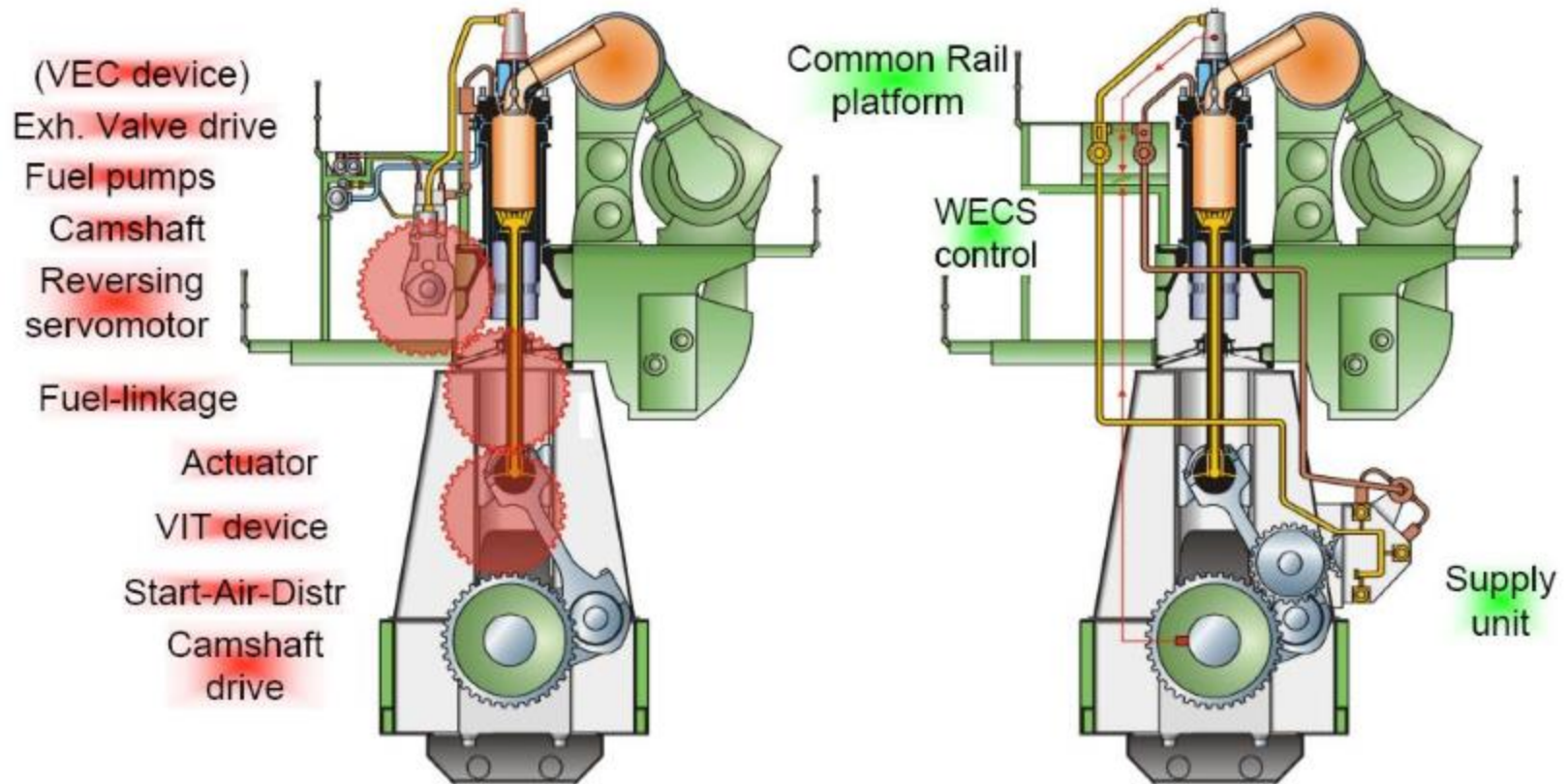
Illustration from

CIMAC Paper 153, page 5, Helsinki 2016

MAN Diesel & Turbo

SYSTEM OIL BENEFITS

2-stroke engine design development



Technical aspects: **System Oil** in operation

- Increased oil stress => particle contamination
- Varnish as result of oxidation
- Contamination of system oil from stuffing box & fuel pumps
- Increased viscosity because of oxidation
- Viscosity affects friction losses (& fuel consumption)



Grete Maersk - 2011:
Oxidised & Dirty System Oil



Grete Maersk - 2012:
Continuously Refreshed Oil

Reduced Piston cooling

Result from clean engine operation



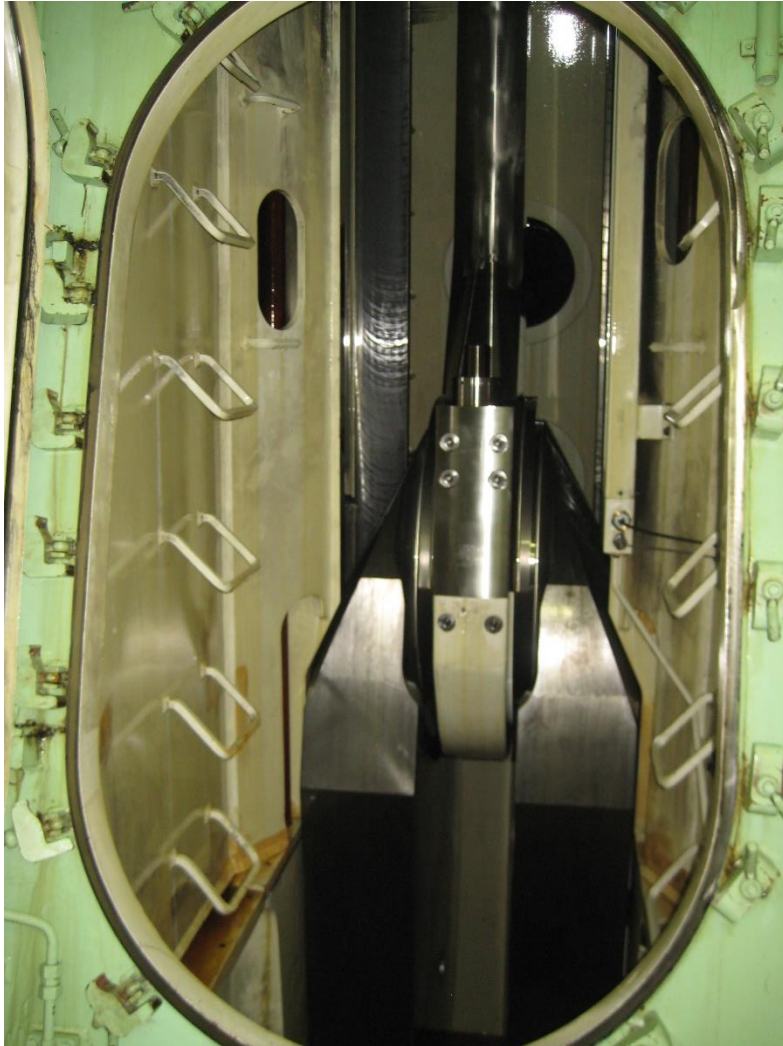
Cooling bores condition as it is (without cleaning)

Dirty engine operation



Considerable amount of deposits on cooling bore tips

Mary Maersk (S80)



SIMPLE INSTALLATION

SEA-Mate® Blending on Board Installation B500Mk2



Lloyd's
Register



BUREAU
VERITAS



SEA-Mate® Blending on Board Installation B500Mk2

Connections:

- System oil
- High BN oil
- Aux Eng oil
- Air
- Electricity
- Discharge

Piping done by the crew.



SEA-Mate® Blending on Board Installation

Mary Maersk (B3000)



Connections:

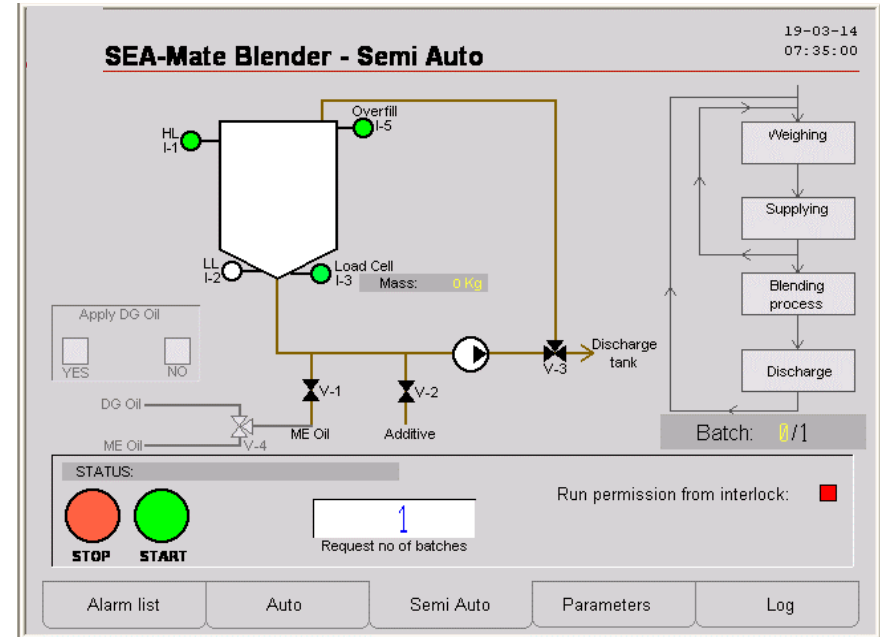
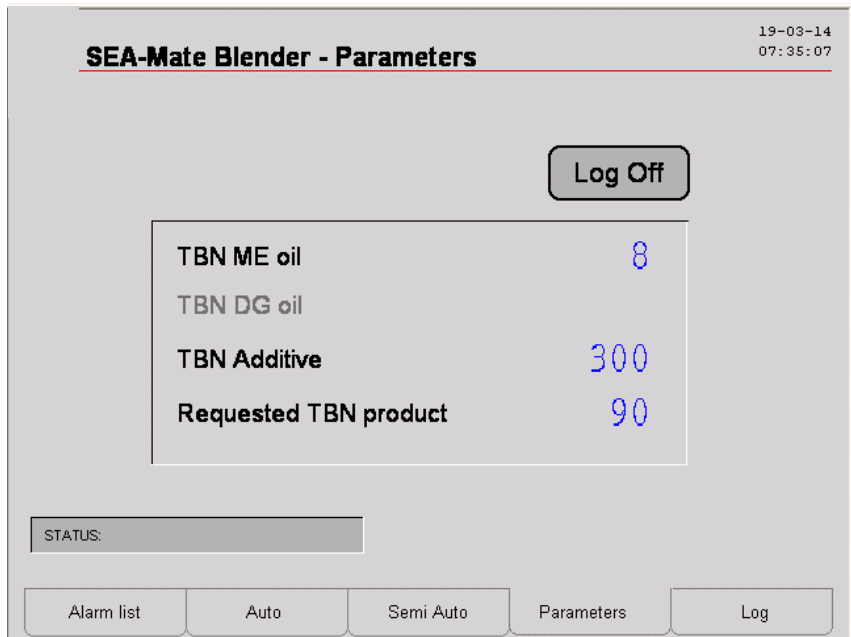
- System oil
- High BN oil
- Air
- Electricity
- Discharge

Piping done by the crew.



Blender Operation

(Graphics on B1000Mk2 and B3000, B500Mk2 has smaller screen)



Operation:

- BOB can be 100% automatic
- Semi-automatic operation, where the crew just has to enter the requested BN and start Blending!

2020

0.5% S compliance scenario



Considering the scenario, flexibility of lubricant quality is and will even be more of paramount importance both for technical and financial reasons.

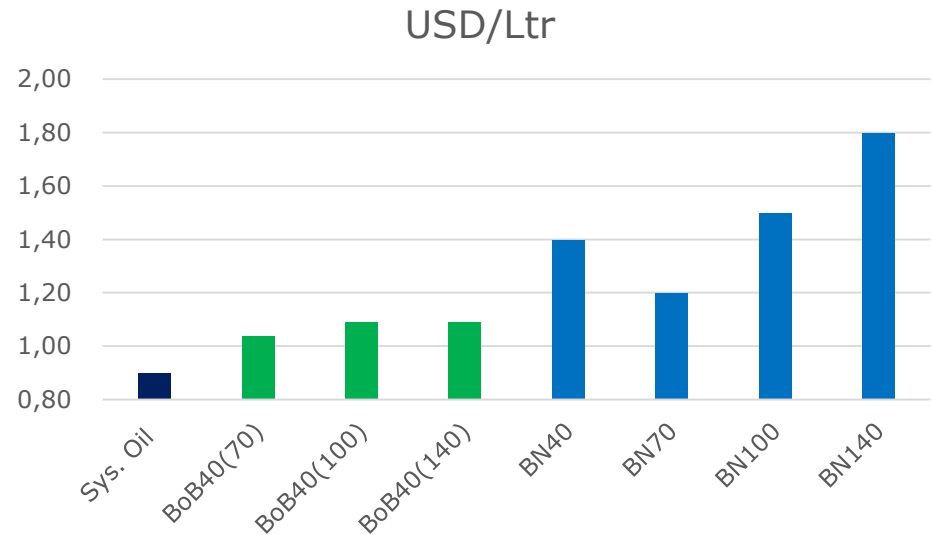
Result of changes 2008 -> 2018:

- **2008:** cylinder oils - 40 and 70 BN
- **2018:** cylinder oils – 15, 25, 40, 60, 70, 100 BN, 140 BN

Blended oil calculation

Typical prices today and what the cost will be for blended oil using BN70, BN100 or BN140 to blend down to BN40.

Annual saving with same feedrate and consumption using the blended oil compared to standard BN40.



Examples of annual saving with BoB
(blended from BN70)

	Engine power	load(%)	Days	kWh	Feedrate	An Cons(ltr)	Price	Sum	Diff
BN40	14.000	60%	250	50.400.000	0,80	42.442	1,40	59.419	0
BoB	14.000	60%	250	50.400.000	0,80	42.442	1,04	44.140	-15.279

Examples of annual saving with BoB using oil from the generators.

	Engine power	load(%)	Days	kWh	Feedrate	An Cons(ltr)	Price	Sum	Diff
BN40	14.000	60%	250	50.400.000	0,80	42.442	1,40	59.419	0
BoB	14.000	60%	250	50.400.000	0,80	42.442	0,95	40.320	-19.099

Examples of high BN cylinder oils and additives

High BN additives:

Chevron – Marine Taro Special HT Ultra (140 BN)

Premier 6 - OptMax Flexguard 140 (140 BN)

Shell – Alexia 140 (140 BN)

ExxonMobil - RN006273F (140 BN)

Castrol – Cyltech 140 (140 BN)

Gulf Oil Marine – GulfSea Cylcare 50140X (140 BN)

TOTAL – Talusia HR 140 (140 BN)

Castrol - X08011PBA (300BN)

ExxonMobil - RT 2522-2 (250 BN)

BP - R11014A (322 BN)

Chevron - Marine MCLA 7050 (312 BN)

Infineum - M7090 (312 BN)

Premier 6 - OptMax BOB300 (300 BN)

Total Lubmarine – Talumar B (300 BN)

Total Lubmarine – Talumar C (300 BN)

PetroChina – RHY3532 (300 BN)

ENGINES USING BLENDERS TODAY

S42MC
S46ME
G50ME
S50MC
L50MC
RTFlex-58
RTA62U
S80ME
S70ME
RTA82
K90ME
RT-Flex96
RTA96
K98ME



Images from the
production facility in
Poland





Thank you for your attention