

MAN Diesel SEA-Mate®

Onboard Blending and Fluid Analysis Systems



Introduction

The SEA-Mate® B2000 Blending System

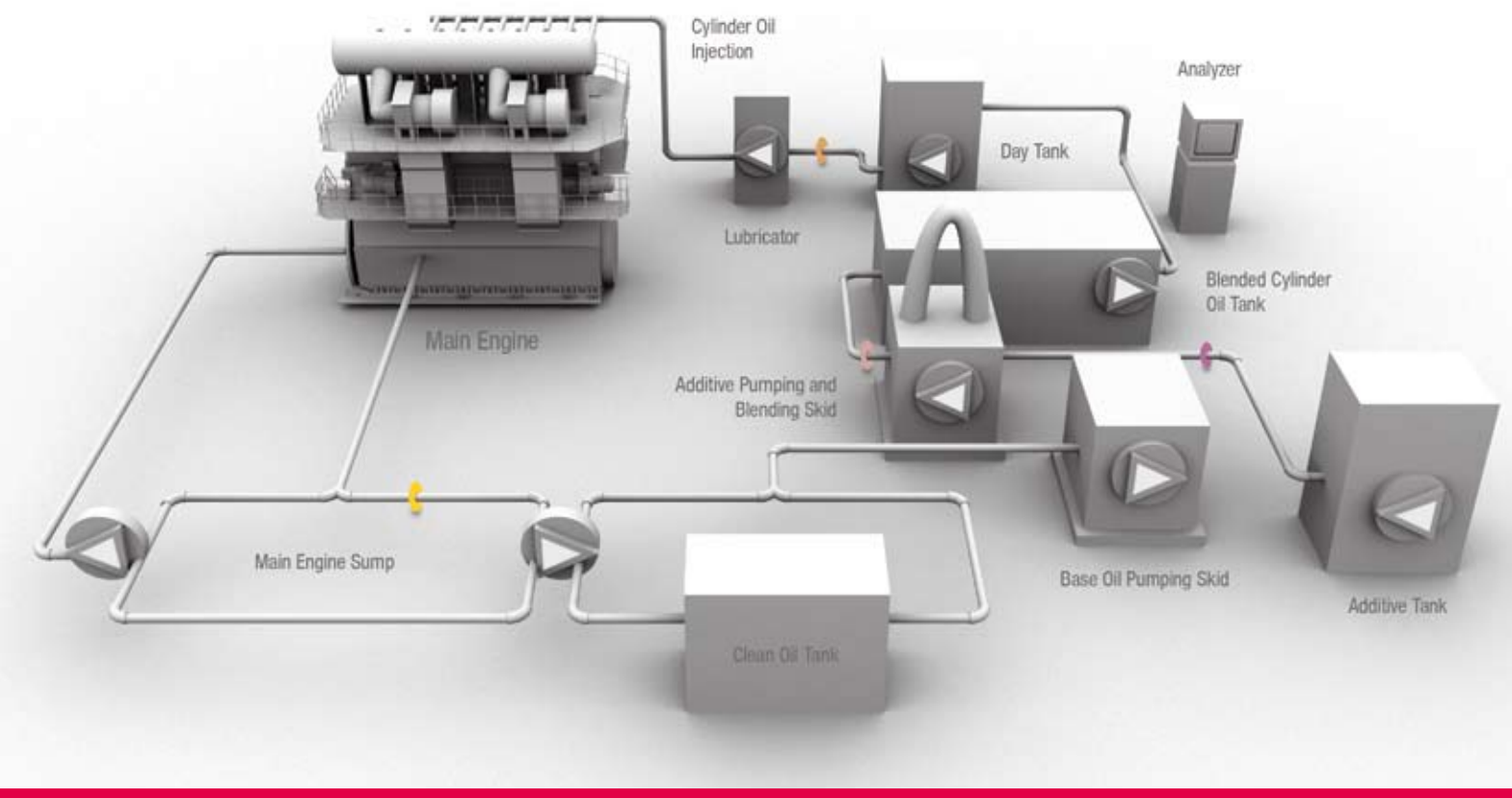


Fig. 1: Drawing of the SEA-Mate® B2000 Blending

As the number of Sulphur Emission Control Areas (SECA) grows, and new regulations are implemented, marine engines will increasingly be required to burn low-sulphur fuel oil within these areas, but can continue to burn high-sulphur fuel oil in non-restricted areas. Theoretically, two cylinder oils should be kept onboard to cope with different sulphur content fuel oils.

The SEA-Mate® B2000 Blending System eliminates this need for multiple BN cylinder oils and is suitable for all two-stroke engines. The system allows the operator to blend cylinder oil to different levels of BN (Base Number) to cope with varying sulphur contents of fuel oil.

A three-year test on a stationary power plant with an MAN B&W 12K90MC-S engine showed that the blended cylinder oil performed equal to one of the industry's best cylinder oils from the leading oil company.

The SEA-Mate® B2000 Blending System was then installed on a number of container ships for onboard field testing in cooperation with MAN Diesel. After 4000 hours and numerous inspections, the results were determined to be fully satisfactory.

Working Principle

The SEA-Mate® B2000 Blending System utilises the used main engine system oil and blends it with the special additive package to produce the blended cylinder oil. Using the SEA-Mate® B2000 Blending System, the operator needs only to purchase the main engine system oil and the additive. The cylinder oil is blended to a specific BN number according to the sulphur level of the fuel oil.

Operationally, the used main engine system oil is pumped to a clean oil tank and the sump tank is replenished with fresh oil. The used main engine system oil is then pumped through the base oil pumping skid (Fig. 3, page 5) to the additive pumping and blending skid, where it is combined with the additive as shown in Fig. 1.

Initially, the condition of the used system oil should be evaluated. The oil must meet MAN Diesel's specifications in terms of viscosity and contamination. In a short period of time, the replenishment of the oil will result in the system oil constantly meeting the specifications of new oil. This has numerous advantages for the engine, such as improved undercrown cooling, improved fluidity, increased bearing protection and improved performance when the system oil is used as the hydraulic oil.

With the SEA-Mate® B2000 blender, the crew can generate the proper blend of oil. Using the control panel, the operator simply enters the BN of the base oil, the additive (a constant), and the BN-target for the blended cylinder oil. The system will automatically control the dosage of additive to meet the target. Blending tests have indicated that the accuracy of the SEA-Mate® B2000 Blender is ± 2 BN. Specification of the quantity to be blended is only necessary when operating the blender in the semi-auto mode. The system will stop automatically when the designated quantity has been blended. In the full-auto mode, the system will start and stop automatically according to a pre-determined level in the blended cylinder oil tank.

The specialised additive package manufactured for this application by the primary oil suppliers utilises the same base technology as used in their respective commercial cylinder oils. The SEA-Mate® B2000 system can be installed by MAN Diesel PrimeServ with no need for off hire.

SEA-Mate® M3000

The Fluid Analyzer

A SEA-Mate® M3000 Analyzer

The patented XRF technology is incorporated with the SEA-Mate® B2000 Blending System to help evaluate the cylinder condition and identify any potential problems within 6 minutes, so that corrective action can be taken. Analysing the scrape-down oil from each cylinder liner provides the crew with an accurate and virtually real-time understanding of cylinder lubrication condition. It has been proved that increases in wear debris can be detected by XRF as soon as 24 to 48 hours before the situation reaches the point that activates the temperature alarm.



Fig. 2: SEA-Mate® M3000 Fluid Analyzer

The SEA-Mate® M3000 analyses the scrape-down oil for catfines, aluminium, etc:

- Calcium (lube oil additive)
- Chromium (piston ring/grove)
- Copper (bearings, stuffing box rings) Iron (all engine components) Lead (bearings)
- Sulphur (fuel oil content)
- Silicon (catfines, sand)
- Vanadium (fuel impurity)
- Zinc (lube oil additive)
- Tin (bearing component)

It is appropriate to note that although X-rays are used to evaluate the samples, the tubes are only on during the actual testing. The SEA-Mate® M3000 Analyzers have been thoroughly tested and certified as safe by TÜV in Germany.

Because the molecular weights of aluminum and silicon (catfines) are very light, the SEA-Mate® M3000 utilises a secondary X-ray tube to ensure that the accuracy of the catfine measurement. In order to minimise the interference of air, which is heavily laden with silicon, helium is used to expel air between the X-ray tube and the oil sample for the purpose of improved accuracy.

The SEA-Mate® M3000 Analyzer utilises a bar code method of identification of both the sample point and the sample bottle. This eliminates the risk of mislabeling samples and greatly expedites the sampling process.

Economic Advantages

Using the SEA-Mate® B2000 System



Onboard SEA-Mate® B2000 Blending System

Additive Savings

The most important role of the additive in the cylinder oil is to neutralise the acid formed from the combustion of the HFO. Its neutralising ability is measured by BN. By using the SEA-Mate® B2000 Blending System, the control of the BN in the cylinder oil can be accurately controlled.

You can adjust the BN to best fit the sulphur content of HFO. The existing standard 70 BN cylinder oil is best suited for operation with high-sulphur fuel. However, sulphur content of commercially available HFO is usually between 2-3% by average.

It has been proven that it is not necessary to use BN 70 cylinder oil when running 2-3% sulphur content HFO. You can save 14%, 29% or 43% of the net additive cost by reducing the BN level from 70 to 60, 50 or 40 respectively.

Since the additive cost is a large portion of the total cylinder oil price, reductions in additive treat rate result in direct measurable lubricant savings.

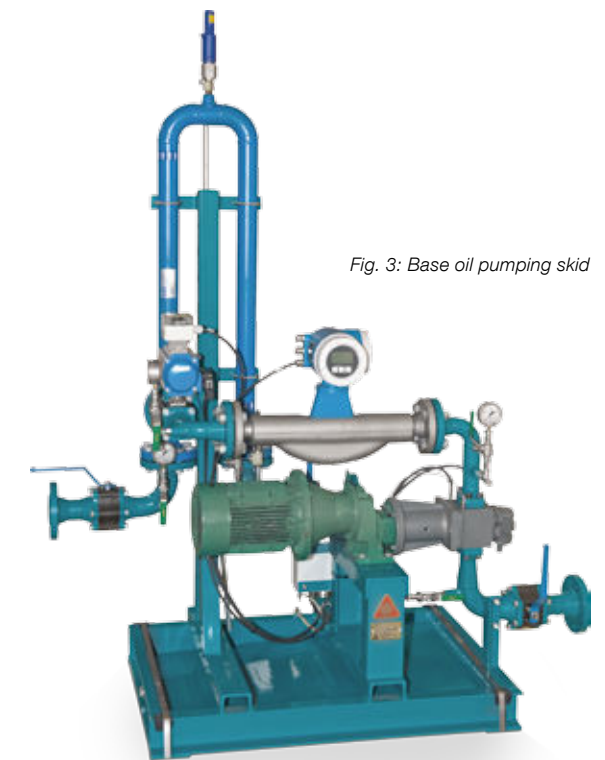


Fig. 3: Base oil pumping skid

Enviromental Advantages

Using the SEA-Mate® B2000 System



Improved Engine Condition

Research by MAN Diesel has shown that unreacted additives increase the level of deposits in the combustion chamber. This can lead to a significantly shorter TBOs.

Furthermore, it keeps the engine sump very clean. It would also extend the life of the various moving parts inside the crankcase, such as bearings, chain, and timing gears.

Particulate Reduction

By optimising the BN of the blended cylinder oil, particulate emissions are reduced, thereby having a positive impact on the environment.

Elimination of System Oil Disposal

Because the system oil is used to blend the cylinder oil on a regular basis, when using the SEA-Mate® B2000 Blending System, the system oil in the main engine sump is kept in a condition similar to new. This precludes any need for system oil change-outs (even partially), therefore saving the trouble and cost of disposal of large amounts of waste system oil as well as the waste oil's impact on the environment.

Predict Problems, and Optimise Cylinder Oil Feed Rate

Traditionally, oil analysis is done at a laboratory on shore. Onboard test kits are also used but can only test viscosity, water and BN. By using the SEA-Mate® Analyzer, elemental analysis can be done onboard in 6 minutes.

The SEA-Mate® M3000 Analyzer can evaluate all lubricants and fuels used onboard the vessel.

Additionally, the analysis is done directly through the oil sample bottle. No decanting is required. Furthermore, since the analysis is non-destructive, the sample can be retained for further advanced analysis or for legal purposes in the event of a quality claim issue.

Historically, lubricant analysis has been done by the oil supplier. If the ship owner changes suppliers, all analysis history is lost. The SEA-Mate® M3000 Analyzer maintains all data history regardless of who the oil supplier is.

In one of the field tests, a vessel's iron level in the scrape down oil from No. 3 cylinder showed a sudden increase from <100 ppm to 350 ppm. The piston was pulled at the next port, and a broken S-lock was determined to be the cause. The rings were replaced.

Further analysis after the repair showed that the iron level returned to normal, thus confirming that the problem had been resolved.

Monitor the HFO Purifier Performance

The maritime industry continues to suffer from costly wear due to less than optimal purification. When fuel with high cat fine levels of 40, 50 or even 80 ppm is taken onboard, purification down to 15 ppm becomes challenging.

To protect the engine, the HFO quality needs to be checked after the separator to make sure it meets the MAN Diesel specification. Since it is not practical to send HFO samples from the separator to a land-based lab for analysis, the SEA-Mate® M3000 Analyzer can help protect the engine by checking the purifier efficiency right away onboard whenever required.

Conclusion

Introducing major technical advances for two-stroke engines is a core value of MAN Diesel. In recent history, our development and introduction of the Alpha ACC concept has revolutionised the industry and produced significant savings for our customers.

The introduction of the SEA-Mate® Analyzer and Blending System takes us to the next level of innovation. This state-of-the-art technology enables our customers to better address environmental regulations, avoid unscheduled downtime, provide greatly improved supply continuity, and reduce overall costs of lubrication.

MAN Diesel

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