White paper

Collating live boiler system data with OEM knowledge

An opportunity for deep OPEX awareness and continuous boiler optimization

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1. Introduction

Today's marine market is an uncertain one, in which ship owners and operators face new technical challenges and changing financial conditions. Safeguarding and improving vessel economy in the fast of such change can be a difficult proposition.

Boiler systems are one area on board where the potential for progress is frequently overlooked. Above all, weakness can be seen in three areas:

- **OPEX**
  Boiler system OPEX is unclear or difficult to determine on many vessels – an issue that will likely become more significant from 2020 onward.
- **Crew capabilities**
  Crews often have difficulty monitoring boiler condition and prioritizing the maintenance efforts that prevent damage and service interruptions.
- **Optimization**
  Fine-tuning that can significantly increase boiler performance and economy requires time and expense in the form of service visits from boiler experts.

Today there are technical solutions available that allow easy gains in all of these areas. The most advanced boiler manufacturers are developing services that combine live data from digital monitoring with deep OEM knowledge, thus giving crews and fleets simpler ways to determine the right courses of action.

This paper explores the three areas above and highlights the issues such digital services can address.

2. Understanding the importance of boiler system OPEX

For a number of years, the marine industry has been in a state of significant change. Whether due to fluctuating oil prices or the implications of new legislation, ship owners and operators have been forced to look more closely at their operations. Profit margins are smaller and earnings are at risk, which means every vessel within a fleet must be operated and maintained in a proper manner so as to maximize its operating economy.

Unfortunately, the role of boiler systems in that economy is usually underestimated. On a tanker (VLCC or Suezmax), for example, a large boiler such as the Alfa Laval Aalborg OL can account for almost 10% of the total fuel consumed due to the vessel's extensive discharge operations. This has been demonstrated in an internal evaluation performed by Alfa Laval.

At the same time, evidence shows that boilers in operation tend to underperform by 5–10%, which increases vessel fuel costs. In light of the data, it becomes clear that boiler systems have a high impact on overall vessel OPEX, which makes improving their operation and maintenance a priority.

Digital services for boiler systems can:

- Establish boiler system OPEX accurately and in concrete terms
- Indicate opportunities for rectifying boiler underperformance

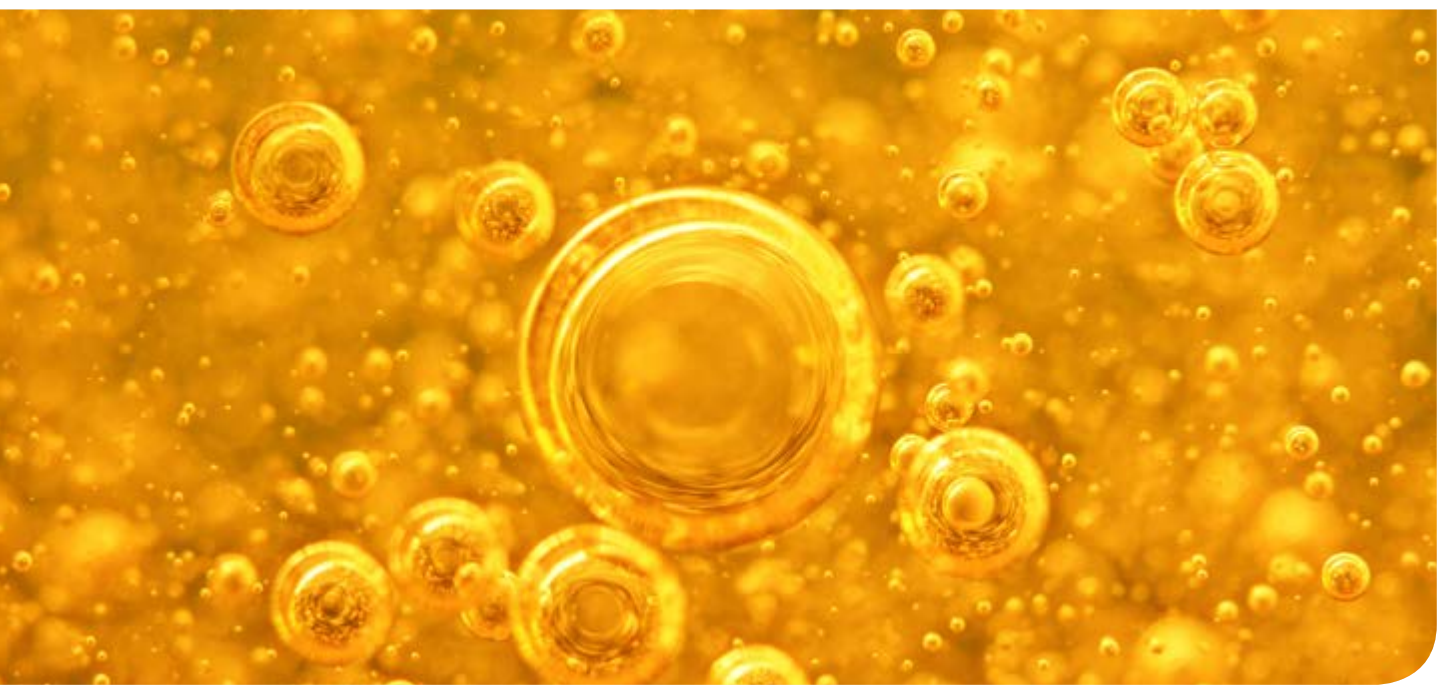
3. New fuels will influence OPEX from 2020 onward

Unfortunately, boiler system OPEX may become more difficult to evaluate or anticipate following the implementation of the global sulphur cap on 1st January 2020. The 0.5% fuel sulphur limit set by MARPOL Annex VI will greatly increase the range of fuel types available on the market. Roughly categorized, they will include:

- Marine gas oil (MGO) fuels comprised exclusively of distillates
- Marine diesel oil (MDO) fuels comprising various blends of distillate with a small proportion of heavy fuel oils
- Very-low-sulphur fuel oil (VLSFO) with a maximum sulphur content of 0.5%
- Ultra-low-sulphur fuel oil (ULSFO) with a maximum sulphur content of 0.1%

As with other fuel-driven systems on board, the introduction of these new fuels will have important implications for the operation of fired boiler systems. In addition, they may have a significant impact on boiler system OPEX. According to many fuel experts, the increase in the number of available distillate types will mean the following:

- Price uncertainty will likely lead to an overall rise in bunker prices
- Distillate prices will likely increase more than those of current fuels



4. New demands on already pressured crews

Another issue pointed out in relation to the 2020 sulphur cap is the fact that there will be a wide range of fuel viscosities and blends. Regardless whether the new fuels are used by the engine or the boiler, they will need to be tested on board and cannot be presumed usable from day one.

Many OEMs – including boiler OEMs – have deployed specific strategies for maintaining the performance of their equipment, regardless of fuel type. These new strategies must be implemented by vessel crews, who may be inexperienced, overworked and already struggling with current routines and OEM recommendations.

Failure to meet OEM prescriptions can have serious consequences for boiler systems. If important actions are neglected or improperly performed, the results may be:

- Back pressure due to soot build-up
- Incorrect oil/air ratio that leads to poor combustion
- Scaling or oil contamination in the feed water

If not promptly corrected, such issues can lead to boiler system failure, which in the worst cases can leave a vessel off-hire. This represents tremendous losses for the ship owner or operator, both through repair costs and lost earnings. Since a boiler repair can potentially take more than 10 days, the impact on OPEX can be massive.

Digital services for boiler systems can:

- Reduce the additional burden on crews when working with new fuels
- Help ensure that OEM strategies for working with new fuels are implemented correctly
- Provide immediate indications of potential problems, allowing them to be solved before damage or failure occurs

5. Knowledge critical to understanding boiler parameters

A major obstacle to taking the right actions at the right time – no matter if the routines are established or new – is lack of crew knowledge. The overall performance of a boiler system cannot be evaluated without considering a number of parameters, such as:

- Oxygen content
- CO_2 content
- Flue gas temperature
- Furnace pressure

These parameters have a critical role in maintaining a boiler system and improving its operation. For example:

1. Furnace pressure indicates a need for cleaning. Pressure within normal limits indicates that the smoke side is clean, while higher pressures indicate soot build-up. Since soot build-up can accumulate very rapidly once it starts, the crew must be able to recognize and understand the pressure change in time.
2. Temperature is important to monitor in conjunction with steam trap inspections, which are a tricky procedure for crews. A difference in temperature should be seen in the temperature before and after the steam trap. If no difference is present, the trap is leaking.
3. Continuous monitoring of oxygen content, CO_2 content and flue gas temperature is needed in order to ensure that the boiler system is operating optimally in relation to the vessel's steam requirements.

All of the parameters mentioned are readily available from the boiler control system. However, checking and adjusting them manually requires action and considerable knowledge on the part of an operator, as well as time for proper analysis. Rotating crews, who may work on different vessels with different configurations during the course of a year, may not have the right knowledge in hand. Even experienced crews may lack the necessary knowledge foundation. Moreover, there is a risk of human error, such that crews may misread, misrecord or simply misunderstand important parameters.

When crews do not obtain the right information or interpret it correctly, the risk is that they make the wrong decision – or no decision at all, which can have similar consequences. This risk is especially great when crews lack time or the solution requires effort, as there may be other tasks on board that they see as more critical.

Whatever the reasons for crew failings, the implications for the boiler system are the same: decreased performance, additional OPEX and increased risk of costly downtime.

Digital services for boiler systems can:

- Automate the collection and analysis of key data needed to evaluate boiler system performance
- Remove the potential for human error in logging and analysing key boiler system parameters
- Help prevent improper decisions made due to lack of knowledge, time or focus

6. Achieving deeper boiler optimization

Unfortunately, it has been difficult for fleet superintendents and onshore staff to recognize crew failings or to know a particular boiler's operating condition in real time. This is problematic when fleets are looking to achieve not just basic economy, but also more significant gains. In light of today's slimmer margins, many marine businesses are seeking a sharper – and often greener – competitive edge, which requires deeper optimization.

When it comes to boiler systems, achieving this sort of optimization involves bringing an expert service engineer on board to adjust the burner's combustion. This is usually an OEM service engineer, who evaluates the oxygen, CO_2 content and flue gas temperature using a flue gas analyser. If necessary, the engineer can adjust the oil/air ratio as well, either from the boiler control system or via the cam band in the case of a relay-based control system.

Visits from an OEM service engineer ensure that available expertise is used to the fullest to optimize performance. However, such visits have to be arranged, which involves both an expense and a time commitment. Moreover, it is not uncommon for issues or emergencies to arise on board the vessel or along its route, meaning that a planned visit cannot be prioritized or carried out.

Digital services for boiler systems can:

- Provide insights into boiler performance without going on board
- Reduce the need for OEM service visits
- Create opportunities for continuous optimization rather than spot efforts

7. Digital services offer easier, better answers

Fortunately, modern technology is providing new opportunities for certainty, even in the face of new fuels and uncertain crew competence. The most advanced boiler manufacturers are developing and deploying digital services with the potential to improve boiler maintenance, performance and OPEX, while at the same time making life significantly easier for crews and fleet superintendents.

The advantage of these services lies in their combination of automatic digital equipment monitoring with the unique knowledge and insights of the OEM. Key equipment parameters are accurately relayed to the boiler manufacturer in real time, allowing boiler service experts to identify immediate issues and perform deeper analyses over time.

Instead of following and interpreting key boiler parameters themselves, crews can receive regular, timely recommendations for necessary actions or possible improvements – thus removing potential for human error, reducing stress on board and freeing up time for other valuable activities. Likewise, fleet superintendents have access to a clear snapshot of boiler system performance, including graphs and trend data, which can be used for fine-tuning boiler operations on a single vessel or across the fleet.

The potential benefits of digital services like these are many:

- Reduced risk of boiler system issues and downtime (and potential time off-hire)
- Improved combustion efficiency (potentially 5–10%)
- Increased fuel efficiency (potential annual savings of USD 25–50,000 based on 1500 tonnes of HFO)
- Reduced risk of black smoke when the vessel is in harbour
- Prolonged boiler lifetime
- Better utilization of crew time and effort
- Reduced need for crew competence investments
- Greatly decreased OPEX for the boiler system and vessel

Alfa Laval is among those suppliers with digital services for improving boiler system operation, fine-tuning boiler system performance and reducing boiler system OPEX. To learn about the options and considerations for your specific boiler configuration or fleet, contact Alfa Laval or visit **www.alfalaval.com/boilerdigitalservices**

About Alfa Laval

Alfa Laval is a leading global provider of specialized products and engineering solutions.

Our equipment, systems and services are dedicated to helping customers to optimize the performance of their processes. Time and time again. We help our customers to heat, cool, separate and transport products such as oil, water, chemicals, beverages, foodstuff, starch and pharmaceuticals.

Our worldwide organization works closely with customers in almost 100 countries to help them stay ahead.

How to contact Alfa Laval
Up-to-date Alfa Laval contact details for all countries are always available on our website at www.alfalaval.com

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