Solution overview

Preparing boilers for the 2020 sulphur cap

Fuel line recommendations for Alfa Laval Aalborg boiler systems

April 2019

Your partner for all 2020 fuel challenges

The coming global sulphur cap will have a sweeping impact on marine fuels and the systems that depend on them. Alfa Laval is committed to providing equipment and strategies that will ensure compliant operation, but also safety and fuel efficiency.

Fuel systems for boilers are a small but important part of that work. Still more is being done near the engine, where the Alfa Laval Adaptive Fuel Line is securing new levels of protection and efficiency – even as fuels change. To learn more about fuel line products and the Alfa Laval Adaptive Fuel Line, visit **www.alfalaval.com/fuelline**

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More about how the 2020 sulphur cap will impact boiler systems can be found at **www.alfalaval.com/boiler2020**

1. Introduction

In 2004, the MARPOL Annex VI Regulations for the Prevention of Air Pollution from Ships were agreed upon and adopted. Regulation 14 of the annex established a stepwise reduction of permissible SOx emissions. As of 1 January 2020, the global sulphur cap will be 0.5% m/m, while the previously adopted limit of 0.1% m/m in Emission Control Areas (ECAs) will remain in force.

Complying with Regulation 14 will have a tremendous impact on maritime industry. Vessels will need to find ways to reduce their SOx emissions, and there are multiple strategies owners/managers can choose to achieve the necessary reduction. Even though the boiler will be only a small part of the overall decision, most strategies will affect the boiler's operation.

This document aims to provide information and recommendations on how to optimize boiler operation using compliant fuel oils.

Vessels fitted with a scrubber that is also connected to the boiler can operate on high-sulphur fuel oil (HSFO) as the primary fuel for the boiler. However, compliant fuel oil might be required temporarily, especially in cases where an open-loop scrubber is selected. The boiler fuel line will thus need to be optimized according to sailing area (ECAs and/or global cap area) and the compliant fuel selected in the different trading areas. We duly recommend that you contact us for a case-by-case consideration of such projects. This document does not consider such options.

2. IMO implementation plan

The IMO Marine Environment Protection Committee, at its seventy-third session (MEPC 73), approved guidance on the development of a ship implementation plan for consistent implementation of the 0.5% sulphur limit under MARPOL Annex VI.

Issues to consider for boiler operations are addressed directly and indirectly in various sections of the guidance:

"Technical capability of ships to handle different types of fuels (e.g. suitability of fuel pumps to handle both higher and lower viscosity fuels, restrictions on fuels suitable for use in a ship's boilers, particularly the use of distillate fuels in large marine boilers)"

"Compatibility of different types of fuels e.g. when paraffinic and aromatic fuels containing asphaltenes are commingled in bunkering or fuel changeover"

"The ship tank configuration and fuel system may require adjustments. A fully segregated fuel system for distillate fuels and blended fuels is recommended because they may require special attention. Ship tank configuration and segregated fuel system will also allow for better management of potentially incompatible fuels."

A link to the full text of the issued guidance is available **here**.

3. Alfa Laval Aalborg boiler fuel line systems

Original Fuel Line System (pre-2010)

Prior to 2010, Alfa Laval (at the time Aalborg Industries) supplied boilers with a simple fuel line system, the Original Fuel Line System, that was not designed for MGO operation. Additionally, all fuel changeover procedures were conducted manually. Fuel oil systems were designed to use HFO as the primary fuel, with MDO used solely during start-up and not for continuous operation.

Post-2010, enhanced systems were introduced as standard. This was in response to IMO's announcement of pending ECA regulations restricting the sulphur content of fuels used in ECAs to 0.1% (and prompting the use of MGO within those ECAs).

Vessels delivered with an Aalborg boiler after 2010 should have been supplied with either a Single-Line Fuel System or a Double-Line Fuel System (described below). Additionally, both of these systems have been delivered as upgrade solutions for an Original Fuel Line System.

Single-Line Fuel System

A Single-Line Fuel System ensures safe operation of the boiler with low-viscosity fuels (MGO) and through automated fuel changeover procedures. However, its design does not ensure segregation between different fuels. Additionally, the design does not consider additional constraints introduced by a 0.5% sulphur limit and the new residual fuels entering the market, especially with regard to fuel compatibility.

Double-Line Fuel System

A Double-Line Fuel System also ensures safe operation of the boiler with low-viscosity fuels (MGO) and through automated fuel changeover procedures. At the same time, it ensures segregation* of the fuels (if only two are used) in line with recent IMO guidance leading up to the implementation of the 0.5% global sulphur cap.

* *Even with a Double-Line Fuel System, mixing of a very small volume of fuel is required and considered acceptable provided the system is operated as per instruction manuals.*

4. Recommendations for compliant boiler operation

The fuels referred to in this paper can be summarized/categorized as follows:

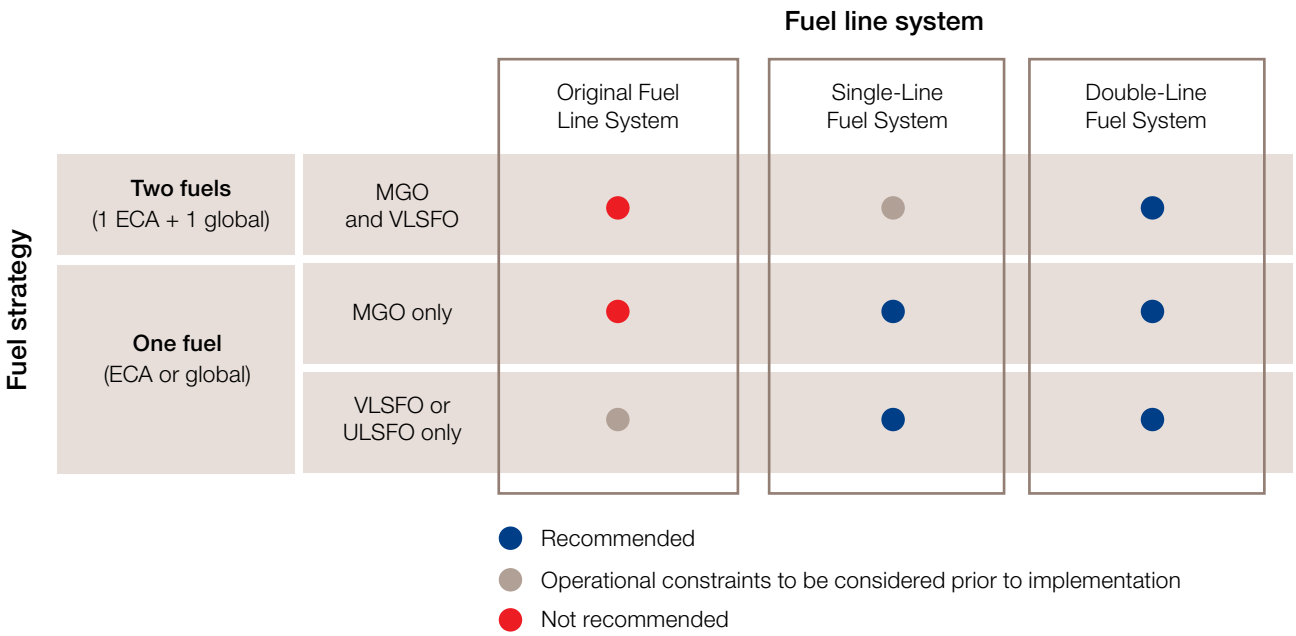
- **Marine gas oil (MGO)**
  Marine fuels that consist exclusively of distillates and fall with DMA/DMZ ISO 8217 categories
- **Marine diesel oil (MDO)**
  Marine fuels generally composed of various blends of distillates and a small portion of heavy fuel oils which fall within the DMB ISO 8217 category
- **High-sulphur fuel oil (HSFO)**
  Fuels with a maximum sulphur content of 3.5%
- **Very-low-sulphur fuel oil (VLSFO)**
  Fuels with a maximum sulphur content of 0.5%
- **Ultra-low-sulphur fuel oil (ULSFO)**
  Fuels with a maximum sulphur content of 0.1%

To meet the IMO regulations for both ECAs (implemented from 1 Jan 2015) and the 2020 global sulphur cap, this paper will consider three fuel strategy options for boiler operation:

1. Operation on MGO and VLSFO
2. Operation on MGO only
3. Operation on VLSFO or ULSFO only (temporary operation on distillate)

Note: Other fuel strategies are possible, but this document focuses on only these. For any other fuel strategies, please contact our team for support and advice.

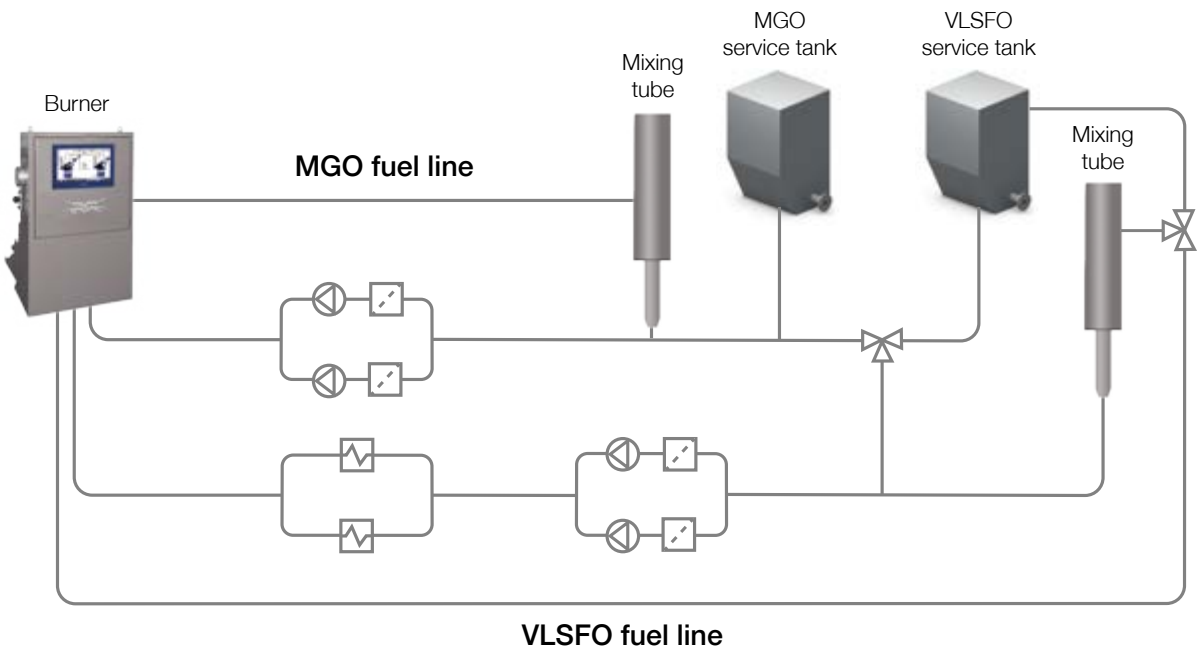
Alfa Laval's recommendations for fuel line and fuel strategy combinations are as follows:



4.1 Boiler operation on two fuels

From 1 January 2020, Alfa Laval's recommendation is the operation of boilers with a Double-Line Fuel System.

Example:



The Double-Line Fuel System can be supplied as an upgrade package for existing systems. It fulfils IMO requirements/guidance as follows:

- **Fuel segregation**
  With a Double-Line Fuel System operated with two fuels, MGO (pure distillate, 0.1% sulphur compliant) and VLSFO (0.5% sulphur compliant), boilers are prepared for operation in all areas. The two independent lines, one for each fuel, ensure proper segregation* of the two fuels.
- **Handling of low-viscosity fuels**
  Originally designed for the safe and efficient operation of MGO, the Double-Line Fuel System fulfils IMO requirements with the highest level of safety standards:
  - Replacement of the burner lance suitable for steam atomizing under MGO operation (steam-atomizing burner only)
  - Additional flame scanner
  - Optimization of post-purge times and change of shutdown procedures
  - Additional pumps able to handle the low-viscosity fuel oils
  - Rebuild of the fuel oil supply line

Due to the lack of segregation, lack of safety optimization for handling low-viscosity fuels and lack of automatic fuel changeover sequences – and thus the inability to meet IMO guidance – we do not support the Original Fuel Line System as a viable solution for a two-fuel strategy.

* *Note: Even with a Double-Line Fuel System, mixing of a very small volume of fuel is required and considered acceptable provided the system is operated as per instruction manuals.*

4.2 Boiler operation on one fuel

MGO (0.1% compliant) is compliant globally. Locking the boiler to MGO is therefore an option, but one with likely consequences for fuel cost. Locking the boiler to MGO requires safety adjustments to the burner/fuel line that vary from system to system.

We would be glad to provide our best recommendation. Please contact us.

Vessels sailing only in global cap areas or in ECAs might opt for boiler operation on one fuel only – VLSFO or ULSFO. Both fuels are expected to be residual marine or blended fuels which require heating, and temporary operation on distillate marine fuels will still be required in the event of a dead ship. These operational profiles will require specific recommendations related to the viscosity and heating.

We would be glad to provide our best recommendation. Please contact us.

4.3 Specific recommendation for new compliant fuels

New fuels available to meet the demands of 2020 (VLSFO and ULSFO) are entering the market and have been shown to have highly variable compositions and characteristics. This brings some challenges and additional operational considerations into play if these fuels are chosen to fire the boiler.

Some of these fuels may have properties (e.g. cat fines or fatty acid) that could accelerate the wearing of fuel line and boiler system components. We duly maintain the component stock of critical spare parts, but we recommend that you consider the purchase of an emergency spare parts kit for this specific purpose – the Alfa Laval 2020 Spare Parts Kit.

5. Conclusions and additional information

Original Fuel Line Systems

If the vessel will operate within both ECA areas and global cap areas, we duly advise fulfilling IMO implementation guidance by:

- Upgrading to a Double-Line Fuel System
- Upgrading to lock the boiler to MGO operation only

Single-Line Fuel Systems

Depending on the operational profile of the vessel and the fuel implementation plan, it may be challenging to operate the boiler with a Single-Line Fuel System and/or to comply with IMO guidance.

Upgrading to a Double-Line Fuel System could be considered.

If continuing to operate or upgrading from a Single-Line Fuel System, tailor-made recommendations are available for the different single-line configurations. Integrating the currently available information on the fuel environment after 1 January 2020, we can provide detailed operational considerations and recommendations to support an understanding of the limitations and help secure effective boiler operation.

Please contact us for the considerations and recommendations for your specific fuel line configuration.

Double-Line Fuel Systems

A Double-Line Fuel System operated with two fuels is our recommended solution for boiler operation following the introduction of the IMO 0.5% global sulphur cap.

For vessels already fitted with this fuel system design, or choosing to upgrade to it, tailor-made recommendations are available for the different double-line configurations. Integrating the currently available information on the fuel environment after 1 January 2020, we can provide detailed operational considerations and recommendations to support an understanding of the limitations and help secure effective boiler operation.

Please contact us for the considerations and recommendations for your specific fuel line configuration.

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.

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