CIMAC
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ON COMBUSTION ENGINES

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CIMAC Position Paper

New 0.10% sulphur marine (ECA) fuels

Introduced to the market to meet the SO_x ECA fuel sulphur specification of maximum 0.10%

By CIMAC WG7 Fuels

This publication is only for guidance and gives an introduction to the technical and commercial considerations related to the new marine fuels that are entering the market. It neither claims to cover any aspect of the matter, nor does it reflect all legal aspects in detail. It is not meant to, and cannot, replace own knowledge of the pertaining directives, laws and regulations. Furthermore the specific characteristics of the individual products and the various possible applications have to be taken into account. This is why, apart from the assessments and procedures addressed in this guide, many other scenarios may apply.

The first edition of this CIMAC Position Paper was approved by the members of the CIMAC WG7 ‘Fuels’ in June 2015.

Content

1 Summary

New 0.10% sulphur (S) marine fuels recently introduced in the market offer an economically attractive alternative to conventional distillate fuels such as DMA. Before purchasing a new fuel product, operators should carefully consider the specific technical and operational challenges this fuel may have and where necessary, contact the fuel supplier or OEM for the considerations to be made to ensure safe operation.

2 Introduction

Legislative changes on the 1st of January 2015 require ships operating in SOx Emission Control Areas (ECA) to reduce their sulphur oxide (SO_x) emissions. The SO_x ECA's currently included are the Baltic Sea, The North Sea, the English Channel and waters within 200 nautical miles from the coast of USA, the coastal waters around Puerto Rico and the U.S. Virgin Islands (the US Caribbean ECA) and Canada. The latest IMO SOx requirements can be met by using fuel with a sulphur content of maximum 0.10% or by equivalent means such as using an exhaust gas cleaning system.

Alternative fuels (methanol, LNG, biofuels) and systems are available to ensure compliance, however these are still at an early stage of their development and feasibility limited by logistical, technological, and/or sustainability factors.

3 New fuels with maximum 0.10% sulphur

Traditional marine distillate fuel, referred to as marine gasoil or DMA, today is the most widely available 0.10% sulphur marine fuel and expected to be the main fuel used in SO_x ECA's from 1st Jan 2015 onwards; already more than 70% of marine distillate fuels (DMA, DMB) supplied in the main bunker ports have a sulphur content below 0.10%.

To meet the increased demand for 0.10% S marine fuel, several fuel suppliers have, however, developed new fuel formulations that are claimed to be more cost effective than conventional distillate fuels such as DMA. Several of these fuels combine properties of both distillate and residual marine fuels.

These new fuels can broadly be divided in the following categories;

- ultra low sulphur residual fuel oils; Typically, these fuels have lower viscosity and density, and better ignition and combustion properties compared with conventional residual marine fuels.
- blends of a distillate fuel with small amount of residual fuel oil (DMB type)
- heavy distillates; fuels with low metal content but with higher viscosity than conventional DMA

As every fuel supplier has designed its own unique formulation, properties of the new 0.10% sulphur fuels currently seen in the market vary significantly, which means that each fuel has its own specifics in terms of storing, handling and using the fuel.

However, due to these fuels only recently being launched, there is limited experience in their use at this time. The International Council on Combustion Engines (CIMAC) recognizes this and has recently initiated a working group with technical experts from the industry (ship owners, OEMs, fuel suppliers, testing agencies) to address this and collate information in order to develop a technical guide predominantly for ship owners, operators and fuel buyers.

3.1 Some common characteristics of the new 0.10% sulphur fuels

- **Compatibility and stability**
  - While there is always a risk of incompatibility when different fuels are being mixed, most of the new fuels are **more paraffinic** and consequently carry an increased risk of incompatibility with conventional residual fuels. Note that there is a similar risk when conventional DMA is mixed with conventional residual fuel.
- **Viscosity** of the new fuels is generally lower than conventional residual fuel grades RMG and RMK but **higher** than DMA, which means they may require heating. Compared with conventional DMA there may be a reduced risk of thermal shock during change over however operators should, as always, ensure that temperature gradients do not exceed the recommended max 2°C/min.
- **Density** of the new fuels is in general lower than conventional residual fuels. This may require adjustment of centrifuges to ensure adequate cleaning of the fuel.
- The new fuels generally have **excellent ignition** quality.
- **Pour point** of the new fuels varies significantly. In some cases, pour point exceeds limits stated in ISO8217 for DM and RM grades. The general rule is that fuels should be stored at min 10°C above pour point (Note: pour point indicates temperature below which the fuel does not flow). These fuels may have different cold flow characteristics than conventional fuels and relying only on pour point is not sufficient to ensure problem-free operation (reference is made to CIMAC Guideline 01. 2015, “Cold flow properties of marine fuel oils” http://www.cimac.com/working-groups/wg7-fuels/index.html).
- **Cat fines and sediment** content are typically lower than that of conventional residual fuel. Some of these new fuels are free of cat fines whereas others contain only small amounts of cat fines. In order to protect the engine, the general recommendation is to use the ship’s residual fuel treatment system to clean the fuel.

3.2 Key technical considerations for ship owners and operators

- **Ship tank configuration and fuel system**
  - The viscosity of most of these new fuels is such that they cannot be used in distillate fuel-only systems and machinery as they require heating for cleaning and combustion. A fully segregated fuel system for both residual fuels and these new fuels is recommended to minimize risk of incompatibility and formation of sludge when switching from conventional residual fuels to the new fuel and vice-versa.
  - Note: Tank cleaning is recommended when using a residual fuel tank for storing these new fuels. This is to prevent sludge that has built up in these tanks from entering the fuel system.
- **Heating requirements**
  Due to the cold flow properties of most of these new fuels, permanent heating of the fuel may be necessary to minimize the risk of wax formation, also in storage. This is especially important in colder regions.
- **Fuel treatment system**
  - Some of these new fuels may contain cat fines and/or sediments and therefore need onboard cleaning.
  - Separator temperature and settings should be adjusted to the fuels viscosity and density. Please refer to recommendations from OEM and fuel supplier.

- Note: Considering that many of these new fuels have lower viscosities compared to conventional residual fuels, care should be taken to ensure no overheating occurs.

- **Fuel change-over** procedures for switching between new and conventional residual fuels are essentially not different compared to switching between conventional DMA and residual fuel; controlled change-over minimizes risk of thermal shock on equipment and fuel incompatibility. The higher viscosity of many of these new fuels may even reduce the risk of thermal shock compared with conventional DMA.

- **Lubrication**
  - Two-stroke engines: the normal cylinder lubrication recommendation is to use high-BN cylinder oil (70-100 BN) when operating on high-sulphur fuels and low-BN cylinder oil (15-40 BN) when operating on low-sulphur fuel products. The same lubrication recommendations apply for new fuels as for conventional low sulphur DMA, i.e. use low BN cylinder lube oils and operate at the lowest recommended cylinder lube oil dosage in order to avoid complications with deposits building-up. Please refer to OEM recommendations.
  - Four-stroke engines: For longer term continuous operation on low sulphur fuels a change of system oil to a lower BN may be required.

3.3 Key commercial considerations for ship owners and operators

Apart from technical considerations, fuel availability is also important. Fuel buyers should have a bunkering strategy in place that considers tank capacity and configuration to the operating profile of the vessel. Some of the new fuels are only available in one specific region and cannot be sourced in other areas.

Although the new fuel types are produced to meet the max. 0.10% sulphur requirement for use within SO_x ECA **they do not always fit fully into either the 'table 1' or 'table 2' grades of the ISO 8217 specification.** They can however be divided between being a predominantly residual marine based blend product (RM) or predominantly distillate marine (DM) blend product, essentially those containing residual components and those not. The ISO 8217 specification, however, still provides a very good basis to order against. It should be ensured however that any exceptions to the nominated ISO 8217 grade are clearly stated; these exceptions to be based on the available specification data from the fuel supplier.

4 Conclusion

In conclusion, these new 0.10% sulphur fuels offer an economically attractive alternative to conventional distillate fuels such as DMA. Before purchasing a new fuel product however, operators should carefully consider the specific technical and operational challenges this type of fuel may have and where necessary, contact the fuel supplier or OEM for the considerations to be made to ensure safe operation.

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