



BIOFUELS AS MARINE FUELS UNDER THE IMO'S AND EU'S REGULATORY FRAMEWORK

This Regulatory News provides background information and guidance for the use of biofuels for Class, EU and IMO requirements.

This publication supersedes the earlier ABS Regulatory News No.06/2022, with the addition of example calculations for the conversion factor (C_F) for biofuels.

INTRODUCTION

With new regulations aimed at reducing air pollutants and greenhouse gases (GHGs), there is increased interest in biofuels. Zero and low carbon fuels, such as hydrogen, ammonia, and biofuels with negligible sulfur can lower particulate matter, gaseous and carbon emissions. MARPOL Annex VI has dealt with the use of biofuels by fuel oil quality regulations under Regulation 18.3.2, while the [ISO standard 8217 "Petroleum products – Fuels \(class F\) – Specifications of marine fuels"](#) was modified in 2017 to widen tolerance for use of biofuels in existing and new fuel oil grades.

CLASS AND STATUTORY REQUIREMENTS

Safety – SOLAS Flash Point

Liquid biofuels, or biofuel blends, intended as "drop-in" fuels to replace conventional residual or distillate fuel oils are to meet the SOLAS requirement for a flashpoint of not less than 60° C.

Safety – ISM Requirements

The IMO International Safety Management Code (ISM Code) provides an international standard for the safe management and operation of ships and the prevention of pollution. With respect to biofuels, the fuel supplier's fuel specifications, Bunker Delivery Note (BDN), SDS sheets, equipment manufacturer's recommendations and industry stakeholder guidelines provide the basis for operators to undertake their ISM Code obligations. While there are some risks to equipment and operation with certain biofuels, the 'drop-in' nature and similarity to conventional residual or distillate fuels makes application relatively simple.

KEY NOTES

- Applicable Vessel Types: All
- Required Actions: Attention to Class and Statutory requirements
- References:
 - MARPOL Annex VI Regulation 18.3
 - Marine Vessels Rules 4-2-1
 - MEPC.1/Circ.795/Rev.8
 - MEPC.1/Circ.878
 - ISO 8217:2017
 - MEPC.1/Circ.905
 - Directive (EU) 2018/2001
 - Regulation (EU) 2023/957
 - Delegated Regulation (EU) 2023/2776
 - ICAO's CORSIA Approved Sustainability Certification Schemes

| CHEMICAL COMPOSITION | FAME | HVO | DIESEL |
|---|-------|----------------|--------|
| Density at 20° C (kg/m ³) | 885 | 780 | 825 |
| Lower Heating Value (LHV) (MJ/kg) | 37.1 | 44.1 | 43.1 |
| Viscosity at 20° C (mm ² /s) | 7.5 | 3.0 (at 40° C) | 5.0 |
| Surface Tension (N/m) | 0.026 | - | 0.028 |
| Cetane Number (CN) | 56 | 80-99 | 40-50 |
| Stoichiometric Air/Fuel Ratio | 12.5 | - | 15 |
| Oxygen Content (% vol.) | -11 | 0 | 0 |
| Aromatics Content (% vol.) | - | 0 | -30 |
| Sulfur Content (ppm) | - | 0 | < 3.5 |

Environment – MARPOL Annex VI NOx Implications

IMO fuel oil quality requirements of MARPOL Annex VI regulation 18 classify fuel oils into two main categories:

1. Regulation 18.3.1.1: addresses blends of hydrocarbons from petroleum refining.
2. Regulation 18.3.2: addresses fuel oil derived by methods other than petroleum refining.

Within the latter, Regulation 18.3.2.2 indicates that such fuel is not to cause an engine to exceed the applicable NOx emission limit. Biofuels may be considered to fall under either category since they may be a blend of bioderived product with conventional petroleum derived sources or be solely bioderived.

There have been ongoing discussions within the industry and in the IMO on how Regulation 18.3.2 should be applied to biofuels. The outcome of these discussions is a revision 8 of [MEPC.1/Circ.795 “Unified Interpretations to MARPOL Annex VI”](#) approved by the [Marine Environment Protection Committee, at its eightieth session \(MEPC80\)](#) which now provides a Unified Interpretation (UI) on the application of biofuels to marine engines and, in many cases, allows the use of biofuels without the need to validate the NOx impacts.

Class Requirements

All machinery and equipment intended to consume marine fuel oils are to be designed to burn all intended fuels and meet ABS' Class requirements. However, biofuels or “biodiesels” are still liquid fuels and therefore are not a type defining parameter (please refer to ABS [Marine Vessels Rules 4-2-1/13.5.2 and Table 4 “Type Defining Parameters”](#)) of an internal combustion engine. Furthermore, not all internal combustion engines are designed for the wide variety of residual and distillate marine fuels that are available for marine application.

The suitability of the engines to burn all marine fuels is also demonstrated through the engine designer internal testing, which forms part of the manufacturer’s MARPOL Annex VI Technical File Stage A type testing. Engine type tests (and NOx certification testing) are typically undertaken on distillate grade marine fuels, and this is acceptable for all liquid fuels, under the type defining parameters, that an engine may operate on in service.

The suitability of a particular engine design to burn biofuels should be confirmed by the engine designer, who will typically issue generic guidance or provide specific acceptance of a particular biofuel. Makers have issued service letters or operational guidelines for biofuels.



Where engines are intended for burning residual fuel

oils, or other special fuel oils which may be interpreted as applicable to biofuels, the suitability for that is to be demonstrated during shipboard trials as per [Marine Vessels Rules 4-2-1/13.9.6](#).

GUIDANCE FOR OPERATORS

Statutory NOx:

1. **Operation on distillate biofuels containing up to seven percent FAME:** The grades detailed by [ISO 8217:2017](#) – is permitted and would not require NOx recertification or any onboard NOx emissions measurements to be undertaken for engines already certified to Regulation 13.
2. **For blends between 7-30 percent (inclusive) biofuel:** Assessment of NOx impacts is not required under the provisions of [MEPC.1/Circ.795/Rev.8](#).
3. **For blends of more than 30 percent of biofuel:** If biofuel can be burnt without changes to the NOx critical components or settings, assessment of NOx impacts is also not required. Operators are to clarify whether they intend to:
 - a. undertake emissions trials under MARPOL Annex VI regulation 3.2,

- b. apply for use of the biofuel as an ‘Equivalent’ under Annex VI regulation 4, or
- c. apply the unified interpretation by [MEPC.1/Circ.795/Rev.8](#).

Dialogue with the flag Administration will be required for application under regulations 3.2 or 4, and further guidance on this process can be provided by the local ABS office.

Most marine 2-stroke slow speed engines and larger 4-stroke medium speed engines, which are designed for a broad range of distillate and residual marine fuels, can already accommodate a wide variation in fuel quality and have the span of NO_x performance criteria associated with the engines’ adjustable features defined in the NO_x Technical File. These engines are likely able to burn biofuels without any changes to the NO_x critical components or settings. In these cases, confirmation from the NO_x Technical File compiler or engine designer is to be obtained.

Statutory Safety:

1. The owner/operator should develop an implementation plan, or similar, for the use of biofuels and change-over requirements in their Safety Management System (SMS). The plan need not be submitted for approval but may be treated as part of the ISM-SMS documentation in place. Unless detailed requirements are published by IMO, the 2020 guidance under [MEPC.1/Circ.878](#) may be used as a template for developing biofuel implementation plan.

Classification:

1. **For blends between 7-30 percent and blends more than 30 percent of biofuel**, a confirmation from the OEM should be submitted to ABS on the suitability of the engines to burn the proposed biofuels and that they have no objection and/or applicable conditions to the biofuel use. Any limitations or requirements for application on board are to be followed.
2. **For blends of more than 30 percent biofuel**, specifications of the proposed biofuel(s), engines intended to run the fuels, and, as applicable, trial testing dates are to be submitted. The fuel specification may include a lab test providing the fuel parameters demonstrating compliance with IMO’s flashpoint and sulfur content requirements under SOLAS and MARPOL.
 - a. Risk assessment showing that risk control measures are in place in case of engine failure or fuel related issues. Any changes to the ship fuel oil system require submission of plans for review.
 - b. If the assessment results that the fuel is considered “special fuel” as per [MVR 4-2-1/13.9.6](#), then on board verification during trials should be undertaken; otherwise trials can be omitted at the discretion of ABS.
 - c. Upon satisfactory review of the submitted information, ABS will issue a letter indicating acceptance for Class purposes and/or the conditions/limitations to the proposed testing with copy to the responsible Survey office, and if applicable, indicating that shipboard suitability tests are to be demonstrated to an attending Surveyor.



ABS Class Notations on Biofuels

Upon owner’s request, the optional class notation **Biofuel-1** or **Biofuel-2** may be granted once the vessel has complied with the requirements of [Marine Vessels Rules, Part 6 “Specialized Items and Systems”](#).

Biofuel-1 may be assigned to vessels using a biofuel blend of up to, and including, 30 percent biofuel in compliance with IMO requirements and with subsection 5.i.

Biofuel-2 may be assigned to vessels using a biofuel blend of greater than 30 percent biofuel, complying with IMO requirements and with subsection 5.i and 5.ii-5.iv. Re-evaluation of emissions may be required if the vessel requires significant changes to its critical NO_x technical components to burn biofuels, as per MARPOL Annex VI

| Notation | Change in NO_x Critical Components? | Relevant Sections | Relevant Interpretations of MEPC.1/Circ.795 Rev.8 |
|-----------------|--|------------------------------------|--|
| Biofuel-1 | No | 5.i, 7.1.1, 7.1.2.i | Interpretation 13.1 |
| Biofuel-2 | No | 5.i through 5.iv, 7.1.1, 7.1.2.ii | Interpretation 13.2 |
| | Yes | 5.i through 5.iv, 7.1.1, 7.1.2.iii | Interpretation 13.3 |

Onboard verification:

When there is a need for demonstration of the use of a biofuel on board with ship trials, ABS surveyors will verify the following as applicable, along with any comments from ABS engineering or the ship's Flag Administration:

1. Any changes to fuel systems or engines have been completed in accordance with the approved plans.
2. Crew is familiar with the fuels and any required fuel changeover procedures or guidance (e.g., implementation plans) are available and implemented.
3. Fuel analysis reports or bunker delivery notes (BDNs), SDSs will be checked for compliance with the expected biofuel specification.
4. The satisfactory change-over and operation of the engine(s) on the biofuels.
5. Flag approval, comments and any guidance are to be obtained as appropriate.
6. The survey report shall include confirmation of the above items with applicable statement observation.

GHG EMISSION FACTORS FOR BIOFUELS

When produced from renewable biomass, such as plant fibers and other materials, biofuels have the potential to offset the carbon footprint of a vessel due to the carbon dioxide (CO₂) absorption of the plant feedstock, which can help counterbalance the combustion emissions. However, the total carbon reduction potential of different biofuels depends on their source feedstock, production pathways and fugitive emissions such as GHG slip during production or transportation.

IMO DCS and Attained Carbon Intensity Indicator (CII):

MEPC 80 approved circular [MEPC.1/ Circ.905](#) Interim guidance on Biofuel (with application as of 1 October 2023) which provides that properly certified¹ biofuels with a well-to-wake (**WtW**) **GHG emissions** reduction of at least 65 percent compared to fossil MGO of 94 gCO_{2e}/MJ (i.e., **not exceeding 33 gCO_{2e}/MJ**) may be assigned a C_F equal to the value of the WtW GHG emissions of the fuel according to the certificate multiplied by its Lower Calorific Value (LCV).

This allows GHG intensity credit to be given to sustainable biofuels/biofuel blends for the purpose of DCS and CII, pending the development of the comprehensive method to account for WtW GHG emissions and removals based on the IMO Guidelines on Life Cycle GHG Intensity of Marine Fuels (LCA Guidelines). For fuel blends, the C_F is to be calculated as a weighted average of the C_F for each amount of fuel, biofuel and fossil fuel, **by energy**. In any case, the C_F value of a biofuel cannot be less than zero. The verification of the reported biofuel consumption shall be backed up with Proof of Sustainability (PoS) or similar documentation from a recognized scheme along with the Bunker Delivery Note (BDN).

According to the Circular MEPC.1/Circ.905, the approved sustainability certification schemes are those included in the [ICAO's CORSIA Approved Sustainability Certification Schemes](#). In general, the BDN is to be provided along with the Proof of Sustainability (PoS) or similar documentation from a recognized scheme. The Certificate of supplier is also to be submitted in case it is not publicly available. In case the PoS and BDN do not contain the necessary information to correlate the specification of the delivered biofuel with the biofuel covered by the PoS, additional documentation is to be submitted.

C_F calculation example

A vessel receives 125 MT of B30 fuel oil mix of FAME with WtW GHG intensity equal to 23 gCO_{2e}/MJ and LCV equal to 0.037 MJ/g, and LFO with LCV value of 0.0412 MJ/g and C_F equal to 3.151 gCO₂/gfuel. Since subject

¹ ICAOs Approved Sustainability Certification Schemes and the CORSIA Sustainability Criteria (Chapter 2) for CORSIA Eligible Fuels

FAME has a WtW GHG intensity less than 33 gCO_{2e}/MJ and is certified as sustainable, its C_F is equal to:

$$C_{F,FAME} = WtW \left[\frac{gCO_{2e}}{MJ} \right] \cdot LCV \left[\frac{MJ}{gfuel} \right] = 23 \cdot 0.037 = 0.851 \text{ gCO}_2/gfuel$$

According to the Interim Guidance, the C_F of B30 fuel shall be calculated as the **weighted average** for the respective amount of fuel **by energy**.

| Type | LCV [MJ/g] | Fuel [kg] | Energy [MJ] | % Energy | C _F [gCO ₂ /fuel] | Weighed C _F [gCO ₂ /fuel] |
|-----------------|------------|----------------|------------------|--------------|---|---|
| FAME | 0.0370 | 37,500 | 1,387,500 | 27.8 | 0.851 | |
| LFO | 0.0412 | 87,500 | 3,605,000 | 72.2 | 3.151 | |
| Fuel mix | | 125,000 | 4,992,500 | 100.0 | | 2.512 |

$$C_{F,B30 LFO} = \frac{27.8}{100} \cdot C_{F,FAME} + \frac{72.2}{100} \cdot C_{F,LFO} = 0.278 \cdot 0.851 + 0.722 \cdot 3.151 = 2.512 \text{ gCO}_2/gfuel$$

Under IMO DCS, the relevant consumption of B30 LFO shall be reported in the 'Other' field by specifying the energy weighted average C_F and by referring to MEPC.1/Circ.905.

EU MRV:

[Regulation \(EU\) 2023/957](#) introduced several amendments to Regulation (EU) 2015/757, EU MRV with the purpose of aligning the MRV system with the additional reporting requirements that arise from the inclusion of maritime industry in the EU ETS. To that aim, [Delegated Regulation \(EU\) 2023/2776](#) introduced Part C in Annex II of the EU MRV Regulation, requiring the reporting of total aggregated emissions of GHGs covered by Directive 2003/87/EC with any applicable derogation such as the derogation from the general principle to use **the default CO₂ emission factor (EF_{CO₂})** for the case of sustainable certified biofuels.

In more detail, the Renewable Energy Directive, [Directive \(EU\) 2018/2001](#) (RED II), Article 29 specifies the sustainability and GHG emissions, saving criteria that a biofuel shall comply with in order to be considered sustainable. In that case, according to paragraph 1.2 *Derogation from the general principle and use of emission factors pursuant to Article 14 of Directive 2003/87/EC*, of Part C under Annex II, the **EF_{CO₂} of the biomass fraction of the fuel shall be zero**.

EF_{CO₂} calculation example

Assuming again that the vessel received 125 MT of LFO grade B30, where the FAME content expressed in %(m/m) is 30 percent, certified as sustainable in accordance with Directive (EU) 2018/2001, the EF_{CO₂} of the FAME in the context of EU MRV is equal to zero while the EF_{CO₂} of the blend shall be calculated as the mass weighted average EF_{CO₂} of LFO and FAME respectively.

| Type | Fuel [kg] | % Mass | EF _{CO₂} [gCO ₂ /fuel] | Weighed EF _{CO₂} [gCO ₂ /fuel] |
|-----------------|----------------|--------------|---|---|
| FAME | 37,500 | 30.0 | 0 | |
| LFO | 87,500 | 70.0 | 3.151 | |
| Fuel mix | 125,000 | 100.0 | | 2.206 |

$$C_{F,B30 LFO} = \frac{30}{100} \cdot C_{F,FAME} + \frac{70}{100} \cdot C_{F,LFO} = 0.3 \cdot 0 + 0.7 \cdot 3.151 = 2.206 \text{ gCO}_2/gfuel$$

In addition, Regulation (EU) 2023/957 also requires the monitoring and reporting of two additional GHGs, CH₄ and N₂O. These emissions can be calculated for biofuels with the same methodology as applied for typical fossil fuels; by multiplying the fuel consumption with the equivalent emission factor. Delegated Regulation (EU) 2023/2776 provides, in Annex I EFs, for the covered fossil fuels and for several biofuels such as Hydrotreated Vegetable Oil (HVO). For biofuels not explicitly covered in the Delegated Regulation, a default EF for CH₄ equal to 0.00005 gCH₄/gfuel and 0.00018 gN₂O/gfuel for N₂O shall be used respectively.

EU's approved sustainability certification schemes can be found in [European Commission's website](#). These include inter alia International Sustainability and Carbon Certification Scheme (ISCC EU) and Roundtable of Sustainable Biofuels EU RED (RSB EU RED).

GENERAL INFORMATION

For general information on marine fuels, see the following ABS publications with links:

- [Amendments to EU MRV Regulation 2015/757](#)
- [Amendments to the EU ETS: Inclusion of Maritime Emissions](#)
- [ABS Marine Fuel Oil Advisory](#)
- [ABS Whitepaper on Biofuels as a Marine Fuel](#)

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