



ENERGY EFFICIENCY OF SHIPS

Proposed amendments to the 2022 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships and the 2022 Guidelines on survey and certification of the Energy Efficiency Design Index (EEDI)

Submitted by IACS

SUMMARY

Executive summary: This document proposes amendments to the *2022 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships* (resolution MEPC.364(79)) and the *2022 Guidelines on survey and certification of the Energy Efficiency Design Index (EEDI)* (resolution MEPC.365(79)), taking into account the increased use of methanol dual-fuel engines on ships.

Strategic direction, if applicable: 3

Output: 3.5

Action to be taken: Paragraph 13

Related documents: Resolutions MEPC.364(79) and MEPC.365(79)

Introduction

1 The *2012 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships* were adopted by resolution MEPC.212(63). After several amendments to these Guidelines, MEPC 79 adopted the *2022 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships* by resolution MEPC.364(79) (hereunder referred to as the 2022 EEDI Calculation Guidelines).

2 Also, the same session of the Committee adopted the *2022 Guidelines on survey and certification of the Energy Efficiency Design Index (EEDI)* by resolution MEPC.365(79), superseding the *2014 Guidelines on survey and certification of the Energy Efficiency Design Index (EEDI)* (resolution MEPC.254(67), as amended). Resolution MEPC.365(79) was subsequently amended by resolutions MEPC.374(80) and MEPC.403(83) and consolidated as MEPC.1/Circ.855/Rev.3 (hereunder referred to as the 2022 EEDI Survey and Certification Guidelines).

Discussion

3 The above-mentioned Guidelines contain several provisions addressing ships equipped with dual-fuel engines. However, those provisions apply only to dual-fuel configurations using gaseous fuel – and more specifically LNG – as one of the two fuels. In particular:

- .1 paragraph 2.2.1 of the 2022 EEDI Calculation Guidelines defines the application of the EEDI formula for dual-fuel engines, including the method for identifying the "primary fuel" and calculating the attained EEDI accordingly. However, this provision applies exclusively to gas–liquid dual-fuel engines;
- .2 paragraph 4.2.3 of the 2022 EEDI Survey and Certification Guidelines sets verification criteria for the C_F factor for gas (LNG) and the specific fuel consumption (SFC) of gas fuel for ships equipped with dual-fuel engine(s), again addressing only dual-fuel operation with LNG; and
- .3 the table in paragraph 4.2.3.2 of the 2022 EEDI Survey and Certification Guidelines provides reference data (normal density, lower calorific value and tank filling rates) for fuel types relevant to dual-fuel operation with LNG and liquid fuel. No corresponding data are provided for dual-fuel engines operating with two liquid fuels.

4 Consequently, the current EEDI framework does not cover dual-fuel engines operating with two liquid fuels, such as those using methanol or ethanol in combination with conventional marine fuel oil.

EEDI for dual-fuel engines using two liquid fuels

5 To achieve the goals of the 2023 IMO GHG Strategy, the use of sustainable alternative fuels such as methanol in newly-constructed ships and existing ships is gradually increasing. Methanol dual-fuel engines have been certified and issued with Engine International Air Pollution Prevention (EIAPP) certificates which have a maximum continuous rating (MCR) value for methanol dual-fuel mode (methanol fuel as the main fuel and traditional liquid fuel oil as the pilot oil). Those EIAPP certificates also include a single-cylinder MCR value obtained from testing under pure traditional fuel oil mode. The primary reason for this is the need to take into account the present global availability of methanol fuel, as methanol dual-fuel engines are expected to operate under methanol mode.

6 While the application of methanol fuel as a low-carbon fuel is being promoted, concerns and desires from the shipping industry regarding the attained EEDI calculation for ships equipped with methanol dual-fuel engines have also been raised. The desire is to treat the attained EEDI calculation for ships equipped with methanol dual-fuel engines in a manner analogous to that for ships equipped with LNG dual-fuel engines, taking into account the ship's fuel capacity configuration (methanol (alternative fuel) vs. fuel oil). Because the 2022 EEDI Calculation Guidelines only address dual-fuel engines using gas fuels (e.g. LNG) and liquid fuels, the direct application of paragraph 2.2.1 of the 2022 EEDI Calculation Guidelines to methanol dual-fuel engines lacks a clear regulatory basis.

7 IACS believes that this issue is significant and would be better addressed by revising the 2022 EEDI Calculation Guidelines to ensure the unified implementation of the attained EEDI calculation for ships equipped with dual-fuel engines using alternative fuels (including methanol, ethanol or other fuels).

8 With regard to the revision of the 2022 EEDI Calculation Guidelines, IACS recognized a few issues for methanol and ethanol dual-fuel engines, as follows:

- .1 methanol dual-fuel engines typically experience a reduction in MCR of approximately 10% when operating on methanol. For ethanol dual-fuel engines, the MCR derating can exceed 15%, particularly in retrofit applications. While ammonia is not directly relevant to the current discussion, as it does not contribute to CO₂ emissions, it can result in MCR reductions as high as 20%;
- .2 in cases where methanol or ethanol is used as the primary fuel, clarity is required in respect of which MCR value should be used for determining P_{ME} – should it be the higher MCR value based on the traditional liquid fuel oil (MDO operation), even if the engine operates primarily on methanol or ethanol? Correspondingly, which MCR should be used to define the 75% load point for specific fuel consumption (SFC) measurement? If the SFC for methanol or ethanol is calculated at 75% of the marine diesel oil (MDO)-based MCR, the load point on the MCR/SFC curve may shift significantly, thereby affecting the value to be considered; and
- .3 in cases where methanol or ethanol is not regarded as the primary fuel, which MCR value should be used for determining P_{ME} – should the higher MCR value based on the traditional liquid fuel oil (MDO operation) be used only, or the two different MCRs operating on methanol or ethanol and pure fuel oil respectively be used in the weighted average calculation, as stated in paragraph 2.2.1.2 of the 2022 EEDI Calculation Guidelines?

9 Given that methanol or ethanol fuels are being encouraged to be used as effective midterm measures in the shipping industry, it is reasonable to give consideration to the EEDI calculation of such ships equipped with methanol or ethanol dual-fuel engines. Considering that methanol or ethanol dual-fuel engines are still under development, and keeping the issues highlighted in paragraph 8 in mind, IACS is of the view that, currently, a simplified approach could be followed. This would disregard the effect of MCR derating and both P_{ME} and SFC_{ME} would be calculated based on the higher MCR, even when methanol or ethanol is the primary fuel.

Proposals

10 In light of the discussion above, IACS proposes amendments to the 2022 EEDI Calculation Guidelines by adding two footnotes to paragraph 2.2.1 of the 2022 EEDI Calculation Guidelines, as follows (additions in "shaded"):

"In the case of a ship equipped with a dual-fuel main or auxiliary engine, the C_F factor for gas fuel and the C_F factor for fuel oil should apply and be multiplied with the specific fuel oil consumption of each fuel at the relevant EEDI load point. Meanwhile, it should be identified whether gas fuel is regarded as the "primary fuel" in accordance with the formula below: ¹

¹ For the purpose of this formula, the term "gas" may be taken to include any other fuel used in dual-fuel mode including liquid fuels.

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$$P_{ME(i)} \cdot (f_{DFgas(i)} \cdot (C_{FME\ pilot\ fuel(i)} \cdot SFC_{ME\ pilot\ fuel(i)} + C_{FME\ gas(i)} \cdot SFC_{ME\ gas(i)}))$$

$$+ f_{DFliquid(i)} \cdot C_{FME liquid(i)} \cdot SFC_{ME liquid(i)} \Big)^2$$

² Both P_{ME} and SFC_{ME} should be determined based on the higher MCR among the different fuel modes regardless of which fuel is the primary fuel. "

11 Similarly, IACS proposes amendments to the 2022 EEDI Survey and Certification Guidelines by adding a footnote to paragraph 4.2.3 of the 2022 EEDI Survey and Certification Guidelines, as follows (additions in "shaded"):

"For ships equipped with dual-fuel engine(s) using LNG and fuel oil, the C_F factor for gas (LNG) and the specific fuel consumption (SFC) of gas fuel should be used by applying the following criteria as a basis for the guidance of the Administration: ³

³ For the purpose of this paragraph, the terms "LNG" and "gas" may be taken to include any fuel used in dual-fuel mode including liquid fuels".

12 Furthermore, density and filling rate values for alternative fuels would consequently need to be defined in the 2022 EEDI Survey and Certification Guidelines. Therefore, to keep it practicable, IACS proposes to add a note to paragraph 4.2.3.2 as follows (additions in "shaded"):

"Normal density, low calorific value and filling rate for tanks of different kinds of fuel are listed below.

Type of fuel	Density (kg/m ³)	Low calorific value (kJ/kg)	Filling rate for tanks
Diesel/gas oil	900	42,700	0.98
Heavy fuel oil	991	40,200	0.98
Liquefied natural gas (LNG)	450	48,000	0.95*

* Subject to verification of tank loading limit in the IGF and/or IGC Codes, where applicable, corresponding to the normal density used in the calculation of f_{DFgas} .

Note: In case of other fuels, the low calorific value should be taken from resolution MEPC.364(79), where available. If not listed, values consistent with industry standards should be applied. Density values should correspond to industry standards. Filling rate for tanks values should reflect the applicable design specifications".

Action requested of the Committee

13 The Committee is invited to consider the information provided in this document, in particular the proposals in paragraphs 10 to 12, and take action as appropriate.