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PREVENTION OF AIR POLLUTION FROM SHIPS

Proposal for an Energy Efficiency Design Index Verification Process

Submitted by the United States

SUMMARY	
Executive summary:	This document proposes a verification and approval process for the Energy Efficiency Design Index for new ships. This document invites the Committee to consider and develop possible remedial options in case a ship should fail to attain its required EEDI.
Strategic direction:	7.3
High-level action:	7.3.1
Planned output:	7.3.1.3
Action to be taken:	Paragraph 14
Related documents:	GHG-WG 2/2/1, GHG-WG 2/2/7, GHG-WG 2/2/14, GHG-WG 2/2/16 and MEPC 59/4/2

Introduction

1 This document provides the United States Government's views on the issue of verification and approval of the energy efficiency design index (EEDI). The United States strongly supports the EEDI, but notes that it is not a substitute for taking action in reducing emissions from the existing fleet. The United States looks forward to making significant progress on both the EEDI and on actions to address GHG emissions from existing ships at MEPC 59.

Objective

2 At the fifty-eighth session of the MEPC, the Draft Interim Guidelines on the Method of Calculation of the EEDI for New Ships were developed with a view to further refine and improve them. The objective of this document is to further the discussion on the EEDI by proposing a verification and approval process for the EEDI for new ships, which might include remedial options in case a vessel fails to attain its required EEDI.

EEDI framework

3 The United States supports an EEDI framework that includes a mandatory sea trial verification of a ship's EEDI. A ship is required to undergo a sea trial to verify its important safety and performance related characteristics. Similarly, a sea trial should be required to verify a ship's EEDI. Verifying a ship's EEDI via sea trial provides conclusive evidence to support whether or not a ship, as it is actually built and operated, meets its required EEDI. Such evidence provides assurance that the EEDI is resulting in meaningful and verifiable greenhouse gas reductions to address global climate change. Furthermore, an EEDI sea trial verification requirement is analogous to the IMO testing requirement for engine certification, as specified by MARPOL Annex VI, for meeting NO_X emissions requirements.

4 The United States does not support a mandatory verification of a ship's EEDI at its design stage. The United States does anticipate that a design stage prediction of a ship's EEDI would be useful for shipbuilders and ship purchasers to consider as part of their contractual agreement. This might allow the purchaser to consider options that might improve a ship's efficiency and possibly reduce operating costs. However, the United States does not feel that such a predicted EEDI should be part of any regulatory framework for EEDI verification. Although the United States understands that a design stage EEDI prediction might be fairly accurate due to shipbuilders', and perhaps classification societies', knowledge and experience, it also understands that production variations and design changes during construction might impact the ultimate value of a ship's EEDI. The United States is also concerned that a design stage verification of a ship's EEDI might not be certifiable by any Administration because the flag of a ship is oftentimes not known at this early stage. Furthermore, design stage verification does not provide the same degree of assurance as sea trial verification. Requiring only design stage EEDI verification with no sea trial verification might diminish the perceived importance of the EEDI itself, and it might even tempt shipbuilders to predict optimistically low EEDIs at the design stage. Finally, requiring only design stage EEDI verification is inconsistent with MARPOL Annex VI emissions requirements, which require actual testing to verify an engine's emissions performance prior to certification.

Actions to be taken if attained EEDI is below the required EEDI

5 If a ship's attained EEDI, as verified by sea trial, is lower than its required EEDI, the ship may then be certified by the Administration as meeting its EEDI requirement. A shipbuilder might find it instructive to compare a ship's predicted EEDI to its corresponding sea trial verified EEDI. Discrepancies could be evaluated to optimize future ship builds and to improve the design stage EEDI predictions.

Actions to be taken if attained EEDI is above the required EEDI

6 If a ship's attained EEDI, as verified by sea trial, is higher than its required EEDI, then remedial action must be taken. If the Energy Efficiency Design Index is to be an effective measure to ensure that meaningful and verifiable greenhouse gas reductions are achieved to address global climate change, then any EEDI deficiency must be addressed in some way. The United States believes that there are several options available for a shipbuilder and/or ship purchaser to address such a deficiency. Remedial action might involve modifying a ship's design. If such action is taken, then another sea trial should be required to verify that the ship, as it has been redesigned, meets its required EEDI, prior to certification by the Administration. Other options beyond modifying a ship's design could be developed to address an EEDI deficiency. Examples of ship redesign options and other options are described in the following section.

Potential remedial action to address an EEDI deficiency

7 If a ship should fail to meet its required EEDI at sea trial, then a full scope of potential design changes should be explored to determine if a cost-effective modification to the ship might be made. An assessment of the individual parameters within the EEDI equation provides significant insight into the various options.

8 Specifically, the numerator of the EEDI equation essentially combines the power used by the ship with power reductions such as waste heat (P_{WH}) and efficient alternative energy (P_{eff}). Each term has a power component (P) with its associated Specific Fuel Consumption (*SFC*) and a fuel CO_2 conversion factor. The auxiliary power (P_{AE}) of the ship is calculated either as a percentage of the main engine power (P_{ME}) or via a ship's load balance table. In the EEDI equation, the waste heat and alternative energy systems are considered replacement power for another power generating system. The values used in the EEDI equation for these systems are the power generated by the specific system (P_{eff}), along with a usage factor (f_{eff}) to account for part time usage, along with the *SFC* and CO_2 conversion factor of the power generating system it offsets. The denominator of the EEDI equation consists of the ship's capacity (*Capacity*) multiplied by the ship speed (V_{ref}) achieved at 75% of the installed main engine power. It is worth emphasizing that a ship's speed in the EEDI equation is not the same as its design speed or contract speed, but instead it is the value obtained from a sea trial which is then converted to EEDI standard conditions.

9 Based upon the EEDI equation, examples of potential ship modifications to address an EEDI deficiency are discussed below. These examples are not meant to be an exhaustive list of reduction opportunities, especially because each ship may be unique. However, this list does illustrate that there are a number of opportunities for improvements.

.1 Increase usage of power saving systems:

- P_{WH} – There may be opportunities to install additional waste heat recovery systems or to further optimize existing waste heat systems. Additionally, optimization of the trade-off between engine efficiency and waste heat recovery efficiency might be possible. The United States notes that modifying the engine might trigger an engine emissions recertification.

- P_{eff} – There may be opportunities to add efficient technologies that reduce a ship's main or auxiliary power requirements. These technologies include wind power through sails, kites, Flettner rotors, and solar power. There may be opportunities to increase the usage factor of these systems as well.

.2 Improve specific fuel consumption:

- SFC_{ME} – There may be opportunities to further optimize the fuel consumption of the main engine(s).

- SFC_{AE} – There may be opportunities to further optimize the fuel consumption of the auxiliary engines.

- Specific fuel consumption might be improved via further optimization of cooling water heat exchangers, intercoolers, turbochargers, optimizing oil viscosity, or perhaps via other measures. Note that some of these engine-related changes might trigger an engine emissions recertification.

.3 Increase ship speed at a given power output:

- V_{ref} – Design changes to increase V_{ref} at the same propulsion power might be possible. Examples include trim improvements through ballast optimization, minimization of hull resistance, advanced propeller blade designs, propeller tip winglets, propeller nozzle installation, rudder profile optimization, air lubrication, etc.

.4 Require the use of a low carbon fuel:

- C_f – The CO_2 conversion factor would be improved if the main and/or auxiliary engines operated on a lower carbon fuel, or perhaps on a blended fuel containing some percentage of a low carbon fuel.

.5 Improve ship capacity:

- *Capacity* – Modify the ship by improving cargo hold or deck cargo capacity. This option might involve major structural changes and even lengthening or shortening of the ship.

.6 Derate engine power:

- P_{ME} – Permanently derate the power of the main engine. This affects P_{ME}, but it affects V_{ref} to a much lesser extent. This can be accomplished by limiting engine speed or by decreasing the pitch and/or diameter of the propeller(s). P_{AE} may also have further reductions based on the reduced main engine power if the auxiliary power EEDI equations based on main engine power are used, instead of the load balance method.

- P_{AE} – Permanently derate the power of the auxiliary engines if the load balance approach is used to determine auxiliary power. This affects P_{AE}, but it does not affect V_{ref}. This can be accomplished by limiting the amount of electrical power produced by limiting the maximum fuel rate of the auxiliary engines.

.7 Ship loads:

- There are likely many other opportunities to use more efficient technologies that individually reduce a ship's power requirements marginally, while collectively reducing the EEDI measurably. The United States believes that many ships fail to utilize energy efficient pumps, motors, lighting and other basic devices and systems that are available today. The increased usage of these technologies can yield quantifiable efficiency improvements and yield substantial operating cost savings, and thus help finance the addition of even more sophisticated energy efficient technology upgrades in the future.

10 In some cases it might not be cost-effective to fully address a ship's EEDI deficiency through design modifications. To be prepared for such a situation, other options should be considered for further development. The following list of options is presented for discussion purposes only. The United States does not necessarily advocate any of the following options. Without prejudice to our future position, the United States would like to promote further discussion and perhaps further development of such options, which might help address certain EEDI deficiencies.

11 If the ship cannot meet the required EEDI through design changes such as those described above, then the following options might be worth considering for further development:

.1 a ship with a deficient EEDI could be allowed to operate, but only if a mandatory operational measure is enforced that allows it to meet its required EEDI. This might be in the form of a speed limit via derating main engine power. Such an operational measure must be verifiable by the respective Administration. Such a mandatory operational measure could be eliminated in the future if the ship undergoes some design modification that improves its EEDI to a point where the operational measure is no longer needed. Such a modification should be verified by a sea trial;

.2 a modest and temporary compliance margin could be established during the initial implementation of the EEDI. Such a provision would allow a ship that marginally exceeds its required EEDI to achieve certification. This margin would allow shipbuilders to gain experience with the EEDI process without having to make costly design changes after a sea trial. Such a compliance margin should be phased out after the first few years of the mandatory programme;

.3 a ship with a deficient EEDI could be allowed to operate temporarily while a design change is engineered for that ship. Once such a design change is actually implemented on the ship, sea trial verification should be required. Such a design change would need to result in a new EEDI that would at least offset all of the excess emissions that the ship emitted during its operation with a deficient EEDI;

.4 a ship with a deficient EEDI could be allowed to operate, but some type of agreement to offset its emissions would be negotiated. For example, the next ship in a series of identical ships would have to attain a sea trial-verified EEDI that is sufficiently lower than its predecessor, such that it would at least offset the emissions of the deficient ship preceding it. Such an option would likely have to be administered at the shipyard level, and it might also result in competitive issues with respect to having some ships built that meet the required EEDI and other ships that do not; and

.5 a ship with a deficient EEDI could be allowed to operate, but some form of a market based measure would be utilized to offset excess emissions. To ensure that such an option would not be used to intentionally design a ship to exceed its required EEDI, such an option should only be allowed up to some modest threshold of an EEDI deficiency.

12 Each of the preceding options requires further development. During such development it might become apparent that some of these options are ultimately unworkable due to their complexity or due to competitive issues. Nevertheless, the United States presents these options

to foster further dialogue regarding the implications of a ship failing to attain its required EEDI at sea trial; the United States welcomes further discussion and other possible options at MEPC 59.

Conclusions

13 A ship's attained EEDI should be verified via sea trial in order to ensure meaningful greenhouse gas reductions; to ensure that there is sufficient incentive to design and build ships that will clearly meet their required EEDIs; and to ensure consistency between the EEDI requirements and IMO's other emissions requirements, which already require emissions verification through testing. Furthermore, it is important to carefully consider the implications of a ship not attaining its required EEDI during sea trial. It is evident that there are several remedial design modifications available to the shipbuilder and ship purchaser. In addition to these options, there may be other steps that could be considered for further development that would allow a deficient ship to be brought into service in a way that would fully offset its excess emissions.

Action requested of the Committee

14 The Committee is invited to consider the above comments and take action as appropriate.

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