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PREVENTION OF AIR POLLUTION FROM SHIPS

Energy Efficiency Design Index for Propulsion Redundancy

Submitted by INTERTANKO

SUMMARY

Executive summary:	This document provides information on the impact of the application of the method of calculation of the Energy Efficiency Design Index for specially built dual-engine shuttle tankers and suggests a solution by way of a ship specific design element correction factor
Strategic direction:	7.3
High-level action:	7.3.1
Planned output:	7.3.1.3
Action to be taken:	Paragraph 18
Related documents:	MEPC.1/Circ.681 and MEPC 59/24

Introduction

1 The Marine Environment Protection Committee, at its fifty-ninth session, approved the interim Guidelines on the method of calculation of the Energy Efficiency Design Index for new ships. The Committee also invited Member Governments and observer organizations to use the interim guidelines for the purpose of test and trials on a voluntary basis and to provide the outcome and experiences in applying the interim Guidelines to future sessions of the Committee for further improvement of the method of calculation of the EEDI for new ships.

2 INTERTANKO has collected data on a significant number of tankers of various sizes and of various categories and used the interim guidelines in assessing the EEDI values for each of these tankers. A comprehensive report is provided to the Committee in document MEPC 60/4/3.

3 One of the results of these assessments was that, although the EEDI formula is adequate for a large majority of oil and chemical tankers with conventional designs, the EDDI formula would not be appropriate for a certain category of tankers, namely dual-engine shuttle tanker designs.

These designs are required by safety criteria of the specific operations they have to undertake and the environmental conditions under which they have to operate. Most of these conditions are referred to but not limited to the offshore activity in the North Sea.

4 While the term *shuttle tanker* is not specifically defined in SOLAS, a shuttle tanker is a type of crude oil tanker built particularly to carry oil from offshore oil platforms and other offshore oil producing installations. To be classified as a shuttle tanker, and therefore qualify for use of the correction factor proposed in this document, a vessel must meet at least three criteria:

.1 Bow loading class notation;

.2 Dynamic positioning type 1 or 2 class notation; and

.3 Client's special minimum requirements regarding dynamic positioning (DP) operational capabilities and DP/machinery system redundancy to safely maintain manoeuvrability in all weather conditions in the event of a single engine failure.

5 Offshore loading often involves operation in sensitive areas, as the oilfields are often located a short distance from land. This places a high importance on the ability to maintain manoeuvrability in all weather conditions. The twin-screw shuttle tanker concept has been adopted as a common industry standard for DP-2 offshore loading in harsh weather conditions, or offshore loading for customers' companies with high technical and operational requirements.

6 In addition, coastal States have adopted additional requirements, for instance that shuttle tankers operating in areas under their jurisdiction perform dynamic positioning and comply with redundancy requirements. Compliance with such additional technical and operational requirements often necessitates the use of a dual-engine twin-screw shuttle tanker.

7 Relative to conventional tankers, the current dual-engine shuttle tankers have more installed main engine power in order to perform dynamic positioning and to comply with redundancy requirements. Therefore, direct application of the EEDI formula will penalize these ships if the specific design features required by specific safety requirements and standards are not recognized. This is already recognized in the second IMO GHG Study 2009.

> "*... ice-class ships and ships with* ***redundant propulsion systems*** *may be less energy-efficient; however, such ships also have extra capabilities [1].*" (MEPC 59/INF.10, paragraph 5.6)

8 Therefore, INTERTANKO submits this document to:

.1 explain the issue; and

.2 suggest a simple solution that would address the problem with no impact on the current EEDI formula, namely to use the current correction factor *fj* to account for this specific design element/requirement.

The solution is similar to that agreed for ice-classed ships.

Justification

9 The assessment to justify the problem defined was done by using a large amount of data from the Lloyd's Register-Fairplay database. Four categories of vessels (crude oil tankers, shuttle tankers, product tankers, and crude oil/product tankers) between 80,000 and 160,000 metric tonnes

deadweight have been included. Vessels with missing data or electric-drives were not considered. After calculating an EEDI value for each vessel, outliers (defined as any point beyond 1 standard deviation) were removed. This left data on 797 vessels.

10 Some assumptions were made to facilitate calculation of EEDI values. A C_F value of 3.114 has been used for both main and auxiliary engines since both shuttle tankers and conventional tankers burn primarily HFO in both the main and auxiliary engines. A specific fuel consumption of 190 g/kWh and 210 g/kWh has been assumed for all main and auxiliary engines, respectively. The service speed supplied by LR-Fairplay has been used for V_{ref}, and the total installed power of main engines (in kW) reported by LR-Fairplay is assumed to be 100% of MCR.

11 Investigation revealed no significant difference in the relationship between deadweight and total main engine power for conventional tankers (i.e. crude oil tankers, product tankers, and crude oil/product tankers) and single engine shuttle tankers. Therefore, there appears to be no justification for any correction factor for single engine shuttle tankers.

12 However, there is a significant difference between conventional tankers and dual-engine shuttle tankers which is due to redundancy requirements (ref. figure 1). Therefore, a ship specific design element correction factor appears justified for dual-engine shuttle tankers.

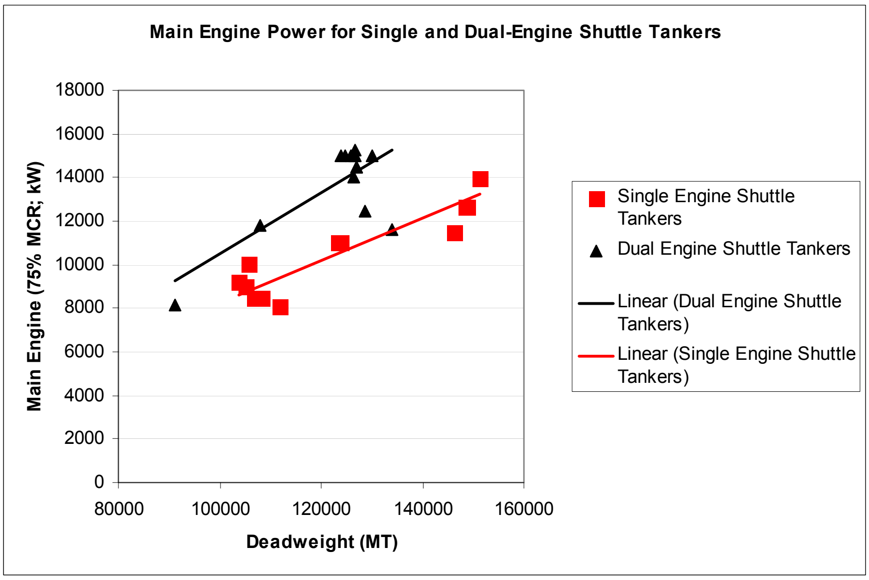

Figure 1

Estimation of Ship Specific Design Element Correction Factor, f_j

13 The intent is to estimate a ship specific design element correction factor, f_j, for dual-engine shuttle tankers. Without such a correction factor, the consequence of mandating the same EEDI would remove the option of building tankers with added necessary safety features to meet requirements for redundancy in certain operations.

14 The correction factor is estimated as the average ratio of the installed main engine power at 75% MCR for single-engine shuttle tankers to dual-engine shuttle tankers at both 90,000 and 150,000 metric tonnes of deadweight, which is roughly the size range of shuttle tanker capacities. A graphical representation is shown in figure 2, and the calculation shown below.

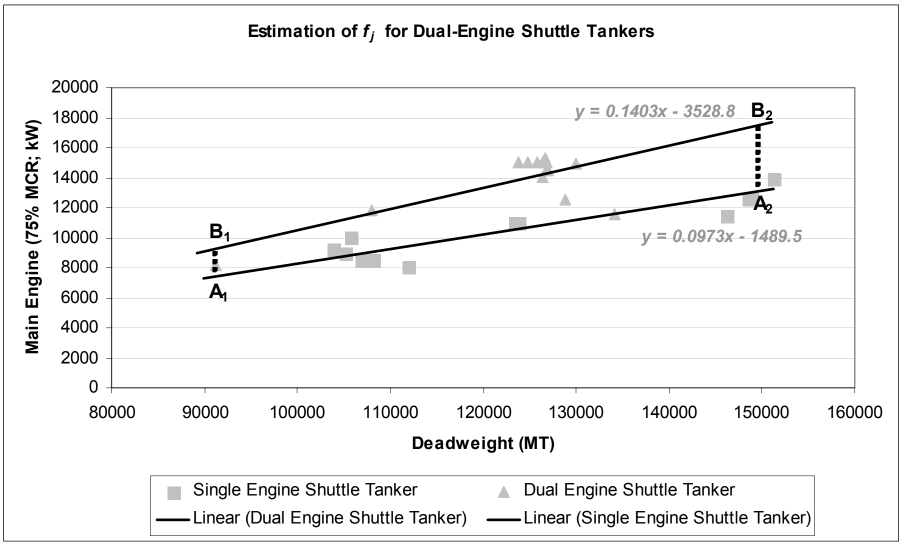

Figure 2

$$f_j = \frac{(A_1/B_1)+(A_2/B_2)}{2}$$

$$f_j = \frac{(7267.5/9098.2)+(13105.5/17516.2)}{2}$$

$$f_j \cong 0.77$$

Application of the Correction Factor

15 Shown in figure 3 are installed main engine power ratings for single and dual-engine shuttle tankers after applying the estimated correction factor to dual-engine shuttle tankers. The results suggest that the correction factor will allow dual-engine shuttle tankers to have the same incentive to improve design efficiency as conventional and single-engine shuttle tankers with no penalty on using extra power required for safety reasons.

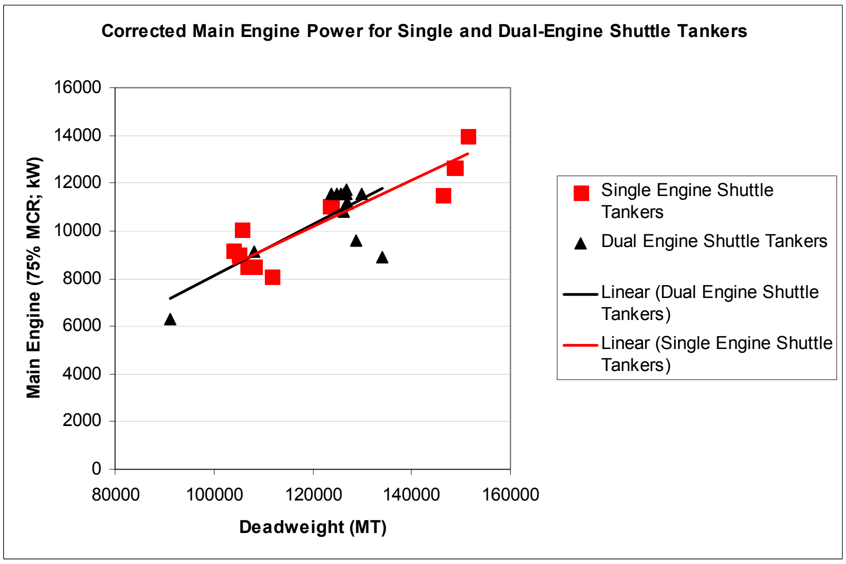

Figure 3

16 INTERTANKO would therefore suggest the following additional insertions to MEPC.1/Circ.681:

.1 add a new definition as subparagraph 1.5 as follows and change the remaining subparagraph numbers to 1.6 to 1.11 accordingly:

> *1.5 Shuttle Tanker with Propulsion Redundancy – A tanker between 80,000 and 160,000 deadweight used for loading of crude oil from offshore installations equipped with dual-engine and twin-propellers need to meet the requirements for dynamic positioning and redundancy propulsion class notation.*;

.2 under the current subparagraph 2.8, number the text starting with *The factor* f_j, *for ice-classed ships ...* as 2.8.1; and

.3 add a new subparagraph 2.8.2 with the following text:

> *2.2.8 The factor* f_j, *for shuttle tankers with propulsion redundancy should be* f_j, $= 0.77$.

17 Although this document does not directly consider other tankers and other ship types (e.g., offshore supply vessels) that currently may have redundant propulsion class notation, the Committee is invited to consider whether it may be appropriate that similar consideration is given to other ship types in order to avoid that the EEDI formula removes the safety benefits of redundant propulsion systems.

Action requested of the Committee

18 The Committee is invited to consider adding to the interim Guidelines on the method of calculation of the Energy Efficiency Design Index for new ships, a value for the f_j, factor for shuttle tankers with propulsion redundancy and other consequent additions as suggested in paragraph 16 of this document.