

MARINE ENVIRONMENT PROTECTION
COMMITTEE
65th session
Agenda item 4

MEPC 65/4/4
8 February 2013
Original: ENGLISH

AIR POLLUTION AND ENERGY EFFICIENCY

Revised proposal for the inclusion of the ro-ro cargo and ro-ro passenger ship types into the IMO energy efficiency regulatory framework

Submitted by Germany, Sweden, Community of European Shipyards Associations (CESA) and INTERFERRY

SUMMARY

Executive summary: This document provides fine-tuning of the proposal outlined in document MEPC 64/4/14 for the inclusion of the ro-ro cargo and ro-ro passenger ship types into the EEDI framework, based on the discussions in the working group on Air Pollution and Energy Efficiency at MEPC 64

Strategic direction: 7.3

High-level action: 7.3.2

Planned output: 7.3.2.1

Action to be taken: Paragraph 17

Related documents: MEPC 64/4/14, MEPC 64/WP.11, MEPC 64/23; MEPC 65/4; MEPC 64/4/11 and MEPC 64/4/20

Introduction

1 During MEPC 64, and in line with the work plan and schedule for further development of technical and operational measures for ships as developed and endorsed by MEPC 63, a proposal for the inclusion of the ro-ro cargo and ro-ro passenger ship types into the energy efficiency regulatory framework was presented as outlined in document MEPC 64/4/14.

2 The proposal was widely supported and it was agreed, within the working group on Air Pollution and Energy Efficiency, to finalize draft amendments to regulation 21 of MARPOL Annex VI at the next session (MEPC 65), in accordance with the work plan, with regards to the correction factors for use in calculation of the attained EEDI and method of calculation of reference line for ro-ro passenger ships and ro-ro cargo ships other than vehicle carriers.

The draft amendments should be based on the proposal in document MEPC 64/4/14, taking comments in document MEPC 64/4/23 into account (MEPC 64/WP.11, paragraph 12.6).

3 This document provides “fine-tuning” of the methodology presented in MEPC 64/4/14 and responds to the request by MEPC 64. This proposal is based on the discussions of document MEPC 64/4/14 at MEPC 64 and is submitted in order to facilitate the finalization of the inclusion of the ro-ro cargo and ro-ro passenger ship types into the energy efficiency regulatory framework.

Application of and reduction rates for the required EEDI for ro-ro cargo and ro-ro passenger ships

4 Both lower size thresholds and reduction rates were proposed for the respective ship types (ro-ro cargo and ro-ro passenger ships) in document MEPC 64/4/20. The values proposed in document MEPC 64/4/20 are well founded and substantiated by statistical analyses of the potential coverage of the fleet population. Therefore, it is proposed that the values in MEPC 64/4/20 with regard to lower size thresholds and reduction rates for the ro-ro cargo and ro-ro passenger ships are used when finalizing the inclusion of these ship types into the energy efficiency regulatory framework. The values have been inserted in the proposed amendments to regulation 21 of MARPOL Annex VI, as set out in annex 1.

Calculation of auxiliary power, P_{AE} , for ro-ro passenger ships and application of f_{jRoRo}

5 When deriving the EEDI reference lines for ro-ro cargo and ro-ro passenger ships as proposed in document MEPC 64/4/14, the methodology given in guidelines for calculation of reference lines for use with the Energy Efficiency Design Index (EEDI)(resolution MEPC.215(63)) has been applied. The guidelines stipulate that the auxiliary power P_{AE} is to be calculated in accordance with paragraphs 2.5.6.1 and 2.5.6.2 of the *2012 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships* (resolution MEPC.212(63)). P_{AE} is defined as the required auxiliary engine power to supply normal maximum sea load, including necessary power for propulsion machinery/systems and accommodation.

6 However, as correctly noted in document MEPC 64/4/11 (Denmark, Japan and Norway), the generic methodology for the calculation of P_{AE} cannot be considered as applicable for the ro-ro passenger ships fleet. Based upon a comprehensive assessment of available data, MEPC 64/4/11 proposed a methodology in which the auxiliary power for ro-ro passenger ships is determined as a function of the gross tonnage, defined as follows:

$$P_{AE} = 0.866 \times GT^{0.732}$$

7 Since the equation outlined in MEPC 64/4/11 seems to better reflect the necessary auxiliary power demands for ro-ro passenger ships, it has been integrated into this amended proposal for the development of an EEDI reference line for ro-ro passenger ships.

8 Since the P_{AE} , as defined above, is not speed dependent, but constant when the main particulars are set, the EEDI expressed as a function of the speed could in some cases exhibit increasing EEDI values for decreasing speed. This is due to the fact that, when auxiliary power P_{AE} in the EEDI-equation numerator is represented by a constant value, the P_{AE} will take precedence when the speed, and consequently also the main engine power, is reduced resulting in increasing quotient, and obviously, when the speed is zero, the EEDI becomes infinity, ∞ . This is, of course, also valid for the original EEDI when P_{AE} is represented by a constant value.

9 The correction factor f_{jRoRo} as proposed in MEPC 64/4/14, is intended to normalize the speed-power performance of individual ships to comparable conditions. Hence, it can be concluded that this correction should not be applied on the auxiliary power P_{AE} , but only on the main engine power, P_{ME} . Consequently, for the purpose of calculating the EEDI reference lines for the ro-ro cargo and ro-ro passenger ships respectively the equations followed by this adjustment are as set out in paragraphs 10 and 11.

10 For ro-ro cargo ships, the estimated index value for each individual ship is calculated as follows:

$$\text{Estimated Index Value} = \frac{3.1144 \times (f_{jRoRo} \times 190 \times \sum P_{MEi} + 215 \times P_{AE})}{\text{Cap} \times V_{\text{ref}}}$$

11 For ro-ro passenger ships, the estimated index value for each individual ship is calculated as follows:

$$\text{Estimated Index Value} = \frac{3.1144 \times (f_{jRoRo} \times 190 \times \sum P_{MEi} + 215 \times P_{AE})}{f_{cRoPass} \times \text{Cap} \times V_{\text{ref}}}$$

12 As a result of introducing these equations and correction factors, it has been shown that the correlation for ro-ro cargo ships increases from 0.423 to 0.716 and, for ro-ro passenger ships, it increases from 0.396 to 0.808, which can be seen in annex 4.

Conclusions

13 Based on the decisions at MEPC 64, this document responds to the request by MEPC 64 and provides fine-tuning of the proposal in document MEPC 64/4/14, as outlined above. The proposed amendments are based on the discussions in the working group on Air Pollution and Energy Efficiency at MEPC 64. The following fine-tuning amendments have been made:

- .1 Specified lower size thresholds and reduction rates, originating from document MEPC 64/4/20, have been included in the draft regulations as shown in annex 1. The reduction rates are equivalent to those of other ship types, already covered by the EEDI regulatory framework, and this should clarify that ro-ro cargo and ro-ro passenger ships will have to lower its EEDI value at an equal rate as other ship types covered by the requirements.
- .2 The equation outlined in document MEPC 64/4/11, has been integrated into this amended proposal for the development of an EEDI reference line for ro-ro passenger ships, as it seems to better reflect the necessary auxiliary power demands for these ships.

14 A proposal for draft amendments to chapter 4 of MARPOL Annex VI, is given in annex 1 and proposals for draft amendments to the guidelines, resolution MEPC.212(63) and resolution MEPC.215(63) respectively, are given in annex 2 and annex 3 of this document. Based on these adjustments, the EEDI reference lines for the ro-ro cargo and the ro-ro passenger ships have been recalculated and are presented in annex 4.

15 As acknowledged at previous sessions, the inclusion of the ro-ro cargo and ro-ro passenger ship segments into the IMO energy efficiency regulatory framework calls for some means to take into account the hydrodynamic performance of individual ships. The amended methodology, as presented in this document, addresses directly the speed-power relation of a ship as an integral part of the calculations. This means that a design which leads to actual reductions of CO₂ emissions gets a lower attained EEDI compared to a design that does not lead to such reductions. Since the same corrections are applied when the reference lines are

derived, the speed-power performance of a new-built ship will be compared to the fleet average hydrodynamic performance, hereby leading to substantial reductions of CO₂ emissions for the ro-ro cargo and ro-ro passenger ship segments.

16 In conclusion, the application of the correction factors and calculation methodology as proposed in this document, will lead to substantial reductions of CO₂ emissions from the ro-ro cargo and the ro-ro passenger ship segment.

Actions requested of the Committee

17 The Committee is invited to consider the proposal for the inclusion of ro-ro cargo ships and ro-ro passenger ships into the energy efficiency regulatory framework as presented in this document and related annexes, and take action as appropriate.

ANNEX 1

**PROPOSED AMENDMENTS TO REGULATION 21 OF MARPOL ANNEX VI
REQUIRED EEDI**

1. The following amendments to MARPOL VI/21 are proposed. Proposed new text is shown as **bold and shaded** and text proposed to be deleted as ~~strikethrough~~.

Regulation 21

Required EEDI

1 For each:

- .1 new ship;
- .2 new ship which has undergone a major conversion; and
- .3 new or existing ship which has undergone a major conversion that is so extensive that the ship is regarded by the Administration as a newly-constructed ship.

which falls into one of the categories defined in regulation 2.25 to 2.31, **2.34 and 2.35** and to which this chapter is applicable, the attained EEDI shall be as follows:

$$\text{Attained EEDI} \leq \text{Required EEDI} = (1-X/100) \times \text{Reference line value}$$

where X is the reduction factor specified in Table 1 for the required EEDI compared to the EEDI Reference line.

Table 1. Reduction factors (in percentage) for the EEDI relative to the EEDI Reference line

Ship Type	Size	Phase 0 1 Jan 2013 – 31 Dec 2014	Phase 1 1 Jan 2015 – 31 Dec 2019	Phase 2 1 Jan 2020 – 31 Dec 2024	Phase 3 1 Jan 2025 and onwards
Bulk Carrier	20,000 DWT and above	0	10	20	30
	10,000 – 20,000 DWT	n/a	0-10*	0-20*	0-30*
Gas Carrier	10,000 DWT and above	0	10	20	30
	2,000 – 10,000 DWT	n/a	0-10*	0-20*	0-30*
Tanker	20,000 DWT and above	0	10	20	30
	4,000 – 20,000 DWT	n/a	0-10*	0-20*	0-30*

Ship Type	Size	Phase 0 1 Jan 2013 – 31 Dec 2014	Phase 1** 1 Jan 2015 – 31 Dec 2019	Phase 2 1 Jan 2020 – 31 Dec 2024	Phase 3 1 Jan 2025 and onwards
Containership	15,000 DWT and above	0	10	20	30
	10,000 – 15,000 DWT	n/a	0-10*	0-20*	0-30*
General Cargo Ship	15,000 DWT and above	0	10	15	30
	3,000 – 15,000 DWT	n/a	0-10*	0-15*	0-30*
Refrigerated Cargo Ship	5,000 DWT and above	0	10	15	30
	3,000 – 5,000 DWT	n/a	0-10*	0-15*	0-30*
Combination Carrier	20,000 DWT and above	0	10	20	30
	4,000 – 20,000 DWT	n/a	0-10*	0-20*	0-30*
Ro-Ro Cargo Ship	2,000 DWT and above	n/a	5	20	30
	1,000 – 2,000 DWT	n/a	0-5*	0-20*	0-30*
Ro-Ro Passenger Ship	4,000 GT and above	n/a	5	20	30
	1,000 – 4,000 GT	n/a	0-5*	0-20*	0-30*

* Reduction factor to be linearly interpolated between the two values dependent upon vessel size. The lower value of the reduction factor is to be applied to the smaller ship size.

** In case of ro-ro cargo ships and ro-ro passenger ships, Phase 1 commences when the amendments to MARPOL Annex VI take effect for these ship types.

Table 2. Parameters for determination of reference values for the different ship types

Ship Type defined in Regulation 2	a	b	c
2.25 Bulk Carrier	961.79	DWT of the ship	0.477
2.26 Gas Carrier	1120.00	DWT of the ship	0.456
2.27 Tanker	1218.80	DWT of the ship	0.488
2.28 Container Ship	174.22	DWT of the ship	0.201
2.29 General Cargo Ship	107.48	DWT of the ship	0.216
2.30 Refrigerated Cargo Carrier	227.01	DWT of the ship	0.244
2.31 Combination Carrier	1219.00	DWT of the ship	0.488
2.34 Ro-Ro Cargo Ship	1405.15	DWT of the ship	0.498
2.35 Ro-Ro Passenger Ship	752.16	DWT of the ship	0.381

ANNEX 2

PROPOSED AMENDMENTS THE 2012 GUIDELINES ON THE METHOD OF CALCULATION OF THE ATTAINED ENERGY EFFICIENCY DESIGN INDEX (EEDI) FOR NEW SHIPS

1. The following amendments to paragraph 2 of resolution MEPC.212(63) are proposed. Proposed new text is shown as **bold and shaded** and text proposed to be deleted as ~~strikethrough~~.

2 Energy Efficiency Design Index (EEDI)

.3 *Capacity* is defined as follows:

- .1 For bulk carriers, tankers, gas tankers, ro-ro cargo ships, **ro-ro passenger ships**, general cargo ships, refrigerated cargo carrier and combination carriers, deadweight should be used as *Capacity*.
- .2 For passenger ships ~~and ro-ro passenger ships~~, gross tonnage in accordance with the International Convention of Tonnage Measurement of Ships 1969, Annex I, regulation 3 should be used as *Capacity*.

.8 f_j is a correction factor to account for ship specific design elements:

- .2 The factor f_j , for shuttle tankers with propulsion redundancy should be $f_j = 0.77$. This correction factors applies to shuttle tankers with propulsion redundancy between 80,000 and 160,000 deadweight. The Shuttle Tankers with Propulsion Redundancy are tankers 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^{bis} For ro-ro cargo and ro-ro passenger ships f_{jRoRo} is calculated as follows:

$$f_{jRoRo} = \frac{1}{Fn_L^\alpha \times \left(\frac{L_{PP}}{B_S}\right)^\beta \times \left(\frac{B_S}{d_S}\right)^\gamma \times \left(\frac{L_{PP}}{\nabla^{1/3}}\right)^\delta}$$

where the Froude's number, Fn_L , is defined as:

$$Fn_L = \frac{0.5144 \times V_{ref}}{\sqrt{L_{PP} \times g}}$$

and the exponents α , β , γ and δ are defined as follows:

Ship Type	Exponent:			
	α	β	γ	δ
Ro-Ro Cargo Ship	2.00	0.50	0.75	1.00
Ro-Ro Passenger Ship	2.50	0.75	0.75	1.00

.3 For other ship types, f_j should be taken as 1.0.

.12 f_c is the cubic capacity correction factor and should be assumed to be one (1.0) if no necessity to the factor is granted.

.3 For ro-ro passenger ships having a DWT/GT-ratio less than 0.25, the following cubic capacity correction factor, f_{cRoPax} , should apply:

$$f_{cRoPax} = \left(\frac{(DWT/GT)}{0.25} \right)^{-0.8}$$

Where DWT is the *Capacity* and GT is the gross tonnage in accordance with the International Convention of Tonnage Measurement of Ships 1969, Annex I, regulation 3.

.14 Summer load line draught, d_s , is the vertical distance, in metres, from the moulded baseline at mid-length to the waterline corresponding to the summer freeboard draught to be assigned to the ship.

.15 Breadth, B_s , is the greatest moulded breadth of the ship, in metres, at or below the load line draught, d_s .

.16 Volumetric displacement, ∇ , in cubic metres (m^3), is the volume of the moulded displacement of the ship, excluding appendages, in a ship with a metal shell, and is the volume of displacement to the outer surface of the hull in a ship with a shell of any other material, both taken at the summer load line draught, d_s , as stated in the approved stability booklet/loading manual.

ANNEX 3

PROPOSED AMENDMENTS TO GUIDELINES FOR CALCULATION OF REFERENCE LINES FOR USE WITH THE ENERGY EFFICIENCY DESIGN INDEX (EEDI)

1. The following amendments of resolution MEPC.215(63) are proposed. Proposed new text is shown as **bold and shaded**.

Calculation of reference lines

13

13.5^{bis} For ro-ro passenger ships P_{AE} is calculated as follows:

$$P_{AE} = 0.866 \times GT^{0.732}$$

13.6 no correction factors are used except for f_{jRoRo} and f_{cRoPax} ; and

15

15^{bis} For ro-ro cargo ships the estimated index value for each individual ship is calculated as follows:

$$Estimated\ Index\ Value = \frac{3.1144 \times (f_{jRoRo} \times 190 \times \sum P_{MEi} + 215 \times P_{AE})}{Cap \times V_{ref}}$$

15^{ter} For ro-ro passenger ships the estimated index value for each individual ship is calculated as follows:

$$Estimated\ Index\ Value = \frac{3.1144 \times (f_{jRoRo} \times 190 \times \sum P_{MEi} + 215 \times P_{AE})}{f_{cRoPax} \times Cap \times V_{ref}}$$

Calculation of reference lines

16 For all ship types to which these guidelines apply **except for ro-ro passenger ships**, parameters "a" and "c" are determined from a regression analysis undertaken by plotting the calculated estimated index values against 100 per cent deadweight (100% DWT).

16^{bis} For ro-ro passenger ships, parameters "a" and "c" are determined from a regression analysis undertaken by plotting the calculated estimated index values against corrected deadweight, DWT', for ships to which the capacity correction factor, f_{cRoPax} , applies and against 100 per cent deadweight (100% DWT) for ships to which the capacity correction factor does not apply.

ANNEX 4

REFERENCE LINES FOR RORO-CARGO AND RORO-PASSENGER SHIP

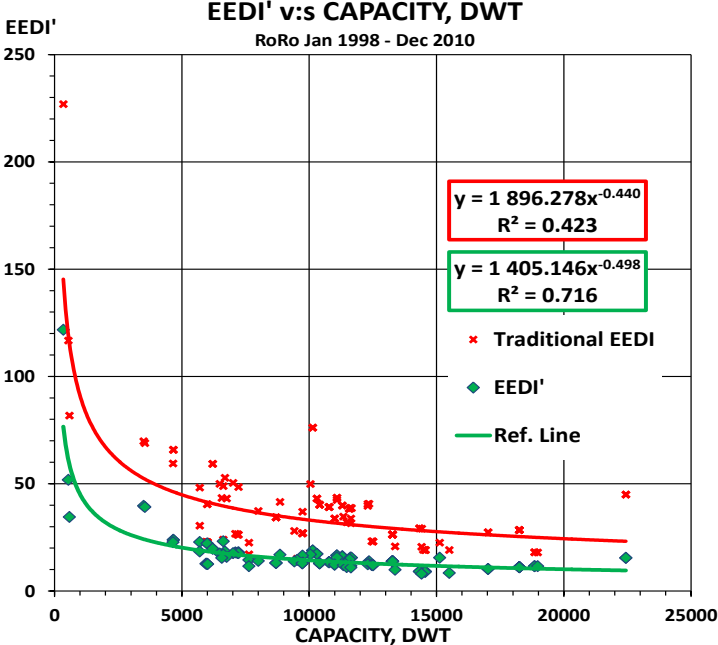


Figure 1 EEDI'-Reference Line for Ro-Ro Cargo Ships

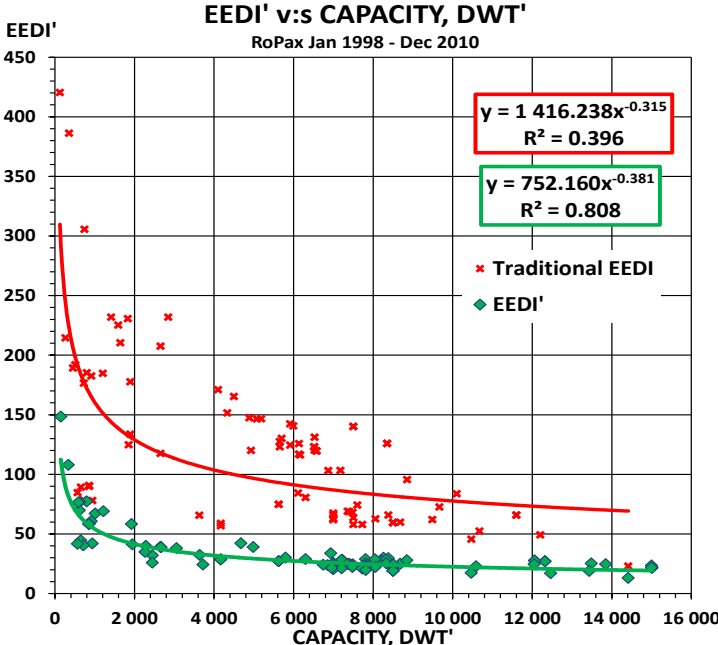


Figure 2 EEDI'-Reference Line for Ro-Ro Passenger Ships