ANNEX 16

RESOLUTION MEPC.354(78)
(adopted on 10 June 2022)

2022 GUIDELINES ON THE OPERATIONAL CARBON INTENSITY
RATING OF SHIPS (CII RATING GUIDELINES, G4)

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee (the Committee) conferred upon it by international conventions for the prevention and control of marine pollution from ships,

NOTING that the Committee adopted, by resolution MEPC.328(76), the *2021 Revised MARPOL Annex VI*, which will enter into force on 1 November 2022,

NOTING IN PARTICULAR that the *2021 Revised MARPOL Annex VI* (MARPOL Annex VI) contains amendments concerning mandatory goal-based technical and operational measures to reduce carbon intensity of international shipping,

NOTING FURTHER that regulation 28.6 of MARPOL Annex VI requires ships to which this regulation apply to determine operational carbon intensity rating taking into account guidelines developed by the Organization,

RECOGNIZING that the aforementioned amendments to MARPOL Annex VI require relevant guidelines for uniform and effective implementation of the regulations and to provide sufficient lead time for industry to prepare,

NOTING that, at its seventy-sixth session, the Committee adopted, by resolution MEPC.339(76) the *2021 Guidelines on the operational carbon intensity rating of ships (CII rating guidelines, G4)*,

HAVING CONSIDERED, at its seventy-eighth session, draft *2022 Guidelines on the operational carbon intensity rating of ships (CII rating guidelines, G4)*,

1   ADOPTS the *2022 Guidelines on the operational carbon intensity rating of ships (CII rating guidelines, G4)*, as set out in the annex to the present resolution;

2   INVITES Administrations to take the annexed Guidelines into account when developing and enacting national laws which give force to and implement requirements set forth in regulation 28.6 of MARPOL Annex VI;

3   REQUESTS the Parties to MARPOL Annex VI and other Member Governments to bring the annexed Guidelines to the attention of masters, seafarers, shipowners, ship operators and any other interested parties;

4   AGREES to keep the Guidelines under review in light of experience gained with their implementation, of additional data collected and analysed, also taking into consideration that

in accordance with regulation 28.11 of MARPOL Annex VI a review of the operational measure to reduce carbon intensity of international shipping shall be completed by 1 January 2026;

5   REVOKES the *2021 Guidelines on the operational carbon intensity rating of ships (CII rating guidelines, G4)*, adopted by resolution MEPC.339(76).

ANNEX

**2022 GUIDELINES ON THE OPERATIONAL CARBON INTENSITY
RATING OF SHIPS (CII RATING GUIDELINES, G4)**

1   Introduction

1.1   These Guidelines provide the methods to assign operational energy efficiency performance ratings to ships, as referred to in regulation 28 of MARPOL Annex VI. On this basis, the boundaries for determining a ship's annual operational carbon intensity performance from year 2023 to 2030 are also provided.

2   Definitions

2.1   *MARPOL* means the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocols of 1978 and 1997 relating thereto, as amended.

2.2   *IMO DCS* means the data collection system for fuel oil consumption of ships referred to in regulation 27 and related provisions of MARPOL Annex VI.

2.3   For the purpose of these Guidelines, the definitions in MARPOL Annex VI, as amended, apply.

2.4   *Operational carbon intensity rating* means to assign a ranking label from among the five grades (A, B, C, D and E) to the ship based on the attained annual operational carbon intensity indicator, indicating a major superior, minor superior, moderate, minor inferior, or inferior performance level.

3   Framework of the operational energy efficiency performance rating

3.1   An operational energy efficiency performance rating should be assigned annually to each ship to which regulation 28 of MARPOL Annex VI applies, in a transparent and robust manner, based on the deviation of the attained annual operational carbon intensity indicator (CII) of a ship from the required value.

3.2   To facilitate the rating assignment, for each year from 2023 to 2030, four boundaries are defined for the five-grade rating mechanism, namely superior boundary, lower boundary, upper boundary, and inferior boundary. Thus, a rating can be assigned through comparing the attained annual operational CII of a ship with the boundary values.

3.3   The boundaries are set based on the distribution of CIIs of individual ships in year 2019. The appropriate rating boundaries are expected to generate the following results: the middle 30% of individual ships across the fleet segment, in terms of the attained annual operational CIIs, are to be assigned rating C, while the upper 20% and further upper 15% of individuals are to be assigned rating D and E respectively, and the lower 20% and further lower 15% of the individuals are to be assigned rating B and A, respectively, as illustrated in figure 1.
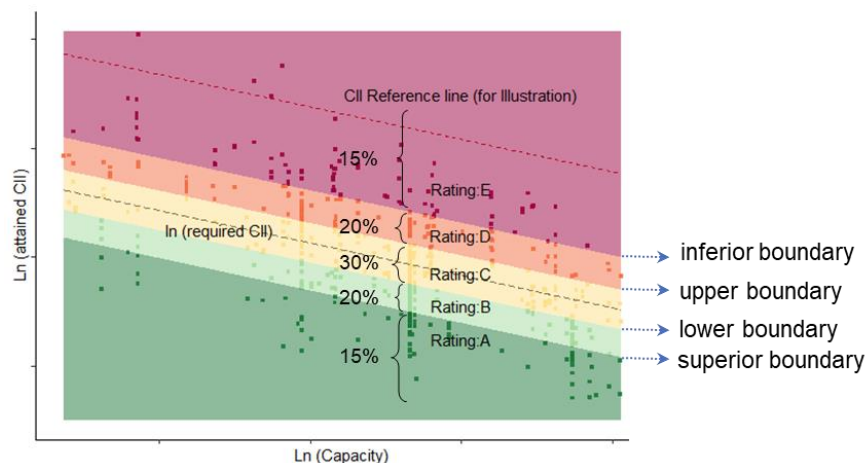
Figure 1: Operational energy efficiency performance rating scale

3.4   Given the incremental operational carbon intensity reduction factors over time, the boundaries for defining performance ratings should be synchronized accordingly, although the relative distance between the boundaries should not change. The rating of a ship would be determined by the attained CII and the predetermined rating boundaries, rather than the attained CII of other ships. Note that the distribution of ship individual ratings in a specific year may not be always identical with the scenario in 2019, where for example 20% may achieve A, 30% may achieve B, 40% may achieve C, 8% may achieve D and 2% may achieve E in a given year.

4   Method to determine the rating boundaries

4.1   The boundaries can be determined by the required annual operational CII in conjunction with the vectors, indicating the direction and distance they deviate from the required value (denoted as dd vectors for easy reference), as illustrated in figure 2.
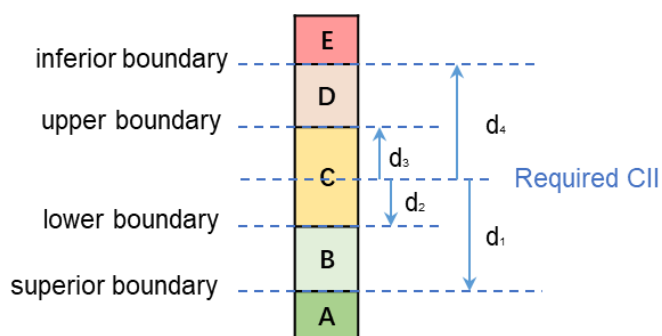

Figure 2: dd vectors and rating bands

4.2   Statistically, the dd vectors depend on the distribution of the attained annual operational CII of ships of the type concerned, which can be estimated through a quantile regression, taking data collected through DCS in year 2019 as the sample.

4.3   The quantile regression model for a specific ship type can be developed as follows:

$$\ln(attained\ CII) = \delta^{(p)} - c\ln(Capacity) + \varepsilon^{(p)}, \quad p = \{0.15, 0.35, 0.50, 0.65, 0.85\} \text{ (1)}$$

where $Capacity$ is identical with the one used in the operation carbon intensity indicator as specified in the Guidelines on operational carbon intensity indicators and the calculation

methods (G1); p is the typical quantile, meaning the proportion of observations with a lower value is $p\%$; $\delta^{(p)}$ is the constant term, and $\varepsilon^{(p)}$ is the error term.

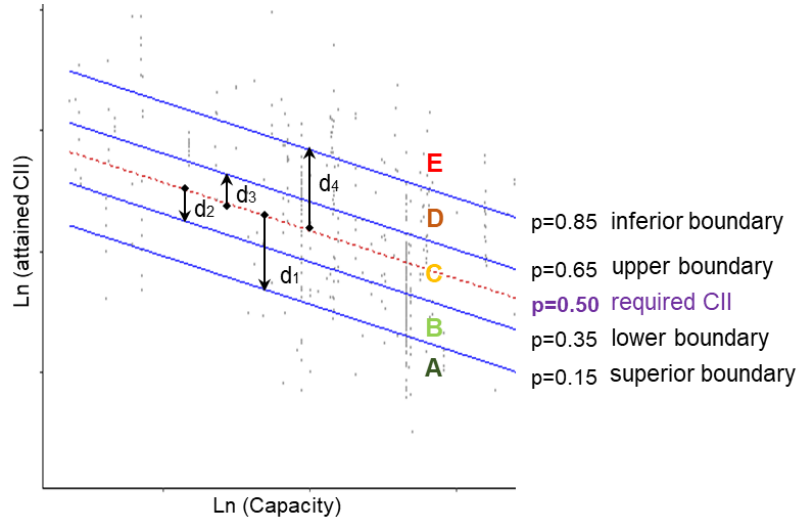4.4   The quantile regression lines in logarithm form are illustrated in Fig.3.

Figure 3: Quantile regression lines in logarithm form

4.5   Then, the dd vectors can be calculated based on the estimates of the intercept ($\hat{\delta}^{(p)}$), in accordance with Eq.(2), as follows:

$$
\left.
\begin{aligned}
d_1 &= \hat{\delta}^{(0.15)} - \hat{\delta}^{(0.50)} \\
d_2 &= \hat{\delta}^{(0.35)} - \hat{\delta}^{(0.50)} \\
d_3 &= \hat{\delta}^{(0.65)} - \hat{\delta}^{(0.50)} \\
d_4 &= \hat{\delta}^{(0.85)} - \hat{\delta}^{(0.50)}
\end{aligned}
\right\}
\tag{2}
$$

4.6   Through an exponential transformation of each dd vector, the four boundaries fitted in the original data form can be derived based on the required annual operational carbon intensity indicator ($required\ CII$), as follows:

$$
\left.
\begin{aligned}
superior\ boundary &= \exp(d_1) \cdot required\ CII \\
lower\ boundary &= \exp(d_2) \cdot required\ CII \\
upper\ boundary &= \exp(d_3) \cdot required\ CII \\
inferior\ boundary &= \exp(d_4) \cdot required\ CII
\end{aligned}
\right\}
\tag{3}
$$

Rating boundaries of ship types

The estimated dd vectors after exponential transformation for determining the rating boundaries of ship types are as follows:

Table 1: dd vectors for determining the rating boundaries of ship types

Ship type		Capacity in CII calculation	dd vectors (after exponential transformation)			
			exp(d1)	exp(d2)	exp(d3)	exp(d4)
Bulk carrier		DWT	0.86	0.94	1.06	1.18
Gas carrier	65,000 DWT and above	DWT	0.81	0.91	1.12	1.44
	less than 65,000 DWT	DWT	0.85	0.95	1.06	1.25
Tanker		DWT	0.82	0.93	1.08	1.28
Container ship		DWT	0.83	0.94	1.07	1.19
General cargo ship		DWT	0.83	0.94	1.06	1.19
Refrigerated cargo carrier		DWT	0.78	0.91	1.07	1.20
Combination carrier		DWT	0.87	0.96	1.06	1.14
LNG carrier	100,000 DWT and above	DWT	0.89	0.98	1.06	1.13
	less than 100,000 DWT		0.78	0.92	1.10	1.37
Ro-ro cargo ship (vehicle carrier)		GT	0.86	0.94	1.06	1.16
Ro-ro cargo ship		GT	0.76	0.89	1.08	1.27
Ro-ro passenger ship		GT	0.76	0.92	1.14	1.30
Cruise passenger ship		GT	0.87	0.95	1.06	1.16

By comparing the attained annual operational CII of a specific ship with the four boundaries, a rating can then be assigned. For example, given the required CII of a bulk carrier in a specific year as 10 gCO_2/(dwt.nmile), then the superior boundary, lower boundary, upper boundary, and inferior boundary is 8.6, 9.4, 10.6 and 11.8 gCO_2/(dwt.nmile). If the attained CII is 9 gCO_2/(dwt.nmile), the ship would be rated as "B".

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