Subject

Summary of the outcomes of MEPC 79

ClassNK
Technical Information

No. TEC-1293
Date 27 March 2023

To whom it may concern

The seventy-nineth session of the Marine Environment Protection Committee (MEPC 79) was held from 12 to 16 December 2022. A summary of the discussions and the decisions taken at MEPC 79 is provided as below for your information.

1. Greenhouse Gases (GHG) emission reduction measures
Reduction of greenhouse gas (GHG) emissions to address global warming is a universal challenge, and the measures to reduce GHG emissions from international shipping have been deliberated at IMO. Such measures introduced at the IMO so far include the regulation of "Energy Efficiency Design/Existing Ship Index" (EEDI/EEXI), retaining of the "Ship Energy Efficiency Management Plan" (SEEMP) onboard, and rating by "Carbon Intensity Indicator" (CII).

Furthermore, taking the adoption of the Initial IMO Strategy on the reduction of GHG emissions from ships, which includes the emission reduction target and the candidate measures to reduce GHG emissions, the IMO continues to discuss on measures to reduce GHG emissions in order to decarbonize the international shipping.

(1) Amendments to the Guidelines on the method of calculation of the attained EEDI for new ships
Taking the increasing demand for using ethane as a ship fuel, particularly for ethane carriers, 2022 Guidelines on the method of calculation of the attained EEDI for new ships were adopted to include the lower calorific value and conversion factor (CF) of ethane.
(Refer to Res. MEPC.364(79) as attachment 4)

(2) Amendments to the Guidelines on survey and certification of the EEDI
The calculation of EEDI requires the calculation of ship speed based on the speed trial results, by assuming that the weather is calm with no wind and no waves. The current Guidelines on survey and certification of the EEDI refers to ITTC Recommended Procedure 7.5-04-01-01.1 Speed and Power Trials 2017 (hereafter referred to as 2017 ITTC Procedure) or ISO 15016:2015 for determining ship speed taking into account the external effects (wind, current, waves, shallow water, displacement, water temperature and water density).

(To be continued)

Since the revisions of ITTC Procedure are available, MEPC 79 adopted 2022 Guidelines to refer to the amended 2022 ITTC Procedure as well as 2017 ITTC Procedure.
(Refer to Res. MEPC.365(79) as attachment 5)

(3) EEDI Phase 4

Regulation 24.6 of MARPOL Annex VI keeps the IMO review the status of technological developments and, if proven necessary, amend the reduction rates etc. set out in the regulation. In accordance with the regulation, MEPC established the Correspondence Group to continue its work on the possible introduction of EEDI Phase 4.

Based on the final report of the Correspondence Group, MEPC 79 concluded that the introduction of EEDI Phase 4 should be carefully pursued at a future session, due to the fact that further investigations are required on regulations for both new propulsion technologies such as alternative fuels and wind energy that would affect application of EEDI Phase 4 and also additional regulatory scope taking into account the IMO Strategy on the reduction of GHG emissions from ships.

(4) Carbon Intensity Indicator (CII)

CII is a rating mechanism for ships, which compares the attained CII, calculated based on the operational fuel consumption data collected from the IMO Data Collection System for fuel oil consumption of ships (DCS), with the CII reference lines.

MEPC 79 approved the following unified interpretations related to CII and DCS:

- If a ship is delivered in October or later, the rating based on the data between the delivery date and the end of that calendar year will not be counted for the determination of whether the ship should develop a Corrective Action Plan (i.e., a ship rated as D for three consecutive years or rated as E for one year).
- In case of a change of company, a new ship operational carbon intensity plan (SEEMP Part III) will be required to be submitted for the verification by the new company, where the year of change is the starting year of the three-year implementation plan.
- The Corrective Action Plan to achieve the required annual operational CII for a ship with an inferior rating (i.e., a ship rated as D for three consecutive years or rated as E for one year) should be developed to achieve the required CII for data collected in the second calendar year after the reporting year that resulted in such inferior rating.
- Data relating to boil-off gas (BOG) consumed onboard LNG-fueled ships or LNG carriers for propulsion or operation (including BOG burnt in a Gas Combustion Unit (GCU) for cargo tank pressure control or other operational purposes) is required to be collected and reported as fuel oil consumption as part of the IMO DCS.
  (Refer to MEPC.1/Circ.795/Rev.7 as attachment 6)

(To be continued)

(5) Onboard Carbon Capture Systems

There have been initiatives to develop methods for reducing GHG emissions by segregating and capturing carbon dioxide (CO2) from exhaust gases onboard ships.

At this session, a proposal was made that the amount of CO2 captured by CO2 Capture Systems should be taken into consideration when calculating the attained EEDI/EEXI and CII. Due to the time constraints, MEPC 79 agreed that the discussion will be continued at the next session.

(6) Revision of the Initial IMO Strategy on the reduction of GHG emissions from ships

The Initial IMO Strategy on the reduction of GHG emissions from ships (hereafter referred to as the Initial IMO Strategy), adopted in 2018, envisages to improve transportation efficiency by at least 40% by 2030, pursuing efforts towards 70% by 2050, and also aims for the total annual emissions from international shipping reduced by at least 50% by 2050 compared to 2008. The IMO Strategy is subject to a review every five years.

Up until the last session, it was recognized that the aforementioned GHG reduction target should be improved and therefore agreed that the Initial IMO Strategy is subject to a review, aiming for adoption of the revision at MEPC 80 to be held in July 2023.

At this session, there were comments advising either zero GHG emission or net-zero GHG emission (practically zero by deducting the amount of GHG absorbed by forests from those emitted) and proposals such as to introduce a new target for GHG reduction by 2040. On the other hand, there were also comments advising that setting a new goal would necessitate a valid scientific background and therefore the GHG reduction goals in the current Initial IMO Strategy should be kept. In conclusion, MEPC 79 agreed to continue the revision process of the Initial IMO Strategy, aiming for adoption at MEPC 80.

(7) Mid-term measures for reduction of GHG

The Initial IMO Strategy contains a list of measures such as market-based measures (MBM) etc. to achieve mid- and long-term GHG reduction goals. To proceed with the consideration of such measures, MEPC 76, held in 2021, developed the work plan as follows:

Phase	Work item	Timeline
I	Collation and initial consideration of proposals for measures	2021-2022
II	Assessment and selection of measures to further develop	2022-2023
III	Development of measures for statutory requirements	2023-

At this session, there were a number of supports to the comments suggesting the adoption of GHG reduction measures that combine both regulatory and market-based measures, and therefore MEPC 79 agreed to the plan to conclude the work item in Phase II (assessment of measures) at MEPC 80. The mid-term measures proposed so far include the following:

(To be continued)

Regulatory Measures

- GHG Fuel Standard (GFS)
  Each ship calculates GFS value, expressed in the mass of GHG emissions per unit of energy used (gCO2e/MJ). Reduction factor for GFS will be enhanced year by year.

Market-based Measures

- Feebate
  Ships using fossil fuels pay for the levy and ships using zero-emission fuels receive rebate.
- GHG levy
  Ships pay GHG levy for US$100 per tonne of marine fuel. The revenue will be funded to climate change mitigation and adaptation projects under UNFCCC, and subsidized to R&D projects for new technologies under IMO.
- International Maritime Sustainability Funding and Reward (IMSF&R)
  Using CII mechanism, ships above upper benchmark level pay funding contributions and ships below lower benchmark level receive rewards.
- Funding and Reward (F&R)
  Ships pay funding contributions according to the amount of CO2 emissions from ships and ships using eligible alternative fuels receive rewards.
- Emission Cap-and-Trade System (ECTS)
  Based on the annual cap on GHG emissions, each ship is required to acquire and surrender allowances for GHG emissions by auctioning.

2. BWM Convention

(1) Application of BWM Convention to ships operating at ports with challenging water quality
With regard to the use of ballast water treatment systems (BWMS), as there are ports with challenging water quality that make it difficult to operate BWMS continuously, there has been a proposal to allow that ballast water is taken without passing through BWMS in such ports, and employing ballast water exchange plus treatment (BWE + BWT) at areas where the treatment system can operate normally.

At this session, it was suggested that the criteria such as for the "challenging water quality" affecting continuous normal operation of the BWMS should be clearly defined. MEPC 79 agreed to continue the discussion at the next session.

(2) Temporary storage of treated sewage and grey water
The prohibition on the discharge of treated sewage and grey water at certain ports has led to temporary storage of treated sewage and grey water in ballast tanks.

(To be continued)

At this session, it was endorsed that the BWM Convention did not preclude the temporary storage of grey water or treated sewage in ballast tanks and this storage should be permitted.. Recognizing the need for developing specific procedures to prevent contamination of ballast tanks by temporary storage of sewage and greywater, MEPC 79 agreed to consider developing a guidance for such temporary storage at future sessions.

(3) Commissioning tests of BWMS

While commissioning tests of BWMS including analysis of treated ballast water have been required for those installed on or after 1 June 2022, MEPC 79 discussed on the interpretation on whether or not it is necessary to conduct commissioning tests in cases where an installed BWMS on board a ship undergoes an upgrade or change to a major component.

As a result, MEPC 79 approved a unified interpretation that if an installed BWMS on board a ship undergoes an upgrade or change to a major component, such BWMS shall be regarded as a newly installed BWMS, so a commissioning test shall be conducted accordingly.
(Refer to BWM.2/Circ.66/Rev.4 as attachment 7)

(4) Amendments to the format of Ballast Water Record Book

It was noted that problems have arisen during PSC inspections due to different interpretations for recording the Ballast Water Record Book (BWRB) specified in Appendix II of the BWM Convention. The necessities for a revision of the BWRB format and a guidance on how to describe it have been under discussion.

MEPC 79 approved amendments to the BWRB format to be recorded in terms of Codes (letter) and Items (number), similar to the format of the Oil Record Book, with a view to adoption at MEPC 80.

3. Air pollution

(1) Unified Interpretation on use of synthetic fuels

With the switch to alternative fuels under consideration from the perspective of GHG emission reduction, MEPC 78, held in June 2022, approved a uniform interpretation on the application of NOx emission limits to biofuels and a biofuel blend with fossil fuels. According to the unified interpretation, additional confirmation of NOx emission is not required, if the blend ratio of biofuel and fossil fuel is below 30% and if no changes to NOx critical components or setting/operating values are required in order to use biofuel or a biofuel blend.

At this session, revised Unified Interpretation was approved to treat synthetic fuels, produced from renewable sources similar in composition to petroleum distillate fuels, which are expected to be used in the future, in the same way as biofuels in terms of NOx emission.
(Refer to MEPC.1/Circ.795/Rev.7 as attachment 6)

(To be continued)

4. Amendments to mandatory instruments
MEPC 79 adopted amendments to mandatory instruments as follows:

(1) Designation of emission control area for SOx and PM
Amendments to MARPOL Annex VI to add the Mediterranean Sea as Emission Control Areas (ECAs) for SOx and PM were adopted. Requirements regarding SOx and PM emissions (Regulation 14 etc. of ANNEX VI) in the Mediterranean Sea Area as ECA will start being enforced on 1 May 2025.
(Refer to Res. MEPC.361(79) as attachment 2)

(2) Garbage Record Book
Amendments to MARPOL Annex V were adopted to expand the scope of Garbage Record Book, which has been required to be provided for vessels of 400 gross tons or more, to vessels of 100 gross tons or more.
(Refer to Res. MEPC.360(79) as attachment 1)

Entry into force: 1 May 2024

(3) Information to be included in Bunker Delivery Note (BDN)
Amendments to Appendix V of MARPOL Annex VI were adopted to include flashpoint as mandatory information in the BDN.
(Refer to Res. MEPC.362(79) as attachment 3)

Entry into force: 1 May 2024

(4) Information to be submitted under Data Collection Systems (IMO DCS)
With the introduction of CII regulations, amendments to Appendix IX of MARPOL Annex VI were adopted to add CII related information to reporting items from Flag/RO to IMO database under Data Collection System for fuel oil consumption of ships (IMO DCS).
(Refer to Res. MEPC.362(79) as attachment 3)

Entry into force: 1 May 2024

A summary of the outcomes of MEPC 79 is also available on the IMO website.
https://www.imo.org/en/MediaCentre/MeetingSummaries/Pages/MEPC-default.aspx

(To be continued)

For any questions about the above, please contact:

NIPPON KAIJI KYOKAI (ClassNK)
External Affairs Department, Administration Center Annex, Head Office
Address: 3-3 Kioi-cho, Chiyoda-ku, Tokyo 102-0094, Japan
Tel.: +81-3-5226-2038
Fax: +81-3-5226-2734
E-mail: xad@classnk.or.jp

Attachment:

1. Res. MEPC.360(79): Amendments to MARPOL Annex V (Regional Reception Facilities within Arctic Waters and Garbage Record Book)
2. Res. MEPC.361(79): Amendments to MARPOL Annex VI (Mediterranean Sea Emission Control Area for Sulphur Oxides and Particulate Matter)
3. Res. MEPC.362(79): Amendments to MARPOL Annex VI (Regional Reception Facilities Within Arctic Waters, Information to be Included in the Bunker Delivery Note (BDN) and Information to be Submitted to the IMO Ship Fuel Oil Consumption Database)
4. Res. MEPC.364(79): 2022 Guidelines on the Method of Calculation of the Attained Energy Efficiency Design Index (EEDI) for New Ships
5. Res. MEPC.365(79): 2022 Guidelines on the Survey and Certification of the Energy Efficiency Design Index (EEDI)
6. MEPC.1/Circ.795/Rev.7: Unified Interpretations to MARPOL ANNEX VI
7. BWM.2/Circ.66/Rev.4: Unified interpretations to the BWM Convention and the BWMS Code

ANNEX 2

RESOLUTION MEPC.360(79)
(adopted on 16 December 2022)

AMENDMENTS TO THE INTERNATIONAL CONVENTION FOR THE PREVENTION OF POLLUTION FROM SHIPS, 1973, AS MODIFIED BY THE PROTOCOL OF 1978 RELATING THERETO

MARPOL ANNEX V

(Regional reception facilities within Arctic waters and Garbage Record Book)

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 conferred upon it by international conventions for the prevention and control of marine pollution from ships,

RECALLING ALSO article 16 of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL), which specifies the amendment procedure and confers upon the appropriate body of the Organization the function of considering amendments thereto for adoption by the Parties,

HAVING CONSIDERED, at its seventy-ninth session, proposed amendments to MARPOL Annex V concerning regional reception facilities within Arctic waters and Garbage Record Book, which were circulated in accordance with article 16(2)(a) of MARPOL,

1 ADOPTS, in accordance with article 16(2)(d) of MARPOL, amendments to MARPOL Annex V, the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with article 16(2)(f)(iii) of MARPOL, that the amendments shall be deemed to have been accepted on 1 November 2023 unless prior to that date not less than one third of the Parties or Parties the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet have communicated to the Organization their objection to the amendments;

3 INVITES the Parties to note that, in accordance with article 16(2)(g)(ii) of MARPOL, the said amendments shall enter into force on 1 May 2024 upon their acceptance in accordance with paragraph 2 above;

4 REQUESTS the Secretary-General, for the purposes of article 16(2)(e) of MARPOL, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Parties to MARPOL;

5 ALSO REQUESTS the Secretary-General to transmit copies of the present resolution and its annex to Members of the Organization which are not Parties to MARPOL.

ANNEX

AMENDMENTS TO MARPOL ANNEX V

(Regional reception facilities within Arctic waters and Garbage Record Book)

Regulation 8 – Reception facilities

1 In the first sentence of paragraph 2.2, the words "sub-paragraph 3.1" are replaced by the words "paragraph 2.1".

2 Paragraph 3 is replaced by the following:

"3 The following States may satisfy the requirements in paragraphs 1 and 2.1 of this regulation through regional arrangements when, because of those States' unique circumstances, such arrangements are the only practical means to satisfy these requirements:

.1 small island developing States; and

.2 States the coastline of which borders on Arctic waters, provided that regional arrangements shall cover only ports within Arctic waters of those States.

Parties participating in a regional arrangement shall develop a Regional Reception Facilities Plan, taking into account the guidelines developed by the Organization.*

The Government of each Party participating in the arrangement shall consult with the Organization, for circulation to the Parties of the present Convention, on:

.1 how the Regional Reception Facilities Plan takes into account the guidelines developed by the Organization;*

.2 particulars of the identified Regional Ships Waste Reception Centres, taking into account the guidelines developed by the Organization;* and

.3 particulars of those ports with only limited facilities."

Regulation 10 – Placards, garbage management plans and garbage record-keeping

3 The first sentence of the chapeau of paragraph 3 is replaced by the following:

"3 Every ship of 100 gross tonnage and above and every ship which is certified to carry 15 or more persons engaged in voyages to ports or offshore terminals under the jurisdiction of another Party to the Convention and every fixed or floating platform shall be provided with a Garbage Record Book."

* Refer to the *2012 Guidelines for the development of a Regional Reception Facilities Plan* (resolution MEPC.221(63)), as amended by resolution MEPC.363(79).

4 Paragraph 3.6 is replaced by the following:

".6 In the event of any discharge or accidental loss referred to in regulation 7 of this annex an entry shall be made in the Garbage Record Book, or in the case of any ship of less than 100 gross tonnage, an entry shall be made in the ship's official logbook of the date and time of occurrence, port or position of the ship at time of occurrence (latitude, longitude and water depth if known), the reason for the discharge or loss, details of the items discharged or lost, categories of garbage discharged or lost, estimated amount for each category in cubic metres, reasonable precautions taken to prevent or minimize such discharge or accidental loss and general remarks."

***

ANNEX 3

RESOLUTION MEPC.361(79)
(adopted on 16 December 2022)

AMENDMENTS TO THE ANNEX OF THE PROTOCOL OF 1997 TO AMEND THE INTERNATIONAL CONVENTION FOR THE PREVENTION OF POLLUTION FROM SHIPS, 1973, AS MODIFIED BY THE PROTOCOL OF 1978 RELATING THERETO

(Mediterranean Sea Emission Control Area for Sulphur Oxides and Particulate Matter)

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 conferred upon it by international conventions for the prevention and control of marine pollution from ships,

RECALLING ALSO article 16 of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocols of 1978 and 1997 relating thereto (MARPOL), which specifies the amendment procedure and confers upon the appropriate body of the Organization the function of considering amendments thereto for adoption by the Parties,

HAVING CONSIDERED, at its seventy-ninth session, proposed amendments to MARPOL Annex VI, concerning the Mediterranean Sea Emission Control Area for Sulphur Oxides and Particulate Matter, which were circulated in accordance with article 16(2)(a) of MARPOL,

1 ADOPTS, in accordance with article 16(2)(d) of MARPOL, amendments to MARPOL Annex VI, the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with article 16(2)(f)(iii) of MARPOL, that the amendments shall be deemed to have been accepted on 1 November 2023 unless prior to that date not less than one third of the Parties or Parties the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet have communicated to the Organization their objection to the amendments;

3 INVITES the Parties to note that, in accordance with article 16(2)(g)(ii) of MARPOL, the said amendments shall enter into force on 1 May 2024 upon their acceptance in accordance with paragraph 2 above;

4 ALSO INVITES the Parties to note that, in accordance with regulation 14.7 of MARPOL Annex VI, ships operating in the Mediterranean Sea Emission Control Area for Sulphur Oxides and Particulate Matter are exempt from the requirements in paragraphs 4 and 6 of regulation 14 of MARPOL Annex VI and from the requirements of paragraph 5 of that regulation insofar as they relate to paragraph 4 of that regulation until 1 May 2025;

5 INVITES coastal States of the Mediterranean Sea Emission Control Area for Sulphur Oxides and Particulate Matter to ratify and effectively implement MARPOL Annex VI, as soon as possible, if they have not yet done so, at least by the date of entry into force of the said amendments;

6 REQUESTS the Secretary-General, for the purposes of article 16(2)(e) of MARPOL, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Parties to MARPOL;

7 ALSO REQUESTS the Secretary-General to transmit copies of the present resolution and its annex to Members of the Organization which are not Parties to MARPOL.

ANNEX

AMENDMENTS TO MARPOL ANNEX VI

(Mediterranean Sea Emission Control Area for Sulphur Oxides and Particulate Matter)

Regulation 14
Sulphur oxides (SO_X) and particulate matter

1 At the end of paragraph 3.3, the word "and" is deleted. At the end of paragraph 3.4, "." is replaced by "; and". A new paragraph 3.5 is added as follows:

".5 the Mediterranean Sea Emission Control Area, which means the area described by the coordinates provided in appendix VII to this annex."

Appendix VII
Emission control areas (regulations 13.6 and 14.3)

2 A new paragraph 4 is inserted, as follows:

"4 In respect of the application of regulation 14.4, the Mediterranean Sea Emission Control Area for Sulphur Oxides and Particulate Matter includes all waters bounded by the coasts of Europe, Africa and Asia, and is described by the following coordinates:

.1 the western entrance to the Straits of Gibraltar, defined as a line joining the extremities of Cape Trafalgar, Spain (36°11'.00 N, 6°02'.00 W) and Cape Spartel, Morocco (35°48'.00 N, 5°55'.00 W);

.2 the Strait of Canakkale, defined as a line joining Mehmetcik Burnu (40°03'N, 26°11'E) and Kumkale Burnu (40°01'.00 N, 26°12'.00 E); and

.3 the northern entrance to the Suez Canal excluding the area enclosed by geodesic lines connecting points 1-4 with the following coordinates:

Point	Latitude	Longitude
1	31˚29'.00 N	32°16'.00 E
2	31˚29'.00 N	32°28'.48 E
3	31˚14'.00 N	32°32'.62 E
4	31˚14'.00 N	32°16'.00 E

***

ANNEX 4

MEPC RESOLUTION MEPC.362(79)
(adopted on 16 December 2022)

AMENDMENTS TO THE ANNEX OF THE PROTOCOL OF 1997 TO AMEND THE INTERNATIONAL CONVENTION FOR THE PREVENTION OF POLLUTION FROM SHIPS, 1973, AS MODIFIED BY THE PROTOCOL OF 1978 RELATING THERETO

Amendments to MARPOL Annex VI (Regional reception facilities within Arctic waters, information to be included in the bunker delivery note (BDN) and information to be submitted to the IMO Ship Fuel Oil Consumption Database)

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 conferred upon it by international conventions for the prevention and control of marine pollution from ships,

RECALLING ALSO article 16 of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocols of 1978 and 1997 relating thereto (MARPOL), which specifies the amendment procedure and confers upon the appropriate body of the Organization the function of considering amendments thereto for adoption by the Parties,

HAVING CONSIDERED, at its seventy-ninth session, proposed amendments to MARPOL Annex VI concerning regional reception facilities within Arctic waters, information to be included in the bunker delivery note (BDN) and information to be submitted to the IMO Ship Fuel Oil Consumption Database, which were circulated in accordance with article 16(2)(a) of MARPOL,

1 ADOPTS, in accordance with article 16(2)(d) of MARPOL, amendments to MARPOL Annex VI, the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with article 16(2)(f)(iii) of MARPOL, that the amendments shall be deemed to have been accepted on 1 November 2023 unless prior to that date not less than one third of the Parties or Parties the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet have communicated to the Organization their objection to the amendments;

3 INVITES the Parties to note that, in accordance with article 16(2)(g)(ii) of MARPOL, the said amendments shall enter into force on 1 May 2024 upon their acceptance in accordance with paragraph 2 above;

4 ALSO INVITES the Parties to consider the early application of the amendments to appendix IX with regard to information to be submitted to the IMO Ship Fuel Oil Consumption Database from 1 January 2024;

5 REQUESTS the Secretary-General, for the purposes of article 16(2)(e) of MARPOL, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Parties to MARPOL;

6 ALSO REQUESTS the Secretary-General to transmit copies of the present resolution and its annex to Members of the Organization which are not Parties to MARPOL.

ANNEX

AMENDMENTS TO MARPOL ANNEX VI

(Regional reception facilities within Arctic waters, information to be included in the bunker delivery note (BDN) and information to be submitted to the IMO Ship Fuel Oil Consumption Database)

Regulation 17
Reception facilities

1 Paragraph 2 is replaced by the following:

"2 The following States may satisfy the requirements in paragraph 1 of this regulation through regional arrangements when, because of those States' unique circumstances, such arrangements are the only practical means to satisfy these requirements:

.1 small island developing States; and

.2 States the coastline of which borders on Arctic waters, provided that regional arrangements shall cover only ports within Arctic waters of those States.

Parties participating in a regional arrangement shall develop a Regional Reception Facilities Plan, taking into account the guidelines developed by the Organization.*

The Government of each Party participating in the arrangement shall consult with the Organization, for circulation to the Parties of the present Convention, on:

.1 how the Regional Reception Facilities Plan takes into account the guidelines developed by the Organization;*

.2 particulars of the identified Regional Ships Waste Reception Centres taking into account the guidelines developed by the Organization;* and

.3 particulars of those ports with only limited facilities."

Appendix V
Information to be included in the bunker delivery note (regulation 18.5)

2 The following new item 9 and associated footnote are added to the list, below item 8 "Sulphur content (% m/m)":

"The flashpoint (°C) specified in accordance with standards acceptable to the Organization,* or a statement that the flashpoint has been measured at or above 70ºC;"

* ISO 2719:2016, Determination of flash point – Pensky-Martens closed cup method, Procedure A (for Distillate Fuels) or Procedure B (for Residual Fuels)."

3 Existing item 9 is renumbered as new item 10 in the list.

* Refer to the *2012 Guidelines for the development of a Regional Reception Facilities Plan* (resolution MEPC.221(63)), as amended by resolution MEPC.363(79).

Appendix IX
Information to be submitted to the IMO Ship Fuel Oil Consumption Database (regulation 27)

4 Appendix IX is replaced by the following:

" Appendix IX

Information to be submitted to the IMO Ship Fuel Oil Consumption Database (regulation 27)

Identity of the ship

IMO number ……

Period of calendar year for which the data is submitted

Start date (dd/mm/yyyy) …….

End date (dd/mm/yyyy) ……..

Technical characteristics of the ship

Year of delivery……..……

Ship type, as defined in regulation 2 of this annex or other (to be stated) ……..

Gross tonnage (GT)[1] ……...

Net tonnage (NT)[2] ……

Deadweight tonnage (DWT)[3] …….

Power output (rated power) [4] of main and auxiliary reciprocating internal combustion engines over 130 kW (to be stated in kW) ……

Attained EEDI[5] (if applicable)……..……..……

Attained EEXI[6] (if applicable)……..

Ice class[7]……...

1 Gross tonnage should be calculated in accordance with the International Convention on Tonnage Measurement of Ships, 1969.

2 Net tonnage should be calculated in accordance with the International Convention on Tonnage Measurement of Ships, 1969. If not applicable, note "N/A".

3 DWT means the difference in tonnes between the displacement of a ship in water of relative density of 1,025 kg/m^3 at the summer load draught and the lightweight of the ship. The summer load draught should be taken as the maximum summer draught as certified in the stability booklet approved by the Administration or an organization authorized by it. If not applicable, note "N/A".

4 Rated power means the maximum continuous rated power as specified on the nameplate of the engine.

5 Refer to the *2018 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships* (resolution MEPC.308(73), as amended by resolutions MEPC.322(74) and MEPC.332(76)), and as may be further amended.

6 Refer to the *2022 Guidelines on the method of calculation of the attained Energy Efficiency Existing Ship Index (EEXI)* (resolution MEPC.350(78)).

7 Ice class should be consistent with the definition set out in the International Code for Ships Operating in Polar Waters (Polar Code) (resolutions MEPC.264(68) and MSC.385(94)). If not applicable, note "N/A".

Fuel oil consumption, by fuel oil type in metric tonnes and methods used for collecting fuel oil consumption data ……

Distance travelled ……

Hours under way……

For ships to which regulation 28 of MARPOL Annex VI applies:

Applicable CII:[8] ☐AER ☐cgDIST

Required annual operational CII[9]……

Attained annual operational CII before any correction[10]……
Attained annual operational CII[11]……Operational carbon intensity rating:[12]
☐A ☐B ☐C ☐D ☐E

CII for trial purpose (none, one or more on voluntary basis):[13]

☐ EEPI (gCO_2/t•nm): ……

☐ cbDIST (gCO_2/berth•nm): ……

☐ clDIST (gCO_2/m•nm): ……

☐ EEOI (gCO_2/t•nm or others)[14]: ……."

***

8 Refer to the *2022 Guidelines on operational carbon intensity indicators and the calculation methods (CII guidelines, G1)* (resolution MEPC.352(78)).

9 Refer to the *2022 Guidelines on the reference lines for use* with operational carbon intensity indicators *(CII reference lines guidelines, G2)* (resolution MEPC.353(78)) and *2021 Guidelines on the* operational carbon intensity *reduction factors relative to reference lines (CII reduction factors guidelines, G3)* (resolution MEPC.338(76)).

10 As calculated in accordance with the *2022 Guidelines on operational carbon intensity indicators and the calculation methods* (*CII guidelines, G1*) (resolution MEPC.352(78)) before any correction using *Interim guidelines on correction factors and voyage adjustments for CII calculations (G5)* (resolution MEPC.355(78)).

11 As calculated in accordance with the *2021 Guidelines on operational carbon intensity indicators and the calculation methods* (*CII guidelines, G1*) (resolution MEPC.352(78)) and having been corrected taking into account *Interim guidelines on correction factors and voyage adjustments for CII calculations (G5)* (resolution MEPC.355(78)).

12 Refer to the *2022 Guidelines on the operational carbon intensity rating of ships (CII rating guidelines, G4)* (resolution MEPC.354(78)).

13 Refer to the *2022 Guidelines on operational carbon intensity indicators and the calculation methods* (*CII guidelines, G1*) (resolution MEPC.352(78)).

14 Refer to the *Guidelines for voluntary use of the ship energy efficiency operational indicator (EEOI))* (MEPC.1/Circ.684).

ANNEX 9

RESOLUTION MEPC.364(79)

2022 GUIDELINES ON THE METHOD OF CALCULATION OF THE ATTAINED ENERGY EFFICIENCY DESIGN INDEX (EEDI) FOR NEW SHIPS

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 regulation 22 (Attained Energy Efficiency Design Index (attained EEDI)) of MARPOL Annex VI, as amended, requires that the EEDI shall be calculated taking into account the guidelines developed by the Organization,

NOTING ALSO that the Committee adopted, at its seventy-third session, *2018 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships* (resolution MEPC.308(73)),

NOTING FURTHER that, at its seventy-fourth and seventy-sixth sessions, it adopted, by resolutions MEPC.322(74) and MEPC.332(76), respectively, amendments to the *2018 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships*,

HAVING NOTED, at its seventy-ninth session, the need to further amend the *2018 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships* (resolution MEPC.308(73), as amended),

1 ADOPTS the *2022 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships,* as set out in the annex to the present resolution;

2 INVITES Administrations to implement the 2022 EEDI Calculation Guidelines when developing and enacting national laws which give force to, and implement provisions set forth in regulation 22 of MARPOL Annex VI, as amended;

3 REQUESTS the Parties to MARPOL Annex VI and other Member Governments to bring the amendments to the attention of shipowners, ship operators, shipbuilders, ship designers and any other interested parties;

4 AGREES to keep these Guidelines, as amended, under review, in light of experience gained with their implementation;

5 AGREES that these Guidelines supersede the *2018 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships* (resolution MEPC.308(73), as amended by resolutions MEPC.322(74) and MEPC.332(76)).

ANNEX

2022 GUIDELINES ON THE METHOD OF CALCULATION OF THE ATTAINED ENERGY EFFICIENCY DESIGN INDEX (EEDI) FOR NEW SHIPS

CONTENTS

2.2.10 f_{eff} ; Factor of each innovative energy efficiency technology

2.2.11 f_i ; Capacity factor for technical/regulatory limitation on capacity

2.2.11.1 f_i ; Capacity correction factor for ice-class ships

2.2.11.2 $f_{i\,VSE}$; Ship-specific voluntary structural enhancement

2.2.11.3 f_{iCSR} ; Ships under Common Structural Rules (CSR)

2.2.11.4 f_i for other ship types

2.2.12 f_c ; Cubic capacity correction factor

2.2.12.1 f_c for chemical tankers

2.2.12.2 f_c for gas carriers

2.2.12.3 f_c for ro-ro passenger ships (f_{cRoPax})

2.2.12.4 f_c for bulk carriers having R of less than 0.55 ($f_{c\ bulk\ carriers\ designed\ to\ carry\ light\ cargoes}$)

2.2.13 Lpp ; Length between perpendiculars

2.2.14 f_l ; Factor for general cargo ships equipped with cranes and other cargo-related gear

2.2.15 d_s ; Summer load line draught

2.2.16 B_s ; Breadth

2.2.17 ∇ ; Volumetric displacement

2.2.18 g ; Gravitational acceleration

2.2.19 f_m ; Factor for ice-classed ships having IA Super and IA

APPENDIX 1 A generic and simplified power plant

APPENDIX 2 Guidelines for the development of electric power tables for EEDI (EPT-EEDI)

APPENDIX 3 A generic and simplified marine power plant for a cruise passenger ship having non-conventional propulsion

APPENDIX 4 EEDI calculation examples for use of dual-fuel engines

1 Definitions

1.1 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.

1.2 For the purpose of these Guidelines, the definitions in chapter 4 of MARPOL Annex VI, as amended, apply.

2 Energy Efficiency Design Index (EEDI)

2.1 EEDI formula

The attained new ship Energy Efficiency Design Index (EEDI) is a measure of ships' energy efficiency (g/t · nm) and calculated by the following formula:

$$\frac{\left(\prod_{j=1}^{n} f_j\right)\left(\sum_{i=1}^{nME} P_{ME(i)} \cdot C_{FME(i)} \cdot SFC_{ME(i)}\right) + \left(P_{AE} \cdot C_{FAE} \cdot SFC_{AE}*\right) + \left(\left(\prod_{j=1}^{n} f_j \cdot \sum_{i=1}^{nPTI} P_{PTI(i)} - \sum_{i=1}^{neff} f_{eff(i)} \cdot P_{AEeff(i)}\right) C_{FAE} \cdot SFC_{AE}\right) - \left(\sum_{i=1}^{neff} f_{eff(i)} \cdot P_{eff(i)} \cdot C_{FME} \cdot SFC_{ME}**\right)}{f_i \cdot f_c \cdot f_l \cdot Capacity \cdot f_w \cdot V_{ref} \cdot f_m}$$

* If part of the Normal Maximum Sea Load is provided by shaft generators, SFC_{ME} and C_{FME} may – for that part of the power – be used instead of SFC_{AE} and C_{FAE}

** In case of $P_{PTI(i)} > 0$, the average weighted value of (SFC_{ME} · C_{FME}) and (SFC_{AE} · C_{FAE}) to be used for calculation of P_{eff}

Note: This formula may not be applicable to a ship having diesel electric propulsion, turbine propulsion or hybrid propulsion system, except for cruise passenger ships and LNG carriers.

2.2 Parameters

For the calculation of EEDI by the formula in paragraph 2.1, the following parameters apply.

2.2.1 C_F ; Conversion factor between fuel consumption and CO_2 emission

C_F is a non-dimensional conversion factor between fuel consumption measured in g and CO_2 emission also measured in g based on carbon content. The subscripts $_{ME(i)}$ and $_{AE(i)}$ refer to the main and auxiliary engine(s) respectively. C_F corresponds to the fuel used when determining *SFC* listed in the applicable test report included in a Technical File as defined in paragraph 1.3.15 of the NO_x Technical Code ("test report included in a NO_x Technical File" hereafter). The value of C_F is as follows:

Type of fuel	Reference	Lower calorific value (kJ/kg)	Carbon content	C_F (t-CO_2/t-Fuel)
1 Diesel/Gas Oil	ISO 8217 Grades DMX through DMB	42,700	0.8744	3.206
2 Light Fuel Oil (LFO)	ISO 8217 Grades RMA through RMD	41,200	0.8594	3.151
3 Heavy Fuel Oil (HFO)	ISO 8217 Grades RME through RMK	40,200	0.8493	3.114
4 Liquefied Petroleum Gas (LPG)	Propane	46,300	0.8182	3.000
	Butane	45,700	0.8264	3.030
5 Ethane		46,400	0.7989	2.927

Type of fuel	Reference	Lower calorific value (kJ/kg)	Carbon content	C_F (t-CO_2/t-Fuel)
6 Liquefied Natural Gas (LNG)		48,000	0.7500	2.750
7 Methanol		19,900	0.3750	1.375
8 Ethanol		26,800	0.5217	1.913

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:

$$f_{DFgas} = \frac{\sum_{i=1}^{ntotal} P_{total(i)}}{\sum_{i=1}^{ngasfuel} P_{gasfuel(i)}} \times \frac{V_{gas} \times \rho_{gas} \times LCV_{gas} \times K_{gas}}{\left(\sum_{i=1}^{nLiquid} V_{liquid(i)} \times \rho_{liquid(i)} \times LCV_{liquid(i)} \times K_{liquid(i)} \right) + V_{gas} \times \rho_{gas} \times LCV_{gas} \times K_{gas}}$$

$f_{DFliquid} = 1 - f_{DFgas}$

where,

f_{DFgas} is the fuel availability ratio of gas fuel corrected for the power ratio of gas engines to total engines; f_{DFgas} should not be greater than 1;

V_{gas} is the total net gas fuel capacity on board in m^3. If other arrangements, like exchangeable (specialized) LNG tank-containers and/or arrangements allowing frequent gas refuelling are used, the capacity of the whole LNG fuelling system should be used for V_{gas}. The boil-off rate (BOR) of gas cargo tanks can be calculated and included in V_{gas} if it is connected to the fuel gas supply system (FGSS);

V_{liquid} is the total net liquid fuel capacity on board in m^3 of liquid fuel tanks permanently connected to the ship's fuel system. If one fuel tank is disconnected by permanent sealing valves, V_{liquid} of the fuel tank can be ignored;

ρ_{gas} is the density of gas fuel in kg/m^3;

ρ_{liquid} is the density of each liquid fuel in kg/m^3;

LCV_{gas} is the low calorific value of gas fuel in kJ/kg;

LCV_{liquid} is the low calorific value of liquid fuel in kJ/kg;

K_{gas} is the filling rate for gas fuel tanks;

K_{liquid} is the filling rate for liquid fuel tanks;

P_{total} is the total installed engine power, P_{ME} *and* P_{AE} in kW;

$P_{gasfuel}$ is the dual-fuel engine installed power, P_{ME} *and* P_{AE} in kW;

.1 If the total gas fuel capacity is at least 50% of the fuel capacity dedicated to the dual-fuel engines , namely $f_{DFgas} \geq 0.5$, then gas fuel is regarded as the "Primary fuel," and $f_{DFgas} = 1$ and $f_{DFliquid} = 0$ for each dual-fuel engine.

.2 If $f_{DFgas} < 0.5$, gas fuel is not regarded as the "primary fuel." The C_F and *SFC* in the EEDI calculation for each dual-fuel engine (both main and auxiliary engines) should be calculated as the weighted average of C_F and *SFC* for liquid and gas mode, according to f_{DFgas} and $f_{DFliquid}$, such as the original item of $P_{ME(i)} \cdot C_{FME(i)} \cdot SFC_{ME(i)}$ in the EEDI calculation is to be replaced by the formula below.

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

2.2.2 V_{ref} ; Ship speed

V_{ref} is the ship speed, measured in nautical miles per hour (knot), on deep water in the condition corresponding to the *capacity* as defined in paragraphs 2.2.3.1 and 2.2.3.3 (in the case of passenger ships and cruise passenger ships, this condition should be summer load draught as provided in paragraph 2.2.4) at the shaft power of the engine(s) as defined in paragraph 2.2.5 and assuming the weather is calm with no wind and no waves.

2.2.3 *Capacity*

Capacity is defined as follows.

2.2.3.1 For bulk carriers, tankers, gas carriers, LNG carriers, ro-ro cargo ships (vehicle carriers), ro-ro cargo ships, ro-ro passenger ships, general cargo ships, refrigerated cargo carrier and combination carriers, deadweight should be used as *capacity*.

2.2.3.2 For passenger ships and cruise 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*.

2.2.3.3 For containerships, 70% of the deadweight (DWT) should be used as *capacity*. EEDI values for containerships are calculated as follows:

.1 attained EEDI is calculated in accordance with the EEDI formula using 70% deadweight for *capacity*;

.2 estimated index value in the Guidelines for calculation of the reference line is calculated using 70% deadweight as:

$$Estimated\ \ Index\,Value = 3.1144 \cdot \frac{190 \cdot \sum_{i=1}^{NME} P_{MEi} + 215 \cdot P_{AE}}{70\%\mathrm{DWT} \cdot V_{ref}}$$

.3 parameters a and c for containerships in table 2 of regulation 24 of MARPOL Annex VI are determined by plotting the estimated index value against 100% deadweight, i.e. a = 174.22 and c = 0.201 were determined;

.4 required EEDI for a new containership is calculated using 100% deadweight as:

$$\text{Required EEDI} = (1\text{-}X/100) \cdot a \cdot 100\%\ \text{deadweight}^{-c}$$

where X is the reduction factor (in percentage) in accordance with table 1 in regulation 24 of MARPOL Annex VI relating to the applicable phase and size of new containership.

2.2.4 *Deadweight*

Deadweight means the difference in tonnes between the displacement of a ship in water of relative density of 1,025 kg/m^3 at the summer load draught and the lightweight of the ship. The summer load draught should be taken as the maximum summer draught as certified in the stability booklet approved by the Administration or an organization recognized by it.

2.2.5 *P ;* Power of main and auxiliary engines

P is the power of the main and auxiliary engines, measured in kW. The subscripts $_{ME(i)}$ and $_{AE(i)}$ refer to the main and auxiliary engine(s), respectively. The summation on *i* is for all engines with the number of engines ($_{nME}$) (see diagram in appendix 1).

2.2.5.1 $P_{ME(i)}$; Power of main engines

$P_{ME(i)}$ is 75% of the rated installed power (MCR[1]) for each main engine (*i*).

For LNG carriers having diesel electric propulsion system, $P_{ME(i)}$ should be calculated by the following formula:

$$P_{ME(i)} = 0.83 \times \frac{MPP_{Motor(i)}}{\eta_{(i)}}$$

Where:

$MPP_{Motor(i)}$ is the rated output of motor specified in the certified document.

$\eta_{(i)}$ is to be taken as the product of electrical efficiency of generator, transformer, converter and motor, taking into consideration the weighted average as necessary.

The electrical efficiency, $\eta_{(i)}$, should be taken as 91.3% for the purpose of calculating attained EEDI. Alternatively, if the value more than 91.3% is to be applied, the $\eta_{(i)}$ should be obtained by measurement and verified by method approved by the verifier.

For LNG carriers having steam turbine propulsion systems, $P_{ME(i)}$ is 83% of the rated installed power ($MCR_{SteamTurbine}$) for each steam turbine$_{(i)}$.

The influence of additional shaft power take off or shaft power take in is defined in the following paragraphs.

2.2.5.2 $P_{PTO(i)}$; Shaft generator

Where shaft generators are installed, $P_{PTO(i)}$ is 75% of the rated electrical output power of each shaft generator. In the case of shaft generators installed with a steam turbine, $P_{PTO(i)}$ is 83% of the rated electrical output power and the factor of 0.75 should be replaced by 0.83.

For calculating the effect of shaft generators, two options are available:

[1] The value of MCR specified on the EIAPP certificate should be used for calculation. If the main engines are not required to have an EIAPP certificate, the MCR on the nameplate should be used.

Option 1:

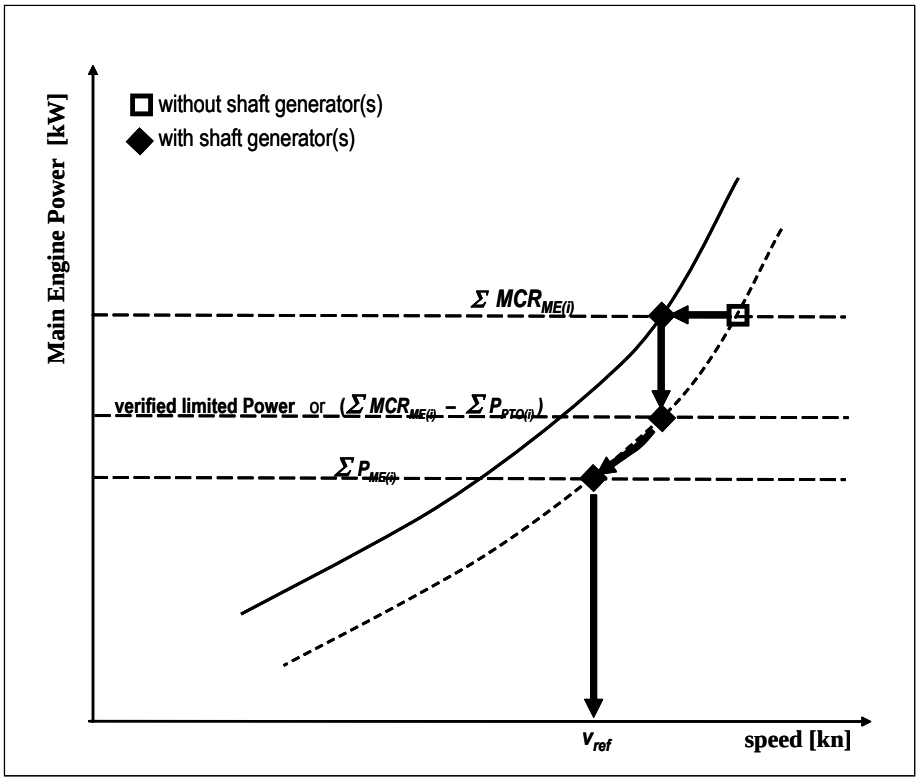
The maximum allowable $P_{PTO(i)}$ deduction should be no more than P_{AE}/0.75 with P_{AE} as defined in paragraph 2.2.5.6. For this case, $\Sigma P_{ME(i)}$ is calculated as:

$$\sum_{i=1}^{nME} P_{ME(i)} = 0.75 \times \sum MCR_{ME(i)} - 0.75 \times \sum P_{PTO(i)} \quad with \ \sum P_{PTO(i)} \leq \frac{P_{AE}}{0.75}$$

or

Option 2:

Where an engine is installed with a higher rated power output than that which the propulsion system is limited to by verified technical means, then the value of $\Sigma P_{ME(i)}$ is 75% of that limited power for determining the reference speed, V_{ref} and for EEDI calculation. The following figure gives guidance for determination of $\Sigma P_{ME(i)}$:



2.2.5.3 $P_{PTI(i)}$; Shaft motor

Where shaft motors are installed, $P_{PTI(i)}$ is 75% of the rated power consumption of each shaft motor divided by the weighted average efficiency of the generator(s), as follows:

$$\sum P_{PTI(i)} = \frac{\sum \left(0.75 \cdot P_{SM,\max(i)}\right)}{\eta_{\overline{Gen}}}$$

Where:

$P_{SM,\max(i)}$ is the rated power consumption of each shaft motor

$\eta_{\overline{Gen}}$ is the weighted average efficiency of the generator(s)

Where shaft motors are installed with a steam turbine, $P_{PTI(i)}$ is 83% of the rated power consumption and the factor of 0.75 should be replaced to 0.83.

The propulsion power at which V_{ref} is measured, is:

$$\sum P_{ME(i)} + \sum P_{PTI(i),Shaft}$$

Where:

$$\sum P_{PTI(i),Shaft} = \sum \left(0.75 \cdot P_{SM,\max(i)} \cdot \eta_{PTI(i)}\right)$$

$\eta_{PTI(i)}$ is the efficiency of each shaft motor installed

Where the total propulsion power as defined above is higher than 75% of the power the propulsion system is limited to by verified technical means, then 75% of the limited power is to be used as the total propulsion power for determining the reference speed, V_{ref} and for EEDI calculation.

In the case of combined PTI/PTO, the normal operational mode at sea will determine which of these is to be used in the calculation.

Note: The shaft motor's chain efficiency may be taken into consideration to account for the energy losses in the equipment from the switchboard to the shaft motor, if the chain efficiency of the shaft motor is given in a verified document.

2.2.5.4 $P_{eff(i)}$; Innovative mechanical energy-efficient technology for main engine

$P_{eff(i)}$ is the output of the innovative mechanical energy-efficient technology for propulsion at 75% main engine power.

Mechanical recovered waste energy directly coupled to shafts need not be measured, since the effect of the technology is directly reflected in the V_{ref}.

In the case of a ship equipped with a number of engines, the C_F and *SFC* should be the power-weighted average of all the main engines.

In the case of a ship equipped with dual-fuel engine(s), the C_F and *SFC* should be calculated in accordance with paragraphs 2.2.1 and 2.2.7.

2.2.5.5 P_{AEeff} ; Innovative mechanical energy-efficient technology for auxiliary engine

$P_{AEeff\ (i)}$ is the auxiliary power reduction due to innovative electrical energy-efficient technology measured at $P_{ME(i)}$.

2.2.5.6 P_{AE} ; Auxiliary engine power

P_{AE} is the required auxiliary engine power to supply normal maximum sea load including necessary power for propulsion machinery/systems and accommodation, e.g. main engine pumps, navigational systems and equipment and living on board, but excluding the power not for propulsion machinery/systems, e.g. thrusters, cargo pumps, cargo gear, ballast pumps, maintaining cargo, e.g. reefers and cargo hold fans, in the condition where the ship engaged in voyage at the speed (V_{ref}) under the condition as mentioned in paragraph 2.2.2.

2.2.5.6.1 For ships whose total propulsion power ($\sum MCR_{ME(i)} + \frac{\sum P_{PTI(i)}}{0.75}$) is 10,000 kW or above, P_{AE} is defined as:

$$P_{AE\ (\Sigma MCR_{ME(i)} \geq 10,000\,kW)} = \left(0.025 \times \left(\sum_{i=1}^{nME} MCR_{ME(i)} + \frac{\sum_{i=1}^{nPTI} P_{PTI(i)}}{0.75} \right) \right) + 250$$

2.2.5.6.2 For ships whose total propulsion power ($\sum MCR_{ME(i)} + \frac{\sum P_{PTI(i)}}{0.75}$) is below 10,000 kW, P_{AE} is defined as:

$$P_{AE\ (\Sigma MCR_{ME(i)} < 10,000\,kW)} = \left(0.05 \times \left(\sum_{i=1}^{nME} MCR_{ME(i)} + \frac{\sum_{i=1}^{nPTI} P_{PTI(i)}}{0.75} \right) \right)$$

2.2.5.6.3 For LNG carriers with a reliquefaction system or compressor(s), designed to be used in normal operation and essential for maintaining the LNG cargo tank pressure below the maximum allowable relief valve setting of a cargo tank in normal operation, the following terms should be added to above P_{AE} formula in accordance with 2.2.5.6.3.1, 2.2.5.6.3.2 or 2.2.5.6.3.3 as below:

.1 For ships having reliquefaction system:

$$+ CargoTankCapacity_{LNG} \times BOR \times COP_{reliquefy} \times R_{reliquefy}$$

Where:

CargoTankCapacity$_{LNG}$ is the LNG Cargo Tank Capacity in m^3.

BOR is the design rate of boil-off gas of entire ship per day, which is specified in the specification of the building contract.

COP$_{reliquefy}$ is the coefficient of design power performance for reliquefying boil-off gas per unit volume, as follows:

$$COP_{reliquefy} = \frac{425\,(kg/m^3) \times 511\,(kJ/kg)}{24\,(h) \times 3600\,(\mathrm{sec}) \times COP_{cooling}}$$

COP$_{cooling}$ is the coefficient of design performance of reliquefaction and 0.166 should be used. Another value calculated by the manufacturer and verified by the Administration or an organization recognized by the Administration may be used.

$R_{reliquefy}$ is the ratio of boil-off gas (BOG) to be reliquefied to entire BOG, calculated as follows:

$$R_{reliquefy} = \frac{BOG_{reliquefy}}{BOG_{total}}$$

.2 For LNG carriers with direct diesel driven propulsion system or diesel electric propulsion system, having compressor(s) which are used for supplying high-pressured gas derived from boil-off gas to the installed engines (typically intended for 2-stroke dual-fuel engines):

$$+ COP_{comp} \times \sum_{i=1}^{nME} SFC_{ME(i),gasmode} \times \frac{P_{ME(i)}}{1000}$$

Where:

COP_{comp} is the design power performance of compressor and 0.33 (kWh/kg) should be used. Another value calculated by the manufacturer and verified by the Administration or an organization recognized by the Administration may be used.

.3 For LNG carriers with direct diesel driven propulsion system or diesel electric propulsion system, having compressor(s) which are used for supplying low-pressured gas derived from boil-off gas to the installed engines (typically intended for 4-stroke dual-fuel engines):

$$+ 0.02 \times \sum_{i=1}^{nME} P_{ME(i)}$$ [2]

2.2.5.6.4 For LNG carriers having diesel electric propulsion system, $MPP_{Motor(i)}$ should be used instead of $MCR_{ME(i)}$ for P_{AE} calculation.

2.2.5.6.5 For LNG carriers having a steam turbine propulsion system and whose electric power is primarily supplied by turbine generator closely integrated into the steam and feed water systems, P_{AE} may be treated as 0(zero) instead of taking into account electric load in calculating $SFC_{SteamTurbine}$.

2.2.5.7 Use of electric power table

For ships where the P_{AE} value calculated by paragraphs 2.2.5.6.1 to 2.2.5.6.3 is significantly different from the total power used at normal seagoing, e.g. in cases of passenger ships (see NOTE under the formula of EEDI), the P_{AE} value should be estimated by the consumed electric power (excluding propulsion) in conditions when the ship is engaged in a voyage at reference speed (V_{ref}) as given in the electric power table,[3] divided by the average efficiency of the generator(s) weighted by power (see appendix 2).

[2] With regard to the factor of 0.02, it is assumed that the additional energy needed to compress BOG for supplying to a 4-stroke dual fuel engine is approximately equal to 2% of P_{ME}, compared to the energy needed to compress BOG for supplying to a steam turbine.

[3] The electric power table should be examined and validated by the verifier. Where ambient conditions affect any electrical load in the power table, such as that for heating ventilation and air conditioning systems, the contractual ambient conditions leading to the maximum design electrical load of the installed system for the ship in general should apply.

2.2.6 Consistency of parameters V_{ref}, *Capacity* and *P*

V_{ref}, *Capacity* and *P* should be consistent with each other. As for LNG carries having diesel electric or steam turbine propulsion systems, V_{ref} is the relevant speed at 83% of MPP_{Motor} or $MCR_{SteamTubine}$ respectively.

2.2.7 *SFC;* Certified specific fuel consumption

SFC is the certified specific fuel consumption, measured in g/kWh, of the engines or steam turbines.

2.2.7.1 *SFC* for main and auxiliary engines

The subscripts $_{ME(i)}$ and $_{AE(i)}$ refer to the main and auxiliary engine(s), respectively. For engines certified to the E2 or E3 test cycles of the NO_X Technical Code 2008, the engine specific fuel consumption ($SFC_{ME(i)}$) is that recorded in the test report included in a NO_x Technical File for the engine(s) at 75% of MCR power of its torque rating. For engines certified to the D2 or C1 test cycles of the NO_x Technical Code 2008, the engine specific fuel consumption ($SFC_{AE(i)}$) is that recorded on the test report included in a NO_x Technical File at the engine(s) 50% of MCR power or torque rating. If gas fuel is used as primary fuel in accordance with paragraph 4.2.3 of the *Guidelines on survey and certification of the Energy Efficiency Design Index (EEDI)*, *SFC* in gas mode should be used. Where installed engines have no approved NO_X Technical File tested in gas mode, the *SFC* of gas mode should be submitted by the manufacturer and confirmed by the verifier.

The *SFC* should be corrected to the value corresponding to the ISO standard reference conditions using the standard lower calorific value of the fuel oil (42,700kJ/kg), referring to ISO 15550:2002 and ISO 3046-1:2002.

For ships where the P_{AE} value calculated by paragraphs 2.2.5.6.1 to 2.2.5.6.3 is significantly different from the total power used at normal seagoing, e.g. conventional passenger ships, the specific fuel consumption (SFC_{AE}) of the auxiliary generators is that recorded in the test report included in a NO_x Technical File for the engine(s) at 75% of MCR power of its torque rating.

SFC_{AE} is the power-weighted average among $SFC_{AE(i)}$ of the respective engines *i*.

For those engines which do not have a test report included in a NO_x Technical File because their power is below 130 kW, the *SFC* specified by the manufacturer and endorsed by a competent authority should be used.

At the design stage, in case of unavailability of test report in the NO_X file, the *SFC* specified by the manufacturer and endorsed by a competent authority should be used.

For LNG driven engines of which *SFC* is measured in kJ/kWh, the *SFC* value should be corrected to g/kWh using the standard lower calorific value of the LNG (48,000 kJ/kg), referring to the 2006 IPCC Guidelines.

Reference lower calorific values of additional fuels are given in the table in paragraph 2.2.1 of these Guidelines. The reference lower calorific value corresponding to the conversion factor of the respective fuel should be used for calculation.

2.2.7.2 *SFC* for steam turbines (*SFC*$_{SteamTurbine}$)

The *SFC*$_{SteamTurbine}$ should be calculated by the manufacturer and verified by the Administration or an organization recognized by the Administration as follows:

$$SFC_{SteamTurbine} = \frac{FuelConsumption}{\sum_{i=1}^{nME} P_{ME(i)}}$$

Where:

.1 *Fuel consumption* is fuel consumption of boiler per hour (g/h). For ships whose electric power is primarily supplied by turbine generator closely integrated into the steam and feed water systems, not only P_{ME} but also *electric loads* corresponding to paragraph 2.2.5.6 should be taken into account.

.2 The *SFC* should be corrected to the value of LNG using the standard lower calorific value of the LNG (48,000 kJ/kg) at SNAME Condition (condition standard; air temperature 24°C, inlet temperature of fan 38°C, seawater temperature 24°C).

.3 In this correction, the difference of the boiler efficiency based on lower calorific value between test fuel and LNG should be taken into account.

2.2.8 f_j ; Ship-specific design elements

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

2.2.8.1 Power correction factor for ice-classed ships

The power correction factor, f_j, for ice-classed ships should be taken as the greater value of f_{j0} and $f_{j,min}$ as tabulated in table 1 but not greater than $f_{j,max}$ = 1.0.

For further information on approximate correspondence between ice classes, see HELCOM Recommendation 25/7.[4]

Table 1: Correction factor for power f_j for ice-classed ships

Ship type	f_{j0}	$f_{j,min}$ depending on the ice class			
		IA Super	IA	IB	IC
Tanker	$\frac{17.444 \cdot DWT^{0.5766}}{\sum_{i=1}^{nME} MCR_{ME(i)}}$	$0.2488 \cdot DWT^{0.0903}$	$0.4541 \cdot DWT^{0.0524}$	$0.7783 \cdot DWT^{0.0145}$	$0.8741 \cdot DWT^{0.0079}$
Bulk carrier	$\frac{17.207 \cdot DWT^{0.5705}}{\sum_{i=1}^{nME} MCR_{ME(i)}}$	$0.2515 \cdot DWT^{0.0851}$	$0.3918 \cdot DWT^{0.0556}$	$0.8075 \cdot DWT^{0.0071}$	$0.8573 \cdot DWT^{0.0087}$
General cargo ship	$\frac{1.974 \cdot DWT^{0.7987}}{\sum_{i=1}^{nME} MCR_{ME(i)}}$	$0.1381 \cdot DWT^{0.1435}$	$0.1574 \cdot DWT^{0.144}$	$0.3256 \cdot DWT^{0.0922}$	$0.4966 \cdot DWT^{0.0583}$
Refrigerated cargo ship	$\frac{5.598 \cdot DWT^{0.696}}{\sum_{i=1}^{nME} MCR_{ME(i)}}$	$0.5254 \cdot DWT^{0.0357}$	$0.6325 \cdot DWT^{0.0278}$	$0.7670 \cdot DWT^{0.0159}$	$0.8918 \cdot DWT^{0.0079}$

[4] HELCOM Recommendation 25/7 may be found at http://www.helcom.fi

Alternatively, if an ice-class ship is designed and constructed based on an open water ship with the same shape and size of hull with EEDI certification, the power correction factor, f_j, for ice-classed ships can be calculated by using propulsion power of the new ice-class ship required by ice-class regulations, $P_{ice\ class}$, and the existing open water ship, P_{ow}, as follows:

$$f_j = \frac{P_{ow}}{P_{ice\ class}}$$

In this case, V_{ref} should be measured at the shaft power of the engine(s) installed on the existing open water ship as defined in paragraph 2.2.5.

2.2.8.2 Power correction factor for shuttle tankers with propulsion redundancy

The power correction 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 dwt. Shuttle tankers with propulsion redundancy are tankers used for loading 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.

2.2.8.3 Correction factor for ro-ro cargo and ro-ro passenger ships (f_{jRoRo})

For ro-ro cargo and ro-ro passenger ships f_{jRoRo} is calculated as follows:

$$f_{jRoRo} = \frac{1}{F_{n_L}^{\alpha} \cdot \left(\frac{L_{pp}}{B_s}\right)^{\beta} \cdot \left(\frac{B_s}{d_s}\right)^{\gamma} \cdot \left(\frac{L_{pp}}{\nabla^{1/3}}\right)^{\delta}} \quad ; \quad \text{If } f_{jRoRo} > 1 \text{ then } f_j = 1$$

where the Froude number, F_{n_L}, is defined as:

$$F_{n_L} = \frac{0.5144 \cdot V_{ref}}{\sqrt{L_{pp} \cdot g}}$$

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

2.2.8.4 Correction factor for general cargo ships

The factor f_j for general cargo ships is calculated as follows:

$$f_j = \frac{0.174}{Fn_{\nabla}{}^{2.3} \cdot C_b{}^{0.3}} \quad ; \quad \text{If } f_j > 1 \text{ then } f_j = 1$$

Where

$$Fn_{\nabla} = \frac{0.5144 \cdot V_{ref}}{\sqrt{g \cdot \nabla^{\frac{1}{3}}}} \quad ; \quad \text{If } Fn_{\nabla} > 0.6 \text{ then } Fn_{\nabla} = 0.6$$

and

$$C_b = \frac{\nabla}{L_{pp} \cdot B_s \cdot d_s}$$

2.2.8.5 Correction factor for other ship types

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

2.2.9 f_w ; Factor for speed reduction at sea

f_w is a non-dimensional coefficient indicating the decrease of speed in representative sea conditions of wave height, wave frequency and wind speed (e.g. Beaufort Scale 6), and is determined as follows:

2.2.9.1 for the attained EEDI calculated under regulations 22 and 24 of MARPOL Annex VI, f_w is 1.00;

2.2.9.2 when f_w is calculated according to the sub-paragraph 2.2.9.2.1 or 2.2.9.2.2 below, the value for attained EEDI calculated by the formula in paragraph 2.1 using the obtained f_w should be referred to as "*attained EEDI*$_{weather}$";

2.2.9.2.1 f_w can be determined by conducting the ship-specific simulation on its performance at representative sea conditions. The simulation methodology should be based on the Guidelines developed by the Organization[5] and the method and outcome for an individual ship should be verified by the Administration or an organization recognized by the Administration; and

2.2.9.2.2 In cases where a simulation is not conducted, f_w should be taken from the "Standard f_w " table/curve. A "Standard f_w " table/curve is provided in the Guidelines[5] for each ship type defined in regulation 2 of MARPOL Annex VI, and expressed as a function of capacity (e.g. deadweight). The "Standard f_w " table/curve is based on data of actual speed reduction of as many existing ships as possible under the representative sea condition.

2.2.9.3 f_w and *attained EEDI*$_{weather}$, if calculated, with the representative sea conditions under which those values are determined, should be indicated in the EEDI Technical File to distinguish it from the attained EEDI calculated under regulations 22 and 24 of MARPOL Annex VI.

---

[5] Refer to *Interim guidelines for the calculation of the coefficient f_w for decrease in ship speed in a representative sea condition for trial use*, approved by the Organization and circulated by MEPC.1/Circ.796.

2.2.10 $f_{eff(i)}$; Factor of each innovative energy efficiency technology

$f_{eff(i)}$ is the availability factor of each innovative energy efficiency technology. $f_{eff(i)}$ for waste energy recovery system should be one (1.0)[6].

2.2.11 f_i ; Capacity factor for technical/regulatory limitation on capacity

f_i is the capacity factor for any technical/regulatory limitation on capacity, and should be assumed to be one (1.0) if no necessity of the factor is granted.

2.2.11.1 Capacity correction factor for ice-classed ships

The capacity correction factor, f_i, for ice-classed ships having DWT as the measure of capacity should be calculated as follows:

$$f_i = f_{i(ice\ class)} \cdot f_{iC_b},$$

where $f_{i(ice\ class)}$ is the capacity correction factor for ice-strengthening of the ship, which can be obtained from Table 2 and f_{iC_b} is the capacity correction factor for improved ice-going capability, which should not be less than 1.0 and which should be calculated as follows:

$$f_{iC_b} = \frac{C_{b\ reference\ design}}{C_b},$$

where $C_{b\ reference\ design}$ is the average block coefficient for the ship type, which can be obtained from Table 3 for bulk carriers, tankers and general cargo ships, and C_b is the block coefficient of the ship. For ship types other than bulk carriers, tankers and general cargo ships,

$f_{iC_b} = 1.0.$

[6] EEDI calculation should be based on the normal seagoing condition outside Emission Control Areas designated under regulation 13.6 of MARPOL Annex VI.

Table 2: Capacity correction factor for ice-strengthening of the hull

Ice class[7]	$f_{i(ice\ class)}$
IC	$f_{i(IC)}$ = 1.0041 + 58.5/*DWT*
IB	$f_{i(IB)}$ = 1.0067 + 62.7/*DWT*
IA	$f_{i(IA)}$ = 1.0099 + 95.1/*DWT*
IA Super	$f_{i(IAS)}$ = 1.0151 + 228.7/*DWT*

Table 3: Average block coefficients $C_{b\ reference\ design}$ for bulk carriers, tankers and general cargo ships

	Size categories				
Ship type	below 10,000 DWT	10,000 – 25,000 DWT	25,000 – 55,000 DWT	55,000 – 75,000 DWT	above 75,000 DWT
Bulk carrier	0.78	0.80	0.82	0.86	0.86
Tanker	0.78	0.78	0.80	0.83	0.83
General cargo ship	0.80				

Alternatively, the capacity correction factor for ice-strengthening of the ship ($f_{i(ice\ class)}$) can be calculated by using the formula given for the ship-specific voluntary enhancement correction coefficient ($f_{i\ VSE}$) in paragraph 2.2.11.2. This formula can also be used for other ice classes than those given in Table 2.

2.2.11.2 $f_{i\ VSE}$[8] ; Ship-specific voluntary structural enhancement

$f_{i\ VSE}$ for ship-specific voluntary structural enhancement is expressed by the following formula:

$$f_{iVSE} = \frac{DWT_{referencedesign}}{DWT_{enhanceddesign}}$$

where:

$$DWT_{referencedesign} = \Delta_{ship} - lightweight_{referencedesign}$$

$$DWT_{enhanceddesign} = \Delta_{ship} - lightweight_{enhanceddesign}$$

For this calculation the same displacement (Δ) for reference and enhanced design should be taken.

DWT before enhancements ($DWT_{reference\ design}$) is the deadweight prior to application of the structural enhancements. DWT after enhancements ($DWT_{enhanced\ design}$) is the deadweight following the application of voluntary structural enhancement. A change of material (e.g. from

[7] For further information on approximate correspondence between ice classes, see HELCOM Recommendation 25/7, which can be found at http://www.helcom.fi

[8] Structural and/or additional class notations such as, but not limited to, "strengthened for discharge with grabs" and "strengthened bottom for loading/unloading aground", which result in a loss of deadweight of the ship, are also seen as examples of "voluntary structural enhancements".

aluminium alloy to steel) between reference design and enhanced design should not be allowed for the $f_{i\ VSE}$ calculation. A change in grade of the same material (e.g. in steel type, grades, properties and condition) should also not be allowed.

In each case, two sets of structural plans of the ship should be submitted to the verifier for assessment: one set for the ship without voluntary structural enhancement; the other set for the same ship with voluntary structural enhancement (alternatively, one set of structural plans of the reference design with annotations of voluntary structural enhancement should also be acceptable). Both sets of structural plans should comply with the applicable regulations for the ship type and intended trade.

2.2.11.3 f_{iCSR} ; Ships under the Common Structural Rules (CSR)

For bulk carriers and oil tankers, built in accordance with the Common Structural Rules (CSR) of the classification societies and assigned the class notation CSR, the following capacity correction factor f_{iCSR} should apply:

$$f_{iCSR} = 1 + (0.08 \cdot LWT_{CSR} / DWT_{CSR})$$

Where DWT_{CSR} is the deadweight determined by paragraph 2.2.4 and LWT_{CSR} is the light weight of the ship.

2.2.11.4 f_i for other ship types

For other ship types, f_i should be taken as one (1.0).

2.2.12 f_c ; Cubic capacity correction factor

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

2.2.12.1 f_c for chemical tankers

For chemical tankers, as defined in regulation 1.16.1 of MARPOL Annex II, the following cubic capacity correction factor f_c should apply:

$f_c = R^{-0.7} - 0.014$, where R is less than 0.98
or
$f_c = 1.000$, where R is 0.98 and above;

where: R is the capacity ratio of the deadweight of the ship (tonnes) as determined by paragraph 2.2.4 divided by the total cubic capacity of the cargo tanks of the ship (m^3).

2.2.12.2 f_c for gas carriers

for gas carriers having direct diesel driven propulsion system constructed or adapted and used for the carriage in bulk of liquefied natural gas, the following cubic capacity correction factor f_{cLNG} should apply:

$$f_{cLNG} = R^{-0.56}$$

where: R is the capacity ratio of the deadweight of the ship (tonnes) as determined by paragraph 2.2.4 divided by the total cubic capacity of the cargo tanks of the ship (m^3).

Note: This factor is applicable to LNG carriers defined as gas carriers in regulation 2.2.14 of MARPOL Annex VI and should not be applied to LNG carriers defined in regulation 2.2.16 of MARPOL Annex VI.

2.2.12.3 f_c for ro-ro passenger ships (f_{cRoPax})

For ro-ro passenger ships having a DWT/GT-ratio of 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.

2.2.12.4 f_c for bulk carriers having R of less than 0.55 ($f_{c\ bulk\ carriers\ designed\ to\ carry\ light\ cargoes}$)

For bulk carriers having R of less than 0.55 (e.g. woodchip carriers), the following cubic capacity correction factor, $f_{c\ bulk\ carriers\ designed\ to\ carry\ light\ cargoes}$, should apply:

$$f_{c\ bulk\ carriers\ designed\ to\ carry\ light\ cargoes} = R^{-0.15}$$

where R is the capacity ratio of the deadweight of the ship (tonnes) as determined by paragraph 2.2.4 divided by the total cubic capacity of the cargo holds of the ship (m^3).

2.2.13 L_{pp} ; Length between perpendiculars

Length between perpendiculars, L_{pp}, means 96% of the total length on a waterline at 85% of the least moulded depth measured from the top of the keel, or the length from the foreside of the stem to the axis of the rudder stock on that waterline, if that were greater. In ships designed with a rake of keel the waterline on which this length is measured should be parallel to the designed waterline. L_{pp} should be measured in metres.

2.2.14 f_l ; Factor for general cargo ships equipped with cranes and cargo-related gear

f_l is the factor for general cargo ships equipped with cranes and other cargo-related gear to compensate in a loss of deadweight of the ship.

$$f_l = f_{cranes} \cdot f_{sideloader} \cdot f_{roro}$$

f_{cranes}	= 1	If no cranes are present
$f_{sideloader}$	= 1	If no side loaders are present
f_{roro}	= 1	If no ro-ro ramp is present

Definition of f_{cranes} *:*

$$f_{cranes} = 1 + \frac{\sum_{n=1}^{n}\left(0.0519 \cdot SWL_n \cdot \mathrm{Re}\,ach_n + 32.11\right)}{Capacity}$$

where:

SWL	=	Safe Working Load, as specified by crane manufacturer in metric tonnes
Reach	=	Reach at which the Safe Working Load can be applied in metres
N	=	Number of cranes

For other cargo gear such as side loaders and ro-ro ramps, the factor should be defined as follows:

$$f_{sideloader} = \frac{Capacity_{No\ sideloaders}}{Capacity_{sideloaders}}$$

$$f_{RoRo} = \frac{Capacity_{No\ RoRo}}{Capacity_{RoRo}}$$

The weight of the side loaders and ro-ro ramps should be based on a direct calculation, by analogy with the calculations made for factor f_{ivse}.

2.2.15 d_s ; Summer load line draught

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.

In the case of a new ship with multiple load line certificates or with a load line certificate containing multiple summer load lines, the maximum summer draught should be used to calculate and verify the required and attained EEDI. For ships that may have previously received multiple EEDI assessments for several deadweights that correspond to multiple load lines, all those EEDI assessments should remain valid.

2.2.16 B_s ; Breadth

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

2.2.17 ∇ ; Volumetric displacement

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.

2.2.18 g ; Gravitational acceleration

g is the gravitational acceleration, 9.81m/s^2.

2.2.19 f_m ; Factor for ice-classed ships having IA Super and IA

For ice-classed ships having IA Super or IA, the following factor, f_m, should apply:

f_m = 1.05

For further information on approximate correspondence between ice classes, see HELCOM Recommendation 25/7[9].

[9] HELCOM Recommendation 25/7 may be found at http://www.helcom.fi

3 Mandatory reporting of attained EEDI values and related information

3.1 In accordance with regulation 22.3 of MARPOL Annex VI, for each ship subject to regulation 24, the Administration or any organization duly authorized by it shall report the required and attained EEDI values and relevant information taking into account these Guidelines via electronic communication.

3.2 Information to be reported are as follows:

.1 applicable EEDI phase (e.g. Phase 1, Phase 2);

.2 identification number (IMO Secretariat use only);

.3 ship type;

.4 common commercial size reference[10] (see Note (3) in appendix 5 to these Guidelines), if available;

.5 DWT or GT (as appropriate);

.6 year of delivery;

.7 required EEDI value;

.8 attained EEDI value;

.9 dimensional parameters (length L_{pp} (m), breadth B_s (m), and draught (m));

.10 V_{ref} (knots) and P_{ME} (kW);

.11 use of innovative technologies (4th and 5th terms in the EEDI equation, if applicable);

.12 short statement[10] describing the principal design elements or changes employed to achieve the attained EEDI (as appropriate), if available;

.13 type of fuel used in the calculation of the attained EEDI, and for dual-fuel engines, the f_{DFgas} ratio; and

.14 ice class designation (if applicable).

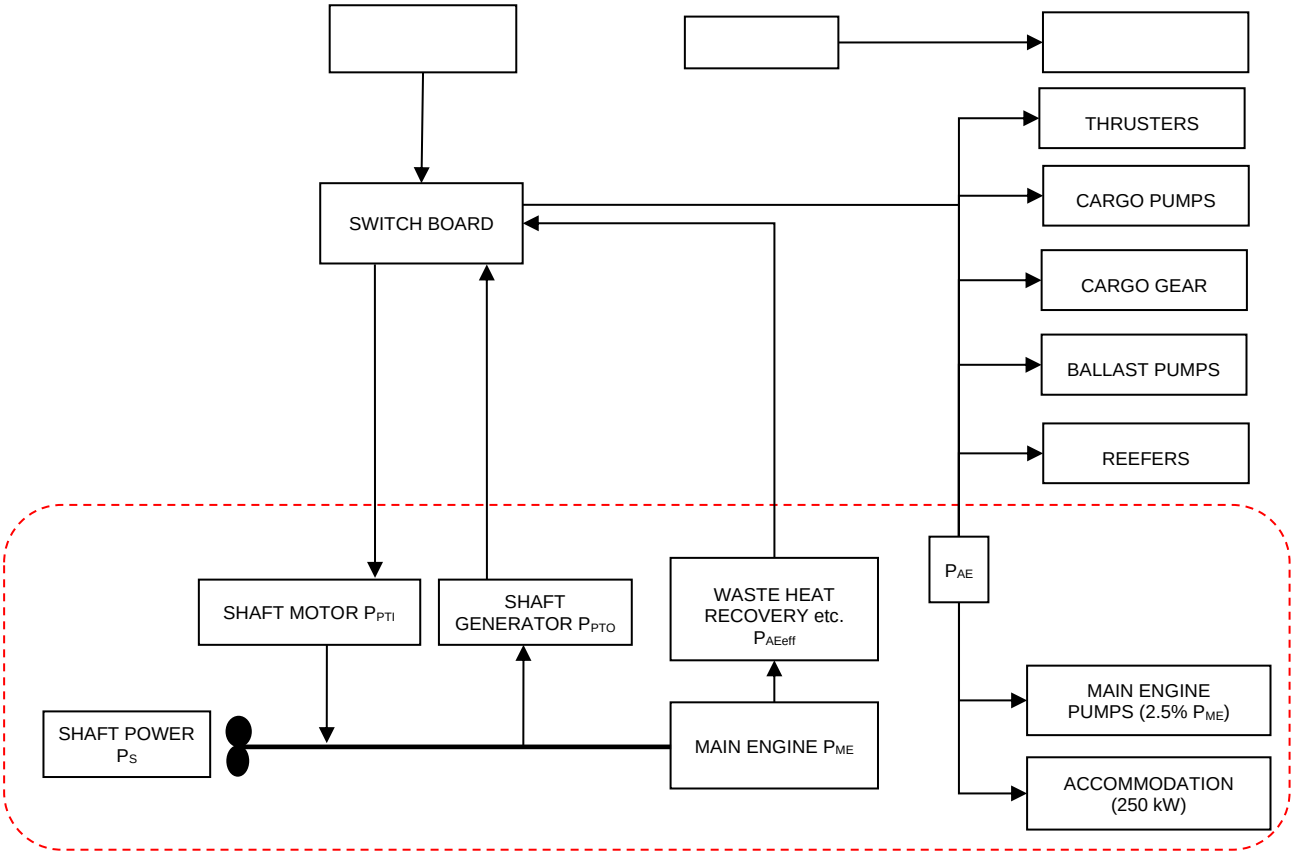
3.3 The information in paragraph 3.2 is not required to be reported for ships for which the required and attained EEDI values had been already reported to the Organization.

3.4 A standardized reporting format for mandatory reporting of attained EEDI values and related information is presented in appendix 5.

[10] Not subject to verification.

APPENDIX 1

A GENERIC AND SIMPLIFIED MARINE POWER PLANT



Note 1: Mechanical recovered waste energy directly coupled to shafts need not be measured, since the effect of the technology is directly reflected in the V_{ref} .

Note 2: In the case of combined PTI/PTO, the normal operational mode at sea will determine which of these to be used in the calculation.

APPENDIX 2

GUIDELINES FOR THE DEVELOPMENT OF ELECTRIC POWER TABLES FOR EEDI (EPT-EEDI)

1 Introduction

This appendix contains a guideline for the document "Electric power table for EEDI" which is similar to the actual shipyards' load balance document, utilizing well defined criteria, providing standard format, clear loads definition and grouping, standard load factors, etc. A number of new definitions (in particular the "groups") are introduced, giving an apparent greater complexity to the calculation process. However, this intermediate step to the final calculation of P_{AE} stimulates all the parties to a deep investigation through the global figure of the auxiliary load, allowing comparisons between different ships and technologies and eventually identifying potential efficiencies improvements.

2 Auxiliary load power definition

P_{AE} is to be calculated as indicated in paragraph 2.2.5.6 of the Guidelines, together with the following additional three conditions:

.1 non-emergency situations (e.g. "no fire", "no flood", "no blackout", "no partial blackout");

.2 evaluation time frame of 24 hours (to account loads with intermittent use); and

.3 ship fully loaded with passengers and/or cargo and crew.

3 Definition of the data to be included in the electric power table for EEDI

The electric power table for EEDI calculation should contain the following data elements, as appropriate:

.1 Load's group;
.2 Load's description;
.3 Load's identification tag;
.4 Load's electric circuit identification;
.5 Load's mechanical rated power "*Pm*" (*kW*);
.6 Load's electric motor rated output power (*kW*);
.7 Load's electric motor efficiency "*e*" (*/*);
.8 Load's rated electric power "*Pr*" (*kW*);
.9 Service factor of load "*kl*" (*/*);
.10 Service factor of duty "*kd*" (*/*);
.11 Service factor of time "*kt*" (*/*);
.12 Service total factor of use "*ku*" (*/*), where *ku=kl·kd·kt;*
.13 Load's necessary power "*Pload*" (*kW*), where *Pload=Pr·ku;*
.14 Notes;
.15 Group's necessary power (*kW*); and
.16 Auxiliaries load's power P_{AE} (*kW*).

4 Data to be included in the electric power table for EEDI

Load groups

4.1 The loads are divided into defined groups, allowing a proper breakdown of the auxiliaries. This eases the verification process and makes it possible to identify those areas where load reductions might be possible. The groups are listed below:

.1 A – Hull, deck, navigation and safety services;
.2 B – Propulsion service auxiliaries;
.3 C – Auxiliary engine and main engine services;
.4 D – Ship's general services;
.5 E – Ventilation for engine-rooms and auxiliaries room;
.6 F – Air conditioning services;
.7 G – Galleys, refrigeration and laundries services;
.8 H – Accommodation services;
.9 I – Lighting and socket services;
.10 L – Entertainment services;
.11 N – Cargo loads; and
.12 M – Miscellaneous.

All the ship's loads should be delineated in the document, excluding only P_{AEeff}, the shaft motors and shaft motors chain (while the propulsion services auxiliaries are partially included below in paragraph 4.1.2 B). Some loads (i.e. thrusters, cargo pumps, cargo gear, ballast pumps, maintaining cargo, reefers and cargo hold fans) still are included in the group for sake of transparency; however, their service factor is zero in order to comply with paragraph 2.2.5.6 of the Guidelines (see rows 4 and 5 of the electric power table contained in this appendix), therefore making it easier to verify that all the loads have been considered in the document and there are no loads left out of the measurement.

4.1.1 A – Hull, deck, navigation and safety services

.1 loads included in the hull services typically are: ICCP systems, mooring equipment, various doors, ballasting systems, bilge systems, stabilizing equipment, etc. Ballasting systems are indicated with service factor equal to zero to comply with paragraph 2.5.6 of the Guidelines (see row 5 of the electric power table contained in this appendix);

.2 loads included in the deck services typically are: deck and balcony washing systems, rescue systems, cranes, etc.;

.3 loads included in the navigation services typically are: navigation systems, navigation's external and internal communication systems, steering systems, etc.; and

.4 loads included in the safety services typically are: active and passive fire systems, emergency shutdown systems, public address systems, etc.

4.1.2 B – Propulsion service auxiliaries

This group typically includes propulsion secondary cooling systems, such as LT cooling pumps dedicated to shaft motors, LT cooling pumps dedicated to propulsion converters, propulsion UPSs, etc. Propulsion service loads do not include shaft motors (*PTI(i)*) and the auxiliaries

which are part of them (shaft motor own cooling fans and pump, etc.) and the shaft motor chain losses and auxiliaries which are part of them (i.e. shaft motor converters including relevant auxiliaries such as converter own cooling fans and pumps, shaft motor transformers including relevant auxiliaries losses, such as propulsion transformer own cooling fans and pumps, shaft motor harmonic filter including relevant auxiliaries losses, shaft motor excitation system including the relevant auxiliaries consumed power, etc.). Propulsion service auxiliaries include manoeuvring propulsion equipment such as manoeuvring thrusters and their auxiliaries whose service factor is to be set to zero.

4.1.3 C – Auxiliary engine and main engine services

This group includes cooling systems, i.e. pumps and fans for cooling circuits dedicated to alternators or propulsion shaft engines (seawater, technical water dedicated pumps, etc.), lubricating and fuel systems feeding, transfer, treatment and storage, ventilation system for combustion air supply, etc.

4.1.4 D – Ship's general services

This group includes loads which provide general services which can be shared between shaft motor, auxiliary engines and main engine and accommodation support systems. Loads typically included in this group are cooling systems, i.e. pumping seawater, technical water main circuits, compressed air systems, freshwater generators, automation systems, etc.

4.1.5 E – Ventilation for engine-rooms and auxiliaries room

This group includes all fans providing ventilation for engine-rooms and auxiliary rooms that typically are engine-rooms cooling supply-exhaust fans, auxiliary rooms supply and exhaust fans. All the fans serving accommodation areas or supplying combustion air are not included in this group. This group does not include cargo hold fans and garage supply and exhaust fans.

4.1.6 F – Air conditioning services

All loads that make up the air conditioning service that typically are air conditioning chillers, air conditioning cooling and heating fluids transfer and treatment, air conditioning's air handling units ventilation, air conditioning re-heating systems with associated pumping, etc. The air conditioning chillers service factor of load, service factor of time and service factor of duty are to be set as 1 (*kl=1, kt*=1 and *kd*=1) in order to avoid the detailed validation of the heat load dissipation document (i.e. the chiller's electric motor rated power is to be used). However, *kd* is to represent the use of spare chillers (e.g. four chillers are installed and one out four is spare then *kd=0* for the spare chiller and *kd*=1 for the remaining three chillers), but only when the number of spare chillers is clearly demonstrated via the heat load dissipation document.

4.1.7 G – Galleys, refrigeration and laundries services

All loads related to the galleys, pantries refrigeration and laundry services that typically are galleys various machines, cooking appliances, galleys' cleaning machines, galleys auxiliaries, refrigerated room systems including refrigeration compressors with auxiliaries, air coolers, etc.

4.1.8 H – Accommodation services

All loads related to the accommodation services of passengers and crew that typically are crew and passengers' transportation systems, i.e. lifts, escalators, etc. environmental services, i.e. black and grey water collecting, transfer, treatment, storage, discharge, waste systems including collecting, transfer, treatment, storage, etc. accommodation fluids transfers, i.e. sanitary hot and cold water pumping, etc., treatment units, pools systems, saunas, gym equipment, etc.

4.1.9 I – Lighting and socket services

All loads related to the lighting, entertainment and socket services. As the quantity of lighting circuits and sockets within the ship may be significantly high, it is not practically feasible to list all the lighting circuits and points in the EPT for EEDI. Therefore circuits should be grouped into subgroups aimed to identify possible improvements of efficient use of power. The subgroups are:

.1 Lighting for 1) cabins, 2) corridors, 3) technical rooms/stairs, 4) public spaces/stairs, 5) engine-rooms and auxiliaries' room, 6) external areas, 7) garages and 8) cargo spaces. All should be divided by main vertical zones; and

.2 Power sockets for 1) cabins, 2) corridors, 3) technical rooms/stairs, 4) public spaces/stairs, 5) engine-rooms and auxiliaries' room, 6) garages and 7) cargo spaces. All should be divided by main vertical zones.

The calculation criteria for complex groups (e.g. cabin lighting and power sockets) subgroups are to be included via an explanatory note, indicating the load composition (e.g. lights of typical cabins, TV, hair dryer, fridge).

4.1.10 L – Entertainment services

This group includes all loads related to entertainment services, typically public spaces audio and video equipment, theatre stage equipment, IT systems for offices, video games, etc.

4.1.11 N – Cargo loads

This group will contain all cargo loads such as cargo pumps, cargo gear, maintaining cargo, cargo reefers loads, cargo hold fans and garage fans for sake of transparency. However, the service factor of this group is to be set to zero.

4.1.12 M – Miscellaneous

This group will contain all loads which have not been associated with the above-mentioned groups but still are contributing to the overall load calculation of the normal maximum sea load.

Loads description

4.2 This identifies the loads (for example "seawater pump").

Loads identification tag

4.3 This tag identifies the loads according to the shipyard's standards tagging system. For example, the "PTI1 fresh water pump" identification tag is "SYYIA/C" for an example ship and shipyard. This data provides a unique identifier for each load.

Loads electric circuit identification

4.4 This is the tag of the electric circuit supplying the load. Such information enables the data validation process.

***Loads mechanical rated power* "*Pm*"**

4.5 This data is to be indicated in the document only when the electric load is made by an electric motor driving a mechanical load (e.g. a fan or a pump). This is the rated power of the mechanical device driven by an electric motor.

Loads electric motor rated output power (kW)

4.6 The output power of the electric motor as per maker's name plate or technical specification. This data does not take part of the calculation but is useful to highlight potential over-rating of the combination motor-mechanical load.

Loads electric motor efficiency "e" (/)

4.7 This data is to be entered in the document only when the electric load is made by an electric motor driving a mechanical load.

Loads rated electric power "Pr" (kW)

4.8 Typically the maximum electric power absorbed at the load electric terminals at which the load has been designed for its service, as indicated on the maker's name plate and/or maker's technical specification. When the electric load is made by an electric motor driving a mechanical load, the load's rated electric power is: *Pr=Pm/e (kW).*

Service factor of load "kl" (/)

4.9 Provides the reduction from the loads rated electric power to loads necessary electric power that is to be made when the load absorbs less power than its rated power. For example, in the case of an electric motor driving a mechanical load, a fan could be designed with some power margin, leading to the fact that the fan rated mechanical power exceeds the power requested by the duct system it serves. Another example is when a pump rated power exceeds the power needed for pumping in its delivery fluid circuit. Another example is where an electric self-regulating semi-conductors heating system is oversized and the rated power exceeds the power absorbed, according a factor *kl.*

Service factor of duty "kd" (/)

4.10 Factor of duty is to be used when a function is provided by more than one load. As all loads are to be included in the EPT for EEDI, this factor provides a correct summation of the loads. For example when two pumps serve the same circuit and they run in duty/stand-by their *kd* factor will be ½ and ½. When three compressors serve the same circuit and one runs in duty and two in stand-by, then *kd* is 1/3, 1/3 and 1/3.

Service factor of time "kt" (/)

4.11 A factor of time based on the shipyard's evaluation about the load duty along 24 hours of ship's navigation as defined at paragraph 3. For example the Entertainment loads operate at their power for a limited period of time, 4 hours out 24 hours; as a consequence *kt=4/24.* For example, the seawater cooling pumps operate at their power all the time during the navigation at *Vref*. As a consequence *kt=1*.

Service total factor of use "ku" (/)

4.12 The total factor of use that takes into consideration all the service factors: *ku=kl·kd·kt.*

Loads necessary power "Pload" (kW)

4.13 The individual user contribution to the auxiliary load power is *Pload=Pr·ku.*

Notes

4.14 A note, as free text, could be included in the document to provide explanations to the verifier.

Groups necessary power (kW)

4.15 The summation of the "Loads necessary power" from group A to N. This is an intermediate step which is not strictly necessary for the calculation of *PAE*. However, it is useful to allow a quantitative analysis of the *PAE*, providing a standard breakdown for analysis and potential improvements of energy saving.

Auxiliaries load's power PAE (kW)

4.16 Auxiliaries load's power *PAE* is the summation of the "Load's necessary power" of all the loads divided by the average efficiency of the generator(s) weighted by power.

PAE=ΣPload(i)/(average efficiency of the generator(s) weighted by power)

Layout and organization of the data indicated in the electric power table for EEDI

5 The document "Electric power table for EEDI" is to include general information (i.e. ship's name, project name, document references, etc.) and a table with:

.1 one row containing column titles;

.2 one column for table row ID;

.3 one column for the groups identification ("A", "B", etc.) as indicated in paragraphs 4.1.1 to 4.1.12 of this appendix;

.4 one column for the group descriptions as indicated in paragraphs 4.1.1 to 4.1.12 of this appendix;

.5 one column each for items in paragraphs 4.2 to 4.14 of this appendix (e.g. "load tag");

.6 one row dedicated to each individual load;

.7 the summation results (i.e. summation of powers) including data from paragraphs 4.15 to 4.16 of this appendix; and

.8 explanatory notes.

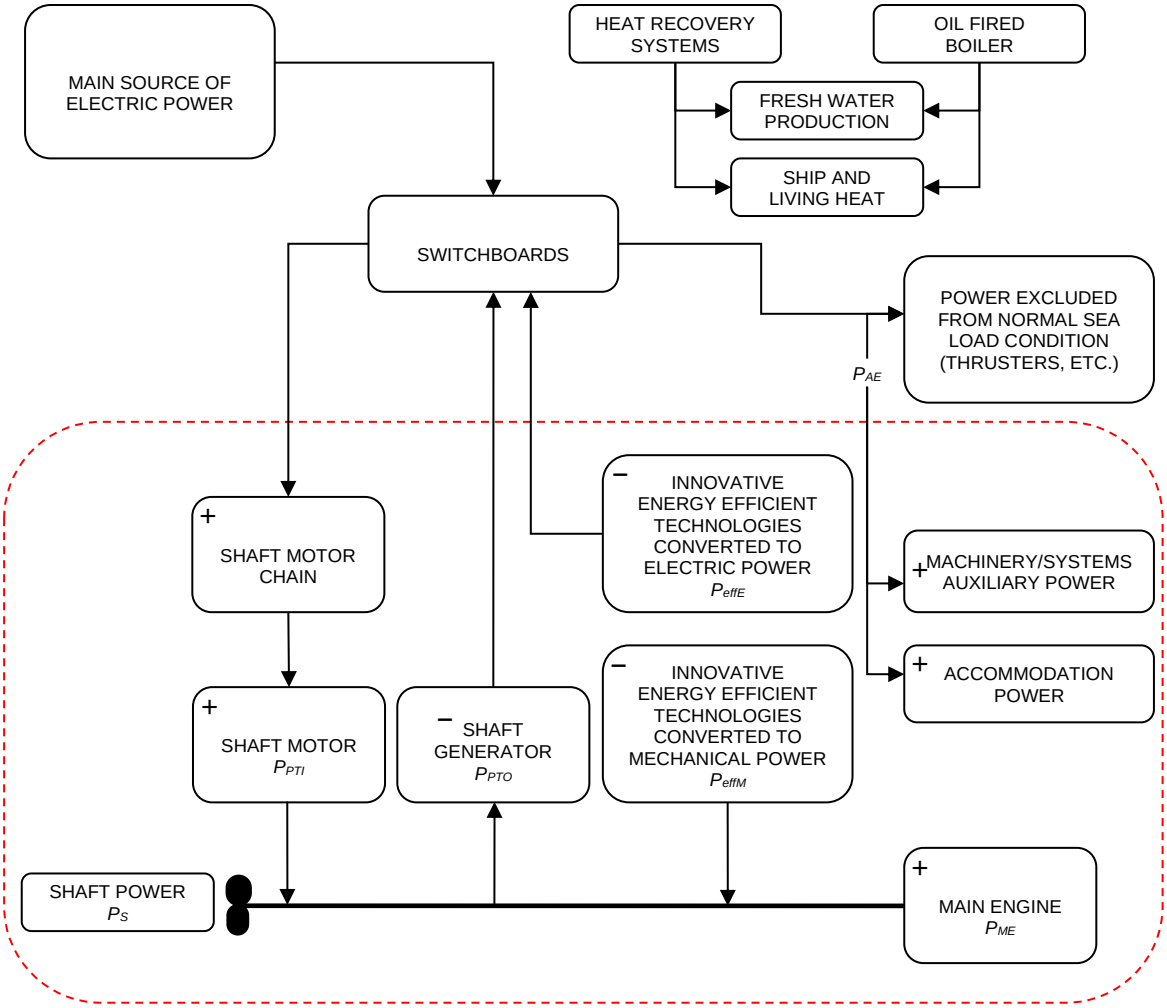
An example of an electric power table for EEDI for a cruise postal ship which transports passengers and has a car garage and reefer holds for fish trade transportation is indicated below. The data indicated and the type of ship are for reference only.

ELECTRIC POWER TABLE FOR EEDI			HULL "EXAMPLE"	PROJECT "EXAMPLE"										(NMSL=Normal Maximun Sea Load)
id	Load group	Load description	Load identification tag	Load electric circuit Identification	Load mechanical rated power "Pm" [kW]	Load electric motor rated output power [kW]	Load electric motor efficiency "e" [/]	Load Rated electric power "Pr" [kW]	service factor of load "kl" [/]	service factor of duty "kd" [/]	service factor of time "kt" [/]	service total factor of use "ku" [/]	Load necessary power "Pload" [kW]	Note
1	A	Hull cathodic protection Fwd	xxx	yyy	n.a.	n.a.	n.a.	5.2	1	1	1*	1	5.2	*in use 24hours/day
2	A	Hull cathodic protection mid	xxx	yyy	n.a.	n.a.	n.a.	7.0	1	1	1*	1	7	*in use 24hours/day
3	A	Hull cathodic protection aft	xxx	yyy	n.a.	n.a.	n.a.	4.8	1	1	1*	1	4.8	*in use 24hours/day
4	A	Ballast pump 3	xxx	yyy	30	36	0.92	32.6	0.9	0.5	1	0*	0	*not in use at **NMSL** see para 2.5.6 of Circ.681
5	A	Fwd Stb mooring winch motor n.1	xxx	yyy	90	150	0.92	97.8	0.8	1	0*	0*	0	*not in use at **NMSL** see para 2.5.6 of Circ.681
6	A	WTDs system main control panel	xxx	yyy	n.a.	n.a.	n.a.	0.5	1	1	1*	1	0.5	*in use 24hours/day
7	A	WTD 1, deck D frame 150	xxx	yyy	1.2	3	0.91	1.3	0.7	1	0.104*	0.0728	0.096	*180 secs to open/close x 100 opening a day
8	A	WTD 5, deck D frame 210	xxx	yyy	1.2	3	0.91	1.3	0.7	1	0.156*	0.1092	0.14	*180 secs to open/close x 150 opening a day
9	A	Stabilisers control unit	xxx	yyy	n.a.	n.a.	n.a.	0.7	1	1	1*	1	0.7	*in use 24hours/day
10	A	Stabilisers Hydraulic pack power pump 1	xxx	yyy	80	90	0.9	88.9	0.9	1	0*	0	0	*NMSL=> calm sea,=> stabiliser not in use
11	A	S-band Radar 1 controller	xxx	yyy	n.a.	n.a.	n.a.	0.4	1	1	1*	1	0.4	*in use 24hours/day
12	A	S-band Radar 1 motor	xxx	yyy	0.8	1	0.92	0.9	1	1	1*	1	0.9	*in use 24hours/day
13	A	Fire detection system bridge main unit	xxx	yyy	n.a.	n.a.	n.a.	1.5	1	1	1*	1	1.5	*in use 24hours/day
14	A	Fire detection system ECR unit	xxx	yyy	n.a.	n.a.	n.a.	0.9	1	1	1*	1	0.9	*in use 24hours/day
15	A	High pressure water fog contol unit	xxx	yyy	n.a.	n.a.	n.a.	1.2	1	1	1*	1	1.2	*in use 24hours/day
16	A	High pressure water fog engines rooms pump 1a	xxx	yyy	25	30	0.93	26.9	0.9	0.5	0*	0	0	*NMSL=> not emergency =>Load not in use
17	A	High pressure water fog engines rooms pump 1b	xxx	yyy	25	30	0.93	26.9	0.9	0.5	0*	0	0	* not emergency situations
18	B	PTi port fresh water pump 1	xxx	yyy	30	36	0.92	32.6	0.9	0.5*	1	0.45	14.7	* pump1,2 one is duty and one is stand-by
19	B	PTi port fresh water pump 2	xxx	yyy	30	36	0.92	32.6	0.9	0.5*	1	0.45	14.7	* pump1,2 one is duty and one is stand-by
20	B	Thrusters control system	xxx	yyy	n.a.	n.a.	n.a.	0.5	1	1	1*	1	0.5	in use 24hours/day (even if thruster motor isn't)
21	B	Bow thruster 1	xxx	yyy	3000	3000	0.96	3125.0	1	1	0*	0	0	*NMSL=>thrusters motor are not in use
22	B	PEM port cooling fan 1	xxx	yyy	20	25	0.93	21.5	0.9	1	n.a.	n.a	n.a.*	*this load is included in the propulsion chain data
23	C	HT circulation pump 1 DG 3	xxx	yyy	8	10	0.92	8.7	0.9	0.5*	1	0.45	3.9	* pump1,2 one is duty and one is stand-by
24	C	HT circulation pump 2 DG 3	xxx	yyy	8	10	0.92	8.7	0.9	0.5*	1	0.45	3.9	* pump1,2 one is duty and one is stand-by
25	C	DG3 combustion air fan	xxx	yyy	28	35	0.92	30.4	0.9	1	1*	0.9	27.4	*in use 24hours/day
26	C	DG3 exhaust gas boiler circulationg pump	xxx	yyy	6	8	0.93	6.5	0.8	1	1*	0.8	5.2	*in use 24hours/day
27	C	Alternator 3 external cooling fan	xxx	yyy	3	5	0.93	3.2	0.8	1	1*	0.8	2.75	*in use 24hours/day
28	C	fuel feed fwd booster pump a	xxx	yyy	7	9	0.92	7.6	0.9	0.5*	1	0.45	3.4	* pump1,2 one is duty and one is stand-by
29	C	fuel feed fwd booster pump b	xxx	yyy	7	9	0.92	7.6	0.9	0.5*	1	0.45	3.4	* pump1,2 one is duty and one is stand-by
30	D	Fwd main LT cooling pump 1	xxx	yyy	120	150	0.95	126.3	0.9	0.5*	1	0.45	56.8	* pump1,2 one is duty and one is stand-by
31	D	Fwd main LT cooling pump 2	xxx	yyy	120	150	0.95	126.3	0.9	0.5*	1	0.45	56.8	* pump1,2 one is duty and one is stand-by
32	E	FWD engine room supply fan 1	xxx	yyy	87.8	110	0.93	94.4	0.95	1	1*	0.95	89.7	*in use 24hours/day
33	E	FWD engine room exhaust fan 1	xxx	yyy	75	86	0.93	80.6	0.96	1	1*	0.96	77.4	*in use 24hours/day
34	E	purifier room supply fan 1	xxx	yyy	60	70	0.93	64.5	0.96	0.5	1*	0.48	31.0	*in use 24hours/day
35	E	purifier room supply fan 2	xxx	yyy	60	70	0.93	64.5	0.96	0.5	1*	0.48	31.0	*in use 24hours/day
36	F	HVAC chiller a	xxx	yyy	1450	1600	0.95	1526.3	1	2/3*	1	0.66	1007.4	*1 Chiller is spare; see heat load dissipation doc.
37	F	HVAC chiller b	xxx	yyy	1450	1600	0.95	1526.3	1	2/3*	1	0.66	1007.4	*1 Chiller is spare; see heat load dissipation doc.
38	F	HVAC chiller C	xxx	yyy	1450	1600	0.95	1526.3	1	2/3*	1	0.66	1007.4	*1 Chiller is spare; see heat load dissipation doc.
39	F	A.H.U. Ac station 5.4 supply fan	xxx	yyy	50	60	0.93	53.8	0.9	1	1*	0.9	48.4	*in use 24hours/day
40	F	A.H.U. Ac station 5.4 exhaust fan	xxx	yyy	45	55	0.93	48.4	0.9	1	1*	0.9	43.5	*in use 24hours/day
41	F	Chilled water pump a	xxx	yyy	80	90	0.93	86.0	0.88	0.5*	1	0.44	37.8	* pump1,2 one is duty and one is stand-by
42	F	Chilled water pump b	xxx	yyy	80	90	0.93	86.0	0.88	0.5*	1	0.44	37.8	* pump1,2 one is duty and one is stand-by
43	G	Italian's espresso coffee machine	xxx	yyy	n.a.	n.a.	n.a.	7.0	0.9	1	0.2*	0.18	1.3	*in use 4.8hours/day
44	G	deep freezer machine	xxx	yyy	n.a.	n.a.	n.a.	20.0	0.8	1	0.16*	0.128	3.2	*in use 4hours/day
45	G	washing machine 1	xxx	yyy	n.a.	n.a.	n.a.	8.0	0.8	1	0.33*	0.264	3.2	*in use 8hours/day
46	H	lift pax mid 4	xxx	yyy	30	40	0.93	32.3	0.5	1	0.175*	0.0875	0.9	*in use 4hours/day
47	H	vaccum collecting system 4 pump a	xxx	yyy	10	13	0.92	10.9	0.9	1	1*	0.9	8.7	*in use 24hours/day
48	H	sewage treatmet system 1 pump 1	xxx	yyy	15	17	0.93	16.1	0.9	1	1*	0.9	8.7	*in use 24hours/day
49	H	Gym running machine	xxx	yyy	n.a.	n.a.	n.a.	2.5	1	1	0.3*	0.3	0.8	*in use 7.2hours/day
50	I	Cabin's lighting MVZ3	n.a.	n.a.	n.a.	n.a.	n.a.	80*	1	1	1	1	80.0	* see explainatory note
51	I	corridors ligthing MVZ3	n.a.	n.a.	n.a.	n.a.	n.a.	10*	1	1	1	1	10.0	* see explainatory note
52	I	Cabin's sockets MVZ3	n.a.	n.a.	n.a.	n.a.	n.a.	5*	1	1	1	1	5.0	* see explainatory note
53	L	Main Theatre audio booster amplifier	xxx	yyy	n.a.	n.a.	n.a.	15.0	1	1	0.3*	0.3	4.5	*in use 7.2hours/day
54	L	Video wall atrium	xxx	yyy	n.a.	n.a.	n.a.	2.0	1	1	0.3*	0.3	0.6	*in use 7.2hours/day
55	M	Car Garage supply fan1	xxx	yyy	28	35	0.92	30.4	0.9	1	1*	0*	0	*not in use at **NMSL** see para 2.5.6 of Circ.681
56	M	Fish transportation refeer hold n.2	xxx	yyy	25	30	0.93	26.9	0.9	0.5	0*	0*	0	*not in use at **NMSL** see para 2.5.6 of Circ.681
57	N	Sliding glass roof	xxx	yyy	30	40	0.93	32.3	0.9	1	0.3*	0.27	0.2	*in use 7.2hours/day
											ΣPload(i)=		**3764**	

***PAE* =3764/(weighted average efficiency of generator(s)) [kW]** Group's necessary power (group A=22.9kW, B=29.8kW,C=49.9kW, D=113.7kW, E=229kW , F=3189kW, G=7.6kW, H=19kW, I=95kW, L=5.1kW, M=0kW, N=0.22kW)

APPENDIX 3

A GENERIC AND SIMPLIFIED MARINE POWER PLANT FOR A CRUISE PASSENGER SHIPS HAVING NON-CONVENTIONAL PROPULSION

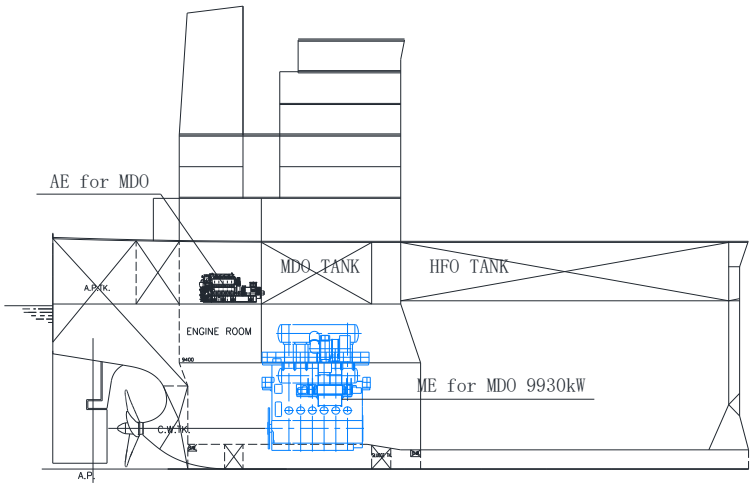


Note: Symbols for plus (+) and minus (−) indicate CO_2 contribution to EEDI formula.

APPENDIX 4

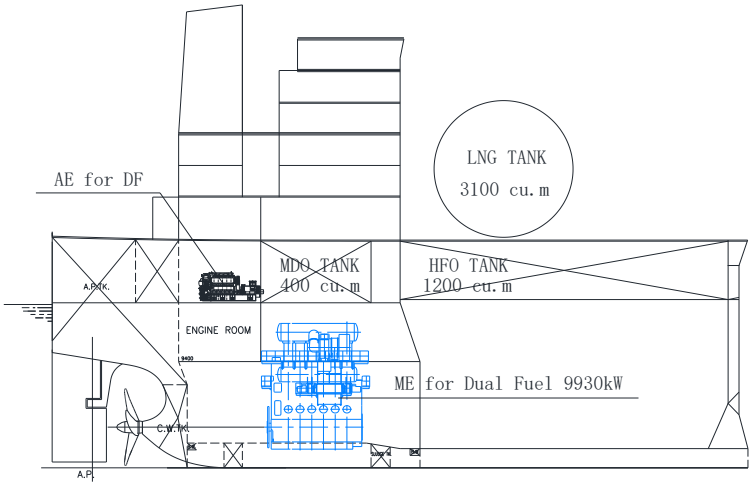
EEDI CALCULATION EXAMPLES FOR USE OF DUAL-FUEL ENGINES

Case 1: Standard Kamsarmax ship, one main engine (MDO), standard auxiliary engines (MDO), no shaft generator:



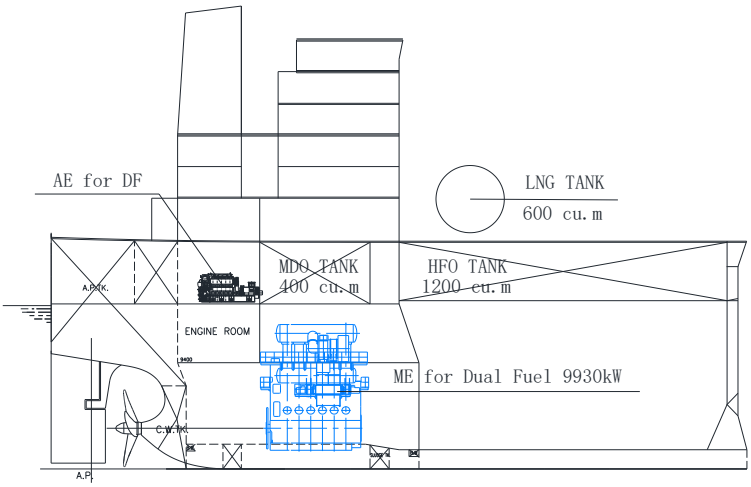
S/N	Parameter	Formula or Source	Unit	Value
1	MCR_{ME}	MCR rating of main engine	kW	9,930
2	Capacity	Deadweight of the ship at summer load draft	DWT	81,200
3	V_{ref}	Ships speed as defined in EEDI regulation	kn	14
4	P_{ME}	0.75 x MCR_{ME}	kW	7,447.5
5	P_{AE}	0.05 x MCR_{ME}	kW	496.5
6	C_{FME}	C_F factor of Main engine using MDO	-	3.206
7	C_{FAE}	C_F factor of Auxiliary engine using MDO	-	3.206
8	SFC_{ME}	Specific fuel consumption of at P_{ME}	g/kWh	165
9	SFC_{AE}	Specific fuel consumption of at P_{AE}	g/kWh	210
10	EEDI	$((P_{ME} \times C_{F\,ME} \times SFC_{ME})+(P_{AE} \times C_{FAE} \times SFC_{AE})) / (V_{ref} \times Capacity)$	gCO_2/tnm	3.76

Case 2: LNG is regarded as the "primary fuel" if dual-fuel main engine and dual-fuel auxiliary engine (LNG, pilot fuel MDO; no shaft generator) are equipped with bigger LNG tanks:



S/N	Parameter	Formula or Source	Unit	Value
1	MCR_{ME}	MCR rating of main engine	kW	9,930
2	Capacity	Deadweight of the ship at summer load draft	DWT	81,200
3	V_{ref}	Ships speed as defined in EEDI regulation	kn	14
4	P_{ME}	0.75 x MCR_{ME}	kW	7,447.5
5	P_{AE}	0.05 x MCR_{ME}	kW	496.5
6	$CF_{Pilotfuel}$	C_F factor of pilot fuel for dual-fuel ME using MDO	-	3.206
7	$CF_{AE\ Plilotfuel}$	C_F factor of pilot fuel for Auxiliary engine using MDO	-	3.206
8	CF_{LNG}	C_F factor of dual-fuel engine using LNG	-	2.75
9	$SFC_{MEPilotfuel}$	Specific fuel consumption of pilot fuel for dual-fuel ME at P_{ME}	g/kWh	6
10	$SFC_{AE\ Pilotfuel}$	Specific fuel consumption of pilot fuel for dual-fuel AE at P_{AE}	g/kWh	7
11	$SFC_{ME\ LNG}$	Specific fuel consumption of ME using LNG at P_{ME}	g/kWh	136
12	$SFC_{AE\ LNG}$	Specific fuel consumption of AE using LNG at P_{AE}	g/kWh	160
13	V_{LNG}	LNG tank capacity on board	m^3	3,100
14	V_{HFO}	Heavy fuel oil tank capacity on board	m^3	1,200
15	V_{MDO}	Marine diesel oil tank capacity on board	m^3	400
16	ρ_{LNG}	Density of LNG	kg/m^3	450
17	ρ_{HFO}	Density of heavy fuel oil	kg/m^3	991
18	ρ_{MDO}	Density of marine diesel oil	kg/m^3	900
19	LCV_{LNG}	Low calorific value of LNG	kJ/kg	48,000
20	LCV_{HFO}	Low calorific value of heavy fuel oil	kJ/kg	40,200
21	LCV_{MDO}	Low calorific value of marine diesel oil	kJ/kg	42,700
22	K_{LNG}	Filling rate of LNG tank	-	0.95
23	K_{HFO}	Filling rate of heavy fuel tank	-	0.98
24	K_{MDO}	Filling rate of marine diesel tank	-	0.98
25	f_{DFgas}	$\frac{P_{ME}+P_{AE}}{P_{ME}+P_{AE}} \times \frac{V_{LNG} \times \rho_{LNG} \times LCV_{LNG} \times K_{LNG}}{V_{HFO} \times \rho_{HFO} \times LCV_{HFO} \times K_{HFO} + V_{MDO} \times \rho_{MDO} \times LCV_{MDO} \times K_{MDO} + V_{LNG} \times \rho_{LNG} \times LCV_{LNG} \times K_{LNG}}$	-	0.5068
26	EEDI	(P_{ME} x ($C_{F\ Pilotfuel}$ x $SFC_{ME\ Pilotfuel}$ + $C_{F\ LNG}$ x $SFC_{ME\ LNG}$) + P_{AE} x ($C_{F\ Pilotfuel}$ x $SFC_{AE\ Pilotfuel}$ + $C_{F\ LNG}$ x $SFC_{AE\ LNG}$)) / (V_{ref} x *Capacity*)	gCO_2/tnm	2.78

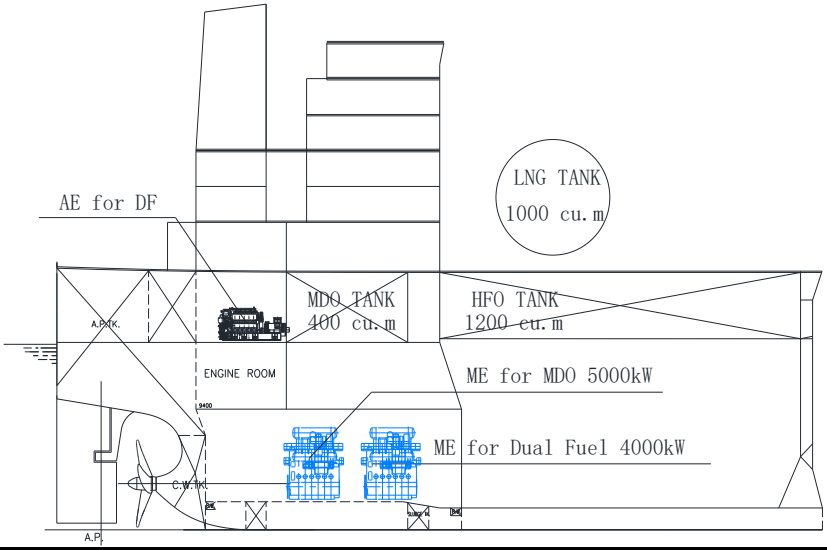
Case 3: LNG is not regarded as the "primary fuel" if dual-fuel main engine and dual-fuel auxiliary engine (LNG, pilot fuel MDO; no shaft generator) are equipped with smaller LNG tanks:



S/N	Parameter	Formula or Source	Unit	Value
1	MCR_{ME}	MCR rating of main engine	kW	9,930
2	Capacity	Deadweight of the ship at summer load draft	DWT	81,200
3	V_{ref}	Ships speed as defined in EEDI regulation	kn	14
4	P_{ME}	0.75 x MCR_{ME}	kW	7,447.5
5	P_{AE}	0.05 x MCR_{ME}	kW	496.5
6	$C_{FPilotfuel}$	C_F factor of pilot fuel for dual-fuel ME using MDO	-	3.206
7	$C_{FAE\ Plilotfuel}$	C_F factor of pilot fuel for Auxiliary engine using MDO	-	3.206
8	C_{FLNG}	C_F factor of dual-fuel engine using LNG	-	2.75
9	C_{FMDO}	C_F factor of dual-fuel ME/AE engine using MDO	-	3.206
10	$SFC_{MEPilotfuel}$	Specific fuel consumption of pilot fuel for dual-fuel ME at P_{ME}	g/kWh	6
11	$SFC_{AE\ Pilotfuel}$	Specific fuel consumption of pilot fuel for dual-fuel AE at P_{AE}	g/kWh	7
12	$SFC_{ME\ LNG}$	Specific fuel consumption of ME using LNG at P_{ME}	g/kWh	136
13	$SFC_{AE\ LNG}$	Specific fuel consumption of AE using LNG at P_{AE}	g/kWh	160
14	$SFC_{ME\ MDO}$	Specific fuel consumption of dual-fuel ME using MDO at P_{ME}	g/kWh	165
15	$SFC_{AE\ MDO}$	Specific fuel consumption of dual-fuel AE using MDO at P_{AE}	g/kWh	187
16	V_{LNG}	LNG tank capacity on board	m^3	600
17	V_{HFO}	Heavy fuel oil tank capacity on board	m^3	1,800
18	V_{MDO}	Marine diesel oil tank capacity on board	m^3	400
19	ρ_{LNG}	Density of LNG	kg/m^3	450
20	ρ_{HFO}	Density of heavy fuel oil	kg/m^3	991
21	ρ_{MDO}	Density of marine diesel oil	kg/m^3	900
22	LCV_{LNG}	Low calorific value of LNG	kJ/kg	48,000
24	LCV_{HFO}	Low calorific value of heavy fuel oil	kJ/kg	40,200
25	LCV_{MDO}	Low calorific value of marine diesel oil	kJ/kg	42,700
26	K_{LNG}	Filling rate of LNG tank	-	0.95
27	K_{HFO}	Filling rate of heavy fuel tank	-	0.98
28	K_{MDO}	Filling rate of marine diesel tank	-	0.98

S/N	Parameter	Formula or Source	Unit	Value
29	f_{DFgas}	$\frac{P_{ME}+P_{AE}}{P_{ME}+P_{AE}} \times \frac{V_{LNG} \times \rho_{LNG} \times LCV_{LNG} \times K_{LNG}}{V_{HFO} \times \rho_{HFO} \times LCV_{HFO} \times K_{HFO} + V_{MDO} \times \rho_{MDO} \times LCV_{MDO} \times K_{MDO} + V_{LNG} \times \rho_{LNG} \times LCV_{LNG} \times K_{LNG}}$	-	0.1261
30	$f_{DFliquid}$	1- f_{DFgas}	-	0.8739
31	EEDI	(P_{ME} x (f_{DFgas} x ($C_{F\ Pilotfuel}$ x $SFC_{ME\ Pilotfuel}$ + $C_{F\ LNG}$ x $SFC_{ME\ LNG}$) + $f_{DFliquid}$ x C_{FMDO} x $SFC_{ME\ MDO}$) + P_{AE} x (f_{DFgas} x ($C_{FAE\ Pilotfuel}$ x $SFC_{AE\ Pilotfuel}$ + $C_{F\ LNG}$ x $SFC_{AE\ LNG}$)+ $f_{DFliquid}$ x C_{FMDO} x $SFC_{AE\ MDO}$)) / (V_{ref} x *Capacity*)	gCO_2/tnm	3.61

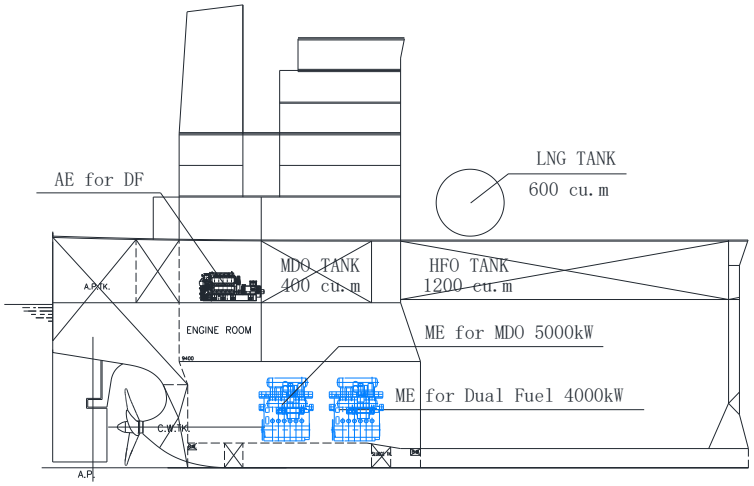
Case 4: One dual-fuel main engine (LNG, pilot fuel MDO) and one main engine (MDO) and dual-fuel auxiliary engine (LNG, pilot fuel MDO, no shaft generator) which LNG could be regarded as "primary fuel" only for the dual-fuel main engine:



S/N	Parameter	Formula or Source	Unit	Value
1	MCR_{MEMDO}	MCR rating of main engine using only MDO	kW	5,000
2	MCR_{MELNG}	MCR rating of main engine using dual-fuel	kW	4,000
3	Capacity	Deadweight of the ship at summer load draft	DWT	81,200
4	V_{ref}	Ships speed	kn	14
5	P_{MEMDO}	0.75 x MCR_{MEMDO}	kW	3,750
6	P_{MELNG}	0.75 x MCR_{MELNG}	kW	3,000
7	P_{AE}	0.05 x (MCR_{MEMDO} + MCR_{MELNG})	kW	450
8	$C_{FPilotfuel}$	C_F factor of pilot fuel for dual-fuel ME using MDO	-	3.206
9	$C_{FAE\ Plilotfuel}$	C_F factor of pilot fuel for auxiliary engine using MDO	-	3.206
10	C_{FLNG}	C_F factor of dual-fuel engine using LNG	-	2.75
11	C_{FMDO}	C_F factor of dual-fuel ME/AE engine using MDO	-	3.206
12	$SFC_{MEPilotfuel}$	Specific fuel consumption of pilot fuel for dual-fuel ME at P_{ME}	g/kWh	6
13	$SFC_{AE\ Pilotfuel}$	Specific fuel consumption of pilot fuel for dual-fuel AE at P_{AE}	g/kWh	7
14	$SFC_{DF\ LNG}$	Specific fuel consumption of dual-fuel ME using LNG at P_{ME}	g/kWh	158
15	$SFC_{AE\ LNG}$	Specific fuel consumption of AE using LNG at P_{AE}	g/kWh	160
16	$SFC_{ME\ MDO}$	Specific fuel consumption of single fuel ME at P_{ME}	g/kWh	180
17	V_{LNG}	LNG tank capacity on board	m^3	1,000
18	V_{HFO}	Heavy fuel oil tank capacity on board	m^3	1,200
19	V_{MDO}	Marine diesel oil tank capacity on board	m^3	400
20	ρ_{LNG}	Density of LNG	kg/m^3	450

S/N	Parameter	Formula or Source	Unit	Value
21	ρ_{HFO}	Density of heavy fuel oil	kg/m^3	991
22	ρ_{MDO}	Density of marine diesel oil	kg/m^3	900
23	LCV_{LNG}	Low calorific value of LNG	kJ/kg	48,000
24	LCV_{HFO}	Low calorific value of heavy fuel oil	kJ/kg	40,200
25	LCV_{MDO}	Low calorific value of marine diesel oil	kJ/kg	42,700
26	K_{LNG}	Filling rate of LNG tank	-	0.95
27	K_{HFO}	Filling rate of heavy fuel tank	-	0.98
28	K_{MDO}	Filling rate of marine diesel tank	-	0.98
29	f_{DFgas}	$\frac{P_{MEMDO} + P_{MELNG} + P_{AE}}{P_{MELNG} + P_{AE}} \times \frac{V_{LNG} \times \rho_{LNG} \times LCV_{LNG} \times K_{LNG}}{V_{HFO} \times \rho_{HFO} \times LCV_{HFO} \times K_{HFO} + V_{MDO} \times \rho_{MDO} \times LCV_{MDO} \times K_{MDO} + V_{LNG} \times \rho_{LNG} \times LCV_{LNG} \times K_{LNG}}$	-	0.5195
30	EEDI	$(P_{MELNG}$ x $(C_{F\ Pilotfuel}$ x $SFC_{ME\ Pilotfuel} + C_{F\ LNG}$ x $SFC_{DF\ LNG}$) + P_{MEMDO} x $C_{F\ MDO}$ x $SFC_{ME\ MDO}$ + P_{AE} x ($C_{FAE\ Pilotfuel}$ x $SFC_{AE\ Pilotfuel} + C_{F\ LNG}$ x $SFC_{AE\ LNG}$)) / (V_{ref} x $Capacity$)	gCO_2/tnm	3.28

Case 5: One dual-fuel main engine (LNG, pilot fuel MDO) and one main engine (MDO) and dual-fuel auxiliary engine (LNG, pilot fuel MDO, no shaft generator) which LNG could not be regarded as "primary fuel" for the dual-fuel main engine:



S/N	Parameter	Formula or Source	Unit	Value
1	MCR_{MEMDO}	MCR rating of main engine using only MDO	kW	5,000
2	MCR_{MELNG}	MCR rating of main engine using dual-fuel	kW	4,000
3	Capacity	Deadweight of the ship at summer load draft	DWT	81,200
4	V_{ref}	Ships speed	kn	14
5	P_{MEMDO}	0.75 x MCR_{MEMDO}	kW	3,750
6	P_{MELNG}	0.75 x MCR_{MELNG}	kW	3,000
7	P_{AE}	0.05 x (MCR_{MEMDO} + MCR_{MELNG})	kW	450
8	$C_{FPilotfuel}$	C_F factor of pilot fuel for dual-fuel ME using MDO	-	3.206
9	$C_{FAE\ Plilotfuel}$	C_F factor of pilot fuel for auxiliary engine using MDO	-	3.206
10	C_{FLNG}	C_F factor of dual-fuel engine using LNG	-	2.75
11	C_{FMDO}	C_F factor of dual-fuel ME/AE engine using MDO	-	3.206
12	$SFC_{MEPilotfuel}$	Specific fuel consumption of pilot fuel for dual-fuel ME at P_{ME}	g/kWh	6
13	$SFC_{AE\ Pilotfuel}$	Specific fuel consumption of pilot fuel for dual-fuel AE at P_{AE}	g/kWh	7
14	$SFC_{DF\ LNG}$	Specific fuel consumption of dual-fuel ME using LNG at P_{ME}	g/kWh	158

S/N	Parameter	Formula or Source	Unit	Value
15	$SFC_{AE\ LNG}$	Specific fuel consumption of AE using LNG at P_{AE}	g/kWh	160
16	$SFC_{DF\ MDO}$	Specific fuel consumption of dual-fuel ME using MDO at P_{ME}	g/kWh	185
17	$SFC_{ME\ MDO}$	Specific fuel consumption of single fuel ME at P_{ME}	g/kWh	180
18	$SFC_{AE\ MDO}$	Specific fuel consumption of AE using MDO at P_{AE}	g/kWh	187
19	V_{LNG}	LNG tank capacity on board	m^3	600
20	V_{HFO}	Heavy fuel oil tank capacity on board	m^3	1,200
21	V_{MDO}	Marine diesel oil tank capacity on board	m^3	400
22	ρ_{LNG}	Density of LNG	kg/m^3	450
23	ρ_{HFO}	Density of heavy fuel oil	kg/m^3	991
24	ρ_{MDO}	Density of marine diesel oil	kg/m^3	900
25	LCV_{LNG}	Low calorific value of LNG	kJ/kg	48,000
26	LCV_{HFO}	Low calorific value of heavy fuel oil	kJ/kg	40,200
27	LCV_{MDO}	Low calorific value of marine diesel oil	kJ/kg	42,700
28	K_{LNG}	Filling rate of LNG tank	-	0.95
29	K_{HFO}	Filling rate of heavy fuel tank	-	0.98
30	K_{MDO}	Filling rate of marine diesel tank	-	0.98
31	f_{DFgas}	$\frac{P_{MEMDO} + P_{MELNG} + P_{AE}}{P_{MELNG} + P_{AE}} \times \frac{V_{LNG} \times \rho_{LNG} \times LCV_{LNG} \times K_{LNG}}{V_{HFO} \times \rho_{HFO} \times LCV_{HFO} \times K_{HFO} + V_{MDO} \times \rho_{MDO} \times LCV_{MDO} \times K_{MDO} + V_{LNG} \times \rho_{LNG} \times LCV_{LNG} \times K_{LNG}}$	-	0.3462
32	$f_{DFliquid}$	$1 - f_{DFgas}$	-	0.6538
33	EEDI	$(P_{MELNG} \times (f_{DFgas} \times (C_{F\ Pilotfuel} \times SFC_{ME\ Pilotfuel} + C_{F\ LNG} \times SFC_{DF\ LNG}) + f_{DFliquid} \times C_{FMDO} \times SFC_{DF\ MDO})) + P_{MEMDO} \times C_{F\ MDO} \times SFC_{ME\ MDO} + P_{AE} \times (f_{DFgas} \times (C_{FAE\ Pilotfuel} \times SFC_{AE\ Pilotfuel} + C_{F\ LNG} \times SFC_{AE\ LNG}) + f_{DFliquid} \times C_{FMDO} \times SFC_{AE\ MDO})) / (V_{ref} \times Capacity)$	gCO_2/tnm	3.54

APPENDIX 5

STANDARD FORMAT TO SUBMIT EEDI INFORMATION TO BE INCLUDED IN THE EEDI DATABASE

IMO number (1)	Type of ship (2)	Common commercial size (3)	Capacity (4)		Dimensional parameters			Year of delivery	Applicable phase	Required EEDI	Attained EEDI	Vref (knot) (9)	P_{ME} (kW) (10)	Type of fuel (11)	f_{DF} gas (12)	Ice class (13)	EEDI 4th term (Installation of innovative electrical technology)		EEDI 5th term (Installation of innovative mechanical technology)		Short statement as appropriate describing the principal design elements or changes employed to achieve the attained EEDI (15)
			DWT	GT (5)	Lpp (m) (6)	Bs (m) (7)	Draught (m) (8)										Yes/ No	Name, outline and means/ ways of performance of technology (14)	Yes/ No	Name, outline and means/ ways of performance of technology (14)	

Note:

(1) IMO number to be submitted for Secretariat use only.
(2) As defined in regulation 2 of MARPOL Annex VI.
(3) Common commercial size reference (TEU for containership, CEU (RT43) for ro-ro cargo ship (vehicle carrier), cubic metre for gas carrier and LNG carrier), if available, should be provided.
(4) The exact DWT or GT, as appropriate, should be provided. The Secretariat should round the DWT or GT data up to the nearest 500 when these data are subsequently provided to MEPC. (For containerships, 100% DWT should be provided while 70% of DWT should be used when calculating the EEDI value).
(5) GT should be provided for a cruise passenger ship having non-conventional propulsion as defined in regulations 2.2.11 and 2.2.19, respectively, of MARPOL Annex VI. Both DWT and GT should be provided for a ro-ro cargo ship (vehicle carrier) as defined in regulation 2.2.27 of MARPOL Annex VI.
(6) As defined in paragraph 2.2.13 of these Guidelines. The exact Lpp should be provided. The Secretariat will round the Lpp data up to the nearest 10 when these data are subsequently provided to MEPC.
(7) As defined in paragraph 2.2.16 of these Guidelines. The exact Bs should be provided. The Secretariat will round the Bs data up to the nearest 1 when these data are subsequently provided to MEPC.
(8) As defined in paragraph 2.2.15 of these Guidelines. The exact draught should be provided. The Secretariat will round the draught data up to the nearest 1 when these data are subsequently provided to MEPC.
(9) As defined in paragraph 2.2.2 of these Guidelines. The exact V_{ref} should be provided. The Secretariat will round the V_{ref} data up to the nearest 0.5 when these data are subsequently provided to MEPC.
(10) As defined in paragraph 2.2.5.1 of these Guidelines. The exact P_{ME} should be provided. The Secretariat will round the P_{ME} data up to the nearest 100 when these data are subsequently provided to MEPC.
(11) As defined in paragraph 2.2.1 of these Guidelines or other (to be stated). In the case of a ship equipped with a dual-fuel engine, type of "primary fuel" should be provided.
(12) As defined in paragraph 2.2.1 of these Guidelines, if applicable.
(13) Ice class, which was used to calculate correction factors for ice-classed ships as defined in paragraphs 2.2.8.1 and 2.2.11.1 of these Guidelines, if applicable, should be provided.
(14) In the case that the innovative energy efficiency technologies are already included in the *2021 Guidance on treatment of innovative energy efficiency technologies for calculation and verification of the attained EEDI and EEXI* (MEPC.1/Circ.896), the name of technology should be identified. Otherwise, name, outline and means/ways of performance of the technology should be identified.
(15) To assist IMO in assessing relevant design trends, provide a short statement as appropriate, describing the principal design elements or changes employed to achieve the attained EEDI.

***

ANNEX 10

RESOLUTION MEPC.365(79)

2022 GUIDELINES ON SURVEY AND CERTIFICATION OF THE ENERGY EFFICIENCY DESIGN INDEX (EEDI)

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 conferred upon it by international conventions for the prevention and control of marine pollution from ships,

NOTING that regulation 5 (Surveys) of MARPOL Annex VI, as amended, requires ships to which chapter 4 applies shall also be subject to survey and certification taking into account guidelines developed by the Organization,

NOTING ALSO that the Committee adopted, at its sixty-seventh session, the *2014 Guidelines on survey and certification of the Energy Efficiency Design Index (EEDI)* (resolution MEPC.254(67)),

NOTING FURTHER that, at its sixty-eighth and seventy-third sessions, it adopted, by resolutions MEPC.261(68) and MEPC.309(73), respectively, amendments to the *2014 Guidelines on survey and certification of the Energy Efficiency Design Index (EEDI)*,

HAVING NOTED, at its seventy-ninth session, the need to further amend the *2014 Guidelines on survey and certification of the Energy Efficiency Design Index (EEDI)* (resolution MEPC.254(67), as amended),

1 ADOPTS the *2022 Guidelines on survey and certification of the Energy Efficiency Design Index (EEDI)*, as set out in the annex to the present resolution;

2 INVITES Administrations to implement the 2022 EEDI Survey and Certification Guidelines when developing and enacting national laws which give force to and implement provisions set forth in regulation 5 of MARPOL Annex VI, as amended;

3 REQUESTS the Parties to MARPOL Annex VI and other Member Governments to bring the amendments to the attention of shipowners, ship operators, shipbuilders, ship designers and any other interested groups;

4 AGREES to keep these Guidelines, as amended, under review, in light of the experience gained with their application;

5 AGREES that these Guidelines supersede the *2014 Guidelines on survey and certification of the Energy Efficiency Design Index (EEDI)* (resolution MEPC.254(67), as amended by resolutions MEPC.261(68) and MEPC.309(73)).

ANNEX

2022 GUIDELINES ON SURVEY AND CERTIFICATION OF THE ENERGY EFFICIENCY DESIGN INDEX (EEDI)

Table of contents

1 GENERAL

The purpose of these guidelines is to assist verifiers of the Energy Efficiency Design Index (EEDI) of ships in conducting the survey and certification of the EEDI, in accordance with regulations 5, 6, 7, 8 and 9 of MARPOL Annex VI, and assist shipowners, shipbuilders, manufacturers and other interested parties in understanding the procedures for the survey and certification of the EEDI.

2 DEFINITIONS[1]

2.1 *Verifier* means an Administration or organization duly authorized by it which conducts the survey and certification of the EEDI in accordance with regulations 5, 6, 7, 8 and 9 of MARPOL Annex VI and these guidelines.

2.2 *Ship of the same type* means a ship the hull form (expressed in the lines such as sheer plan and body plan), excluding additional hull features such as fins, and principal particulars of which are identical to that of the base ship.

2.3 *Tank test* means model towing tests, model self-propulsion tests and model propeller open water tests. Numerical calculations may be accepted as equivalent to model propeller open water tests or used to complement the tank tests conducted (e.g. to evaluate the effect of additional hull features such as fins, etc. on ship's performance), with the approval of the verifier.

3 APPLICATION

These guidelines should be applied to new ships for which an application for an initial survey or an additional survey specified in regulation 5 of MARPOL Annex VI has been submitted to a verifier.

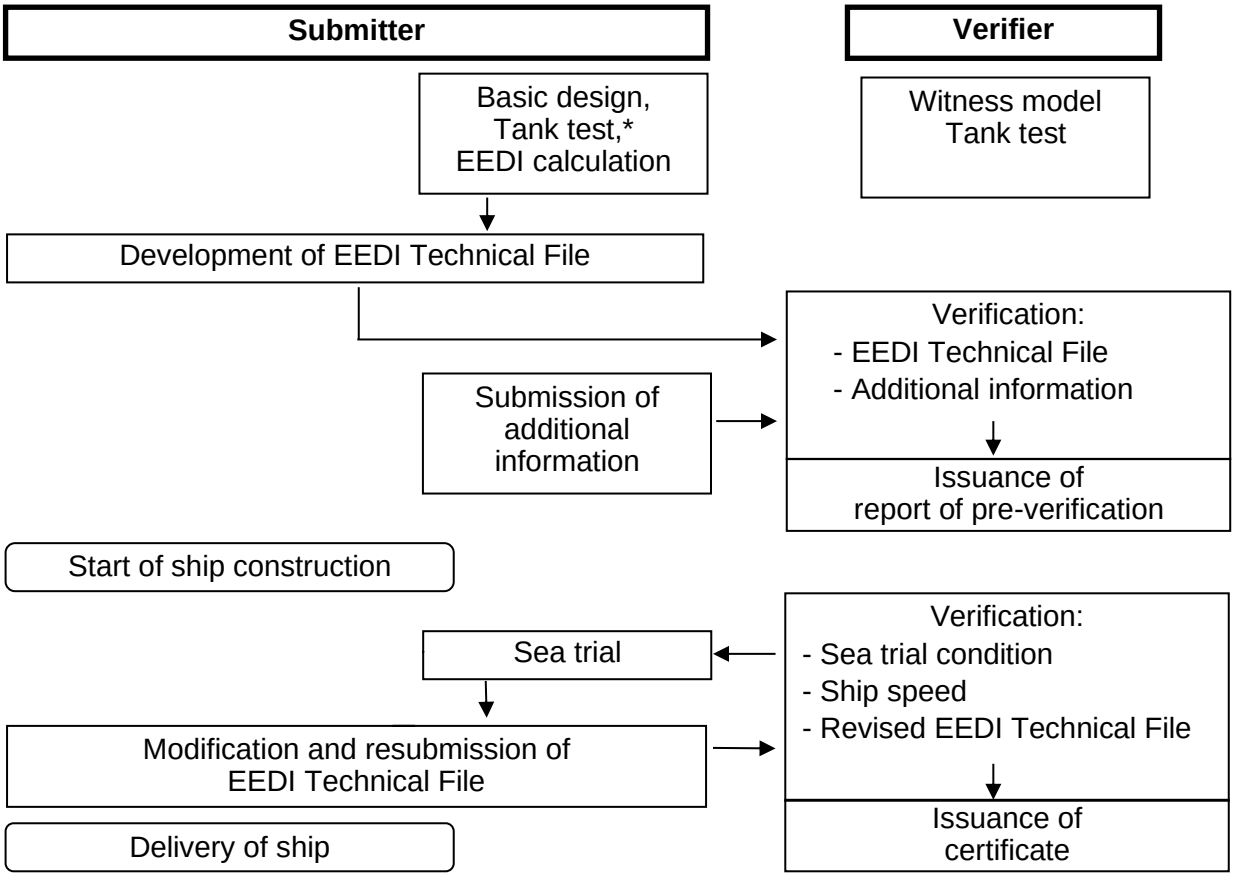
4 PROCEDURES FOR SURVEY AND CERTIFICATION

4.1 General

4.1.1 The attained EEDI should be calculated in accordance with regulation 22 of MARPOL Annex VI and the *2022 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships* (resolution MEPC.364(79)) (EEDI Calculation Guidelines). Survey and certification of the EEDI should be conducted in two stages: preliminary verification at the design stage and final verification at the sea trial. The basic flow of the survey and certification process is presented in figure 1.

4.1.2 The information used in the verification process may contain confidential information of submitters which requires Intellectual Property Rights (IPR) protection. In the case where the submitter wants a non-disclosure agreement with the verifier, the additional information should be provided to the verifier upon mutually agreed terms and conditions.

[1] Other terms used in these guidelines have the same meaning as those defined in the *2022 Guidelines on the method of calculation of the attained EEDI for new ships* (resolution MEPC.364(79)).



* To be conducted by a test organization or a submitter.

Figure 1: Basic flow of survey and certification process

4.2 Preliminary verification of the attained EEDI at the design stage

4.2.1 For the preliminary verification at the design stage, an application for an initial survey and an EEDI Technical File containing the necessary information for the verification and other relevant background documents should be submitted to a verifier.

4.2.2 The EEDI Technical File should be written at least in English. The EEDI Technical File should include as a minimum, but not be limited to:

.1 deadweight (DWT) or gross tonnage (GT) for passenger and ro-ro passenger ships, the maximum continuous rating (MCR) of the main and auxiliary engines, the ship speed (V_{ref}), as specified in paragraph 2.2.2 of the EEDI Calculation Guidelines, type of fuel, the specific fuel consumption (*SFC*) of the main engine at 75% of MCR power, the *SFC* of the auxiliary engines at 50% MCR power, and the electric power table[2] for certain ship types, as necessary, as defined in the EEDI Calculation Guidelines;

[2] Electric power table should be validated separately, taking into account guidelines set out in appendix 2 to these Guidelines.

.2 power curve(s) (kW – knot) estimated at design stage under the condition as specified in paragraph 2.2.2 of the EEDI Calculation Guidelines, and, in the event that the sea trial is carried out in a condition other than the above condition, also a power curve estimated under the sea trial condition;

.3 principal particulars, ship type and the relevant information to classify the ship as such a ship type, classification notations and an overview of the propulsion system and electricity supply system on board;

.4 estimation process and methodology of the power curves at design stage;

.5 description of energy-saving equipment;

.6 calculated value of the attained EEDI, including the calculation summary, which should contain, at a minimum, each value of the calculation parameters and the calculation process used to determine the attained EEDI;

.7 calculated values of the attained $EEDI_{weather}$ and f_w value (not equal to 1.0), if those values are calculated, based on the EEDI Calculation Guidelines; and

.8 for LNG carriers:

.1 type and outline of propulsion systems (such as direct drive diesel, diesel electric, steam turbine);

.2 LNG cargo tank capacity in m^3 and BOR as defined in paragraph 2.2.5.6.3 of the EEDI Calculation Guidelines;

.3 shaft power of the propeller shaft after transmission gear at 100% of the rated output of motor (MPP_{Motor}) and $\eta_{(i)}$ for diesel electric;

.4 maximum continuous rated power ($MCR_{SteamTurbine}$) for steam turbine; and

.5 $SFC_{SteamTurbine}$ for steam turbine, as specified in paragraph 2.2.7 of the EEDI Calculation Guidelines.

A sample of an EEDI Technical File is provided in appendix 1 to these guidelines.

4.2.3 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:

.1 final decision on the primary fuel rests with the Administration;

.2 the ratio of calorific value of gas fuel (LNG) to total marine fuels (HFO/MGO), including gas fuel (LNG) at design conditions should be equal or larger than 50% in accordance with the formula below. However, the Administration can accept a lower value of the percentage taking into account the intended voyages:

$$\frac{V_{gas} \times \rho_{gas} \times LCV_{gas} \times K_{gas}}{\left(\sum_{i=1}^{nLiquid} V_{liquid(i)} \times \rho_{liquid(i)} \times LCV_{liquid(i)} \times K_{liquid(i)} \right) + V_{gas} \times \rho_{gas} \times LCV_{gas} \times K_{gas}} \geq 50\%$$

Whereby,

V_{gas} is the total net tank volume of gas fuel on board in m^3;

V_{liquid} is the total net tank volume of every liquid fuel on board in m^3;

ρ_{gas} is the density of gas fuel in kg/m^3;

ρ_{liquid} is the density of every liquid fuel in kg/m^3;

LCV_{gas} is the low calorific value of gas fuel in kJ/kg;

LCV_{liquid} is the low calorific value of liquid fuel in kJ/kg;

K_{gas} is the filling rate for gas fuel tanks;

K_{liquid} is the filling rate for liquid fuel tanks.

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	42700	0.98
Heavy Fuel Oil	991	40200	0.98
Liquefied Natural Gas (LNG)	450	48000	0.95*

* subject to verification of tank filling limit

.3 in case the ship is not fully equipped with dual-fuel engines, the C_F factor for gas (LNG) should apply only for those installed engines that are of dual-fuel type and sufficient gas fuel supply should be available for such engines; and

.4 LNG fuelling solutions with exchangeable (specialized) LNG tank-containers should also fall under the terms of LNG as primary fuel.

4.2.4 The *SFC* of the main and auxiliary engines should be quoted from the approved NO_x Technical File and should be corrected to the value corresponding to the ISO standard reference conditions using the standard lower calorific value of the fuel oil (42,700 kJ/kg), referring to ISO 15550:2002 and ISO 3046-1:2002. For the confirmation of the *SFC*, a copy of the approved NO_x Technical File and documented summary of the correction calculations should be submitted to the verifier. In cases where the NO_x Technical File has not been approved at the time of the application for initial survey, the test reports provided by manufacturers should be used. In this case, at the time of the sea trial verification, a copy of

the approved NO_x Technical File and documented summary of the correction calculations should be submitted to the verifier. In the case that gas fuel is determined as primary fuel in accordance with paragraph 4.2.3 and that installed engine(s) have no approved NO_x Technical File tested in gas mode, the *SFC* of gas mode should be submitted by the manufacturer and confirmed by the verifier.

> **Note:** *SFC* in the NO_x Technical File are the values of a parent engine, and the use of such value of *SFC* for the EEDI calculation for member engines may have the following technical issues for further consideration:
>
> .1 the definition of "member engines" given in the NO_x Technical File is broad and specification of engines belonging to the same group/family may vary; and
>
> .2 the rate of NO_x emission of the parent engine is the highest in the group/family – i.e. CO_2 emission, which is in the trade-off relationship with NO_x emission, can be lower than the other engines in the group/family.

4.2.5 For ships to which regulation 24 of MARPOL Annex VI applies, the power curves used for the preliminary verification at the design stage should be based on reliable results of tank tests. A tank test for an individual ship may be omitted based on technical justifications such as availability of the results of tank tests for ships of the same type. In addition, the omission of tank tests is acceptable for a ship for which sea trials will be carried out under the condition as specified in paragraph 2.2.2 of the EEDI Calculation Guidelines, upon agreement of the shipowner and shipbuilder and with the approval of the verifier. To ensure the quality of tank tests, the ITTC quality system should be taken into account. Model tank tests should be witnessed by the verifier.

> **Note:** It would be desirable in the future that an organization conducting a tank test be authorized.

4.2.6 The verifier may request further information from the submitter, in addition to that contained in the EEDI Technical File, as necessary, to examine the calculation process of the attained EEDI. For the estimation of the ship speed at the design stage much depends on each shipbuilder's experience, and it may not be practicable for any person/organization other than the shipbuilder to fully examine the technical aspects of experience-based parameters, such as the roughness coefficient and wake scaling coefficient. Therefore, the preliminary verification should focus on the calculation process of the attained EEDI to ensure that it is technically sound and reasonable and follows regulation 22 of MARPOL Annex VI and the EEDI Calculation Guidelines.

> **Note 1:** A possible way forward for more robust verification is to establish a standard methodology of deriving the ship speed from the outcome of tank tests, by setting standard values for experience-based correction factors such as roughness coefficient and wake scaling coefficient. In this way, ship-by-ship performance comparisons could be made more objectively by excluding the possibility of arbitrary setting of experience-based parameters. If such standardization is sought, this would have an implication on how the ship speed adjustment based on sea trial results should be conducted, in accordance with paragraph 4.3.8 of these guidelines.
>
> **Note 2:** A joint industry standard to support the method and role of the verifier is expected to be developed.

4.2.7 Additional information that the verifier may request the submitter to provide includes, but is not limited to:

.1 descriptions of a tank test facility; this should include the name of the facility, the particulars of tanks and towing equipment, and the records of calibration of each monitoring equipment;

.2 lines of a model ship and an actual ship for the verification of the appropriateness of the tank test; the lines (sheer plan, body plan and half-breadth plan) should be detailed enough to demonstrate the similarity between the model ship and the actual ship;

.3 lightweight of the ship and displacement table for the verification of the deadweight;

.4 detailed report on the method and results of the tank test; this should include at least the tank test results at sea trial condition and under the condition as specified in paragraph 2.2.2 of the EEDI Calculation Guidelines;

.5 detailed calculation process of the ship speed, which should include the basis for the estimation of experience-based parameters such as roughness coefficient, and wake scaling coefficient;

.6 reasons for exempting a tank test, if applicable; this should include lines and tank test results of ships of the same type, and the comparison of the principal particulars of such ships and the ship in question. Appropriate technical justification should be provided, explaining why the tank test is unnecessary; and

.7 for LNG carriers, detailed calculation process of P_{AE} and $SFC_{SteamTurbine}$.

4.2.8 The verifier should issue the report on the Preliminary Verification of the EEDI after it has verified the attained EEDI at the design stage, in accordance with paragraphs 4.1 and 4.2 of these guidelines.

4.3 Final verification of the attained EEDI at sea trial

4.3.1 Sea trial conditions should be set as the conditions specified in paragraph 2.2.2 of the EEDI Calculation Guidelines, if possible.

4.3.2 Prior to the sea trial, the following documents should be submitted to the verifier: a description of the test procedure to be used for the speed trial, the final displacement table and the measured lightweight, or a copy of the survey report of deadweight, as well as a copy of the NO_x Technical File, as necessary. The test procedure should include, as a minimum, descriptions of all necessary items to be measured and corresponding measurement methods to be used for developing power curves under the sea trial condition.

4.3.3 The verifier should attend the sea trial and confirm:

.1 propulsion and power supply system, particulars of the engines or steam turbines, and other relevant items described in the EEDI Technical File;

.2 draught and trim;

.3 sea conditions;

.4 ship speed; and

.5 shaft power and RPM.

4.3.4 Draught and trim should be confirmed by the draught measurements taken prior to the sea trial. The draught and trim should be as close as practical to those at the assumed conditions used for estimating the power curves.

4.3.5 Sea conditions should be measured in accordance with ITTC Recommended Procedure 7.5-04-01-01.1 *Preparation, Conduct and Analysis of Speed/Power Trials* (2017, 2021 or 2022 version, as may be applicable at the time of sea trials) or ISO 15016:2015.

4.3.6 Ship speed should be measured in accordance with ITTC Recommended Procedure 7.5-04-01-01.1 *Preparation, Conduct and Analysis of Speed/Power Trials* (2017, 2021 or 2022 version, as may be applicable at the time of sea trials) or ISO 15016:2015, and at more than two points of which range includes the power of the main engine as specified in paragraph 2.2.5 of the EEDI Calculation Guidelines.

4.3.7 The main engine output, shaft power of propeller shaft (for LNG carriers having diesel electric propulsion system) or steam turbine output (for LNG carriers having steam turbine propulsion system) should be measured by shaft power meter or a method which the engine manufacturer recommends and the verifier approves. Other methods may be acceptable upon agreement of the shipowner and shipbuilder and with the approval of the verifier.

4.3.8 The submitter should develop power curves based on the measured ship speed and the measured output of the main engine at sea trial. For the development of the power curves, the submitter should calibrate the measured ship speed, if necessary, by taking into account the effects of wind, current, waves, shallow water, displacement, water temperature and water density in accordance with ITTC Recommended Procedure 7.5-04-01-01.1 *Preparation, Conduct and Analysis of Speed/Power Trials* (2017, 2021 or 2022 version, as may be applicable at the time of sea trials) or ISO 15016:2015. Upon agreement with the shipowner, the submitter should submit a report on the speed trials including details of the power curve development to the verifier for verification.

4.3.9 The submitter should compare the power curves obtained as a result of the sea trial and the estimated power curves at the design stage. In case differences are observed, the attained EEDI should be recalculated, as necessary, in accordance with the following:

.1 for ships for which sea trial is conducted under the condition as specified in paragraph 2.2.2 of the EEDI Calculation Guidelines: the attained EEDI should be recalculated using the measured ship speed at sea trial at the power of the main engine as specified in paragraph 2.2.5 of the EEDI Calculation Guidelines; and

.2 for ships for which sea trial cannot be conducted under the condition as specified in paragraph 2.2.2 of the EEDI Calculation Guidelines: if the measured ship speed at the power of the main engine as specified in paragraph 2.2.5 of the EEDI Calculation Guidelines at the sea trial conditions is different from the expected ship speed on the power curve at the corresponding condition, the shipbuilder should recalculate the attained EEDI by adjusting ship speed under the condition as specified in paragraph 2.2.2 of the EEDI Calculation Guidelines by an appropriate correction method that is agreed by the verifier.

An example of scheme of conversion from trial condition to EEDI condition at EEDI power is given as follows:

V_{ref} is obtained from the results of the sea trials at trial condition using the speed-power curves predicted by the tank tests. The tank tests shall be carried out at both draughts: trial condition corresponding to that of the S/P trials and EEDI condition. For trial conditions the power ratio α_P between model test prediction and sea trial result is calculated for constant ship speed. Ship speed from model test prediction for EEDI condition at EEDI power multiplied with α_P is V_{ref}.

$$\alpha_P = \frac{P_{Trial,P}}{P_{Trial,S}}$$

where:

$P_{Trial,P}$: power at trial condition predicted by the tank tests

$P_{Trial,S}$: power at trial condition obtained by the S/P trials

α_P: power ratio

Figure 2 shows an example of scheme of the conversion to derive the resulting ship speed at EEDI condition (V_{ref}) at EEDI power.

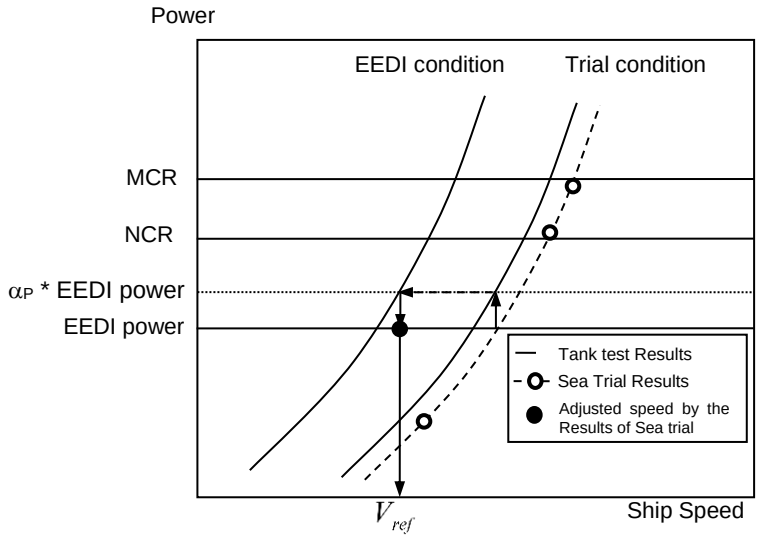


Figure 2: An example of scheme of conversion from trial condition to EEDI condition at EEDI power

Note: Further consideration would be necessary for speed adjustment methodology in paragraph 4.3.9.2 of these guidelines. One of the concerns relates to a possible situation where the power curve for sea trial condition is estimated in an excessively conservative manner (i.e. power curve is shifted in a leftward direction) with the intention to get an upward adjustment of the ship speed by making the measured ship speed at sea trial easily exceed the lower-estimated speed for sea trial condition at design stage.

4.3.10 In cases where the finally determined deadweight/gross tonnage differs from the designed deadweight/gross tonnage used in the EEDI calculation during the preliminary verification, the submitter should recalculate the attained EEDI using the finally determined deadweight/gross tonnage. The finally determined gross tonnage should be confirmed in the Tonnage Certificate of the ship.

4.3.11 The electrical efficiency $\eta_{(i)}$ should be taken as 91.3% for the purpose of calculating the attained EEDI. Alternatively, if a value of more than 91.3% is to be applied, $\eta_{(i)}$ should be obtained by measurement and verified by a method approved by the verifier.

4.3.12 In cases where the attained EEDI is calculated at the preliminary verification by using *SFC* based on the manufacturer's test report, owing to the non-availability at that time of the approved NO_x Technical File, the EEDI should be recalculated by using *SFC* in the approved NO_x Technical File. Also, for steam turbines, the EEDI should be recalculated by using *SFC* confirmed by the Administration or an organization recognized by the Administration at the sea trial.

4.3.13 The EEDI Technical File should be revised, as necessary, by taking into account the results of sea trials. Such revision should include, as applicable, the adjusted power curve based on the results of sea trials (namely, modified ship speed under the condition as specified in paragraph 2.2.2 of the EEDI Calculation Guidelines), the finally determined deadweight/gross tonnage, η for LNG carriers having diesel electric propulsion system and *SFC* described in the approved NO_x Technical File, and the recalculated attained EEDI based on these modifications.

4.3.14 The EEDI Technical File, if revised, should be submitted to the verifier for confirmation that the (revised) attained EEDI is calculated in accordance with regulation 22 of MARPOL Annex VI and the EEDI Calculation Guidelines.

4.4 Verification of the attained EEDI in case of major conversion

4.4.1 In cases of a major conversion of a ship, the shipowner should submit to a verifier an application for an Additional Survey with the EEDI Technical File duly revised, based on the conversion made and other relevant background documents.

4.4.2 The background documents should include as a minimum, but are not limited to:

.1 details of the conversion;

.2 EEDI parameters changed after the conversion and the technical justifications for each respective parameter;

.3 reasons for other changes made in the EEDI Technical File, if any; and

.4 calculated value of the attained EEDI with the calculation summary, which should contain, as a minimum, each value of the calculation parameters and the calculation process used to determine the attained EEDI after the conversion.

4.4.3 The verifier should review the revised EEDI Technical File and other documents submitted and verify the calculation process of the attained EEDI to ensure that it is technically sound and reasonable and follows regulation 22 of MARPOL Annex VI and the EEDI Calculation Guidelines.

4.4.4 For verification of the attained EEDI after a conversion, speed trials of the ship are required, as necessary.

APPENDIX 1

SAMPLE OF EEDI TECHNICAL FILE

1 Data

1.1 General information

Shipbuilder	JAPAN Shipbuilding Company
Hull no.	12345
IMO no.	94111XX
Ship type	Bulk carrier

1.2 Principal particulars

Length overall	250.0 m
Length between perpendiculars	240.0 m
Breadth, moulded	40.0 m
Depth, moulded	20.0 m
Summer load line draught, moulded	14.0 m
Deadweight at summer load line draught	150,000 tons

1.3 Main engine

Manufacturer	JAPAN Heavy Industries Ltd.
Type	6J70A
Maximum continuous rating (MCR)	15,000 kW x 80 rpm
SFC at 75% MCR	165.0 g/kWh
Number of set	1
Fuel type	Diesel Oil

1.4 Auxiliary engine

Manufacturer	JAPAN Diesel Ltd.
Type	5J-200
Maximum continuous rating (MCR)	600 kW x 900 rpm
SFC at 50% MCR	220.0 g/kWh
Number of set	3
Fuel type	Diesel Oil

1.5 Ship speed

Ship speed in deep water at summer load line draught at 75% of MCR	14.25 knots

2 Power curves

The power curves estimated at the design stage and modified after the speed trials are shown in figure 2.1.

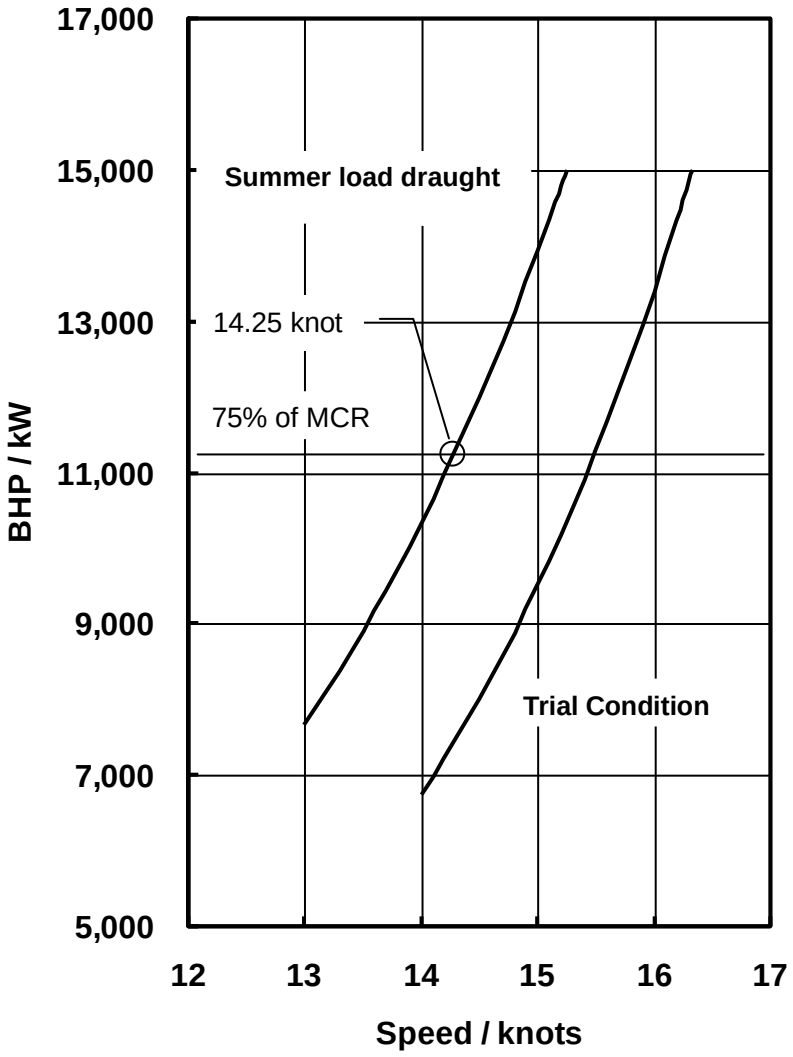


Figure 2.1: Power curves

3 Overview of propulsion system and electric power supply system

3.1 Propulsion system

3.1.1 Main engine
Refer to paragraph 1.3 of this appendix.

3.1.2 Propeller

Type	Fixed pitch propeller
Diameter	7.0 m
Number of blades	4
Number of set	1

3.2 Electric power supply system

3.2.1 Auxiliary engines
Refer to paragraph 1.4 of this appendix.

3.2.2 Main generators

Manufacturer	JAPAN Electric
Rated output	560 kW (700 kVA) x 900 rpm
Voltage	AC 450 V
Number of set	3

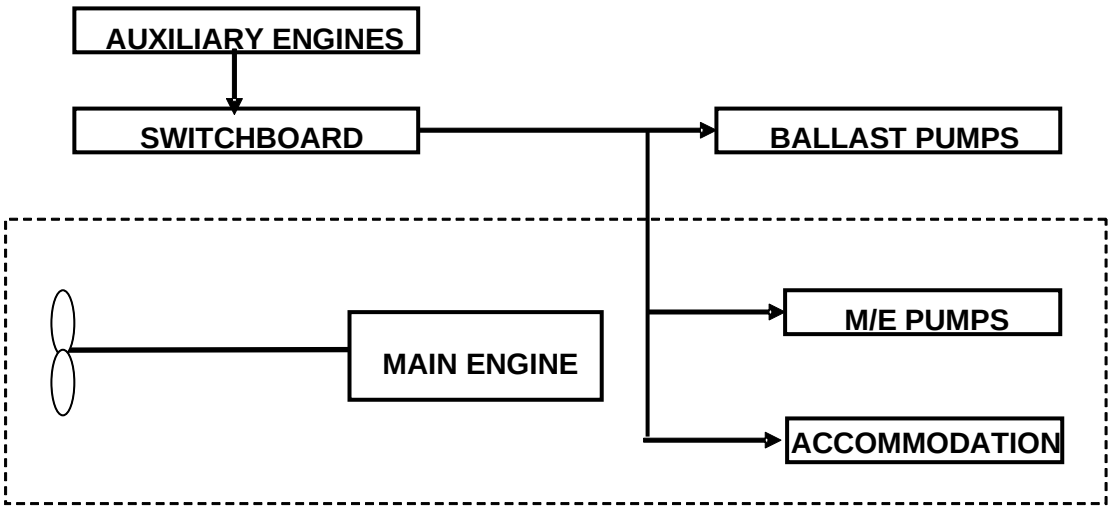


Figure 3.1: Schematic figure of propulsion and electric power supply system

4 Estimation process of power curves at design stage

Power curves are estimated based on model test results. The flow of the estimation process is shown below.

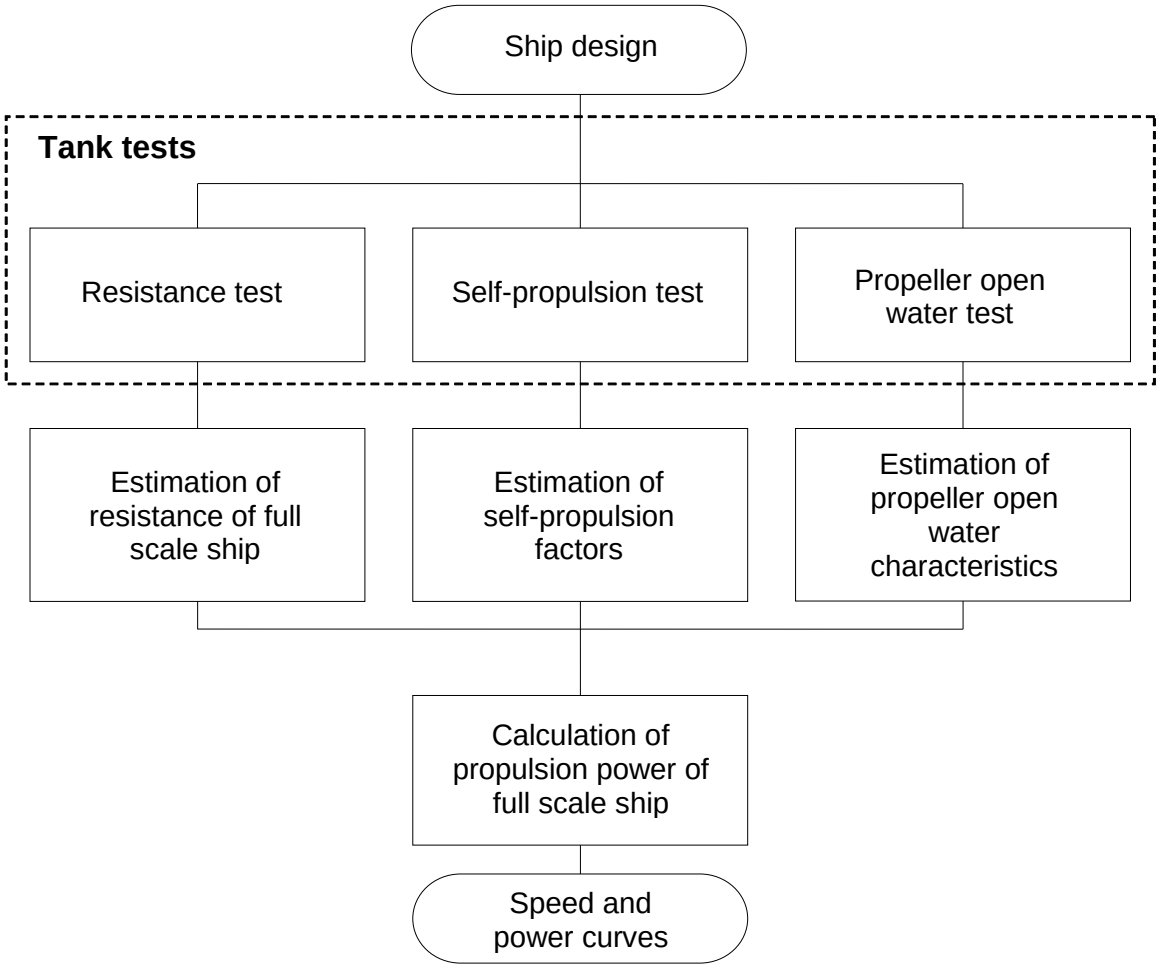


Figure 4.1: Flow chart of process for estimating power curves

5 Description of energy-saving equipment

5.1 Energy-saving equipment the effects of which are expressed as $P_{AEeff(i)}$ and/or $P_{eff(i)}$ in the EEDI calculation formula

N/A

5.2 Other energy-saving equipment

(Example)

5.2.1 Rudder fins

5.2.2 Propeller boss cap fins

……
(Specifications, schematic figures and/or photos, etc., for each piece of equipment or device should be indicated. Alternatively, attachment of a commercial catalogue may be acceptable.)

6 Calculated value of attained EEDI

6.1 Basic data

Type of ship	Capacity DWT	Speed V_{ref} (knots)
Bulk Carrier	150,000	14.25

6.2 Main engine

MCR_{ME} (kW)	Shaft gen.	P_{ME} (kW)	Type of fuel	C_{FME}	SFC_{ME} (g/kWh)
15,000	N/A	11,250	Diesel Oil	3.206	165.0

6.3 Auxiliary engines

P_{AE} (kW)	Type of fuel	C_{FAE}	SFC_{AE} (g/kWh)
625	Diesel Oil	3.206	220.0

6.4 Ice class

N/A

6.5 Innovative electrical energy-efficient technology

N/A

6.6 Innovative mechanical energy-efficient technology

N/A

6.7 Cubic capacity correction factor

N/A

6.8 Calculated value of attained EEDI

$$EEDI = \frac{\left(\prod_{j=1}^{M} f_j\right)\left(\sum_{i=1}^{nME} P_{ME(i)} \cdot C_{FME(i)} \cdot SFC_{ME(i)}\right) + \left(P_{AE} \cdot C_{FAE} \cdot SFC_{AE}\right)}{f_i \cdot f_c \cdot Capacity \cdot f_w \cdot V_{ref}}$$

$$+ \frac{\left\{\left(\prod_{j=1}^{M} f_j \cdot \sum_{i=1}^{nPTI} P_{PTI(i)} - \sum_{i=1}^{neff} f_{eff(i)} \cdot P_{AEeff(i)}\right) C_{FAE} \cdot SFC_{AE}\right\} - \left(\sum_{i=1}^{neff} f_{eff(i)} \cdot P_{eff(i)} \cdot C_{FME} \cdot SFC_{ME}\right)}{f_i \cdot f_c \cdot Capacity \cdot f_w \cdot V_{ref}}$$

$$= \frac{1 \times (11250 \times 3.206 \times 165.0) + (625 \times 3.206 \times 220.0) + 0 - 0}{1 \cdot 1 \cdot 150000 \cdot 1 \cdot 14.25}$$

$$= 2.99 \quad (\mathrm{g - CO_2/ton \cdot mile})$$

attained EEDI: 2.99 g-CO_2/ton mile

7 Calculated value of attained $EEDI_{weather}$

7.1 Representative sea conditions

	Mean wind speed	Mean wind direction	Significant wave height	Mean wave period	Mean wave direction
BF6	12.6 (m/s)	0 (deg.)*	3.0 (m)	6.7 (s)	0 (deg.)*

* Heading direction of wind/wave in relation to the ship's heading, i.e. 0 (deg.) means the ship is heading directly into the wind.

7.2 Calculated weather factor, f_w

f_w	0.900

7.3 Calculated value of attained $EEDI_{weather}$

attained $EEDI_{weather}$: 3.32 g-CO_2/ton mile

APPENDIX 2

GUIDELINES FOR VALIDATION OF ELECTRIC POWER TABLES FOR EEDI (EPT-EEDI)

1 INTRODUCTION

The purpose of these guidelines is to assist recognized organizations in the validation of electric power tables (EPT) for the calculation of the Energy Efficiency Design Index (EEDI) for ships. As such, these guidelines support the implementation of the EEDI Calculation Guidelines and the *Guidelines on survey and certification of the Energy Efficiency Design Index (EEDI)*. These guidelines will also assist shipowners, shipbuilders, ship designers and manufacturers in relation to aspects of the development of more energy-efficient ships and also in understanding the procedures for the EPT-EEDI validation.

2 OBJECTIVES

These guidelines provide a framework for the uniform application of the EPT-EEDI validation process for ships for which required auxiliary engine power is calculated under paragraph 2.2.5.7 of the EEDI Calculation Guidelines.

3 DEFINITIONS

3.1 *Applicant* means an organization, primarily a shipbuilder or a ship designer, which requests the EPT-EEDI validation in accordance with these guidelines.

3.2 *Validator* means a recognized organization which conducts the EPT-EEDI validation in accordance with these guidelines.

3.3 *Validation* for the purpose of these guidelines means review of submitted documents and survey during construction and sea trials.

3.4 *Standard EPT-EEDI-Form* refers to the layout given in appendix 3, containing the EPT-EEDI results that will be the subject of validation. Other supporting documents submitted for this purpose will be used as reference only and will not be subject to validation.

3.5 P_{AE} herein is defined as per the definition in paragraph 2.2.5.6 of the EEDI Calculation Guidelines.

3.6 *Ship service and engine-room loads* refer to all the load groups which are needed for the hull, deck, navigation and safety services, propulsion and auxiliary engine services, engine-room ventilation and auxiliaries and ship's general services.

3.7 *Diversity factor* is the ratio of the "total installed load power" and the "actual load power" for continuous loads and intermittent loads. This factor is equivalent to the product of service factors for load, duty and time.

4 APPLICATION

4.1 These guidelines are applicable to ships as stipulated in paragraph 2.2.5.7 of the EEDI Calculation Guidelines.

4.2 These guidelines should be applied for new ships for which an application for an EPT-EEDI validation has been submitted to a validator.

4.3 The steps of the validation process include:

.1 review of documents during the design stage

.1 check if all relevant loads are listed in the EPT;

.2 check if reasonable service factors are used; and

.3 check the correctness of the P_{AE} calculation based on the data given in the EPT.

.2 survey of installed systems and components during construction stage

.1 check if a randomly selected set of installed systems and components are correctly listed with their characteristics in the EPT.

.3 survey of sea trials

.1 check if selected units/loads specified in EPT are observed.

5 SUPPORTING DOCUMENTS

5.1 The applicant should provide as a minimum the ship electric balance load analysis.

5.2 Such information may contain shipbuilders' confidential information. Therefore, after the validation, the validator should return all or part of such information to the applicant at the applicant's request.

5.3 A special EEDI condition during sea trials may be needed and defined for each ship and included in the sea trial schedule. For this condition, a special column should be inserted into the EPT.

6 PROCEDURES FOR VALIDATION

6.1 General

P_{AE} should be calculated in accordance with the EPT-EEDI Calculation Guidelines. EPT-EEDI validation should be conducted in two stages: preliminary validation at the design stage and final validation during sea trials. The validation process is presented in figure 1.

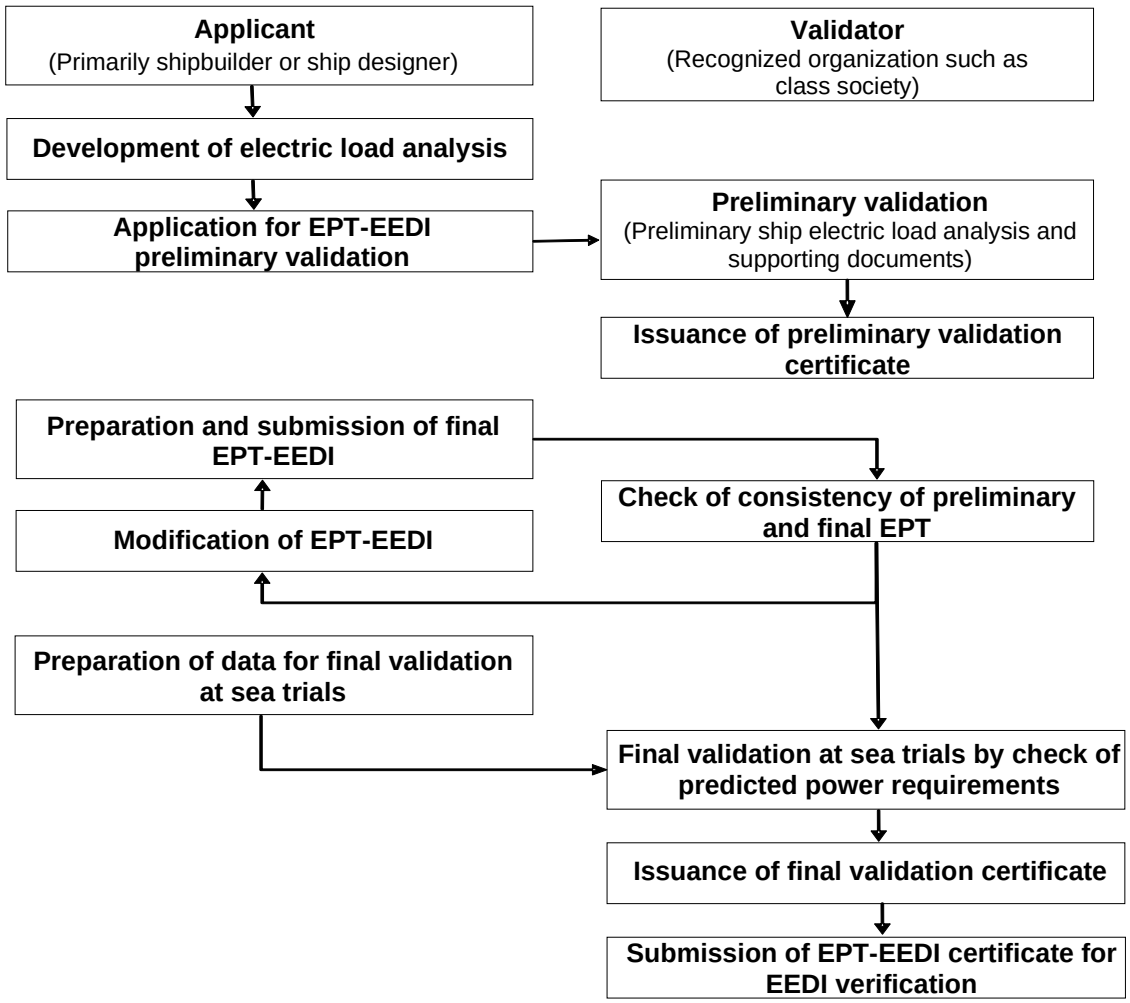


Figure 1: Basic flow of EPT-EEDI validation process

6.2 Preliminary validation at the design stage

6.2.1 For the preliminary validation at the design stage, the applicant should submit to a validator an application for the validation of EPT-EEDI, inclusive of the EPT-EEDI Form, and all the relevant and necessary information for the validation as supporting documents.

6.2.2 The applicant should supply as a minimum the supporting data and information, as specified in appendix A (to be developed).

6.2.3 The validator may request from the applicant additional information to that contained in these guidelines, as necessary, to enable the validator to examine the calculation process of the EPT-EEDI. The estimation of the ship EPT-EEDI at the design stage depends on each applicant's experience, and it may not be practicable to fully examine the technical aspects and details of each machinery component. Therefore, the preliminary validation should focus on the calculation process of the EPT-EEDI that should follow best marine practices.

> **Note:** A possible way forward for more robust validation is to establish a standard methodology of deriving the ship EPT by setting standard formats as agreed and used by industry.

6.3 Final validation

6.3.1 The final validation process should as a minimum include a check of the ship electric load analysis to ensure that all electric consumers are listed, and that their specific data and the calculations in the power table itself are correct and are supported by sea trial results. If necessary, additional information has to be requested.

6.3.2 For the final validation, the applicant should revise the EPT-EEDI Form and supporting documents as necessary, by taking into account the characteristics of the machinery and other electrical loads actually installed on board the ship. The EEDI condition at sea trials should be defined and the expected power requirements in these conditions documented in the EPT. Any changes within the EPT from design stage to construction stage should be highlighted by the shipyard.

6.3.3 The preparation for the final validation includes a desktop check comprising:

.1 consistency of preliminary and final EPT;

.2 changes of service factors (compared to the preliminary validation);

.3 all electric consumers are listed;

.4 their specific data and the calculations in the power table itself are correct; and

.5 in case of doubt, component specification data is checked in addition.

6.3.4 A survey prior to sea trials is performed to ensure that machinery characteristics and data as well as other electric loads comply with those recorded in the supporting documents. This survey does not cover the complete installation but selects randomly a number of samples.

6.3.5 For the purpose of sea trial validation, the surveyor will check the data of selected systems and/or components given in the special column added to the EPT for this purpose or the predicted overall value of electric load by means of practicable measurements with the installed measurement devices.

7 ISSUANCE OF THE EPT-EEDI STATEMENT OF VALIDATION

7.1 The validator should stamp the EPT-EEDI Form as "Noted" having validated the EPT-EEDI in the preliminary validation stage, in accordance with these guidelines.

7.2 The validator should stamp the EPT-EEDI Form as "Endorsed" having validated the final EPT-EEDI in the final validation stage in accordance with these guidelines.

APPENDIX 3

ELECTRIC POWER TABLE FORM FOR ENERGY EFFICIENCY DESIGN INDEX (EPT-EEDI FORM) AND STATEMENT OF VALIDATION

Ship ID:
IMO no.: _____
Ship's name: _____
Shipyard: _____
Hull no.: _____

Applicant:

Name: _____
Address: _____
_____

Validation stage:

☐ Preliminary validation

☐ Final validation

Summary results of EPT-EEDI

Load group	**Seagoing condition EEDI Calculation Guidelines**		**Remarks**
	Continuous load (kW)	**Intermittent load (kW)**	
Ship service and engine-room loads			
Accommodation and cargo loads			
Total installed load			
Diversity factor			
Normal seagoing load			
Weighted average efficiency of generators			
P_{AE}			

Supporting documents

Title	**ID or remarks**

Validator details:
Organization: _____
Address: _____
_____

This is to certify that the above-mentioned electrical loads and supporting documents have been reviewed in accordance with EPT-EEDI Validation guidelines and the review shows a reasonable confidence for use of the above P_{AE} in EEDI calculations.

Date of review: _____ Statement of validation no. _____

This statement is valid on condition that the electric power characteristics of the ship do not change.

Signature of Validator

_____
Printed name:

***

INTERNATIONAL MARITIME ORGANIZATION

E

4 ALBERT EMBANKMENT
LONDON SE1 7SR
Telephone: +44 (0)20 7735 7611 Fax: +44 (0)20 7587 3210

MEPC.1/Circ.795/Rev.7
16 December 2022

UNIFIED INTERPRETATIONS TO MARPOL ANNEX VI

1 The Marine Environment Protection Committee, at its seventy-ninth session (12 to 16 December 2022), approved unified interpretations to MARPOL Annex VI, which included:

.1 extending the scope of the unified interpretation of regulation 18.3 of MARPOL Annex VI concerning the use of biofuels to include synthetic fuels;

.2 clarifying the reporting of boil-off gas (BOG) consumed on board ships in the IMO Data Collection System (IMO DCS);

.3 clarifying EEDI reporting requirements in regulation 22.3 of MARPOL Annex VI; and

.4 issues related to the development and verification of the SEEMP and the issuance of the Statement of Compliance for CII reporting.

2 The updated consolidated text of all existing unified interpretations to MARPOL Annex VI, including those set out in circular MEPC.1/Circ.795/Rev.6, are set out in the annex.

3 The regulation numbers in the annexed unified interpretations refer to the *2021 Revised MARPOL Annex VI*, as adopted by resolution MEPC.328(76), which entered into force on 1 November 2022.

4 Member Governments are invited to apply the annexed unified interpretations to MARPOL Annex VI, as appropriate, and bring them to the attention of all Parties concerned.

5 Member Governments are also invited to note MEPC.1/Circ.897 setting out cross-reference tables between the *2021 Revised MARPOL Annex VI* and the previous MARPOL Annex VI.

6 This circular revokes MEPC.1/Circ.795/Rev.6.

***

ANNEX

UNIFIED INTERPRETATIONS TO MARPOL ANNEX VI

1 Definition of "new ship"

Regulation 2
Definitions

Regulation 2.2.18 reads as follows:

"*New ship* means a ship:

.1 for which the building contract is placed on or after 1 January 2013; or

.2 in the absence of a building contract, the keel of which is laid or which is at a similar stage of construction on or after 1 July 2013; or

.3 the delivery of which is on or after 1 July 2015."

***Interpretation*:**

1.1 For the application of the definition "new ship" as specified in regulation 2.2.18 to each Phase specified in table 1 of regulation 24, it should be interpreted as follows:

.1 the date specified in regulation 2.2.18.1 should be replaced with the start date of each Phase;

.2 the date specified in regulation 2.2.18.2 should be replaced with the date six months after the start date and end date of each Phase; and

.3 the date specified in regulation 2.2.18.3 should, for Phase 1, 2 and 3, be replaced with the date 48 months after the start date and end date of each Phase.

1.2 With the above interpretations, the required EEDI of each phase is applied to the following new ship which falls into one of the categories defined in regulations 2.2.5, 2.2.7, 2.2.9, 2.2.14, 2.2.15, 2.2.22, 2.2.29 and to which chapter 4 is applicable:

.1 the required EEDI of Phase 0 is applied to the following new ship:

.1 the building contract of which is placed in Phase 0, and the delivery is before 1 January 2019; or

.2 the building contract of which is placed before Phase 0, and the delivery is on or after 1 July 2015 and before 1 January 2019; or

in the absence of a building contract:

.3 the keel of which is laid or which is at a similar stage of construction on or after 1 July 2013 and before 1 July 2015, and the delivery is before 1 January 2019; or

.4 the keel of which is laid or which is at a similar stage of construction before 1 July 2013, and the delivery is on or after 1 July 2015 and before 1 January 2019;

.2 the required EEDI of Phase 1 is applied to the following new ship:

.1 the building contract of which is placed in Phase 1, and the delivery is before 1 January 2024; or

.2 the building contract of which is placed before Phase 1, and the delivery is on or after 1 January 2019 and before 1 January 2024; or

in the absence of a building contract:

.3 the keel of which is laid or which is at a similar stage of construction on or after 1 July 2015 and before 1 July 2020, and the delivery is before 1 January 2024; or

.4 the keel of which is laid or which is at a similar stage of construction before 1 July 2015, and the delivery is on or after 1 January 2019 and before 1 January 2024;

.3 the required EEDI of Phase 2 is applied to the following new ship:

.1 for ship types where Phase 2 ends on 31 March 2022:

.1 the building contract of which is placed in Phase 2, and the delivery is before 1 April 2026; or

.2 the building contract of which is placed before Phase 2, and the delivery is on or after 1 January 2024 and before 1 April 2026; or

in the absence of a building contract:

.3 the keel of which is laid or which is at a similar stage of construction on or after 1 July 2020 and before 1 October 2022, and the delivery is before 1 April 2026; or

.4 the keel of which is laid or which is at a similar stage of construction before 1 July 2020, and the delivery is on or after 1 January 2024 and before 1 April 2026;

.2 for ship types where Phase 2 ends on 31 December 2024:

.1 the building contract of which is placed in Phase 2, and the delivery is before 1 January 2029; or

.2 the building contract of which is placed before Phase 2, and the delivery is on or after 1 January 2024 and before 1 January 2029; or

in the absence of a building contract:

.3 the keel of which is laid or which is at a similar stage of construction on or after 1 July 2020 and before 1 July 2025, and the delivery is before 1 January 2029; or

.4 the keel of which is laid or which is at a similar stage of construction before 1 July 2020, and the delivery is on or after 1 January 2024 and before 1 January 2029;

.4 the required EEDI of Phase 3 is applied to the following new ship:

.1 for ship types where Phase 3 commences with 1 April 2022 and onwards:

.1 the building contract of which is placed in Phase 3; or

.2 the building contract of which is placed before Phase 3, and the delivery is on or after 1 April 2026; or

in the absence of a building contract:

.3 the keel of which is laid or which is at a similar stage of construction on or after 1 October 2022; or

.4 the keel of which is laid or which is at a similar stage of construction before 1 October 2022 and the delivery of which is on or after 1 April 2026;

.2 for ship types where Phase 3 commences with 1 January 2025 and onwards:

.1 the building contract of which is placed in Phase 3; or

.2 the building contract of which is placed before Phase 3, and the delivery is on or after 1 January 2029; or

in the absence of a building contract:

.3 the keel of which is laid or which is at a similar stage of construction on or after 1 July 2025; or

.4 the keel of which is laid or which is at a similar stage of construction before 1 July 2025 and the delivery of which is on or after 1 January 2029.

2 Major conversion

Regulation 2
Definitions

Regulation 2.2.17 reads as follows:

"*Major conversion* means in relation to chapter 4 of this Annex a conversion of a ship:

.1 which substantially alters the dimensions, carrying capacity or engine power of the ship; or

.2 which changes the type of the ship; or

.3 the intent of which in the opinion of the Administration is substantially to prolong the life of the ship; or

.4 which otherwise so alters the ship that, if it were a new ship, it would become subject to relevant provisions of the present Convention not applicable to it as an existing ship; or

.5 which substantially alters the energy efficiency of the ship and includes any modifications that could cause the ship to exceed the applicable required EEDI as set out in regulation 24 of this Annex or the applicable required EEXI as set out in regulation 25 of this Annex."

***Interpretation*:**

2.1 For regulation 2.2.17.1, any substantial change in hull dimensions and/or capacity (e.g. change of length between perpendiculars (L_{PP}) or change of assigned freeboard) should be considered a major conversion. Any substantial increase of total engine power for propulsion (e.g. 5% or more) should be considered a major conversion. In any case, it is the Administration's authority to evaluate and decide whether an alteration should be considered as major conversion, consistent with chapter 4.

Note: Notwithstanding paragraph 2.1, assuming no alteration to the ship structure, both decrease of assigned freeboard and temporary increase of assigned freeboard due to the limitation of deadweight or draft at calling port should not be construed as a major conversion. However, an increase of assigned freeboard, except a temporary increase, should be construed as a major conversion.

2.2 Notwithstanding paragraph 2.1, for regulation 2.2.17.5, the effect on Attained EEDI as a result of any change of ships' parameters, particularly any increase in total engine power for propulsion, should be investigated. In any case, it is the Administration's authority to evaluate and decide whether an alteration should be considered as major conversion, consistent with chapter 4.

2.3 A company may, at any time, voluntarily request re-certification of the EEDI, with IEE Certificate reissuance, on the basis of any new improvements to the ships' efficiency that are not considered to be major conversions.

2.4 In regulation 2.2.17.4, the terms "new ship" and "existing ship" should be understood as they are used in MARPOL Annex I, regulation 1.9.1.4, rather than as the defined terms in regulations 2.2.13 and 2.2.18.

2.5 The term "a ship" referred to in regulation 5.4.2 is interpreted as "new ship".

3 Ships dedicated to the carriage of fruit juice in refrigerated cargo tanks

Regulation 2
Definitions

Regulation 2.2.22 reads as follows:

> "*Refrigerated cargo carrier* means a ship designed exclusively for the carriage of refrigerated cargoes in holds."

***Interpretation*:**

3.1 Ships dedicated to the carriage of fruit juice in refrigerated cargo tanks should be categorized as refrigerated cargo carrier.

4 Timing for existing ships to have on board a SEEMP

Regulation 5
Surveys

Regulation 5.4.4 reads as follows:

> "For existing ships, the verification of the requirement to have a SEEMP on board according to regulation 26 of this Annex shall take place at the first intermediate or renewal survey identified in paragraph 1 of this regulation, whichever is the first, on or after 1 January 2013."

Regulation 6
Issue or endorsement of Certificates and Statements of Compliance related to fuel oil consumption reporting and operational carbon intensity rating

Regulation 6.4 reads as follows:

> "An International Energy Efficiency Certificate for the ship shall be issued after a survey in accordance with the provisions of regulation 5.4 of this Annex to any ship of 400 gross tonnage and above before that ship may engage in voyages to ports or offshore terminals under the jurisdiction of other Parties."

Regulation 26
Ship Energy Efficiency Management Plan (SEEMP)

Regulation 26.1 reads as follows:

> "Each ship shall keep on board a ship specific Ship Energy Efficiency Management Plan (SEEMP). This may form part of the ship's Safety Management System (SMS)."

***Interpretation*:**

4.1 The International Energy Efficiency Certificate (IEEC) should be issued for both new and existing ships to which chapter 4 applies. Ships which are not required to keep an SEEMP on board are not required to be issued with an IEEC.

4.2 The SEEMP required by regulation 26.1 is not required to be placed on board an existing ship to which this regulation applies until the verification survey specified in regulation 5.4.4 is carried out.

4.3 For existing ships, a SEEMP required in accordance with regulation 26 should be verified on board according to regulation 5.4.4, and an IEEC should be issued, not later than the first intermediate or renewal survey, in accordance with chapter 2, whichever is earlier, on or after 1 January 2013, i.e. a survey connected to an intermediate/renewal survey of the IAPP Certificate.

4.4 The intermediate or renewal survey referenced in paragraph 4.3 relates solely to the timing of the verification of the SEEMP on board, i.e. these IAPP Certificate survey windows will also become the IEEC initial survey date for existing ships. The SEEMP is, however, a survey item solely under chapter 4 and is not a survey item relating to IAPP Certificate surveys.

4.5 In the event that the SEEMP is not available on board during the first intermediate/renewal survey of the IAPP Certificate on or after 1 January 2013, the RO should seek the advice of the Administration concerning the issuance of an IEEC and be guided accordingly. However, the validity of the IAPP Certificate is not impacted by the lack of a SEEMP as the SEEMP is a survey item solely under chapter 4 and not under the IAPP Certificate surveys.

4.6 With respect to ships required to keep on board a SEEMP, such ships exclude platforms (including FPSOs and FSUs) and drilling rigs, regardless of their propulsion, and any other ship without means of propulsion.

4.7 The SEEMP should be written in a working language or languages understood by ships' personnel.

5 Section 2.3 of the supplement to the IAPP Certificate

Regulation 8
Form of Certificates and Statements of Compliance related to fuel oil consumption reporting and operational carbon intensity rating

Regulation 8.1 reads as follows:

> "The International Air Pollution Prevention Certificate shall be drawn up in a form corresponding to the model given in appendix I to this Annex and shall be at least in English, French or Spanish. If an official language of the issuing country is also used, this shall prevail in case of a dispute or discrepancy."

Appendix I
Form of International Air Pollution Prevention (IAPP) Certificate (Regulation 8)

Section 2.3 of the supplement to International Air Pollution Prevention Certificate reads as follows:

"2.3 Sulphur oxides (SO_x) and particulate matter (regulation 14).

2.3.1 When the ship operates outside of an emission control area specified in regulation 14.3, the ship uses:

.1 fuel oil with a sulphur content as documented by bunker delivery notes that does not exceed the limit value of 0.50% m/m, and/or ……..……..……..…….....□

.2 an equivalent arrangement approved in accordance with regulation 4.1 as listed in paragraph 2.6 that is at least as effective in terms of SO_x emission reductions as compared to using a fuel oil with a sulphur content limit value of 0.50% m/m ……..……..……..…….....□

2.3.2 When the ship operates inside an emission control area specified in regulation 14.3, the ship uses:

.1 fuel oil with a sulphur content as documented by bunker delivery notes that does not exceed the limit value of 0.10% m/m, and/or ……..……..……..……□

.2 an equivalent arrangement approved in accordance with regulation 4.1 as listed in paragraph 2.6 that is at least as effective in terms of SO_x emission reductions as compared to using a fuel oil with a sulphur content limit value of 0.10% m/m ……..……..……□

2.3.3 For a ship without an equivalent arrangement approved in accordance with regulation 4.1 as listed in paragraph 2.6, the sulphur content of fuel oil carried for use on board the ship shall not exceed 0.50% m/m as documented by bunker delivery notes ……..……..……□"

***Interpretation*:**

5.1 Section 2.3 of the Supplement ("as documented by bunker delivery notes") allows for an "x" to be entered in advance of the dates indicated in all of the relevant check boxes recognizing that the bunker delivery notes, required to be retained on board for a minimum period of three years, provide the subsequent means to check that a ship is actually operating in a manner consistent with the intent as given in section 2.3.

6 Identical replacement engines

Regulation 13
Nitrogen oxides (NO_x)

Regulation 13.1.1.2 reads as follows:

"Each marine diesel engine with a power output of more than 130 kW that undergoes a major conversion on or after 1 January 2000 except when demonstrated to the satisfaction of the Administration that such engine is an identical replacement to the engine that it is replacing and is otherwise not covered under paragraph 1.1.1 of this regulation."

Regulation 13.2.2 reads as follows:

"For a major conversion involving the replacement of a marine diesel engine with a non-identical marine diesel engine or the installation of an additional marine diesel engine, the standards in this regulation at the time of the replacement or addition of the engine shall apply."

Interpretation:

6.1 In regulation 13.1.1.2, the term "identical" (and hence, by application of the converse, in regulation 13.2.2 the term "non-identical") as applied to engines under regulation 13 should be taken as:

6.2 An "identical engine" is, as compared to the engine being replaced,[1] an engine which is of the same:

.1 design and model;

.2 rated power;

.3 rated speed;

.4 use;

.5 number of cylinders; and

.6 fuel system type (including, if applicable, injection control software):

.1 for engines without EIAPP certification, have the same NO_X critical components and settings;[2] or

[1] In those instances where the replaced engine will not be available to be directly compared with the replacing engine at the time of updating the Supplement to the IAPP Certificate reflecting that engine change it is to be ensured that the necessary records in respect of the replaced engine are available in order that it can be confirmed that the replacing engine represents "an identical engine".

[2] For engines without EIAPP Certification there will not be the defining NO_x critical component markings or setting values as usually given in the approved Technical File. Consequently, in these instances, the assessment of "... same NO_x critical components and settings ..." shall be established on the basis that the following components and settings are the same:

Fuel system:

.1 fuel pump model and injection timing; and

.2 injection nozzle model.

Charge air:

.1 configuration and, if applicable, turbocharger model and auxiliary blower specification; and

.2 Cooling medium (seawater/freshwater).

.2 for engines with EIAPP certification, belonging to the same Engine Group/Engine Family.

7 Time of replacement of an engine

Regulation 13
Nitrogen oxides (NO_x)

Regulation 13.2.2 reads as follows:

> "For a major conversion involving the replacement of a marine diesel engine with a non-identical marine diesel engine, or the installation of an additional marine diesel engine, the standards in this regulation at the time of the replacement or addition of the engine shall apply."

Interpretation:

7.1 The term "time of the replacement or addition" of the engine in regulation 13.2.2 should be taken as the date of:

.1 the contractual delivery date of the engine to the ship;[3] or

.2 in the absence of a contractual delivery date, the actual delivery date of the engine to the ship,[3] provided that the date is confirmed by a delivery receipt; or

.3 in the event the engine is fitted on board and tested for its intended purpose on or after six months from the date specified in sub-paragraphs of regulation 13.5.1.2, as appropriate, the actual date that the engine is tested on board for its intended purpose applies in determining the standards in this regulation in force at the time of the replacement or addition of the engine.

7.2 Entry of the date in paragraph 7.1 above, provided the conditions associated with those dates apply, should be made in the item 8.a "Major conversion – According to regulations 13.2.1.1 and 13.2.2" of the Supplement of IAPP Certificate.

7.3 If the engine is not tested within six months after the date specified in sub-paragraphs of regulation 13.5.1.2, as appropriate due to unforeseen circumstances beyond the control of the shipowner, then the provisions of "unforeseen delay in delivery" may be considered by the Administration in a manner similar to UI4 of MARPOL Annex I.

8 Engine changeover/on-off recording requirements

Regulation 13
Nitrogen oxides (NO_x)

Regulation 13.5.3 reads as follows:

> "The tier and on/off status of marine diesel engines installed on board a ship to which paragraph 5.1 of this regulation applies which are certified to both Tier II and Tier III or which are certified to Tier II only shall be recorded in such logbook or electronic record book as prescribed by the Administration at entry into and exit from a NO_x Tier III emission control area, or when the on/off status changes within such an area, together with the date, time and position of the ship."

[3] The engine is to be fitted on board and tested for its intended purpose within six months after the date specified in sub-paragraphs of regulation 13.5.1.2, as appropriate.

Interpretation:

8.1 For the application of this regulation:

.1 "marine diesel engines installed on board a ship to which paragraph 5.1 of this regulation applies" includes additional or replaced engines;[4] installed on or after the relevant emission control area takes effect;

.2 "certified to Tier II only" means a Tier II engine that is installed on board a ship which is constructed on or after the emission control area where the ship is operating takes effect;

.3 Tier II engines stipulated under the Tier II requirement of regulation 13.4, i.e. Tier II engines installed on board a ship constructed before the entry into force of the emission control area where the ship is operating, are not considered to be a "Tier II only" engine in the context of record keeping. Such exclusion is extended to Tier II engines replaced after the entry into force of the relevant emission control areas on board ships of this category, if the replacement engines meet resolution MEPC.230(65);

.4 if an engine installed on a ship constructed before the entry into force of the emission control area where the ship is operating has undergone a major conversion as described in regulation 13.2.1, those engines are to be Tier III engines; thus the above interpretation in .1 above applies; and

.5 recording is required for the Tier II engine operation in a NECA under the exemption according to regulation 13.5.4.

9 Application of sulphur limit to emergency equipment

Regulation 14
Sulphur oxides (SO_x) and particulate matter

Regulation 14.1 reads as follows:

"The sulphur content of fuel oil used or carried for use on board a ship shall not exceed 0.50% m/m."

Interpretation:

9.1 Regulation 14.1 of MARPOL Annex VI for the prohibition on the carriage of non-compliant fuel oil should be applied to the fuel oil of emergency equipment.

[4] Additional or replaced engine: refer to section 7.1 of MEPC.1/Circ.795/Rev.6.

10 VOC management plan

Regulation 15
Volatile organic compounds (VOCs)

Regulations 15.6 and 15.7 read as follows:

"6 A tanker carrying crude oil shall have on board and implement a VOC management plan approved by the Administration. Such a plan shall be prepared taking into account the guidelines developed by the Organization. The plan shall be specific to each ship and shall at least:

.1 provide written procedures for minimizing VOC emissions during the loading, sea passage and discharge of cargo;

.2 give consideration to the additional VOC generated by crude oil washing;

.3 identify a person responsible for implementing the plan; and

.4 for ships on international voyages, be written in the working language of the master and officers and, if the working language of the master and officers is not English, French or Spanish, include a translation into one of these languages.

7 This regulation shall also apply to gas carriers only if the types of loading and containment systems allow safe retention of non-methane VOCs on board or their safe return ashore.[5] "

***Interpretation*:**

10.1 The requirement for a VOC management plan applies only to a tanker carrying crude oil.

11 Continuous-feed type shipboard incinerators

Regulation 16
Shipboard incineration

Regulation 16.9 reads as follows:

"For incinerators installed in accordance with the requirements of paragraph 6.1 of this regulation the combustion chamber gas outlet temperature shall be monitored at all times the unit is in operation. Where that incinerator is of the continuous-feed type, waste shall not be fed into the unit when the combustion chamber gas outlet temperature is below 850°C. Where that incinerator is of the batch-loaded type, the unit shall be designed so that the combustion chamber gas outlet temperature shall reach 600°C within five minutes after start-up and will thereafter stabilize at a temperature not less than 850°C."

[5] Resolution MSC.30(61) on *International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk.*

***Interpretation*:**

11.1 For the application of this regulation, the term "waste shall not be fed into the unit" should be interpreted as follows:

> For continuous-feed incinerators solid waste shall not be fed into the unit when the combustion chamber flue gas outlet temperature is below 850°C. Sludge oil generated during normal operation of a ship should not be regarded as waste in connection with this regulation, and can be fed into the unit when the required preheat temperature of 650°C in the combustion chamber is achieved.

11.2 For the application of this regulation, the term "the unit shall be designed so that the combustion chamber gas outlet temperature shall reach 600°C within five minutes after start up" should be interpreted as follows:

> Batch loaded incinerators should be designed so that the temperature in the actual combustion space where the solid waste is combusted should reach 600°C within five minutes after start-up.

12 Applicability of the requirements for a bunker delivery note

Regulation 18
Fuel oil availability and quality

Regulation 18.5 reads as follows:

> "For each ship subject to regulations 5 and 6 of this Annex, details of fuel oil for combustion purposes delivered to and used on board shall be recorded by means of a bunker delivery note that shall contain at least the information specified in appendix V to this Annex."

Regulation 18.6 reads as follows:

> "The bunker delivery note shall be kept on board the ship in such a place as to be readily available for inspection at all reasonable times. It shall be retained for a period of three years after the fuel oil has been delivered on board."

Interpretation:

12.1 For the application of these regulations, they should be interpreted as being applicable to all ships of 400 gross tonnage or above and, at the Administration's discretion, to ships of less than 400 gross tonnage.

13 Application of regulation 18.3 for biofuel and synthetic fuel

Regulation 18
Fuel oil availability and quality

Regulation 18.3 reads as follows:

> "Fuel oil for combustion purposes delivered to and used on board ships to which this Annex applies shall meet the following requirements."

Interpretation

13.1 A fuel oil which is a blend of not more than 30% by volume of biofuel or synthetic fuel should meet the requirements of regulation 18.3.1 of MARPOL Annex VI. A fuel oil which is a blend of more than 30% by volume of biofuel or synthetic fuel should meet the requirements of regulation 18.3.2 of MARPOL Annex VI. For the purposes of this interpretation, a biofuel is a fuel oil which is derived from biomass and hence includes, but is not limited to, processed used cooking oils, fatty-acid-methyl-esters (FAME) or fatty-acid-ethyl-esters (FAEE), straight vegetable oils (SVO), hydrotreated vegetable oils (HVO), glycerol or other biomass to liquid (BTL) type products. For the purposes of this interpretation, a synthetic fuel is a fuel oil from synthetic or renewable sources similar in composition to petroleum distillate fuels. The Product Name, as entered onto the bunker delivery note, should be of sufficient detail to identify whether, and to what extent, a biofuel or a synthetic fuel is blended into the product as supplied.

Regulation 18.3.2.2 reads as follows:

> "fuel oil for combustion purposes derived by methods other than petroleum refining shall not cause an engine to exceed the applicable NO_X emission limit set forth in paragraphs 3, 4, 5.1.1 and 7.4 of regulation 13."

Interpretation

13.2 A marine diesel engine certified in accordance with the requirements of regulation 13 of MARPOL Annex VI, which can operate on a biofuel or a synthetic fuel or blends containing these fuels without changes to its NO_x critical components or settings/operating values outside those as given by that engine's approved Technical File, should be permitted to use such a fuel oil without having to undertake the assessment as given by regulation 18.3.2.2 of MARPOL Annex VI. For the purposes of this interpretation, parent engine emissions tests undertaken on DM or RM grade fuels to the ISO 8217:2005 standard, as required by paragraph 5.3.2 of the NO_x Technical Code, should be valid for all DM or RM grade fuels used in operation, or that the engine may be designed for, or capable of operation on, including those meeting the ISO 8217 standards superseding ISO 8217:2005.

13.3 Where fuel oils are derived from methods other than petroleum refining, or fuel oil which is a blend of more than 30% by volume of biofuel or synthetic fuel and does not fall under 13.2 of this unified interpretation, or other fuels required to undertake the assessment as given by regulation 18.3.2.2 of MARPOL Annex VI and for which have not been specifically certified in accordance with the regulation 13 limits at test bed for that specific fuel and Engine Group/Family, the following is interpreted as an acceptable route to demonstrate compliance with regulation 18.3.2.2:

.1 the ship's IAPP Certificate may continue to be issued where the overall NO_x emissions performance has been verified to not cause the specified engine to exceed the applicable NO_x emissions limit when burning said fuels using the onboard simplified measurement method in accordance with 6.3 of the NO_x Technical Code 2008, or the direct measurement and monitoring method in accordance with 6.4 of the NO_x Technical Code 2008, or by reference to relevant test-bed testing. For the purposes of this interpretation and demonstration of compliance with regulation 18.3.2.2 of MARPOL Annex VI, and as applicable to possible deviations when undertaking measurements on board, an allowance of 10% of the applicable limit may be accepted.

14 Confirmation of compliance for new ships

Regulation 5
Surveys

Regulation 5.4.5 reads as follows:

> "The Administration shall ensure that for each ship to which regulation 27 applies, the SEEMP complies with regulation 26.2 of this Annex. This shall be done prior to collecting data under regulation 27 of this Annex in order to ensure the methodology and processes are in place prior to the beginning of the ship's first reporting period. Confirmation of compliance shall be provided to and retained on board the ship."

Regulation 26
Ship Energy Efficiency Management Plan (SEEMP)

Regulation 26.2 reads as follows:

> "In the case of a ship of 5,000 gross tonnage and above, the SEEMP shall include a description of the methodology that will be used to collect the data required by regulation 27.1 of this Annex and the processes that will be used to report the data to the ship's Administration."

Interpretation:

14.1 Ships should keep on board both a SEEMP that is in compliance with regulation 26.2 and confirmation of compliance as required by regulation 5.4.5.

15 Boil-off gas consumed on board ships

Regulation 2
Definitions

Regulation 2.1.14 reads as follows:

> "*Fuel oil* means any fuel delivered to and intended for combustion purposes for propulsion or operation on board a ship, including gas, distillate and residual fuels."

Regulation 27
Collection and reporting of ship fuel oil consumption data

Regulation 27.1 reads as follows:

> "From calendar year 2019, each ship of 5,000 gross tonnage and above shall collect the data specified in appendix IX to this Annex, for that and each subsequent calendar year or portion thereof, as appropriate, according to the methodology included in the SEEMP."

Appendix IX
Information to be submitted to the IMO Ship Fuel Oil Consumption Database

Appendix IX reads as follows:

> "Fuel oil consumption, by fuel oil type in metric tonnes and methods used for collecting fuel oil consumption data".

Interpretation:

15.1 For Data relating to Boil-off Gas (BOG) consumed on board the ship for propulsion or operation (e.g. BOG used for propulsion, operational needs such as in a boiler, or burnt in a Gas Combustion Unit (GCU) for cargo tank pressure control or other operational purposes) is required to be collected and reported as fuel as part of the Ship Fuel Oil Consumption Data Collection System.

16 Access to the disaggregated data

Regulation 27
Collection and reporting of ship fuel oil consumption data

Regulation 27.8 reads as follows:

> "Except as provided for in paragraphs 4, 5 and 6 of this regulation, the disaggregated data that underlies the reported data noted in appendix IX to this Annex for the previous calendar year shall be readily accessible for a period of not less than 12 months from the end of that calendar year and be made available to the Administration upon request."

Interpretation:

16.1 The disaggregated data is not required to be kept on board the ship provided that the disaggregated data can be made available by the Company.

17 Requirements for reporting attained EEDI and relevant information

Regulation 22
Attained Energy Efficiency Design Index (attained EEDI)

Regulation 22.3 reads as follows:

> "For each ship subject to regulation 24 of this Annex, the Administration or any organization duly authorized by it shall report to the Organization the required and attained EEDI values and relevant information, taking into account the guidelines developed by the Organization, via electronic communication:
>
> .1 within seven months of completing the survey required under regulation 5.4 of this Annex; or
>
> .2 within seven months following 1 April 2022 for a ship delivered prior to 1 April 2022."

Interpretation:

17.1 For new ships that have completed the initial survey required in regulation 5.4.1 of MARPOL Annex VI on or after 1 April 2022, the EEDI data and relevant information shall be submitted within seven months after the completion date of the initial survey (in accordance with regulation 22.3.1).

17.2 For new ships that have completed the initial survey required in regulation 5.4.1 of MARPOL Annex VI prior to 1 April 2022:

.1 if they have not undergone a major conversion specified in regulation 5.4.2 or 5.4.3, the EEDI data and relevant information shall be submitted within seven months after 1 April 2022 (in accordance with regulation 22.3.2);

.2 if they have undergone a major conversion specified in regulation 5.4.2 or 5.4.3 on or after 1 April 2022, the EEDI data and relevant information of the major conversion shall be submitted within seven months after the completion date of general or partial survey required in regulation 5.4.2 or the initial survey required in regulation 5.4.3 (in accordance with regulation 22.3.1); and

.3 if they have completed a major conversion specified in regulation 5.4.2 or 5.4.3 prior to 1 April 2022, the EEDI data and relevant information of the major conversion shall be submitted within seven months after 1 April 2022 (in accordance with regulation 22.3.2).

17.3 For existing ships that have completed the initial survey required in regulation 5.4.3 of MARPOL Annex VI on or after 1 April 2022, the EEDI data and relevant information shall be submitted within seven months after the completion date of the initial survey (in accordance with regulation 22.3.1).

17.4 For existing ships that have completed the initial survey required in regulation 5.4.3 of MARPOL Annex VI prior to 1 April 2022, the EEDI data and relevant information shall be submitted within seven months after 1 April 2022 (in accordance with regulation 22.3.2).

17.5 For ships for which up-to-date EEDI data have already been reported to the Organization prior to 1 April 2022, the reporting of EEDI data and information shall not be required on or after 1 April 2022.

18 Inclusion of the annual operational CII and rating in the Statement of Compliance

Regulation 8
Form of Certificates and Statements of Compliance related to fuel oil consumption reporting and operational carbon intensity rating
Regulation 8.3 reads as follows:

> "The Statement of Compliance pursuant to regulations 6.6 and 6.7 of this Annex shall be drawn up in a form corresponding to the model given in appendix X to this Annex and shall be at least in English, French or Spanish. If an official language of the issuing Party is also used, this shall prevail in case of a dispute or discrepancy."

Interpretation:

18.1 The Statement of Compliance form given in appendix X of MARPOL Annex VI has been updated to include the attained annual operational CII and the rating for ships to which regulation 28 applies. The new form should be used from the entry into force date (1 November 2022); however the new parts for the attained CII and rating will not be populated until 2024 when the relevant values are available.

19 Ship Energy Efficiency Management Plan (SEEMP) Part III

Regulation 26
Ship Energy Efficiency Management Plan (SEEMP)

Regulation 26.3.1 reads as follows:

> "In the case of a ship of 5,000 gross tonnage and above, which falls into one or more of the categories in regulations 2.2.5, 2.2.7, 2.2.9, 2.2.11, 2.2.14 to 2.2.16, 2.2.22, and 2.2.26 to 2.2.29 of this Annex:
>
> .1 On or before 1 January 2023 the SEEMP shall include:
>
> .1 a description of the methodology that will be used to calculate the ship's attained annual operational CII required by regulation 28 of this Annex and the processes that will be used to report this value to the ship's Administration;
>
> .2 the required annual operational CII, as specified in regulation 28 of this Annex, for the next three years;
>
> .3 an implementation plan documenting how the required annual operational CII will be achieved during the next three years; and
>
> .4 a procedure for self-evaluation and improvement."

Interpretation:

19.1 A ship delivered after 1 January 2023 should comply with regulation 26.3.1 of MARPOL Annex VI at delivery. If delivered on 1 October or later, the following year will then be the first year of the three-year implementation plan and an inferior rating given, in accordance with regulation 28.6 of MARPOL Annex VI, for the remainder of the calendar year of delivery needs not to be counted in for the determination of whether the ship should develop a Corrective Action Plan required by regulation 26.3.2 of MARPOL Annex VI. Nothing in this interpretation relieves any ship of its reporting obligations under regulations 27 and 28 of MARPOL Annex VI.

19.2 A ship changing company, or changing from one Administration to another and from one company to another concurrently, after 1 January 2023 should comply with regulation 26.3.1 at change of company and a new SEEMP III will be required. The year of change should be the first year of the next three-year implementation plan.

19.3 In order to document how the required annual operational CII will be achieved during the next three years, the SEEMP Part III should be a rolling three-year plan, YYYY (first year of implementation plan), YYYY+1 and YYYY+2.

19.4 In the case of updating the SEEMP Part III on the elements in regulation 26.3.1 of MARPOL Annex VI, the original three-year plan may remain.

20 Plan of corrective actions to achieve the required annual operational CII

Regulation 28
Operational carbon intensity

Regulation 28.7 reads as follows:

> "A ship rated as D for three consecutive years or rated as E shall develop a plan of corrective actions to achieve the required annual operational CII."

Regulation 28.9 reads as follows:

> "A ship rated as D for three consecutive years or rated as E shall duly undertake the planned corrective actions in accordance with the revised SEEMP."

Interpretation:

20.1 In case an inferior rating is given for data collected in calendar year YYYY, the revised SEEMP, including the plan of corrective actions, should be verified in year YYYY+1, and it should be developed to achieve the required annual operational CII for data collected in the calendar year YYYY+2.

INTERNATIONAL MARITIME ORGANIZATION

E

4 ALBERT EMBANKMENT
LONDON SE1 7SR
Telephone: +44 (0)20 7735 7611 Fax: +44 (0)20 7587 3210

BWM.2/Circ.66/Rev.4
14 February 2023

INTERNATIONAL CONVENTION FOR THE CONTROL AND MANAGEMENT OF SHIPS' BALLAST WATER AND SEDIMENTS, 2004

Unified interpretations to the BWM Convention and the BWMS Code

1 The Marine Environment Protection Committee, at its seventy-ninth session (12 to 16 December 2022), approved a revised unified interpretation to regulation E-1.1.5 of the BWM Convention and the Form of the International Ballast Water Management Certificate, concerning commissioning testing of a ballast water management system which has undergone a major modification or an upgrade on board an existing ship in order to improve the performance of the BWMS and ensure compliance with the D-2 standard.

2 MEPC 79 also approved a unified interpretation to paragraph 4.10 of the BWMS Code, concerning requirements for the calibration of the BWMS components that take measurements.

3 The updated consolidated text of all existing unified interpretations to the BWM Convention and the BWMS Code, including those set out in BWM.2/Circ.66/Rev.3, is set out in annexes 1 and 2, respectively.

4 Member Governments and international organizations are invited to apply the annexed unified interpretations to the BWM Convention and the BWMS Code and bring them to the attention of all parties concerned.

5 This circular revokes BWM.2/Circ.66/Rev.3.

***

ANNEX 1

UNIFIED INTERPRETATIONS TO THE BWM CONVENTION

1 Date to be used for determining the implementation of mandatory commissioning testing of individual ballast water management systems in accordance with resolution MEPC.325(75)

Regulation E-1
Surveys

Regulations E-1.1.1 and E-1.1.5 read as follows:

> "1 An initial survey before the ship is put in service or before the Certificate required under regulation E-2 or E-3 is issued for the first time. This survey shall verify that the ballast water management plan required by regulation B-1 and any associated structure, equipment, systems, fittings, arrangements and material or processes comply fully with the requirements of this Convention. This survey shall confirm that a commissioning test has been conducted to validate the installation of any ballast water management system by demonstrating that its mechanical, physical, chemical and biological processes are working properly, taking into account the guidelines developed by the Organization.*
>
> 5 An additional survey, either general or partial, according to the circumstances, shall be made after a change, replacement, or significant repair of the structure, equipment, systems, fittings, arrangements and material necessary to achieve full compliance with this Convention. The survey shall be such as to ensure that any such change, replacement or significant repair has been effectively made, so that the ship complies with the requirements of this Convention. When an additional survey is undertaken for the installation of any ballast water management system, this survey shall confirm that a commissioning test has been conducted to validate the installation of the system by demonstrating that its mechanical, physical, chemical and biological processes are working properly, taking into account the guidelines developed by the Organization.*

* Refer to the *2020 Guidance for the commissioning testing of ballast water management systems* (BWM.2/Circ.70/Rev.1), as amended."

Interpretation:

1.1 Irrespective of new ships under construction subject to regulation E-1.1.1 or existing ships retrofitting ballast water management system(s) (BWMS) on board subject to regulation E-1.1.5, the commissioning testing of individual BWMS taking into account the guidelines developed by the Organization* should be conducted if the initial or additional survey is completed on or after 1 June 2022. If the initial or additional survey is completed before 1 June 2022, the commissioning testing of individual BWMS remains subject to the specific requirements of the Administration(s).

1.2 In case an installed BWMS on board a ship undergoes an upgrade or change to a major component as defined under paragraph 3.9 of the BWMS Code, the BWMS should be regarded as a newly installed BWMS. A commissioning test should be conducted in accordance with regulation E-1.1.5 of the BWM Convention and an International Ballast Water Management Certificate (IBWMC) for that ship should be re-issued accordingly.

* Refer to the *2020 Guidance for the commissioning testing of ballast water management systems* (BWM.2/Circ.70/Rev.1), as amended.

2 "Date installed" in relation to "Method of ballast water management used"

Appendix I
Form of the International Ballast Water Management Certificate

The following information regarding "Details of ballast water management method(s) used" is to be provided on the certificate:

"Method of ballast water management used .....
Date installed (if applicable) (dd/mm/yyyy) .....
Name of manufacturer (if applicable) ....."

Interpretation:

2.1 For the purpose of completing the International Ballast Water Management Certificate, the date when the latest commissioning has been completed in accordance with section 8 of the BWMS Code (resolution MEPC.300(72)) should be used.

2.2 Notwithstanding the above, it should be noted that, with regard to the deadline for installing a ballast water management system, operative paragraph 5 of resolution MEPC.300(72) (*Code for Approval of Ballast Water Management Systems*) is as follows:

> "5 RESOLVES that, for the purpose of operative paragraph 4 of this resolution, the word "installed" means the contractual date of delivery of the ballast water management system to the ship. In the absence of such a date, the word "installed" means the actual date of delivery of the ballast water management system to the ship;"

2.3 Consequently, two dates, i.e. the contractual date of delivery or the actual date of delivery, and the date following the latest commissioning and operation, may exist in relation to installing a ballast water management system.

3 Principal ballast water management method(s) employed on the ship

Appendix I
Form of the International Ballast Water Management Certificate

Appendix I of the BWM Convention reads as follows:

"…Method of ballast water management used .....
Date installed (if applicable) (dd/mm/yyyy) .....
Name of manufacturer (if applicable) .....

The principal ballast water management method(s) employed on this ship is/are:

☐ in accordance with regulation D-1
☐ in accordance with regulation D-2
(describe) .....
☐ the ship is subject to regulation D-4
☐ other approach in accordance with regulation....."

Interpretation:

3.1 For a ship which is occasionally engaged in an international voyage and is not intending to discharge ballast water back to the original location, having been granted an exemption by its Administration, taking into account BWM.2/Circ.52/Rev.1, on the condition that the ship implements the D-1 standard in lieu of the D-2 standard, the principal ballast water management method(s) employed is:

"☒ other approach in accordance with regulation D-1 taking into account BWM.2/Circ.52/Rev.1."

3.2 For a ship granted an exemption in accordance with regulation A-4 of the BWM Convention, the principal ballast water management method employed on the ship is:

"☒ other approach in accordance with regulation A-4 ."

3.3 For a ship which is fitted with a BWMS on board and is certified in accordance with the D-2 standard, even if the ship will also use other ballast water management methods as contingency measures, as reflected in its Ballast Water Management Plan, the principal ballast water management method employed on this ship is:

"☒ in accordance with regulation D-2
(describe) ..... "

3.4 For a ship which has employed an "other approach" in accordance with regulation B-3.6 or B-3.7 of the BWM Convention, the Ballast Water Management Plan should describe the other approach that has been approved for the ship.

3.5 In the case of an Administration that requires its ships which are subject to equivalent compliance under regulation A-5 to carry International Ballast Water Management Certificates, those certificates should refer to regulation A-5 in the item "other approach" as their principal ballast water management method employed.

***

ANNEX 2

UNIFIED INTERPRETATIONS TO THE BWMS CODE

1 Requirements for the calibration of the BWMS components that take measurements

Chapter 4
Technical specifications

Paragraph 4.10 reads as follows:

> "4.10 Facilities shall be provided for checking, at the renewal surveys and according to the manufacturer's instructions, the performance of the BWMS components that take measurements. A calibration certificate certifying the date of the last calibration check shall be retained on board for inspection purposes. Only the manufacturer or persons authorized by the manufacturer shall perform the accuracy checks."

Interpretation:

1.1 For BWMS components that take measurements, the interval for an accuracy check/calibration (or replacement of a sensor in case it cannot be calibrated) should not be mandatorily linked to the survey scheme for the BWMS, even though a validity check of calibration certificates should be conducted at BWM annual/intermediate/renewal surveys. The accuracy check/calibration of BWMS components that take measurements should be performed in accordance with the calibration procedure at intervals specified in the manufacturer's instructions.

_____