MARITIME AND PORT AUTHORITY OF SINGAPORE
SHIPPING CIRCULAR
NO. 8 OF 2019

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Applicable to: Shipowners, shipmanagers, operators, agents, surveyors and masters of Singapore-registered ships

RESOLUTIONS ADOPTED BY THE 72nd AND 73rd SESSION OF THE MARITIME ENVIRONMENT PROTECTION COMMITTEE (MEPC 72 AND MEPC 73) OF THE IMO

1. This circular informs the Shipping Community of the resolutions adopted by MEPC 72 and 73 [1] and urges the shipping community to prepare for the implementation of these resolutions.

2. The mandatory resolutions adopted by **MEPC 72** include the following:

a. Resolution MEPC.296(72) - **Amendments to Regulation A-1 and D-3 of the International Convention for the Control and Management of Ship's Ballast Water and Sediments, 2004**

*Amendments to Regulation A-1 (Definitions) and Regulation D-3 (Approval requirements for ballast water management systems) will enter into force on **13 October 2019**, and will be given effect through amendments to the Prevention of Pollution of the Sea (Ballast Water Management) Regulations. A new definition for BWMS Code is incorporated in Regulation A-1. Regulation D-3 requires ballast water management systems used to comply with the Convention, to be approved by the Administration as follows:*

.1 ballast water management systems installed on or after 28 October 2020 shall be approved in accordance with the BWMS Code, as may be amended; and

[1] The 72nd and 73rd session of Maritime Environment Protection Committee (MEPC 72 and MEPC 73) was held in IMO headquarter on 9 to 13 April 2018 and 22 to 26 October 2018 respectively.

.2 ballast water management systems installed before 28 October 2020 shall be approved taking into account the guidelines developed by the Organization or the BWMS Code, as may be amended.

b. Resolution MEPC.297(72) - **Amendments to Regulation B-3 of the International Convention for the Control and Management of Ship's Ballast Water and Sediments, 2004**

*Amendments to Regulation B3 will enter into force on **13 October 2019.** This amendment will be incorporated in the Prevention of Pollution of the Sea (Ballast Water Management) Regulations 2017 under the second schedule. This regulation essentially requires existing ships to comply with Regulation D-2 of the Ballast Water Management Convention at the renewal survey as determined by the Committee (which is the renewal survey associated with the ships International Oil Pollution Prevention Certificate) following the date of entry into force of the Ballast Water Management Convention. A ship constructed on or after 8 September 2017 shall conduct ballast water management that at least meets the standard described in regulation D-2. A ship constructed before 8 September 2017 to which the renewal survey as determined by the Committee (which is the renewal survey associated with the ships International Oil Pollution Prevention Certificate) does not apply, shall comply with Regulation D-2 from the date decided by the Administration, but not later than 8 September 2024.*

c. Resolution MEPC.299(72) – **Amendments to Regulations E-1 and E-5 of the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004.**

*Amendments to Regulation E-1 (Surveys) and Regulation E-5 (Duration and validity of the Certificate) will enter into force on **13 October 2019**, and will be given effect through amendments to the Prevention of Pollution of the Sea (Ballast Water Management) Regulations. Under the amended Regulation E-1 and Regulation E-5, an "additional survey" carried out onboard ships for the Ballast Water Management Convention is not required to be endorsed in the International Ballast Water Management Certificate.*

d. Resolution MEPC.300(72) – **Code for Approval of Ballast Water Management Systems (BWMS).**

Under this resolution, the BWMS Code was approved by the Committee. The BWMS Code will take effect on 13 October 2019 upon entry into force of the associated amendments to the BWM Convention. The 2016 Guidelines for approval of ballast water management systems (G8) adopted by resolution MEPC.279(70) shall be revoked when the BWMS Code takes effect. BWMS approved taking into account the 2016 Guidelines for

approval of ballast water management systems (G8) adopted by resolution MEPC.279(70) shall be deemed to be in accordance with the BWMS Code.

e. Resolution MEPC.301(72) – **Amendments to MARPOL Annex VI (ECAs and Required EEDI for RO-RO cargo and RO-RO passenger ships.**

*This resolution adopts amendments to regulation 13 (Nitrogen Oxides) and regulation 21 (Required EEDI) of MARPOL Annex VI. The former clarifies that the emission control area in regulation 13 refers to a NO_X Tier III emission control area. The latter provides amended parameters for the determination of EEDI reference values for RO-RO cargo and RO-RO passenger ships. The amendments are expected to enter into force on **1 September 2019**, and will be given effect through amendments to the Prevention of Pollution of the Sea (Air) Regulations.*

f. Resolution MEPC.302(72) – **Amendments to the International Code for the Construction and Equipment of ships carrying Dangerous Chemicals in Bulk (IBC Code).**

*This resolution adopts amendments to the IBC Code concerning the Model form of the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk. The amendments are expected to enter into force on **1 January 2020**.*

g. Resolution MEPC.303(72) – **Amendments to the Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (BCH Code).**

*This resolution adopts amendments to the BCH Code concerning the Model form of the Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk. The amendments are expected to enter into force on **1 January 2020**.*

3. **MEPC 72** also adopted the following resolutions:

a. Resolution MEPC.298(72) - **Determination of the survey referred to in Regulation B-3, as amended, of the BWM Convention.**

With this resolution the Committee determined that the renewal survey referred to in paragraph 10 of Regulation B-3 of the BWM Convention is the renewal survey for the ship associated with the International Oil Pollution Prevention Certificate pursuant to Annex I of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL).

b. Resolution MEPC.304(72) – **Initial IMO Strategy on Reduction of GHG emission from ships.**

This resolution adopts the Initial IMO Strategy on Reduction of GHG Emissions from Ships. The initial IMO Strategy is kept under review, with a view to adopt a Revised IMO Strategy on reduction of GHG emissions from ships in 2023.

4. The mandatory resolution adopted by **MEPC 73** includes the following:

a. Resolution MEPC.305(73) - **Amendments to MARPOL Annex VI.**

*This resolution adopts amendments to regulation 14 (Sulphur Oxides) and Appendix I (Supplement to International Air Pollution Prevention Certificate) of MARPOL Annex VI to prohibit the carriage of non-compliant fuel oil for combustion purposes for propulsion or operation on board a ship. The amendments are expected to enter into force on **1 March 2020**, and will be given effect through amendments to the Prevention of Pollution of the Sea (Air) Regulations.*

5. **MEPC 73** also adopted the following resolutions:

a. Resolution MEPC.306(73) – **Amendments to the Guidelines for Ballast Water Management and Development of Ballast Water Management Plan (G4) (Resolution MEPC.127(53)).**

Under this amendment to the Guidelines for Ballast Water Management and Development of Ballast Water Management Plan (G4), a new paragraph 4.3 was included in part B of the Guidelines which reads as follows "4.3 The ballast water management plan may include contingency measures developed taking into account guidelines developed by the Organization." The Guidance on contingency measures under the Ballast Water Management Convention is promulgated via BWM.2/Circ.62, as may be amended.*

b. Resolution MEPC.307(73) – **2018 Guidelines for the Discharge of Exhaust Gas Recirculation (EGR) Bleed-Off Water.**

This resolution specifies the requirements for the discharge to the sea of bleed-off water when using EGR.

c. Resolution MEPC.308(73) – **2018 Guidelines on the Method of Calculation of the Attained Energy Efficiency Design Index (EEDI) for New Ships.**

This resolution provides guidance for calculating the attained EEDI for new ships. This guidance should be taken into account when implementing regulation 20 (Attained EEDI) of MARPOL Annex VI. This guidance supersedes the 2014 Guidelines adopted by resolution MEPC.245(66), as amended by resolution MEPC.263(66) and MEPC.281(70), and MEPC.1/Circ.866.

d. Resolution MEPC.309(73) – **Amendments to the 2014 Guidelines on Survey and Certification of the Energy Efficiency Design Index (EEDI) (Resolution MEPC.254(67)), as amended by Resolution MEPC.261(68)).**

This resolution adopts amendments to the 2014 Guidelines on survey and certification of the Energy Efficiency Design Index (EEDI). This guidance should be taken into account when implementing regulation 5 (Surveys) of MARPOL Annex VI.

e. Resolution MEPC.310(73) – **Action Plan to Address Marine Plastic Litter from Ships.**

This resolution contains the action plan to address marine plastic litter from ships, including fishing vessels. This action plan will be kept under review with a view to assessing, in 2023, the effectiveness of the actions within the action plan against the intended outcomes.

f. Resolution MEPC.311(73) – **2018 Guidelines for the Application of MARPOL Annex I Requirements to Floating, Production, Storage and Offloading Facilities (FPSOs) and Floating Storage Units (FSUs).**

This resolution provides guidance when applying the relevant requirements of MARPOL Annex I to FPSOs and FSUs.

6. In addition to the adoption of resolutions, the following Unified Interpretations (UI) of MARPOL were also approved by **MEPC 72** and **MEPC 73**:

a. BWM.2/Circ.66 – Unified Interpretations of Appendix I (Form of the International Ballast Water Management Certificate) of the BWM Convention.

b. MEPC.1/Circ.795/Rev.3 – Unified Interpretations of regulations 2.9, 5.4.5, 22.2, 22.3, 22A.1, 22A.8 and appendix IX of MARPOL Annex VI concerning confirmation of compliance for new ships, boil-off gas consumed on board ships and access to the disaggregated data.

7. The Unified Interpretations (UI) listed in paragraph 6 are acceptable to MPA and should be applied with immediate effect.

8. Any queries relating to this circular should be directed to Mr Ho Sin Gian (Tel: 6375 2424) and Mr Princet Ang (Tel: 6375 6259).

CAPT DAKNASH GANASEN
DIRECTOR OF MARINE
MARITIME AND PORT AUTHORITY OF SINGAPORE

ANNEX 1

RESOLUTION MEPC.296(72)
(adopted on 13 April 2018)

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

Amendments to regulations A-1 and D-3
(Code for Approval of Ballast Water Management Systems (BWMS Code))

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 article 19 of the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (the BWM Convention), which specifies the amendment procedure and confers upon the Marine Environment Protection Committee of the Organization the function of considering amendments thereto for adoption by the Parties,

NOTING ALSO resolution MEPC.300(72), by which it adopted the Code for Approval of Ballast Water Management Systems (BWMS Code),

HAVING CONSIDERED, at its seventy-second session, proposed amendments to regulations A-1 and D-3 of the BWM Convention to make the provisions of the BWMS Code mandatory,

1 ADOPTS, in accordance with article 19(2)(c) of the BWM Convention, amendments to regulations A-1 and D-3, the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with article 19(2)(e)(ii) of the BWM Convention, that the amendments shall be deemed to have been accepted on 13 April 2019 unless, prior to that date, more than one-third of the Parties have notified the Secretary-General that they object to the amendments;

3 INVITES the Parties to note that, in accordance with article 19(2)(f)(ii) of the BWM Convention, the said amendments shall enter into force on 13 October 2019 upon their acceptance in accordance with paragraph 2 above;

4 REQUESTS the Secretary-General, for the purposes of article 19(2)(d) of the BWM Convention, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Parties to the BWM Convention;

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

6 REQUESTS FURTHER the Secretary-General to prepare a consolidated certified text of the BWM Convention.

ANNEX

AMENDMENTS TO THE ANNEX TO THE BWM CONVENTION

(BWMS Code)

Section A – General provisions

Regulation A-1 – Definitions

1 A new paragraph 8 is added as follows:

"8 "BWMS Code" means the *Code for Approval of Ballast Water Management Systems* adopted by resolution MEPC.300(72), as may be amended by the Organization, provided that such amendments are adopted and brought into force in accordance with article 19 of the present Convention relating to amendment procedures applicable to the Annex."

Section D – Standards for ballast water management

Regulation D-3 – Approval requirements for ballast water management systems

2 Paragraph 1 is replaced with the following:

"1 Except as specified in paragraph 2, ballast water management systems used to comply with this Convention shall be approved by the Administration as follows:

.1 ballast water management systems installed[1] on or after 28 October 2020 shall be approved in accordance with the BWMS Code, as may be amended; and

.2 ballast water management systems installed[1] before 28 October 2020 shall be approved taking into account the guidelines[2] developed by the Organization or the BWMS Code, as may be amended."

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1 Refer to paragraph 2 of the Unified interpretation of appendix I (Form of the International Ballast Water Management Certificate) of the BMW Convention related to "date installed" contained in BWM.2/Circ.66.

2 Refer to resolutions MEPC.125(53), MEPC.174(58) or MEPC.279(70), as appropriate."

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ANNEX 2

RESOLUTION MEPC.297(72)
(adopted on 13 April 2018)

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

Amendments to regulation B-3

(Implementation schedule of ballast water management for 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 conferred upon it by international conventions for the prevention and control of marine pollution from ships,

NOTING article 19 of the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (the BWM Convention), which specifies the amendment procedure and confers upon the Marine Environment Protection Committee of the Organization the function of considering amendments thereto for adoption by the Parties,

HAVING CONSIDERED, at its seventy-second session, proposed amendments to regulation B-3 of the BWM Convention concerning the implementation schedule of ballast water management for ships,

RECALLING resolution MEPC.287(71), by which it resolved that the Parties should implement the amended regulation B-3 immediately after the entry into force of the BWM Convention, in lieu of the implementation schedule recommended in resolution A.1088(28) on the application of the BWM Convention and notwithstanding the schedule set forth in regulation B-3, with a view to avoiding the creation of a dual treaty regime during the time period between the entry into force of the BWM Convention and the entry into force of the amended regulation B-3,

1 ADOPTS, in accordance with article 19(2)(c) of the BWM Convention, amendments to regulation B-3, the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with article 19(2)(e)(ii) of the BWM Convention, that the amendments shall be deemed to have been accepted on 13 April 2019 unless, prior to that date, more than one-third of the Parties have notified the Secretary-General that they object to the amendments;

3 INVITES the Parties to note that, in accordance with article 19(2)(f)(ii) of the BWM Convention, the said amendments shall enter into force on 13 October 2019 upon their acceptance in accordance with paragraph 2 above;

4 REQUESTS the Secretary-General, for the purposes of article 19(2)(d) of the BWM Convention, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Parties to the BWM Convention;

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

6 REQUESTS FURTHER the Secretary-General to prepare a consolidated certified text of the BWM Convention.

ANNEX

AMENDMENTS TO THE ANNEX TO THE BWM CONVENTION

(Implementation schedule of ballast water management for ships)

Section B – Management and control requirements for ships

Regulation B-3 – Ballast water management for ships

1 The text of regulation B-3 is replaced with the following:

"1 A ship constructed before 2009:

.1 with a ballast water capacity of between 1,500 and 5,000 cubic metres, inclusive, shall conduct ballast water management that at least meets the standard described in regulation D-1 or regulation D-2 until the renewal survey described in paragraph 10, after which time it shall at least meet the standard described in regulation D-2;

.2 with a ballast water capacity of less than 1,500 or greater than 5,000 cubic metres shall conduct ballast water management that at least meets the standard described in regulation D-1 or regulation D-2 until the renewal survey described in paragraph 10, after which time it shall at least meet the standard described in regulation D-2.

2 A ship constructed in or after 2009 and before 8 September 2017 with a ballast water capacity of less than 5,000 cubic metres shall conduct ballast water management that at least meets the standard described in regulation D-2 from the date of the renewal survey described in paragraph 10.

3 A ship constructed in or after 2009, but before 2012, with a ballast water capacity of 5,000 cubic metres or more shall conduct ballast water management in accordance with paragraph 1.2.

4 A ship constructed in or after 2012 and before 8 September 2017 with a ballast water capacity of 5,000 cubic metres or more shall conduct ballast water management that at least meets the standard described in regulation D-2 from the date of the renewal survey described in paragraph 10.

5 A ship constructed on or after 8 September 2017 shall conduct ballast water management that at least meets the standard described in regulation D-2.

6 The requirements of this regulation do not apply to ships that discharge ballast water to a reception facility designed taking into account the Guidelines developed by the Organization for such facilities.

7 Other methods of ballast water management may also be accepted as alternatives to the requirements described in paragraphs 1 to 5 and paragraph 8, provided that such methods ensure at least the same level of protection to the environment, human health, property or resources, and are approved in principle by the Committee.

8 A ship constructed before 8 September 2017 to which the renewal survey described in paragraph 10 does not apply, shall conduct ballast water management that at least meets the standard described in regulation D-2 from the date decided by the Administration, but not later than 8 September 2024.

9 A ship subject to paragraphs 2, 4 or 8 will be required to comply with either regulation D-1 or regulation D-2, until such time as it is required to comply with regulation D-2.

10 Notwithstanding regulation E-1.1.2, the renewal survey referred to in paragraphs 1.1, 1.2, 2 and 4 is:

.1 the first renewal survey, as determined by the Committee,[1] on or after 8 September 2017 if:

.1 this survey is completed on or after 8 September 2019; or

.2 a renewal survey is completed on or after 8 September 2014 but prior to 8 September 2017; and

.2 the second renewal survey, as determined by the Committee,[1] on or after 8 September 2017 if the first renewal survey on or after 8 September 2017 is completed prior to 8 September 2019, provided that the conditions of paragraph 10.1.2 are not met."

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[1] Reference is made to resolution MEPC.298(72).

ANNEX 4

RESOLUTION MEPC.299(72)
(adopted on 13 April 2018)

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

Amendments to regulations E-1 and E-5

(Endorsements of additional surveys on the International Ballast Water Management Certificate)

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 article 19 of the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (the BWM Convention), which specifies the amendment procedure and confers upon the Marine Environment Protection Committee of the Organization the function of considering amendments thereto for adoption by the Parties,

HAVING CONSIDERED, at its seventy-second session, proposed amendments to regulations E-1 and E-5 of the BWM Convention concerning endorsements of additional surveys on the International Ballast Water Management Certificate,

1 ADOPTS, in accordance with article 19(2)(c) of the BWM Convention, amendments to regulations E-1 and E-5, the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with article 19(2)(e)(ii) of the BWM Convention, that the amendments shall be deemed to have been accepted on 13 April 2019 unless, prior to that date, more than one-third of the Parties have notified the Secretary-General that they object to the amendments;

3 INVITES the Parties to note that, in accordance with article 19(2)(f)(ii) of the BWM Convention, the said amendments shall enter into force on 13 October 2019 upon their acceptance in accordance with paragraph 2 above;

4 INVITES FURTHER the Parties to consider the application of the aforesaid amendments to the BWM Convention as soon as possible to ships entitled to fly their flag;

5 REQUESTS the Secretary-General, for the purposes of article 19(2)(d) of the BWM Convention, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Parties to the BWM Convention;

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

7 REQUESTS FURTHER the Secretary-General to prepare a consolidated certified text of the BWM Convention.

ANNEX

AMENDMENTS TO THE ANNEX TO THE BWM CONVENTION

(Endorsements of additional surveys on the International Ballast Water Management Certificate)

Section E – Survey and certification requirements for ballast water management

Regulation E-1 – Surveys

1 In paragraph 1.5, the last sentence "Such surveys shall be endorsed on the Certificate issued under regulation E-2 and E-3" is deleted.

Regulation E-5 – Duration and validity of the Certificate

2 In the chapeau of paragraph 8, the words "annual survey" are replaced by "annual or intermediate survey".

3 In paragraph 8.3, the words "annual surveys" are replaced by "annual or intermediate surveys".

4 The existing paragraph 9.1 is deleted and the existing paragraphs 9.2 to 9.4 are renumbered as paragraphs 9.1 to 9.3, respectively.

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ANNEX 5

RESOLUTION MEPC.300(72)
(adopted on 13 April 2018)

CODE FOR APPROVAL OF BALLAST WATER MANAGEMENT SYSTEMS
(BWMS CODE)

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 D-3 of the Annex to the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (the BWM Convention), provides that ballast water management systems used to comply with the Convention must be approved by the Administration,

NOTING ALSO that it adopted, by resolution MEPC.125(53), *Guidelines for approval of ballast water management systems* (Guidelines (G8)), and by resolutions MEPC.174(58) and MEPC.279(70) revisions thereof,

DESIRING to make the Guidelines (G8) mandatory under the BWM Convention in the form of a code for approval of ballast water management systems,

NOTING resolution MEPC.296(72), by which it adopted amendments to regulations A-1 and D-3 of the BWM Convention to make the provisions of the Code for Approval of Ballast Water Management Systems referred to above mandatory,

RECALLING that it agreed, at its sixty-eighth session, to provisions for non-penalization of early movers that have installed ballast water management systems approved taking into account resolutions MEPC.125(53) and MEPC.174(58), as contained in the Roadmap for the implementation of the BWM Convention,

BEARING IN MIND the Organization's established practice with regard to the validity of type approval certification for marine products (MSC.1/Circ.1221), which is that the Type Approval Certificate itself has no influence on the operational validity of existing ballast water management systems approved and installed on board a ship and manufactured during the period of validity of the relevant Type Approval Certificate, meaning that the system need not be renewed or replaced due to expiration of such Certificate,

HAVING CONSIDERED, at its seventy-second session, the draft Code for Approval of Ballast Water Management Systems,

1 ADOPTS the *Code for Approval of Ballast Water Management Systems (BWMS Code)*, as set out in the annex to the present resolution;

2 INVITES Parties to the BWM Convention to note that the BWMS Code will take effect on 13 October 2019 upon entry into force of the associated amendments to the BWM Convention;

3 AGREES to keep the BWMS Code under review in the light of experience gained with its application and to amend it as necessary;

4 DECIDES that ballast water management systems approved not later than 28 October 2018, taking into account the Guidelines (G8) adopted by resolution MEPC.174(58), may be installed on board ships before 28 October 2020;

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;

6 RESOLVES that references to the Guidelines (G8) and 2016 Guidelines (G8) in existing IMO instruments should be read to mean references to the BWMS Code;

7 AGREES that the dates referenced in this resolution will be considered in any reviews carried out in accordance with regulation D-5 of the BWM Convention, to determine whether a sufficient number of appropriate technologies are approved and available;

8 RESOLVES to revoke the *2016 Guidelines for approval of ballast water management systems* (G8) adopted by resolution MEPC.279(70) when the BWMS Code takes effect;

9 REQUESTS the Secretary-General to transmit certified copies of the present resolution and the text of the BWMS Code contained in the annex to all Parties to the BWM Convention;

10 REQUESTS FURTHER the Secretary-General to transmit copies of the present resolution and the text of the BWMS Code contained in the annex to the Members of the Organization which are not Parties to the BWM Convention.

ANNEX

CODE FOR APPROVAL OF BALLAST WATER MANAGEMENT SYSTEMS (BWMS CODE)

Contents

1 INTRODUCTION

General

1.1 The Code for Approval of Ballast Water Management Systems (BWMS Code) is aimed primarily at Administrations, or their designated bodies, in order to assess whether ballast water management systems (BWMS) meet the standard set out in regulation D-2 of the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (the Convention). In addition, the Code is intended for manufacturers and shipowners as a reference on the evaluation procedure that equipment will undergo and the requirements placed on BWMS. The Code should be applied in an objective, consistent and transparent way and its application should be evaluated periodically by the Organization.

1.2 Articles and regulations referred to in this Code are those contained in the Convention.

1.3 The Code includes general requirements concerning the design, installation, performance, testing, environmental acceptability, technical procedures for evaluation and procedures for issuance of Type Approval Certificates of BWMS and reporting to the Organization.

1.4 The Code is intended to fit within an overall framework for evaluating the performance of systems that includes the experimental shipboard evaluation of prototype systems under the provisions of regulation D-4, approval of BWMS and associated systems that comply fully with the requirements of the Convention, and port State control sampling for compliance under the provisions of article 9 of the Convention.

1.5 The approval requirements of regulation D-3 stipulate that BWMS used to comply with the Convention must be approved by the Administration, in accordance with this Code. In addition to such BWMS approval, as set forth in regulation A-2 and regulation B-3, the Convention requires that discharges of ballast water from ships must meet the regulation D-2 performance standard on an on-going basis. Approval of a system is intended to screen out BWMS that would fail to meet the standards prescribed in regulation D-2 of the Convention. Approval of a system, however, does not ensure that a given system will work on all ships or in all situations. To satisfy the Convention, a discharge must comply with the D-2 standard throughout the life of the ship.

1.6 BWMS shall be designed to not impair the health and safety of the ship or personnel, nor to present any unacceptable harm to the environment or to public health.

1.7 BWMS shall meet the standards of regulation D-2 and the conditions established in regulation D-3 of the Convention. The Code serves to evaluate the safety, environmental acceptability, practicability and biological effectiveness of the systems designed to meet these standards and conditions. The cost effectiveness of type-approved equipment will be used in determining the need for revisions of the Code.

1.8 To achieve consistency in its application, the approval procedure requires that a uniform manner of testing, analysis of samples, and evaluation of results is developed and applied. Amendments to this Code shall be duly circulated by the Secretary-General. Due consideration shall be given to the practicability of the BWMS.

Goal and purpose

1.9 The goal of the Code is to ensure uniform and proper application of the standards contained in the Convention. As such the Code should be updated as the state of knowledge and technology may require.

1.10 The purpose of the Code is to provide a uniform interpretation and application of the requirements of regulation D-3 and to:

.1 define test and performance requirements for the approval of BWMS;

.2 set out appropriate design, construction and operational parameters necessary for the approval of BWMS;

.3 provide direction to Administrations, equipment manufacturers and shipowners in determining the suitability of equipment to meet the requirements of the Convention and of the environmental acceptability of treated water; and

.4 ensure that BWMS approved by Administrations are capable of achieving the standard of regulation D-2 in land-based and shipboard evaluations and do not cause unacceptable harm to the ship, the crew, the environment or public health.

Applicability

1.11 This Code applies to the approval of BWMS in accordance with the Convention.

1.12 This Code applies to BWMS intended for installation on board all ships required to comply with regulation D-2.

1.13 BWMS approved taking into account the 2016 Guidelines (G8) adopted by resolution MEPC.279(70) shall be deemed to be in accordance with the BWMS Code.

2 BACKGROUND

2.1 The requirements of the Convention relating to approval of BWMS used by ships are set out in regulation D-3.

2.2 Regulation D-2 stipulates that ships conducting ballast water management in accordance with the ballast water performance standard of the Convention shall discharge:

.1 less than 10 viable organisms per cubic metre greater than or equal to 50 µm in minimum dimension;

.2 less than 10 viable organisms per millilitre less than 50 µm in minimum dimension and greater than or equal to 10 µm in minimum dimension; and

.3 less than the following concentrations of indicator microbes, as a human health standard:

.1 Toxicogenic *Vibrio cholerae* (serotypes O1 and O139) with less than 1 colony forming unit (cfu) per 100 mL or less than 1 cfu per 1 g (wet weight) of zooplankton samples;

.2 *Escherichia coli* less than 250 cfu per 100 mL; and

.3 Intestinal Enterococci less than 100 cfu per 100 mL.

3 DEFINITIONS

For the purpose of this Code:

3.1 *Active Substance* means a substance or organism, including a virus or a fungus, that has a general or specific action on or against harmful aquatic organisms and pathogens.

3.2 *Ballast water management system* (BWMS) means any system which processes ballast water such that it meets or exceeds the ballast water performance standard in regulation D-2. The BWMS includes ballast water treatment equipment, all associated control equipment, piping arrangements as specified by the manufacturer, control and monitoring equipment and sampling facilities. For the purpose of this Code, BWMS does not include the ship's ballast water fittings, which may include piping, valves, pumps, etc., that would be required if the BWMS was not fitted.

3.3 *Ballast water management plan* means the plan referred to in regulation B-1 of the Convention describing the ballast water management process and procedures implemented on board individual ships.

3.4 *Control and monitoring equipment* means the equipment installed for the effective operation and control of the BWMS and the assessment of its effective operation.

3.5 *Convention* means the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004.

3.6 *Failed test cycle* is a valid test cycle in which the performance of the BWMS resulted in treated water that is determined to be non-compliant with the standard set within regulation D-2. A failed test cycle interrupts the required consecutive test cycles and terminates the test.

3.7 *Invalid test cycle* is a test cycle in which, due to circumstances outside the control of the BWMS, the requirements for a valid test cycle are not met. When a test cycle is invalid, it does not count as one of the required consecutive test cycles in a test and the test can be continued.

3.8 *Land-based testing* means a test of the BWMS carried out in a laboratory, equipment factory or pilot plant including a moored test barge or test ship, according to Parts 2 and 3 of the annex to this Code, to confirm that the BWMS meets the ballast water performance standard described in regulation D-2 of the Convention.

3.9 *Major components* means those components that directly affect the ability of the system to meet the ballast water performance standard described in regulation D-2.

3.10 *Representative sampling* means sampling that reflects the relative concentrations (chemicals) and numbers and composition of the populations (organisms) in the volume of interest. Samples shall be taken in a time-integrated manner and the sampling facility shall be installed, taking into account guidelines developed by the Organization.[1]

3.11 *Sampling facilities* refers to the means provided for sampling treated or untreated ballast water as needed in this Code and in the guidelines developed by the Organization.[1]

3.12 *Shipboard testing* means a full-scale test of a complete BWMS carried out on board a ship according to part 2 of the annex to this Code, to confirm that the system meets the standards set by regulation D-2 of the Convention.

3.13 *Successful test cycle* means a valid test cycle where the BWMS functions to its specifications and treated water is determined to meet the ballast water performance standard described in regulation D-2.

3.14 *System Design Limitations* (SDL) of a BWMS means the water quality and operational parameters, determined in addition to the required type approval testing parameters, that are important to its operation, and, for each such parameter, a low and/or a high value for which the BWMS is designed to achieve the performance standard of regulation D-2. The SDL should be specific to the processes being employed by the BWMS and should not be limited to parameters otherwise assessed as part of the type approval process. The SDL should be identified by the manufacturer and validated under the supervision of the Administration, taking into account Guidance developed by the Organization, and in accordance with this Code.

*3.*15 *Test cycle* refers to one testing iteration (to include uptake, treatment, holding and discharge as appropriate) under a given set of requirements used to establish the ability of a BWMS to meet the set standards.

3.16 *Test* means the set of required test cycles.

3.17 *Treatment Rated Capacity* (TRC) means the maximum continuous capacity expressed in cubic metres per hour for which the BWMS is type-approved. It states the amount of ballast water that can be treated per unit time by the BWMS to meet the ballast water performance standard in regulation D-2. The TRC is measured at the inlet of the BWMS.

3.18 *Valid test cycle* means a test cycle in which all the required test conditions and arrangements, including challenge conditions, test control, and monitoring arrangements (including piping, mechanical and electrical provisions) and test analytical procedures were achieved by the test organization.

3.19 *Viable organisms* means organisms that have the ability to successfully generate new individuals in order to reproduce the species.

[1] Refer to the *Guidelines for ballast water sampling (G2)* (resolution MEPC.173(58)).

4 TECHNICAL SPECIFICATIONS

4.1 This section details the general technical requirements which a BWMS shall meet in order to obtain type approval.

General principles for operation

4.2 A BWMS shall be effective in meeting the D-2 standard on short voyages and long voyages (i.e. short and long intervals between treatment and discharge), regardless of temperature, unless the system is intentionally constructed for use in specific waters.

4.3 Ballast water discharged following treatment shall be safe for the environment on short voyages and long voyages (i.e. short and long intervals between treatment and discharge), regardless of temperature.

4.4 The design of the BWMS shall account for the fact that, regardless of the BWMS technology employed, viable organisms remaining after treatment may reproduce in the interval between treatment and discharge.

Ballast water management systems

4.5 The BWMS shall be designed and constructed:

.1 for robust and suitable operation in the shipboard environment;

.2 for the service for which it is intended;

.3 to mitigate any danger to persons on board when installed. Equipment that could emit dangerous gases/liquids shall have at least two independent means of detection and shutdown of the BWMS (i.e. hazardous gas level reaching lower explosive limits (LEL) or level of toxic concentrations that can result in severe effects on human health); and

.4 with materials compatible with: the substances used; the purpose for which it is intended; the working conditions to which it will be subjected; and the environmental conditions on board.

4.6 The BWMS shall not contain or use any substance of a dangerous nature, unless adequate risk mitigation measures are incorporated for storage, application, installation and safe handling, acceptable to the Administration.

4.7 In case of any failure compromising the proper operation of the BWMS, audible and visual alarm signals shall be given in all stations from which ballast water operations are controlled.

4.8 All working parts of the BWMS that are liable to wear or to be damaged shall be easily accessible for maintenance. The routine maintenance of the BWMS and troubleshooting procedures shall be clearly defined by the manufacturer in the operation, maintenance and safety manual. All maintenance and repairs shall be recorded.

4.9 To avoid interference with the BWMS, the following items shall be included:

.1 every access of the BWMS beyond the essential requirements of paragraph 4.8 shall require the breaking of a seal;

.2 if applicable, the BWMS shall be so constructed that a visual indication is always activated whenever the BWMS is in operation for purposes of cleaning, calibration or repair, and these events shall be recorded by the control and monitoring equipment; and

.3 the BWMS shall be provided with the necessary connections to ensure that any bypass of the BWMS will activate an alarm, and that the bypass event is recorded by the control and monitoring equipment.

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.

4.11 The BWMS shall be provided with simple and effective means for its operation and control. It shall be provided with a control system that shall be such that the services needed for the proper operation of the BWMS are ensured through the necessary arrangements.

4.12 The BWMS shall, if intended to be fitted in hazardous area locations, comply with the relevant safety regulations for such spaces. Any electrical equipment that is part of the BWMS shall be based in a non-hazardous area, or shall be certified by the Administration as safe for use in a hazardous area. Any moving parts, which are fitted in hazardous areas, shall be arranged so as to avoid the formation of static electricity.

4.13 The BWMS shall be designed so as not to endanger the health and safety of the crew, interact negatively with the ship's systems and cargo or produce any adverse environmental effects. The BWMS shall not create long-term impacts on the safety of the ship and crew through corrosive effects in the ballast system and other spaces.

4.14 It shall be demonstrated, by using mathematical modelling and/or calculations, that any up or down scaling of the BWMS will not affect the functioning and effectiveness on board a ship of the type and size for which the equipment will be certified. In doing so, the manufacturer of the equipment shall take into account the relevant guidance developed by the Organization.

4.15 Scaling information shall allow the Administration to verify that any scaled model is at least as robust as the land-based-tested model. It is the responsibility of the Administration to verify that the scaling used is appropriate for the operational design of the BWMS.

4.16 At a minimum, the shipboard test unit shall be of a capacity that allows for further validation of the mathematical modelling and/or calculations for scaling, and preferably selected at the upper limit of the rated capacity of the BWMS, unless otherwise approved by the Administration.

Control and monitoring equipment

4.17 Administrations shall ensure that type-approved BWMS have a suitable control and monitoring system that will automatically monitor and record sufficient data to verify correct operation of the system. The control and monitoring equipment shall record the proper functioning or failure of the BWMS. Where practical, SDL parameters should be monitored and recorded by the BWMS to ensure proper operation.

4.18 The BWMS shall incorporate control equipment that automatically monitors and adjusts necessary treatment dosages or intensities or other aspects of the BWMS of the ship, which while not directly affecting treatment, are nonetheless required for proper administration of the necessary treatment.

4.19 The equipment shall be able to produce (e.g. display, print or export) a report of the applicable self-monitoring parameters in accordance with part 5 of the annex for official inspections or maintenance, as required.

4.20 To facilitate compliance with regulation B-2, the control and monitoring equipment shall also be able to store data for at least 24 months. In the event that the control and monitoring equipment is replaced, means shall be provided to ensure the data recorded prior to replacement remains available on board for 24 months.

4.21 For BWMS that could emit dangerous gases, a means of gas detection by redundant safety systems shall be fitted in the space of the BWMS, and an audible and visual alarm shall be activated at a local area and at a manned BWMS control station in case of leakage. The gas detection device shall be designed and tested in accordance with IEC 60079-29-1 or other recognized standards acceptable to the Administration. Monitoring measures for dangerous gases with independent shutdown shall be provided on the BWMS.

4.22 All software changes introduced to the system after the pre-test evaluation shall be done according to a change handling procedure ensuring traceability.

5 TYPE APPROVAL PROCESS

5.1 The type approval requirements for BWMS are as described below.

5.2 The manufacturer of the equipment shall submit information regarding the design, construction, operation and functioning of the BWMS in accordance with Part 1 of the annex, including information regarding the water quality and operational parameters that are important to the operation of the system. This information shall be the basis for a first evaluation of suitability by the Administration.

5.3 Following the Administration's pre-test evaluation, the BWMS shall undergo land-based, shipboard and other tests in accordance with the procedures described in Parts 2 and 3 of the annex. The BWMS tested for type approval shall be a final and complete product that meets the requirements of section 4 and it shall be constructed using the same materials and procedures that will be used to construct production units.

5.4 Successful fulfilment of the requirements and procedures outlined in Parts 2 and 3 of the annex, as well as all other requirements of this Code, shall lead to the issuance of a Type Approval Certificate by the Administration in accordance with section 6.

5.5 The limitations of the BWMS, in addition to the required type approval testing parameters identified in paragraphs 2.29 and 2.46 of the annex, as submitted by its manufacturer and validated by the Administration, shall be documented on the Type Approval Certificate. These design limitations do not determine if the equipment may be type-approved or not, but provide information on the conditions beyond the type approval testing parameters under which proper functioning of the equipment can be expected.

5.6 When a type-approved BWMS is installed on board, an installation survey according to section 8 shall be carried out.

5.7 The documentation submitted for approval shall include at least the following:

.1 a description and diagrammatic drawings of the BWMS;

.2 the operation, maintenance and safety manual;

.3 hazard identification;

.4 environmental and public health impacts; and

.5 System Design Limitations.

6 APPROVAL AND CERTIFICATION PROCEDURES

6.1 A BWMS which in every respect fulfils the requirements of this Code may be approved by the Administration for fitting on board ships. The approval shall take the form of a Type Approval Certificate of BWMS, specifying the main particulars of the BWMS and validated SDL. Such certificates shall be issued in accordance with Part 7 of the annex in the format shown in the appendix.

6.2 A BWMS that in every respect fulfils the requirements of this Code except that it has not been tested at all the temperatures and salinities set out in Part 2 of the annex shall only be approved by the Administration if corresponding limiting operating conditions are clearly stated on the issued Type Approval Certificate with the description "Limiting Operating Conditions". For the limiting values, the SDL shall be consulted.

6.3 A Type Approval Certificate of a BWMS shall be issued for the specific application for which the BWMS is approved, e.g. for specific ballast water capacities, flow rates, salinity or temperature regimes, or other limiting operating conditions or circumstances as appropriate.

6.4 A Type Approval Certificate of a BWMS shall be issued by the Administration based on satisfactory compliance with all the requirements described in Parts 1, 2, 3 and 4 of the annex.

6.5 The SDL shall be specified on the Type Approval Certificate in a table that identifies each water quality and operational parameter together with the validated low and/or high parameter values for which the BWMS is designed to achieve the ballast water performance standard described in regulation D-2.

6.6 An Administration may issue a Type Approval Certificate of a BWMS based on testing already carried out under supervision by another Administration. In cases where the approval of a BWMS by an Administration for installation on a ship operating under its authority is to be granted on the basis of testing carried out by another Administration, the approval may be conveyed through the issuance of the International Ballast Water Management Certificate.

6.7 A Type Approval Certificate shall only be issued to a BWMS that has been determined by the Administration to make use of an Active Substance after it has been approved by the Organization in accordance with regulation D-3.2. In addition, the Administration shall ensure that any recommendations that accompanied the Organization's approval have been taken into account before issuing the Type Approval Certificate.

6.8 The Type Approval Certificate shall be issued taking into account guidance developed by the Organization.[2]

[2] Refer to *Validity of type approval certification for marine products* (MSC.1/Circ.1221).

6.9 An approved BWMS may be type approved by other Administrations for use on their ships. Should a BWMS approved by one country fail type approval in another country, then the two countries concerned shall consult one another with a view to reaching a mutually acceptable agreement.

6.10 An Administration approving a BWMS shall promptly provide a type-approval report to the Organization in accordance with part 6 of the annex. Upon receipt of a type-approval report, the Organization shall promptly make it available to the public and Member States by appropriate means.

6.11 In the case of a type approval based entirely on testing already carried out under supervision by another Administration, the type-approval report shall be prepared and kept on file and the Organization shall be informed of the approval.

6.12 In the case of a BWMS that was previously type-approved by an Administration taking into account the revised Guidelines (G8) adopted by resolution MEPC.174(58), the manufacturer, in seeking a new type approval under this Code, shall only be requested to submit to the Administration the additional test reports and documentation set out in this Code.

7 INSTALLATION REQUIREMENTS FOLLOWING TYPE APPROVAL

7.1 The BWMS shall be accompanied by sampling facilities installed taking into account guidelines developed by the Organization,[3] so arranged in order to collect representative samples of the ship's ballast water discharge.

7.2 Suitable bypasses or overrides to protect the safety of the ship and personnel shall be installed and used in the event of an emergency and these shall be connected to the BWMS so that any bypass of the BWMS shall activate an alarm. The bypass event shall be recorded by the control and monitoring equipment and within the ballast water record book.

7.3 The requirement in paragraph 7.2 does not apply to internal transfer of ballast water within the ship (e.g. anti-heeling operations). For BWMS that transfer water internally which may affect compliance by the ship with the standard described in regulation D-2 (i.e. circulation or in-tank treatment) the recording in paragraph 7.2 shall identify such internal transfer operations.

8 INSTALLATION SURVEY AND COMMISSIONING PROCEDURES FOLLOWING TYPE APPROVAL

8.1 The additional information outlined in the paragraphs below is intended to facilitate ship operations and inspections and assist ships and Administrations in preparing for the procedures set out in the *Survey Guidelines for the purpose of the International Convention for the Control and Management of Ships' Ballast Water and Sediments under the Harmonized System of Survey and Certification,*[4] developed by the Organization, which describe the examination of plans and designs and the various surveys required under regulation E-1.

[3] Refer to the *Guidelines for ballast water sampling (G2)* (resolution MEPC.173(58)).

[4] Refer to the *Survey Guidelines under the Harmonized System of Survey and Certification (HSSC), 2017* (resolution A.1120(30)).

8.2 The Administration issuing the International Ballast Water Management Certificate shall verify that the following documentation is on board in a suitable format:

.1 for the purpose of information, a copy of the Type Approval Certificate of the BWMS;

.2 the operation, maintenance and safety manual of the BWMS;

.3 the ballast water management plan of the ship;

.4 installation specifications, e.g. installation drawing, piping and instrumentation diagrams, etc.; and

.5 installation commissioning procedures.

8.3 Prior to the issuance of the International Ballast Water Management Certificate, following the installation of a BWMS, the Administration should verify that:

.1 the BWMS installation has been carried out in accordance with the technical installation specification referred to in paragraph 8.2.4;

.2 the BWMS is in conformity with the relevant Type Approval Certificate BWMS;

.3 the installation of the complete BWMS has been carried out in accordance with the manufacturer's equipment specification;

.4 any operational inlets and outlets are located in the positions indicated on the drawing of the pumping and piping arrangements;

.5 the workmanship of the installation is satisfactory and, in particular, that any bulkhead penetrations or penetrations of the ballast system piping are to the relevant approved standards; and

.6 the installation commissioning procedures have been completed.

Annex

PART 1 – SPECIFICATIONS FOR PRE-TEST EVALUATION OF SYSTEM DOCUMENTATION

1.1 Adequate documentation shall be prepared and submitted to the Administration and be shared with the test organization as part of the approval process well in advance of the intended approval testing of a BWMS. Approval of the submitted documentation shall be a prerequisite for carrying out independent approval tests.

1.2 Documentation shall be provided by the manufacturer/developer for two primary purposes: evaluating the readiness of the BWMS for undergoing approval testing and evaluating the manufacturer's proposed SDL and validation procedures.

Documentation

1.3 The documentation to be submitted as a part of the readiness evaluation shall include at least the following:

.1 a BWMS technical specification, including at least:

.1 a description of the BWMS, treatment processes it employs and details of any required permits;

.2 adequate information including descriptions and diagrammatic drawings of the pumping and piping arrangements, electrical/electronic wiring, monitoring system, waste streams and sampling points. Such information should enable fault finding;

.3 details of major components and materials used (including certificates where appropriate);

.4 an equipment list showing all components subject to testing including specifications, materials and serial numbers;

.5 an installation specification in accordance with manufacturers installation criteria requirements for the location and mounting of components, arrangements for maintaining the integrity of the boundary between safe and hazardous spaces and the arrangement of the sample piping;

.6 information regarding the characteristics and arrangements in which the system is to be installed, including scope of the ships (sizes, types and operation) for which the system is intended. This information may form the link between the system and the ship's ballast water management plan; and

.7 a description of BWMS side streams (e.g. filtered material, centrifugal concentrate, waste or residual chemicals) including a description of the actions planned to properly manage and dispose of such wastes;

.2 the operation, maintenance and safety manual, including at least:

.1 instructions for the correct operation of the BWMS, including procedures for the discharge of untreated water in the event of malfunction of the ballast water treatment equipment;

.2 instructions for the correct arrangement of the BWMS;

.3 maintenance and safety instructions and the need to keep records;

.4 troubleshooting procedures;

.5 emergency procedures necessary for securing the ship;

.6 any supplementary information considered necessary for the safe and efficient operation of the BWMS, e.g. documentation provided for approval under the *Procedure for approval of ballast water management systems that make use of Active Substances (G9)* (resolution MEPC.169(57)); and

.7 calibration procedures;

.3 information on any hazard identification conducted to identify potential hazards and define appropriate control measures, if the BWMS or the storage tanks for processing chemicals could emit dangerous gases or liquids;

.4 information regarding environmental and public health impacts including:

.1 identification of potential hazards to the environment based on environmental studies performed to the extent necessary to assure that no harmful effects are to be expected;

.2 in the case of BWMS that make use of Active Substances or Preparations containing one or more Active Substances, the dosage of any Active Substances used and the maximum allowable discharge concentrations;

.3 in the case of BWMS that do not make use of Active Substances or preparations, but which could reasonably be expected to result in changes to the chemical composition of the treated water such that adverse impacts to receiving waters might occur upon discharge, the documentation shall include results of toxicity tests of treated water as described in paragraph 2.19 of this annex; and

.4 sufficient information to enable the test organization to identify any potential health or environmental safety problems, unusual operating requirements (labour or materials), and any issues related to the disposal of treatment by-products or waste streams;

.5 information regarding SDL including:

.1 the identification of all known parameters to which the design of the BWMS is sensitive;

.2 for each parameter the manufacturer shall claim a low and/or a high value for which the BWMS is capable of achieving the Performance Standard of regulation D-2; and

.3 the proposed method for validating each claimed SDL shall be set out, together with information on the source, suitability and reliability of the method;

.6 a software change handling and revision control document including all software changes introduced to the system after the pre-test evaluation. These shall be done according to a change handling procedure ensuring traceability. Therefore, the manufacturer shall present a procedure describing how changes are to be handled and how revision control is maintained. As a minimum for a modification request, the following types of information shall be produced and logged:

.1 reason for modification;

.2 specification of the proposed change;

.3 authorization of modification; and

.4 test record;

.7 functional description including a textual description with necessary supporting drawings, diagrams and figures to cover:

.1 system configuration and arrangement;

.2 scope of supply;

.3 system functionality covering control, monitoring, alarm and safety functions;

.4 self-diagnostics and alarming functionalities; and

.5 safe states for each function implemented.

1.4 The documentation may include specific information relevant to the test set-up to be used for land-based testing according to this Code. Such information should include the sampling needed to ensure proper functioning and any other relevant information needed to ensure proper evaluation of the efficacy and effects of the equipment. The information provided should also address general compliance with applicable environment, health and safety standards during the type-approval procedure.

Readiness evaluation

1.5 During the readiness evaluation, the Administration shall ensure that each technical specification set out in section 4 of this Code has been met, other than those that will be assessed during later testing.

1.6 The readiness evaluation shall examine the design and construction of the BWMS to determine whether there are any fundamental problems that might constrain the ability of the BWMS to manage ballast water as proposed by the manufacturer, or to operate safely, on board ships.

1.7 Administrations shall ensure adequate risk assessments including the implementation of preventative actions have been undertaken relating to the safe operation of BWMS.

1.8 As a first step the manufacturer shall provide information regarding the requirements and procedures for installing, calibrating and operating (including maintenance requirements) the BWMS during a test. This evaluation should help the test organization to identify any potential health or environmental safety problems, unusual operating requirements (labour or materials), and any issues related to the disposal of treatment by-products or waste streams.

1.9 The test facility shall have a procedure to deal with deviations that occur prior to testing and an evaluation process which includes an assessment and validation process to address any unforeseen deviations that may occur during testing. Deviations from the testing procedure shall be fully reported.

1.10 During the readiness evaluation the major components of the BWMS shall be identified. Major components are considered to be those components that directly affect the ability of the system to meet the performance standard described in regulation D-2. Upgrades or changes to major components shall not take place during type approval testing. A change to a major component requires a new submission of the test proposal and shall involve a new evaluation and repeating of the land-based and shipboard tests.

1.11 The Administration may allow replacements of non-major components of equivalent specification (independently approved to a recognized and equal operational standard) during type approval. Replacements of non-major components during testing shall be reported.

1.12 Upgrades of the BWMS that relate to the safe operation of that system may be allowed during and after type approval and shall be reported. If such safety upgrades directly affect the ability of the system to meet the standard described in regulation D-2, it shall be treated as a change of a major component, as per paragraph 1.10 above.

1.13 The evaluation shall identify consumable components in the BWMS. The Administration may allow replacement of like-for-like consumable components during type approval testing and all replacements shall be reported.

System Design Limitation evaluation

1.14 The SDL evaluation shall be undertaken by the Administration. It shall assess the basis for the manufacturer's claim that the SDL include all known water quality and operational parameters to which the design of the BWMS is sensitive and that are important to its ability to achieve the performance standard described in regulation D-2.

1.15 The Administration shall also evaluate the suitability and reliability of the methods proposed for validating the claimed low and/or high values for each SDL. These methods may include tests to be undertaken during land-based, shipboard or bench-scale testing and/or the use of appropriate existing data and/or models.

PART 2 –TEST AND PERFORMANCE SPECIFICATIONS FOR APPROVAL OF BALLAST WATER MANAGEMENT SYSTEMS

2.1 The Administration decides the sequence of land-based and shipboard testing. The BWMS used for testing must be verified by the Administration to be the same as the BWMS described under Part 1 of the annex with major components as described in the documentation submitted in accordance with paragraphs 1.3.1.3 and 1.3.1.4 of this annex.

Quality assurance and quality control procedures

2.2 The test facility shall demonstrate its competency in conducting valid type approval tests in two ways:

.1 by having implemented a rigorous quality control/quality assurance programme, approved, certified and audited by an independent accreditation body, or to the satisfaction of the Administration; and

.2 by demonstrating its ability to conduct valid test cycles with appropriate challenge water, sample collection, sample analysis and method detection limits.

It is the responsibility of the Administration, or its authorized delegate, to determine the acceptability of the test facility.

2.3 The test facility's quality control/quality assurance programme shall consist of:

.1 a Quality Management Plan (QMP), which addresses the quality control management structure and policies of the testing body (including subcontractors and outside laboratories);

.2 a Quality Assurance Project Plan (QAPP), which defines the methods, procedures, and quality assurance and quality control (QA/QC) protocols used by the test facility for testing BWMS in general. It identifies the test team members, and it includes all relevant standard operating procedures (SOPs), typically as appendices; and

.3 a Test/Quality Assurance Plan (TQAP), that provides specific details for conducting a test of a given BWMS at a given site and time. The TQAP includes detailed plans for commissioning the BWMS, the experimental plan, decommissioning, and reporting the results. The TQAP identifies all organizations involved in the test and includes the BWMS manufacturer's documentation and performance claims. The TQAP also identifies the data to be recorded, operational and challenge parameters that define a valid test cycle, data analyses to be presented in the verification report and a schedule for testing. Appropriate statistical distributions shall be considered and used to analyse data.

2.4 The test facility performing the BWMS tests shall be independent. It shall not be owned by or affiliated with the manufacturer or vendor of any BWMS, or by the manufacturer or supplier of the major components of that equipment.

Avoiding sampling bias

2.5 The sampling protocol must ensure organism mortality is minimized, e.g. by using appropriate valves and flow rates for flow control in the sampling facility, submerging nets during sampling collection, using appropriate sampling duration and handling times, and appropriate concentrating methodology. All methods to avoid sampling bias shall be validated to the satisfaction of the Administration.

Shipboard tests

2.6 A shipboard test cycle includes:

.1 the uptake of ballast water of the ship;

.2 treatment of the ballast water in accordance with paragraph 2.8.4 of this annex by the BWMS;

.3 the storage of ballast water on the ship during a voyage; and

.4 the discharge of ballast water from the ship.

2.7 Shipboard testing of BWMS shall be conducted by the test facility, independent of the BWMS manufacturer, with the system being operated and maintained by the ships' crew as per the operation, maintenance and safety manual.

Success criteria for shipboard testing

2.8 In evaluating the performance of BWMS installation(s) on a ship or ships, the following information and results shall be supplied to the satisfaction of the Administration:

.1 test plan to be provided prior to testing;

.2 documentation that an in-line BWMS is of a capacity to reflect the flow rate of the ballast water pump for the TRC of the BWMS;

.3 documentation that an in-tank BWMS is of a capacity to reflect the ballast water volume that it is intended to treat within a specified period of time;

.4 the amount of ballast water tested in the test cycle on board shall be consistent with the normal ballast operations of the ship and the BWMS shall be operated at the TRC for which it is intended to be approved;

.5 documentation showing that the discharge of each valid test cycle was in compliance with regulation D-2. For a test to be valid, the uptake water for the ballast water to be treated shall contain a density of viable organisms exceeding 10 times the maximum permitted values in regulation D-2.1;

.6 sampling regime and volumes for analysis:

.1 for the enumeration of viable organisms greater than or equal to 50 μm or more in minimum dimension:

.1 influent water shall be collected over the duration of uptake as one time-integrated sample. The sample shall be collected as a single, continuous sample or a composite of

sequential samples, e.g. collected at intervals during the beginning, middle and end of the operation. The total sample volume shall be at least 1 m^3. If a smaller volume is validated to ensure representative sampling of organisms, it may be used;

.2 treated discharged water shall be collected as one time-integrated sample over the duration of discharge from the tank(s). The sample may be collected as a single, continuous sample or a composite of sequential samples, e.g. collected throughout the beginning, middle and end the operation. The total sample volume shall be at least 3 m^3;

.3 if samples are concentrated for enumeration, the organisms shall be concentrated using a mesh with holes no greater than 50 µm in the diagonal dimension. Only organisms greater than 50 µm in minimum dimension shall be enumerated; and

.4 the full volume of the sample shall be analysed unless the total number of organisms is high, e.g. 100. In this case, the average density may be extrapolated based on a well-mixed subsample using a validated method;

.2 for the enumeration of viable organisms greater than or equal to 10 µm and less than 50 µm in minimum dimension:

.1 influent water shall be collected over the duration of uptake as one, time-integrated sample. The sample shall be collected as a single, continuous sample or a composite of sequential samples, e.g. collected at intervals during the beginning, middle and end of the operation. A sample of at least 10 L shall be collected, and a fraction may be subsampled for transport to the laboratory, provided it is representative of the sample and is a minimum of 1 L. A minimum of three 1 mL subsamples shall be analysed in full to enumerate organisms;

.2 treated discharged water shall be collected as one time-integrated sample over the duration of discharge from the tank(s). The sample may be collected as a single, continuous sample or a composite of sequential samples, e.g. collected throughout the beginning, middle and end of the operation. A sample of at least 10 L shall be collected, and a fraction may be subsampled for transport to the laboratory, provided it is representative of the sample and is a minimum of 1 L. A minimum of six 1 mL subsamples shall be analysed in full to enumerate organisms;

.3 the sample may not be concentrated for analysis unless the procedure is validated. Only organisms greater than 10 µm and less than 50 µm in minimum dimension shall be enumerated; and

.4 the full volume of the sample shall be analysed unless the total number of organisms is high, e.g. 100. In this case, the average density may be extrapolated based on a well-mixed subsample using a validated method;

.3 for the evaluation of bacteria:

.1 for the influent and discharge samples, the minimum 10 L sample referred to in paragraphs 2.8.6.2.1 and 2.8.6.2.2, or another sample at least 10 L in volume and collected in a similar manner should be used, a subsample of minimum 1 L may be transferred to a sterile container for analysis;

.2 a minimum of three subsamples of appropriate volume taken from the 1 L subsample described above shall be analysed for colony forming units of bacteria listed in regulation D-2; and

.3 the toxicogenic test requirements shall be conducted in an appropriately approved laboratory. If no approved laboratory is available, the analysis method may be validated to the satisfaction of the Administration.

.7 the test cycles including invalid test cycles shall span a period of not less than six months;

.8 three consecutive test cycles in compliance with regulation D-2 are to be performed. Any invalid test cycle does not affect the consecutive sequence;

.9 the six-month shipboard test period starts and ends with the completion of a successful test cycle or invalid test cycle that meets the D-2 standard. The three consecutive and valid test cycles that are required in paragraph 2.8.8 above must be suitably separated across the six-month period;

.10 the source water for test cycles shall be characterized by measurement of salinity, temperature, particulate organic carbon, total suspended solids and dissolved organic carbon; and

.11 for system operation throughout the test period, the following information shall also be provided:

.1 documentation of all ballast water operations including volumes and locations of uptake and discharge, and if heavy weather was encountered and where;

.2 documentation that the BWMS was operated continuously throughout the test period for all ballasting and deballasting of the ship;

.3 documentation detailing water quality parameters identified by the test organization that should be provided as appropriate and practicable;

.4 the possible reasons for an invalid test cycle, or a test cycle discharge failing the D-2 standard, which shall be investigated and reported to the Administration;

.5 documentation of scheduled maintenance performed on the system during the test period;

.6 documentation of unscheduled maintenance and repair performed on the system during the test period;

.7 documentation of engineering parameters, monitored as appropriate to the specific system; and

.8 a report detailing the functioning of the control and monitoring equipment.

Land-based testing

2.9 The land-based testing provides data to determine the biological efficacy and environmental acceptability of the BWMS under consideration for type approval. The approval testing aims to ensure replicability and comparability to other treatment equipment.

2.10 Any limitations imposed by the BWMS on the testing procedure described here shall be duly noted and evaluated by the Administration.

2.11 The test set-up including the BWMS shall operate as described in the provided operation, maintenance and safety manual during at least five consecutive successful test cycles in each salinity.

2.12 A land-based test cycle shall include the uptake of ballast water by pumping, the storage of ballast water, treatment of ballast water within the BWMS (except in control tanks), and the discharge of ballast water by pumping. The order will be dependent on the BWMS.

2.13 At least two test cycles in each salinity tested shall be conducted in order to evaluate compliance with the D-2 standard at the minimum holding time specified by the BWMS manufacturer.

2.14 Test facilities carrying out identification of Relevant Chemicals and toxicity testing of the treated ballast water from test cycles with a storage time which is shorter or longer than five days shall ensure that sufficient volumes of treated water are collected after five days or are reserved after the efficacy testing to permit the requirements of guidelines[5] developed by the Organization, for approval of BWMS making use of Active Substances, to be assessed for at least one test cycle per salinity.

2.15 Land-based testing of BWMS shall be independent of the system manufacturer.

2.16 Testing shall occur using different water conditions sequentially as provided for in paragraphs 2.29 and 2.31 of this annex.

2.17 The BWMS shall be tested at its TRC or as given in paragraphs 2.25 to 2.28 of this annex for each test cycle. The equipment shall function to specifications during this test.

[5] Refer to the *Procedure for approval of ballast water management systems that make use of Active Substances (G9)* (resolution MEPC.169(57)).

2.18 The analysis of treated water discharge from each test cycle shall determine if the treated discharge meets regulation D-2.

2.19 The analysis of treated water discharge from the relevant test cycle(s) shall also be used to evaluate the formation of Relevant Chemicals as well as the toxicity of the discharged water for BWMS that make use of Active Substances. The same evaluation shall be conducted for those BWMS that do not make use of Active Substances or Preparations but which could reasonably be expected to result in changes to the chemical composition of the treated water such that adverse impacts to receiving waters might occur upon discharge. Toxicity tests of the treated water discharge shall be conducted, taking into account guidelines developed by the Organization.[6]

Land-based testing set-up

2.20 The test set-up for approval tests shall be representative of the characteristics and arrangements of the types of ships in which the equipment is intended to be installed. The test set-up shall therefore include at least the following:

.1 the complete BWMS to be tested;

.2 piping and pumping arrangements; and

.3 the storage tank that simulates a ballast tank, constructed such that the water in the tank shall be completely shielded from light.

2.21 The control and treated simulated ballast tanks shall each include:

.1 a minimum capacity of 200 m^3;

.2 the use of standard industry practices for design and construction for ships; surface coatings shall be in accordance with the *Performance standard for protective coatings of dedicated seawater ballast tanks on all new ships and of double-sided skin spaces of bulk carriers* (PSPC) (resolution MSC.215(82)); and

.3 the minimum modifications required for structural integrity on land.

2.22 The control and treated simulated ballast tanks should include normal internal structures, including lightening and drainage holes.

2.23 The test set-up shall be pressure-washed with tap water, dried and swept to remove loose debris, organisms and other matter before starting testing procedures, and between test cycles.

2.24 The test set-up shall include facilities to allow sampling as described in paragraphs 2.40 and 2.41 of this annex and provisions to supply influents to the system, as specified in paragraphs 2.29, 2.30, 2.33 and 2.34 of this annex. The installation arrangements shall conform in each case with those specified and approved under the procedure outlined in section 7 of this Code.

[6] Refer to paragraphs 5.2.3 to 5.2.7 of the *Procedure for approval of ballast water management systems that make use of Active Substances (G9)* (resolution MEPC.169(57)).

Ballast water management system scaling

2.25 Scaling of the BWMS should take into account guidance developed by the Organization.[7] The Administration shall verify that the scaling used is appropriate for the operational design of the BWMS.

2.26 BWMS with at least one model with a TRC equal to or smaller than 200 m^3/h shall not be downscaled.

2.27 For BWMS with at least one model that has a TRC higher than 200 m^3/h or 1000 m^3/h the following must be observed for land-based testing. In-line treatment equipment may be downsized for land-based testing, but only when the following criteria are taken into account:

.1 BWMS with at least one model with a TRC higher than 200 m^3/h but lower than 1,000 m^3/h may be downscaled to a maximum of 1:5 scale, but may not be lower than 200 m^3/h; and

.2 BWMS with at least one model with a TRC equal to, or higher than, 1,000 m^3/h may be downscaled to a maximum of 1:100 scale, but may not be lower than 200 m^3/h.

2.28 In-tank treatment equipment shall be tested on a scale that allows verification of full-scale effectiveness. The suitability of the test set-up shall be evaluated by the manufacturer and approved by the Administration.

Land-based test design – inlet and outlet criteria

2.29 For any given set of test cycles (five are considered a set) a salinity range shall be chosen for each cycle. Given the salinity of the test set-up for a test cycle in fresh, brackish and marine water, each shall have dissolved and particulate content in one of the combinations set out in the table below. Deviations from the marine and brackish salinity ranges of the table shall be reported and justified and the resulting tests shall not be less challenging for the BWMS than would be the circumstance if the deviations had not occurred:

	Salinity		
	Marine 28 – 36 PSU	**Brackish 10 – 20 PSU**	**Fresh < 1 PSU**
Dissolved organic carbon (DOC)	> 1 mg/L	> 5 mg/L	> 5 mg/L
Particulate organic carbon (POC)	> 1 mg/L	> 5 mg/L	> 5 mg/L
Total suspended solids (TSS)	> 1 mg/L	> 50 mg/L	> 50 mg/L

2.30 The source of the test water shall be natural water. Any augmentation of test water with dissolved organic carbon (DOC), particulate organic carbon (POC) or total suspended solids (TSS) to achieve the minimum required content shall be validated and approved by the Administration. As natural DOC constituents are complex and primarily of aromatic character, the type of added DOC is particularly critical to the evaluation of BWMS performance. The validation shall ensure that relevant properties of the augmented water (such as the oxidant demand/TRO decay and UV absorption in the range of 200 to 280 nm, the production of disinfectant by-products and the particle size distribution of suspended solids) are

[7] Refer to the *Guidance on scaling of ballast water management systems* (BWM.2/Circ.33/Rev.1).

equivalent, on a mg/L basis, to that of natural water that would quantitatively meet the challenge conditions. In addition, the validation shall ensure that augmentation does not bias a test for or against any specific treatment process. The test report shall include the basis for the selection, use and validation of augmentation.

2.31 The BWMS must be tested in conditions for which it will be approved. For a BWMS to achieve an unlimited Type Approval Certificate with respect to salinity, one set of test cycles shall be conducted within each of the three salinity ranges with the associated dissolved and particulate content as prescribed in paragraph 2.29 above. Tests under adjacent salinity ranges in the above table shall be separated by at least 10 PSU.

2.32 Use of standard test organisms (STO):

.1 the use of standard test organisms (STO) is permissible if the challenge levels in naturally occurring water at the test facility require supplementation. The use of STO shall not be considered standard practice and the Administration shall in every case review that the selection, number and use of supplementary STOs ensures that the challenge posed to the BWMS provides an adequately robust test. The use of STOs shall not bias a test for or against any specific treatment process. They shall be locally isolated to ensure that the risk to the local environment is minimized; non-indigenous organisms which have the potential to cause harm to the environment shall not be used;

.2 procedures, processes and guidance for the use of STO shall be based on the most relevant and up-to-date available scientific data. Such procedures, processes and guidance shall form a part of the testing facilities quality assurance regimes; and

.3 the use of STO, including concentrations and species, shall be recorded within the test report. The test report shall include information pertaining to the evaluation and justification for the use of STO, an assessment of the impact of their use on other test parameters and potential impacts on the test being undertaken. The information contained within the report shall reflect both the positive and negative impacts of the use of STO.

2.33 The influent water shall include:

.1 test organisms of greater than or equal to 50 µm or more in minimum dimension that shall be present in a total density of preferably 10^6 but not less than 10^5 individuals per cubic metre, and shall consist of at least five species from at least three different phyla/divisions;

.2 test organisms greater than or equal to 10 µm and less than 50 µm in minimum dimension that shall be present in a total density of preferably 10^4 but not less than 10^3 individuals per mL, and shall consist of at least five species from at least three different phyla/divisions;

.3 heterotrophic bacteria that shall be present in a density of at least 10^4 living bacteria per mL; and

.4 a variety of organisms which shall be documented according to the size classes mentioned above regardless of whether natural organism assemblages or cultured organisms were used to meet the density and organism variety requirements.

2.34 The following bacteria do not need to be added to the influent water, but shall be measured at the influent and at the time of discharge:

.1 coliform;

.2 Enterococcus group;

.3 *Vibrio cholerae*; and

.4 heterotrophic bacteria.

2.35 If cultured test organisms are used, local applicable quarantine regulations shall be taken into account during culturing and discharge.

Land-based monitoring and sampling

2.36 Change of numbers of test organisms by treatment and during storage in the simulated ballast tank shall be measured using methods described in Part 4 of this annex (paragraphs 4.5 to 4.7).

2.37 It shall be verified that the treatment equipment performs within its specified parameters, such as power consumption and flow rate, during the test cycle.

2.38 The range of operational flow rates that a BWMS is expected to achieve in service, at the maximum and minimum operational flow rates (where it is appropriate for that technology), shall be verified after the filter on the discharge side of the pump. The range of flow rate may be derived from empirical testing or from computational modelling. Where appropriate for the technology, demonstration of system efficacy at low flow rates shall reflect the need for flow reduction during the final stages of ballast operations.

2.39 Environmental parameters such as pH, temperature, salinity, dissolved oxygen, TSS, DOC, POC and turbidity (Nominal Turbidity Unit, NTU) shall be measured at the same time that the samples described are taken.

2.40 Samples during the test for the purposes of determining biological efficacy shall be taken at the following times and locations: immediately before the treatment equipment, immediately after the treatment equipment and upon discharge after the appropriate holding time.

2.41 The control and treatment cycles may be run simultaneously or sequentially. Control samples are to be taken in the same manner as the equipment test as prescribed in paragraph 2.40 above and upon influent and discharge.

2.42 Facilities or arrangements for sampling shall be provided to ensure representative samples of treated and control water can be taken that introduce as little adverse effects as possible on the organisms.

2.43 Samples described in paragraphs 2.40 and 2.41 above shall be collected with the following sampling regime and volumes for analysis:

.1 for the enumeration of viable organisms greater than or equal to 50 µm or more in minimum dimension:

.1 influent water shall be collected over the duration of uptake as one time-integrated sample. The sample shall be collected as a single, continuous sample or a composite of sequential samples, e.g. collected at intervals during the beginning, middle and end of the operation. The total sample volume shall be at least one cubic metre. If smaller volume is validated to ensure representative sampling of organisms, it may be used;

.2 control and treated discharged water shall be collected as one time-integrated sample over the duration of discharge from the tank(s). The sample may be collected as a single, continuous sample or a composite of sequential samples, e.g. collected throughout the beginning, middle and end of the operation. The total sample volume shall be at least 3 m^3;

.3 if samples are concentrated for enumeration, the organisms shall be concentrated using a mesh with holes no greater than 50 µm in the diagonal dimension. Only organisms greater than 50 µm in minimum dimension shall be enumerated; and

.4 the full volume of the sample shall be analysed unless the total number of organisms is high, e.g. 100. In this case, the average density may be extrapolated based on a well-mixed subsample using a validated method;

.2 for the enumeration of viable organisms greater than or equal to 10 µm and less than 50 µm in minimum dimension:

.1 influent water shall be collected over the duration of uptake as one, time-integrated sample. The sample shall be collected as a single, continuous sample or a composite of sequential samples, e.g. collected at intervals during the beginning, middle and end of the operation. A sample of at least 10 L shall be collected, and a fraction may be subsampled for transport to the laboratory, provided it is representative of the sample and is a minimum of 1 L. A minimum of three 1 mL subsamples shall be analysed in full to enumerate organisms;

.2 control and treated discharged water shall be collected as one time-integrated sample over the duration of discharge from the tank(s). The sample may be collected as a single, continuous sample or a composite of sequential samples, e.g. collected throughout the beginning, middle and end of the operation. A sample of at least 10 L shall be collected, and a fraction may be subsampled for transport to the laboratory, provided it is representative of the sample and is a minimum of 1 L. A minimum of six 1 mL subsamples shall be analysed in full to enumerate organisms;

.3 the sample may not be concentrated for analysis unless the procedure is validated. Only organisms greater than 10 μm and less than 50 μm in minimum dimension shall be enumerated; and

.4 the full volume of the sample shall be analysed unless the total number of organisms is high, e.g. 100. In this case, the average density may be extrapolated based on a well-mixed subsample using a validated method; and

.3 for the evaluation of bacteria:

.1 for the influent and discharge samples, a minimum 10 L sample referred to in paragraphs 2.8.6.2.1 and 2.8.6.2.2 above, respectively, or another sample at least 10 L in volume and collected in a similar manner, should be used; a subsample of minimum 1 L may be transferred to a sterile container for analysis;

.2 a minimum of three subsamples of appropriate volume taken from the 1 L subsample described above shall be analysed for colony forming units of bacteria listed in regulation D-2; and

.3 the toxicogenic test requirements shall be conducted in an appropriately approved laboratory. If no approved laboratory is available, the analysis method may be validated to the satisfaction of the Administration.

2.44 The samples shall be analysed as soon as possible after sampling, and analysed live within six hours or treated in such a way so as to ensure that proper analysis can be performed.

2.45 If in any test cycle the discharge results from the control water is of a concentration less than or equal to 10 times the values in regulation D-2.1, the test cycle is invalid.

Temperature

2.46 The effective performance of BWMS through a ballast water temperature range of 0°C to 40°C (2°C to 40°C for fresh water) and a mid-range temperature of 10°C to 20°C shall be the subject of an assessment verified by the Administration.

2.47 This assessment may include:

.1 testing during land-based, shipboard, laboratory or bench-scale testing; and/or

.2 the use of existing data and/or models, provided that their source, suitability and reliability is reported.

2.48 The report submitted to the Administration shall contain all documentation (including procedures, methods, data, models, results, explanations and remarks) associated with the temperature assessment. The report shall include at least the information identified in paragraph 2.57 of this annex.

Evaluation of regrowth

2.49 The evaluation of the regrowth of organisms shall be undertaken to the satisfaction of the Administration in land-based and/or shipboard testing in at least two test cycles in each salinity.

2.50 In the case of land-based testing being performed with a holding time of less than five days, a sufficient volume of treated uptake water shall be held under conditions similar to conditions in the relevant holding tank. In the case of shipboard testing, water shall be retained on board for the evaluation of regrowth during a shipboard test cycle. Additional bench-scale testing may be used to supplement the land-based and/or shipboard testing.

2.51 In the case of a BWMS that includes mechanical, physical, chemical and/or biological processes intended to kill, render harmless or remove organisms within ballast water at the time of discharge or continuously between the time of uptake and discharge, regrowth shall be assessed in accordance with sections "Shipboard tests" and "Land-based testing" of this annex with a holding time of at least five days.

2.52 Otherwise, the enumeration of organisms to assess regrowth shall be undertaken at least five days after the completion of all of the mechanical, physical, chemical and/or biological processes intended to kill, render harmless or remove organisms within ballast water.

2.53 Any neutralization of ballast water required by the BWMS shall occur at the end of the holding time and immediately before the enumeration of organisms.

2.54 The evaluation of regrowth is not intended to evaluate contamination in ballast tanks or piping, such as may arise from the presence of untreated water or residual sediments.

2.55 A report shall be submitted to the Administration containing all documentation (including procedures, methods, data, models, results, explanations and remarks) associated with the evaluation of regrowth. The report shall include at least the information identified in paragraph 2.57 of this annex.

Reporting of test results

2.56 After approval tests have been completed, a report shall be submitted to the Administration. This report shall include information regarding the test design, methods of analysis and the results of these analyses for each test cycle (including invalid test cycles), BWMS maintenance logs and any observed effects of the BWMS on the ballast system of the ship (e.g. pumps, pipes, tanks, valves). Shipboard test reports shall include information on the total and continuous operating time of the BWMS.

2.57 The reports submitted in accordance with paragraph 2.56 above shall contain at least the following information:

.1 the name and address of the laboratory performing or supervising the inspections, tests or evaluations, and its national accreditation or quality management certification, if appropriate;

.2 the name of the manufacturer;

.3 the trade name, product designation (such as model numbers), and a detailed description of the equipment or material inspected, tested or evaluated;

.4 the time, date, and place of each approval inspection, test or evaluation;

.5 the name and title of each person performing, supervising, and witnessing the tests and evaluations;

.6 executive summary;

.7 introduction and background;

.8 for each test cycle, inspection or evaluation conducted, summary descriptions of:

.1 experimental design;

.2 methods and procedures;

.3 results and discussion, including a description of any invalid test cycle (in the case of a report referred to in Part 2 of this annex) and a comparison to the expected performance; and

.4 in the case of land-based testing, test conditions including details on challenge water preparation in line with paragraph 2.30 of this annex;

.9 a description or photographs of the procedures and apparatus used in the inspections, tests or evaluation, or a reference to another document that contains an appropriate description or photographs;

.10 at least one photograph that shows an overall view of the equipment or material tested, inspected or evaluated and other photographs that show:

.1 design details; and

.2 each occurrence of damage or deformation to the equipment or material that occurred during the approval tests or evaluations;

.11 the operational safety requirements of the BWMS and all safety-related findings that have been made during the inspections, tests or evaluations;

.12 an attestation that the inspections, tests or evaluations were conducted as required and that the report contains no known errors, omissions or false statements. The attestation must be signed by the chief officer of the laboratory, or the chief officer's representative;

.13 appendices, including:

.1 the complete test plan and the data generated during tests and evaluations reported under paragraph 2.57.8 above, including at least:

.1 for land-based tests, whether ambient, cultured or a mixture of test organisms have been used (including a species-level identification for cultured organisms, and an identification to the lowest possible taxonomic level for ambient organisms);

.2 for shipboard tests, the operating parameters of the system during successful treatment operations (e.g. dosage rates, ultraviolet intensity and the energy consumption of the BWMS under normal or tested TRC, if available);

.3 for SDL, details of all procedures, methods, data, models, results, explanations and remarks, leading to validation; and

.4 invalid test information.

.2 the QMP, the QAPP and quality assurance and quality control records;

.3 maintenance logs including a record of any consumable components that were replaced; and

.4 relevant records and test results maintained or created during testing.

2.58 The results of biological efficacy testing of the BWMS shall be accepted if during the land-based and shipboard testing conducted as specified in sections "Shipboard tests" and "Land-based testing" of this annex it is shown that the system has met the standard in regulation D-2 and that the uptake water quality requirements were met in all individual test cycles as provided in paragraph 4.7 below.

2.59 The test report shall include all test cycles during land-based and shipboard tests, including failed test cycles and invalid test cycles with the explanation required in paragraph 2.8.11.4 for both shipboard and land-based tests.

2.60 The Administration shall identify and redact commercially sensitive information (information that is proprietary and not related to the BWMS performance) and make all other information available to interested parties and the Organization. The information shall include all of the test reports, including failed tests from both land-based and shipboard testing.

PART 3 – SPECIFICATION FOR ENVIRONMENTAL TESTING FOR APPROVAL OF BALLAST WATER MANAGEMENT SYSTEMS

3.1 The electrical and electronic sections of the BWMS in the standard production configuration shall be subject to the relevant tests specified in paragraph 3.3 below at a laboratory approved for the purpose by the Administration or by the accreditation body of the laboratory, with relevant accreditation[8] covering the relevant test standards.

3.2 Evidence of successful compliance with the environmental tests below shall be submitted to the Administration by the manufacturer together with the application for type approval.

3.3 Equipment is to be tested taking into account international test specifications for type approval.[9]

[8] Refer to *General requirements for the competence of testing and calibration laboratories* (ISO/IEC 17025:2017).

[9] Refer to IACS UR E10, Rev.6, October 2014 – *Test Specification for Type Approval*.

3.4 A report on environmental tests shall be submitted to the Administration and include at least the information identified in paragraph 2.57 of this Annex.

PART 4 – SAMPLE ANALYSIS METHODS FOR THE DETERMINATION OF BIOLOGICAL CONSTITUENTS IN BALLAST WATER

Sample processing and analysis

4.1 Samples taken during testing of BWMS are likely to contain a wide taxonomic diversity of organisms, varying greatly in size and susceptibilities to damage from sampling and analysis.

4.2 When available, widely accepted standard methods for the collection, handling (including concentration), storage, and analysis of samples should be used. These methods shall be clearly cited and described in test plans and reports. This includes methods for detecting, enumerating, and determining minimum dimension of and identifying organisms and for determining viability (as defined in this Code).

4.3 When standard methods are not available for particular organisms or taxonomic groups, methods that are developed for use shall be described in detail in test plans and reports. The descriptive documentation shall include any experiments needed to validate the use of the methods.

4.4 Given the complexity in samples of natural and treated water, the required rarity of organisms in treated samples under regulation D-2, and the expense and time requirements of current standard methods, it is likely that several new approaches will be developed for the analyses of the composition, concentration and viability of organisms in samples of ballast water. Administrations/Parties are encouraged to share information concerning methods for the analysis of ballast water samples, using existing scientific venues, and documents distributed through the Organization.

Sample analysis for determining efficacy in meeting the discharge standard

4.5 Sample analysis is meant to determine the species composition and the number of viable organisms in the sample. Different samples may be taken for determination of viability and for species composition.

4.6 The viability of organisms shall be determined taking into account guidance developed by the Organization[10] using methodologies appropriate to the ballast water treatment technology being tested. Such methodologies shall provide assurance that organisms not removed from ballast water have been killed or rendered harmless to the environment, human health, property and resources. Viability may be established by assessing the presence of one or more essential characteristics of life, such as structural integrity, metabolism, reproduction, motility or response to stimuli.

4.7 A treatment test cycle shall be deemed successful if:

.1 it is valid in accordance with paragraph 2.8.5 (shipboard) or 2.29, 2.30, 2.33 and 2.47 (land-based testing) of this annex as appropriate;

[10] Refer to the *Guidance on methodologies that may be used for enumerating viable organisms* (BWM.2/Circ.61).

.2 the density of organisms greater than or equal to 50 µm in minimum diameter in the replicate samples is less than 10 viable organisms per cubic metre;

.3 the density of organisms less than 50 µm and greater than or equal to 10 µm in minimum diameter in the replicate samples is less than 10 viable organisms per mL;

.4 the density of *Vibrio cholerae* (serotypes O1 and O139) is less than 1 cfu per 100 ml, or less than 1 cfu per 1 g (wet weight) zooplankton samples;

.5 the density of *E. coli* in the replicate samples is less than 250 cfu per 100 mL;

.6 the density of Intestinal Enterococci in the replicate samples is less than 100 cfu per 100 mL; and

.7 no averaging of test cycles, or the discounting of failed test cycles, has occurred.

4.8 It is recommended that a non-exhaustive list of standard methods and innovative research techniques be considered.[11]

Sample analysis for determining eco-toxicological acceptability of discharge

4.9 Toxicity tests of the treated water discharge shall be conducted taking into account guidelines developed by the Organization.[12]

PART 5 – SELF-MONITORING

Introduction

5.1 BWMS shall monitor and store a minimum number of parameters for detailed evaluation. In addition, all system indications and alerts shall be stored and available for inspection. Data storage and retrieval shall follow common standards. This part gives an overview of the minimum required self-monitoring parameters.

Monitoring of parameters

5.2 The applicable self-monitoring parameters listed below shall be recorded for every BWMS.[13] Any additional parameters that are necessary to ascertain system performance and safety shall be determined by the Administration and stored in the system. If a parameter is not applicable due to the particulars of the system, the Administration may waive the requirement to record that parameter. Limiting operating conditions on the operation of the BWMS shall be determined by the manufacturer and approved by the Administration.

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[11] Suggested sources may include but are not limited to:
.1 The Handbook of Standard Methods for the Analysis of Water and Waste Water
.2 ISO standard methods
.3 UNESCO standard methods
.4 World Health Organization
.5 American Society of Testing and Materials (ASTM) standard methods
.6 United States EPA standard methods
.7 Research papers published in peer-reviewed scientific journals
.8 MEPC documents

[12] Refer to paragraphs 5.2.3 to 5.2.7 of the *Procedure for approval of ballast water management systems that make use of Active Substances (G9)* (resolution MEPC.169(57)).

[13] Associated guidance for a template on technical details of the monitoring parameters and record intervals to be developed by the Organization.

General information for all systems

5.3 The information and applicable self-monitoring parameters to be recorded for all systems shall include, inter alia:

.1 general information: ship name, IMO number, BWMS manufacturer and type designation, BWMS serial number, date of BWMS installation on ship, BWMS TRC and principle of treatment (in-line/in-tank);

.2 operational parameters: all recorded parameters should be time tagged if applicable: BWMS operational modes and any transition modes, including bypass operations (e.g. uptake, discharge, warming-up, cleaning and start up), ballast water pump in operation (yes/no – if information is available from ship), flow-rate at system outlet, and indication of the ballast water tank that is involved in the ballast water operation when practicable;

.3 it is recommended that positional information on ballast water operations and on the holding time should be recorded automatically. Otherwise it shall be entered manually in the ballast water record book as appropriate. Administrations are encouraged to apply automatic position information recording to ships which install BWMS during a ship's building to the greatest extent possible;

.4 system alerts and indications: all systems shall have an alert regime. Every alert shall be logged and time stamped. To assist the inspections it would be helpful to record an alert summary after each ballast water operation automatically, if possible;

.5 general alerts include: shutdown of system while in operation, when maintenance is required, BWMS bypass valve status and status of BWMS valves representing system operational mode as appropriate;

.6 operational alerts: whenever a relevant parameter exceeds the acceptable range approved by the Administration, the system shall give an alert. In addition, an alert shall be logged and time stamped also when a combination of relevant parameters exceeds system specifications, even if each single parameter does not exceed its approved range. If a safety relevant parameter (safety for crew, cargo and/or the ship) related to the BWMS exceeds approved limits, an alert/alarm shall be mandatory (e.g. hydrogen level at appropriate measurement point(s));

.7 the Administration may require additional alerts depending on the design of the system and for future developments; and

.8 the SDL parameters and their corresponding data such as range, alarm limit, alert delay, etc., be password protected on a level above what is required for normal operation and maintenance, i.e. on a system administrator level. Change of any data or parameters which are password protected and interruption of the measurement (wire break, signal out of range) shall be automatically logged and retrievable on a maintenance access level.

Data storage and retrieval

5.4 Storage of data shall follow the requirements in paragraphs 4.17 to 4.22 of this Code. The equipment shall be able to store a minimum number of self-monitoring parameters following common standards determined by the Organization.

5.5 The control and monitoring equipment shall automatically record the proper functioning or failure of a BWMS without user interaction and add a time stamp to every entry. Additionally, the system shall have a tool to produce summary text files for each ballast water operation on demand to support inspections work.

5.6 The system shall store the required data in an acceptable format to be able to display, print or export the data for official inspections. An acceptable format could be:

.1 an internationally standardized readable format (e.g. text format, pdf, MS Excel); or

.2 the extensible mark-up language (xml).

5.7 The equipment shall be so designed that, as far as is practical, it will not be possible to manipulate either the data being stored by the system or the data which has already been recorded. Any attempt to interfere with the integrity of the data shall be recorded.

5.8 Permanent deletion of recordings shall not be possible. The system shall be capable of storing recorded data for at least 24 months to facilitate compliance with regulation B-2 of the Convention. Where navigation equipment is connected to the monitoring system to provide data for recording, the interfaces shall be developed taking into account applicable parts of relevant international standards.[14]

PART 6 – VALIDATION OF SYSTEM DESIGN LIMITATIONS

6.1 The objective of the SDL approach is twofold. Firstly, it ensures that the performance of the BWMS has been transparently assessed with respect to the known water quality and operational parameters that are important to its operation, including those that may not be specifically provided for in this Code. Secondly, it provides transparent oversight of BWMS performance claims by the manufacturer that may go beyond specific criteria in this Code. Although the validation of SDL yields information that is reported on the Type Approval Certificate, this information does not affect the eligibility of a BWMS to receive type approval.

6.2 The low and/or high parameter values for each SDL shall be validated to the satisfaction of the Administration as follows:

.1 the validation shall be overseen by the Administration and shall consist of a rigorous evidence-based assessment of a specific claim by the BWMS manufacturer that the equipment will operate as intended between pre-stated parameter values;

.2 tests to validate SDL shall be undertaken in accordance with paragraphs 2.2 to 2.4 of this annex. Such tests may be combined with land-based and/or shipboard testing if the QAPP establishes that the validation tests will not interfere with the specific procedures in Part 2 of this annex. Laboratory or bench-scale testing may also be used in the validation of SDL;

[14] Refer to *Digital interfaces for navigational equipment within a ship* (IEC 61162).

.3 methods other than testing, such as the use of existing data and/or models, may be used in the validation of SDL. The source, suitability and reliability of such methods shall be reported; and

.4 validation is not intended as a stress-test of the BWMS or as a procedure for identifying equipment failure points. Validation shall be undertaken independently of the BWMS manufacturer and shall be separate from BWMS research and development activities. Data and models may be supplied by the manufacturer when appropriate but shall be independently assessed.

6.3 Claims of open-ended performance (expressed as the lack of either a low or a high parameter value for a System Design Limitation) shall also be validated.

6.4 BWMS manufacturers may include a margin of error in claiming SDL. For this reason, SDL should not necessarily be interpreted as the exact parameter values beyond which the BWMS is incapable of operation. The Administration shall take this into account in considering whether to include any additional restrictions on the Type Approval Certificate in connection with the validation of SDL.

6.5 SDL shall be established for all known parameters to which the design of the BWMS is sensitive that are important to the operation of the BWMS. In the case of SDL parameters that are also subject to specific criteria in Part 2 of this annex, the procedure set out in Part 2 shall be followed. For such parameters, the approach in paragraph 6.2 above may be used only to the extent that the performance claim goes beyond the specific criteria in Part 2.

6.6 A report shall be submitted to the Administration containing all documentation (including procedures, methods, data, models, results, explanations and remarks) associated with the validation of SDL. The report shall include at least the information identified in paragraph 2.57 of this annex.

PART 7 – TYPE APPROVAL CERTIFICATE AND TYPE APPROVAL REPORT

Type Approval Certificate

7.1 The Type Approval Certificate of a BWMS shall:

.1 identify the type and model of the BWMS to which it applies and identify equipment assembly drawings, duly dated;

.2 identify pertinent drawings bearing model specification numbers or equivalent identification details;

.3 include a reference to the full performance test protocol on which it is based;

.4 identify if it was issued by an Administration based on a Type Approval Certificate previously issued by another Administration. Such a certificate shall identify the Administration that supervised conduction of the tests on the BWMS and a copy of the original test results shall be attached to the Type Approval Certificate of the BWMS;

.5 identify all conditions and limitations for the installation of BWMS on board the ship;

.6 include the SDL, which shall be listed under the heading "This equipment has been designed for operation in the following conditions";

.7 include any restrictions imposed by the Administration due to the minimum holding time or in accordance with paragraph 6.4 of this annex; such restrictions shall include any applicable environmental conditions (e.g. UV transmittance, etc.) and/or system operational parameters (e.g. min/max pressure, pressure differentials, min/max Total Residual Oxidants (TRO) if applicable, etc.); and

.8 include an appendix containing test results of each land-based and shipboard test cycle. Such test results shall include at least the numerical salinity, temperature, flow rates, and where appropriate UV transmittance. In addition, these test results shall include all other relevant variables. The Type Approval Certificate shall list any identified SDL parameters.

Type approval report

7.2 The type approval report shall be submitted to the Organization and made available to the public and Member States by appropriate means. It shall contain at least:

.1 information on the type approval of the BWMS, including:

.1 the approval date;

.2 the name of the Administration;

.3 the name of the manufacturer;

.4 the trade name and product designation (such as model numbers) of the BWMS; and

.5 a copy of the Type Approval Certificate including its appendices, annexes or other attachments;

.2 an executive summary;

.3 a description of the BWMS, including, in the case of BWMS using Active Substances, the following information:

.1 the name of the Active Substance(s) or Preparation(s) employed; and

.2 identification of the specific Marine Environment Protection Committee (MEPC) report and paragraph number granting Final Approval, taking into account guidelines developed by the Organization;[15]

.4 an overview of the process undertaken by the Administration to evaluate the BWMS, including the name and role of each test facility, subcontractor and test organization involved in testing and approving the BWMS, the role of each report in the type approval decision, and a summary of the Administration's approach to overall quality assurance and quality control;

.5 the executive summary of each test report prepared in accordance with paragraphs 2.48, 2.55 to 2.57, 3.4 and 6.6 of this Annex;

[15] Refer to the *Procedure for approval of ballast water management systems that make use of Active Substances (G9)* (resolution MEPC.169(57)).

.6 the operational safety requirements of the BWMS and all safety-related findings that have been made during the type approval process;

.7 a discussion section explaining the Administration's assessment that the BWMS:

.1 in every respect fulfilled the requirements of this Code, including demonstrating under the procedures and conditions specified for both land-based and shipboard testing that it met the ballast water performance standard described in regulation D-2;

.2 is designed and manufactured according to requirements and standards;

.3 is in compliance with all applicable requirements;

.4 has been approved taking into account the recommendations provided by the MEPC in the Final Approval of the BWMS, if any;

.5 operates within the SDL at the TRC, performance, and reliability as specified by the manufacturer;

.6 contains control and monitoring equipment that operates correctly;

.7 was installed in accordance with the technical installation specification of the manufacturer for all tests; and

.8 was used to treat volumes and flow rates of ballast water during the shipboard tests consistent with the normal ballast operations of the ship; and

.8 the following annexes:

.1 appropriate information on quality control and assurance; and

.2 each complete test report prepared in accordance with paragraphs 2.48, 2.55 to 2.57, 3.4 and 6.6 of this annex.

7.3 The Administration may redact proprietary information of the manufacturer from the type approval report before submitting it to the Organization.

7.4 The Type Approval Certificate and the type approval report (including their entire contents and all annexes, appendices or other attachments) shall be accompanied by a translation into English, French or Spanish if not written in one of those languages.

7.5 Documents shall not be incorporated by reference into the Type Approval Certificate. The Administration may incorporate an annex by reference into the type approval report if the reference (e.g. internet URL) is expected to remain permanently valid. Upon any reference becoming invalid, the Administration shall promptly re-submit the type approval report to the Organization and include the referenced document or an updated reference to it; and the Organization shall promptly make the revised report available to the public and Member States through appropriate means.

APPENDIX

BADGE OR CIPHER **(Limiting Operating Conditions apply)***

NAME OF ADMINISTRATION

TYPE APPROVAL CERTIFICATE OF BALLAST WATER MANAGEMENT SYSTEM

This is to certify that the ballast water management system listed below has been examined and tested in accordance with the requirements of the specifications contained in the *Code for Approval of Ballast Water Management Systems* (resolution MEPC.300(72)). This certificate is valid only for the ballast water management system referred to below.

Name of ballast water management system: .....

Ballast water management system manufactured by: .....

Under type and model designation(s) .....
and incorporating:

To equipment/assembly drawing No.: ..... date: .....

Other equipment manufactured by: .....

To equipment/assembly drawing No.: ..... date: .....

Treatment Rated Capacity (m^3/h): .....

A copy of this Type Approval Certificate shall be carried on board a ship fitted with this ballast water management system, for inspection on board the ship. If the Type Approval Certificate is issued based on approval by another Administration, reference to that Type Approval Certificate shall be made.

Limiting Operating Conditions imposed are described in this document.

(Temperature / Salinity)

Other restrictions imposed include the following: .....

This equipment has been designed for operation in the following conditions:** .....

Official stamp

Signed .....
Administration of .....
Issued this ..... day of ..... 20 .....
Valid until this ..... day of .....20 .....

***

* Delete as appropriate.

** Insert System Design Limitations.

ANNEX 6

RESOLUTION MEPC.301(72)
(adopted on 13 April 2018)

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

(ECAs and required EEDI for ro-ro cargo ships and ro-ro passenger 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 conferred upon it by international conventions for the prevention and control of marine pollution from ships,

NOTING 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-second session, proposed amendments to MARPOL Annex VI concerning ECAs and the required EEDI for ro-ro cargo ships and ro-ro passenger ships,

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 March 2019 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 September 2019 upon their acceptance in accordance with paragraph 2 above;

4 INVITES FURTHER the Parties to consider the application of the aforesaid amendments to regulation 21 of Annex VI of MARPOL concerning new parameters for determination of reference values of the EEDI to ships entitled to fly their flag as soon as possible, prior to entry into force;

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 REQUESTS FURTHER 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

(ECAs and the required EEDI for ro-ro cargo ships and ro-ro passenger ships)

Regulation 13 – Nitrogen oxides (NO_X)

1 In paragraph 5.3, the words "an emission control area designated under paragraph 6 of this regulation" are replaced with the words "a NO_X Tier III emission control area".

Regulation 21 - Required EEDI

2 In table 2 (Parameters for determination of reference values for the different ship types) of paragraph 3, rows 2.34 and 2.35 for ro-ro cargo ships and ro-ro passenger ships are replaced by the following:

2.34 Ro-ro cargo ship	1405.15	DWT of the ship	0.498
	1686.17*	DWT of the ship where DWT≤17,000* 17,000 where DWT > 17,000*	
2.35 Ro-ro passenger ship	752.16	DWT of the ship	0.381
	902.59*	DWT of the ship where DWT≤10,000* 10,000 where DWT > 10,000*	

* to be used from phase 2 and thereafter.

***

ANNEX 7

RESOLUTION MEPC.302(72)
(adopted on 13 April 2018)

AMENDMENTS TO THE INTERNATIONAL CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING DANGEROUS CHEMICALS IN BULK (IBC CODE)

(Model form of International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk)

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 resolution MEPC.19(22) by which it adopted the *International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code)*, and resolution MEPC.16(22) by which the IBC Code has become mandatory under Annex II of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL),

NOTING article 16 of MARPOL and regulation 1.4 of MARPOL Annex II concerning the procedure for amending the IBC Code,

HAVING CONSIDERED, at its seventy-second session, proposed amendments to the IBC Code concerning the Model form of the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk,

1 ADOPTS, in accordance with article 16(2)(d) of MARPOL, amendments to the IBC Code, 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 to the IBC Code shall be deemed to have been accepted on 1 July 2019 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 amendments to the IBC Code shall enter into force on 1 January 2020 upon their acceptance in accordance with paragraph 2 above;

4 REQUESTS the Secretary-General, in conformity with article 16(2)(e) of MARPOL, to transmit certified copies of the present resolution and the text of the amendments to the IBC Code contained in the annex to all parties to MARPOL;

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

ANNEX

AMENDMENTS TO THE INTERNATIONAL CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING DANGEROUS CHEMICALS IN BULK (IBC CODE)

(Model form of International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk)

APPENDIX

MODEL FORM OF INTERNATIONAL CERTIFICATE OF FITNESS FOR THE CARRIAGE OF DANGEROUS CHEMICALS IN BULK

1 The existing paragraph 6 is replaced by the following:

"6 That the loading and stability information booklet required by paragraph 2.2.5 of the Code has been supplied to the ship in an approved form."

2 A new paragraph 7 is added as follows:

"7 That the ship must be loaded:

.1* only in accordance with loading conditions verified compliant with intact and damage stability requirements using the approved stability instrument fitted in accordance with paragraph 2.2.6 of the Code;

.2* where a waiver permitted by paragraph 2.2.7 of the Code is granted and the approved stability instrument required by paragraph 2.2.6 of the Code is not fitted, loading shall be made in accordance with one or more of the following approved methods:

(i)* in accordance with the loading conditions provided in the approved loading and stability information booklet referred to in 6 above; or

(ii)* in accordance with loading conditions verified remotely using an approved means ……; or

(iii)* in accordance with a loading condition which lies within an approved range of conditions defined in the approved loading and stability information booklet referred to in 6 above; or

(iv)* in accordance with a loading condition verified using approved critical KG/GM data defined in the approved loading and stability information booklet referred to in 6 above; and

.3* in accordance with the loading limitations appended to this Certificate.

Where it is required to load the ship other than in accordance with the above instruction, then the necessary calculations to justify the proposed loading conditions shall be communicated to the certifying Administration who may authorize in writing the adoption of the proposed loading condition.**

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* Delete as appropriate.

** Instead of being incorporated in the Certificate, this text may be appended to the Certificate, if duly signed and stamped."

***

ANNEX 8

RESOLUTION MEPC.303(72)
(adopted on 13 April 2018)

AMENDMENTS TO THE CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING DANGEROUS CHEMICALS IN BULK (BCH CODE)

(Model form of Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk)

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

RECALLING ALSO resolution MEPC.20 (22) by which it adopted the *Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (BCH Code)*, and resolution MEPC.16(22) by which the BCH Code has become mandatory under Annex II of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL),

NOTING article 16 of MARPOL and regulation 1.4 of MARPOL Annex II concerning the procedure for amending the BCH Code,

HAVING CONSIDERED, at its seventy-second session, proposed amendments to the BCH Code concerning the Model form of the Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk,

1 ADOPTS, in accordance with article 16(2)(d) of MARPOL, amendments to the BCH Code, 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 to the BCH Code shall be deemed to have been accepted on 1 July 2019 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 amendments to the BCH Code shall enter into force on 1 January 2020 upon their acceptance in accordance with paragraph 2 above;

4 INVITES ALSO the Maritime Safety Committee to note this resolution and take action as appropriate;

5 REQUESTS the Secretary-General, in conformity with article 16(2)(e) of MARPOL, to transmit certified copies of the present resolution and the text of the amendments to the BCH Code contained in the annex to all parties to MARPOL;

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

ANNEX

AMENDMENTS TO THE CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING DANGEROUS CHEMICALS IN BULK (BCH CODE)

(Model form of Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk)

APPENDIX

MODEL FORM OF CERTIFICATE OF FITNESS FOR THE CARRIAGE OF DANGEROUS CHEMICALS IN BULK

1 The existing paragraph 6 is replaced by the following:

"6 That the loading and stability manuals required by paragraph 2.2.1.1 of the Code have been supplied to the ship in an approved form."

2 A new paragraph 7 is added as follows:

"7 That the ship must be loaded:

.1* only in accordance with loading conditions verified compliant with intact and damage stability requirements using the approved stability instrument fitted in accordance with paragraph 2.2.1.2 of the Code;

.2* where a waiver permitted by paragraph 2.2.1.3 of the Code is granted and the approved stability instrument required by paragraph 2.2.1.2 of the Code is not fitted, loading should be made in accordance with one or more of the following approved methods:

(i)* in accordance with the loading conditions provided in the approved loading and stability manuals referred to in 6 above; or

(ii)* in accordance with loading conditions verified remotely using an approved means ……..……; or

(iii)* in accordance with a loading condition which lies within an approved range of conditions defined in the approved loading and stability manuals referred to in 6 above; or

(iv)* in accordance with a loading condition verified using approved critical KG/GM data defined in the approved loading and stability manuals referred to in 6 above; and

.3* in accordance with the loading limitations appended to this Certificate.

Where it is required to load the ship other than in accordance with the above instruction, then the necessary calculations to justify the proposed loading conditions should be communicated to the certifying Administration who may authorize in writing the adoption of the proposed loading condition.**

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* Delete as appropriate

** Instead of being incorporated in the Certificate, this text may be appended to the Certificate, if duly signed and stamped."

***

ANNEX 3

RESOLUTION MEPC.298(72)
(adopted on 13 April 2018)

DETERMINATION OF THE SURVEY REFERRED TO IN REGULATION B-3, AS AMENDED, OF THE BWM CONVENTION

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 resolution MEPC.297(72), by which it adopted amendments to regulation B-3 of the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (the BWM Convention),

NOTING ALSO that paragraph 10 of regulation B-3 of the BWM Convention, as amended, states that the Committee shall determine the renewal survey to which paragraphs 1.1,1.2, 2 and 4 of regulation B-3 of the BWM Convention shall apply,

DETERMINES that the renewal survey referred to in paragraph 10 of regulation B-3 of the BWM Convention is the renewal survey for the ship associated with the International Oil Pollution Prevention Certificate pursuant to Annex I of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL).

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ANNEX 11

RESOLUTION MEPC.304(72)
(adopted on 13 April 2018)

INITIAL IMO STRATEGY ON REDUCTION OF GHG EMISSIONS FROM SHIPS

THE MARINE ENVIRONMENT PROTECTION COMMITTEE

RECALLING Article 38(e) of the Convention on the International Maritime Organization (the 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,

ACKNOWLEDGING that work to address greenhouse gas (GHG) emissions from ships has been undertaken by the Organization continuously since 1997, in particular, through adopting global mandatory technical and operational energy efficiency measures for ships under MARPOL Annex VI,

ACKNOWLEDGING ALSO the decision of the thirtieth session of the Assembly in December 2017 that adopted for the Organization a strategic direction entitled "Respond to Climate Change",

RECALLING the United Nations 2030 Agenda for Sustainable Development,

1 ADOPTS the Initial IMO Strategy on Reduction of GHG Emissions from Ships (hereinafter the Initial Strategy) as set out in the annex to the present resolution;

2 INVITES the Secretary-General of the Organization to make adequate provisions in the Integrated Technical Cooperation Programme (ITCP) to support relevant follow-up actions of the Initial Strategy that may be further decided by the Committee and undertaken by developing countries, particularly least developed countries (LDCs) and small island developing States (SIDS);

3 AGREES to keep the Initial Strategy under review, with a view to adoption of a Revised IMO Strategy on reduction of GHG emissions from ships in 2023.

ANNEX

INITIAL IMO STRATEGY ON REDUCTION OF GHG EMISSIONS FROM SHIPS

Contents

1 INTRODUCTION

1.1 The International Maritime Organization (IMO) is the United Nations specialized agency responsible for safe, secure and efficient shipping and the prevention of pollution from ships.

1.2 The Strategy represents the continuation of work of IMO as the appropriate international body to address greenhouse gas (GHG) emissions from international shipping. This work includes Assembly resolution A.963(23) on *IMO policies and practices related to the reduction of greenhouse gas emissions from ships*, adopted on 5 December 2003, urging the Marine Environment Protection Committee (MEPC) to identify and develop the mechanisms needed to achieve the limitation or reduction of GHG emissions from international shipping.

1.3 In response to the Assembly's request, work to address GHG emissions from ships has been undertaken, including inter alia:

.1 MEPC 62 (July 2011) adopted resolution MEPC.203(62) on *Inclusion of regulations on energy efficiency for ships in MARPOL Annex VI* introducing mandatory technical (EEDI) and operational (SEEMP) measures for the energy efficiency of ships. To date more than 2,700 new ships have been certified to the energy efficiency design requirement;

.2 MEPC 65 (May 2013) adopted resolution MEPC.229(65) on *Promotion of technical co-operation and transfer of technology relating to the improvement of energy efficiency of ships*, which, among other things, requests IMO, through its various programmes (ITCP,[1] GloMEEP project,[2] MTCC network,[3] etc.), to provide technical assistance to Member States to enable cooperation in the transfer of energy efficient technologies, in particular to developing countries; and

.3 MEPC 70 (October 2016) adopted, by resolution MEPC.278(70), amendments to MARPOL Annex VI to introduce the d*ata collection system for fuel oil consumption of ships*, containing mandatory requirements for ships to record and report their fuel oil consumption. Ships of 5,000 gross tonnage and above (representing approximately 85% of the total CO_2 emissions from international shipping) are required to collect consumption data for each type of fuel oil they use, as well as other, additional, specified data including proxies for "transport work".

1.4 This Initial Strategy is the first milestone set out in the *Roadmap for developing a comprehensive IMO Strategy on reduction of GHG emissions from ships* (the Roadmap) approved at MEPC 70. The Roadmap identifies that a revised Strategy is to be adopted in 2023.

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1 Integrated Technical Cooperation Programme http://www.imo.org

2 Global Maritime Energy Efficiency Partnerships http://glomeep.imo.org

3 Global Maritime Technology Cooperation Centres Network http://gmn.imo.org

Context

1.5 The Initial Strategy falls within a broader context including:

.1 other existing instruments related to the law of the sea, including UNCLOS, and to climate change, including the UNFCCC and its related legal instruments, including the Paris Agreement;

.2 the leading role of the Organization for the development, adoption and assistance in implementation of environmental regulations applicable to international shipping;

.3 the decision of the thirtieth session of the Assembly in December 2017 that adopted for the Organization a Strategic Direction entitled "Respond to climate change"; and

.4 the United Nations 2030 Agenda for Sustainable Development.

Emissions and emission scenarios

1.6 The *Third IMO GHG Study 2014* has estimated that GHG emissions from international shipping in 2012 accounted for some 2.2% of anthropogenic CO_2 emissions and that such emissions could grow by between 50% and 250% by 2050. Future IMO GHG studies would help reduce the uncertainties associated with these emission estimates and scenarios.

Objectives of the Initial Strategy

1.7 The Initial Strategy is aimed at:

.1 enhancing IMO's contribution to global efforts by addressing GHG emissions from international shipping. International efforts in addressing GHG emissions include the Paris Agreement and its goals and the United Nations 2030 Agenda for Sustainable Development and its SDG 13: "*Take urgent action to combat climate change and its impacts*";

.2 identifying actions to be implemented by the international shipping sector, as appropriate, while addressing impacts on States and recognizing the critical role of international shipping in supporting the continued development of global trade and maritime transport services; and

.3 identifying actions and measures, as appropriate, to help achieve the above objectives, including incentives for research and development and monitoring of GHG emissions from international shipping.

2 VISION

IMO remains committed to reducing GHG emissions from international shipping and, as a matter of urgency, aims to phase them out as soon as possible in this century.

3 LEVELS OF AMBITION AND GUIDING PRINCIPLES

Levels of ambition

3.1 Subject to amendment depending on reviews to be conducted by the Organization, the Initial Strategy identifies levels of ambition for the international shipping sector noting that technological innovation and the global introduction of alternative fuels and/or energy sources for international shipping will be integral to achieve the overall ambition. The reviews should take into account updated emission estimates, emissions reduction options for international shipping, and the reports of the Intergovernmental Panel on Climate Change (IPCC), as relevant. Levels of ambition directing the Initial Strategy are as follows:

.1 carbon intensity of the ship to decline through implementation of further phases of the energy efficiency design index (EEDI) for new ships

to review with the aim to strengthen the energy efficiency design requirements for ships with the percentage improvement for each phase to be determined for each ship type, as appropriate;

.2 carbon intensity of international shipping to decline

to reduce CO_2 emissions per transport work, as an average across international shipping, by at least 40% by 2030, pursuing efforts towards 70% by 2050, compared to 2008; and

.3 GHG emissions from international shipping to peak and decline

to peak GHG emissions from international shipping as soon as possible and to reduce the total annual GHG emissions by at least 50% by 2050 compared to 2008 whilst pursuing efforts towards phasing them out as called for in the Vision as a point on a pathway of CO_2 emissions reduction consistent with the Paris Agreement temperature goals.

Guiding principles

3.2 The principles guiding the Initial Strategy include:

.1 the need to be cognizant of the principles enshrined in instruments already developed, such as:

.1 the principle of non-discrimination and the principle of no more favourable treatment, enshrined in MARPOL and other IMO conventions; and

.2 the principle of common but differentiated responsibilities and respective capabilities, in the light of different national circumstances, enshrined in UNFCCC, its Kyoto Protocol and the Paris Agreement;

.2 the requirement for all ships to give full and complete effect, regardless of flag, to implementing mandatory measures to ensure the effective implementation of this strategy;

.3 the need to consider the impacts of measures on States, including developing countries, in particular, on LDCs and SIDS as noted by MEPC 68 (MEPC 68/21, paragraphs 4.18 to 4.19) and their specific emerging needs, as recognized in the Organization's Strategic Plan (resolution A.1110(30)); and

.4 the need for evidence-based decision-making balanced with the precautionary approach as set out in resolution MEPC.67(37).

4 LIST OF CANDIDATE SHORT-, MID- AND LONG-TERM FURTHER MEASURES WITH POSSIBLE TIMELINES AND THEIR IMPACTS ON STATES

Timelines

4.1 Candidate measures set out in this Initial Strategy should be consistent with the following timelines:

.1 possible short-term measures could be measures finalized and agreed by the Committee between 2018 and 2023. Dates of entry into force and when the measure can effectively start to reduce GHG emissions would be defined for each measure individually;

.2 possible mid-term measures could be measures finalized and agreed by the Committee between 2023 and 2030. Dates of entry into force and when the measure can effectively start to reduce GHG emissions would be defined for each measure individually; and

.3 possible long-term measures could be measures finalized and agreed by the Committee beyond 2030. Dates of entry into force and when the measure can effectively start to reduce GHG emissions would be defined for each measure individually.

4.2 In aiming for early action, the timeline for short-term measures should prioritize potential early measures that the Organization could develop, while recognizing those already adopted, including MARPOL Annex VI requirements relevant for climate change, with a view to achieve further reduction of GHG emissions from international shipping before 2023.

4.3 Certain mid- and long-term measures will require work to commence prior to 2023.

4.4 These timelines should be revised as appropriate as additional information becomes available.

4.5 Short-, mid- and long-term further measures to be included in the Revised IMO GHG Strategy should be accompanied by implementation schedules.

4.6 The list of candidate measures is non-exhaustive and is without prejudice to measures the Organization may further consider and adopt.

Candidate short-term measures

4.7 Measures can be categorized as those the effect of which is to directly reduce GHG emissions from ships and those which support action to reduce GHG emissions from ships. All the following candidate measures[4] represent possible short-term further action of the Organization on matters related to the reduction of GHG emissions from ships:

.1 further improvement of the existing energy efficiency framework with a focus on EEDI and SEEMP, taking into account the outcome of the review of EEDI regulations;

.2 develop technical and operational energy efficiency measures for both new and existing ships, including consideration of indicators in line with the three-step approach that can be utilized to indicate and enhance the energy efficiency performance of shipping, e.g. Annual Efficiency Ratio (AER), Energy Efficiency per Service Hour (EESH), Individual Ship Performance Indicator (ISPI) and Fuel Oil Reduction Strategy (FORS);

.3 establishment of an Existing Fleet Improvement Programme;

.4 consider and analyse the use of speed optimization and speed reduction as a measure, taking into account safety issues, distance travelled, distortion of the market or trade and that such measure does not impact on shipping's capability to serve remote geographic areas;

.5 consider and analyse measures to address emissions of methane and further enhance measures to address emissions of Volatile Organic Compounds;

.6 encourage the development and update of national action plans to develop policies and strategies to address GHG emissions from international shipping in accordance with guidelines to be developed by the Organization, taking into account the need to avoid regional or unilateral measures;

.7 continue and enhance technical cooperation and capacity-building activities under the ITCP;

.8 consider and analyse measures to encourage port developments and activities globally to facilitate reduction of GHG emissions from shipping, including provision of ship and shoreside/onshore power supply from renewable sources, infrastructure to support supply of alternative low-carbon and zero-carbon fuels, and to further optimize the logistic chain and its planning, including ports;

.9 initiate research and development activities addressing marine propulsion, alternative low-carbon and zero-carbon fuels, and innovative technologies to further enhance the energy efficiency of ships and establish an International Maritime Research Board to coordinate and oversee these R&D efforts;

.10 incentives for first movers to develop and take up new technologies;

[4] The Initial Strategy is subject to revision based on fuel oil consumption data collected during 2019-2021 and does not prejudge any specific further measures that may be implemented in Phase 3 of the three-step approach.

.11 develop robust lifecycle GHG/carbon intensity guidelines for all types of fuels, in order to prepare for an implementation programme for effective uptake of alternative low-carbon and zero-carbon fuels;

.12 actively promote the work of the Organization to the international community, in particular, to highlight that the Organization, since the 1990s, has developed and adopted technical and operational measures that have consistently provided a reduction of air emissions from ships, and that measures could support the Sustainable Development Goals, including SDG 13 on Climate Change; and

.13 undertake additional GHG emission studies and consider other studies to inform policy decisions, including the updating of Marginal Abatement Cost Curves and alternative low-carbon and zero-carbon fuels.

Candidate mid-term measures

4.8 Measures can be categorized as those the effect of which is to directly reduce GHG emissions from ships and those which support action to reduce GHG emissions from ships. All the following candidate measures represent possible mid-term further action of the Organization on matters related to the reduction of GHG emissions from ships:

.1 implementation programme for the effective uptake of alternative low-carbon and zero-carbon fuels, including update of national actions plans to specifically consider such fuels;

.2 operational energy efficiency measures for both new and existing ships including indicators in line with three-step approach that can be utilized to indicate and enhance the energy efficiency performance of ships;

.3 new/innovative emission reduction mechanism(s), possibly including Market-based Measures (MBMs), to incentivize GHG emission reduction;

.4 further continue and enhance technical cooperation and capacity-building activities such as under the ITCP; and

.5 development of a feedback mechanism to enable lessons learned on implementation of measures to be collated and shared through a possible information exchange on best practice.

Candidate long-term measures

4.9 All the following candidate measures represent possible long-term further action of the Organization on matters related to the reduction of GHG emissions from ships:

.1 pursue the development and provision of zero-carbon or fossil-free fuels to enable the shipping sector to assess and consider decarbonization in the second half of the century; and

.2 encourage and facilitate the general adoption of other possible new/innovative emission reduction mechanism(s).

Impacts on States

4.10 The impacts on States of a measure should be assessed and taken into account as appropriate before adoption of the measure. Particular attention should be paid to the needs of developing countries, especially small island developing States (SIDS) and least developed countries (LDCs).

4.11 When assessing impacts on States the impact of a measure should be considered, as appropriate, inter alia, in the following terms:

.1 geographic remoteness of and connectivity to main markets;

.2 cargo value and type;

.3 transport dependency;

.4 transport costs;

.5 food security;

.6 disaster response;

.7 cost-effectiveness; and

.8 socio-economic progress and development.

4.12 The specification for and agreement on the procedure for assessing and taking into account the impacts of measures related to international shipping on States should be undertaken as a matter of urgency as part of the follow-up actions.

4.13 Disproportionately negative impacts should be assessed and addressed, as appropriate.

5 BARRIERS AND SUPPORTIVE MEASURES; CAPACITY-BUILDING AND TECHNICAL COOPERATION; R&D

5.1 The Committee recognizes that developing countries, in particular LDCs and SIDS, have special needs with regard to capacity-building and technical cooperation.

5.2 The Committee acknowledges that development and making globally available new energy sources that are safe for ships could be a specific barrier to the implementation of possible measures.

5.3 The Committee could assist the efforts to promote low-carbon technologies by facilitating public-private partnerships and information exchange.

5.4 The Committee should continue to provide mechanisms for facilitating information sharing, technology transfer, capacity-building and technical cooperation, taking into account resolution MEPC.229(65) on *Promotion of technical co-operation and transfer of technology relating to the improvement of energy efficiency of ships*.

5.5 The Organization is requested to assess periodically the provision of financial and technological resources and capacity-building to implement the Strategy through the ITCP and other initiatives including the GloMEEP project and the MTCC network.

6 FOLLOW-UP ACTIONS TOWARDS THE DEVELOPMENT OF THE REVISED STRATEGY

6.1 A programme of follow-up actions of the Initial Strategy should be developed.

6.2 The key stages for the adoption of a Revised IMO GHG Strategy in 2023 as set out in the Roadmap, are as follows:

Spring 2018 (MEPC 72)	Adoption of the Initial Strategy[5] including, inter alia, a list of candidate short-, mid- and long-term further measures with possible timelines, to be revised as appropriate as additional information becomes available
January 2019	Start of Phase 1: Data collection (Ships to collect data)
Spring 2019 (MEPC 74)	Initiation of Fourth IMO GHG Study using data from 2012-2018
Summer 2020	Data from 2019 to be reported to IMO
Autumn 2020 (MEPC 76)	Start of Phase 2: data analysis (no later than autumn 2020) Publication of Fourth IMO GHG Study for consideration by MEPC 76
Spring 2021 (MEPC 77)	Secretariat report summarizing the 2019 data pursuant to regulation 22A.10 Initiation of work on adjustments on Initial IMO Strategy, based on Data Collection System (DCS) data
Summer 2021	Data for 2020 to be reported to IMO
Spring 2022 (MEPC 78)	Phase 3: Decision step Secretariat report summarizing the 2020 data pursuant to regulation 22A.10
Summer 2022	Data for 2021 to be reported to IMO
Spring 2023 (MEPC 80)	Secretariat report summarizing the 2021 data pursuant to regulation 22A.10 Adoption of Revised IMO Strategy, including short-, mid- and long-term further measure(s), as required, with implementation schedules

6.3 The Marginal Abatement Cost Curve (MACC) for each measure, as appropriate, should be ascertained and updated, and then evaluated on a regular basis.

[5] Initial IMO Strategy is subject to revision based on DCS data during 2019-2021 and does not prejudge any specific further measures that may be implemented in Phase 3 of the three-step approach.

7 PERIODIC REVIEW OF THE STRATEGY

7.1 The Revised Strategy is to be adopted in spring 2023.

7.2 The Revised Strategy should be subject to a review five years after its final adoption.

7.3 The Committee should undertake the review including defining the scope of the review and its terms of reference.

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ANNEX 1

RESOLUTION MEPC.305(73)
(adopted on 26 October 2018)

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

(Prohibition on the carriage of non-compliant fuel oil for combustion purposes for propulsion or operation on board a ship)

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 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-third session, proposed amendments to MARPOL Annex VI concerning the prohibition on the carriage of non-compliant fuel oil for combustion purposes for propulsion or operation on board a ship,

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 September 2019 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 March 2020 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 REQUESTS FURTHER 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

(Prohibition on the carriage of non-compliant fuel oil for combustion purposes for propulsion or operation on board a ship)

ANNEX VI

REGULATIONS FOR THE PREVENTION OF AIR POLLUTION FROM SHIPS

Regulation 14
Sulphur oxides (SO_X) and particulate matter

General requirements

1 Paragraph 1 is replaced by the following:

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

Requirements within emission control areas

2 Paragraph 3 is replaced by the following:

"3 For the purpose of this regulation, an emission control area shall be any sea area, including any port area, designated by the Organization in accordance with the criteria and procedures set forth in appendix III to this Annex. The emission control areas under this regulation are:

.1 the Baltic Sea area as defined in regulation 1.11.2 of Annex I of the present Convention;

.2 the North Sea area as defined in regulation 1.14.6 of Annex V of the present Convention;

.3 the North American Emission Control Area, which means the area described by the coordinates provided in appendix VII to this Annex; and

.4 the United States Caribbean Sea Emission Control Area, which means the area described by the coordinates provided in appendix VII to this Annex."

3 Paragraph 4 is replaced by the following:

"4 While a ship is operating within an emission control area, the sulphur content of fuel oil used on board that ship shall not exceed 0.10% m/m."

4 The subtitle "Review provision" and paragraphs 8, 9 and 10 are deleted.

Appendix I

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

Supplement to International Air Pollution Prevention Certificate (IAPP Certificate)

5 Paragraphs 2.3.1 and 2.3.2 are replaced by the following and a new paragraph 2.3.3 is added as follows:

"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

……..……☐"

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ANNEX 2

RESOLUTION MEPC.306(73)
(adopted on 26 October 2018)

AMENDMENTS TO THE GUIDELINES FOR BALLAST WATER MANAGEMENT AND DEVELOPMENT OF BALLAST WATER MANAGEMENT PLANS (G4) (RESOLUTION MEPC.127(53))

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 that the International Conference on Ballast Water Management for Ships held in February 2004 adopted the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (the Ballast Water Management Convention) together with four Conference resolutions,

NOTING that regulation A-2 of the Ballast Water Management Convention requires that discharge of ballast water shall only be conducted through ballast water management in accordance with the provisions of the Annex to the Convention,

NOTING FURTHER that regulation B-1 of the Annex to the Ballast Water Management Convention provides that each ship shall have on board and implement a ballast water management plan approved by the Administration, taking into account Guidelines developed by the Organization,

NOTING FURTHER that, at its fifty-third session, the Committee adopted, by resolution MEPC.127(53), the *Guidelines for ballast water management and development of ballast water management plans* (G4),

HAVING CONSIDERED, at its seventy-third session, proposed amendments to the Guidelines (G4),

1 ADOPTS amendments to the *Guidelines for ballast water management and development of ballast water management plans*, as set out in the annex to the present resolution;

2 INVITES Governments to apply the Guidelines, as amended, as soon as possible;

3 AGREES to keep the Guidelines, as amended, under review.

ANNEX

AMENDMENTS TO THE GUIDELINES FOR BALLAST WATER MANAGEMENT AND DEVELOPMENT OF BALLAST WATER MANAGEMENT PLANS (G4)

1 Paragraph 4.3 is added in part B:

"4.3 The ballast water management plan may include contingency measures developed taking into account guidelines developed by the Organization[*]."

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[*] Refer to the *Guidance on contingency measures under the BWM Convention* (BWM.2/Circ.62, as may be amended).

ANNEX 3

RESOLUTION MEPC 307(73)
(adopted on 26 October 2018)

2018 GUIDELINES FOR THE DISCHARGE OF EXHAUST GAS RECIRCULATION (EGR) BLEED-OFF WATER

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,

RECALLING ALSO that, at its fifty-eighth session, it adopted, by resolution MEPC.176(58), a revised MARPOL Annex VI (hereinafter referred to as "MARPOL Annex VI") and, by resolution MEPC.177(58), a revised Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines (hereinafter referred to as the "NO_X Technical Code 2008"),

NOTING regulation 13 of MARPOL Annex VI which makes the NO_X Technical Code 2008 mandatory under that Annex,

NOTING ALSO that the use of NO_X-reducing devices is envisaged in the NO_X Technical Code 2008 and that exhaust gas recirculation (EGR) systems are such NO_X-reducing devices for compliance with the Tier II and/or Tier III NO_X limit,

RECOGNIZING the need to develop guidelines for the discharge of EGR bleed-off water,

HAVING CONSIDERED, at its seventy-third session, draft guidelines for the discharge of EGR bleed-off water, prepared by the Sub-Committee on Pollution Prevention and Response, at its fifth session,

1 ADOPTS the *2018 Guidelines for the discharge of exhaust gas recirculation (EGR) bleed-off water*, as set out at annex to the present resolution;

2 INVITES Administrations to take the annexed Guidelines into account in developing provisions for regulating the discharge of EGR bleed-off water;

3 REQUESTS Parties to MARPOL Annex VI and other Member Governments to bring the annexed Guidelines to the attention of shipowners, ship operators, shipbuilders, marine diesel engine manufacturers and any other interested parties;

4 AGREES to keep these Guidelines under review in light of experience gained with their application.

ANNEX

2018 GUIDELINES FOR THE DISCHARGE OF EXHAUST GAS RECIRCULATION (EGR) BLEED-OFF WATER

1 INTRODUCTION

1.1 Regulation 13.5 of MARPOL Annex VI requires marine diesel engines to meet the Tier III NO_X emission levels when operating in a NO_X Tier III emission control area in accordance with the provisions in regulations 13.5.1 and 13.5.2.

1.2 One method for reducing NO_X emissions is to use Exhaust Gas Recirculation (EGR), which is an internal engine process resulting in a NO_X reduction which will meet the requirements of the regulation. By means of this process, condensate of exhaust gas will be generated and discharged as bleed-off water, which should be handled differently depending on the fuel oil sulphur content. EGR may also be used as a Tier II compliance option.

1.3 These Guidelines cover the discharge of EGR bleed-off water. They are recommendatory in nature; however, the Administrations are invited to base their implementation on these Guidelines.

2 GENERAL

2.1 Purpose

The purpose of these Guidelines is to specify requirements for the discharge to the sea of bleed-off water when using EGR.

2.2 Application

These Guidelines should apply to a marine diesel engine fitted with an EGR device having a bleed-off water discharge arrangement, for which the EIAPP Certificate is first issued on or after 1 June 2019. It should be noted that any discharge of oil or oily mixtures into polar waters is prohibited by the Polar Code (see also paragraphs 3.1 and 3.2 of these Guidelines).

2.3 Definitions

2.3.1 "Bleed-off water" means water to be discharged directly, or via a holding tank, to the sea from an EGR water treatment system.

2.3.2 "EGC" means exhaust gas cleaning.

2.3.3 "EGCS Guidelines" means the *2015 Guidelines for exhaust gas cleaning systems* (resolution MEPC.259(68), as may be amended).

2.3.4 "EGR record book" means a record of the maintenance and servicing of the monitoring equipment required by these Guidelines. This may be met by following the relevant requirements of the EGCS Guidelines. This record would include the date, time, location and quantity of residues delivered ashore from the EGR water treatment system or may be recorded in the EGCS Record Book.

2.3.5 "Manual for EGR bleed-off discharge system" means the manual containing the system description, discharge limits and the relevant items required for Onboard Monitoring Manual (OMM) in the EGCS Guidelines or the Revised Guidelines.

2.4 Required documents

The EGR record book and manual for EGR bleed-off discharge system should be approved by the Administration. The following documents should be retained on board the ship as appropriate and should be available for surveys as required:

.1 manual for EGR bleed-off discharge system;

.2 certificates for type approval of oil content meters (15 ppm alarm);

.3 operating and maintenance manuals of oil content meters (15 ppm alarm); and

.4 EGR record book.

3 DISCHARGE OF EGR BLEED-OFF WATER INTO THE SEA

3.1 Bleed-off water when using fuel oil not complying with the relevant limit value in regulation 14 of MARPOL Annex VI

3.1.1 The bleed-off water discharged to the sea from an EGR water treatment system may or may not be combined with the discharge water from an EGC system. In either case, this discharge to the sea should be documented, monitored and recorded, as appropriate, in accordance with the relevant requirements of the EGCS Guidelines. Upon request, the Administration should be provided with bleed-off water samples according to appendix 3 of the EGCS Guidelines, as applicable.

3.1.2 Bleed-off water which is retained onboard in a holding tank should not be discharged to the sea, except when:

.1 the ship is en route[1] and outside polar waters,[2] ports, harbours or estuaries; and

.2 the bleed-off water discharged meets the provisions of paragraph 3.1.1.

3.2 Bleed-off water when using fuel oil complying with the relevant limit value in regulation 14 of MARPOL Annex VI

3.2.1 In case the EGR system is in operation and the sulphur content of the fuel oil used for the engine complies with regulation 14 of MARPOL Annex VI, the discharge of bleed-off water should meet the requirements of paragraph 3.1, unless the following conditions are satisfied:

.1 the ship is en route[1] outside polar waters,[2] ports, harbours or estuaries;

.2 the sulphur content of the fuel oil used for the engine when the EGR system is in operation complies with the relevant requirements of regulation 14 of MARPOL Annex VI;

.3 the oil content meter is type approved in accordance with the annex of resolution MEPC.107(49), as amended;

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1 Refer to Unified Interpretation to regulation 15.2.1 of the revised MARPOL Annex I (MEPC 55/23, annex 18).

2 Refer to the *International Code for Ships Operating in Polar Waters* (Polar Code) (resolutions MEPC.264(68) and MSC.385(94)).

.4 the oil content of the bleed-off water discharge and 15 ppm alarm is continuously monitored and recorded; and

.5 the oil content of the discharge does not exceed 15 ppm.

3.2.2 When the EGR system is operated in polar waters,[2] ports, harbours or estuaries, the discharge of bleed-off water to the sea should comply with section 3.1.

3.2.3 Bleed-off water which is retained on board in a holding tank should not be discharged to the sea, except when:

.1 the ship is en route[1] and outside polar waters,[2] ports, harbours or estuaries; and

.2 the bleed-off water discharged meets the provisions of paragraph 3.2.1.

4 RESIDUES FROM EGR WATER TREATMENT SYSTEMS

4.1 Residues from EGR water treatment systems should be delivered ashore to adequate reception facilities. Such residues should not be discharged to the sea or incinerated on board.

4.2 Each ship fitted with an EGR unit should record the storage and disposal of bleed-off water residues in an EGR record book, including the date, time and location of such storage and disposal.

5 BLEED-OFF WATER ADDITIVES

5.1 In case additives are used for enhancing the bleed-off water quality, an assessment of the additive should be performed and documented unless the below substances are used and documented with a Material Safety Data Sheet:

.1 neutralization agent (caustic substance), such as Sodium Hydroxide (NaOH) or Sodium Carbonate (Na_2CO_3); and

.2 flocculants, which are used for marine approved oily-water separating equipment.

5.2 For those technologies which make use of chemicals, additives, preparations or create relevant chemicals, not including those in paragraph 5.1, in situ, there should be an assessment of the bleed-off water additives. The assessment could take into account relevant guidelines such as the *Procedure for approval of ballast water management systems that make use of active substances (G9)* (resolution MEPC.169(57)), and, if necessary, additional bleed-off water discharge criteria should be established.

6 SURVEY AND CERTIFICATION

The bleed-off discharge system and the EGR record book should be subject to survey on installation and at initial, annual/intermediate and renewal surveys by the Administration. The bleed-off discharge system and the EGR record book may also be subject to inspection by port State control.

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ANNEX 5

RESOLUTION MEPC.308(73)
(adopted on 26 October 2018)

2018 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,

RECALLING ALSO that it adopted, by resolution MEPC.203(62), 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 (inclusion of regulations on energy efficiency for ships in MARPOL Annex VI),

NOTING that the aforementioned amendments to MARPOL Annex VI entered into force on 1 January 2013,

NOTING ALSO that regulation 20 (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 FURTHER that the *2012 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships*, adopted by resolution MEPC.212(63), and, the amendments thereto, adopted by resolution MEPC.224(64),

NOTING FURTHER that it adopted, by resolution MEPC.245(66), the *2014 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships*, and by resolutions MEPC.263(68) and MEPC.281(70), amendments thereto,

RECOGNIZING that the aforementioned amendments to MARPOL Annex VI require relevant guidelines for the smooth and uniform implementation of the regulations,

HAVING CONSIDERED, at its seventy-third session, proposed *2018 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships,*

1 ADOPTS the *2018 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships, as amended*, as set out in the annex to the present resolution;

2 INVITES Administrations to take the aforementioned amendments into account when developing and enacting national laws which give force to and implement provisions set forth in regulation 20 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 the light of experience gained with their implementation;

5 SUPERSEDES the *2014 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships* adopted by resolution MEPC.245(66), as amended by resolutions MEPC.263(66) and MEPC.281(70), and MEPC.1/Circ.866.

ANNEX

2018 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

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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

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2.2.12.1 f_c for chemical tankers

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

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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

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 1997relating 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:

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

* 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, 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 Liquefied Natural Gas (LNG)		48,000	0.7500	2.750
6 Methanol		19,900	0.3750	1.375
7 Ethanol		26,800	0.5217	1.913

In 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, gas fuel should be identified whether it 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 to 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 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 21 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 21 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

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

For calculation of 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:

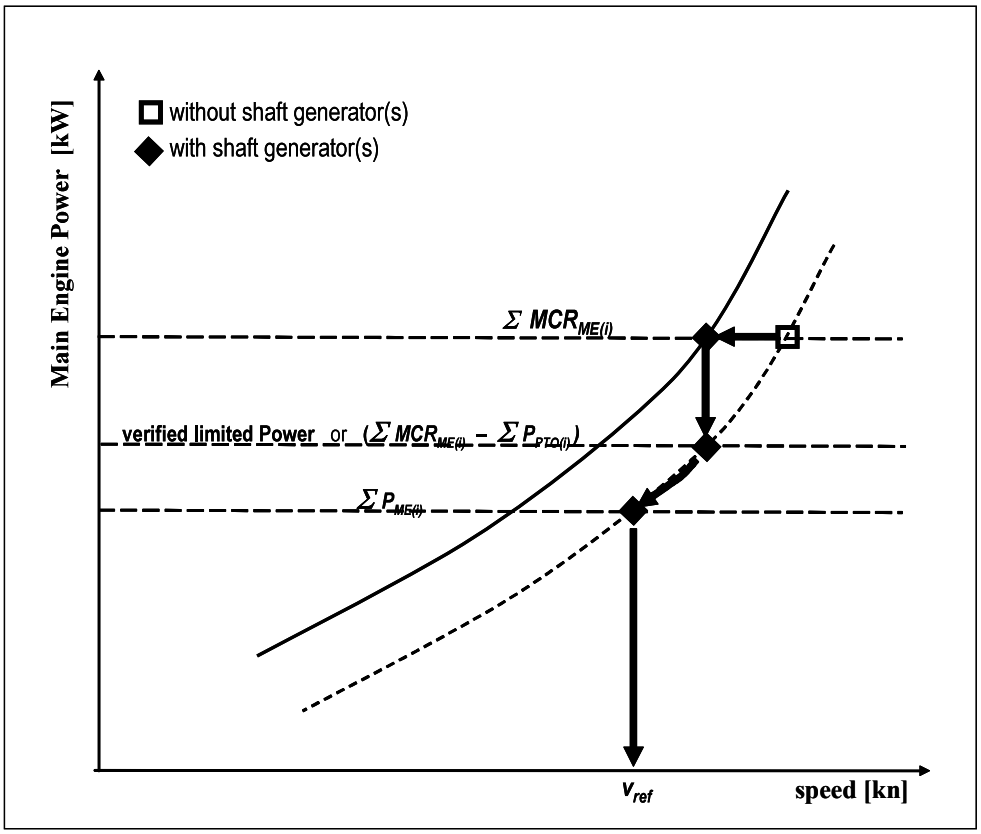
The maximum allowable deduction for the calculation of $\Sigma P_{ME(i)}$ is to be no more than P_{AE} as defined in paragraph 2.2.5.6. For this case, $\Sigma P_{ME(i)}$ is calculated as:

$$\sum_{i=1}^{nME} P_{ME(i)} = 0.75 \times \left(\sum MCR_{ME(i)} - \sum P_{PTO(i)} \right) \quad with \;\; 0.75 \times \sum P_{PTO(i)} \le P_{AE}$$

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

In case where shaft motor(s) 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)

In case that shaft motor(s) are installed to 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 case of combined PTI/PTO, the normal operational mode at sea will determine which of these 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 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 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 which 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:

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

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

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

2.2.5.6.3 For LNG carriers with a reliquiefaction system or compressor(s), designed to be used in normal operation and essential to maintain 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 re-liquefaction 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 re-liquefied 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 $MCR_{ME(i)}$ for P_{AE} calculation.

2.2.5.6.5 For LNG carriers having steam turbine propulsion system and of which 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 ship 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).

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[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. In case 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.

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 its 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 should be corrected to the *SFC* value of 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 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 of which 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, sea water 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 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 of crude oil from offshore installations equipped with dual-engine and twin-propellers need to meet the requirements for dynamic positioning and redundancy propulsion class notation.

2.2.8.3 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 20 and 21 of MARPOL Annex VI, f_w is 1.00;

2.2.9.2 when f_w is calculated according to the subparagraph 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[4] 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 20 and 21 of MARPOL Annex VI.

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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, fi, 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 Area 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".

aluminum 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 2.26 of MARPOL Annex VI and should not be applied to LNG carriers defined in regulation 2.38 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. wood chip 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, in analogy to the calculations as 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.

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

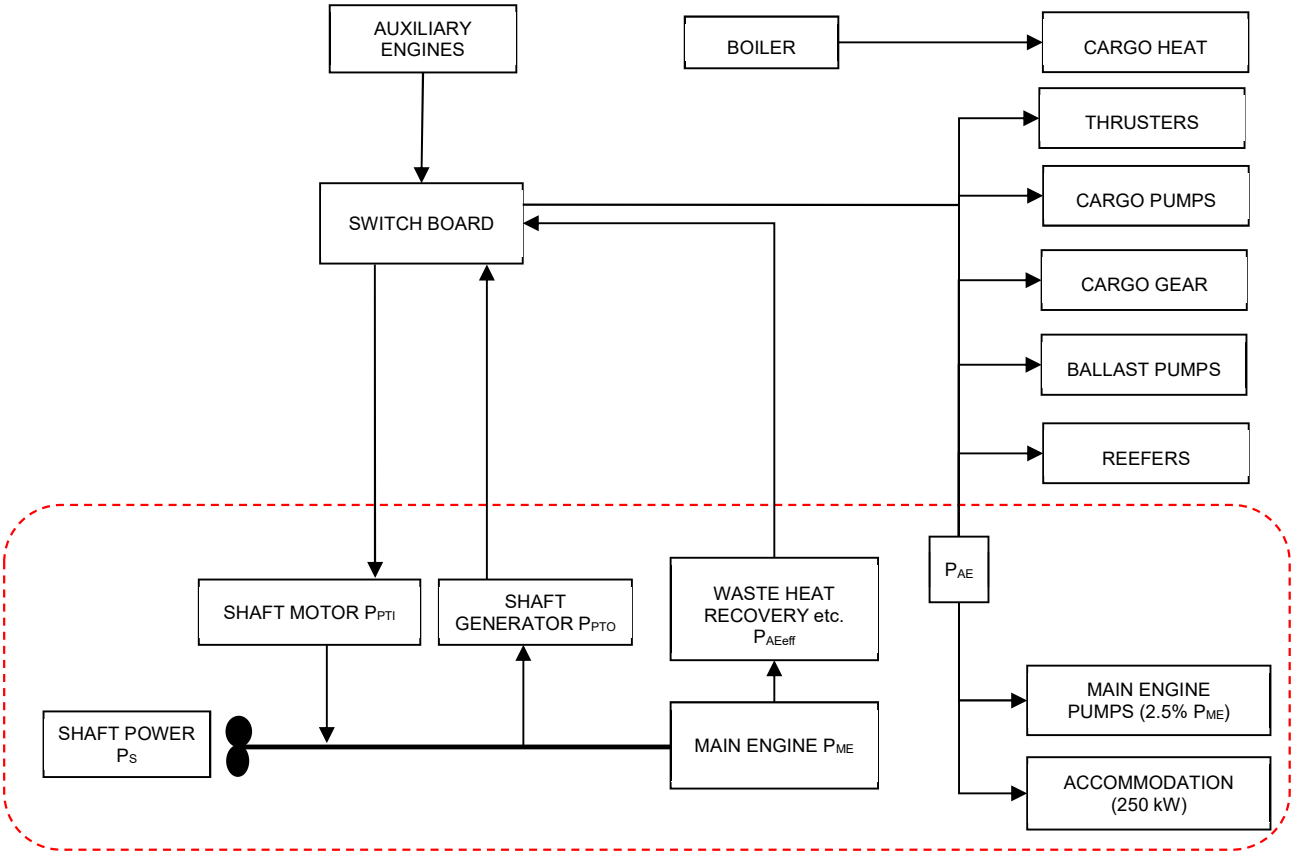
Volumetric displacement, ∇, in cubic metres (m^3), is the volume of the moulded displacement of the ship, excluding appendages, in a ship with a metal shell, and is the volume of displacement to the outer surface of the hull in a ship with a shell of any other material, both taken at the summer load 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.

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 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, fresh water 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, etc., typical cabins).

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 to 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 allows the data validation process.

Loads mechanical rated power "Pm"

4.5 This data is to be indicated in the document only when th electric load is made by an electric motor driving a mechanical load (for example a fan, a pump, etc.). 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 absorb less power than its rated power. For example, in case of 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 exceed the power needed for pumping in its delivery fluid circuit. Another example in case of electric self-regulating semi-conductors electric 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 serves 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=Σ*Pload(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", etc.);

.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.

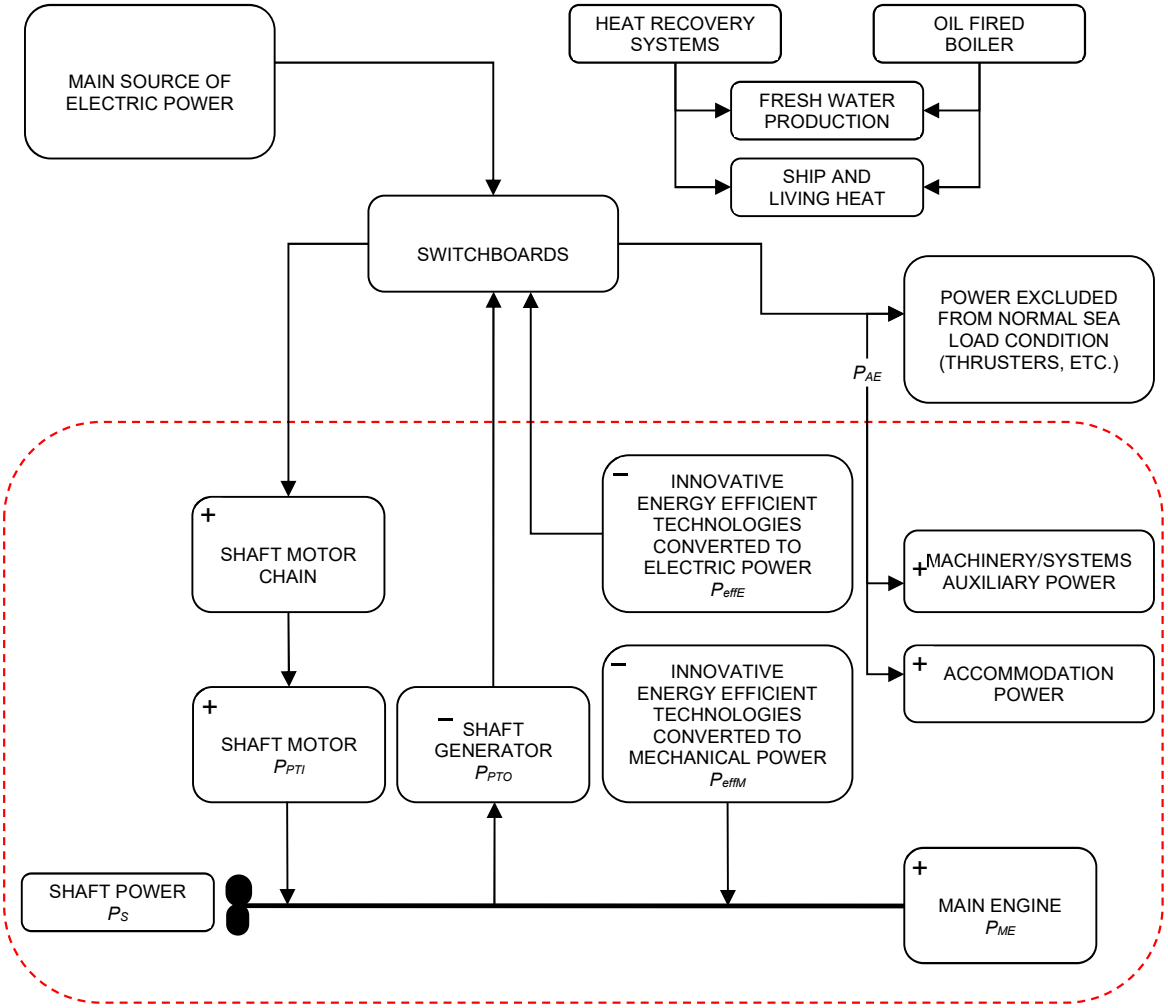
An example of an electric power table for EEDI for a cruise postal ship which transports passengers and has a car garage and reefer holds for fish trade transportation is indicated below. The data indicated and the type of ship is for reference only.

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

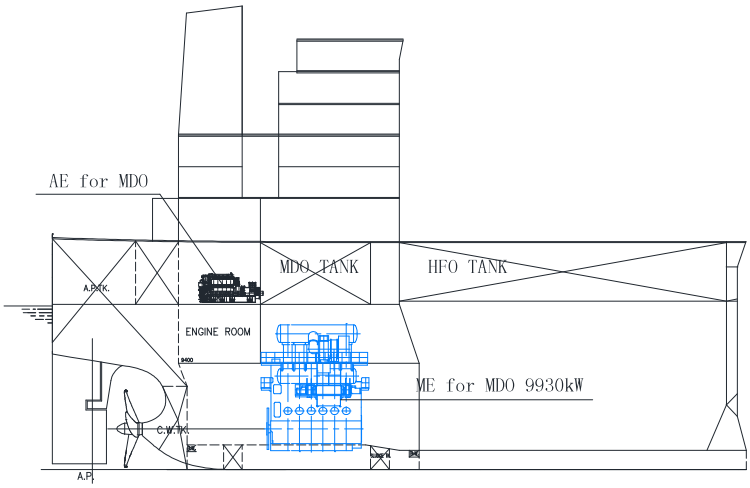


Note: Symbols for plus (+) and minus (−) indicate CO_2 contribution to EEDI formula.

APPENDIX 4

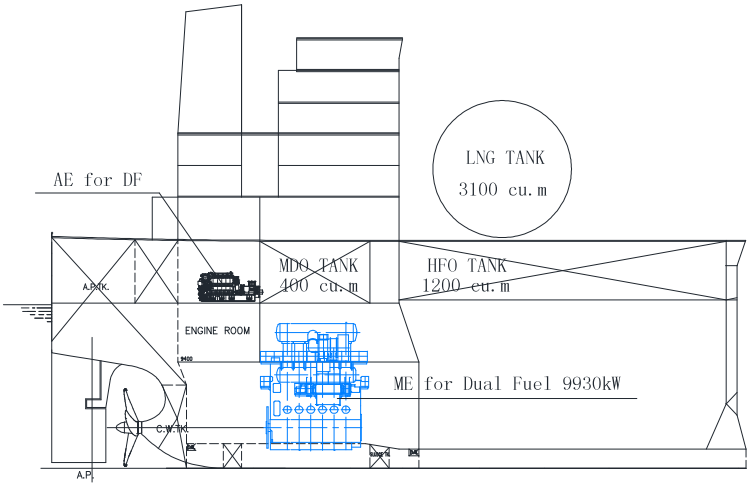
EEDI CALCULATION EXAMPLES FOR USE OF DUAL FUEL ENGINES

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



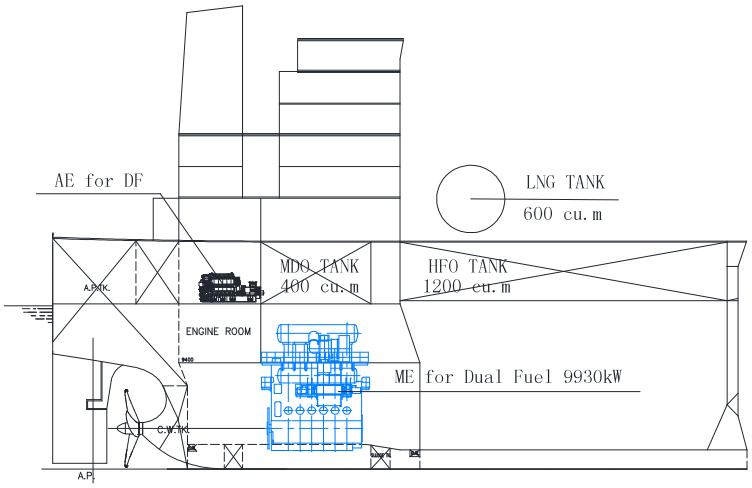
S/N	Parameter	Formula or Source	Unit	Value
1	MCR_{ME}	MCR rating of main engine	kW	9930
2	Capacity	Deadweight of the ship at summer load draft	DWT	81200
3	V_{ref}	Ships speed as defined in EEDI regulation	kn	14
4	P_{ME}	0.75 x MCR_{ME}	kW	7447.5
5	P_{AE}	0.05 x MCR_{ME}	kW	496.5
6	C_{FME}	C_F factor 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	9930
2	Capacity	Deadweight of the ship at summer load draft	DWT	81200
3	V_{ref}	Ships speed as defined in EEDI regulation	kn	14
4	P_{ME}	0.75 x MCR_{ME}	kW	7447.5
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	3100
14	V_{HFO}	Heavy fuel oil tank capacity on board	m^3	1200
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	48000
20	LCV_{HFO}	Low calorific value of heavy fuel oil	kJ/kg	40200
21	LCV_{MDO}	Low calorific value of marine diesel oil	kJ/kg	42700
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

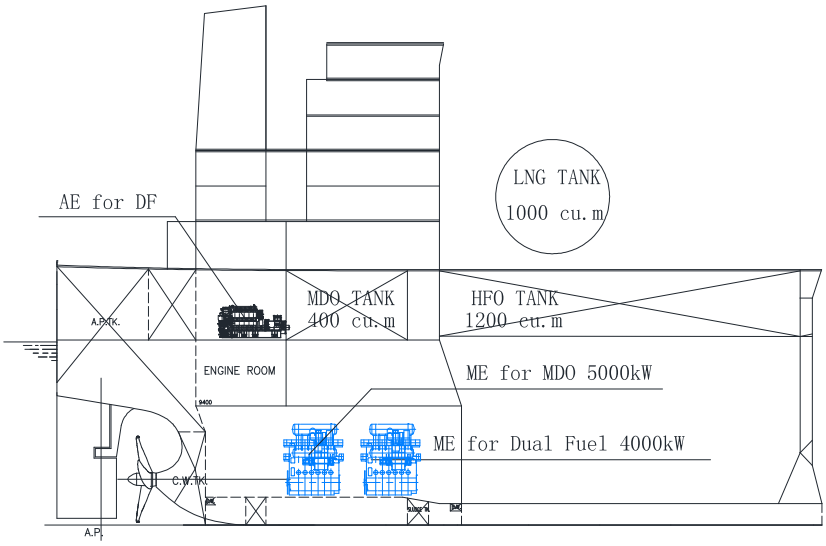
Case 3: LNG is not regarded as the "primary fuel" if dual-fuel main engine and dual-fuel auxiliary engine (LNG, pilot fuel MDO; no shaft generator) are equipped with smaller LNG tanks:



S/N	Parameter	Formula or Source	Unit	Value
1	MCR_{ME}	MCR rating of main engine	kW	9930
2	Capacity	Deadweight of the ship at summer load draft	DWT	81200
3	V_{ref}	Ships speed as defined in EEDI regulation	kn	14
4	P_{ME}	0.75 x MCR_{ME}	kW	7447.5
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	1800
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	48000
24	LCV_{HFO}	Low calorific value of heavy fuel oil	kJ/kg	40200
25	LCV_{MDO}	Low calorific value of marine diesel oil	kJ/kg	42700
26	K_{LNG}	Filling rate of LNG tank	-	0.95
27	K_{HFO}	Filling rate of heavy fuel tank	-	0.98

S/N	Parameter	Formula or Source	Unit	Value
28	K_{MDO}	Filling rate of marine diesel tank	-	0.98
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

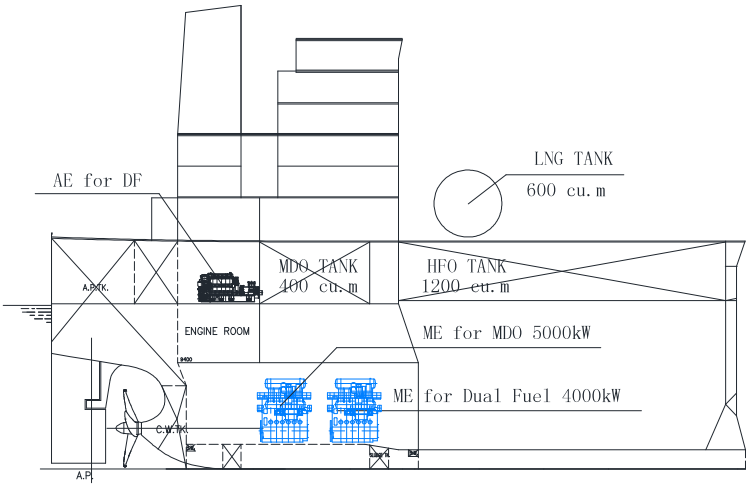
Case 4: One dual-fuel main engine (LNG, pilot fuel MDO) and one main engine (MDO) and dual-fuel auxiliary engine (LNG, pilot fuel MDO, no shaft generator) which LNG could be regarded as "primary fuel" only for the dual-fuel main engine:



S/N	Parameter	Formula or Source	Unit	Value
1	MCR_{MEMDO}	MCR rating of main engine using only MDO	kW	5000
2	MCR_{MELNG}	MCR rating of main engine using dual fuel	kW	4000
3	Capacity	Deadweight of the ship at summer load draft	DWT	81200
4	V_{ref}	Ships speed	kn	14
5	P_{MEMDO}	0.75 x MCR_{MEMDO}	kW	3750
6	P_{MELNG}	0.75 x MCR_{MELNG}	kW	3000
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	1000
18	V_{HFO}	Heavy fuel oil tank capacity on board	m^3	1200

S/N	Parameter	Formula or Source	Unit	Value
19	V_{MDO}	Marine diesel oil tank capacity on board	m^3	400
20	ρ_{LNG}	Density of LNG	kg/m^3	450
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	48000
24	LCV_{HFO}	Low calorific value of heavy fuel oil	kJ/kg	40200
25	LCV_{MDO}	Low calorific value of marine diesel oil	kJ/kg	42700
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	5000
2	MCR_{MELNG}	MCR rating of main engine using dual fuel	kW	4000
3	Capacity	Deadweight of the ship at summer load draft	DWT	81200
4	V_{ref}	Ships speed	kn	14
5	P_{MEMDO}	0.75 x MCR_{MEMDO}	kW	3750
6	P_{MELNG}	0.75 x MCR_{MELNG}	kW	3000
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	-	2.75
12	$SFC_{MEPilotfuel}$	Specific fuel consumption of pilot fuel for dual fuel ME at P_{ME}	g/kWh	6

S/N	Parameter	Formula or Source	Unit	Value
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	$SFC_{DF\ MDO}$	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	1200
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	48000
26	LCV_{HFO}	Low calorific value of heavy fuel oil	kJ/kg	40200
27	LCV_{MDO}	Low calorific value of marine diesel oil	kJ/kg	42700
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	$(P_{MELNG}$ x (f_{DFgas} x ($C_{F\ Pilotfuel}$ x $SFC_{ME\ Pilotfuel}$ + $C_{F\ LNG}$ x $SFC_{DF\ LNG}$) + $f_{DFliquid}$ x C_{FMDO} x $SFC_{DF\ MDO}$))+ P_{MEMDO} x $C_{F\ MDO}$ 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	3.54

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ANNEX 7

RESOLUTION MEPC.309(73)
(adopted on 26 October 2018)

AMENDMENTS TO THE 2014 GUIDELINES ON SURVEY AND CERTIFICATION OF THE ENERGY EFFICIENCY DESIGN INDEX (EEDI) (RESOLUTION MEPC.254(67), AS AMENDED BY RESOLUTION MEPC.261(68))

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 that it adopted, by resolution MEPC.203(62), 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 (inclusion of regulations on energy efficiency for ships in MARPOL Annex VI),

NOTING that the aforementioned amendments to MARPOL Annex VI entered into force on 1 January 2013,

NOTING ALSO 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 FURTHER that it adopted, by resolution MEPC.214(63), the *2012 Guidelines on survey and certification of the Energy Efficiency Design Index (EEDI)*, and, by resolution MEPC.234(65), the amendments thereto,

NOTING FURTHER that it adopted, by resolution MEPC.254(67), the *2014 Guidelines on survey and certification of the Energy Efficiency Design Index (EEDI)*, and by resolution MEPC.261(68), amendments thereto,

RECOGNIZING that the aforementioned amendments to MARPOL Annex VI require relevant guidelines for the smooth and uniform implementation of the regulations,

HAVING CONSIDERED, at its seventy-third session, proposed amendments to the *2014 Guidelines on survey and certification of the Energy Efficiency Design Index (EEDI)*, as amended,

1 ADOPTS amendments to the *2014 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 take the aforementioned amendments into account 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.

ANNEX

AMENDMENTS TO THE 2014 GUIDELINES ON SURVEY AND CERTIFICATION OF THE ENERGY EFFICIENCY DESIGN INDEX (EEDI) (RESOLUTION MEPC.254(67), AS AMENDED BY RESOLUTION MEPC.261(68))

1 Footnote for the title of section 2 is replaced by the following:

"**2 DEFINITIONS**[1]

1 Other terms used in these guidelines have the same meaning as those defined in the *2018 Guidelines on the method of calculation of the attained EEDI for new ships* (resolution MEPC.308(73))."

2 Paragraph 4.1.1 is replaced by the following:

"4.1.1 The attained EEDI should be calculated in accordance with regulation 20 of MARPOL Annex VI and the *2018 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships* (resolution MEPC.308(73)) (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."

3 Paragraphs 4.2.2.1 and 4.2.2.2 are replaced by the following:

".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 for certain ship types, as necessary, as defined in the EEDI Calculation 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;"

4 Paragraph 4.2.8.2 is replaced by the following:

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

5 Paragraph 4.2.8.5 is replaced by the following:

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

6 Paragraph 4.2.5 is replaced by the following:

"4.2.5 For ships to which regulation 21 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."

7 Paragraph 4.2.7.4 is replaced by the following:

".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;"

8 Paragraph 4.3.1 is replaced by the following:

"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."

9 Paragraph 4.3.5 is replaced by the following:

"4.3.5 Sea conditions should be measured in accordance with ITTC Recommended Procedure 7.5-04-01-01.1 Speed and Power Trials 2017 or ISO 15016:2015."

10 Paragraph 4.3.6 is replaced by the following:

"4.3.6 Ship speed should be measured in accordance with ITTC Recommended Procedure 7.5-04-01-01.1 Speed and Power Trials 2017 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."

11 Paragraph 4.3.8 is replaced by the following:

"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 Speed and Power Trials 2017 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."

12 Paragraphs 4.3.9.1 and 4.3.9.2 are replaced by 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."

13 Paragraph 4.3.13 is replaced by the following:

"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."

14 Section 2 of appendix 2 is replaced by the following:

"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."

15 Paragraph 3.5 of appendix 2 is replaced by the following:

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

16 Paragraph 4.1 of appendix 2 is replaced by the following:

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

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ANNEX 10

RESOLUTION MEPC.310(73)
(adopted on 26 October 2018)

ACTION PLAN TO ADDRESS MARINE PLASTIC LITTER FROM SHIPS

THE MARINE ENVIRONMENT PROTECTION COMMITTEE

RECALLING Article 38(e) of the Convention on the International Maritime Organization (the 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,

ACKNOWLEDGING that work to prevent pollution by garbage from ships has been undertaken by the Organization since the adoption of MARPOL Annex V,

ACKNOWLEDGING ALSO the relevance of the work on marine plastic litter undertaken by the Parties to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 and its 1996 Protocol, including the adoption in 2016 of a "Recommendation to Encourage Action to Combat Marine Litter",

ACKNOWLEDGING FURTHER the relevant work of other international organizations in relation to marine plastic litter, in particular FAO and UN Environment, and the importance of existing cooperation mechanisms, including GESAMP, the Joint FAO/IMO Ad Hoc Working Group on IUU fishing and related matters, and the Global Partnership for Marine Litter,

RECALLING the United Nations 2030 Agenda for Sustainable Development, in particular Sustainable Development Goal (SDG) 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development,

RECALLING ALSO that the Assembly, at its thirtieth session, in December 2017, recognized the ongoing problem of marine plastic pollution, as addressed in MARPOL Annex V, which required further consideration as part of a global solution within the framework of ocean governance, in pursuance of the target of Sustainable Development Goal 14 to prevent and significantly reduce marine pollution of all kinds by 2025,

1 ADOPTS the Action Plan to address marine plastic litter from ships (hereinafter the Action Plan) as set out in the annex to the present resolution;

2 NOTES the application of the Action Plan to all ships, incuding fishing vessels;

3 INVITES the Secretary-General of the Organization to make adequate provisions in the Integrated Technical Cooperation Programme (ITCP) to support relevant follow-up actions of the Action Plan;

4 AGREES to keep the Action Plan under review, with a view to assessing, in 2023, the effectiveness of the actions within the Action Plan against the intended outcomes.

ANNEX

ACTION PLAN TO ADDRESS MARINE PLASTIC LITTER FROM SHIPS

1 Background

1.1 Marine plastic litter enters the marine environment as a result of a wide range of land- and sea-based activities. Both macroplastics (e.g. large plastic items such as plastic bags, water bottles and fishing gear) and microplastics (small plastic particles generally five millimetres or less in size) persist in the marine environment and result in harmful effects on marine life and biodiversity, as well as negative impacts on human health. In addition, marine plastic litter negatively impacts on activities such as tourism, fisheries and shipping. This plastic material has the potential to be brought back into the economy by means of reuse or recycling. Studies demonstrate that despite the existing regulatory framework to prevent marine plastic litter from ships discharges into the sea continue to occur.

1.2 IMO has recognized the importance of preventing pollution by garbage, including plastics, from ships since the adoption of MARPOL Annex V, as well as the dumping of various types of waste, including plastics, into the sea through the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 (London Convention or LC) and its 1996 Protocol (London Protocol or LP). This commitment was reinforced by the IMO Assembly, at its thirtieth session, in December 2017, recognizing the ongoing problem of marine plastic pollution, as addressed in MARPOL Annex V, which required further consideration as part of a global solution within the framework of ocean governance, in pursuance of the target of Sustainable Development Goal 14 to prevent and significantly reduce marine pollution of all kinds by 2025.

1.3 IMO has committed to working closely with a number of partners to address the issue of marine plastic litter including, but not limited to:

.1 FAO through the Joint FAO/IMO Ad Hoc Working Group on IUU Fishing and Related Matters (JWG);

.2 the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP);

.3 the UN Environment-managed Global Partnership on Marine Litter (GPML);

.4 the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea (ICP); and

.5 the United Nations Environment Assembly (UNEA).

1.4 IMO recognizes the importance of continued action to manage this global issue with the development of an Action Plan to address marine plastic litter from ships. In addition, the thirty-eighth Consultative Meeting of Contracting Parties to the London Convention and the eleventh Meeting of Contracting Parties to the London Protocol adopted a "Recommendation to Encourage Action to Combat Marine Litter".

2 Objective

The Action Plan to address marine plastic litter from ships has been developed to contribute to the global solution for preventing marine plastic litter entering the oceans through ship-based activities. This Action Plan provides IMO with a mechanism to identify specific

outcomes, and actions to achieve these outcomes, in a way that is meaningful and measureable. The Action Plan builds on existing policy and regulatory frameworks, and identifies opportunities to enhance these frameworks and introduce new supporting measures to address the issue of marine plastic litter from ships.

3 Time frames

3.1 In line with the time frames provided in Sustainable Development Goal 14, the measures within this Action Plan should be completed by 2025.

3.2 Priority actions under this plan, to be pursued upon adoption of this plan, have been identified in the below table of actions. Further specific time frames for individual measures should be evaluated during the annual review and evaluation process by the Marine Environment Protection Committee.

4 Actions

	Outcome	Measures	Parent Organ	Coordinating/ Associated Organ	Priority	Associated partners
1.	**Reduction of marine plastic litter generated from, and retrieved by, fishing vessels**	Consider making the IMO Ship Identification Number Scheme mandatory for all fishing vessels over 24 metres in length through an amendment to the Cape Town Agreement once it enters into force. Encourage the ratification of the Cape Town agreement	MSC / MEPC			
2.		Consider making mandatory, through an appropriate IMO instrument (e.g. MARPOL Annex V), the marking of fishing gear with the IMO Ship Identification Number, in cooperation with the Food and Agriculture Organization of the United Nations (FAO)	MEPC	PPR / III (JWG)		FAO
3.		Further investigate logging of the identification number for each item of fishing gear on board a fishing vessel	MEPC	PPR / III		FAO
4.		Preparation of a circular reminding IMO Member States to collect information from their registered fishing vessels regarding any discharge or accidental loss of fishing gear	MEPC	PPR		
5.		Consider the development of best management practice to facilitate incentives for fishing vessels to retrieve derelict fishing gear and deliver it to port reception facilities, in collaboration with FAO	MEPC / MSC	PPR / III (JWG) / SDC		FAO

	Outcome	Measures	Parent Organ	Coordinating/ Associated Organ	Priority	Associated partners
6.		Consider the issue of waste that has been collected during fishing operations building on experience gathered from established projects	MEPC	PPR		
7.		Review the application of placards, garbage management plans and garbage record-keeping (regulation 10, MARPOL Annex V), for example making the Garbage Record Book mandatory for ships of 100 GT and above	MEPC	PPR		
8.		Preparation of a circular reminding Member States to enforce MARPOL Annex V on fishing vessels through PSC measures. Encourage port State control MoUs to develop PSC procedures that include fishing vessels	MEPC	PPR / III		
9.	**Reduction of shipping's contribution to marine plastic litter**	Review the application of placards, garbage management plans and garbage record-keeping (regulation 10, MARPOL Annex V), for example making the Garbage Record Book mandatory for ships of 100 GT and above	MEPC	PPR		
10		Consider the establishment of a compulsory system of formatted declarations of the loss of containers and the means on board to easily identify the exact number of losses Also, consider establishing an obligation to report through a standardized procedure the loss of containers	MSC / MEPC		X	

	Outcome	Measures	Parent Organ	Coordinating/ Associated Organ	Priority	Associated partners
11		Consider ways to communicate the location of containers lost overboard based on additional information to be provided by interested parties	MEPC			
12		Consider the most appropriate instrument to address the responsibility and liability for plastic consumer goods lost at sea from ships	LEG / MEPC	PPR		
13		Consider enhancing the enforcement of MARPOL Annex V, including, where possible, through a risk-based approach	MEPC	PPR / III		
14	**Improvement of the effectiveness of port reception and facilities and treatment in reducing marine plastic litter**	Consider the requirement for port reception facilities to provide for separate garbage collection for plastic waste from ships, including fishing gear to facilitate reuse or recycling	MEPC	PPR		
15		Consider mechanisms to enhance the enforcement of MARPOL Annex V requirements for the delivery of garbage to reception facilities	MEPC	PPR		

	Outcome	Measures	Parent Organ	Coordinating/ Associated Organ	Priority	Associated partners
16		Consider the development of tools to support the implementation of cost frameworks associated with port reception facilities, taking into account the need to not create disincentives for the use of port reception facilities, the potential benefits of cost incentives that provide no additional fees based on volume and identifying waste types that can be reduced, reused or recycled through schemes that identify waste revenue	MEPC	PPR		
17		IMO to encourage Member States to effectively implement their obligation to provide adequate facilities at ports and terminals for the reception of garbage, as required by regulation 8 of MARPOL Annex V Consider facilitating the mandatory use of port waste management plans to ensure the provision of adequate waste reception facilities Encourage Member States to address the entire process of plastic garbage handling and ensure that landed garbage is managed in a sustainable manner ashore Identify information from the port waste management plans that can be shared via the Global Integrated Shipping Information System (GISIS) Take into consideration work being undertaken under the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972	MEPC	PPR / III		

	Outcome	Measures	Parent Organ	Coordinating/ Associated Organ	Priority	Associated partners
		(London Convention or LC) and its 1996 Protocol (London Protocol or LP) (LC/LP) on this issue				
18		Further consider the impact on Small Island Developing States and on remote locations such as polar regions when planning for the disposal of waste to land-based facilities	MEPC	PPR		
19	**Enhanced public awareness, education and seafarer training**	Consider ways to promote the work of IMO to address marine plastic litter generated from ships	MEPC	PPR		
20		Consider tasking the HTW Sub-Committee with reviewing chapter III of STCW-F (Basic safety training for all fishing vessel personnel) to ensure that all fishing vessel personnel, before being assigned any shipboard duties, receive basic training on marine environment awareness oriented on marine plastic litter including abandoned, lost or otherwise discarded fishing gear (ALDFG)	MEPC	HTW		
21		Consider how the model course "Marine Environmental Awareness 1.38" could be amended/revised to specifically address marine plastic litter Further consider how to ensure familiarization of all seafarers within the existing STCW (International Convention on Standards and Training, Certification and Watch keeping for Seafarers) minimum requirements and taking into account existing best practice, guidelines and programmes	MEPC	HTW / PPR		

	Outcome	Measures	Parent Organ	Coordinating/ Associated Organ	Priority	Associated partners
22	**Improved understanding of the contribution of ships to marine plastic litter**	Consider extending the reporting requirement in regulation 10.6 of MARPOL Annex V to include reporting data on discharge or accidental loss of fishing gear by the flag State to IMO via GISIS or other means if appropriate	MEPC	PPR / III		
23		Encourage Member States and international organizations that have conducted any scientific research related to marine litter to share the results of such research, including any information on the areas contaminated by marine litter from ships	MEPC	PPR	X	
24		Conduct a study on marine plastic litter, including macro and microplastics, from all ships	MEPC LC/LP	PPR	X	GESAMP, FAO, UN Environment, RFMOs, World Oceans Assessment, Regional Seas Conventions
25		Invite Member States and international organizations to undertake studies to better understand microplastics from ships			X	

	Outcome	Measures	Parent Organ	Coordinating/ Associated Organ	Priority	Associated partners
26	**Improved understanding of the regulatory framework associated with marine plastic litter from ships**	Consider the development of a regulatory framework matrix for the purpose of a gap analysis	MEPC	PPR / III	X	
27	**Strengthened international cooperation**	Make information available to the United Nations Environment Assembly (UNEA)	MEPC LC/LP	PPR		
28		Continue work with other United Nations bodies and agencies, as well as with international fora, which are active in the matter of marine plastic litter from shipping, such as through the Global Partnership on Marine Litter (GPML)	MEPC LC/LP	PPR	X	
29	**Targeted technical cooperation and capacity-building**	Address implementation issues related to the action plan to address marine plastic litter from ships in the context of IMO technical cooperation and capacity-building activities	MEPC TCC	PPR / III		
30		Consider the establishment of externally funded major projects under the auspices of IMO in support of the action plan to address marine plastic litter from ships	MEPC	PPR		

5 Review and Evaluation

5.1 This Action Plan will be reviewed periodically to ensure that it continues to deliver against the objective and outcomes identified within the plan. Periodic review and evaluation of the plan will facilitate assessing the effectiveness of the actions within the plan, updating the plan with new information and incorporating new actions identified based on the implementation of the Action Plan or as a result of new information.

5.2 IMO will undertake a review of the Action Plan (i.e. assess the need for updating actions and/or incorporating new actions to the plan) annually and a comprehensive review (i.e. assessing the effectiveness of the actions within the plan against the objective and outcomes identified within the plan) after five years.

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ANNEX 14

RESOLUTION MEPC.311(73)
(adopted on 26 October 2018)

2018 GUIDELINES FOR THE APPLICATION OF MARPOL ANNEX I REQUIREMENTS TO FLOATING PRODUCTION, STORAGE AND OFFLOADING FACILITIES (FPSOs) AND FLOATING STORAGE UNITS (FSUs)

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 that, at its fifty-third session, it adopted , by resolution MEPC.139(53), the *Guidelines for the application of the revised MARPOL Annex I requirements to floating production, storage and offloading facilities (FPSOs) and floating storage units (FSUs)* (Guidelines), which were further amended by resolution MEPC.142(54),

RECOGNIZING the need to align the relevant provisions of the Guidelines with the amendments to MARPOL Annex I adopted since MEPC 54.

HAVING CONSIDERED, at its seventy-third session, draft 2018 Guidelines for the application of MARPOL Annex I requirements to floating production, storage and offloading facilities (FPSOs) and floating storage units (FSUs) prepared by the Sub-Committee on Pollution Prevention and Response, at its fifth session,

1 ADOPTS the *2018 Guidelines for the application of MARPOL Annex I requirements to floating production, storage and offloading facilities (FPSOs) and floating storage units (FSUs)*;

2 INVITES Governments to take the 2018 Guidelines into account when applying the relevant requirements of MARPOL Annex I to FPSOs and FSUs;

3 AGREES to keep the 2018 Guidelines under review in light of experience gained;

4 REVOKES the *Guidelines for the application of the revised MARPOL Annex I requirements to floating production, storage and offloading facilities (FPSOs) and floating storage units (FSUs)* (resolution MEPC.139(53), as amended by resolution MEPC.142(54)).

ANNEX

2018 GUIDELINES FOR THE APPLICATION OF MARPOL ANNEX I REQUIREMENTS TO FLOATING PRODUCTION, STORAGE AND OFFLOADING FACILITIES (FPSOs) AND FLOATING STORAGE UNITS (FSUs)

1 The Marine Environment Protection Committee, at its forty-ninth session (14 to 18 July 2003), recognizing the necessity to provide appropriate guidance for the application of MARPOL Annex I requirements to floating production, storage and offloading facilities (FPSOs) used for the offshore production and storage of oil, and floating storage units (FSUs) used for the offshore storage of produced oil, approved the Guidelines for application of MARPOL Annex I requirements to FPSOs and FSUs. The Guidelines were issued as MEPC/Circ.406 on 10 November 2003.

2 The Marine Environment Protection Committee, at its fifty-third session, adopted, by resolution MEPC.139(53), *the Guidelines for the application of the revised MARPOL Annex I requirements to floating production, storage and offloading facilities (FPSOs) and floating storage units (FSUs)* to replace MEPC/Circ.406 and update the Guidelines' references to the requirements of MARPOL Annex I as amended by resolution MEPC.117(52).

3 The Marine Environment Protection Committee, at its seventy-third session, recognizing that similar revision would be needed for the Guidelines, agreed to the adoption of these Guidelines to replace resolution MEPC.139(53), as amended, with a view to updating the Guidelines to address the application of all new MARPOL Annex I amendments up to resolution MEPC.276(70).

4 The purpose of these Guidelines is to provide for uniform application of MARPOL Annex I requirements to FPSOs and FSUs that are used for the offshore production and storage or for the offshore storage of produced oil.

5 The Committee noted the complex issues involved in applying the requirements of MARPOL Annex I to FPSOs and FSUs, whose arrangements, functions and operations fall under the over-riding control of coastal States.

6 In addition, the Committee found that the role of FPSOs and FSUs in operation does not include transport of oil. Accordingly, FPSOs and FSUs are a form of floating platform and do not lie within the definition of *oil tanker* in regulation 1.5 of MARPOL Annex I. They are therefore subject to the provisions of MARPOL Annex I that relate to fixed and floating platforms, including regulation 39.

7 The Committee noted that the environmental hazards associated with the quantities of produced oil stored on board operational FPSOs and FSUs are similar to some of the hazards related to oil tankers, and that relevant requirements of MARPOL Annex I in relation to *oil tankers* could be adapted to address those hazards in an appropriate manner. Based on the above and recognizing that these floating platforms are stationary when operating, the Committee recommends that coastal States, flag States and others associated with the design, construction and operation of FPSOs and FSUs apply the relevant MARPOL Annex I regulations referred to in annex 1 to the Guidelines. References contained in annex 1 relate to MARPOL Annex I up to and including the amendments contained in resolution MEPC.276(70).

8 These Guidelines have been prepared with a view to providing the necessary guidance and interpretation information which may be specifically applicable to FPSOs and FSUs, and accordingly represent a single document describing the application of MARPOL Annex I to these floating platforms.

9 The provisions of these Guidelines are for application to FPSOs and FSUs when located at their operating station. However they also take into account the abnormal and rare circumstances of:

.1 voyages for drydocking, repair or maintenance work; or

.2 disconnection of the platform in extreme environmental or emergency conditions.

In either case, the FPSO/FSU should not transport oil to a port or terminal except with the specific agreement of the flag and relevant coastal States, obtained on a single voyage basis. When undertaking any voyage away from the operating station, for whatever purpose, FPSOs and FSUs will be required to comply with the discharge provisions of MARPOL Annex I for *oil tankers*.

10 In order to avoid development of an entire new text from MARPOL Annex I attending to such terminology matters and notwithstanding the basis for these Guidelines outlined above, in any regulation indicated to apply to FPSOs and FSUs by the Guidelines at annex 1, the following interpretation of terminology should be used:

.1 "oil tanker" should be read as "FPSO or FSU";

.2 "carry" should be read as "hold";

.3 "cargo" should be read as "produced oil and oily mixtures"; and

.4 "voyage" should be read to include "operations".

11 Oil tanker requirements that are extended by the Guidelines to apply to FPSOs/FSUs are identified through the phrase "recommend application" or similar, while "applies" is used for requirements to be implemented irrespective of the contents of these Guidelines.

12 The requirement for oil tankers to undergo enhanced surveys is contained in SOLAS regulation XI-1/2. Since SOLAS does not apply to the vast majority of FPSOs and FSUs, which are permanently moored at their operating stations, the relevant oil tanker requirements of resolution A.1049(27) (2011 ESP Code) have been included as one of the provisions of the Guidelines in order to ensure a satisfactory standard of structural integrity for FPSOs and FSUs. Reflecting the operational characteristics of FPSOs and FSUs, the Guidelines also make provision for limited departure from resolution A.1049(27) in respect of acceptance of in-water surveys under conditions which do not compromise safety and pollution prevention.

13 In implementing the provisions of these Guidelines, Member Governments are invited to use and recognize the Record of Construction and Equipment for FPSOs and FSUs at annex 2 in place of Forms A and B appended to MARPOL Annex I.

14 The Committee noted that most operations of FPSOs and FSUs are different from other ships covered by MARPOL Annex I and, recognizing that the coastal State has jurisdiction over fixed and floating platforms operating in waters under its jurisdiction, Member Governments may find it necessary to depart from the provisions of these Guidelines. Accordingly, Member Governments are invited to advise the Organization of their experience in applying these Guidelines so that it can be taken into account if future amendments to these Guidelines are deemed necessary.

ANNEX 1

RECOMMENDED PROVISIONS OF MARPOL ANNEX I FOR APPLICATION TO FPSOs AND FSUs

Article	Subject	Basis of Application
Art. 2(3)(b)(ii)	Def. *Discharge*	In accordance with Reg. 39 and UI 67, produced water, offshore processing drainage and displacement water are not included in the meaning of *discharge.*
Art. 2(4)	Def. *Ship*	FPSOs/FSUs are "fixed or floating platforms" and are therefore included in this definition.

Regulation	Subject	Basis of Application
1.1 to 1.4	Defs. *Oil, Crude Oil, Oily mixture, Oil fuel*	Apply.
1.5	Def. *Oil tanker*	FPSOs/FSUs are adapted primarily for a purpose other than to carry (transport) oil and are therefore excluded from this definition.
1.6 and 1.7	Defs. *Crude Oil tanker, Products carrier*	Not applicable.
1.8	Def. *Combination carrier*	Not applicable for same reasons as 1.5.
1.9	Def. *Major conversion*	Conversion of an *oil tanker* or *combination carrier* to an FPSO/FSU and *vice versa* should be considered to be a *major conversion.* Alterations or modifications required for an existing FPSO/FSU to move to another field should not be considered a *major conversion*.
1.10 and 1.11	Defs. *Nearest land, Special area*	Apply.
1.12	Def. *Instantaneous rate of discharge of oil*	Not applicable to FPSO/FSU at operating station as this definition applies when the ship is under way (refer regs. 34.1.4 and 31.2, 31.3 and 36.6).
1.13 to 1.26	Defs. *Various*	Apply.
1.27	Def. *Anniversary date*	Applies.
1.28.1, 1.28.2 and 1.28.9	Defs. *Ship age groups*	Apply.
1.28.3 to 1.28.8	Defs. *Oil tanker age groups*	Not applicable.
1.29 to 1.38	Defs. *Various*	Apply.
2.1	Application	Applies.

Regulation	Subject	Basis of Application
2.2 and 2.3	Application	Not applicable as the scope of application of these Guidelines is for FPSOs and FSUs when located at their normal operational station, including where appropriate temporary disconnection from the riser at the operating station for the minimum period necessary to ensure the safety of the vessel in extreme environmental or emergency conditions.
2.4	Application	Not applicable.
2.5 and 2.6	Existing tankers engaged in specific trades	Not applicable.
3.1 to 3.3	Exemptions and waivers	Any Administration using this clause in relation to FPSOs/FSUs would need to justify such use in relation to the terms of paragraph .1 and in accordance with the requirements of paragraph .3.
3.4 and 3.5	Exemptions and waivers	Recommend application in order to sanction the waiver arrangements outlined in 31.2, e.g. for operations within special areas (3.5.2.1) in compliance with 3.5.2.4 to 3.5.2.7. Transfer of oily mixtures to offload tankers for discharge ashore is acceptable within this waiver.
3.6	Exemptions and waivers	Recommend application.[1]
4	Exceptions	Applies.
5	Equivalents	Applies.
6	Surveys and inspections	Applies. Notwithstanding whether SOLAS 74 applies to an FPSO/FSU, surveys of FPSOs and FSUs should be conducted to the standard specified for *oil tankers* in SOLAS 74 regulation XI-1/2, except for the provisions of 2.2 of Annex B, Parts A and B, to resolution A.1049(27) (2011 ESP Code), as amended in relation to dry-dock survey. The coastal and flag States may accept bottom survey of the ship afloat instead of in dry-dock when the conditions are satisfactory and the proper equipment and suitably qualified personnel are available.
7	Issue of certificate	IOPP Certificate should be issued unless flag and coastal States have other means of certificating/documenting compliance.
8	Issue of certificate by another Government	Applicable.
9	Form of certificate	Applicable. When completing the IOPP certificate, FPSOs'/FSUs' "type of ship" should be shown as "ship other than any of the above" and this entry should be annotated with "FPSO" or "FSU" together with details of operational location. Record of Construction and Equipment for FPSOs and FSUs given at Annex 2 should be used for the IOPP Supplement. Where this is done, Form A or Form B required by the Convention need not be provided.

[1] If an Administration decides to apply these provisions to FPSOs and FSUs, it is invited to notify all parties involved so that a sufficient amount of time is allowed for the provisions to be complied with, which should be at least one year from the date of notification.

Regulation	Subject	Basis of Application
10	Duration of certificate	Applicable.
11	Port State control on operational requirements	Applies to FPSO/FSU at its operating station, recognizing that under Art. 2(5) and UNCLOS Arts. 56 and 60, the coastal State exercises sovereign rights for the purposes of exploration and exploitation of their natural resources. However, port State control powers are applicable at other times such as if the FPSO/FSU voyages to a port in another State for maintenance purposes.
12	Tanks for oil residues (sludge)	Applicable.
12A	Oil fuel tank protection	Applies to new purpose built FPSOs and FSUs only excluding the requirements of paragraph 6. However, when undertaking any voyage away from the operating station for whatever purpose, the double bottom oil fuel tanks are to be empty unless they are in compliance with the requirements of paragraph 6.
13	Standard discharge connection	Applicable.
14	Oil filtering equipment	Applicable subject to applicable provisions of Reg. 15 and 34. For reasons of practicality, the equipment need not be fitted provided the machinery space discharges are disposed of in accordance with options a, b, d or e in relation to regulation 15.2. A waiver may be issued under 14.5.3, where all oily mixtures are discharged either ashore or into production stream.
15A	Discharges outside special areas	In accordance with Reg. 39 and UI 67, applies only to machinery space discharges and contaminated sea water from operational purposes such as produced oil tank cleaning water, produced oil tank hydrostatic testing water, water from ballasting of produced oil tank to carry out inspection by rafting. Since FPSOs/FSUs and other fixed and floating platforms cannot comply with 15.2.1 when operating on station then these oils and oily mixtures may, with the agreement of the coastal State: a. be sent ashore; b. be incinerated; c. have water separated and discharged if not exceeding 15 ppm oil content under 34.2; d. be discharged in accordance with this clause subject to waiver of the *en route* requirement; e. be added to the production stream; or f. be treated using a combination of these methods.
15B	Discharges in special areas	Applicable, but FPSOs/FSUs cannot comply with 15.3.1 when operating on station. This requirement should be handled consistent with 15A above. Coastal State may issue dispensation from 15.3.1 where satisfied that this dispensation does not prejudice the environment.

Regulation	Subject	Basis of Application
15C and 15D	Requirements for ships <400 GT and general req.	Apply.
16.1, 16.2 and 16.4	Segregation of oil and water ballast and carriage of oil in forepeak tanks	Apply. The principles of 16.3 should be extended to all other FPSOs and FSUs.
16.3	"	Applies to FPSOs/FSUs which are capable of disconnecting from the riser at the operating station as collision bulkhead requirement is in SOLAS rather than MARPOL. This principle is also relevant to stern collision as per 19.7.
17	Oil Record Book Part I	Applies.
18.1 to 18.9	Segregated ballast tanks	Recommend application subject to the conditions listed for 18.2 and 18.3.
18.2	"	Not applicable, but FPSO/FSU should have sufficient ballast capacity to meet stability and strength requirements in design and operational conditions of loading.
18.3	"	Recommend application, noting that there should normally be separation between ballast and produced oil (crude) tanks and pumping systems, but temporary cross-connection may be permitted for the duration of transfer operations. In such exceptional cases where sea water is introduced into produced oil tanks for the operational purposes listed above in relation to 15.2, it should be dealt with as provided for under that clause.
18.8.1 to 18.8.4	Requirements for oil tankers with dedicated clean ballast tanks	Recommend application similar to 18.1 to 18.9.
18.10.1	Existing oil tankers having special ballast arrangements	Recommend application to meet 18.2 and 18.3 as modified by these Guidelines.
18.10.2	"	Recommended application consistent with 18.3 and 35.2 as modified by these Guidelines.
18.10.3	"	Not applicable.
18.11	SBT for oil tankers >=70,000 DWT delivered after 31.12.79	Recommend application, subject to the conditions listed for 18.2 and 18.3.
18.12 to 18.15	Protective location of segregated ballast spaces	Not applicable. Refer to 19.3.1 for corresponding provisions in relation to both new purpose-built FPSOs/FSUs and other non-purpose-built FPSOs/FSUs.

Regulation	Subject	Basis of Application
19	Double hull and double bottom requirements for oil tankers delivered on or after 6.07.96	Not applicable, except as detailed below.
19.3.1 and 19.3.6	"	Recommend application to new purpose-built FPSOs/FSUs so as to provide protection against relatively low-energy collision. (NOTE: Appropriate measures should also be taken for other FPSOs/FSUs to address this collision hazard).
19.5	"	Applicable to the extent that the Guidelines referred to can be used to demonstrate equivalency with 19.3.1 and 19.3.6 as modified above.
19.7	"	Recommend application to new construction purpose-built FPSOs/FSUs and other FPSOs/FSUs which are arranged with a fore peak or collision bulkhead. Similarly, oil should not be held in integral tanks located at the stern in FPSOs/FSUs which may offload to a tanker moored astern or alongside of the FPSO/FSU.
19.8	"	Recommend application to new construction purpose built FPSOs/FSUs and other FPSOs/FSUs which may be modified to meet this regulation.
20 (as amended by resolution MEPC.111(50))	Double hull and double bottom requirements for oil tankers delivered before 6.07.96	Not applicable.
21	Prevention of pollution from oil tankers carrying heavy grade oil as cargo	Not applicable.
22	Pump-room bottom protection	Not applicable.
23	Accidental oil outflow performance	Not applicable.
24	Damage assumptions	Recommend application with regard to side damage only. It is recommended that protective measures, such as fendering, be used to minimize side impact damage such as that which might be experienced during offloading and supply vessel berthing operations. Such protection, however, should not be considered to reduce the minimum transverse extent of side penetration damage.
25	Hypothetical outflow of oil	Recommend application for side damages only in accordance with 24 above.
26	Limitation of size and arrangement of cargo tanks	Recommend application based on 24 and 25 above.

Regulation	Subject	Basis of Application
27	Intact stability	Recommend application.
28.1 to 28.5	Subdivision and damage stability	Recommend application only in respect of side damage in accordance with 24 above.
28.6	Stability instrument	Recommend application.[2]
28.7	Damage assumptions for oil tankers >=20,000 DWT delivered on or after 6.07.96	Not applicable.
29	Slop tanks	Applies.
30.1	Pumping, piping and discharge arrangement	Applies, except that manifold is to be provided in at least one position on the FPSO/FSU.
30.2	"	Not applicable for FPSOs.
30.3 to 30.7	"	Recommend application, particularly for management of contaminated sea as per Reg.18.3.
31	Oil discharge monitoring and control system	Applies only to tank cleanings and contaminated sea water (refer Art. 2(3)(b)(ii), Reg. 39 and UI 67) and should be read in light of Reg. 34. Not required where all oily mixtures are discharged to shore.
32	Oil/water interface detector	Applies only to tank cleanings and contaminated sea water (refer Art. 2(3)(b)(ii), Reg. 39 and UI 67) and should be read in light of Reg. 34. Not required where all oily mixtures are discharged to shore.
33	Crude oil washing requirements	COW system should be fitted unless produced oil characteristics are not suitable for COW.
34	Control of discharge of oil	Applicable as detailed below.
34.1	Discharges outside special areas	Recommended application whenever the FPSO/FSU is not at its operating station.
34.2	"	Applies.
34.3 to 34.5	Discharges in special areas	Apply.
34.6	Oil tankers <150 GT	Recommend application if FPSO/FSU is less than 150 GT.
34.7 to 34.9	General requirements	Apply.
35	Crude oil washing operations	Recommended application to any produced oil tanks used for water ballast as water ballast is subject to different discharge requirements than produced water. COW O&E Manual is to be provided for any COW system fitted.
36	Oil Record Book Part II	Part II should be applied in principle as part of oil production management system when on station, noting that this function must be complied with on voyage.

[2] If an Administration decides to apply these provisions to FPSOs and FSUs, it is invited to notify all parties involved so that a sufficient amount of time is allowed for the provisions to be complied with, which should be at least one year from the date of notification.

Regulation	Subject	Basis of Application
37.1 to 37.3	SOPEP	Applies in respect of SOPEP. However, contingency plan in accordance with requirements of OPRC Art 3(2) may be accepted under UI 65 as meeting this requirement. In such cases a separate SOPEP in accordance with the MARPOL format is not required. This acceptance of the contingency plan does not apply to a disconnectable FPSO/FSU unless that plan remains applicable when the FPSO/FSU is not connected to the riser.
37.4	Access to stability and residual strength calculation programmes	Applicable.
38	Reception facilities	FPSOs/FSUs should not be considered as offshore terminals and should not receive dirty ballast or slops from offload tankers.
39	Special requirements for fixed or floating platforms	Applies, subject to UI 67.
40	Scope of application (for chapter 8 – Prevention of pollution during transfer of oil cargo between oil tankers at sea)	The regulations contained in this chapter shall not apply to oil transfer operations associated with fixed or floating platforms including drilling rigs; floating production, storage and offloading facilities (FPSOs) used for the offshore production and storage of oil; and floating storage units (FSUs) used for the offshore storage of produced oil.
41	General rules on safety and environmental protection	Not applicable (in chapter 8).
42	Notification (for chapter 8)	Not applicable (in chapter 8).
43	Special requirements for the use or carriage of oils in the Antarctic area	Applies.
44	Application (for chapter 10 – Verification of compliance with the provisions of this Convention)	Applies.
45	Verification of compliance	Applies.

Regulation	Subject	Basis of Application
46	Definitions (for chapter 11 – International Code for ships operating in polar waters)	Applies.
47	Application and requirements	Applies.

ANNEX 2

RECORD OF CONSTRUCTION AND EQUIPMENT FOR FPSOs AND FSUs

In respect of the provisions of resolution MEPC.311(73) "Guidelines for the application of MARPOL Annex I[3] requirements to FPSOs and FSUs", hereafter referred to as the "Guidelines".

Notes:

1 This form should be used for Floating Production Storage and Offloading facilities (FPSOs) and Floating Storage Units (FSUs) to which regulation 39 of Annex I of the Convention applies.

2 This Record should be permanently attached to the IOPP Certificate. The IOPP Certificate should be available on board the ship at all times.

3 If the language of the original Record is neither English nor French nor Spanish, the text should include a translation into one of these languages.

4 Entries in boxes shall be made by inserting either a cross (x) for the answers "yes" and "applicable" or a dash (-) for the answers "no" and "not applicable" as appropriate.

5 Unless otherwise stated, regulations mentioned in this Record refer to regulations of the revised Annex I of the Convention as implemented under the Guidelines and resolutions refer to those adopted by the International Maritime Organization.

1. Particulars of ship

1.1 Name of ship
.....

1.2 Distinctive number or letters
.....

1.3 IMO number (if applicable)
.....

1.4 Port of registry (if applicable)
.....

1.5 Gross tonnage (if applicable)
.....

1.6 Produced liquids holding capacity of ship ..... (m^3)

1.7 Deadweight of ship .....(tonnes) (regulation 1.23)

1.8 Length of ship ..... (m) (regulation 1.19)

1.9 Operating station (lat/long)
.....

1.10 Coastal State
.....

[3] Annex I of International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto, hereafter referred to as the "Convention".

1.11 Date of build:

1.11.1 Date of building contract .....

1.11.2 Date on which keel was laid or ship was at a similar stage of construction .....

1.11.3 Date of delivery .....

1.12 Conversion to FPSO/FSU (if applicable):

1.12.1 Date of conversion contract .....

1.12.2 Date on which conversion was commenced .....

2. Equipment for the control of oil discharge from machinery space bilges and oil fuel tanks (regulations 14, 15 and 34)

2.1 Carriage of ballast water in oil fuel tanks:

2.1.1 The ship may under normal conditions carry ballast water in oil fuel tanks □

2.2 Type of oil filtering equipment fitted:

2.2.1 Oil filtering (15 ppm) equipment (regulation 14.6) □

2.2.2 Oil filtering (15 ppm) equipment with alarm and automatic stopping device (regulation 14.7) □

2.3 Approval standards:[4]

2.3.1 The separating/filtering equipment:

.1 has been approved in accordance with resolution A.393(X); □

.2 has been approved in accordance with resolution MEPC.60(33); □

.3 has been approved in accordance with resolution MEPC.107(49); □

.4 has been approved in accordance with resolution A.233(VII); □

.5 has been approved in accordance with national standards not based upon resolutions A.393(X) or A.233(VII); □

.6 has not been approved; □

[4] Refer to *the Recommendation on international performance and test specifications of oily-water separating equipment and oil content meters* adopted by the Organization on 14 November 1977 by resolution A.393(X), which superseded resolution A.233(VII). Further reference is made to the *Guidelines and specifications for pollution prevention equipment for machinery space bilges* adopted by the Marine Environment Protection Committee of the Organization by resolution MEPC.60(33), which, effective on 6 July 1993, superseded resolutions A.393(X) and A.444(XI) and the revised *Guidelines and specifications for pollution prevention equipment for machinery spaces of ships* adopted by the Marine Environment Protection Committee of the Organization by resolution MEPC.107(49) which, effectively on 1 January 2005, superseded resolutions MEPC.60(33), A.393(X) and A.444(XI).

2.3.2 The process unit has been approved in accordance with resolution A.444(XI) □

2.3.3 The oil content meter:

.1 has been approved in accordance with resolution A.393(X); □

.2 has been approved in accordance with resolution MEPC.60(33); □

.3 has been approved in accordance with resolution MEPC.107(49); □

2.4 Maximum throughput of the system is ..... m^3/h

2.5 Waiver of regulation 14:

2.5.1 The requirements of regulations 14.1 and 14.2 are waived in respect of the ship:

.1 As the ship is provided with adequate means for disposal of oily residues in accordance with the Guidelines □

.2 In accordance with regulation 14.5.1 the ship is engaged exclusively in operations within special area(s): □
Name of special area(s)

2.5.2 The ship is fitted with holding tank(s) for the total retention on board of all oily bilge water as follows: □

Tank identification	**Tank location**		**Volume (m^3)**
	Frames (from) - (to)	Lateral position	
		Total volume: .....…….m^3	

3. Means for retention and disposal of oil residues (sludge) (regulation 12) and oily bilge water holding tank(s)[5]

3.1 The ship is provided with oil residue (sludge) tanks for retention of oil residues (sludge) on board as follows:

Tank identification	**Tank location**		**Volume (m^3)**
	Frames (from) – (to)	Lateral position	
		Total volume: .....…….m^3	

[5] Oily bilge water holding tank(s) are not required by the Convention, if such tank(s) are provided they should be listed in table 3.3.

3.2 Means for the disposal of oil residues (sludge) retained in oil residue (sludge) tanks:

3.2.1 Incinerator for oil residues (sludge) ……..... □

3.2.2 Auxiliary boiler suitable for burning oil residues (sludge) □

3.2.3 Facility for adding oil residues to production stream □

3.2.4 Other acceptable means, state which …….. □

3.3 The ship is provided with holding tank(s) for the retention on board of oily bilge water as follows:

Tank identification	**Tank location**		**Volume (m^3)**
	Frames (from) – (to)	Lateral position	
		Total volume: .....……..m^3	

3A. Oil fuel tank protection (regulation 12A)

3A.1 The ship is required to be constructed according to regulation 12A and complies with the requirements of:

.1 Paragraph 7 or 8 (double side construction) □

.2 Paragraphs 6 and either 7 or 8 (double hull construction) □

.3 Paragraph 11 (accidental oil fuel outflow performance) □

3A.2 The ship is not required to comply with the requirements of regulation 12A □

4. Standard discharge connection
(regulation 13)

4.1 The ship is provided with a pipeline for the discharge of residues from machinery bilges and sludges to reception facilities, fitted with a discharge connection □

5. Construction
(regulations 18, 26 and 28)

5.1 In relation to the application of regulation 18, the ship is:

5.1.1 Provided with SBT □

5.1.2 Provided with COW □

5.1.3 Provided with sufficient ballast capacity to meet stability and strength requirements □

5.1.4 Provided with CBT

5.2 Segregated ballast tanks (SBT): □

5.2.1 The ship is provided with SBT consistent with regulation 18 □

5.2.2 The ship is provided with SBT which includes tanks or spaces not used for oil outboard of all produced oil tanks □

5.2.3 SBT are distributed as follows:

Tank	**Volume (m^3)**	**Tank**	**Volume (m^3)**
		Total volume	..... m^3

5.3 Dedicated clean ballast tanks (CBT):

5.3.1 The ship is provided with CBT consistent with regulation 18.8 □

5.3.2 CBT are distributed as follows:

Tank	**Volume (m^3)**	**Tank**	**Volume (m^3)**
		Total volume	..... m^3

5.3.3 The ship has been supplied with a valid Dedicated Clean Ballast Tank Operation Manual, which is dated ……..…… □

5.3.4 The ship has common piping and pumping arrangements for ballasting the CBT and handling produced oil □

5.3.5 The ship has separate independent piping and pumping arrangements for ballasting the CBT □

5.4 Crude oil washing (COW):

5.4.1 The ship is equipped with a COW system □

5.4.2 The ship is equipped with a COW system consistent with regulations 33 and 35 □

5.4.3 The ship has been supplied with a valid Crude Oil Washing Operations and Equipment Manual which is dated …… □

5.5 Limitation of size and arrangements of produced oil tanks (regulation 26):

5.5.1 The ship is constructed according to the provisions of regulation 26 □

5.6 Subdivision and stability (regulation 28):

5.6.1 The ship is constructed consistent with regulation 28 □

5.6.2 Information and data required under regulation 28.5 have been supplied to the ship in an approved form □

5.6.3 The ship is constructed consistent with regulation 27 □

5.6.4 The ship is provided with an Approved Stability Instrument consistent with regulation 28.6 □

5.6.5 In place of an Approved Stability Instrument, consistent with regulation 3.6 stability is verified by the following means:

.1 loading only to approved conditions defined in the stability information provided to the master in accordance with regulation 28.5 □

.2 verification is made remotely by a means approved by the Administration □

.3 loading within an approved range of loading conditions defined in the stability information provided to the master in accordance with regulation 28.5 □

.4 loading in accordance with approved limiting KG/GM curves covering all applicable intact and damage stability requirements defined in the stability information provided to the master in accordance with regulation 28.5 □

5.7 Double-hull/side construction:

5.7.1 The ship is constructed consistent with regulation 19 as follows:

.1 paragraph 3 (double-hull construction) □

.2 paragraphs 3.1 and 3.6 (double sides) □

.3 paragraph .5 (alternative method approved by the Marine Environment Protection Committee) □

5.7.2 The ship is constructed consistent with regulation 19.6 □

6. Retention of oil on board (regulations 29, 31 and 32)

6.1 Oil discharge monitoring and control system:

6.1.1 The ship comes under category ..... oil tanker as defined in resolution A.496(XII) or A.586(14)[6] *(delete as appropriate)* □

6.1.2 The system comprises:

.1 control unit □

.2 computing unit □

.3 calculating unit □

6.1.3 The system is:

.1 fitted with a starting interlock □

.2 fitted with automatic stopping device □

6.1.4 The oil content meter is approved under the terms of resolution A.393(X) or A.586(14) or MEPC.108(49)[7] *(delete as appropriate)* suitable for crude oil □

6.1.5 The ship has been supplied with an operations manual for the oil discharge monitoring and control system □

6.2 Slop tanks:

6.2.1 The ship is provided with ..... dedicated slop tank(s) with the total capacity of ..... m^3, which is. .... % of the oil carrying capacity, in accordance with:

.1 regulation 29.2.3 □

.2 regulation 29.2.3.1 □

.3 regulation 29.2.3.2 □

.4 regulation 29.2.3.3 □

6.2.2 Produced oil tanks have been designated as slop tanks □

6.3 Oil/water interface detectors:

6.3.1 The ship is provided with oil/water interface detectors approved under the terms of resolution MEPC.5(XIII) □

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[6] FPSOs and FSUs the keels of which are laid, or which are at a similar stage of construction, on or after 2 October 1986, should be fitted with a system approved under resolution A.586(14).

[7] For oil content meters installed on tankers built prior to 2 October 1986, refer to the *Recommendation on international performance and test specifications for oily-water separating equipment and oil content meters* adopted by the Organization by resolution A.393(X). For oil content meters as part of discharge monitoring and control systems installed on tankers built on or after 2 October 1986, refer to the *Guidelines and specifications for oil discharge monitoring and control systems for oil tankers* adopted by the Organization by resolution A.586(14). For oil content meters as part of discharge monitoring and control systems installed on oil tankers built on or after 1 January 2005, refer to the revised *Guidelines and specifications for oil discharge monitoring and control systems for oil tankers* adopted by the Organization by resolution MEPC.108(49).

6.4 Waiver of regulation:

6.4.1 The requirements of regulations 31 and 32 are waived in respect of the ship as follows:

.1 The ship is engaged exclusively in operations within special area(s) (regulation 3.5) □

Name of special area(s)……

.2 The ship is provided with adequate means of disposal of contaminated sea water

a. sent ashore □

b. incinerated □

c. added to the production stream □

7. Pumping, piping and discharge arrangements
(regulation 30)

7.1 The overboard discharge outlets for segregated ballast are located:

7.1.1 Above the waterline □

7.1.2 Below the waterline □

7.2 The overboard discharge outlets, other than the discharge manifold, for clean ballast are located:[8]

7.2.1 Above the waterline □

7.2.2 Below the waterline □

7.3 The overboard discharge outlets, other than the discharge manifold, for dirty ballast water or oil-contaminated water from produced oil tank areas are located:

7.3.1 Above the waterline □

7.3.2 Below the waterline in conjunction with the part flow arrangements consistent with regulation 30.6.5 □

7.3.3 Below the waterline □

[8] Only those outlets which can be monitored are to be indicated.

7.4 Discharge of oil from produced oil pumps and oil lines (regulations 30.4 and 30.5):

7.4.1 Means to drain all produced oil pumps and oil lines at the completion of produced oil discharge:

.1 drainings capable of being discharged to a produced oil tank or slop tank □

.2 for discharge a special small-diameter line is provided □

8. Shipboard oil pollution emergency plan
(regulation 37)

8.1 The ship is provided with a shipboard oil pollution emergency plan in compliance with regulation 37.1 □

8.2 The ship is provided with an oil pollution emergency plan approved in accordance with procedures established by …… as the coastal State in compliance with the unified interpretation of regulation 37.1 □

8.3 The ship is provided with a contingency plan in accordance with requirements of OPRC Art. 3(2) accepted in accordance with regulation 37 □

9. Surveys

9.1 Records of surveys in accordance with resolution A.1049(27), as amended maintained on board □

9.2 In-water surveys in lieu of dry-docking authorized as per documentation …… □

10. Equivalents

10.1 Equivalents have been approved by the Administration for certain requirements of the guidelines on those items listed under paragraph(s) ……. ……..…… of this Record □

11. Compliance with part II-A – chapter 1 of the Polar Code

11.1 The ship is in compliance with additional requirements in the environment-related provisions of the introduction and section 1.2 of chapter 1 of part II-A of the Polar Code □

THIS IS TO CERTIFY that this Record is correct in all respects.
Issued at ……

(Place of issue of the Record)

…… ……

(Signature of duly authorized official issuing the Record)

(Seal or stamp of the issuing authority, as appropriate)

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ANNEX 9

UNIFIED INTERPRETATION OF APPENDIX I (FORM OF THE INTERNATIONAL BALLAST WATER MANAGEMENT CERTIFICATE) OF THE BWM CONVENTION

Appendix I – Form of the International Ballast Water Management Certificate

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

1 For the purpose of completing the International Ballast Water Management Certificate, the date when commissioning has been completed in accordance with section 8 of the Guidelines (G8) (MEPC.174(58) or MEPC.279(70), as applicable) should be used.

2 Notwithstanding the above, it should be noted that, with regard to the deadline for installing a ballast water management system, operative paragraph 6 of resolution MEPC.279(70) (*2016 Guidelines for approval of ballast water management systems (G8)*) is as follows:

> "6 AGREES that, for the purpose of operative paragraphs 4 and 5 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;"

3 Consequently, two dates, i.e. the contractual date of delivery or the actual date of delivery, and the date following commissioning and operation, may exist in relation to installing a ballast water management system.

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ANNEX 8

UNIFIED INTERPRETATIONS OF REGULATIONS 2.9, 5.4.5, 22.2, 22.3, 22A.1, 22A.8 AND APPENDIX IX OF MARPOL ANNEX VI

1 Confirmation of compliance for new ships

Regulation 5.4.5 reads as follows:

> ".5 The Administration shall ensure that for each ship to which regulation 22A applies, the SEEMP complies with regulation 22.2 of this Annex. This shall be done prior to collecting data under regulation 22A 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 22.2 reads as follows:

> "2 On or before 31 December 2018, 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 22A.1 of this Annex and the processes that will be used to report the data to the ship's Administration."

Regulation 22.3 reads as follows:

> "3 The SEEMP shall be developed taking into account guidelines adopted by the Organization."

Interpretation:

Ships that are delivered on or after 1 January 2019 should keep on board both a SEEMP that is in compliance with regulation 22.2 and confirmation of compliance as required by regulation 5.4.5.

2 Boil-off gas consumed on board ships

Regulation 2.9 reads as follows:

> "9 *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 22A.1 reads as follows:

> "1 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 reads as follows:

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

Interpretation:

Data relating to Boil-off Gas (BOG) consumed on board the ship for propulsion or operation is required to be collected and reported as fuel as part of the Data Collection System for fuel oil consumption of ships.

3 Access to the disaggregated data

Regulation 22A.8 reads as follows:

> "8 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:

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

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