Summary of the outcomes of IMO MEPC 84

ClassNK Technical Information

To whom it may concern

The 84th session of the International Maritime Organization (IMO) Marine Environment Protection Committee (MEPC 84) was held from 27 April to 1 May 2026. Since the minutes, resolutions and circulars of the meeting were recently released from the IMO, a summary of the decisions taken at MEPC 84 is provided below for your information.

1. Reduction of Greenhouse Gas (GHG) emissions from ships
At MEPC 80 in 2023, the IMO adopted the 2023 IMO Strategy on Reduction of GHG Emissions from Ships (2023 IMO GHG Strategy), which sets out the IMO's levels of ambition (see the table below) including the aim to reach net-zero GHG emissions from international shipping by or around 2050. Further discussions continued in developing a framework of "Mid-term measures for reduction of GHG emissions" for achieving the levels of ambition set out in the 2023 IMO GHG Strategy.

Target year	Levels of ambition and indicative checkpoints (as of 2023)
2030	・ To reduce CO_2 emissions per transport work by at least 40% (compared to 2008) ・ To reduce total annual GHG emissions by at least 20% (striving for 30%) (compared to 2008) ・ Uptake of zero GHG emission fuels etc. to represent at least 5% of the energy used (striving for 10%)
2040	・ To reduce total annual GHG emissions by at least 70% (striving for 80%) (compared to 2008)
2050	・ To reach net-zero GHG emissions by or around 2050 at the latest

(1) Mid-term measures for reduction of GHG emissions
At MEPC 83 in April 2025, the draft amendments to MARPOL Annex VI on the mid-term measures was approved (*), comprising the concepts of "regulating GHG fuel intensity of the fuel used by a ship (GFI regulations)" and "accelerating decarbonization through the IMO Net-Zero Fund" as the two pillars. The draft amendments were subsequently considered at the extraordinary MEPC session (MEPC ES.2) in October 2025 with a view to adoption. However, differing views among IMO Member States resulted in a decision to postpone consideration for one year.
* For details of the approved mid-term measures, please refer to the "What is the IMO's Mid-term measures and how it works" published by ClassNK.

(To be continued)

(i) Consideration of the framework of the mid-term measures
Prior to MEPC 84, various comments and proposals for amendments to the approved draft amendments (hereinafter "current draft amendments") were submitted, including:

- The current draft amendments should be adopted without modification;
- Opposition to the current draft amendments, proposing an approach without carbon pricing and an international fund and without excluding specific fuels;
- Proposals to set more pragmatic GHG intensity standards, taking into account the commercial availability of alternative fuels; and
- Proposals to relax GHG intensity requirements, expand flexibility mechanisms such as the transfer of compliance between ships, and not establish a fund.

At this session, discussions focused on how to proceed with future deliberations on the framework for mid-term measures, including whether to resume the extraordinary MEPC session.

In the discussions during the session, many delegations expressed views both in support of and in opposition to the aforementioned comments and proposals. At the same time, a number of Member States indicated that adjustments to the current draft amendments would be possible. As a result, it was agreed to hold intersessional working group meetings on GHG reduction in September 2026 and November 2026 (the week prior to MEPC 85), with the aim to address remaining concerns and issues with the current draft amendments.

Furthermore, regarding the extraordinary MEPC session that has been suspended since October 2025, it was agreed that it could be resumed immediately after MEPC 85 (on 4 December 2026), subject to the final decisions to be made at MEPC 85.

(ii) Development of relevant guidelines necessary for the implementation of the mid-term measures (current draft amendments)
In the week preceding MEPC 84 (from 20 to 24 April 2026), the 21st session of the IMO Intersessional Meeting of the Working Group on Reduction of GHG Emission from Ships (ISWG-GHG 21) was held.

At ISWG-GHG 21, work was undertaken to develop guidelines necessary for the implementation of the current draft mid-term measures, as follows:

- Draft guidelines for calculation of attained annual GHG fuel intensity (GFI) (including draft guidance on how to monitor, report and verify the energy derived from wind propulsion systems)
- Draft guidelines for rewards for ships used zero or near-zero fuels/technologies
- Draft governance provisions of the IMO Net-Zero Fund
- Draft guidelines on fuel certification scheme

The development of these draft guidelines will continue, taking into account ongoing discussions on the mid-term measures.

(To be continued)

(2) Practical application of the Guidelines on Life Cycle GHG Intensity of Marine Fuels (LCA Guidelines)

In the context of the decarbonization of shipping, increasing attention is being paid not only to greenhouse gas (GHG) emissions generated during the combustion of fuels, but also to GHG emissions arising over the entire life cycle of fuels, including their production and distribution processes, particularly with respect to low- and zero-carbon fuels such as hydrogen, ammonia and biomass based fuels, which are expected to be increasingly deployed in the future. At MEPC 80, the Guidelines on the life cycle GHG intensity of marine fuels (LCA Guidelines, MEPC.376(80)) were adopted, establishing the methodology for calculating the life cycle GHG intensity of fuels used on board ships, covering the entire fuel life cycle from feedstock extraction through production, distribution and onboard use, as well as default GHG intensity values for different fuel types. Subsequently, at MEPC 81, amendments to the LCA Guidelines (MEPC.391(81)) were adopted; however, since default GHG intensity values have so far been specified for only five types of marine fuels, including fossil derived heavy fuel oils and certain biofuels, work toward practical implementation has continued, including the further development of default values, refinement of calculation methodologies, as well as the development of sustainability criteria and certification schemes.

At this session, it was reconfirmed that the LCA Guidelines constitute a common technical foundation underpinning the GHG Fuel Intensity (GFI) regulation, the assessment of zero and near zero emission fuels (ZNZ), and the fuel certification scheme (SFCS). The following ways forward were agreed during the session:

- Avoided emissions would not be included in LCA calculations at this stage;
- Embodied emissions (i.e. emissions associated with fuel production facilities and infrastructure) would likewise not be included in LCA calculations;
- The fuel certification scheme (SFCS) would cover the certification of GHG emissions at the well to tank (WtT) stage as well as compliance with sustainability requirements, and the full application of the LCA Guidelines, third party certification, the assurance of traceability, and the prevention of double counting would constitute its fundamental principles; and
- With respect to chain of custody, the mass balance approach would be adopted as the basic model, and the book and claim approach would not be adopted.

Furthermore, the following technical matters requiring further expert consideration will continue to be considered by relevant expert bodies, such as the GESAMP LCA Working Group:

- The technical validity of avoided emissions (such as consistency with attributional LCA, reliance on counterfactual assumptions, and the risk of double counting);
- The treatment of upstream emissions in cases where cargo is used as fuel;
- Technical aspects related to onboard carbon capture systems (OCCS) (including tank to wake calculation methodologies, requirements for permanent storage, and the allocation of verification responsibilities between onboard and onshore components);
- The detailed numerical design and statistical treatment of default values; and

(To be continued)

- The detailed design of the chain of custody.

(3) Measurement of methane and nitrous oxide emissions from ships
In addition to CO_2 emitted upon fuel combustion, emissions of methane (CH_4) and nitrous oxide (N_2O) are also gaining increased attention as they are considered as greenhouse gases (GHG) with global warming effects. At MEPC 83, the "Guidelines for Test-Bed and Onboard Measurements of Methane and/or Nitrous Oxide Emissions from Marine Diesel Engines" (MEPC.402(83)) were adopted, and it was also agreed to keep them under review.

At this session, the revised "2026 Guidelines for Test-Bed and Onboard Measurements of Methane and/or Nitrous Oxide Emissions from Marine Diesel Engines" were adopted to incorporate the following amendments:

- Addition of a calculation formula to correct the measurement results of the methane slip from LNG-fuelled engines to an agreed reference gas composition;
- Addition of the reference CH_4 content of LNG fuel (84.6 wt% / 92.2 mol%) as the basis for the aforementioned correction:
- Clarification on the treatment of crankcase emissions of CH_4;
- Addition of a provision allowing the use of total hydrocarbon emissions recorded in the NOx Technical File as a proxy for CH_4 emissions in cases where CH_4 measurements have not been conducted; and
- Alignment of measurement and calculation methods with ISO 8178.

Additionally, in order to calculate the annual CH_4 and/or N_2O emissions using the values measured and calculated in accordance with the aforementioned guidelines, the use of engine load data during operation is considered as one of the options. Therefore, the "Guidelines for Engine Load Monitoring (ELM) and Calculation of Emission Values" were also adopted.

Furthermore, regarding the direct measurement of CH_4 and/or N_2O emissions on board, the "Guidelines for Continuous Emission Monitoring Systems (CEMS) used to Quantify Methane (CH_4) and/or Nitrous Oxide (N_2O) Emissions from Marine Diesel Engines" were adopted for analyzing and monitoring exhaust gases.

It was then agreed to establish a correspondence group to continue discussions for the further improvement of the framework for measurement and verification of CH_4 and N_2O emissions.
(Refer to Res. MEPC.414(84) as Attachment 4, Res. MEPC.415(84) as Attachment 5 and Res. MEPC.416(84) as Attachment 6)

(To be continued)

(4) Onboard carbon capture and storage

The development and demonstration of Onboard Carbon Capture and Storage (OCCS) systems, which reduce GHG emissions from ships by separating and capturing CO_2 from exhaust gases, are progressing. At MEPC 83, the work plan for developing a regulatory framework for the use of OCCS (e.g. consideration of how GHG emission reductions achieved through OCCS could be reflected in the IMO regulatory framework, and criteria for the disposal and use of captured carbon) was agreed with the target completion year of 2028.

At this session, it was agreed to add the development of specific methodological guidance on OCCS accounting, verification, and certification to the aforementioned work plan. Furthermore, it was also agreed in general that the OCCS value chain includes technologies that involve permanent mineralization of CO_2. Discussions on the treatment of OCCS, including the calculation of the attained annual GHG fuel intensity, will continue taking into account the work plan revised at this session.

2. Air pollution

(1) Revision of the NOx Technical Code for Certification of Non-Carbon-Based Fuel Engines

Regulation 13 of MARPOL Annex VI regulates NOx (Nitrogen Oxides) emissions from marine diesel engines, with detailed requirements set out in the NOx Technical Code (NTC).

At this session, discussions were held on methods for calculating NOx emissions for engines using non-carbon-based fuels such as hydrogen and ammonia, which are expected to increase in use so as to reduce GHG emissions

As a result of the discussions, amendments to the NTC were approved, introducing the calculation methods using "hydrogen balance method" and "oxygen balance method" to determine exhaust gas flow rates for calculating NOx emissions from non-carbon-based fuel engines.

If the amendments are adopted at MEPC 85, they are expected to enter into force at the earliest in the summer of 2028.

(2) Regulation of Volatile Organic Compound (VOC) Emissions from Ships

In support of efforts to reduce GHG emissions, discussions have been held with the aim of strengthening measures for reducing emissions of volatile organic compounds (VOCs).

At this session, the draft amendments to MARPOL Annex VI were approved requiring newly constructed crude oil tankers to be equipped with pressure/vacuum (P/V) valves with a minimum set pressure of 0.20 bar.

If the amendments are adopted at MEPC 85, they are expected to enter into force at the earliest in the summer of 2028 and will apply to tankers carrying crude oil constructed on or after the date of entry into force of the amendments.

(To be continued)

(3) Unified Interpretation on Shipboard Incinerators
Regulation 16 of MARPOL Annex VI specifies requirements for shipboard incinerators, requiring incinerators of batch-loaded type to be designed so that the combustion chamber gas outlet temperature to reach 600°C within five minutes after start-up and will thereafter stabilize at a temperature not less than 850°C.

At this session, a unified interpretation was approved clarifying that the abovementioned requirement applies only for type approvals and should be distinguished from requirements during onboard inspections in actual operations.
(Refer to MEPC.1/Circ.795/Rev.10 as Attachment 7)

3. Others
(1) Review of the BWM Convention
Since the entry into force of the Ballast Water Management (BWM) Convention in 2017, an Experience-Building Phase (EBP) has been implemented to assess its effectiveness and to consider potential amendments. Based on the Convention Review Plan (CRP) adopted at MEPC 80, review work has been ongoing.

At this session, draft amendments to the BWM Convention incorporating, inter alia, the following elements were approved, where relevant Guidelines for practical implementation of the amendments (including those indicated with *) will be further developed or amended:

- Addition of exceptions from the application of the Convention, namely discharges due to operating in challenging water quality (CWQ) conditions or applying contingency measures (Reg. A-3);
- Addition of items that should be included in the Ballast Water Management Plan (BWMP), such as identification of BWMS approval (in accordance with BWMS Code, G8 Guidelines or Reg. D-4), maintenance procedures and schedules, procedures for safe ballast water exchange, plans for contingency measures, and (if applicable) procedures for the temporary storage of treated sewage and/or grey water in ballast water tanks (Reg. B-1);
- Addition of maintenance log of BWMS in BWRB (Reg. B-2)*;
- Maintaining onboard evidence of familiarization of the crew with their duties in the implementation of ballast water management and BWMP (Reg. B-6)*;
- Addition of compliance with the Maximum Allowable Discharge Concentration (MADC) of active substances (Reg. D-2);
- As survey requirements, verification of achievement of the standard in Reg. D-2 at intermediate and renewal surveys, and annual sampling of residual active substances (Reg. E-1)*; and
- Addition of requirements for approval of time-bound repair plan by both the flag and destination port State(s) whenever an accident occurs to a ship or a defect is discovered which substantially affects the ability of the ship to conduct ballast water management in accordance with the Convention (Reg. E-1).

(To be continued)

In addition, the "2026 Guidelines for Ballast Water Management Plans (G4 Guidelines)" have been adopted, enhancing provisions taking into account the above amendments to the Convention, thereby making the Guidelines more practical for implementation. The existing G4 Guidelines (MEPC.127(53) and its amendments) will be revoked at the time of entry into force of the above amendments to BWM Convention.

The above amendments to the Convention are being pursued along with amendments to the BWMS Code. However, because the draft amendments to the BWMS Code could not be finalized at this session, further consideration will take place through correspondence group discussions towards approval at MEPC 85. Therefore, once the timing for approval and adoption of amendments to the BWMS Code at or after the next MEPC 85 is determined, the expected entry-into-force date for the amendments to both the Convention and the BWMS Code will also be settled. The aforementioned EBP will conclude at the time of the entry into force of the amendments to BWM Convention above and BWMS Code.
(Refer to Res. MEPC.409(84) as Attachment 3)

(2) Forced Evaporation of Oily Bilge Water

Oily bilge water generated in the engine room is treated using oil separators as specified in Regulation 14 of Annex I to the MARPOL Convention. As alternative measures, it was principally agreed during the deliberations of MEPC 78 and 82 that the treatment utilizing forced evaporation by heating oily bilge water is also permissible.

At this session, draft amendments to MARPOL Annex I were approved to:

- Introduce the new Regulation 12B related to oily bilge water holding tanks and service tanks;
- Add relevant entries to the supplement to the IOPP Certificate; and
- Amend machinery space operations code (D) to be recorded in the Oil Record Book

If the amendments are adopted at MEPC 85, they are expected to enter into force at the earliest in the summer of 2028. With these amendments, forced evaporation treatment of oily bilge water will be explicitly permitted under MARPOL Annex I.

In addition, draft amendments to the IBTS Guidelines (setting out that maximum temperature of the oily bilge water service tanks should not exceed 105^{0}C, etc.) and the Oil Record Book Guidelines (adding record examples) were approved in principle with a view to final approval by MEPC 85 in conjunction with the adoption of the aforementioned amendments to MARPOL Annex I.

(3) Prevention of Transboundary Transfer of Aquatic Invasive Species via Biofouling

To address concerns regarding the transfer of invasive aquatic species via biofouling, MEPC 80 previously adopted "2023 Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species" (MEPC.378(80)) amending the 2011 guidelines, and MEPC 83 approved "Guidance on In-Water Cleaning of Ships' Biofouling". MEPC has further been discussing the development of an international regulatory framework in this regard.

(To be continued)

At this session, it was agreed that the relevant legally binding framework should take the form of a standalone instrument. A correspondence group was also established to consider the structure, table of contents, list of related guidelines and a draft work plan, with a view to reporting to the 14th session of the Sub-Committee on Pollution Prevention and Response (PPR 14).

4. Amendments to mandatory instruments
MEPC 84 adopted amendments to mandatory instruments as follows:

(1) Addition of NOx / SOx / PM Emission Control Area (North-East Atlantic ECA)
Amendments to MARPOL Annex VI were adopted to newly designate the North-East Atlantic Ocean area (see figure below) as an emission control area (ECA) for nitrogen oxides (NOx) under regulation 13, and for sulphur oxides (SOx) and particulate matter (PM) under regulation 14 of MARPOL Annex VI.
(Refer to Res. MEPC.407(84) as Attachment 1)

Entry into force: 1 September 2027

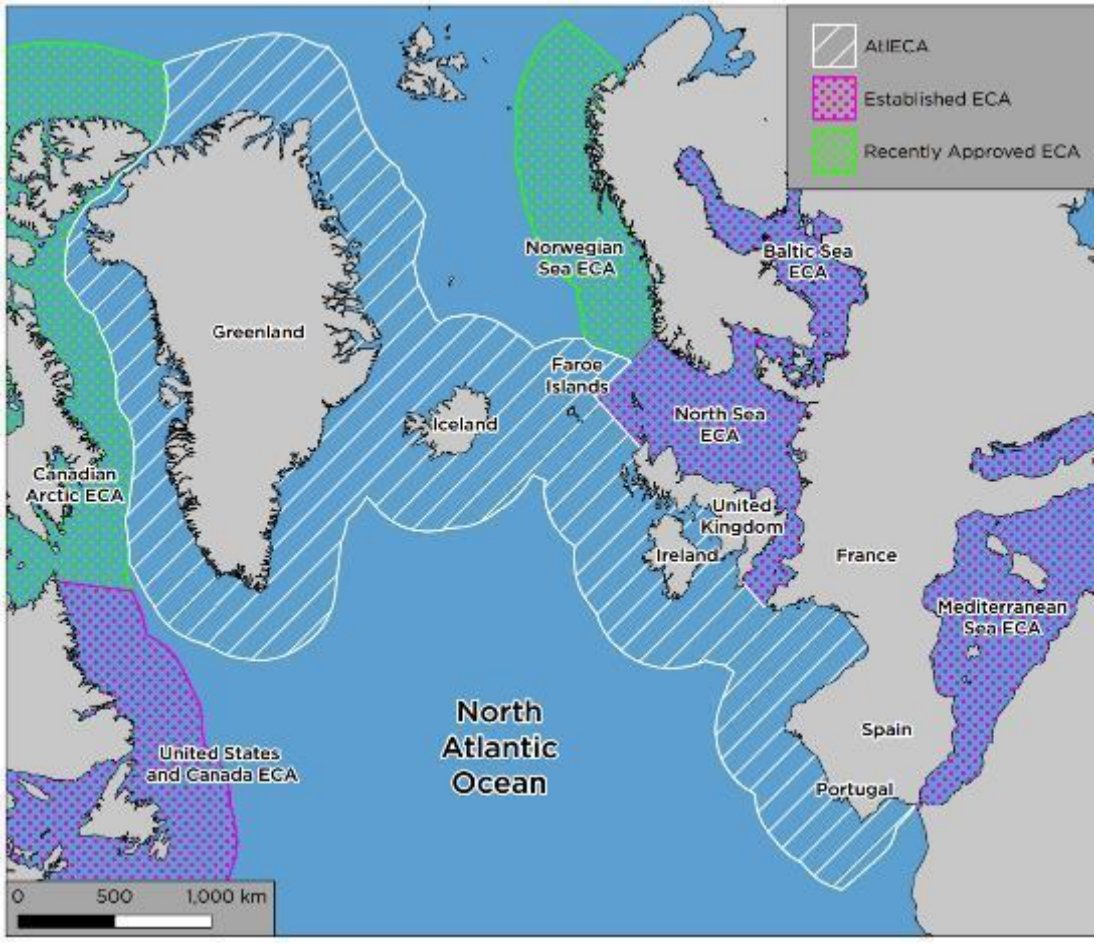

Illustration of North-East Atlantic ECA

(To be continued)

After the entry into force of the amendments, the NOx Tier III emission limit will apply to the following ships operating in the North-East Atlantic ECA:

- Ships for which the building contract is placed on or after 1 January 2027;
- In the absence of a building contract, ships the keels of which are laid or which are at a similar stage of construction on or after 1 July 2027; or
- Ships delivered on or after 1 January 2031.

Furthermore, from 1 September 2028, which is 12 months after the date of entry into force, SOx emission requirements will apply to ships operating in the North-East Atlantic ECA, limiting the sulphur content of fuel oil used onboard ships to 0.10%.

(2) NOx Regulations for Marine Diesel Engines
Following the amendments to the NOx Technical Code adopted at MEPC 83 (MEPC.397(83)), consequential amendments to Regulation 2, Appendices I and II of Annex VI to the MARPOL Convention were adopted.
(Refer to Res. MEPC.408(84) as Attachment 2)

Entry into force: 1 September 2027

(3) Accessibility to the IMO DCS Database
Amendments to regulation 27 of MARPOL Annex VI were adopted to improve access to data collected under the IMO Data Collection System (IMO DCS), enabling the following:

- Access by Parties to MARPOL Annex VI to non-anonymized data for ships (the Administration of a Party to the present Convention may notify that its express approval will be necessary before the data of ships entitled to fly its flag are included in the non-anonymized database); and
- Access by public users to anonymized data for all ships.

(Refer to Res. MEPC.407(84) as Attachment 1)

Entry into force: 1 September 2027

A summary of the outcomes of MEPC 84 is also available on the IMO website.
https://www.imo.org/en/MediaCentre/MeetingSummaries/Pages/MEPC-default.aspx

(To be continued)

For any questions about the above, please contact:

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Attachment:

1. Res. MEPC.407(84): Amendments to MARPOL Annex VI (Clarification of Entries in Data Reporting Required by Regulations 27 and 28, Designation of the North-East Atlantic as an Emission Control Area for Nitrogen Oxides, Sulphur Oxides and Particulate Matter, Accessibility to the IMO Ship Fuel Oil Consumption Database, and Review Clause of the Short-Term GHG Reduction Measure)
2. Res. MEPC.408(84): Amendments to MARPOL Annex VI (Use of Multiple Engine Operational Profiles for a Marine Diesel Engine, Including Clarifying Engine Test Cycles)
3. Res. MEPC.409(84): 2026 Guidelines for Ballast Water Management and Development of Ballast Water Management Plans (G4)
4. Res. MEPC.414(84): 2026 Guidelines for Test-Bed and Onboard Measurements of Methane (CH_4) and/or Nitrous Oxides (N_2O) Emissions from Marine Diesel Engines
5. Res. MEPC.415(84): Guidelines for Engine Load Monitoring (ELM) and Calculation of Emission Values (ELM Guidelines)
6. Res. MEPC.416(84): Guidelines for Continuous Emission Monitoring Systems (CEMS) Used to Quantify Methane (CH_4) and/or Nitrous Oxide (N_2O) Emission from Marine Diesel Engines
7. MEPC.1/Circ.795/Rev.10: Unified Interpretations to MARPOL Annex VI

ANNEX 3

RESOLUTION MEPC.407(84)
(adopted on 1 May 2026)

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

(Clarification of entries in data reporting required by regulations 27 and 28, designation of the North-East Atlantic as an Emission Control Area for Nitrogen Oxides, Sulphur Oxides and Particulate Matter, accessibility to the IMO Ship Fuel Oil Consumption Database, and review clause of the short-term GHG reduction measure)

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

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

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

HAVING CONSIDERED, at its eighty-fourth session, proposed amendments to MARPOL Annex VI concerning the clarification of entries in data reporting required by regulations 27 and 28, the designation of the North-East Atlantic as an Emission Control Area for Sulphur Oxides, Particulate Matter and Nitrogen Oxides, the accessibility of the IMO Ship Fuel Oil Consumption Database (IMO DCS), and the review clause of the short-term GHG reduction measure, which were circulated in accordance with article 16(2)(a) of MARPOL,

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

2 DETERMINES, in accordance with article 16(2)(f)(ii) and (iii) of MARPOL, that the amendments shall be deemed to have been accepted on 1 March 2027 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 2027 upon their acceptance in accordance with paragraph 2 above;

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

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

ANNEX

AMENDMENTS TO MARPOL ANNEX VI

(Clarification of entries in data reporting required by regulations 27 and 28, designation of the North-East Atlantic as an Emission Control Area for Nitrogen Oxides, Sulphur Oxides and Particulate Matter, accessibility to the IMO Ship Fuel Oil Consumption Database, and review clause of the short-term GHG reduction measure)

ANNEX VI

REGULATIONS FOR THE PREVENTION OF AIR POLLUTION FROM SHIPS

Regulation 13
Nitrogen oxides (NO_x)

Tier III

1 At the end of paragraph 5.1.3.1, "." is replaced with ";" and a new sub-paragraph .2 is added to paragraph 5.1.3, as follows:

".2 that ship is constructed on or after 1 January 2027 and is operating in the North-East Atlantic Emission Control Area. For the North-East Atlantic Emission Control Area, "ship constructed on or after 1 January 2027" means a ship:

.1 for which the building contract is placed on or after 1 January 2027; or

.2 in the absence of a building contract, the keel of which is laid or which is at a similar stage of construction on or after 1 July 2027; or

.3 the delivery of which is on or after 1 January 2031."

Emission control area

2 At the end of sub-paragraph .5 of paragraph 6, the word "and" is deleted, and at the end of sub-paragraph .6 of paragraph 6, "." is replaced with "; and".

3 New sub-paragraph .7 is added to paragraph 6, as follows:

".7 the North-East Atlantic Emission Control Area, which means the area described by the coordinates provided in appendix VII to this Annex."

Regulation 14
Sulphur oxides (SO_X) and particulate matter

4 At the end of sub-paragraph .6 of paragraph 3, the word "and" is deleted, and at the end of sub-paragraph .7 of paragraph 3, "." is replaced with "; and".

5 New sub-paragraph .8 is added to paragraph 3, as follows:

".8 the North-East Atlantic Emission Control Area, which means the area described by the coordinates provided in appendix VII to this Annex."

Regulation 20
Goal

6 The paragraph is replaced by the following:

"The goal of this chapter is to reduce the carbon intensity of international shipping, working towards the levels of ambition set out in the 2023 IMO Strategy on Reduction of GHG Emissions from Ships."

Regulation 25
Required EEXI

7 Paragraph 3 is replaced by the following:

"3 This regulation shall be kept under review in light of its implementation, taking into account the 2023 IMO Strategy on Reduction of GHG Emissions from Ships."

Regulation 27
Collection and reporting of ship fuel oil consumption data

8 Paragraphs 11 to 15 are replaced by the following new paragraphs 11 to 16:

"11 The Secretary-General of the Organization shall grant the Administration of a ship or any organization duly authorized by it access to all the reported data for all the preceding calendar years in the IMO Ship Fuel Oil Consumption Database for that ship.

12 Parties shall have access to a non-anonymized database containing data for all ships to which this regulation applies strictly for their analysis and consideration.

13 Notwithstanding paragraph 12 of this regulation, the Administration of a Party to the present Convention may notify the Secretary-General of the Organization that its express approval will be necessary before the data of ships entitled to fly its flag are included in the non-anonymized database.

14 The Secretary-General of the Organization shall maintain an anonymized database such that identification of a specific ship will not be possible, and facilitate access to public user accounts.

15 The IMO Ship Fuel Oil Consumption Database shall be undertaken and managed by the Secretary-General of the Organization, pursuant to guidelines developed by the Organization.

16 On an ad hoc basis, the Secretary-General of the Organization may share data with analytical consultancies and research entities, under strict confidentiality rules.

17 The Secretary-General of the Organization, on the request of a company, shall grant access to the fuel oil consumption reports of the company's owned ship(s) in a non-anonymized form to the general public."

Regulation 28
Operational carbon intensity

Review

9 Paragraph 11 is replaced by the following:

"11 This regulation shall be kept under review in light of its implementation, taking into account the 2023 IMO Strategy on Reduction of GHG Emissions from Ships."

Appendix VII
Emission control areas (regulations 13.6 and 14.3)

10 New paragraphs 6 and 7 are inserted, as follows:

"6 The North-East Atlantic Emission Control Area includes the exclusive economic zones and territorial seas, extending up to 200 nautical miles from the baselines of Greenland, Iceland, the Faroes, Ireland, the mainlands of the United Kingdom, France, Spain and Portugal, as set out in paragraph 7 below. This designation excludes the seas bounded by the North Sea area, as defined in regulation 1.14.6 of Annex V of the present Convention.

7 The geographic outer boundaries of the North-East Atlantic Emission Control Area are delineated by a series of geodesic lines connecting specified coordinates of latitude and longitude. These coordinates are referenced to the World Geodetic System 1984 (WGS 1984) datum as outlined below:

.1 the northernmost outer boundary of the North-East Atlantic Emission Control Area begins at the coordinate 86°19'.18 N, 60°10'.17 W, as outlined in regulation 14.3 and appendix VII of MARPOL Annex VI. From this point, the boundary extends eastward, following the outer boundaries of the exclusive economic zones of Iceland, the Faroes, and the eastern part of the mainland of the United Kingdom, until reaching the coordinate 62°00'.00 N, 01°22'.25 E, where it intersects with the northern boundary of the North Sea area. The boundary of this section is defined by connecting the following coordinates in sequential order:

Point	Latitude	Longitude
1	86°19'.18 N	60°10'.17 W
2	86°57'.80 N	37°45'.68 W
3	86°39'.87 N	12°26'.95 W
4	85°37'.64 N	01°00'.60 E
5	83°42'.56 N	07°58'.17 E
6	82°20'.92 N	05°51'.60 E
7	79°52'.93 N	01°38'.37 W
8	78°19'.00 N	03°20'.63 W
9	76°59'.35 N	02°49'.70 W
10	76°03'.97 N	04°27'.87 W
11	75°18'.13 N	04°17'.90 W
12	74°30'.64 N	04°50'.57 W
13	72°49'.62 N	11°28'.77 W
14	71°52'.99 N	12°46'.03 W
15	69°54'.98 N	13°37'.77 W
16	69°35'.00 N	13°16'.00 W
17	69°34'.77 N	12°24'.42 W
18	69°09'.46 N	09°42'.43 W
19	68°20'.93 N	07°34'.34 W
20	67°30'.09 N	06°32'.60 W
21	66°24'.66 N	05°45'.14 W
22	65°41'.60 N	05°34'.40 W
23	65°15'.62 N	02°38'.26 W
24	64°26'.05 N	00°29'.18 W
25	63°53'.22 N	00°29'.44 W
26	62°53'.47 N	00°38'.36 E
27	62°00'.00 N	01°22'.25 E

.2 continuing from the coordinate 62°00'.00 N, 01°22'.25 E, the boundary proceeds along the northwestern outer limits of the North Sea area, as defined in regulation 1.14.6 of Annex V of the present Convention. The boundary excludes the area south of latitude 62°00'.00 N and east of longitude 04°00'.00 W, connecting the following coordinates:

Point	Latitude	Longitude
27	62°00'.00 N	01°22'.25 E
28	62°00'.00 N	04°00'.00 W
29	58°33'.94 N	04°00'.00 W

.3 continuing southward, the boundary follows the southwestern outer limits of the North Sea area, as defined in regulation 1.14.6 of Annex V of the present Convention, excluding the English Channel and its approaches eastward of longitude 05°00'.00 W and northward of latitude 48°30'.00 N, until the boundary reaches its southernmost coordinate at 48°30'.00 N, 05°00'.00 W.

Point	Latitude	Longitude
30	48°30'.00 N	05°00'.00 W

.4 the following section of the North-East Atlantic Emission Control Area extends southward from the coordinate 48°30'.00 N, 05°00'.00 W, until it reaches the intersection of two boundaries: the line joining Cape Trafalgar, Spain (36°11'.00 N, 06°02'.00 W), and Cape Spartel, Morocco (35°48'.00 N, 05°55'.00 W), as outlined in regulation 14.3 and this appendix; and the eastern outer limit of Spain's mainland exclusive economic zone at the coordinate 35°57'.59 N, 05°58'.27 W. This section of the North-East Atlantic

Emission Control Area encompasses the waters within the exclusive economic zones and territorial seas of the mainland territories of France, Portugal, and Spain. The area is bounded to the east by the coasts of these countries and to the west by the outer limits of their respective exclusive economic zones. The coordinates defining the outer limits, extending from the southernmost points northward, are as follows:

Point	Latitude	Longitude
31	35°57'.59 N	05°58'.27 W
32	35°57'.88 N	06°02'.14 W
33	35°57'.94 N	06°03'.00 W
34	35°57'.98 N	06°03'.48 W
35	35°58'.09 N	06°04'.90 W
36	35°55'.91 N	06°16'.72 W
37	35°54'.85 N	06°22'.58 W
38	35°54'.63 N	06°23'.83 W
39	35°53'.50 N	06°30'.25 W
40	35°53'.34 N	06°31'.23 W
41	35°52'.13 N	06°38'.74 W
42	35°51'.94 N	06°39'.54 W
43	35°49'.70 N	06°48'.66 W
44	35°49'.60 N	06°49'.22 W
45	35°49'.18 N	06°51'.55 W
46	35°48'.61 N	06°59'.14 W
47	35°48'.51 N	06°59'.81 W
48	35°47'.62 N	07°06'.03 W
49	35°46'.01 N	07°31'.75 W
50	35°46'.00 N	07°32'.00 W
51	35°26'.00 N	08°05'.00 W
52	35°19'.00 N	08°21'.00 W
53	35°11'.00 N	08°53'.00 W
54	35°07'.00 N	09°13'.00 W
55	35°01'.00 N	10°30'.00 W
56	34°55'.00 N	11°40'.00 W
57	34°57'.00 N	12°17'.00 W
58	37°00'.00 N	13°09'.00 W
59	38°10'.00 N	13°42'.00 W
60	38°43'.00 N	13°46'.00 W
61	41°09'.00 N	13°16'.00 W
62	41°23'.77 N	13°18'.00 W
63	41°24'.03 N	13°17'.61 W
64	41°24'.04 N	13°17'.61 W

Point	Latitude	Longitude
65	41°28'.00 N	13°18'.00 W
66	41°29'.12 N	13°19'.54 W
67	41°30'.12 N	13°20'.50 W
68	41°30'.99 N	13°21'.34 W
69	41°35'.55 N	13°25'.32 W
70	41°44'.00 N	13°30'.10 W
71	41°54'.17 N	13°35'.21 W
72	42°04'.57 N	13°39'.38 W
73	42°15'.70 N	13°43'.28 W
74	42°24'.69 N	13°45'.77 W
75	42°31'.79 N	13°47'.34 W
76	42°39'.44 N	13°48'.60 W
77	42°52'.53 N	13°50'.12 W
78	43°00'.67 N	13°50'.66 W
79	43°09'.85 N	13°50'.86 W
80	43°18'.03 N	13°50'.54 W
81	43°27'.44 N	13°49'.62 W
82	43°41'.45 N	13°47'.12 W
83	43°57'.73 N	13°42'.42 W
84	44°10'.36 N	13°37'.36 W
85	44°20'.93 N	13°32'.09 W
86	44°25'.70 N	13°29'.41 W
87	44°33'.99 N	13°24'.15 W
88	44°43'.13 N	13°17'.74 W
89	44°55'.81 N	13°08'.03 W
90	45°01'.23 N	13°03'.33 W
91	45°01'.37 N	13°03'.21 W
92	45°07'.52 N	12°57'.42 W
93	45°14'.79 N	12°49'.94 W
94	45°22'.20 N	12°41'.48 W
95	45°29'.33 N	12°32'.60 W
96	45°35'.60 N	12°23'.73 W
97	45°43'.59 N	12°11'.30 W
98	45°50'.60 N	11°59'.37 W

Point	Latitude	Longitude
99	46°02'.77 N	11°37'.11 W
100	46°08'.97 N	11°24'.71 W
101	46°15'.55 N	11°09'.69 W
102	46°21'.12 N	10°55'.44 W
103	46°25'.27 N	10°47'.40 W
104	46°29'.31 N	10°39'.08 W

Point	Latitude	Longitude
105	46°32'.75 N	10°31'.66 W
106	46°37'.94 N	10°19'.19 W
107	46°42'.62 N	10°06'.98 W
108	46°45'.83 N	09°58'.26 W
109	46°48'.86 N	09°48'.96 W
110	46°52'.16 N	09°37'.92 W
111	46°52'.73 N	09°35'.99 W

.5 continuing from the coordinate 46°52'.73 N, 09°35'.99 W, the boundary proceeds in a northern direction, following the western outer limits of the exclusive economic zones of the mainlands of the United Kingdom, Ireland, Iceland, the Faroes, and Greenland, until it reaches the southernmost intersection of the exclusive economic zone of Greenland and the Canadian Arctic Emission Control Area, at the coordinate 61°24'.74 N, 57°16'.16 W, as detailed in regulation 14.3 and this appendix. The coordinates for this section are as follows:

Point	Latitude	Longitude
112	48°10'.49 N	10°48'.56 W
113	48°10'.81 N	10°48'.56 W
114	48°36'.38 N	12°36'.48 W
115	49°12'.41 N	13°56'.75 W
116	49°41'.42 N	14°39'.12 W
117	50°07'.69 N	15°08'.26 W
118	50°34'.07 N	15°29'.32 W
119	51°17'.55 N	15°54'.73 W
120	51°43'.99 N	16°02'.88 W
121	52°11'.47 N	16°05'.45 W
122	52°41'.54 N	16°01'.85 W
123	53°10'.97 N	15°50'.66 W
124	54°05'.16 N	16°00'.59 W
125	54°45'.40 N	15°55'.82 W
126	55°13'.09 N	15°43'.87 W
127	55°38'.99 N	15°25'.22 W
128	56°12'.21 N	14°50'.96 W
129	56°34'.63 N	14°19'.86 W
130	56°57'.19 N	14°36'.16 W
131	57°25'.36 N	14°48'.11 W
132	57°46'.48 N	14°52'.42 W

Point	Latitude	Longitude
133	58°10'.58 N	14°52'.18 W
134	58°37'.54 N	14°47'.13 W
135	59°08'.50 N	14°29'.17 W
136	59°36'.59 N	14°03'.25 W
137	59°55'.59 N	13°37'.56 W
138	60°09'.13 N	13°16'.39 W
139	60°42'.23 N	14°00'.03 W
140	60°09'.28 N	17°03'.21 W
141	59°58'.44 N	20°22'.34 W
142	60°03'.00 N	22°08'.29 W
143	60°31'.10 N	25°30'.33 W
144	60°55'.19 N	27°17'.15 W
145	61°31'.52 N	28°48'.06 W
146	62°14'.11 N	29°52'.18 W
147	63°18'.12 N	30°52'.05 W
148	62°30'.13 N	33°39'.15 W
149	61°24'.86 N	35°02'.45 W
150	58°10'.71 N	37°39'.21 W
151	57°12'.46 N	39°29'.13 W
152	56°31'.75 N	42°11'.97 W
153	56°23'.72 N	44°27'.68 W

Point	Latitude	Longitude
154	56°42'.83 N	47°08'.20 W
155	57°52'.48 N	51°48'.36 W

Point	Latitude	Longitude
156	58°41'.66 N	53°40'.40 W
157	61°24'.74 N	57°16'.16 W

.6 continuing along the outer boundary of the Canadian Arctic Emission Control Area until ending at the south coast of Hans Island (Tartupaluk) at 80°49'.29 N, 66°27'.04 W. The coordinates for this section refer sequentially from Point No.174 through Point No.51 in the table in paragraph 5.2 of appendix VII of MARPOL Annex VI.

.7 continuing from the north coast of Hans Island (Tartupaluk) at 80°49'.91 N, 66°27'.40 W along the outer boundary of the Canadian Arctic Emission Control Area, until reaching the northernmost outer boundary of the North East Atlantic Emission Control Area at the coordinates 86°19'.18 N, 60°10'.17 W. The coordinates for this section refer sequentially from Point No.50 through Point No.23 in the table in paragraph 5.1 of appendix VII of MARPOL Annex VI.

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

11 The section "Identity of the ship" is replaced by the following:

"**Identity of the ship**

IMO number . . . . . .

Period of calendar year for which the data is submitted……

For the purpose of regulation 27:

Start date (dd/mm/yyyy) ……..

End date (dd/mm/yyyy)……..

For the purpose of regulation 28:

Start date (dd/mm/yyyy) ……..

End date (dd/mm/yyyy)……."

12 In the section on "Fuel oil consumption data", the term "Oil-fired Boiler(s)" is replaced by "Fired Boiler(s)".

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ANNEX 4

RESOLUTION MEPC.408(84)
(adopted on 1 May 2026)

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

(Use of multiple engine operational profiles for a marine diesel engine, including clarifying engine test cycles)

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

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

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

RECALLING FURTHER the adoption of amendments to the Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines (NO_x Technical Code 2008), by means of resolution MEPC.397(83), on the use of multiple engine operational profiles for a marine diesel engine, including clarifying engine test cycles,

HAVING CONSIDERED, at its eighty-fourth session, proposed amendments to MARPOL Annex VI concerning the use of multiple engine operational profiles for a marine diesel engine, including clarifying engine test cycles, which were circulated in accordance with article 16(2)(a) of MARPOL,

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

2 DETERMINES, in accordance with article 16(2)(f)(ii) and (iii) of MARPOL, that the amendments shall be deemed to have been accepted on 1 March 2027 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 2027 upon their acceptance in accordance with paragraph 2 above;

4 ALSO INVITES the Parties to note that the said amendments shall enter into effect on the dates specified in operative paragraph 4 of resolution MEPC.397(83);

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

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

ANNEX

AMENDMENTS TO MARPOL ANNEX VI

(Use of multiple engine operational profiles for a marine diesel engine, including clarifying engine test cycles)

ANNEX VI

REGULATIONS FOR THE PREVENTION OF AIR POLLUTION FROM SHIPS

Regulation 2
Definitions

1 Paragraph 1.19 is replaced by the following:

"1.19 *Irrational emission control strategy* means any strategy or measure that, when a marine diesel engine is operated under normal conditions of use, reduces the effectiveness of an emission control system to a level below that expected from the applicable emission test procedures".

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

Supplement to the International Air Pollution Prevention Certificate (IAPP Certificate)

2 New rows are to be added to the table in section 2.2.1, as follows:

.1 For Tier I (below 13.7.1.2) enter new row:

"

9f	Tier I	NTC 8 (Multiple Engine Operational Profiles)	□	□	□	□	□

"

.2 For Tier II (below 13.7.1.2) enter new row:

"

10g	Tier II	NTC 8 (Multiple Engine Operational Profiles)	□	□	□	□	□

"

.3 For Tier III (below 13.7.1.2) enter new row:

"

11e	Tier III	NTC 8 (Multiple Engine Operational Profiles)	□	□	□	□	□

"

Appendix II

Test cycles and weighting factors (regulation 13)

3 The full text of appendix II is replaced by the following:

"The following test cycles and weighting factors shall be applied for verification of compliance of marine diesel engines with the applicable NO_x limit in accordance with regulation 13 of MARPOL Annex VI using the test procedure and calculation method as specified in the NO_x Technical Code.

.1 For a fixed pitch propeller propulsion engine or a propeller-law operated non-propulsion engine, test cycle E3 shall be applied in accordance with table 1.

.2 For a propulsion engine that does not operate with a fixed pitch propeller, including an engine fitted as part of a diesel-electric installation or an engine operated with a controllable-pitch propeller, test cycle E2 shall be applied in accordance with table 2.

.3 For a non-propulsion engine that is a constant-speed engine, test cycle D2 shall be applied in accordance with table 3.

.4 For a non-propulsion engine that operates as a variable-speed engine, not included above, test cycle C1 shall be applied in accordance with table 4.

Table 1 – Test cycle for a marine diesel engine as given by .1 above

Test cycle E3	Speed	100%	91%	80%	63%
	Power	100%	75%	50%	25%
	Weighting factor	0.2	0.5	0.15	0.15

Table 2 – Test cycle for a marine diesel engine as given by .2 above

Test cycle E2	Speed	100%	100%	100%	100%
	Power	100%	75%	50%	25%
	Weighting factor	0.2	0.5	0.15	0.15

Table 3 – Test cycle for a marine diesel engine as given by .3 above

Test cycle D2	Speed	100%	100%	100%	100%	100%
	Power	100%	75%	50%	25%	10%
	Weighting factor	0.05	0.25	0.3	0.3	0.1

Table 4 – Test cycle for a marine diesel engine as given by .4 above

Test cycle C1	Speed	Rated				Intermediate			Idle
	Torque	100%	75%	50%	10%	100%	75%	50%	0%
	Weighting factor	0.15	0.15	0.15	0.1	0.1	0.1	0.1	0.15

In the case of a marine diesel engine to be certified in accordance with paragraph 5.1.1 of regulation 13, the specific emission at each individual mode point shall not exceed the applicable NO_x emission limit value by more than 50% except as follows:

.1 The 10% mode point in the D2 test cycle.

.2 The 10% mode point in the C1 test cycle.

.3 The idle mode point in the C1 test cycle".

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ANNEX 6

RESOLUTION MEPC.409(84)
(adopted on 1 May 2026)

2026 GUIDELINES FOR BALLAST WATER MANAGEMENT AND DEVELOPMENT OF BALLAST WATER MANAGEMENT PLANS (G4)

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

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

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 the 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 ALSO resolution MEPC.127(53), by which the Committee adopted the *Guidelines for ballast water management and development of Ballast Water Management Plans* (G4) and resolved to keep them under review, and resolutions MEPC.306(73) and MEPC.370(80), by which the Committee adopted amendments to the Guidelines (G4),

HAVING CONSIDERED, at its eighty-fourth session, the outcome of the Correspondence Group on Review of the BWM Convention,

1 ADOPTS the *2026 Guidelines for ballast water management and development of Ballast Water Management Plans*, as set out in the annex to this resolution;

2 INVITES Member Governments to bring these Guidelines to the attention of all parties concerned and to apply the Guidelines as soon as possible, or when the Convention becomes applicable to them;

3 AGREES to keep the Guidelines under review; and

4 RESOLVES to revoke the *Guidelines for ballast water management and development of Ballast Water Management Plans* adopted by resolution MEPC.127(53) and amended by resolutions MEPC.306(73) and MEPC.370(80) when the amendments to the BWM Convention approved at the same session enter into force.

ANNEX

2026 GUIDELINES FOR BALLAST WATER MANAGEMENT AND DEVELOPMENT OF BALLAST WATER MANAGEMENT PLANS (G4)

1 INTRODUCTION

1.1 Ballast water is essential to control trim, list, draught, stability, or stresses of the ship. However, ballast water may contain aquatic organisms or pathogens which, if introduced into the sea, including estuaries, or into freshwater courses, may create hazards to the environment, human health, property or resources, impair biological diversity or interfere with other legitimate uses of such areas.

1.2 The selection of appropriate methods of ballast water management should take into account the need to ensure that ballast water management practices used to comply with this Convention do not cause greater harm than they prevent to the environment, human health, property or resources of any States and the safety of ships.

1.3 The objectives of these Guidelines are to assist Governments, appropriate authorities, ships masters, operators and owners, and port authorities, as well as other interested parties, in preventing, minimizing and ultimately eliminating the risk of introducing harmful aquatic organisms and pathogens from ships' ballast water and associated sediments while protecting ships' safety in applying the *International Convention for the Control and Management of Ships' Ballast Water and Sediments* (hereinafter referred to as "the Convention").

1.4 These guidelines consist of two parts:

Part A – "Guidelines for ballast water management", which contains guidance on the general principles of ballast water management; and

Part B – "Guidelines for the development of Ballast Water Management Plans", which contains guidance on the structure and content of Ballast Water Management Plans required by regulation B-1 of the Convention.

2 DEFINITIONS

2.1 For the purposes of these Guidelines, the definitions in the Convention apply.

2.2 Ballast water tank means any tank, hold, or space used for the carriage of ballast water.

3 APPLICATION

3.1 The Guidelines apply to all ships and to flag Administrations, port States, coastal States, ship owners, ship operators, ships' personnel involved in ballast water management, ship designers, ship builders, classification societies as well as other interested parties.

PART A – GUIDELINES FOR BALLAST WATER MANAGEMENT

1 SHIP OPERATIONAL PROCEDURES

1.1 Precautionary practices

Avoiding unnecessary discharge of ballast water

1.1.1 If it is necessary to take on and discharge ballast water in the same port to facilitate safe cargo operations, care should be taken to avoid unnecessary discharge of ballast water that has been taken up in another port.

1.1.2 Managed ballast water, which is mixed with unmanaged ballast water, is no longer in compliance with regulations D-1 and D-2 of the annex to the Convention.

Minimizing the uptake of harmful aquatic organisms, pathogens and sediments

1.1.3 When loading ballast water, every effort should be made to avoid the uptake of potentially harmful aquatic organisms, pathogens, and sediment that may contain such organisms. The uptake of ballast water should be minimized or, where practicable, avoided in areas and situations such as:

.1 in areas identified by the port State in connection with advice provided by ports under paragraph 2.2.2;

.2 in darkness when organisms may rise up in the water column;

.3 in very shallow water;

.4 where propellers may stir up sediment; or

.5 where dredging is or recently has been carried out.

1.2 Ballast water management options

1.2.1 Ballast water exchange

1.2.1.1 Ballast water exchange is to be conducted in accordance with regulation B-4 of the Convention and in accordance with the Guidelines for ballast water exchange.

1.2.1.2 The voyage should be planned taking into account when ballast water exchange in accordance with regulation B-4 of the Convention can be carried out.

1.2.1.3 Because of the possibility that partial exchange may encourage re-growth of organisms, ballast water exchange should only be commenced in any tank if there is sufficient time to complete the exchange to comply with the standard in regulation D-1 and the ship can comply with the distance from land and minimum water depth criteria in regulation B-4. As many complete tanks should be exchanged to the standard in regulation D-1 as the time allows; if for any tank the standard in regulation D-1 can not be fully met the exchange should not be commenced for that tank.

1.2.1.4 If ballast water exchange is not undertaken for the reasons in regulation B-4.4, i.e. if the master reasonably decides that such exchange would threaten the safety or stability of the ship, its crew, or its passengers because of adverse weather, ship design or stress, equipment failure, or any other extraordinary condition, then details of the reasons ballast water exchange was not undertaken are to be recorded in the Ballast Water Record Book.

1.2.1.5 A port State may designate areas in which exchange may be conducted taking into account the Guidelines on designation of areas for ballast water exchange. Designated areas should only be used for those ballast water tanks that are intended to be discharged in the port of that State, and that could not be exchanged in accordance with regulation B-4.1 of the Convention.

1.2.2 Ballast water management systems

1.2.2.1 Ballast water management systems installed for compliance with regulation B-3 are to be approved in accordance with regulation D-3. Such systems are to be operated in accordance with the system design criteria and the manufacturer's operational and maintenance instructions. The use of such systems should be detailed in the ship's Ballast Water Management Plan. All failures and malfunctions of the system are to be recorded in the Ballast Water Record Book.

1.2.3 Discharge to ballast water reception facilities

1.2.3.1 If ballast water reception facilities provided by a port State are utilized, regulation B-3.6 applies.

1.2.4 Prototype ballast water treatment technologies

1.2.4.1 Prototype ballast water treatment technologies should be used within a programme approved by the Administration in accordance with regulation D-4.

1.3 Sediment management

1.3.1 Regulation B-5 requires that all ships shall remove and dispose of sediments from spaces designated to carry ballast water in accordance with the Ballast Water Management Plan.

1.3.2 All practical steps should be taken during ballast water uptake to avoid sediment accumulation, however, it is recognized that sediment will be taken on board and will settle on tank surfaces. When sediment has accumulated, consideration should be given to flushing tank bottoms and other surfaces when in suitable areas, i.e. areas complying with the minimum depth and distance described by regulations B-4.1.1 and B-4.1.2.

1.3.3 The volume of sediment in a ballast water tank should be monitored on a regular basis.

1.3.4 Sediment in ballast water tanks should be removed in a timely basis in accordance with the Ballast Water Management Plan and as found necessary. The frequency and timing of removal will depend on factors such as sediment build-up, ship's trading pattern, availability of reception facilities, workload of the ship's personnel and safety considerations.

1.3.5 Removal of sediment from ballast water tanks should preferably be undertaken under controlled conditions in port, at a repair facility or in dry dock. The removed sediment should preferably be disposed of in a sediment reception facility if available, reasonable and practicable.

1.3.6 When sediment is removed from the ship's ballast water tanks and is to be disposed of by that ship at sea, such disposal should only take place in areas outside 200 nm from land and in water depths of over 200 m.

1.3.7 Regulation B-5 requires that ships constructed in or after 2009 should, without compromising safety or operational efficiency, be designed and constructed with a view to minimizing the uptake and undesirable entrapment of sediment, facilitating removal of sediment, and providing safe access to allow for sediment removal and sampling, taking into account the *Guidelines on design and construction to facilitate sediment control on ships* (G12). This also applies to ships constructed prior to 2009, to the extent practicable.

1.4 Additional measures

1.4.1 Ships to which additional measures apply, under regulation C-1, should take them into account in the ship's voyage planning. Actions taken to comply with any additional measures should be recorded in the Ballast Water Record Book.

1.5 Exemptions

1.5.1 Regulation A-4 provides that an exemption may be granted from the requirements of regulations B-3 or C-1 by a Party or Parties to a ship in specific circumstances. Applications for and the granting of such exemptions should be completed in accordance with the *2017 Guidelines for risk assessment under regulation A-4 of the BWM Convention* (G7).

1.5.2 Ships granted an exemption referred to in paragraph 1.5.1 above should record the exemption in the Ballast Water Record Book and what actions have been taken with regard to the ship's ballast water.

2 RECORDING PROCEDURES

2.1 Procedures for ships

2.1.1 To facilitate the administration of ballast water management and treatment procedures on board each ship, a responsible officer is to be designated in accordance with regulation B-1 to ensure the maintenance of appropriate records and to ensure that ballast water management and/or treatment procedures are followed and recorded.

2.1.2 When carrying out any ballast water operation, the details are to be recorded in the Ballast Water Record Book together with any exemptions granted in accordance with regulation B-3 or C-1. In recording these operations and exemptions, the *2024 Guidance on ballast water record-keeping and reporting* (BWM.2/Circ.80/Rev.1, as may be amended) should be taken into account.

2.1.3 Where a port State requires specific information regarding the management of ballast water on a ship bound for a port, offshore terminal or anchorage area in that port State, a completed ballast water reporting form (BWRF) as set out in the *2024 Guidance on ballast water record-keeping and reporting* (BWM.2/Circ.80/Rev.1, as may be amended) may be submitted prior to entry into that port State in a time frame required by that port State. Keeping records on a tank-by-tank basis, while not mandatory, may facilitate the completion of a BWRF. An example form for maintaining voluntary tank-by-tank records is annexed to the *2024 Guidance on ballast water record-keeping and reporting*.

2.1.4 Where a port State requires information on a ships ballast operations, relevant documentation, which takes account of the information requirements of the Convention, should be made available to the port State.

2.2 Procedures for port States

2.2.1 Port States should provide ships with details of their requirements concerning ballast water management, including:

.1 the location and terms of use of areas designated for ballast water exchange under regulation B-4.2 of the Convention;

.2 any additional measures determined under regulation C-1 of the Convention;

.3 warnings concerning ballast uptake and any other port contingency arrangements in the event of emergency situations; and

.4 the availability, location and capacities of reception facilities that are provided for the environmentally safe disposal of ballast water and/or sediments, under article 5 and regulation B-3.6.

2.2.2 To assist ships in applying the precautionary practices described in section 1.1 of part A, port States are required by regulation C-2 of the Convention to endeavour to notify mariners of area(s) where ships should not uptake ballast water owing to known conditions. Similar notification should be given for areas where the uptake of ballast water should be minimized, such as:

.1 areas with outbreaks, infestations or known populations of harmful organisms and pathogens;

.2 areas with current phytoplankton blooms (algal blooms, such as red tides);

.3 nearby sewage outfalls;

.4 areas where a tidal stream is known to be the more turbid;

.5 areas where tidal flushing is known to be poor;

.6 nearby dredging operations; and

.7 nearby or in sensitive or estuarine sea areas.

3 TRAINING AND EDUCATION

3.1 Regulation B-6 requires that officers and crew shall be familiar with their duties in the implementation of ballast water management particular to the ship on which they serve. Owners, managers, operators, and others involved in officer and crew training for ballast water management should consider the following:

3.2 Training for ships' masters and crews as appropriate should include instructions on the requirements of the Convention, the ballast water and sediment management procedures and the Ballast Water Record Book particularly having regard to matters of ship safety and maintenance of records taking into account the information contained in these Guidelines.

3.3 The Ballast Water Management Plan should include training and education on ballast water management practices and the systems and procedures used on board the ship.

PART B – GUIDELINES FOR THE DEVELOPMENT OF BALLAST WATER MANAGEMENT PLANS

1 INTRODUCTION

1.1 These Guidelines have been developed to assist with the preparation of a ship's Ballast Water Management Plan (hereafter referred to as "the Plan"). The Plan must be approved by the Administration in accordance with regulation B-1 of the Convention.

1.2 This part is comprised of three primary sections:

.1 General: this section provides the objectives and a general overview of the subject matter and introduces the reader to the basic concept of the Guidelines and the Plan that is expected to be developed from them. This section also contains guidance on updating and use of the Plan.

.2 Mandatory provisions: this section provides guidance to ensure that the mandatory provisions of regulation B-1 of the annex to the Convention are met.

.3 Non-mandatory provisions: this section provides guidance concerning the inclusion of other information in the Plan. This information, although not required under regulation B-1 of the Convention, may be found useful by local authorities in ports visited by the ship, or may provide additional assistance to the ship's master.

1.3 The format for a Ballast Water Management Plan is given in the appendix. Ships should consider utilizing the standard format to provide greater consistency.

2 GENERAL

2.1 Concept of the Guidelines

2.1.1 These Guidelines are intended to provide a basis for the preparation of the Plans for individual ships. The broad spectrum of ships for which Plans are required makes it impractical to provide specific guidelines for each ship type. For a Plan to be effective and to comply with regulation B-1 of the annex of the Convention, it must be carefully tailored to the particular ship for which it is intended. Properly used, the Guidelines will ensure that all appropriate issues that may be applicable to a particular ship are considered in developing the Plan.

2.1.2 The issues that may require consideration include but are not limited to: type and size of ship, volume of ballast water carried and total capacity of tanks used for ballast water, ballast water pumping capacity, ship and crew safety issues, voyage type and length, the ship's typical operational requirements, and ballast water management techniques used on board.

2.2 Concept of the Plan

2.2.1 The Plan is required to be on board the ship and available to guide personnel in the safe operation of the ballast system employed on a particular ship. Effective planning ensures that the necessary actions are taken in a structured, logical, and safe manner.

2.2.2 For the Plan to accomplish its purpose, it must be:

.1 realistic, practical and easy to use;

.2 understood by ship's personnel engaged in ballast water management, both on board and ashore;

.3 evaluated, reviewed, and updated as necessary; and

.4 consistent with the operational ballasting requirements of the ship.

2.2.3 The Plan envisioned by regulation B-1 of the Annex to the Convention is intended to be a simple document. Inclusion of extensive background information on the ship, its structure, etc., should be avoided, as this is generally available elsewhere. If such information is relevant, it should be kept in annexes, or an existing document or manual reference should be made to the location of the information.

2.2.4 The Plan is a document to be used on board by the ship's personnel engaged in ballast water management. The Plan must therefore be available in a working language of the ship's personnel. A change in the personnel and/or the working language would require the issuance of the Plan in the new language(s).

2.2.5 The Plan should be readily available for inspection by officers authorized by a Party to the Convention.

2.3 Exemptions

2.3.1 Regulation A-4 allows that an exemption may be granted to a ship from regulation B-3 or C-1.

2.3.2 Details of exemptions should be retained with the Plan.

2.3.3 Any exemption granted is to be recorded in the Ballast Water Record Book.

2.4 Additional measures

2.4.1 The Convention, in regulation C-1 (Additional Measures), gives a Party, individually or jointly with other Parties, the right to introduce measures in addition to those in section B. Such additional measures are to be communicated to the Organization at least 6 months prior to the projected date of implementation.

2.4.2 The Plan should be accompanied by the most recent list of additional measures, as communicated by the Organization relevant to the ship's trade. The Plan should contain details and advice on the actions a ship must take to comply with any additional measures that may be required in accordance with regulation C-1 and for any emergency or epidemic situations.

2.5 Review of the Plan

2.5.1 Regular review of the Plan by the owner, operator, or master should be conducted to ensure that the information contained is accurate and updated. A feedback system should be employed which will allow quick capture of changing information and incorporation of it into the Plan.

2.5.2 The Plan should be updated when any ballast water management system installed on the ship is upgraded or retrofitted.

2.5.3 Changes to the provisions of this Plan will need Administration approval.

3 MANDATORY PROVISIONS

3.1 This section provides individual guidelines for the 12 mandatory provisions of regulation B-1 of the Annex to the Convention. In addition, it provides information to assist ships' personnel in managing ballast water and sediments.

3.2 Regulation B-1 of the Annex to the Convention provides that the Plan shall be specific to each ship and shall at least:

.1 detail safety procedures for the ship and the crew associated with ballast water management as required by the Convention;

.2 provide a detailed description of the actions to be taken to implement the ballast water management practices required by the Convention;

.3 identify whether any ballast water management system installed on the ship was type approved in accordance with the BWMS Code or taking into account the Guidelines (G8), or is being operated in accordance with regulation D-4;

.4 include high-level information on maintenance procedures and schedules necessary to keep any ballast water management system installed on the ship operating in good working order, and refer to the operation, maintenance and safety manual for the detailed procedures;

.5 detail the procedures for the disposal of sediments at sea and to shore;

.6 include the procedures for co-ordinating shipboard ballast water management that involves discharge to the sea with the authorities of the State into whose waters such discharge will take place;

.7 include a procedure for safe ballast water exchange, including for partially treated and/or non-neutralized ballast water, taking into account the Guidelines developed by the Organization;

.8 detail how the ship will plan for contingency measures, taking into account the Guidelines developed by the Organization;

.9 include, if applicable, a procedure for the temporary storage of treated sewage and/or grey water in ballast water tanks, taking into account the Guidelines developed by the Organization;

.10 designate the officer on board in charge of ensuring that the Plan is properly implemented;

.11 contain the reporting requirements for ships provided for under the Convention; and

.12 be written in the working language of the ship. If the language used is not English, French or Spanish, a translation into one of these languages should be provided.

3.3 The Ballast Water Management Plan should give guidance on the ballast handling procedures to be followed, including:

.1 uptake of ballast water;

.2 step-by-step procedures and sequences for the ballast system used;

.3 detailed procedures for contingency measures;

.4 procedures for the temporary storage of treated sewage and/or grey water in ballast water tanks, if applicable; and

.5 any operational or safety restrictions including those associated with the ballast system used. This will also assist ship's personnel when responding to enquiries from inspection officers authorized by a Party.

3.4 Safety aspects of the ballast system used should include, as applicable, guidance on:

.1 stability to be maintained at all times to values not less than those recommended by the Organization (or required by the Administration);

.2 approved longitudinal stress and, where applicable, torsional stress values are to be maintained within permitted values;

.3 transfer or exchange of ballast water that can generate significant structural loads by sloshing action in partially-filled tanks. If these operations include partially-filled tanks, consideration should be given to carrying out the operation in favourable sea and swell conditions such that the risk of structural damage is minimized;

.4 wave-induced hull vibrations when carrying out ballast water exchange;

.5 forward and aft draughts and trim, with particular reference to bridge visibility, slamming and minimum forward draft;

.6 the effects of any potential hazards and occupational health that may affect the ship's personnel shall also be identified together with any safety precautions that need to be taken; and

.7 the possible effects of tank over pressurization.

3.5 If a ship is able to complete at least 95 per cent volumetric exchange in less than three pumped volumes, documentation indicating that this ballast water exchange process has been approved under regulation D-1.2 should be provided in the Plan.

3.6 The Plan should also include procedures for the disposal of sediments and in particular:

.1 on the sediment removal or reduction at sea, and when cleaning of the ballast tanks to remove sediments;

.2 regarding the safety considerations to be taken if tank entry is required to remove sediments; and

.3 regarding the use of port reception facilities for sediments.

3.7 The Plan should detail suitable contingency measures to be taken in the event that the ship is unable to manage ballast water in accordance with regulation D-2, taking into account the Guidelines[1] developed by the Organization.

3.8 The Plan should include ship-specific measures and procedures related to managing challenging water quality conditions, taking into account the Guidelines[2] developed by the Organization.

3.9 The Plan should include, if applicable, a procedure for the temporary storage of treated sewage and/or grey water in ballast water tanks, taking into account the Guidelines[3] developed by the Organization.

3.10 The Plan should clearly identify the officer in charge of ballast water management and outline his/her duties, which should include:

.1 ensuring that the ballast water management performed follows the procedures in the Plan;

.2 ensuring that the Ballast Water Record Book and any other necessary documentation are maintained; and

.3 being available to assist the inspection officers authorized by a Party for any sampling that may need to be undertaken.

3.11 The Plan should contain guidance on the recording requirements according to the ship's Ballast Water Record Book provided for under this Convention, including details of exemptions granted to the ship.

3.12 In addition to the above, the Plan should include the following:

.1 A foreword which should provide the ship's crew with explanations on the need for ballast water management and for record keeping. The foreword should include a statement that "This Plan must be kept available for inspection on request by an authorized authority".

.2 Ship particulars, including at least:

.1 ships' name, flag, port of registry, gross tonnage, IMO number[4], length (BP), beam, international call sign, and deepest ballast drafts (normal and heavy weather);

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

2 Refer to the *Interim guidance on the application of the BWM Convention to ships operating in challenging water quality conditions* (resolution MEPC.387(81), as may be amended).

3 Refer to the *Guidance for the temporary storage of treated sewage and/or grey water in ballast water tanks* (BWM.2/Circ.82, as may be amended).

4 In accordance with resolution A.600(15) IMO Ship Identification Number Scheme.

.2 the total ballast water capacity of the ship in cubic metres and other units if applicable to the ship;

.3 a brief description of the main ballast water management method(s) used on the ship; and

.4 identification (rank) of the officer in charge for implementing the Plan.

.3 Information on the ballast system used on board, including:

.1 ballast water tank arrangement;

.2 ballast water capacity plan;

.3 a ballast water piping and pumping arrangement, including air pipes and sounding arrangements;

.4 ballast water pump capacities;

.5 the ballast system used on board, including high-level information on operation and maintenance procedures and schedules necessary to keep any ballast water management system installed on the ship in good working order, with references to the operation, maintenance and safety manual (OMSM) held on board;

.6 any installed ballast water management systems and identification of whether any of these systems were type approved in accordance with the BWMS Code[5], as may be amended, or taking into account the Guidelines developed by the Organization[6], or are being operated in accordance with regulation D-4; and

.7 a plan and profile of the ship, or a schematic drawing of the ballast arrangement.

.4 Information on ballast water sampling, including:

.1 A list or diagrams indicating the location of sampling and access points in pipelines and ballast water tanks, to enable crew members to assist the authorized officers of a Party that have reason to obtain samples.

.2 Ship-specific guidance for conducting onboard sampling, which is sufficiently detailed to prevent improper sample collection (e.g. any ship and/or ballast water management system particulars that can impact the quality of discharge samples collected for sampling).

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[5] Refer to the *Code for Approval of Ballast Water Management Systems* (resolution MEPC.300(72), as may be amended).

[6] Refer to the *Guidelines for the approval of ballast water management systems* (G8) (resolutions MEPC.125(53), MEPC 174(58) or MEPC.279(70), as appropriate).

.3 This section should make clear that sampling of ballast water is primarily a matter for the authorized inspection officers, and there is unlikely to be any need for crew members to take samples except at the express request, and under the supervision, of the authorized inspection officers.

.4 The authorized inspection officers should be advised of all safety procedures to be observed when entering enclosed spaces.

.5 Provisions for crew training and familiarization, including:

.1 requirements of a general nature regarding ballast water management;

.2 training and information on ballast water management practices;

.3 ballast water exchange;

.4 ballast water treatment systems;

.5 general safety considerations;

.6 the Ballast Water Record Book and maintenance of records;

.7 the operation and maintenance of installed ballast water management systems;

.8 safety aspects associated with the particular systems and procedures used on board the ship which affect the safety or human health of crew and passengers and/or the safety of the ship;

.9 precautions for entering tanks for sediment removal;

.10 procedures for the safe handling and packaging of sediment; and

.11 storage of sediment.

4 NON-MANDATORY INFORMATION

4.1 In addition to the provisions required by articles and regulations of the Convention, the owner/operator may include in the Plan, as appendices, additional information such as: provision of additional diagrams and drawings, shipboard equipment and reference materials. National or regional requirements that differ from the Convention may also be recorded for reference.

4.2 Non-mandatory information may also include manufacturer manuals (either as extracts or complete) or a reference to the location on board of such manuals and other relevant material.

APPENDIX

STANDARD FORMAT FOR THE BALLAST WATER MANAGEMENT PLAN

PREAMBLE

The Ballast Water Management Plan should contain the information required by regulation B-1 of the Convention.

For guidance in preparing the Plan the following information is to be included. The Plan should be specific to each ship.

INTRODUCTION

At the beginning of each Plan, wording should be included to reflect the intent of the following text.

1 This Plan is written in accordance with the requirements of regulation B-1 of the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (the Convention) and the associated Guidelines.

2 The purpose of the Plan is to meet the requirements for the control and management of ships' ballast water and sediments in accordance with the Guidelines for ballast water management and the Development of Ballast Water Management Plans (resolution MEPC.409(84)) ("the Guidelines"). It provides standard operational guidance for the planning and management of ships' ballast water and sediments and describes safe procedures to be followed.

3 This Plan has been approved by the Administration and no alteration or revision shall be made to any part of it without the prior approval of the Administration.

4 This Plan may be inspected on request by an authorized authority.

Note: The Plan is to be written in the working language of the crew; if the text is not in English, French, or Spanish, the Plan is to include a translation into one of these languages.

SHIP PARTICULARS

At least the following details should be included:

Ship's name;
Flag;
Port of registry;
Gross tonnage;
IMO number[7];
Length (BP);
Beam;
International call sign;
Deepest ballast drafts (normal and heavy weather);

[7] In accordance with resolution A.600(15), IMO Ship Identification Number Scheme.

Total ballast water capacity of the ship in cubic metres and other units if applicable to the ship;

A brief description of the main ballast water management method(s) used on the ship; and

Identification (rank) of the appointed ballast water management officer.

INDEX

An index of sections should be included to reference the content of the Plan.

PURPOSE

Should contain a brief introduction for the ship's crew, explaining the need for ballast water management, and the importance of accurate record keeping.

PLANS/DRAWINGS OF THE BALLAST SYSTEM

Plans or drawings of the ballast system, for example:

1) ballast water tank arrangement;

2) ballast water capacity plan;

3) a ballast water piping and pumping arrangement, including air pipes and sounding arrangements;

4) ballast water pump capacities;

5) the ballast system used on board, with references to detailed operational and maintenance manuals held on board;

6) installed ballast water management systems; and

7) a plan and profile of the ship, or a schematic drawing of the ballast arrangement.

DESCRIPTION OF THE BALLAST SYSTEM

A description of the ballast system.

BALLAST WATER SAMPLING POINTS

Lists and/or diagrams indicating the location of sampling and access points in pipelines and ballast water tanks.

A note that sampling of ballast water is primarily a matter for the authorized authority, and there is unlikely to be any need for crew members to take samples except at the express request, and under the supervision, of the authorized authority.

OPERATION OF THE BALLAST SYSTEM

A detailed description of the operation of the ballast system(s) used on board.

Information on general ballast water management precautionary practices, including:

- *high-level information on operation and maintenance procedures and schedules necessary to keep any ballast water management system installed on the ship in good working order, with references to the operation, maintenance and safety manual (OMSM) held on board;*
- *a procedure for safe ballast water exchange, including partially treated and/or non-neutralized ballast water, taking into account the Guidelines developed by the Organization[8];*
- *a detailed plan for contingency measures, taking into account the Guidelines developed by the Organization[9]; and*
- *procedures for the temporary storage of treated sewage and/or grey water in ballast water tanks, if applicable, taking into account the Guidelines developed by the Organization[10].*

SAFETY PROCEDURES FOR THE SHIP AND THE CREW

Details of specific safety aspects of the ballast system used.

OPERATIONAL OR SAFETY RESTRICTIONS

Details of specific operational or safety restrictions including those associated with the management system which affects the ship and or the crew including reference to procedures for safe tank entry.

DESCRIPTION OF THE METHOD(S) USED ON BOARD FOR BALLAST WATER MANAGEMENT AND SEDIMENT CONTROL

Details of the method(s) used on board for the management of ballast water and for sediment control including step-by-step operational procedures, including identification of whether any ballast water management system installed on the ship was type approved in accordance with the BWMS Code[11], as may be amended, or taking into account the Guidelines developed by the Organization[12], or is being operated in accordance with regulation D-4.

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8 Refer to the *2017 Guidelines for ballast water exchange* (G6) (resolution MEPC.288(71), amended by resolution MEPC.371(80)), the *Interim guidance on the application of the BWM Convention to ships operating in challenging water quality conditions* (resolution MEPC.387(81)), or the *Guidance on contingency measures under the BWM Convention* (BWM.2/Circ.62), as may be amended.

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

10 Refer to the *Guidance for the temporary storage of treated sewage and/or grey water in ballast water tanks* (BWM.2/Circ.82, as may be amended).

11 Refer to the Code for Approval of Ballast Water Management Systems (resolution MEPC.300(72), as may be amended).

12 Refer to the *Guidelines for the approval of ballast water management systems* (G8) (resolutions MEPC.125(53), MEPC 174(58) or MEPC.279(70), as appropriate).

PROCEDURES FOR THE DISPOSAL OF SEDIMENTS
Procedures for the disposal of sediments at sea and to shore.

METHODS OF COMMUNICATION

Details of the procedures for co-ordinating the discharge of ballast in waters of a coastal State.

DUTIES OF THE BALLAST WATER MANAGEMENT OFFICER

O*utline of the duties of the designated officer.*

RECORDING REQUIREMENTS

Details of the record-keeping requirements of the Convention.

CREW TRAINING AND FAMILIARIZATION

Information on the provision of crew training and familiarization.

EXEMPTIONS

Details of any exemptions granted to the ship under regulation A-4.

APPROVING AUTHORITY

Details and stamp of approving authority.

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ANNEX 16

RESOLUTION MEPC.414(84)
(adopted on 1 May 2026)

2026 GUIDELINES FOR TEST-BED AND ONBOARD MEASUREMENTS OF METHANE (CH_4) AND/OR NITROUS OXIDE (N_2O) EMISSIONS FROM MARINE DIESEL ENGINES

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 eightieth session, it adopted, by resolution MEPC.377(80), the *2023 IMO Strategy on reduction of GHG emissions from ships* (2023 IMO GHG Strategy) setting out the levels of ambition for the international shipping sector in reducing GHG emissions,

NOTING that the 2023 IMO GHG Strategy provides that in order to support the global availability and uptake of zero or near-zero GHG emission technologies, fuels and/or energy sources, the Organization may consider and analyse measures to address emissions of methane (CH_4) and nitrous oxide (N_2O),

RECALLING that, at its eighty-third session, it adopted, by resolution MEPC.402(83), the *Guidelines for test-bed and onboard measurements of methane (CH_4) and/or nitrous oxide (N_2O) emissions from marine diesel engines*,

HAVING CONSIDERED, at its eighty-fourth session, draft revised guidelines for test-bed and onboard measurements of methane (CH_4) and/or nitrous oxide (N_2O) emissions from marine diesel engines,

1 ADOPTS the *2026 Guidelines for test-bed and onboard measurements of methane (CH_4) and/or nitrous oxide (N_2O) emissions from marine diesel engines*, as set out in the annex to the present resolution;

2 INVITES Member States to encourage shipowners, ship operators, shipbuilders, marine diesel engine manufacturers and any other interested groups to voluntarily apply these Guidelines when undertaking measurements, calculation and reporting of CH_4 and/or N_2O emission values from marine diesel engines;

3 ALSO INVITES Member States to share data gathered in applying these Guidelines to future sessions of the Committee;

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

5 AGREES that these Guidelines supersede the *Guidelines for test-bed and onboard measurements of methane (CH_4) and/or nitrous oxide (N_2O) emissions from marine diesel engines* adopted by resolution MEPC.402(83).

ANNEX

2026 GUIDELINES FOR TEST-BED AND ONBOARD MEASUREMENTS OF METHANE (CH_4) AND/OR NITROUS OXIDE (N_2O) EMISSIONS FROM MARINE DIESEL ENGINES

1 Introduction

1.1 The purpose of these Guidelines is to specify the protocol for test-bed and onboard measurements, calculation and reporting of methane (CH_4) and/or nitrous oxide (N_2O) emission values from marine diesel engines, as well as documentation and verification of CH_4 and/or N_2O emission values.

1.2 For the purpose of these Guidelines, "methane-containing fuel" means natural gas, bio-methane, e-methane, and mixtures of these fuels.

1.3 The measurements, calculations and reporting for CH_4 and/or N_2O emission values should be carried out in accordance with the NO_x Technical Code 2008 as amended, (NTC 2008) other than as specifically provided for in the protocol set out in appendix 1 of these Guidelines. All references in appendix 1 are to NTC 2008.

1.4 For onboard measurements, the protocol set out in appendix 1 may be accepted for an Individual Engine or for an Engine Group represented by the Parent Engine. It should not be accepted for an Engine Family without further justifications. For test-bed measurements, the protocol may also be accepted for an Engine Family.[1]

2 Information to be included in the CH_4 and/or N_2O file

2.1 The applicant for the establishment of the emission values should prepare a CH_4 and/or N_2O file that should contain the following information:

.1 details of the engine as tested should include but are not limited to:

.1 model and designation;

.2 rated power and rated speed;

.3 listing of NO_x critical components as fitted and settings / operating values as applied including, for CH_4, NO_x certified maximum liquid-to-gas fuel ratios across load range; and

.4 other components and settings / operating values which affect CH_4 and/or N_2O emissions;

.2 details, including drawings of exhaust system, showing sampling position(s);

[1] The composition of an Engine Family or an Engine Group as defined in NTC 2008 is set solely by factors affecting NO_x emissions; those cannot be assumed to be equally applicable to CH_4 and/or N_2O emissions. In some instances, such as liquid-to-gas fuel ratio, the requirements for highest NO_x will tend to result in lowest CH_4.

.3 where $C_{slip-CH4}$ is reported, crankcase emissions should only be included for trunk piston engines without closed crankcase ventilation. Details of how that was determined should be provided. If crankcase emissions are not measured, an emission value based on technical justification and relevant emission data may be used. If the manufacturer does not have such data, an emission value of 1 g/kWh should be used;

.4 a copy of the relevant engine test data, as given in appendix 2 of these Guidelines and any additional data to fully define the engine performance and enable calculation of the gaseous emissions of CH_4 and/or N_2O. For test-bed measurements, this information can also be provided in the test report as referred to in section 5.10 of the NTC 2008;

.5 where a CH_4 and/or N_2O reducing device or system is used, the CH_4 and/or N_2O file should contain documentation on the emission abatement device, giving details of its intended purpose, manner of operation, critical components and settings / operating values together with information on any consumables necessary for its operation. Where exhaust gas samples are to be drawn from both before and after the device, details of analyser changeover arrangements and sequencing should be given if only one set of analysers is to be used.

3 The use of existing measurement data

3.1 Existing measurements conducted prior to the adoption of these Guidelines may be accepted, provided that they were carried out in accordance with the NTC 2008. In such cases, the provisions applicable exclusively to onboard measurements, as set out in these Guidelines, may have been applied.

3.2 If existing measurements for CH_4 have not been conducted, emission values for total hydrocarbons (HC), as set out in the engine's NO_x technical file, may be used as a proxy. The CH_4 emission values may be established based on the weighted percentage of methane in the gas fuel. Where the fuel composition is not available in the engine's NO_x technical file, total HC emissions should be assumed to consist of 100% CH_4.

3.3 If the existing measurements based on the E2 test cycle do not contain emission values for the 10% load point or the lowest mode point at which gas fuel would be used, data from the D2 test cycle of the same parent engine may be considered representative provided that the same parent engine is certified for both D2 and E2 cycles and operates with identical settings.

4 Verification of the CH_4 and/or N_2O emission values

4.1 In order to confirm that the emission values have been established in accordance with these Guidelines, the CH_4 and/or N_2O file should be submitted to the Administration for verification.

4.2 On receipt of the CH_4 and/or N_2O file from the applicant and satisfactory completion of the verification, a Statement of emission values for CH_4 and/or N_2O should be issued by the Administration. The form of Statement of emission values for CH_4 and/or N_2O is set out in appendix 3 of these Guidelines.

APPENDIX 1

PROTOCOL FOR TEST-BED AND ONBOARD MEASUREMENTS OF CH_4 AND/OR N_2O EMISSIONS FROM MARINE DIESEL ENGINES BASED ON THE NO_x TECHNICAL CODE 2008

Explanatory note:
This protocol does not amend mandatory provisions in NTC 2008. Measurements, calculations and reporting of CH_4 and/or N_2O emission values should be carried out in accordance with NTC 2008, other than as specifically provided for in the protocol.

<table>
<tr><th>Paragraph of NO_x Technical Code 2008</th><th>Addition to NTC 2008</th></tr>
<tr><td colspan="2">Abbreviations, subscripts and symbols</td></tr>
<tr><td></td><td>In table 1, the definitions of N_2O and NMHC are added as follows:
<table>
<tr><th>Symbol</th><th>Definition</th></tr>
<tr><td>N_2O</td><td>Nitrous oxide</td></tr>
<tr><td>NMHC</td><td>Non-methane hydrocarbons</td></tr>
</table></td></tr>
<tr><td></td><td>In table 2, abbreviations for FTIR, NDUV, NMC are added as follows:
<table>
<tr><th>Symbol</th><th>Definition</th></tr>
<tr><td>FTIR</td><td>Fourier transform infrared (analyser)</td></tr>
<tr><td>NDUV</td><td>Non-dispersive ultraviolet (analyser)</td></tr>
<tr><td>NMC</td><td>Non-methane cutter</td></tr>
</table>
Note: NMC = flame ionization detector (FID) with non-methane cutter</td></tr>
<tr><td></td><td>In table 3, symbols and terms for C_{fCH4}, C_{fN2O} and $C_{slip\text{-}CH4}$ are added as follows:
<table>
<tr><th>Symbol</th><th>Term</th></tr>
<tr><td>C_{fCH4}</td><td>g CH_4 / g fuel[2] (applicable to liquid fuels and non-methane gas fuels)</td></tr>
<tr><td>C_{fN2O}</td><td>g N_2O / g total fuel (applies to both gas and liquid fuels)</td></tr>
<tr><td>$C_{slip\text{-}CH4}$</td><td>% (of the mass of the methane-containing fuel used by the energy converter), corrected to reference gas composition (applicable to methane-containing fuels, excluding pilot fuel[3])</td></tr>
</table></td></tr>
</table>

[2] For methane containing fuels, the $C_{slip\text{-}CH4}$ covers the role of C_{fCH4}, so C_{fCH4} is set to zero for these fuels. For the purpose of these Guidelines, non-methane gas fuels should be regarded as liquid fuels.

[3] CH_4 emissions from the pilot fuel are accounted for in the $C_{slip\text{-}CH4}$ value. For pilot fuel used in a dual fuel engine, CH_4 emissions should not therefore be determined separately on the basis of the quantity of pilot fuel used.

	Note: $C_{slip\text{-}CH4}$ is a factor accounting for CH_4 (expressed in % of mass of methane containing fuel consumed in the energy converter) which is emitted from the energy converter (including fuel from combustion chamber/oxidation process and from crankcase, as appropriate).
Chapter 3	
3.2 Test cycles and weighting factors to be applied	For the test cycles E2 and E3, the specific emission at the 10% mode point or the lowest mode point at which gas fuel would be used should be measured and reported in addition to the existing mode points. **For onboard measurements only**: In setting the load points of the test cycle to be followed the provisions of 6.4.6.7 should apply. In the case of the 100% load point this should, subject to the engine emission test plan, be allowed to be no lower than 85% of rated power. If that value cannot be achieved, then the test should be deferred to such time that at least that power level can be achieved. The test cycle 100% power weighting factor under 3.2 should be applied irrespective of the actual power developed at that load point.
Chapter 5	
5.2.5.3 Positioning of abatement device or system	Requirements do not necessarily apply to CH_4 and/or N_2O abatement device or system. The installation requirements of the device should be respected and provided in the CH_4 and/or N_2O file.
5.6.1 Permissible deviations of instruments for engine-related parameters and other essential parameters	**For onboard measurements only**: Engine performance and ambient condition monitoring equipment requirements should be in accordance with the requirements of 6.4.5.1.
5.9.2	CH_4 and/or N_2O should be added to the list of main exhaust components. In the case of CH_4, this means CH_4 as reported by the measurement device before correction for NMC efficiency.
5.9.3.2 Exhaust gas temperature at sample probe for HC	For the measurement of CH_4 and/or N_2O, there are no minimum temperature requirements.
5.9.6.2 Test sequence	**For onboard measurements only**: At each load point of a test cycle the provisions of 6.4.6.8 should apply rather than those of 5.9.6.2. In the case of the E3 test cycle, if the actual propeller curve differs from the E3 curve, the load point used should be set using the measured engine power.
5.11 Data evaluation for gaseous emissions	In addition to the concentrations for the species to be determined as specified by 5.11 of NTC 2008, the concentrations of CH_4 and/or N_2O are to be determined. The averaged results are to be given in ppm.

Where the NMC methane efficiency is not 0% and/or the NMC ethane efficiency is not 100% the CH_4 concentration to be used in equation 18a is calculated as follows:

The concentration of CH_4 should be calculated as follows for propane as calibration gas, bypassing NMC:

$$c_{CH4} = \frac{c_{HC(wCutter)} - c_{HC(w/oCutter)} * (1 - E_e)}{f_{RF\ CH4(HC-FID)} * (E_e - E_m)}$$

The concentration of CH_4 should be calculated as follows for methane as calibration gas, passing through the NMC:

$$c_{CH4} = \frac{c_{HC(wCutter)} * f_{RF\ CH4(HC-FID)} * (1 - E_m) - c_{HC(w/oCutter)} * (1 - E_e)}{f_{RF\ CH4(HC-FID)} * (E_e - E_m)}$$

where:

$c_{HC(wCutter)}$ is the HC concentration with the sample gas flowing through the NMC;

$c_{HC(w/oCutter)}$ is the HC concentration with the sample gas bypassing the NMC;

$f_{RF\ CH4(HC-FID)}$ is the methane response factor;

E_m is the methane efficiency as determined per appendix IV, 8.5.1 ; and

E_e is the ethane efficiency as determined per appendix IV, 8.5.2.

5.12.5.1 Calculation of the emission mass flow rates

For the calculation of the emission mass flow rates in 5.12.5.1, u_{gas} values for N_2O and/or CH_4 should be calculated using table 5 as extended:

Gas		HC	CH_4	N_2O
ρ_{gas} kg/m^3		*	0.716	1.9631
	ρ_e[†]	Coefficient u_{gas}[‡]		
Liquid fuel[**]	1.2943	0.000479	0.000553	0.001517
Rapeseed Methyl Ester	1.2950	0.000536	0.000553	0.001516
Methanol	1.2610	0.001133	0.000568	0.001557

	<table><tr><td>Ethanol</td><td>1.2757</td><td>0.000805</td><td>0.000561</td><td>0.001539</td></tr><tr><td>Natural gas</td><td>1.2661</td><td>0.000558*</td><td>0.000565</td><td>0.001551</td></tr><tr><td>Propane</td><td>1.2805</td><td>0.000512</td><td>0.000559</td><td>0.001533</td></tr><tr><td>Butane</td><td>1.2832</td><td>0.000505</td><td>0.000558</td><td>0.001530</td></tr></table> * In the case of HC emissions when using natural gas as the fuel, the given u_{gas} value of 0.000558 should be used for NMHC on the basis of CH2.93. For total HC, the u_{gas} of CH_4 should be used.
5.12.5.2	The CH_4 and/or N_2O concentration to be entered into equation 18a is the value from 5.11 on a wet basis.
5.12.6 Calculation of the specific emission	Calculate C_{fCH4} (g/g fuel and g/kWh), C_{fN2O} (g/g fuel and g/kWh) and $C_{slip-CH4}$ (% of the mass of the methane containing fuel used by the engine) for each load point where emissions are measured. For liquid fuels and non-methane gas fuels: $C_{fgas} = q_{mgas} / fuel\ flow$ where: q_{mgas} (g/h): mass flow of CH_4/N_2O as measured (from combustion); *fuel flow* (g/h): total mass flow of fuels applicable to C_{fCH4} (i.e. the total flow of liquid fuels and/or non-methane gas fuels). For methane-containing fuels: $C_{slip-CH4,act} = (q_{mCH4} / fuel\ flow) \cdot 100$ where: q_{mCH4} (g/h): mass flow of CH_4 as measured (unburned slip); *fuel flow* (g/h): total mass flow of methane containing fuels (excluding pilot fuels). Calculate the average weighed emissions $C_{fgas} = \sum\_i=1...n\ (q_{mgas} \cdot W_{Fi}) / sum\_i=1..n\ (q_{fuel,i} \cdot W_{Fi})$ With $q_{fuel,i}$ being the fuel flow at each mode point. $C_{slip-CH4,\ act} = \Sigma\ i=1...n\ (\ q_{mCH4,\ act} \cdot W_{Fi}) / 10 / \Sigma\ \_i=1..n\ (q_{fuel,i} \cdot W_{Fi})$ $C_{slip-CH4} = C_{slip-CH4,act} \times \frac{X_{CH4ref}}{X_{CH4act}}$

	where: $C_{slip-CH4,act}$ = C_{slip} value calculated with actual fuel gas composition during testing X_{CH4ref} = mass fraction of methane in the reference fuel (w-%) X_{CH4act} = mass fraction of methane in the test fuel (w-%) Reference fuel methane fraction 84.6 w-% (92.2 mol-%) as in the mathematical average of LNG compositions in ISO 23306:2020. q_{mgas} (g/h): see section 5.12.5.2 of the NTC 2008, equation 18a Fuel flow (g/h) as measured.
Appendix III	
	Section 1.1 CH_4 and/or N_2O are added to the list of components included in the exhaust gas analysis system.
	Figure 1 • For arrangements of exhaust gas analysis measurement systems for the measurement of CH_4, refer to ISO 8178-1 section 7.4.4. • Alternatively, the arrangements described in 3.6 below should be accepted. • NMC and N_2O analyser should be arranged, installed and operated in accordance with the respective manufacturer's recommendations.
	Section 1.2 Analysers for CH_4 and N_2O: see section 3
	Section 3 **3.6 Methane (CH_4) analysis** The reference method for CH_4 should be FID + NMC. Alternatively, a dual FID set-up as described in appendix 4 to these guidelines should be accepted. Other principles / systems should be accepted if proven against FID+NMC with exhaust gases of the compositions to be measured. It should be ensured that the HC / CH_4 analyser(s) to be used have duly calibrated ranges for the respective concentrations to be measured. The NMC should have the capacity to handle the expected CH_4 and NMHC concentrations. **3.7 Nitrous oxide (N_2O) analysis** An FTIR analyser, an NDIR (non-dispersive infrared) analyser, laser infrared analyser or NDUV analyser may be used in accordance with the instrument supplier's instructions.

	Note: According to sections 5.4.2 and 5.4.3 of the NTC 2008, other systems or analysers may, subject to the approval of the Administration, be accepted if they yield equivalent results to that of the equipment referenced.
Appendix IV	**Calibration of the analytical and measurement instruments**
	Requirements of table 1 or table 3 regarding fuel measurement device apply separately to both liquid fuel meter and gas fuel meter.
	In addition to the calibration procedures of appendix IV of the NTC 2008, relevant parts of ISO 8178-1 for calibration of CH_4 and/or N_2O measurement instruments should be applied. FID should be calibrated with NMC bypassed with NMC efficiencies E_e and E_m determined separately.
	Section 2 "C_2H_6 and purified synthetic air" is added to 2.2.1.5. A new sub-paragraph "2.2.1.6 N_2O and purified nitrogen" is added after the existing 2.2.1.5.
	Section 5 N_2O is added to the list of analysers in the first sentence of 5.4.2.
8.4	For measurement of N_2O, a new section 8.4 applies
8.4.1	The interference should be checked prior to first use of an analyser and after major servicing or updating of software.
8.4.2	In those cases where the analyser applies compensation algorithms which use as inputs the concentrations of other measured gases those measurements should be undertaken concurrently with this verification check.
8.4.3	For NDIR - The potential for cross interferences effects of CO, CO_2, H_2O, CH_4 and SO_2 as applicable should be checked.
8.4.3.1	Apart from H_2O the interference species are dependent on the selected N_2O absorption band used by the device which should be known. From that knowledge good engineering judgement should be used to determine the interference gases to be used based on those which may be expected to be present in the exhaust gases to be measured.
8.4.4	For FTIR or Laser Infrared – The interference gases depend on the selected N_2O absorption band used by the device which should be known. Based on that knowledge good engineering judgement should be used to determine the interference gases to be used.
8.4.5	The combined effect of the interference gases should not be more 1.0 µmol/mol.

8.4.6	Verification procedure: .1 The concentrations of the interference span gases as identified from 8.4.3 or 8.4.4 should be at least as high as the maximum values to be encountered in service. Those interference gases may be presented in the form of a multi-component span gas. .2 The N_2O analyser is started, operated, zeroed and spanned as in service. .3 Humified interference test gas should be fed into the analyser. That test gas should be generated by bubbling the multi-component span gas through distilled H_2O in a sealed container. If the sample is not treated by a dryer the container temperature should be controlled to generate a H_2O concentration at least as high as the expected maximum when in service. If the sample is treated by a dryer the container temperature should be controlled to generate a H_2O concentration at least as high as the expected maximum based on the dryer outlet temperature when in service. .4 The water mole fraction of the test gas should be determined from measurements taken as close as possible to the analyser inlet. Those measurements may be dew point and absolute pressure. .5 Condensation in the piping leading from the container generating the humidified test gas to the analyser should be minimized by maintaining an adequate minimum temperature. .6 Following stabilization, the analyser output should be recorded for 30 s. The arithmetic mean response over that period should be compared with the limit in 8.4.5.
8.4.6.1	As an alternative to the multi-component span gas in 8.4.6 individual span gases may be run separately. Where an interference gas concentration is higher than that to be measured in service the determined interference value should be scaled down by the ratio of in-service maximum / span concentration. Where the H_2O concentration is below that to be measured in service, but not below 0.025 mol/mol H_2O content, the determined interference may be scaled up by the ratio of maximum in-service value / the value used. The sum of the individual interferences should be compared with the limit in 8.4.5.
8.4.7	An interference verification check report documenting the procedure as followed, including the rational for the interference gases used and their concentrations, and the outcomes of that procedure is to be prepared and should be available as may be required.

8.4.8	Alternative approaches to the verification of N_2O analyser interference may be acceptable. Where so used the justification for the approach taken should be included in the report as required by 8.4.7. Irrespective of the procedure followed the limit given by 8.4.5 remains applicable.
8.5	**Efficiency of the non-methane cutter (NMC)**
	The NMC is used for the removal of the non-methane hydrocarbons from the sample gas by oxidizing all hydrocarbons except CH_4. Ideally, the conversion rate for CH_4 is 0% and for the other hydrocarbons, as represented by ethane, is 100%. The efficiency of the NMC may be checked as part of the pretest verification procedures under 6.1 and again on completion of the measurement exercise (at the time of rechecking the analysers in accordance with 5.9.9 of NTC 2008) with the average of the two *Em* and *Ee* values so obtained being used to correct the measured CH_4 concentrations. In any case, the efficiency verification should be done within 185 days before testing, and after major maintenance. With the agreement of the Administration, alternative approaches to the assessment of NMC efficiency may be accepted. Methane efficiency ≤ 15% Ethane efficiency ≥ 98%
8.5.1	**NMC methane efficiency**
	Methane calibration gas at a concentration typical of that to be measured is flowed through the FID analyser with and without the NMC bypassed. The methane efficiency, *Em*, is determined as: $$E_m = 1 - \frac{c_M\ (wCutter)}{c_M\ (w/oCutter)}$$ Where: c_M *(wCutter)* HC concentration with CH_4 flowing through the NMC (ppmC1) c_M *(w/oCutter)* HC concentration with CH_4 bypassing NMC (ppmC1)

8.5.2	**NMC ethane efficiency**
	Ethane calibration gas at a concentration typical of the expected non-methane hydrocarbon concentration to be measured is flowed through the FID analyser with and without the NMC bypassed. The ethane efficiency, *Ee*, is determined as: $$E_e = 1 - \frac{c_E\ (wCutter)}{c_E\ (w/oCutter)}$$ Where: c_E *(wCutter)* HC concentration with C_2H_6 flowing through the NMC (ppmC1) c_E *(w/oCutter)* HC concentration with C_2H_6 bypassing NMC (ppmC1)

APPENDIX 2

ENGINE TEST REPORT AND TEST DATA – CH_4 AND/OR N_2O CALCULATIONS

Engine	
Manufacturer	
Engine type	
Emission abatement device	
Engine family or Engine group identification	
Serial number	
Rated power	
Rated speed	

Emissions test results:					
Test cycle					
C_{fCH4} weighted					g/g fuel
$C_{slip\text{-}CH4}$ weighted					% (of the mass of the methane containing fuel used by the engine)
N_2O (weighted)					g/g total fuel
Test identification					
Date/time					
Test site					
Test number					
Company					
Date and place of report					
Signature					

Measurement equipment					
	Manufacturer	Model	Measurement ranges	Calibration	
				Span gas conc.	Deviation of calibration
Analyser					
HC / CH_4 Analyser*			ppm		%
N_2O Analyser			ppm		%
CO Analyser			ppm		%
CO_2 Analyser			%		%
O_2 Analyser			%		%
Speed			rpm		%

Torque			Nm		%
Power, if applicable			kW		%
Fuel flow-liquid					%
Fuel flow-gas					%
Air flow					%
Exhaust flow					%
Temperatures					
Charge air coolant inlet			°C		°C
Exhaust gas			°C		°C
Inlet air			°C		°C
Charge air			°C		°C
Fuel-liquid			°C		°C
Fuel-gas			°C		°C
Pressures					
Exhaust gas			kPa		kPa
Charge air			kPa		kPa
Atmospheric			kPa		kPa
Vapour pressure					
Intake air			kPa		%
Humidity					
Intake air			%		%

* For FID+NMC

Make and model of NMC		
	Before measurement	After measurement
NMC CH_4 gas concentration	ppmC	ppmC
HC with CH_4 through NMC	ppmC	ppmC
HC with CH_4 bypassing NMC	ppmC	ppmC
NMC methane efficiency *Em*		
NMC C_2H_6 gas concentration	ppmC	ppmC
HC with C_2H_6 through NMC	ppmC	ppmC
HC with C_2H_6 bypassing NMC	ppmC	ppmC
NMC ethane efficiency *Ee*		

Liquid fuel characteristics

Fuel type				
Fuel properties:			**Fuel elemental analysis:**	
Density	ISO 3675	kg/m^3	Carbon	% m/m
Viscosity	ISO 3104	mm^2/s	Hydrogen	% m/m
Water	ISO 3733	% V/V	Nitrogen	% m/m
Lower heating value/Hu		MJ/kg	Oxygen	% m/m
			Sulphur	% m/m

Gas fuel characteristics

Fuel type:				
Fuel properties			**Fuel elemental analysis**	
Methane number	EN16726:2015		Carbon	% m/m
Lower heating value		MJ/kg	Hydrogen	% m/m
Boiling point		°C	Nitrogen	% m/m
Density at boiling point		kg/m³	Oxygen	% m/m
Pressure at boiling point		Bar (abs)	Sulphur	% m/m
			Methane, CH_4	mol%
			Ethane, C_2H_6	mol%
			Propane, C_3H_8	mol%
			Isobutane, i C_4H_{10}	mol%
			N-Butane, n C_4H_{10}	mol%
			Pentane, C_5H_{12}	mol%
			C_6+	mol%
			CO_2	mol%

Gaseous emissions data

Mode	1	2	3	4	5	6	7	8	9	10
Power/Torque (%)										
Speed (%)										
Time at beginning of mode										

Gaseous emissions data:										
Sampling position										
HC concentration (ppmC)										
CH_4 concentration (ppmC)* recorded#										
CH_4 concentration (ppmC)* - corrected#										
N_2O concentration (ppm)*										
CO concentration (ppm)										
CO_2 concentration (%)										
O_2 concentration (%)										
CH_4 mass flow (kg/h)*#										
N_2O mass flow (kg/h)*										
CO mass flow (kg/h)										
CO_2 mass flow (kg/h)										
O_2 mass flow (kg/h)										
CH_4 (g/g)*#										
CH_4 (g/kWh)* #										
N_2O (g/g)*										
N_2O (g/kWh)*										

* As applicable.

As applicable to either liquid or gas fuel.

Engine parameters to be measured and recorded

Mode	1	2	3	4	5	6	7	8	9	10
Power/Torque (%)										
Speed (%)										
Time at beginning of mode										

Engine data										
Speed (rpm)										
Power (kW)										
Mean effective pressure (kPa)										
Fuel rack/gas admission duration** (mm/sec)										
Liquid-to-gas fuel ratio (on mass basis)										
Liquid Fuel flow (kg/h or m^3/h*)										
Gas Fuel flow (kg/h)										
Exhaust flow (q_{mew}) (kg/h)										
Exhaust temperature at the sampling point (ºC)										
Charge air coolant temperature in (ºC)										
Charge air coolant temperature out (ºC)										
Charge air temperature (ºC)										
Charge air reference temperature (ºC)										
Charge air pressure (kPa)										
Fuel-liquid temperature before the engine (ºC)										
Fuel-gas temperature before the engine (ºC)										

Ambient data										
Atmospheric pressure (kPa)										
Intake air temperature (°C)										
Intake air humidity (g/kg)										
Relative humidity (RH) of intake air* %										
Air temperature at RH sensor* (°C)										
Dry bulb temperature of intake air* (°C)										
Wet bulb temperature of intake air* (°C)										

* As applicable.
** Only for engines to be tested with gas fuel.

Abatement device:

The report should state whether reported data before or after device- hence the gaseous emission data page will need to be repeated, if both are to be given.

Additionally, if both before and after data given, the analyser data should, if relevant, be repeated to cover all analysers used.

For each mode point, the following device data should additionally be recorded: Settings, Operating values and Consumption (specified rates).

APPENDIX 3

FORM OF STATEMENT OF EMISSION VALUES FOR METHANE (CH_4) AND/OR NITROUS OXIDE (N_2O)

Issued in accordance with the *2026 Guidelines for test-bed and onboard measurements of methane (CH_4) and/or nitrous oxide (N_2O) emissions from marine diesel engines* (resolution MEPC.414(84)) under the authority of the Government of:

……
(full designation of the country)

by.....
(full designation of the competent person or organization authorized)

Particulars of applicant

Name of applicant……

THIS IS TO DECLARE THAT:

1 the applicant has submitted to this Administration the information recommended by the *2026 Guidelines for test-bed and onboard measurements of CH_4 and/or N_2O emissions from marine diesel engines* (resolution MEPC.414(84));

2 the emission value(s) have been established in accordance with the *2026 Guidelines for test-bed and onboard measurements of CH_4 and/or N_2O emissions from marine diesel engines* (resolution MEPC.414(84));

3 the engine weighted verified emissions value(s) are as follows:

1	Engine manufacturer and model	
2	Engine serial number	
3	Abatement device manufacturer and model	
4	Device serial number	
5	Use (applicable test cycle(s) – NTC 3.2)	
6	C_{fCH4} (g/g fuel)*	
7	$C_{slip\text{-}CH4}$ % (of the mass of the methane containing fuel used by the engine)*	
8	C_{fN2O} (g/g fuel)*	

* Include as appropriate

Issued at……...
(place of issue of the Statement)

(dd/mm/yyyy): ....
(date of issue) *(signature of duly authorized official issuing the Statement)*

(seal or stamp of the authority, as appropriate)

APPENDIX 4

DUAL FLAME IONIZATION DETECTOR (FID) SET-UP TO MEASURE METHANE (CH_4)

1 Measuring set-up

1 A dual FID set-up to measure methane (CH_4) requires two FID analysers which should be compliant with the specifications of the NO_x Technical Code 2008 (NTC 2008), and one NMC equipment which should be compliant with the requirements of appendix 1 of these guidelines. The NMC should have a bypass function to enable the testing of the efficiency of the NMC. The bypass function is required only for testing the efficiency of the NMC. The sampling system also should be compliant with the NTC 2008. The analyser set-up is shown in figure 1:

.1 One FID connected downstream of the NMC (called the NMC-FID); and

.2 One FID connected to the sample system in parallel, without an NMC (called the HC-FID)

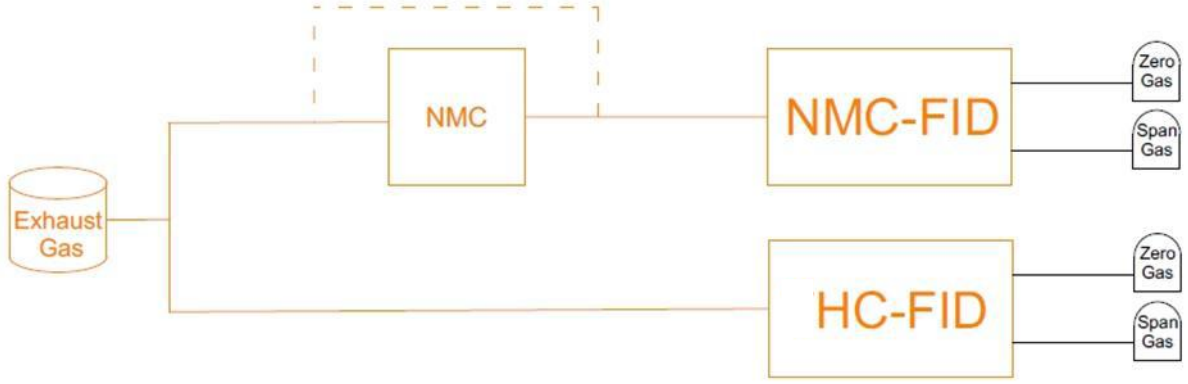

Figure 1 – *Dual FID set-up for measurement of methane (CH_4)*

2 The FIDs and the NMC should be operated according to the manufacturer's specification.

2 Gases and calibration

3 The following gases should be available for the establishment of a calibration curve ,daily adjustments and span checks in accordance with 5.9.9 of the NTC 2008:

.1 CH_4 span gas, at a concentration of at least 80% of the NMC-FID measurement range;

.2 C_3H_8 span gas, at a concentration of at least 80% of the HC-FID measurement range (calculated on a C1 basis, according to the NTC 2008);

.3 a zero gas, that can be either purified nitrogen or purified synthetic air; and

.4 hydrogen/helium mixture and purified synthetic air for the operation of the FIDs.

4 All aforementioned gases should be compliant with section 2 of appendix IV of the NTC 2008.

5 Both FIDs should be zeroed with the zero gas. The linearity check, establishment of calibration curve and span calibration of the HC-FID and the NMC-FID should be done with the C_3H_8 and CH_4 gas mixtures respectively. The NMC should not be bypassed during this check.

3 Efficiency of the NMC and CH_4 response factor

3.1 CH_4 response factor

6 The CH_4 response factor RF_{CH4} is calculated only for the HC-FID. The procedure for determining the response factor should be done according to section 8.2 of appendix IV of the NTC 2008. According to the NTC 2008, the test should be performed when the analyser is first commissioned and after major service has taken place.

7 The CH_4 response factor for the NMC-FID is set to 1.

3.2 Efficiency of NMC

8 This section details the procedure for determining the Ethane efficiency *Ee* and Methane efficiency *Em*, as described in section 8.5 of appendix 1 to these Guidelines. The procedure described below is performed on the NMC-FID only.

.1 A zero gas (as mentioned in section 2) and gas mixtures containing CH_4 and C_2H_6 at a concentration above 80% of the analyser's measuring range are prepared, as well as a hydrogen/helium mixture and purified synthetic air for the operation of the FID. All gases need to be compliant with section 2 of appendix IV of the NTC 2008;

.2 The NMC-FID is warmed up and operated according to the instructions of the manufacturer;

.3 The NMC-FID is calibrated with zero gas and CH_4 gas, through the NMC;

.4 C_2H_6 gas is introduced to the analyser, through the NMC and the concentration is recorded as c_{C2H6}(wCutter);

.5 C_2H_6 gas is introduced to the analyser, bypassing the NMC and the concentration is recorded as c_{C2H6}(w/oCutter);

.6 CH_4 gas is introduced to the analyser, through the NMC and the concentration is recorded as c_{CH4}(wCutter);

.7 CH_4 gas is introduced to the analyser, bypassing the NMC and the concentration is recorded as c_{CH4}(w/oCutter); and

.8 The Ethane efficiency (*Ee*) and Methane efficiency (*Em*) are calculated as follows:

$$E_e = 1 - \frac{c_{C_2H_6}(wCutter)}{c_{C_2H_6}(w/oCutter)} \qquad \text{(eqn. 1)}$$

$$E_m = 1 - \frac{c_{CH_4}(wCutter)}{c_{CH_4}(w/oCutter)} \qquad \text{(eqn. 2)}$$

9 In order comply with section 8.5 of appendix 1 to these Guidelines the achieved efficiencies should be: *Ee* ≥ 98% and *Em* ≤ 15%.

10 It is important to note that the value of *Em* calculated based on (eqn. 2) is only relevant for the NMC efficiency check. For the calculations in section 4, *Em* is set to 0.

4 Calculation of corrected CH_4 concentration

11 The corrected CH_4 concentration (c_{CH4cor}) can be calculated with the following formula:

$$c_{CH4_{cor}} = \frac{c_{CH4} - c_{HC}(1 - E_e)}{1 - ((1 - E_e) * RF_{CH4})} \qquad \text{(eqn. 3)}$$

where:

$c_{CH4_{cor}}$: corrected CH_4 concentration (ppm)
c_{CH4}: CH_4 concentration (ppm) as measured with the NMC-FID
c_{HC}: HC concentration (ppmC1) as measured with the HC-FID
E_e: Ethane efficiency (see section 3.2)
RF_{CH4}: CH_4 response factor of the HC-FID (see section 3.1)

12 The corrected CH_4 concentration $c_{CH4_{cor}}$ should be used to determine the methane mass flow rate as explained in section 5.12.5 of appendix 1 to these Guidelines.

***

ANNEX 17

RESOLUTION MEPC.415(84)
(adopted on 1 May 2026)

GUIDELINES FOR ENGINE LOAD MONITORING (ELM) AND CALCULATION OF EMISSION VALUES

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 eightieth session, it adopted, by resolution MEPC.377(80), the *2023 IMO Strategy on reduction of GHG emissions from ships* (2023 IMO GHG Strategy) setting out the levels of ambition for the international shipping sector in reducing GHG emissions,

NOTING that the 2023 IMO GHG Strategy provides that in order to support the global availability and uptake of zero or near-zero GHG emission technologies, fuels and/or energy sources, the Organization may consider and analyse measures to address emissions of methane (CH_4) and nitrous oxide (N_2O),

HAVING CONSIDERED, at its eighty-fourth session, draft guidelines for engine load monitoring (ELM) and calculation of emission values,

1 ADOPTS the *Guidelines for engine load monitoring (ELM) and calculation of emission values*, as set out in the annex to the present resolution;

2 INVITES Member States to encourage shipowners, ship operators, shipbuilders, marine diesel engine manufacturers and any other interested groups to voluntarily apply these Guidelines when undertaking measurements, calculation and reporting of CH_4 and/or N_2O emission values from marine diesel engines;

3 ALSO INVITES Member States to share data gathered in applying these Guidelines to future sessions of the Committee;

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

ANNEX

GUIDELINES FOR ENGINE LOAD MONITORING (ELM) AND CALCULATION OF EMISSION VALUES

1 Introduction

1.1 The purpose of this procedure is to specify the method for engine load monitoring (ELM) to establish factors that reflect the actual operation of a marine diesel engine, and for the calculation of emission values.

1.2 The ELM can be used to monitor actual engine load during operation instead of the pre-defined weighting factors as described in section 3.2 of the NO_x Technical Code 2008 (NTC 2008), as amended, and to be used in combination with verified CH_4/N_2O emission measurements to arrive at more representative emission values.

2 Emission values at different engine loads

2.1 The emission values for the different engine loads are based on the verified CH_4 and/or N_2O emission values established in accordance with the *2026 Guidelines for test-bed and onboard measurements of methane (CH_4) and/or nitrous oxide (N_2O) emissions from marine diesel engines* (resolution MEPC.414(84)). Between the measured points, the emission value is calculated by linear interpolation of the closest data points above and below the load point. For engine loads below the lowest measured load point, the emission value at the 10% load point or the lowest mode point at which gas fuel would be used should be used for the calculations. For engine loads above the highest measured load point, the emission value at the highest measured load point should be used.

3 Load monitoring

3.1 The load of each engine to which this ELM procedure is to be applied should be monitored. Load signal may be based on load measurement from the torque flange, the shaft strain gauge or calculated from the generator output, etc. In case no direct load measurement signal is available, estimated load based on e.g.: cylinder pressure, injection duration, etc. may also be used subject to the approval of the Administration, as in paragraph 6.4.3.4 of the NTC 2008. Measurement equipment used in conjunction with this ELM procedure should meet the requirements given in tables 3 and 4 of the NTC 2008, appendix IV and be calibrated in accordance with the manufacturer's recommendations.

3.2 Engine load should be continuously monitored and recorded onto a data recording and processing device at a rate which should not be less than 0.0035 Hz. Engine load is averaged in 30-minute intervals (or other time period approved by the Administration). Zero load or liquid fuel only operation should be excluded from the averaging.

3.3 When the engine has a gas fuel flow measurement device installed, calibration of the flow meters should be specified in the data collection procedure, and the calibration and maintenance records should be included in the yearly report referred to in section 5.

4 Calculations

4.1 Emission values for corresponding engine loads are calculated from verified measurements in unit g/g fuel, $C_{slip\text{-}CH4}$ (% of the mass of the methane containing fuel used by the energy converter), or g/kWh. Calculation of yearly emission values (g/g fuel) is done by following the procedure.

Option A: If an engine has a gas fuel flow measurement device installed (example in table 2):

.1 total fuel mass (kg) is calculated during the 30-minute period (or other appropriate time period) based on the fuel flowmeter;

.2 $C_{slip\text{-}CH4}$ (%) emission factor for the load averaged over the period is calculated from the measurement data as described in section 2;

.3 CH_4 emission mass in kg during the period is calculated by multiplying the fuel mass by the $C_{slip\text{-}CH4}$ (%) emission factor; and

.4 total weighted $C_{slip\text{-}CH4}$ (%) for the year is calculated by dividing the sum of the emissions (kg) by fuel mass (kg) and multiplied by 100.

Option B: If there is no gas fuel flow measurement device installed (example in table 3):

.1 specific emission factor in g/kWh for the load averaged over the 30-minute period (or other appropriate time period) is obtained from the measurement data as described in section 2;

.2 engine load is converted to power (kW);

.3 emission mass in kg during the period is calculated by multiplying the engine power output (kW) with time (h) and the specific emission factor in g/kWh, divided by 1000; and

.4 total weighted $C_{slip\text{-}CH4}$ (%) for the year is calculated by dividing the sum of the emission (kg) by fuel mass (kg) and multiplied by 100.

Table 1: Example data set to demonstrate interpolation and calculations in tables 2 and 3

Measurement points	Load (%)	Engine power (kW)	Fuel flow LNG (kg/h)	LNG (g/kWh)	CH_4 (g/kWh)	$C_{slip\text{-}CH4}$ (%)
5	92	4,031	608	151	3.54	2.3
4	77	3,410	512	150	3.08	2.0
3	50	2,239	350	156	3.91	2.5
2	26	1,152	204	177	7.30	4.1
1	11	500	108	216	13.10	6.1

Table 2: Example of calculation if gas fuel flow data is available (for Option A)

Interval	Load (avg)	Fuel (kg)	$C_{slip\text{-}CH4}$ (%)	Emission mass (kg)
00:00-00:30	5%	34.8	6.1%	2.1
00:30-01:00	15%	66.8	5.5%	3.7
01:00-01:30	55%	190	2.4%	4.6
01:30-02:00	55%	190	2.4%	4.6
02:00-02:30	73%	244	2.1%	5.1
02:30-03:00	95%	313.5	2.3%	7.2
03:00-03:30	32%	120.25	3.7%	4.4
Total		1,159		32
Weighted $C_{slip\text{-}CH4}$ (%)				**2.7%**

Table 3: Example of calculation if gas fuel flow data is not available (for Option B)
(Engine rated power: 4,400 kW, Total fuel used during the period: 1,159 kg)

Interval	Load (avg)	Engine power (kW)	CH_4 (g/kWh)	Emission mass (kg)
00:00-00:30	5%	220	13.1	1.4
00:30-01:00	15%	660	11.6	3.8
01:00-01:30	55%	2,420	3.8	4.6
01:30-02:00	55%	2,420	3.8	4.6
02:00-02:30	73%	3,212	3.2	5.1
02:30-03:00	95%	4,180	3.5	7.4
03:00-03:30	32%	1,408	6.5	4.6
Total				32
Weighted $C_{slip\text{-}CH4}$ (%)				**2.7%**

5 Approval and verification

The monitoring method, data collection procedure and yearly load monitoring data and corresponding emission calculations should be approved by the Administration.

***

ANNEX 18

RESOLUTION MEPC.416(84)
(adopted on 1 May 2026)

GUIDELINES FOR CONTINUOUS EMISSION MONITORING SYSTEMS (CEMS) USED TO QUANTIFY METHANE (CH_4) AND/OR NITROUS OXIDE (N_2O) EMISSIONS FROM MARINE DIESEL ENGINES

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 eightieth session, it adopted, by resolution MEPC.377(80), the *2023 IMO Strategy on reduction of GHG emissions from ships* (2023 IMO GHG Strategy) setting out the levels of ambition for the international shipping sector in reducing GHG emissions,

NOTING that the 2023 IMO GHG Strategy provides that in order to support the global availability and uptake of zero or near-zero GHG emission technologies, fuels and/or energy sources, the Organization may consider and analyse measures to address emissions of methane (CH_4) and nitrous oxide (N_2O),

HAVING CONSIDERED, at its eighty-fourth session, draft guidelines for continuous emission monitoring systems (CEMS) used to quantify methane (CH_4) and/or nitrous oxide (N_2O) emissions from marine diesel engines,

1 ADOPTS the *Guidelines for continuous emission monitoring systems (CEMS) used to quantify methane (CH_4) and/or nitrous oxide (N_2O) emissions from marine diesel engines*, as set out in the annex to the present resolution;

2 INVITES Member States to encourage shipowners, ship operators, shipbuilders, marine diesel engine manufacturers and any other interested groups to voluntarily apply these Guidelines when undertaking measurements, calculation and reporting of CH_4 and/or N_2O emission values from marine diesel engines;

3 ALSO INVITES Member States to share data gathered in applying these Guidelines to future sessions of the Committee;

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

ANNEX

GUIDELINES FOR CONTINUOUS EMISSION MONITORING SYSTEMS (CEMS) USED TO QUANTIFY METHANE (CH_4) AND / OR NITROUS OXIDE (N_2O) EMISSIONS FROM MARINE DIESEL ENGINES

TABLE OF CONTENTS

1 Introduction

1.1 The purpose of these Guidelines is to provide a uniform framework for the onboard measurement and mass basis quantification of the emissions of methane (CH_4) and/or nitrous oxide (N_2O) emitted from marine diesel engines by means of a continuous emission monitoring system (CEMS). As such, these are the CH_4 or N_2O emissions to the atmosphere resulting from the particular fuel oil or, in the case of dual-fuel operation, the fuel oils and mix ratio in use at the time of measurement. Additionally, these Guidelines provide a framework for the certification of a CEMS by the Administration.

1.2 These Guidelines are divided into sections as shown in table 1.

Table 1: Section Topics

Section	Topic
2	Exhaust gas measurement and associated requirements. In addition to CH_4 and/or N_2O, this section also covers the measurement of other exhaust gas components as may be required to be measured.
3	Determination of exhaust gas flow as required in order to quantify by mass the emission rate of CH_4 and / or N_2O. Two options are provided: .1 carbon balance method. This is as given in appendix VI of the NO_x Technical Code 2008 (NTC 2008). The output from the given calculation procedures is the mass flow rate (wet) of the exhaust gas. .2 direct measurement method. This involves the measurement of the velocity of the exhaust gas. From that the volumetric exhaust gas flow rate (wet) at reference conditions is determined.
4	Intermediate and final calculations which are used to give the mass basis emission rate of CH_4 and / or N_2O over a time period referred to in these Guidelines as the reporting interval.
5	Data recording and storage requirements associated with the operation of the CEMS. It also covers the scope of the reports that the data recording device should be capable of generating.
6	Documentation requirements: For each CEMS there should be an Administration approved CEMS file detailing the system and the operating procedures to be followed together with related requirements covering the functionality of the CEMS and verification that the data generated is reliable. Additionally, a CEMS record book should be maintained on board, detailing all maintenance and servicing actions undertaken in respect of the CEMS together with details of the actions taken to resolve recorded fault conditions.
7	Certification. This covers the initial and annual surveys which should be undertaken together with the form of the CEMS Certificate to be issued.

1.3 Terms, abbreviations and definitions

1.3.1 Unless otherwise specified, the terms and definitions used in this Guideline have the same meaning as those set forth in MARPOL Annex VI, as amended, and in the NTC 2008.

1.3.2 References to the NTC 2008 mean the Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines, adopted by resolution MEPC.177(58), as amended.

1.3.3 Abbreviations, as given in table 2, and definitions as given in table 3, are applied in these Guidelines.

Table 2: Abbreviations

General	
CEMS	Continuous emission monitoring system
NTC 2008	NO_x Technical Code 2008, as amended
UTC	Universal Time Coordinated
Chemical compounds and related terms	
CH_4	Methane
$C_{slip-CH4}$	Methane slip as mass % of methane based gas fuel used
C_2H_6	Ethane
CO_2	Carbon dioxide
CO	Carbon monoxide
H_2O	Water vapour
HC	Hydrocarbons
N_2O	Nitrous oxide
NMHC	Non-methane hydrocarbons
Abbreviations for analysers which may be used for the measurement of emissions	
ECS	Electrochemical sensor
FTIR	Fourier transform infrared
HFID	Heated flame ionization detector
LIA	Laser infrared analyser including TDLAS
MS	Mass spectrometry
NDIR	Non-dispersive infrared
NDUV	Non-dispersive ultraviolet
NMC	Non-methane cutter
PMD	Paramagnetic detector
TDLAS	Tunable diode laser absorption spectroscopy
ZRDO	Zirconium dioxide sensor

Table 3: Definitions

Applicant	The entity which presents a CEMS for certification in accordance with these Guidelines.
Continuous emission monitoring system (CEMS)	A system for the ongoing measurement, quantification and reporting of CH_4 and / or N_2O emissions from one or more installed marine diesel engines in service. A CEMS includes the other measurement and supporting devices necessary to achieve those objectives. A CEMS may be in operation only under certain engine conditions as given by 6.1.1.3.
Extractive sampling system	System which extracts a representative sample flow from the exhaust gas stream of the monitored marine diesel engine and transfers that sample to the exhaust gas analysers which form part of a CEMS.
In situ	Exhaust gas analyser arrangements installed on the exhaust duct which directly measure one or more of the emission components of the exhaust gas stream from the monitored marine diesel engine.
Maintenance	Activities scheduled, or condition indicated, undertaken on board by ship's staff in order that the CEMS and its component parts continues to function as intended and to meet the requirements of these Guidelines. Maintenance does not include repair periods when the required CEMS output would not be available owing to malfunction or failure of a system component.
Methane based gas fuel	Fuel oils such as natural gas, biomethane or e-methane, of which the principal component is methane. Typically supplied and stored onboard in a cooled and/or pressurized condition. It does not include such as ″gas-to-liquid″ (GTL) liquid fuel oils.
Reporting interval (RI)	The time interval, as given by 5.14, in hours, over which the emission of CH_4 and / or N_2O, in kg, is reported by the CEMS. The overall emission of CH_4 and / or N_2O over a required period of CEMS operation being the sum of all the reporting interval values over that period.
Servicing	Specialist services periodically undertaken in order that the CEMS and its component parts continues to function as intended and to meet the requirements of these Guidelines.

2 Exhaust gas measurement

2.1 In situ analysers, or the sample probe of an extractive sampling system, should be located on the exhaust duct at a position such that the exhaust gas being analysed or sampled is representative of the exhaust gas as emitted to the atmosphere from the marine diesel engine being monitored. That location should be at least 0.5 m or 3 pipe diameters, whichever is the greater, upstream of the exit to atmosphere. Where HFID + NMC is used to measure CH_4, the requirements of 5.9.3.2 of the NTC 2008 should be met.

2.2 Exhaust gas streams from different engines should not be combined upstream of the in situ analysers or the extractive sampling position.

2.3 The exhaust gas should be analysed, as required, with instruments operating on the respective listed principles as given in table 4.

Table 4: Exhaust gas reference measurement methods

CH_4	HFID + NMC, FTIR, LIA
N_2O	FTIR, LIA, NDIR, NDUV
CO_2	NDIR
HC	HFID
H_2O	FTIR, MS, LIA
O_2	PMD, ECS, ZRDO[1]

2.4 Exhaust gas analysers operating on principles other than those given by 2.3 may be accepted, subject to the approval of the Administration, provided they yield equivalent results to those of analysers operating on the listed reference operating principles when used with exhaust gas of the compositions to be measured.

2.5 The analyser specifications and performance should meet the requirements of 1.6, 1.7, 1.8, 1.9 and 1.10 of appendix III of the NTC 2008.

2.6 The selected analyser range should be such that the measured emission value is within 15% - 100% of that range. Analysers should have the capability to automatically switch ranges as necessary in order to remain within 15% - 100% of the range applied according to the concentrations measured in which case the output signal to the data recording device should be duly scaled or so indicated.

2.7 As an alternative to the requirements of 2.6, the provisions of 1.4 of appendix III of the NTC 2008 may be applied as agreed to by the Administration.

[1] Where O_2 is to be measured in order to determine the dry / wet correction factor the analyser type should be ZRDO but should not be used for engines using a low-flashpoint fuel.

2.8 Analysers should be arranged, installed, operated, maintained and serviced in accordance with the respective manufacturers' recommendations in order to meet the requirements of 1.7, 1.8, 1.9 and 1.10 of appendix III of the NTC 2008, and section 5 and, if applicable, section 8 or 9 of appendix IV of the NTC 2008 together with, if relevant, appendix 3 of these Guidelines.

2.9 Where used, the HFID should be calibrated and spanned using a methane in air gas mixture of the appropriate concentration.

2.10 If used, an NMC should be arranged, installed, operated, maintained and serviced in accordance with the manufacturer's recommendations in order to meet the requirements of appendix 4 of these guidelines.

2.11 Pure, calibration and span gases, as required, should comply with section 2 of appendix IV of the NTC 2008. Declared concentrations should be traceable to national and/or international standards. Calibration and span gases should be in accordance with the analyser manufacturer's recommendations.

2.12.1 C_2H_6, where required for NMC efficiency verification, should be as a C_2H_6 and purified synthetic air mixture.

2.12.2 N_2O calibration and span gases should be as a N_2O and purified nitrogen mixture.

2.12.3 H_2O calibration and span gas should be as a H_2O and purified synthetic air or nitrogen mixture or an alternative approach as agreed to by the Administration.

2.13 Analysers should have an ongoing zero and span check capability in order to periodically verify that the zero or span drift has not exceeded 2% of full scale of the selected range. In order to avoid the zero or span drift exceeding 2% full scale of the range used, the zero and/or span values should be capable of being reset as required. Analyser span gases should be between 80% to 100% of the analyser scale being spanned.

2.14 Alternative arrangements to those required by 2.13 may be accepted, subject to the approval of the Administration, provided that the resulting zero or span drift is verified as being no more than 2% full scale of the range selected.

2.15 Extractive sampling systems

2.15.1 For each engine to be monitored the exhaust gas sample probe, of either a centreline or multi-hole – closed-end design, should extract from a zone covering 10% to 90% of the exhaust duct internal diameter.

2.15.2 The sample transfer line should be constructed of suitable material and maintained at a temperature sufficient to prevent the deposition or condensation of exhaust gas components.

2.15.3 The gas sampling system should have an ongoing procedure to periodically verify that the sampling system meets the requirements of section 4 of appendix IV of the NTC 2008 in respect of ingress leakage.

2.15.4 The exhaust gas sample as analysed may be in a wet or dry condition according to the design and operating arrangements of the analysers which are to be used. A gas-drying device, if used, should have minimal effect on the composition of the gases to be measured and should meet the requirements of 1.2.13 of appendix III of the NTC 2008. Chemical dryers should not be used.

2.15.5 Where an analyser is used to process exhaust gas samples from more than one engine's exhaust duct, a flushing arrangement should be provided of sufficient duration to ensure that the gas stream as analysed and reported to the data recording device as required by 5.5 is representative of the exhaust gas emitted from the engine to which the analyser's output signal will be assigned.

3 Determination of exhaust gas flow rate

3.1 Where required, the exhaust gas flow rate should be determined by either:

.1 carbon balance method; or

.2 direct measurement method.

3.2 Carbon balance method

3.2.1 The measured values required for the carbon balance method, as given by appendix VI of the NTC 2008, should be obtained in accordance with the requirements of this paragraph.

3.2.2 The exhaust gas CO_2 concentration should be measured in accordance with the requirements of section 2 as applicable. The background, ambient CO_2ad value should be set to 0.03%.

3.2.3 It is not required to measure the exhaust gas CO concentration and in the calculation procedure CO should be set to zero.

3.2.4 Where the engine operates on a methane based gas fuel, the CH_4 concentration should be measured and used in place of HC in the calculation procedure if HC is not separately measured in accordance with 1.2.9 and 3.3 of appendix III of the NTC 2008. Where the CEMS is to report only N_2O emissions to the atmosphere it is not required to measure HC and in the calculation procedure HC should be set to zero.

3.2.5 Liquid fuel mass basis composition, in terms of carbon, hydrogen and nitrogen, may be obtained by:

.1 analysis of a representative sample of the liquid fuel used;

.2 use of default values as given in table 5 for petroleum-derived fuel oils; or

.3 in the case of liquid fuels not covered by table 5, use of default values as agreed to by the Administration.

Table 5: Petroleum-derived fuel oils: default composition values

Sulphur content:	Carbon %	Hydrogen %	Nitrogen %
≤ 0.10 %	87.5 %	12.44 %	0.0 %
> 0.10 - ≤ 0.50 %	87.0 %	12.35 %	0.2 %
> 0.50 %	85.0 %	11.90 %	0.4 %

3.2.6 Methane based gas fuel mass basis composition, in terms of carbon, hydrogen and nitrogen, may be obtained by:

.1 analysis of a representative sample of the gas fuel used; or

.2 calculation from the cargo certificate of quality, in the case of boil-off gas, or the bunker delivery note, in the case of a supplied gas fuel on the basis of:

Carbon % = (100 – N_2 %) · 0.75
Hydrogen % = (100 – N_2 %) · 0.25

3.2.7 The absolute humidity value, H_a or H_{sc} as appropriate, should be determined in accordance with section 5.12.3.2.1 of the NTC 2008 for H_a or 5.12.4.6 of the NTC 2008 for H_{sc}.

3.2.8 The liquid fuel mass net flow consumption rate of the monitored engine should be determined by direct measurement on either a mass flow or volume flow – temperature compensated basis.

3.2.9 As an alternative to the requirements of paragraph 3.2.8, where for a dual-fuel engine, the liquid fuel mass flow rate does not exceed 10% of the gas fuel flow rate, the engine builder's declared liquid fuel rates as given in the CEMS file, as agreed to by the Administration, may instead be used.

3.2.10 The gas fuel mass net flow consumption rate of the monitored engine should be determined by direct measurement on either a mass flow or volume flow – temperature and pressure compensated basis.

3.2.11 The engine performance and ambient condition monitoring equipment used to provide data for the carbon balance method should be installed and maintained in accordance with the respective manufacturers' recommendations such that the requirements of section 1.3 and table 3 or table 4 of appendix IV of the NTC 2008 are met in respect of the possible deviations.

3.3 Direct measurement method

3.3.1 In order to apply the direct measurement method, the following parameters should be measured:

.1 exhaust gas mean velocity (m/s)[2];

.2 exhaust duct relative pressure (kPa) at the position where .1 is measured;

.3 exhaust gas temperature (K) at the position where .1 is measured; and

.4 barometric pressure p_b (kPa).

3.3.2 The exhaust gas and ambient condition measurement devices used to provide data for the application of the direct measurement method should be installed and maintained in accordance with the respective manufacturers' recommendations such that the requirements of section 1.3 and table 3 or table 4 of appendix IV of the NTC 2008 are met in respect of the possible deviations.

[2] Guidance on the installation requirements for devices to measure exhaust gas velocity is provided in appendix 5 of these Guidelines.

3.3.3 Where there is an arrangement by which the exhaust gas stream from a monitored engine could bypass the exhaust velocity measurement point:

.1 whenever the CEMS is in operation, there should be a continuously operating monitoring system fitted to all such bypass arrangements. The monitoring system should be capable of detecting whether the bypass is not shut or is subject to leakage. The bypass monitoring system should be approved by the Administration; and

.2 where the bypass monitoring system as required by paragraph 3.3.3.1 detects that a bypass is not shut or is subject to leakage, a signal indicating that should be transmitted to the data recording device as a fault condition to be recorded under 5.12.

3.3.4 In order to assess whether the means used to measure the exhaust gas flow are within the permitted deviation as given by table 3 of appendix IV of the NTC 2008 at the time of installation and at intervals not exceeding 12 months thereafter or whenever the data screening as required by 4.4 or 4.12 indicates an validity issue, the values determined at four equally spaced loads across the used load range of the engine should be cross-checked by comparison with the application carbon balance method, as given by 3.2, at each of those load points. The CO_2 analyser and the other measurement equipment required to perform that carbon balance method check need not be permanently installed but are required to meet the requirements of section 2 as applicable.

3.3.5 An alternative procedure to the requirements of 3.3.4 in respect of exhaust gas flow rate verification may be used, subject to approval by the Administration, provided it can be so shown by that procedure that the exhaust gas flow rates across the used load range of the monitored engine are within the permitted deviation as given by table 3 of appendix IV of the NTC 2008.

4 Calculation procedures

4.1 The end point of the calculation procedures of this Guideline is to quantify, by weight (kg), the emission to the atmosphere of CH_4 and / or N_2O over a reporting interval (RI), as given by 5.14, at the time of measurement.

4.2 The calculation steps which are to be followed, as given by the CEMS file, may be undertaken offline or, to the extent required, may be automated and undertaken in real-time. In either case the same requirements apply to the processing of the measured, input and default - fixed data through to the required end value of CH_4 and / or N_2O emitted over the particular reporting interval as applied at the time of measurement.

4.3 The calculation procedure should include the following steps:

.1 screening of all measured and input data;

.2 alignment of device output signals, as applicable;

.3 intermediate calculations, as applicable;

.4 determination of CH_4 and / or N_2O, as required, emission quantity over the reporting interval; and

.5 review of outcomes of intermediate and CH_4 and / or N_2O emission quantity calculations.

4.4 Measured or input data screening

4.4.1 All measured and input data, as recorded in accordance with section 5, should be screened for validity prior to use in the calculation procedures.

4.4.2 The screening of each data item should be against an ongoingly developed expected value range for the fuel type and mix and engine load which should also take into account such aspects as ambient conditions and other potentially influencing factors in accordance with the procedure as given in the CEMS file. Guidance as to this screening procedure is provided in appendix 6. Where a measured or input value is found to be outside the expected range, it should be evaluated as to whether it is a valid, representative, value. If it is a valid value, even if outside the expected range, then it should be used in the calculation procedure as applied and comment covering that finding entered into the CEMS record book. If it is found not to be a valid value, then that finding and the determined reasons for the error together with the resolving action taken should be recorded under section 5.12 and in the CEMS record book.

4.4.3 The screening of measured data should also be used to filter out signal spikes which do not reflect the actual parameter being measured. Where such spikes are removed from the data prior to use in the calculation procedures, a comment covering that action should be entered into the CEMS record book.

4.5 Signal alignment

4.5.1 Owing to time lags through the engine, and any emission abatement device if fitted, together with potentially differing response times between the various measurement devices used, it may be necessary to align all data to a common time reference. This need for signal alignment should also be taken into account where an analyser is to monitor the exhaust gas emissions from more than one engine.

4.5.2 Where signal alignment is required, the procedure by which that is to be undertaken should be detailed in the CEMS file.

4.6 Intermediate calculation – dry / wet correction

4.6.1 Where an emission species is not measured on a wet basis it should be converted, as required, to a wet basis using one of the following methods:

4.6.2 Calculation of dry / wet correction factor

4.6.2.1 The dry / wet correction factor should be calculated in accordance with section 5.12.3 of the NTC 2008.

4.6.2.2 Measurement of CO_2 should be in accordance with the relevant requirements as given by section 2. CO is not required to be measured and should be taken as zero.

4.6.2.3 The carbon and hydrogen content values of the fuel or fuels as used should be obtained in accordance with paragraph 3.2.5 or 3.2.6, as appropriate.

4.6.2.4 Where $H_a \geq H_{sc}$, with H_{sc} as calculated in accordance with paragraph 5.12.4.6 of the NTC 2008, then H_{sc} should be used instead of H_a in the calculation.

4.6.2.5 If water or steam is added or injected into the fuel oil as is to be used, charge air, engine combustion chamber or exhaust gas stream prior to the measurement or sampling position, then the metered quantity so added or injected should also be taken into account when determining the applicable dry / wet correction factor using a procedure approved by the Administration. That procedure should be detailed in the CEMS file.

4.6.2.6 If the water content of the exhaust gas stream, as a product of the inlet air humidity and water formed by combustion, is reduced by exhaust gas duct arrangements or devices prior to the measurement or sampling position, then either sections 4.6.3 or 4.6.4 should instead be used.

4.6.3 Direct measurement of water content

4.6.3.1 Where the water vapour content of the exhaust gas stream is directly measured the analyser used should meet the relevant requirements of section 2.

4.6.3.2 The dry / wet correction factor from direct measurement:

$$k_{wr3} = (1 - c_{H2Ow}/100) \cdot 1.008$$

where:

c_{H2Ow} = measured water vapour concentration (%)

4.6.4 Indirect measurement of water content

4.6.4.1 Where the water vapour content of the exhaust gas stream is to be determined by the measurement of both the wet and dry concentrations of oxygen before and after the dryer unit that should be undertaken using a zirconium dioxide sensor meeting the requirements of section 2.

4.6.4.2 The dry / wet correction factor from indirect measurement:

$$k_{wr4} = O_2w/O_2d$$

where

O_2w = Measured O_2 concentration – wet basis (%)

O_2d = Measured O_2 concentration – dry basis (%)

4.7 Intermediate calculation – NMC CH_4 correction

4.7.1 Where the NMC methane efficiency is not 0 % and/or the NMC ethane efficiency is not 100 %, the corrected CH_4 concentration to be used in paragraphs 4.10.1 and 4.11.1 should be calculated as follows:

$$c_{CH4corr} = \frac{c_{HC}(wCutter) \cdot (1 - E_m) - c_{HC}(w/oCutter) \cdot (1 - E_e)}{E_e - E_m}$$

where:

c_{HC} (wCutter) = HC concentration with sample gas through NMC (ppmC1)

c_{HC} (w/oCutter) = HC concentration with NMC bypassed – i.e. usual HC reading (c_{HC}) (ppmC1)

E_m = NMC methane efficiency (see appendix 4)

E_e = NMC ethane efficiency (see appendix 4)

4.8 Intermediate calculation – exhaust gas mass flow rate by carbon balance

4.8.1 The calculation of the exhaust gas mass flow rate by the carbon balance method should be undertaken in accordance with the procedures as given by appendix VI of the NTC 2008.

4.9 Intermediate calculation – exhaust gas volume flow rate by direct measurement

4.9.1 The exhaust gas volume flow rate under reference conditions (101.3 kPa, 273 K) should be calculated as follows:

$$q_{vew} = \frac{v_n \cdot D^2 \cdot \pi \cdot 3600 \cdot P_{da} \cdot T_{ref}}{4 \cdot T_d \cdot P_{ref}}$$

where:

q_{vew} = exhaust gas volume flow rate at reference conditions (Nm^3/h)

v_n = mean velocity of exhaust gas (m/s)

D = internal diameter of exhaust duct at point of velocity measurement (m)

P_{da} = absolute pressure of exhaust gas in the duct = $P_{dr} + P_b$

P_{dr} = relative pressure of exhaust gas in duct (kPa)

P_b = barometric pressure (kPa)

T_{ref} = reference temperature: 273 (K)

T_d = temperature of exhaust gas at point of velocity measurement (K)

P_{ref} = reference pressure: 101.3 (kPa)

4.10 Intermediate calculation (CH_4 only) - direct calculation of the methane slip method

4.10.1 For the application of this method, methane slip % should be calculated as follows:

$$c_{slip\text{-}CH4} = \frac{CH_4\text{m}}{\frac{CO_2\text{m}}{GF\text{-}C_f + LF_{mf} \cdot LF\text{-}C_f} + CH_4\text{m}} \cdot 100$$

where:

$C_{slip\text{-}CH4}$ = methane slip (%)

CH_4m = CH_4 (mg/m^3)

= CH_4 (ppm) · 0.716

CO_2m = CO_2 (mg/m^3)

= CO_2 (%) · 10,000 · 1.964

Note: CH_4 (ppm) and CO_2 (%), as used above, are to be either both dry basis readings or both to the same wetness fraction. Where it is necessary to convert a dry basis reading to a wet basis then one of the Dry / Wet Correction options as given by section 4.6 should be used.

$GF\text{-}C_f$ = gas fuel carbon factor

= carbon % (from 3.2.6) · 0.03664

$LF\text{-}C_f$ = liquid fuel carbon factor

= carbon % (from 3.2.5) · 0.03664

LF_{mf} = liquid fuel mass fraction (to a precision of not less than three decimal places)

$$= \frac{\text{liquid fuel mass flow rate (kg/h)}}{\text{gas fuel mass flow rate (kg/h)}}$$

Note: For the purposes of these Guidelines a fuel which is not a methane based gas fuel should be regarded as a liquid fuel

4.10.2 The exhaust gas CH_4 and CO_2 concentrations should be measured in accordance with the requirements of section 2 as applicable.

4.10.3 The liquid fuel mass net flow consumption rate of the monitored engine should be determined by direct measurement on either a mass flow or volume flow – temperature compensated basis.

4.10.4 As an alternative to the requirements of paragraph 4.10.3, where, for a dual-fuel engine, the liquid fuel mass flow rate does not exceed 10% of the gas fuel flow rate, the engine builder's declared liquid fuel rates as given in the CEMS file, as agreed to by the Administration, may instead be used.

4.10.5 The gas fuel mass net flow consumption rate of the monitored engine should be determined by direct measurement on either a mass flow or volume flow – temperature and pressure compensated basis.

4.10.6 The fuel flow meters and other measurement devices to be used in the application of the direct calculation of methane slip method should be installed and maintained in accordance with the respective manufacturers' recommendations such that the requirements of section 1.3 and table 3 or table 4 of appendix IV of the NTC 2008 are met in respect of the possible deviations.

4.11 Determination of CH_4 and / or N_2O emission quantity over the reporting interval

4.11.1 The CH_4 and / or N_2O emission quantity (kg), to a precision of at least one decimal place, over a reporting interval, as given by 5.14, should be calculated, as applicable, from the data as recorded in accordance with section 5, as follows:

q_{mgas} = $u_{gas} \cdot c_{gas} \cdot q_{mew} \cdot RI / 1000$

= $w_{gas} \cdot c_{gas} \cdot q_{vew} \cdot RI / 1000$

= $C_{slip\text{-}CH4} \cdot m_{fg} \cdot RI / 100$

where:

q_{mgas} = mass of CH_4 or N_2O emitted to atmosphere over the reporting interval (kg)

u_{gas} = as given by appendix 2 of these guidelines

w_{gas} = as given by appendix 2 of these guidelines

c_{gas} = wet basis concentration of CH_4 corrected or N_2O (ppm)

Note: where a NMC is used the c_{gas} CH_4 value is the value as corrected by 4.7.1.

q_{mew} = exhaust gas mass flow rate (g/h) – 4.8.1

q_{vew} = exhaust gas volume flow rate at reference conditions (Nm^3/h) – 4.9.1

RI = reporting interval used at time of measurement (h) – 5.14

$C_{slip\text{-}CH4}$ = % CH_4 Slip – 4.10.1

m_{fg} = gas fuel mass flow rate (kg/h) – 4.10.5

4.11.2 In the case of CH_4 reporting, where the crankcase emissions from trunk piston engines are not led to the exhaust duct upstream of the CH_4 measurement or sampling point, the outcome of the quantification under 6.1.2.1.7.2 should be added to the outcome of paragraph 4.11.1.

4.12 Review of outcomes of intermediate and CH_4 or N_2O emitted quantity calculations

4.12.1 The outcomes of the intermediate and CH_4 or N_2O emitted quantity calculations should be screened for possible calculation errors.

4.12.2 The review of each calculated value should be against an ongoingly developed expected value range for the fuel type and mix and engine load which should also take into account such aspects as ambient conditions and other potentially influencing factors in accordance with the procedure as given in the CEMS file. Guidance as to this screening procedure is provided in appendix 6 of these guidelines. Where a calculated value is found to be outside the expected range it should be evaluated as to whether it is a valid calculated value. If it is a valid calculated value, then it should be retained. If it is found not to be a valid calculated value, then that finding and the determined reasons for that error, together with the resolving action taken, should be recorded under paragraph 5.13 and in the CEMS record book.

5 Data recording device

5.1 The data recording device should be of a robust, tamper-proof design meeting the requirements of section 4 of the *Guidelines for the use of Electronic Record Books under MARPOL Annex VI*[3].

[3] Resolution MEPC.312(74) on *Guidelines for the use of electronic record books under MARPOL.*

5.2 Where the calculations in accordance with section 4 are to be undertaken on board in an automated manner as part of the CEMS, those processing functions should be considered to be an inherent part of the data recording device and all requirements related to that device should be considered to be equally applicable, as appropriate, to its data processing functions.

5.3 Where a CEMS covers more than one engine, appropriate arrangements, as agreed to by the Administration, should be in place to ensure that the data recorded for each engine is clearly distinguished so that the data in respect of each engine can be readily identified, duly recorded and reported as required.

5.4 The data recording device should record whenever an engine, identified under paragraph 6.1.1.2, is in operation and whether or not the engine operating conditions identified under paragraph 6.1.1.3 apply.

5.5 Whenever the CEMS is in operation the data recording device should, as a minimum, record the following:

.1 the averaged output, over the reporting interval applied, of each of the exhaust gas analysers as listed in the CEMS file. The output from analysers for CO_2, H_2O and O_2 should be recorded in terms of % to a precision of not less than two decimal places. The output from analysers for CH_4 and /or N_2O should be recorded in terms of ppm to at least the nearest whole number;

.2 the outcomes of the zero and span checks of the exhaust gas analysers as listed in CEMS file including the evaluation and acceptability of any zero or span drift together with subsequent resets of the respective zero / span values;

.3 where an Administration has, under paragraph 2.14, approved an alternative approach to the zero / span check procedure, data showing the functionality of that approach so that drift does not exceed 2% of the full scale of the range used;

.4 where exhaust gas analysers are used in an extractive sampling arrangement, the measured values of the sample transfer line leak test procedure used and the evaluation together with the pass / fail assessment of that finding;

.5 where the carbon balance method is used to calculate exhaust gas mass flow rate, the averaged measured values, over the reporting interval applied, are used in that calculation;

.6 where the direct measurement method is used to calculate exhaust gas volume flow rate at reference conditions, the averaged measured values, over the reporting interval applied, are used in that calculation;

.7 where the direct calculation of the methane slip method is used, the averaged measured net fuel flow rates and other measured values, over the reporting interval applied, are used in that calculation;

.8 where the dry/wet correction factor is to be calculated or determined, the measured values, averaged over the reporting interval applied, are used in that calculation or determination;

.9 for extractive sampling systems incorporating a sample gas dryer, the sample gas outlet temperature from the dryer, averaged over the reporting interval applied;

.10 other measured data as used in the calculation processes or which are used indicate the operating condition of the CEMS or component parts thereof;

.11 other measured data used in the application of alternative or additional procedures, as agreed to or approved by the Administration, to those given by these Guidelines; and

.12 periods when the required data is not being transmitted to the data recorder owing to the agreed maintenance periods as given by paragraph 6.1.8.2.

5.6 The data recording device should record the following input data together with the time-date range over which they apply:

.1 zero and span gas composition data together with respective validity dates of those zero or span gases;

.2 if applicable, determined liquid fuel composition data;

.3 if applicable, determined gas fuel composition data;

.4 where an NMC is used, E_m and E_e;

.5 where the provisions of either paragraph 3.2.9 or 4.10.4 are followed, the derived liquid fuel mass flow rates are used;

.6 other input data as used in the calculation procedures applied; and

.7 other input data used in the application of alternative or additional procedures, as agreed to or approved by the Administration, to those given by these Guidelines.

5.7 The data recording device should have the capability to upload and store copies of the test certificates or other documentation from which the input data under paragraph 5.6 was obtained.

5.8 The data recording device should record the default values used and, if applicable, the time-date range, or other criteria, over which they apply together with any fixed values used in the calculation procedures:

.1 if applicable, default liquid fuel composition data;

.2 if applicable, exhaust duct internal diameter at the point of velocity measurement;

.3 other default or fixed values used in the calculation procedures applied; and

.4 other default or fixed values used in the application of alternative or additional procedures, as agreed to by the Administration, to those given by these Guidelines.

5.9 The data recording device should record the following intermediate calculation values determined for each reporting interval:

.1 if NMC is used, the E_m and E_e corrected CH_4 concentration;

.2 if used, absolute humidity values and whether that is as H_a or H_{sc};

.3 if used, dry / wet correction factor;

.4 if the carbon balance method is used, the exhaust gas mass flow rate (kg/h);

.5 if the direct measurement method is used, the exhaust gas volume flow rate at reference conditions (Nm^3/h);

.6 if the direct calculation of the methane slip method is used, the $C_{slip\text{-}CH4}$ value; and

.7 calculated values related to the application of alternative or additional procedures, as agreed to or approved by the Administration, to those given by these Guidelines.

5.10 The data recording device should record:

.1 the determined weight, expressed in kg, of CH_4 and / or N_2O emission to the atmosphere, as determined under section 4.11 and screened by section 4.12 as valid, for each reporting interval; or

.2 for each reporting interval during a zero/span check procedure as recorded under paragraph 5.5.2 or 5.5.3, a leak check procedure as recorded under paragraph 5.5.4 or an agreed CEMS maintenance period as recorded under paragraph 5.5.12, the CH_4 and / or N_2O emission (kg) to atmosphere as the average of that of the last reporting interval before reporting ceased and that of the first reporting interval following stabilization on restart.

5.11 Where the calculations in accordance section 4 of these Guidelines are undertaken remotely from the CEMS, the data recording device should be capable of being uploaded with the data required by paragraphs 5.6, 5.7, 5.8, 5.9 and 5.10.

5.12 The data recording device should record those periods when the CEMS was not able to generate the CH_4 and / or N_2O emission value required by paragraph 5.10.1 owing to:

.1 non-availability of data due to malfunction or failure of an identified exhaust gas analyser, other measurement device or necessary item of support equipment which forms part of the CEMS. Such periods are outside those provided for by paragraph 5.10.2;

.2 a measurement or input data fault condition, as identified by the screening required by section 4.4, and should additionally record details of the fault which resulted in that inability to provide valid data. The related inputs for this function may be manual, automated or a mix of both;

.3 a fault detected by the zero or span check facility required by paragraph 2.13 or 2.14 by which the zero or span drift exceeded 2% of the full scale of the range used. That fault condition should be applied to all data recorded since the last data point where the zero or span drift was within the required range. This function should be automated;

.4 in the case of an extractive sampling system, where the sample line leak detection procedure, required by paragraph 2.15.3, detects that there is an ingress leakage. That fault condition should be applied to all data recorded since the last data point where the sampling system was verified as free of ingress leakage. This function should be automated; and

.5 the monitoring system required by paragraph 3.3.3 detecting that a bypass arrangement was either not shut or subject to leakage. This function should be automated.

5.13 The data recording device should also record periods when the CEMS was not able to generate the CH_4 and / or N_2O emission value required by paragraph 5.10.1 owing to calculation fault conditions, as identified by the review required by section 4.12, and should additionally record details of the fault which resulted in that error. The related inputs for this function may be manual, automated or a mix of both.

5.14 The recording undertaken in accordance with paragraphs 5.4, 5.5, 5.9, 5.10, 5.12 and 5.13 should be against UTC with a reporting interval (RI) not greater than 0.20 hours. Where required, shorter reporting intervals may be used in order to cover periods of different engine operating conditions.

5.15 The data recording device should be capable of preparing and downloading reports in a readily usable format over user selected time-date ranges covering, but not limited to, the following either individually or as a user selected combined report:

.1 periods of engine operation and engine operating condition under section 5.4;

.2 measured data values under paragraph 5.5;

.3 input values under paragraph 5.6 and the associated supporting data under paragraph 5.7;

.4 default or fixed values under paragraph 5.8;

.5 intermediate calculated values under paragraph 5.9;

.6 CH_4 and / or N_2O emitted to the atmosphere for each reporting interval under paragraph 5.10;

.7 CH_4 and / or N_2O emitted to atmosphere;

.8 occurrence and duration of zero/span check periods, leak check periods and maintenance periods, as allowed by paragraph 6.1.8.2, which interrupted the CEMS from generating the required output under paragraph 5.10.1; and

.9 occurrence, duration and summary details of fault conditions which prevented the CEMS from operating as required as recorded under paragraphs 5.12 or 5.13.

5.16 The data recorded should be retained on board for a period of not less than 18 months from the date of recording. If the data recording device is changed over that period, it should be ensured that the required data is retained on board and available as required for surveys or inspections.

6 CEMS documentation

6.1 CEMS file

6.1.1 For each CEMS there should be a CEMS file, prepared by the applicant and approved by the Administration. The CEMS file should be retained on board the ship on which the CEMS is installed and be available for surveys and inspections as required. The CEMS file should, as a minimum, contain:

.1 whether CH_4, N_2O or both are to be monitored and reported;

.2 identify the engine, or engines, whose exhaust gas streams the CEMS is to monitor;

.3 under what engine operating conditions the CEMS is intended to operate[4]; and

.4 the information required by paragraphs 6.1.2 to 6.1.10.

6.1.2 Marine diesel engine

6.1.2.1 Details of the marine diesel engine, or engines, the exhaust emissions of which the CEMS is to monitor. Those details should include, but are not limited to:

.1 engine onboard reference and duty;

.2 manufacturer, model number and serial number;

.3 rated power and rated speed;

.4 NO_x certification 'engine approval number';

.5 where fuel oil consumption is to be measured as part of these procedures, details should be given of the fuel flow meters to be used and other associated measurement devices together with the calculation procedures, if required, to present the data on a net mass flow basis. The relevant fuel oil service system piping diagrams should be included showing the location of the fuel flow measurement devices;

.6 diagram giving the layout of the engine's exhaust gas system including all incorporated devices and any bypass arrangements; and

.7 where CH_4 is to be monitored and reported, in the case of trunk piston engines using a methane based gas fuel, the means by which the crankcase emissions of CH_4, in terms of kg of CH_4 over each reporting interval, are to be determined:

.1 where the crankcase vent, or vents, discharge only into either the engine's intake air or the exhaust duct at a position upstream of the exhaust gas sampling position, that arrangement should be detailed on the exhaust gas piping diagram as required by paragraph 6.1.2.1.6; or

[4] It may, for example, be given that the CEMS is only intended to operate when the engine is in a dual fuel mode, or not under 'standby' conditions, or not under a certain minimum % of rated power or speed.

.2 where the crankcase vent does not discharge into the engine's inlet air or exhaust duct at a position upstream of the measurement or sampling position:

.1 The procedures by which the total CH_4 crankcase emissions are to be quantified in terms of kg CH_4 over each reporting interval, as agreed to by the Administration. In the case where the crankcase has more than one outlet, the means by which the CH_4 emissions from each outlet are to be determined, in terms of kg CH_4 over each reporting interval, should be given. The influence of crankcase ventilation systems on that quantification should also be described, including any mitigation or correction procedures applied so that the reported CEMS data accurately reflects the total crankcase CH_4 emissions for each reporting interval; or

.2 The crankcase emissions of CH_4, in terms of kg of CH_4 over each reporting interval, should be derived from the engine builder's advised values, taking into account relevant influencing factors including, but not limited to, design specifics, torque, speed and time between top-end overhauls.

6.1.3 CH_4 and / or N_2O emission reduction device

6.1.3.1 Where a CH_4 and / or N_2O emission reduction device is fitted, details of the device should be given. Those details should include, but are not limited to:

.1 the exhaust emission component(s) intended to be reduced;

.2 the manner of operation of the reduction device, including details and criteria governing usage of any required energy inputs and/or consumables;

.3 the engine operating conditions under which the reduction device is intended to function; and

.4 the arrangement of the reduction device relative to the layout of the exhaust system as required by paragraph 6.1.2.1.6.

6.1.4 Exhaust gas analysers

6.1.4.1 Details of each exhaust gas analyser device which are to form part of the CEMS should be given. Those details for each such device should include, but are not limited to:

.1 measured exhaust emission component;

.2 analyser manufacturer and model;

.3 measurement principle. Where that measurement principle differs from that given by paragraph 2.3 the approval certification of that equivalent means as issued by the Administration;

.4 details of any necessary ancillary components or system requirements necessary for the analyser to function;

.5 whether that analyser measures on a wet or dry basis;

.6 if required, the means by which a dry basis reading will be corrected to wet basis, or wet to dry, together with:

.1 details of the measurement equipment necessary to apply that dry/wet correction; and

.2 the means by which other required data to perform that dry / wet correction will be obtained;

.7 analyser ranges to be used and the criteria for any range change;

.8 zero and span gas compositions, as applicable;

.9 if applicable, details of the zero and span check procedures, the frequency of that operation and the means by which the analyser would be reset such that the drift, in either case, does not exceed 2% full scale of the range used. Additionally, it should be given that such zero and span checks should only be undertaken under steady CH_4 and / or N_2O emission rate conditions, as indicated by paragraph 5.5 or as recorded by paragraph 5.10.1 prior to undertaking that check;

.10 the minimum reporting interval required in order to obtain a stable reading from the analyser;

.11 where a NMC is used, details of that device including CH_4 / NMHC ranges and design E_m and E_e efficiencies; and

.12 where an analyser is to be used to monitor the exhaust gas emissions from more than one exhaust duct, the means by which it will be ensured that the analysed gas sample will be representative of the engine to which the findings will be assigned. This is to also cover sample switching, flushing, how the gas sample in the disengaged sample feed lines will remain updated, the T_{90} response factors (that is the time required for the analyser's output signal to register 90% of the input change) of the analysers involved and other relevant factors particular to the proposed system. This arrangement is to be agreed to by the Administration.

6.1.4.2 In the case of extractive sampling systems, details of the individual components of that system should be given which should include, but are not limited to:

.1 sample probe - design, fittings, and materials;

.2 sample transfer lines - operating temperatures and materials;

.3 if fitted, sample filter arrangements;

.4 if fitted, sample dryer - operating principle and exhaust gas sample outlet temperature range; and

.5 details of the leak check procedure to be applied and the frequency of that operation. Additionally, it should be given that such leak checks should only be undertaken under steady CH_4 and / or N_2O emission rate conditions, as indicated by paragraph 5.5 or as recorded by paragraph 5.10.1 prior to undertaking that check.

6.1.4.3 A diagram should be included showing the arrangement of the exhaust gas analysers and any associated devices or systems relative to the layout of the exhaust system as required by paragraph 6.1.2.1.6.

6.1.5 Exhaust gas flow

6.1.5.1 Where the exhaust gas flow rate is to be determined, it should be given whether that is to be by means of the carbon balance method or the direct measurement method:

6.1.5.2 Where the carbon balance method is to be used:

.1 details of the measurement devices necessary to apply the carbon balance method;

.2 a diagram showing the arrangement of those measurement devices relative to the layout of the exhaust system as required by paragraph 6.1.2.1.6;

.3 the means by which fuel composition data required for the carbon balance method will be obtained;

.4 where the provisions of paragraph 3.2.9 are to be followed, the derived liquid fuel mass flow rate to be used across the load engine range. If there is more than one such rate, the basis by which the particular liquid fuel rate would be selected should be given; and

.5 the means by which the exhaust gas water vapour content is to be determined.

6.1.5.3 Where the direct measurement method is to be used:

.1 details of the exhaust gas velocity measurement device to be used including its declared maximum deviation across the required operating range when used with exhaust gas;

.2 details of the installation requirements of the velocity measurement device;

.3 exhaust duct internal diameter at the point of velocity measurement;

.4 details of the other measurement equipment necessary to apply the direct measurement method;

.5 the means by which the exhaust gas water vapour content, if required, is to be determined;

.6 a diagram should be included showing the arrangement of the required measurement devices relative to the layout of the exhaust system as required by paragraph 6.1.2.1.6;

.7 where there is an arrangement by which the exhaust gas stream from a monitored engine could bypass the exhaust gas velocity measurement point, details should be provided of the Administration agreed monitoring system as required by paragraph 3.3.3; and

.8 details of the procedures to be applied to verify that the exhaust gas flow rates across the used load range of the monitored engine are within the permitted deviation limit as given by table 3 of appendix IV of the NTC 2008.

6.1.6 Calculation procedures

6.1.6.1 It should be given as to whether the required calculations, are to be undertaken offline or, to the extent required, automated and undertaken in real-time.

6.1.6.2 Details of the measured and input data screening procedure as required by paragraph 4.4 should be given. For each measured or input parameter to be used in the calculation procedures to be applied, the initially expected value range should be given for the engine loads and fuel types and mixes to be covered. These procedures should also cover how this aspect of the data screening procedure is to be informed from subsequent in service measured or input data and how it may be affected by such as ambient conditions and other relevant potentially influencing factors. The procedure should also cover the evaluation of measured or input values falling outside the expected range as to whether or not they represent valid values together with, where they are not valid, the resolving action to be taken. Guidance on the development of this screening procedure is provided in appendix 6.

6.1.6.3 Details should be given of the signal alignment procedure, if required, in accordance with 4.5. That procedure should give which baseline parameter the other signals are to be aligned to together with the rationale of that selection.

6.1.6.4 Where the provisions of paragraph 4.10.4 are to be followed, the derived liquid fuel mass flow rate to be used across the load engine range. If there is more than one such rate, the basis by which the particular liquid fuel rate would be selected should be given.

6.1.6.5 All intermediate calculations which are to be undertaken should be given. Where default values are to be used those should be given relative to the criteria for their application.

6.1.6.6 The means by which the CH_4 and / or N_2O emission quantity is to be calculated over each reporting interval in accordance with section 4.11 should be given.

6.1.6.7 Details of the procedures for the review of the outcomes of the intermediate and CH_4 and / or N_2O emitted quantity calculations as required by section 4.12 should be given. For each calculated item, the initially expected value range should be given for the engine loads and fuel types and mixes to be covered. These procedures should include how this aspect of the data screening procedure is to be informed from subsequent in service calculated data. The procedure should also cover the evaluation of calculated values falling outside the expected range as to whether or not they represent valid values together with, where they are not valid, the resolving action to be taken. Guidance as to the development of this review procedure is provided in appendix 6 of these guidelines.

6.1.7 Data recording device

6.1.7.1 Details should be given of the data recording device. Those details should include information showing that the design of that device meets the requirements of section 4 of the *Guidelines for the use of Electronic Record Books under MARPOL*[5].

6.1.7.2 The reporting interval to be used should be given. Where the reporting interval may be altered, the criteria for the selection of the particular reporting interval, together with the range of reporting intervals to be used, should be given.

6.1.7.3 The real-time measurement, input and calculated value data streams to the data recording device as required by paragraphs 5.5, 5.6 and 5.9, respectively should be given.

6.1.7.4 The means by which the uploading of data as required by paragraph 5.7 is to be undertaken should be given.

6.1.7.5 The default values to be used under 5.8 and, if applicable, whether there would be a time-date range, or other criteria, over which they would apply together with any fixed values used in the calculation procedures, should be given.

6.1.7.6 Where calculation procedures are to be undertaken offline, details of the procedure and frequency for uploading the processed data into the data recording device, as required by paragraph 5.11, should be given. That frequency should not be more than 30 days from the date on which the measurements were undertaken.

6.1.7.7 Details should be given of the means by which reports, as required, may be obtained in accordance with paragraph 5.15.

6.1.7.8 The period over which, in accordance with paragraph 5.16, data will be retained on board should be given. Procedures covering the possible change of the data recording device should also be given.

6.1.8 CEMS maintenance

6.1.8.1 Details should be given of the routine maintenance requirements of the CEMS and its component parts so that it continues to function as intended and to meet the requirements of these Guidelines. In this reference may be made to the respective manufacturer's specified documentation, which would not be required to be reproduced in the CEMS file itself. However, any such documentation should be retained on board and be available as required.

6.1.8.2 It should be given that maintenance of exhaust gas analysers, other measurement devices or necessary support equipment which form part of the CEMS should, whenever possible, be undertaken when the CEMS itself is not required to be in operation. Where that is not possible, the frequency and duration of the respective required maintenance periods should be given, as agreed to by the Administration.

6.1.8.3 It should be given that maintenance of CEMS components which interrupts the determination of the CH_4 and / or N_2O emission value under section 4.11 should be coordinated so as to minimize the overall duration when paragraph 5.10.2 applies. Additionally, it should also be given that such maintenance should only be undertaken under steady CH_4 and / or N_2O emission rate conditions, as indicated by paragraph 5.5 or recorded by paragraph 5.10.1 prior to undertaking that maintenance.

5 Resolution MEPC.312(74) as may be amended.

6.1.9 CEMS servicing

6.1.9.1 Details should be given of the servicing requirements of the CEMS and its component parts so that it continues to function as intended and to meet the requirements of these Guidelines. This should include the exhaust gas analyser calibration and interference checks as required by these Guidelines, together with the calibration checks on other measurement devices.

6.1.9.2 It should be given that servicing of exhaust gas analysers, other measurement devices or necessary support equipment which form part of the CEMS should not be undertaken when the CEMS itself is intended, by paragraph 6.1.1.3, to be in operation.

6.1.10 Additional information

6.1.10.1 The CEMS file may include any additional information the applicant considers necessary to describe the CEMS and/or its manner of operation.

6.1.10.2 The CEMS file should include any additional information the Administration considers to be necessary to describe the CEMS and/or its manner of operation.

6.1.11 Amendments to CEMS file

6.1.11.1 Any amendment to the CEMS file should be approved by the Administration, taking into account the effect of the proposed change on the performance of the CEMS, prior to the implementation of the change requiring that amendment. Where an addition, deletion or amendment to the CEMS file is separate from the CEMS file as initially approved, it should be retained with the CEMS file and should be considered as part of it.

6.2 CEMS record book

6.2.1 A CEMS record book should be maintained up to date on board and should be available for surveys and inspections as required. The format and extent of the CEMS record book should be approved by the Administration. Where the CEMS record book is to be maintained in an electronic form it should meet the relevant requirements of section 4 of the *Guidelines for the use of Electronic Record Books under MARPOL* (resolution MEPC.312(74)), as may be amended. Where the CEMS record book is to be maintained in a written form, it should cover the points as given by section 4 of the *Guidelines for the use of Electronic Record Books under MARPOL*.

6.2.2 The CEMS record book should be used to record:

.1 all maintenance actions, both as provided for under paragraph 6.1.8.1 and otherwise, undertaken on the CEMS, including like-for-like replacements;

.2 servicing actions undertaken on the CEMS including all servicing reports covering calibration, interference checks and other repair / replacement activities;

.3 open / shut status of a bypass connection as covered by paragraph 3.3.3.

.4 the corrective actions taken to resolve any fault conditions as recorded by paragraphs 5.12 or 5.13; and

.5 actions undertaken under paragraph 4.4.3 to remove signal spikes from the recorded data prior to use in the calculation procedures.

6.2.3 The CEMS record book should be retained onboard for a period of not less than two years from the date of last entry or for longer as required by the Administration.

7 CEMS certification

7.1 Prior to the use of a CEMS for the purpose of providing CH_4 and / or N_2O emission data in accordance with relevant requirements, that CEMS should be subject to an initial survey. On satisfactory completion of that survey, a CEMS Certificate, the form of which is given in appendix 1 of these guidelines, should be issued by the Administration.

7.2 Thereafter, and for as long as that CEMS continues to be used in relation to the provision of CH_4 and / or N_2O data, it should remain subject to annual surveys which should be undertaken not less than 12 months following the date of the previous survey.

7.3 The initial and annual surveys of the CEMS should confirm that the CEMS is as detailed in the CEMS file, that the CEMS functions in accordance with the relevant requirements of these Guidelines and that the procedures as given in the CEMS file are being duly applied.

7.4 Where a CEMS covers more than one engine, the initial and annual survey should verify that the arrangements to separately measure, calculate and report the emissions from each engine are operating as required.

7.5 Initial and annual surveys should include a period when the CEMS is in operation in accordance with paragraph 6.1.1.3.

7.6 At the initial survey, the screening of the CEMS measured, input and output data in accordance with the procedures detailed in the CEMS file should be demonstrated.

7.7 At annual surveys, it should be verified that the CEMS measured, input and reported data streams have been subject to the review procedures as detailed in the CEMS file.

7.8 If the CEMS is not in service at the time that an annual survey is due, an initial survey should be undertaken and, at that time a new CEMS Certificate duly issued before further CH_4 and / or N_2O emission data is provided.

7.9 At annual surveys, it should be confirmed that the CEMS record book has been maintained as required.

APPENDIX 1

FORM OF CEMS CERTIFICATE

Issued in accordance with the *Guidelines for continuous emission monitoring systems (CEMS) used to quantify methane (CH_4) and/or nitrous oxide (N_2O) emissions from marine diesel engines* (resolution MEPC.416(84)) under the authority of the Government of:

……
(full designation of the country)

by.....
(full designation of the competent person or organization authorized)

Particulars of ship

Name of ship .....
IMO Number.....

CEMS

CEMS file approval reference.....
Engines covered by CEMS

Engine	1	2	3	4
Manufacturer:				
Model:				
Serial number:				
NO_x approval number:				

CH_4 reported – yes / no*
N_2O reported – yes / no*

THIS IS TO CERTIFY that the CEMS as installed is as detailed in the CEMS file, that the CEMS functions in accordance with the relevant provisions of the CEMS Guidelines and that the screening of the CEMS output data in accordance with the procedures detailed in the CEMS file has been satisfactorily demonstrated.

Issued at……...
(place of issue of the Statement)

(dd/mm/yyyy): ....
(date of issue) *(signature of duly authorized official issuing the Statement)*

(seal or stamp of the authority, as appropriate)

* Delete as appropriate

ENDORSEMENT FOR ANNUAL SURVEYS

THIS IS TO CERTIFY that the CEMS as installed remains as detailed in the CEMS file, that the CEMS functions and is operated in accordance with the CEMS file and that the CEMS reported data streams have been subject to the screening procedures as detailed in the CEMS file:

Annual Survey 1

Signed ……..
(signature of duly authorized official)

Place .....

Date (dd/mm/yyyy) .....

(seal or stamp of the authority, as appropriate)

Annual Survey 2

Signed ……..
(signature of duly authorized official)

Place .....

Date (dd/mm/yyyy) .....

(seal or stamp of the authority, as appropriate)

Annual Survey 3

Signed ……..
(signature of duly authorized official)

Place .....

Date (dd/mm/yyyy) .....

(seal or stamp of the authority, as appropriate)

Annual Survey 4

Signed ……..
(signature of duly authorized official)

Place .....

Date (dd/mm/yyyy) .....

(seal or stamp of the authority, as appropriate)

Annual Survey n*

* Add as appropriate

APPENDIX 2

CH_4 AND N_2O u_{GAS} AND w_{GAS} VALUES

1 For the calculation of the exhaust gas mass flow rates in paragraph 4.11.1, u_{gas} values for CH_4 and / or N_2O, as required, should be calculated using table 5 of the NTC 2008 as extended by the following:

Gas		HC	CH_4	N_2O
ρ_{gas} kg/m^3		*	0.716	1.9631
	ρ_e†	Coefficient u_{gas}‡		
Liquid fuel**	1.2943	0.000479	0.000553	0.001517
Rapeseed Methyl Ester	1.2950	0.000536	0.000553	0.001516
Methanol	1.2610	0.001133	0.000568	0.001557
Ethanol	1.2757	0.000805	0.000561	0.001539
Natural gas	1.2661	0.000558*	0.000565	0.001551
Propane	1.2805	0.000512	0.000559	0.001533
Butane	1.2832	0.000505	0.000558	0.001530

In the case of dual-fuel operation, the u_{gas} value to be used should be determined from the values given above proportioned according to the respective fuel mass ratio.

* in the case of HC emissions when using natural gas as the fuel, the given u_{gas} value of 0.000558 should be used for NMHC on the basis of CH2.93. For total HC, the u_{gas} of CH_4 should be used.

2 For the calculation of the exhaust gas volume flow rate at reference conditions (Nm^3/h) in 4.11.1, w_{gas} values for CH_4 and / or N_2O, as required, should be calculated using table 5 of the NTC 2008 as extended by the following:

Gas		**HC**	**CH_4**	**N_2O**
ρ_{gas} kg/m^3		*	0.716	1.9631
	ρ_e†	Coefficient w_{gas}‡		
Liquid fuel**	1.2943	0.000620	0.000716	0.001964
Rapeseed Methyl Ester	1.2950	0.000694	0.000716	0.001964
Methanol	1.2610	0.001429	0.000716	0.001964
Ethanol	1.2757	0.001027	0.000716	0.001964

Gas		HC	CH_4	N_2O
ρ_{gas} kg/m^3		*	0.716	1.9631
Natural gas	1.2661	0.000706*	0.000716	0.001964
Propane	1.2805	0.000656	0.000716	0.001964
Butane	1.2832	0.000648	0.000716	0.001964

In the case of dual-fuel operation, the w_{gas} value to be used should be determined from the values given above proportioned according to the respective fuel mass ratio.

* in the case of HC emissions when using natural gas as the fuel, the given w_{gas} value of 0.000706 should be used for NMHC on the basis of CH2.93. For total HC, the w_{gas} of CH_4 should be used.

APPENDIX 3

CH_4 ANALYSER AND N_2O ANALYSER INTERFERENCE CHECKS

1 The interference should be checked prior to the first use of an analyser and after major servicing or updating of software.

2 In those cases where the analyser applies compensation algorithms which use as inputs the concentrations of other measured gases those measurements should be undertaken concurrently with this verification check.

3 For NDIR or NDUV - The potential for cross interferences effects of CO, CO_2, H_2O, CH_4 and SO_2 as applicable should be checked.

3.1 Apart from H_2O the interference species are dependent on the selected N_2O absorption band used by the device which should be known. From that knowledge good engineering judgement should be used to determine the interference gases to be used based on those which may be expected to be present in the exhaust gases to be measured.

4 For FTIR or LIA – The interference gases depend on the selected CH_4 or N_2O absorption band used by the device which should be known. Based on that knowledge, good engineering judgement should be used to determine the interference gases to be used.

5 The combined effect of the interference gases should not be more than 2% of the measured range or 2 ppm, whichever is the greater.

6 Verification procedure:

.1 the concentrations of the interference span gases as identified from paragraphs 3 or 4 of this appendix should be at least as high as the maximum values to be encountered in service. Those interference gases may be presented in the form of a multi-component span gas;

.2 the CH_4 or N_2O analyser is started, operated, zeroed and spanned as in service;

.3 humified interference test gas should be fed into the analyser. That test gas should be generated by bubbling the multi-component span gas through distilled H_2O in a sealed container. If the sample is not treated by a dryer the container temperature should be controlled to generate a H_2O concentration at least as high as the expected maximum when in service. If the sample is treated by a dryer the container temperature should be controlled to generate a H_2O concentration at least as high as the expected maximum based on the dryer outlet temperature when in service;

.4 the water mole fraction of the test gas should be determined from measurements taken as close as possible to the analyser inlet. Those measurements may be dew point and absolute pressure;

.5 condensation in the piping leading from the container generating the humidified test gas to the analyser should be minimized by maintaining an adequate minimum temperature; and

.6 following stabilization, the analyser output should be recorded for 30 seconds. The arithmetic mean response over that period should be compared with the limit in paragraph 5 of this appendix.

7 As an alternative to the multi-component span gas in paragraph 6 of this appendix, individual span gases may be run separately. In either case, where an interference gas concentration is higher than that to be measured in service the determined interference value should be scaled down by the ratio of in-service maximum / span concentration. Where the H_2O concentration is below that to be measured in service, but not below 0.025 % H_2O content, the determined interference may be scaled up by the ratio of maximum in-service value / the value used. The sum of the individual interferences should be compared with the limit in paragraph 5 of this appendix.

8 An interference verification check report documenting the procedure as followed, including the rational for the interference gases used and their concentrations, and the outcomes of that procedure is to be prepared and should be included in the CEMS record book.

9 Alternative approaches to the verification of CH_4 or N_2O analyser interference may be accepted if agreed to by the Administration. Where so used the justification for the approach taken should be included in the report as required by paragraph 8 of this appendix. Irrespective of the procedure followed, the limit given by paragraph 5 of this appendix remains applicable.

APPENDIX 4

EFFICIENCY OF THE NON-METHANE CUTTER (NMC)

1 The NMC is used for the removal of the non-methane hydrocarbons from the sample gas by oxidizing all hydrocarbons except CH_4. Ideally, the conversion rate for CH_4 is 0% and for the other hydrocarbons, as represented by ethane, C_2H_6, is 100%. Since a NMC may fail or performance deteriorate rapidly and without warning if operated outside certain ranges of gas concentrations and temperature ranges, the efficiency of the NMC should be checked as frequently as necessary to confirm that the requirements of paragraph 2 of this appendix are met. With the agreement of the Administration, alternative approaches to the assessment of NMC efficiency may be accepted.

2 Methane efficiency should not be more than 15%. Ethane efficiency should be at least 98%.

NMC methane efficiency

3 Methane calibration gas at a concentration typical of that to be measured is flowed through the FID analyser with and without the NMC bypassed. The methane efficiency, E_m, is determined as:

$$E_m = 1 - \frac{c_M\ (wCutter)}{c_M\ (w/oCutter)}$$

where:

$c_M\ (wCutter)$ HC concentration with CH_4 flowing through the NMC (ppmC1)

$c_M\ (w/oCutter)$ HC concentration with CH_4 bypassing NMC (ppmC1)

NMC ethane efficiency

4 Ethane calibration gas at a concentration typical of the expected non-methane hydrocarbon concentration to be measured is flowed through the FID analyser with and without the NMC bypassed. The ethane efficiency, E_e, is determined as:

$$E_e = 1 - \frac{c_E\ (wCutter)}{c_E\ (w/oCutter)}$$

where:

$c_E\ (wCutter)$ HC concentration with C_2H_6 flowing through the NMC (ppmC1)

$c_E\ (w/oCutter)$ HC concentration with C_2H_6 bypassing NMC (ppmC1)

APPENDIX 5

GUIDANCE ON THE INSTALLATION REQUIREMENTS FOR DEVICES TO MEASURE EXHAUST GAS VELOCITY

1 The determination of exhaust gas flow via direct measurement of mean exhaust gas velocity for an installed marine diesel engine is complex, owing to the fluid dynamic behaviour of that exhaust gas and the arrangement of the typical exhaust duct and associated devices such as exhaust gas boilers and silencers. Consequently, particular care should be taken to avoid errors in the measurement of that velocity across the load range – see paragraph 5.5.2.1 of the NTC 2008.

Objective definition

2 Prior to selecting a monitoring methodology, the objective of the direct measurement should be clearly communicated to the potential providers of the velocity measurement device in order to ensure methodological alignment.

3 A particular point to note is that for gases the viscosity increases as temperature increases, the converse to that experienced with liquids, hence the resulting flow profile in the engine's exhaust duct will alter over the engine's load range as the uptake exhaust gas temperature changes. A further point on this is where there are exhaust duct connections, such as wastegates / bypasses feeding in, or equipment such as exhaust gas boilers, extracting heat from the exhaust gas stream, a significant range of different exhaust gas temperatures can be encountered at the point of measurement for the same nominal engine load, noting additionally that where if engine can operate with a highly variable torque / speed profile, that in itself will be a another complicating factor.

4 Furthermore, if the device is to measure velocity when operating in both liquid only and dual-fuel modes there will be different exhaust gas compositions and hence densities.

Measurement requirements

5 Direct measurement of the mean velocity of the exhaust gas stream necessitates the following core components:

.1 preliminary investigation of the exhaust gas flow profiles across the engine's operating load range should be conducted either through validated in situ measurements or computational fluid dynamics (CFD) simulations, taking into account expected ranges of operating conditions and exhaust gas temperatures to be encountered; and

.2 mean velocity measurement at the designated sampling location.

6 Mean velocity may be derived from a series of point velocity measurements across the measurement plane or through alternative validated techniques. Measurement points should be distributed to represent regions of equal cross-sectional area. The selected measurement plane needs to be representative of the duct's volumetric flow rate and located in a region exhibiting uniform and stable flow characteristics.

APPENDIX 6

GUIDANCE ON THE DEVELOPMENT OF THE SCREENING AND REVIEW PROCEDURES AS REQUIRED BY SECTIONS 4.4 AND 4.12

1 The user of a CEMS as covered by these Guidelines should ensure, in accordance with section 4.12, that the intermediate calculated values and output data, as retained on the data recording device and as submitted to the Administration are, to the extent possible, correct. To that end, these Guidelines also require, in section 4.4, that the measured and input data is screened prior to use in the relevant calculation procedures as included in the CEMS file.

2 As given by these Guidelines, there are performance requirements in respect of the various measurement devices which should be met, in part that is demonstrated by the periodic checking or calibration of those devices. However, such devices may be subject to malfunction in service either as a result of problems with the measurement device itself or other factors such as its mounting or the transmission of the output signal. Similarly, input data may not have been correctly determined or could be subject to transcription errors through the reporting and entry processes.

3 Consequently, the CEMS file includes procedures which cover the screening (6.1.6.2) and review (6.1.6.6) activities. The particular nature and performance of these activities will depend on individual company processes and quality management procedures and hence it is not the intent of these Guidelines to detail such. Instead, the guidance as provided by this appendix is intended to assist users of CEMS in developing their particular procedures.

4 In this, there would be seen to be the:

.1 **initial data**, i.e. the data that is available and has been collected during commissioning of both the engine and the CEMS together with its supporting systems; and

.2 **ongoing data**, i.e. the data that is collected with the CEMS running.

5 In either case the same core point applies – if nothing changes the inputs, the outputs equally do not change. If there is a change in the outputs, is that level of change commensurate with the recorded changes to the inputs.

Initial data

6 From the factory acceptance test (FAT) of an engine and basic engineering experience, there should be a set of data available, augmented by in-service engine-room data logging, in terms of such parameters as fuel rates, both liquid and gas, operating pressures and temperatures across the load range.

7 In terms of the emission values and exhaust gas flow rates across the load range, there will be the Parent Engine test report as included the engine's approved technical file. Where the engine in question was either the Parent Engine or is an identical Member Engine to that Parent Engine, then the emission values and exhaust flow rates as given in that report provide a starting point for the emission values to be encountered in service. In some instances, CH_4 will have been measured (ppm) and quantified, for example in terms of methane slip – being the % of the methane based gas fuel which was present in the exhaust gas stream. Where CH_4 was not previously measured there will nevertheless be the

hydrocarbons (HC) reading – which for an engine using a methane based gas fuel will not be higher than the CH_4 value. Of course, where the test report is in respect of the NO_x certification requirements, then the engine's rating and NO_x critical components, settings / operating values will have been that combination which resulted in the highest NO_x values – one aspect of which is that the engine would have been tested with the highest liquid/gas fuel ratio, whereas the lower the liquid/gas fuel ratio the likelihood is that HC and CH_4 emission would have been higher. Of course, where the engine in question is not identical in some way to the Parent Engine, such as rating, number of cylinders, then due allowance would need to be applied as to how the Parent Engine test values related to that engine.

8 However, it would be seen that at the commissioning of a CEMS, which of necessity should be with the engine in operation, would be the time at which the initial benchmark of all to be measured values would be established across the load range.

9 In terms of the input values, for example those from a fuel testing service, engineering knowledge and experience should be applied to the values as received – and as entered into the CEMS system – most notably as to whether the units of a reported value are those as used by the CEMS system or is conversion first necessary. Similarly for the default values – are they correct, and in the units as used by the CEMS?

10 From these initial measured and input / default values then benchmark intermediate and final values would be determined and verified, as part of the CEMS commissioning process, as being as expected.

Ongoing data

11 There will be changes in the measured values at or around any particular load point over time due to differing influencing conditions, and this information should be used to build on the initial data. However, for the measured values, these should alter gradually as those influencing factors such as differing fuel qualities, wear, ambient conditions change over time. Hence, if there are any major differences in measured values due to, for example, a different engine management package being used – in contrast if there is a major change in just one measured value, then that may be indicative of a sensor malfunction – not ignoring that more than one sensor could fail / malfunction at the same time (as a result of a voltage spike?).

12 Similarly for the intermediate calculated values and final output data, there will be evolving changes – hence if there are major changes, jumps, in those values why? As before, are these due, for example, to a change in the engine management package or have the units of a particular input value have been incorrectly entered.

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MEPC.1/Circ.795/Rev.10
18 June 2026

UNIFIED INTERPRETATIONS TO MARPOL ANNEX VI

1 The Marine Environment Protection Committee, at its eighty-fourth session (27 April to 1 May 2026), approved:

.1 a unified interpretation to regulation 13.2.3 of MARPOL Annex VI, as well as a revised unified interpretation of regulation 13.2.2 on "Time of replacement of an engine" to clarify the application date for a major conversion following the introduction of a NO_x emission control area which uses the three date criteria; and

.2 a revised unified interpretation to regulation 16.9 of MARPOL Annex VI on "Continuous-feed type shipboard incinerators" to clarify requirements for incinerator type approval testing.

2 The consolidated text of all existing unified interpretations to MARPOL Annex VI, including those set out in MEPC.1/Circ.795/Rev.9, is set out in the annex.

3 This revision reflects the text of regulations 2.1.14, 18.3, 18.3.2 and 18.5.1 of MARPOL Annex VI as amended by resolution MEPC.385(81).

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

5 This circular revokes MEPC.1/Circ.795/Rev.9.

***

ANNEX

UNIFIED INTERPRETATIONS TO MARPOL ANNEX VI

1 Definition of "heavy load carrier"

Regulation 2
Definitions

Regulation 2.2.15 reads as follows:

> "*General cargo ship* means a ship with a multi-deck or single-deck hull designed primarily for the carriage of general cargo. This definition excludes specialized dry cargo ships, which are not included in the calculation of reference lines for general cargo ships, namely livestock carrier, barge carrier, heavy load carrier, yacht carrier, nuclear fuel carrier."

***Interpretation*:**

1.1 The following are considered as a "heavy load carrier":

.1 heavy load deck carriers;[1]

.2 semi-submersible project cargo carriers;

.3 semi-submersible heavy load deck carriers (including dock lift ships);

.4 heavy lift multi-purpose ships (see paragraph 1.2 below);

.5 premium project carriers (see paragraph 1.2 below); and

.6 project cargo carriers (see paragraph 1.3 below).

1.2 Heavy lift multi-purpose ships and premium project carriers should fulfil the adapted criterion of "ships engaged in lifting operations" contained in regulation 2.3 of the International Code on Intact Stability, 2008 (2008 IS Code), as amended by resolution MSC.443(99), and comply as follows:

$$\text{SWL} \times \text{Outreach} \geq 0.67 \times \text{Displacement} \times (D - T) / B$$

where:

SWL = maximum safe working load of a crane of one single crane;

Outreach = outreach from the turning axis of the crane;

Displacement = displacement of vessel at draft T;

T = freeboard draft;

[1] Ships, which do not feature a cargo hold and carry project cargo on a flat deck; not fitted with cargo coamings/chutes/tippers.

B = moulded breadth of the vessel measured amidships at draft *T*;

D = depth for freeboard.

1.3 For project cargo carriers with or without cargo gear, the Administration may base its decision on a design and operation-specific application compiled by the owner/company.

2 Major conversion

Regulation 2
Definitions

Regulation 2.2.17 reads as follows:

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

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

.2 which changes the type of the ship; or

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

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

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

***Interpretation*:**

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

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

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

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

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

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

3 Definition of "new ship" for calculation of the required EEDI

Regulation 2
Definitions

Regulation 2.2.18 reads as follows:

"*New ship* means a ship:

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

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

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

***Interpretation*:**

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

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

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

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

3.2 With the above interpretations, the required EEDI of each phase is applied to the following new ship to which chapter 4 is applicable:

.1 the required EEDI of Phase 0 is applied to the following new ship, which falls into one of the categories defined in regulations 2.2.5, 2.2.7, 2.2.9, 2.2.14, 2.2.15, 2.2.22 and 2.2.29:

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

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

in the absence of a building contract:

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

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

.2 the required EEDI of Phase 1 is applied to the following new ship, which falls into one of the categories defined in regulations 2.2.5, 2.2.7, 2.2.9, 2.2.11, 2.2.14, 2.2.15, 2.2.16, 2.2.22, 2.2.26, 2.2.27, 2.2.28 and 2.2.29:

.1 for ship types where Phase 1 commences on 1 January 2015:

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

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

in the absence of a building contract:

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

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

.2 for ship types where Phase 1 commences on 1 September 2015:

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

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

in the absence of a building contract:

.3 the keel of which is laid or which is at a similar stage of construction on or after 1 March 2016 and before 1 July 2020, and the delivery is before 1 January 2024; or

.4 the keel of which is laid or which is at a similar stage of construction before 1 March 2016, and the delivery is on or after 1 September 2019 and before 1 January 2024;

.3 the required EEDI of Phase 2 is applied to the following new ship, which falls into one of the categories defined in regulations 2.2.5, 2.2.7, 2.2.9, 2.2.11, 2.2.14, 2.2.15, 2.2.16, 2.2.22, 2.2.26, 2.2.27, 2.2.28, and 2.2.29:

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

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

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

in the absence of a building contract:

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

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

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

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

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

in the absence of a building contract:

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

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

.4 the required EEDI of Phase 3 is applied to the following new ship, which falls into one of the categories defined in regulations 2.2.5, 2.2.7, 2.2.9, 2.2.11, 2.2.14, 2.2.15, 2.2.16, 2.2.22, 2.2.26, 2.2.27, 2.2.28 and 2.2.29:

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

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

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

in the absence of a building contract:

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

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

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

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

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

in the absence of a building contract:

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

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

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

Regulation 2
Definitions

Regulation 2.2.22 reads as follows:

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

***Interpretation*:**

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

5 Timing for existing ships to have a SEEMP on board

Regulation 5
Surveys

Regulation 5.4.4 reads as follows:

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

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

Regulation 6.4 reads as follows:

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

Regulation 26
Ship Energy Efficiency Management Plan (SEEMP)

Regulation 26.1 reads as follows:

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

***Interpretation*:**

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

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

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

5.4 The intermediate or renewal survey referenced in paragraph 5.3 relates solely to the timing of the verification of the SEEMP on board, i.e. these IAPP Certificate survey windows will also become the IEEC initial survey date for existing ships. The SEEMP is, however, a survey item solely under chapter 4 and is not a survey item relating to IAPP Certificate surveys.

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

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

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

6 Confirmation of compliance for new ships

Regulation 5
Surveys

Regulation 5.4.5 reads as follows:

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

Regulation 26
Ship Energy Efficiency Management Plan (SEEMP)

Regulation 26.2 reads as follows:

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

Interpretation:

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

7 Section 2.3 of the supplement to the IAPP Certificate

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

Regulation 8.1 reads as follows:

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

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

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

> "2.3 Sulphur oxides (SO_x) and particulate matter (regulation 14).
>
> 2.3.1 When the ship operates outside of an emission control area specified in regulation 14.3, the ship uses:

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

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

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

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

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

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

***Interpretation*:**

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

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

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

Regulation 8.3 reads as follows:

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

Interpretation:

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

9 Identical replacement engines

Regulation 13
Nitrogen oxides (NO_x)

Regulation 13.1.1.2 reads as follows:

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

Regulation 13.2.2 reads as follows:

> "For a major conversion involving the replacement of a marine diesel engine with a non-identical marine diesel engine, or the installation of an additional marine diesel engine, the standards in this regulation at the time of the replacement or addition of the engine shall apply. For the purpose of this regulation, the installation of a marine diesel engine replacing a steam system shall be considered a replacement engine. In the case of replacement engines only, if it is not possible for such a replacement engine to meet the standards set forth in paragraph 5.1.1 of this regulation (Tier III, as applicable), then that replacement engine shall meet the standards set forth in paragraph 4 of this regulation (Tier II), taking into account the guidelines developed by the Organization. The Administration shall notify the Organization in those instances where a Tier II rather than a Tier III replacement engine has been installed on or after 1 August 2025 in accordance with the provisions of this paragraph."

Interpretation:

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

9.2 An "identical engine" is, as compared to the engine being replaced,[2] an engine which is of the same:

.1 design and model;

.2 rated power;

.3 rated speed;

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

.4 use;

.5 number of cylinders; and

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

.1 for engines without EIAPP certification, have the same NO_x critical components and settings;[3] or

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

10 Time of replacement of an engine

Regulation 13
Nitrogen oxides (NO_x)

Regulation 13.2.2 reads as follows:

> "For a major conversion involving the replacement of a marine diesel engine with a non-identical marine diesel engine, or the installation of an additional marine diesel engine, the standards in this regulation at the time of the replacement or addition of the engine shall apply. For the purpose of this regulation, the installation of a marine diesel engine replacing a steam system shall be considered a replacement engine. In the case of replacement engines only, if it is not possible for such a replacement engine to meet the standards set forth in paragraph 5.1.1 of this regulation (Tier III, as applicable), then that replacement engine shall meet the standards set forth in paragraph 4 of this regulation (Tier II), taking into account the guidelines developed by the Organization. The Administration shall notify the Organization in those instances where a Tier II rather than a Tier III replacement engine has been installed on or after 1 August 2025 in accordance with the provisions of this paragraph."

Interpretation:

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

.1 the contractual delivery date of the engine to the ship;[4] or

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

Fuel system:

.1 fuel pump model and injection timing; and

.2 injection nozzle model.

Charge air:

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

.2 cooling medium (seawater/freshwater).

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

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

.3 in the event the engine is fitted on board and tested for its intended purpose on or after six months from the date[5] specified in sub-paragraphs of regulations 13.5.1.2 or 13.5.1.3, as appropriate, the actual date that the engine is tested on board for its intended purpose applies in determining the standards in this regulation in force at the time of the replacement or addition of the engine.

10.2 Entry of the date in paragraph 10.1 above, provided the conditions associated with those dates apply, should be made in item 8.a "Major conversion – According to regulations 13.2.1.1 and 13.2.2" of the Supplement of IAPP Certificate.

10.3 If the engine is not tested within six months after the date[5] specified in the sub-paragraphs of regulations 13.5.1.2 or 13.5.1.3, as appropriate, owing to unforeseen circumstances beyond the control of the shipowner, then the provisions of "unforeseen delay in delivery" may be considered by the Administration in a manner similar to UI4 of MARPOL Annex I.

11 Application dates for major conversion using the criteria based on "three dates"

Regulation 13
Nitrogen oxides (NO_x)

Regulation 13.2.3 reads as follows:

"A marine diesel engine referred to in paragraph 2.1.2 or 2.1.3 of this regulation shall meet the following standards:

.1 for a ship constructed prior to 1 January 2000, the standards set forth in paragraph 3 of this regulation shall apply; and

.2 for a ship constructed on or after 1 January 2000, the standards in force at the time the ship was constructed shall apply."

Interpretation:

For the application of regulation 13.2.3.2:

For a ship constructed on or after 1 March 2026 and operating in the Norwegian Sea Emission Control Area defined in regulation 13.5.1.2.3 or for a ship constructed on or after 1 January 2027 and operating in the North-East Atlantic Emission Control Area defined in regulation 13.5.1.3.2, the three dates application criteria based on the building contract date, or in absence of a building contract the keel laying date, or the delivery date should be used to determine "the time the ship was constructed", without prejudice to the definition of "ship constructed" as set out in regulation 2.1.28.

[5] For an emission control area using the three dates application criteria based on the building contract date, or the keel laying date, or the delivery date, the date referred to in paragraph 10.1.3 and 10.3 is the building contract date or the keel laying date as applicable.

12 Engine change-over/on-off recording requirements

Regulation 13
Nitrogen oxides (NO_x)

Regulation 13.5.3 reads as follows:

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

Interpretation:

For the application of this regulation:

.1 "marine diesel engines installed on board a ship to which paragraph 5.1 of this regulation applies" includes additional or replaced engines;[6] installed on or after the relevant emission control area takes effect;

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

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

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

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

13 Application of the sulphur limit to emergency equipment

Regulation 14
Sulphur oxides (SO_x) and particulate matter

Regulation 14.1 reads as follows:

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

[6] Additional or replaced engine: refer to section 10.1 above.

Interpretation:

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

14 VOC management plan

Regulation 15
Volatile organic compounds (VOCs)

Regulations 15.6 and 15.7 read as follows:

> "6 A tanker carrying crude oil shall have on board and implement a VOC management plan approved by the Administration. Such a plan shall be prepared taking into account the guidelines developed by the Organization. The plan shall be specific to each ship and shall at least:
>
> .1 provide written procedures for minimizing VOC emissions during the loading, sea passage and discharge of cargo;
>
> .2 give consideration to the additional VOC generated by crude oil washing;
>
> .3 identify a person responsible for implementing the plan; and
>
> .4 for ships on international voyages, be written in the working language of the master and officers and, if the working language of the master and officers is not English, French or Spanish, include a translation into one of these languages.
>
> 7 This regulation shall also apply to gas carriers only if the types of loading and containment systems allow safe retention of non-methane VOCs on board or their safe return ashore.[7] "

***Interpretation*:**

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

15 Continuous-feed type shipboard incinerators

Regulation 16
Shipboard incineration

Regulation 16.9 reads as follows:

> "For incinerators installed in accordance with the requirements of paragraph 6.1 of this regulation the combustion chamber gas outlet temperature shall be monitored at all times the unit is in operation. Where that incinerator is of the continuous-feed type, waste shall not be fed into the unit when the combustion chamber gas outlet temperature is below 850°C. Where that incinerator is of the batch-loaded type, the unit shall be designed so that the combustion chamber gas outlet temperature

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

shall reach 600°C within five minutes after start-up and will thereafter stabilize at a temperature not less than 850°C."

***Interpretation*:**

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

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

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

Batch loaded incinerators should be designed so that the temperature in the actual combustion space where the solid waste is combusted should reach 600°C within five minutes after start-up. This is a design requirement to be verified during type approval testing only. The onboard monitoring of combustion chamber flue gas outlet temperature is intended for safe operation and continuous compliance and should not be used for verification of this design requirement.

16 Application of regulation 18.3 for biofuel and synthetic fuel

Regulation 18
Fuel oil availability and quality

Regulation 18.3 reads as follows:

"Fuel oil delivered to and used on board a ship to which this Annex applies shall meet the following requirements."

Interpretation:

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

Regulation 18.3.2.2 reads as follows:

"fuel oil derived by methods other than petroleum refining shall not (…) cause an engine to exceed the applicable NO_x emission limit set forth in paragraphs 3, 4, 5.1.1 and 7.4 of regulation 13."

Interpretation:

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

16.3 Where fuel oils are derived from methods other than petroleum refining, or fuel oil which is a blend of more than 30% by volume of biofuel or synthetic fuel and does not fall under 15.2 of this unified interpretation, or other fuels required to undertake the assessment as given by regulation 18.3.2.2 of MARPOL Annex VI and for which have not been specifically certified in accordance with the regulation 13 limits at test bed for that specific fuel and Engine Group/Family, the following is interpreted as an acceptable route to demonstrate compliance with regulation 18.3.2.2:

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

17 Applicability of the requirements for a bunker delivery note (BDN)

Regulation 18
Fuel oil availability and quality

Regulation 18.5.1 reads as follows:

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

Regulation 18.6 reads as follows:

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

Interpretation:

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

17.2 The bunker delivery note (BDN) required by regulation 18.5.1 is acceptable in either hard copy or electronic format provided it contains at least the information specified in appendix V to MARPOL Annex VI and is retained and made available on board in accordance with regulation 18.6. In addition, an electronic BDN should be protected from edits, modifications or revisions, and authentication should be possible by a verification method such as a tracking number, watermark, date and time stamp, QR code, GPS coordinates or other verification methods.

18 Requirements for reporting attained EEDI and relevant information

Regulation 22
Attained Energy Efficiency Design Index (attained EEDI)

Regulation 22.3 reads as follows:

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

Interpretation:

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

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

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

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

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

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

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

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

19 Ship Energy Efficiency Management Plan (SEEMP) Part III

Regulation 26
Ship Energy Efficiency Management Plan (SEEMP)

Regulation 26.3.1 reads as follows:

"In the case of a ship of 5,000 gross tonnage and above, which falls into one or more of the categories in regulations 2.2.5, 2.2.7, 2.2.9, 2.2.11, 2.2.14 to 2.2.16, 2.2.22, and 2.2.26 to 2.2.29 of this Annex:

.1 On or before 1 January 2023, the SEEMP shall include:

.1 a description of the methodology that will be used to calculate the ship's attained annual operational CII required by regulation 28 of this Annex and the processes that will be used to report this value to the ship's Administration;

.2 the required annual operational CII, as specified in regulation 28 of this Annex, for the next three years;

.3 an implementation plan documenting how the required annual operational CII will be achieved during the next three years; and

.4 a procedure for self-evaluation and improvement."

Interpretation:

19.1 A ship delivered after 1 January 2023 should comply with regulation 26.3.1 of MARPOL Annex VI at delivery. If delivered on 1 October or later, the following year will then be the first year of the three-year implementation plan and an inferior rating given, in accordance with regulation 28.6 of MARPOL Annex VI, for the remainder of the calendar year of delivery needs not to be counted in for the determination of whether the ship should develop a Corrective Action Plan required by regulation 26.3.2 of MARPOL Annex VI.

Nothing in this interpretation relieves any ship of its reporting obligations under regulations 27 and 28 of MARPOL Annex VI.

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

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

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

20 Boil-off gas consumed on board ships

Regulation 2
Definitions

Regulation 2.1.14 reads as follows:

> "*Fuel oil* means any fuel delivered to and intended for use on board a ship."

Regulation 27
Collection and reporting of ship fuel oil consumption data

Regulation 27.1 reads as follows:

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

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

Appendix IX reads as follows:

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

Interpretation:

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

21 Access to the disaggregated data

Regulation 27
Collection and reporting of ship fuel oil consumption data

Regulation 27.8 reads as follows:

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

Interpretation:

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

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

Regulation 28
Operational carbon intensity

Regulation 28.7 reads as follows:

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

Regulation 28.9 reads as follows:

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

Interpretation:

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