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| --- |
| **SHIP ENERGY EFFICIENCY MANAGEMENT (SEEMP) PLAN PART II** |
|  |
| **In accordance with Resolution MEPC.282(70)**  **Profile view of the ship** |
|  |
| **COMPANY NAME**  Address line 1  Address line 2  Telephone Number  Fax Number  E-Mail |
|  |

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# REVISION HISTORY

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Rev.No. | Date | Reason for Issue | Prepared by (Name and Company Name) | Verified by | Approved by |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
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|  |  |  |  |  |  |

# GENERAL

Regulation 22.2 of MARPOL Annex VI specifies that, "On or before 31 December 2018, in the case of a ship of 5,000 gross tonnage and above, the SEEMP shall include a description of the methodology that will be used to collect the data required by regulation 22A.1 of this Annex and the processes that will be used to report the data to TL." Part II of the SEEMP, the Ship Fuel Oil Consumption Data Collection Plan (hereinafter referred to as "Data Collection Plan") contains such methodology and processes.

With respect to part II of the SEEMP, this document provide guidance for developing a ship-specific method to collect, aggregate, and report ship data with regard to annual fuel oil consumption, distance travelled, hours underway and other data required by regulation 22A of MARPOL Annex VI to be reported to TL.

Pursuant to regulation 5.4.5 of MARPOL Annex VI, TL should ensure that each ship's SEEMP complies with regulation 22.2 of MARPOL Annex VI prior to collecting any data.

# GUIDANCE ON METHODOLOGY FOR COLLECTING DATA ON FUEL OIL CONSUMPTION, DISTANCE TRAVELLED AND HOURS UNDERWAY

**Fuel oil consumption** *(Regulation 2.9 of MARPOL Annex VI defines "fuel oil" as "fuel oil means any fuel delivered to and intended for combustion purposes for propulsion or operation on board a ship, including gas, distillate and residual fuels.")*

Fuel oil consumption should include all the fuel oil consumed on board including but not limited to the fuel oil consumed by the main engines, auxiliary engines, gas turbines, boilers and inert gas generator, for each type of fuel oil consumed, regardless of whether a ship is underway or not. Methods for collecting data on annual fuel oil consumption in metric tonnes include (in no particular order):

1. method using bunker delivery notes (BDNs):

This method determines the annual total amount of fuel oil used based on BDNs, which are required for fuel oil for combustion purposes delivered to and used on board a ship in accordance with regulation 18 of MARPOL Annex VI; BDNs are required to be retained on board for three years after the fuel oil has been delivered. The Data Collection Plan should set out how the ship will operationalize the summation of BDN information and conduct tank readings. The main components of this approach are as follows:

* annual fuel oil consumption would be the total mass of fuel oil used on board the vessel as reflected in the BDNs. In this method, the BDN fuel oil quantities would be used to determine the annual total mass of fuel oil consumption, plus the amount of fuel oil left over from the last calendar year period and less the amount of fuel oil carried over to the next calendar year period;
* to determine the difference between the amount of remaining tank oil before and after the period, the tank reading should be carried out at the beginning and the end of the period;
* in the case of a voyage that extends across the data reporting period, the tank reading should occur by tank monitoring at the ports of departure and arrival of the voyage and by statistical methods such as rolling average using voyage days;
* fuel oil tank readings should be carried out by appropriate methods such as automated systems, soundings and dip tapes. The method for tank readings should be specified in the Data Collection Plan;
* the amount of any fuel oil offloaded should be subtracted from the fuel oil consumption of that reporting period. This amount should be based on the records of the ship's oil record book; and
* any supplemental data used for closing identified difference in bunker quantity should be supported with documentary evidence;

1. method using flow meters:

This method determines the annual total amount of fuel oil consumption by measuring fuel oil flows on board by using flow meters. In case of the breakdown of flow meters, manual tank readings or other alternative methods will be conducted instead. The Data Collection Plan should set out information about the ship's flow meters and how the data will be collected and summarized, as well as how necessary tank readings should be conducted:

* annual fuel oil consumption may be the sum of daily fuel oil consumption data of all relevant fuel oil consuming processes on board measured by flow meters;
* the flow meters applied to monitoring should be located so as to measure all fuel oil consumption on board. The flow meters and their link to specific fuel oil consumers should be described in the Data Collection Plan;
* note that it should not be necessary to correct this fuel oil measurement method for sludge if the flow meter is installed after the daily tank as sludge will be removed from the fuel oil prior to the daily tank;
* the flow meters applied to monitoring fuel oil flow should be identified in the Data Collection Plan. Any consumer not monitored with a flow meter should be clearly identified, and an alternative fuel oil consumption measurement method should be included; and
* calibration of the flow meters should be specified. Calibration and maintenance records should be available on board;

1. method using bunker fuel oil tank monitoring on board:

* to determine the annual fuel oil consumption, the amount of daily fuel oil consumption data measured by tank readings which are carried out by appropriate methods such as automated systems, soundings and dip tapes will be aggregated. The tank readings will normally occur daily when the ship is at sea and each time the ship is bunkering or de-bunkering; and
* the summary of monitoring data containing records of measured fuel oil consumption should be available on board.

Any corrections, e.g. density, temperature, if applied, should be documented. *(For example, ISO 8217 provides a method for liquid fuel. )*

**Conversion factor CF**

If fuel oils are used that do not fall into one of the categories as described in the *2014 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships* (resolution MEPC.245(66)), as amended, and have no CF-factor assigned (e.g. some "hybrid fuel oils"), the fuel oil supplier should provide a CF-factor for the respective product supported by documentary evidence.

**Distance travelled**

Appendix IX of MARPOL Annex VI specifies that distance travelled should be submitted to TL and:

* distance travelled over ground in nautical miles should be recorded in the log-book in accordance with SOLAS regulation V/28.1 *(Distance travelled measured using satellite data is distance travelled over the ground.)*
* the distance travelled while the ship is underway under its own propulsion should be included into the aggregated data of distance travelled for the calendar year; and
* other methods to measure distance travelled accepted by TL may be applied. In any case, the method applied should be described in detail in the Data Collection Plan.

**Hours underway**

Appendix IX of MARPOL Annex VI specifies that hours underway should be submitted to TL. Hours underway should be an aggregated duration while the ship is underway under its own propulsion.

**Data quality**

The Data Collection Plan should include data quality control measures which should be incorporated into the existing shipboard safety management system. Additional measures to be considered could include:

* the procedure for identification of data gaps and correction thereof; and
* the procedure to address data gaps if monitoring data is missing, for example, flow meter malfunctions.

**A standardized data reporting format**

Regulation 22A.3 of MARPOL Annex VI states that the data specified in appendix IX of the Annex are to be communicated electronically using a standardized form developed by the Organization. The collected data should be reported to TL in the standardized format shown in appendix 2.

# DIRECT CO2 EMISSIONS MEASUREMENT

Direct CO2 emission measurement is not required by regulation 22A of MARPOL Annex VI. Direct CO2 emissions measurement, if used, should be carried out as follows:

* this method is based on the determination of CO2 emission flows in exhaust gas stacks by multiplying the CO2 concentration of the exhaust gas with the exhaust gas flow. In case of the absence or/and breakdown of direct CO2 emissions measurement equipment, manual tank readings will be conducted instead;
* the direct CO2 emissions measurement equipment applied to monitoring is located exhaustively so as to measure all CO2 emissions in the ship. The locations of all equipment applied are described in this monitoring plan; and
* calibration of the CO2 emissions measurement equipment should be specified. Calibration and maintenance records should be available on board.

# APPENDIX 1 – SHIP FUEL OIL CONSUMPTION DATA COLLECTION PLAN

1. **Ship Particulars**

|  |  |
| --- | --- |
| Name of ship |  |
| IMO number |  |
| Company |  |
| Flag |  |
| Ship Type |  |
| Gross Tonnage |  |
| NT |  |
| DWT |  |
| EEDI (if applicable) |  |
| Ice class |  |

1. **Record of revision of Fuel Oil Consumption Data Collection Plan**

|  |  |
| --- | --- |
| Date of revision | Revised Provision |
|  |  |
|  |  |

1. **Ship engines and other fuel oil consumers and fuel oil types used**

|  |  |  |  |
| --- | --- | --- | --- |
| No | Engines or other fuel oil consumers | Power | Fuel oil types |
| 1 | Type/model of main engine | (kW) |  |
| 2 | Type/model of auxiliary engine | (kW) |  |
| 3 | Boiler | (…) |  |
| 4 | Inert gas generator | (…) |  |

1. **Emission factor**

*CF* is a non-dimensional conversion factor between fuel oil consumption and CO2 emission in the *2014 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships* (resolution MEPC.245(66)), as amended. The annual total amount of CO2 is calculated by multiplying annual fuel oil consumption and *CF* for the type of fuel.

|  |  |  |
| --- | --- | --- |
| Fuel oil Type | |  | | --- | | *CF*  (t-CO2 / t-Fuel) | |
| Diesel/Gas oil (e.g. ISO 8217 grades DMX through DMB) | 3.206 |
| Light fuel oil (LFO) (e.g. ISO 8217 grades RMA through RMD) | 3.151 |
| Heavy fuel oil (HFO) (e.g. ISO 8217 grades RME through RMK) | 3.114 |
| Liquefied petroleum gas (LPG) (Propane) | 3.000 |
| Liquefied petroleum gas (LPG) (Butane) | 3.030 |
| Liquefied natural gas (LNG) | 2.750 |
| Methanol | 1.375 |
| Ethanol | 1.913 |
| Other (………) |  |

1. **Method to measure fuel oil consumption**

The applied method for measurement for this ship is given below. The description explains the procedure for measuring data and calculating annual values, measurement equipment involved, etc.

|  |  |
| --- | --- |
| Method | Description |
| *Method 1:* *bunker delivery notes (BDNs) [Please modify acc.to company’s procedure] [Delete if N/A]*  *Method 2: flow meters [Please modify acc.to company’s procedure] [Delete if N/A]*  *Method 3: bunker fuel oil tank monitoring on board [Please modify acc.to company’s procedure] [Delete if N/A]* | *Taken soundings containing each type of fuel oil, received BDN’s records, bunker supply quantity recording, on-board measurement systems, the density measured by the fuel supplier at fuel uplift and recorded on the fuel invoice or BDN, the density measured in a test analysis conducted in an accredited fuel test laboratory, where available.*  *Annual fuel oil consumption to be the sum of daily fuel oil consumption data of all relevant fuel oil consuming processes on board measured by flow meters.* *Amount for each type of fuel consumed from previous daily report for each navigation condition (at sea, at berth, at anchoring) to be recorded. The amount to be calculated based on fuel flow meter as per; The following formula to be used:*  *(FOC measured by flow meter) [KL] × (density) [g/cm3] × (volume conversion factor) = FOC (MT)*  *The fuel sounding tapes are not used for the other purposes but fuel measuring. The sounding tapes are cleaned and kept in safe separately after each measurement. The thermometers are dismantled once the related tanks are free of charge, tested and reconnected in case found in good order. The electric pressure sensors are dismantled at each ship’s renewal survey period and calibrated* *to the authorised service.* |

1. **Method to measure distance travelled**

|  |
| --- |
| Description *[Please modify acc.to company’s procedure]* |
| *Data source is record in deck log book obtained from GPS or Paper chart.*  *The distance travelled is calculated by the two GPS aparatus on board or Paper Chart.Recording of distance traveled is done through gps and deck logbook which are reviewed by master. Both logbook entries are made in an hourly period. This information is recorded daily into the form and reported to the company by daily/arrival/departure reports by Master.* |

1. **Method to measure hours underway**

|  |
| --- |
| Description *[Please modify acc.to company’s procedure]* |
| *Time spend at sea is measured from (a) the date and time ship left the last berth of the port of departure to (b) the date and time ship is moored at the first berth of the port of arrival. Anchorage is excluded from time spent at sea*  *Drifting is included as part of time at sea*. |

1. **Processes that will be used to report the data to TL**

|  |
| --- |
| Description *[Please modify acc.to company’s procedure]* |
| *The vessel prepares “Voyage Status Log” based respectively on the Deck log book and Engine log book every day during the preparation of Daily Report. Fuel consumption and other relevant data is recorded manually on board. The vessel is reporting the data in the form daily to the office in standardized formats; the data is then stored, processed, and analyzed ashore. After the end of calender year, Company aggregates the data into annual value and reports the data to the Administration or RO for verification. In addition, the relevant underlying data will be exported to IT System established by Administration / RO for verification according to requirements.*  *Vessel Send Daily Report 🡪 Data is processed Voyage Status Log 🡪 Company Data quality control 🡪 Company Reporting for verification* |

1. **Data quality**

|  |
| --- |
| Description *[Please modify acc.to company’s procedure]* |
| *Internal reviews and validation of relevant data*  *This note will formalize all actions conducted by the related department with regards to the checks and the reviews applied to measurements related to fuel, time, and distance*  *Distance, time, fuel, time spent at sea* |

# APPENDIX 2 – STANDARDIZED DATA REPORTING FORMAT FOR THE DATA COLLECTION SYSTEM

**STANDARDIZED DATA REPORTING FORMAT FOR THE DATA COLLECTION SYSTEM**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Method used to measure fuel oil consumption9 | Fuel oil consumption (t) | | | | | | | | | | Hours underway (h) | Distance Travelled (nm) | Power output8 (rated power) (kW) | | Ice class7 (if applicable) | EEDI (if applicable)6 (gCO2/t.nm) | DWT5 | NT4 | Gross Tonnage3 | Ship type2 | IMO number1 | End date (dd/mm/yyyy) | Start date (dd/mm/yyyy) |
| (Cf ;…..) | Other(……….) | Ethanol  (Cf: 1.913) | Methanol  (Cf: 1.375) | LNG  (Cf: 2.750) | LPG (Butane) (Cf: 3.030) | LPG (Propane) (Cf: 3.000) | HFO  (Cf: 3.114) | LFO  (Cf: 3.151) | Diesel/Gas Oil (Cf: 3.206) | Auxiliary Engine(s) | Main Propulsion Power |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

*1 In accordance with the IMO Ship Identification Number Scheme, adopted by the Organization by resolution A.1078(28).*

*2 As defined in regulation 2 of MARPOL Annex VI or other (to be stated).*

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

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

*5 DWT means the difference in tonnes between the displacement of a ship in water of relative density of 1025 kg/m3 at the summer load draught and the lightweight of the ship. The summer load draught should be taken as the maximum summer draught as certified in the stability booklet approved by TL or an organization recognized by it.*

*6 EEDI should be calculated in accordance with the 2014 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships, as amended, adopted by resolution MEPC.245(66). If not applicable, note "N/A".*

*7 Ice class should be consistent with the definition set out in the International Code for ships operating in polar waters (Polar Code), adopted by resolutions MEPC.264(68) and MSC.385(94)). If not applicable, note "N/A".*

*8 Power output (rated power) of main and auxiliary reciprocating internal combustion engines over 130 kW (to be stated in kW). Rated power means the maximum continuous rated power as specified on the nameplate of the engine.*

*9 Method used to measure fuel oil consumption: 1: method using BDNs, 2: method using flow meters, 3: method using bunker fuel oil tank monitoring."*

# APPENDIX 3 – SAMPLE OF THE BDN SUMMARIES

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Date of Operations  (dd/mm/yyyy) | Fuel Oil Type/Mass(MT) | | | | | | | | Descriptions | | |
| DO/GO | LFO | HFO | LPG(P) | LPG(B) | LNG | Others(CF) |  | | |
| ① BDN | | | | | | | | | |
| 09/01/2019 |  |  |  |  |  |  |  |  | | |
| 02/05/2019 |  |  | 150 |  |  |  |  |  | | |
| 08/07/2019 |  |  |  |  |  |  |  |  | | |
| 09/10/2019 |  |  |  |  |  |  |  |  | | |
| 10/12/2019 |  |  | 300 |  |  |  |  |  | | |
| ①Annual Supply Amount | 0 | 0 | 450 | 0 | 0 | 0 | 0 |  | | |
| ② Correction for the tank oil remaining | | | | | | | | | |
| 01/01/2019 |  |  | 400 |  |  |  |  |  | | |
| 31/12/2019 |  |  | 200 |  |  |  |  |  | | |
| ②Correction for the tank oil remaining | 0 | 0 | 200 | 0 | 0 | 0 | 0 | The difference in the amount of the remaining tank oil at the beginning/end of the data collection period. | | |
| ③ Other corrections | | | | | | | | | |
| 30/03/2019 |  |  |  |  |  |  |  |  | | |
| 15/09/2019 |  |  |  |  |  |  |  |  | | |
| 31/12/2019 |  |  |  |  |  |  |  |  | | |
| ③Annual other corrections | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  | | |
| Annual Fuel Consumption | | | | | | | | | |
| Annual Fuel Consumption  (①+②+③) | 0 | 0 | 650 | 0 | 0 | 0 | 0 |  | | |

Explanatory remarks; If bunker supply/correction data have been recorded in a Company’s electronic reporting system, the data is acceptable to be submitted in the existing format instead of submitting the data by this format.

# APPENDIX 4 – SAMPLE OF THE COLLECTED DATA SUMMARIES

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Date from  (dd/mm/yyyy) | Date to\*  (dd/mm/yyyy) | Distance Travelled  (n.m) | Hours Underway  (hh:mm) | Fuel Consumption (Metric tons) | | | | | | |
| DO/GO | LFO | HFO | LPG(P) | LPG(B) | LNG | Others(CF) |
| 01/01/2019 |  | 210 | 24:00 | 2 | 3 | 19 | 0 | 0 | 0 | 0 |
| 02/01/2019 |  | 283 | 24:00 | 2 | 0 | 20 | 0 | 0 | 0 | 0 |
| 03/01/2019 |  | 321 | 24:00 | 2 | 0 | 18 | 0 | 0 | 0 | 0 |
| 04/01/2019 |  | 221 | 24:00 | 1 | 0 | 19 | 0 | 0 | 0 | 0 |
| 05/01/2019 |  | 320 | 18:00 | 2 | 0 | 13 | 0 | 0 | 0 | 0 |
| 06/01/2019 |  | 302 | 24:00 | 2 | 0 | 17 | 0 | 0 | 0 | 0 |
| 07/01/2019 |  | 210 | 24:00 | 1 | 0 | 19 | 0 | 0 | 0 | 0 |
| 08/01/2019 |  | 302 | 24:00 | 1 | 0 | 20 | 0 | 0 | 0 | 0 |
| 09/01/2019 |  | 280 | 24:00 | 2 | 0 | 21 | 0 | 0 | 0 | 0 |
| 10/01/2019 |  | 50 | 01:00 | 3 | 0 | 2 | 0 | 0 | 0 | 0 |
| 11/01/2019 |  | 198 | 24:00 | 3 | 0 | 21 | 0 | 0 | 0 | 0 |
| ・ |  | ・ | ・ | ・ | ・ | ・ | ・ | ・ | ・ | ・ |
| ・ |  | ・ | ・ | ・ | ・ | ・ | ・ | ・ | ・ | ・ |
| ・ |  | ・ | ・ | ・ | ・ | ・ | ・ | ・ | ・ | ・ |
| 30/12/2019 |  | 320 | 24:00 | 0 | 0 | 20 | 0 | 0 | 0 | 0 |
| 31/12/2019 |  | 213 | 24:00 | 1 | 0 | 17 | 0 | 0 | 0 | 0 |
| Annual Total | |  |  |  |  |  |  |  |  |  |

*\*In the case of daily underlying data, this column would be left in blank.*

*Explanatory remarks;*

*If the listed data in the format have been recorded in a Company’s electronic reporting system, the data is acceptable to be submitted in the existing format instead of submitting the data by this format.*