Ship Energy Efficiency Management Plan (SEEMP)

Part II - Ship Fuel Oil Consumption Data Collection Plan

(*** Shipping)

Name of Ship	
IMO NO.	

Ver. No	Date	History	Remark

This guidance was developed to assist in the preparation of the Ship Energy Efficiency Management Plan ("SEEMP") required by regulation 22 of MARPOL Annex VI and was prepared in accordance with Resolution MEPC.282 (70).

We have made every effort to ensure that the information contained in this guidance is accurate, but please note that there is possibility of unintended mistranslations and errors in the content, and the content in this plan should be written and modified to suit the actual situation of the ship.

1. Introduction

1.1 Background

With growing concerns of Environment, the International Maritime Organization (IMO), the main regulatory body for shipping, has developed technical and operational measures below in order to regulate shipping energy efficiency and thereby control the marine GHG emissions.

- Energy Efficiency Design Index (EEDI)
- Energy Efficiency Operational Index (EEOI)
- Ship Energy Efficiency Management Plan Part I & Part II (SEEMP)

SEEMP Part II (Ship Fuel Oil Consumption Data Collection System) applies to ships in the case of 5,000 gross tonnage and above. The SEEMP shall be amended to include data collection systems by 31 December 2018 as a result of the MEPC 70th session, and individual ships after 1 January 2019 shall be required to comply with the methodology specified in the SEEMP part II.

1.2 Purpose

This plan is designed to ensure that the International Maritime Organization has committed to full participation and implementation in the marine fuel consumption data collection system to be enacted in 2019, in order to improve the efficiency of the energy used in the activities of the ship, to reduce costs, to reduce GHG(green house gas) emissions and to protect the natural environment.

Also, this plan provides for the construction of a standard ship fuel consumption collection plan, which not only allows the workplace to prepare for the IMO international conventions, but also enables the best way to operate the ship energy efficiently.

1.3 Implementation

For the implementation of SEEMP, in general, shipping companies need to organize two groups: A Company Management Team and an Onboard Management Team.

Firstly, the Company Management Team will be responsible for developing the plan; assessing the appropriate measures to be introduced within the fleet; collecting the information from the fleet; and monitoring and assessing the effectiveness of those implemented measures.

Secondly, the Onboard Management Team, ship's crews, will be involved in applying selected energy saving measures into practice. In order to implement the SEEMP effectively, crew familiarization will be essential, but at the same time, the administrative burden to the crews should be kept to a minimum.

This plan should be written in the common language of the crew. If it is not English, French or Spanish, the plan must be translated into one of these languages.

1.4 Definition

(1) Ship fuel oil consumption data means the data required to be collected in annual basis and reported as specified in appendix IX to MARPOL Annex VI.

(2) Safety management system means a structured and documented system enabling company personnel to implement effectively the company safety and environmental protection policy.

(3) 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.

(4) Emission means any release of substances, subject to control by MARPOL Annex VI, from ships into the atmosphere or sea.

(5) Conversion Factor(Cf) means non-dimensional conversion factor between fuel oil consumption and CO2 emission.

(6) Voyage means the period between a departure from a port to the departure from the next port. Alternative definitions of a voyage could also be acceptable.

(7) Company means the owner of the ship or any other organization or person such as the manager, or the bareboat charterer, who has assumed the responsibility for operation of the ship from the owner of the ship and who on assuming such responsibility has agreed to take over all the duties and responsibilities imposed by the International Management Code for the Safe Operation of Ships and for Pollution Prevention, as amended.

(8) Calendar year means the period from 1 January until 31 December inclusive.

(9) Distance travelled means distance travelled over ground.

1.5 Relation between SEEMP Part I and Part II

There are two parts to a SEEMP. Part I provides a possible approach for monitoring ship and fleet efficiency performance over time and some options to be considered when seeking to optimize the performance of the ship. Part II provides the methodologies ships of 5,000 gross tonnage and above should use to collect the data required pursuant to regulation 22A of MARPOL Annex VI and the processes that the ship should use to report the data to the ship's Administration or any Organization duly authorized by it. Ultimately, GHG emissions can be calculated through Part II, and since this series of activities is closely related to the energy efficiency activities of Part I, it is essential to carry out activities to improve energy efficiency of Part I.

1.6 Fuel Consumption Data Collection Process

Ship	• Data collection methodology to be included in the ship's SEEMP. • Submits data to flag State or RO in accordance with regulation 22A.
Flag Administration	• Aggregates data and submits to IMO Secretariat. • Verifies the ship's SEEMP and the data reported complies with regulation 22A. • Issues SOC(Statement of Compliance) to the ship.
IMO Secretariat	• Aggregates all data submitted by flag States, ROs, and non-party ships.
Database	• Data will be anonymized to the extent that individual ships cannot be identified. • Access to anonymized data will be restricted to IMO Member States only.

2. Ship fuel oil consumption data collection

2.1 Ship particulars

Name of ship	
IMO number	
Company	
Flag	
Ship type	
Gross tonnage	
NT	
DWT	
EEDI (if applicable)	
Ice class	

2.2 Ship fuel oil consumption data collection

	Fuel oil consumers	Type/Model	Power	Fuel oil types
1	Main engine			
2	Auxiliary engine			
3	Composite boiler			
4	Auxiliary boiler			
5	Inert gas generator			
6	Hydro power pack engine			
7				
8				
9				
10				

2.3 Emission factor

C_F 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 C_F for the type of fuel.

Fuel oil Type	C_F (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 (.....)	

Conversion factor C_F

If fuels are used that do not fall into one of the above categories, fuel supplier should provide a C_F-factor for the respective product supported by documentary evidence. (e.g. some "hybrid fuels", "non-fossil fuels")

2.4 Method to measure fuel oil consumption

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 as below(in no particular order):

Method	Desctription
A	☐ Method using bunker delivery notes(BDNs)
B	☐ Method using flow meters
C-1	☐ Method using fuel oil tank monitoring(indirect measurement)
C-2	☐ Method using fuel oil tank monitoring(direct measurement)

	Fuel consumer	Method to measure
1	Main engine	Choose A / B / C-1 / C-1
2	Auxiliary engine	Choose A / B / C-1 / C-1
3	Em’cy diesel engine	Choose A / B / C-1 / C-1
4	Composite boiler	Choose A / B / C-1 / C-1
5	Auxiliary boiler	Choose A / B / C-1 / C-1
6	Inert gas generator	Choose A / B / C-1 / C-1
7	Hydro power pack engine	Choose A / B / C-1 / C-1
8	(If applicable)	
10		

(1) Method "A" : 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. Annual fuel oil consumption(Q) would be calculated as follows.

$$Q = T_1 + R - S - T_2$$

Q = Annual fuel oil consumption

T_1 = Amount of remaining tank oil at the beginning of the year

R = Total amount of bunkering for calendar year

S = Total amount of fuel oil offloaded for calendar year

T_2 = Amount of remaining tank oil at the end of the year

Fuel oil tank readings should be carried out by appropriate methods such as automated systems(remote reading), soundings and dip tapes. The amount of any fuel oil loaded or offloaded should be based on the records of the ship's oil record book. Any supplemental data used for closing identified difference in bunker quantity should be supported with documentary evidence.

In 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.

The Bunker Delivery Note(BDN) is to be included at least the following information in accordance with MAROL Annex VI Appendix 5.

- Name and IMO number of receiving ship
- Port of bunkering
- Date of commencement of delivery
- Name, address and telephone number of fuel oil supplier
- Delivered product name
- Quantity in metric tons
- Density at 15°C
- Sulfur content, %m/m

Based on the quantities in metric tons above, the total amount of oil supply and demand can be calculated annually.

(2) Method "B" : 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. 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 and should be identified in this plan. In case of the breakdown of flow meters, manual tank readings or other alternative methods will be conducted instead. 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

Flow meters	Location	Type/Model	Fuel consumer	Fuel oil type
1				
2				
3				
4				

<Information of flow meters>

	Fuel consumer	Fuel oil types	Method to measure
1			
2			
3			
4			

<In case for consumer not monitored with a flow meter>

(3) Method "C-1" : using fuel oil tank monitoring(indirect measurement)

This method determines the annual total consumption of fuel oil by measuring the remaining amount of the fuel oil tank through indirect reading using an automation systems(remote reading). The total annual consumption is calculated

by summing up the measured daily fuel consumption. The measurement of the remaining amount of the tank is normally carried out daily and every time the ship is to receive or discharge fuel oil. A summary of the measurement data, including a record of the measured fuel consumption, shall be provided on board. When a fuel oil purifier is installed, the amount of sludge generated can be reduced from fuel oil consumption.

(4) Method "C-2" : using fuel oil tank monitoring(direct measurement)

This method determines the residual amount of the fuel oil tank and the total annual consumption of the fuel oil by directly measuring the tank using sounding or dip tapes. The total annual consumption is calculated by summing up the measured daily fuel consumption. The measurement of the remaining amount of the tank is normally carried out daily and every time the ship is to receive or discharge fuel oil. A summary of the measurement data, including a record of the measured fuel consumption, shall be provided on board. When a fuel oil purifier is installed, the amount of sludge generated can be reduced from fuel oil consumption.

2.5 Method to measure distance travelled

(1) 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.

(2) Distance travelled over ground in nautical miles should be recorded in the log-book in accordance with SOLAS regulation V/28.1[3];

[3] Distance travelled measured using satellite data is distance travelled over the ground.

(3) When the distance travelled is measured using a satellite data, the devices used are as below.

Device	Location	Type/Model	Alternative method
1			
2			
3			

(4) Other methods to measure distance travelled accepted by the Administration

may be applied. In any case, the method applied should be described this plan.

2.6 Method to measure hours underway

(1) Hours underway should be an aggregated duration while the ship is underway under its own propulsion.

(2) The hours underway should be recorded in the log-book.

(3) The period during anchorage should be excluded from the hours underway.

(4) The period when the ship is underway under its own propulsion during and anchorage or a berth should be included.

2.7 Procedure that will be used to report the data to the Administration

(1) From calendar year 2019, each ship of 5,000 gross tonnage and above shall collect the data specified in appendix I, for that and each subsequent calendar year or portion thereof, as appropriate, according to the methodology included in this plan.

(2) Except as provided for in paragraphs (4), (5) and (6) of this article, at the end of each calendar year, the ship shall aggregate the data collected in that calendar year or portion thereof, as appropriate.

(3) Except as provided for in paragraphs (4), (5) and (6) of this article, within three months after the end of each calendar year, the ship shall report to its Administration, the aggregated value for each datum specified in appendix I, via electronic communication and using a standardized format to be developed by the Organization.

(4) In the event of the transfer of a ship from one Administration to another, the ship shall on the day of completion of the transfer or as close as practical thereto report to the losing Administration, the aggregated data for the period of the calendar year corresponding to that Administration, as specified in appendix I and, upon prior request of that Administration, the disaggregated data.

(5) In the event of a change from one Company to another, the ship shall on the day of completion of the change or as close as practical thereto report to its Administration, the aggregated data for the portion of the calendar year corresponding to the Company, as specified in appendix I and, upon request of its Administration, the disaggregated data.

(6) In the event of change from one Administration to another and from one Company to another concurrently, paragraph 4 of this regulation shall apply.

(7) The data shall be verified according to procedures established by the Administration, taking into account guidelines to be developed by the

Organization.

(8) On ships which verification has been completed, a "Statement of compliance" shall be issued by the Administration.

(9) Except as provided for in paragraphs (4), (5) and (6) of this regulation, the disaggregated data that underlies the reported data noted in appendix I 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.

(10) The Administration shall ensure that the reported data noted in appendix I to this Annex by its registered ships of 5,000 gross tonnage and above are transferred to the IMO Ship Fuel Oil Consumption Database via electronic communication and using a standardized format to be developed by the Organization not later than one month after issuing the Statements of Compliance of these ships.

(11) On the basis of the reported data submitted to the IMO Ship Fuel Oil Consumption Database, the Secretary-General of the Organization shall produce an annual report to the Marine Environment Protection Committee summarizing the data collected, the status of missing data, and such other relevant information as may be requested by the Committee.

(12) The Secretary-General of the Organization shall maintain an anonymized database such that identification of a specific ship will not be possible. Parties shall have access to the anonymized data strictly for their analysis and consideration.

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

2.8 Data quality

(1) When using method "A"(method of using bunker delivery notes)

a) The tank reading should be carried out at the beginning and the end of the bunkering.

b) During a bunkering, even keel should be kept as possible.

c) If fuel oil supplied and actual received differs by more than OO%, process according to the procedure and maintain related records.

d) BDNs are required to be retained on board for three years after the fuel oil has been delivered.

(2) When using method "B"(method of using flow meters)

a) Flow meters shall be periodically calibrated by a specialist at intervals not exceeding OO months.

b) Calibration and maintenance records of the flow meters shall be available on board and shall be kept for a minimum of OO months.

c) The standard error range of the flow meters shall be within O%.

d) In case of failure of the flowmeter, it is possible to replace it by using historical log records in the log-book.

(3) When using method "C-1"(method of using indirect measurement for fuel oil tank)

a) The remote reading device shall be periodically calibrated by a specialist at intervals not exceeding OO months.

b) The standard error range of the remote reading device shall be within O%.

c) Calibration and maintenance records of the remote reading device shall be available on board and shall be kept for a minimum of OO months.

d)Fuel oil tanks shall be measured directly on a regular basis to verify the validity of the remote reading device.

e) Measures shall be taken to ensure the validity of the measurements in case of heavy weather.

(4) When using method "C-2"(method of using direct measurement for fuel oil tank)

a) Measures shall be taken to ensure the validity of the measurements in case of heavy weather.

2.9 Direct CO2 Emissions Measurement

Direct CO_2 emission measurement is not required by regulation 22A of MARPOL Annex VI, but if direct CO2 emission measurement is used, it should be as follows.

(1) This method is based on the determination of CO_2 emission flows in exhaust gas stacks by multiplying the CO_2 concentration of the exhaust gas with the exhaust gas flow. In case of the absence or/and breakdown of direct CO_2 emissions measurement equipment, manual tank readings will be conducted instead.

(2) The direct CO_2 emissions measurement equipment applied to monitoring is located exhaustively so as to measure all CO_2 emissions in the ship.

(3) The measurement device shall be periodically calibrated by a specialist at intervals not exceeding OO months.

(4) The standard error range of the measurement device shall be within O%.

(5) Calibration and maintenance records of the measurement device shall be available on board and shall be kept for a minimum of OO months.

Device	Location	Model/Type	Fuel Consumer	Fuel oil used
1				
2				
3				
4				

<Information of CO2 measurement device>

APPENDIX I

A STANDARDIZED DATA REPORTING FORMAT

Method used to measure fuel oil consumption[9]		
Fuel oil consumption (t)	Other(.....)	
	(Cf ;.....)	
	Ethanol (Cf: 1.913)	
	Methanol (Cf: 1.375)	
	LNG (Cf: 2.750)	
	LPG (Butane) (Cf: 3.030)	
	LPG (Propane)	
	HFO (Cf: 3.114)	
	LFO (Cf: 3.151)	
	Diesel/Gas Oil (Cf: 3.206)	
Hours not at berth (h)		
Distance Travelled from berth to berth(nm)		
Power output(rated power) of M.E. and A.E.(kW)[8]	Auxiliary Engine(s)	
	Main Propulsion Power	
Ice class[7] (if applicable)		
EEDI (if applicable)[6] (gCO2/t.nm)		
DWT[5]		
NT[4]		
GT[3]		
Ship type[2]		
IMO number[1]		
End date (dd/mm/yyyy)		
Start date (dd/mm/yyyy)		

Note:

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 the Administration 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 II

Resolution MEPC.282(70)

Refer to the attached document