



MTCC ASIA  
Maritime Technology Cooperation Centre



GMN | The Global  
MTCC Network  
A global network for energy-efficient shipping

# QUICK GUIDANCE FOR SHIP FUEL OIL CONSUMPTION DATA COLLECTION AND REPORTING



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## Mandatory requirements on ship fuel oil consumption data collection and reporting

IMO adopted amendments to MARPOL Annex VI on data collection system for fuel oil consumption of ships through the resolution MEPC.278(70), which entered into force on 1 March 2018. The amendments require ships of 5,000 gross tonnage and above shall to collect consumption data for each type of fuel oil they use, as well as other, additional, specified data including proxies for transport work. The aggregated data shall be reported to the flag State after the end of each calendar year (the first calendar year begins from 1 January until 31 December inclusive 2019 within 3 months after the end of each calendar year) and the flag State, having determined that the data has been reported in accordance with the requirements, issues a Statement of Compliance to the ship no later than 5 months from the beginning of the calendar year. Flag States are required to subsequently transfer this data to an IMO Ship Fuel Oil Consumption Database. IMO will be required to produce an annual report to MEPC, summarizing the data collected. Before the process, on or before 31 December 2018, in the case of a ship of 5,000 gross tonnage and above, the SEEMP in its Part II shall include a description of the methodology that is used to collect the data and the processes that are used to report the data to the ship's flag State.



Regulatory timeline of ship fuel oil data collection

## Intent of ship fuel oil consumption data collection and reporting

The amount of CO<sub>2</sub> emissions from a ship is able to be calculated based on the multiplication between ship's fuel consumption and fuel emission factor:

$$\text{Amount of CO}_2 \text{ emission} = \text{ship's fuel consumption} \times \text{fuel emission factor}$$

As the fuel emission factor of CO<sub>2</sub> varies from different types of fuel, the annual accurate amount of various types of ships' fuel consumption shall be firstly obtained before the annual accurate amount of CO<sub>2</sub> emissions from ships is calculated.

### Emission factor of CO<sub>2</sub> for various types of fuel oil

Fuel oil type	C <sub>F</sub> (t-CO <sub>2</sub> / 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

## Data types of ship fuel oil consumption collection and reporting

### Ship static data

#### Static data reporting format for the data collection system

No.	Ship static data	Requirement
1	IMO number	In accordance with the IMO Ship Identification Number Scheme, adopted by the Organization by resolution A.1078(28).

2	Ship type	As defined in regulation 2 of MARPOL Annex VI or other (to be stated).		
3	Gross tonnage	Gross tonnage should be calculated in accordance with the International Convention on Tonnage Measurement of Ships, 1969.		
4	Net tonnage	NT should be calculated in accordance with the International Convention on Tonnage Measurement of Ships, 1969. If not applicable, note "N/A".		
5	DWT	DWT means the difference in tonnes between the displacement of a ship in water of the relative density of 1025 kg/m <sup>3</sup> 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 (if applicable)	EEDI should be calculated in accordance with the appendix IX of MARPOL Annex VI and to the 2016 Guidelines for the development of a SEEMP (resolution MEPC.282(70)), in particular its appendix. If not applicable, note "N/A".		
7	Ice class (if applicable)	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) (kW)	Main Propulsion Power	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.	
		Auxiliary Engine (s)		

## Ship dynamic data

### Dynamic data reporting format for the data collection system

No.	Ship dynamic data	Requirements
1	Start date (dd/mm/yyyy)	The first day of a calendar year, for example, 1 January, 2019.
2	End date (dd/mm/yyyy)	The last day of a calendar year, for example, 31 December 2019.
3	Distance travelled (nm)	The distance travelled over ground while the ship is underway under its own propulsion shall be recorded in the log-book.
4	Hours underway (h)	The time period corresponding to the ship's distance travelled.
5	Fuel oil consumption (t)	Quantity in metric tonnes. 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
6	Method used to measure fuel oil consumption	Methods used to measure fuel oil consumption: 1: method using BDNs 2: method using flow meters 3: method using bunker fuel oil tank monitoring

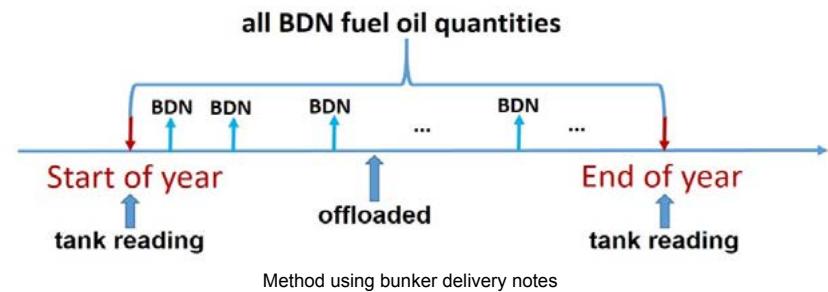
## Data submitted to IMO by flag state

Upon completion and verification of the data collected by its ships, aggregated data of ships shall be submitted by the flag State or a Recognized Organization to IMO via the dedicated GISIS module in accordance with the User guidance on the ship fuel oil consumption GISIS module (IMO Ship fuel oil consumption database) (Circular letter No.3827).

### Methods of ship fuel oil consumption data collection

#### Method using bunker delivery notes (BDNs)

In this method, the fuel oil quantities recorded in the BDNs would be used to determine the annual total amount of fuel oil consumption, plus the amount of fuel oil left over from the last calendar year period, less the amount of fuel oil carried over to the next calendar year period and less the amount of fuel oil offloaded during the calendar year.



#### Precautions of using BDNs

- For voyages that span the data reporting period, stage fuel oil consumption should be performed by means of tank reading at the voyage starting port and using the average number of voyage days.
- The tank monitoring should be carried out by using appropriate methods and should be

clearly defined in the data collection plan.

- The accuracy of this method mainly depends on the accuracy of the amount of fuel oil recorded on BDNs.
- The tank monitoring method for determining the remaining tank oil quantity before and after the cycle should be read and calibrated according to the requirements.
- The annual amount of fuel oil offloaded shall be determined on the basis of the records in the Ship's Oil Logbook.
- Any supplementary data used for determining tank fuel discrepancies should provide supporting documentary evidence.
- A summary of annual BDNs shall be provided to flag state on the specified date.
- This method is not applicable for ships where there are no BDNs on board.
- If the ship uses shipborne cargo (such as LNG) as fuel, this method cannot be used alone.

Other corrections							
③ Annual other corrections	0	0	0	0	0	0	0
Annual fuel oil consumption							
Annual Fuel Oil Consumption (① + ② + ③)	0	0	650	0	0	0	0

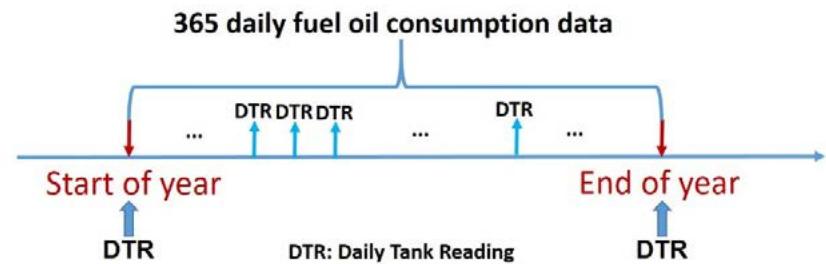
## Data submitted to flag state by ship

### Sample of the annual collected data summaries by using bunker delivery notes

Date of Operations (dd/mm/yyyy)	Fuel oil type/Mass(t)							Descriptions
	DO/ GO	LFO	HFO	LPG (P)	LPG (B)	LNG	Others	
<b>Bunker delivery notes</b>								
01/01/2019			150					
02/01/2019								
12/01/2019			300					
.....			0					
① Annual Supply Amount	0	0	450	0	0	0	0	
<b>Correction for the tank oil remaining</b>								
01/01/2019			400					
31/12/2019			200					
② Correction for the tank oil remainings	0	0	200	0	0	0	0	

## Method using bunker fuel oil tank monitoring on board

The annual fuel oil consumption on a ship will be identified by calculating all daily records. The means of using bunker fuel oil tank monitoring on ships can be categorized as manual, mechanical and electronic.



Method using bunker fuel oil tank monitoring on board

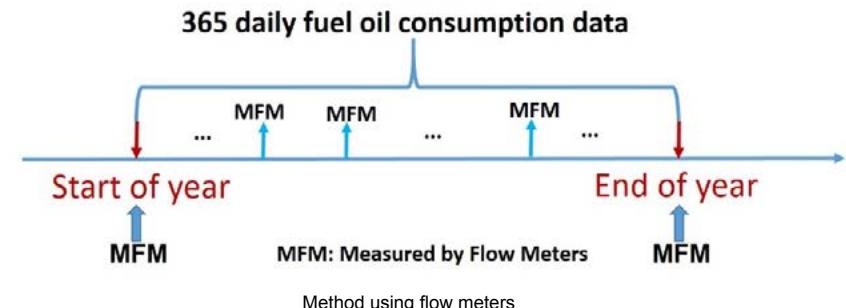
## **Precautions of using bunker fuel oil tank monitoring on board**

- Before measuring, it should be clear whether to take sounding or ullage, and then identify the datum plate and the measurement point.
  - The tape shall be qualified and within the validity period of use.
  - The tape cannot be bent or damaged and connection between tape and weighted bob should not be loosened.
  - The scale of tape should be clearly visible and the minimum division value should be no more than 1 mm.
  - Generally, the 500 grams bob for the measurement of light oil and 1000-gram bob for crude oil or heavy oil.
  - When measuring light oil, the tape should be raised up and rolled back as long as the bob touches the bottom of the oil tank.
  - When measuring heavy oil, the tape should be raised up and rolled back after the bob touches the bottom of the oil tank for about 5 seconds.
  - When taking sounding, the tape should be rolled inside the oil tank stably so that the bob is able to touch the tank bottom lightly. It should be avoided that the liquid leve sloshing caused by heavily rolling the tape inside the oil tank affects the measurement results.
  - When reading, the tape should not be laid flat or inverted in order to prevent the liquid level from rising, and the line of sight should be vertical to the tape. The millimeter value should be read firstly followed by the centimeter, decimeter and meter.
  - If the water mark or oil mark on the tape is not clear, the oil finding paste should be applied at the predicted value position. Then the reading should be based on the discoloration line on the tape.
  - After the measurement is completed, the liquid remaining on the tape should be wiped off with a dry cloth while the tape is being rolled back, and the tape should be completely stowed in its drum.
  - The accuracy of manual measurement is related to such factors as the position of datum plate, measuring tools, conversion tables, ship inclination, etc.
  - Measuring tools should be calibrated and maintained regularly, and records of such calibrations and maintenance should be kept on board ships.
  - The volume measured manually may differ from the actual volume.
  - Manual tank reading method is not suitable for ships fueled by gas.

## Data submitted to flag state by ship

## Method using flow meters

The fuel flow is often measured directly (by volume, velocity or mass) or indirectly by pressure. In principle, flow meters readings of marine energy equipment should be recorded daily and fuel consumption of the ship should be calculated daily.



## Precautions of using flow meters

- If the flowmeter fails, manual tank reading or other alternative methods should be performed;
- The connection of the flowmeter to specific fuel consumer should be described in the data collection plan;
- Any fuel consumer not monitored by a flowmeter should be clearly identified and alternative fuel consumption measurement method shall be included;
- If the flowmeter is installed after the fuel oil daily tank, there is no need to correct the fuel oil measurement method due to the sludge, because the sludge will be removed before the fuel reaches the fuel oil daily tank;
- Calibration of flow meters shall be specified, and records of calibration and maintenance shall be kept on board.

## Data submitted to flag state by ship

Sample of the annual collected data summaries by using flow meters

Date from (dd/mm/ yyyy)	Date to (dd/mm/ yyyy)	Distance travelled (nm)	Hours underway (hh:mm)	Fuel oil consumption (Metric tons)							
				DO/GO	LFO	HFO	LPG (P)	LPG (B)	LNG	Others	
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	
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
31/12/2019		213	24:00	1	1	17	0	0	0	0	
Annual total											

## Additional notes

- Whether the ship is underway or not, fuel consumption shall include all fuel consumers on board, and shall not be limited to the main engine, auxiliary engines, gas turbines, boilers and inert gas generators;
- Within the same reporting period, the same method should be applied to collect data on ship fuel consumption. If it is really necessary to change the method, necessary records and explanations shall be made;
- The daily fuel consumption data of ships should be recorded by electronic system in compliance with relevant requirements to avoid human errors and reduce the workload;
- The ship's daily noon report can be designed to cover the fuel consumption data types, and thus fuel consumption data collection can be completed through the work of daily report without increasing the additional workload;
- In order to verify the integrity, reliability and accuracy of the data, the flag state or the Recognized Organization may also require ships to provide copies of the ship's log book, engine log book, oil record book, BDNs, daily report, arrival and departure report, data collection plan, summaries of data, distance travelled and hours underway, information to demonstrate that the ship followed the data collection plan, etc.

## Basic operations of demo ship fuel oil consumption data collection and reporting

- Double clicking the folder .
- E-system of Voluntary Ship Fuel Consumption Data Collection and Reporting
- Open the **ShipInfo.hch** by using the software of **Notepad.exe** and input the ship's name and other 8 static data.
- Close and save the file of **ShipInfo.hch**.

Ship name:
IMO Number:
Ship type:
bulk carrier
Gross Tonnage:
64283
Net Tonnage:
35998
Deadweight Tonnage:
99761
Main propulsion power(kW):
13974
Auxiliary engine power output (kW):
680
EEDI:
N/A
Ice class:
N/A

Input of ship static data

- Double click the Data input.exe for inputting the dynamic ship data.

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Input of ship dynamic data

- Set **Start date** and **End date**, and select **Annual** in the field of **Statistics**, the annual collected data summary which is required to be submitted to the flag state from ship can be automatically displayed.

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Annual collected data summary submitted to flag state

- Click the button **Confirm** at the bottom right and the ship dynamic data is stored locally.
- Double click the Data aggregated.exe for producing annual ship aggregate data.

- Select **Aggregated** in the field of **Statistics**, the annual aggregated data summary which is required to be submitted to the IMO from flag state can be automatically displayed.

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Production of annual ship aggregated data

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Annual aggregated data summary to IMO



The International Maritime Organization (IMO) and European Union (EU) reached an agreement in December 2015 to establish Maritime Technology Cooperation Centres (MTCCs) in five regions, i.e. Asia, Africa, Latin America, Caribbean and Pacific. The overall objective is to enhance capacity building in mitigating climate change through the effective adoption of global efficient energy measures by way of technical mentorship, professional training, data collection, regional coordination in adhering to international regulations on energy efficiency of ships. In December 2016, following the win of one-year bidding competition, Shanghai Maritime University (SMU) entered into an agreement with IMO as the host institution of MTCC-Asia, which was then inaugurated in 15th May 2017. The center serves as a promoting hub in Asia for IMO-EU MTCC projects by providing innovative technologies in curbing greenhouse gas, sharing of technical expertise and discovering innovative ways to reduce the carbon emission from ships through conferences, workshops, maritime education and training, and technological co-operations and transfer.



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