Correction Factors and Voyage Adjustments in CII Calculations

Carbon Intensity Indicator (CII) Actions to Take

This technical information provides guidance on global implementation of the Carbon Intensity Indicator (CII). Vessel owners are advised to plan for compliance.

Applicable Regulations in MARPOL Annex VI

Regulation 26 of the revised MARPOL Annex VI (MEPC. 328(76)) expands the requirements which are to be addressed through a vessel's Ship Energy Efficiency Management Plan (SEEMP). A new "Part III" is to be created to address calculation and implementation of the Annual Operational CII.

Regulation 28 of the revised MARPOL Annex VI defines the application and requirements of the CII on specific vessel types of 5,000 GT and above. This regulation establishes the need for calculation of a Required Annual Operational CII, which will serve as the baseline for the Operational Carbon Intensity Rating. This rating will be assigned annually for each vessel as a ranking label from among the five grades (A, B, C, D and E) based on the calculated Attained Annual Operational CII, indicating a major superior, minor superior, moderate, minor inferior, or inferior performance level.

Information to be submitted to the IMO Ship Fuel Oil Consumption Database (Reg. 27)

From calendar year 2019, each ship of 5,000 gross tonnage and above shall collect the data specified in appendix IX of Annex VI, for that and each subsequent calendar year or portion thereof, as appropriate according to the methodology included in the SEEMP.

In this regard, revised sample form of the required information describes in below:

Identity of the ship			
Ship Name		IMO No.	
Technical characteristics of the ship			
Delivery Date			
Ship type, as defined in Reg. 2 of Annex VI or other (to be stated)			
Gross tonnage (GT)[1]			
Net tonnage (NT)[2]			
Deadweight tonnage (DWT)[3]			
Power output (rated power)[4] of main and auxiliary reciprocating internal combustion engines over 130 kW (to be stated in kW)			
Attained EEDI[5] (if applicable)			
Attained EEXI[6] (if applicable)			
Ice class[7]			
Fuel oil consumption, by fuel oil type in metric tonnes and methods used for collecting fuel oil consumption data			
Distance travelled			
Hours under way			
For ships to which regulation 28 of MARPOL Annex VI applies			
Applicable CII[8]			
AER □ / cg $_{DIST}$ □			
Required annual operational CII[9]			
Attained annual operational CII before any correction[10]			
Attained annual operational CII[11]			
Operational carbon intensity rating:[12]			□A □B □C □D □E
CII for trial purpose (none, one or more on voluntary basis)[13]			
EEPI (gCO_2/t•nm)			
cb_{DIST} (gCO2/berth•nm)			
cl_{DIST} (gCO2/m•nm)			
EEOI (gCO2/t•nm or others)[14]			

1 Gross tonnage should be calculated in accordance with the International Convention on Tonnage Measurement of Ships, 1969.
2 Net tonnage should be calculated in accordance with the International Convention on Tonnage Measurement of Ships, 1969. If not applicable, note "N/A".
3 DWT means the difference in tonnes between the displacement of a ship in water of relative density of 1,025 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 organized by it. If not applicable, note "N/A".
4 Rated power means the maximum continuous rated power as specified on the nameplate of the engine.
5 Refer to the 2018 Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships (resolution **MEPC.308(73)**, as amended by resolutions **MEPC.322(74)** and **MEPC.332(76)**), and as may be further amended.
6 Refer to the 2022 Guidelines on the method of calculation of the attained Energy Efficiency Existing Ship Index (EEXI) (resolution **MEPC. 350(78)**).
7 Ice class should be consistent with the definition set out in the International Code for Ships Operating in Polar Waters (Polar Code) (resolutions **MEPC.264(68)** and **MSC.385(94)**). If not applicable, note "N/A".
8 Refer to the 2022 Guidelines on operational carbon intensity indicators and the calculation methods (CII guidelines, G1) (resolution **MEPC. 352(78)**).
9 Refer to the 2022 Guidelines on the reference lines for use with operational carbon intensity indicators (CII reference lines guidelines, G2) (resolution **MEPC.353(78)**) and 2021 Guidelines on the operational carbon intensity reduction factors relative to reference lines (CII reduction factors guidelines, G3) (resolution **MEPC.338(76)**).
10 As calculated in accordance with the 2022 Guidelines on operational carbon intensity indicators and the calculation methods (CII guidelines, G1) (resolution **MEPC.352(78)**) before any correction using Interim guidelines on correction factors and voyage adjustments for CII calculations (G5) (resolution **MEPC.355(78)**).
11 As calculated in accordance with the 2021 Guidelines on operational carbon intensity indicators and the calculation methods (CII guidelines, G1) (resolution **MEPC.352(78)**) and having been corrected taking into account Interim guidelines on correction factors and voyage adjustments for CII calculations (G5) (resolution **MEPC.355(78)**).
12 Refer to the 2022 Guidelines on the operational carbon intensity rating of ships (CII rating guidelines, G4) (resolution **MEPC. 354(78)**).
13 Refer to the 2022 Guidelines on operational carbon intensity indicators and the calculation methods (CII guidelines, G1) (resolution **MEPC. 352(78)**).
14 Refer to the Guidelines for voluntary use of the ship energy efficiency operational indicator (EEOI)) (MEPC.1/Circ.684).

So, as mentioned above, the CII rating must be calculated and reported by considering the correction factors and voyage adjustments, if needed.

Correction factors and voyage adjustments for CII calculations

It should be noted that the use of correction factors and voyage adjustments should in no way undermine the goal of reducing the carbon intensity of international shipping as set out in regulation 20 of MARPOL Annex VI.
For the purpose of this article, the following definitions apply.

- IMO DCS means the IMO Ship Fuel Oil Consumption Database referred to in regulation 27 and related provisions of MARPOL Annex VI.
- A voyage period is a period of time where the ship meets the criteria to apply a voyage adjustment in this article.
- A voyage adjustment deducts relevant fuel consumption, as well as the associated distance travelled from the calculation of attained CII for a defined period subject to certain threshold conditions being met.
- A tanker should be considered in Ship-to-Ship (STS) operation when operating in accordance with regulation 41.2 of MARPOL Annex I and applying the best practices in accordance with the OCIMF Ship to Ship Transfer Guide for Petroleum, Chemical and Liquefied Gases. For the purpose of this article, a tanker is engaged in an STS voyage if a voyage between cargo loading and cargo discharging locations, or a voyage between cargo discharging and cargo loading locations does not exceed 600 nautical miles and the time for each of these voyages (which does not include port or discharge time) is limited to 72 hours.
- A Shuttle Tanker is a tanker which is equipped with Dynamic Positioning and specialized cargo handling equipment making them capable of loading crude oil at offshore installations.
- A self-unloading bulk carrier is a bulk carrier with an onboard cargo handling system that is utilized to discharge dry bulk cargo via a boom conveyor or shipboard cargo pipeline equipment.

For all ships to which regulation 28 of MARPOL Annex VI applies, the operational carbon intensity formula defined in below should be applied when using voyage adjustments or correction factors.

$$\frac{\sum_j CF_j \cdot \{FC_j - (FC_{voyage,j} + TF_j + (0.75 - 0.03y_i) \cdot (FC_{electrical,j} + FC_{boiler,j} + FC_{others,j}))\}}{f_i \cdot f_m \cdot f_c \cdot f_{iVSE} \cdot Capacity \cdot (D_t - D_x)}$$

- A correction factor means a factor in the numerator or denominator of the CII formula which adjusts the calculation of the attained CII.
- A refrigerated container is an intermodal shipping container that is refrigerated (including chilled and frozen containers) or heated for the transportation of temperature sensitive cargo, which will receive its power from the ship's power supply.
- Ice edge is defined by paragraph 4.4 of the WMO Sea-Ice Nomenclature, March 2014 as the demarcation at any given time between the open sea and sea ice of any kind, whether fast or drifting.

Voyage adjustment

The parameter $FC_{voyage,\,j}$ is the total mass (in grams) of fuel of type j, consumed in voyage periods during the calendar year which may be deducted from the calculation of the attained CII in case the ship encounters one of the following situations:

- Scenarios specified in regulation 3.1 of MARPOL Annex VI, which may endanger safe navigation of a ship;

- Sailing in ice conditions, which means sailing of an ice-classed ship in a sea area within the ice edge

In cases where $FC_{voyage,\,j}$ is used:

- Any associated distance travelled must also be deducted using D_x otherwise ships will benefit from distance travelled without any associated CO_2 emission.
- The ship should report data for the deductions associated with voyage adjustments to the Administration.

The next correction is the parameter TF_j which to be calculated according to the following method:

TF_j = (1 − AF_{Tanker}) · $FC_{S,j}$ represents the quantity of fuel j removed for STS or shuttle tanker operation, where $FC_{S,j}$ = FC_j for shuttle tankers and $FC_{S,j}$ is the total quantity of fuel j used on STS voyages for STS vessels.

If TF_j > 0

then $FC_{electrical,\,j}$ = $FC_{boiler,\,j}$ = $FC_{others,j}$ = 0;

AF_{Tanker} for Corrections to Shuttle Tankers or STS voyages on tankers and are calculated as:

- Tankers engaged in STS voyages as defined above may apply the correction factor AF_{Tanker} STS to all fuel consumption relating to STS voyages, including cargo transfer at offshore location, voyage, cargo discharge and waiting periods at anchor or drifting during which the ship reports being part of an STS operation and voyage. The STS operation includes fuel consumption in port where the transferred cargo is discharged after such a voyage.

$AF_{Tanker,\,STS}$ = 6.1742 × DWT−0.246

- Shuttle tankers equipped with Dynamic Positioning as defined above may apply the correction factor $AF_{Tanker,}$ Shuttle to total fuel consumption:

$AF_{Tanker,\,Shuttle}$ = 5.6805 x DWT−0.208

Deduction factors

$\boldsymbol{FC_{electrical,\,j}}$ is the mass (in grams) of fuel of type j, consumed for production of electrical power during the calendar year which may be deducted from the calculation of the attained CII for the following purposes:

- Electrical consumption of refrigerated containers (on all ships where they are carried) using the calculation methodology.
- Electrical consumption of cargo cooling/re-liquefaction systems on gas carriers and LNG Carriers.
- Electrical consumption of discharge pumps on tankers

Appendix 1 provides the details of the Correction Factor calculations relating to electrical power.

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APPENDIX 1

Part A. $FC_{Electrical}$ for Corrections relating to electrical power

1 Refrigerated containers

For ships carrying refrigerated containers, the correction factor $FC_{Electrical}$ may be applied as follows:

1. For ships that have the ability to monitor reefer electrical consumption, the ship may calculate reefer container kWh consumption as follows:

$$\boldsymbol{FC_{electrical_{reefer,j}} = Reefer\ kWh \times SFOC}$$

- $\boldsymbol{FC_{electrical_{reefer,j}}}$ *(Reefer fuel oil consumption) represents the estimated fuel consumption attributed to in-use refrigerated containers carried.*
- $\boldsymbol{Reefer\ kWh}$ *is measured on the ship by the kWh meter counter on the ship.*
- $\boldsymbol{SFOC}$ *represents the specific fuel consumption in g/kWh as a weighted average of the engines used to provide the electrical power, as per the EEDI/EEXI Technical File or the NOx Technical File. In the case of ships without a Technical File, a default value of 175 g/kWh for 2 stroke engines and 200 g/kWh for 4 stroke engines may be applied. In the case of waste heat recovery systems as defined under Category C1 in MEPC.1/Circ.896 the SFOC to be used will be at the discretion of the Administration.*

Alternatives such as derivation of fuel consumption or kWh from auto-logged data may be used subject to approval by the Administration. Note that ship reefer kWh consumption should not include consumption during voyage adjustment periods.

2. For ships that do not have the ability to monitor reefer electrical consumption, the ship may calculate reefer kWh consumption as follows:

$$\boldsymbol{FC_{electrical\_reefer,j}} = Cx\ .24\ .SFOC_{avg}\ .(Reefer\_days_{sea} + \sum Reefer\_days_{port})$$

Where:

- $\boldsymbol{Cx}$ represents a default reefer consumption of 2.75 kW/h.
- $\boldsymbol{Reefer\_days_{sea}}$ represents the number of in-use reefer-days over the declared period and may be derived using the number of reefer containers as recorded in the BAPLIE file multiplied by the number of days at sea.
- $\boldsymbol{SFOC_{avg}}$ represents the specific fuel consumption in g/kWh as a weighted average of the engines used to provide the electrical power, as per the EEDI/EEXI Technical File or NOx Technical File. In the case of ships without a Technical File, a default value of 175 g/kWh for 2 stroke engines and 200 g/kWh for 4 stroke engines may be applied. In the case of waste heat recovery systems as defined under Category C1 in MEPC.1/Circ.896 the SFOC to be used will be at the discretion of the Administration.

In ports where shore-power is not used, the number of in-use reefers at port should be calculated as:

$$Reefer\_days_{port} = \frac{No_c\ Arrival + No_c\ Departure}{2} \times Days_{port}$$

Where:

- $\boldsymbol{Days_{port}}$ represents number of days in port.
- $\boldsymbol{Reefer\_days_{port}}$ represents the number of in-use reefer days while at port.*

* The number of reefers on board while in port should be calculated to equal the number of reefers at arrival and at departure as calculated above. Same calculation applies for Reefer days sea in port.

- $\boldsymbol{No_c\ Arrival}$ represents number of reefer containers on arrival.
- $\boldsymbol{No_c\ Departure}$ represents number of reefer containers at departure.

In all cases, the actual number of in-use reefers carried is documented in the BAPLIE file.
Note that ship reefer kWh consumption should not include consumption during voyage adjustment periods.

2 Cargo cooling systems on gas carriers and LNG carriers

For gas carriers and LNG carriers with electrical cargo cooling systems or re-liquefaction plants, the correction factor $FC_{electrical}$ may be applied as follows:

1. Gas carriers and LNG carriers may calculate cargo cooling kWh consumption as follows:

$$FC_{electrical\_cooling,j} = Cooling\ kWh \times SFOC$$

Where:

- $FC_{electrical\_cooling,j}$ (cargo cooling fuel oil consumption) represents the estimated fuel consumption attributed to cooling of gas cargoes.
- $Cooling\ kWh$ is measured on the ship by the kWh meter counter on the ship.
- $SFOC$ represents the specific fuel consumption in g/kWh associated with the relevant source of electrical power as per the EEDI/EEXI Technical File or NOx Technical File. In the case of ships without a Technical File, a default value of 175 g/kWh for 2 stroke engines and 200 g/kWh for 4 stroke engines may be applied. In the case of waste heat recovery systems as defined under Category C1 in MEPC.1/Circ.896 the SFOC to be used will be at the discretion of the Administration.

Alternatives such as derivation of fuel consumption or kWh from auto-logged data may be used subject to approval by the Administration. Note that cargo cooling kWh consumption should not include consumption during voyage adjustment periods.

Alternatives such as derivation of actual fuel consumption from auto-logged data may be used subject to approval by the Administration. Note that cargo cooling kWh consumption should not include consumption during voyage adjustment periods.

3 Electric cargo discharge pumps on tankers

For tankers with directly or indirectly electrically powered discharge pumps, the correction factor $FC_{electrical}$ may be applied as follows:

.1 Tankers may calculate cargo discharge kWh consumption as follows:

$$FC_{electrical\_discharge,j} = discharge\ kWh \times SFOC$$

Where:

- $FC_{electrical\_discharge,j}$ (cargo discharge fuel oil consumption) represents the estimated fuel consumption attributed to use of cargo discharge pumps.
- $discharge\ kWh$ is measured on the ship by the kWh meter counter on the ship.
- $SFOC$ represents the specific fuel oil consumption in g/kWh associated with the relevant source of electrical power as per the EEDI/EEXI Technical File or NOx Technical File. In the case of ships without a Technical File, a default value of 175 g/kWh for 2 stroke engines and 200 g/kWh for 4 stroke engines may be applied. In the case of waste heat recovery systems as defined under Category C1 in MEPC.1/Circ.896 the SFOC to be used will be at the discretion of the Administration.

Part B. FC_{Boiler} and FC_{Others} for corrections relating to cargo heating and discharge on tankers

.1 In the case of boilers used for cargo heating, the amount of fuel used by the boiler (FC_{boiler}) should be measured by accepted means, e.g. tank soundings, flow meters.

.2 For tankers which use steam driven cargo pumps, the amount of fuel used by the boiler (FC_{boiler}) should be measured by accepted means, e.g. tank soundings, flow meters

Some amount of fuel consumed by the boiler during cargo heating or discharge operations may be attributed to other purposes, e.g. calorifiers. It is not necessary to split these out from reporting.

Note that boiler consumption should not include consumption during voyage adjustment periods.

$FC_{boiler,\,j}$ is the mass (in grams) of fuel of type j, consumed by the oil fired boiler during the calendar year which may be deducted from the calculation of the attained CII, for the purposes of cargo heating and cargo discharge on tankers.

FC_{boiler} for cargo heating and discharge pumps on tankers

For tankers with fuel fired boilers used for cargo heating or steam driven cargo pumps, the following correction factor may be applied for the period that the cargo heating or discharge pumps are in operation:

$FC_{others,\,j}$ is the mass (in grams) of fuel of type j, consumed by standalone engine driven cargo pumps during discharge operations on tankers which may be deducted from the calculation of the attained CII. For tankers with discharge pumps powered by their own generator, the amount of fuel used for the period that the discharge pumps are in operation (FC_{Others}) should be measured by accepted means, e.g. tank soundings, flow meters.

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