

**Changes to legislation:** There are outstanding changes not yet made to Regulation (EU) 2015/757 of the European Parliament and of the Council. Any changes that have already been made to the legislation appear in the content and are referenced with annotations. (See end of Document for details) View outstanding changes

## ANNEX I

**Methods for monitoring CO<sub>2</sub> emissions****[<sup>F1</sup>A.CALCULATION OF CO<sub>2</sub> EMISSIONS (ARTICLE 9)**

For the purposes of calculating CO<sub>2</sub> emissions companies shall apply the following formula:

Fuel consumption × emission factor

Fuel consumption shall include fuel consumed by main engines, auxiliary engines, gas turbines, boilers and inert gas generators.

Fuel consumption within ports at berth shall be calculated separately.

The following default values for emission factors for fuels used on board shall be applied:

Type of fuel	Reference	Emission factor (t-CO <sub>2</sub> /t-fuel)
1. Diesel/Gas oil	ISO 8217 Grades DMX through DMB	3,206
2. Light fuel oil (LFO)	ISO 8217 Grades RMA through RMD	3,151
3. Heavy fuel oil (HFO)	ISO 8217 Grades RME through RMK	3,114
4. Liquefied petroleum gas (LPG)	Propane	3,000
	Butane	3,030
5. Liquefied natural gas (LNG)		2,750
6. Methanol		1,375
7. Ethanol		1,913

Appropriate emission factors shall be applied for biofuels, alternative non-fossil fuels and other fuels for which no default values are specified.]

**B. METHODS FOR DETERMINING CO<sub>2</sub> EMISSIONS**

The company shall define in the monitoring plan which monitoring method is to be used to calculate fuel consumption for each ship under its responsibility and ensure that once the method has been chosen, it is consistently applied.

Actual fuel consumption for each voyage shall be used and be calculated using one of the following methods:

- (a) Bunker Fuel Delivery Note (BDN) and periodic stocktakes of fuel tanks;
- (b) Bunker fuel tank monitoring on board;
- (c) Flow meters for applicable combustion processes;

---

**Changes to legislation:** There are outstanding changes not yet made to Regulation (EU) 2015/757 of the European Parliament and of the Council. Any changes that have already been made to the legislation appear in the content and are referenced with annotations. (See end of Document for details) View outstanding changes

---

(d) Direct CO<sub>2</sub> emissions measurements.

Any combination of these methods, once assessed by the verifier, may be used if it enhances the overall accuracy of the measurement.

1. Method A: BDN and periodic stocktakes of fuel tanks

This method is based on the quantity and type of fuel as defined on the BDN combined with periodic stocktakes of fuel tanks based on tank readings. The fuel at the beginning of the period, plus deliveries, minus fuel available at the end of the period and de-bunkered fuel between the beginning of the period and the end of the period together constitute the fuel consumed over the period.

The period means the time between two port calls or time within a port. For the fuel used during a period, the fuel type and the sulphur content need to be specified.

This method shall not be used when BDN are not available on board ships, especially when cargo is used as a fuel, for example, liquefied natural gas (LNG) boil-off.

Under existing MARPOL Annex VI regulations, the BDN is mandatory, is to be retained on board for three years after the delivery of the bunker fuel and is to be readily available. The periodic stocktake of fuel tanks on-board is based on fuel tank readings. It uses tank tables relevant to each fuel tank to determine the volume at the time of the fuel tank reading. The uncertainty associated with the BDN shall be specified in the monitoring plan. Fuel tank readings shall be carried out by appropriate methods such as automated systems, soundings and dip tapes. The method for tank sounding and uncertainty associated shall be specified in the monitoring plan.

Where the amount of fuel uplift or the amount of fuel remaining in the tanks is determined in units of volume, expressed in litres, the company shall convert that amount from volume to mass by using actual density values. The company shall determine the actual density by using one of the following:

- (a) on-board measurement systems;
- (b) [<sup>F1</sup>the density measured by the fuel supplier at fuel uplift and recorded on the fuel invoice or BDN;]
- (c) [<sup>F2</sup>the density measured in a test analysis conducted in an accredited fuel test laboratory, where available.]

**Textual Amendments**

- F2** Inserted by [Commission Delegated Regulation \(EU\) 2016/2071 of 22 September 2016 amending Regulation \(EU\) 2015/757 of the European Parliament and of the Council as regards the methods for monitoring carbon dioxide emissions and the rules for monitoring other relevant information \(Text with EEA relevance\).](#)

The actual density shall be expressed in kg/l and determined for the applicable temperature for a specific measurement. In cases for which actual density values are not available, a standard density factor for the relevant fuel type shall be applied once assessed by the verifier.

2. Method B: Bunker fuel tank monitoring on-board

This method is based on fuel tank readings for all fuel tanks on-board. The tank readings shall occur daily when the ship is at sea and each time the ship is bunkering or de-bunkering.

---

**Changes to legislation:** *There are outstanding changes not yet made to Regulation (EU) 2015/757 of the European Parliament and of the Council. Any changes that have already been made to the legislation appear in the content and are referenced with annotations. (See end of Document for details) View outstanding changes*

---

The cumulative variations of the fuel tank level between two readings constitute the fuel consumed over the period.

The period means the time between two port calls or time within a port. For the fuel used during a period, the fuel type and the sulphur content need to be specified.

Fuel tank readings shall be carried out by appropriate methods such as automated systems, soundings and dip tapes. The method for tank sounding and uncertainty associated shall be specified in the monitoring plan.

Where the amount of fuel uplift or the amount of fuel remaining in the tanks is determined in units of volume, expressed in litres, the company shall convert that amount from volume to mass by using actual density values. The company shall determine the actual density by using one of the following:

- (a) on-board measurement systems;
- (b) the density measured by the fuel supplier at fuel uplift and recorded on the fuel invoice or BDN;
- (c) the density measured in a test analysis conducted in an accredited fuel test laboratory, where available.

The actual density shall be expressed in kg/l and determined for the applicable temperature for a specific measurement. In cases for which actual density values are not available, a standard density factor for the relevant fuel type shall be applied once assessed by the verifier.

### 3. Method C: Flow meters for applicable combustion processes

This method is based on measured fuel flows on-board. The data from all flow meters linked to relevant CO<sub>2</sub> emission sources shall be combined to determine all fuel consumption for a specific period.

The period means the time between two port calls or time within a port. For the fuel used during a period, the fuel type and the sulphur content need to be monitored.

The calibration methods applied and the uncertainty associated with flow meters used shall be specified in the monitoring plan.

Where the amount of fuel consumed is determined in units of volume, expressed in litres, the company shall convert that amount from volume to mass by using actual density values. The company shall determine the actual density by using one of the following:

- (a) on-board measurement systems;
- (b) [<sup>F1</sup>the density measured by the fuel supplier at fuel uplift and recorded on the fuel invoice or BDN;]
- (c) [<sup>F2</sup>the density measured in a test analysis conducted in an accredited fuel test laboratory, where available.]

The actual density shall be expressed in kg/l and determined for the applicable temperature for a specific measurement. In cases for which actual density values are not available, a standard density factor for the relevant fuel type shall be applied once assessed by the verifier.

### 4. Method D: Direct CO<sub>2</sub> emissions measurement

---

**Changes to legislation:** There are outstanding changes not yet made to Regulation (EU) 2015/757 of the European Parliament and of the Council. Any changes that have already been made to the legislation appear in the content and are referenced with annotations. (See end of Document for details) [View outstanding changes](#)

---

The direct CO<sub>2</sub> emissions measurements may be used for voyages and for CO<sub>2</sub> emissions occurring in ports located in a Member State's jurisdiction. CO<sub>2</sub> emitted shall include CO<sub>2</sub> emitted by main engines, auxiliary engines, gas turbines, boilers and inert gas generators. For ships for which reporting is based on this method, the fuel consumption shall be calculated using the measured CO<sub>2</sub> emissions and the applicable emission factor of the relevant fuels.

This method is based on the determination of CO<sub>2</sub> emission flows in exhaust gas stacks (funnels) by multiplying the CO<sub>2</sub> concentration of the exhaust gas with the exhaust gas flow.

The calibration methods applied and the uncertainty associated with the devices used shall be specified in the monitoring plan.

**Changes to legislation:**

There are outstanding changes not yet made to Regulation (EU) 2015/757 of the European Parliament and of the Council. Any changes that have already been made to the legislation appear in the content and are referenced with annotations.

[View outstanding changes](#)

**Changes and effects yet to be applied to the whole legislation item and associated provisions**

- [Art. 9\(2\)\(a\)](#) words substituted by [S.I. 2018/1388 reg. 3\(7\)\(b\)](#)