MARPOL Annex VI - Prevention of Air Pollution from Ships

National Workshop (virtual) on Ratification and Effective Implementation of MARPOL Annex VI for Lebanon
10 December 2020

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Content

Introduction

MARPOL Annex VI overview

Chapter 1 – General (Regs. 1-4)

Chapter 2 – Survey, certification & means of control (Regs. 5-11)

Chapter 3 - Requirements for control of emissions (Regs. 12-18)

Chapter 4 – Energy efficiency regulations for ships (Regs. 19-23)
Sources of Pollution from Ships

Exhaust Gases (SOx, NOx, GHG, etc.) from:
- main and auxiliary engines
- boilers
- incinerators

Emissions of Freon/Halon gases (From refrigeration system)

Evaporation from cargo (VOCs)

Oil spills

Loss by accidents – ship cargoes & life

Bilge-water disposal/ tank washing

Sewage & Garbage

Loss of cargo

Emissions from paint solutions

Ballast water discharge

© Damen shipyards

Black carbon (Polar Code)
Methane (for ships using LNG)
International Convention for the Prevention of Pollution from Ships (MARPOL)

Air Pollution Conference 1997

- MARPOL: Main international convention covering prevention of operational or accidental pollution of the marine environment by ships

- Air Pollution Conference 1997 adopted new Annex VI “Regulations for the Prevention of Air Pollution from Ships” through adding a Protocol to MARPOL 73/78

- Entered into force May 2005

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<td>Air Pollution &amp; Energy Efficiency</td>
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MARPOL Annex VI – Chapter 1

General
Regulation 1 - Application

1. The provisions of this Annex shall apply to all ships, except where expressly provided otherwise in Regulations 3, 5, 6, 13, 15, 16, 18, 19, 20, 21, 22 and 22A of this Annex

- When suffering damage to ship or equipment
- When saving life at sea
- When securing safety of ship
- Ship trials for research
- Emissions from sea bed activities
- Ships smaller than certain size
- Certain ship size and ship types based on specific regulations

Application ➔ All Ships

Does not apply ➔
Regulation 2 – Definitions

- A large number of terms are defined (more than 50).
- Example terms defined are:
  - **Emission Control Area** where the adoption of special mandatory measures to control NO$_x$ or SO$_x$ …
  - **Fuel oil** means any fuel delivered to and intended for combustion ….. including gas, distillate and residual fuels.
  - **Marine diesel engine** means any reciprocating internal combustion engine operating on liquid or dual fuel … In addition, a gas fuelled engine installed on a ship constructed on or after 1 March 2016 …
- Various ship types
- Etc.
Regulation 3 - Exceptions and Exemptions

➤ Regulations of this Annex shall not apply:

➤ When suffering damage to ship or equipment

➤ When saving life at sea

➤ When securing safety of ship

➤ Ship trials for research

➤ Emissions from sea bed activities (for marine platforms)
Regulation 4 – Equivalents

1. The Administration of a Party may allow any … apparatus .. or compliance methods used as an alternative if such … appliances or compliance methods are at least as effective as that required by this Annex, ….

2. The Administration of a Party which allows such an alternative … shall communicate to the Organization for circulation to the Parties the particulars thereof, for their information and appropriate action …

Notifications from Parties are available through the IMO Global Integrated Shipping Information System (GISIS)

http://gisis.imo.org/Public/
MARPOL Annex VI – Chapter 2

Survey, Certification and Means of Control
Regulation 5 – Surveys and Inspections

➢ Every ship of 400 gross tonnage or above … shall be subject to the surveys specified below:

a. An **initial survey** before the ship is put into service or …

b. A **renewal survey** at intervals specified by the Administration, but not exceeding five years, …

c. An **intermediate survey** within 3 months before or after the second third anniversary date of the certificate….

d. An **annual survey** within 3 months before or after each anniversary date of the certificate….

➢ Surveys of ships … shall be carried out by **officers of the Administration** or **RO** (Recognised Organisation) ….
Regulation 6 – Issue or Endorsement of Certificates

1. An International Air Pollution Prevention (IAPP) Certificate shall be issued, after an initial or renewal survey ..., to:

2. An International Energy Efficiency (IEE) Certificate shall be issued, after an initial survey....

3. A Statement of Compliance related to fuel oil consumption .... shall be issued to the ship ....

Regulation 7:

• Allows the Issue of a Certificate by another Party
• Prohibits issue of certificates to non-parties.
Regulation 8 – Form of Certificates

The IAPP Certificate and its Supplement* shall be drawn up in a form corresponding to the model given in appendix I to this Annex ...

Guidance on the Supplement to the IAPP Certificate (MEPC.1/Circ.849)
Regulation 9 – Duration and Validity of Certificates

➢ An IAPP Certificate shall be issued for a period specified by the Administration, which shall not exceed five years.

  ▪ Renewal details, dates, etc. given …. 

➢ An IEE Certificate is valid for the life of the ship.

➢ A Statement of Compliance for fuel oil consumption DCS is valid for one year.
Regulation 10 – Port State Control on Operational Requirements

1. A ship, when in a port or an offshore terminal under the jurisdiction of another Party, **is subject to inspection by officers duly authorized by such Party** ....

2. … the Party shall take such steps as to ensure that **the ship shall not sail** until the situation has been brought to order in accordance with the requirements of this Annex.

And other aspects .....
Regulation 11 – Detection of Violations and Enforcement

1. **Parties shall co-operate in the detection of violations** and the enforcement of the provisions of this Annex ....

2. **Any Party shall furnish to the Administration evidence**, if any, that the ship has emitted any of the substances in violation of the provisions of this Annex.

3. **Upon receiving such evidence**, **the Administration shall investigate the matter** ...... and when sufficient evidence is available ..., **it shall act against the ship in accordance with its law** as soon as possible.

And other aspects .....
MARPOL Annex VI – Chapter 3

Requirements for Control of Emissions
MARPOL Annex VI – Chapter 3 regulations

- Ozone Depleting Substances (Reg. 12)
- Volatile Organic Compounds (Reg. 15)
- Nitrogen Oxides (NOx) (Reg. 13)
- Shipboard Incineration & Reception facilities (Regs. 16 and 17)
- Sulphur Oxides (SOx) and PM (Reg. 14)
- Fuel quality and availability (Reg. 18)
Regulation 12 – Ozone Depleting Substances (ODS)

- **Ozone**: $O_3$

- **Ozone layer**: ~25 km from Earth

- **Function of Ozone layer**: Protection of Earth from Ultra Violet sun lights.

- **Ozone depletion**: Refers to decline of Ozone layer ([the ozone hole](#)).

- **ODS**: Primary cause of ozone depletion is the presence of [chlorine-containing gases](#) (CFCs).

- ODS on board ship is used mainly in the refrigeration equipment and AC units.
Refrigerants: Family Tree, ODP, GWP

CFC
Chlorofluorocarbon
Production Ban 1996

- R11
  ODP = 1.0
  GWP = 4000

- R12
  ODP = 0.9
  GWP = 8500

- R115
  (R502)
  ODP = 0.283
  GWP = 5591

HCFC
Hydrochlorofluorocarbon
Transitional Substance
Banned in new plant

- R22
  ODP = 0.055
  GWP = 1700

- R141b
  (Foam blow)
  ODP = 0.11
  GWP = 630

HFC
Hydrofluorocarbon
Ozone Friendly
Under question

- R410A
  ODP = 0
  GWP = 1890
  (High Pressure)

- R404A
  ODP = 0
  GWP = 3748
  (High GWP)

- R407C
  ODP = 0
  GWP = 1610
  (Flammability?)

Environmentally Inert
Natural Substances

- Ammonia
  ODP = 0
  GWP = <1

- Carbon Dioxide
  ODP = 0
  GWP = 1.0

- Propane/Isobutane
  ODP = 0
  GWP = 3.0

ODP – Ozone Depleting Potential
GWP – Global Warming Potential

Montreal Protocol aims to phase out the ODS gases.
Regulation 12 – Ozone depleting substances (ODS)

- Does not apply to *permanently sealed units* (Reg.12.1) with no refrigerant charging connections …
- Any **deliberate emissions** prohibited (Reg.12.2)
- Other than Hydrochlorofluorocarbon (HCFC) all other ODS banned in new ships from **19 May 2005** (Reg.12.3.1)
- HCFC banned in new ships from **1 January 2020** (Reg.12.3.2)
- Delivery to **reception facilities** following removal (Reg.12.4)
Where the ODS containing equipment located on-board the ship?

- **Supplement to IAPP Certificate** - Maintain a list of equipment containing ODS (Reg.12.5)

### Table 2. Control of emissions from ships

#### 2.1 Ozone depleting substances (regulation 12)

**2.1.1** The following fire-extinguishing systems, other systems and equipment containing ozone depleting substances, other than hydro-chlorofluorocarbons, installed before 19 May 2005 may continue in service:

<table>
<thead>
<tr>
<th>System or equipment</th>
<th>Location on board</th>
<th>Substance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**2.1.2** The following systems containing hydro-chlorofluorocarbons (HCFCs) installed before 1 January 2020 may continue in service:

<table>
<thead>
<tr>
<th>System or equipment</th>
<th>Location on board</th>
<th>Substance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
How to find what has happened to ODS material and equipment?

Ships are required to complete an ODS Record Book (Reg. 12.6) for rechargeable systems.

Entries in the ODS Record Book (Reg. 12.7) include mass (kg) of substance used for:

- **Recharge**, full or partial, of equipment containing ODS;
- **Repair** or maintenance of equipment containing ODS;
- **Discharge** of ODS to the atmosphere;
- **Discharge** of ODS to land-based reception facilities;
- **Supply** of ODS to the ship.
MARPOL Annex VI – Regulation 13

Nitrogen Oxides (NO\textsubscript{x})
### Regulation 13 NO\textsubscript{x} - Application

**Applies to**
- Marine diesel engines with a power output more than **130 kW** installed on a ship constructed on or after 1 January 2000
- Marine diesel engines with a power output more than **130 kW** which undergo a major conversion on or after 1 January 2000
- Marine diesel engines with an Approved Method installed on a ship constructed on or 1 Jan 1990 to 31 Dec 1999

**Not applicable to**
- Emergency marine diesel engines
- Marine diesel engines installed on lifeboats
- Any device or equipment intended to be used solely in case of emergency

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**UN Environment**

**MAP**

**REMPECC**

**IMO**
Regulation 13 - NOx emission limits

**Tier I**
- Constructed on or after 1 Jan. 2000

**Tier II**
- Constructed on or after 1 Jan. 2011

**Tier III***
- Constructed on or after 1 Jan. 2016
- Applied in ECAs
- Tier II applied outside of ECAs

* For a ship operating within North American ECA and US Caribbean Sea Area ECA

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**Graph and Notes:**
- **20% reduction**
- **80% reduction**

**Axes:**
- **NOx emission limit (g/kWh)**
- **Rated engine speed (rpm)**
Tier III
Emission Control Areas (ECAs) for NO\textsubscript{x} emission control

North America ECA + US Caribbean ECA for **ships constructed on or after 1 January 2016**

North Sea and Baltic Sea ECA NO\textsubscript{x}: Applicable to **ships constructed on or after 1 January 2021**.
Regulation 13 (NO$_x$) – Engine certification

- Test bed exhaust emission measurement according to NOx Technical Code (NTC)
  - To demonstrate that NOx is below the IMO Tier.

- NO$_x$ Technical File
  - Information on performance and emissions tests + components, settings, operating values & adjustments to be observed

- Issue of Engine International Air Pollution Prevention (EIAPP) Certificate or statement of compliance for an engine:
  - Issued for each engine
  - Valid for the engines life (unless major conversion)
  - If there are NOx reductions technologies, specific certification rules applies.

There are options for ship-board measurement, verification and certification but not practiced due to complexity of measurements.
How to demonstrate compliance to Nox Regs.?

• Presence of valid certificates and documents:
  • EIAPP Certificate
  • $\text{NO}_x$ Technical File
  • Record books showing maintenance records and changes to engines
  • In case of NOx changeover for ECA, details of changeover;
  • Detailed examination of each engine and the above to show validity and correct settings/practices
MARPOL Annex VI – Regulation 14

Sulphur Oxides (SO\textsubscript{x}) and Particulate Matter
Regulation 14 – Fuel sulphur limits

The graph illustrates the fuel sulphur limits over time.

- **Non-ECA**:
  - 1.1.2012: 4.50%
  - 1.1.2012: 3.50%
  - 1.1.2020: 1.1.2015: 0.10%
  - 1.1.2020: 0.50%

- **ECA**:
  - 1.7.2010: 1.00%
  - 1.1.2015: 0.50%

**Time**

**Fuel oil**

% sulphur
Emission Control Areas (ECAs) for SO\textsubscript{X} emission control

North Sea and Baltic Sea ECAs

North American ECA
(Effectuated from 01/08/2012)

U.S. Caribbean ECA
(Effectuated from 01/01/2014)
IMO ECA-SOx and non-IMO SOx control regions

Extended China Domestic ECA (DECA) is now in place.
SO$_x$ compliance options

- **Multi-fuel options**: 2 or more separate fuels on-board, i.e. LS and HS fuel oils.

- **LNG as marine fuel or other alternative fuels**: Specific regulations applies.

- **SO$_x$ scrubber systems**: Specific regulations applies (equivalent method: 2015 Guidelines for exhaust gas cleaning, resolution MEPC.259(68))
Demonstrating compliance to ECA for two-fuel option (Reg. 14.6)

- **Fuel Changeover Plan:** For ships with two fuels when and entering or leaving an ECA-SOx

- **Logbook/Record Book:** Record all the details of switching fuels including:
  - Volume of low sulphur fuel oils in each tank
  - Date,
  - Time
  - Position of the ship
  - Etc.
Compliance to 2020 Sulphur limit – Carriage Ban

• Carriage ban of carrying any fuel with sulphur > 0.5%.
  • Unless scrubber is used.

• Ships can still carry high sulphur fuel as cargo but not as fuel.
Guidelines intended for use by Administrations, port States, shipowners, shipbuilders and fuel oil suppliers. **Main content:**

1. **Definitions** (DM, RM, ULSFO, VLSFO, HSHFO)

2. **Ship implementation planning** for 2020 (cf: MEPC.1/Circ.878)

3. **Impact on fuel and machinery systems:** distillate fuels (including distillate fuel with FAME) / Residual fuels / Key technical considerations for shipowners and operators / ISO Standard for residual fuels / Cylinder lubrication

4. **Verification issues and control mechanism and actions:** Survey and certification by Administrations / Control measures by port States / Control on fuel oil suppliers / Information sharing related to non-compliances under MARPOL Annex VI

5. **Fuel oil non-availability:** Guidance and information sharing on fuel oil non-availability / Standard format for reporting fuel oil non-availability (FONAR) – Appendix 1

6. **Possible safety implications** relating to fuel oils meeting the 0.50% m/m sulphur limit – Appendix 2
MARPOL Annex VI – Regulation 15

Volatile Organic Compounds (VOC)
What is VOC and its impact?

Volatile Organic Compounds (VOCs) are:

- Lighter parts of crude oil or their products that evaporates and discharged to atmosphere (mainly during ship loading with oil)
- Health issue: Can cause cancer
- Mainly from oil tankers
- Normally polluting the port of loading
How to reduce the VOC emissions: Use a Vapour Emission Control System (VECS)

- **High & Low Pressure Alarms**
- **Tank Level Alarms**
- **Level Gauge**
- **Vapour**
- **Oil**

System Components:
- ** Mast Riser**
- **P/V Valve**
- **Vapour Manifold**
- **Cargo Manifold**
Regulation 15 - VOC

- Regulation enables **ports and terminals** to implement VOC controls

- **VOC control from tankers** during loading/unloading of oil cargoes

- **Vapour Emissions Control System (VECS)** (MSC/Circ.585 guidelines)

- Crude oil tankers to have an approved **VOC Management Plan** (does not apply to gas carriers - Reg. 15.7)

- There are specific notification rules for VOC-control ports to follow.
MARPOL Annex VI – Regulation 16

Shipboard Incineration
Regulation 16 - Shipboard incineration

• Prohibits incineration of (Reg.16.2):
  • MARPOL Annex I, II & III cargoes,
  • Polychlorinated biphenyls (PCB),
  • Garbage containing heavy metals,
  • Refined petroleum products containing halogens,
  • Sewage and sludge oil not generated on board,
  • Exhaust gas cleaning system residues.

• Permits incineration of:
  • PVC – plastics (where type approved to do so) (Reg.16.3)
  • Sewage sludge and sludge oil (generated during normal operation of engines and boilers). This is not permitted in ports, harbours and estuaries (Reg.16.4)
Certificate needed for all incinerators installed from 1 January 2000.

Certification according to: “2014 Standard Specification for Shipboard Incinerators” (Reg. 16.6.1).

Incinerator shall be provided with a manufacturer’s operating manual which is to be retained.

Personnel to be trained in use (Reg. 16.7 – 16.8).

All incinerators should have a combustion flue gas outlet temperature monitoring system.

Etc. ………………….
MARPOL Annex VI – Regulation 17

Reception Facilities
Regulation 17 – Reception Facilities

- Parties are obliged to provide facilities without causing delay for:
  - Reception of ODS in ship repair yards (Reg.17.1.1); and
  - Reception of Exhaust Gas Cleaning System residues (Reg.17.1.2)
- Reception of ODS in ship breaking facilities (Reg.17.1.3)
- If unable to provide reception facilities, Party shall inform IMO (Reg.17.3 & 17.4).
- Each Party shall notify the Organization ….. When they are unavailable or alleged to be inadequate.
MARPOL Annex VI – Regulation 18

Fuel oil availability and quality
Regulation 18 – Fuel oil availability

• Parties to promote availability of compliant fuel oils (Reg.18.1)
• Ships found not to be in compliance (Reg.18.2.1)
  • Record of actions taken to achieve compliance
  • Need to demonstrate “best efforts” to obtain compliant fuel
• Ship should not be required to deviate or delay unduly the voyage in order to achieve compliance (Reg.18.2.2).
• Party required to take into account all relevant circumstances to determine action (Reg.18.2.3).
• Ship required to notify Administration and port of destination when unable to purchase compliant fuel (Reg.18.2.4).
• Party to notify the Organization when ship presents evidence of non-availability (Reg.18.2.5)
FONAR (Fuel Oil Non-Availability Reporting)

- If not in compliance, operators must:
  - Submit a FONAR
  - Notify Flag State
  - Notify Port State

- The FONAR means to capture information on:
  - Attempt to obtain compliant fuel
  - Non-availability of fuel
  - Attempt to find alternative sources of compliant fuel
  - Everything else to demonstrate best intentions.

APPENDIX 1

FUEL OIL NON-AVAILABILITY REPORT (FONAR)

Note:

1. This report is to be sent to the flag Administration and to the competent authorities in the relevant port(s) of destination in accordance with regulation 18.2.4 of MARPOL Annex VI. The report shall be sent as soon as it is determined that the ship/operator will be unable to procure compliant fuel oil and preferably before the ship leaves the port/terminal where compliant fuel cannot be obtained. A copy of the FONAR should be kept on board for inspection for at least 36 months.

2. This report should be used to provide evidence if a ship is unable to obtain fuel oil compliant with the provisions stipulated in regulations 14.1 or 14.4 of MARPOL Annex VI.

3. Before filing a FONAR, the following should be observed by the ship/operator:
   1. A fuel oil non-availability report is not an exemption. According to regulation 18.2 of MARPOL Annex VI, it is the responsibility of the Party of the destination port, through its competent authority, to scrutinize the information provided and take action, as appropriate.
   3.2 In the case of insufficiently supported and/or repeated claims of non-availability, the Party may require additional documentation and substantiation of fuel oil non-availability claims. The ship/operator may also be subject to more extensive inspections or examinations while in port.
   3.3 Ships/operators are expected to take into account logistical conditions and/or terminal/port policies when planning bunkering, including but not limited to having to change berth or anchor within a port or terminal in order to obtain compliant fuel.
Regulation 18 – Fuel oil quality

• Required properties of fuel oil identified (Reg.18.3).

• When bunkering fuel, receive a Bunker Delivery Note (BDN) (Reg. 18.5).

• BDN required to be retained for 3 three years (Reg. 18.6).

• BDN accompanied by representative sample, … retained for 12 months (Reg.18.8.1).

• Inspection and verification by PSC (Reg.18.7.1 & Reg.18.7.2).
Regulation 18 - Local suppliers of fuel oil

Parties are required to:

- Maintain a register of local suppliers of fuel oil (Reg.18.9.1)
- Local suppliers to provide a certified BDN and sample (Reg.18.9.2), and retain a copy of the BDN for 3 years (Reg.18.9.3)
- Take action against local suppliers of fuel oil that does not comply with that stated on BDN (Reg.18.9.4)
- Inform the Administration of a ship when ship is found to be non-compliant (Reg.18.9.5)
- Inform IMO of all cases of non-compliant fuel oil being supplied (Reg.18.9.6)
MARPOL Annex VI – Chapter 4

Energy efficiency regulations (CO2 emissions)
IMO shipping energy efficiency regulatory framework

- **EEDI and SEEMP**: Mandatory from 2013
- **DCS**: Mandatory from 2019
- **EEOI**: Voluntary
- **Initial IMO GHG Strategy**: Agreed in 2018 and under intense discussion
<table>
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<th>Resolution MEPC.203(62)</th>
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<td>Reg. 13 Nitrogen Oxides(NOx)</td>
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</tr>
<tr>
<td>Reg. 14 Sulphur Oxides(SOx) and Particular Matter</td>
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<td>Reg. 15 Volatile Organic Compounds (VOCs)</td>
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<td>Reg. 17 Reception Facilities</td>
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<td>Reg. 18 Fuel Oil Availability and Quality</td>
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<td>Reg. 21 Required EEDI</td>
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<td>Reg. 22 SEEMP</td>
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<td>Reg. 22A Data Collection System (DCS)</td>
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<td>Reg. 23 Promotion of technical co-operation and transfer of technology</td>
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<tr>
<td>Appendix VIII Form of International Energy Efficiency(IEE) Certificate</td>
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</table>
Regulation 19 - Applications

• This chapter **shall apply** to all ships of 400 gross tonnage and above.

• The provisions of this chapter **shall not apply** to ships solely operating in Flag’s national waters.

• Regulation 20 and regulation 21 **shall not apply** to ships with **non-conventional propulsion** with the exception of cruise passenger ship with electric propulsion, and LNG carriers ……… …
Regulation 20 – Attained EEDI

- The attained EEDI shall be calculated for:
  - each **new ship**;
  - each **new ship** which has undergone a **major conversion**; and
  - each **new or existing ship** which has undergone a major conversion, .... regarded by the Administration as a **newly constructed ship**

- The above are applicable to ships defined in Regulations 2.25 to 2.35.

- The attained EEDI shall be specific to each ship ........ and be accompanied by the **EEDI Technical File** ....

- The attained EEDI **shall be calculated** taking into account the **IMO guidelines**.

- The attained EEDI **shall be verified**, .... taking into account the **IMO guidelines**
Regulation 21 – Required EEDI

Regulatory limit of EEDI for a ship
Regulation 21.1 – Required EEDI

- Required EEDI is calculated for New Ships, or cases with major conversion.

- For ships defined in Regulation 2.25 to 2.31

- The Required EEDI shall be calculated as follows:

\[
\text{Required EEDI} = (1 - \frac{X}{100}) \times (\text{Reference EEDI})
\]

- Where
  - **Reference EEDI** is the EEDI from reference line
  - **X** is the reduction factor
Regulation 21.3 – Reference line (value)

- Reference line = \( a^*b^{-c} \)

### Table 2. Parameters for determination of reference values for the different ship types

<table>
<thead>
<tr>
<th>Ship type defined in regulation 2</th>
<th>a</th>
<th>b</th>
<th>c</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.25 Bulk carrier</td>
<td>961.79</td>
<td>DWT of the ship</td>
<td>0.477</td>
</tr>
<tr>
<td>2.26 Gas carrier</td>
<td>1120.00</td>
<td>DWT of the ship</td>
<td>0.456</td>
</tr>
<tr>
<td>2.27 Tanker</td>
<td>1218.80</td>
<td>DWT of the ship</td>
<td>0.488</td>
</tr>
<tr>
<td>2.28 Container ship</td>
<td>174.22</td>
<td>DWT of the ship</td>
<td>0.201</td>
</tr>
<tr>
<td>2.29 General cargo ship</td>
<td>107.48</td>
<td>DWT of the ship</td>
<td>0.216</td>
</tr>
<tr>
<td>2.30 Refrigerated cargo carrier</td>
<td>227.01</td>
<td>DWT of the ship</td>
<td>0.244</td>
</tr>
<tr>
<td>2.31 Combination carrier</td>
<td>1219.00</td>
<td>DWT of the ship</td>
<td>0.488</td>
</tr>
</tbody>
</table>
Regulation 21: Reduction factor (X) for calculation of Required EEDI

<table>
<thead>
<tr>
<th>Size</th>
<th>Phase 0 1 Jan 2013 – 31 Dec 2014</th>
<th>Phase 1 1 Jan 2015 – 31 Dec 2019</th>
<th>Phase 2 1 Jan 2020 – 31 Dec 2024</th>
<th>Phase 3 1 Jan 2025 onwards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulk Carriers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;20,000 Dwt</td>
<td>0%</td>
<td>10%</td>
<td>20%</td>
<td>30%</td>
</tr>
<tr>
<td>10-20,000 Dwt</td>
<td>n/a</td>
<td>0-10%*</td>
<td>0-20%*</td>
<td>0-30%*</td>
</tr>
<tr>
<td>Gas tankers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;10,000 Dwt</td>
<td>0%</td>
<td>10%</td>
<td>20%</td>
<td>30%</td>
</tr>
<tr>
<td>2-10,000 Dwt</td>
<td>n/a</td>
<td>0-10%*</td>
<td>0-20%*</td>
<td>0-30%*</td>
</tr>
<tr>
<td>Tanker and combination carriers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;20,000 Dwt</td>
<td>0%</td>
<td>10%</td>
<td>20%</td>
<td>30%</td>
</tr>
<tr>
<td>4-20,000 Dwt</td>
<td>n/a</td>
<td>0-10%*</td>
<td>0-20%*</td>
<td>0-30%*</td>
</tr>
<tr>
<td>Container ships</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;15,000 Dwt</td>
<td>0%</td>
<td>10%</td>
<td>20%</td>
<td>30%</td>
</tr>
<tr>
<td>10-15,000 Dwt</td>
<td>n/a</td>
<td>0-10%*</td>
<td>0-20%*</td>
<td>0-30%*</td>
</tr>
<tr>
<td>General Cargo ships</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;15,000 Dwt</td>
<td>0%</td>
<td>10%</td>
<td>15%</td>
<td>30%</td>
</tr>
<tr>
<td>3-15,000 Dwt</td>
<td>n/a</td>
<td>0-10%*</td>
<td>0-15%*</td>
<td>0-30%*</td>
</tr>
<tr>
<td>Refrigerated cargo carriers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;5,000 Dwt</td>
<td>0%</td>
<td>10%</td>
<td>15%</td>
<td>30%</td>
</tr>
<tr>
<td>3-5,000 Dwt</td>
<td>n/a</td>
<td>0-10%*</td>
<td>0-15%*</td>
<td>0-30%*</td>
</tr>
</tbody>
</table>

* The reduction factor is to be linearly interpolated between the two values depending on the vessel size. The lower value of the reduction factor is to be applied to the smaller ship size.
Required EEDI for different phases as a function of ship size
Regulation 21.1 – Regulatory requirement

Attained EEDI ≤ Required EEDI

--- Required EEDI
X: Ship A – compliant
X: Ship B – non-compliant

Attained EEDI

Size (DWT or GT)
Regulation 22

Ship Energy Efficiency Management Plan (SEEMP)

1. Each ship shall keep on board a ship specific Ship Energy Efficiency Management Plan (SEEMP). This may form part of the ship's Safety Management System (SMS).

2. The SEEMP shall be developed taking into account guidelines adopted by the Organization.
SEEMP framework (see details in the relevant Guidelines)

• SEEMP works through four steps:
  • Planning,
  • Implementation
  • Monitoring, and
  • Self-evaluation

• Continuous improvement cycle for improving ship energy management

• Within the SEEMP, a number of Energy Efficiency Measures are documented for implementation.
Regulation 22A – Fuel Consumption Data Collection system for ships
IMO Data collection and reporting framework

- Regulations for mandatory measurement and reporting of the ship’s annual fuel consumption.
- The system have three main elements:
  1. Data collection and reporting by ships (company)
  2. Data verification by Flag State and delivery to IMO
  3. Data storage in a centralised database at the IMO.
IMO ship fuel DCS: Main features

• Applicable to ships greater than 5000 GT.

• Annual reporting with no need for voyage data.

• IMO number for ship identification

• Company responsible for submission of data.

• Flag Administration responsible for data verification.

• Compliance through having a Statement of Compliance (SOC) issued annually.

• Aggregated data to be submitted and stored in an IMO database
IMO ship fuel consumption DCS: Types of data to be reported

The following data to be reported annually:

• Ship IMO number

• Technical characteristics of the ship:
  • Ship type
  • Gross Tonnage
  • Net tonnage
  • Deadweight at summer load line
  • Main and auxiliary engine MCR (Maximum Continuous Rating)
  • EEDI, if applicable
  • Ice class, if applicable

• Total annual fuel consumption by fuel type

• Distance travelled

• Hours underway
IMO ship fuel consumption DCS: Ship fuel oil consumption measurement

• Three main methods to be used:
  • Use of BDN plus additional ship-board fuel stock check.
  • Use of regular ship-board fuel stock check
  • Use of fuel flow meters.

• The methodology to be specified in SEEMP Part II: Data Collection Plan

• All the relevant data and calculations to be retained by ship for a set period.
IMO ship fuel DCS: Regulatory timetable

**2018**
- **01/03/18** Entry into force
- **31/12/18** SEEMP shall include a Data Collection Plan

**2019**
- **01/04/20** Ship to Administration reporting
- **01/06/20** Issuance of Statement of Compliance

**2020**
- **01/08/20** Administration to IMO reporting

**2021**
- **31/05/21** End of validity Statement of Compliance
Verification aspects – Statement of Compliance

- Verification is the responsibility of Flag Administration.

- What will be verified:
  - The data collection method and process (to be included in SEEMP).
  - The actual data submitted and their compliance with the agreed process.

- A Statement of Compliance (SOC) will be issued for each calendar year by Administration.

- The SOC and disaggregated data should be retained on-board the ship for a set period (for at least the period of its validity).
IMO ship fuel DCS: Reporting and IMO database

- It is the responsibility of the Flag Administration to transfer the relevant data to the IMO database.
- IMO will set up a “Fuel Oil Consumption Data Base”.
- IMO will store the data in the above data base.
- Access to database by MARPOL Annex VI Parties will be possible but ships will remain anonymous.

The IMO Fuel Oil Consumption database is now part of the GESIS and Administrations will have access to it.
Initial IMO GHG Strategy
Initial IMO GHG Strategy: Main targets

• Total GHG emissions from international shipping
  • To peak as early as possible..
  • Reduce the total annual emissions by at least 50% by 2050 as compared to 2008.

• Ship operational energy efficiency
  • Energy efficiency of shipping (tonne CO2/tonne.mile cargo) to reduce by an average of at least 40% by 2030, with main aim of reaching 70% by 2050, as compared to 2008.
How to do it: By identifying and regulating new Energy Efficiency Measures

• Initial IMO GHG Strategy advocates the energy efficiency activities as below:

  • **Short term measures**: Are those that can be defined and finalised between 2018 and 2023.

  • **Mid-term measures** are those that will be those beyond short term and for discussion by the IMO between 2023 and 2030.

  • **Long-term measures** are those measures that are going to be finalized, regulated and agreed by the IMO beyond 2030.
IMO GHG Strategy status

- Agreed in 2018

- Being debated mainly in two areas:
  - Measures to be developed and regulated
  - Impact assessment on countries

- Revised version by 2023.

- MEPC has already debated some short term measures and the following has moved forward:
  - EEXI: A similar scheme as EEDI but for existing ships.
  - CII (Carbon Intensity Index): An operational efficiency indicator for measurement of energy efficiency of ships.
  - EEDI: Further increase in Reduction Factors (X) and bringing forward dates for Phase 3.

- There are requests for IMO to include debate on MBM on the agenda.
REMPEC, an IMO / UNEP Centre assisting the Mediterranean coastal States in ratifying, transposing, implementing and enforcing international maritime conventions related to the protection of the marine environment

Thank you

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