

# TÜRK LOYDU



## **SURVEY and CERTIFICATION RULES on ENERGY EFFICIENCY of SHIPS (MARPOL 73/78 ANNEX VI, CHAPTER 4)**

**July 2019**

This latest edition incorporates all rule changes. The latest revisions are shown with a vertical line. The section title is framed if the section is revised completely. Changes after the publication of the rule are written in red colour.

Unless otherwise specified, these Rules apply to ships for which the date of contract for construction as defined in TL-PR 29 is on or after 1<sup>st</sup> of July 2019. New rules or amendments entering into force after the date of contract for construction are to be applied if required by those rules. See Rule Change Notices on TL website for details.

"General Terms and Conditions" of the respective latest edition will be applicable (see Rules for Classification and Surveys).

If there is a difference between the rules in English and in Turkish, the rule in English is to be considered as valid. This publication is available in print and electronic pdf version.

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## FOREWORD

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**1. DEFINITIONS OF TERMS USED IN GUIDELINES**

“TL” means Türk Loydu

"New ship" means a ship:

1. For which the building contract is placed on or after 1 January 2013; or
2. In the absence of a building contract, the keel of which is laid or which is at a similar stage of construction on or after 1 July 2013; or
3. The delivery of which is on or after 1 July 2015.

(**TL note:** For the application of phases specified in regulation 21 (required EEDI) to “new ship”, refer to Annex 2 B of these guidelines or MEPC.1/Circ 795/Rev.5)

"Existing ship" means a ship which is not a new ship.

"Major Conversion" means a conversion of a ship (in relation to energy efficiency) :

1. Which substantially alters the dimensions, carrying capacity or engine power of the ship; or
2. Which changes the type of the ship; or
3. The intent of which in the opinion of the Administration is substantially to prolong the life of the ship; or
4. Which otherwise so alters the ship that, if it were a new ship, it would become subject to relevant provisions of the present Convention not applicable to it as an existing ship; or
5. Which substantially alters the energy efficiency of the ship and includes any modifications that could cause the ship to exceed the applicable required EEDI.

(**Additional information:** Unified Interpretations for major conversion (MEPC.1/Circ 795/Rev.5)):

1. For regulation 2.24.1 of MARPOL Annex VI, any substantial change in hull dimensions and/or capacity (e.g. change of length between perpendiculars (LPP) or change of assigned freeboard) should be considered a major conversion. Any substantial increase of total engine power for propulsion (e.g. 5 per cent or more) should be considered a major conversion. In any case, it is the Administration's authority to evaluate and decide whether an alteration should be considered as major conversion, consistent with chapter 4 of MARPOL Annex VI.
2. Notwithstanding paragraph 1, for regulation 2.24.5 of MARPOL Annex VI, the effect on attained EEDI as a result of any change of ship's parameters, particularly any increase in total engine power for propulsion, should be investigated. In any case, it is the Administration's authority to evaluate and decide whether an alteration should be considered as major conversion, consistent with chapter 4 of MARPOL Annex VI.
3. A company may, at any time, voluntarily request re-certification of EEDI with IEEC reissuance on the basis of any new improvements to the ship efficiency that are not considered to be major conversion.

4. In regulation 2.24.4 of MARPOL Annex VI, terms "new ship" and "existing ship" should be understood as they are used in MARPOL Annex I regulation 1.9.1.4, rather than as the defined terms in regulations 2.22 and 2.23.

5. The term "a ship" referred to in regulation 5.4.2 of MARPOL Annex VI is interpreted as "new ship."

**(Additional information:** For application details of major conversion refer to "6. EEDI VERIFICATION FOR MAJOR CONVERSIONS" of these guidelines.)

"EEDI" is Energy Efficiency Design Index

"Attained EEDI" is the EEDI value achieved by an individual ship in accordance with regulation 20 of chapter 4 of MARPOL 73/78 Annex VI. Attained EEDI is specific to each ship and indicates the estimated performance of the ship in terms of energy efficiency. The attained EEDI shall be verified, based on the EEDI technical file, either by the Administration or by any organization duly authorized by it. **TL** acts as a verifier for the EEDI.

"Required EEDI" is the maximum allowable value of attained EEDI that is allowed by regulation 21 of chapter 4 of MARPOL 73/78 Annex VI for the specific ship type and size.

"EEDI Technical File" is a documentation package that contains the information necessary for the calculation of the attained EEDI and shows the process of calculation. The EEDI Technical File has to be approved by the recognized organization or a classification society on their behalf. EEDI Technical File should be written at least in English.

"Reference line" is a curve representing an average index value fitted on a set of individual index values for a defined group of ships. The reference lines were established by using existing ships index values for each ship type to which regulation 21 (Required EEDI) of MARPOL Annex VI is applicable.

"EEDI Condition" is a ship's loading condition corresponding to the maximum summer load draught in order to determine the capacity under EEDI calculations. For container ships, capacity is to set to 70 % of DWT. For ships other than container ships; capacity is to set to DWT.

"SEEMP" is Ship Energy Efficiency Management Plan. This plan shall be ship specific. The Ship Energy Efficiency Management Plan (SEEMP) is a management plan designed to improve the ship energy efficiency by implementing operational or technical measures such as but not limited to speed optimization, optimum trim, propeller polishing, and energy saving devices.

"Verifier" means an Administration or organization duly authorized by it, which conducts the survey and certification of the EEDI in accordance with regulations 5, 6, 7, 8 and 9 of MARPOL Annex VI. **TL** acts as a verifier for the EEDI.

"Tank test" means model towing tests, model self-propulsion tests and model propeller open water tests. Numerical calculations may be accepted as equivalent to model propeller open water tests or used to complement the tank tests conducted (e.g. to evaluate the effect of additional hull features such as fins, etc., on ship's performance), with approval of the verifier.

"IAPP Certificate" is International Air Pollution Prevention Certificate

"EIAPP Certificate" is Engine International Air Pollution Prevention Certificate

“IEEC” is International Energy Efficiency Certificate

“ITTC” is International Towing Tank Conference. The International Towing Tank Conference is a voluntary association of worldwide organizations that have responsibility for the prediction of hydrodynamic performance of ships and marine installations based on the results of physical and numerical modeling.

“Industry guidelines” means guidelines issued by PR 38 and MEPC 76/INF.28

## **2. GENERAL REQUIREMENTS OF CHAPTER 4 OF MARPOL 73/78 ANNEX VI AND APPLICABILITY TO SHIPS**

The amendments to MARPOL 73/78 ANNEX VI apply to all ships of 400 gross tonnage and above engaged in international voyages. In principle the regulations on “attained EEDI” and “required EEDI” shall not apply to ships mentioned hereunder:

- which have non-conventional propulsion, except that “attained EEDI” and “required EEDI” shall apply to cruise passenger ships having non-conventional propulsion and LNG carriers having conventional or non-conventional propulsion, delivered on or after 1 September 2019, as defined in MARPOL Annex VI, paragraph 43 of regulation 2. “required EEDI” and “required EEDI” shall not apply to **category A ships as defined in the Polar Code**.
- Which are waived by the Administration from having to comply with the requirements. In compliance with MARPOL Annex VI, Regulation 19.5, the waiver shall not apply to ships:
  - for which the building contract is placed on or after 1 January 2017; or
  - in the absence of a building contract, the keel of which is laid or which is at a similar stage of construction on or after 1 July 2017; or
  - the delivery of which is on or after 1 July 2019; or
  - in cases of a major conversion of a new or existing ship, as defined in 1. (Regulation 2.24 of MARPOL Annex VI, Chapter 1), on or after 1 January 2017, and in which regulation 5.4.2 and regulation 5.4.3 of MARPOL Annex VI, Chapter 2 apply.
- ships not propelled by mechanical means, and platforms including FPSOs and FSUs and drilling rigs, regardless of their propulsion.

For innovative technologies other than diesel-electric propulsion, turbine propulsion or hybrid propulsion systems, MEPC.1/Circ.896 "2021 Guidance on treatment of innovative energy efficiency technologies for calculation and verification of the attained EEDI **and EEXI**" shall be used if applicable for the system.

### **2.1 Attained EEDI**

The attained EEDI shall be calculated for

“1. Each new ship;

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2. Each new ship which has undergone a major conversion; and
3. Each new or existing ship which has undergone a major conversion, that is so extensive that the ship is regarded by the Administration as a newly constructed ship”

That falls into one or more of the categories defined in Regulation 2.25 to 2.35, 2.38 and 2.39 of MARPOL 73/78 ANNEX VI, attained EEDI shall be calculated in accordance with IMO Resolution MEPC 308(73) **as amended by MEPC 322(74)**

and MEPC 332(76) "2018 GUIDELINES ON THE METHOD OF CALCULATION OF THE ATTAINED ENERGY EFFICIENCY DESIGN INDEX (EEDI) FOR NEW SHIPS".

For the definition of each type of ship, please refer to Annex 1.

For each ship subject to regulation 21 of MARPOL Annex VI, the Administration or TL duly authorized by it shall report to the Organization the required and attained EEDI values and relevant information via electronic communication within 7 months of completing the survey required under regulation 5.4 of MARPOL Annex VI.

## **2.2 Required EEDI**

For each:

"1. New ship;

2. New ship which has undergone a major conversion; and

3. New or existing ship which has undergone a major conversion that is so extensive that the ship is regarded by the Administration as a newly constructed ship"

That falls into one of the categories defined in Regulation 2.25 to 2.31, 2.33 to 2.35, 2.38 and 2.39 of MARPOL 73/78 ANNEX VI; a ship's attained EEDI shall be on or below the required EEDI for that ship type and size.

Required EEDI is scheduled to become more stringent from Phase 0 to Phase 3 by using a reduction factor (X) from the reference line. For the details on the required EEDI, please refer to Annex 2. Attained EEDI is to satisfy:

$$\text{Attained EEDI} \leq \text{Required EEDI} = (1-X/100) \times \text{Reference Line Value}$$

## **2.3 SEEMP**

All ships (new and existing ships) with a gross tonnage of 400 tonnage and above engaged in international voyages 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). With respect to ships required to keep on board a SEEMP, such ships exclude platforms (including FPSOs and FSUs) and drilling rigs, regardless of their propulsion.

SEEMP shall be developed according to IMO Resolution MEPC.282(70) "2016 GUIDELINES FOR THE DEVELOPMENT OF A SHIP ENERGY EFFICIENCY MANAGEMENT PLAN (SEEMP)"

For new ships, the verification of the requirement to have a SEEMP on board according to regulation 22 shall take place at the initial survey before a new ship is put in service and before the IEEC is issued.

For existing ships, the verification of the requirement to have a SEEMP on board according to regulation 22 shall take place at the initial survey before the IEEC is issued. (For existing ships, initial survey of IEEC is the first intermediate or renewal survey of the International Air Pollution Prevention Certificate (IAPP Certificate), whichever is the first, on or after 1 January 2013)

## **2.4 IEEC**

International Energy Efficiency Certificate (IEEC), is to be issued for all ships (new and existing ships) after the requirements of the Initial Survey for any ship of 400 gross tonnage and above engaged in international voyages have been satisfied according to chapter 4 of MARPOL 73/78 ANNEX VI.

For new ships, initial survey shall be completed before a new ship is put in service.

The IEEC has no expiry date, since it will be valid throughout the life of the ship and subsequent periodical surveys are not required. The IEEC shall only cease to be valid in any of the cases listed hereunder. In cases 2 and 3 IEEC shall be rewritten or reissued.

1. If the ship is withdrawn from service; or
2. If the ship undergoes a major conversion; or
3. Upon transfer of the ship to the flag of another State

Where the Flag Administration has not ratified ANNEX VI of MARPOL 73/78 and if **TL** authorized by Administration, **TL** will carry out the relevant surveys and issue "Document/**Statement** of Compliance" on behalf of the Administration.

In relation to chapter 4, any port State inspection shall be limited to verifying, when appropriate, that there is a valid International Energy Efficiency Certificate on board, in accordance with article 5 of the Convention.

## **3. INITIAL SURVEY REQUIREMENTS OF IEEC**

New ships required to carry IEEC after completion of initial survey of IEEC. (**TL note:** Refer to "1. DEFINITIONS OF TERMS USED IN GUIDELINES" for "new ship" definition in guidelines)

Briefly, during initial survey of IEEC for new ships, **TL** surveyor shall verify that:

- Ship's attained EEDI is in accordance with the requirements in chapter 4 of ANNEX VI of MARPOL 73/78
- Ship has an approved EEDI Technical File
- The technical equipment listed in the EEDI Technical File is available on board (engine, shaft, generator)
- The ship specific SEEMP is provided onboard. (SEEMP does not to be approved by the Administration or Classification Society under the revised MARPOL ANNEX VI)
- The SEEMP is established in a working language or languages understood by ship's personnel
- The SEEMP is developed taking into account IMO Resolution MEPC.282(70) "2016 GUIDELINES FOR THE DEVELOPMENT OF A SHIP ENERGY EFFICIENCY MANAGEMENT PLAN (SEEMP)"

In detail, **TL** surveyor shall also verify that SEEMP includes items listed hereunder:

- Energy efficiency improvement measures (representative examples of the measures are presented in chapter 5 of MEPC.282(70), e.g. weather routing, speed optimization, etc.)



- Monitoring methods for energy efficiency
- Measurable goals for energy efficiency
- Procedures of evaluation
- Fuel oil consumption data collection plan (for a ship to which regulation 22A applies)
  - Description of the methodology that will be used to collect the data
  - Processes that will be used to report the data

#### **4. EEDI VERIFICATION PROCESS OF NEW SHIPS FROM DESIGN STAGE TO FINAL VERIFICATION**

The attained EEDI shall be calculated for

1 Each new ship;

2. Each new ship which has undergone a major conversion; and

3. Each new or existing ship which has undergone a major conversion, that is so extensive that the ship is regarded by the Administration as a newly constructed ship”

That falls into one or more of the categories defined in Regulation 2.25 to 2.35, 2.38 and 2.39 of MARPOL 73/78 ANNEX VI. Attained EEDI shall be calculated in accordance with IMO Resolution MEPC 308(73) **as amended by MEPC 322(74) and MEPC 332(76)** "2018 GUIDELINES ON THE METHOD OF CALCULATION OF THE ATTAINED ENERGY EFFICIENCY DESIGN INDEX (EEDI) FOR NEW SHIPS" and Part II of Industry Guidelines.

For the definition of each type of ship, please refer to Annex 1.

Before the design stage designer/owner/shipbuilder should assess by taking into account ship type, DWT, construction date etc.; the situation of the ship, whether:

- The the ship has to comply with required EEDI according to regulation 21 of chapter 4 of MARPOL 73/78 Annex VI (refer to Annex 2 of guidelines)
- Which phase is applicable for the ship (refer to Annex 2 of guidelines)

**(Additional information:** In determining a ship's attained Energy Efficiency Design Index (EEDI) as per resolution MEPC 308(73), **as amended by MEPC.322(74) and MEPC 332(76)**, a lower threshold for the minimum installed propulsion power for bulk carriers, oil and chemical tankers and combination carriers is needed. The method for determining this lower minimum threshold is contained in MEPC 232 (65) as amended by MEPC 255(67) and 262(68), "2013 Interim Guidelines for determining minimum propulsion power to maintain the manoeuvrability of ships in adverse conditions" **and the Guidelines for determining minimum propulsion power to maintain the manoeuvrability of ships in adverse conditions (MEPC.1/Circ.850/Rev.3)**

EEDI verification is conducted in accordance with MEPC.254(67) as amended by MEPC 261(68) and MEPC 309(73) "2014 GUIDELINES ON SURVEY AND CERTIFICATION OF THE ENERGY EFFICIENCY DESIGN INDEX (EEDI)" and TL-PR 38.

EEDI verification is conducted through 2 steps:

- Preliminary verification at the design stage
- Final verification during sea trials

For ships to which regulation 21 (required EEDI) of MARPOL Annex VI applies, the power curves used for the preliminary verification at the design stage should be based on reliable results of tank test.

For ensuring the quality of tank tests, ITTC quality system should be taken into account. **TL** is to familiarize with the towing tank test organization test facilities, measuring equipment, standard model-ship extrapolation and correlation method (applied method and tests description) and quality system for consideration of complying with the requirements of 15.6 of Industry guidelines prior to the test attendance when **TL** has no recent experience with the tank test facilities.

When in addition the towing tank test organization quality system is not ISO 9001 certified; the following additional information relative to the towing tank test organization is to be submitted to **TL**:

- Descriptions of the tank test facility; this should include the name of the facility, the particulars of tanks and towing equipment, and the records of calibration of each monitoring equipment.
- Quality manual containing at least the information listed in the ITTC Sample quality manual (2002 issue) Records of measuring equipment calibration.

**TL** will audit the quality management system of the towing tank if previous experience is insufficiently demonstrated.

Model tank test should be witnessed by the **TL** or further to the agreement of the submitter of the EEDI Technical File and the Shipowner, **TL** may accept towing tank tests reports witnessed by another Society if the towing tank tested ship is of the same type as the ship of which the EEDI is verified. Acceptance of towing tank tests witnessed by another Society:

- Copies of the following documents are to be provided to **TL**, with due consideration given to the protection of the Intellectual Property Rights (IPR) as indicated under paragraph 14 of Industry guidelines:
  - Calculation of the reference speed of the verified ship explicitly making reference to the speed power curves of the tank tested ship model
  - Witnessing protocol of the tank tested ship endorsed by the surveyor of the Witnessing Society
  - Towing tank test report of the tank tested ship
- On specific request of **TL**, the following additional information is to be submitted:
  - Ship lines and model particulars, loading and operating conditions of the tank tested ship as described in 4.2.7.2 of IMO "2014 Guidelines on Survey and Certification of the Energy Efficiency Design Index (EEDI)" as amended, showing that the verified ship and the tank tested ship are of the same type
- If some of the relevant information is held by the original Witnessing Society, the submitter should authorize the Witnessing Society to make the information available to **TL**.

Towing tank tests of a new ship performed before the entry into force of MARPOL Annex VI amendments introducing the EEDI have not been witnessed by a Verifier. In this case, towing tank test results provided by a tank test organization

with quality control certified according to a recognized scheme or with experience acceptable to **TL** may be accepted by **TL**.

A tank test for an individual ship may be omitted in the following cases:

- The results of tank tests for ships of the same type are available
- Speed trials will be carried under the EEDI condition upon agreement of the shipowner and shipbuilder and with approval of the **TL**.
- Required EEDI is not applied
- Other cases based on technical justifications

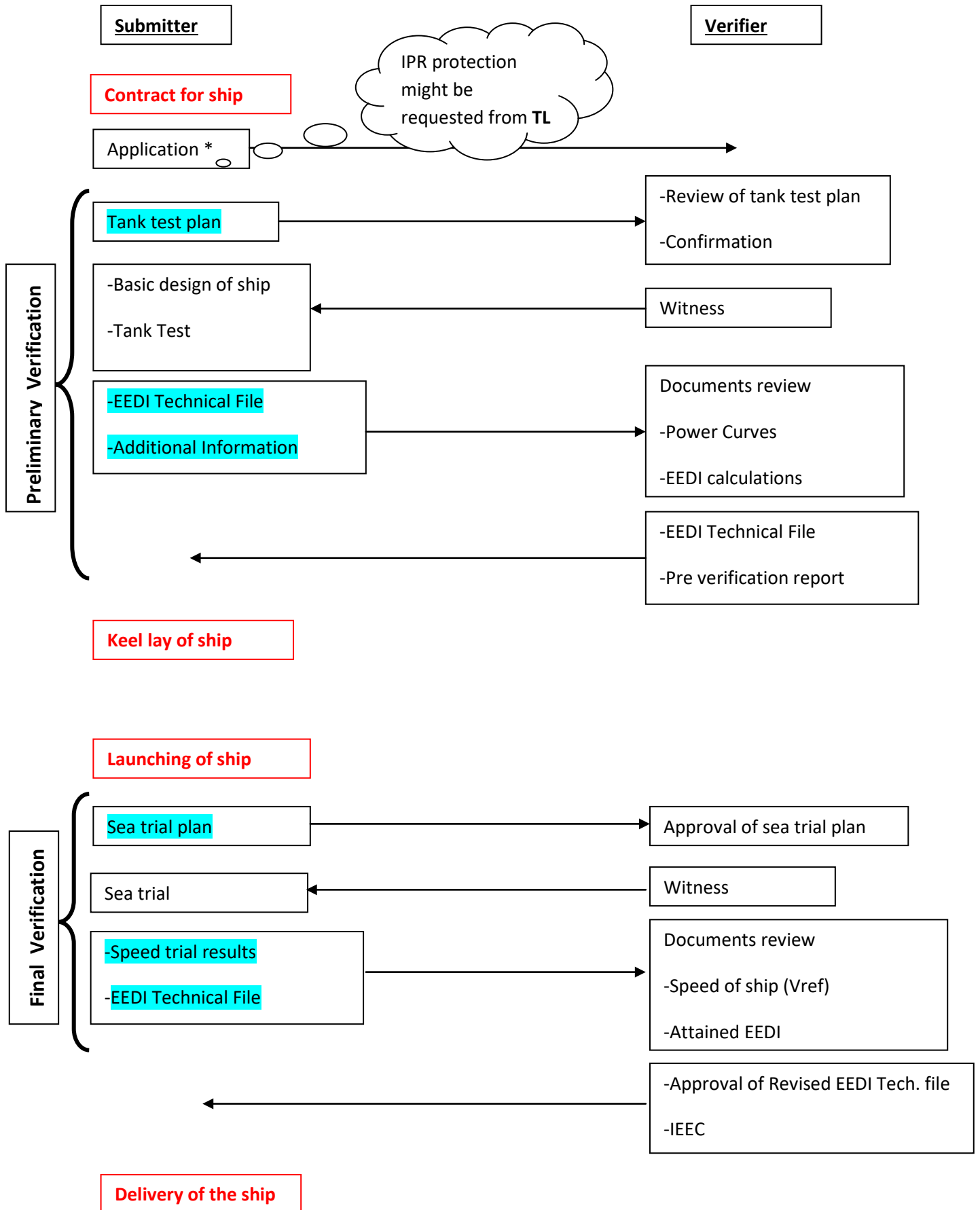
In line with the MEPC.254(67) as amended by MEPC 261(68) and MEPC 309(73) "2014 GUIDELINES ON SURVEY AND CERTIFICATION OF THE ENERGY EFFICIENCY DESIGN INDEX (EEDI)" (4.1.2), it is recognized that the documents submitted for verification may contain confidential information of submitters, which requires Intellectual Property Rights (IPR) protection. In the case where the submitter wants a non-disclosure agreement with the **TL**, the additional information should be provided to **TL** upon mutually agreed terms and conditions.

Documents to be submitted for preliminary verification at the design stage

For preliminary verification stage submitter shall submit documents listed hereunder to **TL**:

- If necessary, documented information about tank test facility.
- Tank tests plan (min. 3 copies)
- EEDI Technical File (min. 3 copies)
- EIAPP certificates and NOx technical files of engines or technical files of engine manufacturers (min. 3 copies)
- Electric Power Table, if applicable
- Additional information (min. 3 copies)
  - Preliminary trim and stability booklet,
  - Documentation for innovative technologies if necessary for calculation of EEDI,
  - Model test results,
  - Lines plan of model ship and actual ship,
  - Detailed calculation process for determining the ships speed which includes the way to estimate the power curves etc.

Basic Flow of Survey and Certification Process



Data for preliminary EEDI technical file

Parameter	Description	Unit
C <sub>F</sub>	The conversion factor of the fuel type used for EIAPP cert. in NO <sub>x</sub> Tech. File of all main and auxiliary engines (MEPC.308(73), <b>as amended by MEPC.322(74) and MEPC 332(76)</b> .)	g CO <sub>2</sub> /g fuel
Δ	The displacement should be taken from the loading manual / preliminary trim and stability booklet.	t
DWT	The deadweight should be taken from the loading manual / preliminary trim and stability booklet, alternatively a freeboard calculation.	t
f <sub>eff(i)</sub>	The availability factor for each innovative energy efficiency technology shall be based on comprehensive documentation of the determination for each innovative energy efficiency technology For waste heat recovery systems f <sub>eff(i)</sub> shall be set to one.	
f <sub>i</sub>	For ice-classed ships f <sub>i</sub> is determined by the standard given in MEPC. 308(73), <b>as amended by MEPC.322(74) and MEPC 332(76)</b> . Documentation on intended ice class	
f <sub>j</sub>	For ships with planned ice class f <sub>j</sub> is given in MEPC. 308(73), <b>as amended by MEPC.322(74) and MEPC 332(76)</b> . Documentation on intended ice class	
f <sub>w</sub>	Refer to MEPC.1/Circ. 796	
f <sub>c</sub>	Cubic capacity correction factor given in MEPC. 308(73), <b>as amended by MEPC.322(74) and MEPC 332(76)</b> .	
f <sub>i</sub>	For general cargo ships equipped with cranes and other cargo-related gear to compensate in a loss of deadweight of the ship	
f <sub>m</sub>	<b>For ice-classed ships having IA Super or IA f<sub>m</sub> is determined by the standard given in MEPC. 308(73), as amended by MEPC.322(74) and MEPC 332(76) .</b> Documentation on intended ice class	
GT	GT shall be calculated acc. to the International Convention of Tonnage Measurements of ships 1969, corresponding documentation shall be submitted	
Lightweight	The lightweight shall be taken from the loading manual / preliminary trim and stability booklet.	t
P <sub>AE</sub>	<ul style="list-style-type: none"> <li>- If <math>\sum MCR_{ME(i)} &gt; 10,000</math> Kw, P<sub>AE</sub> shall be calculated as: <math>P_{AE} = 0.025 \cdot (MCR_{ME} + 250)</math></li> <li>- If <math>\sum P_{ME(i)} &lt; 10,000</math> Kw, P<sub>AE</sub> shall be: <math>P_{AE} = 0.05 \cdot MCR_{ME}</math></li> <li>- For LNG Carriers with a reliquefaction system or compressor(s) extra items, in accordance with MEPC. 308(73), <b>as amended by MEPC.322(74) and MEPC 332(76)</b> ., to be added to above P<sub>AE</sub> formulations, is to be provided.</li> </ul> <p>For ship where the P<sub>AE</sub> value calculated as above is significantly different from the total power used at normal seagoing condition, The P<sub>AE</sub> calculation in accordance with MEPC. 308(73), <b>as amended by MEPC.322(74) and MEPC 332(76)</b> ., (see also MEPC. 308(73) <b>as amended by MEPC.322(74) and MEPC 332(76)</b> Appendix 2 for guidance), is to be provided.</p>	kW

Data for preliminary EEDI technical file

Parameter	Description	Unit
$P_{Aeff(i)}$	Manufacturer's documentation acc. to existing IEC and ISO standards incl. factory acceptance test data for auxiliary power reduction with innovative mechanical energy efficient technology.	kW
$P_{eff(i)}$	Manufacturer's documentation acc. to existing IEC and ISO standards incl. factory acceptance test data for power output of each innovative mechanical energy efficient technology.	kW
$P_{ME(i)}$	EIAPP certificate to document MCR of main engine(s). Manufacturer's documentation is required if an EIAPP certificate is not available at the design stage.	kW
$P_{PTI(i)}$	Manufacturer's documentation acc. to existing IEC and ISO standards incl. factory acceptance test data for power take-in devices (e.g. shaft motor).  If a shaft motor is installed also the weighted average efficiency of the generators shall be documented.	kW
$P_{PTO(i)}$	Manufacturer's documentation acc. to existing IEC and ISO standards incl. factory acceptance test data for power take-off devices (e.g. shaft generator) and their efficiency.  Alternatively a fixed value of 0.9 could be used as efficiency.	kW
$SFC_{AE}$	EIAPP certificate and NO <sub>x</sub> Technical File acc. NO <sub>x</sub> Technical Code to document specific fuel oil consumption at 50% of MCR power of auxiliary engine(s).  Manufacturer's documentation is required if an EIAPP certificate is not available at the design stage.  If no EIAPP Certificate for an engine is available because its power is below 130 kW, the SFC specified by the manufacturer and endorsed by a competent authority should be used	g/kWh
$SFC_{ME(i)}$	EIAPP certificate and Technical File acc. NO <sub>x</sub> Technical Code to document specific fuel oil consumption at 75% of MCR power of main engine(s)  Manufacturer's documentation is required if an EIAPP certificate is not available at the design stage.	g/kWh
$V_{ref}$	A speed-power curve from towing tank test (or equivalent) for  a) EEDI conditions, and b) Ballast conditions at sea trial  The documents shall include the name and particulars of the towing tank facility where the towing tank tests were conducted and the details of the calculation method.	kn

Sub Steps for preliminary verification

1. Review of the tank test plan
2. Witnessing of the tank tests

**TL** shall verify:

- Quality control of the tank test facility
  - Ship model: Manufacturing accuracy
  - Propeller Model: Manufacturing accuracy
  - Calibration records of measuring equipment
  - Draught at the resistance test and self-propulsion test
  - Measurement items of resistance test, self-propulsion test and propeller open water test
3. Document review

**TL** will check that the work done by the tank test organisation is consistent with the present IMO Guidelines. In particular, **TL** will review that the power curves at full scale are determined in a consistent way between sea trials and EEDI loading conditions, applying the same calculation process of the power curves and considering justifiable differences of experience based parameters between the two conditions, in order to verify the results for the design stage based on the EEDI Technical File and Additional Information.

4. Issuance of preliminary verification report

After the completion of the preliminary verification of EEDI at design stage, a preliminary verification report will be issued by **TL**.

Documents to be submitted for final verification during sea trials

- Sea trial plan (min. 3 copies)
- Results of speed trial (min. 3 copies) (Documentation shall include description of measuring and sea trial procedure observed and measured environmental conditions, draft and trim of the ship, uncorrected measured data, and the calibration records of the measuring equipment used. The sea trial report shall include the speed-power curves.)
- EEDI Technical File (Final) (min. 3 copies)
- NOx Technical File (for confirmation of specific fuel consumption of the main and auxiliary engines) (min. 3 copies)

- Additional information (min. 3 copies)
  - Results of inclining test /Lightweight survey (for confirmation of deadweight)
  - Final trim and stability booklet
  - Documentation of measured main and auxiliary power reduction with innovative mechanical energy efficient technology and method used
  - Documentation of reference speed calculation

Data for final EEDI technical file after sea trial

Parameter	Description	Unit
$f_w$	Refer to MEPC.1/Circ. 796	
GT	International Tonnage Certificate	
Lightweight	Derived lightweight determined in inclining test. Alternatively, a lightweight survey documentation	t
$P_{AE}$	Only if the $P_{AE}$ value calculated by the standard method is significantly different from the total power used at normal seagoing, documentation of consumed electric power (excluding propulsion) in EEDI condition at reference speed ( $V_{ref}$ ), according to guidelines.	kW
$P_{Aeff(i)}$	Documentation of measured auxiliary power reduction with innovative mechanical energy efficient technology and method used	kW
$P_{eff(i)}$	Documentation of measured power of each innovative mechanical energy efficient technology and method used	kW
$P_{ME(i)}$	EIAPP certificate for the main engine(s) Documentation of measured shaft power and method used at sea trial, and the calibration records of the measuring equipment used.	kW
$P_{PTI(i)}$	Documentation of measured power taken-in and method used Manufacturer's documentation on efficiency of the installed generators	kW
$P_{PTO(i)}$	Documentation of measured power taken-off and method used Manufacturer's documentation on efficiency	kW
$SFC_{AE}$	- EIAPP certificate for the main engine's and the technical file acc. NO <sub>x</sub> Technical Code - If no NO <sub>x</sub> Technical File for an engine is available because its power is below 130 kW , the SFC specified by the manufacturer and endorsed by a competent authority should be used	g/kWh
$SFC_{ME(i)}$	EIAPP certificate for the main engine(s) and the technical file acc. NO <sub>x</sub> Technical Code.	g/kWh
$V_{ref}$	Measured speed acc. ISO 15016 and ISO 19019 at sea trials for EEDI condition or for ballast draft corresponding to the towing tank tests (or equivalent) speed calculation, documentation of the calculation procedure used to determine $V_{ref}$ Documentation of sea trial with measurement protocol incl. list of measurement equipment, measuring method, and speed-power curves.	kn



Data for final EEDI technical file after sea trial

Parameter	Description	Unit
$C_F$	The conversion factor of the fuel type used for EIAPP cert. in NO <sub>x</sub> Tech. File	g CO <sub>2</sub> /g fuel
$\Delta$	Displacement tables as given in the final stability booklet or from the results of the inclining test	t
DWT	The deadweight of summer load draft as outlined in the final stability booklet.	t
$F_{eff(i)}$	If applicable, documentation on measured availability for each innovative energy efficiency technology and method used	
$f_i$	Class certificate including ice class notation	
$f_j$	Class certificate including ice class notation	
$f_m$	Class certificate including ice class notation	

#### Sub Steps for final verification

1. Review of the sea trial procedure (TL shall examine the programme of the sea trial to check that the test procedure and in particular that the number of speed measurement points comply with the requirements of the IMO Verification Guidelines (2014 Guidelines on survey and certification of EEDI, Res. MEPC.254(67), as amended adopted on 17 October 2014, referred to as the "IMO Verification Guidelines" in the present document)
2. Witnessing of the sea trial (TL shall take notes the main parameters to be used for the final calculation of the EEDI, as given under 4.3.3 of the IMO Verification Guidelines)

TL shall verify:

- Propulsion and power supply system, particulars of the engines, and other relevant items described in the EEDI Technical File;
- Speed trial conditions, including weather conditions, sea conditions, draught, trim and displacement;
- Ship speed and output of the main engine; and
- The machinery characteristics of some important electric load consumers and producers included in the EPT, if applicable.

3. Confirmation of attained EEDI

The relevant data measured during the speed trials is to be confirmed and the correction process for the attained EEDI is to be verified. Specifically, it is to be confirmed that the reference ship speed ( $V_{ref}$ ), normally the ship speed at 75% MCR power under EEDI Condition, is determined based on the power curves developed by the results of speed trial and speed correction.

#### 4. Approval of EEDI Technical File

The final EEDI Technical File is to be confirmed and approved by TL. (SAMPLE OF EEDI TECHNICAL FILE template in Appendix 1 of IMO Verification Guidelines shall be used)

#### **5. EEDI VERIFICATION FOR MAJOR CONVERSIONS\***

As per regulation 20 (attained EEDI) of chapter 4 of MARPOL 73/78 Annex VI, the attained EEDI shall be calculated for each new ship which has undergone a major conversion; and each new or existing ship which has undergone a major conversion, that is so extensive that the ship is regarded by the Administration as a newly constructed ship which falls into one or more of the categories in regulations 2.25 to 2.35, 2.38 and 2.39. (Refer to Annex 1 for definition of ship types)

As per regulation 21 (required EEDI) of chapter 4 of MARPOL 73/78 Annex VI, for each new ship which has undergone a major conversion; and new or existing ship which has undergone a major conversion that is so extensive that the ship is regarded by the Administration as a newly constructed ship that falls into one of the categories defined in Regulation 2.25 to 2.31, 2.33 to 2.35, 2.38 and 2.39 of MARPOL 73/78 ANNEX VI; a ship's attained EEDI shall be on or below the required EEDI for that ship type and size. \*\*

For each new and existing ship that has undergone a major conversion which is so extensive that the ship is regarded by the Administration as a newly constructed ship, the attained EEDI shall be calculated and meet the requirement of paragraph 21.1 of chapter 4 of MARPOL 73/78 Annex VI with the reduction factor applicable corresponding to the ship type and size of the converted ship at the date of the contract of the conversion, or in the absence of a contract, the commencement date of the conversion.

According to regulation 5 of chapter 2 of MARPOL 73/78 Annex VI, ships to which chapter 4 applies shall also be subject to the surveys specified below, taking into account MEPC. 254(67) as amended by MEPC 261(68) and MEPC 309(73) "2014 Guidelines on Survey and Certification of the Energy Efficiency Design Index" adopted by the Organization:

- A general or partial survey, according to the circumstances, after a major conversion of a ship to which this regulation applies. The survey shall ensure that the attained EEDI is recalculated as necessary and meets the requirement of regulation 21, with the reduction factor applicable to the ship type and size of the converted ship in the phase corresponding to the date of contract or keel laying or delivery determined for the original ship in accordance with regulation 2.23 (new ship definition) of chapter 1 of MARPOL 73/78 Annex VI;
- In cases where the major conversion of a new or existing ship is so extensive that the ship is regarded by the Administration as a newly constructed ship, the Administration shall determine the necessity of an initial survey on attained EEDI. Such a survey, if determined necessary, shall ensure that the attained EEDI is calculated and meets the requirement of regulation 21, with the reduction factor applicable corresponding to the ship type and size of the converted ship at the date of the contract of the conversion, or in the absence of a contract, the commencement date of the conversion.

An IEEC issued shall cease to be valid in if a new certificate is issued following major conversion of the ship.

\*For definition of major conversion and UIs on major conversion, refer to 1. DEFINITIONS OF TERMS USED IN GUIDELINES

- \*\* Refer to Annex 1 for definition of ship types

Annex 1

Definition of each type of ship according to MARPOL 73/78 Annex VI.

Chapter 1, Regulation 2:

.25 "Bulk carrier" means a ship which is intended primarily to carry dry cargo in bulk, including such types as ore carriers as defined in SOLAS chapter XII, regulation 1, but excluding combination carriers.

.26 "Gas carrier" in relation to chapter 4 of Marpol Annex VI means a cargo ship, other than an LNG carrier as defined in paragraph 38 of this regulation, constructed or adapted and used for the carriage in bulk of any liquefied gas.

.27 "Tanker" in relation to chapter 4 means an oil tanker as defined in MARPOL Annex I, regulation 1 or a chemical tanker or an NLS tanker as defined in MARPOL Annex II, regulation 1. **(Additional information:** Fruit Juice carriers shall be categorized as "Refrigerated cargo carriers" as agreed by MEPC 64, refer to MEPC.1/Circ 795/Rev.5)

.28 "Container ship" means a ship designed exclusively for the carriage of containers in holds and on deck.

.29 "General cargo ship" means a ship with a multi-deck or single deck hull designed primarily for the carriage of general cargo. This definition excludes specialized dry cargo ships, which are not included in the calculation of reference lines for general cargo ships, namely livestock carrier, barge carrier, heavy load carrier, yacht carrier, nuclear fuel carrier.

.30 "Refrigerated cargo carrier" means a ship designed exclusively for the carriage of refrigerated cargoes in holds.

.31 "Combination carrier" means a ship designed to load 100% deadweight with both liquid and dry cargo in bulk.

.32 "Passenger ship" means a ship which carries more than 12 passengers.

.33 "Ro-ro cargo ship (vehicle carrier)" means a multi deck roll-on-roll-off cargo ship designed for the carriage of empty cars and trucks.

.34 "Ro-ro cargo ship" means a ship designed for the carriage of roll-on-roll-off cargo transportation units.

.35 "Ro-ro passenger ship" means a passenger ship with roll-on-roll-off cargo spaces."

.38 "LNG carrier" in relation to chapter 4 of Marpol Annex VI means a cargo ship constructed or adapted and used for the carriage in bulk of liquefied natural gas (LNG).

.39 "Cruise passenger ship" in relation to chapter 4 of Marpol Annex VI means a passenger ship not having a cargo deck, designed exclusively for commercial transportation of passengers in overnight accommodations on a sea voyage.

.40 "Conventional propulsion" in relation to chapter 4 of Marpol Annex VI means a method of propulsion where a main reciprocating internal combustion engine(s) is the prime mover and coupled to a propulsion shaft either directly or through a gear box.

.41 "Non-conventional propulsion" in relation to chapter 4 of Marpol Annex VI means a method of propulsion, other than conventional propulsion, including diesel-electric propulsion, turbine propulsion, and hybrid propulsion systems.

.42 "Polar Code" means the International Code for Ships Operating in Polar Waters, consisting of an introduction, parts I-A and II-A and parts I-B and II-B, adopted by resolutions MSC.385(94) and MEPC.264(68), as may be amended, provided that:

.1 amendments to the environment-related provisions of the introduction and chapter 1 of part II-A of the Polar Code are adopted, brought into force and take effect in accordance with the provisions of article 16 of the present Convention concerning the amendment procedures applicable to an appendix to an annex; and

.2 amendments to part II-B of the Polar Code are adopted by the Marine Environment Protection Committee in accordance with its Rules of Procedure.

.43 "A ship delivered on or after" 1 September 2019 means a ship:

.1. for which the building contract is placed on or after 1 September 2015; or

.2. in the absence of a building contract, the keel of which is laid, or which is at a similar stage of construction, on or after 1 March 2016; or

.3. the delivery of which is on or after 1 September 2019

Annex 2

A- Summary information on the calculation of required EEDI according to regulation 21 of chapter 4 of MARPOL 73/78

Annex VI:

Attained EEDI  $\leq$  Required EEDI =  $(1-X/100) \times$  Reference line value

Reference line value =  $a \times b^{-c}$

**Parameters for Determination of Reference Line Values for the Different Ship Types**

Ship Type	Reference line
Bulk carrier	$961.79 \times DWT^{-0.477}$
	<i>Applicable from 01.04.2022</i> where $DWT \leq 279,000$ $961.79 \times DWT^{-0.477}$ where $DWT > 279,000$ * $961.79 \times 279,000^{-0.477}$
Gas carrier	$1120.00 \times DWT^{-0.456}$
Tanker	$1218.80 \times DWT^{-0.488}$
Container ship	$174.22 \times DWT^{-0.201}$
General cargo ship	$107.48 \times DWT^{-0.216}$
Refrigerated cargo carrier	$227.01 \times DWT^{-0.244}$
Combination carrier	$1219.00 \times DWT^{-0.488}$
Ro-ro cargo ship (vehicle carrier)	$DWT/GT < 0.3$ $(DWT/GT)^{-0.7} \times 780.36 \times DWT^{-0.471}$ $DWT/GT > 0.3$ $1812.63 \times DWT^{-0.471}$
	$1405.15 \times DWT^{-0.498}$ where $DWT \leq 17,000$ * $1686.17 \times DWT^{-0.498}$ where $DWT > 17,000$ * $1686.17 \times 17,000^{-0.498}$
Ro-ro cargo ship	$1405.15 \times DWT^{-0.498}$ where $DWT \leq 17,000$ * $1686.17 \times DWT^{-0.498}$ where $DWT > 17,000$ * $1686.17 \times 17,000^{-0.498}$
	$752.16 \times DWT^{-0.381}$ where $DWT \leq 10,000$ * $902.59 \times DWT^{-0.381}$ where $DWT > 10,000$ * $902.59 \times 10,000^{-0.381}$
LNG Carrier	$2253.7 \times DWT^{-0.474}$
Cruise passenger ship having non-conventional propulsion	$170.84 \times GT^{-0.214}$

\* to be used from phase 2 and thereafter

**Reduction factors (in percentage) for the EEDI relative to the EEDI Reference line**

Ship Type	Size (DWT)	EEDI Reduction factor (X)					
		Phase 0	Phase 1	Phase 2	Phase 2	Phase 3	Phase 3
		1 Jan. 2013- 31 Dec. 2014	1 Jan 2015- 31 Dec. 2019	1 Jan. 2020- 31 Mar. 2022	1 Jan. 2020- 31 Dec. 2024	1 Apr 2022 -	1 Jan. 2025 -
Bulk carrier	20,000 -	0 %	10 %		20 %		30 %
	10,000 – 20,000	n/a	0 - 10 %		0 - 20 %		0 - 30 %
Gas carrier	15,000 -	0	10 %	20 %		30 %	
	10,000 – 15,000	0 %	10 %		20 %		30 %
	2,000 – 10,000	n/a	0 - 10 %		0 - 20 %		0 - 30 %
Tanker	20,000 -	0 %	10 %		20 %		30 %
	4,000 – 20,000	n/a	0 - 10 %		0 - 20 %		0 - 30 %
Container ship	200,000	0 %	10 %	20 %		50 %	
	120,000 – 200,000	0 %	10 %	20 %		45 %	
	80,000 – 120,000	0 %	10 %	20 %		40 %	
	40,000 – 80,000	0 %	10 %	20 %		35 %	
	15,000 – 40,000	0 %	10 %	20 %		30 %	
	10,000 – 15,000	n/a	0 -10 %	0 - 20 %		15 - 30 %	
General cargo ship	15,000 -	0 %	10 %	15 %		30 %	
	3,000 – 15,000	n/a	0 -10 %	0 - 15 %		0 - 30 %	
Refrigerated cargo carrier	5,000 -	0 %	10 %		15 %		30 %

	3,000 – 5,000	n/a	0 -10 %		0 - 15 %		0 - 30 %
Combination carrier	20,000 -	0 %	10 %		20 %		30 %
	4,000 – 20,000	n/a	0 -10 %		0 - 20 %		0 - 30 %
LNG carrier*	10000 -	n/a	10 %**	20 %		30 %	
Ro-ro cargo ship* (vehicle carrier)	10000 -	n/a	5 %**		15 %		30 %
Ro-ro cargo ship*	2000 -	n/a	5 %**		20 %		30 %
	1000 – 2000	n/a	0 -5 %**		0 - 20 %		0 - 30 %
Ro-ro passenger ship*	1000 -	n/a	5 %**		20 %		30 %
	250 – 1000	n/a	0 -5 %**		0 - 20 %		0 - 30 %
Cruise passenger ship* having non-conventional propulsion	85000 GT -	n/a	5 %**	20 %		30 %	
	25000 – 85000 GT	n/a	0 -5 %**	0 - 20 %		0 - 30 %	

Reduction factor to be linearly interpolated between the two values dependent upon vessel size. The lower value of the reduction factor is to be applied to the smaller ship size.

(\*). Reduction factor applies to those ships delivered on or after 1 September 2019, as defined in Annex 1 (MARPOL Annex VI, Chapter 1, paragraph 43 of regulation 2).

(\*\*). Phase 1 commences for those ships on 1 September 2015.

B- Applicability of Phases specified in table 1 of regulation 21 (required EEDI) of MARPOL Annex VI to new ships according to MEPC.1/Circ 795/Rev.5

Summary table for applicability of phases to new ships

<b>Contract</b> <b>Delivery</b>	<b>Before</b> <b>1 Jan. 2013</b>	<b>1 Jan. 2013 -</b> <b>31 Dec. 2014</b>	<b>1 Jan. 2015 -</b> <b>31 Dec. 2019</b>	<b>1 Jan. 2020 -</b> <b>31 Dec. 2024</b>	<b>1 Jan. 2025 -</b>
Before 1 July 2015	n/a	Phase 0	Phase 1	-	-
1 July 2015 – 31 Dec. 2018	Phase 0	Phase 0	Phase 1	-	-
1 Jan. 2019 – 31 Dec. 2023	Phase 1	Phase 1	Phase 1	Phase 2	-
1 Jan. 2024 – 31 Dec. 2028	Phase 2	Phase 2	Phase 2	Phase 2	Phase 3
1 Jan. 2029 -	Phase 3	Phase 3	Phase 3	Phase 3	Phase 3

(In the absence of a building contract)

<b>Keel-lay</b> <b>Delivery</b>	<b>Before</b> <b>1 July. 2013</b>	<b>1 July. 2013 -</b> <b>30 June. 2015</b>	<b>1 July. 2015 -</b> <b>30 June. 2020</b>	<b>1 July. 2020 -</b> <b>30 June. 2025</b>	<b>1 July. 2025 -</b>
Before 1 July 2015	n/a	Phase 0	-	-	-
1 July 2015 – 31 Dec. 2018	Phase 0	Phase 0	Phase 1	-	-
1 Jan. 2019 – 31 Dec. 2023	Phase 1	Phase 1	Phase 1	Phase 2	-
1 Jan. 2024 – 31 Dec. 2028	Phase 2	Phase 2	Phase 2	Phase 2	Phase 3
1 Jan. 2029 -	Phase 3	Phase 3	Phase 3	Phase 3	Phase 3

Summary table for applicability of phases to new ships where Phase 3 commences with 1 April 2022 and onwards

<b>Contract</b> <b>Delivery</b>	<b>Before</b> <b>1 Jan. 2013</b>	<b>1 Jan. 2013 -</b> <b>31 Dec. 2014</b>	<b>1 Jan. 2015 -</b> <b>31 Dec. 2019</b>	<b>1 Jan. 2020 -</b> <b>31 Mar. 2022</b>	<b>1 Apr. 2022 -</b>
Before 1 July 2015	n/a	Phase 0	Phase 1	-	-
1 July 2015 – 31 Dec. 2018	Phase 0	Phase 0	Phase 1	-	-
1 Jan. 2019 – 31 Dec. 2023	Phase 1	Phase 1	Phase 1	Phase 2	-
1 Jan. 2024 – 31 Mar. 2026	Phase 2	Phase 2	Phase 2	Phase 2	Phase 3
1 Apr. 2026 -	Phase 3	Phase 3	Phase 3	Phase 3	Phase 3

(In the absence of a building contract)

<b>Keel-lay</b> <b>Delivery</b>	<b>Before</b> <b>1 July. 2013</b>	<b>1 July. 2013 -</b> <b>30 June. 2015</b>	<b>1 July. 2015 -</b> <b>30 June. 2020</b>	<b>1 July. 2020 -</b> <b>30 Sep. 2022</b>	<b>1 Oct. 2022 -</b>
Before 1 July 2015	n/a	Phase 0	-	-	-
1 July 2015 – 31 Dec. 2018	Phase 0	Phase 0	Phase 1	-	-
1 Jan. 2019 – 31 Dec. 2023	Phase 1	Phase 1	Phase 1	Phase 2	-
1 Jan. 2024 – 31 Mar. 2026	Phase 2	Phase 2	Phase 2	Phase 2	Phase 3
1 Apr. 2026 -	Phase 3	Phase 3	Phase 3	Phase 3	Phase 3



## **USEFUL REFERENCE DOCUMENTS**

### **IMO DOCUMENTS**

**RESOLUTION MEPC.203(62):** AMENDMENTS TO THE ANNEX OF THE PROTOCOL OF 1997 TO AMEND THE INTERNATIONAL CONVENTION FOR THE PREVENTION OF POLLUTION FROM SHIPS, 1973, AS MODIFIED BY THE PROTOCOL OF 1978 RELATING THERETO (Inclusion of regulations on energy efficiency for ships in MARPOL Annex VI)

**RESOLUTION MEPC.308(73) as amended by MEPC 322(74) and MEPC 332(76):** 2018 GUIDELINES ON THE METHOD OF CALCULATION OF THE ATTAINED ENERGY EFFICIENCY DESIGN INDEX (EEDI) FOR NEW SHIPS

**RESOLUTION MEPC.282(70):** 2016 GUIDELINES FOR THE DEVELOPMENT OF A SHIP ENERGY EFFICIENCY MANAGEMENT PLAN (SEEMP)

**RESOLUTION MEPC.254(67) as amended by MEPC 261(68) and MEPC 309(73):** 2014 GUIDELINES ON SURVEY AND CERTIFICATION OF THE ENERGY EFFICIENCY DESIGN INDEX (EEDI)

**RESOLUTION MEPC.231(65):** 2013 GUIDELINES FOR CALCULATION OF REFERENCE LINES FOR USE WITH THE ENERGY EFFICIENCY DESIGN INDEX (EEDI)

**MEPC.1/Circ.684:** GUIDELINES FOR VOLUNTARY USE OF THE SHIP ENERGY EFFICIENCY OPERATIONAL INDICATOR (EEOI)

**MEPC.1/Circ 795/Rev.5:** UNIFIED INTERPRETATIONS TO MARPOL ANNEX VI

**MEPC 76/INF.28:** 2020 INDUSTRY GUIDELINES ON CALCULATION AND VERIFICATION OF THE ENERGY EFFICIENCY DESIGN INDEX (EEDI)

**MEPC.1/Circ.796:** INTERIM GUIDELINES FOR THE CALCULATION OF THE COEFFICIENT  $f_w$  FOR DECREASE IN SHIP SPEED IN A REPRESENTATIVE SEACONDITION FOR TRIAL USE

**MEPC 64/INF.6:** SPEED/POWER TRIALS, PART 2, ANALYSIS OF SPEED/POWER TRIAL DATA

**MEPC 232(65) as amended by MEPC 255(67) and MEPC 262(68):** 2013 INTERIM GUIDELINES FOR DETERMINING MINIMUM PROPULSION POWER TO MAINTAIN THE MANOEUVRABILITY OF SHIPS IN ADVERSE CONDITIONS.

**MEPC.1/Circ.850/Rev.3:** GUIDELINES FOR DETERMINING MINIMUM PROPULSION POWER TO MAINTAIN THE MANOEUVRABILITY OF SHIPS IN ADVERSE CONDITIONS

**MEPC.1/Circ.896:** 2021 GUIDANCE ON TREATMENT OF INNOVATIVE ENERGY EFFICIENCY TECHNOLOGIES FOR CALCULATION AND VERIFICATION OF THE ATTAINED EEDI AND EEXI

**IACS PR38/Rev.3:** PROCEDURE FOR CALCULATION AND VERIFICATION OF THE ENERGY EFFICIENCY DESIGN INDEX (EEDI).

**ITTC (INTERNATIONAL TOWING TANK CONFERENCE) DOCUMENTS**

ITTC- Sample Quality Manual (2002)

ITTC Guidelines about CFD analysis:

<b>7.5-03</b>		<b>CFD</b>
<b>7.5-03-01</b>		<b>General</b>
<u>7.5-03-01-01</u>	P	<u>Uncertainty Analysis in CFD, Verification and Validation Methodology and Procedures</u>
<u>7.5-03-01-02</u>	G C	<u>Uncertainty Analysis in CFD, Guidelines for RANS Codes</u>
<u>7.5-03-01-03</u>	P	<u>CFD User's Guide</u>
<u>7.5-03-01-04</u>	P	<u>CFD Verification</u>

ITTC Guidelines about calibration:

<b>7.6</b>		<b>CONTROL OF INSPECTION, MEASURING AND TEST EQUIPMENT</b>
<b>7.6-01</b>		<b>Measuring Equipment</b>
<u>7.6-01-01</u>		<u>Control of Inspection, Measuring and Test Equipment</u>

ITTC Guidelines about ship models & manufacture accuracy and propeller model:

<b>7.5</b>		<b>PROCESS CONTROL</b>
<b>7.5-01</b>		<b>Test Preparation</b>
<b>7.5-01-01</b>		<b>Ship Models</b>
<u>7.5-01-01-01</u>	P	<u>Ship Models</u>

ITTC Guidelines about resistance test:

<b>7.5-02-02</b>		<b>Resistance</b>
<u>7.5-02-02-01</u>	P	<u>Resistance Tests</u>
<u>7.5-02-02-02</u>	G	<u>General Guideline for Uncertainty Analysis in Resistance Tests</u>
<u>7.5-02-02-02.1</u>	G	<u>Example for Uncertainty Analysis of Resistance Tests in Towing Tanks</u>

7.5-02-02-02.2	G	<u>Practical Guide for Uncertainty Analysis of Resistance Measurements in Routine Tests</u>
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ITTC Guidelines about propulsion test and propeller model accuracy

<b>7.5-02-03</b>		<b>Propulsion</b>
<b>7.5-02-03-01</b>		<b>Performance</b>
7.5-02-03-01.1	P	<u>Propulsion / Bollard pull Test</u>
7.5-02-03-01.2	P	<u>Uncertainty Analysis: Example for Propulsion Test</u>

ITTC Guidelines about propeller open water test

<b>7.5-02-03-02</b>		<b>Propulsor</b>
<u>7.5-02-03-02.1</u>	P	<u>Open Water Test</u>
<u>7.5-02-03-02.2</u>	P	<u>Uncertainty Analysis: Example for Open Water Test</u>

ITTC Guidelines about speed trial prediction calculation

7.5-02-03-01.4	P	<u>1978 ITTC Performance Prediction Method</u>
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ITTC Guidelines about final verification on sea trial

<b>7.5-04</b>		<b>Full Scale Measurements</b>
<b>7.5-04-01</b>		<b>Speed and Power Trials</b>
<u>7.5-04-01-01.1</u>	P	<u>Preparation, Conduct and Analysis of Speed/Power Trials</u>

**STANDARDS**

ISO 15016:2015: Ships and marine technology – Guidelines for the assessment of speed and power performance by analysis of speed trial data

ISO 19019:2005: Sea-going vessels and marine technology — Instructions for planning, carrying out and reporting sea trials

BSRA Standard method of speed trials analysis – BSRA report 486 / 1976