GUIDANCE NOTES
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CHINA CLASSIFICATION SOCIETY

GUIDELINES ON CALCULATION AND VERIFICATION OF THE ENERGY EFFICIENCY DESIGN INDEX (EEDI) OF INTERNATIONAL SEA-GOING SHIPS

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CONTENTS

Chapter 1 General.....1
1.1 General requirements.....1
Chapter 2 Attained EEDI Calculation.....1
2.3 Definition and selection of parameters in Attained EEDI calculation formula.....1
Chapter 5 Final Verification.....2
5.1 General provisions.....2
5.3 Verification of speed trial.....2
5.5 Basic requirement for revised EEDI technical file.....2
Appendix 3 Review and Witness Points.....3
Appendix 6 EEDI Ship Trail Based on ISO15016:2015.....5

Chapter 1 General

1.1 General requirements

1.1.2 These Guidelines are mainly developed based on the following documents:

(6) International Association of Classification Societies (IACS) PR38. Rev.~~3~~6: Procedure for calculation and verification of the Energy Efficiency Design Index (EEDI);
(7) CCS Rules for Green-Eco Ships;
(8) ISO 15016:~~2015~~2025 "Ships and marine technology-Guidelines for the assessment of speed and power performance by analysis of speed trial data".
(9) MEPC403(83) Amendments to the 2022 Guidelines on Survey and Certification of the Energy Efficiency Design Index (EEDI).
(10) MEPC410(84) Amendments to the 2022 Guidelines on the Method of Calculation of the Attained Energy Efficiency Design Index (EEDI) for New Ships.
(11) MEPC411(84) Amendments to the 2022 Guidelines on Survey and Certification of the Energy Efficiency Design Index (EEDI).

Chapter 2 Attained EEDI Calculation

2.3 Definition and selection of parameters in Attained EEDI calculation formula

2.3.1 Carbon conversion factor (C_F)

2.3.1.2 In case of a ship equipped with a dual-fuel main or auxiliary engine, the C_F-factor for gas fuel and the C_F-factor for fuel oil are to apply and be multiplied with the specific fuel consumption of each fuel at the relevant EEDI load point.

(1) The fuel availability of gas fuel[①] is to be calculated in accordance with the formula below:

$$f_{DFgas} = \frac{\sum_{i=1}^{ntotal} P_{total(i)}}{\sum_{i=1}^{ngasfuel} P_{gasfuel(i)}} \times \frac{V_{gas} \times \rho_{gas} \times LCV_{gas} \times K_{gas}}{\left(\sum_{i=1}^{nLiquid} V_{liquid(i)} \times \rho_{liquid(i)} \times LCV_{liquid(i)} \times K_{liquid(i)} \right) + V_{gas} \times \rho_{gas} \times LCV_{gas} \times K_{gas}}$$

$$f_{DFliquid} = 1 - f_{DFgas}$$

Normal density, Lower Calorific Value and filling rate for tanks of different kinds of fuel are shown in Table 2.3.1.2.

Parameter Default Values **Table 2.3.1.2**

Type of fuel	Density (kg/m^3)	Lower Calorific Value (kJ/kg)	Filling rate for tanks
Diesel/Gas Oil	900	42700	0.98
Heavy Fuel Oil	991	40200	0.98
Liquefied Natural Gas (LNG)	450	48000	0.95*

*Subject to verification of tank loading limit in the IGF and/or IGC Codes, where applicable, corresponding to the normal density used in the calculation of f DFgas。

Note: In case of other fuels, the low calorific value should be taken from resolution MEPC.364(79), where available. If not listed, values consistent with industry standards should be applied. Density values should correspond to industry standards. Filling rate for tanks values should reflect the applicable design specifications.

① For the purpose of this paragraph, the terms "LNG" and "gas" may be taken to include any fuel used in dual-fuel mode including liquid fuels.

(2) If the total gas capacity is at least 50% of the fuel capacity dedicated to the dual fuel engines, namely $f_{DFgas} \geq 0.5$, then gas fuel is regarded as the "primary fuel", and $f_{DFgas} = 1$ and $f_{DFliquid} = 0$ for each dual fuel engine.

(3) If $f_{DFgas} < 0.5$, gas fuel is not regarded as the "primary fuel". The C_F and SFC in the EEDI calculation for each dual fuel engine (both main and auxiliary engines) are to be calculated as the weighted average of C_F and SFC for gas and liquid mode, according to f_{DFgas} and $f_{DFliquid}$, such as the original item of $P_{ME(i)} \cdot C_{FME(i)} \cdot SFC_{ME(i)}$ in the EEDI calculation is to be replaced by the formula below:

$$P_{ME(i)} \cdot (f_{DFgas(i)} \cdot (C_{FME\ pilot\ fuel(i)} \cdot SFC_{ME\ pilot\ fuel(i)} + C_{FME\ gas(i)} \cdot SFC_{ME\ gas(i)}) + f_{DFliquid(i)} \cdot C_{FME\ liquid(i)} \cdot SFC_{ME\ liquid(i)})$$ ①

Chapter 5 Final Verification

5.1 General provisions

5.1.1 The final verification of EEDI is to include:

(3) plan approval unit's review of the test report submitted by the test organization; confirmation that the power and speed have been corrected in accordance with ITTC Recommended Procedure 7.5-04-01-01.2 Speed and Power Trials Part 2;~~2017~~ (latest version) or ISO 15016:~~2015~~2025.

5.3 Verification of speed trial

5.3.2 Speed trial is to be carried out based on the following requirements:

(4) Sea conditions are to be measured in accordance with ITTC Recommended Procedure 7.5-04-01-01.1 (~~2017, 2021 or 2022~~ latest version) Speed and Power Trials Part 1 or ISO 15016: ~~2015~~2025.

(5) Ship speed is to be measured in accordance with ITTC Recommended Procedure 7.5-04-01-01.1 (~~2017, 2021 or 2022~~ latest version) Speed and Power Trials Part 1or ISO 15016: ~~2015~~2025 and at more than three points of which range includes the main engine power defined in 2.2.5 of IMO 2022 EEDI Calculation Guidelines. This requirement applies individually to each ship, even if the ship is a sister ship of a parent vessel.

(7) The submitter is to develop power curves based on the measured ship speed and the measured output of the main engine at sea trial. For the development of the power curves, the submitter should correct the measured ship speed, if necessary, by taking into account the effects of wind, tide, waves, shallow water, displacement, water temperature and water density in accordance with ITTC Recommended Procedure 7.5-04-01-01.2 Speed and Power Trials Part 2; ~~2017~~ (latest version) or ISO 15016:~~2015~~2025.The submitter is to submit a report on the speed trials, including details of the power curve development, to the verifier for verification.

5.5 Basic requirements for revised EEDI technical file

5.5.2 The sea trial report, final stability file including lightweight of the ship and displacement table based on the results of the inclining test or the lightweight check and lines of actual ship (if amended) is to be submitted at the same time in addition to the revised EEDI technical file. The power curve and ship speed under the condition of full load draught are to be calculated and determined in accordance with the measured data at sea trial, and corrected by taking into account the effects of wind, tide, waves and shallow water, in accordance with ITTC Recommended Procedure 7.5-04-01-01.2 Speed and Power Trials Part 2; ~~2017~~ (latest version) or ISO 15016:~~2015~~2025.

① Both P_{ME} and SFC_{ME} should be determined based on the MCR certified in accordance with the NOx Technical Code 2008.

Appendix 3 Review and Witness Points

Ref.	Function	Survey method	Reference document	Documentation to be submitted to CCS	Remarks
01	EEDI Technical File	Review	2.3 of the Guidelines	Relevant information required by 2.3 of the Guidelines	
02	Limitation of power	Review	2.3.5.3 of the Guidelines	Verification file of limitation technical means	Only if means of limitation are fitted
03	Electric Power Table	Review	Appendix 2 and 7 of the Guidelines	EPT-EEDI form	Only if P_{AE} is significantly different from the values computed in accordance with Chapter 2 of the Guidelines
04	Calibration of towing tank test measuring equipment	Review & witness	Appendix 4 of the Guidelines	Calibration reports	Check at random that measuring devices are well identified and that calibration reports are currently valid
05	Model tests – ship model	Review & witness	Appendix 5 of the Guidelines	Ship lines plan & offsets table Ship model report	
06	Model tests – propeller model	Review & witness	Appendix 5 of the Guidelines	Propeller model report	
07	Model tests – Resistance test, Propulsion test, Propeller open water test	Review & witness	Appendix 5 of the Guidelines	Towing tank tests report	Propeller open water test is not needed if a stock propeller is used. In this case, the open water characteristics of the stock propeller are to be annexed to the towing tank tests report
08	Model-ship extrapolation and correction	Review	Latest version of ITTC 7.5-02 - 03-01.4 1978 ITTC performance prediction method; Appendix 5 of the Guidelines	Extrapolation and correlation calculation report	Check that the power-speed curves obtained for the EEDI condition and sea trial condition are obtained using the same calculation and correlation methods
09	Numerical calculations replacing towing tank tests	Review	Latest version ofITTC 7.5-03-01-04 or equivalent	Report of calculations	Verification calculations replacing model tests
10	Check of power of equipment listed in EPT-EEDI form prior to sea trials	Witness	Appendix 2 of the Guidelines		Only if P_{AE} is computed from EPT

Ref.	Function	Survey method	Reference document	Documentation to be submitted to CCS	Remarks
11	Programme of sea trials	Review	5.2.1 of the Guidelines	Programme of sea trials	Check minimum number of measurement points (3) Check the EEDI condition in EPT (if P_{AE} is computed from EPT)
12	Sea trials	Witness	ITTC 7.5-04-01-01.1 (latest revision)or ISO 15016：~~2015~~2025		Check: • Propulsion power, particulars of the engines • Draught and trim • Sea conditions • Ship speed • Shaft power & rpm Check operation of means of limitations of engines or shaft power (if fitted) Check the power consumption of selected consumers included in sea trials condition EPT (if P_{AE} is computed from EPT)
13	Sea trials – corrections calculation	Review	ITTC 7.5-04-01-01.2 or ISO 15016：~~2015~~2025	Sea trials report	Check that the displacement and trim of the ship in sea trial condition has been obtained with sufficient accuracy Check compliance with ISO 15016:~~2015~~2025 or ITTC Recommended Procedure 7.5-04- 01- 01.2
14	Sea trials – adjustment from trial condition to EEDI condition	Review	5.4.1(2) of the Guidelines	Power curves after sea trial	Check that the power curve estimated for EEDI condition is obtained by power adjustment
15	EEDI Technical File – revised after sea trials	Review	5.4.2 to 5.4.5 of the Guidelines	Revised EEDI Technical File	Check that the file has been updated according to sea trials results

~~Appendix 6 EEDI Ship Trial Based on ISO15016:2015~~

The specific deleted text is omitted.