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Progress and present status of the draft revised Guidelines for determining minimum propulsion power to maintain the manoeuvrability of ships in adverse conditions

Submitted by Denmark, Germany, Japan, Spain and IACS

SUMMARY

Executive summary: This document provides information on the progress and present status of the draft revised Guidelines for determining minimum propulsion power to maintain the manoeuvrability of ships in adverse conditions

Strategic direction: 7.3

High-level action: 7.3.2

Output: 7.3.2.4

Action to be taken: Paragraph 25

Related documents: MEPC 64/4/42, MEPC 64/23; MEPC 67/4/16, MEPC 67/4/25, MEPC 67/INF.14, MEPC 67/INF.22, MEPC 67/WP.12, MEPC 67/20; MEPC 68/3/7, MEPC 68/3/11, MEPC 68/INF.32; MEPC 69/INF.23; MEPC 70/5/20, MEPC 70/5/30, MEPC 70/INF.30, MEPC 70/INF.33, MEPC 70/INF.35; MEPC 71/INF.28, MEPC 71/INF.29; MSC 93/21/5, MSC 93/INF.13; resolutions MEPC.232(65), MEPC.255(67) and MEPC.262(68)

Introduction

1 The 2012 *Guidelines on the method of calculation of the attained Energy Efficiency Design Index (EEDI) for new ships* (resolution MEPC.212(63)) represent a major step forward in implementing the regulations on energy efficiency of ships (resolution MEPC.203(62)). However, concerns had been expressed regarding sufficiency of propulsion and steering abilities of ships to maintain their manoeuvrability in adverse conditions if the EEDI requirements are achieved by simple reduction of the installed engine power. This gave a reason for additional considerations and studies by the International Association of Classification Societies (IACS), which served as a basis for the *Interim Guidelines for determining minimum propulsion power to maintain the manoeuvrability of ships in adverse*

conditions (MSC-MEPC.2/Circ.11), which was updated in annex 1 to document MEPC 65/4/3 and subsequently adopted as the *2013 Interim Guidelines for determining minimum propulsion power to maintain the manoeuvrability of ships in adverse conditions* (2013 Interim Guidelines) by resolution MEPC.232(65) and were further updated by resolutions MEPC.255(67) and MEPC.262(68).

2 To address the challenges of this issue by more in depth research, the research project Energy Efficient Safe Ship Operation (SHOPERA, www.shopera.org) and Japan's research project (these projects are hereinafter collectively referred to as "the Projects") have worked together for revising the 2013 Interim Guidelines through technical and practical considerations and evaluation. As an outcome of the Projects, an outline of the draft revised 2013 Interim Guidelines was submitted to MEPC 70 in order to invite any comment from Member States, IGOs and NGOs (MEPC 70/5/20).

3 At MEPC 70, the Committee, having recalled that MEPC 68 had agreed to await the outcome of the research projects (MEPC 68/21, paragraph 3.81) and that the full text of the draft revised 2013 Interim Guidelines would be submitted to MEPC 71 (MEPC 70/5/20, paragraph 14), agreed to note all documents submitted to that session on this issue and invited interested Member Governments and/or international organizations to take into account all submitted documents as well as other views expressed, when preparing the full text of the draft revised 2013 Interim Guidelines (MEPC 70/18, paragraph 5.43).

4 Upon receiving related comments at MEPC 70, the Projects conducted further studies on the draft revised Guidelines. Results of the studies have shown that the specified scenarios for ship's handling in adverse conditions should be modified (see paragraph 9), and the applied adverse weather conditions became more severe than those specified in the existing Interim Guidelines (see paragraph 12). A possible updated draft revised version of the Interim Guidelines, based on the outcome of these studies, is contained in the annex to MEPC71/INF.28.

Ship types and sizes

5 The Projects assume that the draft revised Guidelines could be applied, at this stage, only to tankers, bulk carriers and combination carriers. This proposal is based on the case studies performed by both parties of the Projects, which show that these ship types are most critical with respect to the sufficiency of power for manoeuvrability in adverse conditions. The Projects are of the opinion that further consideration for other ship types should be done at a later stage.

6 Furthermore, the Projects assume that the application of the draft revised Guidelines should be limited to ships of 20,000 deadweight tonnage and above at this time because a systematic evaluation of the required standard environmental conditions for ships with deadweight less than 20,000 tonnage has not been completed yet. The Projects are of the view that further consideration for these ships should be done in the future.

Loading condition

7 The Projects have reached a conclusion that only the maximum summer load condition corresponding to the EEDI condition should be evaluated for tankers, bulk carriers and combination carriers, because it is the most severe over all loading conditions in terms of the required propulsion power in adverse conditions. The Projects share the view that the required propulsion power under heavy ballast condition is typically less than the required power under full load conditions. This view is based on the results of applied direct calculation methods. The Projects are also of the view that normal ballast condition does not need to be

considered because ship masters are expected to change from the normal ballast condition to the heavy ballast condition when informed by weather forecast in advance.

Scenarios for ship's handling in adverse conditions

8 The Projects developed three realistic scenarios for evaluating ship's handling in adverse conditions. The specification of the scenarios was based on a series of interviews with shipowners, ship masters and chief engineers, accidents and weather statistics, as well as the analysis of the seakeeping performance of ships in waves.

9 Based on the evaluation of results of conducted studies for a series of existing eco-ships (refer to document MEPC71/INF.29), the Projects have reached a conclusion that the following scenario "Weathervaning in coastal areas under strong gale condition" is always more demanding, in comparison with other scenarios, with respect to the required installed propulsion power for tankers, bulk carriers and combination carriers. Therefore, this scenario is proposed to be considered as the only required scenario for the evaluation of the sufficiency of ship's propulsion power to maintain the manoeuvrability in adverse conditions for bulk carriers, tankers and combination carriers.

Scenario "Weathervaning in coastal areas under strong gale condition"

Area	Coastal areas
Weather conditions	[BF8 (gale) for $L_{pp} < 200$ m to BF9 (strong gale) for $L_{pp} > 250$ m, linear over L_{pp} between 200 m and 250 m]
Encountered wave and wind angle	Head seas to 30 degrees off-bow for a situation of weathervaning
Propulsion ability	Speed through water at least [2 knots]
Steering ability	Ability to keep heading into head seas to 30 degrees off-bow

Characteristics of the adverse weather conditions

10 Based on the assessment of results of the seakeeping performance in waves of a series of existing ships, the interviews held with shipowners, ship masters and chief engineers, shipping log data provided by ship operating companies, met-ocean statistical data, as well as statistics of accidents and corresponding weather conditions (Beaufort strength), the Projects have developed the adverse weather conditions that should be applied in the assessment.

11 Because of the diversity of the weather and sea conditions, in view of the many parameters affecting them, the Projects share the view that the adverse weather conditions applied in the assessment should be verified based on the results of the assessment of the operability of a large number of existing ships in specified weather conditions (benchmark). Based on these studies and the validation results for a series of representative existing bulk carriers and tankers, the Projects have reached a conclusion that the following conditions are suitable for the specification of the adverse weather conditions of the scenario:

- .1 [BF8 for $L_{pp} < 200$ m;
- .2 BF9 for $L_{pp} > 250$ m; and
- .3 linearly interpolated over L_{pp} between 200 m and 250 m.]

12 Based on the results of measurements in coastal areas within 20 nautical miles from the Pacific Coast of Japan and at 20 to 30 nautical miles from the North Sea coastline of Great

Britain regarding the relation between Beaufort number (wind speed) and significant wave height, the Projects determined the significant wave height corresponding to Beaufort number in coastal areas, which should be applied in the assessment of the scenario (coastal areas), considering an additional safety margin. The following table shows a comparison of results for the adverse weather conditions according to the existing Guidelines and the draft revised Guidelines. It is found that the adverse weather conditions applied in the draft revised Guidelines are obviously more severe than those in the existing Guidelines.

	Existing Guidelines	Draft revised Guidelines
Beaufort number	BF7 for $L_{pp}<200$ m BF8 for $L_{pp}>250$ m	[BF8 for $L_{pp}<200$ m BF9 for $L_{pp}>250$ m]
Wind speed	15.7 m/s for $L_{pp}<200$ m 19.0 m/s for $L_{pp}>250$ m	[19.0 m/s for $L_{pp}<200$ m 22.6 m/s for $L_{pp}>250$ m]
Significant wave height h_s	4.0 m for $L_{pp}<200$ m 5.5 m for $L_{pp}>250$ m	[4.5 m for $L_{pp}<200$ m 6.0 m for $L_{pp}>250$ m]

Assessment procedures

13 The Projects share the view that designers and Administrations should be given the flexibility of applying assessment procedures of different complexity, ranging from simple, albeit conservative, empirical formulae, to more advanced procedures, depending on the needs of a particular design, such as propulsion and steering characteristics of the ship under assessment. Therefore, the Projects basically assume two different assessment procedures, noting that a ship satisfying the requirements of one of these two procedures can be considered as having sufficient propulsion power to maintain the manoeuvrability in adverse conditions. The assumed procedures differ in their levels of complexity and accuracy: in the order of increasing complexity and accuracy in the following paragraphs 13.1 and 13.2, the proposed procedures are:

- .1 Minimum Power Lines: the Projects propose that minimum power lines in accordance with resolution MEPC.232(65), as amended by resolutions MEPC.255(67) and MEPC.262(68), should still be applicable for tankers, bulkers and combination carriers; and
- .2 Minimum Power Assessment: the Projects developed an assessment procedure for the sufficiency of the propulsion power for tankers, bulk carriers and combination carriers, based on the evaluation of external forces and the solution of a basic manoeuvring equation in accordance with the scenario "Weathervaning in coastal areas under strong gale condition".

14 Minimum Power Assessment is based on the solution of a one degree of freedom manoeuvring equation in the longitudinal direction of the ship to demonstrate that the ship can with the speed of [2 knots] through water in wind and wave directions from head to 30 degrees off-bow for a situation of weathervaning. The assessment consists of the following steps:

- .1 calculate the maximum total resistance in the longitudinal ship direction over wind and wave directions from head to 30 degrees off-bow;
- .2 calculate corresponding required brake power and rotation speed of the installed engine, considering the resistance and propulsion characteristics of the ship including appendages; and

- .3 check whether the required brake power does not exceed the limit of the available brake power of the installed engine, defined in accordance with the engine manufacturer data at the actual rotation speed of the installed engine.

15 Based on validation results for a series of representative existing ships, the Projects have reached the conclusion that the proposed adverse conditions and the Minimum Power Assessment procedure form an effective and reliable way to assess the minimum installed propulsion power for sufficient manoeuvrability in adverse conditions for tankers, bulk carriers and combination carriers.

16 Furthermore, the Projects investigated the strictness of the draft revised Guidelines by comparing the obtained assessment results between the existing Guidelines and the draft revised Guidelines. From the comparison results, it was found that the requirements of the draft revised Guidelines are on the safe side, compared to those of the existing Guidelines, for the main reason that the proposed adverse weather conditions are more severe than those specified in the existing Guidelines.

17 For other ship types, the Projects share the view that further consideration of scenarios and criteria, as well as of the multitude of propulsion and steering systems used on ships of other types, are necessary to propose suitable assessment procedures; the basis for the development of such scenarios and criteria has been elaborated by the project SHOPERA and laid down in document MEPC 70/INF.33.

View of shipowners/operators

18 The Projects have had consultations with shipping industry organizations (hereinafter referred to as "the Industry") on the draft revised Guidelines because the view of the Industry should also be taken into account before finalizing the Guidelines. The following are views of the Industry on the draft revised Guidelines.

19 Adverse weather conditions in the scenarios, maximum of which is BF9, are still not severe enough to represent the actual weather conditions which ships meet under usual operation in coastal areas. Ships sometimes have difficulties to avoid extreme weather conditions because of the geographical situation or commercial reason. Therefore, these situations should also be considered for developing the revised Guidelines.

20 The proposed adverse weather conditions have different levels of severity based on the length of ships. However, it is not reasonable to introduce different adverse weather conditions for large and small ships. Many ships of less than 250 m in length are operated under the same level of adverse weather conditions. Therefore, the scenarios should reflect the actual operation of ships.

21 Advance speed of 2 knots in the scenario is not enough to maintain the ships position under the strong current. Current speed often becomes more than 2 knots and ships would not be able to keep their position under such a situation. Therefore the minimum speed of 2 knots should be increased.

22 In coastal areas, it is not reasonable to assume that simply moving away from the coastline will provide deeper water or more open water away from other ships. There are many offshore areas that are characterized by shallow waters and close proximity to other ships. In particular where offshore locations have shallow water there is an increased likelihood of navigational hazards such as wind farms and other offshore installations.

Proposal

23 As written above, the co-sponsors still have different views on the adverse environmental conditions in the draft revised Guidelines although the co-sponsors have had lengthy discussions in many sessions of the MEPC and the MSC. Based on the situation above, the co-sponsors share the view that the draft revised Guidelines is still not mature enough to be finalized at MEPC 71 and further consideration should be given. Thus, the co-sponsors propose not to rush into finalizing the draft revised Guidelines at this session. Rather, the co-sponsors also share the view that the Committee should continue the discussion for finalizing environmental conditions in parallel with the discussion of the EEDI review for phase 3 EEDI requirements required under regulation 21.6 of MARPOL Annex VI.

24 In this regard, one issue that the co-sponsors need to bear in mind is that the current interim Guidelines apply only for phase 0 and phase 1. Thus, the extension of the Interim Guidelines for phase 2 may also need to be considered as a possible interim solution because no other guidelines than the present version of the Interim Guidelines are available at this point in time.

Action requested of the Committee

25 The Committee is invited to consider and take action as appropriate.
