Towards more rational guidelines to determine minimum propulsion power for Safe Operation under adverse Weather Conditions

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Member of 28th ITTC SC PSS
ITTC SC Performance of Ships at Service

Membership

• Names of ten members
• Chairman Jinbao Wang
• Supervision by the ITTC Advisory Council chair Prof. G. Strasser

Activities

• New ISO Standard 15016:2015 on Sea Trials (currently under refinement)
• Specification of $fw$ coefficient involved in the formula of EEDI
• Minimum power requirement for manoeuvring in adverse sea conditions

April 14, 2016
Joint ITTC-SHOPERA Public Workshop
INTRODUCTION - BACKGROUND

IMO issued Guidelines on Dec. 2012 (MSC-MEPC.2/Circ.11)

On May 2013, 65th MEPC revised slightly minimum power line and (more important) reduced significantly the sea conditions in the simplified method to quite milder ones, especially for the smaller vessels.

A study to assess the seakeeping performance, including added resistance in wind and waves, for four BCs (DWT 30000-176000 T) and one VLCC DWT 306000 T has been carried out in Greece by HCS. In this study the capabilities of the tested vessels to attain a minimum speed with manoeuvring capabilities were investigated using state-of-the-art numerical tools in fully laden and heavy ballast conditions, at the speed provided by MEPC empirical formulas.

The characteristics of the actual propulsion system and the results of the sea trials were taken into account.
RESULTS OF THE INVESTIGATION - 1

On the basis of this study for BCs & Tankers larger than 20000 DWT, the following comments were made:

- In MSC-MEPC.2/Circ.11/ Dec.2012 level 1 method (minimum power line) is milder than level 2 (simplified method), which is irrational.

- This was remedied by 65th MEPC via reducing the sea conditions of level 2 method to quite mild ones. However, there is no reason for differentiating the sea conditions according to ship size.

- On the basis of detailed calculations, the tested vessels proved to be marginal at heavy ballast condition, which is the critical one for these vessels in adverse sea conditions. Heavy ballast condition should be included in the calculations.

- Some bugs were identified in the empirical formula in the specification of the required minimum speed (e.g. submerged lateral area of hull, corrected for breadth effect). They haven’t yet been remedied.
RESULTS OF THE INVESTIGATION - 2

Furthermore:

- There wasn’t any reasoning for associating the minimum speed with the manoeuvring capabilities of the ships.

- The aging and fouling of ships and propellers should be taken into account to provide some margin in both level 1 & level 2, criteria.

- In the study calculations were carried out at the sea conditions specified MSC-MEPC.2/Circ.11 which was available at that time.

- Additional calculations were performed for the quite severe ISC 2008 conditions. Some of the tested ships nearly satisfied these conditions. This demonstrates that there is space to ask for stricter limiting sea conditions than those of MSC-MEPC.2 / Circ.11, which can be identified as realistic, taking into account ocean statistics.
RESULTS OF THE INVESTIGATION - 3

Additional aspects that need further inspection and fixing:

- Most of the existing ships were well above the specified minimum power line. The Greek delegation proposed to compromise at a stricter minimum power line, higher than the current.

- It is reasonable to base the Guidelines on existing installed power levels. The percentage of these designs that should satisfy that line, should be decided. The proper selection and the reliability of the data base of BCs and Tankers over 20000 DWT should be ensured.

- Common procedures and test cases should be decided, before proceeding to this investigation. In any case a study to clarify “what is a safe manoeuvring speed” should be performed.

- Statistics of the ocean provide a basis for establishing realistic limiting sea conditions to be used in the Guidelines for minimum power requirements.
Adopted on [15 May 2015]

AMENDMENTS TO THE 2013 INTERIM GUIDELINES FOR DETERMINING MINIMUM PROPULSION POWER TO MAINTAIN THE MANOEUVRABILITY OF SHIPS IN ADVERSE CONDITIONS (RES. MEPC.232(65), AS AMENDED BY RES. MEPC.255(67))

IMO/MEPC in its 68th session (May 2015):

ADOPTED amendments jointly proposed by Japan and Greece to the 2013 Interim guidelines for determining minimum propulsion power to maintain the manoeuvrability of ships in adverse conditions, as amended, as set out in the annex to the present resolution;

INVITED Administrations to take the aforementioned amendments into account when developing and enacting national laws which give force to and implement provisions set forth in regulation 21.5 of MARPOL Annex VI, as amended;
Adopted on [15 May 2015]

AMENDMENTS TO THE 2013 INTERIM GUIDELINES FOR DETERMINING MINIMUM PROPULSION POWER TO MAINTAIN THE MANOEUVRABILITY OF SHIPS IN ADVERSE CONDITIONS (RES. MEPC.232(65), AS AMENDED BY RES. MEPC.255(67))

Table 1: Parameters a and b for determination of the minimum power line values for the different ship types

<table>
<thead>
<tr>
<th>Ship type</th>
<th>a</th>
<th>b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulk carrier which DWT is less than 145,000</td>
<td>0.0763</td>
<td>3374.3</td>
</tr>
<tr>
<td>Bulk carrier which DWT is 145,000 and over</td>
<td>0.0490</td>
<td>7329.0</td>
</tr>
<tr>
<td>Tanker</td>
<td>0.0652</td>
<td>5960.2</td>
</tr>
<tr>
<td>Combination Carrier</td>
<td>see tanker above</td>
<td></td>
</tr>
</tbody>
</table>
MINIMUM POWER LINE METHOD (BULK CARRIERS)

Minimum Power Line Value - Bulk Carriers

- Initial Approach - DWT < 276K
- Initial Approach - DWT >= 276K
- Revised Approach
- Revised Approach +10%
- Revised Approach +15%
- New-2015

April 14, 2016
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MINIMUM POWER LINE METHOD (TANKERS)

Minimum Power Line Value - Tankers

- Initial Approach
- Revised Approach
- Revised Approach +10%
- Revised Approach +15%
- New-2015

April 14, 2016
Joint ITTC-SHOPEREA Public Workshop
Objectives: Developing a physics-based prediction method of maneuvering motions of ships in adverse weather conditions and establishing it, so that it can be used to evaluate the validity of the Interim Level 2 Guidelines.

JAPANESE VALIDATION STUDY

Within JASNAOE research project, results of a validation study on the Greek proposal were presented recently. The study pertains to 15 BCs and 15 Tankers built in Japan and sailing at fully laden condition in a fully developed seaway with air prevailing at 9 & 10 BF ($H_{1/3} = 7 & 9$ m). There is no evidence that the hull forms correspond to contemporary designs.

Only fully laden condition has been considered, although the Greek study concluded that the heavy ballast condition is the critical one.

Although the study used different hull forms and different sea conditions, their results are consistent with the Greek study.
• In addition, the authors of the study proposed regression curves based on NMRI method for the quick estimation of added resistance, which they conclude that overestimate the actual values.

• To avoid seakeeping calculations Grigoropoulos, Loukakis & Perakis proposed “Seakeeping standard series for oblique seas (A synopsis)” (Ocean Engineering, Vol. 27, pp. 111-126, 2000) which provide robust interpolation capabilities within systematic runs of Series 60 hull forms.

• JASNAOE developed a numerical simulation program based on 4-DOF equations with course keeping for comprehensive assessment, carried out tank tests in wind and waves at NRI for Fisheries Engineering with good results and sets the comprehensive assessment as a tool for the development of the practical simplified method.

• Bugs in Level 2 Assessment should be removed.
• Contrary to JASNAOE, SHOPERA assumes a speed of 4 kn. SHOPERA also considers any heading when leaving coastal areas.

• Keeps heading bow to bow-quartering waves. JASNAOE avoids head waves.

• The database of ships used in the investigations should be agreed to be common and open to any third party so that any discrepancy in the results between the various projects can be easily identified and resolved.

• The assumptions made during the analysis should be clear and agreed between the stakeholders.

• Tomorrow we will hear about the benchmark study organized by SHOPERA.
THANK YOU ALL
FOR YOUR KIND
ATTENTION!