

Subject

Preparation, conduct and analysis method of speed trial for EEDI verification

ClassNK

Technical Information

No. TEC-1030
Date 29 May 2015
Rev. Date 1 April 2024

To whom it may concern

In order to determine the ship's attained EEDI required by MARPOL ANNEX VI, the ship speed in calm sea conditions is to be calculated based on the speed trial results. Since the ISO standard which is prescribed in IMO's guidelines on survey and certification of EEDI as the methods for conduct/analysis of speed trial has been revised recently, this ClassNK Technical Information provides information on the effective date and relevant requirements of the new standard.

1. Background

In MEPC 62 held in July 2011, some issues to the existing ISO15016 (2002 edition) were pointed out by European shipowners and research institutes, and IMO urged ISO and ITTC to review the standard. In response to it, ISO and ITTC commenced their collaborative work at WG17 formed under the umbrella of ISO/TC8/SC6, and developed the draft international standard with the addition of new tidal correction method called "Iterative method", while incorporating the basic concept of ITTC recommended procedure (2012 edition). Following the completion of prescribed procedure within ISO, new ISO standard has been published on 1 April 2015 as ISO15016:2015.

2. Application of ISO15016:2015

In MEPC 68 held in this May, it was agreed to revise the guidelines on survey and certification of EEDI to refer ISO15016:2015 as the conduct/analysis method to be used for speed trial of the ships. Further, as a result of the deliberations on the application of new ISO standard, it was agreed to recommend the use of ISO15016:2015 to ships for which the speed trial for EEDI verification is conducted on or after 1 September 2015. An early implementation of the new ISO standard prior to that date is encouraged as well, with no problem for EEDI verification.

3. Major change items of the conduct/analysis method of speed trial

For the major changes associated with the revision of ISO standard, please refer to Attachment 1. In ISO15016:2015, the various kinds of constraint conditions, which is no provisions in 2002 edition, in relation to the preparation/conduct methods of speed trial are to be added as well as a changing of the analysis method of speed trial data. Therefore, the extra care is needed if the speed trial scheduled on or after 1 September 2015 and/or based on the new ISO standard for the first time is planned.

(To be continued)

NOTES:

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4. New ISO-based Progressive Speed Trial Analysis software "PrimeShip-GREEN/ProSTA"
ClassNK has developed "PrimeShip-GREEN/ProSTA", software for speed trial data analysis in accordance with ISO15016:2015, and released it on 1 May 2015, in order to facilitate smooth adoption of the new ISO standard for the maritime industry including shipbuilders and shipowners.

ClassNK provides this software free of charge to customers, and please refer to the following website for more information.

URL: <http://www.classnk.or.jp/hp/en/activities/primeship/index.html>

For any questions about the above, please contact:

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Attachment:

1. Major changes in ISO15016:2015

Attachment 1. to
ClassNK Technical Information No. TEC-1030

Major changes in ISO15016:2015

ISO15016:2015 / 1 - Mutual agreement

- The following stipulation is included in the scope from the practical point of view and the perspective of accuracy:
"If it is physically impossible to meet the conditions in this Standard, a practical treatment is allowed based on the documented mutual agreement among the Owner, the Verifier and the Shipbuilder."

<ISO15016:2002>

There is no stipulation on the mutual agreement.

ISO15016:2015 / 6.1 - Shaft torque measurement device

- When the shaft torque measurement is possible, the G-Modulus of 82,400 N/mm² shall be used if no certificate based on an actual shaft torsional test is available.

<ISO15016:2002>

There is no requirement for the G-Modulus.

ISO15016:2015 / 7.1 – Ship's condition for Displacement

- The deviation of the actual displacement during the speed trial shall be within 2 % of the displacement used during the tank test.
- The ship's draught, trim and displacement shall be obtained immediately prior to the speed trial.
- In the event that reading the draught marks will be unsafe or provide an inaccurate result, displacement determination shall be conducted either by reading the internal draught measurement system or by evaluating all tank soundings.

<ISO15016:2002>

There is no requirement for the timing of the measurement.

ISO15016:2015 / 7.2 - Ship's condition for Trim

- For the even keel condition, the trim shall be less than 0.1 % of Lpp.
- For the trimmed trial condition, the fore draught shall be within ± 0.1 m of the ship's condition for which tank test results are available.

<ISO15016:2002>

The deviation from the specified trim shall be less than 1 % of the midship draught.

ISO15016:2015 / 8.2 - Trial boundary condition for Wind

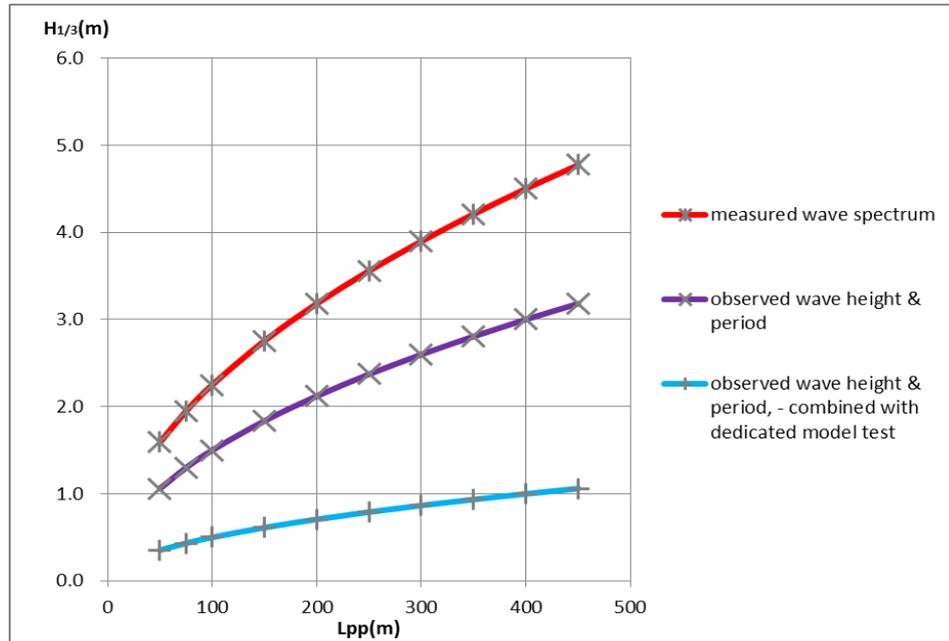
- The wind velocity during the speed trial shall not be higher than:
BF6 (Lpp > 100m) or BF5 (Lpp ≤ 100m)

<ISO15016:2002>

Whenever possible, BF6 (Lpp > 100m) or BF5 (Lpp ≤ 100m)

ISO15016:2015 / 8.3 - Limit for wave height used for correction

- The wave height used for the wave correction is limited by the measurement method and/or the correction method. (allowable wave height)



<ISO15016:2002>

There is no requirement for allowable wave height based on the measurement method and/or the correction method.

ISO15016:2015 / 8.4 - Trial boundary condition for Water depth

In principle, it is preferable to avoid the correction for shallow water effects by selecting a suitable trial location.

- If the water depth in the speed trial area is less than the larger of the values obtained from the following two formulae, shallow water correction may be applied:

$$h = 3 \sqrt{(B \cdot T_M)}, \quad h = 2.75 V_S^2 / g$$

B: ship's breadth (m), T_M: ship's draught at midships (m), V_S: measured ship's speed (m/s)

- The value of water depth to be used for correction shall not be less than the larger value obtained from the following two formulae:

$$h = 2 \sqrt{(B \cdot T_M)}, \quad h = 2 V_S^2 / g$$

<ISO15016:2002>

$\Delta V_S / V_S \leq 0.02$, ΔV_S : the ship's speed loss due to shallow water (m/s)

ISO15016:2015 / 8.5 - Trial boundary condition for Current

- The change of the current speed within the time span of 1 Double Run is more than 0.5 knots, the current correction is not applicable.

<ISO15016:2002>

There is no requirement for the change of the current speed.

ISO15016:2015 / 10.1 - Time slot for speed trial

- Where wave height, period or wave directions are derived from visual observation, the schedule for the speed trial shall be arranged such that all speed runs around EEDI power are conducted by daylight.

<ISO15016:2002>

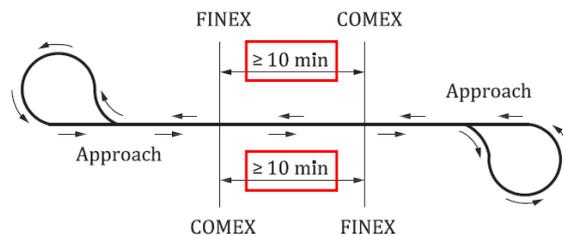
There is no requirement for the time slot for the speed trial.

ISO15016:2015 / 10.3 - Run duration

- The run duration shall be the same for all speed runs with a minimum of 10 minutes.

<ISO15016:2002>

There is no requirement for the run duration.



ISO15016:2015 / 10.4 - Trial direction

- The speed runs shall be carried out by heading into and following the dominant wave direction.

<ISO15016:2002>

There is no requirement for the trial direction.

ISO15016:2015 / 10.7 - Number of Speed runs and Power settings

The number of speed runs required depends on the current correction method to be applied.

'Iterative' method (ISO15016:2015 / 10.7.1)

Based on the assumption that the current speed varies with a semi-diurnal period, 'iterative' method conducts iterative calculation until the speed/power curve converge proper engine powers with the current correction.

⇒ 'Iterative' method requires 1 Double Run at the same power setting

- A minimum of 4 Double Runs (8 runs) at 3 different power settings between 65% MCR and 100% MCR for the first ship are required.
 - ✓ Around EEDI / Contract power : 2 Double Runs (1Double Run for sister ships)
 - ✓ Below EEDI / Contract power : 1 Double Run
 - ✓ Above EEDI / Contract power : 1 Double Run

'Mean of means' method (ISO15016:2015 / 10.7.2)

Based on the assumption that the current speed varies parabolically within a given power setting, 'Mean of means' method removes the effect of current and second order current variations by increasing the speed runs.

⇒ 'Mean of means' method requires 2 Double Runs (4 runs) at the same power setting.

- A minimum of 6 Double Runs (12 runs) at 3 different power settings between 65% MCR and 100% MCR for the first ship are required.
 - ✓ Around EEDI / Contract power : 2 Double Runs (1Double Run for sister ships)
 - ✓ Below EEDI / Contract power : 2 Double Runs (1Double Run for sister ships)
 - ✓ Above EEDI / Contract power : 2 Double Runs (1Double Run for sister ships)

Note:

- (1) Ship speed needs to be measured at more than two points of which range includes the EEDI power, normally 75% MCR, in accordance with the IMO's guidelines on survey and certification of EEDI.
- (2) Even if it is a sister ship, in case where the speed trial is conducted based on ISO15016:2015 for the first time, it is necessary to apply the requirements equal to the first ship, regarded as the first ship specified in the ISO standard.

<ISO15016:2002>

There is no requirement for the number of speed runs and power settings.

ISO15016:2015 / 11.3 - Data acquisition system

- The following parameters, as a minimum, shall be continuously recorded during each speed run with a sampling rate of at least 1Hz. The average values are used in the speed trial analysis.
 - ✓ Time (GPS time)
 - ✓ Propeller shaft torque or power
 - ✓ Propeller shaft speed
 - ✓ Pitch of CPP
 - ✓ Ship's position (DGPS)
 - ✓ Ship's heading (Gyrocompasses or DGPS)
 - ✓ Measured ship's speed over ground (DGPS)
 - ✓ Relative wind direction
 - ✓ Relative wind velocity

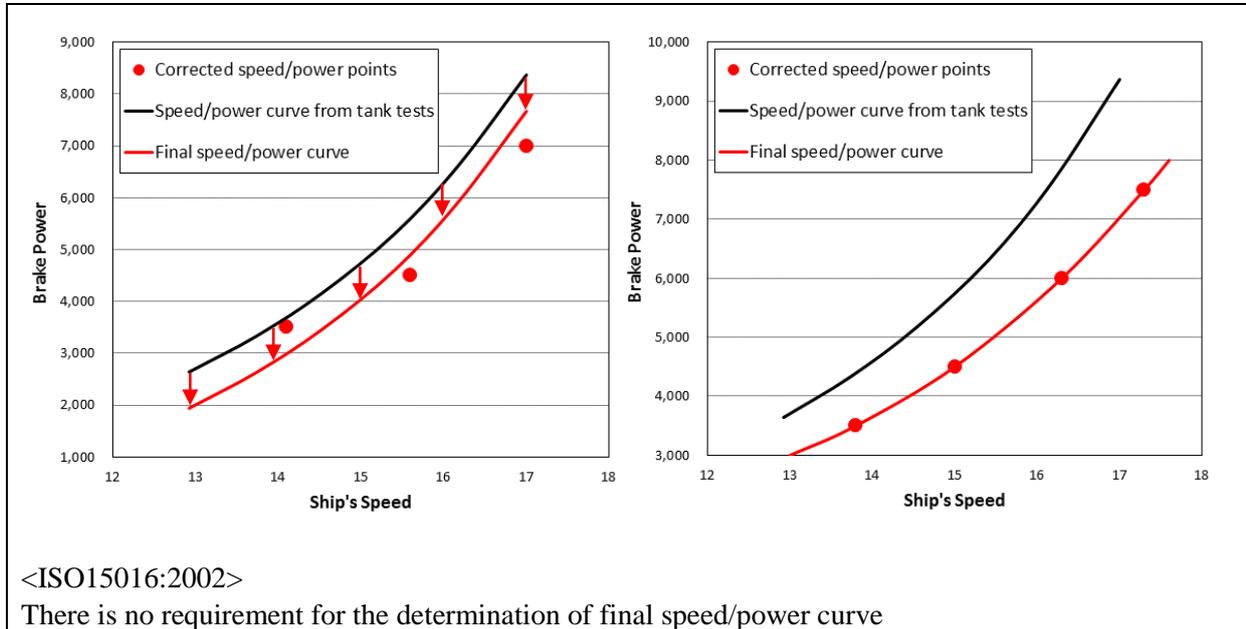
<ISO15016:2002>

There is no requirement for the sampling rate

ISO15016:2015 / 13 - Determination of final speed/power curve

The determination of final speed/power curve depends on the number of power settings measured.

- For 3 power settings:
The speed/power curve from the tank tests for the specific ship design at the trial draught is shifted along the power axis to find the best fit with all corrected speed/power points according to the 'least squares' method (see left side graph).
- For more than 3 power settings:
The same procedure mentioned above or it is acceptable to find the best fit with all corrected speed/power points using the 'least squares' method (see right side graph).



ISO15016:2015 / Annex I - Estimation method of 'V_{ref}' for ships for which sea trial cannot be conducted under EEDI condition

- (1) Power curves under EEDI condition and sea trial condition are estimated from the tank test results.
- (2) 'V_{ref}' should be adjusted taking into account the difference between the EEDI power (normally 75% MCR) on the power curve obtained from results of speed trials and the engine output on the estimated power curve under sea trial condition at the same speed.

