Review of the EEDI Scheme for RoRo Ships

Implementation Problems and Gaps

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General Status of the EEDI Scheme

- EEDI formula available for almost all shiptypes;
- A lot of implementation experience has been gained for MEPC 62 standard shiptypes;
- Limited implementation experience available for complex “European” MEPC 66 shiptypes, e.g. RoRo and cruise;
- 2014 Guidelines on Survey and Certification of the EEDI – lacking pragmatic criteria for LNG as Primary fuel;
- 2015 Industry Guidelines for Calculation and Verification of the EEDI / IACS PR No. 38 still contain uncertainties.

Compliance problems have been reported for RoRo ships – clarification is needed in order to ensure a level-playing field world-wide!
Lack of data from new RoRo ships (above, MEPC 70/INF.14)
Errors and inconsistencies in the database used for the reference lines

Database vs. Real Ship
(provided by FSG)
RoRo EEDI @ Tripartite 2016

EEDI contract situation from design perspective (provided by FSG)

Contract safe?
### Systematic Inconsistencies

- **Different draft used for sea trials and EEDI:**
  - Service speed @ design draft vs. EEDI @ max. dwt draft;
  - $\Delta$ is shiptype specific and very pronounced for RoRo ships, submerged full breadth transom (stern ramp) increasing power;
  - 8-10% for the dwt carriers and 5-7% for the volume carriers.

- **Specific Fuel Consumption (SFC):**
  - $\text{NO}_x$ Tier II optimization yields an increase of about 3% in marine diesel engines' SFC, at the 75% MCR EEDI condition;
  - Shiptypes using 2-stroke engines enjoy a margin to 190 g/kWh
  - 4-stroke medium speed engines dominate the RoRo segment.

- **CO}_2\ Conversion Factor (C_F):**
  - EEDI derived from test bed results normally using MDO / MGO yield a 3% higher attained EEDI (not specific for RoRo ships).
LNG as Primary Fuel

MS Searoad Mersey II by FSG

- operating on LNG between two harbours, receiving LNG trailers (3 · 41.78 m³) every 2 days
- redundant capacity (735 m³) to fully operate on MDO
- not considered to be a LNG ship without permission from the flag.

Source: FSG

Par. 4.2.3 – LNG as Primary Fuel

For ships equipped with DF engine(s) (…), the $C_F$-factor and SFC of gas fuel should be used by applying the following criteria as a basis for the guidance of the Administration:

1. final decision on the primary fuel rests with the Administration;
2. the ratio of calorific value of gas fuel to total marine fuels at design conditions should be equal or larger than 50% (…). However the Administration can accept a lower value (…) taking into account the intended voyages:

\[
\frac{V_{\text{gas}} \times \rho_{\text{gas}} \times LCV_{\text{gas}} \times K_{\text{gas}}}{\left( \sum_{i \in \text{design fuel}} V_{\text{fuel}(i)} \times \rho_{\text{fuel}(i)} \times LCV_{\text{fuel}(i)} \times K_{\text{fuel}(i)} \right) + V_{\text{gas}} \times \rho_{\text{gas}} \times LCV_{\text{gas}} \times K_{\text{gas}}} \geq 50\%
\]

This design primary fuel definition does not reflect operational CO₂ emissions and might exclude DF ships from the LNG fuel factor. MEPC 70/5/5 is an improvement, translating operational aspects into design requirements.
Par. 2.5.6.1/2 – Standard $P_{AE}$ definition:

\[ P_{AE} = \left( 0.025 \cdot \left( \sum MCR_{ME} + \frac{\sum P_{PTI}}{0.75} \right) \right) + 250 \]

\[ P_{AE} = \left( 0.05 \cdot \left( \sum MCR_{ME} + \frac{\sum P_{PTI}}{0.75} \right) \right) \]

2.5.6.4 For ship where the $P_{AE}$ value calculated by Par. 2.5.6.1 to 2.5.6.3 is significantly different from the total power used at normal seagoing, e.g. in cases of passenger ships (…), the $P_{AE}$ value should be estimated by the consumed electric power (…) as given in the electric power table, (…). This requirement has originally been developed for ships with unconventional machinery, e.g. cruise ships, only. EPT is – so far – not clearly defined for RoRo ships.

PR38 Par. 5.2 – Electrical Power Table

For a ship where the $P_{AE}$ value calculated by Par. 2.5.6.1 to 2.5.6.3 (…) is significantly different from the total power used at normal seagoing operations, e.g. for cruise passenger ships, and as an option if the difference leads to a variation of the computed EEDI value exceeding 1%, the $P_{AE}$ value could be estimated by the electric power (excl. propulsion) in conditions when the ship is engaged in a voyage at reference speed ($V_{ref}$) as given in the electric power table (EPT), (…).

Based on the estimation uncertainties, it is unreasonable to define 1 % as a threshold value for the EPT option. It should be clarified in IMO Guidance that EPT is an option for the designer.
RoRo EEDI Submissions to MEPC 70

- MEPC 70/5/21 by Finland, Germany, Sweden and CESA
  Rectify systematic errors, *lift reference line by 15% and clarify implementation problems*

- MEPC 70/5/22 by INTERFERRY
  QA database, rectify systematic errors, *lift reference line by 30% and limit application to smaller RoRo ships*

- MEPC 70/5/28 by Denmark
  Develop better RoRo EEDI and limit application to smaller RoRo ships

- MEPC 70/5/34 by INTERFERRY
  Extend the waiver clause by 3 years for all ships

- MEPC 70/INF.27 by Republic of Korea

- MEPC 70/INF.37 by INTERFERRY
All submissions report on RoRo compliance problems.

*(MEPC 70/INF.27)*

Summary

- Design of EEDI compliant RoRo ships is challenging already today, sometimes impossible without utilizing clean fuels or innovative technologies;
- The database used for the reference lines is not reliable, contains errors and inconsistencies resulting in over ambitious requirements;
- The EEDI scheme contains systematic errors, which are more significant for RoRo ships;
- The available Guidelines and IACS interpretations require clarifications on RoRo related issues.
The way forward at MEPC 70ff

- Rectify systematic errors of the EEDI scheme;
- Recalculate and lift Reference Line by ~15%;
- Do not extrapolate EEDI requirements into the unknown;
- Maintain the challenge to improve the EEDI;
- Do not account effects twice: QA and systematic errors;
- Do not change EEDI scheme or RoRo correction factors;
- Solve implementation problems, e.g. regarding LNG to encourage alternative fuels and innovative systems, which will be required for phase 2 reductions;
- Other ship types that have a margin should not be modified until more evidence is provided.

Thank you for your kind attention!

Source: Ulstein Verft