Subject: Tech. Inf. 2014-07

Underwater noise from ships and methods of reduction

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All respectful ICS customers/surveyors

With gratitude,

According to MEPC.1/circ.833 which has been promulgated by IMO, on the subject of underwater noise pollution originated by merchant ships and its effect on marine environment (marine echo-system), and ways of reducing of this effect, the relevant technical information has been circulated to you for your observation.

The actual document related to the above mentioned subject and also the supplementary attachments are accessible through the following address on ICS Network (ICS-WAN):

\\server\ICS Organization\Convention and LegislationDepartment\Publication\tech\2014\07

A.GHOLAM ABOLFAZL
head of Convention & Legislation Department
Iranian Classification Society – ICS

موضوع: اطلاعیه فنی۰۷-۲۰۱٤

نویز حاصل از تردد کشتیها (زیرآبی) و راههای کاهش آن

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کلیه بازرسان و مشتریان محترمICS

با سلام و احترام

باتوجه به بخشنامه MEPC.1/circ.833 سازمانی جهانی دریانوردی، در خصوص پدیده آلودگی صوتی توسط شناورهای تجاری و تاثیر مستقیم آن بر اکوسیستم دریا و همچنین راههای کاهش این آلودگی، اطلاعیه فنی در این خصوص حضورتان ارسال می گردد.

این بخشنامه به انضمام پیوست‌های تکمیلی آن در بخش CLD از شبکه داخلی موسسه با آدرس ذیل قابل دسترسی می‌باشد.

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ع.غلام ابوالفضل
سرپرست واحد کنوانسیون ها و مقررات دریایی
موسسه رده بندی ایرانیان

Content:

1. GENERAL:

The pervasive nature of noise pollution from commercial ships threatens the health of many coastal regions. As the global commercial shipping fleet increases its size and speed, noise added to the marine environment has intensified; background levels are now elevated at some sites by at least 10 times what they were in the 1960s and have doubled in intensity every decade for the past 40 years.

Underwater noise computational models (e.g. CFD, SEA, FEA, and BEM) may be useful for both new and existing ships in understanding what reductions might be achievable for certain changes in design or operational behavior.

- **CFD:** Computational Fluid Dynamics,
- **SEA:** Statistical Energy Analysis,
- **FEA:** Finite Element Analysis,
- **BEM:** Boundary Element Method

2. APPLICATION:

2-1) This technical information can be applied to any commercial ship.

2-2) This technical information do not address the introduction of noise from naval and war ships and the deliberate introduction of noise for other purposes such as sonar or seismic activities.

3. PURPOSE:

3-1) These non-mandatory Guidelines are intended to provide general advice about reduction of underwater noise to designers, shipbuilders and ship operators. They are not intended to form the basis of a mandatory document.

3-2) These Guidelines consider common technologies and measures that may be relevant for most sectors of the commercial shipping industry. Designers, shipbuilders, and ship operators are encouraged to also consider technologies and operational measures not included in these Guidelines, which may be more appropriate for specific applications.

4. EQUIPMENTS WHICH AFFECT UNDERWATER NOISES:

4-1) Propeller:

Propellers should be designed and selected in order to reduce cavitation. Cavitation will be the dominant radiated noise source and may increase underwater noise significantly. Cavitation can be reduced under normal operating conditions through good design, such as optimizing propeller load, ensuring as uniform water flow as possible into propellers (which can be influenced by hull design), and careful selection of the propeller characteristics such as:
Diameter, Blade number, Pitch, Skew and Sections.

4-1-1) Ship with a controllable pitch propeller could have some variability on shaft speed to reduce operation at pitch settings too far away from the optimum design pitch which may lead to unfavorable cavitation behavior.

4-1-2) The ship and its propeller could be model tested in a cavitation test facility such as a cavitation tunnel for optimizing the propeller design with respect to cavitation induced pressure pulses and radiated noise.

4-1-3) Noise-reducing propeller design options are available for many applications and should be considered. However, it is acknowledged that the optimal propeller with regard to underwater noise reduction cannot always be employed due to technical or geometrical constraints. It is also acknowledged that design principles for cavitation reduction can cause decrease of efficiency.

4-2) Hull Design:

4-2-1) Uneven or non-homogeneous wake fields are known to increase cavitations.
Structural optimization to reduce the excitation response and the transmission of structure-borne noise to the hull.

4-2-2) Considerations can be given to the investigation of structural optimization to reduce the excitation response and the transmission of structure-borne noise to the hull.

● **Definition of "CAVITATION":**
The sudden formation and collapse of low-pressure bubbles in liquids by means of mechanical forces, such as those resulting from rotation of a marine propeller.

4-3) Onboard machinery:

4-3-1) Consideration should be given to the selection of onboard machinery along with appropriate vibration control measures, proper location of equipment in the hull, and optimization of foundation structures that may contribute to reducing underwater radiated and onboard noise affecting passengers and crew.

4-3-2) Designers, ship owners and shipbuilders should request that manufacturers supply information on the airborne sound levels and vibration produced by their machinery and recommend methods of installation that may help reduce underwater noise.

4-3-3) Diesel-electric propulsion has been identified as an effective propulsion-train configuration option for reducing underwater noise.
In some cases, The adoption of a diesel-electric system should be considered as it may facilitate effective vibration isolation of the diesel generators which is not usually possible with large direct drive configurations.

The use of high-quality electric motors may also help to reduce vibration being inducted into the hull.

4-3-4) The most common means of propulsion on board ships is the diesel engine. The large two-stroke engines used for most ships' main propulsion are not suitable for consideration of resilient mounting. However, for suitable four-stroke engines, flexible couplings and resilient mountings should be considered, and where appropriate, may significantly reduce underwater noise levels. Four-stroke engines are often used in combination with a gear box and controllable pitch propeller. For effective noise reduction, consideration should be given to mounting engines on resilient mounts, possibly with some form of elastic coupling between the engine and the gear box. Vibration isolators are more readily used for mounting of diesel generators to foundations.

5. ADDITIONAL TECHNOLOGIES FOR EXISTING SHIPS:

In addition to their use for new ships, the following technologies are known to contribute to noise reduction for existing ships:

1- Design and installation of new propellers;
2- Installation of wake conditioning devices; and
3- Installation of air injection to propeller (e.g. in ballast condition)

6. OPERATIONAL AND MAINTENANCE CONSIDERATIONS:

Although the main components of underwater noise are generated from the ship design (i.e. hull form, propeller, the interaction of the hull and propeller, and machinery configuration), operational modifications and maintenance measures should be considered as ways of reducing noise for both new and existing ships. These include, among others:

6-1) Propeller cleaning:
Propeller polishing done properly removes marine fouling and vastly reduces surface roughness, helping to reduce propeller cavitation.

6-2) Underwater hull surface:
Maintaining a smooth underwater hull surface and smooth paintwork may also improve a ship's energy efficiency by reducing the ship's resistance and propeller load. Hence, it will help to reduce underwater noise emanating from the ship. Effective hull coatings that reduce drag on the hull, and reduce turbulence, can facilitate the reduction of underwater noise as well as improving fuel efficiency.

6-3) Selection of ship speed:

6-3-1) In general, for ships equipped with fixed pitch propellers, reducing ship speed can be a very effective operational measure for reducing underwater noise, especially when it becomes lower than the cavitation inception speed.

6-3-2) For ships equipped with controllable pitch propellers, there may be no reduction in noise with reduced speed. Therefore, consideration should be given to optimum combinations of shaft speed and propeller pitch.

6-3-3) However, there may be other, overriding reasons for a particular speed to be maintained, such as safety, operation and energy efficiency. Consideration should be given in general to any critical speeds of an individual ship with respect to cavitation and resulting increases in radiated noise.

6-3-4) Rerouting and operational decisions to reduce adverse impacts on marine life:
Speed reductions or routing decisions to avoid sensitive marine areas including well-known habitats or migratory pathways when in transit will help to reduce adverse impacts on marine life.