THE NEW IMO NOISE CODE: A LOST TECHNICAL OPPORTUNITY. IRREVERSIBLE AND HIGH COST CONSEQUENCES FOR FISHERMEN AND OTHER SEAMEN THAT WILL CONTINUE BEING DEAF.

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More than thirty years have passed since the appearance of the Code IMO Resolution A.468 (XII) until the adoption by Maritime Safety Committee on November 2012 of the Resolution MSC. 337(91). The Code of Noise Levels on board Ships. In this large period of time, much progress has been made; especially in the topics of noise and vibration on board “all types of ships” as well as the outdoor noise generated by them, which especially affects the environment and the marine life. As a direct consequence, and focusing only on protecting the health of all the seamen on board all types of ships again noise, the corresponding EU-Directives have become local laws of the Member States, mandatory for Ship-owners and Sailors.

In parallel and obeying market requirements, the optional Noise and Vibration Comfort Class Notations of the different Classification Societies have been implemented in most of the Passenger Ships, for both Passenger and Crew spaces. Besides, in this demanding scenario, the noise and vibration consultants and the Shipbuilding Industry have had to move forward on providing solution to fulfil these requirements. Based on real cases, it has been proved that the compliance with the strictest requirements, including those concerning the Underwater Radiated Noise (URN) by the ships, is achievable.

In this independent consultant’s opinion, with 37 years of experience solving noise and vibration problems during all his professional lifetime, the new IMO Noise Code appears as politically or diplomatically correct but technically obsolete, limited, unfair, source of commercial unbalances and, more seriously, not able to fulfil the aim of its definition: to protect personnel against noise on board ships. In order to avoid that these strong words, with all the respect, could appear as demagogic, in the present report the technical reasons and evidences supporting them are presented.

1 The “New” and “Old” Code of noise on board vessels. Technical aspects. Comparative analysis.

1.1. Introduction.

We will examine and analyse the new resolution MSC-337(91) “Adoption of the Code on Noise Level On Board Ships”. Throughout the text we refer to this code as “the new resolution” or “new code”. This new resolution replaces the resolution A. 468(XII) “Code on Noise Levels On Board Vessels”, currently in force. We will refer to this code as the “old code”.

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Aiming at allowing the reader to shape their own opinion in this paragraph a comparative about the most important aspects of both resolutions has been carried out, starting with technical aspects and finishing with the formal ones.

1.2. Comparison between Noise Limits in the different ship spaces.

The first difference between both resolutions: A. 468(XII) and MSC-337(91) is found in the division of vessels according to ship size. Whereas the first one is applicable for vessels whose tonnage is equal or larger than 1600GT’s, there are two sub-groups in the second one: Vessels whose tonnage goes from 1600GT’s to 10000GT’s and another group for those vessels whose tonnage is above 10000GT’s.

<table>
<thead>
<tr>
<th>NOISE LEVEL LIMITS- dB(A)</th>
<th>IMO A.468(XII) November 1981</th>
<th>MSC-337(91) November 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Designation of Room and Spaces</strong></td>
<td><strong>SHIP SIZE</strong></td>
<td><strong>Designation of Room and Spaces</strong></td>
</tr>
<tr>
<td>Machines (Continuously manned)**</td>
<td>≥ 1600 GT</td>
<td>Machinery Spaces *</td>
</tr>
<tr>
<td>Machines (Not Continuously manned)**</td>
<td>90</td>
<td>110</td>
</tr>
<tr>
<td>Machinery Control Room</td>
<td>75</td>
<td>Machinery Control Room</td>
</tr>
<tr>
<td>Workshops</td>
<td>85</td>
<td>Workshops other than those forming part of the Machinery spaces</td>
</tr>
<tr>
<td>Non-specific work spaces **</td>
<td>90</td>
<td>Non-specific work spaces **(Other work areas)</td>
</tr>
<tr>
<td><strong>NAVIGATION SPACES</strong></td>
<td><strong>Designation of Room and Spaces</strong></td>
<td><strong>SHIP SIZE</strong></td>
</tr>
<tr>
<td>Navigation bridge and chartrooms</td>
<td>65</td>
<td>Navigation bridge and chartrooms</td>
</tr>
<tr>
<td>Listening post, including navigation bridge wings* and windows</td>
<td>70</td>
<td>Lock-out posts, incl. navigation bridge wings*** and windows</td>
</tr>
<tr>
<td>Radio rooms (with radio equipment operating but not producing audio signal)</td>
<td>60</td>
<td>Radio rooms (with radio equipment operating but not producing audio signal)</td>
</tr>
<tr>
<td>Radar rooms</td>
<td>65</td>
<td>Radar rooms</td>
</tr>
<tr>
<td><strong>ACCOMMODATION SPACES</strong></td>
<td><strong>Designation of Room and Spaces</strong></td>
<td><strong>SHIP SIZE</strong></td>
</tr>
<tr>
<td>Cabins and hospitals</td>
<td>60</td>
<td>Cabins and hospital****</td>
</tr>
<tr>
<td>Messrooms</td>
<td>65</td>
<td>Messrooms</td>
</tr>
<tr>
<td>Recreation rooms</td>
<td>65</td>
<td>Recreation rooms</td>
</tr>
<tr>
<td>Open recreation areas</td>
<td>75</td>
<td>Open recreation areas (external recreation areas)</td>
</tr>
<tr>
<td>Offices</td>
<td>65</td>
<td>Offices</td>
</tr>
<tr>
<td><strong>SERVICES SPACES</strong></td>
<td><strong>Designation of Room and Spaces</strong></td>
<td><strong>SHIP SIZE</strong></td>
</tr>
<tr>
<td>Galley’s, without food processing equipment operating</td>
<td>75</td>
<td>Galley’s, without food processing equipment operating</td>
</tr>
<tr>
<td>Servitories and pantries</td>
<td>75</td>
<td>Servitories and pantries</td>
</tr>
<tr>
<td><strong>NORMALLY UNOCCUPIED SPACES</strong></td>
<td><strong>Designation of Room and Spaces</strong></td>
<td><strong>SHIP SIZE</strong></td>
</tr>
<tr>
<td>Spaces not specified</td>
<td>90</td>
<td>Spaces referred to in section 3.14 (Measurements shall be taken in all locations with unusually high noise levels where seafarers may be exposed, even for relatively short periods, and at intermittently used machinery locations)</td>
</tr>
</tbody>
</table>

(*) Reference is made to resolution A.343 (IX) which also applies.
(**) Ear protectors should be worn when the noise level is above 85 dB(A).

Figure 1. Noise limits in terms of Sound Pressure.

According to that, Noise Limits of both Codes for the different vessel spaces and their denominations have been shown in the table of the attached Fig 1. From the analysis of the Fig 1, we can see that the changes are in the following points:

- The Noise Limits of the different spaces has not been modified for the first group with respect to the Resolution A. 468(XII). Therefore the old Code is kept in force in these vessels, which means that the seafarers of these vessels are under the same level of protection as 31 years ago. No detailed explanation about why these limits are still applicable has been found in the new Code.

- However, some improvements have been introduced in the noise limits for the vessels above 10000GT’s. They have been confined to a reduction of 5 dB(A) in the following spaces: Cabins and hospitals, mess rooms, recreation rooms and offices, mainly.
1.3. Noise exposure level comparatives.

Noise is a pollutant for people’s health: The grade of affectation and its progress over time depend on the two following points: Noise level the person is exposed to and the duration or exposure time to it.

According to chapter 5 of both Resolutions, the old and new one, if the Level Noise Limits specified in the Chapter 4, are fulfilled in the different accommodation spaces (Fig 1) the 24 hour equivalent continuous sound level shall not exceed 80 dB(A). This indicator is expressed as Leq (24) <80 dB(A).

Unlike the old Code, the new Resolution MSC-337(91) recommends (should be), but not requires as mandatory experimental verification during the official sea trials of the fulfillment of this criterion for all the personnel of the ship crew, according to the method described in its Section 3.7.

Both regulations keep the requirement of using ear protectors or reducing the exposure time for those spaces in which the noise levels exceed 85 dB(A). The new regulation also specifies the attenuation of these ear protectors, which shall be at least 25 dB (A), whereas the old one did not have any specific requirement for these devices. Moreover, both resolutions keep identical criteria concerning the exposure limits to high noise level.

As summary of the comparative analysis of the “Exposure Levels” specified by both resolutions, the following observations are highlighted.

- Both resolutions keep the same requirement about the fact that unprotected seafarers should not be exposed to 24 hour equivalent continuous sound level greater than 80 dB(A).
- The new resolution: MSC-337(91), unlike the old one, A. 468(XII), specifies the minimum attenuation required on the ear protectors, setting a value of 25 dB(A) at least for the “Zone D. Daily Exposure” and between 25 and 35 dB(A) for the Zone B. Occasional exposure.

Consequently, except for the last amendments, there have not been any significant changes with regard to “exposure levels” between the Resolution A. 468(XII), proclaimed 31 years ago, and the new Resolution MSC-337(91) which comes into force in 2014.

2 The “new” and “old Code” of noise levels on board ships. Formal aspects and exemptions.

2.1. Introduction.

Once the analysis of the most significance technical aspects of both resolutions is done, in this paragraph we will focus on the “formal aspects and exemptions”.

In the authors’ opinion, they are both more confusing, ambiguous and contradictory than expected for any Standard, Directive or Regulation aimed at complying with the basic aim of the seafarer protection against noise on board vessels, a dangerous pollutant with lagged effects and in some cases with irreversible worker health consequences as it is recognized by countless International Bodies.

2.2. Formal Aspects.

A first look at the justification points of the adoption of the Code on Noise Level On Board Ships gives the reader hope about the strength and conviction of the following aspects:

- Necessity of forcing to comply with Noise Level Limits in the different ship spaces as well as setting noise exposure limits which, complying with the Resolution II-1/3-12 of SOLAS, guaranties the seafarer protection against noise.
- Such belief is strengthening when the code, referring to the Regulation II-1/3-12, is strong about that the vessel shall be constructed to reduce on board noise.
Any hope about the regulatory strength of the new Resolution, vital for the fight and reduction of the noise on board ships, disappears when in the next page, Chapter 1, paragraph 1.1.3, under the General paragraph, the following can be read:

“Although this Code is legally treated as a mandatory instrument under the SOLAS Convention, the following provisions of this Code remain recommendatory, options for compliance, or informative in nature”.

And the situation becomes absolutely confusing when the new code refers to its provisions as “recommendatory”, “optional” for compliance and “informative in nature”.

The fact that the code remains recommendatory can be understood for the annexe 2 “Suggested methods of attenuating noise” as they are general guidelines for this purpose. However, the big inconsistency with the targets initially pursued is found in the fact that the code also remains recommendatory and optional in the Chapter 5 of the new regulation MSC-337(91), where the noise exposure limits are defined for the different sound pressure levels in the different work spaces and rest of the ship crew.

This fact is not either understood when the paragraph 1.2 “Purpose” says “the purpose of the Code is to limit noise levels and to reduce seafarers exposure to noise to achieve, among other aspects, the following:

- Protect the seafarer from excessive noise levels which may give rise to a noise-induced hearing loss and,
- Provide the seafarer with an acceptable degree of comfort in rest, recreation and other spaces and also provide conditions for recuperation from the effects of exposure to high noise levels”.

2.3. Exemptions.

Regarding the exemptions, the new Resolution MSC-337(91) and the old code A.468(XII) have the same exemptions concerning the two following aspects: 1) Vessel tonnage which the code is applicable from and 2) Type of vessels.

1. Vessel tonnage.

As the old code, the new resolution sets that the code applies to new ships of a gross tonnage of 1600 and above and that it may be applied for new ships of gross tonnage of less than 1600 as far as reasonable and practical

2. Type of vessels.

Both resolutions presuppose that the code, seen as a tool for protection of the seafarers against noise, is not applicable to the following kind of vessels: 1) dynamically supported crafts, 2) high-speed crafts, 3) fishing vessels, 4) pipe-laying barges, 5) crane barges, 6) mobile offshore drilling units, 7) pleasure yachts not engaged in trade, 8) ships of war and troopship, 9) ships not propelled by mechanical means, 10) pile driving vessels and 11) dredgers.

2.4. Comments about the formal aspects. Regulatory Obsolescence.

There is no need to be an expert on law to realize that, after a first comparison of the old and new code with the current regulatory framework in Europe (Directive 2003/10/EC), these regulations are contradicting each other with regard to this matter. Indeed, the protection of the seafarers’ health against high noise levels provided by the new code is limited to the ones on board of the new merchant vessels which, because of type and tonnage, it is applicable to.

Secondly, the delegation to the Administration of the application of the Code on Noise Level on Board Ships to the existing vessels, which for tonnage are within the field of application, and to the other vessels whose tonnage is below 1600GT’s will lead to the following situation: First, we have those Administrations of the Member States of the European Union which, as they are subject
to the Directive 2003/10/EC, will be forced to the rigorous application of its provisions without any kind of discrimination with regard to vessel tonnage or type and even age. Very difficult situation for these Administrations which shall be solved. On the other hand there are the Administrations of those countries which endorsed the resolution but they still lack the specific regulations adapted to the maritime sector. In this case no actions are expected, as happened since the adoption of the old Code. So, we are in a scenario where workers will be protected differently from noise because of difference in the scope and requirements depending on the country.

2.5. Comments on the Exemptions because of Tonnage. Technical Obsolescence.

From a technical point of view, the following comments about the exemptions because of tonnage applicable in the old and new code are pointed out:

- It is difficult to understand why, after 31 years and considering the technical improvements achieved in the Noise Control field, the new resolution has the same exemptions with regard to vessel tonnage. It has been either written by the same authors or they have the same unjustified technical preconceptions about the noise control on vessels whose tonnage is below 1600GT’s.

- Everyone knows that the noise levels of some pleasure vessels, in particular yachts, whose tonnage is much lower than 1600GT’s, are excellent and in compliance with the strictest Comfort Class of the Classification Societies. This is a conclusive proof of there is no technical limitation which makes impossible to guaranty the workers’ health because of the vessel tonnage. However, this “acoustical advantage” is usually associated to an added value of the ship owner’s wealth.

![Figure 2. “Silent vessels” of tonnage below 1600GT’s.](image)

- In order to break the cliché about the high cost of the noise control for all kind of vessels we encourage the reader to look for the two documented references [11, 12]. The first one corresponds with a fishing research vessel, and the second one with a research vessel, Fig 2. The ship-lengths are 27 m and 46.7 m respectively. Both vessels have a tonnage much lower
than 1600GT’s. As it can be seen, Fig 3 the noise levels obtained are in compliance with the limits imposed by the Resolution A. 468(XII) in the first case, and with the Comfort Class Notation COMF-NOISE-1 of Bureau Veritas in the second case. The cost required to achieve these targets, including the numerical predictions and the noise insulation materials, has not exceeded 1% of the total cost of the vessel for the first one, and 2% for the second one.

Therefore, neither the technical unfeasibility nor the economical unfeasibility can support the application of exemptions with regard to vessel tonnage, what lead to a lack of protection of the seafarers working on them against the harmful effects of noise.

3 Inconsistency of the "Exemptions" by size. Technical and Economic Feasibility for the Construction of Silent Fishing Vessels.

In this concern a “warning to seafarers” was launched by the first author in 2006 [11] as result of the successful experimental data obtained, detailed later, on board the fishing research vessel “Emma Bardan” of the General Secretariat Spanish Fisheries Administration. Based on what was coming the following question was presented as a suggestion:

“Why do comfort levels (noise) on a fishing vessel not have to be, at least, equal to those of other workplace?”

The convenience of using the positive experience of this ship as a “technological reference” for future construction of this type of vessels in compliance with the Directive 2003/10/EC was pointed out. Perhaps those who today are having problems on transferring their vessels to other Member States in compliance with the provisions of the Directive will possibly regret not having been able to hear these suggestions.

In parallel the participation of the authors since 1997 in the dynamic and acoustic design of five fishing research vessels in strict compliance with the ICES Nº 209 Underwater Radiated Noise Regulation has enabled to verify and validate the effectiveness of the “Noise & Vibration Comprehensive Management” tool developed by him. Special mention could be done to the publication in the ASA (Acoustic Society of America) related to the Fishing Research Vessels "Ramón Margalef" of the IEO-Spanish Oceanography Institute. The experimental data published includes its “underwater footprint” enable to qualify this ship among the most silent in the civilian fleet.

On the basis of the foregoing let us prove the "technical and economic feasibility" on reducing noise levels on board ships of gross tonnage below 1600 GT's, and therefore all kinds of fishing vessels. The data provided are sufficient, at least, to demonstrate the technical inconsistency of the exemption included on both Resolutions, the new and old one related to the ship size.

Figure 4. Noise Levels. Fishing “Emma Bardán” (upper) and FRV “Ramón Margalef” (below).
For both vessels mentioned previously and with small modifications depending of the particular requirements for each project, the same methodology, “Noise & Vibration Comprehensive Management”, has been applied. The practical description of their development are detailed in different references [11,14, 15]. The experimental noise levels obtained on board these two ships as results of the application of the methodology described are summarized in the attached Fig 4.

**Figure 5.** Comparative of Noise Levels: Fishing Vessel 80’s / Fishing Vessel 2004.

**Figure 6.** “Emma Bardán” and “Ramón Margalef”. Noise Exposure Levels during 24 hours.

As validation of the tool used, the calculated and the experimental values obtained during the Sea Trials of the fishing vessel (“Emma Bardán”) are presented.

The first significant achievement is the appreciable noise reduction for this kind of vessels. Indeed, the Fig 5 shows the noise levels distribution of a fishing vessel of the 80’s, where “nothing had been done” due to the “absence of requirements”, and the corresponding ones of “Emma Bardán”, representative vessel of this type where, where the appropriate methodology was applied.

Based on the experimental noise levels obtained on board the two vessels, the fishing and the FRV one, the noise exposure levels during 24 hours for a representative sample of the crew members of both: Captain, Chief Engineer and Sailors, have been calculated. Both calculations have been done assuming the use or not of personal protective devices, Fig 6.

4 Conclusions.

From the above the following conclusions, technically and experimentally documented and supported, could be highlighted:
• From the “regulatory” point of view, both resolutions become obsolete, firstly, due to the appearance of the Directive 2003/10/EC within the European Community. In fact and meanwhile the referred Directive and their corresponding transpositions are intended to protect “all personnel on board seagoing ships”, regardless of vessel type, size and even age; both Resolutions A. 468(XII) and MSC-337 (91), due to the “exemptions” included on them related to “size” and “type of ships” are limiting their “real scope” of protection to only “few seafarers” (less than 5%); those on board merchant ships above 1600 GT’s.

• From a "technical" point of view both Resolutions become obsolete because, as it has been evidenced in this paper, the Shipbuilding Industry in the last 31 years, particularly the Spanish one, has demonstrated their ability to respond successfully to the technological challenge to achieve and produce vessels of all kinds ensuring environmental conditions without risk to the health of all the seamen who work on them.

Note

This paper is a summary of a more exhaustive and deeper paper titled: “The new IMO Noise Code: Open letter to the maritime safety committee. A technical opportunity lost: the fishermen and other seamen will continue being deaf. For any interested reader, it is available under request sent by email to publiobp@tsisl.es

REFERENCES

5. Resolution MSC. 337(91). “Adoption of the Code on Noise Levels on board Ships”.
7. Directiva 2006/87/CE del Parlamento Europeo y del Consejo de 12 de diciembre de 2.006 por la que se establecen las prescripciones técnicas de las embarcaciones de la navegación interior y se deroga la Directiva 82/714/CEE del Consejo.
9. AQUO- “Achievement QUiet Oceans” project founded by the EC within the 7º FP.