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COMFORT CLASS AND PASSENGER SHIPS

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ABSTRACT

Since 96-97, the only official rules requiring noise and vibration limits, on board ships, were the IMO resolution A468-(XII)-1981 and the ISO standard 6954-1985. These recommendations concerned essentially the crew accommodation, passenger spaces were excluded. This gap was filled, recently, by the Classification Societies which have included, in their own rules, comfort classes for passenger and crew accommodation. In this paper, the objectives and the application of these comfort classes to passenger ships are described. Passenger comfort has become, these last years, a very important contractual point, subject to heavy penalties when the ship does not fulfil the required comfort class. These comfort classes will be able to evoluate, only if it exists exchanges with builders for leading to adapted solutions, for each objective, corresponding to the best compromise between cost and weight which have not be considered by these classification societies.

1 - INTRODUCTION

Passenger comfort is significant for the evaluation of the ship in the market, it has became these last years a very important contractual point, subject to heavy penalties when the ship does not fulfil the required comfort class.

In 1994, the first comfort class appeared, published by a Classification Society. Based on the state of the art, relative to the acoustic and vibratory comfort for ships built the ten last years, they have seemed at this time, like a compulsory evolution for the next years. Now, all the Classification Societies have their own comfort class. Some of their requirements are more or less an utopia view than a realistic one, without considering systematically the technical process and the financial impact in the application of such targets.

2 - COMFORT CLASS AND COMFORT EVALUATION

Comfort class is a class notation giving comfort limits on noise and vibration. The class is issued when full scale measurements on board verify that the ship fulfils specified requirements.

Noise and vibration are classified according to a comfort rating from 1 to 3, which reflects "high" (1) to "acceptable" (3) comfort.

The comfort ratings requested by Classification Societies for passenger accommodation are summed up in the tables below:

Location	DNV			B.V.			L.R.	
	CRN(1)	CRN(2)	CRN(3)	1	2	3	1	2
Top grade cabins	44	47	50	45	50	50	45	50
Standard cabins	49	52	55	50	55	55	45	50
Public rooms	55	58	62	55	60	65	55	60
Open recreation decks	65	65	70	65	70	75	65	70

Table 1: Sound pressure levels in passenger accommodation expressed in dB(A).

- DNV: DET NORSKE VERITAS (NORVEGIAN CLASSIFICATION SOCIETY)
- BV: BUREAU VERITAS (FRENCH CLASSIFICATION SOCIETY)
- L.R.: LLOYD'S REGISTER (ENGLISH CLASSIFICATION SOCIETY)

To ensure that passengers will not be annoyingly disturbed by a normal activity in the adjacent cabins, specific sound reduction index is specified, taking into account the back ground noise levels of the cabin. The comfort class criteria related to sound insulation for passenger cabins are shown in the table 2.

Location	DNV	B.V.	L.R.
Between tope grade cabins	R'w = 46 dB	R'w = 42 dB	R'w = 45 dB
Between standard cabins	R'w = 41 dB	R'w = 40 dB	R'w = 45 dB
Between cabins and public standard rooms	R'w = 55 dB	R'w = 55 dB	R'w = 55 dB
Between cabins and show rooms	R'w = 65 dB	R'w = 65 dB	

Table 2.

Noise from walking, jogging, aerobic rooms... generally called human activities, are another disturbing type of noise.
In order to assure satisfactory comfort for passengers with respect to impact noise in cabins with very low back ground noise levels, the Classification Societies recommend a normalised impact sound pressure level depending on the deck coverings.
A normalised impact sound pressure level of 50 dB is commonly required in cabins. This level is easily met with soft deck coverings as carpet, but for cabins located below areas with hard deck coverings as marble or teak, the above requirement is relaxed to 60 dB due to constructional limitations.
For cabins located below dance floors, stages, aerobic rooms, an impact sound level of 45 dB has been set.

Location	DNV			B.V.			L.R.	
	1	2	3	1	2	3	1	2
TOP grade cabins	1.5	2.0	2.5	1.5	2	2.5	1.5	2.0
STANDARD cabins	1.5	2.5	4	2	2.5	3	1.5	2.5
Public rooms	1.5	2.5	4	2	2.5	3	1.5	2.5
Pax recreation open decks	2.5	3.5	5	3	3	4	2.5	3.5

Table 3: Vibratory velocity level in passenger accommodation expressed in mm/sec. peak.

2.1 - Application of these criteria to passenger ships built in the yard
Most of passenger ships built these last ten years in our yard satisfy the noise criteria defined in the comfort class. From a contractual point of view, some of them can meet comfort rating 1, but most of them met a comfort rating between 1 and 2.
Regarding the vibration criterion, most of them satisfy the comfort rating 1 of the Classification Society.

2.2 - Application of comfort class criteria to two new band ships, one developing 20 MW propulsion and the other 40 MW
If ships built in our yard met comfort rating 1 of Classification Societies as DNV and BV, in term of background noise levels and vibratory levels. They do not fully satisfy them at the present.
In fact, the sound reduction indices to achieve between cabins or between cabins and specific public rooms are far from the present standard of the passenger ships.
In particular, the sound index recommended by some Classification Societies, between cabins and entertainment rooms are minimum 65 dB, in order to obtain a sufficient noise environment in the cabins, located just above the Show room in the fore part of the ships.

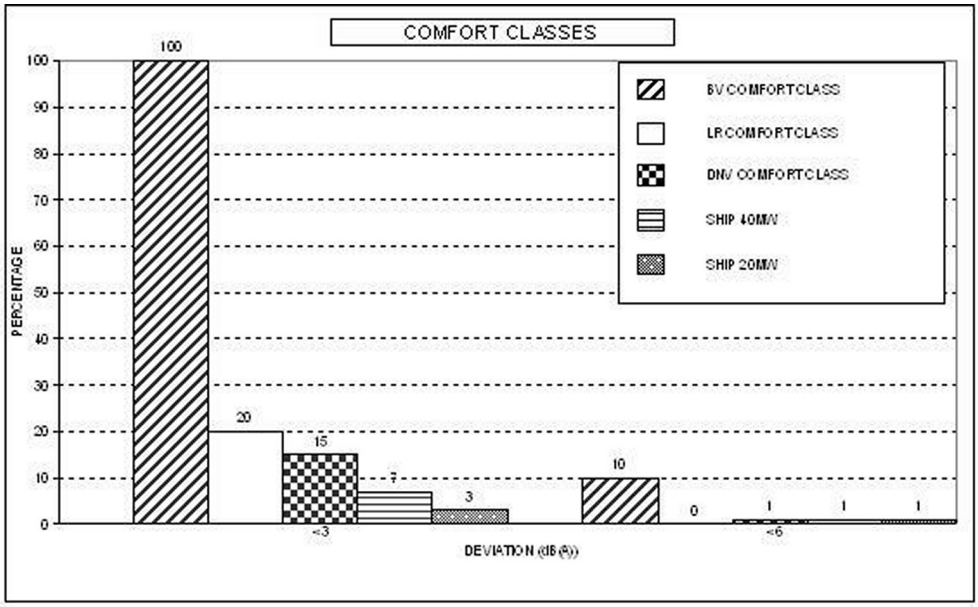

Figure 1: Application of comfort class at two passenger ships.

Unless special precautions are taken, complaints from passengers in quiet cabins located in the fore part of the ship, just above the show room stage. In these cabins, the background noise level is so low, about 40 dB(A), that when show is playing, the noise level in these cabins can increase by about 20 dB(A), dominated by the low frequency sound (< 100 Hz) which is very hard to reduce, without adding heavy constructions. The following table shows the minimum added weight expressed in kg/m ^{2} to meet the sound indexes required between cabins and specific public spaces by the Classification Societies.

Rw (dB)	M (kg/m^2)
45 dB	$15 - 20$ kg/m^2
55 dB	$25 - 30$ kg/m^2
60 dB	$45 - 50$ kg/m^2
65 dB	≥ 70 kg/m^2

Table 4.

The cruise ships delivered in years 85-90 dedicated the fore part of the ship to cabins and show rooms were located in the aft ship, and no cabins were situated above or below show rooms.

3 - CONCLUSIONS

The comfort, on board cruise ships, is became these to last years a very important contractual point. The International standards, as ISO 6954 [4] and IMO, A 468 (XII) [5] are not dedicated to luxury cruise ships and no more in line with comfort requirements requested by the owners for their ships.
Now they have considered the limits recommended in the Classification Society comfort class as a satisfying level of comfort.

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