



# Vibration Control:

## Comfort Class Levels onboard Luxury Yachts.



Yacht – Owner and Guest Vibration levels in mm/s [peak] between 5 – 100 Hz						
<u>Locations</u>	<u>Comfort rating numbers (crn)</u>					
	<u>In harbour condition</u>			<u>Transit condition</u>		
	<u>1</u>	<u>2</u>	<u>3</u>	<u>1</u>	<u>2</u>	<u>3</u>
Guest Stateroom	0.5	1.0	2.0	1.0	1.5	2.0
Owner's Stateroom	0.5	1.0	2.0	1.0	1.5	2.0
Lounges   saloons	0.5	1.0	2.0	1.0	2.0	3.0
Outdoor re-creation areas	0.5	1.0	2.0	2.0	3.0	4.0
Navigation Bridge	0.5	1.0	2.0	1.0	2.0	3.0

If you ask us, based on over 30 years of experience onboard Luxury Yachts, **what are the nowadays comfort class 1 levels** we will refer to the above mentioned table abstracted (and modified) from DNV.

This paper will give you the most important steps to be carried out (studied) in order to meet the above mentioned targets onboard Luxury Yachts (displacement) over 40 meter in length. Please consult us in case your Yacht does not meet this size | displacement.

The below mentioned studies are carried out by Silent Line Engineering Department:

### **Finite Element Analysis (FEA):**

In order to avoid resonance and annoying vibrations Finite Element Analysis is essential to be carried out prior to the construction stage. By means of Finite Element Analysis (computer software program) the most important parts of the ship structure (ship foundations | aft structure above the propellers | deck structures | bulkheads) are modeled and the outcome (natural frequencies and mode shapes [Hz]) are compared with the most important disturbing frequencies emitted by main diesel engines, propulsion propellers etc.

**Other than this comparison (natural frequencies versus disturbing frequencies) we also check upon that the natural frequency of deck structures will not be lower than 15 Hz.**



## ***Structural Analysis and Optimization (SAO):***

Structural Analysis and Optimization is less well-known than Finite Element Analysis. Finite Element Analysis is related to vibrations (from 1 – 25 Hz) while Structural Analysis and Optimization starts from 25 Hz and up.

Structural Analysis and Optimization is an in-house developed computer simulation model that calculates radiation of structure-borne noise from steel | aluminium structures. This is an important tool in order to achieve low noise and vibration levels.

We are aware that sound deadening materials (single or sandwich) are applied in order to reduce radiation of structure-borne noise | increase damping of structure-borne noise however this means additional weight and cost.

***Active noise and vibration control means reduce the noise and the source as much as possible. By means of Finite Element Analysis and Structural Analysis and Optimization we do reduce the noise and vibration levels at the structure as much as possible.***

***Silent Line Engineering:***

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