



# ABS GUIDE FOR COMFORT ON YACHTS AND RELATED ADVISORY SERVICES

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Owners and guests determine their enjoyment and satisfaction based also on their perceived level of comfort. Excessive levels of noise and vibration have a negative impact on these perceptions resulting in poor overall comfort, which translates into less enjoyment and satisfaction while on board.

Yacht owners are seeking higher standards of comfort for their own and their guests' best experience on board. Whether starting a new build project or embarking on a refit, levels of noise and vibration become inevitably part of the specification and should be addressed.

With comfort being an important focus area, the vessel's overall ambient environment becomes a primary parameter of judgement. Owner and guests' enjoyment and satisfaction on board yachts is often based on human comfort parameters.

Therefore, the primary objectives of designing for human comfort are aimed at promoting overall wellbeing, enjoyment, satisfaction and safety. Designing to stringent requirements for noise and vibration allows for a higher level of comfort for owners and their guests.

## KEY DESIGN CONCERNS

**Whole-Body Vibration (WBV)** — Tolerance to vibration may be varied. Research shows that prolonged exposure to vibration can result in a variety of issues, including motion sickness. For this reason, limits based on human WBV responses should be set to achieve better comfort.

**Noise** — Inappropriate levels of noise can interfere with speech and hearing and can produce a sense of annoyance. Unexpected intermittent noises can be more disruptive than continuous ones and may cause physiological reactions and emotional changes. Limiting noise is crucial to provide owners and guests with a relaxing and enjoyable atmosphere.

Reducing WBV and noise improves the crew's ability to perform their duties and ultimately the safety on board.

## ABS RESPONSE

To provide yacht owners and operators with the means to promote enhanced levels of comfort, ABS has published the *ABS Guide for Comfort of Yachts*. This Guide specifies comfort requirements based on human performance research.

It is intended for use by yacht owners requesting the optional ABS notations of COMF(Y) or COMF+(Y).

## ABS CAPABILITY FOR ADDRESSING YACHT NOISE AND VIBRATION

ABS offers a wide range of services to provide noise and vibration analysis and mitigation evaluation

ABS noise and vibration analysis and mitigation services for yachts are based on a three-stage approach to support the design improvement process and cost-benefit solutions:

### STEP 1

- Collect required design information
- Identify possible unfavorable scenarios for analysis and when needed, analyze available measurement data
- Define baseline analysis parameters
- Obtain the owner's agreement on the analysis scenarios and parameters

### STEP 2

- Define a suitable technical approach with the owner
- Develop numerical models in accordance with the agreed approach
- Perform the noise and vibration analyses
- Review analysis results with the owner

### STEP 3

- Assess options for the mitigation plan with the owner if required
- Evaluate the effectiveness of the mitigation plan through the noise and vibration analysis
- Upon the owner's request, analyze measurement data to validate the analysis, mitigation plan and design improvement

to meet owners' needs. The process is based on a three-stage approach that includes the following services:

- **Onboard Noise Analysis** — Statistical energy analysis (SEA) method is used for onboard noise analysis for steel, aluminum and fiberglass reinforced plastic (FRP) yachts.

Major noise and vibration sources are considered in the analysis, such as heating, ventilating and air conditioning (HVAC) systems, main engines, engine exhausts, auxiliary equipment and wave loads during navigation and at anchor. The noise source levels can be determined based on vendor specifications and the ABS in-house database.

The analysis results are evaluated against the owner's requirements. If the predicted results exceed allowable noise limits, ABS can evaluate various mitigation solutions to help achieve desired noise levels.

- **Whole-body Free Vibration Analysis** — The objective of whole-body free vibration analysis is to calculate the natural periods and the associated vibration modes that can be used in the design to avoid resonance of the yacht's structure.

Using a global finite element model, ABS can model and evaluate the mitigation plan to address issues that may adversely impact the yacht's structure.

- **Whole-body Forced Vibration Analysis** — Whole-body forced vibration analysis calculates the responses of the structure resulting from the main engine/propulsors. ABS can calculate the propulsion excitation forces using computational fluid dynamics (CFD).

The forced vibration responses near accommodation areas, the vicinity of excitation sources and specific areas such as owner's or guest's cabins and entertainment areas can be investigated in detail in order to ensure higher levels of comfort.

Analysis results are evaluated against acceptance criteria. When predicted results exceed allowable vibration limits, ABS can evaluate mitigation options for reducing vibration levels.

- **Local Vibration Analysis** — Upper Deck superstructures can be analyzed, and their natural

frequencies can be evaluated to avoid coinciding with primary excitation frequencies that could result in resonance and ultimately deteriorate the overall experience on board. When coinciding frequencies are found, ABS can evaluate mitigation options to avoid resonance.

- **Human Whole-body Vibration (Human WBV) Verification** — Statistical and spectral analyses of raw data obtained from onboard measurement of vibration are performed to verify if the vibration level is acceptable to the Comfort criteria according to ABS COMF(Y) notation or ISO 20283-5 (2016).



For additional information on ABS' noise and vibration control services, please contact us at [yachts@eagle.org](mailto:yachts@eagle.org).

#### WORLD HEADQUARTERS

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