Owners and guests determine their enjoyment based on their perceived level of comfort. Excessive levels of noise and vibration can have a negative impact on these perceptions, overall comfort, enjoyment and satisfaction while on board.

Yachts have stringent requirements for noise and vibration to provide a high level of comfort to owners and their guests. As more yachts (private and commercial) become available consumers will become more selective when making decisions regarding yachts, taking primarily into consideration price and comfort. With comfort being a primary focus area, owners and guests may make comfort judgements based on their experience with regards to a vessel’s ambient environment.

Owner and guest acceptability of a vessel is based on human comfort. Therefore, the major objectives of designing for comfort are aimed at promoting overall wellbeing, enjoyment, satisfaction, and safety.

### KEY DESIGN CONCERNS

**Whole-body Vibration** - Tolerance to vibration may be varied. Research shows that prolonged exposures to vibration can result in a variety of issues, including motion sickness. For this reason, limits based on human whole-body vibration responses should be set if comfort is to be achieved.

**Noise** - Inappropriate levels of noise can interfere with speech, 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 if owners and guests are to be provided with a relaxing and enjoyable atmosphere.

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**ABS Guide for Comfort on Yachts and Related Advisory Services**

ABS Noise and Vibration Advisory services for Yachts are based on a three-stage approach to support the design improvement process and cost-benefit solutions:

| STEP 01 | • Collect required design information  
|         | • Identify the possible unfavorable scenario for analysis  
|         | • Define baseline parameters  
|         | • Obtain client’s agreement on the scenario and design parameters |

| STEP 02 | • Define suitable technical approach with the client  
|         | • Develop numerical model in accordance with the agreed approach  
|         | • Perform numerical analysis  
|         | • Review and evaluate the analysis results |

| STEP 03 | • Provide options for mitigation plan(s) with clients if required  
|         | • Re-evaluate the mitigation plan and improve the design  
|         | • Perform full-scale measurement during sea trial to validate the numerical analysis and design improvement |
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 solutions 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 on-board 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 analysis results are evaluated against the owner’s requirements. If the predicted results exceed allowable noise limits, ABS can provide various mitigation solutions to help achieve desired noise levels.

• **Whole-body Free Vibration Analysis**
  The objective of whole-body free vibration analysis is to avoid resonance of the yacht’s structure.

  Using a global Finite Element Model, ABS can model and resolve 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 areas 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 propose mitigation options for reducing vibration levels.

• **Local Vibration Analysis**
  Upper Deck superstructures can be analyzed and their natural frequencies evaluated to avoid coinciding with primary excitation frequencies. This could result in resonance and ultimately deteriorate the overall experience on board. When coinciding frequencies are found, ABS can propose mitigation options to avoid resonance.

• **Human Whole-body Vibration (WBV) Verification**
  ABS offers two different services for human whole-body vibration comfort and machinery. Verification of comfort measurements help 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.