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Good Vibrations

Protecting your clients and their transaction is one of the most important things a yacht broker can do. In terms of the well-being of the vessel itself, a vibration analysis is the most important safeguard that can be put in place —and it's a very small monetary investment.

A vibration analysis can verify and document the condition of the vessel, helping to negotiate the selling price for the buyer, or protect the seller from faulty claims after the sale. It also sheds light on items that need to be addressed immediately, and those that will need attention in the near future. The formal documentation provided in a vibration analysis report is even more important if maintenance on the vessel wasn't diligently documented, or if the seller is being less than forthcoming.

Everything with mass vibrates. Vibration is a mechanical principal, in which oscillations occur around a point of equilibrium. When vibration is present, it should never be regarded merely as an annoyance. When a vessel's machinery is noticeably noisy and vibrating, there most definitely are underlying mechanical issues.

Vibration isolation theory is not too difficult to understand once some basic terms become familiar. Frequency is the number of complete cycles of oscillation that occur in a given period of time. Natural frequency is the number of complete cycles of oscillation a mass will vibrate in a given period of time if a force displaces it from its center, allowing it to vibrate freely. Disturbing frequency is defined as the frequency of vibration that is caused by an unbalanced, rotating, or, reciprocating movement of mass. When the disturbing frequency equals the natural frequency of the isolation system, exaggerated movement occurs, called resonance.

When working to reduce vibration, the theory of isolation comes into play, particularly in regards to engine mounts. All machines, while in operation, emit vibration of some sort that will vary in intensity or amplitude. Since vibration is a force, introducing an opposite force can reduce the transmission. Successfully "isolating" the vibration requires an assessment of the installation, including the weight of what is supported; the disturbing frequency of the machine, and the rigidity of the structure of the supporting machine and its foundation.

When seeking to reduce the transmission of vibration, a robust material that deflects when exposed to static load should be introduced. The material needs to be so resilient, that it returns to its original height after the load is removed. Rubber in engine mounts is a prime example of a material that has these properties. When engine mounts deflect from the mass of the engine, they establish low natural frequency of the isolation system. When the isolation system is at a lower frequency than that of the machine, vibration is absorbed by the rubber in each phase of its cycle. The lower the natural frequency and the higher engine RPM, the more efficient the isolation system. Successful isolation systems also aid in noise reduction, as they break the flow of structure-borne noise coming from the machine.

A prudent investment

Vibration analysis uses collected data to break down vibration into individual frequency components. Seasoned analysts use three methods to analyze data: manufacturer's requirements, comparing it to another similar machine that is known to be operating well, and utilizing published vibration standards. The frequency, direction, and amplitude of the vibration are then examined. Using those factors as a basis, mechanical issues such as deteriorated or incorrectly installed engine mounts, bent shafts, engine misfire, exhaust deficiencies, and propeller issues can be detected.

The benefits of having a vibration analysis go way beyond forecasting mechanical failures, however. The analysis provides valuable information backed up by science that cannot be argued during the negotiations taking place during a sale. A vibration analysis is a prudent investment that provides peace of mind that the client is getting what he or she is paying for, and that the broker's transaction is solid.