

Reduction of oscillations on a passenger boat

by Heinz Joas

During the commissioning of the new passenger boat shown in **Fig. 1**, oscillations occurred at higher speeds which were particularly irritating in the region of the main passenger decks. Further damping of the motor mountings and coupling and the fitting of additional bearings for the propeller shaft did not significantly improve the situation.

Oscillation measurements were carried out at various speeds to obtain information on the constructional changes necessary to produce an improvement. A total of four B 12 Acceleration Transducers were installed on the main deck, on the gear box and on the shaft bearings on both the motor and transmission sides. **Figure 2** illustrates two of these measuring points. The transducer signals were amplified by the KWS 28 5 kHz CF Measuring Amplifier shown in **Fig. 3** and then passed to a line recorder and a magnetic tape recorder. The resonant frequencies of various component parts were also determined by impulse excitation.

A visual evaluation of the acceleration signals was made and to compare the recorded analog trace, a computerized frequency analysis of the tape recordings produced cascade diagrams for various motor speeds as shown in **Fig. 4**. The evaluation showed that with rising speed the amplitude of the oscillations reached a maximum and then reduced with a further increase in speed. The reason for this is that in the speed region of 1600 rpm the 64 Hz resonant frequency of the ship's structure and the two second order excitation frequencies from the motor shaft (66.4 Hz) and from the four-blade propeller (56.5 Hz) are very close together. A further reason for the unpleasant sensation is the resonant frequency of the globe of the human eye between 40 Hz and 80 Hz.

A reduction in the oscillations was obtained with a relatively simple stiffening in the ship's ribs, which raised the resonant frequency beyond the maximum operating frequency. This reduced the irritating deck oscillations to an acceptable level. If required, further

remedies could be implemented, i.e. changing the motor speed, modifying the gear transmission or changing the number of blades on the propeller.

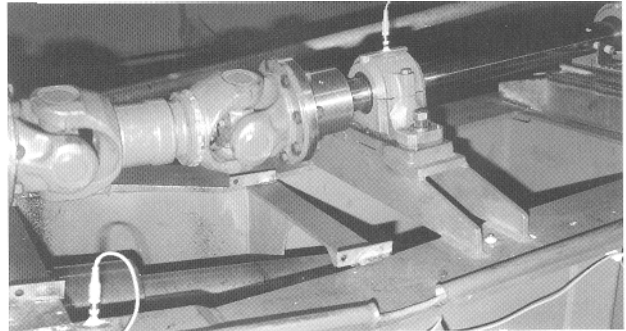


Fig. 2: B 12 Acceleration Transducer on the shaft bearing and the bed of the gearbox



Fig. 3: Instruments used, including the three-channel KWS 382.D4 CF Measuring Amplifier



Fig. 1: The passenger boat on which tests were made

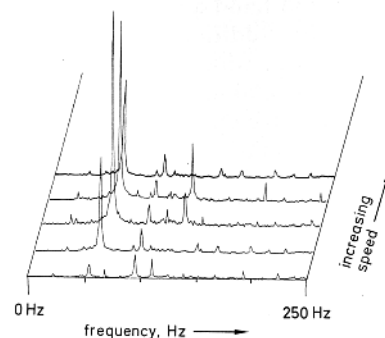


Fig. 4: Amplitude spectrum for increasing speed

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