

Isolating Centrifugal Pumps on Fully Decoupled Inertia Slabs

Aim

Vibrations and structure borne noise generated by pumps can negatively influence the life cycle costs of the machinery and at the same time affect the comfort level of people and in the case of the aquarium also the animals.

According to the McNally institute www.mcnallyinstitute.com the following components can be affected by vibrations:

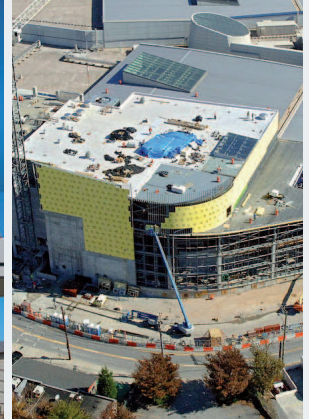
The life of the mechanical seal is directly related to shaft movement. Vibration can cause carbon face chipping and seal face opening. Drive lugs will wear, and metal bellows seals will fatigue. In some instances, the shaft movement can cause the rotating seal components to contact the inside of the stuffing box, or some other stationary object, causing the seal faces to open and allowing solids to penetrate between the lapped faces. Vibration is



also a major cause of set screws becoming loose and slipping on the shaft, causing the lapped seal faces to open.

- Packing is sensitive to radial movement of the shaft. You'll not only experience excessive leakage, but excessive sleeve or shaft wear also. Additional flushing will be required to compensate for the heat that'll be generated by the high friction packing.
- Bearings are designed to handle both a radial and axial load. They were not designed for the vibration that can cause a brinneling (denting) of the bearing races.

- Critical dimensions and tolerances such as wear ring clearance and impeller setting will be affected by vibration. Bearing internal clearances are measured in tenths of thousands of an inch (thousandths of a millimeter).
- Pump components can be damaged by vibration. Wear rings, bushings and impellers are three examples.
- Bearing seals are very sensitive to shaft radial movement. Shaft damage will increase and the seals will fail prematurely. Labyrinth seals operate with a very close tolerance. Excessive movement can damage these tolerances also.



Solution

– **Pump and motor hold down bolts can become loose.**¹ The greatest problem in the case of the aquarium project was due to the great number of different pumps with different performance requirements requiring the selection of a solution with most accurate definition of gage and load deflection to assure the strict alignment of all the pre-designed plumbing components.

Based on the given target frequency for each pump, calculations were done individually with the Getzner's FreqCalc online calculation tool.

The minimum required frequency ratio of 1.6 (excitation to natural frequency) given by the responsible acoustic consultant Wilson, Ihrg & Associates could be reached with a material thickness as low as one

inch. Even higher ratios would have been possible, but the cost factor and the customer's desire to pour the concrete in place without any additional distribution layers made a full surface bearing the best solution.

¹ Mc Nally Institute, www.mcnallyinstitute.com/02-html/2-09.html 12.21.2010

