

Developing a Test Rig to Examine how Vibration Leads to Mechanical Seal Failure

Liquid mechanical face seals are widely used in pumps. They are used as an end seal to contain the process fluid inside the pump with little contamination to the surrounding environment. Mechanical seals fail do to a variety of different reasons. One reason was brought up in 2005 by Stefanko and Leishear showing a link between pump vibration and mechanical seal life. 100s of pumps were tested until a mechanical seal failure, for each pump the vibration level and fluid temperature was recorded. There was a correlation between all three of the parameters: temperature, vibration, and mechanical seal life. Mechanical seals are radial seals, so it is not clear why lateral vibration would harm the mechanical seals. The pitch vibration from the pump is small, so it is also unknown why it fails mechanical seals. This project involved the initial year of a two year test project to determine the underlying reason for the link between pump vibration and mechanical seal life. The ending result for this year is a finished test rig design, with all of the components either here, or being machined. The test rig consists of an overhung rotor design. The mechanical seal is then easy to access with minimal disassembly. There is a "floating rotor" and a "floating stator". "Floating" meaning that the lateral and pitch motion can be controlled. Rotordynamics and stress analyses were performed on the design to insure the speed and force requirements are met. The max speed of the rig is 3600 rpm and the maximum differential pressure is 90 psi. The temperature is controlled using an external flow loop. Next year will involve tests of the mechanical seals to determine the root cause of failures.