

Accelerometers: Hermetic sealing and helium leak testing

Hermeticity

Loosely defined as a “metal to metal weld, braze, solder or metal to glass fusion,” *hermetic sealing* is a vague (and often abused) term. Under the previous definition, even a porous weld would qualify as hermetic – in spite of its inability to prevent contamination. Epoxy sealed sensors are not considered hermetic. In order to quantify and compare levels of hermetic sealing, or hermeticity, we can use a leakage scale where the leakage rate of helium is stated in units of cc/sec at 1 atmosphere of pressure. Wilcoxon industrial sensors have the highest hermetic seal rating in the industry. The Helium Leak Test (HLT) is used to qualify the sealing of all sensor designs and Wilcoxon maintains a continuous monitoring program to ensure the proper sealing of all hermetically rated accelerometers.

Helium Leak Testing

HLT is performed by placing units to be tested in a chamber, and then pressurizing that container with helium. Pressures of 90 to 120 psi are typical of the exposure for standard leak tests; Wilcoxon uses 120 psi. After an appropriate length of exposure, the units are removed and placed one at a time in a test chamber. A vacuum is drawn and, when the vacuum is low enough, the remaining escaping gasses are sent to a mass spectrometer tuned to detect helium. The HLT equipment can detect leak rates to 1×10^{-9} cc/sec and below. Units with leak rates above approximately 1×10^{-3} cc/sec will saturate the detector and are usually considered “gross leakers.” Such units are not considered hermetic, even though they are welded and may look sealed.

All accelerometers rated as “hermetic” on the data sheet are qualified using HLT. Wilcoxon uses the results of HLT in setting parameters for welding equipment to ensure consistent hermetic qualified welds. Since all hermetically rated accelerometers have been subjected to pressure testing of 120 psi, they are rated to withstand 100 psi of pressure from submersion. Because helium particles are very tiny compared to water molecules, passing an HLT ensures that the accelerometer will survive underwater submersion indefinitely.

Benefits

One of the most common causes of piezoelectric sensor failure is the failure of a hermetic seal, or a lack of hermetic sealing in the first place. The typical vibration accelerometer that is permanently mounted on a machine is exposed to cyclical temperature variations. As the sensor temperature increases, the interior pressure increases, and some of the atmosphere escapes. Decreasing temperatures cause a partial vacuum to form inside the sensor, bringing the exterior atmosphere into the sensor. Over time, this exchange of atmosphere will lead to contamination of the sensor interior, which will in turn lead to a failure of the electronic circuit. A hermetic seal minimizes this exchange and extends the life of the sensor to 20 years or more.