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 previously cited definition even a porous weld would qualify as hermetic even though its ability to prevent contamination would be negligible. Epoxy sealed sensors are not considered hermetic. In order to quantify and compare levels of hermetic sealing, we can use a leakage scale where the leakage rate of helium is stated in cc/second at 1 atmosphere of pressure. Wilcoxon industrial sensors have the highest hermetic seal rating in the industry. Wilcoxon uses the Helium Leak Test (HLT) to qualify the sealing of all sensor designs and 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 time of exposure, the units are removed and, one at a time, placed 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 about 1×10^{-3} cc/sec will saturate the detector and are usually considered "gross leakers." A "gross leaker" is not considered hermetic, even though it is 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 insure 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. Since helium molecules are very tiny compared to water molecules, passing an HLT ensures surviving underwater submersion for an indefinite period of time.

Benefits

One of the greatest causes of piezoelectric sensor failure is the failure of a hermetic seal or a sensor that is not hermetically sealed. The typical vibration accelerometer that is mounted permanently to a machine is exposed to cyclical temperature variations. As the sensor temperature increases, the interior pressure increases too 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 “breathing” exchange of atmosphere will allow contamination of the sensor interior leading to a failure of the electronic circuit. A hermetic seal minimizes this exchange and allows sensors to survive for 20 years or more.

Wilcoxon Sensing Technologies
20511 Seneca Meadows Parkway
Germantown, MD 20876
USA

Tel: +1 (301) 330-8811
Fax: +1 (301) 330-8873
www.wilcoxon.com
info@wilcoxon.com